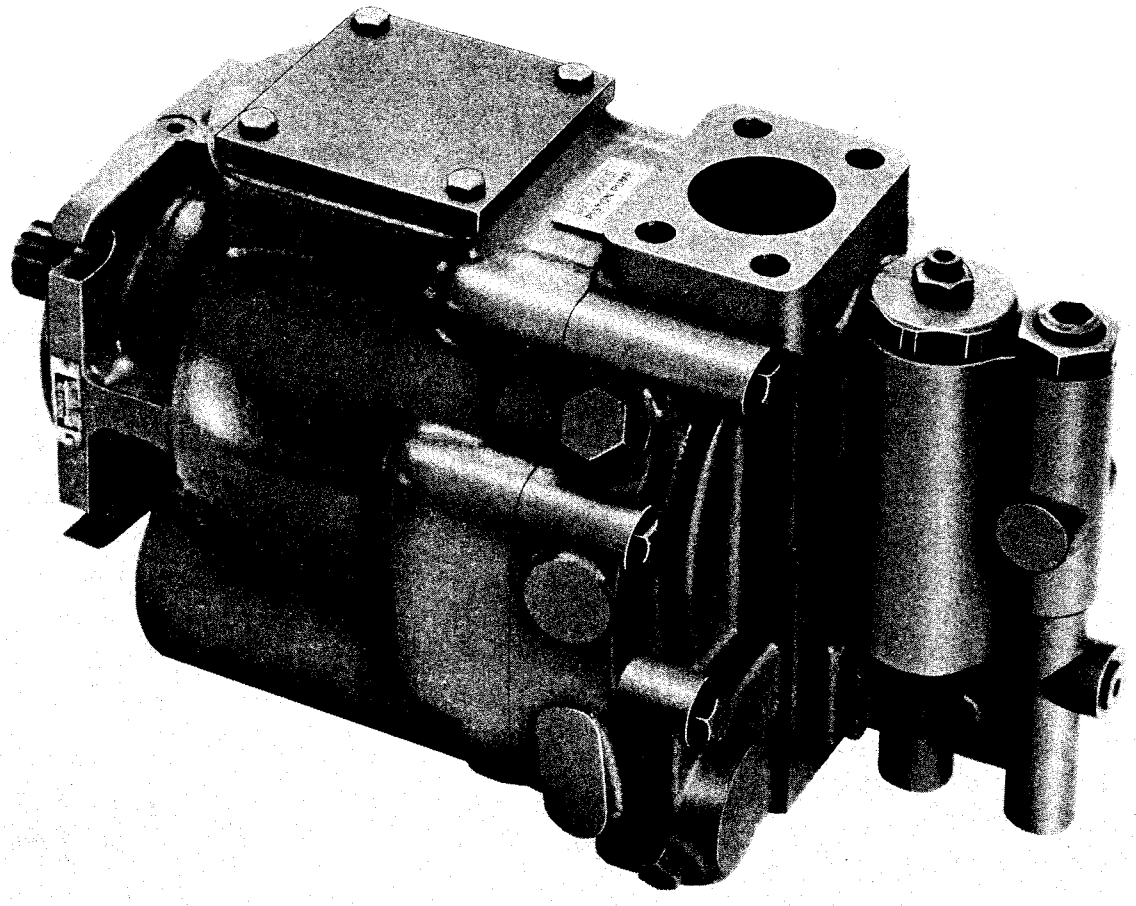
VICKERS®
A TRINOVA COMPANY

Overhaul Manual

Heavy Duty
Piston
Pump

PVE27
PVE35
PVE47
PVE62



Vickers, Incorporated

P.O. Box 302
Troy, Michigan 48007-0302

Revised 4-1-88 M-2240-S

TABLE OF CONTENTS

Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes basic operating characteristics and provides service and overhaul information for PVE 27/35/47/62 series piston pumps. The information contained herein pertains to the latest design series as shown in the model code breakdown in Table 1.

B. RELATED PUBLICATIONS

Service part numbers and installation dimensions are not included in this manual. The service parts drawings that pertain to the PVE series pumps are listed in Table 2. These drawings are available from any sales engineering office.

C. MODEL CODE DESCRIPTION

Each pump is identified by a model code description number that is stamped on the pump's nameplate (i.e. PVE27L-680752). The model code is divided into two parts. The first part (PVE27L) identifies the basic type of pump, the flow rating, and the input shaft rotation. The second part (680752) is the pump assembly number. The assembly number identifies other variations within the pump. These variations include the type of input shaft, port configuration, pump design, type of control, control design, and special option features. Service inquiries should always include the complete model code number.

MODEL CODE BREAKDOWN

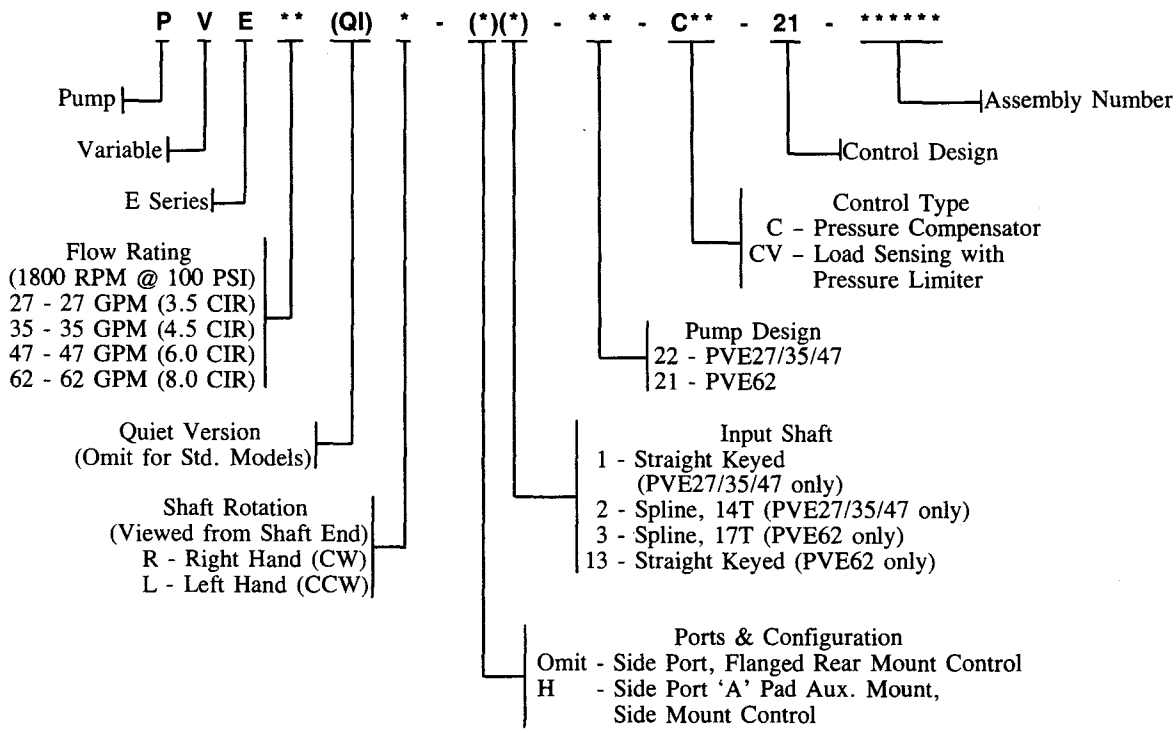


Table 1. Model Code Breakdown

Model	Service Parts Drawing
PVE27*-**-22-C**-21	M-2246-S
PVE35*-**-22-C**-21	M-2247-S
PVE47*-**-22-C**-21	M-2248-S
PVE62*-**-21-C**-21	M-2249-S

Table 2. Related Publications

Section II – DESCRIPTION

A. BASIC PUMP

Figure 1 describes the basic construction of a PVE series piston pump. Major parts include the drive shaft, housing, yoke, rotating group, valve plate, control piston, bias piston, valve block, and compensator control. The rotating group consists of nine pistons, a shoe plate, a swash plate, and a cylinder block.

B. PUMP CONTROLS

Two types of pump controls are available. One type is the standard 'C' compensator control that limits pump outlet pressure to a desired level. The other type of control is the 'CV' pressure limiter/load sensing control. This control limits pump outlet pressure and also regulates pump displacement to match load requirements. Control types are shown in Figures 3 and 4.

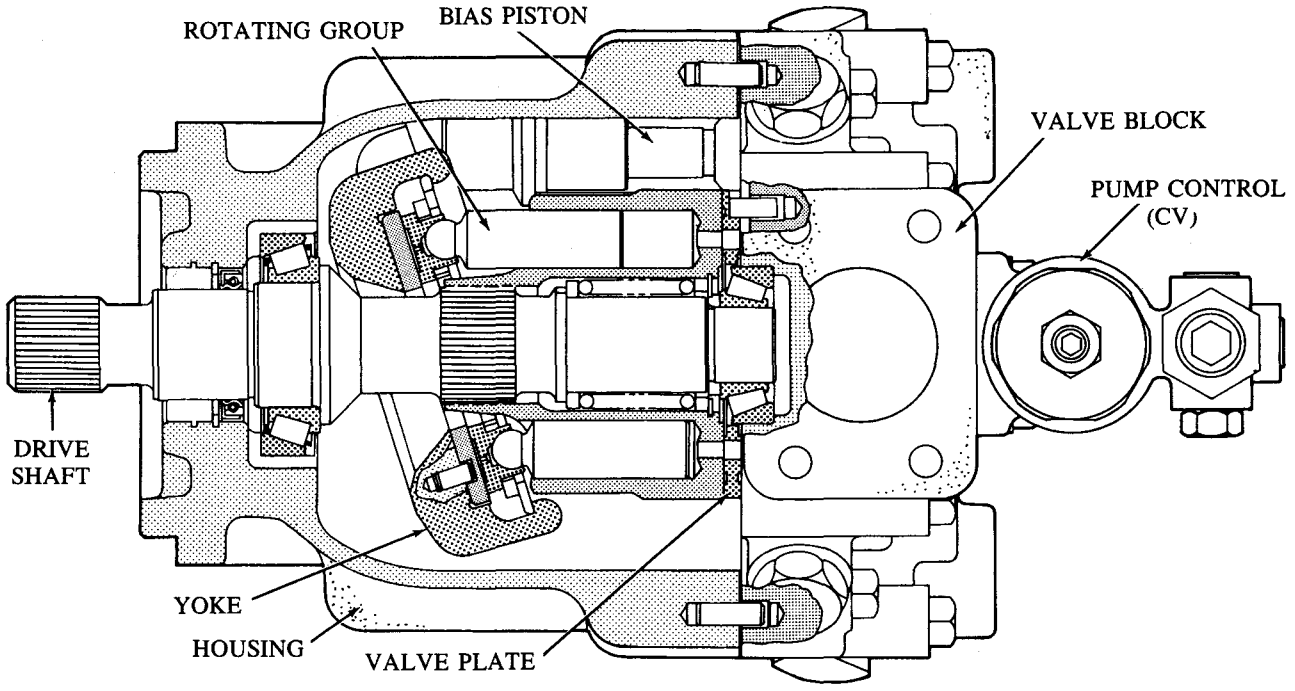


Figure 1. PVE Basic Description

Section III – PRINCIPLES OF OPERATION

A. BASIC PUMP OPERATION

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate. See Figure 2. The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted valve plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

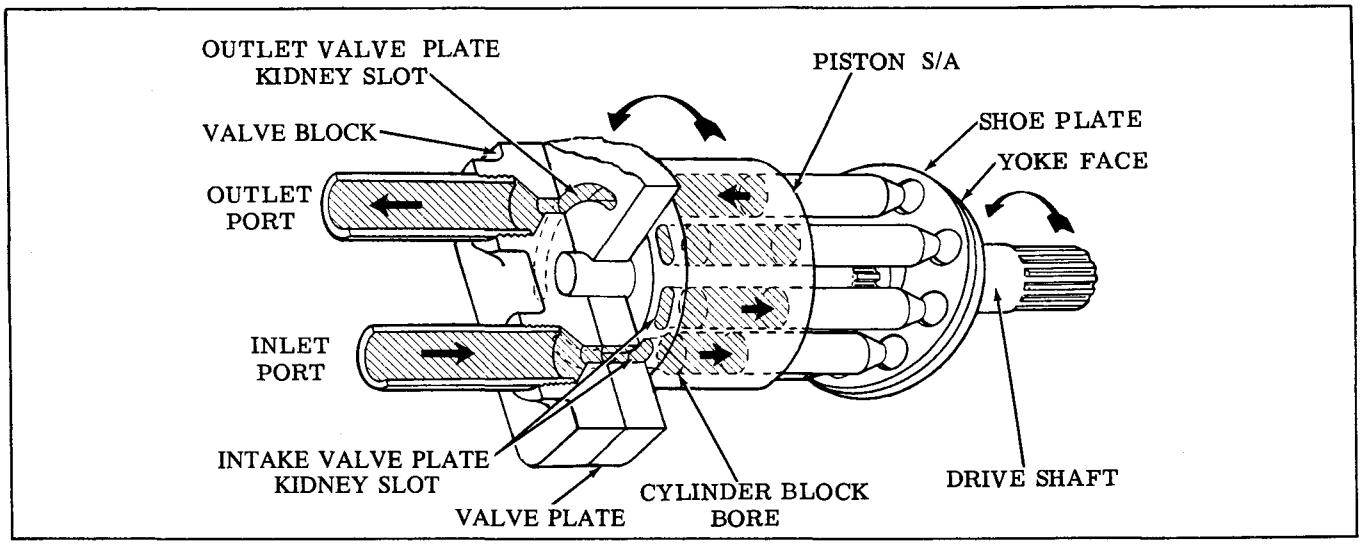


Figure 2. Basic Pump Operation

B. CONTROL OPERATION

1. 'C' Compensator Control - The standard 'C' compensator control is an internally pilot operated, spring offset, 3-way valve. Its purpose is to limit system pressure to some desired level by varying pump displacement. This control only provides the flow required to satisfy the load demand, while maintaining a constant preset pressure. Refer to Figure 3 for the following discussion.

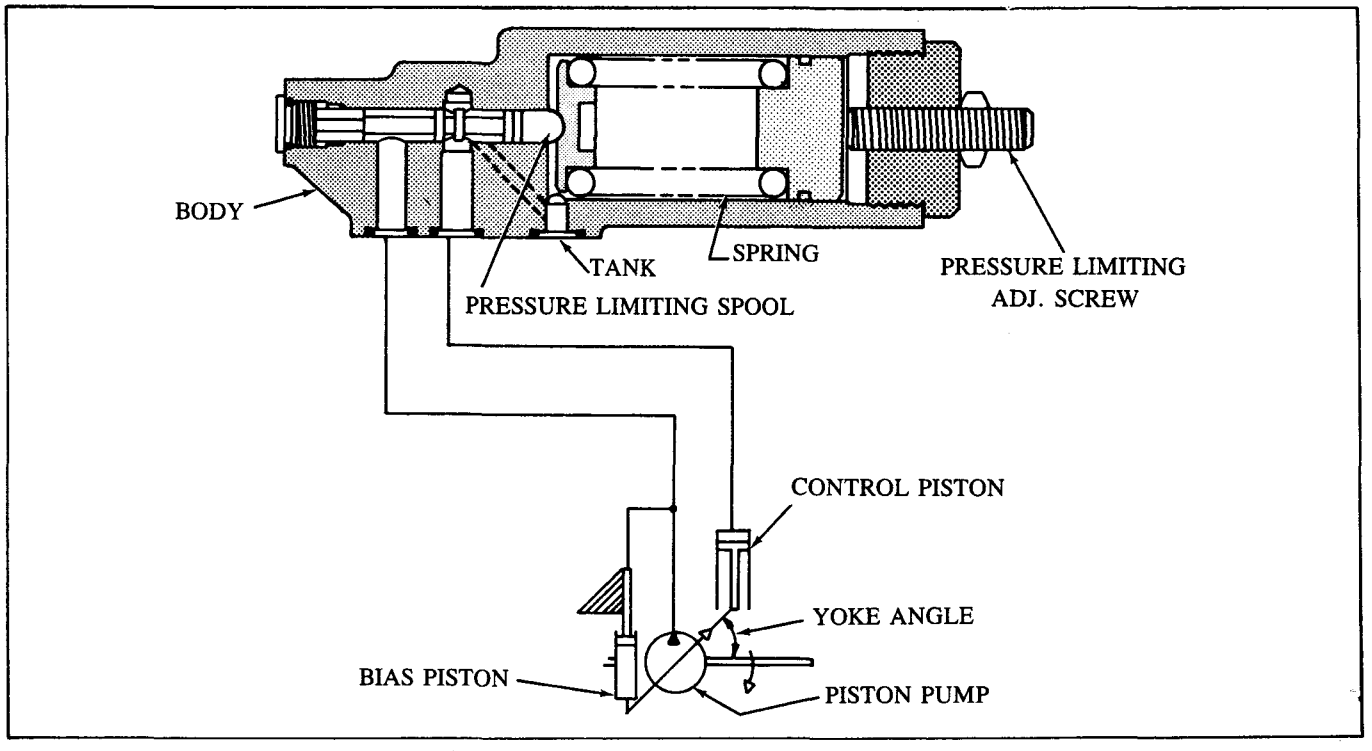


Figure 3. PVE27/35/47/62 Pressure Compensated 'C' Control System

During operation, load or system pressure is continually fed to the bias piston. The function of the bias piston is to maintain the yoke at a full pump displacement position. Load or system pressure is also fed to the compensator spool chamber within the control. Pressure within the compensator spool chamber acts upon the spring force of the compensator spring.

When load or system pressure is below the pressure setting of the compensator spring, the compensator spool remains offset and the pump continues to operate at full displacement. When load or system pressure approaches the compensator pressure setting, the compensator spool will start to move and overcome the compensator spring force. Fluid will then meter into the control piston area. Since the control piston area is twice that of the bias piston, the control piston pushes the yoke towards minimum pump displacement. The compensator control continues to meter fluid to the control piston, adjusting the pump displacement, and pumping only enough fluid to satisfy the load demand while holding the system at a constant pressure.

When load or system pressure exceeds the compensator setting, the compensator spool shifts towards the spring chamber area. A maximum amount of fluid is then metered to the control piston area, causing the yoke to shift to minimum pump displacement.

When system pressure decreases below the compensator pressure setting, the compensator spool returns to its original position and the yoke returns to maintain maximum pump displacement.

2 . 'CV' Control (PVE27/35/47/62) - This control combines the standard 'C' pressure compensator feature with a load sensing feature. The purpose of the 'CV' control is to provide lower horsepower requirements to the load. The load sensing portion of the control functions at pressures below the compensator setting in order to provide constant flow characteristics to the load. Operation of the load sensing control is such that when pressure rises across the load, the load sensing portion of the control adjusts pump outlet flow to provide a constant flow of fluid through the spool orifice within a load sensing type directional valve.

NOTE

In a load sensing system, the load pressure signal must be generated through a special load sensing type directional valve to the CV control. In a multiple spool load sensing valve, the internal logic must be fed through the highest pressure signal to the CV control. For further information on load sensing valves, contact your nearest Vickers sales engineering office. Refer to Figure 4 for the following discussion.

Assume an actuator load pressure is gradually increasing and the pump outlet pressure is below the pressure setting of the compensator. As actuator load pressure increases, the load sensing portion of the control senses a differential pressure (ΔP) between the pump outlet and actuator load. As long as the ΔP between

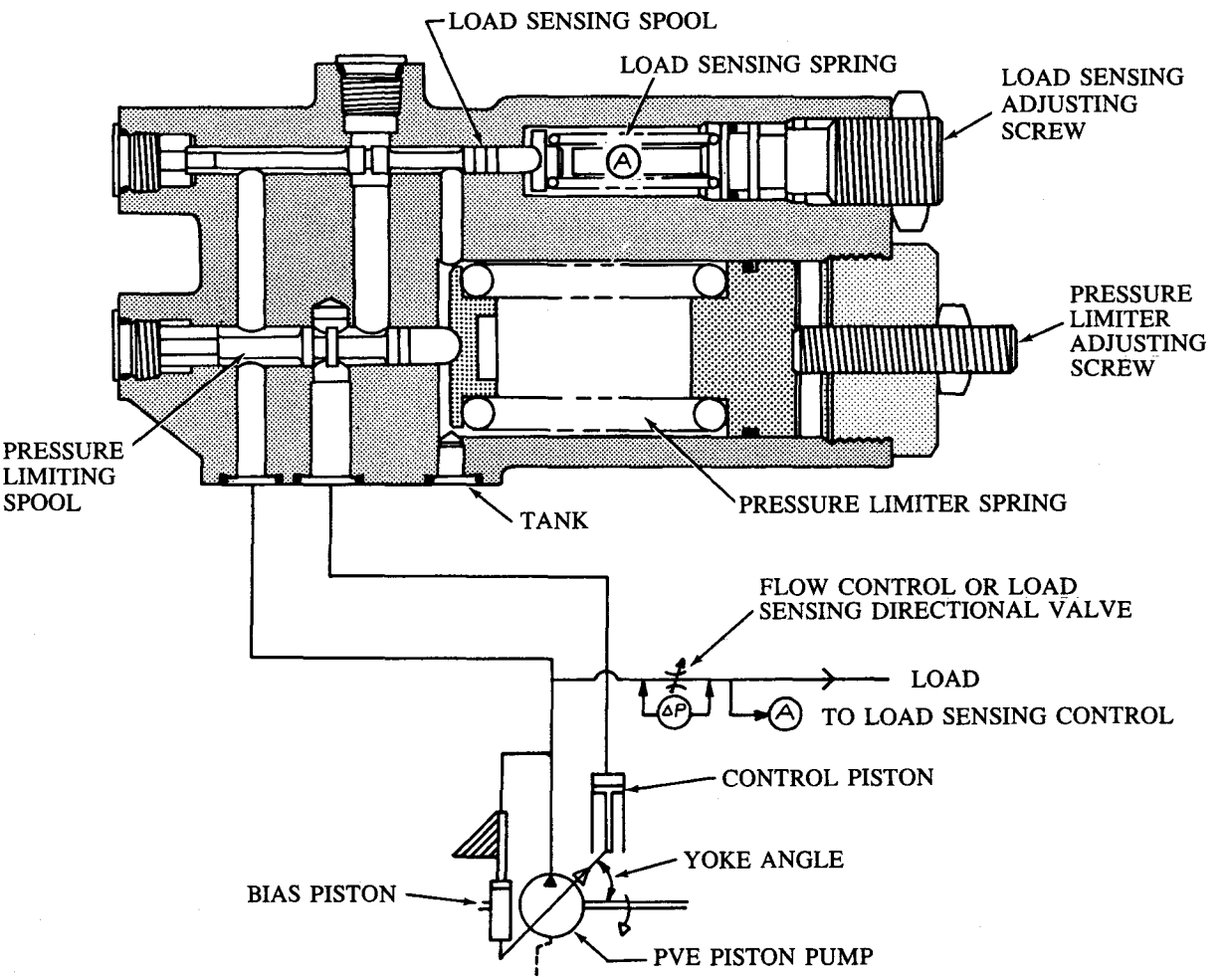


Figure 4. CV Control System (PVE27/35/47/62)

the pump outlet and the actuator load is less than ΔP setting, the pump will deliver maximum flow. When the ΔP exceeds the setting of the load sensing portion of the control, the load sensing spool will move and meter fluid to the control piston area within the pump and decrease pump displacement (flow). As a result, only the required amount of fluid is delivered through the load sensing directional valve to the load.

If the orifice within the load sensing directional valve is significantly reduced or closed, pump outlet pressure will increase to the pressure setting of the compensator. At this condition, the pressure compensator portion of the control overrides the load sensing portion of the control, and moves the yoke to achieve minimum pump displacement at maximum pressure. During this phase, a power loss is created because no work is being performed. To reduce such a power loss, the pump will enter a *standby* condition (minimum displacement @ minimum pressure). The *standby* condition is accomplished through the design of the load sensing directional valve. The load sensing valve meters trapped fluid within the load circuit through its internal valving system to tank. Thus, horsepower requirements to the load are reduced and system efficiency is increased.

NOTE
The earlier PVE62*-**-10 design pump uses a different 'CV' control. This control is shown in control manual M-2231-S.

Section IV - INSTALLATION

A. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION
Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings.

1. Direct Mounting - A pilot on the pump mounting flange assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without engineering approval.

C. SHAFT ROTATION

CAUTION
Never drive a pump in the wrong direction of rotation. Seizure will result and cause expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with clean solvent to remove loose particles.

NOTE
For information on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube.

Section V – SERVICE MAINTENANCE

A. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. See Table 4.

B. CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

C. SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1.. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

D. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet M-2950-S for oil selection is available from Technical Publications, Troy, MI.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your sales representative.

E. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to the system, it should be pumped through a 10 micron absolute filter. The use of a porta-filter transfer unit (PFTU) to filter clean fluid into the system is recommended. For further information on the porta-filter transfer unit, obtain service drawing I-3952-S.

It is important that the fluid be kept clean and free from any substance that may cause improper operation or wear to the pump and other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from entering the system.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. PRODUCT LIFE

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

Section VI - TROUBLESHOOTING

The troubleshooting chart (Table 3) lists common difficulties experienced with pumps and hydraulic systems. The chart indicates probable causes and remedies for each of the troubles listed.

TROUBLE	PROBABLE CAUSE	REMEDY
I. Excessive noise in pump.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended fluid. DO NOT over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	Check inlet (suction) lines and fittings for air leaks.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief valve open.	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair
IV. Loss of fluid.	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating sections of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Misadjusted or broken pump control.	Adjust or replace pump control.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 3. Troubleshooting Chart

Section VII - OVERHAUL

A. GENERAL

In most cases, the pump will not require a complete overhaul as described within this section of the manual. In general, pump disassembly is accomplished according to the item number sequence as shown in Figure 9. For pump assembly, reverse the item number sequence. The item number sequence can also be used as a guide for partial disassembly and assembly. If the pump needs a complete overhaul, obtain the necessary service tools listed in Section VII-B. Repair of this unit is intricate and should not be attempted without proper tools.

B. SERVICE TOOLS

1. Standard Tools
   a. A torque wrench (50 lb. ft. max.) with a short extension.
   b. A ½" and ⅝" socket.
   c. A set of hex key wrenches with a socket adaptor.
   d. A 6" crescent wrench.
   e. A feeler gage.
   f. A medium size screwdriver.
   g. A rubber tip hammer.
   h. A needle nose pliers.
   i. Vice grip pliers.
   j. A large nut wrench that opens to 2 inches.
   k. Internal Truarc pliers.
   l. Petroleum jelly lubricant or equivalent that is compatible with system fluid.
   m. Cleaning solvent that is compatible with system fluid.

2. Special Tools
   a. A dial indicator and accessories.
   b. Bearing race removal tool and shim stock. (See Figure 5.)
   c. A cylinder block spring decompression tool. (See Figure 6.)
   d. Two studs (8" long × 0.437-14 dia./C1-2A thd. class).
   e. Shaft seal assembly tool. (See Figure 7.)
   f. Force indicator tool that will read up to 25 lb.
   g. Bearing race installation tool. (See Figure 8.)
   h. In addition to the above tools, an arbor press is required to assemble bearings. A chain fall is also recommended to handle the pump.
   i. A piece of shim stock or teflon material (8" × 3" × .003").

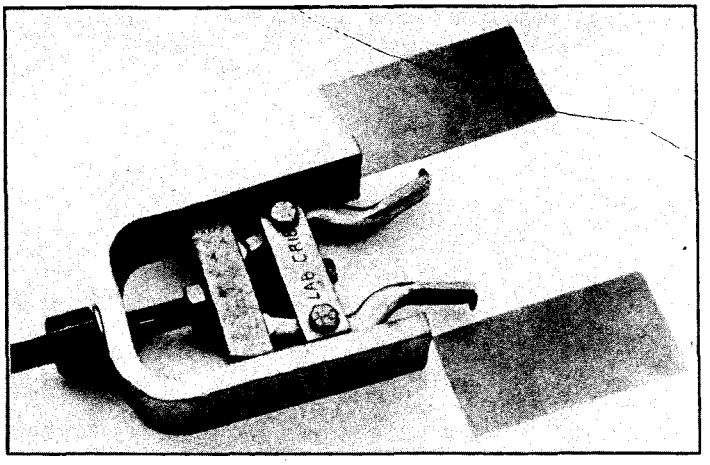


Figure 5. Valve Block Bearing Race Removal Tool and Shim Stock.

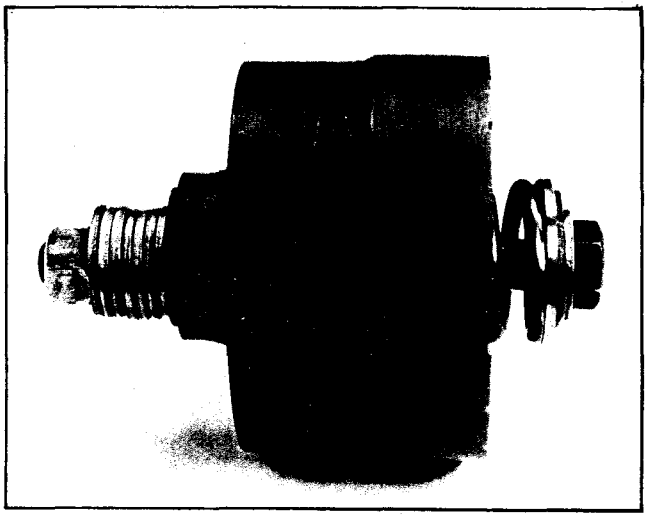


Figure 6. Cylinder Block Subassembly Disassembly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

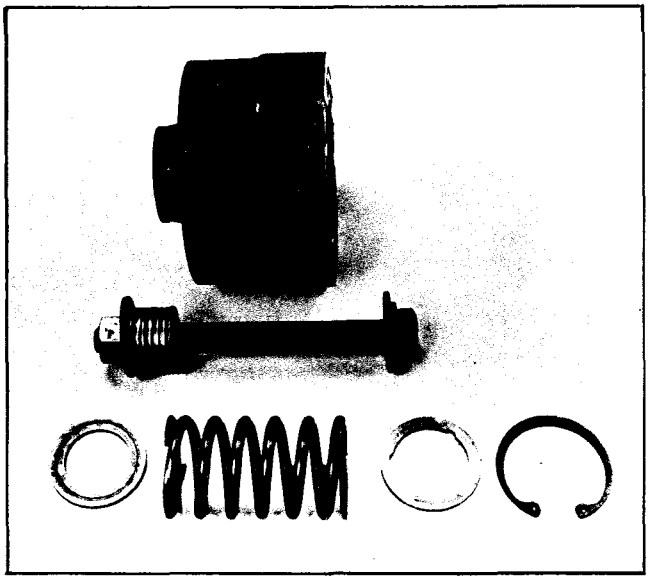
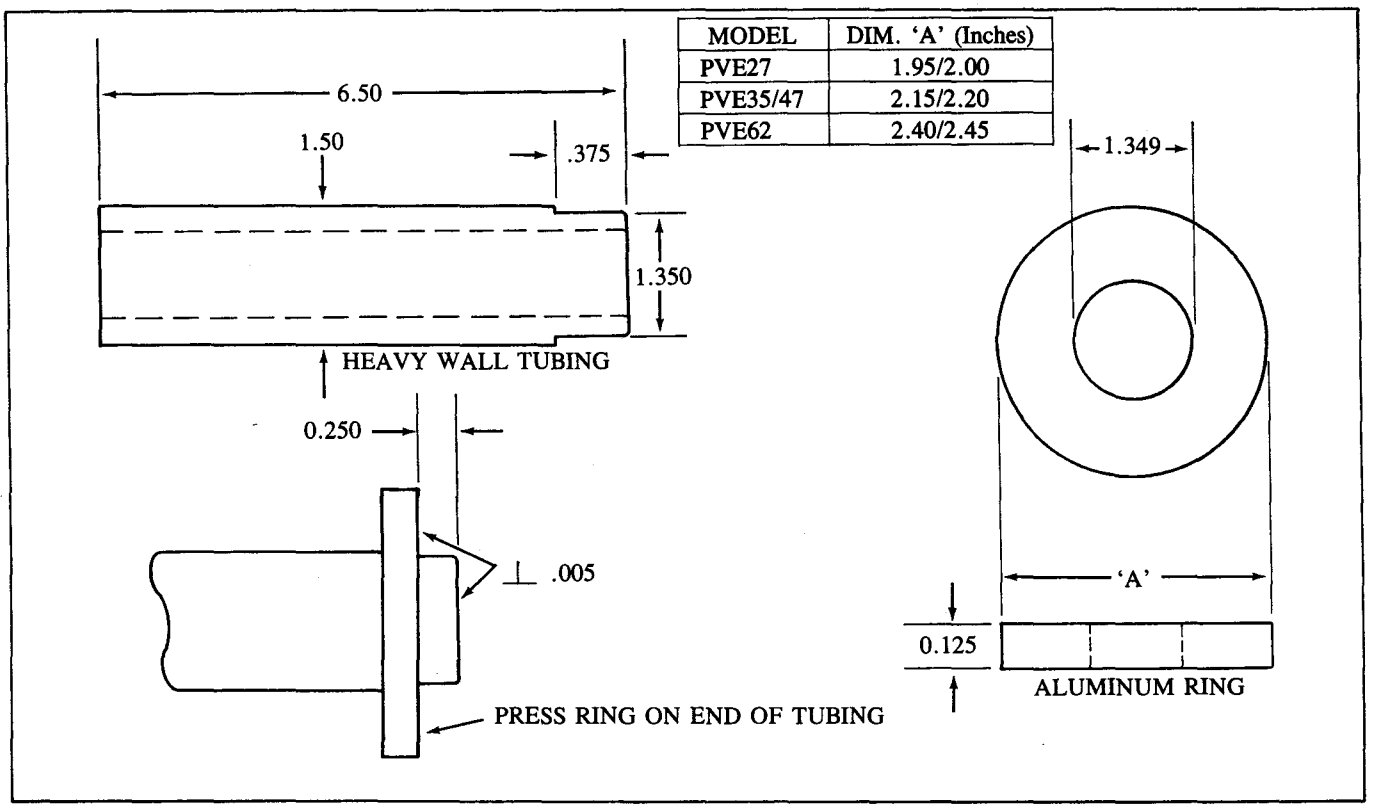
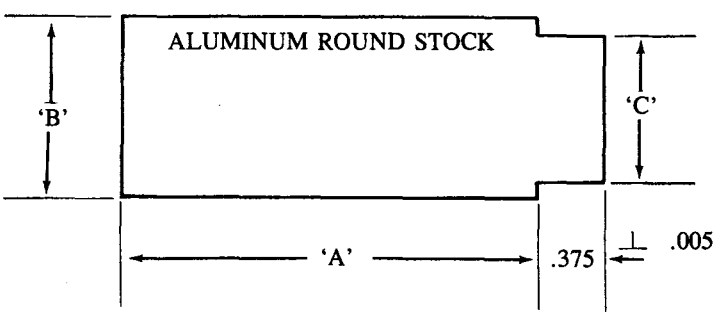


Figure 6a. Cylinder Block Subassembly Parts.



MODEL	DIM. 'A' (Inches)
PVE27	1.95/2.00
PVE35/47	2.15/2.20
PVE62	2.40/2.45

Figure 7. Shaft Seal Driver.



MODEL	BRG. RACE ITEM NO.	DIM. 'A' (Inches)	DIM. 'B' (Inches)	DIM. 'C' (Inches)
PVE27	48	4.00	1.98/2.00	0.98/0.99
	74		2.70/2.80	1.50/1.60
PVE35	48	4.00	2.10/2.20	1.00/1.10
	74		2.75/2.85	1.45/1.55
PVE47	48	4.00	2.30/2.40	1.00/1.10
	74		3.15/3.25	1.65/1.75
PVE62	48	4.00	2.50/2.60	1.20/1.30
	74		3.40/3.50	1.80/1.90

Figure 8. Bearing Race Installation Tool.

C. UNIT REMOVAL

1. Block the vehicle if it is on a slope to prevent uncontrolled movement.

CAUTION

Before breaking the circuit connection, make sure power is off and system pressure is released. Lower all vertical cylinders, discharge accumulators, and block any load that could generate pressure.

2. Drain the fluid from the system.

3. Remove drain plug (28) from the pump's valve block (33) and drain the fluid from the pump.

4. Before breaking any circuit connections at the pump, clean the pump exterior to prevent dirt from entering the system.

5. Disconnect all hydraulic lines at the pump.

6. Remove the unit from the vehicle. Use a chain fall.

7. Put the unit on a clean, steel work bench that will support the unit's weight.

CAUTION

Cleanliness is essential when working on a hydraulic system or system component. Always work in a clean area. Contamination can cause serious damage to a hydraulic system.

8. Before unit disassembly, cap or plug all open circuit connections on the vehicle so dirt does not enter the system.

D. UNIT DISASSEMBLY

NOTE

All parts within the unit must be kept clean during the overhaul process. Handle each part with great care. The close tolerance of

ITEM	NOMENCLATURE	QTY.	ITEM	NOMENCLATURE	QTY.
1, 1a	Screw	4	40	Bias Piston	1
▲2, 2a	O-Ring	3	41	Spring	1
3, 3a	Nut	1	42	Bias Stem	1
4, 4a	Adjustment Screw	1	▲43	O-Ring	1
5, 5a	Plug	1	44	Pin	2
6, 6a	Spring Seat	1	45	Poppet	1
▲7, 7a	O-Ring	1	46	Seat	1
8, 8a	Spring	1	47	Spring	1
9, 9a	Spring Guide	1	48	Bearing S/A	1
10, 10a	Plug	1	49	Shim (Spacer)	A/R
▲11, 11a	O-Ring	1	50	Screw	4
12, 12a	Press. Comp. Spool	1	51	Cover	1
13, 13a	Control Body	1	▲52	O-Ring	1
14	Nut	1	53	Spacer	1
15	Adjustment Screw	1	54	Pin	1
16	Spring Seat	1	55	Spacer Limiter	1
▲17	Back-Up Ring	1	56	Cylinder Block S/A	1
▲18	O-Ring	1	57	Retaining Ring	1
19	Spring	1	58	Spring Guide	1
20	Spring Guide	1	59	Spring	1
21	Plug	1	60	Spring Guide	1
▲22	O-Ring	1	61	Shoe Plate	1
23	Load Sensing Spool	1	62	Piston S/A	9
24	Plug	1	63	Screw	4
▲25	O-Ring	1	64	Cover	1
26	Plug	1	▲65	O-Ring	1
▲27	O-Ring	1	66	Spacer	1
28	Plug	1	67	Shim	A/R
▲29	O-Ring	1	68	Shaft	1
30	Plug	1	69	Bearing S/A	1
▲31	O-Ring	1	70	Bearing S/A	1
32	Screw	8	71	Yoke	1
33	Valve Block	1	72	Swash Plate	1
34	Valve Plate	1	73	Pin	1
▲35	Gasket	1	74	Bearing S/A	1
36	Pin	1			
37	Control Piston	1	▲75	Shaft Seal	1
38	Control Stem	1	76	Retaining Ring	1
▲39	O-Ring	1	77	Housing	1

▲ - Included in seal kit. Refer to parts drawing for seal kit number.

Figure 9. Part Nomenclature

the parts makes this requirement very important. Clean all parts that are removed from the unit with a commercial solvent that is compatible with the system fluid. Compressed air may be used in the cleaning process, however, it must be filtered to remove water and any other contamination.

NOTE

Refer to Figure 9 for the following disassembly procedure.

PVE27/35/47/62 Control Disassembly (Items 1-27 or 1a-13a)

NOTE

If the unit has a load sensing 'CV' control, follow item numbers 1 through 27 as shown in Figure 9. If the unit has a pressure compensator 'C' control, follow item numbers 1a through 13a. The following procedure describes the disassembly of a 'CV' control.

1. Loosen the four screws (1) from the control and remove the control from valve block (33).

2. Remove o-rings (2) from the control mounting surface.

3. Secure the control in a bench vice.

4. Remove nut (3) from adjusting screw (4), then remove the adjusting screw from retainer plug (5).

5. Use a large nut wrench and remove retainer plug (5) from control body (13).

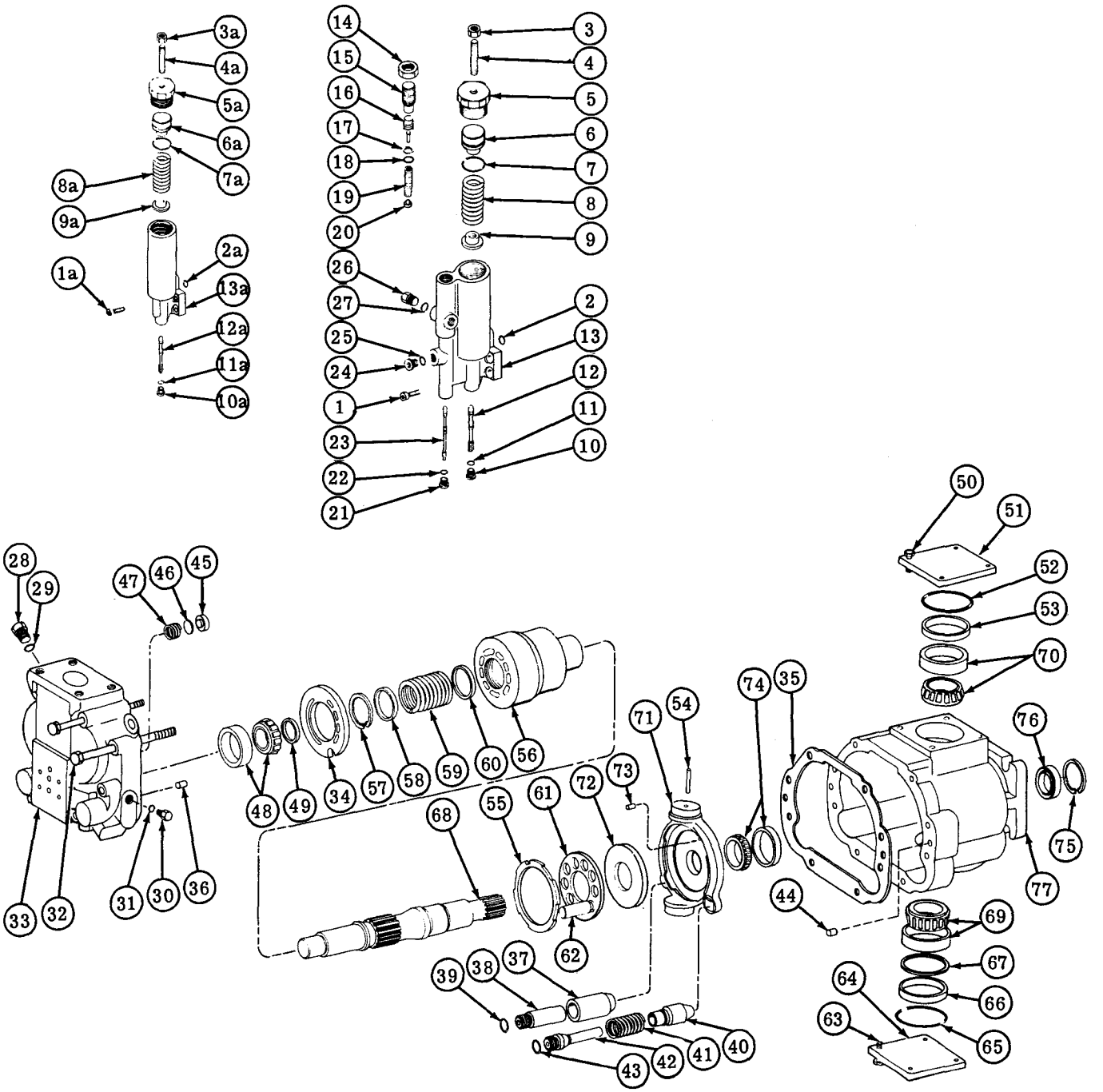


Figure 9. PVE Exploded View

6. Remove parts (6) through (9) from control body (13). Remove o-ring (7) from spring retainer (6).

7. Remove plug (10). Remove o-ring (11) from plug (10).

8. Remove spool (12).

9. Loosen nut (14) and remove parts (15) through (20) from control body. Remove o-ring (18) and back-up ring (17) from spring retainer (16).

10. Remove plug (21). Remove o-ring (22) from plug (21).

11. Remove load sensing spool ()23) from control housing bore.

12. Remove plugs (24) and (26). Remove o-rings (25) and (27) from the plugs.

13. Discard all o-rings and back-up ring.

Valve Block Disassembly (Items 30 through 49)

NOTE
Refer back to Figure 9, PVE exploded view, for following disassembly procedures.

1. Remove plug (30) and o-ring (31) from valve block (33).

2. Loosen the eight screws (32) that attach the valve block to the pump housing (77).

3. At this time, remove two screws (32) that are opposite of each other and replace these screws with two studs. The studs are referenced in Section VII-B, Special Tools.

4. Remove the remaining six screws from the valve block.

5. Remove the valve block from the pump housing.

NOTE
To dislodge valve block (33) from the housing (77), tap on side of valve block with a rubber hammer. Slowly remove the valve block away from the housing. The studs will act as a guide during this procedure. (Note: The valve plate (34) may stick to the cylinder block (56) or valve block (33) during removal of the valve block.) Be careful not to damage the valve plate or valve block during this operation. Once the valve block moves away, do not allow the valve block to move back against the pump housing (77) because the valve plate may get damaged.

6. Remove valve plate (34).

7. Remove and discard housing gasket (35).

8. Remove pin (36) from valve block (33).

9. Remove control piston (37), bias piston (40), and bias spring (41). *DO NOT* remove control stem (38), o-ring (39), bias stem (42), and o-ring (43) from valve block (33) unless they are damaged.

NOTE
If control stem (38) or bias stem (42) needs to be removed from valve block (33), secure the valve block in a sturdy vise. Make sure the vise jaws do not damage the valve block face. Insert a hex key wrench into the stem and turn the wrench counterclockwise. It may be necessary to use an extension on the wrench because the control and bias stem are secured to the valve block with Loctite 270 cement. Remove o-ring (39) and o-ring (43) from the stems.

10. *DO NOT* remove pin (44) from housing (77) unless damaged. If pin removal is necessary, use vice grip pliers.

11. Take a blunt screwdriver and push down on poppet (46). The poppet is located in the valve block face underneath seat (45). Release the screw driver from the poppet and check to see if the poppet returns against seat (45). *DO NOT* remove seat (45), poppet (46), and spring (47) from valve block (33) if the poppet returns against the seat.

12. Remove roller bearing (48) and shims (49) from end of shaft (68).

Rotating Group Removal (Items 50 through 62)

1. Remove the four screws (50) that hold pintle cover (51) to pump housing (77). Remove pintle cover (51), o-ring (52), and spacer (53). Discard o-ring (52).

2. Remove pin (54) from yoke hub.

3. Reach into pump housing (77) and rotate spacer (55) so that the lobes on the spacer unlock shoe plate (61) from yoke (71).

4. Reach in with both hands and remove the complete rotating group from housing (77). The complete rotating group consists of items 55 through 62.

WARNING
DO NOT remove retaining ring (57) from cylinder block (56) because spring (59) is under high compression. Bodily harm may result if the retaining ring is removed without adequate caution. In most cases, the parts inside the cylinder block will not require removal. However, if spring (59) is damaged, the parts within the cylinder block must be removed. See Figure 6 for disassembly instructions.

Shaft and Yoke Removal (Items 63 through 73)

NOTE
Shaft (68) and/or (71) removal is necessary if any of the following conditions are noted.

a. Damage at bearing surface or spline area of shaft (68).

b. Yoke (71) bind (i.e. yoke does not move freely back and forth within pump housing).

c. The yoke shows evidence of heavy wear or cracks.

d. The pintle bearings (69 or 70) are worn or defective.

e. Shaft seal (76) leakage noted during pump operation.

NOTE
If any of the above conditions are noted, perform the following steps.

1. Remove the four screws (63) from pintle cover (64), then remove pintle cover (64), o-ring (65), spacer (66), and shims (67).

2. Secure housing (77) in a vice so that shaft (68) is in a horizontal position.

3. Remove shaft (68) from housing (77) by tapping on spline end of shaft with a rubber hammer.

4. Move yoke (71) side to side against pintle bearings (69, 70) until the yoke hubs dislodge from the pintle bearings.

5. Remove pintle bearings (69, 70) from housing (77).

6. Remove yoke (71) from housing (77).

7. Wash yoke (71) in clean solvent, then remove swash plate (72) from yoke. *DO NOT* remove pin (73) from yoke unless damaged. If a new yoke is installed, obtain a new pin (73).

Bearing & Shaft Seal Removal (Items 48, 74, 75, 76)

1. Remove roller bearing (74) from housing (77).

2. Inspect roller bearings (48 and 74) for pitting and cracks. Turn roller bearings in their associated bearing race and check for roughness and bind. The roller bearings must turn freely within the bearing race with no signs of bind. If a roller bearing shows evidence of bind, wash the bearing in a clean solvent and recheck for bind. If binding persists, replace the roller bearing and bearing race. Refer to Figures 10 and 11 for the bearing race removal procedure.

3. Remove retaining ring (75) from housing (77) with Truarc pliers.

4. Remove shaft seal (76) from housing (77). Refer to Figure 12 for instructions.

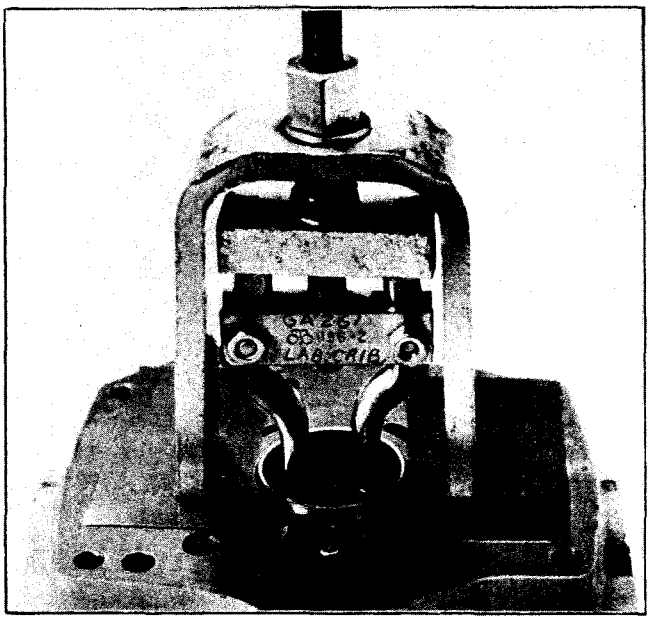


Figure 10. Removal of Bearing Race (48) from Valve Block (33).

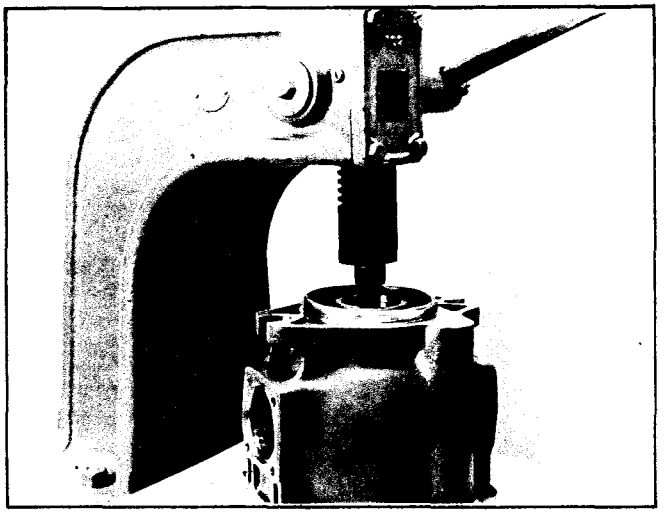


Figure 11. Removal of Front Bearing Race (74).

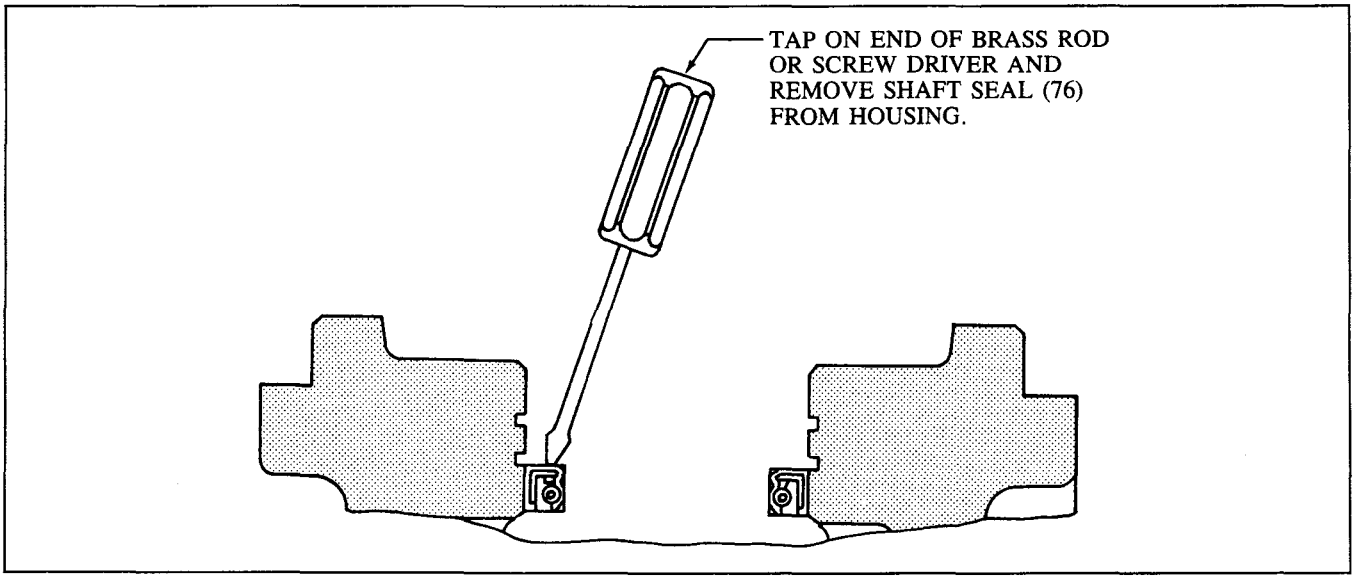


Figure 12. Shaft Seal (76) Removal.

E. INSPECTION, REPAIR, AND PART REPLACEMENT

NOTE
Before inspection of parts, clean all parts with a solvent that is compatible with system fluid.

PVE Control Parts

1. Inspect all parts for wear and/or erosion.

2. Inspect the plugs and screws for damaged threads, burrs, etc. Replace any plug or screw that has damaged threads.

3. Inspect springs for squareness. The spring ends must be parallel within three degrees (3°).

4. Check each spool for proper movement within the body S/A. A lubricated spool *must* move freely under the influence of gravity. Check the spool orifice for restriction. To clean the spool orifice, pour some clean solvent in a squeeze bottle. then apply the solvent to the nose end of the spool and observe the flow of solvent from the spool orifice.

Rotating Group Parts

1. Inspect cylinder block face (56) for wear, scratches, and/or erosion. If cylinder block condition is questionable, replace the entire rotating group.

2. Check each cylinder block bore for excessive wear. Use the piston and shoe S/A (62) for this purpose. The pistons should be a very close fit and slide in and out of cylinder block bores. *NO BINDING CAN BE TOLERATED.* If binding occurs, clean the cylinder block and pistons. Lubricate the cylinder block bores with clean fluid and try again. Even minor contamination of the fluid may cause a piston to freeze up in a cylinder bore.

3. Inspect each of the nine piston and shoe subassemblies (62) for a maximum end play of 0.005 inch between the piston and shoe. Also check the face dimension of each shoe. The face dimension must be within 0.001 inch. See Figure 13.

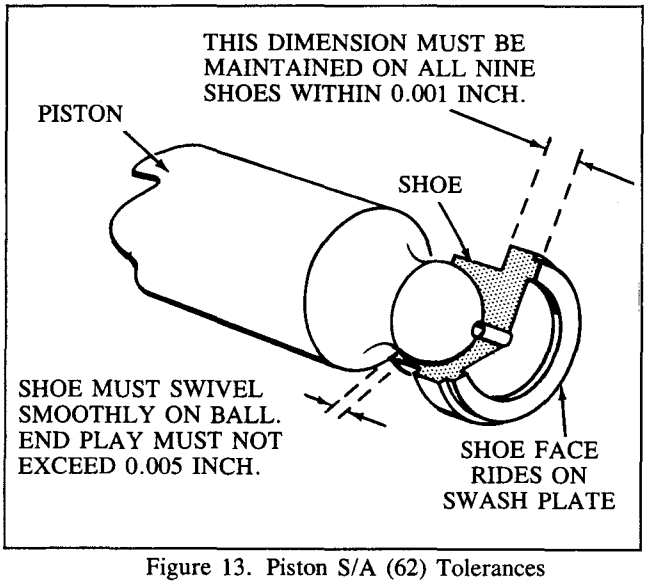


Figure 13. Piston S/A (62) Tolerances

4. Inspect the shoe plate (61) for heavy wear and cracks. If heavy wear and/or cracks are found, replace the shoe plate.

Valve Block & Associated Parts

1. Inspect valve block (33) for erosion, cracks, and burrs. Clean up minor burrs with an India stone. If erosion or cracks are noted, replace the valve block.

2. Inspect roller bearing and bearing race (48) for nicks and pitting. Make sure the roller bearing turns freely within the bearing race. If the roller bearing needs replacement, both the roller bearing and the bearing race mut be replaced. To remove bearing race from valve block, refer to Figure 10.

3. Inspect valve plate (34) for erosion, excessive wear, heavy scratches, and cracks. If any of the above conditions are found, replace the valve plate.

4. Inspect control and bias piston parts (37, 38, 40, 41, 42) for burrs, scratches, and cracks. Clean up minor scratches with 500 grit paper. Remove burrs with an India stone. The control and bias piston (37, 40) should move freely over the respective control stem and bias stem (38, 42).

Yoke Parts

1. Inspect yoke (71) face for wear, roughness or scoring. Check the yoke hubs (pintle bearing surfaces) for wear and cracks. Replace the yoke, if defective.

2. Inspect the face of swash plate (72) for wear, scratches, and possible fracture. Replace, if defective.

3. Inspect the limiter spacer (55) for heavy wear and cracks. Replace, if defective.

4. Inspect pintle bearings (69 and 70) for wear, pitting, and smooth operation. If a pintle bearing needs to be replaced, the roller bearing and the bearing race must be replaced.

5. Check the pintle spacers (53 and 66) and shims (67) for burrs and flatness. Replace, if necessary.

Shaft/Housing Parts

1. Inspect drive shaft (68) for wear, shipped splines, and burrs. Remove burrs with an India stone. Inspect the contact area of bearing (74) and shaft seal (76). Replace the drive shaft if wear or scoring is greater than 0.005 T.I.R. (total indicator reading).

2. Inspect drive shaft bearing (74) for roughness, pitting of rollers, and excessive end play. Replace, if defective. If the bearing needs to be replaced, the bearing race inside the housing (77) also requires replacement. To remove the bearing race from the housing, refer to Figure 11.

3. Inspect housing (77) mounting flange for nicks and burrs. Remove minor nicks and burrs with an India stone. Also check the housing for damaged or stripped threads. If any thread is damaged, replace the housing.

4. Check remaining pump parts for excessive wear, damaged threads, burrs, cracks, and erosion. Replace any part that is in a questionable condition.

F. ASSEMBLY

Assembly is generally performed in the reverse order of disassembly. Refer to Figure 9 during the following assembly procedure.

NOTE

Obtain a new seal kit. Refer to the appropriate part drawing as listed in Table 2 for the seal kit part number. Apply a light film of clean hydraulic fluid to the new seals. This will make assembly easier and also provide initial lubrication of moving parts. Assemble the piston pump as follows:

1. If shaft seal (76) was removed, install a new shaft seal into pump housing (77). Lubricate the shaft seal and housing bore with petroleum jelly before assembly. Use an arbor press and the shaft seal assembly tool. The shaft seal assembly tool is shown in Figure 8. Make sure the spring member of the shaft seal is face up during assembly.

2. Install retaining ring (75) into the second groove within the housing bore next to the shaft seal. Use Truarc pliers for this operation.

3. If bearing race (74) was removed from housing (77) install a new bearing race into housing with an arbor press. Make sure the bearing race is face up to accommodate the matching roller bearing. Press the bearing race until it rests at bottom of housing. Use the bearing race tool as described in Figure 14. After the bearing race is installed, apply a liberal amount of petroleum jelly to the matching roller bearing. Install the roller bearing into the bearing race.

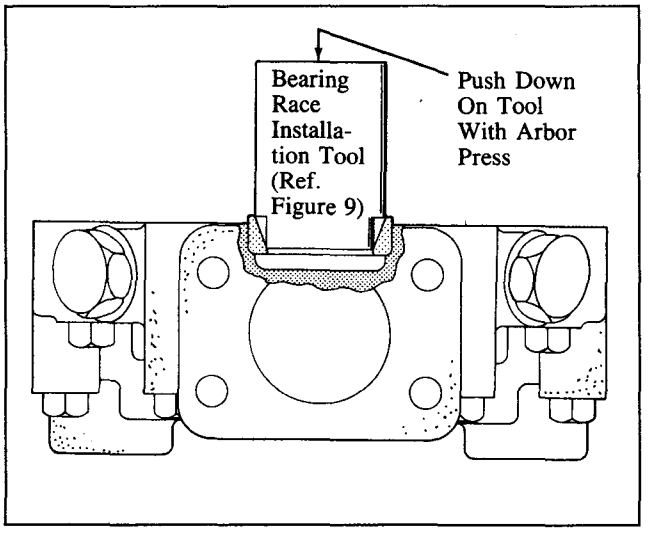


Figure 14. Installation of Bearing Race (48) into Valve Block (33).

4. Install pin (73) into yoke (71).

5. Apply a thin coat of clean hydraulic fluid on both sides of swash plate (72). Align pin (73) with hole in swash plate (72), then install swash plate (72) into yoke.

NOTE

The following step describes the assembly of shaft (68) into housing (77). Refer to Figure 15 during this process.

6. Install shaft (68) as follows:

a. Lubricate roller bearing (74) and shaft (68). Assemble roller bearing (74) on shaft (68).

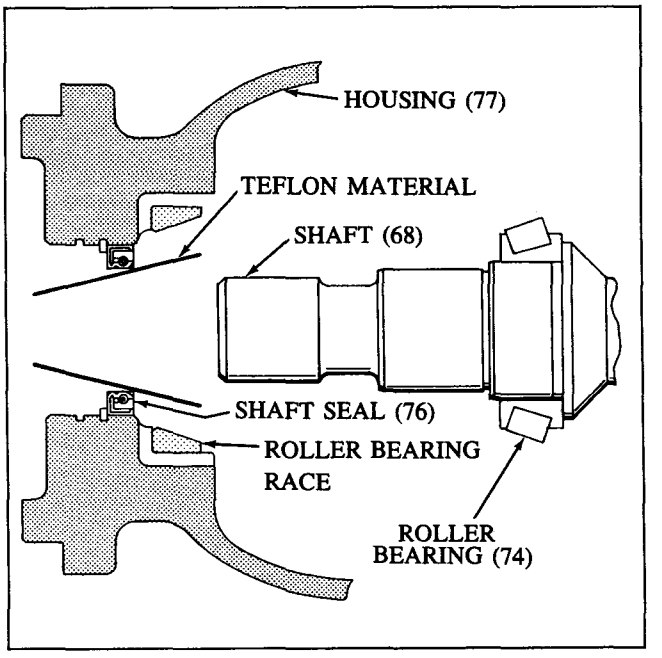


Figure 15. Shaft (68) Installation

b. Take a piece of shim stock or teflon material (8″ × 3″ × .003″) and roll it into a funnel shape. Insert the teflon material into the shat seal (76) as shown.

c. Install shaft (68) into housing (77). (NOTE: The teflon material will be forced out of shaft seal during this process.)

7. If yoke (71) was removed from housing (77), assemble the yoke into housing as follows:

a. Place the pump housing on its side with pintle bearing (70) area of housing face up.

b. Insert yoke (71) into housing (77) so that both yoke hubs are centered at pintle area of housing.

NOTE

The pin hole in the yoke hub *MUST* be exposed. If the pin hole is not exposed, turn the yoke 180°.

c. Lubricate pintle bearing (70) with clean hydraulic fluid. Orient the bearing to match the bearing race. Install pintle bearing (70) onto yoke hub. Next, carefully insert the bearing race over the pintle bearing and into the housing. *DO NOT* force the bearing race if it does not fit properly. Simply reposition the yoke hub directly underneath the pintle opening of housing and insert the bearing race.

d. Position the housing to assemble the other pintle bearing (69). Install the bearing into housing as described in step 'c'.

NOTE

The following step describes a pintle bearing preload procedure. This procedure is necessary to insure proper yoke movement during actual pump operation.

8. If required, obtain a new pintle shim kit as noted in the parts drawing. Perform the following steps (a through f).

a. Position housing (77) so that the pin hole in yoke hub is exposed.

b. Assemble spacer (53) on top of pintle bearing (70). Install o-ring (52) into housing groove. Fasten cover (51) to housing with four screws (50). Tighten the screws to 15-18 Nm (11-13 lb. ft.).

c. Position the housing to assemble parts 67 through 63. Make sure the yoke hub *DOES NOT* have a pin hole.

d. If a new yoke (71) and/or pintle bearings (69, 70) are used, install .025/.027 shim (67) thickness on top of pintle bearing (69). If the yoke and/or pintle bearings are not replaced, install the shims (67) that were removed at disassembly.

NOTE

Always install shim (67) at pintle area of housing that does not have a pin hole in yoke hub.

e. Install spacer (66), o-ring (65), and cover (64). Fasten cover (64) to housing (77) with four screws (63). Tighten the screws to 15-18 Nm (11-13 lb. ft.).

f. Push on the yoke pad as shown in Figure 16. The force to move the yoke (71) should be between 10-15 lbs. If the force is too low, shims (67) must be added. If the force is too high, shims (67) must be removed. (Note: .001 shim thickness equals approximately 1 lb.). If the force is between 10-15 lbs., proceed to step 9. If the force is too low or too high, remove parts (63, 64 and 66) and adjust shim (67) thickness to obtain 10-15 lb. force.

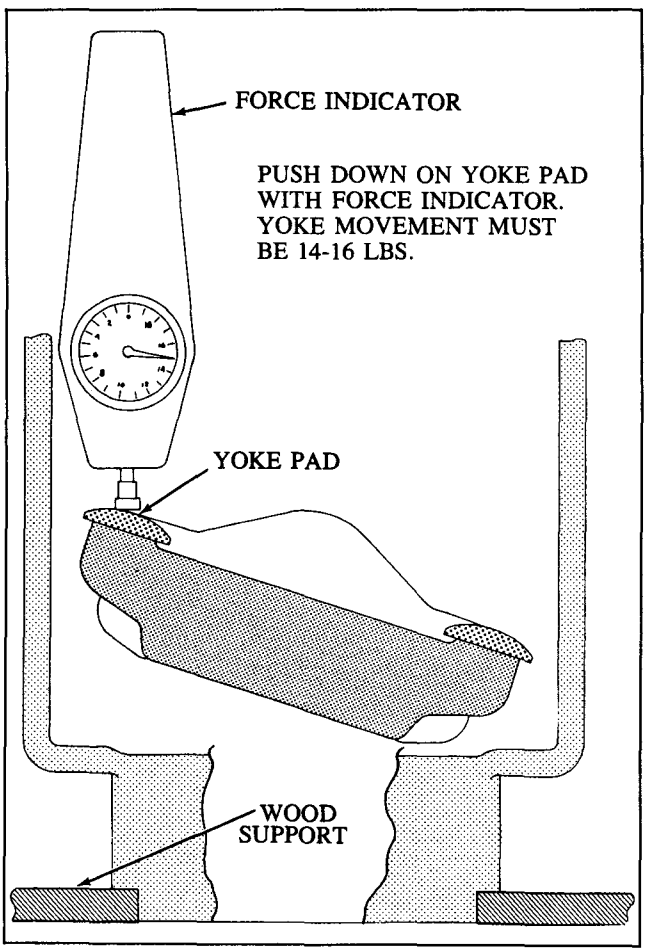


Figure 16. Yoke Force

NOTE

The following step describes the shaft end play procedure. This procedure is necessary to insure proper pump operation. Final shaft end play must be 0.001-0.004.

9. Obtain a shaft spacer kit as noted in the parts drawing. Perform the following steps:

a. If bias and control parts (37 through 43) are attached to valve block (33), remove parts 37, 40 and 41.

b. If pins (44) were removed, install two new pins into housing (77).

c. Install housing gasket (35) against housing.

d. Install tail bearing (48) on end of shaft (68) so the bearing rollers match up with bearing race within the valve block (33).

NOTE

If bearing race (48) was removed from valve block (33), install a new bearing race into valve block. Refer to Figure 14 for instructions.

e. Position valve block (33) on the two studs and carefully slide the valve block against housing gasket (35). Make sure mounting pins (44) engage properly into valve block.

f. Apply a small amount of hydraulic fluid to screw (32) threads. Secure the valve block (33) to housing (77) with six screws (32). Tighten the screws to 50-55 Nm (37-41 lb. ft.).

g. Set the pump on the work bench so that shaft (68) is straight up (vertical). Push down on shaft to insure bearings (48, 74) are seated.

h. Place a dial indicator at end of shaft (68). Set the dial indicator to 0.00.

i. Place vice grip pliers underneath shaft spline and lift up on shaft (68).

j. Observe the dial indicator reading to determine the amount of shaft movement. For example: If dial indicator needle reads 0.040, a 0.036-0.039 shim (49) thickness must be added to end of shaft to obtain a 0.001-0.004 shaft end play (0.040 minus 0.036-0.039 equals 0.001-0.004). Repeat this step two times to insure a proper measurement.

k. Remove valve block (33) from housing (77). Remove tail bearing (48) from end of shaft (68).

l. Install shims (49) to end of shaft (68) according to the measurement obtained in step 'j'.

m. Install tail bearing (48) on end of shaft (68) next to shims (49).

n. Repeat steps 'e' through 'j'. If 0.001/0.004 shaft end play is obtained, proceed to step 'o'.

o. Remove valve block (33), tail bearing (48), and shims (49) from pump. Set these parts aside for final assembly.

10. Remove pintle cover (51) from housing (77).

11. If required, assemble rotating group prts 60 through 57 into cylinder block (56). Use the spring decompression tool as shown in Figure 6a.

12. Lubricate cylinder block (56) with clean hydraulic fluid. Install the nine piston S/A (62) into shoe plate (61) as shown.

13. Install spacer limiter (55) over the cylinder block against the outer diameter of shoe plate (61). Rotate the spacer limiter so the spacer limiter notch lines up with the hole in the yoke hub.

14. Feed the nine pistons (62) into the cylinder block bores. Then install rotating parts 56 through 62 into yoke (71) against swash plate (72).

15. Insert pin (54) into yoke hub so that it fully engages into the spacer limiter notch. *(This step is very critical. If pin (54) does not engage into the spacer limiter notch, the pump will experience early failure.)*

16. Install pintle cover (51). Tighten screws (50) to 15-18 Nm. (11-13 lb. ft.).

17. Install shims (49) to end of shaft (68).

18. Install tail bearing (48) on shaft (68) next to shims (49).

19. If required, assemble o-ring (43) on bias stem (42) and o-ring (39) on control stem (38). Apply one drop of Loctite 270 cement to bias and control stem threads. Install the bias and control stems into valve block (33). Secure the stems with a hex key wrench.

20. Assemble spring (41) and piston (40) on bias stem (42). Install piston (37) on control stem (38).

21. Insert pin (36) into valve block (33).

22. Lubricate valve block face with a light film of clean hydraulic fluid.

23. Place valve plate (34) on valve block face with bronze side face up. (Note: The notch on valve plate (34) must fit over pin (36)).

24. Carefully assemble valve block (33) onto housing (77). Make sure the bias spring (41) and bias piston (42) are in place against the yoke pad during the assembly process. If the spring or piston falls off the bias stem (43), apply a liberal amount of petroleum jelly to the spring and piston.

25. Install screws (32) hand tight. Remove the two studs from housing (77) and install the remaining two screws (32). Cross tighten the screws to 50-55 Nm (37-41 lb. ft.).

26. Assemble o-rings (31 and 29) on plugs (30 and 28). Install the plugs into valve block (33). Tighten the plugs to value noted in Table 4.

MODEL	PLUG	TORQUE (Nm)	TORQUE (lb. ft.)
PVE27/35	10, 10a, 21, 24	18 - 20	13 - 15
	26	40 - 45	30 - 33
	28	54 - 59	40 - 43
	30	15 - 16	11 - 12
PVE47	10, 10a 21, 24	18 - 20	13 - 15
	26	40 - 45	30 - 33
	28	75 - 83	55 - 61
	30	15 - 16	11 - 12
PVE62	28	41 - 49	30 - 36
	30	14 - 19	10 - 14

Table 4. Plug Torque

G. PVE CONTROL ASSEMBLY

'CV' CONTROL

NOTE
The following steps (1 through 12) describe the assembly procedure for PVE27/35/47/62 pumps with a 'CV' control. This control is assembled in reverse item number sequence order as shown in Figure 9.

1. Assemble o-rings (27 & 25) on plugs (26 & 24). Install the plugs into compensator body (13) as shown. Tighten the plugs to the value listed in Table 4.

2. Lubricate load sensing spool (23) and install it into compensator body (13) as shown.

3. Assemble o-ring (22) on plug (21). Install the plug into compensator body (13). Tighten the plug to the value listed into Table 4.

4. Install spring guide (20) and spring (19).

5. Assemble o-ring (17) on spring seat (16). Then assemble back-up ring (18).

6. Install spring seat (16) and adjusting screw (15) into body (13). Install nut (14) on adjusting screw (15) hand tight.

7. Lubricate compensator spool (12) and install it into body (13) as shown.

8. Assemble o-ring (11) on plug (10). Install the plug into body (13) and tighten to the value listed in Table 4.

9. Install spring guide (9) and spring (8) into body (13).

10. Assemble o-ring (7) on spring seat (6). Install spring seat (6) and plug (5) into body (13).

11. Assemble adjusting screw (4) into plug (5) until spring tension is felt. Install nut (3) on adjusting screw (4) hand tight.

12. Install three o-rings (2) on control mounting surface. Align the o-rings with holes in valve block (33) mounting pad. Install the control to valve block (33) with four screws (1). Cross tighten the screws to 31-37 Nm (23-28 lb. ft.).

'C' Control

NOTE
The following steps (1 through 5) describe the assembly procedure for the 'C' control. Refer to Figure 9.

1. Assemble o-ring (11a) on plug (10a). Install the plug into body (13a) and tighten to the value noted in Table 4.

2. Install spring guide (9a) and spring (8a) into body (13a).

3. Assemble o-ring (7a) on spring seat (6a). Install spring seat and plug (5a) into body (13a).

4. Assemble adjusting screw (4a) into plug (5a) until spring tension is felt. Install nut (3a) on adjusting screw (4a) hand tight.

5. Install three o-rings (2a) on body mounting surface. Align the o-rings with holes in valve block (33) mounting pad. Install the control to valve block (33) with four screws (1a). Cross tighten the screws to 31-37 Nm (23-28 lb. ft.).

A. TEST CONDITIONS

1. Fluid entering the pump inlet must be filtered to meet an ISO (International Standard Organization) cleanliness code of 19/15 or cleaner. Selections from OFP, OFR and OFRS series filters are recommended. For recommended fluid types, refer to bulletin M-2950-S.

2. Pump inlet pressure must be maintained between 1.15 bar and 0.85 bar (2 PSIG-5 inches Hg).

3. Operate the pump at a fluid temperature of 120°F ±10°F.

4. PVE operating parameters are listed in Table 5.

PUMP MODEL	RATED PRESSURE (PSI)	RATED SPEED (RPM)	RATED DISPLACEMENT (CIR)
PVE27	3625	2400	3.5
PVE27QI	3625	1800	3.5
PVE35	3625	2200	4.5
PVE35Q	3625	2100	4.5
PVE35QI	3625	1800	4.5
PVE47	3625	2100	6.0
PVE47QI	3625	1800	6.0
PVE62	3625	2000	8.0
PVE62QI	3625	1500	8.0

Table 5. PVE Operating Parameters.

B. PRELIMINARY SET-UP

1. If a hydraulic test stand is available with adequate horsepower capabilities, mount the pump on the test stand. If a test stand is not available, mount the pump on the vehicle and proceed to connect the hydraulic lines to the pump. Refer to Section IV for pump installation instructions.

2. Connect the case line, inlet and outlet line, load sensing line (if required), pressure gauges, and other equipment as described in Figure 17. Make sure all connections are tight.

3. Remove drain plug (28) from valve block (33) and fill the pump with clean hydraulic fluid. Reinstall the plug and torque to value noted in Table 4.

NOTE
The following step describes the preliminary setting of the PVE control adjustment screws (15, 4, 4a) prior to test. Refer to Figure 9 for screw locations.

4. Turn the control adjustment screws as follows:

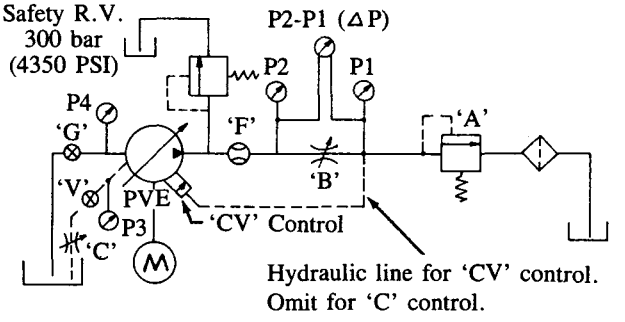
a. PVE27/35/47/62 pump with 'CV' control: Turn load sensing screw (15) clockwise until it bottoms out. Turn pressure compensator screw (4) clockwise until it bottoms out, then back off on screw (4) two full turns.

b. PVE27/35/47/62 pump with 'C' control: Turn pressure compensator screw (4a) clockwise until it bottoms out, then back off on screw (4a) two full turns.

C. START-UP

NOTE
Refer to Figure 17 during the following discussion.

'A' = Load Valve
'B' = Flow Control or Load Sensing Valve
'C' = Internal Check Valve
'G' = Globe Valve (Inlet)
'V' = Needle Valve
'F' = Flow Meter
P1 = Pressure Gauges (5000 PSI)
P2 = Pressure Gauge
P3 = Case Drain Pressure Gauge
P4 = Inlet Pressure Gauge



Note: Valve 'B' and pressure gauge P1 not required for PVE with 'C' control.

Figure 17. PVE Test Circuit

1. Fully open valve 'G' and 'V'.

2. Fully open valve 'B' and set valve 'A' to minimum pressure setting.

3. Start the test stand or vehicle engine. Operate the pump at 600 RPM and at minimum outlet pressure. Check the system for leaks and unusual noise. Increase the pump to 1200 RPM until all the air is purged out of the system.

CAUTION
If unusual noise is noted, shut down the system immediately to avoid pump damage. Refer to the Troubleshooting Chart (Table 3) for possible repair solution.

D. PERFORMANCE TEST

NOTE
Refer to Figure 17 during the following discussion.

1. Increase the pump to the rated speed (RPM) as specified in Table 5. Adjust valve 'A' until 28 bar (400 PSIG) outlet pressure is obtained at 'P2'. Hold this condition until the air is purged out of system.

PUMP MODEL	RATED SPEED (RPM)	FLOW @ 28 bar (400 PSI)	MAX. FLOW LOSS @ 250 bar (3625 PSI)
PVE27	2400	130 - 144 1/m (34.3 - 38.0 GPM)	12 1/m (3.2 GPM)
PVE27QI	1800	95.8 - 10.9 1/m (25.3 - 29.3 GPM)	12 1/m (3.2 GPM)
PVE35	2200	154.1 - 171.0 1/min (40.7 - 45.2 GPM)	13 1/m (3.4 GPM)
PVE35Q	2100	145 - 160 1/m (38 - 42 GPM)	13 1/m (3.4 GPM)
PVE35QI	1800	126.1 - 139.2 1/m (33.3 - 36.8 GPM)	13 1/m (3.4 GPM)
PVE47	2100	196 - 216 1/m (51.8 - 57.1 GPM)	17.5 1/m (4.6 GPM)
PVE47QI	1800	167.5 - 186.4 1/m (44.2 - 49.2 GPM)	17.5 1/m (4.6 GPM)
PVE 62	2000	249 - 275 1/m (65.8 - 72.6 GPM)	22 1/m (5.8 GPM)
PVE62QI	1500	187 - 207 1/m (49.4 - 54.7 GPM)	22 1/m (5.8 GPM)

Table 6. Flow Specifications

2. Increase the outlet pressure to 150 bar (2175 PSIG). Hold this condition for one minute. Reduce the outlet pressure to 28 bar (400 PSIG) and observe the pump flow from flowmeter "F". Pump flow must meet the requirement as stated in Table 6 when the fluid temperature at pump outlet is 120 °F ± 10 °F.

3. Increase the pump outlet pressure to 250 bar (3625 PSIG). The pump must be able to meet the flow loss requirement as stated in Table 6. Hold this condition for one minute.

4. Visually inspect shaft seal (76) for leakage throughout the performance test.

E. 'CV' & 'C' CONTROL ADJUSTMENT PROCEDURE

NOTE

To adjust the 'CV' control, perform steps 1 through 7. To adjust the 'C' control, perform steps 1, 2, 3, 6, and 7. Refer to Figures 9 and 17 during the adjustment procedure. Turn the adjusting screws clockwise to increase pressure and counterclockwise to decrease pressure.

1. Perform the preliminary set-up procedure (Section VIII-B), start-up procedure (Section VIII-C), and the performance test (Section VIII-D).

2. Set the pump to rated RPM as shown in Table 5.

3. Adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

4. Adjust valve 'B' to obtain an outlet flow that is specified in Table 7.

5. Turn load sensing screw (15) until 20 ± 1 bar (290 ± 14.5 PSID) pressure differential is obtained between 'P2' and 'P1'. Tighten nut (14).

6. Open valve 'B' and adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

PUMP MODEL	RATED SPEED (RPM)	PUMP OUTLET FLOW FOR SETTING ΔP
PVE27	2400	70 1/m (18.5 GPM)
PVE27QI	1800	50 1/m (13.2 GPM)
PVE35	2200	80 1/m (21.0 GPM)
PVE35Q	2100	75 1/m (19.8 GPM)
PVE35QI	1800	65 1/m (17.2 GPM)
PVE47	2100	105 1/m (27.7 GPM)
PVE47QI	1800	90 1/m (23.8 GPM)
PVE62	2000	130 1/m (34.0 GPM)
PVE62QI	1500	144 1/m (38.0 GPM)

Table 7. Outlet Flow Setting

7. Turn pressure compensator screw (4, 4a) until pressure at 'P2' starts to decay below 3625 PSI. Adjust screw (4, 4a) to a desired pressure level. If a pressure level is not specified, djust the screw to 250 bar (3625 PSI).

F. STABILITY AND INTERNAL CHECK VALVE TEST

NOTE

Refer to Figure 17 during the following discussion.

1. Adjust valve 'A' to obtain 28 bar (400 PSIG) outlet pressure at 'P2'. Operate the pump at rated speed (RPM) as stated in Table 5.

2. Close valve 'A' rapidly. There shall be no indication of pump instability. (Note: Pump instability is established when outlet pressure oscillations exceed ±3.5 bar (50 PSI) around the control pressure setting (3625 PSI). When valve 'A' is closed, the pressure at 'P2' shall be within ±4.0 (58 PSI) of the initial pressure setting.

3. Close needle valve 'V'. The differential pressure between 'P3' and 'P4' must be 0.9-1.7 bar (13-25 PSID). Open needle valve 'V'.