



GEY 441A  
Reformatted, October 1992

## **GE Power Systems**

Steam Turbine

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# **Axial Piston Variable Volume Pumps**

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*These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the GE Company.*

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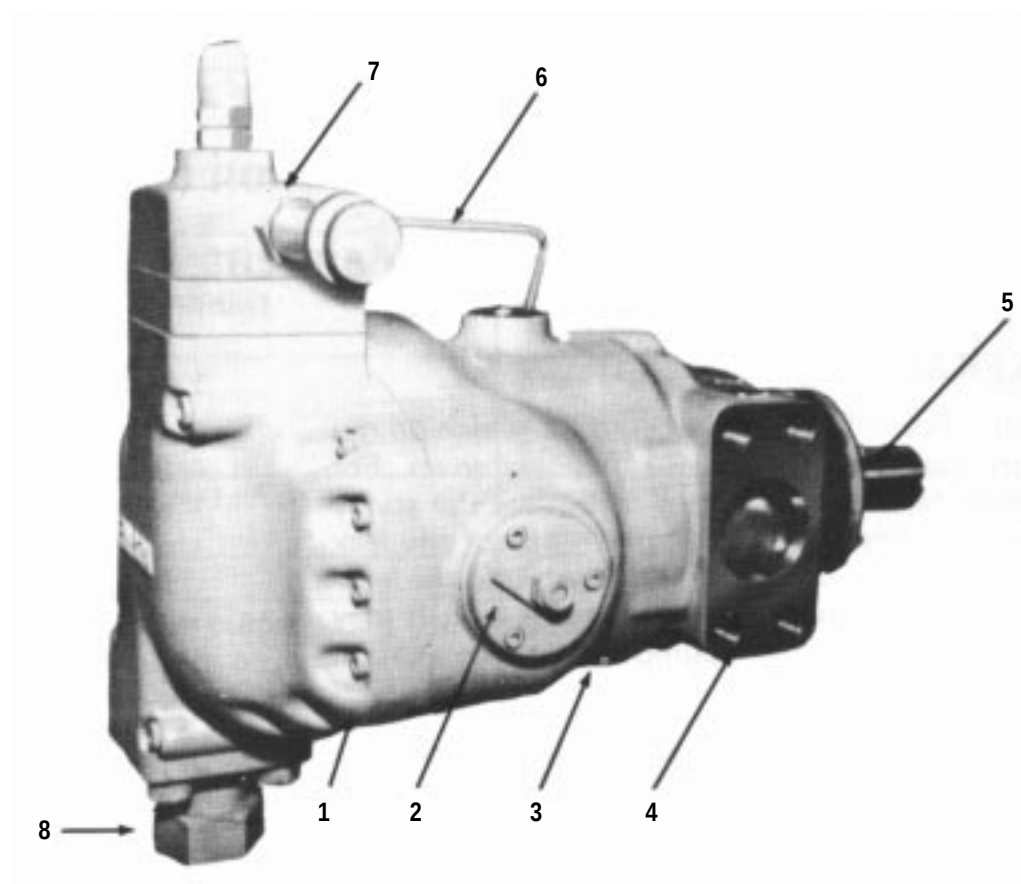
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## Bulletin SPP-PV09-SH

**DENISON****SERVICE LITERATURE**

# AXIAL PISTON VARIABLE VOLUME PUMPS

| G.E. No.        | Denison Model No.       | Code No.  |                 |
|-----------------|-------------------------|-----------|-----------------|
| 155-B2439-P0001 | PV09YA-053-31R-04-Y2-S5 | 015-28866 | (BRONZE BARREL) |
|                 | PV09XS-053-31R-04-Y2-S5 | 015-46094 | (STEEL BARREL)  |
| 155-B2439-P0003 | PV09YA-032-31R-YP-Y2-S5 | 015-29956 | (BRONZE BARREL) |
|                 | PV09XS-032-31R-YP-Y2-S5 | 015-46095 | (STEEL BARREL)  |





## Section I

### Introduction and Description

#### GENERAL

This manual contains installation, operation, maintenance, and overhaul instructions for the 900 series variable volume axial piston pumps. The low pressure models were designed for applications that do not require more than 3500 psi. See Table I for pump data.

#### DESCRIPTION

Power applied to the pump shaft turns the rotating as-

sembly (barrel and bearing assembly, piston and shoe assembly, and attached parts) creating the pumping action. The volume of the oil delivered is controlled by changing the length of piston strokes within the barrel and bearing assembly. The piston strokes are changed by raising the hanger above center to increase the volume. The volume is decreased by returning the hanger to center. The hanger position is changed by the various controls that are bolted to the hanger end cap. The controls are easily removed as units.

TABLE I

### TYPICAL PERFORMANCE DATA

| Volume Setting | Model Number              | Delivery in GPM |          |          |          |
|----------------|---------------------------|-----------------|----------|----------|----------|
|                |                           | 1000 psi        | 2000 psi | 3000 psi | 3500 psi |
| Full 1200 RPM  | PV09 *-053-31 R-04-Y-2-S5 | 53.5            | 53.2     | 52.6     | 52.3     |
|                | PV09 *-032-31R-YP-Y-2-S5  | 32.5            | 32.2     | 31.6     | 31.3     |

\*YA – Bronze Barrel, XS – Steel Barrel

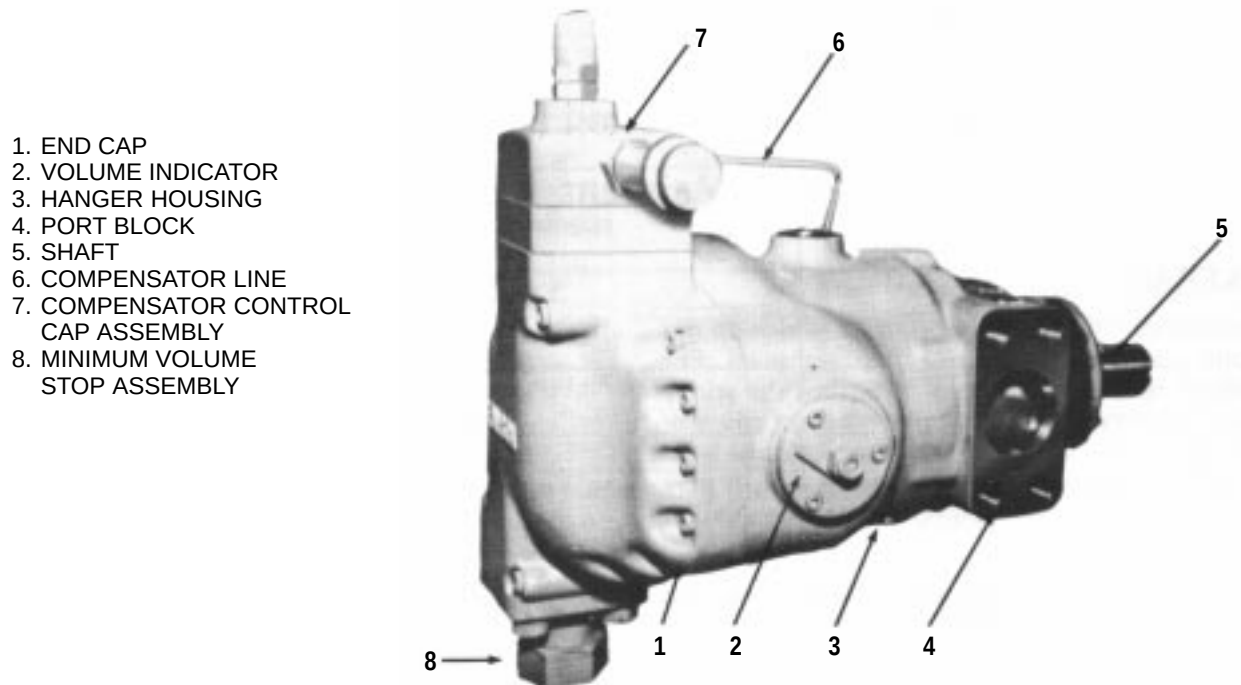


FIGURE 1  
VARIABLE VOLUME PUMP W/PRESSURE COMPENSATOR  
(Compensator cap and line shown on left hand model)

## Section II

### Installation

#### MOUNTING

The pump should be mounted on a base of sufficient strength and in such a manner as to maintain a positive alignment with the prime mover. Close shaft alignment with the prime mover is of utmost importance. A flexible-type coupling must be used between the prime mover and the pump.

#### PIPING

All piping should be of adequate size and strength to assure free flow at the pressures involved. All system piping must be clean before the pump is connected. Piping

workmanship must be accurate in order to eliminate any undue strain on the pump when tightening flange bolts. *Do not use galvanized pipe.*

Check that the entire hydraulic stem is free from dirt, lint, scale and other foreign material.

#### FILL PUMP

Immediately upon pump installation fill pump with clean hydraulic fluid. Use fluid in accordance with G.E. specifications given in GEK 46357 (fluid specs.) The case drain must be of adequate size to assure that the case pressure does not exceed 100 psi.

## Section III

### Operation

For initial, normal and low temperature starting, refer to GEK 46355 Hydraulic Power Unit.

## Section IV

### Maintenance

#### GENERAL

Maintenance is limited to operations which do not require complete system or pump teardown. For example, repair of system or pump leaks or sticky valves. The first operation in the repair of any leak is to tighten the screws or fittings around the leakage area. If this does not remedy the leak, it may be necessary to open the pump and replace a gasket or "O" ring.

If the pump does not operate properly or there is evidence of damage, overhaul the equipment in accordance with Section V.

Before opening the pump, drain fluid by removing the plug (38, fig. 2.) Always refill the pump housing with clean fluid upon completion of the repair operation. Use fluid in

accordance with GEK 46357. Purge the system if necessary.

Before reassembling any parts, they must be absolutely clean and free from dirt, lint or other foreign matter. All parts must be washed in a cleaning fluid such as Stoddard solvent or equivalent. *Do not use a chlorinated solvent.* All "O" rings and gaskets must be clean and carefully examined for cuts or other damage. Replace any damaged parts.

#### TROUBLE SHOOTING

Table III lists possible troubles and remedies for the complete pump assembly. Perform only those operations possible under maintenance. Refer to Section V for overhaul procedures.

**TABLE III**  
**TROUBLE SHOOTING CHART**

| Trouble                                                            | Possible Cause                                                                                                                                                                             | Remedy                                                                                                                           |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| No Pressure                                                        | Prime mover not operating.                                                                                                                                                                 | Check prime mover.                                                                                                               |
|                                                                    | Defective system relief valve.                                                                                                                                                             | Check system valves.                                                                                                             |
|                                                                    | Wrong rotation.                                                                                                                                                                            | Reverse rotation immediately to prevent breakage of pump parts.                                                                  |
| Insufficient Pressure                                              | Leak in pipe joints or fittings.                                                                                                                                                           | Inspect thoroughly all joints. Tighten if necessary.                                                                             |
|                                                                    | Pump not delivering oil.                                                                                                                                                                   | Check fluid circulation by removing plug or line near pump.                                                                      |
|                                                                    | System relief valve set too low or valve sticking open. Parts may be dirty, worn or broken.                                                                                                | Check relief valve.                                                                                                              |
|                                                                    | Dirt in system.                                                                                                                                                                            | Drain fluid and clean system tank.                                                                                               |
|                                                                    | Dirty system filters.                                                                                                                                                                      | Replace filters.                                                                                                                 |
|                                                                    | Leakage in system.                                                                                                                                                                         | Inspect all pipe connections and tighten loose connections or fittings. Check fluid level. Add fluid as necessary. Purge system. |
| Chattering or Vibration in Hydraulic System                        | Air in system.                                                                                                                                                                             | Cycle pressure in system.                                                                                                        |
| Pump Making Noise                                                  | Coupling misalignment.                                                                                                                                                                     | Realign couplings.                                                                                                               |
|                                                                    | Pump parts worn or broken, solid matter wedged between pump internal operating parts.                                                                                                      | Overhaul pump.                                                                                                                   |
|                                                                    | Dirty system.                                                                                                                                                                              | Clean filters.                                                                                                                   |
| Insufficient Flow                                                  | Clogged filters; restriction in suction line.                                                                                                                                              | Clean filters, remove and blow out lines.                                                                                        |
|                                                                    | Air in suction lines due to loose union.                                                                                                                                                   | Tighten suction line union.                                                                                                      |
|                                                                    | Insufficient fluid in system.                                                                                                                                                              | Add hydraulic fluid.                                                                                                             |
|                                                                    | System relief valve sticking in open position.                                                                                                                                             | Check relief valve thoroughly.                                                                                                   |
|                                                                    | Fluid viscosity too heavy.                                                                                                                                                                 | Start pump unit in accordance with Section III, "Low Temperature Starting."                                                      |
|                                                                    | Broken shaft or coupling failure.                                                                                                                                                          | Replace coupling if damaged. If shaft is damaged, overhaul pump.                                                                 |
|                                                                    | Break in piping.                                                                                                                                                                           | Repair or replace.                                                                                                               |
| Breakage of Rotor, Piston, Shoes, Shaft or Port Plate              | Excessive pressure above pump rating. Seizure due to lack of oil supply. Solid matter wedged between pump operating parts.                                                                 | Overhaul pump.                                                                                                                   |
| Excessive Wear on Port Plate, Shoes, Pistons, and All Moving Parts | Lack of oil supply. Oil Viscosity too low. Abrasive matter in oil. Sustained high pressure above maximum rating. Coupling misalignment. High overload impact pressures. Pump operated dry. | Overhaul pump.                                                                                                                   |

## Section V

### Overhaul

#### GENERAL

The instructions contained in this section cover a complete teardown of the pumps. Disassemble only as far as necessary to replace or repair the worn parts. If a complete disassembly is required, follow the index numbers 1 through 53.

#### DISASSEMBLY

Remove drain plugs (38) as necessary to drain the pump. Remove key (52) from the pump shaft. Remove the fluid connections by removing the eight screws. Remove items 1 through 4. The index plate assembly, barrel and bearing assembly, port plate, and port block must be handled with care to avoid marring the precision finish of the parts.

#### PISTON AND SHOE ASSEMBLY

The hanger must be removed from the housing to check the piston and shoe assembly. Remove items 5 through 16 and lift hanger (18) with items 19 through 24 attached. The inner bushing (17) can now be removed from the hanger housing. *Do not remove screw (19) and nut (20) from the hanger unless a replacement is required. These parts were set at the factory to prevent the pump from over-stroking.*

Remove screw (24) to release the index plate assembly (22) from the hanger.

#### BARREL AND BEARING ASSEMBLY

Remove items 25 through 29 from barrel. Remove screws (31) and barrel stop (32) to release the barrel assembly. Insert two heavy wood dowels into the bores of the barrel and with an oscillating motion pull the barrel assembly from the hanger housing. Do not allow the face of the barrel to strike the end of the shaft. Take care that the bronze face plate of the steel barrel version does not fall from the barrel. *Do not remove the inner bearing race from the bronze or steel barrel.* These parts are available only as an assembly. The bronze barrel and bearing assembly and the steel barrel and bearing assembly are interchangeable.

The port plate (34) may cling to the face of the bearing and barrel assembly. Use caution to prevent port plate from dropping. If the port plate remains on the port block (33), it may be removed by inserting two brass rods the same diameter as the porting in each port and squeezing together to free port plate. Remove pin (41).

Remove screws (35) and (36) and remove the hanger housing (37) from the port block (53) and remove "O" ring (40).

Remove six screws (42), seal retainer (43), and "O" ring (44). To remove the part of the shaft seal that is in the seal retainer, insert a piece of brass rod that is smaller than the outboard opening of the seal retainer and press the seal seat and rubber gasket out.

Wrap a piece of shim stock or thick tape around the shaft to cover the keyway before removing the remainder of the seal from the shaft. Do not bump or damage the carbon seal face.

Place a brass rod (5/8" dia. or larger) inside the splined end of the shaft and press the entire shaft assembly from (46) the port block (53).

Bend back the teeth of lock washer (48).

Remove the lock nut (47) and lock washer. Support the inner race of bearings (49) and press the shaft (51) from the bearings. Remove spacers (50).

#### CLEANING

All parts must be absolutely clean and free from dirt, lint, or other foreign material. All parts of the pump must be washed in Stoddard solvent or equivalent cleaning compound. **DO NOT USE A CHLORINATED SOLVENT.** The pump body and port block must also be washed thoroughly in case of bearing failure. After all parts are cleaned they must be protected with a light film of fluid and covered until reinstalled in the pump.

#### INSPECTION AND REPAIR

Replace any damaged or substandard "O" rings, gaskets, or seals at reassembly. Replace all worn or damaged parts. If repair parts are not available, some moving parts may be replaced for limited service, as an emergency measure only. These parts are the port plate, bearing and barrel assembly, creep plate, shoe retainer, piston and shoe assembly.

#### PORT PLATE

Scratches that appear on the sealing bands around the arcuate ports can be removed by hand lapping on an accurate lapping block using carborundum abrasive. After lapping, the faces of the port plate must be parallel within .0002 of an inch.

#### BARREL AND BEARING ASSEMBLY

Replace the assembly if there is an indication of damage or excessive wear to the cylinder bores. Scratches on the



face of the bronze barrel around the cylinder ports may be removed by hand lapping with carborundum finishing compound Grade A280V8WS or equivalent abrasive. If wear damage to the bronze barrel is excessive a very fine machine cut may be taken off the face but not more than 0.010 of an inch total should be removed and the face of the barrel must be perpendicular to the spline within 0.0005 of an inch. If wear damage to the face plate of the steel barrel is excessive, replace the face plate (See page 12, Fig. IV-a).

### PISTON AND SHOE ASSEMBLY with RETAINER

Remove scratches from the sealing bands of the bronze shoes by hand lapping. Lap the assembly as a unit only. Use the shoe retainer as the holding fixture. Lap on an accurate lapping block with carborundum finishing compound Grade A280V8WS or equivalent. Check fit of pistons in cylinder barrel bore. Clearance should be from .0008 to .0016 inches.

### CREEP PLATE

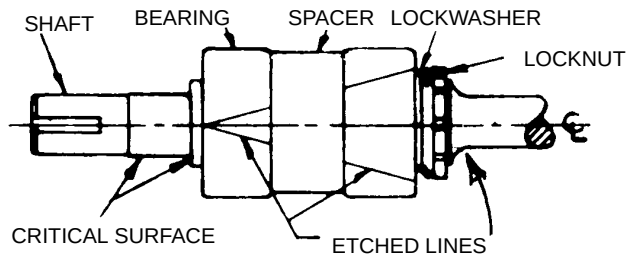
Lap work face of creep plate on an accurate lapping block using carborundum finishing compound Grade A280V8WS or equivalent.

#### "CAUTION"

**Clean all pieces after lapping. Make certain all lap-compound is removed. Coat the parts with fluid.**

### ASSEMBLY PROCEDURES

#### SHAFT AND BEARINGS



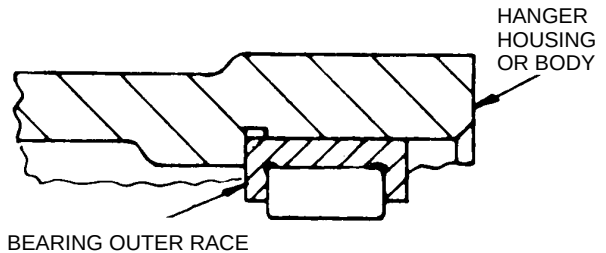
1. Before assembly of bearings (49) to shaft (51), note the etched lines across the O.D. of the bearings. Always assemble bearings to shaft so that the etched lines form a "V".
2. Install one bearing onto shaft, press it snugly against the shoulder of the shaft.
3. Insert the bearing spacers (50) over shaft and against bearing.

4. Press on second bearing, seating against bearing spacers.
5. Assemble bearing lockwasher (48) to shaft, make sure tang of lockwasher fits into groove in shaft, seat against bearing.
6. Thread bearing locknut (47) onto shaft. Put chamfered edge of locknut toward lockwasher. Tighten locknut securely.
7. Bend tang of lockwasher into aligned slot of locknut.

*NOTE: Press bearings onto shaft with a smooth, steady force. Do not "beat" into place.*

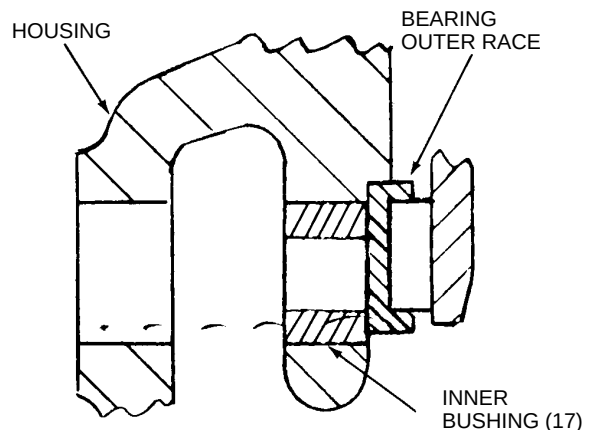
### INSTALLATION OF BEARINGS IN HANGER HOUSING

1. Press outer race of barrel bearing into I.D. of hanger housing (37) seating it against shoulder.



*NOTE: Press bearing into body with a smooth, steady force. Do not "beat" into place.*

2. Insert needle bearing and bushing assembly (17) into the inner bore of the hanger housing, entering the housing through the space between the larger outer bore and the inner bore. The assembly (17) must be seated against the outer race.

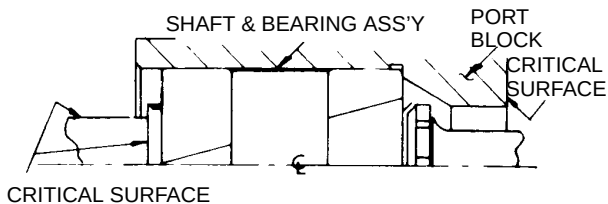


## MOUNTING HANGER HOUSING ON PORT BLOCK

1. Position hanger housing (37) with round opening turned up.
2. Place "O" ring (40) in groove in hanger housing.
3. Position the port block on the hanger housing with the external end up. Install screws (35) and (36) through port block and thread into hanger housing. Torque these screws evenly, 130 ft. lbs.

## INSTALLING SHAFT AND BEARING ASSEMBLY

1. Press shaft and bearing assembly (46) into port block, (53), seating it against shoulder in port block.

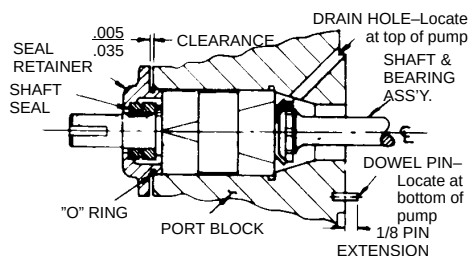


*NOTE: Press shaft and bearing assembly into port block with a smooth, steady force. Do not "beat" into place.*

## ASSEMBLE SHAFT SEAL AND SEAL RETAINER IN PORT BLOCK

1. Insert "O" ring (44) onto seal retainer (43).
2. Insert shaft seal (45) into bore of seal retainer. Use care so as not to cut or scratch sealing surface of shaft seal.
3. Assemble pilot O.D. of seal retainer into pilot bore of port block while slipping I.D. of shaft seal over shaft. Again use care to avoid damaging the shaft seal.
4. Insert the six socket head cap screws (42) and tighten snugly. There should be clearance between seal retainer and port block. Do not torque screws excessively.

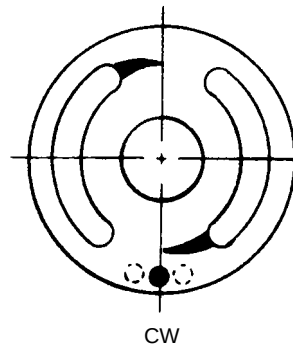
## PORT PLATE PIN



1. Press dowel pin (41) into port block. Measure pin extension to insure proper assembly. During assembly, this pin locates the bottom of the pump.
2. Install "O" ring (39) on plug (38) and install in bottom hole in the hanger housing.

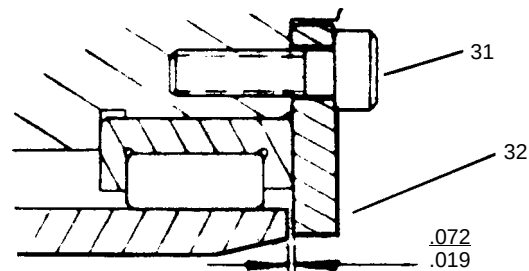
## PORT PLATE INSTALLATION

1. Position the hanger housing, port block and shaft assembly with the external end of the shaft extended down.
2. Slip port plate (34) over shaft and into pilot bore of body, making sure hole in port plate goes over dowel pin in port block. Check to insure port plate is firmly seated against port block by trying to rotate the port plate radially. If a slight movement is obtainable the port plate is properly assembled.
3. Check pump rotation to make sure that the correct port plate is being used.



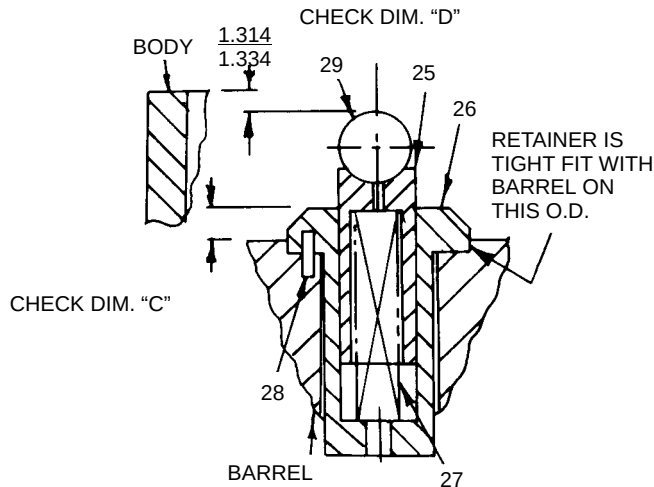
## INSTALLATION OF BARREL ASSEMBLY

1. Slip barrel onto shaft and seat gently against the port plate. Be careful not to damage the lapped surface of the bronze barrel and port plate. When installing the steel barrel assembly be certain the bronze face plate is in place and is secured by the two face plate pins (See Fig. IV-a).



2. Place stops (32) in counterbore of the hanger housing. Insert screws (31) through the stops and thread into the housing. Tighten securely. There must be *no clearance* between the stop and the outer bearing race. See above sketch for clearance between the stop and inner race.

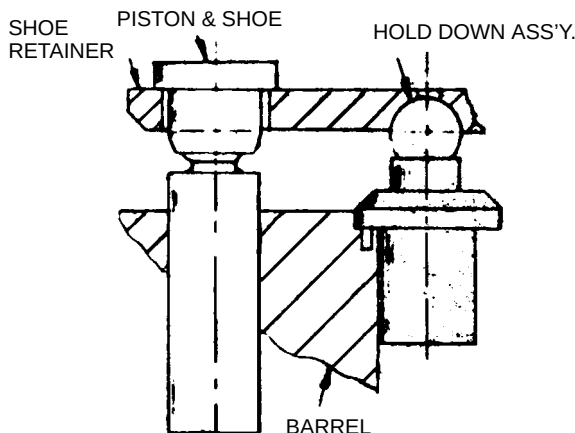
3. Insert pin (28) in the hole provided in the barrel spline.
4. Install spring retainer (26) in the counterbore in barrel and over the pin (28). The retainer may require some pressure to properly seat it in the counterbore. Check dimension "C" for proper installation.



5. Insert spring (27) in spring socket (25) then insert (25 and 27) into (26).
6. Apply fluid to the ball seat of the spring socket (26) and place ball (29) in socket. Check dimension "D". If dimension "D" is greater than measurement shown, add spacer or washers on top of the spring (27) and under spring socket (25).

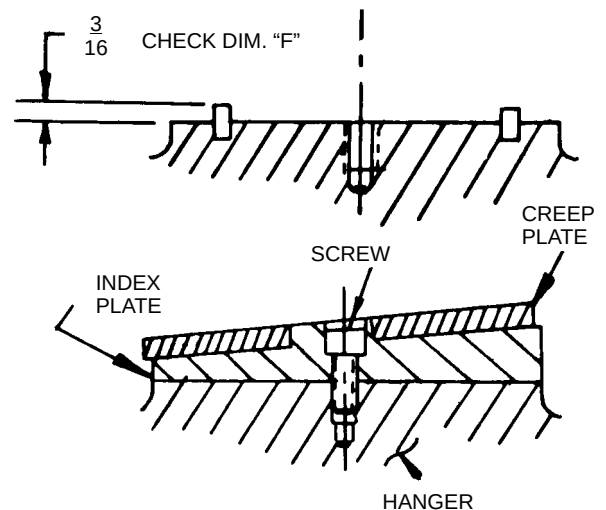
### INSTALLATION OF PISTON AND SHOE ASSEMBLY

1. Insert the seven piston assemblies in the shoe retainer as shown. Lubricate the pistons and the bores of the barrel.
2. Insert the pistons in the bores of the barrel and position the shoe retainer on the steel ball (29).



### INSTALLATION OF HANGER

1. Thread hex nut (20) on hex head screw (19) and install in hanger (18). The positioning of these parts will be determined later when setting the hanger. For assembly purposes this screw will be considered to be on the top of the hanger.
2. Refer to figure II page 9. Insert the two rollers (32) in the hanger. Press the 3/8" pins (33) through the hanger and rollers. Install the four cotter pins (44) in (33).
3. Insert the dowel pins (21) in the hanger (18). Check dimension "F" for proper assembly.



4. Position the hanger (18) with the flat side facing the assembler and screw (19) at the top (12 o'clock). Align index plate (22) over dowel pin (21) with the thick side of the plate at 9 o'clock.

**The index plate must be installed in this position for right hand operation.**

Install screw (24) through index plate and tighten.

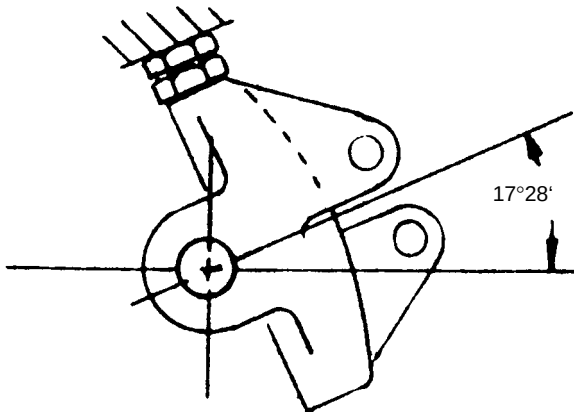
5. Apply fluid to both sides of the creep plate (23) and install on the index plate. The creep plate must be free to rotate.
6. Position dowel pin (41) and plug (38) at 6 o'clock (bottom of pump). Insert hanger with screw (19) at 12 o'clock (top) in the hanger housing (37).
7. Press indicator shaft (14) into one of the trunnion pins (15). Assembly keys (16) to trunnion pins.
8. Slip trunnion pins through housing, hanger, and inner bushing assembly in body, engaging keyway in hanger with key in trunnion pin. Must be snug, but slide free. The trunnion pin with the indicator shaft

should be on the right hand side of the pump, when facing the open end of the hanger housing.

9. Slip trunnion spacers (13) and trunnion needle bearings (12) over trunnion pins and into bores in housing until bushing assemblies are flush with body.
10. Assemble gasket (11), cap (9) and three screws (7) on left hand side of pump. Tighten screws securely.
11. Place "O" ring (10) into groove in cap (8), then slip cap and gasket (11) over indicator shaft (14), install three screws (7) and tighten securely.
12. Place indicator (6) on indicator shaft and thread on nut (5).

### SETTING HANGER "FULL VOLUME" POSITION

1. Using a protractor, or other equivalent tool, position the hanger, as indicated in sketch, above the horizontal centerline of the pump.



2. Hold hanger in this position and back out stop screw until it contacts stop surface of body, then lock screw in place.
3. With the hanger in this (full volume) position align indicator (6) with "full" mark on the trunnion cap and re-tighten nut (5).

### INSTALL END CAP TO PUMP

1. Assemble the top part of the controls on the end cap (3).
2. After control is installed, proceed as follows: lightly grease gasket (4) and place on housing.

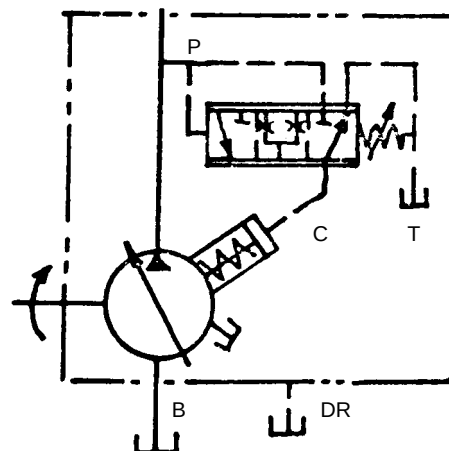
3. Hold end cap (3) against housing with word "Denison" right side up and reading from left to right, and insert screws (1) and (2), tighten securely.
4. Attach the controls to the bottom of the end cap after cap (3) is mounted.

### PRESSURE COMPENSATOR CONTROL

The pressure compensator control of the PV09 pump contains a 3-way directional valve which is directly offset C to T, P blocked by an adjustable spring which establishes compensating pressure. (See schematic and assembly view.) Pump discharge pressure acts directly against the end of the spool of this 3-way valve. The spool seeks a throttling position P to C to T while compensating at partial stroke and shifts P to C, T blocked at minimum stroke against the minimum stop.

Whenever P is ported to C, pressure is applied against the control piston, pressing this piston against the hanger mechanism, reducing the angle of the cam plate. The greater the control pressure, the greater distance the hanger is depressed, reducing the volume but maintaining pressure. The volume will continue to reduce until the bottom stop is encountered. This minimum stop is used only when it is not desirable to go to zero volume delivery.

The adjustment which decides when the pump is to decrease volume is the knurled knob on top of the pump housing. Always be certain after adjustment that the knurled lock nut is hand tight.



SCHEMATIC

# Pressure Compensator Control for PV09

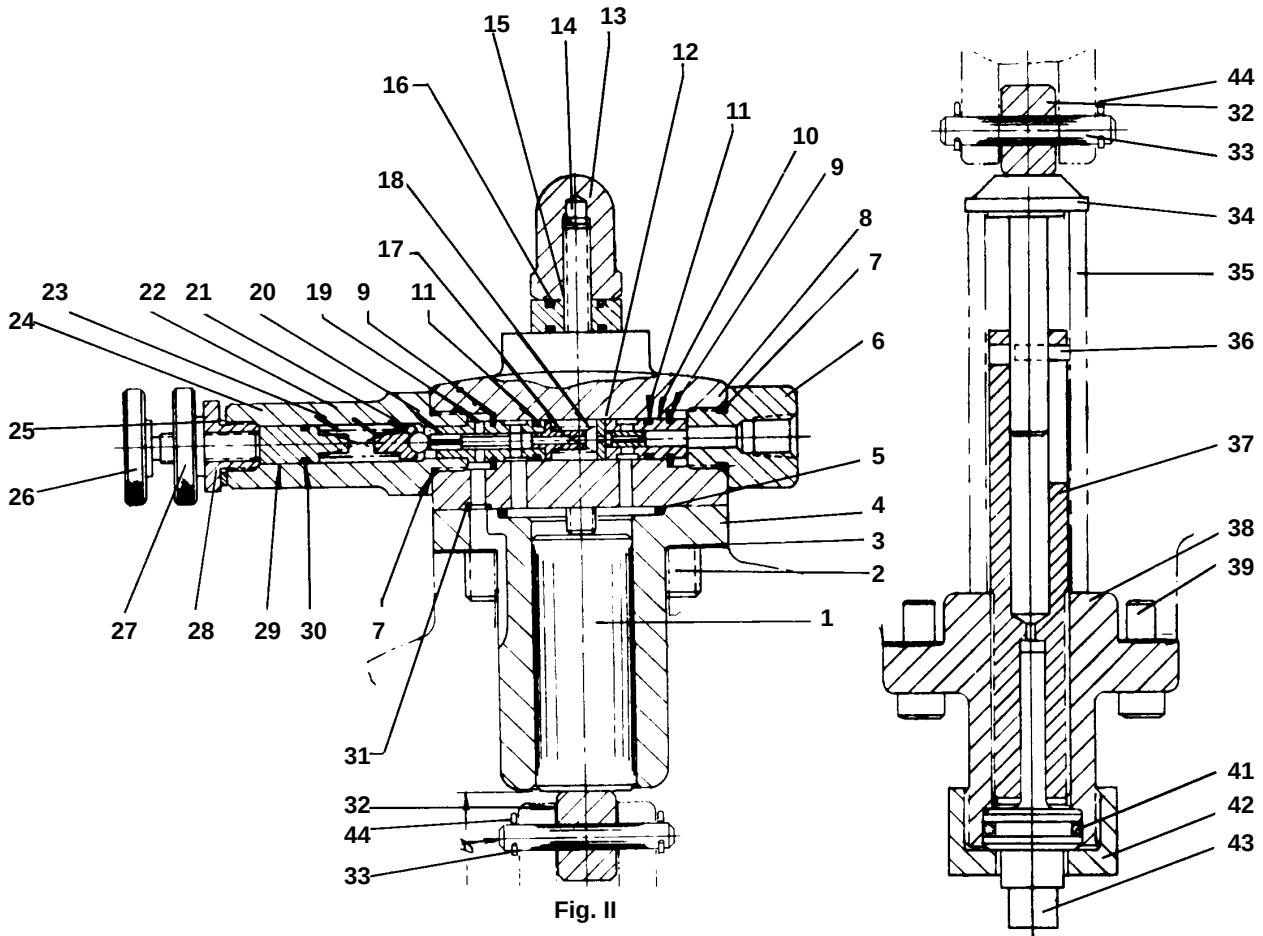
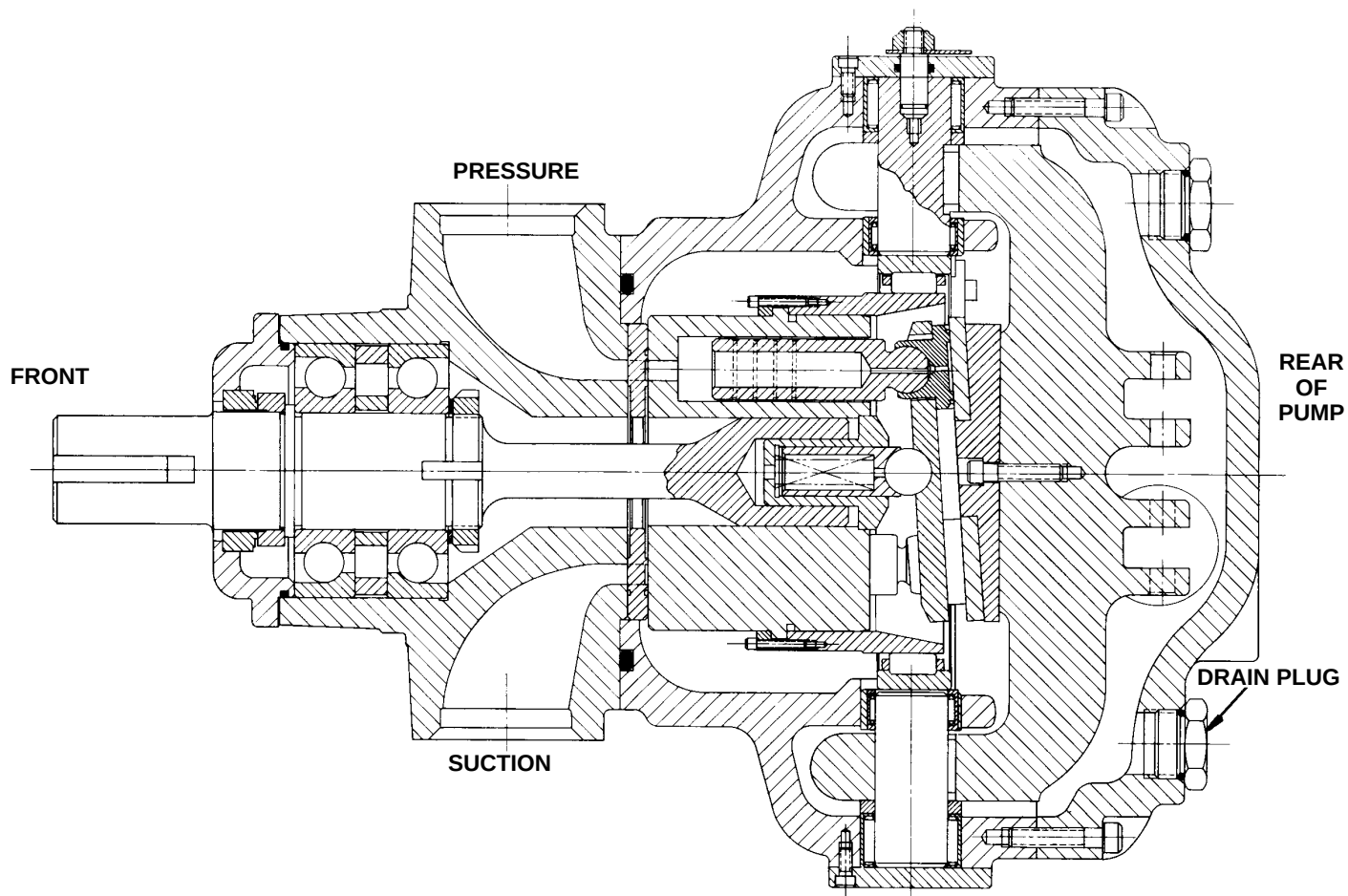


Fig. II

| ITEM                                   | QTY. | PART NO.  | DESCRIPTION                     |
|----------------------------------------|------|-----------|---------------------------------|
| 1                                      | 1    | 035-40835 | Control piston                  |
|                                        | 1    | 035-70778 | Control piston (reduced volume) |
| 2                                      | 4    | 358-24360 | SHC screw 5/8-11 x 2-1/4        |
| 3                                      | 2    | 035-12279 | Gasket (Vellumoid)              |
| 4                                      | 1    | 035-40836 | Piston housing                  |
| 5                                      | 1    | 675-00225 | "O" ring 70-6230-3              |
| 6                                      | 1    | 035-12562 | *Spool stop                     |
| 7                                      | 2    | 675-00908 | **"O" ring 70-6290-8            |
| 8                                      | 1    | 035-14027 | *Control cap                    |
| 9                                      | 2    | 356-15885 | *Snap ring Eaton #413           |
| 10                                     | 1    | 035-13982 | *Control sleeve                 |
| 11                                     | 2    | 675-00012 | **"O" ring 70-6227-7            |
| 12                                     | 1    | 035-13977 | *Brass piston                   |
| 13                                     | 1    | 035-12565 | *Cap                            |
| 14                                     | 1    | 311-16352 | *SS set screw, 3/8-16 x 3-3/4   |
| 15                                     | 1    | 035-12566 | *Lock nut                       |
| 16                                     | 2    | 675-00114 | **"O" ring 70-6227-12           |
| 17                                     | 1    | 035-22051 | *Spring                         |
| 18                                     | 1    | 035-13976 | *Spring retainer                |
| 19                                     | 1    | 035-13981 | *Control sleeve                 |
| 20                                     | 1    | 035-45998 | *Control piston                 |
| 21                                     | 1    | 201-08001 | *Steel ball 1/4"                |
| 22                                     | 1    | 035-11697 | *Ball support                   |
| 23                                     | 1    | 035-12289 | *Spring                         |
| * S15-00164-5 Compensator cap assembly |      |           |                                 |
| # S15-13652-5 Minimum stop assembly    |      |           |                                 |

| ITEM | QTY. | PART NO.  | DESCRIPTION               |
|------|------|-----------|---------------------------|
| 24   | 1    | 035-12555 | *Adjustment housing       |
| 25   | 1    | 348-10040 | *Lock washer              |
| 26   | 1    | 035-17115 | *Adjusting screw          |
| 27   | 1    | 035-17116 | *Lock nut                 |
| 28   | 1    | 035-17117 | *Retainer nut             |
| 29   | 1    | 035-11712 | *Seal piston              |
| 30   | 1    | 675-00012 | **"O" ring 70-6227-7      |
| 31   | 1    | 675-00008 | **"O" ring 70-6227-3      |
| 32   | 1    | 035-40831 | Roller                    |
| 33   | 2    | 035-44564 | Pin 3/8" dia.             |
| 34   | 2    | 035-40855 | #Follower                 |
| 35   | 1    | 035-40854 | #Spring                   |
| 36   | 1    | 325-12110 | #Roll pin 3/16 x 11/16    |
| 37   | 1    | 035-40856 | #Stop pin                 |
| 38   | 1    | 035-40858 | #Stop body                |
| 39   | 4    | 358-24200 | SHC screw 5/8-11 x 1-1/2  |
| 41   | 1    | 675-00214 | **"O" ring 70-6227-19     |
| 42   | 1    | 035-14752 | #Nut                      |
| 43   | 1    | 035-14751 | #Tongue                   |
| 44   | 4    | 322-03220 | Pin-cotter                |
| N/S  | 1    | 035-40988 | Tubing for R.H. pump      |
| N/S  | 1    | 035-40989 | Tubing for L.H. pump      |
| N/S  | 2    | 473-10404 | Fitting Parker #4-4CBTX-S |



## BRONZE BARREL VERSION

PUMP ASSEMBLED FOR  
RIGHT HAND ROTATION

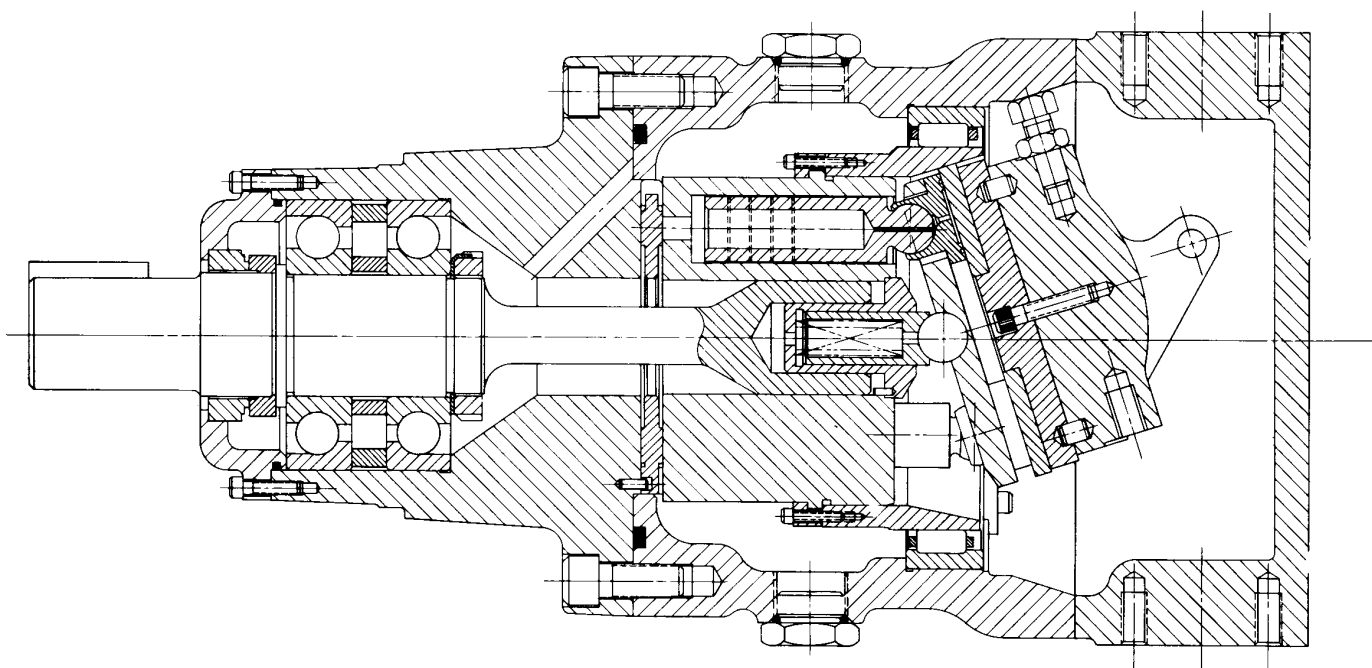
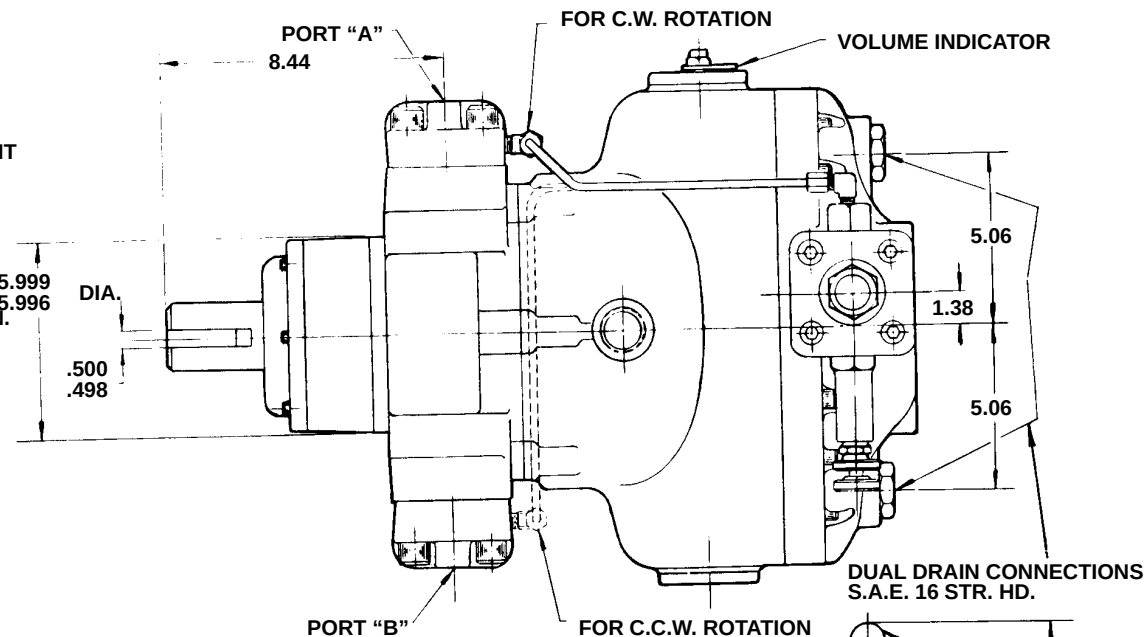


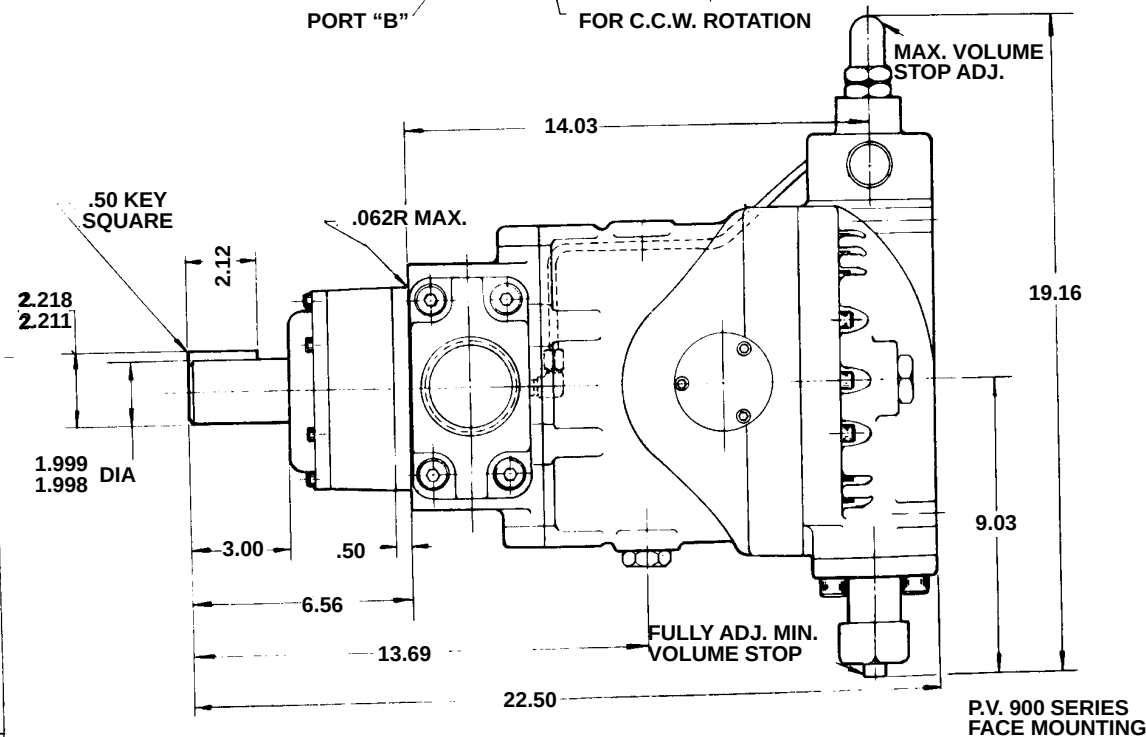
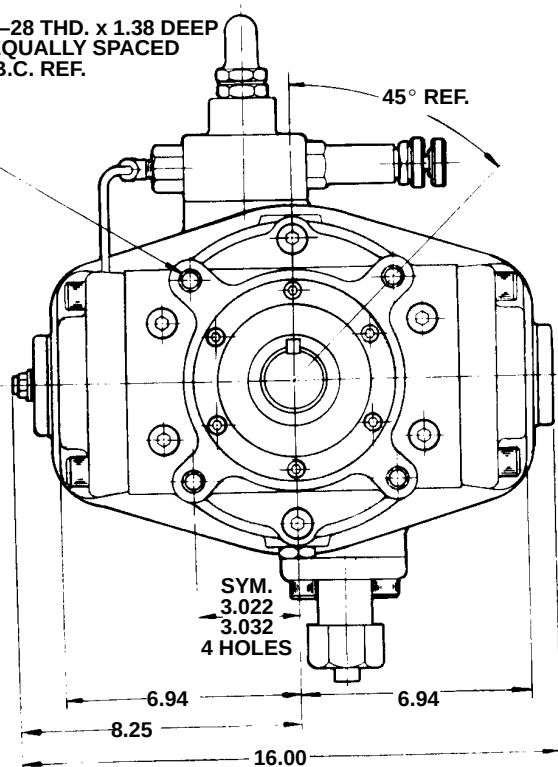
Fig. III

**NOTES:**

1. DIRECTION OF ROTATION IS AS VIEWED FROM SHAFT END OF UNIT
2. FOR CLOCKWISE ROTATION:  
PORT "A" PRESSURE  
PORT "B" SUCTION
3. FOR COUNTER CLOCKWISE ROTATION:  
PORT "A" SUCTION  
PORT "B" PRESSURE
4. HOUSING TO BE FILLED WITH OIL BEFORE STARTING
5. UNIT MUST BE EXTERNALLY DRAINED FROM TOP MOST POSITION.



5/8-11 UNC-28 THD. x 1.38 DEEP  
4 HOLES (EQUALLY SPACED  
ON 8.56 B.C. REF.



## PARTS LIST

| ITEM | QTY. | PART NO.  | DESCRIPTION                          |
|------|------|-----------|--------------------------------------|
| 1    | 16   | 358-16620 | SHCS, 3/8-16 x 1-3/4                 |
| 2    | 4    | 358-16360 | SHCS, 3/8-16 x 4                     |
| 3    | 1    | 035-44161 | End cap                              |
| 4    | 1    | 035-41087 | End Cap Gasket                       |
| 5    | 1    | 331-16000 | Elastic Stop Nut 3/8-16              |
| 6    | 1    | 035-40763 | Indicator                            |
| 7    | 6    | 358-12080 | SHCS, 1/4-20 x 1/2                   |
| 8    | 1    | 035-41080 | Trunnion Cap (Indicator)             |
| 9    | 1    | 035-41079 | Trunnion Cap                         |
| 10   | 1    | 675-00112 | "O" Ring 70-6227-10                  |
| 11   | 2    | 035-41084 | Gasket (Trunnion)                    |
| 12   | 2    | 230-10020 | Trunnion Needle Bearing              |
| 13   | 2    | 035-41081 | Trunnion Spacer                      |
| 14   | 1    | 035-40746 | Indicator Shaft                      |
| 15   | 2    | 035-41085 | Trunnion Pin                         |
| 16   | 2    | 035-41083 | Key                                  |
| 17   | 2    | S15-28930 | Needle Bearing & Spacer Sub Assembly |
| 18   | 1    | 035-41091 | Hanger                               |
| 19   | 1    | 313-20182 | Sq. Hd. Set Screw 1/2-13 x 1-1/4     |
| 20   | 1    | 333-20000 | Hex Nut 1/2-13                       |
| 21   | 2    | 324-22408 | Dowel Pin 3/8 x 1/2                  |
| 22   | 1    | 035-41088 | Index Plate                          |
| 23   | 1    | 035-41086 | Creep Plate                          |
| 24   | 1    | 358-14140 | SHCS, 5/16-18 x 7/8 Lg.              |
| 25   | 1    | 035-41029 | Retainer - Spring                    |
| 26   | 1    | 035-41028 | Socket - Spring                      |
| 27   | 1    | 035-40961 | Spring                               |
| 28   | 1    | 324-20806 | Dowel Pin                            |
| 29   | 1    | 201-28001 | Ball                                 |
| 30   | 1    | S15-14770 | Piston & Shoe Assembly with Retainer |

\* Bronze Barrel and Bearing Assembly.  
For replacement specify Part No. S15-41420 (Steel).

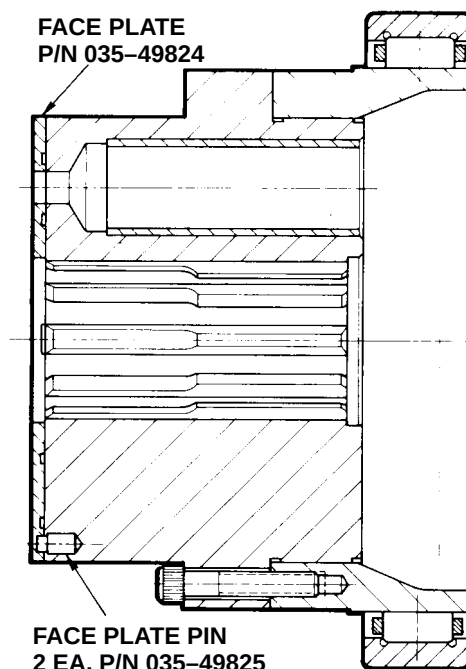
| ITEM | QTY.        | PART NO.  | DESCRIPTION                              |
|------|-------------|-----------|------------------------------------------|
| 31   | 2           | 359-15126 | SHC Screw 3/8-24 x 3/4 (Nylok)           |
| 32   | 2           | 035-41082 | Barrel Stop                              |
| 33   | 1           | S15-20776 | Barrel & Bearing Assembly                |
| 34   | 1           | 035-43034 | Right-Hand Port Plate (CW)               |
| 35   | 2           | 358-24200 | SHC Screw 5/8-11 x 1-1/2                 |
| 36   | 4           | 358-24360 | SHC Screw 5/8-11 x 4                     |
| 37   | 1           | 035-41095 | Hanger Housing                           |
| 38   | 1           | 488-14164 | Hex Plug AN-814-D-16                     |
| 39   | 4           | 675-00916 | "O" Ring 70-6290-16                      |
| 40   | 4           | 675-00441 | "O" Ring 70-6227-68                      |
| 41   | 1           | 324-21208 | Port Plate Pin 3/16 x 1/2                |
| 42   | 6           | 358-12160 | SHC Screw 1/4-20 x 1                     |
| 43   | 1           | 035-40981 | Shaft Seal Retainer                      |
| 44   | 1           | 675-00246 | "O" Ring 70-6230-24                      |
| 45   | 1           | 623-12331 | Shaft Seal Assembly                      |
| 46   | 1           | S15-13674 | Shaft & Bearing Assembly (47 through 51) |
| 47   | 1           | 341-10011 | Lock Nut N-11                            |
| 48   | 1           | 350-01011 | Lock Washer W-11                         |
| 49   | 1           | 230-82045 | Shaft Bearing (Matched Pair)             |
| 50   | 1           | S15-13591 | Bearing Spacer Assembly                  |
| 51   | 1           | 035-40968 | Pump Shaft                               |
| 52   | 1           | 035-20102 | Shaft Key                                |
| 53   | 1           | 035-40987 | Port Block                               |
| NS   | 1           | 035-17789 | Suction Flange                           |
| NS   | 1           | 035-47666 | Pressure Flange with 1/4 NPT Connection  |
| NS   | 2           | 675-00230 | "O" Ring 70-6230-8 for Flanges           |
| NS   | as req. 1-5 | 345-10020 | Spacer (Ref. Par. 6, pg. 7)              |
|      |             | S15-17790 | Seal Kit for Pump & Controls             |

NS - Not Shown

All parts listed above are used on PV09YA-053 (53 GPM) and PV09YA-032 (32 GPM).

The control piston (item 1) on page 9 is the only difference in the pumps.

Part No. 035-70778 is a longer control piston used in the reduced volume pump.



S15-41420 Steel Barrel and Bearing Assembly

Fig. IV-a



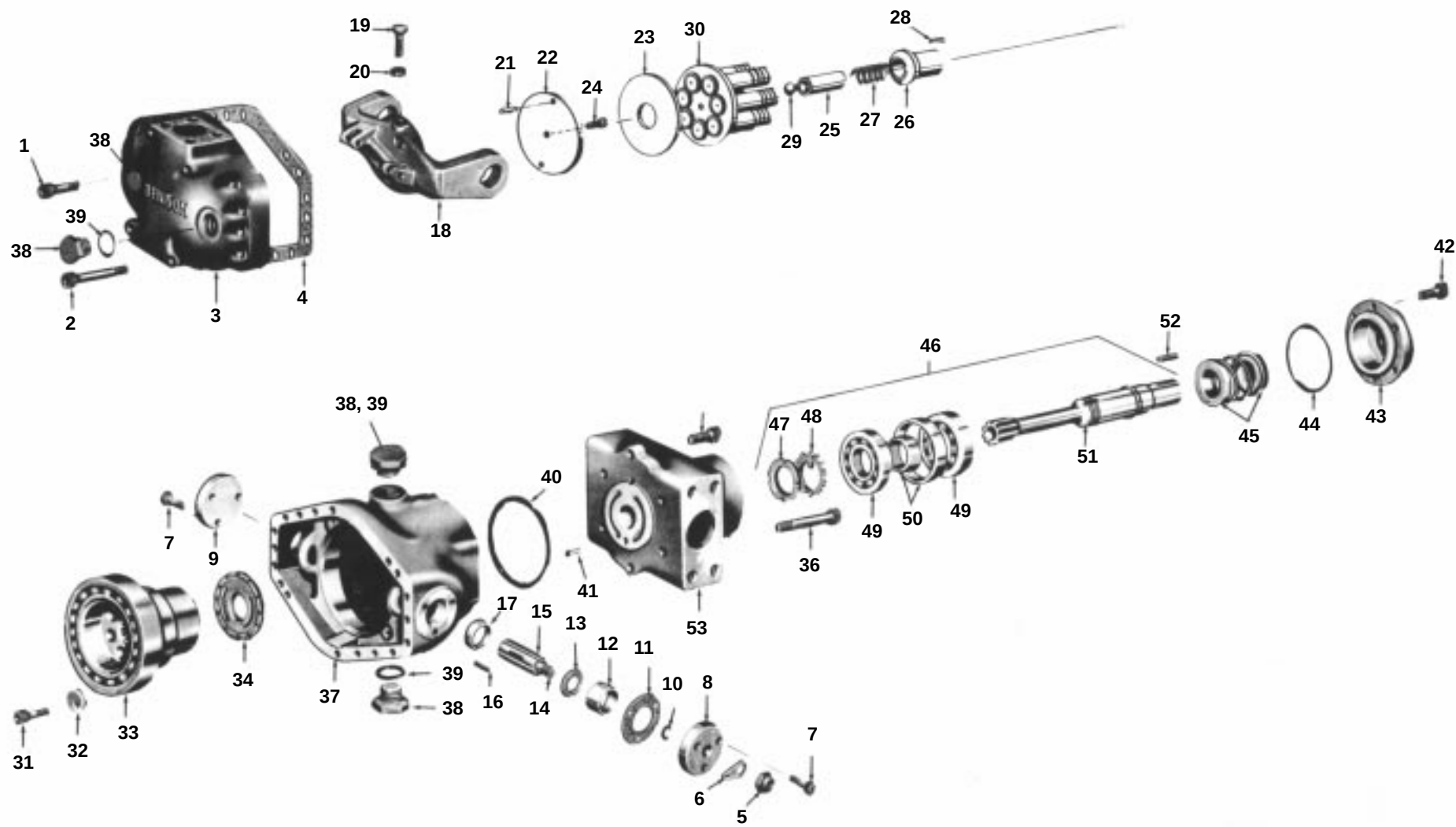


Fig. V

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