

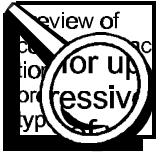
A-09b

MAINTENANCE MECHANIC TRAINING

SKILL DEVELOPMENT GUIDE

Duty A: Pumps (Not Hydraulic)
A-09b: Rebuild Pump (Aro Diaphragm)

Issued 06/01/98



Task Preview

Rebuild Pump (1/2" Aro Diaphragm)

A Maintenance Mechanic rebuilds an Aro diaphragm pump when an Operator reports that the pump is operating erratically or the pump is locking up. A ruptured diaphragm is a typical pump problem that requires rebuilding the pump.

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

The steps for rebuilding the pump are sectioned in two parts: disassembly and reassembly. During disassembly you will remove the manifold outlet, ball sleeves and balls, manifold inlet, fluid cap, diaphragm, and valve block. These parts are reassembled in reverse order.

You will be required to handle cleaning solvents during the rebuild steps. Heavy industrial gloves and a respirator are the recommended protective clothing 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 rebuild a 1/2" Aro diaphragm 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 request to rebuild a 1/2" Aro diaphragm pump, rebuild the pump.

Task Standards

1. Pump must be rebuilt using a repair kit specified by the 1/2" Aro Diaphragm Pump Service Manual.
2. U-cup packing seals, pilot valve assembly, pilot rod, and o-rings must be lubricated with Amojel assembly lubricant.
3. The polished side of the valve plate must mate with the dished side of the valve insert.
4. Fasteners must be tightened wrench-tight.
5. Valve block holes must align with the motor body.
6. The pump must operate per specifications.
7. Cleaning solution disposal must comply with HAZMAT regulations.

What You Will Need

This section contains the safety information, tools, and resources you will need before rebuilding an Aro diaphragm pump.

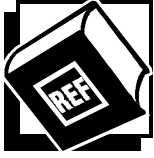
SAFETY FIRST

**DON'T TAKE
CHANCES**

- Follow all Caterpillar facility safety standards when performing this task.
- When working in the paint area, wear heavy industrial gloves and a respirator fitted with charcoal filter for protection against the hazards associated with the cleaning solvents.
- An explosive hazard exists with cleaning solvents. Smoking is not permitted in the paint or cleaning areas.
- Know the location of the MSDS for the cleaning solutions.
- Cleaning solution disposal must comply with HAZMAT regulations.



- 1/2" Aro diaphragm pump repair kit
- 1/2" Aro diaphragm pump
- Amojel assembly lubricant
- tank of solvent and solvent tray for cleaning parts
- tray with putty knife
- wire brush
- external snap ring pliers
- 1/2" wrench
- 7/16" wrench
- 7/8" wrench



□ 1/2" Aro Diaphragm Pump Service Manual



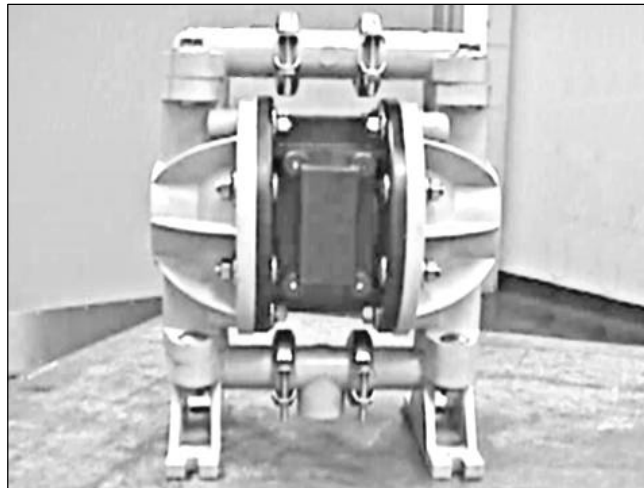
Task Steps

Rebuild Pump (1/2" Aro Diaphragm)

Warning: A heavy grade of industrial rubber gloves must be worn to protect skin from harmful solvents. When working in a paint area, wear a respirator fitted with a charcoal filter.

PART 1: Disassembly

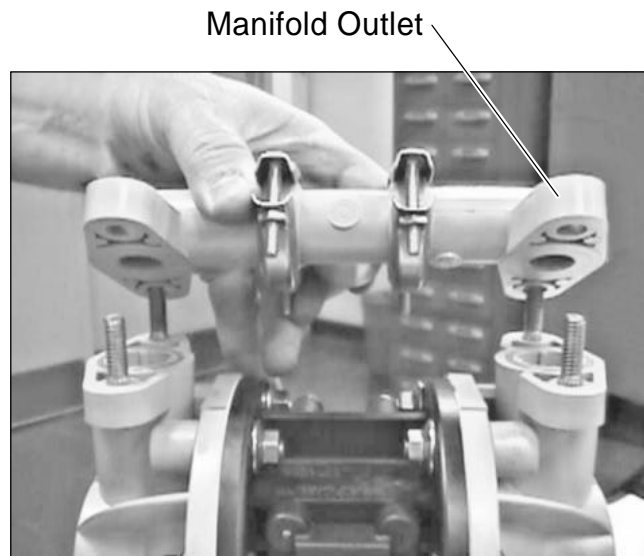
1. Obtain the repair kit specified for the Aro diaphragm pump.
 - Refer to the Aro Diaphragm Service Manual for part number. The pump is shown below.



1/2" Aro Diaphragm Pump

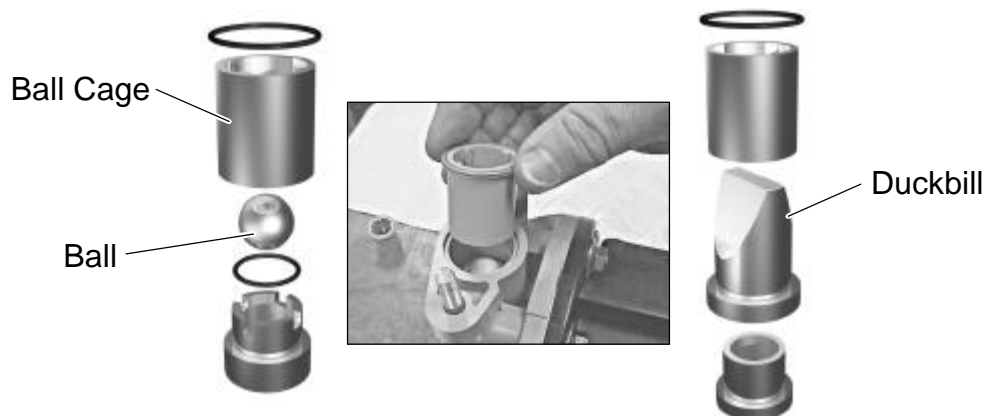
Note: Be sure to mark all mating parts to ensure proper reassembly.

2. Remove the manifold outlet assembly.
 - Using a 1/2" wrench, remove the four 5/16" bolts.
 - Lift off the manifold outlet, as shown below.



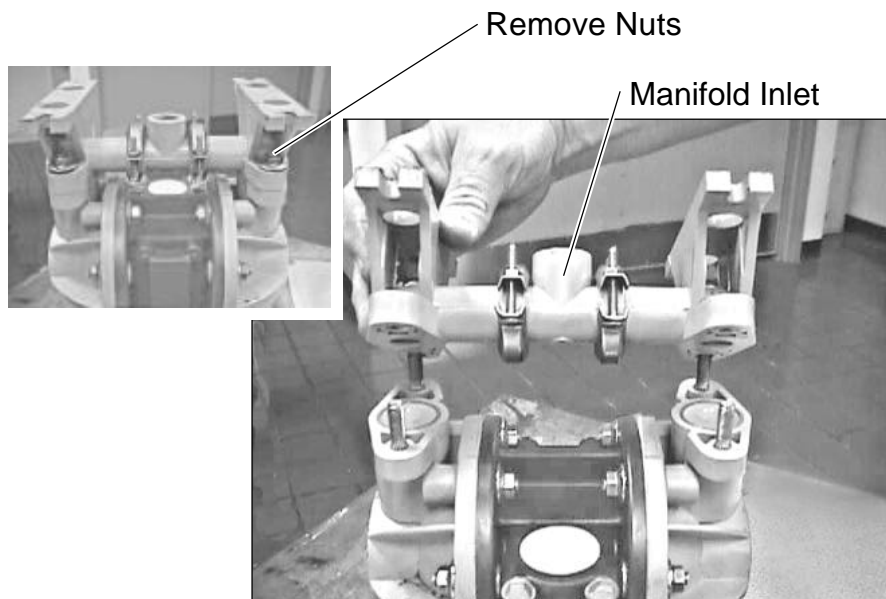
3. Remove the balls and ball cages.

The pump will be equipped with either duckbills or balls. See the figure below.



- Inspect the balls and cages for dirt and damage; inspect duckbills for cracks in the clapper area.

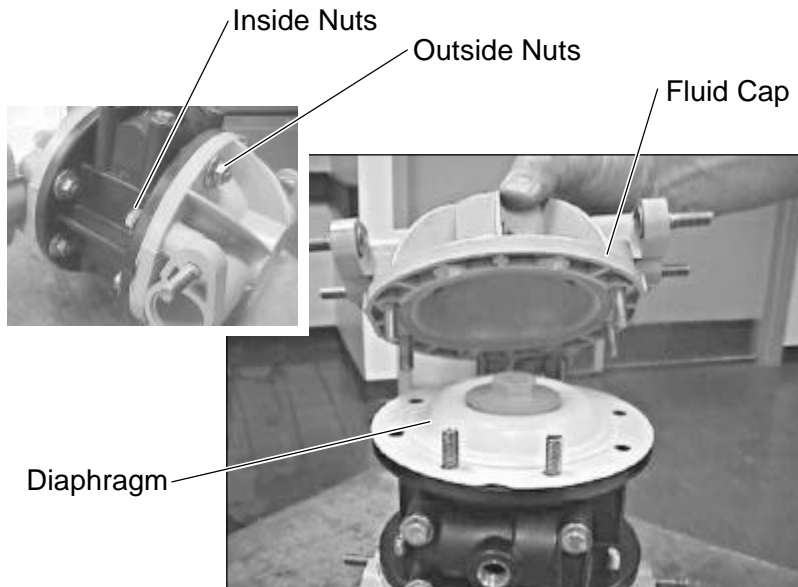
4. Remove the manifold inlet assembly.
- Turn the pump upside down.
 - Using a 1/2" wrench, remove the four 5/16" nuts.
 - Lift off the manifold inlet, as shown below.



- Remove the seats, o-rings, and balls.
- Inspect for dirt and damage.

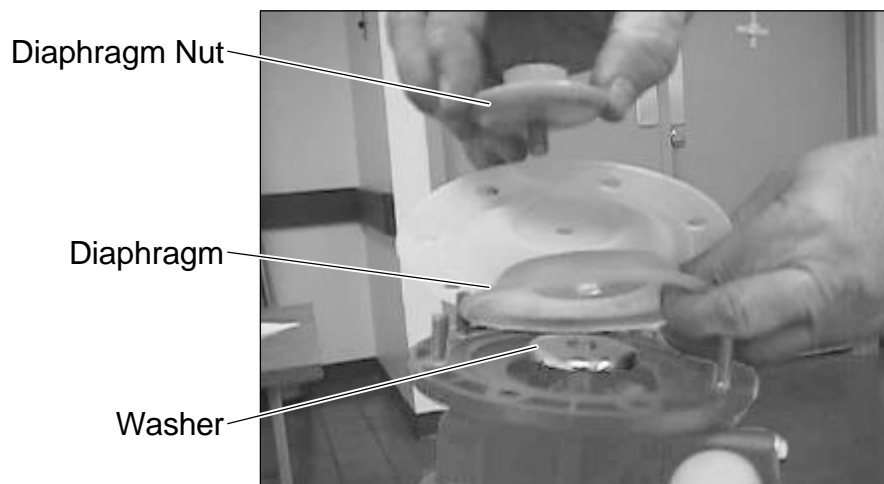
5. Remove the fluid caps.

- Using a 1/2" wrench, remove the eight flange nuts and bolts on each cap.
- Remove the caps. See the figure below.

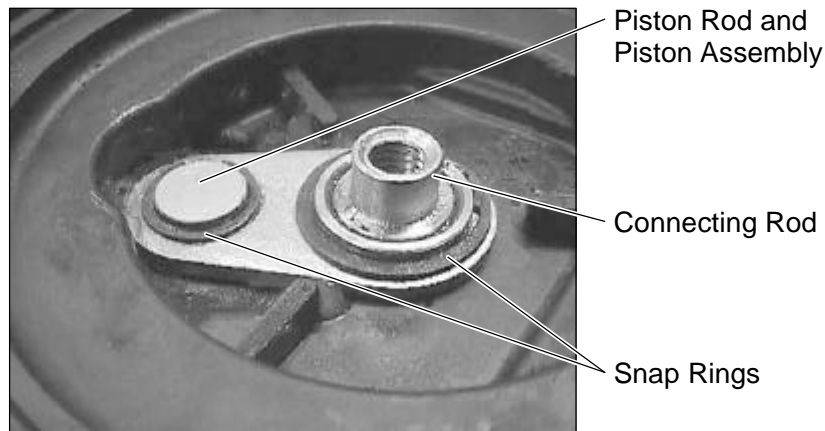


6. Remove the diaphragm components.

- Using a 7/8" wrench, remove the diaphragm nut.
- Remove the gasket, diaphragm, and washer. See the figure below.



- Inspect the diaphragm for holes or cracks. You will replace damaged components during reassembly.
7. Remove the pilot rod assembly and diaphragm connecting rod.
- Using external snap ring pliers, remove the two snap rings.
 - Remove the plate, diaphragm connecting rod, pilot rod, and valve assembly. See the figure below.



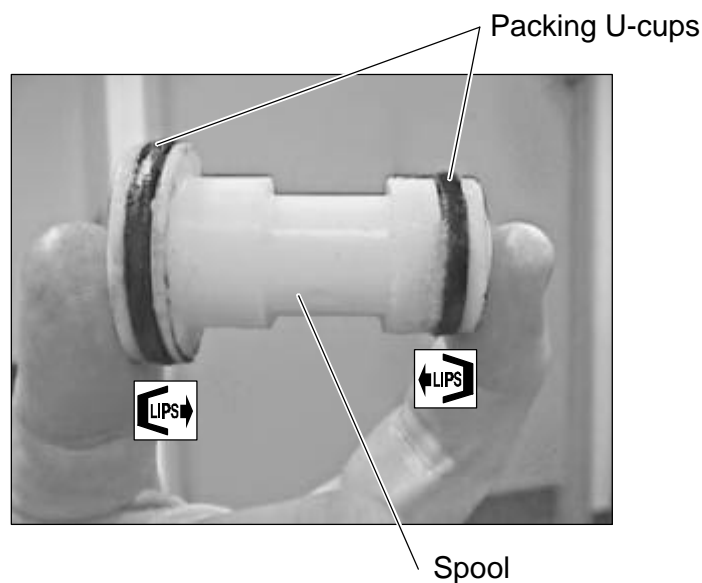
8. Remove the valve block from the motor body.
- Using a 7/16" wrench, remove the four 1/4-20 x 5 bolts.
 - Pull the valve block assembly off the motor body. See the figure below.



- Remove the valve insert and plate valve.
 - Remove the plug from the bottom of the valve block.
 - Remove the spool from the valve block.
 - Remove the packing U-cup.
9. Inspect all pump components.
- Inspect for dirt and debris; clean parts as necessary.
 - Inspect the piston for groove wear and pitted surfaces. Note parts that need replacing.
 - Dispose of cleaning solvents per HAZMAT procedures.

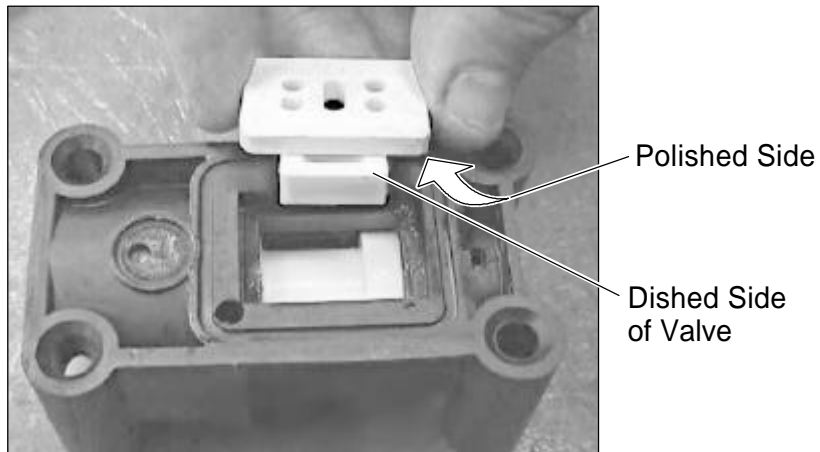
PART 2: Reassembly

1. Reassemble the valve block.
- Apply Amojel assembly lubricant to the packing and packing U-cups. The U-cup lips must face the spool center. U-cups must face each other.
 - Install the packing U-cups on the spool. Insert the spool into the valve block. See the figure below.

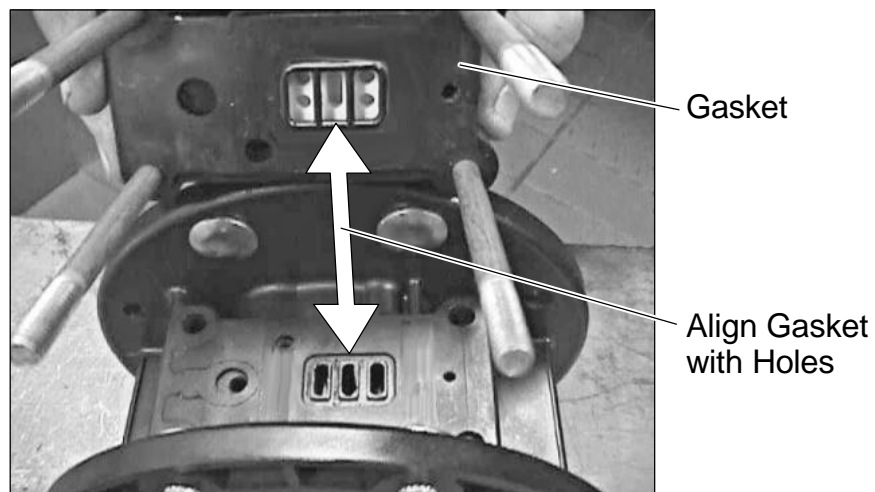


- Apply Amojel assembly lubricant to the o-ring. Install the o-ring on the plug. Insert the plug into the spool.

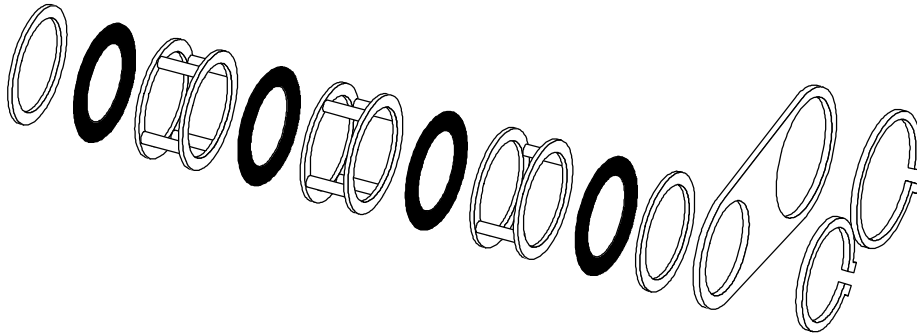
- Install the valve insert and valve plate into the spool groove. The dished side of the valve insert should be against the polished face of the valve plate. See the figure below.



- Install the gasket on the valve block. Check to ensure that the gasket holes are aligned with the valve plate holes.
- Install the valve block on the pump body. Check to ensure that the valve block holes align with the pump body. Align as necessary. See the figure below.
- Using a 7/16" wrench, install the four 1/4-20 x 5 bolts. Tighten the bolts hand-tight.



- Tighten the bolts wrench-tight.
- 2. Install the pilot valve assembly, pilot rod, and connecting rod.
 - Apply Amojel assembly lubricant to the pilot valve assembly. Pilot valve components must be configured as shown below.

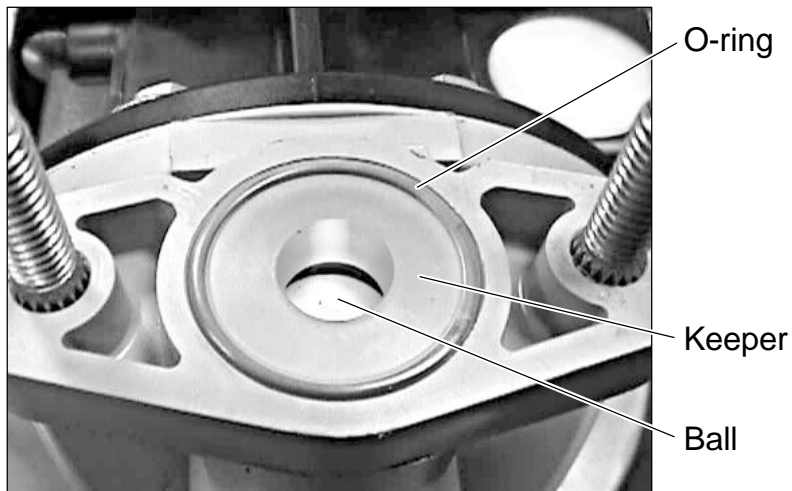


- Insert the pilot rod into the pilot rod assembly.
- Apply Amojel assembly lubricant to the connecting rod. Install the o-ring on the rod. Insert the connecting rod into the motor.
- Install the valve plate.
- Using external snap ring pliers, install the two snap rings.
- 3. Install the diaphragm components.
 - Install the washer, diaphragm, and gasket.
 - Using a 7/8" wrench, install the diaphragm nut. Tighten the nut wrench-tight.
 - Repeat step 3 for the other side of the pump.
- 4. Install the fluid caps.
 - Using a 1/2" wrench, install the eight flange nuts and bolts for each cap. Tighten the nuts wrench-tight.

5. Install the manifold inlet.

- Insert the balls, o-rings, and keepers or the duckbills.

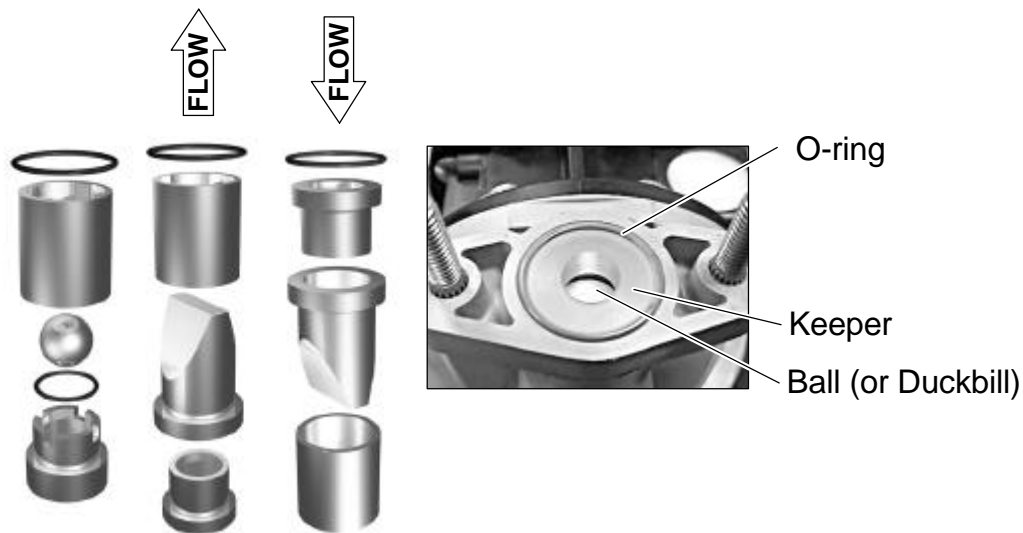
Note: If equipped with duckbills, the duckbills must point in the same direction. When the duckbills face down, the inlet is on the top. See the figure below.



- Place the manifold inlet on the diaphragm gasket.
- Using a ½” wrench, install the four 5/16” nuts and tighten the nuts wrench-tight.

6. Install the manifold outlet.

- Install an o-ring on the outside diameter of each ball cage. Install the ball cage and ball. See the figure below.



- Place the manifold outlet on the fluid cap.
- Using a 1/2" wrench, install the four 5/16" nuts and tighten wrench-tight.

7. Test the pump.

- Submerge the pump in water until the inlet fitting is submerged.

Note: The pump will start operating during the next step. Place your hand or a cloth over the pump outlet valve to avoid splash.

- Blow low pressure air into the inlet on the valve block until the pump starts operating. If the pump fails to operate, identify the problem. Repair the pump as necessary.

8. Tag the pump if it is to be stored.

9. Clean up the work area.

10. Document the work history.



Concept Check

Rebuild Pump (Aro Diaphragm)

Answer the following questions to check your understanding of rebuilding an Aro diaphragm 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. Which of the following pump components require lubrication during reassembly?
 - a. pilot valve assembly
 - b. o-rings
 - c. valve face plate
 - d. pilot rod
2. The packing U-cup lips must face:
 - a. towards the spool center.
 - b. away from the spool center.
3. The _____ side of the valve plate must mate with the dished side of the valve insert:
 - a. unpolished
 - d. polished

Answers: (1. a., b., d 2. a 3. b.)

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

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

- disassemble the pump
- clean the pump components
- reassemble the pump

Your Trainer will observe as you rebuild the pump to ensure that the pump is disassembled and reassembled 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

Pump must be reassembled using the specified parts. Fasteners must be tightened wrench-tight. U-cup packing seals, pilot valve assembly, pilot rod and o-rings must be lubricated with Amojel assembly lubricant. The polished side of the valve plate must mate with the dished side of the valve insert. Cleaning solutions must be disposed of per regulatory procedures. 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.