

AA-02

MAINTENANCE MECHANIC TRAINING

SKILL DEVELOPMENT GUIDE

Duty AA: Pumps (Fluid Power)

AA-02: Overhaul Piston Pump

Issued 01/01/99



Task Preview

Overhaul Piston Pump

A Maintenance Mechanic overhauls a piston pump when an Operator reports that the front seal leaks or the pump does not deliver the fluid.

The piston pump is usually overhauled in the shop or in an area near the pump location.

The procedure for overhauling the piston pump is divided into four parts: disassembly, clean and inspect, reassembly, and preparation for testing. During disassembly you will separate the three major components. You will remove the internal components, clean and inspect these components for serviceability, replace as necessary. These parts are reassembled in reverse order. When the pump is overhauled, prepare the pump for testing. Mount the pump to the test stand and connect all hoses to the pump.

During the cleaning steps you will be required to handle cleaning solvents. Heavy industrial gloves and a respirator are the recommended protective equipment when cleaning pump components. Cleaning solutions must be disposed of per HAZMAT procedures.

How your skills will be checked

The Skill Check will require you to overhaul a piston pump. All tools, materials, and resources will be available. The Evaluator will verify that your demonstration meets the skill objective by observing or measuring each task standard. You must demonstrate safe work practices during the Skill Check. Contact your Evaluator when you are ready for the Skill Check.



Skill Objective

Given a repair ticket, overhaul the piston pump.

Task Standards

1. All polished surfaces must be free from wear or scoring.
2. The tolerance between the piston and shoe must not exceed 0.003 inch.
3. The swash plate must be aligned according to the model code.
4. The shoe must swivel smoothly on the ball end of the piston.
5. All safe practices must be demonstrated.

What You Will Need

This section contains the safety information, tools, and resources you will need before overhauling a piston pump.

SAFETY FIRST

**DON'T TAKE
CHANCES**

- Follow all Caterpillar facility safety standards when performing this task.
- Wear heavy industrial gloves for protection against the hazards associated with the cleaning solvents.
- An explosion hazard exists with cleaning solvents. Smoking is not permitted in the cleaning area.
- Know the location of the MSDS for the cleaning solutions.
- Solvents must be disposed of according to the HAZMAT regulations.



- hammer and punch
- external snap ring pliers
- screw driver (flat blade)
- Allen wrenches
- air impact wrench with 15/16, 1 1/4, and 9/16 inch socket
- wiping rags, paper towels
- Maintenance Mechanic hand tools
- rebuild kit



- Service and Maintenance Instructions, Fixed and Variable Displacement in-line piston pumps and motors
- work order printout
- repair ticket
- crib parts printout



Task Steps

Overhaul Piston Pump

Part A: Piston Pump Disassembly

1. Obtain all replacement parts.
2. Clean the pump.
3. Drain the hydraulic fluid.
 - Remove the vent plug.
 - Slide a bucket directly under the pump.
 - Remove the drain plug.



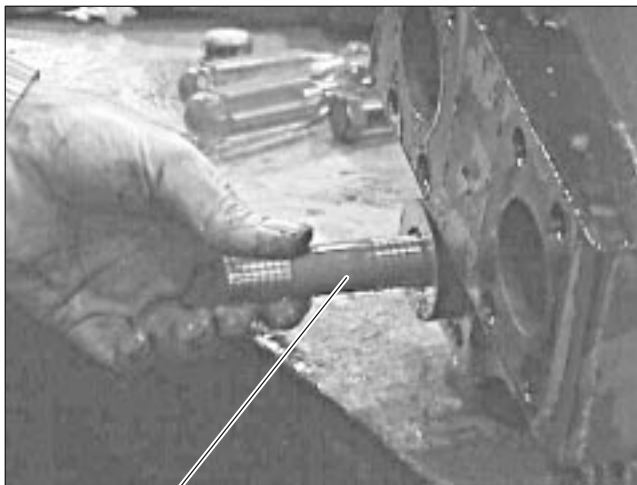
4. Remove the valve plate.

- Unbolt the four bolts from the large control piston cover.
- Remove the cover and pull the control piston out of the cylinder.

Control Piston

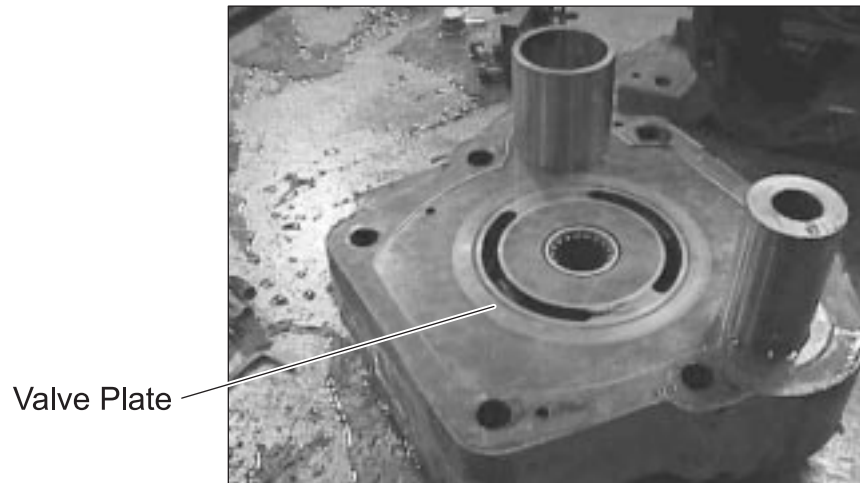


- Unbolt the four bolts from the small control piston cover.
- Remove the cover and pull the spring and control piston out of the cylinder.



Small Control Piston

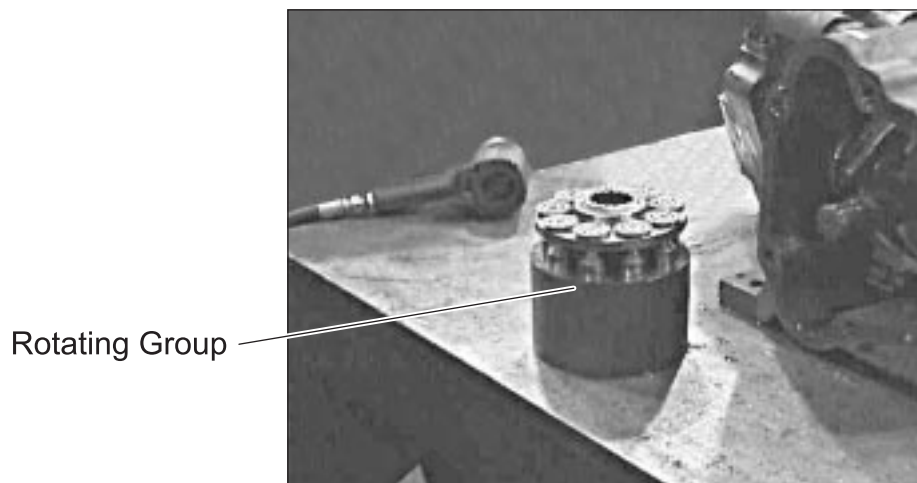
- Unbolt the six bolts from the valve plate.
- Remove and set the valve plate out of the way.



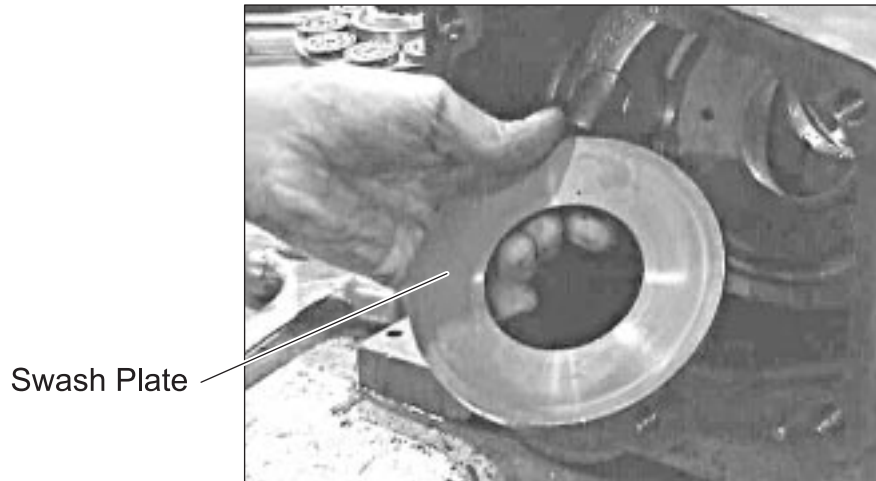
5. Remove the rotating group.

- Turn the rotating group slightly to free it from the swash plate.
- Tilt the housing and remove the rotating group.

Note: Pay attention to the cylinder block to prevent its separation from the rotating group.

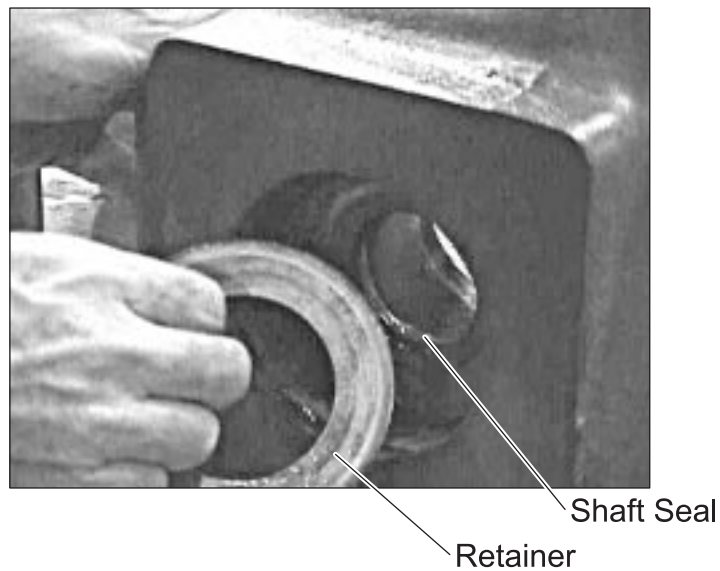


- Remove the swash plate.

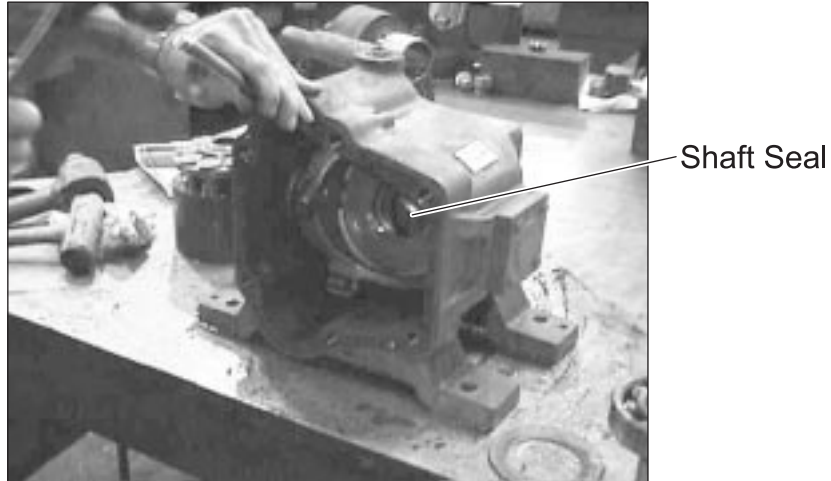


6. Remove the drive shaft and bearing assembly.

- Using snap ring pliers, remove the retainer snap ring.
- Tap the end of the drive shaft with a soft head hammer.
- Pull the drive shaft from the pump and set it out of the way.
- Remove the retainer.



- Using a hammer and brass rod, punch the shaft seal out of the pump housing.



7. Remove the compensator.

- Unbolt the four bolts that hold the compensator to the housing.

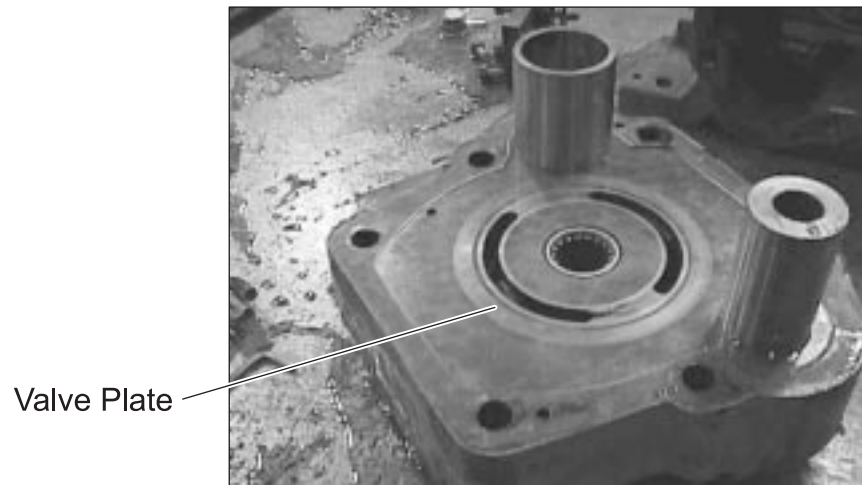


Compensator

- Remove and set the compensator out of the way.

Part B: Parts Cleaning and Inspection

1. **Clean all parts thoroughly.**
2. **Inspect the valve plate.**
 - Examine the polished surface of the valve plate for wear or scoring.

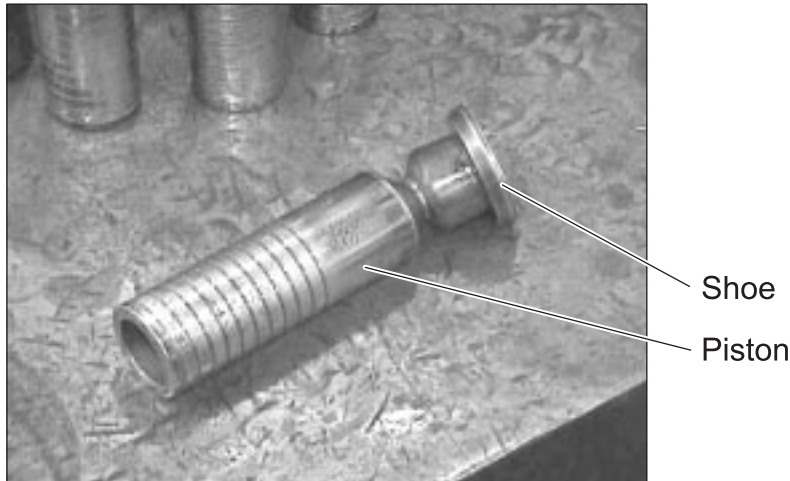


3. **Inspect the rotating group.**

Note: Both the rotating group and the swash plate come as a matched set. If replacing one item, replace the set.

- Inspect the bores and valve plate-mating surface of the cylinder block for wear and scoring.
- Inspect the piston and shoe assemblies for wear and damage.

- Check the shoe face to back shoulder dimension of all nine-piston assemblies. The shoe must swivel smoothly on the ball end of the piston. The end play must not exceed 0.003 inch.



Note: A variation greater than 0.001 inch between all nine shoes will result in excessive wear. If any one of the piston and shoe assemblies needs replacement, then all nine assemblies must be replaced.

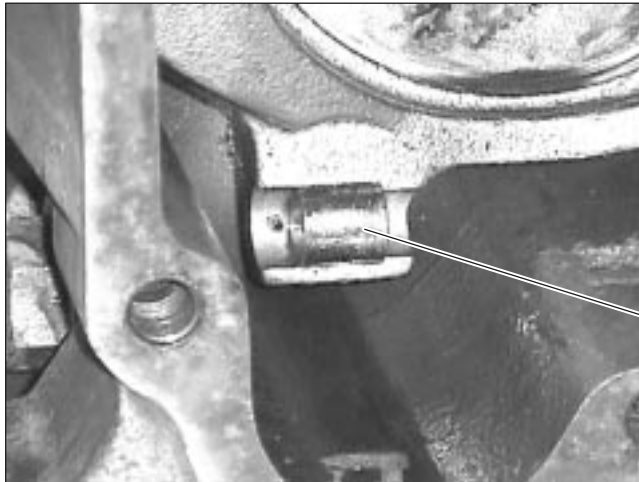
4. Inspect the swash plate.

- Inspect the plate for wear and scoring. Replace the plate if any signs of wear and scoring are present.

5. Inspect the yoke and bearing assembly.

- Check the yoke and the yoke bearing assembly for wear and scoring.

- Check both roller bearings for wear and scoring.



Roller Bearing

6. Inspect the bearing and drive shaft.



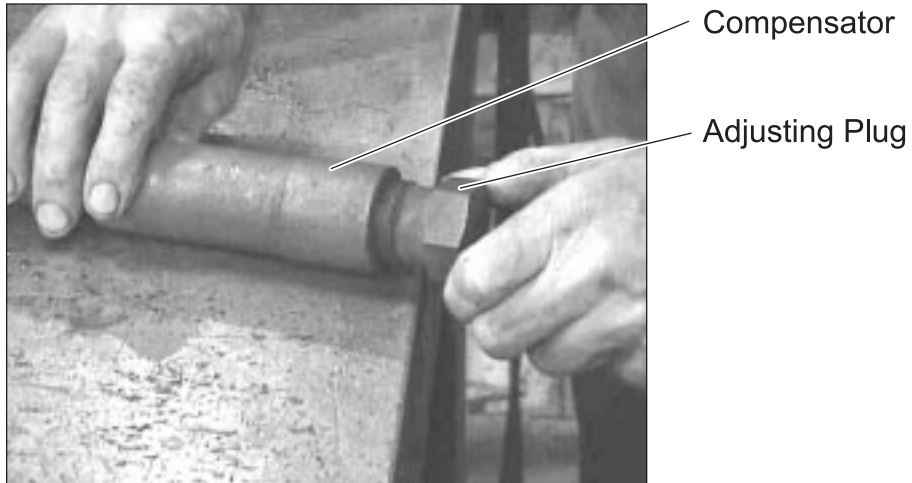
Drive Shaft

Bearing

- Inspects all bearings for roughness or excessive play, replace if necessary.
- Inspect the shaft seal journal for scoring or wear. Replace the drive shaft if wear is excessive.

7. Disassemble and inspect the compensator.

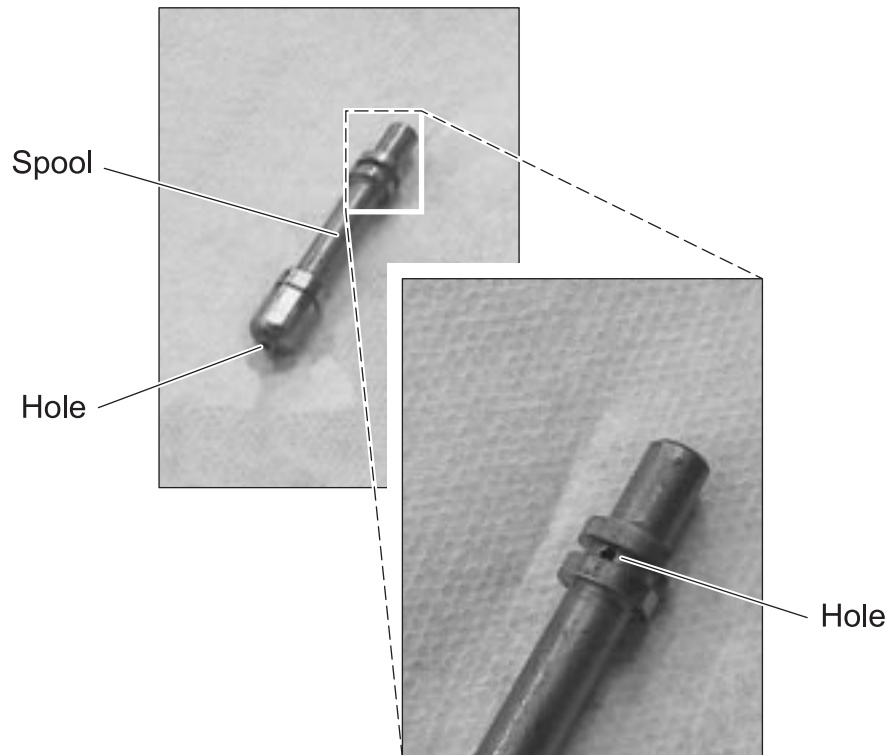
- Unscrew the adjusting plug.



- Tilt the compensator up and let the spring, seat, and spool slide out.



- Inspect the spool for wear or scoring. Ensure the hole through the spool is unobstructed.

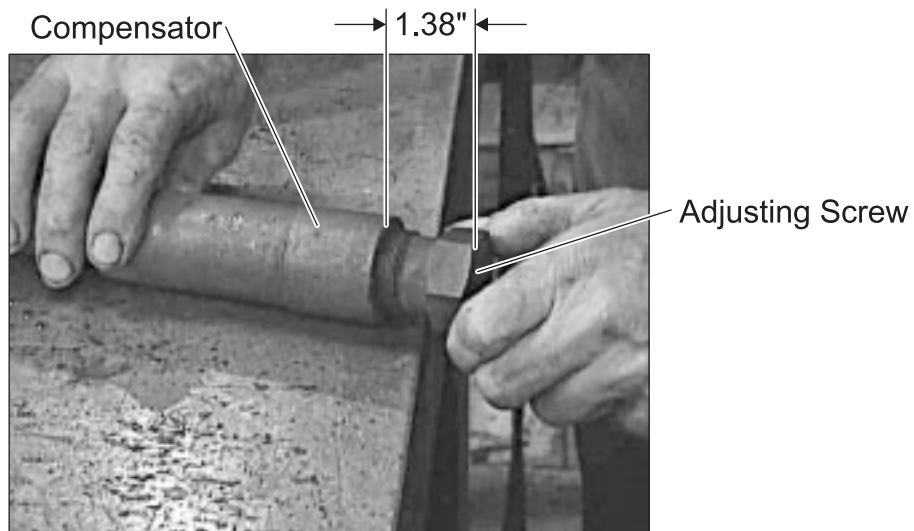


- Inspect the seat for wear or scoring.

8. Reassemble the compensator.

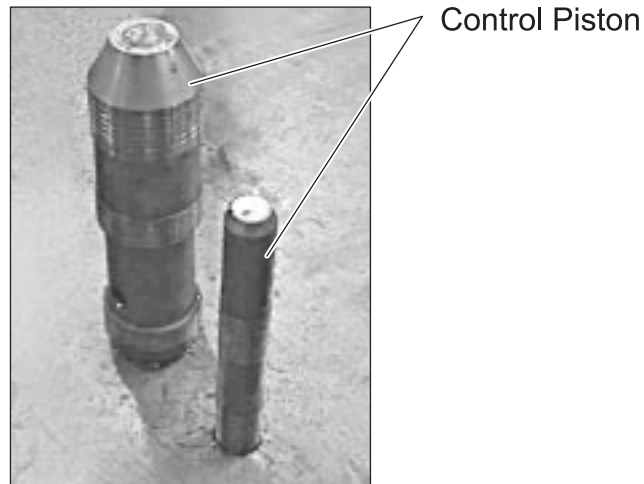
- Install the spool into the compensator body, use a pair of needle nose pliers if necessary.
- Place the seat on the spring and slide the assembly into the compensator body.
- Screw in the adjusting plug.

- Set the adjusting plug at 1.38 inches for the start.



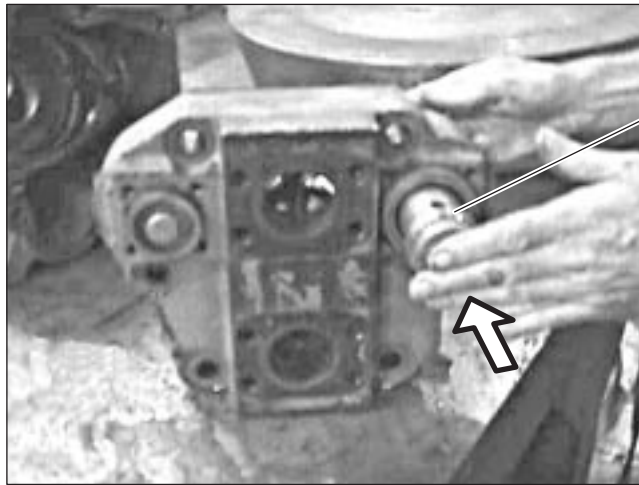
9. Inspect both control pistons.

- Check both control pistons for wear and scoring.



10. Perform a manual pressure check of both control pistons.

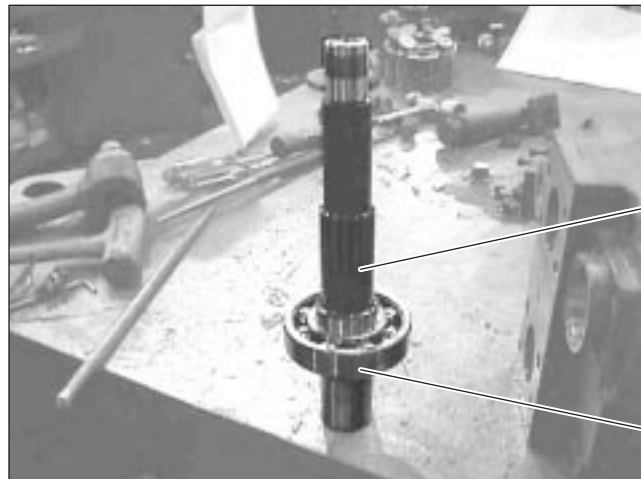
- Slide each piston in and out of its respective cylinder while holding your hand over one end of the cylinder to check for some pressure.



Control Piston

Part C: Piston Pump Assembly

1. Install the drive shaft and bearing assembly.

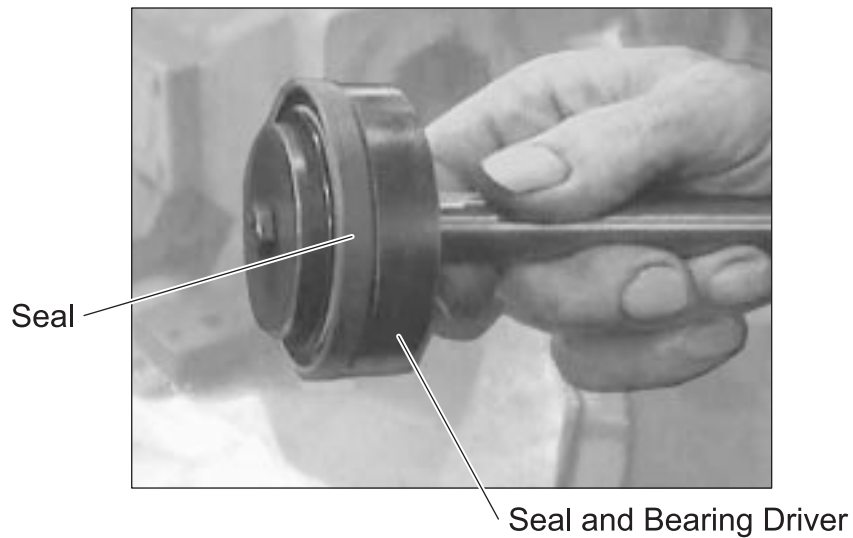


Drive Shaft

Bearing

Note: Heat the bearing for ease of assembly to shaft.

- Using a seal and bearing adapter, install a new shaft seal in the housing.

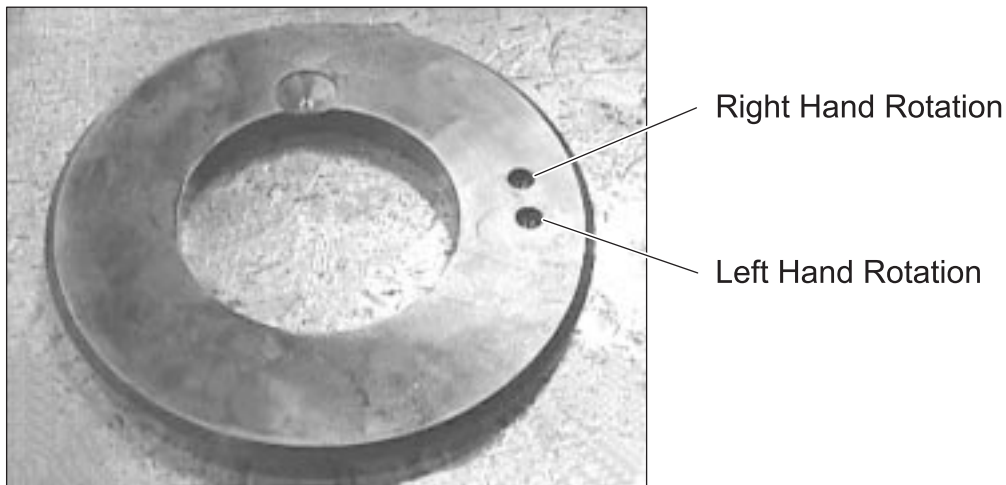


- Place the retainer over the shaft seal.
- Insert the drive shaft and bearing assembly in the housing and tap the end with a soft head hammer.
- Secure the drive shaft and bearing with the snap ring.

2. Install the swash plate.

- Determine the correct position for the swash plate.
- Turn the swash plate over with the three small holes are facing up.

- Use the model code to determine the placement of the swash plate. The sixth alphanumeric is the indicator for rotation as viewed from the shaft end. If the indicator is an 'R' its right hand rotation and an 'L' is for left hand rotation. The 'R' corresponds with the top hole on the swash plate. The 'L' corresponds with the bottom hole on the swash plate. This pump has an 'R' as the sixth digit therefore the top hole is the one used.



- Install the swash plate with the holes facing inward. Ensure that the hole selected is on the pin of the yoke.

3. **Install the rotating group assembly.**

- Slightly rotate the rotating group assembly to aid in aligning the spherical washer and the cylinder block splines with those of the drive shaft.
- Push the assembly onto the shaft.

4. **Install the valve plate.**

- Place the valve plate on the back of the pump.
- Install two bolts at opposite corners.
- Tighten each bolt alternately to draw the valve plate evenly against the pump housing.
- Once the two bolts are tight, install the other four bolts.
- Tighten all bolts in a star pattern.
- Install the small control piston followed by the spring and then the cover.

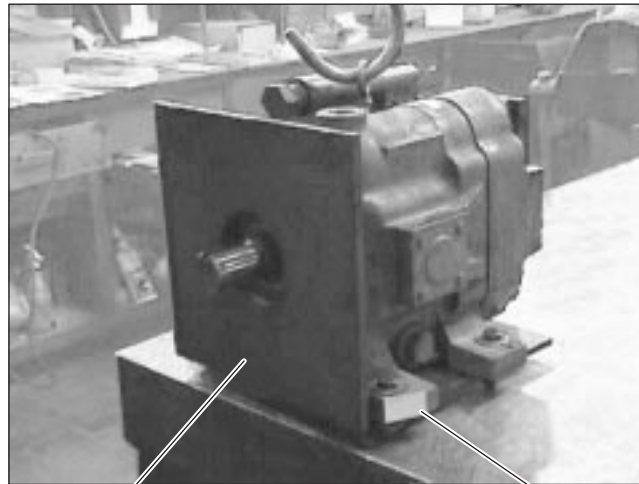
- Install the large control piston and the cover.

5. Install the compensator.

Part D: Piston Pump Test Preparation

1. Mount the piston pump to the mounting plate.

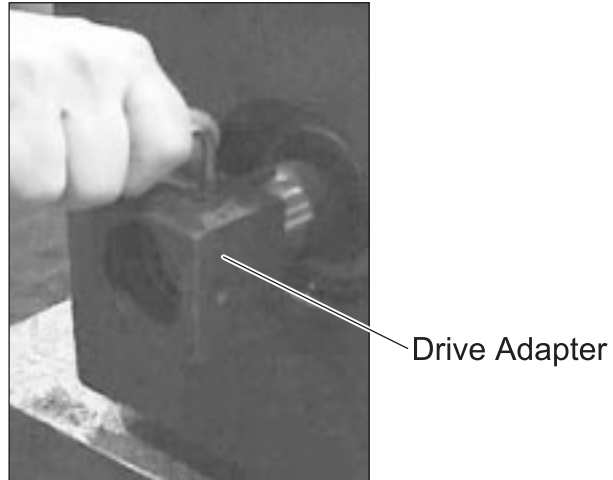
- Cut the corners at approximately 45 degrees, if not already done.
- Bolt the pump to the mounting plate.



Mounting Plate

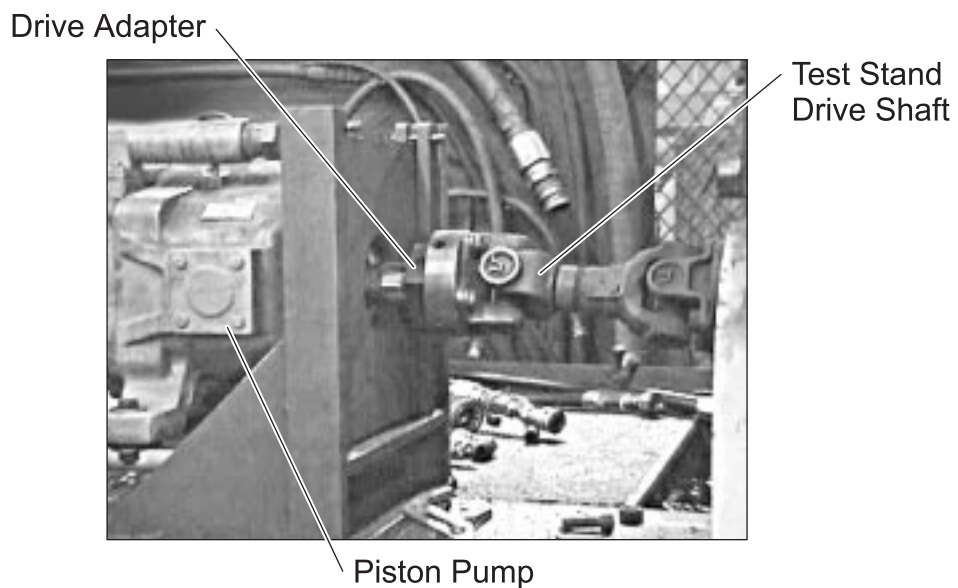
Cut at 45°

- Attach the drive adapter to the drive shaft of the pump.



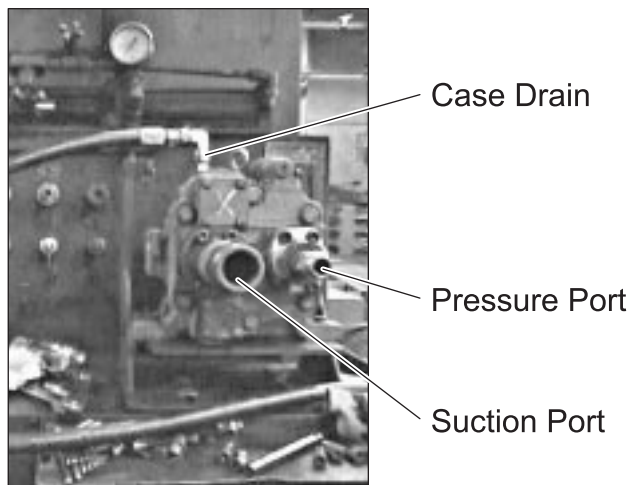
2. Slide the mounting plate and pump on the stand.

- Lock the pump in the test stand and connect the test stand drive shaft to the pump.



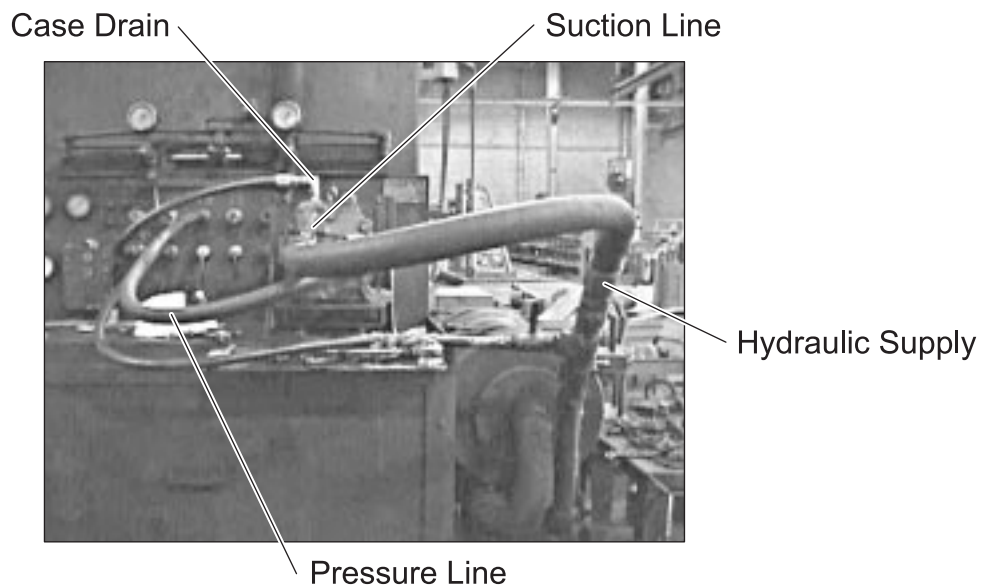
3. Connect the hydraulic hoses from the test stand to the pump.

- Use the model code to determine which port is pressure and which one is return. The sixth alphanumeric is the indicator for rotation as viewed from the shaft end. If the indicator is an 'R' its right hand rotation and an 'L' is for left hand rotation. This pump has an 'R' as the sixth digit and looking from the back of the pump the right port is the pressure port.
- Secure the two inch adapter to the suction port (left) of the pump.
- Secure the one inch adapter to the pressure port of the pump.
- Secure the case drain adapter to the top of the pump.
- Attach quick disconnect end of the hose to the inlet connection (51) on the test stand.
- Attach the threaded end of the hose to the case drain adapter on the pump.



- Attach the quick disconnect end of the hose to the super charge flow connection (26) on the test stand.
- Attach the threaded end of the hose to the hydraulic supply.
- Attach the quick disconnect end of the hose to the pressure port to test pumps connection (8) on the test stand.

- Attach the other quick disconnect end of the hose to pressure port of the pump.
- Attach the quick disconnect end of the hose to the suction connection on the pump.
- Attach the other end of the hose to the hydraulic supply.
- Ensure that all hoses are connected as shown below.



- 4. Follow the test procedures spelled out in the test stand procedure book and the manufacturer's manual.**



Concept Check

Overhaul Piston Pump

Answer the following questions to check your understanding of overhauling a piston pump. Circle the correct answer in each question. Then compare your responses with the answers at the bottom of this page. Some of the questions may have more than one correct answer. If you have difficulty answering a question, review the Skill Development Guide or ask your Trainer for assistance.

1. The tolerance between the piston and the shoe must not exceed:
 - a. 0.001 inch.
 - b. 0.002 inch.
 - c. 0.003 inch.
 - d. 0.004 inch.

2. When aligning the swash plate, align it:
 - a. with the hole at the top.
 - b. according the model code.
 - c. with the hole at the bottom.

3. The swash plate is aligned according with the model coder.
 - a. True
 - b. False

Answers: (1. c 2. b 3. a)

Next Step

If you are ready to demonstrate the task now, ask your Evaluator or Trainer to schedule the Skill Check. However, if you need to practice some of the steps first, continue to the next section.



Practice

The following practice will help prepare you for the Skill Check. Ask your Trainer to set up the practice for you. After you complete a practice, ask your Trainer to check your work.

Practice 1

Your Trainer will designate a piston pump for the overhauling activity. You will be asked to select the required repair kit. During this practice you will:

- disassemble the piston pump
- clean and inspect the piston pump
- reassemble the piston pump
- prepare the piston pump for testing

Your Trainer will observe as you reassemble the piston pump to ensure that the piston pump is assembled properly. You are required to follow all the recommended safe practices associated with handling cleaning solvents. All cleaning solutions must be disposed of per HAZMAT regulations.

Practice Objective 1

The piston pump must be overhauled using the specified rebuild kit. Check to ensure that all defective parts are replaced. All polished surfaces must be free from wear or scoring. The tolerance between the piston and shoe must not exceed 0.003 inch. The shoe must swivel smoothly on the ball end of the piston. The swash plate must be aligned according to the model code. All safe practices must be demonstrated.

Next Step

Continue to practice until you are ready for the Skill Check. When you are ready to demonstrate the task, ask your Evaluator or Trainer to schedule the Skill Check.