# SERVICE INSTRUCTIONS

## OILGEAR TYPE "PVL" TWO-WAY VARIABLE DELIVERY PUMPS

### PURPOSE OF INSTRUCTIONS

These instructions are written to simplify your work when installing, operating and maintaining Oilgear type "PVL" pumps. Acquaintance with the construction, principle of operation and characteristics of these units will help you attain satisfactory performance, reduce down time and increase the units life. Some units have been modified from those described in this bulletin and other changes may be made without notice.

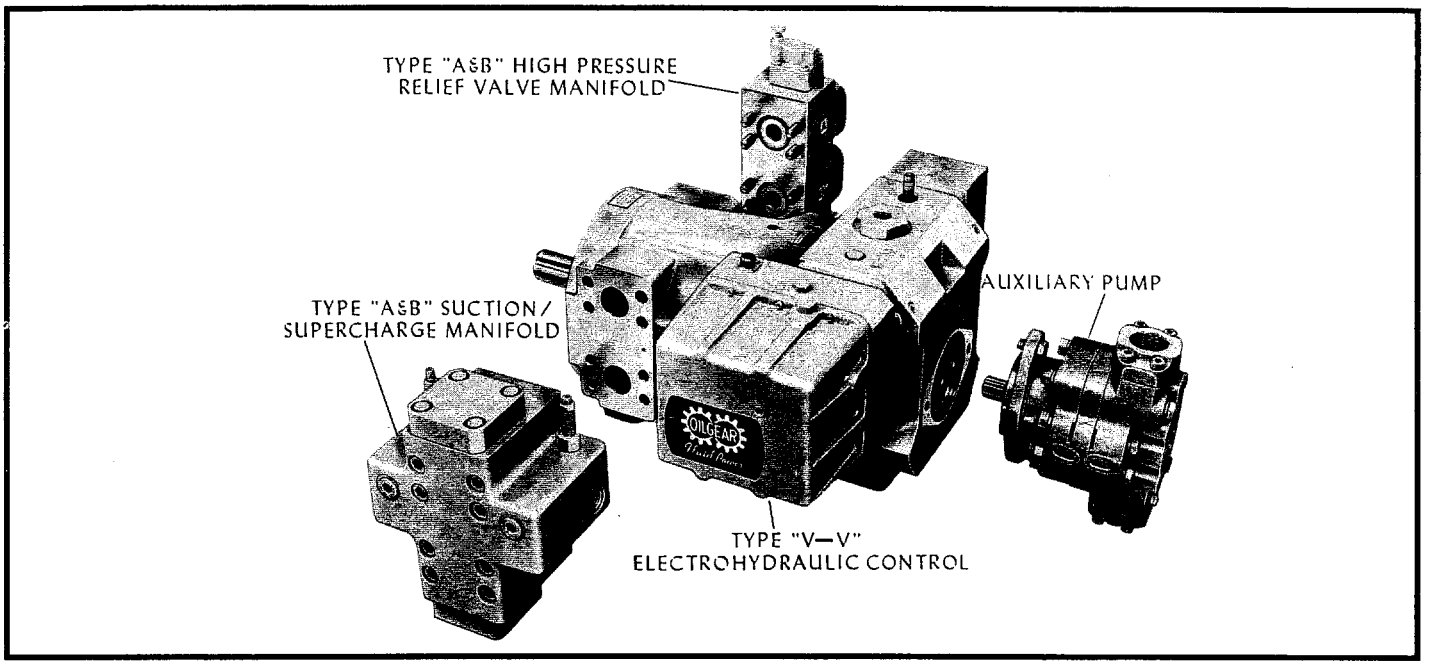


Figure 1. Typical Oilgear "PVL" Pump with typical control, auxiliary pump, supercharge manifold and high pressure relief manifold (55188-R).

### REFERENCE MATERIAL

| | | |
|---|---|---|
| Specifications | Bulletin | 47005 |
| Fluid Recommendations | Bulletin | 90000 |
| Contamination Evaluation Guide | Bulletin | 90004 |
| Filtration Recommendations | Bulletin | 90007 |
| Piping Information | Bulletin | 90011 |
| Full Flow Gear Pump Filters | Data Sheet | 89907 |

PUMP CONTROL INSTRUCTIONS

| | | |
|---|---|---|
| "A" Air | Bulletin | 947097 |
| "C" Acceleration/Deceleration | Bulletin | 947977 |
| "H" Hydraulic Servomotor | Bulletin | 947477 |
| "P" Pressure Compensator | Bulletin | 947577 |
| "Q" Power Limiter | Bulletin | 947579 |
| "S" Screw Shaft | Bulletin | 947177 |
| "V-U" Electronic, Solenoid | Bulletin | 947776 |
| "V-V" Electrohydraulic Servo | Bulletin | 947777 |
| "K" Opposing (Bias) Control | Data Sheet | 947087 |

## I. PREPARATION AND INSTALLATION

**NOTE: Parts drawings and lists are located on pages 16 thru 27. To aid in location of parts, numerals parenthesised (##) in text correspond to Parts List Item Number.**

### A. MOUNTING

PUMP WITHOUT RESERVOIR. The pump may be mounted in any position. But, for convenience the recommended mounting position is with the driveshaft axis on a horizontal plane and with case drain "Port 1" to the top side. Secure the unit to a rigid mounting surface. See section "B" on "Piping Information".

PUMP WITH RESERVOIR. These units are usually fully piped and equipped, although it may be necessary to connect to supercharge circuit when used. Mount reservoir on level foundation with reservoir bottom at least six (6) inches above floor level to facilitate fluid changes.

## B. PIPING AND FITTINGS

See reference "Piping Information" bulletin and individual circuit diagram before connecting pump to system. All connections must be tight to prevent air from being drawn into system or fluid leaking from system. Install air bleed valves at highest points in system.

**CAUTION:**

**Pumps not equipped with suction/supercharge and high pressure relief valve manifolds must have relief valves to protect pump and system against overloads.**

Suction and relief valve discharge tubes should reach within 1-2 times their diameter from bottom of reservoir. Do not "bottom-out" tubes in reservoir. If unit is equipped with auxiliary (gerotor-type) pump, connect suction tube to port 3. If the unit is equipped with optional suction/supercharge manifold and used on suction circuited applications, connect suction tube to port 5. For full supercharge circuited applications, connect port 5 to supercharge system and port 2, relief valve discharge, to reservoir. Port 6, on units equipped with a high pressure relief valve manifold, is the High Pressure Relief Valve (HPRV) discharge port and must be connected to reservoir.

**CAUTION:**

**Altering circuit configuration, from suction to full supercharge and vice versa, requires changing manifold plugs. See appropriate cutaway diagram to determine changes.**

If pump does not have a suction manifold with a Pilot Pressure Relief Valve, circuit a 100 to 200 cipm flow to Port "1Y" (in front housing) to provide thru case flow.

Arrange line from "case drain" (Port 1) so case remains full of fluid (non-siphoning). Each drain line must be a separate line, unrestricted, full sized and connect directly to the reservoir below lowest fluid level.

## C. POWER

Power is required in proportion to volume and pressure used. Standard low starting torque motors are suitable for most applications. Motor size recommendations for specific applications can be obtained from The Oilgear Company.

**CAUTION:**

**Never start or stop unit under load unless system is approved by The Oilgear Company. It may be necessary to provide delivery bypass in some circuits.**

## D. DRIVE

See rotation direction plate on unit's housing. Clockwise units should not be driven counter-clockwise or counterclockwise units driven clockwise. Use direct drive.

**CAUTION:**

**Do not drive coupling onto pump driveshaft. If fit is too tight, it may be necessary to heat coupling (see manufacturer's instructions).**

Misalignment of pump shaft to driveshaft should not exceed 0.005" (0,13mm) Total Indicator Readout (TIR) in any plane.

## E. FILTRATION

To assure long life from hydraulic system, keep fluid clean at all times. Oilgear recommends the use of a filter between the auxiliary (pilot) pump and connection to control and/or suction/supercharge manifold. See referenced bulletin on "Filtration Recommendations" and "Contamination Evaluation". Replace filter elements when filter condition indicator reaches "change" area at normal fluid temperature. Drain and thoroughly clean filter case. Use replacement elements of same Beta 10 ratio (normally a ratio of 15 or more).

## F. FLUID COOLING

When pump is operated continuously at rated pressure or frequent peak loads, auxiliary cooling of fluid may be necessary. Fluid temperature should not exceed limits specified in referenced bulletin on "Fluid Recommendations". If cooler is added to units with optional Suction/Supercharge Manifold, connect cooler input to port 8A, output to 8B and block manifold ports 4B, 4C, 8, 8C 8D and 8E. For full supercharge circuits, also block port 2A (port 2 is open). For suction circuits, block port 2 (port 2A is open). All other manifold ports should be open.

## G. AIR BREATHER

On most installations, an air breather is mounted on top of fluid reservoir. It is important for the breather to be of adequate size to allow air flow in and out of the reservoir as fluid level changes. Keep breather case filled to the "fluid level" mark. About once every six months, remove cover, wash screen in solvent, clean breather, refill case to "level" mark and install dry screen. See manufactures recommendations.

## H. FLUID, FILLING AND STARTING RECOMMENDATIONS

Refer to instruction plate on unit, reservoir, machine and/or referenced "Fluid Recommendations" bulletin. Pump all fluid into reservoir through a clean (Beta 10 ratio of 15 or more) filter. Fill reservoir to, but not above, "high level" mark on sight gage. **Remove case drain line and prefill pump case with hydraulic fluid.** Turn driveshaft a few times by hand with a spanner wrench to be sure parts are "free".

**Table 1. Torque to turn shaft.**

| Unit Size | 075 | 175 | 250 | 320 |
|---|---|---|---|---|
| Approx. Torque to turn driveshaft - ft. lbs. | 17 | 25 | 63 | 67 |
| Nm. | 23 | 34 | 85 | 91 |

With pump under "no load" or with pump control at "neutral", turn drive unit on and off several times before allowing pump to attain full speed. The system can usually be filled by running the pump and operating the control. Watch fluid level mark in the reservoir and stop pump if level reaches "low" mark. Add fluid and start again. With differential (cylinder) systems, fluid must not be above "high level" when ram is retracted or below "low level" when extended.

Bleed air from system by cautiously opening air bleed petcocks at highest point in the system. Close connections or petcocks tightly when solid stream of fluid appears.

**CAUTION:**

**Fluid may be under high pressure and caution is advised to prevent stream from hitting personnel or machinery.**

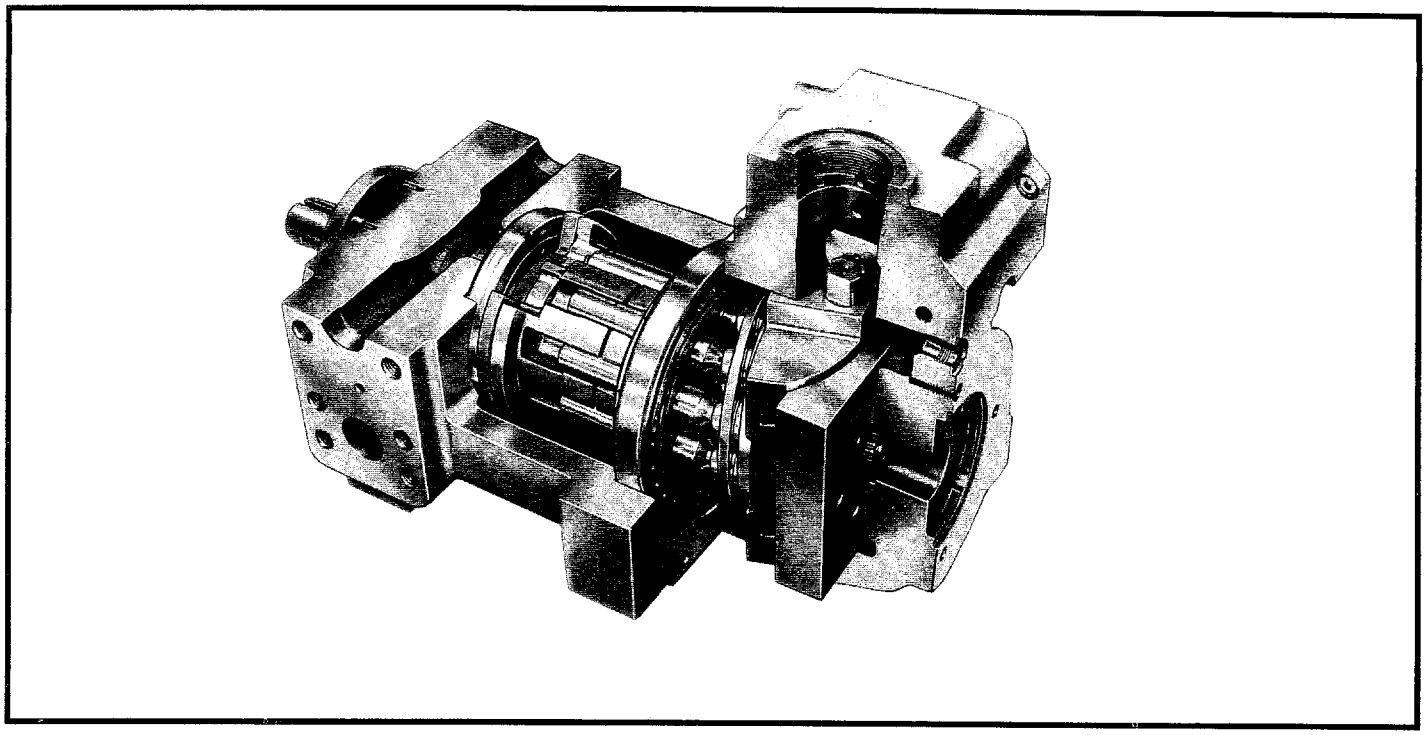

Figure 2. Cutaway of typical "PVL" Pump (55204-R).

## II. CONSTRUCTION

### A. HIGH PRESSURE PUMP

See Figures 2 and 8. A driveshaft (48) runs through the centerline of the pump front and rear housings (14 & 51) with one half of the floating cylinder (34) splined to it. A cylinder bearing (35) supports the cylinder and driveshaft inboard end and a front shaft bearing (50) supports the outboard end. The port plate assembly (41) has two crescent shaped ports. One crescent connects the pumping piston assemblies (32), during the upper half revolution and the other crescent port connects the piston assemblies, during the lower half revolution. Pumping pistons in the cylinder are held against the cradle (18) by harness-plate (31). The semi-cylindrical shaped cradle limits the piston stroke and swivels in arc shaped cradle bearings (28). The cradle is swiveled by control pistons, which are operated by the control and opposing operator assemblies (covered in referenced material). See Figure 3, a stroke indicator assembly (1) rides on a ramp in the opposing operator control piston giving a visual indication of cradle position.

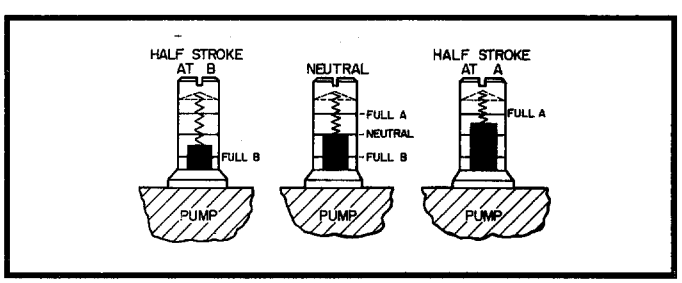


Figure 3. Stroke indicator positions for a unit driven (rotated) clockwise (when facing driveshaft) and with bias control on left side of the pump. (509464 sh. 2).

### B. OPTIONAL AUXILIARY (PILOT) PUMP

See Figure 8. A gerotor-type gear pump assembly (9) is often spline coupled to the rear end of the driveshaft. Other types of pilot pumps may also be used, and mounting arrangements may vary.

### C. OPTIONAL SUCTION/SUPERCHARGE MANIFOLD

TYPES A & B. See Figure 9. Although slightly different in configuration, the TWO-WAY pump manifold for each size consists basically of two large, spring supported disc-type main check valves (204), a cartridge-type or manifold mounted Pilot Pressure Relief Valve (PPRV) assembly (220), two small disc-type check valves (208) and a cartridge-type (230) or reverse flow-type (234) Back Pressure Relief Valve (BPRV). Provisions for internal plugging are made so the manifold can be ported for suction applications or full super-charged applications and addition of coolers.

TYPES C & D (see Figure 10) manifolds are for ONE-WAY pump service and consists of one large spring-supported, disc-type main check valve (204) and a cartridge (230) or reverse-flow type Back Pressure Relief Valve (BPRV) assembly.

TYPES E & F (see Figure 10) manifolds are for SUPER-CHARGE service only, and consist of basically two spring supported, disc-type main check valves (204), a case bleed orifice (207) and a Pilot Pressure Relief Valve (PPRV) (210).

### D. OPTIONAL HIGH PRESSURE RELIEF VALVE MANIFOLD

TYPES A, B, C, D (see Figure 11) manifolds contain a large, balanced-type High Pressure Relief Valve (HPRV) (438 or 485) for each high pressure port. Each relief valve is operated by a smaller pilot relief valve poppet (408 or 468). Size 250 and 320 manifolds differ in configuration from sizes 075 and 170, but contain the same basic parts.

TYPES E & F (see Figure 12) manifolds for size 075 contain the aforementioned components plus a cross-over relief valve for transmission service and a cartridge-type Back Pressure Relief Valve (BPRV) (446).

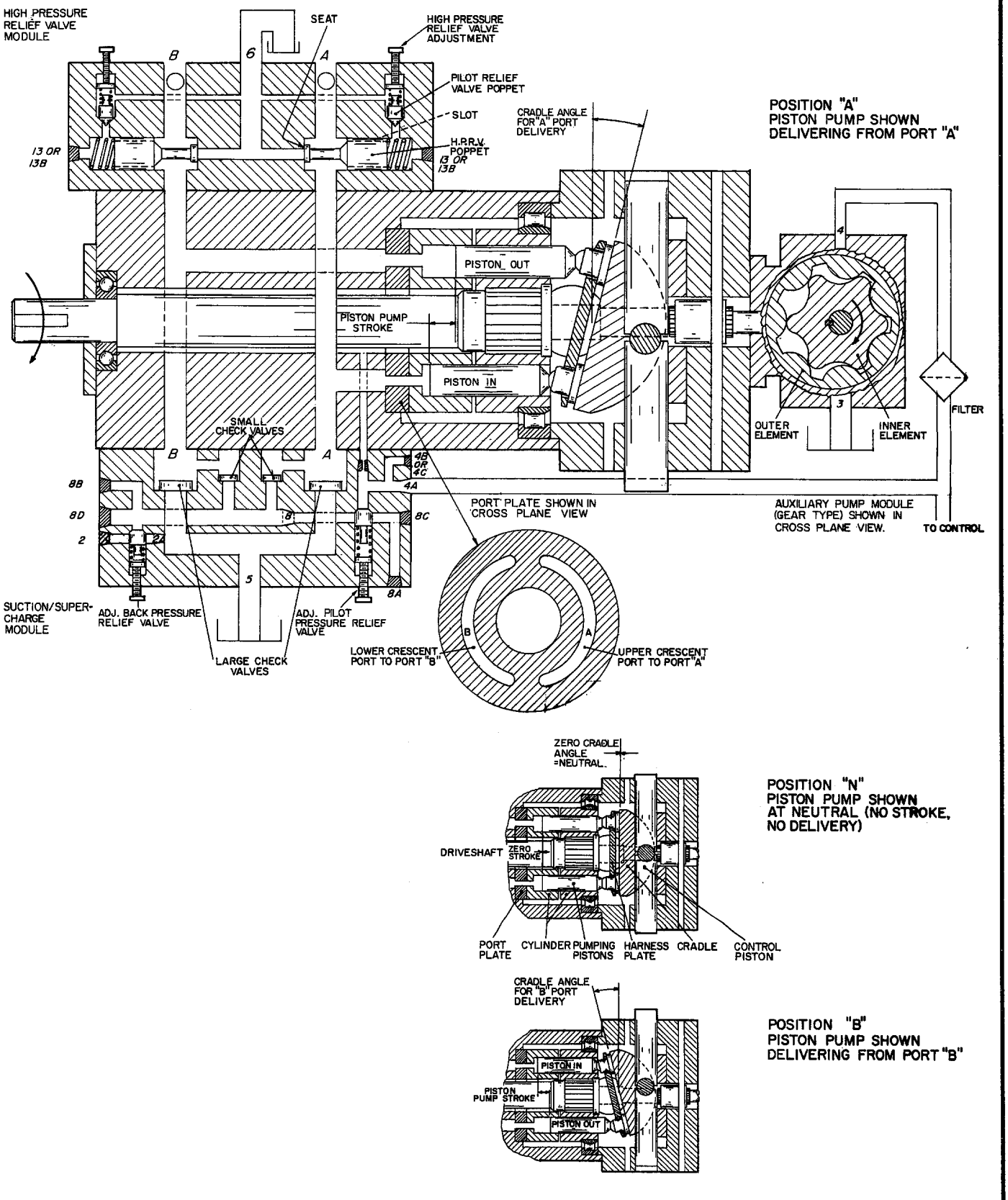


FIGURE 4.

Figure 4. Cut-a-Way Circuit Diagram of a Typical "PVL" Pump w/o Controls (509464 sh. 1).

# III. PRINCIPLE OF OPERATION

(Types "A" and "B" Suction/Supercharge and High Pressure Relief Valve manifolds are described. Operation of other manifold types are similar).

## A. HIGH PRESSURE PUMP

See Figure 4. POSITIONA. Rotating driveshaft clockwise turns the cylinder, which contains pumping pistons. A harness-plate holds piston shoes against the cradle. When control shifts the cradle to an angular position (as shown), the cradle face is not parallel to cylinder face. As pistons revolve around cradle face, an inward-outward motion of pistons is imparted.

During the lower half revolution, each piston bore becomes exposed to the lower crescent of the port-plate. Each piston moves outward, drawing fluid from port "B", into the piston bore until it's outermost stroke is reached. At that point, the piston bore passes the lower crescent port opening and the bore is blocked.

During the upper half revolution of the cylinder, each piston becomes exposed to the upper crescent of the port-plate. Each piston moves inward, displacing fluid thru the upper half crescent port to port "A" until its innermost stroke is reached. At that point, the piston bore passes the upper crescent opening and the bore is blocked.

A study of the diagram will show that the degree of cradle angle determines the length of piston stroke (difference between outermost and innermost position) therefore determining the amount of delivery from the high pressure pump. For two-way pumps, the direction of cradle angle determines which port is inlet or outlet.

See Figure 4. POSITION N. Neutral position results when the control, which positions control pistons, centers the cradle. The cradle angle is now zero, cradle face is now parallel to cylinder face, therefore no inward or outward pumping motions exist as piston shoes rotate around the cradle face. The lack of inward and outward pumping motions results in no fluid being displaced from piston bores to port-plate and delivery or suction ports.

See Figure 4. POSITION B. If cradle angle is reversed, the piston will stroke outward during the upper half revolution, draw fluid from port "A" and then will move inward during the lower half revolution and deliver fluid to port "B". Therefore, reversal of cradle angle (from Position A) reverses pump delivery.

It should be noted that when a two-way pump reverses flow - the rate of delivery is decelerated as the swashblock moves toward the neutral position - flow is stopped as swashblock crosses neutral position - flow accelerates from the other port as swashblock moves in that direction. Thus, flow reversal is "cushioned" by the pump itself. The degree of "cushion" is determined by the rate (speed) of swashblock reversal.

## B. AUXILIARY PUMP (Gerotor Type)

See Figure 4. The inner element of the gerotor pump shown has one "tooth" less than the outer element thus forming a series of "pockets". As the inner element is rotated, the outer element also rotates. During the lower half revolution, the size of the "pockets" increases and fluid is drawn through ports from the reservoir. As the rotation continues, the "pockets" of fluid are squeezed during the upper half rotation and fluid is delivered from port 4 through an optional filter to the control, auxiliary devices and Suction/Supercharge Manifold.

## C. SUCTION/SUPERCHARGE MANIFOLD

TYPES A, B, C & D. See Figure 4. The adjustable Pilot Pressure Relief Valve (PPRV) protects the pilot pump, pump controls and any other auxiliary devices connected the pilot pump circuit from overloads.

Exhaust from the Pilot Pump Relief Valve (PPRV), when available, is used to partially supercharge the high pressure pump through small poppet-type check valves. If a cooler is used, internal port 8 is blocked and PPRV exhaust can be ported out port 8A, through cooler, back to port 8B and, (when available) to partially supercharge the high pressure pump. If pressure in the high pressure pump circuit is greater than that of the PPRV exhaust circuit, the small poppet valves will be held shut and pressure will build up until it opens the Back Pressure Relief Valve (BPRV), then allowing exhaust to flow through port 2A. Note: If system is fully supercharged at port 5, port 2A will be plugged and BPRV will exhaust through port 2.

Port 5 is connected to either the reservoir (on suction circuits) or to supercharge system. If high pressure pump is drawing fluid from port "B" and the amount of fluid from the return circuit and/or PPRV exhaust is not sufficient, the large check valve connected to that port will open, allowing the piston pump to draw fluid directly from the reservoir or the full supercharge system. Because the fluid is being delivered from port "A" and high pressure is being generated in that line, the large check valve at port "A" is held closed. Opposite delivery reverses the functions of these check valves.

## D. HIGH PRESSURE RELIEF VALVE MANIFOLD

See Figure 4. As fluid is delivered by the high pressure pump, it passes around the High Pressure Relief Valve (HPRV) poppet stem through the axial slots in the HPRV poppet, the valve is in a balanced state with the spring holding the valve closed against the seat. When pressure generated in the line reaches the relief valve setting, the small pilot relief valve poppet opens and pressure in the spring-end of HPRV poppet decreases. Now, the HPRV is in an unbalanced state. Greater pressure on the stem end forces poppet against spring, lifting HPRV poppet off of seat, exhausting fluid through port 6. When excess pressure is relieved, the pilot relief valve poppet closes, balancing HPRV poppet, while the spring closes the valve on the seat to maintain pressure. Construction provisions are made to dampen the opening and closing action for the HPRV poppet and in turn preventing poppet from chattering.

# IV. SPECIFICATIONS

See reference material, pump control material and individual application circuit for exceptions.

Control connecting rod stroke, from neutral to full stroke (either side) is 0.80 inches (20,32 mm) for all sizes.

## A. HIGH PRESSURE PUMP

Table 2. High Pressure Pump Specifications.

| Pump Size | | 075 | | 170 | | 250 | 320 |
|---|---|---|---|---|---|---|---|
| Minimum drive rpm | | 600 | | 600 | | 600 | 600 |
| Maximum drive rpm, free Suction | | 1400 | | 1300 | | 1200 | 1200 |
| Maximum drive rpm, Supercharge | | 1800 | | 1800 | | 1500 | 1500 |
| Rated rpm | 60 hz. | 1200 | 1800 | 1200 | 1800 | 1200 | 1200 |
| | 50 hz. | 1000 | 1500 | 1000 | 1500 | 1500 | 1500 |
| Delivery at 5000 psi (345 bar) | | | | | | | |
| gpm | 60 hz. | 36.6 | 55.0 | 82.0 | 123 | 122 | 159 |
| lpm | 50 hz. | 115 | 173 | 258 | 387 | 576 | 750 |

## B. OPTIONAL AUXILIARY (PILOT) PUMP (Standard Gerotor-Type)

Gerotor-type pilot pumps of all sizes are available with a number of element widths that determine delivery volume. Check the second part of model code on Gerotor Pump Name-Plate to determine what type pump you have. P2B - **254** - 16S20B is an example for Pump Code Number 254. It will be necessary to figure ratios from the listed data for speeds and pressure other than listed. For other pumps, see manufacturer's specifications.

Table 3. Generated Rotor Pump Specifications.

| Pump Code Number | 169 | 254 | 339 | 390 | 645 | 900 |
|---|---|---|---|---|---|---|
| gpm at 1200 rpm | | | | | | |
| 0 psi | 8.8 | 13.1 | 17.6 | 20.1 | 33.5 | 46.7 |
| 1000 psi | 7.7 | 11.3 | 15.5 | 19.3 | 31.1 | 43.8 |
| lpm at 1500 rpm | | | | | | |
| 0 bar | 41,6 | 62,0 | 83,3 | 95,1 | 158,4 | 221,0 |
| 70 bar | 36,5 | 53,4 | 73,4 | 91,4 | 147,2 | 207,3 |

## C. SUCTION/SUPERCHARGE MANIFOLD

TYPES A, B, C, D, E, & F. The Pilot Pressure Relief Valve (PPRV) and Back Pressure Relief Valve (BPRV) are both adjustable. Their setting depends on type of control used and other circuit requirements. Check individual application circuit for your system requirements. NOTE: The setting of PPRV must be at least 100 psi (6,9 bar) more than that of BPRV.

Table 4. Relief Valve Specifications.

| Pump Size | | 075 | 170 | 250 & 320 |
|---|---|---|---|---|
| Pilot Pressure Relief Valve | | | | |
| Adjustable Range | psi | 25-1000 | 25-1000 | 25-3000 |
| | bar | 1,8-68,9 | 1,8-68,9 | 1,8-206,9 |
| Standard Pressure | psi | 450 | 550 | 650 |
| | bar | 31 | 37,9 | 44,8 |
| Back Pressure Relief Valve | | | | |
| Adjustable Range | psi | 25-1000 | 25-1000 | 40-135 |
| | bar | 1,8-68,9 | 1,8-68,9 | 2,8-9,3 |
| Standard Pressure | psi | 60 | 60 | 60 |
| | bar | 4,1 | 4,1 | 4,1 |

## D. HIGH PRESSURE RELIEF VALVE MANIFOLD

TYPES A, B, C, E & F. The High Pressure Relief Valve (HPRV) is adjustable on all sizes. Maximum setting for all sizes should not exceed 5000 psi (345 bar). For higher pressure applications consult The Oilgear Company.

# V. MALFUNCTIONS AND CAUSES

## A. UNRESPONSIVE OR SLUGGISH CONTROL

1. Faulty control or binding control pistons - see control and opposing operator literature.
2. Cradle (18) binding on cradle bearings (28) or cradle support-plate (30).
3. Insufficient control circuit (pilot pump) volume - operation of other auxiliary devices in circuit may rob volume from control circuit.
4. Low control pressure (pilot pressure relief valve setting) or dirty filter elements in gear pump circuit.
5. Worn cradle bearings (28).

## B. INSUFFICIENT HIGH PRESSURE PUMP VOLUME

1. Delivery limited by faulty control (see appropriate control instruction bulletin).
2. Obstructed suction circuit or insufficient supercharge volume.
3. Insufficient drive motor speed.
4. Worn or grooved cylinder wear-plate (40) and/or port-plate assembly (42).
5. Worn piston/shoe assemblies (32) or piston bores in cylin der halves (34 and 38).
6. Main check valve disc (204) or small check valve disc (208) on pressure side of suction/supercharge manifold struck open or leaking.
7. Main or pilot High Pressure Relief Valve (HPRV) poppets (438 or 408) (485 or 468) stuck in open position; worn or dirty seats or broken springs.

## C. IRREGULAR OR UNSTEADY OPERATION

1. Faulty (unsteady) control. An oscillating stroke indicator stem (1C) is indicative of an unstable control.
2. Reservoir fluid is low or supercharge is insufficient.
3. Air entering hydraulic system.
4. Worn axial piston pump or pilot pump.
5. Faulty output circuit components (cylinders, motors, valves, etc.).

## D. LOSS OF PRESSURE

1. Worn piston pump.
2. Worn or grooved port-plate assembly (41) or cylinder wear-plate (40); port-plate and/or wear-plate separation, from cylinder or each other.
3. Worn piston/shoes assemblies (32) not seated on cradle wear-plate (16).
4. Main or pilot High Pressure Relief Valve (HPRV) poppets (438 or 468) stuck open; worn or dirty seats or broken springs.
5. Faulty output circuit components (cylinders, motors, valves, etc.).

## E. EXCESSIVE OR HIGH PEAK PRESSURE

1. High Pressure Relief Valve (HPRV) set too high.
2. Binding HPRV poppets (438 or 408) (485 or 468).
3. Clogged orifice slots in HPRV main poppet (438 or 485).
4. Unwanted back pressure in HPRV pilot valve discharge circuit; circuit clogged with dirt.

## F. EXCESSIVE NOISE

1. Pump incorrectly being stopped or started under load.
2. Low fluid level in reservoir or insufficient supercharge resulting in cavitation.
3. Air entering hydraulic system.
4. Improper auxiliary (pilot) pump-coupling alignment or mounting not rigid.
5. Suction line problem i.e.; obstructions in line, line too long, line diameter too small or line has too many bends or loops. This applies to main pump and auxiliary (pilot) pumps.
6. Broken or worn piston/shoe assembly (32).
7. Worn or pitted bearings (35 and 50).
8. Pump rotating in wrong direction.
9. HPRV not seating properly or dampers (432) not operable.

## G. EXCESSIVE HEATING

1. Operating pump above rated or peak pressure.
2. Low fluid level in reservoir or insufficient supercharge.
3. Air entering hydraulic system.
4. Worn auxiliary (pilot) or piston pump.
5. Worn or grooved cylinder wear-plate (40) and/or port plate (41).
6. Excessive pump relief valve discharge or leakage.
7. Faulty output circuit components (continuous blowing of relief valves or slip through valves, cylinders, etc.).
8. Insufficient cooling provision or clogged coolers.

# VI. TESTING AND ADJUSTING

**WARNING: Shut pump off and release pressure from system before removing plugs or pipes, installing gages, etc. Failure to comply with these instructions could result in personal injury or death.**

## A. HIGH PRESSURE RELIEF VALVES (HPRV)

See Figure 11. To check pressure at pump port "A" connect a 6000 psi or 415 bar (minimum) - gage to port "A" flange or port "AB", "AD" or "AE". To check pressure at port "B", connect gage to port "B" flange or port "BA", "BD", or "BE".

**CAUTION:**

**Discharge fluid past High Pressure Relief Valve only long enough to check and adjust setting or excessive heating and damage may result.**

Start pump with control at "neutral" and adjust control for approximately 1/2 volume. Check setting on stroke indicator (1). Be sure HPRV is not being vented through ports 13 or 13B and, on dual pressure heads, pilot pressure is applied to head. Stall ram or output shaft of driven components. Gage will read HPRV setting. Compare reading with "IV-D, Specifications" or your individual application circuit. Make adjustments when fluid is warm. For units with adjustable pilot pressure head (405) or (453), turn pressure adjusting screw (411 or 463) clockwise to increase setting and CCW to decrease. For units with dual pressure pilot heads (415), add shims (417) to increase setting or remove to decrease. Do not adjust for pressure higher than those in specifications.

## B. PILOT PRESSURE RELIEF VALVE (PPRV).

See Figures 8 and 13. To check pressure, fluid should be warm. Install a 1500 psi (104 bar) gage for sizes 075 & 170 and 3000 psi, (207 bar) for sizes 250 & 230, into port 4B or 4C of manifold or remove pipe from port 4A and install one leg of a tee fitting into port, a gage into another, then connect line from auxiliary (pilot) pump to the remaining leg. Compare gage reading with "IV-C, Specifications" or your individual application circuit drawing. Turning the adjusting stem of the auxiliary pump relief valve clockwise increases setting. Turning stem CCW decreases setting.

**NOTE: Port 4C does not exist on size 075 manifolds or modules.**

**CAUTION:**

**Dirty filter elements in the pilot pressure circuit may cause a pressure drop, in turn, restricting available pilot pressure.**

## C. AUXILIARY PUMP (Gerotor Type)

See Figure 13. If pilot pressure is insufficient after adjusting PPRV, check the rest of pilot pressure circuit to be sure fluid is not bypassed or leaking somewhere in the circuit. If not, remove module or piping leading to supercharge manifold, then install a pipe tee fitting in port 4 of the auxiliary (pilot) pump, a needle valve in another leg of the fitting and 1500 psi (104 bar) gage in the remaining leg. **NOTE: Port 4 is always auxiliary (pilot) pump outlet, although, depending on mounted position, it can be facing either up or down, or to either side.** Place a container of a known volume near the needle valve outlet to catch auxiliary (pilot) pump fluid. Start pump with the pump control at neutral and needle valve open. Close needle valve until the gage reads 1000 psi (70 bar), then measure volume pumped into container over a specific time period. Limit discharge to prevent reservoir fluid from going below "low" level. Volume measured should be as listed in Section "IV-B, Specifications".

## D. BACK PRESSURE RELIEF VALVE (BPRV).

See Figures 9 or 10. To check Back Pressure Relief Valve (BPRV) setting, place 1500 psi (104 bar) gage in ports 8B or 8D on sizes 075, 250, 320 and ports 8B or 8C on size 170. Pilot pump delivery must be warm and connected to port 4A. With control set at "neutral", compare gage reading with those listed in Section "IV-C, Specifications" or your individual application circuit dawning. On size 075 and 170 units, BPRV setting can be increased by turning adjusting stem clockwise or decreased by inserting 0.375 bolt size S.A.E. washers that are 0.06 inch (1,5mm) thick between (BPRV) spring (233) and (BPRV) plunger (234). Each washer increases setting 8.5 psi (0,6 bar). Remove shims to decrease setting.

## E. PILOT PRESSURE RELIEF (PPRV)

See Figure 13. To check pilot pressure relief valve setting, install a 1500 psi (104 bar) gage into port "4B" of manifold. Gage will read relief valve setting. Turn adjusting stem of relief valve clockwise to increase setting. Turn counterclockwise to decrease setting.

## F. AXIAL PISTON PUMP

To check for worn axial piston unit, insert high pressure gages good for 1000 psi (70 bar) ABOVE unit rating in ports "A" and "B" or "AA" and "BB" of pump.

**CAUTION:**

**If unit is not equipped with HPRV manifold, block lines at point immediately following the system relief valve Do not block line between pump and relief valve or damage will result.**

Block high pressure lines (A or B) to circuit. Relief valves must be set above 1000 psi (70 bar) without leakage. Check stroke indicator (1) and set pump control at neutral. Before starting pump, remove stroke indicator assembly and insert a dial indicator with an adapter to prevent fluid leakage from the fitting.

**CAUTION:**

**Do not keep pump on stroke against blocked line any longer than necessary to check slip.**

Start the drive motor. Both gages should read identical low pressures at neutral. If not, adjust control until pressures read the same. Press dial indicator stem down until it touches ramp on control piston, then set dial indicator for zero. Slowly adjust the pump control for delivery from port "A" or "B" until the gage in the corresponding port reads 2500 psi (172 bar). Record the dial indicator measurement and stop drive motor. The piston pump may require approximately 5% stroke to raise 2500 psi (172 bar). This equals a measurement of 0.017 inches (0.43mm) on dial indicator. In some cases, it may be more convenient to measure control piston stroke, which should be 0.04 inches (1,02mm) to raise 2500 psi (172 bar). Additional stroke indicates wear, but does not become critical until it impairs performance.

# VII. DISASSEMBLY

## A. GENERAL

Refer to Figures 8 thru 13. It will be advantageous to tag similar parts (particularly screws plugs and o'rings) during disassembly to be certain they will be returned to original location. Do not remove (locator) roll pins unless they are deformed or otherwise in need of replacement.

## B. PREPARATION

For disassembly and assembly, a large crane capable of handling the weight of the pump (see referenced "Specification Bulletin") will be necessary.

While disassembling or assembling unit, we recommend choosing an area where no traces of dust, sand or other abrasive particles, which could damage the unit, are in the air. We also recommend not working near welding, sand blasting, grinding benches and the like. Place all parts on a CLEAN surface. To clean parts which have been disassembled, it is important to use CLEAN solvents. All tools and gages should be CLEAN prior to working with these units and new CLEAN lint free rags used to handle and dry parts.

**WARNING: NEVER attempt to remove or install any components or assembly while unit is running. Always stop the pump, shut-off power and release pressure from the system before servicing or testing. Be sure provisions have been made so case drain line can be disconnected from the unit without causing the line to drain (siphon) the reservoir.**

Disconnect case drain line from port "1" and drain pump case through port "1A" on the bottom of case. If plugs are inaccessible, it may be necessary to remove pump from mounting before draining it. Cap or plug all ports and CLEAN outside of the unit to prevent entry of dust into the system.

Refer to Figures 8 thru 13. Depending upon what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies or disconnect the driveshaft and front housing from the driving shaft and the high pressure piping.

## C. CONTROL GROUP

See Figure 8. See appropriate reference material for controls and opposing operators. Disconnect linkage and piping leading to control, then remove control and opposing operator from case. Remove stroke indicator assembly (1), cradle pin access fitting (2) and o'ring (3). Cradle pin cover (2A), screws (2B) and o'ring (2C) should also be removed on sizes 250 and 320. Press corners of control link washer (4) down, then remove screws (5) to uncouple control piston from control coupling link (6). **Note:- units equipped with VV and VS controls are not equipped with the coupling link assembly.** Remove control pistons and o'rings (7) from case.

**NOTE: Be careful not to drop control coupling link (6), control link washer (4) or screw (5) into pump housing. More inclusive pump disassembly would be required if that happens.**

## D. AUXILIARY (PILOT) PUMP GROUP

**NOTE: Parts and repair information for ALL auxiliary pumps must be obtained from the manufacturer of the pump.**

See Figure 8. Remove screws (8) then slide auxiliary pump assembly (9) from case. Remove o'ring (10) and pull auxiliary pump spline coupling (11) with roll pin (12) from shaft end. If auxiliary pump is of the gerotor type, separate pump case so inner and outer elements of gerotor pump can be inspected. For other auxiliary pump types, see manufacturer's instructions.

## E. REAR HOUSING AND CRADLE GROUP

See Figure 5. Prior to removal of rear housing (14) remove cylinder gap inspection plug (82). Using a feeler gauge, measure the amount of cylinder gap between the scribe marks. **Record this measurement as "Dimension A" for use during inspection and assembly steps.**

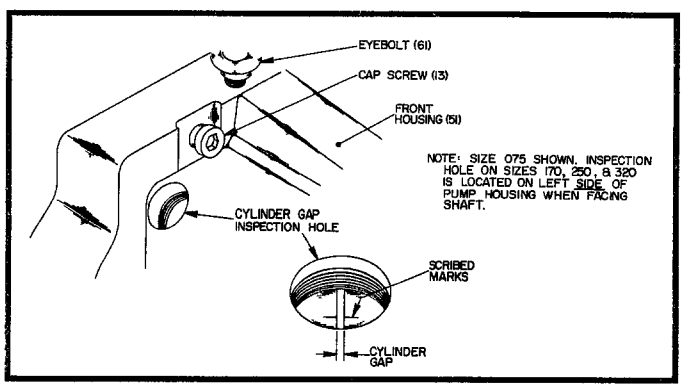


Figure 5. Cylinder Gap Inspection Hole (509464 sh. 2).

See Figure 8. Using a suitable hoist, to support the rear housing (14) remove screws (13). Partially pull rear housing (14) straight out from front (or center) housing (51), without tilting. Separate pump pistons/shoe assemblies (32) and harness plate (31) from cradle wear-plate (16). Remove rear housing and housing halves gasket (15).

Position rear housing on bench, large counterbore up and then remove cradle wear plate (16) and o'rings (16B). Install a 3/8-16 NC bolt into top of cradle control pin (17), then pull from cradle and housing. Remove cradle (18).

PUMPS WITHOUT AUXILIARY PUMPS - remove screws (21), rear case cover (22) and o'ring (10). Remove nylock screw (29), spring washer (29A) and cradle support plate (30) on sizes 170, 250 and 320.

**CAUTION:**

**Do not attempt to remove cam saddle plate from rear housing.**

## F. PISTON PUMP AND PORT-PLATE GROUP

See Figure 8. Mark each piston, its cylinder bore and location in harness-plate for ease of inspection and assembly. Pull pump piston harness-plate (31) with piston assemblies (32), from cylinder. Using a sling, pull pump front cylinder half (34) with inner race of cylinder bearing (35), piston harness fulcrum (33) and roll pin (36) from front housing (51) and driveshaft assembly (48). Do not press off bearing or remove pin unless replacement is necessary. Remove pump rear cylinder half (38). **Do not remove cylinder halves springs (37 & 37B) and shims (37A) from cylinder half at this time. They will be removed during inspection.** Cylinder wear-plate (40) located on dowel pin (39), should come out with cylinder half. Do not remove dowel pin (39) unless damaged. Remove port-plate assembly (41). Dowel pin (42) may remain in case.

## G. SUCTION/SUPERCHARGE MANIFOLD GROUP

(Types A and B described. Others are similar)

See Figure 9. Disconnect any piping connected to manifold. Place a sling around manifold, use a suitable hoist, then remove screws (200) and manifold body (201) from pump. Remove o'ring (203). Pull main check valve spring retainers (202) and remove o'ring (203) from body. Remove main check valve discs (204) with main check valve springs (205). Main check valve seats (206) are pressed into body and should not be removed unless damaged. Remove o'ring (207) and small check valve discs (208) with small check valve springs (209). Small check valve seats (210) are pressed into body and should be removed only when being replaced. Remove o'ring (211). Orifice plug (212) can be inspected without removal. For inspection, pilot pressure relief valve (220) can be removed as an assembly. Back pressure relief valve (230) on sizes 075 and 170 can be removed as an assembly for inspection. On sizes 250 and 320, remove hollow plug (231) and o'ring (232). Remove back pressure relief valve spring (233), any shims (231A) and pull back pressure relief valve plunger (234) from its bore.

## H. HIGH PRESSURE RELIEF VALVE MANIFOLD GROUP

(Types A and B Described. Others are similar)

See Figure 11. SIZES 075 and 170 ONLY. Disconnect all piping leading to manifold. Place a sling around manifold, then remove mounting screws (400) and HPRV (401) from pump. Remove o'rings (402). Remove screws (406), lift pilot pressure relief valve head assemblies (405 or 415) from pins (404), then remove o'rings (407 and 430) from head and manifold. Remove pilot relief valve poppet (408) and spring (409). For pumps equipped with adjustable pressure pilot head, remove adjusting screw plug (414). Remove pilot valve spring cap (412) with o'ring (413) from bore. For pumps with dual pressure pilot heads, insert a rod through pilot pressure/drain connection and push out dual pressure piston (418) with shims (417). Remove high pressure relief spring (431). Remove high pressure relief damper plug (432) with high pressure relief valve poppet assembly. Pull damper plug (432) with damper chamber spring (433), o'ring (434) and damper chamber spacer (435) from poppet. Remove high pressure relief valve poppet (438) and push high pressure

relief valve support rod (437) through poppet to remove high pressure relief valve balanced piston (436).

SIZES 250 and 320 ONLY. Disconnect piping to manifold. Use a suitable hoist, then place a sling around the manifold. Remove mounting screws (450A), then high pressure relief valve manifold (450) from pump. Remove screws (452) and pilot relief valve head (453). Turn out adjusting knob cap (455), with dowel pin (457) and o'ring (458). Pilot relief valve spring guide (465) and o'ring (466) may come out with adjusting knob assembly- if not remove them. Remove pilot relief valve spring (467) and pilot relief valve poppet (468). To inspect seat, remove pilot relief valve cap (469) and using a 1/4-20 x 2 bolt, pull out pilot relief valve seat (470) with o'ring (471). Remove o'ring (480 & 481) from manifold. High pressure relief valve spacer (482) can be pulled off roll pin (483). Remove spacer plug (493). Remove high pressure relief valve springs (484) and pull out high pressure relief valve poppets (485). To inspect seat, remove screws (487) and relief valve exhaust manifold (488). After removing o'ring (489), pull out high pressure relief valve seat spacer (490) and high pressure relief valve seat (491) can be pressed off roll pins (492).

## I. DRIVESHAFT AND SEAL GROUP

See Figure 8. Disconnect coupling from driving shaft and remove pump from mounting. Remove driveshaft coupling key (43). Remove screws (44) and slide driveshaft seal gland (45) with driveshaft seal (47) carefully off driveshaft. If replacement is necessary, seal can be removed from gland. Remove o'ring (46). Pull driveshaft assembly (48) from front housing (51). Remove retaining ring (49), then front shaft bearing (50) can be pressed off shaft if replacement is necessary.

# VIII. INSPECTION

Clean all parts thoroughly. Inspect all seals and o'rings for hardening cracking or deterioration and replace if necessary. Check all locating pins for damage and springs for cracking or signs of fatigue.

**WARNING - Always wear safety goggles when using solvents or compressed air. Failure to wear goggles could result in serious personal injury.**

## A. CONTROL AND OPERATOR GROUP

See Figure 8. See applicable reference material on controls and opposing operators. Control pistons must slide smoothly in housing bores. Check for smooth movement of indicator stem (1C) in indicator cap (1A).

## B. AUXILIARY (PILOT) PUMP GROUP - Gerotor Type

Inspect inner and outer elements for nicks, burrs or signs of wear. Check face plates for scratches or grooves. Check bearings for smooth rotation. If necessary, check auxiliary pump nameplate and replace auxiliary pump as an assembly or contact auxiliary pump manufacturer for current parts information.

## C. REAR HOUSING AND CRADLE GROUP

See Figure 8. Inspect cradle wear-plate (16) for scratches, grooves, cracks or uneven surface. Cradle wear-plate on sizes 170, 250 and 320 can be lightly stoned if wear-plate defects are minor. If defects are still present after stoning, cradle wear-plate must be replaced. Compare cradle bearing (28) thickness in wear area to thickness in pin track. Replace bearings if difference is greater than .005" (0,13mm). If new cradle bearings are required, ON SIZE 075 UNITS, remove screws (24), pull saddle (25) from rear housing (14) and drive studs (27) from back of saddle. New studs must be used when assembling bearings to saddle. If new cradle bearings are required; ON SIZE 170, 250 & 320 UNITS; remove cradle bearing screws (27) and withdraw cradle bearings (28) from cam saddle plate. Check mating surface of cradle (18) for cracks or excessive wear. Replace if necessary. Check cradle support-plate (30) on sizes 170, 250 and 320 for cracks and excessive wear. Replace if necessary. Cradle movement in cradle bearings must be smooth.

## D. PISTON PUMP AND PORT-PLATE GROUP

See Figure 8. Check both control piston surfaces and respective bores for any signs of scratching and galling. Polish with fine emery if needed. Pistons must slide freely in piston bores. Check all pump piston assemblies for smooth action in their bores. Check piston walls and bores for scratches and other signs of excessive wear. Replace if necessary.

Piston shoes must pivot smoothly, but end play must not exceed .003" (0,076mm). Check shoes for end play on piston assemblies (32) as follows: Place square end of piston onto bench and hold down firmly. Pull on end of shoe with other hand and notice end play. A good piston-shoe fit will have no end play, but the shoe must rotate and pivot on the piston ball. Inspect each shoe face for nicks or scratches. Measure shoe thickness, which is that part held between harness-plate and cradle. All shoes must be equal within .0005" (0,013mm). **Replace** any piston **assemblies that do not meet** the aforementioned criteria.

Inspect cylinder bearing (35) for galling, pitting, binding or roughness. Replace if necessary. Closely examine mating faces of cylinder wear-plate (40) and port-plate assembly (41) for flatness, scratches or grooves. If faces are not flat and smooth, the wear-plate will "lift off" of port-plate resulting in delivery loss and damage to pump.

Refer to "Dimension A" (the cylinder gap measurement) taken during "VII E; DISASSEMBLY, REAR HOUSING AND CRADLE GROUP". See table 5 for proper spring (37) shimming (37A) (size 075, 170 and 250 units) or number of springs (37 & 37B) used (size 320 units) for designated cylinder gap measurement (Dimension A).

Rear cylinder half (38) for size 075 thru 250 contain nine spring each. Remove each spring and confirm that (for sizes 075 thru 250) the correct number of shims are behind each spring or (for size 320) the correct number of small springs are in place. If not **(for size 075 thru 250),** place the appropriate number (per Table 5) of shims (37A) in each bore of rear cylinder half (38) and place springs (37) on top of them or **(for size 320)** place the appropriate number of small springs (37B) (per Table 5) in the rear cylinder half (38) in addition to the nine large springs (37).

## E. SUCTION/SUPERCHARGE MANIFOLD GROUP

(Types A and B describes. Others are similar).

See Figure 9. Examine check valve seats (206 and 210), main check valve discs (204) and small check valve discs (208) for foreign matter, scratches, grooves and/or cracks.

Check action of pilot pressure relief valve (220) for smooth operation. If defective, replace entire PPRV assembly. Back pressure relief valve assemblies (230) should be inspected in the same manner and replaced only as an assembly for sizes 075 and 170. For sizes 250 and 320, inspect BRPV plunger (234) and seat for foreign matter, scratches, grooves and/or cracks. Use a lapping compound to lap plunger seat, if necessary. If

Table 5. Cylinder Halves Spring Shimming

| UNIT SIZE | 075 | 170 | | 250 | | 320 | |
|---|---|---|---|---|---|---|---|
| DRIVE RPM | 1800 or less | 1500 or less | 1200 to 1800 | 1500 or less | 1500 | 1200 or less | 1200 to 1500 |
| Nominal cylinder Gap, in in. | .073-.107 | .070-.130 | .075-.110 | .070-.130 | .075-.110 | .070-.100 | .070-.089 |
| No. shims/spring | 0 | 0 | 0 | 0 | 0 | 0* | 0* |
| Cylinder Gap, in. | .108-.142 | .131-.190 | .111-.137 | .131-.193 | .111-.141 | .101-.150 | .090-.130 |
| No. shims/spring | 1 | 2 | 2 | 2 | 1 | 3* | 3* |
| Cylinder Gap, in. | .143-.177 | .191-.250 | .138-.167 | .194-.250 | .142-.172 | .151-.190 | .131-.170 |
| No. shims/spring | 2 | 4 | 3 | 4 | 2 | 6* | 6* |
| Cylinder Gap, in. | .178-.212 | | .168-.197 | | .173-.203 | .191-.220 | .171-.210 |
| No. shims/spring | 3 | | 4 | | 3 | 9* | 9* |
| Each shim thickness, in. | .035 | .030 | | .031 | | | |

*Size 320 units do not use shims to vary spring force. Nine **large** springs (37) are **always** located in equally spaced bores near the outside circumference of the rear cylinder half (38). For gaps more than nominal, the indicated number of **small** springs (37B) are equally spaced in bores located about a smaller circumference.

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lapping compound is used, clean all parts thoroughly. Clean "V" slot in plunger. Plunger-to-body clearance should be .001 inch (0,025mm) at both diameters. Check plunger hole or orifice for obstruction.

## F. HIGH PRESSURE RELIEF VALVE MANIFOLD GROUP

(Types A and B described. Others are similar).

See Figure 11. SIZE 075 and 170 ONLY. Inspect pilot relief valve poppet (408) and seat for foreign matter, scratches, grooves and/or cracks. If damaged, replace poppet. Inspect HPRV poppet (438) and clean axial grooves. Inspect poppet face and seat. To smooth scratched surfaces, lightly lap poppet to seat by hand. Thoroughly clean off all lapping compound. Replace poppet if necessary. Balance piston (436) must move freely in poppet (438) and poppet must move freely in body (401). Inspect thru-holes drilled in damper chamber spacer (435) and plug (432). The holes must be clean to prevent HPRV chatter.

See Figure 11. SIZES 250 and 320 ONLY. Inspect pilot relief valve poppet (468) and seat (470) for scratches or grooves. Replace if necessary. Check HPRV poppet (485). It must be clean with lateral grooves open. Check poppet shoulder and seat (491) for scratches, grooves and cracks. Hand lap smooth and thoroughly. Orifice (486) MUST NOT be plugged. Clean if necessary, but do not change orifice size. Check for smooth movement of poppet (485) in body (450) and seat (491).

## G. DRIVESHAFT AND SEAL GROUP

See Figure 8. Check drive shaft seal (47) for deterioration or cracks. Replace if necessary. Check front shaft bearing (50) for galling, pitting, binding or roughness. Replace if necessary.

# IX. ASSEMBLY

Refer to Figures 8 thru 13. The procedure for assembling the pump in basically the reverse order of disassembly. During assembly install new gaskets, seals and o'rings. Apply a thin film of CLEAN grease or hydraulic fluid to sealing components to ease assembly. If new rotating group is used, lubricate thoroughly with CLEAN hydraulic fluid. Apply generously to all wear surfaces.

**CAUTION:**

**If bearing race is heated in oil to ease assembly, DO NOT heat over 250°F (120°C).**

**NOTE: Size 075 units are assembled differently than size 170, 250 or 320. See appropriate sub-section.**

**SIZE 075 ONLY (sizes 170 & larger, see page 12).**

## A. DRIVESHAFT AND SEAL GROUP

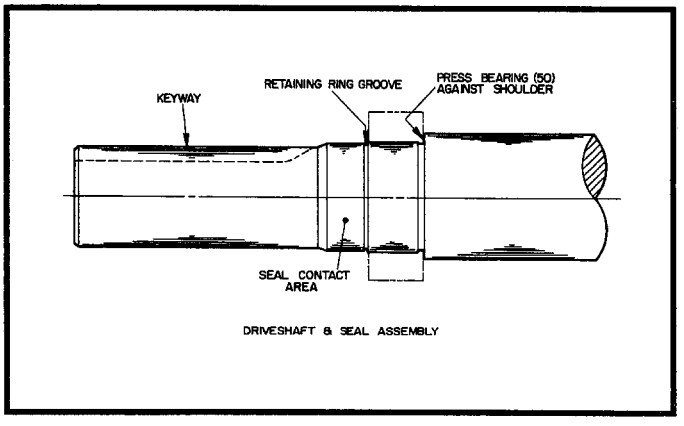


Figure 6. Driveshaft Assembly (509464 sh. 2).

See Figures 6 and 8. If front shaft bearing (50) is being replaced, heat bearing in oil, then press onto driveshaft by pressing on inner race, until snug against shoulder on shaft. Lock in place with retaining ring (49) being careful not to damage "seal contact area" on shaft. Slide driveshaft assembly (48) into front housing (51) until bearing seats in housing bore. It may be necessary to tap lightly on outer bearing race to seat bearing. Install gland o'ring (46) into housing. If driveshaft seal (47) is being replaced, press new seal into driveshaft seal gland (45) until it bottoms-out on gland shoulder. Tape key-way to prevent cutting seal when installing gland. Slide gland onto driveshaft until nose (on gland) contacts outer race of bearing. Secure with screws (44) torqued to 77-87 in. lbs. (8,7-9,8 Nm). Remove tape from key-way, then install driveshaft coupling key (43) onto shaft.

## B. MAIN PUMP AND PORT-PLATE

**NOTE: DO NOT apply grease to face of port-plate assembly (41) and wear-plate (40) that come in contact with each other.**

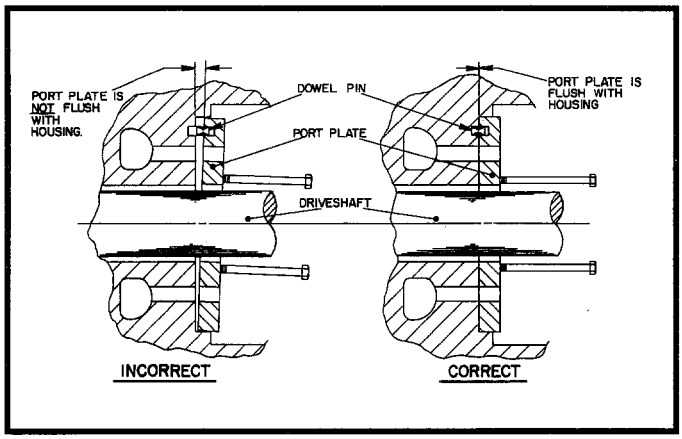


Figure 7. Port-Plate Installation (509464 sh. 2).

See Figures 7 and 8. Apply a light coating of hydraulic fluid to mating faces of port-plate assembly and wear-plate. Install 1/4-20 bolts, 3" or longer, into two holes provided near the center of port-plate and use them to guide port-plate into front housing (51), using dowel pin (42) to locate. Port-plate assembly (41) must be fully seated. Check as follows: Press down firmly on side of port-plate. Using a rubber mallet, tap lightly on opposite side - notice resulting sound. A clicking or rattling sound indicates port-plate is not seated - i.e.; rocking, wobbling, etc. A solid sounding "thud" indicates port-plate assembly is seated properly. Remove and reseat, if necessary.

**CAUTION:**

**Do Not attempt to hammer or force port-plate assembly into seated position.**

If dowel pins were removed, press into rear cylinder (port) half (38) a total of .38" (9,7mm). Apply a light coating of hydraulic fluid to face of wear-plate (40), then locate on dowel pins, which must be below surface in wear-plate.

If cylinder halves springs (37) and shims (37A) weren't returned to their bores during "VIII D. INSPECTION, PISTON PUMP", consult that section for appropriate distribution of springs and shims.

**NOTE: If NEW replacement cylinder halves (34 and 38) are being used, install only cylinder springs (37) into their bores in cylinder half (38). The, cylinder gap will have to be measured and shimming determined after section "C" is completed.**

**NOTE: Marks are scribe onto the outer diameter of each cylinder half. Also, a set of numbers is stamped near the scribe marks. The cylinder halves are not interchangeable, therefore, when assembling, notice scribe marks and numbers. The marks MUST line up and numbers must match. DO NOT interchange cylinder halves. If marks don't line up and/or numbers do not match, DO NOT USE.**

Press or shrink fit cylinder bearing (35) onto other cylinder half (34). Install roll pin (36) into clearance hole in cylinder half (38). Assemble rear cylinder to front cylinder (34). Place piston harness fulcrum (33) in bore of front cylinder half (34) Place pump piston harness-plate (31) on fulcrum (with tapered surface facing the cylinder) and install pistons (32) through harness-plate (31) into the cylinders.

Use a suitable hoist and insert entire cylinder-piston assembly into front housing (51), onto splines of driveshaft. Install outer race of bearing (35) onto cylinder, until it contacts shoulder of front housing (51).

## C. REAR HOUSING AND CRADLE GROUP

See Figure 8. If cradle bearings (28) were removed or replaced; install onto cam saddle plate (25) using new studs (27). If cradle wear-plate (16) has been removed or replaced, apply grease to backside, then install into cradle bore. Place cradle (18) onto pad in bottom of housing and insert cradle control pin (17) into cradle through case drain hole on top of housing. Insert control pistons into control bores of rear housing (14). When used, insert two screws (5) thru link (6) and washer (4) and into control pistons. After screws are tight, back screws one turn, then bend corners of control link washer (4) up to prevent screw from backing out.

Install rear housing (14) with gasket (15) onto front housing (51) and **observe cylinder gap thru inspection hole (port 1-L) as housing screws (13) are tightened.**

**WARNING:**

**If the cylinder gap "A" dimension closes up to less than 0.06 inches (1,5mm) while tightening, STOP... BECAUSE THERE IS A PROBLEM.** Disassemble and check location of all parts.

After housing screws are pulled up tight, cylinder gap (see previous Figure 5) must be measured with a feeler gage.

If original cylinder halves (34 and 38) have been re-installed, the Dimension "A" should be unchanged from that measured during disassembly and shimming confirmed or re-done during "VIII D. INSPECTION, PISTON PUMP" will be correct.

If NEW replacement cylinder halves (34 and 38) are being used, and the gap is Dimension "A" is other than "Nominal" as shown in previous Table 5, it will be necessary to disassemble the pump and follow the shimming procedure covered in "VIII D. INSPECTION, PISTON PUMP".

**WARNING:**

**If the gap in less than required, disassemble as necessary and correct the problem. DO NOT run a pump that has less than the "nominal" gap.**

If pump is not equipped with a pilot pump, insert o'ring (10) into rear case cover bore, then fasten rear cover (22) to housing using four screws (21).

**SIZES 170, 250 and 320 ONLY (Size 075, see page 11).**

## A. DRIVESAHFT AND SEAL GROUP

See Figures 6 and 8. If front shaft bearing (50) is being replaced, heat bearing in oil, then press on inner race, forcing bearing onto driveshaft until snug against shoulder on shaft. Lock in place with retaining ring (49), being careful not to damage "seal contact area" on shaft. Slide driveshaft assembly (48) into front housing (51) until bearing seats in housing bore.. It may be necessary to tap lightly on outer bearing race to seat bearing. Install gland o'ring (46) into housing. If driveshaft seal (47) is being replaced, press new seal into driveshaft seal gland (45) until it bottoms-out on gland shoulder. Tape key-way to prevent cutting seal when installing gland. Slide gland onto driveshaft until nose on gland contacts outer race of bearing. Secure with screws (44) to 25-30 ft. lbs. (33,9 to 40,8 Nm) on size 250 and 320 and 10-15 ft. lbs. (13,5 to 20 Nm.) on size 170. Remove tape from key-way, then install key (43) onto shaft.

## B. MAIN PUMP AND PORT-PLATE

**NOTE: DO NOT apply grease to mating faces of port-plate assembly (41) and wear-plate (40), that come in contact with each other.**

See Figures 7 and 8. Apply a light coating of hydraulic fluid to mating face of port-plate and wear-plate (40), that come in contact with each other. Install bolts, 3" or longer into two (2) holes provided near the center of port-plate. Size 170 is tapped for 1/4-20. Sizes 250 and 320 are tapped for 5/6-18. Use bolts to guide port-plate into front housing (51). Use dowel pin (42) to locate properly. Port-plate assembly (41) must be fully seated. Check as follows: Press down firmly on side of port-plate. Using a rubber mallet, tap lightly on opposite side - notice resulting sound. A clicking or rattling sound indicates port-plate is rocking, wobbling, etc. A solid sounding "thud" indicates port-plate is seated properly. Remove and reseat, if necessary.

**CAUTION:**

**Do Not attempt to hammer or force port-plate assembly into seated position.**

If dowel pins (39) were removed, press into rear cylinder half (38) a total of .38" (9,7mm). Apply a light coating of hydraulic fluid to face of wear-plate (40), then locate on dowel pins. Ends of pins (39) must be below surface of wear-plate (40).

If cylinder halves springs (37 & 37B) and shims (37A) weren't returned to their bores during "VIII. INSPECTION, D. PISTON PUMP", consult that section for appropriate distribution of springs and shims.

**NOTE: If NEW replacement cylinder halves (34 and 38) are being used, install only cylinder springs (37) into their bores in cylinder half (38). The cylinder gap will have to be measured and shimming determined after section "C" is completed.**

**NOTE: Marks are scribe on the outer diameter of each cylinder half. Also, a set of numbers is stamped near the scribe marks. These cylinder halves are not inter changeable, therefore, when assembling, notice scribe marks and numbers. The marks MUST line up and number must match. DO NOT interchange cylinder halves. If marks don't line up and/or numbers do not match, DO NOT USE.**

Using a suitable hoist, install rear cylinder half (38) into housing (51) with cylinder springs (37) and shims in bores. If cylinder bearing (35) was replaced, press or shrink inner race onto cylinder half (34). If roll pin (36) was removed, reassemble into cylinder half (34).

Cylinder half (34) and driveshaft are both splined. Line up roll pin (36) with hole in cylinder half (38) then, using a suitable hoist, install cylinder half (34) onto driveshaft. Hold pump piston harness-plate (31) against piston harness fulcrum (33) and insert a piston assembly (32) thru harness-plate and both cylinder halves. Rotate this piston to the top and then insert another piston at the bottom. After this is done, rotate the cylinder so the two pistons are near the horizontal, then insert the remaining pistons. "DUMMY" pistons, available from the Oilgear Company can be used to aid in this assembly procedure.

Install outer race of bearing (35) onto cylinder until it contacts shoulder of housing (51).

## C. REAR HOUSING AND CRADLE GROUP

See Figure 8. If cradle bearings (28) were removed or replaced, install onto cam saddle-plate (25) using new cradle bearing screws (27). Place cradle support-plate (30) on top of cam saddle-plate with the radius of each parallel, then secure with two screw (29) and spring washers (29A). If cradle wearplate has been removed or replaced, apply grease to backside, then install into cradle bore. Place cradle (18) in housing and position on cradle support-plate (30). Insert cradle control pin (17) thru case drain hole on top of housing and into cradle. Insert control pistons into bores of rear housing (14). When used, insert two screw (5) thru control link washer (4) and into control pistons. After screws are tight, back screws out one turn, then bend corners of control link washer (4) up to prevent screw from backing out.

Using a suitable hoist, install rear housing (14) with gasket (15) onto front housing (51) while preventing cradle (18) from falling off of support-plate (30). **Observe cylinder gap (see previous Figure 5) thru inspection hole (port 1-L or 1--LA) as housing screws (13) are tightened.**

**WARNING:**

**If the cylinder gap "A" dimension closes up to less than 0.06 inches (1,5 mm) while tightening, STOP ... BECAUSE THERE IS A PROBLEM.** Disassemble and check location of all parts.

After housing screws are pulled up tight, cylinder gap (see previous Figure 5) must be measured with a feeler gage.

If original cylinder halves (34 and 38) have been re-installed the Dimension "A" should be unchanged from that measured during disassembly and shimming confirmed or re-done during "VIII D. INSPECTION, PISTON PUMP" will be correct.

If NEW replacement cylinder halves (34 and 38) are being used, and the gap Dimension "A" is other than "Nominal" as shown in previous Table 5, it will be necessary to disassemble the pump and follow the shimming procedure covered in "VIII D. INSPECTION, PISTON PUMPS".

**WARNING:**

**If the gap is less than required; disassemble as necessary and correct the problem. DO NOT run a pump that has less than the "nominal" gap.**

If gap is correct, tighten screws (13) to the following:

Size 170:- 135-140 ft. lbs. (183-190 Nm).

Sizes 250 and 320:- 193-198 ft. lbs. (261-268 Nm).

If pump is not equipped with a pilot pump, insert o'ring (10) into rear cover (22) bore, then fasten rear cover to housing using four screws (21).

**ALL PUMPS, EXCEPT WHERE NOTED**

## D. AUXILIARY (PILOT) PUMP GROUP

See Figure 8. If necessary, reassemble per manufacturer's instructions. Insert o'ring (10) into bore. Slide gear pump spline coupling (11), with roll pin (12) onto gear pump assembly (9) shaft and insert assembly into rear housing bore until spline coupling engages spline or rear driveshaft. Fasten with screws (8).

## E. HIGH PRESSURE RELIEF VALVE (HPRV) MANIFOLD. (Types A and B described. Others are similar).

SIZES 075 AND 170 ONLY

NOTE: Manifold with blind heads are not equipped with parts No. 431 thru 437. Also, roll pins No. 404 are not used on the blind-head end of manifold.

See Figure 11. Place support rod (437) into bore of balance piston (436), then insert piston into poppet (438). Install o'ring (434) onto damper plug (432), then insert damper chamber spring (433) into plug. Damper chamber spacer (435) has cross drilled holes on one end. Insert cross-drill end into chamber spring.

Insert damper plug assembly into bore of poppet (438), then insert poppet assembly into manifold. Support rod must bottom-out in drilled hole and poppet must seal on seat in manifold.

MANIFOLD WITH BLIND HEADS. Place a stack of shims (424) on poppet (438) until the blind head (420) no longer contacts manifold when blind head spacer (423) is inserted. Remove one shim and reassemble, insert o'rings (422 & 430) and secure head with screws (421). This procedure is necessary to prevent leakage while holding poppet closed.

MANIFOLD WITH DUAL PRESSURE HEADS. Insert shims (417) into dual pressure piston (418) and tap until flat. Insert assembly into dual pressure head (415).

MANIFOLD WITH ADJUSTABLE PRESSURE HEADS. Install relief valve adjusting screw plug (414), with pressure adjusting screw (411) and jam nut (410) into pilot pressure adjustable pilot head (405). Place o'ring (413) onto pilot valve spring cap (412), then insert into bore of adjusting screw.

Insert pilot relief valve spring (409) into bore, then insert pilot relief valve poppet (408) into spring. Place o'rings (407) and (430) into their respective bores. Place spring (431) onto damper plug and guide pilot head assemblies onto roll pins (404). **Important: Pilot poppet must seat in drilled manifold passage.** Secure pilot head (405 or 415) with screws (406). With o'rings (402) in place, secure manifold (401) to pump with screw (400). Torque screws (400) to 90-100 ft. lbs. (122-135 Nm) on size 075 and 180-190 ft. lbs. (244-257 Nm.) on size 170.

SIZE 250 AND 320 ONLY. Guide seat (491) onto roll pin (492) and press in until seated on shoulder. Insert HPRV seat spacer (490) and o'ring (489) into bore, then fasten relief valve exhaust manifold (488) to HPRV manifold, using screws (487). Place spring (484) into poppet (485). Be sure orifice plug (486) is in poppet, then slide poppet into bore until it seats. Locate spacer (482) on roll pin (483), then push into place until shoulder seats. Insert spacer plug (493) into bore of HPRV spacer (482) until it reseats on spring (484). Insert o'rings (480 & 481) into bores. Be sure orifice plug (472) is in drilled passage under port 13, in pilot relief valve head (453). Place o'rings (471) onto pilot relief valve seat (470) and insert seat into pilot head bore. Turning in pilot relief valve cap (469) will press seat in. Place pilot relief valve poppet (468) on one end of spring (467) and spring guide (465), with o'ring (466) on opposite end. Insert dowel pin (457) into spring guide to be held by o'ring (466), then place complete assembly in pilot head bore so poppet seats properly. O'ring (458) must be inside adjusting knob cap (455). Slide o'ring (456) over cap, then insert cap assembly into bore and slide cap over dowel pin (457). Install cap assembly. Fasten assembled pilot heads (453) to manifold, using screw (452). Tighten screws (452) to 234-244 ft. lbs. (336-330 Nm.). Insert o'rings (451) into bores and secure HPRV manifold (450) to pump using screws (450). Tighten to 380 - 390 ft. lbs. (513 - 527 Nm).

## F. SUCTION/SUPERCHARGE MANIFOLD GROUP

(Types A and B described. Others are similar)

See Figure 9. Reinstall all internal plugs and orifices (213) and (212) and external plugs with o'rings (217 & 218).

SIZES 075 AND 170 ONLY. Install BPRV assembly (230) with o'rings.

SIZES 250 AND 320 ONLY. Install BPRV plunger (234) into manifold bore, then insert shims (231A) and spring (233) into plunger bore.

Install PPRV assembly (220) with o'rings. If removed, press small check valve seats (210) into body. Install small check valve discs (208), then insert small check valve springs (209) into poppets. Press main check valve seat (206) into body, if removed. Assemble main check valve springs (205) onto main check valve discs (204), with large spring diameter resting on disc. Install disc onto seat in bore. Align spring retainer (202) fins with ribs in bore, then press into place. Insert o'rings (203, 207, 211) into proper bores, then using screws (200) secure manifold body (201) to pump. NOTE: Orifice (212) drain hole (211) must be aligned with drain hole in pump case. Tighten screws (200) to the torques shown in Table 6.

Table 6. Torques

| PUMP SIZE | Ft. Lbs. | Nm. |
|---|---|---|
| 075 | 90-100 | 122-135 |
| 130 | 180-190 | 244-257 |
| 250 & 320 | 380-390 | 513-527 |

## G. CONTROLS GROUP

See Figure 8. Insert control piston into case bores until they both engage cradle control pin. Be sure piston with slot is on indicator side of pump. When used, align holes in control coupling link (6) and washer (4) with thread tap in control piston. Tighten screws (5) all the way down. After tightening, loosen one turn and bend up a corner of the washer to lock screws in place. Install cradle pin access plug (2), with o'ring (3) in place. Install stroke indicator assembly (1). See reference material for assembly of control and opposing operator. Install o'rings (7), then secure control and operator to pump.

**NOTE: The following applies to Type "K", "V-U" controlled opposing operators.** The spherical end of push pin must face operator head. Flat end must face shims, in control piston.

**SEE SECTION "I. PREPARATION and INSTALLATION"**

O'RING SIZES

ARP 568 UNIFORM SIZE NUMBERS

for O'rings (w/Durometer)

BASIC PUMP

| ITEM NO. | PUMP SIZE 075 | 170 | 250 & 320 |
|---|---|---|---|
| 1B | 908 - 90 | 908 - 70 | 908 - 70 |
| 2C | | | 343 - 70 |
| 3 | 932 - 70 | 932 - 70 | 932 - 70 |
| 7 | 240 - 70 | 240 - 70 | 343 - 90 |
| 10 | 347 - 70 | 355 - 70 | 355 - 70 |
| 16B | | 012 - 70 | 012 - 70 |
| 46 | 240 - 70 | 251 - 70 | 256 - 70 |
| 51C | | | 378 - 70 |
| 51E | | | 906 - 70 |
| 52 | | | 341 - 90 |
| 53 | | | 113 - 70 |
| 80A | 906 - 70 | 910 - 70 | 910 - 70 |
| 81A | 908 - 70 | 908 - 70 | 908 - 70 |
| 83A | 914 - 70 | | |

A & B SUCTION/SUPERCHARGE MANIFOLDS

| ITEM NO. | PUMP SIZE 075 | 170 | 250 & 320 |
|---|---|---|---|
| 203 | 328 - 90 | 232 - 90 | See Note |
| 207 | 213 - 90 | 213 - 90 | 213 - 90 |
| 211 | 211 - 70 | 211 - 70 | See Note |
| 215 | | 334 - 70 | 340 - 70 |
| 218 | 912 - 70 | 912 - 70 | 912 - 70 |
| 232 | | 920 - 70 | |

NOTE: O'rings for sizes 150 & 320 are actually located on the pump - not the suction/supercharge manifold. See numbers 52 & 53 on basic pump parts list.

C, D, E & F SUCTION/SUPERCHARGE MANIFOLDS

| ITEM NO. | PUMP SIZE 075 | 170 | 250 & 320 |
|---|---|---|---|
| 203 | 328 - 90 | 232 - 90 | See Note |
| 208 | 912 - 70 | | 916 - 70 |
| 209 | 908 - 70 | | 908 - 70 |
| 212 | | 910 - 70 | 910 - 70 |
| 214 | | 916 - 70 | 916 - 70 |
| 215 | 334 - 70 | 336 - 70 | 340 - 70 |
| 232 | | 920 - 70 | 920 - 70 |

NOTE: The o'rings for size 250 & 320 pumps are actually located on the pump -- not the suction manifold. See number 52 on basic pump parts list.

PILOT PRESSURE RELIEF VALVE MANIFOLDS

| ITEM NO. | PUMP SIZE 075 | 170 | 250 & 320 |
|---|---|---|---|
| 250 | 912 - 70 | | |
| 252 | 226 - 70 | | |
| 261 | | 912 - 70 | 912 - 70 |
| 263 | | 920 - 70 | 920 - 70 |
| 266 | | 906 - 70 | 906 - 70 |
| 269 | | 228 - 70 | 228 0 70 |

A, B, C, D, E & F HIGH PRESSURE RELIEF VALVE MANIFOLDS

| ITEM NO. | PUMP SIZE 075 | 170 | 250 & 320 |
|---|---|---|---|
| 402 | 332 - 90 | 327 - 90 | |
| 407 | 222 - 90 | 222 - 90 | |
| 413 | 111 - 90 | 111 - 90 | |
| 422 | 222 - 70 | 222 - 70 | |
| 430 | 117 - 70 | 117 - 70 | |
| 434 | 115 - 90 | 115 - 90 | |
| 440 | 906 - 70 | 906 - 70 | |
| 451 | | | 330 - 90 |
| 456 | | | 212 - 70 |
| 458 | | | 011 - 70 |
| 466 | | | 011 - 70 |
| 471 | | | 113 - 90 |
| 480 | | | 333 - 90 |
| 481 | | | 113 - 90 |
| 489 | | | 337 - 70 |

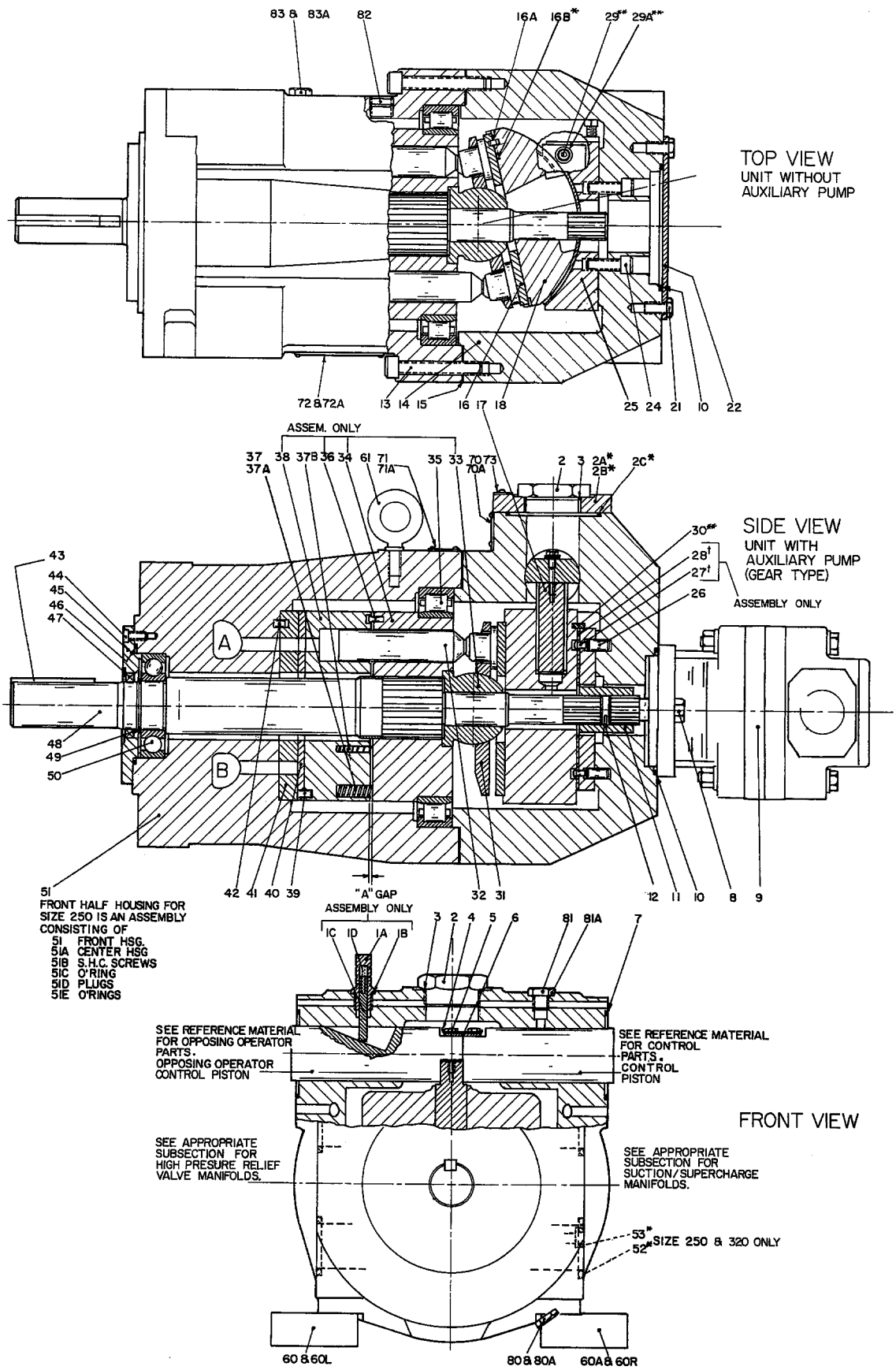


Figure 8. Parts Drawing, "PVL" Pumps (509464 sh. 3).

# X. PARTS LIST

Parts used in this assembly are per Oilgear specifications. Use Oilgear parts to ensure compatibility with assembly requirements. When ordering replacement parts, be sure to include pump type designation, serial number, bulletin number and item number. To assure seal and packing compatibility specify type of hydraulic fluid used.

**BASIC "PVL" PUMP**

| ITEM NO. | DESCRIPTION |
|---|---|
| 1 | Assembly, Stroke Indicator |
| 1A | Cap, Stroke Indicator |
| (S)1B | O'ring |
| 1C | Stem, Stroke Indicator |
| 1D | Spring, Stroke Indicator |
| 2 | Fitting, Cradle Pin Access and Case Drain |
| 2A* | Cover, Cradle Pin |
| 2B* | Screw, SHC |
| (S)2C* | O'ring |
| (S)3 | O'ring |
| 4 | Washer, Control Link |
| 5 | Screw, HHC |
| 6 | Link, Control Coupling |
| (S)7 | O'ring |
| 8 | Screw, HHC |
| 9 | Assembly, Auxiliary Pump |
| (S)10 | O'ring |
| 11 | Coupling, Auxiliary Pump Spline |
| 12 | Pin, Roll |
| 13 | Screw, SHC |
| 14 | Housing, Rear |
| (S)15 | Gasket, Housing Halves |
| (R)16 | Wear-plate, Cradle |
| 16A | Pin, Locating |
| 16B** | O'ring |
| 17 | Pin, Cradle Control |
| 18 | Cradle |
| 21 | Screw, HHC |
| 22 | Cover, Rear Case |
| 24 | Screw, SHC |
| 25 | Saddle-plate, Cam |
| 26 | Pin, Dowel |
| (R)27 | Screw, Cradle Bearing (stud for size 075 only) |
| (R)28 | Bearing, Cradle |
| 29** | Screw, Shoulder |
| 29A** | Washer, Spring |
| (R)30** | Support-plate, Cradle |
| (R)31 | Harness-plate, Pump Piston |
| (R)32 | Assembly, Piston/Shoe |
| (R)33+ | Fulcrum, Piston Harness |
| (R)34+ | Half, Front Cylinder |
| (R)35 | Bearing, Cylinder |
| (R)36+ | Pin, Roll |

| ITEM NO. | DESCRIPTION |
|---|---|
| 37 | Spring, Cylinder Halves Large |
| 37A | Shims, Cylinder Halves Spring |
| 37B++ | Spring, Cylinder Halves Small |
| (R)38+ | Half, Rear Cylinder |
| (R)39 | Pin, Dowel |
| (R)40 | Wear-plate, Cylinder |
| (R)41 | Assembly, Port-plate |
| 42 | Pin, Dowel |
| (R)43 | Key, Driveshaft Coupling |
| 44 | Screw, SHC |
| 45 | Gland, Driveshaft Seal |
| (S)46 | O'ring |
| (S)47 | Seal, Driveshaft |
| (R)48 | Assembly, Driveshaft |
| (R)49 | Ring, Retaining |
| (R)50 | Bearing, Front Shaft |
| 51 | Housing, Front |
| 51A* | Housing, Center |
| 51B* | Screw, SHC |
| (S)51C* | O'ring |
| 51D* | Plugs |
| (S)51E* | O'ring |
| (S)52* | O'ring |
| (S)53* | O'ring |
| 60A | Screw, SHC |
| 60L | Foot, Left Mounting |
| 60R | Foot, Right Mounting |
| 61 | Eyebolt |
| 70 | Plate, Rotation Direction |
| 70A | Screw, Drive |
| 71 | Nameplate |
| 71A | Screw, Drive |
| 72 | Plate, Fluid Recommendation |
| 72A | Screw, Drive |
| 73 | Plate, Caution |
| 80 | Plug, No. 10 SAE |
| (S)80A | O'ring |
| (S)81 | Plug, 8 SAE |
| (S)81A | O'ring |
| 82 | Plug, 3/4" Pipe (Flush Seal) |
| 83 | Plug, 14 SAE |
| (S)83A | O'ring |

* These parts used only on sizes 250 & 320 pumps.

** These parts used only on sizes 170, 250 & 320 pumps.

+ Sold only as an assembly.

++ Size 320 only

(S) Included in type "A" seal kit

(R) Included in type "B" rotary kit.

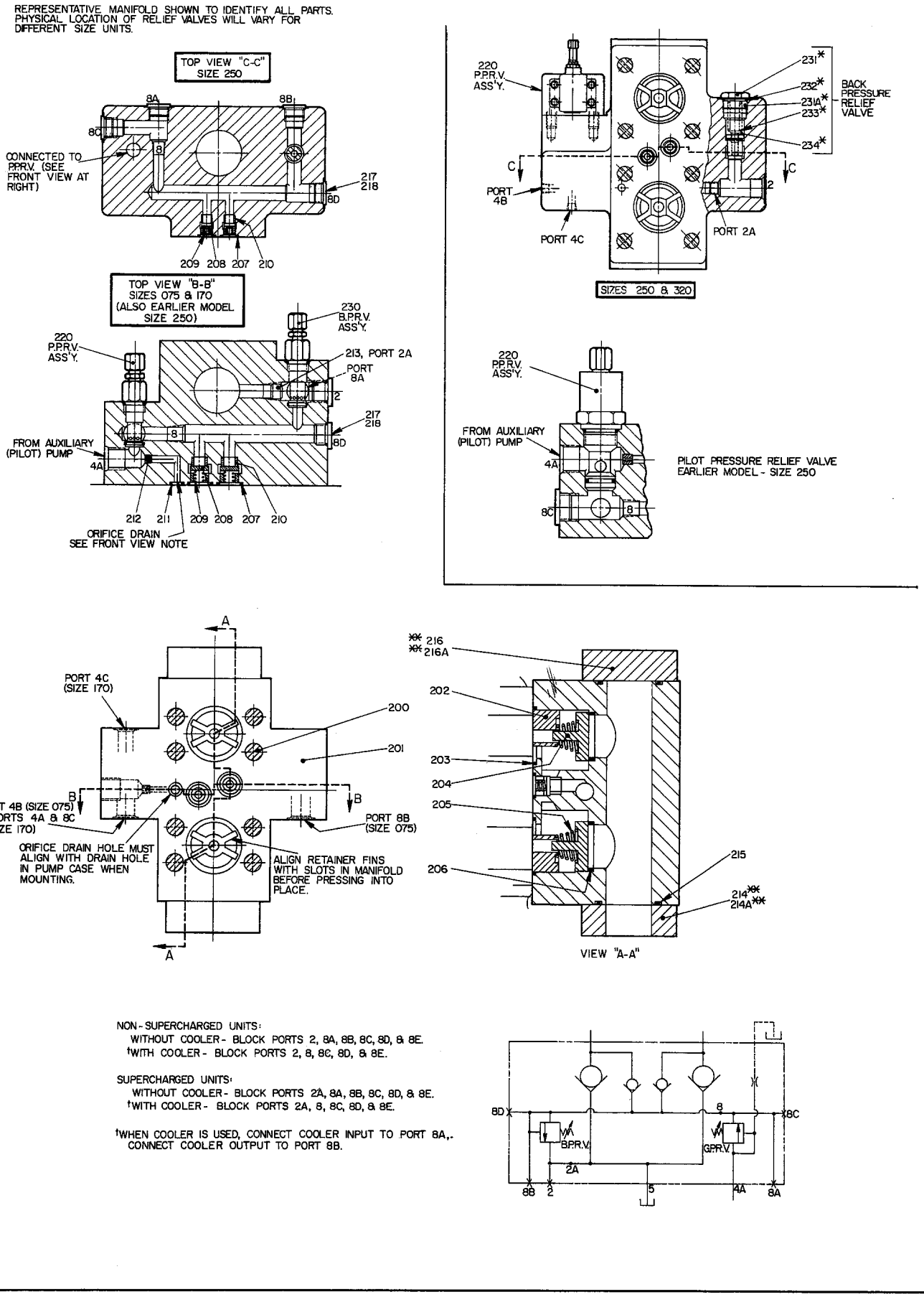


Figure 9. Parts Drawing, "PVL" Types A and B Suction/Supercharge Manifold (509464 sh. 4).

## A & B SUCTION/SUPERCHARGE MANIFOLDS

| ITEM NO. | DESCRIPTION |
|---|---|
| 200 | Screw, SHC |
| 201 | Body, Manifold |
| 202 | Retainer, Main Check Valve Spring |
| (S)203 | O'ring |
| 204 | Disc, Main Check Valve |
| 205 | Spring, Main Check Valve |
| 206 | Seat, Main Check Valve |
| (S)207 | O'ring |
| 208 | Disc, Small Check Valve |
| 209 | Spring, Small Check Valve |
| 210 | Seat, Main Check Valve |
| (S)211 | O'ring |
| 212 | Orifice for Plug-Specify Size |
| 213 | Plug (some manifolds) |
| 214** | Flange, Pipe |
| 214A | Screw, SHC |
| (S)215** | O'ring |
| (S)216** | Flange |
| 216A** | Screw, SHC |
| 217 | Plug, No. 12 SAE |
| (S)218 | O'ring |
| 220 | Ass'y., Pilot Pressure Relief Valve w/O-ring |
| 230 | Ass'y., Back Pressure Relief Valve w/O-ring |
| 231* | Plug, Hollow |
| 231A | Shims |
| (S)232* | O'ring |
| 233* | Spring, BPRV |
| 234* | Plunger, BPRV |

* These parts used only on sizes 250 & 320 pumps.

** These parts used only on sizes 170, 250 & 320 pumps.

(S) Included in type "A" seal kit.

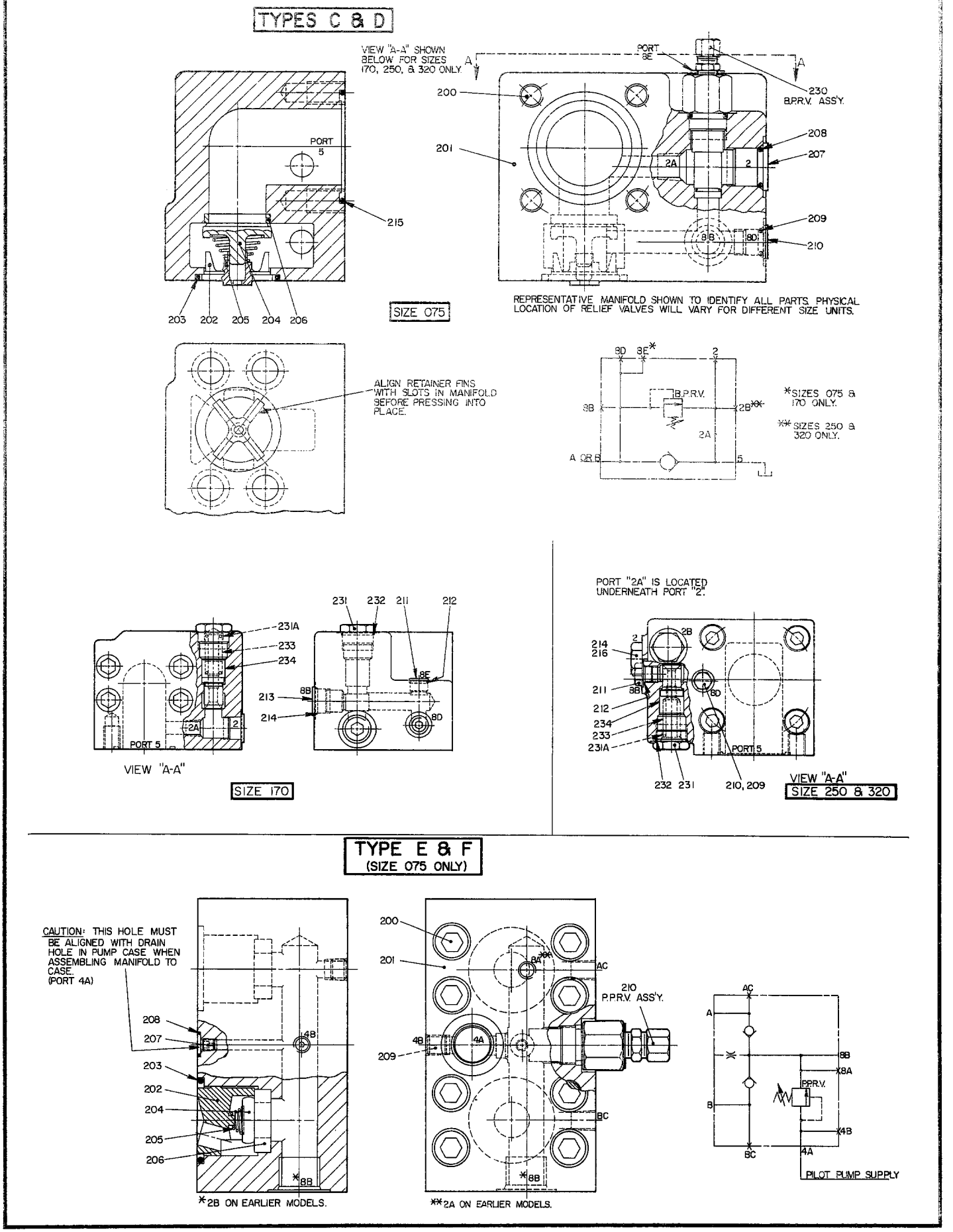


Figure 10. Parts Drawing, "PVL" Types E and D Suction/Supercharge and Types E and F. Supercharge Manifolds (509464 sh. 5).

## C & D SUCTION/SUPERCHARGE MANIFOLDS

| ITEM NO. | DESCRIPTION |
|---|---|
| 200 | Screw, SHC (Mtg.) |
| 201 | Body, Manifold |
| 202 | Retainer, Spring |
| (S)203 | O'ring |
| 204 | Disc, Check Valve |
| 205 | Spring, Check Valve |
| 206 | Seat, Check Valve |
| 207 | Plug, No. 12 SAE |
| 208 | O'ring |
| (S)209 | O'ring |
| (S)210 | Plug, No. 8 SAE |
| 211 | Plug, No. 10 SAE |
| 212 | O'ring |
| (S)213 | Plug, No. 16 SAE |
| 214 | O'ring |
| (S)215 | O'ring |
| (S)216 | Plug, No. 16 SAE |
| 230 | Valve, Back Pressure Relief |
| 231 | Plug, No. 20 SAE |
| 231A | Washer (.375) |
| (S)232 | O'ring |
| 233 | Spring, Compression |
| 234 | Plunger |

## E & F SUCTION/SUPERCHARGE MANIFOLDS

| | |
|---|---|
| 200 | Screw, SHC (Mtg.) |
| 201 | Body, Manifold |
| 202 | Cage, Check Valve |
| (S)203 | O'ring |
| 204 | Disc, Check Valve |
| 205 | Spring, Check Valve |
| 206 | Seat, Check Valve |
| 207 | Plug, .602 NPT x .089 Dia. Orifice |
| (S)208 | O'ring |
| 209 | Plug, 1/4" NPT Pipe |
| 210 | Valve, Pilot Pressure Relief |

(S) Included in type "A" Seal Kit

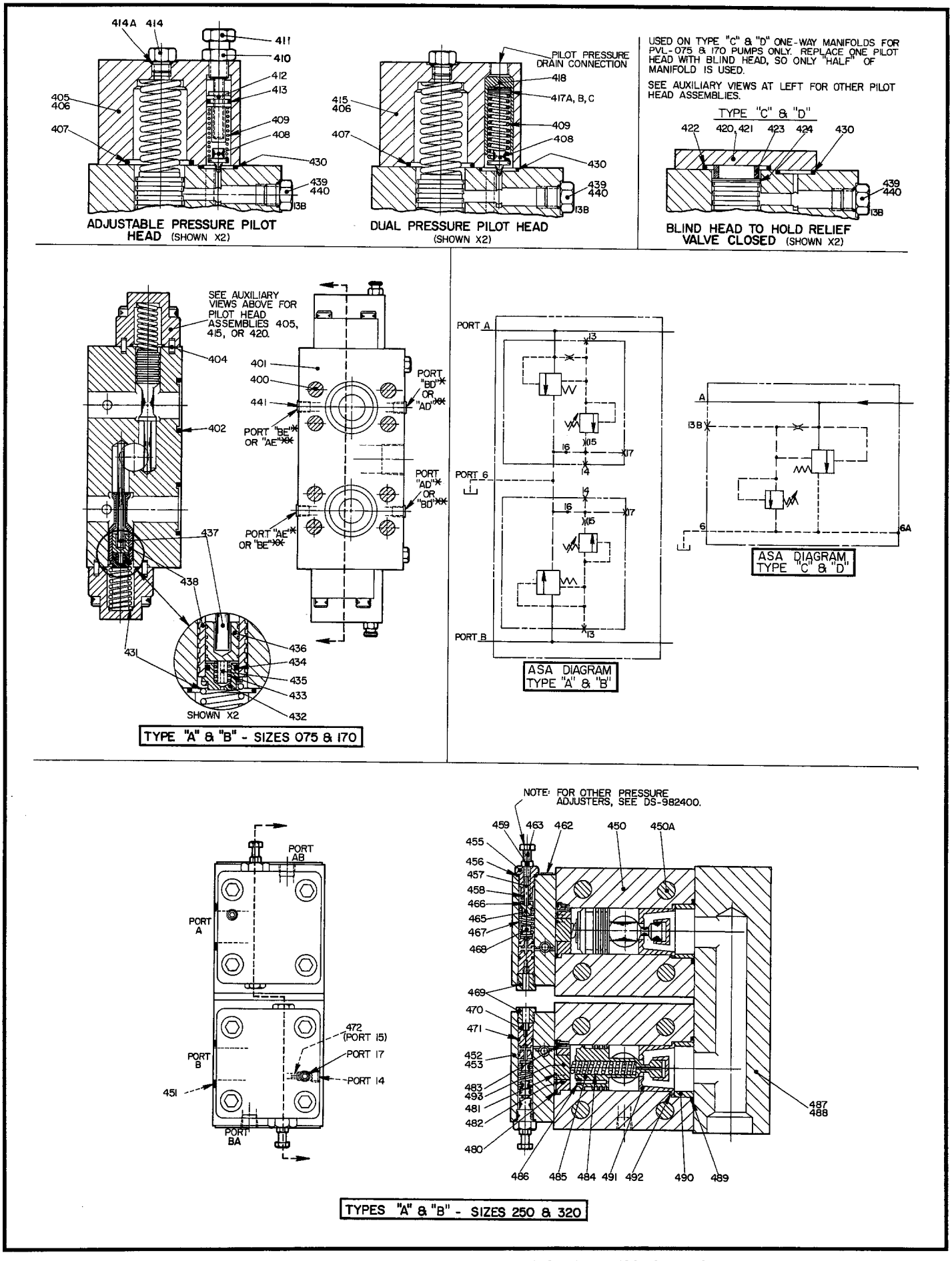


Figure 11. Parts Drawing, "PVL" Types A, B, C and D High Pressure Relief Valves (509464 sh. 6).

## A, B, C & D HIGH PRESSURE RELIEF VALVE MANIFOLDS

SIZE 075 & 170

| ITEM NO. | DESCRIPTION |
|---|---|
| 400 | Screw, SHC (Mtg.) |
| 401 | Manifold, HPRV |
| (S)402 | O'ring |
| 404 | Pin, Roll |
| 405 | Head, Adjust. Pilot Pressure RV |
| 406 | Screw, SHC (Mtg.) |
| (S)407 | O'ring |
| 408 | Poppet, Pilot RV |
| 409 | Spring, Pilot RV |
| 410 | Nut, Jam |
| 411 | Screw, Adjusting |
| 412 | Cap, Pilot Valve Spring |
| (S)413 | O'ring |
| 414 | Plug, Adjusting Screw |
| 414A | O'ring |
| 415 | Head, Dual Pressure Pilot |
| 417A | Shim, .003" |
| 417B | Shim, .005" |
| 417C | Shim, .010" |
| 418 | Piston, Dual Pressure |
| 420 | Head, Blind |
| 421 | Screw, SHC (Mtg.) |
| (S)422 | O'ring |
| 423 | Spacer |
| 424 | Shims, .002" |
| (S)430 | O'ring |
| 431 | Spring |
| 432 | Plug, Damper |
| (S)434 | O'ring |
| 435 | Spacer, Damper Chamber |
| 436 | Piston, Bal. |
| 437 | Rod, Support |
| 438 | Poppet |
| 439 | Plug, HH |
| (S)440 | O'ring |
| 441 | Plug, 1/4" NPT |

SIZE 250 & 320

| ITEM NO. | DESCRIPTION |
|---|---|
| 450 | Manifold, HPRV |
| 450A | Screw, SHC (Mtg.) |
| (S)451 | O'ring |
| 452 | Screw, SHC (Mtg.) |
| 453 | Head, Pilot RV |
| 455 | Cap, Adj. Screw |
| (S)456 | O'ring |
| 457 | Pin, Dowel |
| (S)458 | O'ring |
| 459 | Nut, Jam |
| 462 | Plate, Adj. Direction |
| 463 | Screw, Adj. |
| 465 | Guide, Spring |
| (S)466 | O'ring |
| 467 | Spring, Pilot RV |
| 468 | Poppet, Pilot RV |
| 469 | Cap, Pilot RV |
| 470 | Seat, Pilot RV |
| (S)471 | O'ring |
| 472 | Plug, Orifice |
| (S)480 | O'ring |
| (S)481 | O'ring |
| 482 | Spacer, HPRV |
| 483 | Pin, Roll |
| 484 | Spring |
| 485 | Poppet |
| 486 | Orifice |
| 487 | Screw, SHC |
| 488 | Manifold, RV Exhaust |
| (S)489 | O'ring |
| 490 | Spacer, HPRV Seat |
| 491 | Seat |
| 492 | Pin, Roll |
| 493 | Spacer, Plug |

(S) Included in type "A" seal kit.

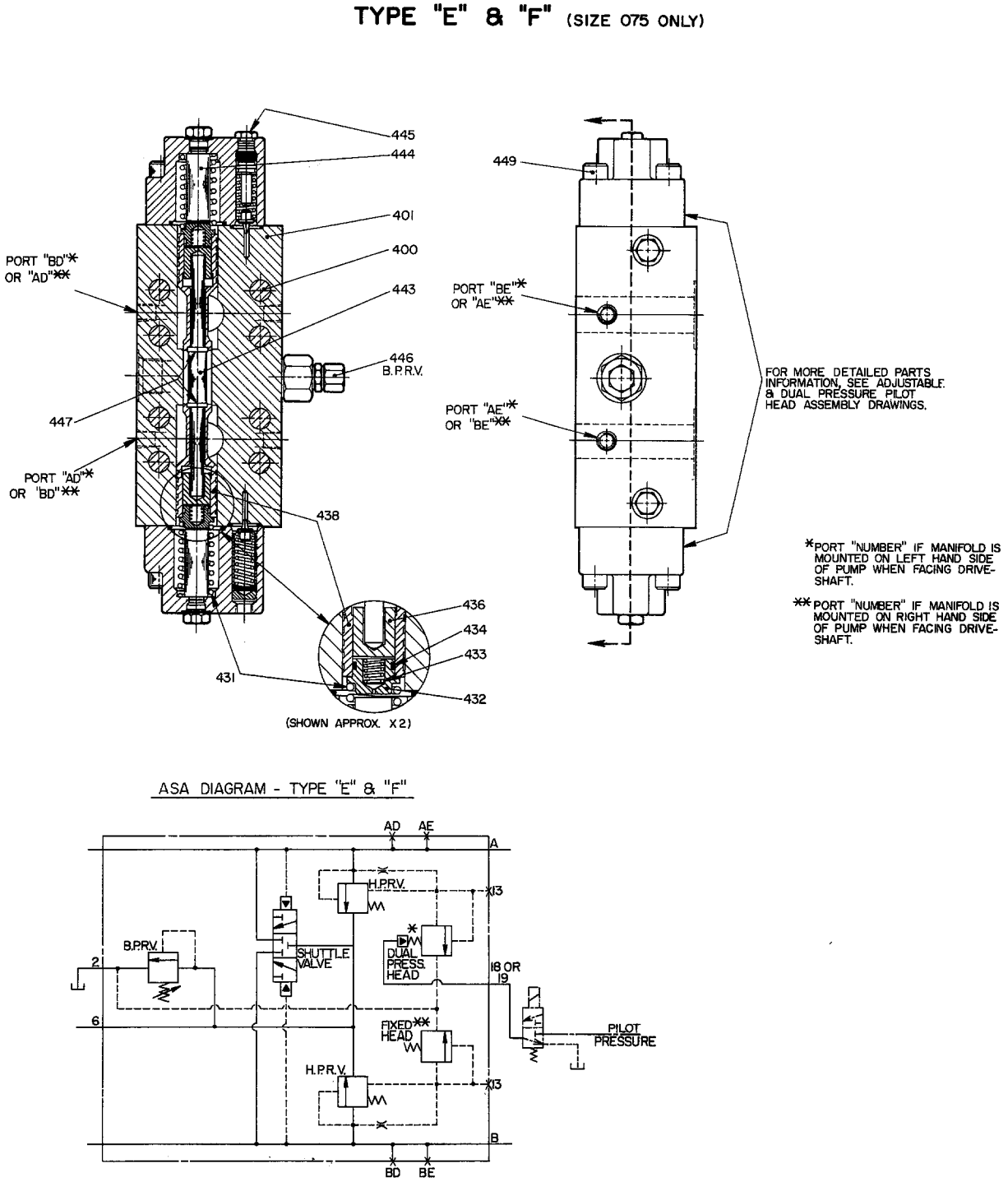


Figure 12. Parts Drawing, "PVL" Types E and F High Pressure Relief Valves (509464 sh. 7).

## E & F HIGH PRESSURE RELIEF VALVE MANIFOLD

| ITEM NO. | DESCRIPTION |
|---|---|
| 400 | Screw, SHC (Mtg.) |
| 401 | Manifold, HPRV |
| 431 | Spring |
| 432 | Plug, Damper |
| 433 | Spring, Damper Chamber |
| (S)434 | O'ring |
| 438 | Poppet |
| 443 | Rod, Shuttle |
| 444 | Stop |
| 445 | Plug, No. 5 SAE |
| 446 | Valve, Back Pressure Relief |
| 447 | Shim |
| 449 | Screw, SHC (Mtg.) |

(S) Included in type "A" seal kit.

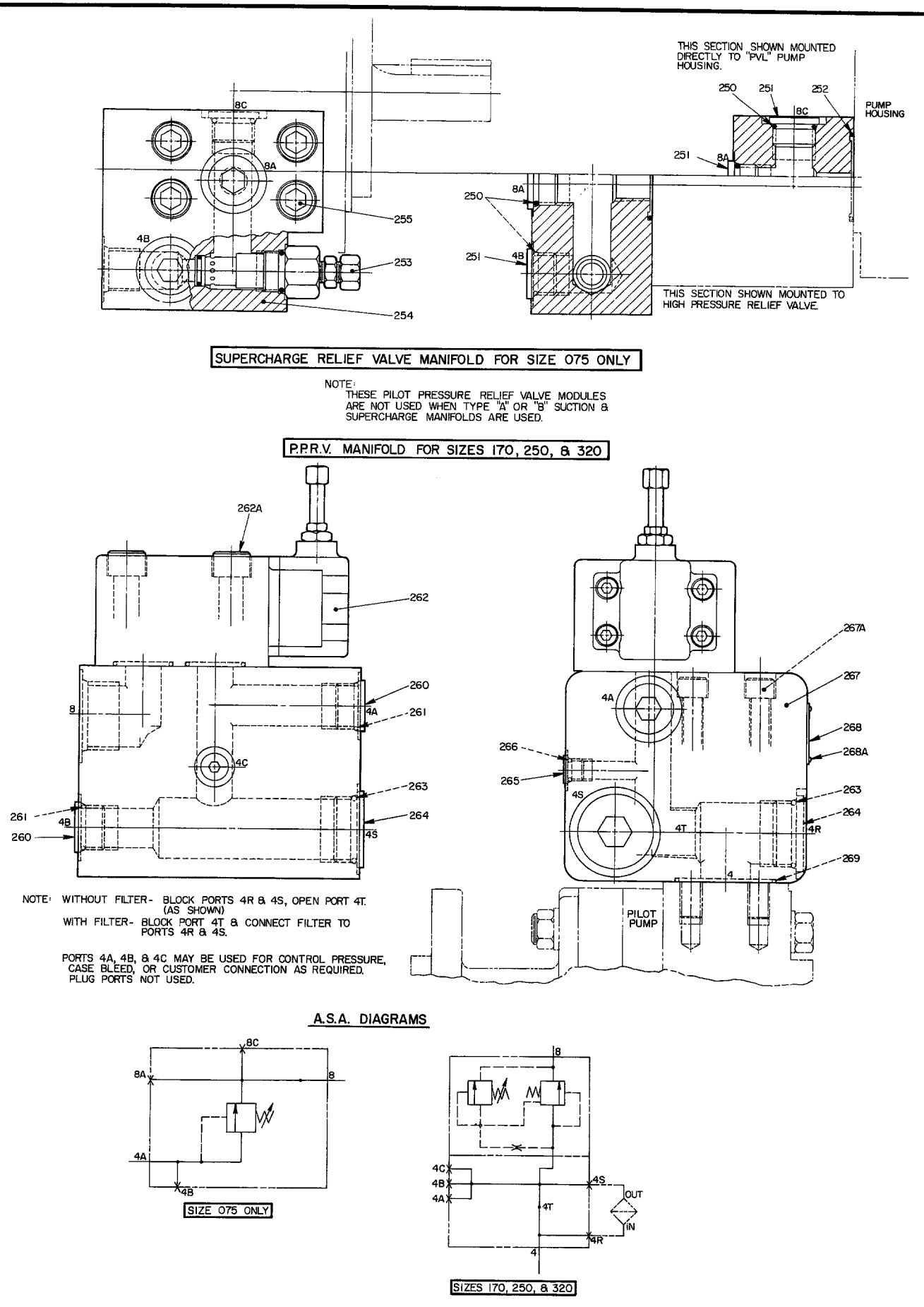


Figure 13. Parts Drawing, "PVL" Pilot Pressure Relief Valve Manifolds (509464 sh. 8).

## PILOT PRESSURE RELIEF VALVE MANIFOLDS

SIZE 075

| ITEM NO. | DESCRIPTION |
|---|---|
| (S)250 | O'ring |
| 251 | Plug, No. 12 SAE |
| (S)252 | O'ring |
| 253 | Valve, Relief |
| 254 | Body, Manifold |

SIZE 170, 250 & 320

| ITEM NO. | DESCRIPTION |
|---|---|
| 260 | Plug, No. 12 SAE |
| (S)261 | O'ring |
| 262 | Valve, Relief |
| 262A | Screw, SHC (Mtg.) |
| 264 | Plug, No. 20 SAE |
| 265 | Plug, No. 6 SAE |
| (S)263 | O'ring |
| 267 | Body, Manifold |
| 267A | Screw, SHC (Mtg.) |
| 268 | Nameplate, Filter |
| 268A | Screw, No. 2 x 1/8 |
| (S)269 | O'ring |

(S) Included in type "A" seal kit.

## XI. AFTER SALES SERVICE

Oilgear builds products that last. However, it is the nature of this type of machinery to require proper maintenance regardless of the care that goes into its manufacture. Oilgear has several service programs to help you.

### "STAY-ON-STREAM" SERVICE:

By signing up for Oilgear's "Stay-On-Stream" program you can prepare for problems before they happen. Certain field tests such as fluid testing, slip testing and electronic profile recording comparisons can be performed by our field service people or your own trained personnel. These tests can indicate problems before they become "down-time" difficulties.

### SERVICE SCHOOLS:

Oilgear holds schools to train your maintenance personal. A "general" hydraulic or electronic school is conducted in our Milwaukee plant on a regular basis. "Custom" schools, specifically addressing your particular hydraulic and electrohydraulic equipment can be conducted in your plant.

### SPARE PARTS AVAILABILITY:

Prepare for future needs by stocking Oilgear original factory parts. Having the correct parts and necessary skills "in-plant" enables you to minimize down-time. Oilgear has developed parts kits to cover likely future needs. Oilgear field service technicians also stand ready to assist your maintenance people in trouble-shooting and repairing equipment.

## OILGEAR EXCHANGE SERVICE

Standard replacement pumps and motors are available to users of Oilgear equipment where comparable units will be returned in exchange. When standard replacements must be modified to replace units which are special, shipment will depend on availability of parts, assembly and test time necessary.

To obtain this service, place an order for an exchange unit and provide the serial number and type designation. The replacement unit will be shipped F.O.B. our factory. Milwaukee, Wisconsin. User retains the replacement and returns the worn unit prepaid to The Oilgear Company for reconditioning and test. When the unit is reconditioned and stocked, the user is billed the cost of reconditioning or a flat rate exchange price if one has been applied to that particular type of unit.

Oilgear
PERFORMANCE
ASSURANCE

**THE OILGEAR COMPANY**
2300 So. 51st. Street
Milwaukee, WI 53219

BULLETIN 947077B

Litho in USA