

DUAL LINE LUBRICATING SYSTEMS

MODEL : KEP-41E

MOTOR-DRIVEN LUBRICATING PUMPS

INSTRUCTION MANUAL

**KWK** KOWA CORPORATION

改定発行：2015年7月10日

## Introduction

Thank you very much for purchasing the DUAL LINE LUBRICATING SYSTEMS.

This instruction Manual has been compiled as a practical guide for the operation and maintenance of the lubricating system which incorporates the Model KEP-41E motor-driven lubricating pump.

All descriptions contained herein are based on the standard system, which may, therefore, be different from those of purchased system. Such a problem can be solved by referring to the final specifications. However, it is required to understand that some changes caused by the modification of equipment may not be described in the final specifications.

## Guarantee

The guaranteed period this system will be one year from the commencement of operation. Any defect or failure occurring during the guaranteed period, for which KWK is liable in design and manufacturing, shall be corrected and / or eliminated by KWK without compensation. However, any defect or failure caused by improper operation which is not described in this Instruction Manual shall not guaranteed, even though the defect or failure occurs within the guaranteed period.

## PRECAUTIONS OF SAFETY

Before the installation, operation, maintenance and inspection, read carefully this instruction manual and other accompanying documents for correct service.

Familiarize with the knowledge of equipment, information of safety and all of cautionary instructions for service.

The precautions of safety is shown in each equipment of the centralized lubricating system by using safety mark.

Particular attention should be called to the places where these safety marks are given.

The safety marks are divided into "WARNING" and "CAUTION".



If mishandled; In case a dangerous situation may occur, it could result in death or serious injury



light injury, and in case a physical damage may occur.

If mishandled; In case a middle injury or

For the matter being mentioned in the CAUTION, it may result in an importance according to circumstances. The important content is given to all of safety mark, and obeys it without fail.

This system provides the max. Working pressure 21MPa (210kg/cm<sup>2</sup>). When each equipment is disassembled and inspected, stop the operation of pump, and release the pressure to perform the operation as 0MPa (0kg/cm<sup>2</sup>).

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## 1. General description of DUAL LINE LUBRICATING SYSTEMS (End type)

### 1-1 Outline of lubricating equipment

This system comprises motor-driven lubricating pump unit which will supply grease or oil to high pressure, external piping, measuring valves and control panel which is used to operate the lubricating system.

The schematic diagram of this system is as shown in Fig.1.

All the following descriptions are for the type used for greasing. When used for oil lubrication, the measuring valve and the tank of the pump are changed but all the other parts are commonly.

The motor-driven lubricating pump unit consists of pump body, electric motor, and hydraulic-operated reversing valve, all of which are mounted on a common base made of steel plate.

A reservoir made of steel plate is installed on the top of the lubricating pump, on which a level rod is provided to indicate the amount of grease stored in the reservoir.

A pressure gauge is also attached to the lubricating pump unit to show the discharge pressure of the pump.

The outside piping consists of the two main supply pipes of parallel piping from the two outlets on the solenoid operated reversing valve of the lubricating pump, the pressure control valve at the end of main supply piping, the branch piping from the main supply piping, and the sub-supply pipe from the measuring valve.

The optimum type of measuring valve is selected according to the number of lubricating ports and the quantity of grease fed, and installed near lubricating port.

In addition, a control panel is provided for automatic operation of the lubricating pump.

Also installed is lubricating pump which serves to supply grease into the reservoir.

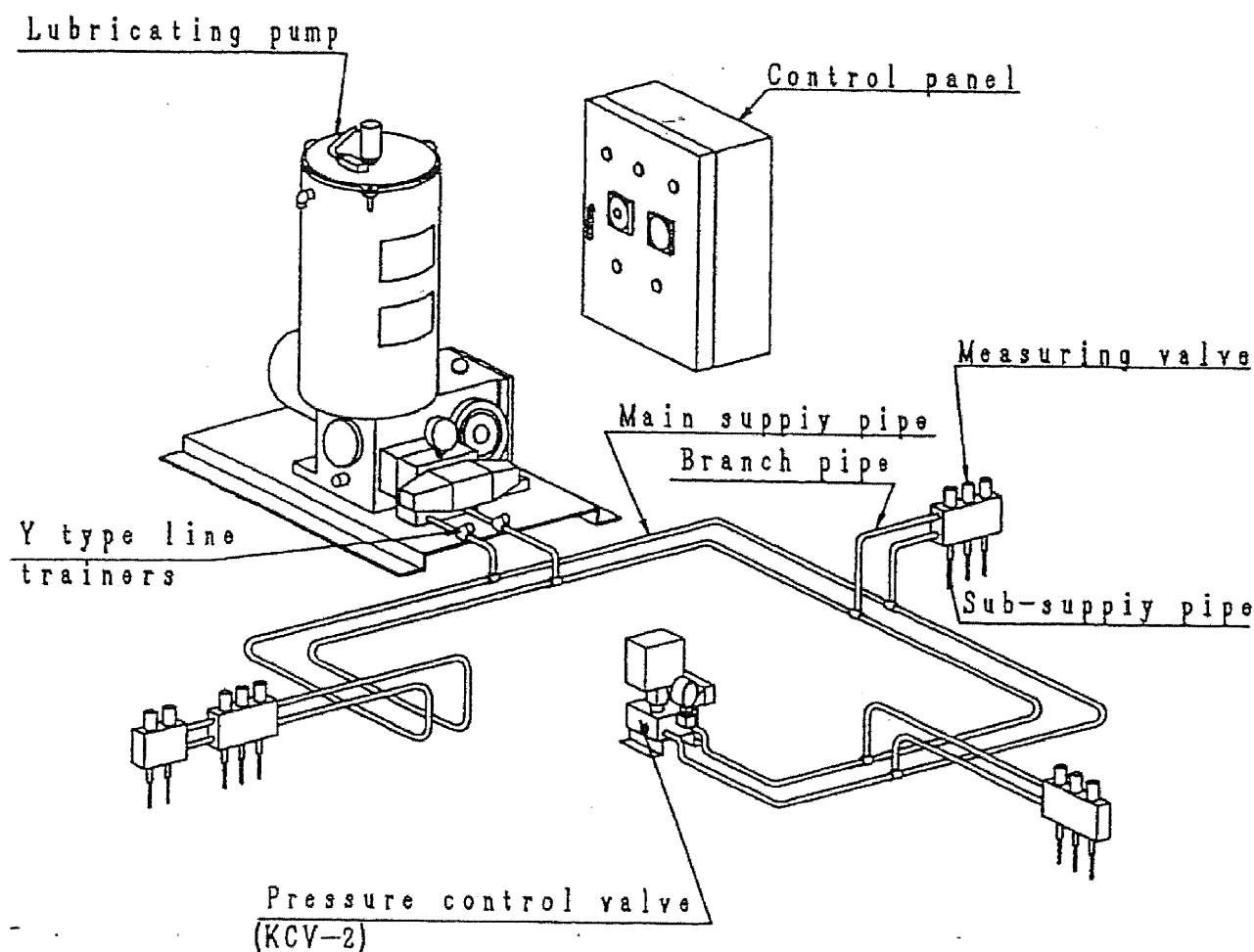


Fig.1 Schematic diagram of lubricating circuit

#### 1-2 Outline of lubricating circuit

The lubricating route is as outlined in Fig.2 (A, B, C).

When the lubricating pump is suspended, the solenoid operated reversing valve is under the condition of Fig. 2A, and the main supply piping No.1 and No. 2 lines are connected to the tank. When the lubricating pump is operated, the solenoid operated reversing valve is turned to the route of Fig. 2B, the discharged grease from the pump flows through No. 1 line in arrow direction to be pressed into the inlets under each measuring valve for grease feeding of one time to one system. When the lubricating completes, the limit switch and pressure switch incorporated in the pressure control valve functions to send signals to the control panel and the pump motor comes to stop automatically and the solenoid operated reversing valve is returned to the condition of Fig. 2A.

When the pump is operated again, the lubricating route becomes as shown in Fig. 2C, the upper inlets of the measuring valves for lubricating of the 2<sup>nd</sup> time.

When the lubricating completes, the limit switch incorporated in the pressure control valve functions to stop the pump automatically, and the solenoid operated reversing valve is returned to the condition of Fig. 2A.

The above condition A, B, C, are repeated at every time of lubricating.

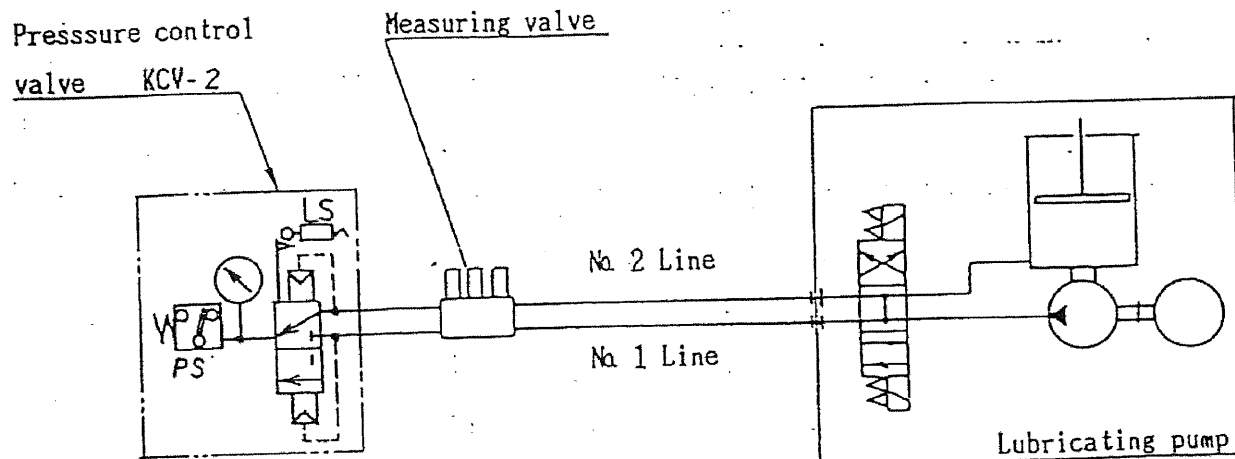


Fig. 2 A

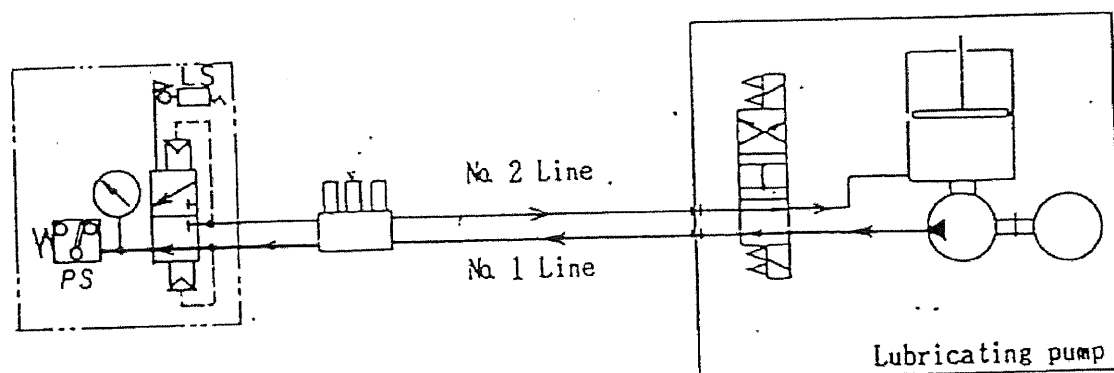


Fig. 2 B

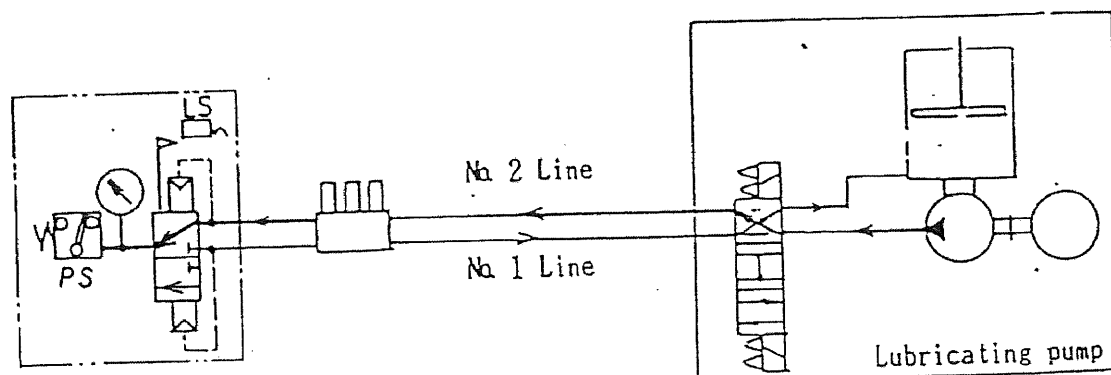


Fig. 2 C

### 1-3 Specifications of equipment

#### (1) Specifications of lubricating pump

Nomenclature	Item	Lubricating pump model and specifications
		KEP-41E
Pump	Applicable grease	NLGI No.00~No.1
	Discharge capacity (cm <sup>3</sup> /min)	252/60Hz
	Discharge pressure (MPa)	* Max.20.6
	Pump's revolutions (rpm)	120/60Hz
Geared motor	Type	Totally-enclosed, three-phase induction motor, continuous rating IP55
	Output × No. of poles	0.4kW × 4P
	Voltage, Frequency	* 3 φ - AC480V, 60Hz
	Reduction gear ratio	1/15
Reservoir	Capacity (Lit.)	40
	Level switch	* Low level switch 1 stage * High level switch 1 stage
Solenoid operated reversing valve	Model	UL-DSG-03-3C3-D24-5090S
	External pipe joints	2×Rc(PT)3/8
Total mass (kg)		172

- ※ For the outside dimensions and the internal structure, please refer to the drawings of the principal equipment at the end of this manual.
- ※ Check the column with asterisk mark(\*) referring to the final specifications.

(2) Specifications of measuring valve

Measuring valve size	Model	Discharge ports	Discharge capacity cm³/stroke		Adjustable amount cm³/one revolution of screw	Mounting bolts (Attachment)	Mass (kg)	Pipe joints	
			Max.	Min.				Inlet	Discharge
KS-30	KS-31	1	1.2	0.2	0.06	M8×65L	1.2	PT3/8	PT1/4
	KS-32	2					2.0		
	KS-33	3					2.8		
	KS-34	4					3.7		
KS-40	KS-41	1	2.5	0.6	0.10		1.4		
	KS-42	2					2.3		
	KS-43	3					3.2		
	KS-44	4					4.0		
KS-50	KS-51	1	5.0	1.2	0.15		1.5		
	KS-52	2					2.5		
	KS-53	3					3.5		
	KS-54	4					4.6		
KW-30	KW-32	2	1.2	0.2	0.06	1.5			
	KW-34	4				2.5			
	KW-36	6				3.5			
	KW-38	8				4.5			
	KW-310	10				5.5			
KW-50	KW-52	2	5.0	1.2	0.15	1.5			
	KW-54	4				2.5			
	KW-56	6				3.5			
	KW-58	8				4.5			

① The working pressure is 1MPa or lower.

② Working pressure : 21MPa

[The maximum working pressure of measuring valve using oil should be 10MPa.]

- ③ Applicable grease : NLGI No.00~No.1

## 2. Installation of equipment and piping procedure

### 2-1 Installation of lubricating pump

The lubricating pump is designed so as to be used indoor. It should be kept in mind that the pump is to be accommodated in a shed or housing capable of protecting the machine from weather, when being installed outdoor.

Maintenance of the machine should be easy even during operation, and the place should be free from excessive dust, temperature change and moisture.

Install the lubricating pump horizontally on a sturdy channel or concrete foundation.

Note that if stresses are locally applied to the lubricating pump frame when the foundation bolts are tightened, it may cause deflection of the pump center alignment and early damage to unit.

In either case, the pump base should be raised more than 50mm above the floor surface in order to facilitate the maintenance, inspection and water draining. Set up the control panel in place where the lubricating pump can be easily operated and controlled.

### 2-2 Piping procedure

#### (1) General precautions

As shown in Fig.1, the piping consists of the main supply pipes coming from the hydraulic-operated reversing valve of the lubricating pump unit, branch pipes running from the main supply pipes to the measuring valve, and the sub-supply pipes from the outlets of the measuring valve to lubricating points or bearing to be lubricated. All pipes should be supported properly so as to prevent them from being damaged by vibration, and should not be laid on locations where the pipes may be damaged by other obstacles.

#### (2) Connection of main supply pipes and branch pipes

The main supply pipes and branch pipes between the lubricating pump and measuring valve are subject to pressures as high as 21MPa. This fact requires that pipe material incorporated in the above pipe lines should safely withstand the pressure and should have an inside diameter which allow grease to flow smoothly.

Use the steel pipes of STPG 38 (schedule 80) or of higher grade.

The lubricating pump is operated at the maximum discharge pressure of 10MPa or 21MPa.

If the use at the maximum pressure of 21MPa is predetermined, the pump is delivered with the specifications for 10MPa. In this case, STPG 38 (schedule 40) may be used as the piping material.

If the lubricated points of a machine include any moving part which slides or swings, flexible hoses is used for the sub-supply pipes.

To the moving parts of the main supply pipes and branch pipes, use the high-pressure rubber hoses for the maximum working pressure 21MPa.

Where the hoses surface may possibly be worn out by sliding, use wire braided hoses on the surface.

(a) “Y” type line strainers and glove valves.

The “Y” type line strainers should be installed on the discharge pipes of the hydraulic-operated reversing valve.

It should be kept in mind that the strainer is to be installed so that it can be removed and cleaned easily, with its installation direction corresponding to the flow direction of grease.

Also, be sure to install the screwed globe valves and pressure gauge as illustrated in order to check the lubricating pump performance and to provide convenience when the system is out of order.

(b) Attaching 2-way check valve

When the main supply pipe rises from the lubricating pump level more than 5 meters or when oil is used, attach 2-way check valve near the lubricating pump in series with the “Y” type line strainers to prevent reverse flow of the grease.

(3) Mounting measuring valve

(a) It isn't advisable to attach the measuring valves directly to the main supply pipes.

Unlike the case attached to the branch pipes, direct attaching to the main supply pipes makes it difficult to continue operation of the system when the measuring valves must be removed for piping line improvement in future or for troubles. It also can cause error motion of the whole system due to air allowed into the main



pipes.

- (b) When measuring valves are connected in series, limit the number of pieces to about 3, in principle. When more than three measuring valves are used, branch a separate pipe from the main pipe for the piping connection.

If the spacing between measuring valves is 0.5 meter or shorter, however, up to 5 measuring valves can be attached.

- (c) The measuring valve should be mounted on a support exclusively used for this purpose or separately fabricated base plate equivalent to the aforementioned support. The measuring valve should be installed at the location as close to the lubricating point as possible, where its indicator rods can be seen easily from the surrounding areas, and where the amount of supplied grease can be adjusted easily.
- (d) The measuring valve should be protected with a steel plate cover, when being installed at the dusty location often splashed with water and subject to a high radiation heat.
- (e) Blank the ends of the measuring valves attached to the branch pipes and main supply pipes with a high-pressure plug.
- (f) To confirm the lubricating operation of measuring valve easily, the branch pipes should be connected correctly to the measuring valves so that the indicator rod of the respective measuring valves move in same direction. In a more detailed explanation, all pipes branched from No.1 discharge line should be connected to the upper ports of the respective measuring valves.

(The same result may be obtained even if the pipes branched from No.1 line is connected to the lower ports of the measuring valves.)

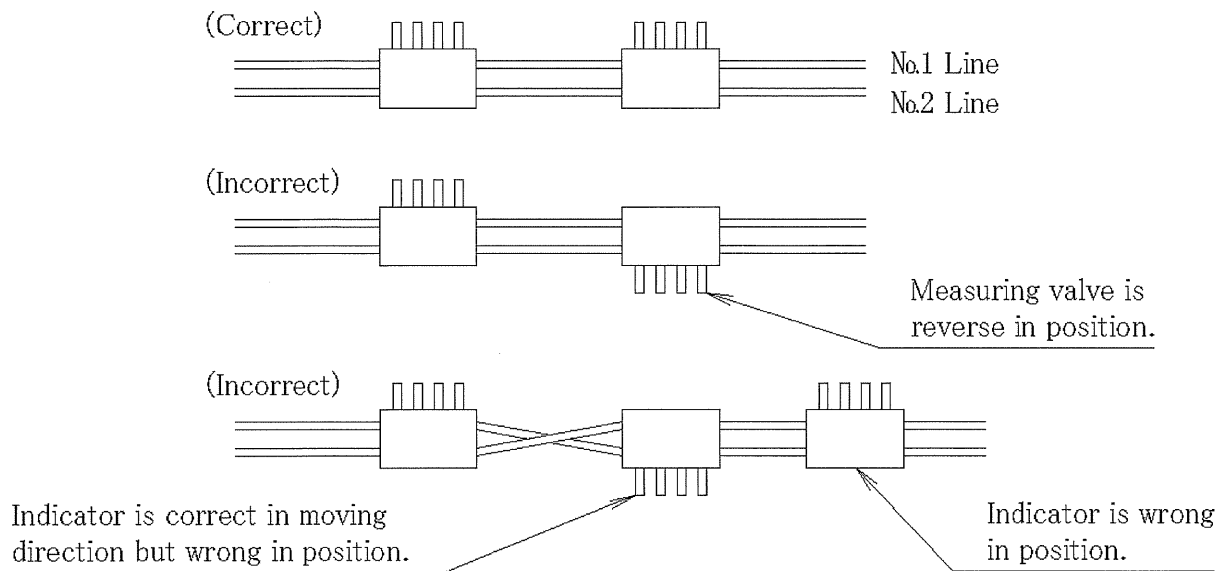


Fig.3 Connection of measuring valve

#### (4) Connection of sub-supply pipes (Lube piping)

- (a) Since the pressure required for greasing against the back pressure of bearings and resistance of the sub-supply pipes reaches the maximum operating pressure, it is necessary to use the material which withstands the pressure of 3MPa for the piping from the measuring valves to the points of lubrication.

For the piping, 8A (1/4B) steel pipes or 6  $\phi$  and 8  $\phi$  copper pipes are used.

- (b) When the bearings are submitted to a high back-pressure, prevent reverse flow of grease and error motion of the measuring valves by using check valves or inverse flow check valves. (Select the piping material carefully as the withstand pressure of the sub-supply pipes also changes in this case.)

- (c) Bearings must be composed so as to ensure discharge of old grease.

For sealed type bearings, it is necessary to lead the filled grease to the outside by attaching a relief valve to the bearings.

- (d) When the lubricated points of a machine include any moving part which slides flexible hoses must be used.

#### (5) Attaching pressure control valve

- (a) For connection of the pressure control valve, select a point of easy inspection and pressure adjustment extending the connection from farthest measuring valve from

the lubricating pump.

- (b) The measuring valve should be protected with a steel plate cover, when being installed at the dusty location often splashed with water and subject to a high radiation heat.
- (c) To connect the pressure control valve to the lubricating piping, be sure to attach a screw type globe valve in-between as it facilitates lubricating pump performance check and trouble-shooting of the system.

### 3. Construction and function of lubricating pump

#### 3-1 Greasing pump body

See the assembly sectional view of greasing pump body.

The greasing pump body lies under the tank, the power is transmitted to the crank shaft in the pump casing by direct-coupling of motor, and the reciprocating motion of main plungers 1 & 2 and valve plunger is made by the connecting rod being connected thereto for suction of grease.

Thus, the system of pump provides double plunger system by the combination of main plungers 1 & 2 and valve plunger.

#### 3-2 Operation of double plunger

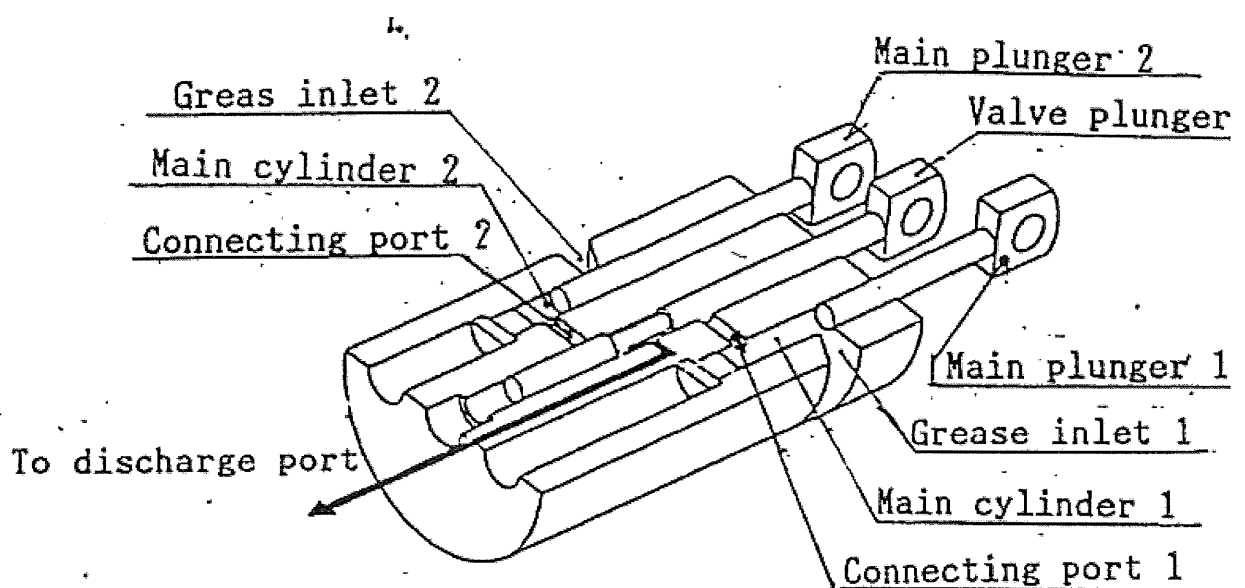


Fig.4-1

Grease inlet 1 is opened by retracting the main plunger, and grease enters the main cylinder 1 from grease reservoir. The main plunger 2 finishes pushing out of grease, and simultaneously valve plunger retracts and closes the connecting port 2.

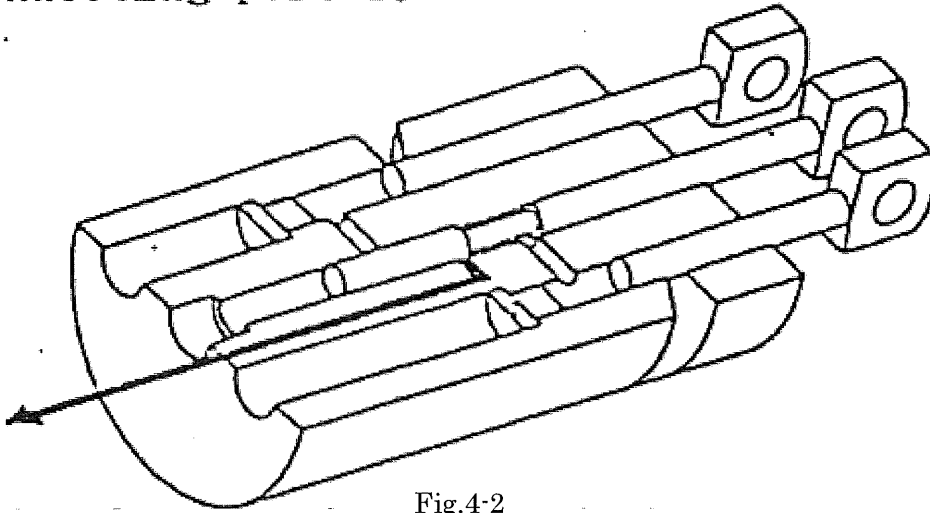


Fig.4-2

The main plunger advances and closes the grease inlet 1, and simultaneously the valve plunger retracts and opens the connecting port 1. Grease in the main cylinder for discharge with the advance of main plunger 2 retracts and the inside of main cylinder 2 provides the vacuum.

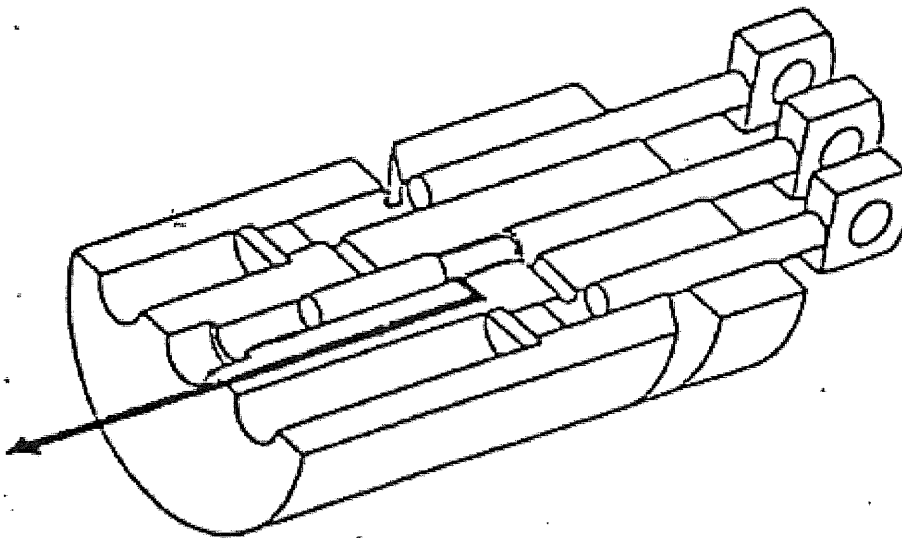


Fig.4-3

The main plunger 1 finishes pushing out of grease, and simultaneously valve plunger advances and closes the connecting port 1. Then, the main plunger 2 retracts and opens the grease inlet 2.

Grease enters the main cylinder 2.

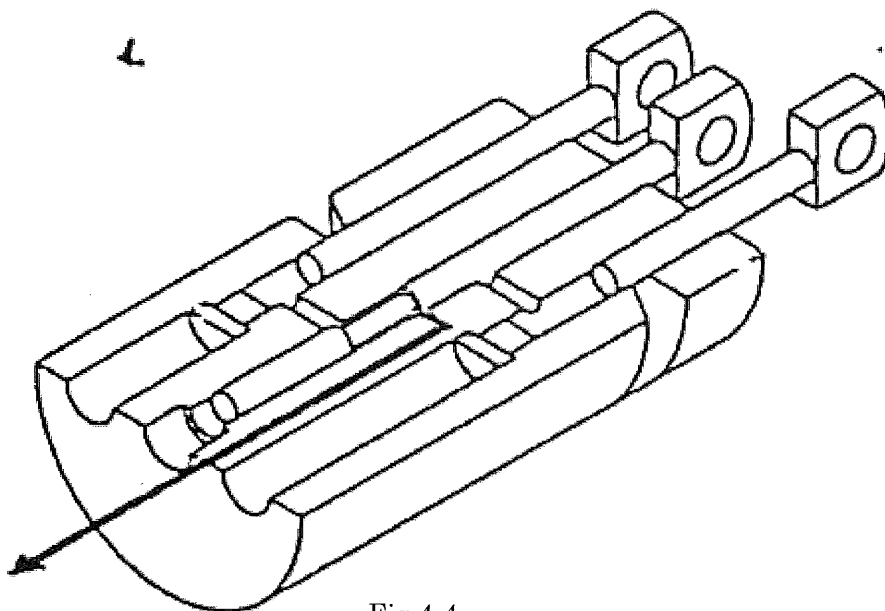


Fig.4-4

The inside of main cylinder 1 provides the vacuum by retracting the main plunger 1.

Then, the main plunger 2 advances and closes the grease inlet 2, and simultaneously the valve plunger advances and opens the connecting port 2.

Grease in the main cylinder 2 passes through the inside of valve cylinder for discharge with the advance of main plunger 2.

### 3-3 Relief valve and pressure relief valve

#### (a) Relief valve

The relief is incorporated in the sub-plate being mounted on the pump body.

This relief valve is provided for opening the emergency pressure when the pipeline is choked for some reason or other, the relieved grease pressure is opened to the tank, and it protect all of greasing system.

Lubricating pump model	Maximum discharge pressure	Relief valve set pressure
KEP-41E	21MPa	23MPa $\pm$ 0.5MPa

To meet the specification in case of the agreement, the relief valve has been already adjusted in the shipment at our factory. Therefore, avoid adjusting the relief valve at random on job-site.

#### (b) Pressure relief valve

In case of the test running or the charge of electric writing, the pump (motor) may

reverse.

With reversing of the pump, it is built so as to escape into the tank by the action of pressure relief valve without discharging grease.

When the pump reverses in this pressure relief valve, the inside of cylinder provides abnormally high pressure unlike the forward in timing of double plunger, and the plunger breaks. Accordingly, in order to prevent its breakage, this valve opens abnormally high pressure to the tank, and it acts for protection of the pump.

Reversing the motor adversely affects the pump. Hence find it as quickly as possible, and take care to avoid reversing for long.

(A correct direction of rotation of pump is cast on the surface of casing of pump body.)

The pressure relief valve has been adjusted in KWK factory in accordance with the specifications at the time of concluding the agreement, before being delivered.

Therefore, it is recommended that relief valve should not be adjusted at the site.

The pressure relief valve which has been set at 11MPa can be distinguished from other valves by the mark stamped on the cap and by red paint.

(c) Pump relief valve

At a test run or when the electrical wiring is changed, the pump (motor) may possibly turn in reverse.

Should such happens, the grease is not discharged but released into the tank as the pump relief valve functions.

Unlike the condition of forward turn of the double plunger timing, inverse turn of the pump causes abnormal high pressure in the cylinder and the plunger is broken.

To prevent the breakage, the pump relief valve discharges the abnormal high-pressure into the reservoir to protect the pump.

Find inverse rotation of the motor earlier as far as possible and refrain from keeping reverse turn for a long time as it affects the pump performance.

(The correct turning direction of the pump is indicated by arrow mark plate on the coupling cover.)

### 3.4 Reservoirs

#### (1) Reservoir

The reservoir is to store grease. A follower plate is provided in the reservoir so as to level out the grease surface along with grease consumption and to shut off the outside air.

On the center of the follower plate, a level rod is placed vertically going through the cover at the top of the reservoir and a cylindrical cam for level switch is provided on level rod.

A grease overflow port is also provided at the upper part for overflow of excessively filled grease.

#### (2) Low level switch

If grease is consumed until the reservoir is emptied, air is admitted into the pump, and may also be admitted into pipe line. Once air is admitted into the pipe, the lubricating operation becomes extremely unstable.

In the extreme case, grease must be drained completely from the pipe line in order to purge air, and the pipe line must be refilled with new grease.

A low level switch is provided at the upper part of the reservoir as the standard specification so that the pump operation stops and alarm is given when the grease is consumed to certain limit.

The cam to operate the low-level switch is at the upper end of the level rod.

When the grease is used and the follower plate comes down to certain level, the level rod directly connected to the follower plate also comes down, and the cam actuates the low level switch.

The signal from the low level switch is transferred to the control panel through the terminal box of the pump to issue alarm and to stop the motor.

Besides the low level switch, a high level switch can also be attached easily at a field site so as to transmit the signal of high grease level.



(3) Level switches for special specifications

The following switches are available as the special specifications.

Lubricating pump model	No. of level switches	Application
KEP-41E-S1	Low level switch : 1 High level switch : 1	For applications in which grease is added by means of motor-driven transfer pump.
KEP-41E-S2	Low level switch : 2 High level switch : 2	For applications in which grease is automatically added by means of bulk feeding system.

These switches are set depending on customer's order and are shipped after adjustment.

(The lubricating pump of the standard specification is provided with one low level switch.)

### 3-5 Solenoid operated reversing valve and pressure control valve

#### (1) Solenoid operated reversing valve

Attached to the lubricating pump base, the solenoid operated reversing valve is used together with the pressure control valve at the end of the main supply pipe to feed the grease supplied from the pump alternatively to the two grease mains.

The grease pressurized by the pump goes through the selector, actuates all the measuring valve, and then operates the pressure control valve.

The solenoid electrically interlocked with the select switch of the pressure control valve is actuated for switching.

#### (2) Pressure control valve

The pressure control valve is used together with an end type motor-driven lubricating pump. The pressure line side of two main supply pipes is detected by using a limit switch.

When reached the preset pressure, the pressure switch is actuated, and it brings the motor-driven lubricating pump to stop and transmit lubricating complete signal.

Ordinarily, one control valve is provided near the end of the main supply pipe.

The pressure control valve consist of a piston operated by grease pressure, a switching mechanism interlocked with the piston, and limit switches, and the change-over pressure can be set by the adjust screw within the range from 2.5 to 20 MPa.

#### (3) Operation of solenoid operated reversing valve and pressure control valve

When the solenoid SOL-b is energized to operate the pump, the grease sent from the pump is transferred to the main supply pipe L1 through the inlet P. At this point, the other main supply pipe L2 is connected to T to be opened to the grease tank.

The grease transferred to L1 is completely supplied to each measuring valve. When the pressure of main supply L1 is transmitted, the piston moves, and the pressure gauge and pressure switch are connected to the line of L1. The limit switch is interlocked with this piston, and it transmits the change-over of the pressure line to the electric control panel.

When the grease lubrication is completed and the pressure in L1 increases and the pressure reach the preset pressure of pressure switch, it signals to the electric control valve.

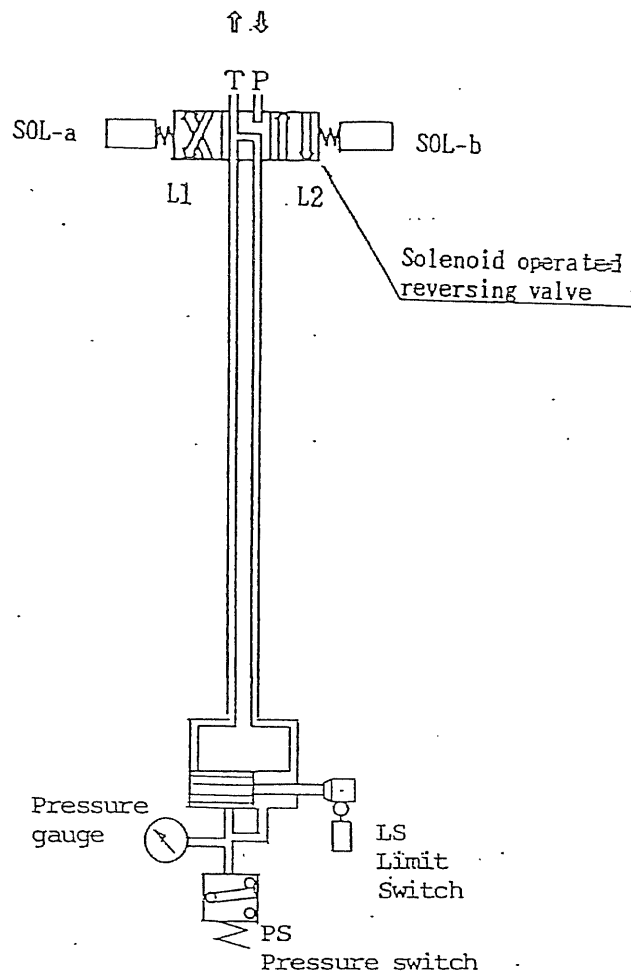


Fig.5

When the solenoid SOL-b is de-energized, the pump driving motor is stopped at the same time. When the solenoid is de-energized, the solenoid operated reversing valve returns to the neutral piston, and the main supply piped of L1, L2 are connected to T, and the pressure in the pipe is released to the grease tank.

In case of the next grease lubrication, the solenoid SOL-a is energized, and the inlet P of pump is connected to the main supply L2, and T being introduced in the grease tank is connected to the main supply pipe L1. The grease being pressurized from the pump reaches the pressure control valve through L2, and the piston is actuated in the direction opposite to the preceding case. Next, when the pressure in the pipe increases and reaches the preset pressure, the pressure switch is actuated, and the solenoid SOL-b is de-energized and also it brings the pump to stop.

The change-over pressure is adjusted to 4MPa before shipment from our plant.

#### 4. Trial operation

##### 4-1 Confirmation before operation

(1) Check the installation, piping and wiring before test operation.

- (a) Unions and flanges of main supply pipe and branch pipe.
- (b) Sub-supply pipes connected to all bearings to be lubricated.
- (c) Plug of measuring valve.
- (d) Electric wiring on the primary and secondary sides.

(2) Lubricant oil to the lubrication pump unit.

(Oil is filled up to the center of the oil level gauge if not specified by the client.)

Lubricating pump model	Pump casing (crank case)	Brand
KEP-41E	1.5L	Showa Shell Sekiyu Omala Oil 150

Recommended brand

JIS K 2219, class 2 No.4 gear oil or the equivalent

Name of company	Brand
JX Nippon Oil & Energy	BONNOC M 150
Idemitsu Kosan Co.Ltd.	CE Compound 150
ESSO	Spartan EP 150
Mobil Oil Co.	Mobil Gear 629
Shell International Petroleum Co.	Omala Oil 150

(3) Lubricant replenishment to the motor with reduction gear.

Before shipment, grease is already sealed in the gear casing of the motor with reduction gear.

Lubricating pump model	Reduction gear box	Brand
KEP-41E	0.3kg	NIPPON GREASE NIGHTIGHT LMS No.000

How to replace grease.

After disassembling the reduction gear in the specified method and cleaning the inside,

fill the gear casing with new grease. As for the disassembling method, refer to the following paragraph 7-4, Disassembling and Assembling.

(4) Direction of pump rotation

- (a) Turn on the power source switch and control source switch. Depress the pushbutton switch for manual starting, and confirm the direction of motor rotation.
- (b) Follow the arrow mark on the coupling cover. The correct rotation is to the clockwise from the motor fan side.
- (c) If the rotating direction is reverse, the motor should be rewired by interchanging the 2 lines of the 3 power lines.

4-2 Grease selection

There are quite different kinds of grease of different quality and characteristics. Select suitable grease to the operating conditions out of the recommended kinds of grease given below.

Ordinarily, any grease is applicable within the range of NLGI standard No.00 No.1 (fluidity 430 to 310).

Note:

1. Molybdenum or graphite-filled grease

Solid lubricant is on will affect the life of the pump (wear).

If the particle size is 1 $\mu$ m or less, it can be used almost without problems.

If the particle size is about 1~3 $\mu$ m, it can be used. But wear becomes violently.

It cannot be used if the particle size is greater than 3 $\mu$ m. (Pump life will be extremely short.)

2. Grease containing metals in powder form such as copper and zinc cannot be used.

Name of company	Brand
ESSO Standard oil Co.	LITHTAN No.0~No.1 LITHTAN EP No.0~No.1
Shell International Petroleum Co.	ALVANIA EP GREASE No.0~No.1 ALVANIA GREASE No.0~No.1 EP GREASE No.0~No.1
Mobil Oil Co.	MOBIL PLEX 45,46 MOBILUX 1

### 4-3 Grease filling

(As the grease for filling, use the same brand as the one used for each customer.)

#### (1) Filling reservoir with grease

Fill the grease into the reservoir by the pump with care not to allow intrusion of dust or air from the filling port (Snap-on coupling) on the side of lubricating pump unit.

NOTE: The reservoir should never be filled with grease from the upper side, with the top cover and the follower plate removed. Such a filling manner may cause unexpected trouble during operation.

#### (2) Filling sub-supply pipe (Lube Line) with grease.

The sub-supply pipe ranging from the discharge port of measuring valve to the lubricating point should be filled with grease by means of a grease gun, before commencing the operation.

After filling grease, connect the sub-supply pipes to the measuring valves.

#### (3) Filling main supply and branch pipes with grease.

##### (a) Preparation

- a) Remove the plugs at the end of No.1 and No.2 lines of the hydraulic reversing valve so that the grease and air in the piping can be drawn out. Fully close the screw type glove valve near the pump.
- b) Receive the grease coming out from the points where the plugs are removed in the above a) and b) with a vinyl bag, pail or waste cloth.

- c) For grease filling, it is necessary to operate the lubricating pump for several hours or longer in continuity. Since the maximum setting of the protective timer is 30 minutes, alarm is given and the pump stops when operation for more than 30 minutes. To prevent the alarm only for the test run, remove the protective timer on the control panel.

(The alarm is given only at empty reservoir or motor overload when the pump is operated under this condition.)

This isn't necessary when a filling pump is used for grease filling.

NOTE : Be sure to attach the protective timer to the original condition when grease filling completes.

(b) Filling procedure

- a) Turn the power switch to 「ON」 to operate the lubricating pump.
- b) Air is drawn out through the measuring valves where the plugs (PT3/8) are removed, then the grease comes out but refrain from plugging the measuring valves soon. Take out the grease coming out to compare with new grease and plug the measuring valves only after making sure that equally clean grease to unused grease comes out.
- c) When grease is filled into the main supply pipe and sent to the pressure control valve at the end of branch pipes, make sure that the grease is free from inclusion of any foreign substance in the same manner as for the preceding item, measure the pipe resistance, then stop the lubricating pump.

d) Pipe fluid resistance measurement

Watch the pressure of lubricating pump during operation of step c), and then record the point of the highest pressure when grease comes out of the pipe connection of pressure adjusting valve.

e) Check electrical system and connecting

When the filling work completes, connect the pressure control valve of completely filled line only to the piping, and operate the lubricating pump. The grease is discharged again into the filled line (No.1 line for example), and the pressure increase little by little as the piping connected this time.

If the piping systems and electrical wiring systems of the solenoid reversing valve and the pressure control valve are connected correctly, the pressure control valve is changed and the limit switch is actuated by the switch cam to transmit lubricating complete signal, and the lubricating pump comes to a stop.

If the pressure control valve is not changed, the pressure increases further and the lubricating pump is eventually relieved and comes to a stop once.

In this case, the wiring of the limit switch (NO and NC) must be changed each other as the connection of the electrical, wiring is not correct.

- f) Operate the lubricating pump again. The No.2 line is filled this time as the pressure control valve is switched. Fill the No.2 line with grease in the same procedure as for No.1 line and make sure that the pressure control valve is switched and the lubricating pump comes to a stop automatically.

(c) After filling

When both lines are filled completely, turn off the power switch and attach the protective timer which was removed in the procedure 4-3-(3)-(a)-d).

Also clean the joints and plugs of the measuring valve in preparation for the following grease leak test. The filter of the "Y" type line strainer shall be cleaned as well.

#### 4-4 Leak test

This is check the line for no grease leakage from the pipe joints when the maximum discharge pressure 21MPa of the lubricating pump is applied.

Carry out the test in the following order.

- (1) Close the screw valve at the inlet of the pressure control valve so that the internal line pressure is not applied. (To prevent the pressure control valve from being switched.)
- (2) Set the protective timer at about 15 minutes and operate the lubricating pump.
- (3) The pointer of the pressure gauge to lubricating pump goes up slowly reaching 23MPa in due course. (As the hydraulic-operated reversing valve is not changed, the pressure in the piping line goes up and the relief valve of the lubricating pump functions.)
- (4) The protective timer function 15 minutes later to give over time signal and the lubricating pump comes to a stop.



- (5) Turn off operation power switch to reset the alarm then turn on the switch soon again.
- (6) Open the screw type valve closed in item (1) then operate the pump. The pressure in the line increase to change the pressure control valve and the lubricating pump stops.
- (7) Operate the lubricating pump again to test leakage of the other line in the same procedure.
- (8) When the alarm is given and the lubricating pump comes to a stop, turn off the control power and go around the whole piping to check for no leakage.

Check the position of the indicator rod in preparation for the next operation check of the measuring valve. (See paragraph 4-5)

#### 4-5 Measuring valve operation check, discharge pressure and changed over pressure measurement.

- (1) Check whether the indicator rod of each measuring valve is out or in and mark all measuring valve with pencil stone or chalk. Operate the lubricating pump and wait for completion of lubricating and automatic stop.

- (2) Discharge pressure and changed over pressure measurement

Read the point of the highest pressure immediately before completion of lubricating and record the reading.

Discharge line	Discharge pressure	Changed over pressure
No.1 line	P1d= MPa	P1s= MPa
No.2 line	P2d= MPa	P2s= MPa

- (a) Discharge pressure . . . . Read the pressure gauge of the lubricating pump.
- (b) Changed over pressure . . . . Read the pressure gauge of the pressure control

NOTE: Judge discharging to No.1 line or No.2 line by checking the switch cam of the hydraulic operated reversing valve.

- (3) After making sure that the changed over pressure (P1s & P2s) is up to about 4MPa check the indicator rod should be moved to the opposite side of the position marking is above item (1). Erase the marks where the indicator rod is moved.
- (4) Where the indicator rod position does not coincide, the indicator rod is not moved.
- (5) Operate the pump again and record the discharge pressure of the other line.

By this operation, the indicator of the measuring valve returns to the original position.

- (6) For any measuring valve of which indicator rod does not move, refer to paragraph 4-8.

#### 4-6 Changed over pressure adjustment

When the indicator rods of all the measuring valves are operated, adjust the changed over pressure in the following manner so that the measuring valve operate exactly for the next lubricating.

- (1) Adjusting method

Loosen the lock nut of the hydraulic-operated reversing valve and adjust the changed over pressure by turning the adjust screw while watching the pressure gauges (P1s and P2s). Operate the pump while checking the changed over pressure.

(Left turn of the adjust screw increases the changed over pressure.)

- (2) Increase the changed over pressure by 1MPa.

After the adjustment, the reversing pressure (Pn) becomes as follows.

$$P1n=P1s+1$$

$$P2n=P2s+1$$

- (3) Minimum operating changed over pressure.

As described above, set the end pressure to at least 5MPa.

(4MPa+1MPa or up when delivered)

- (4) Lock nut locking

After the pressure adjustment, be sure to fasten the lock nut. If neglected, the pressure adjust screw is turned by vibration and the changed over pressure may be disordered.

#### 4-7 For any measuring valve with non-operating indicator rod

- (1) When the bearings are subjected to back pressure, particularly for hydraulic turbines of power plants, the indicator rod may sometimes fail to operate unless the changed over pressure is increased.

Changed over pressure = back pressure + approx. 4MPa.

Approximately the pressure given by the above equation is required.

- (2) For the indicator rod (piston) of no operation, remove the sub-supply pipes.

(3) Operate the lubricating pump, wait for automatic stop, and then check for operation.

(a) When operated

The sub-supply pipes and bearings are in trouble.

a) Check the sub-supply pipe for no breakage.

b) Set a pressure gauge at the top end of a grease gun to feed grease directly from the sub-supply pipe to the bearings and check the back pressure.

The conceivable causes are:

b)-1 Back pressure is high by nature and high back pressure is normal.

(take the measure of (3)-(b)-b))

b)-2 Measuring valve piston fails to operate as the bearing is filled fully with grease and there is no grease relief. Attach a relief valve to the bearing in this case.

b)-3 Inadequate design or machining of bearing.

(b) When operation fails

a) In most cases, the piston is sticking due to foreign substance in the piping and allowed into the measuring valve. (Normal measuring valve operates at 1MPa or lower.)

b) Take the following measure.

b)-1 Close the globe valve near the inlet of the pressure control valve and operate the lubricating pump, then the pressure in the piping goes up gradually and the lubricating pump reaches the maximum discharge pressure. Check if the indicator rod moves under this condition and if not, clean the measuring valve. If it moves, open the globe valve near the inlet of pressure control valve as it can be operated only if the pressure is applied.

Increase the changed over pressure little by little to point where the indicator rod is moved at every operation of the lubricating pump.

Set the pressure adjust screw at the changed over pressure where the indicator rod is moved plus 1 to 2 MPa.

b)-2 Refrain from grinding the piston with sand paper at the cleaning as the discharge efficiency is lowered.

#### 4-8 Record of test run

At the end of the test run, carry out the check in accordance with the test run record shown at the end of this manual for final confirmation.

(1) Lubricating time, discharge pressure (changed over pressure).

Operate the lubricating pump for several times of lubricating and record the average time and pressure.

(2) Checking automatic start-up of pump.

Put the start timer pointer close to 0 hour as much as possible and make sure that the pump starts automatically.

(3) Alarm lamp and alarm check (while operating the pump)

(a) Grease low level

Check by the pushing the low level switch by hands.

(b) Set the protective timer at a timer shorter than the lubricating time recorded in (1), and operate the pump to check the lamp.

(c) Motor overload

Move the test lever of the thermal relay horizontally for checking. After testing, push the set lever then normal condition is restored.

(4) Timer set

(a) Start timer

Set the operating interval in accordance with our specifications and the machine maker instructions.

(b) Protective timer

Set the timer at the lubricating time measured in (1) plus 5 minutes.

## 5. Maintenance and inspection

### 5-1 Grease replacement for motor with reduction gear (see paragraph 4-1 (2) )

Although the reduction gear is filled with grease with before shipment, please the grease with new one at 20,000 hours (4 to 5 years) of operation.

### 5-2 Precautions for adding grease

- (1) The reservoir should be filled with grease by means of a filling pump.

It should be kept in mind that grease is to be supplied through the filling port of the pump. A strainer provided in the filling port should be cleaned periodically.

- (2) Grease may be deteriorated if it has been mixed with another brand of grease. To prevent this, it is recommended to obtain the adequate instructions from a grease manufacturer when using a different brand of grease.

### 5-3 Spare parts

It is recommended that the following spare should be provided to minimize the shutdown period of the system in the case of emergency.

- (1) For pump
  - (a) Cylinder plunger set
  - (b) Various packing
  - (c) Pressure gauge and limit switch
  - (d) Hydraulic-operated reversing valve KRV-22SL
- (2) Various types of measuring valves
- (3) For control panel
  - (a) Signal lamps
  - (b) Fuse elements
  - (c) Auxiliary relays
  - (d) Timers
- (4) Miscellaneous
  - (a) Flexible hoses
  - (b) Pipes and joints

#### 5-4 Inspection

The following items should be inspected periodically.

- (1) Operation time of lubricating pump, discharge pressure, pipe end pressure.
- (2) Reversing operation of hydraulic-operated reversing valve. (Switch cam movement)
- (3) Operation of measuring valve
- (4) Grease leakage from pipe
- (5) Damage of respective equipment
- (6) Amount of grease remaining in reservoir and grease storage can

## 6. Trouble shooting and remedy

It is recommended for better results that the cause of a trouble or failure should be detected by tracing simple defects first.

No.	Descriptions	Causes	Remedies
(1)	Pump motor fails to start, even if push-button switch is depressed.	a. Power supply is not on.	a-1. Turn on main power switch and operation power switch. a-2. Check the primary voltage (between R.S.T.) with a taster.
		b. Fuse is blown.	b-1. Turn on the no-fuse breaker. b-2. Replace the cylindrical fuse.
		c. Motor wiring is discontinued.	c. Reconnect the wire.
(2)	The alarm lights up. The alarm lights up and pump operation fails even when the operating power switch is turned off once and then turn to on again.	a. The tank is empty.	a. Supply grease with a filling pump.
		b-1. The motor is over-loaded. b-2. Sticking of reduction gear (Insufficient lubricant)	b-1. Check and repair. b-2. Replace the reduction gear.
(3)	Pointer of pump pressure gauge deflects too much.	a. Air is trapped in main pipe and branch pipe.	a. Disconnect the piping at several points and operate the pump to draw the air.
		b. Refer to item (4) if grease retard alarm is given.	
(4)	Alarm buzzer	Grease retarding is resulted.	

	sounds.  When the control power switch is turned off once and to ON again, the pump operates but the buzzer sounds again soon and the pump comes to a stop.	a. Sticking or breakage of plunger. (Inclusion of foreign substance)	a. Replace the cylinder and plunger.
		b. Insufficient discharge quantity or discharge pressure due to wear of cylinder or plunger.	b. Replace the cylinder and plunger.
		c. Dust is caught by the check valve.	c. Overhauling.
		d. Air is trapped in the pump.	d. Tighten the air vent plug of the level
		e. The grease used is too hard to be absorbed.	e. Change the grease with softer one.
		f. Miss-connection of the piping system.	f. Check and correct the piping.
		g. Grease leakage from the main or branch pipe.	g. Check and repair the piping.
		h. Excessive air allowed in the main or branch pipe.	h. Disconnect the piping at several points, and operate the pump to draw out the air.
		i. Dust is caught by the relief valve.	i. Overhauling.
		j. Malfunction of hydraulic-operated reversing valve, sticking of piston, or loosening due to wear.	j. Disassemble for repair or replace.



		k. High pressure due to inadequate adjustment of the changeover pressure of hydraulic-operated reversing valve.	k. Replace the cylinder and plunger.
		l. Inadequate setting of protective timer.	l. Set the timer at lubricating time +5 minutes.
		m. Malfunction of limit switch or miss-wiring.	m. Check the limit switch (push by hands) or repair.
(5)	Operating noise of pump is too high or not normal.	a. Wear.	a. Replace the reduction gear and the lubricating pump proper.
(6)	Water stays in the reservoir.	a. Quality of the supplied grease is not good.	a. Check the grease and check the quality with the grease maker.
		b. The pump is wet with water.	b. Attach a cover.
		c. Check valve is defective (for hydraulic turbin).	c. Overhaul the check valve or replace.
		d. Check valve attaching is neglected (for hydraulic turbin).	d. Attach the check valve.
(7)	Indicator stem of some measuring valves fail to operate.	a. Bearings are blocked.	a. Check the bearings and improve.
		b. Lube pipes are broken.	b. Check and changed over pressure.
		c. Changed over pressure of hydraulic operated reversing valve is too low.	c. Adjust the changed over pressure.

		d. Sticking of measuring valve due to dust clogging.	d. Overhaul the measuring valve or replace.
		e. Branch pipe is too long.	e. Lower the flow resistance by increasing the changed over pressure or by making the branch pipe larger.
(8)	All the measuring valves fail to operate.	Refer to above item (4) in this case as alarm is given.	

## 7. Disassembly & assembly

This motor-driven pump is able to operate stably for long, which eliminates the need for frequent disassembly and reassembly of the pump body.

The sliding areas such as the cylinder & plunger of the pump body & piston of pressure control valve are precisely machined. Therefore, it sometimes a satisfactory result will not be obtained even if the plunger only is replaced.

The replacement of cylinder and plunger shall be performed surely as the set.

The replacement of cylinder & plunger and that of piston of pressure control valve are carried out in principle at our specified service shop.

Hence please contact the agency who delivered the equipment or our specified service shop.

### 7-1 Preparation

(1) Prepare surely the treated oil, waste cloth besides tools.

(2) Purge all of grease in the tank before removing the cylinder.

(Remove the joint at the supply port, feed the compressed air from the overflow port of tank, and grease is purged simply.)

(3) Bring the pressure control valve at a clear place where the bench lies with the valve assembled, and make the disassembly and reassembly.

### 7-2 Precautions

(1) When the greasing pump body is disassembled, renew the lubricant in the pump body without fail.

(2) Shim is put between bearing cover at the driving side and body casing.

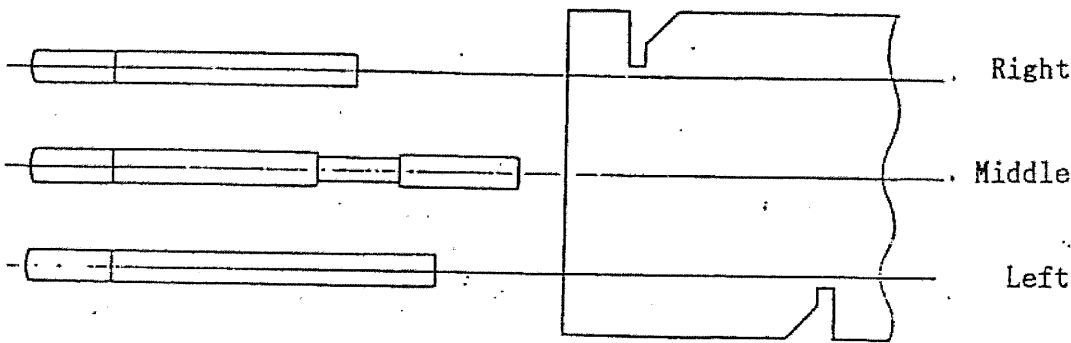
Be careful not to lose this shim.

With the reassembly, incorporate the shim in the same thickness as the removal.

When the shim is put between motor and bearing cover at the driving side, use the same procedures.

### 7-3 Operation

Cautionary instructions only are described therein.

Content of Operation	Cautionary Instructions
(1) Incorporation of cylinder	<p>a. Of two slots (grease suction port) for cylinder, incorporate so that the left slot comes on this side.</p> <p>b. Apply clean grease to the outside of cylinder, and put the cylinder therein.</p>
(2) Incorporation of plunger	<p>a. Incorporate first the plunger and connecting rod.</p> <p>b. Incorporate the plunger into the cylinder.</p> <p>c. As given to Fig.6, incorporate a short plunger into the left, a long plunger into the middle, and a midway plunger into the right.</p>
 <p style="text-align: center;">Fig.6</p>	
(3) Incorporation of connecting rod cap	Match the identification mark at the connecting rod side and that at the cap side for incorporation.
(4) Confirmation after assembly	When the paragraphs (1)~(3) are carried out, turn the crank shaft by hand, and make sure that it turns lightly before

	<p>mounting the motor on the pump body.</p> <p>(When it provides a heavy turning and does not turn readily, it is caused by improper assembly.)</p>
(5) Assembly of pressure control valve (KCV-2 type)	<p>Since it liable to assemble erroneously, make the assembly carefully with the drawing (See the end) watched without fail.</p>
(6) Removal of tank	<p>a. Remove the level switch of the tank in advance. In case the level switch is S1 or S2 Specification (See the paragraph3-4, (3)), provide the tag to each level switch to put the marks of CLLS, HLS in order to avoid mistake in case of incorporation.</p> <p>b. Remove the joint at the supply port, and purge all of grease in the tank.</p> <p>Then, feed the air from the overflow port, and grease is purged promptly.</p> <p>c. Take the cap, and draw out the fitting bolt of the tank bottom by using hexagon wench. M12 (opposite side of hexagon:10mm)</p>

## 7-4 Disassembly and assembly

(1) As for sectional assembly drawing of the geard-motor, refer to Fig.7

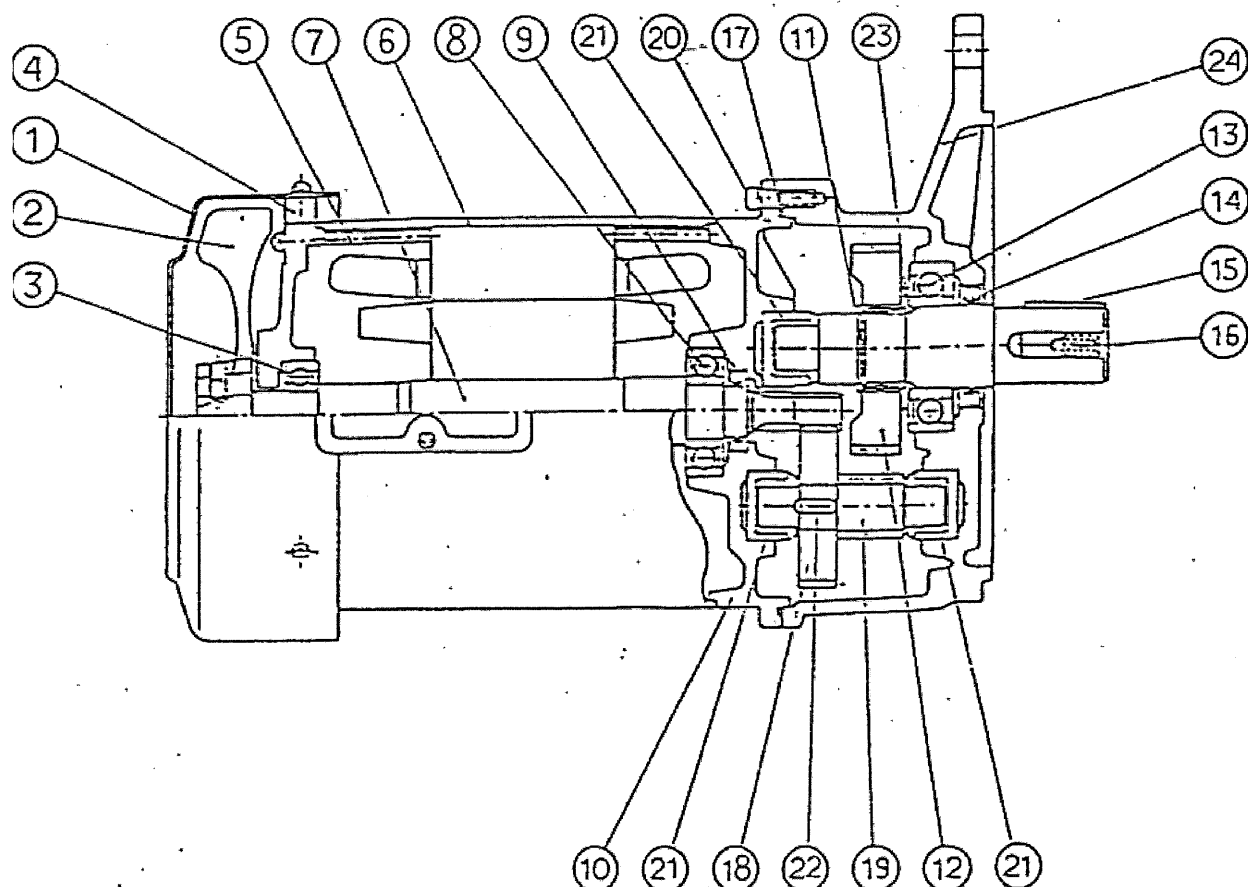


Fig.7

① FAN COVER

② FAN

③ BEARING

④ B SEALED

⑤ BOLTS

⑥ MOTOR FRAME

⑦ MOTOR SHAFT

⑧ BEARING

⑨ OIL SEAL

⑩ D SEALED

⑪ STOP RING

⑫ GEAR B

⑬ BEARING

⑭ OIL SEAL

⑮ PARALLEL KEY

⑯ OUT PUT SHAFT

⑰ O RING

⑱ GEAR B

⑲ UNION B

⑳ HEX SOCKET BOLT

㉑ UNIVERSAL BEARING

㉒ SGL RND KEY

㉓ OUT PUT SHAFT COLLAR

㉔ FRANGE

## 8. Operation Record of KWK DUAL LINE LUBRICATING SYSTEMS

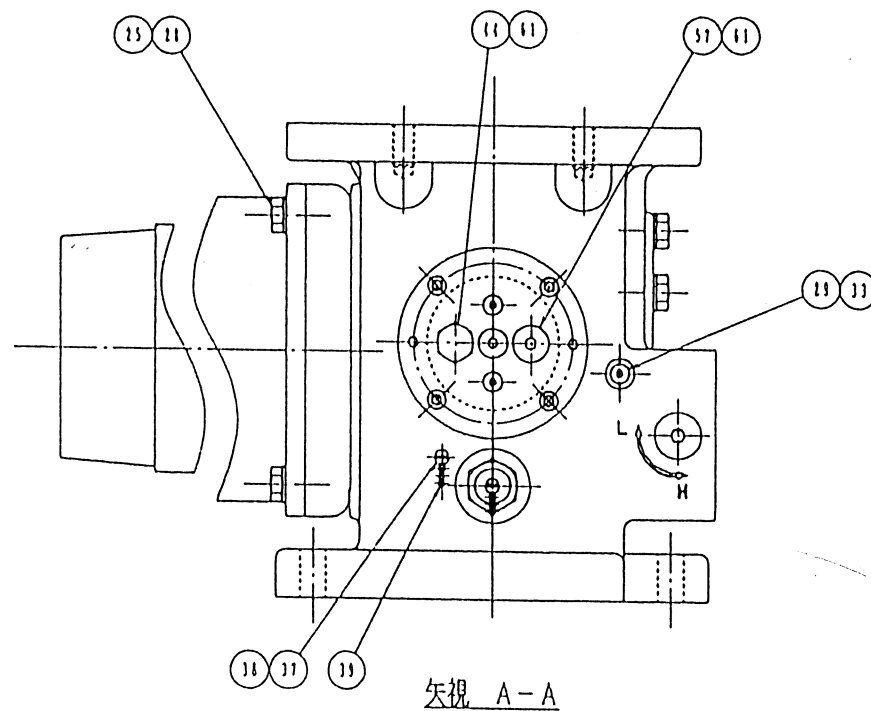
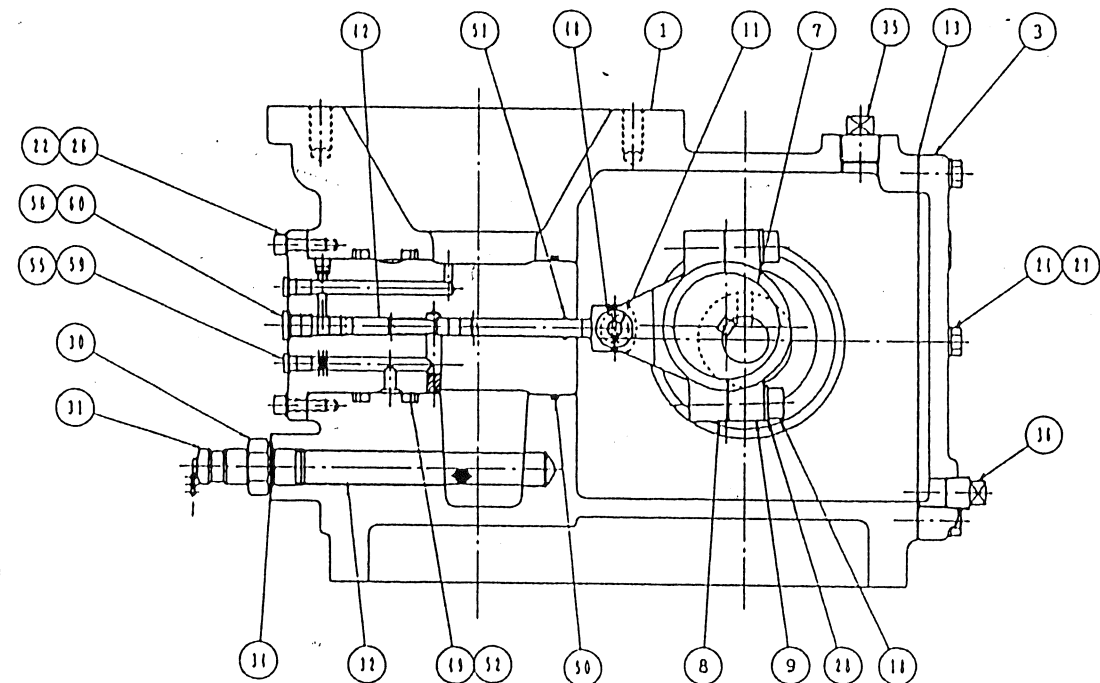
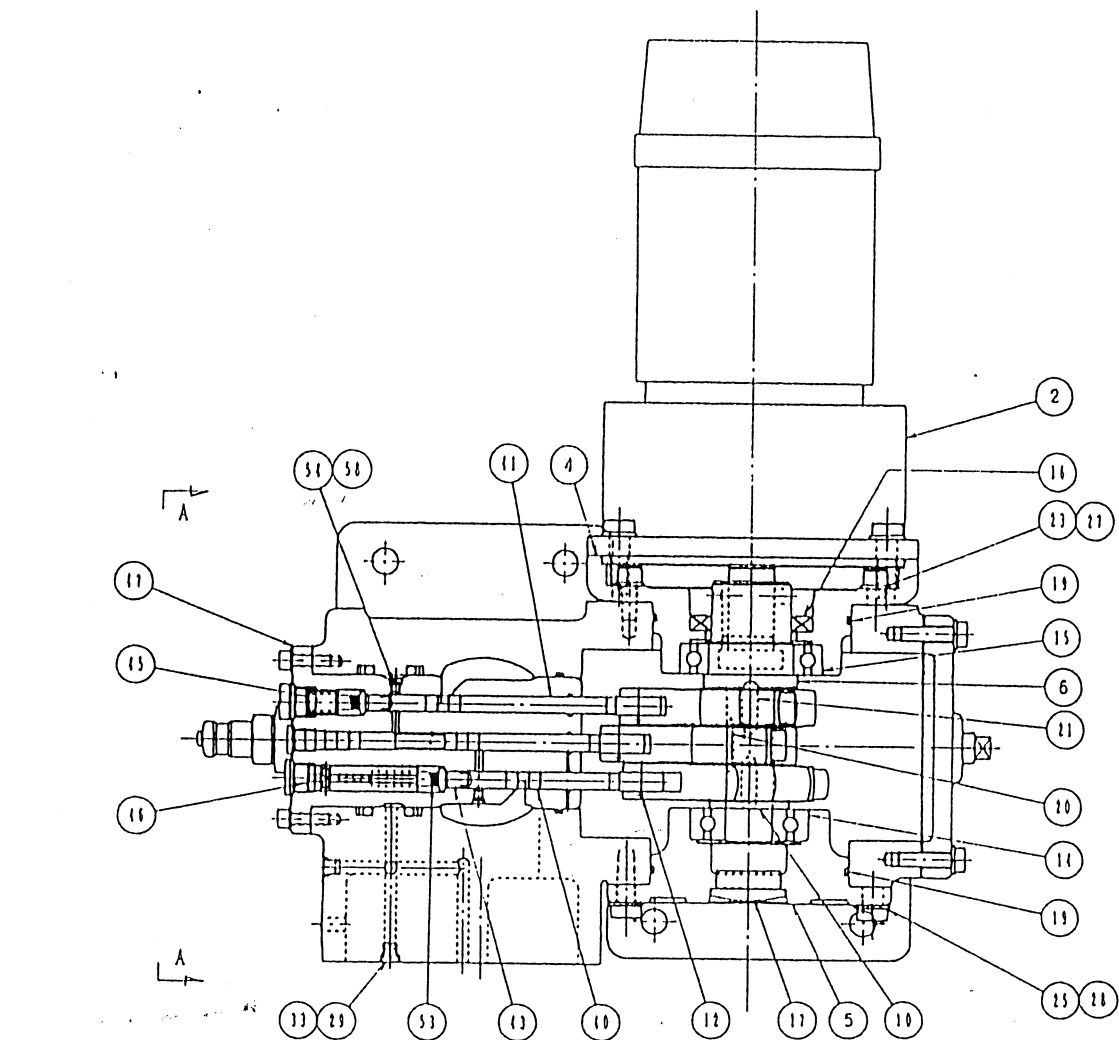
Specifications		
Type of pump		Grease filling method : Concentrated filling, Exclusive pump, etc.
Pump No.		Type of filling pump
Motor voltage		Name of grease used
Type of control panel		Type of measuring valve used
Control system	Auto/Manual start	Number of measuring valve used
Details of test operation		
Lubricating pump		Control panel
Lubricating pump & Reduction gear box		Voltage, motor : _____V / control : _____V
oil volume : good / bad		Pilot lamp (power supply) :                      good / bad
Motor rotating direction : normal / reverse		Pilot lamp (operation) :                      good / bad
Lubricating pump operation noise		Pilot lamp (alarm) :                      good / bad
: normal / excessive		Auto start of pump :                      good / bad
Lubricating time (No.1 line)		Auto stop of pump :                      good / bad
: min. _____ sec.		Alarm (low level switch) :                      good / bad
Lubricating time (No.2 line)		Alarm (over time) :                      good / bad
: min. _____ sec.		Alarm (overload) :                      good / bad
Discharge pressure (No.1 line)		Timer setting (for start) :                      hrs.
: _____ MPa		Timer setting (for protection) :                      hrs.
Discharge pressure (No.2 line)		Measuring valve
: _____ MPa		All operations :                      good / bad
Changed over pressure (No.1 line)		
: _____ MPa		
Changed over pressure (No.2 line)		
: _____ MPa		
Others	Grease leakage from piping :    yes / no	Damage of piping :                      yes / no
Special notes		

NO.	PARTS NO.	PARTICULARS	Q'TY	WEIGHT REMARKS	CODE
1	50C 9	RESERVOIR BODY	1	33.92	521
2	50C 30	RESERVOIR COVER	1	9.3	542
3	C3 10	OIL SEAL	1	0.012 AC1013AO(NOK)	806
4	30C 49	HEX.SOL.HD.PLUG	1	0.055 M26	299
5	C1 8	RD.HD.MACH:SCREW	2	0.001 M4×8L	676
6	50C 83	LEVEL ROD	1	0.847	595
7	50C 21	SWITCH CAM	1	0.58	533
8	C1 22	HEX.SOL.HD.SCREW	2	0.001 M5×5L	690
9	10C 10	ATR VENT SCREW	1	0.003	10
10	C3 43	STEEL BALL	1	----- 1/8(φ 3.175)	839
11	C4 9	SCREW	1	0.004 M10×10L	887
12	C1 54	HEX.NUT	2	0.029 M20	722
13	50C 58	FOLLOWER PLATE	2	4.26	570
14	C1 95	HEX.HD.BOLT	6	0.132 M8×35L	365
15	50C 55	FOLLOWER PACKING	1	1.17	567
16	C3 67	SPRING WASHER	6	0.011 M8	863
17	C1 47	HEX.NUT	6	0.032 M8	715
18	50C 42	TANK PACKING	1	0.032	554
19	C1 41	HEX.SOL.HD.BOLT	6	0.283 M12×40L	709
20	C3 41	SEEL WASHER	6	0.03 M12	837
21	C3 69	SPRING WASHER	3	0.016 M12	865
22	C1 52	HEX.NUT	3	0.052 M12	720
23	C4 76	LIMIT SWITCH	1	0.28 ZE-Q21-2(OMRON)	954
24	50C 51	PACKING PLATE	1	1.10	563
25	90C 6	NAME PLATE	1	-----	348



NO.	PARTS NO.	PARTICULARS	Q'TY	WEIGHT REMARKS	CODE
26	50C 75	NAME PLATE	1	0.011	587
27	C3 4	RIVET	4	----- #2-3mm	800
28	90C 6	NAME PLATE	1	-----	346
29	50C 36	FLANGE	1	6.154	348
30	50C 72	BOT	3	0.129	584
31	C3 36	SCR.ELBOW	1	0.15 PT3/8	832
32	50C 46	BRACKET	3	0.051	558

REV.	改定内容	DESCRIPTION	DATE
△			
△			
△			



NO.	PARTICULARS	QTY	MATERIAL	REMARKS
61	CU-PACKING	2	M16	
60	CU-PACKING	1	M12	
59	CU-PACKING	2	M8	
58	CU-PACKING	5	M5	
57	HEX. SOL. HD. PLUG	1	M16	
56	HEX. SOL. HD. PLUG	1	M12	
55	HEX. SOL. HD. PLUG	2	M8	
54	HEX. SOL. HD. PLUG	5	M5	
53	SPRING	2	SWPB	KS-800376
52	BACK UP RING	2	P70T2	
51	O-RING	3	IAP9	
50	O-RING	1	IAG70	
49	O-RING	2	IBP70	
48	NEEDLE BEARING	3	RNA0-8x15x10	
47	CYLINDER	1	FCD-45	FP-1240
46	VALVE RETAINER (2)	1	SS400	FP-1238
45	VALVE RETAINER (1)	1	SS400	FP-1237
44	SPRING RETAINER	1	SS400	FP-1239
43	VALVE PISTON	2	SCM415	FP-1236
42	VALVE PLUNGER	1	SCM415	FP-1234
41	MAIN PLUNGER (2)	1	SCM415	FP-1233
40	MAIN PLUNGER (1)	1	SCM415	FP-1232
39	BALL CHAIN	1	4x200L	
38	CONNECTER	2	4	
37	PAN SCREW	2	M4x8L	
36	PLUG	1	Rc 3/8	
35	ORIFFICE PIPE PLUG	1	KS-800583	
34	CU-PACKING	1	M20	
33	CU-PACKING	3	M8	
32	FILTER ELEMENT	1	SUS	KS-800383
31	CAP	1	C1602BD	KS-800514
30	NIPPLE	1	C1602BD	KS-800116
29	HEX. SOL. HD. PLUG	3	M8	
28	SPRING WASHER	16	M10	
27	SPRING WASHER	14	M8	
26	SPRING WASHER	4	M6	
25	HEX. BOLT	10	M10x20L	
24	HEX. BOLT	6	M8x10L	
23	HEX. SOCKET BOLT	8	M8x20L	
22	HEX. SOCKET BOLT	4	M6x20L	
21	KEY (RND)	1	8x7x24	
20	KEY	2	8x7x20	
19	O-RING	2	IAG100	
18	STRIPPER BOLT	6	8x26	
17	OIL GAUGE	1	414	
16	OIL SEAL	1	AC2507A0 (NO	
15	BEARING	1	#6009	
14	BEARING	1	#6305	
13	FYBER PACKING	1	#1500	FP-1241
12	SPRING PIN	3	SCM415	FP-1235
11	CONNECTING ROD PIN	3	S25C	FP-1243
10	SPACER	1	PBC2	FP-1231
9	CONNECTING ROD COVER	3	PBC2	FP-1230
8	CONNECTING ROD	3	S55C	FP-1229
7	CAM	1	S55C	FP-1228
6	CRANK SHAFT	1	FC20	FP-1227
5	BEARING COVER (FREE SIDE)	1	FC20	FP-1226
4	BEARING COVER (DRIVE SIDE)	1	FC20	FP-1225
3	BODY COVER	1	FC200	FP-1223, 122
2	GEARD MOTOR	1		
1	PUMP HOUSING	1		

CUSTOMER			
SPECIFICATION			
CHECKED BY	DRAWN BY		
DESIGNED BY			
SEC. CHIEF			
L. TAKATA			
H. 10. 7			
KOWA CORP.		KEP-41 PUMP ASSEMBLY	
OSAKA JAPAN		DWG. No. FA-0725	
3RD ANGLE PROJECTION		SCALE 1/2	



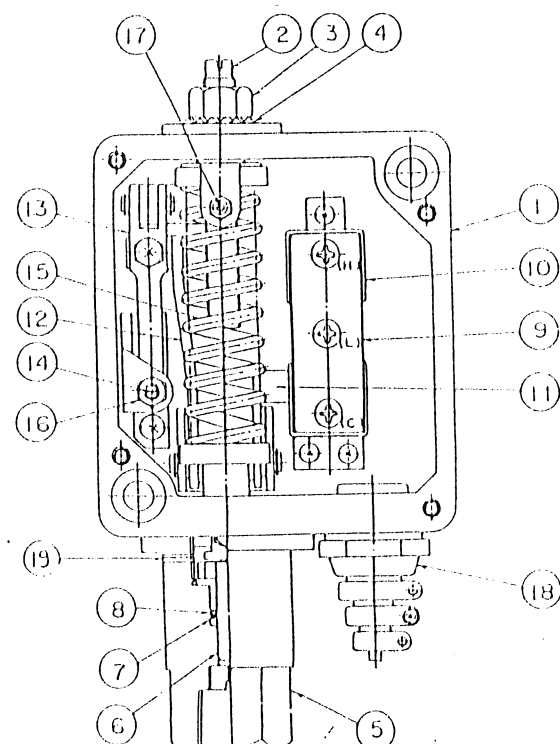
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C

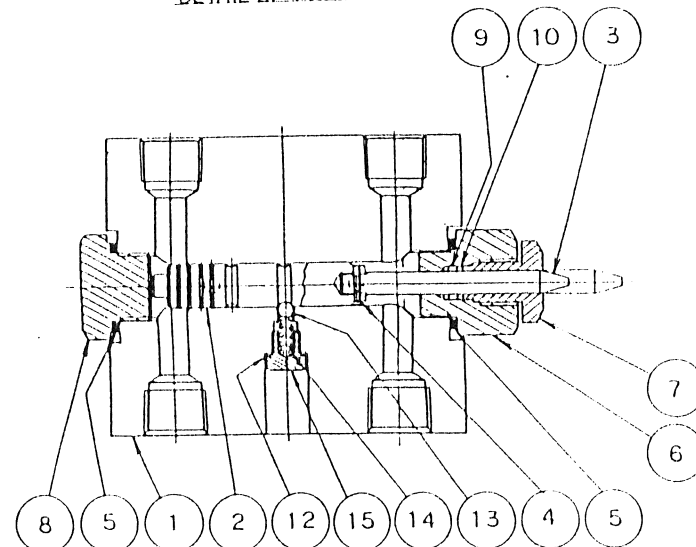
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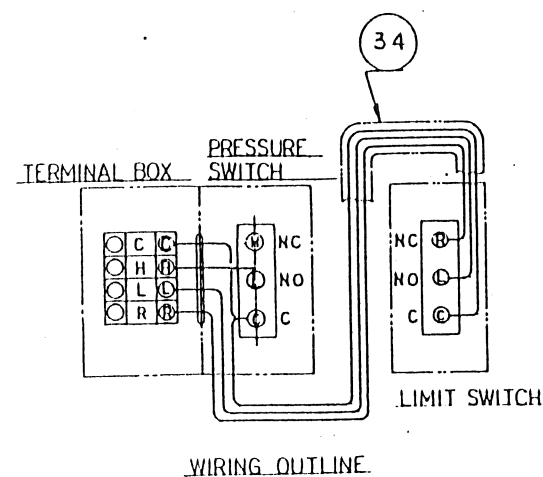
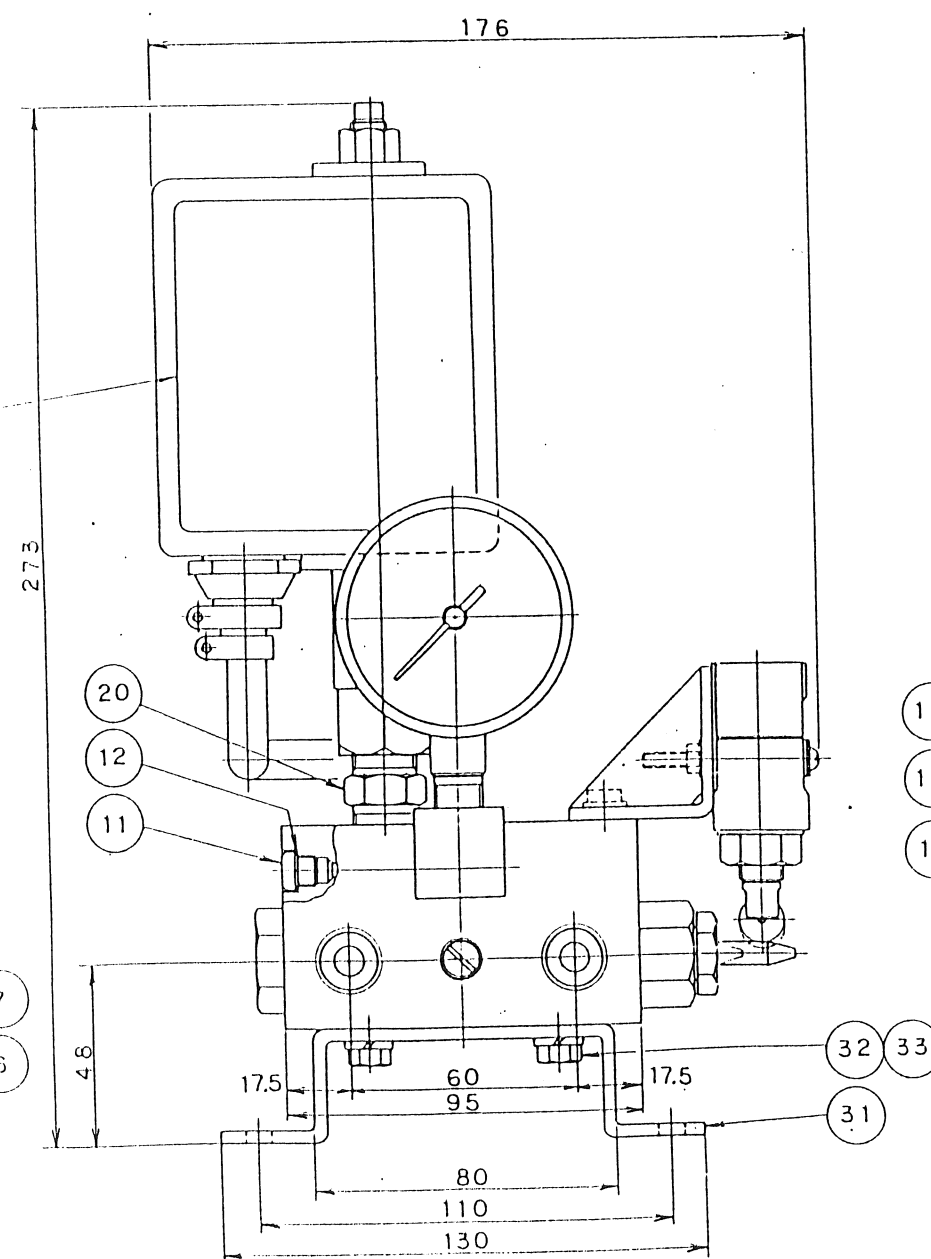
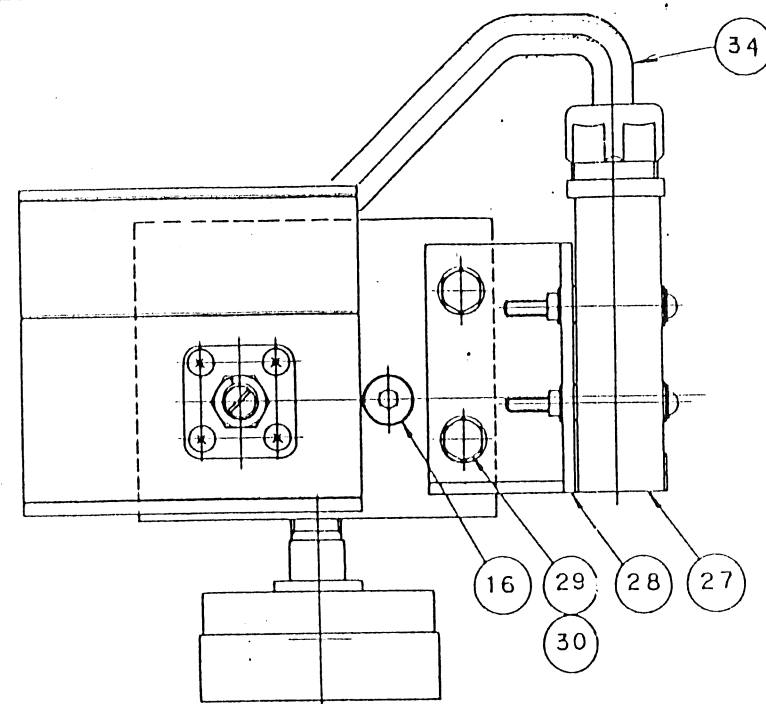


- 1 CASE
- 2 PRESSURE ADJUSTABLE SCREW
- 3 LOCK NUT
- 4 WASHER
- 5 CYLINDER
- 6 PISTON
- 7 O RING
- 8 BACK-UP RING
- 9 MICRO SWITCH
- 10 SWITCH HOLDER
- 11 SWITCH LEVER
- 12 LEVER(1)
- 13 LEVER(2)
- 14 SCREW FOR DIFFERENTIAL PRESSURE
- 15 SPRING
- 16 LOCK NUT
- 17 SCREW
- 18 CABLE GRAND
- 19 DRAIN PORT

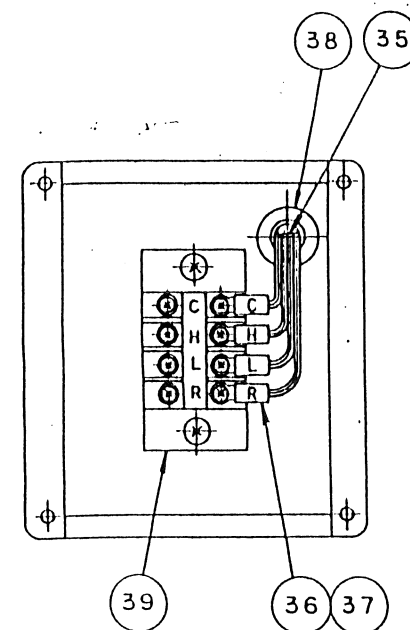
DETAIL OF PRESSURE SWITCH



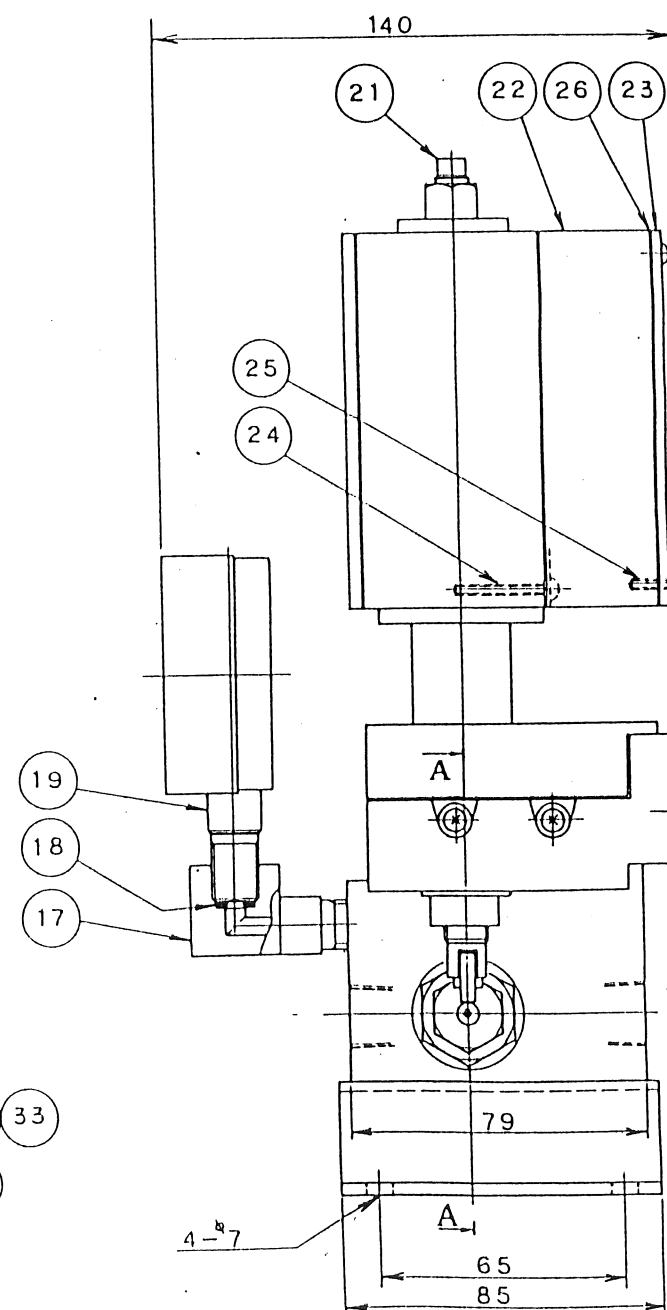
SECTION OF A-A



WIRING OUTLINE



TERMINAL BOX



40	NAME PLATE	1	
39	TERMINAL	1	
38	BUSH	1	
37	MARK TUBE	10	
36	COMPRESSION TERMINAL	10	
35	CABLE	1	2mm <sup>2</sup>
34	CABLE CORD	1	2mm <sup>2</sup>
33	SPRING WASHER	4	M6
32	HEX. BOLT	4	M6x10L
31	BASE PLATE	1	
30	SPRING WASHER	2	M6
29	HEX. BOLT	2	M6x10L
28	BASE	1	
27	LIMIT SWITCH	1	ZE-Q21-2
26	PACKING	1	
25	MACHIN SCREW	4	M3x10L
24	MACHIN SCREW	4	M3x25L
23	COVER	1	
22	TERMINAL BOX	1	
21	PRESSURE SWITCH	1	
20	HEX. NIPPLE	1	PT3/8
19	PRESSURE GAUGE	1	350kg/cm <sup>2</sup> PF1/4
18	PACKING	1	ø11xø5.5x1t
17	CONNECTER	1	PT1/4xPF1/4
16	PLUG	1	PT1/4
15	SPRING RETAINER	1	
14	COIL SPRING	1	
13	STEEL BALL	1	1/6.5B
12	PACKING	2	
11	PLUG	1	
10	BACK UP RING	2	P6T3
9	SEAL PACKING	1	
8	PLUG	1	
7	PACKING RETAINER	1	
6	PACKING GLAND	1	
5	PACKING	2	
4	PIN	1	
3	SWITCH CAM ROD	1	
2	SWITCH CAM PISTON	1	
1	BODY	1	
NO	NAME	Q'TY	REMARKS

CUSTOMER

SPECIFICATION

CHECKED BY

DRAWN BY

SEC. CHIEF

DESIGNED BY

DATE

KOWA CORP.

OSAKA JAPAN

DWG. NO.

EA-0123

CODE NO.

TRACED BY

3RD ANGLE PROJECTION

SCALE 1/4 (A1)

広和株式会社

DUAL LINE LUBRICATING SYSTEMS

MODEL : KEP-41L

MOTOR-DRIVEN LUBRICATING PUMPS

INSTRUCTION MANUAL

**KWK** KOWA CORPORATION

## Introduction

Thank you very much for purchasing the DUAL LINE LUBRICATING SYSTEMS.

This instruction Manual has been compiled as a practical guide for the operation and maintenance of the lubricating system which incorporates the Model KEP-41L motor-driven lubricating pump.

All descriptions contained herein are based on the standard system, which may, therefore, be different from those of purchased system. Such a problem can be solved by referring to the final specifications. However, it is required to understand that some changes caused by the modification of equipment may not be described in the final specifications.

## Guarantee

The guaranteed period this system will be one year from the commencement of operation. Any defect or failure occurring during the guaranteed period, for which KWK is liable in design and manufacturing, shall be corrected and / or eliminated by KWK without compensation. However, any defect or failure caused by improper operation which is not described in this Instruction Manual shall not guaranteed, even though the defect or failure occurs within the guaranteed period.

## PRECAUTIONS OF SAFETY

Before the installation, operation, maintenance and inspection, read carefully this instruction manual and other accompanying documents for correct service.

Familiarize with the knowledge of equipment, information of safety and all of cautionary instructions for service.

The precautions of safety is shown in each equipment of the centralized lubricating system by using safety mark.

Particular attention should be called to the places where these safety marks are given.

The safety marks are divided into "WARNING" and "CAUTION".



If mishandled; In case a dangerous situation may occur, it could result in death or serious injury



light injury, and in case a physical damage may occur.

If mishandled; In case a middle injury or

For the matter being mentioned in the CAUTION, it may result in an importance according to circumstances. The important content is given to all of safety mark, and obeys it without fail.

This system provides the max. Working pressure 21MPa (210kg/cm<sup>2</sup>). When each equipment is disassembled and inspected, stop the operation of pump, and release the pressure to perform the operation as 0MPa (0kg/cm<sup>2</sup>).

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## 1. General description of DUAL LINE LUBRICATING SYSTEMS (Loop type)

### 1-1 Outline of lubricating equipment

This system comprises motor-driven lubricating pump unit which will supply grease or oil to high pressure, external piping, measuring valves and control panel which is used to operate the lubricating system.

The schematic diagram of this system is as shown in Fig.1.

All the following descriptions are for the type used for greasing. When used for oil lubrication, the measuring valve and the tank of the pump are changed but all the other parts are commonly.

The motor-driven lubricating pump unit consists of pump body, electric motor, and hydraulic-operated reversing valve, all of which are mounted on a common base made of steel plate.

A reservoir made of steel plate is installed on the top of the lubricating pump, on which a level rod is provided to indicate the amount of grease stored in the reservoir.

A pressure gauge is also attached to the lubricating pump unit to show the discharge pressure of the pump.

The outside piping consists of the two main supply pipes of parallel piping from the two outlets on the solenoid operated reversing valve of the lubricating pump, the pressure control valve is selected according to the number of lubricating ports and the quantity of grease fed, and installed near lubricating port.

In addition, a control panel is provided for automatic operation of the lubricating pump.

Also installed is lubricating pump which serves to supply grease into the reservoir.

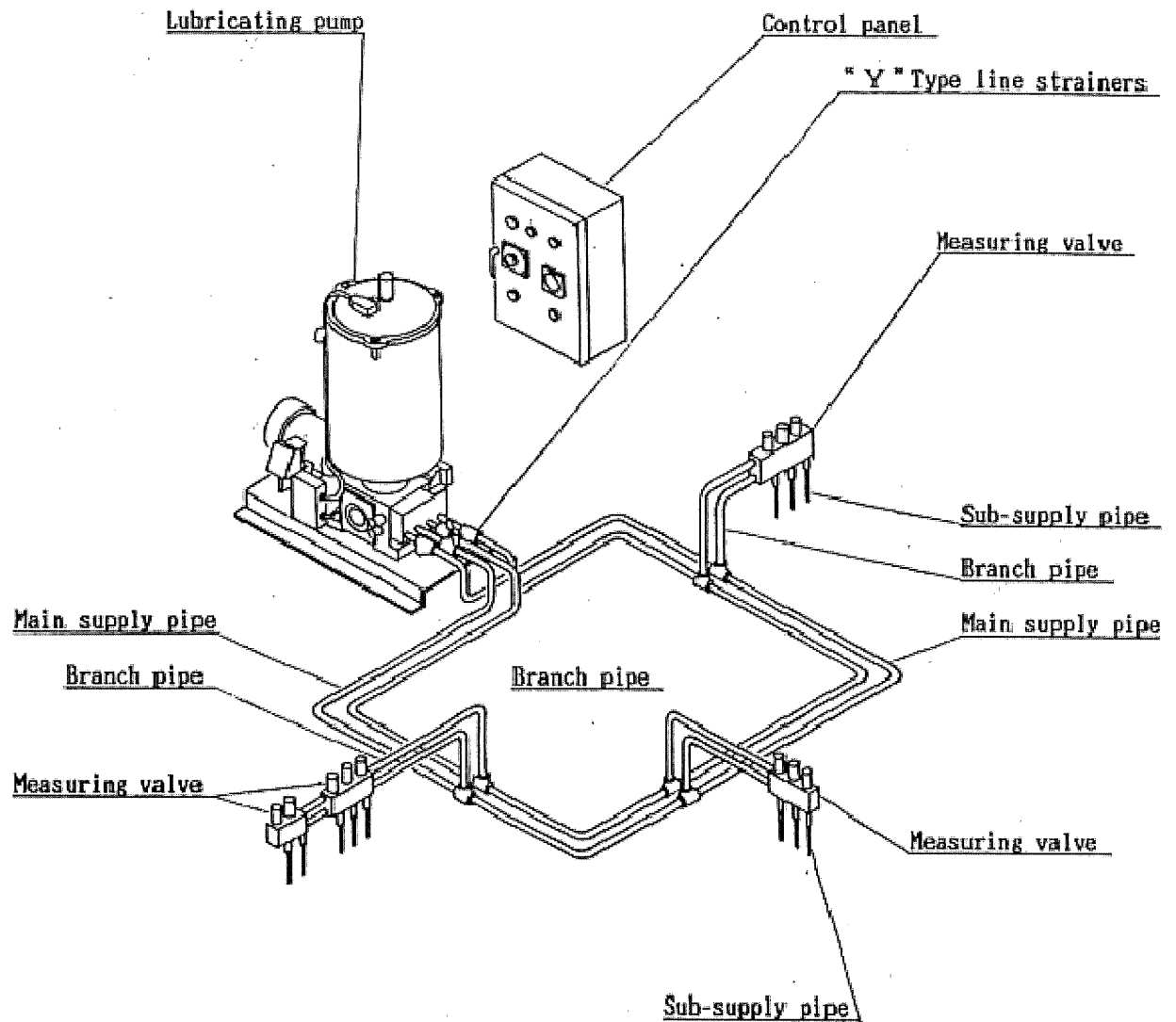


Fig.1 Schematic diagram of lubricating circuit

## 1-2 Outline of lubricating circuit

The schematic diagram of the lubricating circuit is as shown in Fig.2 (A and B).

Fig.2 (A) indicates that the discharged grease from the lubricating pump is transferred in the arrow direction through the hydraulic-operated reversing valve (KRV).

While Fig.2 (B) shows that the grease transferred to No.2 line and No.1 line is open to the tank.

Note that normal operation of this equipment fails if the discharge port of hydraulic-operated reversing valve attached to the lubricating pump is erroneously connected to the return port piping.

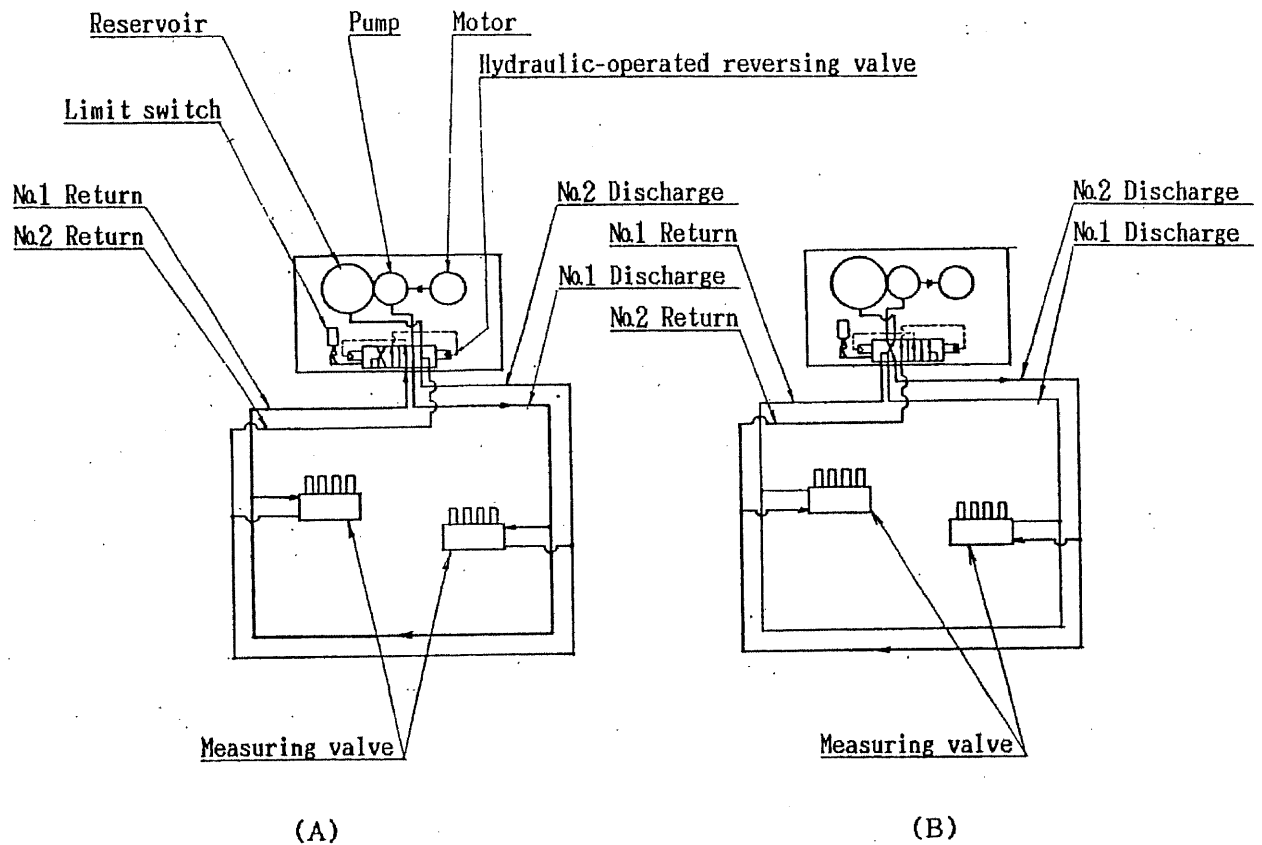


Fig.2 Lubricating circuit

In Fig.2 (A), grease discharged from the lubricating pump passes through the hydraulic-operated reversing valve and flows through the line No.1 in the direction of arrow. The grease is then fed under pressure into each measuring valve through the upper side inlet (supply port) to complete one lubricating operation.

Upon completion of lubricating operation, the hydraulic-operated reversing valve is changed over by the pressurized grease at the return port of the No.1 line. This allows the lubricating circuit to form a circuit shown in Fig.2 (B). Simultaneously with the above, a limit switch attached to reversing valve is actuated to stop the lubricating pump drive motor. When the motor is restarted, grease is supplied under pressure through the No.2 discharge line in the direction of arrow shown in Fig.2(B).

The grease is then fed under pressure into each measuring valve through the lower side inlet (supply port) to perform the second lubricating operation.

Upon completion of the second lubricating operation, the hydraulic-operated reversing valve is changed over again by pressurized grease at the return port of the No.2 line.

This allows the lubricating system to form the circuit shown in Fig.2 (A).

Simultaneously, the limit switch is actuated to stop the lubricating pump.

The lubricating cycles described and illustrated in Fig.2 (A) and (B) are alternately repeated until the lubricating operation is completed.

### 1-3 Specifications of equipment

#### (1) Specifications of lubricating pump

Nomenclature	Item	Lubricating pump model and specifications
		KEP-41L
Pump	Applicable grease	NLGI No.00~No.1
	Discharge capacity (cm <sup>3</sup> /min)	210/50Hz    252/60Hz
	Discharge pressure (MPa)	* Max.20.6
	Pump's revolutions (rpm)	100/50Hz    120/60Hz
Geared motor	Type	Totally-enclosed, three-phase induction motor, continuous rating IP55
	Output × No. of poles	0.4kW × 4P
	Voltage, Frequency	* 3 φ - AC480V, 60Hz
	Reduction gear ratio	1/15
Reservoir	Capacity (Lit.)	40
	Level switch	* Low level switch 1 stage * High level switch 1 stage
Solenoid operated reversing valve	Model	UL-DSG-03-3C3-D24-5090S
	External pipe joints	2 × Rc(PT)3/8
Total mass (kg)		172

※ For the outside dimensions and the internal structure, please refer to the drawings of the principal equipment at the end of this manual.

※ Check the column with asterisk mark(\*) referring to the final specifications.

(2) Specifications of measuring valve

Measuring valve size	Model	Discharge ports	Discharge capacity cm³/stroke		Adjustable amount cm³/one revolution of screw	Mounting bolts (Attachment)	Mass (kg)	Pipe joints	
			Max.	Min.				Inlet	Discharge
KS-30	KS-31	1	1.2	0.2	0.06	M8×65L	1.2	PT3/8	PT1/4
	KS-32	2					2.0		
	KS-33	3					2.8		
	KS-34	4					3.7		
KS-40	KS-41	1	2.5	0.6	0.10		1.4		
	KS-42	2					2.3		
	KS-43	3					3.2		
	KS-44	4					4.0		
KS-50	KS-51	1	5.0	1.2	0.15		1.5		
	KS-52	2					2.5		
	KS-53	3					3.5		
	KS-54	4					4.6		
KW-30	KW-32	2	1.2	0.2	0.06	1.5			
	KW-34	4				2.5			
	KW-36	6				3.5			
	KW-38	8				4.5			
	KW-310	10				5.5			
KW-50	KW-52	2	5.0	1.2	0.15	1.5			
	KW-54	4				2.5			
	KW-56	6				3.5			
	KW-58	8				4.5			

① The working pressure is 1MPa or lower.

② Working pressure : 21MPa

[The maximum working pressure of measuring valve using oil should be 10MPa.]

- ③ Applicable grease : NLGI No.00~No.1

## 2. Installation of equipment and piping procedure

### 2-1 Installation of lubricating pump

The lubricating pump is designed so as to be used indoor. It should be kept in mind that the pump is to be accommodated in a shed or housing capable of protecting the machine from weather, when being installed outdoor.

Maintenance of the machine should be easy even during operation, and the place should be free from excessive dust, temperature change and moisture.

Install the lubricating pump horizontally on a sturdy channel or concrete foundation.

Note that if stresses are locally applied to the lubricating pump frame when the foundation bolts are tightened, it may cause deflection of the pump center alignment and early damage to unit.

In either case, the pump base should be raised more than 50mm above the floor surface in order to facilitate the maintenance, inspection and water draining. Set up the control panel in place where the lubricating pump can be easily operated and controlled.

### 2-2 Piping procedure

#### (1) General precautions

As shown in Fig.1, the piping consists of the main supply pipes coming from the hydraulic-operated reversing valve of the lubricating pump unit, branch pipes running from the main supply pipes to the measuring valve, and the sub-supply pipes from the outlets of the measuring valve to lubricating points or bearing to be lubricated.

All pipes should be supported properly so as to prevent them from being damaged by vibration, and should not be laid on locations where the pipes may be damaged by other obstacles.

#### (2) Connection of main supply pipes and branch pipes

The main supply pipes and branch pipes between the lubricating pump and measuring valve are subject to pressures as high as 21MPa. This fact requires that pipe material incorporated in the above pipe lines should safely withstand the pressure and should have an inside diameter which allow grease to flow smoothly.

Use the steel pipes of STPG 38 (schedule 80) or of higher grade.

The lubricating pump is operated at the maximum discharge pressure of 10MPa or 21MPa.

If the use at the maximum pressure of 21MPa is predetermined, the pump is delivered with the specifications for 10MPa. In this case, STPG 38 (schedule 40) may be used as the piping material.

If the lubricated points of a machine include any moving part which slides or swings, flexible hoses is used for the sub-supply pipes.

To the moving parts of the main supply pipes and branch pipes, use the high-pressure rubber hoses for the maximum working pressure 21MPa.

When the hoses surface may possibly be worn out by sliding, use wire braided hoses on the surface.

(a) Installation of pressure gauge.(Recommendation)

Install the pressure gauge near the hydraulic-operated reversing valve for No.1 and No.2 return lines of the main supply pipes as in Fig.3 in order to check the grease pressure.

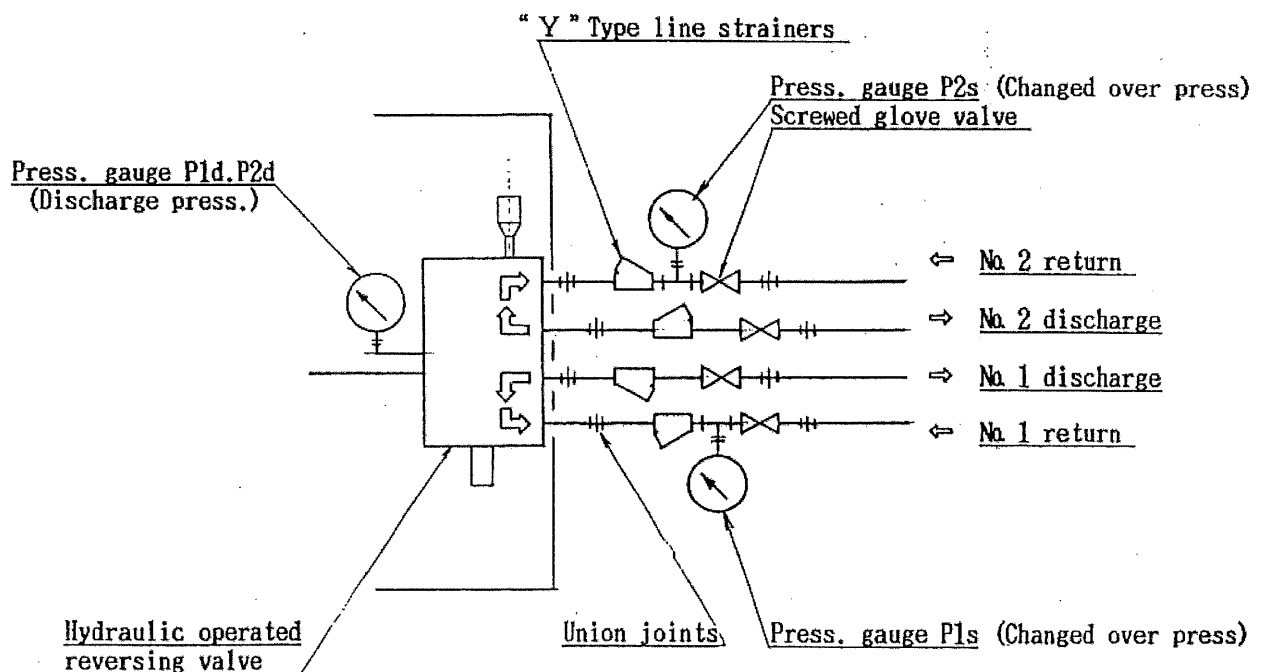


Fig.3

(b) "Y" type line strainers and glove valves.

As shown in Fig.3, the "Y" type line strainers should be installed on the discharge



pipes of the hydraulic-operated reversing valve.

It should be kept in mind that the strainer is to be installed so that it can be removed and cleaned easily, with its installation direction corresponding to the flow direction of grease.

Also, be sure to install the screwed globe valves and pressure gauge as illustrated in order to check the lubricating pump performance and to provide convenience when the system is out of order.

(c) Attaching 2-way check valve

When the main supply pipe rises from the lubricating pump level more than 5 meters or when oil is used, attach 2-way check valve near the lubricating pump in series with the “Y” type line strainers to prevent reverse flow of the grease.

(3) Mounting measuring valve

(a) It isn't advisable to attach the measuring valves directly to the main supply pipes.

Unlike the case attached to the branch pipes, direct attaching to the main supply pipes makes it difficult to continue operation of the system when the measuring valves must be removed for piping line improvement in future or for troubles. It also can cause error motion of the whole system due to air allowed into the main pipes.

(b) When measuring valves are connected in series, limit the number of pieces to about 3, in principle. When more than three measuring valves are used, branch a separate pipe from the main pipe for the piping connection.

If the spacing between measuring valves is 0.5 meter or shorter, however, up to 5 measuring valves can be attached.

(c) The measuring valve should be mounted on a support exclusively used for this purpose or separately fabricated base plate equivalent to the aforementioned support. The measuring valve should be installed at the location as close to the lubricating point as possible, where its indicator rods can be seen easily from the surrounding areas, and where the amount of supplied grease can be adjusted easily.

(d) The measuring valve should be protected with a steel plate cover, when being installed at the dusty location often splashed with water and subject to a high

radiation heat.

- (e) Blank the ends of the measuring valves attached to the branch pipes and main supply pipes with a high-pressure plug.
- (f) To confirm the lubricating operation of measuring valve easily, the branch pipes should be connected correctly to the measuring valves so that the indicator rod of the respective measuring valves move in same direction. In a move detailed explanation, all pipes branched from No.1 discharge line should be connected to the upper ports of the respective measuring valves.

(The same result may be obtained even if the pipes branched from No.1 line is connected to the lower ports of the measuring valves.)

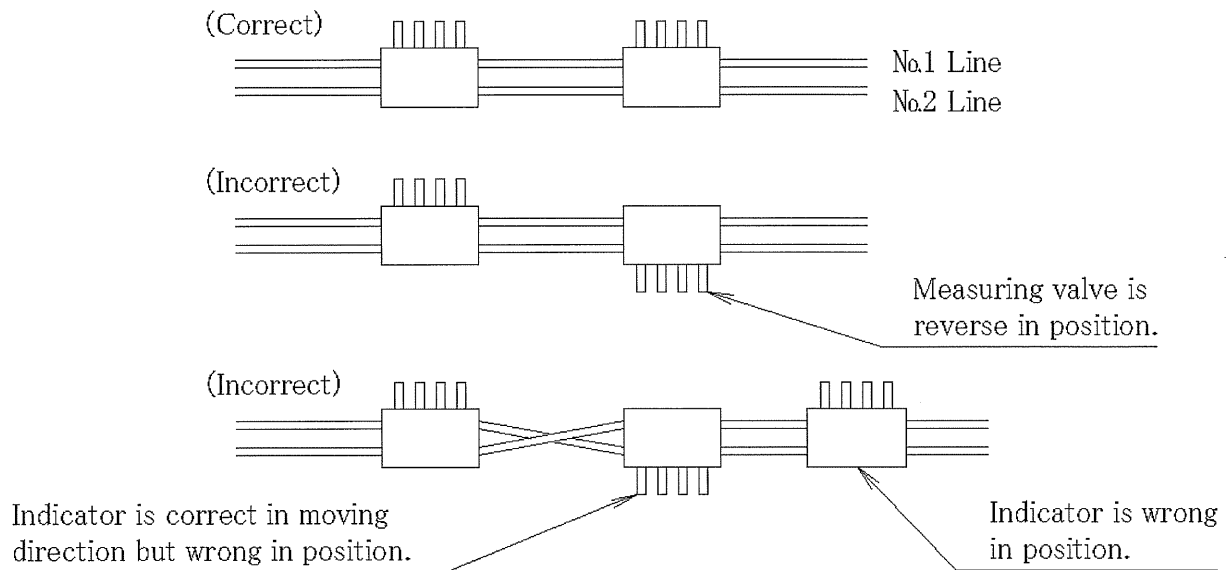


Fig.4 Connection of measuring valve

(4) Connection of sub-supply pipes (Lube piping)

- (a) Since the pressure required for greasing against the back pressure of bearings and resistance of the sub-supply pipes reaches the maximum operating pressure, it is necessary to use the material which withstands the pressure of 3MPa for the piping from the measuring valves to the points of lubrication.

For the piping, 8A (1/4B) steel pipes or 6  $\phi$  and 8  $\phi$  copper pipes are used.

- (b) When the bearings are submitted to a high back-pressure, prevent reverse flow of grease and error motion of the measuring valves by using check valves or inverse flow check valves. (Select the piping material carefully as the withstand pressure of the sub-supply pipes also changes in this case.)

- (c) Bearings must be composed so as to ensure discharge of old grease.

For sealed type bearings, it is necessary to lead the filled grease to the outside by attaching a relief valve to the bearings.

- (d) When the lubricated points of a machine include any moving part which slides flexible hoses must be used.

### 3. Construction and function of lubricating pump

#### 3-1 Greasing pump body

See the assembly sectional view of greasing pump body.

The greasing pump body lies under the tank, the power is transmitted to the crank shaft in the pump casing by direct-coupling of motor, and the reciprocating motion of main plungers 1 & 2 and valve plunger is made by the connecting rod being connected thereto for suction of grease.

Thus, the system of pump provides double plunger system by the combination of main plungers 1 & 2 and valve plunger.

#### 3-2 Operation of double plunger

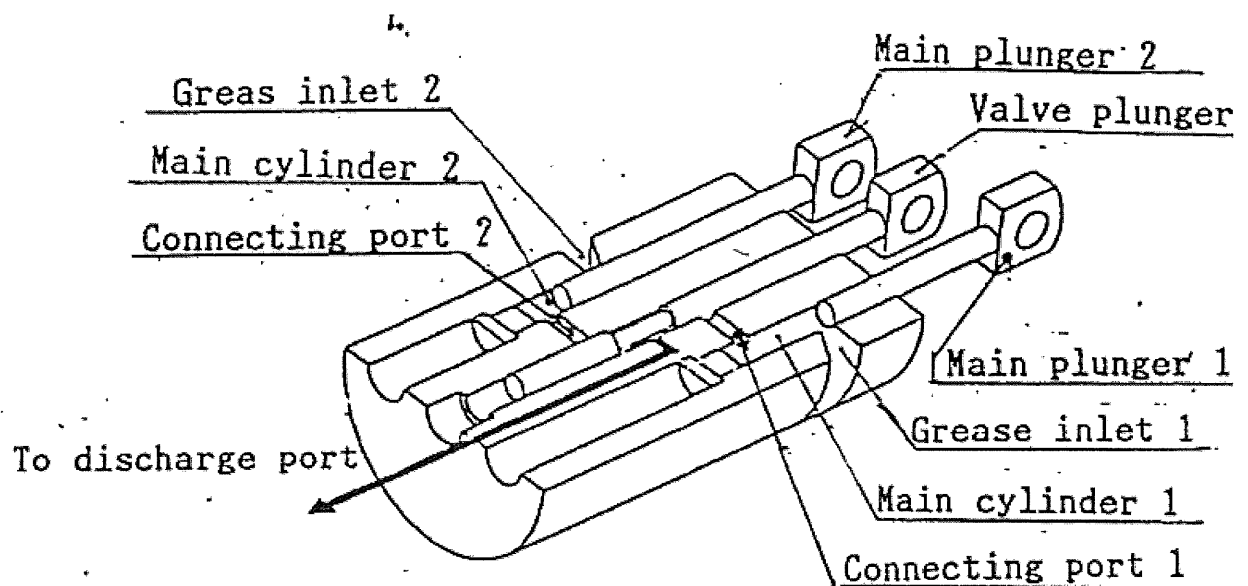


Fig.5-1

Grease inlet 1 is opened by retracting the main plunger, and grease enters the main cylinder 1 from grease reservoir. The main plunger 2 finishes pushing out of grease, and simultaneously valve plunger retracts and closes the connecting port 2.

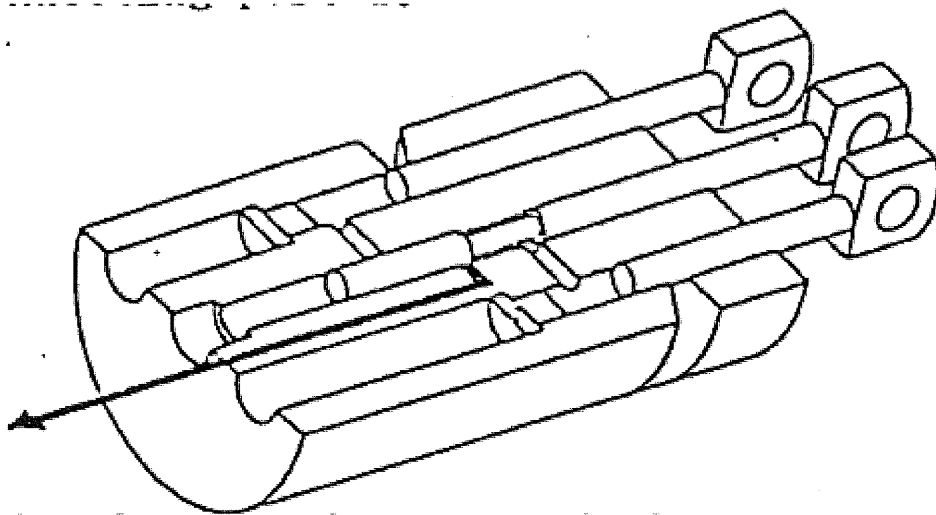


Fig.5-2

The main plunger advances and closes the grease inlet 1, and simultaneously the valve plunger retracts and opens the connecting port 1. Grease in the main cylinder for discharge with the advance of main plunger 2 retracts and the inside of main cylinder 2 provides the vacuum.

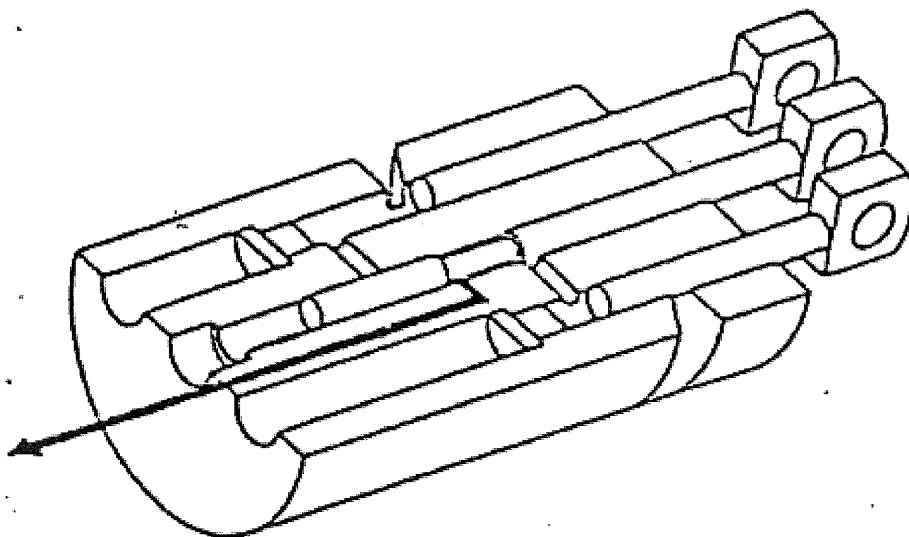


Fig.5-3

The main plunger 1 finishes pushing out of grease, and simultaneously valve plunger advances and closes the connecting port 1. Then, the main plunger 2 retracts and opens the grease inlet 2.

Grease enters the main cylinder 2.

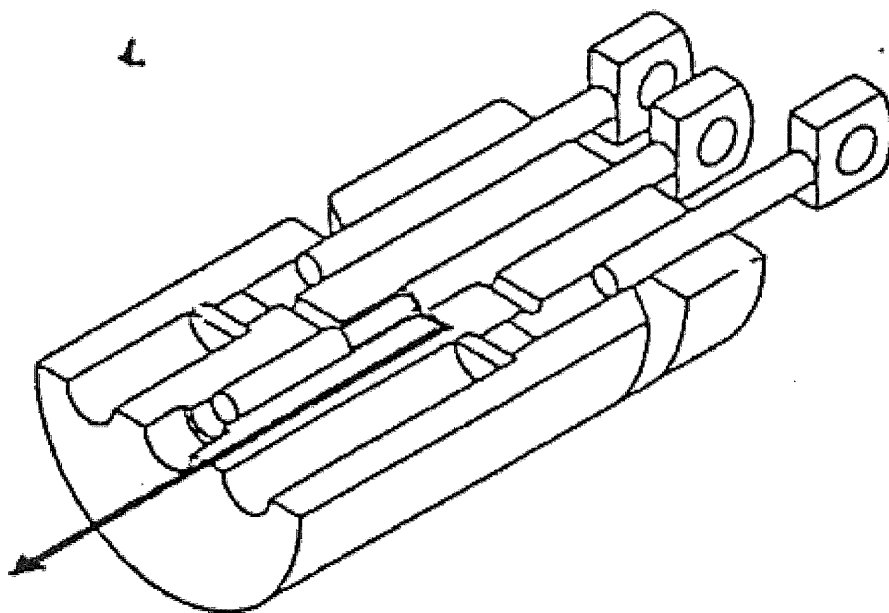


Fig.5-4

The inside of main cylinder 1 provides the vacuum by retracting the main plunger 1.

Then, the main plunger 2 advances and closes the grease inlet 2, and simultaneously the valve plunger advances and opens the connecting port 2.

Grease in the main cylinder 2 passes through the inside of valve cylinder for discharge with the advance of main plunger 2.

### 3-3 Relief valve and pressure relief valve

#### (1) Relief valve

The relief is incorporated in the sub-plate being mounted on the pump body.

This relief valve is provided for opening the emergency pressure when the pipeline is choked for some reason or other, the relieved grease pressure is opened to the tank, and it protect all of greasing system.

Lubricating pump model	Maximum discharge pressure	Relief valve set pressure
KEP-41L	21MPa	23MPa $\pm$ 0.5MPa

To meet the specification in case of the agreement, the relief valve has been already adjusted in the shipment at our factory. Therefore, avoid adjusting the relief valve at random on job-site.

(2) Pressure relief valve

In case of the test running or the change of electric wiring, the pump (motor) may reverse.

With reversing of the pump, it is built so as to escape into the tank by the action of pressure relief valve without discharging grease.

When the pump reverses in this pressure relief valve, the inside of cylinder provides abnormally high pressure unlike the forward in timing of double plunger, and the plunger breaks. Accordingly, in order to prevent its breakage, this valve opens abnormally high pressure to the tank, and it acts for protection of the pump.

Reversing the motor adversely affects the pump. Hence find it as quickly as possible, and take care to avoid reversing for long.

(A correct direction of rotation of pump is cast on the surface of casing of pump body.)

The pressure relief valve has been adjusted in KWK factory in accordance with the specifications at the time of concluding the agreement, before being delivered.

Therefore, it is recommended that relief valve should not be adjusted at the site.

### 3-4 Reservoirs

#### (1) Reservoir

The reservoir is to store grease. A follower plate is provided in the reservoir so as to level out the grease surface along with grease consumption and to shut off the outside air.

On the center of the follower plate, a level rod is placed vertically going through the cover at the top of the reservoir and a cylindrical cam for level switch is provided on level rod.

A grease overflow port is also provided at the upper part for overflow of excessively filled grease.

#### (2) Low level switch

If grease is consumed until the reservoir is emptied, air is admitted into the pump, and may also be admitted into pipe line. Once air is admitted into the pipe, the lubricating operation becomes extremely unstable.

In the extreme case, grease must be drained completely from the pipe line in order to purge air, and the pipe line must be refilled with new grease.

A low level switch is provided at the upper part of the reservoir as the standard specification so that the pump operation stops and alarm is given when the grease is consumed to certain limit.

The cam to operate the low-level switch is at the upper end of the level rod.

When the grease is used and the follower plate comes down to certain level, the level rod directly connected to the follower plate also comes down, and the cam actuates the low level switch.

The signal from the low level switch is transferred to the control panel through the terminal box of the pump to issue alarm and to stop the motor.

Besides the low level switch, a high level switch can also be attached easily at a field site so as to transmit the signal of high grease level.



(3) Level switches for special specifications

The following switches are available as the special specifications.

Lubricating pump model	No. of level switches	Application
KEP-41L-S1	Low level switch : 1 High level switch : 1	For applications in which grease is added by means of motor-driven transfer pump.
KEP-41L-S2	Low level switch : 2 High level switch : 2	For applications in which grease is automatically added by means of bulk feeding system.

These switches are set depending on customer's order and are shipped after adjustment.

(The lubricating pump of the standard specification is provided with one low level switch.)

### 3-5 Hydraulic-operated reversing valve

#### (1) Construction and function

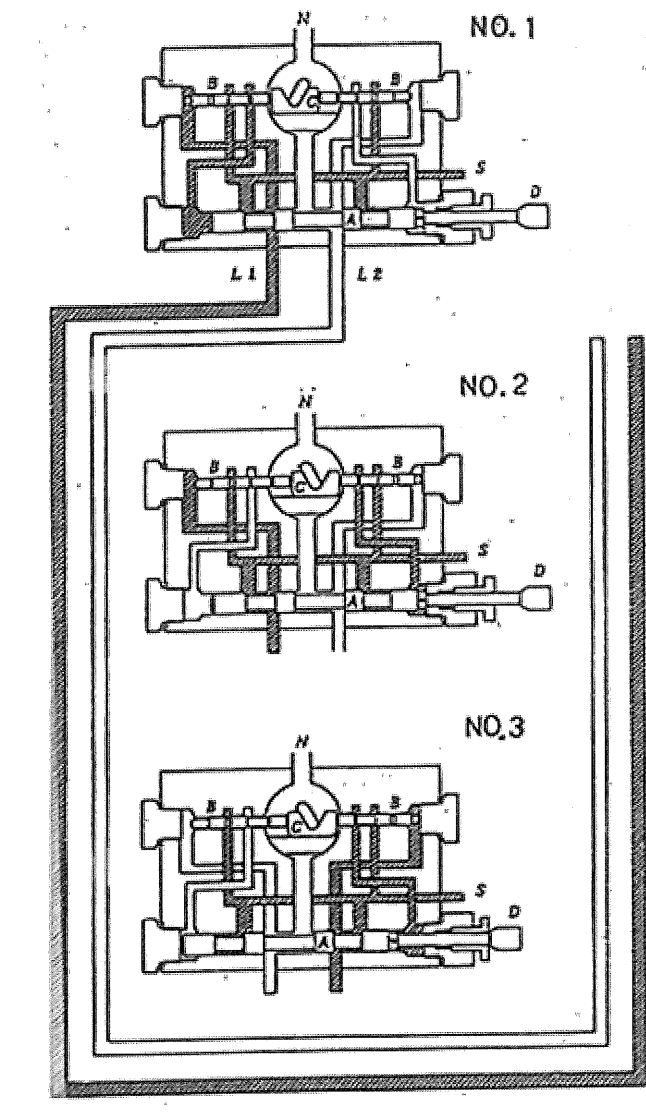
This reversing valve serves to feed grease discharged from the pump alternately to the two main supply pipes. The grease fed by the pump pass through the reversing valve, and is sent to one main supply pipes, and actuates measuring valves. And the pressure in piping becomes high. The grease with which pressure became high returns to the reversing valve through its return port, actuate the valve piston. The aforementioned piston movement changes over the grease passage so as to be connected to the other main supply pipe.

The composition is as shown in Fig.6.

Two pistons are provided in the reversing valve. On one of the pistons, a rack is provided at the center part, which is engaged with a pinion. A lever and spring are attached to the pinion in order to retain the passage reversing pressure.

A cam is provided on the tip of the other piston to actuate a limit switch.

(2) Function



(a) In No.1 of Fig.5, grease pressurized by the pump passes through the inlet S and is forced into the main supply pipe L1 by means of the piston A. At this time, the other main supply pipe L2 is connected to the reservoir through N. The darkened part of Fig.5 shows the existence of pressurized grease.

When the inner pressure of the main supply pipe L1 is raised, and all measuring valves complete their operations, the pressure at the end of the pipe L1 begins to increase.

(b) When the pressure in L1 exceeds the set valve, the piston B is moved to the right as shown in the No.2 of Fig.5. During this movement, grease entering into the cylinder through the inlet S is forced against the right end of the piston A by the movement of piston B. At the same time, the left end part of the piston A is connected to the relief line N.

(c) Grease entering the cylinder through the inlet S and pressurized by the pump moves the piston A to the left, as shown in the No.3 of Fig.5. Upon completion of the above movement, the main supply pipe L1 is connected to the relief line N.

During this movement, the grease from the inlet S is fed to the main supply pipe L2.

The piston A is provided with a switch cam rod D, as shown in Fig.5, so that the line

reversing operations can be observed from the outside.

The switch cam rod D actuates the limit switch when moving to the right and left, by which the lubricating pump is stopped.

When the lubricating pump is started again, grease is admitted into the main supply pipe L2 as shown in No.3 of Fig.5.

After all the measuring valve have been actuated by grease pressurized by the pump, the pressure at the end of L2 line. When the pressure exceeds the set value, the piston B is moved to the left. With the movement of the piston B, the pressurized grease from the inlet S is forced against the left end of the piston A. This allows the piston A to move to the right as shown in No.1 of Fig.5. At this time, the limit switch is actuated by means of the switch cam rod D, and the lubricating pump stops. The line reversing pressure of this hydraulic-operated reversing valve can be adjusted by means of a spring tension adjustment screw attached to the block C.

The line reversing pressure of the hydraulic-operated reversing valve has been adjusted at 10MPa in KWK factory before delivery.

#### 4. Trial operation

##### 4-1 Confirmation before operation

- (1) Check the installation, piping and wiring before test operation.
  - (a) Unions and flanges of main supply pipe and branch pipe.
  - (b) Sub-supply pipes connected to all bearings to be lubricated.
  - (c) Plug of measuring valve.
  - (d) Electric wiring on the primary and secondary sides.

- (2) Lubricant oil to the lubrication pump unit.

(Oil is filled up to the center of the oil level gauge if not specified by the client.)

Lubricating pump model	Pump casing (crank case)
KEP-41L	1.5L

Recommended brand

JIS K 2219, class 2 No.4 gear oil or the equivalent

Name of company	Brand
ESSO Standard Oil Co.	Pen-O-Led EP-2
Mobil Oil Co.	Mobil Compound BB
Shell International Petroleum Co.	Shell Omala Oil 150

- (3) Lubricant replenishment to the motor with reduction gear.

Before shipment, grease is already sealed in the gear casing of the motor with reduction gear.

Lubricating pump model	Reduction gear box	Brand
KEP-41L	0.3kg	NIPPON GREASE NIGHTIGHT LMS No.000

#### 4-2 Grease selection

There are quite different kinds of grease of different quality and characteristics. Select suitable grease to the operating conditions out of the recommended kinds of grease given below.

Ordinarily, any grease is applicable within the range of NLGI standard No.00 No.1 (fluidity 430 to 310).

Note:

1. Molybdenum or graphite-filled grease

Solid lubricant is on will affect the life of the pump (wear).

If the particle size is 1 $\mu$ m or less, it can be used almost without problems.

If the particle size is about 1~3 $\mu$ m, it can be used. But wear becomes violently.

It cannot be used if the particle size is greater than 3 $\mu$ m. (Pump life will be extremely short.)

2. Grease containing metals in powder form such as copper and zinc cannot be used.

Name of company	Brand
ESSO Standard oil Co.	LITHTAN No.0~No.1
	LITHTAN EP No.0~No.1
Shell International Petroleum Co.	ALVANIA EP GREASE No.0~No.1
	ALVANIA GREASE No.0~No.1
	EP GREASE No.0~No.1
Mobil Oil Co.	MOBIL PLEX 45,46
	MOBILUX 1

#### 4-3 Grease filling

(As the grease for filling, use the same brand as the one used for each customer.)

##### (1) Filling reservoir with grease

Fill the grease into the reservoir by the pump with care not to allow intrusion of dust or air from the filling port (Snap-on coupling) on the side of lubricating pump unit.

NOTE : The reservoir should never be filled with grease from the upper side, with the top cover and the follower plate removed. Such a filling manner may cause unexpected trouble during operation.

##### (2) Filling sub-supply pipe (Lube Line) with grease.

The sub-supply pipe ranging from the discharge port of measuring valve to the lubricating point should be filled with grease by means of a grease gun, before commencing the operation.

After filling grease, connect the sub-supply pipes to the measuring valves.

##### (3) Filling main and branch pipes with grease.

###### (a) Preparation

- a) Remove the plugs at the end of No.1 and No.2 lines of the hydraulic reversing valve so that the grease and air in the piping can be drawn out. Fully close the screw type glove valve near the pump.
- b) Receive the grease coming out from the points where the plugs are removed in the above a) and b) with a vinyl bag, pail or waste cloth.
- c) For grease filling, it is necessary to operate the lubricating pump for several hours or longer in continuity. Since the maximum setting of the protective timer is 30 minutes, alarm is given and the pump stops when operation for more than 30 minutes. To prevent the alarm only for the test run, remove the protective timer on the control panel.

(The alarm is given only at empty reservoir or motor overload when the pump is operated under this condition.)

This isn't necessary when a filling pump is used for grease filling.

NOTE: Be sure to attach the protective timer to the original condition when grease filling completes.

(b) Filling procedure

- a) Turn the power switch to 「ON」 to operate the lubricating pump.
- b) Air is drawn out through the measuring valves where the plugs (PT3/8) are remove, then the grease comes out but refrain from plugging the measuring valves soon. Take out the grease coming out to compare with new grease and plug the measuring valves only after making sure that equally clean grease to unused grease comes out.
- c) When grease is filled into the main supply pipe and sent to the pressure control valve at the end of branch pipes, make sure that the grease is free from inclusion of any foreign substance in the same manner as for the preceding item, measure the pipe resistance, then stop the lubricating pump.

d) Pipe fluid resistance measurement

Watch the pressure of lubricating pump during operation of step c), and then record the point of the highest pressure when grease comes out of the pipe connection of pressure adjusting valve.

e) Check electrical system and connecting

When the filling work completes, connect the pressure control valve of completely filled line only to the piping, and operate the lubricating pump. The grease is discharged again into the filled line (No.1 line for example), and the pressure increase little by little as the piping connected this time.

If the piping systems and electrical writing systems of the solenoid reversing valve and the pressure control valve are connected correctly, the pressure control valve is changed and the limit switch is actuated by the switch cam to transmit lubricating complete signal, and the lubricating pump comes to a stop.

If the pressure control valve is not changed, the pressure increases further and the lubricating pump is eventually relieved and comes to a stop once.

In this case, the writing of the limit switch (NO and NC) must be changed each other as the connection of the electrical, writing is not correct.



- f) Operate the lubricating pump again. The No.2 line is filled this time as the pressure control valve is switched. Fill the No.2 line with grease in the same procedure as for No.1 line and make sure that the pressure control valve is switched and the lubricating pump comes to a stop automatically.

(c) After filling

When both lines are filled completely, turn off the power switch and attach the protective timer which was removed in the procedure 4-3-(3)-(a)-d).

Also clean the joints and plugs of the measuring valve in preparation for the following grease leak test. The filter of the “Y” type line strainer shall be cleaned as well.

#### 4-4 Leak test

This is check the line for no grease leakage from the pipe joints when the maximum discharge pressure 21MPa of the lubricating pump is applied.

Carry out the test in the following order.

- (1) Close the screw valve at the inlet of the pressure control valve so that the internal line pressure is not applied. (To prevent the pressure control valve from being switched.)
- (2) Set the protective timer at about 15 minutes and operate the lubricating pump.
- (3) The pointer of the pressure gauge to lubricating pump goes up slowly reaching 23MPa in due course. (As the hydraulic-operated reversing valve is not changed, the pressure in the piping line goes up and the relief valve of the lubricating pump functions.)
- (4) The protective timer function 15 minutes later to give over time signal and the lubricating pump comes to a stop.
- (5) Turn off operation power switch to reset the alarm then turn on the switch soon again.
- (6) Open the screw type valve closed in item (1) then operate the pump. The pressure in the line increase to change the pressure control valve and the lubricating pump stops.
- (7) Operate the lubricating pump again to test leakage of the other line in the same procedure.
- (8) When the alarm is given and the lubricating pump comes to a stop, turn off the control power and go around the whole piping to check for no leakage.

Check the position of the indicator rod in preparation for the next operation check of the

measuring valve. (See paragraph 4-5)

#### 4-5 Measuring valve operation check, discharge pressure and changed over pressure measurement.

- (1) Check whether the indicator rod of each measuring valve is out or in and mark all measuring valve with pencil stone or chalk. Operate the lubricating pump and wait for completion of lubricating and automatic stop.
- (2) Discharge pressure and changed over pressure measurement (See Fig.3)

Read the point of the highest pressure immediately before completion of lubricating and record the reading.

Discharge line	Discharge pressure	Changed over pressure
No.1 line	P1d= MPa	P1s= MPa
No.2 line	P2d= MPa	P2s= MPa

- (a) Discharge pressure . . . . Read the pressure gauge of the lubricating pump.
  - (b) Changed over pressure . . . . Read the pressure gauge of the pressure control valve.
- (3) After making sure that the changed over pressure (P1s & P2s) is up to about 4MPa, check the indicator rod should be moved to the opposite side of the position marking is above item (1). Erase the marks where the indicator rod is moved.
  - (4) Where the indicator rod position does not coincide, the indicator rod is not moved.
  - (5) Operate the pump again and record the discharge pressure of the other line.

By this operation, the indicator of the measuring valve returns to the original position.

- (6) For any measuring valve of which indicator rod does not move, refer to paragraph 4-7.

#### 4-6 Changed over pressure adjustment

When the indicator rods of all the measuring valves are operated, adjust the changed over pressure in the following manner so that the measuring valve operate exactly for the next lubricating.

- (1) Adjusting method

Loosen the lock nut of the pressure control valve and adjust the changed over pressure by turning the adjust screw while watching the pressure gauges (P1s and

P2s). Operate the pump while checking the changed over pressure.

(Left turn of the adjust screw increases the changed over pressure.)

- (2) Increase the changed over pressure by 1MPa.

After the adjustment, the reversing pressure (Pn) becomes as follows.

$$P1n=P1s+1$$

$$P2n=P2s+1$$

- (3) Minimum operating changed over pressure.

As described above, the changed over pressure must be set for use at least at 5MPa.

(4MPa+1MPa or up when delivered)

- (4) Lock nut locking

After the pressure adjustment, be sure to fasten the lock nut. If neglected, the pressure adjust screw is turned by vibration and the changed over pressure may be disordered.

#### 4-7 For any measuring valve with non-operating indicator rod

- (1) When the bearings are subjected to back pressure, particularly for hydraulic turbines of power plants, the indicator rod may sometimes fail to operate unless the changed over pressure is increased.

Changed over pressure = back pressure + approx. 4MPa.

Approximately the pressure given by the above equation is required.

- (2) For the indicator rod (piston) of no operation, remove the sub-supply pipes.  
(3) Operate the lubricating pump, wait for automatic stop, and then check for operation.

- (a) When operated

The sub-supply pipes and bearings are in trouble.

- a) Check the sub-supply pipe for no breakage.  
b) Set a pressure gauge at the top end of a grease gun to feed grease directly from the sub-supply pipe to the bearings and check the back pressure.

The conceivable causes are:

- b)-1 Back pressure is high by nature and high back pressure is normal.

(take the measure of (3)-(b)-b))

- b)-2 Measuring valve piston fails to operate as the bearing is filled fully with

grease and there is no grease relief. Attach a relief valve to the bearing in this case.

b)-3 Inadequate design or machining of bearing.

(b) When operation fails

a) In most cases, the piston is sticking due to foreign substance in the piping and allowed into the measuring valve. (Normal measuring valve operates at 1MPa or lower.)

b) Take the following measure.

b)-1 Close the globe valve near the inlet of the pressure control valve and operate the lubricating pump, then the pressure in the piping goes up gradually and the lubricating pump reaches the maximum discharge pressure. Check if the indicator rod moves under this condition and if not, clean the measuring valve. If it moves, open the globe valve near the inlet of pressure control valve as it can be operated only if the pressure is applied.

Increase the changed over pressure little by little to point where the indicator rod is moved at every operation of the lubricating pump.

Set the pressure adjust screw at the changed over pressure where the indicator rod is moved plus 1 to 2 MPa.

b)-2 Refrain from grinding the piston with sand paper at the cleaning as the discharge efficiency is lowered.

#### 4-8 Record of test run

At the end of the test run, carry out the check in accordance with the test run record shown at the end of this manual for final confirmation.

(1) Lubricating time, discharge pressure (changed over pressure).

Operate the lubricating pump for several times of lubricating and record the average time and pressure.

(2) Checking automatic start-up of pump.

Put the start timer pointer close to 0 hour as much as possible and make sure that the pump starts automatically.

(3) Alarm lamp and alarm check (while operating the pump)

(a) Grease low level

Check by the pushing the low level switch by hands.

(b) Set the protective timer at a timer shorter than the lubricating time recorded in (1), and operate the pump to check the lamp.

(c) Motor overload

Move the test lever of the thermal relay horizontally for checking. After testing, push the set lever then normal condition is restored.

(4) Timer set

(a) Start timer

Set the operating interval in accordance with our specifications and the machine maker instructions.

(b) Protective timer

Set the timer at the lubricating time measured in (1) plus 5 minutes.

## 5. Maintenance and inspection

### 5-1 Oil change in lubricating pump

Lubricating oil the pump casing should be changed 200 hours after the commencement of operation and then every one year or 2,500 hours after the initial oil change.

### 5-2 Precautions for adding grease

- (1) The reservoir should be filled with grease by means of a filling pump.

It should be kept in mind that grease is to be supplied through the filling port of the pump. A strainer provided in the filling port should be cleaned periodically.

- (2) Grease may be deteriorated if it has been mixed with another brand of grease. To prevent this, it is recommended to obtain the adequate instructions from a grease manufacturer when using a different brand of grease.

### 5-3 Spare parts

It is recommended that the following spare should be provided to minimize the shutdown period of the system in the case of emergency.

- (1) For pump
  - (a) Cylinder plunger set
  - (b) Various packing
  - (c) Pressure gauge and limit switch
  - (d) Hydraulic-operated reversing valve KRV-22SL
- (2) Various types of measuring valves
- (3) For control panel
  - (a) Signal lamps
  - (b) Fuse elements
  - (c) Auxiliary relays
  - (d) Timers
- (4) Miscellaneous
  - (a) Flexible hoses
  - (b) Pipes and joints

#### 5-4 Inspection

The following items should be inspected periodically.

- (1) Operation time of lubricating pump, discharge pressure, pipe end pressure.
- (2) Reversing operation of hydraulic-operated reversing valve. (Switch cam movement)
- (3) Operation of measuring valve
- (4) Grease leakage from pipe
- (5) Damage of respective equipment
- (6) Amount of grease remaining in reservoir and grease storage can

## 6. Trouble shooting and remedy

It is recommended for better results that the cause of a trouble or failure should be detected by tracing simple defects first.

No.	Descriptions	Causes	Remedies
(1)	Pump motor fails to start, even if push-button switch is depressed.	a. Power supply is not on.	a-1. Turn on main power switch and operation power switch. a-2. Check the primary voltage (between R.S.T.) with a taster.
		b. Fuse is blown.	b-1. Turn on the no-fuse breaker. b-2. Replace the cylindrical fuse.
		c. Motor wiring is discontinued.	c. Reconnect the wire.
(2)	The alarm lights up. The alarm lights up and pump operation fails even when the operating power switch is turned off once and then turn to on again.	a. The tank is empty.	a. Supply grease with a filling pump.
		b-1. The motor is over-loaded.	b-1. Check and repair.
		b-2. Sticking of reduction gear (Insufficient lubricant)	b-2. Replace the reduction gear.
		b-3. Sticking of reduction gear (Insufficient lubricant).	b-3. Replace the reduction gear.
(3)	Pointer of pump pressure gauge deflects too much.	b-4. Disconnection of motor circuit (Voltage is applied to two phase only of the three.)	b-4. Check and repair the wiring or replace the motor.
		a. Air is trapped in main pipe and branch pipe.	a. Disconnect the piping at several points and operate the pump to draw the air.
		b. Refer to item (4) if grease retard alarm is given.	



(4)	<p>Alarm buzzer sounds.</p> <p>When the control power switch is turned off once and to ON again, the pump operates but the buzzer sounds again soon and the pump comes to a stop.</p>	Grease retarding is resulted.	
		a. Reverse rotation of motor.	a. Exchange the two phases of the three places.
		b. Air is trapped in the pump.	b. Tighten their vent plug of the level rod. Draw out the air from the tank.
		c. The grease used is too hard to be absorbed.	c. Check the grease with softer one.
		d. Misconnection of the piping system.	d. Check and correct the piping.
		e. Grease leakage from the main or branch pipe.	e. C.
		f. Excessive air allowed in the main or branch pipe.	f. Disconnect the piping at several points, and operate the pump to draw out the air.
		g. Inadequate setting of protective timer.	g. Set the timer at lubricating time +5 minutes.
		h. Malfunction of limit switch or mis-wiring.	h. Check the limit switch (push by hands) or repair.
		i. Dust is caught by the relief valve.	i. Overhauling.
		j. Malfunction of hydraulic-operated reversing valve, sticking of piston, or loosening due to wear.	j. Disassemble for repair or replace.

		k. Insufficient discharge quantity or discharge pressure due to wear of cylinder or plunger.	k. Replace the cylinder and plunger.
(5)	Operating noise of pump is too high or not normal.	a. Wear.	a. Replace the reduction gear and the lubricating pump proper.
		b. Inadequate shim adjustment.	b. Add another shim. (Insert a thinner shim for trial.)
(6)	Water stays in the reservoir.	a. Quality of the supplied grease is not good.	a. Check the grease and check the quality with the grease maker.
		b. The pump is wet with water.	b. Attach a cover.
		c. Check valve is defective (for hydraulic turbine).	c. Overhaul the check valve or replace.
		d. Check valve attaching is neglected (for hydraulic turbine).	d. Attach the check valve.
(7)	Indicator stem of some measuring valves fail to operate.	a. Bearings are blocked.	a. Check the bearings and improve.
		b. Sub-supply pipes are broken.	b. Check and repair the sub-supply pipes.
		c. Changed over pressure of hydraulic operated reversing valve is too low.	c. Adjust the changed over pressure.
		d. Sticking of measuring valve due to dust clogging.	d. Overhaul the measuring valve or replace.

		e. Branch pipe is too long.	e. Lower the flow resistance by increasing the changed over pressure or by making the branch pipe larger.
(8)	All the measuring valves fail to operate.	Refer to above item (4) in this case as alarm is given.	

## 7. Disassembly & assembly

This motor-driven pump is able to operate stably for long, which eliminates the need for frequent disassembly and reassembly of the pump body.

The sliding areas such as the cylinder & plunger of the pump body & piston of pressure control valve are precisely machined. Therefore, it sometimes a satisfactory result will not be obtained even if the plunger only is replaced.

The replacement of cylinder and plunger shall be performed surely as the set.

The replacement of cylinder & plunger and that of piston of pressure control valve are carried out in principle at our specified service shop.

Hence please contact the agency who delivered the equipment or our specified service shop.

### 7-1 Preparation

(1) Prepare surely the treated oil, waste cloth besides tools.

(2) Purge all of grease in the tank before removing the cylinder.

(Remove the joint at the supply port, feed the compressed air from the overflow port of tank, and grease is purged simply.)

(3) Bring the pressure control valve at a clear place where the bench lies with the valve assembled, and make the disassembly and reassembly.

### 7-2 Precautions

(1) When the greasing pump body is disassembled, renew the lubricant in the pump body without fail.

(2) Shim is put between bearing cover at the driving side and body casing.

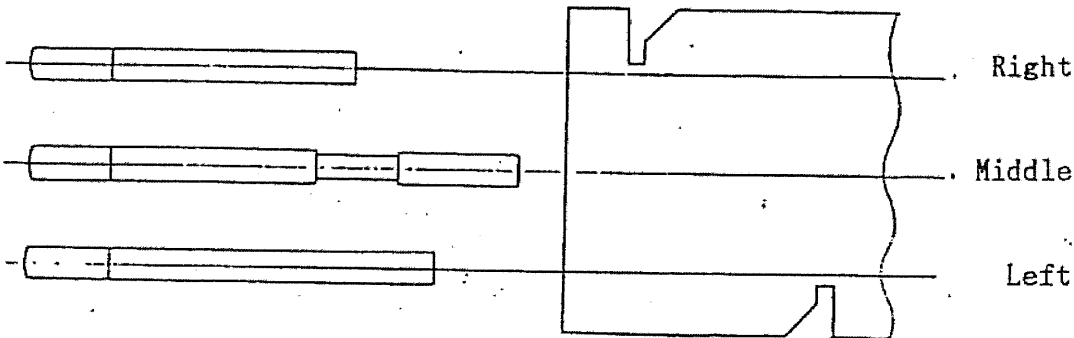
Be careful not to lose this shim.

With the reassembly, incorporate the shim in the same thickness as the removal.

When the shim is put between motor and bearing cover at the driving side, use the same procedures.

### 7-3 Operation

Cautionary instructions only are described therein.

Content of Operation	Cautionary Instructions
(1) Incorporation of cylinder	<p>a. Of two slots (grease suction port) for cylinder, incorporate so that the left slot comes on this side.</p> <p>b. Apply clean grease to the outside of cylinder, and put the cylinder therein.</p>
(2) Incorporation of plunger	<p>a. Incorporate first the plunger and connecting rod.</p> <p>b. Incorporate the plunger into the cylinder.</p> <p>c. As given to Fig.7, incorporate a short plunger into the left, a long plunger into the middle, and a midway plunger into the right.</p>
 <p style="text-align: center;">Fig.7</p>	
(3) Incorporation of connecting rod cap	Match the identification mark at the connecting rod side and that at the cap side for incorporation.
(4) Confirmation after assembly	When the paragraphs (1)~(3) are carried out, turn the crank shaft by hand, and make sure that it turns lightly before

	<p>mounting the motor on the pump body.</p> <p>(When it provides a heavy turning and does not turn readily, it is caused by improper assembly.)</p>
(5) Assembly of pressure control valve (KCV-2 type)	<p>Since it liable to assemble erroneously, make the assembly carefully with the drawing (See the end) watched without fail.</p>
(6) Removal of tank	<p>a. Remove the level switch of the tank in advance. In case the level switch is S1 or S2 Specification (See the paragraph3-4, (3)), provide the tag to each level switch to put the marks of CLLS, HLS in order to avoid mistake in case of incorporation.</p> <p>b. Remove the joint at the supply port, and purge all of grease in the tank.</p> <p>Then, feed the air from the overflow port, and grease is purged promptly.</p> <p>c. Take the cap, and draw out the fitting bolt of the tank bottom by using hexagon wench. M12 (opposite side of hexagon:10mm)</p>

## 7-4 Disassembly and assembly

(1) As for sectional assembly drawing of the gear-motor, refer to Fig.8

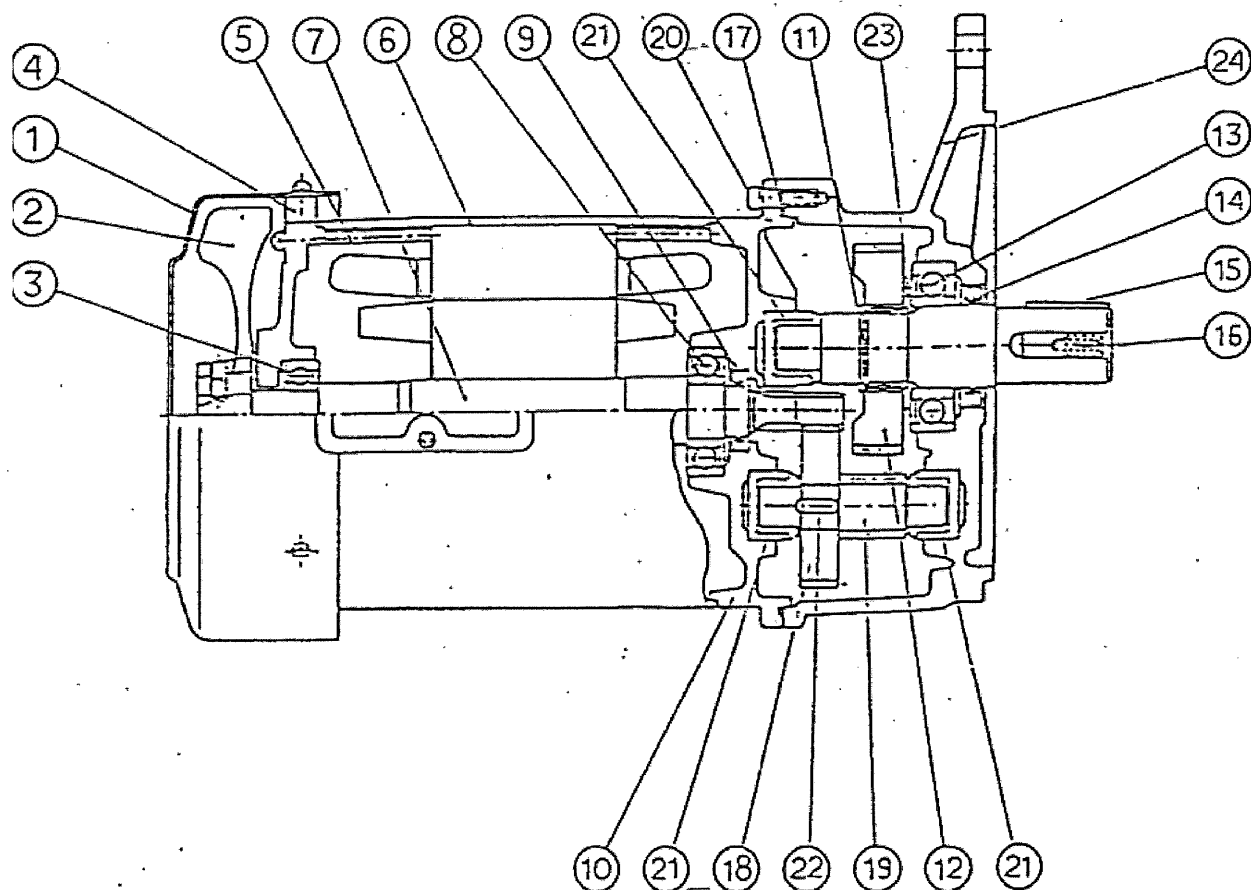


Fig.8

① FAN COVER

② FAN

③ BEARING

④ B SEALED

⑤ BOLTS

⑥ MOTOR FRAME

⑦ MOTOR SHAFT

⑧ BEARING

⑨ OIL SEAL

⑩ D SEALED

⑪ STOP RING

⑫ GEAR B

⑬ BEARING

⑭ OIL SEAL

⑮ PARALLEL KEY

⑯ OUT PUT SHAFT

⑰ O RING

⑱ GEAR B

⑲ UNION B

⑳ HEX SOCKET BOLT

㉑ UNIVERSAL BEARING

㉒ SGL RND KEY

㉓ OUT PUT SHAFT COLLAR

㉔ FRANGE

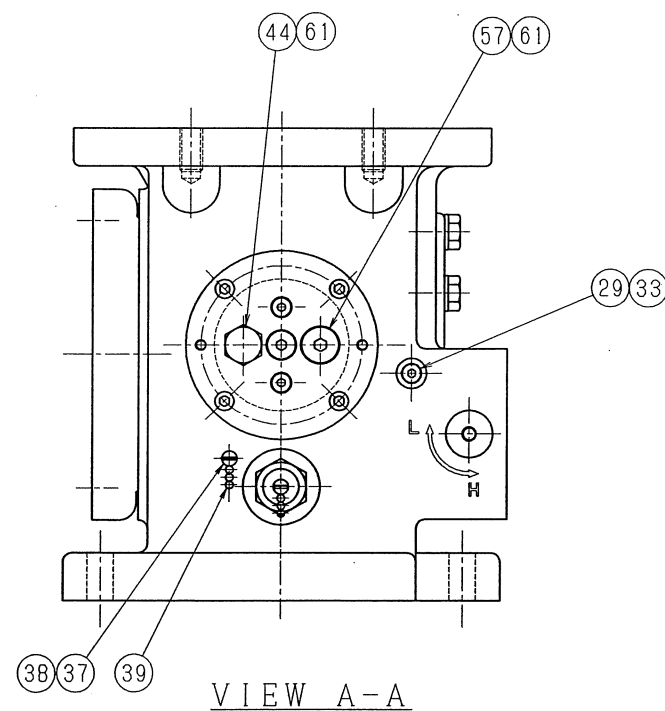
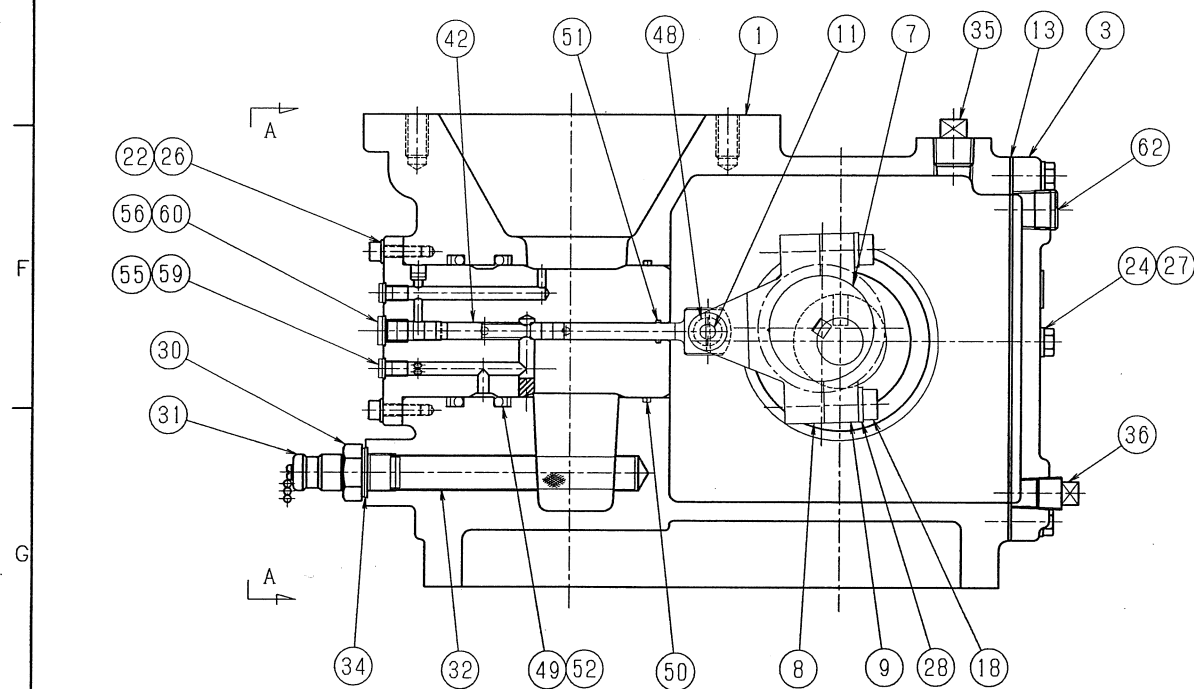
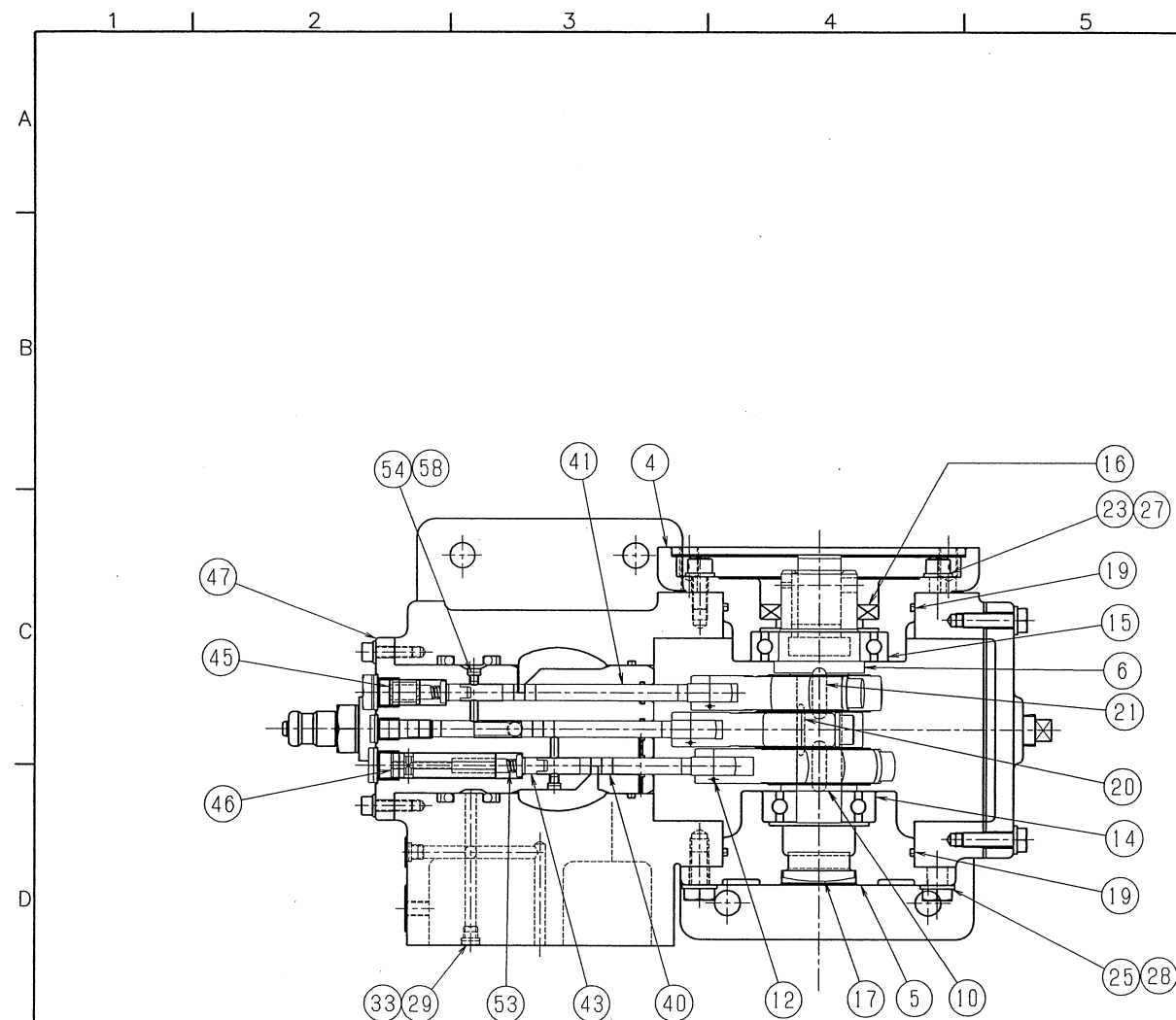
# 8. Operation Record of KWK DUAL LINE LUBRICATING SYSTEMS

Specifications		
Type of pump	Grease filling method : Concentrated filling, Exclusive pump, etc.	
Pump No.	Type of filling pump	
Motor voltage	Name of grease used	
Type of control panel	Type of measuring valve used	
Control system	Auto/Manual start	Number of measuring valve used
Details of test operation		
Lubricating pump		Control panel
Lubricating pump & Reduction gear box		Voltage, motor : _____V / control : _____V
oil volume : good / bad		Pilot lamp (power supply) : good / bad
Motor rotating direction : normal / reverse		Pilot lamp (operation) : good / bad
Lubricating pump operation noise		Pilot lamp (alarm) : good / bad
: normal / excessive		Auto start of pump : good / bad
Lubricating time (No.1 line)		Auto stop of pump : good / bad
: min. _____ sec.		Alarm (low level switch) : good / bad
Lubricating time (No.2 line)		Alarm (over time) : good / bad
: min. _____ sec.		Alarm (overload) : good / bad
Discharge pressure (No.1 line)		Timer setting (for start) : hrs.
: _____ MPa		Timer setting (for protection) : hrs.
Discharge pressure (No.2 line)		Measuring valve
: _____ MPa		All operations : good / bad
Changed over pressure (No.1 line)		
: _____ MPa		
Changed over pressure (No.2 line)		
: _____ MPa		
Others	Grease leakage from piping : yes / no	Damage of piping : yes / no
Special notes		





NO.	PARTS NO.	PARTICULARS	Q'TY	WEIGHT REMARKS	CODE
1	50C 9	RESERVOIR BODY	1	33.92	521
2	50C 30	RESERVOIR COVER	1	9.3	542
3	C3 10	OIL SEAL	1	0.012 AC1013AO(NOK)	806
4	30C 49	HEX.SOL.HD.PLUG	1	0.055 M26	299
5	C1 8	RD.HD.MACH:SCREW	2	0.001 M4×8L	676
6	50C 83	LEVEL ROD	1	0.847	595
7	50C 21	SWITCH CAM	1	0.58	533
8	C1 22	HEX.SOL.HD.SCREW	2	0.001 M5×5L	690
9	10C 10	ATR VENT SCREW	1	0.003	10
10	C3 43	STEEL BALL	1	----- 1/8(φ 3.175)	839
11	C4 9	SCREW	1	0.004 M10×10L	887
12	C1 54	HEX.NUT	2	0.029 M20	722
13	50C 58	FOLLOWER PLATE	2	4.26	570
14	C1 95	HEX.HD.BOLT	6	0.132 M8×35L	365
15	50C 55	FOLLOWER PACKING	1	1.17	567
16	C3 67	SPRING WASHER	6	0.011 M8	863
17	C1 47	HEX.NUT	6	0.032 M8	715
18	50C 42	TANK PACKING	1	0.032	554
19	C1 41	HEX.SOL.HD.BOLT	6	0.283 M12×40L	709
20	C3 41	SEEL WASHER	6	0.03 M12	837
21	C3 69	SPRING WASHER	3	0.016 M12	865
22	C1 52	HEX.NUT	3	0.052 M12	720
23	C4 76	LIMIT SWITCH	1	0.28 ZE-Q21-2(OMRON)	954
24	50C 51	PACKING PLATE	1	1.10	563
25	90C 6	NAME PLATE	1	-----	348

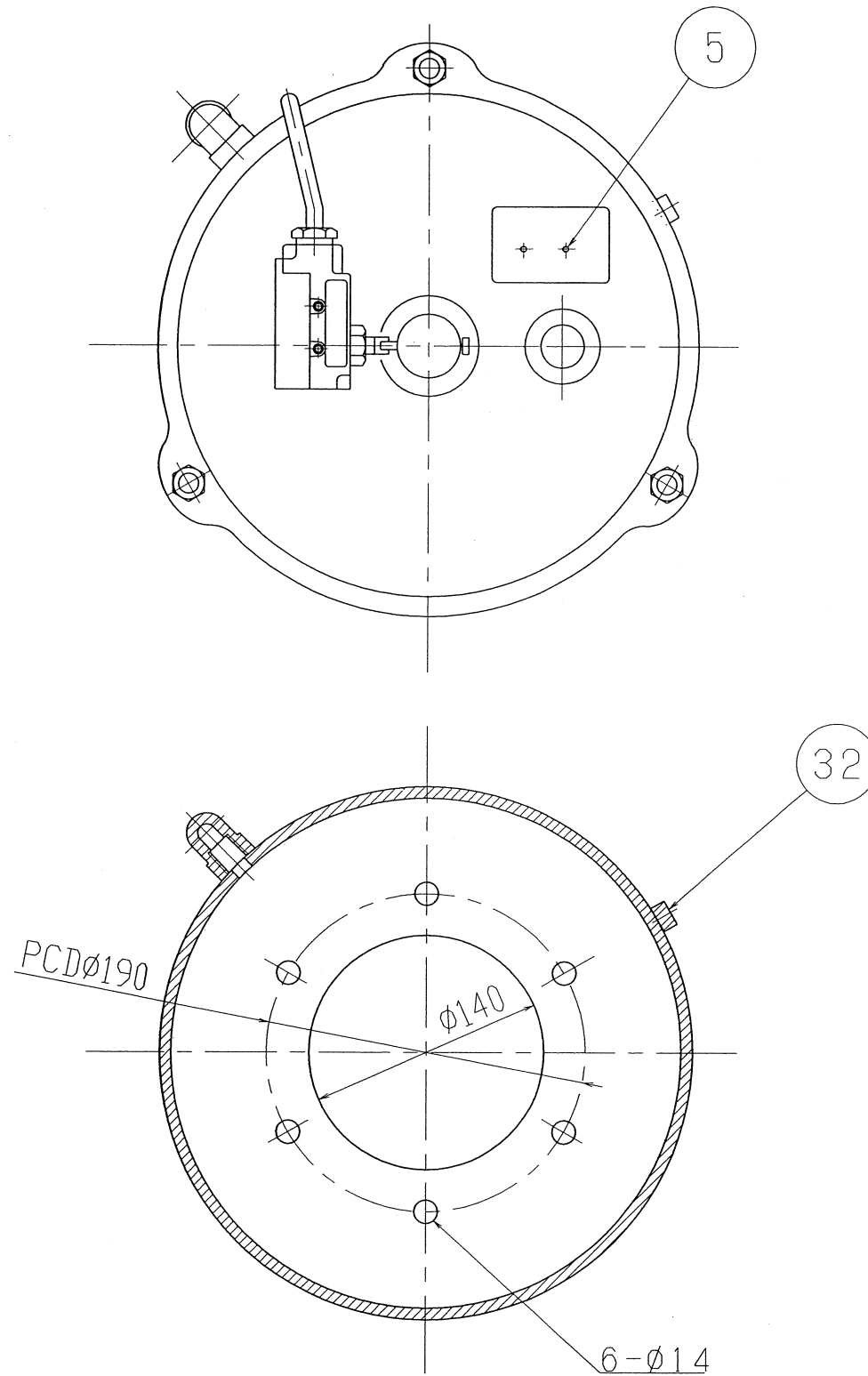
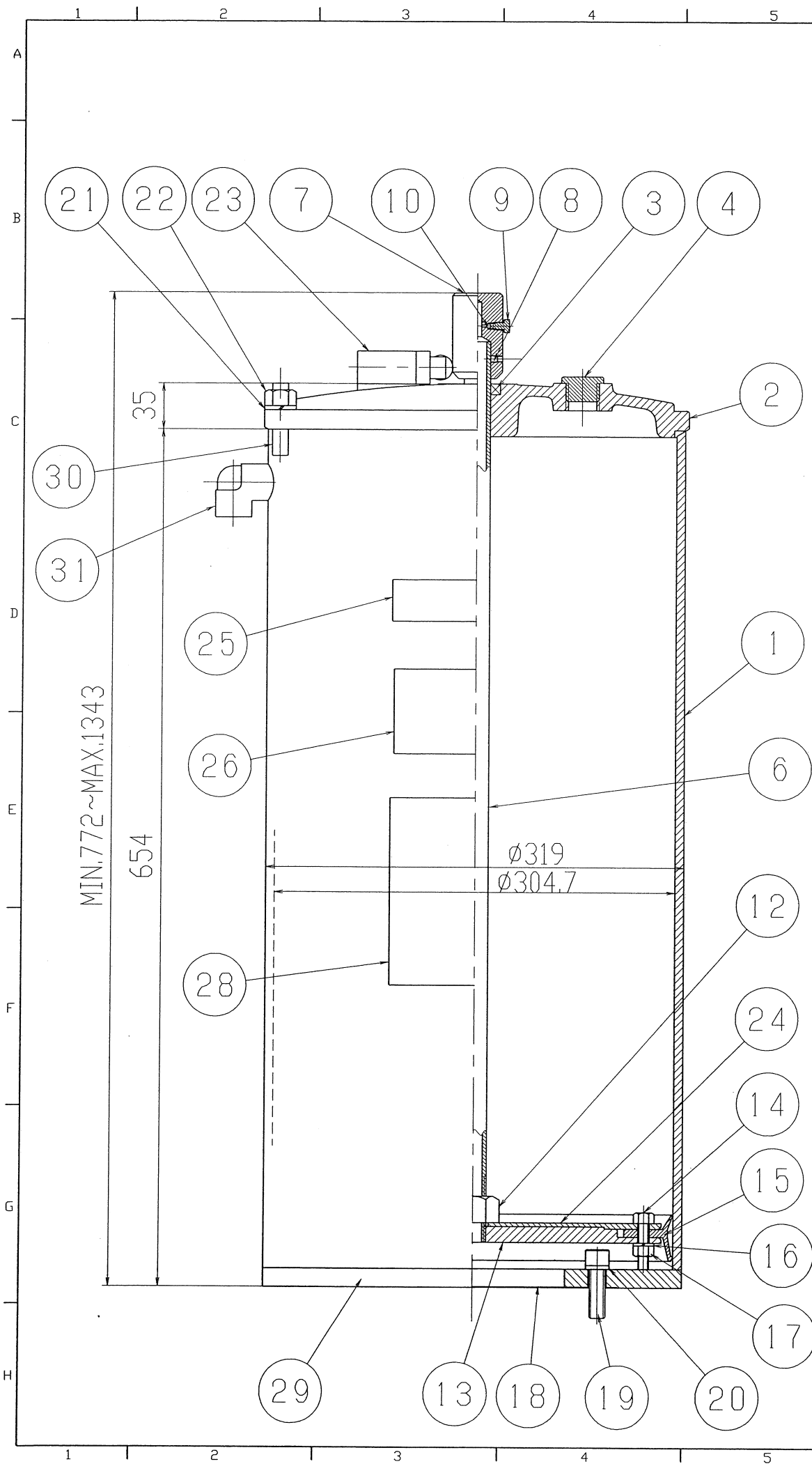
NO.	PARTS NO.	PARTICULARS	Q'TY	WEIGHT REMARKS	CODE
26	50C 75	NAME PLATE	1	0.011	587
27	C3 4	RIVET	4	----- #2-3mm	800
28	90C 6	NAME PLATE	1	-----	346
29	50C 36	FLANGE	1	6.154	348
30	50C 72	BOT	3	0.129	584
31	C3 36	SCR.ELBOW	1	0.15 PT3/8	832
32	50C 46	BRACKET	3	0.051	558



改定REV	改定内容 DESCRIPTION	日付DATA	担当 SIGN
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△			

62	HEX.SOCKET HEAD PLUG	1	HS-PG	R1/2	0.03
61	COPPER WASHER	2	X3011	M16	0.01
60	COPPER WASHER	1	X3008	M12	0.01
59	COPPER WASHER	2	X3005	M8	0.01
58	COPPER WASHER	5	X3003	M5	0.01
57	WASHER FACED PLUG	1	X2017	M16	0.02
56	WASHER FACED PLUG	1	X2007	M12	0.02
55	WASHER FACED PLUG	2	X2002	M8	0.02
54	WASHER FACED PLUG	5	X2001	M5	0.02
53	SPRING	2	A2017	KS-800376	0.04
52	BACK UP RING	2	BUR	P70 T2	0.01
51	O-RING	3	Z1005	1AP9	0.01
50	O-RING	1	Z1210	1AG70	0.01
49	O-RING	2	Z1123	1BP70	0.01
48	NEEDLE BEARING	3	Z3018	RNA0-8 × 15 × 10T2	0.05
47	CYLINDER	1	A6017	FP-1240	0.20
46	VALVE RETAINER(2)	1	A6015	FP-1238	0.05
45	VALVE RETAINER(1)	1	A6014	FP-1237	0.02
44	SPRING RETAINER	1	A6016	FP-1239	0.03
43	VALVE PISTON	2	A6013	FP-1236	0.01
42	VALVE PLUNGER	1	A6011	FP-1234	0.10
41	MAIN PLUNGER(2)	1	A6010	FP-1233	0.10
40	MAIN PLUNGER(1)	1	A6009	FP-1232	0.10
39	BALL CHAIN	1	Z2204	φ 4 × 200L	0.05
38	CONNECTER	2	-	φ 4	0.02
37	SLOTTED HEAD SCREW	2	PNS	M4 × 8L	0.02
36	SQUARE HEAD PLUG	1	Z5103	R3/8	0.02
35	AIR VENT VALVE	1	A3017	KS-800583	0.10
34	COPPER WASHER	1	X3013	M20	0.01
33	COPPER WASHER	3	X3005	M8	0.01
32	FILTER ELEMENT	1	A8005	KS-800383,SUS	0.10
31	GREASE FILLING PORT CAP	1	X1103	KS-800514	0.05
30	GREASE FILLING PORT NIPPLE	1	X1101	KS-800116	0.05
29	WASHER FACED PLUG	3	X2002	M8	0.01
28	SPRING WASHER	12	SW	M10	0.01
27	SPRING WASHER	14	SW	M8	0.01
26	SPRING WASHER	4	SW	M6	0.01
25	HEX. HEAD BOLT	6	HB	M10 × 20L	0.03
24	HEX. HEAD BOLT	6	HB	M8 × 30L	0.03
23	HEX. SOCKET HEAD BOLT	8	CB	M8 × 20L	0.03
22	HEX. SOCKET HEAD BOLT	4	CB	M6 × 20L	0.02
21	KEY (RND)	1	Z4409	8 × 7 × 24	0.05
20	KEY	2	Z4408	8 × 7 × 20	0.05
19	O-RING	2	Z1206	1AG100	0.05
18	STRIPPER BOLT	6	-	8 × 26	0.03
17	OIL GAUGE	1	A6022	VAB ( φ 34)	0.03
16	OIL SEAL	1	Z3109	AC2507A0 (NOK)	0.10
15	BEARING	1	Z3020	#6009	0.24
14	BEARING	1	Z3019	#6305	0.23
13	COVER PACKING	1	A6018	FP-1241,#6500	0.04
12	SPRING PIN	3	SPP		0.02
11	CONNECTING ROD PIN	3	A6012	FP-1235	0.05
10	SPACER	1	A6020	FP-1243	0.05
9	CONNECTING ROD COVER	3	A6008	FP-1231	0.15
8	CONNECTING ROD	3	A6007	FP-1230	0.25
7	CAM	3	A6006	FP-1229	0.20
6	CRANK SHAFT	1	A6005	FP-1228	0.65
5	BEARING COVER(FREE SIDE)	1	A6004	FP-1227	2.58
4	BEARING COVER(DRIVE SIDE)	1	A6003	FP-1226	4.19
3	BODY COVER	1	A5103	SM-KEP41-51-P-COVER	2.57
2	-	-	-	-	-
1	PUMP BODY	1	A6001	FP-1223,1224	19.00
No.	NAME	Q'ty	P.No.	NOTE	MASS

CUSTOMER			
SPECIFICATION			
APPROVED <i>Kato</i> <i>Jan 7 '09</i>	DRAWN BY KATSUTORI	KEP-41 PUMP ASSEMBLY	
CHECKED BY 吉	DESIGNED BY 2009.1.07		
09.1.07	KATOU		
崎	2009.1.07		
KOWA CORP. OSAKA JAPAN		DWG. No. ePUMP-KEP41-ASSY 	
		CFD.No. CODE No.	
 3RD ANGLE PROJECTION		SCALE	DATE OF ISSUE MFG. NO.



32	BLACKET	3	
31	HIGH PRESSURE ELBOW	1	Rc3/8
30	BOLT	3	
29	FLANGE	1	
28	NAME PLATE	1	
27			
26	NAME PLATE	1	
25	NAME PLATE	1	
24	HOLD PACKING PLATE	1	
23	LIMIT SWITCH	1	ZE-Q21-2 (OMRON)
22	HEX. NUT	3	M12
21	SPRING WASHER	3	M12
20	SEAL WASHER	6	M12
19	HEX. SOCKET BOLT	6	M12X40
18	TANK PACKING	1	
17	HEX. NUT	6	M8
16	SPRING WASHER	6	M8
15	FOLLWER PACKING	1	
14	HEX. BOLT	6	M8X35
13	FOLLWER PLATE	1	
12	HEX. NUT	2	M20
11			
10	STEEL BOLL	1	1/8B (3.175)
9	AIR VENT PLUG	1	
8	HEX. SOCKET SET SCREW	2	M5X5
7	SWITCH CAM	1	
6	LEVEL ROD	1	
5	CRROS RECESSED HEAD SCREW	1	M4X8
4	HEX. PLUG	1	M26
3	OIL SEAL	1	AC1013AO (NOK)
2	TANK COVER	1	
1	TANK BODY	1	
NO.	NAME	Q'ty	NOTE

CUSTOMER

SPECIFICATION

CHECKED BY	DRAWN BY
Shimono	KATSUTORI
2009.10.26	2009.10.26
SECCHIEF	DESIGNED BY
Miyazaki	SHIMONO
10.26.09	2009.10.26

40Lit. (S0)  
GREASE TANK ASSY

KOWA CORP.  
OSAKA JAPAN

DWG. No. eSA-TANK-40L-S0  
CFD No.  
COD No.

3RD ANGLE PROJECTION

SCALE 1/2

DATE OF ISSUE MFG. NO.

(A1)

協議印

出図先

購買

製造

客先

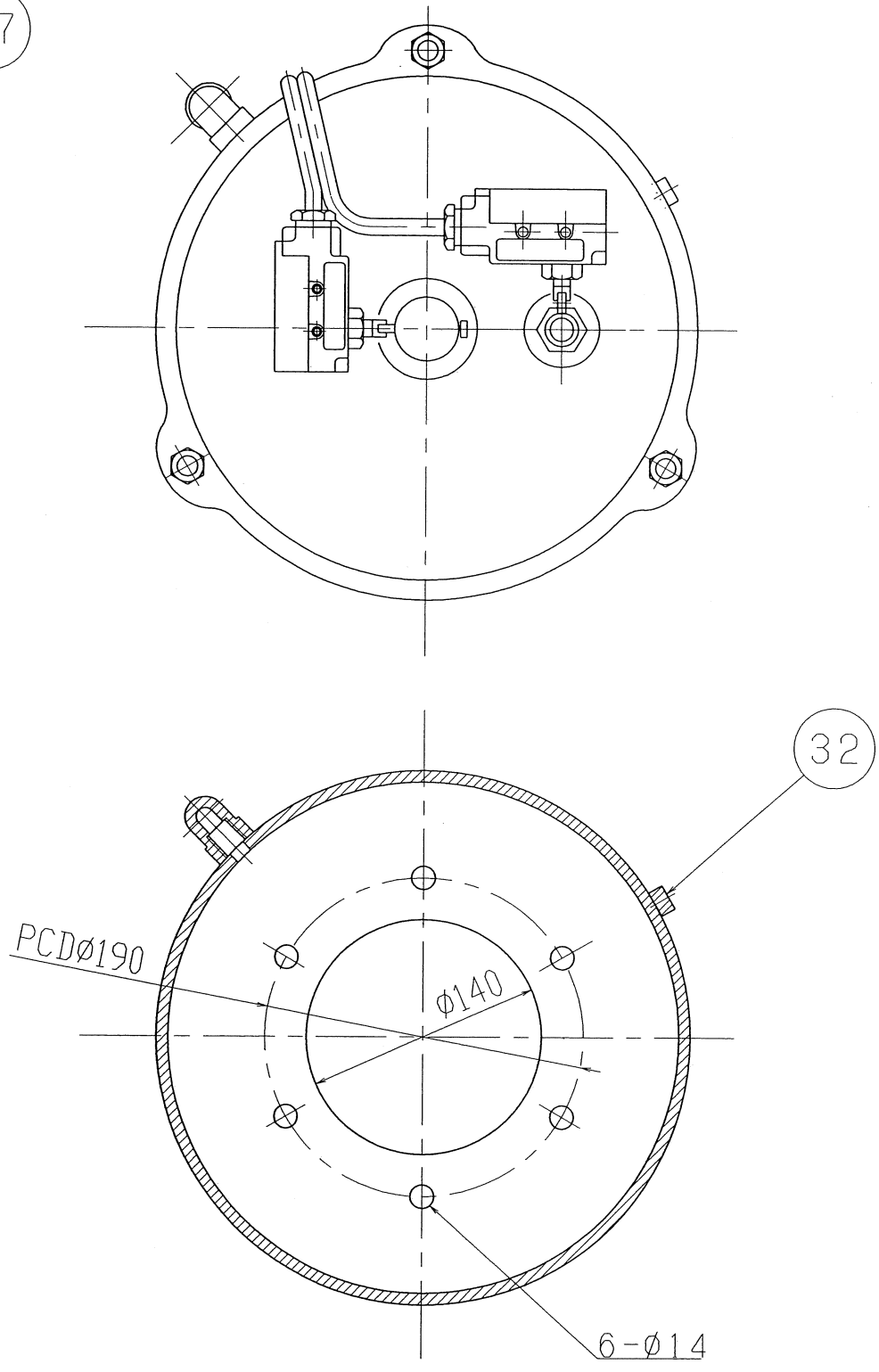
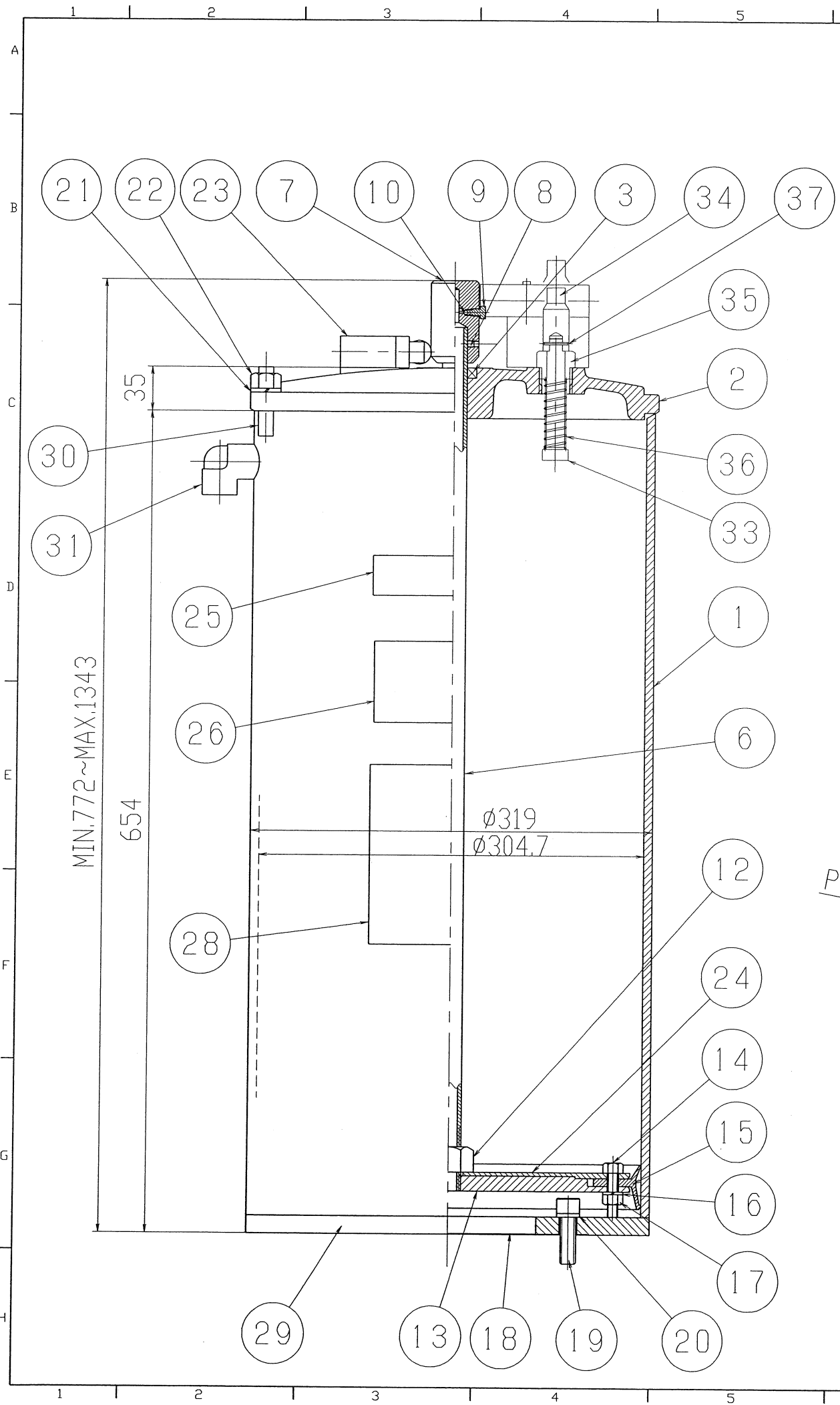
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A1

A3

出図日



NO.	NAME	Q'ty	NOTE
37	SPRING PIN	1	$\phi 2 \times 18$
36	COIL SPRING	1	
35	HIGH LEVEL ROD GUIDE	1	
34	HIGH LEVEL SWITCH CAM	1	
33	HIGH LEVEL ROD	1	
32	BLACKET	3	
31	HIGH PRESSURE ELBOW	1	Rc 3/8
30	BOLT	3	
29	FLANGE	1	
28	NAME PLATE	1	
27			
26	NAME PLATE	1	
25	NAME PLATE	1	
24	HOLD PACKING PLATE	1	
23	LIMIT SWITCH	2	ZE-Q21-2 (OMRON)
22	HEX. NUT	3	M12
21	SPRING WASHER	3	M12
20	SEAL WASHER	6	M12
19	HEX. SOCKET BOLT	6	M12X40
18	TANK PACKING	1	
17	HEX. NUT	6	M8
16	SPRING WASHER	6	M8
15	FOLLWER PACKING	1	
14	HEX. BOLT	6	M8X35
13	FOLLWER PLATE	1	
12	HEX. NUT	2	M20
11			
10	STEEL BOLL	1	1/8B ( $\phi 3.175$ )
9	AIR VENT PLUG	1	
8	HEX. SOCKET SET SCREW	2	M5X5
7	SWITCH CAM	1	
6	LEVEL ROD	1	
5			
4			
3	OIL SEAL	1	AC1013AO (NOK)
2	TANK COVER	1	
1	TANK BODY	1	

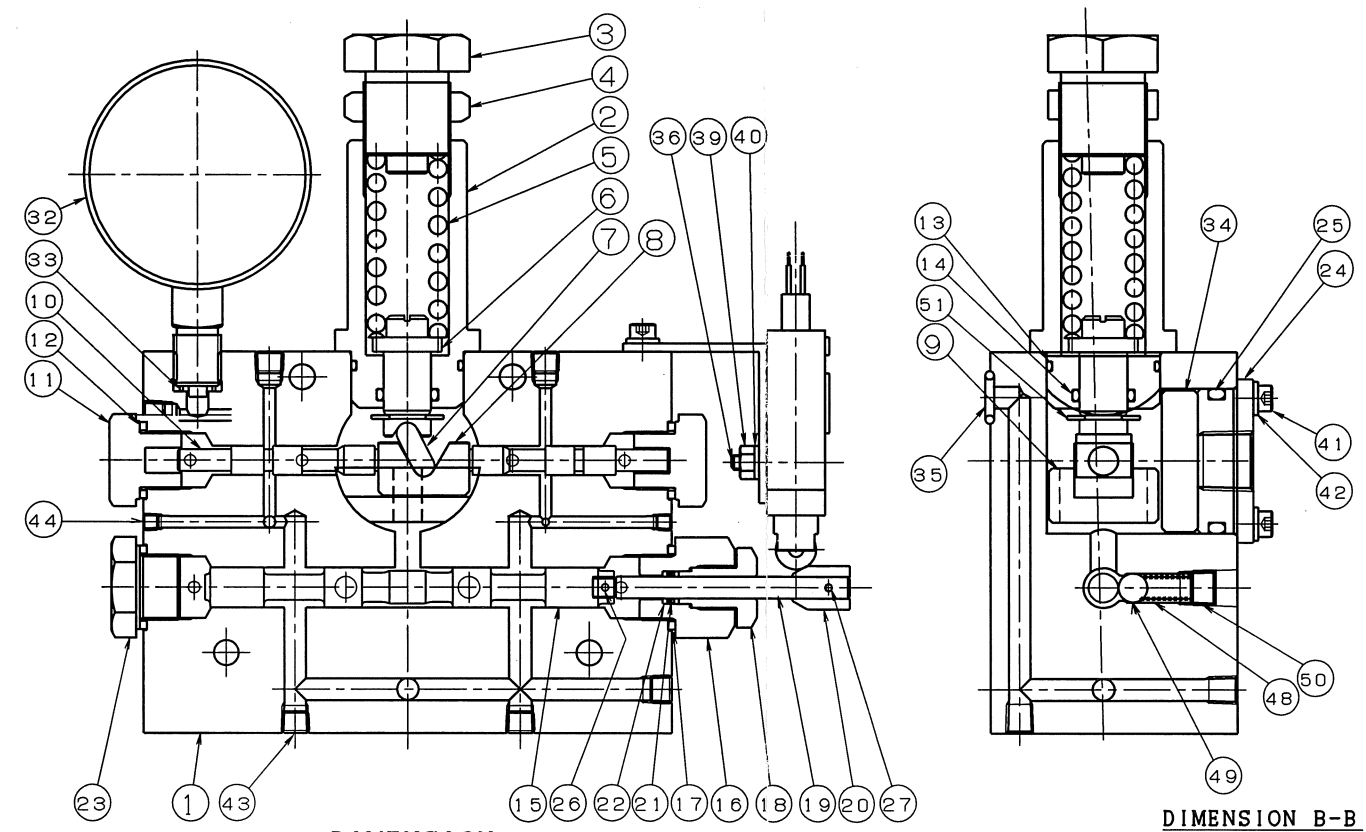
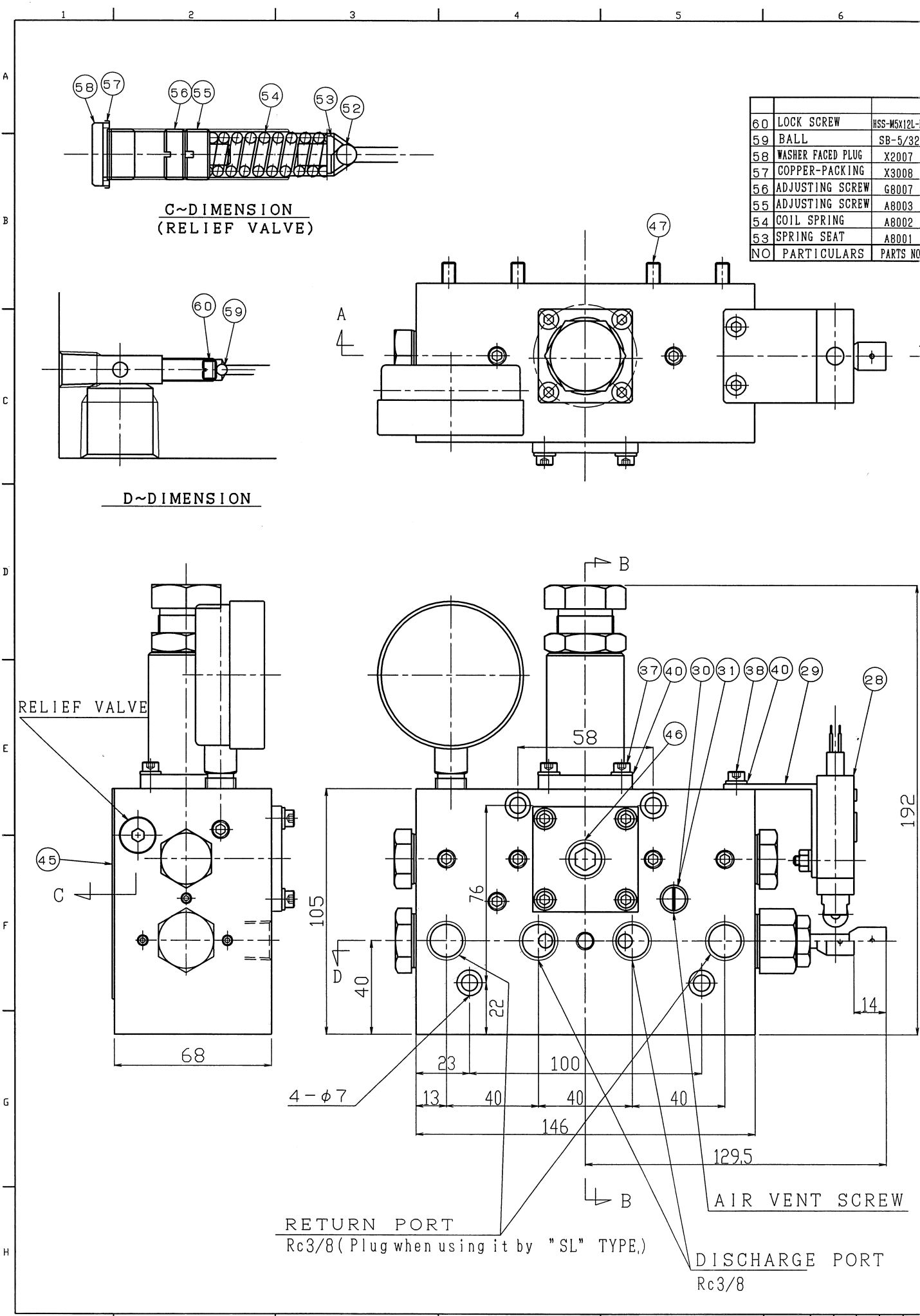
CUSTOMER			
SPECIFICATION			
CHECKED BY Shimono 2009.10.26	DRAWN BY KATSUTORI 2009.10.26	40Lit. (S1) GREASE TANK ASSY	
SEC. CHIEF Mizuno 10.26.09	DESIGNED BY SHIMONO 2009.10.26		
KOWA CORP. OSAKA JAPAN		DWG. No. eSA-TANK-40L-S1	購買 製造 客先 控 接写部数 A1 A3 出図日
3RD ANGLE PROJECTION		SCALE 1/2	
		DATE OF ISSUE MFG. NO.	



REV					改定内容		DESCRIPTION		DATE		REVISION	
△	△	△	△									
△	△	△	△									
△	△	△	△									

60	LOCK SCREW	HSS-M5X12L-F	1	-	M5X12L(TYPE:L ONLY)	52	BALL	SB-3/16	1	-	4.7625φ	26	PARALLEL PIN	PP	1	-	φ2X10L	
59	BALL	SB-5/32	1	-	φ3.9688(TYPE:L ONLY)	51	E-RING	ER	1	-	E10	25	O-RING	OR	1	-	1AP34	
58	WASHER FACED PLUG	X2007	1	-	M12X10L	50	PLUG	HS-PG	1	0.01	Rc1/8	24	COVER PLATE	-	1	0.14	K-804273	
57	COPPER-PACKING	X3008	1	-	φ15Xφ12.5X1.5t	49	BALL	SB	1	-	5/16(φ7.9375)	23	SCREW HEX PLUG	A9007	1	0.05	KS-800263	
56	ADJUSTING SCREW	G8007	1	-	M12	48	SPRING	-	1	-	KS-802012	22	BACK-UP RING	BUR	2	-	P-6	
55	ADJUSTING SCREW	A8003	1	-	-	47	HEX SOCKET BOLT	-	4	-	M6X6.5L	21	O-RING	SKSEAL	1	-	P-6	
54	COIL SPRING	A8002	1	-	-	46	HEX SOCKET PLUG	-	1	-	R3/8	20	SWITCH CAM	A9006	1	0.02	KS-800252	
53	SPRING SEAT	A8001	1	-	-	45	BODY PACKING	A9021	1	-	KS-800270	19	SWITCH CAM LOD	A9003	1	0.02	KS-800251	
NO				PARTICULARS	PARTS NO	Q' TY	MASS(kg)	REMARKS		NO				PARTICULARS	PARTS NO	Q' TY	MASS(kg)	REMARKS
														</				

7.57kg



CUSTOMER		SPECIFICATION	
CHECKED BY	DRAWN BY	KRV-22L(SL) ASS'Y	
Kato	SHIMONO	REVERSING VALVE	
SEC. CHIEF	DESIGNED BY	DWG. No. KS-805000	
Miyazaki	Y. MORIHASHI	DATE OF ISSUE 11 (A1)	
2001.6.28	2001.6.28	SCALE 1/1	
KOWA CORP.		DATE OF ISSUE 11 (A1)	
OSAKA JAPAN		SCALE 1/1	
3RD ANGLE PROJECTION		DATE OF ISSUE 11 (A1)	