

# D-35-SD/G-35-SD Maintenance

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**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.

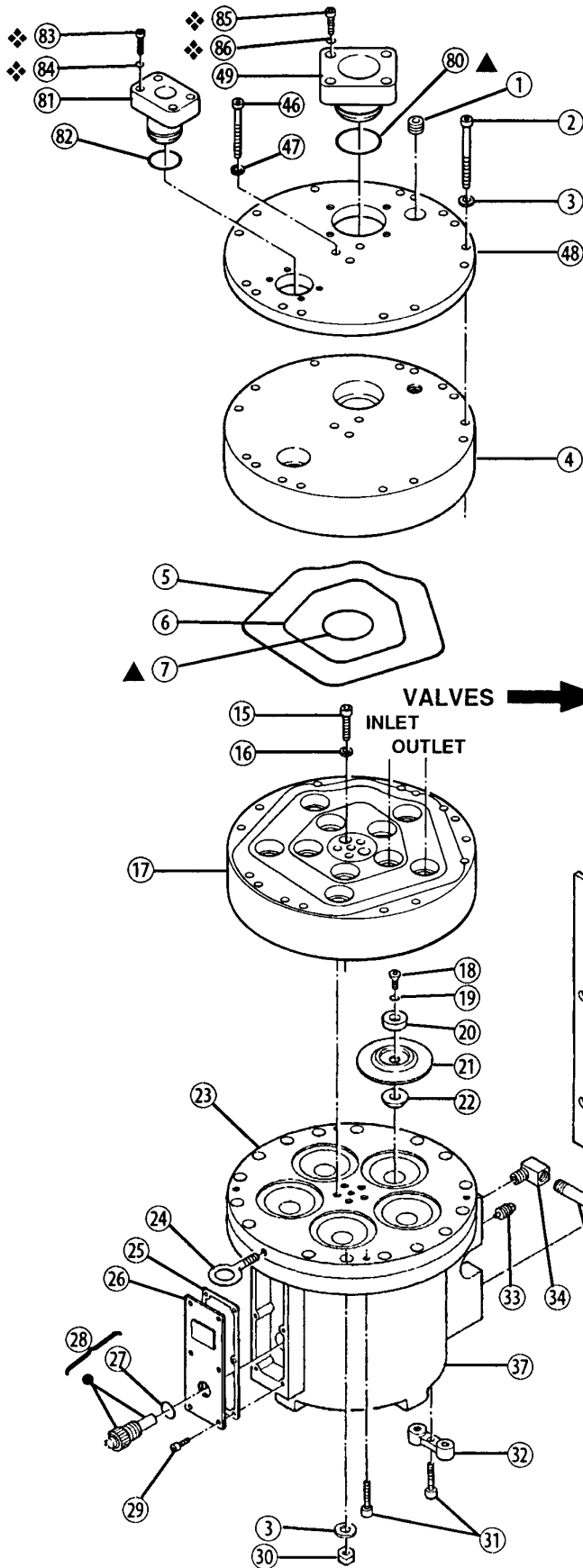
**Caution:** Protect the pump from freezing. Refer also to the "Shutdown Procedure".

## Shutdown Procedure During Freezing Temperatures

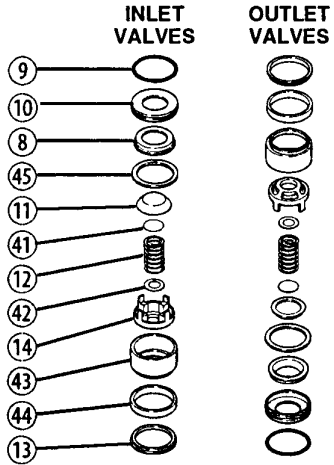
1. Disconnect the inlet and outlet piping from the pump.
2. Remove the drain plug (1) at the bottom center of the manifold.
3. Open any draincocks in the piping.
4. Start the pump, and allow it to run until all fluid is removed from the pump head.
5. Stop the pump, and reinstall the drain plug.
6. Fill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

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

# D-35-SD/G-35-SD Service (Fluid End)



Bolt Torque Specifications	
Ref. No.	Assembly Torque
2	65 ft-lbs
15	9 ft-lbs
29	9 ft-lbs
31	25 ft-lbs
40	45 ft-lbs
46	65 ft-lbs
83	15 ft-lbs
85	20 ft-lbs



❖ Supplied only on pumps with NPT adapters.

▲ O-rings ⑦ and ⑩ are close to the same size: do not interchange them. ⑦ is slightly larger than ⑩.

# D-35-SD/G-35-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 (31) 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 D-35/G-35 Tool Kit (includes 8 mm and 10 mm hex bit sockets)
- 1/2 in. drive socket wrench
- 18 mm box-end wrench
- Straightedge (at least 12 in. long)
- Two 2 in.-high blocks, approximately 2 to 3 in. wide and 8 to 10 in. long
- Medium Phillips-head screwdriver
- Mallet
- 1.50 in.-diameter rod, at least 2 in. long
- 1.75 in.-diameter rod, approximately 4 in. long
- Small torque wrench — rated to at least 27 in.-lbs (3 N-m)
- Torque wrench — rated to at least 75 ft-lbs (100 N-m)
- New oil
- Grease or petroleum jelly
- Water or compatible solvent for cleaning

## Service Procedures

### 1. Remove Inlet and Outlet Adapters (49, 81)

**Note:** When removing the adapters as explained below, twist them slightly to break loose any dried material that may have caused them to stick in place. Then ease them out of the manifold (you may have to pry carefully between the adapter flange and manifold).

- a. If your pump has **SAE** flange adapters, they can simply be pulled out of the manifold.
- b. If your pump has **NPT** or **BSPT** adapters, they are fastened to the manifold support by four socket-head capscrews and O-rings. Remove the capscrews (83, outlet; 85, inlet) and O-rings (84, outlet; 86, inlet), then pull the adapters out of the manifold.
- c. Inspect each adapter, and replace if worn or if any cracks have developed. Replace the O-rings (80, 82) with new ones.

### 2. Remove Manifold Support (48), Manifold (4), and Valve Plate (17)

- a. With a 10 mm hex Allen wrench, and an 18 mm box-end wrench, remove all nuts (30) and capscrews (2) around the manifold support plate. Do not remove the four capscrews (31) that are installed through the back of the pump housing.
- b. With a 10 mm hex Allen wrench, remove the centerbolts (46) and washers (47) 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 (48) and manifold (4).
- 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 and where the O-rings seal between manifold and valve plate. 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 the plug (1) is removed, then lay it on a flat surface with the flow channels facing you. Place a straightedge across the surface of the manifold.

A warped manifold support or manifold should be replaced.

- e. With a 10 mm hex Allen wrench, remove the two socket-head capscrews (15) that hold the valve plate to the cylinder casting.

**Note:** There is an O-ring (16) under the head of each capscrew, which acts as a washer between it and the plastic valve plate.

# D-35-SD/G-35-SD Service (Fluid End)

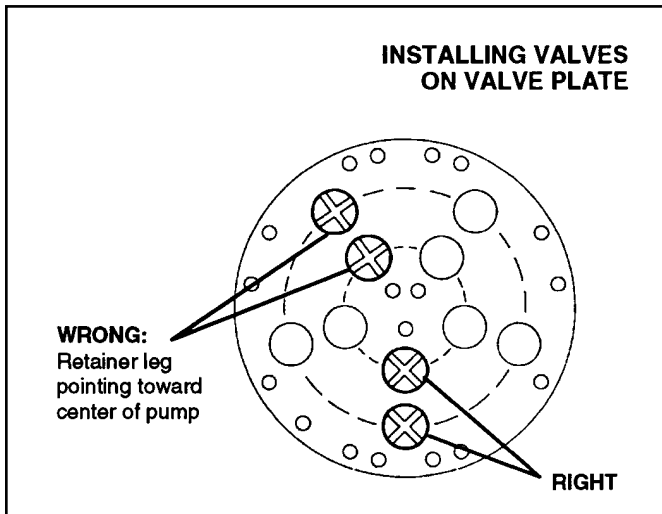
## 3. Remove and Inspect Valve Assemblies (8-14, 41-45)

**Note:** Wanner Repair Kits contain some or all of the required components to replace items (8-14) and (41-45), as well as all O-rings for sealing the valve plate and adapters to the manifold. Consult the appropriate Parts Manual for your pump to determine which Repair Kit to order.

### Remove the Valve Assemblies

The five inlet and five 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.

Remove the O-rings (5, 6, 7) from the valve plate, then set it 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:

- Inlet (5 center valves).** From the large hole at the bottom of the diaphragm pocket in the valve plate, press down on the spring retainer (14) 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 (13) 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.

- Outlet (5 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 (11) 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 (10) 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.

- 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.

**Note:** A machined recess was cut around the perimeter of the valve plate (next to the outer manifold O-ring groove) at the factory. Do not mistake this feature for warpage.

### Inspect the Valve Components

Inspect the individual components of each valve as follows:

- Check the spring retainer (14) that is housed inside the shell (43). Be sure to locate the polyurethane washer (42) that sits in the spring retainer recess and supports the spring (12). 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.

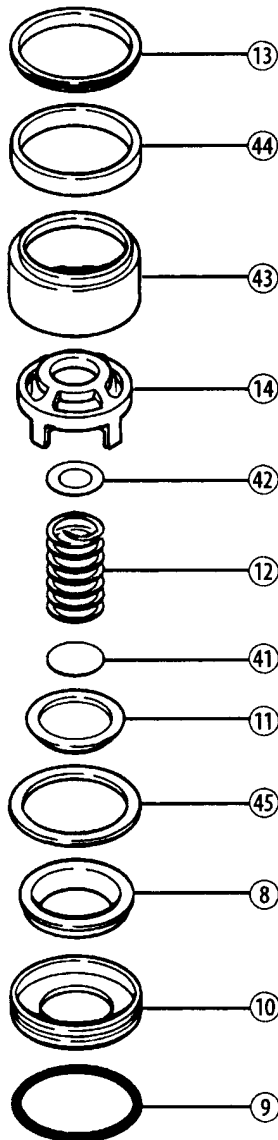
Press out the old spring retainer and push in a new one if required. It is always a good idea to use a new polyurethane washer in the spring retainer recess. Be careful to put only one washer into each retainer recess.

- Check the valve spring (12) 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.
- Check the valve (11) 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 (41) 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-35-SD/G-35-SD Service (Fluid End)

## MODEL D-35 (NONMETALLIC HEAD) SLURRY VALVE ASSEMBLY



- d. Remove the valve seat (8) from its holder (10). 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 (9) 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

- Clean the valve ports, shoulders, and O-ring grooves in the valve plate (17) 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; lubricate the valve ports and O-ring grooves with a compatible grease, oil, or lubricating gel such as petroleum jelly.
- Install new O-rings (5, 6, 7) into the valve plate grooves.
- Install new O-rings (9) and seats (8) into each valve seat holder (10). Lubricate the O-rings.
- Install new polyurethane washers (42, 41) into each spring retainer recess and each valve recess, respectively. Install the spring retainers (14) into their shells (43) 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.

- Install a new crush seal (44) on five of the shell subassemblies just completed above, for use in the outlet valves. Press the spacers (13) 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.

- Inlet (5 center valves).** Insert the five remaining spacers (13) 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 (44) onto the nose of the inlet valve spacers. **The seals *must* fit around the nose of the spacers.**

Insert the three-piece shell subassemblies (43, 14, 42) 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

# D-35-SD/G-35-SD Service (Fluid End)

the nose of the shell (43) presses into the inner diameter of the crush seal (44). Use a 1.50-in.-diameter rod to press down evenly on the shell 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 (45) into the valve bores so that they rest on top of the shell subassemblies. Insert the springs (12) and valves (11), ensuring that each valve has a polyurethane washer (41) pressed into its recess — to minimize wear on the valve and the end of the spring.

Finally, press the valve seat subassemblies (8, 10, 9) 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 a 1.75-in.-diameter rod 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.

- g. **Outlet (5 outer valves).** Press the five remaining valve seat subassemblies (8, 10, 9) into the **outer** ring of valve bores in the valve plate. The flat, metal end of the valve seat holder (10) 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 a 1.75-in.-diameter rod to push the seat into the valve bore until it is flush with the plate, then use a 1.50-in.-diameter rod to push down on the seats until they hit the shoulder at the bottom of each bore.

Insert the spacers (45) into the valve bores so they rest on top of the valve seats. Place the valves (11) and springs (12) onto the seats, ensuring that each valve has a polyurethane washer (41) 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.

## 4. Inspect and Replace Diaphragms (21)

- 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 T-handle hex wrench is included in the Wanner Tool Kit.
- c. Remove the screw (18), O-ring (19), and follower (20) 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 (22) for any rough surfaces or edges. **Do not** remove the plunger from the valve plunger (69). 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 (18), removing any oil from it. Apply medium-strength threadlocker to the screw. Reinstall the screw, the follower (20), and a new O-ring (19). Tighten to 18 in.-lbs (2.0 N-m).
- h. Repeat the above inspection procedure (and replacement, if necessary) with the other four diaphragms.

# D-35-SD/G-35-SD Service (Fluid End)

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

- a. Remove the oil drain cap (36) and allow all oil and contaminant to drain out.
- b. 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.**
- c. Repeat the flushing procedure (Step b).
- d. Fill the reservoir with fresh oil, manually turn the pump shaft to circulate the oil, and drain once again.
- e. Refill the reservoir. If the oil appears milky, there is still contaminant in the reservoir. Repeat the flushing procedure until the oil appears clean.

## 6. Prime the Hydraulic Cells

- a. With the pump **horizontal and the fluid-end head removed**, fill the reservoir with the appropriate Hydra-Oil for the application.
- b. 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.
- c. Wipe excess oil from the cylinder casting and diaphragms.

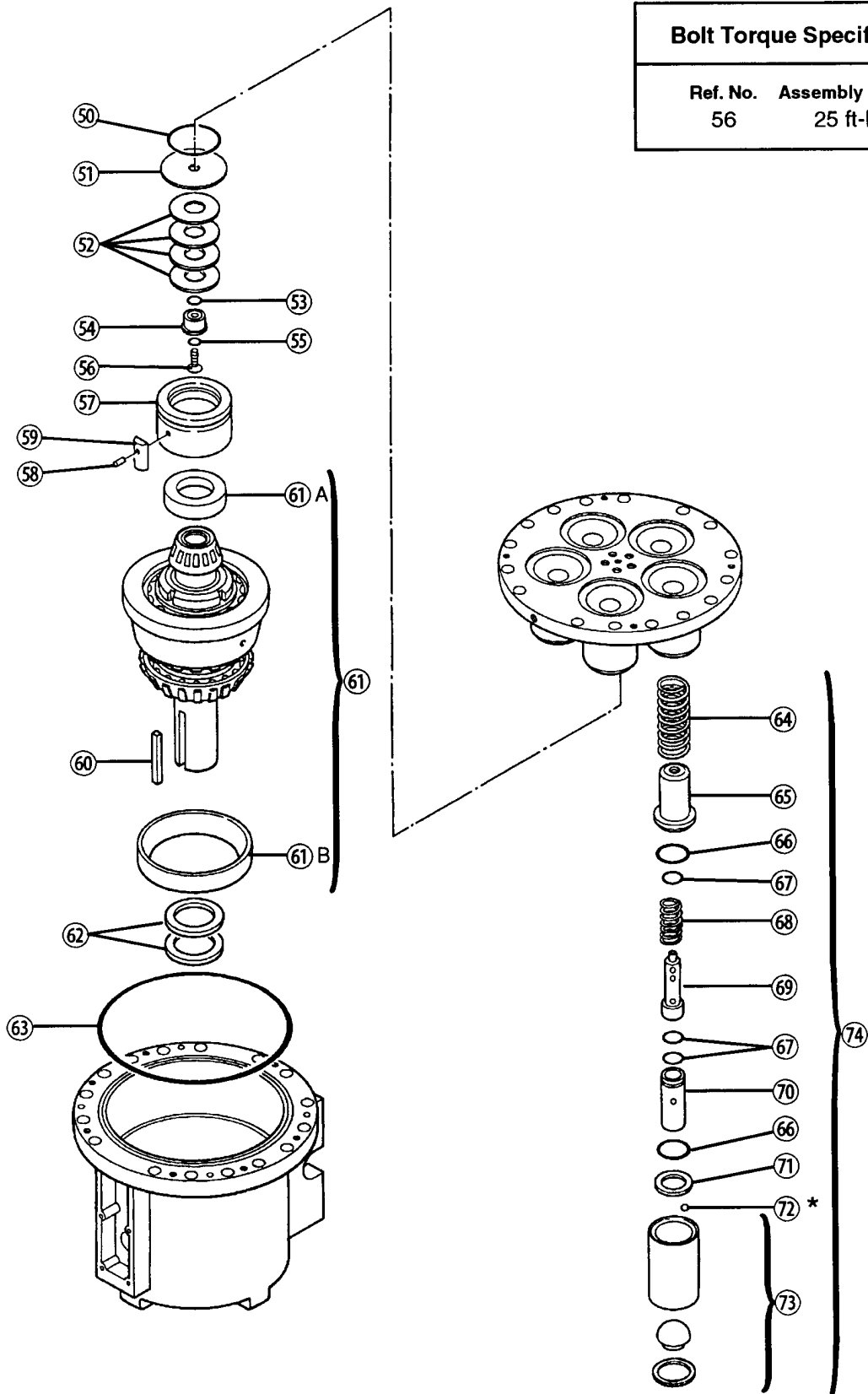
## 7. Reinstall Valve Plate (17), Manifold (4), and Manifold Support (48)

- a. Reinstall the valve plate (17), with the valve assemblies installed as outlined above, onto the cylinder casting. Use the two socket-head capscrews (15) with O-rings (16) to fasten the valve plate to the cylinder casting. Torque to **no more than 9 ft-lbs (12 N-m)**. Verify that the valve assemblies and O-rings (5, 6, 7) are still in place.
- b. With the manifold support and manifold nested together, and the capscrews (46) and washers (47) in place through the center holes, locate the drain plug (1) at the bottom and hold the manifold and support against the valve plate. Tighten the capscrews (46) by hand.
- c. Insert all capscrews (2), washers (3), and nuts (30) loosely. Align the outer surfaces of the valve plate, manifold, and manifold support, and torque the capscrews (46) to 65 ft-lbs (88 N-m).
- d. Alternately tighten all capscrews (2) until secured.  
**Note: The valve assemblies are being compressed by the manifold during this tightening sequence. It is critical to compress all parts evenly.**  
Torque the capscrews (2) to 65 ft-lbs (88 N-m).
- e. Recheck the torque on the capscrews (46).

## 8. Reinstall Inlet and Outlet Adapters (49, 81)

- a. With new O-rings (80, 82) in place on the adapters, push each adapter into its proper bore in the manifold until the back of the flange hits the manifold support. The holes in the flange of each adapter should be aligned to the tapped holes in the manifold support. Twist the adapter as required to get proper alignment.
- b. If using **SAE** flange adapters, reassembly of the pump fluid end is complete.  
If using **NPT** or **BSPT** adapters, fasten each adapter to the manifold support using capscrews (83, outlet; 85, inlet) and O-rings (84, outlet; 86, inlet). Be sure to use one O-ring under the head of each capscrew, to prevent damage to the plastic adapters and for proper thread engagement in the manifold support.
- c. Alternately tighten each set of capscrews (83, 85) until all are secured. Torque the outlet adapter capscrews (83) to **no more than 15 ft-lbs (20 N-m)**, and the inlet adapter capscrews (85) to **no more than 20 ft-lbs (27 N-m)**.

# D-35-SD/G-35-SD Service (Hydraulic End)



Bolt Torque Specifications	
Ref. No.	Assembly Torque
56	25 ft-lbs

\* Qty per piston: 4



# D-35-SD/G-35-SD Service (Hydraulic 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 the hydraulic end (oil reservoir) of the pump.

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

**Caution:** The four socket-head capscrews (31) that screw through the back of the pump housing (37) into the cylinder housing (23) hold these parts together. Do not remove these four screws except when repairing the hydraulic end.

**Note:** The following service procedures refer several times to the Wanner D-35 Tool Kit. Do not repair the hydraulic end of the pump without using the tools in this Kit (available from Wanner Engineering or your local distributor). Refer also to the list of tools and supplies in the Fluid End Service Section.

## 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

## Service Procedure

### 1. Remove Pump Housing

- Remove the manifold and valve plate, and the diaphragms, from the pump. Refer to the Fluid End Service Section.
- Drain the oil from the pump housing by removing the drain plug (36). Dispose of the oil properly.
- Check the shaft for sharp burrs. Smooth any burrs, to prevent scarring the seals (62) when removing the shaft.
- Reinsert two perimeter capscrews (2) through the pump housing (37) and cylinder housing (23) from the shaft end, at the 10 and 2 o'clock positions, to support the parts as the pump is being disassembled. For additional support of the cylinder housing, use an overhead lift hooked through the eyebolt (24).
- Install the Shaft Rotator (from the Tool Kit) over the shaft. Push it on all the way, so the front of the Rotator touches the pump housing. Tighten the Rotator set screw into the keyway. This will keep the shaft assembly (61) attached to the pump housing (37) when the cylinder housing (23) is removed.
- Alternately loosen the four socket-head capscrews (31) that secure the cylinder housing (23) to the pump housing. The piston return springs (64) will push the cylinder housing out of the pump housing. Loosen each screw one or two turns before going to the next one, and continue until all four screws are removed. The cylinder housing should now be free to slide along the two capscrews inserted in Step "d" above. Remove the cylinder housing assembly.
- Remove the shaft assembly (61) by loosening the set screw in the Shaft Rotator and sliding the shaft out of the seals (62). The parts are heavy and you may need a second person or a lifting device to move some of them.
- Remove the bearing adjustment plate (57) from the cylinder housing. Inspect the bearing cup (61A) for wear and replace if necessary. Removing screw (56) will allow parts (50-56) to be removed and cleaned. Note how the disk springs (52) are stacked, for reassembly later. Inspect O-rings (50, 53, 55) and replace with new ones if necessary.
- Inspect the cam and bearings (61), and the bearing cup (61B) in the pump housing. If the bearings are pitted or binding, or if the bearing cup in the housing is worn, contact Wanner Engineering.

**Caution:** If a bearing cup or bearing cone is replaced, they must be replaced as a pair or premature failure will result.

# D-35-SD/G-35-SD Service (Hydraulic End)

## 2. Disassemble Pistons

- Place the cylinder housing assembly (23) on a clean flat surface, with the piston feet side down.
- With the diaphragms removed (see the Fluid End Service Section), thread a follower screw (18) approximately three turns into one of the valve plungers (69). Tap the follower screw lightly with a hammer, and the plunger (22) should slip off the valve plunger (69). Remove the follower screw, and the hydraulic piston assembly (74) can then be removed. Repeat this for all five cylinders.
- Inspect and clean all parts of the hydraulic piston assembly (74), and replace all O-rings and any other parts that are worn or damaged. Repeat this on all five assemblies.
- Clean and inspect the entire cylinder housing (23) and pump housing (37) before reassembling any pistons or bearings into them. Contact Wanner Engineering to discuss replacement of the cylinder housing if there is any heavy scoring of the cylinder walls.

## 3. Reassemble Pistons

**Note: When reassembling the hydraulic pistons, use new plungers (22). They are press-fit onto the valve plungers (69) and are not reusable.**

- Drop a ball (72) into each opening in the bottom of the piston assembly (73).  
**Note: using grease on the O-rings, and lubricating the parts, will aid in assembly.**
- Insert a retaining washer (71) and O-ring (66) to hold the balls in place.
- Insert a valve plunger (69) into the valve cylinder (70). Slide a spring (68) over the valve plunger (69), inside the valve cylinder (70).
- Insert an O-ring (67) into the spring retainer (65).
- Install two O-rings (67) onto the valve cylinder (70).
- Install an O-ring (66) onto the spring retainer (65).
- Slide the assembled valve cylinder (70), valve plunger (69), and spring (68) into the spring retainer (65).
- Slide the complete cylinder-and-retainer assembly into the piston assembly (73).
- Insert a piston return spring (64) into the piston assembly.
- Repeat the above procedure for the other four pistons.

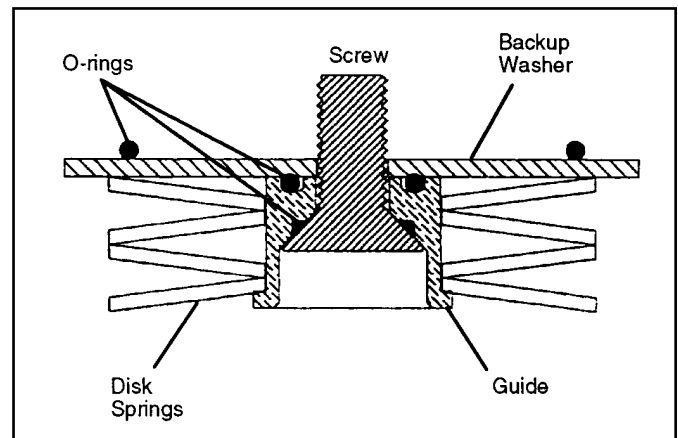
## 4. Reassemble Pump Housing, Shaft Assembly, and Cylinder Housing

**Note: Inspect the shaft seals (62) 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 Scotch-Brite™.**

- With the pump housing horizontal and mounted on the baseplate, insert the cam assembly (61) into the pump housing. If the shaft seals (62) are still in the pump housing (37), wrap the shaft with the Seal Protector Bag (from the D-35 Tool Kit). Grease the bag and slide it through the seals, then remove the bag.

Place the Shaft Rotator (from the Tool Kit) over the end of the shaft and slide it up tight against the pump housing. Keep the cam assembly (61) tight against the pump housing bearing, and horizontal, and tighten the Shaft Rotator set screw to the shaft keyway. This will hold the cam assembly horizontal and aid in assembly.

- Install the O-ring (63) onto the pump housing. Use grease to aid in holding the O-ring.
- Place the cylinder housing (23) face-down on a clean surface.
- Install the O-ring (50), backup washer (51), disk springs (52), and disk spring guide (54) with O-rings (53, 55). Be sure the disk springs are stacked correctly and the guide is passing through the center of each one before torquing screw (56) to 25 ft-lbs (34 N-m). Refer to the illustration below.



- Insert the bearing adjustment plate (57), with the bearing cup (61A), dowel pin (58), and key (59), into the cylinder housing (23).

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- f. Insert the five piston assemblies into the cylinder housing. Visually inspect the small holes in the foot end of each piston to be sure that each ball (72) is in place. **If any balls are missing or not visible, remove the piston assembly, disassemble it, and reassemble correctly.**
- g. To aid in assembly, insert two perimeter capscrews (2) through the pump housing from the shaft side, at the 10 and 2 o'clock positions.
- h. Pick up the cylinder housing assembly and slide it onto the two capscrews (2) that are in the pump housing. It will slide on until the piston feet contact the cam. Insert up to eight more capscrews (2) through the pump housing and cylinder housing to aid in alignment.
- i. Using an 11/16 in. (17 mm) hex socket or box-end wrench, install the four 10 mm x 100 mm fully-threaded bolts (from the Tool Kit) through the pump housing where the four socket-head capscrews (31) were fastened. Tighten these four bolts evenly, and the cylinder housing assembly should pull itself tight against the pump housing. As you tighten the bolts, keep checking the shaft alignment by turning it with the Shaft Rotator. If the shaft begins to bind and becomes difficult to turn, back off on the bolts and realign the shaft.  
One at a time, remove the fully-threaded bolts and replace them with the capscrews (31). Tighten all four capscrews to 25 ft-lbs (34 N-m).
- j. Turn the shaft once again to check its alignment, then remove the Shaft Rotator.
- 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 (69) 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 four plungers and diaphragms.

## 5. Install Shaft Seals (62)

- a. Wrap the shaft with the Seal Protector Bag (from the D-35 Tool Kit). Grease the bag and slide on one seal (62) up to the pump housing.  
Pack the inside (spring side) of the second seal half-full with grease. Slide this seal on and flush against the first seal. Make sure the outside diameters of the two seals are clean and free of grease. Remove the protector bag by sliding it off the shaft.
- b. Apply an anaerobic seal sealant or bearing retaining compound (such as Loctite® 601 or 609) to the outside diameter of the seals.  
Install the Shaft Rotator/Seal Inserter (from the D-35 Tool Kit) over the shaft. Using a mallet, tap the tool to push the two seals into the pump housing. Wipe off excess sealant.

## 6. Reinstall Plungers (22)

**Note: If the plungers (22) have been removed from the valve plungers (69), 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 Wanner Tool Kit).

## 7. Reinstall Diaphragms

- a. With the plunger guide tool still screwed into the valve plunger (69), pull the valve plunger up until the cross-holes in the valve plunger are exposed.
- b. Insert a diaphragm Allen wrench (from the Wanner Tool Kit), or a similar dowel-type object, through the holes — to hold the plunger (22) away from the cylinder casting, and to keep the valve plunger from turning when the diaphragm is being installed.
- c. Unscrew the plunger guide lifter from the valve plunger, and place the diaphragm (21) onto the plunger (22), ridge-side out.
- d. Center the diaphragm follower (20) on the diaphragm.
- e. Place the O-ring (19) onto the follower screw (18).
- 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 (20) and diaphragm (21), and screw it into the valve plunger (69).
- 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 four cylinders.
- j. Fill the reservoir with fresh oil and prime the pump, as outlined in the Fluid End Service Section.

## 8. Reassemble Pump Head

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