Hydra-Cell INDUSTRIAL PUMPS

Depco Home

D-40

SPECIFICATIONS

Capacity, variable to	5 - 40 gpm [19 – 151 liters/min]
Pressure, variable to	1200 psi [83 bar]
Max. temperature	250° F **(consult factory in excess of 180° F)**
Inlet port	2½ NPT
Discharge port	1¼ NPT
Shaft diameter	2"
Shaft rotation	Reversible
Dimensions	Length: 23" [584 mm] Width: 15" [381 mm] Height: 16.25" [413 mm]
Bearings	Timken® tapered roller
Reservoir capacity	19 U.S. pints [9 liters]
Weight (pump)	370 lbs [168 kg]

MATERIALS OF CONSTRUCTION *

Hydra-Cell is manufactured in many heavy-duty materials for special pumping needs, and may be customized in other materials of construction.

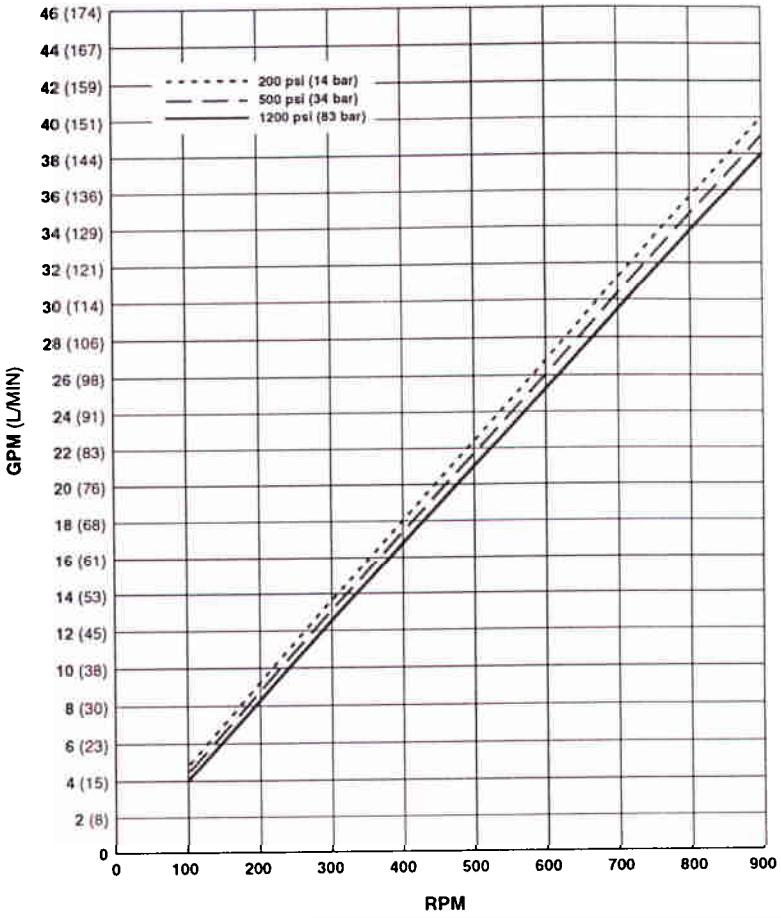
Pumping Head	Diaphragms	Valve Seats
Cast Iron 316 Stainless Steel	Buna-N Viton® EPDM Neoprene	17-4 PH Stainless Steel Nitronic® 50

Valves	Valve Springs	Spring Retainers
17-4 PH Stainless Steel Nitronic 50	17-7 PH Stainless Steel Nitronic 50	Celcon® Polypropylene Zytel®

* Other materials available by special order.

PERFORMANCE CHART

Performance may vary ±5%.

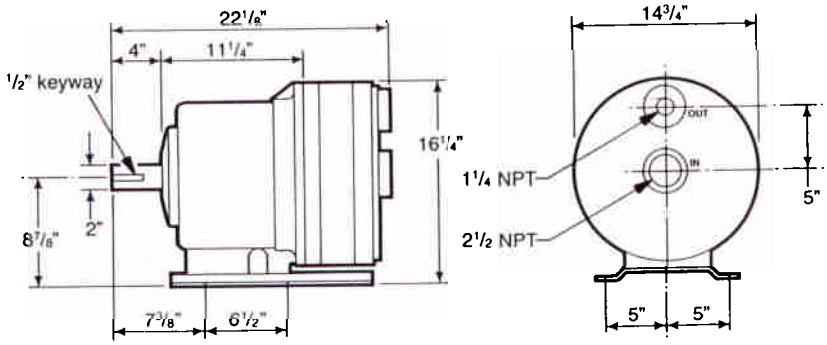


Determining required HP:

$$\frac{225 \times rpm}{63{,}000} + \frac{gpm \times psi}{1{,}460} = \text{electric brake HP}$$

NOTE: Horsepower is for electric motors. Consult engine manufacturer for gasoline or diesel horsepower requirements.

DIMENSIONS



Mounting slots: 21/32" x 1-5/32".

Pump configurations and dimensions are intended as general guidelines only. Contact the factory for exact specifications.

WANNER ENGINEERING, INC.
1204 Chestnut Avenue, Minneapolis, MN, 55403 USA
(612) 332-5681 FAX: (612) 332-6937
Toll free FAX (USA only): (800) 332-6812

WANNER INTERNATIONAL, LTD.
Grange Court, Grange Road
Tongham, Surrey, GU10 1DW, England
(0252) 781234 FAX (0252) 781235

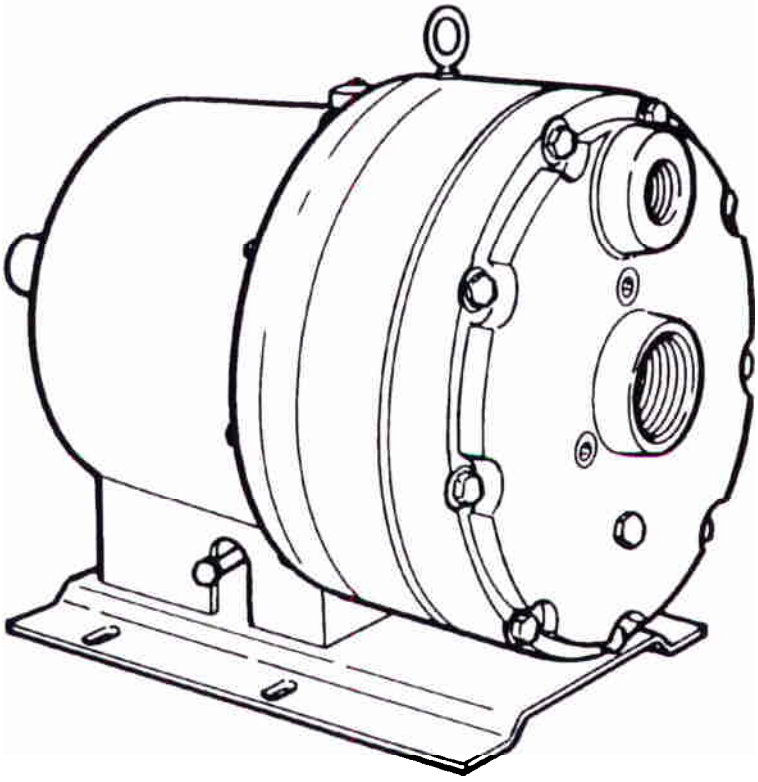
INSTALLATION/SERVICE MANUAL

MODELS D-40, G-40

SIMPLY BUILT TO LAST

Hydra-Cell

INDUSTRIAL PUMPS



WANNER ENGINEERING, INC.

1204 Chestnut Avenue, Minneapolis, MN 55403
TEL: (612) 332-5681 FAX: (612) 332-6937
TOLL-FREE FAX [U.S. only]: (800) 332-6812

Contents

	Page
Installation	2
Maintenance	5
Service (Fluid End)	5
Service (Hydraulic End)	8
Troubleshooting	10

Installation

IMPORTANT PRECAUTIONS

Adequate Fluid Supply. To avoid cavitation and premature pump failure, be sure that the pump will have an adequate fluid supply and that the inlet line will not be obstructed. See "Inlet Piping."

Positive Displacement. This is a positive-displacement pump. To avoid severe system damage if the discharge line is ever blocked, install a relief valve downstream from the pump. See "Discharge Piping."

Safety Guards. Install adequate safety guards over all pulleys and belts. Follow all codes and regulations regarding installation and operation of the pumping system.

Shut-Off Valves. Never install shut-off valves between the pump and discharge pressure regulator, or in the regulator bypass line.

Freezing Conditions. Protect the pump from freezing. See also the Maintenance Section.

LOCATION

Locate the pump as close to the supply source as possible.

Install it in a lighted clean space where it will be easy to inspect and maintain. Allow room for checking the oil level, changing the oil, and removing the valve plate and manifold.

MOUNTING

Do not exceed the maximum pump speed of 900 rpm.

The pump shaft can rotate in either direction.

To prevent vibration, mount the pump securely on a level rigid base.

On a belt-drive system, align the sheaves accurately: poor alignment wastes horsepower and shortens the belt and bearing life. Make sure the belts are properly tightened, as specified by the belt manufacturer.

On a direct-drive system, align the shafts accurately.

INLET PIPING: Suction-Feed System

CAUTION: When pumping at temperatures above 160° F (71° C), use a pressure-feed system instead.

Install draincocks at any low points of the suction line, to permit draining in freezing conditions.

Provide for permanent or temporary installation of a vacuum gauge to monitor the inlet suction. Vacuum at the pump inlet should not exceed 7 in. Hg (180 mm Hg).

Consult the factory for the following situations:

- Extreme temperature application — above 150° F or below 40° F (above 65° C or below 4° C).
- Pressure feeding of pumps
- Manifolding of inlets or of discharge piping
- Viscous or abrasive fluid applications
- Chemical compatibility problems

SUPPLY TANK

Use a supply tank that is large enough to provide time for any trapped air in the fluid to escape. Tank size should be twice the maximum pump flow rate.

Do not attach the supply tank to the pump and motor stand.

Install a separate inlet line from the supply tank to each pump.

Install the inlet and bypass lines so they empty into the supply tank below the lowest water level and on the opposite side of the baffle from the pump outlet line.

If a line strainer is used in the system, install it in the inlet line to the supply tank.

To reduce aeration and turbulence, install a completely submerged baffle plate to separate incoming and outgoing liquids.

Install a vortex breaker in the supply tank over the outlet port to the pump.

Place a cover over the supply tank to prevent foreign objects from falling into it.

HOSE SIZE AND ROUTING

Size the suction line at least one size larger than the pump inlet.

Size the suction line so that the velocity will not exceed 1 to 3 ft/sec (0.3 to 0.9 m/sec).

$$\text{Velocity} = \frac{0.408 \times \text{gpm}}{(\text{Pipe I.D. in in.})^2}$$

or

$$\text{Velocity} = \frac{21.22 \times \text{liters/min}}{(\text{Pipe I.D. in mm})^2}$$

Keep the suction line as short and direct as possible.

Use flexible hose and/or expansion joints to absorb vibrations, expansions, or contractions.

If possible, keep the suction line level. Don't have any high points to collect vapor unless these high points are vented.

To reduce turbulence and resistance, do not use 90° elbows. If turns are necessary in the suction line, use 45° elbows or arrange sweeping curves in the flexible inlet hose.

If a block valve is used, be sure it is fully opened so that the flow to the pump is not restricted. The opening should be at least the same diameter as the inlet plumbing I.D.

Do not use a line strainer or filter in the suction line unless regular maintenance is assured. If used, it should have a free-flow area at least three times the free-flow area of the inlet.

Install piping supports where necessary to relieve strain on the inlet line and to minimize vibration.

INLET PIPING: Pressure-Feed System

Provide for permanent or temporary installation of a vacuum/pressure gauge to monitor the inlet vacuum or pressure. Pressure at the pump inlet should not exceed 40 psi (275 kPa): if it could get higher, install an inlet pressure regulator.

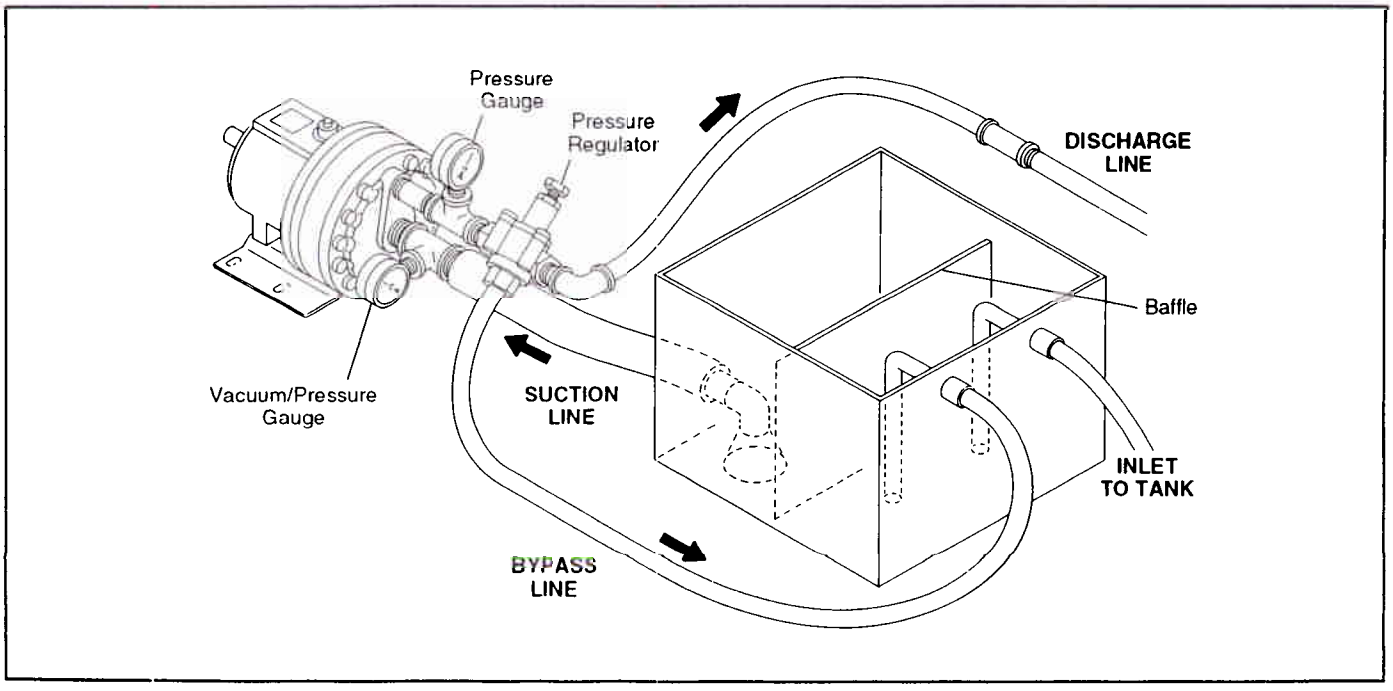
DISCHARGE PIPING

HOSE SIZE AND ROUTING

Size the discharge line one or two sizes larger than the pump discharge opening. Use the shortest, most direct route.

Size the discharge line so that the velocity will not exceed 8 to 10 ft/sec (2.4 to 3.0 m/sec).

Use flexible hose between the pump and hard piping, to absorb vibrations, expansions, or contractions.



Never install a shut-off valve in the discharge line between the pump and the regulator, or in the bypass line.

Select pipe or hose that meets the pressure requirements of the system (working pressure of the hose should not exceed 25% of the bursting pressure).

Support the pump and piping independently.

PRESSURE REGULATION

Install a pressure regulator or unloader in the discharge line. Bypass pressure must not exceed the pressure limit of the pump.

Size the regulator so that, when fully open, it will be large enough to relieve the full capacity of the pump without overpressurizing the system.

Locate the valve as close to the pump as possible and ahead of any other valves.

Adjust the pressure regulating valve to no more than 10% over the maximum working pressure of the system. Do not exceed the manufacturer's pressure rating for the pump and/or regulator.

To reduce the chance of turbulence and cavitation, route the bypass line to the supply tank or to the suction line as far as possible from the pump.

If the pump will be operating for a long time with the discharge closed and fluid bypassing, install a thermal protector in the bypass line to prevent severe temperature buildup in the bypassed fluid.

CAUTION: *Never* install shutoff valves in the bypass line or between the pump and pressure regulator.

Provide for permanent or temporary installation of a pressure gauge to monitor the discharge pressure at the pump.

For additional system protection, install a "pop-off" safety relief valve in the discharge line, downstream from the pressure regulator.

BEFORE INITIAL START-UP

Before you start the pump, be sure that:

- All shut-off valves are open, and the pump has an adequate supply of fluid.
- All connections are tight.
- The oil level is to the line on the oil fill plug's dipstick (27).
- The relief valve on the outlet of the pump is adjusted so the pump starts under minimum pressure.
- All pulleys and belts are properly aligned, and belts are tensioned according to specification.
- All pulleys, belts, and couplings have adequate safety guards.

INITIAL START-UP PROCEDURE

1. Turn on power to the pump motor.
2. Check the inlet pressure or vacuum. Inlet vacuum must not exceed 7 in. Hg (180 mm Hg). Inlet pressure must not exceed 40 psi (275 kPa).
3. Listen for any erratic noise and look for unsteady flow.
4. If the system has an air lock and the pump fails to prime:
   a. Turn off the power.
   b. Remove the drain plug (2) on the bottom center of the manifold.
   c. Briefly restart the system and operate it until fluid comes out the drain-plug hole.
   d. Turn off the power and reinstall the drain plug.
5. Adjust the discharge pressure regulator to the desired operating and bypass pressures.
6. After the pressure regulator is adjusted, set the "pop-off" safety relief valve at 100 psi (690 kPa) higher than the desired operating pressure.

Maintenance

DAILY

Check the oil level and the condition of the oil. The oil level should be to the line on the oil fill plug's dipstick (27).

Use the appropriate Wanner Hydra-Oil 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 (22) 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 500 operating hours thereafter. When changing, remove the drain plug (34) 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.

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 (2) 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.

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 bolts (25) that screw through the back of the pump housing into the cylinder casting hold the cylinder casting over the hydraulic end of the pump. *Do not remove* them except when repairing the hydraulic end.

1. Remove Manifold(5) and Valve Plate(18)

a. With a ½-in. hex-head socket (14-mm hex bit adapter), remove the centerbolts (1) and washers (if appropriate) in the center of the manifold.

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.

b. Remove all nuts (31) and bolts (3) around the manifold. Do **not** remove the four bolts (25) that are installed through the back of the pump housing.

c. Remove the manifold (5).

d. Inspect the manifold for warping or wear around the inlet and outlet ports. If wear is excessive, replace the manifold or return it to Wanner Engineering for resurfacing.

To check if the manifold is warped, remove the O-rings and place a straightedge across it. A warped manifold should be replaced.

NOTE: Before removing the valve plate ("e" and "f" below), insert two bolts (3) from the shaft end of the pump, through two holes in the top of the cylinder casting (24), and into the valve plate (18). This will hold the valve plate in place when the socket-head cap screws are removed.

e. With a 3/8-in. hex-head socket (10-mm hex bit adapter), remove the four socket-head cap screws (17).

f. Remove and inspect the valve plate (18).

2. Inspect Valves (9-16)

The three inlet and three outlet valve assemblies are identical (but face in opposite directions). Inspect them while they are still in the valve plate: look for excess wear on the valve seat and valve, or for foreign material in the valve assembly.

If further inspection is necessary or if they must be replaced, remove them as outlined below.

REMOVE VALVES

a. **Inlet (3 center valves).** From the front side of the valve plate (18), insert a seat remover (from the Wanner Tool Kit) through the valve seat (10), and pull on it. The valve seat (10) will come loose, followed by the valve (11), valve spring (12), washer (14) and retainer (15).

b. **Outlet (3 outer valves).** Grasp and pull the spring retainer (15) from the front side of the valve plate.

Remove the retainer, washer (14), valve spring (12) and valve (11).

Use the wrench-operated Valve Seat Removal Tool included in the Wanner Tool Kit to remove the valve seat (10).

DISASSEMBLE AND INSPECT VALVES

c. Remove the O-ring (13).

d. Insert a large screwdriver between the spring retainer (15) and valve seat (10), and twist.

e. Inspect the O-rings. Replace if worn.

f. Inspect the valves and valve seats for wear, and replace if necessary. Replace the valve springs and spring retainers whenever the valves are replaced.

REASSEMBLE VALVES

g. Apply grease to the outside of the valve seat and O-ring (9), then reassemble the valve assemblies.

REINSTALL VALVES

h. Clean the valve ports and shoulders with emery cloth, and lubricate with grease or petroleum jelly.

i. **Inlet (3 center valves).** Insert the valve assemblies into the valve plate, retainer first.

Outlet (3 outer valves). Insert the valve assemblies into the valve plate, valve seat first.

3. Inspect and Replace Diaphragms (22)

a. Lift the diaphragm by one edge, and turn the pump shaft until the diaphragm pulls up. This will expose machined cross-holes in the valve plunger shaft (52) behind the diaphragm.

b. Insert a hex wrench through the top hole, to hold the diaphragm out. 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 rating.
- **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 plunger shaft. Smooth the surfaces and edges as necessary with emery cloth or a fine file, being careful to keep particles out of the pump.

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 allow the pump to 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 the screw (19) and remove any oil from it. Apply medium-strength threadlocker to the screw. Reinstall the follower (21), a new O-ring (20), and the screw.

h. Repeat the above inspection procedure (and replacement, if necessary) with the other two diaphragms.

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

a. Remove the oil drain cap (34) and allow all oil and contaminants 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.

5. Prime the Hydraulic Cells

a. With the pump **horizontal**, fill the reservoir with the appropriate Wanner Hydra-Oil motor 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.

6. Reinstall Valve Plate(18) and Manifold(5)

a. Insert two bolts (3) from the shaft end of the pump, through the top two holes of the pump.

b. Hang the valve plate on these two bolts.

c. Insert four socket-head cap screws (17) through the valve plate, and hand-tighten the valve plate to the cylinder casting. Watch the alignment.

d. Using petroleum jelly or grease, install the outlet valve O-rings (16) and centerbolt O-rings (6) on the valve plate.

e. Again using petroleum jelly or grease, install the manifold O-ring (7) on the manifold.

f. Hang the manifold on the two bolts (3).

g. Install centerbolts (1) and washers if appropriate. Torque to 180 ft-lbs (240 N-m).

h. Install the bolts (3), washers (4), and nuts (31) around the edge of the manifold. Torque to 90 ft-lbs (120 N-m).

i. Recheck all bolts for tightness.

Service (Hydraulic End)

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

CAUTION: Do not disassemble the hydraulic end of the pump 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 bolts (25) that screw through the back of the pump housing into the cylinder casting (24) hold the cylinder 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. We strongly urge you *not* to 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

a. Remove the head of the pump and the diaphragms as outlined in the Fluid-End Service Section.

b. Drain the oil from the pump housing by removing the drain cap (34).

c. Remove the base plate (35).

d. Set the hydraulic end of the pump face-down on the cylinder casting (24).

e. Check the shaft for sharp burrs. Smooth any burrs, to prevent scarring the housing seals (64) when you disassemble the pump.

f. Remove the bolts (25) that secure the pump housing to the cylinder casting (remove two opposite bolts at a time, loosening them evenly). The piston return springs (49) will force the cylinder casting and pump housing apart. The bearing adjusting plate (61) and disc springs (60) may fall out.

g. Lift off the pump housing (30).

h. Inspect the cam assembly (62), and the bearing race in the rear of the pump housing. If the bearings are pitted or binding, or if the pump housing race is worn, contact Wanner Engineering.

2. Disassemble Pistons

a. With the pump housing removed (see above), turn the cylinder casting (24) over and set it on a flat surface, piston side down. Be careful so the pistons don't separate from the cylinder casting.

b. Remove the plunger (23) from the valve plunger (52). The plunger is press-fit on the valve plunger: with the diaphragms removed (see the Fluid-End Service Section), use a flat-tipped rod or punch to tap the valve plunger in the middle of the plunger. With light tapping, the plunger (23) should slip off the valve plunger.

The hydraulic piston assembly (49-58) can now be disassembled. Inspect all parts, and replace all O-rings and any other parts that are worn or damaged.

c. Repeat step b for the remaining pistons.

NOTE: When you reassemble the hydraulic piston, use *new* plungers (23). They are press-fit onto the valve plungers (52) and are generally not reusable.

3. Reassemble Pistons

a. Drop a ball (57) into each opening in the bottom of a piston assembly (58).

b. Insert a retaining washer (56) and O-ring (55) to hold the ball in place.

c. Insert a valve plunger (52) into a valve cylinder (54). Slide a spring (51) over the plunger, inside the valve cylinder.

d. Insert an O-ring (53) into a spring retainer (50).

e. Install an O-ring (53) on a valve cylinder (54).

f. Lubricate the inside of a spring retainer (50), then slide the assembled valve cylinder, plunger, and spring (51-54) into the retainer.

g. Lubricate the inside wall of the piston.

h. Slide the complete cylinder-and-retainer assembly (50-55) into the piston assembly (58).

i. Insert a return spring (49) into the piston assembly.

j. Repeat the above procedure for the other two pistons.

4. Remove Shaft Seals (64)

Inspect the shaft seals (64) before continuing. If they look damaged in any way, replace them. Remove by pounding them out from inside the pump housing. Both seals should be replaced at the same time. Clean the bore of the housing using emery cloth or Scotch-Brite™.

5. Reassemble Pump Housing and Cylinder Casting

a. Place the cylinder casting (24) face-down on two boards, avoiding contact between the diaphragms and boards.

b. Insert the disc springs (60) and bearing adjusting plate (61) into the cylinder casting. If they don't stick together as a unit, reassemble them, pack them with grease, and hold them together while inserting them into the cylinder casting.

   Insert the small bearing cup with the larger inside diameter facing **out**. The bearing cup must be flush with or lower than the cylinder casting.

c. Insert the assembled pistons (49-58) into the cylinder casting.

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 bolts (25) will be installed.

e. Stand the camshaft assembly (62) on the cylinder casting (24).

   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. Wrap the seal protector bag (part of the Wanner Tool Kit) over the shaft.

g. Install the O-ring (65) into the pump housing (30), using grease or petroleum jelly to hold it in place.

   Slide the pump housing down over the shaft. Be sure the holes in the pump housing and the cylinder casting are properly aligned.

h. Drop the bolts through the four appropriate holes in the pump housing (30). Screw the bolts (from the Wanner Tool Kit) into the four threaded holes in the cylinder casting, but don't tighten them yet. You may want to insert a few bolts (3) into the unthreaded holes of the pump housing and cylinder casting (24) to help align the parts.

i. Alternately tighten the bolts to evenly draw the pump 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 becomes difficult to turn, back off the nuts and realign the shaft. When the pump housing is tight against the cylinder casting, you should be able to turn the shaft smoothly.

j. After all the bolts are tightened, remove two opposite bolts. Insert two cap screws (25) with washers into the same holes, and tighten.

   Remove the two remaining bolts, and replace them with cap screws.

k. Turn the shaft again to check its alignment.

6. Replace Shaft Seals (64)

a. 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.

b. With a soft mallet and the larger-diameter side of the flat plate, tap the first seal (with its spring side into the pump) into the housing. With the reverse side of the plate, push the seal 1/8 in. (3 mm) further into the housing.

c. Pack the inside (spring side) of the second seal half full with grease. With the larger diameter of the plate, tap the second seal flush with the pump housing (30).

7. Install Plungers

NOTE: If the plungers (23) have been removed from the valve plungers (52), do not reuse them. Install new ones instead.

a. With the pump shaft appropriately rotated, place a plunger on the exposed screw end of the plunger guide tool from the Wanner Tool Kit. The larger-diameter side of the plunger should face the tool.

b. Screw the guide (with the plunger) into the valve plunger (52) until tight.

c. Pull the valve plunger (52) up until its crossholes are exposed.

d. Insert a hex wrench (from the Wanner Tool Kit), or a similar dowel-type object, through the top crosshole.

e. Hold the bottom of the guide with a 1-in. (25-mm) wrench, and turn the top of the guide with a 9/16-in. (15-mm) wrench. Press the plunger onto the valve plunger (52). 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. Remove the plunger guide tool from the valve plunger.

b. Place the diaphragm (22) onto the plunger (23), ridge-side out.

c. Center the diaphragm follower (21) on the diaphragm.

d. Place the O-ring (20) onto the follower screw (19).

e. Apply a small amount of threadlocker to the threads of the follower screw.

f. Insert the follower screw (19), with its O-ring, through the diaphragm follower (21) and diaphragm (22), and screw it into the valve plunger (52).

g. Hold the diaphragm hex wrench, and tighten the follower screw.

h. Repeat the above procedure for the plungers and diaphragms of the other two cylinders.

i. 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.

Troubleshooting

Cavitation

Inadequate fluid supply because of:
- Inlet line collapsed or clogged
- Clogged line strainer
- Inlet line too small or too long
- Air leak in inlet line
- Worn or damaged inlet hose
- Suction line too long
- Too many valves and elbows in inlet line.

Fluid too hot for inlet suction piping system.
Air entrained in fluid piping system.
Aeration and turbulence in supply tank.
Inlet suction vacuum too high.

SYMPTOMS OF CAVITATION
- Excessive pump valve noise
- Premature failure of spring or retainer (12,15)
- Premature failure of diaphragms (22)
- Volume or pressure drop
- Rough-running pump
- Piston return spring failure (inside hydraulic end).

Drop in Volume or Pressure

Air leak in suction piping.
Clogged suction line or suction strainer.
Suction line inlet above fluid level in tank.
Inadequate fluid supply.
Pump not operating at proper RPM.
Relief valve bypassing fluid.
Worn pump valve parts.
Foreign material in inlet or outlet valves.
Loss of oil prime in cells because of low oil level.
Ruptured diaphragm.
Cavitation.
Warped manifold from overpressurized system.
O-rings forced out of their grooves from overpressurization.
Air leak in suction line strainer or gasket.
Cracked suction hose.
Empty supply tank.
Excessive aeration and turbulence in supply tank.
Worn and slipping drive belt(s).
Worn spray nozzle(s).
Cracked cylinder casting.

Pump Runs Rough

Worn pump valves.
Air lock in outlet system.
Oil level low.
Wrong weight oil for cold operating temperatures (change to lighter weight).
Air in suction line.
Restriction in inlet/suction line.
Cavitation.
Hydraulic cells not primed after changing diaphragms.
Foreign material in inlet or outlet valves.
Damaged diaphragm.
Fatigued or broken valve spring (12).
Broken piston return spring (inside hydraulic end).

Premature Failure of Diaphragm

Frozen pump.
Puncture by a foreign object.
Elastomer incompatible with fluid being pumped.
Cavitation.
Pump running too fast.

Broken piston return spring (49).
Excess pressure.

Water in Oil Reservoir

Condensation.
Ruptured diaphragm.
Hydraulic cells not properly primed after diaphragm replacement.
Frozen pump.
Diaphragm screw O-ring (20) missing or cracked.
Cracked cylinder casting.

Water Pulsations

Foreign object lodged in pump valve.
Loss of prime in hydraulic cells because of low oil level.
Air in suction line.
Valve spring (12) broken.
Cavitation.
Aeration or turbulence in supply tank.

Valve Wear

Normal wear.
Cavitation.
Abrasives in the fluid.
Valve incompatible with corrosives in the fluid.
Pump running too fast.

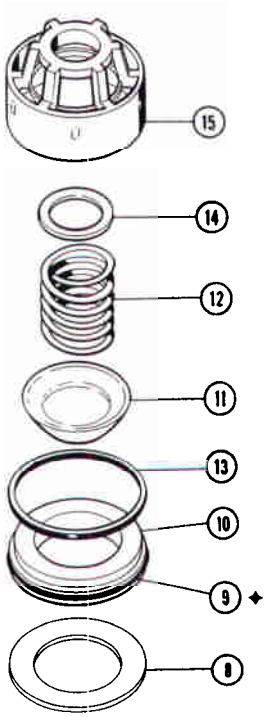
Loss of Oil

External seepage.
Rupture of diaphragm.
Frozen pump.
Diaphragm screw O-ring (20) missing or cracked.
Worn shaft seal.
Oil drain piping or fill cap loose.
Valve plate and manifold bolts loose.

Premature Failure of Valve Spring or Retainer

Cavitation.
Foreign object in the pump.
Pump running too fast.
Spring/retainer material incompatible with fluid being pumped.
Excessive inlet pressure.

MODEL D-40 AND G-40 VALVE ASSEMBLY



✦ O-ring (9) is shown installed on valve seat (10).