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OPERATION & MAINTENANCE MANUAL
FOR
PV2R SERIES SINGLE PUMPS

MODEL: PV2R1
PV2R2
PV2R3
PV2R4

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*Attach the corresponding
EI-sheet and structural diagram.

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PREFACE

This operation and maintenance manual is designed mainly for operation and maintenance in the field. Refer to the External Drawing for mounting dimensions, performance and precautions on operation and the Structural Diagram for the construction.

To keep the PV2R Series Single Pumps operating well for a long time, be sure to follow the items described in this manual.

1. OPERATING PROCEDURE

1.1 Installation and piping

Besides the items on the attached External Diagram, follow the ones below:

- 1) To avoid bad influence of distortion by piping to the pump pipe smoothly.
- 2) Do not apply unreasonable force or impact on the shaft.

1.2 Operation

When operating initially or after a long pause, it may be difficult to suck oil. Pour clean operation oil from the pump suction port before operation and also it is recommended to discharge air by loosening the connection on the delivery side a little if an air discharging valve is not provided on the delivery side.

The procedure on operation is as follows:

- 1) Adjust control valves, etc. so that the pump delivery oil may directly return to the tank as much as possible or the actuator may move without any load.

(Note): Do not start with the delivery side blocked.

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- 2) Turn ON and OFF the input switch of the motor and check the following two points.
 - Check if the rotating direction of the pump and that indicated by the arrow on the name plate match.
 - Check if the pump sucks the oil normally.
- 3) When no abnormality is observed in the above 2), operate the pump continuously and discharge air in the system.
- 4) The set pressure in the circuit shall be less than the maximum operating pressure. If used with the pressure exceeding the maximum operating one, wear on a camring or vane may become excessive or other parts may be damaged, so be careful of the pressure.

1.3 Hydraulic Fluids

Selection, maintenance and management of oil used affect greatly to the longevity of the pump. Therefore, follow the items on the External Drawing.

2. MAINTENANCE AND INSPECTION

Inspect the following items daily besides precautions common to the entire hydraulic system such as management of operation oil or inspection of filters.

- 1) Malfunction of the unit which can be regarded as lack of delivery.
- 2) Unstabilized pressure of the unit, such as abnormal pressure vibration or pressure drop.
- 3) Abnormal noise.
- 4) Abnormal generation of heat.
- 5) Oil leakage to outside.

If any of the above abnormality is observed, take measures by referring to "5. TROUBLESHOOTING".

3. DISASSEMBLY

When replacing the cartridge kit, the shaft assembly or the seals, disassemble in the following manner.

Fully take care of handling of the hydraulic pump because many precision parts for structure are used in it and mixing of foreign matter may easily affect it. Therefore, let a person who is well familiar to the handling of hydraulic pumps disassemble or reassemble (as in 4.).

Moreover, since the cartridge kit is a heart of the pump, be extremely careful of handling it and never disassemble the kit.


3.1. Preparation before disassembly

Prepare the following items.

- 1) Clean washing oil (kerosine oil or light oil)...for washing parts.
- 2) Lithium grease (cup grease is not good)...for applying to the oil seal, O-ring and backup ring.
- 3) Clean operation oil of the same kind used in the unit...for lubricating parts.
- 4) Tools shown in the following table.

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Table of Tools Required to Disassemble and Reassemble

| Pump model Tool name | Tool size | | | | Remarks |
|--|--|-------|-------|-------|---|
| | PV2R1 | PV2R2 | PV2R3 | PV2R4 | |
| Hexagonal bar wrench Double flat milling mm | 8 | 10 | 17 | 17 | For cover mounting bolt (17) |
| | 8 | 8 | 10 | 14 | For suction flange mounting bolt |
| | 6 | 8 | 8 | 10 | For delivery flange mounting bolt |
| | - | - | - | 5 | For reducer valve cover mounting bolt (25) |
| | 8 | 10 | 14 | - | For mounting bracket mounting bolt (31) |
| | - | - | - | 17 | |
| Snap ring remover (Stop ring pliers) | For C stop ring (for hole)  | | | | For snap ring (10) |
| Wooden hammer or plastic hammer | (of appropriate size) | | | | For removing shaft (4) |

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3.2 Precautions on disassembling work

Disassemble sequentially by referring to the Structural Diagram. (The disassembling procedure is shown in the item 3-3.) At that time, be careful of the following items.

1) General precautions

- a. Never scratch the parts.
- b. Do not pollute the parts. (Put the parts on a clean surface.)
- c. Cover the opening of the removed piping, etc. and prevent any foreign material from getting in.
- d. To facilitate reassembling correctly later on, arrange the parts neatly.

2) Cartridge kit

Be particularly careful when handling the cartridge since it is a heart of the pump.

3) Shaft

To protect the oil seal, remove the key first and then take out the shaft together with the bearing.

4) Parts pressured in

Do not pull out the parts pressured in (bearings, oil seals) except for replacement purpose. Oil seals, especially, cannot be reused if removed.

3.3 Disassembling procedure

Disassemble in the following procedure by referring to Fig. 1.

O-rings or backup rings may come out together when taking out each part, so handle carefully so as not to scratch.

- 1) Pull out the cover mounting bolts ①⑦ (4 pcs.) and remove the cover ②. At that time, pull them out straight since the cover ② and the cartridge kit may get entangled to make them difficult to pull out. ③
- 2) Take out the cartridge kit ③ from the body ①. At this time, pull it out by turning little by little since the O-ring around the kit may block from pulling out.
- 3) Remove the key ⑦.
- 4) Take out the snap ring ⑩.
- 5) Pull out the shaft ④ by tapping the end of it with a wooden hammer or a plastic hammer lightly. At that time, be careful not to scratch the lip of the oil seal ⑧ with the key groove.

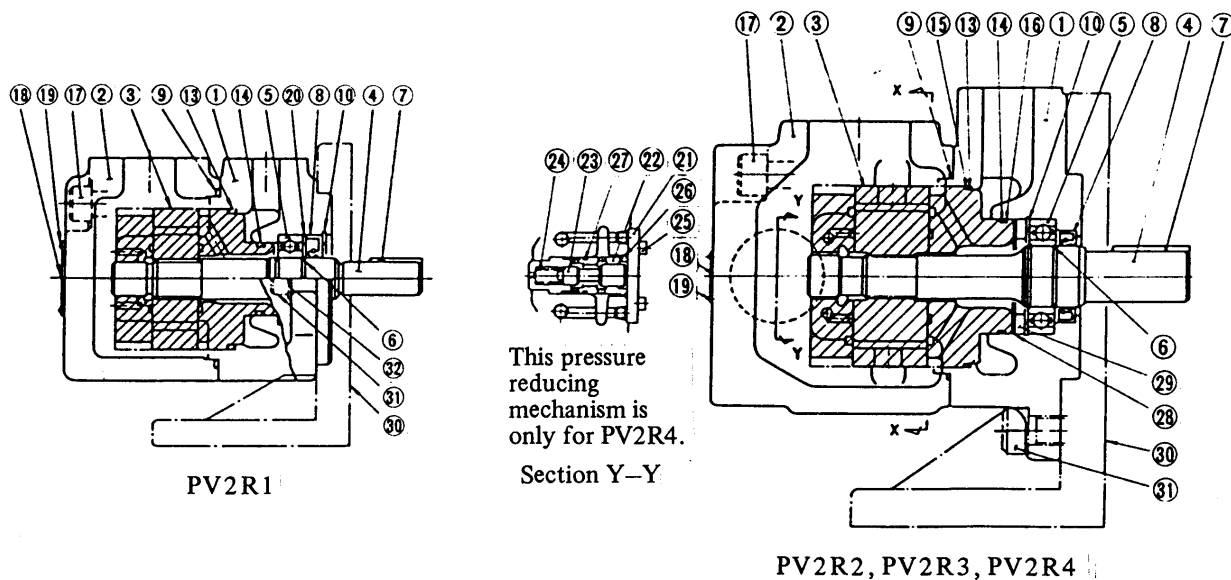
In case of PV2R1, the oil seal is pulled out together with

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the shaft, so prepare a new oil seal when reassembling.

- 6) A pressure reducing mechanism is incorporated in the cover of PV2R4. To disassemble this part, pull out the bolts (25) (4 pcs.) and remove the cover (21). Then take out the spool (23) and the spring (24) and finally pull out the sleeve (22).

Fig. 1 Internal Structural Diagram



| Key No. | Part Name | Q'ty | Remarks | Key No. | Part Name | Q'ty | Remarks | Key No. | Part Name | Q'ty | Remarks |
|---------|---------------|------|-----------------------------|---------|----------------------------|-----------------|---|---------|---|------|---------------------------------|
| 1 | Body | 1 | | 11 | - | - | | 21 | Cover | 1 | Only for PV2R4 |
| 2 | Cover | 1 | | 12 | - | - | | 22 | Sleeve | 1 | |
| 3 | Cartridge kit | 1 | Replace as a shaft assembly | 13 | O-ring | 1 | Included in the cartridge kit (key No. ③) | 23 | Spool | 1 | |
| 4 | Shaft | 1 | | 14 | O-ring | 1 | | 24 | Spring | 1 | |
| 5 | Bearing | 1 | | 15 | Backup ring | 1★ ¹ | | 25 | Hexagonal socket head bolt | 4 | |
| 6 | Snap ring | 2 | | 16 | Backup ring | 1★ ¹ | | 26 | O-ring | 1 | |
| 7 | Key | 1 | | 17 | Hexagonal socket head bolt | 4 | | 27 | O-ring | 1 | |
| 8 | Oil seal | 1 | | 18 | Name plate | 1 | | 28 | Wave washer | 1 | |
| 9 | O-ring | 1 | | 19 | Rivet | 4 | | 29 | Spacer | 1 | |
| 10 | Snap ring | 2 | | 20 | Backup ring | 1 | Only for PV2R1 | 30 | Mounting bracket | 1 | |
| | | | | | | | | | Hexagonal socket head bolt ★ ² | 2 | Only for models of hood mounted |
| | | | | | | | | | Hexagonal socket head bolt ★ ³ | 4 | |
| | | | | | | | | | Plain washer | 2 | Only for PV2R1 |

★¹ : Not used for PV2R1.

★² : Used for PV2R1, PV2R2 and PV2R3.

★³ : Used for PV2R4

Note: This diagram indicates the internal structure. When ordering the part No. and quantity by referring the attached Structural Diagram.

4. REASSEMBLY

Reassembly in the reverse order of disassembly by referring to the Structural Diagram. In this case, be careful of the following items.

1) General precautions

- a. Never scratch any parts.
- b. Completely wash each part with washing oil and after washing dip internal parts in clean operation oil.
- c. Reassemble in clean and dustless atmosphere and be careful of getting foreign material in.

2) Oil seal

Before inserting the shaft, apply previously prepared lithium grease to the gap between two lips on the inner circumference of the oil seal.

3) Cartridge kit

- a. When inserting a cartridge kit, apply lithium grease to the O-ring and the backup ring in advance to prevent them from damaging.
- b. Confirm that the pin of the cartridge kit and the pin hole of the cover exactly match.

4) Shaft sub-assembly

When replacing a shaft sub-assembly, remove the key from the shaft in advance in order to prevent the oil seal from damaging on insertion of the shaft.

5) Tightening torque of mounting bolts

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| Model of pump | Tightening torque kgf-m | |
|---------------|-------------------------|-----------------------------------|
| | Cover mounting bolt | Tightening bolt for reducer valve |
| PV2R1 | 6.85±± 10% | — |
| PV2R2 | 11.8 ± 10% | — |
| PV2R3 | 55.9 ± 10% | — |
| PV2R4 | 55.9 ± 10% | 1.47 ± 10% |

6) After assembly is completed, check the smooth rotation of the shaft by turning it by hand.

5. TROUBLESHOOTING

When any trouble occurs, examine the cause by the following table and take appropriate measures.

5.1

Abnormal phenomena; Part 1

The pump does not deliver oil at all, or sufficiently or the pressure does not increase.

| Part troubled | Cause | Measures |
|---------------------------|---|--|
| Erroneous specifications. | Reverse rotation of motor. | •Change the rotating direction. |
| | Rotating speed too low. | •Increase speed up to the rated one. |
| | Oil viscosity too high. | •Replace with operation oil of appropriate viscosity. •Preheat to make the rated viscosity. |
| | The height from the oil level to the pump too high. | •Lower the pump mounting height. |
| | Suction piping too thin or too bent. | •Use pipe with larger diameter. •Make the bent smooth. |

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| Part troubled | Cause | Measures |
|--|--|---|
| Bad maintenance | Suction of air due to lack of oil level in tank. | •Add operation oil up to the specified level. |
| | Air mixed in from suction system (loosened connecting parts or damaged seals). | •Retighten the connecting parts. •Replace if seals are damaged. |
| | Clogging of filter for tank with pollution. | •Wash the filter. |
| | Clogging of suction pipe. | •Wash the pipe. |
| Shaft | Suction of air due to abnormal wear of sliding part to the oil seal or breakage. | •Replace. |
| Pump cartridge | Abnormal wear. | •Replace by a cartridge. •Check operation oil and if wear powder is mixed in or excessive pollution or deterioration is observed, replace operation oil and flush the piping when necessary. |
| | Damage by burning. | |
| | Damaged O-ring or backup ring. | •Replace. |
| O-ring on the oil seal or the contact surface of body and cover. | Suction of air due to abnormal wear or damage. | •Replace. |
| Defective units other than pump | Maladjustment or disorder of valve and actuator. | •Inspect the flow of oil sequentially by tracing it and readjust or repair any abnormal part. |
| | Abnormal oil leak in the circuit. | |

5.2

Abnormal phenomena; Part 2

The pump generates abnormal noise.

| Part troubled | Cause | Measures |
|--|---|---|
| Bad installation Erroneous specification. | Forcible biased load is applied to the pump due to piping in case of piping by steel pipes. | <ul style="list-style-type: none"> •Change a part of delivery piping to rubber hose. •Loosen the mounting part once and re-pipe so that the biased load may not be applied to the pump. |
| | Excessive difference between the shaft and the motor shaft. | •Reinstall within TIR0.25 mm, of eccentricity and 0.2° of angle error. |
| | Viscosity of operation oil too high or too low. | •Use within the range of rated viscosity. |
| | Temperature of operation oil too high or too low. | •Use within the range of the range of rated oil temperature. |
| Bad maintenance | Suction of air due to lack of oil level in tank. | •Add operation oil up to the specified level. |
| | Air mixed in from suction system (loosened connecting parts or damaged seals). | •Retighten the connecting parts or replace if seals are damaged. |
| | Clogging of filter for tank with pollution. | •Wash the filter. |
| | Clogging of suction pipe. | •Wash the pipe. |
| Shaft | Suction of air due to abnormal wear of sliding part to the oil seal. | •Replace. |
| O-ring on the oil seal or the contact surface of body and cover. | Suction of air due to abnormal wear or damage. | •Replace. |
| Bearing | Breakage | •Replace. |
| Pump cartridge. | Abnormal wear. | <ul style="list-style-type: none"> •Replace by a cartridge. •Check operation oil and if wear powder is mixed in or excessive and flush the piping when necessary. |
| | Damage by during. | |
| | Damaged O-ring or backup ring. | •Replace. |

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5.3

Abnormal phenomena; Part 3
The pump generates abnormal heat.

| Part troubled | Cause | Measures |
|-----------------|-----------------------------|---|
| Pump cartridge. | Low performance by abnormal | • Replace by a cartridge. • Check operation oil and flush. |
| | Damage by burning. | |

5.4

Abnormal phenomena; Part 4
Oil leaks outside the pump.

| Parts troubled | Cause | Measures |
|----------------|--------------------------|----------|
| Oil seal | Abnormal wear or damage. | Replace. |
| O-ring | | |

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