

GROUP 5 MAIN PUMP

1. REMOVAL AND INSTALL

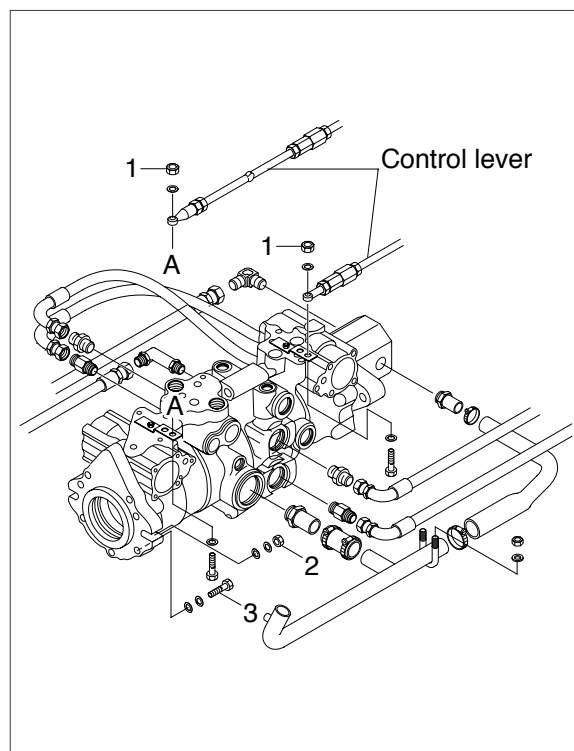
1) REMOVAL

▲ If engine is running or full up pressure into hydraulic system, absolutely does not repair or tighten hose, fitting.
As hydraulic line explode, dangerous accident may occur.

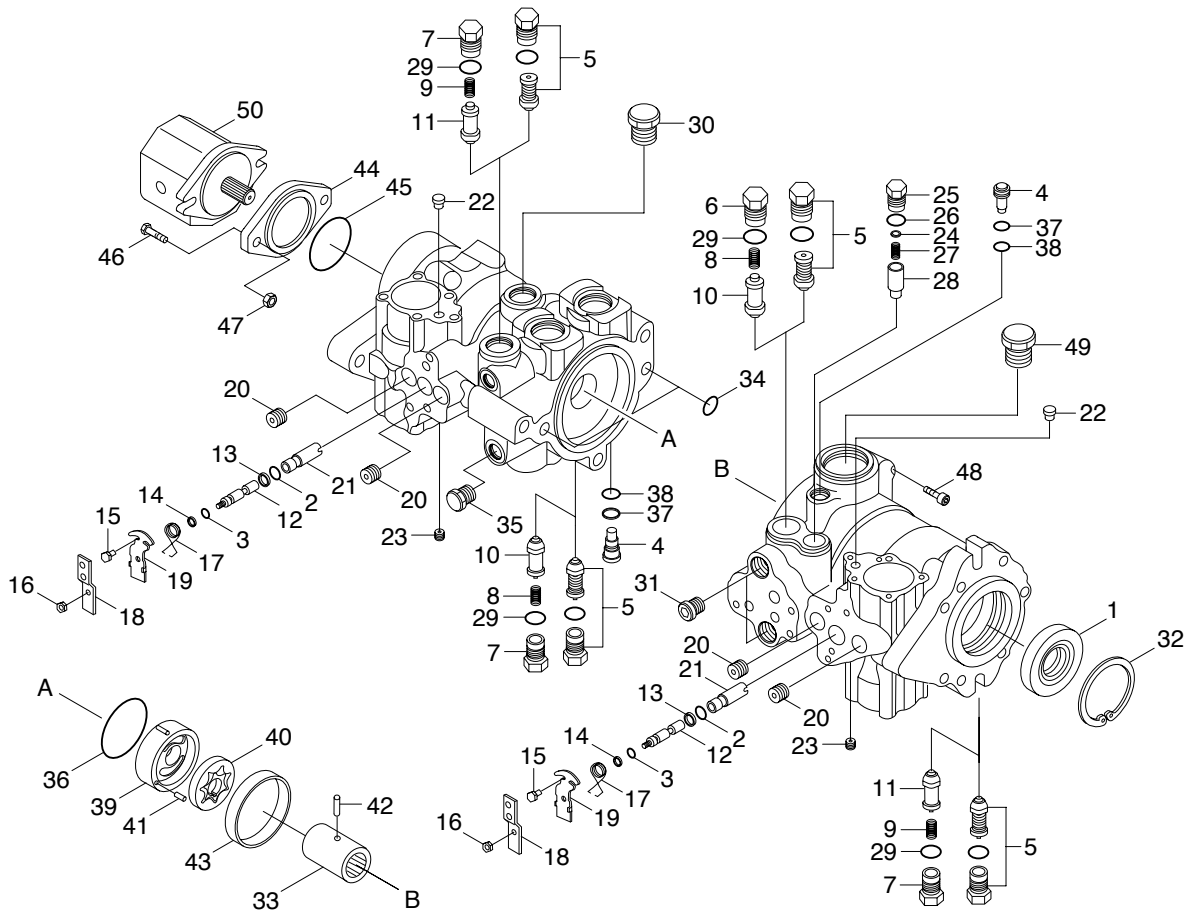
- (1) Lowered the bucket on the ground.
- (2) Shut off engine and raise the seat bar and move pedals until both pedal lock.
- (3) Tilt canopy and remove the front cover.
For tilting and lowering of the canopy, refer to page 4-14 of the operator's manual.
- (4) Loosen the nut and disassemble control lever.
- (5) Disassemble hoses connected with main pump and auxiliary pump.
- (6) Loosen the nut(2) and bolt(3).

2) INSTALL

- (1) Install pump to frame by tightening the nut(2) and bolts(3).
 - Tightening torque
 - Nut(2) : $14.4 \pm 2.2 \text{kgf} \cdot \text{m}$
($104.1 \pm 15.9 \text{lbf} \cdot \text{ft}$)
 - Bolt(3) : $6.9 \pm 1.4 \text{kgf} \cdot \text{m}$
($49.9 \pm 10.1 \text{lbf} \cdot \text{ft}$)
- (2) Assemble hose connected with main pump and auxiliary pump.
- (3) Fix control rod and control lever with lock washer and nut(1).
 - Tightening torque : $6.9 \pm 1.4 \text{kgf} \cdot \text{m}$
($49.9 \pm 10.1 \text{lbf} \cdot \text{ft}$)



2. STRUCTURE



- | | | | | | |
|----|---------------|----|----------------------|----|------------------|
| 1 | Lip seal | 18 | Control valve handle | 35 | Plug |
| 2 | O-ring | 19 | Return bracket | 36 | O-ring |
| 3 | O-ring | 20 | Plug | 37 | Back up ring |
| 4 | Bypass valve | 21 | Control valve sleeve | 38 | O-ring |
| 5 | Relief valve | 22 | Orifice plug | 39 | Gerotor cover |
| 6 | Special plug | 23 | Orifice plug | 40 | Gerotor assembly |
| 7 | Special plug | 24 | Shim | 41 | Pin |
| 8 | Spring | 25 | Plug | 42 | Pin |
| 9 | Spring | 26 | O-ring | 43 | Ring |
| 10 | Check poppet | 27 | Spring | 44 | Plate cover |
| 11 | Check poppet | 28 | Relief valve | 45 | O-ring |
| 12 | Spool | 29 | O-ring | 46 | Screw |
| 13 | Back up ring | 30 | Plug | 47 | Nut |
| 14 | Back up ring | 31 | Plug | 48 | Screw |
| 15 | Screw | 32 | Ring | 50 | Auxiliary pump |
| 16 | Special nut | 33 | Coupling | | |
| 17 | Return spring | 34 | O-ring | | |

3. GENERAL DESCRIPTION

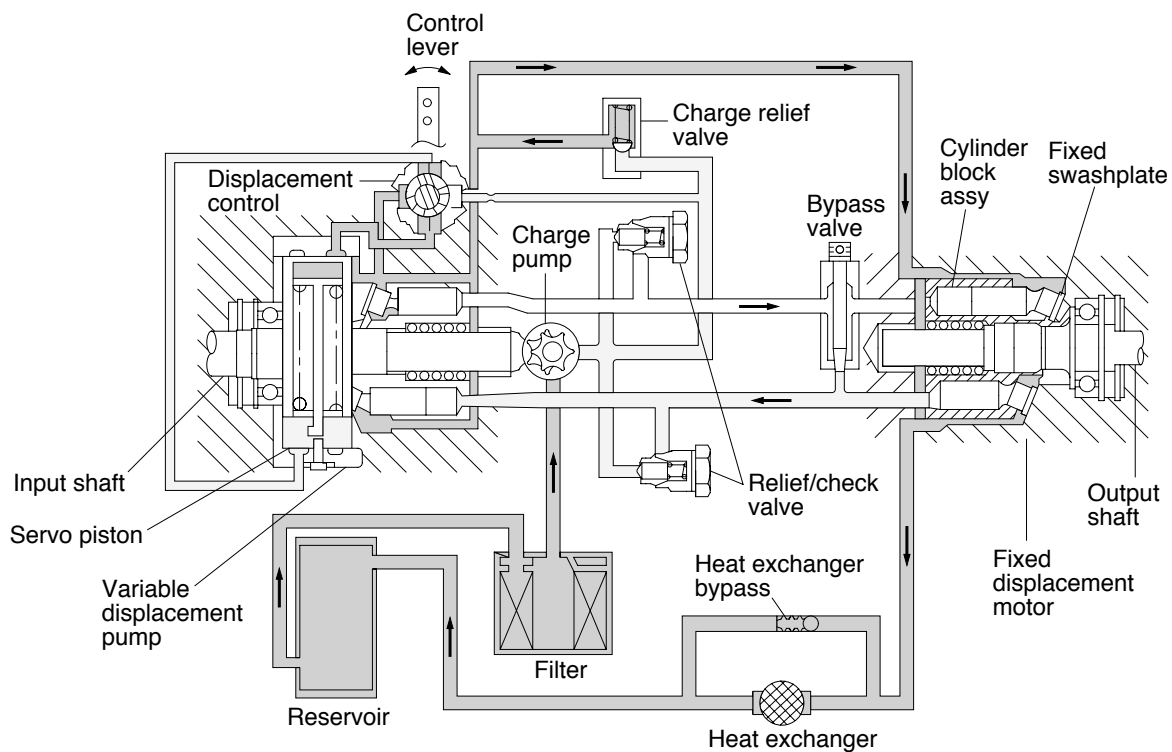
Main pump are a compact, state of the art design, using the parallel axial piston design in conjunction with a tillable swashplate to vary the pump's displacement. Reversing the direction of tilt of the swashplate reverses the flow of oil from the pump and thus reverses the direction of the motor output rotation.

Main pump are controlled by a compact responsive hydro mechanical, closed loop control system.

A charge relief valve and charge check valves are included in the pump end cap to control the makeup and cooling oil flow for the system. The charge check valves also incorporate the high pressure relief valve function into their design.

The main pump is including a 1.4in/rev(22.9cc/rev) integral gerotor type charge pump.

The fixed displacement motors also incorporate the parallel axial piston design. Fixed displacement motors utilize a fixed swashplate angle.

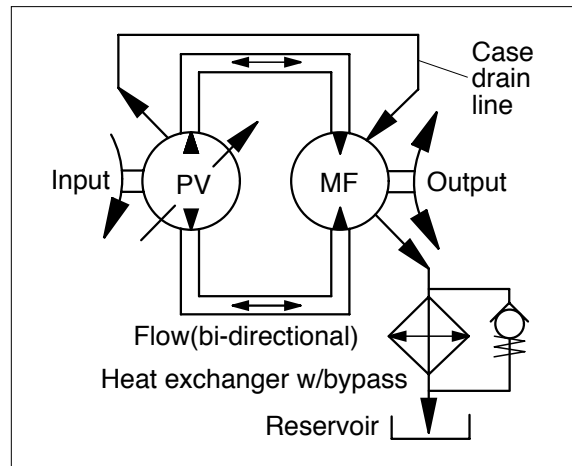


4. TRANSMISSION HYDRAULIC SUPPORT SYSTEM

The main pump are easy to install, requiring no adjustments and few auxiliary components. They have their own hydraulic support system which discussed in this section.

1) BASIC CLOSED CIRCUIT

The main ports of the pump are connected by hydraulic lines to the main ports of the motor. Fluid flows, in either direction, from the pump to the motor then back to the pump in this closed circuit. Either of the hydraulic lines can be under high pressure. The direction and speed of fluid flow (And the motor output shaft rotation) depends on the position of the pump swashplate. The system pressure is determined by the machine load.



2) CASE DRAIN AND HEAT EXCHANGER

The pump and motor require case drain lines to remove hot fluid from the system. The pump case should be drained from its upper drain port to insure the case remains full of fluid. The pump case drain is then connected to the lower drain port on the motor housing. The upper motor housing drain port is then connected to the reservoir. A heat exchanger, with a bypass valve, may be required to cool the case drain fluid before it returns to the reservoir.

When operating pump near rated speed, some case flow may have to be diverted around the motor to ensure pump case pressure remain within recommended limits.

Continuous case pressure should not exceed 25psi(1.7bar).

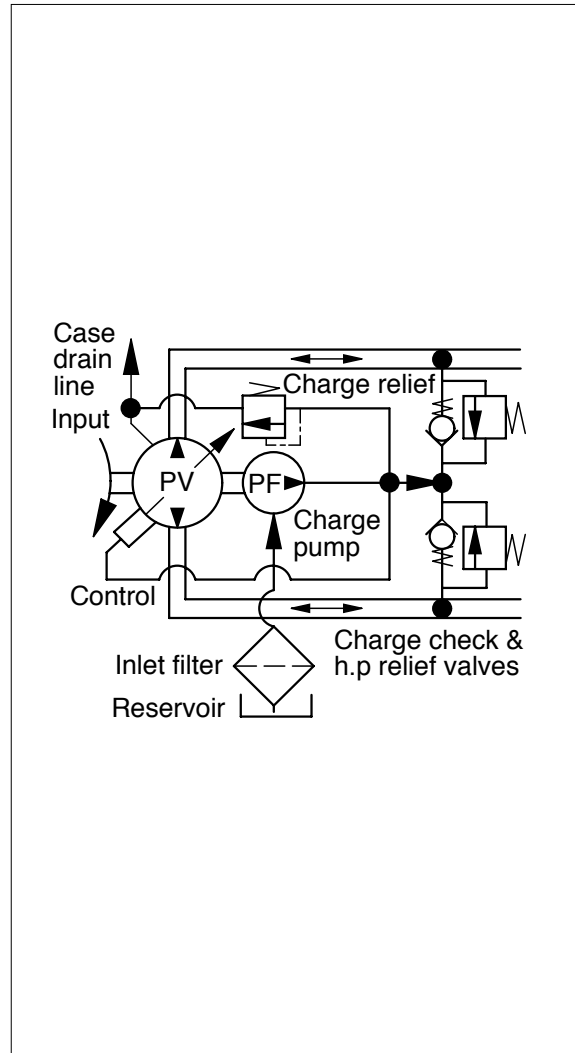
3) CHARGE SYSTEM AND INLET FILTER

The charge pump supplies cool fluid to the system and keeps the closed loop charged to prevent cavitation. The charge pump draws its fluid from the system reservoir.

The inlet vacuum, measured at the charge pump inlet should not exceed 5in.Hg(8bar abs), except during cold starts.

Since either or the main hydraulic lines can be high pressure, two charge check valves are used to direct the charge supply into the low pressure line. These check valves are incorporated into the high pressure relief valves in the pump end cap. Any charge flow not being used for the closed circuit is discharged over a direct operating charge relief valve, through the pump and motor housings and back to the system reservoir. The charge pressure relief valve is 290psi (20bar).

Charge pressure must not be less than 220psi(15.2bar) for satisfactory operation. Pressure less than this may result in premature unit failure or loss of control.



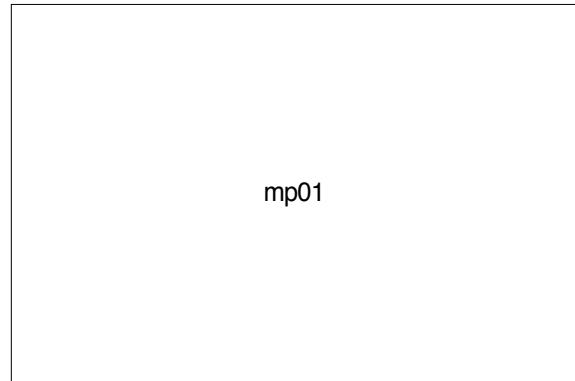
4) HIGH PRESSURE RELIEF VALVES

Two optional combination check / high pressure relief valves may be provided in the pump end cap for overload protection. These cartridge type relief valves are factory set and are not field adjustable. Changing the maximum system pressure can be accomplished by installing different cartridges with the desired setting.

▲ Certain service procedures may require the machine to be disabled (Wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders.

▲ Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.

▲ Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.



5. CONTROLS AND OPTIONS

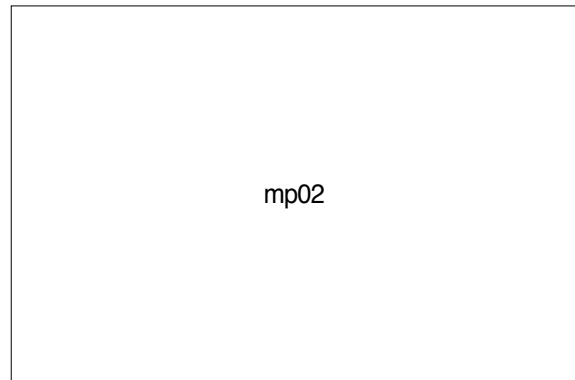
1) MANUAL DISPLACEMENT CONTROL

With the manual displacement control(MDC), the pump displacement and output flow, in either direction, is approximately proportional to the angular movement of the control handle. The control will return to neutral if the pump control handle is released the control centering mechanism is not sufficient to overcome external control linkage friction.

This control may have various sized orifices installed in the supply and drain passages for controlling maximum acceleration and deceleration(Control response).

2) BYPASS VALVE

In some applications it is desirable to bypass fluid, allowing, for example, a vehicle to be moved short distances at low speeds without running the prime mover. This is accomplished by a manually operated bypass valve installed in the pump housing. When open(Unscrewed 2 turns maximum), this valve connects both sides of the pump/motor closed circuit and allows the motor to turn. This valve must be fully closed for normal operation.



6. START UP AND MAINTENANCE

1) START UP PROCEDURE

- (1) The following start up procedure should always be followed when starting up a new main pump installation or when restarting an installation in which either the pump or motor had been removed from the system.

The following procedure may require the machine to be disabled(Wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders. Take necessary safety precautions before moving the machine.

- (2) Prior to installing the pump and/or motor, inspect the units for damage incurred during shipping and handling. Make certain all system components(Reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.
- (3) Fill the reservoir with recommended hydraulic fluid, which should be passed through a 10 micron(Normal, no bypass) filter prior to entering the reservoir. The use of contaminated fluid will cause damage to the components, which may result in unexpected machine movement.
- (4) The inlet line leading from the reservoir to the pump should be filled prior to start up. Check inlet line for properly tightened fittings and make sure it is free of restrictions and air leaks.
- (5) Be certain to fill the pump and/or motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.
- (6) Install a 0 to 500psi(35bar) pressure gauge in the charge pressure gauge port to monitor the charge pressure during start up.
- (7) It is recommended that the external control input signal be disconnected at the pump control until after initial start up. This will allow the pump to remain in its neutral position.
- (8) Jog or slowly rotate prime mover until charge pressure starts to rise. Start the prime mover and run at the lowest possible rpm until charge pressure has been established. Excess air may be bled from the high pressure lines through the high pressure gauge ports.
Do not start prime mover unless pump is in neutral position(0 swashplate angle). Take precautions to prevent machine movement in case pump is actuated during initial start up.
- (9) Once charge pressure has been established, increase speed to normal operating rpm. Charge pressure should be approximately 290psi(20bar) minimum. If charge pressure is incorrect, shut down and determine cause for improper pressure.
Inadequate charge pressure will affect the operator's ability to control the machine.
- (10) Shut down prime mover and connect external control input signal. Start prime mover, checking to be certain pump remains in neutral. With prime mover at normal operating speed, slowly check for forward and reverse machine operation.
- (11) Charge pressure should remain at 290psi(20bar) minimum during forward or reverse operation. Continue to cycle slowly between forward and reverse for at least 5 minutes.
- (12) Shut down prime mover, remove gauges, and plug ports. Check reservoir level and add fluid if necessary.
- (13) The transmission is now ready for operation.

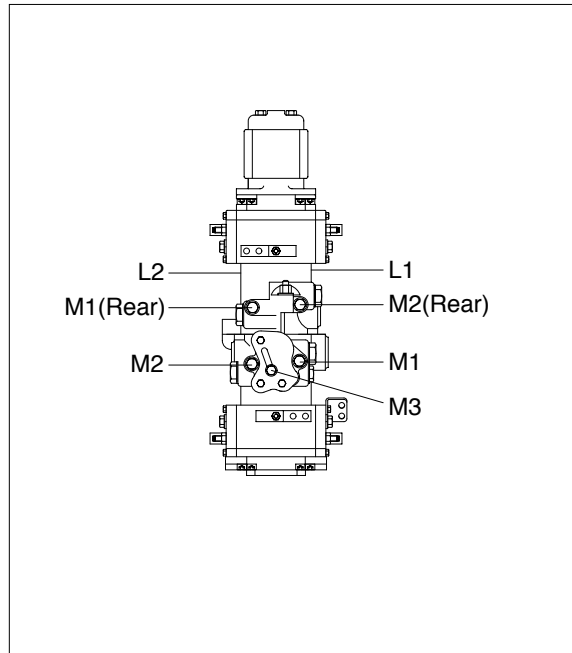
3) MAINTENANCE

- (1) To insure optimum service life on this pump, regular maintenance of the fluid and filter must be performed.
- (2) Check the reservoir daily for proper fluid level, the presence of water(Noted by a cloudy to milky appearance, or free water in bottom of reservoir), and rancid fluid order(Indicating excessive heat).
- (3) It is recommended that the fluid and filter be changed per the machine every 500hrs.
- (4) It may be necessary to change the fluid more frequently than the above intervals if the fluid becomes contaminated with foreign matter(Dirt, water, grease, etc.) or if the fluid has been subjected to temperature levels greater than the maximum recommended. Never reuse fluid.
- (5) The filter should be changed whenever the fluid is changed or whenever the filter indicator shows that it is necessary to change the filter.

7. TROUBLESHOOTING

1) GAUGE INSTALLATION

- (1) Various pressure and vacuum gauge readings can be a great asset in troubleshooting problems with this transmission or support system.
- (2) It will be necessary to install a high pressure gauge into the system pressure gauge ports to check the setting of the high pressure relief valve.
- (3) Measuring the charge pump inlet vacuum will help locate restrictions in the inlet lines, filter, etc.
- (4) Case pressure readings can help locate restrictions in the return lines, oil cooler and return filter.



Port		Description
M1	System pressure port A	6000psi or 400bar gauge
		9/16 - 18 O-ring fitting
M2	System pressure port B	6000psi or 400bar gauge
		9/16 - 18 O-ring fitting
M3	Charge pressure	1000psi or 70bar gauge
		9/16 - 18 O-ring fitting or tee into charge pressure filter outlet line
L1	Case pressure	1000psi or 70bar gauge
L2		1-1/16 - 12 O-ring fitting

Snubbers are recommended to protect pressure gauge. Frequent gauge calibration is necessary to insure accuracy.

8. INSPECTIONS AND ADJUSTMENTS

1) MANUAL DISPLACEMENT CONTROL

Disconnect the external control linkage from the control handle and check for neutral by manually operating the control handle. Releasing the control handle should allow the pump to return to neutral. If operation is satisfactory with the external control linkage disconnected, the problem is not in the hydrostatic transmission.

If operation is not satisfactory with the external control linkage disconnected from the handle, the control may be incorrectly adjusted.

mp02

2) CHECK / HIGH PRESSURE RELIEF VALVE

The system check/relief valves have the dual purpose of providing make up oil during by directional rotation and providing protection from system over pressure. When the problem occurs in one direction only, interchange the check/relief valves to see if the problem changes to the other direction. If so, one check/relief valve cartridge is either malfunctioning or does not have the proper setting.

The relief valves are factory set and should not be tampered with except for replacing the entire cartridge. Disassembly may change the setting and cause erratic unit operation or premature failure.

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3) PUMP CHARGE RELIEF VALVE

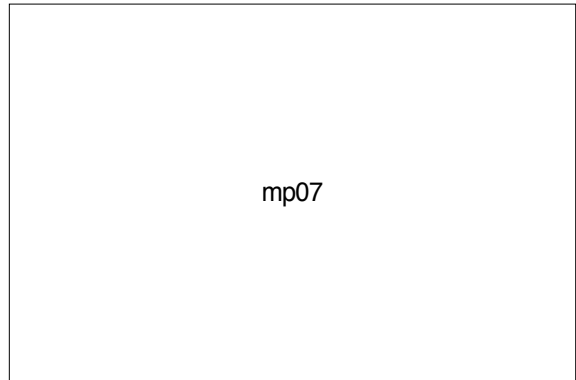
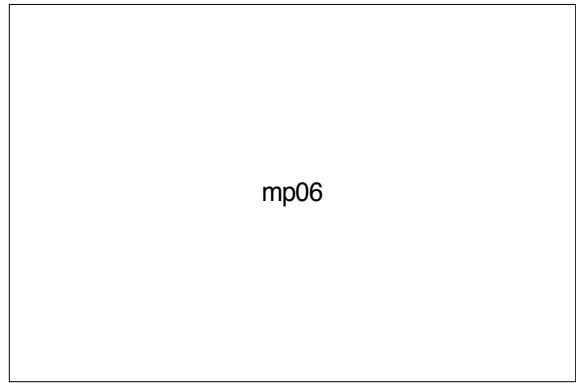
If charge pressure is low(Less than 290psi (20bar) above case pressure), the charge relief valve should be inspected. Inspect for foreign material holding the poppet open, and for scoring or wear on the poppet and seat in the housing.

Adjustment of the charge pressure is accomplished by changing the shim thickness behind the spring.

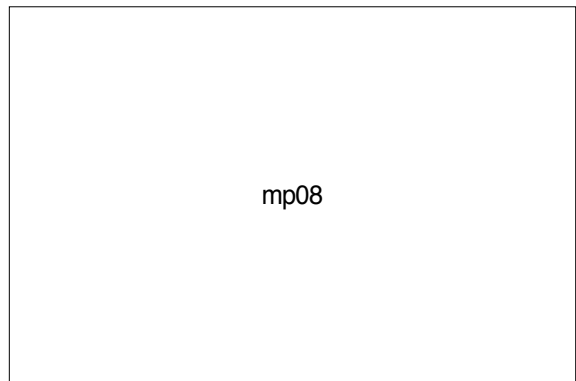
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**4) MANUAL DISPLACEMENT CONTROL(MDC)
NEUTRAL BRACKET ADJUSTMENT**

(1) Remove the external control linkage from the control handle. Remove the servo cross-port line (Installed while making the washplate neutral adjustment) and install a 0 to 500psi(0 to 35bar) gauge in each servo gauge port.



(2) Loosen the washer head screw to allow the neutral bracket to move, but not freely. **The following procedure may require the machine to be disabled(Wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders.**



- (3) Start the prime mover and slowly accelerate to normal operating rpm.
- (4) Insert phillips screwdriver into the 1/4" clearance hole and engage the slot of the neutral adjust bracket. Slowly rotate the neutral adjust bracket, using the phillips screwdriver, until the pressure is equal on both servo gauges.
- (5) Slowly rotate the neutral adjust bracket until one of the servo gauges starts to increase in pressure. Mark the position of the neutral adjust bracket.
- (6) Slowly rotate the neutral adjust bracket in the opposite direction until the other servo gauge begins to increase in pressure. Mark the position of the neutral adjust bracket.
- (7) Rotate the neutral adjust bracket to a position between the two marks and hold while torquing the washer head screw to 95 to 132in · lbs(10.8 to 14.9Nm).
- (8) Stop the prime mover. Remove the gauges and install the gauge port plugs. Install and adjust, if necessary, the external control linkage.



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9. DISASSEMBLY AND ASSEMBLY

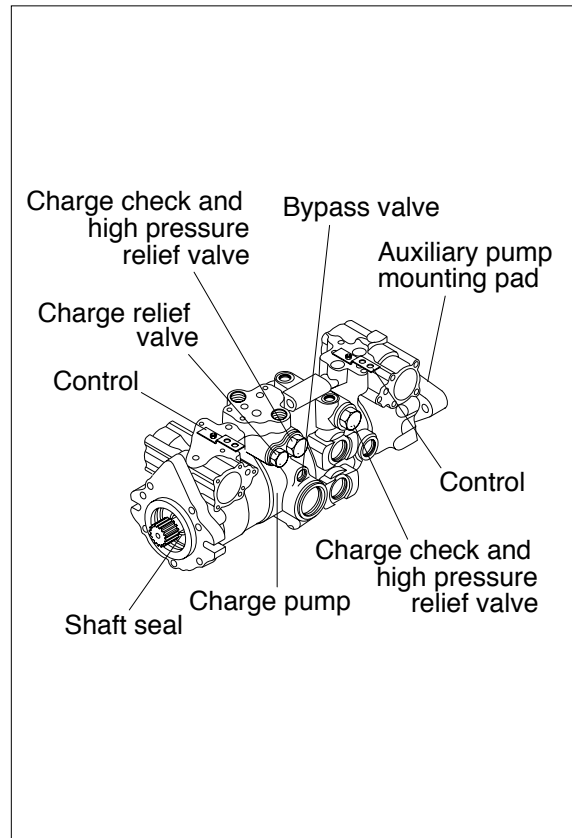
1) GENERAL

- (1) Minor repairs may be performed, following the procedures in this section, without voiding the unit warranty.

Cleanliness is a primary means of assuring satisfactory transmission life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals.

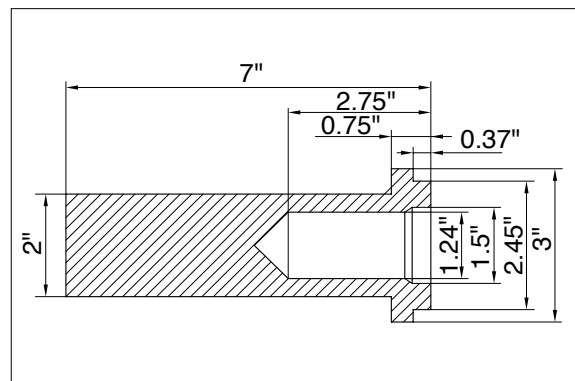
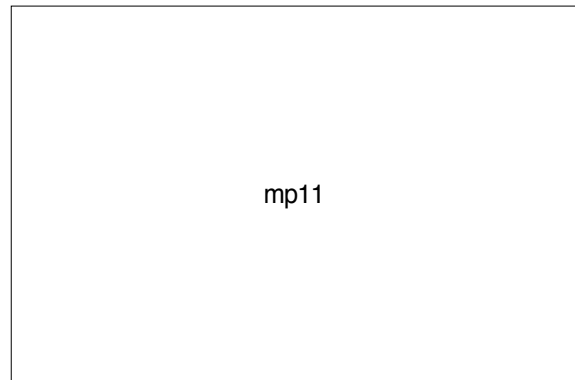
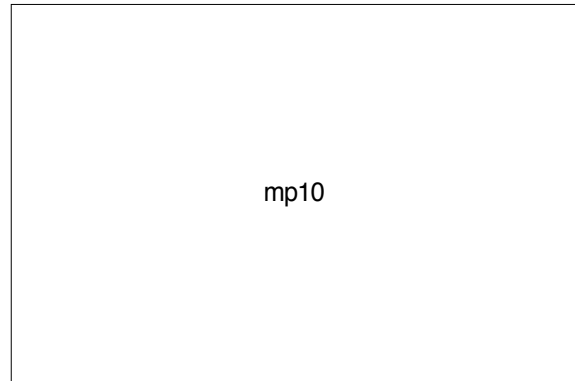
Protect all exposed sealing surfaces and open cavities from damage and foreign material.

It is recommended that all gaskets and O-rings be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.



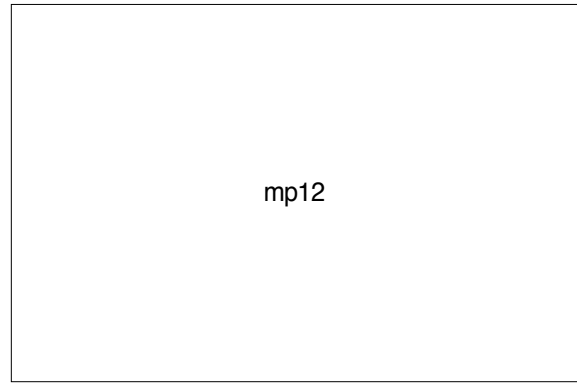
2) SHAFT SEAL

- (1) Lip type shaft seals are used on this pumps. These seals can be replaced without major disassembly of the unit. However, replacement of the shaft seal requires removal of the pump from the machine.
- (2) Remove the retaining ring from the housing.
- (3) Carefully remove the seal from the housing bore. The face of the seal may be punctured with a sharp instrument (Such as a screw driver) to aid in prying the seal out, or a slide hammer type puller may be used to remove the seal. Care must be taken so as not to damage the housing bore or shaft. Once removed, the seal is not reusable.
- (4) Prior to installing the new seal inspect the sealing area on the shaft for rust, wear or contamination. Polish the sealing area on the shaft if necessary.
- (5) Wrap the spline or key end of shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the inside diameter of the new seal with petroleum jelly. The outside diameter of the seal may be lightly coated with a sealant(Such as loctite high performance sealant #59231) prior to installation. This will aid in preventing leaks caused by damage to the housing seal bore.
- (6) Slide the new seal over the shaft and press it into the housing bore. Be careful not to damage seal. A seal installer tool can be made to aid in installing the seal. Dimensions for this tool are shown in the accompanying drawing.
- (7) Reinstall the seal retaining ring.



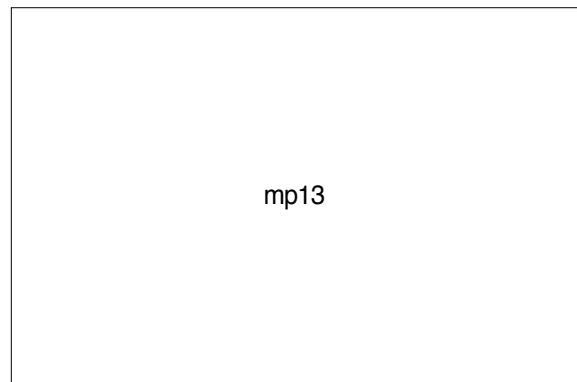
3) BYPASS VALVE

- (1) Unscrew the bypass valve from the housing. Inspect the valve and mating seat for damage or foreign material. It is recommended that the O-ring and back up ring be replaced.
Bypass valves are available with integral bypass orifices for specific application.
- (2) Reinstall the bypass valve into the housing. Torque to 7~10lbf · ft (9.5~13.6Nm).

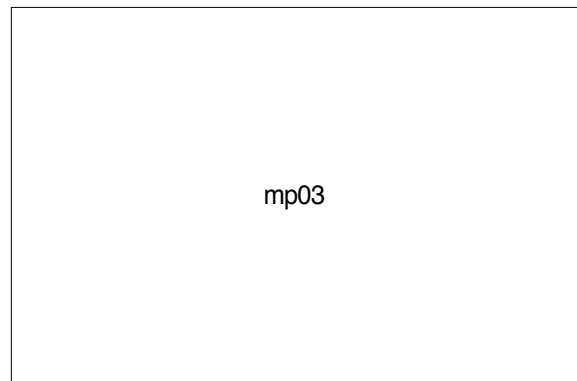


4) CHARGE CHECK AND HIGH PRESSURE RELIEF VALVES

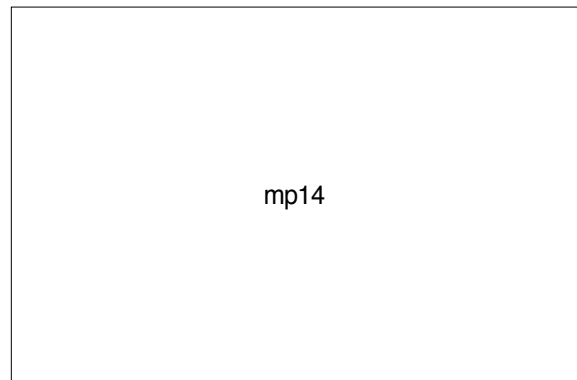
- (1) Remove the charge check and high pressure relief valve hexagon plug.



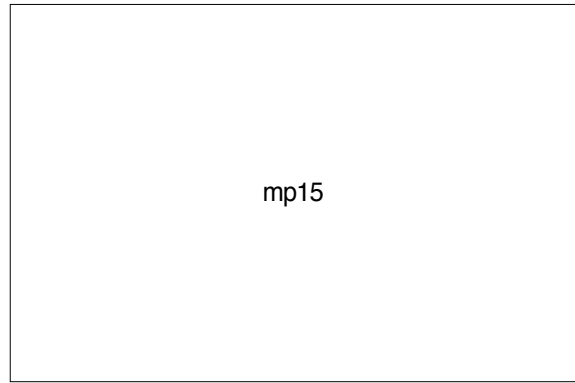
- (2) Remove the spring and check poppet or valve cartridge from the housing. Inspect the valve and mating seat in the housing for damage or foreign material. It will be necessary to replace the housing if the seat is damaged.



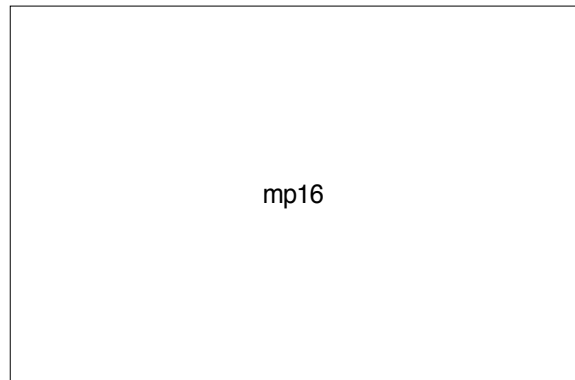
- (3) Several designs of charge check and high pressure relief valves have been used. Do not attempt to mix different vintage parts.



- (4) The valve poppet or cartridge, spring, plug and main housing were changed at date code 87-40, and are not individually interchangeable with earlier design parts. If the pump housing must be replaced on a unit with date code 86-14 through 87-39, the latest design charge check and high pressure relief valves must also be installed. Refer to the appropriate service parts manual for more information.

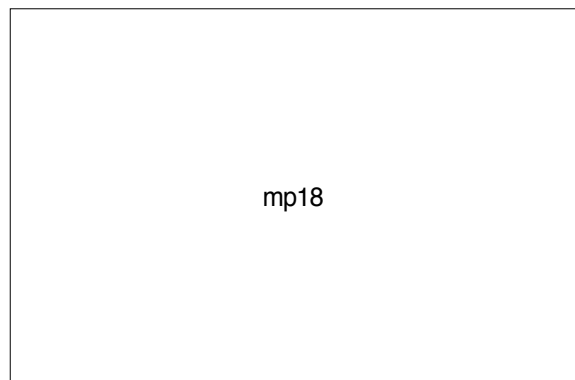


- (5) Reinstall the valve cartridge, spring and plug(With O-ring) into the housing. Torque the plug to 30~70lbf · ft(41~95Nm). The relief valves are factory set and should not be tampered with except for replacing the entire cartridge. Disassembly may change the setting and cause erratic unit operation or premature failure.

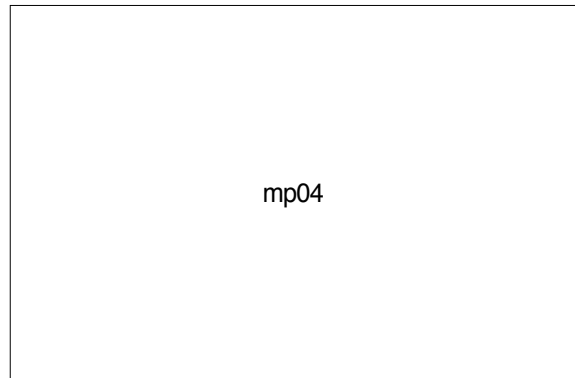


5) CHARGE PRESSURE RELIEF VALVE

- (1) Remove charge relief valve hexagon plug.
(2) Remove the spring and poppet from the housing. Do not alter the shims or interchange parts with another valve. Inspect the poppet and mating seat in the end cap for damage or foreign material.



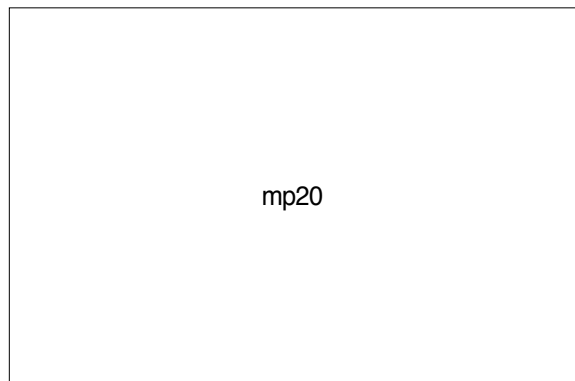
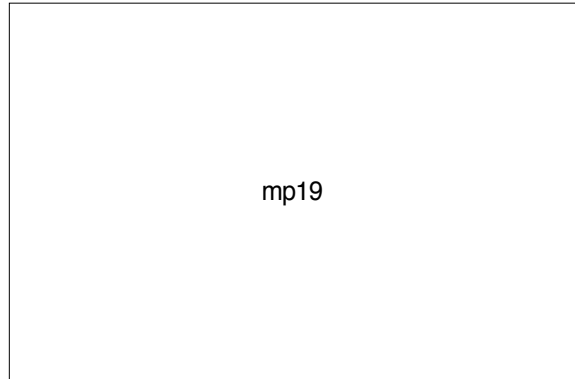
- (3) Reinstall the poppet, spring and plug(With shims and O-ring) into the housing. Torque the plug to 30~70lbf · ft(41~95Nm).



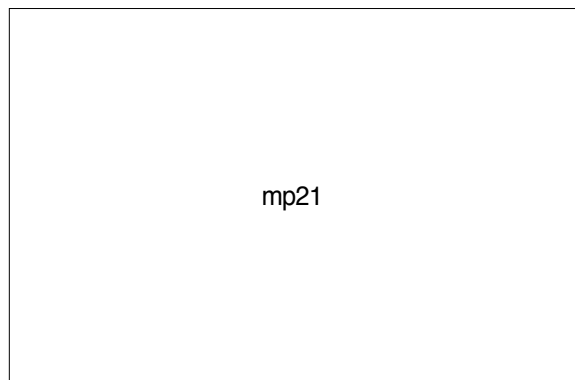
6) CONTROL SPOOL

The removal of any portion of the control mechanism may result in the loss of neutral, which will necessitate readjustment.

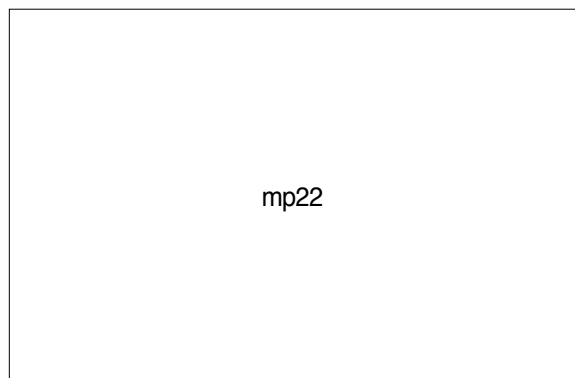
- (1) Before disassembly, note the position of the control handle and neutral bracket as either up or down.
- (2) Remove the screw and washer or flange head screw retaining the neutral bracket to the housing using a 7/16" or 3/8" wrench.
- (3) The spool (With neutral bracket, neutral spring, control handle and nut) can now be removed from the unit.



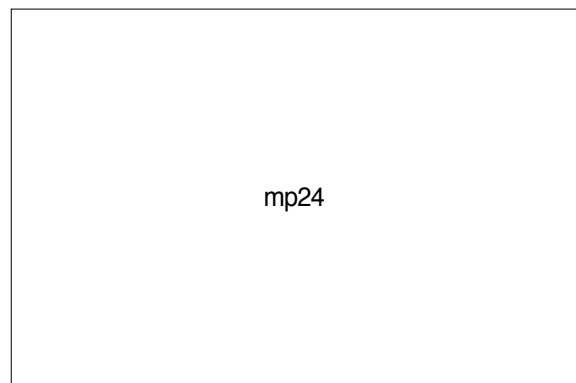
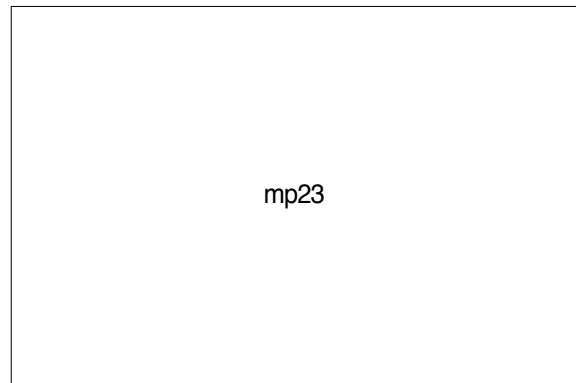
- (4) Remove the control sleeve from the unit by carefully gripping the end of the sleeve with pliers and pulling out.



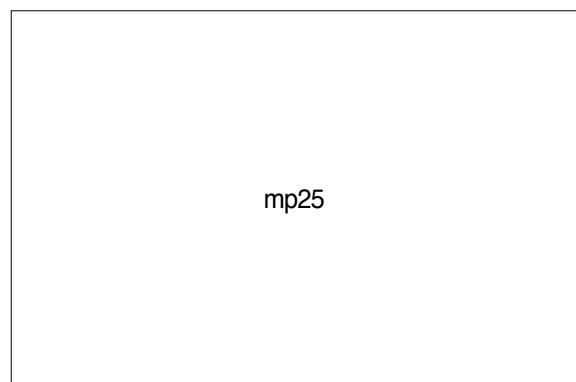
- (5) If it is necessary to remove the control handle and neutral bracket from the spool, remove the nut from the spool using a 1/2" hexagon wrench. Remove the lock washer. Disengage the neutral spring from the handle and remove the handle from the spool. The neutral spring and neutral bracket can now be removed from the spool.



- (6) To gain access to the control inlet orifice, remove the plug located between the control sleeve bore and the filter adapter, using an internal hexagon wrench(3/16"). Remove the inlet orifice plug using an internal hexagon wrench(5/32").



- (7) After disassembly, all parts should be thoroughly cleaned in a suitable solvent. Replace the O-rings with a small amount of clean petroleum jelly prior to assembly.

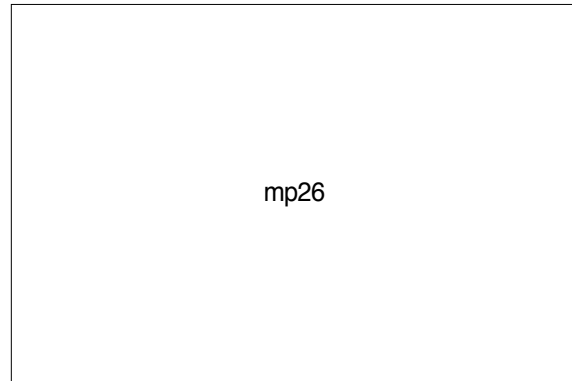


- (8) Inspect the control inlet orifice for plugging.
- (9) Always install a control inlet orifice with a screen when servicing the pump. Pumps not equipped with an inlet orifice should have a screen plug with a 3.96mm(0.156") through hole installed in the inlet orifice position.

(10) Inspect the control drain orifice, which is incorporated into the control valve sleeve.

(11) Install the control inlet orifice/screen plug and torque to 20~30lbf · ft(2.2~3.4Nm). Install the external plug. Apply a thread sealant to the external pipe plug used on later units.

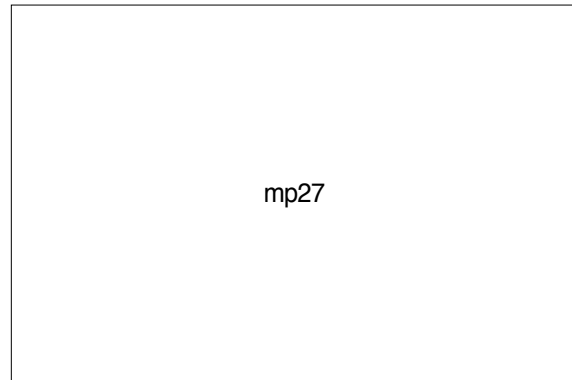
(12) Install the neutral bracket and neutral spring onto the spool. Install the handle onto the spool, aligning the marks made at disassembly. Engage the neutral spring with the handle and neutral bracket. Install the external tooth lock washer and nut onto the spool and torque to 10~20lbf · ft(13.6~16.3Nm).



(13) Align the control sleeve so its slot will engage the swashplate feedback pin(Slot positioned toward the pump cover) and insert the sleeve into the housing. Install the special washer onto the control sleeve.

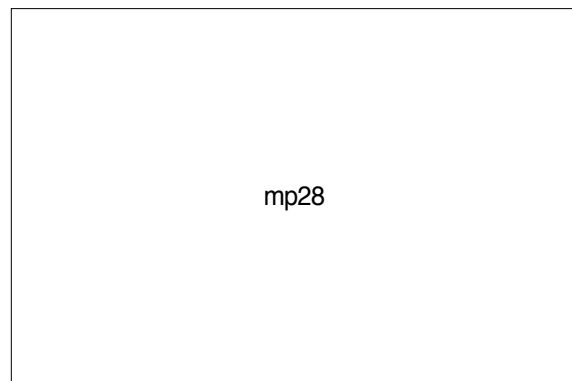
(14) Install the control spool assembly into the control sleeve, being certain that the control handle is oriented as noted during disassembly.

The slot in the handle end of the spool must be oriented toward the pump cover.



(15) Orient the control sleeve washer so its flat clears the neutral bracket. Align the marks made at disassembly and fasten the neutral bracket to the housing with the locking flange head screw.

Pumps using a hexagon head screw and star lock washer to retain the neutral bracket should have this hardware replaced with the locking flange head screw. Refer to the appropriate service parts manual for the part number.



(16) Readjust the neutral position of the control. Refer to the inspections and adjustment section at page 2-31 for details.



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