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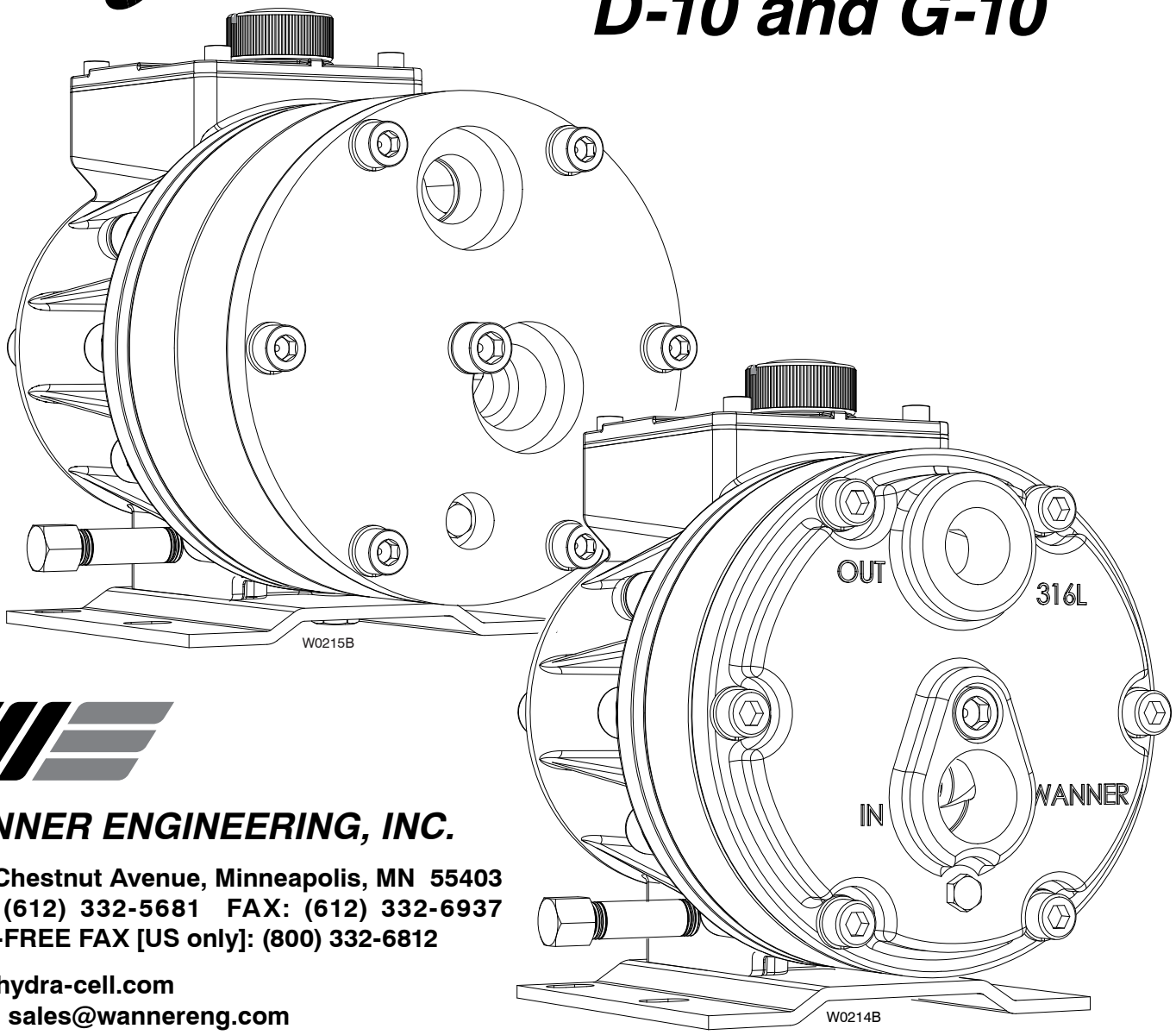
Installation & Service

D10-991-2400B

Hydra-Cell®

INDUSTRIAL PUMPS

Models: D-10 and G-10



WANNER ENGINEERING, INC.

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D/G-10 Contents

	Page
Specifications	2
Dimensions	4
Installation	5
Maintenance	9
Service (Fluid End)	10
Service (Hydraulic End)	15
Troubleshooting	18

D/G-10 Specifications

Max Pressure	Metallic: 1000 psi (70 bar) Non-Metallic: 250 psi (17 bar) Slurry Duty (SD): 300 psi (21 bar)

Capacity @ Max Pressure

	rpm	gpm	l/min
D/G-10-X	1450	7.8	29.0
D/G-10-E	1750	8.0	30.3
D/G-10-S	1750	6.0	22.7
D/G-10-I	1750	3.9	14.9

Delivery @ Max Pressure

	revs/gal	revs/liter
D/G-10-X	185	50
D/G-10-E	219	58
D/G-10-S	292	77
D/G-10-I	448	117

Max Inlet Pressure	
Metallic:	250 psi (17 bar)
Non-Metallic:	50 psi (3.5 bar)
Slurry Duty (SD):	50 psi (3.5 bar)
Max Temperature	
Metallic:	250°F (121°C) – consult factory for temperatures above 160°F (71°C)
Non-Metallic:	Polypropylene: 120°F (49°C); Kynar, Celcon & Slurry Duty: 140°F (60°C) – consult factory for temperatures above 120°F (49°C)
Inlet Port	D-10: 1 inch NPT G-10: 1 inch BSPT
Discharge Port	D-10: 3/4 inch NPT G-10: 3/4 inch BSPT
Shaft Diameter	7/8 inch (22.22 mm)
Shaft Rotation	Bidirectional
Bearings	Tapered roller
Oil Capacity	1.1 US quarts (1.05 liters)
Weight	Metallic Heads: 48 lbs (22 kg) Non-Metallic Heads: 35 lbs (16 kg)

Calculating Required Horsepower (kW)*

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

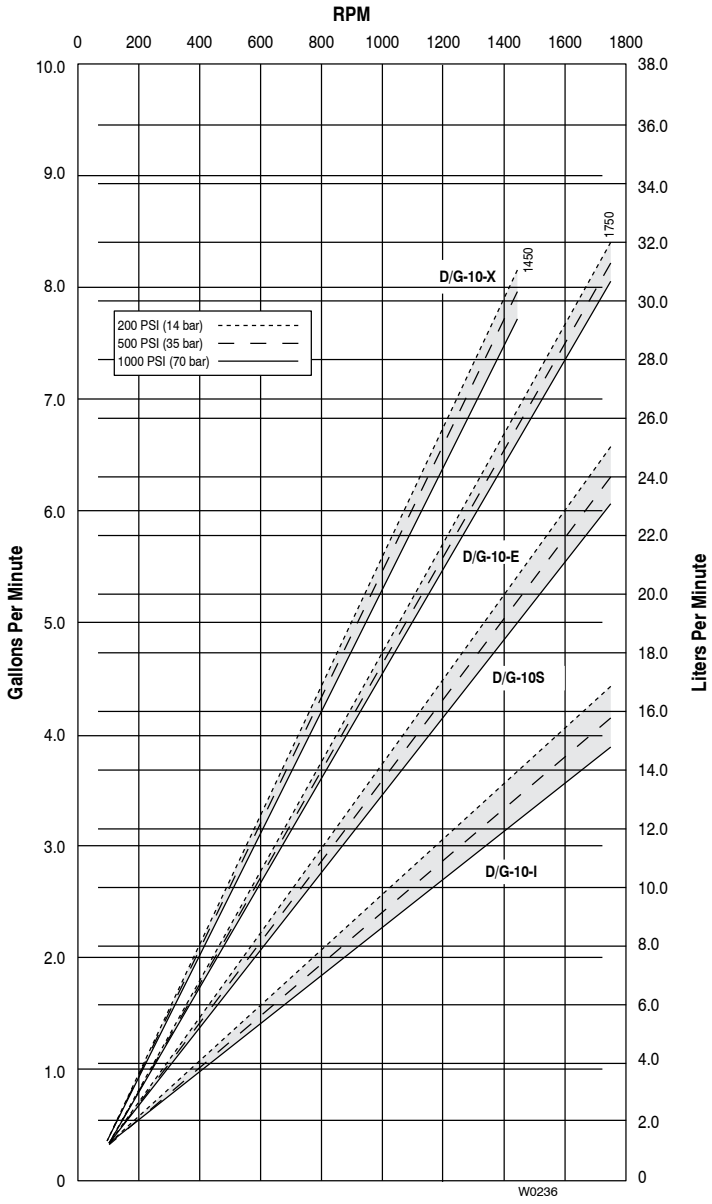
$$\frac{15 \times rpm}{84{,}428} + \frac{lpm \times bar}{511} = \text{electric motor kW*}$$

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

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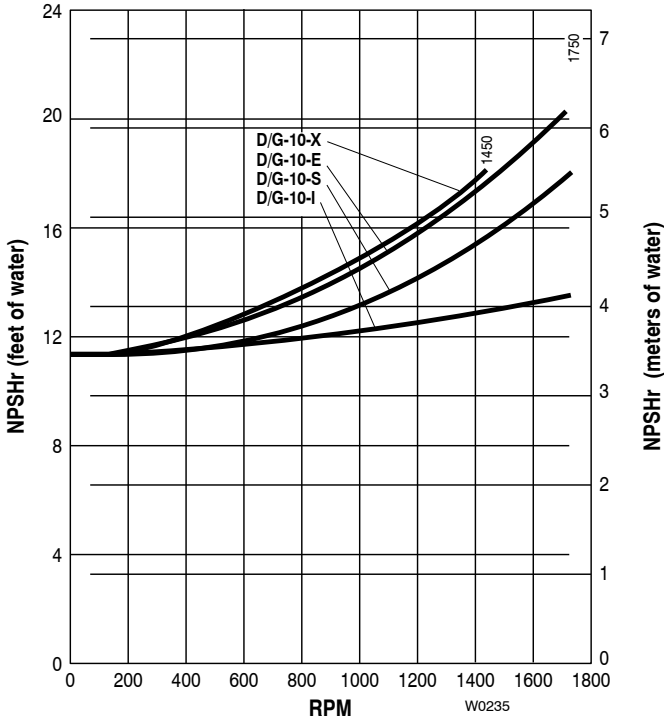
D/G-10 Specifications

Performance*

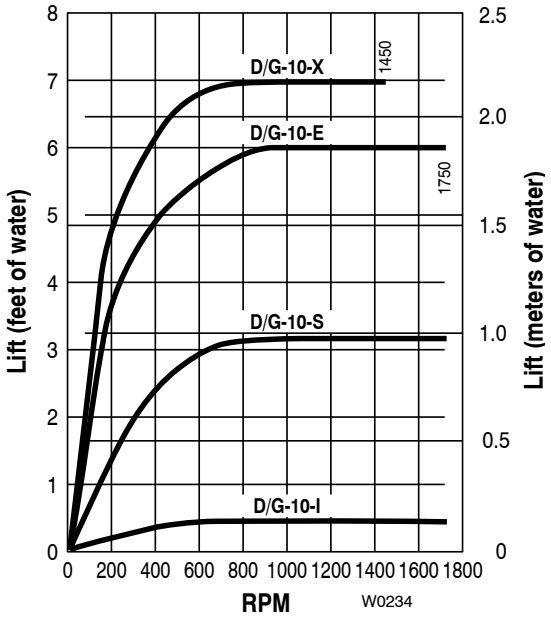


* Specifications depict D/G-10 metallic and non-metallic pump head models only. Contact factory or visit our web site (www.hydra-cell.com) for performance specifications on slurry duty (SD) models.

Net Positive Suction Head – NPSHr*



Dry Lift*



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D/G-10 Dimensions

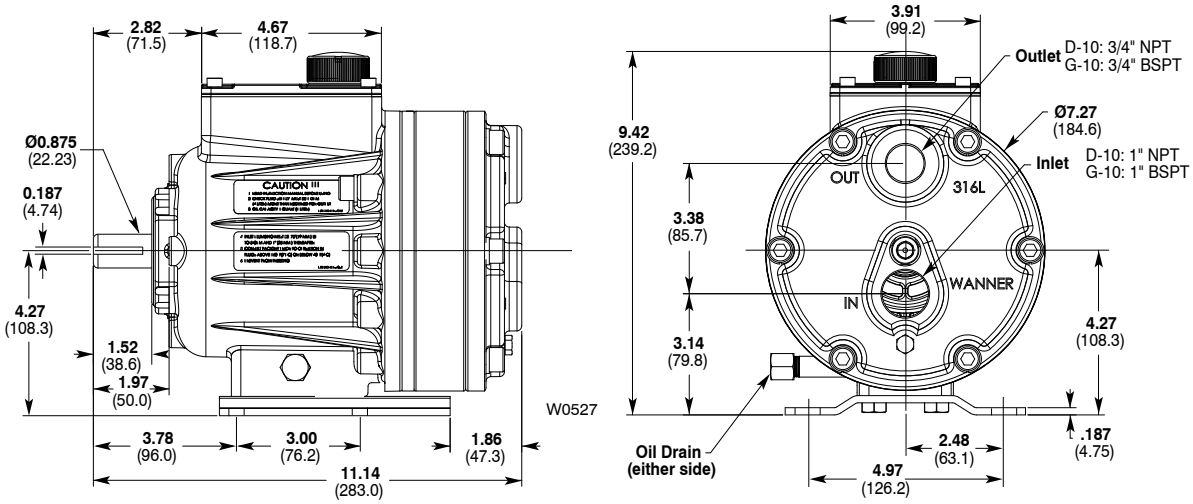
Models with Metallic Pumping Head

Brass

Cast Iron

316 Stainless Steel

Nickel Alloy (C Series)

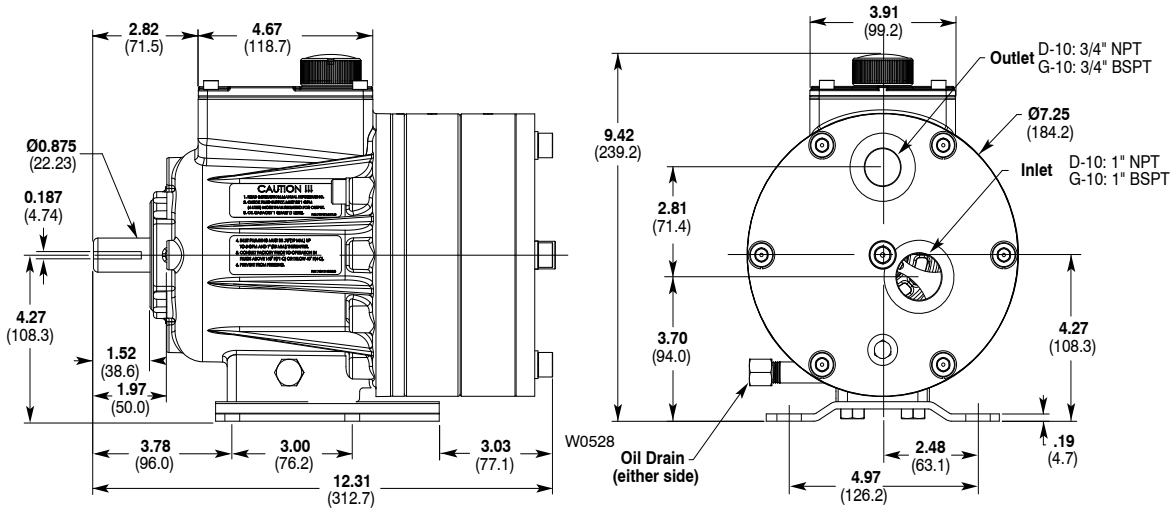


Models with Non-Metallic or Slurry Duty (SD) Pump Head

Kynar®

Polypropylene

Celcon



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D/G-10 Installation

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 pump head (manifold, valve plate and related items).

Mounting

The pump shaft can rotate in either direction.

To prevent vibration, mount the pump and motor 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. Unless otherwise specified by the coupling manufacturer, maximum parallel misalignment should not exceed 0.015 in. (0.4 mm) and angular misalignment should be held to 1° maximum. Careful alignment extends life of the coupling, pump, shafts, and support bearings. Consult coupling manufacturer for exact alignment tolerances.

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”.

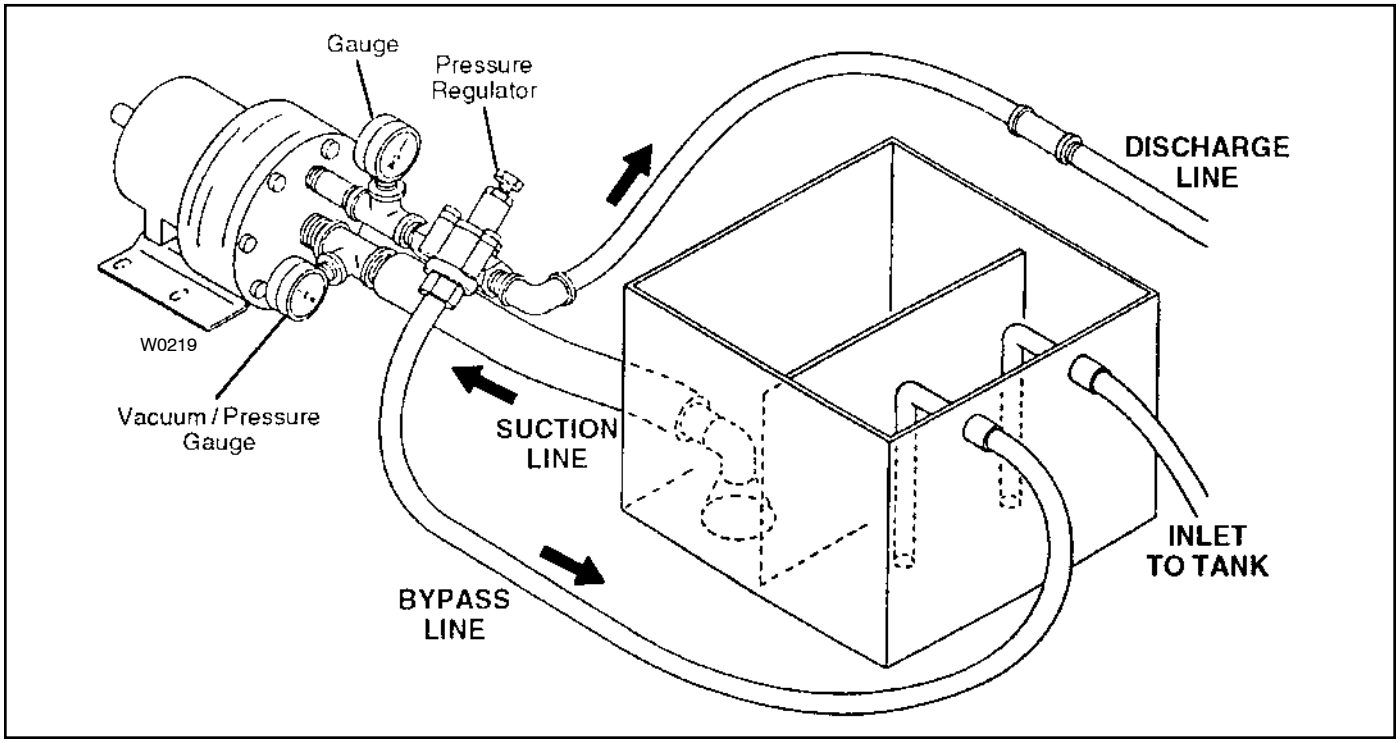
Safety Guards. Install adequate safety guards over all pulleys, belts, and couplings. Follow all codes and regulations regarding installation and operation of the pumping system.

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. (71° C) or below 40° F. (4.4° C)
- Pressure feeding of pumps
- Viscous or abrasive fluid applications
- Chemical compatibility problems
- Hot ambient temperatures – above 110° F. (43° C)
- Conditions where pump oil may exceed 200° F. (93° C) because of a combination of hot ambient temperatures, hot fluid temperature, and full horsepower load — an oil cooler may be required



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Inlet Piping (Suction Feed)

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

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. To maintain maximum flow, vacuum at the pump inlet should not exceed 7 in. Hg at 70° F (180 mm Hg at 21° C). **Do not supply more than one pump from the same inlet line.**

Supply Tank

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

Isolate the pump and motor stand from the supply tank, and support them separately.

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, on the opposite side of the baffle from the pump suction 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 the 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 and Routing

Size the suction line at least one size larger than the pump inlet, and so that the velocity will not exceed 1-3 ft/sec (0.3 to 0.9 m/s):

For pipe in inches: Velocity (ft/sec) = 0.408 x GPM/Pipe ID^2
For pipe in mm: Velocity (m/sec) = 21.2 x LPM/Pipe ID^2

Keep the suction line as short and direct as possible. A maximum of 3 feet (1 m) is recommended.

Use flexible hose and/or expansion joints to absorb vibration, expansion, or contraction.

If possible, keep the suction line level. Do not 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 ID.

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 of 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)

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 250 psi (17 bar); if it could get higher, install an inlet pressure reducing regulator. Do not supply more than one pump from the same inlet line.

Inlet Calculations

Acceleration Head

Calculating the Acceleration Head

Use the following formula to calculate acceleration head losses. Subtract this figure from the NPSHa, and compare the result to the NPSHr of the Hydra-Cell pump.

Ha = (L x V x N x C) ÷ (K x G)

where:

Ha = Acceleration head (ft of liquid)
L = Actual length of suction line (ft) — not equivalent length
V = Velocity of liquid in suction line (ft/sec) [V = GPM x (0.408 ÷ pipe ID^2)]
N = RPM of crank shaft
C = Constant determined by type of pump — use 0.066 for the D-10 and G-10 Hydra-Cell pumps
K = Constant to compensate for compressibility of the fluid — use: 1.4 for de-aerated or hot water; 1.5 for most liquids; 2.5 for hydrocarbons with high compressibility
G = Gravitational constant (32.2 ft/sec^2)

Friction Losses

Calculating Friction Losses in Suction Piping

When following the above recommendations (under “Inlet Piping”) for minimum hose/pipe I.D. and maximum length, frictional losses in the suction piping are negligible (i.e., Hf = 0) if you are pumping a water-like fluid.

When pumping more-viscous fluids such as lubricating oils, sealants, adhesives, syrups, varnishes, etc., frictional losses in the suction piping may become significant. As Hf increases, the available NPSH (NPSHa) will decrease, and cavitation will occur.

In general, frictional losses increase with increasing viscosity, increasing suction-line length, increasing pump flow rate, and decreasing suction-line diameter. Changes in suction-line diameter have the greatest impact on frictional losses: a 25% increase in suction-line diameter cuts losses by more than two times, and a 50% increase cuts losses by a factor of five times.

Consult the factory before pumping viscous fluids.

Minimizing Acceleration Head and Frictional Losses

To minimize the acceleration head and frictional losses:

- Keep inlet lines less than 3 ft (1 m) long
- Use at least 1-1/2 in. (38 mm) I.D. inlet hose
- Use soft hose (low-pressure hose, non collapsing) for the inlet lines
- Minimize fittings (elbows, valves, tees, etc.)
- **Use a suction stabilizer on the inlet.**

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Net Positive Suction Head

NPSHa must be equal to or greater than NPSHr. If not, the pressure in the pump inlet will be lower than the vapor pressure of the fluid — and cavitation will occur.

Calculating the NPSHa

Use the following formula to calculate the NPSHa:

NPSHa = Pt + Hz - Hf - Ha - Pvp

where:

Pt = Atmospheric pressure

Hz = Vertical distance from surface liquid to pump center line (if liquid is below pump center line, the Hz is negative)

Hf = Friction losses in suction piping

Ha = Acceleration head at pump suction

Pvp = Absolute vapor pressure of liquid at pumping temperature

NOTES:

- In good practice, NPSHa should be 2 ft greater than NPSHr
- All values must be expressed in feet of liquid

Atmospheric Pressure at Various Altitudes

Altitude (ft)	Pressure (ft of H_2O)	Altitude (ft)	Pressure (ft of H_2O)
0	33.9	1500	32.1
500	33.3	2000	31.5
1000	32.8	5000	28.2

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.

Support the pump and piping independently. 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: Velocity (ft/sec) = 0.408 x GPM/Pipe ID^2

For pipe in mm: Velocity (m/sec) = 21.2 x LPM/Pipe ID^2

NOTE: Pumps with non-metallic pumping head are limited to 250 psi (17 bar) maximum working pressure rating.

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 over pressurizing 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 or regulator.

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

If the pump may be run 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 safety relief valve in the discharge line, downstream from the pressure regulator.

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D/G-10 Installation

Before Initial Start-Up

Before you start the pump, be sure that:

- All shutoff valves are open, and the pump has an adequate supply of fluid.
- All connections are tight.
- The oil level is 1/4 in. (6 mm) above the cast surface in the upper oil reservoir.
- The relief valve on the pump outlet 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 shaft couplings have adequate safety guards.

Initial Start-Up Procedure

1. Turn on power to pump motor.
2. Check inlet pressure or vacuum. To maintain maximum flow, inlet vacuum must not exceed 7 in. Hg at 70° F (180 mm Hg at 21° C). Inlet pressure must not exceed 250 psi (17 bar).
3. Listen for any erratic noise, and look for unsteady flow. If pump does not clear, refer to Troubleshooting Section.
4. If system has air lock and pump fails to prime:
   a. Turn off power.
   b. Remove pressure gauge or plug from tee fitting at pump outlet (refer to illustration on page 5).

   NOTE: Fluid may come out of this port when the plug is removed. Provide an adequate catch basin for fluid spillage, if required. Fluid will come out of this port when the pump is started, so we recommend that you attach adequate plumbing from this port so fluid will not be sprayed or lost. Use high-pressure-rated hose and fittings from this port. Take all safety precautions to assure safe handling of the fluid being pumped.

   c. Jog system on and off until fluid coming from this port is air-free.
   d. Turn off power.
   e. Remove plumbing that was temporarily installed, and reinstall pressure gauge or plug.
5. Adjust discharge pressure regulator to desired operating and bypass pressures. Do not exceed maximum pressure rating of pump.
6. After pressure regulator is adjusted, set safety relief valve at 100 psi (7 bar) higher than desired operating pressure. To verify this setting, adjust discharge pressure regulator upward until relief valve opens. Follow recommendations in NOTE (step 4b) for handling fluid that will come from relief valve.
7. Reset discharge pressure regulator to desired system pressure.
8. Provide return line from relief valve to supply tank, similar to bypass line from pressure regulator.

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D/G-10 Maintenance

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

Daily

Check oil level and condition of oil. The oil level should be 1/4 in. (6 mm) from the top of the fill port.

Use the appropriate 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 Fluid-End 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 then according to the guidelines below.

Hours Between Oil Changes @ Various Process Fluid Temperatures

Pressure	RPM	<90°F (32°C)	<139°F (60°C)	<180°F (82°C)
Metallic Pump Head				
<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
Non-Metallic Pump Head				
<250 psi (17 bar)	<1200	4,000	3,000	—
	<1800	2,000	1,500	—
Slurry Duty Pump Head				
<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.

When changing, remove the drain plug cap (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. 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

Take all safety precautions to assure safe handling of the fluid being pumped. Provide adequate catch basins for fluid drainage and use appropriate plumbing from drain ports, etc., when flushing the pump and system with a compatible antifreeze.

1. Adjust discharge pressure regulating valve so pump runs under minimum pressure. Stop pump.
2. Drain supply tank; open any draincocks in system piping and collect drainage; remove plug (3) from manifold and collect drainage.
3. Close draincocks in system piping and replace manifold plug.
4. Fill supply tank with enough antifreeze to fill system piping and pump.
   NOTE: Disconnect the system return line from the supply tank and connect it to a separate reservoir.
5. Start pump and allow it to run until system is filled with antifreeze. **NOTE: If the system has an air lock and the pump fails to prime, follow step 4 of the Initial Start-up Procedure to clear the air.**
6. When mostly antifreeze is flowing from system return line, stop pump. Connect system return line back to supply tank and circulate antifreeze for short period.
7. It is also good practice to change oil in hydraulic end before storage for an extended period. This will remove any accumulated condensation and sediment from oil reservoir. Drain and refill hydraulic end with appropriate Hydra-Oil and operate pump for short period to assure smooth performance.

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D/G-10 Service (Fluid 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.

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 two bolts (29; 25 or 44) 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. Remove Manifold (6), Valve Plate (16)

a. Remove all nuts (31) and bolts (4) around the manifold. Do not remove two bolts (29; 25 or 44) that are installed through back of pump housing.

b. Use 3/8-in. (10-mm) hex Allen wrench to remove center bolt (1) and its washer (2).

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.

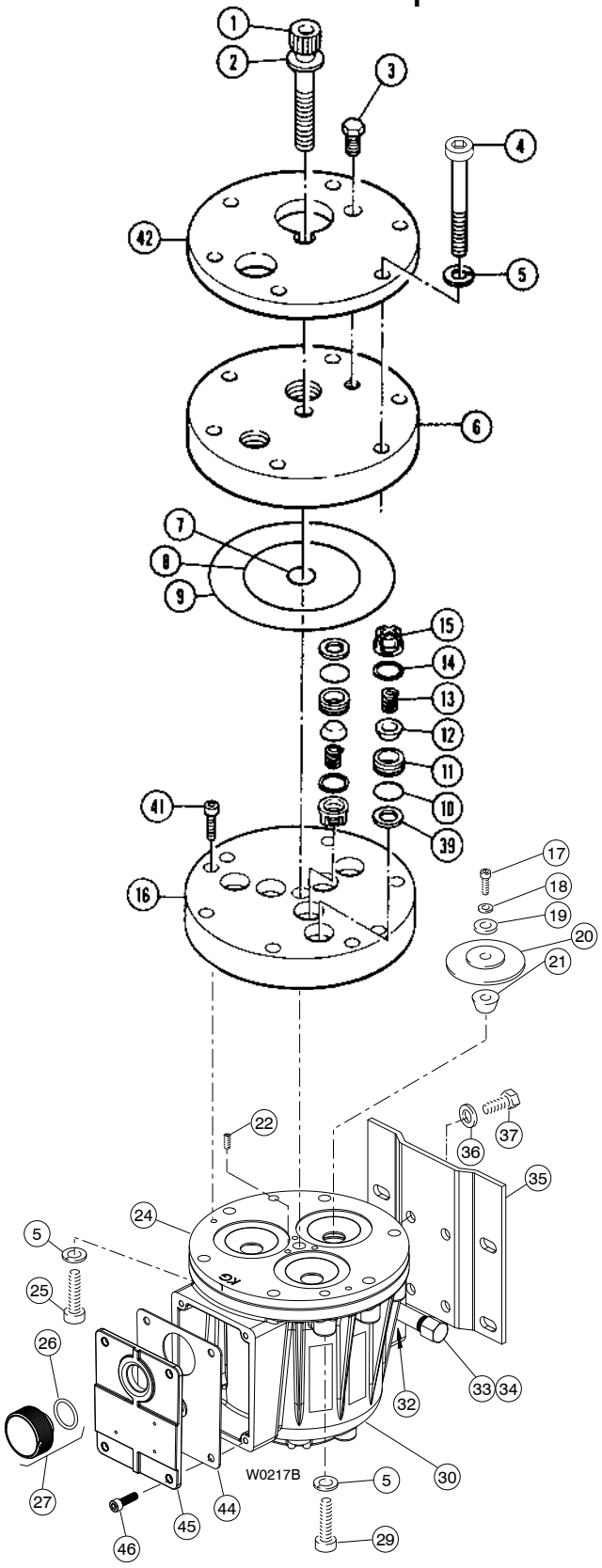
c. Remove manifold (6), and support plate (42) [non-metallic pump head only]. Valve plate (16) will remain on cylinder casting (24).

d. Inspect manifold for warping or wear around inlet and outlet ports. If wear is excessive, replace manifold.

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

***NOTE: For non-metallic slurry duty pumps, see the insert to this manual for fluid valve service (Step 2), then proceed to Step 3 in this manual for remaining service steps.**

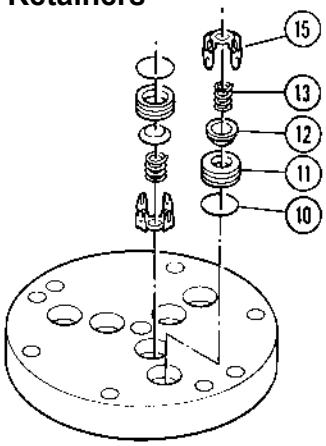
Model D-10/G-10
With Non-Metallic Pump Head*



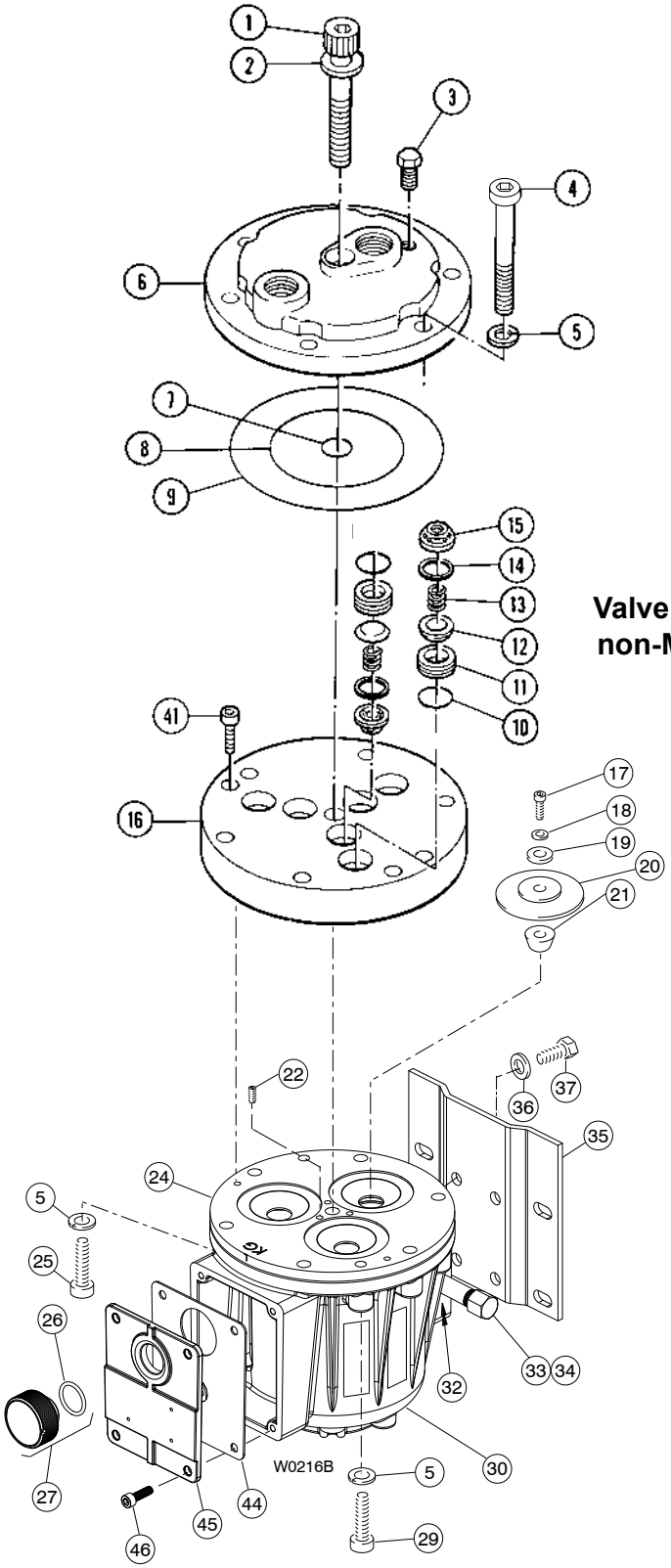
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D/G-10 Service (Fluid End)

Valve Assemblies with Metal Retainers



Valve Assemblies with non-Metallic Retainers



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D/G-10 Service (Fluid End)

2. Inspect Valves (10-15, 39)

***NOTE: For non-metallic slurry duty pumps, see the insert to this manual for fluid valve service (Step 2), then proceed to Step 3 in this manual for remaining service steps.**

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

a. Check spring retainer (15), and replace if worn.
   Note: if your pump has either abrasive duty valve assemblies or a non-metallic pump head there will be a plastic dampening washer (39) at the bottom of each seat. Inspect each one for wear or cracks and replace if necessary.

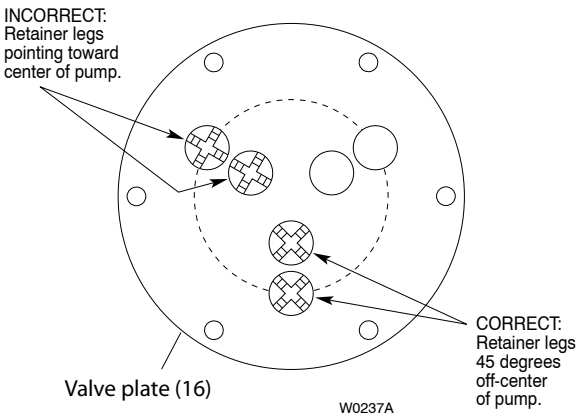
b. Check valve spring (13). If it is shorter than new spring, replace it (don't just stretch old spring).

c. Check 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).

d. Remove valve seat (11). Seat remover is included in Wanner Tool Kit. Inspect valve seat for wear, and replace it if necessary.

e. Reinstall valve assemblies:
   - Clean valve ports and shoulders with emery cloth, and lubricate them with lubricating gel or petroleum jelly.
   - Install O-ring (10) on valve seat (11).
   - **Inlet (3 center valves)**. Insert spring retainer (15) into valve plate, then insert spring (13), valve (12), and valve seat (11). If pump has plastic spring retainers, flat O-ring (14) goes between retainer and seat. Insert dampening washer (39) if included in valve assembly.
   - **Outlet (3 outer valves)**. Insert dampening washer (39) if included in valve assembly. Insert valve seat, valve, and spring, then retainer. If pump has **plastic** retainers, install flat O-ring between retainer and seat. If pump has **metal** spring retainers in outlet valves, position them so leg does not point toward center of pump (refer to illustration below).

Valve Retainer Orientation In Valve Plate



3. Inspect and Replace Diaphragms (20)

If necessary to service the diaphragms, remove the two socket-head cap screws (41) that secure the valve plate (16) to the cylinder casting (24). Inspect the valve plate in the same manner as you did the manifold.

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

b. Insert Allen wrench through one of holes, to hold diaphragm up. Proper size tool is included in Wanner Tool Kit.

c. Remove screw (17), O-ring (18), and follower (19) in center of diaphragm.

d. Remove diaphragm, and inspect it carefully. Ruptured diaphragm generally indicates pumping system problem, and replacing only diaphragm will not solve larger problem. Inspect diaphragm for following:
   - **Half-moon marks**. Usually caused by cavitation of pump (refer to "Troubleshooting" section).
   - **Concentric circular marks**. Usually caused by cavitation of pump (refer to "Troubleshooting" section).
   - **Small puncture**. Usually caused by sharp foreign object in fluid, or by ice particle.
   - **Diaphragm pulled away** from center screw or from cylinder sides. Usually caused by fluid being frozen in pump, or by over pressurization of pump.
   - **Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping fluid that is incompatible with diaphragm material.
   - **Slice in ridge of diaphragm**. Occurs when Viton diaphragm is operated at cold temperatures.
   - **Diaphragm edge chewed away**. Usually caused by over pressurizing system.

e. Inspect plunger (21) for any rough surfaces or edges. **Do not** remove plunger from plunger shaft. Smooth surfaces and edges as necessary with emery cloth or 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 new diaphragm (or reinstall old one, as appropriate), ridge side out.

g. Clean screw (17) and remove any oil from it. Apply medium-strength threadlocker to screw. Reinstall screw and follower (19), and a new O-ring (18). Tighten to 18 in.-lbs (2.0 N-m).

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

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D/G-10 Service (Fluid End)

4. Flush Contaminant from Hydraulic End

(only if diaphragm has ruptured)

a. Remove oil drain cap (34) and allow all oil and contaminate to drain out.
b. Fill reservoir with kerosene or solvent, manually turn pump shaft to circulate 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 flushing procedure (step b).
d. Fill reservoir with fresh oil, manually turn pump shaft to circulate oil, and drain once again.
e. Refill reservoir. If oil appears milky, there is still contaminate in reservoir. Repeat flushing procedure until oil appears clean.

5A. Prime Hydraulic Cells on Standard Pumps

a. With pump horizontal, and fluid-end head removed, fill reservoir with correct Hydra-oil for application. Have catch basin for oil that leaks from behind diaphragms when priming. Catch oil and dispose of it properly; **do not reuse it**.
b. All air in oil within hydraulic cell (behind diaphragms) must be forced out by turning shaft (which pumps piston). Shaft rotator is included in Wanner Tool Kit. Turn shaft until bubble-free flow of oil comes from behind all diaphragms. Watch oil level in reservoir; if it gets too low during priming, air will be drawn into pistons (inside hydraulic end) and will cause pump to run rough.
c. Wipe excess oil from cylinder casting (24) and diaphragms (20).
d. Ensure that oil is 1 inch (25 mm) from top of fill port.
e. Replace oil fill cap (27).

5B. Priming 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)

a. Install valve plate (16) but without outlet valves installed (or else remove outlet valves; leave seats installed) on cylinder housing. Tighten two socket-head screws (41).
b. Fill reservoir with correct Hydra-oil to fill port.
c. With blunt pointer (eraser end of pencil), reach in through each outlet valve port and push follower-diaphragm backwards. Note air bubbles coming out at oil fill port. Now turn shaft about 1/2 turn.
d. Repeat depressing diaphragms and rotating shaft (approximately 4-6 times) until no more air bubbles escape and oil has dropped about 1 inch (25 mm) from top of fill port. Hydraulic cells are now primed. Replace oil fill cap.
e. 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 valve centered on seat and allow retainer to fit all way into port flush.
f. Install manifold (6) and complete installation.

Alternative Method #1:

With pump horizontal, and fluid-end head removed, fill reservoir with correct Hydra-oil for application. Have catch basin for oil that leaks from behind diaphragms when priming. Catch oil and dispose of it properly; **do not reuse it.**

a. All air in oil within hydraulic piston behind diaphragms must be forced out by turning shaft (which pumps piston). Shaft rotator is included in the Hydra-Cell Tool Kit. Keep pressure on diaphragms while turning shaft until bubble-free flow of oil comes from behind all diaphragms. Maintain oil level in reservoir. Do not allow oil level to be lower than reservoir.
b. Quickly attach loaded valve plate (16) (before oil runs out past diaphragms) with socket head screws (41), but do not tighten completely. Leave gap between valve plate and cylinder housing. Turn shaft 2-3 turns to finish forcing out air behind diaphragms. Hydraulic cells are now primed. Now finish tightening valve plate with two socket head screws and add pump manifold.
c. Wipe excess oil from around pump head.
d. Check that oil level is 1 inch (25 mm) from top of fill port.
e. Replace oil fill cap and complete installation.

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

This simple and clean method of priming Hydra-cells requires an inlet head pressure of at least 5 feet (1.5 m) or 2 psi (.14 bar). Pressure source is required to hold diaphragms back while piston moves to force out air.

Completely assemble pump and fill reservoir with correct Hydra-oil to fill port.

a. **When tank head pressure is being used to prime**, install pump back into system and connect 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 pump shaft by hand and watch for bubbles exiting oil reservoir fill opening. This will take several rotations; when no more bubbles come out and reservoir level has dropped about 1 in. (25 mm), hydraulic cells are primed.
c. Replace oil fill cap and complete installation.
d. **When compressed air is being used to prime**, insert clean air hose to pump inlet and restrict pump outlet. Turn shaft quarter turn and then apply air pressure into manifold to put pressure on diaphragms. This will force air out from inside pistons and bubbles will appear at reservoir opening. Repeat for several rotations until no more air bubbles come out and reservoir level has dropped about 1 in. (25 mm). Hydraulic cells are now primed.
e. Replace oil fill cap and complete installation.

6. Reinstall Pumping Head

MODEL D-10

NOTE: Use bolt (29) protruding through cylinder casting at 10 o'clock position to locate valve plate on cylinder casting. Place "blind hole" on valve plate over this bolt.

a. Reinstall valve plate (16), with valve assemblies installed as outlined above, onto cylinder casting. Recheck that blind hole is over protruding bolt at 10 o'clock position. Install socket-head cap screws (41) and secure valve plate to cylinder casting.
b. Reinstall O-rings (7,8,9) on rear side of manifold. Use petroleum jelly or lubricating gel to hold them in place.
c. Reinstall manifold onto valve plate. Be sure drain plug (3) is at the bottom of manifold.

   NOTE: on pumps with non-metallic head position support plate (42) onto manifold with ports and bolt holes aligned properly.
d. Insert all bolts (4), washers (5), and nuts (31). Hand tighten.
e. Reinstall center bolt (1) with its washer (2), and torque to 45 ft-lbs.
f. Alternately tighten perimeter bolts (4) until all are secure. Torque to 45 ft-lbs.
g. Recheck all bolts for tightness.

MODEL G-10

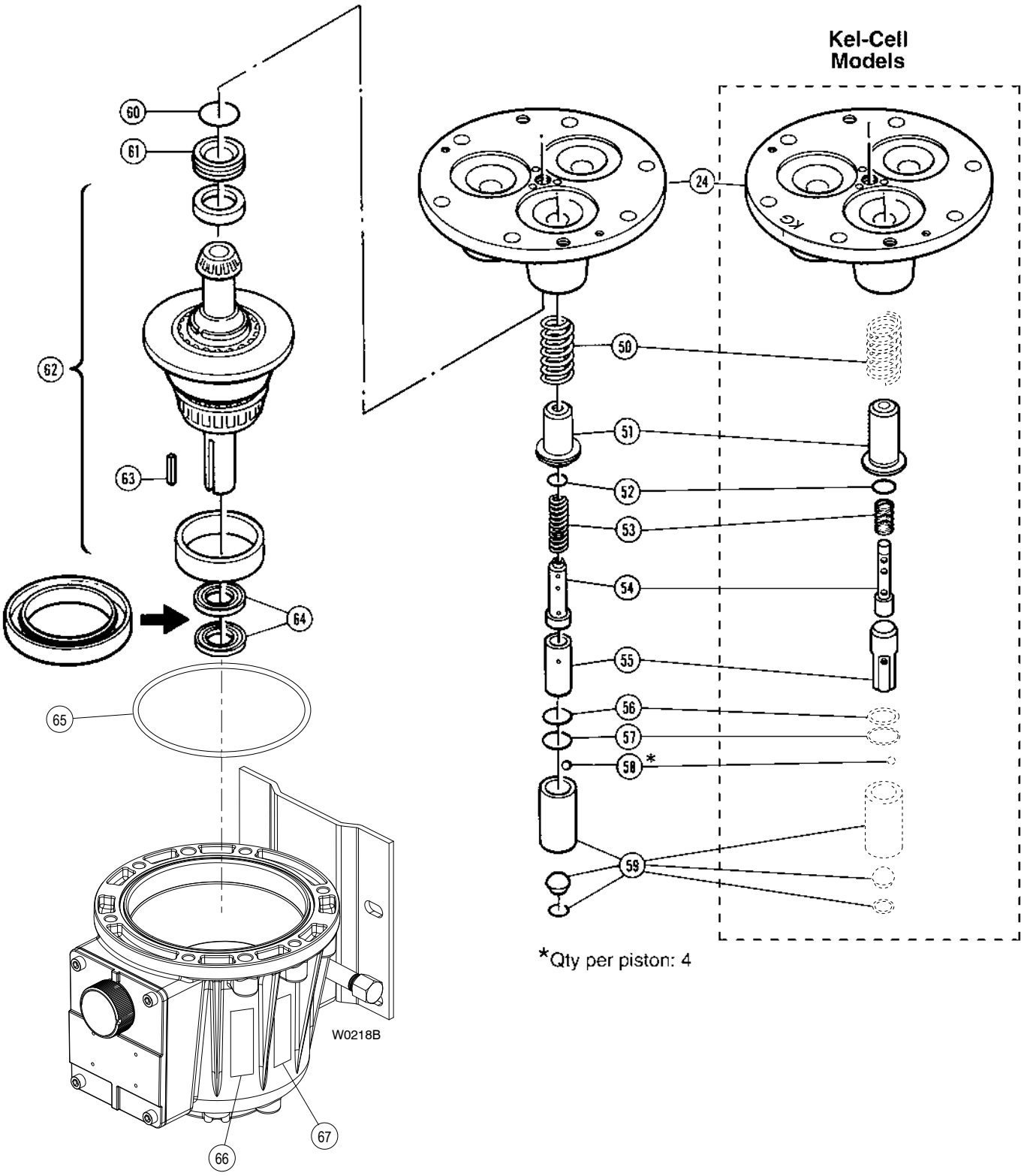
NOTE: Use the bolt (29) protruding through the cylinder casting at the 10 o'clock position to locate the valve plate on the cylinder casting. Place the "blind hole" on the valve plate over this bolt.

a. Reinstall valve plate (16), with valve assemblies installed as outlined above, onto cylinder casting. Recheck that blind hole is over protruding bolt at 10 o'clock position. Install two socket-head cap screws (41) and secure valve plate to cylinder casting.
b. Reinstall O-rings (7,8,9) on rear side of manifold. Use petroleum jelly or lubricating gel to hold them in place.
c. Reinstall manifold onto valve plate. Be sure drain plug (3) is at bottom of manifold.

   NOTE: on pumps with non-metallic head position support plate (42) onto manifold with ports and bolt holes aligned properly.
d. Insert all six bolts (4) around edge of manifold. Reinstall pump center bolt (1) with its washer (2).
e. Alternately tighten perimeter bolts (4) until all are secure. Torque to 54 N-m.
f. Tighten pump center bolt. Torque to 54 N-m.
g. Recheck all bolts for tightness.

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D/G-10 Service (Hydraulic End)



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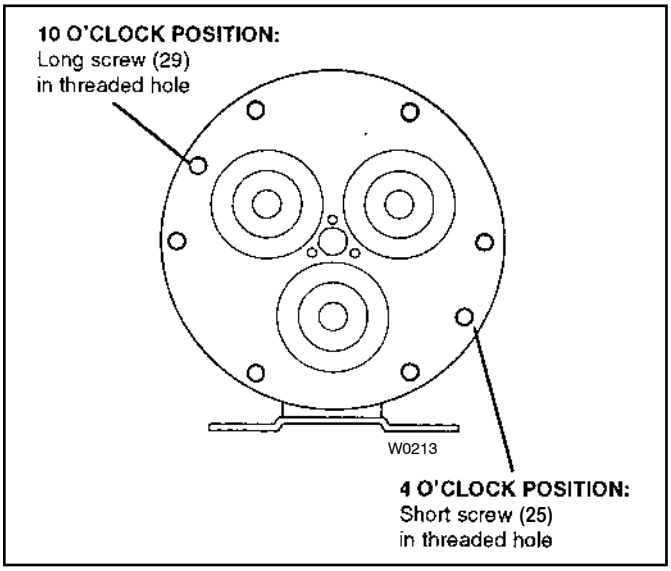
D/G-10 Service (Hydraulic End)

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 (29; 25 or 44) that screw through the back of the housing into the cylinder housing (24) hold the housing 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 (P/N A03-175-1101). 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 head of pump, and diaphragms, as outlined in the Fluid-End Service Section.
b. Drain oil from pump housing by removing drain plug (34).
c. Set hydraulic end of pump face-down on cylinder housing (24), onto smooth, clean surface.
d. Check shaft for sharp burrs. Smooth any burrs, to prevent scarring housing seals (64) when you disassemble pump.
e. Remove bolts (29; 25 or 44) that secure housing to cylinder casting. Piston return springs (50) will force cylinder housing and housing apart.

   NOTE: When reassembling later, note that one bolt (29) is 1/4 in. (5 mm) longer than the other (25 or 44). The longer bolt must be installed in the 10 o'clock position of the cylinder housing (24).
f. Lift off housing (30).
g. Inspect cam and bearings (62), and bearing race in rear of housing. If bearings are pitted or binding, or if housing race is worn, replace them both.

2. Disassemble Pistons

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

   Hydraulic piston assembly (50-59) 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 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.

3. Reassemble Pistons

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

4. Reassemble Pump Housing and Cylinder Housing

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. Clean the bore in the housing using emery cloth or ScotchBrite™.

a. Place cylinder housing (24) face-down on flat surface.
b. Insert assembled pistons (50-59) into cylinder housing. Holes on foot end of pistons should all point toward center of casting.
c. Note location of outer ring of holes in cylinder housing and in pump housing flange (in particular, holes where bolts (29) and (25 or 44) will be installed).
d. Stand camshaft assembly (62) on cylinder housing (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.

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e. Using petroleum jelly or grease to retain it, install O-ring (65) and slide housing (30) down over shaft. Be sure holes in housing and the cylinder housing are properly aligned.

f. Install two assembly studs from Tool Kit, washers and nuts on threaded studs, but don't tighten yet. You may want to insert two or more bolts (4) into unthreaded holes of housing and cylinder housing to help align parts.

g. Alternately tighten the nuts of assembly studs to evenly draw housing down to cylinder housing. Be sure O-ring (65) stays in place.

   Also, as you tighten nuts keep checking shaft alignment by turning shaft (use rotator in Wanner Tool Kit). If shaft begins to bind and become difficult to turn, back off nuts and realign shaft. When housing is tight against cylinder housing, you should be able to turn shaft smoothly.

h. After pump housing and cylinder housing are together, insert bolt (25) with lock washer (5) (at 4 o'clock position) through pump housing and into cylinder housing. Repeat with bolt (29) in 10 o'clock position. Tighten evenly and then remove assembly studs.

i. Turn shaft again to check its alignment.

5. Replace Shaft Seals

a. Apply thin film of grease on seal protector tool (part of Wanner Tool Kit). Slide both seals onto tool, with spring side of seals toward open end of tool.

   Apply heavier coat of grease between seals and press together.

b. Apply coating of Loctite® High-Performance Pipe Sealant with PTFE, or comparable product, to outer surface of both seals and inside surface of the opening in pump housing where seals will rest.

c. Apply light film of grease to drive shaft. Slide seal protector tool (with two seals) over end of shaft.

d. Slide seal inserter tool (from Wanner Tool Kit) over seal protector tool, and press seals completely into place. Tap tool with soft mallet to firmly seat seals.

6. Adjust Cam Shaft Endplay

a. Remove three set screws (22) from cylinder casting (24), and clean them.

b. Insert center bolt (1) into hole in center of cylinder casting. Turn it in to move bearing adjusting plate (61) and cup tight against bearing cone.

c. Back out center bolt two full turns, then turn it back in again until it is tight against adjusting plate (61).

d. Back out the center bolt exactly 1/4 of a turn.

e. With plastic mallet (or regular mallet and wooden board) to prevent damage to shaft, rap end of shaft 3 or 4 times. This will provide about 0.006 in. (0.15 mm) endplay in shaft.

f. Apply removable threadlocker to threads of three cleaned set screws (22).

   Screw three set screws (22) into cylinder casting until they contact bearing adjusting plate (61).

g. Remove center bolt (1).

7. Install Plungers

NOTE: If the plungers (21) have been removed from the valve plungers (54), do not reuse them. Install new ones instead.

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

b. Place plunger on exposed screw end of plunger guide tool (from Wanner Tool Kit). Larger-diameter side of plunger should face tool.

c. Screw guide (with plunger) into valve plunger (54) until tight.

d. Hold single bottom handle of guide, and turn double top handle to force plunger to seat on valve plunger. This is press-fit. When installed, plunger should be tight against shoulder of valve plunger.

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

e. Install diaphragm as outlined below, then repeat procedure for other two plungers and diaphragms.

8. Reinstall Diaphragms

a. With plunger guide tool still screwed into valve plunger (54), pull valve plunger up until cross-holes in valve plunger are exposed.

b. Insert diaphragm Allen wrench (from Wanner Tool Kit), through top hole — to hold plunger (21) away from cylinder casting. This will also keep valve plunger from turning when diaphragm is being installed.

c. Place diaphragm (20) onto plunger (21) ridge-side out.

d. Center diaphragm follower (19) on diaphragm.

e. Place O-ring (18) onto follower screw (17).

f. Apply small amount of threadlocker to threads of follower screw.

g. Insert follower screw (with O-ring) through diaphragm follower (19) and diaphragm (20), and screw it into valve plunger (54).

h. Hold plunger holder, and torque follower screw to 18 in.-lbs (2.0 N-m).

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

j. Fill reservoir with fresh oil and prime pump, as outlined in Fluid-End Service Section.

9. Reassemble Pump Head

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

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D/G-10 Troubleshooting

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 (refer to the Inlet Calculations paragraph of the Installation Section).

Symptoms of Cavitation

- Excessive pump valve noise
- Premature failure of spring or retainer
- Volume or pressure drop
- Rough-running pump
- Premature failure
- Piston return spring failure

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 oil prime in cells because of low oil level
- Ruptured diaphragm
- Cavitation
- Warped manifold from over pressurized system
- O-rings forced out of their grooves from over-pressurization
- 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 belts
- Worn spray nozzles
- Cracked cylinder casting

Pump Runs Rough

- Worn pump valves
- Air lock 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

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

Water (or Process Fluid) in Oil Reservoir

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

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D/G-10 Troubleshooting

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 broken
- Cavitation
- Aeration or turbulence in supply tank

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 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.

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