

DUAL LINE LUBRICATING SYSTEMS  
MOTOR DRIVEN LUBRICATING PUMP  
MODEL : KSPN1000  
(Short Loop Type)

INSTRUCTION MANUAL

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 KSPN1000 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 (Short loop type)

### (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 vertically movable 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 lubricating mains of parallel piping from the two outlets on the hydraulic-operated reversing valve of the lubricating pump and the branch piping from the main piping to the measuring valve and lube piping from the measuring valve to the lubricating points.

The optimum type of measuring valve is selected according to the number of lubricating port.

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

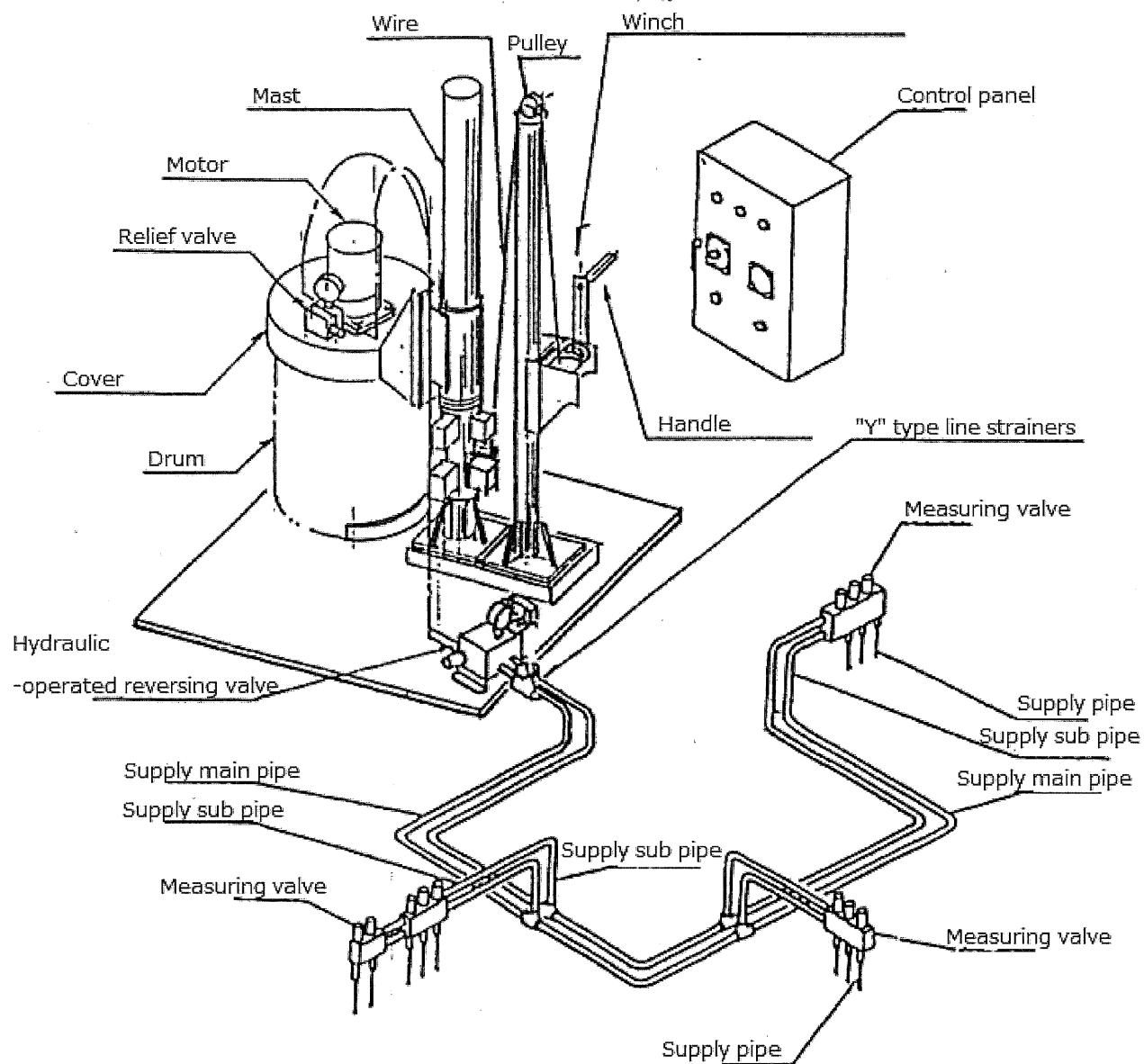


Fig.1 Schematic diagram of lubricating circuit

(2) Outline of lubricating circuit

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

Fig.2 (A) indicates that the discharged grease from 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.1 line and No.1 lines open to the reservoir.

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.

When the measuring valve at the end of No.1 line completes its lubricating operation, the internal pressure of No.1 line goes up to change the hydraulic-operated reversing valve by the grease pressure transferred through the changed over line in the hydraulic-operated reversing valve to the condition of Fig.2 (B). Simultaneously with the above, a limit switch attached to the 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 from 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.

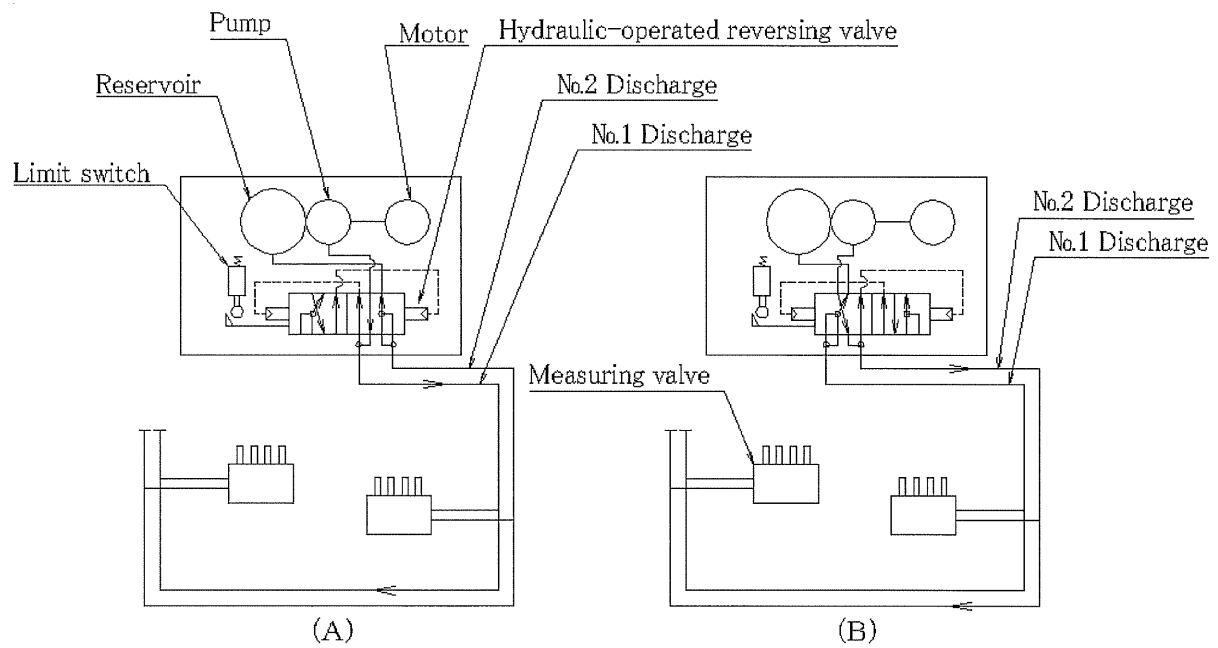


Fig.2 Lubricating circuit

## 2. Features of KSPN1000 type motor-driven lubricating pump

The drum can (200L) is set to this motor-driven lubricating pump to feed the grease.

This type of pump has been conventionally limited to the low pressure in specification and for filling in applications.

However, this pump has made it possible to discharge under a high pressure and is provided with the following features:

- (1) Because this type is a drum direct connection-type high pressure pump, you can omit trouble to leave grease unredeemed from a drum, and to move to the tank of the expression electric grease pump.
- (2) Double plunger method (no-check valve consisting of plunger for discharge and plunger for opening & closing) has been adopted.  
  
Consequently, the effect of dust is lessened and is forcibly discharged in case of air entrapment.  
  
(In the check valve, the function of pump is lost when dust adheres to the check valve.)
- (3) Because the lifting and lowering device attached, the drum exchange work is easy. Because the drum cover is rotated at the position that rises in the pump, work that hangs the drum with the crane and sets it up is easy.
- (4) Lifting up and down the pump stops at the position in which the steering wheel rotation was stopped because the brake function attached to the lifting and lowering device.
- (5) Suction efficiency has been improved by means of stirring blade, and grease level has been reduced evenly. In case of loading and unloading which are defective in a follower plate, its troublesome working has been released.

### 3. Specifications of equipment

#### (1) Specifications of lubricating pump

Pump Type	1001		1002		
Discharge Capacity(cm³/min) 50/60Hz	29/36		59/71		
Motor(kW)	0.4		0.4		
Mass(Lift Type)	200kg(without drum)				
Mass(Hanging Type)	65kg(without drum)				
Pump Type	1003	1004	1005	1006	1007
Discharge Capacity(cm³/min) 50/60Hz	97/117	135/162	195/235	225/275	270/325
Motor(kW)	0.55	0.75	0.55	0.75	0.75
Mass(Lift Type)	250kg(without drum)				
Mass(Hanging Type)	70kg(without drum)				
Pump Type	1008	1009	1010	1011	
Discharge Capacity(cm³/min) 50/60Hz	335/405	380/460	425/510	495/595	
Motor(kW)	1.1	1.1	1.1	1.1	
Mass(Lift Type)	250kg(without drum)				
Mass(Hanging Type)	70kg(without drum)				
Electrical Power	2:AC200V 50Hz/AC220V 60Hz 3 ϕ				
	4:AC400V 50Hz/AC440V 60Hz 3 ϕ				
Discharge Pressure	Max. 20.6MPa				
Pump Method	Double plunger method				
Grease Used	200Lit. Drum Less than NLGI #1				
Low Level Switch	AC250V 15A				

① For the outside dimensions and the internal structure, please refer to the drawings of the principal equipment at the end of this manual.

② Check the column with asterisk mark (\*) referring to the final specifications.

(2) Specifications of measuring valve

Measuring valve size	Model	Discharge ports	Discharge capacity cm <sup>3</sup> /stroke		Adjustable amount cm <sup>3</sup> /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

#### 4. Installation of equipment and piping procedure

##### (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) 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) Installation of pressure gauge.

Near the ends of No.1 and No.2 line piping of the main supply piping, attach a pressure gauge as shown in Fig.3 to check the switching pressure.

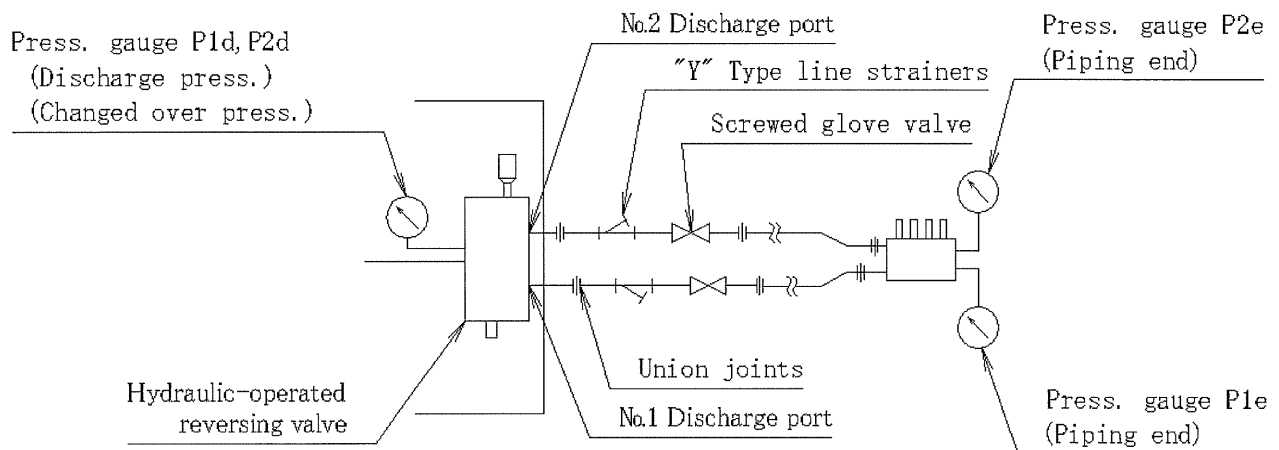


Fig.3

(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 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.)

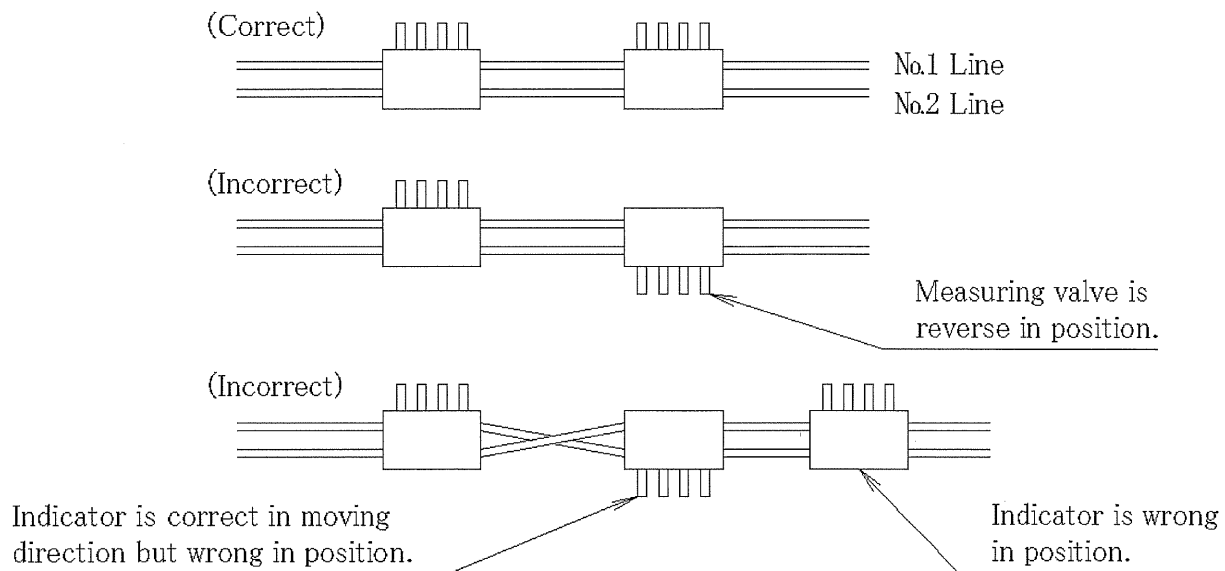


Fig.4 Connection of measuring valve

#### (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.



## 5. Construction and function of lubricating pump

### (1) Pump Body

This motor-driven grease pump is constructed as given below: Turning force is converted into reciprocating motion by means of the rotating shaft of pump being directly connected with reduction gear and the cam being fixed to the rotating shaft, and the suction and discharge of grease is accomplished by the use of plunger which reciprocates in pump cylinder and stirring blade being fixed to the rotating shaft.

This pump is not provided with check valve, and it is double plunger type of pump which is sucked and/or discharged by main plunger (for discharge) and valve plunger (for opening and closing).

### (2) Operation of pump

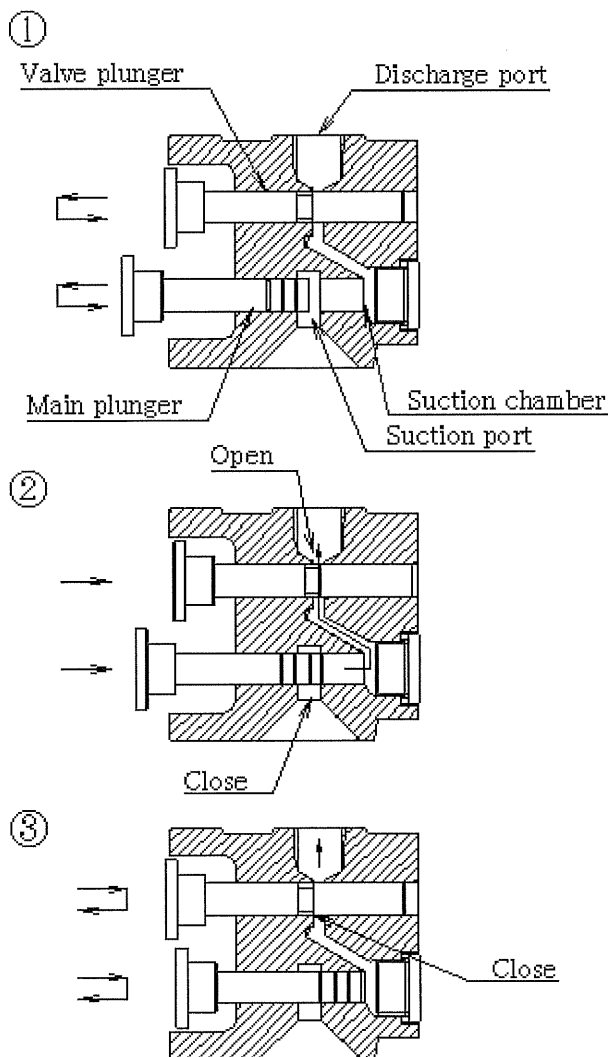


Fig.2

① Main plunger retracts, suction port is opened, and grease enters the suction chamber.

Then, the discharge port is closed by the valve plunger.

② Main plunger advances, simultaneously the valve plunger advances, the port opens, and grease is pushed out of the discharge chamber to the discharge port.

③ Valve plunger retreats, discharge port and main plunger's port are closed.

Simultaneously main plunger begins to retract suction chamber provides negative pressure to prepare suction.

### (3) Relief valve

#### 1) Relief valve

Relief valve is installed to the pump body.

This relief valve is provided for emergency pressure release when the pipe clogged for some reason. If such should happen, the pressurized grease, released from the pipe, is admitted into the drum to protect the lubricating system from being damaged.

The set pressure of relief valve provides  $21\text{MPa}\pm 0.5\text{MPa}$ .

Type of grease pump	Max. discharge pressure	Set pressure of relief valve
KSPN1000	20.6MPa	$21\text{MPa}\pm 0.5\text{MPa}$

#### 2) If the pump reverses

At a test run or when the electric wiring is changed, the pump (motor) sometimes reverses. If the pump reverses, grease is not discharged, but released into the drum through the function of relief valve.

When the pump reverses, unlike the condition of forward turn of the double plunger timing, the reverse safety valve causes abnormal high pressure in the cylinder, resulting in broken plunger. Therefore, to prevent the breakage, the abnormal high pressure is released to protect the pump.

The reverse of motor adversely affects the pump, and finds it as soon as possible, and care should be exercised to avoid the reverse for a long time.

The correct direction of rotation of pump is shown on arrow name-plate.

#### 3) Low Level Switch

The low level switch is provided so that pump operation stops and the alarm is given when grease is consumed to a definite limit. The switch turns ON at a low level.

Rating	AC Max.250V,Current 15A
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#### 4) Pressure Switch

Pressure switch is attached to the front side of the pump. Its purpose is to sense thereby when the system pressure of line increases abnormally owing to the clogging or the measuring valve's choking in the single line lubricating system.

The pressure switch is capable of performing the adjustment of  $3\sim 25\text{MPa}$  and it is set up in  $18\text{MPa}$  at the time of shipment.

## 6. Cautionary instructions of maintenance and handling

### (1) Replacement of Grease

Please lift and desorb with a crane etc. after checking that the rings attached to a pump do not loosen, but are being fixed, when exchanging drums.

Please do not put a power supply into a pump by any means during drum clearing work.

Moreover, be careful for agitator not to touch a drum in the case of desorption. If it touches, it will become a cause of failure of a pump.

After a drum is equipped with a pump, please be sure to fix the set bolt for drum fixation in total.

### (2) About mixing of garbage

When grease is mixed with other brand, grease may be deteriorated. It is recommended to obtain the adequate instructions from a grease manufacturer when using a different brand of grease.

## 7. Test operation

### (1) Confirmation Before Operation

1) Prior to test operation, check that no problem exists in installation, piping, and wiring :

- (a) Are unions and flanges of main supply pipe and branch pipe connected surely ?
- (b) Are sub-supply pipes connected to all bearings to be lubricated ?
- (c) Are the electric wiring works completed on the primary and secondary sides ?
- (d) Has been grease filling and flushing the pipe completed ?

### 2) Direction of Pump's Rotation

- (a) Turn the power supply switch and control supply switch to ON. Depress the push-button switch for manual starting, and confirm the direction of lubricating pump's rotation. As to the direction of rotation, follow the arrow mark on the coupling cover.

The correct rotation is anti-clockwise from the motor fan side.

- (b) In case of a reverse rotation, no grease will be discharged. If the pump is rotated reversely, stop it immediately avoid the operation for a long time.
- (c) When the reverse rotation is corrected to the forward rotation, the motor should be rewired by interchanging 2 lines of 3 power lines.

### (2) Selection of Grease

There are many kinds of grease in different quality and characteristics.

Select suitable grease to the operating conditions from the recommended kinds of grease as given below.

Generally, any grease is applicable with the range of NLGI Standard No.00~No.1

(fluidity : 430~310).

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.

(3) Flushing

Foreign matter such as spatter & dust in the piping cause the malfunction in the measuring valve as well as the failure of bearing. Hence perform fully cleaning in the piping.

8. 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 9)

9. 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.

10. 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 ( $P_n$ ) becomes as follows.

$$P_{1n} = P_{1s} + 1$$

$$P_{2n} = P_{2s} + 1$$

- (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.

11. 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.

## 12. 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.



### 13. Maintenance and inspection

#### (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.

#### (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.

#### (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

#### (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

#### 14. 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.

- Preparation

- (1) Prepare surely the treated oil, waste cloth besides tools.
- (2) Please remove the pump unit from the elevator before remove the cylinder.
- (3) Bring the pressure control valve at a clear place where the bench lies with the valve assembled, and make the disassembly and reassembly.

## 15. 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.
		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.
(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. 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	a. Wear.	a. Replace the reduction gear and the lubricating pump proper.

	not normal.	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.	

## 16. 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 oil volume : good / bad			Voltage, motor : _____V／control : _____V		
			Pilot lamp (power supply) :               good / bad		
Motor rotating direction : normal / reverse			Pilot lamp (operation) :               good / bad		
Lubricating pump operation noise  : normal / excessive			Pilot lamp (alarm) :               good / bad		
			Auto start of pump :               good / bad		
Lubricating time (No.1 line)  : min._____sec.			Auto stop of pump :               good / bad		
			Alarm (low level switch) :               good / bad		
Lubricating time (No.2 line)  : min._____sec.			Alarm (over time) :               good / bad		
			Alarm (overload) :               good / bad		
Discharge pressure (No.1 line)  : _____MPa			Timer setting (for start) :               hrs.		
			Timer setting (for protection) :               hrs.		
Discharge pressure (No.2 line)  : _____MPa			Measuring valve		
			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					