

H-25-SD/G-25-SD Maintenance

NOTE: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

Daily

Check the oil level and the condition of the oil. The oil level should be 1 in. (2.5 cm) from the top of the fill port — so that the floor of the upper reservoir within the pump housing is flooded and the chamber itself is about 1/4 full, allowing for oil expansion as the pump runs and heats up.

Use the appropriate Wanner Hydra-Oil brand motor oil for the application — contact Wanner Engineering if in doubt.

Caution: If you are losing oil but don't see any external leakage, or if the oil becomes discolored and contaminated, one of the diaphragms (21) may be damaged. Refer to the Service Section. Do not operate the pump with a damaged diaphragm.

Caution: Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil as soon as discovered, and replace it with clean oil.

Periodically

Change the oil after the first 100 hours of operation, and every 1000 operating hours thereafter. When changing, remove the drain plug (36) at the bottom of the pump so all oil and accumulated sediment will drain out.

Caution: Do not turn the drive shaft while the oil reservoir is empty.

Check the inlet pressure or vacuum periodically with a gauge. If vacuum at the pump inlet exceeds 7 in. Hg (180 mm Hg), check the inlet piping system for blockages. If the pump inlet is located above the supply tank, check the fluid supply level and replenish if too low.

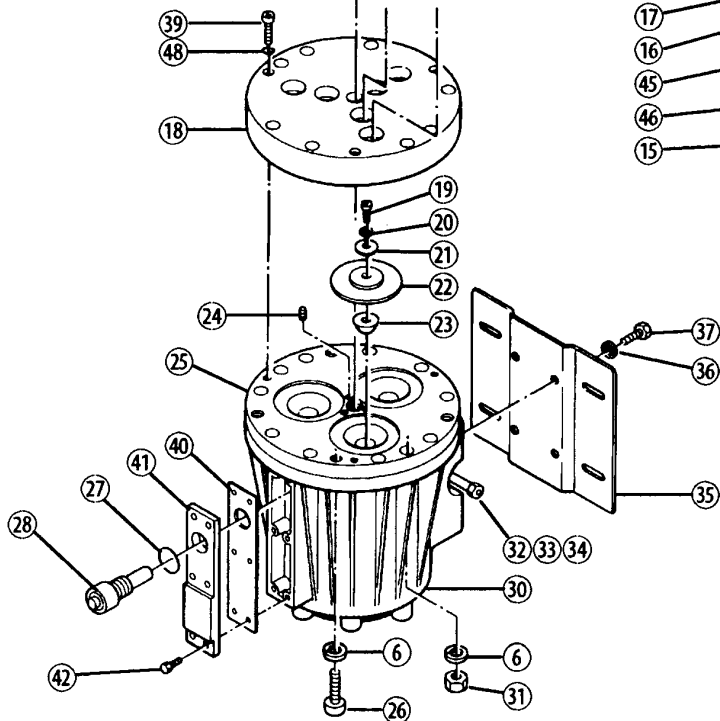
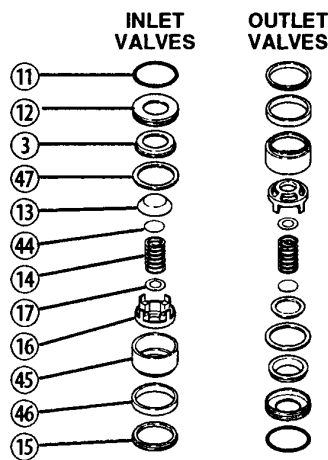
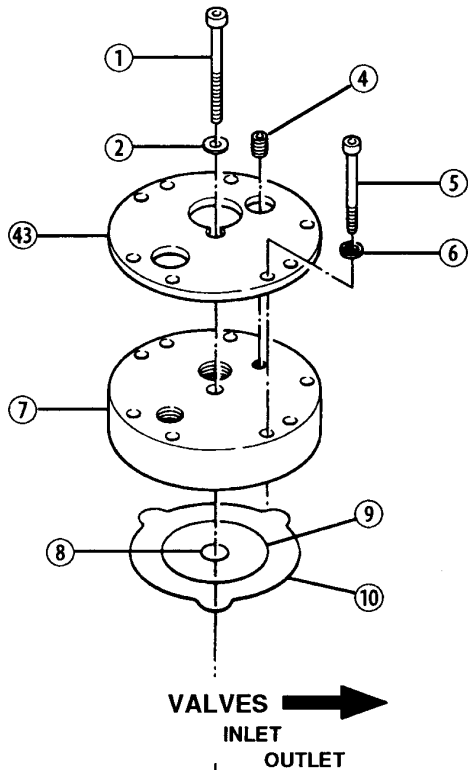
Caution: Protect the pump from freezing. Refer also to the "Shutdown Procedure".

Shutdown Procedure During Freezing Temperatures

1. Disconnect the inlet and outlet piping from the pump.
2. Remove the drain plug (1) at the bottom center of the manifold.
3. Open any draincocks in the piping.
4. Start the pump, and allow it to run until all fluid is removed from the pump head.
5. Stop the pump, and reinstall the drain plug.
6. Fill the pump with antifreeze.

When you put the pump back into service, thoroughly flush the antifreeze.

H-25-SD/G-25-SD Service (Fluid End)



Note: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

This section explains how to disassemble and inspect all easily-serviceable parts of the pump. Repair procedures for the hydraulic end (oil reservoir) of the pump are included in a later section of the manual.

Caution: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (Tel 612-332-5681 or Fax 612-332-6937) or the distributor in your area.

Caution: The four capscrews (26) that screw through the back of the housing into the cylinder casting hold the casting over the hydraulic end of the pump. Do not remove them except when repairing the hydraulic end.

Tools and Supplies

The following tools and supplies are recommended for servicing the fluid end of the pump:

- Wanner G-25 Tool Kit (includes 8-mm and 10-mm hex bit sockets)
- 1/2-in. drive socket wrench
- 16-mm box-end wrench
- Straightedge (at least 10 in. long)
- Two 2-in. high blocks, approximately 2 to 3 in. wide and 6 to 8 in. long
- Medium Phillips-head screwdriver
- Mallet
- Small torque wrench — rated to at least 27 in.-lbs (3 N-m)
- Torque wrench — rated to at least 50 ft-lbs (68 N-m)
- New oil
- Grease or petroleum jelly
- Water or compatible solvent for cleaning

The following additional supplies are recommended for servicing the hydraulic end of the pump:

- 17-mm hex socket or box-end wrench
- 3/4-in. (19-mm) open-end or adjustable wrench
- 1-in. (26-mm) open-end or adjustable wrench
- Emery cloth or ScotchBrite™ pad
- Grease
- Anaerobic seal sealant

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Service Procedure

1. Remove Manifold Support (43), Manifold (7), and Valve Plate (18)

- a. With an 8-mm (or 5/16-in.) hex Allen wrench, and a 16-mm box-end wrench, remove all nuts (31) and capscrews (5) around the manifold support plate. Do not remove the four capscrews (26) that are installed through the back of the pump housing.
- b. With a 10-mm hex Allen wrench, remove the centerbolt (1) and its washer (2) in the center of the manifold support plate.

Caution: Do not turn the pump drive shaft while the manifold and valve plate are off the pump, except when removing diaphragms or repriming the hydraulic cells.

- c. Remove the manifold support (43) and manifold (7).
- d. Inspect the manifold support and manifold for warpage or wear around the inlet and outlet ports. Also inspect the manifold for warpage or wear in the area of the flow channels, especially where the valve assemblies contact the manifold. If wear is excessive, replace the manifold with a new one.

To check the manifold support for warpage, lay it on a flat surface and place a straightedge across it. Check both sides of the plate for warpage.

To check the manifold for warpage, first be sure any plugs or O-rings are removed, then lay it on a flat surface with the flow channels facing you. Place a straightedge across the raised surfaces of the manifold.

Note: A machined recess was cut around the perimeter of the manifold at the factory. Do not mistake this feature for warpage.

A warped manifold support or manifold should be replaced.

- e. With a 5-mm hex Allen wrench (included in the Wanner Tool Kit), remove the three socket-head capscrews (39) that hold the valve plate to the cylinder casting.

Note: There is an O-ring (48) under the head of each capscrew, which acts as a washer between it and the plastic valve plate.

2. Remove and Inspect Valve Assemblies (3, 11-17, 44-47)

Note: Wanner Repair Kits contain some or all of the required components to replace items (3), (11-17), and (44-47), as well as all O-rings for sealing the manifold to the valve plate. Consult the appropriate Parts Manual for your pump to determine which Repair Kit to order.

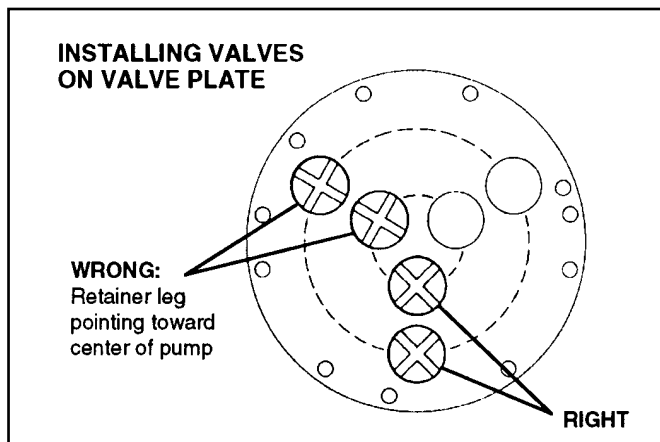
Remove the Valve Assemblies

The three inlet and three outlet valve assemblies in the pump are identical (but face in opposite directions). One at a time, remove each valve assembly with the aid of the valve seat remover tool (from the Wanner Tool Kit), then inspect and reinstall the valve assembly as outlined below. Be careful not to bend or break any of the metal valve components, and not to gouge or scrape the plastic valve plate.

Set the valve plate on 2-in. high blocks, with the valve assemblies facing down. As you press out each valve assembly during the following procedure, be sure there is enough open space below so that the valve can come out of its bore unobstructed.

To remove each valve assembly:

- a. **Inlet (3 center valves).** From the large hole at the bottom of the diaphragm pocket in the valve plate, press down on the spring retainer (16) until the valve seat, valve, and spring fall out of the bore. You may have to use a mallet along with the valve seat remover tool. Next, work the valve seat remover tool between the



spacer (15) and the shoulder of the valve plate bore, again through the large hole at the bottom of the diaphragm pocket.

Press and tap down as required, working your way around the edge of the spacer to force the shell subassembly, crush seal, and spacer evenly out of the valve bore.

- b. **Outlet (3 outer valves).** From the small hole at the bottom of the diaphragm pocket in the valve plate, and through the valve seat bore, press down evenly on the valve (13) until it stops against the spring retainer.

Note: The valve seat remover tool must be tipped approximately 45° to get it through the seat bore.

Continue pressing or tapping, as required, until the spacer, crush seal, shell subassembly, spring, and valve fall out of the valve bore.

Next, work the valve seat remover tool between the seat holder (12) and the shoulder of the valve plate bore, again through the small hole at the bottom of the diaphragm pocket.

Press and tap down as required, working your way around the edge of the seat holder to force the spacer and seat subassembly evenly out of the valve bore.

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- c. Inspect both sides of the valve plate for wear, including the diaphragm pockets, valve bores, and shoulders at the bottom of each bore. Also inspect the face of the valve plate (adjacent to the valve bores) for wear, especially in the areas where the O-rings seal between it and the manifold. Using a straightedge, inspect both sides of the valve plate for warpage. If there is warpage or excessive wear, replace the valve plate.

Inspect the Valve Components

Inspect the individual components of each valve as follows:

- a. Check the spring retainer (16) that is housed inside the shell (45). Be sure to locate the polyurethane washer (17) that sits in the spring retainer recess and supports the spring (14). If the spring retainer is worn in the area of the four tabs that guide and act as a stop for the valve, replace it.

Also look for wear in the area of the recess that supports the spring. The polyurethane washer should have minimized or prevented wear in this area if it stayed in place during operation.

Press out the old spring retainer and push in a new one if required. It is always a good idea to use a new polyurethane washer in the spring retainer recess. Be careful to put only one washer into each retainer recess.

- b. Check the valve spring (14) for wear or damage. Compare its free length to that of a new spring. A worn or otherwise damaged spring should be replaced with a new one. Never attempt to stretch an old spring and reuse it.
- c. Check the valve (13) for uneven or excessive wear. If it has developed an uneven wear pattern or is worn excessively, do not reuse it — replace it with a new one. A valve with an uneven wear pattern will not seal effectively, even against a new seat, resulting in rough operation and reduced output.

Note: Your pump has a urethane washer (44) in the recess on the back side of each valve. It is there to reduce or eliminate wear on the valve caused by motion between the spring and valve. It also helps minimize wear on the end of the spring. It is always a good idea to replace these washers with new ones. Be careful to put only one washer into each valve recess.

- d. Remove the valve seat (3) from its holder (12). Inspect both parts for wear and replace either or both as necessary. It is always a good idea to use a new valve seat and O-ring (11) in the valve seat holder.

Note: Whenever you replace a worn valve, valve seat, or valve spring in any valve assembly, we recommend that you replace them in all valve assemblies at that time, to ensure the most reliable operation when you restart the pump. We also recommend that you always replace the washers and seals in the valve assemblies at that time, for the most reliable operation. All the necessary parts are included in a replacement valve kit and in a complete fluid-end kit.

Reinstall the Valve Assemblies

- a. Clean the valve ports and shoulders in the valve plate (18) with water or a compatible solvent. A ScotchBrite™ pad or brush may be used to abrade any old buildup or residue, but be careful not to scratch the plastic or wear away any of the plastic valve plate material. Rinse the valve plate after cleaning and lubricate the valve ports with a compatible grease, oil, or lubricating gel such as petroleum jelly.

Caution: If the elastomers are made of EPDM, do not use a petroleum-based lubricant on them. Instead, use an EPDM-compatible lubricant. If the product is food-grade, use a compatible food-grade lubricant.

- b. Install new O-rings (11) and seats (3) into each valve seat holder (12). Lubricate the O-rings.
- c. Install new polyurethane washers (17, 44) into each spring retainer recess and each valve recess, respectively. Install the spring retainers (16) into their shells (45) before installing the polyurethane washers in the retainers.

A small amount of grease or petroleum jelly should be used to help the washers stay in place during the rest of the assembly procedure. It is very important that these washers stay in their proper place until assembly is completed. If they do not, they could end up holding a valve open or clogging a valve or filter downstream of the pump. In addition, they will not do their job of minimizing wear of the spring retainers, springs, and valves if they are not properly in place.

- d. Install a new crush seal (46) on three of the shell subassemblies just completed above, for use in the outlet valves. Press the spacers (15) onto the crush seals to create a five-piece subassembly for each outlet valve. It is important to use new crush seals during each rebuilding, because they hold the spacers to the shells during subsequent assembly procedures. Using new crush seals also ensures proper compression on the valve assemblies when the manifold is clamped to the valve plate.

Consult the illustration on page 8 for proper orientation of the spring retainer tabs for both the inlet and outlet valves.

- e. **Inlet (3 center valves).** Insert the three remaining spacers (15) into the inner ring of valve bores in the valve plate. The flat, flanged end must be facing down toward the shoulder of the valve plate.

Note: You may have to press the spacers slightly, as there is a line-to-line fit between the outer diameter of the spacer and the valve bore.

Next, insert the remaining crush seals (46) onto the nose of the inlet valve spacers. **The seals *must* fit around the nose of the spacers.**

Insert the three-piece shell subassemblies (45, 16, 17) into the inlet valve bores. They too may have to be pressed slightly, as there is a line-to-line fit between the outer diameter of the shell and the valve bore. Be sure the nose of the shell (45) presses into the inner diameter of the crush seal (46). The shaft rotator (from the Wanner Tool Kit) can be used to press down evenly on the shell

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subassembly to get the proper fit.

Before continuing, check that each polyurethane washer is in its proper place, nested down into the recess of each spring retainer.

Insert the spacers (47) into the valve bores so that they rest on top of the shell subassemblies. Insert the springs (14) and valves (13), ensuring that each valve has a polyurethane washer (44) pressed into its recess — to minimize wear on the valve and the end of the spring.

Finally, press the valve seat subassemblies (3, 12, 11) down into the valve bores, compressing the valve spring slightly. The valve seat O-ring should be lubricated with grease or petroleum jelly to ease assembly. There is substantial interference between the O-ring and valve bore, so be careful not to shear the O-ring by driving it in too quickly. Use the seal inserter (from the Wanner Tool Kit) to push evenly on the seat, rocking very slightly, if required, to ease the O-ring into the bore. Push down on the valve until it hits the stops on the spring retainer, then let it pop back up to the seat to ensure proper operation.

- f. **Outlet (3 outer valves).** Press the three remaining valve seat subassemblies (11, 3, 12) into the outer ring of valve bores in the valve plate. The flat, metal end of the valve seat holder (12) must be facing down toward the shoulder of the valve plate. The valve bore and O-ring should be lubricated with grease or petroleum jelly to ease assembly. There is substantial interference between the O-ring and valve bore, so be careful not to shear the O-ring by driving it in too quickly.

Use the seal inserter to push the seat into the valve bore until it is flush with the plate, then use the shaft rotator and push down on the seats until they hit the shoulder at the bottom of each bore.

Insert the spacers (47) into the valve bores so they rest on top of the valve seats. Place the valves (13) and springs (14) onto the seats, ensuring that each valve has a polyurethane washer (44) pressed into its recess. Finally, insert the five-piece shell subassemblies into the bores, after checking that each polyurethane washer is in its proper place, nested down in the recess of each spring retainer. You may have to press slightly, as there is a line-to-line fit between the outer diameter of the shell and the valve bore.

From the other side of the valve plate (through the diaphragm pocket), push on the valve until it hits the stops on the spring retainer, then let it pop back to the seat to ensure proper operation. You may have to lightly hold the shell subassembly in place when doing this.

3. Inspect and Replace Diaphragms (22)

- a. Lift one of the diaphragms by one edge, and turn the pump shaft until the diaphragm pulls up. This will expose machined cross-holes in the valve plunger shaft behind the diaphragm.
- b. Insert an Allen wrench through one of the holes, to hold the diaphragm up. The proper size tool is included in the Wanner Tool Kit.
- c. Remove the screw (19), O-ring (20), and follower (21) in the center of the diaphragm.
- d. Remove the diaphragm and inspect it carefully. A ruptured diaphragm generally indicates a pumping system problem, and replacing only the diaphragm will not solve the larger problem. Inspect the diaphragm for the following:
 - **Half-moon marks.** Usually caused by cavitation of the pump (refer to “Troubleshooting”).
 - **Concentric circular marks.** Usually caused by cavitation of the pump (refer to “Troubleshooting”).
 - **Small puncture.** Usually caused by a sharp foreign object in the fluid, or by an ice particle.
 - **Diaphragm pulled away** from the center screw or from the cylinder sides. Usually caused by fluid being frozen in the pump, or by overpressurization of the pump.
 - **Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping a fluid that is incompatible with the diaphragm material.
 - **Slice in ridge of diaphragm.** Occurs when a diaphragm is operated at temperatures below its rated capability.
 - **Diaphragm edge chewed away.** Usually caused by overpressurizing the system.
- e. Inspect the plunger (23) for any rough surfaces or edges. **Do not** remove the plunger from the valve plunger (54). Smooth the surfaces and edges as necessary with emery cloth or a fine file.

Caution: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely (as outlined below) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.
- f. Install a new diaphragm (or reinstall the old one, as appropriate), ridge side out.
- g. Clean and dry the screw (19), removing any oil from it. Apply medium-strength threadlocker to the screw. Reinstall the screw, the follower (21), and a new O-ring (20). Tighten to 18 in.-lbs (2.0 N-m).
- h. Repeat the above inspection procedure (and replacement, if necessary) with the other two diaphragms.

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4. Flush Contaminant from Hydraulic End (only if a diaphragm has ruptured)

- Remove the oil drain cap (34) and allow all oil and contaminant to drain out.
- Fill the reservoir with kerosene or solvent, manually turn the pump shaft to circulate the kerosene, and drain.
Caution: If you have EPDM diaphragms, or if food grade oil is in the reservoir, do not use kerosene or solvents. Instead, flush with the same lubricant that is in the reservoir. Pumps with EPDM diaphragms have an "E" as the 7th digit of the Model No.
- Repeat the flushing procedure (step b).
- Fill the reservoir with fresh oil, manually turn the pump shaft to circulate the oil, and drain once again.
- Refill the reservoir. If the oil appears milky, there is still contaminant in the reservoir. Repeat the flushing procedure until the oil appears clean.

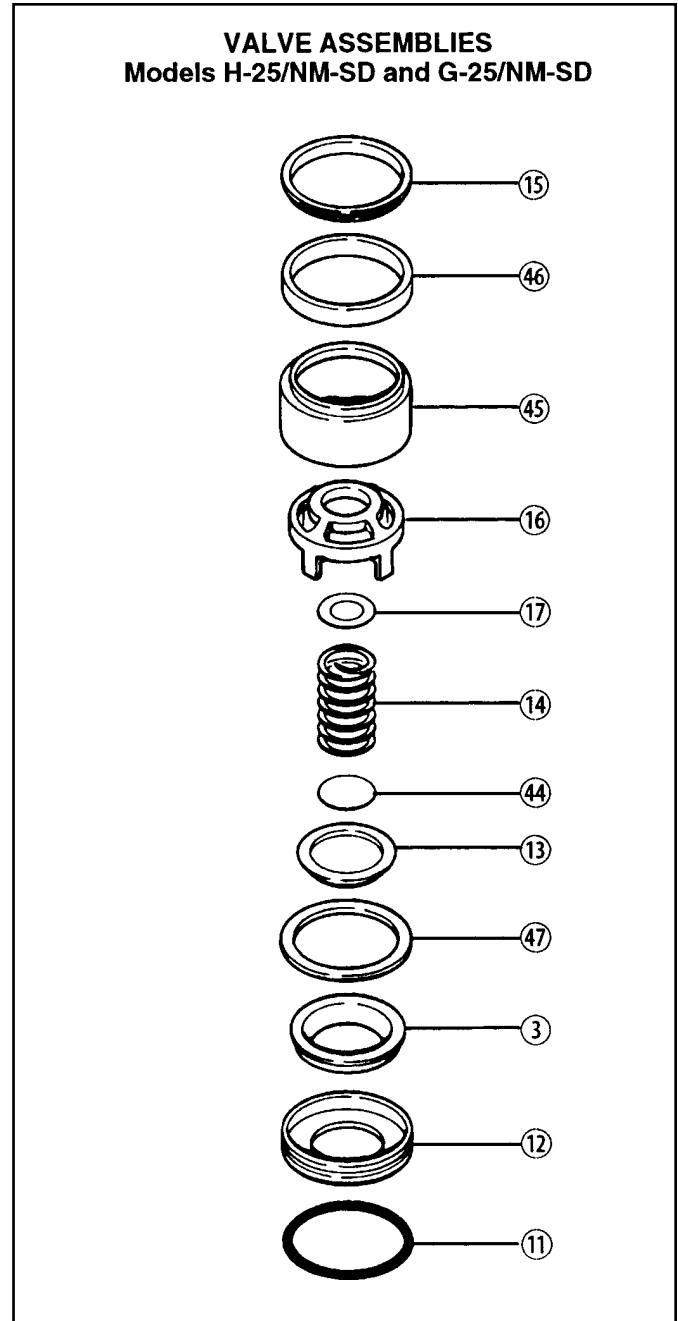
5. Prime the Hydraulic Cells

- With the pump **horizontal and the fluid-end head removed**, fill the reservoir with the appropriate Hydra-Oil for the application.
- All air in the oil within the hydraulic cell (behind the diaphragms) must be forced out by turning the shaft (and thus pumping the piston). A shaft rotator is included in the Wanner Tool Kit. Turn the shaft until a **bubble-free** flow of oil comes from behind all the diaphragms. Watch the oil level in the reservoir; if it gets too low during priming, air will be drawn into the pistons (inside the hydraulic end) and will cause the pump to run rough.
- Wipe excess oil from the cylinder casting and diaphragms.

6. Reinstall Valve Plate (18), Manifold (7), and Manifold Support (43)

- Reinstall the valve plate (18), with the valve assemblies installed as outlined above, onto the cylinder casting. Use the three socket-head capscrews (39) with O-rings (48) to fasten the valve plate to the cylinder casting. Verify that the valve assemblies are still in place.
- Reinstall the O-rings (8, 9, 10) between the valve plate and manifold. Use petroleum jelly or lubricating gel to hold them in place.
- With the manifold support and manifold nested together, and the centerbolt (1) and washer (2) in place through the center hole, locate the drain plug (4) at the bottom and hold the manifold and support against the valve plate. Tighten the centerbolt by hand.

- Insert all bolts (5), washers (6), and nuts (31) loosely. Align the outer surfaces of the valve plate, manifold, and manifold support, and torque the centerbolt to 45 ft-lbs (60 N-m).
- Alternately tighten opposite bolts (5) until all are secured. Torque to 45 ft-lbs (60 N-m).

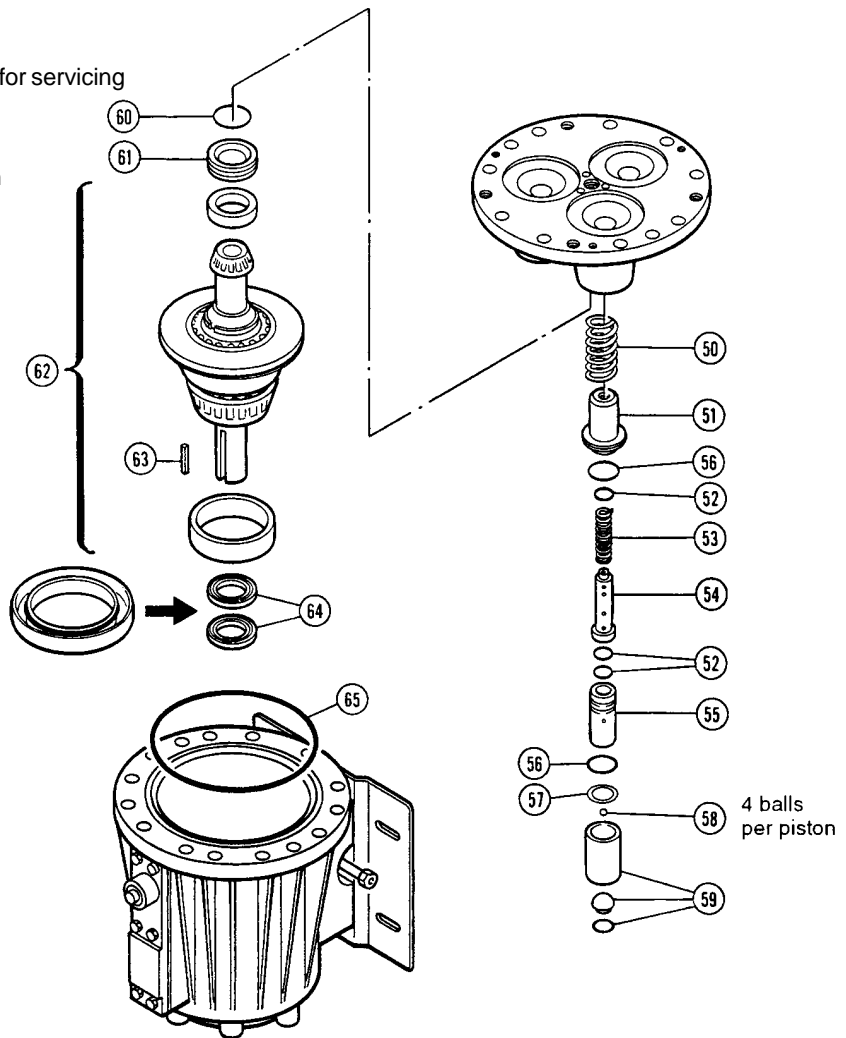


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Tools and Supplies

The following additional supplies are recommended for servicing the hydraulic end of the pump:

- 17 mm hex socket or box-end wrench
- 3/4 in. (19 mm) open-end or adjustable wrench
- 1 in (26 mm) open-end or adjustable wrench
- Emery cloth or ScotchBrite™ pad
- Grease
- Anaerobic seal sealant



Note: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

Caution: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (Tel 612-332-5681 or Fax 612-332-6937) or the distributor in your area.

Caution: The four capscrews (26) that screw through the back of the housing into the cylinder casting (25) hold the casting to the pump housing. Do not remove them except when repairing the hydraulic end.

Note: The following service procedures refer several times to the Wanner Tool Kit. Do not try to repair the hydraulic end of the pump without using the tools in this kit (available from Wanner or your local distributor).

1. Remove Pump Housing

- Remove the head of the pump, and the diaphragms, as outlined in the Fluid End Service Section.
- Drain the oil from the pump housing by removing the drain plug (34). Dispose of the oil properly.
- Set the hydraulic end of the pump face-down on the cylinder casting (25).
- Check the shaft for sharp burrs. Smooth any burrs, to prevent scarring the housing seals (64) when you disassemble the pump.
- Alternately loosen the four capscrews (26) that secure the housing to the cylinder casting. The piston return springs (50) will force the cylinder casting and housing apart. Loosen each screw one to two turns before going to the next one, continuing until all four screws are removed.
- Lift off the housing (30).
- Inspect the cam and bearings (62), and the bearing race in the rear of the housing. If the bearings are pitted or binding, or if the housing race is worn, contact Wanner Engineering.

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2. Disassemble Pistons

- a. With the pump housing removed (see above), turn the cylinder casting over and set it on a flat surface, piston side down.
- b. With the diaphragms removed (see the Fluid End Service Section), reinsert a follower screw (19) into the hole in one of the valve plungers (54). Tap the screw lightly with a hammer; the plunger (23) should slip off the valve plunger (54).
- c. Repeat step “b” for the remaining pistons.
- d. Each hydraulic piston assembly (50-59) can now be disassembled. Lift the cylinder casting straight up and off the pistons. Inspect all parts, and replace all O-rings and any other parts that are worn or damaged.

Note: When you reassemble the hydraulic piston, use new plungers (23). They are press-fit onto the valve plungers (54) and are generally not reusable.

3. Reassemble Pistons

- a. Drop a ball (58) into each opening in the bottom of a piston assembly (59).
- b. Insert a retaining washer (57) and O-ring (56) to hold the ball in place.
- c. Insert a valve plunger (54) into a valve cylinder (55). Slide a spring (53) over the plunger, inside the valve cylinder.
- d. Insert an O-ring (52) into a spring retainer (51).
- e. Install two O-rings (52) on the valve cylinder (55).
- f. Slide the assembled valve cylinder, plunger, and spring (53-55) into the spring retainer (51).
- g. Install an O-ring (56) on the spring retainer (51).
- h. Slide the complete cylinder-and-retainer assembly (51-56) into the piston assembly (59).
- i. Insert a return spring (50) into the piston assembly.
- j. Repeat the above procedure for the other two pistons.

4. Reassemble Pump Housing, Shaft Assembly, and Cylinder Casting

Note: Inspect the shaft seals (64) before continuing. If they look damaged in any way, replace them. We recommend changing the shaft seals whenever the camshaft assembly is removed from the pump housing. New shaft seals will be installed after the pump housing has been assembled over the camshaft and fastened to the cylinder casting (see Step 5 below). Both seals should be replaced at the same time. Remove the seals by pounding them out from inside the pump housing, then clean the seal bore in the housing using emery cloth or ScotchBrite™.

- a. Screw three 10-mm assembly studs (from the Wanner Tool Kit) into three of the four threaded holes in the **outer** ring of holes within the cylinder casting (25). Thread them in all the way, from the diaphragm side of the cylinder casting, until the head bottoms out against the face of the cylinder casting.
Apply a slight torque to them so they will resist rotation during the following steps.
- b. Place the cylinder casting face-down on a flat surface. It will rest on the heads of the three assembly studs just added. This is especially important if the diaphragms and pistons are already assembled to the cylinder casting. **Never lay the cylinder casting face-down with the weight of the casting and/or the pump housing on the diaphragms.**
- c. Insert the assembled pistons (50-59) into the cylinder casting. Check each piston to be sure all check balls (58) are in place.
- d. Note the location of the **outer** ring of holes in the cylinder casting and in the pump housing flange — in particular, the holes where capscrews (26) will be installed.
- e. Stand the camshaft assembly (62) on the cylinder casting (25), and place the seal protector (from the Wanner Tool Kit) over the end of the shaft.
Caution: The pilot bearing must be properly nested in the bearing race during assembly. If misaligned, the bearing will be damaged and the pump will fail within the first hours of operation.
- f. Using grease to retain it, install the O-ring (65) and slide the housing (30) down over the shaft and onto the threaded studs (from step “a”). Be sure the holes in the housing and the cylinder casting are properly aligned.
- g. Install washers (6) and nuts (31) on the threaded studs, but don’t tighten yet. You may want to insert two or more bolts (5) into the unthreaded holes of the housing and cylinder casting to help align the parts.
- h. Alternately tighten the three nuts (31) to evenly draw the housing down to the cylinder casting. Be sure the O-ring (65) stays in place. Also, as you tighten the nuts keep checking the shaft alignment by turning the shaft (use the rotator in the Wanner Tool Kit). If the shaft begins to bind and become difficult to turn, back off the nuts and realign the shaft. When the pump housing is tight against the cylinder casting, you should still be able to turn the shaft smoothly.
- i. After all three nuts (31) are tightened, insert a capscrew (26), with washer (6), into the unused threaded hole in the cylinder casting. Then remove the assembly stud, washer, and nut that are opposite the capscrew just added, and replace them with another capscrew and washer. Finally, remove the other two assembly studs, which should be on opposite sides of the pump housing from each other, and replace them with capscrews and washers. Torque the capscrews to 25 ft-lbs (34 N-m).
- j. Turn the shaft again to check its alignment.

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5. Replace Shaft Seals

- a. Apply a thin film of grease on the seal protector tool (from the Wannier Tool Kit). Slide both seals onto the tool, with the spring side of the seals toward the open end of the tool.
Apply a heavier coat of grease between the seals and press them together. Wipe off any excess grease that may squeeze out onto the outside of the seals.
- b. Apply a coating of Loctite® High-Performance Pipe Sealant with Teflon, or a comparable product, to the outer surface of both seals and the inside surface of the opening in the pump housing where the seals will rest.
- c. Apply a light film of grease to the drive shaft. Slide the seal protector tool (with the two seals) over the end of the shaft.
- d. Slide the seal inserter tool (from the Wannier Tool Kit) over the seal protector tool, and press the seals completely into place. Tap the tool with a soft mallet to firmly seat the seals.

6. Adjust Camshaft Endplay

- a. If the three set screws (24) are in the cylinder casting (25), remove and clean them.
- b. Insert the centerbolt (1) into the hole in the center of the cylinder casting. Turn it in to move the bearing adjusting plate (61) and cup tight against the bearing cone.
- c. Back out the centerbolt **two** full turns, then turn it back in again until it is tight against the adjusting plate (61) to ensure the proper fit.
- d. Back out the centerbolt **exactly 1/4** of a turn.
- e. With a plastic mallet (or a regular mallet and wooden board) to prevent damage to the shaft, rap the end of the shaft three or four times. This will provide about .006 in. (0.15 mm) endplay in the shaft.
- f. Apply removable threadlocker to the threads of the three cleaned set screws (24), then screw them into the cylinder casting until they contact the bearing adjusting plate (61).
- g. Remove the centerbolt (1).

7. Install Plungers

Note: If the plungers (23) have been removed from the valve plungers (54), do not reuse them. Install new ones instead.

- a. Rotate the pump shaft so the piston is in the top-dead-center position.

- b. With the nut turned back toward the hex head of the plunger guide lifter, slide the plunger guide sleeve over the large thread of the lifter (both the lifter and guide are included in the Wannier Tool Kit).
- c. Place a plunger on the exposed screw end of the plunger guide lifter. The larger-diameter side of the plunger should face the tool.
- d. Screw the guide (with the plunger) into the valve plunger (54) until tight.
- e. Hold the plunger guide sleeve with a 1-in. (26-mm) open-end wrench. Turn the hex nut down with a 3/4-in. (19 mm) open-end wrench to force the plunger to seat on the valve plunger. This is a press-fit — when installed, the plunger should be tight against the shoulder of the valve plunger.
Note: Do *not* remove the plunger guide until the diaphragm is installed (see below).
- f. Install the diaphragm as outlined below, then repeat the procedure for the other two plungers and diaphragms.

8. Reinstall Diaphragms

- a. With the plunger guide tool still screwed into the valve plunger (54), pull the valve plunger up until the cross-holes in the valve plunger are exposed.
- b. Insert a diaphragm Allen wrench (from the Wannier Tool Kit), or a similar dowel-type object, through the holes—to hold the plunger (23) away from the cylinder casting, and to keep the valve plunger from turning when the diaphragm is being installed.
- c. Place the diaphragm (22) onto the plunger (23), ridge-side out.
- d. Center the diaphragm follower (21) on the diaphragm.
- e. Place the O-ring (20) onto the follower screw (19).
- f. Apply a small amount of threadlocker to the threads of the follower screw.
- g. Insert the follower screw (with O-ring) through the diaphragm follower (21) and diaphragm (22), and screw it into the valve plunger (54).
- h. Hold the diaphragm Allen wrench, and torque the follower screw to 18 in.-lbs (2.0 N-m).
- i. Repeat the above procedure for the plungers and diaphragms of the other two cylinders.
- j. Fill the reservoir with fresh oil and prime the pump, as outlined in the Fluid End Service Section.

9. Reassemble Pump Head

Reassemble the pump head as outlined in the Fluid End Service Section.