

**Installation & Service**  
**D12-991-2400D**

# **Hydra-Cell®**

## **INDUSTRIAL PUMPS**

**Models: D-12, G-12**



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# D/G-12 Contents

|                               | Page |
|-------------------------------|------|
| Specifications.....           | 2    |
| Dimensions .....              | 4    |
| Installation.....             | 6    |
| Maintenance.....              | 9    |
| Service (Fluid End) .....     | 10   |
| Service (Hydraulic End) ..... | 15   |
| Troubleshooting .....         | 18   |

## D/G-12 Specifications

**Max Pressure** 1000 psi (70 bar)

### Capacity @ Max Pressure

|          | rpm  | gpm | l/min |
|----------|------|-----|-------|
| D/G-12-X | 1450 | 7.8 | 29.0  |
| D/G-12-E | 1750 | 8.0 | 30.3  |
| D/G-12-S | 1750 | 6.0 | 22.7  |
| D/G-12-I | 1750 | 3.9 | 14.9  |

### Delivery @ Max Pressure

|          | revs/gal | revs/liter |
|----------|----------|------------|
| D/G-12-X | 185      | 50         |
| D/G-12-E | 219      | 58         |
| D/G-12-S | 292      | 77         |
| D/G-12-I | 448      | 117        |

**Max Inlet Pressure** 250 psi (17 bar)

**Max Temperature** 250°F (121°C) – consult factory for temperatures above 180°F (82°C)

**Inlet Port** D-12: 1 inch NPT  
G-12: 1 inch BSPT

**Discharge Port** D-12: 3/4 inch NPT  
G-12: 3/4 inch BSPT

**Shaft Diameter** 7/8 inch (22.22 mm)

**Motor Compatibility** D-12: Accepts NEMA 182/184TC and 213/215TC C-Face motors (without feet)

G-12: Accepts IEC 100-112 B5 Flange motors (without feet)

**Shaft Rotation** Bi-directional

**Bearings** Tapered roller

**Oil Capacity** 1.5 US quarts (1.4 liters)

**Weight** 64 lbs (29 kg)

## Calculating Required Horsepower (kW)\*

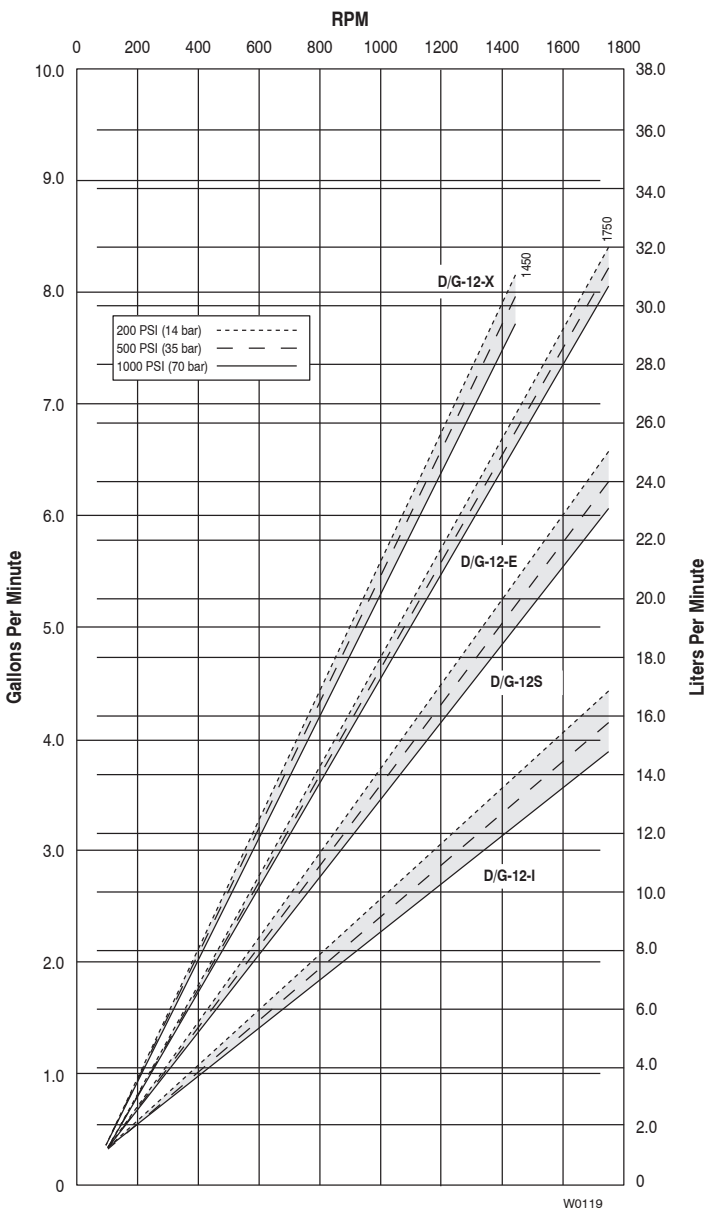
$$\frac{15 \times \text{rpm}}{63,000} + \frac{\text{gpm} \times \text{psi}}{1,460} = \text{electric motor HP}^*$$

$$\frac{15 \times \text{rpm}}{84,428} + \frac{\text{lpm} \times \text{bar}}{511} = \text{electric motor kW}^*$$

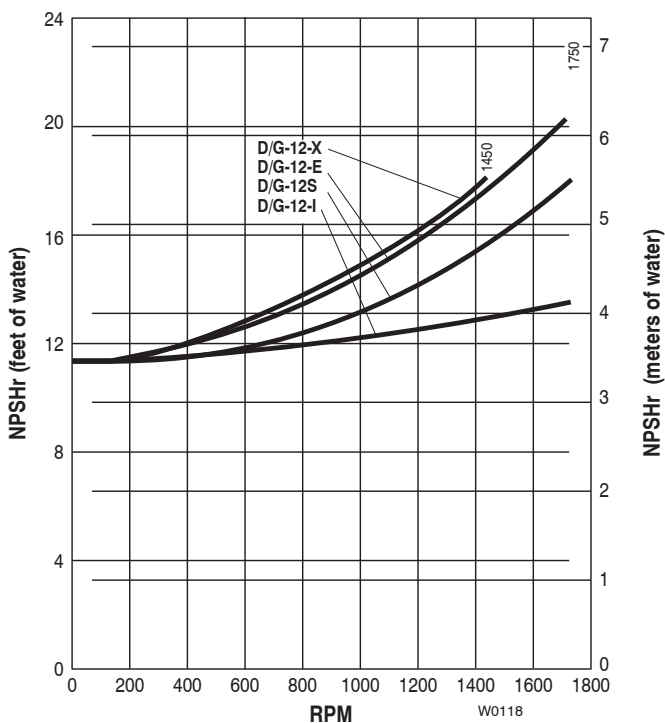
\* rpm equals pump shaft rpm. HP/kW is required application power. Use caution when sizing motors with variable speed drives.

# D/G-12 Specifications

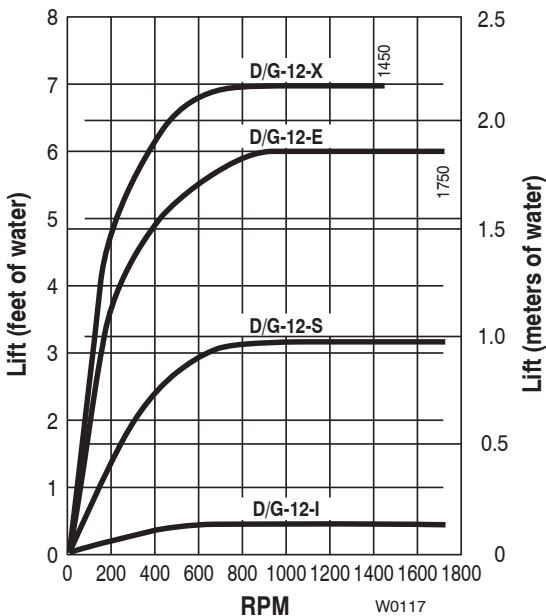
## Performance



## Net Positive Suction Head – NPSHr

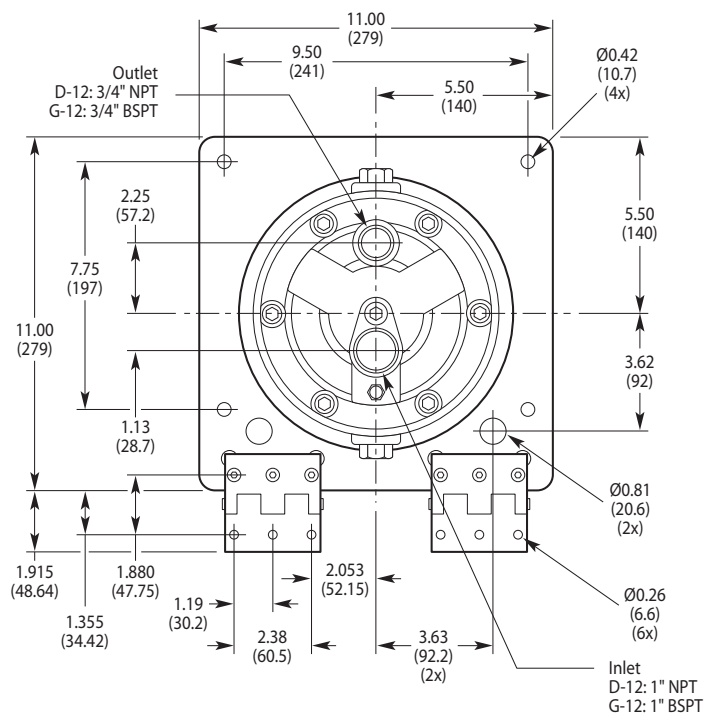


## Dry Lift



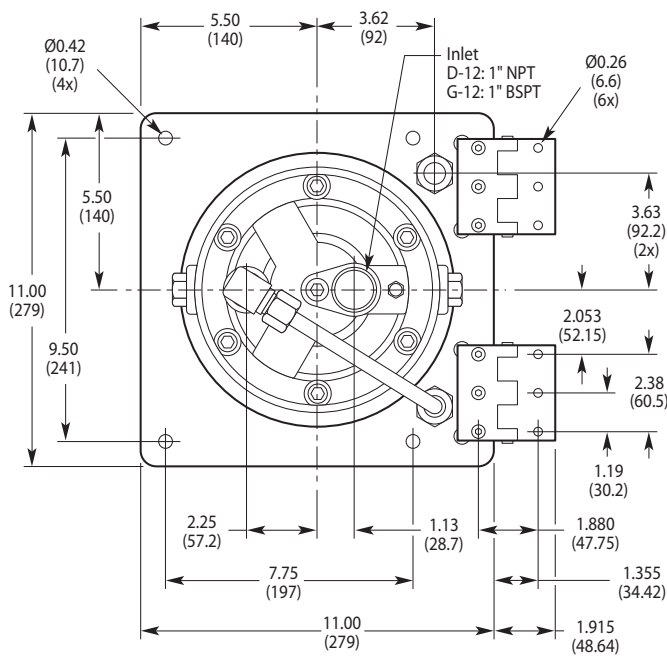
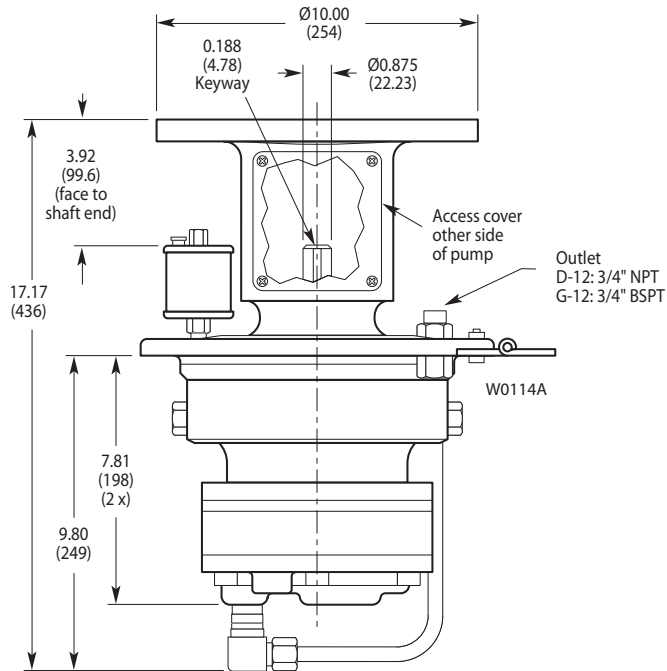
### Models with Standard Configuration Pump Head

Cast Iron (nickel plated)

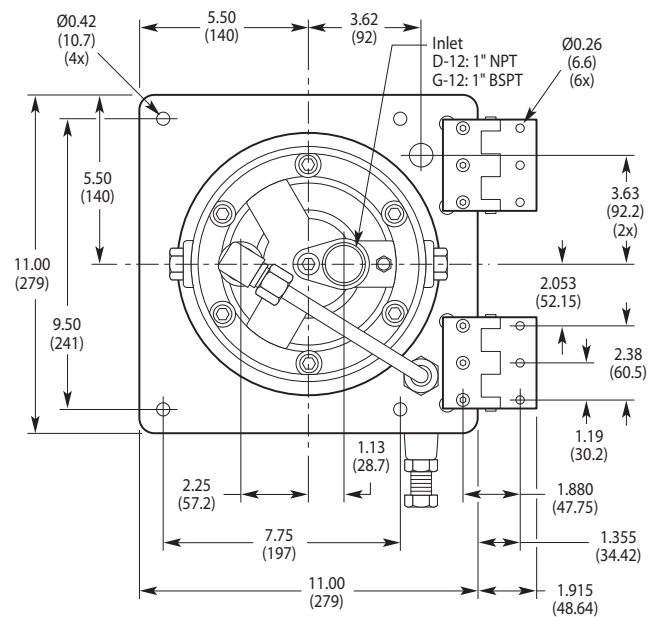
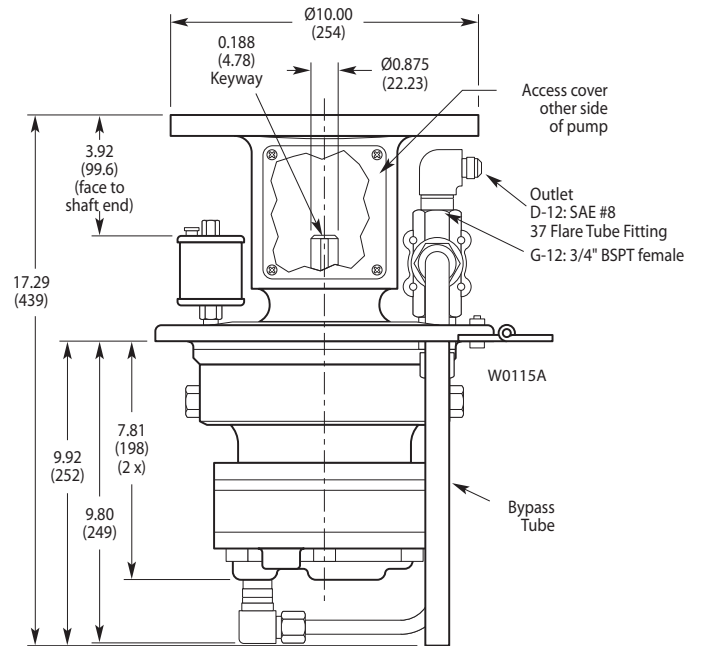


# D/G-12 Dimensions

## Models with Tube Accessory



## Models with Valve/Tube Accessory



# D/G-12 Installation

## Location

The D-12 and G-12 pumps are designed to run vertically with the head submersed in the fluid being pumped. The pump/motor can be hinged to a horizontal position, as shown below, for maintenance and for changing the oil. Allow enough space for the unit to be switched to either position.

## 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 ever becomes blocked, install a relief valve downstream from the pump. See "Discharge Piping".

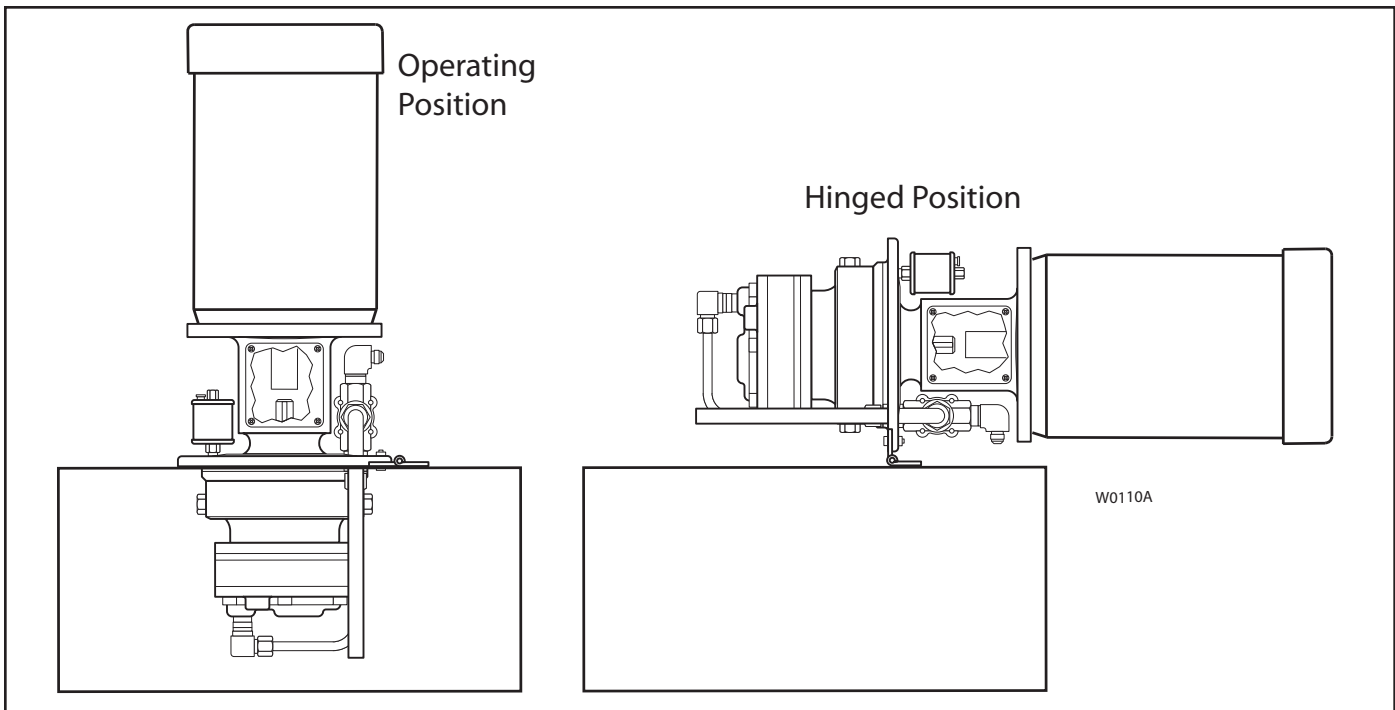
**Safety Guards.** Install adequate safety guards over all pulleys, belts, and couplings. Follow all codes and regulations regarding installation and operation of the pumping system.

**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.

Consult the Factory for the following situations:

- Extreme temperature applications (above 160° F or below 40° F)
- Pressure feeding of pumps
- Viscous or abrasive fluid applications
- Chemical compatibility problems
- Hot ambient temperatures (above 110° F)
- Conditions where pump oil may exceed 200° F because of a combination of hot ambient temperatures, hot fluid temperature, and full horsepower load — an oil cooler may be required



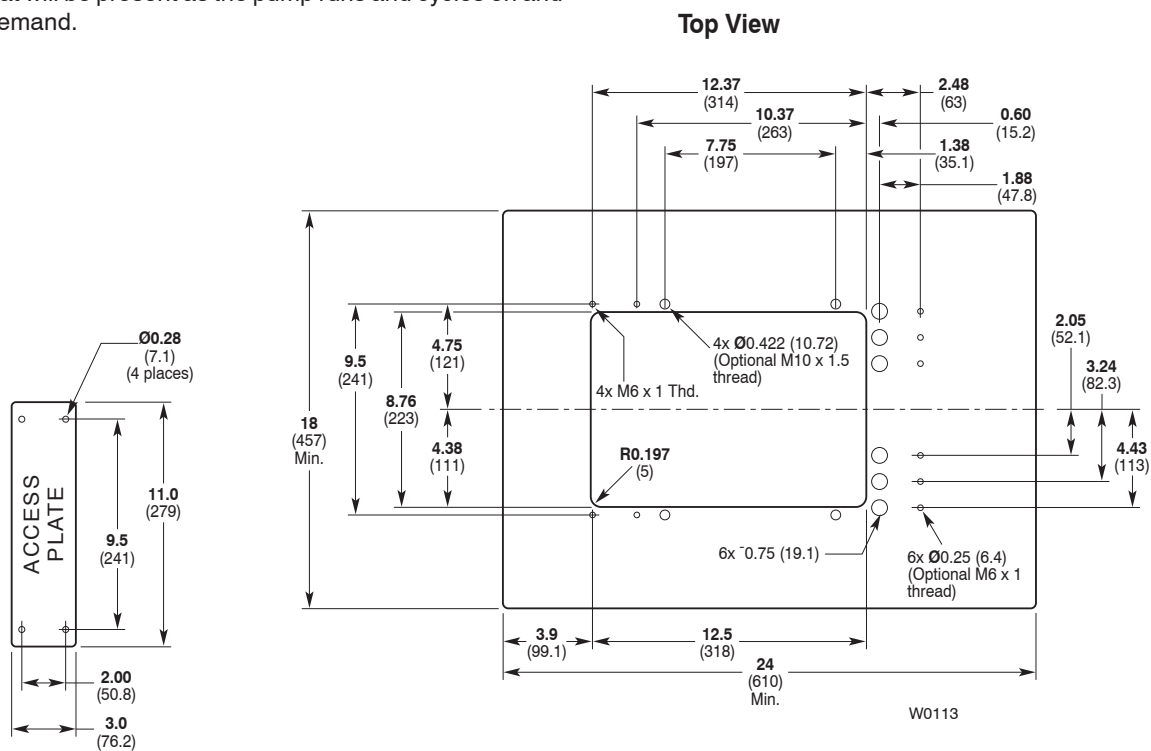
# D/G-12 Installation

## Constructing the Tank

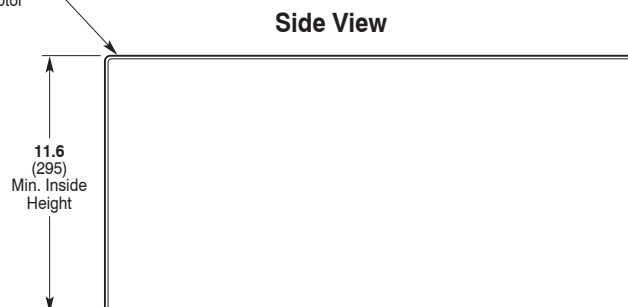
The illustration below shows the minimum inside height, top cutout, access plate size, and hole size and locations required to mount the pump and hinges. The tank should be large enough to avoid aerating the fluid.

Construct the tank so it will support the weight of the pump/motor, approximately 200 lbs (90 kg). It must not tip in normal operation, or when the pump/motor is hinged for maintenance.

Typical machine tool coolant tanks are of sheet metal construction and will not adequately support the D-12 or G-12 pump/motor assembly. Risers inside the tank, support plates, weld nuts, and other techniques should be used to ensure the pump/motor assembly will be secure. Additionally, the pump and mounting must be able to withstand vibrations and on/off shocks that will be present as the pump runs and cycles on and off with demand.



Top of tank must support weight of 200 pounds for pump/motor



# D/G-12 Installation

## Mounting the Pump

Refer to page 7 for illustrations that show the tank top cutout, access plate, and hole sizes and locations. The cutout is larger than the pump housing base to allow for hinging the complete pump and motor assembly. Install the access plate after the pump is mounted vertically, to cover the remaining opening. The access plate must be removed before the pump/motor can be hinged horizontally for maintenance.

Isolate the tank from the system with flexible hose for the piping and flexible wiring to the motor. Allow long-enough flexible hose and wiring for hinging the pump/motor, or attach “quick-connect” fittings for easy maintenance.

With the unit vertical, fasten the pump housing to the tank using four 3/8-in. or 10-mm bolts into the holes in the square mounting base of the housing. Use six 1/4-in. or 6-mm bolts to fasten the two hinges to the tank.

## Inlet Piping

Before entering the section of the tank where the pump inlet is submersed, the fluid being pumped should be prefiltered to one size smaller than the smallest nozzle or tool orifice in the system. Set up baffling in the tank that will allow large particles and chips to settle out before they get close to the pump inlet. Also, install at least two stages of filtering to ensure an adequate supply of fluid to the pump inlet; a coarse mesh followed by a fine mesh to section off the tank closest to the pump. Install the filters in the tank where they can be checked and cleaned regularly; plugged filters can result in pump cavitation, drop in volume or pressure output, and damage to the pump. **Do not connect a line strainer or filter directly onto the pump inlet port.**

If the fluid being pumped gets too hot, a chiller may be required. If pumping machine-tool coolant, operate below the manufacturer's maximum temperature rating for the coolant.

If using the pump isolated from the supply tank, with the inlet fed by a hose or pipe, consult the factory for instructions regarding “Inlet Piping (Suction Feed)”, “Inlet Piping (Pressure Feed)”, and “Inlet Calculations (Acceleration Head, Friction Losses, and NPSH)”. Specific instructions for this situation can also be found in the D10-991-2400 Installation/Service Manual.

## Discharge Piping

### Hose and Routing

Use the shortest, most-direct route for the discharge line.

Select pipe or hose with a **working pressure** rating of at least 1.5 times the maximum system pressure. EXAMPLE: Select a 1500 psi W.P.-rated hose for systems to be operated at 1000 psi gauge pressure.

Use about 6 ft (1.8 m) of flexible hose between the pump and rigid piping to absorb vibration, expansion or contraction, and to isolate the pump/motor/tank from the system.

Size the discharge line so that the velocity of the fluid will not exceed 7-10 ft/sec (2-3 m/sec):

For pipe in inches:  $\text{Velocity (ft/sec)} = 0.408 \times \text{GPM}/\text{Pipe ID}^2$

For pipe in mm:  $\text{Velocity (m/sec)} = 21.2 \times \text{LPM}/\text{Pipe ID}^2$

## Pressure Regulation

### Install a pressure regulator in the discharge line.

There is an accessory kit that allows a Hydra-Cell C-22 Regulating Valve to be mounted on the pump housing, so the bypass fluid goes back to the tank. Bypass pressure must not exceed the pressure limit of the pump, 1000 psi (69 bar).

If the pump may be run for a long time with the discharge closed and fluid bypassing, the fluid in the tank will heat up. Install a thermal protector in the bypass line to prevent severe temperature build-up in the bypassed fluid.

**Caution: Never install shutoff valves in the bypass line or between the pump outlet 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 safety relief valve in the discharge line, downstream from the pressure regulator.

## Before Initial Start-Up

Before you start the pump, be sure that:

- The pipe plug on the pump housing has been removed and the oil reservoir has been installed. The reservoir allows for oil expansion during pump operation. At startup, there is normally no oil in the reservoir; during operation, oil rises in the reservoir (the level will depend on operating conditions).
- All shut-off valves are open, and the pump has an adequate supply of fluid.
- All connections are right.
- The pressure regulator on the pump outlet is adjusted so the pump starts under minimum pressure. This allows air in the system to be expelled easily, and fluid to enter the pump and system.
- The coupler that connects the pump and motor has been sized and installed correctly.
- All guards and safety covers have been installed.
- All electrical wiring has been done correctly to electrical codes.

## Initial Start-Up Procedure

1. Turn on power to the pump motor.
2. Listen for any erratic noise, and look for unsteady flow.
3. Adjust the discharge pressure regulator to the desired operating and bypass pressures. If the pump does not clear, refer to the troubleshooting section at the back of this manual.
4. After the pressure regulator is adjusted, set the safety relief valve at 100 psi (7 bar) higher than the desired operating pressure.



# D/G-12 Maintenance

## Daily

Check the oil level and the condition of the oil. When the pump is operating, the oil in the pump housing gets warm and expands, filling into the oil reservoir. Depending on the type of oil and the operating temperature of the system, the oil level will vary in the reservoir. If there is no oil in the reservoir when the system has reached operating temperature, add oil through the fill cap on the reservoir. Fill the reservoir about 25% full.

If the pump is too full of oil, it will overflow the reservoir and reach equilibrium. This is no cause for concern. When the unit is shut down and the oil has cooled, the oil will drain out of the reservoir and back into the pump housing.

Use the appropriate Wanner Hydra-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 (20) 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. This will help prevent corrosion of internal pump components.**

## Periodically

Change the oil after the first 100 hours of operation, and then according to the guidelines below.

### Hours Between Oil Changes @ Various Process Fluid Temperatures

| Pressure                      | RPM   | <90°F<br>(32°C) | <139°F<br>(60°C) | <180°F<br>(82°C) |
|-------------------------------|-------|-----------------|------------------|------------------|
| <b>Metallic Pump Head</b>     |       |                 |                  |                  |
| <650 psi (45 bar)             | <1200 | 6,000           | 4,500            | 3,000            |
|                               | <1800 | 4,000           | 3,000            | 2,000            |
| <1000 psi (69 bar)            | <1200 | 4,000           | 3,000            | 2,000            |
|                               | <1800 | 2,000           | 1,500            | 1,000            |
| <b>Non-Metallic Pump Head</b> |       |                 |                  |                  |
| <250 psi (17 bar)             | <1200 | 4,000           | 3,000            | —                |
|                               | <1800 | 2,000           | 1,500            | —                |
| <b>Slurry Duty Pump Head</b>  |       |                 |                  |                  |
| <300 psi (21 bar)             | <1200 | 4,000           | 3,000            | —                |
|                               | <1800 | 2,000           | 1,500            | —                |

**NOTE: Minimum oil viscosity for proper hydraulic end lubrication is 16-20 cST (80-100 SSU).**

**NOTE: Use of an oil cooler is recommended when process fluid and/or hydraulic end oil exceeds 180°F (82°C) for Metallic Pump Head models or when hydraulic end oil exceeds 180°F (82°C) for Non-Metallic and Slurry Duty Pump Head models.**

## To change the oil:

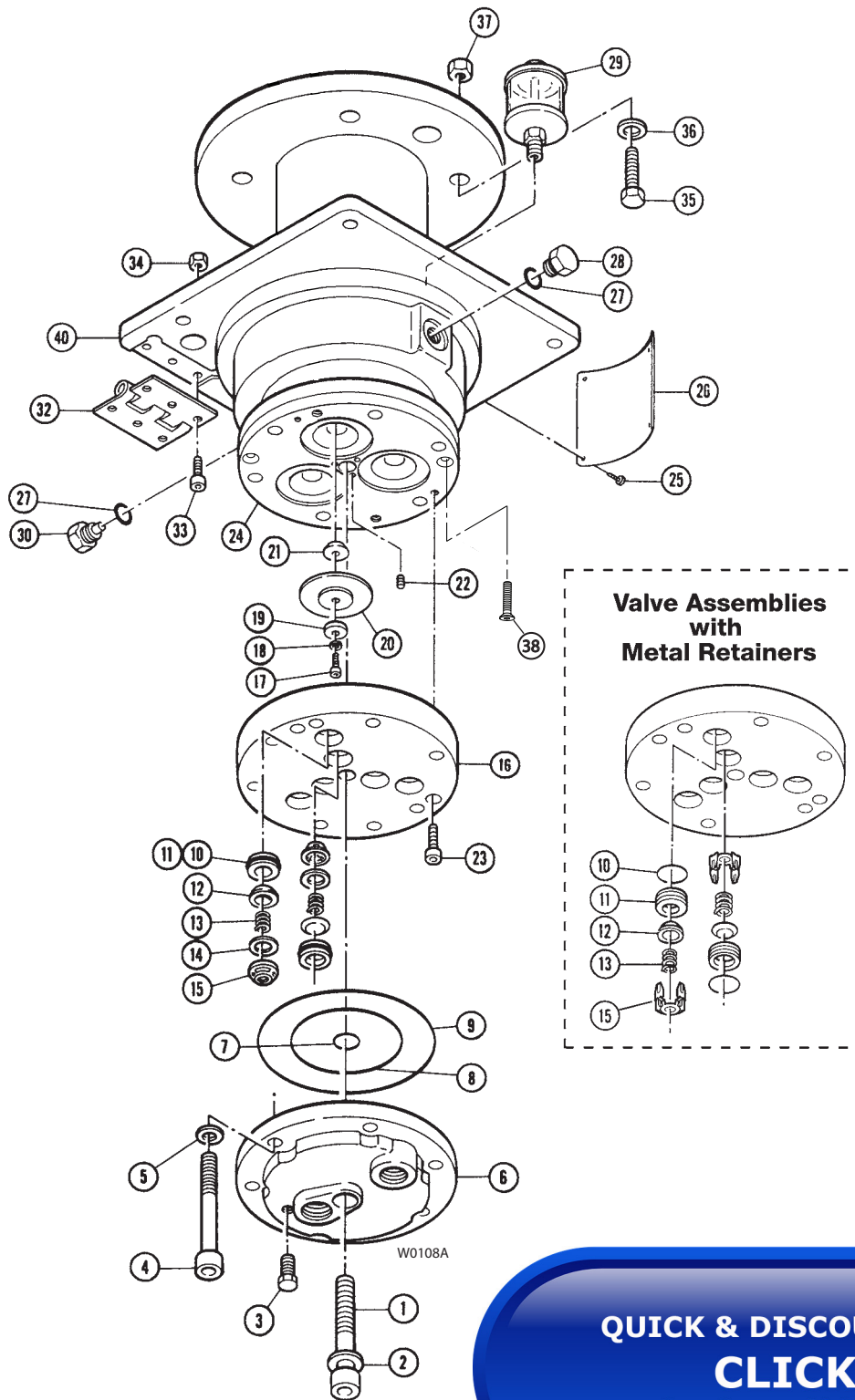
**NOTE: The numbers in parentheses are the Reference Numbers on the exploded view illustrations found later in this manual and also in the Parts Manual.**

1. Disconnect or lock out the electrical power to the pump motor.
2. Remove the access plate on the tank, so there is room to hinge the pump/motor to the horizontal position (see the illustration on page 6).
3. Remove the four bolts that hold the pump base to the tank.
4. Hinge the pump/motor to the horizontal position, and support it in that position.
5. Place a pan under the pump oil drain. Remove the drain plug (30) and fill plug (28) from the pump housing. The drain plug is magnetic — clean any metal from the magnet on the plug.  
**Caution: Do not turn the drive shaft while the oil reservoir is empty.**
6. When the oil has drained, reinstall the drain plug (30). Refill with the appropriate oil, and install the fill plug (28). Tighten to 25 ft-lbs (30 Nm).
7. Hinge the pump/motor back to the vertical position. Reinstall the four bolts that held the pump base to the tank, and reinstall the access plate.
8. Restore the electrical power.
9. Follow the “Initial Startup Procedures”, page 8.

**Caution: Protect the pump from freezing. Contact the factory for shutdown procedure during freezing temperatures if required.**

# D/G-12 Service (Fluid End)

## Models with Standard Valve Assemblies



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# D/G-12 Service (Fluid End)

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.

**NOTE:** The numbers in parentheses are the Reference Numbers on the exploded view illustrations found in this manual and also in the Parts Manual.

**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, Part No. A03-175-1101 (available from Wanner or your local distributor).

**Caution:** Always disconnect power from the motor before doing maintenance on the pump or motor.

**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 two bolts (38) 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.

## 1. Hinge Pump to Horizontal Position

## 2. Disconnect all Electrical Connections (or lock out power to the unit)

## 3. Remove Manifold (6), Valve Plate (16)

- Remove all nuts (31), bolts (4), and washers (5) around the manifold. Do not remove the two bolts (38) that are installed through the back of the pump housing.
- Use a 10-mm hex Allen wrench to remove the pump centerbolt (1) and its washer (2) 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.

- Remove the manifold (6). The valve plate (16) will remain on the cylinder housing (24).
- 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.

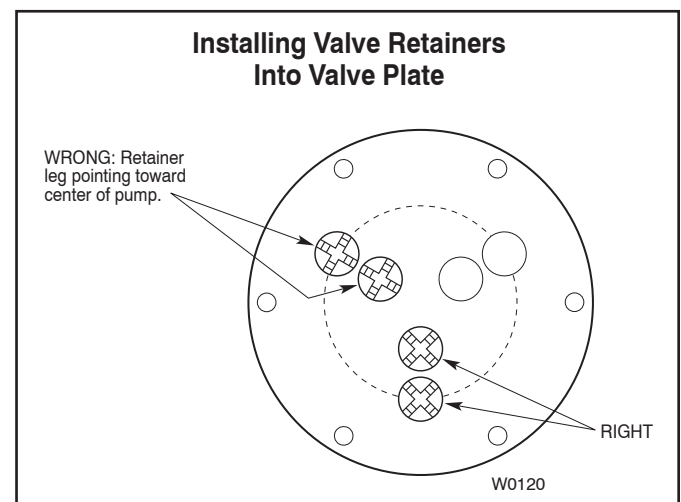
## 4. Inspect Valves (10-15)

The three inlet and three outlet valve assemblies are identical (but face in opposite directions). Inspect each valve as follows:

- Check the spring retainer (15), and replace if worn.
- Check the valve spring (13). If it is shorter than a new spring, replace it (don't just stretch the old spring).
- Check the valve poppet (12). If worn excessively, replace it.

**Note:** If your pump has plastic spring retainers, there is a tetra seal (flat O-ring, 14) between the retainer (15) and valve seat (11).

- Remove the valve seat (11). A seat puller is included in the Wanner Tool Kit. Inspect the valve seat for wear, and replace it if necessary.
- Reinstall the valve assemblies:
  - Clean the valve ports and shoulders with emery cloth, and lubricate them with lubricating gel or petroleum jelly.
  - Install the O-ring (10) on the valve seat (11).
  - Inlet (3 center valves).** Insert the spring retainer (15) into the valve plate, then insert the spring, valve, and valve seat (11,12,13). If the pump has **plastic** spring retainers, install a flat O-ring (14) between the retainer and seat.
  - Outlet (3 outer valves).** Insert the valve seat, valve, and spring, then the retainer. If the pump has **metal** spring retainers in the outlet valves, position them so a leg does not point toward the center of the pump (refer to the illustration).



# D/G-12 Service (Fluid End)

## 5. Inspect and Replace Diaphragms (20)

If it is necessary to service the diaphragms, use a 5-mm Allen wrench to remove the two Allen-head bolts (23) that secure the valve plate (16) to the cylinder housing (24). Inspect the valve plate as you did the manifold.

- 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 plunger shaft behind the diaphragm. To turn the pump over, turn the motor shaft over by turning the motor fan. The fan guard on the motor may have to be removed to allow you to turn the shaft. Reattach the fan guard to the motor when done with maintenance.

**Note:** Alternatively, remove the coupler access plate and rotate the coupler by hand.

- b. Insert the plunger holder through one of the cross-holes in the plunger shaft, to hold the diaphragm up. The proper size tool is included in the Wanner A03-175-1101 Tool Kit.
- c. Remove the screw (17), O-ring (18), and follower (19) 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 casting or casting 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 Viton diaphragm is operated at cold temperatures.
- **Diaphragm edge chewed away.** Usually caused by overpressurizing the system.

- e. Inspect the plunger (21) 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.

**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, ridge side out.
- g. Clean the screw (17) and remove any oil from it. Apply medium-strength threadlocker to the screw. Reinstall the screw and follower (19), and a new O-ring (18). Tighten to 18 in-lbs (2.0 Nm).
- h. Repeat the above inspection procedure (and replacement, if necessary) with the other two diaphragms.

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

- a. With the valve plate and manifold still removed, remove the oil drain cap (30) and allow all oil and contaminant to drain out. Dispose of it properly.
- 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.

# D/G-12 Service (Fluid End)

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## 7A. Prime the Hydraulic Cells on Standard Pumps

- a. With the pump **horizontal and the fluid-end head removed**, remove the oil fill plug (28) from the pump housing and fill the pump housing with the appropriate Hydra-Oil for the application. Have a catch basin for oil that leaks from behind the diaphragms when priming. Catch the oil and dispose of it properly. **Do not reuse oil.**
- b. All air in the oil within the hydraulic cell (behind the diaphragms) must be forced out by turning the shaft (and thus pumping oil into the piston). If the motor is connected to the pump, rotate the shaft by manually rotating the motor fan blade. If the motor and coupler have been removed from the pump, use the shaft rotator that 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.
- d. Ensure that the pump housing is completely full of oil.
- e. Install the oil fill plug (28). Tighten to 25 ft-lbs (30 Nm).

## 7B. Priming the Hydraulic Cells for Kel-Cell Pumps

**NOTE:** Providing oil prime to Kel-Cell fitted pumps requires pressure be applied to the diaphragms. This can be done manually, with the system head pressure, or with pressurized air if available. Review all methods below to determine the procedure most suitable.

### Method #1 (system head pressure *less than 2 psi*)

**NOTE:** This method may require removing the pump completely from the hinged mounting. For hinge mounted pump installations, Alternate Method #1 is recommended.

- a. Install the valve plate (16) but without the outlet valves installed (or else remove the outlet valves; leave the seats installed) onto the cylinder housing. Tighten the two socket-head screws (23).
- b. Fill the pump housing with appropriate Hydra-oil to the fill port.
- c. With a blunt pointer (eraser end of pencil), reach in through each outlet valve port and push the follower-diaphragm backwards. Note the air bubbles coming out at the oil fill port. Now turn the shaft about 1/2 turn.
- d. Repeat depressing diaphragms and rotating shaft (approx. 4-6 times) until no more air bubbles escape. The hydraulic cells are now primed. Add oil to completely fill the pump housing.
- e. Replace the oil fill plug (28). Tighten to 25 ft-lbs (30 Nm).
- f. Install outlet valve assemblies in each outlet valve port. See Parts Manual for correct assembly order. You may have to tip pump (head upward) in order to keep the valve centered on the seat and allow the retainer to fit all the way into port flush.
- g. Install manifold (6) and complete installation.

### Alternative Method #1: (system head pressure *less than 2 psi*)

**NOTE:** This method is recommended for hinge mounted pump.

- a. With the pump **horizontal and the fluid-end head removed**, fill the pump housing with the appropriate Hydra-Oil for the application. Have a catch basin for oil that leaks from behind the diaphragms when priming. Catch the oil and dispose of it properly. **Do not reuse oil.**
- b. All air in the oil within the hydraulic piston behind the diaphragms must be forced out by turning the shaft (and thus pumping the piston). A shaft rotator is included in the Hydra-Cell Tool Kit. Keep pressure on the diaphragms while turning the shaft until a bubble-free flow of oil comes from behind all the diaphragms. Maintain the oil level in the pump housing to prevent air from being drawn into the pistons.

# D/G-12 Service (Fluid End)

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- c. Quickly attach the loaded valve plate (16) (before the oil runs out past the diaphragms) with socket head screws (23), but do not tighten completely. Leave a gap between the valve plate and the cylinder housing. Turn the shaft 2-3 turns to finish forcing out air behind the diaphragms. The hydraulic cells are now primed. Now finish tightening the valve plate with the two socket head screws and add pump manifold.
- d. Wipe excess oil from around the pump head.
- e. Ensure that the pump housing is completely full of oil.
- f. Replace the oil fill plug (28). Tighten to 25 ft-lbs (30 Nm).
- g. Complete installation.

## Method #2 (head pressure *greater* than 2 psi)

**NOTE:** This method may be difficult for D-12 and G-12 pumps as it is difficult to see into the pump housing for air bubbles exiting the oil.

This simple and clean method of priming the Hydra-Cells requires an inlet head pressure of at least 5 feet (1.5 m) or 2 psi (0.14 bar). The pressure source is required to hold the diaphragms back while the piston moves so as to force out the air.

*Completely assemble* the pump and fill the pump housing with the appropriate Hydra-Oil for the application.

### Using tank head pressure to prime

- a. Install the pump back into the system and connect the tank supply line to pump inlet. Pump discharge line may be connected at this time, but end of line must be open to allow air to pass out.
- b. Slowly turn the pump shaft by hand and watch for bubbles exiting the oil. This will take several rotations. When no more bubbles come out, the hydraulic cells are primed. Maintain the oil level in the pump housing to prevent air from being drawn into the pistons.
- c. Replace the oil fill plug (28). Tighten to 25 ft-lbs (30 Nm)
- d. Complete installation.

### Using compressed air to prime

- a. Insert a clean air hose to the pump inlet and restrict the pump outlet.
- b. Turn the shaft a quarter turn and then apply air pressure into the manifold to put pressure on the diaphragms. This will force air out from inside the pistons and you will see bubbles at the fill port opening. Repeat for several rotations until no more air bubbles come out of the oil. The hydraulic cells are now primed. Maintain the oil level in the pump housing to prevent air from being drawn into the pistons.
- c. Replace the oil fill plug (28). Tighten to 25 ft-lbs (30 Nm)
- d. Complete installation.

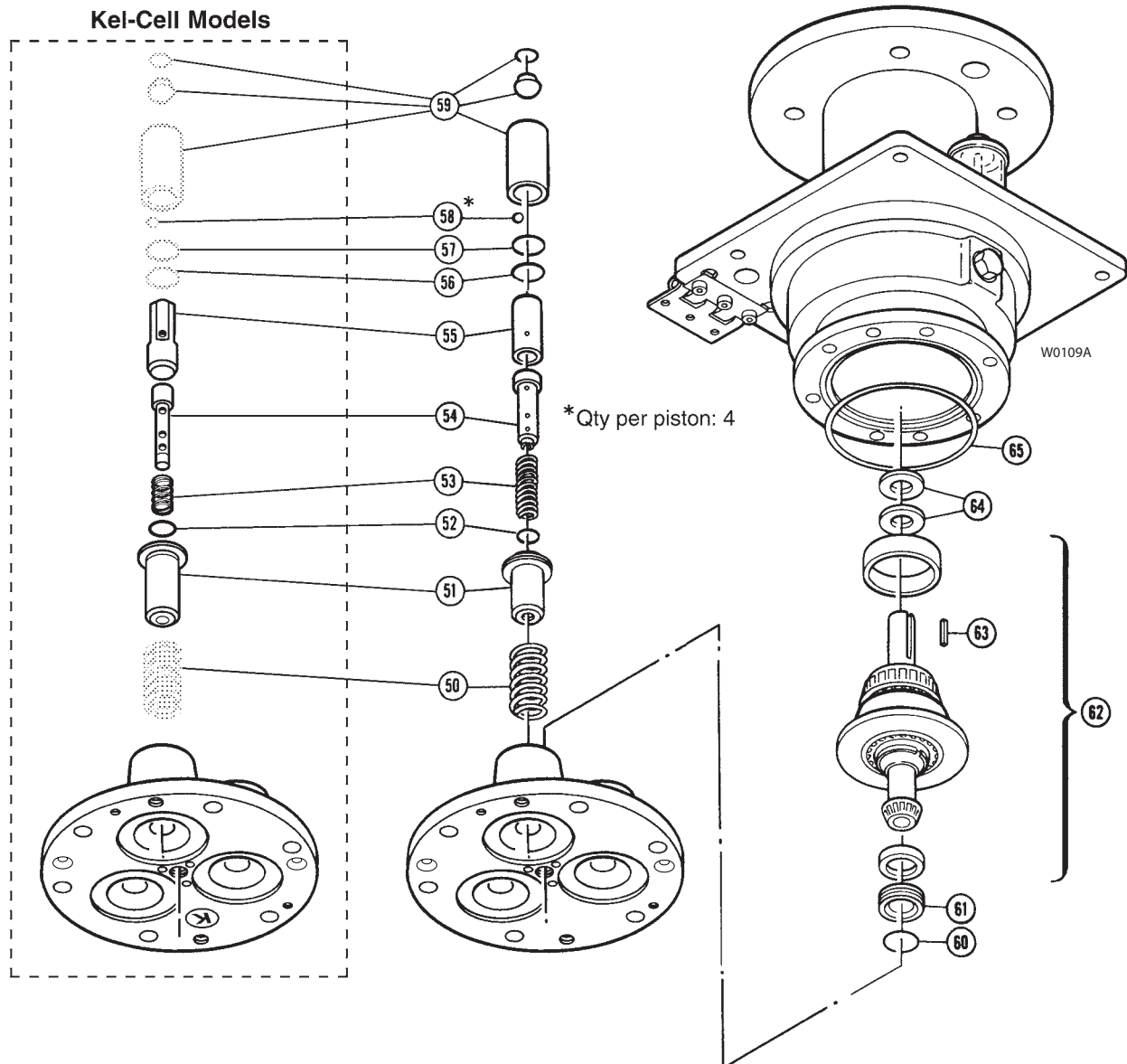
## 8. Reinstall Valve Plate (16), Manifold (6)

- a. Reinstall the valve plate (16), with the valve assemblies installed as outlined above, onto the cylinder casting. Using a 5-mm hex Allen wrench, install the two socket-head capscrews (23) and secure the valve plate to the cylinder housing.
- b. Reinstall the O-rings (7,8,9) on the rear side of the manifold. Use petroleum jelly or lubricating gel to hold them in place.
- c. Reinstall the manifold onto the valve plate. Be sure the drain plug (3) is at the bottom of the manifold.
- d. Insert all six bolts (4) around the edge of the manifold. Reinstall the pump centerbolt (1) with its washer (2).
- e. Alternately tighten the perimeter bolts until all are secure. Torque to 45 ft-lbs (54 Nm).
- f. Tighten the pump centerbolt. Torque to 45 ft-lbs (54 Nm).
- g. Recheck all bolts for tightness.

## 9. Reconnect Electrical Power to Motor (or remove lock-out from power source)



# D/G-12 Service (Hydraulic End)



**Note:** The numbers in parentheses are the Reference Numbers on the exploded view illustrations found in this manual and also 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 two bolts (38) that screw through the back of the pump housing (40) into the cylinder casting (24) 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. We strongly urge you not to try to repair the hydraulic end of the pump without using the tools in this kit, Part No. A03-175-1101 (available from Wanner or your local distributor).

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# D/G-12 Service (Hydraulic End)

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## 1. Remove Motor and Coupler from Pump

## 2. Disconnect all Electrical Connections (or lock out power to the unit)

## 3. 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 (30).
- Stand the hydraulic end of the pump face-down on the cylinder casting (24).
- Check the shaft for sharp burrs. Smooth any burrs, to prevent scarring the housing seals (64) when you disassemble the pump.
- Remove the bolts (38) that secure the housing to the cylinder casting. The piston return springs (50) will force the cylinder casting and housing apart.
- Lift off the housing (40).
- 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.

## 4. Disassemble Pistons

- With the pump housing removed (see above), turn the unit over and set it on a flat surface, piston side down.
- With the diaphragms removed (see the Fluid End Service Section), reinsert a follower screw (17) into the hole in one of the valve plungers (54). Tap the screw lightly with a hammer; the plunger (21) should slip off the valve plunger (54).

The hydraulic piston assembly (50-59) can now be disassembled. Inspect all parts, and replace all O-rings and any other parts which are worn or damaged.
- Repeat step "b" for the remaining pistons.

**Note: When you reassemble the hydraulic piston, use new plungers (21). They are press-fit onto the valve plungers (54) and are not reusable.**

## 5. Reassemble Pistons

- Drop a ball (58) into each opening in the bottom of a piston assembly (59).
- Insert a retaining washer (57) and O-ring (56) to hold the ball in place.
- Insert a valve plunger (54) into a valve cylinder (55). Slide a spring (53) over the plunger, inside the valve cylinder.
- Insert an O-ring (52) into a spring retainer (51).
- Slide the assembled valve cylinder, plunger, and spring (53-55) into the spring retainer (51).
- Slide the complete cylinder-and-retainer assembly (51-55) into the piston assembly (59).
- Insert a return spring (50) into the piston assembly, wide end first. This is a tight fit, and can best be done by "screwing" the spring in counterclockwise.
- Repeat the above procedure for the other two pistons.

## 6. Reassemble Housing and Casting

**Note: 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. Be careful not to damage the seal bore.**

- Place the cylinder casting (24) face-down on a flat surface.
- Insert the assembled pistons (50-59) into the cylinder casting.
- 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 (38) will be installed).
- Stand the camshaft assembly (62) on the cylinder casting (24).

**Caution: The pilot bearing must be properly nested in the bearing race (62) during assembly. If misaligned, the bearing will be damaged and the pump will fail within the first hours of operation.**

- Install the O-ring (65) and slide the housing (40) down over the shaft and onto the threaded studs (from step c). Be sure the holes in the housing and the cylinder casting are properly aligned.



# D/G-12 Service (Hydraulic End)

- f. Using the two threaded studs in the Wanner Tool Kit, put a nut on the studs. Thread the nut down on the stud so the threaded end of the stud can be put through one of the bolt holes in the cylinder casting and through the housing casting. Start another nut on this end of the stud. Now put the other stud through the hole on the other side of the cylinder casting and through the housing. Start this nut.  
Using both studs and the nuts, tighten evenly to draw the cylinder casting tight to the housing. Be sure the O-ring (65) stays in place when pulling the two parts together. When tight, install the bolts (38) and washer into the cylinder casting to hold it to the housing. Remove the two studs and nuts that were part of the Wanner Tool Kit.
- g. Turn the shaft again to check its alignment.

## 7. Replace Shaft Seals

- a. Apply a thin film of grease on the seal protector tool (part of the Wanner 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.
- b. Apply a coating of Loctite® 601 or equivalent locking compound to the outside surface of both seals and the inside surface of the opening in the pump housing where the seal 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 Wanner 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.

## 8. Adjust Camshaft Endplay

- a. If the three set screws (22) are in the cylinder casting (24), 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).
- d. Back out the centerbolt or set screw **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 3 or 4 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 (22).  
Screw the three set screws (22) into the cylinder casting until they contact the bearing adjusting plate (61).
- g. Remove the centerbolt (1).

## 9. Reinstall Plungers

**Note: If the plungers (21) 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 at the exact top center position.
- b. Place a plunger on the screw end of the plunger guide tool from the Wanner Tool Kit. The flat side of the plunger should face the tool.
- c. Screw the guide (with the plunger) into the valve plunger (54) until tight.
- d. Hold the stud with a wrench, and tighten the nut against the plunger guide. This will press-fit the plunger onto the valve plunger. **Never reinstall used plungers (21).**

**Note: Do not remove the plunger guide until the diaphragm is installed (see below).**

- e. Install the diaphragm as outlined below, then repeat the procedure (steps 9a - 9d) for the other two plungers and diaphragms.

## 10. 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 the plunger holder (from the Wanner Tool Kit), through the holes — to hold the plunger (21) away from the cylinder casting, and to keep the valve plunger from turning when the diaphragm is being installed.
- c. Place the diaphragm (20) onto the plunger (21), ridge-side out.
- d. Center the diaphragm follower (19) on the diaphragm.
- e. Place the O-ring (18) onto the follower screw (17).
- f. Apply a small amount of Loctite 242 threadlocker to the threads of the follower screw.
- g. Insert the follower screw (with O-ring) through the diaphragm follower (19) and diaphragm (20), and screw it into the valve plunger (54).
- h. Hold the plunger holder, and tighten the follower screw to 18 in.-lbs (2.0 N-m) of torque.
- 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.

## 11. Reassemble Pump Head

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

## 12. Reconnect Electrical Power to Motor (or remove lock-out from power source)

# D/G-12 Troubleshooting

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## Cavitation

- Inadequate fluid supply because:
  - 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 vacuum too high

## Symptoms of Cavitation

- Excessive pump valve noise
- Premature failure of spring or retainer
- Volume or pressure drop
- Rough-running pump
- Premature failure of diaphragms
- Piston return spring failure (inside hydraulic end)

## Drop in Volume or Pressure

A drop in volume or pressure can be caused by one or more of the following:

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

## Premature Failure of Diaphragm

- Frozen pump
- Puncture by a foreign object
- Elastomer incompatible with fluid being pumped
- Pump running too fast
- Excess pressure
- Cavitation
- Broken piston return spring (50)

## Water (or Process Fluid) in Oil Reservoir

- Condensation
- Ruptured diaphragm
- Hydraulic cell not properly primed after diaphragm replacement
- Frozen pump
- Diaphragm screw O-ring (18) missing or cracked
- Cracked cylinder casting

## Strong Water (or Process Fluid) Pulsations

**NOTE: Small pulsations are normal in single-acting pumps with multiple pumping chambers.**

- Foreign object lodged in pump valve
- Loss of prime in hydraulic cell because of low oil level
- Air in suction line
- Valve spring (13) broken
- Cavitation
- Aeration or turbulence in supply tank

# D/G-12 Troubleshooting

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## Valve Wear

- Normal wear from high-speed operation
- 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 (18) 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.

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### **Limited Warranty**

Wanner Engineering, Inc. extends to the original purchaser of equipment manufactured by it and bearing its name, a limited one-year warranty from the date of purchase against defects in material or workmanship, provided that the equipment is installed and operated in accordance with the recommendations and instructions of Wanner Engineering, Inc. Wanner Engineering, Inc. will repair or replace, at its option, defective parts without charge if such parts are returned with transportation charges prepaid to Wanner Engineering, Inc., 1204 Chestnut Avenue, Minneapolis, Minnesota 55403.

This warranty does not cover:

1. The electric motors (if any), which are covered by the separate warranties of the manufacturers of these components.
2. Normal wear and/or damage caused by or related to abrasion, corrosion, abuse, negligence, accident, faulty installation or tampering in a manner which impairs normal operation.
3. Transportation costs.

This limited warranty is exclusive, and is in lieu of any other warranties (express or implied) including warranty of merchantability or warranty of fitness for a particular purpose and of any noncontractual liabilities including product liabilities based on negligence or strict liability. Every form of liability for direct, special, incidental or consequential damages or loss is expressly excluded and denied.



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