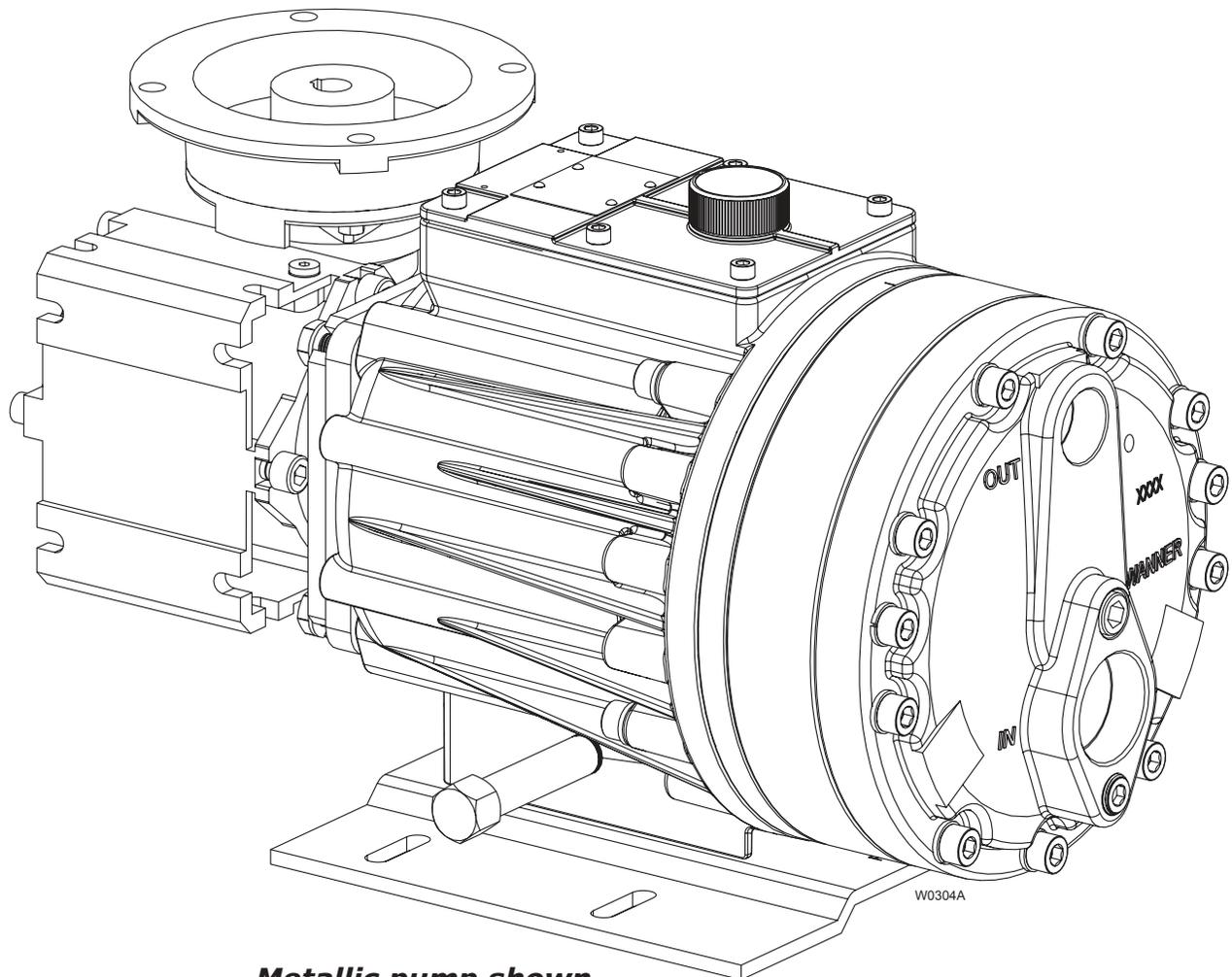


Hydra·Cell[®]

METERING SOLUTIONS™

P600 Metering Pump

Installation, Operation & Maintenance **P600-991-2400A**



Metallic pump shown

 **Wanner Engineering, Inc.**

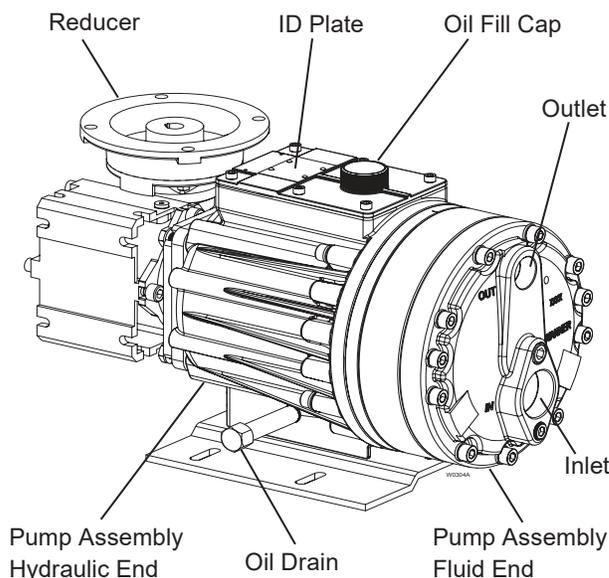
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P600 Contents

| | Page |
|------------------------------|------|
| Operation | 2 |
| Specifications | 2 |
| Dimensions | 3 |
| Installation | 6 |
| Calibration | 8 |
| Maintenance | 9 |
| Fluid End | |
| Service | 10 |
| Parts List | 13 |
| Hydraulic End Service | 17 |
| Parts List | 17 |
| Reducer Parts List..... | 18 |
| Troubleshooting..... | 21 |
| Replacement Parts Kits | 22 |
| Warranty..... | 24 |

Component Identification



P600 Operation

Hydra-Cell Metering Solutions Pumps are hydraulically-actuated, hydraulically-balanced diaphragm metering pumps that exceed API 675 performance standards of $\pm 1\%$ steady state accuracy, $\pm 3\%$ linearity and $\pm 3\%$ repeatability.

Due to their multiple diaphragm design, the P Series metering pumps, with the exception of the P100, provide virtually "pulse-free" linear flow. Unlike conventional single diaphragm metering pumps, this linear flow reduces the need for pulsation dampeners and increases the reliability, performance, and safety of the metering pump system.

Pump operation and plunger activation are accomplished through a crankshaft (P100, P200 and P300) or wobble plate (P400, P500 and P600). Horizontal disk check valves allow for the pumping of particulates that ordinarily collect on vertical ball check valves common to conventional metering pumps.

P Series pumps utilize speed to adjust flow rate through a motor and variable-frequency drive (VFD), eliminating the need for mechanical adjustment.

P600 Specifications

| | | |
|--|---|---------------------|
| Diaphragms per Liquid End | 3 (Kel-Cell pistons) | |
| Flow Control | Electronic variable speed drive | |
| Steady State Accuracy | $\pm 1\%$ | |
| Linearity | $\pm 3\%$ | |
| Repeatability | $\pm 3\%$ | |
| Maximum Pressure | | |
| Metallic Head: | 1000 psi (70 bar) | |
| Non-Metallic Head: Polypropylene: | 250 psi (17 bar) | |
| PVDF: | 350 psi (24 bar) | |
| Maximum Inlet Pressure | 250 psi (17 bar) | |
| Fluid Operating Temperatures* | | |
| Metallic Head: | 250°F (121°C) | |
| Non-Metallic Head: | 140°F (60°C) | |
| * Consult factory for correct component selection for temperatures from 160°F (71°C) to 250°F (121°C). | | |
| Inlet Port | 1 1/2 inch NPT or BSPT | |
| Discharge Port | 1 inch NPT or BSPT | |
| Maximum Solids | 500 microns | |
| Shaft Rotation | Bi-directional | |
| Materials Used | See Replacement Parts Kits Section for individual pump materials. | |
| Oil Capacity | 2.5 US quart (2.4 liters) | |
| Weight | FlexBloc 63 | FlexBloc 75 |
| Metallic Head: | 146 lbs (66.2 kg) | 172.1 lbs (78.1 kg) |
| Non-Metallic Head: | 111 lbs (50.3 kg) | 137.1 lbs (62.2 kg) |

P600 Specifications (Cont'd)

Performance Maximum Flow at Designated Pressure - Imperial *

| All Pump Heads (gph) | | Metallic Pump Heads (gph) | | Pump rpm | Gear Ratio | Motor rpm |
|----------------------|------------|---------------------------|------------|----------|------------|-----------|
| 100 psi | 250 psi | 500 psi | 1000 psi | | | |
| 36.49 (½) | 36.12 (¾) | 35.21 (1) | 33.25 (2) | 30 | 60:1 | 1800 |
| 43.90 (½) | 43.48 (¾) | 42.49 (1) | 40.35 (2) | 36 | 50:1 | |
| 55.00 (½) | 54.53 (¾) | 53.39 (1) | 51.17 (2) | 45 | 40:1 | |
| 73.56 (½) | 72.97 (¾) | 71.58 (1½) | 68.75 (3) | 60 | 30:1 | |
| 88.41 (½) | 87.71 (¾) | 86.12 (1½) | 82.81 (3) | 72 | 25:1 | |
| 110.7 (½) | 109.8 (1) | 107.9 (1½) | 103.9 (3) | 90 | 20:1 | |
| 147.8 (½) | 146.7 (1) | 144.3 (2) | 139.1 (5) | 120 | 15:1 | |
| 222.1 (1) | 220.4 (1½) | 217.0 (3) | 209.4 (5) | 180 | 10:1 | |
| 296.3 (1) | 294.1 (2) | 289.8 (3) | 279.7 (5) | 240 | 7.5:1 | |
| 444.8 (1½) | 441.6 (3) | 435.2 (5) | 420.3 (7½) | 360 | 5:1 | |
| 593.3 (2) | 589.0 (3) | 580.7 (7½) | 560.9 (15) | 480 | 7.5:1 | 3600 |
| 890.3 (3) | 883.9 (5) | 871.6 (10) | 842.1 (15) | 720 | 5:1 | |

*Capacity data shown is for pumps with elastomeric diaphragms. Consult factory for performance characteristics of pumps with PTFE diaphragms.

() Required Motor hp

Performance Maximum Flow at Designated Pressure - Metric *

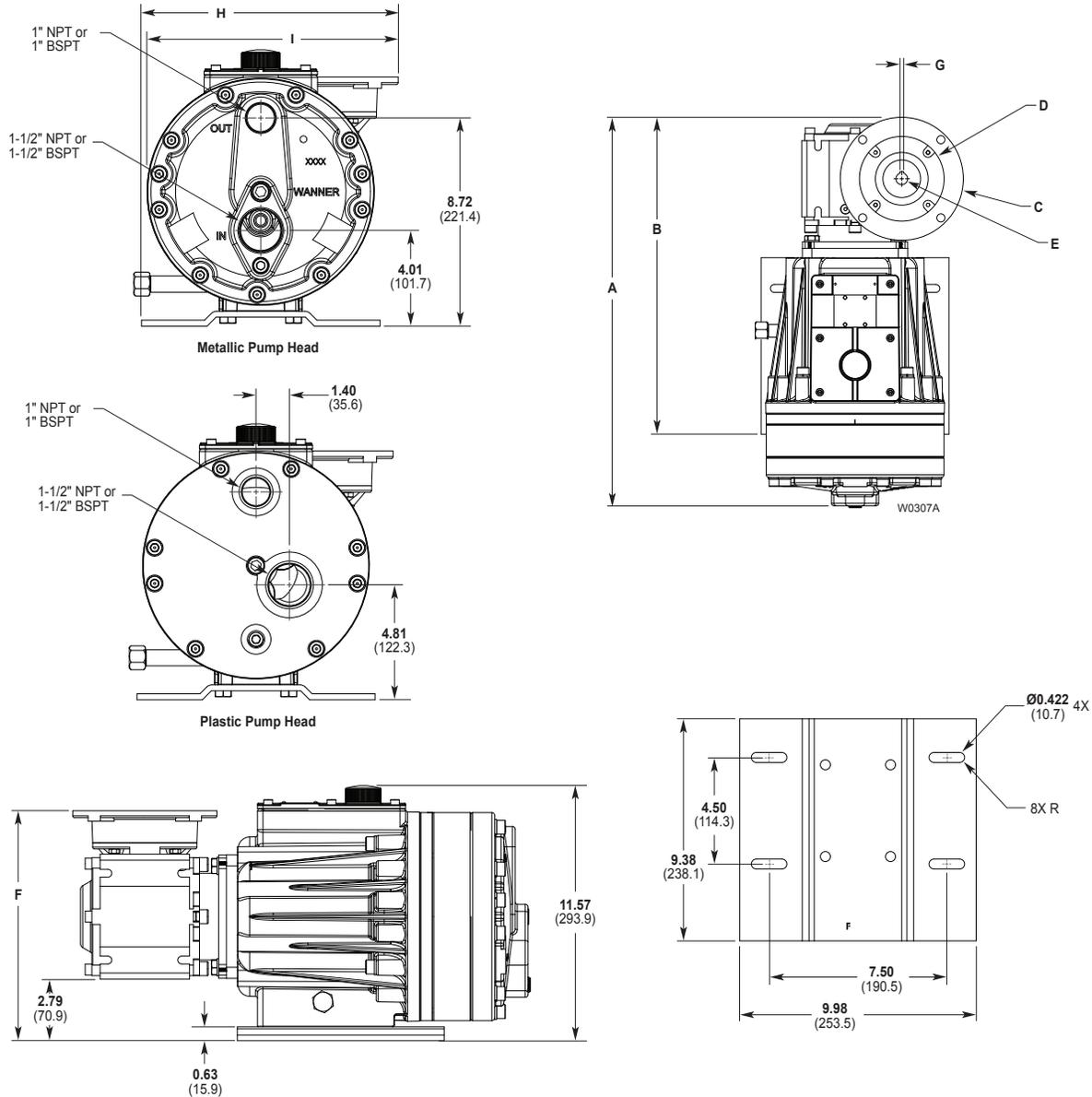
| All Pump Heads (lph) | | Metallic Pump Heads (lph) | | Pump rpm | Gear Ratio | Motor rpm |
|----------------------|--------------|---------------------------|-------------|----------|------------|-----------|
| 7 bar | 17 bar | 34 bar | 69 bar | | | |
| 115.1 (0.37) | 113.9 (0.75) | 111.1 (1.5) | 104.9 (3) | 25 | 60:1 | 1500 |
| 138.5 (0.37) | 137.2 (0.75) | 134.0 (1.5) | 127.3 (3) | 30 | 50:1 | |
| 173.5 (0.37) | 172.0 (0.75) | 168.4 (1.5) | 161.4 (3) | 37.5 | 40:1 | |
| 232.0 (0.37) | 230.2 (0.75) | 225.8 (1.5) | 216.9 (3) | 50 | 30:1 | |
| 278.9 (0.37) | 276.7 (0.75) | 271.7 (1.5) | 261.2 (3) | 60 | 25:1 | |
| 349.2 (0.55) | 346.5 (0.75) | 340.5 (1.5) | 327.8 (3) | 75 | 20:1 | |
| 466.3 (0.75) | 462.7 (1.1) | 455.2 (2.2) | 438.6 (4) | 100 | 15:1 | |
| 700.5 (0.75) | 695.3 (1.5) | 684.7 (3) | 660.4 (5.5) | 150 | 10:1 | |
| 934.7 (1.1) | 927.9 (1.5) | 914.1 (3) | 882.2 (5.5) | 200 | 7.5:1 | |
| 1403 (1.5) | 1393 (2.2) | 1373 (4) | 1326 (7.5) | 300 | 5:1 | |
| 1872 (1.5) | 1858 (4) | 1832 (5.5) | 1769 (7.5) | 400 | 7.5:1 | 3000 |
| 2808 (1.5) | 2788 (4) | 2750 (5.5) | 2656 (7.5) | 600 | 5:1 | |

*Capacity data shown is for pumps with elastomeric diaphragms. Consult factory for performance characteristics of pumps with PTFE diaphragms.

() Required Motor kW

P600 Dimensions

P600 Models - F63

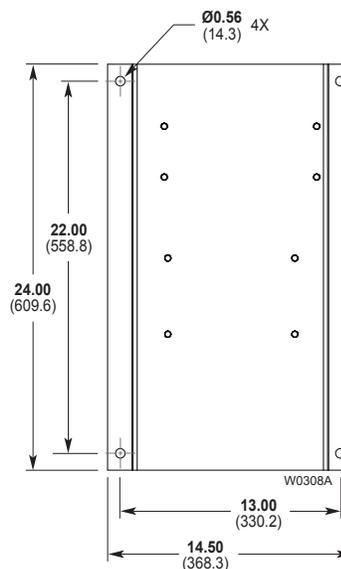
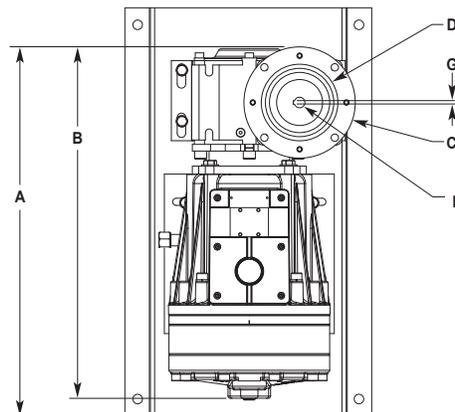
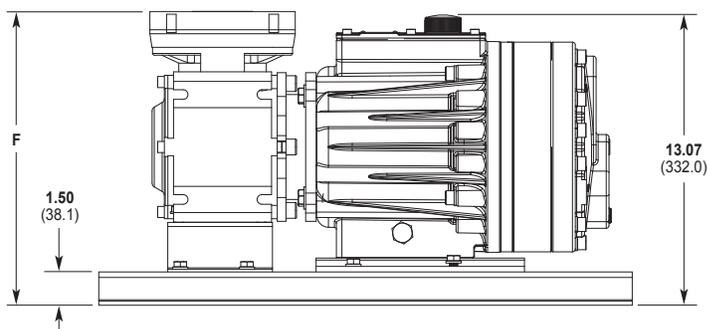
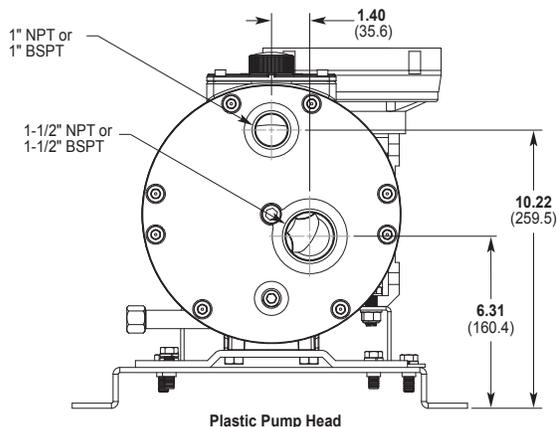
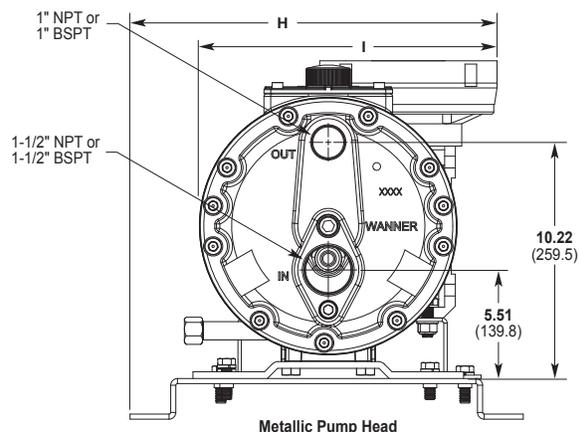


Dimensions in Inches (Millimeters)

| Input Frame Size | A | | B | C | D | E | F | G (Square Key) | H | I |
|------------------|--------------------|-------------------|---------------|----------------|------------------|-----------------|---------------|----------------|---------------|---------------|
| | Metallic Pump Head | Plastic Pump Head | | | | | | | | |
| NEMA 56C | 20.64 (524.3) | 21.56 (547.6) | 16.84 (427.7) | Ø 6.54 (Ø 166) | Ø 4.50 (Ø 114.3) | Ø 0.62 (Ø 15.7) | 10.43 (264.9) | 0.187 (4.75) | 10.74 (272.7) | 10.49 (266.4) |
| NEMA 143/145 TC | 20.64 (524.3) | 21.56 (547.6) | 16.84 (427.7) | Ø 6.54 (Ø 166) | Ø 4.50 (Ø 114.3) | Ø 0.87 (Ø 22.2) | 10.90 (276.9) | 0.187 (4.75) | 10.74 (272.7) | 10.49 (266.4) |
| NEMA 182/184 TC | 21.95 (557.5) | 22.88 (581.2) | 18.16 (461.3) | Ø 9.17 (Ø 233) | Ø 8.50 (Ø 215.9) | Ø 1.12 (Ø 28.4) | 12.03 (305.6) | 0.25 (6.35) | 12.06 (306.3) | 11.81 (300) |
| IEC 63 B5 | 20.13 (511.3) | 21.04 (534.4) | 16.33 (414.8) | Ø 5.51 (Ø 140) | Ø 3.74 (Ø 95) | Ø 0.43 (Ø 11) | 10.25 (260.4) | 0.157 (4) | 10.22 (259.6) | 9.97 (253.3) |
| IEC 71 B5 | 20.52 (521.2) | 21.44 (544.6) | 16.72 (424.7) | Ø 6.30 (Ø 160) | Ø 4.33 (Ø 110) | Ø 0.55 (Ø 14) | 10.25 (260.4) | 0.196 (5) | 10.62 (269.7) | 10.37 (263.4) |
| IEC 80 B5 | 21.30 (541) | 22.23 (564.7) | 17.5 (444.5) | Ø 7.87 (Ø 200) | Ø 5.12 (Ø 130) | Ø 0.75 (Ø 19) | 10.25 (260.4) | 0.236 (6) | 11.40 (289.6) | 11.15 (283.3) |
| IEC 90 B5 | 21.30 (541) | 22.23 (564.7) | 17.5 (444.5) | Ø 7.87 (Ø 200) | Ø 5.12 (Ø 130) | Ø 0.94 (Ø 24) | 10.25 (260.4) | 0.314 (8) | 11.40 (289.6) | 11.15 (283.3) |

P600 Dimensions (Cont'd)

P600 Models - F75



Dimensions in Inches (Millimeters)

| Input Frame Size | A | B | | C | D | E | F | G (Square Key) | H | I |
|------------------|---------------|--------------------|-------------------|----------------|------------------|-----------------|----------------|----------------|---------------|---------------|
| | | Metallic Pump Head | Plastic Pump Head | | | | | | | |
| NEMA 56C | 21.70 (551.2) | 20.70 (524.7) | 21.57 (547.9) | Ø 6.54 (Ø 166) | Ø 4.50 (Ø 114.3) | Ø 0.62 (Ø 15.7) | 13.22 (3.35.9) | 0.187 (4.75) | 13.53 (343.7) | 10.97 (278.7) |
| NEMA 143/145 TC | 21.70 (551.2) | 20.70 (524.7) | 21.57 (547.9) | Ø 6.54 (Ø 166) | Ø 4.50 (Ø 114.3) | Ø 0.87 (Ø 22.2) | 13.22 (3.35.9) | 0.187 (4.75) | 13.53 (343.7) | 10.97 (278.7) |
| NEMA 182/183 TC | 23.01 (583.6) | 22.01 (561.3) | 22.11 (561.6) | Ø 9.17 (Ø 233) | Ø 8.50 (Ø 215.9) | Ø 1.12 (Ø 26.6) | 13.77 (3.49.8) | 0.250 (6.35) | 14.84 (376.9) | 12.29 (312.2) |
| IEC 71 B5 | 21.58 (548.3) | 20.58 (522.7) | 21.45 (544.8) | Ø 6.30 (Ø 160) | Ø 4.33 (Ø 110) | Ø 0.55 (Ø 14) | 13.42 (340.7) | 0.196 (5) | 13.41 (340.6) | 10.85 (275.6) |
| IEC 80 B5 | 22.36 (568.2) | 21.36 (542.5) | 21.16 (562.9) | Ø 7.87 (Ø 200) | Ø 5.12 (Ø 130) | Ø 0.75 (Ø 19) | 13.42 (340.7) | 0.236 (6) | 14.20 (360.6) | 11.63 (295.5) |
| IEC 90 B5 | 22.36 (568.2) | 21.36 (542.5) | 21.16 (562.9) | Ø 7.87 (Ø 200) | Ø 5.12 (Ø 130) | Ø 0.94 (Ø 24) | 13.42 (340.7) | 0.314 (8) | 14.20 (360.6) | 11.63 (295.5) |
| IEC 100/112 B14 | 21.58 (548.3) | 20.58 (522.7) | 21.45 (544.8) | Ø 6.30 (Ø 160) | Ø 4.33 (Ø 110) | Ø 1.10 (Ø 28) | 13.42 (340.7) | 0.314 (8) | 13.41 (340.6) | 10.85 (275.6) |

P600 Installation

Location

Locate the pump as close to the supply source as possible.
Install the pump system in a lighted clean space where it will be easy to inspect and maintain.

Motor and Controller

The P Series pump shaft can rotate in either direction, therefore direction of motor shaft rotation is not critical.

Flow rate is determined by motor speed, which is controlled using an inverter duty constant torque motor and VFD. Flow rate functions can also be easily controlled using the Hydra-Cell Control Freak and appropriate motor.

Accessories

Consult installation drawing below for typical metering fluid system components. Contact Wanner Engineering or the distributor in your area for more details.

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** on page 6.

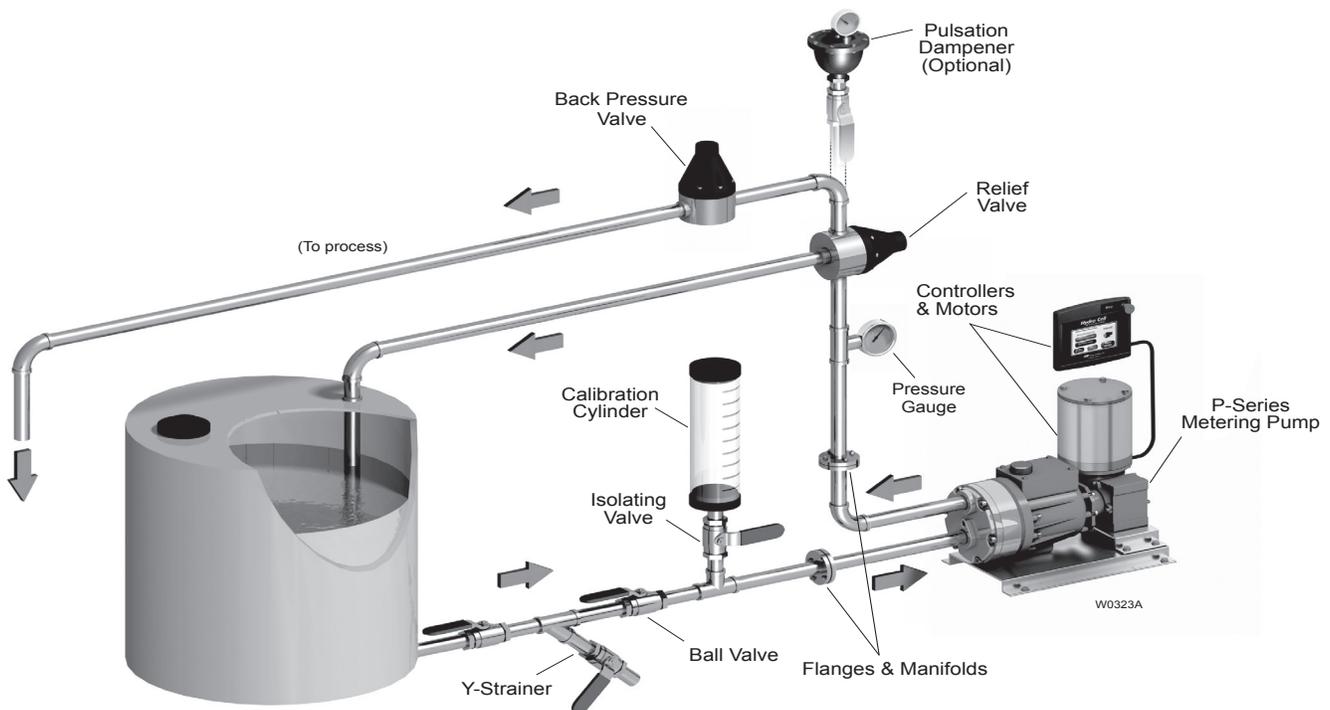
Positive Displacement. This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, install a relief valve downstream from the pump. See **Discharge Piping** on page 6.

Safety Guards. 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.

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)



Typical Metering Installation

P600 Installation (Cont'd)

Safety Precautions

General remarks

These safety / installation instructions contain fundamental information and precautionary notes and must be kept available to all associated with the operation of the pump. Please read them thoroughly prior to installation, electrical connection and commissioning of the unit. It is imperative that all other operating instructions relating to the components of individual units are followed.

These safety / installation instructions do not take local regulations into account. The operator must ensure that such regulations are observed by all, including the personnel carrying out the installation.

Each pump must be labeled by the end user to warn of any hazards that the system process may produce; e.g. corrosive chemicals or hot process etc.

All personnel involved in the operation, maintenance, inspection and installation of the pump must be fully qualified to carry out the work. The personnel's responsibilities, competence and supervision must be clearly defined by the operator. To the extent that if the personnel in question is not already in possession of the requisite know how, appropriate training and instruction must be provided. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by all the responsible personnel.

When installing a Hydra-Cell pump in conjunction with a motor or motor and frequency controller the relevant manuals must be referred to for electromagnetic compatibility. The installation should conform to EN 61800 and EN 60204 as applicable.

All safety instructions in this manual and all relevant local health and safety regulations must be followed.

Attention must be paid to the weight of the pump before attempting to lift either manually or selecting appropriate lifting equipment.

Inlet Piping

Provide for permanent or temporary installation of a compound pressure gauge to monitor the inlet pressure. To maintain maximum flow, the pump inlet should be under flooded suction conditions at all times. **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.

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

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

Hose Sizing and Routing

To minimize acceleration head and frictional losses, size the suction line at least one size larger than the pump inlet, and keep the suction line as short and direct as possible.

Recommendations:

- Keep inlet lines less than 3 ft. (1 m) long
- Use at least 1-1/2" (38 mm) I.D. inlet hose
- Minimize fittings (elbows, valves, tees, etc.)

Inlet Piping (Pressure Feed)

Provide for permanent or temporary installation of a pressure gauge to monitor the inlet pressure. Pressure at the pump inlet should not exceed 250 psi (17 bar); if it could get higher, install a pressure reducing valve. **Do not supply more than one pump from the same inlet line.**

Note: System back pressure must exceed the pump inlet pressure by at least 15 psi (1 bar) in order to prevent flow thru.

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 (103 bar) W.P.-rated hose for systems to be operated at 1000 psi (69 bar) gauge pressure.

Support the pump and piping independently.

Pressure Regulation

Install a pressure relief valve in the discharge line. Bypass pressure must not exceed the pressure limit of the pump.

Size the valve 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 relief 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 valve.

Route the bypass line to the supply tank.

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

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

Minimum Discharge Pressure

To ensure proper capacity control, a minimum discharge pressure of 50 psi (3.5 bar) is required.

P600 Installation (Cont'd)

Initial Start-Up Procedure

Before you start pump, be sure that:

- All shut-off valves are open, and the pump has an adequate supply of fluid.
 - All connections are tight.
 - The oil level is 1/4 inch (6 mm) above the cast surface in the upper oil reservoir.
1. Open priming valve on system back pressure valve so pump starts under minimum pressure.
 2. Turn on power to pump motor.
 3. Check inlet pressure or vacuum. To maintain maximum flow, pump inlet should be under flooded suction conditions at all times. Inlet pressure must not exceed 250 psi (17 bar).
 4. Listen for any erratic noise and look for unsteady flow.
 - Jog pump on and off until fluid coming from priming valve is air-free.
 - Close priming valve.

Calibration

Note: Each metering pump or pump system must be calibrated to determine the pump speed required for the desired flow rate.

Accurate calibration depends on pump discharge pressure and system conditions. When calibrating the pump or system, it is useful to plot capacity curves for future reference. Observe on the curve, that pump capacity decreases slightly as discharge pressure increases.

In order to achieve the best possible results, perform calibration under actual process conditions. Follow these steps:

1. Run pump for 20 minutes at actual process conditions. If process system cannot be used, circulate back to supply tank through pressure relief valve (see Typical Metering Installation drawing). If required system pressure is less than 50 psi (3.5 bar) back pressure valve must be installed and set to produce minimum of 50 psi (3.5 bar) pressure at pump head.
2. Determine maximum pump speed required for all system conditions that need to be satisfied. Measure pump delivery at this maximum speed using system calibration cylinder, flow meter, or similar container. This is the "rated capacity" for pump.
3. Measure pump delivery at 100%, 75%, 50%, 25%, and 10% of maximum speed just determined. Let pump run for 5 minutes at each speed setting before taking capacity measurement.

P600 Maintenance

Note: The numbers in parentheses are Reference Numbers located in the Parts List exploded views of this manual.

Periodically

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

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

1. Check inlet pressure periodically with gauge.
2. Change oil according to hours guidelines in table.
3. Change oil as follows:
 - a. Remove brass cap (34), and allow oil and contaminants to drain completely. Catch oil and dispose of properly.
 - b. Use suitable Hydra-Oil for the application and pump components.

Pump Operation Hours Between Oil Changes at Various Process Fluid Temperatures

| Pressure | <90°F (32°C) | <139°F (60°C) | <180°F (82°C) |
|-------------------------------|-----------------|------------------|------------------|
| Metallic Pump Head | | | |
| <650 psi (45 bar) | 6,000 | 4,500 | 3,000 |
| <1000 psi (70 bar) | 4,000 | 3,000 | 2,000 |
| Non-Metallic Pump Head | | | |
| <250 psi (17 bar) | 4,000 | 3,000 | — |

Note: Minimum oil viscosity for proper hydraulic end lubrication is 16-20 cST (80-100 SSU). P-Series replacement parts kits (complete kits and diaphragm kits) include suitable oil for each P Series pump configuration.

CAUTION: If you are losing oil but don't see any external leakage, or if the oil becomes discolored and contaminated, the diaphragm (22) may be damaged. Refer to the Fluid End Service and Troubleshooting Sections. Do not operate the pump with a damaged diaphragm.

P600 Fluid End Service

Note: The reference numbers in parentheses are shown in the Fluid End Parts List.

This section explains how to disassemble and inspect all easily-serviceable parts of the pump fluid end.

CAUTION: Disassembly of the hydraulic end of the pump should be performed only by a qualified technician. For assistance, contact Wanner Engineering (612-332-5681) or the distributor in your area.

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

1. Remove Manifold (7), Valve Plate (18)

- Remove all bolts (5) around manifold (7). Do not remove four bolts (26) installed through back of pump housing.
- With 3/8 in. (10 mm) hex Allen wrench, remove center bolt (1) and washer (2) in center of 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 manifold (7) and support plate (43). (Support plate (43) is used only with non-metallic pump head.)
- 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. A warped manifold should be replaced.
- Remove three socket-head cap screws (39) with 3/16 in. (5 mm) hex Allen wrench.
- Inspect valve plate (18) in same manner as manifold.

Note: Plastic valve plates and manifolds should also be inspected for cracks, and replaced if necessary.

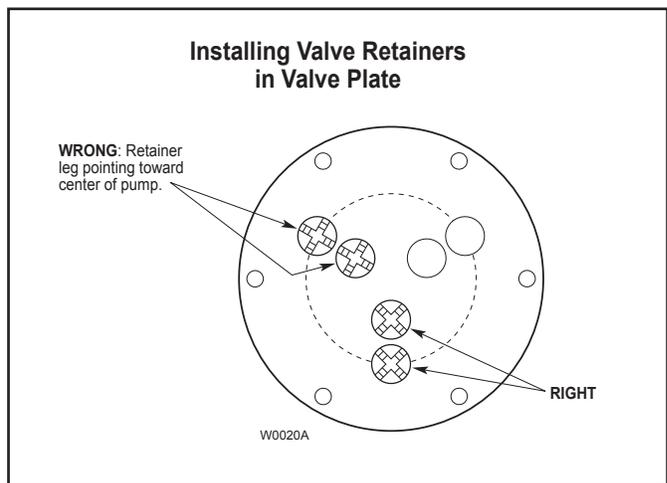
2. Inspect Valves (11-16, 38)

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

- Check spring retainer (16), and replace if worn. **Note:** if your pump has a non-metallic pump head there will be a plastic dampening washer (38) at the bottom of each seat. Inspect each one for wear or cracks and replace if necessary.
- Check valve spring (14). If shorter than new spring, replace (**Do not stretch old spring.**)
- Check valve (13). If worn excessively, replace.

Note: If your pump has plastic spring retainers, there is a tetra seal (flat O-ring, 15) between the retainer (16) and valve seat (12).

- Remove valve seat (12) and O-ring (11). A seat remover is included in Wanner Tool Kit. On cast iron valve plates, be careful not to break metal ridge around O-ring groove. Inspect valve seat for wear, and replace if necessary. A new O-ring should be installed.
- Reinstall the inlet and outlet valve assemblies:
 - Clean valve ports and shoulders with emery cloth, and lubricate with lubricating gel or petroleum jelly.
 - Install O-ring (11) on valve seat (12).
 - Inlet Valves (3 center valves in illustration below).** Insert spring retainer (16) into valve plate (18). Then insert spring (14), valve (13), and valve seat (12). If pump has plastic spring retainers, install flat Tetra seal O-ring (15) between spring retainer and valve seat. Insert dampening washer (38), if included in your valve assembly.
 - Outlet Valves (3 outer valves in illustration below).** Insert dampening washer (38), if included in your valve assembly. Insert valve seat (12), valve (13), spring (14), and spring retainer (16). If pump has **plastic** spring retainers, install flat Tetra seal O-ring (15) between spring retainer and valve seat. If pump has **metal** spring retainers in outlet valves, position them so leg does not point toward center of pump (See illustration below.)



P600 Fluid End Service (Cont'd)

3. Inspect and Replace Diaphragms (22)

If necessary to service diaphragms, remove two socket-head cap screws (39) that secure valve plate (18) to cylinder casting (25). Inspect valve plate the same as manifold in Paragraph 1, step d.

- a. Lift diaphragm (22) by one edge, and turn pump shaft (**use the shaft rotator from the Wanner Tool Kit**) until diaphragm pulls up. This will expose machined cross holes in valve plunger shaft behind diaphragm.
- b. Insert plunger holder (**from the Wanner Tool Kit**) through one of machined cross holes to hold diaphragm up. Don't remove tool until new diaphragm is installed in step f below.
- c. Remove screw (19), O-ring (20), and follower (21) in center of diaphragm (22).
- d. Remove diaphragm and inspect diaphragm carefully. A damaged diaphragm generally indicates a pumping system problem. Replacing diaphragm only, will not solve the larger problem. Inspect diaphragm for following:
 - **Puncture.** Usually caused by sharp foreign object in fluid.
 - **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.
 - **Diaphragm edge chewed away.** Usually caused by over-pressurizing system.
- e. Inspect plunger (23) 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 (22) (or old one, if not damaged), ridge side out.
- g. Clean screw (19) and remove any oil from it. Apply medium-strength thread locker to screw. Reinstall screw, follower (21), and new O-ring (20). Tighten to 18 in-lbs (2.0 N-m).
- h. Repeat above inspection procedure (and replacement, if necessary) with other two diaphragms.

4. Flush Contaminant from Hydraulic End

(Only if a diaphragm has ruptured)

- a. Remove oil drain cap (34) and allow all oil and contaminant to drain out.
- b. Fill reservoir with compatible solvent. Manually turn pump shaft to circulate compatible solvent and drain. Use the shaft rotator provided in Wanner Tool Kit (Part No. A03-175-1102). Dispose of contaminated fluid properly.

CAUTION: If you have an EPDM diaphragm, 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.
- c. Repeat step b. flushing procedure.
- d. Fill reservoir with fresh oil, manually turn pump shaft to circulate oil. Drain oil.

Note: P Series replacement parts kits (complete kits and diaphragm kits) include the correct oil for each specific P Series pump configuration.
- e. Refill reservoir with fresh oil. If oil appears milky, there is still contaminant in reservoir. Repeat steps c and d until oil appears clean.

5. Priming Hydraulic Cells

Note: Providing oil prime to 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 (18) without outlet valves installed (or else remove outlet valves; leave seats installed) on cylinder housing. Tighten three socket-head screws (39).
- b. Fill reservoir with appropriate Hydra-oil to fill port.

Note: P Series replacement parts kits (complete kits and diaphragm kits) include the correct oil for each specific P Series pump configuration.
- c. With blunt pointer (eraser end of pencil), reach in through each outlet valve port and push diaphragm (22) 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 to 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 (28) and O-ring (27).
- e. Install outlet valve assemblies in each outlet valve port. See Parts list for correct assembly order. If necessary, tip pump (head upward) to keep valve (13) centered on valve seat (12) and allow valve retainer (16) to fit flush with port.
- f. Install manifold (7) and complete installation.

P600 Fluid End Service (Cont'd)

5. Priming Hydraulic Cells (Cont'd)

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

- a. With pump horizontal, and the fluid-end head removed, fill reservoir with correct Hydra-oil to fill port.

Note: P Series replacement parts kits (complete kits and diaphragm kits) include the correct oil for each specific P Series pump configuration.

- c. Have catch basin for oil that leaks from behind diaphragms when priming. Catch oil and dispose of properly. **Do not reuse oil.**
- c. All air in oil within hydraulic piston behind diaphragms (22) must be forced out by turning shaft (and pumping piston). A 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.
- d. Quickly attach loaded valve plate (18) (before oil runs out past diaphragms) with socket head screws (39), but do not tighten completely. Leave gap between valve plate and the cylinder housing (25). Turn shaft 2-3 turns to finish forcing out air behind diaphragms. Hydraulic cells are now primed. Finish tightening valve plate with two socket head screws and add pump manifold (7).
- e. Wipe excess oil from around pump head.
- f. Check that oil level is 1 inch (25 mm) from top of fill port.
- g. Replace oil fill cap (28) and O-ring (27) and complete installation.

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). The pressure source is required to hold the diaphragms back while the piston moves so as to force out the air.

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

Note: P Series replacement parts kits (complete kits and diaphragm kits) include the correct oil for each specific P Series pump configuration.

- b. **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.
- c. 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" (25 mm), hydraulic cells are primed.
- d. Replace oil fill cap (28) and O-ring (27) and complete installation.

- e. **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 (22). This will force air out from inside pistons. Observe see bubbles at reservoir opening. Repeat for several rotations until no more air bubbles come out and reservoir level has dropped about 1" (25 mm). Hydraulic cells are now primed.
- f. Replace oil fill cap (28) and O-ring (27) and complete installation.

6. Reinstall Valve Plate (18), Manifold (7)

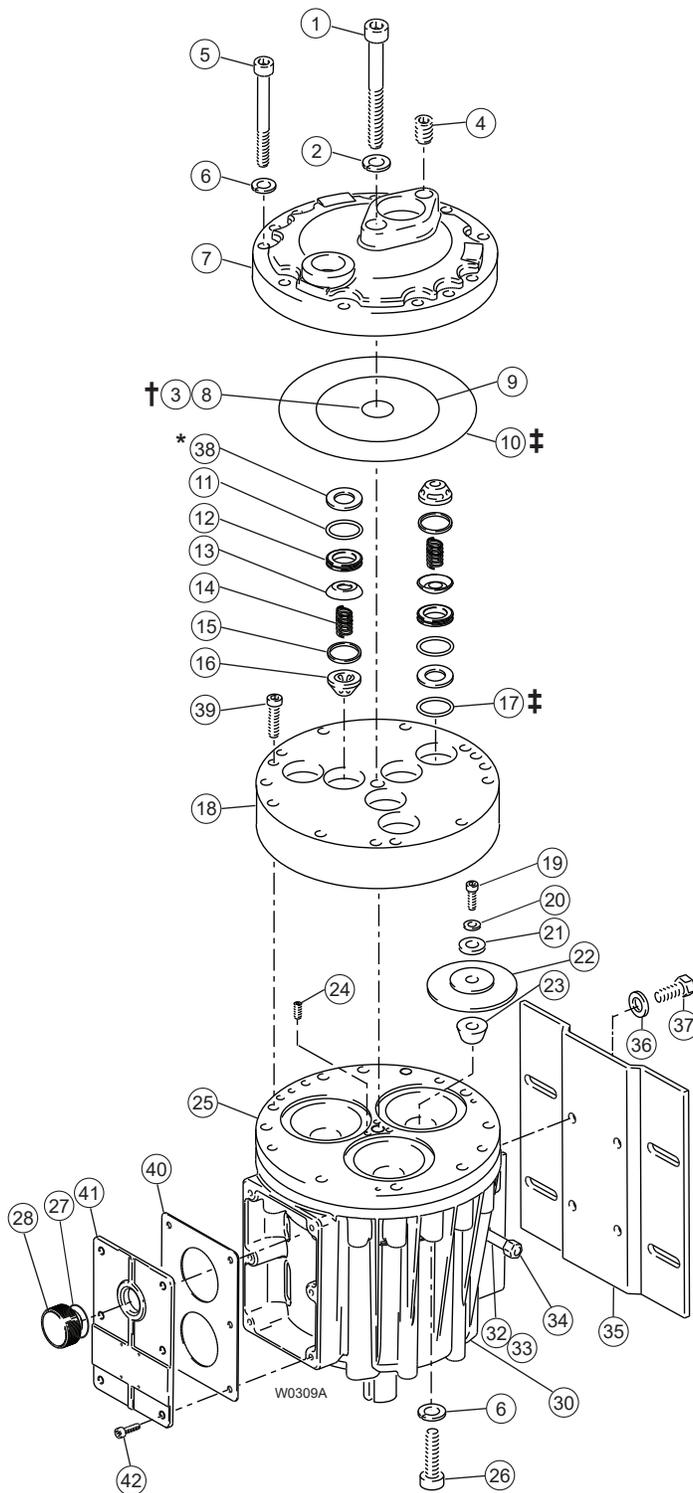
Note: Use the cap screw (26) protruding through the cylinder casting at the 10 o'clock position to locate the valve plate on the cylinder casting. Place the "blind hole" on the valve plate over this bolt.

- a. With valve assemblies installed as outlined above, reinstall valve plate (18) onto cylinder housing (25). Recheck that blind hole is over protruding bolt at 10 o'clock position. Install two socket-head cap screws (39) and secure valve plate to cylinder casting.
- b. Reinstall O-rings (8,9,10) on rear side of the manifold (7). Use petroleum jelly or lubricating gel to hold them in place.
- c. Reinstall manifold onto valve plate. Be sure drain plug (4) is installed in manifold.

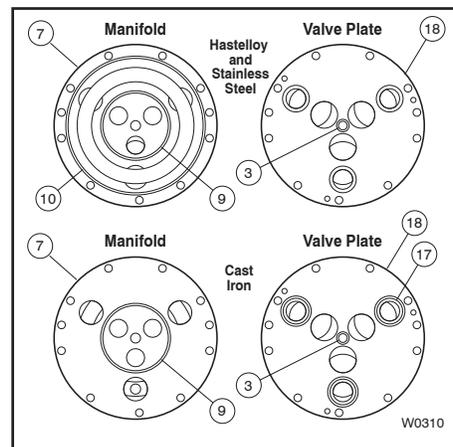
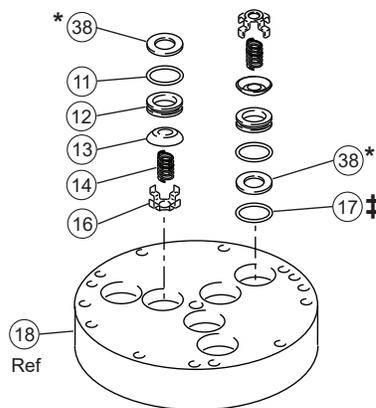
Note: on pumps with non-metallic head, position support plate (43) onto manifold with ports and bolt holes aligned correctly.

- d. Insert bolts (5) and washers (6). Hand tighten.
- e. Reinstall center bolt (1) with washer (2), and torque to 45 ft-lbs (60 N-m).
- f. Alternately tighten six perimeter bolts (5). Torque to 45 ft-lbs (60 N-m).
- g. Recheck all bolts for tightness.

P600 Fluid End Parts, metal



Valve Assemblies with metal spring retainers



† With brass external-centerbolt models, use #8; with all other models, use #3.

‡ With cast iron pump heads, use #17 and not #10; with all other heads, use #10 and not #17.

* Not included with brass pump heads.

| Ref. No. | Part Number | Description | Quantity/ Pump |
|----------|--------------|------------------------------|-------------------|
| 1 | G25-081-2019 | Screw, Cap, soc-hd, SST | 1 |
| 2 | G10-084-1010 | Washer, Flat, SST | 1 |
| 3 | D25-083-2110 | O-ring, Centerbolt, Buna-N | 1 |
| | D25-083-2111 | O-ring, Centerbolt, FKM | 1 |
| | D25-083-2112 | O-ring, Centerbolt, Neoprene | 1 |
| | D25-083-2113 | O-ring, Centerbolt, EPDM | 1 |
| | D25-083-2118 | O-ring, Centerbolt, PTFE | 1 |
| 4 | D25-038-2017 | Plug, Hastelloy C, NPT | 1 |
| | D25-038-2211 | Plug, 316 SST, NPT | 1 |
| | G25-038-2017 | Plug, Hastelloy C, BSPT | 1 |
| | G25-038-2211 | Plug, 316 SST, BSPT | 1 |
| 5 | G25-024-2019 | Screw, Cap, soc-hd, SST | 11 |
| 6 | G25-048-2012 | Washer, Split lock, SST | 25 |

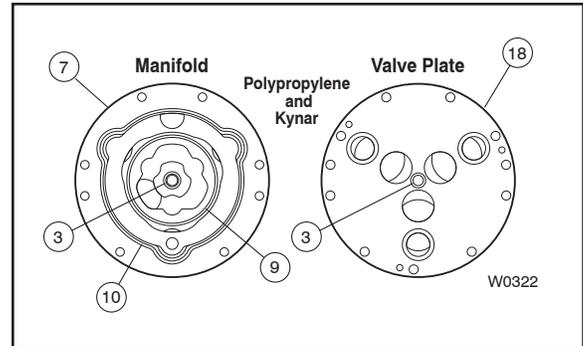
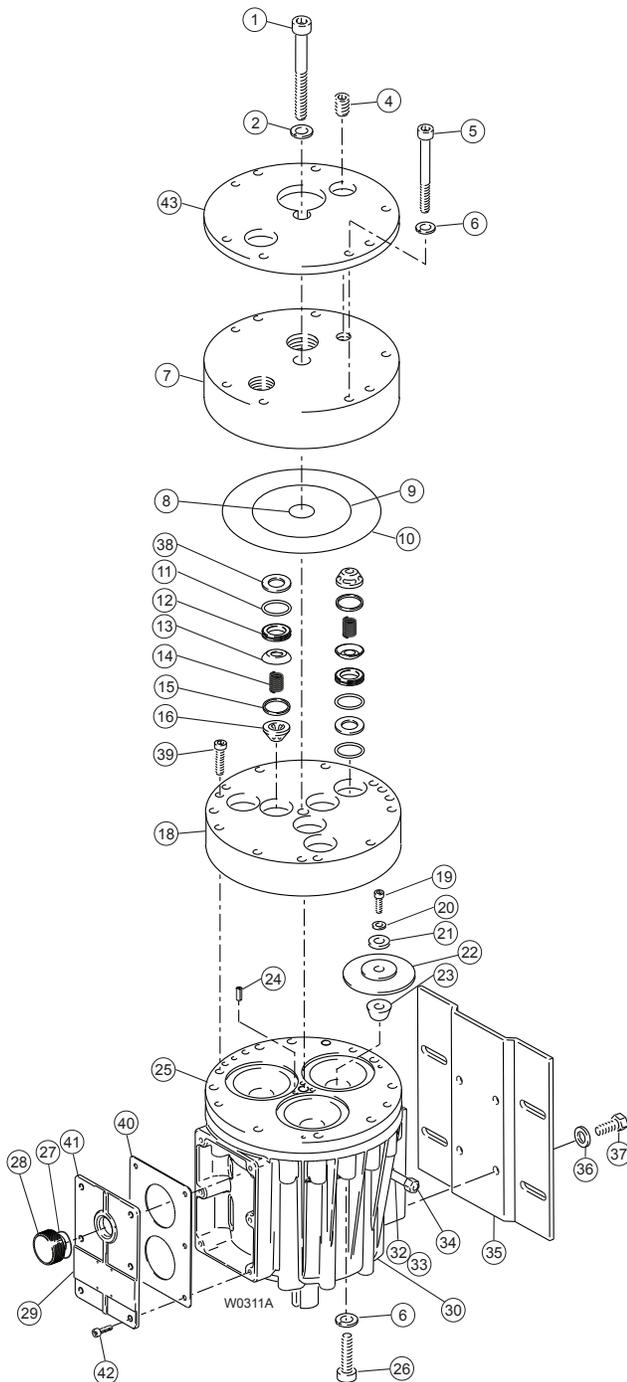
P600 Fluid End Parts, metal (Cont'd)

| Ref. No. | Part Number | Description | Quantity/ Pump | Ref. No. | Part Number | Description | Quantity/ Pump |
|-------------|--|--|-------------------|-------------|--------------|--------------------------------------|-------------------|
| 7 | D25-004-1010 | Manifold, Brass, NPT | 1 | 18 | D25-003-1010 | Valve Plate, Brass | 1 |
| | D25-004-1022 | Manifold, 316 SST, NPT | 1 | | D25-003-1012 | Valve Plate, 316 SST | 1 |
| | D25-004-1026 | Manifold, Cast iron, NPT | 1 | | D25-003-1016 | Valve Plate, Cast iron | 1 |
| | D25-004-1029 | Manifold, Hastelloy C, NPT | 1 | | D25-003-1029 | Valve Plate, Hastelloy C | 1 |
| | D25-004-1081 | Manifold, ANSI flange, 150 x 600 | 1 | 19 | D25-030-2010 | Screw, Flat-hd, 316 SST | 3 |
| | G25-004-1010 | Manifold, Brass, BSPT | 1 | | D25-030-2011 | Screw, Flat-hd, Hastelloy C | 3 |
| | G25-004-1022 | Manifold, 316 SST, BSPT | 1 | 20 | D25-047-2110 | O-ring, Follower, Buna-N | 3 |
| | G25-004-1026 | Manifold, Cast iron, BSPT | 1 | | D25-047-2111 | O-ring, Follower, FKM | 3 |
| | G25-004-1029 | Manifold, Hastelloy C, BSPT | 1 | | D25-047-2112 | O-ring, Follower, Neoprene | 3 |
| 8 | D10-083-2110 | O-ring, center manifold, Buna-N(1) | 1 | | D25-047-2113 | O-ring, Follower, EPDM | 3 |
| | D10-083-2111 | O-ring, center manifold, FKM(1) | 1 | | D25-047-2118 | O-ring, Follower, PTFE | 3 |
| | D10-083-2112 | O-ring, center manifold, Neoprene(1) | 1 | 21 | D25-017-1010 | Follower, 316 SST | 3 |
| | D10-083-2113 | O-ring, center manifold, EPDM(1) | 1 | | D25-017-1011 | Follower, Hastelloy C | 3 |
| | D10-083-2118 | O-ring, center manifold, PTFE(1) | 1 | 22 | D25-018-2312 | Diaphragm, Neoprene | 3 |
| 9 | D25-073-2110 | O-ring, Inner manifold, Buna-N | 1 | | D25-018-2313 | Diaphragm, EPDM | 3 |
| | D25-073-2111 | O-ring, Inner manifold, FKM | 1 | | D25-018-2315 | Diaphragm, FKM | 3 |
| | D25-073-2112 | O-ring, Inner manifold, Neoprene | 1 | | D25-018-2318 | Diaphragm, PTFE | 3 |
| | D25-073-2113 | O-ring, Inner manifold EPDM | 1 | | D25-018-2320 | Diaphragm, Buna-N | 3 |
| | D25-073-2118 | O-ring, Inner manifold, PTFE | 1 | | D25-018-2325 | Diaphragm, Aflas | 3 |
| | (Use on Brass, SST and Hastelloy Pump Heads only) .. | | | 23 | D25-016-1010 | Plunger | 3 |
| 10 | D25-097-2110 | O-ring, Outer manifold, Buna-N | 1 | 24 | G25-082-2010 | Set Screw | 3 |
| | D25-097-2111 | O-ring, Outer manifold, FKM | 1 | 25 | K25-002-1220 | Cylinder Housing Assembly(2) | 1 |
| | D25-097-2112 | O-ring, Outer manifold Neoprene | 1 | | K25-002-1020 | Cylinder Housing | 1 |
| | D25-097-2113 | O-ring, Outer manifold EPDM | 1 | 26 | H25-087-2020 | Screw, Cap, soc-hd, SST | 4 |
| | D25-097-2118 | O-ring, Outer manifold, PTFE | 1 | 27 | D10-080-2110 | O-ring, Buna-N | 1 |
| 11 | D25-035-2110 | O-ring, Valve seat, Buna-N | 6 | 28 | D03-039-1030 | Cap with O-ring, Oil fill | 1 |
| | D25-035-2111 | O-ring, Valve seat, FKM | 6 | 30 | H25-001-1233 | Pump Housing, HCMS | 1 |
| | D25-035-2112 | O-ring, Valve seat, Neoprene | 6 | 31 | G10-028-2011 | Nut, Hex-hd, SST | 10 |
| | D25-035-2113 | O-ring, Valve seat, EPDM | 6 | 32 | D25-076-2210 | Elbow, 3/8" | 1 |
| | D25-035-2118 | O-ring, Valve seat, PTFE | 6 | 33 | D25-077-2210 | Pipe, 3/8" | 1 |
| 12 | D25-020-1012 | Valve Seat, Nitronic 50 | 6 | 34 | D25-078-2210 | Cap, 3/8" | 1 |
| | D25-020-1016 | Valve Seat, Tungsten carbide | 6 | 35 | D25-025-1033 | Base | 1 |
| | D25-020-1017 | Valve Seat, Hastelloy C | 6 | 36 | G25-054-2010 | Washer, Shakeproof, M10 | 4 |
| | D25-020-3300 | Valve Seat, Ceramic | 6 | 37 | G10-029-2010 | Screw, Cap, hex-hd | 4 |
| 13 | D25-021-1011 | Valve, Nitronic 50 | 6 | 38 | D25-125-1017 | Washer, Dampening, Hastelloy C | 6 |
| | D25-021-1016 | Valve, Tungsten carbide | 6 | 39 | G25-088-2010 | Screw, Cap, soc-hd | 3 |
| | D25-021-1017 | Valve, Hastelloy C | 6 | 40 | G25-106-2318 | Gasket, Cover | 1 |
| | D25-021-3300 | Valve, Ceramic | 6 | 41 | H25-105-1018 | Housing cover | 1 |
| 14 | D25-022-3114 | Valve Spring, Elgiloy | 6 | 42 | G25-090-2010 | Screw, Cap, hex-hd | 6 |
| | D25-022-3115 | Valve Spring, Hastelloy C | 6 | | | | |
| 15 | D25-092-2110 | Tetra Seal, Buna-N | 6 | | | | |
| | D25-092-2111 | Tetra Seal, FKM | 6 | | | | |
| | D25-092-2112 | Tetra Seal, Neoprene | 6 | | | | |
| | D25-092-2113 | Tetra Seal, EPDM | 6 | | | | |
| | D25-092-2118 | O-ring, PTFE | 6 | | | | |
| 16 | D25-023-1017 | Retainer, Valve spring, Hastelloy C | 6 | | | | |
| | (Use on Cast Iron Pumping Heads only) | | | | | | |
| 17 | D25-074-2110 | O-ring, Outlet valve, Buna-N | 3 | | | | |
| | D25-074-2111 | O-ring, Outlet valve, FKM | 3 | | | | |
| | D25-074-2112 | O-ring, Outlet valve, Neoprene | 3 | | | | |
| | D25-074-2113 | O-ring, Outlet valve, EPDM | 3 | | | | |
| | D25-074-2118 | O-ring, Outlet valve, PTFE | 3 | | | | |

(1) With brass extenal-centerbolt models, use item 8; with all other models, use item 3.

(2) Cylinder Housing Assembly includes: cylinder housing (25), bearing adjusting plate (61), O-ring (60), screws (24), and bearing cup (62A).

P600 Fluid End Parts, non-metal



| Ref. No. | Part Number | Description | Quantity/ Pump |
|----------|--------------|-----------------------------------|-------------------|
| 1 | G25-081-2018 | Screw, Cap, soc-hd, SST | 1 |
| 2 | G10-084-1010 | Washer, Flat, SST | 1 |
| 4 | D25-038-2017 | Plug, Hastelloy C, NPT | 1 |
| | D25-038-2211 | Plug, 316 SST, NPT | 1 |
| | G25-038-2017 | Plug, Hastelloy C, BSPT | 1 |
| | G25-038-2211 | Plug, 316 SST, BSPT | 1 |
| 5 | G25-024-2018 | Screw, Cap, hex-hd, SST | 8 |
| 6 | G25-048-2012 | Washer, Split lock, SST | 16 |
| 7 | D25-004-1054 | Manifold, Polypropylene, NPT | 1 |
| | D25-004-1057 | Manifold, PVDF, NPT | 1 |
| | G25-004-1054 | Manifold, Polypropylene, BSPT | 1 |
| | G25-004-1057 | Manifold, PVDF, BSPT | 1 |
| 8 | D10-083-2110 | O-ring, Center manifold, Buna-N | 1 |
| | D10-083-2111 | O-ring, Center manifold, FKM | 1 |
| | D10-083-2112 | O-ring, Center manifold, Neoprene | 1 |
| | D10-083-2113 | O-ring, Center manifold, EPDM | 1 |
| | D10-083-2118 | O-ring, Center manifold, PTFE | 1 |
| 9 | D25-073-2110 | O-ring, Inner manifold, Buna-N | 1 |
| | D25-073-2111 | O-ring, Inner manifold, FKM | 1 |
| | D25-073-2112 | O-ring, Inner manifold, Neoprene | 1 |
| | D25-073-2113 | O-ring, Inner manifold, EPDM | 1 |
| | D10-073-2118 | O-ring, Inner manifold, PTFE | 1 |
| 10 | D25-109-2110 | O-ring, Outer manifold, Buna-N | 1 |
| | D25-109-2111 | O-ring, Outer manifold, FKM | 1 |
| | D25-109-2112 | O-ring, Outer manifold, Neoprene | 1 |
| | D25-109-2113 | O-ring, Outer manifold, EPDM | 1 |
| | D25-109-2118 | O-ring, Outer manifold, PTFE | 1 |

P600 Fluid End Parts, non-metal (Cont'd)

| Ref. No. | Part Number | Description | Quantity/ Pump | Ref. No. | Part Number | Description | Quantity/ Pump |
|----------|--------------|--|-------------------|----------|--------------|----------------------------------|-------------------|
| 11 | D25-035-2110 | O-ring, Valve seat, Buna-N | 6 | 31 | G10-028-2011 | Nut, Hex-hd, SST | 8 |
| | D25-035-2111 | O-ring, Valve seat, FKM | 6 | 32 | D25-076-2210 | Elbow, 3/8" | 1 |
| | D25-035-2112 | O-ring, Valve seat, Neoprene | 6 | 33 | D25-077-2210 | Pipe, 3/8" | 1 |
| | D25-035-2113 | O-ring, Valve seat, EPDM | 6 | 34 | D25-078-2210 | Cap, 3/8" | 1 |
| | D25-035-2118 | O-ring, Valve seat, PTFE | 6 | 35 | D25-025-1033 | Base | 1 |
| 12 | D25-020-1012 | Valve seat, Nitronic 50 | 6 | 36 | G25-054-2010 | Washer, Shakeproof, M10 | 4 |
| | D25-020-1016 | Valve Seat, Tungsten carbide | 6 | 37 | G10-029-2010 | Screw, Cap, hex-hd | 4 |
| | D25-020-1017 | Valve seat, Hastelloy C | 6 | 38 | D25-125-2317 | Washer, Dampening, polypropylene | 6 |
| | D25-020-3300 | Valve seat, Ceramic | 6 | | D25-125-2318 | Washer, Dampening, PVDF | 6 |
| 13 | D25-021-1011 | Valve, Nitronic 50 | 6 | 39 | G25-088-2010 | Screw, Cap, soc-hd | 3 |
| | D25-021-1016 | Valve, Tungsten carbide | 6 | 40 | G25-106-2318 | Gasket, cover | 1 |
| | D25-021-1017 | Valve, Hastelloy C | 6 | 41 | H25-105-1018 | Housing cover | 1 |
| | D25-021-3300 | Valve, Ceramic | 6 | 42 | G25-090-2010 | Screw, Cap, hex-hd | 6 |
| 14 | D25-022-3114 | Valve Spring, Elgiloy | 6 | 43 | D25-100-1033 | Manifold support | 1 |
| | D25-022-3115 | Valve Spring, Hastelloy C | 6 | | | | |
| 15 | D25-092-2110 | Tetra Seal, Buna-N | 6 | | | | |
| | D25-092-2111 | Tetra Seal, FKM | 6 | | | | |
| | D25-092-2112 | Tetra Seal, Neoprene | 6 | | | | |
| | D25-092-2113 | Tetra Seal, EPDM | 6 | | | | |
| | D25-092-2118 | O-ring, PTFE | 6 | | | | |
| 16 | D25-023-2317 | Retainer, Valve spring, polypropylene | 6 | | | | |
| | D25-023-2318 | Retainer, Valve spring, PVDF | 6 | | | | |
| 18 | D25-003-1050 | Valve plate, Polypropylene | 1 | | | | |
| | D25-003-1053 | Valve plate, PVDF | 1 | | | | |
| 19 | D25-030-2010 | Screw, Flat-hd, 316 SST | 3 | | | | |
| | D25-030-2011 | Screw, Flat-hd, Hastelloy C | 3 | | | | |
| 20 | D25-047-2110 | O-ring, Follower, Buna-N | 3 | | | | |
| | D25-047-2111 | O-ring, Follower, FKM | 3 | | | | |
| | D25-047-2112 | O-ring, Follower, Neoprene | 3 | | | | |
| | D25-047-2113 | O-ring, Follower, EPDM | 3 | | | | |
| | D25-047-2118 | O-ring, Follower, PTFE | 3 | | | | |
| 21 | D25-017-1010 | Follower, 316 SST | 3 | | | | |
| | D25-017-1011 | Follower, Hastelloy C | 3 | | | | |
| 22 | D25-018-2312 | Diaphragm, Neoprene | 3 | | | | |
| | D25-018-2313 | Diaphragm, EPDM | 3 | | | | |
| | D25-018-2315 | Diaphragm, FKM | 3 | | | | |
| | D25-018-2320 | Diaphragm, Buna-N | 3 | | | | |
| | D25-018-2318 | Diaphragm, PTFE | 3 | | | | |
| | D25-018-2325 | Diaphragm, Aflas | 3 | | | | |
| 23 | D25-016-1010 | Plunger | 3 | | | | |
| 24 | G25-082-2010 | Set Screw | 3 | | | | |
| 25 | K25-002-1210 | Cylinder Housing Assembly(1) | 1 | | | | |
| | K25-002-1020 | Cylinder Housing | 1 | | | | |
| 26 | H25-087-2020 | Screw, Cap, soc-hd, SST | 4 | | | | |
| 27 | D10-080-2110 | O-ring, Buna-N | 1 | | | | |
| 28 | D03-039-1030 | Cap, Oil fill (includes breather and O-ring) | 1 | | | | |
| 29 | D10-040-2420 | Nameplate | 1 | | | | |
| 30 | H25-001-1233 | Pump Housing | 1 | | | | |

(1) Cylinder Housing Assembly includes cylinder casting (25), bearing cup (62A), adjusting plate (61), O-ring (60), and set screws (24).

P600 Hydraulic End Parts List

| Ref. No. | Part Number | Description | Quantity/ Pump |
|----------|--------------|--------------------------------------|-------------------|
| 50 | D25-019-3111 | Spring, Piston return | 3 |
| 51 | D25-042-1010 | Retainer, Piston return spring | 3 |
| 52 | D25-046-2110 | O-ring, Valve cylinder, Buna-N | 9 |
| 53 | K25-045-3110 | Spring, Sleeve valve..... | 3 |
| 54 | K25-044-1010 | Valve Plunger | 3 |
| 55 | K25-043-1010 | Cylinder, Valve | 3 |
| 56 | D25-034-2110 | O-ring, Buna-N..... | 6 |
| 57 | D25-041-1010 | Washer, Ball retainer..... | 3 |
| 58 | D25-015-3010 | Ball | 12 |
| 59 | D25-014-1209 | Piston, with foot and retainer..... | 3 |
| 60 | D25-075-2110 | O-ring, Buna-N | 1 |
| 61 | D25-012-1010 | Bearing Adjusting Plate..... | 1 |
| 62 | H25-007-1210 | (X) Cam Assembly(2)..... | 1 |

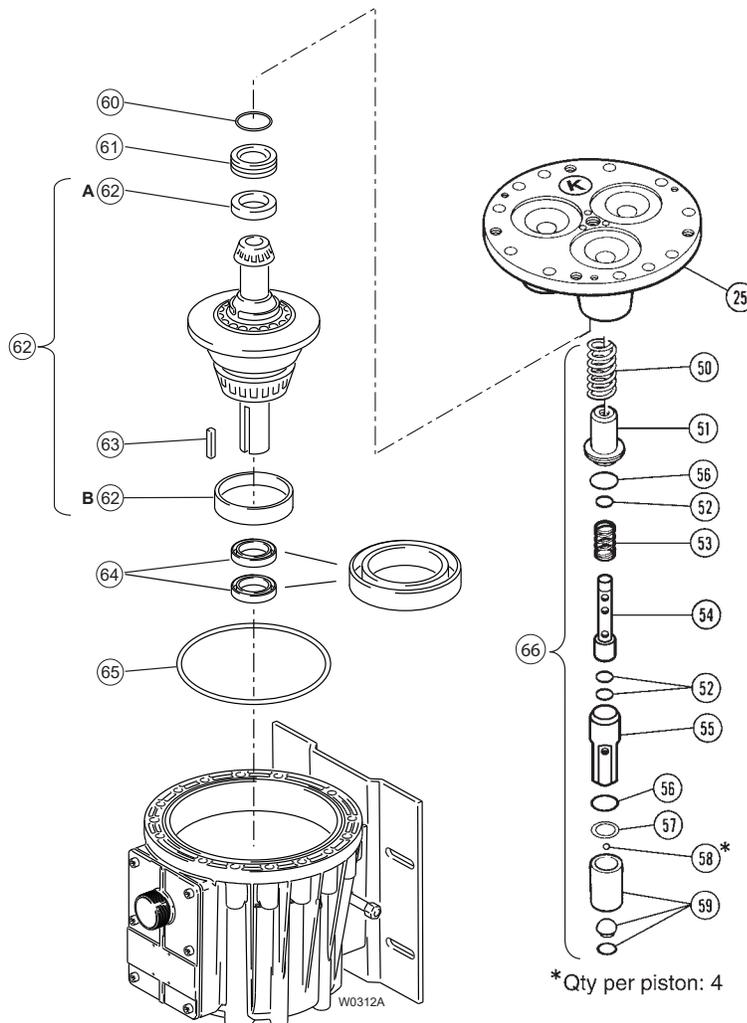
| Ref. No. | Part Number | Description | Quantity/ Pump |
|----------|--------------|-----------------------------------|-------------------|
| 63 | D25-085-2210 | Key, Shaft..... | 1 |
| 64 | H25-031-2112 | Seal, Buna-N..... | 2 |
| 65 | H25-037-2110 | O-ring, Pump housing, Buna-N..... | 1 |
| 66 | K25-014-1210 | Piston Assembly(1) | 1 |
| - | D25-111-2400 | Label, Caution | 1 |

(1) Piston Assembly includes items 50 through 59.

(2) Cam Assembly includes cam, shaft, wobble plate, bearings, and cups. It is only available as an assembly.

Hydraulic End Service

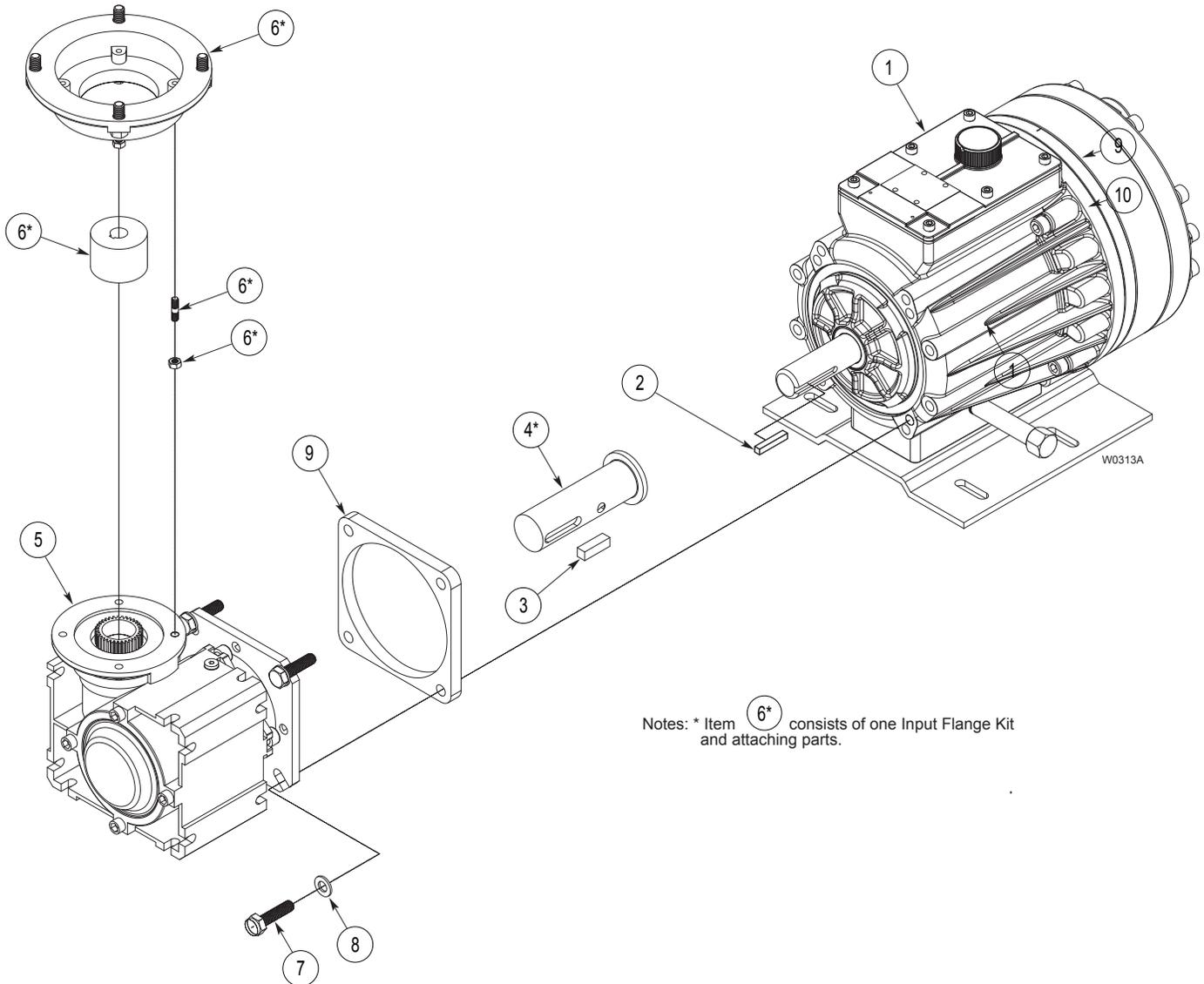
CAUTION: Disassembly of the hydraulic end of the pump should be performed only by a qualified technician. For assistance, contact Wanner Engineering (612-332-5681) or the distributor in your area.



P600-63 Reducer Parts List (1 of 3)

| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|--------------|------------------------------|-------------------|
| 1 | P6-N-PUMP | P600 Pump Assembly..... | 1 |
| 2 | D25-085-2210 | Key, Shaft..... | 1 |
| 3 | 112-033 | Key, 3/8 sq. x 1.125 lg..... | 1 |
| 4 | 112-584 | Shaft, P600-63 | |
| 5 | 112-435 | Reducer, 5:1 ratio | 1 |
| | 112-434 | Reducer, 7.5:1 ratio | 1 |
| | 112-433 | Reducer, 10:1 ratio | 1 |
| | 112-432 | Reducer, 15:1 ratio | 1 |
| | 112-431 | Reducer, 20:1 ratio | 1 |
| | 112-430 | Reducer, 25:1 ratio | 1 |
| | 112-429 | Reducer, 30:1 ratio | 1 |
| | 112-428 | Reducer, 40:1 ratio | 1 |
| | 112-427 | Reducer, 50:1 ratio | 1 |
| | 112-426 | Reducer, 60:1 ratio | 1 |

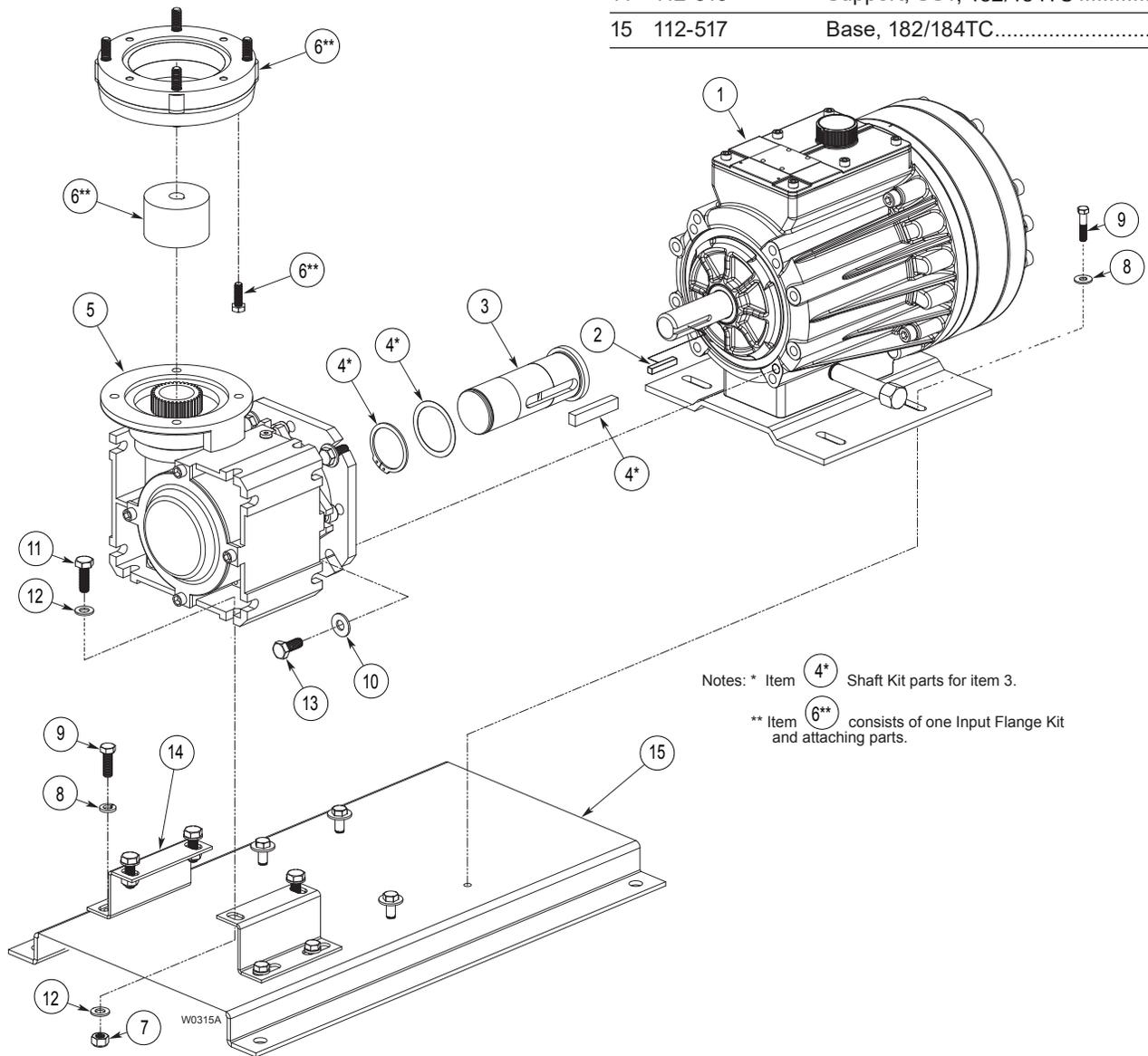
| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|-------------|-------------------------------------|-------------------|
| 6 | 112-555 | Flange, Input, NEMA 56C | 1 |
| | 112-556 | Flange, Input, NEMA 143/145TC | 1 |
| | 112-557 | Flange, Input, NEMA 182/184TC | 1 |
| | 112-558 | Flange, Input, IEC 63 B5 | 1 |
| | 112-559 | Flange, Input, IEC 71 B5 | 1 |
| | 112-560 | Flange, Input, IEC 80 B5 | 1 |
| | 112-561 | Flange, Input, IEC 90 B5 | 1 |
| 7 | 112-527 | Screw, M10 x 1.5 x 40 mm, HHCS..... | 4 |
| 8 | 112-526 | Washer, Flat | 4 |
| 9 | 112-034 | Spacer, Pump, P600 | 1 |



P600-75 Reducer Parts List (2 of 3)

| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|--------------|----------------------------|----------------|
| 1 | P6-N-PUMP | P600 Pump Assembly..... | 1 |
| 2 | D25-085-2211 | Key, 2 inch..... | 1 |
| 3 | 112-528 | Shaft..... | 1 |
| 4 | 112-035 | Shaft Kit..... | 1 |
| 5 | 112-500 | Reducer, 5:1 ratio | 1 |
| | 112-501 | Reducer, 7.5:1 ratio | 1 |
| | 112-502 | Reducer, 10:1 ratio | 1 |
| | 112-503 | Reducer, 15:1 ratio | 1 |
| | 112-537 | Reducer, 20:1 ratio | 1 |
| | 112-538 | Reducer, 25:1 ratio | 1 |
| | 112-549 | Reducer, 30:1 ratio | 1 |
| | 112-539 | Reducer, 40:1 ratio | 1 |
| | 112-540 | Reducer, 50:1 ratio | 1 |
| | 112-541 | Reducer, 60:1 ratio | 1 |

| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|--------------|---------------------------------------|----------------|
| 6 | 112-520 | Flange, Input, NEMA 56C..... | 1 |
| | 112-521 | Flange, Input, NEMA 143/145TC..... | 1 |
| | 112-522 | Flange, Input, NEMA 182/184TC..... | 1 |
| | 112-562 | Flange, Input, IEC 71 B5..... | 1 |
| | 112-506 | Flange, Input, IEC 80 B5..... | 1 |
| | 112-551 | Flange, Input, IEC 90 B5..... | 1 |
| | 112-552 | Flange, Input, IEC 100/112 B14..... | 1 |
| 7 | 100-032 | Locknut, M10, x 1.5, SST..... | 4 |
| 8 | D10-048-2012 | Washer, Lock, SST, 182/184TC..... | 4 |
| 9 | D10-087-2012 | Screw, 3/8-16 x 1.125, HHCS..... | 4 |
| 10 | 112-031 | Washer, Flat, wide, Type A, 3/8"..... | 8 |
| 11 | G10-029-2022 | Screw, M10 x 1.5 x 30 mm, HHCS..... | 4 |
| 12 | 112-526 | Washer, Flat, M10, SST..... | 8 |
| 13 | G25-029-2011 | Screw, M10 x 1.5 x 25 mm, HHCS..... | 4 |
| 14 | 112-519 | Support, SST, 182/184TC..... | 2 |
| 15 | 112-517 | Base, 182/184TC..... | 1 |



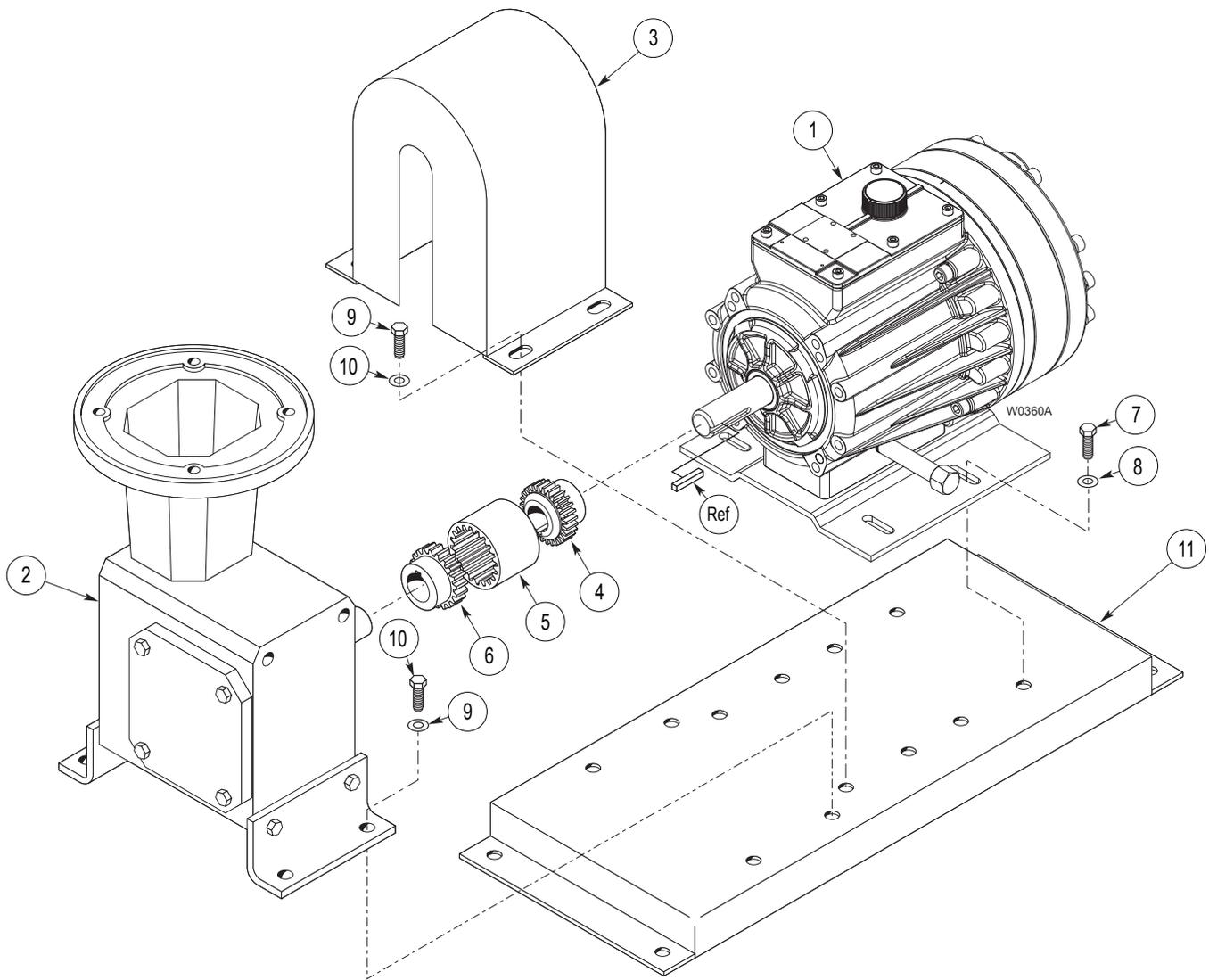
Notes: * Item 4* Shaft Kit parts for item 3.

** Item 6** consists of one Input Flange Kit and attaching parts.

P600 Reducer Parts List (3 of 3)

| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|--------------|---------------------------------------|-------------------|
| 1 | P6-N-PUMP | P600 Pump Assembly, Metallic | |
| 2 | 112-700 | Reducer, 5:1 ratio, 213/215TC | 1 |
| | 112-701 | Reducer, 7.5:1 ratio, 213/215TC | 1 |
| 3 | 112-821 | Guard | 1 |
| 4 | A04-116-2201 | Hub, Coupling, 213/215TC | 1 |
| 5 | A04-115-2200 | Sleeve, Coupling, 213/215TC | 1 |
| 6 | A04-116-2205 | Hub, Coupling, 213/215TC | 1 |

| Ref No. | Part Number | Description | Quantity/ Pump |
|---------|--------------|-------------------------|-------------------|
| 7 | 100-989 | Screw, SST | 4 |
| 8 | C22-018-3102 | Washer, Flat, SST | 4 |
| 9 | 100-913 | Screw, SST | 8 |
| 10 | D10-048-2012 | Washer, Flat, SST | 8 |
| 11 | 112-717 | Base | 1 |



P600 Troubleshooting

| Problem | Probable Cause | Solution |
|---|--|--|
| Motor/Pump Does Not Operate | No power. | Supply correct power according to motor requirements. |
| | Blown fuse/tripped circuit breaker. | Replace/reset, eliminate circuit overload. |
| | Shaft coupling to pump not in place. | Install proper coupling hardware (see parts list). |
| | Current overload - motor. | Motor not rated for pump operating conditions - install proper motor. |
| | Thermal overload - motor. | Motor not rated for pump and/or ambient operating conditions - supply cooling or install proper motor. |
| | Faulty motor drive/controller. | Repair/replace. |
| | Faulty motor. | Repair/replace. |
| | Low liquid level in supply tank (if low-level shut-off is used). | Fill tank. |
| No Delivery | Supply tank empty. | Fill tank. |
| | Loss of prime | Re-prime using Initial Start-Up Procedure. |
| | Inlet line or strainer clogged. | Clear debris and flush, or replace. |
| | Inadequate supply pressure at pump inlet. | Increase supply pressure by raising fluid level in tank, raising tank, or pressurizing suction tank. |
| | Inlet line too restrictive. | Increase inlet line diameter and/or decrease inlet line length. |
| | Fluid viscosity too high. | Reduce viscosity if possible (by heat or some other means). Increase inlet line diameter and/or decrease inlet line length. Increase supply pressure. |
| | Vapor lock/cavitation. | Increase inlet pressure. Decrease fluid temperature. |
| | Pump valves held open or worn out. | Clear debris and flush, or replace (see Fluid End Service) |
| | System relief valve actuating. | Adjust relief valve, or repair, clean, or replace with new relief valve. |
| Delivery Too Low and/or Erratic | Review all Probable Causes and Solutions in Problem 2 No Delivery above. | |
| | Air leak(s) in inlet line. | Locate all leaks and repair. |
| | System back pressure too low. | Adjust back pressure valve to higher setting. Install back pressure valve if none in system. |
| | Pumped fluid characteristics changed. | Monitor supply tank temperature to determine if fluid is too hot (leading to cavitation) or too cold (increasing fluid viscosity). Stabilize temperature at suitable level to resolve problem. Check for entrapped air in the fluid supply system. |
| | Inlet supply pressure changed. | Monitor inlet supply pressure (at the pump) to determine if it is too low, causing a starved condition/cavitation. Stabilize pressure at suitable level to resolve problem. |
| | Pump OK - Calibration system or flow meter error. | Evaluate components and repair/correct problem(s). |
| | Oil condition in pump hydraulic end changed. | Check oil level - if low evaluate for source of leakage. Consult factory for hydraulic end service. |
| | | Change oil per recommended guidelines in maintenance section. |
| Delivery Too High and/or Erratic | System back pressure too low. | Adjust back pressure valve to higher setting. Install back pressure valve if none in system. |
| | Inlet supply pressure changed. | Monitor inlet supply pressure (at the pump) to determine if it is too high, causing a "flow-through" condition. Stabilize pressure at suitable level to resolve problem. |
| | Pump OK - Calibration system or flow meter error. | Evaluate components and repair/correct problem(s). |

P600 Replacement Parts Kits

ORDERING INFORMATION: A Replacement Parts Kit contains 11 digits corresponding to customer-specified design options.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|----|----|

| Digit | Order Code | Description |
|-------|--|---|
| 1-2 | P6 | Pump Configuration For all P600 Pumps |
| 3 | K D V | Kit Designator Complete Fluid End Kit* Diaphragm Kit* Valve Kit (diaphragm not included) |
| 4-5 | 52 55 | Pump Head Version Metallic Pump Head Non-Metallic Pump Head |
| 6 | B C M P S T X | Spring Retainers (Dampening Washers) For Brass pump head (Hastelloy C) For Cast iron pump head (Hastelloy C) For PVDF pump head (PVDF) For Polypropylene pump head (Polypropylene) For 316L Stainless Steel pump head (Hastelloy C) For Hastelloy C pump head (Hastelloy C) Not included in Diaphragm Kit |
| 7 | A E G S X J W P R Z T F Y | Diaphragm & O-ring Material Aflas (with PTFE O-rings) EPDM (EPDM-compatible oil) FKM (Standard oil) FKM (Food-contact oil) FKM (Synthetic oil) PTFE (Food-contact oil) PTFE (Synthetic oil) Neoprene (Standard oil) Neoprene (Food-contact oil) Neoprene (Synthetic oil) Buna-N (Standard oil) Buna-N (Food-contact oil) Buna-N (Synthetic oil) |
| 8-9 | SS TT SC SD TC TD XX | Check Valve Material (Spring/ Valve Seat / Valve) Elgiloy/ Nitronic / Nitronic 50 Hastelloy C / Hastelloy C/ Hastelloy C Elgiloy / Ceramic / Ceramic Elgiloy / Tungsten Carbide / Tungsten Carbide Hastelloy C / Ceramic / Ceramic Hastelloy C /Tungsten Carbide / Tungsten Carbide Not included in Diaphragm Kit |

P600 Tool Kit

The P600 Tool Kit (Part No. A03-175-1102) contains the tools listed below. These tools are used to assist in the repair and maintenance of the P600. See the maintenance sections of this manual for specific application.

| Ref. P600 No. | Tool Part No. | Tool Description | Quantity/Kit |
|---------------|---------------|-----------------------------|--------------|
| 1 | A03-125-1000 | Holder, Plunger..... | 1 |
| 2 | A03-156-1200 | Assembly Studs..... | 1 |
| 3 | A03-162-1201 | Lifter, Plunger guide | 1 |
| 4 | A03-124-1200 | Lever Assembly | 1 |
| 5 | A03-119-1000 | Seat Puller | 1 |
| 6 | A03-158-1001 | Seal Protector | 1 |
| 7 | A03-160-1200 | Insertor/Rotator | 1 |
| 8 | A03-126-1500 | Tool Box | 1 |

* K&D Kits include hydraulic end oil. Oil not included in V Kit.

P600 Replacement Parts Kits (Cont'd)

Metallic Pump Head Kit Contents

| Part Number* | Description | Qty | Kit Designator | | |
|--------------|------------------------|----------|----------------|---|---|
| | | | K | D | V |
| D25-018-____ | Diaphragm | 3 | • | • | |
| D25-047-____ | O-ring, follower | 3 | • | • | |
| D25-074-____ | O-ring, outlet valve | 3 | • | • | • |
| D25-097-____ | O-ring, outer manifold | 1 | • | • | • |
| D25-073-____ | O-ring, inner manifold | 1 | • | • | • |
| D25-083-____ | O-ring, center bolt | 1 | • | • | • |
| D25-035-____ | O-ring, valve seat | 6 | • | | • |
| D25-020-____ | Valve seat | 6 | • | | • |
| D25-021-____ | Valve | 6 | • | | • |
| D25-022-____ | Valve spring | 6 | • | | • |
| D25-023-____ | Retainer, valve spring | 6 | • | | • |
| A01-113-3400 | Threadlocker | 1 | • | • | |
| | Hydraulic end oil | (2.5 qt) | • | • | |

Non-Metallic Pump Head Kit Contents

| Part Number* | Description | Qty | Kit Designator | | |
|--------------|-------------------------|----------|----------------|---|---|
| | | | K | D | V |
| D25-018-____ | Diaphragm | 3 | • | • | |
| D25-047-____ | O-ring, follower | 3 | • | • | |
| D25-109-____ | O-ring, outer manifold | 1 | • | • | • |
| D25-073-____ | O-ring, inner manifold | 1 | • | • | • |
| D10-083-____ | O-ring, center manifold | 1 | • | • | • |
| D25-035-____ | O-ring, valve seat | 6 | • | | • |
| D25-020-____ | Valve seat | 6 | • | | • |
| D25-021-____ | Valve | 6 | • | | • |
| D25-022-____ | Valve spring | 6 | • | | • |
| D25-092-____ | Tetra seal | 6 | • | | • |
| D25-023-____ | Retainer, valve spring | 6 | • | | • |
| D25-125-____ | Washer, dampening | 6 | • | | • |
| A01-113-3400 | Threadlocker | 1 | • | • | |
| | Hydraulic end oil | (2.5 qt) | • | • | |

* Last four digits of part numbers with ____ refer to specific material of construction.

P600 Warranty

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 non-contractual 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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