
Mazak

MAINTENANCE MANUAL

FOR

Mazak

Quick Turn 10N

CHUCKER & UNIVERSAL

SERIAL NUMBER :

6 6 0 7 9

CONTENTS

	Page
1. GENERAL DESCRIPTION	1-1
1-1 Introduction	1-1
1-2 Safety Instructions	1-2
2. FROM MACHINE INSTALLATION TO TRIAL OPERATION	2-1
2-1 Environment	2-1
2-2 Air Source	2-1
2-3 Power Requirements	2-2
2-4 Packing	2-5
2-5 Transportation	2-8
2-6 Machine Fixing Fittings	2-12
2-7 QT-10N (141)/Lifting Device for Domestic Use	2-15
2-7' QT-10N (141)/Lifting Device for Exportable Use	2-16
2-8 QT-10N (141) Machine Lifting	2-17
2-9 Installation	2-18
3. MACHINE CONSTRUCTION AND PART NAMES	3-1
3-1 Part Names	3-1
3-2 Head stock	3-2
3-3 Spindle Drive V-belt	3-22
3-4 Feed System	3-27
3-5 Turret (8D)	3-31
3-5' Turret (12D)	3-39
3-5" Turret (4T)	3-47
3-6 Carriage	3-60
3-7 Tailstock	3-64
3-8 Lubricant and Coolant	3-82
3-8-1 Lubrication	3-82
3-8-2 Lubrication of slideways and ball screws	3-87
3-8-3 Construction and Inspection of Coolant Equipment	3-96

	Page
3-9 Power Chuck	3-103
3-10 Outer Sheet Metal	3-108
3-11 Pneumatics	3-109
3-12 Switches on Machine	3-128
3-13 Zero Return	3-142
 4. TROUBLE AND TROUBLESHOOTING	 4-1
4-1 Coolant is not Supplied.	4-1
4-2 Headstock is unusually hot.	4-1
4-3 Home position of X- or Z-axis fluctuates.	4-1
4-4 Repeatability in positioning is poor.	4-2
4-5 Operation cannot be resumed after collision.	4-2
4-6 Chuck jaws fail to move.	4-2
4-7 Jaw operation stroke is short.	4-3
4-8 Workpiece is tapered.	4-3
4-9 Tailstock spindle cannot be moved.	4-3
4-10 Abnormality of the center of the rotating center. ...	4-4
4-11 Tailstock body cannot be moved.	4-4
4-12 Turret cannot be unclamped.	4-5
4-13 Turret fails to index although it is unclamped.	4-5
4-14 Turret continues rotation.	4-5
4-15 Turret stops before commanded position is indexed. ..	4-6
4-16 Although the turret rotates and stops, correct position is not indexed.	4-6
4-17 Turret is not clamped.	4-6
4-18 Measures for QT-10N (141) Turret Misindex	4-7
4-19 Slideway lube alarm light goes on.	4-9E
4-20 Alarm indication is displayed on the CRT while axis move since error amount in the error register exceeds the preset value.	4-9E
4-21 Spindle fails to start.	4-9E

1. GENERAL DESCRIPTION

1-1 Introduction

This manual describes the following items for the machine operators and maintenance engineers to consult it when necessary so that QUICK-TURN 10N can provide its performance consistently with less down time.

- 1) Necessary items from machine installation to trial operation.
- 2) Necessary items to maintain QUICK-TURN 10N at its best conditions.
- 3) Necessary items for replacing spare parts.
- 4) Necessary items to pinpoint the cause of the encountered troubles and those to restore the machine functions.

Since it is very difficult to list up all possible troubles and defects of the machine which are traceable to a variety of causes, and virtually impossible to cover all of those troubleshooting and repair procedures, please directly contact us or local service stations if you cannot find appropriate instructions in this manual for the encountered trouble.

1-2 Safety Instructions

This machine is provided with a number of safety devices to protect personnel and equipment from injury and damage. Operators should not, however, rely solely upon these safety devices but should operate the machine after fully understanding what special precautions to take by reading the following remarks thoroughly.

1. Basic Operating Practices

DANGER:

1. Do not soil, scratch or remove the caution plate. Should it become illegible or be missing, order another caution plate from the supplier specifying the part number shown at the lower right of the plate.
2. Some control panels, transformers, motors, junction boxes and other parts have high-voltage terminals, these should not be touched, or a severe electric shock will be sustained.
3. Do not touch a switch with wet hands. This, too, can produce an electric shock.

WARNING:

1. The emergency stop push-button switch location should be well known so that it can be operated at any time without having to look for it.
2. Before replacing a fuse, switch off the machine.
3. Provide sufficient working space to avoid hazardous falls.
4. Water or oil can make floors slippery and hazardous. To prevent accidents all floors should be dry and clean.

5. Before operating switches, always check that they are the right ones.
6. Never touch a switch accidentally.
7. Work benches near the machine must be strong enough to prevent accidents. Articles should be prevented from slipping off the bench surface.
8. If a job is to be done by two or more persons, coordinating signals should be given at each step of the operation. Unless a signal is given and acknowledged, the next step should not be taken.

CAUTION:

1. In the event of power failure, turn off the main circuit breaker immediately.
2. Use the recommended hydraulic oils, lubricants and grease or acceptable equivalents.
3. Always press a switch deliberately and fully, then release it.
4. Replacement fuses should have the proper current ratings.
5. Protect the NC unit, operating panel, electric control panel, etc. from shocks, since this could cause a failure or malfunction.
6. Prevent water or dirt and dust from entering the NC unit, operating panel, electric control panel, etc. Always use doors and/or covers.

7. Do not change parameters, volumes and other electrical settings unnecessarily. If such changes are unavoidable, record the values prior to the change so that they can be returned to their original settings if necessary.

2. Before Switching On:

DANGER:

1. Cables, cords or electric wires whose insulation is damaged can produce current leaks and electric shocks. Before using these, check their condition.

WARNING:

1. Be sure the instruction manual and the programming manual are fully understood. Every function and operating procedure should be completely clear.
2. Use safety shoes which are not damaged by oil, safety goggles with side covers, safe clothes and other safety protection.
3. Close all NC unit, operating panel and electric control panel doors and covers.

CAUTION:

1. The power cable from the factory feeder switch to the machine main circuit breaker should have a sufficient sectional area to handle the electric power used.
2. Cables which must be laid on the floor must be protected against chips so that short-circuits will not occur.

3. Before first operating the machine after unpacking or keeping the machine idle for a long period (several days or more), each sliding part must be freshly lubricated. To do so, push and release the pump button several times until the oil seeps out on the sliding parts. The pump button has a return spring, so do not force it to return.
4. Oil reservoirs should be filled to indicated levels. Check and add oil, if necessary.
5. For lubricating points, oil brands and appropriate levels, see the various instruction plates.
6. Switches and levers should operate smoothly. Check that they do.
7. When switching the machine on, put the factory feeder switch, the machine main circuit breaker and the power switch on the operating panel to the ON position in the order.
8. Check the coolant level, and add coolant, if necessary.
9. Change the coolant from time to time.

3. After Control Power Switch Has been Turned On

CAUTION:

When the power switch on the operating panel is ON as described in 7 above, the READY lamp should also be on; check that it is.

4. Routine Inspections

WARNING:

When checking belt tensions, do not get your fingers caught between the belt and pulley.

CAUTION:

1. Check pressure gages for proper readings.
2. Check motors, gear boxes and other parts for abnormal noises.
3. Check belt tensions. Replace any set of belts that has become stretched with a fresh matching set.
4. Check the motor lubrication, and sliding parts for evidence of proper lubrication.
5. Check safety covers and safety devices for proper operation.

5. Warm Up

CAUTION:

1. Warm up the machine, especially the spindle and feed shaft by running them for 10 to 20 minutes at about half or one-third the maximum speed in the automatic operation mode.
2. This automatic operation program should cause each machine component to operate. At the same time, check their operations.

3. Be particularly careful to warm up the spindle which can turn above 4000 rpms.

If the machine is used for actual machining immediately after being started, following a long idle period, sliding parts may be worn due to lack of oil. Also, thermal expansion of the machine components can jeopardize machining accuracy. To prevent this condition, always warm the machine up.

6. Preparations

WARNING:

1. Tooling should conform to the machine specifications, dimensions and types.
2. Seriously worn tools can cause injuries. Replace all such tools with new ones beforehand.
3. The work area should be adequately lighted to facilitate safety checks.
4. Tools and other items around the machine or equipment should be stored to ensure good footing and clear aisles.
5. Tools or any items must not be placed on the headstock, turret, cover and similar places.
6. If the center holes of heavy cylindrical workpiece are too small, the workpieces can jump out when loaded. Be careful about center holes and angles.

CAUTION:

1. Too lengths should be within specified tolerances to prevent interference.
2. Also, observe the instructions in the tooling manual.
3. After installing a tool, make a trial run.
4. After molding soft jaw, make certain that the jaw properly grasps a workpiece with the appropriate chucking pressure.

7. Operation

WARNING:

1. Do not work with long hair that can be caught by the machine. Tie it up at the back, out of the way.
2. Do not operate switches with gloves on. This could cause malfunctions, etc.
3. Whenever a heavy workpiece must be moved, two or more persons should always work together if there is any risk involved.
4. Only trained, qualified workers should operate forklift trucks, cranes or similar equipment and apply slings.
5. Whenever operating a forklift truck, crane or similar equipment, special care should be taken to prevent collisions and damage to surroundings.
6. Wire ropes or slings should be strong enough to handle the loads to be lifted and should conform to the mandatory provisions.
7. Grip workpieces securely.

8. Do not touch chips and tool tips with the bare hands.
9. Stop the machine before adjusting the coolant nozzle at the tip.
10. Never touch a turning workpiece or spindle with bare hands or in any other way.
11. During machining, do not open the front cover or machine door.
12. Do not operate the machine with safety front and chuck covers removed.
13. Always close the front cover before starting the machine.
14. Use a brush to remove chips from the tool tip - not bare hands.
15. Stop the machine whenever installing or removing a tool.
16. Whenever machining magnesium alloy parts, wear a protective mask.
17. If a MOVE command is given while the READY light is out, positioning will be incorrect in the rapid, slow and jog feed and during zero-point return. This also applies after resetting an overtravel limit switch.

CAUTION:





1. During automatic operation, never open the machine door.
2. When performing heavy-duty machining, carefully prevent chips from being accumulated since hot chips can catch fire.

8. To Interrupt Machining

WARNING:

When leaving the machine temporarily after completing a job, turn off the power switch on the operation panel, and the main circuit breaker.

To stop the machine during machining, select the proper one of the following switches;

- 1) Press  (emergency stop button)
- 2) Press  (reset key).
- 3) Press  (feed hold) key.
- 4) Press the MANUAL MODE key.
- 5) Press  (power off) key.

9. Completing a Job

WARNING:

When checking belt tensions, do not get your fingers caught between the belt and pulley.

CAUTION:

1. Always clean the machine or equipment. Remove and dispose of chips and clean cover windows, etc.
2. Do not clean the machine or equipment, before it has stopped.
3. Return each machine component to its initial condition.
4. Check wipers for breakage. Replace broken wipers.

5. Check hydraulic oils and lubricants for contamination or cloudiness.
6. Check coolants, hydraulic oils and lubricants for contamination. Change them if they are seriously contaminated.
7. Check coolant, hydraulic oil and lubricant levels. Add, if necessary.
8. Check belt tensions. Compare with the stretch just after operation. Replace any belt which is stretched too much.
9. Clean the oil pan filter.
10. Before leaving the machine at the end of the shift, turn off the power switch on the operating panel, machine main circuit breaker and factory feeder switch in that order.

10. Safety Devices

1. Front cover, rear cover and coolant cover
2. X- and Z-axis overtravel limit switches
3. Chuck barrier, tail barrier and tool barrier (NC software)
4. Stored stroke limit (NC software)
5. Emergency stop push-button switch

These safety precautions have been written for workers who operate the machine, and to help those engaged in maintenance. Results of a maintenance inspection should be properly evaluated. Also, the machine should be handed over to workers only after it has been put in good working condition. For this purpose, it is necessary to operate the machine. Whenever the machine is operated, the same precautions should be taken for both maintenance and operation.

11. Maintenance Operation Preparations

1. Do not proceed to any maintenance operation unless instructed to do so by the foreman.
2. Cooperate with the foreman when checking a defective condition. Do not come to conclusions alone.
3. If cooperation with any other section is required for maintenance, make arrangements in advance.
4. Replacement parts, consumables (packing, oil seals, O-rings, bearing, oil and grease etc.) should be arranged in advance.
5. Prepare to record preventive and corrective maintenance operations.

CAUTION:

1. Thoroughly read and understand the safety precautions in the instruction manual.
2. Thoroughly read the whole maintenance manual and fully understand the principles, construction and precautions involved.

12. Maintenance Operation

DANGER:

1. Those not engaged in the maintenance work should not operate the main circuit breaker or the control power ON switch on the operating panel. For this purpose, "Do not Touch the Switch, Maintenance Operation in Progress!" or similar wording should be indicated on such switches and at any other appropriate locations. Such indication should be secured by a semi-permanent means in the reading direction.
2. With the machine turned on, any maintenance operation can be dangerous. In principle, the main circuit breaker should be turned off throughout the operation.

WARNING:

1. The electrical maintenance should be done by a qualified person or by others competent to do the job. Keep close contact with the responsible person. Do not decide by yourself.
2. Overtravel limit and proximity switches and interlock mechanisms including functional parts should not be removed or modified.
3. When working at a height, use steps or ladders which are maintained and controlled daily for safety.
4. Fuses, cables, etc. made by qualified manufacturers should be employed.

Until Operation is Begun after Maintenance

WARNING:

1. Arrange things in order around the section to receive the maintenance, including working environments. Wipe water and oil off parts and provide safe working environments.
 2. All parts and waste oils should be removed by the operator and placed far enough away from the machine to be safe.
-
1. The maintenance person should check that the machine operates safely.
 2. Maintenance and inspection data should be recorded and kept for reference.

2. FROM MACHINE INSTALLATION TO TRIAL OPERATION

2-1 Environment

Avoid the following places to install the machine.

- 1) The place exposed to direct sunlight, near heat source, or subjected to large temperature change.
- 2) Humid place
- 3) Dusty place
- 4) Place near a vibration generating equipment
- 5) Weak soil

- Notes:
1. If the machine is to be installed at a place near a vibration generating equipment, provide vibration insulation pit around the machine foundation or other suitable measures to protect the machine from the vibration.
 2. If the machine is to be installed on a weak soil, reinforce the subsoil by driving piles to prevent settling or tilting of machine installation foundation.

2-2 Air Source

Since the clamp mechanisms of the machine are actuated pneumatically, air source as specified below is necessary:

Pressure 5 kg/cm² or higher
Delivery 50 Nℓ/min. or more

Use a compressor of 0.5 HP output.

Note: If the supply air contains water content or if air temperature is very high, it will cause the pneumatic equipment to be damaged. In these cases, it is necessary to provide auxiliary equipment such as an air drier in the pneumatic circuit.

2-3 Power Requirements

If power capacity in your shop is insufficient for the machine, it may cause unexpected serious troubles in machine functions, and furthermore, result in shorter service life of electricals. In addition, insufficient power capacity may result in hazardous conditions for machine operation. Therefore, it is of utmost importance that care should be taken so that the machine can be operated under rated power conditions in your shop.

Total Machine Power Requirements

1) Power requirements

$$\cos \phi = 0.8$$

No.	Item	Spindle motor output	
		10 HP	15 HP
1	Main motor	12	17
2	Control circuitry	3.2	3.2
3	NC	3.8	3.8
	Total (kVA)	19	24

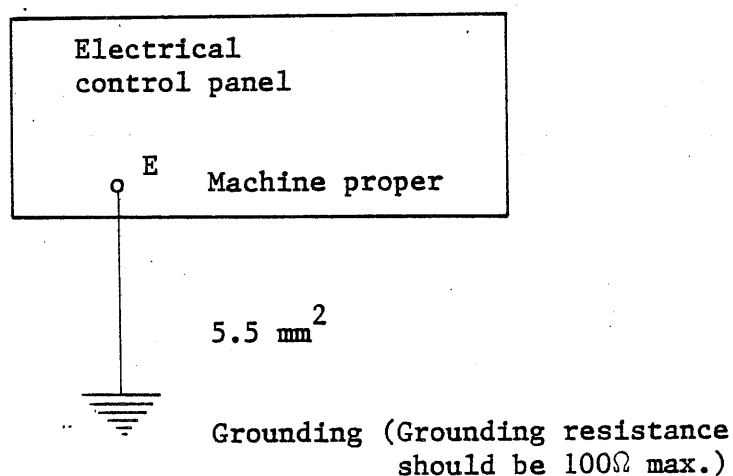
2) Cable size

Main power supply cable 30 mm² or more

Grounding cable 5.5 mm² or more

Note: Wiring for grounding

To avoid hazards caused by leakage, or to protect the control circuit from electrical noises, ground the circuitry through the grounding stud in the electrical control unit.



3) Allowable voltage fluctuation

Supply voltage must be within ±10% of the nominal value. The voltage fluctuating over ±10% of the nominal value may result in the malfunction of the machine.

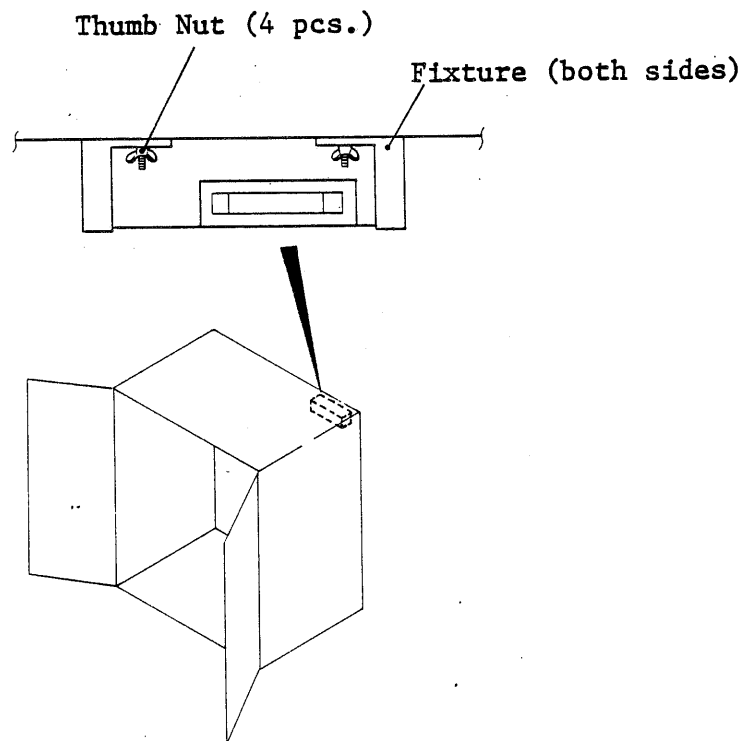
4) Using the intra-panel light

This lamp is powered by dry cells, not by a rechargeable battery. After the life of the cells has expired even during the machine warranty period, the customer should replace them at his cost.

NOTE:

1. When shipped from the factory, the panel is equipped with four dry cells (D-cell).
2. When replacing worn-out cells, use new ones which show no evidence of leakage.

If the lamp is to be used away from the machine or when cells are being replaced, loosen the thumb nuts as illustrated below and remove the fixture. After using, always replace the lamp and secure it.



2-4 Packing

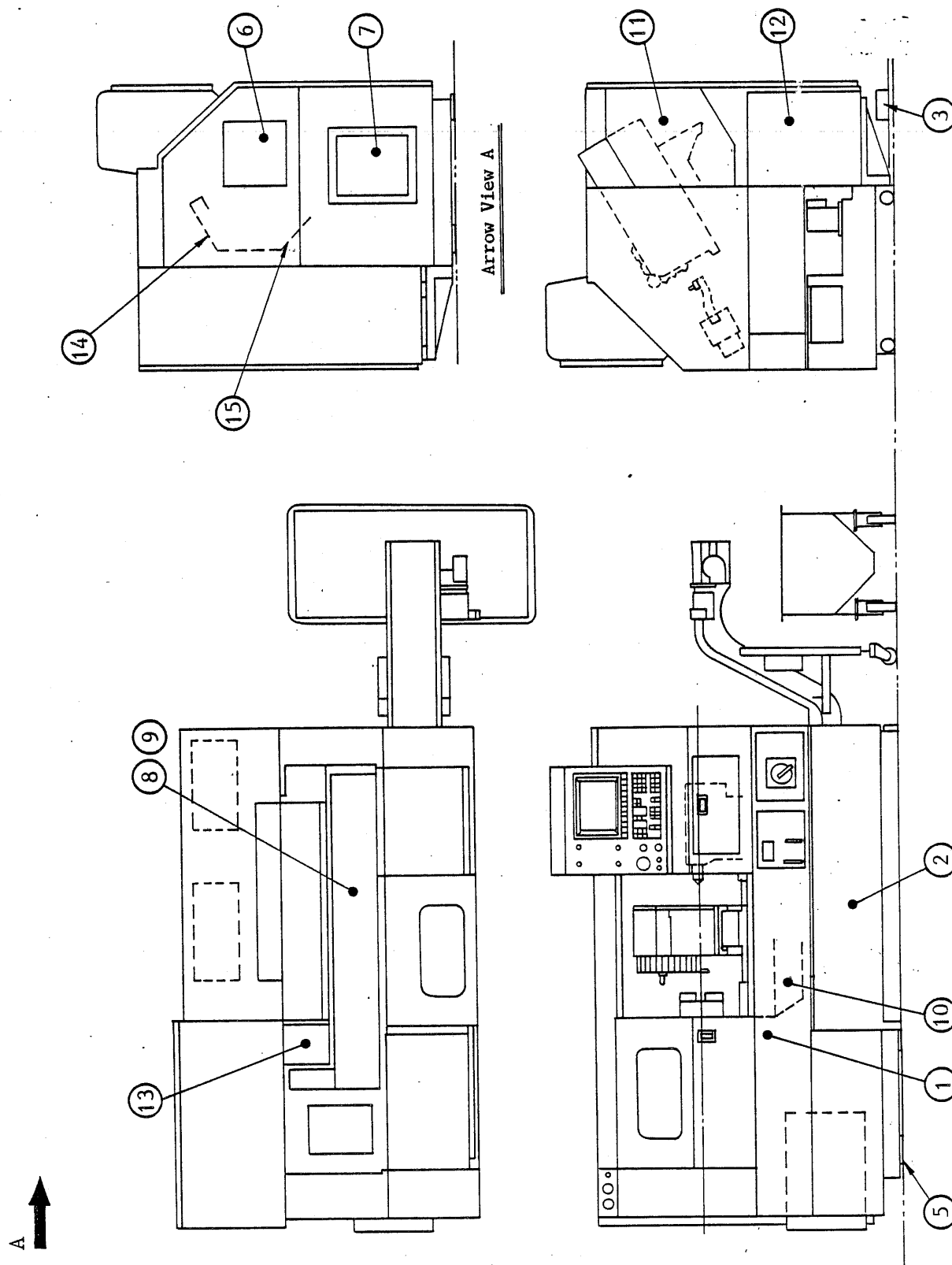
The machine is disassembled and packed in the following units for transportation.

- a) Machine proper including control panel, NC system and hydraulic unit
- b) Chip pan
- c) Tool holder, standard accessories (boxed) and placing board
- d) Chip conveyor and bucket (optional)
- e) Covers (upper and lower side covers, fluorescent lamp covers, upper and lower back covers, illuminator covers, lifting hole cap on carriage wing cover (H) and thru-hole cylinder cover (last item optional)
- f) Robot conveyor (optional) and robot hands (optional)

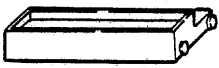



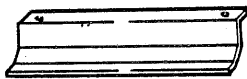
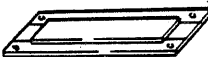
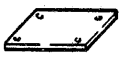
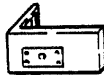
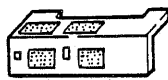
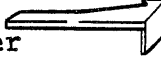
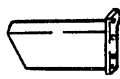

For the respective quantity of the above-mentioned items, see the Check Sheet attached to the machine.

1) Fixing of separately packed parts (① - ⑮)

. For the machine with octagonal turret (standard)
(Universal type)



2) ITEMIZED DELIVERED MACHINE PARTS (CHECK SHEET)

<u>Model: QUICK TURN 10N</u>		<u>Serial number: N-</u>						
<u>Customer:</u>		<u>Total: items</u>						
Item	P/N	Q'ty	A	B	C	D	E	
Body	(1)	1						
Oil pan 	(2)	1						
Spare oil catcher (for lubricating oil recovery) 	(3)	1						
Corrugated cardboard box , Tooling	(4)	1						
Placing board	(5)	1						
Upper side cover 	(6)	1						
Lower side cover 	(7)	1						
Fluorescent lamp 	(8)	1						
Acrylic cover  Ceiling cover	(9)	1						
Chip cover (lower part of front cover) 	(10)	1						
Upper back cover 	(11)	1						
Lower back cover 	(12)	1						
Left caster cover  Control panel	(13)	1						
Wing cover (H) upper cap 	(14)	1						
Wing cover (H) lower cap 	(15)	1						

2-5 Transportation

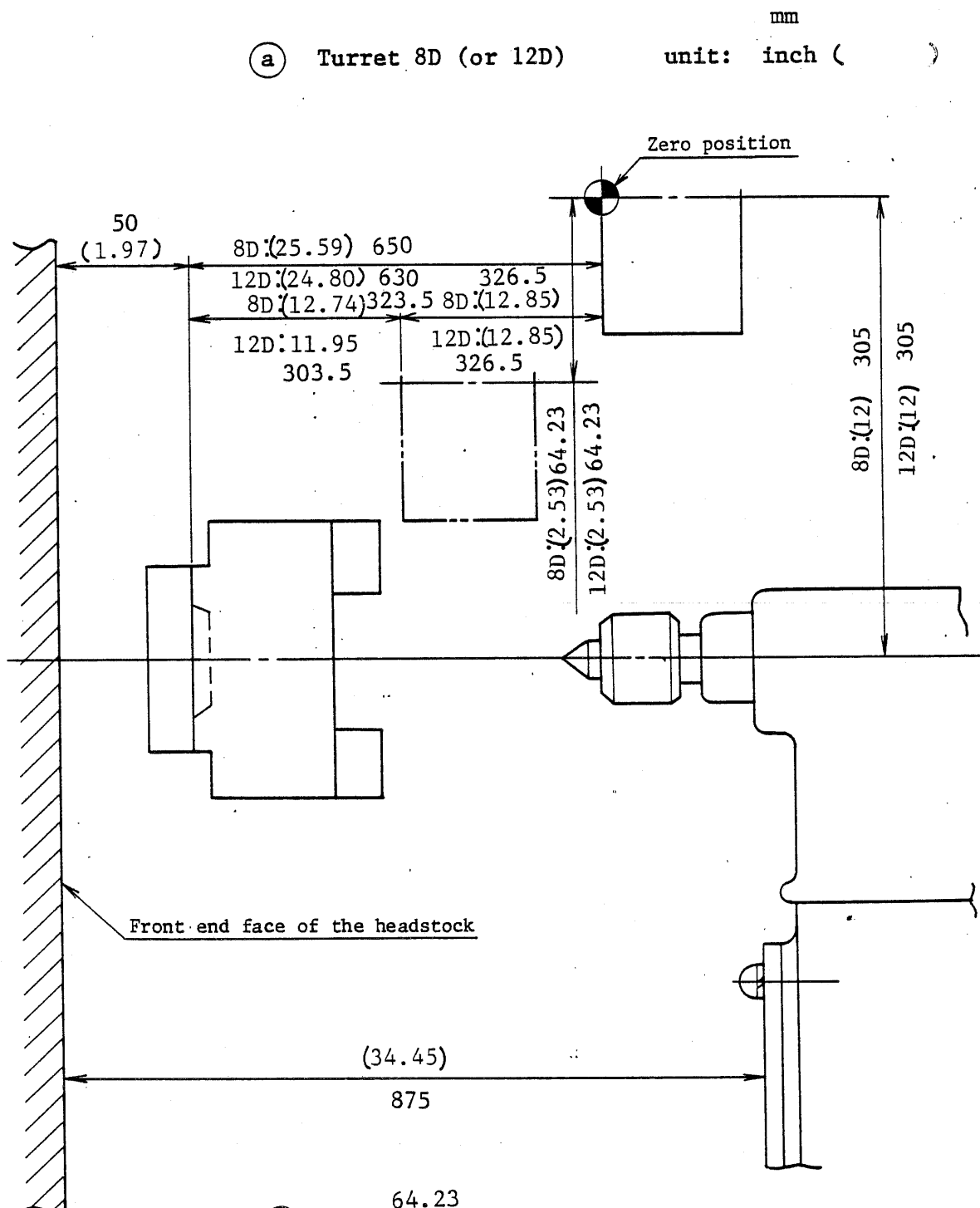
When lifting the machine, extra care should be taken not to impose shock load to the machine proper and the electrical control panel.

Before lifting the machine, check to make sure that each machine unit is fixed in position and that there are no tools or other things on the machine.

The machine should be lifted, roped or clamped only in the manner indicated below.

1) Machine clamping procedures

- (1) Move the turret and the tailstock to the following positions:

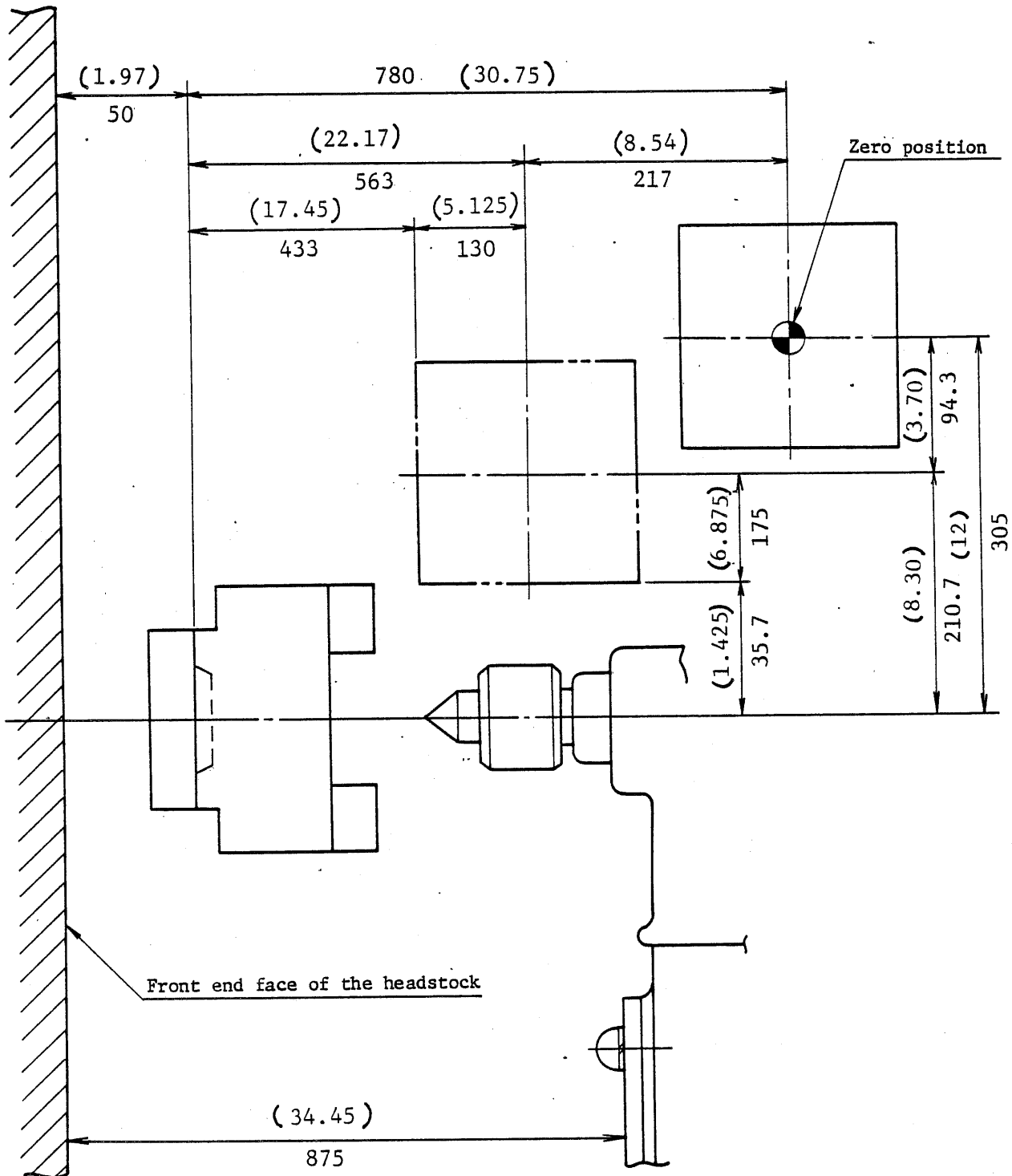


- Turret:
- ① Move $\frac{64.23}{326.5}$ inch from the zero point in -X direction.
 - ② Move (12.85) inch from the zero point in -Z direction.
- Tailstock: Advance the tailstock body to the point where its front end face will be (34.45) in. from that of the headstock.

⑥ Turret 4T

mm

unit: inch ()

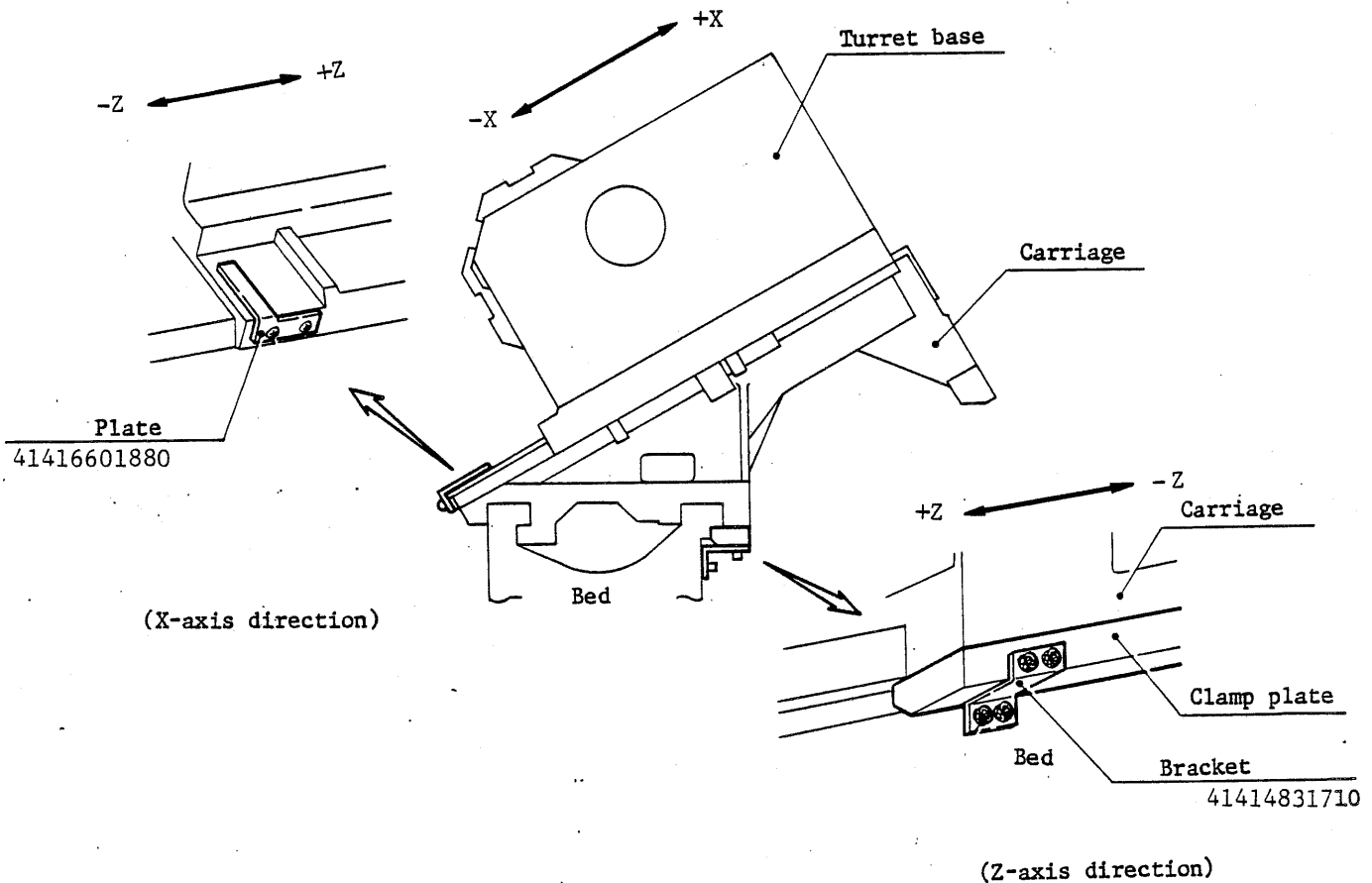


94.3mm

- Turret:
- ① Move(3.70)inch from the zero point in -X direction.
 - ② Move(8.54)inch from the zero point in -Z direction.
- Tailstock: Advance the tailstock body to the point where its front and face will be(34.45) in. from that of the headstock.

2-6 Machine Fixing Fittigs

1) X- and Z-axis directions



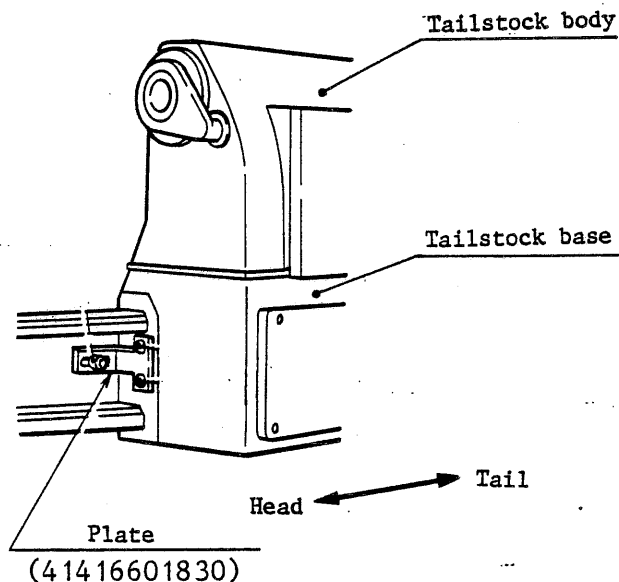
(1) X-axis direction:

To fix the machine in the X-axis direction, remove the small pan-head screws (2-M8 x $\varnothing 16$) of the wiper on the left side of the carriage and screw down the plate (41416601880) together with the wiper.

(2) Z-axis direction:

To fix the machine in the Z-axis direction, screw down the bracket (41414831710) to the clamp plate and bed using the hexagon socket head cap screws (4-M8 x $\varnothing 12$).

2) Tailstock



To fix the tailstock, fix one side of the tailstock fixing fitting (41416601830) to the tailstock base with the small pan-head screws (2-M8 x 16) and the other side to the bed with a hexagon socket head cap screw (1-M8 x 12).

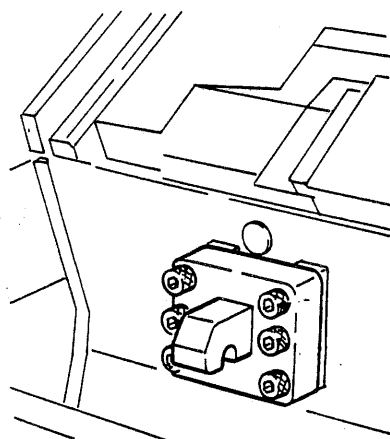
3) Covers, etc.

Remove the following covers before lifting the machine:

- (1) Lifting hole caps on the carriage wing cover on the head side (there are two caps, upper and lower).
- (2) Remove the high grade back cover (upper one only).
- (3) Fasten the tool setter arm to the front cover with pieces of a gummed tape.
- (4) Fasten the chuck foot switch to the bracket of the front cover door rail with a cord.

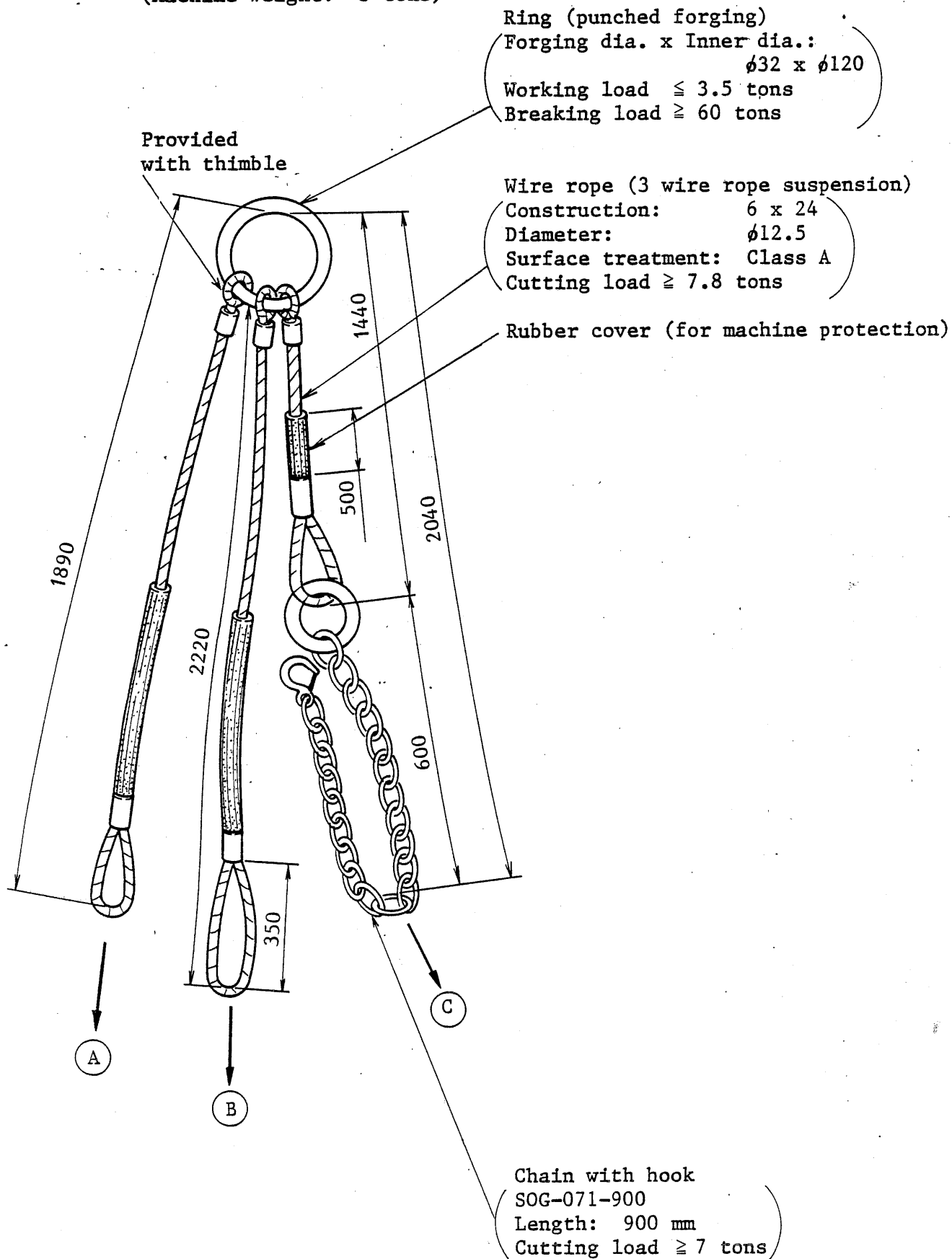
4) Fixing sling hook: 2 sets/unit

- ① Hook: 3-141-66-1205-0
- ② Hexagon socket head cap screw: 6-M20 x 255

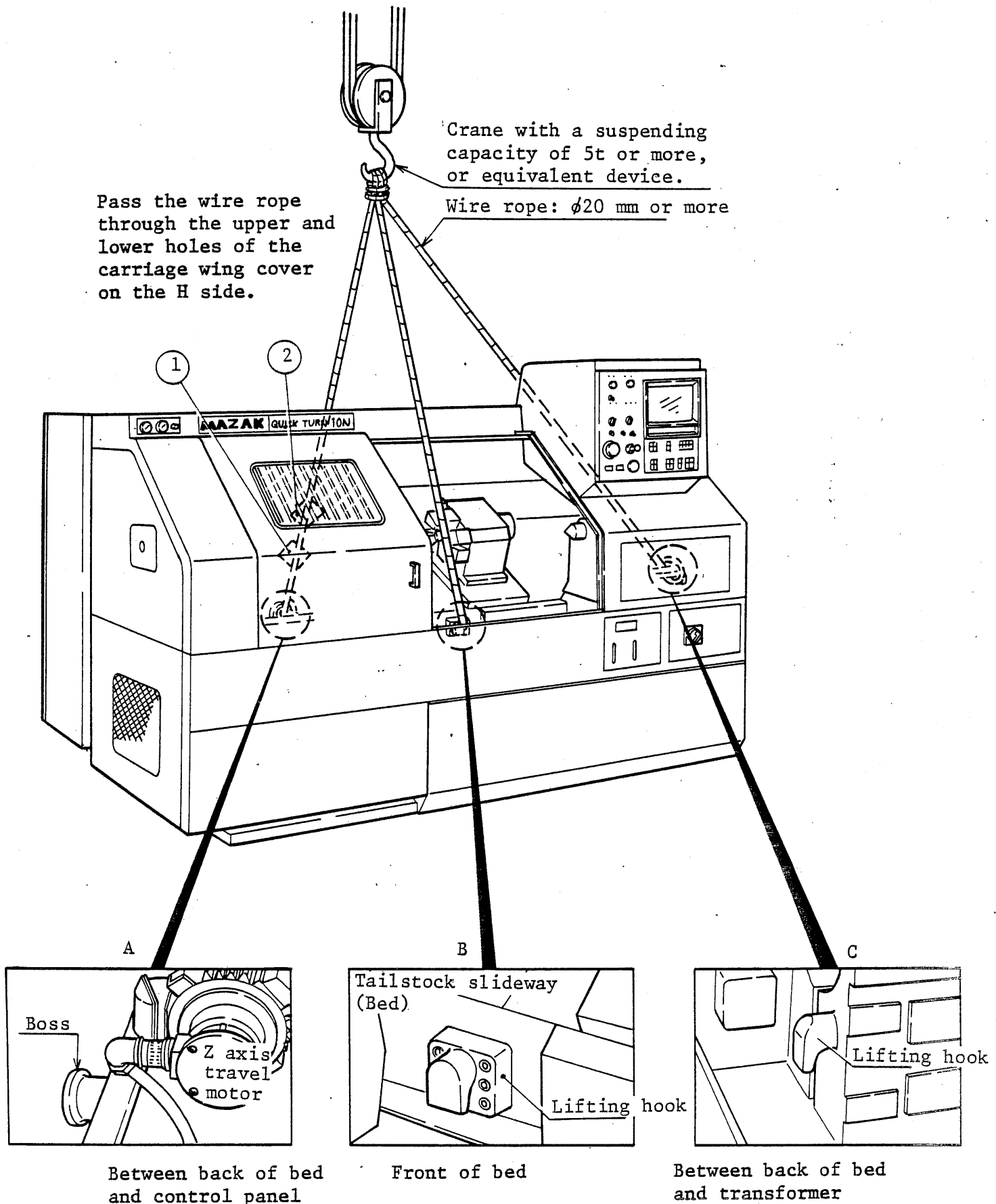


2-7' QT-10N (141)/Lifting Device for Exportable Use

(Machine weight: 3 tons)



2-8 QT-10N (141) Machine Lifting



How to lift the machine

- Notes:
1. The machine should be well balanced when lifted. Before lifting the machine, check to be sure that it is in well balanced by lifting it slightly.
 2. The angle between the wire slings should be less than 60° when lifting the machine.
 3. When lifting the machine with two or more operators, be sure to confirm safety of the intended operation by exchanging signs each other.

2-9 Installation

1) Foundation

Select a level and even site for installing the machine.

Avoid places near vibration generating equipment, heat sources, places exposed to the direct sunshine, or where there is excessive humidity. Although it may differ depending on the quality of the soil, it is important to make the ground and the concrete sufficiently solid so that sinking or settling will not occur with the weight of the machine after the installation.

Note 1: If there is vibration generating equipment near the installation site, and the machine may be affected, take precautionary measures such as providing a vibration insulation pit around the site.

Note 2: The installation site should be sufficiently large so that not only the area where the machine stands but also the maintenance floor is included, as shown in the foundation plan.

2) Preliminary leveling

Fit the foundation bolts and iron foundation plates to the leveling bolt holes of the machine while it is still lifted above the ground. Lower the machine slowly and place it on the foundation carefully so that the foundation bolts are set into the foundation holes made according to the foundation plan. Since the leveling bolts cannot be used at this stage, keep the machine above the lower bed surface. Place the wedge plates under the bed to make a tentative centering adjustment, then level the machine in some measure. When the machine has been roughly leveled by wedge plates, set the foundation bolts with mortar.

3) Inter-unit connections

When the machine is roughly leveled, check and make sure the following before turning the main power on:

- (1) Screws at the terminals are tightened firmly. Retighten, if necessary.
- (2) The Cannon and other connectors are firmly screwed in.
- (3) The relays and the timers are firmly mounted.
- (4) The timer and volume switches are properly set to the specified values.
- (5) The printed circuit boards in the numerical control unit are firmly set.
- (6) The correct phase rotation is established. Incorrect phase rotation may cause troubles and malfunctions of the numerical control system and the AC inverter controller.

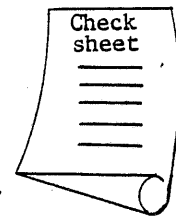
4) Checkups before starting trial operation

When the hydraulic power unit has been connected to the machine proper, check and make sure the following:

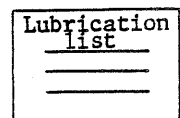
(1) Machine

- o The machine and machine parts are all free from damage.

- o All the parts and accessories are correctly delivered.



- o The lubrication tanks are filled with the specified lubricant and hydraulic fluid to the specified levels.



- o The hydraulic piping runs, and pipes and hoses are firmly connected.

(2) Electricals

Check electricals carefully both "before" and "after" turning the main power ON.

(3) Cautions to be taken after long-term suspension of operation

For the first machine operation after unpacking and after a long-term suspension of machine operation, it is necessary to pull the manual handle of the guideway lubrication pump a few times and confirm that lubricant oozes out from the guideways.

Note: It is not necessary to push back the manual handle; it returns automatically with a spring when let go.

(4) Preparation before trial operation

1. Since the machine is delivered to you with special procedures for transportation, make certain to undo them after the installation following the above-mentioned procedures (2-3, 1)) in the reverse order.
2. Install covers and other parts that have been removed and packaged separately for the machine transportation. (See 2-2, d)).
When installing the front cover and the wing cover, seal joints securely with the sealing bond (supplied in service tool kit box) to prevent leakage.

(5) Cleaning

The guideway surfaces and other parts of the machine are coated with rust-preventive oil. Do not try to run the machine or move units before cleaning them, since the rust-preventive coating is usually soiled with dust and sand.

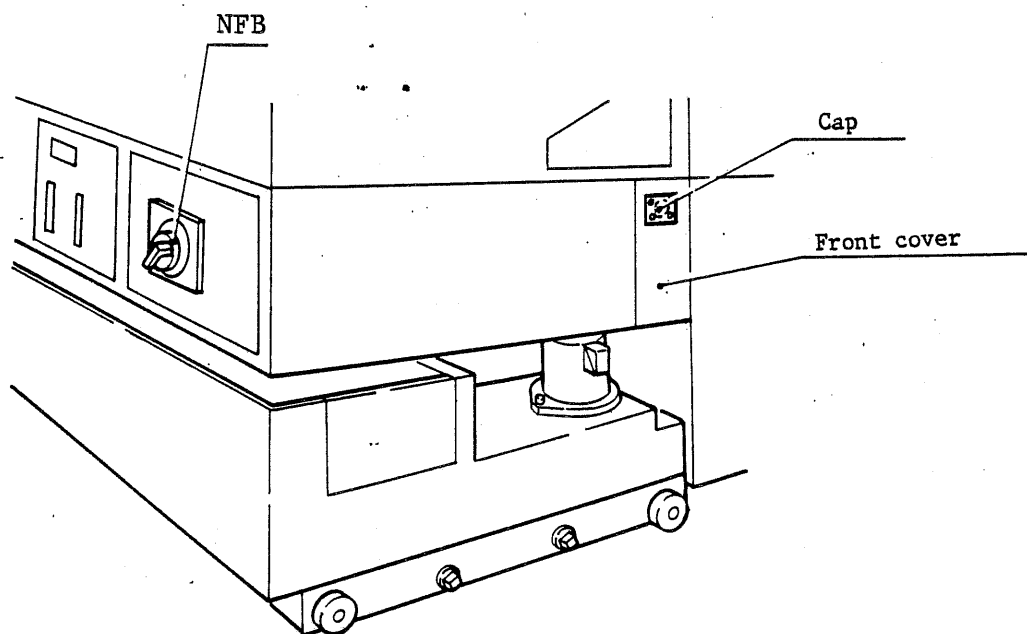
Remove the rust-preventive coating with rags soaked in the cleaning oil. Apply specified lubricant thinly to the guideway surfaces when the coating has been completely cleaned off.

Note 1: Be careful so that the cleaning oil will not enter into the guideway surfaces beyond the wiper.

Note 2: Dispose rags to the specified place after use.

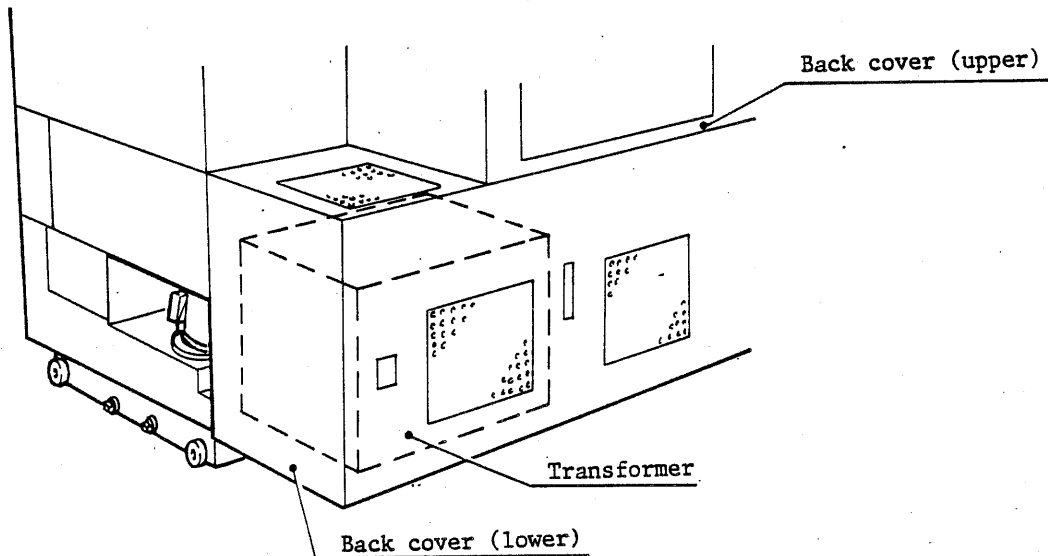
1. Mains connection to NFB

- (a) Remove the cap (with a $\phi 75$ hole) on the tail side of the front cover.
- (b) Connect the mains connector to the cap.
- (c) Wire the mains to the NFB.



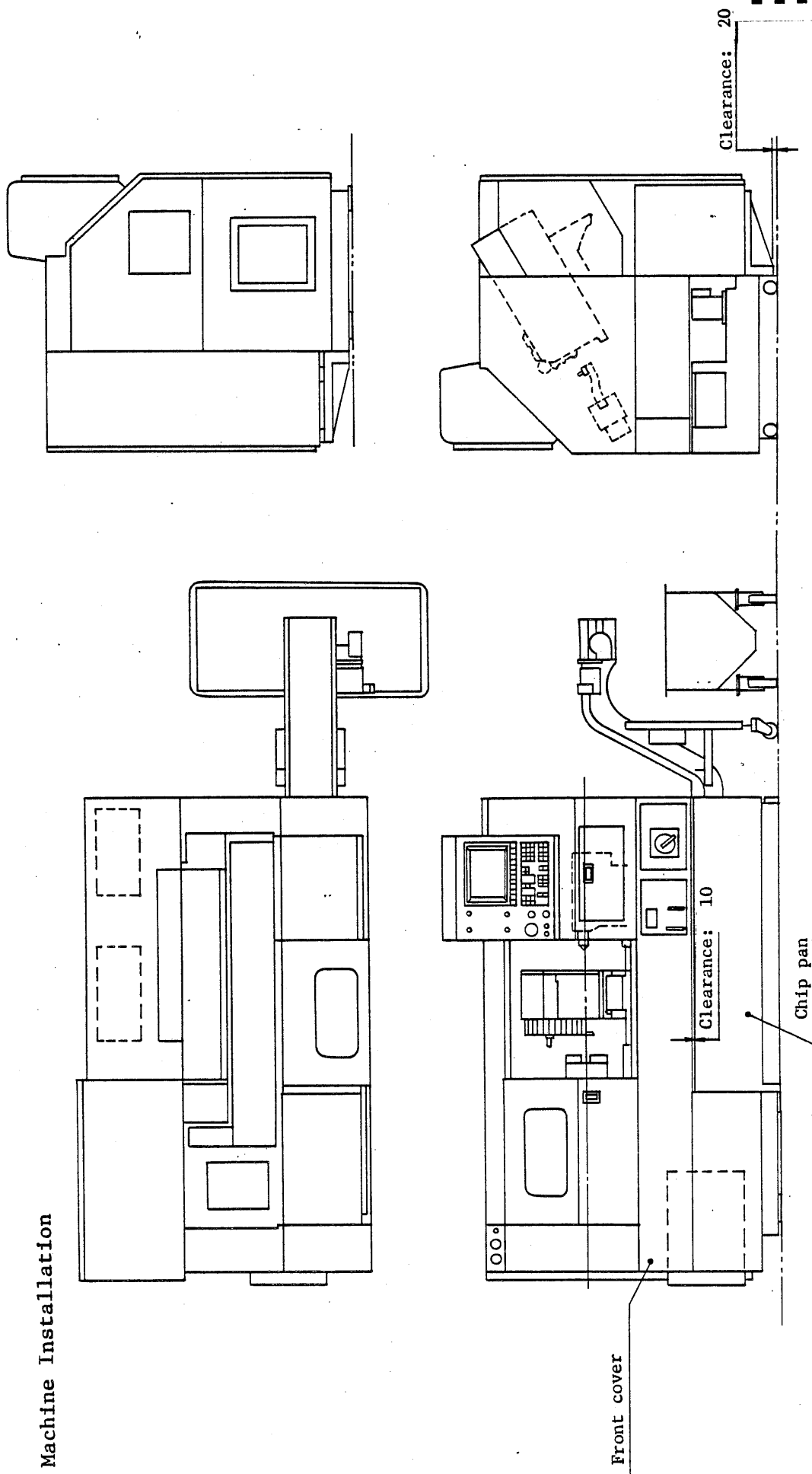
2. Transformer tap changing

- (a) Remove the back covers (both upper and lower covers) at the back of the machine.
- (b) Remove the transformer cover.
- (c) Change the taps in the transformer.



Note: Change the taps following the Electric Circuit Diagram.

Machine Installation



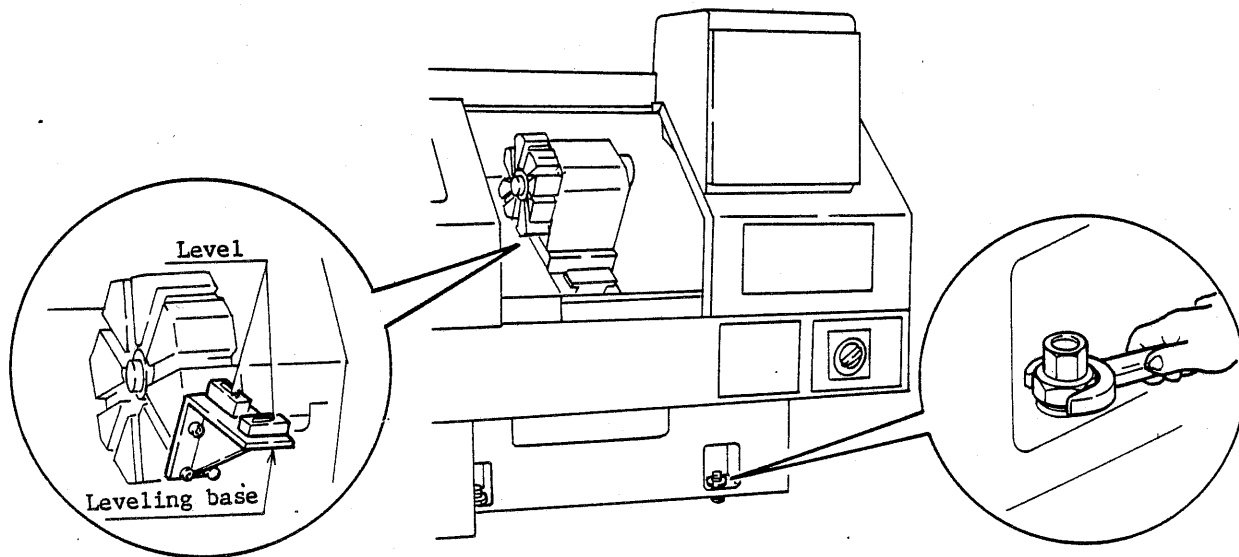
Note: Install the machine so that the clearance between the front cover and the chip pan will be 10 mm when the clearance between the machine bottom and the floor face is 20 mm.

5) Final leveling adjustment

When the mortar has hardened, adjust the machine level again using leveling bolts. The level should be placed in the same manner as when the preliminary leveling was carried out. Refer to the Accuracy Table attached to the machine for the leveling procedures and allowable values.

Note: For the final leveling, the foundation bolts and leveling nuts must be screwed tightly before checking the levels.

Use a level with 0.02 mm minimum reading.



6) Installation and maintenance of inter-unit connections

It is necessary to maintain and service the machine properly in order to retain its accuracy for a prolonged period of time and operate it in the optimum condition. What prevents unexpected machine troubles and faults successfully are observing the operating conditions carefully, carrying out the specified periodical maintenance and replacing worn parts early.

(1) Maintenance upon installation

During the first period after the machine installation, the bed level may shift and affect the machining accuracy, resulting from the settling of the foundation ground, and unstable, or uneven hardening of the foundation itself. The machine may get excessively soiled inside, or some parts may show initial wearing, creating conditions which easily induce accidents.

Therefore, it is of utmost importance to pay careful attention to the machine operation. The following are precautionary items during the period immediately after the first installation of the machine.

1. Run-in operation

When the machine is to be operated for the first time after the installation, it is necessary to run it in with utmost care. Run the machine in for about 100 hours. Avoid loading the machine excessively during this run-in operation.

2. Early checkup of bed level

During the first six months after the installation, check the leveling of the bed and the foundation at least once a month. Take necessary leveling measures if any changes have occurred so that the bed is always maintained level. Check less frequently after the first six months, depending on the changes in the foundation.

If there are few, check regularly once or twice a year.

(2) Checkups of inter-unit connections

Checkups of electrical connections between units including the NC unit, the machine proper, the hydraulic power unit and the operation panel.

1. Loose connectors

These units are connected with Cannon connectors. Check for loose connectors and retighten them if necessary.

2. Loose terminal screws

Check for loose terminal screws connecting units and at various operation panels, and retighten them if necessary.

3. Check for loose terminal screws and mount screws of the micro switches and retighten them if necessary.

(3) Checkups of electrical control panel

Turn the power OFF before checking the electrical control panel.

1. Terminal screws and soldered lines

Check for terminal screws of electricals and retighten them if necessary. Pull the soldered lines of the relay panel lightly by hand to see if they are securely soldered.

2. Plug type fuses

Check for loose plugs and tighten them securely.

3. Spark killers

Check the spark killers individually. It is necessary to replace a spark killer when the case has discolored.

4. Cleaning

Remove dust and other foreign matters carefully from the inside of the electrical control panel to prevent accidents.

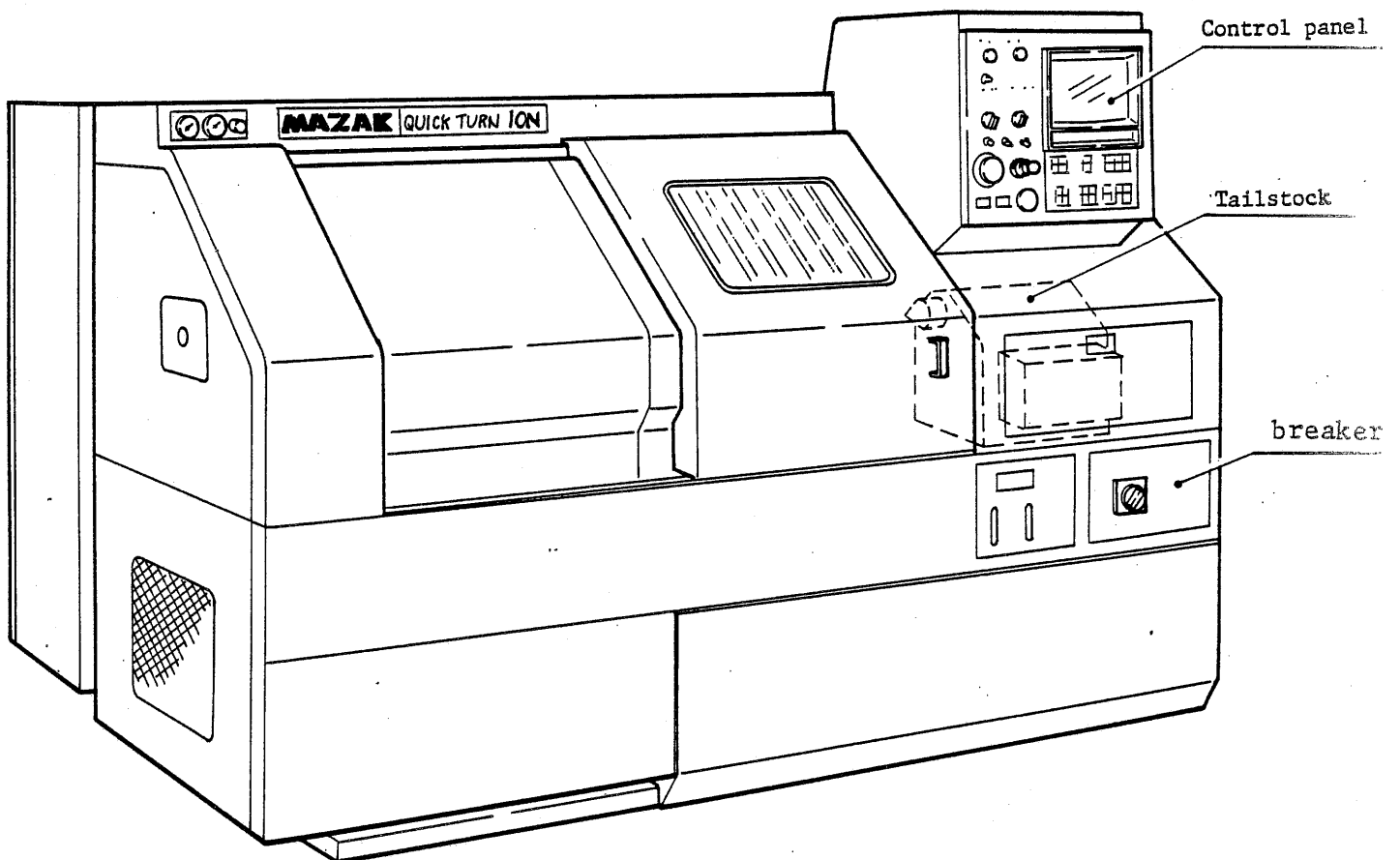
5. Wash the air filter carefully with water when it is found dirty.

3. MACHINE CONSTRUCTION AND PART NAMES

3-1 Part Names

. With 8D (standard), 12D, 4T (option)

(1) Universal type

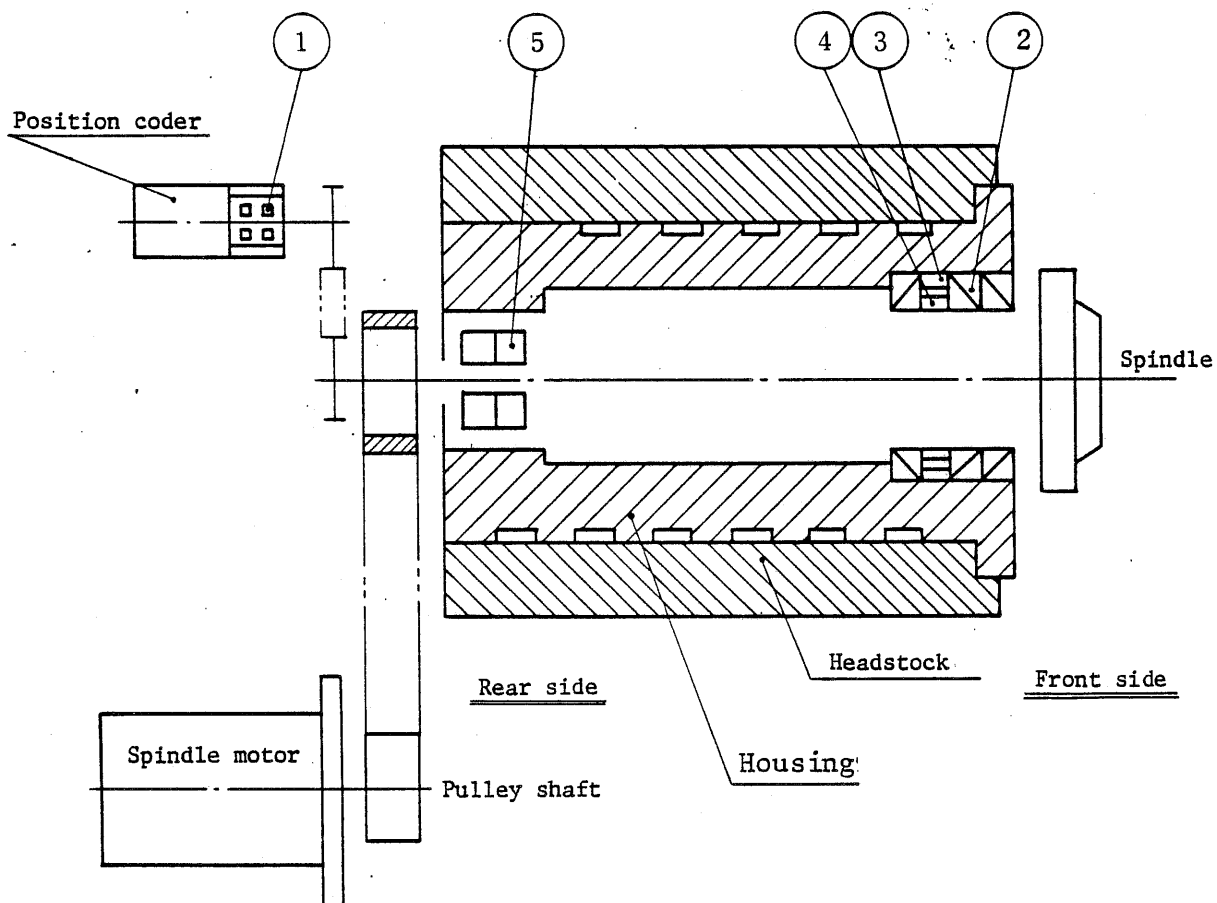


3-2 Head stock

The headstock is one of the most important component units of the machine. All of its component parts are, therefore, highly precisely machined and incorporated with utmost care.

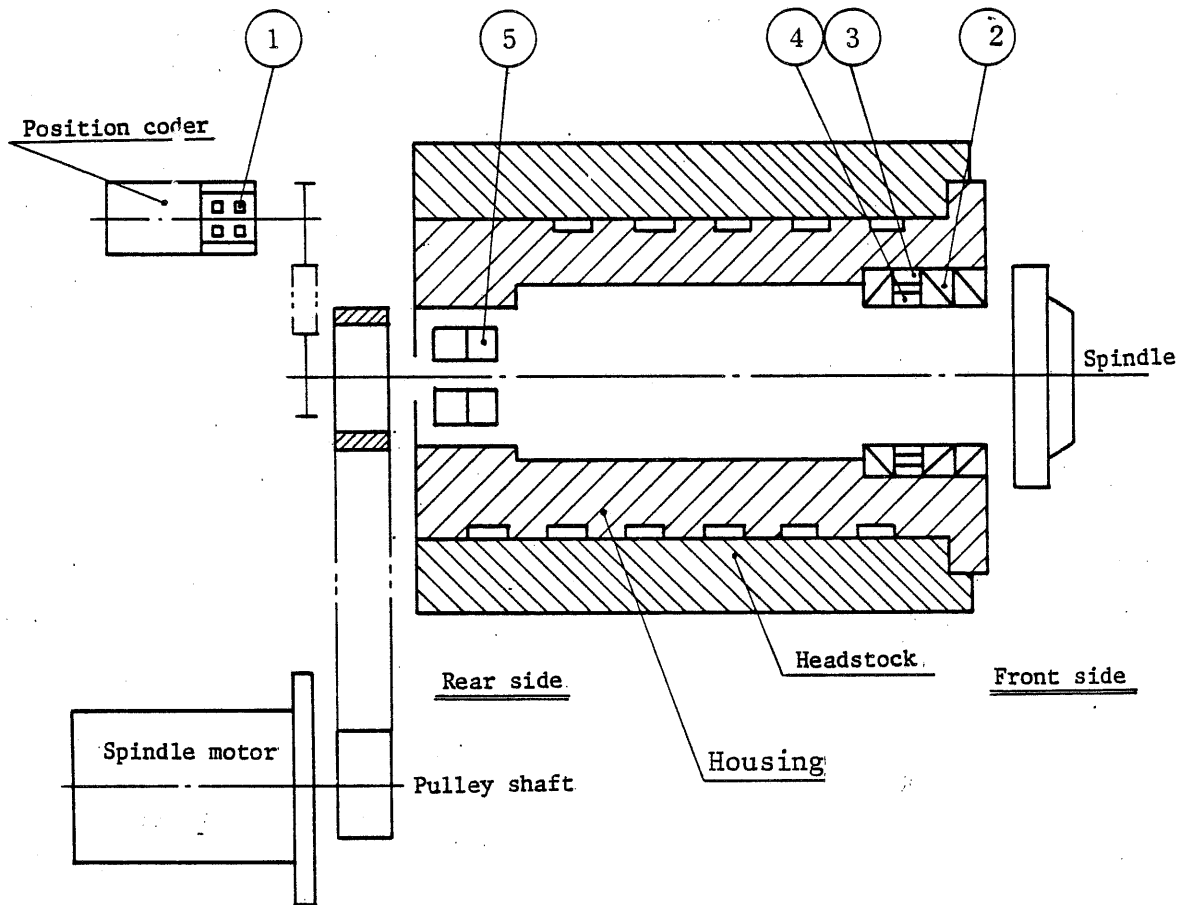
The main component parts of the headstock are the headstock body, spindle, spindle bearings, housings for spindle bearings, pulley and position coder.

1) Construction of spindle table (for 26 - 2600 rpm & 36 - 3600 rpm)



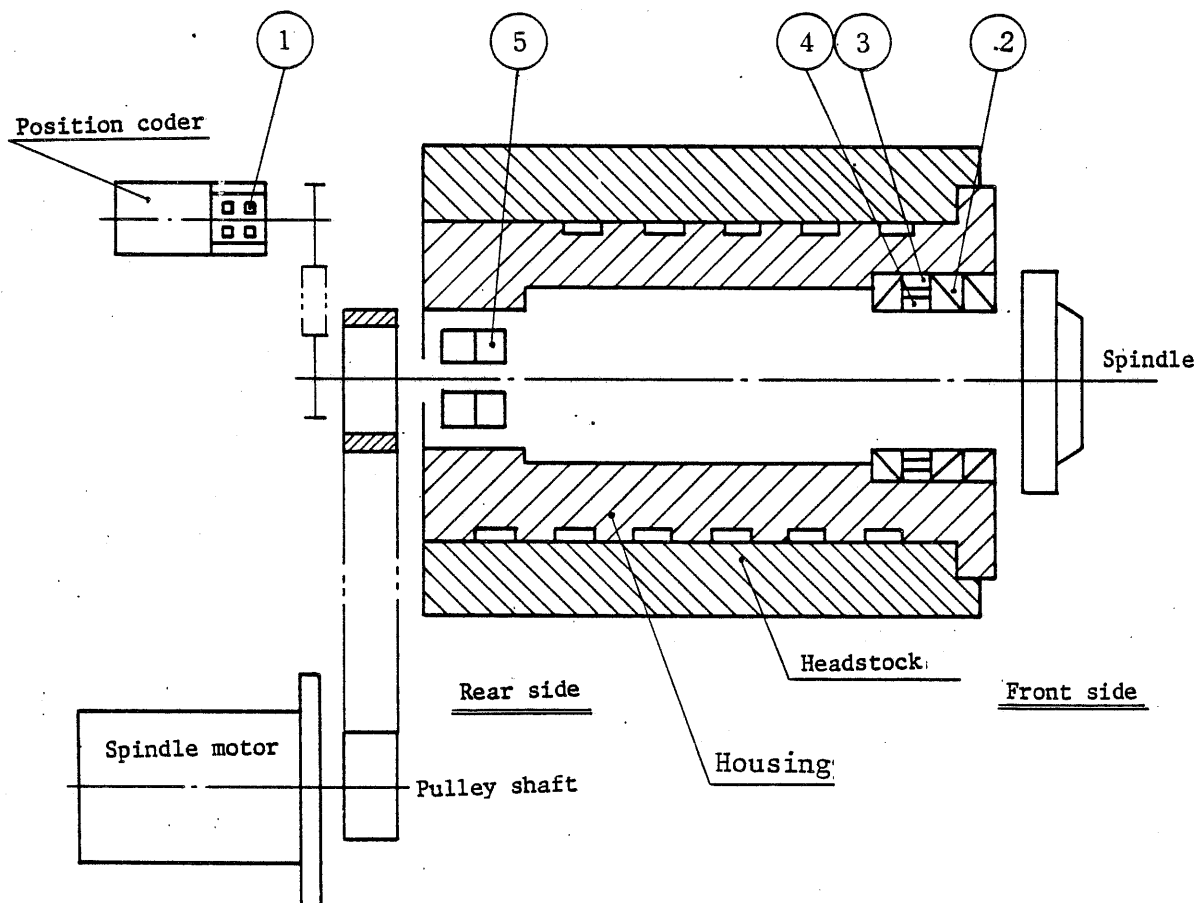
No.	Part name	Part No.	Material	Q'ty	Remarks
1	Ball bearing	E0006005ZZ0		2	6005ZZ
2	Roller bearing	F04NP000140		1	NN3020KMBCC9P4U17
3	Angular contact	F02NP001310		1	100BA10XDBLP4A
4	Roller bearing	F04NP000770		1	NN3016KCC1P5

(for 46 - 4600 rpm)



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Ball bearing	E0006005ZZ0		2	6005ZZ
2	Roller bearing	F04NP000990		1	NN3014KMBRCC9P4
3	Angular contact ball bearing	F02NP001860		1	7016CTYDBDP4 + KL22ACP12

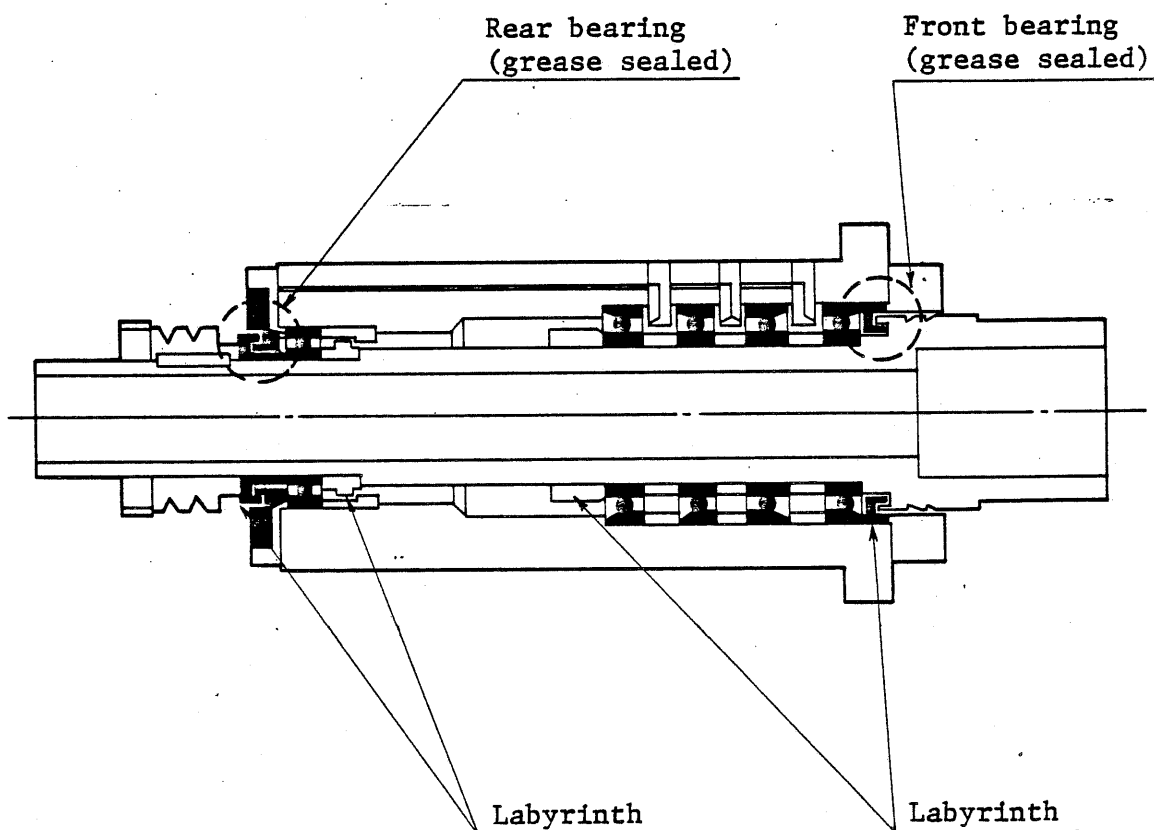
(for 60 - 6000 rpm)



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Ball bearing	E0006005ZZ0		2	6005ZZ
2	Roller bearing	F04NP000990		1	NN3014KMBRCC9P4
3	Angular contact ball bearing	F02NP001850		1	80BNC10TDBDLP4 + KL22A

(1) Spindle (Speed range: 26 - 2600, 36 - 3600 rpm)

The spindle has a 2-point-support construction. The front bearing is a JIS 4 class ultra precision double-row cylindrical roller bearing or a combination high speed angular contact ball bearing. The rear bearing is a JIS 5 class precision double-row cylindrical roller bearing.



Spindle construction

The spindle bearings are lubricated with grease and sealed by labyrinth packing without any surface contact. The amount of grease sealed in the bearing is designed to be strictly controlled because it greatly affects the spindle temperature and service life.

Amount of grease sealed in the front bearing:

- Double-row cylindrical roller bearing 12 g
- Combination angular contact ball bearing 6 g (per bearing)

Amount of grease sealed in the rear bearing:

- Double-row cylindrical roller bearing 7 g

. Greasing Spots (for spindle with speed of 26 - 2600 or 36 - 3600 rpm)

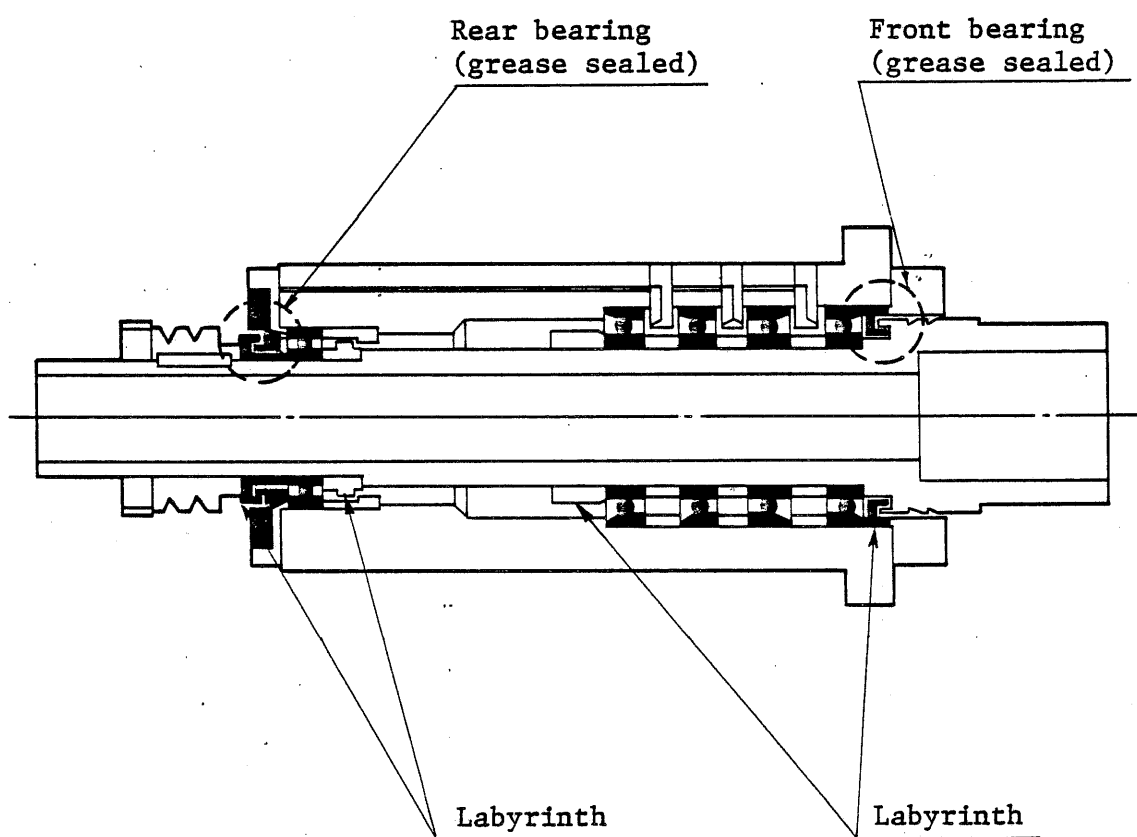
Spindle front bearings (NN3020K)	Mobilax No. 2 (MOBIL)	12 g
Sprindle front bearings (100BA10X)	Maltemp LRL-3 (Kyodo Sekiyu)	6 g/can
Spindle rear bearings (NN3016K)	Mobilax No. 2 (MOBIL)	7 g
Other bearings	Mobilax No. 2 (MOBIL)	Proper amount (15% of space volume)
O-ring groove	Mobilax No. 2 (MOBIL)	Proper amount
High-index coupling gear teeth	Mobilax No. 2 (MOBIL)	Proper amount
Chuck (H01MA8")	BIRAL-NMG (Suga Chemical)	Proper amount

(2) Spindle (speed range: 46 - 4600 rpm)

The spindle has a 2-point-support construction.

The front bearing is a JIS 4 class ultra precision combination high speed angular contact ball bearing.

The rear bearing is a JIS 4 class precision double-row cylindrical roller bearing.



Spindle construction

The spindle bearings are lubricated with grease and sealed by labyrinth packing without any surface contact. The amount of grease sealed in the bearing is designed to be strictly controlled because it greatly affects the spindle temperature and service life.

Amount of grease sealed in the front bearing:

- Combination angular contact ball

bearing 1.8 g (per bearing)

Amount of grease sealed in the rear bearing:

- Double-row cylindrical roller

bearing 1.8 g

. Greasing Spots (for spindle with speed of 46 - 4600 rpm)

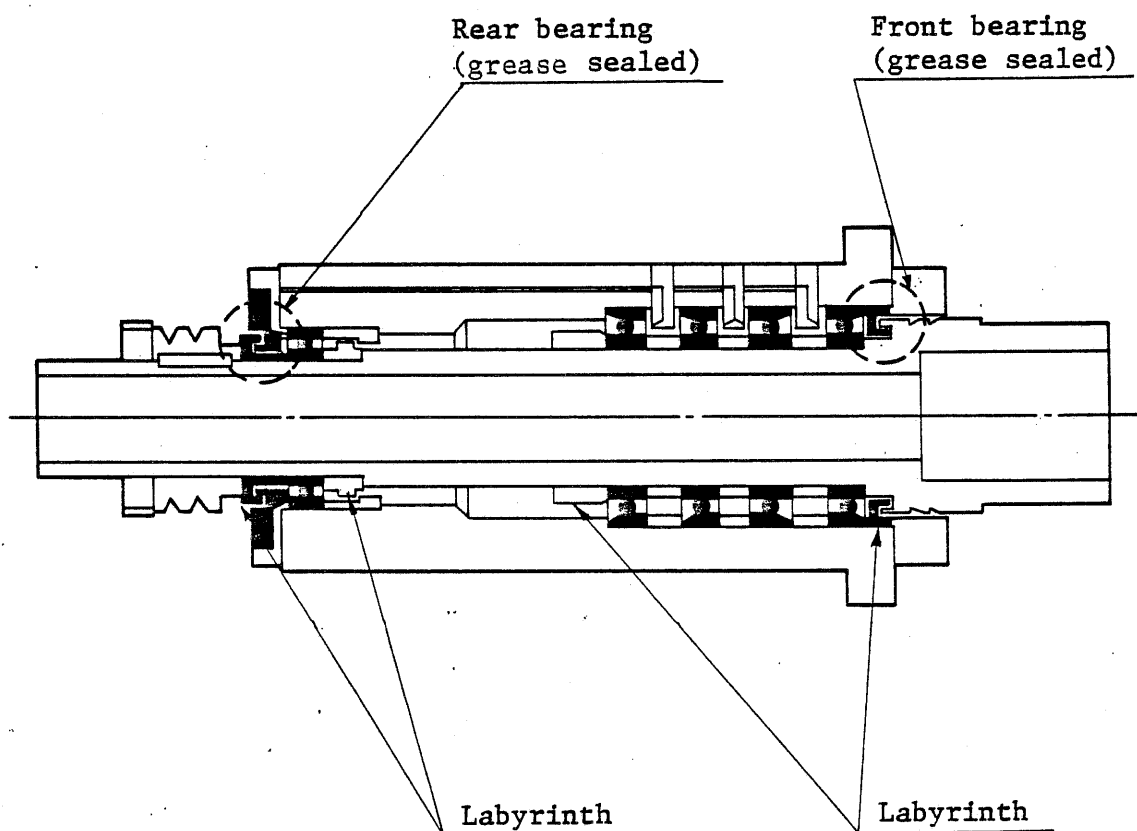
Spindle front bearings (7016CTYDBDP4 + KL22ACP12)	Isoflex NBU 15 (NOK, Kluba)	1.8 g/can
Spindle rear bearings (3014KMBRCC9P4)	Isoflex NBU 15 (NOK, Kluba)	1.8 g
Other bearings	Mobilax No. 2 (MOBIL)	Proper amount (15% of space volume)
O-ring groove	Mobilax No. 2 (MOBIL)	Proper amount
High-index coupling gear teeth	Mobilax No. 2 (MOBIL)	Proper amount
Chuck (H01MA8")	BIRAL-NMG (Suga Chemical)	Proper amount

(3) Spindle (speed range: 60 - 6000 rpm)

The spindle has a 2-point-support construction.

The front bearing is a JIS 4 class ultra precision combination high speed angular contact ball bearing.

The rear bearing is a JIS 4 class precision double-row cylindrical roller bearing.



Spindle construction

The spindle bearings are lubricated with grease and sealed by labyrinth packing without any surface contact. The amount of grease sealed in the bearing is designed to be strictly controlled because it greatly affects the spindle temperature and service life.

Amount of grease sealed in the front bearing:

- Combination angular contact ball

bearing 1.8 g (per bearing)

Amount of grease sealed in the rear bearing:

- Double-row cylindrical roller

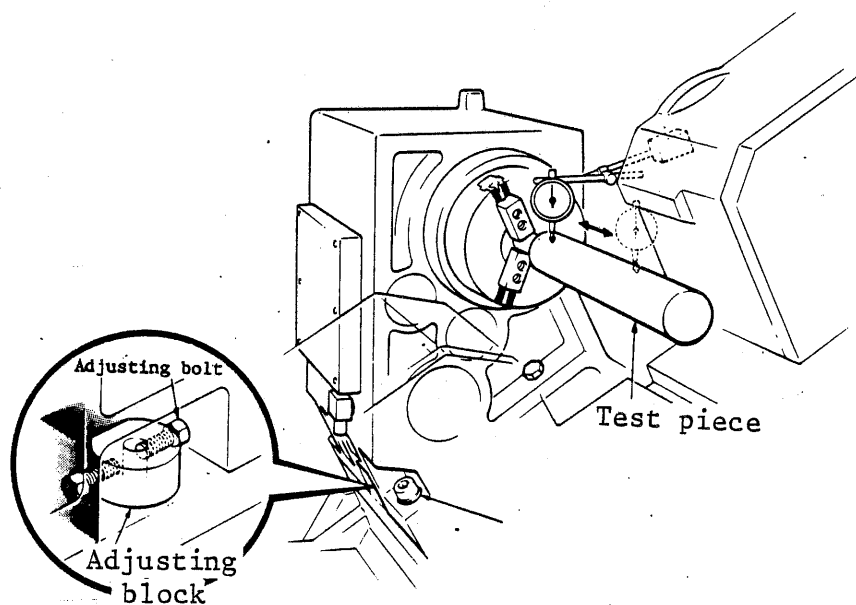
bearing 1.8 g

. Greasing Spots (for spindle with speed of 60 - 6000 rpm)

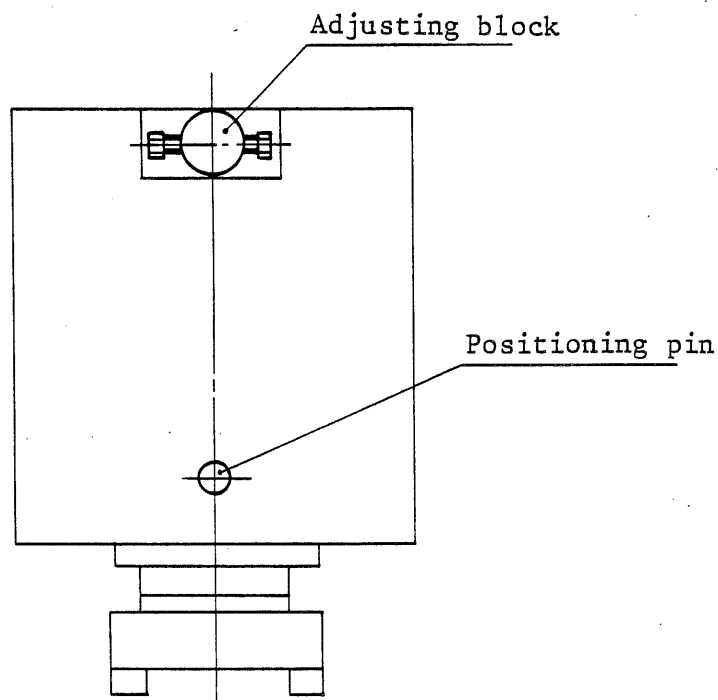
Spindle front bearings (80BNC10TDBDLP4 + KL22A)	Isoflex NBU 15 (NOK, Kluba)	1.8 g/can
Spindle rear bearings (NN3014KMBRCC9P4)	Isoflex NBU 15 (NOK, Kluba)	1.8 g
Other bearings	Mobilax No. 2 (MOBIL)	Proper amount (15% of space volume)
O-ring groove	Mobilax No. 2 (MOBIL)	Proper amount
High-index coupling gear teeth	Mobilax No. 2 (MOBIL)	Proper amount
Chuck (H01MA8")	BIRAL-NMG (Suga Chemical)	Proper amount

2) Alignment of headstock

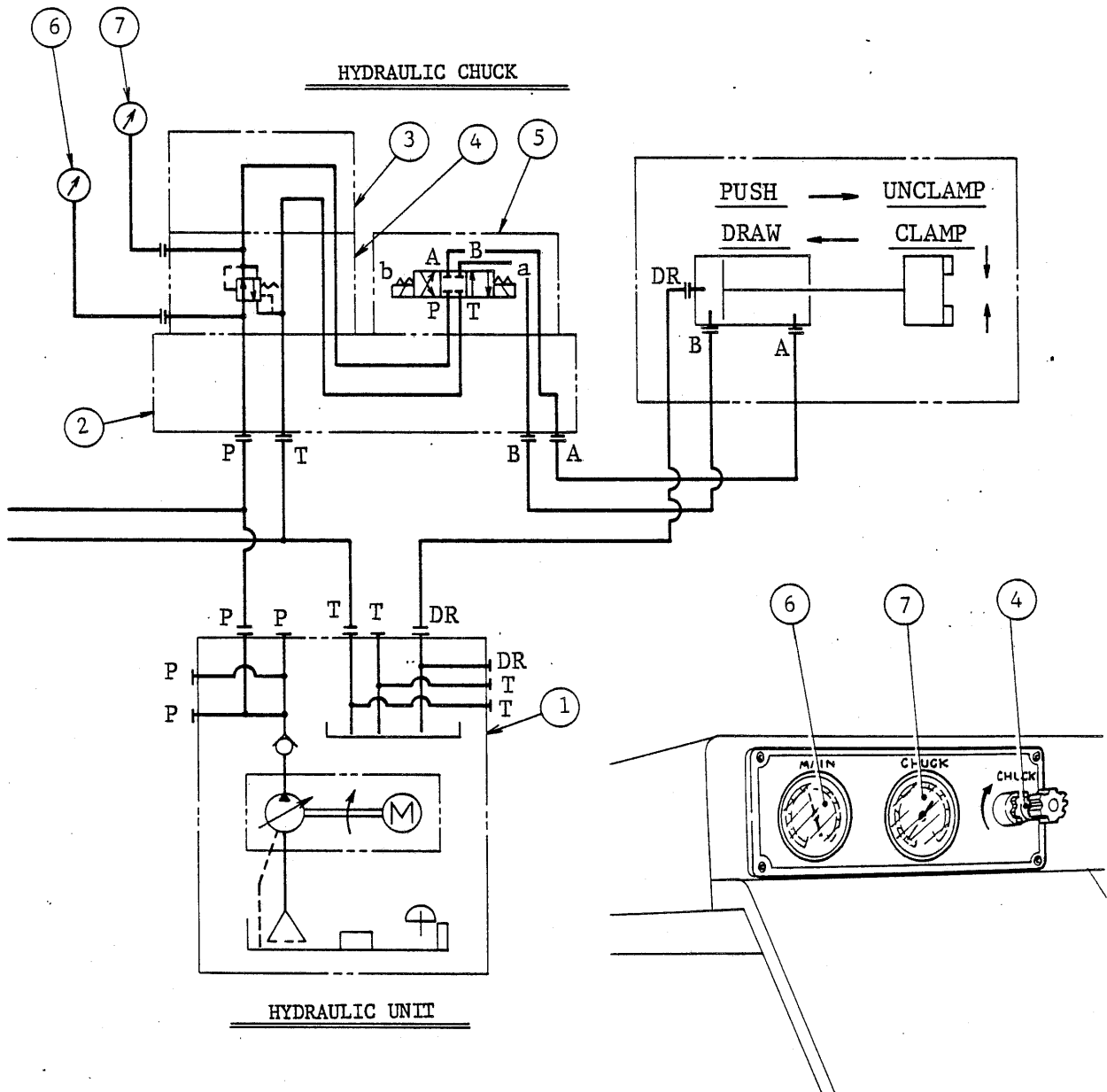
The headstock has been properly aligned at the factory before shipment, and no further adjustment is required after the machine installation. However, if misalignment has occurred due to collision with the turret or other reasons, adjust the headstock alignment following the steps below:



Headstock Alignment



3) Hydraulic chuck pressure adjustment



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Hydraulic unit	G49VK004920	Tokiwa Sangyo	1	TS-222025
2	Manifold	11415235010	Densver	1	
3	Plate	G26TK001230	Tokyo Keiki	1	DGMA-3-C1
4	Reducing valve	G11FH000530	(NACHI)	1	OG-G01-PB-K-5544A
5	Solenoid valve	G16FH000390	(NACHI)	1	SA-G01-C5-C1-11
6	Pressure gage	41415220210	Asahi Keiki	1	for the main pressure
7	Pressure gage	41415220220	Asahi Keiki	1	for the chuck pressure

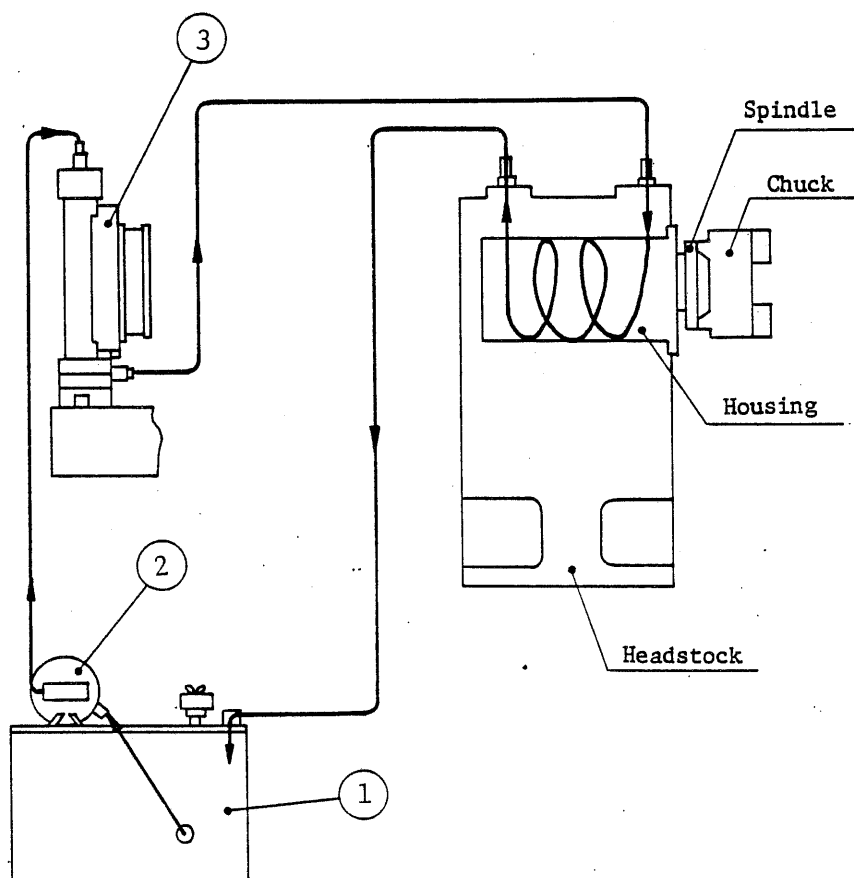
Adjustment Procedure

- a) After setting a round test piece ($\phi 100 \times 300$ mm long) in the chuck, carry out OD turning.
- b) Measure the cylindricity of the cut test piece using a micrometer to check if the front end of the test piece is thicker or thinner.
- c) With placing the stem of the dial indicator at the front end of the test piece, set the pointer reading to zero.
- d) Loosen the six headstock mount bolts.
- e) Headstock alignment is done with one of the two adjust bolts on either side of the adjust block. Loosening one adjust bolt, tighten another bolt to correct the misalignment. When the front end of the test piece is thicker, shift the headstock toward the turret, and shift it away from the turret if the front end of the test piece is thinner.
- f) Secure the headstock mount bolts firmly. After the tighten the two adjust bolts evenly. Read the dial indicator to check to be sure that the headstock is shifted in the desired direction by a required amount. The reading will vary as the bolts are secured.
- g) Cut the test piece again as per item a). If the result of the measurement still fails to fall within the allowable limit, repeat the steps b) through g) again.

Allowable limit: 0.01

4) Spindle Bearing Cooling System (For 6,000 rpm spindle bearings)

The bearings of the spindle with a speed of 6,000 rpm are so designed as to maintain high accuracy by circulating air-cooled oil on the outside of their housing to prevent them from heating up.



No.	Item	<u>Maker</u> <u>Model No.</u>	Q'ty	Remarks
1	Oil tank	<u>Yamazaki</u> 1-146-52 -3368-1	1	V = 10 (Cst) Q = 15.5 (ℓ)
2	Trocoïd pump	<u>Nippon Oil Pump</u> TOP-1ME75 -1-12MA	1	W = AC 100V/75W (G04NR000020) q = 4.5/3.7 (ℓ/min) P = 3 (kg/cm ²)
3	Minifan-cooler	<u>Tokyo Keiki</u> MF-3 YA-S1	1	W = AC 100V/ $\frac{45W}{40W}$ (G34TK000201) q ₁ = 120/105 (ℓ/sec) q ₂ = 600 (Kcal/h)

5) Specification of Spindle Motor (for export use)
(made by Mitsubishi Electric Corp.)

No.	Item	Unit	Specification					
			20 - 2600 (rpm)		36 - 3600 (rpm)		46 - 4600 (rpm)	
			Wide-band rated	Power-up	Wide-band rated	Power up		60 - 6000 (rpm)
1.	Nominal output	HP (kW)	()	()	15 (11)	()	15 (11)	Same as left
2.	Continuous rated output	HP (kW)	()	()	10 (7.5)	()	10 (7.5)	Same as left
3.	Continuous rated output 30 min.	HP (kW)	()	()	15 (11)	()	15 (11)	Same as left
4.	Continuous rated torque	kgm			8.4		4.8	Same as left
5.	Continuous rated torque 30 min.	kgm			12.6		7.2	Same as left
6.	Weight	kg			190		100	Same as left
7.	Model				FR-SE-A160L		FR-SE-B132M	Same as left
8.	Basic speed	rpm			850		1500	Same as left
9.	Max. speed	rpm			5000		6000	Same as left
10.	Inverter's model				FR-SE-22K		FR-SE-2-11K	Same as left
11.	Power capacity	kVA			23		17	Same as left
							4500-6000 rpm 7.5 HP/ 10.7 HP	Same as left

Note: The spindle motor, which is of AC-inverter type, does not require replacement of brushes, etc.

8) Specification of Spindle Motor (for export use)
(made by FANUC)

No.	Item	Unit	Specification					
			20 - 2600 (rpm)		36 - 3600 (rpm)		46 - 4600 (rpm)	
			Wide-band rated	Power-up	Wide-band rated	Power up	Wide-band rated	Power up
1.	Nominal output	HP (kW)	()	()	15 (11)	()	15 (11)	Same as left
2.	Continuous rated output	HP (kW)	()	()	10 (7.5)	()	10 (7.5)	Same as left
3.	Continuous rated output 30 min.	HP (kW)	()	()	15 (11)	()	15 (11)	Same as left
4.	Continuous rated torque	kgm			8.4			
5.	Continuous rated torque 30 min.	kgm			12.6			
6.	Weight	kg						
7.	Model				Model 22			
8.	Basic speed	rpm			850			
9.	Max. speed	rpm			5000			
10.	Inverter's model							
11.	Power capacity	kVA			22			

Note: The spindle motor, which is of AC-inverter type, does not require replacement of brushes, etc.

3-3 Spindle Drive V-belt

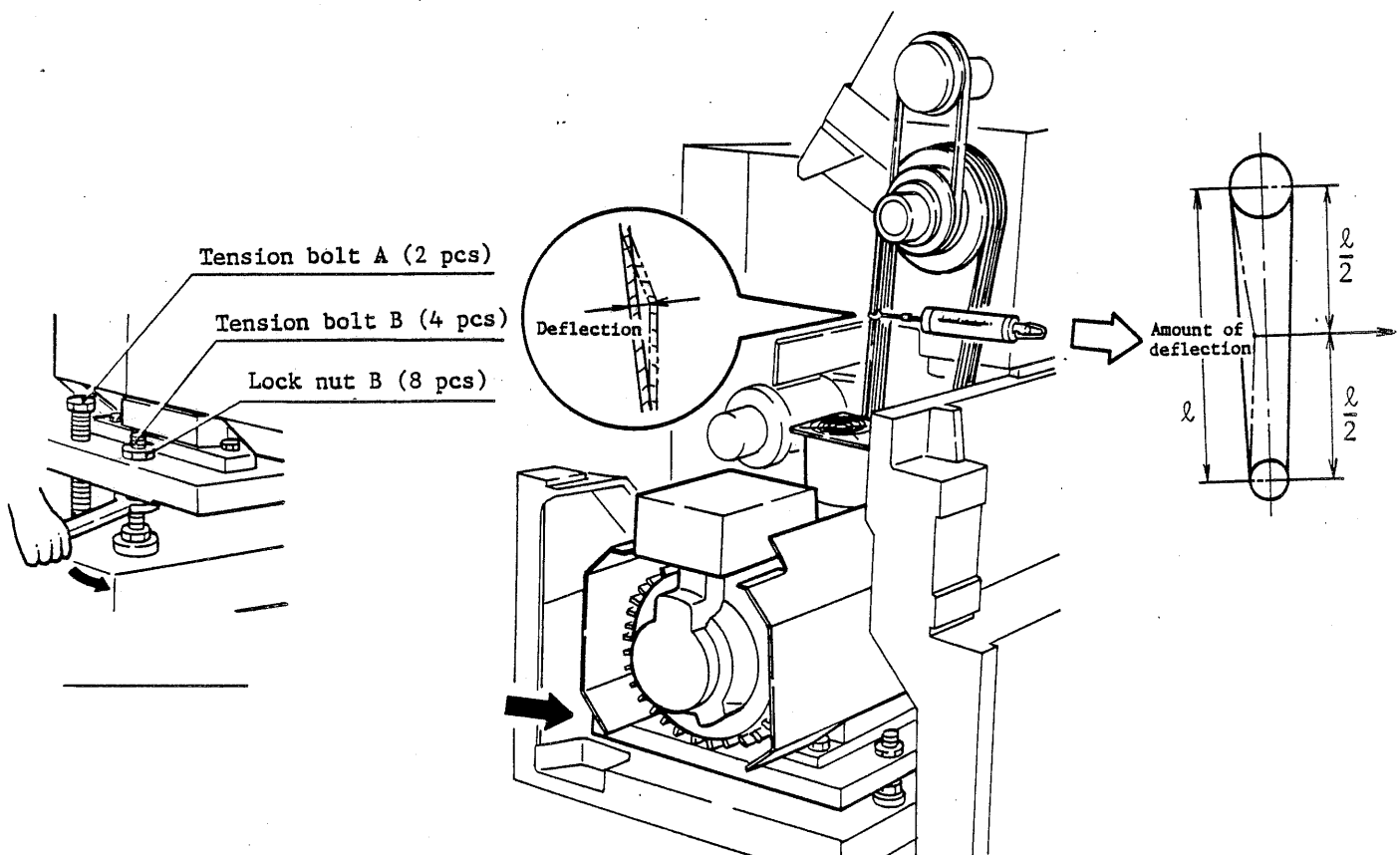
1) Adjustment of V-belt tension

If the spindle drive V-belt is tensed excessively tight, it will result in the shorter service life of the belt and bearings; conversely, a slackened belt cannot transmit the rated motor output to the spindle.

The tension of the belt can be adjusted from the upper and lower sides of the motor base.

The V-belt tension is determined by the amount of deflection when a specified load is applied to the center of the span.

Follow the procedures below and check/adjust the belt tension periodically - in three months after the first machine installation, and every six months after that.



Tension adjustment procedures:

1. Remove the side cover by loosening and removing the side cover clamp bolts.
2. Loosen motor base clamp bolts (4-M12x40) by turning them counter-clockwise.
3. Move the motor lower by tension bolts B and tense the V-belt properly.
4. When the belt has been properly tensed, tighten motor base clamp bolts A, and secure the motor base.

Note 1: The belt tension should be measured at the center of the span.

- 2: The load should be applied to the belt with the right angle (90°).

Item	Specification				
	26 - 2600 rpm 10 HP/15 HP	36 - 3600 rpm 10 HP	36 - 3600 rpm 15 HP	46 - 4600 rpm 15 HP	60 - 6000 rpm 15 HP
Pulley pitch dia. (Head)	φ231	φ166.5	φ205	φ160	φ122.5
Pulley pitch dia. (Motor)	φ100	φ100	φ148	φ122.5	φ122.5
Type of belt	3V x 710	3V x 670	3V x 710	3V x 670	3V x 630
Number of belts	6	6	6	4	4
Pulley center-to-center space	637.5	638.9	621.8	627	606
Static axial load	370	322	494	390	325
Dynamic axial load	164	293	329	211	210
Belt adjust- ment	Deflection	9.9 mm	10.2 mm	10.1 mm	9.7 mm
	Deflection load (min.) (Slip critical point)	1.9 kg/pc.	0.7 kg/pc.	1.6 kg/pc.	2.2 kg/pc.
	Deflection load of fresh belt	2.8 kg/pc.	1.0 kg/pc.	2.4 kg/pc.	3.2 kg/pc.
	Deflection load of replaced belt	2.4 kg/pc.	0.9 kg/pc.	2.1 kg/pc.	2.8 kg/pc.

* Belts are matched sets of "Master Wedge Belt" made by Mitsuboshi.

2) Inspection of V Belt

The V belts used on this machine features good thermal resistance, oil resistance property, static-electricity-proof and longer service life. However, replace the belts when they reached the limitation of service life or wore out.

(1) Service Life of V belt

Standard service life of the V belt is about 10,000 hours of operation (about three years with ten hours operation per day). However, even within such limitation, replace the V belt if the following takes place:

- a) When the rubber lining is peeled off.
- b) Only one or two belts are extremely slackened.
- c) When the belt is cracked at its side.

(2) Precautions for Prolonging Service Life

To ensure longer belt life, observe the following points:

- a) Replace all pieces of V belts with new ones at a time.

Replace all pieces of V belts with new ones even when only one or two belts are cut off. The combined use of new and used ones will reduce their total durability because their lengths and elasticity are unbalanced.

- b) When setting the belts on the pulleys, be sure to return them along the adjust side as near as possible each other. If set forcibly, the belts might be damaged.

c) Cleaning of Pulley Grooves

Oil or dust adhered on the pulley grooves causes the belt to slip, thereby resulting in shorter life of it.

- d) When placing an order for the V belts, be sure to specify "in matched set" in addition to the type and number of them. (If the lengths of the belts being used are not equal, vibration and noise will be resulted. Therefore, it is necessary to use the belts of the same length so far as possible.) V belts between the transmission gearbox and spindle should be used in matched set both for (L) and (H) range.

Adjustment of Timing Belt

1. Timing Belt Use at Position Coder in Headstock

Type of Timing Belt 337 L-050

Tension 3.4 mm/0.4 - 0.55 kgf

2. Timing Belt Used at Axis Drive Unit

Type of Timing Belt 210 L-100

Tension 2.6 mm/1 - 1.3 kgf

* Tension adjustment procedure is the same as for V belt.

3-4 Feed System

1) Construction of feed system

The feed system is assembled and adjusted with extra care because it directly affects the machining accuracy. Each ball screw of the X- and Z-axis is maximally proximated to the reference slideways, guaranteeing a highly accurate feed.

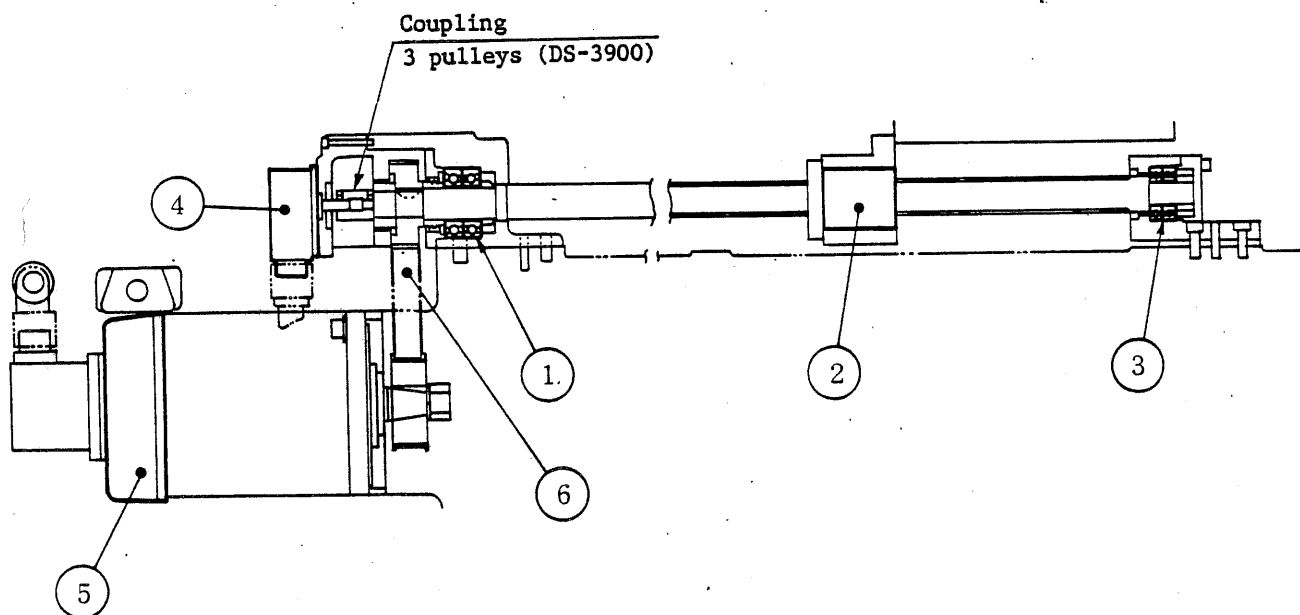
The Z-axis feed mechanism is located on the left end face of the bed, and the X-axis feed mechanism is on the carriage slideways at the +X side of the end face.

2) Construction of Z-axis feed mechanism

The Z-axis feed mechanism consists of a servo motor, a timing belt, a resolver, the ball screw and bearings.

The ball screw is connected by means of the pulleys and the timing belt to the servo motor, the timing belt transmitting the motor speed in the reduction ratio of 18/29. The carriage moves in the Z-axis direction on the bed via the bracket fitted to the ball screw nut.

The ball screw has JIS C3 class accuracy ($\phi 28$ mm (1.11 in.) x 10 mm (0.24 in.) lead). In order to increase its rigidity in the axis direction, preload of 100 kg (220.46 lb) is applied to the ball screw and the nut.



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Radial ball BRG	E006005VP50		1	6005V-P5
	Slast ball BRG	41112502140		2	51105-P5
2	Ball screw (Z axis)	51418420200 51418420100		1	For chucker For universal
3	Ball bearing	E0006004VV0		2	6004VV
4	Resolver	R50MA000350		1	RT-5XB-11
5	Servo motor	R12MA000730		1	HD81-12S
6	Timing belt	L08MH000020		1	210L100
7	Pulley	41422506021			18T
8	Pulley	41552504380			29T

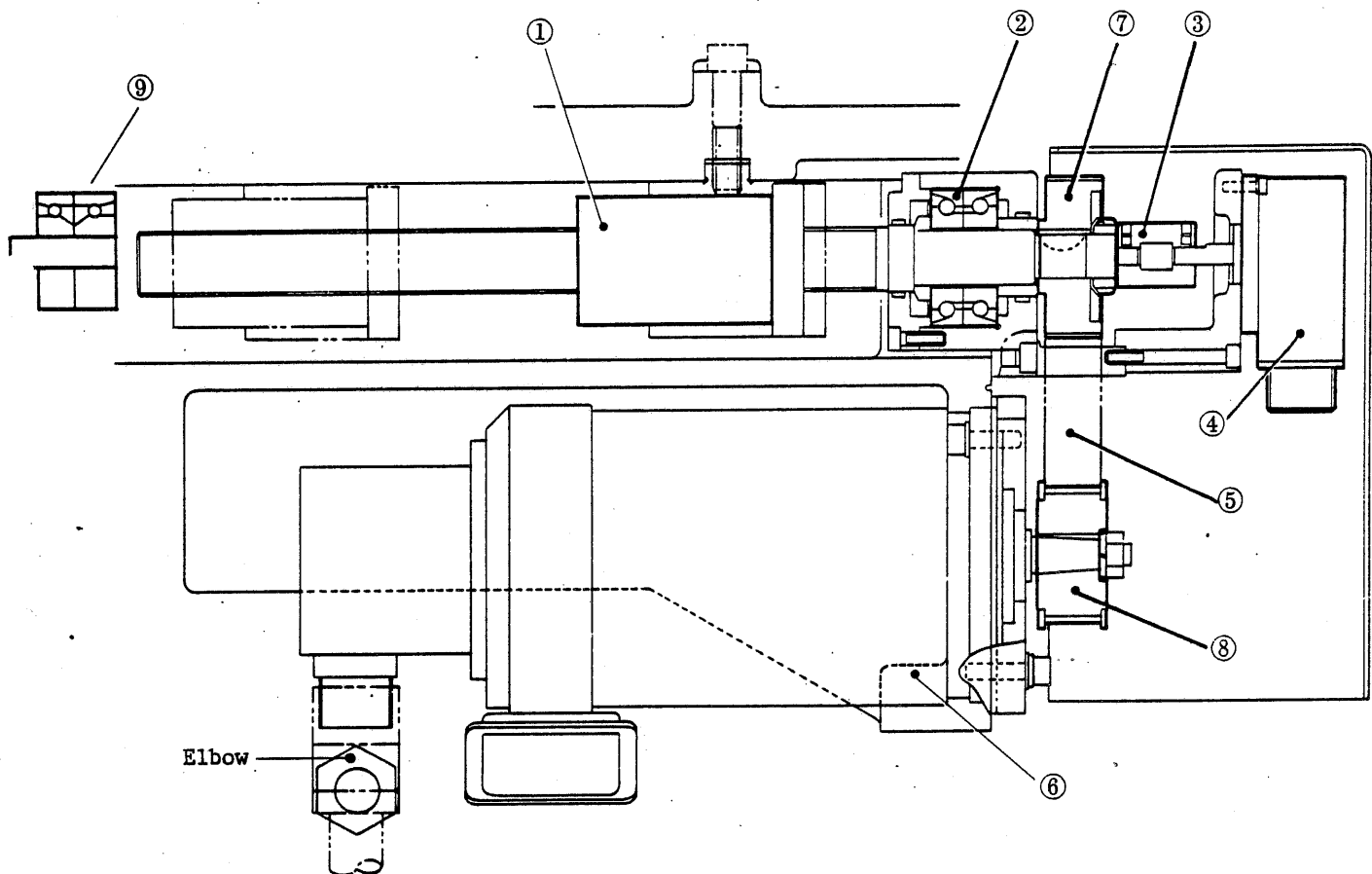
3) Construction of X-Axis Feed Mechanism

The X-axis feed mechanism consists of a servo motor, a resolver, a timing belt, a ball screw and bearing.

The ball screw is connected to the servo motor by means of the pulleys and the timing belt, the timing belt transmitting the motor speed in the reduction ratio of 5/6. The turret base moves on the carriage in the X-axis direction via the ball screw nut fitted at the rear side of the carriage.

The ball screw has JIS C3 class accuracy ($\phi 28$ mm, 6 mm lead). In order to increase its rigidity in the axis direction, preload of 100 kg is applied to the ball screw and the nut.

4) X1-axis feed mechanism diagram



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Ball screw	51418400100		1	
2	Angular contact ball bearing	F02NP001080		1	7204BDB.C8-P5
3	Coupling	L10MN000400		1	DS3900
4	Resolver	R50MA000410		1	RT-3XB-11
5	Timing belt	L08MH000890		1	210L100
6	Servo motor	R12MA000730		1	HD81-12S
7	Pulley	41552504380		1	24T
8	Pulley	41422506020		1	20T
9	Angular contact ball bearing	E25TAA06DB0		1	25TAA06DB-P4

3-5 Turret

1) Schematic

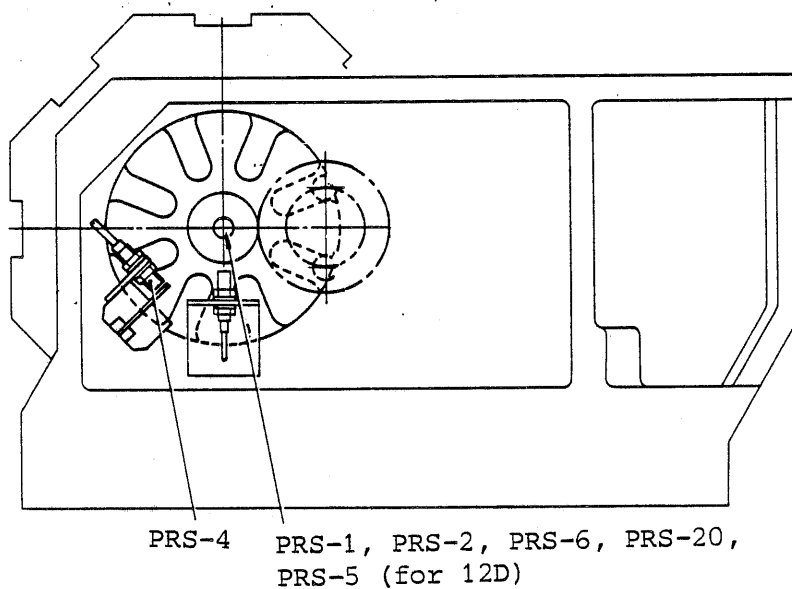
The QUICK TURN 10N employs an AC motor as the drive source to swing and index the turret.

. With 8D (standard)

(1) Turret Swing

Revolutions of motor shaft (I shaft) are transferred to II shaft.

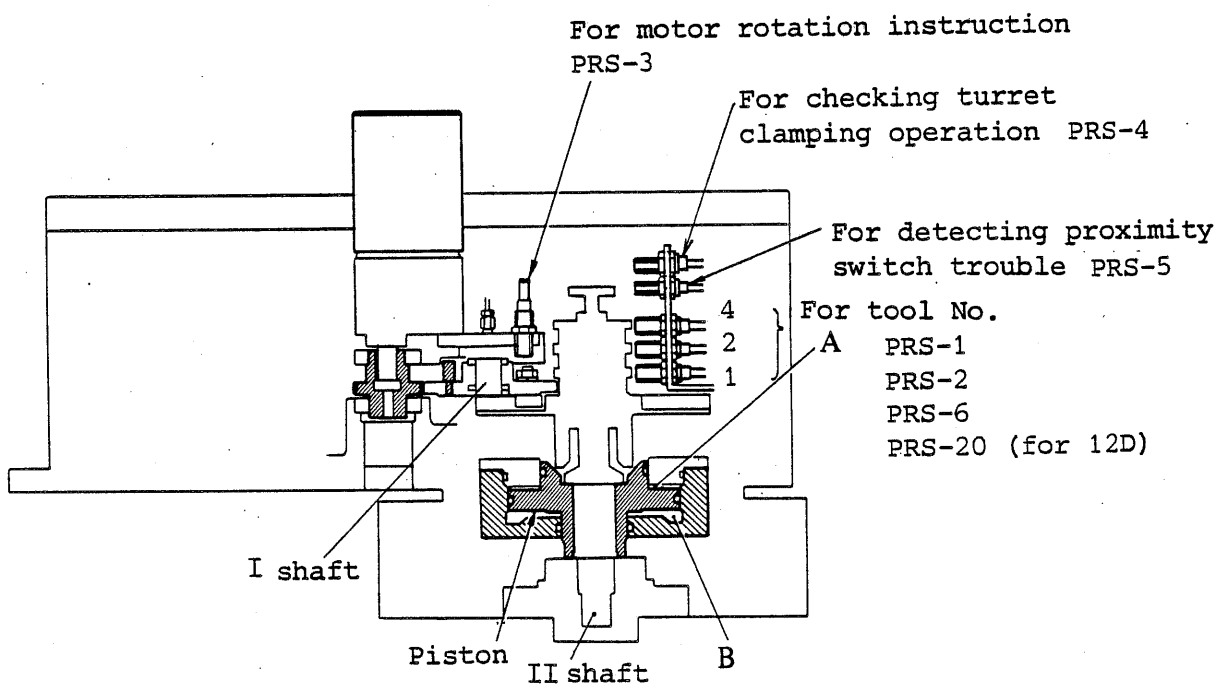
And the turret on II shaft is swung every 45 degrees.



(2) Turret Clamping/Unclamping

When the solenoid valve is energized to supply oil to (A), the turret will clamp.

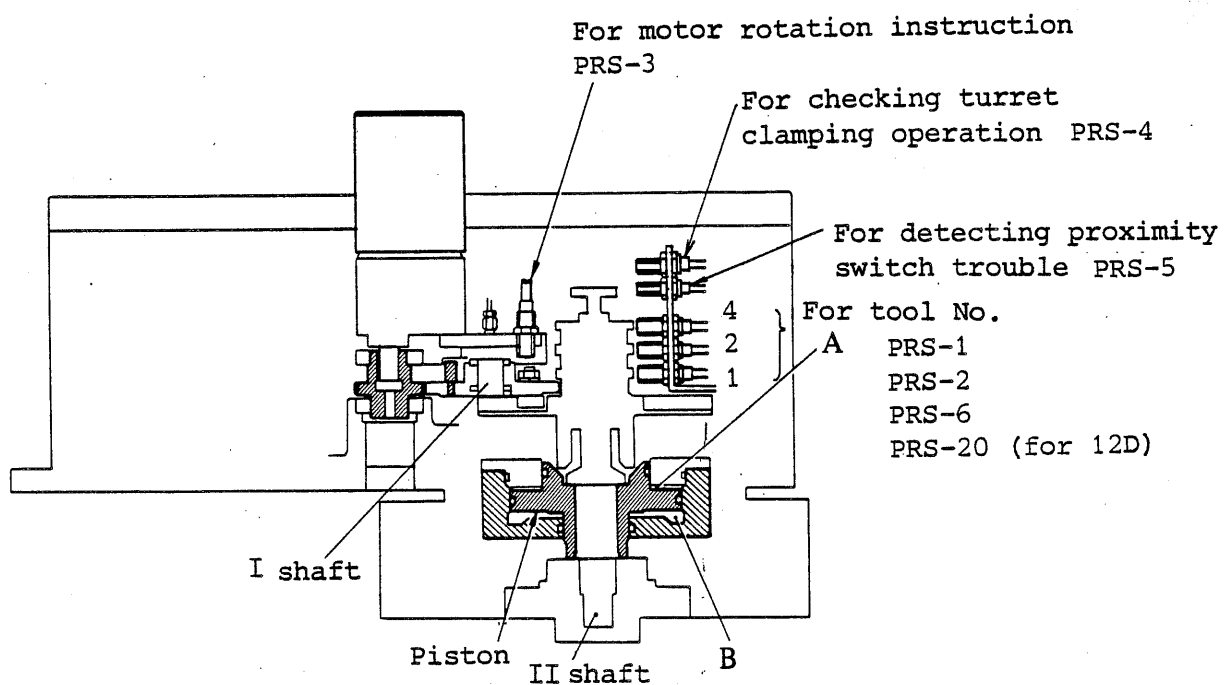
With the oil supplied to (B), the turret will unclamp.



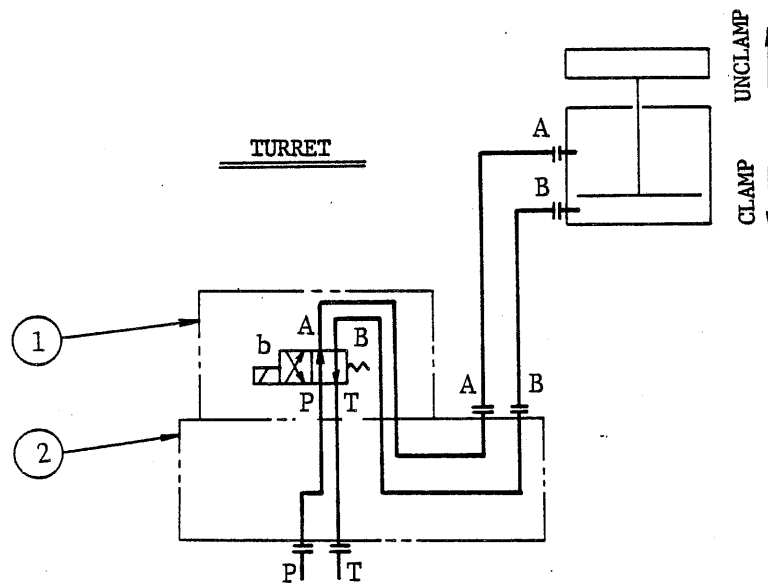
(2) Turret Clamping/Unclamping

When the solenoid valve is energized to supply oil to (A), the turret will clamp.

With the oil supplied to (B), the turret will unclamp.



2) Turret Hydraulic Circuit



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Solenoid valve	G16FH000320	(NACHI)	1	SA-G01-A3X-C1-10
2.	Bracket	11411560680	FC30	1	

3). Notes

- (1) The TURRET CLAMP/UNCLAMP switch is mounted as NC menu key. When confirming the unclamp stroke of the turret and carrying out other maintenance, set the switch at UNCLAMP.

Axis motion is inhibited while the switch is set at UNCLAMP.

Usually the switch should be set at CLAMP.

- (2) The unclamp stroke is set at 5 mm (0.20 in.). In indexing operation, the clearance between the indexing coupling is 1 mm (0.04 in.).
- (3) The clamping force of the turret is 4.3 ton (9,500 lbs) with the hydraulic pressure at 35 kg/cm^2 (497 psi).
- (4) A series of turret index cycle, that is, unclamp, index and clamp, is accomplished by the combination of turret index operation explained in item 1 and turret clamp/unclamp operation in 2.
- (5) Confirming index operation
 - o Proximity switches PRS-1, PRS-2 and PRS-6 confirm 8 positions to detect the index position for tool Nos. (For 12D, PRS-20 confirms 12 positions.)
 - o Turret clamping operation is confirmed by PRS-4.
 - o The motor start or stop is commanded through detection by PRS-3.
 - o When the command with T5 is entered, each of 3 (4 for 12D) notched portions arranged at the rear of II shaft should be positioned in contact with each proximity switch. Refer to timing chart in the following pages.

- o The PRS-5 is provided to detect malfunction of the proximity switches for tool number detection.
- o Refer to the chart for combination of proximity switches for tool number detection.

(6) Others

To release the turret clamp force, turn off the TURRET CLAMP menu on the operating panel. This unclamps the turret. When removing the turret, use this switch. If the turret is tried to remove while the switch is placed in the ON position, the parts clamping the turret might be broken.

(7) Replacing Turret

When replacing the turret or when adjusting the turret if it is misaligned due to collision, follow the steps indicated below:

1. Index T-1 position. (In case of turret replacing)
2. Set the operation mode in the MANUAL position. The CRT display indicates the position or command display. Set the UNCLAMP (TURRET) menu key in the ON position, the turret is then unclamped.
3. Remove the name plate, cap and packing at the center of the turret.
4. Unscrew the set screw on the slotted round nut and then remove the nut using the special tool.

This completes turret removal. When installing the turret, first set the turret on the center shaft with directing the T-1 face to the spindle center. Engage the teeth of the high index coupling positively and then



follow the above indicated steps in the order of 4), 3) and 2).

Notes:

1. After completing the intended work, be sure to set the UNCLAMP switch in the OFF position.
2. Turret index is done with highly accurate high index coupling which should be kept away from dust and foreign matter. Clean around the turret before and after turret replacing and replace the turret carefully.

(8) Motor for turret rotation and reduction equipment

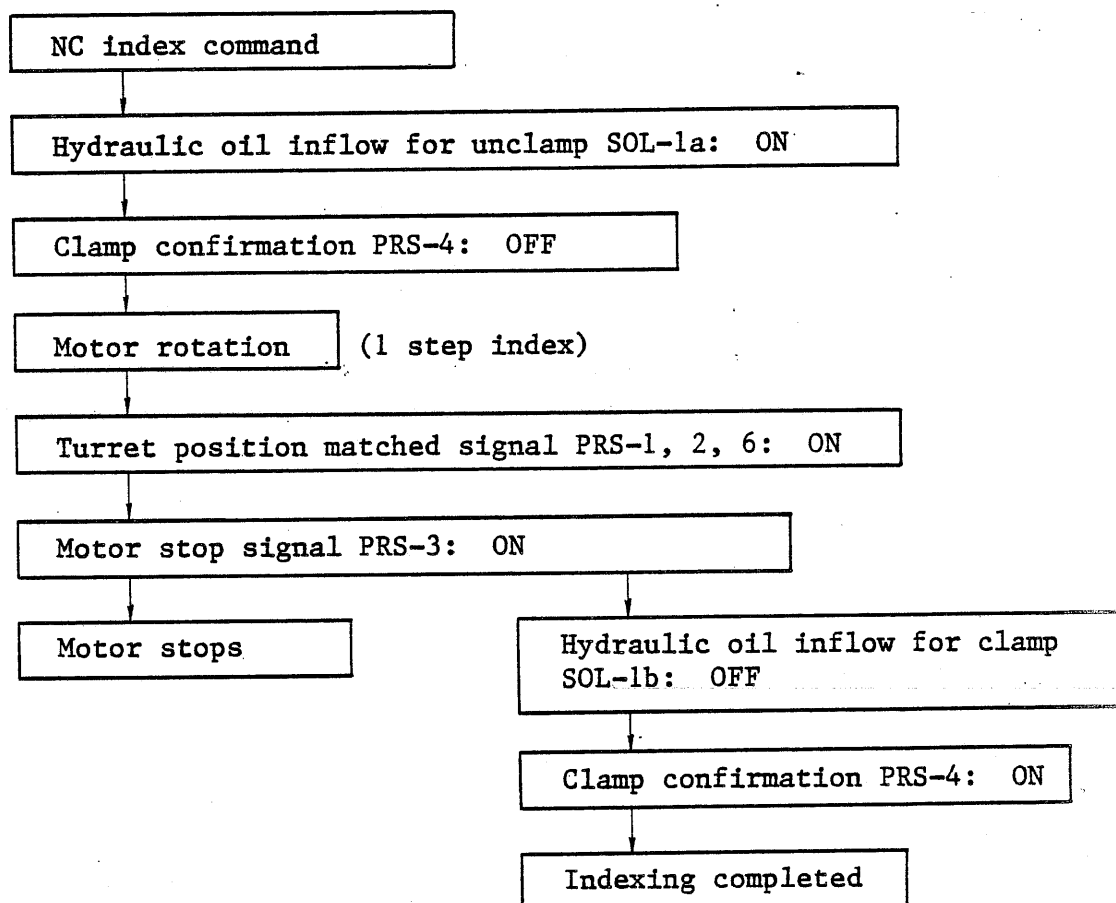
Rotation of the heavy-duty single-phase induction motor (by Matsushita) 91K-100GP-3 is reduced at the reduction ratio of 1/18 via the gear head (by Matsushita) 9GBK18-1, and drives the turret.

* In automatic operation, the turret indexes in the shorter direction selected from the present and commanded turret positions. For manual operation, however, both turret 1 and turret 2 index counterclockwise.

* Assembly and maintenance of the turret can be done by simply removing the cover of the turret base at the tailstock side.



3) 8D (standard) Flowchart

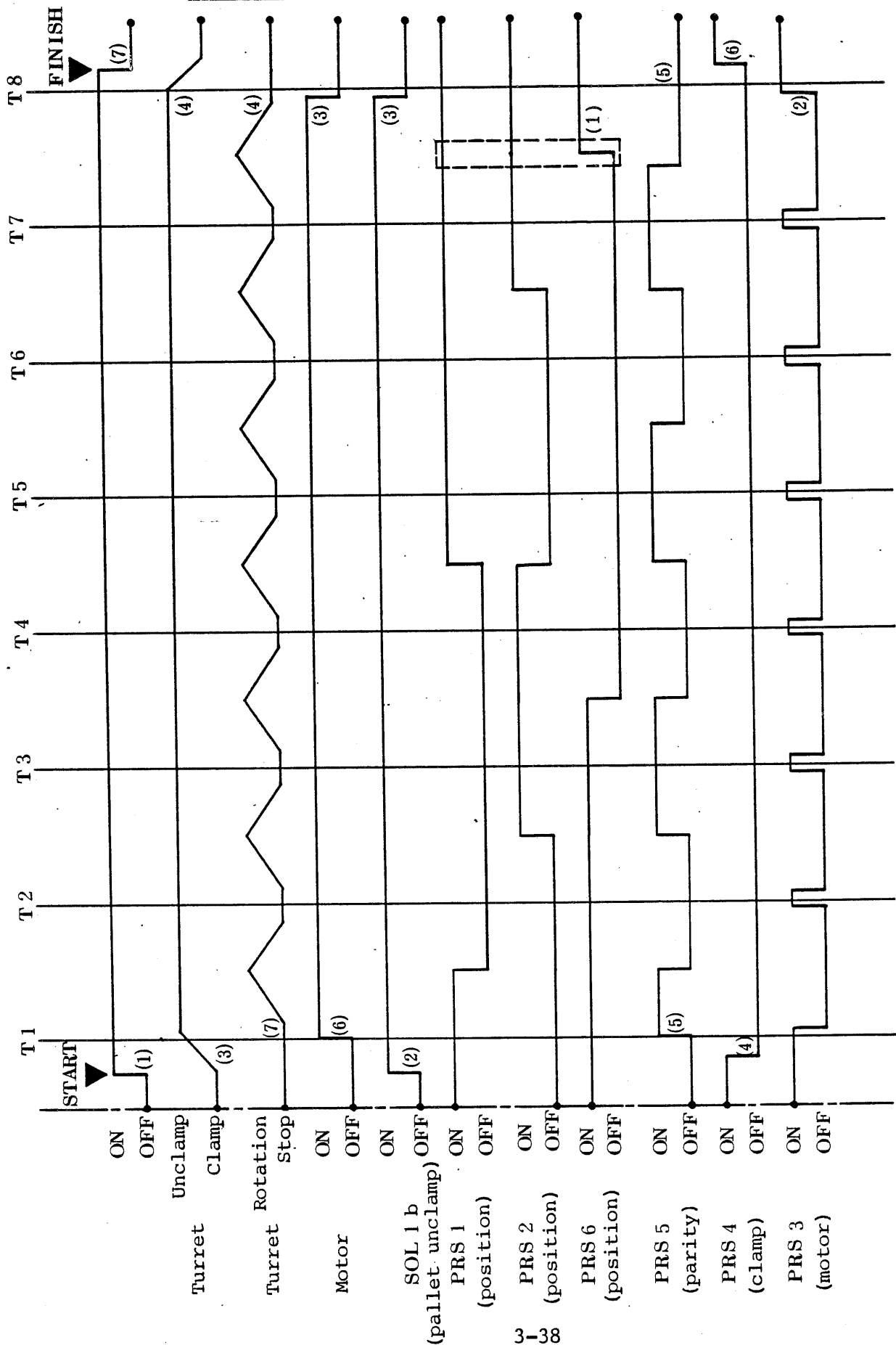


4) Tool No. detection sensor

Tool No. Sensor No.	1	2	3	4	5	6	7	8
PRS 1	ON					ON	ON	ON
PRS 2			ON	ON			ON	ON
PRS 6	ON	ON	ON					ON
PRS 5	ON		ON		ON		ON	

Note: The number of ON when totalled vertically must be added.

5) Turret indexing timing chart . 8D (standard) Timing chart



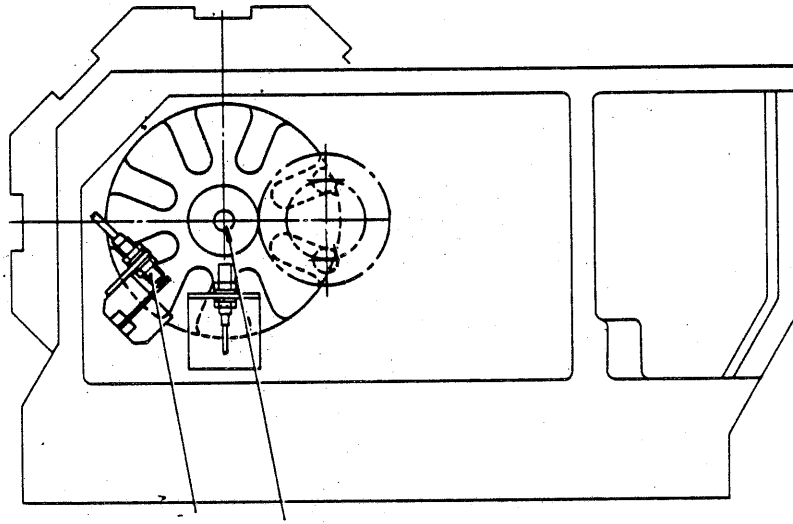
3-5' Turret

1) Schematic

. With 12D (option)

(1) Turret Swing

Revolutions of motor shaft (I shaft) are transferred to II shaft. And the turret on II shaft is swung every 30 degrees.

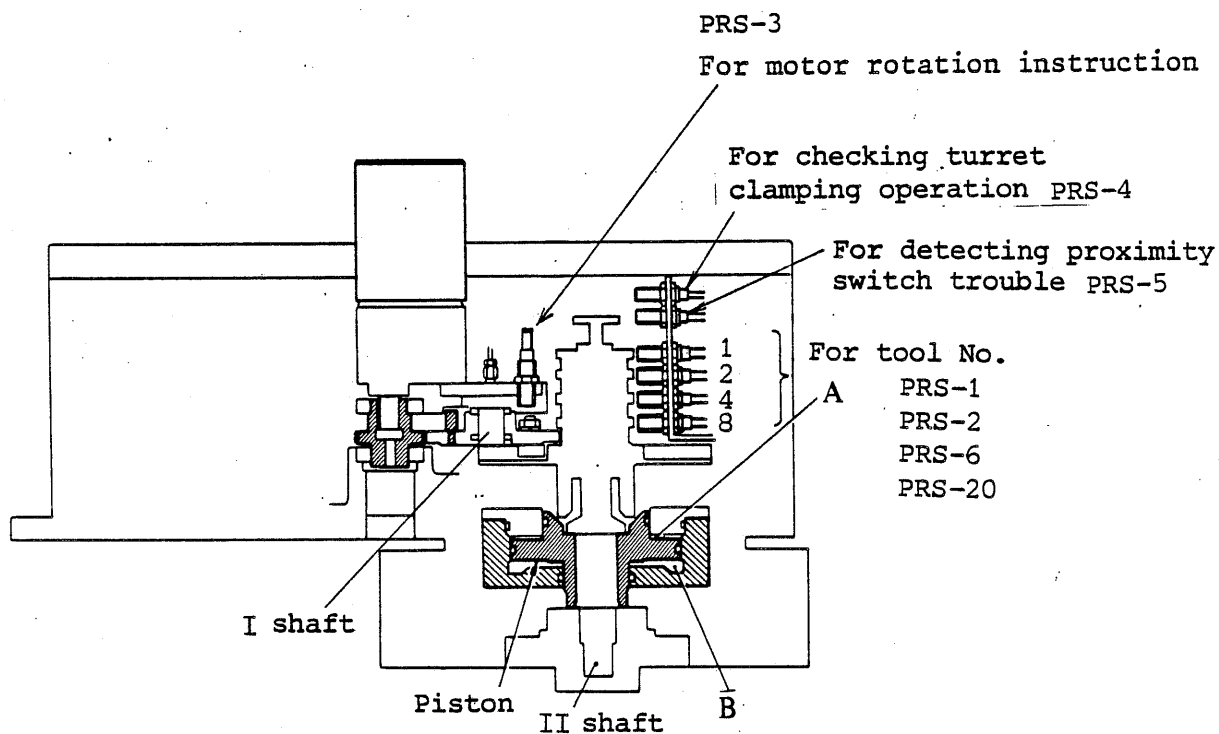


PRS-4 PRS-1, PRS-2, PRS-6, PRS-20, PRS-5

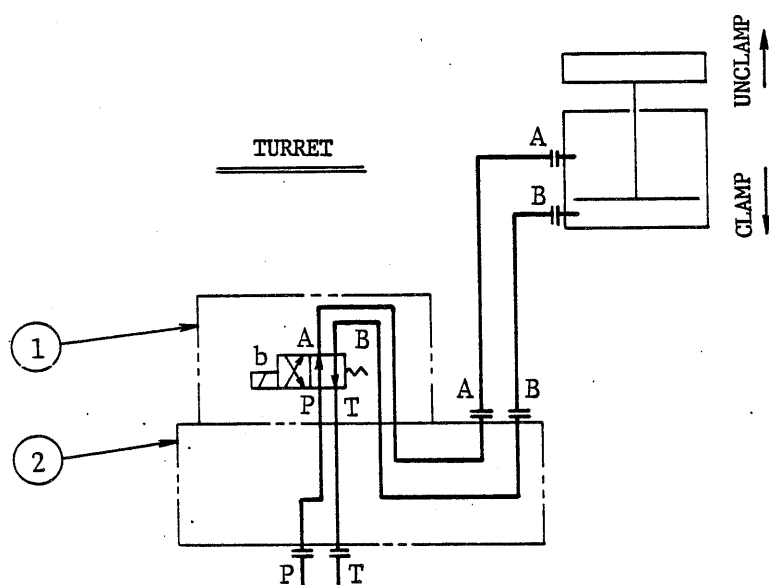
(2) Turret Clamping/Unclamping

When the solenoid valve is energized to supply oil to (A), the turret will clamp.

With the oil supplied to (B), the turret will unclamp.



2) Turret Hydraulic Circuit



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Solenoid valve	G16FH000320	(NACHI)	1	SA-G01-A3X-C1-10
2	Bracket	11411555340	FC30		

3) Notes

- (1) The TURRET CLAMP/UNCLAMP switch is mounted as NC menu key. When confirming the unclamp stroke of the turret and carrying out other maintenance, set the switch at UNCLAMP.

Axis motion is inhibited while the switch is set at UNCLAMP.

Usually the switch should be set at CLAMP.

- (2) The unclamp stroke is set at 5 mm (0.20 in.). In indexing operation, the clearance between the indexing coupling is 1 mm (0.04 in.).
- (3) The clamping force of the turret is 4.0 ton (8,800 lbs) with the hydraulic pressure at 35 kg/cm^2 (497 psi).
- (4) A series of turret index cycle, that is, unclamp, index and clamp, is accomplished by the combination of turret index operation explained in item 1 and turret clamp/unclamp operation in 2.
- (5) Confirming index operation
 - o Proximity switches PRS-1, PRS-2 PRS-6 and PRS-20 confirm 12 positions to detect the index position for tool Nos.
 - o Turret clamping operation is confirmed by PRS-4.
 - o The motor start or stop is commanded through detection by PRS-3.
 - o When the command with T5 is entered, each of 4 notched portions arranged at the rear of II shaft should be positioned in contact with each proximity switch.Refer to timing chart in the following pages.

- o The PRS-5 is provided to detect malfunction of the proximity switches for tool number detection.
- o Refer to the chart for combination of proximity switches for detection.

(6) Others

To release the turret clamp force, turn off the TURRET CLAMP menu on the operating panel. This unclamps the turret. When removing the turret, use this switch. If the turret is tried to remove while the switch is placed in the ON position, the parts clamping the turret might be broken.

(7) Replacing Turret

When replacing the turret or when adjusting the turret if it is misaligned due to collision, follow the steps indicated below:

1. Index T-1 position. (In case of turret replacing)
2. Set the operation mode in the MANUAL position. The CRT display indicates the position or command display. Set the UNCLAMP (TURRET) menu key in the ON position, the turret is then unclamped.
3. Remove the name plate, cap and packing at the center of the turret.
4. Unscrew the set screw on the slotted round nut and then remove the nut using the special tool.

This completes turret removal. When installing the turret, first set the turret on the center shaft with directing the T-1 face to the spindle center. Engage the teeth of the high index coupling positively and then

follow the above indicated steps in the order of 4), 3) and 2).

Notes:

1. After completing the intended work, be sure to set the UNCLAMP switch in the OFF position.
2. Turret index is done with highly accurate high index coupling which should be kept away from dust and foreign matter. Clean around the turret before and after turret replacing and replace the turret carefully.

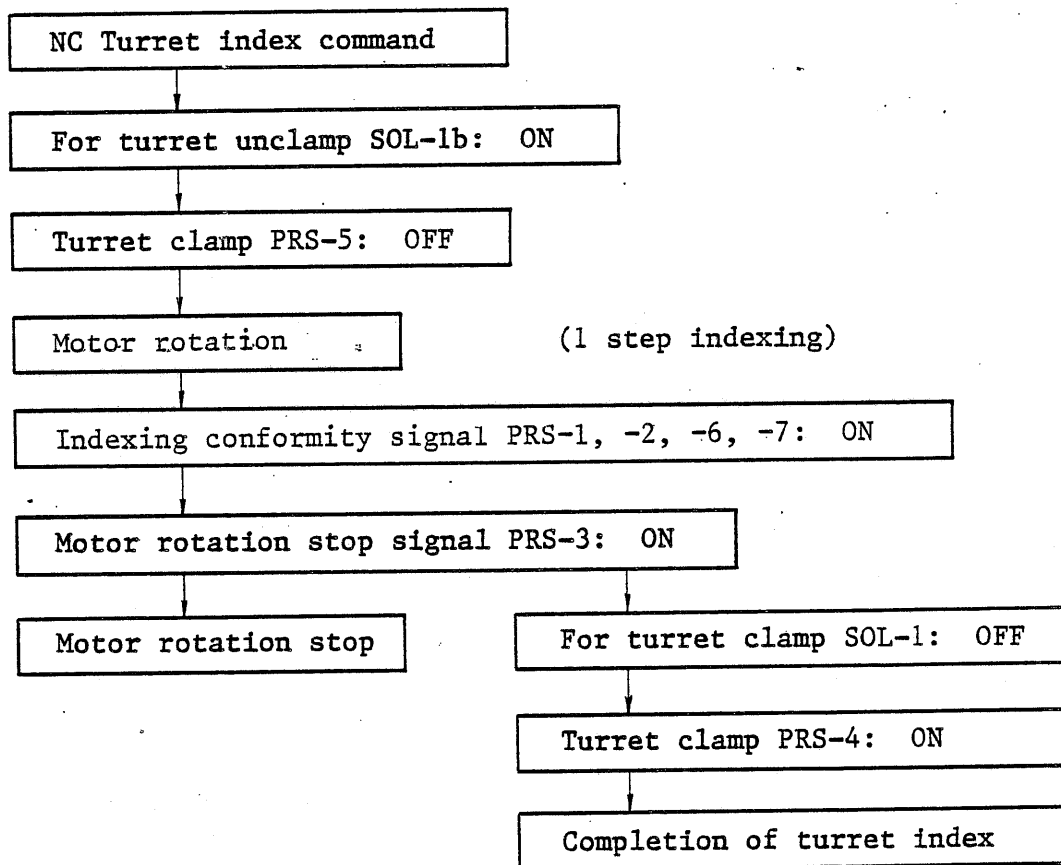
(8) Motor for Turret Rotation and Reduction Equipment

Rotation of the heavy-duty single-phase induction motor (by Matsushita) 91K-100GP-3 is reduced at the reduction ratio of 1/18 via the gear head (by Matsushita) 9GBK18-1, and drives the turret.

* In automatic operation, the turret indexes in the shorter direction selected from the present and commanded turret positions. For manual operation, however, both turret 1 and turret 2 index counterclockwise.

* Assembly and maintenance of the turret can be done by simply removing the cover of the turret base at the tailstock side.

3) Flow Chart - Turret Index Cycle (12D (option))

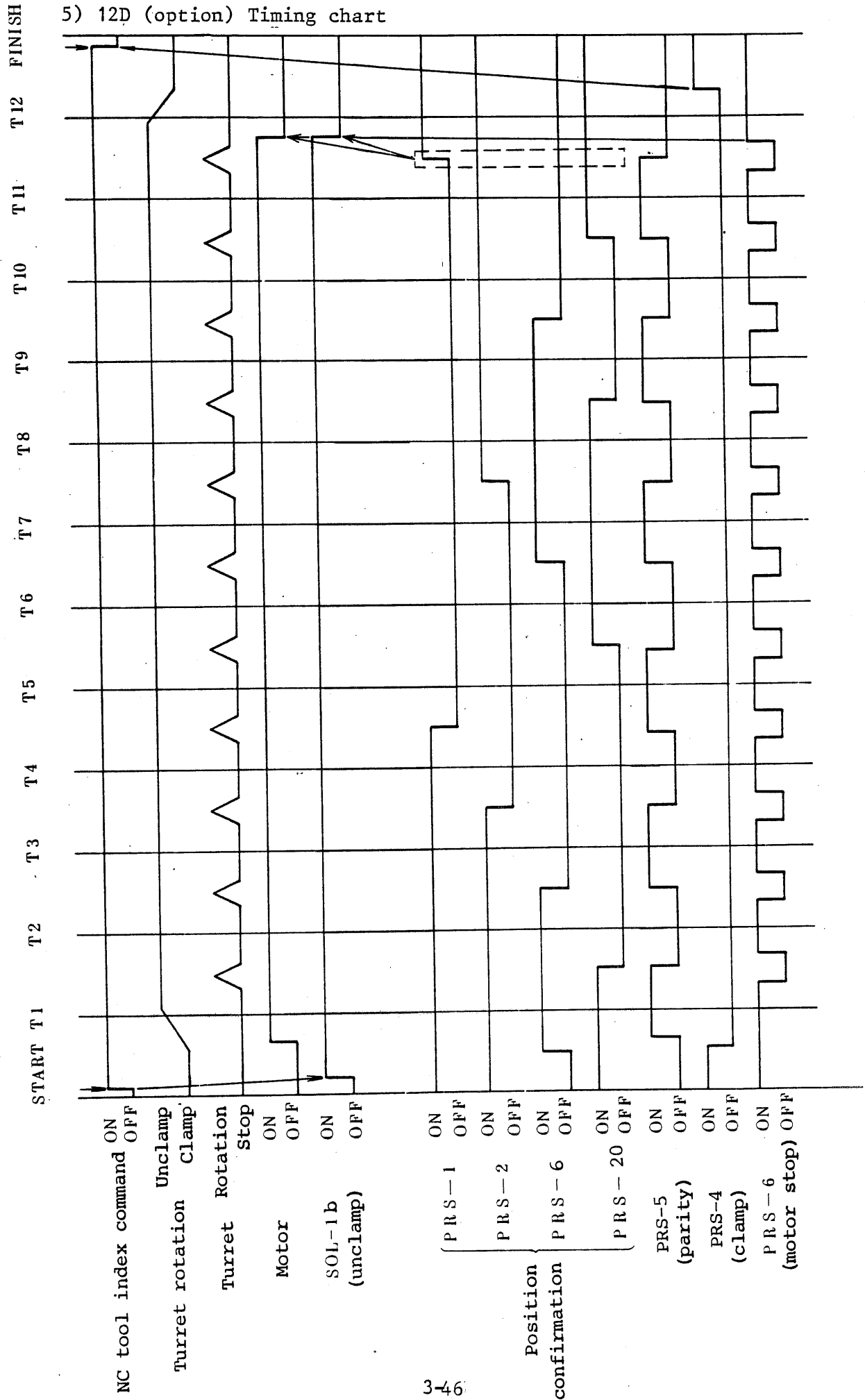


4) Tool No. detection sensor

Tool No. Sensor No.	1	2	3	4	5	6	7	8	9	10	11	12
PRS-1	ON	ON	ON	ON								ON
PRS-2	ON	ON	ON					ON	ON	ON	ON	ON
PRS-6	ON	ON					ON	ON	ON			
PRS-20	ON					ON	ON	ON			ON	ON
PRS-5	ON		ON		ON		ON		ON		ON	

Note: The number of ON when totaled vertically must be odd.

5) 12D (option) Timing chart



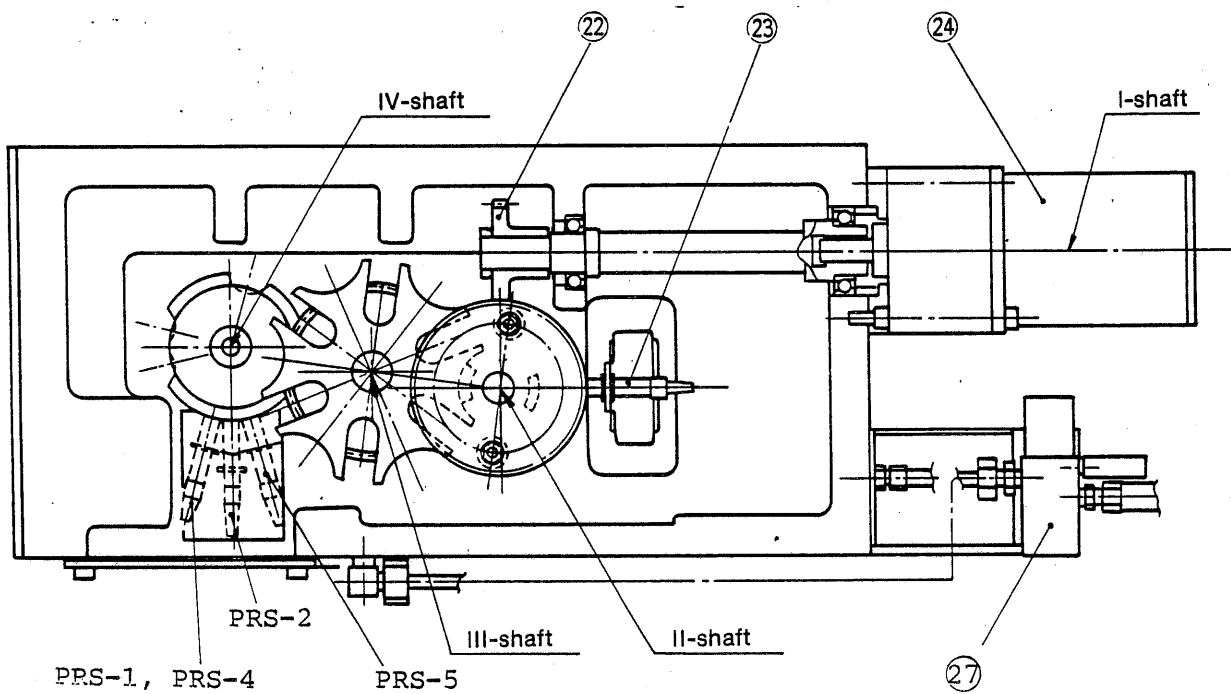
3-5" Turret

1) Schematic

. With 4T (option)

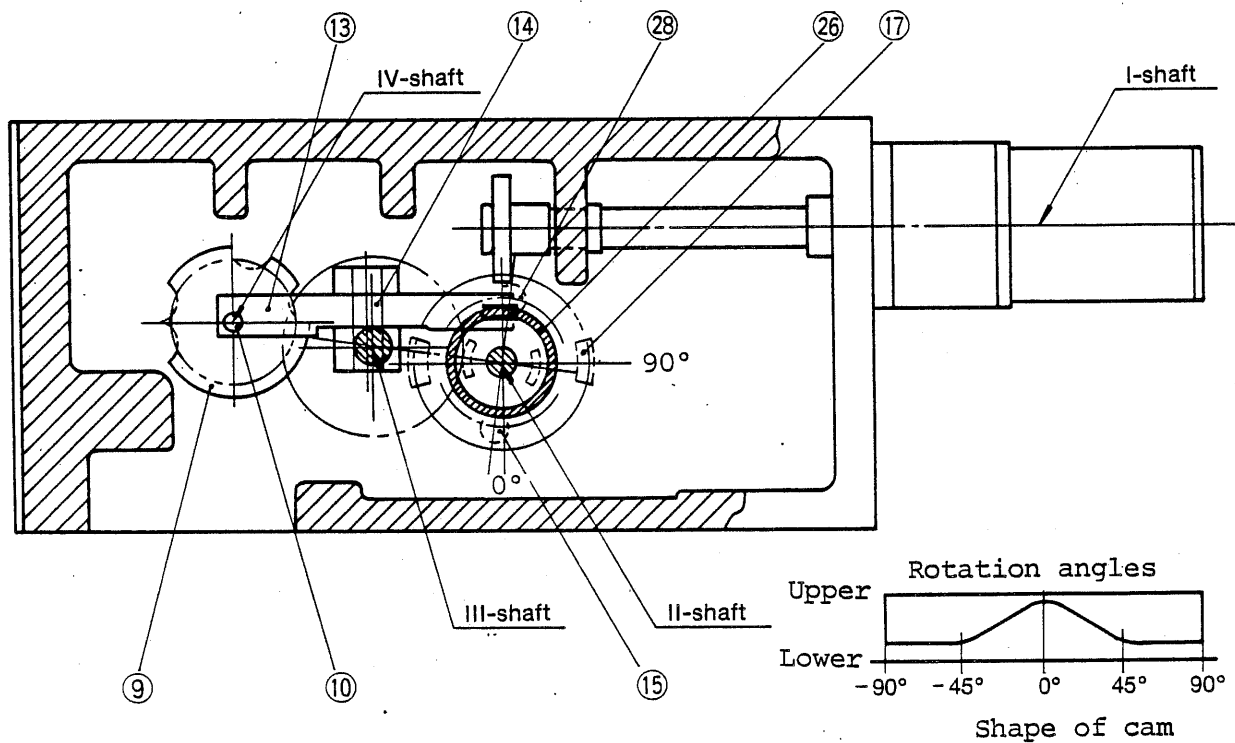
(1) Turret Index

Rotation of the motor shaft (I-shaft) is transmitted to II- and III-shaft, and then to IV shaft to swing the turret every 90 degrees.

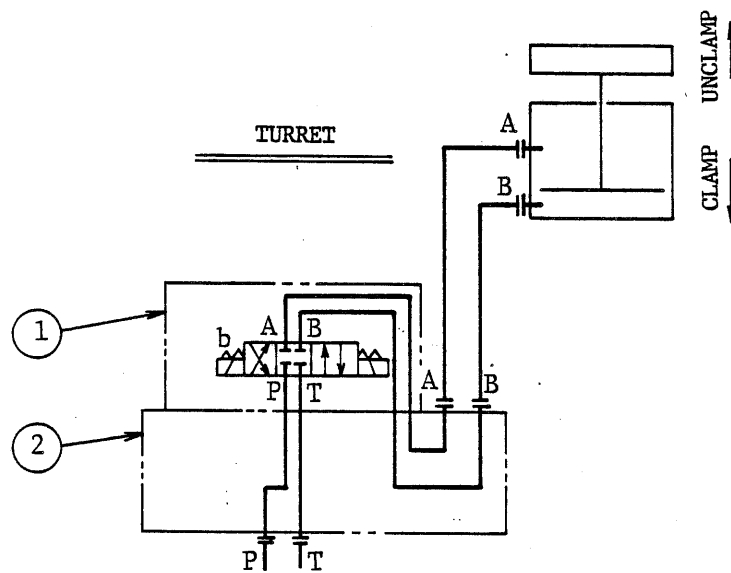


(2) Clamp/Unclamp of Turret

Rotation of the motor shaft (I-shaft) is changed into vertical motion of the IV-shaft via the cam under II-shaft and the lever ⑬.



2) Turret Hydraulic Circuit



No.	Part name	Part No.	Material	Q'ty	Remarks
1	Solenoid valve	G16FH000390	(NACHI)	1	SA-G01-C5-C1-I0
2	Manifold block	21411555630	FC25	1	

3) Notes

- (1) The TURRET CLAMP/UNCLAMP switch is mounted as NC menu key. When confirming the unclamp stroke of the turret and carrying out other maintenance, set the switch at UNCLAMP.

Axis motion is inhibited while the switch is set at UNCLAMP.

Usually the switch should be set at CLAMP.

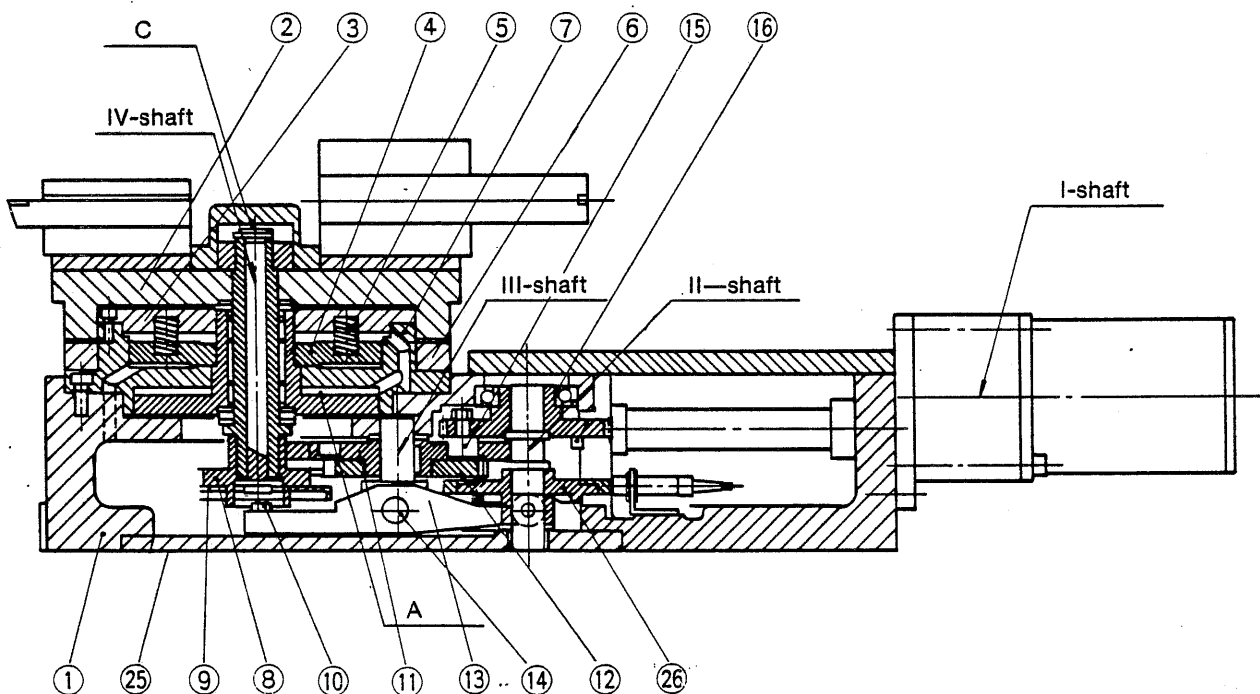
- (2) The unclamp stroke is set at 5 mm (0.20 in.). In indexing operation, the clearance between the indexing coupling is 1 mm (0.04 in.).
- (3) The clamping force of the turret is 1.6 ton (3,500 lbs) with the hydraulic pressure at 35 kg/cm^2 (497 psi).
- (4) Motor for turret rotation and reduction equipment

Rotation of the heavy-duty single-phase induction motor (by Oriental Motor) B0024-464 is reduced at the reduction ratio of 1/30 via the gear head (by Oriental Motor) 6GK30K, and drives the turret.

* In automatic operation, the turret indexes in the shorter direction selected from the present and commanded turret positions. For manual operation, however, both turret 1 and turret 2 index counterclockwise.

* Assembly and maintenance of the turret can be done by simply removing the cover of the turret base at the tailstock side.

- (5) A series of turret index cycle, that is, unclamp, index and clamp, is accomplished by the combination of turret index operation explained in item 1 and turret clamp/unclamp operation in 2. After turret index is completed, the oil is supplied to clamp the turret firmly.



(6) Confirmation of Turret Index

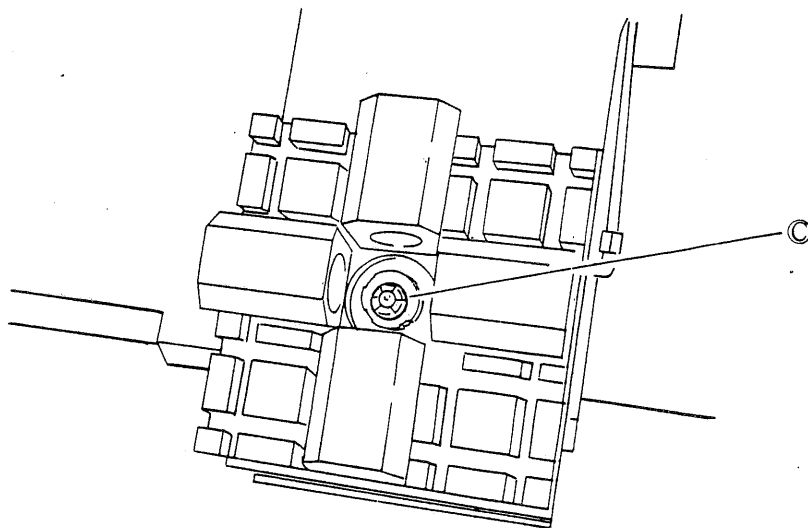
- o Four positions of the turret are confirmed by the proximity switches PRS-1 and PRS-2.
- o Confirmation of turret clamp is made by the proximity switch PRS-4.
- o Motor rotation stop command is given by the proximity switch PRS-3.
- o The respective proximity switches must be located at the center of the notches of the two dogs under the IV shaft when T4 command is provided. (Timing chart will be given later.) Dog position shown above corresponds to T1 command.

(7) Adjustment of Turret Unclamp

As stated before, turret unclamp is made by the lever (13) and its vertical stroke is 5 mm (0.2 inch) at the position of pin (10).

However, the lever stroke for turret unclamp should be set to 4.5 mm (0.18 inch) so that excessive force will not be applied to the lever (13) when turret is clamped.

When the name plate and cap at the center of the turret is removed, socket head set screw inserted with split pin is shown at part (C). To adjust the turret unclamp stroke, rotate the set screw at the center after removing the split pin with the turret clamped. After screwing in the set screw lightly up to the end of screwing-in stroke, loosen it about one fourth turns from such point. Rotate the turret two to three turns then to check to be sure that the set screw remains as adjusted without being secured. After that insert the split pin. This sets the turret unclamp stroke to about 4.5 mm (0.18 inch).



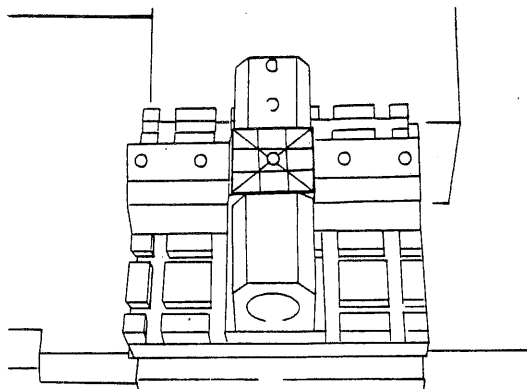
(8) Others

To release the turret clamp force, turn the TURRET CLAMP switch on the operating panel to the OFF position. This releases the oil and clamp force. When removing the turret, use this switch. If the turret is tried to remove while the switch is placed in the ON position, the parts clamping the turret might be broken.

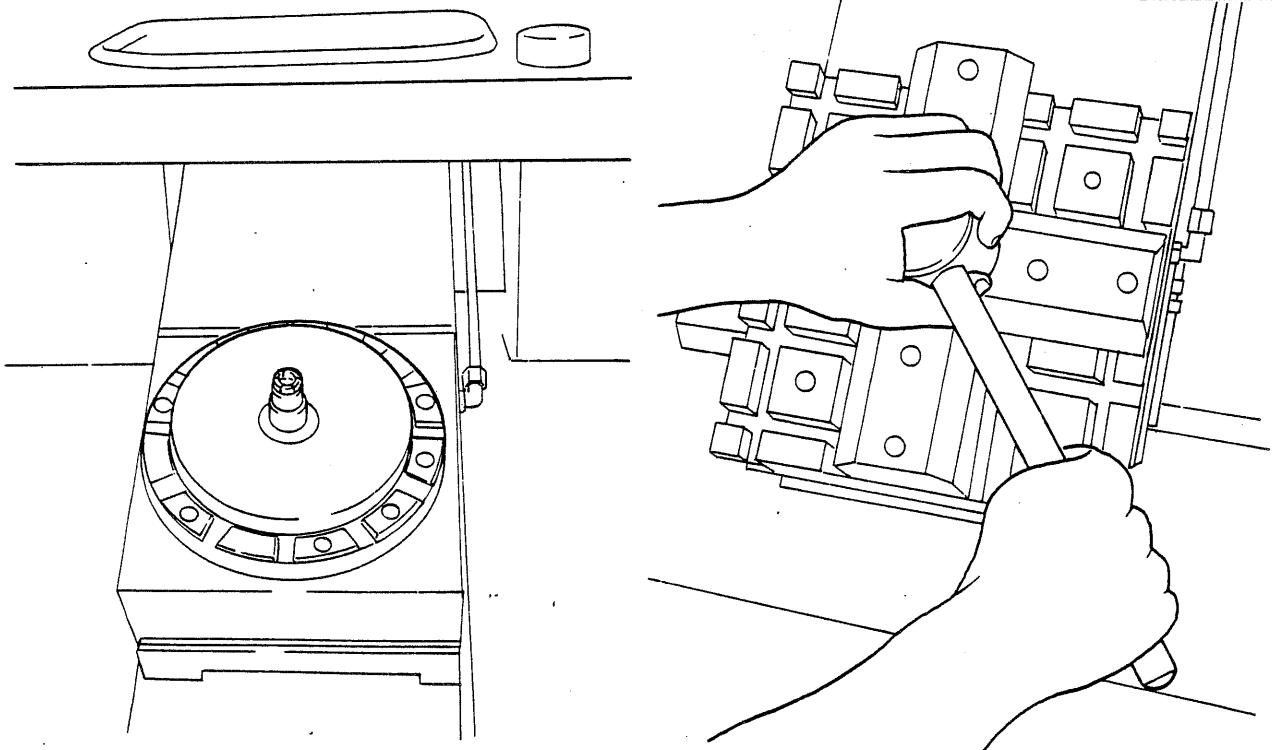
(9) Replacing Turret

When replacing the turret or when adjusting the turret if it is misaligned due to collision, follow the steps indicated below:

1. Index T1-1 position. (In case of turret replacing)
2. Set the operation mode in the MANUAL position. The CRT display indicates the position or command display. Set the UNCLAMP (TURRET) menu key in the ON position, the turret is then unclamped.
3. Remove the name plate, cap and packing at the center of the turret.
4. Unscrew the set screw on the slotted round nut and then remove the nut using the special tool.



5. Screw in the flange of the special tool until the upper face of the flange comes to be flush with the upper face of the threaded shaft. After that screw in two M6x35 mm long camp screws into the turret to remove it from the center shaft.



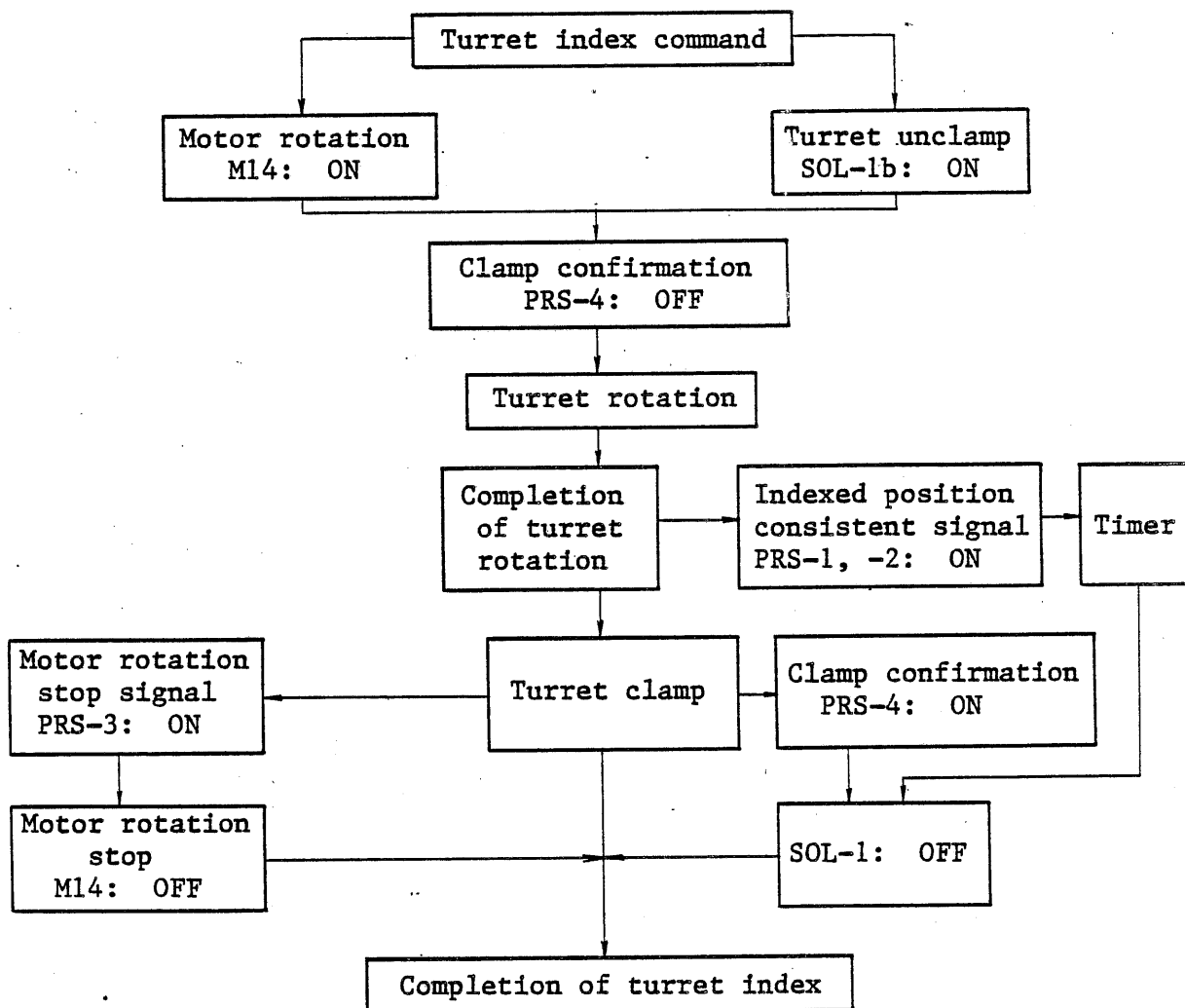
6. After removing the flange of the special tool, remove the turret.

This completes turret removal. When installing the turret, first set the turret on the center shaft with directing the T1-1 face to the chuck side. Engage the teeth of the high index coupling positively and then follow the above indicated steps in the order of 4, 3 and 2.

Notes:

1. After completing the intended work, be sure to set the UNCLAMP switch in the OFF position.
2. Turret index is done with highly accurate high index coupling which should be kept away from dust and foreign matter. Clean around the turret before and after turret replacing and replace the turret carefully.
3. Four boring bar holders fixed onto the turret are all self-bored on the machine. When drilling or reaming a hole which requires strict concentricity with respect to the spindle center, use these four holders.

3) Flow Chart - Turret Index Cycle (4T (option))



4) Tool No. detection sensor

Tool No. Sensor No.	T1	T2	T3	T4
PRS 1	ON	ON		
PRS 2	ON		ON	
PRS 5	ON			ON

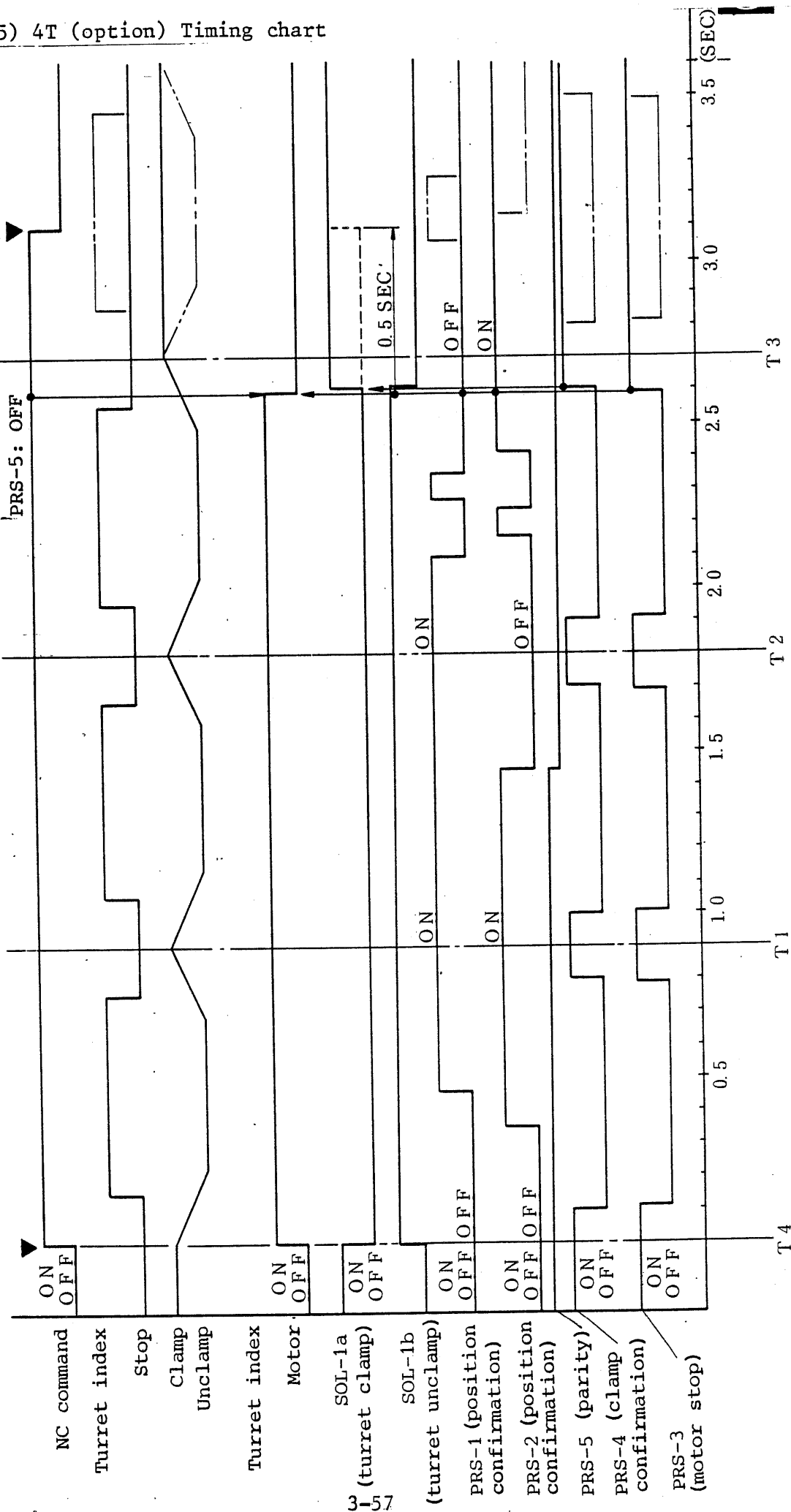
Note: The number of ON when totalled vertically must be odd.

5) 4T (option) Timing chart

T3 command

PRS-1: OFF
PRS-2: ON
PRS-5: OFF

FINISH



Motor

Unit	Item	QT-10N (141)		QT-20N (142)	
		4T	8D/12D	4T	8D/12D
Turret (15)	Maker	Oriental	Matsushita	Matsushita	Oriental
	Maker's Model No.	B0235-464	9IK100GP-3	9IK100GF	B0235-464-E1
	(Y) No.	R13PJ000241		R13MB000230	R13PJ000660
Tailstock (37)	Maker	Matsushita		Matsushita	
	Maker's Model No.	9IK100GF		9IK100GF	
	(Y) No.	R13MB000230		R13MB000230	
Tool setter (91)	Maker	Oriental		Oriental	
	Maker's Model No.	4TK10GK-A		4TK10GK-A	
	(Y) No.	R13PJ000510		R13PJ000510	

Gear Head

Unit	Item	QT-10N (141)		QT-20N (142)	
		4T	8D/12D	4T	8D/12D
Turret (15)	Maker	Oriental	Matsushita	Matsushita	Oriental
	Maker's Model No.	6GK30K (1 = 1/30)	9GBK18-1 (1 = 1/18)	9GBK30 (1 = 1/30)	D0968-163 (1 = 1/15)
	(Y) No.	R13PJ000090		R13MB000680	R13PJ000670
	Maker	Matsushita		Matsushita	
Tailstock (37)	Maker's Model No.	9GBK36 (1 = 1/36)		9GBK36 (1 = 1/36)	
	(Y) No.	R13MB000140		R13MB000140	
	Maker	Oriental		Oriental	
Tool setter (91)	Maker's Model No.	D1009-144 (1 = 1/150)		D1009-144 (1 = 1/150)	
	(Y) No.	R13PJ000740		R13PJ000740	

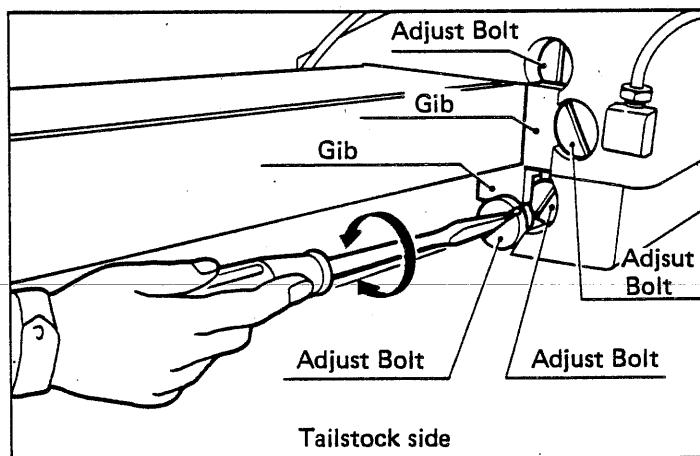
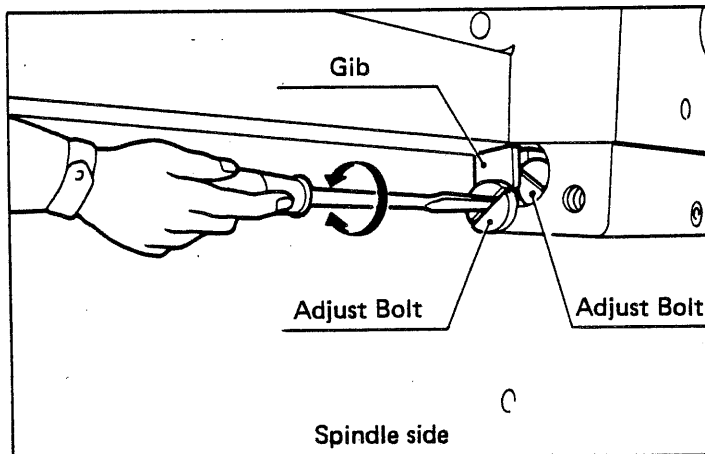
3-6 Carriage

1) Inspection and Adjustment of Gibs and Wipers

The clearance for the slideways on the carriage and cross slide can be adjusted with the gibs. Since the gib adjustment has great influence on lost motion, sensitivity for given pulses, and positioning accuracy, and further on cut surface roughness, adjust them carefully.

(1) Carriage (Z-Axis)

1. Remove the wiper.
2. Loosen all the bolts to allow the gib to move smoothly.
3. Measure the backlash on Z-axis move and enter corresponding compensation data to the control.
4. Adjust the front gib first, and then the rear gib. Tighten the front bolt fully with the bolt at the opposite side left loose. After that return the front bolt about a half turn and then turn the bolt at the opposite side counterclockwise fully to secure the gib in position with these two bolts.
5. Measure the lost motion. When the measured value is less than 0.01 mm (0.0004 inch) the adjustment is complete. If it is larger than 0.01 mm (0.0004 inch), readjust the gib.



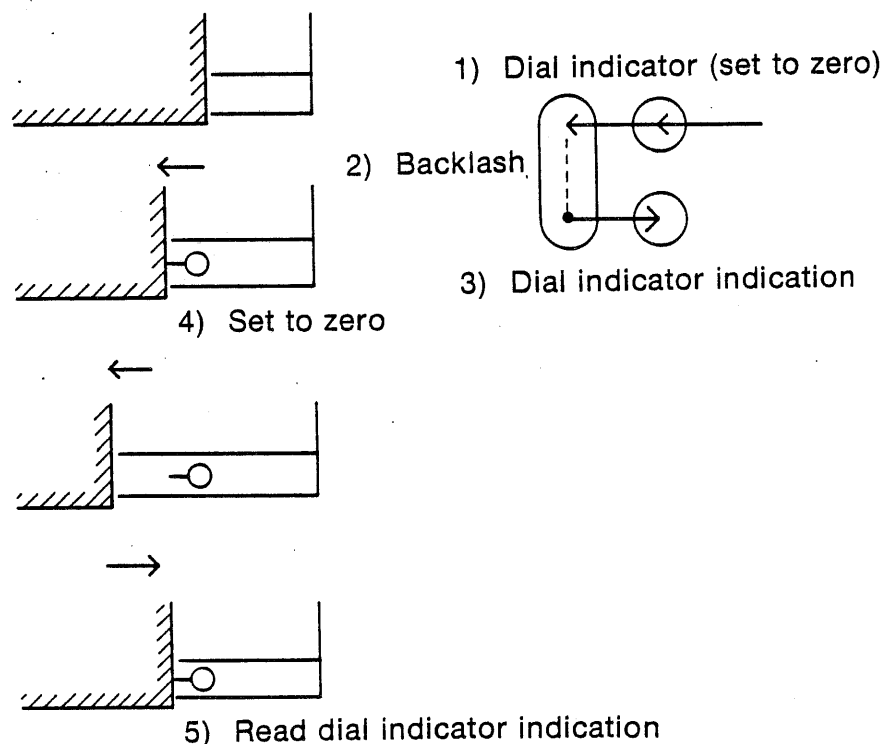
(2) Cross slide (X-Axis)

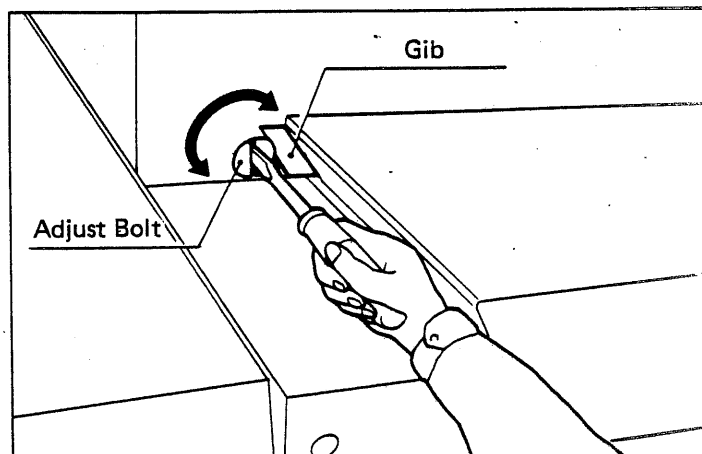
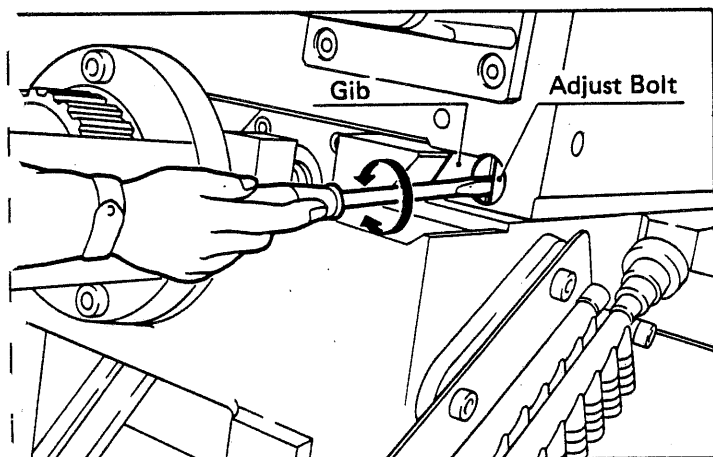
1. Remove the wiper.
2. After loosening the upper bolt, press the gib upward to release the gib.
3. Measure the backlash of X-axis move and enter corresponding compensation data to the control.
4. With loosening the lower bolt, tighten the upper bolt fully.
5. Return the upper bolt about a half turn from the fully tightened position. After that tighten the lower bolt fully to secure the gib in position.

6. Measure the lost motion. When the measured value is less than 0.005 mm (0.0002 inch), the adjustment is complete. If it is larger than 0.005 mm (0.0002 inch), readjust the gib.

Measurement of Lost Motion

1. Move the axis in the negative direction at a rapid feedrate as much as 50.000 mm (1.97 inch).
2. Place the stem of the dial indicator onto the side face of the cross slide at the positive direction of axis move and then set the reading to zero.
3. Move the axis in the negative direction at a rapid feedrate as much as 50.000 mm (1.97 inch).
4. Return the axis in the positive direction at a rapid feedrate by 50.000 mm (1.97 inch).
5. Read the dial indicator.
The read value indicates "lost motion" which expresses total accuracy of axis drive system.



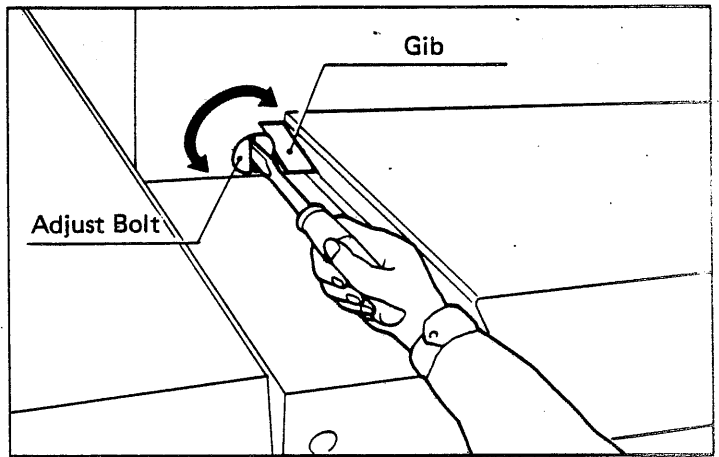
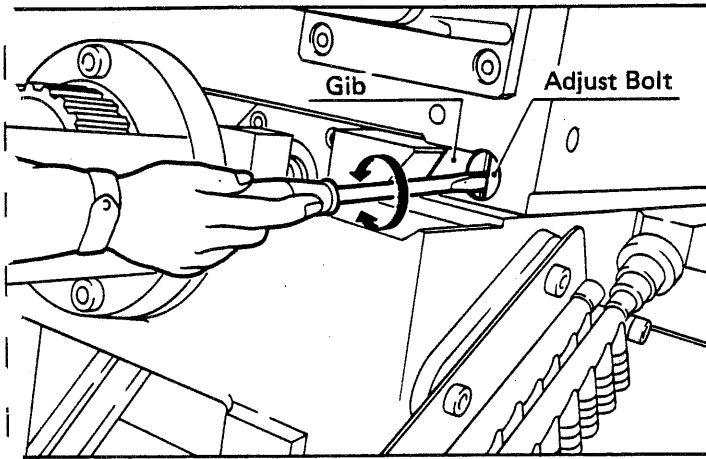


2) Adjustment of Backlash

The resolver serving as a position detector of X- and Z-axis is directly coupled to the axis drive ball screw. Therefore, difference between the actual turret position and resolver indication will result due to the following reasons.

- a) Backlash between ball screw and nut mount surface and other driving elements engaging part of the axis drive system
- b) Improper gib adjustment
- c) Twisted ball screw

The machine is equipped with backlash compensation function to electrically compensate for the mechanical difference. If the backlash is too large, shock load when starting axis move becomes excessively large, while too small backlash overloads bearings and gears causing shorter service life and noise. Although the backlash compensation amount is factory-set to a proper amount, re-set it when the set compensation amount becomes improper during long operation. Required backlash compensation amount can be set as a parameter data to the control.



2) Adjustment of Backlash

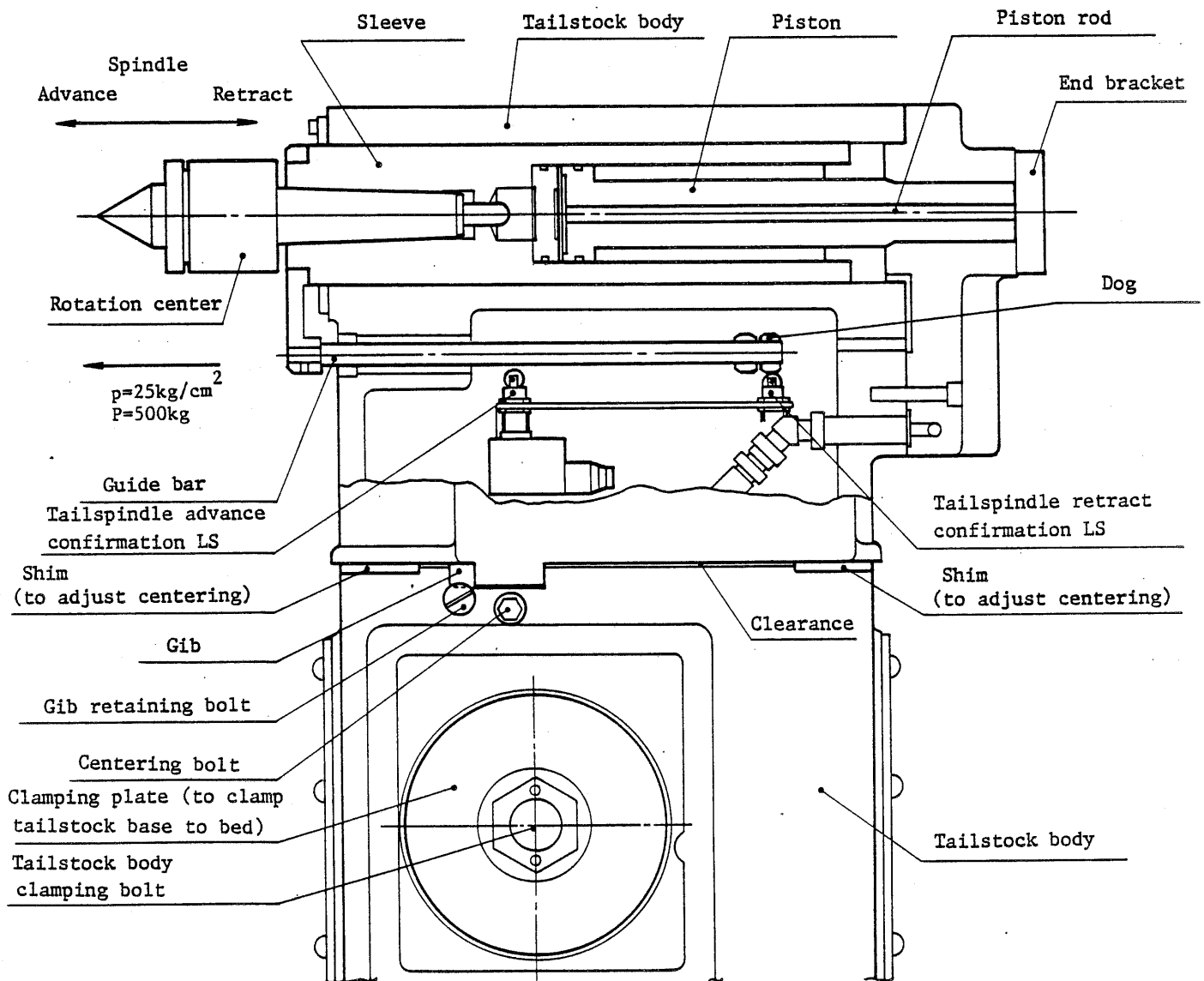
The resolver serving as a position detector of X- and Z-axis is directly coupled to the axis drive ball screw. Therefore, difference between the actual turret position and resolver indication will result due to the following reasons.

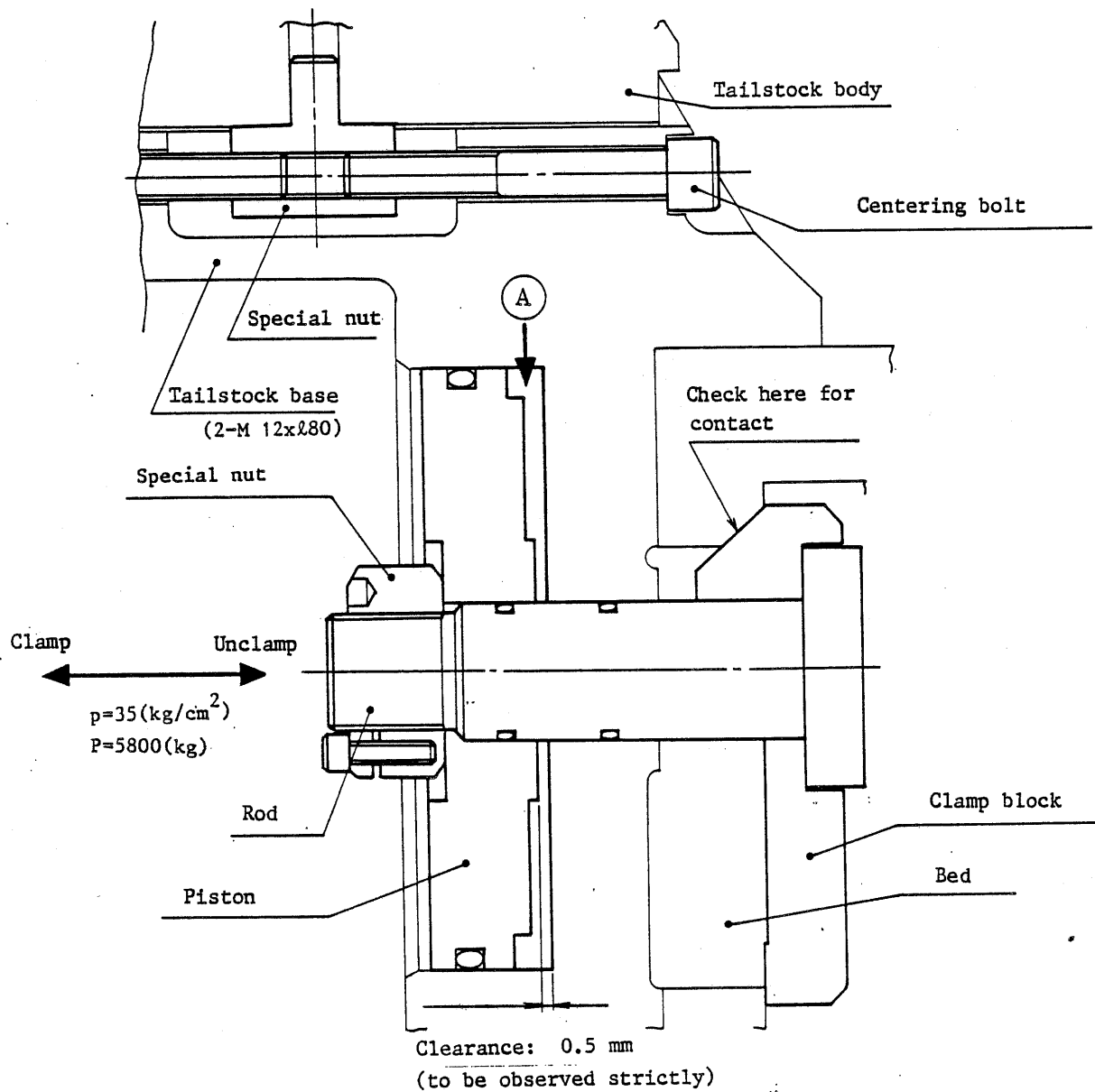
- a) Backlash between ball screw and nut mount surface and other driving elements engaging part of the axis drive system
- b) Improper gib adjustment
- c) Twisted ball screw

The machine is equipped with backlash compensation function to electrically compensate for the mechanical difference. If the backlash is too large, shock load when starting axis move becomes excessively large, while too small backlash overloads bearings and gears causing shorter service life and noise. Although the backlash compensation amount is factory-set to a proper amount, re-set it when the set compensation amount becomes improper during long operation. Required backlash compensation amount can be set as a parameter data to the control.

3-7 Tailstock

1) Schematic

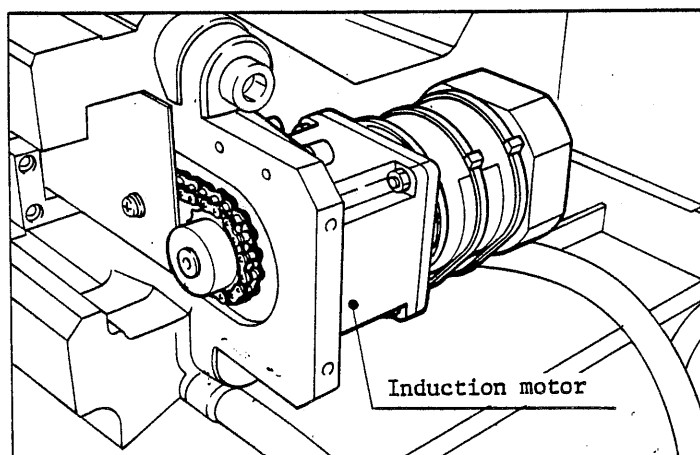
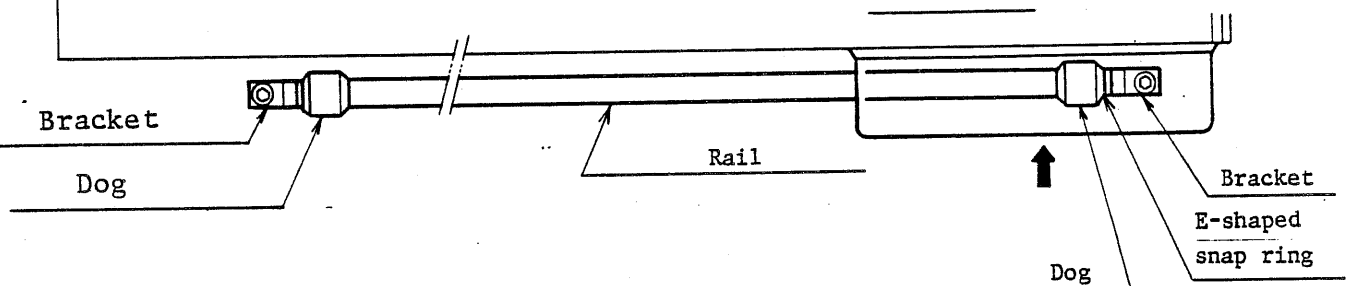
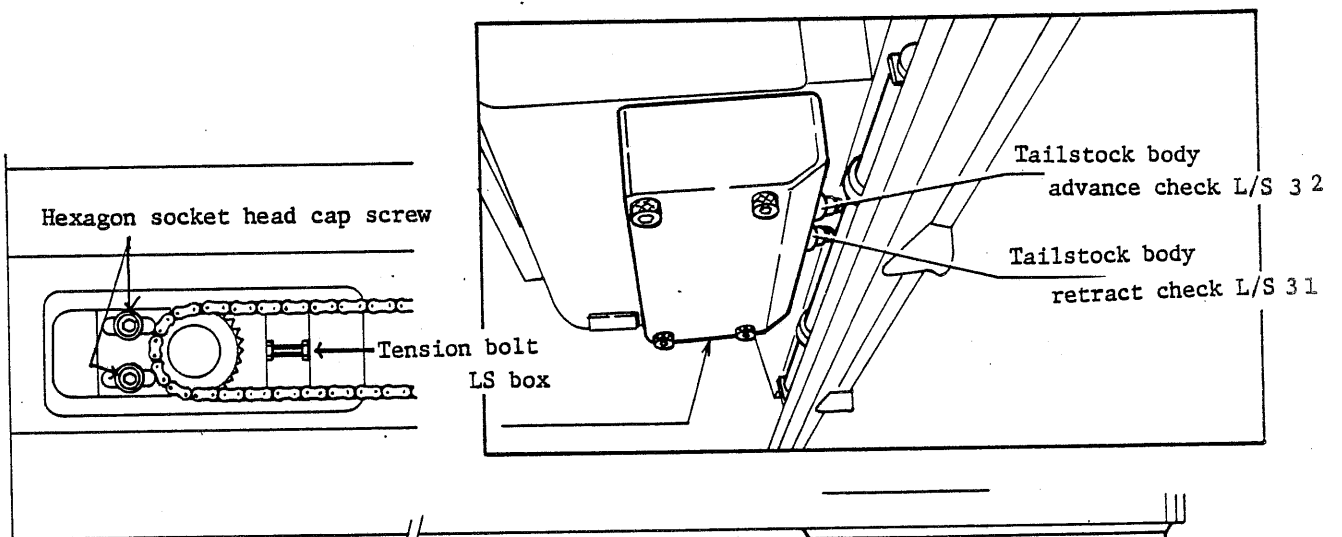


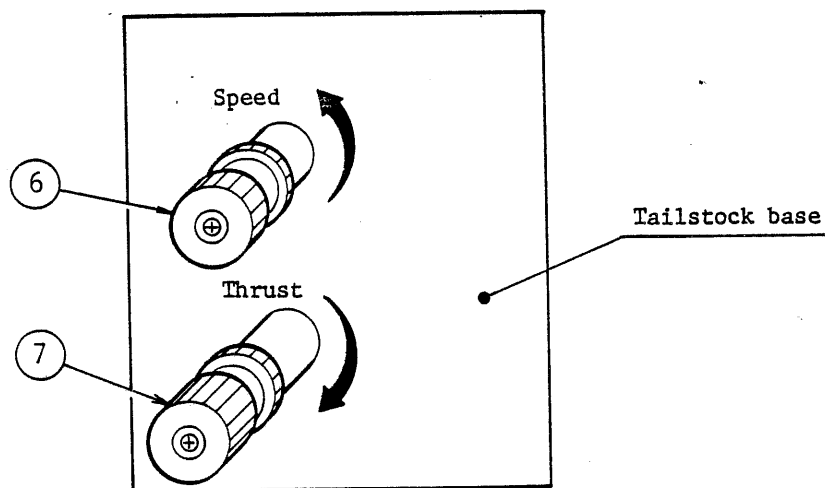


Notes:

1. Fix the tailstock base to the bed using the hydraulic clamping piston and cylinder arranged in the base.
A 0.5 mm clearance (to be observed strictly) is provided between the base and the bed due to discharge of oil pressure from the port (A) when the tailstock moves, therefore, the base can be moved easily by the AC motor.
2. Check the following items when the base cannot be moved easily:
 - a) Has oil pressure been discharged from the port (A)?
 - b) Is the clearance as specified (0.5 mm)? (Too much clearance makes the smooth base move and the tailstock return to the same position impossible.)

Headstock \longleftrightarrow Tailstock end





Speed adjustment for the tail spindle extend (forward) is carried out with the knob ⑥.

Speed increases by turning the knob clockwise.

Thrust adjustment for the tail spindle is carried out with knob ⑦.

Thrust becomes larger by turning the knob clockwise.

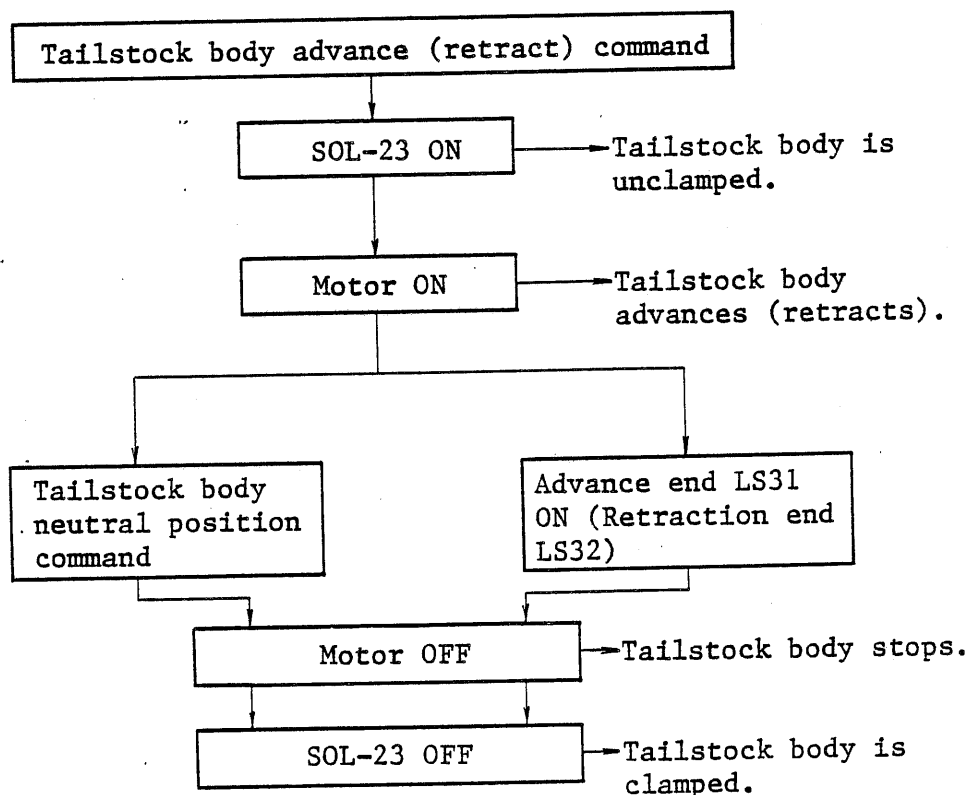
3) Tailstock movement

While automatic operation of the machine the tailstock can be operated either automatically or manually. In the manual tailstock operation, the tailstock body and the tailstock spindle are advanced manually and the workpiece is loaded; in the automatic tailstock operation the workpieces are loaded and unloaded by a robot, and the tailstock body and the tailstock spindle are advanced with M Code automatically to hold the workpiece.

(1) Manual tailstock

1. Tailstock body advance and retract

Move the tailstock body manually with the TAILSTOCK BODY ADVANCE/RETRACT switch on the operation panel.



* As noted above, it is not necessary to set the tailstock body advance end position in manual tailstock body manual traverse. When the advance stroke is set at maximum, the advance end can be set simply by the TAILSTOCK BODY switch on the operation panel.

2. Tailstock spindle advance and retract

Move the tailstock spindle with the TAIL SPINDLE FWD/REV switch on the operation panel. The tailstock spindle advance end and retraction end LS are inoperative.

(2) Automatic tailstock

Automatic tailstock spindle advance and retraction as well as the tailstock body positioning are carried out with M code commands in the program.

{ M10 Tailstock body and spindle motion interlocked OFF
M11 Tailstock body and spindle motion interlocked ON

{ M31 Tailstock spindle advance
M32 Tailstock spindle retract

Example:

Tailstock body is clamped and tailstock spindle advances.

M10, M31

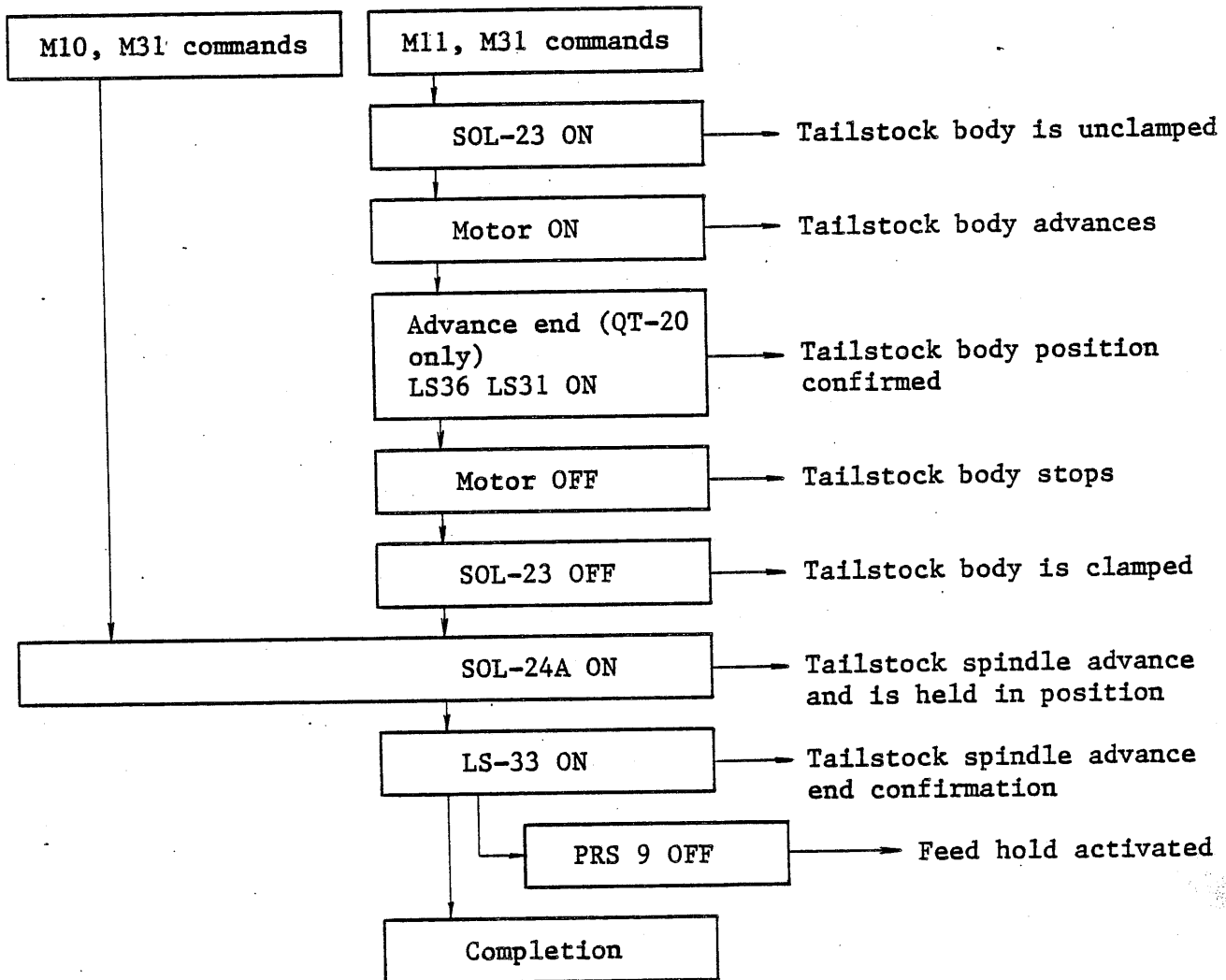
Both tailstock body and spindle advance

M31

* M10 and M11 are modal.

When the power is turned ON, the control automatically selects M11 mode.

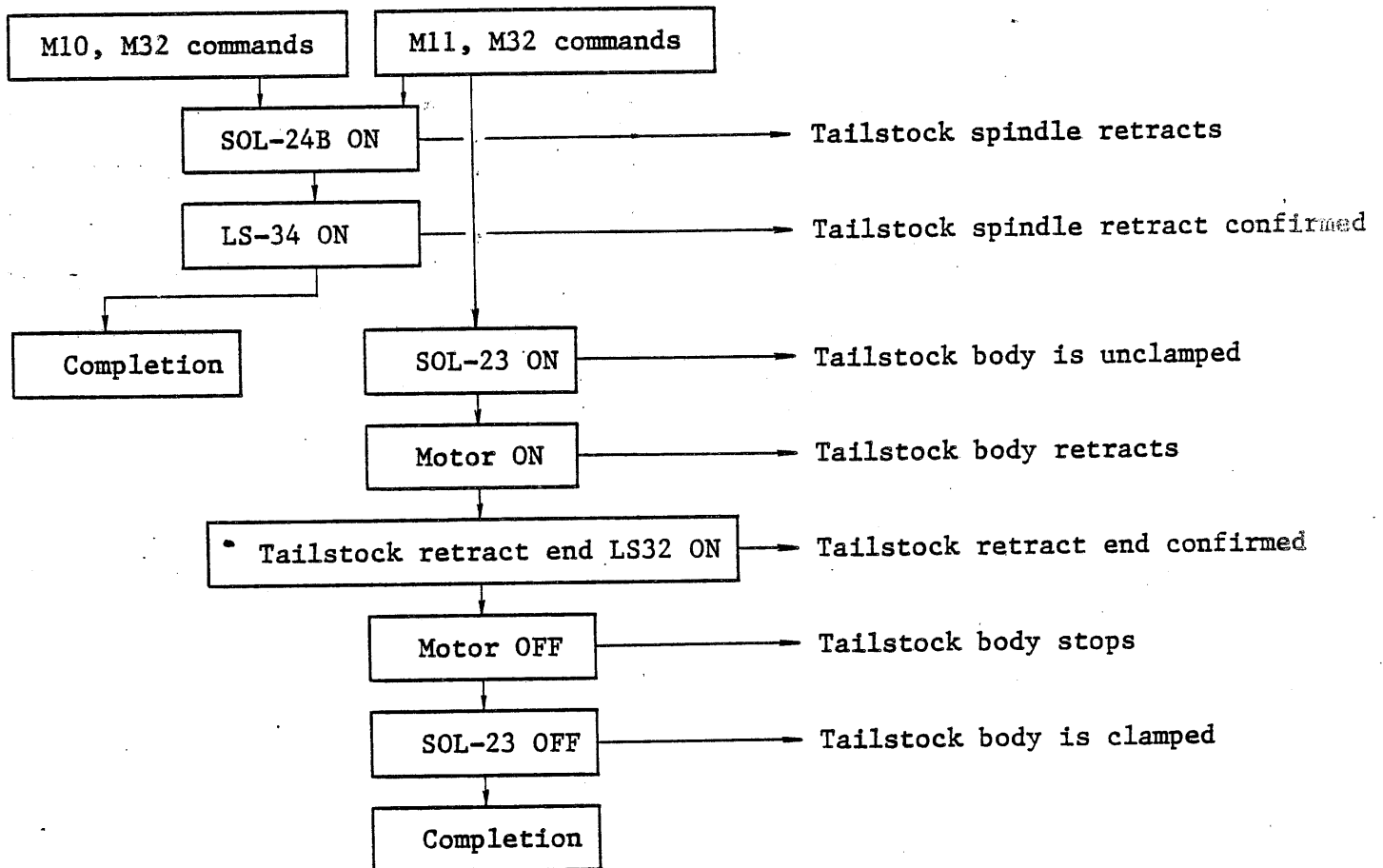
1. Tailstock advance



* The tailstock body is automatically positioned in one of the following two manners:

- (1) Method by adjusting the forward end of tailstock body
(See 3-6-1 (2).)
- (2) Method by striking the tailstock body advance end switch (LS36) , with the carriage previously moved by a single action program, etc. (QT-20 only).

2. Tailstock retract



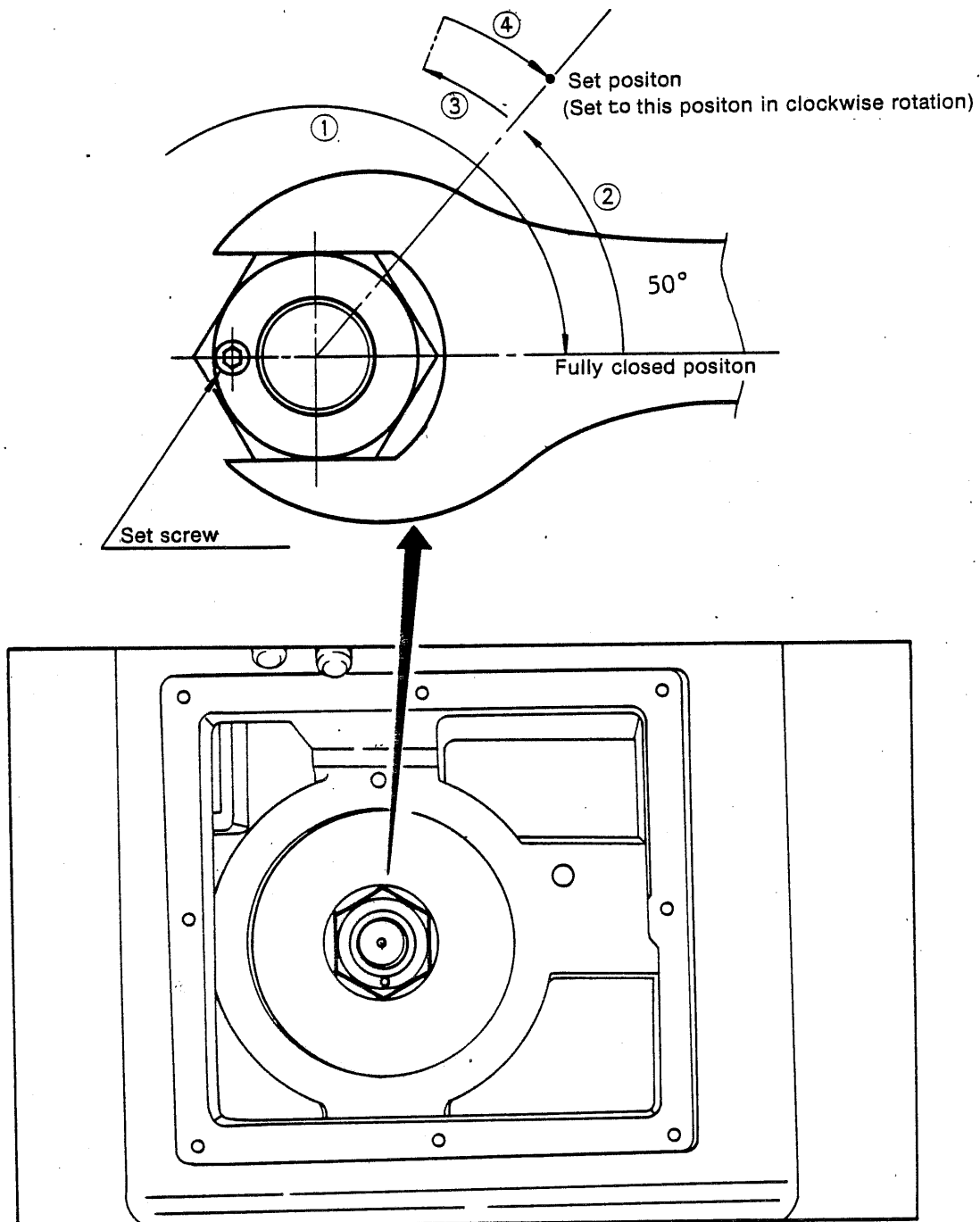
4) Tailstock Spindle

While MANUAL mode of operation, the tailstock spindle is located at the retract end position when the tailstock spindle retract command is given. In AUTO mode operation, the tailstock spindle will not advance while the limit switch at the spindle retract end position is turned on with the tailstock spindle retract command provided.

5) Tailstock Base

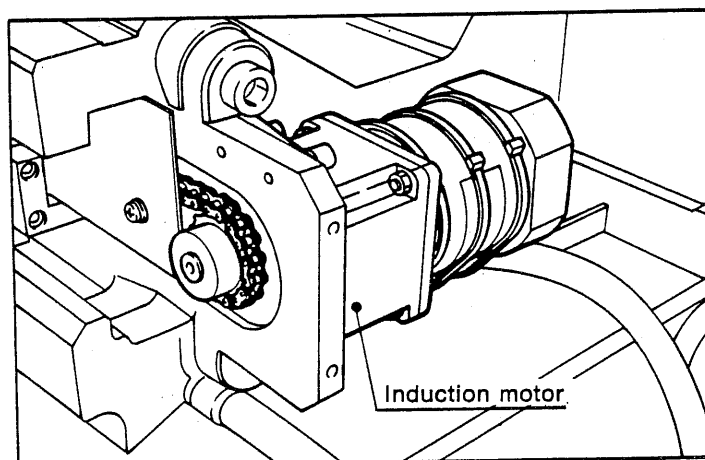
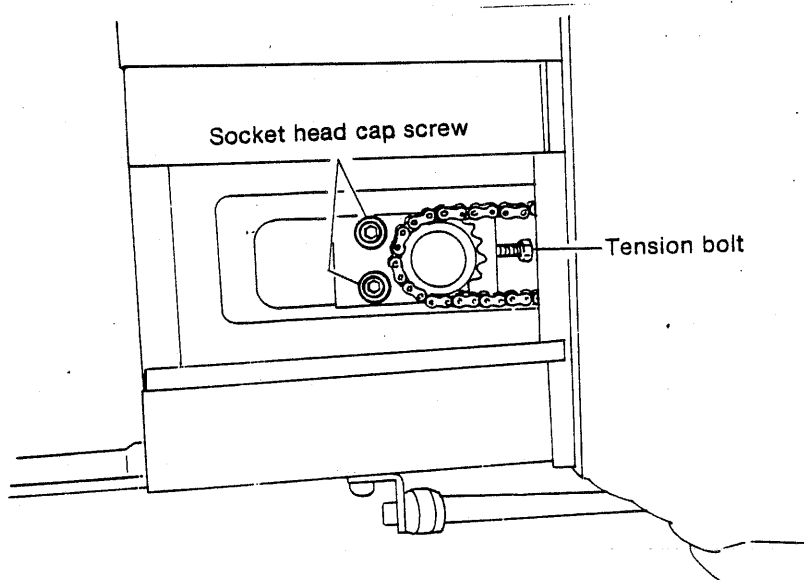
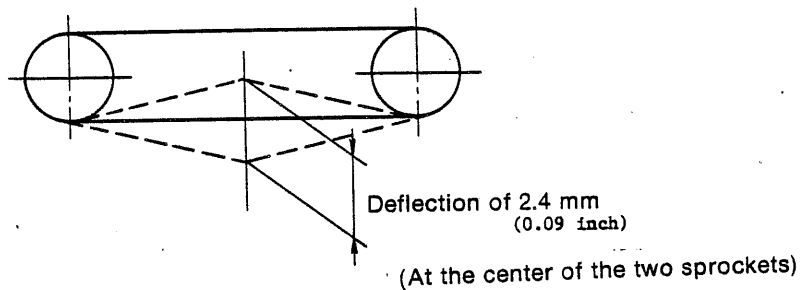
Designed clamp piston stroke in the base is 0.5 mm (0.02 inch). If piston stroke in unclamping gets large, the tailstock base will be twisted, which will in turn adversely affect its return accuracy.

Adjustment of the piston stroke is made with the hex. nut at the center of the piston. Loosen the set screw first and to unclamp the tailstock base. Rotate the nut clockwise fully after that. Then rotate it in the counterclockwise direction over 50°, and then return the nut clockwise to the position 50° to the fully closed point. With this setting, the piston stroke is set to 0.5 mm (0.02 inch).

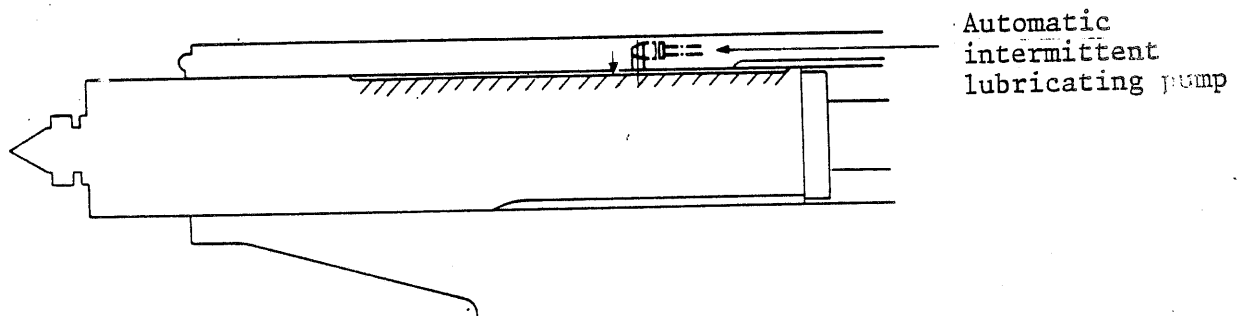


6) Positioning Tailstock

The tailstock is moved by the induction motor provided at the right end of the bed via the chains. Although the chains with minimum elongation are used, adjust them by pulling the sprocket of the headstock side leftward if the tailstock cannot be moved smoothly due to elongation of the chains. Proper amount of chains deflection is 2.4 mm (0.09 inch) as shown below when measured at the center of the two sprockets. When this adjustment is to be made, be sure to position the tailstock at the retract position.



7) Lubrication of tailstock spindle guideways



The tailstock spindle guideways are lubricated by the automatic intermittent lubricating pump which is attached on the right side of the machine.

Discharging a time : 3 - 6 cc/cycle

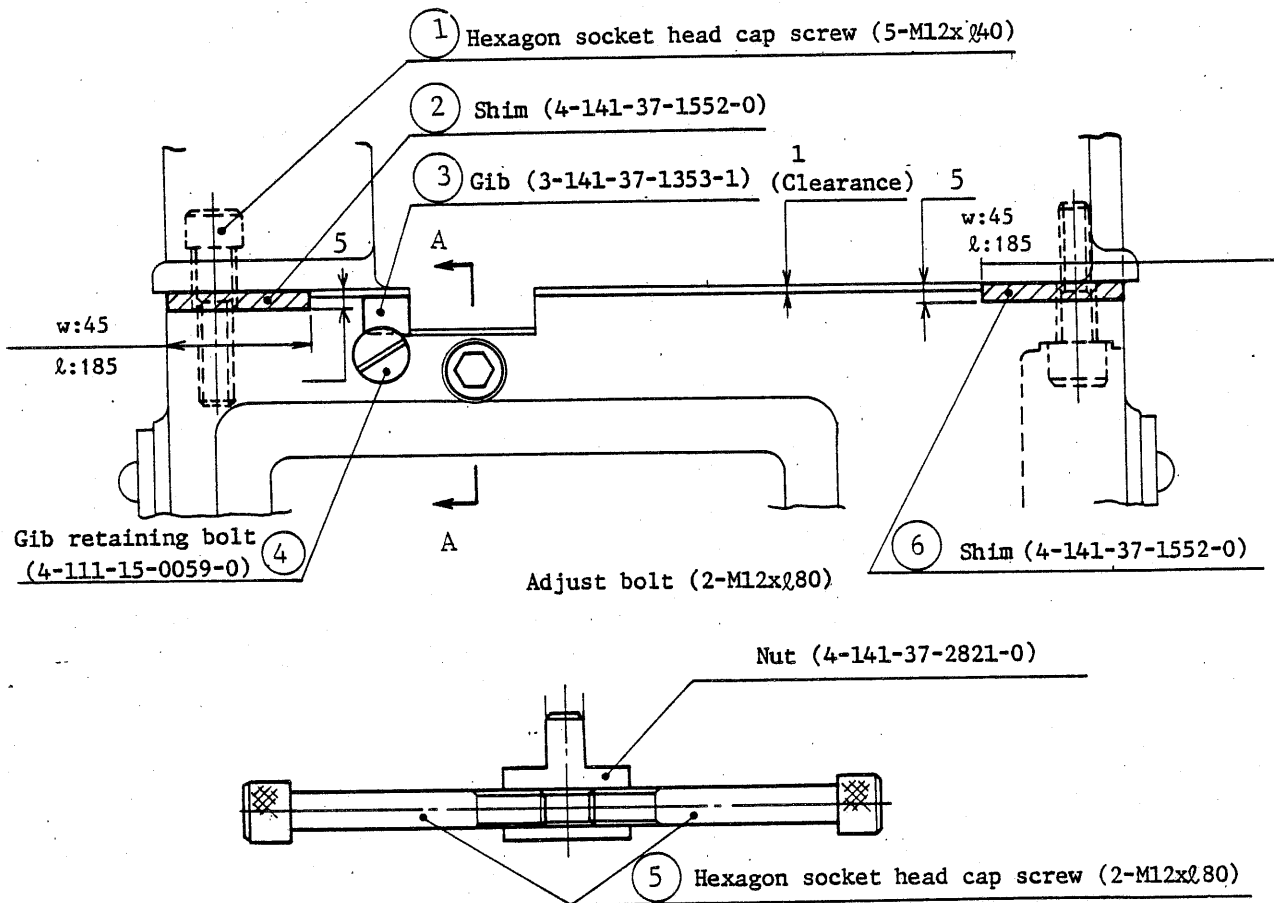
Pump operating interval : 3 min.

Lubrication of tailstock body guideways

Refer to 3-8-2 Lubrication of guideways and ball screws.

8) Tailstock Spindle Centering Adjustment

(a) Vertical adjustment



The tailstock spindle is set about 0.01 mm higher in the vertical direction than the headstock spindle taking into consideration the possible exothermic elongation of the headstock spindle, the rigidity of the tailstock spindle, etc.

To adjust the difference greater than this, replace the shims ② and ⑥ with the new ones whose thickness has been machined to 5.3 mm.

Then, grid them to the proper thicknesses on the spot.

(Always attach or remove the shims with the hexagon socket head cap screw ①.)

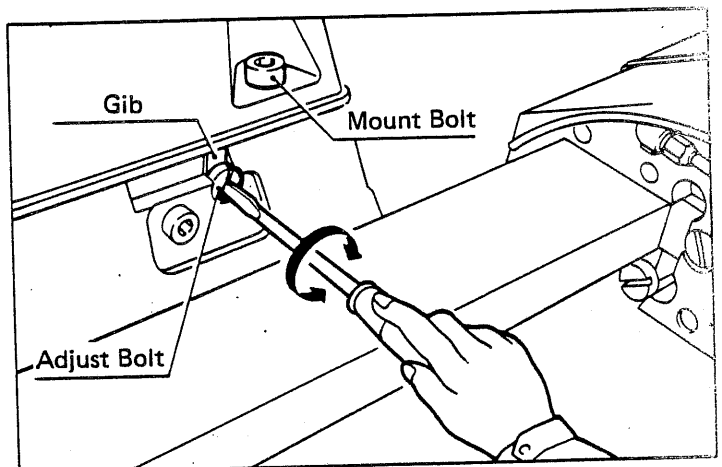
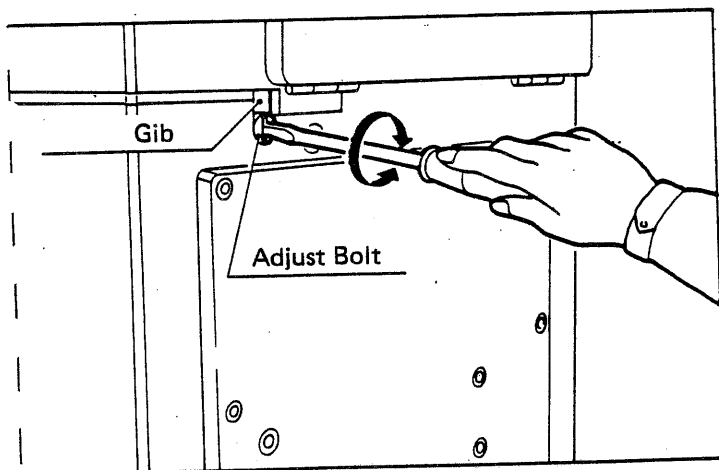
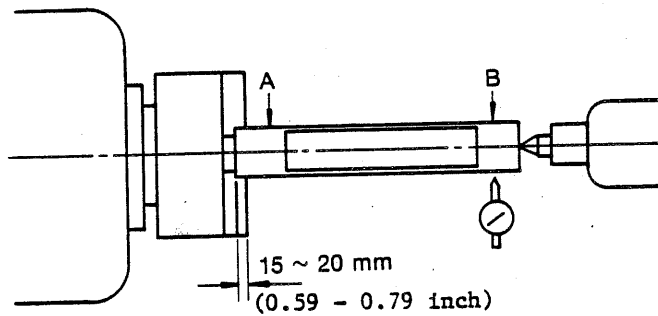
⑥ Horizontal adjustment

When a workpiece turned using the tailstock is tapered, align the tailstock spindle following the steps indicated below:

- 1) Clamp a test piece (round bar) in the chuck and then hold it with the tailstock spindle. The test piece should be clamped in the chuck as much as 15 to 20 mm (0.59 to 0.79 inch).
- 2) Cut the test piece.
- 3) Measure the cylindricity of the cut test piece with micrometer by measuring the diameters A and B.
- 4) Placing the stem of the dial indicator onto the cut workpiece OD at tailstock side, set the reading to zero.
- 5) Loosen the bolts clamping the tailstock top to the tailstock body.
- 6) Alignment of the tailstock spindle can be done with the aligning bolts at the rear of the tailstock. Secure the aligning bolt (clockwise turning) with observing the dial indicator indication. This moves the tailstock body toward the secured direction.

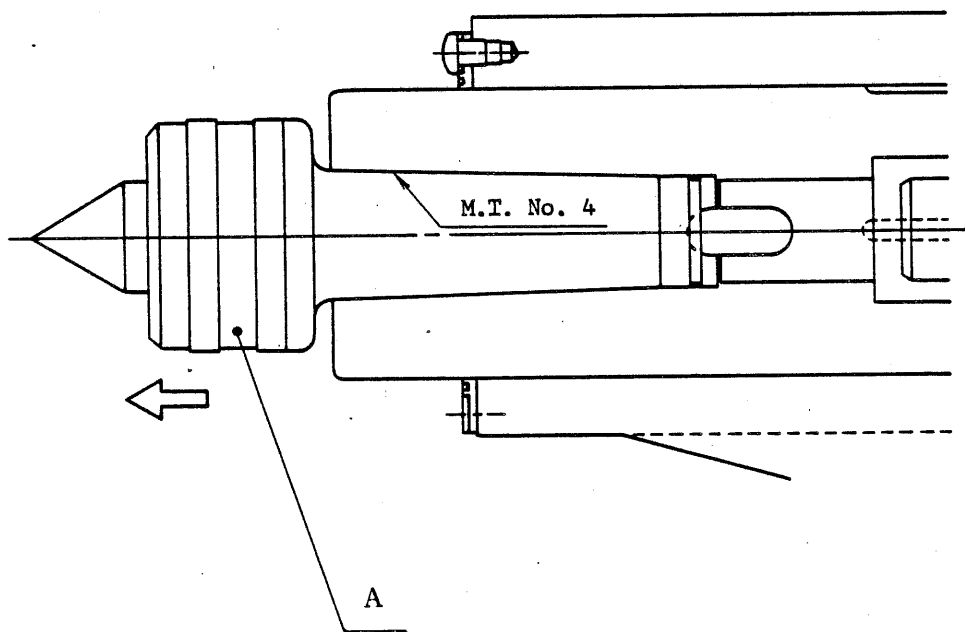
The amount to be moved is about two thirds of the measured difference (a-b).

- 7) After securing the tailstock body clamp bolts, cut the test piece again.
- 8) If the test piece is still tapered, repeat the steps 4) through 7) again.



a) Dead center

Since the QT-10N Tailstock sleeve is provided with the M.T. No. 4 tapered bore, use the dead center whose rotary center is filled with grease.



A: Rotary center LC-5N (Nippon Seiko Corp.)

3-8 Lubricant and Coolant

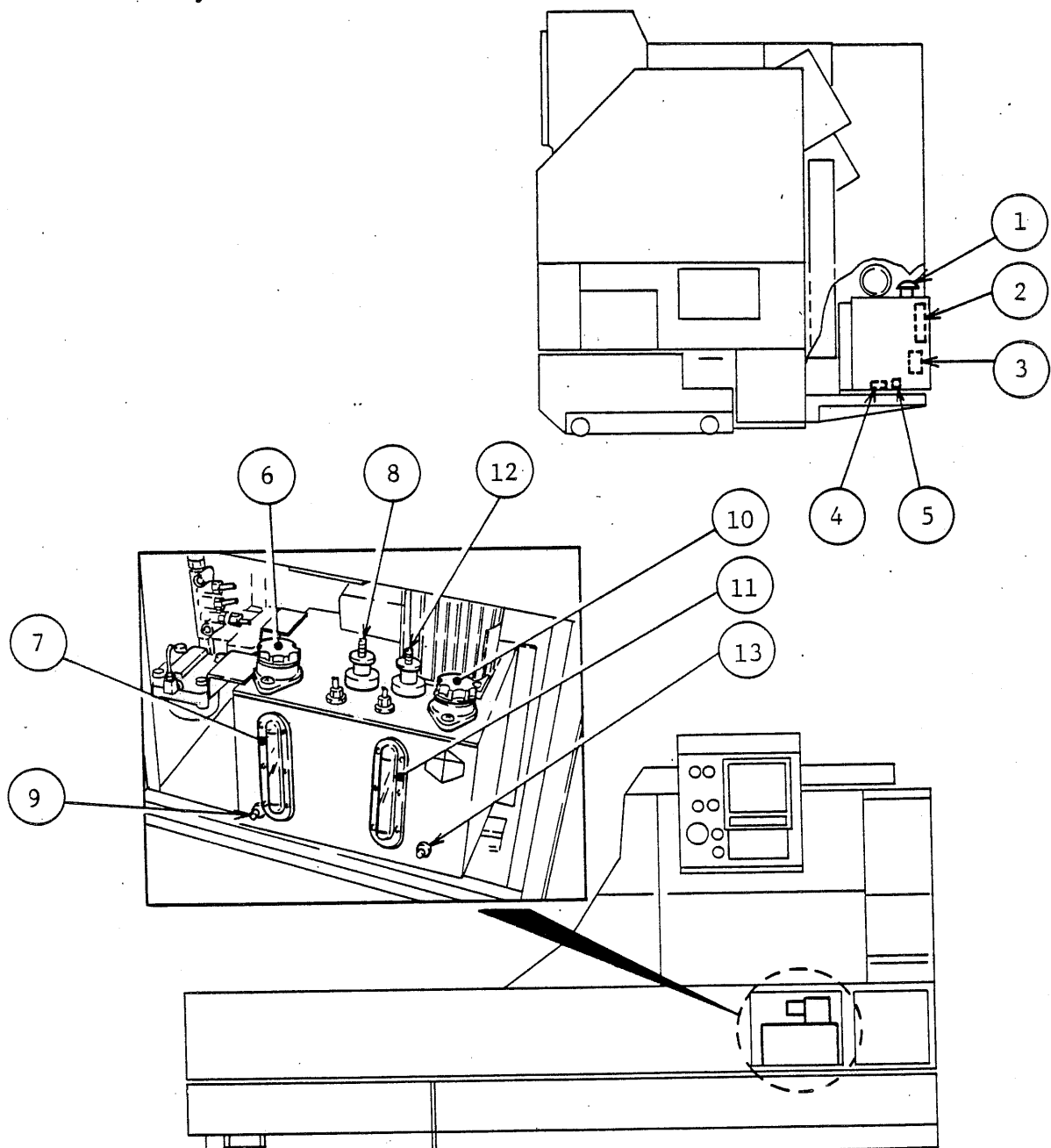
3-8-1 Lubrication

1) Oiling and Greasing Points

Supply only the specified lubricant to the proper level of the tanks. When replenishing or changing the lubricant, refer to the table provided below.

. With 8D (standard), With 12D (option), With 4T

The lubrication period is based upon eight hours operation a day.



No.	Part Name	Lubricating Point	Q'ty	Recommended Oil	Remarks
1	Oil filler port	Hydraulic power unit	39ℓ (8.58 gal.)	TERESSO 32 (ESSO) FBK OIL 32 (Nippon Oil) DAPHNE SUPER MULTI 32 (IDEMITSU)	Exchange oil every 6 months, then clean the filter and the micro separator
2	Level gage				
3	Filter				
4	Micro separator				
5	Drain port				
6	Oil filler port	Ball screw	0.7ℓ (0.15 gal.)	TERESSO 32 (ESSO) FBK OIL 32 (Nippon Oil) DAPHNE SUPER MULTI 32 (IDEMITSU)	Automatic lubrication supply oil upon occasion. Clean the line filter every month.
7	Level gage				
8	Line filter				
9	Drain port				
10	Oil filler port	Slide way & Turret	2.0ℓ (0.44 gal.)	TERESSO 32 (ESSO) VACTRA NO.2 (MOBIL) DAPHNE SUPER MULTI 68 (IDEMITSU)	Automatic lubrication supply oil upon occasion. Clean the line filter every month.
11	Level gage				
12	Line filter				
13	Drain port				

2) Oil Replacement

(1) Lubricant change

Change all lubricant of each unit (headstock, guideways) every six months.

(2) Hydraulic oil change

Although it may vary according to operating conditions, change all hydraulic oil about every 1000 hours of operation (about 6 months) in general. Clean the filter when oil is changed. The filter is chained to the filler port cap.

3) Checkups of automatic intermittent lubrication unit

In these checkups, lubricant is replenished, and the pump filter and the delivery side line filter are checked and cleaned.

(1) Lubricant replenishment

Replenish lubricant early and maintain the required level at all times.

(2) Cleaning of oil tank and oil tank filter

In principle, clean or replace the filter once a year.

Clean the oil tank once a year as well. When the pump is removed from the oil tank, the filter is easily visible. (Refer to the Instruction Manual for filter for removal procedures.)

(3) Cleaning of line filter

Clean the line filter once six months.

(Refer to the Instruction Manual for line filter for removal procedure.)

4) Checkups of pressure gages

(1) Checkups of pressure gages

There are four pressure gages installed in this machine.

Hydraulic power unit	35 kg/cm ²
Hydraulic chuck (varies according to chuck)	10 - 35 kg/cm ²
Hydraulic tailstock	100 - 500 kg

When the pressure gages indicate pressures higher or lower than above, adjust pressure of each unit. It is possible that gages themselves are out of order due to vibration and other causes. This can be checked by observing if the pointer goes down to zero when the power is turned OFF. However, because of the dampener installed in the machine, it may take some time for the pointers to come down to zero.

(2) Replacement of glass

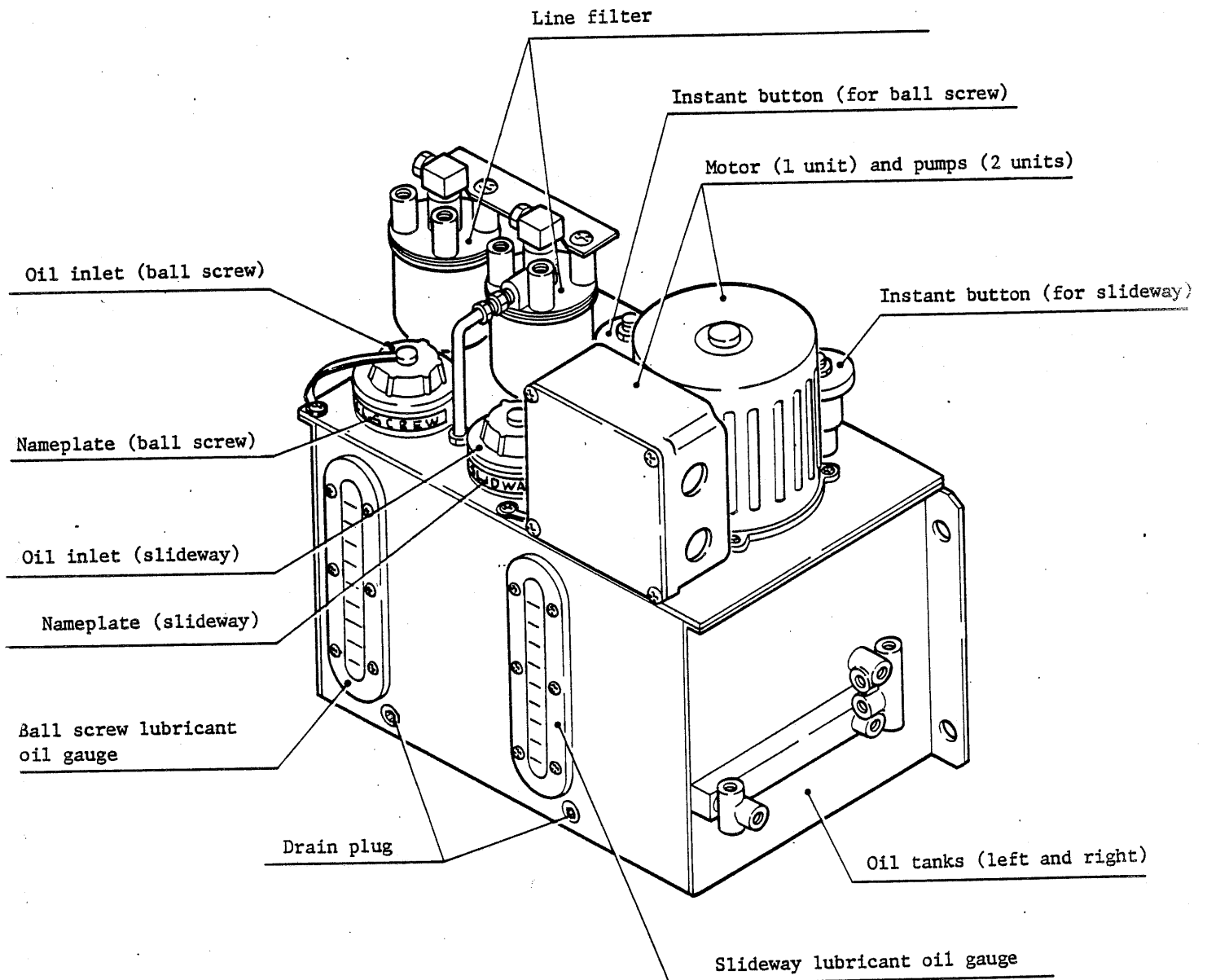
When the front glass of the pressure gage is damaged, replace it in the following way:

Loosen the screws fixing the front cover with a Phillips screwdriver. Remove the front cover and the damaged glass with new one. Replace the front cover back, and retighten the screws securely.

(Part No.: PE-1863-7) Asahi Keiki

3-8-2 Lubrication of slideways and ball screws

1) Sketch of lubrication unit



2) Lubrication of guideways and ball screws

Lubrication of the X-axis guideways, Z-axis guideways and X- and Z-axis ball screws is controlled by the centralized, automatic intermittent type lubrication pump, located at the left side of the machine. Predetermined and constant amount of lubricant is fed to each lubrication point by means of a flow proper unit fitted at the piping run end.

If the lubricant pressure falls below 0.3 kg/cm^2 for some reason, the pressure switch is actuated and the ALARM SLIDEWAY LUBRICATION TROUBLE lamp on the operation panel goes on.

The automatic intermittent type lubrication system consists of an automatic intermittent type lube pump, a distributor, the flow proper unit, a line filter, a pressure switch and pipes.

(a) Pump motor MMX-W (Lube)

Tank capacity:	$2.0 \text{ l} + 0.6 \text{ l}$
Delivery amount:	2.5 cc/cy (Adjustable type)
Intermittency:	3 min.

(b) Pressure switch PO.3 (Tokai Rika)

Set pressure:	0.3 kg/cm^2
---------------	-----------------------

(c) Line filter: FX-1

Filtering accuracy:	30μ
---------------------	----------

(d) Flow units HJB-0 and HJB-1

Resistance type supply system

- * The part numbers in the following table correspond to those in the lubrication piping diagram of the parts list (15 units, 35 units, and 37 units).

Refer to the following table and the parts list when the pipes are checked due to clogging and other reasons.

- * There are 27 lubrication points. 2.5 cc/cy of lubricant are delivered per cycle by the pump every three min., making the delivery per point 0.1 cc/cy.

3) Inspection of lube unit for slideways and ball screws

a) Cleaning of filter

Be sure to clean the oil filter in the oil tank every year. Remove the plastics lube oil tank by pulling it downward, and you can find the filter.

The blue line filter at the side of the lube oil tank is a consumable part.

Replace it every year under normal service conditions, or if delivery of the lube oil is reduced excessively.

b) Inspection of lubricating points

Before starting daily operation, be sure to check if each lubricating point is properly lubricated. If any of the lubricating points is not lubricated, it is caused by clogged flow unit or leakage through lubrication piping runs.

c) Clogged flow unit

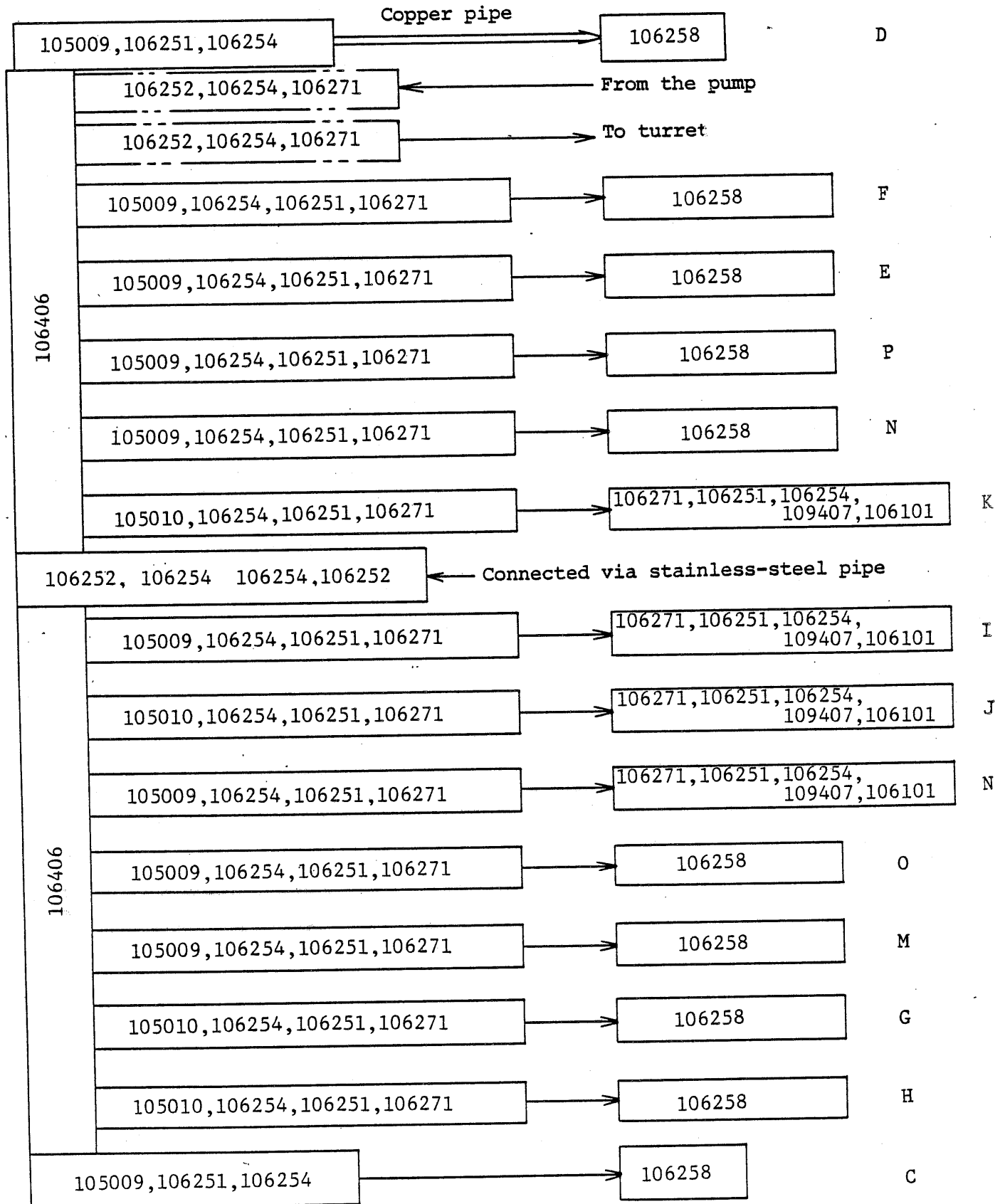
When coolant or impurities enter into the flow unit, check valve seat of the flow unit is clogged, causing it to fail to operate correctly. If the flow unit is clogged, replace it with new one.

4) Troubleshooting of Automatic Intermittent Lubrication Pump

Cause	Measures
. Then no lubricant is fed from the pump.	
Wrong pump drive motor rotating direction (except MMXL)	Reverse motor rotating direction.
Low oil level	Replenish the specified lubricant to the specified level (up to flange surface of the pump).
Clogged suction filter	Clean or replace the suction filter.
Plugged piping runs (collapsed, twisted, disconnected, etc.)	Change the lubricant, if necessary.
No lubricant suction due to high viscosity	Replace them.
Seized inlet check valve at open position	Use the lubricant of the specified viscosity.
Seized outlet check valve at open position	Clean the check valve.
. No pressure building-up	Clean the check valve.
No oil delivered from the pump due to any of the causes indicated above	Follow the instructions above.
Defective check seat packing	Replace it with new one.
Worn V ring in the piston cylinder	Replace it with new one.
. No plunger operation	
Broken reducing mechanism due to reversal operation while initial operation	Replace.
Defective cam	Replace the cam.
Defective motor	Replace the motor.
Worn worm wheel gear	Replace the worm wheel gear.

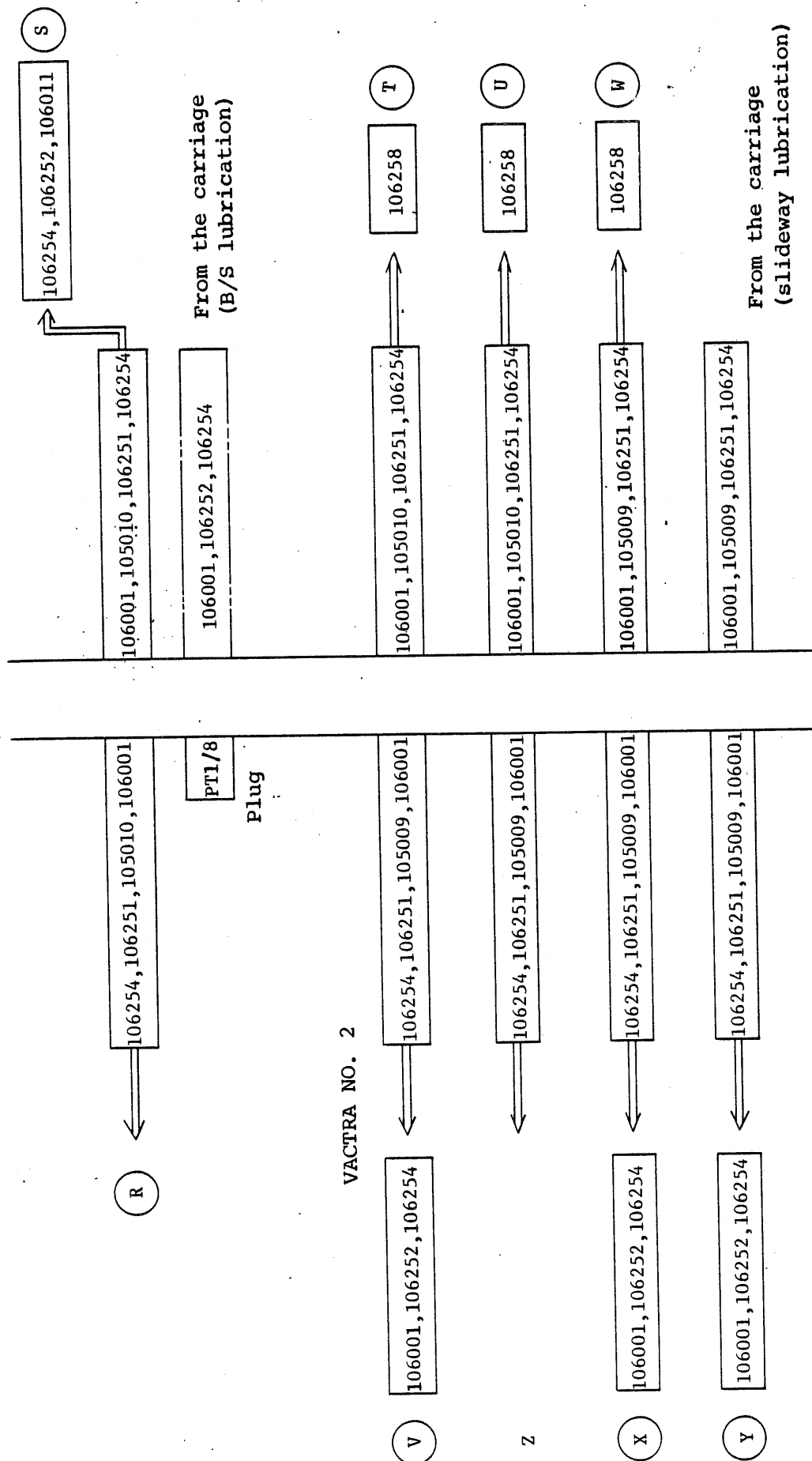


6) carriage slideway lubrication

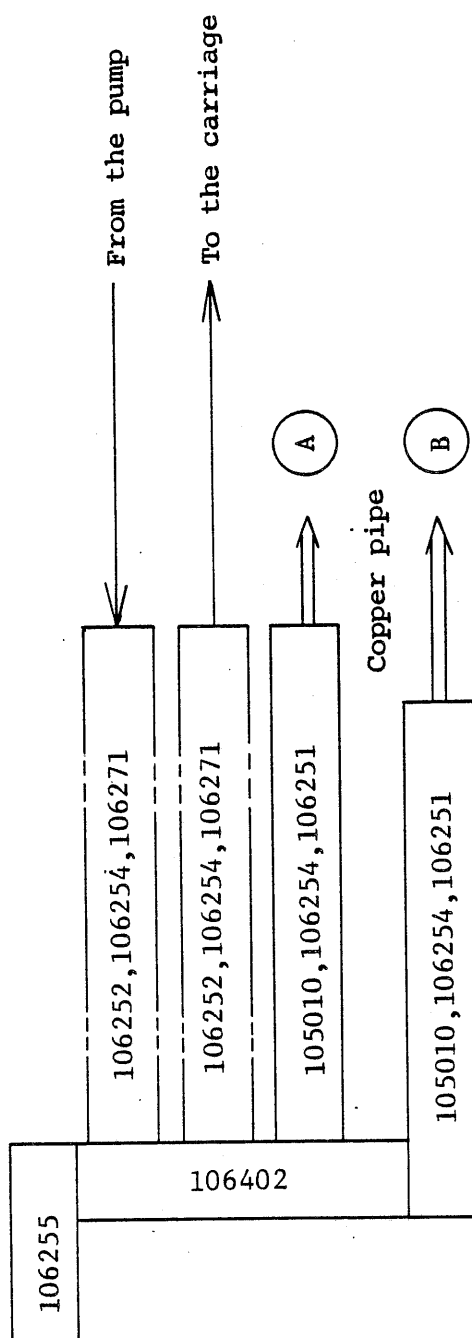


7)

turret lubrication



8) carriage B/S lubrication



3-8-3 Construction and Inspection of Coolant Equipment

1) Construction of Coolant Equipment

The coolant reserved in the oil pan at the front lower part of the machine is pumped through the filter and is supplied to the workpiece from the coolant nozzle in the turret or above the spindle for 8D/12D or 4T, respectively.

Recommended oil:

Solvac 1535G (Mobil)

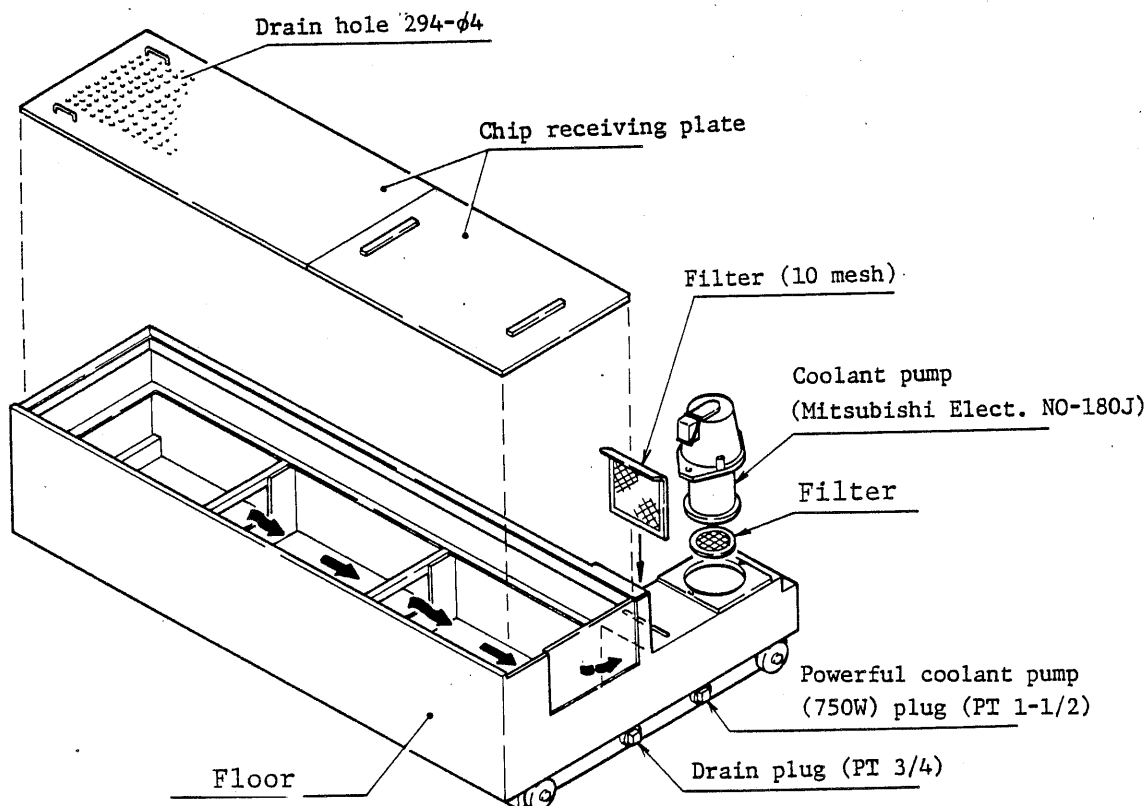
Trimsol (Master Chemical)

2) Coolant tank capacity

Chucker type 150 ℓ

Universal type 190 ℓ

3) Cleaning of filter

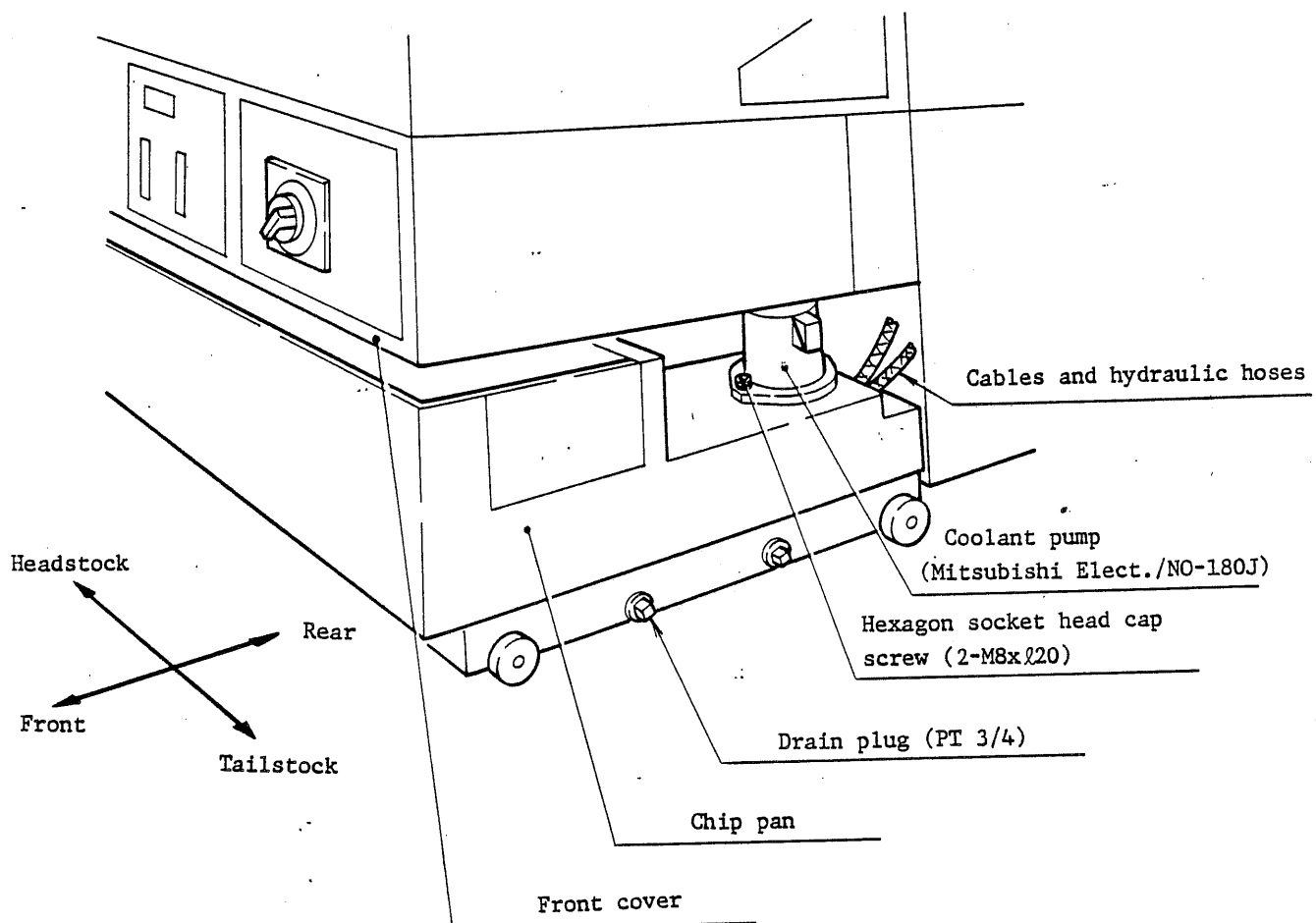


The filter, which partitions off the coolant equipment installation section from the water in the oil pan, can be easily removed and cleaned. Clean it from time to time. At the same time, remove and clean the filter provided under the coolant pump.

4) Replenishment of coolant

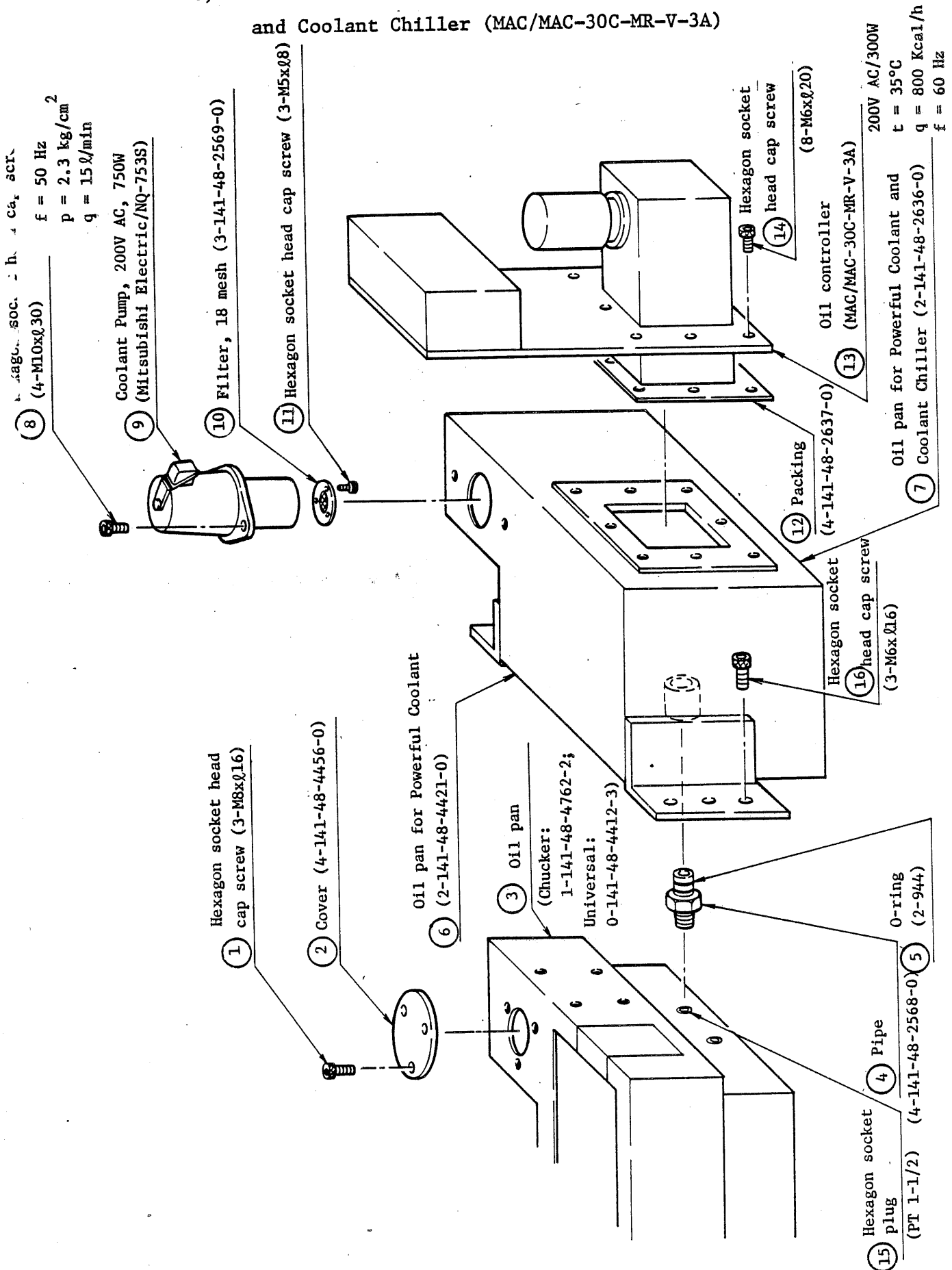
Replenish coolant when its level is over 130 mm lower than the chip receiving plate in the oil pan.

5) Replacement of coolant pump



- ① Remove the drain plug and discharge coolant oil
(Chucker: 150 l ; Universal: 190 l).
- ② Pull out the chip pan toward the front.
- ③ Disconnect the cables and hydraulic hoses of the coolant pump.
- ④ Remove the hexagon socket head cap screw.
- ⑤ Take out the coolant pump.
- ⑥ To assemble, reverse the procedure.

6) Installation of Powerful Coolant (Mitsubishi Electric/NQ-753S) and Coolant Chiller (MAC/MAC-30C-MR-V-3A)



(a) Powerful Coolant installation procedure

Remove hexagon socket plug ⑮ .

Screw pipe ④ into oil pan ③ .

Attach O-ring ⑤ to pipe ④ .

Install oil pan ⑥ to oil pan ③ thru pipe ④ using hexagon socket head cap screws ⑯ .

Attach filter ⑩ to coolant pump ⑨ with hexagon socket head cap screws ⑪ .

Install coolant pump ⑨ to oil pan ⑥ with hexagon socket head cap screws ⑧ .

End

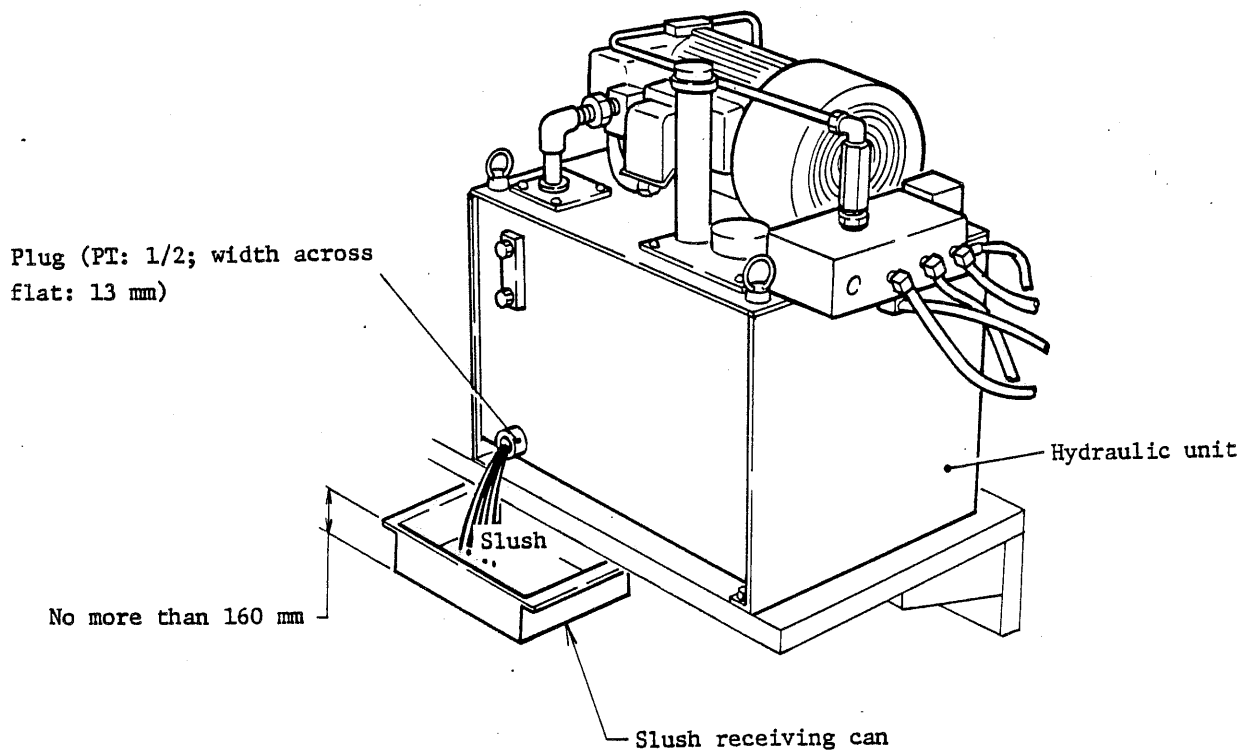
(b) Coolant Chiller installation procedure

Install oil controller ⑬ together with packing ⑫ to oil pan ⑦ with hexagon socket head cap screws ⑭ .

End

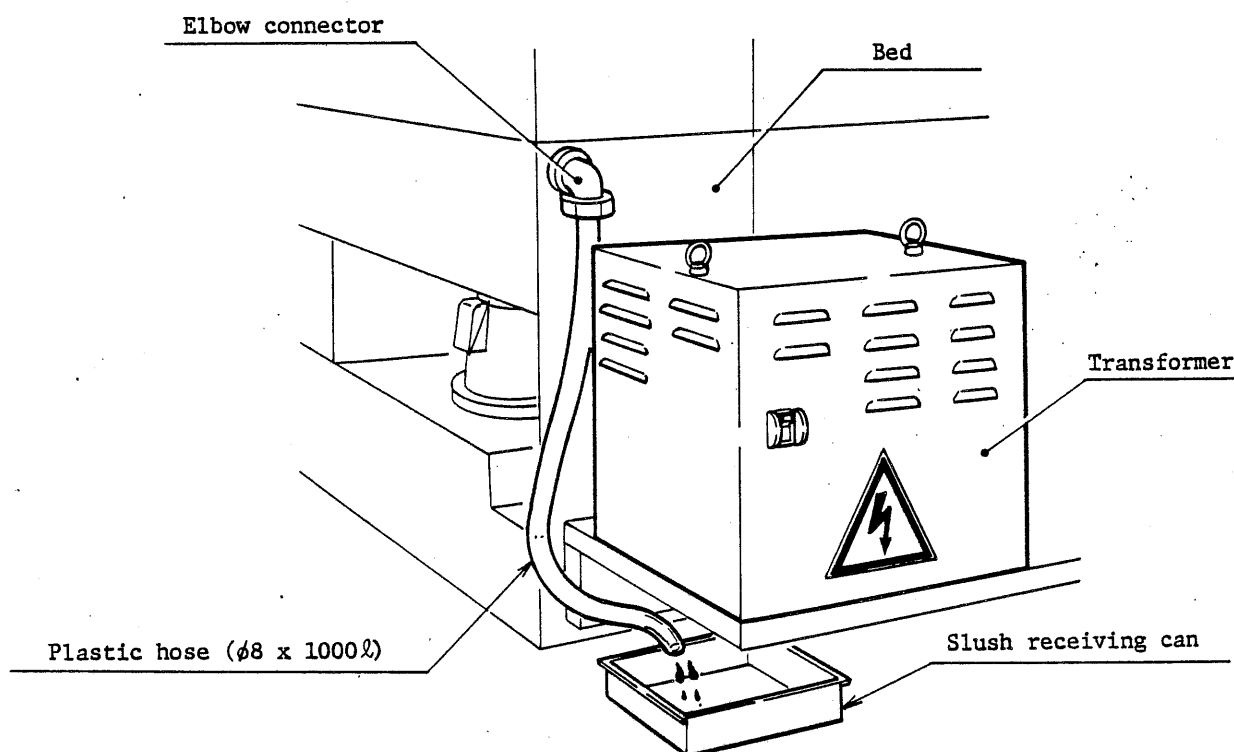
Draining Oil from Hydraulic Units

- (a) Remove both the upper and lower covers.
- (b) Place a slush receiving can (height ≤ 160 mm) under the hydraulic unit.
- (c) Slightly loosen the plug (PT: 1/2; width across flat: 13 mm) at the lower front of the hydraulic unit to drain the oil slowly.
- (d) For slush disposal, follow your company's regulations.



Slush from Slideways

A slideway slush receiving can (200 W x 300 L x 100 H; 6 ℓ) is provided under the transformer support at the back of the bed. Check the can for filling once a week.



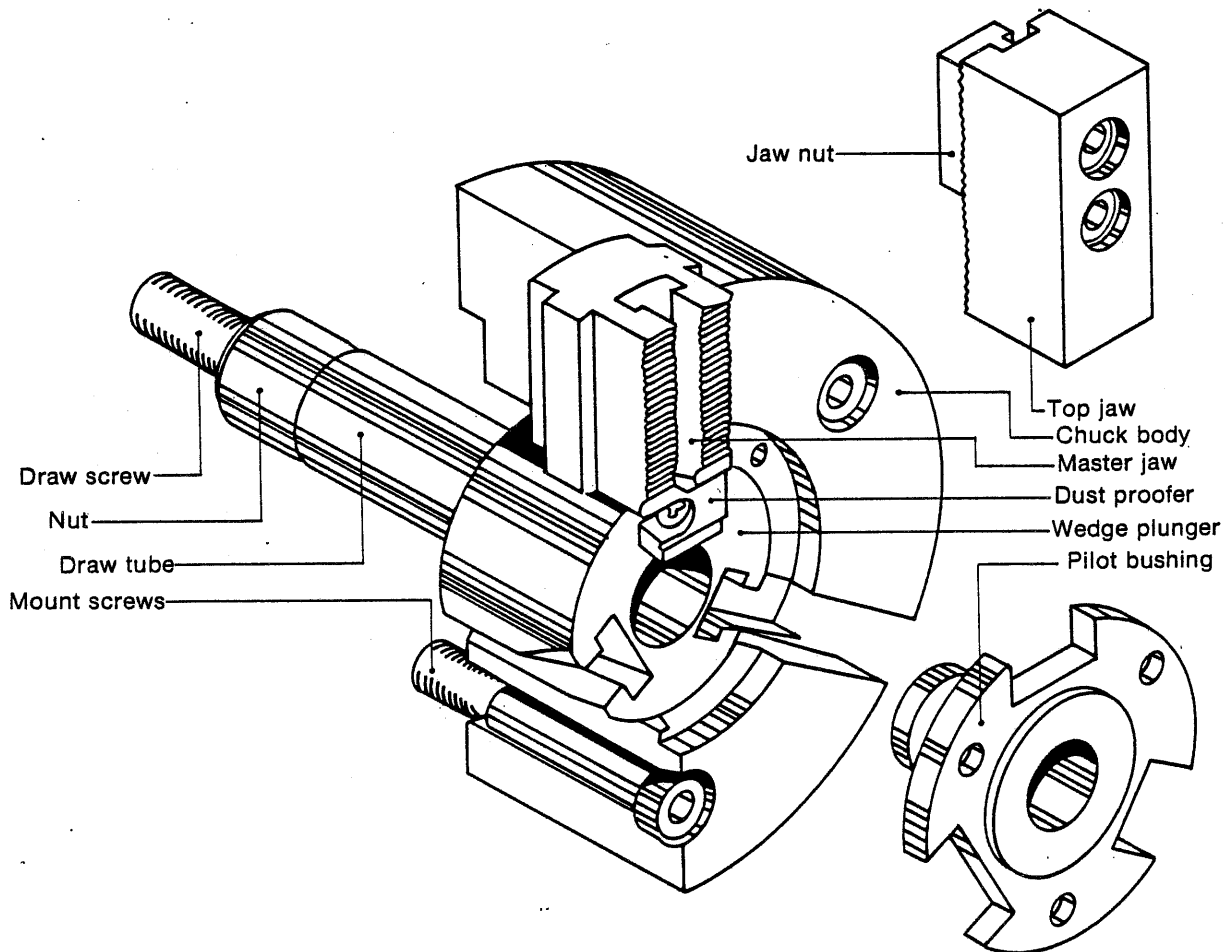
3-9 Power Chuck

The machine is equipped with a power chuck as a standard chuck and an air cylinder. Instructions for the power chuck and air cylinder are given in this section on the models indicated below:

Power Chuck	HO1MA8-A6-J (HOWA)
Air cylinder	HH4CB-125 (HOWA)
Maximum speed	rpm
Maximum pressure	22 kg/cm ² (312.91 PSI)
Maximum chucking force	6,900 kg (15212 lb) (While stationary with a pressure of 22 kg/cm ²)

* Chucking force decreases as chuck speed increases and at 4,000 rpm, it is about 1/2 of the maximum chucking force.

1) Inspection and Maintenance of Power Chuck



Detail of Power Chuck

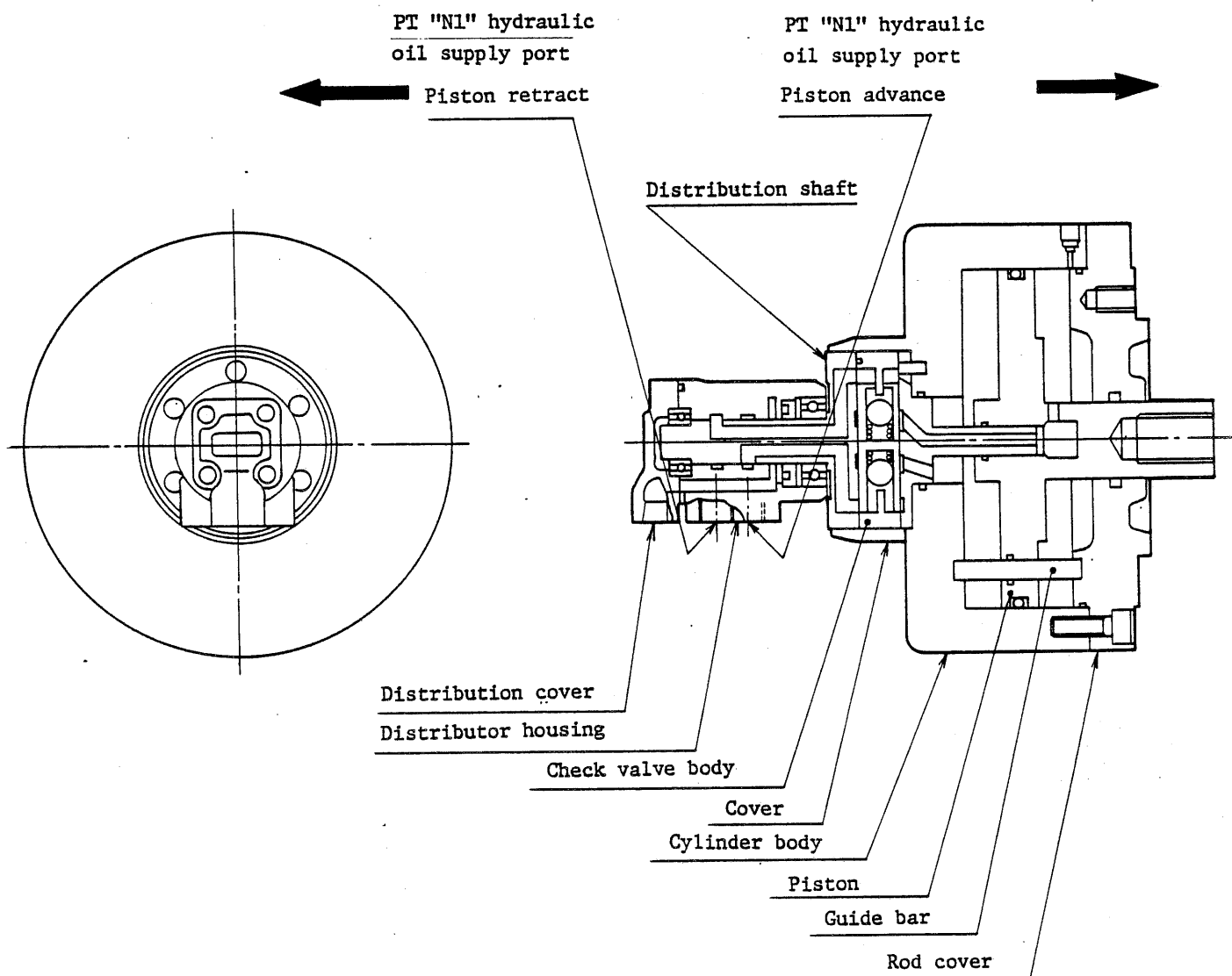
- o Grease weekly through the grease nipple on the master jaw.
 - o After finishing a daily work, be sure to clean the chuck surface.
 - o Clean and grease (Biral-NMG Sugai Kagaku) each component part with removing the master jaws every three months at least.
 - o Disassemble and clean the chuck every six months.
- Replace the parts if worn.

Disassembling Procedure

- (1) Remove the top jaw.
- (2) Remove the dust proofer.
- (3) Remove the pilot bushing.
- (4) Unscrew the stop machine screw at the back of the master jaw.
- (5) Pull out the plunger from the chuck body by tapping it with a wooden hammer.
- (6) Remove the master jaw from the chuck body.

Reverse the procedure above when assembling the chuck.

2) Details of hydraulic cylinder and checkups.



- o This hydraulic cylinder, whose with standing pressure is designed to be less than 35 kg/cm^2 , incorporates a check valve to maintain the pressure even if the supply pressure drops abnormally due to a pressure source failure, piping damage, etc. Check the cylinder for oil leakage every three months (when checking the chuck) by removing the side cover.

3) Disassembly Procedure

- (1) Extract the oil through the pressure detecting ports by removing the plugs in them.

CAUTION: Compressed air spouts from the ports.

- (2) Loosen sixteen mount bolts on the rod cover and remove it.
- (3) Remove the nut fixing the piston body and piston rod. Before removing the nut, loosen the set screw.
- (4) Remove the piston rod by pulling it rightward. This completes disassembly of the cylinder.
- (5) With removing four socket head screws on the distributor shaft, disconnect the piston rod and distributor.
- (6) Hook the wire through the air bleed holes at the projection of the valve and, then, pull out the check valve body from the piston rod.
- (7) After removing the snap ring, pull out the valve and valve seat from the check valve body. When removing the snap ring care should be exercised not to lose it.
- (8) Loosen three cross-recessed pan head screws on the cover (B), and the distributor can be removed. After that remove the snap ring and the remove the distributor body with the bearing. This completes disassembly.

⊙ Cautions on Disassembly

When disassembling the cylinder, be sure to leave match marks on each component part.

⊙ Cautions on Assembly

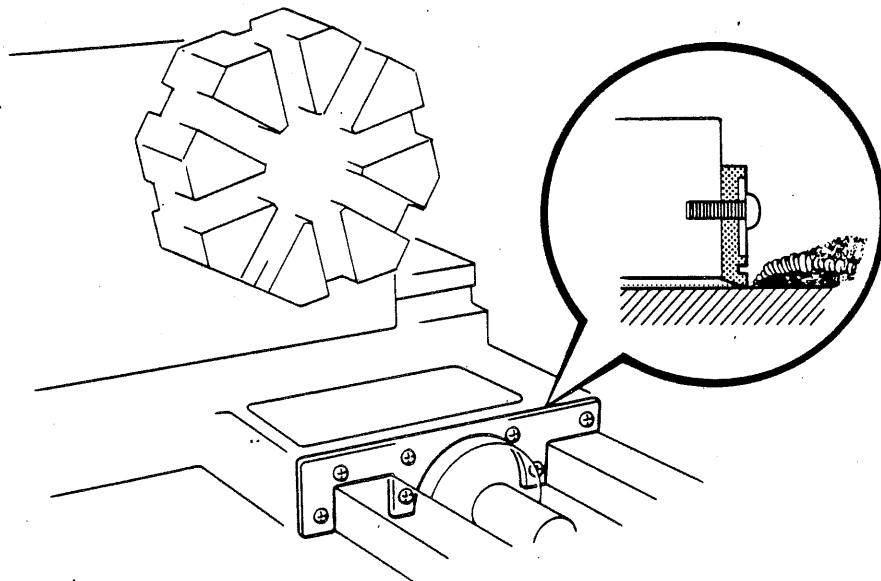
Be sure to keep the component parts away from foreign matter. Coat them with enough grease.

3-10 Outer Sheet Metal

1) Checkups of Wipers

Wipers fitted in each guideway surface prevent carbon particles from entering the guideways and maintain a uniform lubricant coating.

Therefore, it is necessary to check the wipers for worn wiper lips and scratches caused by carbon particles. Replace wipers if any faults are observed.



2) Sealant Coating

Although careful attention is paid to seal machining area completely before shipment and to pack it with every consideration for safe transportation, if any leaks should be discovered, coat the areas with the sealant attached to the machine as standard accessory.

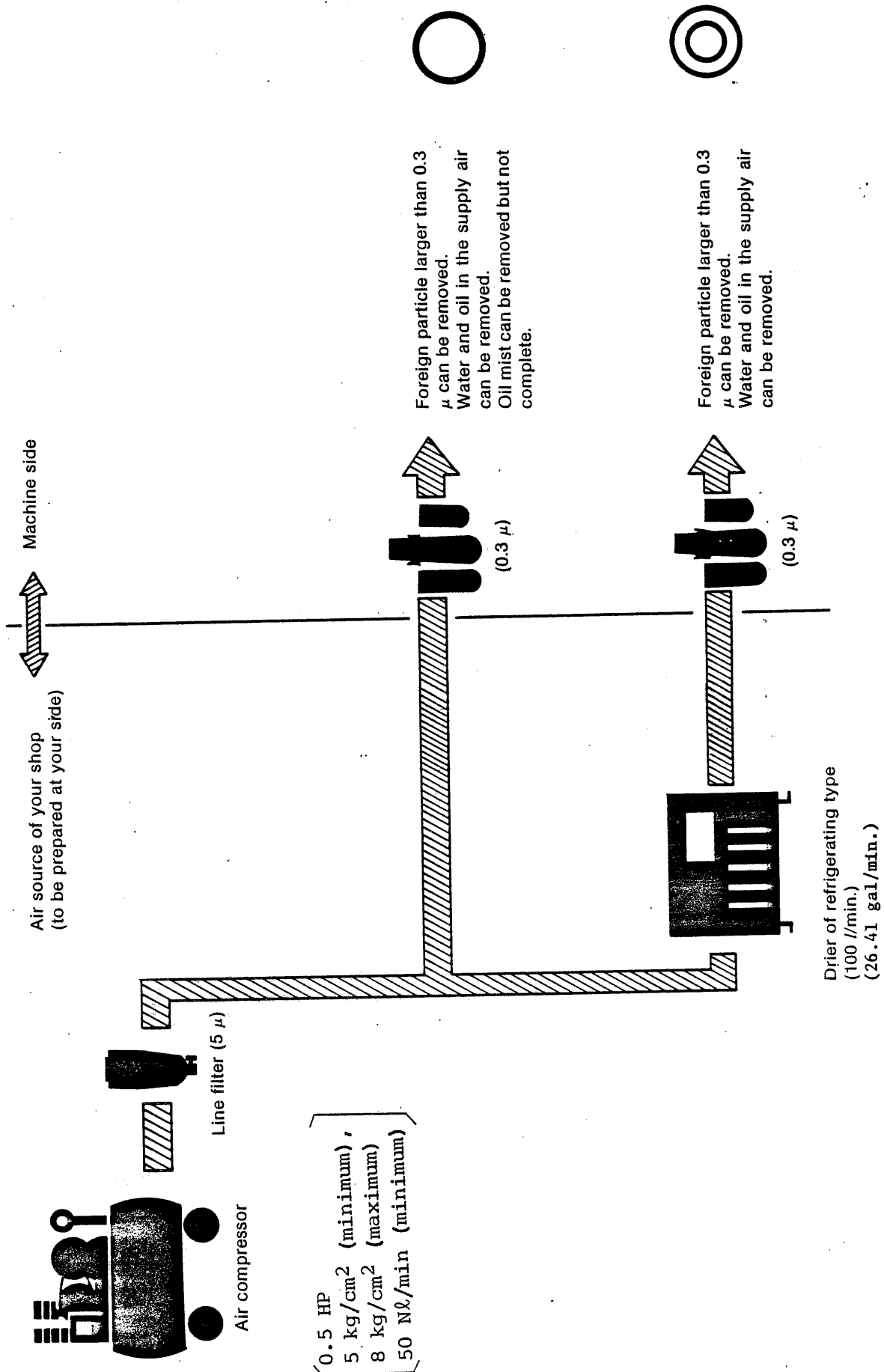
3-11 Pneumatics

1) Dehumidifying Supply Air

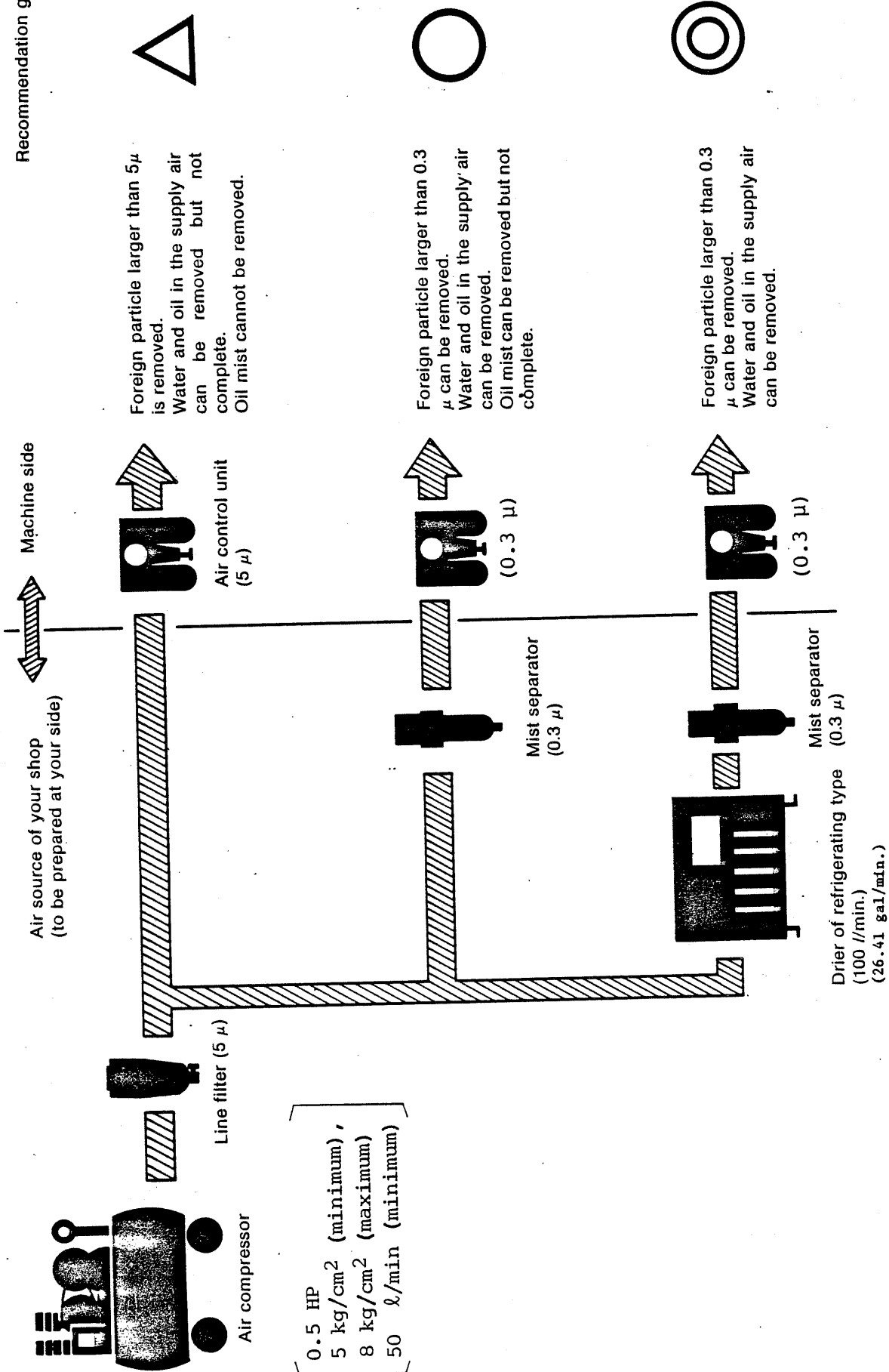
Shown in the following page are the air purifying systems. The compressed air usually contains water, dust, deteriorated oil, carbon particles and other foreign matter, and if the "dirty air" is used, various types of troubles of the pneumatic circuits and equipment will be resulted. Nine of the troubles of the pneumatic equipment are caused by the "quality" of the air being used. And once a trouble takes place, it not only lowers production efficiency, but also requires the machine to stop for maintenance. For the system to operate without troubles, it is of vital importance to supply clean air to the system. QUICK-TURN is equipped with the air control unit as indicated in the following page. Please select the proper air supply system meeting the quality of the air available in your shop.

* The three-piece air kit comprises an air filter, a mist separator and a lubricator at the air intake.

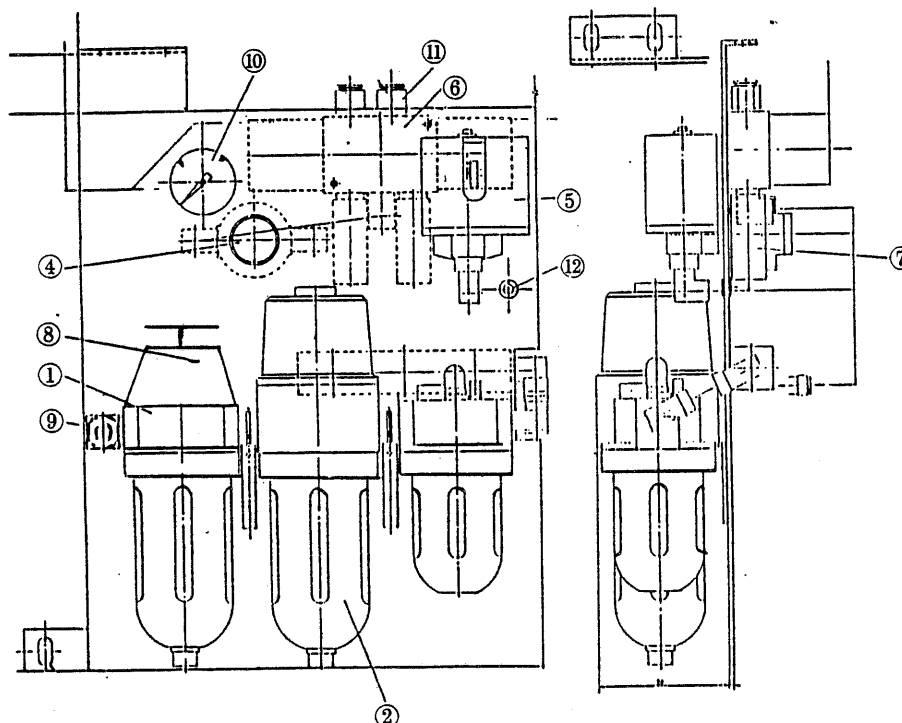
2) Air Purifying System



Recommendation grade



3) Air Valve Unit (INOA-2551) For automatic door open/close
For FLEX robot



No.	Part No.	Part Name	Q'ty	Remarks
1		Filter (with float type automatic drain)	1	AF411-03 x 213
		Filter Element	1	11104-5B
2		Mist Separator (with float type automatic drain)	1	AM311-03
		Separation Element	1	630123
		Coreracing Element	1	630125
		MC Cartridge	1	630127
3		Lubricator	1	AL400-03
4		Reducing Valve	1	AR211-03
5		Pressure Switch	1	IS300-02
6		Solenoid Valve	1	V4320-031V
7		Silencer	2	AN300-03
8		Reducing Valve	1	
9		Coupler	1	30PM.39SH (NITTO KOKI)
10		Pressure Gauge	1	G42-10-01
11		Pipe Joint	2	H10-03
12		Grommet	1	NG-79-D (TAKIGEN)

4) Precautions in Handling and Failure and Action of Oilers

Precautions in Handling Oiler:

- (1) After completion of flushing the air piping, connect the oiler.
- (2) The arrow relieved in the upper part indicates the air inlet. Carry out piping subject to the flowing direction indicated with the arrow. If connected in the reverse direction, the oiler will not function properly.
- (3) Direct the oiler casing (transparent vessel) downward. If directed laterally or upward, the oiler cannot be put into use.
- (4) Remove the oiling plug and fill the clean oil free from dust and water. An applicable oil is turbine oil #90. Do not apply a brake oil or spindle oil.
- (5) Fill the oil up to 80% of the vessel capacity (upper limit of the oil level). An excessively high oil level will cause the oiler to malfunction.
- (6) Use the needle valve stud to adjust the amount of oil to be dipped. Loosening the needle valve stud (turning it counterclockwise) will increase the amount of oil applied. Operate the needle valve stud manually. The use of a tool, etc., for operation may damage the needle, thus making the drip adjustment impossible. Tightening (turning clockwise) the stud will decrease the amount of oil applied.

- (7) Do not allow the plastic oiler casing to be affected by such organic solvents as thinner and alcohol or by such chemicals as carbon tetrachloride, chloroform, sulfuric acid, nitric acid, etc. Besides, avoid using the oiler casing in the atmosphere affected by such solvents and/or chemicals.
- (8) Avoid using the oiler at a place affected by direct sun beams or outdoors in a cold weather area. The ambient temperatures should be 5°C - 60°C.
- (9) Operate the oiler below the maximum working pressure of 9.9 kgf/cm² (140.81 PSI).
- (10) Apply a synthetic neutral detergent to clean the oiler casing. Do not apply a thinner, gasoline, alcohol, etc.

Failure and Action therefore

Failure	Cause	Action
Oil does not dip though air is flowing.	1. Needle valve stud is tightened too tightly.	1. Loosen needle valve stud. (Turn it counterclockwise.)
	2. Piping is connected in the wrong direction.	2. Change connection. (Let oil flow in the arrow-marked direction.)
	3. There is too large an amount of oil in vessel.	3. Reduce the oil.
	4. There is too small an amount of oil in vessel.	4. Fill the oil.
	5. Oiler is clogged with dust. (oil conduit, conduit nut, dipping tube inside the needle guide, oil circuit in the interior of oiler body, etc.)	5. Flush and remove the dust. (Prevent dust from entering.)

Failure	Cause	Action
Oil level is unadjustable.	<ol style="list-style-type: none"> 1. Needle valve stud is too loose. 2. The needle valve guide or needle valve to which dust has adhered could not be closed. 3. The needle valve or needle valve seat has had a scar or has broken. 	<ol style="list-style-type: none"> 1. Close the needle valve stud once. (Turn it clockwise. It can be turned manually.) Then, gradually loosen and adjust the stud. 2. Flush and remove the dust. 3. The affected part or parts must be replaced.
Oil is leaking out of the needle stud.	<ol style="list-style-type: none"> 1. Needle valve stud is too loose. 2. O-ring has been damaged. 	<ol style="list-style-type: none"> 1. Close the needle valve stud. 2. Replace the O-ring.
Air is leaking out of the casing at connections.	<ol style="list-style-type: none"> 1. Casing is loosely tightened. 2. O-ring has been damaged. 3. Casing has broken. 	<ol style="list-style-type: none"> 1. Clamp the casing onto the body. (Turn it clockwise.) 2. Replace the O-ring. 3. Replace the casing.

5) Precautions in Handling of Pressure Switches

(1) Adjustment

- o To set a pressure, turn the adjustment screw. Turning it in the (+) direction indicated on the cover will increase the set pressure and in the (-) direction will decrease the set value. Use a screwdriver to turn the adjustment screw. After completion of setting, fix it with a lock nut. The making/breaking differential pressure is fixed.

- o The dial should be used as a mere rough standard. Its reading error is within 0.5 kgf/cm^2 (7.11 PSI). Adjust the dial to a reading at the center of the indicator.

(2) Installation

- o The pressure switch may be installed either vertically or horizontally.
- o Locate the pressure switch behind the air filter.
Any foreign matter that may have entered in the switch of piston construction type would increase friction, resulting in a significant making/breaking differential pressure.
- o Do not locate the pressure switch at a place affected by direct sun beams, because its cover is made of a resin.

(3) Wiring

- o Wire the microswitch in accordance with the codes given on the nameplate attached to the microswitch. The pressure switch has terminal codes reversed as compared with those given on the microswitch.



NO: Normally operated terminal

NC: Normally closed terminal

C: Common terminal

6) Precautions in Handling and Failure and Action

Operating Instruction:

- (1) Before mounting the pressure reducing valve, flush the air valve to be connected to the pressure reducing valve. Dust, dirt or scale in the air line can result in malfunction or trouble of the pressure reducing valve.
- (2) The air inlet is indicated by the arrow carved in relief. Connect the air lines to the pressure reducing valve in the correct flowing direction. Otherwise, the pressure reducing valve would not operate normally.
- (3) For easy maintenance and inspection, it is recommended to mount the valve guide (at the end opposite to the handle) more than 60 mm (2.36 inch) from the pressure reducing valve.
- (4) Turning the pressure adjusting handle clockwise increases the secondary end pressure. To the contrary, turning it counterclockwise decreases the secondary pressure.
- (5) Never fail to manipulate the handle by the hand. If any tool is used, trouble can result.
- (6) After adjustment, tighten the lock nut securely. This will prevent the pressure adjusting screw from being moved by vibration of the machine. Thus, adjusted pressure will be maintained without deviation.
- (7) Avoid using the pressure reducing valve where temperature is high due to the direct sunlight. Do not install the pressure reducing valve outdoors in a cold district. The ambient temperature suitable to the pressure reducing valve is 5°C to 60°C.

- (8) Use the pressure reducing valve at the pressure not exceeding the maximum operating pressure of 9.9 kgf/cm^2 (140.81 PSI).

The secondary end pressure can be adjusted in the range of 0.5 to 8.5 kgf/cm^2 (7.11 to 120.90 PSI).

Trouble Shooting Chart

Trouble	Possible cause	Remedy
Pressure can not be adjusted.	<ol style="list-style-type: none"> 1. Air flows reversely. Valve is mounted in the reverse direction. 2. Damaged pressure adjusting spring. 3. Damaged valve spring. 4. Valve seat is clogged with dust. 5. Damaged rubber lining for valve. 6. Broken diaphragm. 	<ol style="list-style-type: none"> 1. Check flowing direction. Mount valve in the correct direction if necessary. 2. Replace it with a new one. 3. Replace it with a new one. 4. Remove valve guide and wash valve body and valve seat. 5. Replace valve with a new one. 6. Replace it with a new one.
Secondary pressure will not become zero when pressure adjusting handle is loosened.	<ol style="list-style-type: none"> 1. Valve seat is clogged with dust. 2. Damaged rubber lining for valve. 3. Damaged valve spring. 	<ol style="list-style-type: none"> 1. Wash valve body and valve seat. 2. Replace valve with a new one. 3. Replace it with a new one.
Air leaks from small hole in bonnet.	<ol style="list-style-type: none"> 1. Broken diaphragm. 	<ol style="list-style-type: none"> 1. Replace it with a new one.
Air leaks from a portion near bonnet screws.	<ol style="list-style-type: none"> 1. Loosened bonnet screws. 2. Broken diaphragm. 	<ol style="list-style-type: none"> 1. Tighten them evenly. 2. Replace it with a new one.

7) Precautions in Handling and Failure and Action of Filters with Automatic Drain Unit

Handling the Automatic Drain Unit:

The drain separated in the filter will deposit in the filter casing. This drain has been heretofore discharged, with a manual valve manually opened. Therefore, its discharge has been often neglected, resulting in such an accident that the drain excessively deposited is flowing into piping.

Employing the automatic drain filter, however, will eliminate such accident, because drain is automatically discharged as gathered from the construction and operation explained herein. Thus, you are released from the operation of opening a drain valve periodically.

(1) How to Install:

1. Adjust the air flowing direction to the arrow mark and install the filter vertically, with casing side down. (The inlet is on the relieved arrow mark side.)
2. If too long a thin tube is connected to the drain discharge port, a back pressure will be produced, resulting in an impediment to the operation. This should be strictly avoided.

(Drain piping should have a bore of above $\phi 6$.
Piping length should be kept within 5 meters.)

(2) Causes of Failure and Action therefore

Failure	Cause	Action
Air resistance is high. (Flow decreases.)	Filter element is clogged.	Disassemble and wash.
Air or drain does not stop bursting out of drain discharge port.	1. Working pressure is 1.5 kgf/cm ² G (22.33 PSI) (bar) and below. (Compressor capacity is too small.)	Compressor with a capacity of 0.4 kW or more (with a discharge of 50 Nℓ/min. and above) should be employed.
	2. Orifice plate is clogged.	Disassemble and wash.
	3. Valve is damaged.	Replace valve.
	4. O-ring is damaged.	Replace O-ring.
	5. Filter is inclinedly installed.	Vertically install.
	6. Cap is clogged.	Disassemble and wash.
Dain is not discharged out of drain discharge port.	1. Pressure is beyond working pressure range.	Use filter within working pressure range of 1.5 thru 9.9 kgf/cm ² G bar.
	2. Nozzle of chamber is clogged.	Pierce nozzle with a needle or the like to remove clogging matter.

The automatic drain filter scarcely fails. Should failure take place, recover the normality in accordance with the procedure specified above. If repairing is impossible, contact our sales office or shop. Repairing will be promptly carried out. Most of the malfunctions, meanwhile, have been often caused with solids or viscous substances in the drain. Periodically cleaning the filter in the interior, therefore, will surely prolong the service life of the automatic drain filter.

(3) Precautions

1. Never allow an organic solvent, such as thinner, carbon tetrachloride, trichloroethylene, alcohol or the like, to stick to the filter casing (transparent vessel) which is made of a resin.
2. If the filter is put into use at the location where an organic solvent is likely to stick or under such an atmosphere as possibly affected by an organic solvent, employ the filter with a casing guard or with a metal casing.
3. Avoid the location where the filter is directly exposed to the sunshine and do not fail to use it at a temperature of 60°C and below.
4. Use a neutral detergent to clean the filter in the interior.

8) Precautions in Handling and Failure and Action of Solenoid Valve

(1). Installation

1. The valve may be mounted in any direction provided that the double solenoid valve and three-position valve should be so mounted that the main valve spool may be positioned horizontally.

If possible, avoid mounting the valve at a place where it is likely to be vibrated.

If it is absolutely necessary to mount the valve in such a place, the valve should be so mounted that the main valve spool and pilot valve spool may form a right angle with the direction of the vibration. The vibration resistance of the valve is below 5 g (0.18 oz).

2. Never fail to flush both primary end (supply pressure port end) and secondary end (machine port end) lines to completely remove dust, dirt, scale and other foreign objects which have stuck to the lines.

(2) Trouble Shooting

1. Tracing the cause

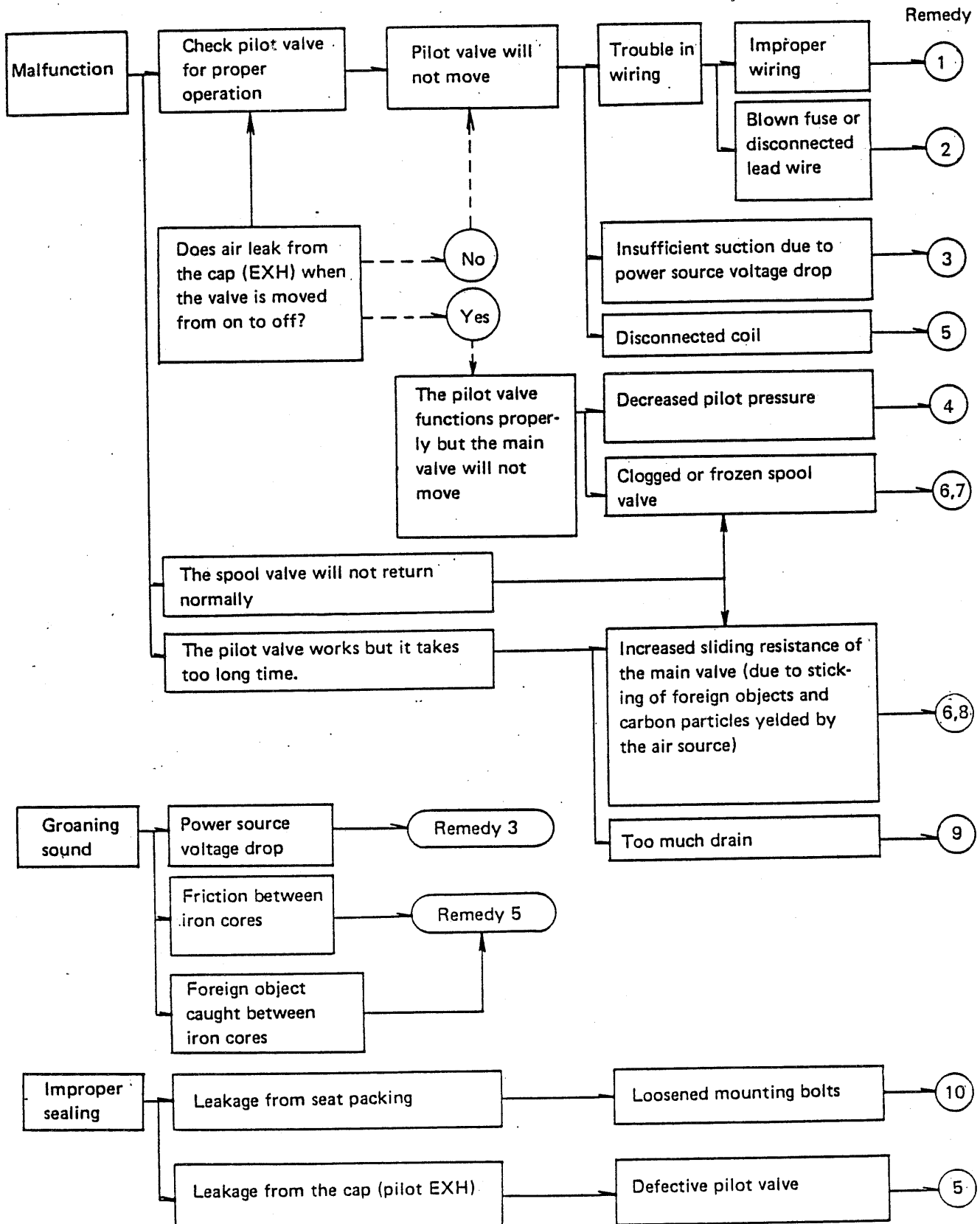
Step 1: What is the trouble?

- (1) Malfunction?
- (2) Groaning sound?
- (3) Improper sealing?

Step 2: Analyze the trouble and check the most likely causes one by one, considering the operating conditions.

Step 3: If the cause of the trouble has been found, take proper remedial measures according to "Remedial measures" in 10-2-3. For replacement of the valve assembly, refer to "11. ASSEMBLING SOLENOID VALVE".

2. Trouble shooting chart



3. Remedial measures

No.	Remedy
1	Connect the wire properly.
2	Replace the parts and connect the wire.
3	Adjust the power source voltage.
4	Adjust the pressure within the specified range.
5	Replace the housing assembly.
6	Remove the main valve spool and sleeve valve. Remove foreign objects.
7	Take anti-freezing measures.
8	Improve the conditions of the air source.
9	Take proper measures to remove the drain.
10	Re-tighten the mounting bolts securely.

To customer:

In case any trouble should arise, please return the valve to us as it is.

9) Precautions in Handling and Failure and Action of Mist Separators (with Automatic Drain Unit)

(1) How to Install:

1. Install the mist separator at a location with the lowest possible air temperature in the pneumatic pipeline. It is recommended to especially locate the mist separator just before an aftercooler.
2. The mist separator may be employed in a terminal device because of a temperature gradient or of a difficulty in flushing. In such a case, install the mist separator just before a reducing valve, if any.
3. Make certain of IN and OUT and carry out piping, with drain outlet side down.
4. Do not connect too long a thin pipe to the drain discharge port. If so, a back pressure will be generated, thus impeding the automatic drain unit from operating properly. For discharge piping, employ a pipe with a bore of 6 and above. Do not extend piping beyond 5 meters (16.4 ft.). Besides, employ an air compressor with a capacity of 0.4 kW and above (discharge: 50Nℓ/min. or more).

(2) Cause of Failure and Action therefor

The mist separator scarcely fails. If any, compressed air may not stop bursting out of the discharge port although the pressure has risen or no drain may be discharged although deposited. In such a case, repair in accordance with the procedure specified below. If repairing is impossible, contact our sales office or shop. Repairing will be promptly carried out. Most of the malfunctions, meanwhile, have been often caused with

solids or viscous substances in the drain. Periodically cleaning the filter in the interior, therefore, will surely prolong the service life of the mist separator.

Failure	Cause	Action
Air or drain does not stop bursting out of drain discharge port.	1. Working pressure is 1.5 kgf/cm ² G (bar) and below.	Employ a compressor with a capacity of 0.75 kW or more. (With a discharge of 100 Nℓ/min. and above.)
	2. Orifice plate is clogged.	Disassemble and wash.
	3. Valve is damaged.	Replace valve.
	4. O-ring is damaged.	Replace O-ring.
	5. Separator is inclinedly installed.	Vertically install.
	6. Cap is clogged.	Disassemble and wash.
Drain is not discharged out of drain discharged port.	1. Pressure is beyond working pressure range.	Use filter within working pressure range of 1.5 thru 9.9 kgf/cm ² G (21.3 thru 140.8 PSI) (bar).
	2. Nozzle of chamber is clogged.	Pierce nozzle with a needle or the like to remove clogging matter.

(3) Precautions

1. Flush piping in the interior without fail or use a new piping material.
2. Never allow an organic solvent, such as thinner, carbon tetrachloride, trichloroethylene, alcohol or the like, to stick to the transparent casing which is made of a resin.
3. If the mist separator is put into use at the location where an organic solvent is likely to stick or under such an atmosphere as possibly affected by an organic solvent, employ with a casing guard or with a metal casing.
4. Use a neutral detergent to clean the filter in the interior.

(4) Replacing Element

While operating for long hours, the mist separator will have its element clogged with scale, etc. and the pressure will come to drop more and more significantly. Once a year or when a pressure drop reaches 1 kgf/cm^2 (bar), replace the element with a new one.

(5) Specification

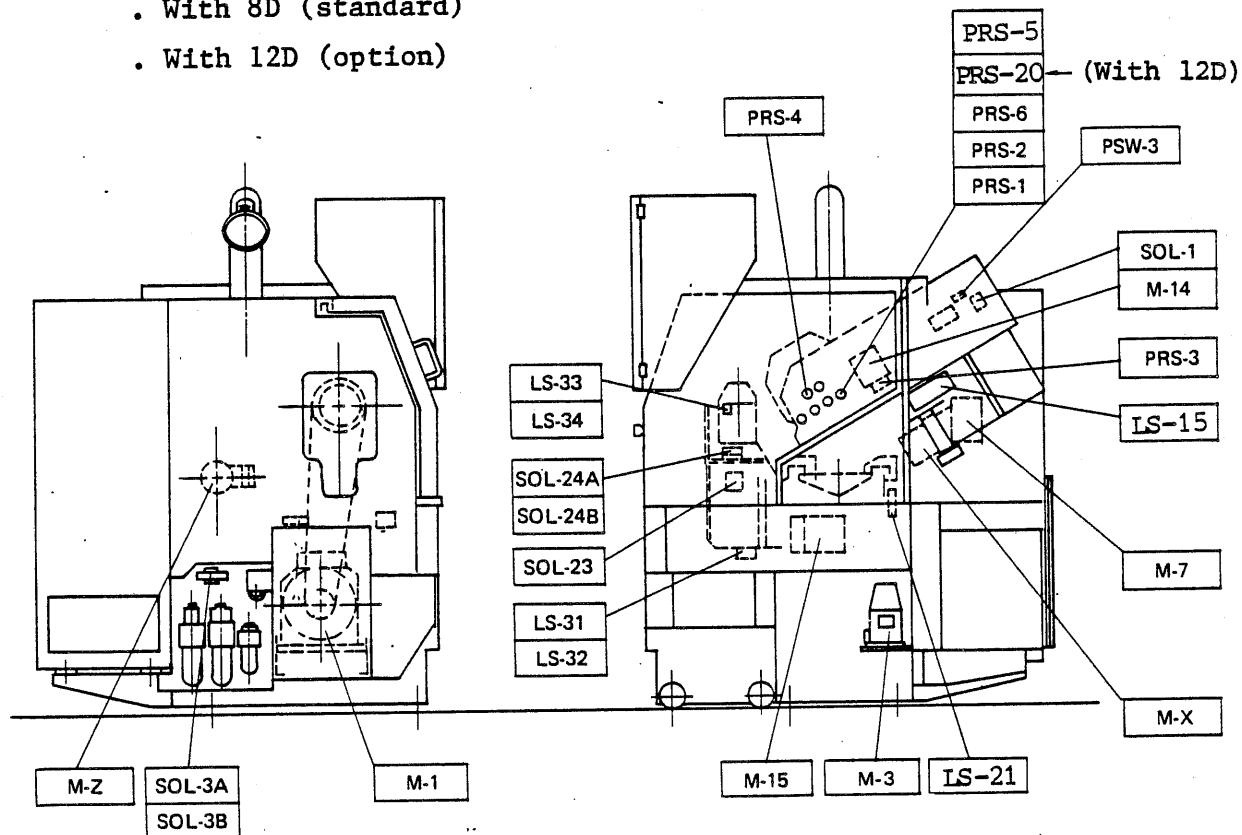
Working pressure range : $1.5 - 9.9 \text{ kgf/cm}^2 \text{G}$
(21.3 - 140.9 PSI)
(1.5 - 9.9 bar)

Working temperature range : $5 - 60^\circ\text{C}$

3-12 Switches on Machine

Arrangement and numbers of switches, motors and valves

- . With 8D (standard)
- . With 12D (option)

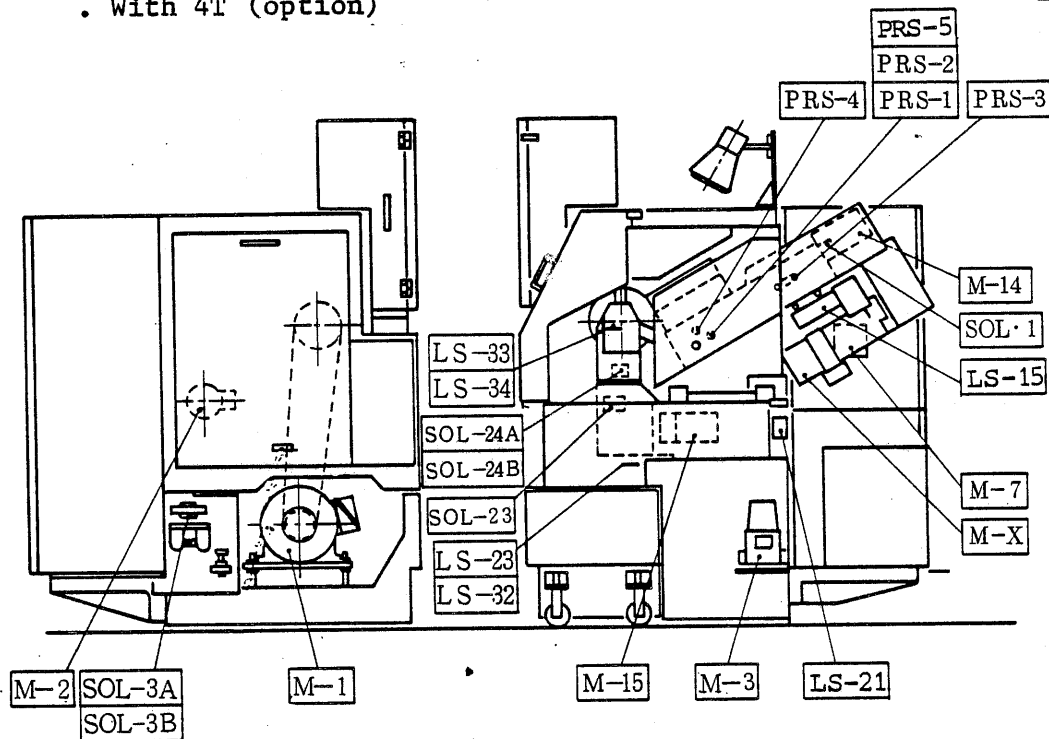


M-1	Spindle Drive Motor Drives the spindle.	5.5/7.5 kW	See the attached sheet. (Mitsubishi)
M-3	Coolant Pump Drive Motor Vacuum type pump to deliver coolant.	180 W	NQ-180J (Mitsubishi)
M-7	Slideway Lubrication & Ball Screw Pump Drive Motor Drives lube pump.	3 W	MMXW x 1 (Lube)
M-14	Turret Index Motor Unclamps, indexes and clamps the turret.	100 W	91K100G-3...8D,12D (Mitsubishi) B0235-464...4T (Oriental)
M-15	Tailstock Body Positioning Motor Moves the tailstock body in Z-axis direction.	100 W	91K100GF-AF (Mitsubishi)

M-X	X-Axis Drive Motor Servo motor to drive the cross slide	0.8 kW	HD-81-12S (Mitsubishi)
M-Z	Z-Axis Drive Motor Servo motor to drive the carriage.	0.8 kW	HD-81-12S (Mitsubishi)
M-5	Chip Conveyor Drive Motor Used to drive the chip conveyor.	0.1 kW	(Mitsubishi)
SOL-1	Turret Clamp Controls oil pressure for turret clamp.		SA-G01-A3X-C1-10 (Nachi)
SOL-3A	Chuck Open		SA-G01-C5-C1-11 (Nachi)
SOL-3B	Chuck Close Controls oil pressure to chuck operating cylinder.		
SOL-23	Tailstock Body Clamp Controls oil pressure for clamping the tailstock body against bed.		SA-G01-A3X-C1-10 (Nachi)
SOL-24A	Tailstock Spindle Advance		SA-G01-C6-C1 (Nachi)
SOL-24B	Tailstock Spindle Retract Controls oil pressure for tailstock spindle operation.		
SOL-30	Turret Clamp 2 Controls air flow for turret clamp 2.		
LS-15	Home Position - X-Axis Used for zeroing X-axis.		SL1-KK (Yamatake)
LS-21	Home Position - Z-Axis Used for zeroing Z-axis.		SL1-KK (Yamatake)
LS-31	Tailstock Body Advance End Limits tailstock body advance end position.		SL1-EK (Yamatake)
LS-32	Tailstock Body Retract End Limits tailstock body retract end position.		SL1-EK (Yamatake)
LS-33	Tailstock Spindle Advance Confirmation Detects tailstock spindle advance position.		SL1-EK (Yamatake)
LS-34	Tailstock Spindle Retract Confirmation Detects tailstock spindle retract position.		SL1-EK (Yamatake)

PRS-1	Turret Position Confirmation #1	FL1-2D6-E3 (Yamatake)
PRS-2	Turret Position Confirmation #2 Eight turret indexed positions are detected by the combination of ON/OFF state of the proximity switches.	FL1-2D6-E3 (Yamatake)
PRS-3	Turret Index Controls ON/OFF of the turret index induction motor.	FL1-2D6-E3 (Yamatake)
PRS-4	Turret Clamp Confirms turret clamp.	FL1-2D6-E3 (Yamatake)
PRS-5	Parity for tool No. detector proximity switch confirms turret unclamp.	FL1-2D6-E3 (Yamatake)
PRS-6	Turret Position Confirmation #3 Eight turret indexed positions are detected by the combination on ON/OFF state of the proximity switches.	FL1-2D6-E3 (Yamatake)
PRS-20	Turret Position Confirmation #4 (with 12D) Twelve turret indexed positions are detected by the combination of ON/OFF state of the proximity switches.	

. With 4T (option)

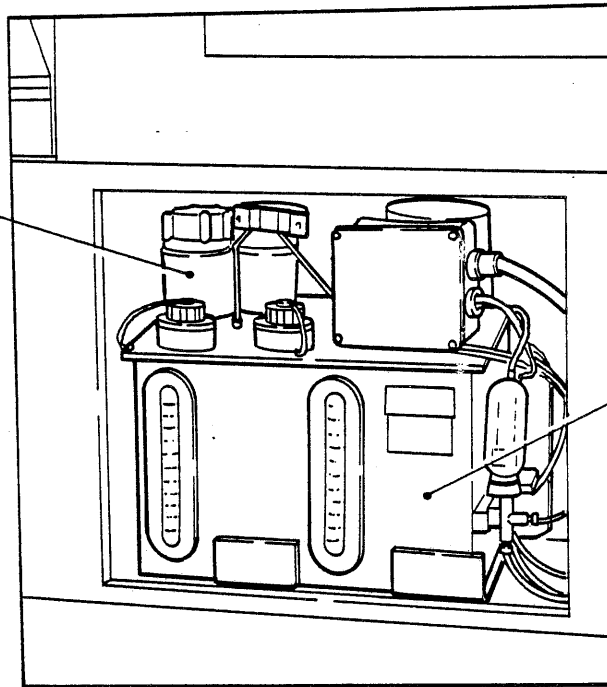


M-1	Spindle Drive Motor Drives the spindle.	5.5/7.5 kW	See the attached sheet. (Mitsubishi)
M-3	Coolant Pump Drive Motor Vacuum type pump to deliver coolant.	180 W	NQ-180J (Mitsubishi)
M-7	Slideway Lubrication Pump Drive Motor Drives lube pump.	3 W	MMXL x 2 (Lube)
M-14	Turret Index Motor Unclamps, indexes and clamps the turret.	100 W	91K100GF (Matsushita)
M-15	Tailstock Body Positioning Motor Moves the tailstock body in Z-axis direction.	100 W	91K100GF (Matsushita)
M-X	X-Axis Drive Motor Servo motor to drive the cross slide	0.8 kW	HD-81-12S (Mitsubishi)
M-Z	Z-Axis Drive Motor Servo motor to drive the carriage.	0.8 kW	HD-81-12S (Mitsubishi)
M-5	Chip Conveyor Drive Motor Used to drive the chip conveyor.	0.1 kW	(Mitsubishi)

SOL-1	Turret Clamp Controls oil pressure for turret clamp.	SA-G01-C5-C1-11 (Nachi)
SOL-3A	Chuck Open	SA-G01-C5-C1-11 (Nachi)
SOL-3B	Chuck Close Controls oil pressure to chuck operating cylinder.	
SOL-23	Tailstock Body Clamp Controls oil pressure for clamping the tailstock body against bed.	SA-G01-A3X-C1-10 (Nachi)
SOL-24A	Tailstock Spindle Advance	SA-G01-C6-C1 (Nachi)
SOL-24B	Tailstock Spindle Retract Controls oil pressure for tailstock spindle operation.	
LS-15	Home Position - X-Axis Used for zeroing X-axis.	SL1-KK (Yamatake)
LS-21	Home Position - Z-Axis Used for zeroing Z-axis.	SL1-KK (Yamatake)
LS-31	Tailstock Body Advance End Limits tailstock body advance end position.	SL1-KK (Yamatake)
LS-32	Tailstock Body Retract End Limits tailstock body retract end position.	SL1-EK (Yamatake)
LS-33	Tailstock Spindle Advance Confirmation Detects tailstock spindle advance position.	SL1-EK (Yamatake)
LS-34	Tailstock Spindle Retract Confirmation Detects tailstock spindle retract position.	SL1-EK (Yamatake)
PRS-1	Turret Position Confirmation	FL1-2D6-E3 (Yamatake)
PRS-2	Turret Position Confirmation Eight turret indexed positions are detected by the combination of ON/OFF state of the proximity switches.	FL1-2D6-E3 (Yamatake)

PRS-3	Turret Index Controls ON/OFF of the turret index induction motor.	FL1-2D6-E3 (Yamatake)
PRS-4	Turret Clamp Confirms turret clamp.	FL1-2D6-E3 (Yamatake)
PRS-5	Parity for tool No. detection proximity switch confirms turret unclamp.	FL1-2D6-E3 (Yamatake)

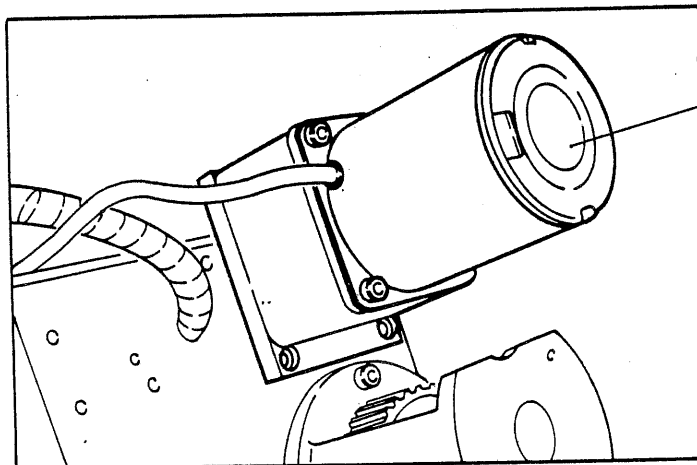
Line Filter



Lubrication Pump

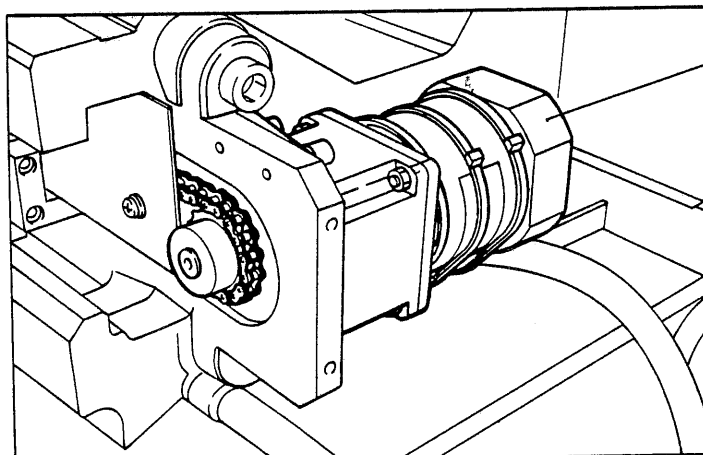
Slideway lubrication pump (M-7)

Ignition Motor



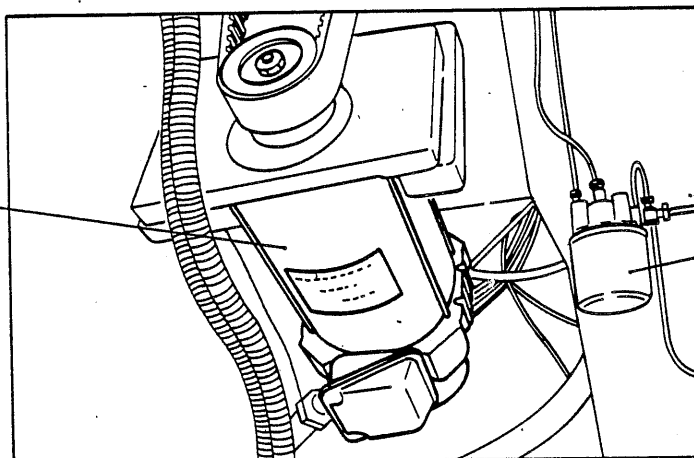
Turret index motor (M-14)

Induction Motor



Tailstock body positioning motor (M-15)

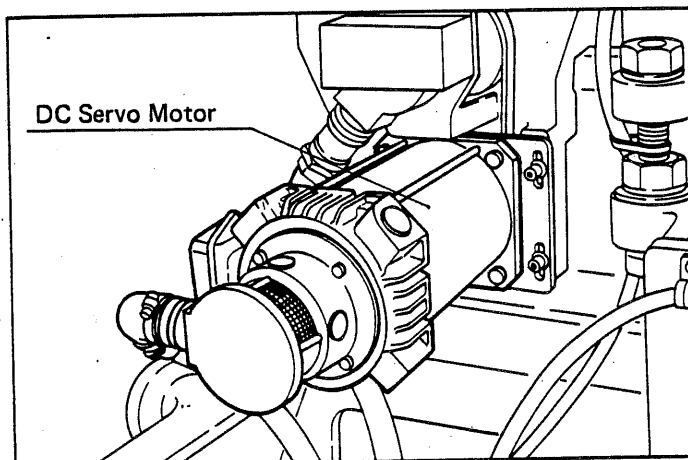
DC Servo Motor



Line Filter

X-axis drive motor (M-X)

DC Servo Motor



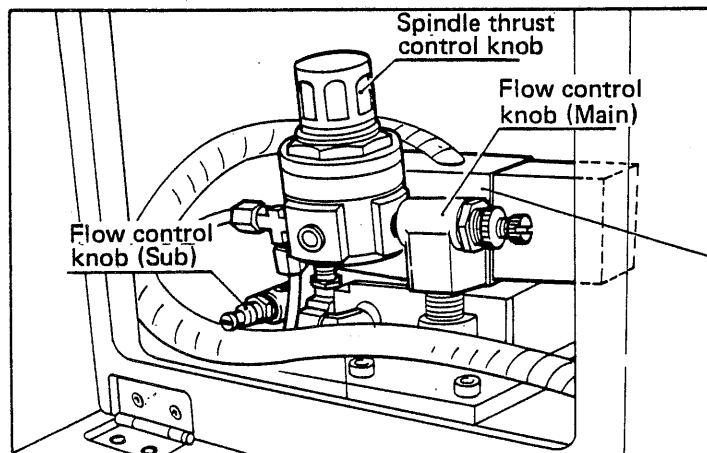
Z-axis drive motor (M-Z)

Flow control knob (Sub)

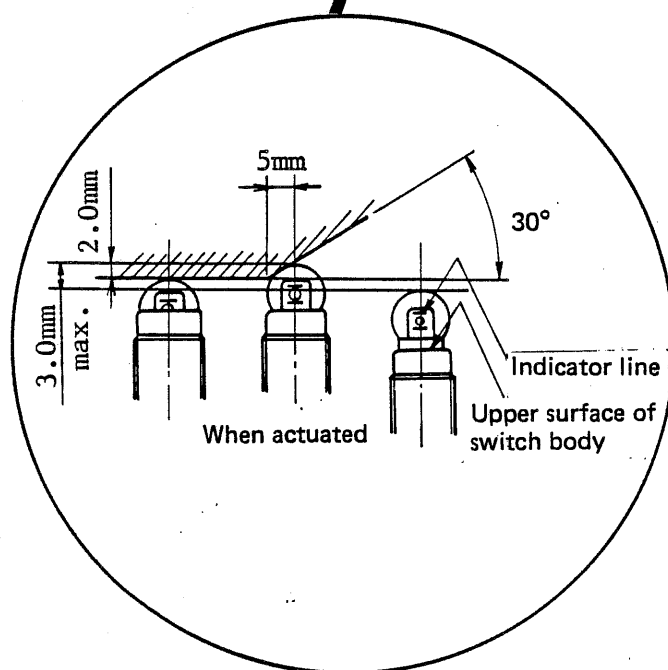
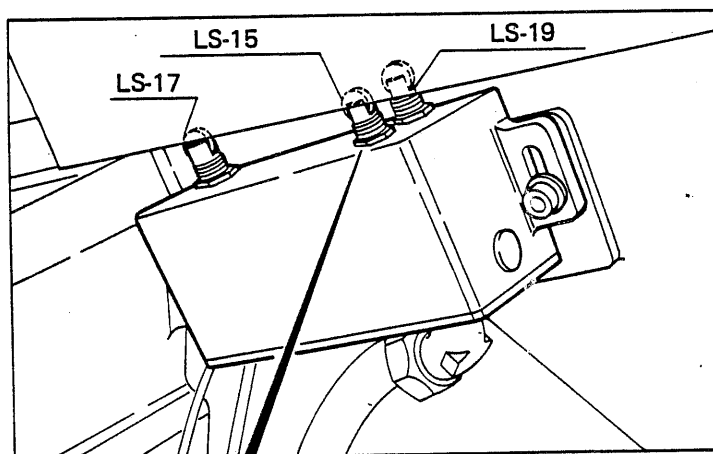
Spindle thrust control knob

Flow control knob (Main)

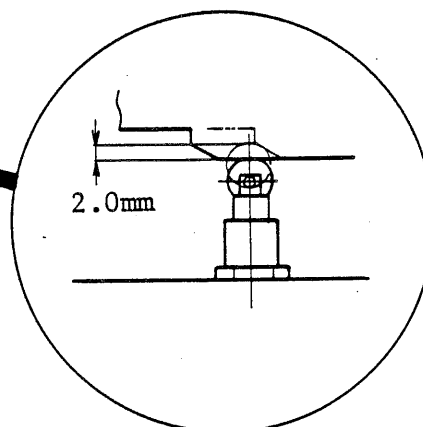
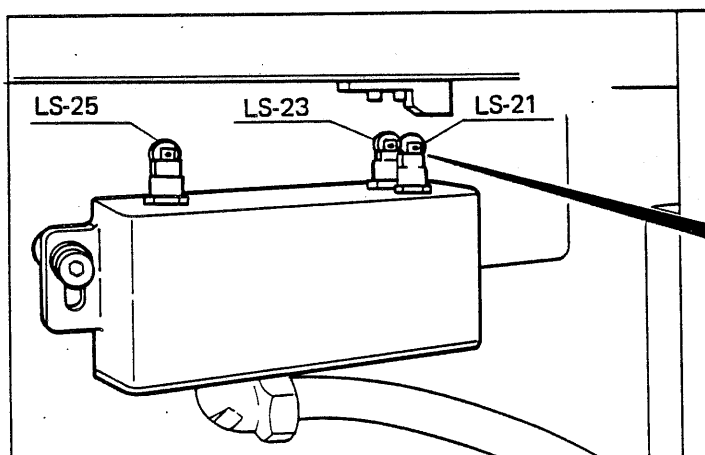
Solenoid Valve



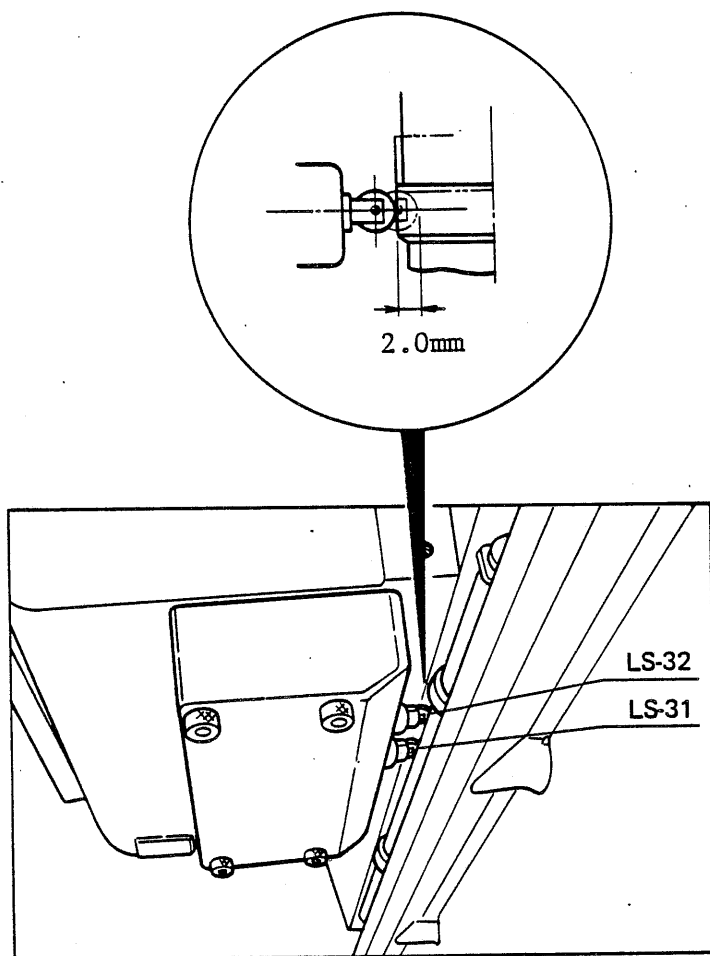
Tailstock spindle advance, retract (SOL-24A, 24B)



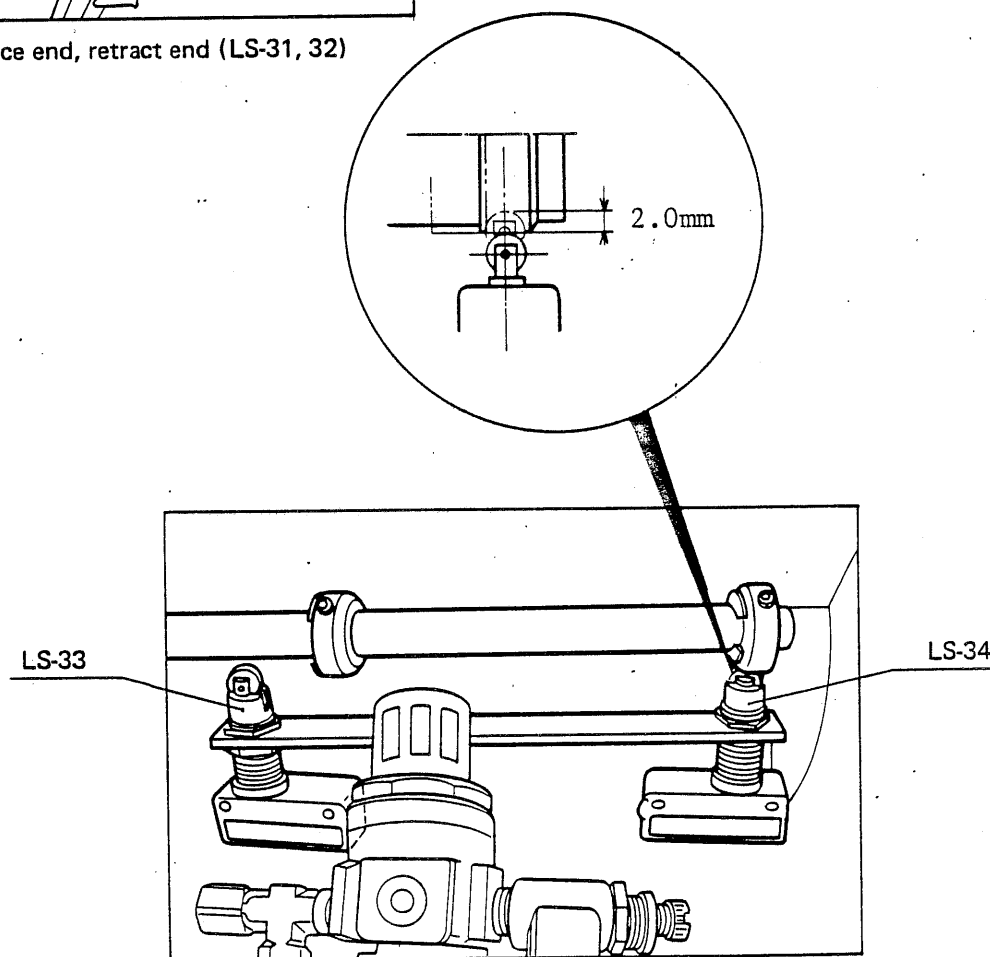
X-axis limit switch (LS-15, 17, 19)



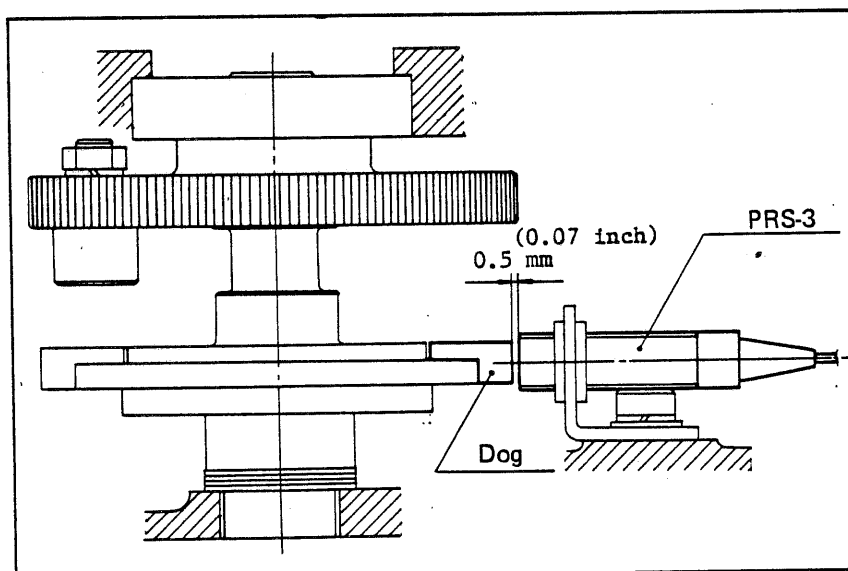
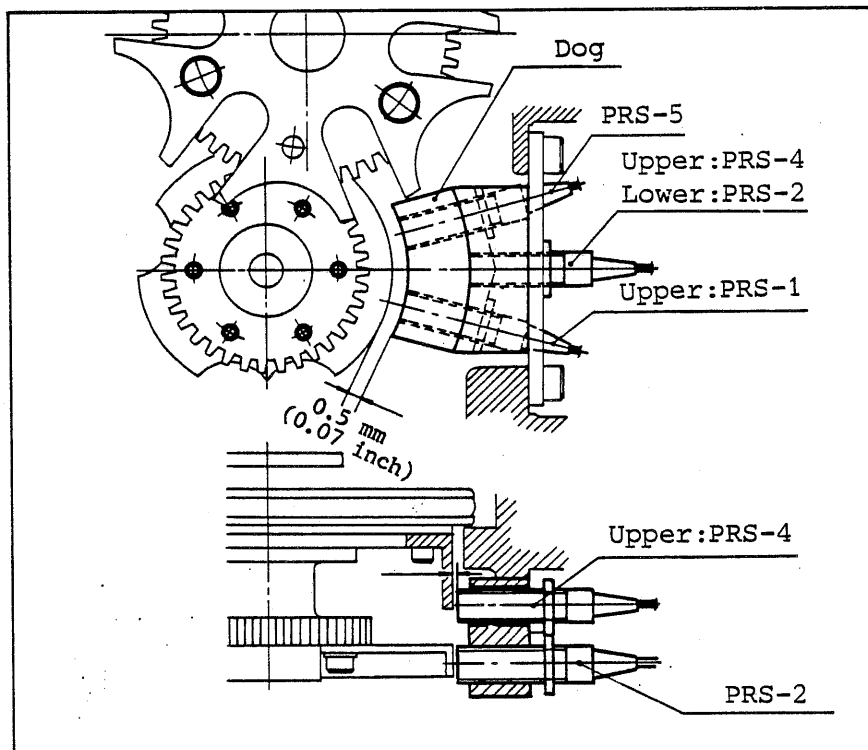
Z-axis limit switch (LS-21, 23, 25)



Tailstock body advance end, retract end (LS-31, 32)



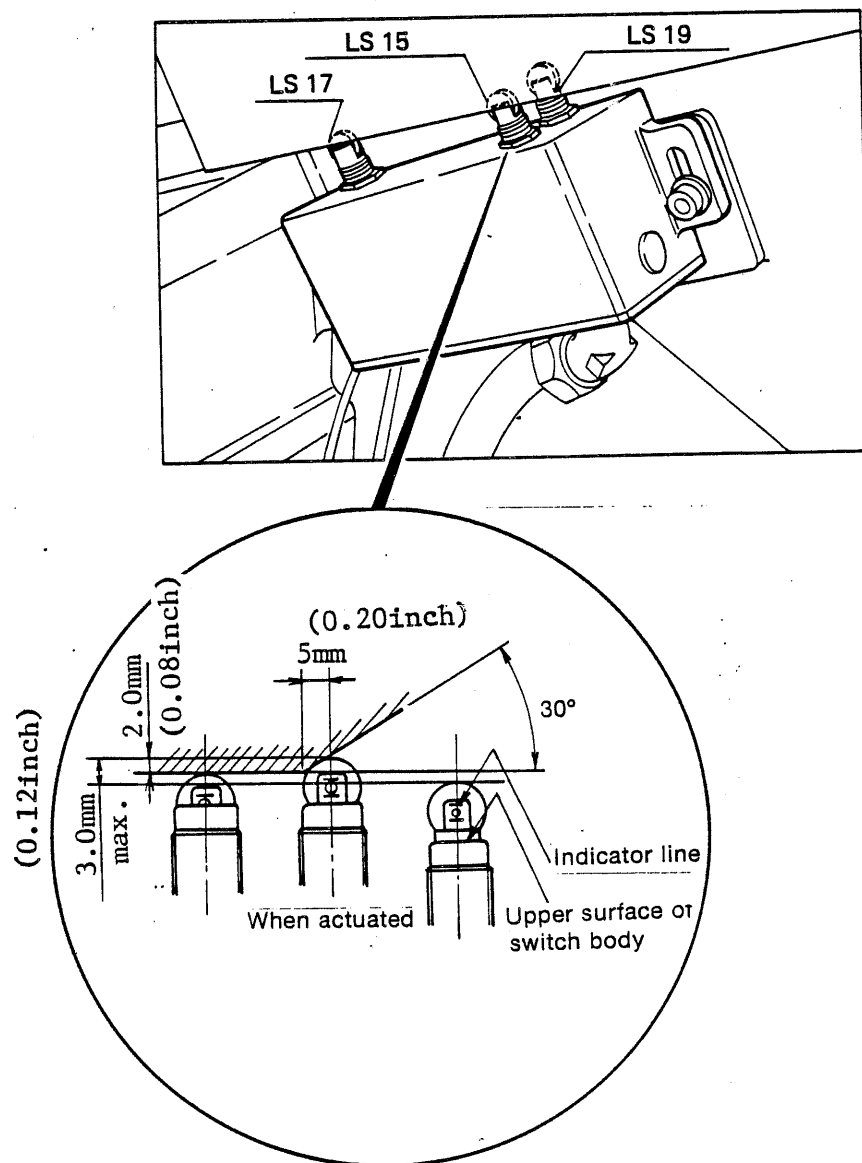
Tailstock spindle advance, retract confirmation (LS-33, 34)



Turret index

Adjustment of Limit Switch

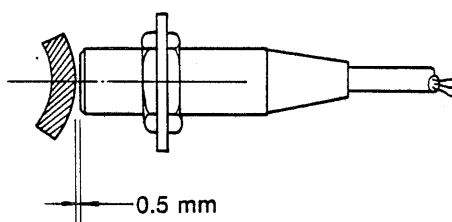
1. Micro Switch



Set the roller pressing-in stroke (roller stroke from actuated position to fully pressed-in position) to 2.0 mm. Observe the indicator lines at the side of the roller when the micro switch reaches the most projected position of the dog: the upper surface of the switch body (blue) should be at the center of the two indicator lines.

2. Proximity Switch

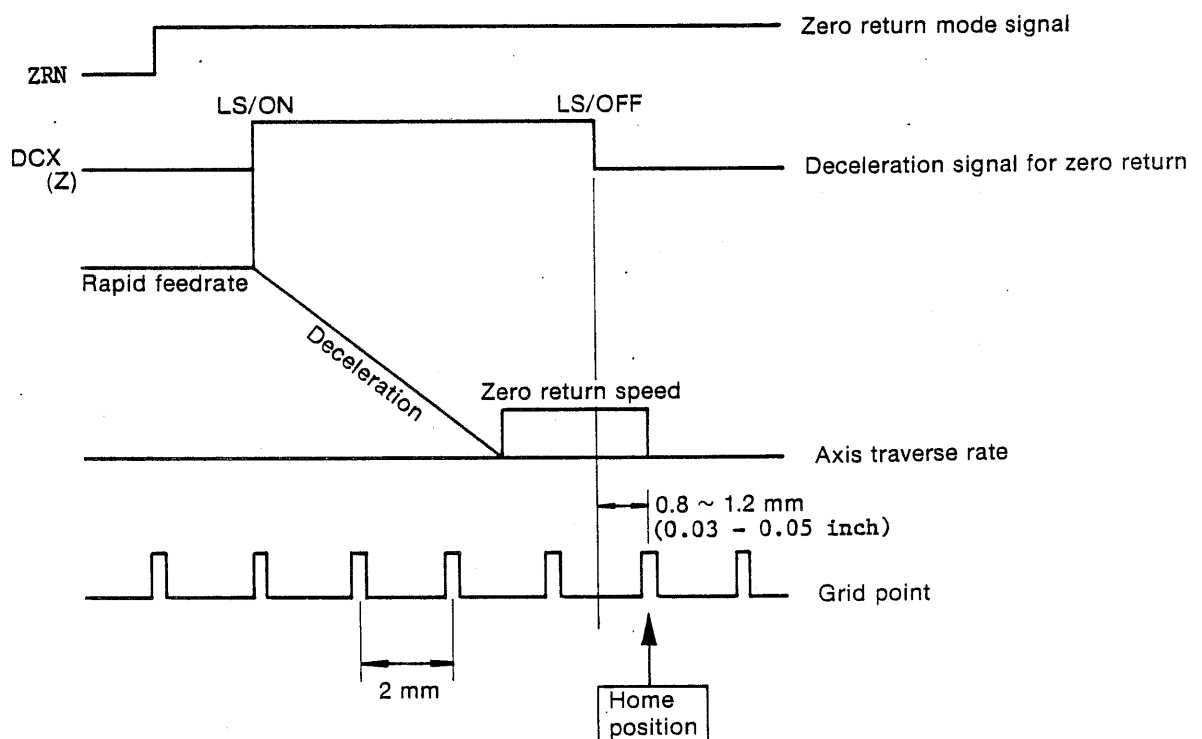
Adjust the position of the proximity switch until the clearance between the dog and the proximity switch is set to 0.5 mm (0.02 inch).



3-13 Zero Return

Zero Return Sequence

- 1) Press the Zero return switch on the operator's control console.
- 2) Zero return the desired axis from a point more than 30 mm (1.18 inch) away from the home position by turning the monolever switch in the positive direction.
- 3) The carriage (Z-axis) or cross slide (X-axis) moves at a rapid feedrate toward the home position. When the home position limit switch is actuated by the dog, deceleration for zero return signal is transmitted and axis traverse rate is decelerated. After that the axis moves at the decelerated speed.
- 4) When the grid point signal from the resolver is turned on after the home position limit switch is turned off, axis move stops and the axis is positioned to the home position. The home positioned indicator light goes on at the same time.



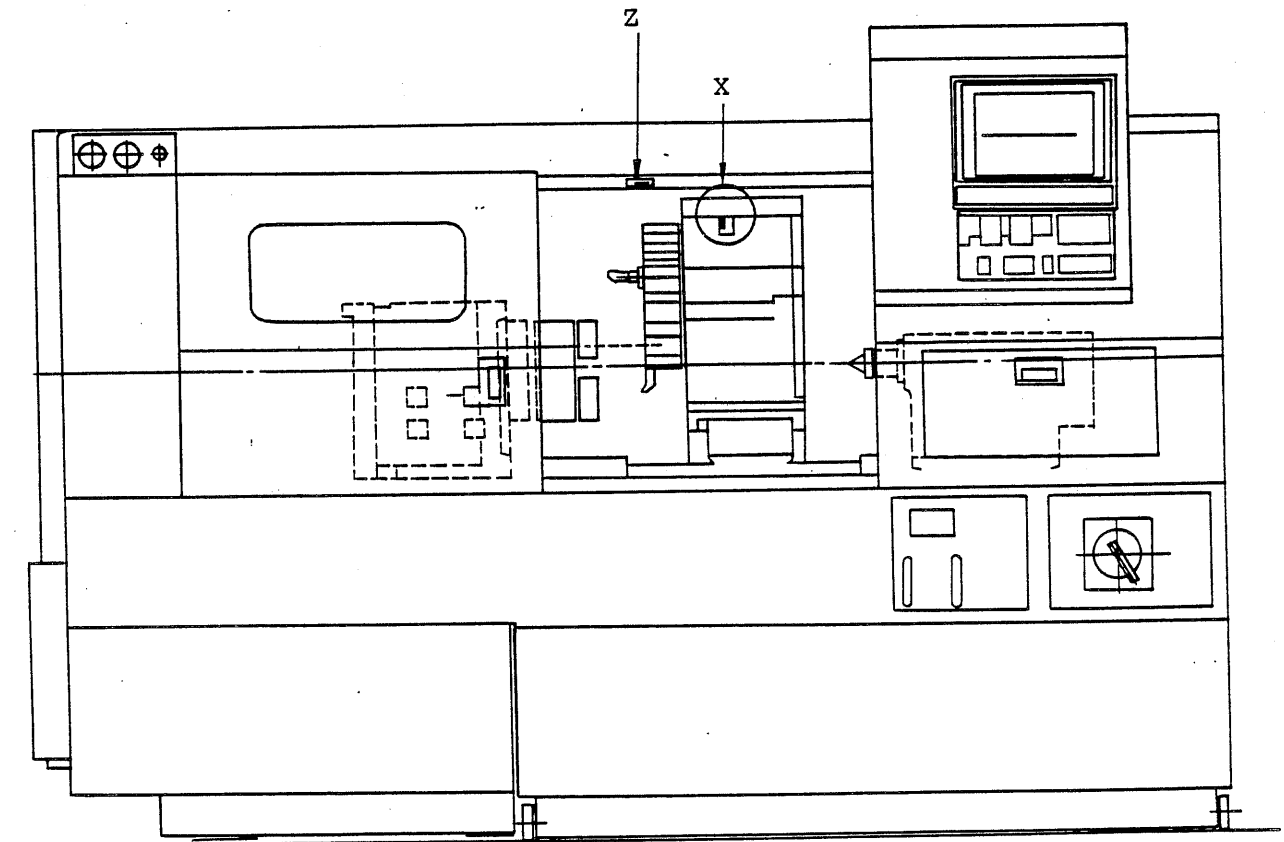
How to Determine Home Position

X-Axis

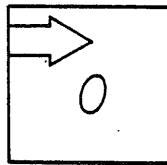
After carrying out OD turning on the test piece (round bar) clamped in the chuck, measure the finished diameter precisely (measured diameter = D). Bring the turret near the finished surface of the test piece and then measure the clearance between the turret front face and the test piece. Provided the measured clearance be L_x , present position of the turret can be calculated in the following equation.

X and Z axes zero return

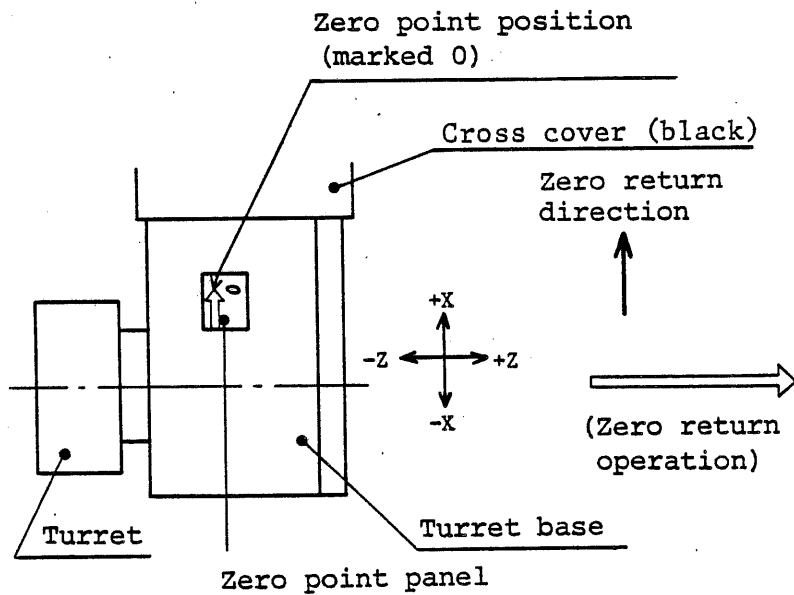
Zero return for X and Z axes is conducted as follows.



(1) X-axis



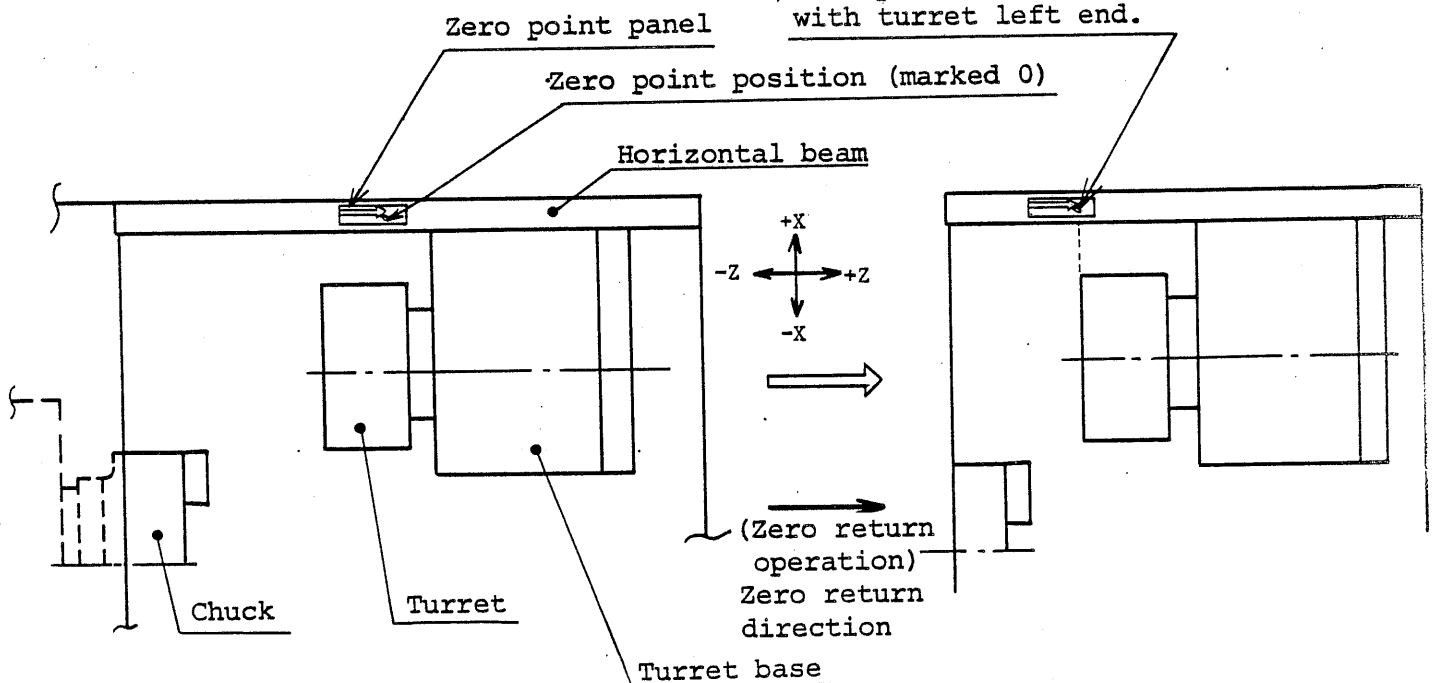
Zero point mark (0) is half hidden.



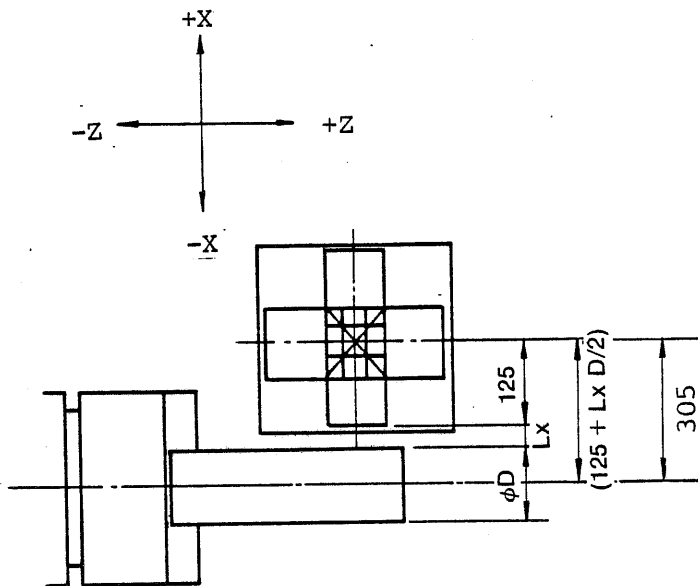
Before carrying out zero return: X axis

(2) Z-axis

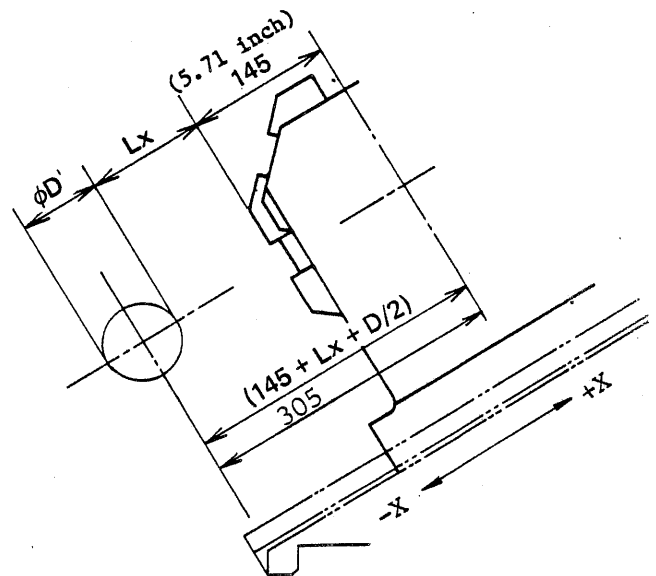
Zero point mark coincides with turret left end.



Before carrying out zero return: X-axis X axis has been zero-returned.



(With 4T (option))



(With 8D (standard))
(With 12D (option))

As known from the program diagram, home position of X-axis is taken at a point 305 mm (12.01 inch) (with 8D (standard), with 12D (option), with 4T (option)) from the spindle center, move X-axis as much as $[305 - (125 + Lx + D/2)]$ (in inch: $[12.01 - (4.92 + Lx + D/2)]$), observing the position display. Then the reached point is the home position on X-axis.

Z-Axis

Home position of Z-axis can be determined in the same manner as determining X-axis home position.

Home position of:

. With 8D (standard), with 12D (option)

Chucker 430 mm (16.93 inch)

Universal 650 mm (25.6 inch)

(from end face of the spindle)

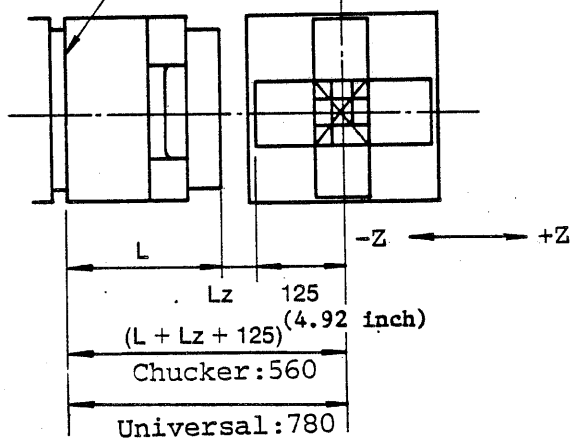
. With 4T (option)

Chuckler 560 mm (22.05 inch)

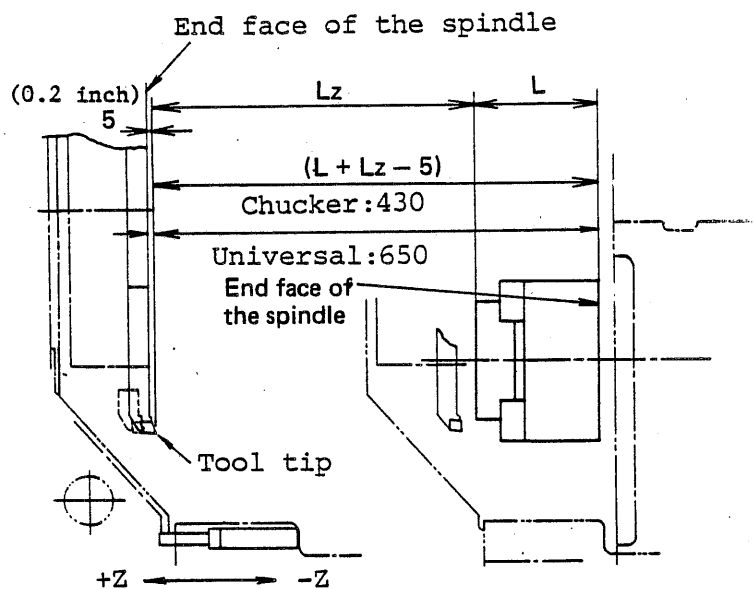
Universal 780 mm (30.7 inch)

(from end face of the spindle)

End face of the spindle



(With 4T (option))



(With 8D (standard))

(With 12D (option))

How to Fix Home Position

(The X-axis values below are counter readings.)

1. Adjust the limit switch actuating stroke (2.0 mm).
Axis stroke for limit switch kept ON (ON - OFF)
X-axis 31 - 32 mm (1.22 - 1.26 inch)
Z-axis 19 - 20 mm (0.75 - 0.79 inch)
2. Locate the turret at the home position in the manner as explained before.
3. After resetting the position display to zero (0), set the dial indicator in the axis move direction. Press the dial indicator as much as 4 to 5 mm (0.16 - 0.2 inch) and set the pointer indication to zero by rotating the outer ring.
4. Adjust the position of the dog so that the limit switch is turned off at a point 2.5 to 3 mm to the home position.
5. Carry out zero return operation.
6. Enter the remaining distance to the home position following parameter ZPX(Z).
7. After turning off power supply once, turn it on again and then carry out zero return operation. This positions the axis to the home position.
8. Adjust the dog position finally so that the limit switch is turned off at a point "value known in step 6 + 0.8 ~ 1.2 mm (0.03 - 0.05 inch) to the home position.

This adjustment is required only when the relative position of the resolver connected to the end of the ball screw with respect to the ball screw is mismatched when flexible coupling is disconnected, for instance. When the shear pin is broken or motor is detached, this adjustment is not necessary.

4. TROUBLE AND TROUBLESHOOTING

4-1 Coolant is not Supplied.

	Inspection Item	Measures
①	Check the COOLANT switch on the operator's control console if it is set correctly.	
②	Check the strainer for coolant if it is completely immersed in the coolant.	
③	Check the strainer filter if it is clogged.	
④	The coolant pump drive motor fails to start.	
⑤	Check the thermal relay of the coolant pump drive motor in the electrical control panel if it is tripped.	

4-2 Headstock is unusually hot.

	Inspection Item	Measures
①	Check to see if the headstock is properly lubricated.	
②	If preload of the spindle bearings is not properly adjusted, it will cause heat building-up of the headstock.	

4-3 Home position of X- or Z-axis fluctuates.

	Inspection Item	Measures
①	Check the home position confirmation limit switch if it is secured in correct position.	
②	Is fluctuation amount 2 mm on position display reading?	
③	Check the resolver of the related axis if it is mounted correctly.	

4-4 Repeatability in positioning is poor.

	Inspection Item	Measures
①	Check the gibs if they are adjusted properly.	
②	Check the slideway lubricated conditions if proper.	
③	Check the bolts and taper pins connecting component parts if they are secure.	
④	Check the resolvers if they are mounted properly.	
⑤	Check the shear pins of the resolver or coupling if they are broken.	

4-5 Operation cannot be resumed after collision.

	Inspection Item	Measures
①	Is the control in NOT READY state?	
②	Check the CRT if alarm no. is displayed.	
③	Check the shear pins if broken.	

4-6 Chuck jaws fail to move.

	Inspection Item	Measures
①	Check the setting pressure of pneumatic circuit if it is correct.	
②	Check the chuck operation pressure adjusting reducing valve if it is set to correct value.	
③	Check the chuck jaws operation control solenoid valve if it works properly.	
④	Check the foot switch if normal.	
⑤	Check the relays operated by the foot switch operation if they operate normally.	
⑥	Check the wedge plunger and master jaws if they are seized up.	

4-7 Jaw operation stroke is short.

	Inspection Item	Measures
①	Check the position of the wedge plunger if it is set in a correct position. (Check if the wedge plunger is struck against the cover or back plate.	Adjust the position of the wedge plunger by rotating the draw screw using an Allen wrench.
②	Check the wedge plunger and master jaws if they are seized up.	

4-8 Workpiece is tapered.

	Inspection Item	Measures
①	Is the headstock correctly aligned? (in case of chuck work)	
②	Is the tailstock spindle correctly aligned? (in case of between centers work)	

4-9 Tailstock spindle cannot be moved.

	Inspection Item	Measures
①	Check the tailstock spindle thrust indication gage if it indicates proper value.	
②	Check the solenoid valve controlling tailstock spindle operation if it is working properly.	
③	Check the relays actuated by the tailstock spindle operation commands if they can work normally.	
④	Check the tailstock spindle operation speed adjust valve if it is clogged.	
⑤	Check the lubricated conditions of the tailstock spindle. If not properly lubricated, the spindle will be seized.	

4-10 Abnormality of the center of the rotating center.

	Inspection Item	Measures
①	Check the tailstock spindle thrust if it is excessively high.	
②	Check the bearing if it is seized up due to excessively high thrust, which in turn results in braking, damage or other troubles.	

4-11 Tailstock body cannot be moved.

	Inspection Item	Measures
①	Check the thermal relay of the tailstock body actuating motor if it is tripped.	
②	Check the tailstock body actuating motor if it gets extraordinarily hot (80°C)	
③	Check the clamp cylinder if it unclamps the tailstock base when moving it.	
④	Check the clamp solenoid if it works normally.	
⑤	Check the relays which are to be actuated by the move commands if they operate correctly.	
⑥	Check the lubricated conditions of the tailstock base if it is seized due to poor lubrication.	
⑦	Check the tailstock drive chains if they are correct.	

4-12 Turret cannot be unclamped.

	Inspection Item	Measures
①	Check the thermal relay of the turret index motor if it is tripped.	
②	Check the turret index motor if it gets extraordinarily hot (80°C).	
③	Check the solenoid valve for clamp operation if it works correctly.	
④	Check the relays which are to be actuated if they operate normally.	
⑤	Check the TURRET CLAMP switch if it is set ON.	
⑥	Check the turret if it can move up and down smoothly.	

4-13 Turret fails to index although it is unclamped.

	Inspection Item	Measures
①	Check the cam follower of the geneva mechanism if it is correct.	
②	Check if the teeth of the high index coupling fail to engage correctly.	
③	Check the slotted round nut at the center of the turret if it is secured correctly.	

4-14 Turret continues rotation.

	Inspection Item	Measures
①	Check the proximity switch for position confirmation if it works normally.	
②	Check the proximity switch for motor stop if it works normally.	
③	Check the relays which are to be actuated by the turret index commands if they operate normally.	

4-15 Turret stops before commanded position is indexed.

	Inspection Item	Measures
①	Check the high index coupling if it fails to mesh correctly.	
②	Check the solenoid valve for turret clamp if it works normally.	
③	Check the cam follower of the geneva mechanism if it is correct.	
④	Check the proximity switch for motor stop if it works normally.	
⑤	Check the motor if stops during indexing.	

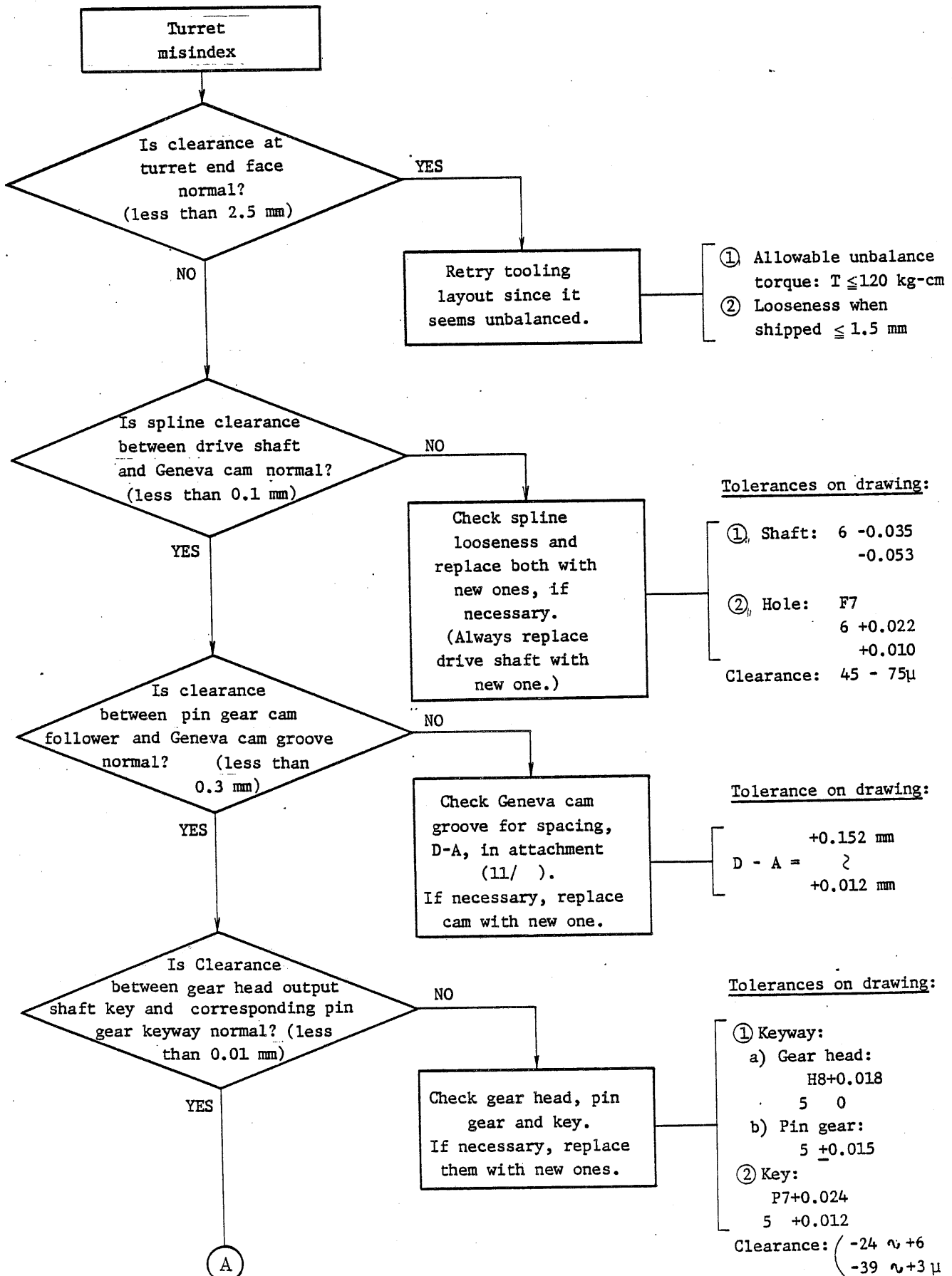
4-16 Although the turret rotates and stops, correct position is not indexed.

	Inspection Item	Measures
①	Check the high index coupling if it fails to mesh correctly.	
②	Check the turret if it is mounted in correct position.	
③	Check the tools on the turret if they causes extraordinary unbalance of the turret.	
④	Check the relays which are to be actuated by the turret clamp command if they work normally.	

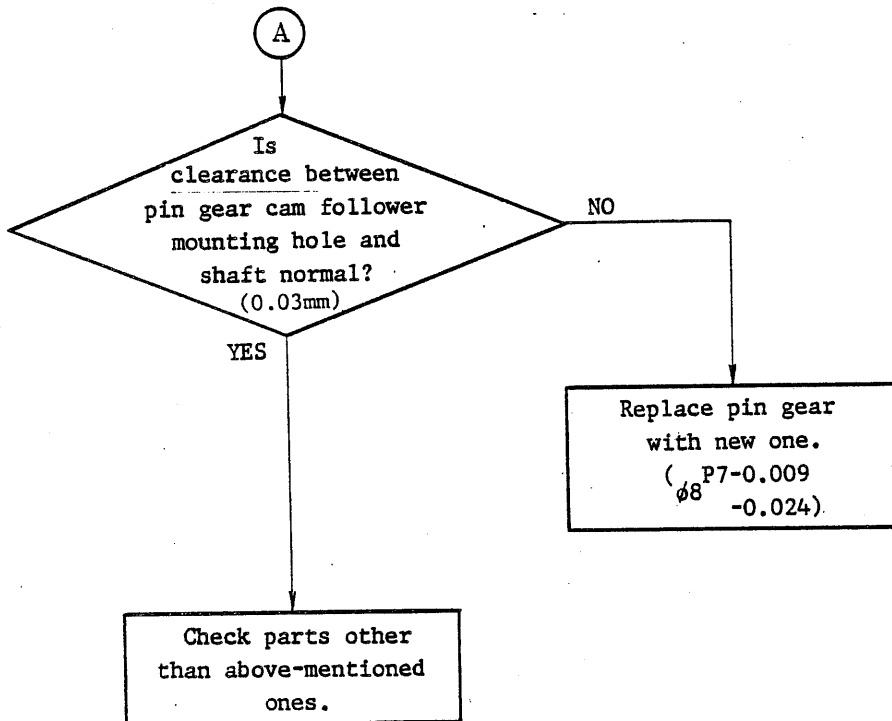
4-17 Turret is not clamped.

	Inspection Item	Measures
①	Check the solenoid valve for turret clamp if it work snormally.	
②	Check the relays which are to be actuated by the turret clamp command if they work normally.	

4-18 Measures for QT-10N (141) Turret Misindex (1/2)



Measures for QT-10N (141) Turret Misindex (2/2)



4-19 Slideway lube alarm light goes on.

	Inspection Item	Measures
①	Check oil level of the lubricant in the tank.	
②	Check the thermal relay in the electrical control panel if it is tripped.	
③	Check the intermittently operated lube pump if it works normally.	

4-20 Alarm indication is displayed on the CRT while axis move since error amount in the error register exceeds the preset value.

	Inspection Item	Measures
①	Check the shear pin of the resolver or coupling if it is broken.	
②	Check the gib if set clearance is too small.	
③	Check the slideways if they are lubricated properly. (Check the flow unit if it is clogged.)	

4-21 Spindle fails to start.

	Inspection Item	Measures
①	Check the system if it is in NOT READY state.	
②	Check the gear shift position if neutral position is selected.	
③	Check the spindle speed range indicator lights (1 and 2) if both of them are off.	
④	Check the spindle speed shift lever if it is set in correct position.	
⑤	Check the motor alarm indicator light if it is on.	