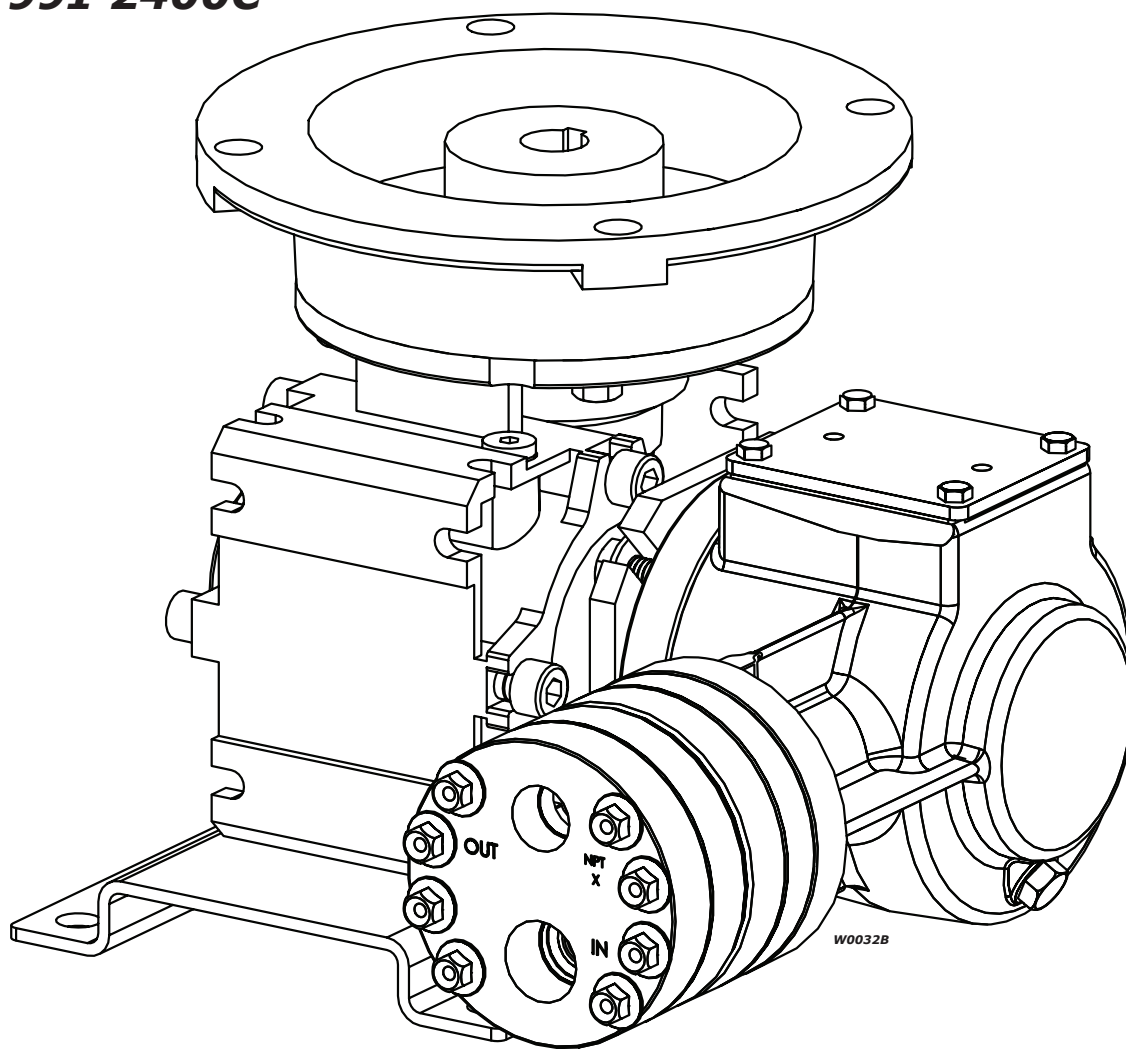


## **P100 Metering Pump**

**Installation, Operation & Maintenance**  
**P100-991-2400C**



**Metallic pump shown**

 **Wanner Engineering, Inc.**

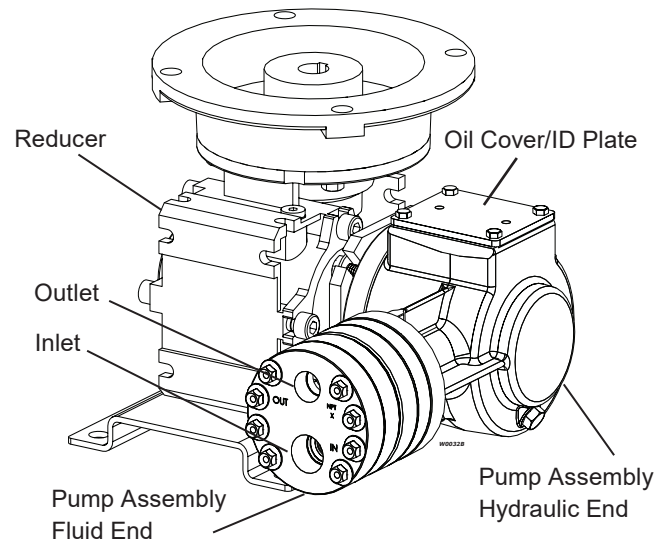
1204 Chestnut Avenue, Minneapolis, MN 55403  
Tel: (612) 332-5681 Fax: (612) 332-6937  
Toll-free fax [US only]: (800) 332-6812  
[www.hydra-cell.com/metering](http://www.hydra-cell.com/metering)  
email: [sales@wannereng.com](mailto:sales@wannereng.com)



# P100 Contents

|                               | Page |
|-------------------------------|------|
| Operation .....               | 2    |
| Specifications .....          | 2    |
| Dimensions .....              | 4    |
| Installation .....            | 5    |
| Calibration .....             | 7    |
| Maintenance .....             | 7    |
| Fluid End                     |      |
| Service .....                 | 8    |
| Parts List .....              | 10   |
| Hydraulic End Parts List..... | 12   |
| Reducer Parts List.....       | 13   |
| Troubleshooting.....          | 14   |
| Replacement Parts Kits .....  | 15   |
| Warranty.....                 | 16   |

## Component Identification



## P100 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.

## P100 Specifications

|  |   |
|--|---|
| <b>Diaphragms per Liquid End</b>   | 1 (non Kel-Cell pistons)  |
| <b>Flow Control</b>  | Electronic variable speed drive                                   |
| <b>Steady State Accuracy</b>   | $\pm 1\%$   |
| <b>Linearity</b>   | $\pm 3\%$   |
| <b>Repeatability</b>   | $\pm 3\%$   |
| <b>Maximum Pressure</b>  |   |
| Metallic Heads:  | 1500 psi (103 bar)  |
| Non-Metallic Heads:  | PVDF: 350 psi (24 bar)  |
|  | Polypropylene: 250 psi (17 bar)                                   |
| <b>Maximum Inlet Pressure</b>  | 250 psi (17 bar)  |
| <b>Fluid Operating Temperatures*</b>   |   |
| 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). |   |
| <b>Inlet Port</b>  | 1/2 inch NPT or BSPT  |
| <b>Discharge Port</b>  | 3/8 inch NPT or BSPT  |
| <b>Maximum Solids</b>  | 200 microns   |
| <b>Shaft Rotation</b>  | Bi-directional  |
| <b>Materials Used</b>  | See Replacement Parts Kits Section for individual pump materials. |
| <b>Oil Capacity</b>  | 1/8 US quart (0.12 liters)  |
| <b>Weight (less motor)</b>   |   |
| Metallic Heads:  | 21.2 lbs (9.6 kg)   |
| Non-Metallic Heads:  | 19.1 lbs (8.7 kg)   |

# P100 Specifications (Cont'd)

## Performance Maximum Flow at Designated Pressure - Imperial \*

| All Pumps (gph) |           | Metallic Pump Heads Only (gph) |           |           | Pump rpm | Gear Ratio | Motor rpm |
|-----------------|-----------|--------------------------------|-----------|-----------|----------|------------|-----------|
| 100 psi         | 250 psi   | 500 psi                        | 1000 psi  | 1500 psi  |          |            |           |
| 1.086 (½)       | 1.077 (¾) | 1.058 (¾)                      | 1.015 (¾) | 0.981 (¾) | 30       | 60:1       | 1800      |
| 1.316 (½)       | 1.300 (¾) | 1.273 (¾)                      | 1.220 (¾) | 1.184 (¾) | 36       | 50:1       |           |
| 1.630 (½)       | 1.628 (½) | 1.607 (¾)                      | 1.535 (¾) | 1.492 (¾) | 45       | 40:1       |           |
| 2.192 (½)       | 2.182 (½) | 2.148 (½)                      | 2.056 (½) | 2.000 (¾) | 60       | 30:1       |           |
| 2.643 (½)       | 2.626 (½) | 2.582 (½)                      | 2.473 (½) | 2.405 (½) | 72       | 25:1       |           |
| 3.318 (½)       | 3.291 (½) | 3.232 (½)                      | 3.099 (½) | 3.014 (½) | 90       | 20:1       |           |
| 4.444 (½)       | 4.400 (½) | 4.316 (½)                      | 4.141 (½) | 4.028 (½) | 120      | 15:1       |           |
| 6.695 (½)       | 6.618 (½) | 6.483 (½)                      | 6.226 (½) | 6.057 (½) | 180      | 10:1       |           |
| 8.947 (½)       | 8.836 (½) | 8.651 (½)                      | 8.311 (½) | 8.085 (½) | 240      | 7.5:1      |           |
| 13.45 (½)       | 13.27 (½) | 12.99 (½)                      | 12.48 (½) | 12.14 (¾) | 360      | 5:1        |           |
| 17.95 (½)       | 17.71 (½) | 17.32 (½)                      | 16.65 (¾) | 16.20 (¾) | 480      | 7.5:1      | 3600      |
| 26.96 (½)       | 26.58 (½) | 25.99 (¾)                      | 24.99 (¾) | 24.31 (1) | 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 \*

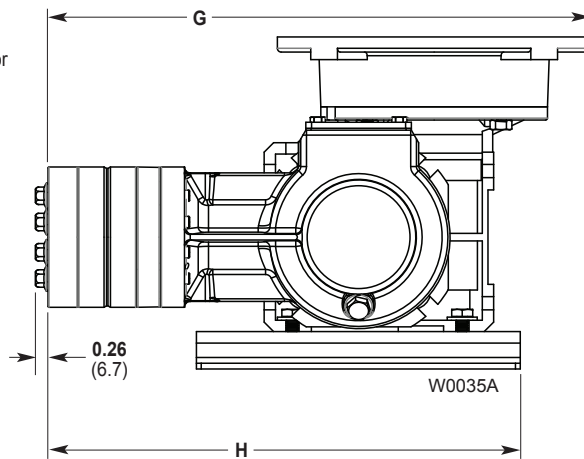
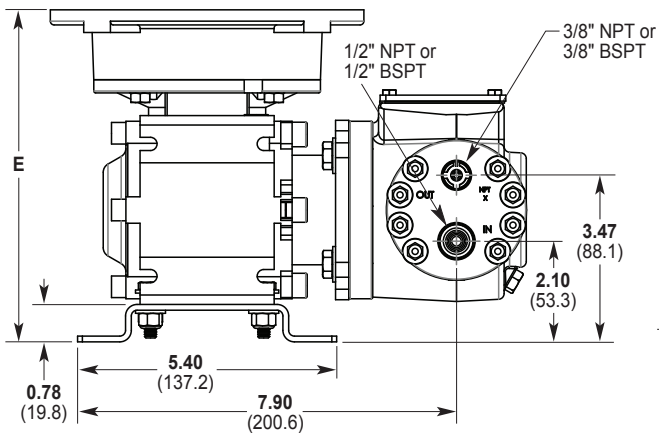
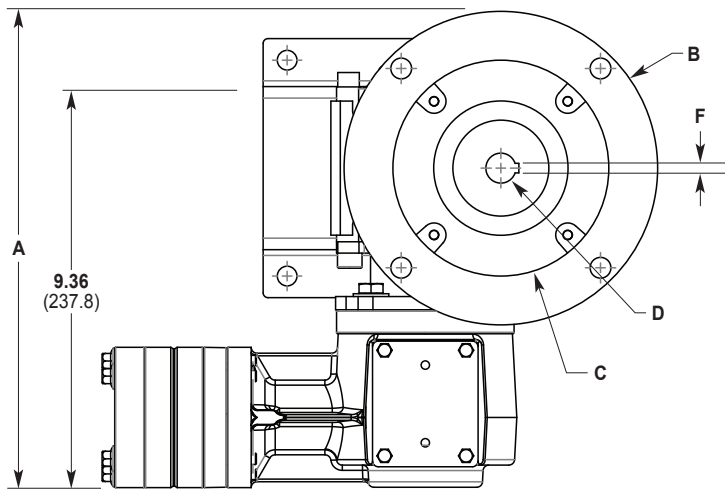
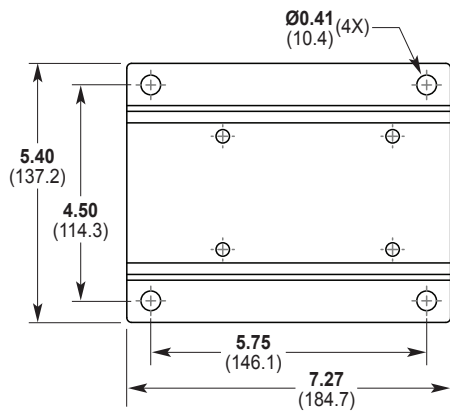
| All Pumps (lpm) |              | Metallic Pump Heads Only (lpm) |              |              | Pump rpm | Gear Ratio | Motor rpm |
|-----------------|--------------|--------------------------------|--------------|--------------|----------|------------|-----------|
| 7 bar           | 17 bar       | 34 bar                         | 69 bar       | 103 bar      |          |            |           |
| 3.425 (0.18)    | 3.396 (0.18) | 3.337 (0.18)                   | 3.203 (0.18) | 3.095 (0.55) | 25       | 60:1       | 1500      |
| 4.150 (0.18)    | 4.102 (0.18) | 4.016 (0.18)                   | 3.850 (0.18) | 3.735 (0.55) | 30       | 50:1       |           |
| 5.140 (0.18)    | 5.135 (0.18) | 5.068 (0.18)                   | 4.841 (0.25) | 4.708 (0.55) | 37.5     | 40:1       |           |
| 6.916 (0.18)    | 6.884 (0.18) | 6.777 (0.18)                   | 6.486 (0.25) | 6.307 (0.25) | 50       | 30:1       |           |
| 8.336 (0.18)    | 8.283 (0.18) | 8.145 (0.18)                   | 7.801 (0.25) | 7.587 (0.25) | 60       | 25:1       |           |
| 10.47 (0.18)    | 10.38 (0.18) | 10.20 (0.18)                   | 9.774 (0.25) | 9.507 (0.25) | 75       | 20:1       |           |
| 14.02 (0.18)    | 13.88 (0.18) | 13.61 (0.18)                   | 13.06 (0.37) | 12.71 (0.37) | 100      | 15:1       |           |
| 21.12 (0.18)    | 20.88 (0.18) | 20.45 (0.18)                   | 19.64 (0.37) | 19.11 (0.37) | 150      | 10:1       |           |
| 28.22 (0.18)    | 27.87 (0.18) | 27.29 (0.18)                   | 26.22 (0.37) | 25.50 (0.37) | 200      | 7.5:1      |           |
| 42.43 (0.18)    | 41.87 (0.18) | 40.96 (0.18)                   | 39.37 (0.37) | 38.30 (0.55) | 300      | 5:1        |           |
| 56.63 (0.37)    | 55.86 (0.37) | 54.64 (0.37)                   | 52.53 (0.55) | 51.10 (0.55) | 400      | 7.5:1      | 3000      |
| 85.04 (0.37)    | 83.85 (0.37) | 81.98 (0.55)                   | 78.84 (0.55) | 76.70 (0.55) | 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

# P100 Dimensions

## P100 Models: Metallic and Non-Metallic



### Dimensions in Inches (Millimeters)

| Input Frame Size | A            | B                 | C                   | D                 | E                   | F<br>(Square Key) | G                  |                   | H                  |                   |
|------------------|--------------|-------------------|---------------------|-------------------|---------------------|-------------------|--------------------|-------------------|--------------------|-------------------|
|                  |              |                   |                     |                   |                     |                   | Metallic Pump Head | Plastic Pump Head | Metallic Pump Head | Plastic Pump Head |
| NEMA 56C         | 9.93 (252.2) | Ø 6.54<br>(Ø 166) | Ø 4.50<br>(Ø 114.3) | Ø .62<br>(Ø 15.7) | Ø 6.92<br>(Ø 175.8) | 0.187 (4.75)      | 11.36<br>(287.4)   | 11.61<br>(294.9)  | 9.84 (250)         | 10.09<br>(256.3)  |
| IEC 63 B5        | 9.42 (239)   | Ø 5.51<br>(Ø 140) | Ø 3.74<br>(Ø 95)    | Ø .43<br>(Ø 11)   | Ø 6.74<br>(Ø 171.3) | 0.157 (4)         | 10.84<br>(275.3)   | 11.09<br>(281.7)  | 9.84 (250)         | 10.09<br>(256.3)  |
| IEC 71 B5        | 9.81 (249.2) | Ø 6.30<br>(Ø 160) | Ø 4.33<br>(Ø 110)   | Ø .55<br>(Ø 14)   | Ø 6.74<br>(Ø 171.3) | 0.196 (5)         | 11.24<br>(285.5)   | 11.49<br>(291.8)  | 9.84 (250)         | 10.09<br>(256.3)  |

# P100 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**.

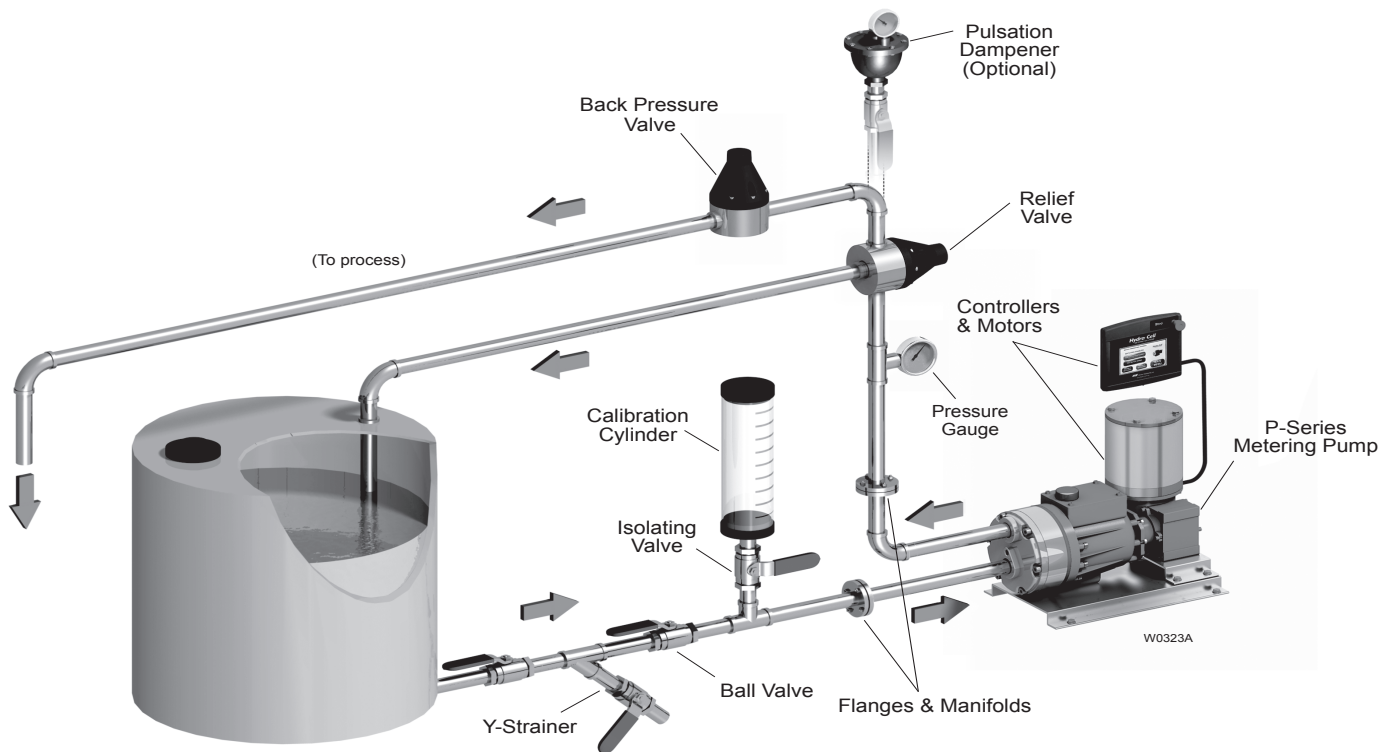
**Positive Displacement.** This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, install a relief valve downstream from the pump. See **Discharge Piping**.

**Safety Guards.** 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 relief valve, 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

# P100 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

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

Provide for permanent or temporary installation of a compound pressure gauge to monitor the inlet pressure. To maintain maximum flow, vacuum at the pump inlet should not exceed 7 in. Hg (180 mm Hg).

**Note: PTFE diaphragms require a minimum suction pressure of 15 psi.**

**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 5/8" (16 mm) I.D. inlet hose
- Minimize fittings (elbows, valves, tees, etc.)

Support the pump and piping independently.

## 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 (17.3 bar). For higher pressures 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 a system 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 overpressurizing 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 recommended.



# P100 Installation (Cont'd)

## Initial Start-Up Procedure

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

**Note:** The oil reservoir in the pump housing is filled and sealed at the factory. To check the oil level, remove the cover (70) and slowly lift the diaphragm (71). Also see Fill and Seal the Oil Reservoir Paragraph in the Fluid End Service Section.

Before starting the pump, be sure that:

1. All shut-off valves are open, and pump has adequate supply of fluid.
2. All connections are tight.
3. Oil reservoir beneath diaphragm (71) is completely full.
4. Open priming valve on system back pressure valve so pump starts under minimum pressure. See Typical Metering Installation drawing.

Turn on power to pump motor and:

1. 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 (17.3 bar).
2. Observe any erratic noise or flow.
3. Jog pump on and off until fluid coming from priming valve is air-free.
4. Close priming valve.
5. Perform pump calibration. See Calibration Procedure.

## 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.

# P100 Maintenance

## 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 drain plug (69), 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.
  - c. There should be no trapped air under oil reservoir diaphragm (71). Also see: **Fill and Seal the Oil Reservoir Paragraph** in the Fluid End Service Section.

## Pump Operation Hours Between Oil Changes at Various Process Fluid Temperatures

| Pressure                      | <90°F<br>(32°C) | <139°F<br>(60°C) | <180°F<br>(82°C) |
|-------------------------------|-----------------|------------------|------------------|
| <b>Metallic Pump Head</b>     |                 |                  |                  |
| <1000 psi (70 bar)            | 6,000           | 4,000            | 2,000            |
| <1500 psi (100 bar)           | 3,000           | 2,000            | 1,500            |
| <b>Non-Metallic Pump Head</b> |                 |                  |                  |
| <250 psi (17 bar)             | 3,000           | 2,000            | —                |

**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.

# P100 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.

## 1. Remove Support Plate (2)/ Manifold (3)

**Note:** Support Plate is used on non-metallic pumps only.

- Remove eight bolts (1) around support plate (2)/manifold (3).
- Remove support plate/manifold.
- Inspect support plate/manifold for warping or wear around inlet and outlet ports. If wear is excessive, replace or return to Wanner Engineering for resurfacing.  
Place a straightedge across manifold to check if it is warped. If warped replace.

## 2. Inspect Valves (4-17)

The inlet and outlet valve assemblies are different (inlet valve is larger) and face opposite directions. Inspect each valve assembly as follows:

- Check spring retainers (4,17), and replace if worn.
- Check valve springs (5,16). If shorter than new spring, replace (do not stretch old spring).
- Check valve discs (6,15). If worn excessively, replace.
- Remove valve seats (9,13) with seat puller provided in Wanner Tool Kit (Part No. A03-175-1105).  
Inspect valve seats for wear, and replace if necessary. New O-rings (8,12) should be installed.
- Check dampening washer (10), and replace if worn.
- Reinstall inlet and outlet valve assemblies:
  - Clean valve ports and shoulders with emery cloth, and lubricate with lubricating gel or petroleum jelly (do not use petroleum products when installing EPDM O-rings).
  - Install O-rings (8,12) on valve seats (9,13).
  - Inlet Valve.** Insert spring retainer (17) into valve plate (21). Then insert spring (16), valve (15), Tetra Seal® (14) and valve seat (13).
  - Outlet Valve.** Insert dampening washer (10), valve seat (9) (for non-metallic retainers only), Tetra Seal® (7), valve (6), spring (5), and spring retainer (4).

## 3. Inspect and Replace Diaphragm (22)

**Note:** Oil escaping from behind diaphragm is possible during the following steps.

- Use 3 mm Allen wrench to remove two capscrews (20) from valve plate (21).
- Lift diaphragm (22) by one edge, and turn pump shaft (**use the shaft rotator from the Wanner Tool Kit**) until diaphragm moves up to “top dead center”. This will expose machined cross holes in plunger shaft behind diaphragm.
- 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 g below.
- Unscrew diaphragm (22). Use 8 mm or 5/16 in. open-end wrench and turn counterclockwise.
- Inspect diaphragm (22) carefully. A damaged diaphragm generally indicates a pumping system problem. Replacing diaphragm will not solve the larger problem. Inspect diaphragm for the following:
  - Puncture.** Usually caused by sharp foreign object in fluid.
  - Diaphragm pulled away from 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.
- CAUTION:** If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check the diaphragm, then flush the reservoir completely (see Flush Contaminant from Hydraulic End paragraph) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.
- Clean away any spilled oil. Apply Loctite® 242 thread locker to threads of new diaphragm (22) (or old one).
- Install diaphragm (22) and tighten to 10 in-lbs (113 N-cm).



# P100 Fluid End Service (Cont'd)

## 4. Flush Contaminant from Hydraulic End

(Only if diaphragm has ruptured)

- a. With valve plate and manifold still removed (see above), remove drain plug (69), four screws (72), cover (70), and oil diaphragm (71). 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. A03-175-1105). 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 and 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. Prime Hydraulic Cell

- a. If necessary, with pump horizontal, remove four screws (72), cover (70), and oil diaphragm (71).
- b. Fill pump housing reservoir (62) with correct Hydra oil for application.

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

- c. Air behind the diaphragm must be forced out by turning shaft and pumping piston. Any air in the hydraulic end will cause the pump to have loss in flow and re-priming will be necessary.
- d. Turn shaft until bubble-free flow of oil comes from behind diaphragm. Use the shaft rotator provided in Wanner Tool Kit (Part No. A03-175-1105). Make sure oil level in reservoir doesn't get to low. Add oil as necessary. If oil gets too low, air will be drawn into hydraulic side of piston.
- e. When oil is bubble-free, refresh oil reservoir.
- f. Install oil diaphragm and cover, using four screws.
- g. Wipe off excess oil on pump housing.

## 6. Reinstall Valve Plate (21) and Support Plate (2) / Manifold (3)

**Note: Support Plate is used on non-metallic pumps only.**

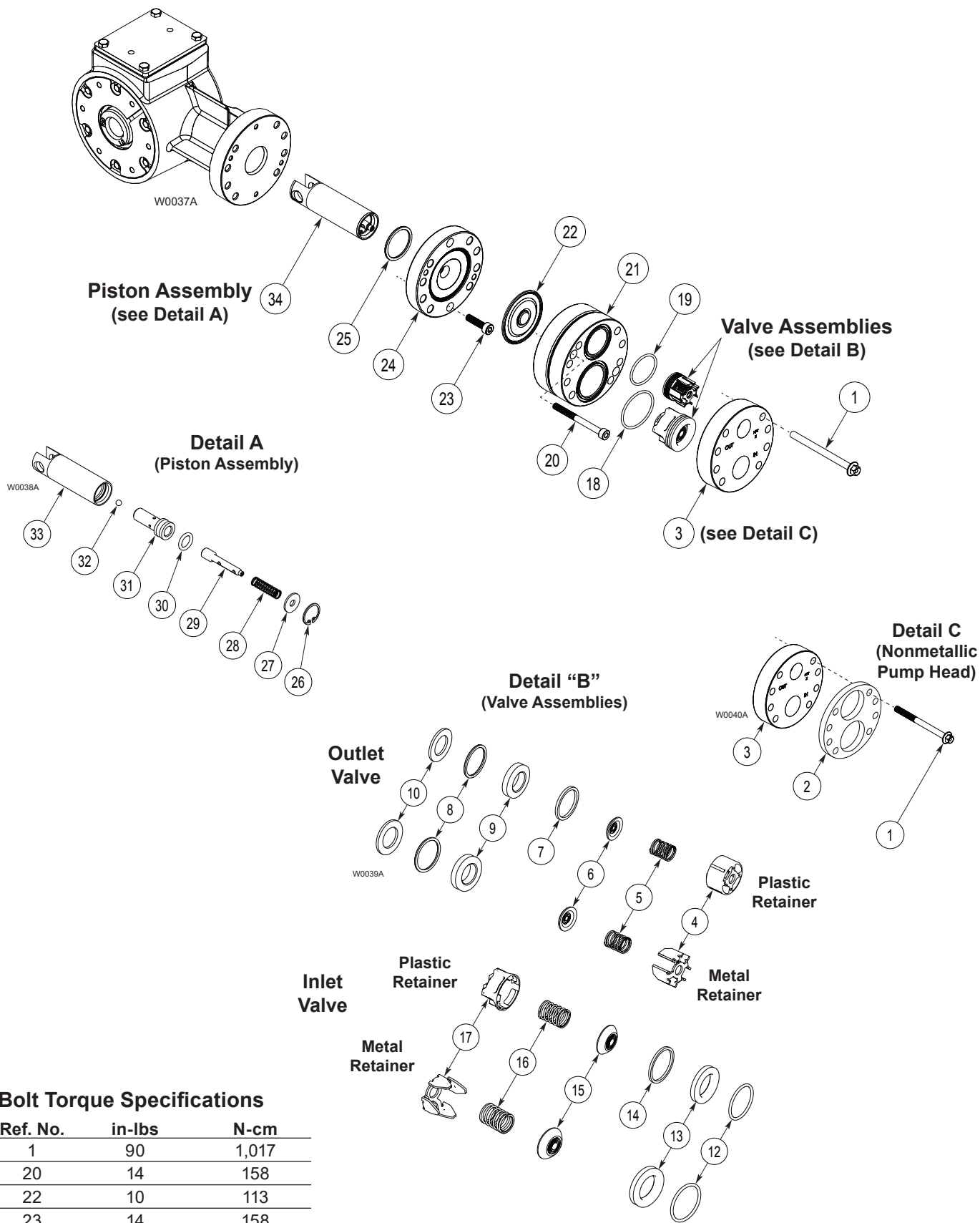
- a. Reinstall valve plate (21) on diaphragm plate (24).
- b. Reinstall O-rings (18,19) on valve plate (21). Use petroleum jelly or lubricating gel to hold them in place (do not use petroleum products when installing EPDM O-rings).
- c. Reinstall support plate (2) / manifold (3) onto valve plate.
- d. Insert eight bolts (1) around edge of manifold, and alternately tighten opposite bolts until all are secure. Torque to 90 in-lbs (1017 N-cm).
- e. Recheck all bolts for tightness.

## 7. Fill Oil Reservoir

- a. If necessary, with pump horizontal, remove four screws (72), cover (70), and oil diaphragm (71). The oil diaphragm extends into pump housing reservoir approximately 1/4 in. to 3/8 in.
- b. Add oil so that when diaphragm is set in reservoir all air is pushed out. Take care not to allow any oil overflow. This may result in an apparent oil leak when the pump is put into use.
- c. Install reservoir cover (70) using four screws (72).
- d. Wipe off excess oil on pump housing.

**Note: The oil diaphragm will flex up and down slightly as the pump operates. The vent holes in the cover allow this to freely occur. Do not block vent holes.**

# P100 Fluid End Parts List



## Bolt Torque Specifications

| Ref. No. | in-lbs | N-cm  |
|----------|--------|-------|
| 1        | 90     | 1,017 |
| 20       | 14     | 158   |
| 22       | 10     | 113   |
| 23       | 14     | 158   |

# P100 Fluid End Parts List (Cont'd)

| Ref. No. | Part Number  | Description  | Quantity/<br>Pump | Ref. No. | Part Number  | Description  | Quantity/<br>Pump |
|----------|--------------|--|-------------------|----------|--------------|--|-------------------|
| 1        | G20-024-2011 | Bolt, Hex-hd, SST.....                               | 8                 | 15       | D10-021-1011 | Inlet Valve, Nitronic .....                          | 1                 |
| 2        | F20-100-1033 | Plate, Manifold support*.....                        | 1                 |          | D10-021-1017 | Inlet Valve, Hastelloy C .....                       | 1                 |
| 3        | F20-004-1010 | Manifold, Brass, NPT .....                           | 1                 |          | D10-021-3300 | Inlet Valve, Ceramic .....                           | 1                 |
|          | F20-004-1012 | Manifold, 316 SST, NPT .....                         | 1                 | 16       | D10-022-3117 | Valve Spring, Inlet, Elgiloy.....                    | 1                 |
|          | F20-004-1017 | Manifold, Hastelloy C, NPT .....                     | 1                 |          | D10-022-3123 | Valve Spring, Inlet, Hastelloy C.....                | 1                 |
|          | F20-004-1050 | Manifold, Polypropylene, NPT .....                   | 1                 | 17       | D10-023-1017 | Retainer, Inlet valve spring,<br>Hastelloy C .....   | 1                 |
|          | F20-004-1053 | Manifold, PVDF, NPT .....                            | 1                 |          | D10-023-2327 | Retainer, Inlet valve spring,<br>polypropylene ..... | 1                 |
|          | G20-004-1010 | Manifold, Brass, BSPT .....                          | 1                 |          | D10-023-2328 | Retainer, Inlet valve spring, PVDF .....             | 1                 |
|          | G20-004-1012 | Manifold, 316 SST, BSPT.....                         | 1                 | 18       | F20-074-2110 | O-ring, Inlet manifold, Buna-N .....                 | 1                 |
|          | G20-004-1017 | Manifold, Hastelloy C, BSPT.....                     | 1                 |          | F20-074-2111 | O-ring, Inlet manifold, FKM.....                     | 1                 |
|          | G20-004-1050 | Manifold, Polypropylene, BSPT .....                  | 1                 |          | F20-074-2112 | O-ring, Inlet manifold, neoprene .....               | 1                 |
|          | G20-004-1053 | Manifold, PVDF, BSPT .....                           | 1                 |          | F20-074-2113 | O-ring, Inlet manifold, EPDM .....                   | 1                 |
| 4        | D03-023-1017 | Retainer, Outlet valve spring,<br>Hastelloy C .....  | 1                 |          | F20-074-2118 | O-ring, Inlet manifold, PTFE .....                   | 1                 |
|          | D03-023-2317 | Retainer, Outlet valve spring,<br>polypropylene..... | 1                 | 19       | D10-034-2110 | O-ring, Outlet manifold, Buna-N .....                | 1                 |
|          | D03-023-2318 | Retainer, outlet valve spring, PVDF .....            | 1                 |          | D10-034-2111 | O-ring, Outlet manifold, FKM .....                   | 1                 |
| 5        | D03-022-3113 | Valve Spring, Outlet, Hastelloy C.....               | 1                 |          | F20-073-2112 | O-ring, Outlet manifold, neoprene .....              | 1                 |
|          | D03-022-3114 | Valve Spring, Outlet, Elgiloy.....                   | 1                 |          | F20-073-2113 | O-ring, Outlet manifold, EPDM .....                  | 1                 |
| 6        | D03-021-1011 | Outlet Valve, Nitronic.....                          | 1                 |          | F20-073-2118 | O-ring, Outlet manifold, PTFE .....                  | 1                 |
|          | D03-021-1017 | Outlet Valve, Hastelloy C .....                      | 1                 | 20       | G20-029-2010 | Cap Screw, Soc-hd .....                              | 2                 |
|          | D03-021-3300 | Outlet Valve, Ceramic .....                          | 1                 | 21       | F20-003-1010 | Valve Plate, Brass .....                             | 1                 |
| 7        | D03-092-2110 | Tetra Seal®, Outlet, Buna-N .....                    | 1                 |          | F20-003-1012 | Valve Plate, 316 SST.....                            | 1                 |
|          | D03-092-2111 | Tetra Seal®, Outlet, FKM .....                       | 1                 |          | F20-003-1017 | Valve Plate, Hastelloy C .....                       | 1                 |
|          | D03-092-2112 | Tetra Seal®, Outlet, neoprene .....                  | 1                 |          | F20-003-1050 | Valve Plate, Polypropylene .....                     | 1                 |
|          | D03-092-2113 | Tetra Seal®, Outlet, EPDM .....                      | 1                 |          | F20-003-1053 | Valve Plate, PVDF.....                               | 1                 |
|          | D03-035-2119 | Tetra Seal®, Outlet, PTFE .....                      | 1                 | 22       | D03-018-1212 | Diaphragm, Neoprene.....                             | 1                 |
| 8        | D03-035-2112 | O-ring, Outlet valve seat, neoprene.....             | 1                 |          | D03-018-1213 | Diaphragm, EPDM .....                                | 1                 |
|          | D03-035-2113 | O-ring, Outlet valve seat, EPDM.....                 | 1                 |          | D03-018-1215 | Diaphragm, FKM .....                                 | 1                 |
|          | D03-035-2118 | O-ring, Outlet valve seat, PTFE.....                 | 1                 |          | D03-018-1218 | Diaphragm, PTFE .....                                | 1                 |
|          | D25-046-2110 | O-ring, Outlet valve seat, Buna-N.....               | 1                 |          | D03-018-1220 | Diaphragm, Buna-N .....                              | 1                 |
|          | D25-046-2111 | O-ring, Outlet valve seat, FKM .....                 | 1                 |          | D03-018-1225 | Diaphragm, Aflas.....                                | 1                 |
| 9        | D03-020-1001 | Valve Seat, Outlet, 316 SST.....                     | 1                 | 23       | G20-088-2010 | Cap-Screw, Soc-hd.....                               | 2                 |
|          | D03-020-1017 | Valve Seat, Outlet, Hastelloy C .....                | 1                 | 24       | F20-002-1010 | Diaphragm Plate.....                                 | 1                 |
|          | D03-020-3300 | Valve Seat, Outlet, ceramic.....                     | 1                 | 25       | D03-075-2110 | O-ring, Diaphragm plate, Buna-N .....                | 1                 |
|          | D15-020-2016 | Valve Seat, Outlet, tungsten carbide ..              | 1                 | 26       | D03-048-2210 | Snap Ring.....                                       | 1                 |
| 10       | D03-125-2317 | Washer, Outlet dampening,<br>polypropylene.....      | 1                 | 27       | D03-049-1000 | Washer .....   | 1                 |
|          | D03-125-2318 | Washer, Outlet dampening, PVDF .....                 | 1                 | 28       | D03-045-3110 | Spring, Sleeve valve.....                            | 1                 |
| 12       | D10-035-2110 | O-ring, Inlet valve seat, Buna-N.....                | 1                 |          | D03-045-3111 | Spring, Sleeve valve for PTFE<br>diaphragm .....     | 1                 |
|          | D10-035-2111 | O-ring, Inlet valve seat, FKM .....                  | 1                 | 29       | D03-044-1000 | Valve Plunger .....                                  | 1                 |
|          | D10-035-2112 | O-ring, Inlet valve seat, neoprene.....              | 1                 | 30       | D03-034-2110 | O-ring, Valve cylinder, Buna-N .....                 | 1                 |
|          | D10-035-2113 | O-ring, Inlet valve seat, EPDM.....                  | 1                 | 31       | D03-043-1000 | Valve Cylinder .....                                 | 1                 |
|          | D10-035-2118 | O-ring, Inlet valve seat, PTFE.....                  | 1                 | 32       | D10-015-3010 | Ball .....   | 1                 |
| 13       | D10-020-1011 | Valve Seat, Inlet, 316 SST .....                     | 1                 | 33       | D03-014-1004 | Piston**.....  | 1                 |
|          | D10-020-1017 | Valve Seat, Inlet, Hastelloy C.....                  | 1                 | 34       | D03-014-1210 | Piston Assembly**(1).....                            | 1                 |
|          | D10-020-3300 | Valve Seat, Inlet, ceramic .....                     | 1                 |          |              |  |                   |
| 14       | D10-092-2110 | Tetra Seal®, Inlet, Buna-N .....                     | 1                 |          |              |  |                   |
|          | D10-092-2111 | Tetra Seal®, Inlet, FKM.....                         | 1                 |          |              |  |                   |
|          | D10-092-2112 | Tetra Seal®, Inlet, neoprene .....                   | 1                 |          |              |  |                   |
|          | D10-092-2113 | Tetra Seal®, Inlet, EPDM .....                       | 1                 |          |              |  |                   |
|          | D10-092-2118 | Tetra Seal®, Inlet, PTFE .....                       | 1                 |          |              |  |                   |

\* For use with Non-Metallic Pump Head models only.

\*\* Non Kel-Cell.

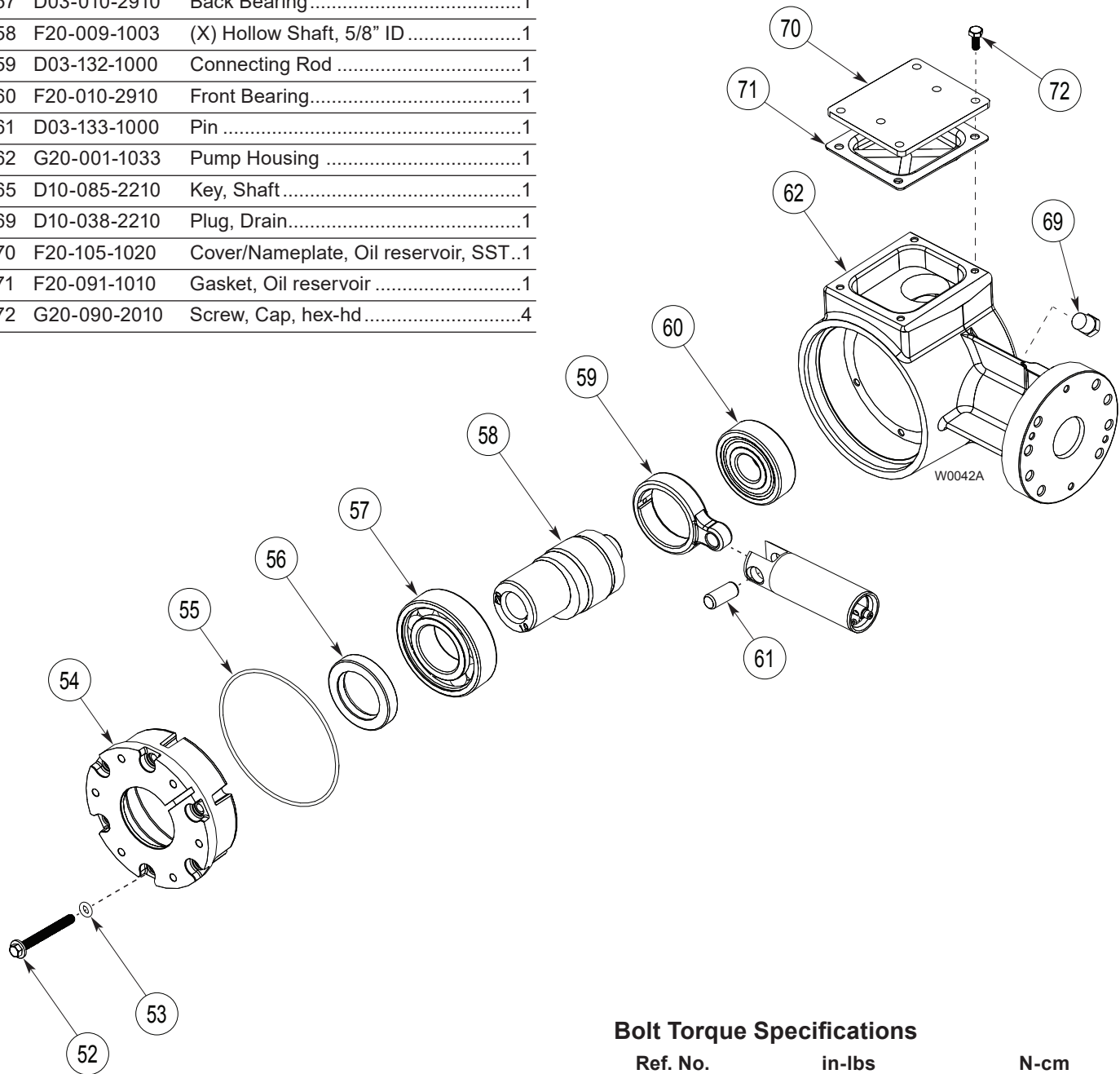
(1) Piston Assembly includes: items 26 through 33.

# P100 Hydraulic End Parts Lists

| Ref. No. | Part Number  | Description                            | Quantity/<br>Pump |
|----------|--------------|--|-------------------|
| 52       | G20-086-2010 | Screw, Cap, hex-hd, flange .....       | 6                 |
| 53       | F20-036-2110 | O-ring, Back cover screw, Buna-N ..... | 6                 |
| 54       | G20-131-1010 | Cover .....                            | 1                 |
| 55       | F20-037-2110 | O-ring, Cover, Buna-N .....            | 1                 |
| 56       | F20-031-2110 | Seal, Buna-N .....                     | 1                 |
| 57       | D03-010-2910 | Back Bearing .....                     | 1                 |
| 58       | F20-009-1003 | (X) Hollow Shaft, 5/8" ID .....        | 1                 |
| 59       | D03-132-1000 | Connecting Rod .....                   | 1                 |
| 60       | F20-010-2910 | Front Bearing .....                    | 1                 |
| 61       | D03-133-1000 | Pin .....                              | 1                 |
| 62       | G20-001-1033 | Pump Housing .....                     | 1                 |
| 65       | D10-085-2210 | Key, Shaft .....                       | 1                 |
| 69       | D10-038-2210 | Plug, Drain .....                      | 1                 |
| 70       | F20-105-1020 | Cover/Nameplate, Oil reservoir, SST .. | 1                 |
| 71       | F20-091-1010 | Gasket, Oil reservoir .....            | 1                 |
| 72       | G20-090-2010 | Screw, Cap, hex-hd .....               | 4                 |

## 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.



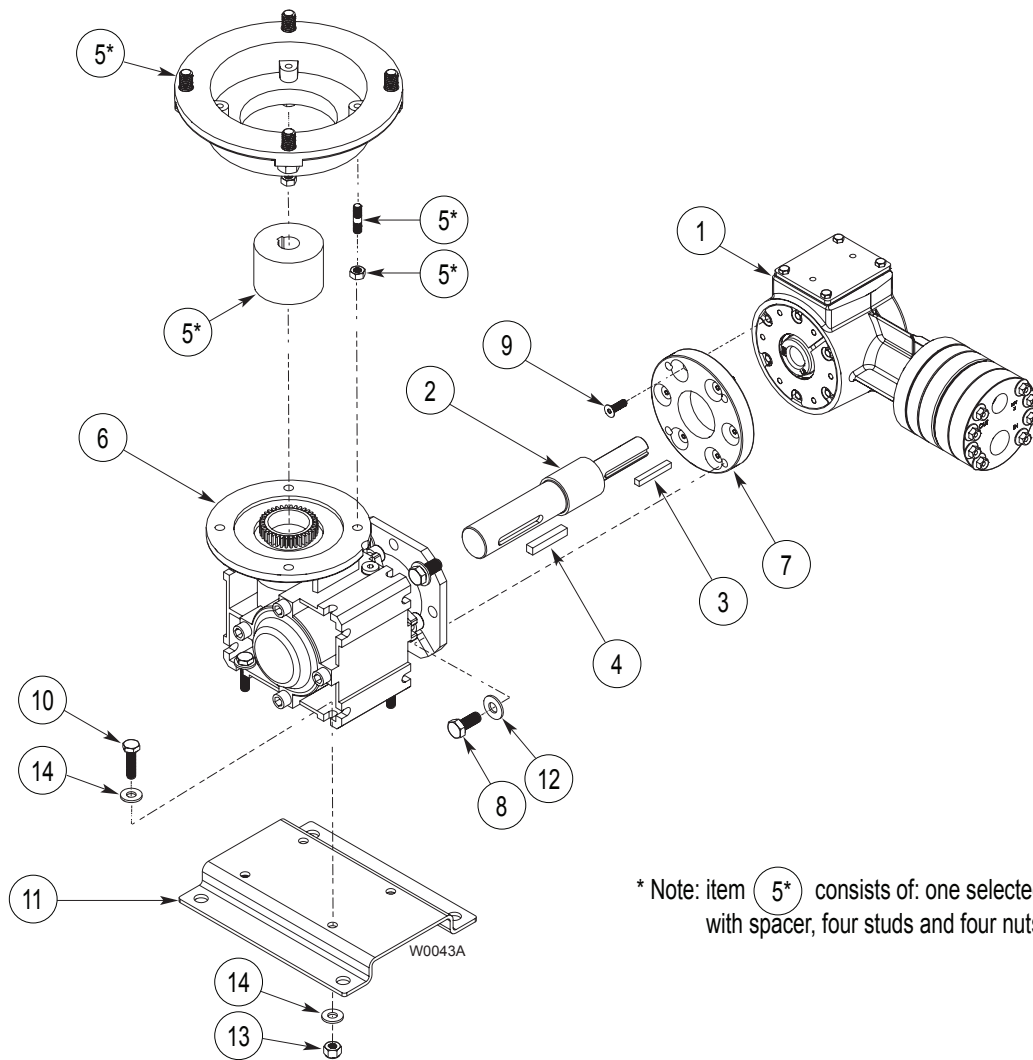
### Bolt Torque Specifications

| Ref. No. | in-lbs | N-cm |
|----------|--------|------|
| 52       | 14     | 158  |
| 72       | 10     | 113  |

# P100 Reducer Parts List

| Ref. No. | Part Number  | Description   | Quantity/ Pump |
|----------|--------------|---|----------------|
| 1        |              | P100 Pump Assembly, NPT ..... Ref<br>P100 Pump Assembly, BPST ..... Ref |                |
| 2        | 112-580      | Shaft, P100/P200.....   | 1              |
| 3        | D10-085-2210 | Key, 0.1875 SQ x 1.00 LG, Steel.....                                    | 1              |
| 4        | D25-085-2210 | Key, 1/4 SQ x 1.40 LG.....  | 1              |
| 5        | 112-555      | Input Flange Kit, NEMA 56C Adapter .....                                | 1              |
|          | 112-558      | Input Flange Kit, IEC 63 B5 Adapter .....                               | 1              |
|          | 112-559      | Input Flange Kit, IEC 71 B5 Adapter .....                               | 1              |
| 6        | 112-411      | Reducer, 5:1 ratio .....  | 1              |
|          | 112-410      | Reducer, 7.5:1 ratio .....  | 1              |
|          | 112-409      | Reducer, 10:1 ratio .....   | 1              |
|          | 112-408      | Reducer, 15:1 ratio .....   | 1              |
|          | 112-407      | Reducer, 20:1 ratio .....   | 1              |
|          | 112-405      | Reducer, 30:1 ratio .....   | 1              |
|          | 112-404      | Reducer, 40:1 ratio .....   | 1              |
|          | 112-403      | Reducer, 50:1 ratio .....   | 1              |
|          | 112-402      | Reducer, 60:1 ratio .....   | 1              |

| Ref. No. | Part Number  | Description                            | Quantity/ Pump |
|----------|--------------|--|----------------|
| 7        | F20-120-1030 | Adapter, P100 Pump .....               | 1              |
| 8        | 100-914      | Screw, 5/16-18 x .75, HHCS .....       | 4              |
| 9        | G20-089-2020 | Screw, M5 x 16 mm, FHS.....            | 6              |
| 10       | 100-659      | Screw, 1/4-20 UNC-2A x 1, HHCS, sst. . | 4              |
| 11       | 112-090      | Baseplate, P100 .....                  | 1              |
| 12       | 100-915      | Washer, flat, sst, 5/16.....           | 4              |
| 13       | 100-063      | Locknut, 1/4-20, sst.....              | 4              |
| 14       | 100-663      | Washer, flat, 1/4, sst.....            | 8              |



# P100 Troubleshooting

| Problem                                  | Probable Cause   | Solution   |
|--|--|--|
| <b>Motor/Pump Does Not Operate:</b>      | 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.   |
| <b>No Delivery</b>                       | 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.   |
| <b>Delivery Too Low and/or Erratic</b>   | 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.  |
| <b>Delivery Too High and/or Erratic.</b> | 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).   |



# P100 Replacement Parts Kits

TO ORDER REPLACEMENT PARTS KIT: A Replacement Parts Kit contains 9 digits corresponding to customer-specified design options.

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

| Digit | Order Code   | Description  |
|-------|--|--|
| 1-2   | <b>P1</b>  | <b>Pump Configuration</b><br>For all P100 Pumps  |
| 3     | <b>K</b><br><b>D</b><br><b>V</b>   | <b>Kit Designator</b><br>Complete Fluid End Kit*<br>Diaphragm Kit*<br>Valve Kit  |
| 4-5   | <b>52</b>  | <b>Pump Head Version</b><br>Standard   |
| 6     | <b>B</b><br><b>M</b><br><b>P</b><br><b>S</b><br><b>T</b><br><b>X</b>   | <b>Spring Retainers/Dampening Washers</b><br>Brass<br>For PVDF pump head<br>For Polypropylene pump head<br>For 316 Stainless Steel pump head<br>For Hastelloy® C pump head<br>Not included in Diaphragm Kit  |
| 7     | <b>A</b><br><b>E</b><br><b>X</b><br><b>S</b><br><b>J</b><br><b>W</b><br><b>P</b><br><b>R</b><br><b>T</b><br><b>F</b> | <b>Diaphragm &amp; O-ring Material</b><br>Aflas/PTFE O-rings (Synthetic Oil)<br>EPDM (EPDM Compatible Oil)<br>FKM (Synthetic Oil)<br>FKM (Food Contact Oil)<br>PTFE (Food Contact Oil)<br>PTFE (Synthetic Oil)<br>Neoprene (Synthetic Oil)<br>Neoprene (Food Contact Oil)<br>Buna-N (Synthetic Oil)<br>Buna-N (Food Contact Oil) |
| 8-9   | <b>SS</b><br><b>TT</b><br><b>SC</b><br><b>TC</b><br><b>XX</b>  | <b>Check Valve Material (Valve Spring / Valve &amp; Seat)</b><br>Elgiloy / 316 SST<br>Hastelloy® C / Hastelloy® C<br>Elgiloy / Ceramic<br>Hastelloy® C / Ceramic<br>Not included in Diaphragm Kit  |

\* Includes Hydraulic End Oil

## Kit Contents

| Part Number† | Description                   | Qty      | Kit Designator |   |   |
|--------------|-------------------------------|----------|----------------|---|---|
|              |                               |          | K              | D | V |
| D03-018-___  | Diaphragm                     | 1        | •              | • |   |
| F20-073-___  | O-ring, outlet manifold       | 1        | •              | • | • |
| F20-074-___  | O-ring, inlet manifold        | 1        | •              | • | • |
| D03-035-___  | O-ring, outlet valve seat     | 1        | •              |   | • |
| D03-020-___  | Valve seat, outlet            | 1        | •              |   | • |
| D03-021-___  | Valve, outlet                 | 1        | •              |   | • |
| D03-022-___  | Valve spring, outlet          | 1        | •              |   | • |
| ‡D03-092-___ | Tetra Seal®, outlet           | 1        | •              |   | • |
| D03-023-___  | Retainer, outlet valve spring | 1        | •              |   | • |
| D03-125-___  | Washer, outlet dampening      | 1        | •              |   | • |
| D11-035-___  | O-ring, inlet valve seat      | 1        | •              |   | • |
| D10-020-___  | Valve seat, inlet             | 1        | •              |   | • |
| D10-021-___  | Valve, inlet                  | 1        | •              |   | • |
| D10-022-___  | Valve spring, inlet           | 1        | •              |   | • |
| ‡D10-092-___ | Tetra Seal®, inlet            | 1        | •              |   | • |
| D10-023-___  | Retainer, inlet valve spring  | 1        | •              |   | • |
| A01-113-3400 | Thread locker                 | 1        | •              | • |   |
|              | Hydraulic End Oil             | (0.5 qt) | •              | • |   |

† Last four digits of part numbers with \_\_\_ refer to specific material of construction.

‡ Not included with metal spring retainers.

## P100 Tool Kit

The P100 Tool Kit (Part No. A03-175-1105) contains the tools listed below. These tools are used to assist in the repair and maintenance of the P100. See the maintenance sections of this manual for specific application.

| Ref. No. | Tool Part No. | Tool Description      | Quantity/Kit |
|----------|---------------|-----------------------|--------------|
| 1        | A03-125-1020  | Holder, Plunger ..... | 1            |
| 2        | A03-195-1200  | Rotator, Shaft .....  | 1            |
| 3        | A03-196-1000  | Lifter, Plunger ..... | 1            |
| 4        | A03-124-1200  | Lever Assembly .....  | 1            |
| 7        | A03-126-1500  | Tool Box .....        | 1            |

# P100 Warranty

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## Limited Warranty

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

This warranty does not cover:

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

This limited warranty is exclusive, and is in lieu of any other warranties (express or implied) including warranty of merchantability or warranty of fitness for a particular purpose and of any 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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