
MACHINING CENTER
VS50/60
INSTRUCTION MANUAL
MAINTENANCE
SEIKI-SEICOS Σ16M/18M

Version 1.01

Introduction

Thank you for your having purchased the machine, favoring our product lines for your use.

This manual contains fundamental information on the maintenance. Please read and fully understand the contents for your safe machine operation.

In particular, the contents of the items concerning safety in this manual and the descriptions on the “caution plates” attached to the machine are important. Please follow the instructions contained and keep them always in mind to ensure safe operation.

The reference record papers on adjusting setting values such as a parameter list are attached to the machine unit and enclosed in the packing. These are necessary for maintenance and adjustment of the machine later on. Please keep them safely not to be mislaid.

The design and specifications of this machine may be changed to meet any future improvement. As the result, there may arise some cases where explanations in this manual could become partly inconsistent with the actual machine. Please note this point in advance.

In this manual, items on the standard and optional specifications are handled indiscriminately. Please refer to the “delivery note” for the detailed specification of your machine confirmation.

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1. INSTALLATION

1-1 Machine Installation

When installing NC machine, solid foundation is essential. It is also most important for maintaining the best condition of cutting accuracy of the machine. The nature of the ground condition of the factory site, for example, rock base or reclaimed land, makes a big difference. It is, therefore, difficult to give any definite rules generally applicable to the installation of this machine. (Refer to the foundation and arrangement drawings.)

The followings are the concrete items to be carefully attended when installing this machine.

- 1) The bearing capacity of soil should be 5 ton/m² or larger and thickness of the foundation should be 300mm or thicker.
- 2) The area of the foundation should be extend to at least 300mm outer circumference of the machine bed.
- 3) When digging vibration proof drains, they should be dug along the circumference of the foundation.
- 4) Placing separate concrete blocks underneath each machine leg instead of a real foundation is often seen, which is just not adequate. Such is no value as proper foundation,

As this machine yields large volumes of chip during machining, carts are often used for chip disposal. The traffic of carts and detaching covers in maintenance work need free space so that the operators can move around without touching other machines. This factor should be considered when selecting the installing position of the machine.

1-1-1 Environment of the Machine

Pay full attention to a room temperature, dust, vibrations, etc. in order to make use of the primary performance of the machine. High accuracy cannot be obtained in the environment where the room temperature greatly changes. Just a slight change of the room temperature partly affects the machine. Be fully careful of effects heat transfer from the direct sunshine, vent, heating unit, and so on.

Under the environment where the air is polluted so much by dust, etc., the sliding sections and electric devices of the machine are greatly effected in their service lives.

Particularly, electronic devices related to controls are susceptible to dust and humidity. Install the machine in the environment as clean as possible.

1. Installation Environment of NC Machine

In case that electric machines and appliances generating high frequency noise are installed or newly erected near by NC machines, keep to the following precautions.

- 1) Example of the electric machines and appliances generating high frequency noise.
 - [1] Arc welding machine
 - [2] Resistance welding machine

[3] High frequency drying machine

[4] Electric discharge machine

[5] Others

2) Installation form of NC machine

[1] Power supply line

The power supply line (AC200V) of NC machine must be separated line with that for electric machines and appliances.

If impossible, connect the line at the point more than 20m apart from the point where the power supply for electric machines and appliances is connected.

[2] Installation place of NC machine

NC machine must be installed more than 20m apart from electric machines and appliances.

[3] Earth of NC machine

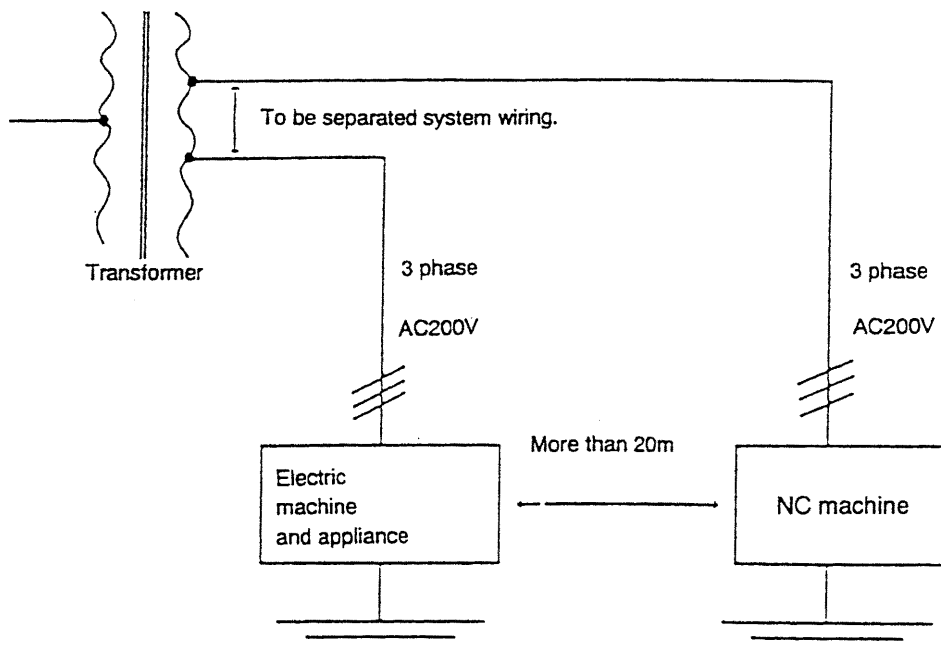
The earth of NC machine must be grounded within 5m from NC machine separating from the ground of electric machines and appliances, and make a ground work with not more than 100Ω or comply with the laws and regulations of the country.

Or the earth wire size must be not less than 8mm^2 .

3) Example of earth of NC machine

The earth state of NC machine and electric machines and appliances illustrated as under.

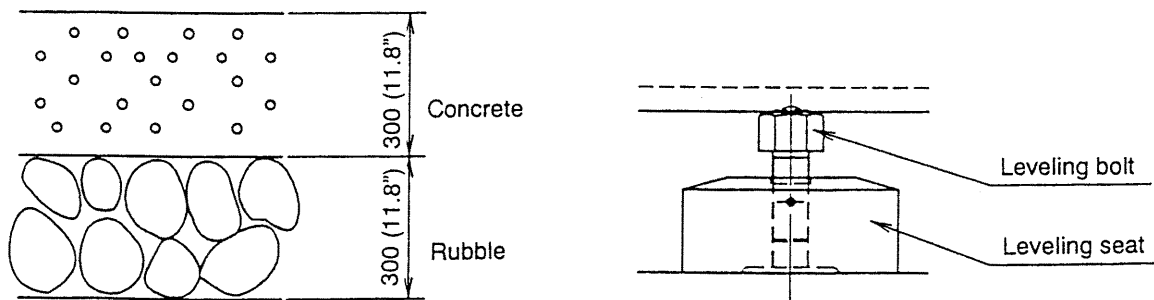
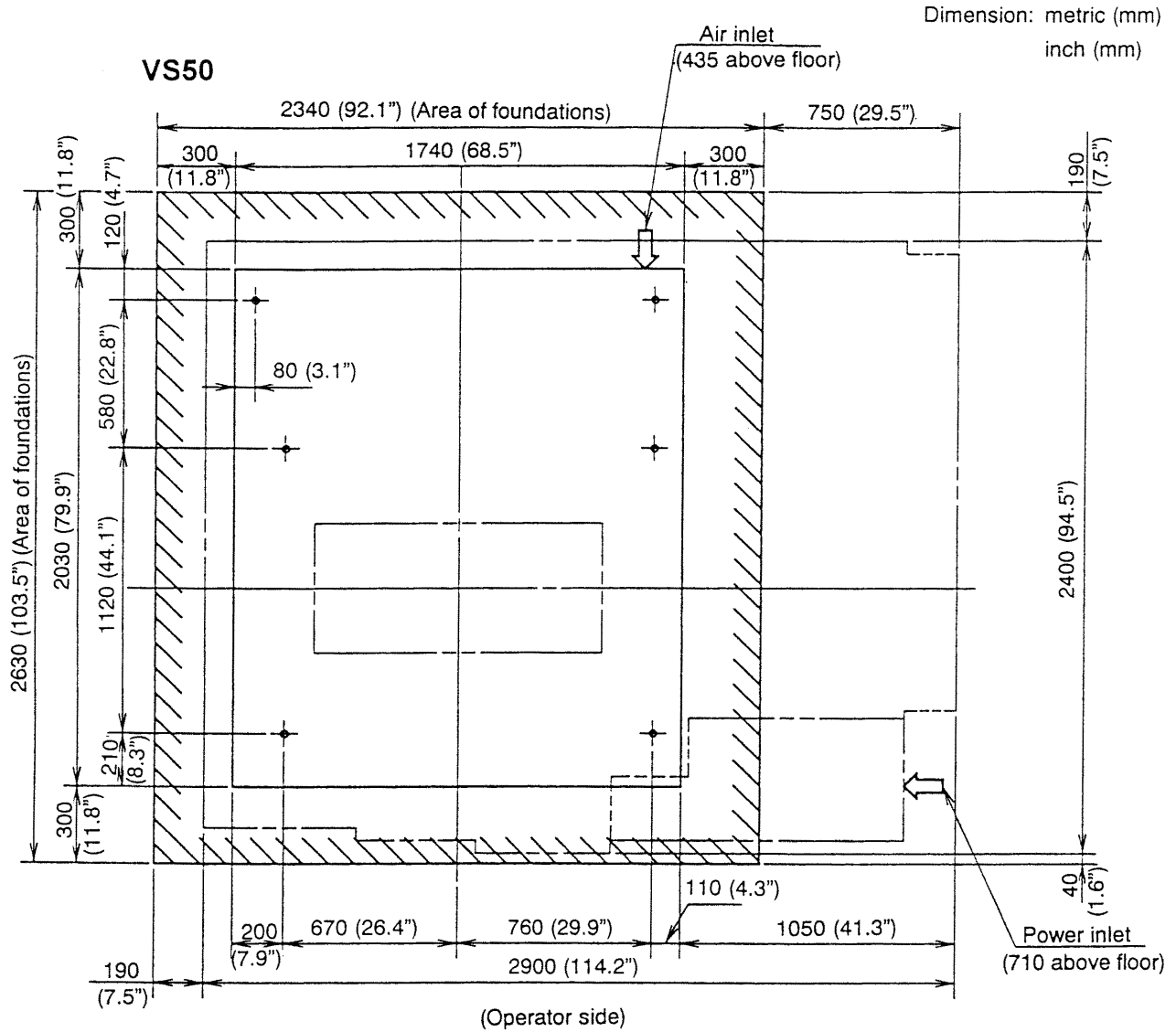
Power receiving equipment



Grounding: Class 3 grounding
work within 5m

[Grounding resistance of 100Ω or
below. Wire size of 8mm^2 or above.]

1-2 Foundation and Layout Drawing

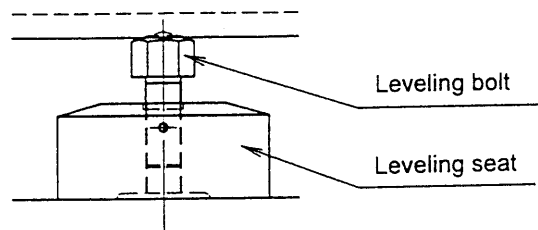
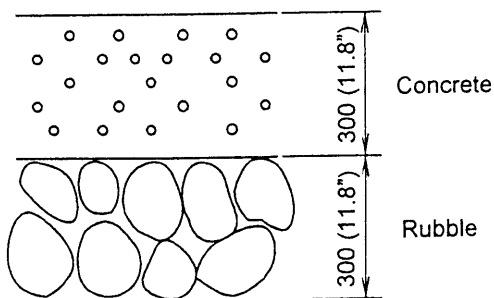
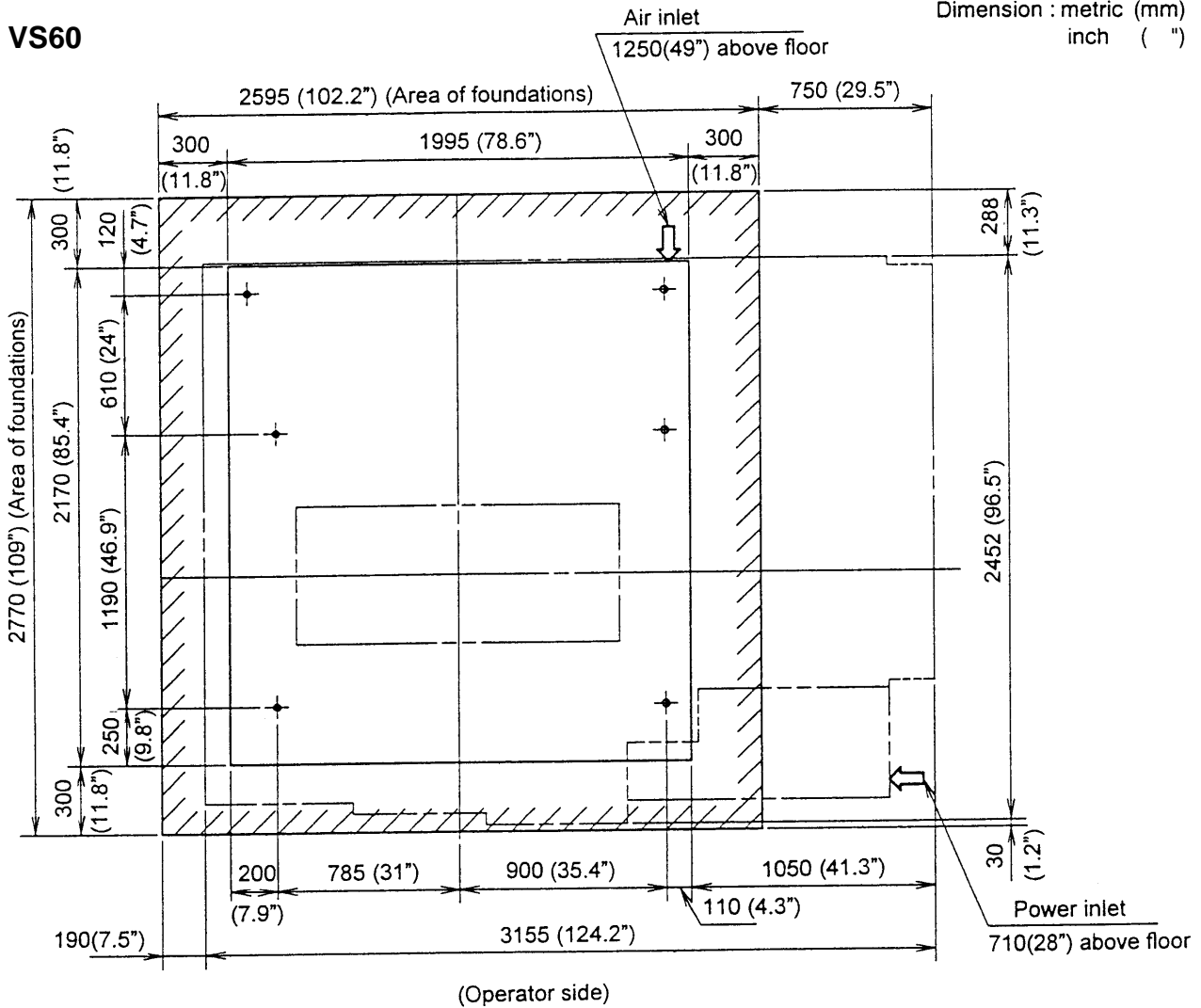


- Note)** 1. Ground bearing force should be 5ton/m² (1000 lbs/ft²) or more. And foundation thickness should be at least 300mm. (12")
2. The area of foundations is to be 300mm (12") or more of the circumference of the machine bed.
3. Install the tremor insulating groove along the outer periphery of the foundation.

Foundation and Layout Drawing

VS60

Dimension : metric (mm)
inch (")



- Note)**
1. Ground bearing force should be 5ton/m² (1000 lbs/ft²) or more. And foundation thickness should be at least 300mm. (12'')
 2. The area of foundations is to be 300mm (12'') or more of the circumference of the machine bed.
 3. Install the tremor insulating groove along the outer periphery of the foundation.

1-3 Transportation of Machine

Since this machine has an integrated structure mechanically and electrically, it can be transported only by detaching its power cord. To fix its moving parts and pass wire ropes around the machine, refer to Fig.1-1.

1-3-1 Precautions for Lifting Work

Pay proper attention to lifting work, because it is one of important steps when transporting the machine.

WARNING

Since the lifting work for machine transportation is carried out with a crane or chain block, its precautions are listed below:

- (1) Use a wire rope whose diameter is 14 mm (0.55 inch) or more.
- (2) Apply a pad to an acute-angle part to protect the wire rope and machine.
- (3) Pass the rope so that the center of gravity of a load will come over the center line of a lifting angle.
- (4) Do not use a rusted wire rope, one which has been untwisted, or one whose core wire is broken.
- (5) Lift the machine gradually. Stop it once when the wire rope become strained, and check a lifting conditions. When the machine is lifted up from the floor, check again that there are no abnormalities with the lifting rope, and proceed with the lifting rope. When lowering the machine, it is necessary to be careful that it is lowered down slowly. Stop lowering the machine immediately before it reaches the floor to check. Then, lower it down completely.

1-3-2 Precautions When Using the Forklift

WARNING

Since the lifting work for machine transportation is carried out with a forklift, its precautions are listed below:

- (1) Select a fork lift which has a sufficient capability to handle and endure a machine weight.
- (2) In order not to damage the outer projected parts of the machine, it is necessary to carry out this work in cooperation with a watchman.
- (3) When inserting the fork under the machine, use the right and left cast grooves provided for fork insertion under the base of the machine proper.
- (4) When lifting the machine, be sure to carry out temporary lifting so that you can lift it with the center of gravity of the machine set at the stablest positions in both longitudinal and crosswise directions.

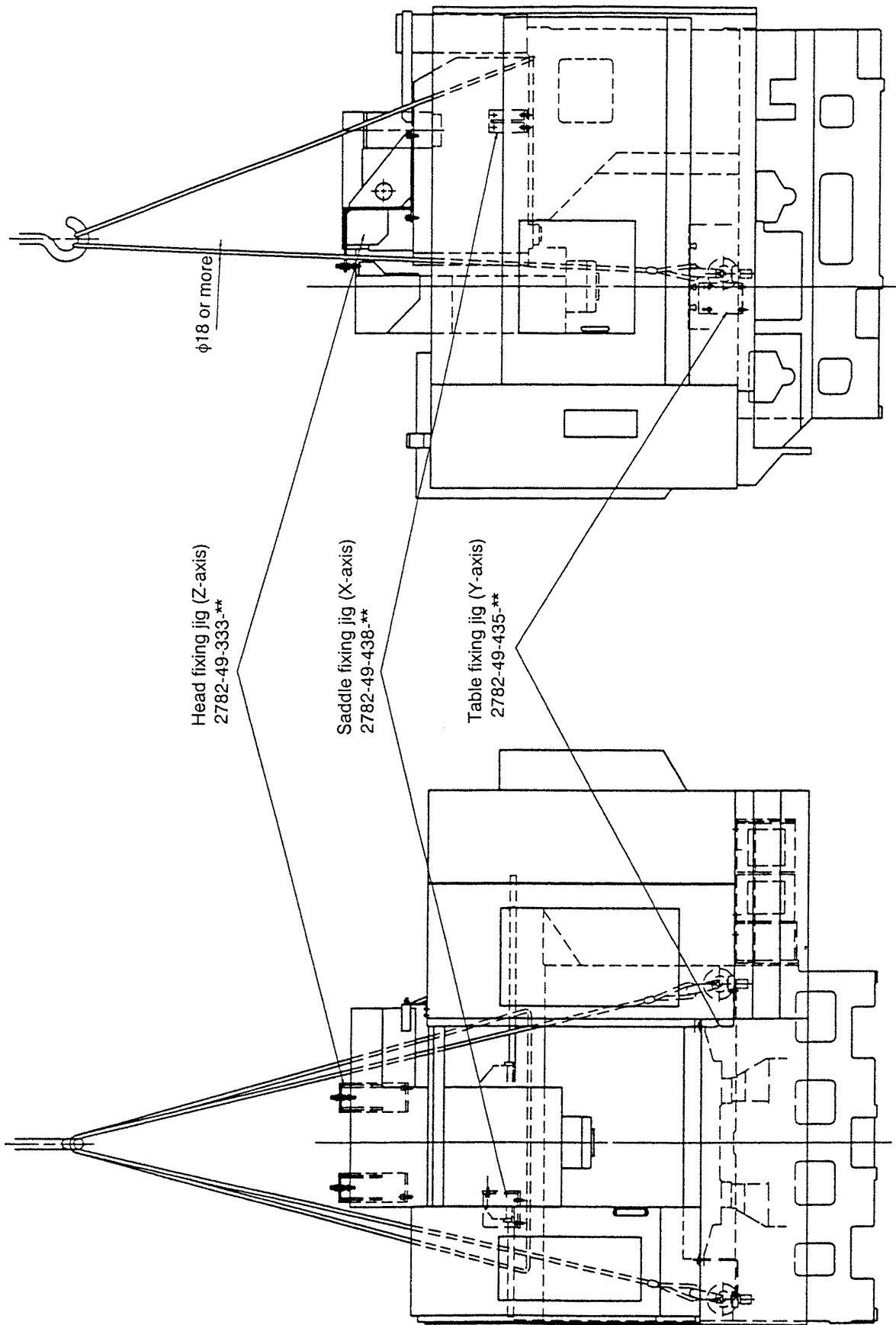


Fig. 1-1 Drawing of transportation

1-4 Electric Wiring

Wires between the machine proper and accessories will be connected by Hitachi Seiki. Wiring from the power supply source to the electric cabinet should be prepared in advance by the customer.

For this purpose, use wires of thickness specified in the following table, depending on the distance from the power supply to the electric cabinet.

Power supply : 200/220V (50/60 Hz) $\pm 10\%$

Source Power Capacity

The electric capacity required for the machine varies depending on the specification of the spindle and the type of option attachments. To calculate the capacity of the machine being installed, add the capacity of option specification on to that of the standard machine.

Machine Electric Capacity = Standard Machine Electric Capacity
+ Total Electric Capacity of Option Attachments

Power Capacity of Standard Machine

Spindle Specification	Power Capacity
4500 min ⁻¹	25 kVA
10000 min ⁻¹	40 kVA
12000 min ⁻¹ Standard	18 kVA
12000 min ⁻¹ High output	36 kVA
20000 min ⁻¹	31 kVA

Option Attachment requiring Additional Power Capacity

Option Attachment	Additional Power Capacity
Oilhole Coolant 0.5MPA	1.3 kVA
Oilhole Coolant 1.5MPA	1.4 kVA
Oilhole Coolant 7.0MPA	3.7 kVA
Through Coolant 0.5MPA	1.3 kVA
Through Coolant 1.5MPA	1.4 kVA
Through Coolant 7.0MPA	3.7 kVA
Jet Coolant	1.0 kVA
Gun Coolant	0.4 kVA
Mist Collector	1.1 kVA
Hydraulic Power Source	1.3 kVA

Thickness of Wire

The source power wire thickness varies depending on the specification of the spindle. Use the wire of the following thickness to meet the specification.

Spindle Specification	Source Power Wire Minimum Thickness	Grounding Wire Minimum Thickness
4500 min ⁻¹	38 mm ²	8 mm ²
10000 min ⁻¹	60 mm ²	8 mm ²
12000 min ⁻¹ Standard	22 mm ²	8 mm ²
12000 min ⁻¹ High output	50 mm ²	8 mm ²
20000 min ⁻¹	50 mm ²	8 mm ²

- * The thicknesses of the source power wire in the above table are calculated on the assumption that three 600V vinyl coated wires are set in a conduit pipe at the ambient temperature is 30°C.

1-5 Air Supply

This machine uses clean air to clean the spindle hole and the tool, for Z axis sliding face and automatic door, or for oil mist unit. The air supply should be prepared by the customer.

Its joint of the machine is of PT1/4, female.

Air pressure : 0.5MPa {5 kgf/cm²} (72 PSI) or more

Flow : 100 • /min. (ANR) (Standard Specification)

*It is recommended to install an air tank having a capacity of 40• or larger, as there are cases when supply of a large volume of air is needed instantaneously.

The machine proper is provided with an air filter and regulator to remove dust and supersaturated moisture from air. When the temperature of the air from the air supply is higher than that of the machine proper, air gets cooled at the machine proper and tends to form water drops.

Jetting air containing water is prone to cause rust on the spindle hole and tool shank, which may affect machining accuracy and cutting surfaces. Therefore, the temperature of the air from the air supply should below. (Water and dust accumulating in the air filter is automatically drained. To manually drain them, see the descriptions on mechanical drain operation.) In case there is a large difference in temperature, install an air drier between the air supply and the machine.

Flow rete

The flow rate to be set varies depending on the option specification. Therefore, the flow rate applicable to the actual machine should be determined by the flow rate for the standard specification machine added by the total required flow rate for the option specification.

Flow rate for the machine = Standard flow rate + flow rate for option specification

Standard specification

Machine specification	Flow rate
#40-12000min ⁻¹	100 ℓ/min (ANR)

Additional flow rate required by optional specifications

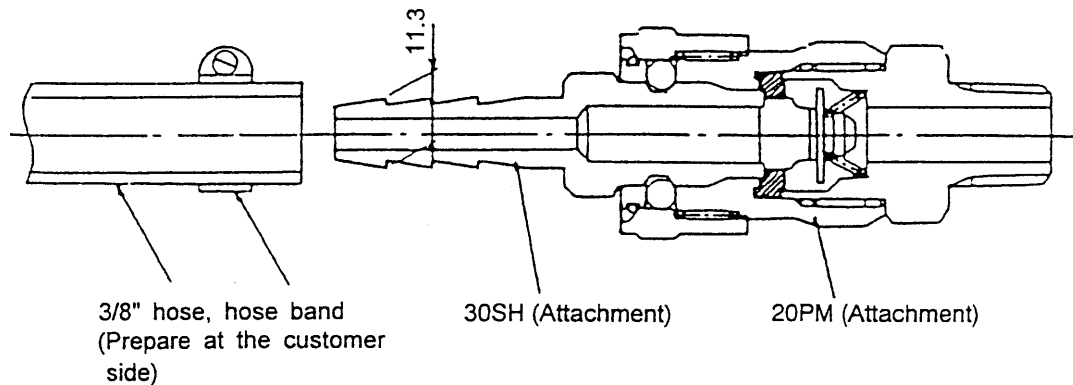
Optional specification	Flow rate
Tool nose air blow	300 ℓ /min (ANR)
Center-through air blow	300 ℓ /min (ANR)
Pulscale X, Y	60 ℓ /min (ANR)
Oil mist/Needle 1 shot	60 ℓ /min (ANR)
Semi-dry processing unit	300 ℓ /min (ANR)

In case with APC (essential)

Air pressure: 0.5MPa (5kg/cm²) or higher

Flow rate: 100 ℓ/min (ANR)

Air tank capacity: 40ℓ or larger



1-6 Oil Supply

When adding lubricating oil, take care of the following:

1. Add the specified amount of the designated oil. Do not use different oils, and do not add too much of oil.
2. Clean the oil supply port in advance. See that dust, etc. do not enter.
3. When adding oil, set a filter on the oil supply port, so that dust and other foreign substance will not enter. In case a filter is not available, use a wire netting of 150 mesh or more.
4. Always use new oil. Do not use a mixture of new and old oil.
5. Even when using new oil, do not use all the oil from the can. Always leave some oil in the can. This is necessary to avoid sediments in the can being used.

For the oil supply positions, intervals, oil amount and quality, see "5-2 Lubrication and Oil

Supply”.

1-7 Mounting Procedure

(1) Dismounting fixtures for shipment and transportation

Upon installing the machine at a fixed place, be sure to dismount the fixtures for shipment/transportations .

- Remove the fixed plate for the table, column and head.

(2) Installation

A leveling method is one of the factors which determine machine accuracy. Proper leveling of the machine is most fundamental.

Carry it out carefully, because it affects not only machining accuracy, but also machine's service life.

First, put leveling pads at installation points on the floor.

Install the machine so that the leveling adjust bolts attached to the machine legs will be placed on them.

Use precision levels whose sensitivity per graduation is' about 0.02 mm/m (0.00025 in./ft.) and length is about 200 mm (8 in.).

Levels used for woodworking/engineering are not recommendable.

Place the levels with the same end in the same direction.

Keep level-placing surfaces clean at any time lest dust, etc. should be caught under the levels.

Outline of Installation Work

[1] Confirming a foam in a level

Adjust so that a foam does not get too long and set it at the center on the table. By turning it by 180°, while holding the position, and observing a foam in memory of the same direction, level has been obtained.

[2] Adjusting the absolute level

As shown in Fig.5-5, place levels on the table in parallel with the X and Y directions, and measure the level of the machine at 3 places in the X and Y directions, respectively.

Adjust the level of the machine with the leveling bolts so that each difference in reading of the levels may be settled within 0.04 mm/m (0.0005 in./ft.) in both X and Y directions.

[3] Adjusting the table operating level

Place the levels at the center of the table and move the X axis almost over its full stroke. Make adjustment in such a way that each difference in reading of the levels at this time will meet within the following target values:

- For the level put in the X-axis direction: 0.02 mm/m (0.00025 in./ft.)
- For the level put in the Y-axis direction: 0.04 mm/m (0.0005 in./ft.)

[4] Reconfirm the above-mentioned steps [1] through [3] and make fine adjustment, if necessary.

[5] When the stable operating levels in [3] cannot be obtained, it is likely that the condition of the floor, where the machine is installed, is improper. Check and improve it, referring to the foundation drawing.

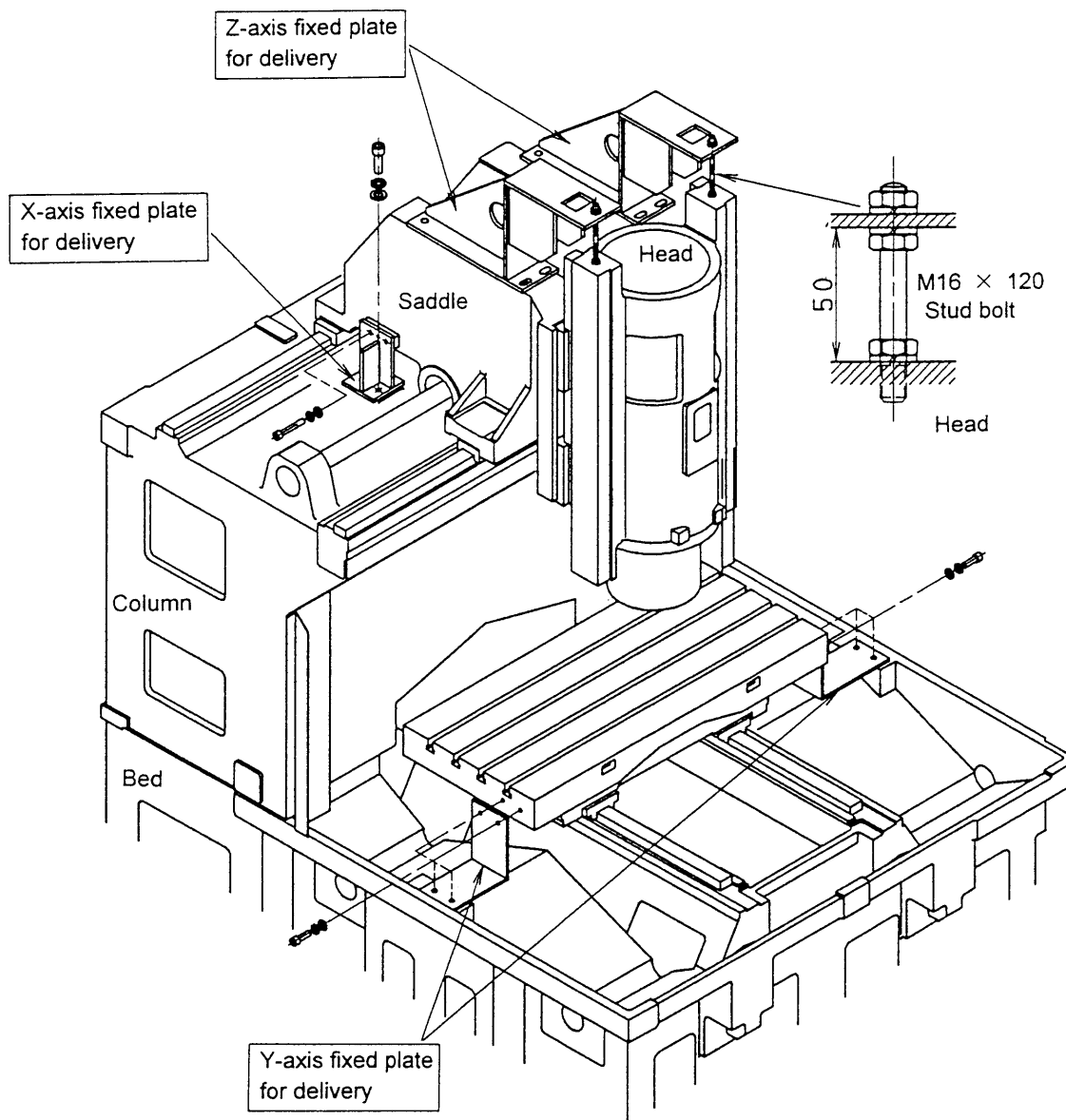


Fig.1-2

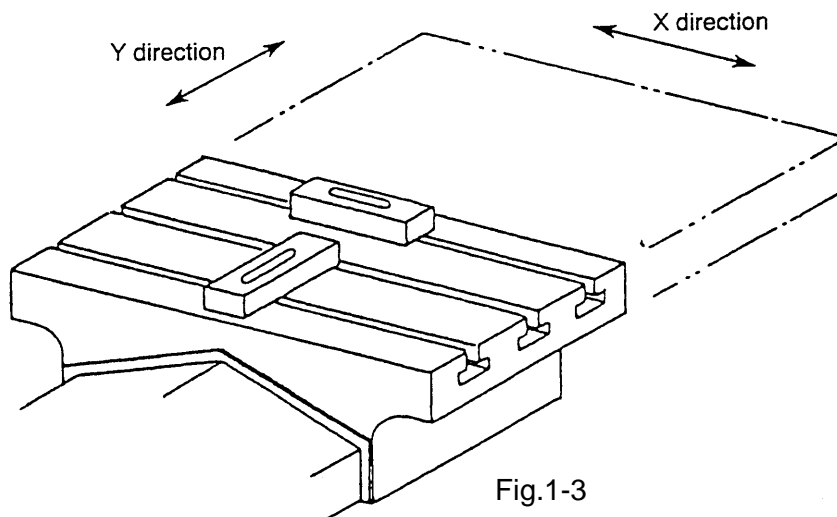
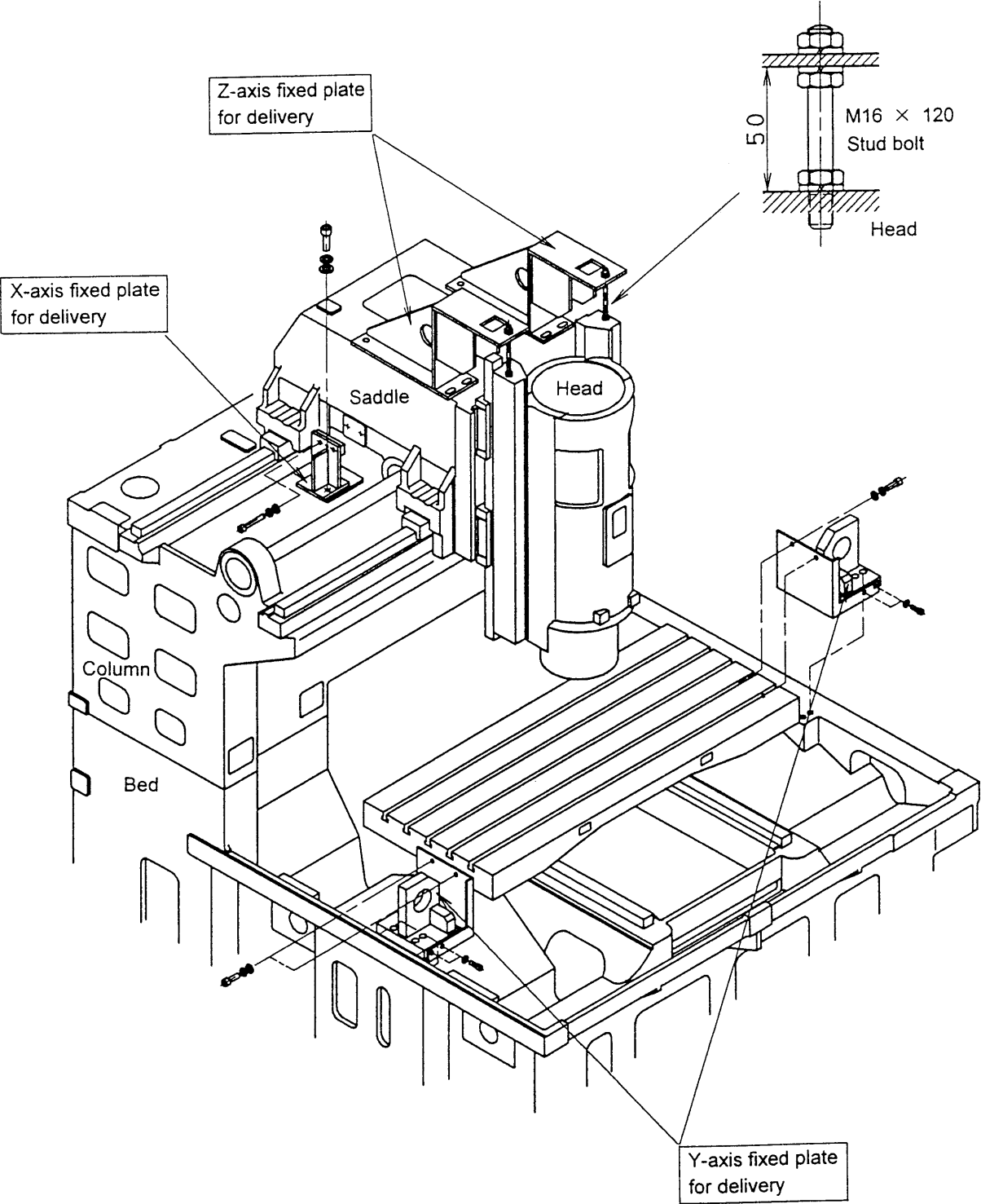


Fig.1-3



2. INSPECTION AND MAINTENANCE

2-1 Daily Check and Periodic Check Items

2-1-1 Daily Checking Items

The following are maintenance items to be checked by operators. These maintenance items are important to prevent machine trouble and to perform efficient operation. Perform maintenance according to the following daily check list.

Daily check list

	Checking part	Check item	Details of checks
1.	Main cooling unit	a) Check main cooling unit for operation.	⇒ Check for sound of fan running
		b) Check cooling unit for sufficient quantity of oil. (Checks before starting work)	⇒ Oil level check
		c) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		d) Check for oil leakage.	⇒ Check for oil leakage
2.	Pneumatic unit	a) Check for normal set pressure.	⇒ Normal value: 5 kgf/cm ²
		b) Check pneumatic unit for faults such as air leakage.	⇒ Check for air leakage
3.	Coolant unit	a) Check coolant unit and piping for faults.	⇒ Checks for coolant leakage and abnormal noise
		b) Check coolant unit for sufficient quantity of coolant.	⇒ Oil level check
		c) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		d) Check for discharge.	⇒ Visual check
		e) Check for oil leakage.	⇒ Check for oil leakage
4.	Operation panel and control panel	a) Check that alarm is not displayed on the screen. (Battery alarm, etc.)	⇒ Visually check it to determine the cause for corrective action.
		b) Check that cooling fan is running.	⇒ Visually check it to determine the cause for corrective action.
5.	Spindle head	a) Check that running-in performed.	⇒ Run in the spindle according to "Spindle warm-up" section of the operation manual.
		b) Check for abnormal noise. (M/C, NCL)	⇒ Check for abnormal noise during spindle running
		c) Check spindle gear lubricating float. (TG) (Checks before starting work)	⇒ Check that spindle head ascends when spindle runs and that it descends when spindle comes to a stop.
		d) Check that spindle tapered portion is cleaned. (M/C)	⇒ Check for removal of dust, fouling and foreign matter such as chips
		e) Check spindle for start, stop and faults. (NCL, spindle)	⇒ Check that spindle start and stop do not spend time too much.
6.	ATC magazine	a) Check that tool pots and tapered portion are cleaned.	⇒ Check for removal of dust, fouling and foreign matter such as chips
		b) Check that ATC grip portion is cleaned.	⇒ Check for removal of dust, fouling and foreign matter such as chips
		c) Check pull stud for tool for looseness.	⇒ Check pull stud for tightness when changing tools.

	Checking part	Check item	Details of checks
7.	Table unit	a) Check that telescopic cover is cleaned.	⇒ Check for removal of foreign matter including chips and chips on wiper portion
		b) Check the quantity of table indexing gear lubricating oil.	⇒ Oil level check
8.	Feed unit	a) Check for abnormal noise.	⇒ Check for abnormal noise when operating feed unit
9.	Covers	a) Check that covers are not detached.	⇒ Check that covers are not detached. If any cover is detached, attach it.
		b) Check that window is cleaned.	⇒ Check for cleaning
		c) Check that nameplate and caution plate are cleaned.	⇒ Check for cleaning
10.	Interlocking device	a) Check door interlocking function.	⇒ Check that spindle does not run when opening door.
11.	Hydraulic unit (Option)	a) Check for normal set pressure.	⇒ Normal value: 35 kgf/cm ² , 45 kgf/cm ² and 70 kgf/cm ² (It depends on the model.)
		b) Check hydraulic unit for faults.	⇒ Checks for abnormal noise and oil leakage.
		c) Check hydraulic unit for sufficient quantity of oil.	⇒ Oil level check
		d) Check that oil temperature is 60°C or less.	⇒ Oil temperature check: Proper temperature is 60°C or less.
		e) Check for oil leakage.	⇒ Check for oil leakage
12.	Lubricating unit (When equipped with a high-speed spindle.)	a) Check for proper consumption.	⇒ 1 liter/10 hours as a guide
		b) Check lubricating unit for sufficient quantity of oil.	⇒ Oil level check
		c) Check that air filter is cleaned.	⇒ Checks for clogging and cleaning.
		d) Check for oil leakage.	⇒ Check for oil leakage (Shorten checking intervals depending on working environment.)
13.	High-pressure coolant (Option)	a) Check high-pressure unit and piping for faults.	⇒ Checks for coolant leakage, abnormal noise and abnormal vibration.
		b) Check for discharge.	⇒ Visual check
		c) Check pump for discharge pressure. (Pressure gage)	⇒ Normal value: 35 kgf/cm ² or 70 kgf/cm ² (It depends on the specifications.)
		d) Check that air filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		e) Check high-pressure pump for sufficient quantity of oil.	⇒ Oil level (cap oil filling) check and replenishment
		f) Check for high-pressure pump oil fouling.	⇒ Checks for oil degradation and oil color
		g) Check for sufficient quantity of coolant.	⇒ Check through main tank

	Checking part	Check item	Details of checks
14.	APC (Option)	a) Check that pallet seating surface is cleaned.	⇒ Check for removal of foreign matter including chips
		b) Check that pallets and cover portion are cleaned.	⇒ Check for removal of foreign matter including chips
15.	Chip conveyor (Option)	a) Check for obstructions on the conveyor.	⇒ Check for removal of obstructions such as workpiece, tool and square bar
		b) Check the quantity of chips in the chip box and that of coolant.	⇒ Check the quantity of chips and that of coolant, and dispose of them as necessary.
		c) Check that a large quantity of chips collect on the chip conveyor. (Inclusive of screw conveyor)	⇒ Prevent a large quantity of chips from collecting on the conveyor. Check that conveyor operates to discharge chips.
		d) Check for abnormal noise.	⇒ Check for abnormal noise when operating chip conveyor
16.	Mist collector (Option)	a) Check that mist does not remain in the hose.	⇒ Visual check Provide angular hose route.
		b) Check that filter is thoroughly cleaned.	⇒ Checks for clogging and cleaning
		c) Check that oil is properly drained.	⇒ Visual check for proper oil drainage
		d) Check mist for leakage.	⇒ Visual check

2-1-2 Periodic Check Items

Periodic checks by maintenance personnel are essential for assuring continued machine accuracy. Perform maintenance at regular intervals according to the following periodic check list.

Periodic check list

	Checking part	Check item	Checking interval				Details of checks
			1	3	6	12	
1.	Main cooling unit	a) Check piping for faults.			O		⇒Check for oil leakage, and tighten connector securely if necessary.
		b) Change hydraulic fluid.			O		⇒Clean the inside of tank and strainer, and change hydraulic fluid as necessary.
2.	Pneumatic unit	a) Check piping for faults.			O		⇒Check for oil leakage, and tighten connector securely if necessary.
		b) Check that filter is thoroughly cleaned.			O		⇒Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
3.	Coolant unit	a) Check for conspicuously dirty coolant unit.	O				⇒Refer to Coolant section in the instruction manual. (NCL)
		b) Check for foul smell.	O				
		c) Check piping for faults.			O		⇒Check for oil leakage, and tighten connector securely if necessary.
4.	Operation panel and control panel	a) Check for conspicuously dirty operation panel and control panel. (Cleaning)			O		⇒Visual check and cleaning
		b) Check for foreign matter in the control panel.			O		⇒Removal of foreign matter
		c) Check that air filter is thoroughly cleaned.			O		⇒Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
		d) Check that cooling fan is cleaned.	O				⇒Check for dirty cooling fan
		e) Check power supply and voltage.			O		⇒Check that secondary voltage of main breaker is set within + - 10% of the specified value.
5.	Table unit	a) Check bolts on the telescopic cover for looseness.		O			⇒Check bolts for tightness, and tighten them if necessary.
6.	Feed unit	a) Check ball screw and guide for lubrication (oil and grease).			O		⇒Visually check oil film.

	Checking part	Check item	Checking interval				Details of checks
			1	3	6	12	
7.	Belt, Timing belt (Z axes,)	a) Check belt for deflection.			O		⇒ Check deflection amount with tension meter. (Normal value: 8mm 5.7/kg)
		b) Check surface for damage and heights for deterioration.			O		⇒ Visual checks and degreasing
8.	Level	a) Check the level of bed and table with level vial.		O			⇒ Level check and adjustment with level vial
9.	LS and SOL	a) Check that LS and SOL are not moistened with oil.		O			⇒ Determine the cause to take corrective action.
		b) Check for oil fouling.		O			⇒ Cleaning
10.	Cover	a) Check mounting bolts for looseness.		O			⇒ Check cover clamping bolts for tightness, and tighten securely if necessary.
11.	Wiper and brush	a) Check wiper and brush for deterioration and damage.		O			⇒ Visual checks
		b) Check for jamming of chips and foreign matter.		O			⇒ Visual checks
12.	Interlocking device	a) Check spindle speed limiting interlocking function.			O		⇒ Check spindle speed limiting interlocking set value (parameter) when using special chuck and jig.
13.	Cable	a) Check for damaged appearance (tears, crushes, stripped conductor, etc.).	O				⇒ Visual checks Replace if there is something wrong.
		b) Check connector for looseness.	O				⇒ Visual check Tighten securely if necessary.
		c) Check for caught cable.	O				⇒ Visual check. Return to normal. Appearance check. Replace if there is something wrong.
		d) Check that cable is not moistened.	O				⇒ Visual check and cleaning. Determine the cause.
14.	OT (Over-travel)	a) Check LS for actuation.	O				⇒ Operate the machine to check function.
15.	Earth leakage breaker	a) Check breaker for operation.		O			⇒ Press test button to check breaker for operation.

	Checking part	Check item	Checking interval				Details of checks
			1	3	6	12	
16.	ATC cam unit	a) Check for proper quantity of oil.				O	⇒ Check oil level gage of cam unit. Supply oil when insufficient.
17.	Hydraulic unit (Option)	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Change hydraulic fluid.			O		⇒ Clean the inside of tank and strainer, and change hydraulic fluid as necessary.
		c) Check that strainer is thoroughly cleaned.			O		⇒ Checks for clogging and cleaning (Shorten checking intervals depending on working environment.)
		d) Check oil for discoloration (fouling).			O		⇒ Check oil color with oil gage. When color is getting brown, change oil.
18.	Lubricating unit (When equipped with a high-speed spindle.)	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Change hydraulic fluid.			O		⇒ Clean the inside of tank and strainer, and change hydraulic fluid as necessary.
		c) Check that strainer is thoroughly cleaned.				O	⇒ Checks for clogging and cleaning
19.	High-pressure coolant (Option)	a) Check piping for faults.			O		⇒ Check for oil leakage, and tighten connector securely if necessary.
		b) Check that filter is thoroughly cleaned.	O				⇒ Checks for clogging and cleaning
		c) Check high-pressure pump for sufficient quantity of oil.	O				⇒ Oil level (cap oil filling) check and replenishment
		d) Check for high-pressure pump oil fouling.	O				⇒ Checks for oil degradation and oil color
		e) Check high-pressure pump suction and discharge valves for damage or wear.				O	⇒ Replace if damage or wear is found.
		f) Check for damaged or dirty high-pressure pump diaphragm.				O	⇒ Replace or clean if necessary.

	Checking part	Check item	Checking interval				Details of checks
			1	3	6	12	
19.	High-pressure coolant (Option)	g) Check gas charging pressure of accumulator.				O	⇒ Recharge if charging pressure is dropped. (Charging pressure: 50 K)
20.	Chip conveyor (Option)	a) Check that chip conveyor is oiled.			O		⇒ Apply grease to sprocket area as necessary.

2-2 Lubrication, Oil Supply and Coolant

When supplying oil, be fully aware of the following:

1. Supply specified oil by specified amount. Do not supply a different type of oil or over the specified amount.

Otherwise, the machine may malfunction.

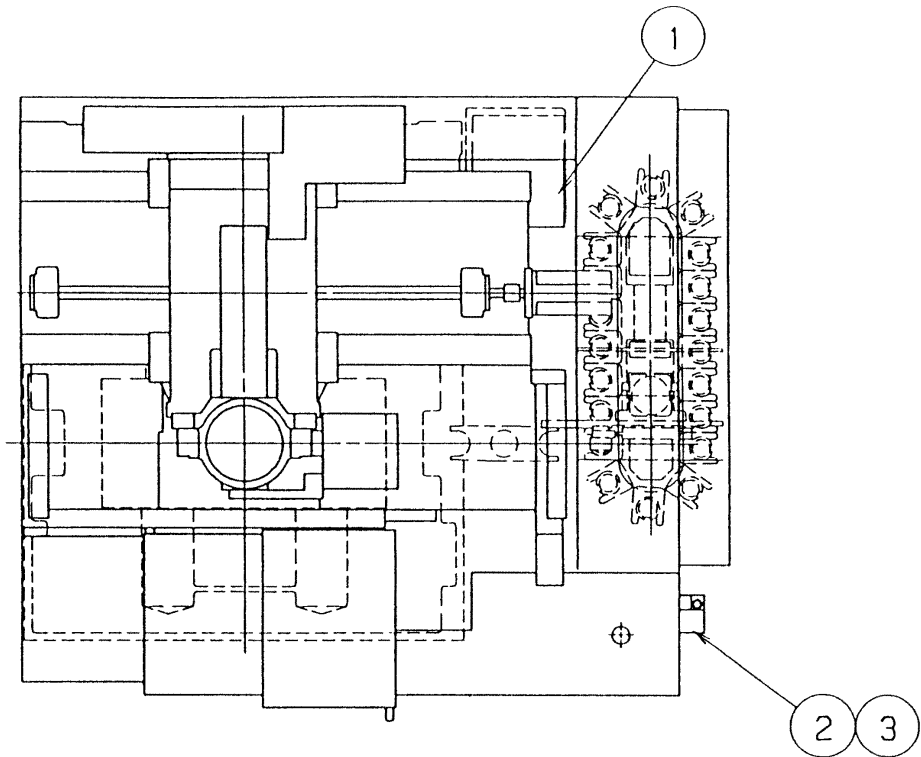
2. Clean an oil inlet port in advance lest dust, etc. should enter inside.
3. When supplying the oil, use a filter to prevent foreign substances from entering inside the tank.

When the filter is not available, use a wire net of 150 mesh or more.

4. Whenever you supply the oil, use new one. Do not mix with reproduced or old oil.
5. Even when opening a new oil can, do not use all oil in it, but leave some unused. This is necessary to eliminate moisture and deposits.

See the lubrication chart for lubricating points, lubrication frequency, oil quantity and oil types.

2-2-1 List of Lubrication and Oil Supply



	Sopt to be lubricated	Lubricating method	Lubricating period	Oil quantity	Nisseki	Idemitsu Kosan	Shell	Mobile	Mitsubishi Oil	ESSO	ISO symbol
1	Spindle cooling	Trochoid pump	Replace every 6 months; add when necessary	17•	Super Mulpus 10	Daphne Super Multi Oil 10	Tetra Oil 10SP	Mobile Velocity Oil No.3	Diamond Lub RO10 (N)	Unipower MP10	FC10
2	Lub. oil tank (Spindle oil air) #50 - 10,000	Gear pump	As necessary	2•	Super Mulpus 32	Daphne Super Multi Oil 32	Tetra Oil 32	Mobile DTE Oil Light	Diamond Tetrad 32	Unipower MP32	FC32
3	Lub. oil tank (Spindle oil air) #40 - 20,000	Gear pump	As necessary	2•	Super Mulpus 22	Daphne Super Multi Oil 22	Tetra Oil 22	Mobile Velocity Oil No.10	Diamond Tetrad 22	Unipower MP22	FC22
4	ATC cam unit		Every exchange the cam unit		Bonnock M68						

2-2-2 Handling of Coolant Unit

1) Maintenance of coolant tank with flat and scraper conveyor

Checking, cleaning and maintenance of coolant tank and accessories are as follows.

a) About cleaning of filters and replacement of elements

Refer to the section 2-10 "Related to Coolant".

In case of the trochoid pump or high pressure pump for oil hole or through coolant are provided optionally, replacement of element is required when a division of indicator or suction filter changes from blue to yellow or red.

b) About cleaning inside of coolant tank

Cleaning of coolant tank once every six months as standard is required since chips accumulate at the bottom of coolant tank.

Coolant

1) How to control coolant fluid

The consistency of coolant fluid is changed depending upon the quality of water used, mixture of chips or foreign substances and evaporation of moisture. And unless the maintenance of the coolant fluid is made for a long time, germs may be generated, that causes to break the filters, the piping and the pump. Check the density of the fluid, and pH timely, replace the coolant fluid, and also clean the inside of the coolant tank in consideration of using conditions.

Since contaminated muddy clods may be generated when a different kind of coolant fluid is mixed up, remove completely the previous fluid through flushing the piping, the tank and the equipment sufficiently, when changing the coolant fluid.

•Items to be checked periodically

It is advised to check the following items periodically.

1. Liquid color check

Observe the color eyes.

When the color is changed to brown, it is presumed that rust may generate. In case of FC and FCD, chips happen to become brown. When the coolant fluid becomes block, it is presumed that it has been corroded. When the fluid becomes block and gives out a putrid smell on Monday morning or after a long period of holidays, the color of the fluid may happen to return to the original color in the afternoon. It is phenomena that the fluid changed through extinction of bacteria (anaerobic germs) by touching the fluid with air.

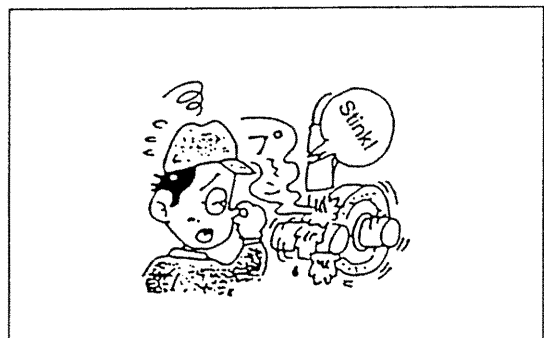
When it is not returned, it is required to replace the fluid, since the fluid is too putrid. In this case, replace all the coolant fluid and make flushing sufficiently. The remaining bacteria will cause to repeat the putrid consequently.

2. Check of the putrid smell

Special care must be taken to smell.

When the fluid is filled with putrid smell, the ingredient of the cutting fluid be destroyed by breeding of bacteria or eaten by bacteria as nutritive substance, that causes the change of its density, lowering of pH and outbreak of rust.

When the putrid smell is not faded away even after half a day in the status of operation, it is required to replace the coolant fluid.



3. Check of the filthiness of the fluid

Observe the filthiness of the fluid by eyes.

The filthiness of the fluid has influence on the machining accuracy, the dirt of the machined work and the dirt of the machine.

And the dirt of the machine makes hard to observe the state of machining from the outside.

4. Check of the quantity

Check the level of the rank periodically.

Shortage of the fluid quantity causes to form bubbles or to disable the fluid to supply sufficiently to the machining point.

And also it will hasten the progress of the putrefaction.

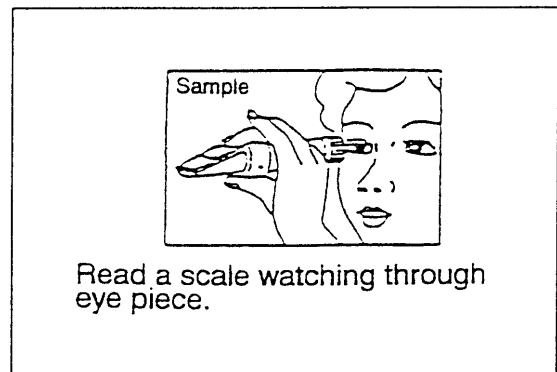
5. Control of the density

It is the most important procedure to control the density of the fluid when soluble cutting oil is used.

It is the best way to measure the density by a refractometer.

If not available, it is possible to control to some extent the density of the fluid by calculating precisely the magnification at the time of dilution and also by calculating the magnification without fail when pouring some more fluid.

It is the most desirable method to check periodically the density by a density-meter, since there are various factors such as change of the ingredients by bacteria, decrease by taking out with the workpieces or vaporization of the fluid. When the density of the cutting fluid is low, serious problems such as bad smell by putrefaction, lowering on the pH and rust promotion will occur. Generally the density of the cutting fluid is within the extent of 20 times through 30 times, but it will be different depending on the kind of cutting fluid. Comply with the maker's recommending value. Since it becomes impossible to measure the fluid when lots of rust preventive oil or lubrication oil is mixed.



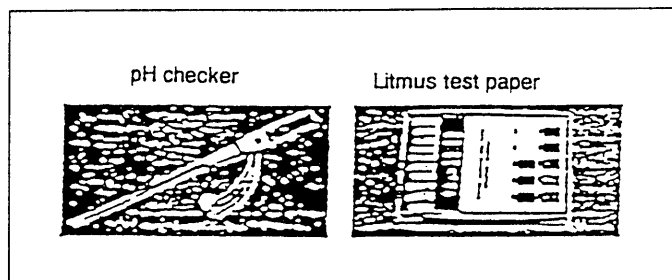
6. Control of the pH

Measure the pH by using either a litmus test paper or a simple pH measuring instrument.

When the pH value of the fluid is 7, the fluid is neutral. When the value is larger than 7, the fluid is alkaline and when it is smaller than 7, the fluid is acidic.

Generally pH8.5 through 9.5 is an ideal value. When the value becomes larger than this, alkaline becomes stronger, that causes the chapping of the skin of the hands.

When it becomes smaller, the fluid is acidulate, that causes hastening of rust. Especially when the pH value of the fluid becomes less than 8, care must be taken since rust is hastened rapidly. In this case, replace the fluid.



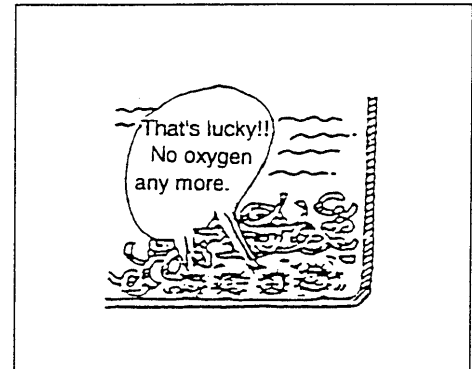
7. Check of the stagnant sludge

Check whether chips and/or sludge stagnate in the tank and the piping.

Remove chips and/or sludge from the tank and the piping by flushing as occasion calls.

And mixture of rust preventive oil and lubrication oil may become the nutritive elements, and the surface of the tank is covered with them, that causes the breeding of anaerobic germs. Remove the adulterated oil periodically.

It is recommendable to employ an eliminator such as skimmer.



2) Control of the waste oil

"Water Pollution Control Law" and "Sewage Water Law" are adapted to the waste oil of cutting fluid.

The substances more than 10 items of ingredients contained in the cutting fluid are designated as organic substance, and they become the object of regulation items. Therefore, appropriate disposition such as disposal by the waste oil disposing system in the factory or taking-over by the waste oil treating trader is required.

The cost for waste oil disposal at the time of replacement of the fluid is directly related to the life of fluid, and 50% of cost-down can be attained by replacing the fluid once a year instead of twice a year.

Accordingly, conclusive control of the using fluid will mean development as a whole.

3) Types and selection of water-soluble cutting agents

Though there are various purposes of cutting agents, the following two points are the most important basically.

Lubrication: The cutting agents reduces friction, prevents generation of heat, and smoothens (Deposition-resistant property).

Cooling: The cutting agent cools generated heat.

In addition to the above-mentioned matters, enviroment- and safety-related metters such as washing property and swarf disposal must be taken into enough consideration. Water-soluble cutting agents are divided into an emulsion type, soluble type, and chemical solution type. Their characteristics are shown in the following table. Do not use the chemical solution type in particular, because it causes detachment of coating and affects seal materials and resin materials adversely.

Type	Emulsion Type	Soluble Type	Chemical Solution Type
Characteristics	<ul style="list-style-type: none"> * This type has been used widely in the cutting field, because it is relatively large in particle diameter (4 to 7 μm) and high in lubricating property. * It is the soluble cutting agent that was made first. * It decomposes easily due to lack of stability. 	<ul style="list-style-type: none"> * This type is excellent in permeability because it is small in particle diameter (0.1 to 0.03 μm). * It has been used mainly for grinding purposes, but it is used also for cutting purposes due to the development of the extreme pressure agent. * Since it uses much surface-active agent, it is likely to affect coating adversely. 	Do not use this type.
Form	<ul style="list-style-type: none"> * Dissolving this in water, it becomes milky. This is because particles dissolved in water are large, reflecting light. 	<ul style="list-style-type: none"> * Dissolving this in water, it becomes semi-transparent. This is because particles dissolved in water are very fine, passing light. 	

2-3 When the Call Light (Yellow Warning Lamp) is Lit Up

1. When the machine is stopped (suspended) by a program stop code (M00, M01, M02, M03, etc.) while executing the program.
2. When the ALARM lamp (red) on the operation panel is lit up: When the ALARM lamp is lit up, the machine comes "standstill" indicating that a trouble occurred.

2-3-1 Kinds of Alarms and Study and Measure of Causes of Obstacles

- (1) Alarms related to the NC cabinet (NC alarm)

"ALARM No." and "ALARM MESSAGE" are displayed on the CRT. Determine the cause of the alarm according to the alarm list, and troubleshoot.

- (2) Alarm related to the equipment of the machine side and the PC control (machine alarm).

Alarm message of No.1000 downward is displayed.

Search for the cause of the troubles outputting the alarm relay number, using the ladder diagram display, and remove the obstacles for restoration.

2-3-2 Replacing Method of Battery

There are two separate battery settings with the machine, namely (1) battery for NC unit and (2) battery for magazine servomotor encoder.

(1) Battery for NC Memory Back Up

NC unit has a battery mounted for keeping the memories regarding programs, offset amounts, parameters and so forth. When the level of the battery voltage gets low down, a warning message "794 Battery Low" is displayed on the screen. In case of the warning, replace the battery without delay.

Caution

Since the life of battery is about one year, replace it once a year periodically even if above alarm is not occurred.

Battery Replacing Procedures

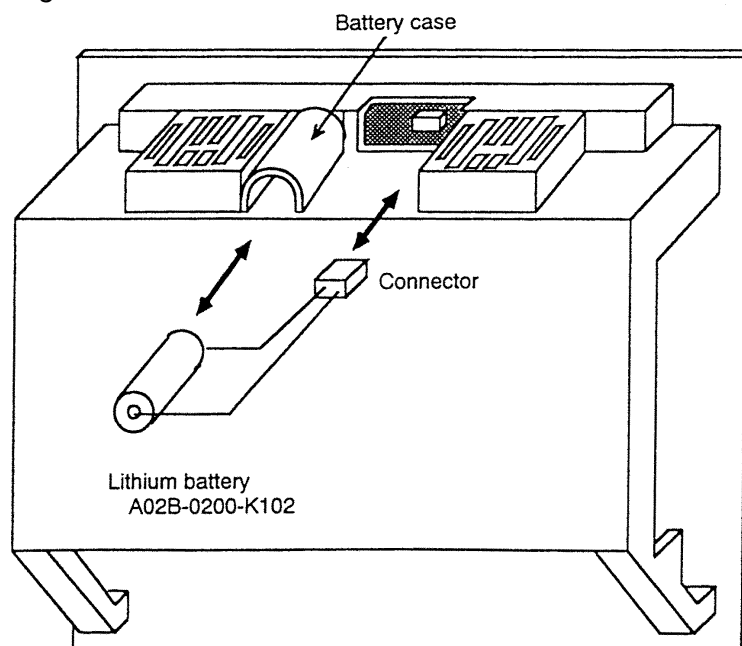
Prepare a lithium battery A02B-0200-K102.

WARNING

If battery replacing procedures are wrong, there are risks of an explosive accident. Do not replace batteries other than the specified one(A02B-0200-K102).

- [1] Turn ON the source power of the machine (CNC), keep it for about 30 seconds then turn it OFF.
- [2] Remove the battery mounted on the upper part of the CNC unit.
Disconnect the connector first, then remove the battery from the battery case.
- [3] Replace a new battery and connect the connector.

Note) The battery case is located in the middle section on the upper part of the unit as shown in the diagram below.



Caution

The procedures [1] through [3] should be completed within 30 minutes.

If a condition of the power OFF and battery had removed is continued 30 min or more, the memory contents of the CNC may be lost.

The memories are lost, if the battery is taken off and left as it is for a longer time.

(2) Battery for Magazine Servomotor Encoder

WARNING

When replacing the battery, turn ON the source power of the machine (CNC) and bring it into the status of Emergency Stop.

The replacing procedures are undertaken while the control panel door is open with the source power ON, which involve certain risks. Thus the handling of this operation should be restricted to those who are well trained in maintenance and safety matters. Be careful not to touch the high tension circuit during the operation, as there is a danger of an electrical shock.

For those machines equipped with an absolute encoder, a battery is installed separately for the encoder.

When Alarm No.F307 or No.F308 is generated, replace a new battery as soon as possible. Delay of battery replacement may cause to a loss of memory on absolute position, necessitating extra work of new original point setting.

Battery Replacing Procedures

[1] Turn ON the source power of the NC unit.

[2] Remove the battery case located bottom side of the magazine servo amplifier module (SVMG).

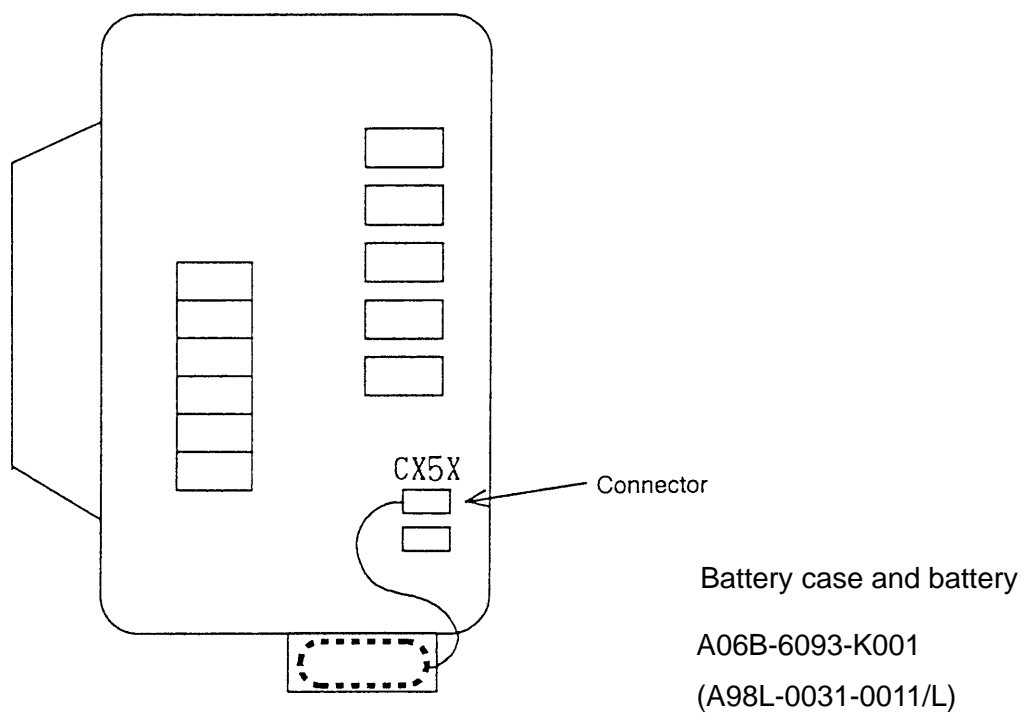
To remove the case, hold both sides of the front part of the case and pull it downward.

[3] Take off the connector attached on the battery.

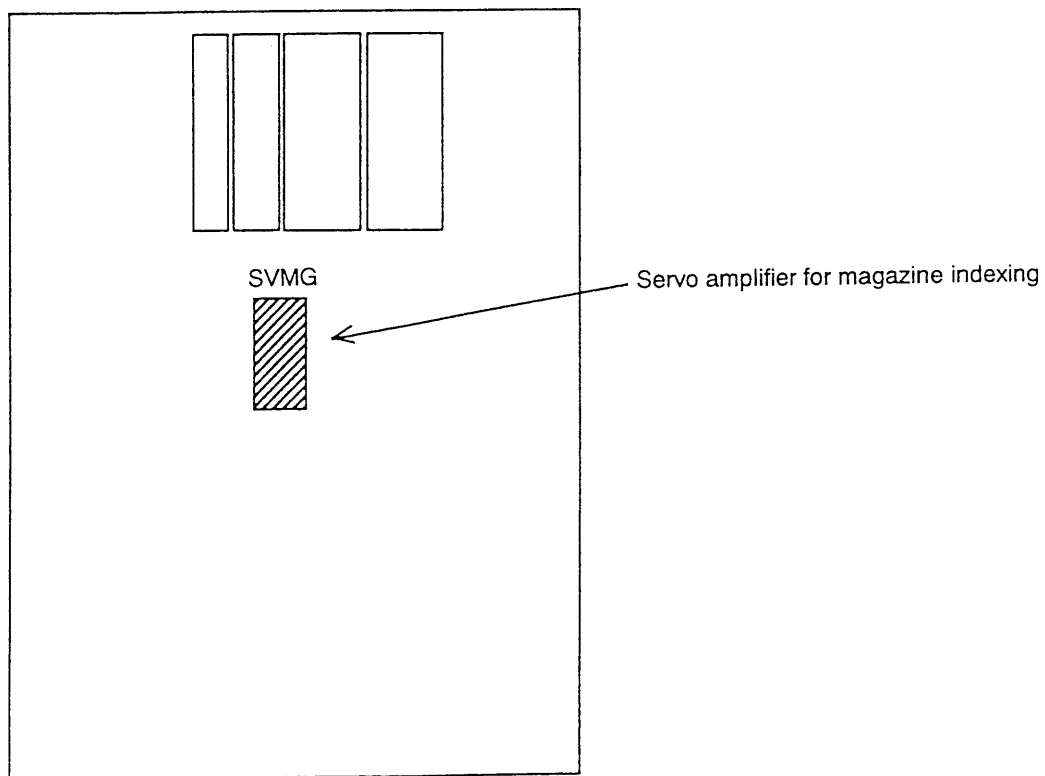
[4] Replace the battery then connect the connector.

[5] Put the battery case on.

Servo Amplifier for Magazine Indexing "SVMG".



The servo amplifier for magazine indexing is located at the place shown by the following diagram in the control panel.



2-3-3 Alarm List

Alarm No.	Address	Message	Reset	Cause	Method of Return
2000	D400.0	DOOR LOCK RELEASE CONDITION ERROR	*	Can not open the door during operation of the spindle, feed axes and programs.	
2001	D400.1	ATC DOOR LOCK RELEASE CONDITION ERROR	*	Can not open the door during the ATC operation.	
2002	D400.2	NO SHUTTER MODE			
2003	D400.3	HYDRAULIC OIL LOW LEVEL		Oil of the hydraulic unit is in short.	
2004	D400.4	HYDRAULIC OIL PRESSURE LOW		Insufficient pressure in the hydraulic system is detected. Oil leakage or defect of the hydraulic unit may be the cause.	
2005	D400.5	NC ALARM			
2006	D400.6	BREAKER TRIP		Excess current of AC100V is detected by defect of the solenoid, the electromagnetic switch, the relay, etc. or by shortage of the wire.	
2007	D400.7	DISTRIBUTOR FUSE BLOWN OUT		Excess current of AC100V is detected by defect of the solenoid, the electromagnetic switch, the relay, etc. or by shortage of the wire.	
2010	D401.0	SPINDLE SPEED ARRIVE ALARM		Action of the spindle start is not completed. Confirm the content when alarm of the spindle amplifier is displayed.	
2011	D401.1	SPINDLE START CONDITION ERROR (TOOL CLAMP)	*		
2012	D401.2	SPINDLE ROTATING COMMAND ERROR (TOOL CLAMP)		Can not confirm fastening of tools while the spindle is rotating. Confirm the tool lock unit and twin arm original position.	
2013	D401.3	CHIP CONVEYOR ISN'T AUTO MODE	*		
2014	D401.4	ATC HAND ISN'T CLOSE	*	Return by the original position return button or by the maintenance mode.	
2015	D401.5	ATC HAND ISN'T OPEN	*	Return by the original position return button or by the maintenance mode.	
2016	D401.6	HAND ISN'T MAGAZINE OR TWIN ARM SIDE	*	Return by the original position return button or by the maintenance mode.	

Alarm No.	Address	Message	Reset	Cause/Method of Return
2017	D401.7	ATC ORIGIN RETURN CYCLE TIME OVER		
2020	D402.0	MYSYT FUNCTION CYCLE TIME OVER		Action of MSTB function is not completed. Alarms that occur simultaneously may be the cause.
2021	D402.1	HYDRAULIC PUMP MOTOR OVER LOAD		Hydraulic motor start confirmation signal turned OFF. If the thermal switch is tripping, the hydraulic system or the hydraulic unit may be defective.
2022	D402.2	FLOOD COOLANT MOTOR OVER LOAD		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.
2023	D402.3	COIL CONVEYOR MOTOR OVER LOAD		Coil conveyor start confirmation signal turned OFF. If the thermal switch is tripping, jamming of cutting chips or the motor may be defective.
2024	D402.4	OIL HOLE COOLANT MOTOR OVER LOAD		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.
2025	D402.5	GUN COOLANT MOTOR OVER LOAD		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.
2026	D402.6	JET COOLANT MOTOR OVER LOAD		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.
2027	D402.7	CHIP CONVEYOR MOTOR OVER LOAD		Alarm signal of the flat conveyor is turned ON. The torque limiter or the thermal relay is tripping by jamming of cutting chips, etc.
2030	D403.0	SPINDLE SPEED CHANGE TIME OVER		
2031	D403.1	SHOWER COOLANT MOTOR OVER LOAD		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.

Alarm No.	Address	Message	Reset	Cause/Method of Return
2032	D403.2	PUSH ATC ORIGIN BUTTON		
2033	D403.3	SPINDLE ORIENTATION COMMAND ERROR (TOOL CLAMP)	*	Can not confirm tool fastening. Confirm status of the tool lock unit.
2034	D403.4	SPINDLE ORIENTATION COMMAND ERROR (X AXIS)		Can not command the other areas than operating area.
2035	D403.5	SPINDLE ORIENTATION TIME OVER		The spindle built-in censor, the spindle amplifier may be defective. When alarm occurs in the spindle amplifier, confirm the alarm.
2036	D403.6	SPINDLE DRIVE UNIT ALARM		
2037	D403.7	SPINDLE ZERO SPEED DETECT ALARM		The status that the spindle isn't rotating is detected. Confirm display (alarm) on the spindle amplifier.
2040	D404.0	SPINDLE SPEED AGREE ALARM		The spindle speed reach signal can not be detected for 10 seconds. Confirm the cutting status and the alarm of the spindle amplifier.
2042	D404.2	M-CODE ERROR (DIRECT TAP CYCLE)	*	Can not command M code related to the spindle during direct tapping.
2043	D404.3	SPINDLE COOLING UNIT ALARM		Operation signal of the main cooling unit can not be detected. Confirm operation status of the unit.
2044	D404.4	SPINDLE COOLING UNIT PRESSURE LOW		Pressure of the main cooling unit is lowered. Confirm oil volume and oil leakage.
2045	D404.5	SPINDLE STOPPED	*	The spindle was stopped by by manual mode during the spindle starting up. Reset or continue the program after making the spindle rotate.
2046	D404.6	TOOL CLAMP UNFINISH	*	Command again after fastening the tool.
2047	D404.7	LS TOOL UNCLAMP ALARM	@	
2050	D405.0	LS TOOL CLAMP ALARM	@	
2051	D405.1	SOL TOOL UNCLAMP ALARM	@	
2052	D405.2	DOOR INS'T CLOSED	*	The door is left open.
2053	D405.3	SPINDLE TOOL IS BROKEN		The tool is broken. Replace it.
2054	D405.4	SPINDLE TOOL IS USED UP		The tool is used up. Replace it.

Alarm No.	Address	Message	Reset	Cause/Method of Return
2055	D405.5	BUCK UP CYCLE ALARM		
2056	D405.6	AUTO-MEASUREMENT AMPLIFIRE ALARM		Alarm signal is emitted from renishaw measuring unit. Confirm the content by display of light receiving section and renishaw manual.
2057	D405.7	TOOL LENGTH MEASUREMENT ALARM		The tool breakage through tool length measuring is detected. Replace it.
2060	D406.0	SPINDLE ISN'T STOPPED	*	Can not command M16 while the spindle is rotating.
2061	D406.1	BE M74 ON	*	Command after canceling auto measuring mode.
2062	D406.2	LUBRICATING OIL PRESSURE LOW		Pressure of lubricating oil is lowered. Check on oil leakage or choking.
2063	D406.3	OL LUBRICATOR AIR PRESSURE LOW		Air pressure of the spindle oil air lubrication is lowered. Check on air leakage or choking.
2064	D406.4	OL LUBRICATOR OIL PRESSURE LOW		Lubricating oil pressure of the spindle oil air lubrication is lowered. Check on oil leakage or choking.
2065	D406.5	LUBRICATING OIL EMPTY		Lubricating oil is running short. Supply lubricating oil.
2066	D406.6	AIR PRESSURE LOW		Pressure of air supplied to the machine is lowered. Check on air leakage and confirm the air supply source.
2067	D406.7	INSPECT LUBRICATING OIL		Date for lubricating oil recovery set by regular maintenance now has come. After recovering lubricating oil, set again date of next recovery on the regular maintenance screen.
2070	D407.0	INSPECT HYDRAULIC OIL		Date for replacing the hydraulic unit set by regular maintenance now has come. After replacing oil, set again date of next replacement on the regular maintenance screen
2071	D407.1	TOOL NUMBER ERROR		Can not use the tool number commanded.
2072	D407.2	NO OPTION		Can not use because of option.
2073	D407.3	MAINTENANCE MODE ON		Maintenance operation (Maintenance) mode is set.
2074	D407.4	MAINTENANCE M CODE ERROR		Can not command in the maintenance mode.
2075	D407.5	M06 ERROR (MEASUREMENT CYCLE)	*	Command after canceling measurement mode.

Alarm No.	Address	Message	Reset	Cause/Method of Return
2076	D407.6	BUCK UP CYCLE ON		
2077	D407.7			
2080	D408.0	X-AXIS ISN'T IN 3RD REFERENCE POSITION	*	Can not command because X-axis is not at the third original point.
2081	D408.1	Z-AXIS ISN'T IN 2ND REFERENCE POSITION	*	Can not command because Z-axis is not at the second original point.
2082	D408.2	ATC TWIN ARM ORIGIN ERROR	*	Return by the original point return button or by maintenance mode.
2083	D408.3	INTERLOCKED BY ATC AREA	*	Command after returning X-axis to operation area.
2084	D408.4	CALLING TOOL IN SPINDLE	*	Command again after confirming the tool number.
2085	D408.5	SPINDLE ORIENTATION UNFINISH	*	Command after executing spindle orientation.
2086	D408.6	ESCAPE X AXIS FROM ATC AREA	*	
2087	D408.7	MAGAZINE POT HAS TOOL	*	Pull out the tool at the tool change position of the magazine.
2090	D409.0	DOOR IS OPEN	*	
2091	D409.1	ATC MAGAZINE DOOR IS OPEN		
2092	D409.2	MAGAZINE POSITION ISN'T COLLECT	*	Move the magazine by the button on the operation panel, and the magazine returns to the right position.
2093	D409.3	ATC MANUAL INTERRUPT MODE	*	ATC operation panel selects manual indexing.
2094	D409.4	ATC MAGAZINE DOOR IS OPEN	*	
2095	D409.5	LS ATC SHUTTER OPEN ALARM		Confirm status of ATC shutter (shutter opening cylinder/LS).
2096	D409.6	LS ATC SHUTTER CLOSE ALARM		Confirm status of ATC shutter (shutter opening cylinder/LS).
2097	D409.7	SOL ATC SHUTTER OPEN ALARM		Confirm status of ATC shutter (shutter opening cylinder/SOL).
2100	D410.0	SOL ATC SHUTTER CLOSE ALARM		Confirm status of ATC shutter (shutter opening cylinder/SOL).
2101	D410.1	SOL TOOL CARRIER TWIN ARM SIDE ALARM		Confirm status of feed band (twin arms side cylinder/SOL).
2102	D410.2	SOL TOOL CARRIER MAGAZINE SIDE ALARM		Confirm status of feed band (magazine side cylinder/SOL).
2103	D410.3	SOL TOOL CARRIER CLOSE ALARM		Confirm status of feed band (hand closing cylinder/SOL).
2104	D410.4	SOL TOOL CARRIER OPEN ALARM		Confirm status of feed band (hand opening cylinder/SOL).

Alarm No.	Address	Message	Reset	Cause/Method of Return
2105	D410.5	LS TOOL CARRIER TWIN ARM ALARM		Confirm status of feed band (twin arms side cylinder's LS).
2106	D410.6	LS TOOL CARRIER MAGAZINE ALARM		Confirm status of feed band (magazine side cylinder's LS).
2107	D410.7	LS TOOL CARRIER CLOSE ALARM		Confirm status of feed band (hand closing cylinder's LS).
2110	D411.0	LS TOOL CARRIER OPEN ALARM		Confirm status of feed band (hand opening cylinder's LS).
2111	D411.1	ATC CAM INDEX INVERTER ALARM		Confirm alarm of inverter in the control box, and refer to the twin arms control unit stated in items 2-9.
2112	D411.2	X-AXIS ISN'T IN ATC POSITION	*	
2113	D411.3	TOOL CARRIER HAND ISN'T ORIGIN	*	Return by the original point return button or by maintenance mode.
2114	D411.4	ATC CAM STOP COMMAND LS DETECT ERROR		LS of [motor stop command] can not be detected when the twin arm is in action (tool change).
2115	D411.5	ATC CAM ORIGIN DETECT ERROR		
2116	D411.6	ATC CAM INDEX ALARM		Refer to item 2-6-3 of ATC trouble shooting.
2117	D411.7	ATC MAGAZINE INDEX TIME OVER		
2120	D412.0	NOT AUTO MODE		The key switch of mode selection does not select AUTO.
2121	D412.1	THROUGH COOLANT FILTER STOPPED UP		Filter choking of the coolant tank (pressure switch) is detected. Remove out cutting chips, etc.
2122	D412.2	MP10 POWER ON ALARM		Alarm signal is on when supplying power to the measuring amplifier (MP10). Confirm status of the measuring amplifier.
2123	D412.3	MP10 POWER OFF ALARM		Alarm signal is not changed when cutting off power to the measuring amplifier (MP10). Confirm status of the measuring amplifier.
2124	D412.4	INTERLOKED BY Z-CANCEL		
2125	D412.5	APC INVERTER ALARM		
2126	D412.6	NEED APC ORIGIN		

Alarm No.	Address	Message	Reset	Cause	Method of Return
2127	D412.7	APC CARRYING NOT READY			
2130	D413.0	APC PALLET LOCATING PIN ISN'T PUT IN			
2131	D413.1	PUSH APC ORIGIN BUTTON AFTER "G30 P3 Y0" COMMAND			
2132	D413.2	PUSH APC ORIGIN BUTTON AFTER "G30 P4 Y0" COMMAND			
2133	D413.3				
2134	D413.4				
2135	D413.5	APC PALLET LOCATING PIN ISN'T COME OUT			
2136	D413.6	LS APC DOOR OPEN ALARM			
2137	D413.7	LS APC DOOR CLOSE ALARM			
2140	D414.0	APC DOOR MOTOR OVER LOAD			
2141	D414.1	APC ARM TURN BY PUSH BUTTON LEFT PIN=CCW RIGHT PIN=CW			
2142	D414.2	LS APC PALLET LOCATING PIN 1 ALARM			
2143	D414.3	LS APC PALLET LOCATING PIN 1 ALARM			
2144	D414.4	LS APC PALLET LOCATING PIN 2 ALARM			
2145	D414.5	LS APC PALLET LOCATING PIN 2 ALARM			
2146	D414.6	PALLET FIT ALARM			
2147	D414.7	SOL APC PALLET LOCATING PIN 1 ALARM			
2150	D415.0	SOL APC PALLET LOCATING PIN 2 ALARM			
2151	D415.1	APC ARM MOTION ALARM			
2152	D415.2	LS APC ARM ORIGIN ALARM			
2153	D415.3	LS APC MIDDLE POSITION OF LEFT PALLET ALARM			

Alarm No.	Address	Message	Reset	Cause/Method of Return
2154	D415.4	LS APC MIDDLE POSITION OF RIGHT PALLET ALARM		
2155	D415.5	LS APC ORIGIN OF RIGHT PALLET ALARM		
2156	D415.6	LS APC ORIGIN OF LEFT PALLET ALARM		
2157	D415.7	PALLET CLAMP OIL SHORTAGE		
2160	D416.0	NO APC DOOR MODE		
2161	D416.1	APC PALLET POSITION ERROR		
2162	D416.2	PALLET CLAMP / UNCLAMP ERROR		
2163	D416.3	APC PREPARATIONS DOOR CLOSE ALARM		
2164	D416.4	APC RIGHT PALLET CHECK ALARM		
2165	D416.5	APC LEFT PALLET CHECK ALARM		
2166	D416.6	PALLET CLAMP ISN'T FINISHED		
2170	D417.0	WORK COUNTER COUNT UP		Used up the number of works set on the screen. Reset the number of workpieces.
2171	D417.1	CUTTING CYCLE COMPLETION		Used up the operation time set on the screen. Reset the number of operation time
2172	D417.2	LS AUTO DOOR OPEN ALARM		Confirm status of the door (cylinder/LS).
2173	D417.3	LS AUTO DOOR CLOSE ALARM		Confirm status of the door (cylinder/LS).
2174	D417.4	SOL AUTO DOOR OPEN ALARM		Confirm status of the door (cylinder/SOL).
2175	D417.5	SOL AUTO DOOR CLOSE ALARM		Confirm status of the door (cylinder/SOL).
2176	D417.6	APC DOOR LOCK RELEASE CONDITION ERROR		
2177	D417.7	APC PREPARTIONS DOOR CLOSE ALARM		

Alarm No.	Address	Message	Reset	Cause	Method of Return
2181	D418.1	CONFIRMATION OF THE TOOL LOCK RETURN COME OFF			
2184	D418.4	DOOR OPEN ALARM			
2185	D418.5	NEED ATC ORIGIN (MAINTENANCE MODE)			
2190	D419.0	CH1 SENSOR BREAK ALARM			
2191	D419.1	CH2 SENSOR BREAK ALARM			
2192	D419.2	CH3 SENSOR BREAK ALARM			
2193	D419.3	CH4 SENSOR BREAK ALARM			
2194	D419.4	CH5 SENSOR BREAK ALARM			
2195	D419.5	X OFF SET BIG DATA ALARM			
2196	D419.6	Y OFF SET BIG DATA ALARM			
2197	D419.7	Z OFF SET BIG DATA ALARM			
2200	D420.0	TAPE FORMAT ERROR			
2201	D420.1	SELECT TOOL IS USED UP			
2202	D420.2	SELECT TOOL IS BROKEN			
2203	D420.3	PRE-CUTTING TOOL CHECK ERROR			
2204	D420.4	DISCORD CALL TOOL = WAITING TOOL ERROR			
2206	D420.6	MESURMENT TOOL R.P.M. OVER			

Alarm No.	Address	Message	Reset	Cause	Method of Return
2207	D420.7	ATC CYCLE ON JOG FEED INTERLOCKED NC RESET OR PROGRAM START			
2230	D423.0	MICRO SEPARATOR ON ALARM			
2231	D423.1	SUPPLY PUMP ON ALARM			
2232	D423.2	FILTER PUMP ON ALARM			
2233	D423.3	FILTER PUMP FILTER STOPPED UP			
2234	D423.4	MICRO SEPARATOR ON			
2235	D423.5	SUPPLY PUMP ON			
2236	D423.6	FILTER PUMP ON			
2237	D423.7	COOLANT OVER FLOW			
2240	D424.0	SUPPLY PUMP IS STOP			
2241	D424.1	INSPECT COOLANT OIL LEVEL			
2242	D424.2	COOLANT COOLING UNIT ALARM			

Alarm No.	Address	Message	Reset	Cause/Method of Return
2243	D424.3	HIGH PRESSURE COOLANT SUPPLY PUMP ON ALARM		Draw pump start confirmation signal is turned OFF. When the thermal switch is tripping, choking of the coolant or the draw pump may be defective.
2244	D424.4	HIGH PRESSURE COOLANT UNIT FILTER STOPPED UP		
2245	D424.5	BE M83/M84 ON		
2246	D424.6	HIGH PRESSURE COOLANT ON ALARM		Coolant motor start confirmation signal turned OFF. If the thermal switch is tripping, the coolant may be choked or the coolant pump may be defective.
2247	D424.7	COOLANT OFF		

Regarding the Cause of Alarms

Alarms resulting from not filling some of requirements during a command are marked with an asterisk (*) in the reset column.

Press the NC reset key then, after adjusting the required conditions, direct the command again.

Regarding the Release of Alarms

To release the alarm, remove the cause of the alarm, then press the **NC RESET** key or the **PROGRAM START** key keeping the machine in operation standby status.

2-4 Parameters

A parameter is an important factor to decide a characteristic and function of the machine.

Contents of parameter are characterize a specification of standard and optional, to select a content of specification and a function in detail and to arrange a capability of the function and procedure of the process etc.

2-4-1 Kinds and Main Contents of Parameter

(1) NC parameter

Refer to the table of NC parameter.

Details of content describe in the maintenance section of instruction manual of the SEIKI-SEICOS.

(2) PC parameter

Refer to the table of PC parameter attached to the machine.

2-4-2 About a Management of Parameter

Since a setting value (data) of each parameter has been set at the manufacturer of the machine, it is not necessary to modify or set at an user except special condition.

(However, except areas of custom macro and backlash pitch error compensation.)

Also, a record table of actual value (setting data) of parameters of NC and PC is attached to the machine, therefore, keep it carefully out provide it for maintenance if needed.

2-4-3 Altering the PC Parameter Setting

(Procedures)

1. Set an emergency stop with the machine.
2. Display NC setting screen by **OPER/MAINT** → **F4/SYSTEM** → [30]: F menu → [2]: F_SETTING, and change PWE from 0 to 1.
3. Display keep relay screen by **RETURN** → [1]: F_PMC → **F3/PMCPRM** → **F3/KEEPRL**.

PMC PRM (KEEP RELAY)			MONIT RUN		
NO.	ADDRESS	DATA	NO.	ADDRESS	DATA
01	K00	XXXXXXXX	11	K10	XXXXXXXX
02	K01		12	K11	
03	K02				
04	K03				
05	K04				
06	K05				
07	K06				
08	K07				
09	K08				
10	K09				
[TIMER] [COUNTR] [KEEPRL] [DATA]					

4. Keep relay addresses K17~K39 become PC parameters. Using Page Key and cursor key, select the bits to be changed into.
5. Return PWE changed by procedure 2: From 1 to 0.

Changing is completed as above.

2-5 List of SOL/LS Functions and Uses (See the SOL/LS Layout for the Location of Equipment.)

(Machine proper)

Item No.	Function and use	Standard specification		Remarks
		SOL	LS	
1	Air source pressure insertion	61A	PS-1	
2	Splash cover door locking ON (Opening)	400A	400A	
3	Splash cover door locking (Opening)	—	400B	
4	ATC magazine door interlocking ON (Opening)	412A	412A	CE mark
5	ATC magazine door interlocking (Closing)	—	412B	CE mark
6	ATC magazine door interlocking (Closing)	—	250B	
7	Spindle air blow	28A	—	
8	-X axis over-travel	—	1A	
9	X axis zero return deceleration	—	2A	
10	-Y axis over-travel	—	6A	
11	+Y axis over-travel	—	6B	
12	Y axis zero return deceleration	—	7A	
13	-Z axis over-travel	—	10A	
14	+Z axis over-travel	—	11A	
15	Y axis zero return deceleration	—	11B	
16	Tool contact check	—	145A	
17	Spindle drawbar return	—	436A	
18	T/L cylinder fall detection	—	495A	
19	T/L cylinder stroke failure detection	—	496A	

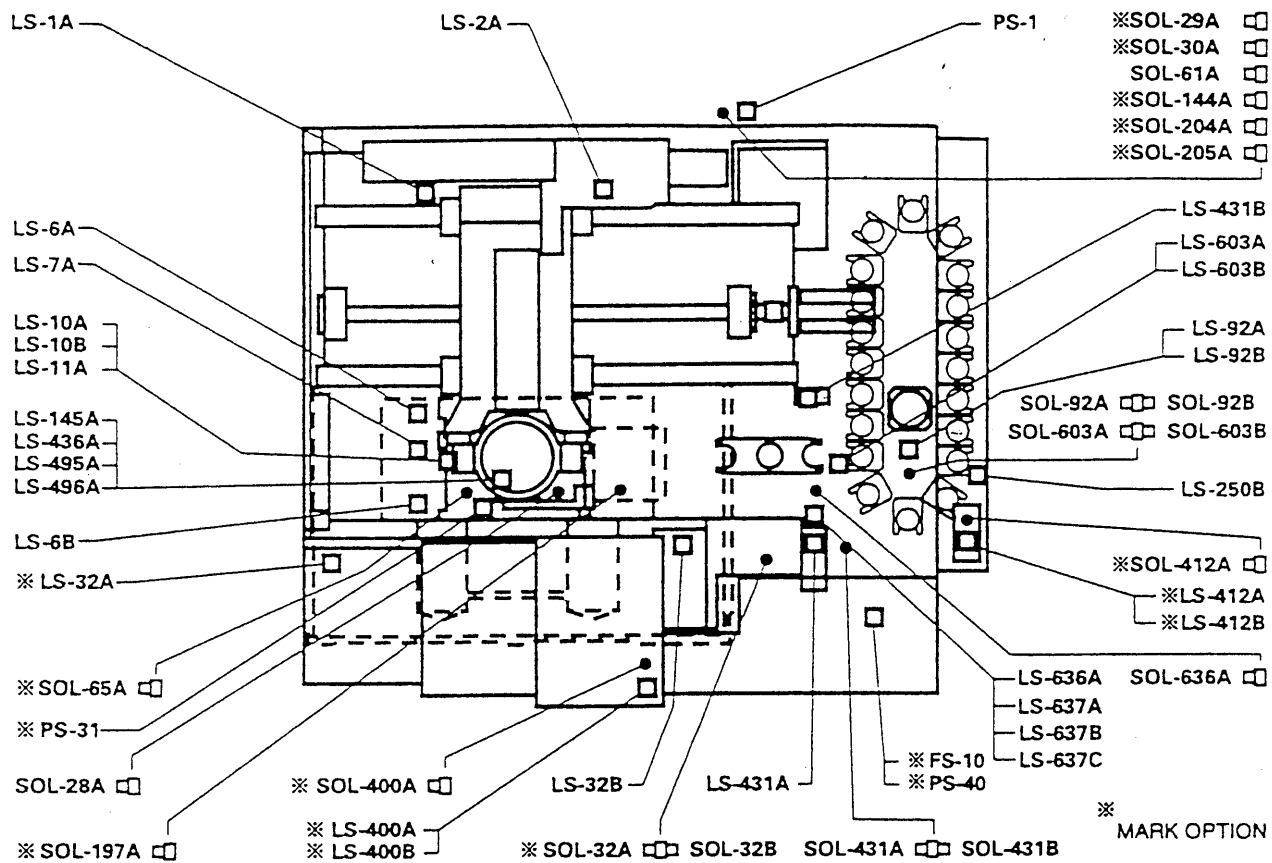
(Related to ATC)

Item No.	Function and use	Standard specification		Remarks
		SOL	LS	
1	ATC shutter opening	431A		
2	ATC shutter closing	431B	431B	
3	Tool carriage magazine side	92A	92A	
4	Tool carriage arm side	92B	92B	
5	Tool carriage hand opening	603A	603A	
6	Tool carriage hand closing	603B	603B	
7	Cam unit backup pump ON	636A	636A	
8	Twin arm torque limiter release	—	638A	
9	Cam indexing check Origin check	—	637A	
10	Cam indexing check Intermediate position sensing	—	637B	
11	Cam indexing check Motor stop	—	637C	

Action of Tool Lock Device and relevant LS Status

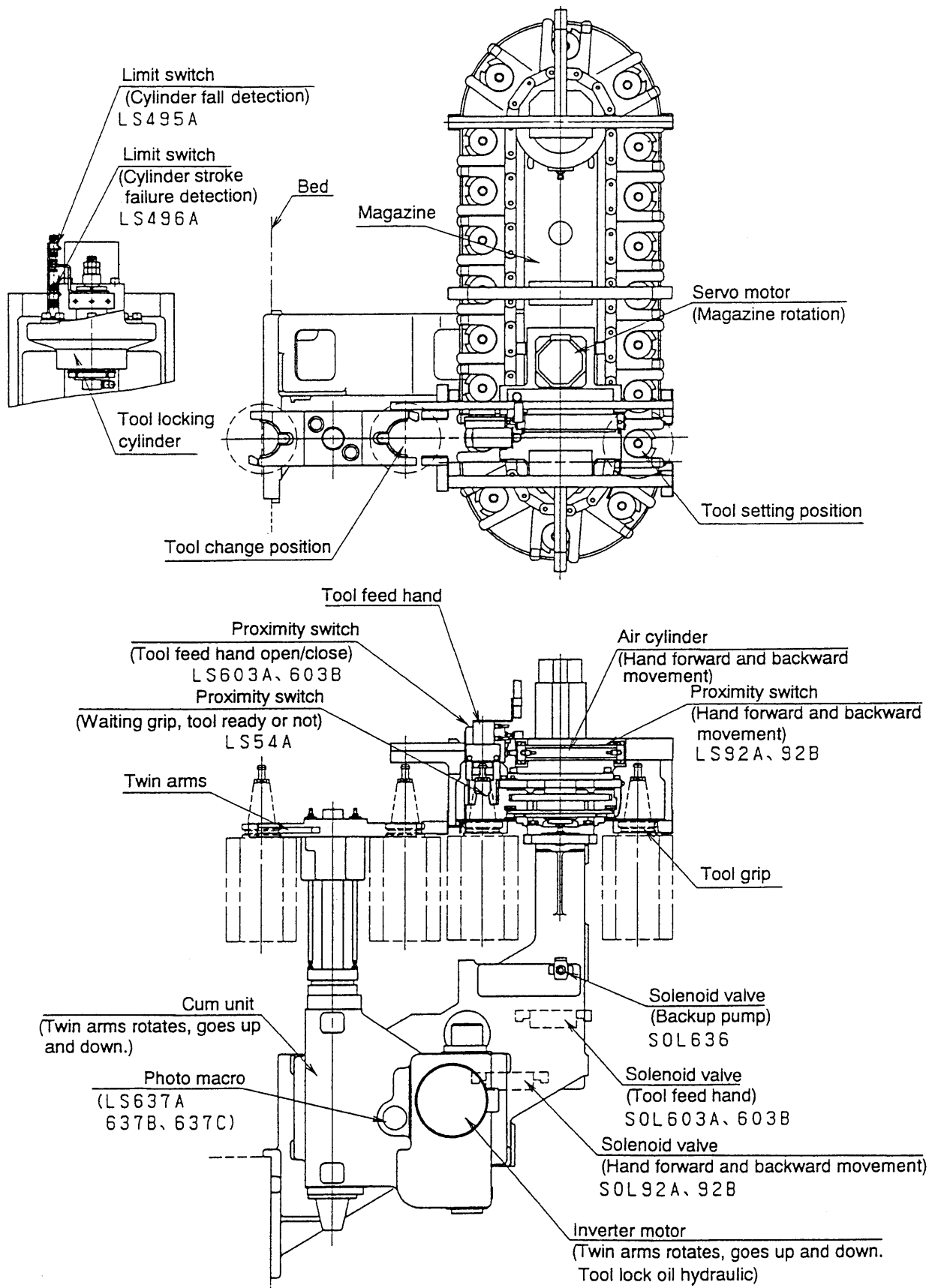
Action \ LS Status	Tool Lock Device		ATC Cam		
	LS436A	LS496A	LS637A	LS637B	LS637C
Tool clamp (No tool on spindle)	ON	OFF	ON	OFF	ON
Tool clamp (A tool on spindle)	OFF	OFF	ON	OFF	ON
Tool unclamp	ON	ON	OFF	ON	—

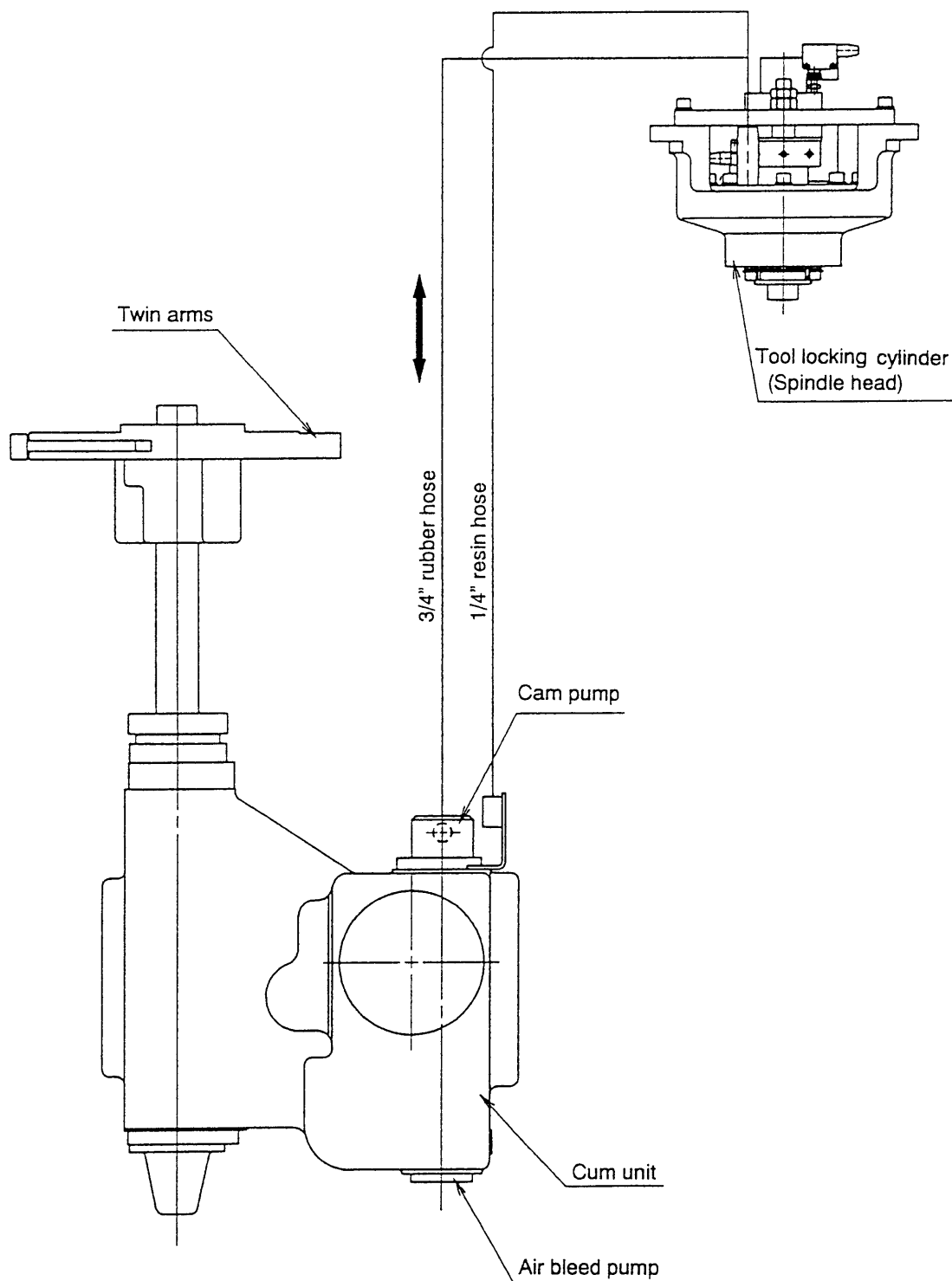
Layout of SOL/LS



2-6 ATC Maintenance and Adjustment

2-6-1 Drive Mechanism General





Caution

Use hoses specified by Hitachi Seiki as 3/4" and 1/4" pressure oil feed hoses between the cam unit and the tool locking cylinder. Use of hoses other than specified may cause serious trouble with the ATC (automatic tool changer).

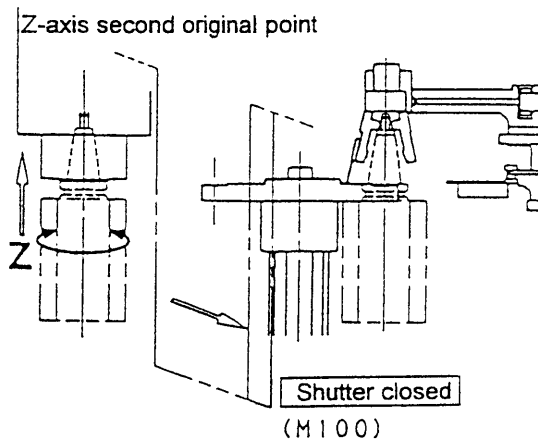
2-6-2 Explanation of Actions ATC

ACT operates continuously according to command contents.

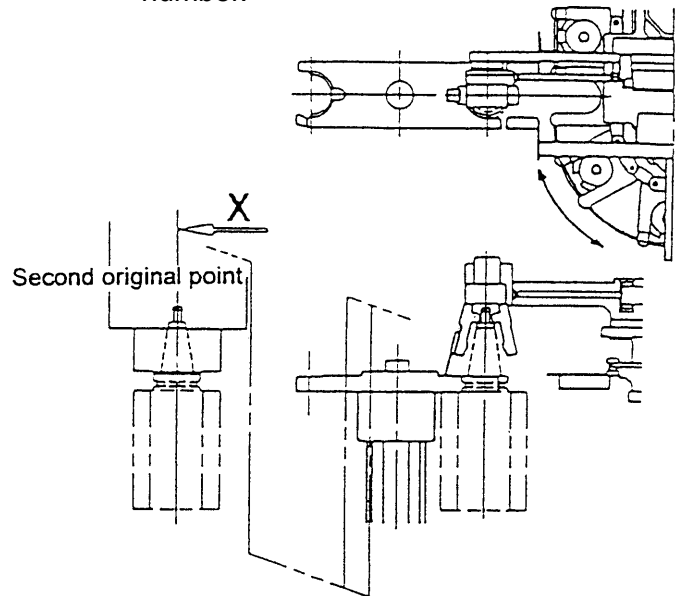
1. Change Spindle and Waiting Tool.....M06 Operation

Note) (M1**) in the figures operates only at the maintenance mode.

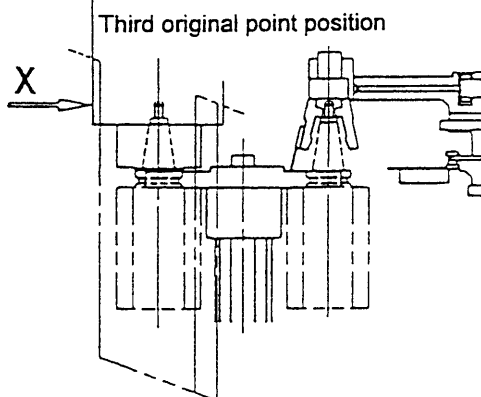
- 1) Open the shutter, and move to the spindle orientation Z-axis second original point.



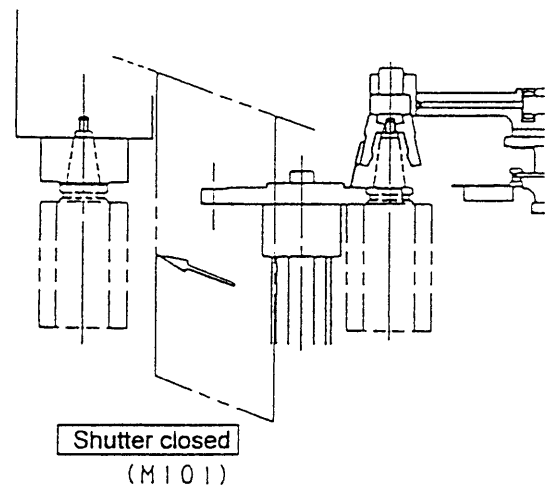
- 4) Move to X-axis second original point, and index magazine of waiting tool number.



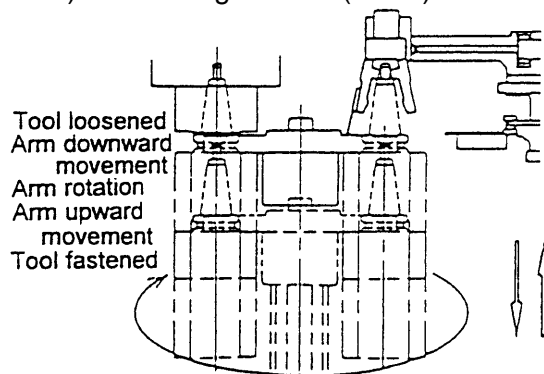
- 2) Move to X-axis third original point (tool change position).



- 5) Shutter is closed.



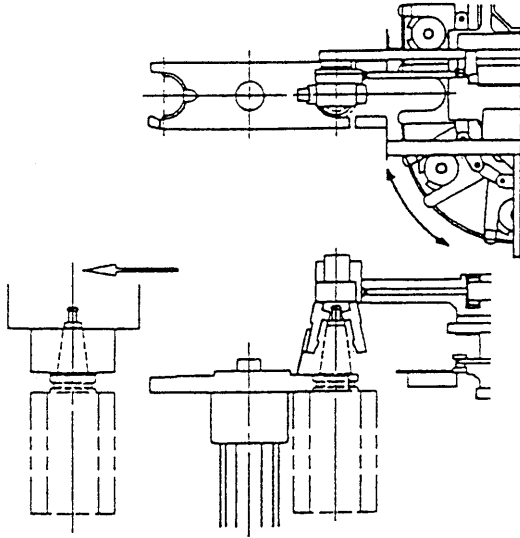
- 3) Tool change action (M117)



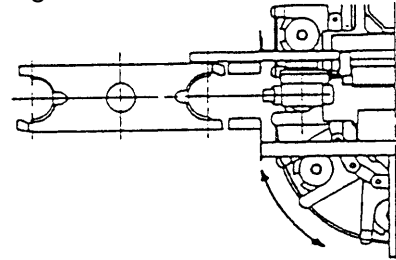
2. Call Tool to Waiting Position.....T01~T20 (T30 Option)

Note) (M1**) in the figures operates only at the maintenance mode.

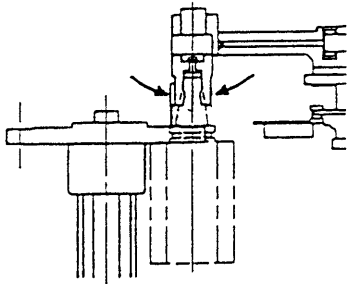
- 1) Index magazine of waiting tool number.



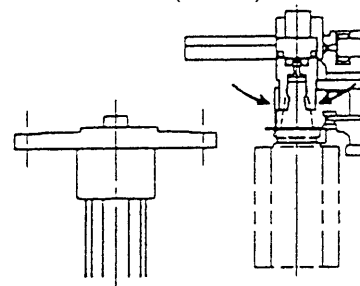
- 5) Index magazine of T code number.



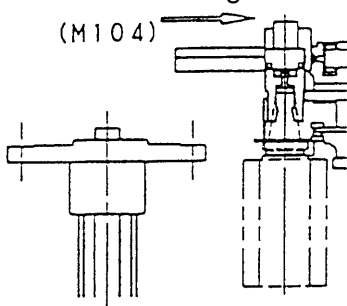
- 2) Feed hand is closed (M102).



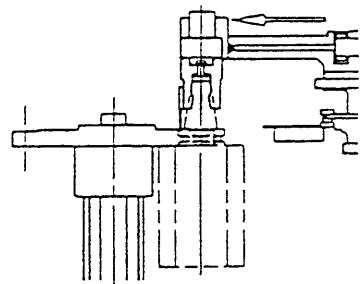
- 6) Feed hand is closed (M102).



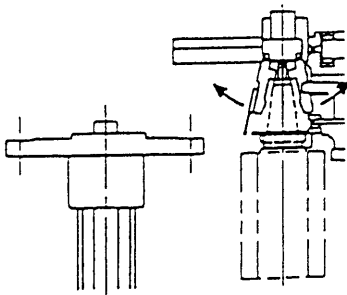
- 3) Move feed hand to magazine side.



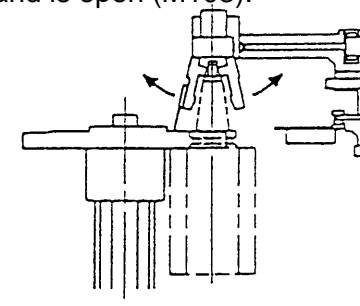
- 7) Move feed hand to twin arms side (M105).



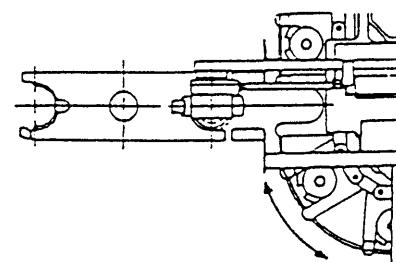
- 4) Feed hand is open (M103).



- 8) Feed hand is open (M103).



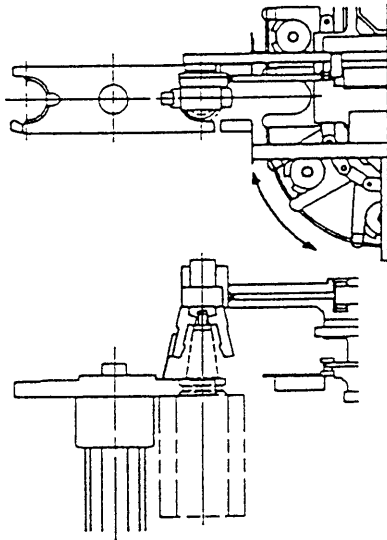
- 9) Index magazine of spindle tool number.



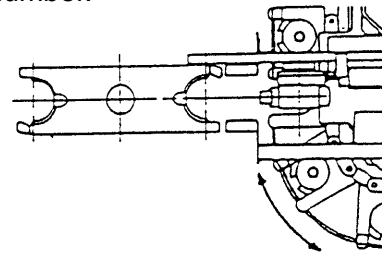
3. Return Waiting Tool to Magazine.....T00 Action

Note) (M1**) in the figures operates only at the maintenance mode.

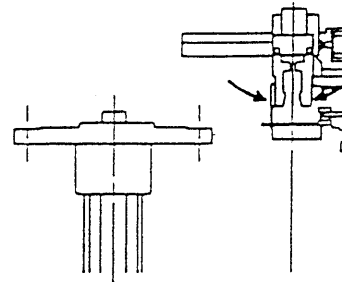
- 1) Index magazine of waiting tool number.



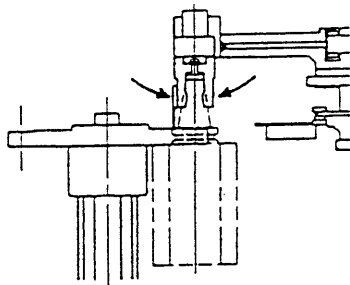
- 5) Index magazine of spindle tool number.



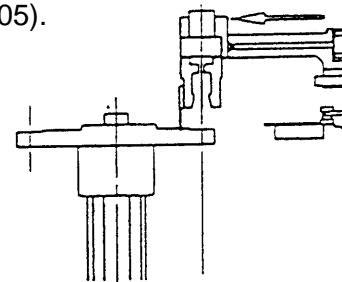
- 6) Feed hand is closed (M102).



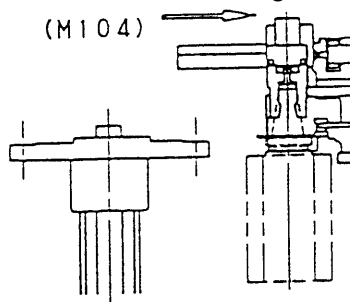
- 2) Feed hand is closed (M102).



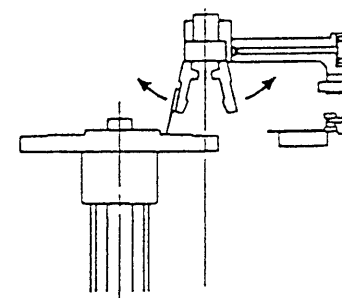
- 7) Move feed hand to twin arms side (M105).



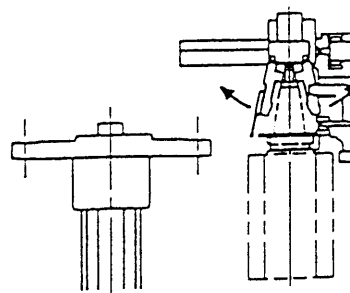
- 3) Move feed hand to magazine side.



- 8) Feed hand is open (M103).



- 4) Feed hand is open (M103).



2-6-3 ATC (Automatic Tool Changer) Maintenance, Adjustment and Operation

Operating Procedure and Details of Operation

The ATC performs operation shown in Fig. *-* depending on the nature of commands. When the above operation stops due to reset, power failure, etc., execute origin return. The methods of return are described below.

(1) Method of setting magazine rotation at the origin (indexing orientation)

Pressing the magazine “FORWARD” or “REVERSE” button allows the magazine to be rotated.

(2) Method of returning the carriage hand to the origin

Pressing the “ORIGIN RETURN” button allows the carriage hand to be returned to the origin.

(3) Method of closing the ATC shutter (Origin)

Pressing the “ORIGIN RETURN” button causes the ATC shutter to be closed.

(4) Method of returning the twin arm

Pressing the “ORIGIN RETURN” button, the twin arm returns to the origin point.

Subsequently, put the X-axis back to the machining area and close the ATC shutter.

Origin Return Action

The order of origin return actions is as shown in the table below corresponding to each ATC stop position.

ATC Stop Position	Action Order
Magazine rotating for returning standby tool	No action
Carriage hand closing on twin arm side	Carriage hand open
Carriage hand moving to magazine side	Carriage hand 1. Twin arm side → 2. Open
Carriage hand opening on the magazine side	Carriage hand 1. Close → 2. Twin arm side → 3. Open
Magazine rotating for T command tool index	[After moving magazine manually to indexing set position] Carriage hand 1. Close → 2. Twin arm side → 3. Open
Carriage hand closing on the magazine side	Carriage hand 1. Close → 2. Twin arm side → 3. Open
Carriage hand moving to twin arm side	Carriage hand 1. Twin arm side → 2. Open
Carriage hand opening on the twin arm side	Carriage hand open
Magazine swinging for spindle tool indexing	No action
Shutter open	Shutter close
Twin arm action in progress	Twin arm remaining action

When origin return cannot be effected by pressing the “ORIGIN RETURN” button, use maintenance M code commanding each action in the order as listed in the above table.

Operation in the Maintenance Mode

When an independent individual action (Maintenance M Code) is required for maintenance, adjusting work etc., exercise the following operations.

1. Turn ON the [MAINT] switch for maintenance located in the machine control panel.
Or, command [M998] in the MDI mode.
2. Be sure that the control panel door is closed for safety measures.
3. Put the mode into [MDI].
4. Command the maintenance M code.
5. Turn OFF the [MAINT] switch.

To cancel [M998], use [M999] command.

* Any command in the maintenance mode should be by individual M code in one block.

Maintenance M Code and Action

In the maintenance mode, M codes listed in the following table can be commanded.

M code	Action	Conditions enabling Action
M100	Opening shutter	
M101	Closing shutter	X-axis is in the machining area.
M102	Closing carriage hand	* Carriage hand is on the magazine side or on the twin arm side. * Twin arm is at the origin point. * Magazine is at the indexing set position.
M103	Opening carriage hand	Same conditions as M102
M104	Carriage hand on magazine side	* Magazine is at the indexing set position. * Carriage hand is closed. * Twin arm is at the origin point. * No tool is at magazine standby position.
M105	Carriage hand on twin arm side	* Magazine is at the indexing set position. * Carriage hand is closed. * Twin arm is at the origin point.
M118	Twin arm forward rotation (One cycle)	No tool shall be mounted on spindle. * Carriage hand shall be positioned at origin.
M119	Twin arm reverse rotation (One cycle)	Same conditions as M118

Actions can be effected disregarding the conditions asterisked (*) in the above table, if a maintenance M code is commanded by keep pressing the "Spindle Stop" button.

ATC Troubleshooting

No.	Alarm	Detail of check		Cause	Remedy
1	ATC cam indexing failure	Check on diagnostic screen that signal from LS is entered into address "X013.6".	Yes	Inadequate tool push allowance	Readjust seeing Section 2-6-6 "Adjusting a tool push allowance".
			Yes	Excessive contact of tool with spindle	Tapping the tool from side with plastic hammer allows it to be pulled out. Contact Hitachi Seiki in the event of frequent occurrence.
			Yes	Tool failure	Check tool. Check pull stud for looseness in particular.
			Yes	Spindle orientation failure	Contact Hitachi Seiki.
			Yes	Malfunction of tool locking device in spindle	Contact Hitachi Seiki.
			No	Malfunction of tool locking cylinder	Inspect related parts according to Section 2.
2	Tool loosening failure	Visually inspect piping (hoses and joints) from ATC cam box to tool locking cylinder. Check for oil leakage.	Leakage	Slight oil leakage from joints (Oozing at most).	Tighten joints securely and see Section 2-6-5.
			Leakage	Large quantity of oil leakage or broken hose	See Section 2-6-5 "Process of bleeding air in the tool locking system".
			No leakage	Cam unit trouble	Contact Hitachi Seiki.
3	Tool clamping failure	Check SOL636 (solenoid valve) for normal function.	Normal	Air leakage into cam unit from air system	Repair air system and leave SOL636 for five minutes with it actuated. Check alarm goes off.
			Normal	Trouble with cam unit may have occurred without air leakage.	Contact Hitachi Seiki.
			Abnormal	Trouble with solenoid valve	Contact Hitachi Seiki.

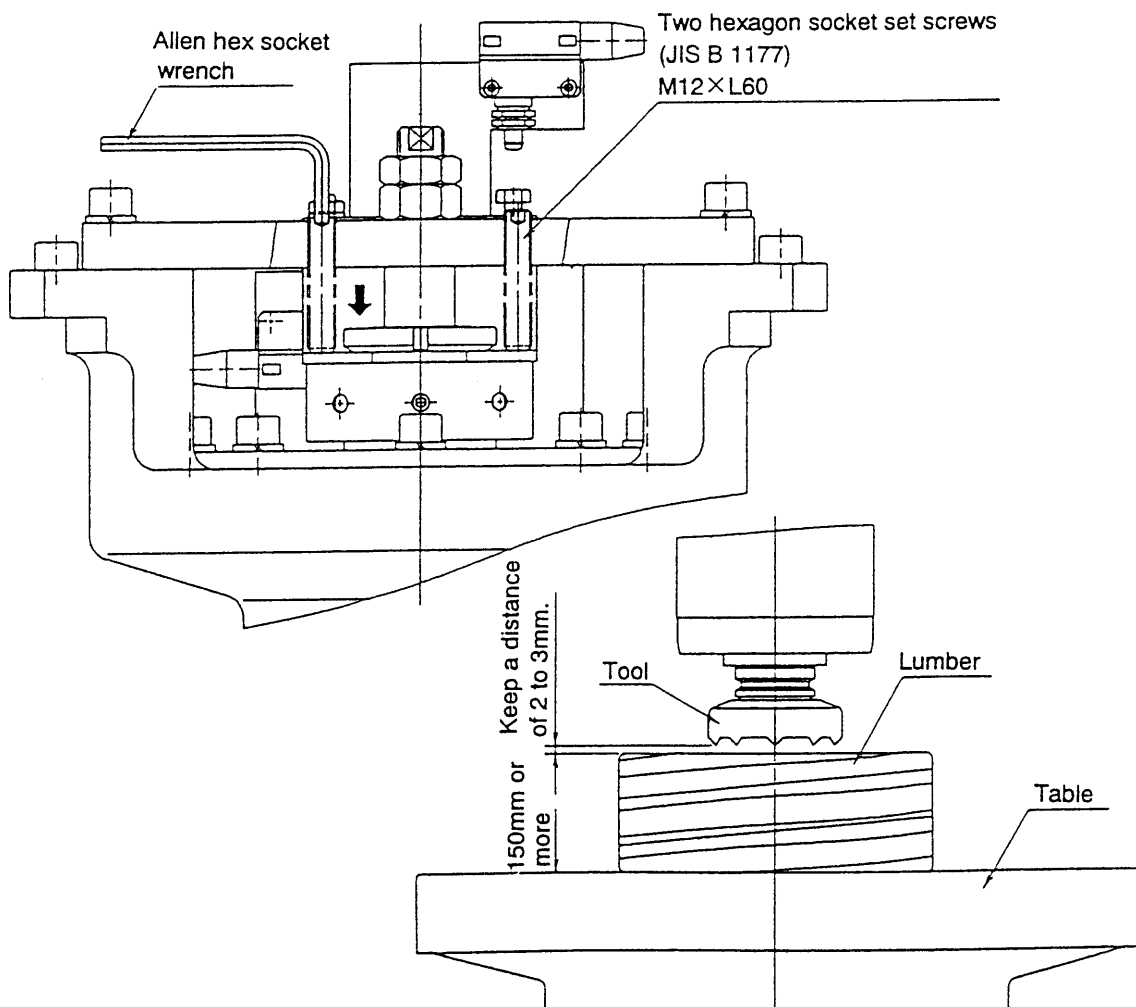
2-6-4 Method of Manual Tool Unclamping

When the tool cannot be pulled out by normal operation due to ATC trouble, etc., it can be forcedly done by hand. Use the following procedure to pull out the tool.

- (1) Turn on the [MAINT] switch in the control panel.
- (2) Operate M120 to supply air to the cam unit.
- (3) Prepare two hexagon socket set screws (JIS B 1177) M12×L60.
- (4) Put them into two threaded holes in the plate on the upper part of the tool lock. (See the figure below.)
- (5) Turn the set screws with the supplied Allen hex socket wrench (6mm) to push down the piston. Give the two set screws a turn alternately then.
- (6) Lowering the piston to the limit allows the tool to be pulled out.
- (7) Pull out the two set screws.
- (8) After this, perform the specified reset operation seeing Section 2-6-3 "Maintenance, adjustment and operation".

Caution

To prevent the tool from falling, always place a 150 mm or more piece of lumber between the tool and the table before performing this operation.



2-6-5 Procedure for Bleeding Air in the Tool Locking System

Air bleeding is performed with a cam unit-contained air bleed pump when air is mixed into the pressure oil feed hoses between the cam unit and the tool locking cylinder.

Caution

Always make sure that a tool is not mounted on the spindle and also that a tool is not mounted on the twin arm before performing the following procedure. Never perform the following procedure without making sure of the above, and contact Hitachi Seiki.

Procedures for air venting of VS50 ATC Cum Unit

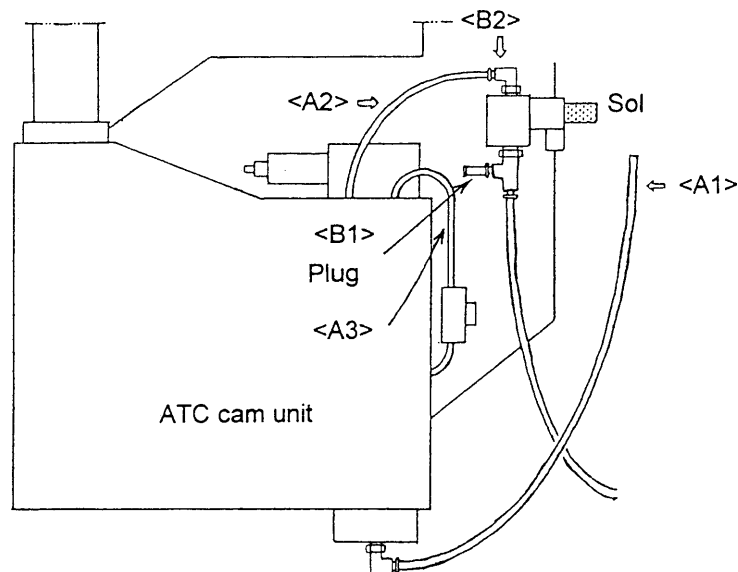
When installing, perform air venting after leveling. ATC and tool Clamping/unclamping must be performed after air venting.

- [1] Clear out tools of the spindle and waiting position, and at the original position of Z-axis, press the emergency stop button.
- [2] Pull out B1 plug of ATC cum unit. Pay attention in order not to loose the plug.
- [3] Pull out tube A2 from B2, and connect it to B1.
- [4] Connect tube A1 of no connection to B2.
- [5] Press [OPERATION PREPARATION] button while, pressing [OVERRIDE MEMORY] button. (Emergency stop button must be reset.)
- [6] Set MDI mode, and command M120.
Cum unit pump is activated, and feed oil in the unit to A3 hose.
In three minutes, M120 is completed.
- [7] As air venting in the cum unit is completed, press the emergency stop button, and return the air tube to the original position.
Pull out A1 tube from B2.
Pull out A2 tube from B1, and connect it to B2.
Connect the plug to B1 tube.
Fix A1 tube.
- [8] Press [OPERATION PREPARATION] button while, pressing [OVERRIDE MEMORY] button. (Emergency stop button must be reset.)
- [9] Push up the maintenance switch in the high voltage box. (Maintenance operation mode is displayed on the upper left of the screen.)
- [10] Set MDI mode, and command M100;. (ATC shutter is opened.)
- [11] Command M997;. (Select without ATC shutter mode.)
[WITHOUT SHUTTER MODE] is displayed on alarm screen.

Air venting of the hose of tool clamping/unclamping

- [12] Push down the maintenance switch in the high voltage box. (Maintenance operation mode is released.)

- [13] Confirm that the spindle and ATC arm have no tools, and put X-axis in the center of the table.
- [14] Set MDI mode, and command M121;.
Rotation action of ATC arm, and tool clamping/unclamping are repeated.
In about 15 minutes, M121 is completed.
- [15] Turn off the power of the machine after M121 is completed. (Without shutter mode is released.
- [16] Switch on the power, and perform tool clamping/unclamping operation by manual mode. Confirm that tools can be attached and detached. If attachment and detachment can be done smoothly, air venting is completed. If not, repeat the procedures from [1].
- [17] After air venting is completed, set MDI mode, and command M998;. (returned to maintenance operation mode.)
- [18] Command M101;. (ATC shutter is closed.)
- [19] Command M999;. (Maintenance operation mode is released.)



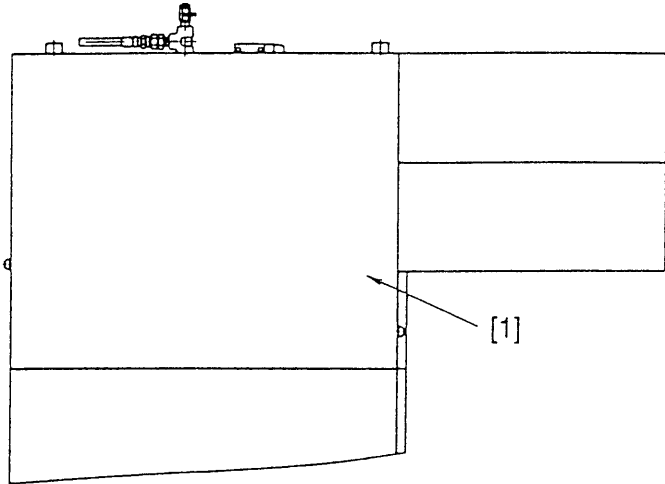
2-6-6 Adjusting a Tool Push Allowance

To permit pulling the tool out of the spindle smoothly in ATC operation and others, the tool is pushed out after it is unclamped from behind.

Use the following procedure to adjust the tool push-out allowance (tool push allowance).

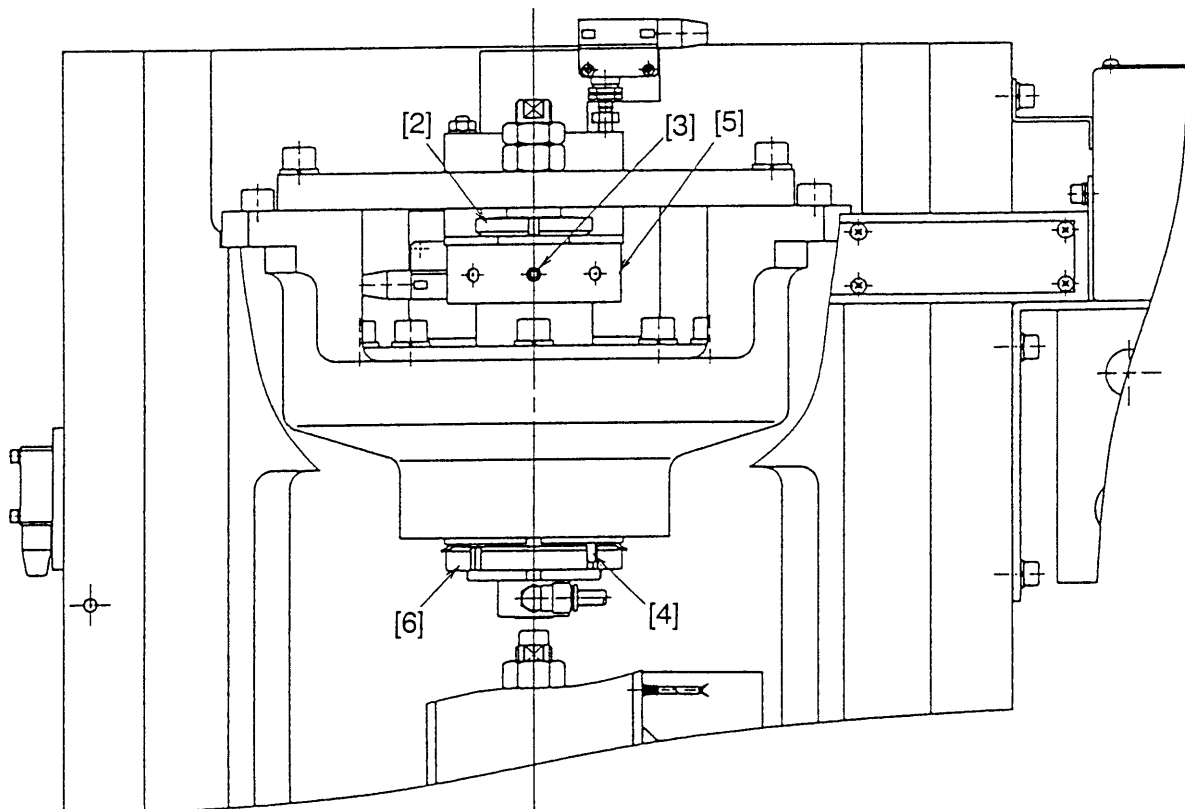
1. Preparation

- (1) Remove the head cover [1].
(It weighs 10kg.)
- (2) Loosen the nut [2].
- (3) Loosen the lock screw [3]
on the tool push allowance
adjusting ring. (One
location)
- (4) Raise the claw [4] across
the groove in the tool push
allowance adjusting nut so
that the nut turns.



2. When the push allowance is insufficient

- (1) Turn the tool push allowance adjusting ring [5] counterclockwise. The screw pitch on the ring is 2mm.
- (2) Turn the tool push allowance adjusting nut [6] clockwise for secure tightening.
- (3) Use the dial gage [7] to adjust the push allowance for about 0.5mm.

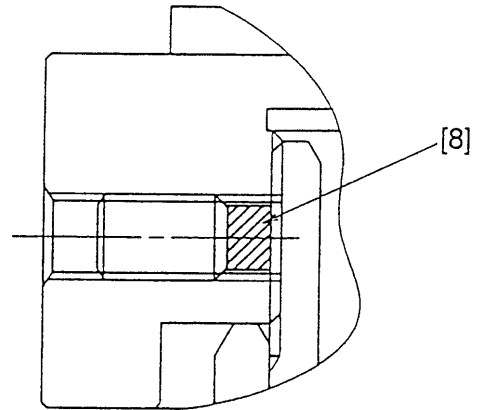
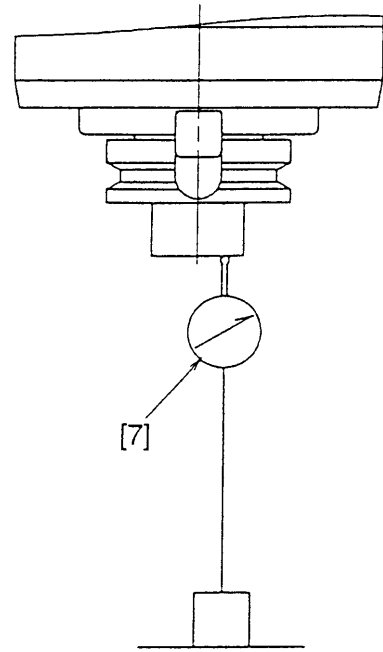


3. When the push allowance is excessive

- (1) Turn the tool push allowance adjusting nut [6] counterclockwise. The screw pitch on the nut is 2mm.
- (2) Turn the tool push allowance adjusting ring [4] clockwise for secure tightening.
- (3) Use the dial gage [7] to adjust the push allowance for about 0.5mm.

4. After adjustment

- (1) Tighten the lock screw [3] on the adjusting ring. When the angle changes greatly, pull out the lock screw and gun metal piece, and tighten with another threaded hole easy to tighten.
- (2) Bend the claw [5] to be put across the adjusting nut to put it across the groove in the nut.
- (3) Tighten the nut [2].
- (4) Attach the head cover [1].



2-7 Each Axis Stroke and Zero Point Adjustment

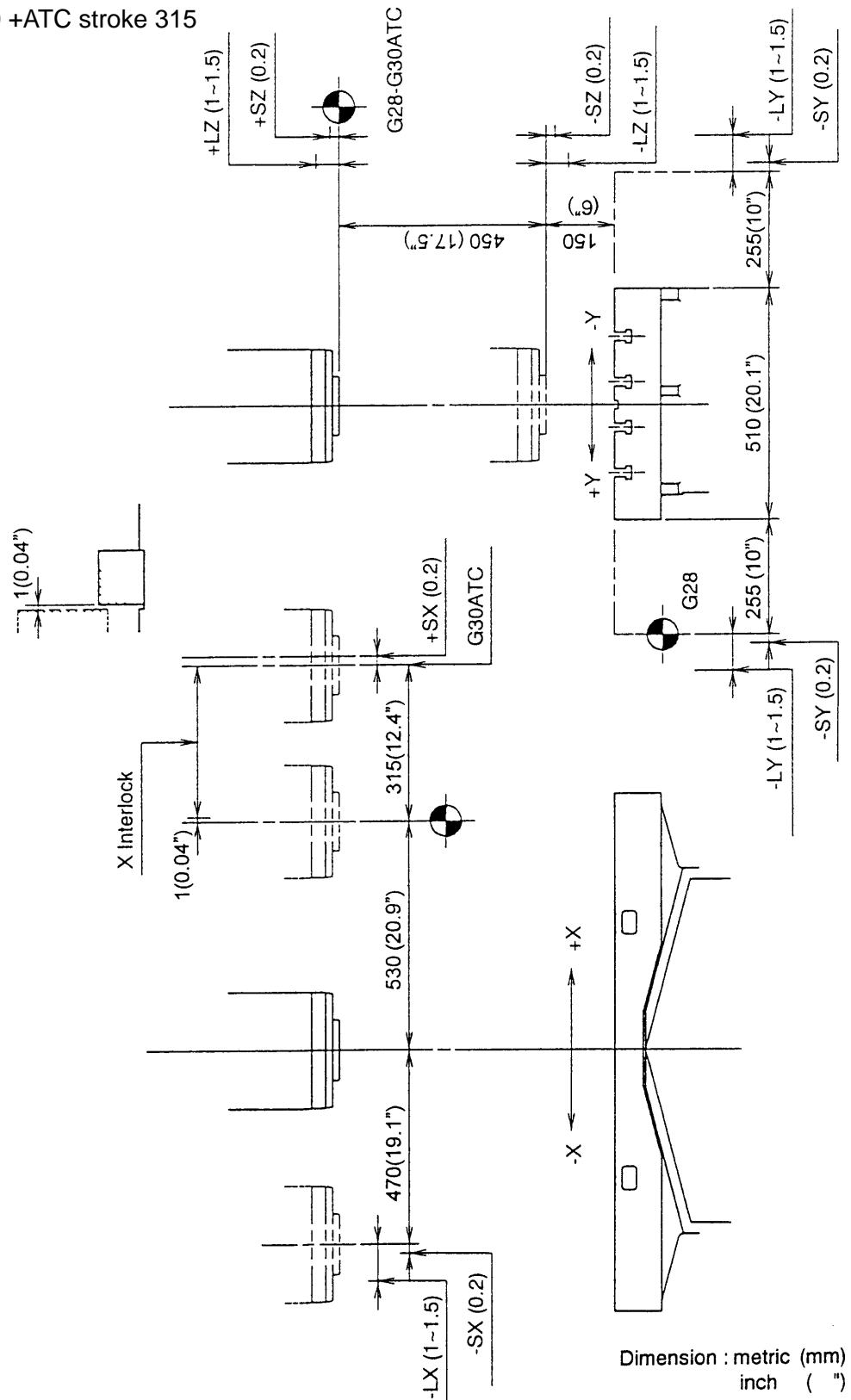
VS50

- (1) Each axis stroke and zero point adjustment
(20 tool and 30 tool ATC specifications)

X-axis 1000 +ATC stroke 315

Y-axis 510

Z-axis 450



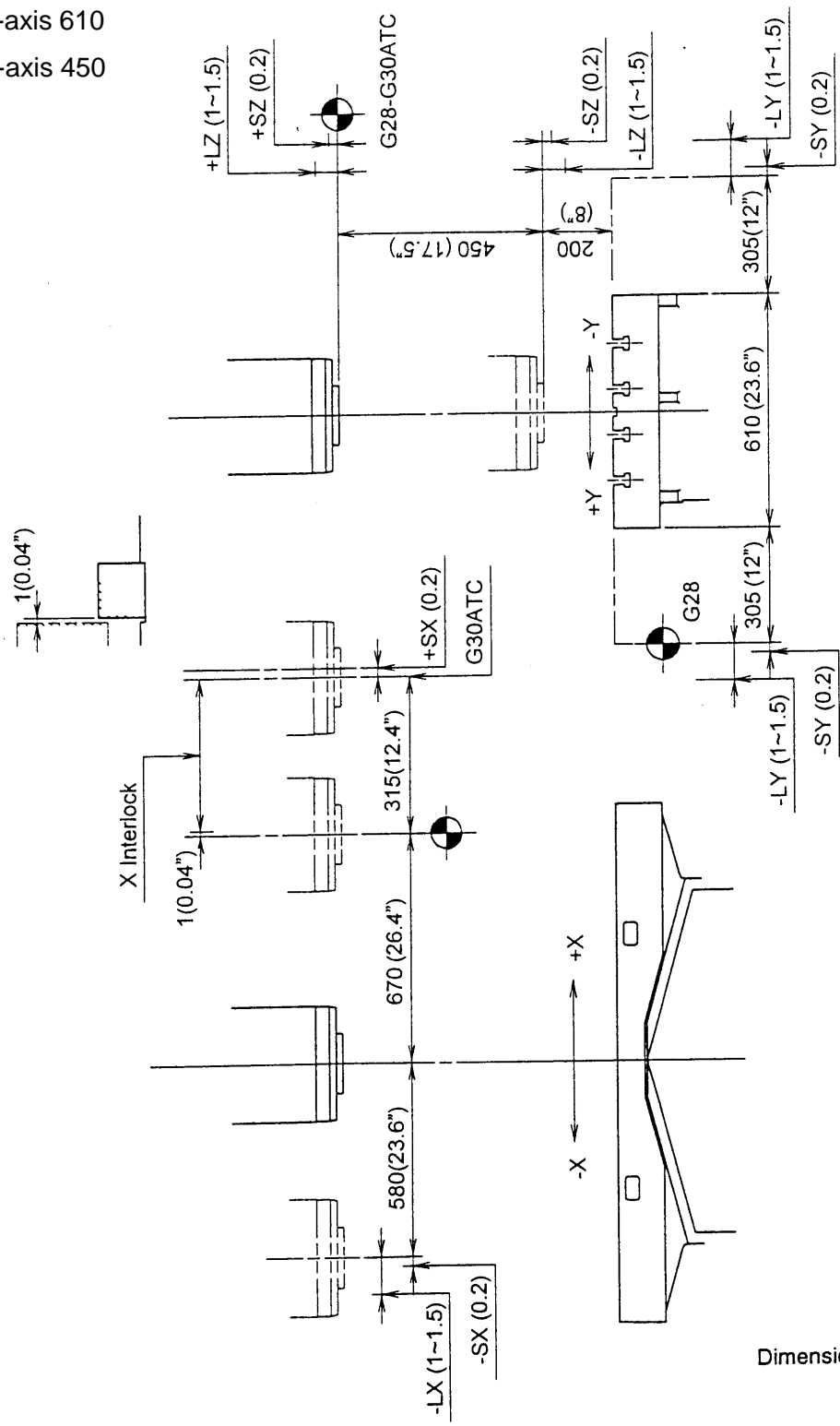
VS60

Each axis stroke and zero point adjustment
(20 tool and 30 tool ATC specifications)

X-axis 1250 +ATC stroke 315

Y-axis 610

Z-axis 450



Dimension : metric (mm)
inch (")

(2) Adjusting parameter No. and contents

Parameter No.	Contents
1226	Machine coordinate value of 2nd reference point
1227	Machine coordinate value of 3rd reference point
1850	Grade shift amount of each axis
1326	+ direction coordinate value of soft stroke limit for each axis
1327	- direction coordinate value of soft stroke limit for each axis

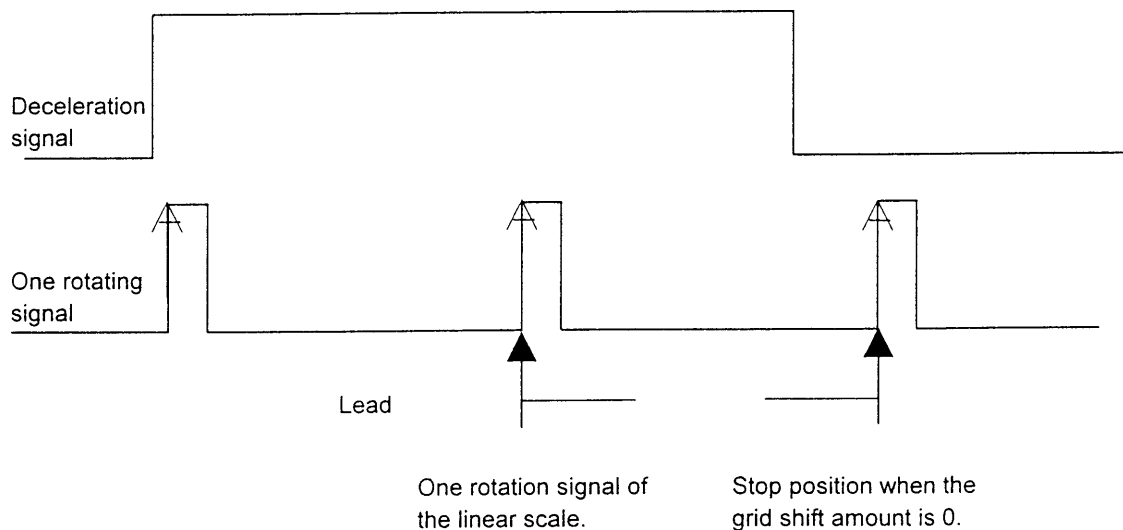
(3) Adjusting .diagnosis input signal No. and contents

Contents		Input signal No. from PC
X axis	Over travel +	G114.0
	Over travel -	G116.0
	Reference point deceleration	G196.0
Y axis	Over travel +	G114.1
	Over travel -	G116.1
	Reference point deceleration	G196.1
Z axis	Over travel +	G114.2
	Over travel -	G116.2
	Reference point deceleration	G196.2
4 axes	Over travel +	G114.3
	Over travel -	G116.3
	Reference point deceleration	G196.3

(4) Procedures of reference point adjustment

- [1] Set 1 bit of the parameter No.1002 to 1 and No.1850 (grid shift amount) to 0.
- [2] Push the emergency button once and set the standby in order to set parameters to the servo.
- [3] Perform manual reference point return.
- [4] Return the lead by half in the reverse direction against the reference point return direction.
- [5] Loosen the dog for reference point deceleration and set the dog to the position where the deceleration signal is turned ON.
- [6] Set the machine reference point and the stop position to the parameter No.1850.

Note) When using the linear scale, turn the one rotation signal sensor ON half this side of the lead from the position where the deceleration signal is turned OFF.



2-8 Countermeasures against shift of follow-up coordinate (shift of memory software OT)

When power failure occurs during axis movement, the follow-up coordinate system is shifted and the software OT may consequently be shifted.

Procedures of recovering follow-up coordinate

- ① Once put the NC source power OFF.
- ② Press the NC source power ON button, while pressing P and CAN buttons. Keep pressing the P and CAN buttons until the NC screen displays $\Sigma 18M$.
- ③ After making preparation for operation, perform zero return of Z, Y, X-axis in this order.
- ④ At the time of X-axis zero return, if a message "Move X-axis to zero return valid area." is displayed, move X-axis to the -X direction by JOG feed. As X-axis enters the valid area, the message changes to "X-axis in zero return valid area".
- ⑤ Perform zero return in the zero return mode.
- ⑥ On completion of zero return, a message "Have the axis returned to machining area." is sometimes displayed. In this case, reset the NC system by pressing NC reset button.

Note 1) During follow-up coordinate releasing operation, S-axis JOG feed is valid in the minus direction only. (This is for avoiding collision with the ATC shutter.)

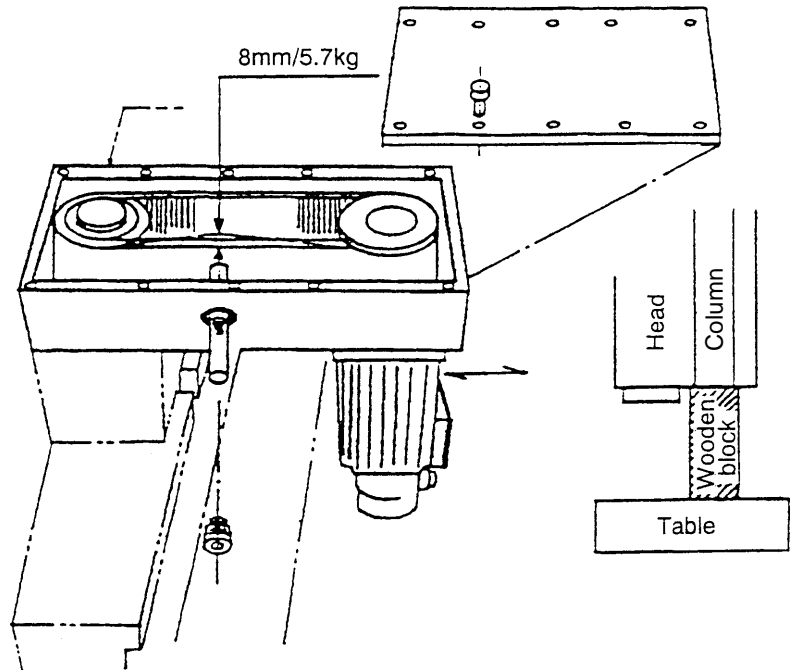
Note 2) During follow-up coordinate releasing operation, X-axis zero return is interlocked until the zero return valid area (-300mm or more from the machine zero point on the minus side) is confirmed.

Note 3) For the feed by manual pulse generator, the axis is not interlocked. When the tool is in contact with work, have the tool escaped to a safe position by manual pulse generator.

2-9 Adjustment of Synchro Belt Tension for Z-axis Feed

Placing a wooden block on the table, lower the head (by the manual handle).

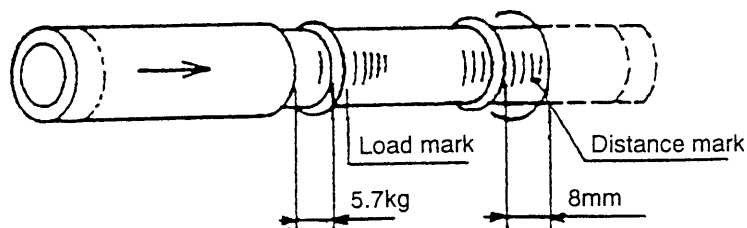
- Measure with a tension meter from a tension confirmation hole and adjust by sliding the servo motor that deflection gets 8mm at 5.7kg.
- After adjusting, disengage the brake release cable, apply brake and raise the head to take out the wooden block.



Note) Use of Tension meter

Inserting a tension meter from a hole by the feed box, apply the tip to the belt.

Setting the ring to 8mm from the hole end, read the ring of a mark scale by inserting until the ring meets the hole end.




2-10 Instructions for Motor/Inverter for ATC Twin Arm Rotation

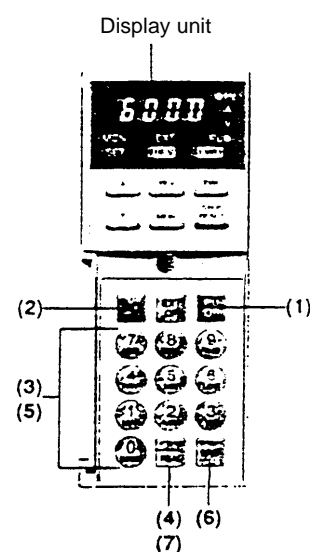
2-10-1 Setting and Changing the Parameters

For the control of an inverter, many parameters are used and it is possible to select the specific parameters necessary for inverter operation and to set proper values for the selected parameters using the parameter unit meeting the application requirements (load and operation conditions).

To protect the parameters from accidental alteration, set "1" for Pr.77 (Parameter write disable selection).

• Operating procedure (Reading and writing the value set in Pr.1 (upper limit frequency))

(1) Press the [PU OP] key The PU operation indicating lamp is lit.	PU Operation 
(2) Press the [SET] key "P." appears in the display unit.	P.
(3) Input "1" (the parameter "P.1" appears in the display unit. number of the parameter to be called.)	P. 1
(4) Press the [READ] key The current set value is displayed in the display unit.	120.0
(5) Input the value to be set ... The new value is displayed in the display unit. (Example:60)	60
(6) Press the [WRITE] key The new value is stored to the memory.	60.00 ↑ Displayed alternately P. 1



..... If the error message "Err." appears in the display unit when the [WRITE] key is pressed, refer to page 20.

- (7) When the [READ] key is pressed next, the parameter number advances to "2" (Pr.2). Press the [READ] key once again, and the current setting for Pr.2 is displayed. In the same operation, the current setting for other parameters can be read.


2-10-2 Initializing the Parameters

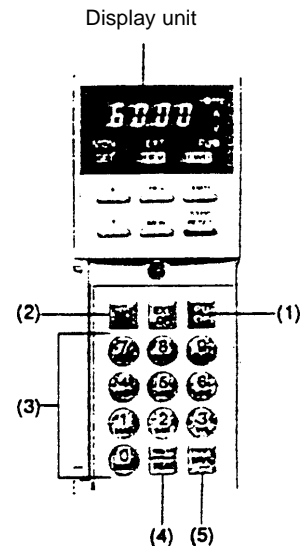
The operation to return the set values for the parameters, excluding the calibration value, to the factory-set values (initialization) is called “parameter clear”.

The operation to initialize all the parameters including the calibration value is called “parameter all clear”.

1) Parameter Clear

• Operating procedure

(1) Press the [PU OP] key The PU operation indicating lamp is lit.	PU Operation 
(2) Press the [SET] key “P.” appears in the display unit.	P.
(3) Input “999” using the “P.999” appears in the display unit. numeric keys.	P.999
(4) Press the [READ] key “Pr.Cr.” appears in the display unit. (Note 1)	Pr.Cr.
(5) Press the [WRITE] key “Pr.Cr” in the display unit blinks on and off. This completes parameter clear operation. (Note 2)	Pr.Cr. (blinking)



Notes: 1. If the [WRITE] key is pressed before pressing the [READ] key, the operation is not accepted.
2. If the attempted parameter clear operation is rejected by the inverter, “Err.” and “Pr. Cr.” are displayed alternately.


Note: In the parameter clear operation, the following parameters are not initialized.

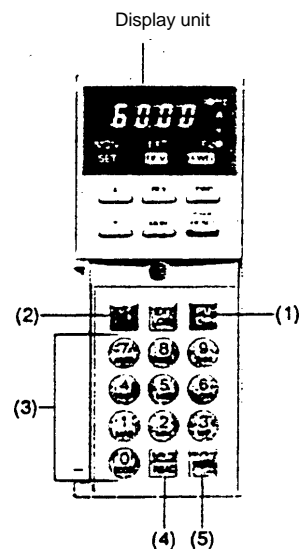
- Pr. 900 FM terminal calibration
- Pr. 902 Frequency setting voltage bias
- Pr. 903 Frequency setting voltage gain
- Pr. 904 Frequency setting current bias
- Pr. 905 Frequency setting current gain
- Pr. 38 Frequency at 5 V (10 V) input
- Pr. 39 Frequency at 20 mA input

Note: While writing of the parameters is disabled, Pr. 77 = 1 or during operation in Pr. 77 = 0, it is not permissible to change the value set for parameters. In this case, however, Pr. 900 to Pr. 905 can be changed.

2) Parameter All Clear

• Operating procedure

(1) Press the [PU OP] key The PU operation indicating lamp is lit.	PU Operation 
(2) Press the [SET] key "P." appears in the display unit.	P.
(3) Input "998" using the "P.998" appears in the display unit. numeric keys.	P.998
(4) Press the [READ] key "ALLC" appears in the display unit. (Note 1)	ALLC
(5) Press the [WRITE] key "ALLC" in the display unit blinks on and off. This completes parameter all clear operation. (Note 2)	ALLC (blinking)



Notes: 1. If the [WRITE] key is pressed before pressing the [READ] key, the operation is not accepted.

2. If the attempted parameter all clear operation is rejected by the inverter, "Err." and "ALLC" are displayed alternately.

Note: While writing of the parameters is disabled, Pr. 77 = 1 or during operation in Pr. 77 = 0, it is not permissible to change the value set for parameters. In this case, however, Pr.900 to Pr.905 can be changed.

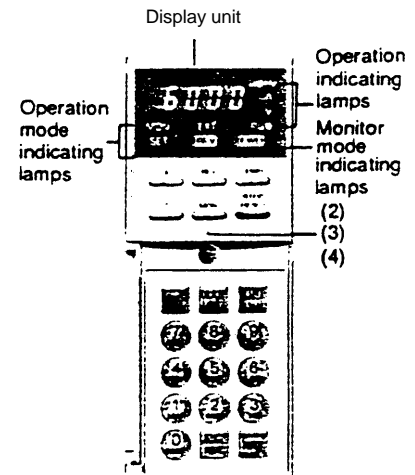
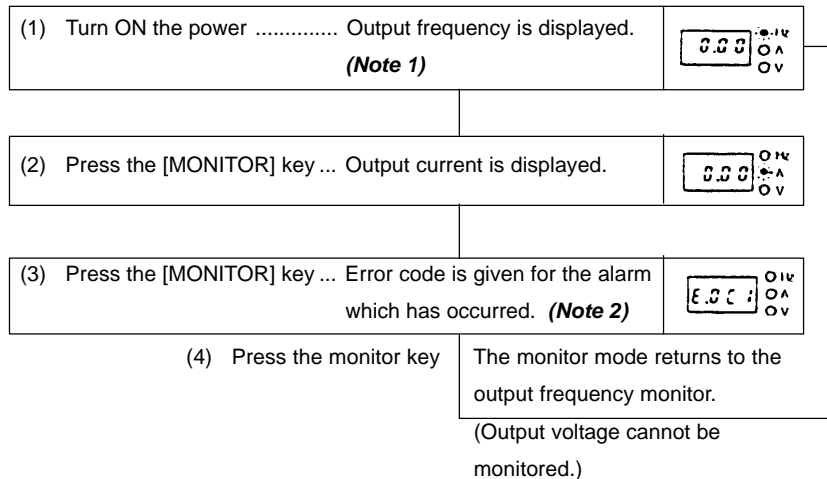
2-10-3 Monitoring

Just after turning ON the power, or when the monitor key is pressed, the parameter unit enters the monitor mode. In the monitor mode, load status (output frequency, output current, etc.), protective function activation status in response to the occurrence of an alarm, etc. can be monitored.

- (1) Changing the monitor information (output frequency, output current, error code)

The monitor information is changed each time the monitor key is pressed.

• Operating procedure



Notes: 1: When the [WRITE] key is pressed while the parameter unit is displaying any of the above indicated monitor data, the priority is given to that monitor mode. After the setting of the priority, the selected information is displayed first when the parameter unit mode is changed to the monitor mode or just after the power is turned ON.

2: If a fault occurs within the inverter, the error message is given immediately.

2-10-4 Errors

If a failure occurs within the inverter during operation, the corresponding error code is automatically displayed in the parameter unit.

1) Error Codes and Contents of Errors

Display	Error Code	Contents of Error
Err 0	E 0	Normal*
Err r.	Err	Setting operation error, reset signal is ON, incorrect connection between the parameter unit and the inverter, etc. wrong incoming voltage.
EOC 1	EOC1	During acceleration, inverter output current exceeded the overcurrent limit.
EOC 2	EOC2	During fixed speed operation, inverter output current exceeded the overcurrent limit.
EOC 3	EOC3	During deceleration, inverter output current exceeded the overcurrent limit.
EOV 1	EOV1	During acceleration, regenerative power from the motor exceeded the regenerative overvoltage limit.
EOV 2	EOV2	During fixed speed operation, regenerative power from the motor exceeded the regenerative overvoltage limit.
EOV 3	EOV3	During deceleration, regenerative power from the motor exceeded the regenerative overvoltage limit.
ETH r	ETH	The electronic thermal relay in the inverter was tripped (current over 150 % of the rated current).
ETH n	ETHM (Note)	The electronic thermal relay in the inverter was tripped (current below 150 % of the rated current, but above 100% current.)
EFAN	EFAN	Fault of the inverter fan (provided for 1.5 K to 3.7 K models)
EOLT	EOLT	During fixed speed operation, the current limit function was continuously activated and the motor stopped.
E BE	E BE	Fault of the brake transistor in the inverter was detected.
EONT	EONT	An external relay was tripped, which was connect to drive by customer.
E PE	E PE	Fault of the memory device in the inverter where the parameter data is stored CPU defective.
EPUE	EPUE	The parameter unit was disconnected from the inverter.
ErET	ErET	Restarting was not possible within the set number of retries.
ECPU	ECPU	Run-away of the CPU.
E GF	E GF	If a ground fault current has flown due to a ground fault occurring in the output (load) side of the inverter, this function stops the inverter output. A ground fault occurring at low ground resistance may activate the overcurrent protection (OC1 to OC3). Provided for the 400 V type only.

Note: The ETHM error occurs if current below 150 % of the current set for the electronic thermal relay (Pr.9) flowed the motor over an extended period of time. <Example>

- If "5 A" is set for Pr. 9 (electronic thermal relay).

$$5(A) \times 150(\%) = 7.5(A)$$

The protective function is activated by a current below 7.5 A, due to the inverse time trip characteristic of the built-in electronic thermal relay circuit.

- * This error is also displayed in the emergency stop status established by selecting the PU STOP key function in external operation is stopped by pressing this stop key during external operation and pressing the stop key.

•Other display

Display	Error Code	Contents of Error
EOP r	EOPT	When the retry function is selected, retry is executed if the corresponding inverter alarm occurs. This message is displayed while retry is executed. The display is given for the period set by Pr.68 (retry execution waiting time).

2) Digital Display (7-Segment Display) and Actual Characters

The indication given by the 7-segment display represents the actual characters as shown below.

Actual Character	Display	Actual Character	Display	Actual Character	Display
0	0	A	A	M	M
1	1	B	B	N	N
2	2	C	C	O	O
3	3	E	E	P	P
4	4	F	F	T	T
5	5	G	G	U	U
6	6	H	H	V	V
7	7	I	I	r	r
8	8	J	J	-	-
9	9	L	L		

3) Logged Error Contents

The contents of the errors are stored for the past four events. To check the contents of these stored errors, follow the procedure indicated below.

• Operating procedure

(1) Press the [MONITOR] key The parameter unit enters the monitor mode.

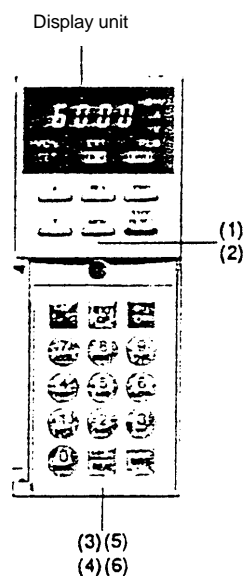
(2) Press the [MONITOR] key The information of the latest error several times until the error display is given
(Note)

(3) Press the [READ] key once The information of the error one before the previous error is displayed.

(4) Press the [READ] key once The information of the error two before the previous error is displayed.

(5) Press the [READ] key once The information of the error three before the previous error is displayed.

(6) Press the [READ] key once The display returns to the information of the latest error.




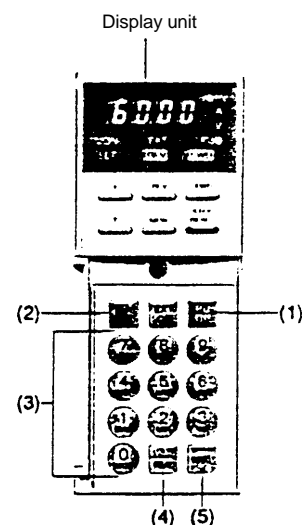
Note: For the information of the latest error, a period is displayed following "E" (Example: E. OC1)

4) Clearing Error Log

The log of errors (four events) can be cleared by the following operation.

• Operating procedure

(1) Press the [PU OP] key The PU operation indicating lamp is lit.	PU Operation 
(2) Press the [SET] key "P." appears in the display unit.	P.
(3) Input "996" using the "P.996" appears in the display numeric keys. unit.	P.996
(4) Press the [READ] key "Er.CL" appears in the display (Note 1) unit.	Er.CL
(5) Press the [WRITE] key "Er.CL" in the display unit blinks. This completes error log clear operation. (Note 2)	Er.CL (blinking)




Notes: 1. If the [WRITE] key is pressed before pressing the [READ] key, the operation is not accepted.
2. If the attempted error history clear operation is rejected by the inverter, "Err." and "Er.CL" are displayed alternately.

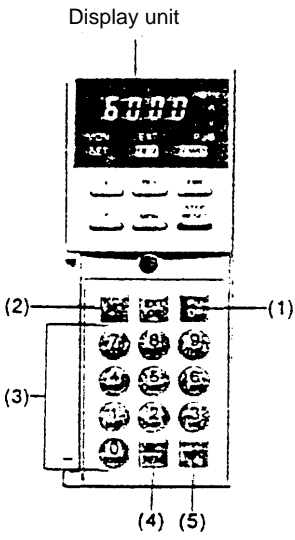
- To check the operation status just before the occurrence of an error:
If an error occurs, the contents of the display unit automatically switches to the display of the actuated protective function. If the monitor key is pressed without resetting the inverter, the display unit displays output frequency. The frequency displayed will be that at which the motor was running just before the occurrence of the error. Current value can be checked in the same manner. However, these values are not stored in the 4 fault memory and are cleared by the reset operation.

2-10-5 Resetting the Inverter

To reset the inverter, follow any of the following four procedures. Remember that the accumulated internal thermal data of the electronic thermal relay and the retry count are cleared if the inverter is reset.

Operation 1

(1) Press the [PU OP] key ... The PU operation indicating lamp is lit.	PU Operation 
(2) Press the [SET] key "P." appears in the display unit.	P.
(3) Input "997" using the numeric keys. "P.997" appears in the display unit.	P.997
(4) Press the [READ] key "rEST" appears in the display unit. (Note 1)	rEST
(5) Press the [WRITE] key ... "rEST" in the display unit is turned off. This completes inverter reset operation. (Note 2)	rEST (off)



Notes: 1: If the [WRITE] key is pressed before pressing the [READ] key, it is not accepted.
2: If the attempted inverter reset clear operation is rejected by the inverter, "Err." and "rEST" are displayed alternately.

Operation 2

Press the [STOP] key while the inverter is in faulty state.

Operation 4

Close the circuit across the reset terminal RES and SD for more than 0.1 second and then open it.

Operation 3

Turn OFF power supply once. After making sure that the POWER indicating lamp or the LED has gone out, turn on power supply again.

2-10-6 Inspection and Maintenance

The general-purpose inverter is static equipment mainly consisting of semi-conductor devices. To prevent problems occurring due to environmental conditions such as high temperature, humidity, dust, and vibration, or aging of the component parts, inspection at regular intervals is necessary.

1) Precautions on Inspection and Maintenance

After the power is turned off, the smoothing capacitor remains charged at high voltage for a while. Remove the front cover and wait until the POWER indicating lamp (refer to page 3) on the printed circuit board goes off. Start inspection or maintenance several minutes after the turning off of the POWER indicating lamp.

2) Inspection Items

(1) Daily inspection

Check the following items during operation.

- a) The motor operates properly.
- b) The environment is normal.
- c) The cooling system is normal.
- d) There is no unusual vibration or noise.
- e) There is no overheat or discoloration.

During operation, check the inverter input/output voltage with a multimeter.

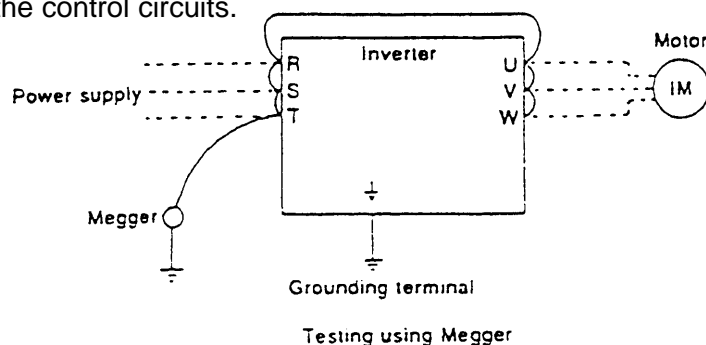
(2) Regular inspection

Check the following items which may be checked only after stopping the inverter at regular intervals.

- a) Check that the cooling system is correct. Clean the air filter, etc.
- b) Tighten the screws and bolts. Since screws and bolts will loosen due to vibration and thermal expansion, check the screws and bolts and tighten them if loose.
- c) Check the conductors and insulators for corrosion and damage.
- d) Measure insulation resistance.
- e) Check the cooling fan, smoothing capacitor, and relay. Replace a defective part.

(3) Testing insulation resistance using a Megger

- a) To test the insulation resistance of the external circuit, disconnect all wires from the inverter terminals so that test voltage will not be applied to the inverter circuits.
- b) For the continuity test of the control circuit, use a multimeter (high resistance range). Do not use a Megger or buzzer for the test.
- c) Conduct the insulation resistance test on the inverter main circuit only. Do not conduct the test on the control circuits.



Daily Inspection and Regular Interval Inspection

Location	Item	Contents	Inspection Interval		Inspection Method	Judgment	Instrument	
			Daily	Interval				
				1 year				2 year
Overall inspection	Environment	Check ambient temperature, humidity, dust, etc.	○			Ambient temperature: -10°C to + 50°C (without freezing) Humidity: Loss than 90 % (non-condensation)	Thermometer, hygrometer, recorder	
	Equipment	Vibration and noise	○		Visual inspection, inspection by ear.	Must be free of abnormal vibration and noise.		
	Supply voltage	Main circuit voltage	○		Measure voltage across terminals R, S, and T	170 to 242 V 50 Hz 170 to 253 V 60 Hz	Multimeter, digital multimeter	
Main circuit	Overall inspection	(1) Insulation resistance (between the main circuit terminal and grounding terminal) (2) Loose connection (3) Overheat on component part (4) Cleaning		○ ○ ○	○ (2) Tighten the loose screws and bolts. (3) Check visually.	(1) After disconnecting all wires at the inverter terminals, close R, S, T, U, V and W terminals. Measure insulation resistance between the point where these terminals are connected and the grounding terminal using a Megger. (1) Must be larger than 5 MΩ. (2) (3) Must be free of abnormalities.	500 VDC Megger	
	Conductors and wires	(1) Distortion in conductors (2) Damage on coating of the conductors		○ ○	(1) (2) Visual inspection	(1) (2) Must be free of abnormalities.		
	Terminal block	Damage		○	Visual inspection	Must be free of abnormalities.		
	Inverter module Converter module	Resistance across the terminals			○	After disconnecting all wires at the inverter terminals, measure resistance across terminals R, S, T and P, N and U, V, W and P, N with a multimeter in the × 1Ω range.		Analog multimeter
	Smoothing capacitor	(1) Leak of fluid (2) Protrusion of the safety valve, or bulging. (3) Measuring the capacitance	○ ○ ○			(1) (2) Visual Inspection (3) Measure with a capacitance measuring instrument.	(1) (2) Must be free of abnormalities. (3) High than 85 % of the rated capacity.	Capacity meter

Location	Item	Contents	Inspection Interval			Inspection Method	Judgment	Instrument
			Daily	Interval				
				1 year	2 year			
Main circuit	Relay	(1) Chattering noise during operation (2) Smoothness on contact		○ ○		(1) Listening inspection (2) Visual inspection	(1) Must be free of abnormalities. (2) Must be free of abnormalities.	
	Resistor	(1) Crack on resistor insulator (2) Disconnection		○ ○		(1) Visual inspection. Cement resistors, wire wound resistor (2) Disconnect the wire at one side and measure resistance with a multimeter.	(1) Must be free of abnormalities. (2) Must be within ±10 % of the Indicated resistance.	Multimeter, digital multimeter
Control circuit Protection circuit	Operation check	(1) Check the balance of interphase output voltage by operating the inverter independently. (2) Conduct the sequence protection operation test to check the protection and display circuits.		○ ○		(1) Measure voltage across the inverter output terminals U, V, W. (2) Short the inverter protection circuit outputs.	(1) Imbalance should be within 4V (for 200V), 8V (for 400 V). (2) The alarm should be output.	Digital multi-meter, rectifier voltmeter
Cooling system	Cooling fan	(1) Abnormal vibration and noise (2) Loose connection	○ ○	○ ○		(1) Turn the fan without applying voltage. (2) Tighten the loose screws and bolts.	(1) Must be able to turn smoothly. (2) Must be free of abnormalities.	
Display	Display unit	(1) LEDs (2) Cleaning	○ ○	○ ○		(1) Check the LEDs on the panel. (2) Clean with rag.	(1) Make sure that the LEDs are lit.	
	Meter	Indication	○			(1) Check the indication of the meter on the panel.	(1) The indication must conform to the specified value.	Voltmeter, ammeter
Motor	Overall inspection	(1) Abnormal vibration and noise (2) Abnormal smell	○ ○			(1) Visual inspection, inspection by body feeling (vibration) and by ear. (2) Smell due to over heating, damage, etc.	(1) (2) Must be free of abnormalities.	
	Insulation resistance	Check with Megger (across terminals and ground terminal)			○	(1) Disconnect wires from the U, V, and W terminals. Motor wires should be included.	(1) Must be higher than 5 MΩ.	500 V Megger.

2-10-7 Troubleshooting

If a fault occurs and the inverter fails to operate properly, locate the cause of the fault and take proper corrective action by referring to the troubleshooting below. If the corresponding information is not found in the table, the inverter has problem, or the component parts are damaged, contact the nearest service representative.

1) Inspection by the Display on the Parameter Unit

In response to the occurrence of a fault, the display unit of the inverter automatically displays the code of the detected fault.

Display	Probable Cause	Check	Corrective Action
Err: Error	<ul style="list-style-type: none"> Operation setting error Reset signal is ON. PU is not connected to the inverter correctly. High input voltage (approx. 260 VAC) Faulty internal circuit CPU run-away 	<ul style="list-style-type: none"> Review the operation method. Is wiring at the reset terminal correct? Is connector secured correctly? Is input voltage correct? 	<ul style="list-style-type: none"> Refer to page 43. Turn OFF the reset signal. Correct the connection. Use correct input voltage. Change the inverter. Reset the inverter (page 42).
OC1: Overcurrent during acceleration (*1)	Overcurrent	<ul style="list-style-type: none"> Is acceleration too fast? Is output short-circuited or grounded? 	<ul style="list-style-type: none"> Extend acceleration time.
OC2: Overcurrent during constant speed operation (*1)		<ul style="list-style-type: none"> Was load changed suddenly? Is output short-circuited or grounded? 	<ul style="list-style-type: none"> Eliminate sudden load change.
OC3: Overcurrent during deceleration (*1)		<ul style="list-style-type: none"> Is deceleration too fast? Is output short-circuited or grounded? Is mechanical brake applied too early? 	<ul style="list-style-type: none"> Extend deceleration time. Check the brake application timing.
OV1: Overvoltage during acceleration	DC overvoltage in main circuit	<ul style="list-style-type: none"> Is acceleration too fast? 	<ul style="list-style-type: none"> Extend acceleration time.
OV2: Overvoltage during constant speed operation		<ul style="list-style-type: none"> Is load changed suddenly? 	<ul style="list-style-type: none"> Eliminate sudden load change.
OV3: Overvoltage during deceleration		<ul style="list-style-type: none"> Is deceleration too fast? 	<ul style="list-style-type: none"> Extend deceleration time. (adjust deceleration time compensating for load GD²) Reduce braking frequency.
THT: Overload warning	Thermal relay for inverter is tripped.	<ul style="list-style-type: none"> Is motor used in the over-loaded condition? 	<ul style="list-style-type: none"> Reduce the load. Increase the capacity of motor and inverter.
THM: Overload warning	Thermal relay for motor is tripped.		
FAN: Fan alarm	Cooling fan of the Inverter has stopped.	<ul style="list-style-type: none"> Is there foreign matter inside the fan assembly? Is there wiring error? 	<ul style="list-style-type: none"> Remove foreign matter. Check the wiring.
OLT: Stall prevention	Operation of the stall prevention function or the current limit function for a long period	<ul style="list-style-type: none"> Is motor used in the over-loaded condition? 	<ul style="list-style-type: none"> Reduce the load. Increase the capacity of motor and Inverter.
BE: Brake transistor alarm (*2)	Faulty brake transistor	<ul style="list-style-type: none"> Is braking frequency correct? 	<ul style="list-style-type: none"> Reduce load (GD²). Reduce braking frequency.
OHT: External thermal relay tripped	An external thermal relay has been tripped.	<ul style="list-style-type: none"> Is the motor overheated? Is an external relay in use? 	<ul style="list-style-type: none"> Reduce load (GD²). Reduce braking frequency. Eliminate sending.

Display	Probable Cause	Check	Corrective Action
PE: Parameter storing device error	Faulty EEPROM	<ul style="list-style-type: none"> Is the number of parameter writing too many? Is EEPROM worn out? 	<ul style="list-style-type: none"> Replace the inverter.
PUE: PU disconnection detected	Connector of the parameter unit is disconnected.	<ul style="list-style-type: none"> Is the parameter unit connection loose? 	<ul style="list-style-type: none"> Install and connect the parameter unit securely.
rET: Retry count over	If operation cannot be resumed within the number of retry times set the inverter alarms and stop retry attempts.	<ul style="list-style-type: none"> Check the cause of the error 	
CPU: CPU error	CPU run-away		<ul style="list-style-type: none"> Replace the inverter.

Notes 1: *1. With the FR-A 024-1.5 K to 3.7 K, if the cooling fan stops, the protection function is activated due to overheating of the main circuit devices. Therefore, check the cooling fan also. The cooling fan must start when power is turned on.

*2. For the inverter equipped with the optional brake resistor.

2: Error output is not given if input voltage is low or momentary power interruption occurs. In these cases, however, the inverter is protected so that the inverter will not be damaged. Depending on the operating status (magnitude of load, during acceleration/ deceleration, etc.), the overcurrent protection function, etc. may be actuated when the input power is restored.

2) Troubles and Check Points

Trouble	Check Points
Motor does not start.	<ol style="list-style-type: none"> (1) Check the main circuit. <ul style="list-style-type: none"> • Is power supplied? (Is the POWER indicating lamp lit?) • Is the motor connected correctly? (2) Check the input signals. <ul style="list-style-type: none"> • Is the start signal input? • Are both the forward and reverse rotation signals input? • Is the frequency set signal zero? • Is the circuit across terminals AU and SD closed (ON) when the frequency setting signal is in the range from 4 to 20 mA? • Is the output stop signal (across terminals MRS and SD) or the reset signal (across terminals RES and SD) ON? (3) Check the values set for parameters. <ul style="list-style-type: none"> • Is the reverse rotation prevention (Pr.78) function set? • Is the setting for the reverse mode (Pr.79) correct? • Are the setting for the bias and gain (Pr.902 to Pr.905) correct? • Is the setting for the start frequency (Pr.13) larger than the operation frequency? • Is the frequency setting for the operation functions (multiple-speed operation, etc.) correct? • Is the setting for the upper limit frequency (Pr.1) zero? (4) Check the load. <ul style="list-style-type: none"> • Is the load too heavy? Is the motor start constrained? (5) Others <ul style="list-style-type: none"> • Has the emergency stop status been established by pressing the parameter unit stop key? (Is "E 0" displayed?) • Is the alarm indicating lamp (ALARM) lit?
Motor rotates in the opposite direction.	<ul style="list-style-type: none"> • Is the phase sequence (U, V, W) at the output terminals correct? • Are the start signals (forward, reverse) connected correctly?
Actual motor speed differs from the set speed excessively.	<ul style="list-style-type: none"> • Is the frequency setting signal correct? (Measure the input signal level.) • Are the values set for the following parameters correct? Pr.1 (upper limit frequency), Pr.38 (frequency at 5 VDC input), Pr.39 (frequency at 20 mA input), Pr.902 to Pr.905 (bias and gain) • Are the input signal lines influenced by external noise? (use shielded wires, if influenced.)
Motor acceleration or deceleration is not smooth.	<ul style="list-style-type: none"> • Is acceleration or deceleration time too short? • Is the load too heavy? • Is the stall prevention function activated due to excessively large value set for torque boost?
Motor speed varies during rotation.	<ul style="list-style-type: none"> • Is the load changing? • Is the frequency setting signal stable?
Motor current is too large.	<ul style="list-style-type: none"> • Is the load too heavy? • Is the value set for torque boost (manual) too large?
Motor speed does not increase.	<ul style="list-style-type: none"> • Is the value set for upper limit frequency correct? Is it too small? • Is the load too heavy? • Is the stall prevention function activated due to excessively large value set for torque boost?
Motor speed fluctuates during motor operation.	<ol style="list-style-type: none"> (1) Check the load. <ul style="list-style-type: none"> • Is the load changing? (2) Check the input signals. <ul style="list-style-type: none"> • Is the frequency setting signal stable? (3) Others <ul style="list-style-type: none"> • In the general-purpose magnetic flux vector control mode, is the setting for applicable motor capacity (Pr.80) correct for the inverter capacity and motor capacity? • In the general-purpose magnetic flux vector control mode, is the wiring length longer than 30 m? • In the V/F control mode, is the wiring length too long ?

Note: "Pr." is an abbreviation of "Parameter."

2-11-2 Pump Unit

1. When using the pump unit:

- [1] Use clean and dry compressed air
- [2] Air containing dust affects the life of the machine.
- [3] Do not forget practicing daily check to avoid accidents and troubles.

Periodical inspection should be exercised once in every 6 month to check wear and secular deterioration of the machine.

2. Specification

Pump MLB01W2	Discharge Quantity	100cc/min (50Hz) 120cc/min (60Hz)			
	Discharge Pressure	15kgf/cm ² {1.5MPa}			
Motor	Voltage	100V		200V	
	Cycle	50Hz	60Hz	50Hz	60Hz
	Amperage	1.5A	1.2A	0.8A	0.6A
	Revolution	2500rpm	3000rpm	2500rpm	3000rpm
	Output	17W×2P			
	Insulation Class	Class E			
	Max. operating time	5 minutes			
	Pausing time	Operating time×2 or longer (min. 2 minutes)			
Total tank capacity		2• (effective capacity 1.3•)			
Float switch (OLV01)		Contact point capacity Max. AC0.33A, DC0.5A			
Pressure switch (GFB8)		Contact point capacity Max. AC250V 5A			
Viscosity range of oil used		50 ~ 800 cSt			

★Press the lubrication button when you wish to operate the pump at an arbitrary time.

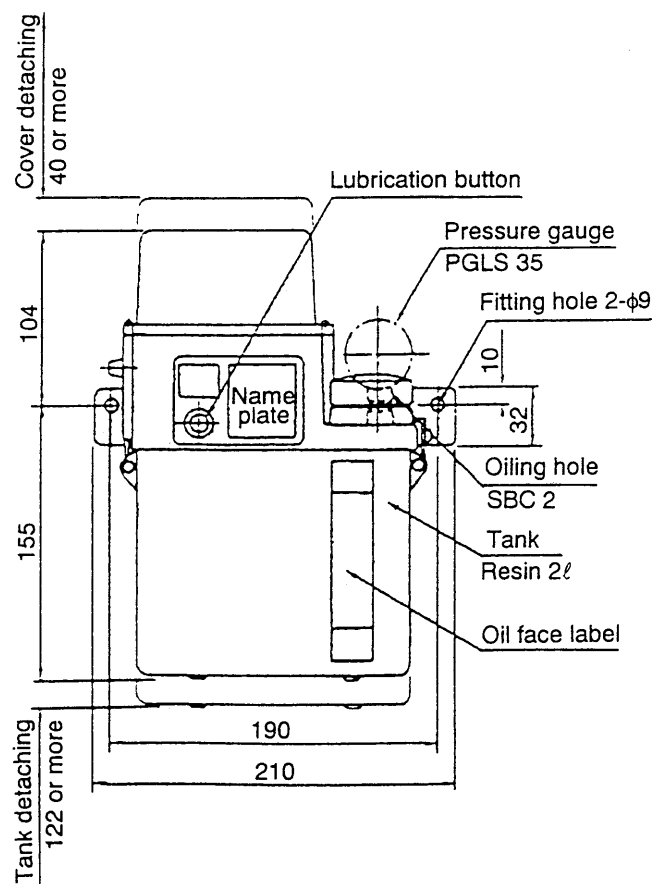
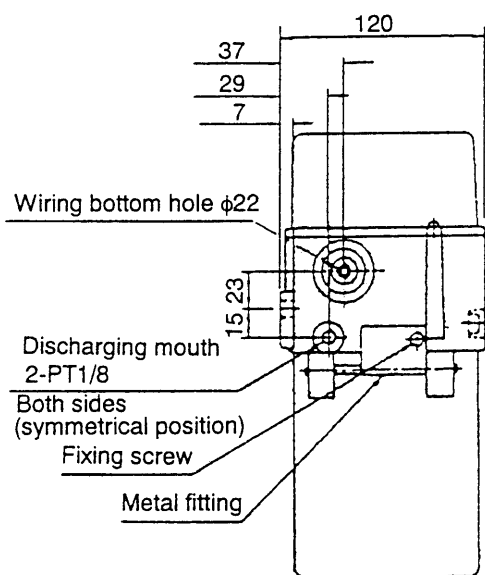
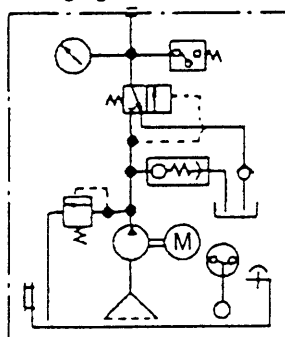
The pump will keep running while the button is being pressed.

3. Outside view

Model type		LCB47613
Pump MLB01W2	Discharge volume	100cc/min
	Discharge pressure	15kgf/cm ² {1.5MPa}
Tank	Total capacity	2•
	Effective capacity	1.3•
Control unit		None
Pump unit weight		4.1kg

Circuit diagram

Discharging mouth PT1/8



2-11-3 Mixing Valve

1. Function

The mechanism of the mixing valve is to supply minimum requirement of lubricating oil intermittently into the flow of compressed air, enabling to efficiently perform two functions of lubrication and cooling.

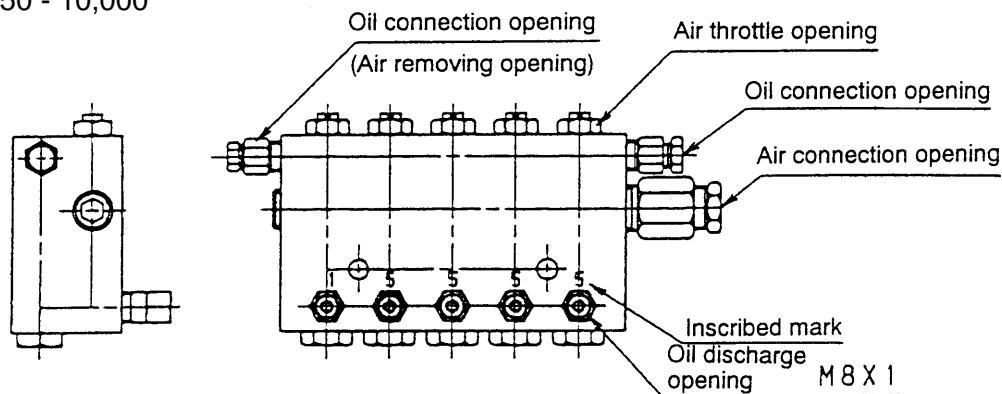
It is especially effective in cooling and lubrication of the bearing part of the high revolution spindle.

2. Specification

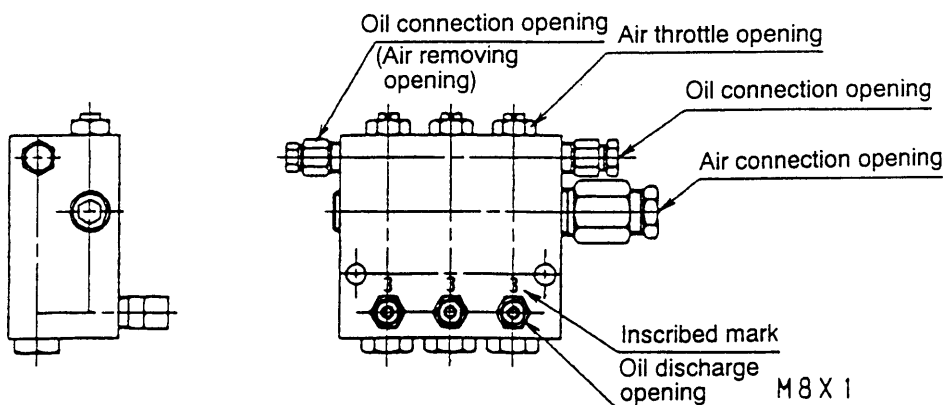
Spindle specification	#50 - 10,000	#40 - 20,000
Type	MIX-1A4C S joint	3B-1 S joint
Oil to apply	High speed spindle oil or turbine oil (Refer to "2-2-1 List of Lubrication and Oil Supply")	
Viscosity to apply	32cSt/40°C	22cST/40°C
Air pressure to apply	0.4Mpa	
Oil pressure too apply	1.5Mpa	
Oil discharge volume	0.01cc×1, 0.05cc×4	0.03cc×3

3. Outside view and name of each part

Y #50 - 10,000



Y #40 - 20,000



2-11-4 Daily maintenance

1. Air removing of mixing valve

- 1) Bring the system into the maintenance mode and make the setting of lubricant discharge at one shot per minute.
- 2) Detach the piping of the nozzle part at the tip.
- 3) Close the air throttle of the mixing valve completely. (by turning the throttle lever clockwise to the end stopper)
- 4) Fill up lubricant in the circuit between the lubrication unit and the mixing valve. (3 ~ 5 shots)
- 5) Confirm that no air remains in the circuit, including the part of the circuit up to the sliding face.
Make necessary measures such as loosening the piping to the switching valve on the lubrication side of the sliding face.
- 6) Repeat discharges until lubricant is filled up in the mixing valve and lubricant begins to flow out to the path on the nozzle side. (several shots)
- 7) Open the air release plug. (loosening it to such an extent that it is held hanging and not dropping off)
- 8) Repeat discharges until air is removed. (about 5 shots)
- 9) Repeat shots until lubricant free of air mixture flows into the circuit on the nozzle side. (If air-free lubricant in the circuit is measured in length of about 10 cm, it is all right.)
- 10) If the lubricant movement at the tip by one shot comes up to the figures in the Table below, it is all right.)
- 11) Open the air throttle. (2 counterclockwise turns)
- 12) Let air-flow go through until lubricant becomes vacant in the circuit after the mixing valve.
- 13) Connect the pipe to the nozzle.

Mixing valve discharge volume and move amount of lubricant in the path

Call No.	Inscribed mark	Discharge volume (cm ³ /stroke)	Move distance (mm)
A	1	0.01	1.5 ~ 2.5
B	3	0.03	5 ~ 8
C	5	0.05	7 ~ 13

Note: The above values are worked out based on the tube inner diameter of 2.5mm.

2. Dry filter

To avoid the influence of variable quality of source air, the circuit has two built-in dry filters. For the maintenance, the first filter is cleaned and the second one is replaced. When a filter is clogged, the pressure switch detects it by dropped air pressure.

1) Replacement

Fill the date of replacement on the label attached on the filter cartridge so that the next replacement date is scheduled, normally 4 to 5 months later, though it varies depending on working conditions. Replacement is also necessary when the pressure loss exceeding 0.7kg/cm^2 of the air passing through the filter, which is an evidence of the clogged condition of the second filter.

2) Cleaning

The first filter is made of stainless steel. The filter can be reused By washing it once in every two years with detergent, though such intervals would vary depending on the working conditions, Use organic detergent such as trichloroethylene, when the contamination is serious, otherwise ordinary detergent will do.

The second filter is made of cotton woven with stainless steel wire, which is subject to shrink or deform when washed and dried. Thus it cannot be washed and reused, therefore must be replaced with new one.

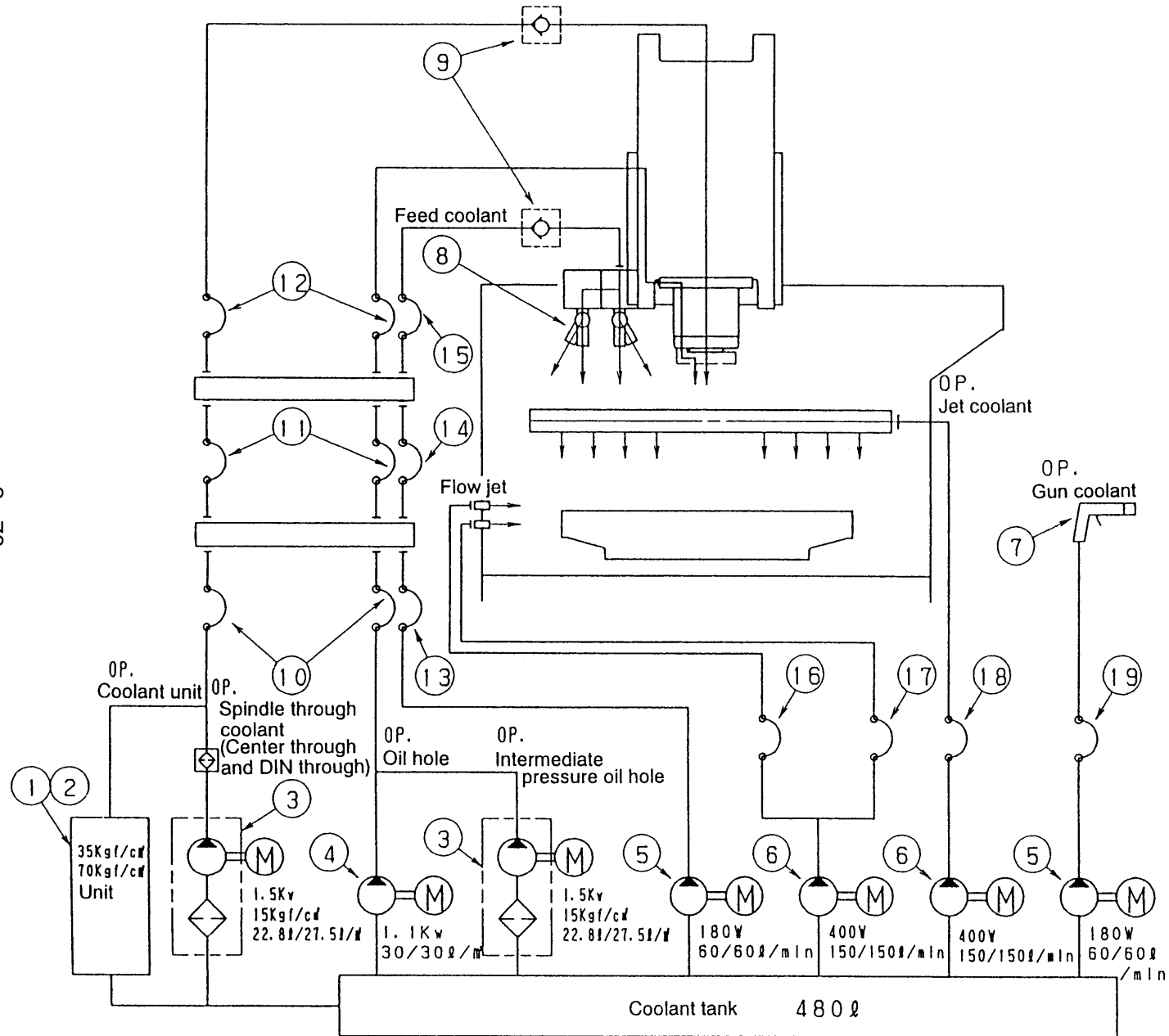
3) Method of replacing filter

There is no need of detaching the unit from the airflow line or from the fitting metal. For replacing, proceed with the following steps keeping the position of the filter unit as it is.

1. Loosen all the bolts on the manifold until the cartridge becomes freely movable.
2. Remove one outside corner bolt and draw out the cartridge side way.
3. Set a new cartridge in the same position.
4. Put the corner bolt back to the position and tighten evenly in turn, first the center bolt then the corner bolt.

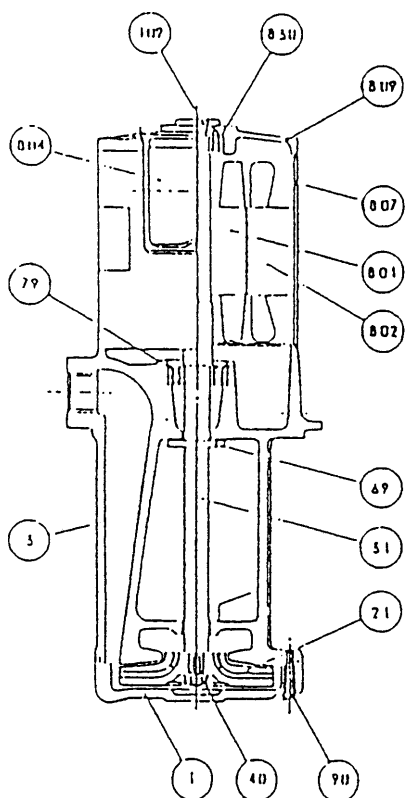
3. Lubricant filter

In order to ensure stable performance of the mixing valve, a main pipe filter is installed in the lubricating circuit. For the maintenance of this filter, exercise inspections with intervals of one year. Filter clogging is detected by the pressure switch.



19	VINYL HOSE	S0-9	2.5m
18	VINYL HOSE	S0-25	2.5m
17	VINYL HOSE	S0-25	2.5m
16	VINYL HOSE	S0-25	2.5m
15	VINYL HOSE	S0-25	2.5m
14	VINYL HOSE	S0-25	2.5m
13	VINYL HOSE	S0-25	2.5m
12	HOSE	P105-12×100cm FU-FU	2
11	HOSE	P105-12×100cm FU-FU	2
10	HOSE	P105-9×70cm FU-FU	2
9	CHECK VALVE	RF1/2	2
8	NOZZLE	SNPT 1/4-40	2
7	COOLANT GUN	SP100	1
6	COOLANT PUMP	LSW25T0.4	1
5	COOLANT PUMP	LSW15T0.18	2
4	COOLANT PUMP	VKR122AD	1
3	TROCHOID PUMP	TOP-2MY1500-216HWNPE-VB15-10	2
2	COOLANT UNIT	RFH25YC3702V-5	1
1	COOLANT UNIT	RFH25YC3702V-6	1
NO	PART NAME	MODEL	QTY

1) Specifications of the coolant pump (for flood/gun coolant)



No.	Part name	Q'ty	Materials	
1	Casing	1	FC15	JISG5501
3	Discharge casing	1	FC15	JISG5501
21	Impeller	1	FC20	JISG5501
31	Spindle	1	S45C	JISG4051
40	Impeller nut	1	SS	JISG3101
69	Cutting edge	1	FPM	
79	Stopper	1	SK-5	JISG4401
90	Hexagon bolt	2	SS	JISG3101
109	Cap	1	FPMI	
801	Rotor	1	A1	
802	Stator	1	S60	JISC2554
804	Terminal boat	1	SPCE	JISG3141
807	Motor frame	1	SPCC	JISG3141
809	Upper bracket	1	FC15	JISG5501
830	Wave form washer	1	SK-5	JISG4401

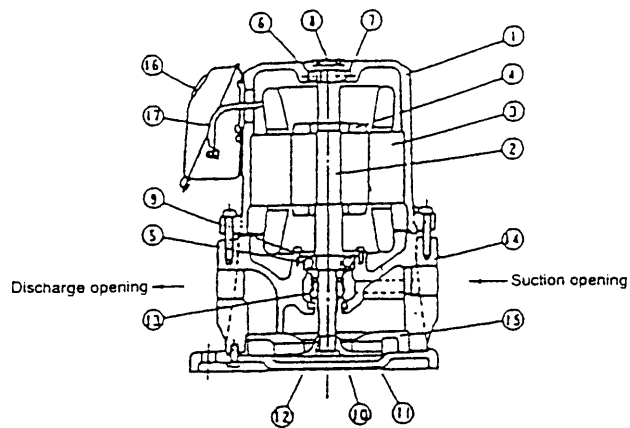
Table of the specifications

Pump model		LSW15A0.18MR	
Pump	Diameter (mm)	15	
	Discharge amount (L/min)	10~60	
	Total lift of pump (m)	9~5	13~8
	Using viscosity limit (cst)	150	75
	Using liquid filtering accuracy	Middle, class accuracy filtering (Max. length of chips possible in the pump :2.5mm))	
	Quality of material	Impeller, casing, discharge casingFC	
Motor	Phase	3	
	Pole	2	
	Output (kW)	0.18	
	Voltage (V)	200	200/220
	Max. permissible current (A)	1.1	1.2
	Frequency (Hz)	50	60
	Synchronous rotation speed (rpm)	3000	3600
	Class of insulation	E	
	Ambient temperature (°C)	-15 ~ 40	
	Temperature rise (deg)	Not more than 75	
	Rating	Continuous	
	Protection method	All closed inner type	
	Bearing	Loading side	6202VV
		Opposite loading side	6202VV
	Gross weight (kgf)	13	
	Painting color	RAL-6011	

Note) 1. Inquire at Hitachi Seiki for other special fluids.

2. It is of the type using 50/60Hz in combination.

2) Coolant pump (For jet coolant)



Parts List

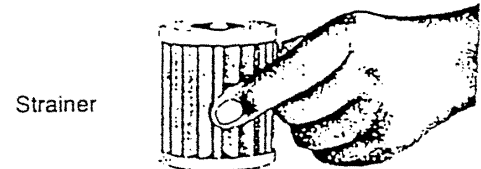
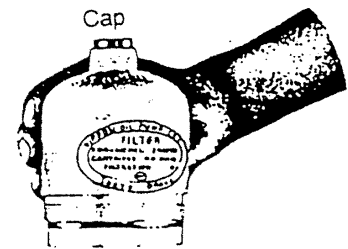
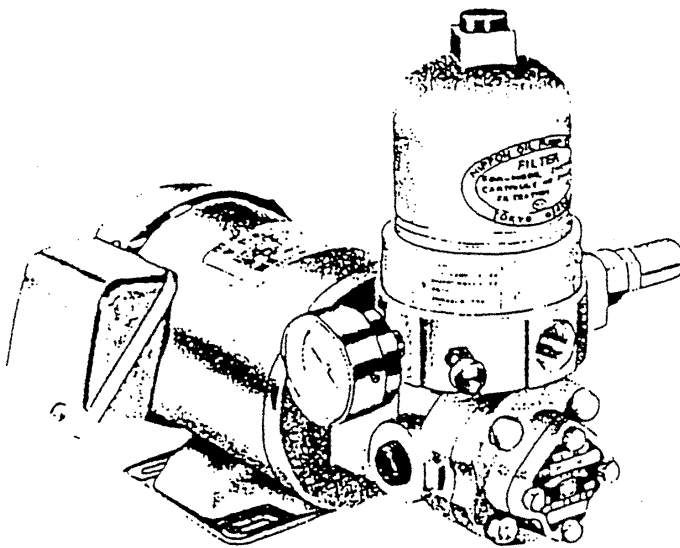
1	Frame
2	Shaft
3	Stator
4	Rotor
5	Driving-side bearing
6	Counter-driving-side bearing
7	Wave washer
8	Rotation direction
9	End cover
10	Impeller
11	Bottom plate
12	Adjusting washer
13	Mechanical seal
14	Casing
15	Spiral box
16	Terminal box
17	Terminal cable

Specification

Standard voltage

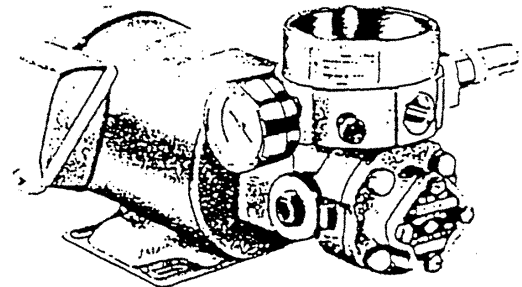
Spec Model	VKN093A	
Output (W)	400	
Rated voltage (V)	200	200/220
Frequency (Hz)	50	60
Rated current (A)	2.4	2.5/2.4
Discharge (• /min)	140	200
Total lift head (m)	5	
Max. suction pipe length (m)	0.7	
Applied viscosity limit (R')	800	300
Standard piping dia. (PS)	1	
Painted color	Mancel N5	
Pump standard	JEM 1242	

3) Oil hole coolant pump (1.5MPa)



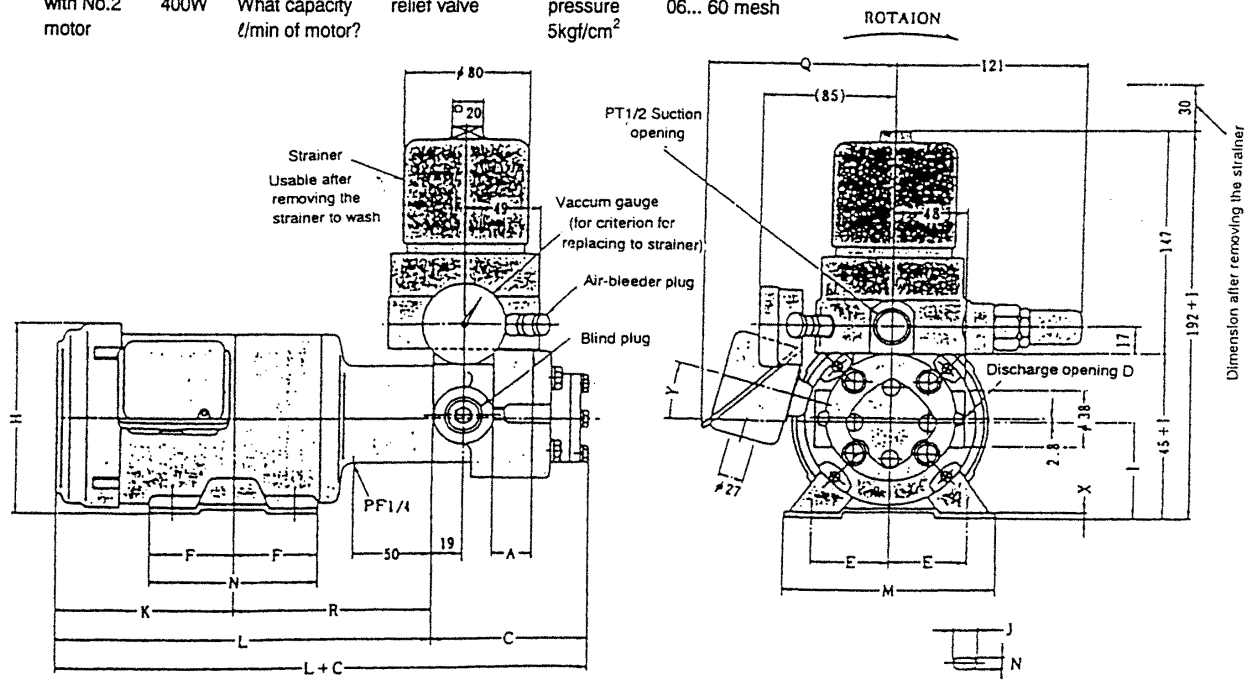
Pump model	Discharge 1500rpm • /min	Discharge 1800rpm • /min	Rotor width A	C	Discharge dia. D PF	Weight kgf
204HWMPVBE	6.0	7.2	10	86	1/2	4.3

Sub-plate with valve



TOP-2M-Y-400-210HAMP-VBE-5K-15

Trochid pump	Abbreviation for pump with No.2 motor	Motor output 400W	Type of trochid pump What capacity l/min of motor?	With filter washing type relief valve	Relief valve setting pressure 5kgf/cm ²	Mesh of filter 15...150 mesh 06... 60 mesh
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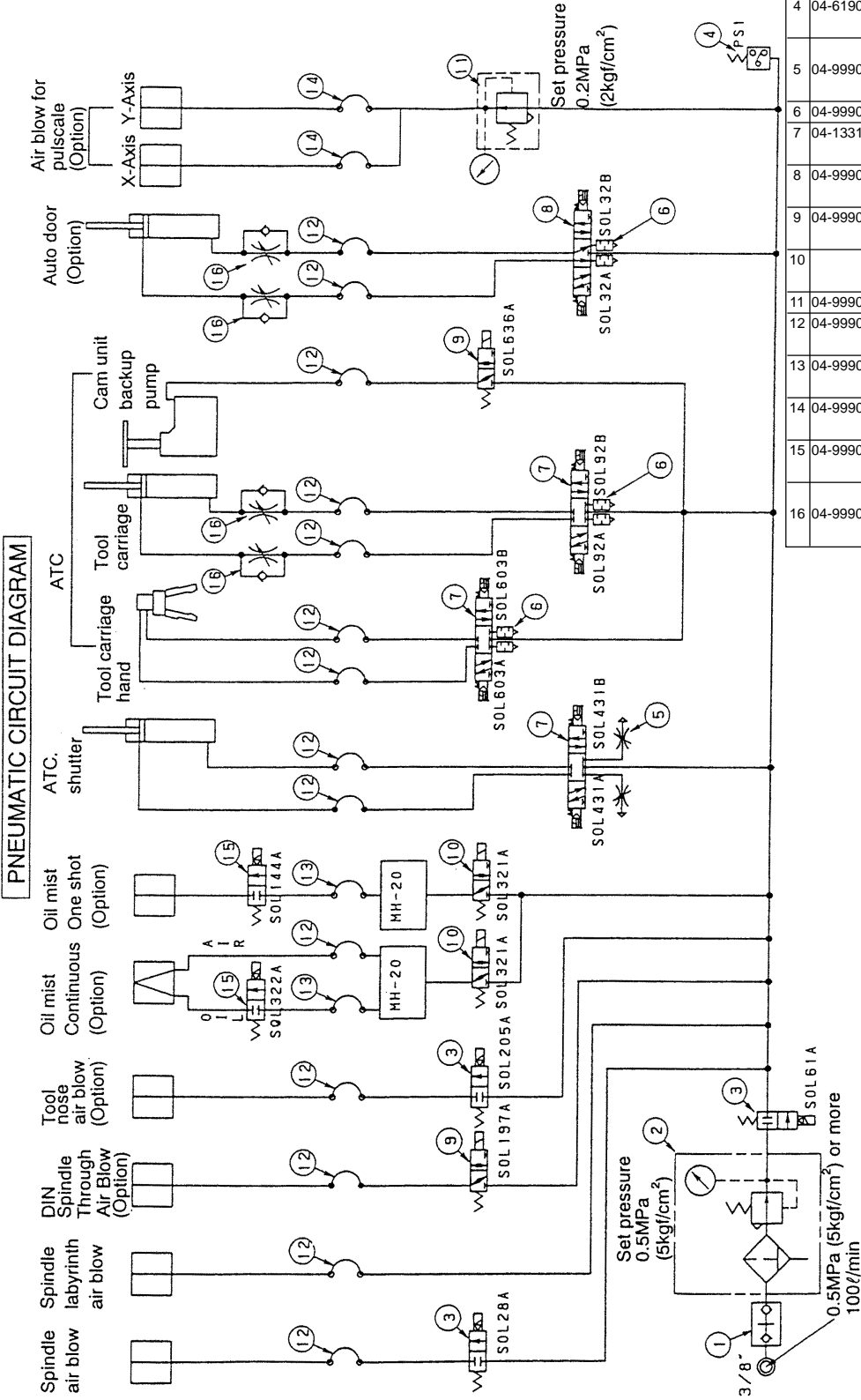


Motor provided (made by Yasukawa Electric Co., Ltd.)

Motor output	K	R	L	I	P	E	F	Q	H	J	M	N	Z	Y	X	Weight kgf
200W	114	127.5	241.5	63	127	50	40	125	127	15	135	108	7	15	3.2	7.5

2-13 Related to Air Pressure

1) Pneumatic circuit diagram



NO	HITACHI SEIKI CODE	PART NAME	PART NUMBER	MAKER
1	04-780301750	COUPLER	30SH+20PM	NITTO KOUKI
2	04-999033438	FILTER REGULATOR	W300-8-F	CKD
3	04-133108210	SOLENOID VALVE	AB41-02-5-02G-AC100V	CKD
4	04-619000420	PRESSURE SWITCH	PE-2T	CKD
5	04-999026702	FLOW CONTROL VALVE	SMW-6A	CKD
6	04-999020056	SILENCER	SLW-8W	CKD
7	04-133149210	SOLENOID VALVE	4F130-08-AC100V	CKD
8	04-999034819	SOLENOID VALVE	4F230-08-AC100V	CKD
9	04-999036941	SOLENOID VALVE	AG31-02-1-02G-AC100V	CKD
10		SOLENOID VALVE	AG31-01-1-02G-AC100V	CKD
11	04-999054394	REGULATOR	R1000-8-B	CKD
12	04-999036941	NYLON TUBE	F-1508	CKD
13	04-999037052	NYLON TUBE	F-1504	CKD
14	04-999037052	NYLON TUBE	F-1506	CKD
15	04-999048762	SOLENOID VALVE	AG31-01-3-02G-AC100V	CKD
16	04-999026702	FLOW CONTROL VALVE	SC3G-6-8	CKD

2) Air filter/regulator unit

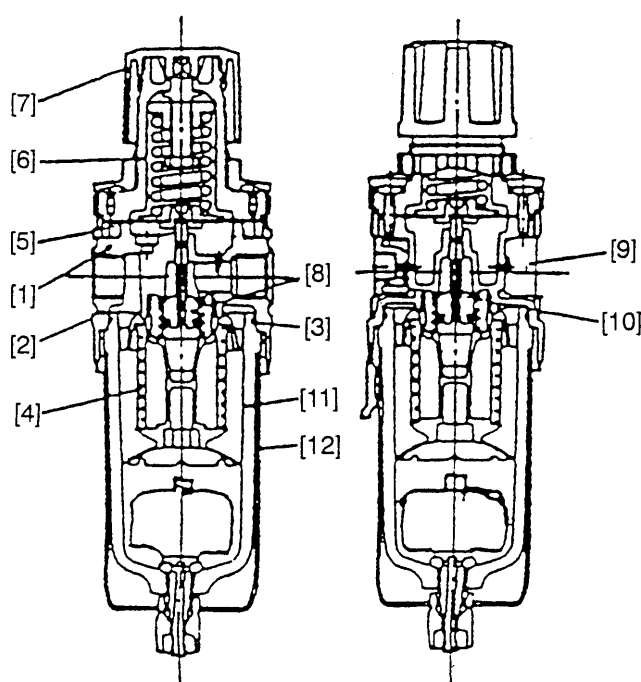
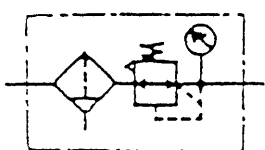
Outline and features

The Selex FR unit (W3000) is an equipment serving both as the filter F3000 which has a high effect for removing water drop and dust and as the regulator R3000 which is capable of setting accurate and stable pressure. It is most suitable to utilize it in a narrow space especially.

Precautions for using

- ☞ Shelter the equipment from direct rays of the sun.
- ☞ Since the material of the bowl is polycarbonet, don't use checmicals such as thinner, carbon tatra-chloride, alcohol, chloro-form, trichlor-ethylene, ecetate ester, sulfuric acid and alkaline soluble fluid etc. and in such atmosphere.
- ☞ Wash the bowl element in water after washing it in domestic neutraldetergent.
- ☞ The ID of the discharging parts of the drain is to be not less than 6mm and its length is to be within 5mm and don't use elevating pipings.
- ☞ Don't move the equipment by gripping the pressure control knob on the regulator section or fling it around.

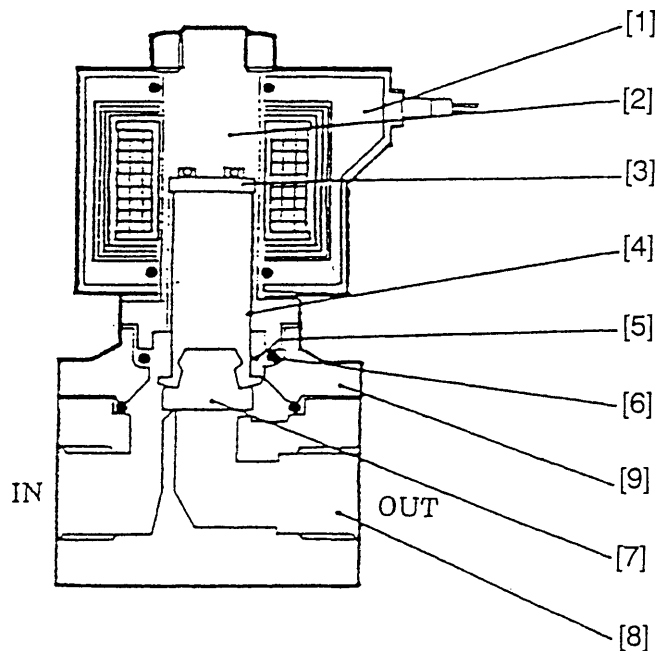
JIS symbol



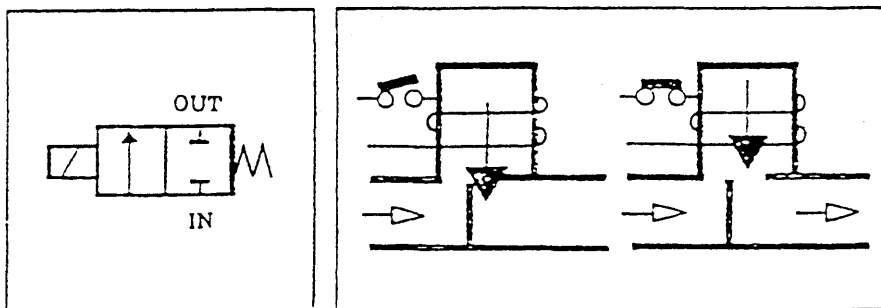
No.	Part name	Material	Part No. W3000
[1]	Plate cover	ABS	—
[2]	Body	ADC	—
[3]	O-ring	Specification NBR	F4-550349
[4]	Element	PP	F4-550350
[5]	Dia-frame ass'y	ZDC, NBR	F4-550464
[6]	Cover	PBT	—
[7]	Nob	POM	—
[8]	Valve ass'y	C3604, NBR	F4-550477
[9]	Pressure gauge ass'y	PBT, NBR	G401
[10]	Gauge plug ass'y	PA, BR	F4-550241
[11]	Bowl ass'y	PC, POM, PUR	F4-550478
[12]	Bowl guard	PA	F3-550425

3) Pneumatic solenoid valve (for spindle air-blow)

AB 41025-02G-AC100V

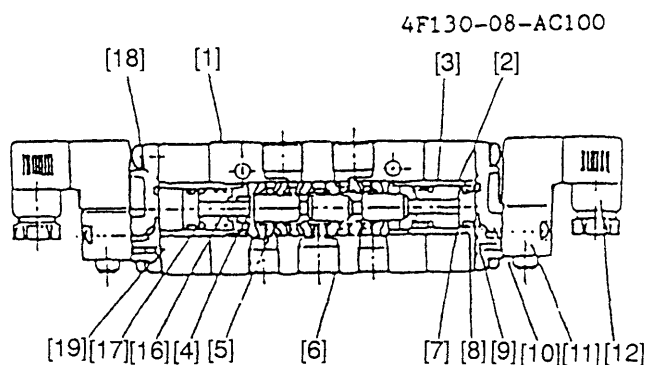


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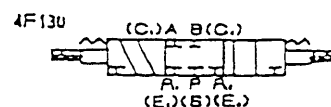


No.	Product Name	Material
1	Coil	Resin, Wound by tape for type H
2	Core assembly	sus405, 316L, L, 403
3	Shading coil	Cu, In case of Body SUS: Ag
4	Plunger	SUS405
5	Spring	SUS304
6	O-ring	Nitric byron Teflon
7	Seal	NBR byron Teflon
8	Body	C3771 or SUS303
9	Stuffing	C3771

4) Pneumatic solenoid valve (for ATC shutter)



● JIS symbol



3 positions are of all port flock.

4F130

SOL X At conduct

P (S) → A (C1)

B (C2) → R2 (E2)

SOL Y At conducted condition

P (S) → B (C2)

A (C1) → R1 (E1)

At non-conducted condition

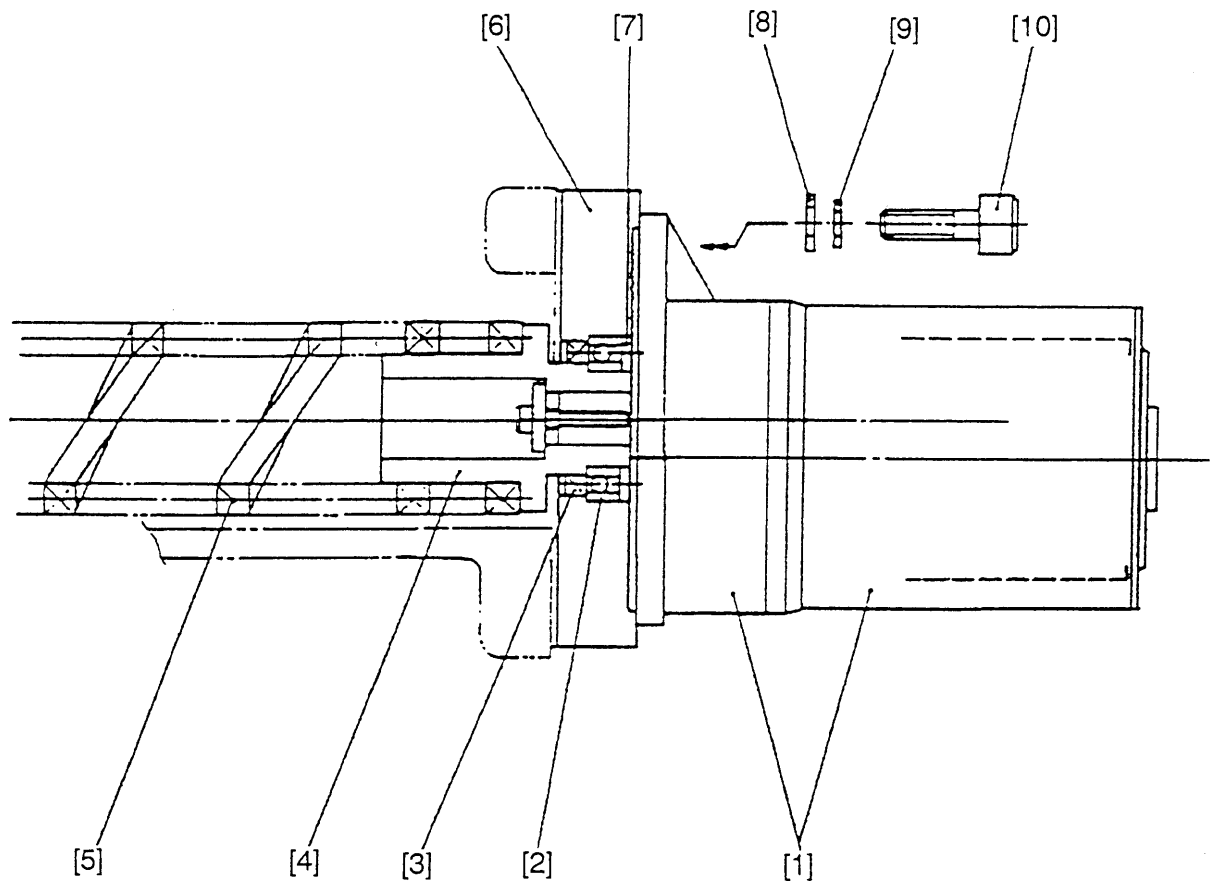
P (S), A (C1), B (C2),

R1 (E1), R2 (E2)...Closed

No.	Part name	Materials	Remarks
[1]	Name plate	Tetoron film	
[2]	Gasket	NBR	Nitrile rubber
[3]	Cylinder(A)	A5058	Aluminum
[4]	Spool	A6063	Aluminum
[5]	Seal ass'y		
[6]	Body	ADC12	
[7]	Piston(B) ass'y		
[8]	Gasket	NBR	Aluminum
[9]	Pilot valve body	ADC12	Aluminum die casting
[10]	Gasket	NBR	Aluminum
[11]	Microsole SOL valve		
[12]	Small DIN terminal box		
[13]	Cylinder(B)	A5056	Aluminum
[14]	Piston(B) ass'y		
[15]	Cap	ADC12	Aluminum die casting
[16]	Spring seat	SS41	
[17]	Spring	SWPB	Piano wire
[18]	O-ring	NBR	Nitrile rubber
[19]	Body block	A5056	Aluminum die casting

[5]	[7]	[11]	[14]
Seal assay	Piston (A) assay	Coil model No.	Piston (B) assay
4F9-112	4F9-110	4F9-Microsole simple	4F9-111
	4F9-159	model No. (Basic	—
		ps132-MOB-Voltage)	—

2-14 Chip Conveyor (For the Inside of Standard Machine)

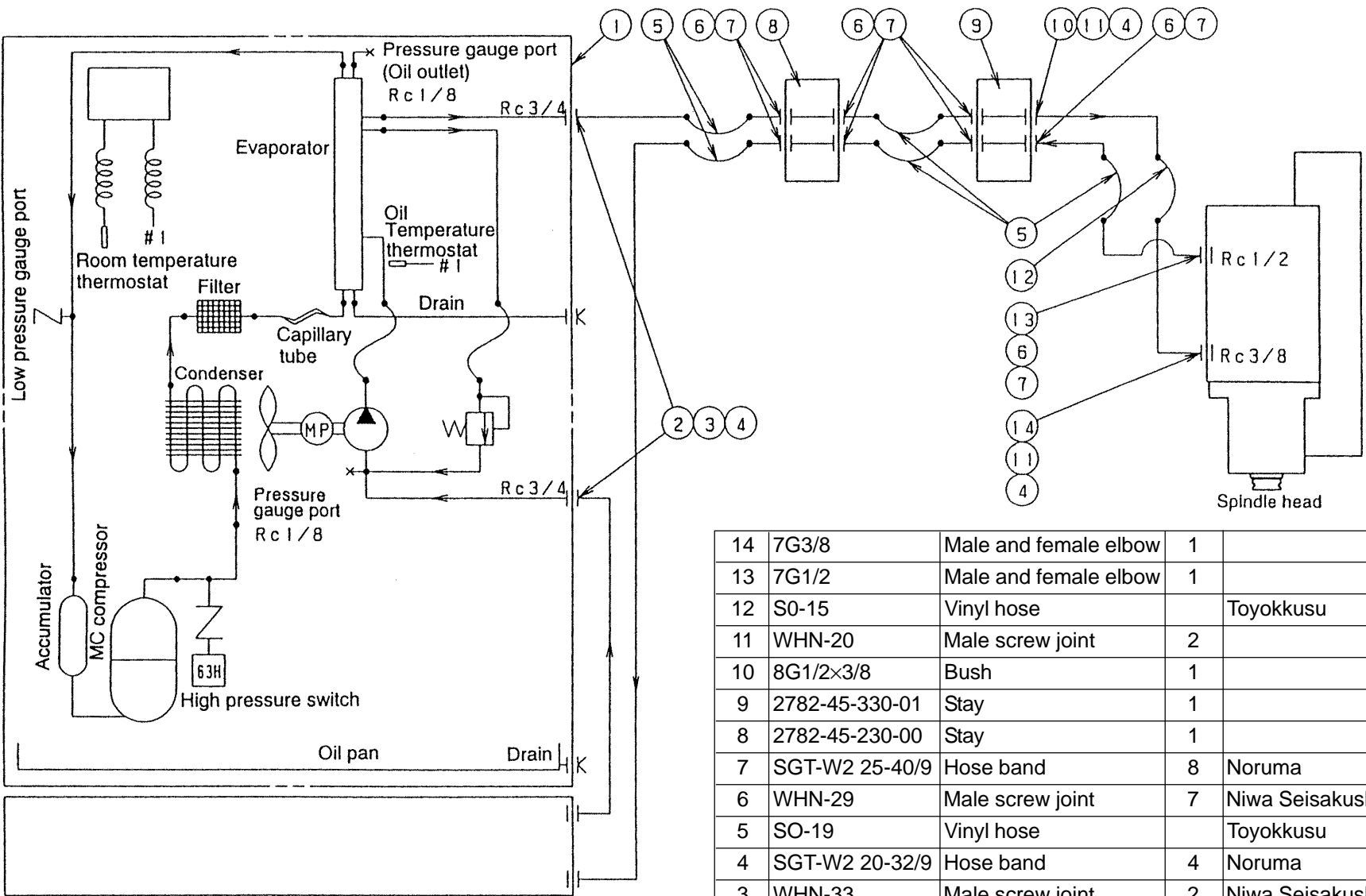


TA 2 - 1974

No.	Part name	Part No.	Q'ty	
[1]	Deceleration motor	G3FM-18-50-T010A	1	0.1KW×4P×φ3
[2]	Bearing	6007. DDU	1	
[3]	Oil seal	AC 2365 EO	1	
[4]	Coil seat	φ39	1	
[5]	Coil spring	° 12×16×φ72×P90 L = 2120	1	
[6]	Housing	157.5×230×30	1	
[7]	Spring for hole	φ65	1	
[8]	Plain washer	1W-12	4	
[9]	Spring washer	2W-12	4	
[10]	Bolt	4B1250	4	
[11]	O ring	G-105	1	

2-15 Spindle Cooling Circuit Diagram

Note: RUN and STOP LEDs light, blink, and go OFF depending on the status of operation.



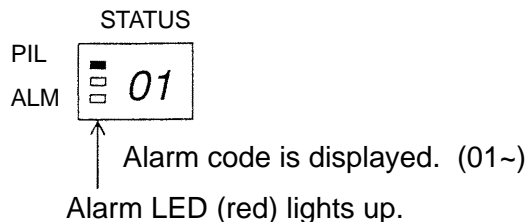
14	7G3/8	Male and female elbow	1	
13	7G1/2	Male and female elbow	1	
12	S0-15	Vinyl hose		Toyokkusu
11	WHN-20	Male screw joint	2	
10	8G1/2×3/8	Bush	1	
9	2782-45-330-01	Stay	1	
8	2782-45-230-00	Stay	1	
7	SGT-W2 25-40/9	Hose band	8	Noruma
6	WHN-29	Male screw joint	7	Niwa Seisakusho
5	SO-19	Vinyl hose		Toyokkusu
4	SGT-W2 20-32/9	Hose band	4	Noruma
3	WHN-33	Male screw joint	2	Niwa Seisakusho
2	7G3/4	Male and female elbow	2	
1	AKS55K-F52	Oil con	1	Daikin
No.	Part No.	Part Name	Q'ty	Maker

VS50 Spindle Cooling Circuit Diagram
Spindle head

2-16 Servo Unit

2-16-1 Alarm Concerning Power Supply Unit (Source Power of Spindle/Servo Amplifier)

When an alarm is generated, the alarm LED (red) lights up on the status display and the alarm code is indicated in two figures on the 7-segment LED.



1) Alarm code 01

● Contents

The main circuit power module (IPM) detected abnormality. (PSM-5.5, -11)

Excessive current flowed at the main circuit power input part. (PSM-15--30)

● Cause and trouble-shooting

(a) IGBT (or IPM) is defective.

⇒Replace the IGBT (or IPM).

(b) Mismatch of AC reactor specification.

⇒Confirm the PSM and AC reactor.

2) Alarm code 02

● Contents

The cooling fan of the controlling circuit part stopped.

● Cause and trouble-shooting

The cooling fan is out of order.

Confirm the condition of the cooling fan rotation.

⇒Replace the cooling fan.

3) Alarm code 03

● Contents

The temperature of the main circuit radiator went up abnormally.

● Cause and trouble-shooting

(a) The cooling fan is out of order.

Confirm the condition of the cooling fan rotation.

⇒Replace the cooling fan.

(b) Dust contamination

⇒Clean up the cooling system by factory air blower or by vacuum cleaner.

(c) Overload overation

⇒Re-examine the operating conditions.

4) Alarm code 04

• Contents

The voltage at the main circuit DC part (DC link) came down.

• Cause and trouble-shooting

(a) Instantaneous power down was generated.

Confirm the source power.

⇒Replace the cooling fan.

(b) Voltage down of input source power.

Confirm the source power specification.

(c) This trouble could occur, when the main circuit source power is cut off while the emergency stop is released.

5) Alarm code 05

• Contents

Power charge to the main circuit was not made within the specified time.

• Cause and trouble-shooting

(a) The number of SVM, SPM connecting units is in excess.

⇒Confirm the PSM specification.

(b) DC link is in short-circuit.

⇒Confirm the connection.

(c) Charging current restricting resistance is defective.

⇒Replace the distribution board.

6) Alarm code 06

• Contents

Input source power is abnormal. (Phase defect)

• Cause and trouble-shooting

(a) Input source power phase is lacking.

Confirm the connection.

7) Alarm code 07

• Contents

The voltage at the main circuit DC part (DC link) became abnormally high.

Ⅵ Cause and trouble-shooting

(a) Excessive regenerating power.

Regeneration is not possible. PSM capacity is insufficient.

⇒Confirm the PSM specification.

(b) Impedance on the AC source power side is high.

⇒Clean up the cooling system by factory air blower or by vacuum cleaner.

(c) Regenerating circuit is abnormal.

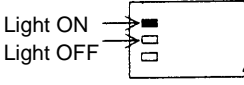
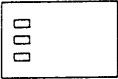
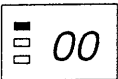
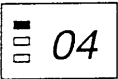
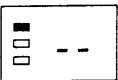
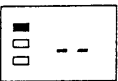
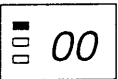
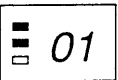
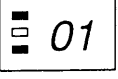
Check the terminal and confirm the voltage at IR, IS is normal.

⇒Replace the distribution board and/or controlling PCB.

(d) IGBT (or IPM) is defective.

⇒Replace IGBT (or IPM).

2-16-2 Spindle Amplifier Status Display

Item	Status Display  LED lit on is indicated by ■	Contents
1.	PIL ALM ERR 	Source power ON indicating LED "PIL" is OFF. Controlling source power is not yet thrown in. Source power circuit is defective. Refer to item 4.3.2.
2.	PIL ALM ERR 	The last two digits of the ROM series is displayed for about 1.0 second after control source power ON. Example) "00": ROM Series 9D00
3.	PIL ALM ERR 	ROM Version display for about 1.0 second. 01, 02, 03, 04 correspond A, B, C, D. Example) "04": ROM Version No. D
4.	PIL ALM ERR  Blinking	CNC source power is not yet thrown in. Waiting serial communication and completion of parameter loading.
5.	PIL ALM ERR 	Parameter loading is completed. The motor is not excited.
6.	PIL ALM ERR 	The motor is excited.
7.	PIL ALM ERR  Alarm code display 01~	Alarm status SPM is not operable condition. Refer to item II. 3.3.
8.	PIL ALM ERR  Error code display 01~	Error status Wrong parameter setting. Sequence is not proper. Refer to parameter setting manual.

2-16-3 Spindle Amplifier Alarm

When the “ERR” LED on the indicating window of the spindle amplifier lights up, the number indicated next right to the LED reading “ER-***” will tell the alarm contents. In the same way, when the “ALM” LED lights on, “AL-***” tells the alarm contents. List of alarm codes are given in the following.

NOTE

Er-xx is not displayed on CRT.

Message	Contents	Countermeasure
Er-01	*Although EPS (there are 2 types: connection signal and PMC→CNC) and MRDY (machine ready signal) are not input, SFR/SRV is input. However, regarding MRDY, pay attention to the setting of use/not use spindle parameter MRDY.	*Confirm the sequence of EPS and MRDY.
Er-02	If spindle motor is not integrated with spindle in system with high-resolution magnetic pulse coder, speed detector of spindle motor is set to 128 p/rev. Attempt to excite motor fails if value other than 128 p/rev is set.	Set the spindle motor speed detector parameter to 128 p/rev.
Er-03	Parameter for high-resolution magnetic pulse coder is not set, but Cs contouring control commands is entered. In this case, motor is not excited.	Check parameter setting for high-resolution magnetic pulse coder.
Er-04	Although parameter setting for using position coder was not performed, commands for servo mode and synchronous control are input. In this case, the motor will not be excited.	Confirm the parameter setting of the position coder.
Er-05	Although option parameter for orientation is not set, the orientation command (ORCM) is input.	Confirm the parameter setting of orientation.
Er-06	Although option parameter for output switchover is not set, LOW winding is selected.	Confirm the parameter setting for output switching and power line status signal.
Er-07	Although Cs contouring control command was entered, SFR/SRV is not entered.	Confirm the sequence.
Er-08	Although servo mode control command was input, SFR/SRV is not input.	Confirm the sequence.
Er-09	Although synchronous control command was input, SFR/SRV is not input.	Confirm the sequence.
Er-10	Cs control command was entered, but another mode (servo mode, synchronous control, orientation) is specified.	Never set another mode when Cs contouring control command is being processed. Before changing to another mode, clear Cs contouring control command.
Er-11	Servo mode command was entered, but another mode (Cs contouring control, synchronous control, orientation) is specified.	Do not command other modes during servo mode command. When moving to other modes, perform after releasing the servo mode command.
Er-12	Synchronous control command was entered, but another mode (Cs contouring control, servo mode, orientation) is specified.	Do not command other mode during synchronous control command. When moving to other modes, perform after releasing the synchronous control command.
Er-13	Orientation command was entered, but another mode (Cs contouring control, servo mode, synchronous control) is specified.	Do not command other modes during orientation command. When moving to other modes, perform after releasing the orientation command.
Er-14	SFR/SRV are simultaneously commanded.	Command one or the other.
Er-15	Cs contouring control command is entered when differential speed control function is enabled by parameter setting (No. 6500#5=1).	Check parameter setting and control input signal.

Message	Contents	Countermeasure
Er-16	Differential mode command (DEFMDA) is entered when differential speed function is disabled by parameter setting (No. 6500#5=1).	Check parameter setting and control input signal.
Er-17	Parameter setting (No. 6511#0, 1, 2) for speed detector is incorrect. (Specified speed detector is not present.)	Check parameter setting.
Er-18	Spindle orientation command of position coder type is entered when use of position code signal is disabled by parameter setting (No. 6501#2=0).	Check parameter setting and control input signal.
Er-19	Although the command for orienting the magnetic sensor system was entered, another mode was issued.	Do not issue another mode while the orientation command is executed. Before issuing another mode, cancel the orientation command. These two settings are incompatible. Check the
Er-20	Both the slave mode and the high-resolution magnetic pulse coder were enabled.	parameter settings. Enter the slave mode command in the normal
Er-21	The slave mode command (SLV=1) was entered under position control (servo mode, orientation, etc.).	operation mode. Enter the position control command in the
Er-22	The position control command (servo mode, orientation, etc.) was entered in the slave operation mode (SLV=1).	normal operation mode.
Er-23	A slave mode command was entered when the slave mode is disabled.	Enable the slave mode.
Er-24	To perform continuous indexing in the mode for orienting the position coder system, incremental operation (INCMD=1) was first performed, then the absolute position command (INCMD=0) was entered.	Check the control input signal (INCMD). To execute the absolute position command continuously, be sure to perform orientation with the absolute position command first.
Contact signal of *ESP	Between ESP1 and ESP2 of spindle control printed circuit board	Contact is open : emergency stop Contact is closed : general operation

Alarm No.	Meanings	Description	Remedy
AL-01	Motor overheat	Detects internal motor temperature: exceeding specified temperature.	Check load status. Cool motor, then reset alarm.
AL-02	Excessive speed deviation	Detects motor speed exceeding specified speed excessively.	Check load status. Reset alarm.
AL-03	DC link section fuse blown	Detects that fuse F4 in DC link section is blown (models 30S and 40S).	Check power transistors, and so forth. Replace fuse.
AL-04	Input fuse blown. Input power open phase.	Detects blown fuse (F1 to F3), open phase or momentary failure of power (models 30S and 40S).	Replace fuse. Check open phase and power supply regenerative circuit operation.
AL-05	Control power supply fuse blown	Detects that control power supply fuse AF2 or AF3 is blown (models 30S and 40S).	Check for control power supply short circuit. Replace fuse.
AL-07	Excessive speed	Detects that motor rotation has exceeded 115% of its rated speed.	Reset alarm.
AL-08	High input voltage	Detects that switch is set to 200 VAC when input voltage is 230 VAC or higher (models 30S and 40S).	Set switch to 230 VAC.
AL-09	Excessive load on main circuit section	Detects abnormal temperature rise of power transistor radiator.	Cool radiator, than reset alarm.
AL-10	Low input voltage	Detects drop in input power supply voltage.	Correct cause, then reset alarm.
AL-11	Overvoltage in DC link section	Detects abnormally high direct current power supply voltage in power circuit section.	Correct cause, then reset alarm.
AL-12	Overcurrent in DC link section	Detects flow of abnormally large current in direct current section of power circuit.	Correct cause, then rest alarm.
AL-13	CPU internal data memory abnormality	Detects abnormality in CPU internal data memory. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-15	Spindle switch/output switch alarm	Detects incorrect switch sequence in spindle switch/output switch operation.	Check sequence.
AL-16	RAM abnormality	Detects abnormality in RAM for external data. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-18	Program ROM sum check error	Detects program ROM data error. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-19	Excessive U phase current detection circuit offset	Detects excessive U phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-20	Excessive V phase current detection circuit offset	Detects excessive V phase current detection circuit offset. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-24	Serial transfer data error	Detects serial transfer data error (such as NC power supply turned off, etc.)	Correct cause, then reset alarm.
AL-25	Serial data transfer stopped	Detects that serial data transfer has stopped.	Correct cause, then reset alarm.
AL-26	Disconnection of position detection signal for Cs contouring control	Detects abnormality in speed detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Correct cause, then reset alarm.
AL-27	Position coder signal disconnection	Detects abnormality in position coder signal (such as unconnected cable and parameter setting error).	Correct cause, then reset alarm.

Alarm No.	Meanings	Description	Remedy
AL-28	Disconnection of position detection signal for Cs contouring control	Detects abnormality in position detection signal for Cs contouring control (such as unconnected cable and adjustment error).	Correct cause, then reset alarm.
AL-29	Short-time overload	Detects that overload has been continuously applied for some period of time (such as restraining motor shaft in positioning).	Correct cause, then reset alarm.
AL-30	Input circuit overcurrent	Detects overcurrent flowing in input circuit.	Correct cause, then reset alarm.
AL-31	Speed detection signal disconnection motor restraint alarm	Detects that motor cannot rotate at specified speed (but rotates at very slow speed or has stopped). (This includes checking of speed detection signal cable.)	Correct cause, then reset alarm.
AL-32	Abnormality in RAM internal to LSI for serial data transfer	Detects abnormality in RAM internal to LSI for serial data transfer. This check is made only when power is turned on.	Correct cause, then reset alarm.
AL-33	Insufficient DC link section charging	Detects insufficient charging of direct current power supply voltage in power circuit section when magnetic contactor in amplifier is turned on (such as open phase and defective charging resistor).	Correct cause, then reset alarm.
AL-34	Parameter data setting beyond allowable range or values	Detects parameter data set beyond allowable range of values.	Set correct data.
AL-35	Excessive gear ratio data setting	Detects gear ratio data set beyond allowable range of values.	Set correct data.
AL-36	Error counter over flow	Detects error counter overflow.	Correct cause, then reset alarm.
AL-37	Speed detector parameter setting error	Detects incorrect setting of parameter for number of speed detection pulses.	Set correct data.
AL-39	Alarm for indicating failure in detecting 1-rotation signal for Cs contouring control	Detects 1-rotation signal detection failure in Cs contouring control.	Make signal adjustment. Check cable shield status.
AL-40	Alarm for indicating 1-rotation signal for Cs contouring control not detected	Detects that 1-rotation signal has not occurred in Cs contouring control.	Make 1-rotation signal adjustment.
AL-41	Alarm for indicating failure in detecting position coder 1-rotation signal.	Detects failure in detecting position coder 1-rotation signal.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL-42	Alarm for indicating position coder 1-rotation signal not detected	Detects that position coder 1-rotation signal has not occurred.	Make 1-rotation signal adjustment for signal conversion circuit.
AL-43	Alarm for indicating disconnection of position coder signal for differential speed mode	Detects that main spindle position coder signal used for differential speed mode is not connected yet (or is disconnected).	Check that main spindle position coder signal is connected to connector CN12.

Alarm No.	Meanings	Description	Remedy
AL-46	Alarm for indicating failure in detecting position coder 1-rotation signal in thread cutting operation.	Detects failure in detecting position coder 1-rotation signal in thread cutting operation.	Make 1-rotation signal adjustment for signal conversion circuit. Check cable shield status.
AL-47	Position coder signal abnormality	Detects incorrect position coder signal count operation.	Make signal adjustment for signal conversion circuit. Check cable shield status.
AL-48	Position coder 1-rotation signal abnormality	Detects that occurrence of position coder 1-rotation signal has stopped.	Make 1-rotation signal adjustment for signal conversion circuit.
AL-49	The converted differential speed is too high.	Detects that difference between a spindle speed and another spindle speed has exceeded allowable limit in differential speed mode.	Calculate differential speed by multiplying speed of other spindle by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL-50	Excessive speed command calculation value in spindle synchronization control	Detects that speed command calculation value exceeded allowable range in spindle synchronization control.	Calculate motor speed by multiplying specified spindle speed by gear ratio. Check if calculated value is not greater than maximum speed of motor.
AL-51	Undervoltage at DC link section	Detects that DC power supply voltage of power circuit has dropped (due to momentary power failure or loose contact of magnetic contactor).	Correct cause, then reset alarm.
AL-52	ITP signal abnormality I	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, then reset alarm.
AL-53	ITP signal abnormality II	Detects abnormality in synchronization signal (ITP signal) with CNC (such as loss of ITP signal).	Correct cause, then reset alarm.
AL-54	Overload current alarm	Detects that excessive current flowed in motor for long time.	Check if overload operation or frequent acceleration/deceleration is performed.
AL-55	Power line abnormality in spindle switching/output switching	Detects that switch request signal does not match power line status check signal.	Check operation of magnetic contractor for power line switching. Check if power line status check signal is processed normally.

2-16-4 Detail of Spindle Amplifier Alarm Contents

AL-01 Motor overheat

Item	Cause of trouble	Check procedure	Remedy
1	Defective fan motor of motor	Check if fan motor is rotating.	Replace fan motor.
2	Overload operation	Check cutting conditions and how tools are worn. Check load meter for cutting.	Review cutting conditions and tools.
3	Dirty motor cooling system	Check motor cooling system for dirt.	Clean motor cooling system with an air gun or vacuum cleaner.
4	Disconnection or loose contact of motor overheat signal line	Check signal line connection status.	Connect signal line correctly.

AL-02 Excessive speed deviation

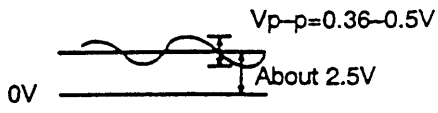
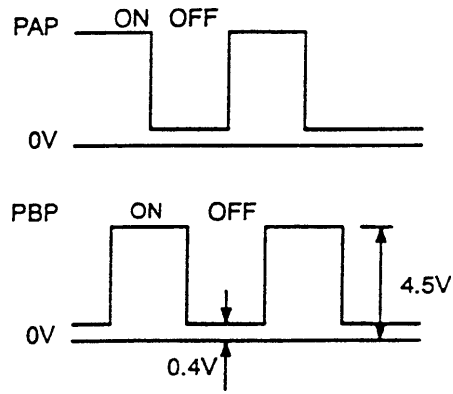
Item	Cause of trouble	Check procedure	Remedy
1	Overload operation (overload)	Check with load meter.	Review cutting conditions and tools.
2	Defective transistor module	Check if transistor collector-emitter is open.	Replace transistor module.
3	Fuse for protecting drive on PCB blown or not inserted correctly (disconnection, loose contact, etc.)	Check if fuses F3A to F3M (models 1S to 26S) or FA to FG (models 30S and 40S) are blown or removed.	Insert fuse4s firmly. Replace any blown fuse.
4	Speed feedback signal abnormality	Check level of speed feedback signal.	Check motor speed detector and signal cable connection.
5	Wiring failure (disconnection, loose contact, etc.)	Check that cables are connected correctly.	

NOTE

How to check the speed feedback signal

Observe the speed feedback signal with an oscilloscope after turning on power and setting the rotation command off (motor stopped and drive power set off).

Observe the test points indicated below, while turning the motor slowly by hand.

Test point	Normal wave form
PA-0V	
PB-0V	Same as above
RA-0V	DC2.5V±0.2V
RB-0V	Same as above
PAA-0V PBA-0V (CW rotation)	 <p>Check that the ON/OFF duty cycle is 50%. (The PAP and PBP signals are inverted in CCW direction.)</p>

AL-03 Blown fuse in DC link section

This alarm indicates that the fuse (F4) in the DC link section is blown.

In this case, the transistor module may have failed.

AL-04 Input fuse blown Input power open phase

Item	Cause of trouble	Check procedure	Remedy
1	High impedance on AC power supply side. Example: Two transformers are connected in series, or variable autotransformer is connected.	Alarm No. 04 is on only at time of deceleration from high speed operation. Alarm No. 04 can be on when F1 to F3 are not blown.	Change power supply to one with low impedance. There may be loose connection of input power cable Example: Open phase due to screws not tightened firmly.
2	Defective transistor module		Replace transistor module and fuse.
3	Defective diode module or thyristor module	Disconnect diode modules DM1 to DM3 and thyristor modules SM1 to SM3, then check A-K connection with multimeter. (Defective modules are usually short-circuited.)	Replace defective part. Replace blown fuse.
4	Defective surge absorber or capacitor	Check surge absorbers Z1 to Z3 and capacitors C4 to C6.	Replace defective part. Replace blown fuse.
5	When input fuse is not blown	Check if Item 1 is applicable.	When Item 1 is not applicable, replace PCB.

AL-05 **Control power supply fuse blown**

Item	Cause of trouble	Check procedure	Remedy
1	Defective PCB	Check AC input voltage. See (5) above.	Replace PCB.
2	Abnormal power supply voltage		

AL-07 **Excessive speed (Detection by digital value)**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

NOTE

See Chapter 6.

AL-08 **High input voltage**

Item	Cause of trouble	Check procedure	Remedy
1	AC power supply voltage 10% higher than rated voltage.	Check power supply voltage.	
2	Incorrect setting of toggle switch for voltage switching.	Check power supply voltage.	Change setting from 200V to 230V.

AL-09 **Heat sink is overheated**

Item	Cause of trouble	Check procedure	Remedy
1	Cooling fan is defective.	Check if fan is rotating.	Replace fan.
2	Overload operation.	Check load by using a load meter.	Re-examine the cutting condition.
3	Dusty and dirty.		Clean using compressed air or vacuum cleaner.

AL-10 **Input power voltage drops**

This alarm indicates abnormally low AC power voltage (-15% or less).

This alarm may be generated even during momentary power failures.

AL-11 **Overvoltage of DC link circuit (Regenerative circuit is faulty ... Regeneration failure)**

Item	Cause of trouble	Check procedure	Remedy
1	High power impedance.		Examine AC power specification.
2	PCB is defective.		Replace PCB.
3	Defective transistor module (TM1).		Replace transistor module.

AL-12 **Overcurrent flows to DC link circuit**

Item	Cause of trouble	Check procedure	Remedy
1	Output terminals or internal circuit of motor is shorted.	Check connections.	
2	Transistor module is defective.	Check the transistor module.	Replace transistor module.
3	PCB is defective.		Replace PCB.

AL-13 CPU internal data memory alarm Replace PCB.

AL-16 RAM abnormality

Item	Cause of trouble	Check procedure	Remedy
1	External data memory (RAM) defective		Replace memory (RAM).
2	PCB defective		Replace PCB.

AL-18 Program ROM sum check error

Item	Cause of trouble	Check procedure	Remedy
1	Program memory data (ROM) defective	Compare data displayed when power is turned ON with ROM labels.	Replace program memory (ROM).

AL-19 Excessive U phase current detection circuit offset

Item	Cause of trouble	Check procedure	Remedy
1	A/D converter defective		Replace A/D converter.
2	U-phase current detector circuit defective.	After power is turned on, check if offset voltage on check terminal IU is beyond range of about $\pm 100\text{mV}$.	Replace PCB.
3	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL-20 Excessive V phase current detection circuit offset

Item	Cause of trouble	Check procedure	Remedy
1	v-phase current detector circuit defective.	After power is turned on, check if offset voltage on check terminal IV is beyond range of about $\pm 100\text{mV}$.	Replace PCB.
2	Loose contact of connectors between PCB and power circuit	Check connector connection between PCB and power circuit.	Ensure that PCB and power circuit are securely connected with each other.

AL-24 Serial transfer data error

AL-25 Serial data transfer stopped

Item	Cause of trouble	Check procedure	Remedy
1	CNC power supply is OFF.	Check that CNC power is ON.	Turn CNC power ON. Connect
2	Defective optical cable for serial data transmission	Check that optical cable is fitted securely to the connector. Check that the cable is not broken. Check that transmission/reception surfaces of the cable are clean.	securely. Replace optical cable. Clean optical cable transmission/reception surfaces.
3	Defective data transmission/reception elements in LSI used in serial data transmission		Replace LSI. Replace PCB.

AL-26 **Disconnection of speed detection signal for Cs contouring control**

Item	Cause of trouble	Check procedure	Remedy
1	Signal level of spindle motor for Cs contouring control is invalid.	Check the signal, and if necessary adjust to the normal level using the variable resistor for signal level adjustment in the preamp.	
2	Signal line of spindle motor for Cs contour control is defective.	Check that signal cable is connected securely to connector. Check that signal cable is not broken.	Connect signal cable securely. Replace signal cable.
3	Defective detector circuit for Cs contour control		Replace detector circuit.
4	Incorrect parameter setting	Check that the parameter setting does not indicate that the Cs contour control detector is used when actually it is not.	Parameter CAXIS1=0 No.4001#5

AL-27 **Position coder signal disconnection**

Item	Cause of trouble	Check procedure	Remedy
1	Position coder signal line defective	Check that signal cable is connected securely to connector. Check that signal cable is not broken.	Connect signal cable securely. Replace signal cable.
2	Incorrect parameter setting	Check that the parameter setting does not indicate that the position coder signal is used when actually it is not.	Parameter MRDY2=0 No. 4001#2

AL-28 **Disconnection of position detection signal for Cs contouring control**

Item	Cause of trouble	Check procedure	Remedy
1	Signal level of spindle detector for Cs axis control is defective	Check the signal level, and if necessary adjust to the normal level using the variable resistor for signal level adjustment in the preamp.	
2	Signal line of spindle detector for Cs axis control is defective	Check the signal cable is connected securely to connector. Check that signal cable is not broken.	Connect signal cable securely. Replace signal cable.
3	Defective detector circuit for Cs axis control		Replace detector circuit.

AL-29 **Short-time overload**

Item	Cause of trouble	Check procedure	Remedy
1	Overload operation (Overload)	Use loadmeter to check that a load close to the load resistance limit is not imposed continuously for 30 seconds or more.	Re-examine cutting conditions and tools.

AL-30 **Input circuit
overcurrent**

Item	Cause of trouble	Check procedure	Remedy
1	Defective of power transistor used for power	Check power transistor.	Replace power transistor.
2	Defective of power regeneration circuit		Replace PCB.

AL-31 **Speed detection
signal
disconnection
motor restraint
alarm**

Item	Cause of trouble	Check procedure	Remedy
1	Motor constrained	Check that nothing is preventing the motor from accelerating.	Remove cause.
2	Defective motor speed feedback signal	Check signal waveform. (Alarm No.2)	Remove cause.
3	Defective motor speed feedback signal cable	Check that cable is connected securely to connector. Check that cable is not broken.	Connect cable securely. Replace cable.

AL-32 **Abnormality in
RAM internal to
LSI for serial
data transfer**

Item	Cause of trouble	Check procedure	Remedy
1	Defective LSI used in serial data transmission		Replace LSI. Replace PCB.

AL-33 **Insufficient DC
link section
charging**

Item	Cause of trouble	Check procedure	Remedy
1	Defective relay used in DC link recharging. Disconnection of resistor used in limiting re-charge current	Check relevant parts.	Replace amp.

AL-34 **Parameter data
setting beyond
allowable range
of values**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect parameter setting	Check if specified parameter value is beyond allowable range of values	Specify value within allowable range.

AL-34 and **F-XXX** are alternately displayed in the spindle amplifier indicator section if an AL-34 alarm is raised.
"XXX" indicates the data number internal to the spindle for a parameter where a value beyond the allowable range is specified.

AL-35 **Excessive gear
ratio data setting**

Item	Cause of trouble	Check procedure	Remedy
1	Parameter data of gear ratio and position gain are too large.	Check gear ratio and position gain data.	Change to suitable values.

AL-37 **Speed detector
parameter
setting error**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of speed feedback pulses (No. 6511)	Check if number of speed feedback pulses matches parameter setting.	Set correct value in parameter.

AL-39 **Alarm for
indicating failure
in detecting
1-rotation signal
for Cs contouring
control**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect data ROM type for Cs contouring control detector circuit, or incorrect setting	Check data ROM type for Cs contouring control detector circuit and setting.	Install correct type of ROM. Perform setting correctly.
2	Low level of Cs contouring control feedback signal, or noise on same feedback signal	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

AL-40 **Alarm for
indicating
1-rotation signal
for Cs contouring
control not
detected**

Item	Cause of trouble	Check procedure	Remedy
1	No occurrence of 1-rotation signal among Cs contouring control feedback signals, or 1-rotation signal offset adjustment error	Check 1-rotation signal among Cs contouring control feedback signals.	Make 1-rotation signal offset adjustment. Check cables.

AL-41 **Alarm for
indicating failure
in detecting
position coder
1-rotation signal**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4, 6, 7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal. or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

AL-47 **Position coder
signal
abnormality**

Item	Cause of trouble	Check procedure	Remedy
1	Incorrect setting of parameter for number of position coder signal pulses (No. 4003#4, 6, 7).	Check number of position coder signal pulses and parameter setting.	Set correct value in parameter.
2	Incorrect amplitude and offset of position coder feedback signal. or noise on same feedback signal.	Check feedback signal level and also check if feedback signal waveform includes noise.	Adjust feedback signal. Check shielding status.

2-17 List of Supply Items

No.	Code No.	Product Name	Model	Q'ty	Remarks	
Head (#50-4500min ⁻¹)						
1	02-341201450	Limit switch	SL1-A	3	Z-axis	VS50/60
2	02-341201470	Limit switch	SL1-H	2	Tool locking up/down	VS50/60
3	02-999038529	Proximity switch	E2E-X2D1-N-5M	1	Check for tool	VS50/60
4	2741-00-301-00	Cylindrical roller bearing	NN3020MBKRCCG28 UPBU21	1	Main bearing	VS50/60
5	2741-00-574-00	Coil spring	TB50*300 special	1	Drawbar spring	VS50/60
6	2782-00-303-00	Angular ball bearing	7017CTYP5	1	Support bearing	VS50/60
7	2782-00-308-00	Angular ball bearing	7020ATYDBCP5P4	1	Main angular bearing	VS50/60
8	2782-49-430-01	Hose	SHOUNAN	1	For through coolant	VS50/60
9	2782-49-432-03	Hose	SHOUNAN	1	One set of tool locking return	VS50/60
10	2772-05-459-00	SKY packing	Fluorine rubber board	1	UTS packing	VS50/60
11	2782-05-340-10	Cover		1	Delson plate	VS50/60
12	2782-05-345-00	SKY packing	Oil-resistant rubber	1	Packing under the a bove plate	VS50/60
13	04-999111859	Hose assembly	PA1412*670CM UA12F-UA12F	1	Tool locking main hose	VS50/60
Related to body (Head, column, saddle and table)						
1	2782-00-503-10	Telescope cover	STD Table	1	Enomoto	VS50
2	2782-00-504-10	Slide cover	STD Table	1	Enomoto	VS50
3	2782-10-431-00	Wiper	HSW-1	1	Fukuikasei	VS50
4	2782-10-432-00	Wiper	HSW-1	1	Fukuikasei	VS50
5	2782-10-433-00	Wiper	HSW-1	1	Fukuikasei	VS50
6	2782-10-434-00	Wiper	HSW-1	1	Fukuikasei	VS50
7	2783-00-500-00	Telescope cover	STD Table	1	Enomoto	VS60
8	2783-00-501-00	Slide cover	STD Table	1	Enomoto	VS60
9	2783-10-431-00	Wiper	HSW-1	1	Fukuikasei	VS60
10	2783-10-432-00	Wiper	HSW-1	1	Fukuikasei	VS60
11	2783-10-433-00	Wiper	HSW-1	1	Fukuikasei	VS60
12	2783-10-434-00	Wiper	HSW-1	1	Fukuikasei	VS60
13	02-341201450	Limit switch	SL1-A	5	Yamatake	VS50/60
14	05-141000380	Timing belt	STS400SMB1248	1	Bando	VS50/60
Splash Guard						
1	2782-75-349-00	Wiper	WP-34	1	Nitta	VS50/60
2	2782-75-350-10	Wiper	HSW-1	1	Fukuikasei	VS50/60
3	2782-75-351-01	Wiper	HSW-1	1	Fukuikasei	VS50/60
4	2782-75-352-03	Wiper	HSW-1	1	Fukuikasei	VS50/60
5	2782-75-353-10	Wiper	HSW-1	1	Fukuikasei	VS50/60
6	2782-75-453-02	Wiper	HSW-1	1	Fukuikasei	VS50/60

No.	Code No.	Product Name	Model	Q'ty	Remarks	
7	2782-75-430-11	Window	720×330×t3	2	STD spec	VS50/60
8	2782-75-431-10	Window	720×330×t5	2	CE mark-capable spec.	VS50/60
9	02-341201450	Limit switch	SL1-A	1	Yamatake	VS50/60
10	02-999043763	Lock switch	TZFS-24VDC	1	SSR	VS50/60
11	04-133149210	Solenoid valve	4F130-08-AC100V	1	CKD	VS50/60
12	04-999111347	Cylinder	SCM-LB-40B-420	1	CKD	VS50/60
13	2782-00-512-10	Winder cover	K-3-620-7379	2	JABARA	VS50/60
ATC						
1	02999093467	Proximity switch	FL2R-4J6HD-L2	1	Yamatake	VS50/60
2	02999096022	Photoelectric switch	EE4-SX473	3	Omron	VS50/60
3	04133107210	Solenoid valve	AG43-02-4-02G-AC100V	1	CKD	VS50/60
4	04133149210	Solenoid valve	4F130-08-AC100	2	CKD	VS50/60
5	05999059576	Belt	B250S5M550	1	Mitsuboshi	VS50/60
6	06326030000	Dust seal	26L30	2		
7	2741-70-536-00	Spring/C Coil	(SWP)			
8	2782-70-470-00	Spring/C Coil	(SWP)			
9	2782-70-474-01	Rail	(MC Nylon)		KSK	VS50/60
10	2782-70-475-01	Rail	(MC Nylon)		KSK	VS50/60
Coolant						
1	2732-00-212-10	Coolant pump	LSW15 T0.18	1	Teraru-Kyokuto	VS50/60
2	02-999043123	Coolant pump	LSW25T0.4	2	Teraru-Kyokuto	VS50/60

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