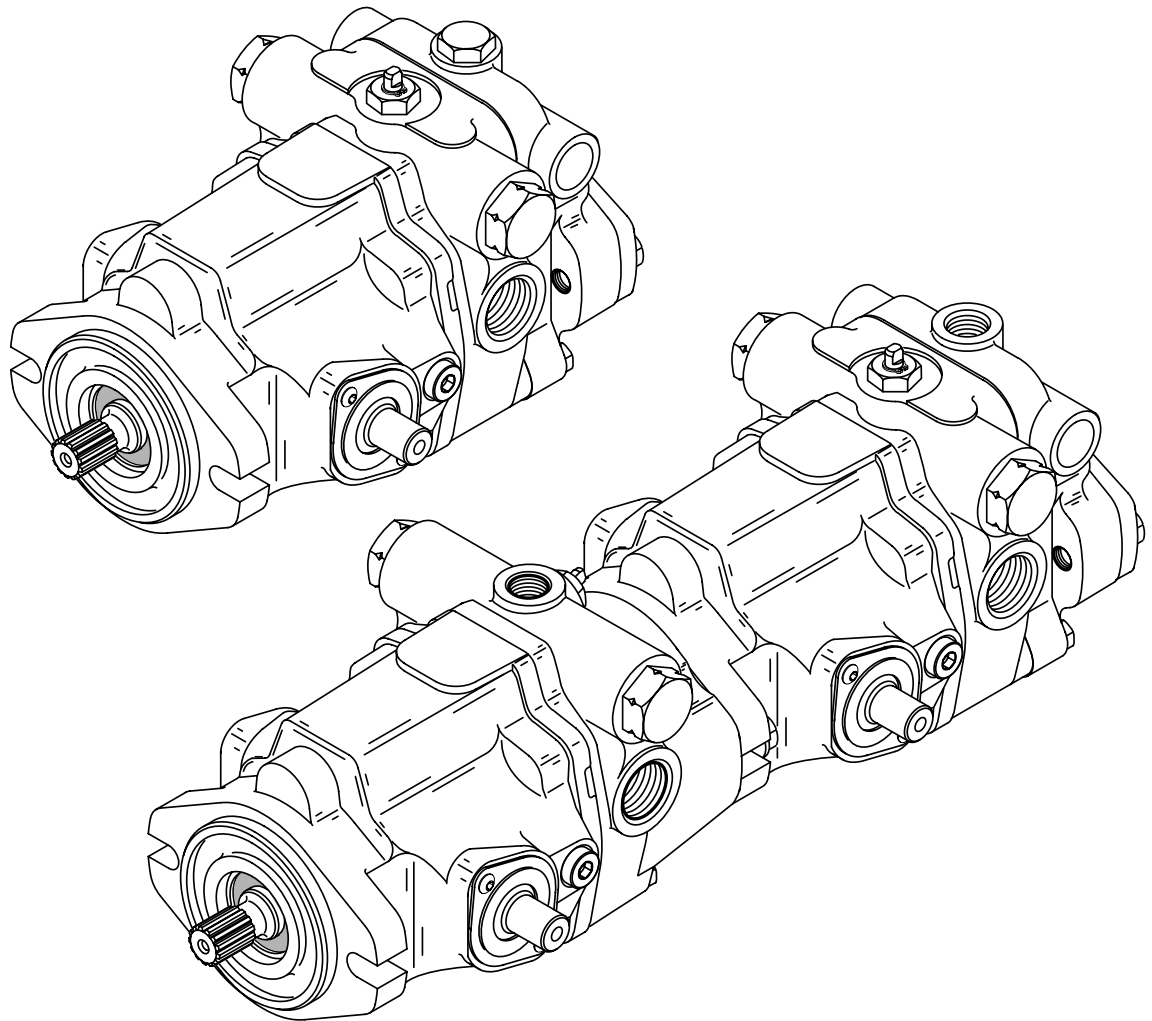




## Repair Information



**Model 70142 / 70144, 20.3 cm<sup>3</sup>/r [1.24 in<sup>3</sup>/r] Displacement  
and 70145, 23.6 cm<sup>3</sup>/r [1.44 in<sup>3</sup>/r] Displacement  
Variable Displacement Piston Pump**

design code **01 02**

with **Valve Plate**

# Introduction

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## Introduction

This manual provides service information for the Eaton Models 70142 / 70144 and 70145 Variable Displacement Piston Pumps. Step by step instructions for the complete disassembly, inspection, and reassembly of the pump are given. The following recommendations should be followed to insure successful repairs.

- Remove the pump from the application.
- Cleanliness is extremely important.
- Clean the port areas thoroughly before disconnecting the hydraulic lines.
- Plug the pump ports and cover the open hydraulic lines immediately after they're disconnected.
- Drain the oil and clean the exterior of the pump before making repairs.
- Wash all metal parts in clean solvent.
- Use compressed air to dry the parts. Do not wipe them dry with paper towels or cloth.
- The compressed air should be filtered and moisture free.
- Always use new seals when reassembling hydraulic pumps.
- For replacement parts and ordering information refer to parts list 6-632.
- Lubricate the new rubber seals with a petroleum jelly (vaseline) before installation.
- Torque all bolts over gasketed joints, then repeat the torquing sequence to make-up for gasket compression.
- Verifying the accuracy of pump repairs on an authorized test stand is essential.

# Identification and Tools Required

## Identification Numbers

Stamped on each unit.

### A - Product Number Description

- 70142 = Piston Pump (20.3 cm<sup>3</sup>/r [1.24 in<sup>3</sup>/r]) with Gerotor
- 70144 = Piston Pump (20.3 cm<sup>3</sup>/r [1.24 in<sup>3</sup>/r]) without Gerotor
- 70145 = Piston Pump (23.6 cm<sup>3</sup>/r [1.44 in<sup>3</sup>/r]) with or without Gerotor
- 78113 = Tandem Piston Pumps (20.3 cm<sup>3</sup>/r [1.24 in<sup>3</sup>/r]) **no Gear Pump**
- 78114 = Tandem Piston Pumps (20.3 cm<sup>3</sup>/r [1.24 in<sup>3</sup>/r]) with Gear Pump
- 78115 = Tandem Piston Pumps (23.6 cm<sup>3</sup>/r [1.44 in<sup>3</sup>/r]) **no Gear Pump**
- 78116 = Tandem Piston Pumps (23.6 cm<sup>3</sup>/r [1.44 in<sup>3</sup>/r]) with Gear Pump

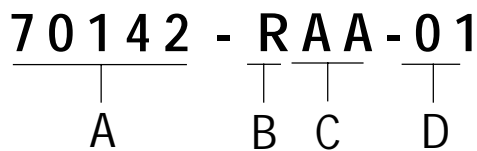
### B - Rotation,

- R = Righthand,
- L = Lefthand

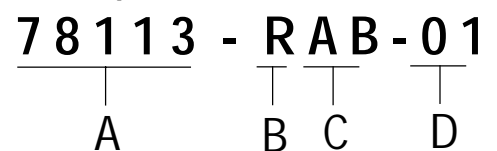
### C - Sequential Letters

### D - Design Code Number

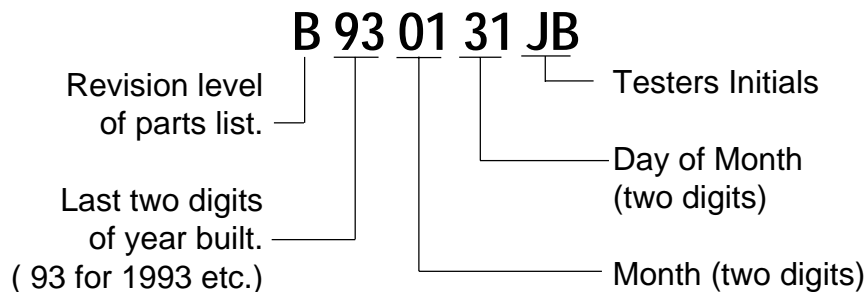
## Single Pump - Product Number



## Tandem Pumps - Product Number



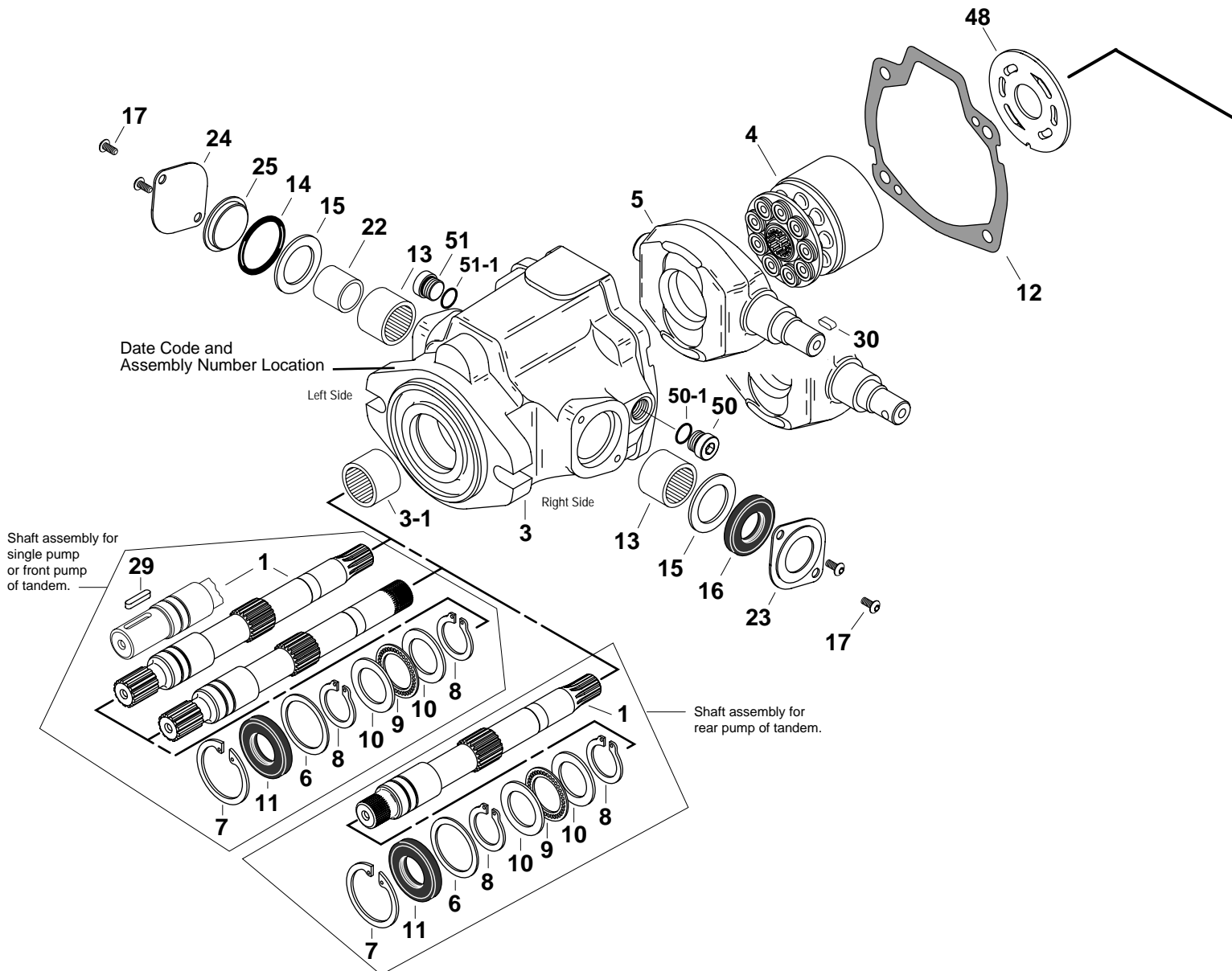
## Serial Number Code:

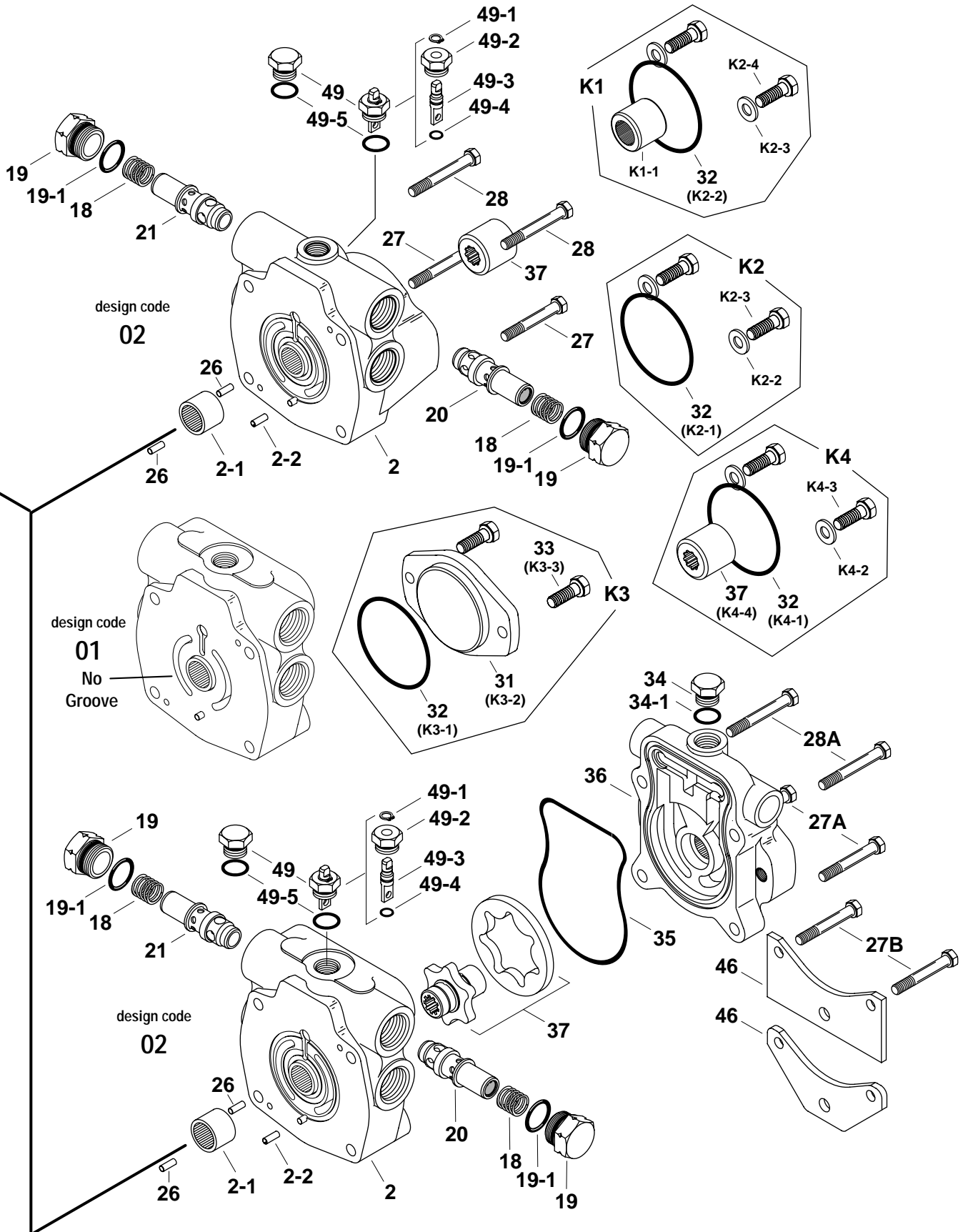


## Required Tools

- 7/16 in. Hex Key (Allen)
- 9/16 in. End Wrench
- 1 in. End Wrench
- 9/16 in. Socket
- 1/2 in. Socket
- Internal Retaining Ring Pliers (straight .090 tip)
- External Retaining Ring Pliers (straight .070 tip)
- O-ring Pick
- Torque Wrench (135.6 N·m [100 lbf·ft] capacity)
- Hammer (soft face)
- Light Petroleum Jelly
- Seal Driver
- Arbor Press

# Parts Drawing - Figure 1-1





# Parts List

Item	Qty.	Description
1	1	Drive Shaft
2	1	Backplate Assembly
3	1	Housing Assembly
4	1	Rotating Kit Assembly
5	1	Camplate
6	1	Washer
+ 7	1	Retaining Ring
+ 8	2	Retaining Ring
9	1	Thrust Bearing
10	2	Bearing Race
+ 11	1	Shaft Seal, Drive
+ 12	1	Housing Gasket
13	2	Needle Bearing
+ 14	1	O-ring, 3.175 mm Dia. x 31.75 mm ID. [.125 in. Dia. x 1.25 in. ID.]
15	2	Washer
+ 16	1	Shaft Seal, Trunnion
17	4	Screw, Pan Head
18	2	Spring
19	2	Plug Assembly
+ 19-1	2	O-ring, 2.38 mm Dia. x 22.23 mm ID. [.0937 in. Dia. x .875 in. ID.]
20	1	Relief Valve for Port "C"
21	1	Relief Valve for Port "D"
22	1	Inner Race
23	1	Seal Cover
24	1	Trunnion Cover
25	1	Cover, O-ring
26	2	Dowel Pin
27	2	Cap Screws, 5/16-18, 50.8 mm [2 in.] Long
28	2	Cap Screws, 5/16-18, 63.5 mm [2.5 in.] Long
29	1	Key, Drive Shaft
30	1	Key, Camplate Trunnion
31	1	Cover Plate (In K3 kit)
+ 32	1	O-ring (In K1, K2, K3 & K4 kit)
33	2	Cap Screws, Cover Plate (In K3 kit)
34	1	Plug Assembly
+ 34-1	1	O-ring, 2.21 mm Dia. x 16.36 mm ID. [.087 in. Dia. x .644 in. ID.]
+ 35	1	Molded O-ring
36	1	Charge Pump Adaptor
37	1	Gerotor set and coupler sub-assembly 6.9 cm <sup>3</sup> /r [.42 in <sup>3</sup> /r] displacement, 6.35 mm [.25 in.] width 13.8 cm <sup>3</sup> /r [.84 in <sup>3</sup> /r] displacement, 12.7 mm [.5 in.] width
37	1	9 tooth coupler (In K4 kit)
46	1	Mounting Bracket, Square shaped
46	1	Mounting Bracket, "V" shaped
48	1	Valve Plate

## Parts List

Item	Qty.	Description
49	1	Dump Valve sub-assembly
+ 49-1	1	Retaining Ring
49-2	1	Separator Plug
49-3	1	Separator
+ 49-4	1	O-ring, 1.59 mm Dia. x 9.53 mm I.D. [.0625 in. Dia. x .375 in. I.D.]
+ 49-5	1	O-ring, 2.46 mm Dia. x 19.18 mm I.D. [.097 in. Dia. x .755 in. I.D.]
49	1	Plug Assembly
49-5	1	O-ring, 2.46 mm Dia. x 19.18 mm I.D. [.097 in. Dia. x .755 in. I.D.]
50	1	Plug Assembly
+ 50-1	1	O-ring, 1.98 mm Dia. x 11.89 mm ID. [.078 in. Dia. x .468 in. ID.]
51	1	Plug Assembly
+ 51-1	1	O-ring, 1.98 mm Dia. x 11.89 mm ID. [.078 in. Dia. x .468 in. ID.]

## Mounting Kits

K1	1	Tandem Piston Pump Mounting Kit
K1-1	1	35T Coupler, 36.8 mm [1.45 in.] long
K1-2	1	O-ring, 1.59 mm Dia. x 101.6 mm ID. [.0625 in. Dia. x 4 in. ID.]
K1-3	2	Cap Screws
K1-4	2	Washer
K2	1	Gear Pump Mounting Kit
K2-1	1	O-ring, 1.59 mm Dia. x 82.55 mm ID. [.0625 in. Dia. x 3.25 in. ID.]
K2-2	2	Washer
K2-3	2	Cap Screws
K3	1	Cover Plate Kit
K3-1	1	O-ring, 1.59 mm Dia. x 82.55 mm ID. [.0625 in. Dia. x 3.25 in. ID.]
K3-2	1	Cover Plate
K3-3	2	Cap Screws
K4	1	Gear Pump Mounting Kit with Coupler
K4-1	1	9T Coupler
K4-2	1	O-ring, 1.59 mm Dia. x 101.6 mm ID. [.0625 in. Dia. x 4 in. ID.]
K4-3	2	Cap Screws
K4-4	2	Washer

## Seal Repair Kit

70142-938	Seal Repair Kit for 70142, 70144 and 70145 piston pump.
-----------	---------------------------------------------------------

**Legend**                    +    Included in seal repair kit.

# Disassembly

## Disassembly

The following instructions apply to a variable displacement piston pump with or without a gerotor charge pump. A tandem pump assembly should be separated into individual pumps before disassembly.

1 Position the pump into a protected jaw vise, clamping onto the outer portion of the flange, with the input drive shaft down. Remove the four cap screws retaining charge pump adapter or backplate.

No gerotor charge pump skip to step 6.

2 Lift the charge pump adapter assembly straight up off backplate, shaft, and gerotor. Gerotor may stay in adapter or on backplate.

3 Remove o-ring from charge pump adapter.

4 Remove outer gerotor ring from either the charge pump adapter or the inner gerotor ring.

Refer to Appendix A for disassembly and inspection of charge pump adapter assembly.

5 Remove the inner gerotor ring and coupler assembly from shaft.

6 Lift backplate straight up off of shaft and housing. Remove valve plate from backplate or from rotating kit assembly, still in housing.

7 From backplate remove dump valve assembly or plug assembly, and relief valve assemblies. Note: Mark the relief valve in relationship to the cavity it was removed, for reassembly purposes.

### Backplate Inspection:

- Check the bearing (press fit) in backplate. If needles remain in cage, move freely, and setting is at the dimension shown in figure 1-3, removal not required.

- Check roll pin in backplate. If tight and set to the dimension shown in figure 1-3, removal not required.

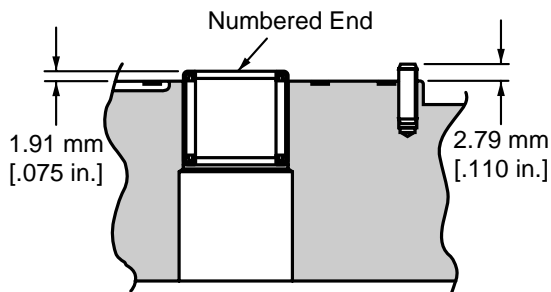


Figure 1-3

8 Remove housing gasket from housing or backplate.

9 To remove rotating kit assembly from housing, first remove pump from vise holding the rotating kit assembly in position. Lower pump so that the shaft end (flange end) is up. Set the rear of housing onto table with housing flat and rotating kit assembly at rest on table. Hole in table for protruding shaft is required. Remove by lifting the housing and shaft from rotating kit assembly.

Refer to Appendix B for disassembly and Inspection of rotating kit.

10 Remove retaining ring from the front of housing. Press the shaft, shaft seal or spacer, and washer from housing. Remove retaining ring, thrust washer, thrust bearing, second thrust washer, and second retaining ring from shaft.

11 To remove camplate from housing, remove the two screws from both sides of housing (four total) retaining seal cover and trunnion cover. Remove seal cover, shaft seal, washer, and bearing from housing. Remove trunnion cover, o-ring cover, o-ring, washer, inner race, and bearing from housing. Slide the camplate over to one side and remove thru the back side of housing.

### Camplate Inspection:

- The finish on the piston shoe surfaces of the camplate should show no signs of scoring.

### Housing Inspection:

- Check the bearing (press fit) in front of housing. If needles remain in cage, move freely, and setting at the dimension shown in figure 1-4, removal not required.

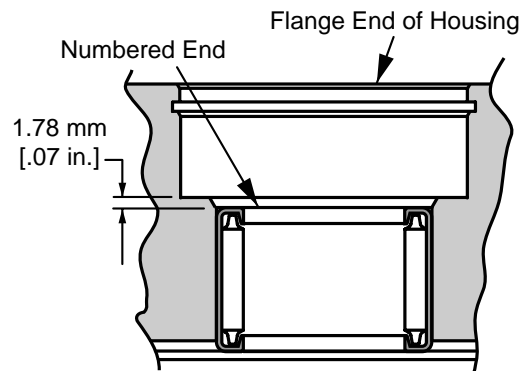


Figure 1-4

12 Discard the shaft seal, gaskets, and o-rings from all assemblies. Replace with new seals upon reassembly.

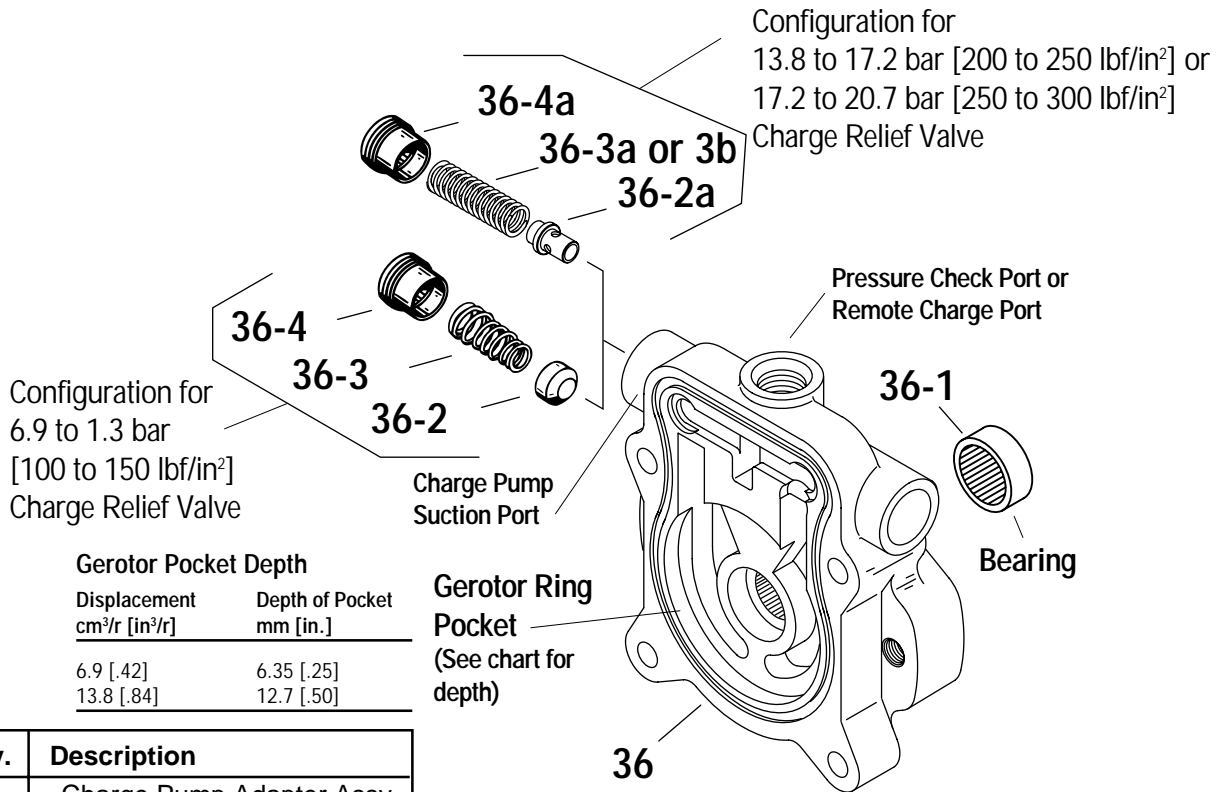


# Reassembly

## Reassembly

- 1 All parts should be cleaned and critical moving parts lubricated before reassembly.
  - 2 If necessary, press new bearing in housing to dimension shown in figure 1-4 with the numbered end of bearing outward.
  - 3 Starting with the camplate, insert camplate into the housing with the long trunnion side down and to the appropriate side of linkage on the machine.
  - 4 On the short trunnion side of camplate install bearing (bearing with numbered side to the inside of pump), bearing race (race with chamfer toward inside of pump), washer, o-ring, o-ring cover, trunnion cover, and retain with two screws. Torque screws 4.1 to 5.4 N·m [36 to 48 lbf·in].
  - 5 On the long trunnion side of camplate install bearing (bearing with numbered side to the inside of pump), washer, trunnion shaft seal, seal cover, and retain with two screws. Torque screws 4.1 to 5.4 N·m [36 to 48 lbf·in].
  - 6 To install shaft, place exterior retaining ring, thrust race, thrust bearing, second thrust race, and second retaining ring onto shaft. Position washer and shaft seal or spacer onto shaft.
  - 7 Install shaft assembly into front of housing: For units with spacer, retain with interior retaining ring and go on to step 8. For units with shaft seal, seat seal into position with seal driver and retain with interior retaining ring.
- Refer to Appendix B for reassembly of rotating kit assembly.
- 8 With flange end of housing up, position rotating kit assembly onto shaft and into housing. Align the spline within the piston block with shaft internal spline. Make sure piston block is engaged fully to put piston shoes in contact with camplate. Check all parts for proper position before proceeding.
  - 9 Clamp pump assembly in a protected jaw vise with the open end of the housing up. Install gasket and two dowel pins onto housing.
  - 10 If necessary, press new bearing and roll pin in backplate to dimension shown in figure 1-3. Bearing installed with the numbered end outward. Roll pin installed with split oriented away from bearing.
  - 11 Install new o-ring on relief valves. Install relief valve in its original cavity in backplate that it was removed. Torque 128 to 142 N·m [95 to 105 lbf·ft].
  - 12 Install new o-ring on dump valve or plug. Install dump valve or plug into backplate. Torque dump valve or plug to 36.6 to 40.7 N·m [ 27 to 30 lbf·ft]
  - 13 Apply a small amount of petroleum jelly to the steel side of valve plate to hold in place for installation. Aligning the index pin, place the valve plate in position onto the backplate, with steel side against backplate.
  - 14 Install backplate assembly onto housing assembly. Making sure valve plate and gasket stay in place.  
No gerotor charge pump, skip to step 17.
  - 15 Install inner gerotor and coupler assembly. The coupler has a "V" groove on one end and this end of coupler should enter backplate first. Lubricate inner gerotor.  
Refer to Appendix A for reassembly of Charge relief valve in adapter plate.
  - 16 Install o-ring and outer gerotor ring onto adapter plate. Lubricate both o-ring and outer gerotor ring to hold in position during assembly of adapter plate. Install adapter plate onto backplate. Make sure o-ring and gerotor ring stay in place.
  - 17 Retain backplate and adapter plate (when used) with four cap screws, Torque 23 to 27 N·m [17 to 20 lbf·ft].
  - 18 Install new o-rings on all plugs. Install plugs into housing. Torque 9/16 in. - 18 plug 28 to 32 N·m [21 to 24 lbf·ft].
  - 19 Refer to start-up procedures on page 17.

# Appendix A - Charge Pump Adapter Assembly



Gerotor Pocket Depth	
Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	Depth of Pocket mm [in.]
6.9 [.42]	6.35 [.25]
13.8 [.84]	12.7 [.50]

Item	Qty.	Description
36	1	Charge Pump Adapter Assy.
36-1	1	Bearing (press fit)
36-2	1	Poppet, Cup
36-2a	1	Poppet, Pin
36-3	1	Spring, Tapered
36-3a	1	Spring, "Light Green" *
36-3b	1	Spring, "Pink" **
36-4	1	Spring Retainer
36-4a	1	Spring Retainer

\*200 to 250 lbf/in<sup>2</sup>  
 \*\*250 to 300 lbf/in<sup>2</sup>

## Reassembly - Charge Pump Adapter Assembly

- 1 If necessary, press new bearing in adapter assembly. The bearing to dimension shown in figure 1-2 with the numbered end of bearing outward and closest to mounting flange.
- 2 Install cup poppet or pin poppet, spring, and spring retainer into charge pump adapter. Torque retainer 6.8 to 9.5 N·m [5 to 7 lbf·ft.]

## Disassembly - Charge Pump Adapter Assembly

1 Remove spring retainer, spring, and poppet from adapter assembly.

### Inspection:

- Inspect the charge pump relief valve seat inside the charge pump adapter. Check to insure that seat is smooth and free of burrs or other defects.
- Inspect the charge pump relief valve spring.
- Inspect the bearing inside the charge pump adapter. The bearing needles must remain in the bearing cage and bearing at dimension shown in figure 1-2.
- Inspect the gerotor pocket inside the charge pump adapter assembly. It should not be scored excessively.

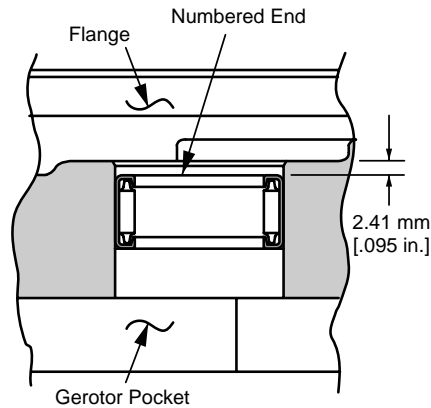
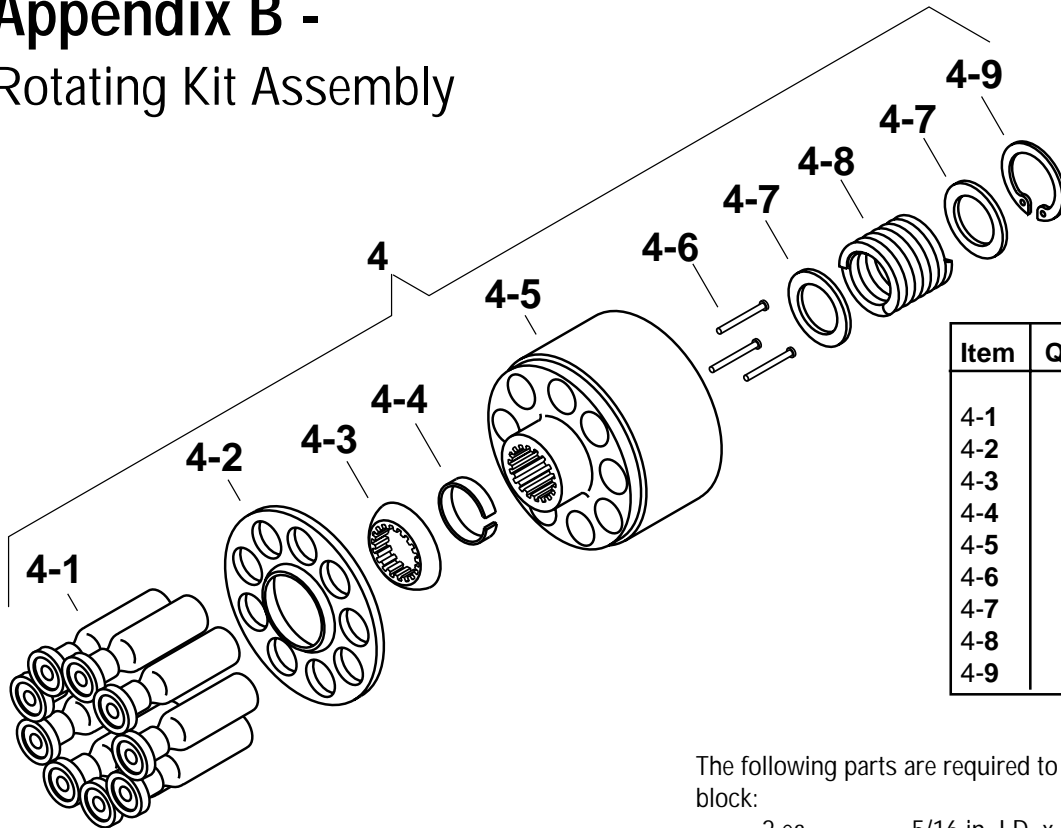


Figure 1-2

# Appendix B - Rotating Kit Assembly



Item	Qty.	Description
4-1	9	Piston assemblies
4-2	1	Spider
4-3	1	Spider Pivot
4-4	1	Retainer
4-5	1	Piston Block
4-6	3	Pins
4-7	2	Washer
4-8	1	Spring
4-9	1	Retaining Ring

## Disassembly - Rotating Kit Assembly

Disassembly of rotating assembly is required for inspection only.

- 1 Remove the nine piston assemblies, spider, and spider pivot from piston block.

### Inspection:

- Examine the O.D. of the pistons for finish condition. They should not show wear or deep scratches. Inspect the shoes for a snug fit on the ball end of the pistons and a flat smooth surface that comes in contact with the camplate. **Do not lap piston shoes.**
- Examine the spider for wear in the pivot area.
- Examine the pivot to insure smoothness and no signs of wear.
- Inspect the piston block surface that makes contact with valve plate. This surface should be smooth and free of deep scratches. **Do not lap piston block.**
- The pistons should move freely in the piston block bore. If not free moving, examine the bore for scoring or contamination.

- 2 To inspect pins and spring **Caution** should be taken in removing spring. The **spring is highly compressed** and the retaining ring should not be removed without compressing the spring safely.

The following parts are required to disassemble the piston block:

- 2 ea. 5/16 in. I.D. x 15/16 in. O.D. flat washers
- 1 ea. 5/16 in. x 2-7/8 in. N.C. cap screw, and
- 1 ea. 5/16 in. N.C. nut

To remove spring, place one of the flat washers over the 5/16 in. x 2-7/8 in. cap screw. Put cap screw through the center of the piston block and apply the second washer. Let washer rest on the three pins and retain with nut. Turning nut and compressing spring inside the block. Use a pair of retaining ring pliers and remove the internal retaining ring. Remove nut, bolt, and the two washers from block. Removing the washer, spring, second washer, three pins, and pin keeper at the same time.

## Reassembly - Rotating Kit Assembly

- 1 To reassemble the rotating kit assembly complete the following: Compress the pin keeper and install in the spline of the piston block. Install the three pins with head end to the inside of the block and position in the special grooves of the piston block spline.
- 2 Install the washer, spring, and second washer into the piston block. Use the two 5/16 in. I.D. washers, nut, and 5/16 in. x 2-7/8 in. cap screw to compress the spring and retain with retaining ring. Remove the nut, cap screw, and the two washers.
- 3 Install the pivot onto the three pins, spider on the pivot, and piston assemblies thru the spider and into piston block, resting on spider.

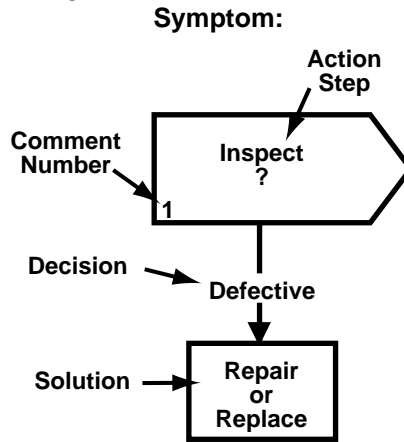
# Fault - Logic Trouble Shooting

This fault - logic trouble shooting guide is a diagnostic aid in locating transmission problems.

Match the transmission symptoms with the problem statements and follow the action steps shown in the box diagrams. This will give expedient aid in correcting minor problems eliminating unnecessary machine down time.

Following the fault - logic diagrams are diagram action comments of the action steps shown in the diagrams. Where applicable, the comment number of the statement appears in the action block of the diagrams.

## Explanatory Diagram



## Recommended Gauge Locations

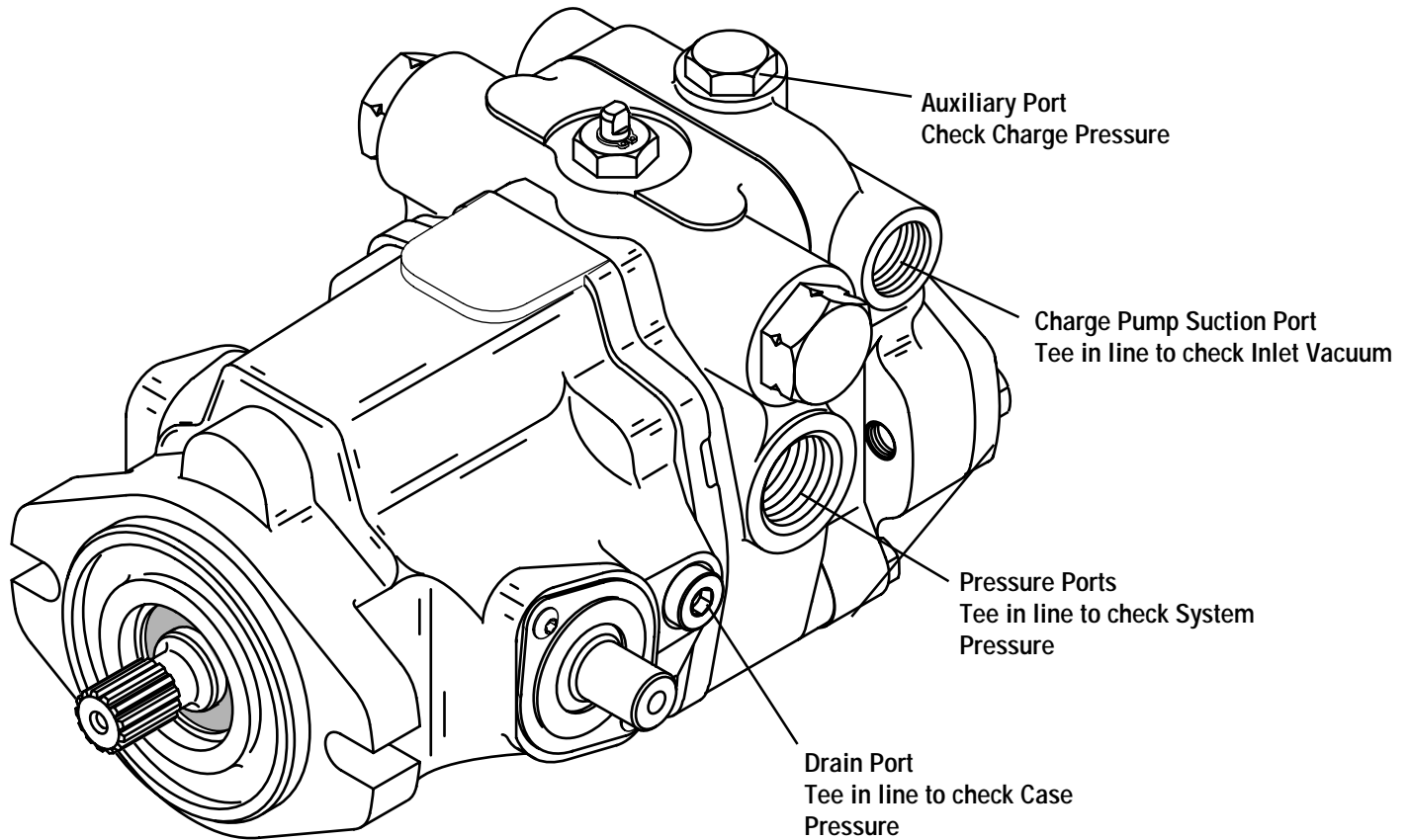


Figure 3-1

### Gauges Recommended

Inlet vacuum gauge: 207 bar to 0 bar [30 lbf/in<sup>2</sup> to 30 inHg]

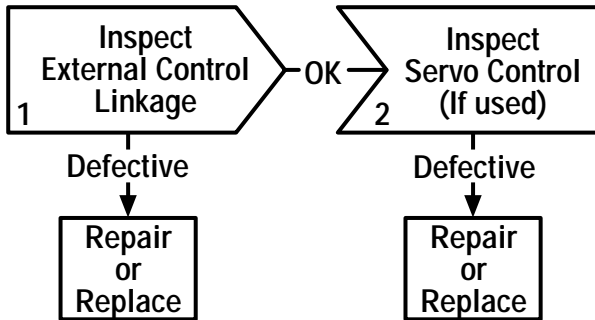
System pressure gauge: 700 bar [10,000 lbf/in<sup>2</sup>]

Charge pressure gauge: 0 to 50 bar [0 to 600 lbf/in<sup>2</sup>]

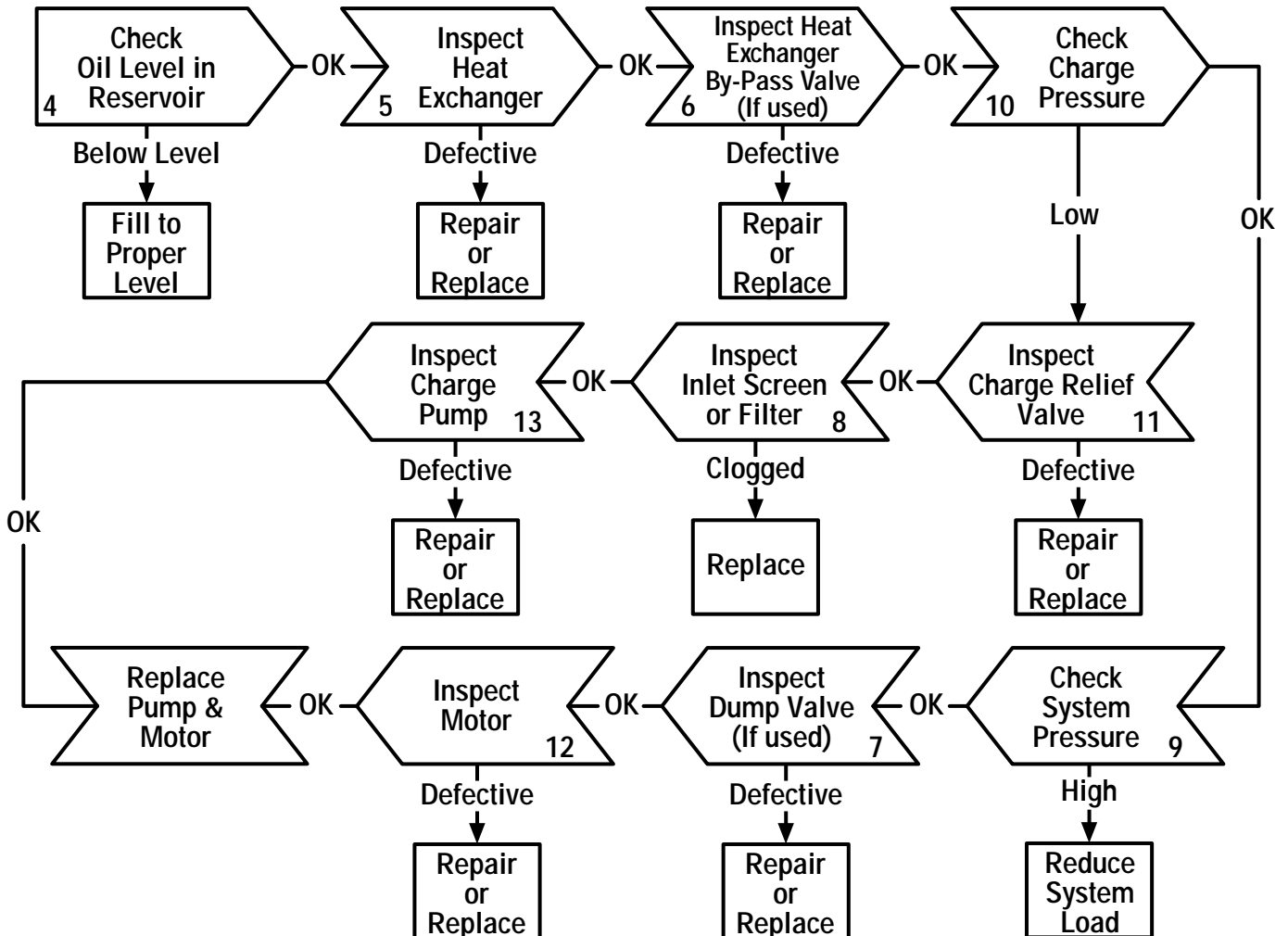
Case pressure gauge: 0 to 25 bar [0 to 300 lbf/in<sup>2</sup>]

# Fault - Logic Trouble Shooting

## Symptom: Neutral Difficult or Impossible to Find

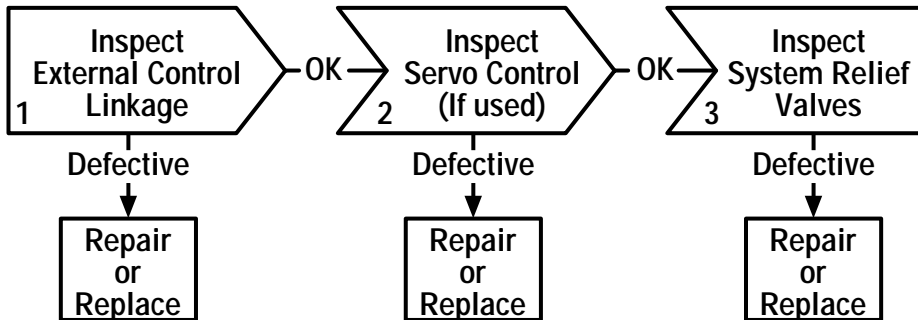


## Symptom: System Operating Hot

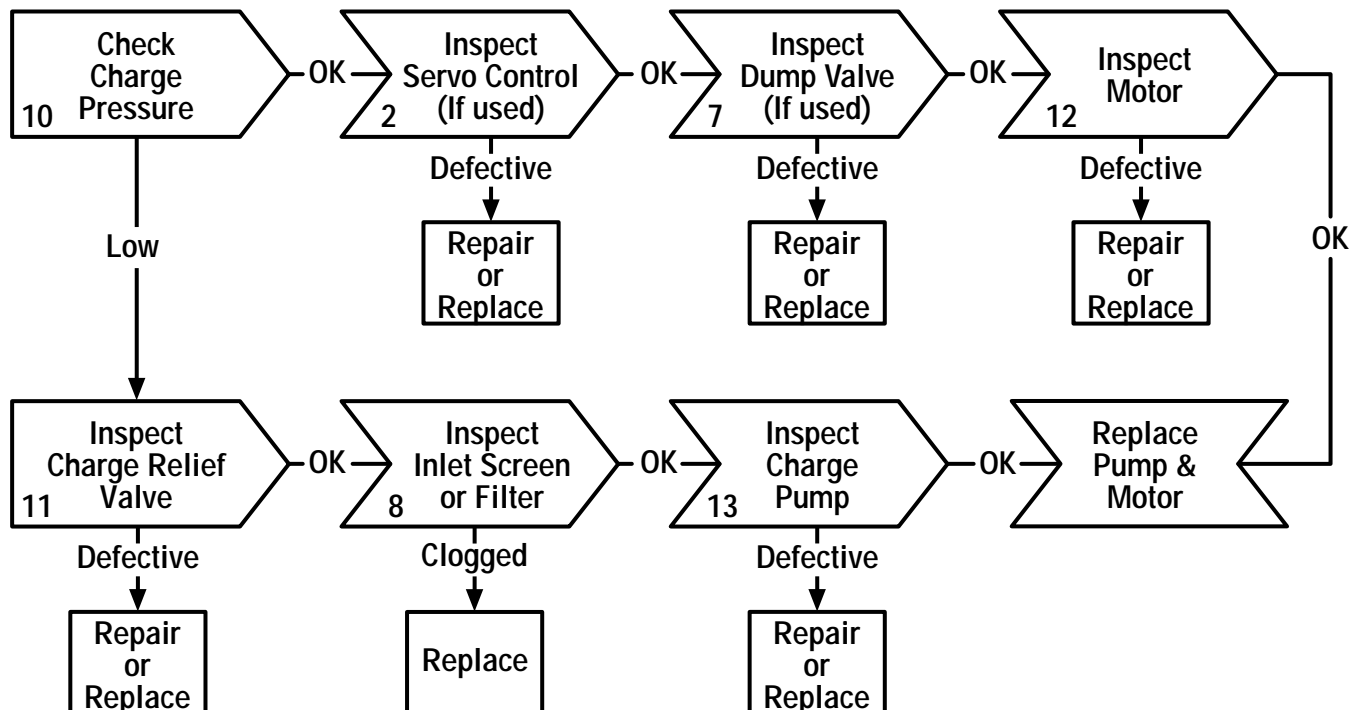


# Fault - Logic Trouble Shooting

## Symptom: Operates in One Direction Only

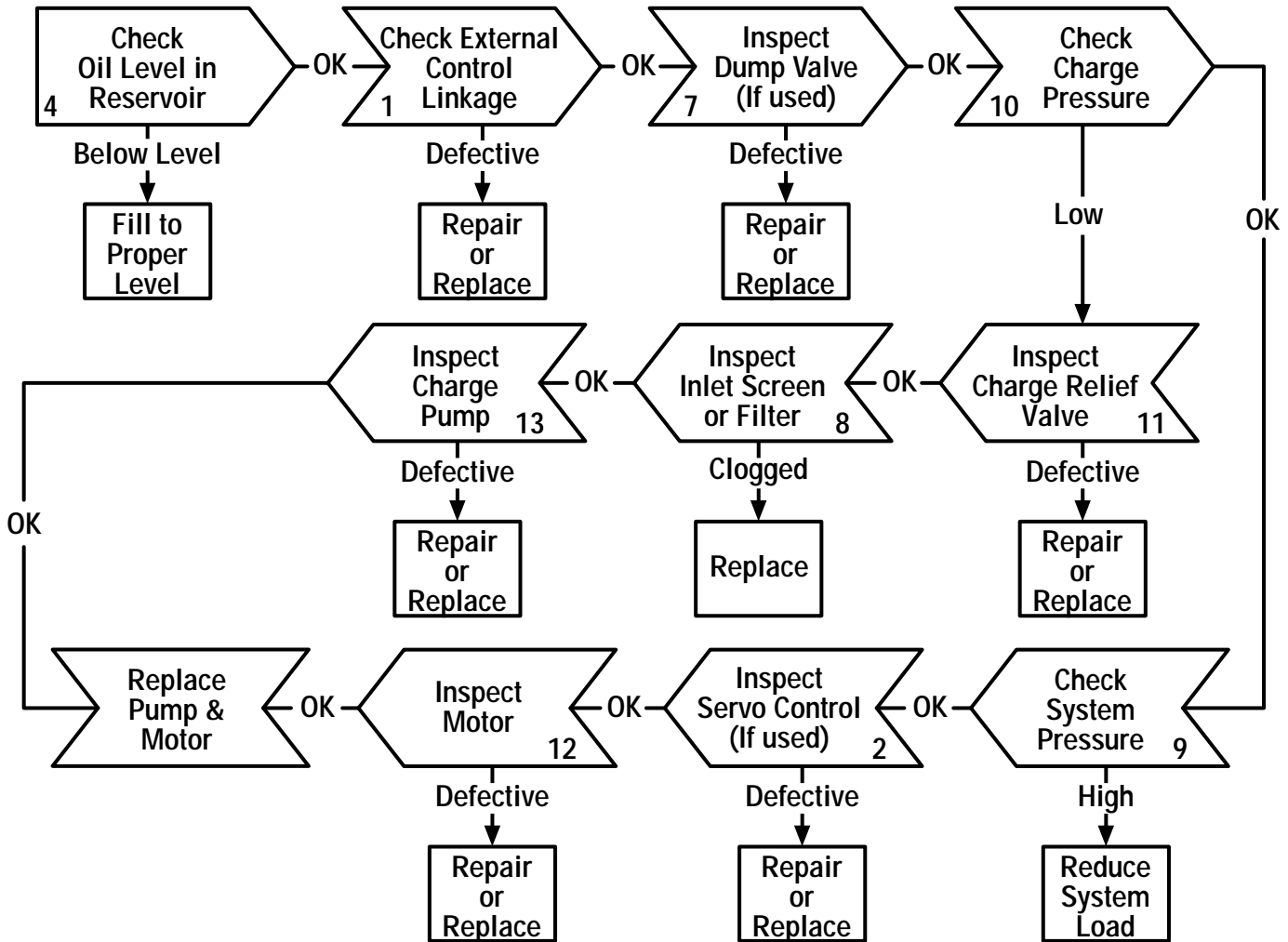


## Symptom: System Response Sluggish



# Fault - Logic Trouble Shooting

Symptom: System Will Not Operate In Either Direction



# Fault - Logic Trouble Shooting

## Diagram Action Step Comments

- 1 **Inspect External Control Linkage for:**
  - a. misadjusted or disconnected
  - b. binding, bent, or broken
  - c. misadjusted, damaged or broken neutral return spring
- 2 **Inspect Servo Control Valve for: (if used)**
  - a. proper inlet pressure
  - b. misadjusted, damaged or broken neutral return spring
  - c. galled or stuck control spool
  - d. galled or stuck servo piston
- 3 **Inspect System Relief Valves \* for:**
  - a. improper pressure relief setting
  - b. damaged or broken spring
  - c. valve held off seat
  - d. damaged valve seat
- 4 **Check Oil Level in Reservoir:**
  - a. consult owner/operators manual for the proper type fluid and level
- 5 **Inspect Heat Exchanger for:**
  - a. obstructed air flow (air cooled)
  - b. obstructed water flow (water cooled)
  - c. improper plumbing (inlet to outlet)
  - d. obstructed fluid flow
- 6 **Inspect Heat Exchanger By-Pass Valve for: (if used)**
  - a. improper pressure adjustment
  - b. stuck or broken valve
- 7 **Inspect Dump Valve for: (if used)**
  - a. held in a partial or full open position
- 8 **Inspect Inlet Screen or Filter for:**
  - a. plugged or clogged screen or filter element
  - b. obstructed inlet or outlet
  - c. open inlet to charge pump
- 9 **Check System Pressure:**
  - a. See figure 3-1 for location of pressure gauge installation.
  - b. consult owner/operators manual for maximum system relief valve settings
- 10 **Check Charge Pressure:**
  - a. See figure 3-1 for location of pressure gauge installation.
  - b. consult owner/operators manual for maximum charge relief valve settings

- 11 **Inspect Charge Relief Valve for:**
  - a. improper charge relief pressure setting \*
  - b. damaged or broken spring
  - c. poppet valve held off seat
- 12 **Inspect Motor for:**
  - a. disconnected coupling
- 13 **Inspect Charge Pump for:**
  - a. broken or missing drive key
  - b. damaged or missing o-ring
  - c. excessive gerotor clearance
  - d. galled or broken gerotor set

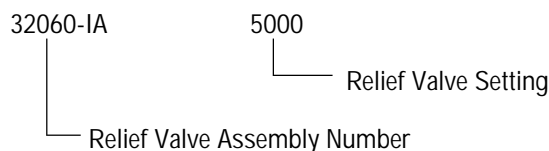
**\* System/Charge Relief Valve  
Pressure Settings for  
Eaton's Variable Displacement  
Controlled Piston Pumps**

Inlet Vacuum	6 inHg max.
Case Pressure	25 lbf/in <sup>2</sup> maximum
Charge Pressure	100 to 150 lbf/in <sup>2</sup> Standard 200 to 250 lbf/in <sup>2</sup> Optional 250 to 300 lbf/in <sup>2</sup> Optional
System Pressure	5000 lbf/in <sup>2</sup> maximum 3000 lbf/in <sup>2</sup> continuous

The high pressure relief valves are all factory preset and cannot be readjusted.

The pressure setting and assembly number is stamped on each high pressure relief valve cartridge.

Valve Identification Example:





# Start-up Procedure

When initially starting a new or a rebuilt transmission system, it is extremely important that the start-up procedure be followed. It prevents the chance of damaging the unit which might occur if the system was not properly purged of air before start-up.

- 1 After the transmission components have been properly installed, fill the pump housing at least half full with filtered system oil. Connect all hydraulic lines and check to be sure they are tight.
- 2 Install and adjust all control linkage.
- 3 Fill the reservoir with an approved oil that has been filtered through a 10 micron filter. Refer to Eaton Hydraulics Technical Data sheet number 3-401 titled [Hydraulic Fluid Recommendations](#).
- 4 Gasoline or L.P. engines: remove the coil wire and turn the engine over for 15 seconds. Diesel engines: shut off the fuel flow to the injectors and turn the engine over for 15 seconds.
- 5 Replace the coil wire or return the fuel flow to the injectors. Place the transmission unit in the neutral position, start the engine and run it at a low idle. The charge pump should immediately pick up oil and fill the system. If there is no indication of fill in 30 seconds, stop engine and determine the cause.
- 6 After the system starts to show signs of fill, slowly move pump camplate to a slight cam angle. Continue to operate system slowly with no load on motors until system responds fully.
- 7 Check fluid level in the reservoir and refill if necessary to the proper level with an approved filtered oil.
- 8 Check all line connections for leaks and tighten if necessary.
- 9 The machine is now ready to be put into operation.
- 10 Frequent filter changes are recommended for the first two changes after placing the machine back into operation. Change the first filter in 3-5 hours and the second at approximately 50 hours approx. hours. Routinely scheduled filter changes are recommended for maximum life of the hydraulic system.

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# Notes

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# Notes

**Order parts from number 6-632 Parts Information booklet.  
Each order must include the following information.**

1. Product and/or Part Number
2. Serial Code Number
3. Part Name
4. Quantity

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