

MACHINING CENTERS

PURCHASED UNITS

MC-H

INSTRUCTION MANUAL (4th Edition)

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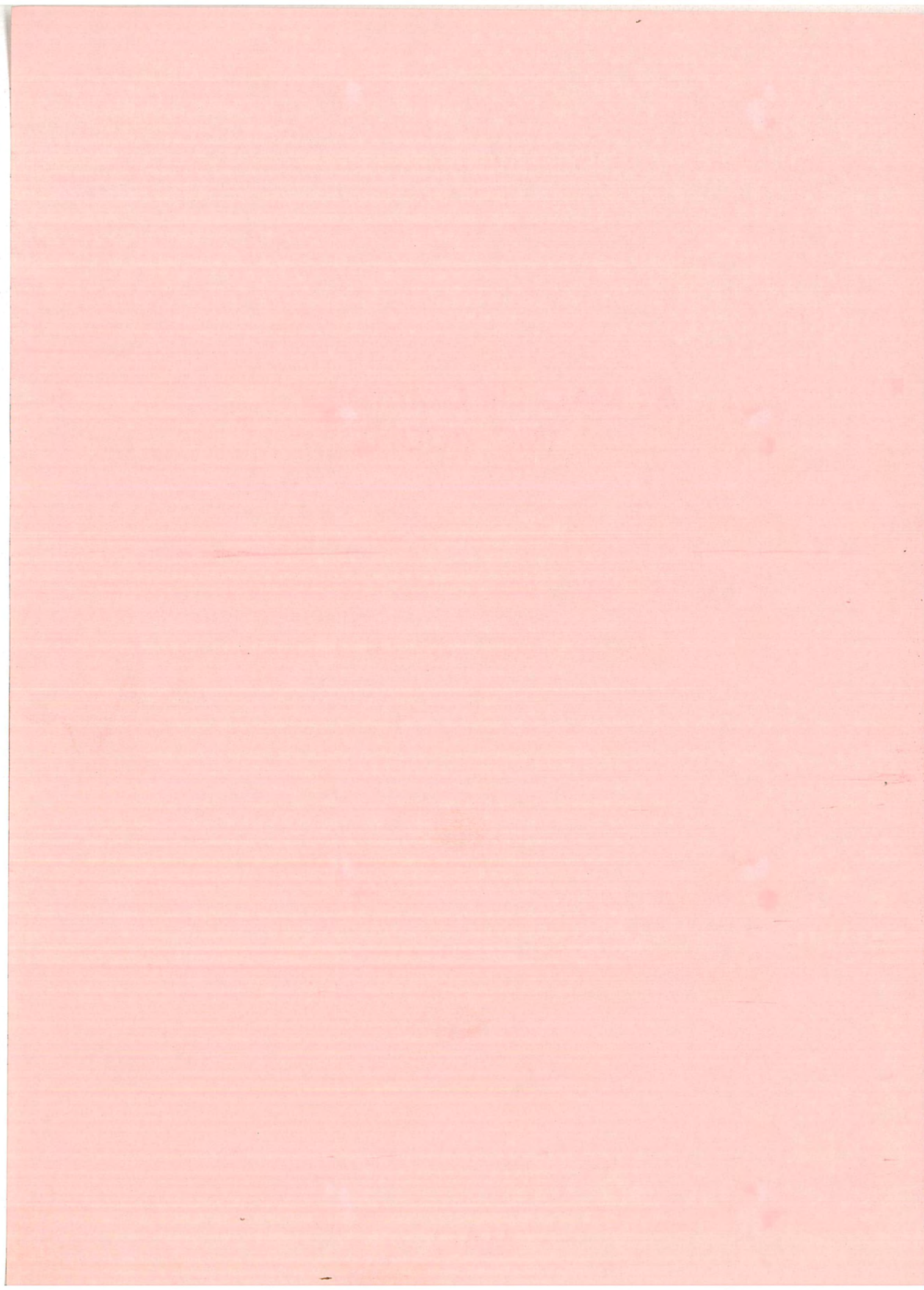
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This book contains several instruction manuals. Some instruction manuals might be for those specifications which are not selected by the user. Refer to the Final Specifications of your machine for details.

**A : MAC Oil Controller
(MC-400H)**

MAC





HANDLING MANUAL

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MAC Oil Controller
MAC-60CPB-FR-OT

MC-400H

90年 6月 28日

株式会社



〒100 東京都千代田区千代田 3-1-5 (丸の内線) 丸の内駅

ME21-059-R1

INSTRUCTION MANUAL

Product Name: MAC Oil Controller

Type: MAC-60CPB-FR-OT (Forced circulation type machine for exclusive use of lubricating oil)
(Body temperature follow-up type control)

Read this manual carefully before operating the equipment to ensure operation and optimum results.

A. Description

The MAC oil controller cools oil with a refrigerator and controls the temperature.

A-1 Compressor

Circulates the cooling gas by compressing, exhausting, and drawing in air.

※Power supply: 3 Φ 200V AC

A-2 Air cooled condenser

The heat caused by the oil cooling (or the coolant), or, in other words, the heat obtained from the oil with the help of cooling gas, is subjected to heat exchange using condenser.

※Forced ventilation cross fin type.

A-3 Fan for condenser

This fan forces the air in the external atmosphere against the fins of the condenser so as to increase the rate of heat transfer from the condenser to the external atmosphere.

Hot air (at 45 °C) is discharged from the fan.

A-4 Capillary tube (expansion valve)

The valve for evaporating the refrigerant by expansion.

A - 5 Evaporator cooling unit

The heat exchanger for cooling the oil using the refrigerant gas.

Coolant solution or other solution containing sludge cannot be used since the cooler is clogged and becomes unrepairable.

A - 6 Cooling pump

A high pressure pump which sends temperature-regulated oil(fluid) to the machine side.

It supplies oil to the main spindle and absorbs oil from the main spindle.

Water or coolant solution cannot be used.

A - 7 Oil temperature sensor

This sensor detects oil(or coolant) temperature.

A - 8 Body temperature sensor

A sensor connected with lead wire taken out of the oil controller main body.

With PT1/8 screw. This sensor is attached to the M/C side.

A - 9 Oil tank

Cooling oil tank. Supply specified oil up to the top of the oil level gauge.

B. Preparation

B-1 Location of MAC oil controller

- B-1-1 Install the unit on a flat, vibration-free, firm area of floor
- 1-2 Select a place free from exhaust heat and sunlight
- 1-3 Consider the area necessary for maintenance.
- 1-4 Though an air filter to prevent the adverse effects of oil mist is provided, a place free of oil mist should be selected.
- 1-5 In order to improve the efficiency of the air cooled condenser, make sure that there are no objects or obstacles within 20 cm of the air inlet filter surface and within 50 cm of the exhaust outlet.
- 1-6 Select a minimally humid area. Though condensation collects on the cooler, this dries naturally, causing no problems.
- 1-7 Do not operate the oil controller continuously if the ambient temperature is over 45°C.
- 1-8 The lower limit of oil cooling control is +10°C, when the temperature is equal to room temperature.
- 1-9 The upper limit of oil cooling control is +45°C.

B-2 Connecting the Oil Pipes

B-2-1 Connect the cooling oil circulation pipes

- 2-2 Fix the suction strainer (100 mesh) in the oil suction pipe.
Any slution in the oil, if allowed to enter this pipe, will damage the trocoid pump and will reduce the efficiency of cooling when it enters the cooler.
- 2-3 Make the oil piping as short as possible so as to reduce the resistance to the oil flow thereby reducing the load on the oil pump. If the suction pipe is either long or narrow, the flow rate of the oil will be decreased which not only results in reduced cooling efficiency but also may cause the trocoid pump to generate a whining noise.

B - 3 Oil tank

B - 3 - 1 Supply specified oil up to the top of the oil level gauge.

3 - 2 Magnet for cleaning oil in the tank can be taken out from the inspection port on the front of the tank.

B - 4 Electric wiring

B - 4 - 1 Connect the three phase AC power supply to the R, S, T, and E (ground) terminals of the terminal box of the unit.

※ In case the optional fuseless circuit breaker is being used, connect the power supply to the terminals of the circuit breaker.

4 - 2 Connect other relevant terminals.

※ Refer to the electrical wiring diagram for instruction during operation and alarm terminal.

4 - 3 When confirming the rotating direction of the equipment, it is unnecessary to check that of the refrigerator.

Confirm by rotation of the oil pump or condenser fan.

At negative phase, the reverse prevention relay works not to allow start.

C. Description

FR type, Electronic machine temperature follow-up type temperature controller.

(Forced circulation type machine for exclusive use of oil pressure operation oil and lubricating oil)

- C-1 This temperature controller is activated by two temperature sensors; one is used to detect body temperature, the other to detect oil temperature. It controls the difference of the two temperatures.
- C-2 Oil temperature is controlled in plus or minus based on the reference body temperature.
- C-3 Body temperature sensor with PT1/8 male screw. Screw into the M/C main body to install.
- C-4 The oil temperature detection sensor is mounted on the inlet of the oil controller.
- C-5 The cooled oil is discharged into the heat generation source (the oil tank, the oil bath or the gear box, etc.) and mixed there at a temperature lower than the set one. When the liquid temperature of oil sucked into the oil controller becomes the set temperature, the cooling operation will stop.

C-6 Adjusting controller

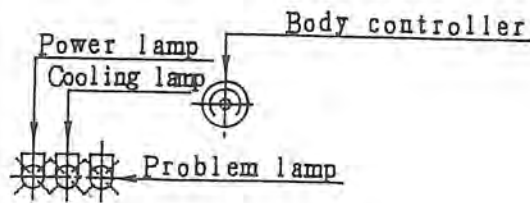
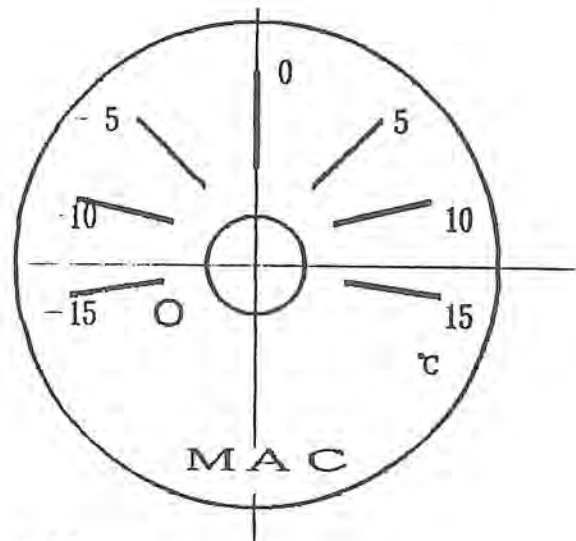
Set the dial in front of the controller to desired scale which indicates the difference between room temperature and oil temperature.

(For instance, scale zero indicates that the oil and room temperatures are the same while scale +5 shows that the former is 5°C higher than the latter.)

Differential: $\pm 1^{\circ}\text{C}$

Control range of oil temperature.

(Body temperature: $+10^{\circ}\text{C}$ to -5°C .)



D. Method of operation

1. Set the operation instruction circuit to OFF, And turn on the power supply.

2. Turn the operation instruction circuit "ON".

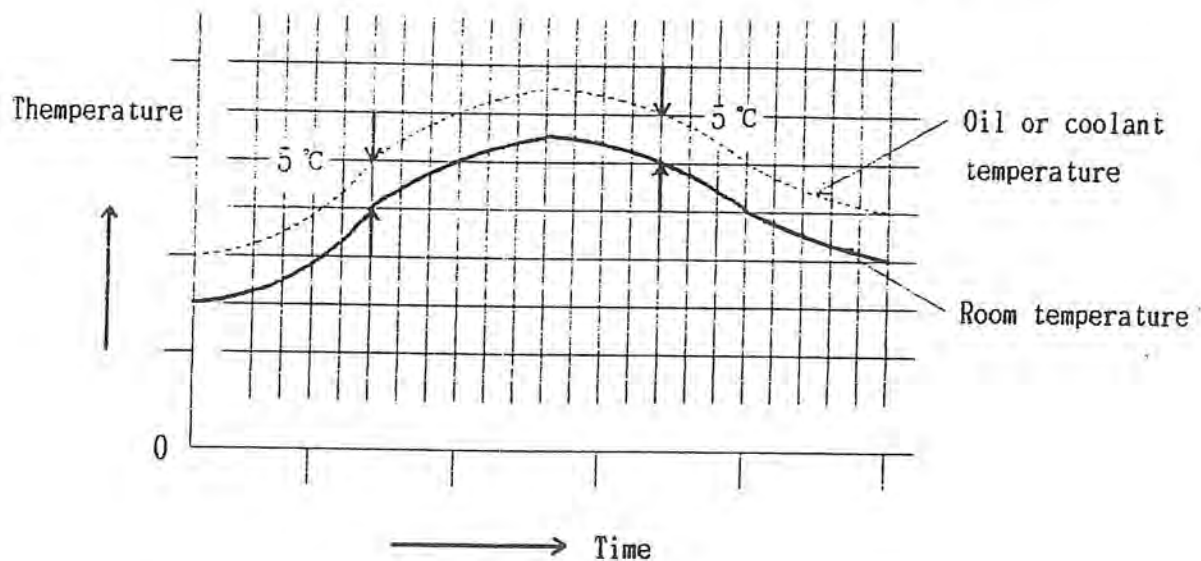
The oil pump operates at all times to circulate cooling oil.

3. If the temperature of the thermostat is decreased, the refrigerator operates and cooler operation lamp(green)lights.

Hot air is discharged from punching of the gauging top plate.

4. Relationship between the oil or coolant temperature and the room temperature is given below.

The above graph shows the relationship when the dial is set to scale + 5 °C.

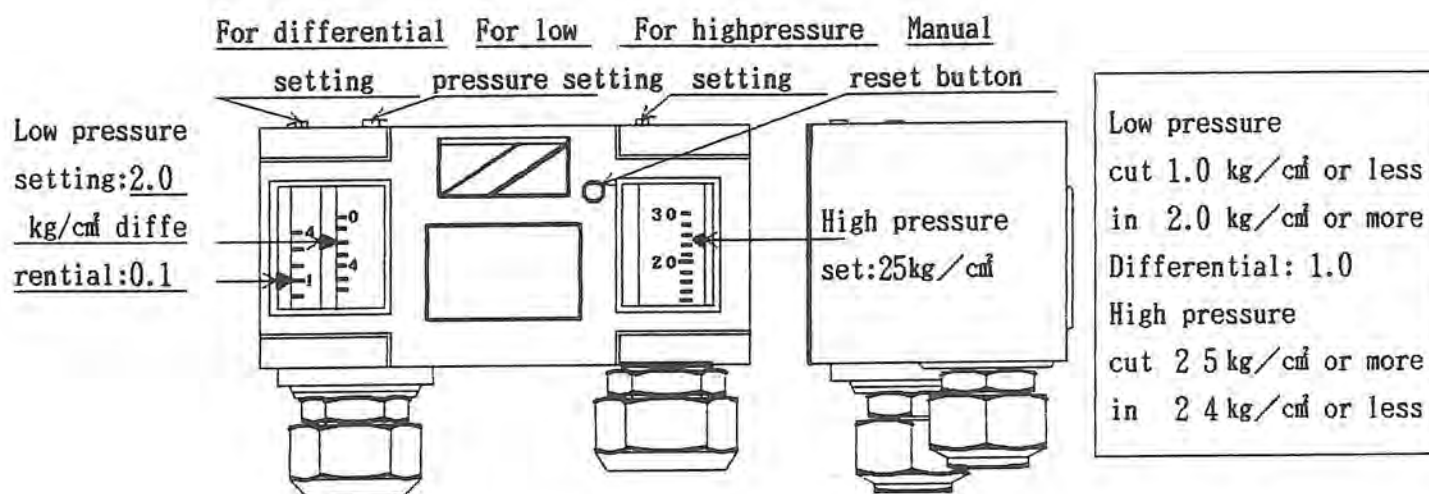


5. Oil temperature is controlled by cooling only and therefore the oil controller needs not heating ability.

E. Control Instrument Description and Maintenance

※When the instrument stops and the abnormality detection lamp goes on during operation, take the following steps:

- E-1 High/low pressure protection switch (H.L.P) Detect and protect the gas pressure at the higher and lower sides so that the gas pressure in the refrigerating cycle can be held normal.



Lower pressure side pressure abnormality

- • • When Freon gas is insufficient in quantity (the gas leaks)

Abnormal cooling detecting lamp within the control panel (red)

- • • Goes on

Fully stop the oil controller.

- ※ 3 or 4 minutes later after the stop of the refrigerator, the lower pressure side is automatically resumed to extinguish that abnormality detecting lamp. Turn ON the operation switch again. However, abnormal cooling takes place in about 5 minutes. (Contact the maker.)

Higher pressure side pressure abnormality

- • • The air filter is clogged. (Wash the air filter with water once in two or three months.)
- • • The ambient temperature exceeds 45 °C.
- • • The oil temperature has suddenly risen.

Abnormal cooling indication lamp (red) within the control panel

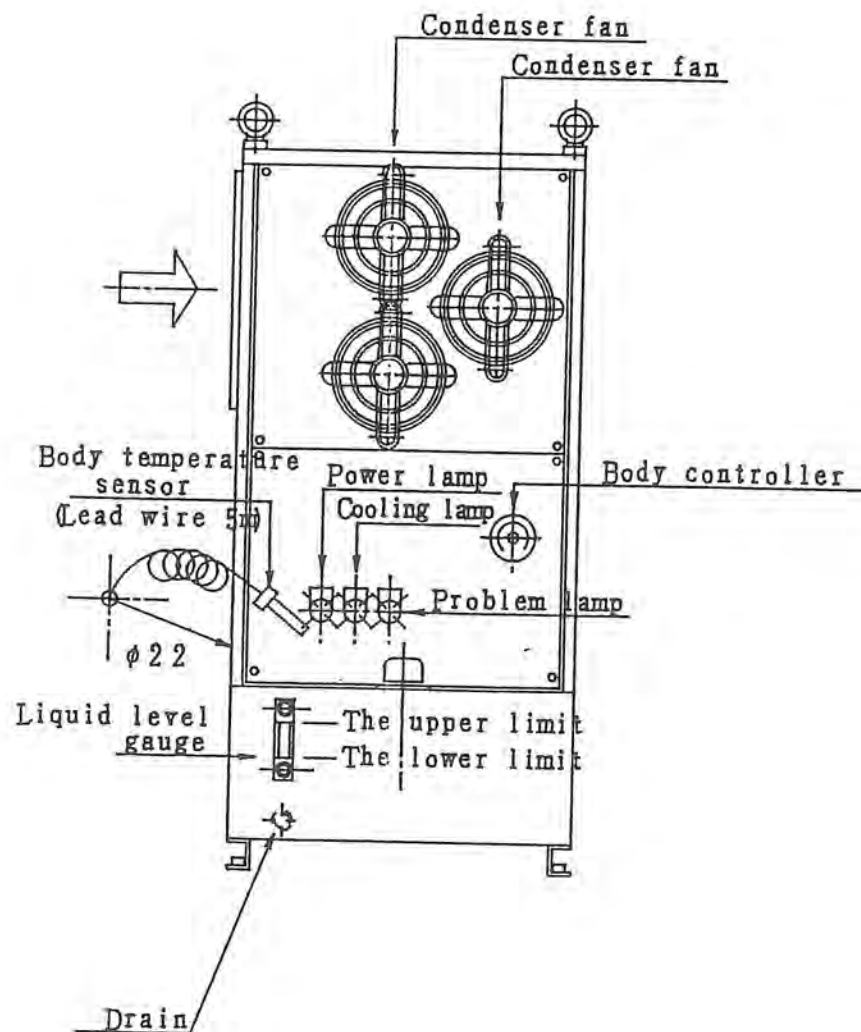
- • • Goes on

Fully stop the oil controller.

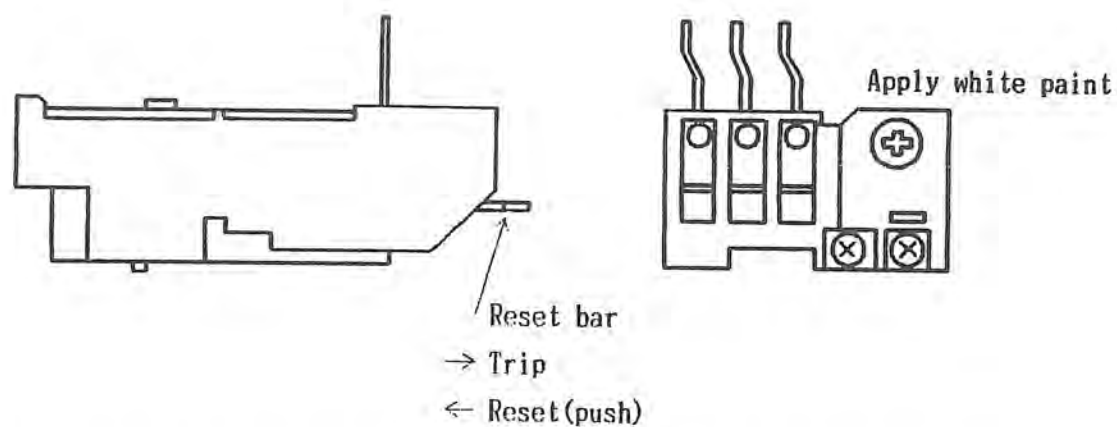
※To reset the higher pressure side, depress the manual reset button of the protection switch (H.L.P.).

The location for installation of the high and low pressure protection switch (H.L.P.) is provided at the lower part of the front side of the control panel.

The reset push-button switch for manual restoration can be pushed over the rubber bush, or if the rubber bush is removed, the reset push-button switch for manual restoration becomes visible.



- E-2 When the thermal relay has been tripped. → Press reset bar of the thermal relay. The thermal relay is provided at the control box. The control box can be seen by opening the front door leaf.

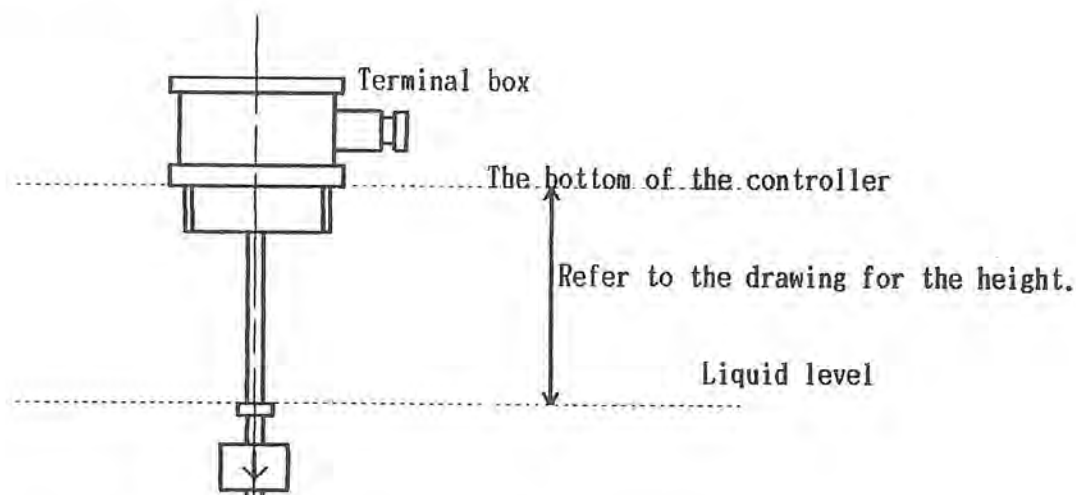


※Refer to the electrical wiring diagram for the set value of the thermal relay.

E-3 Level switch

Warns drop of oil temperature.

When the level decreases, single contact point is actuated and indicates it to the M/C side.



We thank you for your purchase of MAC oil controller.

Our products are manufactured in the complete quality control system.

However, if a failure occurs, contact salesman or company for repair.

Specifications

To : OKUMA IRONWORKS Co., Ltd.

Date: June. 28. 1990

Product Name : MAC Oil Controller

Model : MAC-60CPB-FR-OT

Drawing No. : MO 890512-E

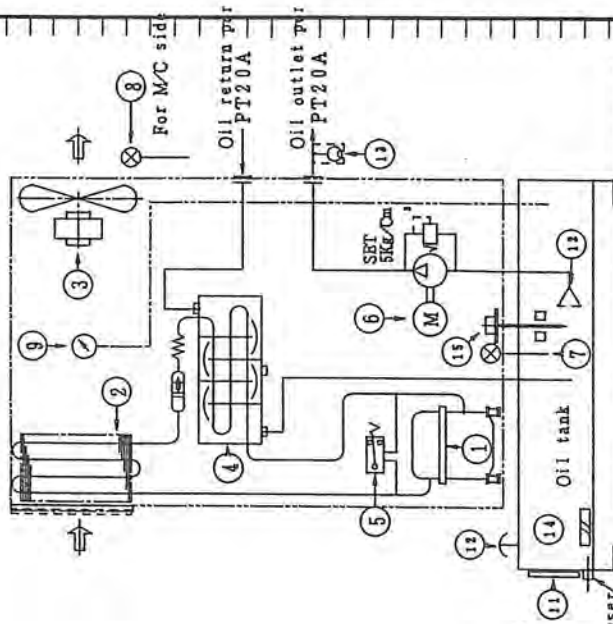
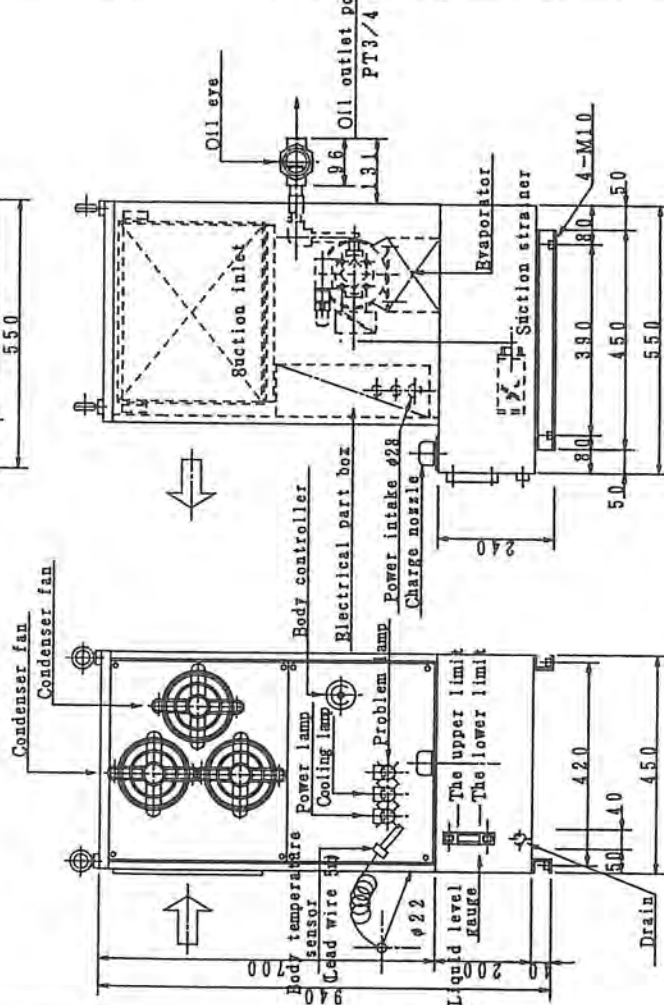
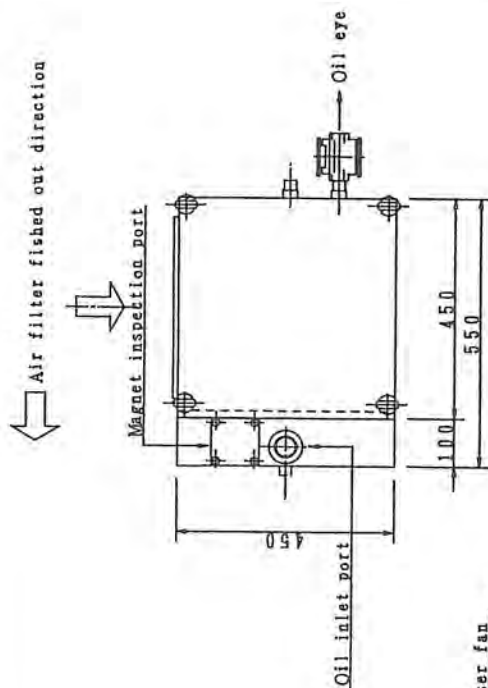
MAC Co., Ltd.

Item	Specifications
Standard cooling capacity	1500/1600 Kcal/Hr 50/60 Hz (at 35°C oil)
Main unit	450×550×700 H. Baking finish (Standard color of OKUMA)
Tank	450×550×200 H. 40 ℓ With liquid level gauge, charge nozzle, and magnet.
Power source	3Φ×AC 200 V. 50/60 Hz
Operation circuit	1Φ×100 V AC 50/60 Hz
Refrigerator	3Φ×AC 200 V×600 W×2 P Rotary type
Condenser	Forced ventilation cross fin. Fan motor 1Φ×AC 200 V×40 W×3
Cooler	Cross fin evaporator tank
Coolant	R-22
Circulating pump	3Φ×AC 200 V×400 W×4 P Discharge 15 ℓ/min 50Hz 18 ℓ/min 60Hz
Operation regulator	Temperature control-Standard temperature follow-up electronic automatic temperature regulator. With Power lamp, Cooling lamp, and Abnormal lamp.
Protector	Overcurrent relay. Noise killer. With abnormality contact. Plugging relay. Level switch.
Weight	Main unit 100 Kg
Capacity of tank	The upper limit. 42 ℓ The lower limit. 30 ℓ
※Description on the nameplate and others shall be both in English and Japanese.	
Remarks: Ambient temperature +45°C max	
Standard temperature follow-up electronic automatic temperature regulator	
Control range 15°C~-15°C	
Oil temperature control range 5°C~+10°C	
Absolute temperature range for oil temperature control +15°C~+45°C	
Accuracy ±0.5°C	

MAC Co., Ltd.

No.6-1

品名 SYMBOL	品名 PART NAME	仕様 SPECIFICATIONS	備考 REMARKS
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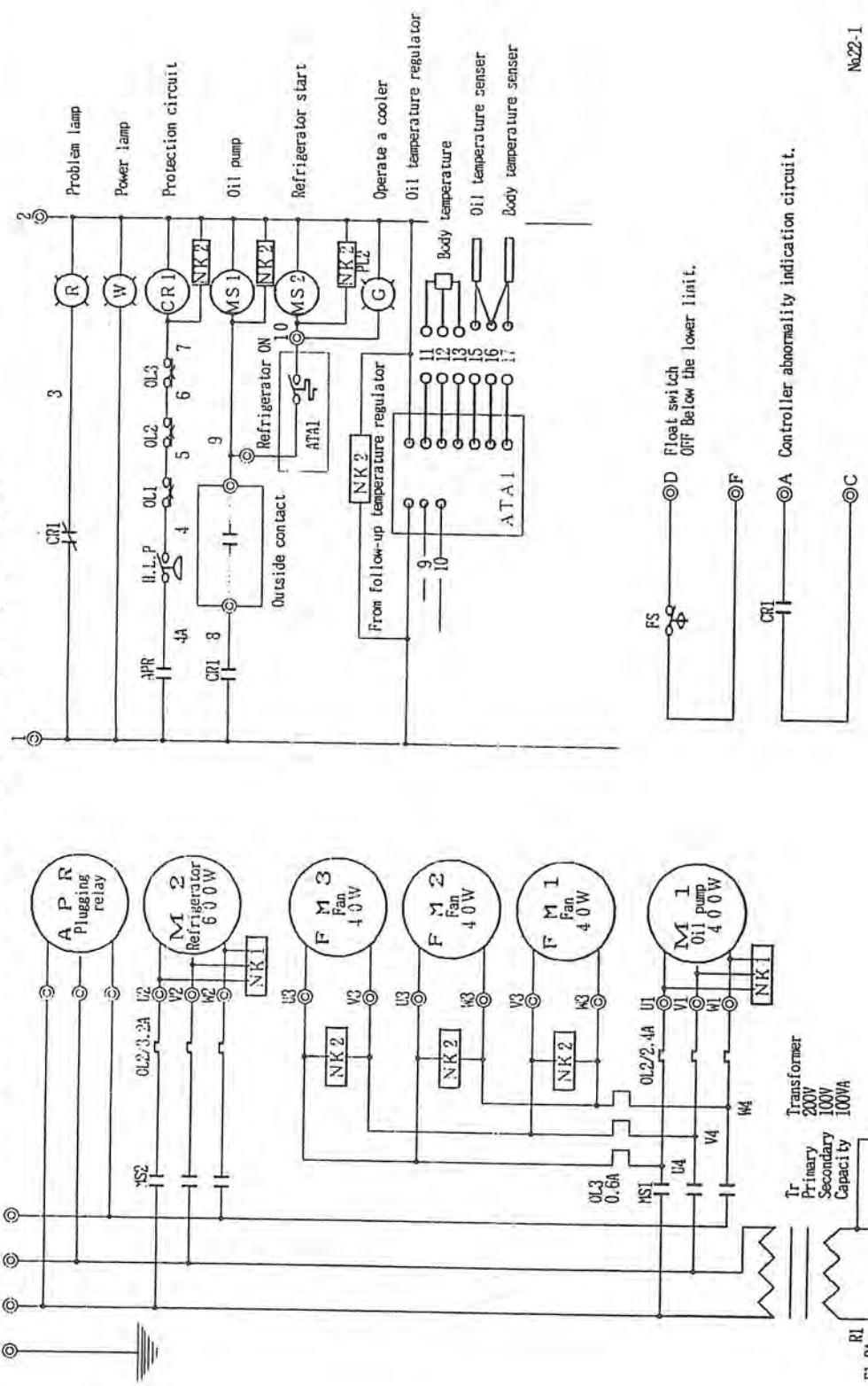
1	Refrigerator condenser
2	Fan
3	Evaporator
4	High and low pressure protection switch
5	Oil pump
6	Oil temperature sensor
7	Body temperature sensor
8	Thermometer
9	Suction strainer
10	Oil level gauge
11	Charge nozzle and air breaser
12	Oil eye
13	Magnet
14	Pilot switch
15	Liquid level gauge is OFF at the lower limit

先 CUSTOMER	OKUMA IRONWORKS Co., Ltd.	SCALE	1/10
品名 ARTICLE	MAC Oil Controller	DATE	'98.08.28
型式 TYPE	MAC-60CPB-PR-OT	CHECKED BY	
図面番号 DRAWING NO.	Assembly Diagram	DESIGNED BY	
図 DRAWING No.	MO-890512-1B	DRAWN BY	Yada B-3
訂正番号 No.		APPROVED BY	
年月日 DATE			
訂正 REVISED			

MAC 株式会社

SYMBOL	NAME	UNIT	REMARKS
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POWER SOURCES 3Φ×AC200V×50/60Hz



No.22-1

CUSTOMER	OKUMA Ironworks Co., Ltd.
ARTICLE	MAC Oil Controller
TYPE	MAC-60CPB-FR-OT
DRAWING NAME	ELECTRIC CIRCUIT DIAGRAM
DRAWING No.	MO-890512-2E
DATE	1990.08.28
DESIGNED BY	MAC
DRAWN BY	MAC
APPROVED BY	MAC

訂正番号	年月日	訂正記号	訂正
△			
△			
△			

株式会社 マック

List of principal parts

Customer : OKUMA IRONWORKS CO., Ltd.

No. 1

Model Name : MAC Oil Controller

Date: June.28.1990

Type : MAC-60CPB-FR-OT

Drawing No : MO-890512-3E

MAC Co., Ltd.

Symbol	Item name	Specifications	Maker	Q'ty	Remarks
C M	Refrigeratpr	R J5475GL6 3 Φ ×200V×600W×2P	Mitsubishi Heavy Industry	1	Rotary
P M	Oil pump	TOP-2MY400-210HAM-VB5 3 Φ ×200V×400W	Nippon oilpump	1	
F M	Fan motor	6550 1 Φ ×200V×40W	Touyo	3	
	Cooler	Cross fin evaporator tank EB-1	MAC	1	
	Condenser	CD-2C Forced ventilation cross fin	MAC	1	
	Dryer	DF-1	Fuji Gel	1	
	Oil temperature thermometer	60 Φ 0~60℃	MAC	1	
	Air filter		MAC	1	
	Oil tank	450×550×200H 40ℓ	MAC	1	
	Charge nozzle	CAB-30B	Masuda	1	
	Oil level gauge	Φ 6×80	MAC	1	
	Suction strainer	W-MSN-06 100 Mesh	Masuda	1	
MS1	Electromagnetic switch for oil pump	SRC-3931-0 3H 1.7~2.6A 100V	Fuji	1	set 2.4A
MS2	Electromagnetic switch for CM	SRC-3931-0 3H 2.8~4.2A 100V	Fuji	1	set 3.2A
CR1	Auxiliary relay	MY-2 100V	Tateishi	1	
OL3	Thermal relay	TR-OH 3H 0.48~0.72A	Fuji	1	set 0.6A
APR	Plugging relay	BAV822201	Matsushita	1	
F1.2	Fuse	AFac30/3A	Fuji	2	
F3	Oil eye	FPS-20S	Daido Kouki	1	
T r	Transformer	TR-SW-1 200/100V 100VA	Aki	1	Single phase compound
ATA	Follow-up temperature regulator	FT-M0030	MAC	1	
	Body temperature sensor	T-321-90-SP Lead wire 4m	Nippon fenall	1	

MAC Co., Ltd.

N016-1

List of principal parts

Customer : OKUMA IRONWORKS CO., Ltd.

No. 2

Date: June.28.1990

Model Name : MAC Oil Controller

Type : MAC-50CPB-FR-OT

Drawing No : MO-890512-4E

MAC Co., Ltd.,

[illegible]

**B : NSK Oil-air Lubricator
(MC-400H)**

Asia

OPERATING MANUAL
FOR
NSK OIL-AIR LUBRICATOR
FINE LUB
ECONOMICAL OAE TYPE

MC-400H

SUPPLIER: NIPPON SEIKO K.K.

MANUFACTURER: ASIA INDUSTRY CO., LTD.

ME21-067-R1

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 - (4) Function of Operation Preparation Completion Signal SW3
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- A. Preparation for Operation
- B. Maintenance, Inspections and Troubleshooting Guide

OPERATING PRECAUTIONS FOR FINE LUB

1. The compressed air supplied must be clean and dry.

The recommended air supply pressure is 3.5 to 4.5 kg/cm².

2. The presence of dust in the air or oil may shorten the life of the equipment.

Use only fresh, clean high speed spindle oil or turbine oil with a viscosity between 10 and 68 cSt at 40°C.

3. Always bleed air from the system before running it for the first time or when it has not been used for a long time.

4. This unit is a high-precision piece of equipment; therefore, use care and don't drop it or treat it roughly.

5. This unit uses NBR (nitrile rubber), Bayton (fluorine rubber), and ABS resin. Do not use any lubricant that may damage one of them (e.g.: ester, glycol base oils).

6. Daily inspection and servicing are essential to ensure safe and reliable operation; therefore, be sure to inspect the unit daily to prevent possible trouble. More thorough inspections should be made every six months to check the equipment for any wear or deterioration.

(See B-1 , Maintenance and Inspections)

1. Specifications

Applicable oil	High speed spindle or turbine oil
Viscosity range	10 to 68 cSt/40°C
Pump type	Air-driven piston oil pump
Air supply pressure	2.5 to 6 kgf/cm ² (recommended pressure 3.5 to 4.5 kgf/cm ²)
Power supply	AC100V 50/60Hz
Max. voltage fluctuation	±10% (90 to 110 V)
Power consumption	During pump operation: approx. 14VA When pump is holding: approx. 4VA
Warning signal contact capacity	AC3V 5mA - 250V 2A 500VA DC3V 5mA - 30V 2A 60W
Float switch contact capacity	Max. AC100V, 0.1A, 3VA
Pump discharge quantity	Approx. 7 cm ³ /stroke
Oil pressure	See Fig. 1-1
Oil discharge time	15 seconds (max. 75 seconds) after operation of oil pressure switch
Pump hold time	10 selectable intervals (1, 2, 4, 8, 16, 24, 32, 64, 128 min.)
Oil-pressure switch actuation pressure	12±1.5 kgf/cm ² , contact capacity: 42V, 2.5A 30VA 5A 30VA
Air-pressure switch actuation pressure	1.5 ^{+1.0} / _{-0.5} kgf/cm ² , contact capacity: 42V, 2.5A 30VA, 5A 30VA
Oil metering	Constant-quantity pistons
Controller	Electronic timer
Oil tank capacity	Approx. 2.7 liters. The effective oil quantity is approx. 1.7 liters.
Mounting orientation	Vertical (with oil supply port on top)
Working temperature range	-10 to +40°C

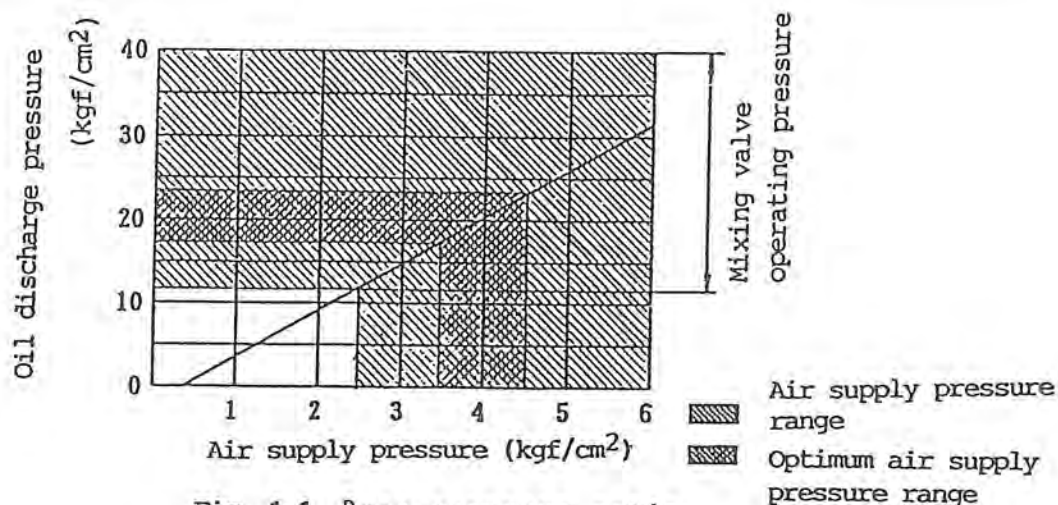


Fig. 1-1 Pump pressure ratio

2. Outside Appearance and Lubrication System Flow Chart

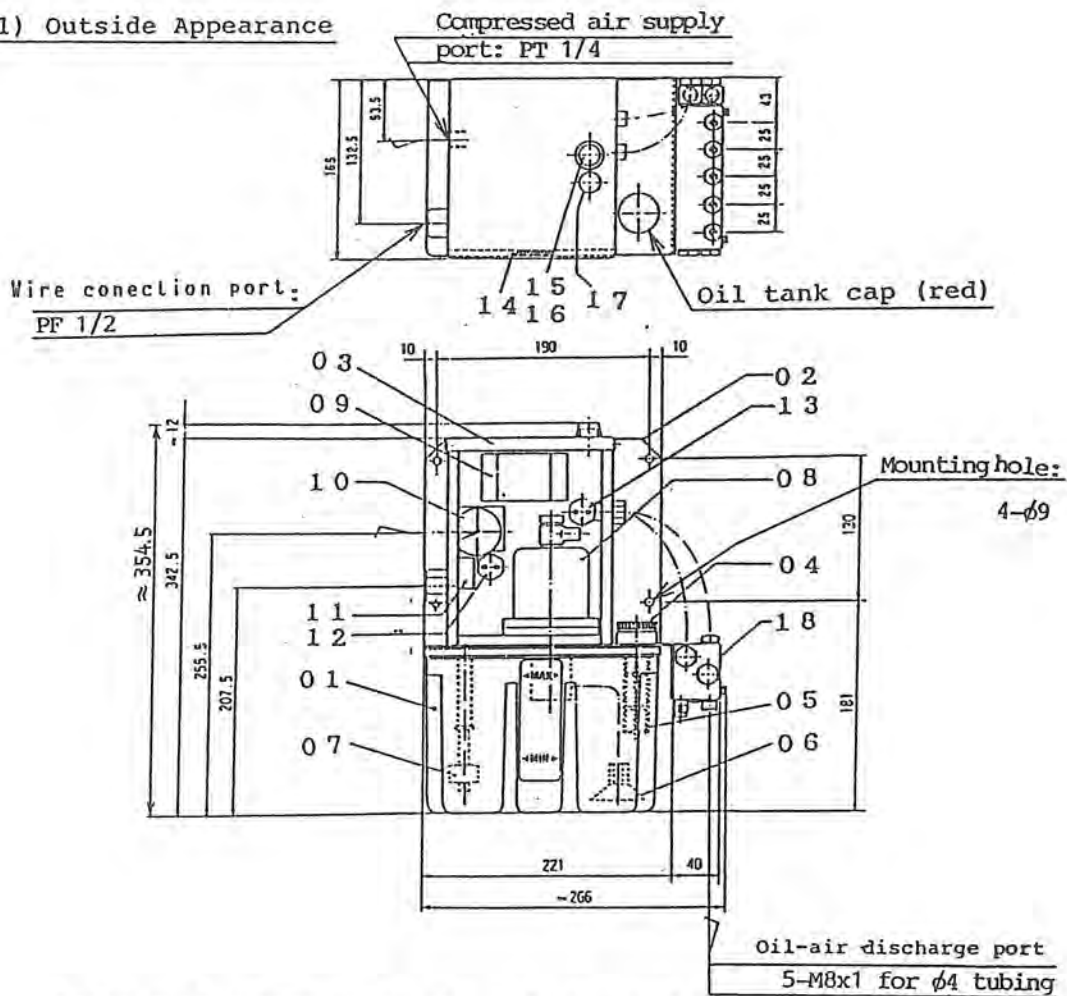
Type No.: Separate Mixing Valve Type OAE

Side-Mounted Mixing Valve Type OAE/MV5-P1x4P2

Economical Type

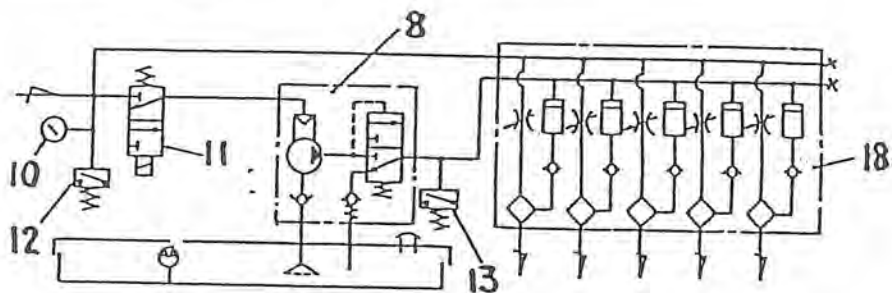
Mixing Valve Type
(Example)

(1) Outside Appearance



Note: This figure shows the Side-Mounted Mixing Valve (MV5) Type. In case of the Separate Mixing Valve Type, the Mixing Valve (Part No. 18) is not included.

(2) Lubrication System Flow Chart



3. Parts and Accessories

(1) Parts Lists

No.	Part Names	Q'ty	Part No.
01	Oil tank (made of plastic)	1	898 000 010
02	Casing	1	NOA-01
03	Head cover	1	NOA-02
04	Oil tank cap (red)	1	ZMB3.04
05	Filter (40 MESH)	1	993 000 098
06	Suction filter (78 MESH)	1	169 440 015
07	Float switch	1	900 175 207
08	Air-driven piston oil pump	1	-
09	Controller	1	IG38-U/I 100V
10	Pressure gage (graduated in kgf/cm ² and Psi)	1	MA-40-10-1/8
11	Solenoid valve	1	SS-232-H-G-NB 100V
12	Fixed type pressure switch (for air)	1	176 110 200-1
13	Fixed type pressure switch (for oil)	1	176 111 201
14	Front cover (transparent acrylic resin)	1	NOA-03
15	Push button switch	1	177 100 012
16	Rubber cap	1	898 210 025
17	Neon lamp (lubrication abnormality)	1	BN-2R 100V
1 18	Mixing valve	1	MV-*****

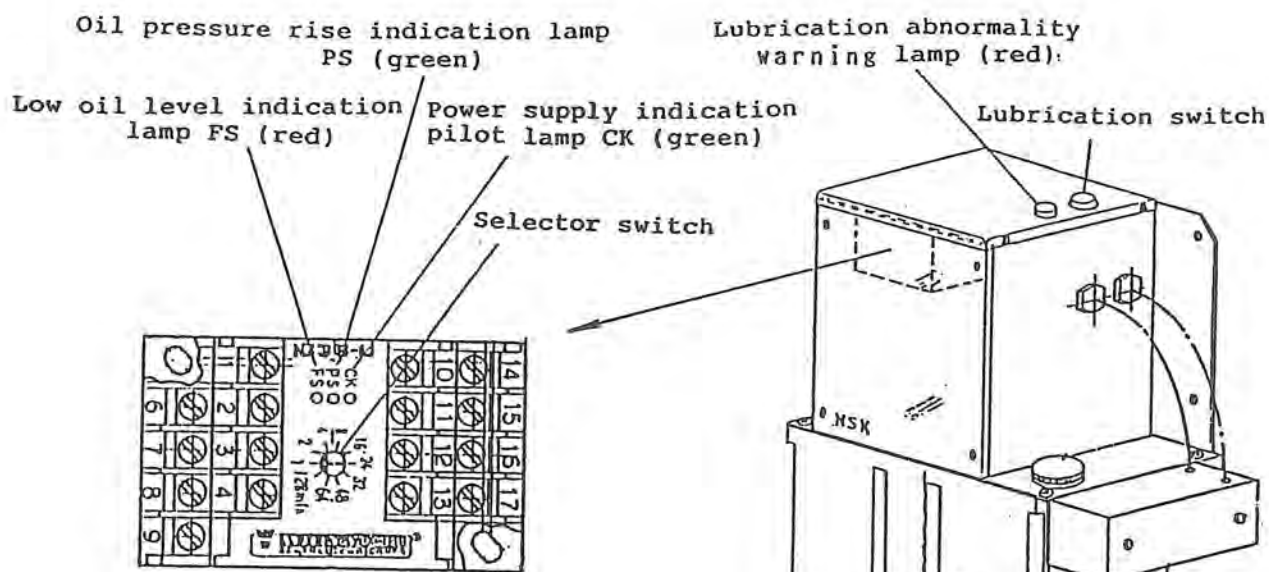
Note *1: The mixing valve is not included with the OAE Type (Separate Mixing Valve Type). It must be provided separately.

(2) Standard Accessories List

Part No.	Part Names	OAE (Separate Mixing Valve Type)	OAE/MV*-***** (Side-Mounted Mixing Valve Type)
OAJ28	Ø8 plastic tubing & fittings	1	-
OAJ11	Ø4 plastic tubing & fittings	-	*
OAJ16	Ø6 plastic tubing & fittings	1	-
OAJ42	Ø8 plastic tubing & fittings	1	1
	Label (Stepping is strictly prohibited)	1	1
	Label (Beware of oil)	1	1
	Label (Beware of solvent)	1	1

* Note: The quantity of tubing and fittings depends on the number of discharge ports on the mixing valve.

4. Front View of Controller and Nomenclature



Front view of Controller
Fig. 4-1

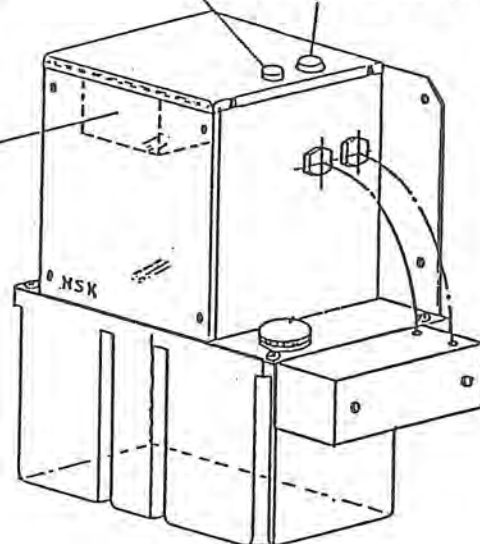
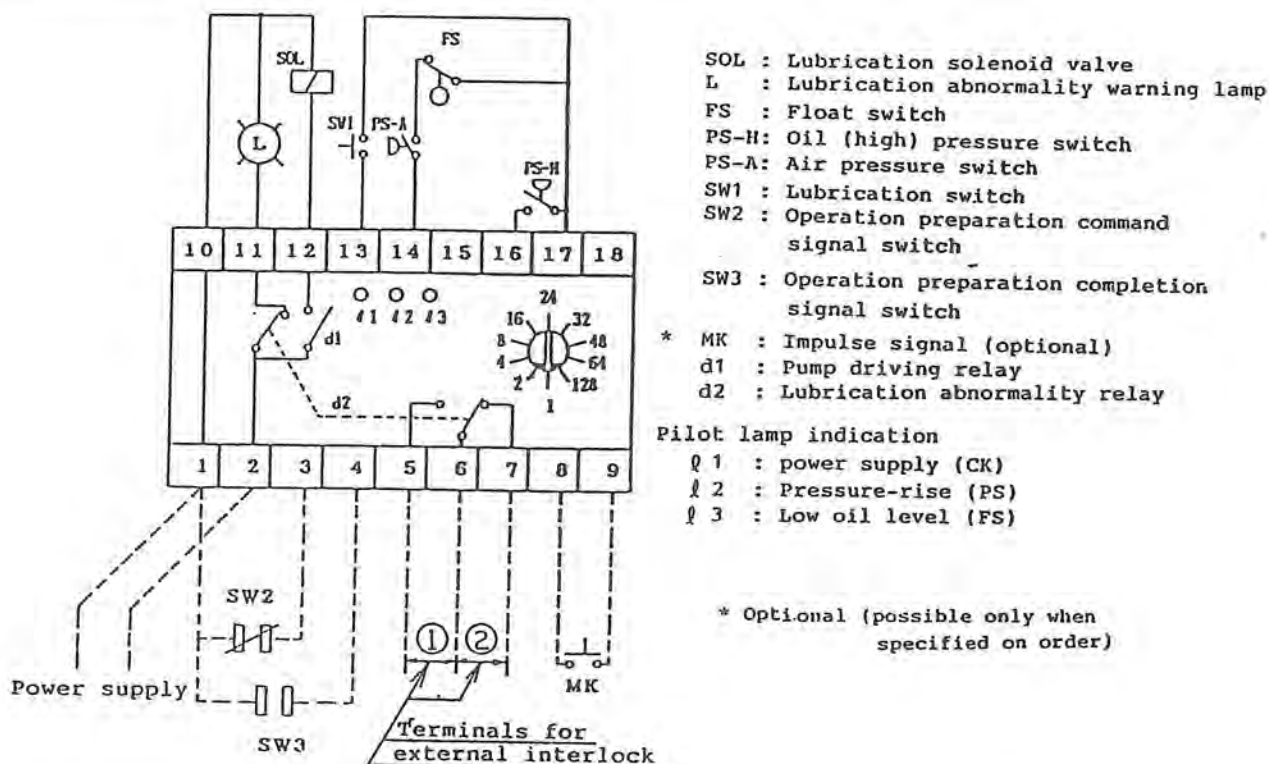


Fig. 4-2

5. Controller Connection Diagram



Note: ① In the case of a lubrication abnormality, terminals 5-6 are OFF
② In the case of a lubrication abnormality, terminals 6-7 are ON

6. Description of Operation

(1) Normal Operation

- ① With the power supply ON, the power supply lamp flashes.
At the same time, the solenoid valve operates the air-driven oil pump and the pressure rise pilot lamp lights.

Note: When both terminals (1) (3) (operation preparation command signal SW2) and (1) (4) (operation preparation completion signal SW3) are turned ON (closed), the pump driving solenoid valve starts operation.
(Unless both (1) (3) and (1) (4) are ON, the pump doesn't operate.)

- ② Oil supplied by the pump passes through a tube to the mixing valve that produces preset constant quantities of oil-air mixture, which is expelled from the discharge ports.
- ③ The hydraulic circuit is closed after the pump starts operation. Accordingly, the oil pressure, which is proportional to the air pressure (refer to the Specifications), rises and the oil pressure switch operates when the pressure exceeds the specified value. (The oil-pressure switch actuation can be confirmed by the lighting of the pressure rise pilot lamp PS in the controller.)
- ④ The oil delivered from the oil-air discharge ports is carried by air to the bearings.
- ⑤ Fifteen seconds⁽¹⁾ after actuation of the oil-pressure switch, the pump stops.

Note (1): It is necessary for the oil-pressure switch to hold for fifteen seconds.

- ⑥ When the pump stops and pressure in the oil circuit declines, the pressure is relieved (residual pressure relief) by the relief valve (residual pressure relief valve) housed in the pump, and the mixing valve again accumulates oil. This pressure relief (residual pressure relief) mechanism is very important for the operation of the mixing valve.
- ⑦ The hold time starts when the pump stops. After expiration of the hold time set on the controller, the pump operates again and the above sequence repeats.
- o The hold time can be selected from ten intervals (1, 2, 4, 8, 16, 24, 32, 48, 64, and 128 min.) by means of a selector switch (See Fig. 4-1).
 - o Even during the hold time, the pump can be operated at will using the lubrication switch (See Fig. 4-2). In this event, the hold time starts to run again after the pump stops.

(2) Operation in Case of Malfunction

- 1) The following situations are abnormal conditions. When an abnormality is found, the pump solenoid valve SOL stops and the abnormality warning lamp lights. At the same time, terminals (6)(7) turn ON (closed) and terminals (5)(6) turn OFF (open), and a no-voltage signal is obtained.

(Abnormal lubrication conditions)

- ① Insufficient pressure rise: The pump delivery pressure fails to turn the oil pressure switch PS-H ON (closed) within 60 seconds after the pump starts.

- ② Failure of relief valve: Oil pressure switch PS-H remains ON (closed) at the end of the hold time.
 - ③ Low oil level: When float switch FS turns OFF (open) because the oil level has dropped.
 - ④ Air pressure drop: When air pressure switch PS-A turns OFF (open) because the air pressure has dropped.
- 2) To reset the lubrication abnormal status, either press the lubrication switch SW1 (ON → OFF) or turn the operation preparation command signal SW2 (terminals (1)(3) OFF (open), or shut off the power supply*.
- (*) To turn the power ON again, wait at least one second.

(3) Function of Operation Preparation Command Signal Switch SW2 (Terminals (1)(3))

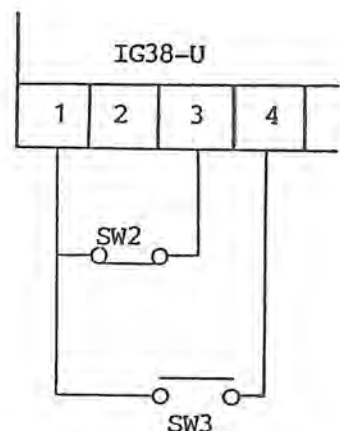
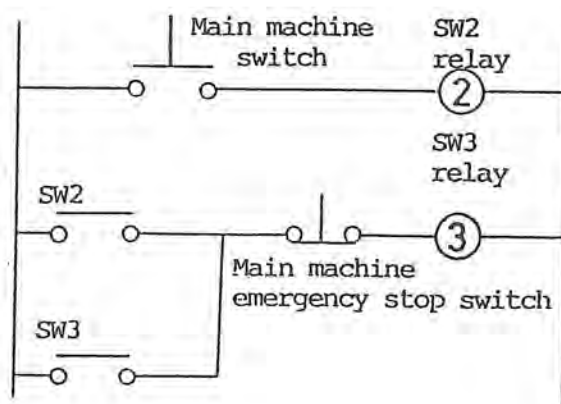
- 1) If the operation preparation command signal switch (terminals (1)(3)) remain OFF (open) when power is supplied, the pump doesn't start and remains stopped. When this switch is turned ON, the pump starts to run (however, terminals (1) and (4) are ON). Once lubrication starts, even if SW2 (terminals (1)(3)) are turned OFF (open) during operation, it doesn't affect the normal operation of the controller.
- 2) When a lubrication abnormality is detected, if SW2 (terminals (1)(3)) is turned OFF (open), the status of the abnormality detected is cleared, thereafter, when SW2 (terminals (1)(3)) is turned ON (closed), the pump restarts (however, terminals (1)(4) remain ON).

(4) Function of Operation Preparation Completion Signal SW3
(Terminals (1)(4))

- 1) When the operation preparation completion signal SW3 (terminals (1)(4)) remains turned OFF (open), the pump doesn't start. During pump operation, if SW3 (terminals (1)(4)) is turned OFF (open) from ON (closed), the pump will stop immediately. At that time, in case pressure switch PS-H is not actuated (ON) yet(*), the next cycle starts from the sequence where SW3 (terminals (1)(4)) is turned ON (closed). But, operation is interrupted after the actuation (ON) of pressure switch PS-H (*), the system will enter the operating cycle only after the set hold time elapses even if SW3 (terminals (1)(4)) is turned ON (closed).

(*) More precisely, 2 seconds after pressure switch PS-H actuation.

⑥ An example of connections showing the function of SW2 and SW3



① Completion of operation preparation

When the main machine switch is pushed and released, the operation preparation becomes complete. (Both SW2 and SW3 on the controller side turn ON (closed).)

② When stopping the machine

The main emergency stop switch for the lubricator in the machine should be pushed without shutting off the power switch of the lubricator. Consequently, the lubricating pump stops since SW3 is OFF (open).

At the next operation, the pump can start operation by pushing the main machine switch, that is, SW3 is ON (closed). Therefore, no unnecessary oil is supplied while the spindle is stopped.

For the timing of pump operation, refer to "(4) Function of Operation Preparation Completion Signal Switch SW3".

③ When stopping the pump owing to a lubrication abnormality

- o When the main machine switch is turned ON (closed), SW2 on the controller side turns OFF (open) and the stop signal in the controller can be reset.

- o When the main machine switch is turned OFF (open), SW2 on the controller side turns ON (closed), and the operation preparation becomes complete again.

(5) Function of Impulse Signal MK (terminals (8)(9)) (Optional (possible only when specified on the order))

The hold intervals can be controlled by the impulse. In such a case, the hold setting SW of the controller becomes the frequency setting SW of the impulse without any change.

A. Preparation for Operation

Applicable type of unit: OAE

1. Preparation for Operation

- (1) Installation
- (2) Electrical Wiring
- (3) Oil Supply
- (4) Oil Supply Line Fittings
- (5) Air Supply Line Fittings
- (6) Air Bleeding
- (7) Oil-Air Piping
- (8) Air Flow Adjustment
- (9) Test Operation

A. Preparation for Operation

(1) Installation

- o Mount the lubricator on a vertical surface.
- o The installation place should be flat, clean, and free from vibration, splashing of cutting oil, etc.

(2) Electrical Wiring

- o Connect an AC 100V power supply through a fuse to terminals (1) (2).
- o Connect a ground wire without fail to prevent shocks.
- o No-voltage signals can be obtained from terminals (5) (6), (6) (7) in case of a lubrication abnormality. (See "Operation in Case of Malfunction" on Page 7) Use them if desired.
- o Lead wires should be extended inside the lubricator through the wire connector. The maximum cable diameter "d" is $\phi 12$.

Note: When both terminals (1) (3) (operation preparation command signal SW2) and (1) (4) (operation preparation completion signal SW3) are turned ON (closed), the pump solenoid SOL starts operation.

(Unless both terminals (1) (3) and (1) (4) are ON, the pump doesn't operate.)

(Operate either by short-circuiting (1) (3) and (1) (4) or provide SW2, SW3 on the machine's side to turn them ON (closed).)

(3) Oil Supply

- o Always use fresh oil as specified on Page 2
- o Use the utmost care to prevent the entry of dust when filling the tank and never remove the strainer.

(4) Oil Supply Line Fittings

- o In case of the Separate Mixing Valve Type, connect tubes between the mixing valve and the lubricator.

Note: It is necessary to consider the expansion of the tubes.
For details, contact an NSK office.

(5) Air Supply Line Fittings (See Fig. A2-1)

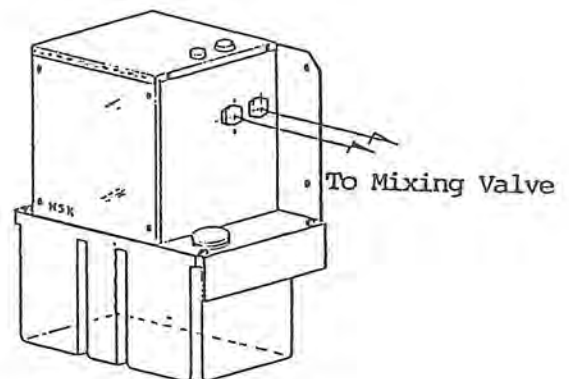
- o Connect the air source to the air supply port of the lubricator. (Connection bore: PT 1/4)
- o Ø8 plastic tubing can be easily connected to the air supply port using OAJ 42 (female/male joint, inlet sleeve, lock nut).

Note: Tighten the lock nut lightly with a wrench and then retighten it 3/4 to 1 turn further after feeling a little resistance. Sealing is obtained in this manner. Never overtighten the lock nut. When retightening it, hold the matched joint fixed with a wrench.

(6) Air Bleeding

- o Always bleed any air out completely. Otherwise oil-air delivery may fail.
- o In case of the Separate Mixing Valve Type, bleed air after completing the oil tubing between the lubricator and mixing valve.

Refer to the Operating Manual
for the Oil-Air Mixing Valve.



(7) Oil-Air Piping (See Fig. A2-1)

- o After completing the air bleeding, connect tubes between the mixing valve oil-air discharge ports and the bearings.
- o The oil-air discharge ports contain M8 × 1 threads enabling easy connections using Ø4 plastic tubes with OAJ11 (inlet sleeve, lock nut).

Note: Tighten the lock nuts with a wrench lightly and then re-tighten them further 3/4 to 1 turn after feeling some resistance. Sealing is obtained in this manner. Never overtighten them.

- * Use the utmost care to prevent the entry of dirt or dust inside the machine when connecting tubes.

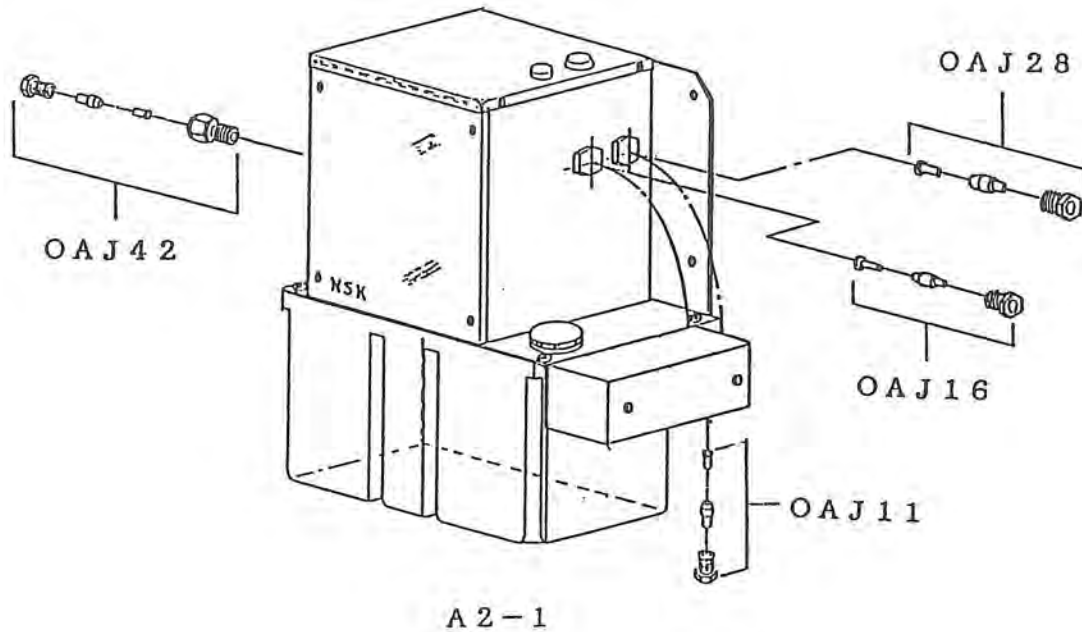
(8) Air Flow Adjustment

- o Connect the tubes to the bearings.
- o Adjust the air flow in the oil-air supply tubes using the air-flow adjusting screws. (Usually open the air flow adjusting screws 2 to 3 turns).
- o After adjusting the air flow, fix the air flow adjusting screws with the lock nuts.

(9) Test Operation

- ① Set the hold time appropriate for the bearing operating conditions on the selector switch.
- ② Confirm that the installation, piping and electrical wiring are complete, and then turn on the power supply to the lubricator.
- ③ Confirm that the pump operates correctly after each hold time and stops after the set time (15 seconds after the pressure-rise pilot lamp in the controller lights).

- ④ Check the lubricator and piping for any oil or air leaks.
- ⑤ Confirm that the lubricator is working normally and then shut off the power supply.



* This figure shows the Side-Mounted Mixing Valve Type.
In case of the Separate Mixing Valve Type, the lubricator
and mixing valve are connected using OAJ28 and OAJ16.

B. Maintenance, Inspections, and Troubleshooting Guide

Applicable type of unit: OAE

1. Maintenance and Inspections

- (1) Daily Inspection
- (2) Inspection when Replenishing Oil
- (3) Periodic Inspection

2. Troubleshooting Guide

- (1) Lubrication Abnormality
- (2) Abnormal Oil Consumption

3. Troubles and Measures

- (1) No Operation of Pump
- (2) Insufficient Pressure Rise in Oil Line
- (3) No Pressure Relief (Residual Pressure Relief)
- (4) Air Bubbles in Oil Line

1. Maintenance and Inspections

Carry out the following inspections to ensure reliable operation of the unit.

(1) Daily Inspection

- o Check if the oil tank is filled with fresh oil.
- o Check whether the air pressure is within the working pressure range.
- o Check if the pump makes any abnormal noise or vibration.
- o Check the lubricator and piping for any oil or air leaks.

(2) Inspection when Replenishing Oil

- o Check the oil cap and strainer for damage or contamination.
- o Check the oil tank and oil for contamination.
- o Confirm that the oil replenishing interval is normal.
- * The mixing valve incorporates piston-type constant-quantity metering devices. Therefore, the oil consumption is determined by the total delivery by the mixing valve and the pump operating cycle. Consequently, a large change in the oil replenishment interval indicates some kind of trouble. Refer to Paragraph 2 (2) on Page B-6 of the troubleshooting guide in case of abnormal oil consumption.

(3) Periodic Inspection

Always turn off the power supply first.

1) Visual Inspection

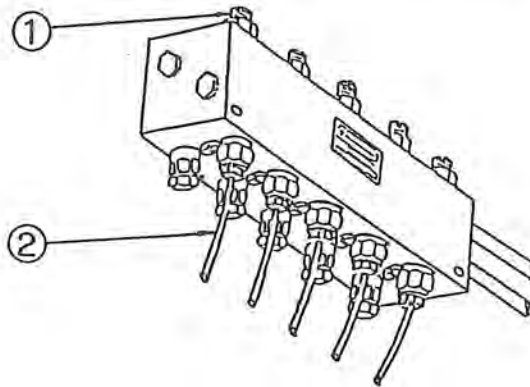
- o Check the oil cap and strainer for damage or contamination and the oil tank and oil for any contamination.
- o Check the electric wiring for any looseness.
- o Check the wire insulation.
- o Check parts and mounting bolts for any looseness.

- o Check inside and outside the lubricator for any contamination.

2) Functional Check

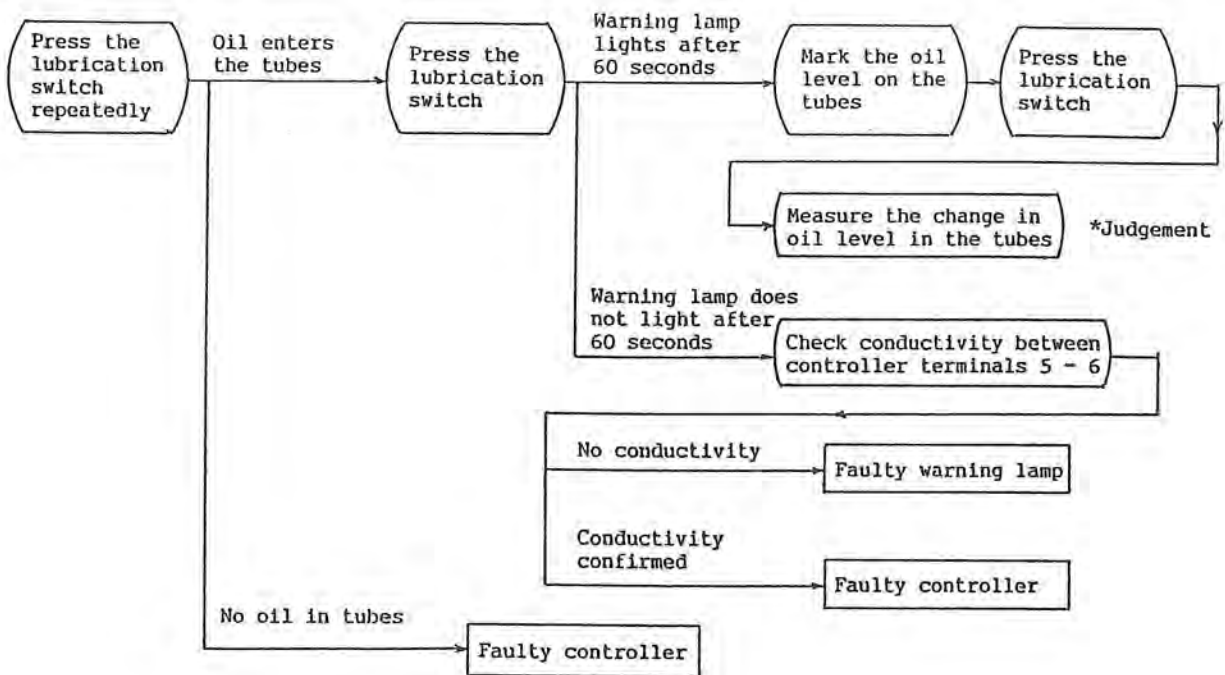
Check the various functions of the lubricator as follows:

- o Check the oil delivery from the mixing valve and controller oil-pressure (pressure-rise) detection.
- ① Fully close the air flow adjusting screws on the mixing valve (by screwing CW till resistance is felt).



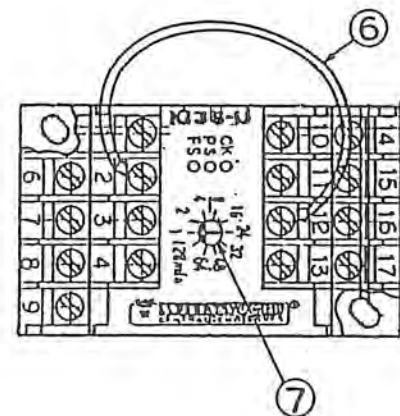
- ② Disconnect the tubing from the mixing valve oil-air delivery ports and connect transparent plastic tubes ($\varnothing 4 \times \varnothing 2.2 \times 300\text{mm}$ approx.).
- ③ To simulate a pressure-rise malfunction, disconnect oil-pressure switch lead No. 16 in the controller. Take care that the disconnected lead does not contact other terminals.

- ④ Turn on the power supply to the lubricator and check it according to the following chart:



* Judgement:

For checking the delivery from the constant-quantity nipples in the mixing valve and change in the oil level, refer to the "Operating Manual for Oil-Air Mixing Valve".



- ⑤ After completing the inspection, turn off the power supply and reconnect oil-pressure switch lead No. 16.
- o Checking detection of the pressure relief (residual pressure relief) by the pump and controller.
- ⑥ To simulate faulty pressure relief, shunt terminals #2 and #12 in the controller.

- ⑦ Set the hold time selector switch on the controller to 2 minutes.
- ⑧ Turn on the power supply, check the pressure-rise pilot lamp PS and the lubrication warning lamp (red) and evaluate the conditions as follows:

Normal:

The pressure-rise pilot lamp PS lights several seconds after the power is turned ON. After 2 minutes and 15 seconds, the lubrication warning lamp (red) should also light.

* The pressure-rise lamp PS remains on.

Abnormal:

The pressure-rise lamp PS lights several seconds after the power is turned on. In 2 minutes and 15 seconds, the pressure-rise lamp should turn off.

* The lubrication abnormality lamp (red) remains off.

- ⑨ After completing the inspection, turn off the power supply, remove the shunt between terminals #2 and #12 in the controller, and reset the hold time.
 - o Checking detection of low air pressure by the air-pressure switch and controller.
- ⑩ Turn on the power supply and shut off the air supply to the lubricator. It is normal if low oil level pilot lamp FS (red) and lubrication abnormality indication lamp (red) light.
- ⑪ After completing the inspection, turn on the air supply to the lubricator and adjust the unit to the original set pressure.

- ⑫ Turn off the power to the lubricator and fully open the air flow adjusting screw to discharge oil inside the mixing valve.
- ⑬ Disconnect the inspection tubes from the mixing valve and reconnect the original ones.
 - o Confirming normal operation of the lubricator
- ⑭ Turn on the power supply and check for normal operation through the entire lubrication cycle.

If all the above inspections prove satisfactory, proper oil supply to each lubrication point is ensured.

In case any trouble is found, contact the nearest NSK office.

2. Troubleshooting Guide

Lubrication is monitored with a float switch in the oil tank, oil-pressure switch, and air-pressure switch.

When a warning lamp lights or when a lubrication warning signal is issued, take the following steps while observing the lamps on the controller.

(When the cause of any abnormality is determined by the troubleshooting guide, see Section 3, "Troubles and Measures" on Page B-8.)

(1) Lubrication abnormality (terminals 6-7 or 5-6 open) signal is generated (when lubrication warning lamp lights)

Controller Display Function

1) The controller is provided with the following three LEDs to indicate certain conditions.

- ① Power supply and timer (CK) green:

When this lights, it indicates that power is supplied to the IC controller and the timer functions normally.

② Pressure-rise (PS) green:

This lights when the pressure switch PS-H is ON.

③ Low oil level (FS) red:

This lights when either the float switch FS or air pressure switch PS-A is OFF.

2) When lubrication warning lamp lights, depending on the lighting of lamps ①, ②, and ③, the possible cause of the abnormality can be determined as follows.

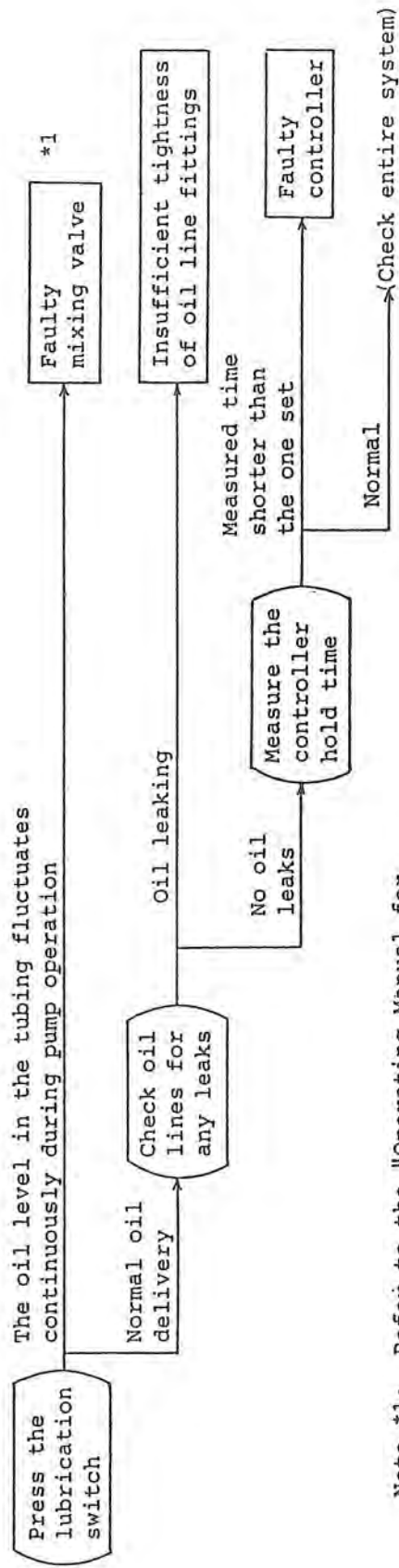
① Power supply	② Pressure rise	③ Low oil level	Cause of abnormality
OFF or ON	-	-	Abnormality in power supply or faulty controller
Flashing	OFF	OFF	Faulty pressure-rise
Flashing	OFF	ON	Low oil level or low air pressure
Flashing	ON	OFF	Faulty pressure (residual pressure) relief
Flashing	ON	ON	*

* Usually such a condition does not occur. If it does occur, failure of a switch, etc. can be suspected.

(2) Abnormal Oil Consumption

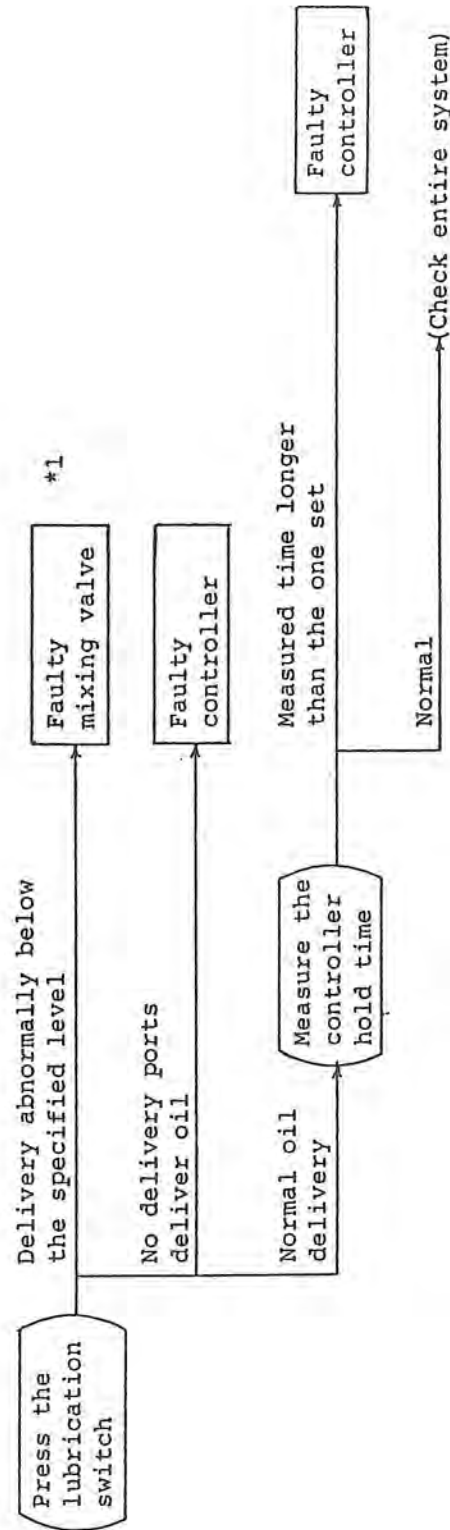
Fully close the air flow adjusting screws on the mixing valve (by screwing CW till resistance is felt) and connect transparent plastic tubes ($\phi 4 \times \phi 2.2 \times 300\text{mm}$ approx.) for the inspection.

1 Oil consumption is high



Note *1: Refer to the "Operating Manual for Oil-Air Mixing Valve".

2 Oil consumption is low



Note *1: Refer to the "Operating Manual for Oil-Air Mixing Valve".

3. Troubles and Measures

(1) No Operation of Pump

Causes	Measures
o Abnormality in power supply	o Check the voltage and connection at the power supply locations o Check fuse, breaker, etc.
o Air pressure drop	o Check the pressure and connections of air source o Check the air pressure using the pressure gage in the lubricator o Adjust the pressure to be within the working pressure range
o Faulty air pressure switch	o Check the conductivity of the pressure switch o Exchange the pressure switch
o Faulty controller	o Confirm the operation by pushing the lubrication switch o Check the power supply locations of the pump-driving solenoid valve o Exchange the controller
o Faulty pump driving Solenoid valve	o Pay attention to abnormal noise and vibration o Measure conductivity of the coil in the solenoid valve o Exchange the solenoid valve

(2) No Pressure Rise in Oil Line

Causes	Measures
o Oil leaks	o Check for leaks from tubes and damage to tubes
o Incomplete air bleeding	o Check the locations in which air easily gathers o Bleed air again
o Suction of air due to low oil level	o Replenish with fresh oil
o Insufficient air pressure to drive pump	o Check the air pressure using the pressure gage in the lubricator o Adjust the pressure to be within the working pressure range
* o Malfunction of pressure relief valve (residual pressure relief valve) (Entry of dust inside the valve, etc.)	o Clean or exchange the valve
* o Clogging of suction strainer	o Clean the suction strainer
* o Faulty seal due to foreign matter in suction port	o Remove foreign matter
o Faulty pressure-rise due to insufficient operation time	o Reexamine the length of tubes

(3) No Pressure Relief (Residual Pressure Relief) (No Dropping of Oil Pressure in the System while the Pump Remains Stopped)

Causes	Measures
o Insufficient time for pressure relief (residual pressure relief)	o Extend the set hold time
* o Malfunction of pressure relief valve (residual pressure relief valve) (Entry of dust inside the valve, etc.)	o Clean or exchange the valve

(4) Air Bubbles in Oil Line

Causes	Measures
o Insufficient tightness of tubes	o Retighten the joints o Exchange parts o Exchange packings and gaskets
o Low oil level	o Replenish with fresh oil

Note: If any trouble is found and the cause is marked with an asterisk (*) in the above table, contact an NSK office.

Guarantee

1. The guarantee period for this unit is one year after delivery.
The repair cost for any trouble occurring after expiration of the guarantee period must be paid by the Purchaser.
2. Even during the guarantee period, the repair cost in the following cases must be paid by the Purchaser.
 - (1) Trouble or damage due to improper repair or modification.
 - (2) Trouble due to improper handling after delivery.
 - (3) Trouble or damage due to fire, public disturbance, earthquake, damage from storm or floods, and other disasters.
 - (4) In case the unit was damaged for any reason other than one attributable to the manufacturer.

**C: Q-PAC
(MC-400H)**

Tokyo Keiki

Q-PAC

INSTRUCTION MANUAL

MC-400H

TOKYO KEIKI CO., LTD.

- HYDRAULIC DESIGN SECTION -

ME21-060-R1

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1. General

This power pack is manufactured by Tokyo Keiki Co., Ltd., for machine tools. Its construction is as shown by the attached hydraulic circuit diagram. It is fully equipped to provide the specified performances.

2. Method of Installation

2.1 Transportation and Installation

- (1) Employ a fork lift to transport the unit. After obtaining proper balance of the unit, suspend from the designated hook. Do not tilt the unit more than 20 degrees in either direction.
 - (2) This Q PAC weights approx. 70 kg without hydraulic oil. When transporting the unit, always employ a fork lift and wire rope of sufficient strength.
-

2.2 Hydraulic Piping

- (1) After the unit has been properly placed, install all required piping by referring to the external view and hydraulic circuit diagrams.
- (2) Remove all rust or dirt from the piping.
- (3) Pipe dimensions and type should be as specified.
- (4) Insure that a section of rubber hose is employed as piping in front of the connection port of the unit. (The minimum length shall be 1 meter.)
- (5) Provide support for the pipe at the required positions. (At intervals of approx. 1 meter.)
- (6) After completion of piping, thoroughly flush all the piping.

2.3 Electric Wiring

main motor ... from terminal *(in terminal box of motor)*

2.4 Selection of Hydraulic Oil for Hydraulic Unit

Table shows the various types of hydraulic oils made by several manufacturers. Use the oil most readily available to you.

Table

Temperature range	Manufacturer	NC fluid	Anti-wear fluid
	Esso Oil	Umivis J 32	Nuto-H, Nuto-HP
	Shell Oil	Shell NC Oil A	Terrus 33
	Mobile Oil	Mobile NC . System Oil .	DTE24

2.5 Oil Supply

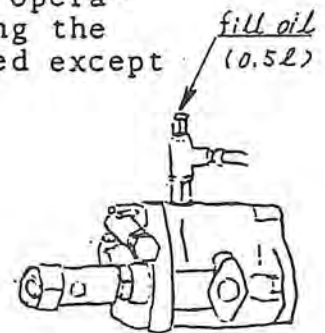
(1) Supplying oil to the reservoir

Remove the related cover from the oil port and pour in oil through the filter so as to be a little over the reference level on the oil level gauge. Use a clean funnel and be careful not to allow any foreign matter or water to enter the unit.

When the valve and pipes are filled with oil after operation is completed, the oil level will be lowered by that amount. Therefore, add additional oil up to the reference level.

(2) Filling the pump housing with hydraulic fluid

Always completely fill the pump housing with fluid (approx, one litre) by removing the plug on top of the tee as shown in right during the initial operation of the pump. (After filling fluid during the initial operation, no more filling is required except as in such case as changing fluid.)



3. Operation and Adjustment

3.1 Pre-adjustment Inspection and Precautions

(1) Check the oil level

The oil level should be slightly over the specified reference level. (Observe the reference line on the oil level gauge attached to the oil tank.)

(2) Check for oil leakage

Check that no leakage of oil in the tank, pipes, valves, etc., is observed.

(3) Check all connections

- a) Insure that all hydraulic pipe connections between the hydraulic unit and actuator are correct.
- b) Check the connection between the hydraulic unit and electrical control panel.

- (4) Check the pressure gauge graduations.

The pressure gauge should indicate zero before the hydraulic unit starts operation.

3.2 Start

- (1) Check the rotational direction of the pump and motor under the no-load condition. Turn the motor switch on for a moment and confirm that the fan on the rear of the motor is rotating in the direction designated by the arrow mark on the piston pump. If rotation is reversed, change the phase to obtain the correct rotational direction.

Once the above checks have been completed, no further inspection is required unless an electrical connection is changed for some reason.

- (2) Start at normal conditions

When confirmation and adjustment are completed for item (1) above, and if fluid temperature is above 0°C, operation can be started immediately.

3.3 Adjustment

- (1) Bleeding air

Air in the hydraulic system will become the cause of irregular motion and noise. Therefore, air must be completely removed prior to normal operation. Bleed air as follows. Reduce the setting pressure of the piston pump.

Remove air from the air bleeder located between the power unit and the actuator or by loosening the fitting located at the highest point of the piping until there no more air remains in the fluid bleeding out.

- (2) Adjustment of piston pump
(refer to attached installation drawing)

This unit uses pressure compensated type variable piston pump. By turning the pressure adjustment screw of the piston pump clockwise (hexagon head) increases pressure and, by turning anti-clockwise decreases pressure. (since there is no stop, be careful not turn excessively anti-clockwise)

3.4 Checking during operation and cautions to take

- (1) Checking of amount of fluid

Check if there is no difference from the previous checking. When there is difference investigate the cause (fluid leakage) and take measures. When the cause is unclear, fill fluid up to the normal line and investigate the cause while operating.

- (2) Checking of pressure gage

Check if the pointer is showing correctly.

3.5 Operation

Operate the unit when all preparation for operation are complete on the actuator side.

If the pressure gauge indicates 65 kg/cm^2 (or the value set by reference to 3.3-(2)), it is normal.

3.6 Stop

The unit is stopped by turning the motor switch off. No special operation is required after stopping the unit.

4. Individual Apparatus Operation

This power pack using the piston pump. This pump is the variable discharge pressure compensating type. The discharge value of the pump may be varied freely in accordance with the flow required by the acuator at 65 kg/cm².

See the section drawing of the element, the symbol of the oil circuit diagram and the specification of the element are written on it.

5. Maintenance and Inspection

5.1 Inspection during Operation

(1) Check the Oil Level

Insure that the oil level is above the level specified. If any discrepancy is noted determine the cause after adding the required amount of oil.

(2) Check the Pressure Gauge Indication

The indicator must indicate the pressure set on the pump or appropriate to the load of the actuator. The pointer should not vibrate excessively. If an abnormal indication is observed, the cause may be either a defect in the pressure gauge or the oil pressure. Determine the cause and take the appropriate counter measures.

(3) Checking of the filter

This unit is installed with a suction filter in the reservoir and low pressure line filter in the return line. Both filters do not detect the clogging of the filter. Thus clean or replace at the time of overhaul or replacement period.

(4) Check the Oil Temperature

When the oil temperature is less than 60 degrees centigrade, the concition is normal, and abnormal if more than 65 degrees centigrade.

(5) Check for Noise During Operation

Check for any abnormal noise when the pump and valve are operating.

(6) Check that there is no variation in the operating speed of the actuator.

The above items should be checked on a periodic basis, a record made of the results. If any abnormal condition is observed, determine the cause immediately and take the proper counter-measure.

5.2 Maintenance While Stopped

(1) Periodic Removal of Water

If the unit is used in an extremely humid location, water may accumulate in the oil tank. Drain this water periodically (once a month) by loosening the oil drain port plug at the bottom of the oil tank.

(2) Check the Locking Bolt and fitting

Inspect at least once a month, and repair any defects.

(3) Prevention of Rust

In the event the unit is not to be operated for more than 6 months, drain the operating oil and apply a rust-proof oil to the unit then operate for several hours. Rust-proofing measures should be taken with the entire system. The rust preventive oil used should be equal to the standards of MIL-L-21260; grade 1.

Mobil Oil	Mobil Coat 501
Idemitsu Kosan	Daphne Sola Rust Engine Oil No.10
Shell Oil	Shell Rust Preventive P-10 Grade 1
Esso Standard Oil	Anti-rust P-1010
Nippon Oil	Rust Preventive Oil P-210

When operation is to be re-started after the above procedure have been taken, wash the unit with flushing oil to minimize mixture of deteriorated oil and hydraulic oil, and discard the mixed oil after circulating the hydraulic oil. Then start operation.

5.3 Oil Storage and Handling

- (1) The storage drum or can must have a suitable cover.
- (2) Before opening the drum can, wipe the upper side carefully to prevent dust from entering the oil.
- (3) Check the oil container and keep it clean.
- (4) When wiping any part coming in contact with the oil, use a cloth to which dust or textile particles do not adhere. A sponge is recommended.

5.4 Down Time for Overhaul and Replacement

The down time for overhaul and replacement cannot be designated since it differs with the degree of usage, presence or absence of impurities, quality of the oil, temperature, degree of maintenance, etc.

Accordingly, check the items listed below, overhaul the unit and replace the parts in which abnormalities are found.

Check item	Interval	Check point	Countermeasure
Hydraulic fluid	Monthly	Color, turbidity, deposit, water, deterioration	If any abnormality is found, take the necessary steps after consulting the manufacturer.
Piston pump	Weekly	Noise (determine by deily observation)	If any abnormality is found, consult the manufacturer.
	Every 2 years	Shaft coupling	Replace the intermediate rubber. If replacement involves difficulty, consult the manufacturer for service.
	Check when replacing the hydraulic oil	Adhered foreign matter	Wash clean regardless of the presence of the foreign matter, and blow dry with air from the inside. <i>(Remove the reservoir top plate to take out the filter).</i>
Air breather	Monthly	Clogging and ventilation	If ventilation is poor, replace with a new part.
Low pressure line filter	3000 hrs		Replace by new filter element
Pressure gauge	Every 6 months	Error in indication	Measure with a reference gauge, or compare with a gauge of high accuracy. If the error is too great, replace with a new gauge.

Oil tank piping, locking bolt, fitting	Every 3 months	Oil leakage, loose thread sections	Repair any abnormalities found.
--	----------------	--	---------------------------------

5.5 Disassembly and Reassembly

Periodic overhaul of the major parts and repair of the trouble should be made by manufacturer.

If disassembly and reassembly must be made for some reason, pay particular attention to the following items.

- (1) Study the operation of the circuit, in addition to operation and construction of the element in advance by referring to the circuit diagram and section drawing of the element.
- (2) Before loosening the locking bolt and fitting make provisions to prevent the residual pressure or difference in the head pressure from causing the oil to spurt out.
- (3) When leaving the unit disassembled, rust is likely to form therefore apply a rust-preventive oil or dummy plug.
- (4) Wash the disassembled parts with kerosine, place in hydraulic oil after drying, then reassemble.
- (5) When reassembling the parts, maintain the tightening torque of the components uniform.
- (6) When reassembling the repaired parts, replace all O-rings and packings.
- (7) Before starting operation, insure that the locking bolts, dummy plugs, fittings, etc. are all tightened.
- (8) In the event a trouble occurs for some unknown reason, consult the manufacture at the nearest address or head office.

6. Troubleshooting

To better prevent troubles from occurring daily maintenance and inspection should be performed on a scheduled basis. As is often the case unexpected items will cause troubles. The troubleshooting chart below is furnished to assist you in locating and clearing troubles more easily.

Trouble	Cause	Countermeasure
The pump will not discharge the oil	(1) Rotational direction of the pump is reversed.	Recheck in the same way as item 3.2 (1).
	(2) The oil has deteriorated. (The viscosity is low)	Consult the manufacturer of the hydraulic oil.
	(3) The oil temperature is not appropriate.	The temperature should be between 0 to 60 degrees in centigrade.
	(4) Insufficient oil in the oil tank.	Check the oil level by observing the oil level gauge, and replenish if insufficient.
	(5) The tank filter is clogged.	Remove and check. <i>(Remove the reservoir top plate to take out the filter)</i>
Pressure in the circuit fails to rise.	(6) The pump fails to discharge the oil due to the causes described in (1) to (5).	If the countermeasures described in (1) to (5) are not sufficient, consult the manufacturer for inspection.
	(7) The adjusting screw for discharge pressure of the pump is not properly adjusted.	Re-adjust in the same way as 3.3.(2).
	(8) Oil leaks in the hydraulic system.	Locate the leak and repair.

TANK FILTER

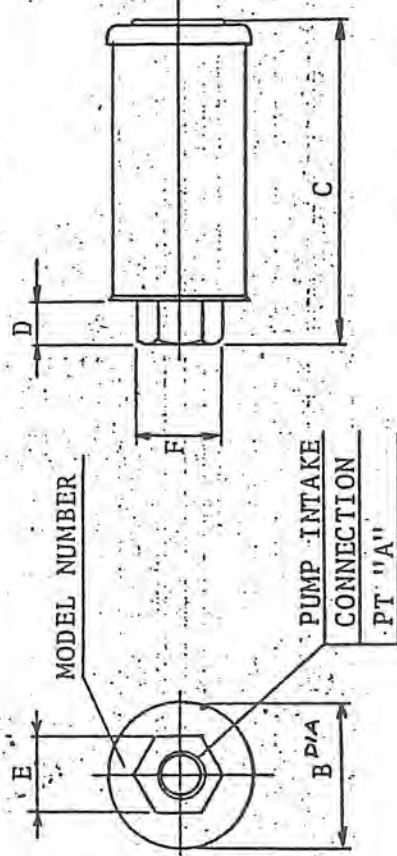
GENERAL USAGE IN AN: OIL: HYDRAULIC CIRCUIT TO PROTECT THE PUMP AND CONTROL SYSTEM FROM SOLIDS OR OTHER FOREIGN MATTER. USED AS AN IMMERSION TANK FILTER ON THE PUMP INTAKE LINE, AS INDICATED BY TYPICAL INSTALLATION DIAGRAMS SHOWN BELOW.

FILTER MESH 100 MESH (.0059")

RATINGS ARE CONSERVATIVE IN ORDER THAT A CHANGE IN OIL VISCOSITY SHOULD NOT MATERIALLY AFFECT CAPACITY.

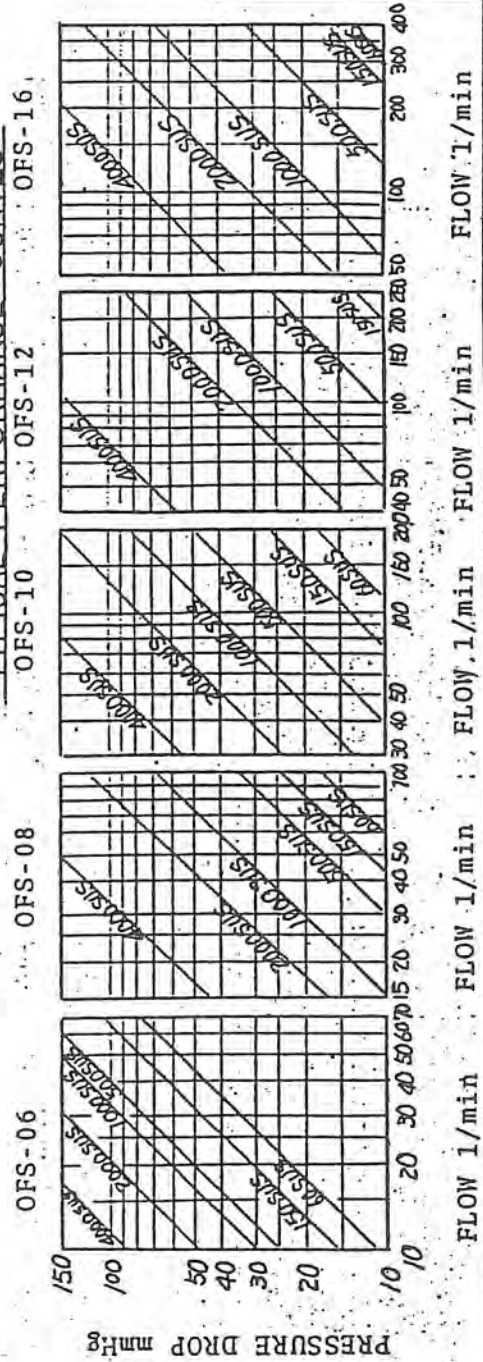
CLEANING SHOULD BE DONE PERIODICALLY BY REMOVING ELEMENTS FROM TANK. WASHING THOROUGHLY IN SUITABLE SOLVENTS AND BLOWING WITH AIR (FROM INSIDE TO OUTSIDE).

MODEL NUMBER	RATED CAPACITY /min	"A"	"B"	"C"	"D"	"E"	"F"
OFS-06-JA-J	35	3/4	56	125	17	35-0.35	40.4
OFS-08-JA-J	60	1	80	190	19	46-0.4	53.1
OFS-10-JA-J	90	1 1/4	100	233	23	58-0.5	67.0
OFS-12-JA-J	140	1 1/2	119	258	25	63-0.6	72.7
OFS-16-JA-J	240	2	147	335	30	77-0.7	88.9

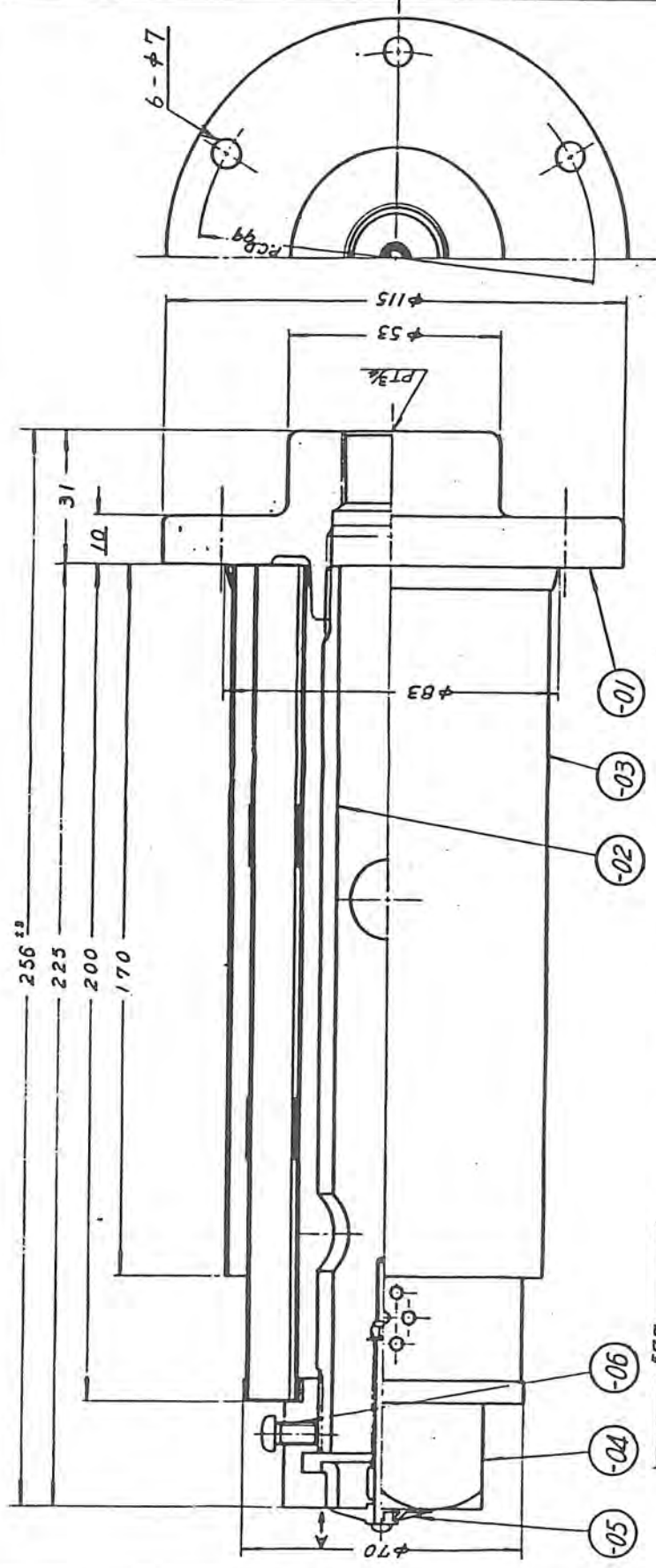


TYPICAL OIL INTAKE FILTER INSTALLATIONS USE FILTERS PIPED IN MULTIPLE TO OBTAIN ADEQUATE CAPACITY

TYPICAL PERFORMANCE CURVES

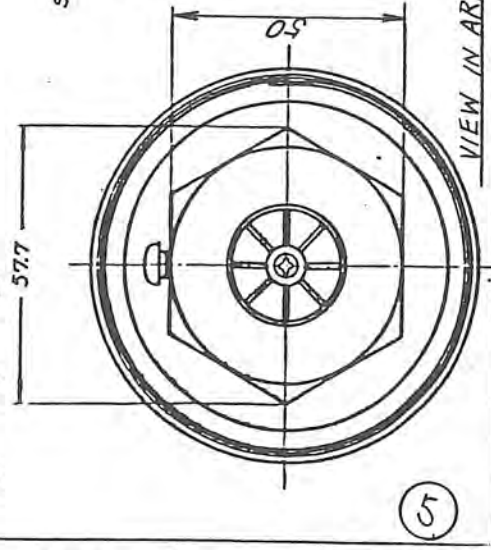


TANK FILTER		SYMBOL (JIS)	
OFS-※-JA-J		TOKYO KEIKI CO. LTD.	
DRAWN	CHARGED	CHECKED	APPROVED
SCALE 1/1		DATE 10	
Dec. 22 '77		B VPA 30635G	



SPECIFICATIONS.

1. FLUID TURBINE OIL 990
2. FLOW RATE 604/min (900/min Max)
3. RANGE OF OIL TEMPERATURE -20°C ~ 120°C
4. ELEMENT FILTRATION RATING 10 MICRON
5. CONNECTION SIZE PT 3/4"
6. 3 Y-PASS VALVE SETTING 1.05 kg/cm²

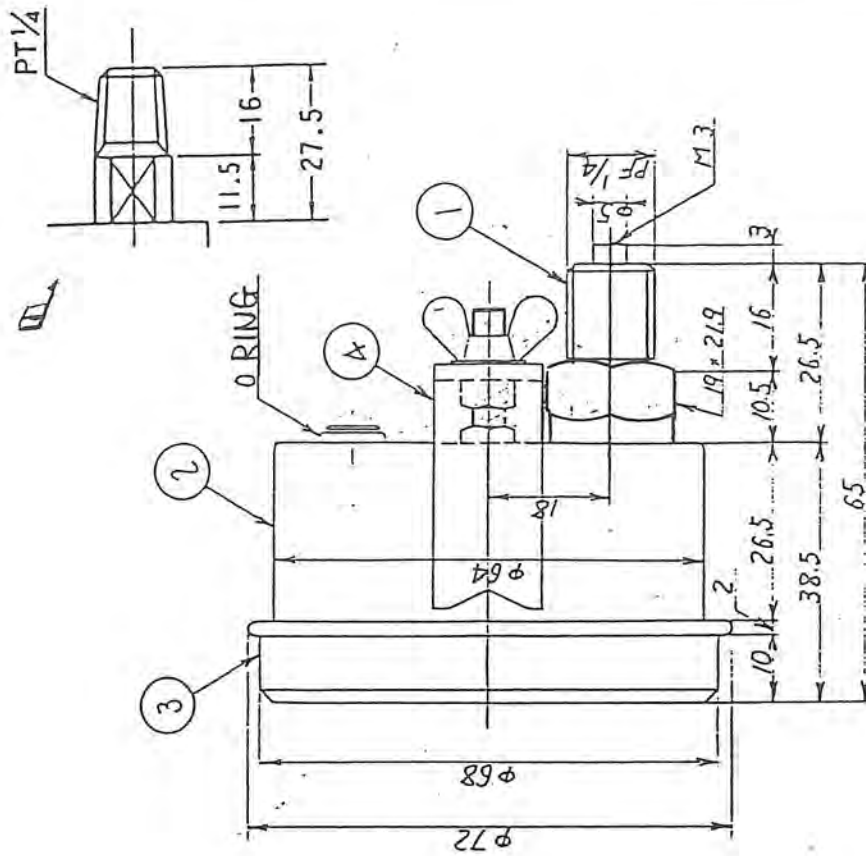
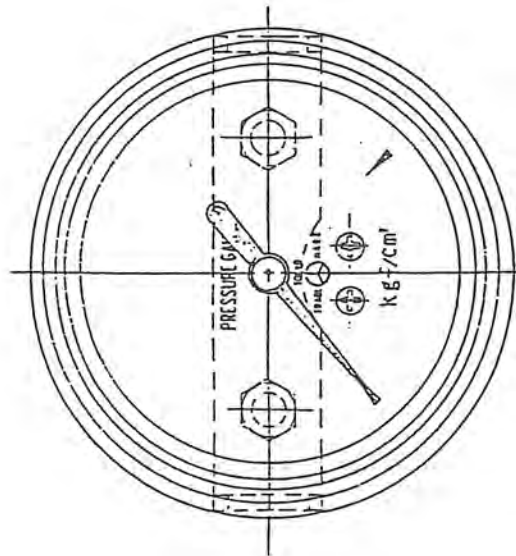


-06 SCREW	SWRM6	1	M5 x 12
-05 VALVE ASSY	-	1	1.05 kg/cm² set
-04 VALVE HOLDER	AC-2A	1	
-03 ELEMENT	-	1	10 MICRON Y-1721
-02 INNER TUBE	S P G	1	IB
-01 COVER	AC-4A	1	
ITEM NAME OF PART	MATERIAL	NO REQD	REMARKS
SCALE	DR'N DATE	9 JUL '79	
DESCRIPTION			
YAMASHIN KOGYO CO., LTD			
RELATION NO.			
WEIGHT	1.5 kg		
NOTE			

VIEW IN ARROW "A"

RETURN LINE FILTER

Y-2209E

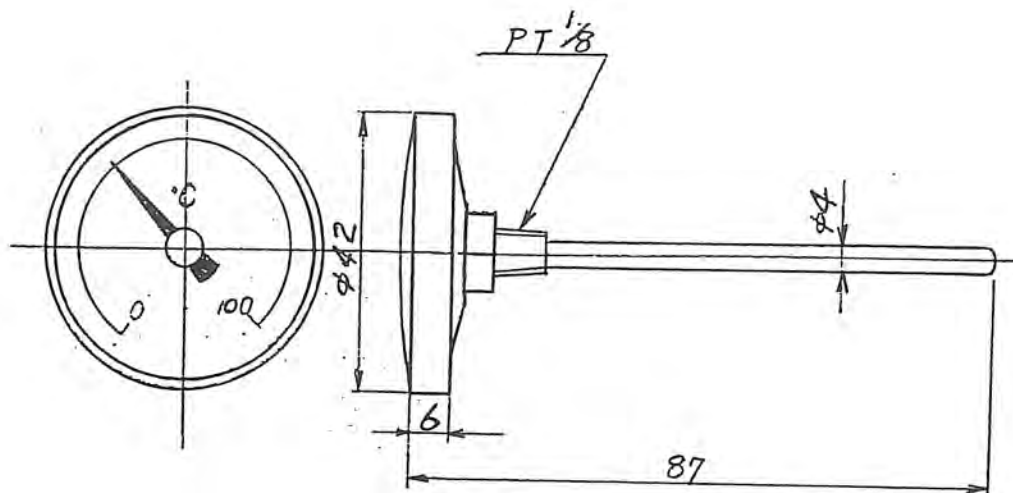


NO.	ARTICLES	MATERIAL	METHOD
1	SOCKET	C3604BD	
2	CASE	A1050P	BLACK PAINT
3	RING	A C	BLACK PAINT
4	BRACKET	SPCD	

OIL FILLED PRESSURE GAUGE

DS 1/4 x φ60

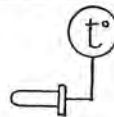
YAMAMOTO KEIKI MFG. CO., LTD.



SPECIFICATION :

-20°C
• TEMPERATURE SCALE : 0°~100°C (32°F~212°F)

GRAPHICAL SYMBOL



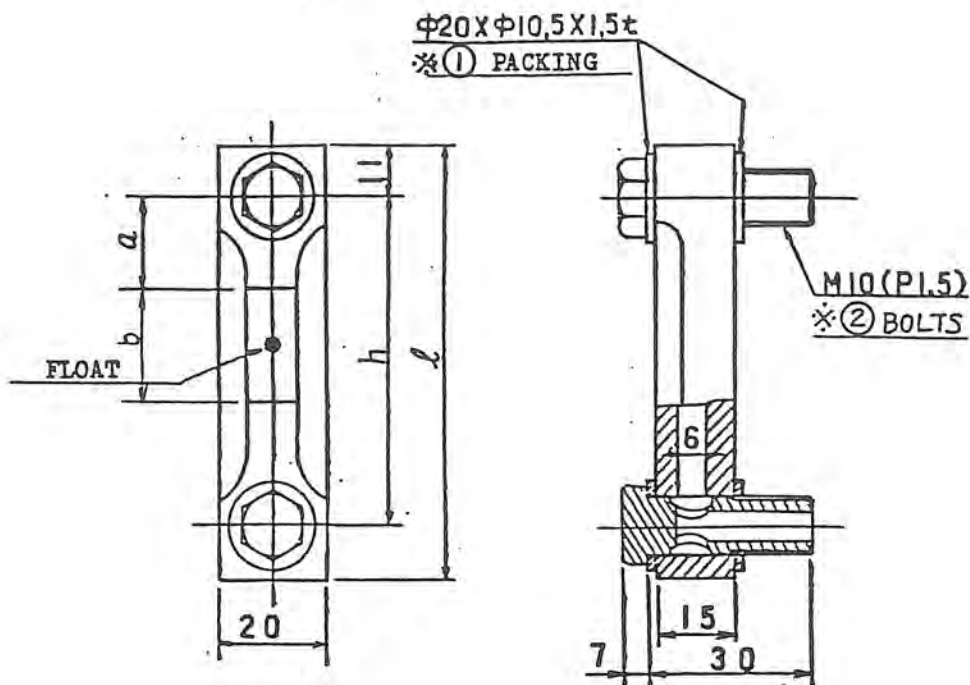
⑦

THERMOMETER

DT-42

TOKYO KEIKI CO., LTD.

DESIGN	DATE	SIZE	STANDARD
T. Hanai / Sawayama	20.1977	A	VPA42351G



MODEL NO.	ℓ	h	a	b
OLG2 -100	122	100	20	40
OLG2 -200	222	200	30	60
OLG2 -300	322	300	30	60

MODEL CODE

NONE-MINERAL OIL — F — OLG2 — 100 — OIL LEVEL GAUGE CENTER CtoC (h)
 "F" — WATER GLYCOL — OIL LEVEL GAUGE SERIES NO.
 PHOSPHATE
 ESTERS

*MARK MATERIALS

MARK	(1) PACKING	(2) BOLTS
NONE	TOMBO #1920	SS41
"F"	TOMBO #1000	SUS304

MANUFACTURE
 MARUWA SANSYO CO., LTD.

OIL LEVEL GAUGE

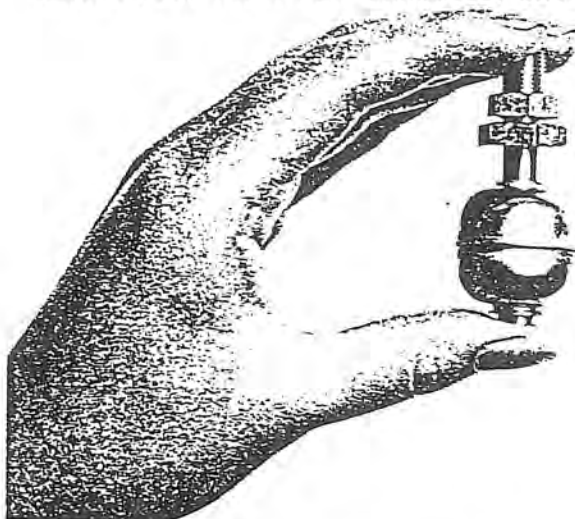
TOKYO KEIKI CO., LTD.

DRAWN	CHARGED	CHECKED	APPROVED
<i>M. Fukuda</i>	<i>S. Kubo</i>	<i>T. Ikeda</i>	
SCALE	DATE	SIZE	CHANGING
80	7.25	A	VKP05008

8

MICRO-SIZE, HIGH PERFORMANCE, LOW PRICE

OL SWITCH



OL Switch was specially developed to detect the Upper and Lower Level of Oil Tank where no spark is allowed, in the smallest possible size by utilizing the Reed Switch of very long life.

OLV-2 is mainly used for General Oil and Water Tank, and OLV-5 is specially designed for High Temperature and Medical Liquids by using Stainless Steel for Body and Float.

USAGE:

Fuel Tank, Lubricant Tank, General Oil Tank, Hydraulic Pressure Machine, Manufacturing Machine, Engine, Washing Machine, Vending Machine, Agricultural Machine, Air-Conditioning Machine, etc.

SPECIFICATION:

Model	OLV-2A-1	OLV-2A-2	OLV-2B-1	OLV-2B-2	OLV-5-1	OLV-5-2	OLH-2-1	OLH-2-2
Volt	AC100V	AC200V	AC100V	AC200V	AC100V	AC200V	AC100V	AC200V
USE for :	Oil & Water		Oil & Water		Oil, Water, and Medical Liquids		Oil & Water	
Pressure : kg/cm ²	30		30		20		30	
Temperature : °C	90		90		100		90	
Material : UNION	Poly-Acetar		BS		nil		Poly-Acetar	
NUT	Poly-Acetar		BS		SUS304		Poly-Acetar	
BODY	Poly-Acetar		BS		SUS304		Poly-Acetar	
FLOAT	Foamed Phenole		Foamed Phenole		SUS304		Foamed Phenole	
STOPPER	SUS304		SUS304		SUS304		SUS304	

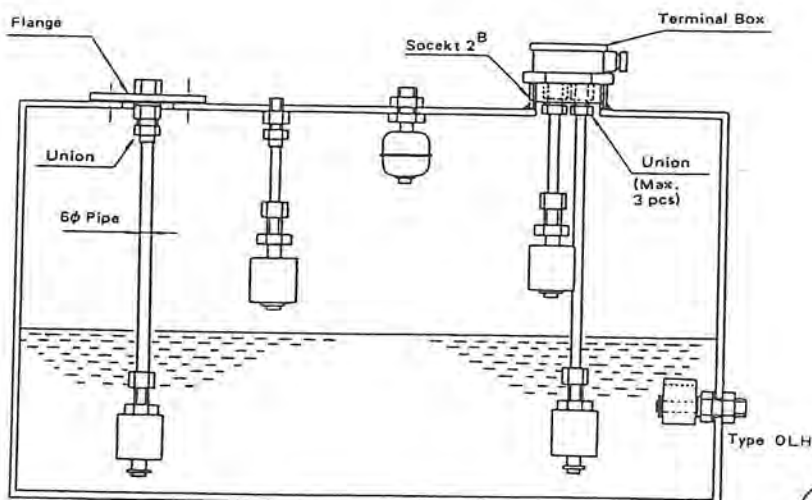
* Each Model with 30cm lead.

REED SWITCH RATINGS

Breaking Capacity: AC 12VA, DC 10W
 Max. Break Current: AC 0.6A, DC 0.5A
 Max. Break Voltage: AC 165V, DC 200V (for AC 100V)
 AC 360V, DC 500V (for AC 200V)

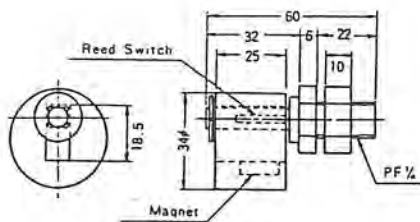
Resistance at
 Maximum Load: 0.1 Ohm
 Life: 10 x 10⁶ times

EXAMPLE OF MOUNTING

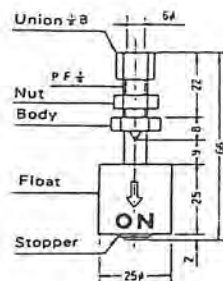


9-1/2

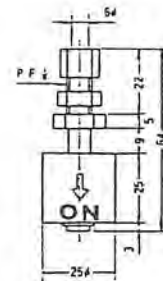
MEASUREMENT



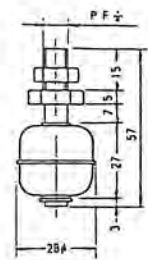
OLH-2



OLV-2A

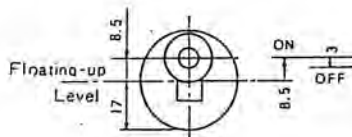


OLV-2B

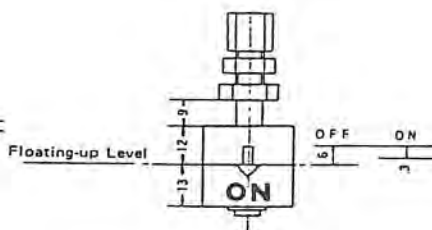


OLV-5

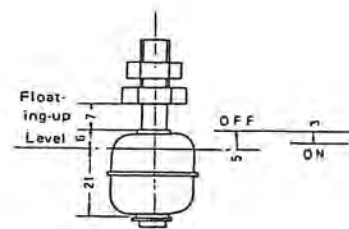
ACTUATION



OLH-2



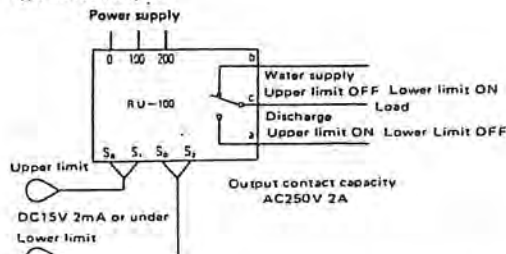
OLV-2A · 2B



OLV-5

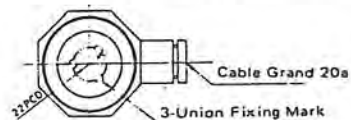
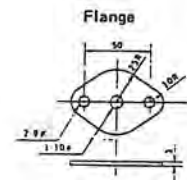
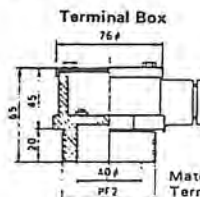
By putting Float upside-down, Switching ON-OFF will be reversed (i.e. OFF-ON). Actuation Level is situated at the same position.

Type RU100 Relay Unit



o Type RU100 Relay Unit is not standard equipment, so please order separately.

FIXING ACCESSORIES



Material: SS (Plated)
Mtg. Hole to Tank: 30φ
With Rubber Packing

LINES OR PRODUCTS

- Power Level Switches (Bin Levelers)
- Resistance Type Liquid Level Indicating Alarms
- Pulse Type Liquid Level Indicating Alarms
- Float Type Liquid Level Indicating Alarms
- Pneumatic Liquid Level Switches
- Magnetic Liquid Level Switches
- Two Liquid Interface Detection Switches
- Float Type Liquid Level Switches
- Reed Type Liquid Level Switches
- OL Switches
- Quick Floats
- Electrode Type Level Sensors
- Cable Floats
- Relay Units
- Buzzer Units
- Line Drivers

NOHKEN CO., LTD.

Agent

Head Office: 15-8, Hiroshiba-cho, Suita, Osaka 565 Tel: (06) 386-8141
Tokyo Office: 23, Matsunaga-cho, Kanda, Chiyoda-ku, Tokyo 101 Tel: (03) 253-5891
Kyushu Office: 1-7-1 Tate-cho, Kokura-Kita-ku, Kita-Kyushu 803 Tel: (093) 581-1430

BALANCED-PISTON TYPE PRESSURE BALANCER VALVE MODEL BSG-02-B-10 MANIFOLD OR SUBPLATE MOUNTING

GENERAL DATA

THIS MULTI-FUNCTION VALVE IS USED WHERE CONTROLLED OUTLET PRESSURE IS ALWAYS DESIRED REGARDLESS OF INLET PRESSURE VARIATION AND OUTLET PRESSURE INTENSIFICATION. WHEN THE INLET PRESSURE IS NOT IDENTIFIED THE VALVE PERFORMS PRESSURE REDUCING VALVE FUNCTION AND WHEN INTENSIFIED THE VALVE PERFORMS PRESSURE RELIEF VALVE FUNCTIONS.

SPECIFICATIONS

MAX. OPERATING PRESSURE 70 kgf/cm²
MAX. FLOW 30 lit/min
ADJUSTABLE PRESSURE RANGE 10-70 kgf/cm²

PRESSURE SETTING

ADJUST PRESSURE BY LOOSENING JAM NUT AND TURNING ADJUSTING HANDLE. COUNTERCLOCKWISE ROTATION INCREASES PRESSURE, COUNTERCLOCKWISE ROTATION DECREASES PRESSURE.

CONSTRUCTION

SERIES BSG VALVES ARE OF COMPOUND TYPE CONSTRUCTION.

FLUID AND SEALS

FOR TEMPERATURES BETWEEN 55 AND 155 °F, A FLUID VISCOSITY RANGING BETWEEN 150,000 AND 225,000 CP AT 100°F IS RECOMMENDED. THE USE OF SYNTHETIC, FIRE-RESISTANT FLUID REQUIRES THE USE OF SPECIAL SEALS, CONTACT SPERRY VICKERS REPRESENTATIVE.

DRAIN CONNECTION

DRAIN CONNECTION SHOULD BE PIPED DIRECTLY TO TANK TO MINIMIZE BACK PRESSURE.

VENT CONNECTION

WHEN REMOTE CONTROL IS NOT REQUIRED, PLUG VENT CONNECTION.

EXCHANGABLE IS 10 DESIGN

MODEL CODE BREAKDOWN

BSG - 02 - B - 11
VALVE SIZE 1/2" (1/4" INCH)
ADJUSTABLE PRESSURE 10-70 (BAR)
DESIGN NUMBER (SUBJECT TO CHANGE)

* JIS PT THREAD IS EQUIVALENT TO BSPT THREAD

137

FULLY EXTENDED

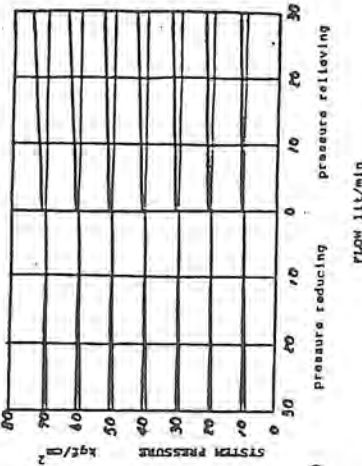
SECTION 'A-A'

PRESSURE ADJUSTMENT CONTROL

JAM NUT

4 HOLES FOR MOUNTING Ø.5 DIA

NOMINAL OVERRIDE CHARACTERISTICS



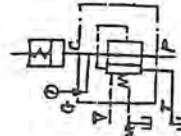
TANK CONNECTION (11 DIA)

* PRESSURE GAUGE CONNECTION 1/4 BSPT THD

CYLINDER CONNECTION (11 DIA)

VENT CONNECTION (4 DIA)

PRESSURE INLET CONNECTION (11 DIA)



STANDARD GRAPHICAL SYMBOLS AND TYPICAL APPLICATION

PRESSURE BALANCER VALVE
MODEL BSG-02-B-10
INSTALLATION DRAWING

© TOKYO KIRI CO. LTD.

REVISED 85.7.29
VA 22397 D

10-1/2

25	GUIDE TUBE	VA 28596	1	24	$\frac{1}{4}$ PLUG	VPJ 7075	1
26	$\frac{1}{16}$ PLUG	VP 113000	1	23	PLUG	VA 12748	1
				22	$\frac{3}{8}$ PLUG	VPJ 7076	1
				21	PLUG	VA 19542	1
				20	ORING	007991219	1
				19	SPRING	VA 19545	1
				18	ORING	007901117	2
				17	SPOOL	VA 19543	1
				16	ORING	007901417	3
				15	BODY	VA 19547	1
				14	ORING	007911117	1
				13	COVER	VA 19544	1
				12	M5 SCREW	001950101	4
				11	$\frac{3}{8}$ NUT	VP 1485	1
				10	KNOB	VA 9378A	1
				9	SCREW	VP 283949	1
				8	WASHER	VP 326317	1~3
				7	PLUNGER	VP 283948	1
				6	O RING	007901217	1
				5	SPRING	VP 2280	1
				4	NAME PLATE	VA 10209	1
				3	POPPET	VP 290057	1
				2	SCREW	000919050	4
				1	SEAT	VA 14927	1
INDEX NO.					PART NAME	PART NO.	Q'TY

BALANCER VALVE

BLG-02-B-11

TOKYO KEIKI CO.LTD.

DRAWN	DESIGNED	CHECKED	APPROVED
E.Holm			
DATE	DATE	DATE	DATE
85.7.23	B	VA 3222G	

REVISED '87.10.30

10-2/4

FENWAL

TE022C

FCJ

SERIES 23000, MINIATURE NON-INDICATING TEMPERATURE CONTROLLERS

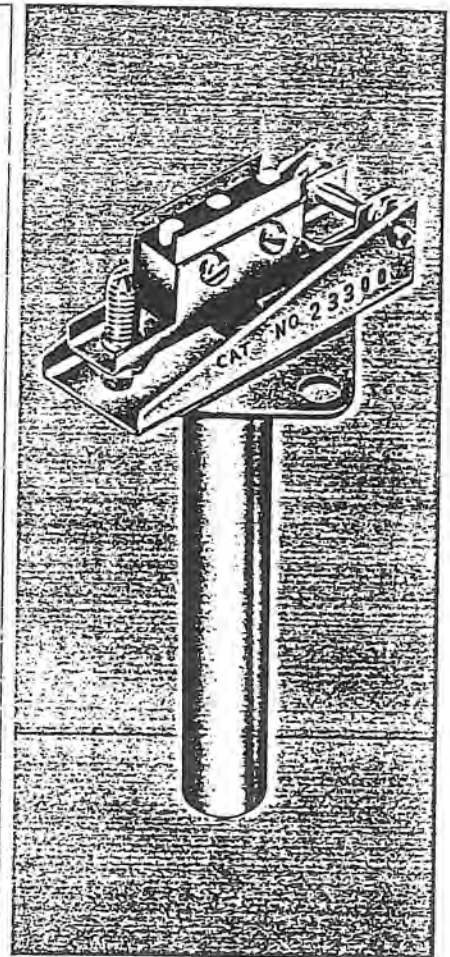
LIQUID EXPANSION-SNAP ACTION THERMOSWITCH UNITS

Fenwal presents a complete line of snap-action units with either single or dual switch control. Control action is provided by an expandable liquid acting on a bellows assembly. Bellows motion, created by volume changes of the liquid, actuates the switch contacts through a push rod.

- **HIGH LOAD CAPACITY** — a variation of application rated switches with current ratings up to 5 amps 125—250 VAC, 0.2 amps 250 VDC.
- **FAST RESPONSE** — expandable liquid which surrounds bellows is in direct contact with temperature sensing outer shell.
- **CUSTOMER ADJUSTED** — a temperature adjusting screw provides simple adjustment of temperature range. Switch can easily be set at any temperature within controller's range.
- **"INDEPENDENTLY ADJUSTABLE"** — on dual switch units each switch may be set individually at any temperature setting within its range thus allowing completely independent action.
- **"TRAVELING DIFFERENTIAL"** — dual switch units are provided with a special traveling differential frame which establishes a predetermined relationship between switches.

Example : If a 10°C differential is selected, any setting of the first switch (with the short adjustment screw) will cause the second to function 10°C higher. This differential is adjustable by the user.

- **VARIETY OF TEMPERATURE RANGES** — single switch and dual switch models are available with 3 temperature ranges from -10 to 150°C.



CAT. NO.	DESCRIPTION	TEMPERATURE RANGE			RATINGS
230XX	SKELETON FRAME COVER is provided by request	Last two digits (XX) identify the Temperature Range			CURRENT RATING AC 5A...250V DC 5A... 30V FACTORY SETTING TOLERANCE ±3°C
231XX		00	10	20	
233XX	DRIP PROOF MODEL	80° ~	30° ~	-10° ~	
231XX-H	JUNCTION BOX, DUAL SWITCH	150°C	100°C	50°C	
237XX	JUNCTION BOX, DUAL SWITCH				
238XX	JUNCTION BOX, DUAL SWITCH				

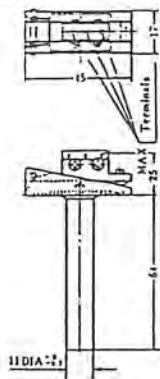
Fenwal® FENWAL CONTROLS OF JAPAN, LTD.

12 - 1/2

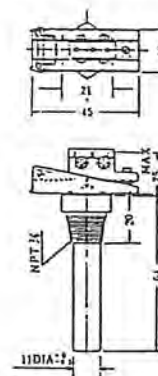
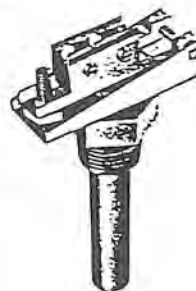
SERIES 23000

SINGLE SWITCH CONTROLS

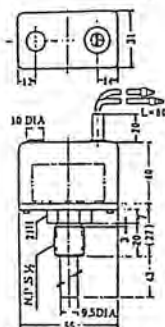
230XX



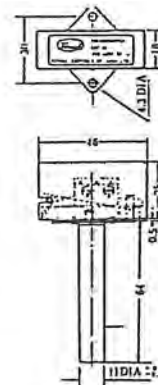
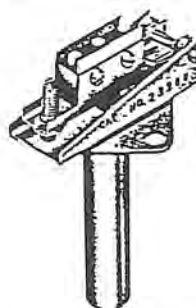
231XX



231XX-H

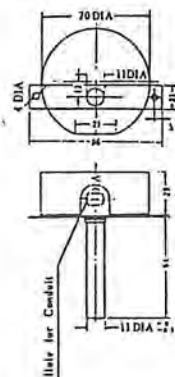
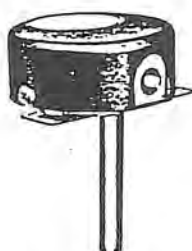


233XX

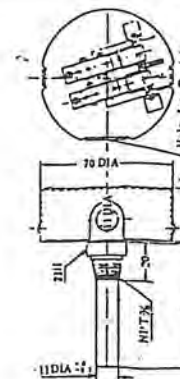
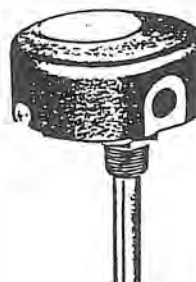


DUAL SWITCH CONTROLS

237XX



238XX



MODIFICATIONS

3

FACTORY TEMPERATURE SETTING

Any unit may be factory preset at any temperature within its listed range. Unless this Modification is specified on order, unit will be shipped, set at approximately 25°C. Specify temperature setting when ordering.
Factory setting tolerance on all 23000 Series THERMO-SWITCH Controls is $\pm 3^\circ\text{C}$.

SPECIAL FEATURES

-S

STAINLESS STEEL SHELL

Where corrosion or electrolysis is suspected S.S SHELL instead of BRASS SHELL may increase controller life.

NOTE: This Special Feature is applicable to all units.

⑫ - 1/2



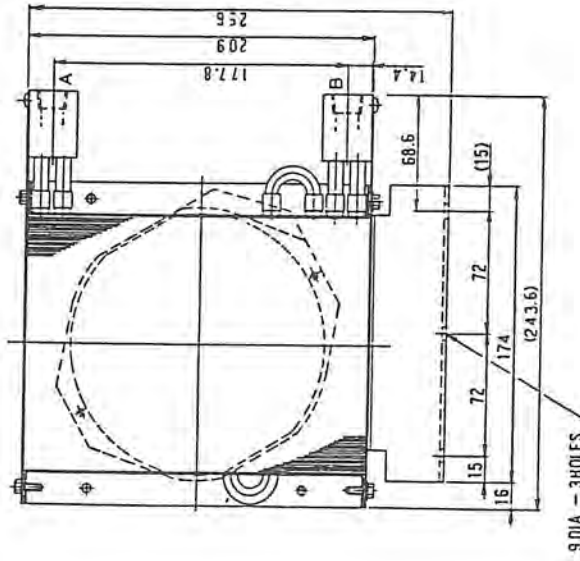
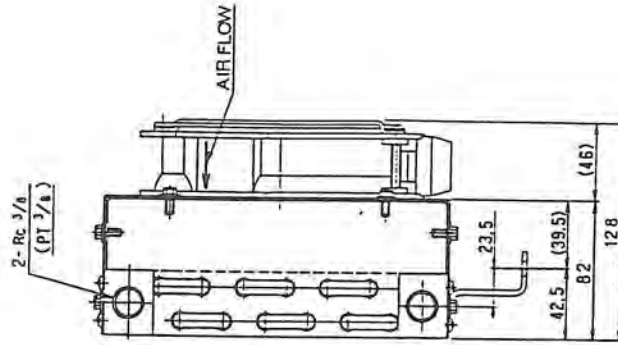
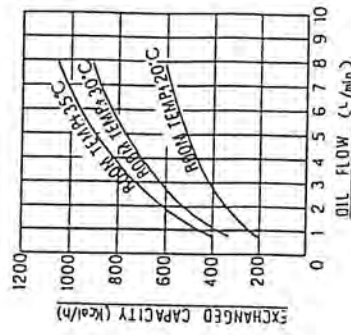
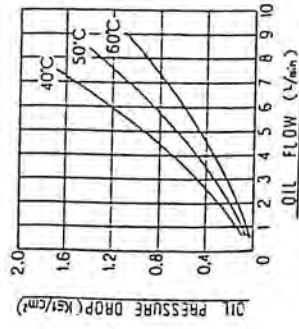
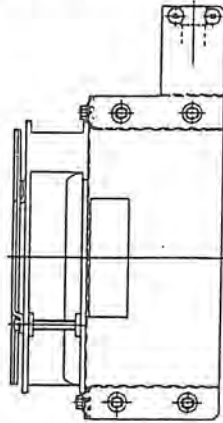
CONTROLS TEMPERATURE.....RELIABLY

Fenwal Controls of Japan, Ltd.

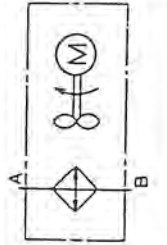
4-10, Nishishinbashi 1-chome, Minato-ku, Tokyo, Japan

Printed in Japan '77/10

MOTOR SPECIFICATION	
KIND	CONDENSER MOTOR (WITH CONDENSER)
INPUT	100 V 30/60 Hz, 37/50 W 0.41/0.44 A
CURRENT	200 V 30/60 Hz, 34/33 W 0.29/0.21 A
MAKER	NMB
MODEL NO.	37/50 PC-101-A 30-809 (200 V) 34/33 PC-201-A 30-806 (200 V)
ADJUNCTION	LEAD 1.5 m (0.5305 m) 0.75 m (0.3012 m)
MASS	4.1 kg



GRAPHICAL SYMBOL



MINI FAN COOLER
SERIES NO. 2, 3

MF-2-100V-20-01

REGISTER NO.
DESIGN NO.
VOLTAGE 100V, 200V
(115, 220, 230, 240V)

FAN COOLER
MF-2-X-XV-20-01

DATE	190.3.1	SIZE	C
DR. NO.	41932724	DR. SHEET	1/1

東京計器 TOKYO KEIKI CO., LTD.

MAGNET

FEATURES:

1. As the excellent permanent magnets are used for the equipments, it is high in magnetic lux on the surface and can absorb the ferrous powder drastically.
2. A range of products in every size as standard ones are available for wider application to any equipments required.
3. Its weight was reduced to be light enough to handle easily.
4. There are two different types of fixing methods - one is fastened by the magnetic absorption while the other can be done by using bolts on the upper and side plates.

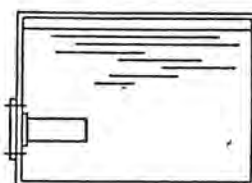
EXAMPLES HOW TO FIX:

To fix on the bottom



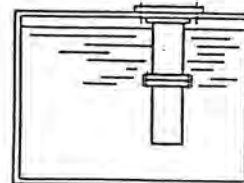
 MFB-A Type

To fix on the side



MFB-B Type

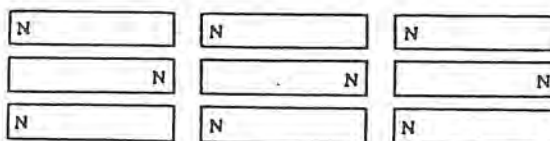
To fix by hanging from the top



MFB-B & MFB-C Types

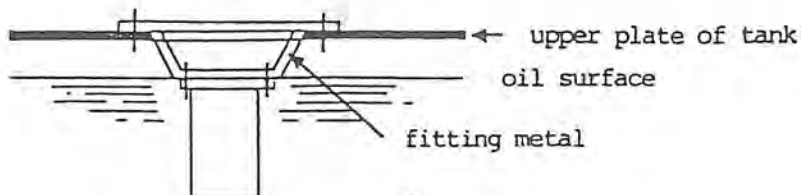
1. For MFB-A Type Fixing

- 1) To fix it on the bottom plate of tank keeping Up-side upper, by which it can be fastened not to move in transport because of its effective absorption.
- 2) In fixing multiply, N-polar marks must be placed alternately as below for the effective absorption of the ferrous powder.



2. For MFB-B & MFB-C Types Fixing

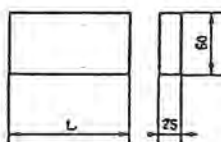
- 1) When it is fixed to the upper plate, fitting metals must be used between the plate and oil surface (50 to 100mm in distance).



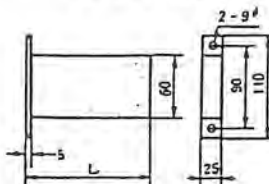
2) In case it is more than 250mm in distance from the surface, both MFB-250C and MFB-B can be used in combination.

SPECIFICATIONS

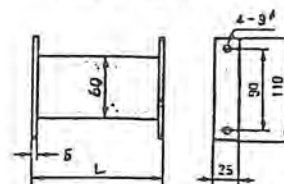
MFB-A Type



MFB-B Type



MFB-C Type



III

Type	Size (mm)	Surface Mag. Lux/Gauss				Wt. (kg)	Qty. of Oil in Tank
		Lg=0 (mm)	10	20	30		
MFB- 50A	60	1,900	700	350	200	0.4	30(Ltr.)
-100A	110					0.7	50
-150A	160					1.0	100
-200A	210					1.3	150
-250A	260					1.6	200
MFB- 50B	60	1,900	700	350	200	0.4	50
-100B	110					0.7	100
-150B	165					1.0	150
-200B	215					1.3	200
-250B	265					1.6	250
MFB-150C	170	1,900	700	350	200	1.0	150
-200C	220					1.3	200
-250C	270					1.6	250

HOW TO SEE THE TYPES OF THE ABOVE TABLE:

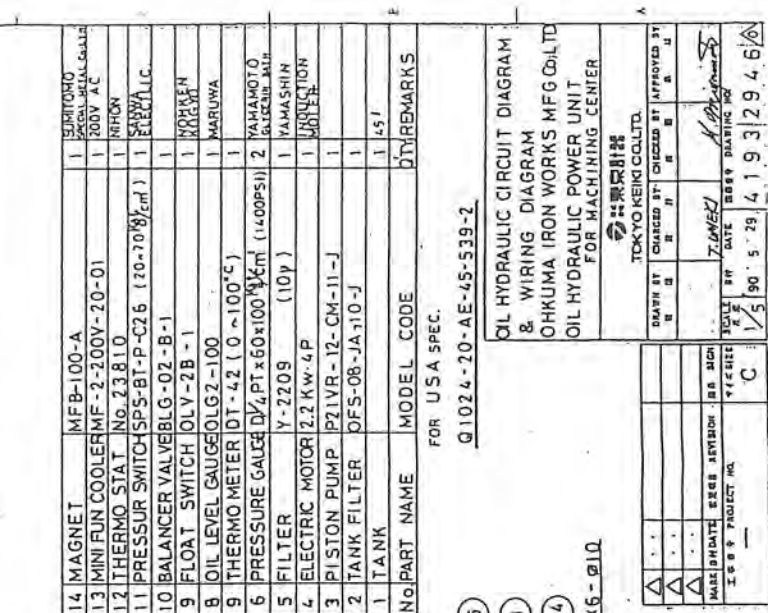
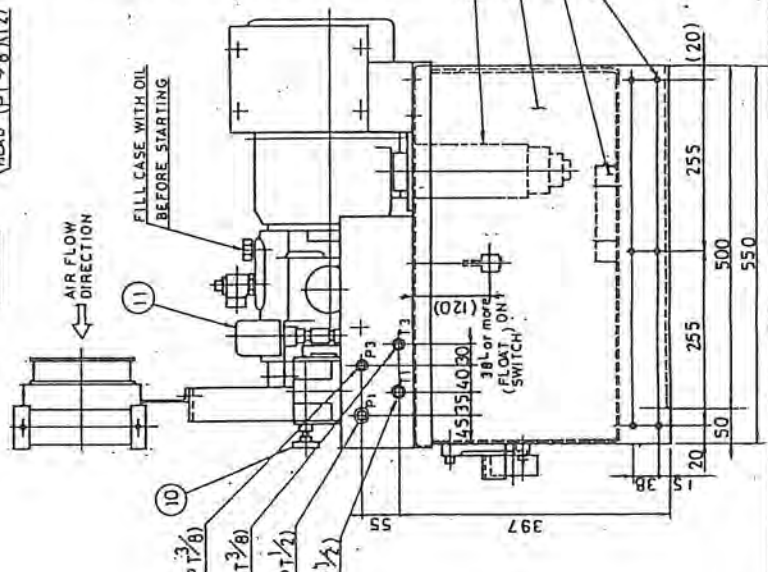
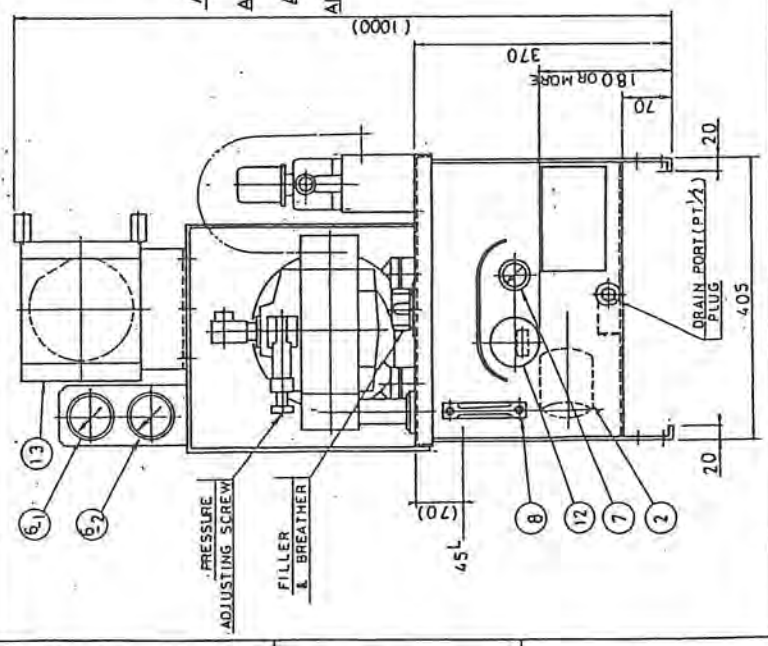
M.F.B. stands for Magnet Filter Block and the figures of 50 to 250 indicate the actual length of the magnets.

The last letter after the figures show as below:

- A: The Flange to fasten by the magnetic absorption is not fitted.
- B: The Flange is fitted on one side.
- C: The Flanges are fitted on both sides.

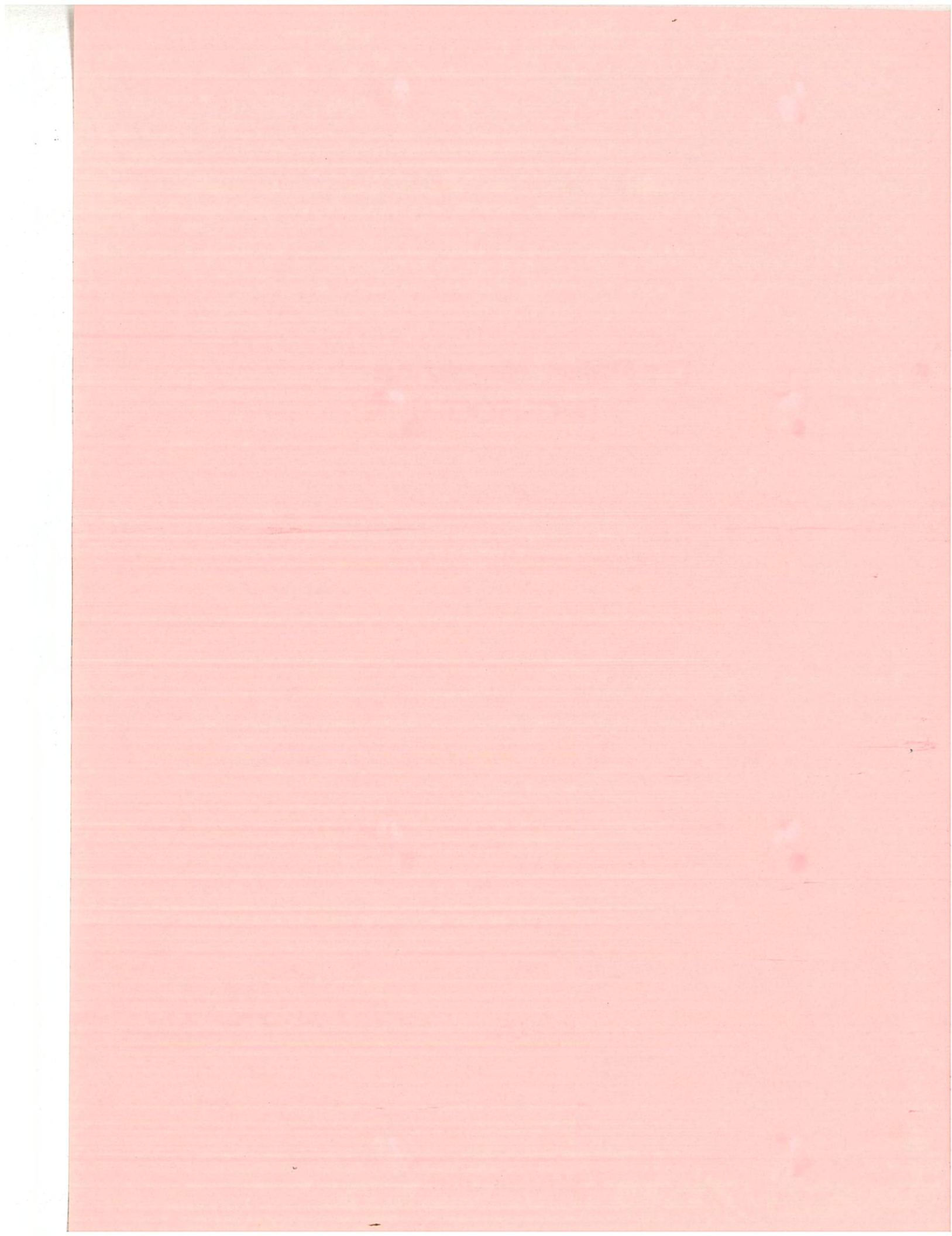
The other items of different sizes and types not specified above will be designed and manufactured exactly on demand.

SUMITOMO SPECIAL METALS CO., LTD.
5-22, Kitahama, Higashi-Ku, Osaka, Japan
Cable Address, "SUMITSUO OSAKA"
Tel. (06) 220-8863 Telex. 522-2651



**D : Pallet Magazine
(MC-500H)**

Tsudakoma



INSTRUCTION MANUAL

FOR

PALLET MAGAZINE

PME50-6S

PME50-10S

(with the Workpiece Set-up Station WSS-D50)

MC500H

10面、6面APC

TSUDAKOMA CORP.

ME21-052-R1

760-503,505E
SEPT.7,1989

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1. OUTLINE

The Pallet Magazine PME50-6S/PME50-10S (hereafter abbreviated to the PME) incorporates various unique mechanisms, has a state-of-the-art construction, and features a stable appearance and quick loading/unloading operation. Its other features are as follows:

- (1) When used with the Machining Center MC-500H (hereafter abbreviated to the M/C), the PME is capable of machining up to 6 to 10 workpieces unattended.
- (2) Since the carrier is driven by the AC servomotor, smooth acceleration and deceleration is achieved. In addition, a high-speed indexing of less than 5 sec. per pitch has become a reality for each pitch of carrier travel.
- (3) With the workpiece set-up station (hereafter abbreviated to the WSS) attached, the PME is capable of loading and unloading the workpieces even during workpiece machining and PME indexing (when a pallet is being changed). This feature increases safety.
- (4) The set-up table can be manually indexed up to 360° in 90° steps. Operating efficiency as well as operability thus improves.

2. SPECIFICATIONS

2-1. External View

See Fig. 1-1 for the external view of the PME50-6S.
See Fig. 1-2 for the external view of the PME50-10S.

2-2. Main Specifications

- (1) Applicable machining center
... MC-500H
- (2) Loadable pallet size
... 500 x 500 mm
Weight of loadable pallet
... 140 kg
- (3) Number of loadable pallets
... 6 or 10 (2 types available)
- (4) Allowable load per pallet
... 800 kg
- (5) Diameter of maximum loadable workpiece
... 730 mm
- (6) Indexing time (for each pitch of carrier travel)
... 4.3 sec. (for the 6-pallet type)
- (7) Carrier driving method
... Control by AC servomotor
- (8) Weight of main unit

PME50-6	PME50-10
2.2 tons	3.3 tons

- (9) Hydraulic source and ports
Source : Pressure, 7.3 kg/cm²; Delivery, 25 lit./min
Port size: P port; PT1/2 T port; PT1/2

2-3. Specifications for Workpiece Set-up Station

- (1) Pallet carrying time
... 8 sec.
- (2) Pallet driving method
... By a geared motor with brake
- (3) Weight of main unit
... 500 kg

3. SET-UP PROCEDURES

3-1. Pallet Magazine (PME)

Set up the PME with the M/C according to the procedures set forth below.

(1) Temporary Installation

Temporarily install the PME referring to the dimensions indicated in the external view (Fig. 1).

(2) Wiring and Piping

Connect the power cable to the unit.
Connect the hydraulic hoses to appropriate ports, using care not to confuse P and T.

(3) Precautions for Initial Operation

- a) Be sure to remove the carrier fixing plate (painted yellow).
- b) Plug the hole from which the carrier fixing plate was removed with the bolt supplied.
- c) Do not place pallets on the carrier yet.

(4) Checking Operations

- a) Carrier indexing
- b) Arm advance and retract
- c) Stopper advance and retract

(5) Place the components in the following positions for set-up.

- a) M/C axes : Pallet change positions
- b) M/C clamp plate: UNCLAMP
- c) Arm : Retract end
- d) Carrier : No. 1 carrier at the M/C position
- e) Stopper : Advance end

(6) Positioning with the M/C

a) Vertical Positioning

- 1) Adjust the leveling bolts under the PME until the tops of the guide rollers for the M/C clamp plate, the carrier, and the intermediate rail are the same height.
- 2) The M30 jack bolts are provided under the PME for leveling purposes. The screw pitch is 3.5 mm.

b) Right-to-Left Positioning

- 1) Use a straightedge or other suitable tool to make sure that the M/C clamp plate, the carrier, and the guide rail for the intermediate rail are aligned with one another.
- 2) Use the M24 adjusting bolts provided under the PME for aligning purposes. The screw pitch is 3 mm.

c) Back-and-Forth Positioning

- 1) Make back-and-forth adjustment until the distance between the guide rollers is 130 mm as indicated in Fig. 1.
- 2) Use the M24 adjusting bolts under the PME for adjusting purposes. The screw pitch is 3 mm.

(7) Pallet Placement and Clamping

- a) Unclamp the clamp plate on the M/C and place a pallet on the No. 1 carrier. Before placing the pallet, remove the hook from the pallet.
- b) Check that the pallet moves smoothly onto the clamp plate when pushed by hand. If not, make positioning adjustments again according to the steps set forth in Sec. (6)-a) and b).
- c) Clamp the pallet while making sure that a bushing hole in the back of the pallet and the locator pin align with each other.

(8) Installation of Pallet Hook

- a) Install hook to the pallet after performing the steps set forth in Sec. (7) above.
 - b) Advance the arm of the PME until it reaches its advance end, using extreme care so that the arm does not interfere with the hook.
 - c) When the arm hook is not positioned at the center of the pallet hook, make back-and-forth adjustment again performing the steps set forth in Sec. (6)-c).
 - d) When the above steps have been satisfactorily performed, install hooks to other pallets in same manner.
- (9) Tighten the jack bolts and adjusting bolts under the PME. Positioning is now complete.

3-2. Workpiece Set-up Station (WSS)

(1) Temporary Installation

Temporarily install the WSS referring to the dimensions indicated in the external view (Fig. 1). Make sure that the cam in the WSS frame front rides on the carrier roller lever.

(2) Wiring

Connect the power cable to the control box. Do not start the trial run of the PME yet.

(3) Precautions for Initial Operation

- a) Do not place pallets on the carrier on the PME which has reached the WSS.
- b) Set the WSS turntable at the home indexing position.
- c) Push the lever down to lock the turntable.

(4) Positioning with the PME

a) Vertical Positioning

- 1) Adjust the leveling bolts under the WSS until the top of the carrier guide roller and that of the turntable guide roller are flush with each other (within the limits of ± 0.5 mm).
- 2) Use the M20 jack bolts under the WSS for leveling purposes. The screw pitch is 2.5 mm.

b) Right-to-Left Positioning

- 1) Use a straightedge or other suitable tool to check that the carrier guide rail and the turntable guide rail are aligned with each other (within the limits of ± 2 mm).
- 2) Use the M16 adjusting bolts under the WSS for aligning purposes. The screw pitch is 2 mm.

c) Back-and-Forth Positioning

- 1) Turn the adjusting bolts until the distance between the stopper front and the center of the chain shaft is 114.5 ± 0.5 mm as shown in Fig. 9.
- 2) Use the M16 adjusting bolts under the WSS for adjusting purposes. The screw pitch is 2 mm.

(5) Confirmation of Positioning

After making sure that the requirements set forth in Sec. (4) have been successively met, tighten the lock nuts on the jack bolts and the adjusting bolts.

(6) Checking Operations

- a) Turn on the power and check the PME for operation.
- b) Make sure that the roller pin turns clockwise and counterclockwise. Also make sure that the carrier stopper moves smoothly up and down.

(7) Placement of Pallets

- a) Install the pallet hook for the WSS.
- b) Turn the roller pin clockwise.
- c) Place the pallet on the turntable while inserting the hook pin into the guide groove in the back of the pallet hook.
- d) Turn the roller pin counterclockwise and make sure that the pallet is loaded smoothly into the carrier.

4. INSPECTION AND MAINTENANCE

4-1. Parts List for Inspection and Maintenance

See the parts list attached.

4-2. Schematic Diagram for Inspection and Maintenance

See Figs. 4 through 9.

4-3. Adjustment of Chain Tension

See Fig. 4.

(1) The chain elongates with time.

When the chain elongates beyond a given permissible limit, carrier stop position accuracy or WSS hook pin stop position accuracy can deteriorate or traveling speed pulsations can occur. In that event, failure in pallet change or transfer may result.

If such is the case, chain tension needs to be readjusted.

(2) Adjustment Procedure

a) PME

- 1) Loosen the bolts, not in round holes but in slots, for holding the inner rails (2 through 7) and the outer rails (17 through 20) and leave them semi-tightened.
- 2) Turn the tension bolt (34) so that it is pressed against the inner rail (5) which, in turn, increases tension.
- 3) Tighten the bolts which are loose.

b) WSS

- 1) The chain should have a proper amount of tension when a lateral deflection of 5 to 15 mm is obtained by pulling up the chain by hand at its center.
- 2) Loosen the bolt holding the bracket.
- 3) Turn the tension bolt to gain a proper amount of tension.
- 4) Tighten the bolt which is loose.

4-4. Adjustment of Workpiece Set-up Position Stop Command Limit Switch (LS75) for Roller Pin on Set-up Station

See Fig. 9.

- (1) The WSS is provided with two roller pin stop command limit switches; one for the pallet unloading position (CW) and the other for the pallet loading position (CCW).
- (2) Since the pallet load/unload motor is equipped with a reducer-connected brake motor, the stop position may slightly change when there are fluctuations in weight of the load carried.

Although such fluctuations do not pose problems with respect to construction, make adjustment if they are too annoying.

(3) Adjustment Method

- a) Adjust the ON actuation point of the dog (265) for the workpiece set-up position stop limit switch (269) for the roller pin (259).
- b) Loosen the dog holding bolt and move the bolt in the slot so that the dog moves in a peripheral direction.

5. MAIN MAINTENANCE PARTS

5-1. Pallet Magazine

品名 Part Name	パーツNO. Part NO.	メーカー Maker	型式または品番 Type
RS100-Sチェーン RS100-S Chain	21	椿本チェーン Tsubakimoto chain	PME50- 6S : PME50-10S 808401AA 808401AC
カムフォロア Cam follower	43 61	THK	CF12R-A ←
カムフォロア Cam follower	54	THK	CF16R-A ←
ローラフォロア Roller follower	56	THK	NART17R ←
クロスローラベアリング Cross roller bearing	92	THK	RD20025CC0 ←
テーパローラベアリング Taper roller bearing	59	NTN	4T-32005X ←
ボールベアリング Ball bearing	108	NTN	6004ZZ ←
ボールプランジャ Ball plunger	74	今尾製作所 Imao	BST12 ←
スプリング Spring	71		808149 ←
RV減速機 RV-Reduction gear	95	帝人製機 Teijin Seiki	RV-60-12J RV-60-81
リミットスイッチ Limit switch	126 133	オムロン OMRON	ZE-NA2-2 ←
リミットスイッチ Limit switch	127	オムロン OMRON	1VE-10NC ←
リードスイッチ Lead switch	142	油研工業 Y u k e n	R05 ←
油圧シリンダ Hydraulic cylinder	122	油研工業 Y u k e n	808055AE ←
油圧シリンダ Hydraulic cylinder	142	油研工業 Y u k e n	808404AA ←
電磁弁 Solenoid valve		東京計器 Tokyo Keiki	DG4V-3-6C-M ← -P7-II-7
電磁弁 Solenoid valve		東京計器 Tokyo Keiki	DG4V-3-2C-M ← -P7-II-7
スロットルチェック弁 Throttle & check valve		東京計器 Tokyo Keiki	DGMFN-3-Y- ← A1W-B1W-20
ACサーボモータ AC servo motor	101	大隈鉄工 OKUMA	BL-NH10JE-12S ←

5-2. Workpiece Set-up Station

品 名 Part Name	パーツNO. Part NO.	メーカー Maker	型式または品番 Type
カムフォロア Cam follower	233	THK	CF16-1UUR-A
カムフォロア Cam follower	234	THK	CF10-1UUR-A
ボールベアリング Ball bearing	253	NTN	6006Z
スプリング プランジャ Spring plunger	290	今尾製作所 Imao	PL12
スプリング Spring	289		808135C
ブレーキ付モータ Brake motor	223	三菱電機 Mitsubishi	808400AA
リミットスイッチ Limit switch	229	オムロン OMRON	WLCA2
リミットスイッチ Limit switch	269 292	オムロン OMRON	D4C-1202
搬送チェーン Carrier chain	248	大同工業 D I D	808226AB DID40-2 68L
搬送チェーン Carrier chain	249	大同工業 D I D	808226AC DID40-2 57L
ドライブチェーン Carrier chain	246	大同工業 D I D	808225AA DID35 58L
ドライブチェーン Carrier chain	247	大同工業 D I D	808225AB DID35 68L

6. REFERENCE

Request details on this machine from the following office:

TSUDAKOMA CORP.

Machine Tool Division

5-18-18 Nomachi, Kanazawa, Japan 921

TEL: (0762) 42-1111

FAX: (0762) 42-4306

TOKYO BRANCH OFFICE

2-6-4 Toranomom, Minatoku, Tokyo, Japan 105

TEL: (03) 503-0781

FAX: (03) 503-0785

OSAKA BRANCH OFFICE

1-10-1 Honmachi, Higashiku, Osaka, Japan 541

TEL: (06) 261-5454

FAX: (06) 261-5455

NAGOYA BRANCH OFFICE

1-11-20 Nishiki, Nakaku, Nagoya, Japan 460

TEL: (052) 211-5941

FAX: (052) 201-4024

7. PARTS LIST

7-1. Pallet Magazine

NO.	品 名	Part Name	PME50- 6S 品番 Part No.	PME50-10S 品番 Part No.
1	フレーム	Frame	814170E	818331
2	インナチェーンガイド	Inner chain guide	814179AA	←
3	"	"	812822	816612B
4	"	"	812823C	816613B
5	"	"	814179AA	←
6	"	"	812824	←
7	"	"	812825	←
8	ローラガイド	Roller guide	812826B	←
9	"	"	812827	816614B
10	"	"	812828C	816615
11	"	"	812826B	←
12	"	"	812829B	←
13	"	"	812832B	←
14	"	"	812831	←
15	"	"	812830B	←
16	アウトチェーンガイド	Outer chain guide	812816	←
17	"	"	812820B	816610
18	"	"	812813B	←
19	"	"	812816	←
20	"	"	812819	816611
21	RS100チェーン	RS100 chain	808401AA	808401AC
22	ディスタンスカラ	Distance collar	812834C	←
23	"	"	812833C	←
24	ローラガイドサポータ	Guide supporter	812835C	←
25	チェーンガイド	Chain guide	816973B	←
26	オイルパンL	Oilpan-L	806255B	←
27	オイルパンR	Oilpan-R	806256B	818333
28	サイドオイルパンL	Side oilpan-L	806257B	818334
29	サイドオイルパンR	Side oilpan-R	806258B	818335
30	セットアップマドカバ	Cover	818199	←
31	フロントカバL	Front cover-L	818175	←
32	フロントカバR	Front cover-R	818176	←
33	テンションBKT	Tension bracket	812651B	←
34	テンションボルト	Tension bolt	A316085B	←
35	油圧マニホールド	Manifold block	814202	←
36	ターミナルボックス	Terminal box	818180	←
37	アンカプレート	Anchor plate	806254	818332
38	ジャッキ ボルト	Jacking bolt	BA230120Y	←
39	アジャスト ボルト	Adjusting bolt	BA224100Y	←
40				
41	ガイドスタンドL	Guide stand-L	806565C	←
42	ガイドスタンドR	Guide stand-R	806566C	←

NO.	品 名	Part Name	PMF50-BS 品番 Part No.	PMF50-10S 品番 Part No.
43	カムフォロア	Cam follower	DN913305C	←
44	M/Cカバ L	M/C cover-L	818181	←
45	M/Cカバ R	M/C cover-R	818182	←
46	センタカバ L	Center cover-L	818183B	←
47	センタカバ R	Center cover-R	818184B	←
48				
49				
50				
51	キャリヤ	Carrier	812657CA	←
52	チェーンガイド	Chain guide	812809B	←
53	チェーンガイド	Chain guide	812807B	←
54	カムフォロア	Cam follower	DN913355C	←
55	ワイバ	Wiper	808079AA, 808080AA	←
56	ローラフォロア	Roller follower	DN911170A	←
57	ローラピン	Roller pin	812804	←
58	ローラホルダ	Roller holder	812803AA	←
59	テーパローラベアリング	Taper roller bearing	808212	←
60	フタ	Cover	812806	←
61	カムフォロア	Cam follower	DN913305C	←
62	ストッパ	Stopper	812808B	←
63	ストッパプレート	Stopper plate	812810B	←
64	ローラ	Roller	810144B	←
65	ピンフランジ	Pin flange	812811B	←
66	スタッド ボルト	Stud bolt	805874C	←
67	ストッパ	Stopper	808148	←
68	ローラ	Roller	805873	←
69	ローラピン	Roller pin	805878	←
70	プレート	Plate	805877	←
71	スプリング	Spring	808149	←
72	ピン	Pin	805879B	←
73	ブラケット	Bracket	805876	←
74	ボールプランジャ	Ball plunger	808034AG	←
75	ワイバ	Wiper	808215	←
76	ワイバプレート	Wiper plate	818266	←
77	ワイバ	Wiper	809040	←
78	オイルパン	Oil pan	812802	←
79	ワイバ	Wiper	808214	←
80				
81	カムプレートスタンド	Cam plate stand	814315C	←
82	スパーサ	Spacer	813421B	←
83	カム-1	Cam-1	805934C	←
84	カム-2	Cam-2	805935B	←
85				
86				
87				

NO.	品 名	Part Name	PME50- 6S 品番 Part No.	PME50-10S 品番 Part No.
88				
89				
90				
91	アンダギヤケース	Under gear case	814180AD	814180AC
92	クロスローラベアリング	Cross roller bearing	808402AA	←
93	ベアリングオサエ	Bearing holder	814188	←
94	27Tスプロケット	27T-Sprocket	814191B	←
95	RV減速機	RV-Reduction gear	808403	808812
96	スプロケットカバ	Sprocket cover	814192	←
97	インプットギヤ	Input gear	808403	808813
98	ベアリングハウジング	Bearing housing	814190B	←
99	ベアリングオサエ	Bearing holder	814189	←
100	テーパスリーブ	Taper sleeve	BL923035B	←
101	サーボモータ	Servo motor	BL-MH101E-12S	←
102	ギヤ	Gear	815305	816900
103	ギヤ	Gear	815304	←
104	アッパギヤケース	Upper gear case	814181AA	←
105	ディスタンスカラ	Distance collar	814183B	←
106	ディスタンスカラ	Distance collar	814182B	←
107	ベアリングオサエ	Bearing holder	814184	←
108	ボールベアリング	Ball bearing	N060042	←
109	インデックスカバ	Index cover	814193C	←
110	キー	Key	814186	←
111				
112				
113				
114				
115	シリンダブラケットL	Cylinder BKT-L	814194	←
116	シリンダブラケットR	Cylinder BKT-R	814316	←
117	ガイドホルダ	Guide holder	810290BB	←
118	ダストシール	Dust seal	BM920045	←
119	ガイドバ	Guide bar	810294AF	←
120	ナックル	Knuckle joint	812805B	←
121	ピン	Pin	810293	←
122	油圧シリンダ	Hydraulic cylinder	808055AE	←
123	シリンダカバ	Cylinder cover	814317	←
124	LSプレート	LS plate	810295B	←
125	カバ	Cover	810299B	←
126	リミットスイッチ	Limit switch	ED06013	←
127	リミットスイッチ	Limit switch	ED06077	←
128	ドッグBKT	Dog bracket	810296	←
129	パレットフック	Pallet hook	812857	←
130	LSブラケット	LS bracket	814351	←
131	LSプレート	LS plate	810295B	←
132	LSカバ	LS cover	810299B	←

7-2. Workpiece Set-up Station

NO.	品 名	Part Name	品番 Part Number	型式 Type
201	フレーム	Frame	816264H	
202	アンカプレート	Anchor plate	816265C	
203	サイド カバ	Side cover	810203C	
204	スイングサークル	Turntable bearing	808901AA	
205	ストッパ	Stopper	816268	
206	ロックピース	Lock pieces	812009	
207	スタッドホルト	Stud bolts	812010	
208	ジャッキボルト	Jacking bolts	BA220100Y	
209				
210	ダストカバ	Dust covers	816273	
211	ローラ パッド	Roller pad	806640	
212	ローラパッド BKT	Roller pad BKT	806641	
213				
214				
215				
216				
217				
218				
219				
220				
221	ターンテーブル	Turn table	816266DA	
222	モータブラケット	Motor BKT	813995B	
223	ブレーキ付モータ	Brake motor	808400AA	
224	シャフト	Shaft	812898	
225	スライドブロック	Slide block	812899B	
226	シャフトブラケット	Shaft brackets	812900B	
227	LSブラケット	LS bracket	812804B	
228	LSカバ	LS cover	812905	
229	リミットスイッチ	Limit switch	EB06014	
230	テンションブロック	Tension block	812906	
231	テンションブロック	Tension block	812907	
232	パレット ストッパ	Pallet stoppers	813434	
233	カムフォロア	Cam followers	BN913355D	
234	カムフォロア	Cam followers	BN913265D	
235				
236				
237				
238				
239				
240				
241	モータスプロケット	Motor sprocket	812910	
242				
243	ドライブスプロケット	Drive sprocket	812911	
244	フロントスプロケット	Front sprocket	812912B	
245	リヤスプロケット	Rear sprocket	812913	

NO.	品 名	Part Name	品番 Part Number	型式 Type
246	ローラチェーン	Roller chains	808225AA	
247	ローラチェーン	Roller chains	808225AB	
248	ローラチェーン	Roller chains	808226AB	
249	ローラチェーン	Roller chains	808226AC	
250	メインシャフト	Main shaft	812914B	
251	シャフト	Shaft	812915B	
252	シャフトスタンド	Shaft stand	812916	
253	ボールベアリング	Ball bearings	N060061	
254	カム	Cam	812921	
255	カム	Cam	812921	
256	カム	Cam	814166	
257	カムホルダ	Cam holder	812919E	
258	チェーンローラピン	Chain roller pins	812922	
259	ローラピン	Roller pin	812923B	
260	ローラ	Roller	812924	
261				
262	カムホルダ	Cam holder	812920	
263	2ピッチリンクプレート	Link plate	805373	
264				
265	ドッグ	Dogs	812927D	
266	ドッグプレート	Dog plates	812926B	
267	チェーンローラピン	Chain roller pins	805156D	
268	2ピッチリンクプレート	Link plates	805850C	
269	リミットスイッチ	Limit switches	ED06080	
270				
271	チェーンカバ	Chain cover	812928B	
272	パレットフック	Pallet hook	818002	
273				
274				
275				
276				
277				
278				
279				
280				
281	インデックスピン	Index pin	816269D	
282	ピンホルダ	Pin holder	816270AB	
283	プレート	Plate	816271	
284	ホルダブラケット	Holder bracket	812934AC	
285	レバブラケット	Lever bracket	812935AD	
286	リンクピン	Link pin	812936	
287	レバ	lever	816272	
288	ニギリ	Knob	W504000A	
289	スプリング	Spring	808135C	
290	スプリングプランジャ	Spring plungers	808126AG	

NO.	品 名	Part Name	品番 Part Number	型式 Type
291	LSブラケット	LS bracket	812939B	
292	リミットスイッチ	Limit switch	EB06080	
293	ドッグ	Dog	810247B	
294	R ナット	R-Nut	815996	
295	ボルト	Bolt	812938	
296	アジャストボルト	Adjusting bolt	816790	
297	O リング	O-ring	M820036A	
298				
299				
300				
301	ターミナル ボックス	Terminal box	805890	
302	TB カバ	TB cover	810256	
303				
304				
305				

8. ATTACHED DRAWINGS

Fig. 1-1 External View (PME50-6S)
1-2 External View (PME50-10S)

Fig. 2 Hydraulic Circuit Diagram

Fig. 3-1 Circuits Diagram of PME
3-2 Circuits Diagram of WSS

Fig. 4 Frame Part Diagram

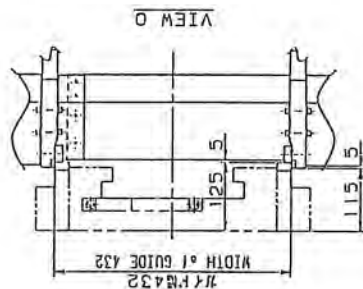
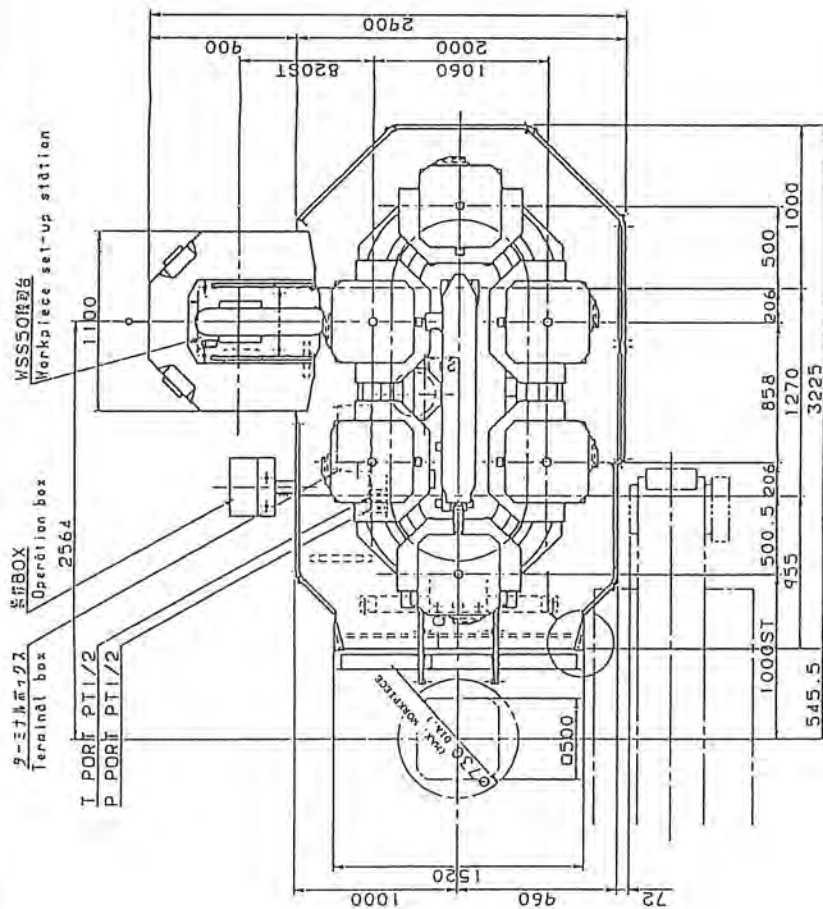
Fig. 5 Carrier Part Diagram

Fig. 6 Arm Part Diagram

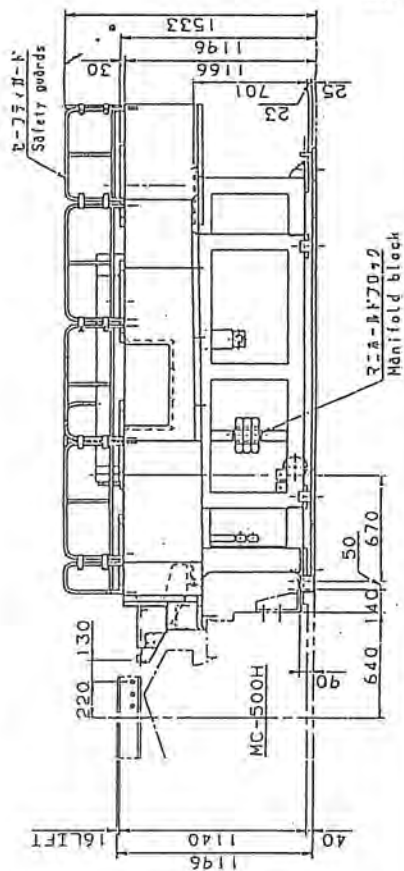
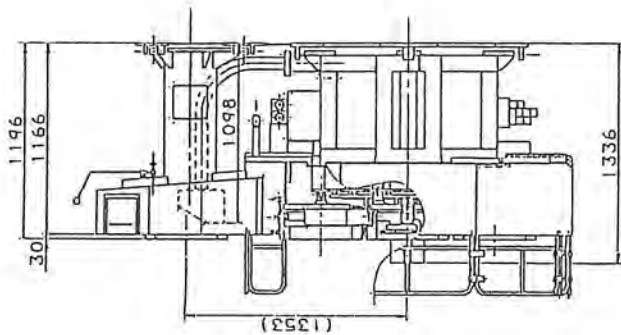
Fig. 7 Carrier Index Part Diagram

Fig. 8 Stopper Part Diagram

Fig. 9 Workpiece Set-up Station Diagram



VIEW D



操作盤 (PPC仕様) 上ハ操作BOXハ設置マセシ
Operation Box cannot be mounted on
Standard Spec. Machine.

Fig. 1-1 外觀圖 EXTERNAL VIEW
PME50-6S (-***)

K20 NISHIMURA L78395C-1
21
July 5, '89

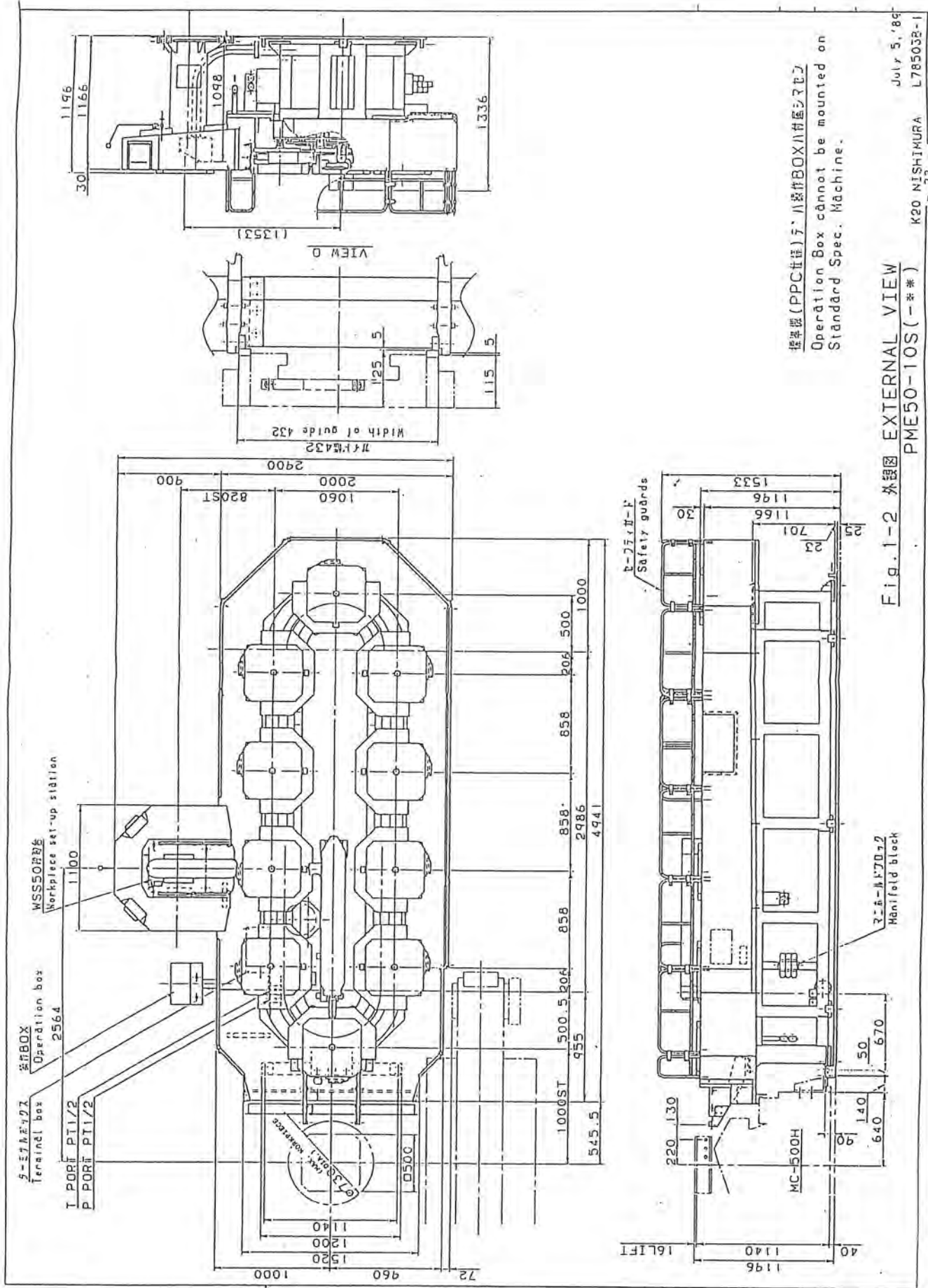
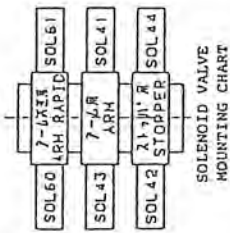
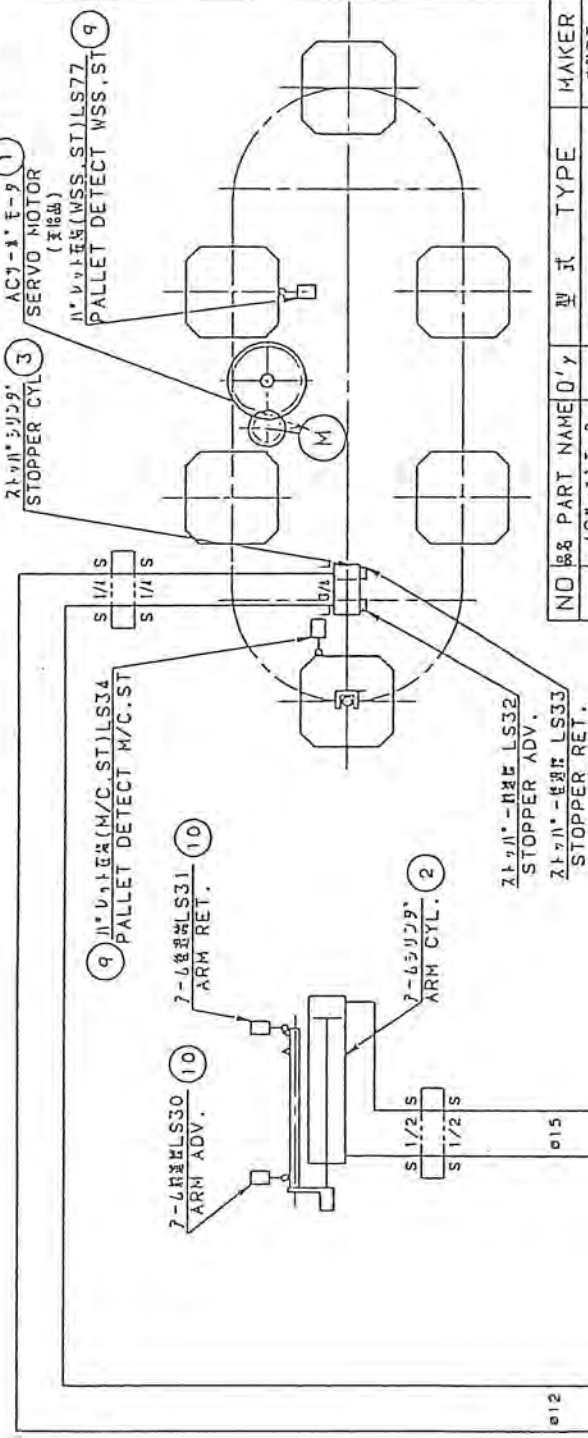


Fig. 1-2 外観図 EXTERNAL VIEW
PME50-10S (一**)

89. 4.	式機用(PME)---MSS---PME---S) 5. 8HV7938' 111
AX2	89. 7. 4 2E1555---73kg/cm ² 1-9MHI100E---MHI101E, B11 1011

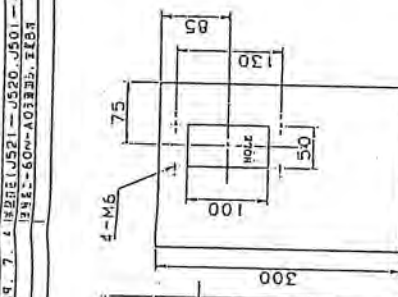
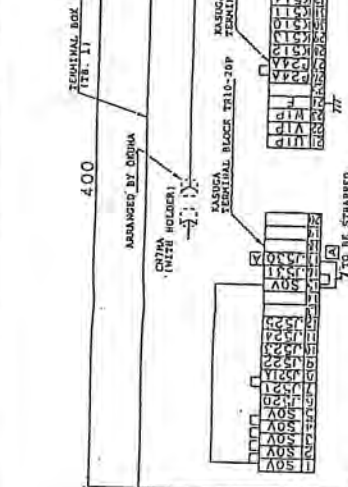
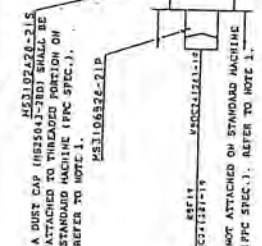
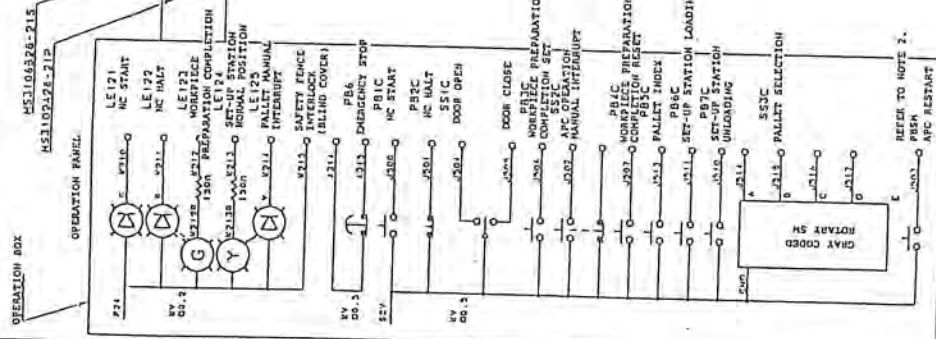


NO	部名	PART NAME	0/y	型式	TYPE	メーカー
1	サーボモーター	SERVO MOTOR	1	BL-NH101E-12S		オキナ
2	7-63リットル	ARM CYLINDER	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
3	7-63リットル	STOPPER CYL	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
4	7-63リットル	ARM CYL.	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
5	7-63リットル	STOPPER ADV.	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
6	7-63リットル	STOPPER RET.	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
7	7-63リットル	ARM RAPID	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
8	7-63リットル	ARM CYL	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
9	7-63リットル	STOPPER	1	CJT70-L55010008-EDA-EX(PME501)		油研工業
10	7-63リットル	STOPPER	1	CJT70-L55010008-EDA-EX(PME501)		油研工業

Fig. 2 油圧回路図 HYDRAULIC CIRCUIT

89. 4.	式機用(PME)---MSS---PME---S) 5. 8HV7938' 111
AX2	89. 7. 4 2E1555---73kg/cm ² 1-9MHI100E---MHI101E, B11 1011

津田駒工業株式会社



L.S. NO	SOL. NO	ACTION
LS30	SOL.43	ADD ADV.
LS31	SOL.41	ADD RET.
	SOL.60	ADD LARIO ADV. SELECTION
	SOL.61	ADD LARIO RET. SELECTION
LS32	SOL.44	STOPPER ADV.
LS33	SOL.42	STOPPER RET.
LS34		PALETTE DEFECT HYC 37
LS77		PALETTE DEFECT HYC 37

- [illegible]

SUPPLIED PARTS:	
553C	1 PC.
SHIELDING COVER FOR 553C	1 PC.
SHIELDING PACKING FOR LE	3 PCS.
ILLUMINATING MARK FOR TERMINAL BOX	3 PCS.

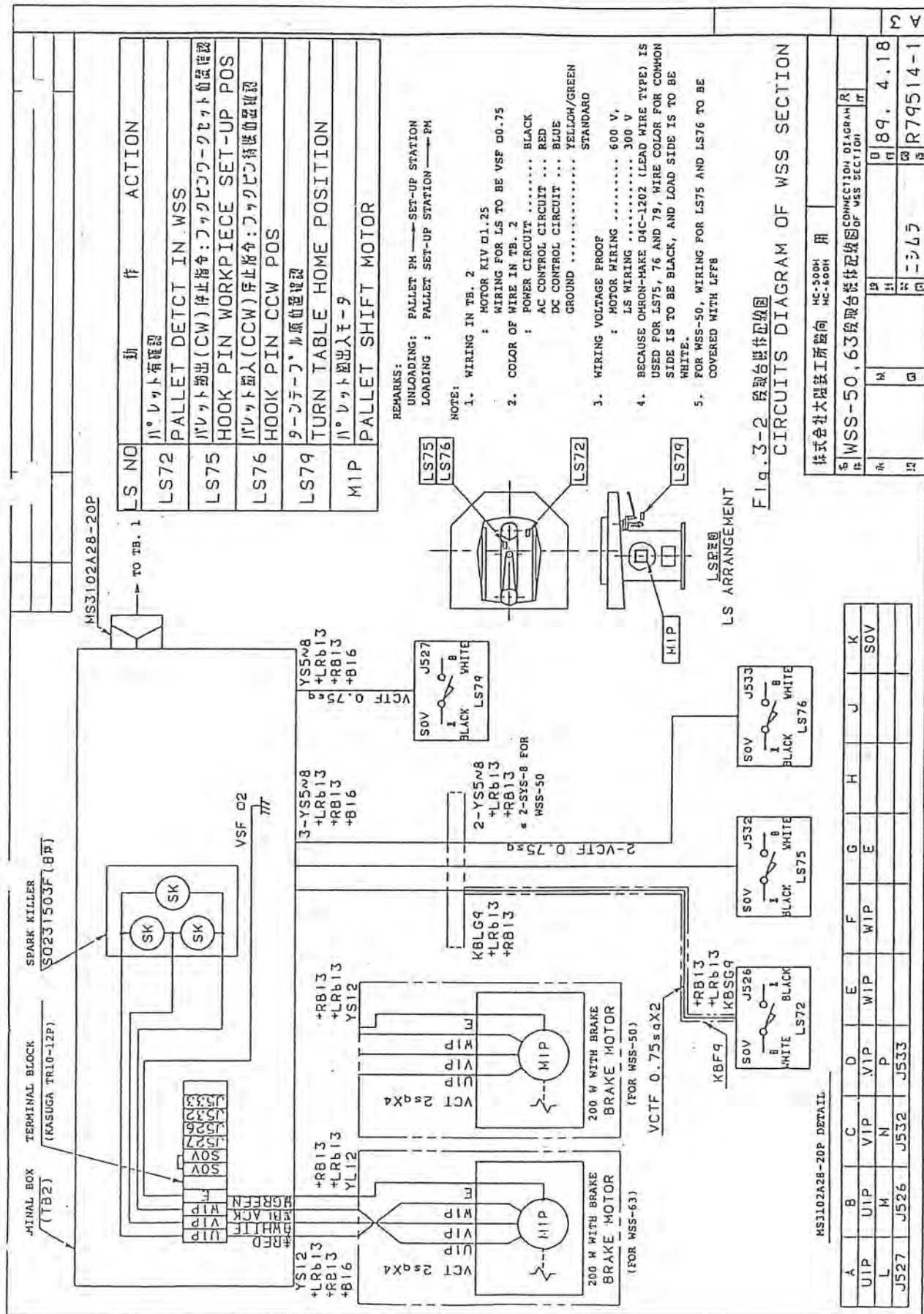
1	2	3	4	5	6	7	8	9	10
SOV	SOV	J520	J520	J522	J523	J524	J527	J526	J532
11	11	12	13	14	15	16	17	18	19
J533	J525	J500	J501	J504	J505	J506	J502	J507	20
21	22	23	24	25	26	27	28	29	30
J511	J510	J514	J515	J516	J517	A314	A315	J513	
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	P24A	P24B	K512	K513	K510
K511	K514	K515	P24	K210	K211	K212	47	48	49
51	52	53	54	55	56	57	A58	K214	K215
								59	60
							J530	J531	J503

A	B	C	D	E	F	G	H	J	K
U1P	U1P	V1P	V1P	W1P	W1P	E			50V
L	H	N	P						
J527	J526	J532	J533						

CANON 38-71 TYPE

A	B	C	D	E	F	G	H	J	K
P24	A314	A315	50V	K210	K212	K213	K214	K215	J500
L	L	N	P	R	S	T	U	V	W
J501	J504	J505	J506	J502	J507	J513	J511	J510	J514
X	Z	a	b	c	d	e	f	g	h
J515	J516	J517	K211						
i	h	a	n	p	r	s			

FIG. NO.	SPECIFICATION	REMARKS
Fig. 3-1	PME製作図	
CIRCUITS DIAGRAM OF PME		



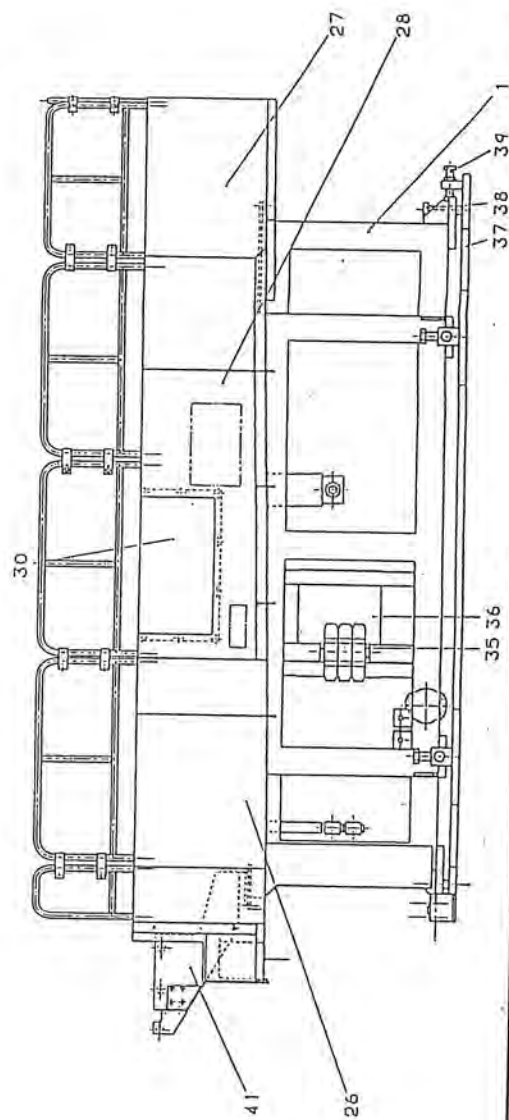
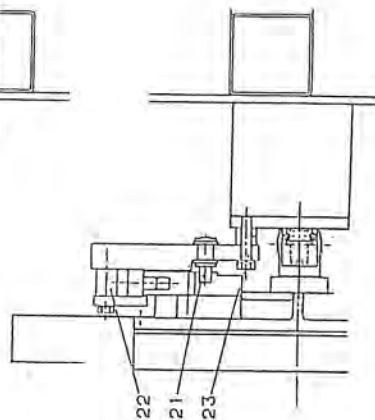
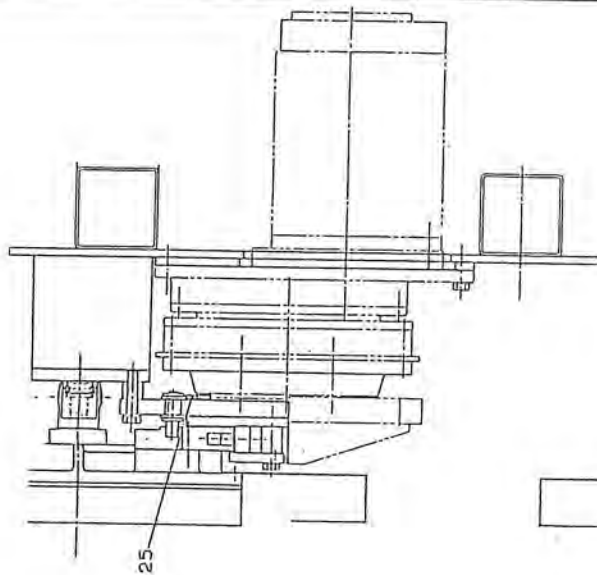
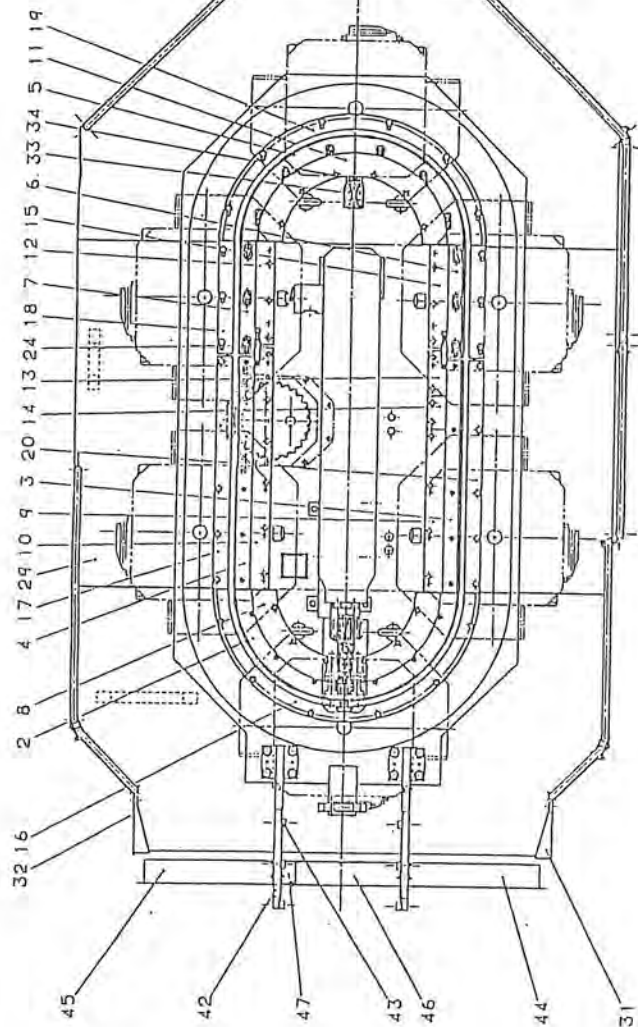


Fig.4 PMSO-6S 2V-688888
Fråme part diagram

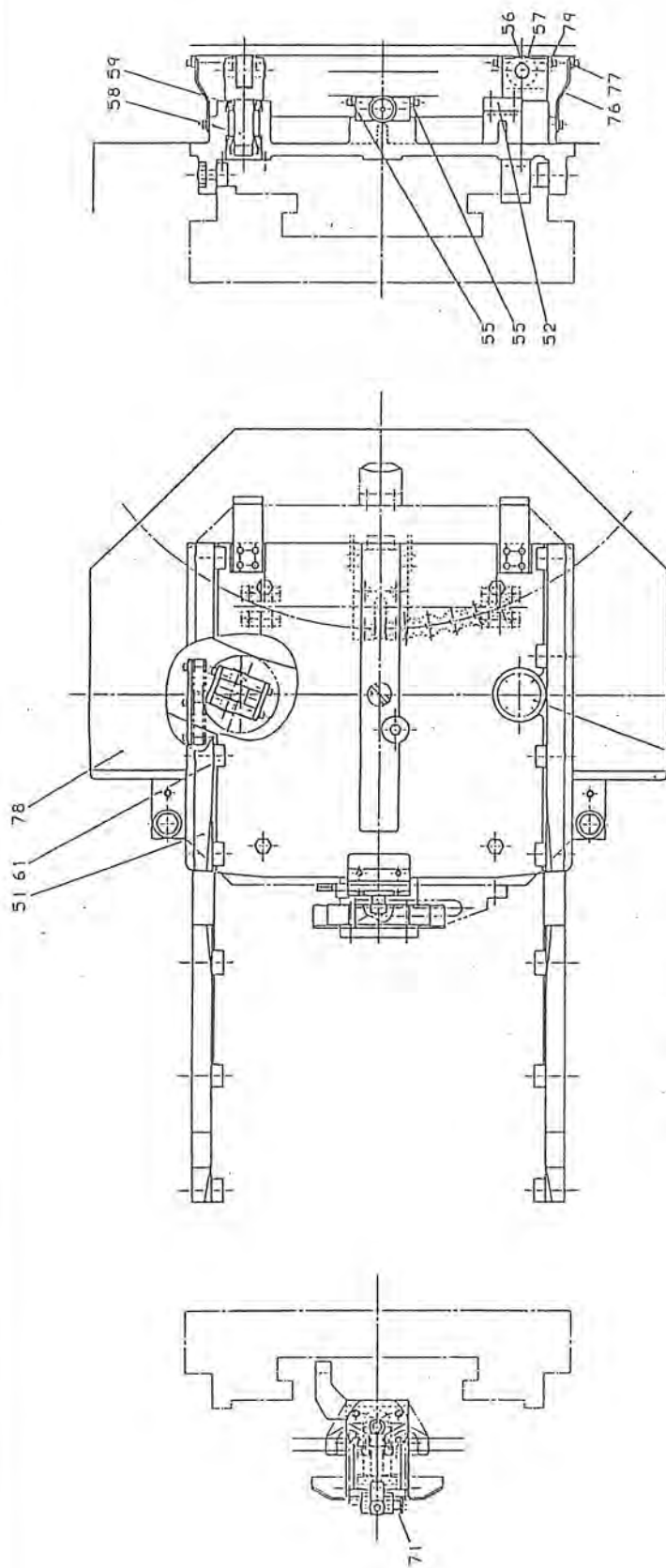


Fig. 5 PM50 3717222222
Carrier part diagram - 27 -

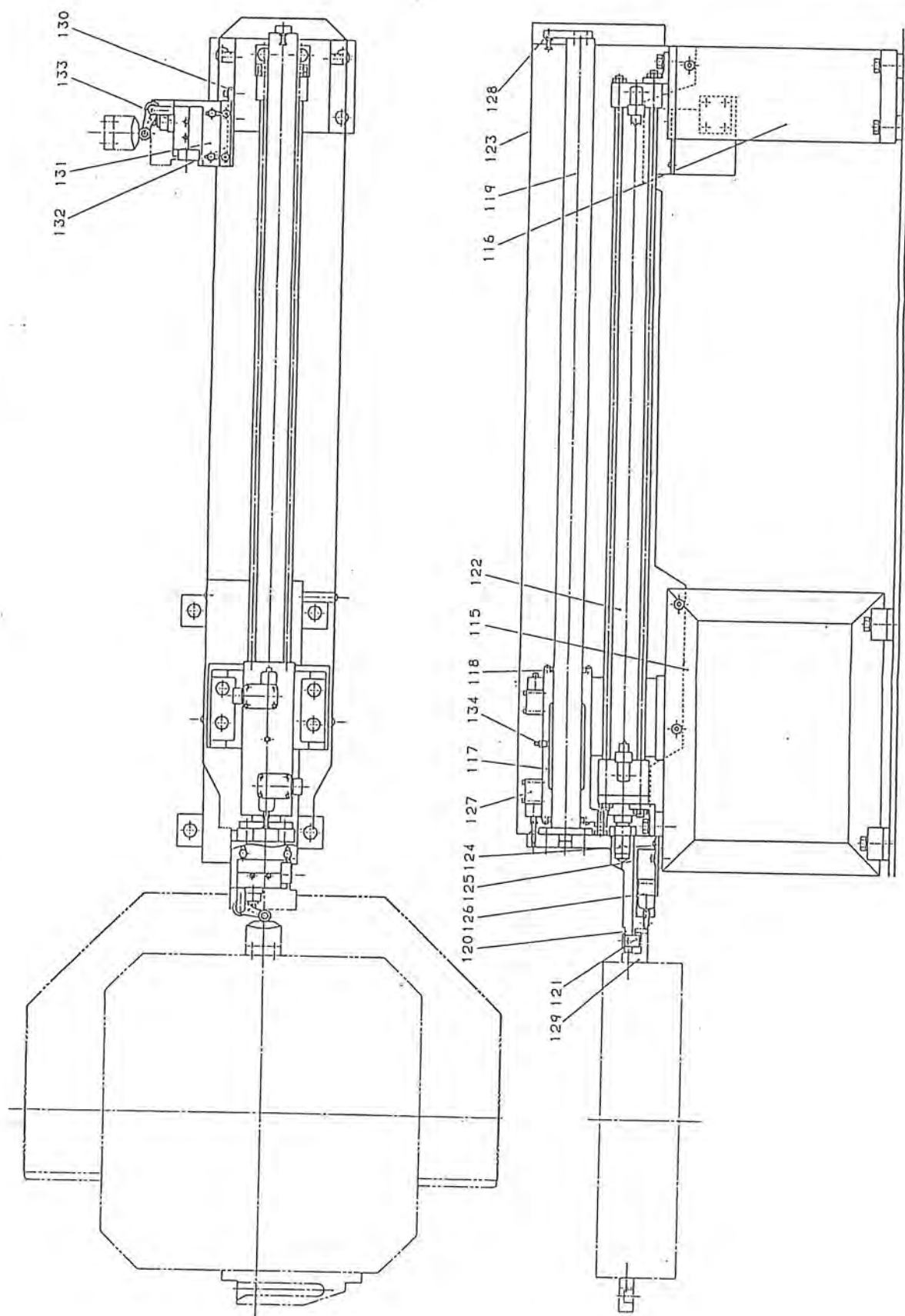


Fig. 6. PM50 7-6594320
Arm part diagram

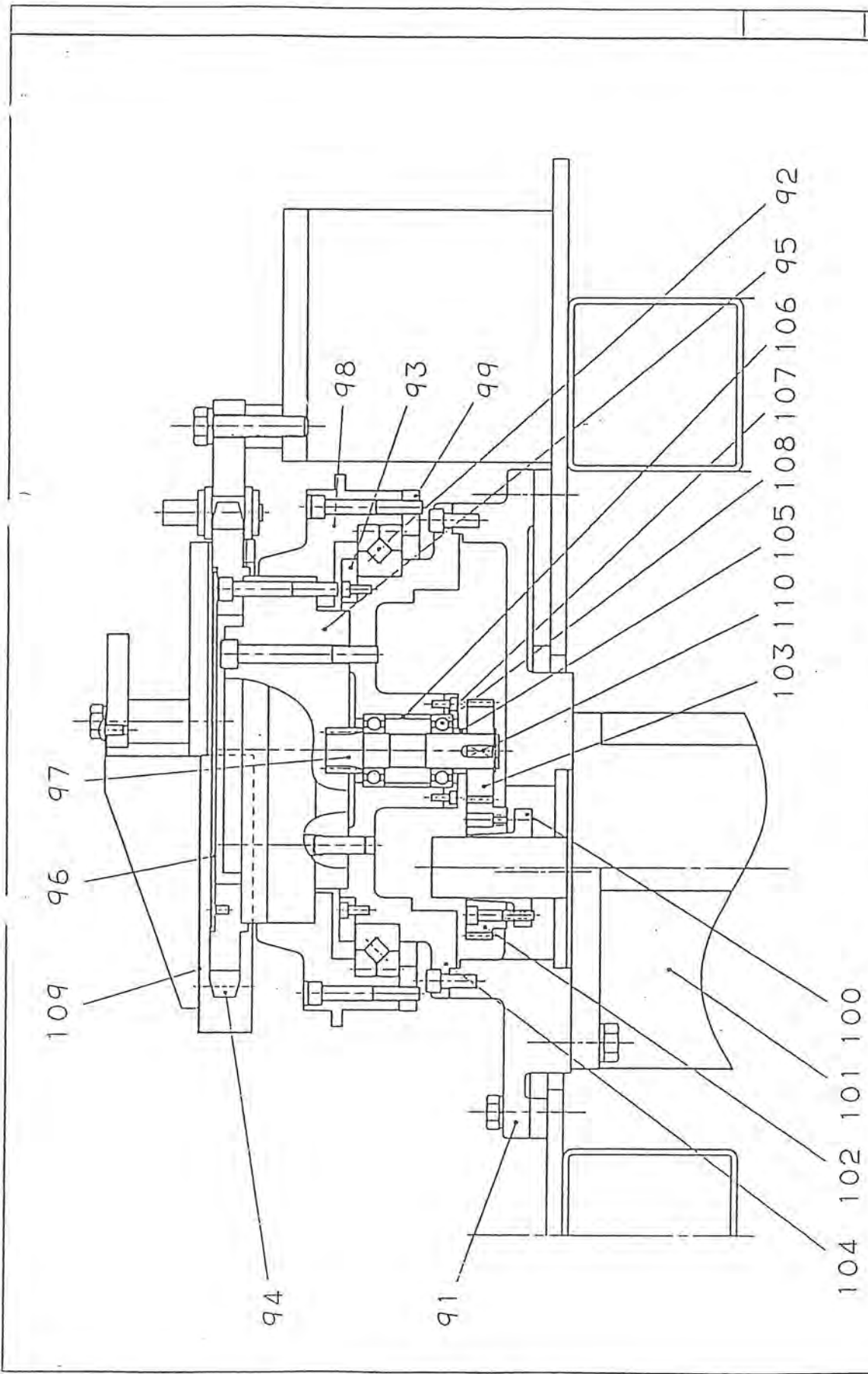


Fig. 7 PME50 キャリヤインデックス部分構造図

Carrier index part diagram K20 NISHIMURA July 5 '89 F78076-1

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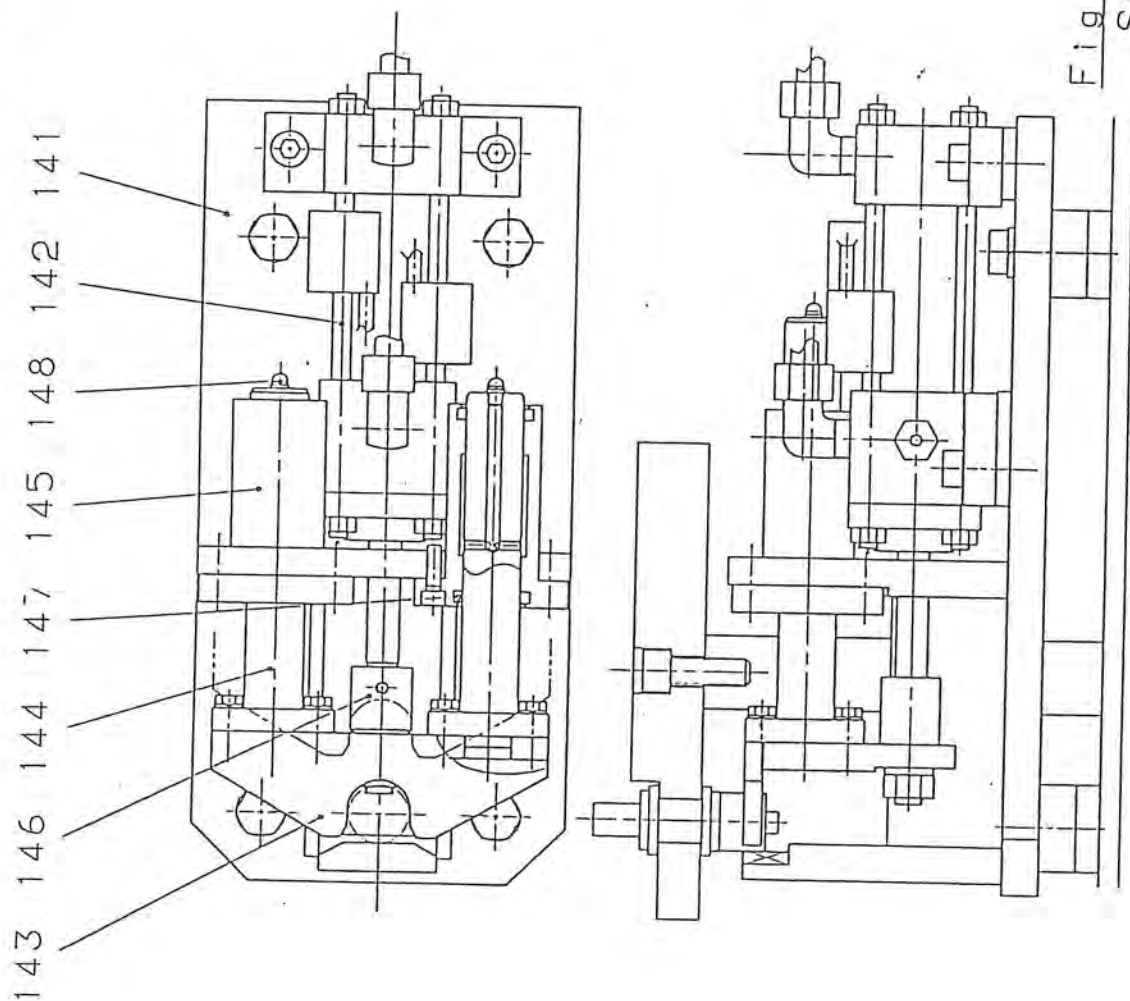


Fig. 8 PME50 ストップ部分構造図
Stopper part diagram

K20 NISHIMURA July5'89 F78074-3

津田駒工業株式会社

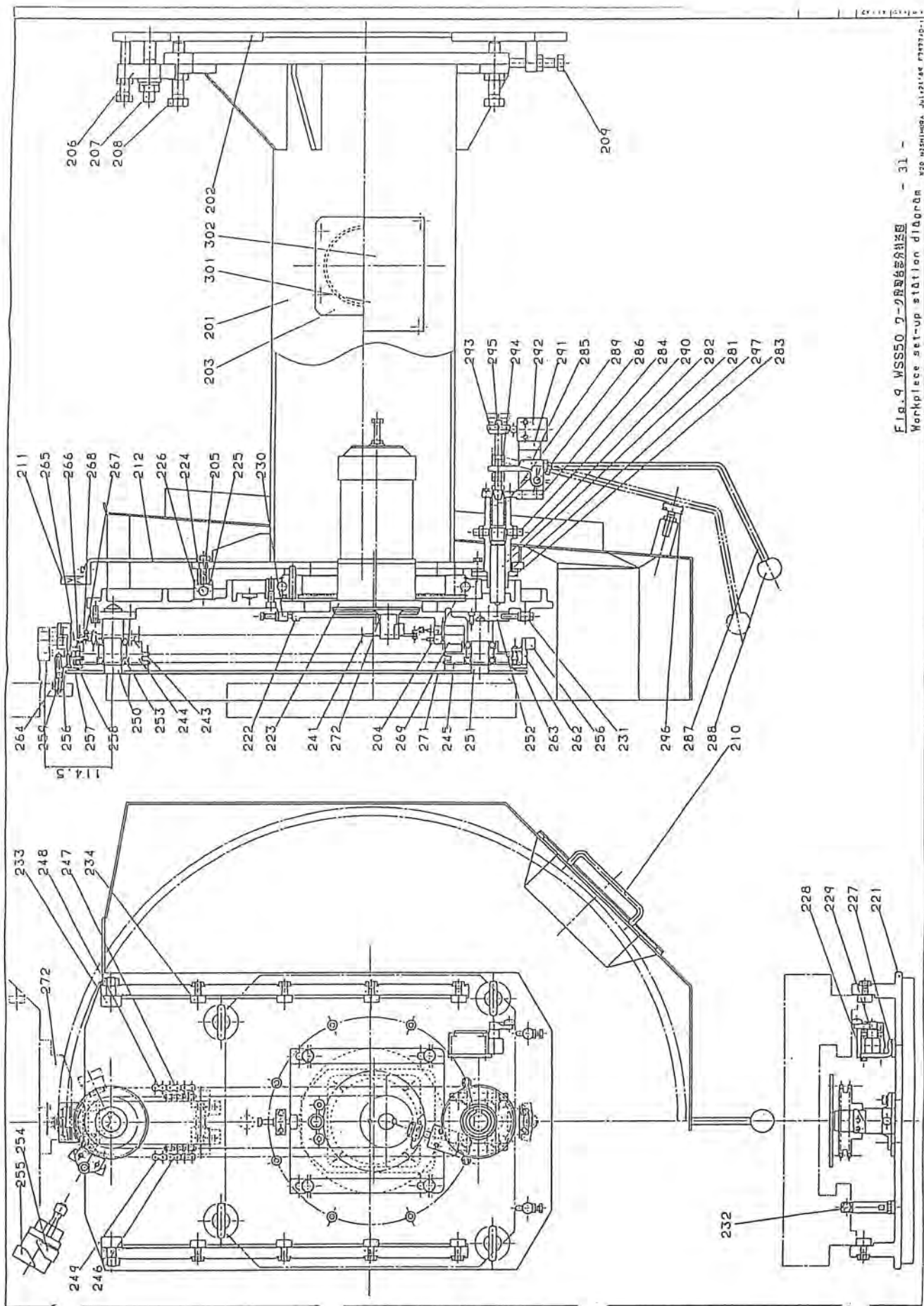
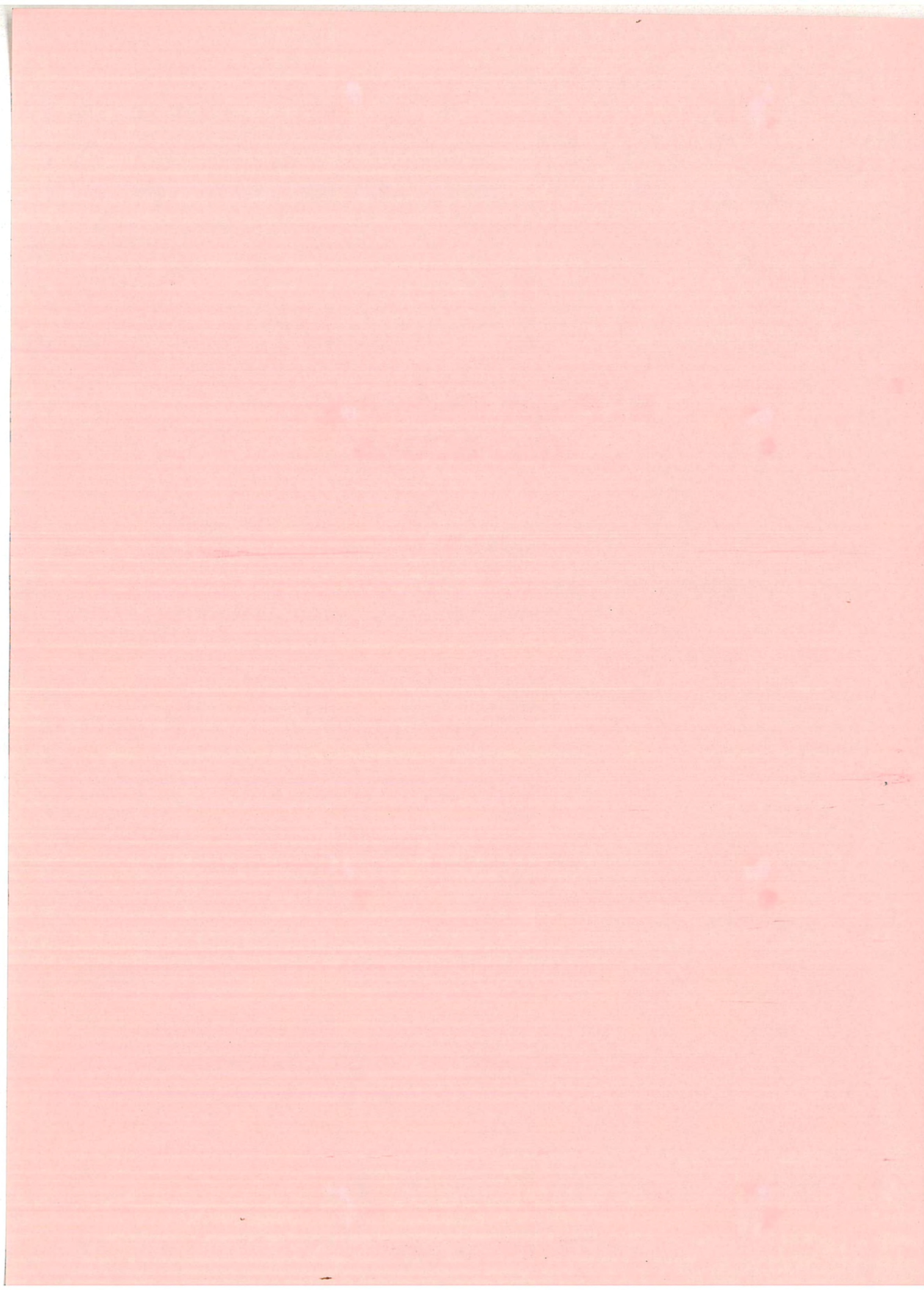


Fig. 9 WSS50 工作物設置站
Workpiece set-up station diagram

**E: Pallet Magazine
(MC-600H)**

Tsudakoma



INSTRUCTION MANUAL

FOR

PALLET MAGAZINE

PME63-6S

PME63-10S

(with the Workpiece Set-up Station WSS-D63)

MC600H

10面、6面APC

TSUDAKOMA CORP.

ME21-053-R1

760-633,635E
SEPT.7,1989

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1. OUTLINE

The Pallet Magazine PME63-6S/PME63-10S (hereafter abbreviated to the PME) incorporates various unique mechanisms, has a state-of-the-art construction, and features a stable appearance and quick loading/unloading operation. Its other features are as follows:

- (1) When used with the Machining Center MC-600H (hereafter abbreviated to the M/C), the PME is capable of machining up to 6 to 10 workpieces unattended.
- (2) Since the carrier is driven by the AC servomotor, smooth acceleration and deceleration is achieved. In addition, a high-speed indexing of less than 6 sec. per pitch has become a reality for each pitch of carrier travel.
- (3) With the workpiece set-up station (hereafter abbreviated to the WSS) attached, the PME is capable of loading and unloading the workpieces even during workpiece machining and PME indexing (when a pallet is being changed). This feature increases safety.
- (4) The set-up table can be manually indexed up to 360° in 90° steps. Operating efficiency as well as operability thus improves.

2. SPECIFICATIONS

2-1. External View

See Fig. 1-1 for the external view of the PME63-6S.
See Fig. 1-2 for the external view of the PME63-10S.

2-2. Main Specifications

- (1) Applicable machining center
... MC-600H
- (2) Loadable pallet size
... 630 x 630 mm
Weight of loadable pallet
... 280 kg
- (3) Number of loadable pallets
... 6 or 10 (2 types available)
- (4) Allowable load per pallet
... 1200 kg
- (5) Diameter of maximum loadable workpiece
... 990 mm
- (6) Indexing time (for each pitch of carrier travel)
... 5.7 sec. (for the 6-pallet type)
- (7) Carrier driving method
... Control by AC servomotor
- (8) Weight of main unit

PME63-6	PME63-10
2.8 tons	4.0 tons

- (9) Hydraulic source and ports
Source : Pressure, 7.3 kg/cm²; Delivery, 25 lit./min
Port size: P port; PT1/2 T port; PT1/2

2-3. Specifications for Workpiece Set-up Station

- (1) Pallet carrying time
... 11 sec.
- (2) Pallet driving method
... By a geared motor with brake
- (3) Weight of main unit
... 600 kg

3. SET-UP PROCEDURES

3-1. Pallet Magazine (PME)

Set up the PME with the M/C according to the procedures set forth below.

(1) Temporary Installation

Temporarily install the PME referring to the dimensions indicated in the external view (Fig. 1).

(2) Wiring and Piping

Connect the power cable to the unit.
Connect the hydraulic hoses to appropriate ports, using care not to confuse P and T.

(3) Precautions for Initial Operation

- a) Be sure to remove the carrier fixing plate (painted yellow).
- b) Plug the hole from which the carrier fixing plate was removed with the bolt supplied.
- c) Do not place pallets on the carrier yet.

(4) Checking Operations

- a) Carrier indexing
- b) Arm advance and retract
- c) Stopper advance and retract

(5) Place the components in the following positions for set-up.

- a) M/C axes : Pallet change positions
- b) M/C clamp plate: UNCLAMP
- c) Arm : Retract end
- d) Carrier : No. 1 carrier at the M/C position
- e) Stopper : Advance end

(6) Positioning with the M/C

a) Vertical Positioning

- 1) Adjust the leveling bolts under the PME until the tops of the guide rollers for the M/C clamp plate, the carrier, and the intermediate rail are the same height.
- 2) The M30 jack bolts are provided under the PME for leveling purposes. The screw pitch is 3.5 mm.

b) Right-to-Left Positioning

- 1) Use a straightedge or other suitable tool to make sure that the M/C clamp plate, the carrier, and the guide rail for the intermediate rail are aligned with one another.
- 2) Use the M24 adjusting bolts provided under the PME for aligning purposes. The screw pitch is 3 mm.

c) Back-and-Forth Positioning

- 1) Make back-and-forth adjustment until the distance between the guide rollers is 160 mm as indicated in Fig. 1.
- 2) Use the M24 adjusting bolts under the PME for adjusting purposes. The screw pitch is 3 mm.

(7) Pallet Placement and Clamping

- a) Unclamp the clamp plate on the M/C and place a pallet on the No. 1 carrier. Before placing the pallet, remove the hook from the pallet.
- b) Check that the pallet moves smoothly onto the clamp plate when pushed by hand. If not, make positioning adjustments again according to the steps set forth in Sec. (6)-a) and b).
- c) Clamp the pallet while making sure that a bushing hole in the back of the pallet and the locator pin align with each other.

(8) Installation of Pallet Hook

- a) Install hook to the pallet after performing the steps set forth in Sec. (7) above.
 - b) Advance the arm of the PME until it reaches its advance end, using extreme care so that the arm does not interfere with the hook.
 - c) When the arm hook is not positioned at the center of the pallet hook, make back-and-forth adjustment again performing the steps set forth in Sec. (6)-c).
 - d) When the above steps have been satisfactorily performed, install hooks to other pallets in same manner.
- (9) Tighten the jack bolts and adjusting bolts under the PME. Positioning is now complete.

3-2. Workpiece Set-up Station (WSS)

(1) Temporary Installation

Temporarily install the WSS referring to the dimensions indicated in the external view (Fig. 1). Make sure that the cam in the WSS frame front rides on the carrier roller lever.

(2) Wiring

Connect the power cable to the control box. Do not start the trial run of the PME yet.

(3) Precautions for Initial Operation

- a) Do not place pallets on the carrier on the PME which has reached the WSS.
- b) Set the WSS turntable at the home indexing position.
- c) Push the lever down to lock the turntable.

(4) Positioning with the PME

a) Vertical Positioning

- 1) Adjust the leveling bolts under the WSS until the top of the carrier guide roller and that of the turntable guide roller are flush with each other (within the limits of ± 0.5 mm).
- 2) Use the M24 jack bolts under the WSS for leveling purposes. The screw pitch is 3 mm.

b) Right-to-Left Positioning

- 1) Use a straightedge or other suitable tool to check that the carrier guide rail and the turntable guide rail are aligned with each other (within the limits of ± 2 mm).
- 2) Use the M16 adjusting bolts under the WSS for aligning purposes. The screw pitch is 2 mm.

c) Back-and-Forth Positioning

- 1) Turn the adjusting bolts until the distance between the stopper front and the center of the chain shaft is 151.2 ± 0.5 mm as shown in Fig. 9.
- 2) Use the M16 adjusting bolts under the WSS for adjusting purposes. The screw pitch is 2 mm.

(5) Confirmation of Positioning

After making sure that the requirements set forth in Sec. (4) have been successively met, tighten the lock nuts on the jack bolts and the adjusting bolts.

(6) Checking Operations

- a) Turn on the power and check the PME for operation.
- b) Make sure that the roller pin turns clockwise and counterclockwise. Also make sure that the carrier stopper moves smoothly up and down.

(7) Placement of Pallets

- a) Install the pallet hook for the WSS.
- b) Turn the roller pin clockwise.
- c) Place the pallet on the turntable while inserting the hook pin into the guide groove in the back of the pallet hook.
- d) Turn the roller pin counterclockwise and make sure that the pallet is loaded smoothly into the carrier.

4. INSPECTION AND MAINTENANCE

4-1. Parts List for Inspection and Maintenance

See the parts list attached.

4-2. Schematic Diagram for Inspection and Maintenance

See Figs. 4 through 9.

4-3. Adjustment of Chain Tension

See Fig. 4.

(1) The chain elongates with time.

When the chain elongates beyond a given permissible limit, carrier stop position accuracy or WSS hook pin stop position accuracy can deteriorate or traveling speed pulsations can occur. In that event, failure in pallet change or transfer may result.

If such is the case, chain tension needs to be readjusted.

(2) Adjustment Procedure

a) PME

- 1) Loosen the bolts, not in round holes but in slots, for holding the inner rails (2 through 7) and the outer rails (17 through 20) and leave them semi-tightened.
- 2) Turn the tension bolt (34) so that it is pressed against the inner rail (5) which, in turn, increases tension.
- 3) Tighten the bolts which are loose.

b) WSS

- 1) The chain should have a proper amount of tension when a lateral deflection of 5 to 15 mm is obtained by pulling up the chain by hand at its center.
- 2) Loosen the bolt holding the bracket.
- 3) Turn the tension bolt to gain a proper amount of tension.
- 4) Tighten the bolt which is loose.

4-4. Adjustment of Workpiece Set-up Position Stop Command Limit Switch (LS75) for Roller Pin on Set-up Station

See Fig. 9.

- (1) The WSS is provided with two roller pin stop command limit switches; one for the pallet unloading position (CW) and the other for the pallet loading position (CCW).
- (2) Since the pallet load/unload motor is equipped with a reducer-connected brake motor, the stop position may slightly change when there are fluctuations in weight of the load carried.

Although such fluctuations do not pose problems with respect to construction, make adjustment if they are too annoying.

(3) Adjustment Method

- a) Adjust the ON actuation point of the dog (265) for the workpiece set-up position stop limit switch (269) for the roller pin (259).
- b) Loosen the dog holding bolt and move the bolt in the slot so that the dog moves in a peripheral direction.

5. MAIN MAINTENANCE PARTS

5-1. Pallet Magazine

品 名 Part Name	パーツNO. Part NO.	メーカ Maker	型式または品番 Type	Type
RS140-Sチェーン RS140-S Chain	21	椿本チェーン Tsubakimoto chain	PME63- 6S 808533AA	PME63-10S 808533AC
カムフォロア Cam follower	43 61	THK	CF16R-A	←
カムフォロア Cam follower	54	THK	CF18R-A	←
ローラフォロア Roller follower	56	THK	NART25R	←
クロスローラベアリング Cross roller bearing	92	THK	RB20025CC0	←
テーパローラベアリング Taper roller bearing	59	NTN	4T-32006X	←
ボールベアリング Ball bearing	108	NTN	6206ZZ	←
ボールプランジャ Ball plunger	74	今尾製作所 Imao	BST12	←
スプリング Spring	71		808149	←
RV減速機 RV-Reduction gear	95	帝人製機 Teijin Seiki	RV-135	←
リミットスイッチ Limit switch	126 133	オムロン OMRON	ZE-NA2-2	←
リミットスイッチ Limit switch	127	オムロン OMRON	1VE-10NC	←
リードスイッチ Lead switch	142	油研工業 Y u k e n	R05	←
油圧シリンダ Hydraulic cylinder	122	油研工業 Y u k e n	808055AA	←
油圧シリンダ Hydraulic cylinder	142	油研工業 Y u k e n	808404AA	←
電磁弁 Solenoid valve		東京計器 Tokyo Keiki	DG4V-3-6C-M -P7-H-7	←
電磁弁 Solenoid valve		東京計器 Tokyo Keiki	DG4V-3-2C-M -P7-H-7	←
スロットルチェック弁 Throttle & check valve		東京計器 Tokyo Keiki	DGMFN-3-Y- A1W-B1W-20	←
A Cサーボモータ AC servo motor	101	大隈鉄工 OKUMA	BL-MH101E-12S	←

5-2. Workpiece Set-up Station

品 名 Part Name	パーツNO. Part NO.	メーカー Maker	型式または品番 Type
カムフォロア Cam follower	233	T H K	CF16-1UUR-A
ボールベアリング Ball bearing	253	N T N	6008ZZ
スプリング プランジャ Spring plunger	290	今尾製作所 Imao	PL12
スプリング Spring	289		808135C
ブレーキ付モータ Brake motor	223	富士電機 Fuji electric	807760
リミットスイッチ Limit switch	229	オムロン OMRON	WLCA2
リミットスイッチ Limit switch	269 292	オムロン OMRON	D4C-1202
搬送チェーン Carrier chain	248	椿本チェーン	807762BA
ドライブチェーン Carrier chain	246	椿本チェーン	808130C

6. REFERENCE

Request details on this machine from the following office:

TSUDAKOMA CORP.

Machine Tool Division

5-18-18 Nomachi, Kanazawa, Japan 921

TEL: (0762) 42-1111

FAX: (0762) 42-4306

TOKYO BRANCH OFFICE

2-6-4 Toranomom, Minatoku, Tokyo, Japan 105

TEL: (03) 503-0781

FAX: (03) 503-0785

OSAKA BRANCH OFFICE

1-10-1 Honmachi, Higashiku, Osaka, Japan 541

TEL: (06) 261-5454

FAX: (06) 261-5455

NAGOYA BRANCH OFFICE

1-11-20 Nishiki, Nakaku, Nagoya, Japan 460

TEL: (052) 211-5941

FAX: (052) 201-4024

7. PARTS LIST

7-1. Pallet Magazine

NO.	品 名	Part Name	PME63- 6S	PME63-10S
			品番 Part No.	品番 Part No.
1	フレーム	Frame	818268D	818337
2	インナチェーンガイド	Inner chain guide	814979	←
3	"	"	810190	812312 ,812313
4	"	"	810193C	814980D,812311
5	"	"	814979	←
6	"	"	810191	←
7	"	"	810192	←
8	ローラガイド	Roller guide	810181B	←
9	"	"	810182	812316
10	"	"	810185	812314B,812315
11	"	"	810181B	←
12	"	"	810184B	←
13	"	"	815099	←
14	"	"	810186	←
15	"	"	810183D	←
16	アウトチェーンガイド	Outer chain guide	810195B	←
17	"	"	810199	814978 ,812309
18	"	"	810197	←
19	"	"	810195D	←
20	"	"	810196	812308
21	RS140チェーン	RS100 chain	808533AA	808533AC
22	ディスタンスカラ	Distance collar	810188	←
23	"	"	810200B	←
24	ローラガイドサポータ	Guide supporter	805931	←
25	チェーンガイド	Chain guide	816972D	←
26	オイルパンL	Oilpan-L	818241	←
27	オイルパンR	Oilpan-R	818242	818339
28	サイドオイルパンL	Side oilpan-L	818243	818340
29	サイドオイルパンR	Side oilpan-R	818244	818341
30	セットアップマドカバ	Cover	818199	←
31	フロントカバL	Front cover-L	818251	←
32	フロントカバR	Front cover-R	818252	←
33	テンションBKT	Tension bracket	818385	←
34	テンションボルト	Tension bolt	A316100B	←
35	油圧マニホールド	Manifold block	814202	←
36	ターミナルボックス	Terminal box	818180	←
37	アンカプレート	Anchor plate	818269	818338
38	ジャッキ ボルト	Jacking bolt	BA230120Y	←
39	アジャスト ボルト	Adjusting bolt	BA224100Y	←
40				
41	ガイドスタンドL	Guide stand-L	818253	←
42	ガイドスタンドR	Guide stand-R	818254	←

NO.	品 名	Part Name	PME63- 6S 品番 Part No.	PME63-10S 品番 Part No.
43	カムフォロア	Cam follower	BN913355C	←
44	M/Cカバ L	M/C cover-L	818255	←
45	M/Cカバ R	M/C cover-R	818256	←
46	センタカバ L	Center cover-L	818257	←
47	センタカバ R	Center cover-R	818258	←
48				
49				
50				
51	キャリヤ	Carrier	810131EC	←
52	チェーンガイド	Chain guide	810137B	←
53	チェーンガイド	Chain guide	810134	←
54	カムフォロア	Cam follower	BN913405C	←
55	ワイパ	Wiper	808079AA,808080AA	←
56	ローラフォロア	Roller follower	BN911250A	←
57	ローラピン	Roller pin	810135	←
58	ローラホルダ	Roller holder	810133CA	←
59	テーパローラベアリング	Taper roller bearing	808026	←
60	フタ	Cover	810140	←
61	カムフォロア	Cam follower	BN913355C	←
62	ストッパ	Stopper	810138B	←
63	ストッパプレート	Stopper plate	805871	←
64	ローラ	Roller	810144B	←
65	ピンフランジ	Pin flange	805872BA	←
66	スタッド ボルト	Stud bolt	805874C	←
67	ストッパ	Stopper	808148	←
68	ローラ	Roller	805873	←
69	ローラピン	Roller pin	805878	←
70	プレート	Plate	805877	←
71	スプリング	Spring	808149	←
72	ピン	Pin	805879B	←
73	ブラケット	Bracket	805876	←
74	ボールプランジャ	Ball plunger	808034AG	←
75	ワイパ	Wiper	808035B	←
76	ワイパプレート	Wiper plate	818170	←
77	ワイパ	Wiper	809040	←
78	オイルパン	Oil pan	810132	←
79	ワイパ	Wiper	808032	←
80				
81	カムプレートスタンド	Cam plate stand	805933E	←
82				
83	カム-1	Cam-1	805934C	←
84	カム-2	Cam-2	805935B	←
85				
86				
87				

			PME63- 6S	PME63-10S
NO.	品 名	Part Name	品番 Part No.	品番 Part No.
88				
89				
90				
91	アンダギヤケース	Under gear case	818207	←
92	クロスローラベアリング	Cross roller bearing	808402AA	←
93				
94	23Tスプロケット	23T-Sprocket	808534D	←
95	RV減速機	RV-Reduction gear	808450C	←
96	スプロケットカバ	Sprocket cover	814532	←
97	インプットギヤ	Input gear	814998	←
98	ベアリング ハウジング	Bearing housing	814531BA	←
99	ベアリング オサエ	Bearing holder	814189	←
100	テーパスリーブ	Taper sleeve	BL923035M	←
101	サーボモータ	Servo motor	BL-MH101E-12S	←
102	ギヤ	Gear	814992	815003
103	ギヤ	Gear	814993	815002
104	アッパギヤケース	Upper gear case	818209	←
105	ディスタンスカラ	Distance collar	814994	←
106	ディスタンスカラ	Distance collar	814995	←
107	ベアリング オサエ	Bearing holder	814996	←
108	ボールベアリング	Ball bearing	N062062	←
109	インデックスカバ	Index cover	814986	←
110	キー	Key	814997	←
111	モータ ブラケット	Motor bracket	818208	818342
112				
113				
114				
115	シリンダブラケットL	Cylinder BKT-L	818210B	←
116	シリンダブラケットR	Cylinder BKT-R	818211	←
117	ガイド ホルダ	Guide holder	810290DB	←
118	ダスト シール	Bust seal	BM920045	←
119	ガイドバ	Guide bar	810294AA	←
120	ナックル	Knuckle joint	810292B	←
121	ピン	Pin	810293	←
122	油圧シリンダ	Hydraulic cylinder	808055AA	←
123	シリンダ カバ	Cylinder cover	812413	←
124	LSプレート	LS plate	810295D	←
125	カバ	Cover	810299D	←
126	リミットスイッチ	Limit switch	EB06013	←
127	リミットスイッチ	Limit switch	EB06077	←
128	ドッグ BKT	Dog bracket	810296	←
129	パレットフック	Pallet hook	810291EA	←
130	LS ブラケット	LS bracket	811977	←
131	LS プレート	LS'plate	810295B	←
132	LS カバ	LS cover	810299D	←

7-2. Workpiece Set-up Station

NO.	品 名	Part Name	品番 Part Number	型式 Type
201	フレーム	Frame	818290B	
202	アンカプレート	Anchor plate	810204C	
203	サイド カバ	Side cover	810203C	
204	スイングサークル	Turntable bearing	808902AA	
205	ストッパ	Stopper	810207C	
206	ロックピース	Lock pieces	812009	
207	スタッドホルト	Stud bolts	812010	
208	ジャッキボルト	Jacking bolts	BA224100Y	
209				
210	ダストカバ	Dust covers	812071B	
211	ローラ パッド	Roller pad	806670	
212	ローラパッド BKT	Roller pad BKT	806671	
213				
214				
215				
216				
217				
218				
219				
220				
221	ターンテーブル	Turn table	812030AC	
222	モータブラケット	Motor BKT	812032	
223	ブレーキ付モータ	Brake motor	807760	
224	シャフト	Shaft	810213C	
225	スライドブロック	Slide block	810214E	
226	シャフトブラケット	Shaft brackets	810215C	
227	LSブラケット	LS bracket	810217B	
228	LSカバ	LS cover	805505	
229	リミットスイッチ	Limit switch	EB06014	
230	テンションブロック	Tension block	810218B	
231				
232	パレット ストッパ	Pallet stoppers	812034	
233	カムフォロア	Cam followers	BN913355D	
234				
235				
236				
237				
238				
239				
240				
241	モータスプロケット	Motor sprocket	810220C	
242	モータスプロホルダ	Sprocket holder	812035	
243	ドライブスプロケット	Drive sprocket	810222C	
244	フロントスプロケット	Front sprocket	810226C	
245	リヤスプロケット	Rear sprocket	810228C	

NO.	品 名	Part Name	品番 Part Number	型式 Type
246	ローラチェーン	Roller chains	808130C	
247				
248	ローラチェーン	Roller chains	807762DA	
249				
250	ドライブシャフト	Drive shaft	810223D	
251	メインシャフト	Main shaft	810224B	
252	シャフトスタンド	Shaft stand	812036	
253	ボールベアリング	Ball bearings	N060082	
254	カム	Cam	810232D	
255	カム	Cam	810232D	
256	カム	Cam	811944E	
257	カムホルダ	Cam holder	810231C	
258	リンクピン	Link pins	810234D	
259	ローラピン	Roller pin	810235B	
260	ローラ	Roller	810236B	
261	リンクカラ	Link collar	810237B	
262	2ピッチリンクプレート	Link plates	810229B	
263				
264	リンクピン	Link pins	812037	
265	ドッグ	Dogs	812038	
266				
267				
268				
269	リミットスイッチ	Limit switches	EB06080	
270	LS スペーサ	LS spacer	812039	
271	チェーンカバ	Chain cover	810240	
272	パレットフック	Pallet hooks	818267	
273				
274				
275				
276				
277				
278				
279				
280				
281	インデックスピン	Index pin	810243D	
282	ピンホルダ	Pin holder	812040AA	
283				
284	ホルダブラケット	Holder bracket	812041	
285	レバブラケット	Lever bracket	812044AB	
286	リンクピン	Link pin	812045	
287	レバ	lever	815103C	
288	ニギリ	Knob	W504000A	
289	スプリング	Spring	808135C	
290	スプリングプランジャ	Spring plungers	808126AG	

NO.	品 名	Part Name	品番 Part Number	型式 Type
291	LSブラケット	LS bracket	812047	
292	リミットスイッチ	Limit switch	EB06080	
293	ドッグ	Dog	810247B	
294	R ナット	R-Nut	815996	
295				
296				
297	スクレーパ	Scraper	BM920045D	
298	ダストカバ	Dust cover	818360	
299	ピン ストッパ	Pin stopper	812042	
300				
301	ターミナル ボックス	Terminal box	810255C	
302	TB カバ	TB cover	810256	
303				
304				
305				

8. ATTACHED DRAWINGS

Fig. 1-1 External View (PME63-6S)
1-2 External View (PME63-10S)

Fig. 2 Hydraulic Circuit Diagram

Fig. 3-1 Circuits Diagram of PME
3-2 Circuits Diagram of WSS

Fig. 4 Frame Part Diagram

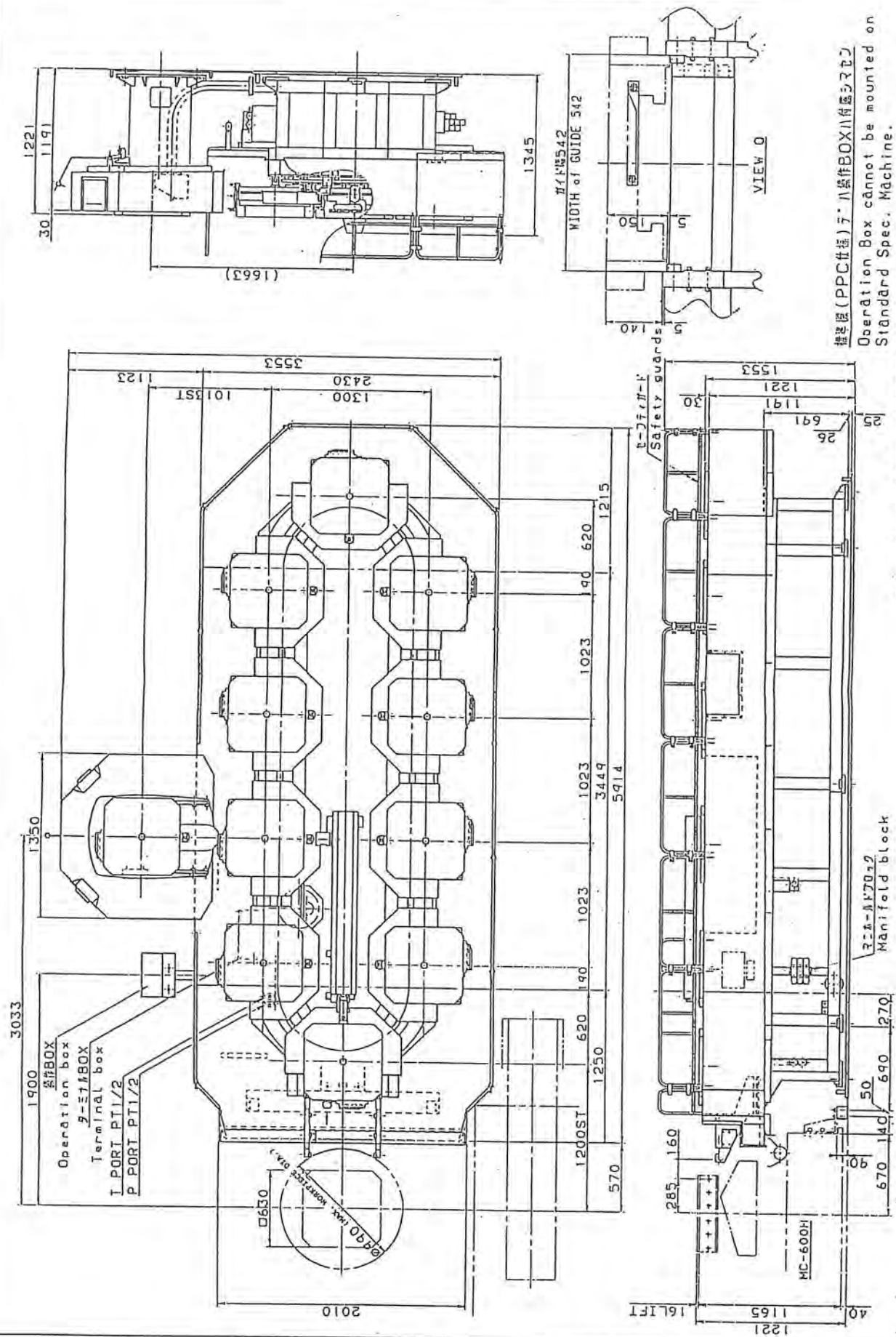
Fig. 5 Carrier Part Diagram

Fig. 6 Arm Part Diagram

Fig. 7 Carrier Index Part Diagram

Fig. 8 Stopper Part Diagram

Fig. 9 Workpiece Set-up Station Diagram



標準版 (PPC仕様) デ・ハ製作BOXハ付蓋シマセフ
Operation Box cannot be mounted on
Standard Spec. Machine.

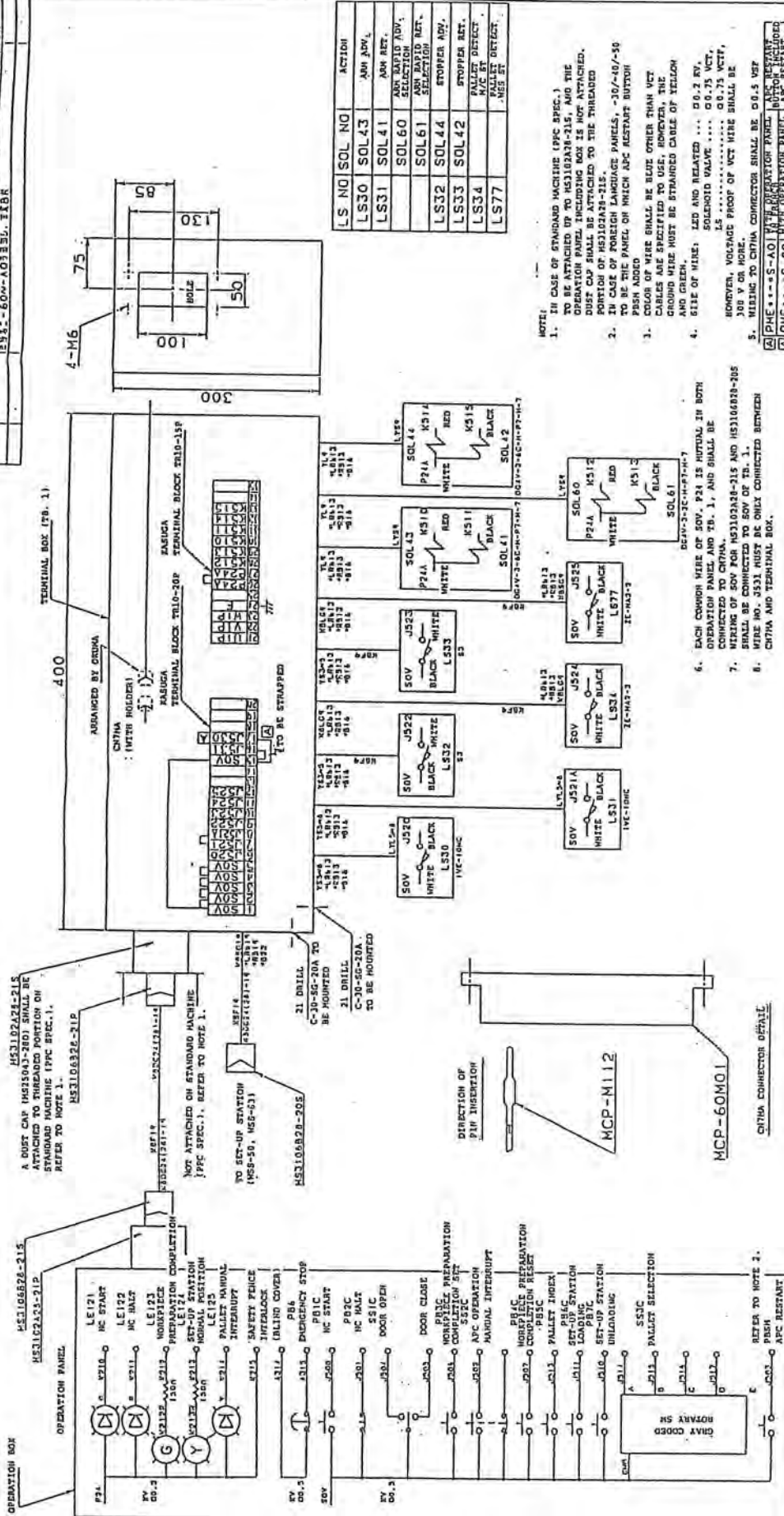
K20 NISHITHURA L78502B-1
July 5, '89

L785028-1

K20 NISHIMURA

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SUPPLIED PARTS:

SSIC	1 PC.
SLING COVER FOR SSIC	1 PC.
RUBBER PACKING FOR LE	3 PCS.
LIGHTING MARK FOR TERMINAL BOX	2 PCS.

	1	2	3	4	5	6	7	8	9	10
S0V	S0V	J520	J521	J522	J523	J524	J527	J526	J532	
I1	12	13	14	15	16	17	18	19	20	
J533	J525	J500	J501	J504	J505	J506	J502	J507		
21	22	23	24	25	26	27	28	29	30	
J511	J510	J514	J515	J516	J517	A314	A315	J513		
31	32	33	34	35	36	37	38	39	40	
					P24A	P24B	K512	K513	K510	
J1	42	43	44	45	46	47	48	49	50	
K511	K512	K515	P21	K210	K211	K212	K213	K214	K215	
51	52	53	54	55	56	57	A559	59	60	
								J531	J503	

	A	B	C	D	E
	UIP	UIP	VIP	VIP	VIP
	L	H	N	P	
J527	J527	J526	J532	J533	

CAUTION 28-21 TYPE					
A	B	C	D	E	
P24	A312	A315	S0V	K210	R
L	H	N	P		
J501	J504	J505	J506	J502	c
X	Z	a	b		
J515	J516	J517	K211		a
I	k	a	n		

F	G	H	J	K
WIP	E			SOV

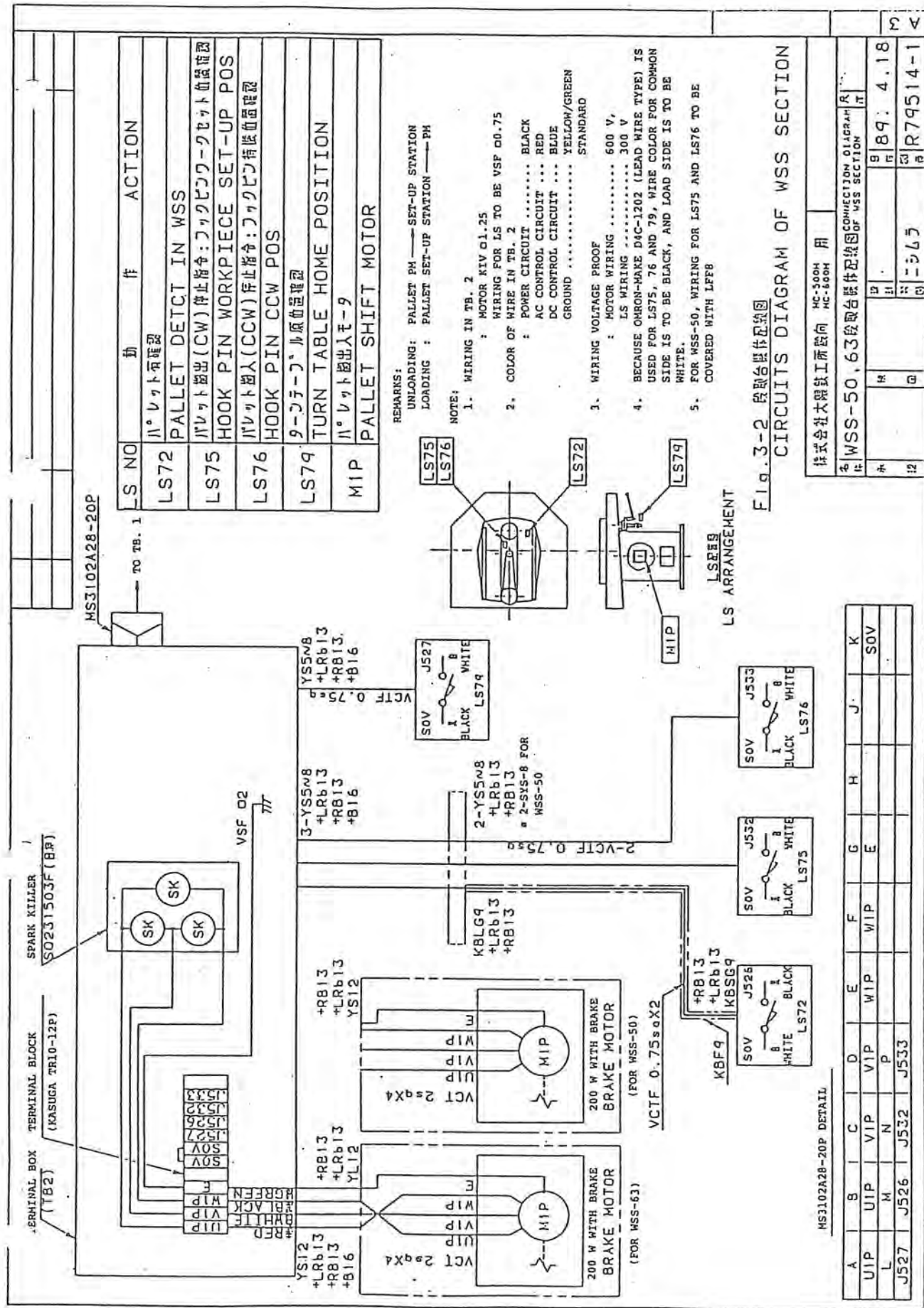
F	G	H	J	K
K212	K213	K214	K215	J500
S	T	U	V	W
J507	J513	J511	J510	J514
d	e	f	g	h
i	j	k	l	m
n	o	p	q	r
s	t	u	v	w
x	y	z	aa	ab
ac	ad	ae	af	ag
ah	ai	aj	ak	al
am	an	ao	ap	aq
ar	as	at	au	av
aw	ax	ay	az	ba
bb	bc	bd	be	bf
bg	bh	bi	bj	bk
bl	bm	bn	bo	bp
bq	br	bs	bt	bu
bv	bw	bx	by	bz
ca	cb	cc	cd	ce
cf	cg	ch	ci	cj
ck	cl	cm	cn	co
cp	cq	cr	cs	ct
cu	cv	cw	cx	cy
cz	da	db	dc	dd
de	df	dg	dh	di
dj	dk	dl	dm	dn
do	dp	dq	dr	ds
dt	du	dv	dw	dx
dy	dz	ea	eb	ec
ed	ee	ef	eg	eh
ei	ej	ek	el	em
en	eo	ep	eq	er
es	et	eu	ev	ew
ex	ey	ez	fa	fb
fc	fd	fe	ff	fg
fh	fi	fj	fk	fl
fm	fn	fo	fp	fq
fr	fs	ft	fu	fv
fw	fx	fy	gz	ha
hb	hc	hd	he	hf
hg	hh	hi	hj	hk
hl	hm	hn	ho	hp
hq	hr	hs	ht	hu
hv	hw	hx	hy	hz
ia	ib	ic	id	ie
if	ig	ih	ii	ij
ik	il	im	in	io
ip	iq	ir	is	it
iu	iv	iw	ix	iy
iz	ja	jb	jc	jd
je	jf	jh	ji	jj
jk	jl	jm	jn	jo
jp	jq	jr	js	jt
ju	jv	jw	kw	la
lb	lc	ld	le	lf
lg	lh	li	lj	lk
ll	lm	ln	lo	lp
lq	lr	ls	lt	lu
lv	lw	lx	ly	lz
ma	mb	mc	md	me
mf	mg	mh	mi	mj
mk	ml	mm	mn	mo
mp	mq	mr	ms	mt
mu	mv	mw	mx	my
mz	na	nb	nc	nd
ne	nf	ng	nh	ni
nj	nk	nl	nm	no
np	nq	nr	ns	nt
nu	nv	nw	nx	ny
nz	oa	ob	oc	od
oe	of	og	oh	oi
oj	ok	ol	om	on
oo	op	oq	or	os
ot	ou	ov	ow	ox
oy	oz	pa	pb	pc
pd	pe	pf	pg	ph
pi	pj	pk	pl	pm
pn	po	pp	pq	pr
ps	pt	pu	pv	pw
px	py	pz	qa	qb
qc	qd	qe	qf	qg
qh	qi	qj	qk	ql
qm	qn	qo	qp	qq
qr	qs	qt	qu	qv
qw	qx	qy	qz	ra
rb	rc	rd	re	rf
rg	rh	ri	rj	rk
rl	rm	rn	ro	rp
rq	rr	rs	rt	ru
rv	rw	rx	ry	rz
sa	sb	sc	sd	se
sf	sg	sh	si	sj
sk	sl	sm	sn	so
sp	sq	sr	ss	st
su	sv	sw	sx	sy
sz	ta	tb	tc	td
te	tf	tg	th	ti
tj	tk	tl	tm	tn
to	tp	tr	ts	tt
tu	tv	tw	tx	ty
tz	ua	ub	uc	ud
ue	uf	ug	uh	ui
uj	uk	ul	um	un
uo	up	uq	ur	us
ut	uv	uw	ux	uy
uz	va	vb	vc	vd
ve	vf	vg	vh	vi
vj	vk	vl	vm	vn
vo	vp	vq	vr	vs
vt	vu	vv	vw	vx
vy	vz	wa	wb	wc
wd	we	wf	wg	wh
wi	wj	wk	wl	wm
wn	wo	wp	wq	wr
ws	wt	wu	wv	ww
wx	wy	wz	xa	xb
xc	xd	xe	xf	xg
xh	xi	xj	xk	xl
xm	xn	xo	xp	xq
xr	xs	xt	xu	xv
xw	xy	xz	ya	yb
yc	yd	ye	yf	yg
yh	yi	yj	yk	yl
ym	yn	yo	yp	yq
yr	ys	yt	yu	yv
yw	yx	yy	yz	za
zb	zc	zd	ze	zf
zg	zh	zi	zj	zk
zl	zm	zn	zo	zp
zq	zr	zs	zt	zu
zv	zw	zx	zy	zz

Fig. 3-1 PME 零件图

CIRCUITS DIAGRAM OF PME

PMET--S(-00) 24PMB

89	4.24
R795138-1	



LS NO	動作	ACTION
LS72	パレット検出	PALLET DETECT IN WSS
LS75	パレット出庫 (CW) 停止指令: フックピクアップセット位置検出	HOOK PIN WORKPIECE SET-UP POS
LS76	パレット出庫 (CCW) 停止指令: フックピクアップ位置検出	HOOK PIN CCW POS
LS79	ターナール位置検出	TURN TABLE HOME POSITION
MIP	パレット出入モーター	PALLET SHIFT MOTOR

REMARKS:
UNLOADING: PALLET PM → SET-UP STATION
LOADING: PALLET SET-UP STATION → PM

NOTE:
1. WIRING IN TB. 2
: MOTOR KIV 01.25
: WIRING FOR LS TO BE VSF 00.75
2. COLOR OF WIRE IN TB. 2
: POWER CIRCUIT BLACK
: AC CONTROL CIRCUIT ... RED
: DC CONTROL CIRCUIT ... BLUE
: GROUND YELLOW/GREEN
STANDARD
3. WIRING VOLTAGE PROOF
: MOTOR WIRING 500 V,
LS WIRING 300 V
4. BECAUSE OHNOM-MAKE D4C-1202 (LEAD WIRE TYPE) IS
USED FOR LS75, 76 AND 79, WIRE COLOR FOR COMMON
SIDE IS TO BE BLACK, AND LOAD SIDE IS TO BE
WHITE.
5. FOR WSS-50, WIRING FOR LS75 AND LS76 TO BE
COVERED WITH LFFB

Fig. 3-2 回路台配図
CIRCUITS DIAGRAM OF WSS SECTION

株式会社大陽鉄工所 設備用		MC-500H MC-600H	
1	WSS-50, 63 回路台配図	CONNECTION DIAGRAM	R
2	89: 4.18	89: 4.18	89: 4.18
3	R79514-1	R79514-1	R79514-1

MS3102A28-20P DETAIL											
A	B	C	D	E	F	G	H	J	K	L	M
UIP	UIP	VIP	VIP	VIP	WIP	E			SOV		
J527	J526	J532	J533								

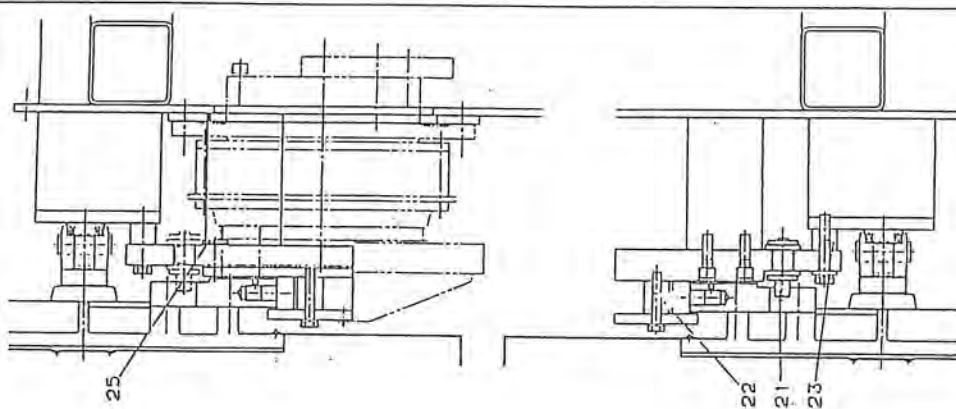
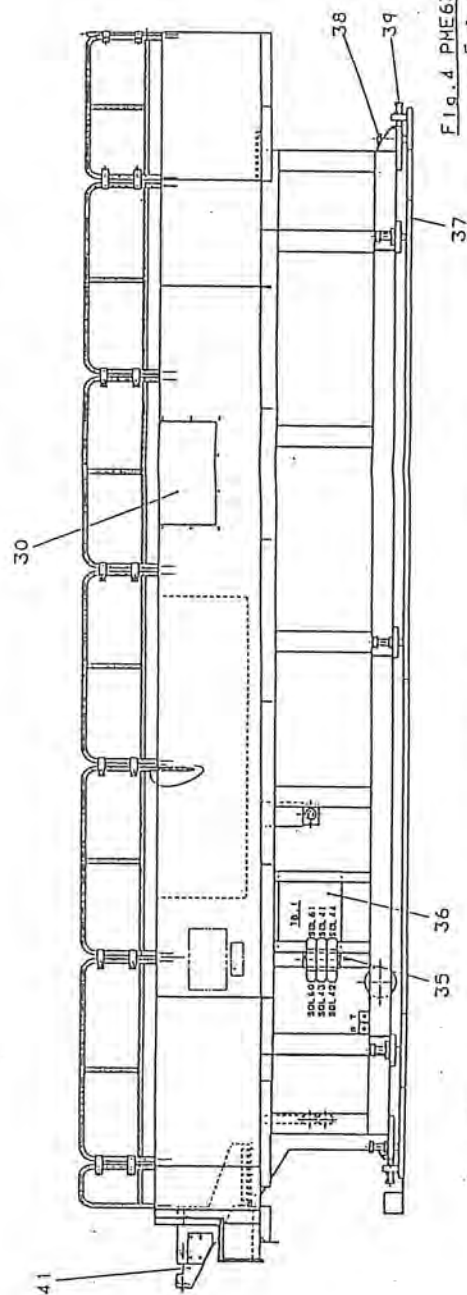
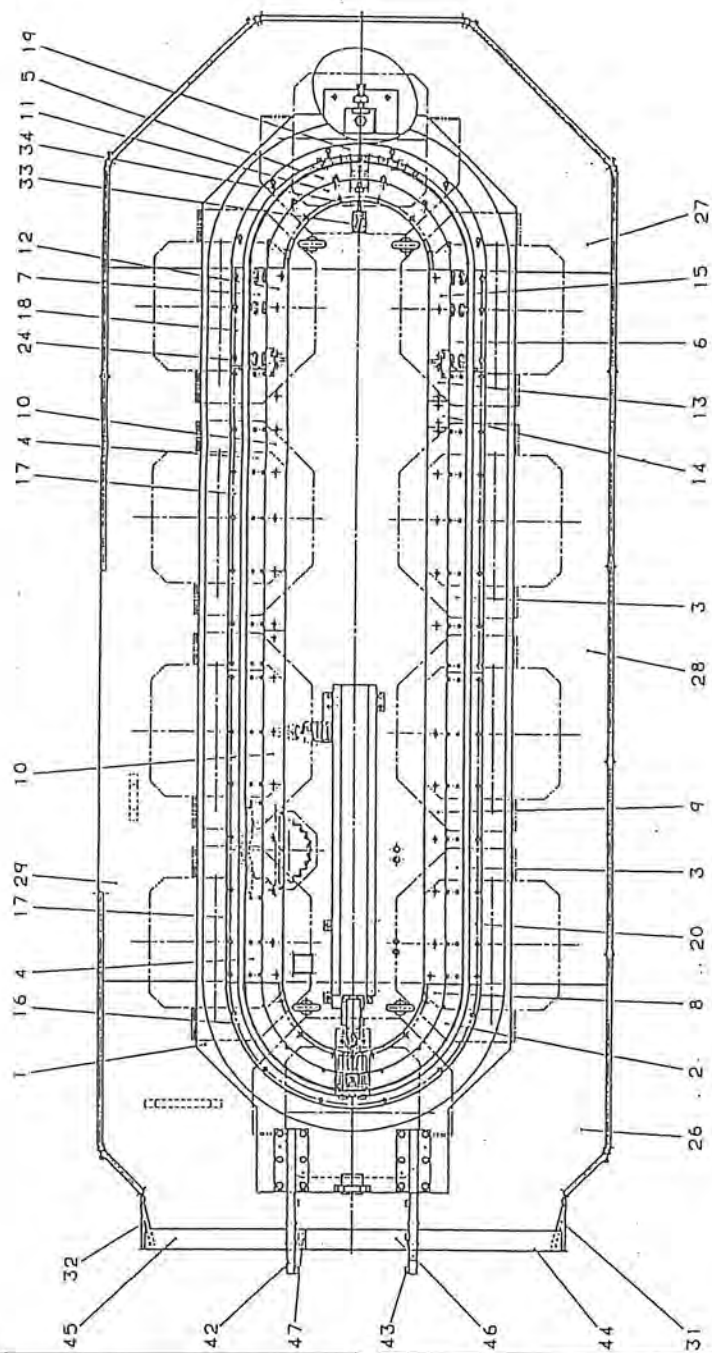


Fig. 4 PHE63-10S JV-658228
Frame part diagram

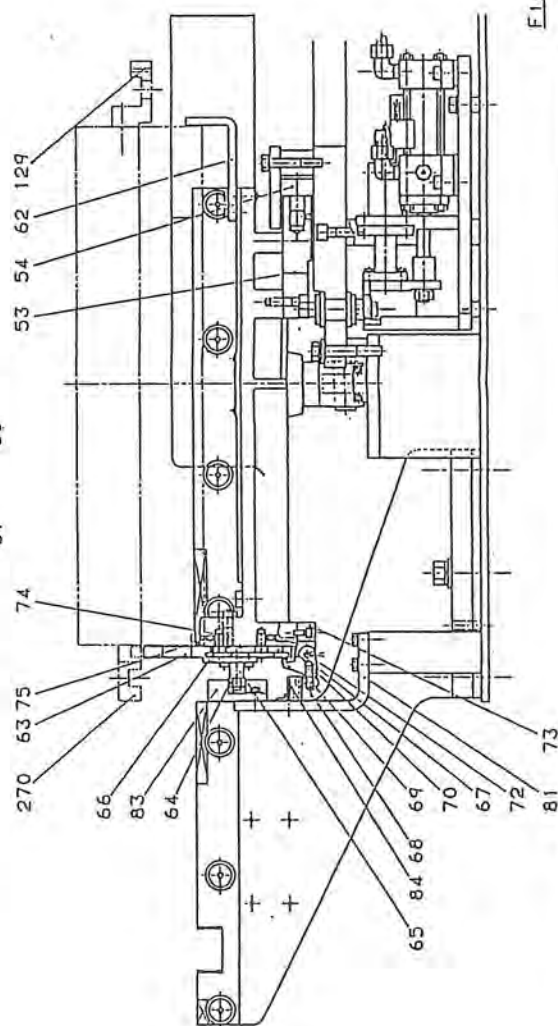
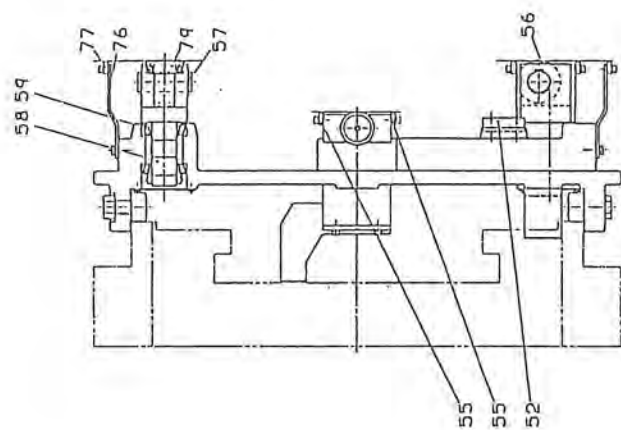
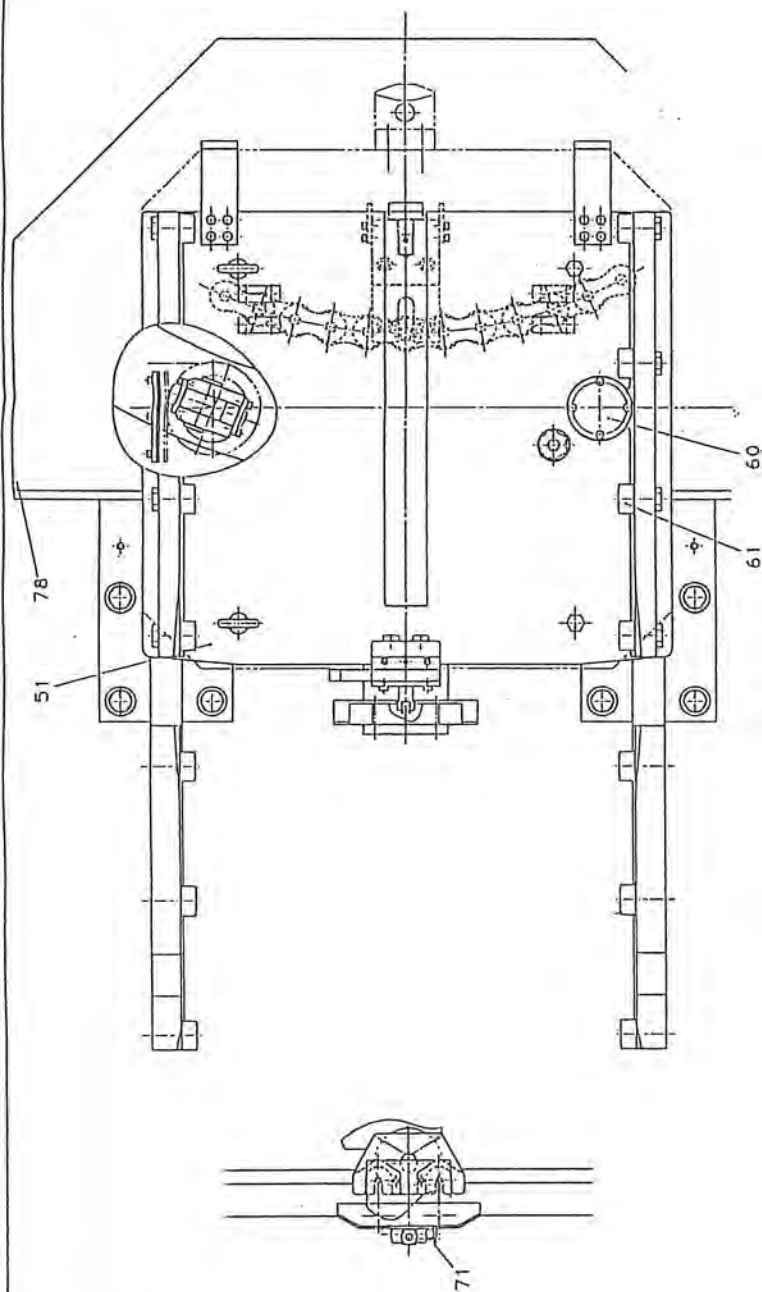


Fig. 5 PME63 типовой
Carrier part diagram - 27 -

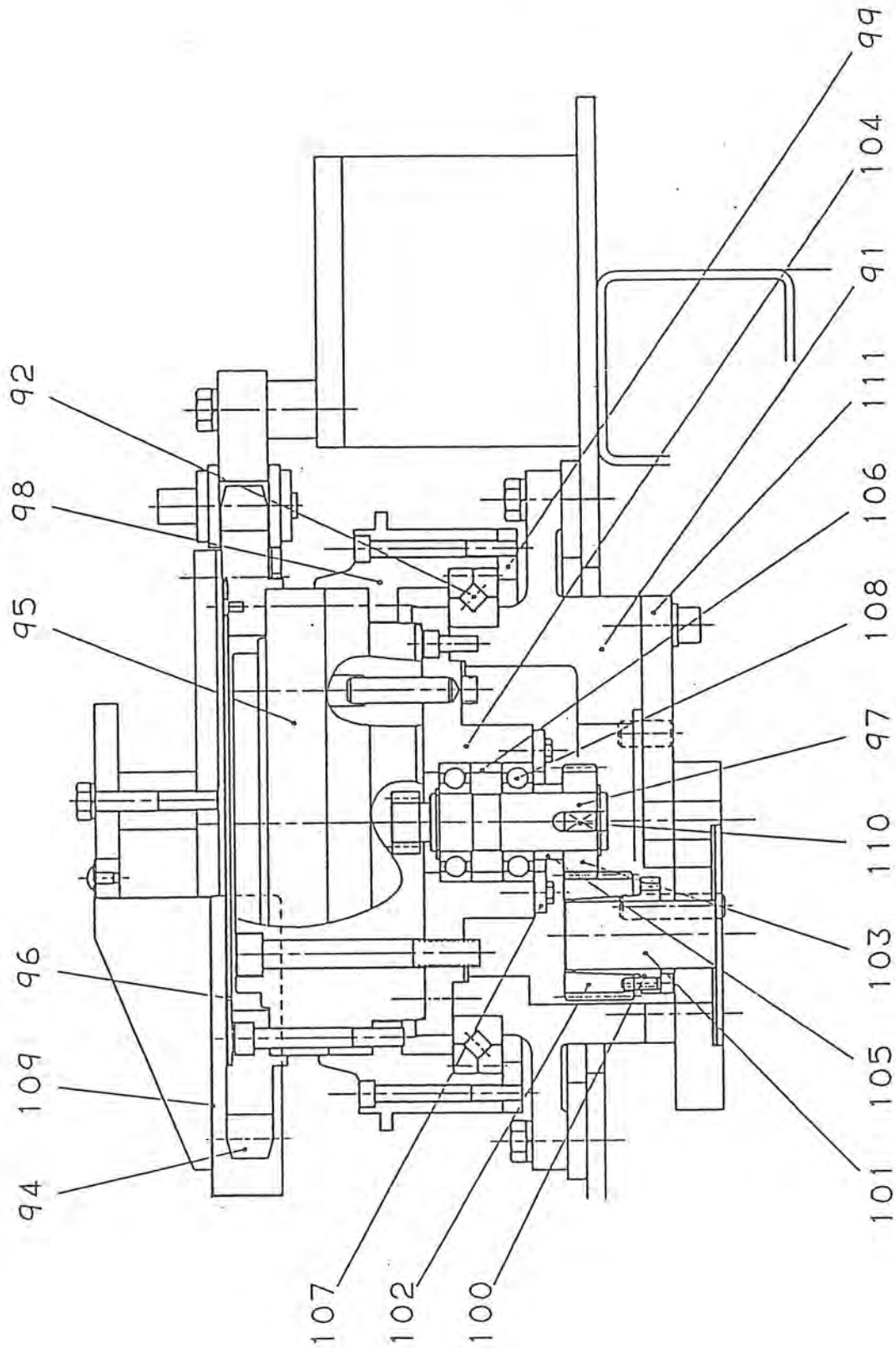


Fig. 7 PME63 キャリヤインデックス部分構造図

Carrier index part diagram K20 NISHIMURA July 7'89 F78057-1

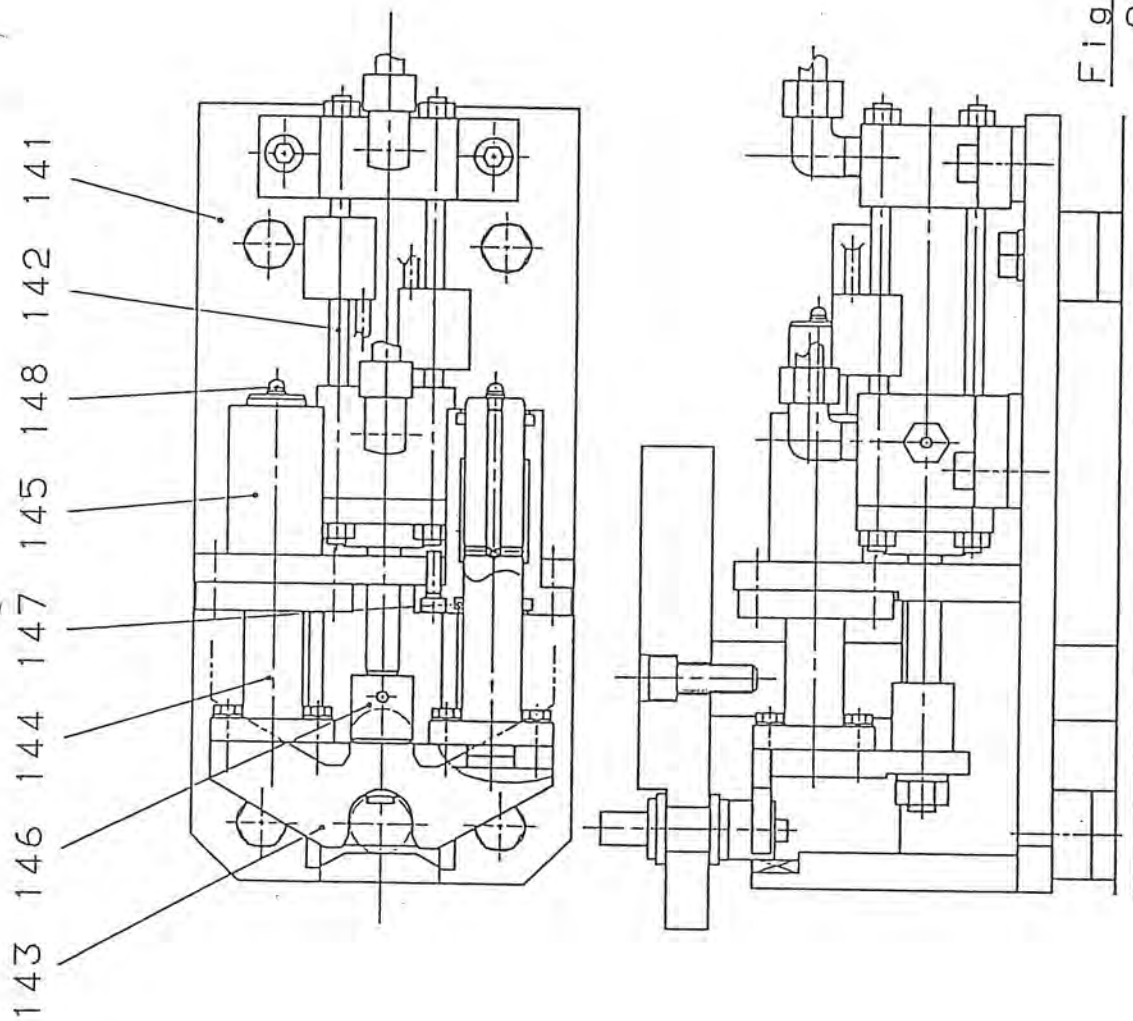


Fig. 8 PME63 ストップ部分構造図
Stopper part diagram

K20 NISHIMURA July 7 '89 F78055-3

浄田硝子株式会社

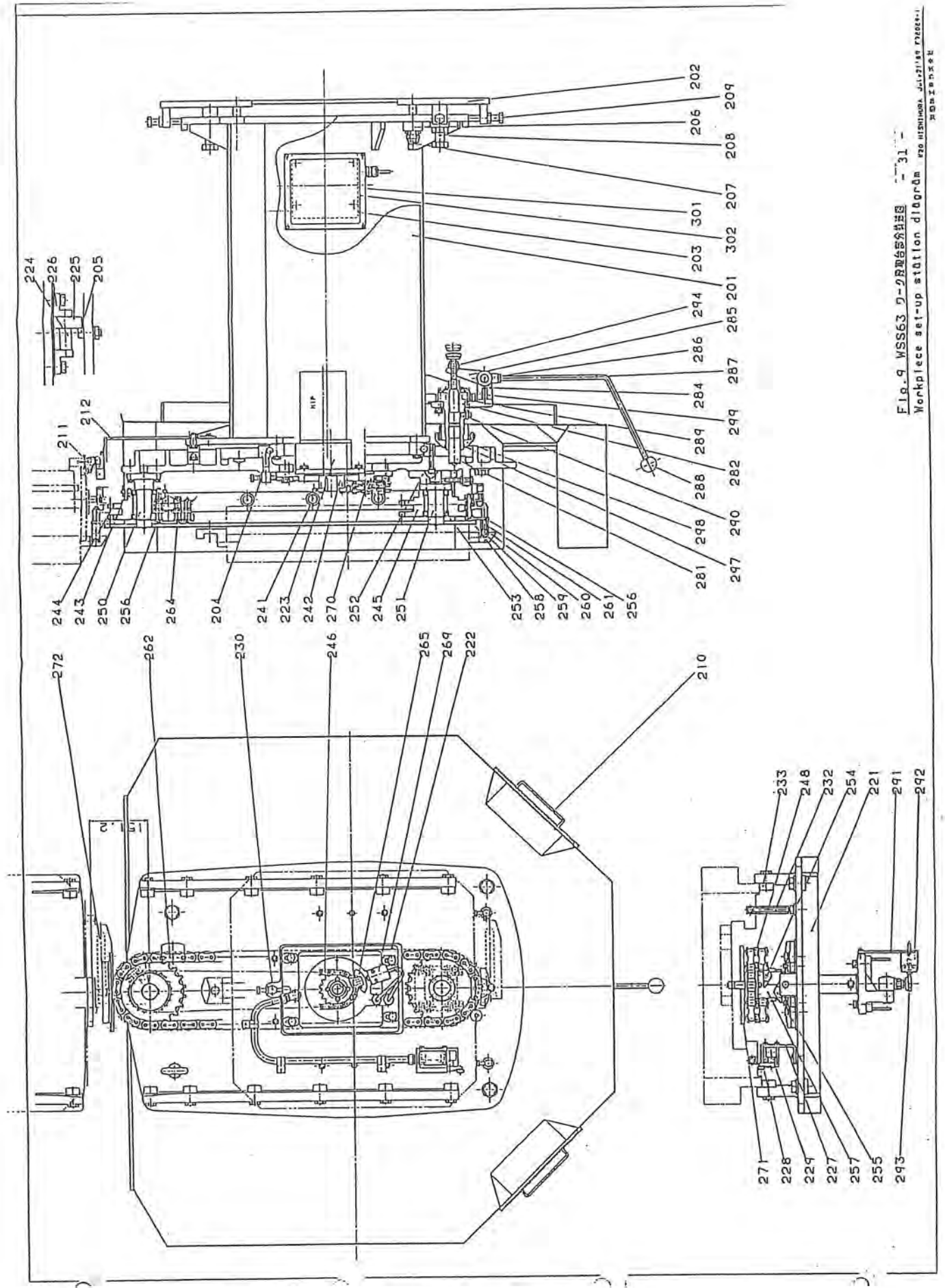
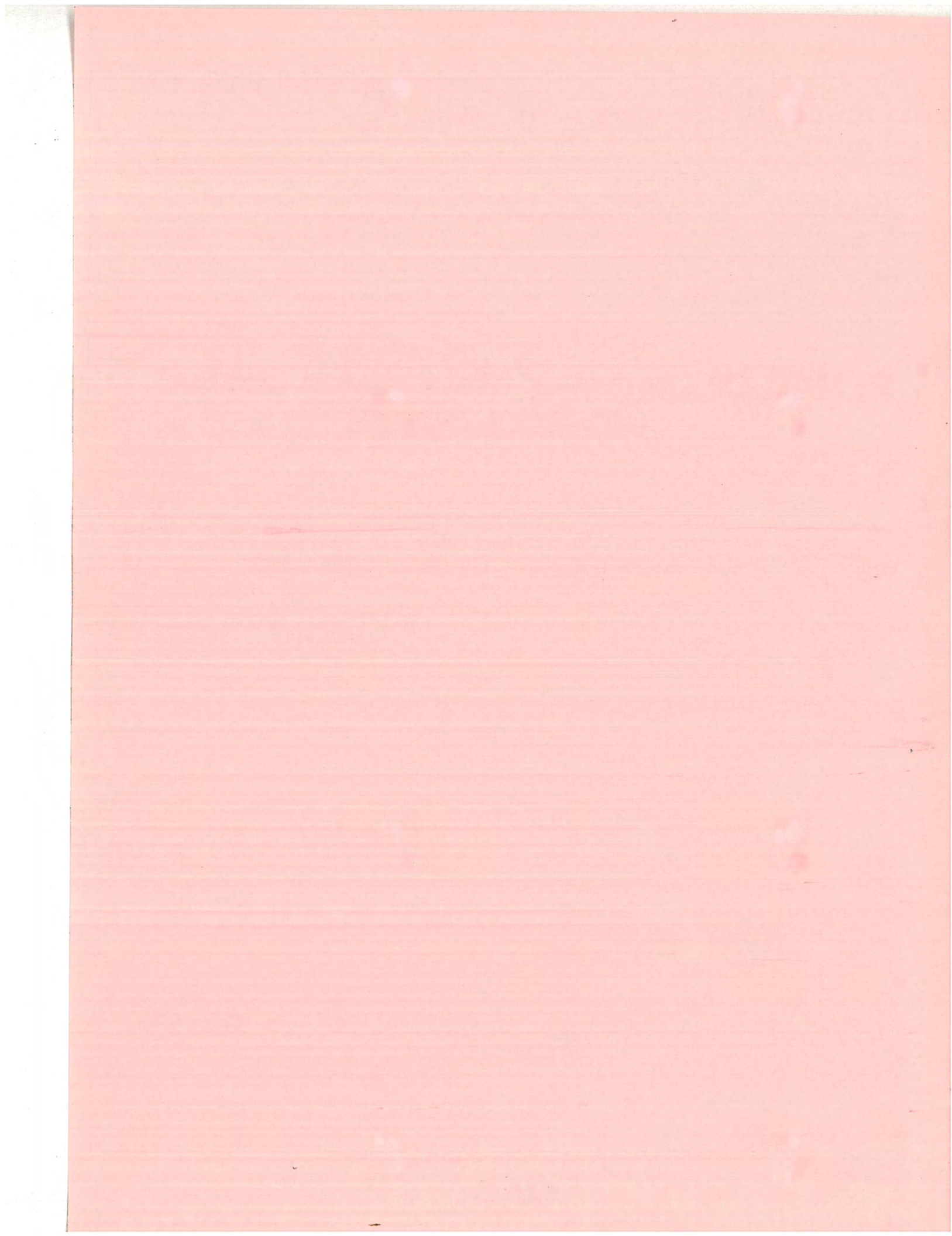


Fig. 9 WSS63 workpiece set-up station diagram - 31 -
 工作物装设站 WSS63 站 图

**F : MAC Oil Controller (Spindlehead cooling)
(MC-500H/600H)**

MAC





HANDLING MANUAL

MAC-60CP-FR-OT-II

'89 三 8 17

MC-500/600H 主軸頭冷却用 (標準)

ME21-054-R1

INSTRUCTION MANUAL

Product Name: MAC Oil Controller

Type: MAC-60CP-FR-OT-1I (Forced circulation type machine for exclusive use of lubricating oil)
(Body temperature follow-up type control)

Read this manual carefully before operating the equipment to ensure operation and optimum results.

A. Description

The MAC oil controller cools oil with a refrigerator and controls the temperature.

A-1 Compressor

Circulates the cooling gas by compressing, exhausting, and drawing in air.

※Power supply: 3 Φ 200V AC

A-2 Air cooled condenser

The heat caused by the oil cooling (or the coolant), or, in other words, the heat obtained from the oil with the help of cooling gas, is subjected to heat exchange using condenser.

※Forced ventilation cross fin type.

A-3 Fan for condenser

This fan forces the air in the external atmosphere against the fins of the condenser so as to increase the rate of heat transfer from the condenser to the external atmosphere.

Hot air (at 45 $^{\circ}\text{C}$) is discharged from the fan.

A-4 Capillary tube (expansion valve)

The valve for evaporating the refrigerant by expansion.

A - 5 Evaporator cooling unit

The heat exchanger for cooling the oil using the refrigerant gas.

Coolant solution or other solution containing sludge cannot be used since the cooler is clogged and becomes unrepairable.

A - 6 Cooling pump

A high pressure pump which sends temperature-regulated oil(fluid) to the machine side.

It supplies oil to the main spindle and absorbs oil from the main spindle.

Water or coolant solution cannot be used.

A - 7 Oil temperature sensor

This sensor detects oil(or coolant) temperature.

A - 8 Body temperature sensor

A sensor connected with lead wire taken out of the oil controller main body.

With PT1/8 screw. This sensor is attached to the M/C side.

A - 9 Oil tank

Cooling oil tank. Supply specified oil up to the top of the oil level gauge.

B-3 Oil tank

B-3-1 Supply specified oil up to the top of the oil level gauge.

3-2 Magnet for cleaning oil in the tank can be taken out from the inspection port on the front of the tank.

B-4 Electric wiring

B-4-1 Connect the three phase AC power supply to the R,S,T,and E(ground) terminals of the terminal box of the unit.

※In case the optional fuseless circuit breaker is being used, connect the power supply to the terminals of the circuit breaker.

4-2 Connect other relevant terminals.

※Refer to the electrical wiring diagram for instruction during operation and alarm terminal.

4-3 When confirming the rotating direction of the equipment, it is unnecessary to check that of the refrigerator.

Confirm by rotation of the oil pump or condenser fan.

At negative phase, the reverse prevention relay works not to allow start.

B. Preparation

B - 1 Location of MAC oil controller

- B - 1 - 1 Install the unit on a flat, vibration-free, firm area of floor
- 1 - 2 Select a place free from exhaust heat and sunlight
- 1 - 3 Consider the area necessary for maintenance.
- 1 - 4 Though an air filter to prevent the adverse effects of oil mist is provided, a place free of oil mist should be selected.
- 1 - 5 In order to improve the efficiency of the air cooled condenser, make sure that there are no objects or obstacles within 20 cm of the air inlet filter surface and within 50 cm of the exhaust outlet.
- 1 - 6 Select a minimally humid area. Though condensation collects on the cooler, this dries naturally, causing no problems.
- 1 - 7 Do not operate the oil controller continuously if the ambient temperature is over 45°C.
- 1 - 8 The lower limit of oil cooling control is +10°C, when the temperature is equal to room temperature.
- 1 - 9 The upper limit of oil cooling control is +45°C.

B - 2 Connecting the Oil Pipes

B - 2 - 1 Connect the cooling oil circulation pipes

- 2 - 2 Fix the suction strainer (100 mesh) in the oil suction pipe.
Any slution in the oil, if allowed to enter this pipe, will damage the trocoid pump and will reduce the efficiency of cooling when it enters the cooler.
- 2 - 3 Make the oil piping as short as possible so as to reduce the resistance to the oil flow thereby reducing the load on the oil pump. If the suction pipe is either long or narrow, the flow rate of the oil will be decreased which not only results in reduced cooling efficiency but also may cause the trocoid pump to generate a whining noise.

C. Description

FR type, Electronic machine temperature follow-up type temperature controller.

(Forced circulation type machine for exclusive use of oil pressure operation oil and lubricating oil)

- C-1 This temperature controller is activated by two temperature sensors; one is used to detect body temperature, the other to detect oil temperature. It controls the difference of the two temperatures.
- C-2 Oil temperature is controlled in plus or minus based on the reference body temperature.
- C-3 Body temperature sensor with PT1/8 male screw. Screw into the M/C main body to install.
- C-4 The oil temperature detection sensor is mounted on the inlet of the oil controller.
- C-5 The cooled oil is discharged into the heat generation source (the oil tank, the oil bath or the gear box, etc.) and mixed there at a temperature lower than the set one. When the liquid temperature of oil sucked into the oil controller becomes the set temperature, the cooling operation will stop.

C-6 Adjusting controller

Set the dial in front of the controller to desired scale which indicates the difference between room temperature and oil temperature.

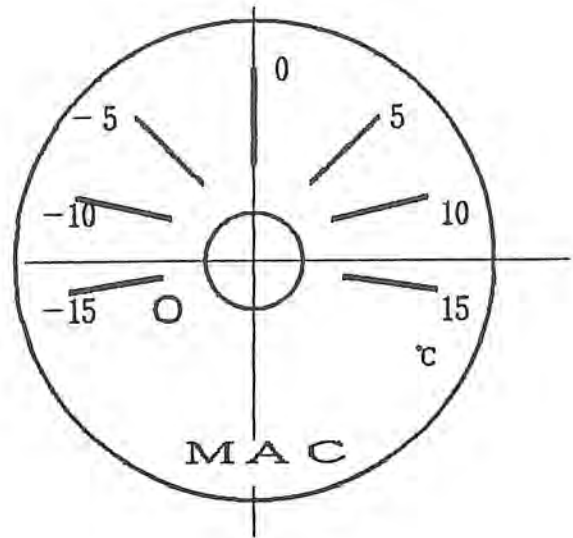
(For instance, scale zero indicates that the oil and room temperatures are the same while scale +5 shows that the former is 5 °C higher than the latter.)

Differential: ± 1 °C

Control range of oil temperature.

(Body temperature:

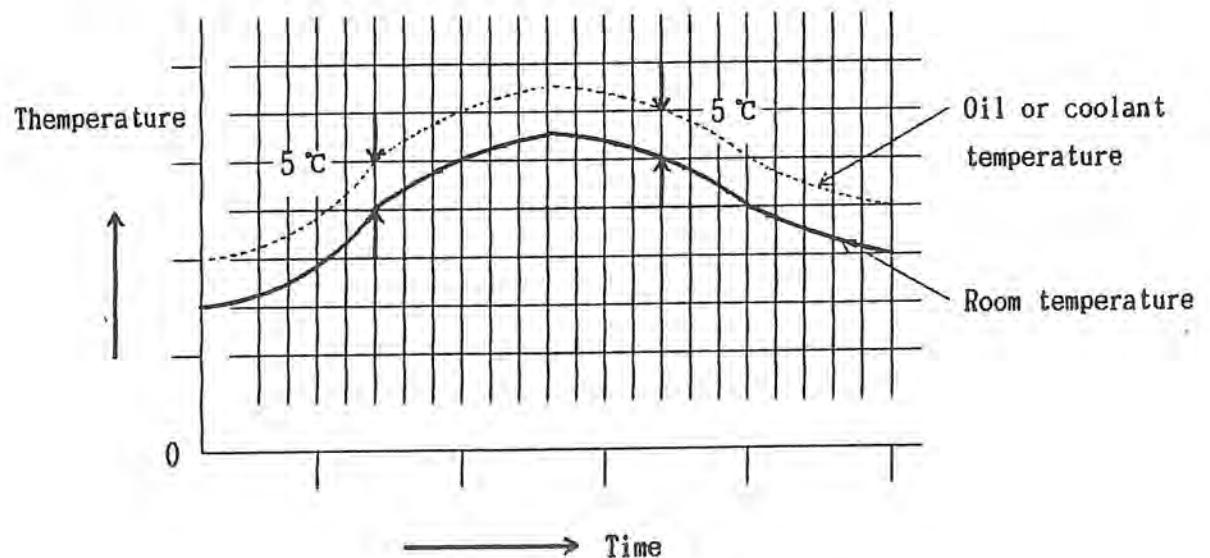
+10 °C to -5 °C.)



D. Method of operation

1. Set the operation instruction circuit to OFF, And turn on the power supply.
2. Turn the operation instruction circuit "ON".
The oil pump operates at all times to circulate cooling oil.
3. If the temperature of the thermostat is decreased, the refrigerator operates and cooler operation lamp(green)lights.
Hot air is discharged from punching of the gauging top plate.
4. Relationship between the oil or coolant temperature and the room temperature is given below.

The above graph shows the relationship when the dial is set to scale + 5 °C.

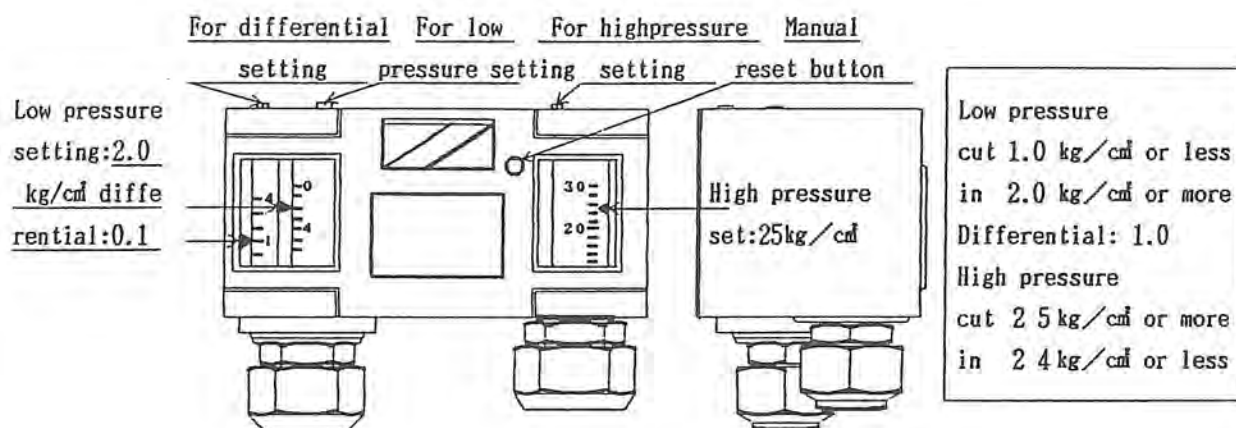


5. Oil temperature is controlled by cooling only and therefore the oil controller needs not heating ability.

E. Control Instrument Description and Maintenance

※When the instrument stops and the abnormality detection lamp goes on during operation, take the following steps:

- E-1 High/low pressure protection switch (H.L.P) Detect and protect the gas pressure at the higher and lower sides so that the gas pressure in the refrigerating cycle can be held normal.



Lower pressure side pressure abnormality

• • • When Freon gas is insufficient in quantity (the gas leaks)

Abnormal cooling detecting lamp within the control panel (red)

• • • Goes on

Fully stop the oil controller.

※ 3 or 4 minutes later after the stop of the refrigerator, the lower pressure side is automatically resumed to extinguish that abnormality detecting lamp. Turn ON the operation switch again. However, abnormal cooling takes place in about 5 minutes. (Contact the maker.)

Higher pressure side pressure abnormality

- • • The air filter is clogged. (Wash the air filter with water once in two or three months.)
- • • The ambient temperature exceeds 45°C .
- • • The oil temperature has suddenly risen.

Abnormal cooling indication lamp (red) within the control panel

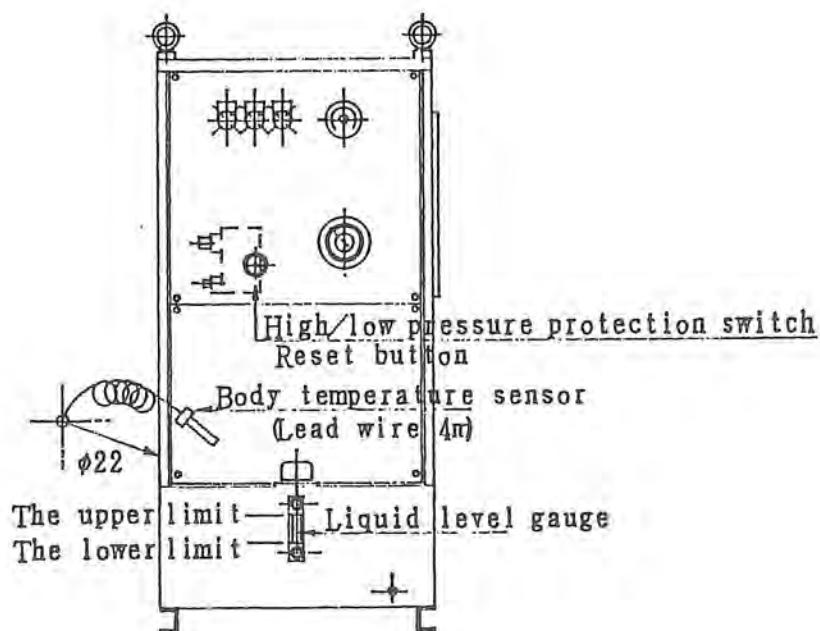
- • • Goes on

Fully stop the oil controller.

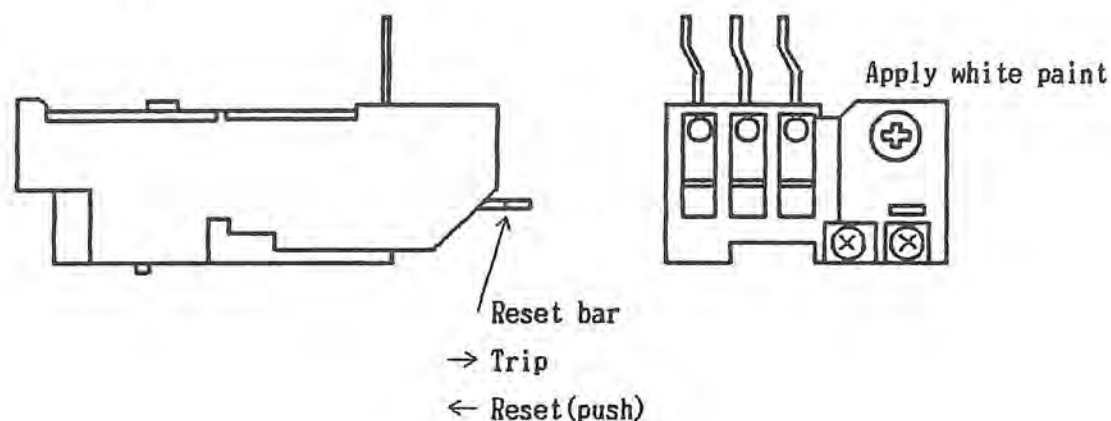
※To reset the higher pressure side, depress the manual reset button of the protection switch (H.L.P.).

The location for installation of the high and low pressure protection switch (H.L.P.) is provided at the lower part of the front side of the control panel.

The reset push-button switch for manual restoration can be pushed over the rubber bush, or if the rubber bush is removed, the reset push-button switch for manual restoration becomes visible.



- E - 2 When the thermal relay has been tripped. → Press reset bar of the thermal relay.
The thermal relay is provided at the control box. The control box can be seen by opening the front door leaf.

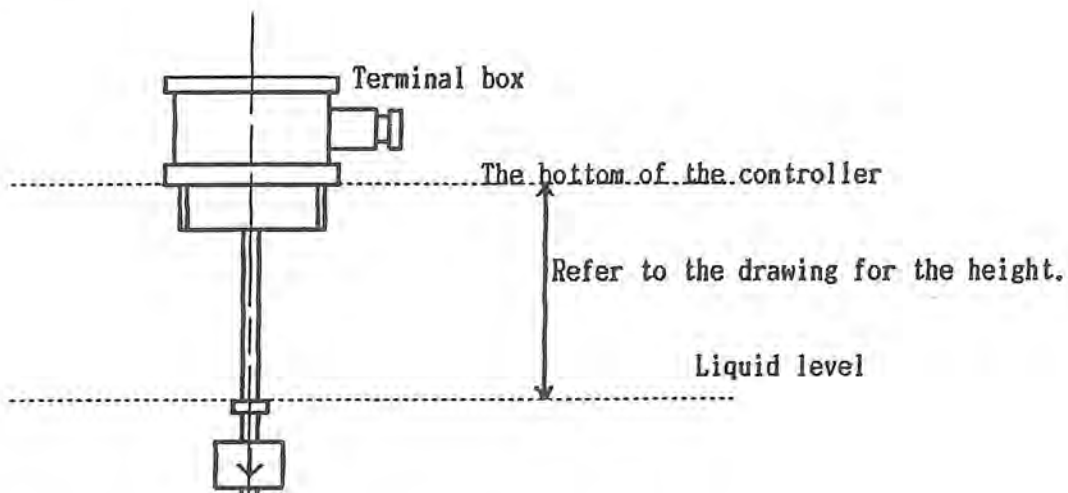


※Refer to the electrical wiring diagram for the set value of the thermal relay.

E - 3 Level switch

Warns drop of oil temperature.

When the level decreases, single contact point is actuated and indicates it to the M/C side.



We thank you for your purchase of MAC oil controller.

Our products are manufactured in the complete quality control system.

However, if a failure occurs, contact salesman or company for repair.

Specifications

To : OKUMA IRONWORKS Co., Ltd.

Date: July 26, 1989

Product Name : MAC Oil Controller

Model : MAC-60CP-FR-OT-11

MAC Co., Ltd. 

Drawing No. : MO-880504-E

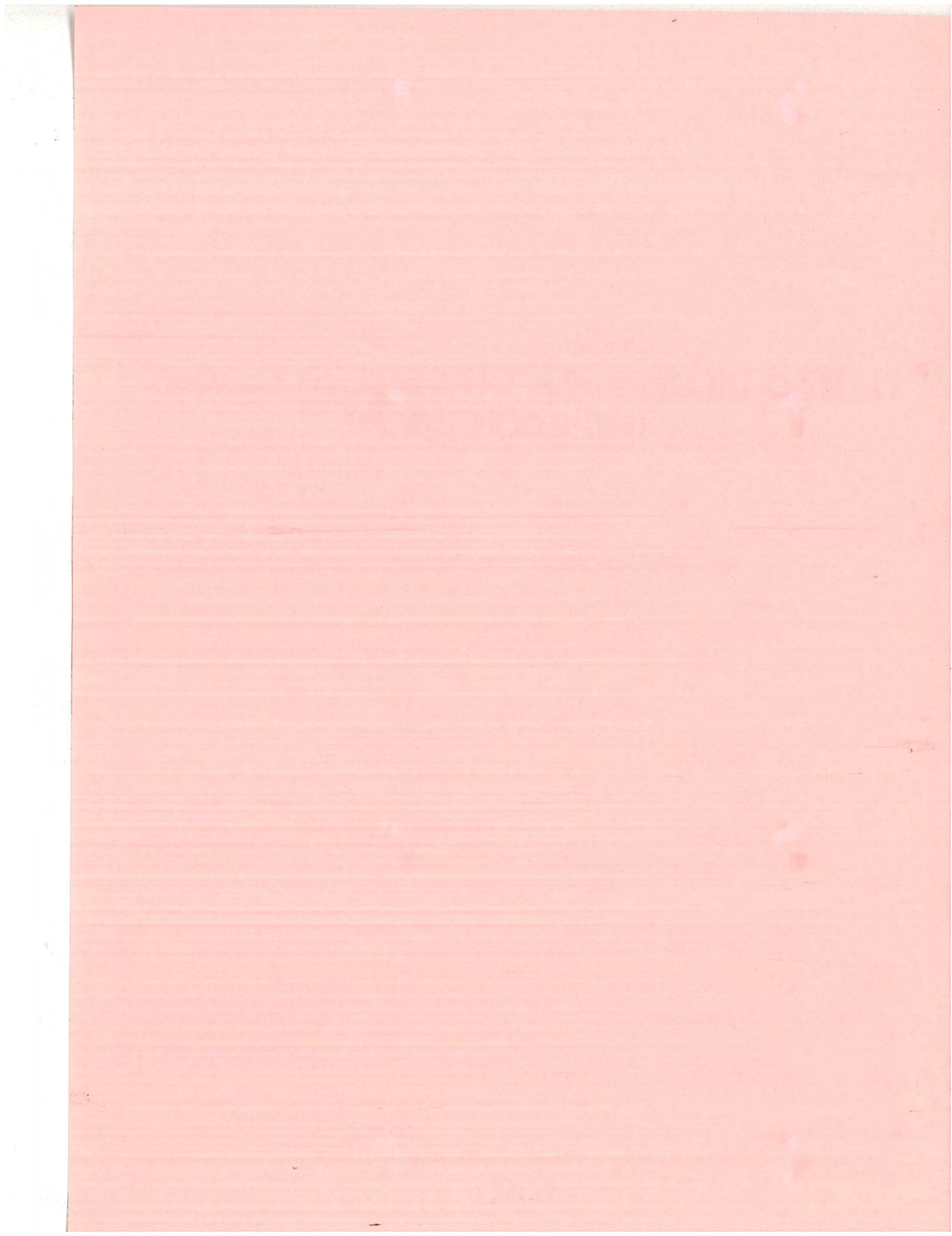
Item	Specifications
Standard cooling capacity	1500/1600 Kcal/Hr 50/60 Hz (at 35°C oil)
Main unit	450×550×700 H. Baking finish (Standard color of OKUMA)
Tank	450×550×200 H. 40 ℓ With liquid level gauge, charge nozzle, and magnet.
Power source	3Φ×AC 200 V. 50/60 Hz
Operation circuit	1Φ×110 V AC 50/60 Hz
Refrigerator	3Φ×AC 200 V×600 W×2 P Rotary type
Condenser	Forced ventilation cross fin. Fan motor 1Φ×AC 200 V×40 W×3
Cooler	Cross fin evaporator tank
Coolant	R-22
Circulating pump	3Φ×AC 200 V×750 W×4 P Discharge 15 ℓ/min Suction 18 ℓ/min 50 Hz 18 ℓ/min 21 ℓ/min 60 Hz
Operation regulator	Temperature control-Standard temperature follow-up electronic automatic temperature regulator. With Power lamp, Cooling lamp, and Abnormal lamp.
Protector	Overcurrent relay. Noise killer. With abnormality contact. Plugging relay.
Weight	Main unit 100 Kg
Capacity of tank	The upper limit. 40 ℓ The lower limit. 30 ℓ
※Description on the nameplate and others shall be both in English and Japanese.	
Remarks: Ambient temperature +45°C max	
Standard temperature follow-up electronic automatic temperature regulator	
Control range 15°C ~ -15°C	
Oil temperature control range -5°C ~ +10°C	
Absolute temperature range for oil temperature control +15°C ~ +45°C	
Accuracy ±0.5°C	

MAC Co., Ltd.

No.6

**G : MAC Oil Controller (Hydraulic oil cooling)
(MC-500H/600H)**

MAC





HANDLING MANUAL

MAC Oil Controller
MAC-40CPC-FR-I

'89 8 17

MC-500/600H 作動油冷却用 (オプショナル)

ホダー A254-2210, 2211, 2212

ME21-055-R1

INSTRUCTION MANUAL

Product Name: MAC Oil Controller

Type: MAC-40CPC-FR-I (Forced circulation type machine for exclusive use
of oil pressure operation oil and lubricating oil)
(Body temperature follow-up type control)

Read this manual carefully before operating the equipment to ensure operation and optimum results.

A. Description

The MAC oil controller cools oil with a refrigerator and controls the temperature.

A-1 Compressor

Circulates the cooling gas by compressing, exhausting, and drawing in air.

※Power supply: 3 Φ 200V AC

A-2 Air cooled condenser

The heat caused by the oil cooling (or the coolant), or, in other words, the heat obtained from the oil with the help of cooling gas, is subjected to heat exchange using condenser.

※Forced ventilation cross fin type.

A-3 Fan for condenser

This fan forces the air in the external atmosphere against the fins of the condenser so as to increase the rate of heat transfer from the condenser to the external atmosphere.

Hot air (at 45 $^{\circ}\text{C}$) is discharged from the fan.

A-4 Capillary tube (expansion valve)

The valve for evaporating the refrigerant by expansion.

A - 5 Evaporator cooling unit

The heat exchanger for cooling the oil using the refrigerant gas.

Coolant solution or other solution containing sludge cannot be used since the cooler is clogged and becomes unrepairable.

A - 6 Cooling pump

A high pressure pump which sends temperature-regulated oil(fluid) to the machine side.

Water or coolant solution cannot be used.

A - 7 Oil temperature sensor

This sensor detects oil(or coolant) temperature.

A - 8 Body temperature sensor

A sensor connected with lead wire taken out of the oil controller main body. With PT1/8 screw. This sensor is attached to the M/C side.

B. Preparation

B - 1 Location of MAC oil controller

- B - 1 - 1 Install the unit on a flat, vibration-free, firm area of floor
- 1 - 2 Select a place free from exhaust heat and sunlight
- 1 - 3 Consider the area necessary for maintenance.
- 1 - 4 Though an air filter to prevent the adverse effects of oil mist is provided, a place free of oil mist should be selected.
- 1 - 5 In order to improve the efficiency of the air cooled condenser, make sure that there are no objects or obstacles within 20 cm of the air inlet filter surface and within 50 cm of the exhaust outlet.
- 1 - 6 Select a minimally humid area. Though condensation collects on the cooler, this dries naturally, causing no problems.
- 1 - 7 Do not operate the oil controller continuously if the ambient temperature is over 45°C.
- 1 - 8 The lower limit of oil cooling control is +10°C, when the temperature is equal to room temperature.
- 1 - 9 The upper limit of oil cooling control is +45°C.

B - 2 Connecting the Oil Pipes

B - 2 - 1 Connect the cooling oil circulation pipes

- 2 - 2 Fix the suction strainer (100 mesh) in the oil suction pipe.
Any slution in the oil, if allowed to enter this pipe, will damage the trocoid pump and will reduce the efficiency of cooling when it enters the cooler.
- 2 - 3 Make the oil piping as short as possible so as to reduce the resistance to the oil flow thereby reducing the load on the oil pump. If the suction pipe is either long or narrow, the flow rate of the oil will be decreased which not only results in reduced cooling efficiency but also may cause the trocoid pump to generate a whining noise.

B - 3 Electric wiring

B - 3 - 1 Connect the three phase AC power supply to the R,S,T,and E(ground) terminals of the terminal box of the unit.

※In case the optional fuseless circuit breaker is being used,
connect the power supply to the terminals of the circuit breaker.

3 - 2 Connect other relevant terminals.

※Refer to the electrical wiring diagram for instruction during
operation and alarm terminal.

3 - 3 When confirming the rotating direction of the equipment, it is unnecessary
to check that of the refrigerator.

Confirm by rotation of the oil pump or condenser fan.

At negative phase, the reverse prevention relay works not to allow start.

C. Description

FR type, Electronic machine temperature follow-up type temperature controller.

(Forced circulation type machine for exclusive use of oil pressure operation oil and lubricating oil)

- C-1 This temperature controller is activated by two temperature sensors; one is used to detect body temperature, the other to detect oil temperature. It controls the difference of the two temperatures.
- C-2 Oil temperature is controlled in plus or minus based on the reference body temperature.
- C-3 Body temperature sensor with PT1/8 male screw. Screw into the M/C main body to install.
- C-4 The oil temperature detection sensor is mounted on the inlet of the oil controller.
- C-5 The cooled oil is discharged into the heat generation source (the oil tank, the oil bath or the gear box, etc.) and mixed there at a temperature lower than the set one. When the liquid temperature of oil sucked into the oil controller becomes the set temperature, the cooling operation will stop.

C-6 Adjusting controller

Set the dial in front of the controller to desired scale which indicates the difference between room temperature and oil temperature.

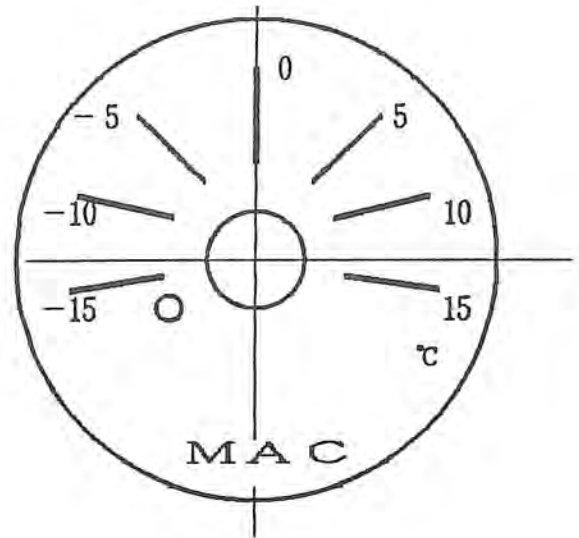
(For instance, scale zero indicates that the oil and room temperatures are the same while scale +5 shows that the former is 5 °C higher than the latter.)

Differential: $\pm 1^{\circ}\text{C}$

Control range of oil temperature.

(Body temperature:

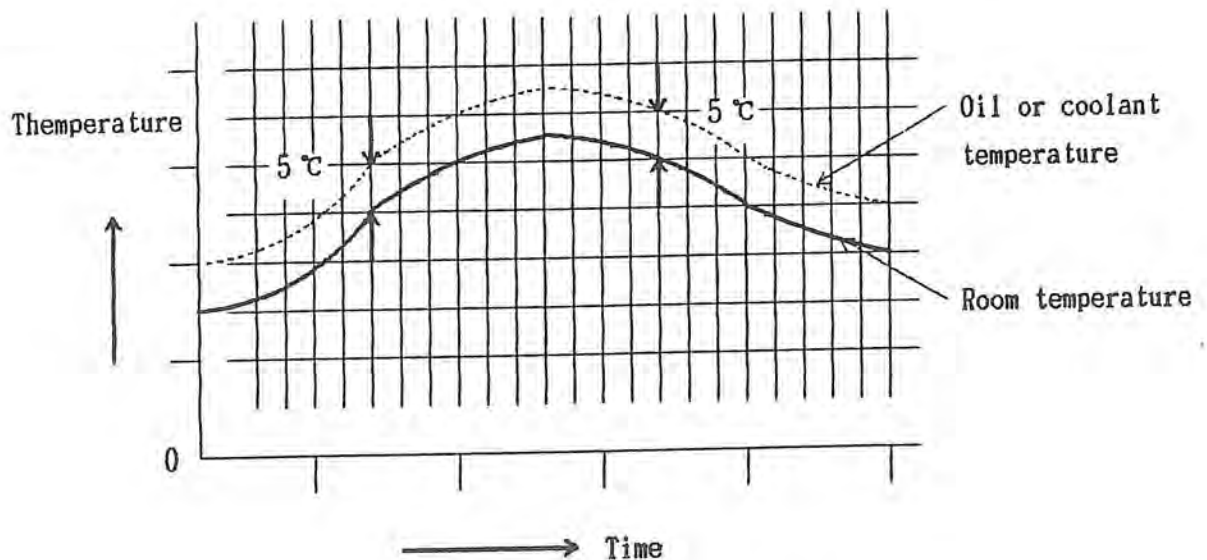
+10°C to -5 °C.)



D. Method of operation

1. Set the operation instruction circuit to OFF, And turn on the power supply.
2. Turn the operation instruction circuit "ON".
The oil pump operates at all times to circulate cooling oil.
3. If the temperature of the thermostat is decreased, the refrigerator operates and cooler operation lamp (green) lights.
Hot air is discharged from punching of the gauging top plate.
4. Relationship between the oil or coolant temperature and the room temperature is given below.

The above graph shows the relationship when the dial is set to scale + 5 °C.



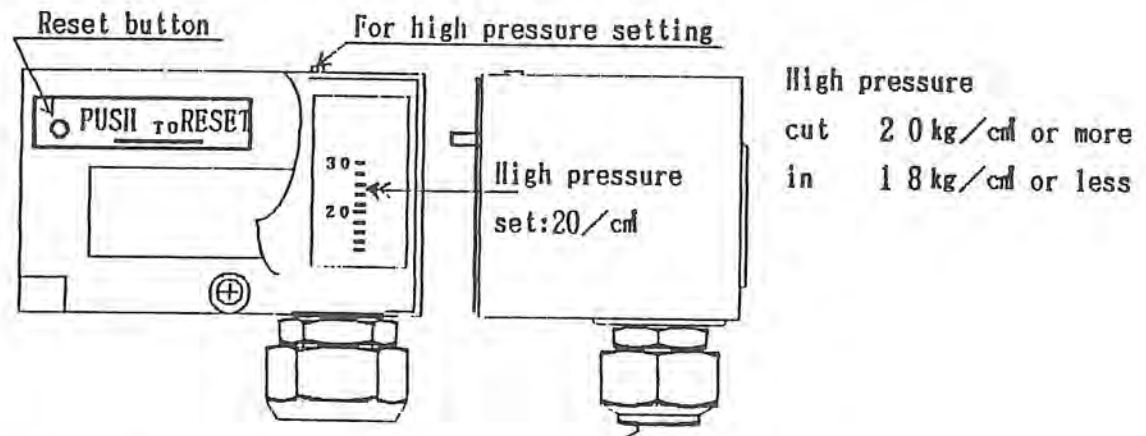
5. Oil temperature is controlled by cooling only and therefore the oil controller needs not heating ability.

E. Control Instrument Description and Maintenance

※When the instrument stops and abnormality detection lamp goes on during operation, take the following steps:

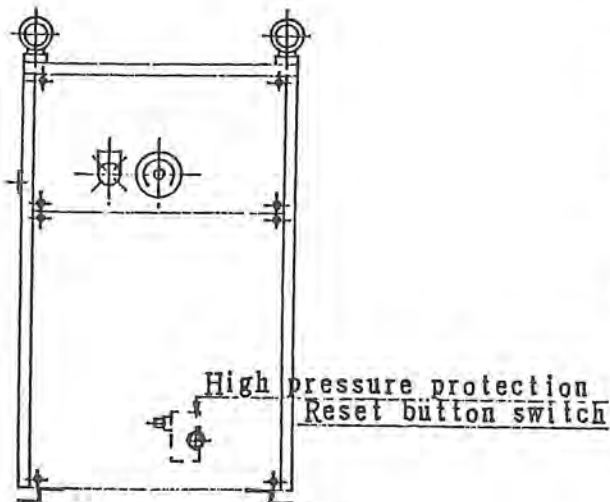
E - 1 High pressure(high tension) protection switch(H.P)

Detect and protect the gas pressure at the higher sides so that the gas pressure in the refrigerating cycle can be held normal.



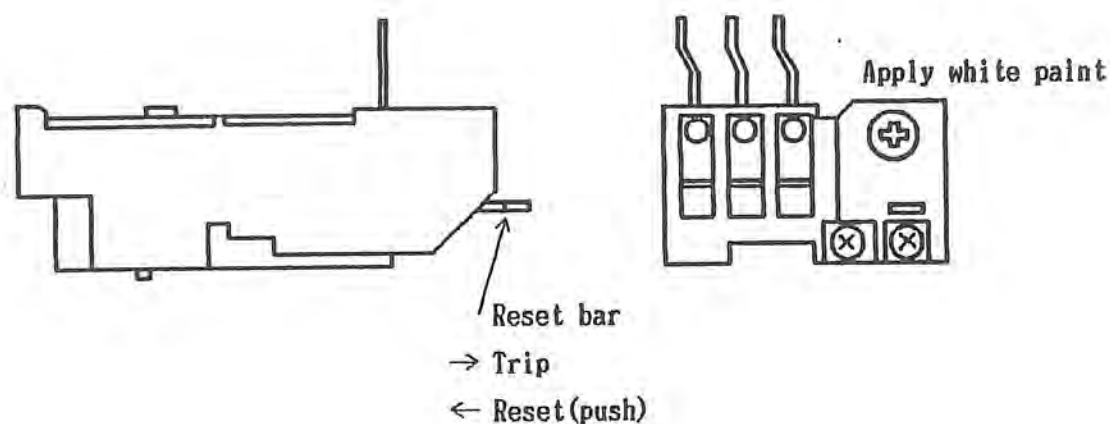
High pressure side pressure abnormality

- • • The air filter is clogged. (wash the air filter with water once in two or three months.)
- • • The ambient temperature exceeds 45 °C.
- • • The oil temperature has suddenly risen.
- Fully stop the oil controller.



The location for the high pressure(high tension) protection switch(H.P) is provided at the lower part of the front side of the control panel. the reset push-button switch for manual restoration can be pushed over the rubber bush, or if the rubber bush is removed, the reset push-button switch for manual restoration.

E-2 When the thermal relay has been tripped. → Press reset bar of the thermal relay.
The thermal relay is provided at the control box. The control box can be seen by opening the front door leaf.



※The thermal relay specified values. . . . Refer to the electric circuit diagram.

※In the abnormal cases as above, the abnormal cooling lamp on the control panel goes on and the refrigerator and oil pump are allowed to stop.

We thank you for your purchase of MAC oil controller.
Our products are manufactured in the complete quality control system.
However, if a failure occurs, contact salesman or company for repair.

Specifications

To : OKUMA IRONWORKS Co., Ltd.

Date: August 2, 1989

Product Name : MAC Oil Controller

Model : MAC-40CPC-FR-I

MAC Co., Ltd.

Drawing No. : MO-890612-E

Item	Specifications
Standard cooling capacity	1000/1200 Kcal/Hr 50/60 Hz (at 35°C oil)
Main unit	450×500×500 H. Baking finish
Power source	3Φ×AC 200 V. 50/60 Hz
Operation circuit	1Φ×110 V AC 50/60 Hz
Refrigerator	3Φ×AC 200 V×450 W×2 P Rotary type
Condenser	Forced ventilation cross fin. Fan motor 1Φ×AC 200 V×40 W×2
Cooler	Cross fin evaporator tank
Coolant	R-22
Circulating pump	3Φ×AC 200 V×200 W×4 P Discharge 15ℓ/min Suction 3ℓ/min 50 Hz 18ℓ/min 4ℓ/min 60 Hz
Operation regulator	Temperature control-Standard temperature follow-up electronic automatic temperature regulator. No operation switch.
Protector	Overcurrent relay. High pressure (high tension) protection switch Noise killer. Abnormality contact.
Weight	Main unit 85 Kg
Remarks: Ambient temperature +45°C max	
Standard temperature follow-up electronic automatic temperature regulator	
Control range 15°C ~ -15°C	
Oil temperature control range -5°C ~ +10°C	
Absolute temperature range for oil temperature control +15°C ~ +40°C	
Accuracy ±1°C	

List of principal parts

Customer : OKUMA IRONWORKS CO., Ltd.

No. 1

Date: August 2, 1989

Model Name : MAC Oil Controller

Type : MAC-40CPC-FR-I

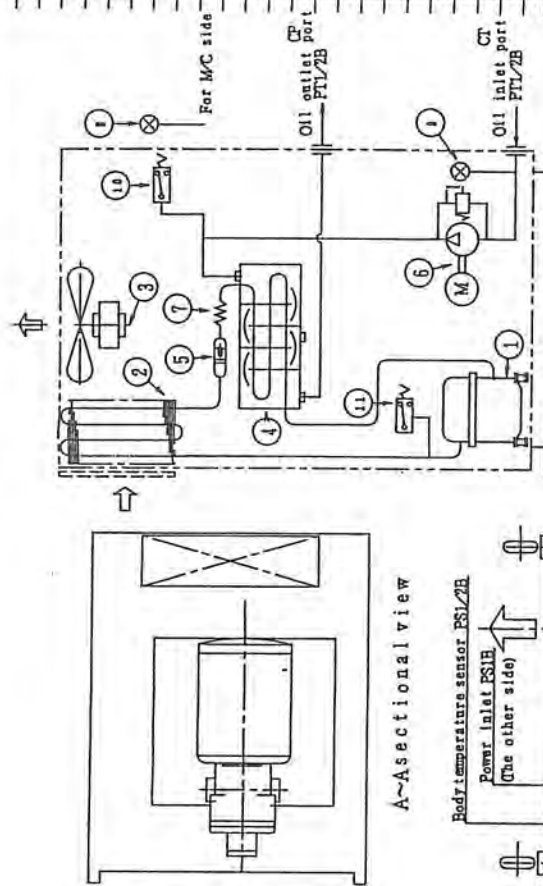
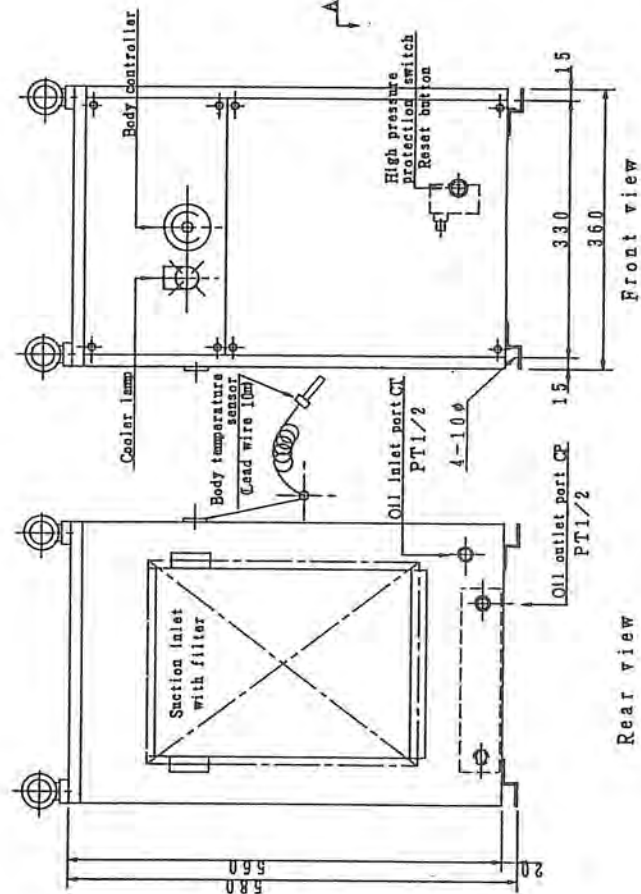
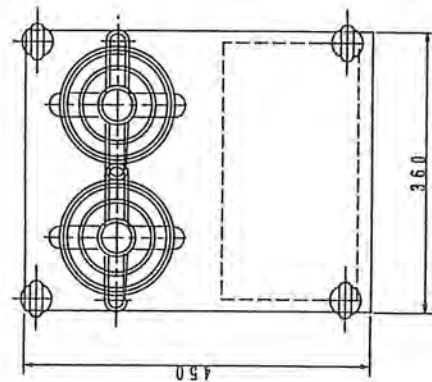
Drawing No : MO-890612-3E

MAC Co., Ltd.

Symbol	Item name	Specifications	Maker	Q'ty	Remarks
C M	Refrigeratpr	R J5360GL 3Φ×200V×450W×2P	Mitsubishi Heavy Industry	1	Rotary
FMI.2	Fan motor	6550 1Φ×200V×40W	Touyou	2	
	Cooler	Cross fin evaporator tank FE-5	MAC	1	
	Condenser	CD-8 Forced ventilation cross fin	MAC	1	
P M		TOP-2MY-200-208HAM-VB4 3Φ×200V×200W×4P	Nippon oilpump	1	3 kg/cmf
	Dryer	FD-1	Fuji Gel	1	
	Air filter	260×360H	MAC	2	
MS1	Electromagnetic switch for oil pump	SRCa3931-02 3H 1.4~2.2A 110V	Fuji	1	3H
MS2	Electromagnetic switch for CM	SRCa3931-02 3H 1.7~2.6A 110V	Fuji	1	3H
H P	High pressure(high tension) protection switch	HNS-130M1	Saginomiya	1	
F1.2	Fuse	F-7111 3A	Sato parts	1	
ATA	Follow-up temperature regulator	FT-M0030 110V	Nippon fenall	1	
NK1	Noise killer	3CRE-50500	Okaya denki	2	
NK2	Noise killer	CRE-10201	Okaya denki	5	
G	Cooler lamp	AH25-ZM-Gh 110V	Fuji	1	
	Oil temperature sensor	T-321-90	MAC	1	
	Body temperature sensor	T-321-90-SP	MAC	1	Lead 10m
APR	Plugging relay	BAV822201	Matsushita	1	
CR1	Auxiliary relay	MY-2	Tateishi	1	
T r	Transformer	200/110V 100VA Single phase compound	Aki	1	

MAC Co., Ltd.

N016-1



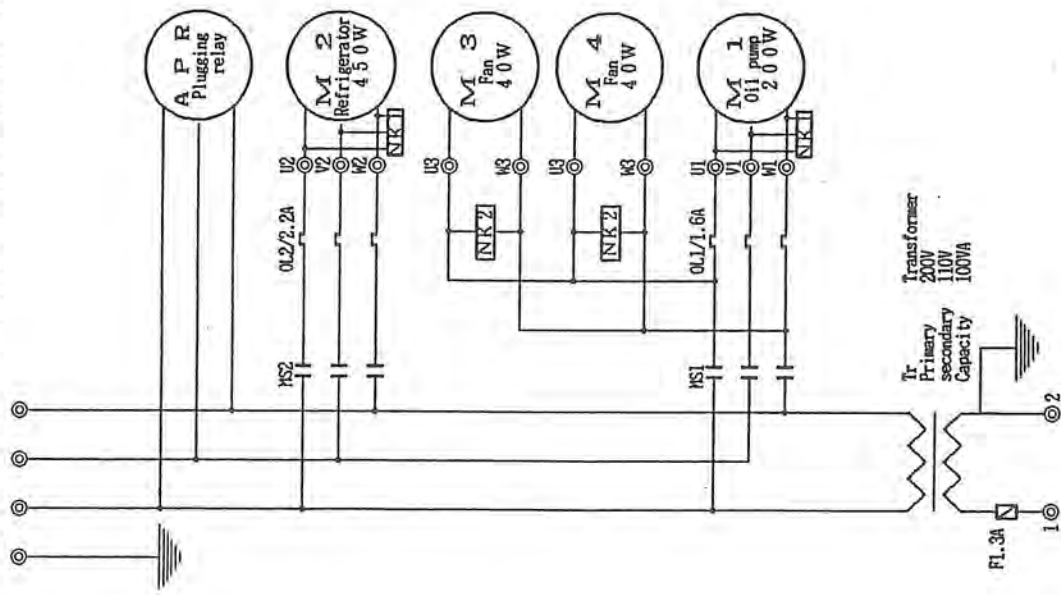
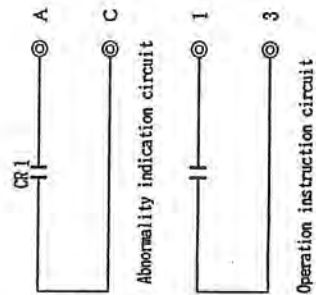
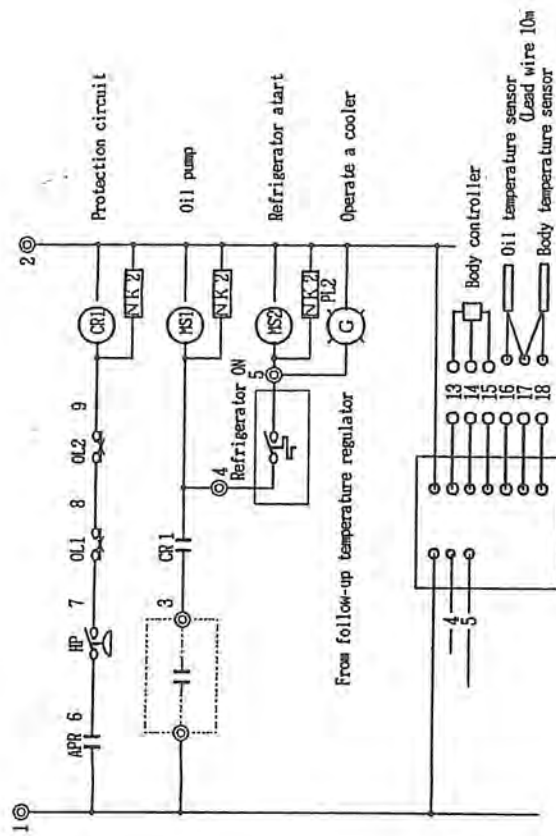
- | | |
|----|--|
| 1 | Refrigerator |
| 2 | Condenser |
| 3 | Fan |
| 4 | Evaporator |
| 5 | Driver |
| 6 | Oil pump |
| 7 | Capillary tube |
| 8 | Body temperature sensor, for MAC side |
| 9 | Oil temperature sensor |
| 10 | Standard temperature follow-up temperature regulator |
| 11 | High pressure protection switch |

客 人	先 客	OKUMA IRONWORKS Co., Ltd.	尺 寸	1/6
CUSTOMER			SCALE	
品 名	名	MAC Oil Controller	日 月 年	1.8.71
ARTICLE			檢 査 日	
型 式	式	MAC-40CPC-FR-I	設 計 者	
圖 面 名 稱	所 圖	Assembly Diagram	設 計 者	
DRAWING NAME			DRAWN BY	NILDA-1
DRAWING No.	番 號	MN-890612-1B	決 定 日	
			APPROVED BY	



 株式会社

品 番 SYMBOL	品 名 PART NAME	仕 様 SPECIFICATIONS	備 考 REMARKS
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No. 22

客 户	定 单	OKUMA Ironworks Co., Ltd.	尺 寸	尺 寸
客 户	定 单	OKUMA Ironworks Co., Ltd.	尺 寸	尺 寸
品 名	品 名	HAC OIL CONTROLLER	尺 寸	尺 寸
型 式	型 式	MAC-40C PC-PR-I	尺 寸	尺 寸
圖 面 番 號	圖 面 番 號	ELECTRIC CIRCUIT DIAGRAM	尺 寸	尺 寸
圖 樣 號	圖 樣 號	MN-890612-2E	尺 寸	尺 寸

訂正番号 No.	年月日 DATE	訂正記号 REVISED
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株式会社
MAC

**H: MAC Oil Controller (Ball screw cooling)
(MC-500H/600H)**

MAC



HANDLING MANUAL

MAC Oil Controller
MAC-60CP-FRW-OT-I

'89 8 17

MC-500/600H ホールネジ冷却 (オプション)

A254-1011 or 1012

ME21-056-R1

INSTRUCTION MANUAL

Product Name: MAC Oil Controller

Type: MAC-60CP-FRW-OT-I (Forced circulation type machine for exclusive use of ball screw cooling)
(Body temperature follow-up type control)

Read this manual carefully before operating the equipment to ensure operation and optimum results.

A. Description

The MAC oil controller cools oil with a refrigerator and controls the temperature.

A-1 Compressor

Circulates the cooling gas by compressing, exhausting, and drawing in air.

※Power supply: 3 Φ 200V AC

A-2 Air cooled condenser

The heat caused by the oil cooling (or the coolant), or, in other words, the heat obtained from the oil with the help of cooling gas, is subjected to heat exchange using condenser.

※Forced ventilation cross fin type.

A-3 Fan for condenser

This fan forces the air in the external atmosphere against the fins of the condenser so as to increase the rate of heat transfer from the condenser to the external atmosphere.

Hot air (at 45 °C) is discharged from the fan.

A-4 Capillary tube (expansion valve)

The valve for evaporating the refrigerant by expansion.

A - 5 Evaporator cooling unit

The heat exchanger for cooling the oil using the refrigerant gas.

Coolant solution or other solution containing sludge cannot be used since the cooler is clogged and becomes unrepairable.

A - 6 Cooling pump

A high pressure pump which sends temperature-regulated oil(fluid) to the machine side.

It supplies oil to the main spindle and absorbs oil from the main spindle.

Water or coolant solution cannot be used.

A - 7 Oil temperature sensor

This sensor detects oil(or coolant) temperature.

A - 8 Body temperature sensor

A sensor connected with lead wire taken out of the oil controller main body.

With PT1/8 screw. this sensor is attached to the M/C side.

A - 9 Oil tank

Cooling oil tank. Supply specified oil up to the top of the oil level gauge.

B. Preparation

B-1 Location of MAC oil controller

- B-1-1 Install the unit on a flat, vibration-free, firm area of floor
- 1-2 Select a place free from exhaust heat and sunlight
- 1-3 Consider the area necessary for maintenance.
- 1-4 Though an air filter to prevent the adverse effects of oil mist is provided, a place free of oil mist should be selected.
- 1-5 In order to improve the efficiency of the air cooled condenser, make sure that there are no objects or obstacles within 20 cm of the air inlet filter surface and within 50 cm of the exhaust outlet.
- 1-6 Select a minimally humid area. Though condensation collects on the cooler, this dries naturally, causing no problems.
- 1-7 Do not operate the oil controller continuously if the ambient temperature is over 45°C.
- 1-8 The lower limit of oil cooling control is +10°C, when the temperature is equal to room temperature.
- 1-9 The upper limit of oil cooling control is +45°C.

B-2 Connecting the Oil Pipes

B-2-1 Connect the cooling oil circulation pipes

- 2-2 Fix the suction strainer (100 mesh) in the oil suction pipe.
Any slution in the oil, if allowed to enter this pipe, will damage the trocoid pump and will reduce the efficiency of cooling when it enters the cooler.
- 2-3 Make the oil piping as short as possible so as to reduce the resistance to the oil flow thereby reducing the load on the oil pump. If the suction pipe is either long or narrow, the flow rate of the oil will be decreased which not only results in reduced cooling efficiency but also may cause the trocoid pump to generate a whining noise.

B - 3 Oil tank

- B - 3 - 1 Supply specified oil up to the top of the oil level gauge.
Cooled oil and the oil discharge, flown back and heated are mixed in the oil tank and its temperature is controlled.

B - 4 Electric wiring

- B - 4 - 1 Connect the three phase AC power supply to the R,S,T, and E(ground) terminals of the terminal box of the unit.
※In case the optional fuseless circuit breaker is being used, connect the power supply to the terminals of the circuit breaker.
- 4 - 2 Connect other relevant terminals.
※Refer to the electrical wiring diagram for instruction during operation and alarm terminal.
- 4 - 3 When confirming the rotating direction of the equipment, it is unnecessary to check that of the refrigerator.
Confirm by rotation of the oil pump or condenser fan.
At negative phase, the reverse prevention relay works not to allow start.

C-1. Description

FRW type, Electronic machine temperature follow-up type temperature controller.

(Forced circulation type machine for exclusive use of ball screw cooling)

- C-1-1 This temperature controller is activated by two temperature sensors; one is used to detect body temperature, the other to detect oil temperature. It controls the difference of the two temperatures.
- C-1-2 Oil temperature is controlled in plus or minus based on the reference body temperature.
- C-1-3 Body temperature sensor with PT1/8 male screw.
Screw into the M/C main body to install.
- C-1-4 The oil temperature detection sensor is mounted on the inlet of the oil controller.
- C-1-5 The cooled oil is discharged into the ball screw and mixed there at a temperature lower than the set one. When the liquid temperature of oil sucked into the oil controller becomes the set temperature, the cooling operation will stop.
- C-1-6 The sensory part of the oil temperature gauge is attached to the oil tank.
- C-1-7 Adjusting controller

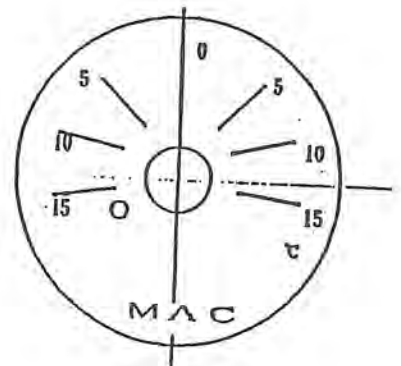
Set the dial in front of the controller to desired scale which indicates the difference between body temperature and oil temperature.

(For instance, scale zero indicates that the oil and body temperatures are the same while scale +5 shows that the former is 5 °C higher than the latter.)

Differential: ± 1 °C Control range of oil temperature.

(Body temperature: +10 °C to -5 °C.)

Body controller for
temperature control

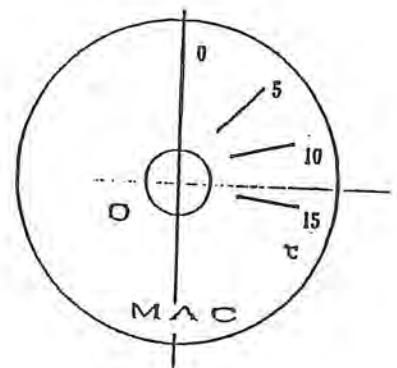


C - 2 Description

For abnormal ball screw detection

- C - 2 - 1 One of the temperature detecting sensor of the temperature controller detects the temperature of the machine body and 2 detect the ball screw temperature.
- C - 2 - 2 When the ball screw temperature becomes higher than that of the machine body, trouble lamp lights up and trouble contact point works.
At the time, the oil controller does not stop.

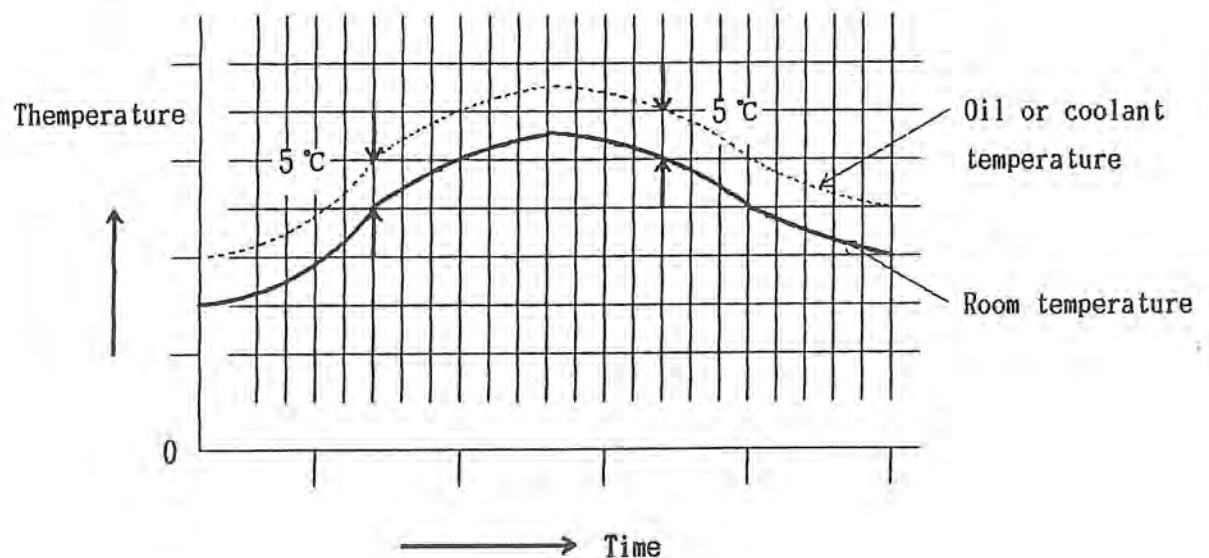
Abnormal ball screw
temperature controller



D. Method of operation

1. Set the operation instruction circuit to OFF, And turn on the power supply.
2. Turn the operation instruction circuit "ON".
The cooling pump operates at all times to circulate oil.
3. If the temperature of the thermostat is decreased, the refrigerator operates and cooler operation lamp(green)lights.
Hot air is discharged from punching of the gauging top plate
4. Relationship between the oil or coolant temperature and the room temperature is given below.

The above graph shows the relationship when the dial is set to scale + 5 °C.

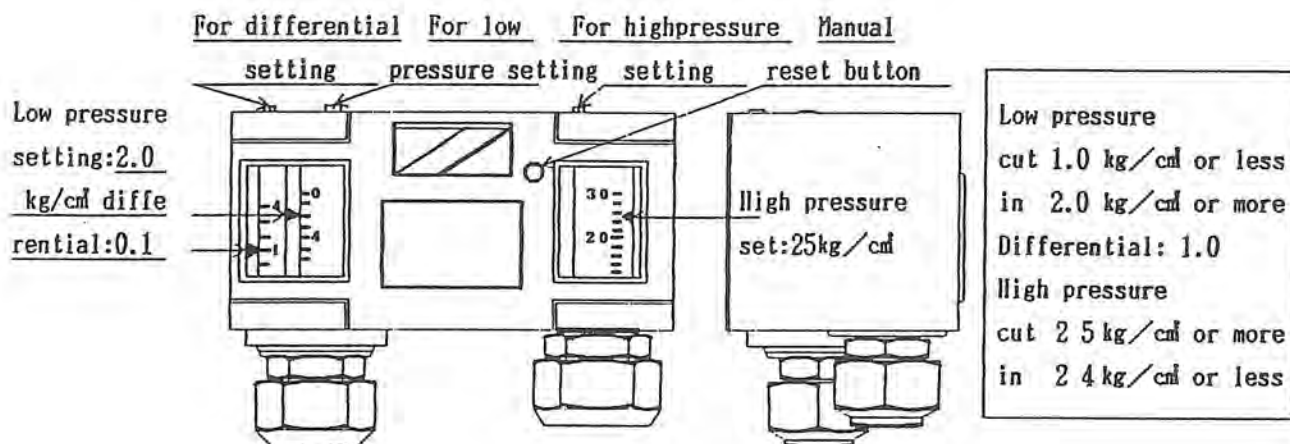


5. Oil temperature is controlled by cooling only and therefore the oil controller needs not heating ability.

E. Control Instrument Description and Maintenance

※When the instrument stops and the abnormality detection lamp goes on during operation, take the following steps:

- E-1 High/low pressure protection switch (H.L.P) Detect and protect the gas pressure at the higher and lower sides so that the gas pressure in the refrigerating cycle can be held normal.



Lower pressure side pressure abnormality

- • • When Freon gas is insufficient in quantity (the gas leaks)

Abnormal cooling detecting lamp within the control panel (red)

- • • Goes on

Fully stop the oil controller.

- ※ 3 or 4 minutes later after the stop of the refrigerator, the lower pressure side is automatically resumed to extinguish that abnormality detecting lamp. Turn ON the operation switch again. However, abnormal cooling takes place in about 5 minutes. (Contact the maker.)

Higher pressure side pressure abnormality

- • • The air filter is clogged. (Wash the air filter with water once in two or three months.)
- • • The ambient temperature exceeds 45°C .
- • • The oil temperature has suddenly risen.

Abnormal cooling indication lamp (red) within the control panel

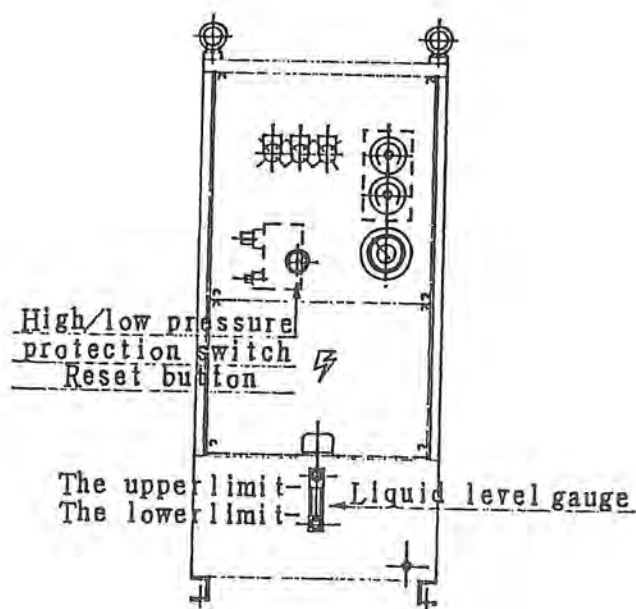
- • • Goes on

Fully stop the oil controller.

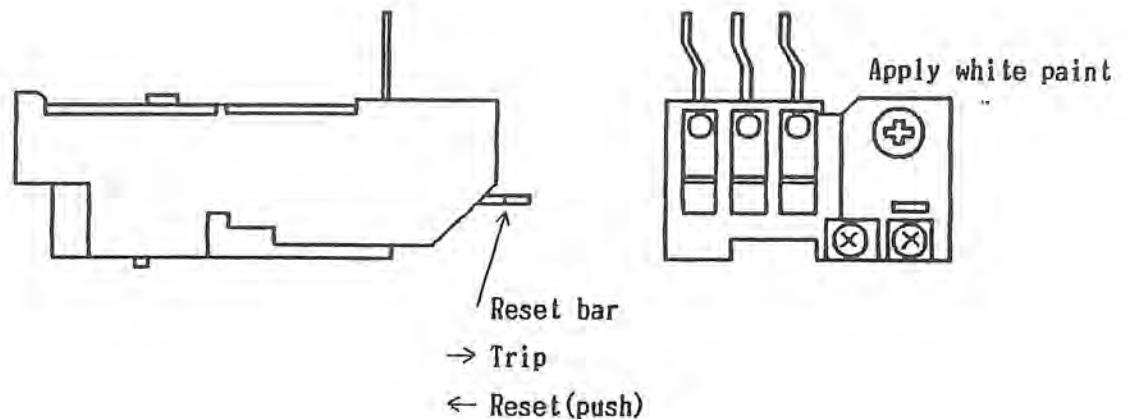
※To reset the higher pressure side, depress the manual reset button of the protection switch (H.L.P.).

The location for installation of the high and low pressure protection switch (H.L.P.) is provided at the lower part of the front side of the control panel.

The reset push-button switch for manual restoration can be pushed over the rubber bush, or if the rubber bush is removed, the reset push-button switch for manual restoration becomes visible.



- E-2 When the thermal relay has been tripped. → Press reset bar of the thermal relay.
The thermal relay is provided at the control box. The control box can be seen by opening the front door leaf.

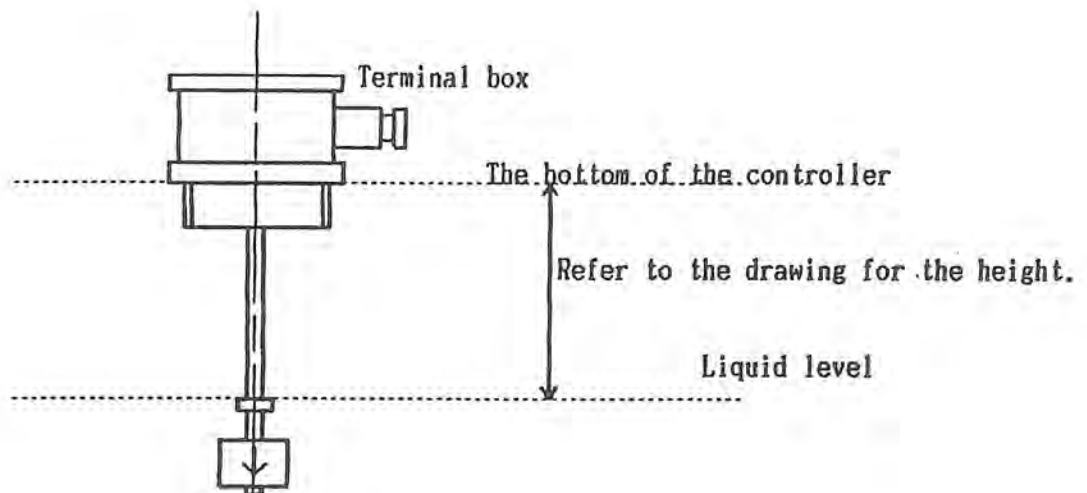


※Refer to the electrical wiring diagram for the set value of the thermal relay.

E-3 Level switch

Warns drop of oil temperature.

When the level decreases, single contact point is actuated and indicates it to the M/C side.



We thank you for your purchase of MAC oil controller.

Our products are manufactured in the complete quality control system.

However, if a failure occurs, contact salesman or company for repair.

S p e c i f i c a t i o n s

To : OKUMA IRONWORKS Co.,Ltd.

Date: August 2,1989

Product Name : MAC Oil Controller

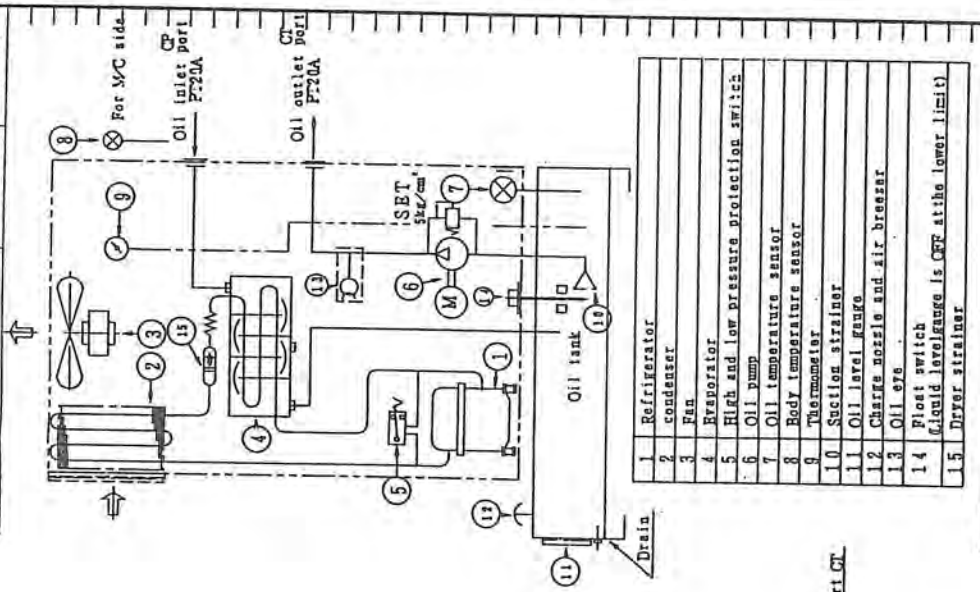
Model : MAC-60CP-FRW-OT-I

MAC Co., Ltd. 

Drawing No. : MO-890507-E

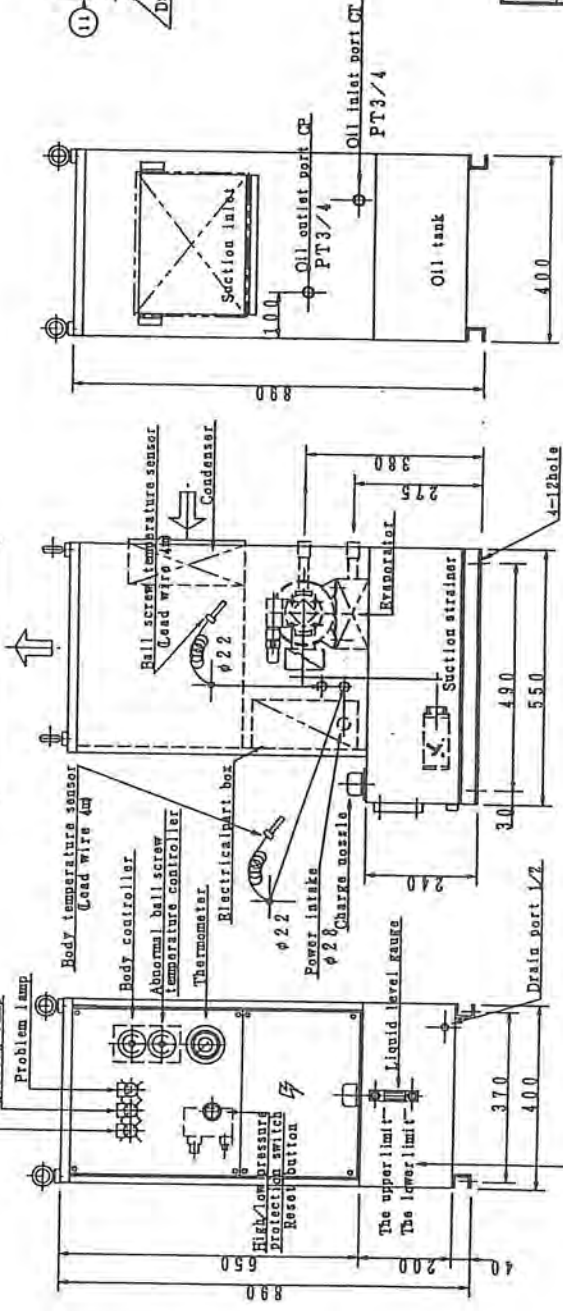
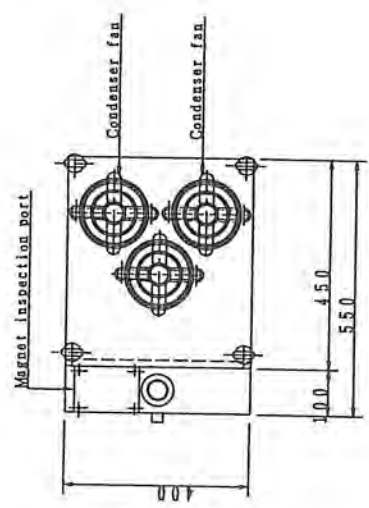
Item	Specifications
Standard cooling capacity	1250/1500Kcal/Hr 50/60Hz (at 35℃ oil)
Main unit	400×450×650H. Baking finish(Standard color of OKUMA)
Tank	400×550×200H. 30ℓ With liquid level gauge, charge nozzle, and magnet.
Power source	3Φ×AC200V. 50/60Hz
Operation circuit	1Φ×AC110V AC50/60Hz (Built-in transformer)
Refrigerator	3Φ×AC200V×600W×2P Rotary type
Condenser	Forced ventilation cross fin. Fan motor 1Φ×AC200V×40W×2
Cooler	Cross fin evaporator tank
Coolant	R-22
Circulating pump	3Φ×AC200V×400W×4P Discharge 18ℓ/min Suction 3ℓ/min 50Hz 21ℓ/min 4ℓ/min 60Hz
Operation regulator	Temperature contro - Standard temperature follow-up electronic automatic temperature regulator. No operation switch. With Power lamp, Coolinglamp, and Abnormal lamp.
Protector	Overcurrent relay. Noise killer. With abnormality contact. Plugging relay.
Weight	Main unit 85Kg
Capacity of tank	The upper limit. 37ℓ The lower limit. 26ℓ
Remarks: Ambient temperature +45℃max Standard temperature follow-up electronic automatic temperature regulator Control range 15℃~-15℃ Accuracy ±0.5℃ Oil temperature control range -5℃~+10℃ Absolute temperature range for oil temperature control +15℃~+45℃ Abnormal ball screw temperature controller Control range +15℃~-15℃ Standard ball screw temperature detection sensor Ball screw temperature detection sensor Ball screw temperature sensor ————— Lead wire 5m×2 ※Description on the nameplate and ohters shall be both in English and Japanese.	

品名 SYMBOL	品名 PART NAME	仕様 SPECIFICATIONS	備考 REMARKS
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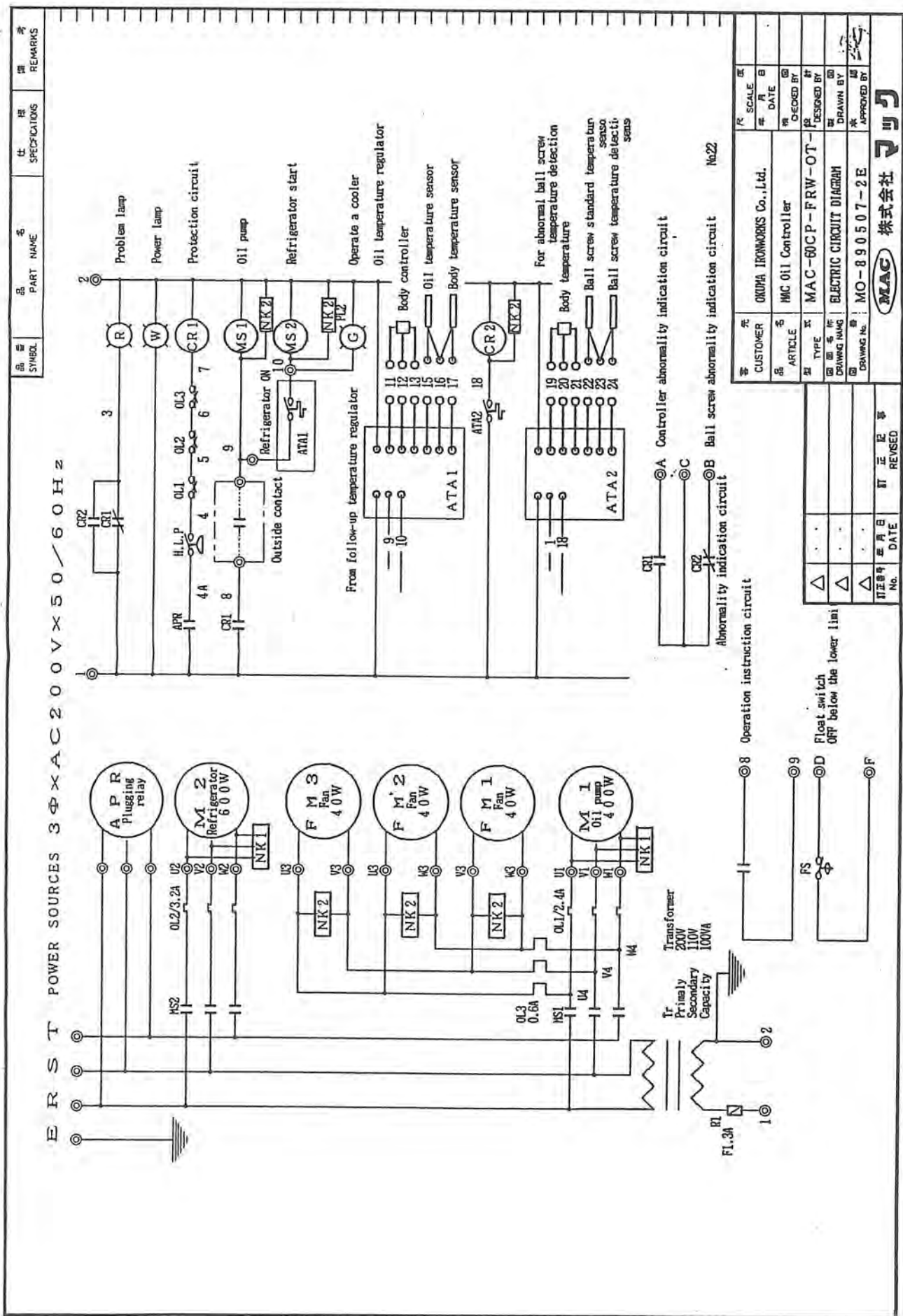
- | | |
|----|---|
| 1 | Refrigerator |
| 2 | condenser |
| 3 | Fan |
| 4 | Evaporator |
| 5 | High and low pressure protection switch |
| 6 | Oil pump |
| 7 | Oil temperature sensor |
| 8 | Body temperature sensor |
| 9 | Thermometer |
| 10 | Section strainer |
| 11 | Oil level gauge |
| 12 | Charge nozzle and air breather |
| 13 | Oil eye |
| 14 | Float switch |
| 15 | Dryer strainer |

顧客 CUSTOMER	OKUMA Ironworks Co. Ltd.	縮尺 SCALE	1/10
品名 ARTICLE	MAC Oil Controller	日付 DATE	1.12.81
型式 TYPE	MAC-60CP-FRW-OT-I	作成 DESIGNED BY	
図面番号 DRAWING No.	Assembly Diagram	図取 DRAWN BY	NT148-1
図 DRAWING No.	MO-890507-1E	承認 APPROVED BY	
MAC 株式会社			



Indicate the upper and lower limits on the liquid level gauge

訂正番号 No.	年月日 DATE	訂正 REVISED
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△		
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品名	品名	仕様	備考
SYMBOL	PART NAME	SPECIFICATIONS	REMARKS
2	Problem lamp		
3	Power lamp		
4A	Protection circuit		
4A	Oil pump		
4A	Refrigerator start		
4A	Operate a cooler		
4A	Oil temperature regulator		
4A	Oil temperature sensor		
4A	Body temperature sensor		
4A	For abnormal ball screw temperature detection		
4A	Ball screw standard temperature sensor		
4A	Ball screw temperature detection sensor		
4A	Controller abnormality indication circuit		
4A	Ball screw abnormality indication circuit		

顧客	顧客	品名	品名	仕様	仕様	備考	備考
CUSTOMER	CUSTOMER	ARTICLE	ARTICLE	TYPE	TYPE	DESIGNED BY	DESIGNED BY
OKUMA Ironworks Co., Ltd.	OKUMA Ironworks Co., Ltd.	MAC 011 Controller	MAC 011 Controller	MAC-60C P-FRW-OT	MAC-60C P-FRW-OT	DRAWN BY	DRAWN BY
				ELECTRIC CIRCUIT DIAGRAM	ELECTRIC CIRCUIT DIAGRAM	APPROVED BY	APPROVED BY
				MO-890507-2E	MO-890507-2E		

訂正	訂正	訂正	訂正	訂正	訂正	訂正	訂正
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年	年	年	年	年	年	年	年
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日	日	日	日	日	日	日	日
月	月	月	月	月	月	月	月
年	年	年	年	年	年	年	年

株式会社 マック

List of principal parts

Customer : OKUMA IRONWORKS CO., Ltd.

No. 1

Model Name : MAC Oil Controller

Date: August 2, 1989

Type : MAC-60CP-FRW-OT-I

Drawing No : MO-890507-3E

MAC Co., Ltd.

Symbol	Item name	Specifications	Maker	Q'ty	Remarks
C M	Refrigeratpr	R J5475GL 6 3 Φ $\times$ 200V $\times$ 600W $\times$ 2P	Mitsubishi Heavy Industry	1	Rotary
P M	Oil return pump	TOP-2MY400-212HAVB 3 Φ $\times$ 200V $\times$ 400W	Nippon oilpump	1	
F M	Fan motor	6 5 5 0 1 Φ $\times$ 200V $\times$ 40W	Touyou	3	
	Cooler	Cross fin evaporator tank EB-1	MAC	1	
	Condenser	CD-1 Forced ventilation cross fin	MAC	1	
	Dryer	DF-1	Fuji Gel	1	
	Oil temperature thermometer	6 0 Φ 0 ~ 6 0 $^{\circ}$ C	MAC	1	
	Air filter		MAC	1	
	Oil tank	4 0 0 $\times$ 5 5 0 $\times$ 2 0 0 H 3 0 ℓ	MAC	1	
	Charge nozzle	MSA-V 5 0	Masuda	1	
	Oil level gauge	Φ 6 $\times$ 8 0	MAC	1	
	Suction strainer	W-MSN-0 6 1 0 0 Mesh	Masuda	1	
MS 1	Electromagnetic switch for oil pump	SRC a 3 9 3 1 -02 3H 1.7~2.6A 110V	Fuji	1	set 2.4A
MS 2	Electromagnetic switch for CM	SRC a 3 9 3 1 -02 3H 2.8~4.2A 110V	Fuji	1	set 3.2A
CR 1	Auxiliary relay	MY-2 1 0 0 / 1 1 0 V	Tateishi	1	
OL 3	Thermal relay	TR-OH 3H 0.48~0.72A	Fuji	1	set 0.6A
APR	Plugging relay	BAV 8 2 2 2 0 1	Matsushita	1	
F 1.2	Fuse	AF a c 3 0 / 3 A	Fuji	2	
F 3	Oil eye	FPS-2 0 S	Daido Kouki	1	
T r	Tansformer	TR-SW-1 200/110V 100VA	Aki	1	Single phase compound
ATA	Follow-up temperature regulator	FT-M 0 0 3 0 1 1 0 V	MAC	1	
	Body temperature sensor	T-3 2 1 -9 0 SP Lead wire 4 m	Nippon fenall	1	

MAC Co., Ltd.

N016-1

List of principal parts

Customer : OKUMA IRONWORKS CO., Ltd.

No. 2

Date: August 2, 1989

Model Name : MAC Oil Controller

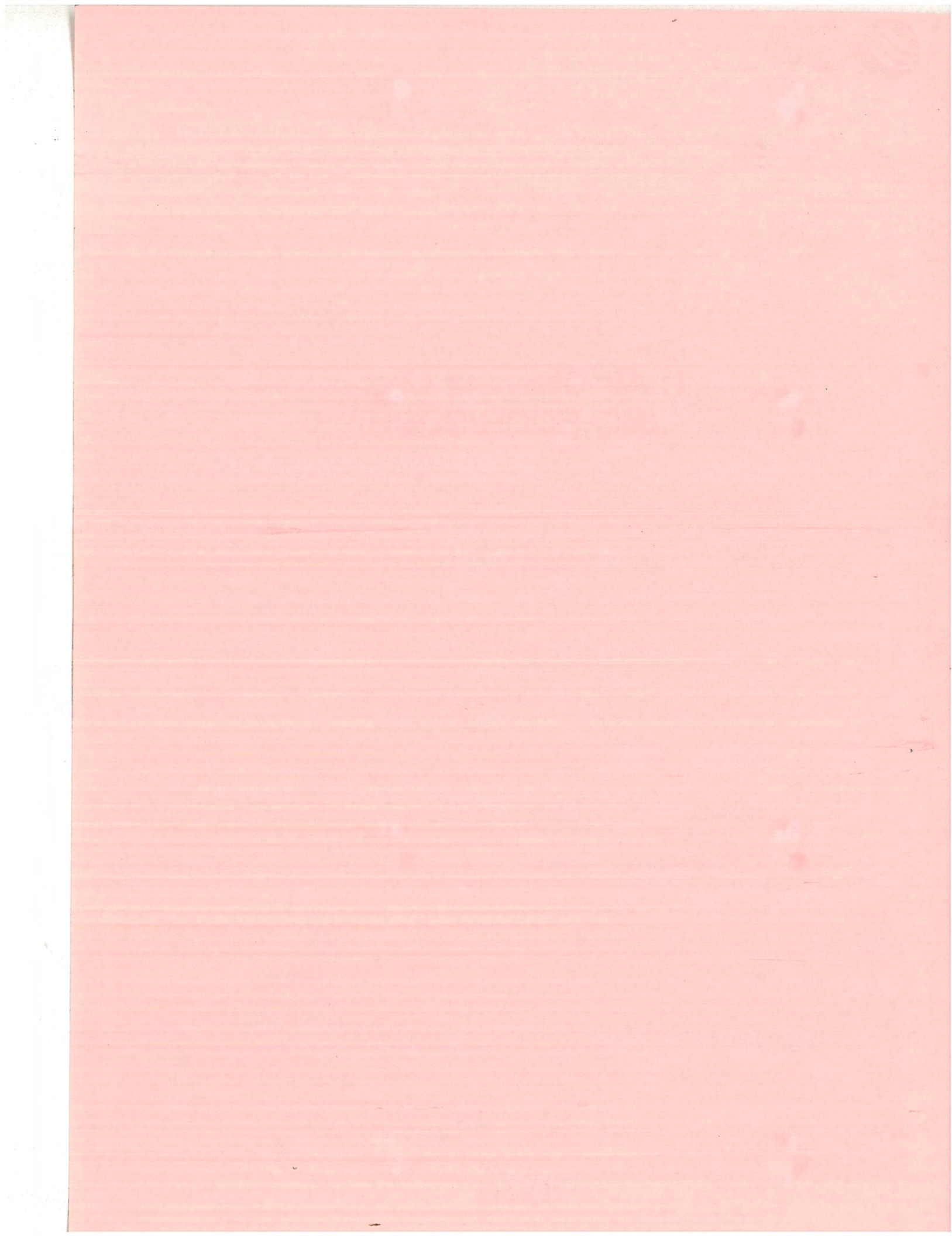
Type : MAC-60CP-FRW-OT-I

Drawing No : MO-890507-4E

MAC Co., Ltd.

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**I: Air Cleaning Unit
(MC-500H/600H)**



OPERATION MANUAL

AIR CLEANING UNIT

INOD-254

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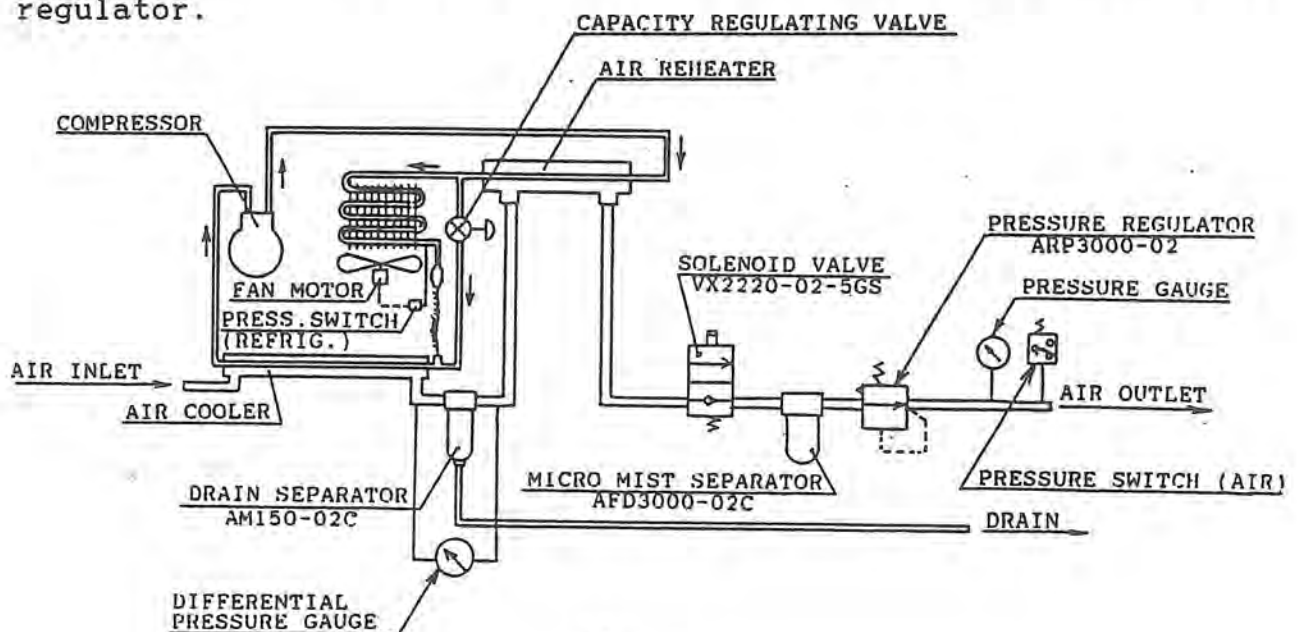
1. EXPLANATION OF FUNCTION

Moist hot air containing foreign matter which enters the air cleaning unit first passes through the air cooler where heat is removed in the form of heat of evaporation of the refrigerant, causing the air to be cooled. At this time, water vapor and oil vapor in the air condense, resulting in water and oil droplets which are separated from the air in the drain separator and then automatically discharged from the auto-drain.

Then the air which was cooled and dehumidified in the air cooler and drain separator passes through the air reheater where it heat-exchanges with hot refrigerant gas, causing the air to be warmed and dried.

Next, dry air passes through solenoid valve, then enters the Micro-mist Separator where solid particles of $0.01\text{ }\mu\text{m}$ or more and also at least 99.9999% of oil mist are separated and removed.

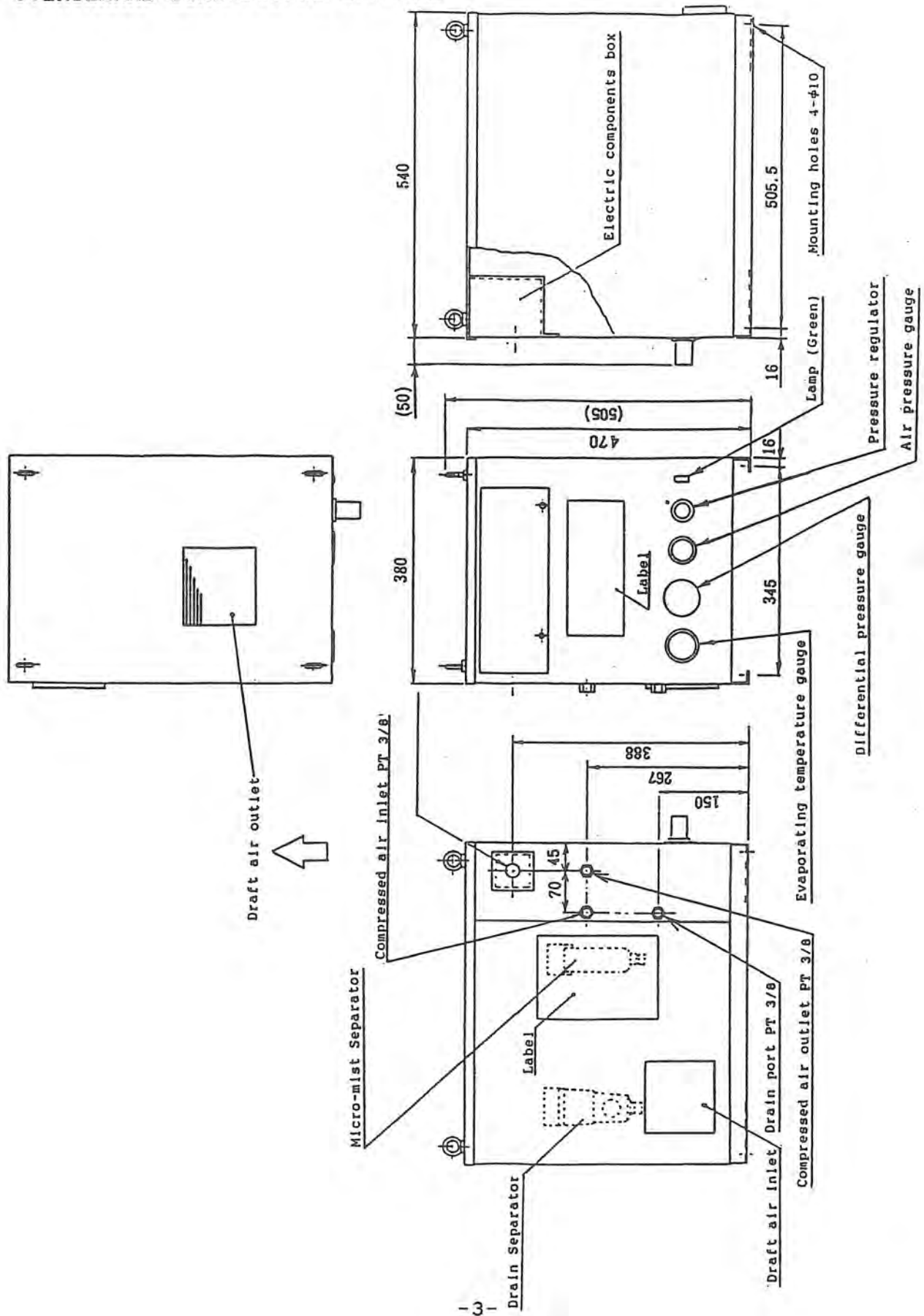
The resulting extremely dry and clean air is supplied to the outlet of the unit after the pressure is regulated by pressure regulator.



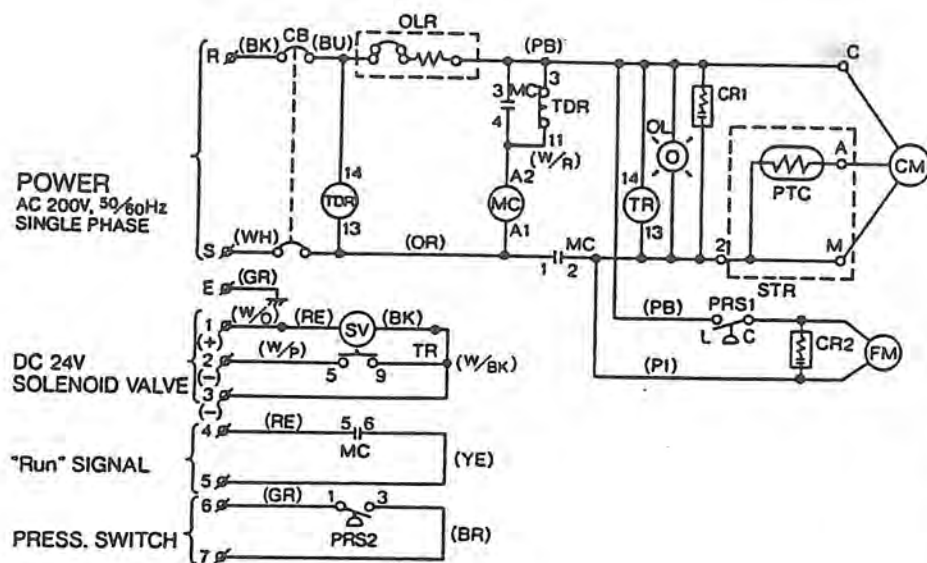
2.SPECIFICATIONS

Model		INOD-254
Air flow rate		Nl/min 200
Operating air conditions	Inlet air pressure kgf/cm ² {kPa}	4 ~ 9.9 {400 ~ 900}
	Inlet air temperature °C	2 ~ 50
	Ambient temperature °C	2 ~ 40
	Outlet air dew point °C	2 ~ 15 (under pressure)
Inlet and ambient air conditions and performance	Inlet air pressure kgf/cm {kPa}	7 {700}
	Inlet air temperature °C	40
	Ambient temperature °C	32
	Flow rate Nl/min	200
	Outlet air dew point °C	10 (under pressure)
	Oil mist removal rate	99.999%
	Pressure drop (initial value) kgf/cm ² {kPa}	0.5 {50}
Electrical specifications	Power source	AC200V(50/60Hz)
	Power consumption W	210/250(50/60Hz)
	Current A	1.6(50/60Hz)
	Nominal outlet of refrigerating compressor W	75
Condenser cooling method		Plate fin tube type forced air cooling
Refrigerant control system		Capillary tube, capacity regulating valve, pressure switch
Refrigerant used		R12
Air inlet and outlet connection port		PT3/8 female thread
Drain connection port		PR3/8 female thread
Weight	kgf	30

3. EXTERNAL DIMENSIONAL DRAWING

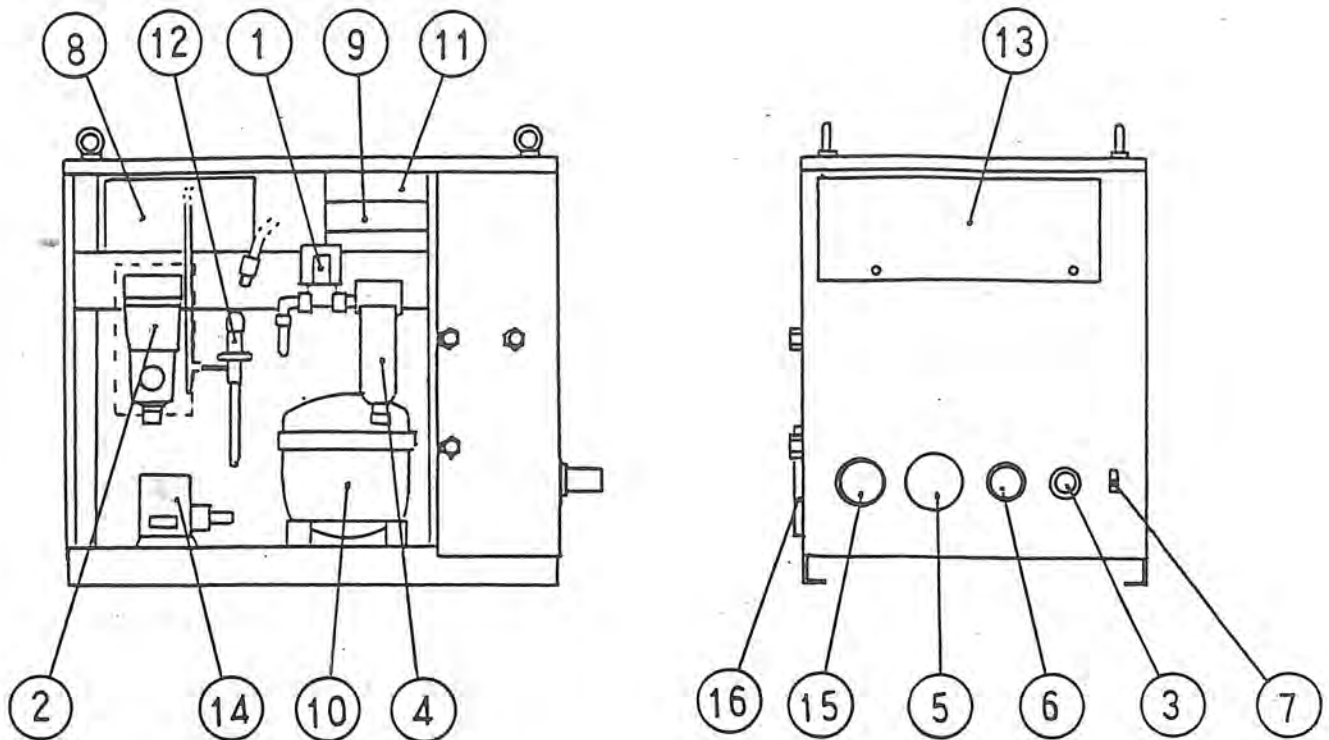


4. ELECTRICAL CIRCUIT DIAGRAM



SYMBOL	DEVICE NAME	REMARKS	SYMBOL	DEVICE NAME	REMARKS
CM	Compressor		MC	Magnetic Contactor	
FM	Fan Moter		TR	Timer	5min.set
PRS1	Press.Switch (Rsefrig.)		TDR	Delay Relay	1sec.set
PRS2	Press.Switch (Air)		STR	Start Relay	
OLR	Overload Relay		CR1,2	Surge Absorber	
CB	Circuit Breaker	10A	SV	Solenoid Valve	Nomal Close, DC 24V
OL	"RUN" Lamp				

5. PARTS NAME



No.	NAME	Remarks	No.	NAME	Remarks
1	Solenoid valve	VX2220-02-5GS	9	Fun Moter	
2	Drain separator (Mist separator)	AM150-02C	10	Compressor	
3	Pressure regulator	ARP3000-02C	11	Condenser	
4	Micro-mist separator	AFD3000-02C	12	Capacity regulating valve	
5	Differential pressure gauge	GD40-2-01-X14	13	Electric componesnts box	
6	Air pressure gauge	G46-2-02 M--X246	14	Pressure switch (Air)	
7	Lamp		15	Evaporating temperating gauge	
8	Air cooler		16	Intake air filter	

6.EXPLANATION OF EACH DEVICE

To ensure that the air cleaning unit operates normally, and also to enable its operation to be monitored, the following devices are provided on the air cleaning unit.

(1) Air pressure gauge

Air pressure gauge indicates outlet air pressure of the unit. The pressure range of the unit is 1.05 to 1.25 kgf/cm² (105-125kPa). If the indicated pressure is out of that range, readjust pressure regulator.

(2) Pressure regulator

Pressure regulator is provided to adjust outlet air pressure of the unit.

The setting value of pressure regulator is as shown below and the regulating handle is locked at that value.

If readjustment is required, pull the handle to unlock
(Push the handle to lock, after adjustment)

	Outlet air pressure	Condition
Pressure regulator Setting Value (Factory-set)	1.15 kgf/cm ² (115kPa)	Inlet air pressure 5kgf/cm ² (500kPa)

(3) Differential pressure gauge

Differential pressure gauge is provided to detect clogging in air filters (Drain Separator and Micro-mist Separator.) which are installed in the unit.

Replace the elements of air filters when the indicate of Differential pressure gauge exceed 1 kgf/cm² (100kPa).

(4) Pressuer switch for compressed air

When the outlet air pressures of the unit reaches the set value of higher (ON value or greater in the table below) the pressure switch operates, causing contacts to be closed. (ON)

On the other hand, if the air pressure fall below the set value or lower (OFF value or below in the table bselow), the contacts to be opered (OFF)

Pressure switch for Compressed Air Set value (Factory-set)	
ON	0.7 kgf/cm ² (70 kPa)
OFF	0.5 kgf/cm ² (50 kPa)

(5) Solenoid valve

It takes about 5 minutes until the temperrature of the various parts of the refrigerant circuit stabilizes after the power is turned ON. For this reason, a solenoed valvse is installed in the unit to prevent air from flowing through it for a period of 5 minutes after it is switched ON, thus ensuring that properly dried air is obtained. (Timer setting: 5 minutes)

If the unit should stop operating because of momentary power failure, trigger of the protective devices, or maloperation, the solenoed valve does not open even when the power is is turned ON before 5 minutes have elapsed, and thus no air flows.

(6) Air intake filter

Air intake filter is installed on the air intakes hole on the left side panel. Check the air intake filter for possible clogging periodically and clean it with a brash or air blow nozzle if any.

(7) Capacity regulating valve

The air cooling temperature of an air-to-refrigerant hert-exchanger will fluctuate in accordance with the condition of the compressed air (temperature, pressure, and flow rate) at the inlet, and also the ambient temperature.

A capacity regulating valve is installed in the unit to prevent freezing of condensed water in the compressed air, even when the load is small, thereby increasing the operating efficiency of the unit.

Before the unit leaves the factory, it is adjusted so that the evaporation temperature under no load conditions is correct, hence adjustment is not necessary for normal opseration.

(8) Refrigerant pressure switch

The refrigerant condensing pressure in the refrigerant circuit is controlled by the ON-OFF of the condenser cooling fan motor.

The fan moter goes ON-OFF during no-load and low load operation of the unit. When the load exceeds a certain value, however, the fan notor will operate continuously.

(9) Overload relay

If the unit is operated in an overloaded condition {see a) to e) below}, the life of the refrigerating compressor, etc., will be significantly reduced and also a breakdown may occur. In order to prevent this, an overload relay is installed inside the terminal cover of the refrigerating compressor. The overload relay operates as a result of both the operating current of the refrigerating compressor and the temperature of the chamber surface, causing the refrigerating compressor to stop. In the event that the overload relay operates, however, be sure to remove the cause of the overload before restarting the unit otherwise the life of the refrigerating compressor, etc., will be greatly reduced, or a breakdown may occur. The overload relay often trips in the event that one of the following overload conditions occurs.

- a) When the supply voltage differs from the rated voltage.
- b) When the condition of the compressed air the inlet is poor. (temperature is high, pressure is low, flowrate is excessively large)
- c) When the heat dissipation of the condenser is poor.
(clogging of the air intake filter or condenser)
- d) When the setting of the capacity regulating valve is high.
(no-load condition)
- e) Refrigerant leakage.

(10) Evaporating Temperature Gauge

If the indicated temperature is as shown below, the system is normal.

Condition	During operation	no operation		
		Ambiesnt Temperature		
		Approx. 10 °C (50 °F)	Approx. 20 °C (68 °F)	Approx. 30 °C (86 °F)
Indicated Temp	0 ~ 15 °C	5 °C (41 °F) or higher	15 °C (59 °F) or higher	25 °C (77 °F) or higher

Note:

The evaporation temperature during operation is independent of the ambient temperature.

The evaporation temperature during operation is higher, the greater the inlet air load.

The pressure dew point temperature is normally 1 to 3 °C (2 to 6 °F) higher than the themperature indicated on the evaparation temperature gauge.

7. INSTALLATION

- (1) During transportation and installation, care should be taken not to jar or drop the unit. This will cause problems.
- (2) Install the unit on a stable, vibration-free, level floor. (levelness within 5°C)
- (3) Install the unit inside the building in a well-ventilated area with little dust and humidity. In no case should the unit be installed outside.
In particular, avoid having cold wind in the winter season beating on the draft hole and the condenser.
- (4) Avoid using the unit in a corrosive environment involving sulfurous acid gas or hydrogen sulfide gas.
- (5) Leave spaces of more than 20 cm between the unit (inlet and outlet of draft air) and walls of other obstacles around the unit to facilitate ventilation and maintenance.
- (6) The ambient temperature range is 2 to 40 °C
(36 to 104 °F)

8. AIR PIPING

- (1) When connecting the air piping, be sure to install a bleed valve as shown in Fig.1, and thoroughly flush the pipes.
- (2) Take steps to prevent vibration from any other equipments being transmitted to the unit.
- (3) Use pipes having a diameter of at least 10 mm and a total length of no more than 5 m for the drain piping. If the resistance of drain piping is large, it will be difficult to discharge drain.
- (4) Ensure that the weight of the pipes is not applied to the unit.

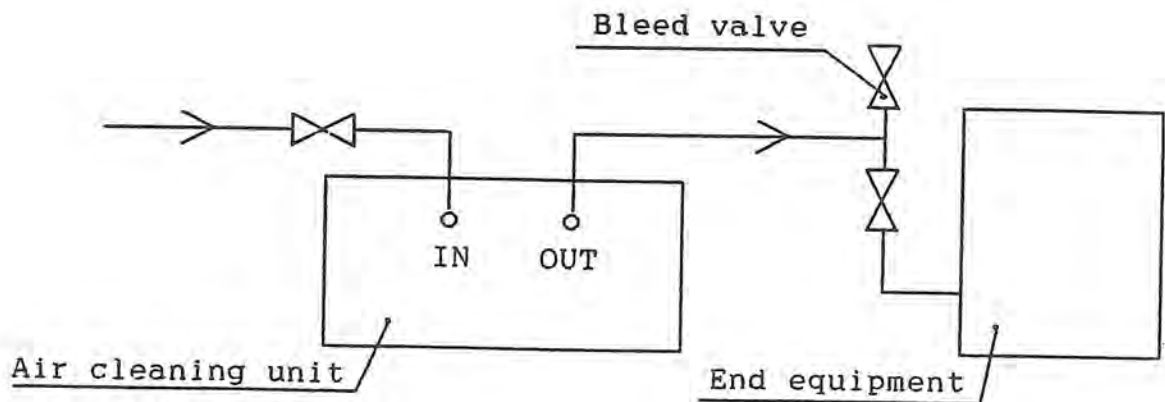


Fig.1

9.ELECTRICAL WIRING

- (1) The necessary electrical supply is 200 VAC, 10 A. The allowable voltage fluctuation is within 10% of the rated voltage.
- (2) Open the front cover of the unit (electric components box) and connect the power cord, grounding wire and signal cord. (See electrical diagram)
- (3) DO not fail to ground the unit.
- (4) Use stranded copper stranded conductor for the power cord and grounding cord. Select the nominal cross-section and length of the cord from the table below.

Nominal cross-section	mm	1.25	2.0	3.5
Length of cord	m	15 max	25 max	45 max

10.OPERATION

- (1) Confirm if installation, air piping, wiring, power source, and fuse capacity are proper.
- (2) Wait for more than 3 minutes before restarting the unit after the unit has been stopped. If the air dryer unit is restarted within 3 minutes after it is stopped (including a stoppage due to a momentary power failure), a locked rotor current of approximately 10 A will flow, and after an interval of 30 seconds to one minute the overload relay will operate, causing the unit to stop. If such operation is repeated, the refrigerating compressor will eventually break down. Under no circumstances, therefore, operate the unit in this way.

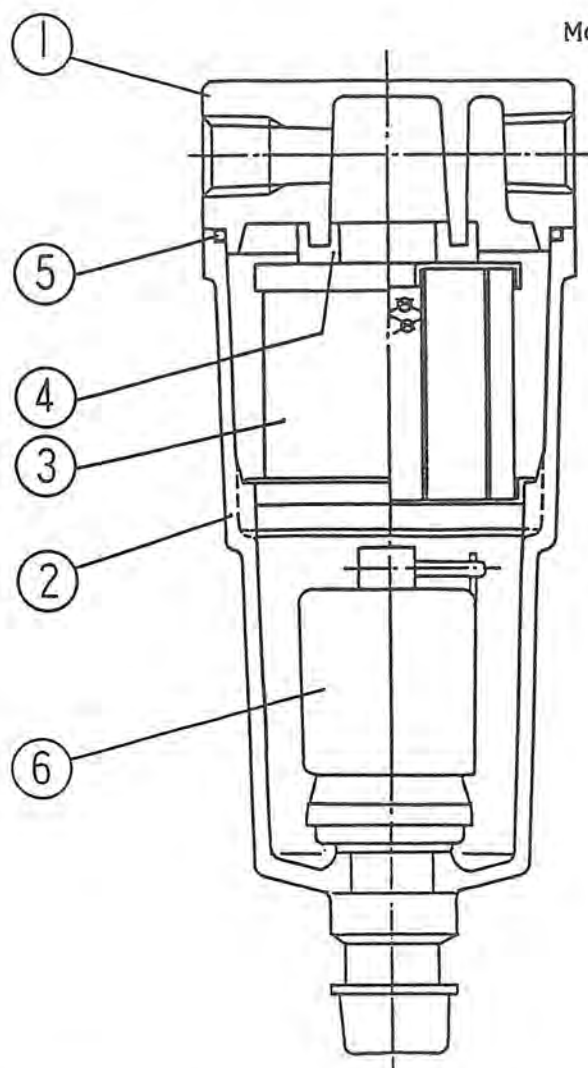
- (3) The fan motor will rotate either intermittently or continuously depending on ambient temperature and inlet air conditions. The lower the ambient temperature and the smaller the inlet air load (the higher the pressure, the lower the temperature, and the lower the air flow rate), the longer the time period in which the fan motor stops rotating.
- (4) When the unit stops because of trouble, the lamp goes off. Turn off the circuit breaker, eliminate the cause, and then turn on the circuit breaker again. (Refer to Troubleshooting)
- (5) The higher the ambient temperature of the inlet temperature and the lower the air pressure, the less the air flow.
(If the air flow rate is constant, dew point under pressure will become higher.)

11. MAINTENANCE

- (1) Special care should be taken to prevent clogging of the condenser and air intake filter on left side panel. Check the condenser and air intake filter for possible clogging periodically and clean them with a brush or air blow nozzle, if any.
- (2) Replace the filter elements of the Drain Separator (mist separator), and Micro-mist Separator either when the reading of differential pressure gauge exceed 1 kgf/cm (14 psi), or after using the unit for one year, according to the "Replacing The Elements of Various Filters" given in paragraph 12.
- (3) Check for lighting-on of the lamp and air pressure.

12.REPLACING THE ELEMENTS OF VARIOUS FILTERS

12-1.Replacement Procedure of Drain Separator (Mist Separator)



Model of Drain Separator

(Mist Separator):AM150-02C

No.	Name	Part No.
1	Body	
2	Housing	
3	Element	Element Assy AM-EL150
4	Gasket	
5	"O"ring	
6	Auto-drain	AD53

- 1) Remove insulation cover
- 2) Untighten the setscrews on top side of Body ① with an Allen wrench. Then remove housing ②.
- 3) Replace Element ③ , Gasket ④ and "O"ring ⑤.

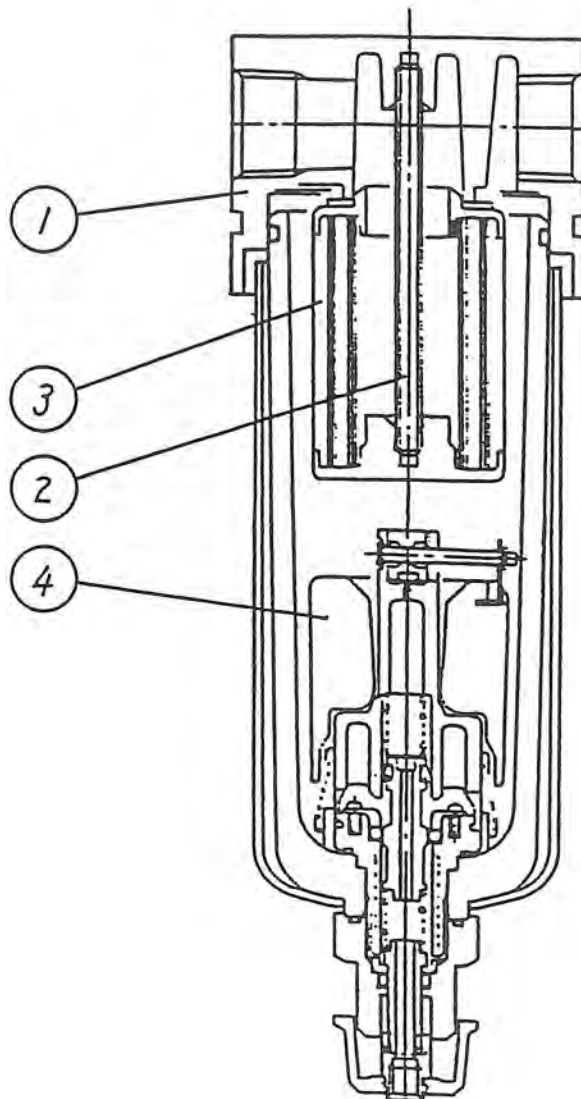
Caution

After replacement of Element, fit insulation cover to Drain Separator again.

12-2.Replacement Procedure of Micro-mist Separator Element

Model of Micro-mist Separator:

AFD3000-02C



No.	Name	Part No.
1	Body	
2	Tension Bolt	
3	Element	63093
4	Auto-drain	AD53PA

1) Remove filter case from Body ①.

Then rotate element ③ counterclockwise, and remove it.

2) Replace Element

13. TROUBLESHOOTING

13-1. Air Pressure at Outlet of the Unit Is Low

Cause	Remedy
Filter elements clogged	Replace filter elements
Primary pressure is low	Raise primary pressure
Air consumption is excessively large	Reduce air consumption
Pressure regulating valve faulty set	Re-set valve
Pressure regulating valve defective	Replace valve

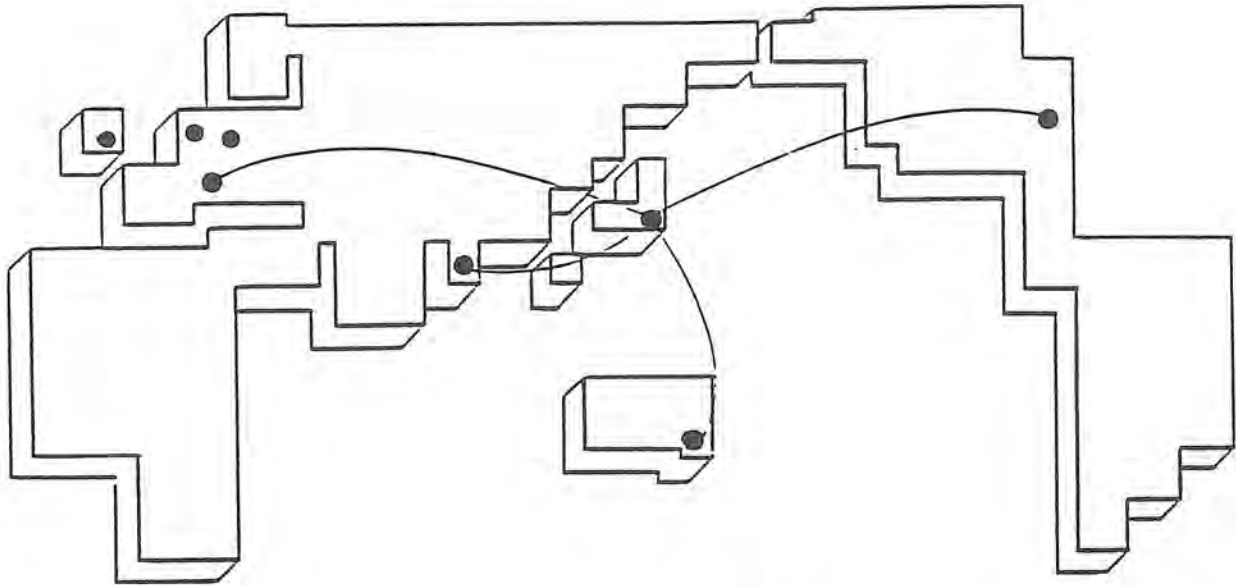
13-2. Water Flows Outlet of the Unit

Cause		Remedy
Refrigerating operation is not running	Power is not on	Turn the circuit breaker in the electric components box "ON".
	Power is on	Overload relay has operated. Turn the circuit breaker OFF and remove cause. (See P) then turn the circuit breaker "ON".
Defective auto drain prevents condensed water from being discharged		Replace auto-drain.
Excessive air flow		Adjust to proper flow rate
Working air pressure is too low		Raise air pressure
Filter element is broken		Replace filter element

13-3. Oil Flows from Outlet of the Unit

Cause	Remedy
Filter element is broken	Replace filter element
Defective auto drain causes collected oil to be carried over	Replace auto-drain
Working air pressure is too low	Raise air pressure
Excessive air flow	Adjust to proper flow rate

Overseas Subsidiaries & Affiliates



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Castle Hill, N.S.W. 2154, Australia
Tel : (02)680-3222
Tlx : 7123152

SMC Pneumatics (S.E.A) Pte., Ltd. (Singapore)
• 73 Tuas Avenue 1, Singapore 2263
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Tlx : 8734355

SMC Pneumatics (S.E.A) Sdn. Bhd. (Malaysia)
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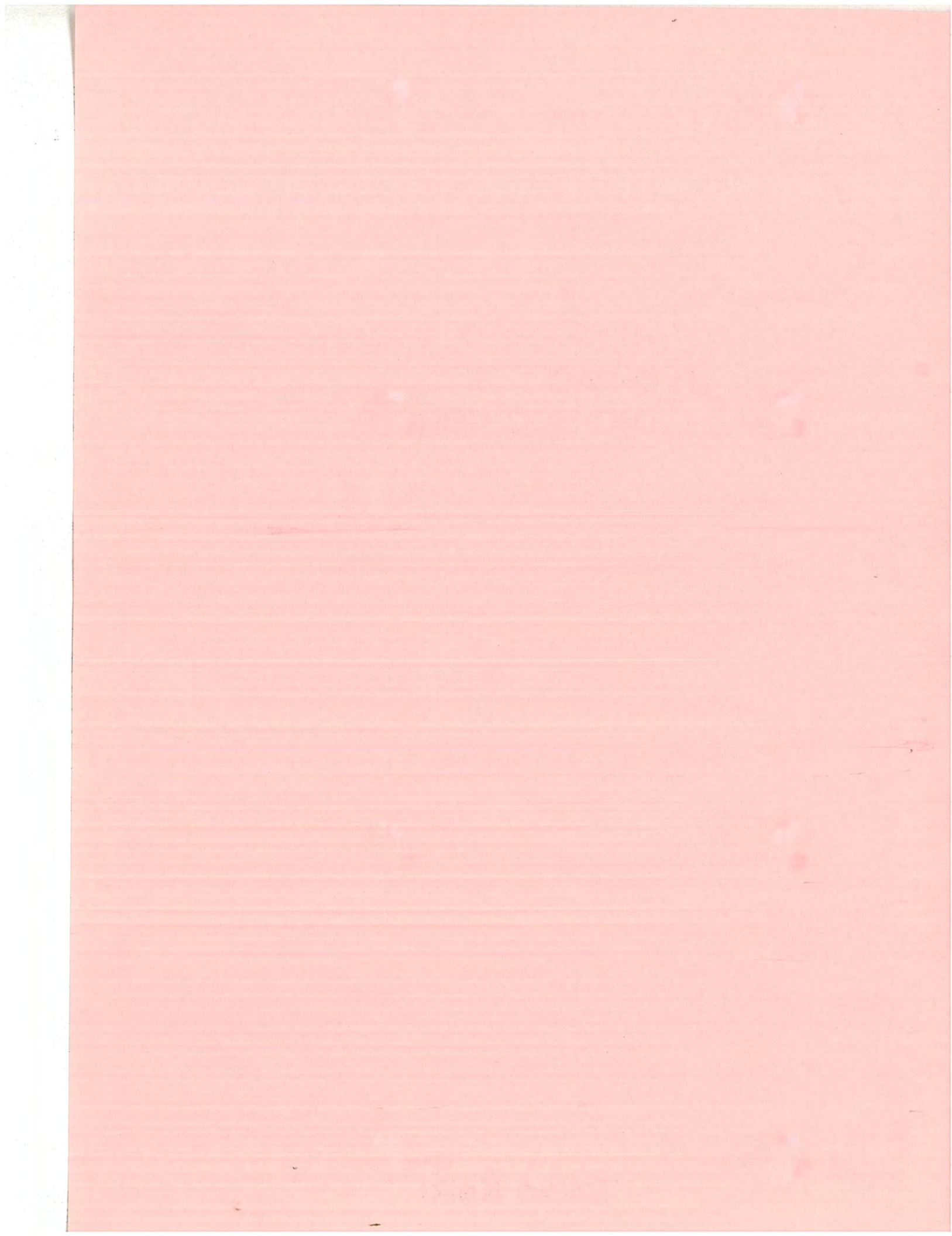
SMC Pneumatics (U.K) Ltd. (England)
15 Heathfield, Stacey Bushes
Milton Keynes MK12 6HP, England
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J: Q-PAC
(MC-500H/600H)

Tokyo Keiki



MC-500/600 H

Q-PAC

INSTRUCTION MANUAL

TOKYO KEIKI CO., LTD.

- HYDRAULIC DESIGN SECTION -

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1. General

This power pack is manufactured by Tokyo Keiki Co., Ltd., for machine tools. Its construction is as shown by the attached hydraulic circuit diagram. It is fully equipped to provide the specified performances.

2. Method of Installation

2.1 Transportation and Installation

- (1) Employ a fork lift to transport the unit. After obtaining proper balance of the unit, suspend from the designated hook. Do not tilt the unit more than 20 degrees in either direction.
- (2) This Q PAC weights approx. 70 kg without hydraulic oil. When transporting the unit, always employ a fork lift and wire rope of sufficient strength.

2.2 Hydraulic Piping

- (1) After the unit has been properly placed, install all required piping by referring to the external view and hydraulic circuit diagrams.
- (2) Remove all rust or dirt from the piping.
- (3) Pipe dimensions and type should be as specified.
- (4) Insure that a section of rubber hose is employed as piping in front of the connection port of the unit. (The minimum length shall be 1 meter.)
- (5) Provide support for the pipe at the required positions. (At intervals of approx. 1 meter.)
- (6) After completion of piping, thoroughly flush all the piping.

2.3 Electric Wiring

main motor ... from terminal *(in terminal box of motor)*

2.4 Selection of Hydraulic Oil for Hydraulic Unit

Table shows the various types of hydraulic oils made by several manufacturers. Use the oil most readily available to you.

Table

Temperature range	Manufacturer	NC fluid	Anti-wear fluid
	Esso Oil	Univis J 32	Nuto-H , Nuto-HP
	Shell Oil	Shell NC Oil A	Terrus 33
	Mobile Oil	Mobile NC . System Oil .	DTE24

2.5 Oil Supply

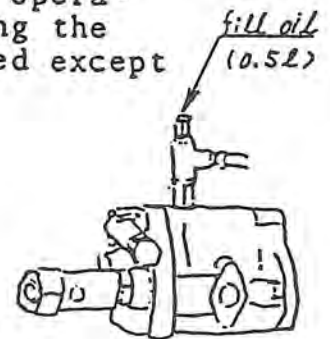
(1) Supplying oil to the reservoir

Remove the related cover from the oil port and pour in oil through the filter so as to be a little over the reference level on the oil level gauge. Use a clean funnel and be careful not to allow any foreign matter or water to enter the unit.

When the valve and pipes are filled with oil after operation is completed, the oil level will be lowered by that amount. Therefore, add additional oil up to the reference level.

(2) Filling the pump housing with hydraulic fluid

Always completely fill the pump housing with fluid (approx, one litre) by removing the plug on top of the tee as shown in right during the initial operation of the pump. (After filling fluid during the initial operation, no more filling is required except as in such case as changing fluid.)



3. Operation and Adjustment

3.1 Pre-adjustment Inspection and Precautions

(1) Check the oil level

The oil level should be slightly over the specified reference level. (Observe the reference line on the oil level gauge attached to the oil tank.)

(2) Check for oil leakage

Check that no leakage of oil in the tank, pipes, valves, etc., is observed.

(3) Check all connections

a) Insure that all hydraulic pipe connections between the hydraulic unit and actuator are correct.

b) Check the connection between the hydraulic unit and electrical control panel.

- (4) Check the pressure gauge graduations.

The pressure gauge should indicate zero before the hydraulic unit starts operation.

3.2 Start

- (1) Check the rotational direction of the pump and motor under the no-load condition. Turn the motor switch on for a moment and confirm that the fan on the rear of the motor is rotating in the direction designated by the arrow mark on the piston pump. If rotation is reversed, change the phase to obtain the correct rotational direction.

Once the above checks have been completed, no further inspection is required unless an electrical connection is changed for some reason.

- (2) Start at normal conditions

When confirmation and adjustment are completed for item (1) above, and if fluid temperature is above 0°C, operation can be started immediately.

3.3 Adjustment

- (1) Bleeding air

Air in the hydraulic system will become the cause of irregular motion and noise. Therefore, air must be completely removed prior to normal operation. Bleed air as follows. Reduce the setting pressure of the piston pump.

(2) Adjustment of piston pump
(refer to attached installation drawing)

3.4 Checking during operation and cautions to take

Check if there is no difference from the previous checking. When there is difference investigate the cause (fluid leakage) and take measures. When the cause is unclear, fill fluid up to the normal line and investigate the cause while operating.

Check if the pointer is showing correctly.

Operate the unit when all preparation for operation are complete on the actuator side.

3.6 Stop

- 3 -

4. Individual Apparatus Operation

This power pack using the piston pump. This pump is the variable discharge pressure compensating type. The discharge value of the pump may be varied freely in accordance with the flow required by the actuator at kg/cm^2 .

See the section drawing of the element, the symbol of the oil circuit diagram and the specification of the element are written on it.

5. Maintenance and Inspection

5.1 Inspection during Operation

(1) Check the Oil Level

Insure that the oil level is above the level specified. If any discrepancy is noted determine the cause after adding the required amount of oil.

(2) Check the Pressure Gauge Indication

The indicator must indicate the pressure set on the pump or appropriate to the load of the actuator. The pointer should not vibrate excessively. If an abnormal indication is observed, the cause may be either a defect in the pressure gauge or the oil pressure. Determine the cause and take the appropriate counter measures.

(3) Checking of the filter

This unit is installed with a suction filter in the reservoir and low pressure line filter in the return line. Both filters do not detect the clogging of the filter. Thus clean or replace at the time of overhaul or replacement period.

(4) Check the Oil Temperature

When the oil temperature is less than 60 degrees centigrade, the condition is normal, and abnormal if more than 65 degrees centigrade.

(5) Check for Noise During Operation

Check for any abnormal noise when the pump and valve are operating.

(6) Check that there is no variation in the operating speed of the actuator.

The above items should be checked on a periodic basis, a record made of the results. If any abnormal condition is observed, determine the cause immediately and take the proper counter-measure.

5.2 Maintenance While Stopped

(1) Periodic Removal of Water

If the unit is used in an extremely humid location, water may accumulate in the oil tank. Drain this water periodically (once a month) by loosening the oil drain port plug at the bottom of the oil tank.

(2) Check the Locking Bolt and fitting

Inspect at least once a month, and repair any defects.

(3) Prevention of Rust

In the event the unit is not to be operated for more than 6 months, drain the operating oil and apply a rust-proof oil to the unit then operate for several hours. Rust-proofing measures should be taken with the entire system. The rust preventive oil used should be equal to the standards of MIL-L-21260; grade 1.

Mobil Oil	Mobil Coat 501
Idemitsu Kosan	Daphne Sola Rust Engine Oil No.10
Shell Oil	Shell Rust Preventive P-10 Grade 1
Esso Standard Oil	Anti-rust P-1010
Nippon Oil	Rust Preventive Oil P-210

When operation is to be re-started after the above procedure have been taken, wash the unit with flushing oil to minimize mixture of deteriorated oil and hydraulic oil, and discard the mixed oil after circulating the hydraulic oil. Then start operation.

5.3 Oil Storage and Handling

- (1) The storage drum or can must have a suitable cover.
- (2) Before opening the drum can, wipe the upper side carefully to prevent dust from entering the oil.
- (3) Check the oil container and keep it clean.
- (4) When wiping any part coming in contact with the oil, use a cloth to which dust or textile particles do not adhere. A sponge is recommended.

5.4 Down Time for Overhaul and Replacement

The down time for overhaul and replacement cannot be designated since it differs with the degree of usage, presence or absence of impurities, quality of the oil, temperature, degree of maintenance, etc.

Accordingly, check the items listed below, overhaul the unit and replace the parts in which abnormalities are found.

Check item	Interval	Check point	Countermeasure
Hydraulic fluid	Monthly	Color, turbidity, deposit, water, deterioration	If any abnormality is found, take the necessary steps after consulting the manufacturer.
Piston pump	Weekly	Noise (determine by deily observation)	If any abnormality is found, consult the manufacturer.
	Every 2 years	Shaft coupling	Replace the intermediate rubber. If replacement involves difficulty, consult the manufacturer for service.
Reservoir filter	Check when replacing the hydraulic oil	Adhered foreign matter	Wash clean regardless of the presence of the foreign matter, and blow dry with air from the inside. (Remove the reservoir top plate to take out the filter.)
Air breather	Monthly	Clogging and ventilation	If ventilation is poor, replace with a new part.
Low pressure line filter	3000 hrs		Replace by new filter element
Pressure gauge	Every 6 months	Error in indication	Measure with a reference gauge, or compare with a gauge of high accuracy. If the error is too great, replace with a new gauge.

Oil tank piping, locking bolt, fitting	Every 3 months	Oil leakage, loose thread sections	Repair any abnormalities found.
--	----------------	--	---------------------------------

5.5 Disassembly and Reassembly

Periodic overhaul of the major parts and repair of the trouble should be made by manufacturer.

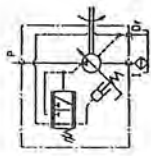
If disassembly and reassembly must be made for some reason, pay particular attention to the following items.

- (1) Study the operation of the circuit, in addition to operation and construction of the element in advance by referring to the circuit diagram and section drawing of the element.
- (2) Before loosening the locking bolt and fitting make provisions to prevent the residual pressure or difference in the head pressure from causing the oil to spurt out.
- (3) When leaving the unit disassembled, rust is likely to form therefore apply a rust-preventive oil or dummy plug.
- (4) Wash the disassembled parts with kerosine, place in hydraulic oil after drying, then reassemble.
- (5) When reassembling the parts, maintain the tightening torque of the components uniform.
- (6) When reassembling the repaired parts, replace all O-rings and packings.
- (7) Before starting operation, insure that the locking bolts, dummy plugs, fittings, etc. are all tightened.
- (8) In the event a trouble occurs for some unknown reason, consult the manufacture at the nearest address or head office.

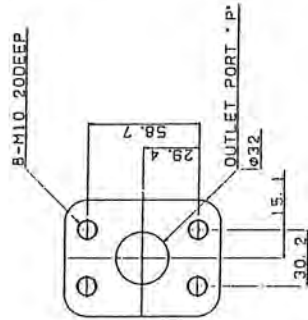
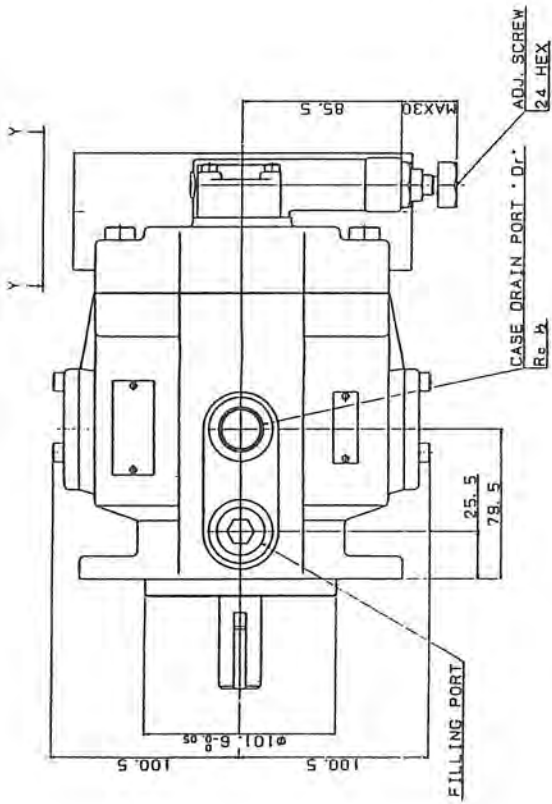
6. Troubleshooting

To better prevent troubles from occurring daily maintenance and inspection should be performed on a scheduled basis. As is often the case unexpected items will cause troubles. The troubleshooting chart below is furnished to assist you in locating and clearing troubles more easily.

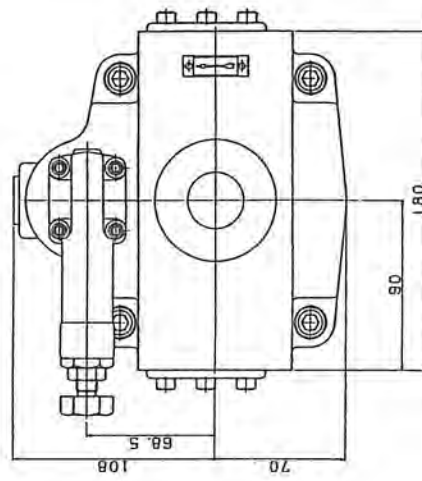
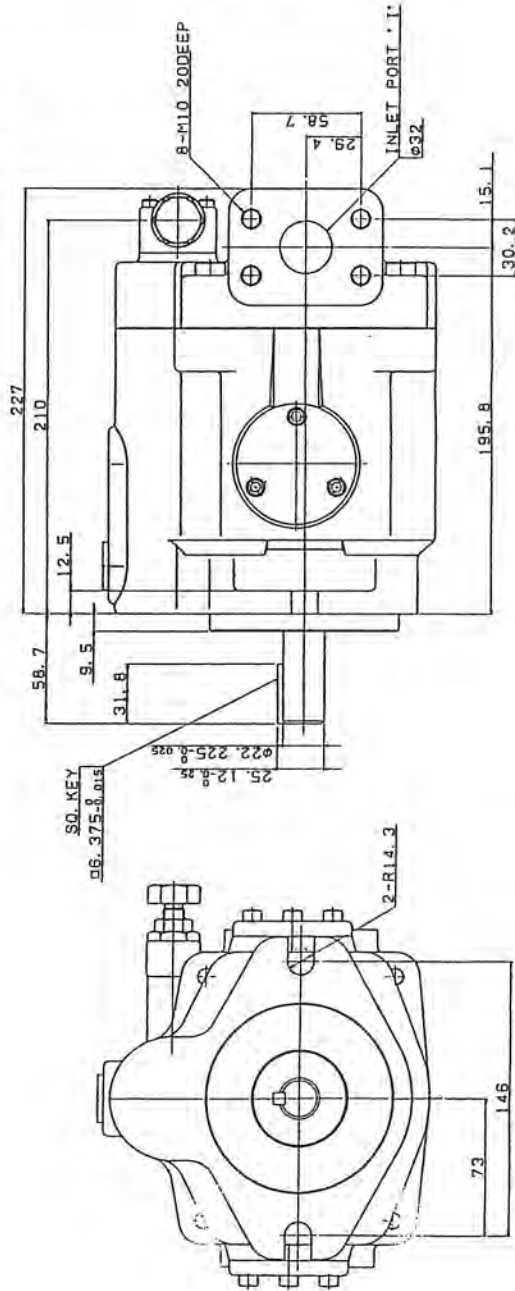
Trouble	Cause	Countermeasure
The pump will not discharge the oil	(1) Rotational direction of the pump is reversed.	Recheck in the same way as item 3.2 (1).
	(2) The oil has deteriorated. (The viscosity is low)	Consult the manufacturer of the hydraulic oil.
	(3) The oil temperature is not appropriate.	The temperature should be between 0 to 60 degrees in centigrade.
	(4) Insufficient oil in the oil tank.	Check the oil level by observing the oil level gauge, and replenish if insufficient.
	(5) The tank filter is clogged.	Remove and check. <i>(Remove the reservoir top plate to take out the filter)</i>
Pressure in the circuit fails to rise.	(6) The pump fails to discharge the oil due to the causes described in (1) to (5).	If the countermeasures described in (1) to (5) are not sufficient, consult the manufacturer for inspection.
	(7) The adjusting screw for discharge pressure of the pump is not properly adjusted.	Re-adjust in the same way as 3.3.(2).
	(8) Oil leaks in the hydraulic system.	Locate the leak and repair.



GRAPHICAL SYMBOL



VIEW Y-Y



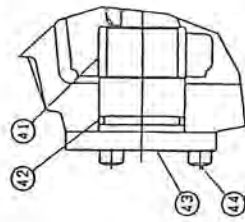
VARIABLE DISPLACEMENT
PISTON PUMP

P21/31VR/L-12-C (H) -11-J

DATE	90-9-28	SIZE	D
REWORKING NO.	42962800	REMARK	1
TOKIMEC		TEST NO	9722
		TESTED BY	ME

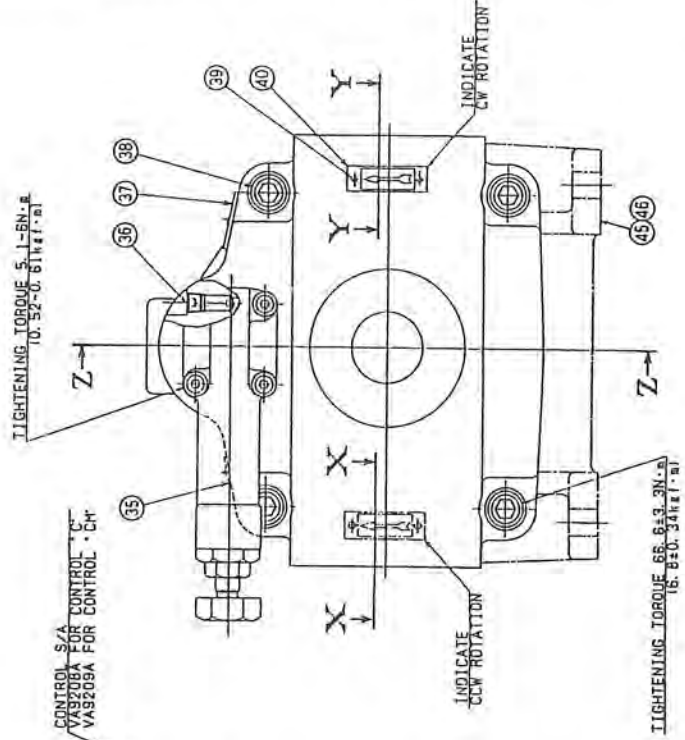
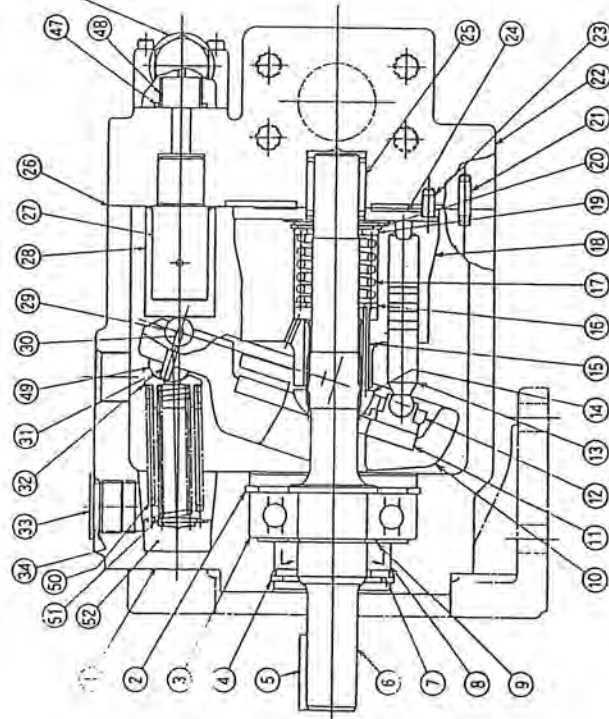
TABLE 1

M O D E L	WAFER PLATE (23) VALVE BLOCK (23) PISTON 3/4 (23) CYLINDER BLOCKING GROUP KIT
P21V(F)R-12-C(M)-11-J	40012503 40013782 VA11346A VP321703 VA12231A
P21V(F)L-12-C(M)-11-J	40013170 40013165 VA11346A VP321703 VA12231A
P31V(F)R-12-C(M)-11-J	40013323 40013324 VA11347A VP260860 VA12232A
P31V(F)L-12-C(M)-11-J	40013325 40013326 VA11347A VP260860 VA12232A



TORQUE 11.5-13.8N.m (1.7-1.4lbf.ft.)

SECTION XX (YY)



48 SLEEVE	VA23609	1	47 O RING	007901817	1
49 SEAT	40013364	1	46 1/2 SCREW	VP1313	2
50 SPRING	VP278634	1	45 FOOT BRACKET	VP199491	1
51 SPRING	VP317239	1	44 HE SCREW	001960161	6
52 SPRING RETAINER	40012523	1	43 PINTLE	40013090	2
			42 D RING	007912417	2
			41 BUSH	40012490	2
			40 ROTATION PLATE	VP266399	1
			39 SCREW	000919050	6
			38 H10 SCREW	001910401	4
			37 NAME PLATE	VA30460	1
			36 1/16 PIPE PLUG	VP113000	1
			35 INSTRUCTION PLATE	VA12512	1
			34 O RING	007991019	1
			33 7/8 PLUG	VP320137	1
			32 SEAT	40013370	1
			31 SPRING PIN	004950127	1
			30 SPRING PIN	004930147	1
			29 ROLLER	40013372	1
			28 PISTON	40013371	1
			27 PISTON ROD	40013856	1
			26 GASKET	40012493	1
			25 BEARING	VP12016	1
			24 WAFER PLATE	SEE TABLE 1	1
			23 PIN	VA29430	1
			22 VALVE BLOCK	SEE TABLE 1	1
			21 PIN	VP167237	2
			20 RETAINING RING	VP93509	1
			19 WASHER	VP245223	1
			18 CYLINDER BLOCK	SEE TABLE 1	1
			17 SPRING	VP247294	1
			16 WASHER	VP241954	1
			15 PIN	VP248612	3
			14 SPHERICAL WASHER	VA28550	1
			13 PISTON 3/4	SEE TABLE 1	(9)
			12 SHOE PLATE	VA26549	1
			11 SWASH PLATE	VT239077	1
			10 YORE	40013581	1
			9 RETAINING RING	006902257	1
			8 SHAFT SEAL	VA29405	1
			7 WASHER	40012494	1
			6 SHAFT	40012495	1
			5 KEY	VP58303	1
			4 RETAINING RING	VA16179	1
			3 BEARING	007063061	1
			2 RETAINING RING	VA26304	1
			1 HOUSING	40013763	1

OUTLET VARIABLE DISPLACEMENT
PISTON PUMP

P21/31V(F)R/L-12-C(H)-11-J

DATE	50-9-29	SIZE	D
REVISED	42962590	REVISION	1

RECEIVED
TOMAC INC.

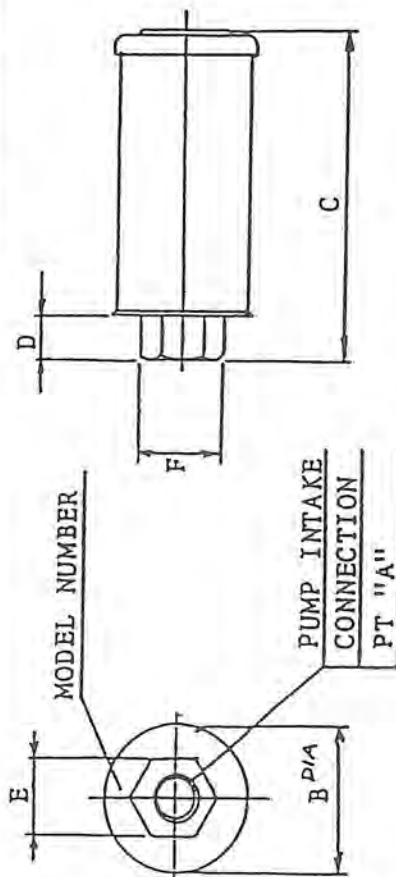
GENERAL USAGE IN AN OIL HYDRAULIC CIRCUIT TO PROTECT THE PUMP AND CONTROL SYSTEM FROM SOLIDS OR OTHER FOREIGN MATTER. USED AS AN IMMERSION TANK FILTER ON THE PUMP INTAKE LINE, AS INDICATED BY TYPICAL INSTALLATION DIAGRAMS SHOWN BELOW.

FILTER MESH 100 MESH (0059")

RATINGS ARE CONSERVATIVE IN ORDER THAT A CHANGE IN OIL VISCOSITY SHOULD NOT MATERIALLY AFFECT CAPACITY.

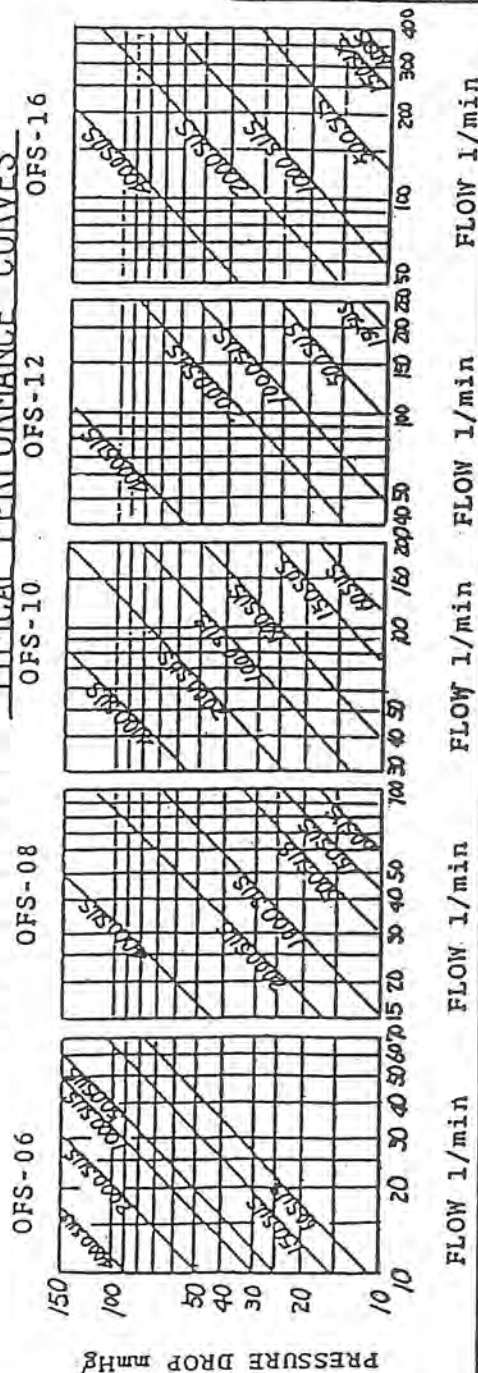
CLEANING SHOULD BE DONE PERIODICALLY BY REMOVING ELEMENTS FROM TANK. WASHING THOROUGHLY IN SUITABLE SOLVENTS AND BLOWING WITH AIR (FROM INSIDE TO OUTSIDE).

MODEL NUMBER	RATED CAPACITY /min	"A"	"B"	"C"	"D"	"E"	"F"
OFS-06-JA-J	35	3/4	56	125	17	35 ⁰ _{-0.35}	40.4
OFS-08-JA-J	60	1	80	190	19	46 ⁰ _{-0.4}	53.1
OFS-10-JA-J	90	1 1/4	100	233	23	58 ⁰ _{-0.5}	67.0
OFS-12-JA-J	140	1 1/2	119	258	25	63 ⁰ _{-0.4}	72.7
OFS-16-JA-J	240	2	147	335	30	77 ⁰ _{-0.7}	88.9



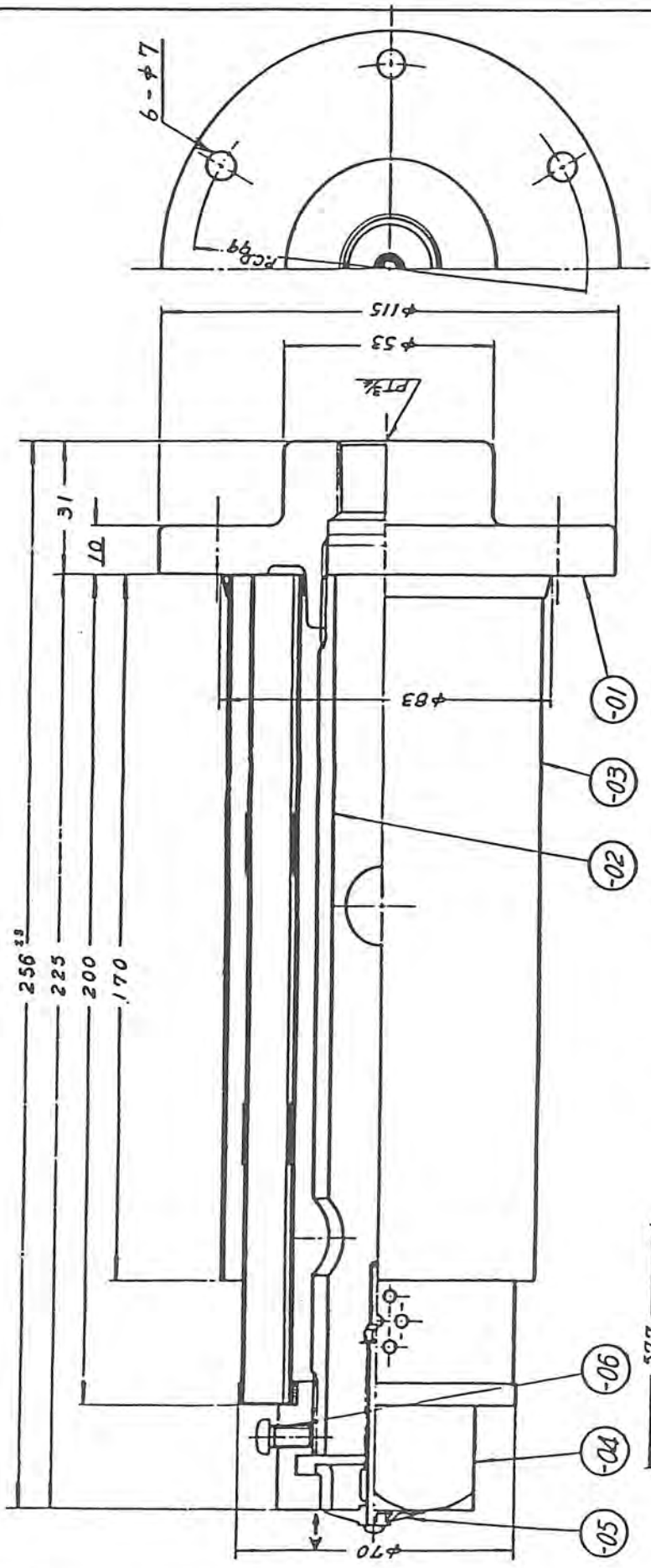
TYPICAL OIL INTAKE. FILTER INSTALLATIONS
USE FILTERS PIPED IN MULTIPLE TO OBTAIN
ADEQUATE CAPACITY

TYPICAL PERFORMANCE CURVES



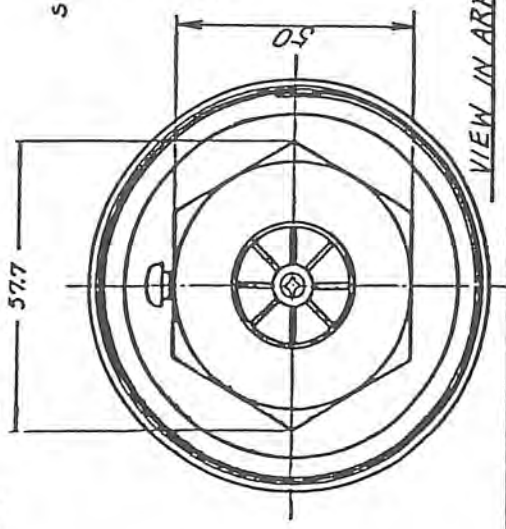
TANK FILTER	QFS-※-JA-J	SYMBOL (JIS)		L
 TOKYO KEIKI CO. LTD.				
DRAWN	CHANGED	ORDERED	APPROVED	
	<i>AK</i>	<i>AK</i>	<i>Tokio</i>	
SCALE	UNIT	FEATURES		
1:1	mm	BIVPA 30635G		
DATE		REV		
DEC 22 '77		1		

256 ±3
225
200
170



SPECIFICATIONS.

- 1 FLUID TURBINE OIL #90
2. FLOW RATE 60 l/min (400 l/min/hr)
- 3 RANGE OF OIL TEMPERATURE -20°C ~ 120°C
4. ELEMENT FILTRATION RATING 10 MICRON
5. CONNECTION SIZE PT 3/4"
6. BY-PASS VALVE SETTING 1.05 kg/cm²



-06 SCREW	SWRM6	1	M5 x 12
-05 VALVE ASS'Y	-	1	1.05 kg/cm ² set
-04 VALVE HOLDER	AC-2A	1	
-03 ELEMENT	-	1	10 MICRON Y-1741
-02 INNER TUBE	SPG	1	IB
-01 COVER	AC-4A	1	
ITEM NAME OF PART	MATERIAL	NO. REQD	REMARKS
SCALE	OR'N DATE	9 JUL '79	
DESCRIPTION			
APPROVED BY			
Y:ll	WEIGHT	1.5 kg	
SIZE			

YAMASHIN KOGYO CO., LTD

RELAY NO.

0.05 NO

Y-2209E

RETURN LINE FILTER

Handling of Y-2209 Return Filter

Y-2209 Return filter consists of simplified return, line, head of aluminium alloy installed on upper surface of oil tank, filter element and bypass valve. It has a construction where filtrated oil flows from inside of element to outside. The specifications consist of aperture of PT3/4", nominal filtration accuracy of 10 μ , bypass valve set pressure of 1.05 Kg/cm². With regard to flowrate, it can flow general mineral operating oil by the rate of 60 l/min normally and 90 l/min. at maximum approximately.

Filter mounting

Previously mount filter mounting flange on upper surface of tank, insert filter intercalating packing, then fix it with 6 bolts (M6xP1.0).

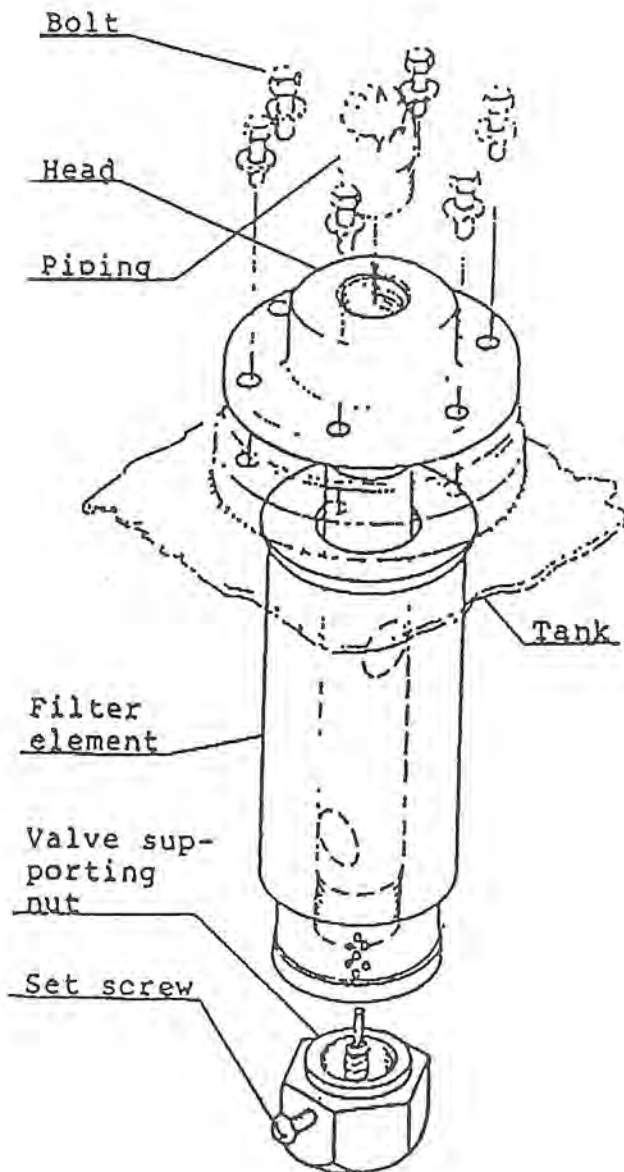
Inlet piping is provided with screw having port size PT3/4". Therefore, applicable is either of PT piping or hose joint piping.

Element replacement

Element replacement period is, although dependent on operating condition, normally made 50 hours after starting operation for the first element and, on the second element and afterward, 500 hours to 1000 hours after the preceding replacement.

In element replacement, remove 6 mounting bolts of

upper cover, pull out filter assembly, then loosen set screw on the side surface of valve supporting nut. Then remove valve supporting nut, thus the element can be removed.



Exploded view of Y-2209
Return filter

Upon completion of replacement with new element, tighten element completely with valve supporting nut, then secure loosening protection by set screw on side surface.

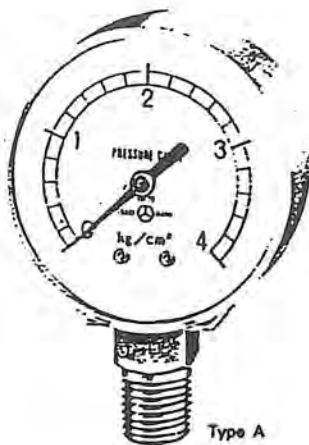
Thereafter, mount it according to the procedure of upper filter mounting.

Article No. of replacing element is Y-174903.

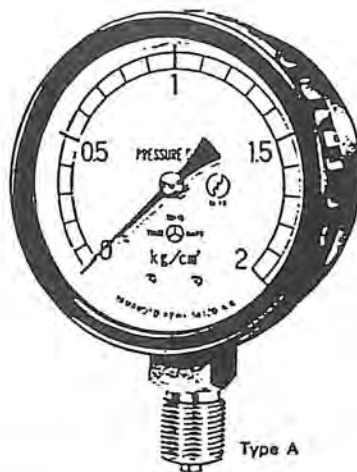
WEATHER-PROOF TYPE GAUGE

This is used for outdoor use or where corrosive gas is in atmosphere. Plastic is used for case.

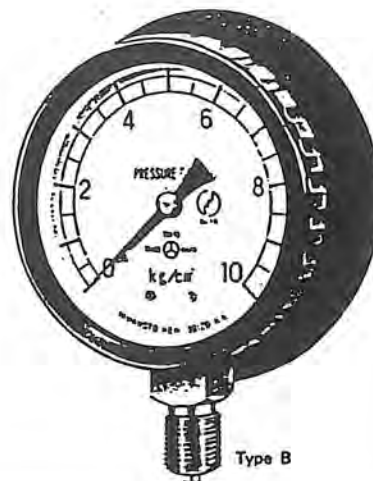
- Size: 50 ϕ /60 ϕ /75 ϕ /100 ϕ
- Pressure range: Pressure gauge 0 kg/cm² ~ 70 kg/cm² Vacuum gauge 76 cmHg ~ 0 cmHg
Compound gauge 76 cmHg ~ 20 kg/cm²
- Shape of casing: Type A/Type B • Shape of shank: T shank
- Connecting screw: $\frac{1}{4}$ ~ $\frac{3}{8}$ • Accuracy: $\pm 1.5\%$ F.S.



Type A



Type A

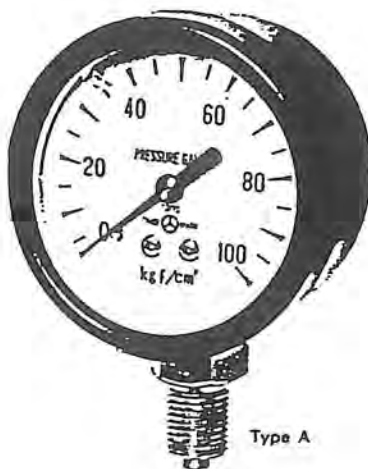


Type B

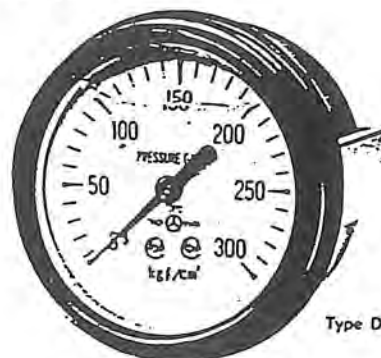
GLYCERIN BATH

This pressure gauge is suitable to use in places where there is strong vibration. Glycerol filled in the case controls abrasion and vibration.

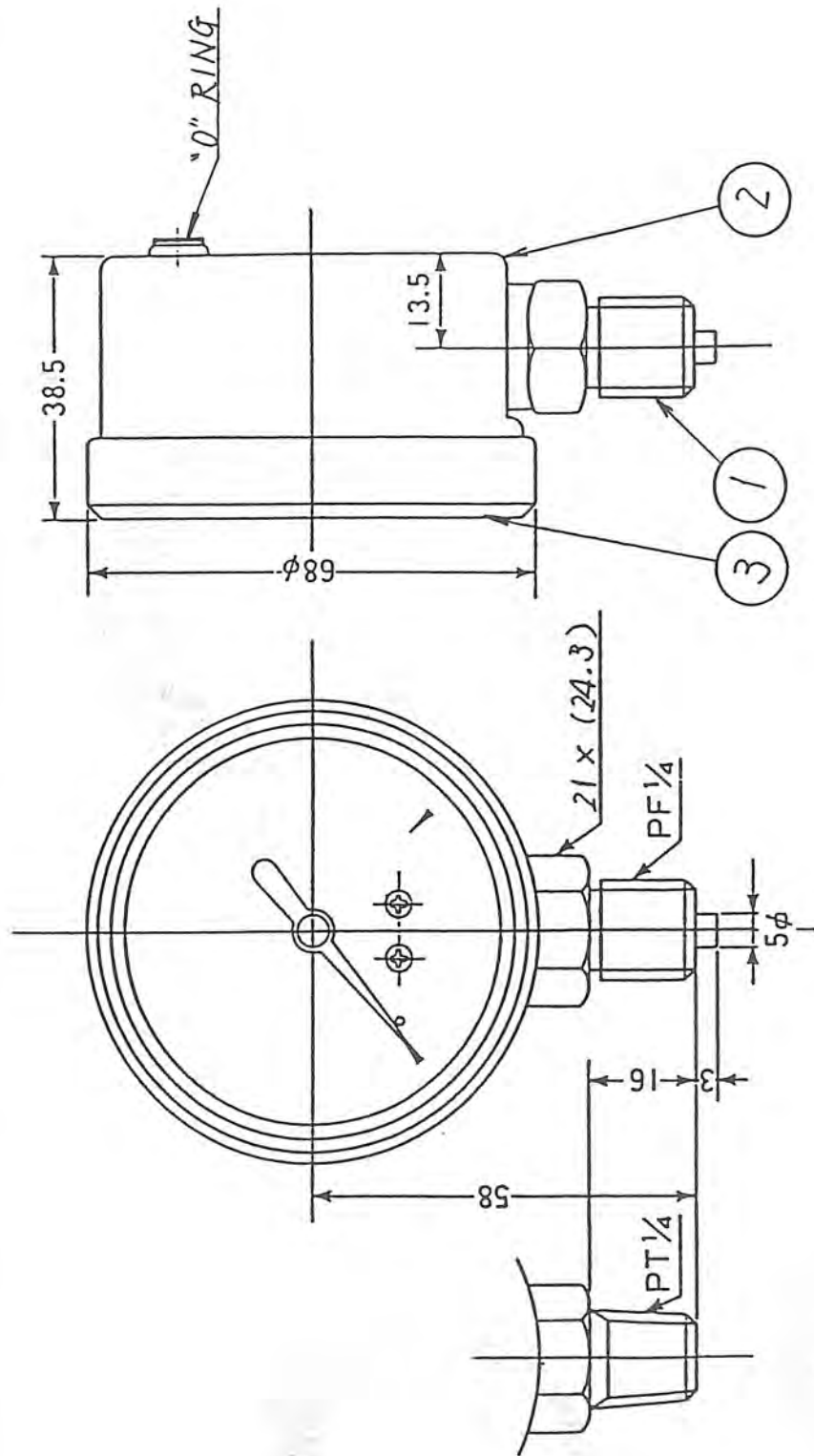
- Size: 60 ϕ /75 ϕ /100 ϕ
- Pressure range: Pressure gauge 0 kgf/cm² ~ 1000 kgf/cm²
Vacuum gauge 76 cmHg ~ 0 cmHg
Compound gauge 76 cmHg ~ 20 kgf/cm²
- Shape of casing: Type A/Type B/Type D
- Shape of shank: S shank • Connecting screw: $\frac{1}{4}$ ~ $\frac{3}{8}$ ~ $\frac{1}{2}$
- Accuracy: $\pm 1.5\%$ F.S.



Type A



Type D



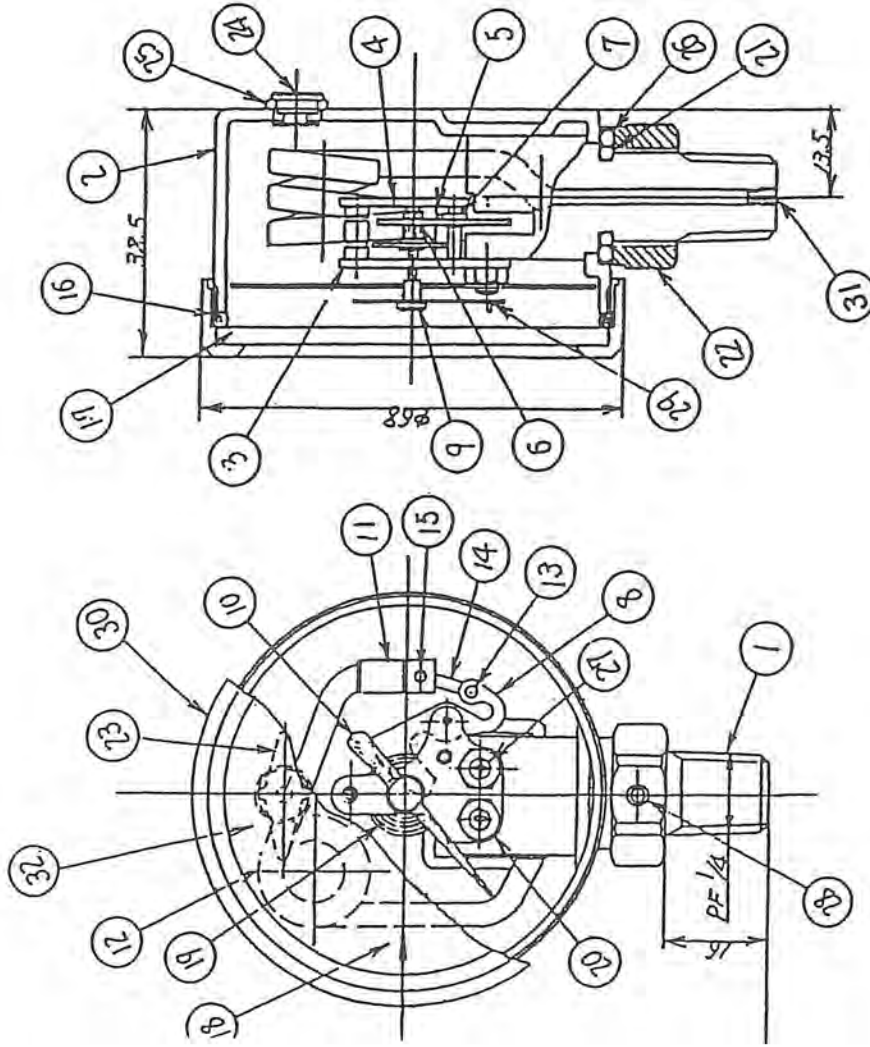
NO.	ARTICLES	MATERIAL	METHOD
1	SOCKET	C3604BD"	
2	CASE	A 1050P	BLACK PAINT
3	RING	A C	BLACK PAINT

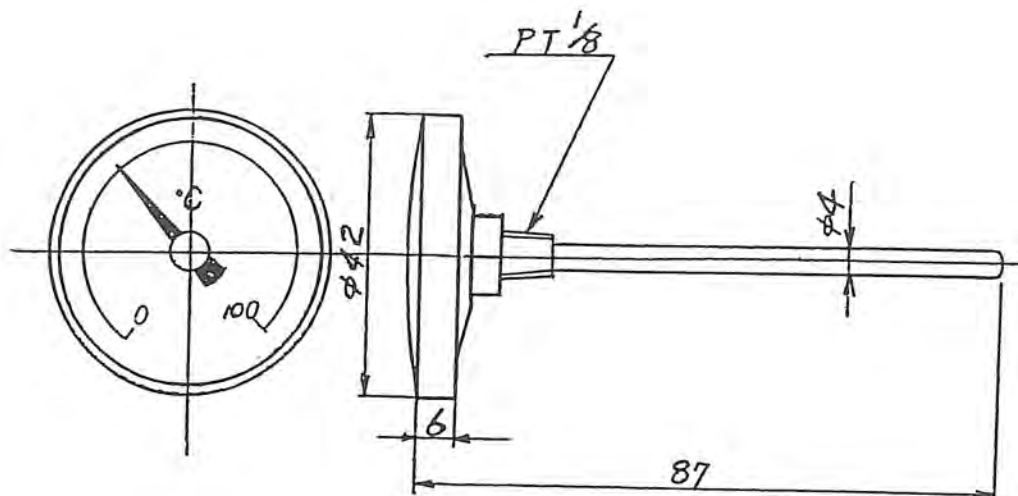
OIL FILLED PRESSURE GAUGE
AS 1/4 x φ60

YAMAMOTO KEIKI MFG. CO., LTD.

'82.5.1

32	GLYDERIN	GLYDERIN	GO / = 90 /
31	THROTTLER	C360480 ^W	3 x 0.3
30	RING	A C	PAINTED BLACK
29	POINTER STOPPER	C360480 ^W	NI. PLATED
28	FIXED LOCK SCREW	S W B M	M4
27	DIAL	C360480 ^W	M2.3.3 NI. PLATED
26	0.00 RING	NITRIL RUBBER	S16 NUT USE
25	0.00 RING	NITRIL RUBBER	J192401-P5
24	SAFETY VALVE	C360480 ^W	NI. PLATED
23	SAFETY SPRING	SUS	—
22	FIXING NUT	C360480 ^W	—
21	0.00 RING	NITRIL RUBBER	S12 SOCKET USE
20	FIXING BOLT	C360480 ^W	M4 x 0.7
19	HAIR SPRING	C53418	—
18	DIAL	A1050P	—
17	GLASS	ACRYLIC GLASS	T = 3
16	0.00 RING	NITRIL RUBBER	JASO - 2060
15	COUPLING PIN	SUS - 304	85 - V
14	COUPLING ROD	C5191P	T = 1.0
13	COUPLING PIN	SUS - 304	85 - V
12	BURDON	C1220T	WELDING FIXED
11	CAP	C360480 ^W	WELDING FIXED
10	POINTER	A1050P	PAINTED BLACK
9	POINTER HEAD	C360480 ^W	NI. PLATED
8	SECTER	C5191P	T = 1.0
7	SECTER. PILLON	SUS - 304	φ1.4
6	PINION	SUS - 304	M-0.2 Z-12
5	SUPPORT	C360480 ^W	φ4
4	BRAS PLATE	C5191P	T = 1.4
3	BRAS PLATE	C5191P	T = 1.4
2	CASE	A1050P	PAINTED BLACK
1	SOCKET	C360480 ^W	—
NO	NAMES	MATERIAL	SPECIFICATION
CHIEF <i>P. S. S. S.</i>			
MANAGER <i>P. S. S. S.</i>			
OPER <i>P. S. S. S.</i>			
DIAL AS 1/4 x 960			
OIL FILLED PRESSURE GAUGE			
SCALE			
1/1			





SPECIFICATION :

-20°C
• TEMPERATURE SCALE : 0°~100°C (32°F~212°F)

GRAPHICAL SYMBOL

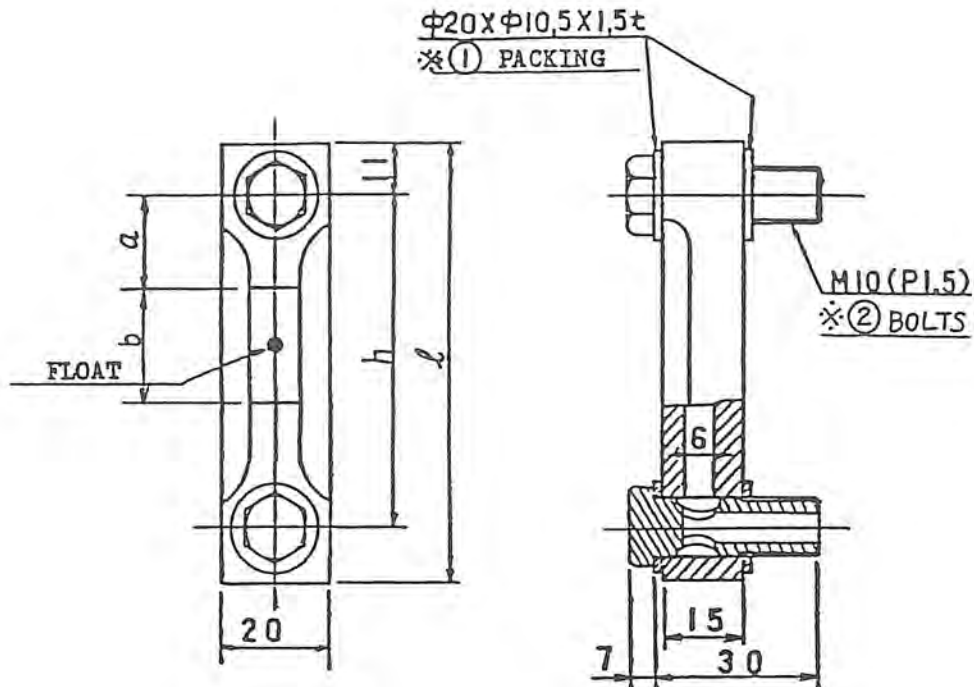


THERMOMETER

DT-42

TOKYO KEIKI CO., LTD

DRAWN	CHECKED	DESIGNED	APPROVED
T. Hanai	K. Sawayama		T. Hanai
SCALE	DATE	SHEET	CONTINUED
1/1	20.12.77	A	VPA42351G



MODEL NO.	l	h	a	b
OLG2 -100	122	100	20	40
OLG2 -200	222	200	30	60
OLG2 -300	322	300	30	60

MODEL CODE

F - OLG2 - 100

NONE-MINERAL OIL — OIL LEVEL GAUGE CENTER CtoC (h)
 "F" — WATER GLYCOL — OIL LEVEL GAUGE SERIES NO.
 PHOSPHATE
 ESTERS

*MARK MATERIALS

MARK	(1) PACKING	(2) BOLTS
NONE	TOMBO #1920	SS41
"F"	TOMBO #1000	SUS304

MANUFACTURE
 MARUWA SANSYO CO., LTD.

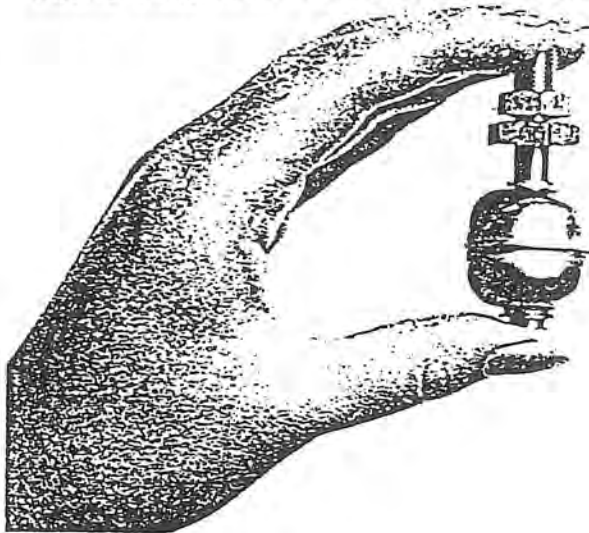
OIL LEVEL GAUGE

TOKYO KEIKI CO., LTD.

DRAWN	CHARGED	CHECKED	APPROVED
<i>M. Fukuda</i>		<i>S. Kubo</i>	<i>T. Ikeda</i>
SCALE	DATE	SIZE	COMPANY
	80.7.25	A	VKP05008

MICRO-SIZE, HIGH PERFORMANCE, LOW PRICE

OL SWITCH



OL Switch was specially developed to detect the Upper and Lower Level of Oil Tank where no spark is allowed, in the smallest possible size by utilizing the Reed Switch of very long life.

OLV-2 is mainly used for General Oil and Water Tank, and OLV-5 is specially designed for High Temperature and Medical Liquids by using Stainless Steel for Body and Float.

USAGE:

Fuel Tank, Lubricant Tank, General Oil Tank, Hydraulic Pressure Machine, Manufacturing Machine, Engine, Washing Machine, Vending Machine, Agricultural Machine, Air-Conditioning Machine, etc.

SPECIFICATION:

Model	OLV-2A-1	OLV-2A-2	OLV-2B-1	OLV-2B-2	OLV-5-1	OLV-5-2	OLH-2-1	OLH-2-2
Volts	AC100V	AC200V	AC100V	AC200V	AC100V	AC200V	AC100V	AC200V
USE for :	Oil & Water		Oil & Water		Oil, Water, and Medical Liquids		Oil & Water	
Pressure : kg/cm ²	30		30		20		30	
Temperature : °C	90		90		100		90	
Material : UNION	Poly-Acetar		BS		nil			
NUT	Poly-Acetar		BS		SUS304		Poly-Acetar	
BODY	Poly-Acetar		BS		SUS304		Poly-Acetar	
FLOAT	Foamed Phenole		Foamed Phenole		SUS304		Foamed Phenole	
STOPPER	SUS304		SUS304		SUS304		SUS304	

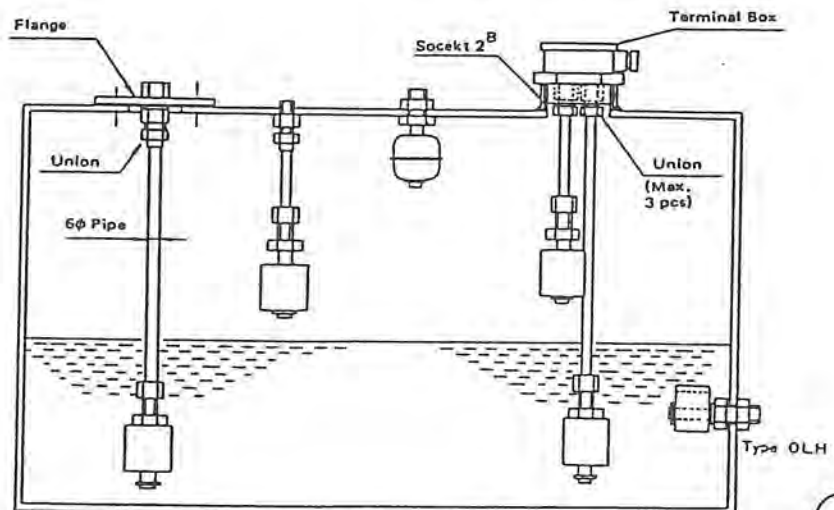
* Each Model with 30cm lead.

REED SWITCH RATINGS

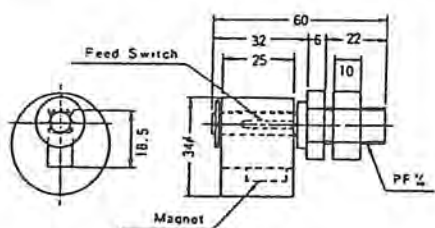
Breaking Capacity: AC 12VA, DC 10W
 Max. Break Current: AC 0.6A, DC 0.5A
 Max. Break Voltage: AC 165V, DC 200V (for AC 100V)
 AC 360V, DC 500V (for AC 200V)

Resistance at Maximum Load: 0.1 Ohm
 Life: 10 x 10⁴ times

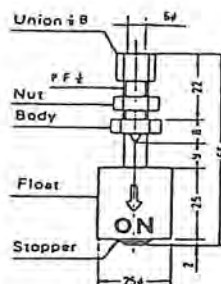
EXAMPLE OF MOUNTING



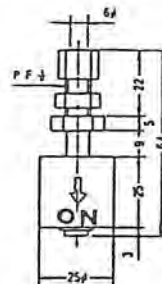
MEASUREMENT



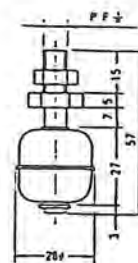
OLH-2



OLV-2A

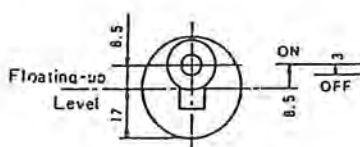


OLV-2B

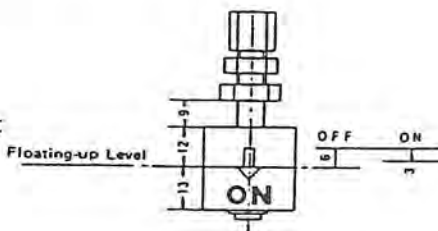


OLV-5

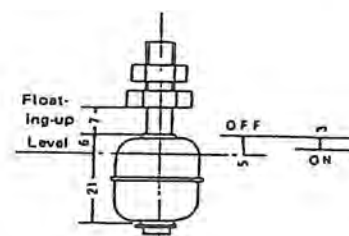
ACTUATION



OLH-2



OLV-2A-2B

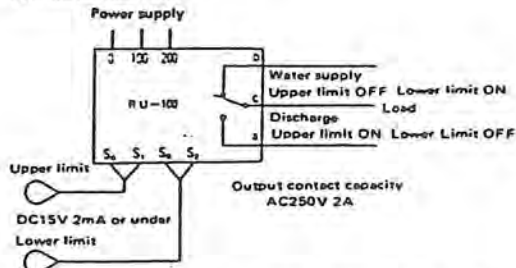


OLV-5

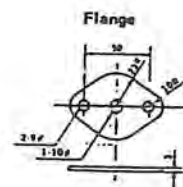
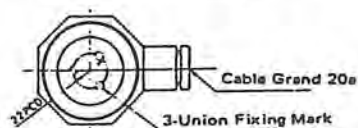
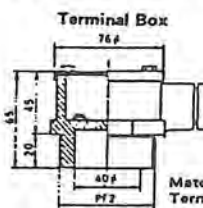
By putting Float upside-down, Switching ON-OFF will be reversed (i.e. OFF-ON). Actuation Level is situated at the same position.

FIXING ACCESSORIES

Type RU100 Relay Unit



- Type RU100 Relay Unit is not standard equipment, so please order separately.



LINES OR PRODUCTS

- Power Level Switches (Bin Levelers)
- Resistance Type Liquid Level Indicating Alarms
- Pulse Type Liquid Level Indicating Alarms
- Float Type Liquid Level Indicating Alarms
- Pneumatic Liquid Level Switches
- Magnetic Liquid Level Switches
- Two Liquid Interface Detection Switches
- Float Type Liquid Level Switches
- Reed Type Liquid Level Switches
- OL Switches
- Quick Floats
- Electrode Type Level Sensors
- Cable Floats
- Relay Units
- Buzzer Units
- Line Drivers

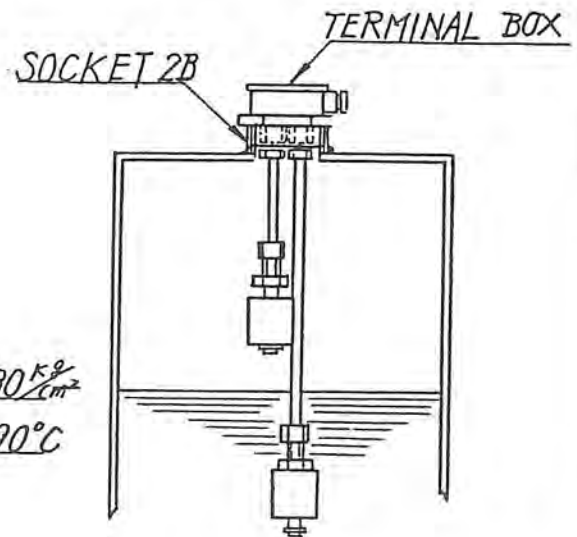
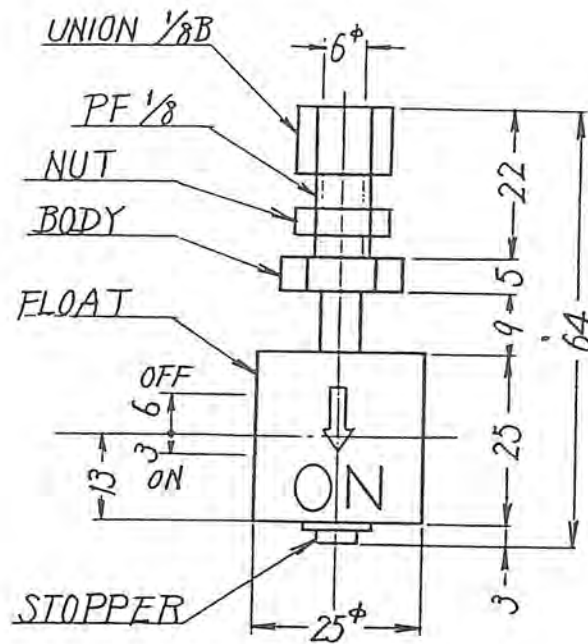
NOHKEN CO., LTD.

Agent

Head Office: 15-8, Hiroshiba-cho, Suita, Osaka 565 Tel: (06) 386-8141

Tokyo Office: 23, Matsunaga-cho, Kanda, Chiyoda-ku, Tokyo 101 Tel: (03) 253-5891

Kyushu Office: 1-7-1 Tate-cho, Kokura-Kita-ku, Kita-Kyushu 803 Tel: (093) 581-1430



NOTES:

MAX OPERATING PRESSURE $30 \frac{\text{kg}}{\text{cm}^2}$
 MAX WORKING TEMPERATURE 90°C

OIL LEVEL SWITCH

OLV-2B-1 (Nohken)

 TOKYO KEIKI CO., LTD.

DRAWN		CHARGED		CHECKED		APPROVED	
T. Kiguchi		S. Kubo		H. Miyamoto		H. Soji	
SCALE	DATE	SIZE	DRAWING NO.				
1/1	18 APR 74	A	VPA18618G				

BALANCED-PISTON TYPE PRESSURE BALANCE VALVE DESIGN MANIFOLD OR SUBPLATE MOUNTING

GENERAL DATA

THIS MULTI-FUNCTION VALVE IS USED WHERE CONTROLLED INLET PRESSURE IS ALWAYS DESIRED REGARDLESS OF INLET PRESSURE VARIATION AND OUTLET PRESSURE INTENSIFICATION BY EXTERNAL LOAD. WHEN OUTLET PRESSURE IS NOT IDENTIFIED THE VALVE SET-POINT REDUCES PRESSURE TO PRESET FUNCTIONS AND WHEN INTERPRETED THE VALVE PERFORMS PRESSURE RELIEF VALVE FUNCTIONS.

SPECIFICATIONS

MAX. OPERATING PRESSURE 70 kgf/cm²
MAX. FLOW 30 llt/min
ADJUSTABLE PRESSURE RANGE 10-70 kgf/cm²

PRESSURE SETTING

ADJUST PRESSURE BY LOOSENING JAM NUT AND TURNING ADJUSTING HANDLE COUNTERCLOCKWISE ROTATION INCREASES PRESSURE, CLOCKWISE ROTATION DECREASES PRESSURE.

CONSTRUCTION

SERIES BLG VALVES ARE OF COMPOUND TYPE CONSTRUCTION.

FLUID AND SEALS

FOR TEMPERATURES BETWEEN 65 AND 155° F, A FLUID VISCOSITY RANGING BETWEEN 150 SSU AND 250 SSU AT 100°F IS RECOMMENDED. THE USE OF SYNTHETIC, FIRE-RESISTANT FLUID REQUIRES THE USE OF SPECIAL SEALS; CONTACT SPERRY VICKERS REPRESENTATIVE.

DRAIN CONNECTION

DRAIN CONNECTION SHOULD BE PIPED DIRECTLY TO TANK TO MINIMIZE BACK PRESSURE.

VENT CONNECTION

WHEN REMOTE CONTROL IS NOT REQUIRED, PLUG VENT CONNECTION.

EXCHANGABLE IS TO DESIGN

MODEL CODE BREAKDOWN

BLG - 02 - B - 11
SERIES BLG
VALVE SIZE
(1/2" - 1 1/4" INCH)
ADJUSTABLE PRESSURE
(8 - 1 MAX. 70 BAR)
DESIGN NUMBER
(SUBJECT TO CHANGE)

* 3/16" NPT THREAD IS EQUIVALENT TO BSPT THREAD

137

FULLY EXTENDED

PRESSURE ADJUSTMENT CONTROL Z

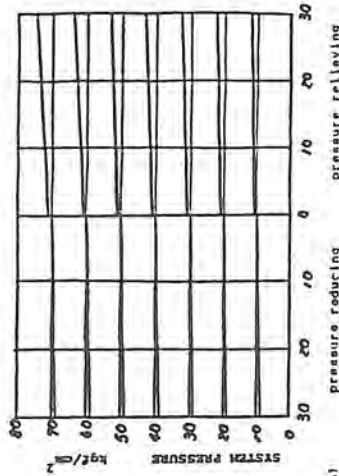
SECTION '2-2'

JAM NUT

DRAIN CONNECTION (1/4 DIA)

4 HOLES FOR MOUNTING Ø.5 DIA

NOMINAL OVERRIDE CHARACTERISTIC



FLOW llt/min

TANK CONNECTION (1/2 DIA)

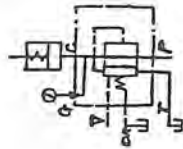
VENT CONNECTION (4 DIA)

PRESSURE INLET CONNECTION (1/2 DIA)

* PRESSURE GAUGE CONNECTION
1/4 NPT TID

CYLINDER CONNECTION (1/2 DIA)

STANDARD GRAPHICAL SYMBOLS
AND TYPICAL APPLICATION



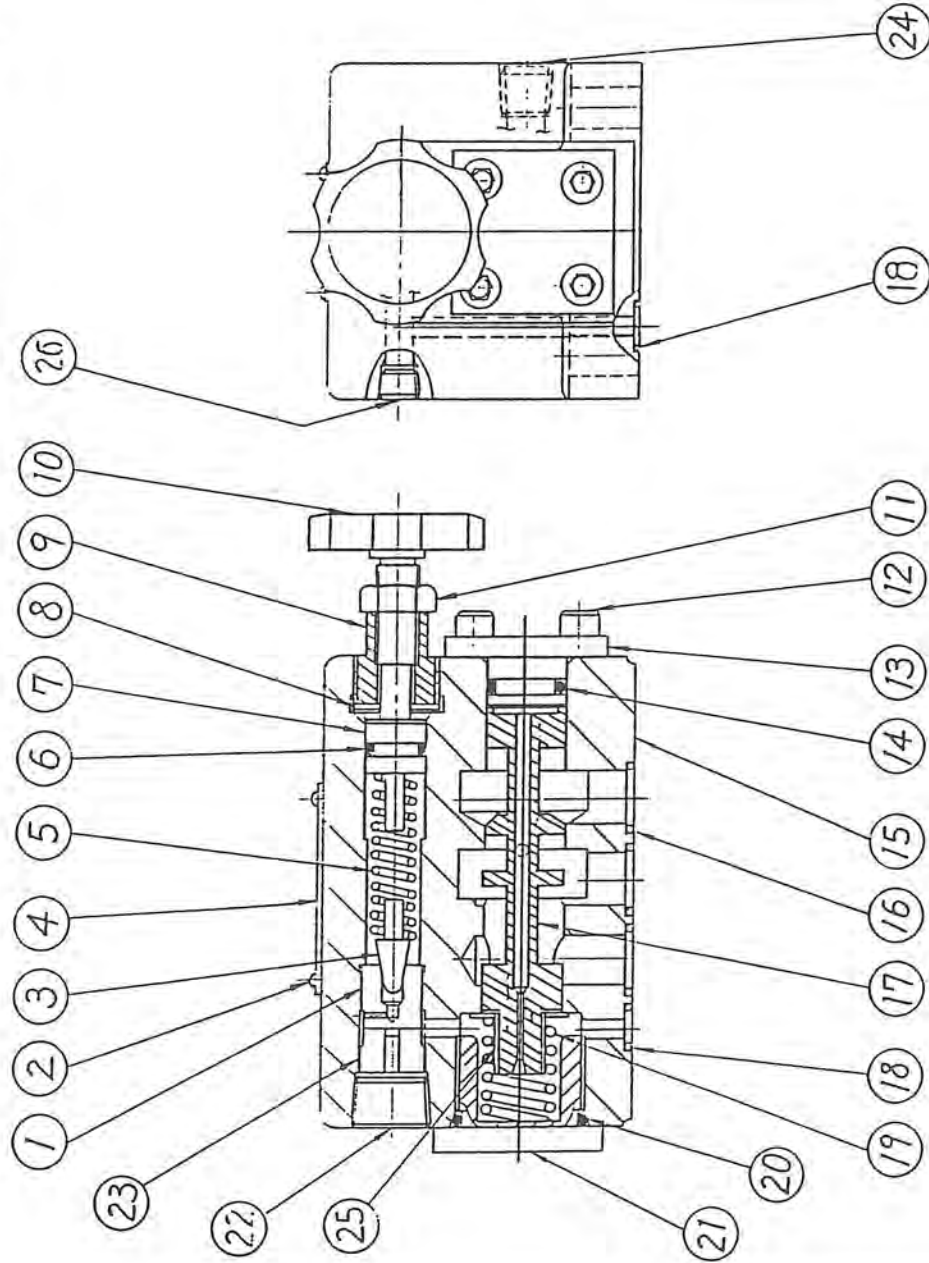
PRESSURE BALANCE VALVE
MODEL SERIES BLG-02-B-10/11
INSTALLATION DRAWING

TOKYO KIKI CO., LTD.

DATE 2-21-80
DRAWN BY 2654/11
CHECKED BY
VA 22397 0

REVISED 05.7.21

25	GUIDE TUBE	VA 28596	1	24	$\frac{1}{4}$ PLUG	VPJ 7075	1
26	$\frac{1}{8}$ PLUG	VP 113000	1	23	PLUG	VA 12748	1
				22	$\frac{3}{8}$ PLUG	VPJ 7076	1
				21	PLUG	VA 19542	1
				20	ORING	007991219	1
				19	SPRING	VA 19545	1
				18	ORING	007901117	2
				17	SPOOL	VA 19543	1
				16	ORING	007901417	3
				15	BODY	VA 19547	1
				14	ORING	007911117	1
				13	COVER	VA 19544	1
				12	M5 SCREW	001950101	4
				11	$\frac{3}{8}$ NUT	VP 1485	1
				10	KNOB	VA 9378A	1
				9	SCREW	VP 283949	1
				8	WASHER	VP 226317	1~3
				7	PLUNGER	VP 283948	1
				6	ORING	007901217	1
				5	SPRING	VP 2280	1
				4	NAME PLATE	VA 10209	1
				3	POPPET	VP 290057	1
				2	SCREW	000919050	4
				1	SEAT	VA 14927	1
				INDEX NO.	PART NAME	PART NO.	QTY



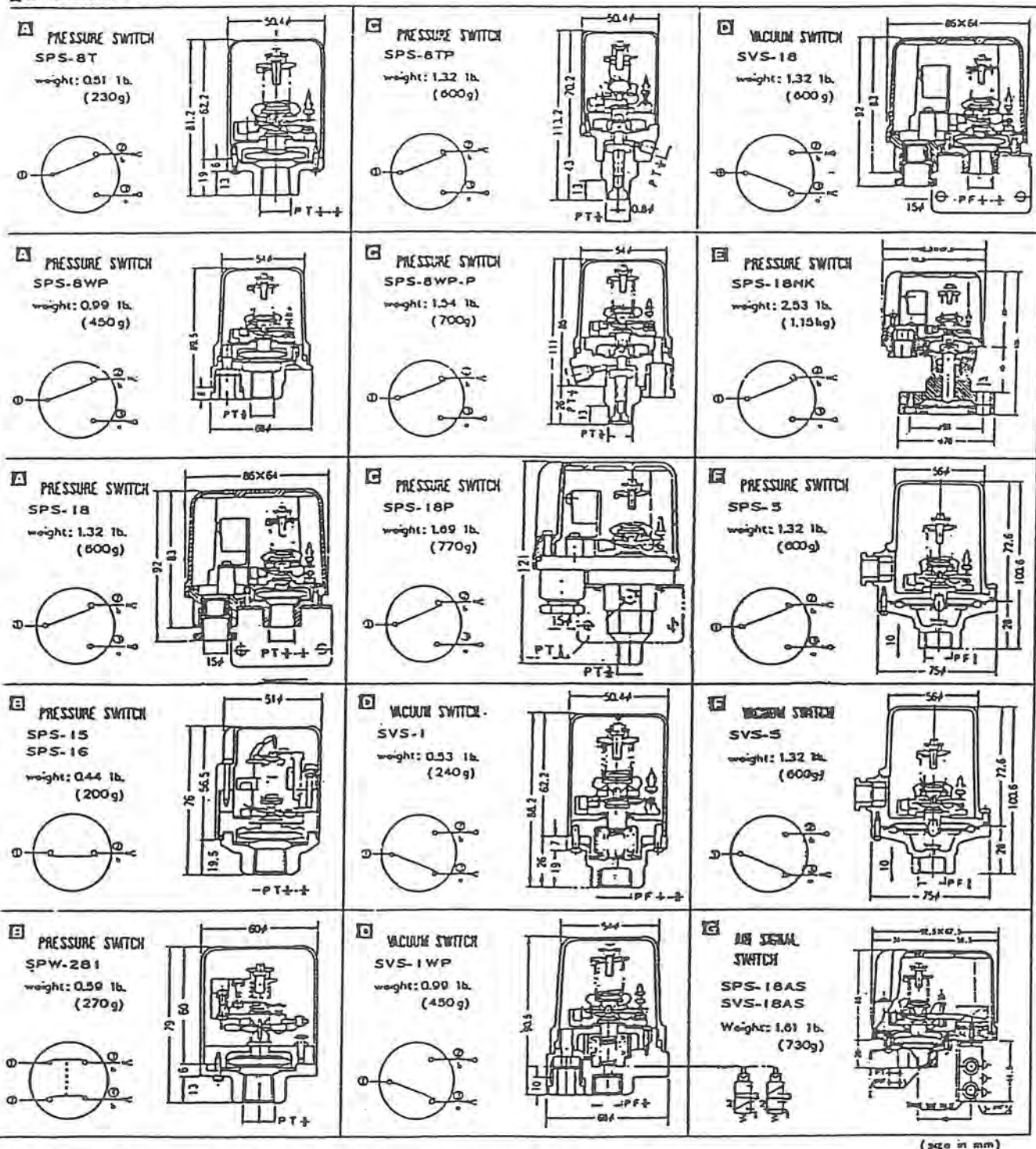
BALANCER VALVE BLG-02-B-11

DRAWN	DESIGNED	CHECKED	APPROVED
E.Hol			
SCALE	DATE	REV	QTY

REVISED '87.10.30

85.7.23 B VA 32222G

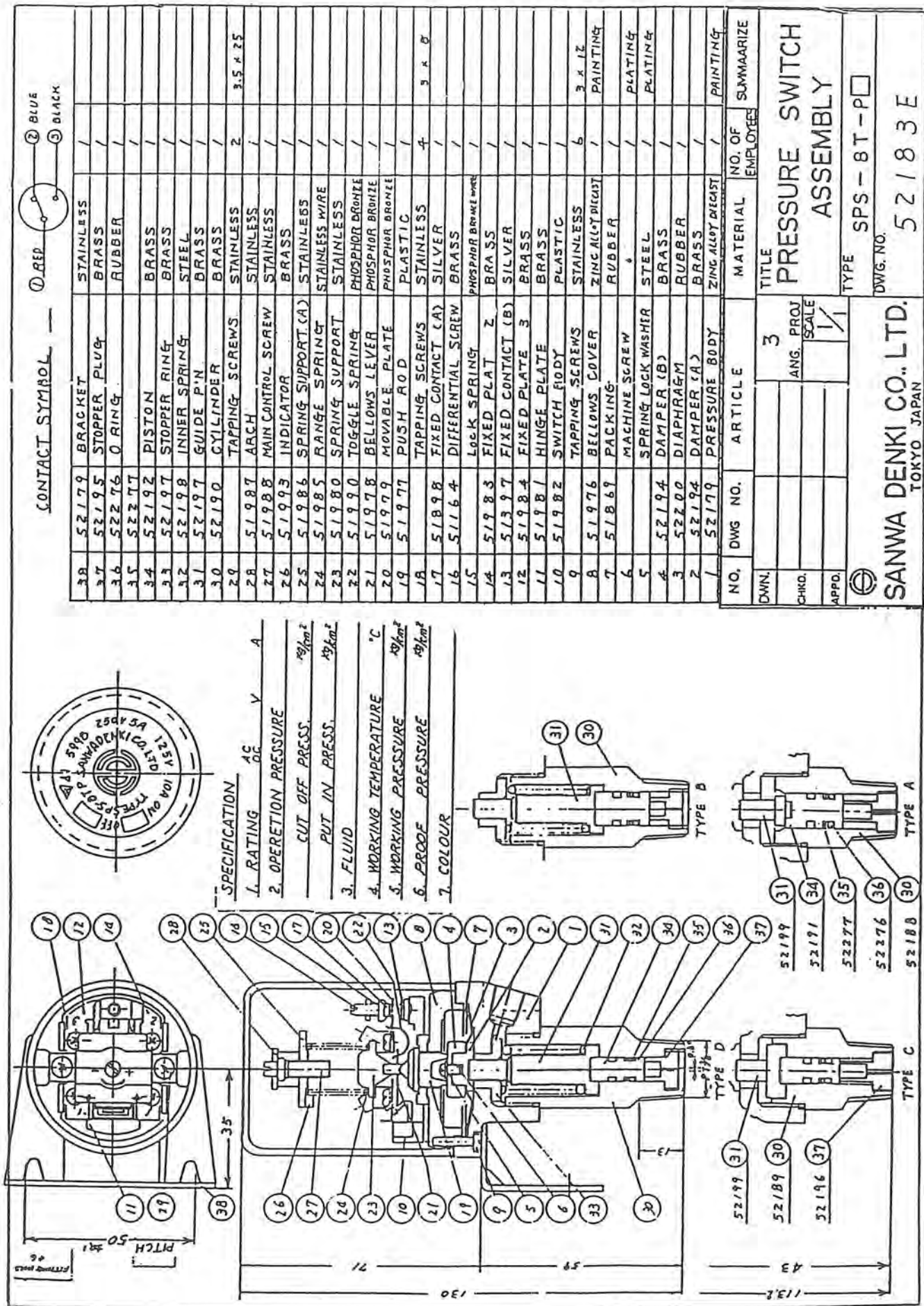
■ DIMENSIONS



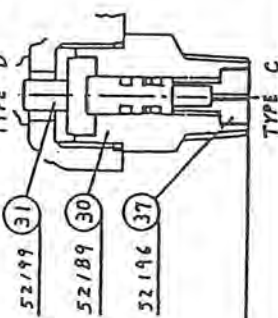
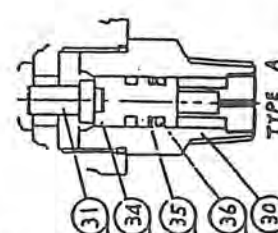
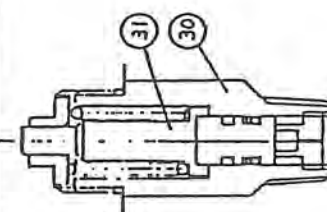
■ ORDERING INFORMATION When ordering, specify the articles belows.

1	MODEL NO	Specify required Model.
2	FLUIDS USED	Specify Air, Water, Oil or Inert Gases etc.
3	ON/OFF POINTS	Specify required ON/OFF points in terms of kg/cm ² , mmHg or mmAq.
4	PORT SIZE	Specify 1/4, 1/2 PT or 1/4, 1/2 PF. (NPT thread available upon request)
5	OTHERS	Specify if you have any additional requests.

- ON/OFF Points will be set at factory before shipment. If one point control is to be used for Alarm etc., be sure to inform us of upper or lower limit value.
- Other Voltages, Porting, and Operating Pressure Ranges are available upon customers' specifications.
- Corrosion Resistant Switches, all of Stainless Steel or PVC etc., are available upon special order.



- SPECIFICATION**
- 1. RATING AC V A
 - 2. OPERATION PRESSURE
 - CUT OFF PRESS. 10 kg/cm^2
 - PUT IN PRESS. 10 kg/cm^2
 - 3. FLUID
 - 4. WORKING TEMPERATURE $^{\circ}\text{C}$
 - 5. WORKING PRESSURE 10 kg/cm^2
 - 6. PROOF PRESSURE 10 kg/cm^2
 - 7. COLOUR



NO.	DWG NO.	ARTICLE	MATERIAL	NO. OF EMPLOYEES
38	52179	BRACKET	STAINLESS	1
37	52195	STOPPER PLUG	BRASS	1
36	52276	O RING	RUBBER	1
35	52277			1
34	52192	PISTON	BRASS	1
33	52197	STOPPER RING	BRASS	1
32	52198	INNER SPRING	STEEL	1
31	52197	GUIDE P.N.	BRASS	1
30	52190	CYLINDER	BRASS	1
29		TAPPING SCREWS	STAINLESS	2
28	51987	ARCH	STAINLESS	1
27	51988	MAIN CONTROL SCREW	STAINLESS	1
26	51993	INDICATOR	BRASS	1
25	51986	SPRING SUPPORT (A)	STAINLESS	1
24	51985	RANGE SPRING	STAINLESS WIRE	1
23	51980	SPRING SUPPORT	STAINLESS	1
22	51990	TOGGLE SPRING	PHOSPHOR BRONZE	1
21	51978	BELLOWS LEVER	PHOSPHOR BRONZE	1
20	51979	MOVABLE PLATE	PHOSPHOR BRONZE	1
19	51977	PUSH ROD	PLASTIC	1
18		TAPPING SCREWS	STAINLESS	4
17	51898	FIXED CONTACT (A)	SILVER	1
16	51164	DIFFERENTIAL SCREW	BRASS	1
15		LOCK SPRING	PHOSPHOR BRONZE WIRE	1
14	51983	FIXED PLATE 2	BRASS	1
13	51397	FIXED CONTACT (B)	SILVER	1
12	51984	FIXED PLATE 3	BRASS	1
11	51981	HINGE PLATE	BRASS	1
10	51982	SWITCH BODY	PLASTIC	1
9		TAPPING SCREWS	STAINLESS	6
8	51976	BELLOWS COVER	ZINC ALLOY DIECAST	1
7	51869	PACKING	RUBBER	1
6		MACHINE SCREW		1
5		SPRING LOCK WASHER	STEEL	1
4	52194	DAMPER (B)	BRASS	1
3	52200	DIAPHRAGM	RUBBER	1
2	52194	DAMPER (A)	BRASS	1
1	52179	PRESSURE BODY	ZINC ALLOY DIECAST	1

TITLE
PRESSURE SWITCH ASSEMBLY

NO. OF EMPLOYEES
3

ANG. PROJ. SCALE
1/1

TYPE
SPS-8T-PO

DWG. NO.
52183E

SANWA DENKI CO., LTD.
TOKYO JAPAN

FENWAL

TE022C

FCJ

SERIES 23000, MINIATURE NON-INDICATING TEMPERATURE CONTROLLERS

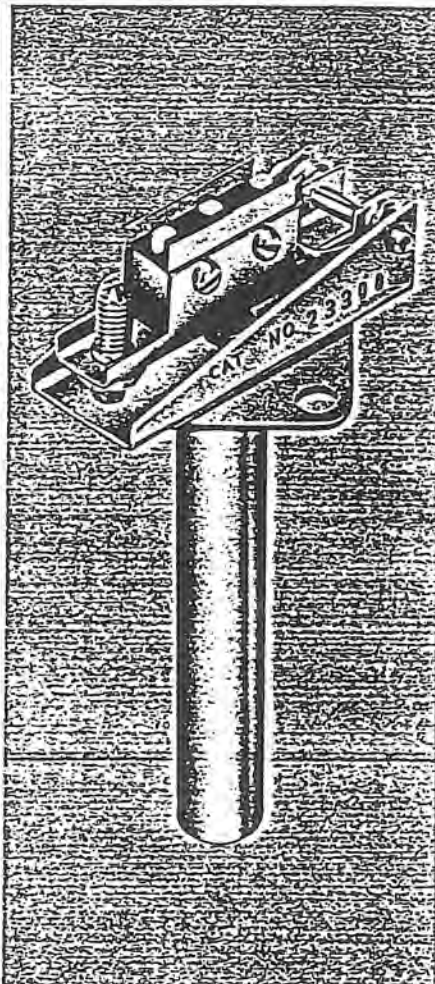
LIQUID EXPANSION-SNAP ACTION THERMOSWITCH UNITS

Fenwal presents a complete line of snap-action units with either single or dual switch control. Control action is provided by an expandable liquid acting on a bellows assembly. Bellows motion, created by volume changes of the liquid, actuates the switch contacts through a push rod.

- **HIGH LOAD CAPACITY** — a variation of application rated switches with current ratings up to 5 amps 125—250 VAC, 0.2 amps 250 VDC.
- **FAST RESPONSE** — expandable liquid which surrounds bellows is in direct contact with temperature sensing outer shell.
- **CUSTOMER ADJUSTED** — a temperature adjusting screw provides simple adjustment of temperature range. Switch can easily be set at any temperature within controller's range.
- **"INDEPENDENTLY ADJUSTABLE"** — on dual switch units each switch may be set individually at any temperature setting within its range thus allowing completely independent action.
- **"TRAVELING DIFFERENTIAL"** — dual switch units are provided with a special traveling differential frame which establishes a predetermined relationship between switches.

Example : If a 10°C differential is selected, any setting of the first switch (with the short adjustment screw) will cause the second to function 10°C higher. This differential is adjustable by the user.

- **VARIETY OF TEMPERATURE RANGES** — single switch and dual switch models are available with 3 temperature ranges from -10 to 150°C.



CAT. NO.	DESCRIPTION	TEMPERATURE RANGE			RATINGS
230XX	SKELETON FRAME COVER is provided by request	Last two digits (XX) identify the Temperature Range			CURRENT RATING AC 5A...250V DC 5A... 30V FACTORY SETTING TOLERANCE ±3°C
231XX					
233XX		00	10	20	
231XX-H	DRIP PROOF MODEL	80° ~	30° ~	-10° ~	
237XX	JUNCTION BOX, DUAL SWITCH	150°C	100°C	50°C	
238XX	JUNCTION BOX, DUAL SWITCH				

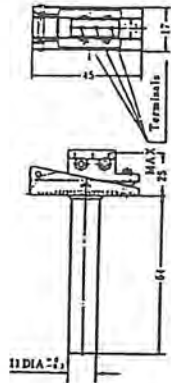


FENWAL CONTROLS OF JAPAN, LTD.

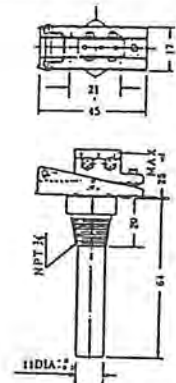
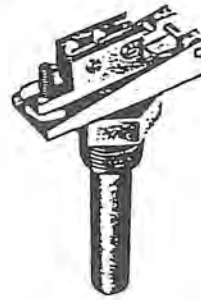
SERIES 23000

SINGLE SWITCH CONTROLS

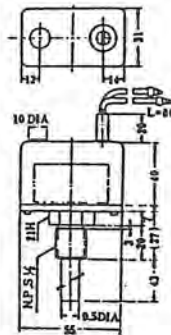
230XX



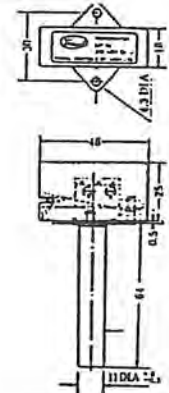
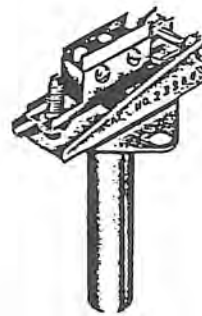
231XX



231XX-H

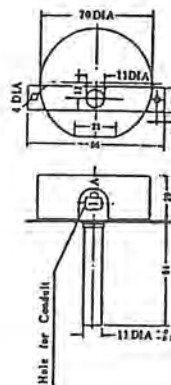
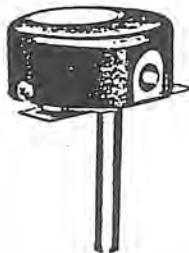


233XX

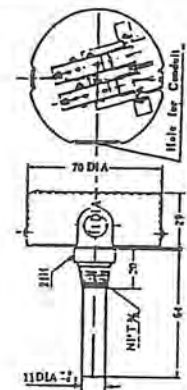
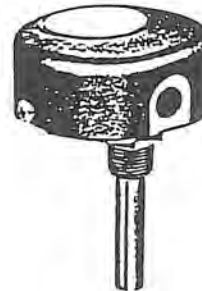


DUAL SWITCH CONTROLS

237XX



238XX



MODIFICATIONS

3

FACTORY TEMPERATURE SETTING

Any unit may be factory preset at any temperature within its listed range. Unless this Modification is specified on order, unit will be shipped, set at approximately 25°C. Specify temperature setting when ordering. Factory setting tolerance on all 23000 Series THERMO-SWITCH Controls is $\pm 3^\circ\text{C}$.

SPECIAL FEATURES

-S

STAINLESS STEEL SHELL

Where corrosion or electrolysis is suspected S.S SHELL instead of BRASS SHELL may increase controller life.

NOTE: This Special Feature is applicable to all units.



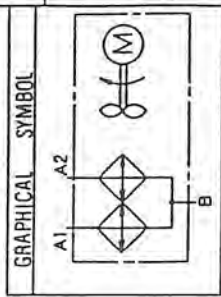
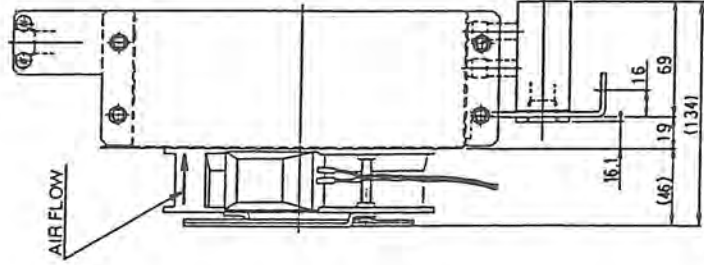
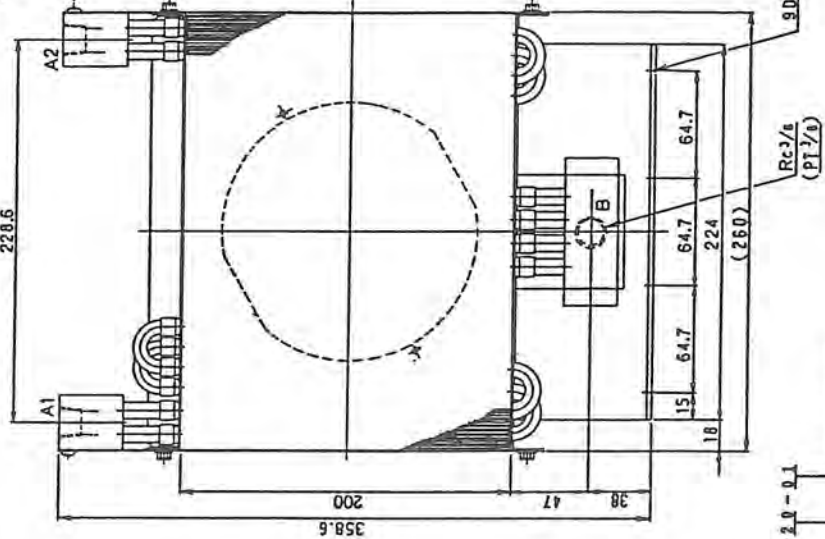
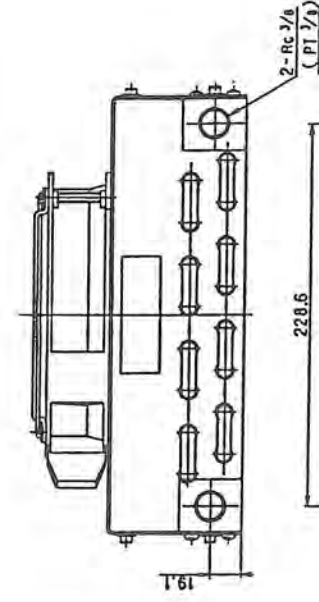
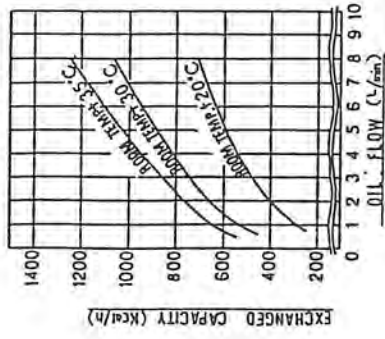
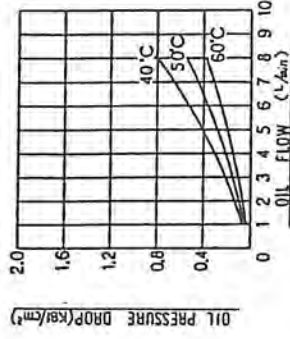
CONTROLS TEMPERATURE.....RELIABLY

Fenwal Controls of Japan, Ltd.

4-10, Nishishinbashi 1-chome, Minato-ku, Tokyo, Japan

Printed in Japan '77/10

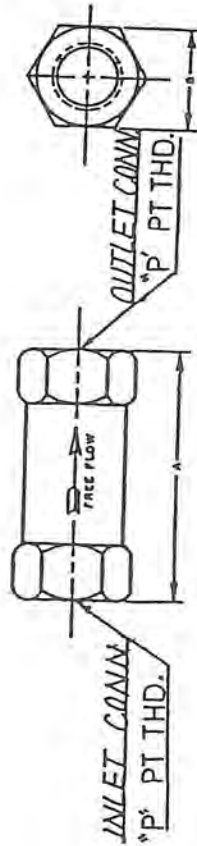
MOTOR SPECIFICATION	
KIND	CONDENSER MOTOR (WITH CONDENSER)
INPUT CURRENT	100V 50/60 Hz, 31/33 W 0.44 A
MAKER	NMB
MODEL NO.	SV5FC-10T-B30-B0T (100V)
ADJUNCTION	SV5FC-20T-B30-B0S (200V)
LEAD	1.5m (JIS C 5305 VFF NEU)
MASS	6.3 kg (0.75lb (30/0.18) 2 CORE)



FAN COOLER
 MF-3-XXXV-20-01
 DATE 1900 3 1
 DRAWING NO. 41932.72.5A
 SHEET 1/1
 TOKYO KENBO CO., LTD.

MF-3-100V-20-01
 MINI FAN COOLER
 SERIES NO. 2, 3
 REGISTER NO.
 DESIGN NO.
 VOLTAGE 100V, 200V
 (115, 220, 230, 240V)

VICKERS IN-LINE TYPE CHECK VALVES
PIPE THREAD CONNECTIONS
SPRING CLOSED CONSTRUCTION



GENERAL USAGE

FOR USE IN FLUID POWER SYSTEMS USING PETROLEUM OR FIRE RESISTANT FLUIDS RATED CAPACITY BASED ON USING HYDRAULIC OIL HAVING A VISCOSITY RATING OF 32 cSt @ 37.8°C
OPERATING PRESSURE ----- MAX RECOMMENDED 210 Nf/cm².
CRACKING PRESSURE AS TABULATED INDICATES PRESSURE REQUIRED TO OPEN VALVE AND ALLOW FREE FLOW.
MODEL NUMBER MUST BE SPECIFIED COMPLETE WHEN ORDERING TO INSURE CORRECT SIZE AND CRACKING PRESSURE REQUIRED.

CAUTION

DO NOT USE THIS VALVE TO CHECK A HIGH VELOCITY REVERSE FLOW RESULTING IN SHOCK CONDITIONS WHERE SUCH CONDITIONS EXIST VICKERS RIGHT ANGLE CHECK VALVE MUST BE USED.

MODEL NO.	*P*	CAPACITY	CRACKING PRESSURE	A	B	MASS
DT8PI-02-5-10-JA-J	1/4	12.14	0.35 4.57	57.1	22.2	0.2 kg
DT8PI-02-65-10-JA-J	3/8	30.3	0.35 4.57	76.2	25.4	0.2
DT8PI-03-5-10-JA-J	3/4	75.8	0.35 4.57	98.4	38.1	0.7
DT8PI-03-65-10-JA-J	1 1/4	189.5	0.35 4.57	133.4	63.5	2.3

GRAPHICAL SYMBOL

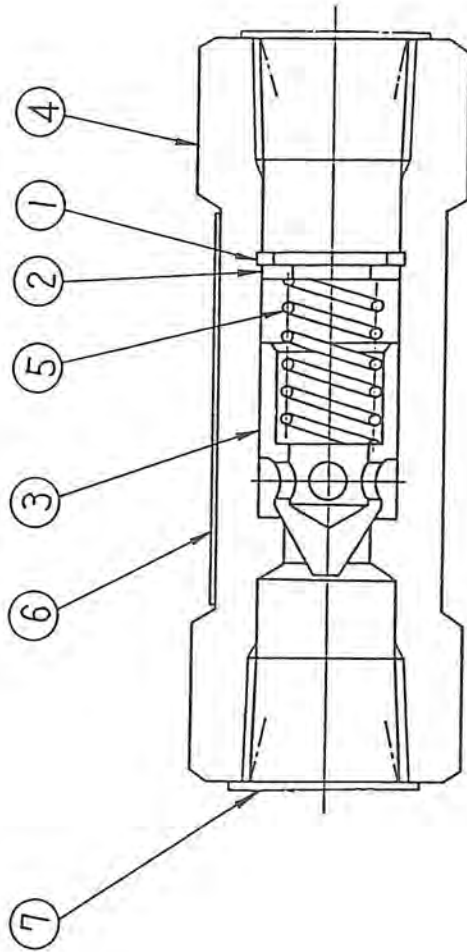


VICKERS

IN-LINE CHECK VALVE
DT8PI-**-5/65-10/11-JA-J

TOKYO KEIKI CO.LTD.

DRAWN	CHANGED	CHECKED	APPROVED
A. Hoshino			
SCALE	DATE	SIZE	MARKING
8.8	84	B	VAJ21558G



TABLE

DT8PI-03-65-10-JA-J	VP 123760
DT8PI-03-30-10-JA-J	VA 12224
DT8PI-03-5-10-JA-J	VP 1237
MODEL NUMBER	⑤ SPRING

7	CAP PLUG	VP 171212	2
6	NAME PLATE	VA 0807	1
5	SPRING	SEE TABLE	1
4	BODY	VPJ123739	1
3	POPPET	VP 123737	1
2	WASHER	VP 123740	1
1	SNAP RING	VP 106642	1
ITEM	PART NAME	PART NUMBER	QTY

IN-LINE CHECK VALVES
DT8PI-03-**-10-JA-J

TOKYO KEIKI CO., LTD.	
DRAWN	CHECKED
H. Saitoh	H. Saitoh
SCALE	DATE
1/1	June 13 '79
SIZE	DRAWING NO.
B	VAJ22490G

REVISED JULY 28 '83

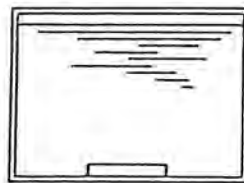
MAGNET

FEATURES:

1. As the excellent permanent magnets are used for the equipments, it is high in magnetic lux on the surface and can absorb the ferrous powder drastically.
2. A range of products in every size as standard ones are available for wider application to any equipments required.
3. Its weight was reduced to be light enough to handle easily.
4. There are two different types of fixing methods - one is fastened by the magnetic absorption while the other can be done by using bolts on the upper and side plates.

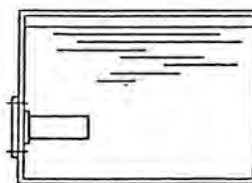
EXAMPLES HOW TO FIX:

To fix on the bottom



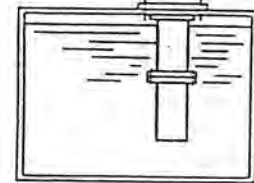
MFB-A Type

To fix on the side



MFB-B Type

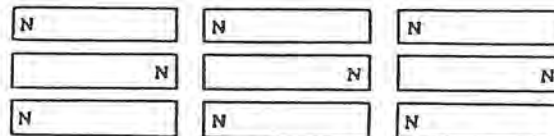
To fix by hanging from, the top



MFB-B & MFB-C Types

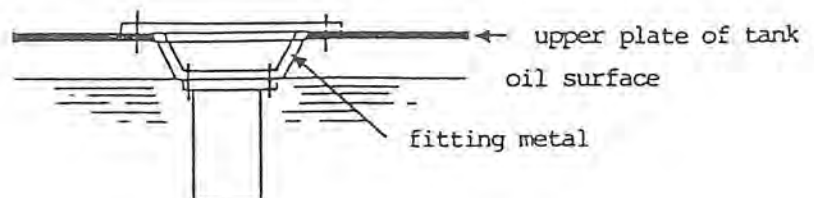
1. For MFB-A Type Fixing

- 1) To fix it on the bottom plate of tank keeping Up-side upper, by which it can be fastened not to move in transport because of its effective absorption.
- 2) In fixing mutiply, N-polar marks must be placed alternately as below for the effective absorption of the ferrous powder.



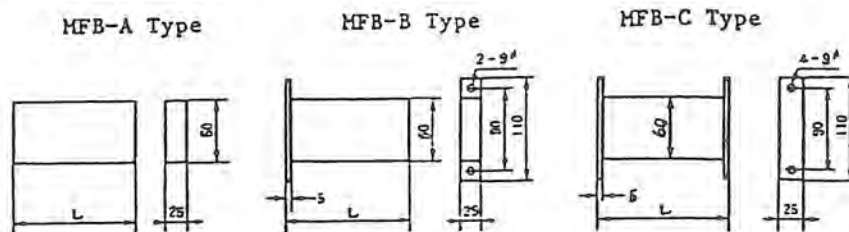
2. For MFB-B & MFB-C Types Fixing

- 1) When it is fixed to the upper plate, fitting metals must be used between the plate and oil surface (50 to 100mm in distance).



2) In case it is more than 250mm in distance from the surface, both MFB-250C and MFB-B can be used in combination.

SPECIFICATIONS



Type	Size (mm)	Surface Mag. Lux/Gauss				Wt. (kg)	Qty. of Oil in Tank
		Lg=0 (mm)	10	20	30		
MFB- 50A	60	1,900	700	350	200	0.4	30(Ltr.)
-100A	110					0.7	50
-150A	160					1.0	100
-200A	210					1.3	150
-250A	260					1.6	200
MFB- 50B	60	1,900	700	350	200	0.4	50
-100B	110					0.7	100
-150B	165					1.0	150
-200B	215					1.3	200
-250B	265					1.6	250
MFB-150C	170	1,900	700	350	200	1.0	150
-200C	220					1.3	200
-250C	270					1.6	250

HOW TO SEE THE TYPES OF THE ABOVE TABLE:

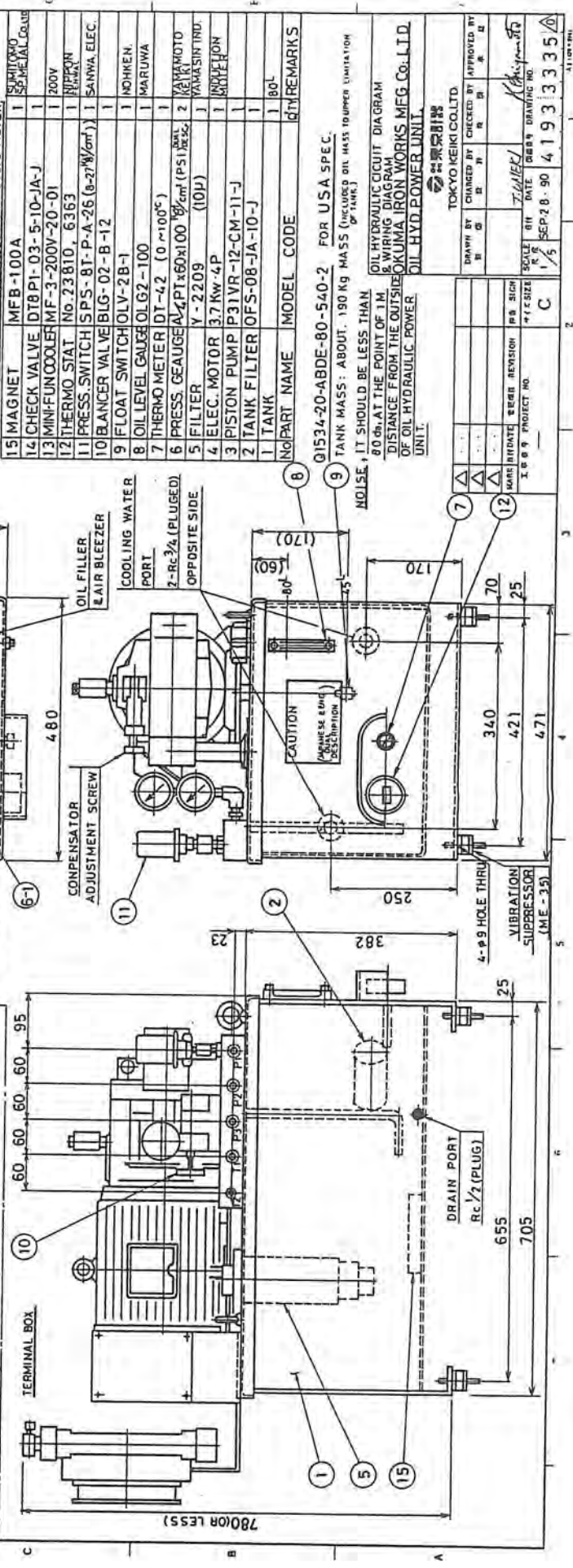
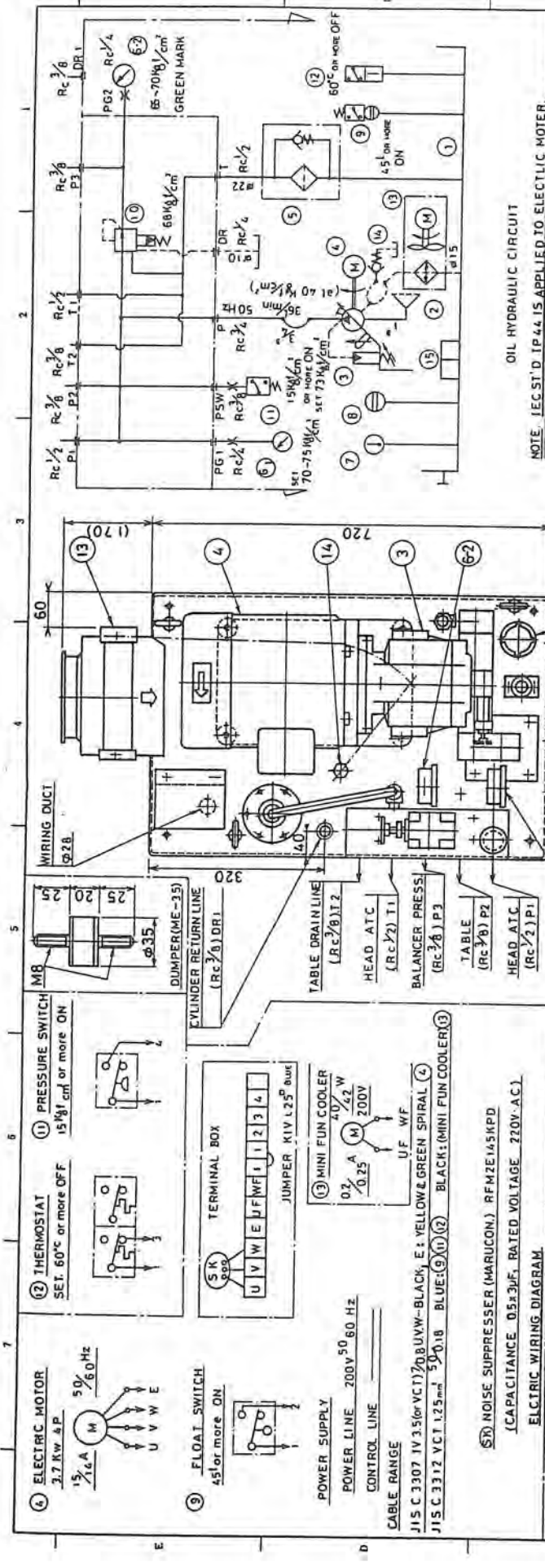
M.F.B. stands for Magnet Filter Block and the figures of 50 to 250 indicate the actual length of the magnets.

The last letter after the figures show as below:

- A: The Flange to fasten by the magnetic absorption is not fitted.
- B: The Flange is fitted on one side.
- C: The Flanges are fitted on both sides.

The other items of different sizes and types not specified above will be designed and manufactured exactly on demand.

SUMITOMO SPECIAL METALS CO., LTD.
5-22, Kitahama, Higashi-Ku, Osaka, Japan
Cable Address, "SUMITSUCO OSAKA"
Tel. (06) 220-8863 Telex. 522-2651



Q1534-20-ABDE-80-540-2 FOR USA SPEC.

9 TANK MASS: ABOUT 190 kg MASS (EXCLUDING OIL MASS TO UPPER LIMITATION OF TANK.)

NOISE, IT SHOULD BE LESS THAN 80 db. AT THE POINT OF 1M DISTANCE FROM THE OUTSIDE OF OIL HYDRAULIC POWER UNIT.

OIL HYDRAULIC CIRCUIT DIAGRAM

WIRING DIAGRAM

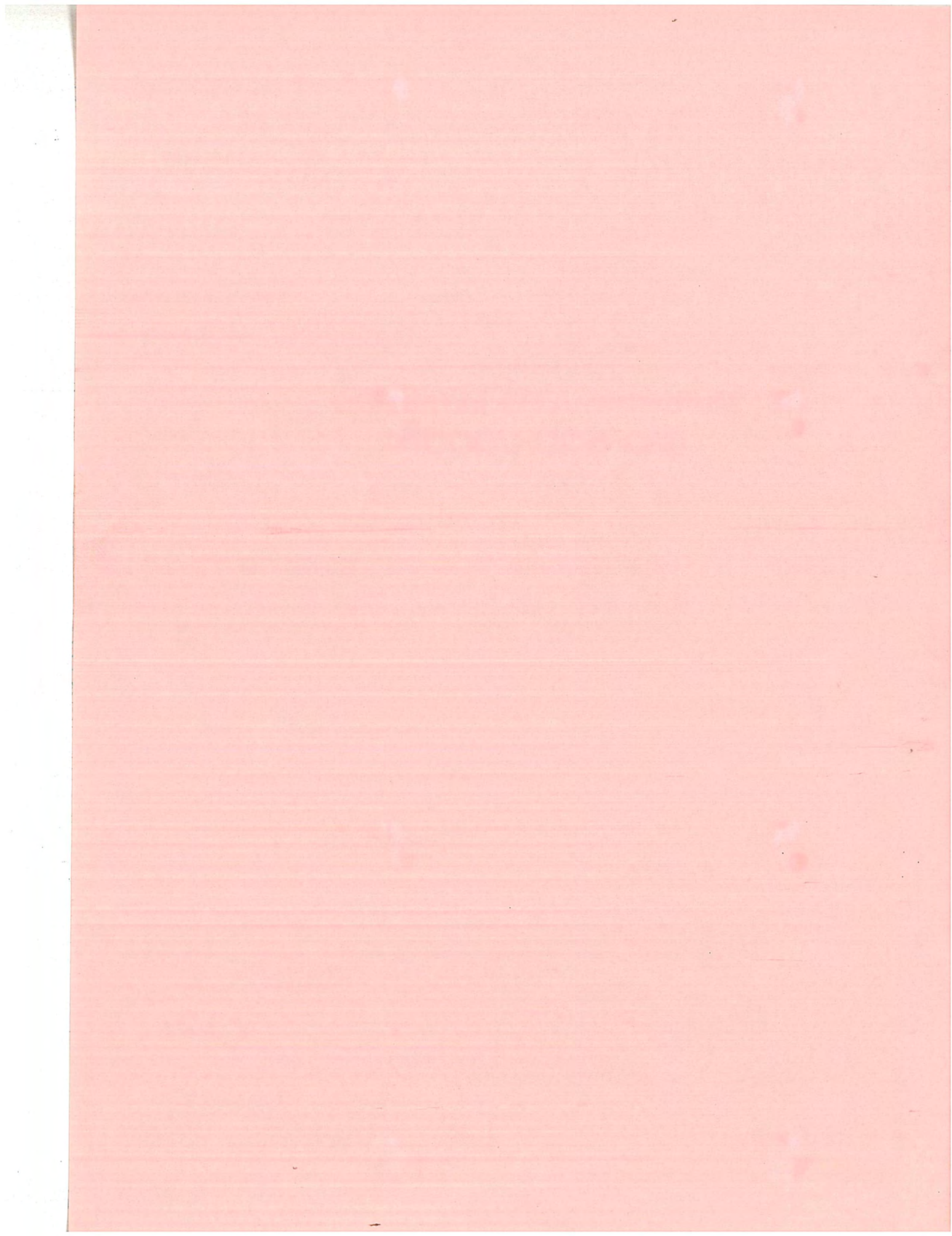
OKUMA IRON WORKS MFG CO. LTD.

OIL HYD POWER UNIT

TOKYO KEIKI CO. LTD.

DRAWN BY	CHIEF BY	CHECKED BY	APPROVED BY
DATE	DATE	DATE	DATE
SCALE	DATE	DATE	DATE
1/5	SEP-28-90	41933335	41933335

**K : Multi-row ATC Magazine
(MC-500H/600H)**



HORIZONTAL MACHINING CENTER

MC-500H

MC-600H

MULTI-ROW ATC MAGAZINE

INSTRUCTION MANUAL (1st Edition)

Symbols

This manual uses the following symbols to emphasize the items which must be strictly observed:



REMARKS

: Precaution in machine operations.

Default of this item affects the machining accuracy and smooth operation.



CAUTION

: Default of this item causes faulty machine operation, machine damage, or possible operator injury.

More care must be exercised to this item than the items indicated under "REMARKS".



WARNING

: Default of this item causes not only machine damage but also a serious accident may result including loss of life.

Sufficient care must be paid to this item.

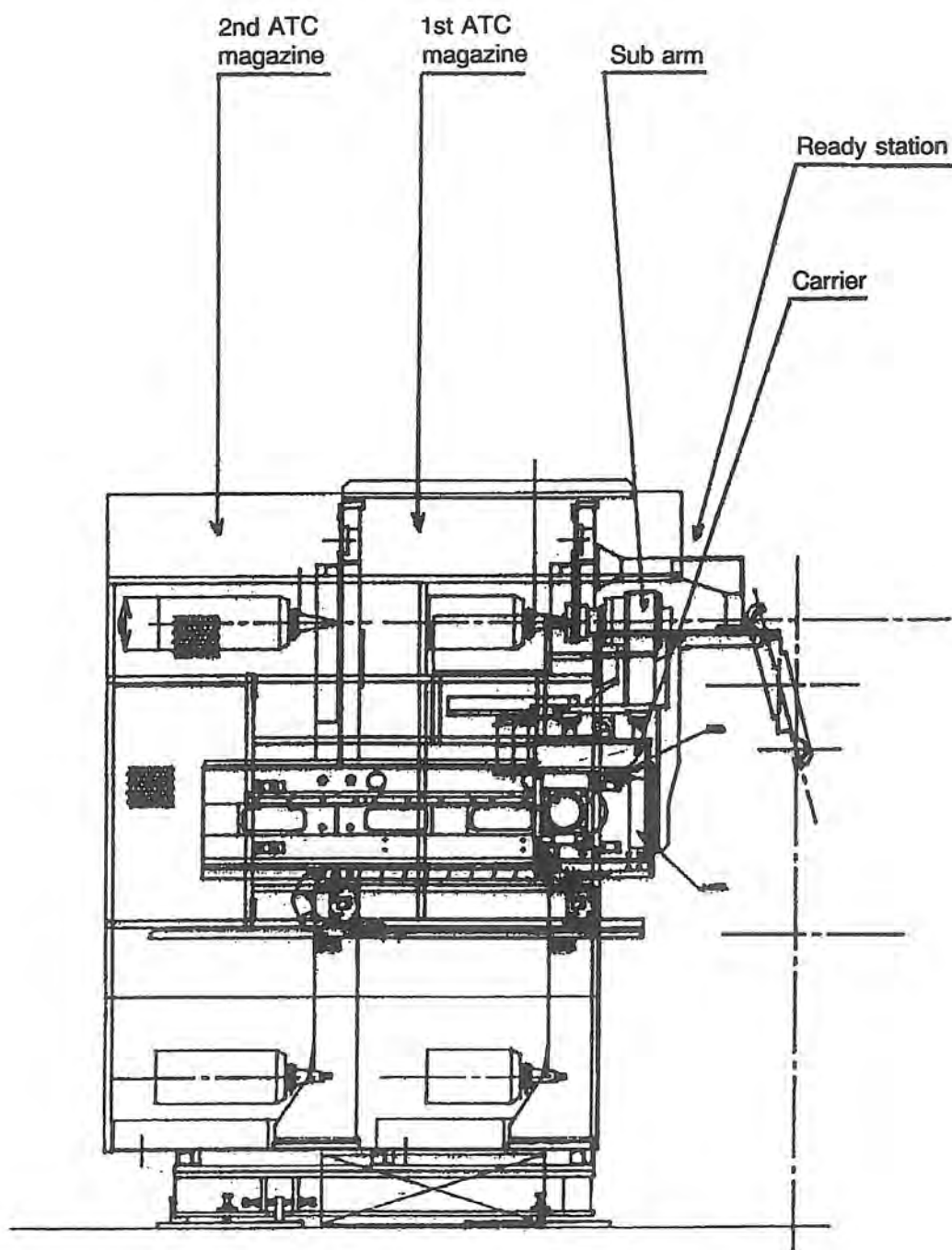
TABLE OF CONTENTS

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1. Outline

The multi-row ATC magazine is provided with toolpots which are arranged on the endless ATC chain, and is capable of storing a maximum of 200 tools; 100 tools in each of the 1st and 2nd ATC magazines (or 240 tools; 120 tools x 2).

At the side face of the magazine frame is a transfer unit which serves to transfer tools.



2. Specifications

	Item	Specification
1	Type	Horizontal
2	Tool shank	BT50 (option: CAT)
3	Pull-stud type	Common to MAS1 and MAS2
4	Tool storage capacity	200 tools (240 tools)
5	Tool number	1st ATC magazine 1 to 100 (1 to 120) 2nd ATC magazine 101 to 200 (121 to 240)
6	Tool drawing force of toolpot	35 – 40 kgf (77 – 88 lbf)
7	CAT/DIN tool mounting direction	The toolpot key is matched with the longer drive key of the tool shank.
8	Toolpot interval	145 mm (5.71 in) in straight portions
9	Tool extracting travel	155 mm (6.10 in)
10	ATC magazine forward rotation direction	Clockwise rotation viewed from the front
11	Maximum tool weight	20 kgf (44 lbf) [optional: 25 kgf (55 lbf)]
12	Maximum tool length	1st ATC magazine : 450 mm (17.72 in) 2nd ATC magazine : 450 mm (17.72 in) (option for 600H : 600 mm (23.62 in))
13	Maximum tool diameter with adjacent tools	Ø135 mm (5.31 in)
14	Maximum tool diameter without adjacent tools	Ø230 mm (9.06 in)
15	Maximum boring bar diameter without adjacent tools	Ø290 mm (11.42 in) The cutting edge of the boring bar is at an angle of 45° degrees to the toolpot key. The OD of the boring bar must be within Ø230 mm (9.06 in).
16	Imbalanced load	Within 200 kgf (440 lbf)
17	Tool selection method	Fixed address
18	Tool transfer sequence	ATC magazines (1st and 2nd) (↔) Sub arm (↔) Ready station (↔) Tool change arm (↔) Spindle
19	ATC magazine rotation speed	34.8 m/min (114.2 fpm)
20	Lubrication method	Toolpot chain : by centralized lubrication system Reducer : by packed grease
21	ATC magazine door interlock	The ATC magazine does not rotate when the door is opened.
22	Tool releasing device	When the foot-pedal switch is depressed, the pneumatic cylinder pushes the rear end of the tool and removes the tool.

3. Configuration

The multi-row ATC magazine consists of the following components.

- (1) 1st and 2nd ATC Magazines
- (2) Carrier
- (3) Sub Arm
- (4) Ready Station

4. Functions/Operations of Each Component

(1) 1st and 2nd ATC Magazines

- (a) Each magazine can store a maximum of 100 tools (or 120 tools). Since the fixed address method is employed, the toolpot number is indicated by the nameplate attached to the magazine link.
- (b) Magazine rotation is controlled by a servomotor.
- (c) To set a tool in the toolpot, push the tool strongly against the toolpot. It will be held by the toolpot by spring force.
- (d) To remove the tool from the toolpot, bring the tool to the tool removal position and step on the foot pedal while holding it by hands with the safety fence door opened.

(2) Carrier

- (a) The carrier transfers the tool between the ready station, 1st ATC magazine, and 2nd ATC magazine.
- (b) It is driven by the rack-and-pinion system controlled by the servomotor through the reducer.
- (c) The sub arm unit is installed on the carrier.
- (d) The carrier travel is 1,355 mm (53.35 in).

(3) Sub Arm

- (a) The sub arm inserts/extracts a tool to/from the toolpot or ready station.
- (b) The tool is held by steel balls.
- (c) To prevent a tool from dropping during transfer, a mechanical interlock is incorporated.
- (d) During loading/unloading of the tool, the interlock is released by the pneumatic cylinder.
- (e) The sub arm is positioned at four positions.
Positioning is controlled by a servomotor.
- (f) The maximum swing angle is 270°.
- (g) Sub arm crosswise motion is guided by an LM guide and driven by the pneumatic cylinder.
- (h) The sub arm crosswise travel is 260 mm (10.24 in).
- (i) Refer to the pneumatic circuit diagram for pneumatic equipments.

(4) Ready Station

- (a) The ready station positions the tool at the ATC magazine side, spindle side, and the 90° index position.
- (b) Positioning and swing of the ready station is driven hydraulically.
Working pressure: 73 kgf/cm² (1,038 psi)
- (c) Air blow is applied to the tapered tool shank during tool removal.
- (d) Refer to the pneumatic circuit diagram for hydraulic equipments.

5 Precautions

- (1) If only one side of the ATC magazine is loaded with tools and the difference in weight between the two sides exceeds 200 kgf (440 lbf), magazine rotation may be inconsistent, causing faulty indexing. Use extra care regarding tool distribution especially when using heavy tools.
- (2) When using a tool whose diameter is larger than 135 mm (5.31 in), pay careful attention to the interference between adjacent tools.
- (3) Chips and dust adhering to the sub arm or ready station will cause the faulty operation of the ATC. Remove them as needed.



WARNING

The tool clamp mechanism in the ATC magazines, sub arm, ready station, tool change arm, and spindle are constructed to hold the tool securely. However, since these units swing or rotate tools with a sharp cutting edge, do not touch or stand near these units while the ATC is operating. The tools might drop due to unexpected causes.

Never open the magazine door and enter the inside of the ATC while the ATC is operating.

6. Periodic Inspection and Maintenance Items

Frequency	Inspection Items
Daily	(1) Check the oil level in the centralized lubrication unit. (2) Check the air system pressure. 5 kgf/cm² (71 psi)
Every Three Months	(1) Apply grease to the rack in the carrier. (2) Clean the inside of toolpots.
Every Six Months	(1) Apply grease to LM guides.
Every Year	(1) Check the tension and apply grease to the carrier box. (2) Check the sub arm drive timing belt for looseness. (3) Check the ATC magazine for abnormal noise during rotation.

7. Lubrication Points

(1) ATC Magazine

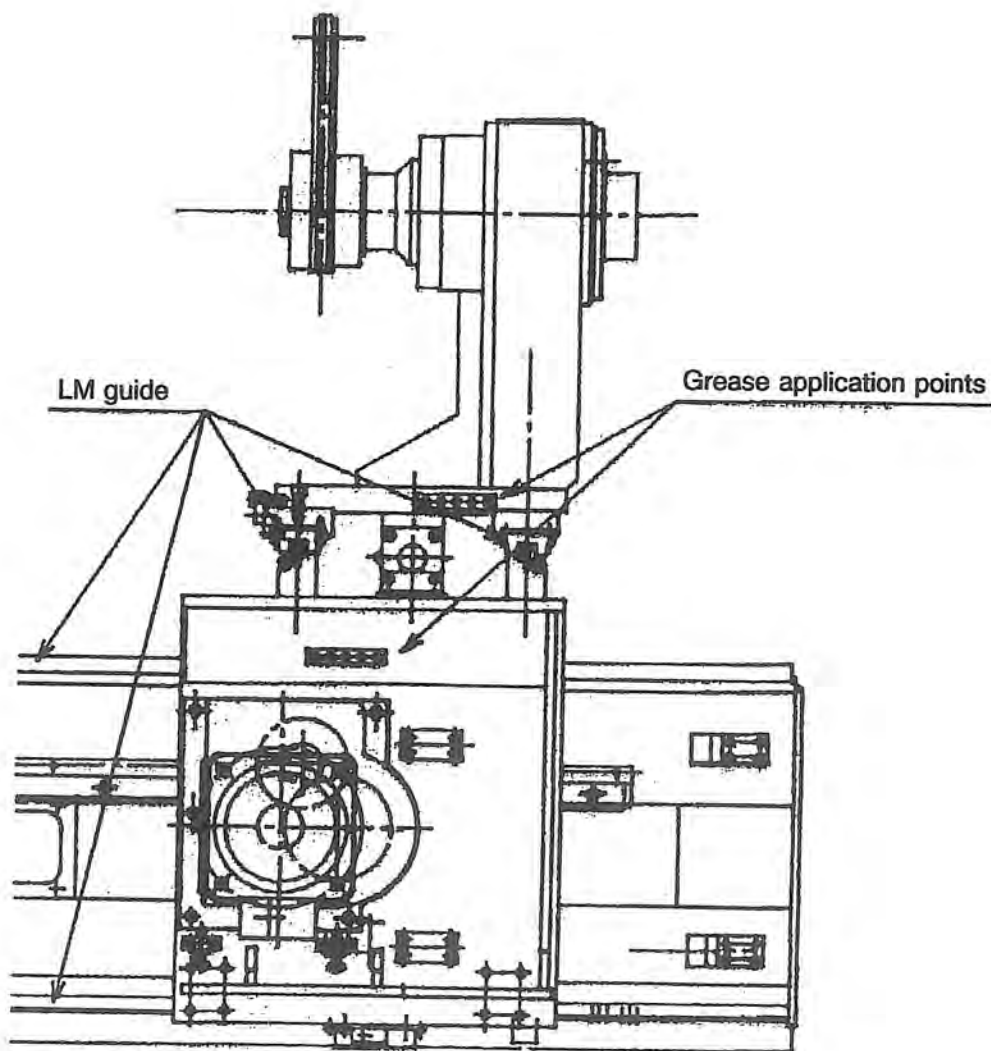
Since the ATC magazine is lubricated forcibly, it does not require replenishment of lubricating oil.

(2) Carrier

(a) LM guide

Apply grease using a grease gun.

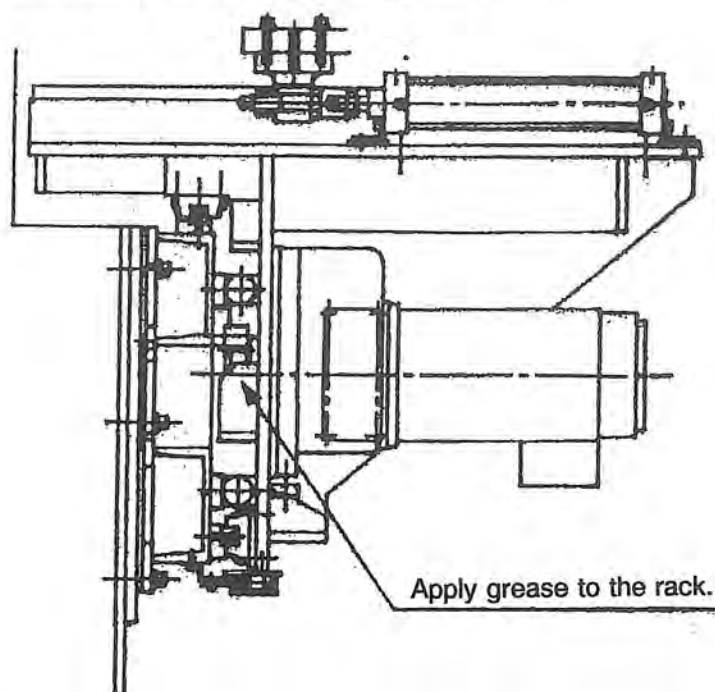
Grease specification: universal grease (JIS NLG I -2)



(b) Rack

Apply grease using a brush.

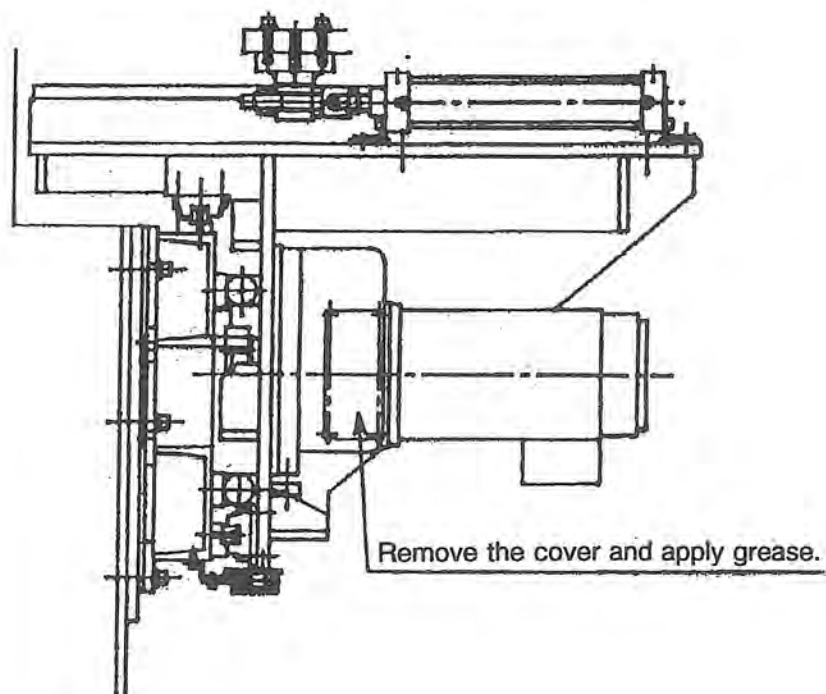
Grease specification: universal grease (JIS NLG I -2)



(c) Reducer's Gears

Apply grease to reducer's gears using a brush.

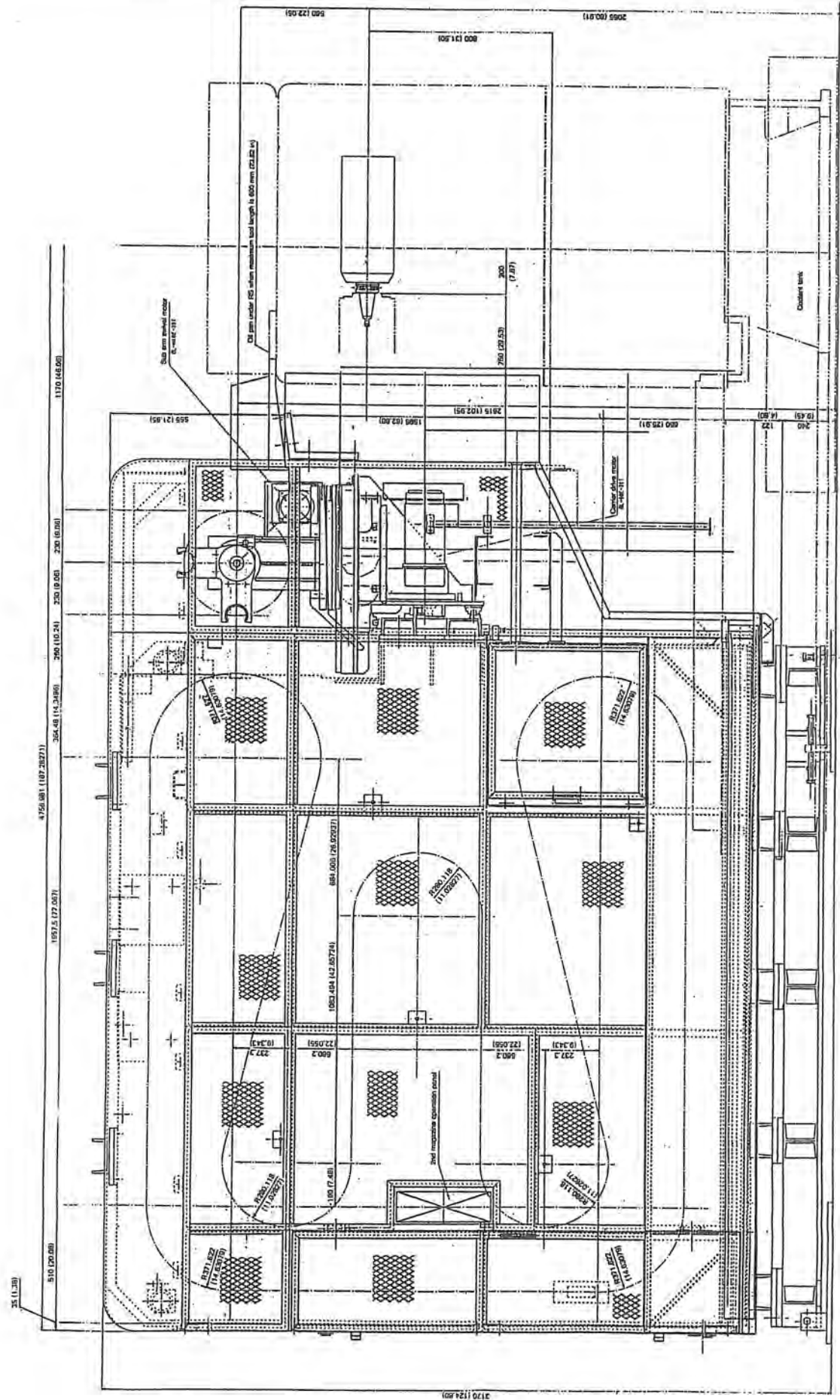
Grease specification: universal grease (JIS NLG I -2)



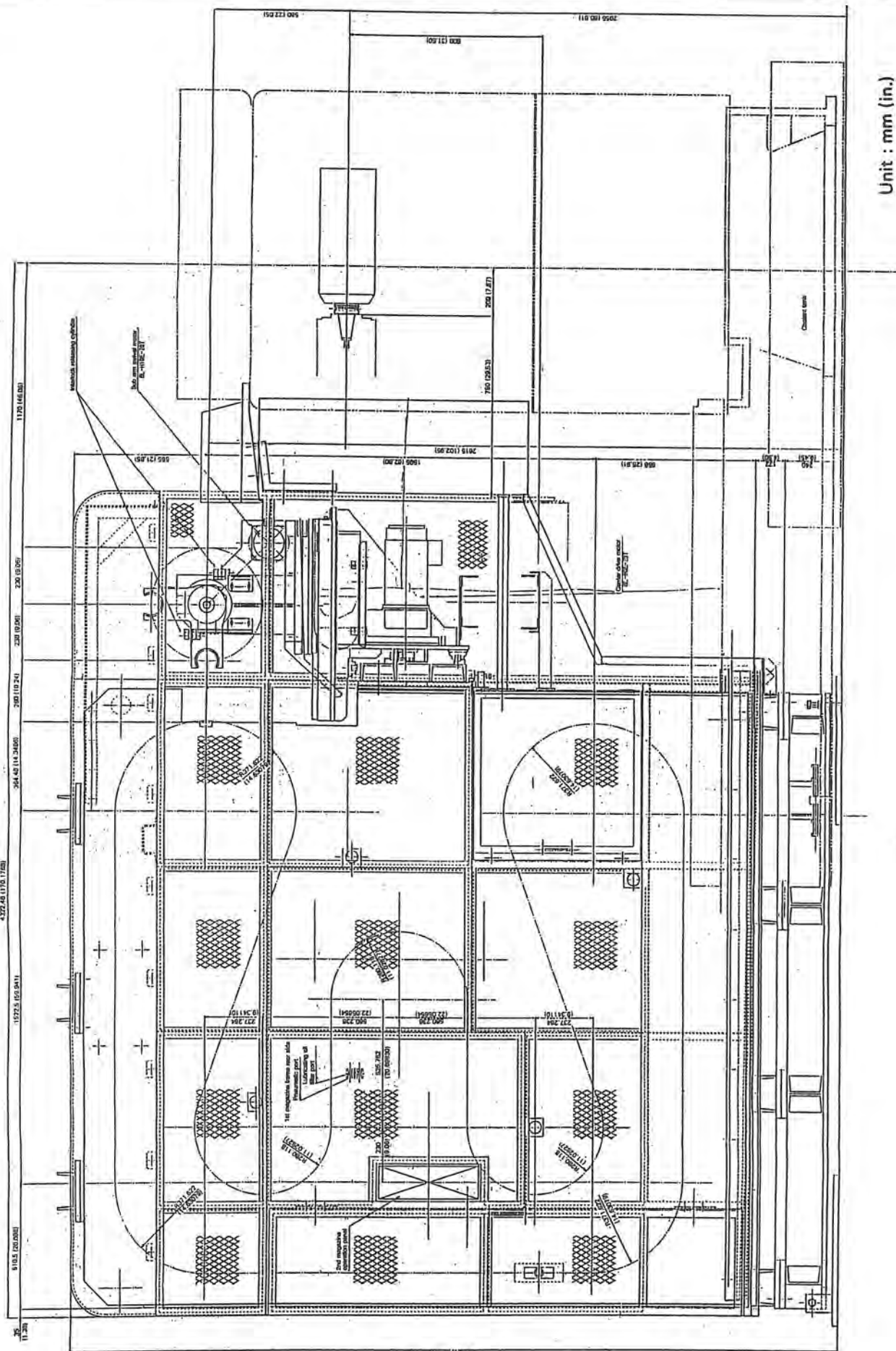
8. Appended Drawings

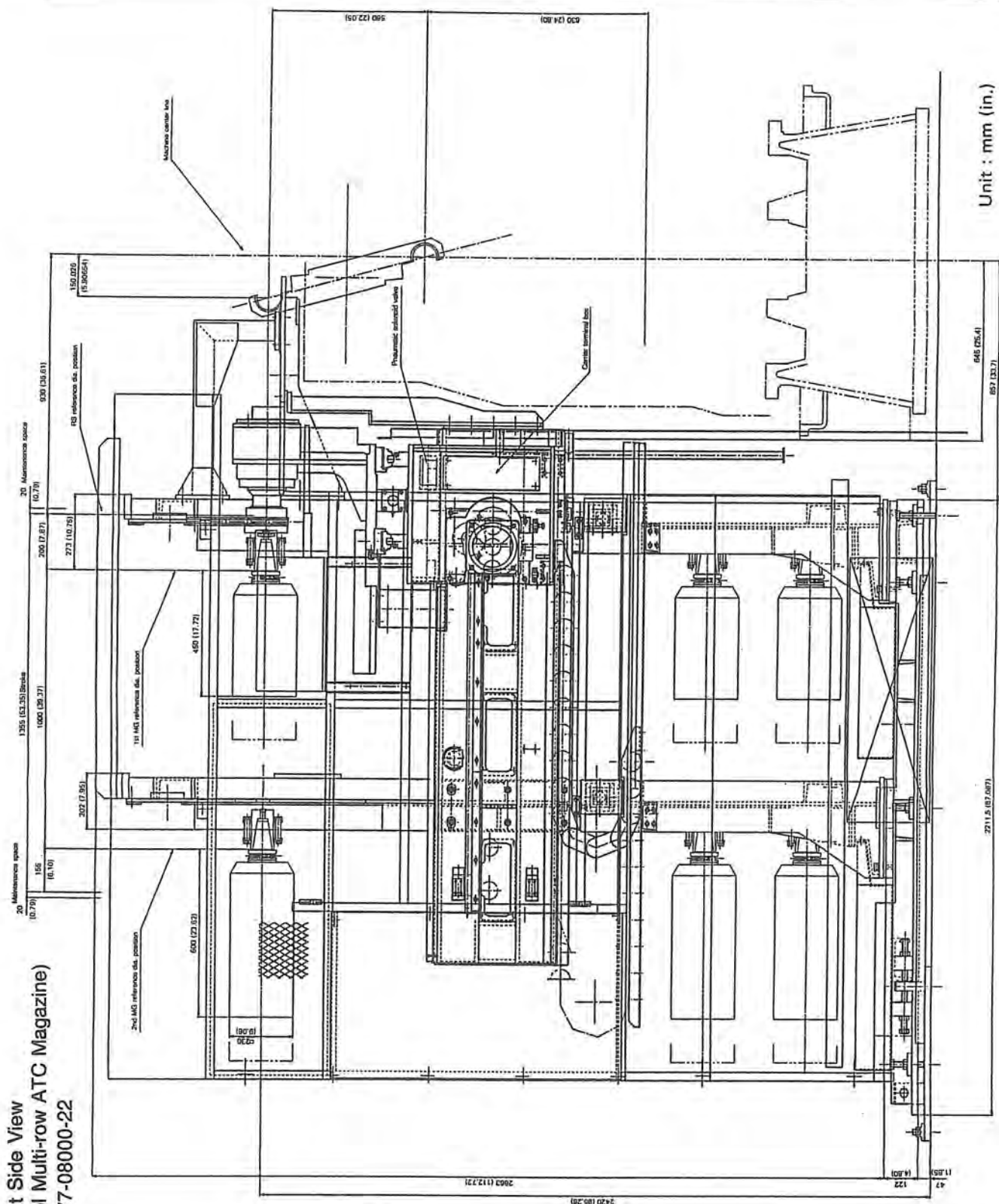
Machine Model	MC-500H 200-tool ATC	MC-600H 200-tool ATC	MC-600H 240-tool ATC
(1) Machine Drawings			
(a) Overall view	TM077-08000-21 TM077-08000-22 TM077-08000-23	TM077-08000-2 TM077-08000-3 TM077-08000-4	TM080-08000-2 TM077-08000-3 TM080-08000-4
(b) Magazine	TM077-06000-6 TM077-06000-7	TM077-06000-6 TM077-06000-7	TM080-06000-6 TM080-06000-7
(c) Carrier	TM077-07000-1 TM077-07000-2 TM077-07000-3	TM077-07000-1 TM077-07000-2 TM077-07000-3	TM077-07000-1 TM077-07000-2 TM077-07000-3
(2) Magazine Installation Drawing	TM077-00100-10	TM077-00100	TM080-00100
(3) Equipment Arrangement Drawing	TM077-00200-1	TM077-00200-1	TM077-00200-1
(4) Skeleton Diagram	TM077-01200-1M	TM077-01200-1M	TM077-01200-1M
(5) Pneumatic Circuit Diagram	TM077-02000-1	TM077-02000-1	TM077-02000-1
(6) Hydraulic Circuit Diagram	TM077-03000	TM077-03000	TM077-03000

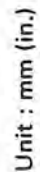
Safety Fence Front View
MC-500H (200-tool Multi-row ATC Magazine) Drawing No. TM077-08000-21



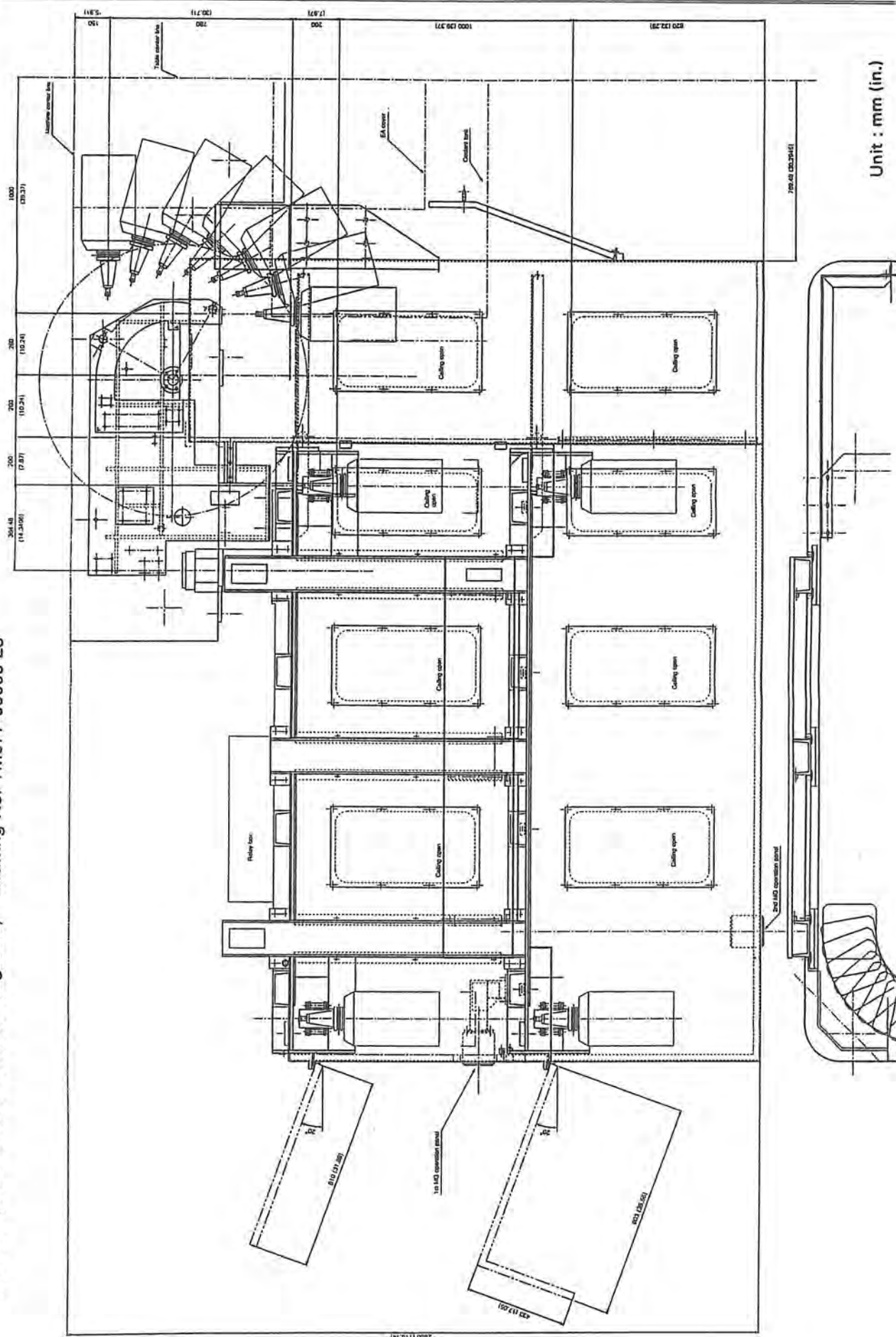
Unit : mm (in.)



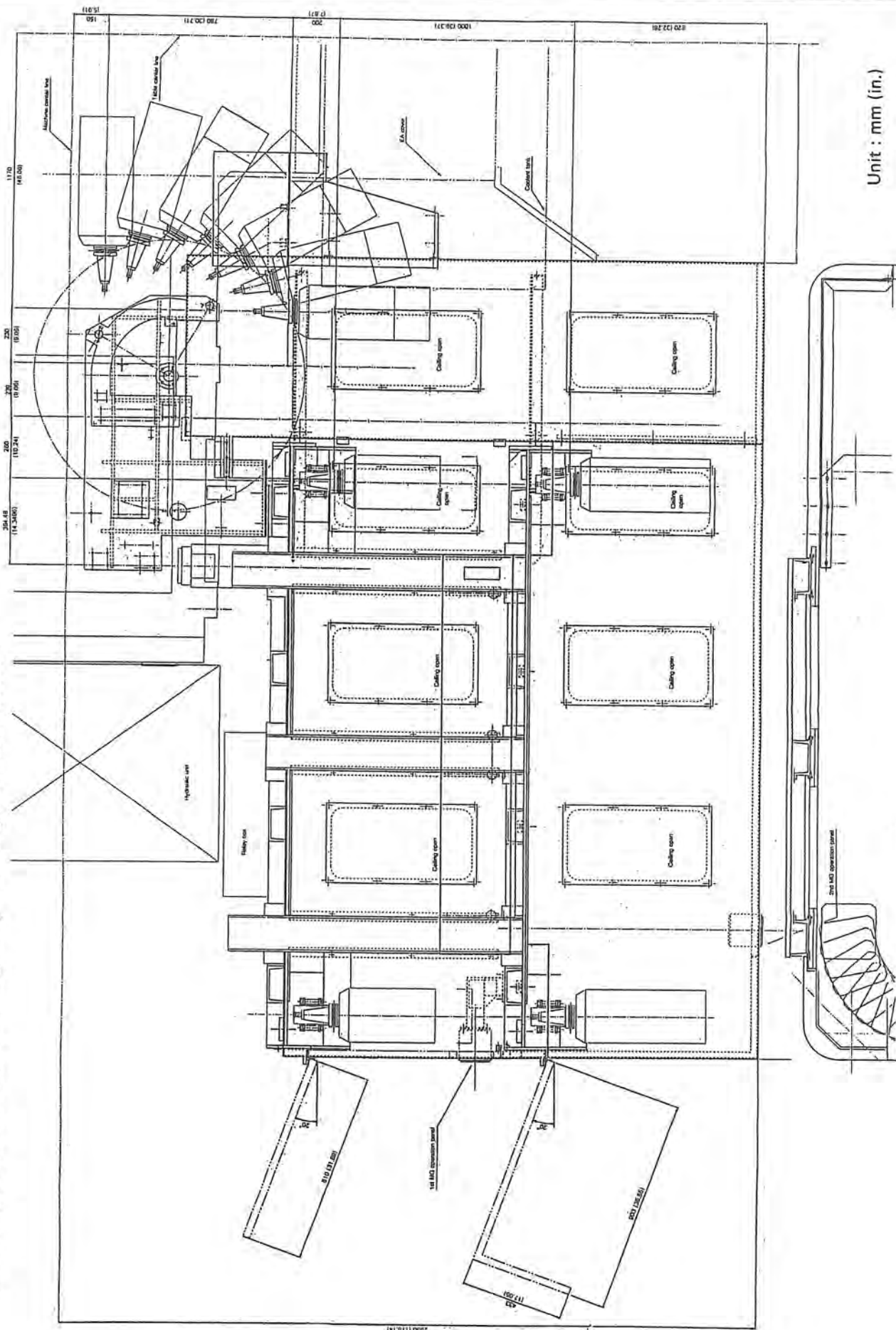




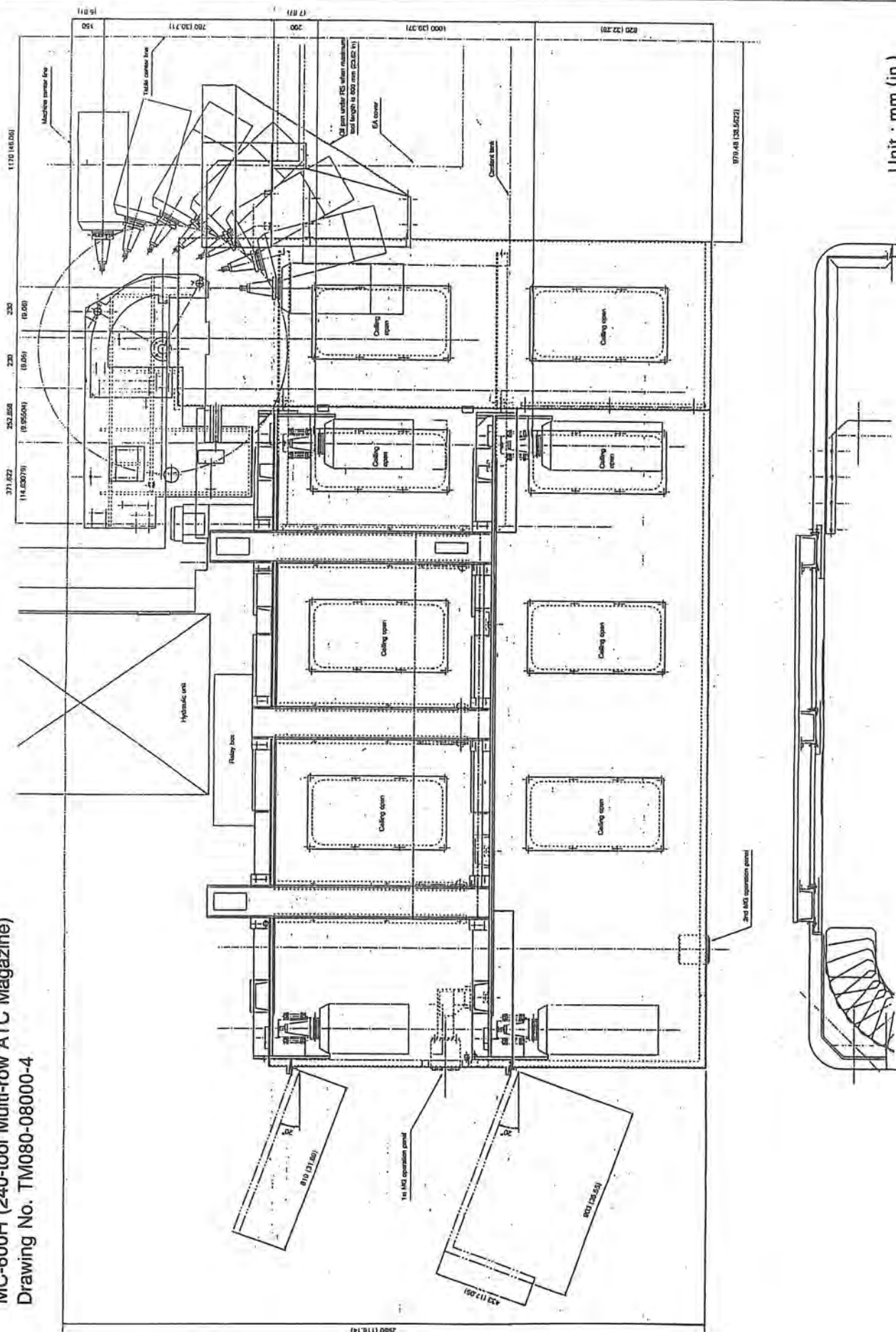
Safety Fence Plane View
MC-500H (200-tool Multi-row ATC Magazine) Drawing No. TM077-08000-23



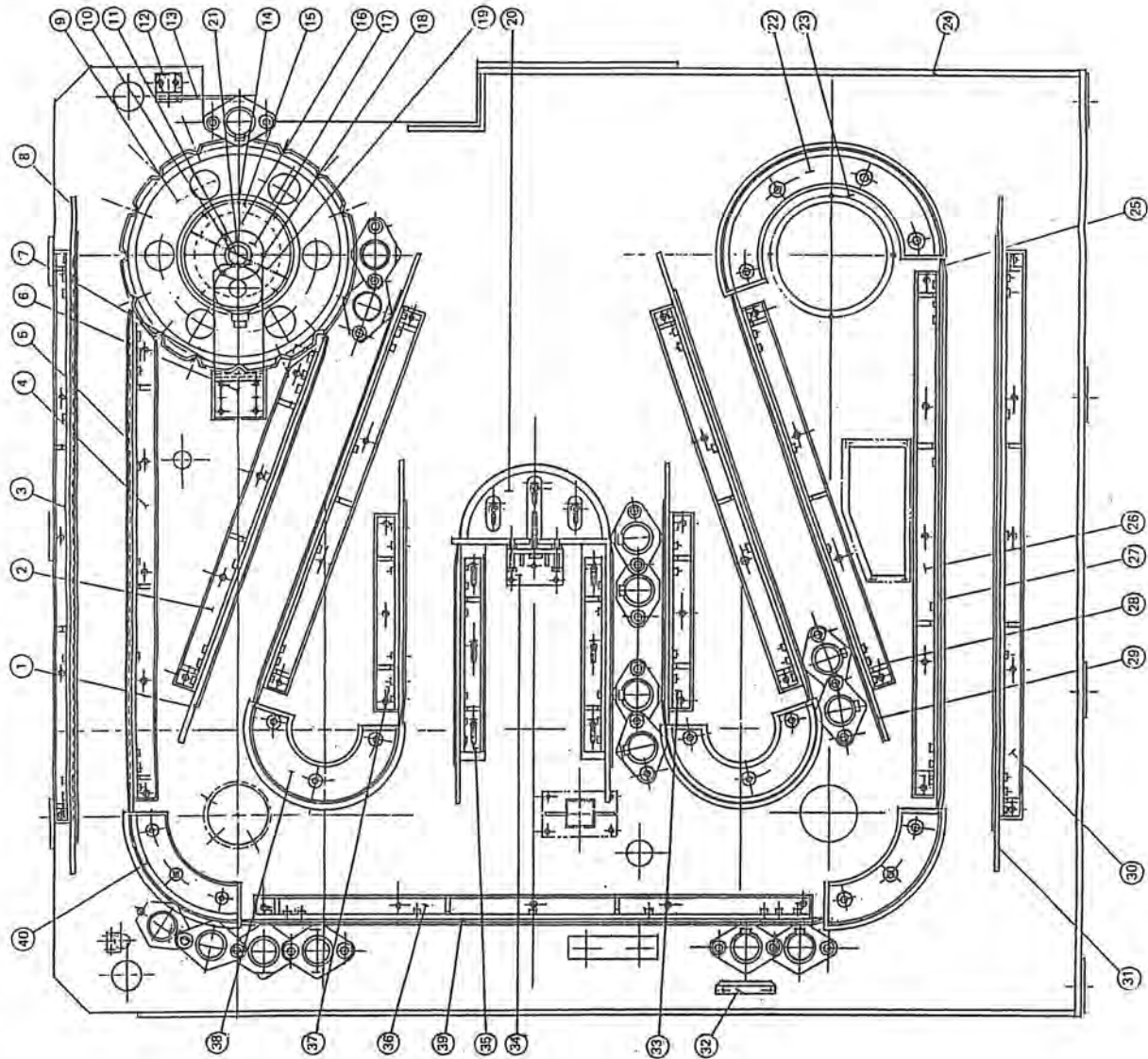
Safety Fence Plane View
MC-600H (200-tool Multi-row ATC Magazine) Drawing No. TM077-08000-4



Unit : mm (in.)

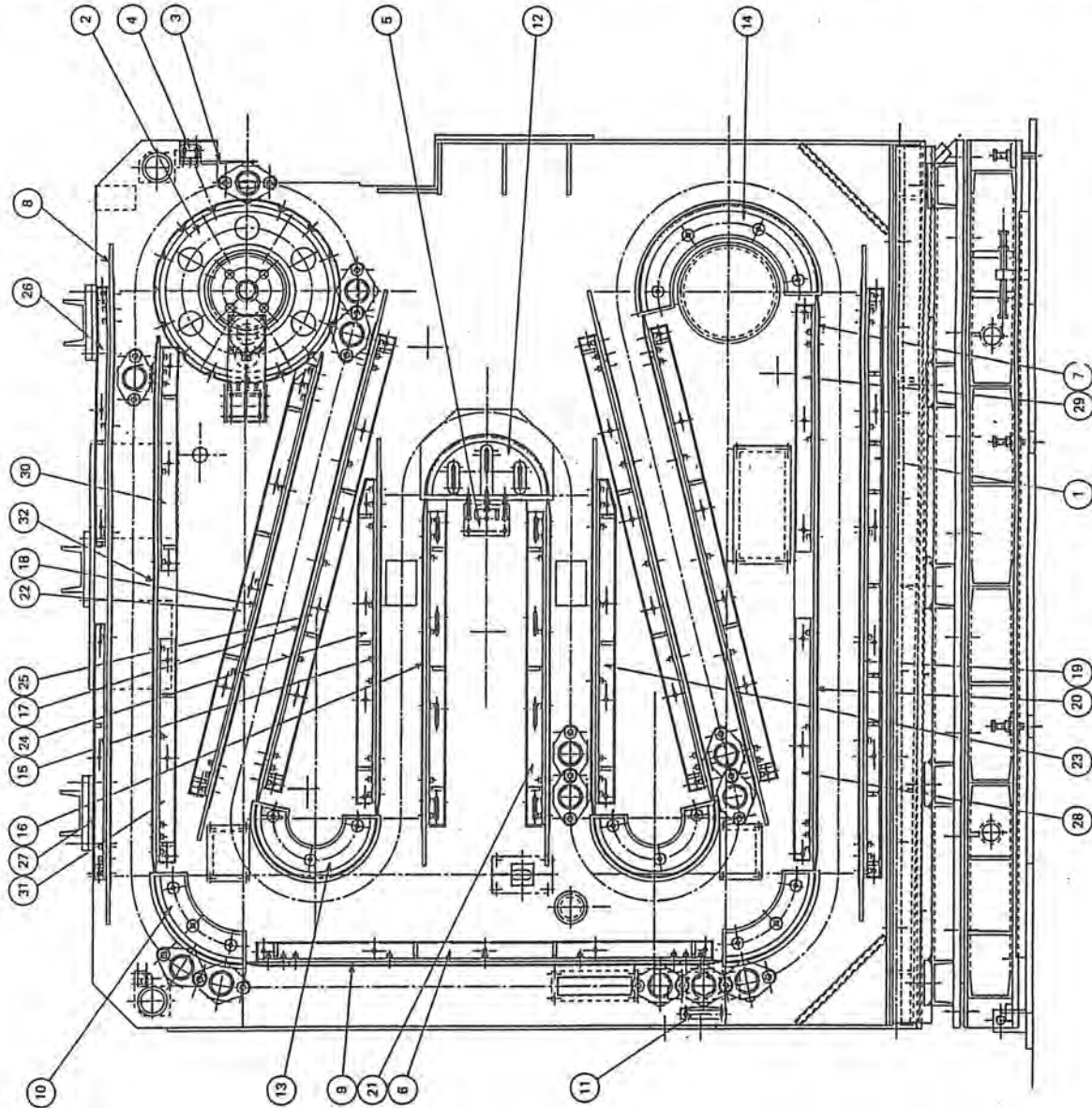


Magazine Assembly Drawing
MC-500H (200-tool Multi-row ATC Magazine)
MC-600H (200-tool Multi-row ATC Magazine) Drawing No. TM077-06000-6



No.	Name	Type	Material/ Maker	Q'ty	Remarks
1	Support	TM079-06007	SS41F/P	2	
2	Drum	254-2321-00	FC25	2	
3	Guide	254-2322-00-01	S45C	2	
4	Support	254-2322-01	SS41P	2	
5	Support	254-2322-04-01	SS41F	2	
6	Support	254-2422-04-01	SS41F	2	
7	Rail	254-2422-14-02	SCM415	28	
8	Rail	254-2422-15	SCM415	24	
9	Rail	254-2422-16	S45C	2	
10	Guide	254-2422-25-01	FC25	2	
11	Steady rest	254-2422-26-01	S45C	2	
12	Guide	254-2522-00-01	FC25	2	
13	Guide	254-2622-00	FC25	4	
14	Guide	254-2622-01	FC25	2	
15	Rail	254-2622-02	S45C	4	
16	Rail	254-2622-03	S45C	4	
17	Rail	254-2622-04	S45C	6	
18	Rail	254-2622-05	S45C	2	
19	Rail	254-2622-06	S45C	4	
20	Rail	254-2622-07	S45C	2	
21	Support	254-2622-13-01	SS41F	4	
22	Support	254-2622-14-01	SS41F	2	
23	Support	254-2622-15-01	SS41F	2	
24	Support	254-2622-16-01	SS41F	2	
25	Support	254-2622-17-01	SS41FP	6	
26	Support	254-2622-20	SS41FP	2	
27	Support	254-2622-21	SS41F	2	
28	Support	254-2622-22	SS41F	2	
29	Support	254-2622-23	SS41F	2	
30	Support	254-2622-24	SS41F	2	
31	Support	254-2622-25	SS41F	2	
32	Rail	254-2622-08	S45C	2	

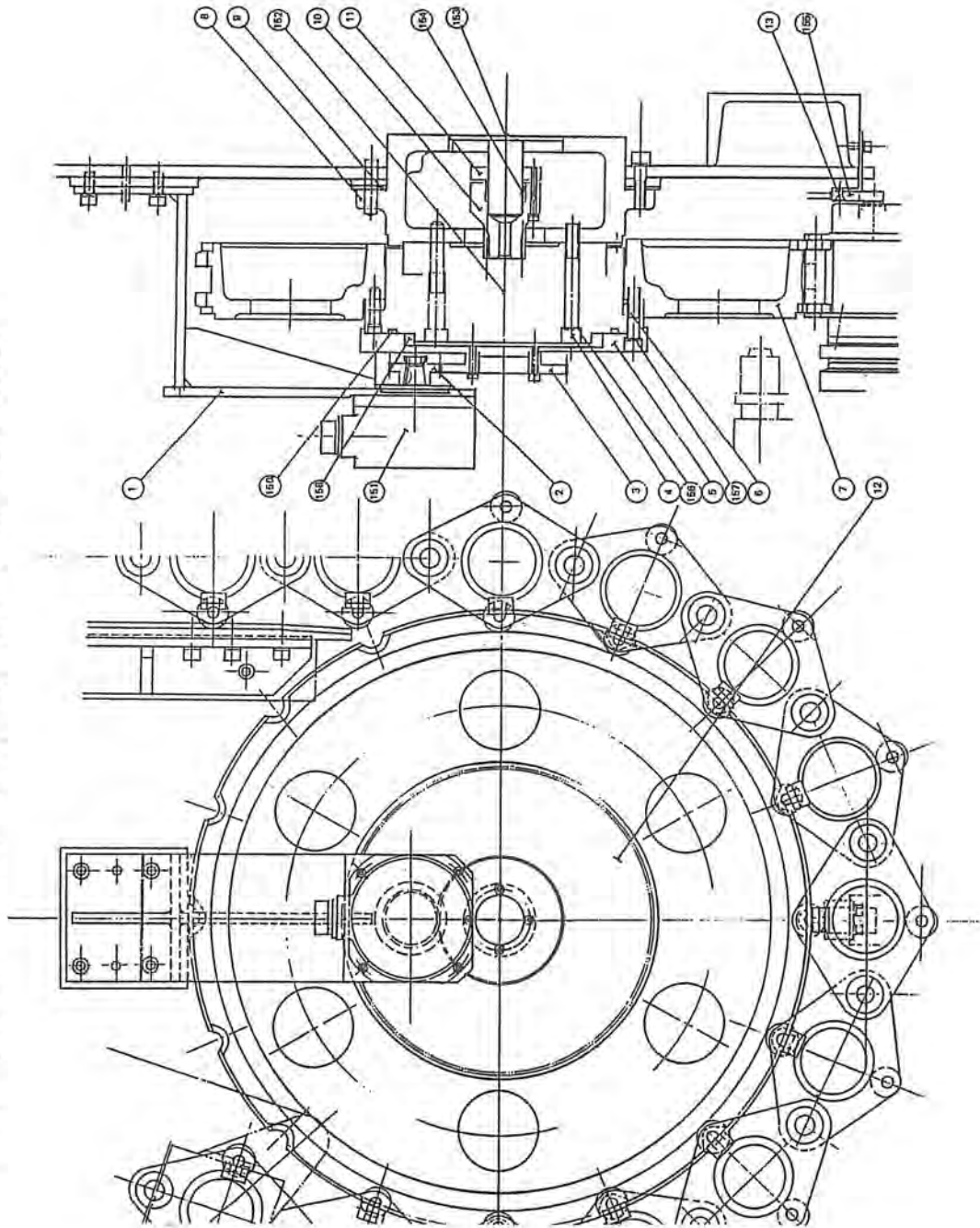
Magazine Assembly Drawing
MC-600H (240-tool Multi-row ATC Magazine) Drawing No. TM080-06000-6



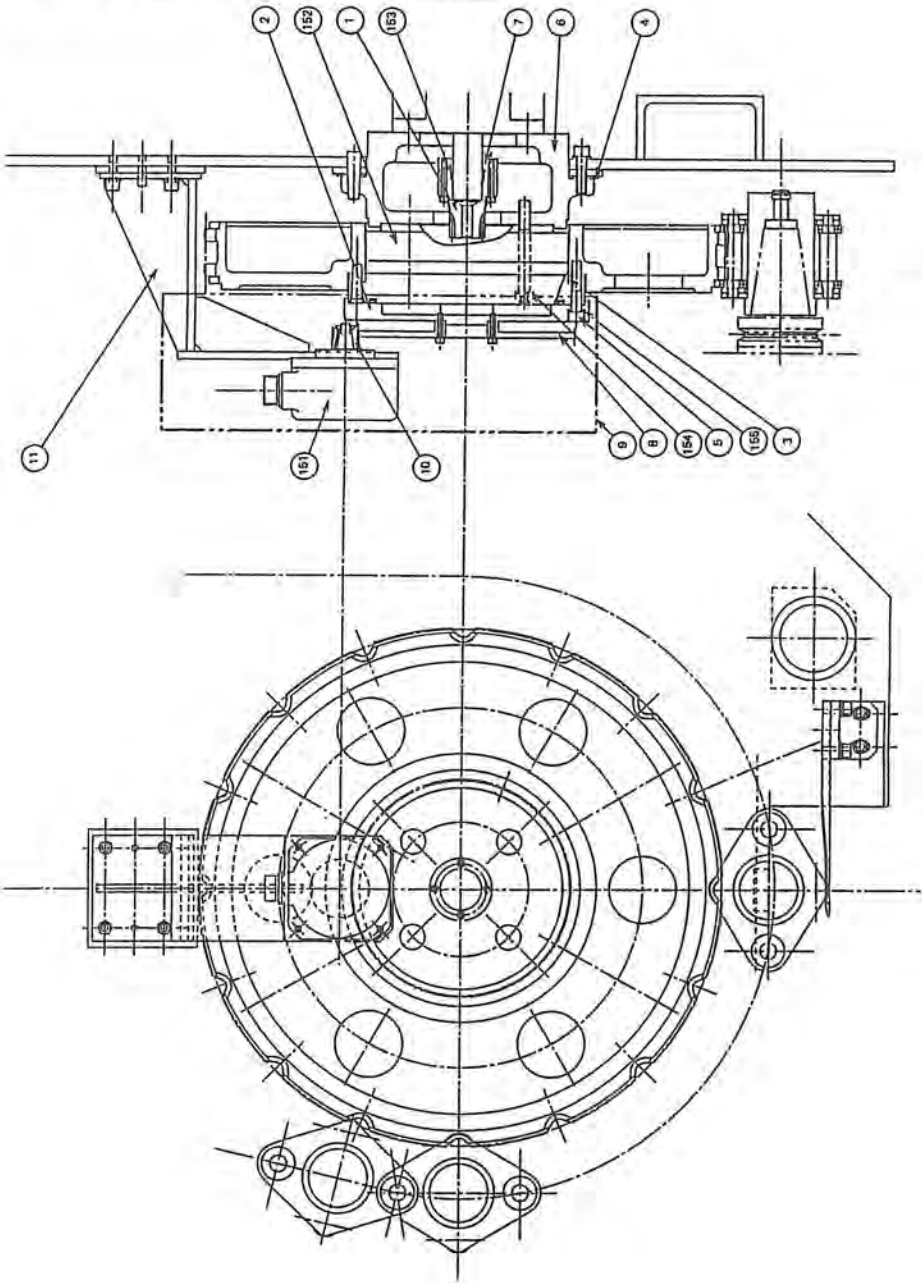
No.	Name	Type	Material/ Maker	Q'ty	Remarks
1	Rail	254-2522-05	S45C	1	
2	Support	254-2522-14-01	SS41F	1	
3	Support	254-2522-10	SS41F/P	1	
4	Support	254-2522-12	SS41F	1	
5	Rail	254-2522-08	S45C	1	
6	Support	254-2520-01	SS41F	1	
7	Cover	254-2420-03	SPHC	1	
8	Rail	254-2422-15	SCM415	8	
9	Drum	254-2321-00	FC25	1	
10	Gear	254-2520-00	S45C	1	
11	Gear	254-2320-01	SCM21	1	
12	Support	254-2322-01	SS41P	1	
13	Guide	254-2322-00	S45C	1	
14	Cover	254-2320-02	S45C	1	
15	Plate	254-2320-04	SPN	1	
16	Motor base	254-2320-08	FC25	1	
17	Gear	254-2420-01	S45C	1	
18	Screw	254-2320-05	SCM4	3	
19	Plate	254-2320-03	STKM13A	1	
20	Guide	254-2522-00	FC25	1	
21	Cover	254-2320-09	S45C	1	
22	Guide	254-2522-02	FC25	1	
23	Guide	254-2422-25	FC25	1	
24	Magazine frame	TM077-06001		2	
25	Rail	254-2422-14	SCM415	12	
26	Support	254-2522-11	SS41F	1	
27	Rail	254-2522-07	S45C	1	
28	Support	254-2522-15	SS41F	3	
29	Rail	254-2522-04	S45C	3	
30	Support	TM077-06005	SS41F/P	1	
31	Rail	254-2522-05	S45C	2	
32	Support	254-2422-25	S45C	1	
33	Rail	254-2522-03	S45C	4	
34	Support	254-2322-04	SS41F	1	
35	Support	254-2522-13	SS41F	2	
36	Support	254-2422-04	SS41F	1	
37	Support	254-2522-15	SS41F	2	
38	Guide	254-2522-01	FC25	2	
39	Rail	254-2422-16	S45C	1	
40	Guide	254-2322-03	FC25	2	

Magazine Assembly Drawing
MC-500H (200-tool Multi-row ATC Magazine)
MC-600H (200-tool Multi-row ATC Magazine) Drawing No. TM077-06000-7

No.	Name	Type	Material/ Maker	Q'ty	Remarks
1	Support	254-2520-01	SS41F	1	
2	Gear	254-2520-00	S45C	1	
3	Gear	254-2420-01	S45C	1	
4	Screw	254-2320-05	SCM4	3	
5	Cover	254-2320-02	S45C	1	
6	Plate	254-2320-03	STKM13A	1	
7	Drum	254-2321-00	FC25	1	
8	Motor base	254-2320-08	FC25	1	
9	Plate	254-2320-04	SPN	1	
10	Gear	254-2320-01	SCM21	1	
11	Cover	254-2320-09	S45C	1	
12	Cover	254-2420-03	SPHC	1	
13	Support	254-2323-00	SS41	1	
150	O-ring	JISB2401-G320		2	
151	Type E encoder			1	
152	Reducer	RV135A-80	Teijin	1	
153	Motor	BH1200E-12SR		1	
154	Mechanical locking element	H1012-0002-85		2	
155	Proximity switch	BESS16-300- JAZ		1	
156	Belleville spring washer	J9812-5230- 000140		1	
157	Belleville spring washer	J9812-5230- 000120		1	
158	Grease	Epnac AP0	NIPPON OIL		

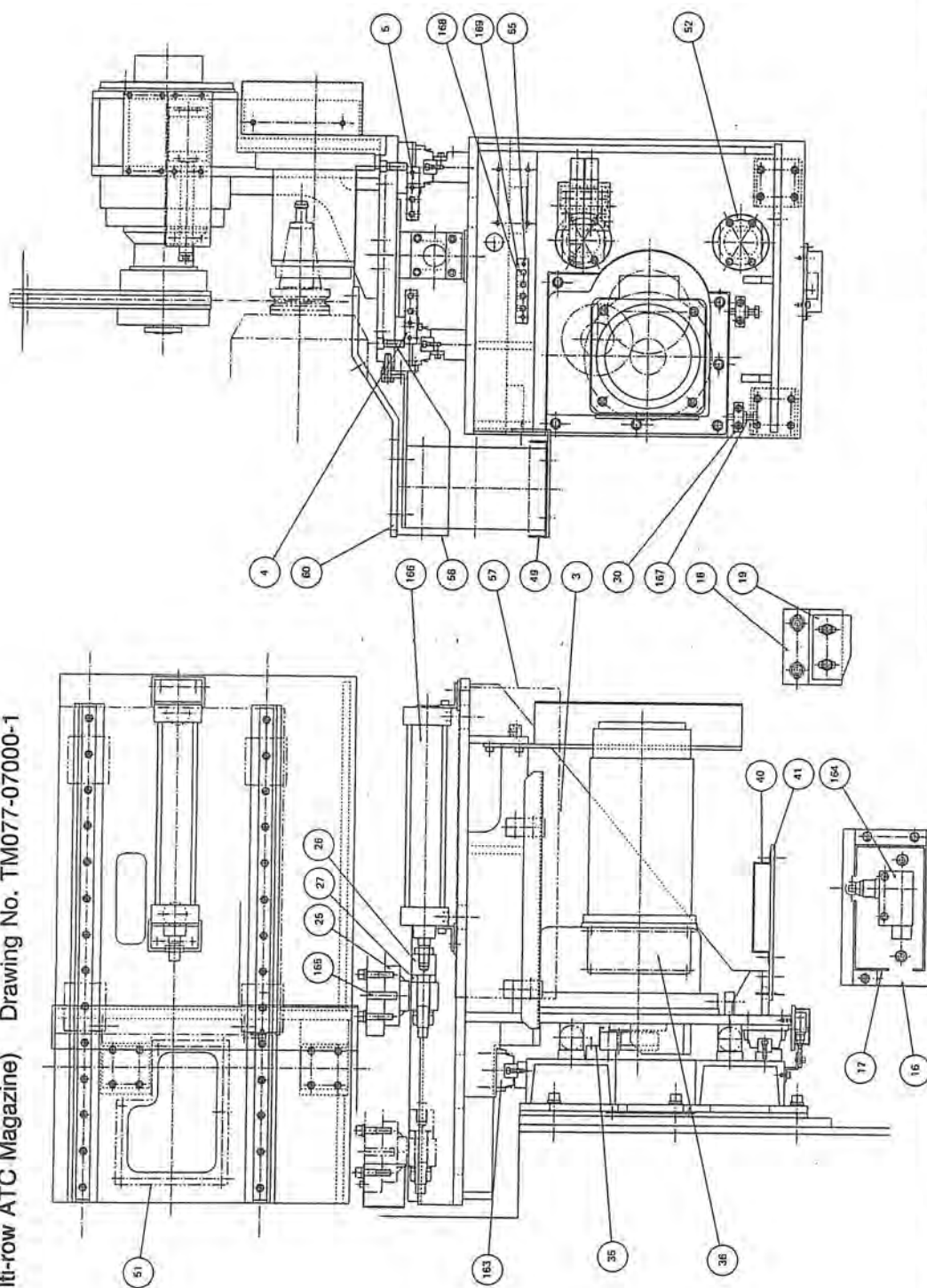


Magazine Assembly Drawing
MC-600H (240-tool Multi-row ATC Magazine) Drawing No. TM080-06000-7



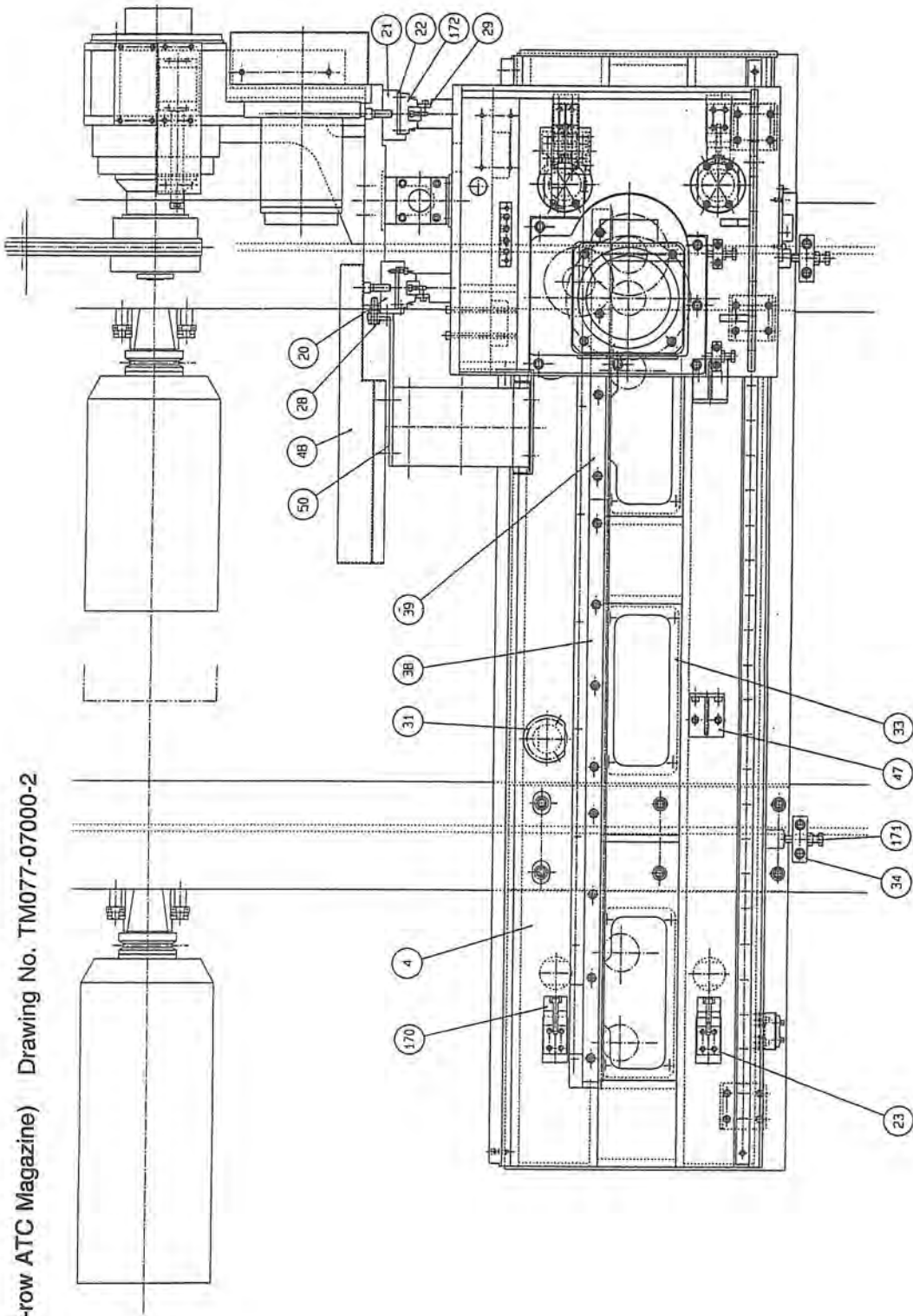
No.	Name	Type	Material/ Maker	Q'ty	Remarks
21	Gear	254-2320-01	SCM21	2	
22	Cover	254-2320-02	S45C	2	
23	Plate	254-2320-03	STKM13A	2	
24	Plate	254-2320-04	SPN	2	
25	Screw	254-2320-05	SCM4	6	
26	Motor base	254-2420-08-01	FC25	2	
27	Cover	254-2320-09	S45C	2	
33	Gear	254-2420-01-01	S45C	2	
34	Cover	254-2420-03	SPHC	2	
42	Gear	254-2620-00	S45C	2	
43	Support	254-2620-01-01	SS41F	2	
151	Type E encoder			2	
152	Reducer	RV135A-81	Teijin	2	
153	Mechanical locking element	H1012-0002-85		4	
154	Belleville spring washer	J9812-5230-000140		2	
155	Belleville spring washer	J9812-5230-000120		2	

Carrier
(All Model Multi-row ATC Magazine) Drawing No. TM077-07000-1



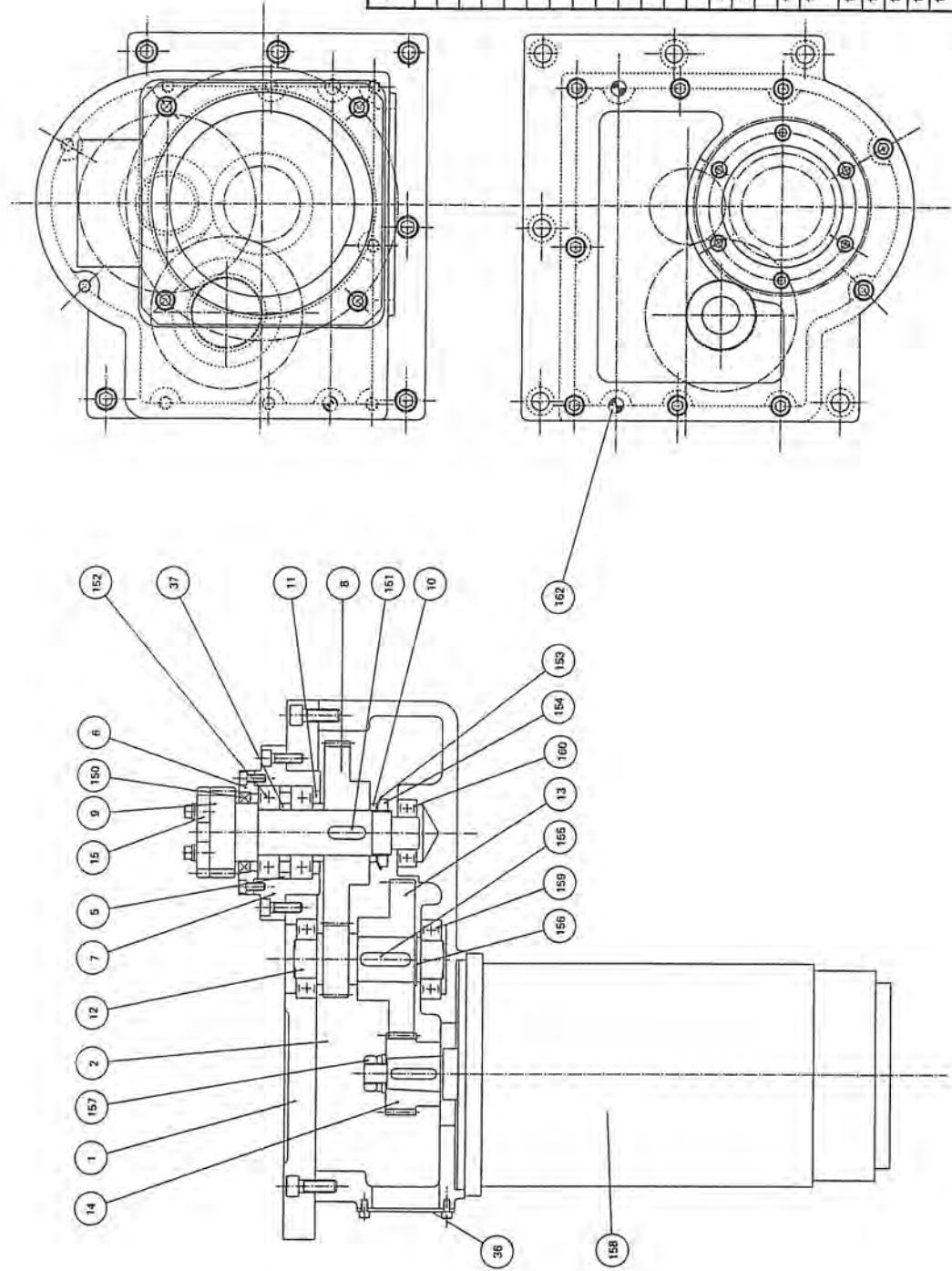
No.	Name	Drawing No. or Type	Material/ Maker	Q'ty	Remarks	No.	Name	Drawing No. or Type	Material/ Maker	Q'ty	Remarks	No.	Name	Drawing No. or Type	Material/ Maker	Q'ty	Remarks
3	Carrier	TM077-07003	SS41D	1		51	Cover	TM077-07051	SPC	1		163	LM guide	HSR25TA 2LUC1 + 1800L-II	THK	2	
13	Bracket	TM077-07013	SS41D	1		52	Stopper	TM077-07052	SS41	2		164	Limit switch	D4E4A1D1	OMRON	1	
17	Cover	TM077-07017	SPC	1		55	Air system	KSP-070404	AG053	1		165	Parallel pin	Ø12m6 x 6dL		2	
18	Plug	TM077-07018	SPC	1		57	Cover	TM077-07057	SPC	1		166	Cylinder	SC2A2-LB-63B 260-PQ-D-SY	CKD	1	
19	Dog	TM077-07019	SS41	2		58	Duct	TM077-07058	SPC	1		167	Hexagon head screw (full)	M10 x 45		2	
25	Bracket	TM077-07025	SS41	1		60	Cover	TM077-07060	SPC	1		168	Grease nipple	PT1/8S		8	
26	Stuff	TM077-07026	S45CD	1		4	Terminal	TM077-02004	AG053	1		169	Elbow	PH4		8	
						5	Terminal	TM077-02005	AG053	1							

Carrier
(All Model Multi-row ATC Magazine) Drawing No. TM077-07000-2



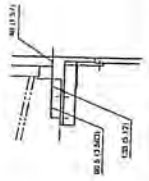
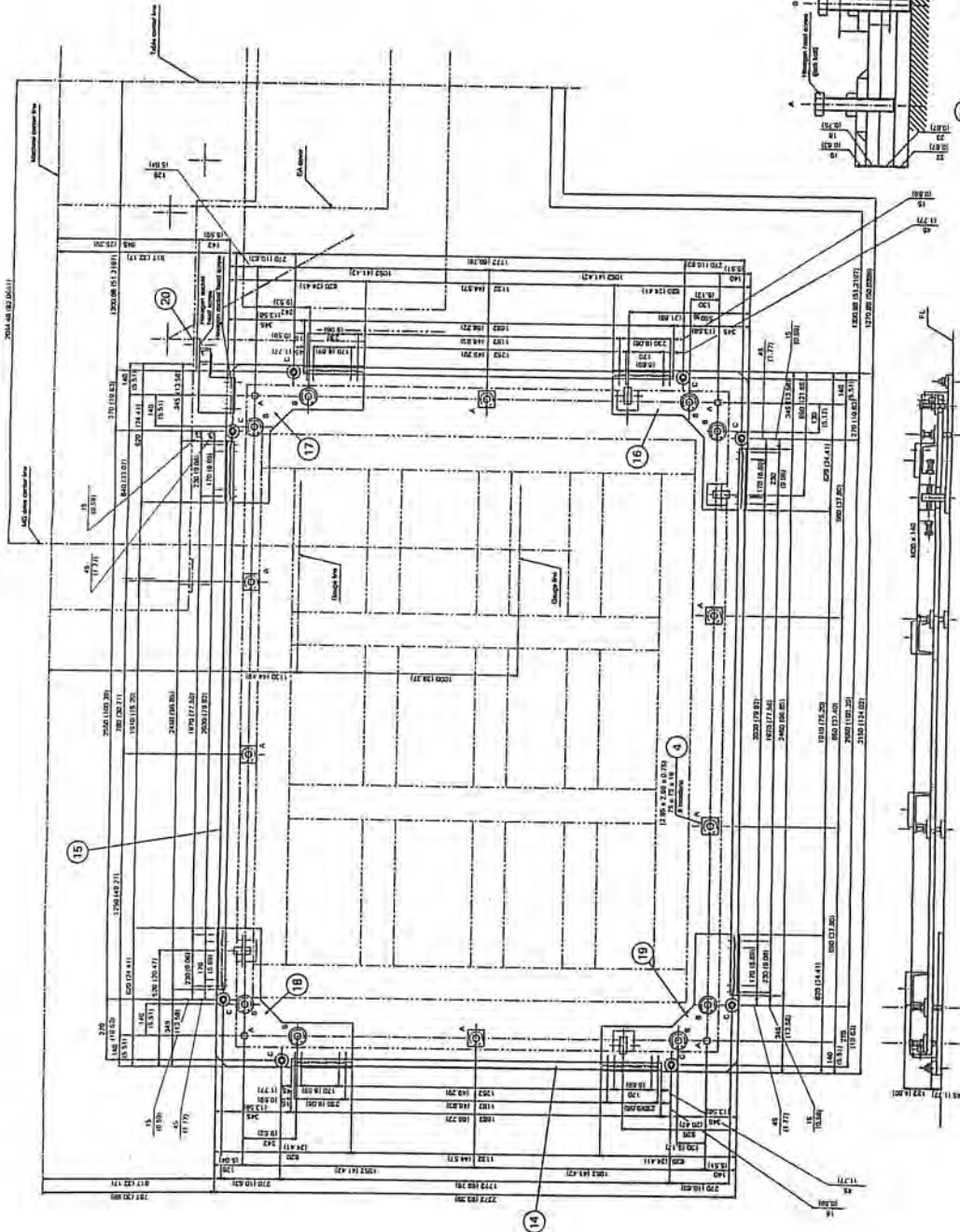
No.	Name	Type	Material/ Maker	Qty	Remarks	No.	Name	Type	Material/ Maker	Qty	Remarks
4	Base	TM077-07004	SS41C	1		29	Plate	TM077-07029	SS41D	2	
20	Block	TM077-07020	SS41	1		31	Cover	TM077-07031	SPC	2	
21	Block	TM077-07021	SS41	1		33	Cover	TM077-07033	SPC	3	
22	Shim	TM077-07022	SS41	2		34	Bracket	TM077-07034	SS41	2	
23	Stopper	TM077-07023	SS41	4		38	CP rack	TM077-07038	On the market	1	
28	Block	TM077-07028	SS41D	2		39	CP rack	TM077-07039	On the market	1	
47	Shay	TM077-07047	SS41	2		171	Headon lead screw (full)	M12 x 60	THK	2	
48	Oil pan	TM077-07048	SPC	1		172	LM guide	MSR25TB 20UC0+880U-II	THK	2	
50	Support	TM077-07050	SS41	1							
170	Feed dumper	FD40 ± 25	Imao	4							

Carrier
(All Model Multi-row ATC Magazine) Drawing No. TM077-07000-3

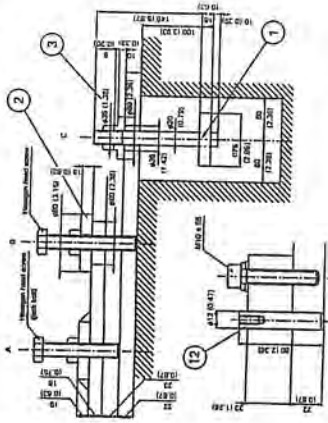


No.	Name	Type	Material/ Maker	Q'ty	Remarks
1	Base	TM077-07001	FC20	1	
2	Gear box	TM077-07002	FC20	1	
5	Collar	TM077-07005	SS41	1	
6	Flange	TM077-07006	S45C	1	
7	Flange	TM077-07007	S45C	1	
8	Gear	TM077-07008	S55C	1	
9	Gear	TM077-07009	S55C	1	
10	Collar	TM077-07010	SS41D	1	
11	Collar	TM077-07011	SS41D	1	
12	Gear	TM077-07012	S55C	1	
13	Gear	TM077-07013	S55C	1	
14	Gear	TM077-07014	S55C	1	
15	Gear	TM077-07015	S55C	1	
36	Cover	TM077-07036	SPC	1	
37	Collar	TM077-07037	SS41	1	
160	Oil seal	AD2651G0	MOK	1	
151	Key	10 x 8 x 30 (rounded square)		1	
162	Bearing	6207LU	NTN	2	
153	Washer	AW07	NTN	1	
154	Shaft nut	AN07	NTN	1	
155	Key	10 x 8 x 40		1	
156	Type C retaining ring for shaft	STW-45	Ochiai	1	
157	Nut (three types)	M15 P1.5		1	
158	BL motor	BL-80E-20T	Okuma	1	
159	Bearing	6206LLU	NTN	2	
160	Bearing	6205LLU	NTN	1	
162	Parallel pin	Ø12x17 x 45L		2	

Foundation Plan
MC-500H (200-tool Multi-row ATC Magazine) Drawing No. TM077-00100-10

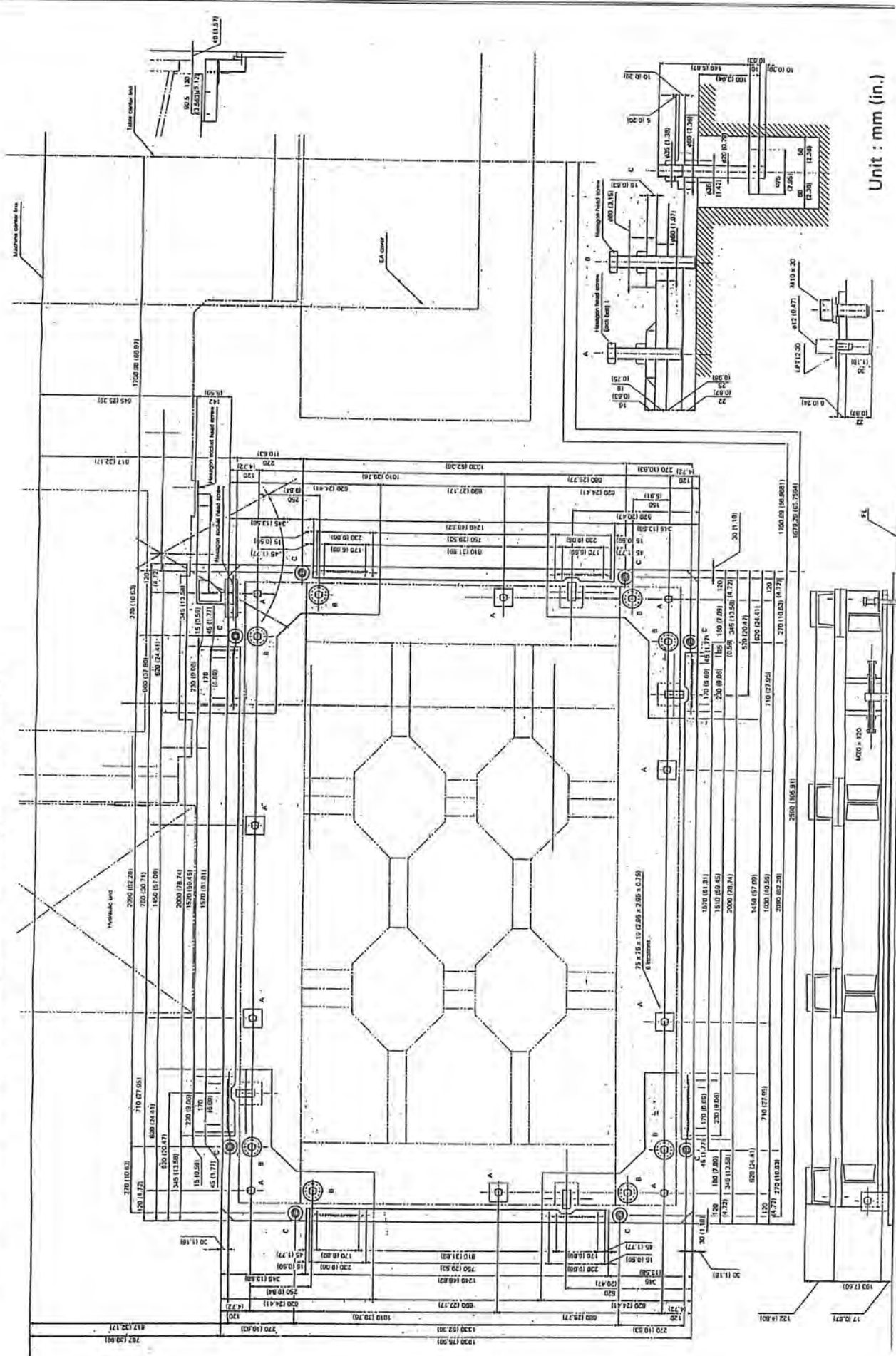


No.	Name	Type	Material/ Maker	Qty	Remarks
1	Foundation bolt	TM077-00101	SS41	8	
2	Thick washer	TM077-00102	SS41D	8	
3	Thick washer	TM077-00103	SS41	8	
4	Plate	TM077-00104	SS41	8	
12	Pin	TM077-00112	SS41	16	
14	Joint	TM077-00114	SS41D	1	
15	Joint	TM077-00115	SS41D	1	
16	Plate	TM077-00116	SS41	1	
17	Plate	TM077-00117	SS41	1	
18	Plate	TM077-00118	SS41	1	
19	Plate	TM077-00119	SS41	1	
20	Support	TM077-00120	SS41	1	
150	Hexagon socket head screw	M10 x 5516		16	
151	Hexagon head screw (full)	M20P1.5 x 110		10	Jack bolt
152	Hexagon head nut	M20P1.5		10	
153	Hexagon head screw	M20 x 140		9	Erected bolt
154	Hexagon head nut	M20		16	
155	Hexagon head screw	M20 x 130		8	
156	Hexagon socket head screw	M12 x 352		2	with W, SW
157	Hexagon socket head screw	M16 x 402		2	with W, SW



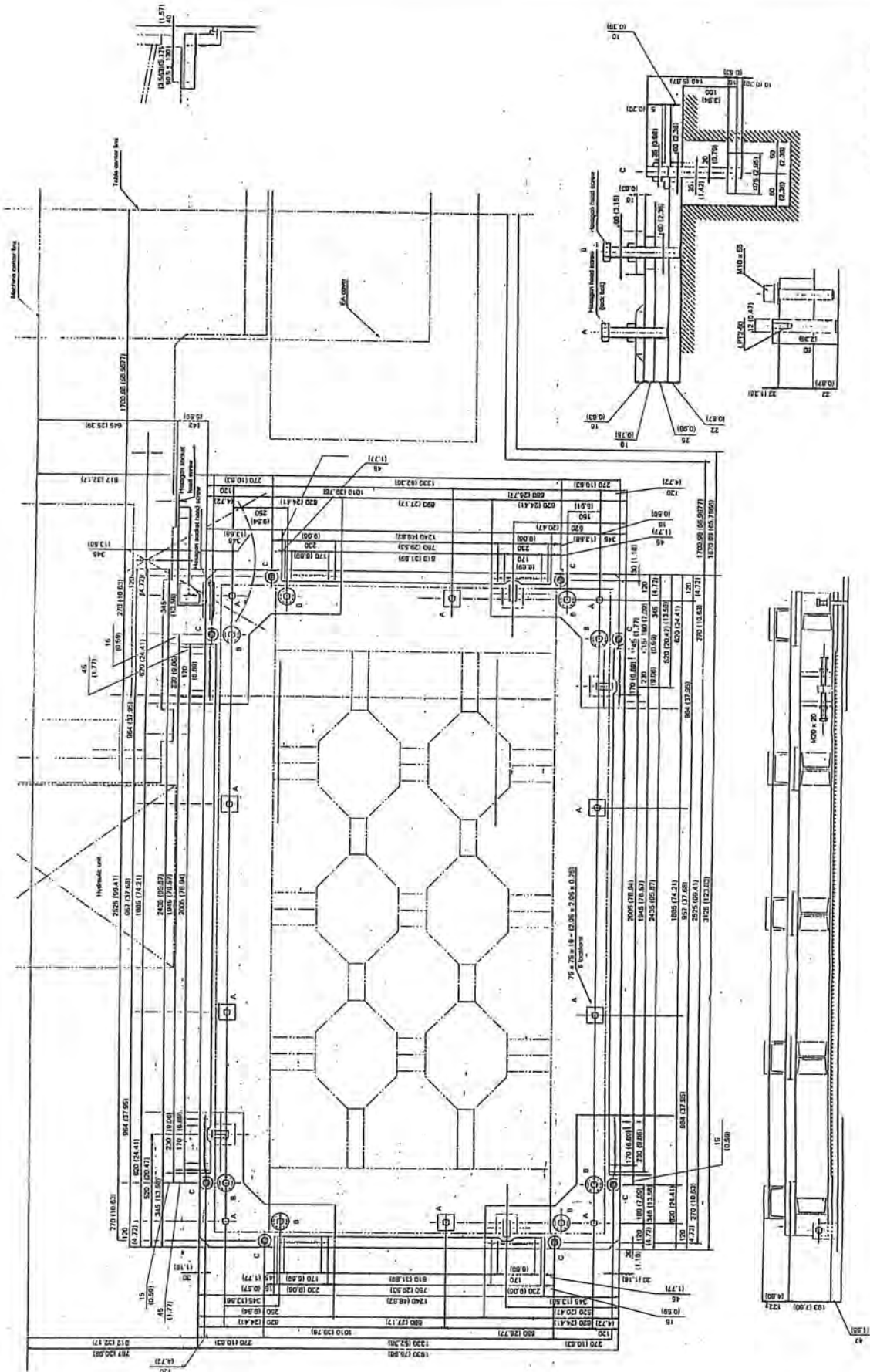
Unit : mm (in.)

Foundation Plan
MC-600H (200-tool Multi-row ATC Magazine) Drawing No. TM077-00100

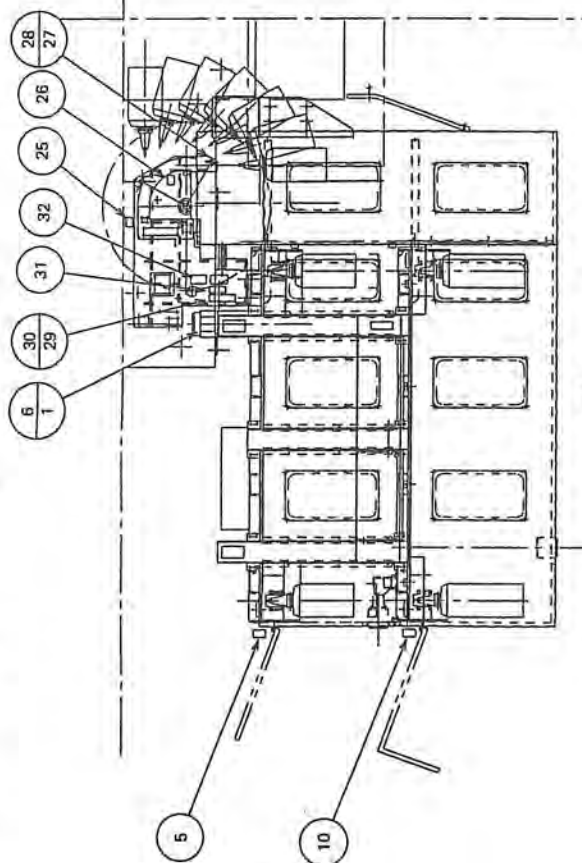


Unit : mm (in.)

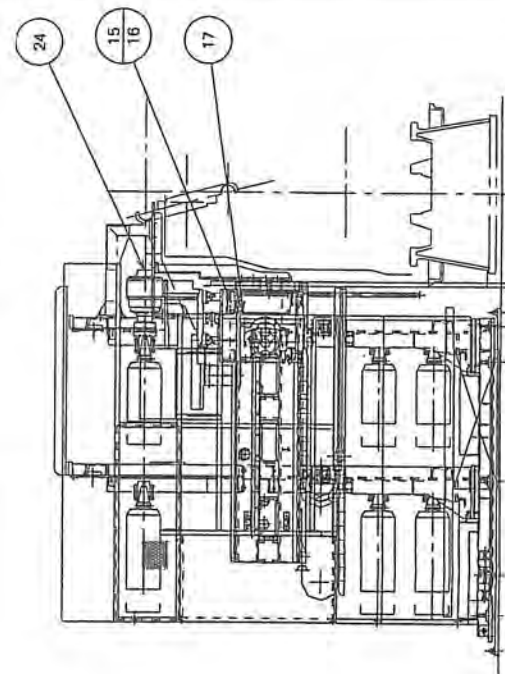
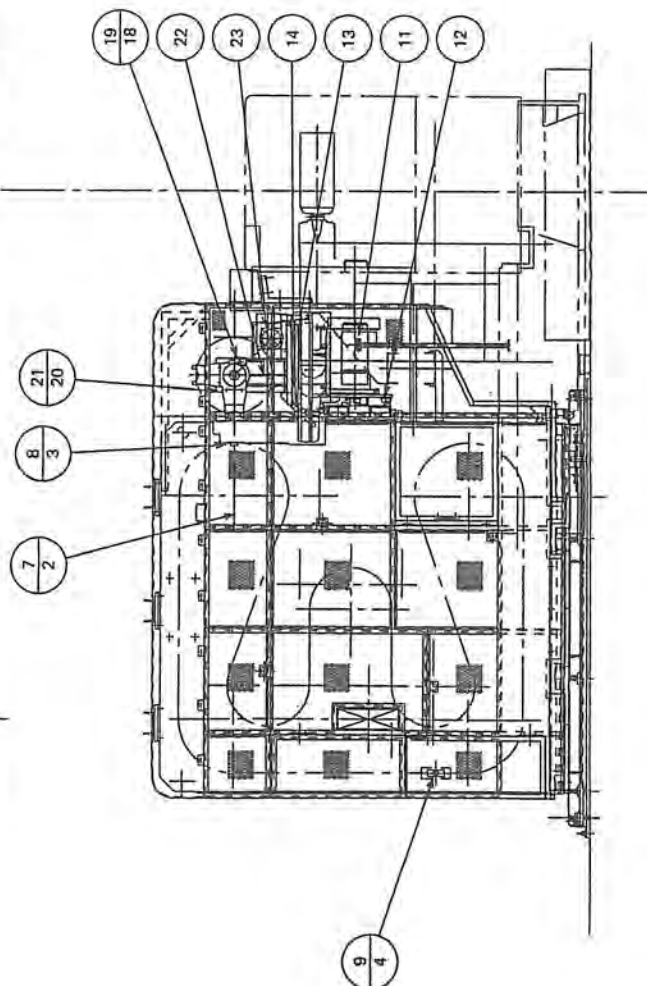
Foundation Plan
MC-600H (240-tool Multi-row ATC Magazine) Drawing No. TM080-00100



Arrangement of Machine Parts
(All Model Multi-row ATC Magazine) Drawing No. TM077-00200-1



No.	Name	Part No.	Type	Q'ty	Maker
1st Magazine					
1	BL motor	MMG1	BL-MH201E-12SS	1	Okuma
2	Index encoder	RMG1	Type F2 encoder	1	Okuma
3	No tool in magazine confirmation	LS9A	DC12V - DC24V BES16-300-JA2	1	Balluff
4	Tool unclamp	LS10A	D-480H	1	SMC
5	Door close confirmation	LS19A	D4B-2173	1	OMRON
2nd Magazine					
6	BL motor	MMG2	BL-MH201E-12SS	1	Okuma
7	Index encoder	RMG2	Type F2 encoder	1	Okuma
8	No tool in magazine confirmation	LS13A	DC12V - DC24V BES16-300-JA2	1	Balluff
9	Tool unclamp	LS14A	D-480H	1	SMC
10	Door close confirmation	LS119A	D4B-2173	1	OMRON
Carrier & Sub Arm					
11	BL motor	MCA	BL-80E-20T	1	Okuma
12	Carrier axis emergency limit	LSCA	D4E-1A101	1	OMRON
13	Sub arm right end limit	LS12A	RO	1	CKD
14	Sub arm left end limit	LS11A	RO	1	CKD
Ready Station					
25	RS at spindle side	LS5A	D4E-1A101	1	OMRON
26	RS at sub arm side	LS6A	D4E-1A101	1	OMRON
27	RS unclamp	LS8A	D4E-1A101	1	OMRON
28	RS clamp	LS7A	D4E-1A101	1	OMRON
29	RS swing to sub arm side	SOL2A	Refer to Hydraulic Circuit Diagram	1	Tokyo Keiki
30	RS swing to spindle side	SOL1A	Refer to Hydraulic Circuit Diagram	1	Tokyo Keiki
31	RS unclamp	SOL3A		1	Tokyo Keiki
32	RS air blow	SOL4A		1	CKD



Skeleton Diagram
(All Model Multi-row ATC Magazine)
Drawing No. TM077-01200-1M

No. of ATC tools	A	B	C	Z1	Z2
200-tool	32	100	64	50	256
240-tool	64	120	32	30	256

- 1 Reduction ratio: A (A times rotation of encoder while one
N = $A \times \frac{B}{Z_p} \times \frac{Z_2}{Z_1}$ rotation of magazine)

$$2 \frac{20.48}{N} = \frac{20.48}{A} = C$$

- 3 Magazine rotation
speed $\frac{B \times 14.5 \text{ mm}}{20} \times \frac{1}{B}$ Length of magazine one rotation

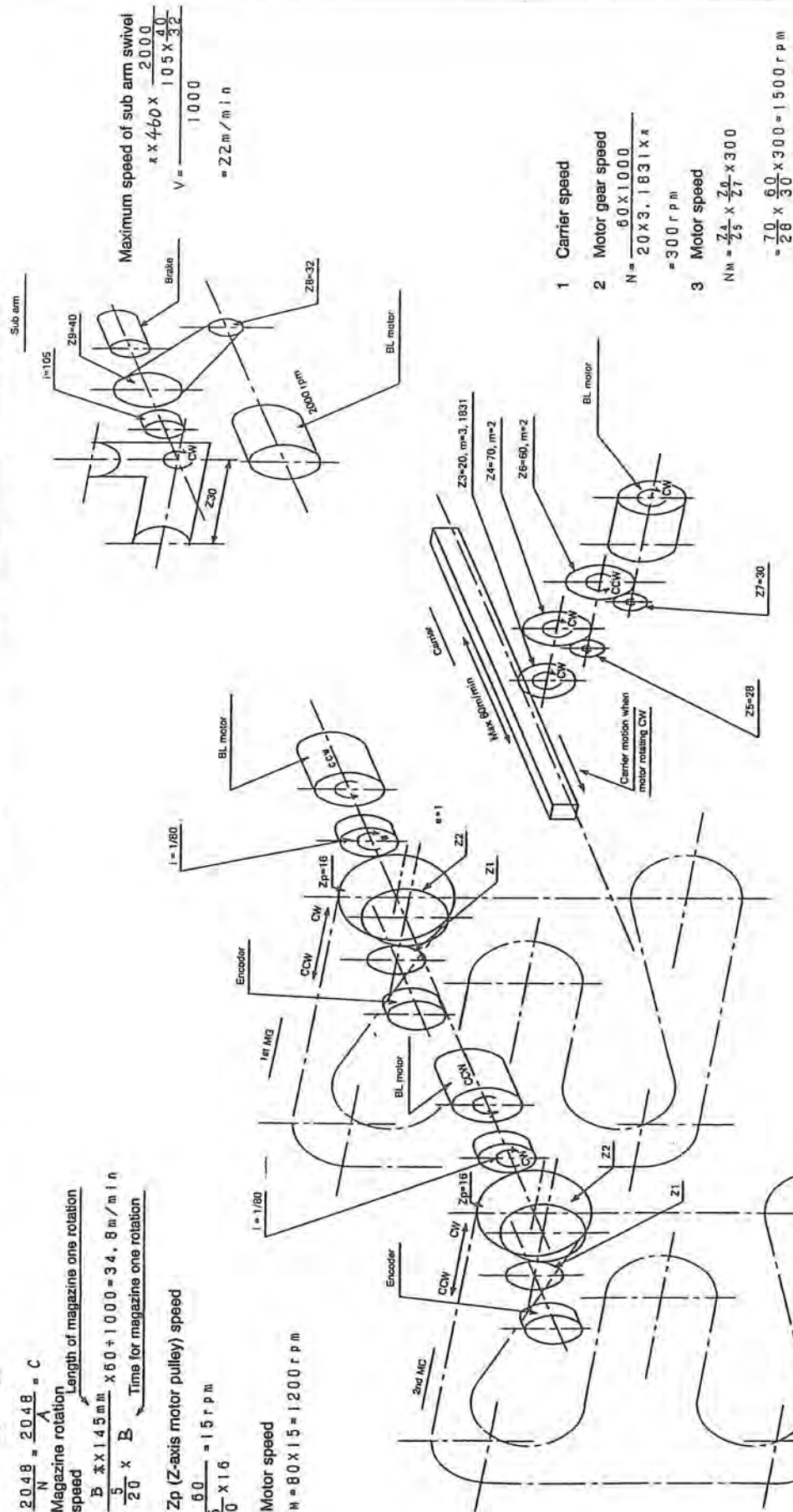
$$\frac{B \times 14.5 \text{ mm}}{20} \times \frac{1}{B} \times 60 \div 1000 = 34.8 \text{ m/min}$$

- 4 Zp (Z-axis motor pulley) speed

$$\frac{60}{20} \times 16 = 15 \text{ rpm}$$

- 5 Motor speed

$$N_M = 80 \times 15 = 1200 \text{ rpm}$$



Pneumatic Circuit Diagram
(All Model Multi-row ATC Magazine)

Drawing No. TM077-02000-1

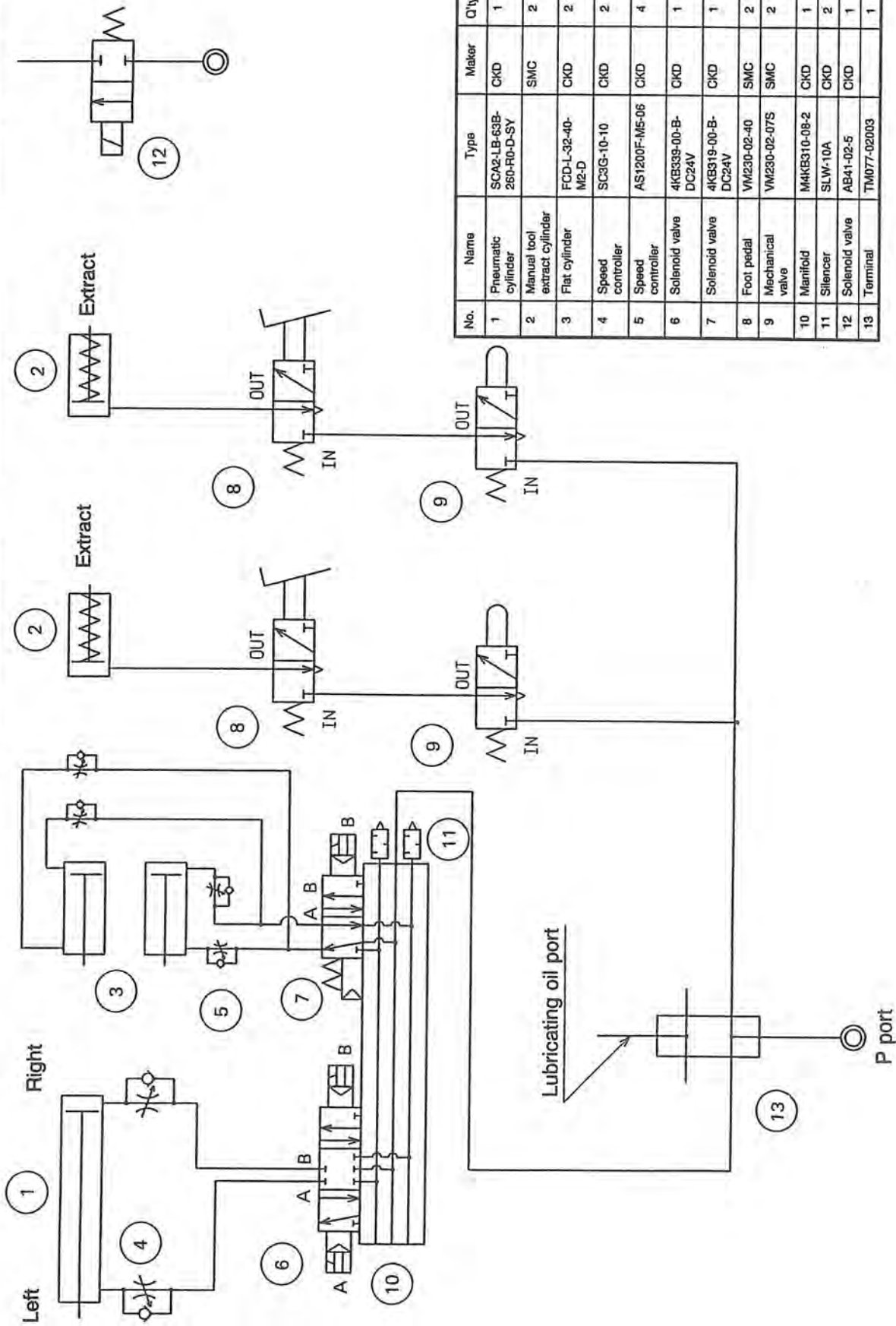
Sub arm left/right

Interlock release

1st MG tool unclamp

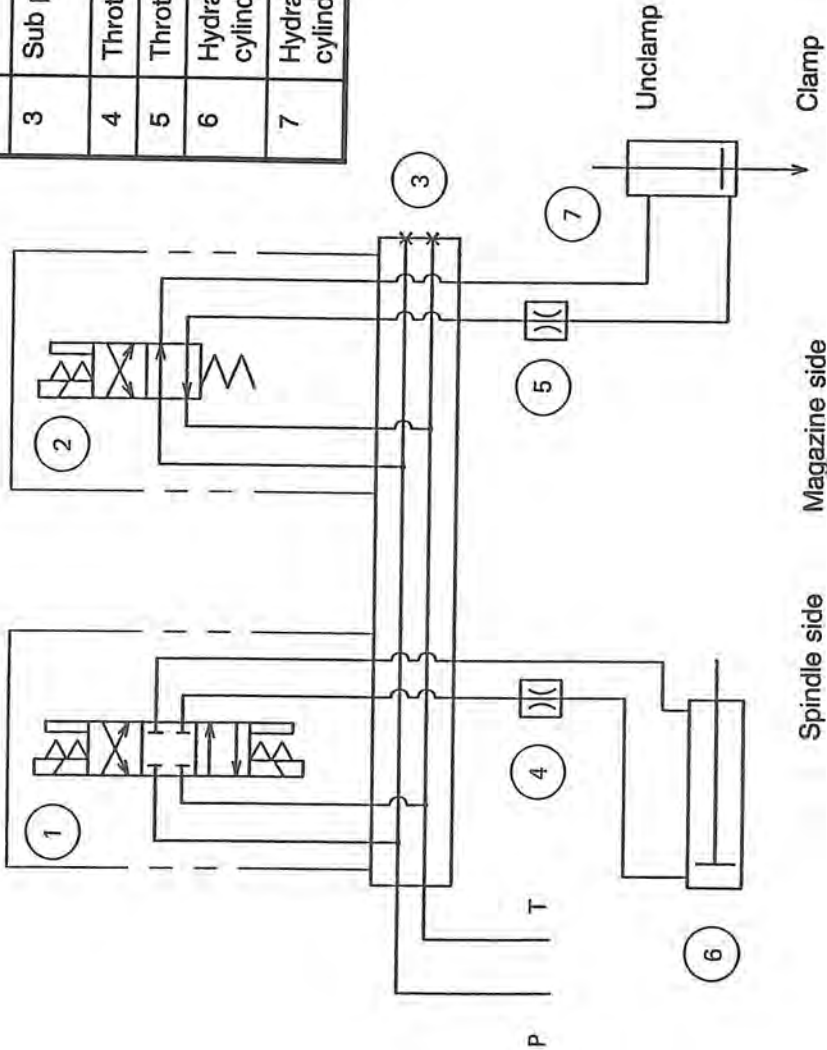
2nd MG tool unclamp

RS air blow



Hydraulic Circuit Diagram
(All Model Multi-row ATC Magazine) Drawing No. TM077-03000

RS swing RS positioning



No.	Name	Type	Maker	Q'ty	Remarks
1	Solenoid valve	DG4V-3-2C-M-P7-H-7-50	Tokyo Keiki	1	
2	Solenoid valve	DG4V-3-2A-M-P7-H-7-50	Tokyo Keiki	1	
3	Sub plate	DGMS-3-2E-10-T-JA-J	Tokyo Keiki	1	
4	Throttle valve	254-2170-13-1	Okuma	1	
5	Throttle valve	265-2499-48	Okuma	1	
6	Hydraulic cylinder	2TA-40B-70B-238-ACD	Horinouchi	1	
7	Hydraulic cylinder	Special		1	

LIST OF PUBLICATIONS

Publication No.	Date	Edition
3454-E-R1	October 1990	3rd
3454-E-R2	February 1992	4th

This manual may be at variance with the actual product due to specification or design changes.

Please also note that specifications are subject to change without notice.

If you require clarification or further explanation of any point in this manual, please contact your OKUMA representative.