

Pressure washer pump disassembly/assembly.

 Remove the manifold bolts with a 5mm Allen wrench. It's best if you have an air impact tool and a set of Allen wrenches with drive sockets. If you don't have these tools, you may need an 8-12 inch length of ¹/₄ inch steel tubing to use as a breaker as shown in fig. 4.1



- 2. Position the wrench so that it has ample space to turn. Make sure it's seated completely and then give it a sudden hard pull to break the bolt loose rather than steady pressure. Sometimes the wrench will strip the hole in the bolt no matter what you do. If that happens use a 3/16 bit and drill straight into the bolt head until it pops off. You can thread the remainder of the bolt out when the manifold is off.
- 3. Once the bolts are removed the manifold will slide straight off with steady pressure accompanied by gentle rocking. Remember that the pistons penetrate deep into the manifold so don't apply sideways force or you could break one. If the manifold is stuck, you can use a rubber mallet or a screwdriver to break it loose but pry only on the thickest parts of the crankcase. Once broken loose it will slide off with steady effort. If one or more of the brass retaining rings are stuck on their piston as shown spray them with WD-40 and let them sit for a while. If that doesn't work, use an awl to gently pry it loose from the weep holes in the bottom of the piston bores.



For the following steps, put the manifold in a vise.

- 1. Remove the valve caps with an air impact tool. If you do not have one you may need a breaker bar.
- 2. Firmly grasp the top of a valve with needle nose pliers as shown in fig 4.2 and pull it straight up and out of the manifold. There is very little side clearance so it may take a try or two before you master the technique. There is an o-ring in the bottom of each valve well that is hard to see and therefore easy to overlook. Set each valve and its corresponding o-ring together to make sure you don't miss one. If you inadvertently install a new o-ring on top of an old one you'll destroy the valve.



3. Once all the valves are removed, clamp up the manifold with the packing wells facing up. With an inside pliers (i.e. brake shoe pliers) remove the retaining rings as shown in fig 4.3. Each one has an o-ring so the proper way to extract them is with steady pressure and a gentle rocking motion. Inside each retaining ring there is a low-pressure fiber packing. Use a pick to remove it, but be careful not to stab your finger.





4. Remove the brass support rings and the fiber flat-washers. With the inside pliers remove the high-pressure fiber packing from the bottom of the well as shown in fig 4.4. Take extreme care not to nick the soft brass walls of the packing well. Removing the high-pressure packings will destroy them so you must replace them all.



5. Remove the packings and retaining rings from one well at a time and tie them up in the correct order with a tie strap.



6. While you have the manifold off, inspect the crankcase interior. To do this quickly and easily, remove the pump mounting bolts and rotate the pump forward. Rest the pistons on a cloth on the deck of the pressure washer and remove the rear cover. Tip the pump back and drain the oil into a clean container so you can examine it carefully for fine metal filings, which indicates excessive bearing or connecting rod wear resulting from over-speeding or insufficient lubrication. Thoroughly clean any sludge out of the interior of the crankcase with WD-40 and blow it dry with compressed air. If the crankcase is okay, bolt it back up to the engine and fill it with the proper grade and quantity of oil.



Piston removal/installation



1. Remove the piston nuts with a 13mm socket wrench. Take care not to lose the copper washer at the end of each piston. If the washer is adhered to the end of the piston with assembly Loctite, use a razor blade as shown in fig. 4.5 to pry it off. The washer has very little bore clearance so it needs to come straight off or it will hang up in the threads.



- 2. Slide the piston off the plunger rod shaft. There is an o-ring under the piston so you may have to twist it back and forth if it binds. Inspect each piston carefully. Even a hairline crack is cause to replace the piston. Wrap each piston in cloth and set it aside with its corresponding washer and nut so you don't mix them up later.
- 3. Remove the slinger washer.
- 4. Set all the parts aside in a clean container.
- 5. Installation is the reverse of these steps. Place a drop of red Loctite on the plunger threads and install the nut to a final torque value of 12 foot pounds.

Generally, this is as far as you'll need to disassemble a pump. Removing the crankshaft involves making minute adjustments to the position of the crank relative to the connecting rod bores as you remove it. When the cost of labor is factored in, there are very few instances where removing the crankshaft is a less expensive alternative to replacing the pump.

Valve installation.



- 1. Coat a new o-ring with grease and push it to the bottom of the well.
- 2. Rub grease on the bottom of the valve and guide it down on top of the o-ring. Press down on it gently to seat it against the o-ring.
- 3. Grease the o-ring in the valve cap and thread it on finger tight.
- 4. Tighten the valve caps to a final value of 50 foot pounds.

Seal and packing installation.

- 1. Use plenty of white grease on all parts as you install them.
- 2. Install a white plastic support ring into the well with the ridge facing toward you.
- 3. The next part is a little tricky, but after one or two successes you'll master the technique. What you need to accomplish is to install the packing with the groove side down into an opening that is slightly smaller than the outer diameter of the new packing, but we need to do it without marring the packing on the sharp corners of the well.
- 4. First put a generous amount of grease into the well. Then coat a packing with grease and tuck one edge into the bottom of the well at a slight angle. Unfortunately there is no way to photograph this procedure so you have to work by feel. Use your fingertips to gently but firmly work the edge of packing over the shoulder and onto the support ring. The last little bit is generally where it will want to hang up. If this happens you can use a thin, blunted screwdriver to coax the last remaining part over the shoulder of the well. The trick is to do it without nicking the packing on the sharp edges, in which case you'll have to discard the packing and start over.
- 5. Install a fiber washer on top of the packing and place the brass support ring over it.
- 6. Coat a new packing with grease and press it into the retaining ring with the grooved side facing outward toward you. Install a new o-ring onto the retaining, coat the entire part with grease, and press it down on top of the fiber washer until it seats.



Manifold installation.

- 1. Rub some white grease on the pistons.
- 2. Align the manifold so that it will slide straight onto the pistons. If the pump crankcase is mounted on the engine, it's easy to get it started on wrong if you're not careful to keep it straight.
- 3. You may encounter some resistance when the pistons come up against the new packings. Use a rubber mallet but be sure to strike squarely on the center valve cap on the front of the manifold. If you drive the manifold on at an angle you can crack a piston or the pump may have trouble developing pressure and may fail the first time you run it.
- 4. Install the manifold bolts to a final value of 14-15 foot pounds. Tighten them in stages and work in a crosswise pattern starting from the center and working toward the edges.
- 5. Fill the pump with the proper quantity and grade of oil.
- 6. Grease the unloader banjo bolt and manifold o-rings and install them to a final value of 25 foot pounds.
- 7. Make sure the pump crankcase is securely bolted to the engine and start the pressure washer.
- 8. Perform an output pressure test.

Main shaft oil seal removal/installation

- 1. Remove the pump from the engine.
- 2. Remove the mounting flange from the pump.



3. Drive the oil seal out of the flange from the pump side, as shown in fig 4.6. Once you have the tool squarely against the inner edge of the oil seal, one sharp blow is generally



all it takes to drive it out. If it takes more than one attempt, rotate the flange so you are not striking in the same place or you could break through the seal and damage the race.

4. Use a length of 1¹/₂ inch PVC pipe to drive a new oil seal straight into the flange. Do this in stages and stop as soon as the seal is completely seated.

Plunger oil seal removal/installation.

If all you're going to do is service a plunger oil seal, you do not need to remove the pump from the engine.

- 1. If you have a shipping cap (non-vented) replace the dipstick with it. If you don't have a shipping cap, wrap a small plastic bag around the dipstick and reinstall it; otherwise oil will run out of the cap when you rotate the pump
- 2. Remove the manifold.
- 3. Unbolt the pump and rotate it as shown in fig 4.7 so the pistons point straight up. Install two bolts to hold it steady.





- 4. With the weep-hole in the bottom of the crankcase at 12:00 o'clock, drive a long thin screwdriver straight into the center of the oil seal at 11:00 0'clock, as shown in fig 4.8.
- 5. Use the weep hole as a lever point to pop the oil seal out. Take care to apply even pressure and the oil seal will slide out.



- 6. Use a Q-tip to clean out the well.
- 7. Coat a new oil seal with grease or motor oil and push it down over the plunger as far as it will go. Take care not to invert the lips of the seal.
- 8. Use a long socket with a diameter slightly smaller than the width of the seal to drive the seal into its seat.
- 9. Install the piston to spec and rebolt the pump to the engine. With the manifold off of the pump, run the engine for ten minutes to make sure that the seal is secure.
- 10. Install the manifold and perform a pressure test.

Direct manifold pressure test.

In order to determine whether a pressure-related problem is in the unloader or the manifold, perform a pressure test directly at the high-pressure outlet.

You won't be able to let go of the trigger gun during this test so you'll need a helper.



You'll need the following parts, as shown in fig 4.9 below: (The manifold was removed for clarity—you do not need to remove it to install these parts.)

- (1) $\frac{1}{2}$ inch brass street elbow
- (1) 3/8 brass hex nipple
- (1) 3/8 brass street elbow
- (1) 3/8 female quick-connect couple



- 1. Remove the unloader and take it to the vise and remove the garden hose inlet fitting, which you will install onto the manifold with a $\frac{1}{2}$ brass street elbow in step 3.
- 2. Thread a 3/8 street elbow into the manifold. Thread a 3/8 female quick connect couple onto a nipple and install it to the elbow.
- 3. Thread a $\frac{1}{2}$ brass street elbow into the water inlet and install the garden hose fitting to it.
- 4. Make sure that the engine is set to the proper RPM.
- 5. Attach the water supply.
- 6. Attach the pressure gauge, high-pressure hose, and gun with a pressure nozzle installed in the tip.



7. With the trigger gun closed, turn on the water supply to check for leaks, which will affect the accuracy of the test.

WARNING: IF YOU RELEASE THE TRIGGER GUN DURING THE NEXT PORTION OF THE TEST YOU WILL DESTROY THE PUMP IN LESS TIME THAN YOU CAN SHUT IT DOWN.

8. With this precaution in mind, hold the trigger gun open and have your assistant start the engine. Have your assistant shut the machine down as soon as it has come up to full pressure. DO NOT LET GO OF THE TRIGGER UNTIL THE ENGINE HAS STOPPED COMPLETELY.

The pressure reading reflects the raw output of the pump. If the pressure is normal, there is a problem with the unloader. There are no user serviceable parts in the unloader and it must be replaced as a unit.

Pressure gauge assembly:

You'll need the following parts to assemble a pressure gauge:

(2) 3/8 brass hex nipples

- (1) 3/8 brass tee
- (1) 3/8-1/4 reducing bushing
- (1) female quick-connect couple
- (1) female quick-connect plug
- (1) 5000PSI pressure gauge

Teflon tape

Assemble the parts as shown.

