

EPM

ELECTRONIC PRECISION METERING

P400 Metering Pump

Installation & Service

P400-991-2400A



W0014



Hydra-Cell
SIMPLY BUILT TO LAST

WANNEK ENGINEERING, INC.

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

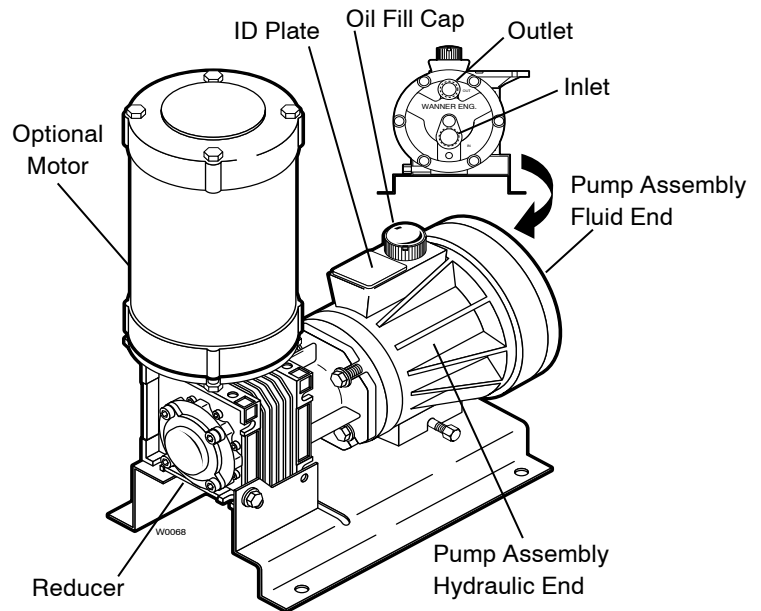
www.epmpump.com
email: sales@wannereng.com

Metallic Pump shown (Motor Optional)

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Component Identification



P400 Specifications

Steady State

Accuracy ±1%

Max Pressure

Metallic Head: 1000 psi (70 bar)
 Non-Metallic Head: Polypropylene: 250 psi (17 bar)
 Kynar: 350 psi (24 bar)

Capacity @ 100 PSI (6.9 bar) Discharge Pressure*

RPM	GPH	LPH
120	40	150
240	82	310
360	120	454
480	165	625
720	245	927

Max Inlet Pressure 250 psi (17 bar)

Max Temperature

Metallic Head: 250°F (121°C) – consult factory for temperatures above 160°F (71°C)
 Non-Metallic Head: 140°F (60°C)

Inlet Port 1 inch NPT, BSPT

Discharge Port 3/4 inch NPT, BSPT

Shaft Rotation Bi-directional

Oil Capacity 1.1 US quart (1.05 liters)

Weight

Metallic Head: 62 lbs (28.1 kg)
 Non-Metallic Head: 49 lbs (22.2 kg)

Motor Horsepower (kW)*

RPM	1/4 (0.18)	1/2 (0.37)	3/4 (0.55)	1 (0.75)
120	1/4 (0.18)	1/4 (0.18)	1/4 (0.18)	1/2 (0.37)
240	1/4 (0.18)	1/2 (0.37)	3/4 (0.55)	1 (0.75)
360	1/4 (0.18)	1/2 (0.37)	3/4 (0.55)	1-1/2 (1.1)
480	3/4 (0.55)	3/4 (0.55)	1-1/2 (1.1)	2 (1.5)
720	3/4 (0.55)	1 (0.75)	2 (1.5)	3 (2.2)
P#	≤100 (7)	≤250 (17)	≤500 (35)	≤1000 (70)

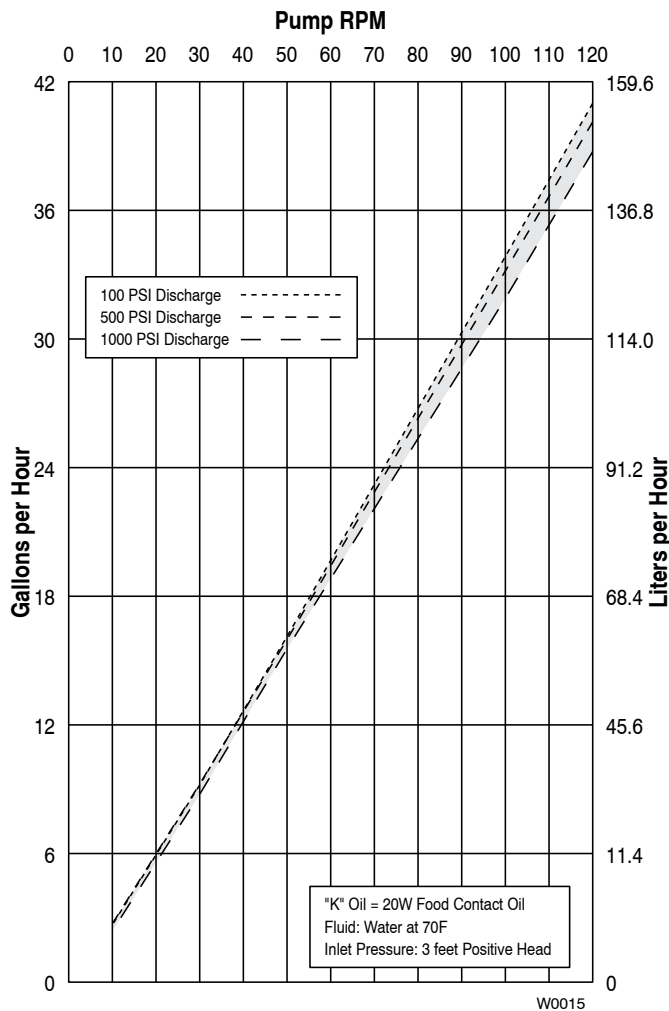
* This chart is approximate. Contact Wanner Engineering to determine specific motor horsepower application requirements.

P = pressure in PSI (bar)

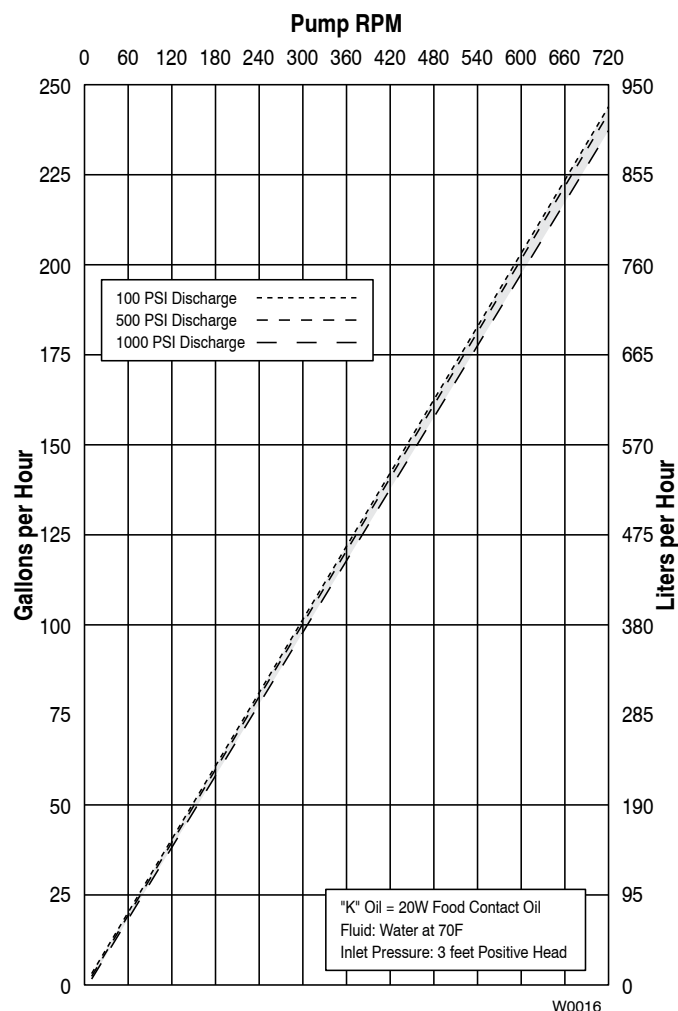
* Capacity data for pumps with elastomeric diaphragms. Consult factory for performance characteristics of pumps with PTFE diaphragms.

P400 Specifications

Capacity @ 120 RPM (max)*



Capacity @ 720 RPM (max)*



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

Repeatability ^(1,2): ±3% of rated capacity over 10:1 turndown ratio.

Linearity ^(1,2): ±3% of rated capacity over 10:1 turndown ratio.

⁽¹⁾ Required pump discharge pressure equals 50 PSI (3.5 bar) minimum.

⁽²⁾ Requires steady state discharge pressure.

P400 Dimensions

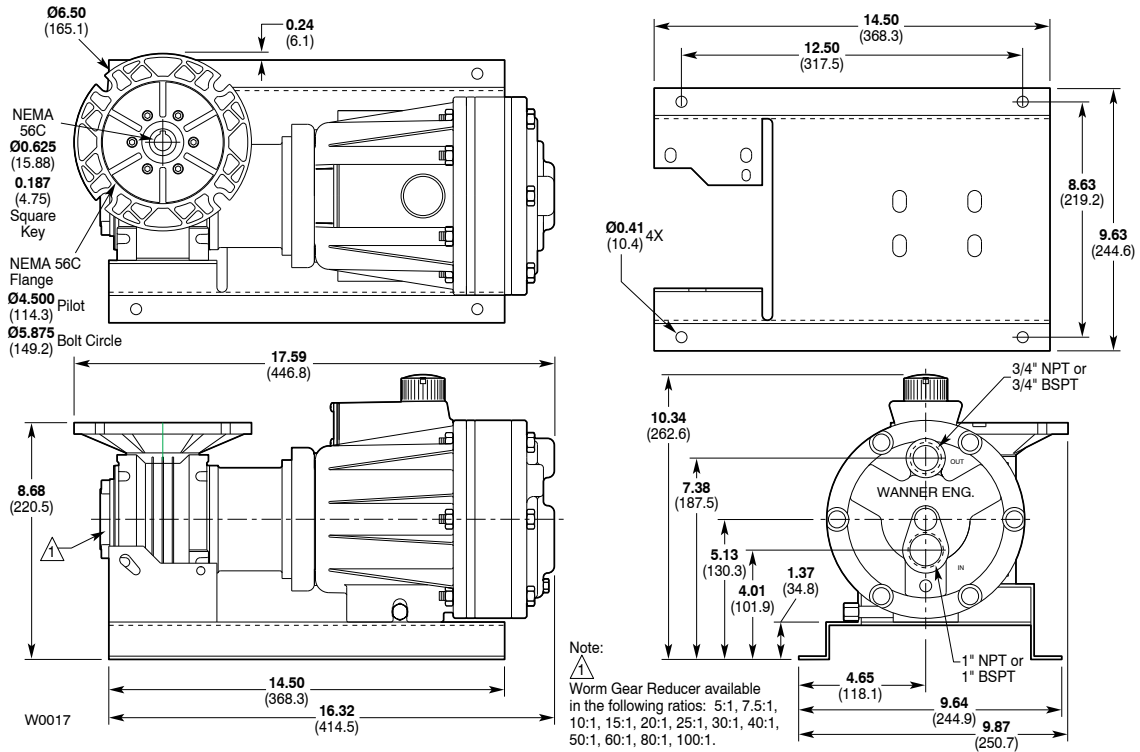
P400 Models with Metallic Pumping Head

316 Stainless Steel

Cast Iron

Hastelloy® C

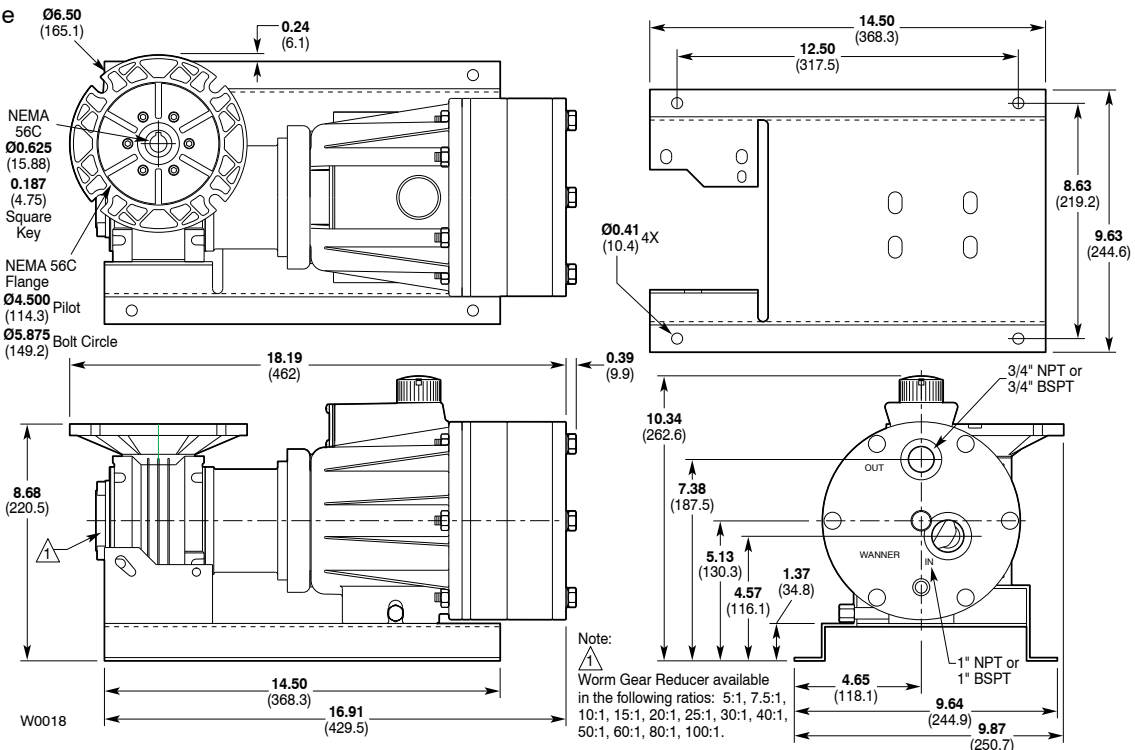
Inches (mm)



P400 Models with Non-Metallic Pump Head

Kynar

Polypropylene



P400 Installation

Location

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

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

Install it in a lighted clean space where it will be easy to inspect and maintain.

Motor and Controller

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

Accessories

Consult installation drawing below for typical precision 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.

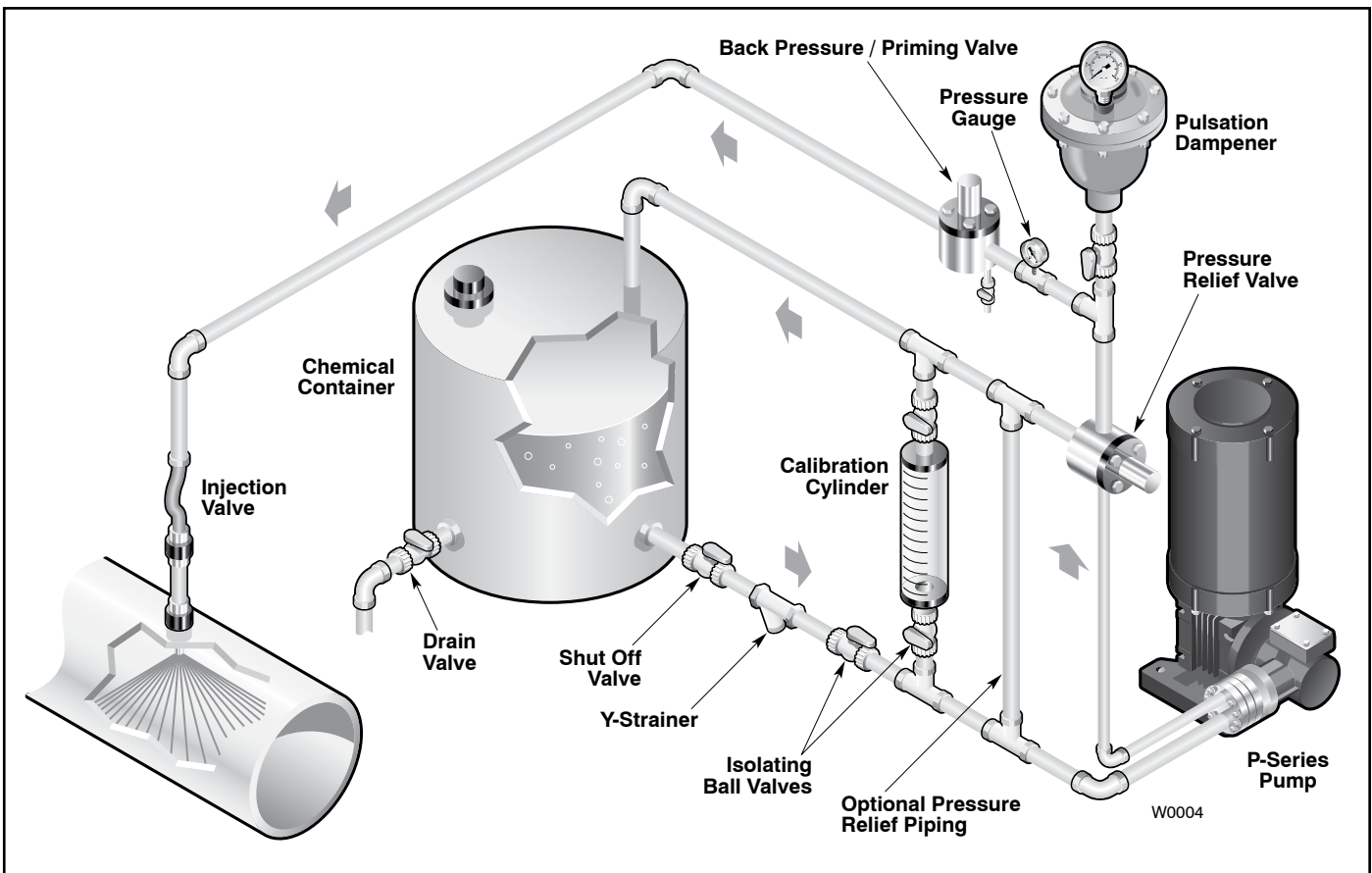
Positive Displacement. This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, install a relief valve downstream from the pump. See **Discharge Piping** on page 6.

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)



P400 Installation

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.

P400 Installation

Initial Start-Up Procedure

Before you start the pump, be sure that:

- All shut-off valves are open, and the pump has an adequate supply of fluid.
 - All connections are tight.
 - The oil level is 1/4 inch (6 mm) above the cast surface in the upper oil reservoir.
1. Open the priming valve on the system back pressure valve so the pump starts under minimum pressure.
 2. Turn on power to the pump motor.
 3. Check the inlet pressure or vacuum. To maintain maximum flow, the 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 the pump on and off until fluid coming from the priming valve is air-free.
 - Close the priming valve.

Calibration Procedure

Each individual metering pump put into service must be calibrated in order to accurately determine required pump speed to achieve the desired flow. The capacity curves shown on page 3 represent a typical pump; individual pumps may vary slightly from these curves. In order to achieve the best possible results, perform calibration under actual process conditions. Follow these steps:

1. Run the pump for 20 minutes at actual process conditions. If the process system cannot be used, circulate back to the supply tank through a pressure relief valve (see Installation drawing on page 5). If required system pressure is less than 50 PSI (3.5 bar) a back pressure valve must be installed and set to produce a minimum of 50 PSI (3.5 bar) pressure at the 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 your system calibration cylinder, flow meter, or some other means. This is considered to be the "rated capacity" for your particular metering pump.
3. Measure pump delivery at 75%, 50%, 25%, and 10% of the maximum speed just determined. Let the pump run for 5 minutes at each speed setting before taking the capacity measurement.
4. Plot these values on linear graph paper using the horizontal axis for RPM and the vertical axis for GPH, or any other unit of measure you may be using for capacity.
5. Draw a best-fit straight line through the points just plotted. For stable conditions, this line predicts pump speed required to achieve desired flow over a 10:1 turndown ratio.

Note: as pump discharge pressure increases, capacity decreases slightly (see Capacity curves on page 3). For any metering pump there are a series of valid capacity curves that may apply. Use the curve that depends on actual pump discharge pressure and other system conditions. It is critically important to develop a custom capacity curve for each pump and each system.

P400 Maintenance

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

Periodically

Change the oil according to the guidelines below. When changing, remove the drain plug (34), Allow all oil and contaminant to drain out. Catch the oil and dispose of it properly.

Hours Between Oil Changes @ 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).

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

Use the appropriate Hydra-Oil for the application.

Note: P Series replacement parts kits (complete kits and diaphragm kits) include the appropriate oil for each specific 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 (20) may be damaged. Refer to the Fluid-End Service Section. Do not operate the pump with a damaged diaphragm.

CAUTION: Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil. Dispose of properly. Replace with clean oil.

Check the inlet pressure periodically with a gauge.

P400 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.

CAUTION: Do not disassemble the hydraulic end of the pump. Contact Wanner Engineering (TEL 612-332-5681 or FAX 612-332-6937) or the distributor in your area.

1. Remove Manifold (6), Valve Plate (16)

a. Remove six nuts (31) and six bolts (4) around manifold (6). Do not remove bolt (25) or bolt (29) installed through back of cylinder housing (24).

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

CAUTION: Do not turn the pump drive shaft while the manifold and valve plate are off the pump, except when removing diaphragms or repriming the hydraulic cells.

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

d. Inspect manifold (6) for warping or wear around inlet and outlet ports. If wear is excessive, replace the manifold.

To check if manifold is warped, remove o-rings (7,8,9) and place straightedge across it. If warped replace.

2. Inspect Valves (10-15, 39)

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

a. Check the spring retainer (15), and replace if worn.

Note: if your pump has a non-metallic pump head there will be a plastic dampening washer (39) at the bottom of each seat. Inspect each one for wear or cracks and replace if necessary.

b. Check valve spring (13). If shorter than new spring, replace (do not stretch old spring).

c. Check valve (12). If worn excessively, replace.

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

d. Remove valve seat (11) and o-ring (10). A seat puller is included in Wanner Tool Kit.

Inspect valve seat for wear, and replace if necessary. A new o-ring should be installed.

e. Reinstall the inlet and outlet assemblies:

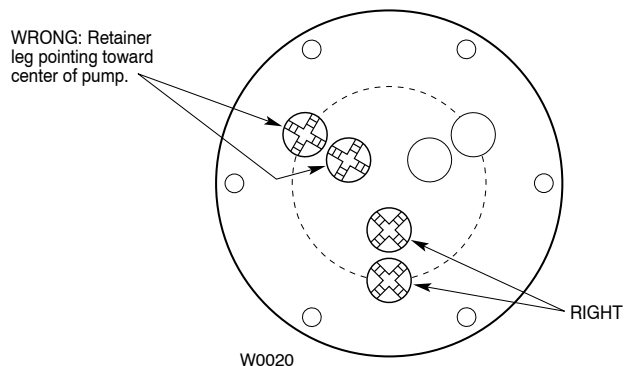
- Clean valve ports and shoulders with emery cloth, and lubricate with lubricating gel or petroleum jelly.

- Install o-ring (10) on valve seat (11).

- **Inlet Valves** (3 center valves in illustration below). Insert spring retainer (15) into valve plate (16). Then insert spring (13), valve (12), and valve seat (11). If the pump has plastic spring retainers, install flat Tetra seal o-ring (14) between spring retainer (15) and valve seat (11). Insert dampening washer (39), if included in your valve assembly.

- **Outlet Valves** (3 outer valves in illustration below). Insert dampening washer (39), if included in your valve assembly. Insert valve seat (11), valve (12), spring (13), and spring retainer (15). If the pump has plastic spring retainers, install flat Tetra seal o-ring (14) between spring retainer and valve seat. If the pump has **metal** spring retainers in the outlet valves, position them so a leg does not point toward the center of the pump (see illustration below).

Installing Valve Retainers Into Valve Plate



P400 Fluid End Service

3. Inspect and Replace Diaphragms (20)

If necessary to service diaphragms, remove two socket-head cap screws (41) that secure valve plate (16) to cylinder casting (24). Inspect valve plate the same as manifold in Section 1 step d.

- a. Lift diaphragm (20) by one edge, and turn pump shaft until diaphragm pulls up. This will expose machined cross-holes in plunger shaft behind diaphragm.
- b. Insert Allen wrench through one of the holes, to hold diaphragm up. The proper size tool is included in the Wanner Tool Kit. (Don't remove tool until new diaphragm is installed in step f below.)
- c. Remove the screw (17), o-ring (18), and follower (19) in center of diaphragm (20).
- d. Remove diaphragm (20), and inspect carefully. A damaged diaphragm generally indicates a pumping system problem. Replacing diaphragm only, will not solve the larger problem. Inspect diaphragm for following:
 - **Small 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 (21) for any rough surfaces or edges. **Do not** remove plunger from the plunger shaft. Smooth the 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 (20) (or old one, if not damaged), ridge side out.
- g. Clean screw (17) and remove any oil from it. Apply medium-strength threadlocker to screw. Reinstall screw and follower (19), and new o-ring (18). Tighten to 18 in-lbs (2.0 N-m).
- h. Repeat above inspection procedure (and replacement, as necessary) with other two diaphragms (20).

4. Flush Contaminant from Hydraulic End

(only if a diaphragm has ruptured)

- a. Remove the brass cap (34) and allow all oil and contaminate to drain out.
- b. Fill reservoir with kerosene or solvent, manually turn pump shaft to circulate kerosene, and drain.

CAUTION: If you have EPDM diaphragms, or if food grade oil is in the reservoir, do not use kerosene or solvents. Instead, flush with the same lubricant that is in the reservoir.

- c. Repeat flushing procedure (step b).
- d. Fill reservoir with fresh oil, manually turn pump shaft to circulate oil. Drain oil.
- 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.

P400 Fluid End Service

5. Priming Hydraulic Cells for Kel-Cell Pumps

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

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

- a. Install valve plate (16) but without the outlet valves installed (or else remove outlet valves; leave seats installed) onto cylinder housing (24). Tighten two socket-head screws (41).
- b. 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. With blunt pointer (eraser end of pencil), reach in through each outlet valve port and push diaphragm (20) backwards. Note air bubbles coming out at oil fill port. Now turn shaft about 1/2 turn.
- d. Repeat depressing diaphragms (20) and rotating shaft (approx. 4-6 times) until no more air bubbles escape and oil has dropped about 1 inch (25 mm) from top of fill port. Hydraulic cells are now primed. Replace oil fill cap (27).
- e. Install outlet valve assemblies in each outlet valve port. See Parts List for correct assembly order. If necessary, tip pump (head upward) in order to keep valve (12) centered on valve seat (11) and allow valve retainer (15) to fit into port flush.
- f. Install manifold (6) and complete installation.

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 (20) 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 (16) (before oil runs out past diaphragms (20)) with socket head screws (41), but do not tighten completely. Leave gap between valve plate and the cylinder housing (24). 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 (6).
- 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 (27) and complete installation.

P400 Fluid End Service

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 (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 (20). 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 (27) and complete installation.

6. Reinstall Pumping Head

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

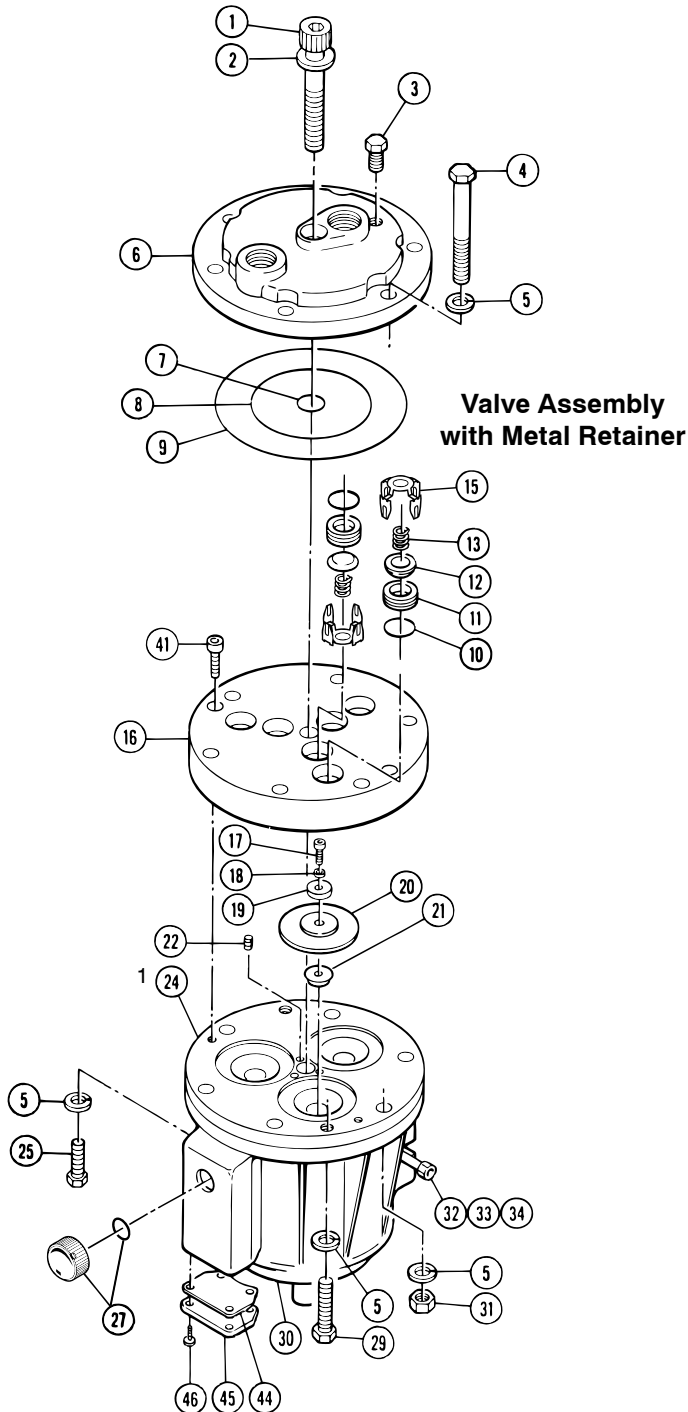
- a. With valve assemblies installed as outlined above, reinstall valve plate (16) onto cylinder housing (24). Recheck that blind hole is over protruding bolt at 10 o'clock position. Install two socket-head cap screws (41) and secure valve plate to cylinder casting.
- b. Reinstall o-rings (7,8,9) on rear side of the manifold (6). Use petroleum jelly or lubricating gel to hold them in place.
- c. Reinstall manifold (6) onto valve plate (16). Be sure drain plug (3) is at bottom of manifold.

NOTE: on pumps with non-metallic head position support plate (42) onto manifold with ports and bolt holes aligned properly.

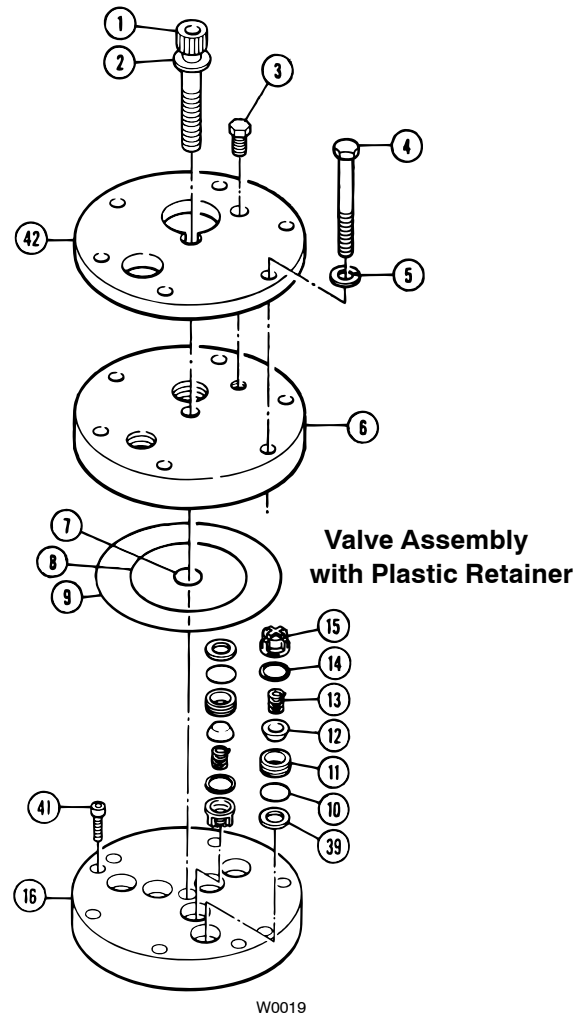
- d. Insert bolts (4), washers (5), and nuts (31). Hand tighten.
- e. Reinstall centerbolt (1) with washer (2), and torque to 45 ft-lbs (60 N-m).
- f. Alternately tighten six perimeter bolts (4). Torque to 45 ft-lbs (60 N-m).
- g. Recheck all bolts for tightness.

P400 Fluid End Parts List

P400 with Metallic Pump Head



P400 with Non-Metallic Pump Head



W0019

1 Cylinder Housing Assembly includes cylinder housing (24), bearing cup, adjusting plate (61), O-ring (60), and set screws (22).

P400 Fluid End Parts List

Ref No.	Part Number	Description	Quantity/ Pump	Ref No.	Part Number	Description	Quantity/ Pump
1	D10-081-2012	Screw, cap, socket head *	1	14	D10-092-2110	Tetra Seal, Buna	6
	D10-081-2017	Screw, cap, socket head **	1		D10-092-2111	Tetra Seal, Viton	6
2	D10-084-2010	Washer, flat	1		D10-092-2112	Tetra Seal, neoprene	6
3	D10-038-2017	Plug, nickel alloy, Hastelloy CW12MW, npt	1		D10-092-2113	Tetra Seal, EPDM	6
	D10-038-2211	Plug, 316 SST, npt	1		D10-092-2118	Tetra Seal, PTFE	6
	G10-038-2017	Plug, nickel alloy, Hastelloy CW12MW, bspt	1	15	D10-023-1017	Retainer, valve spring, Hastelloy C	6
	G10-038-2211	Plug, 316 SST, bspt	1		D10-023-2327	Retainer, valve spring, polypropylene	6
4	D10-024-2010	Bolt, hex-head*	6		D10-023-2328	Retainer, valve spring, Kynar	6
	D10-024-2017	Bolt, hex-head **	6	16	D10-003-1012	Valve Plate, 316 SST*	1
5	D10-048-2010	Washer, split lock	14		D10-003-1019	Valve Plate, cast iron*	1
6	D10-004-1002	Manifold, 316 SST, npt	1		D10-003-1027	Valve Plate, nickel alloy, Hastelloy CW12MW*	1
	D10-004-1017	Manifold, nickel alloy, Hastelloy CW12MW, npt	1		D10-003-1050	Valve Plate, polypropylene**	1
	D10-004-1034	Manifold, cast iron, npt	1		D10-003-1053	Valve Plate, Kynar**	1
	D10-004-1050	Manifold, polypropylene, npt	1	17	D10-030-2010	Screw, flat-head, sst	3
	D10-004-1053	Manifold, Kynar, npt	1		D10-030-2011	Screw, flat-head, Hastelloy C	3
	G10-004-1002	Manifold, 316 SST, bspt	1	18	D10-047-2110	O-ring, follower, Buna-N	3
	G10-004-1017	Manifold, nickel alloy, Hastelloy CW12MW, BSPT	1		D10-047-2111	O-ring, follower, Viton	3
	G10-004-1034	Manifold, cast iron, bspt	1		D10-047-2112	O-ring, follower, neoprene	3
	G10-004-1050	Manifold, polypropylene, bspt	1		D10-047-2113	O-ring, follower, EPDM	3
	G10-004-1053	Manifold, Kynar, bspt	1		D10-047-2118	O-ring, follower, PTFE	3
7	D10-083-2110	O-ring, centerbolt, Buna	1	19	D10-017-1010	Follower, 316 SST	3
	D10-083-2111	O-ring, centerbolt, Viton	1		D10-017-1011	Follower, Hastelloy C	3
	D10-083-2112	O-ring, centerbolt, neoprene	1	20	D10-018-2312	Diaphragm, neoprene	3
	D10-083-2113	O-ring, centerbolt, EPDM	1		D10-018-2313	Diaphragm, EPDM	3
	D10-083-2118	O-ring, centerbolt, PTFE	1		D10-018-2315	Diaphragm, Viton XT	3
8	D10-073-2110	O-ring, inner manifold, Buna	1		D10-018-2318	Diaphragm, PTFE	3
	D10-073-2111	O-ring, inner manifold, Viton	1		D10-018-2320	Diaphragm, Buna-N-XS	3
	D10-073-2112	O-ring, inner manifold, neoprene	1	21	D10-016-1010	Plunger	3
	D10-073-2113	O-ring, inner manifold, EPDM	1	22	D10-082-2010	Set Screw	3
	D10-073-2118	O-ring, inner manifold, PTFE	1	24	K10-002-1010	Cylinder Housing, Kel-Cell	1
9	D10-074-2110	O-ring, outer manifold, Buna*	1		K10-002-1210	Cylinder Housing Assembly, Kel-Cell	1
	D10-074-2111	O-ring, outer manifold, Viton*	1	25	D10-029-2010	Screw, cap, hex-head	1
	D10-074-2112	O-ring, outer manifold, neoprene*	1	27	D03-039-1030	Cap, oil fill (includes O-ring)	1
	D10-074-2113	O-ring, outer manifold, EPDM*	1	29	D10-087-2010	Screw, cap, hex-head	1
	D10-074-2118	O-ring, outer manifold, PTFE*	1	30	D10-001-1033	Pump Housing	1
	D10-109-2110	O-ring, outer manifold, Buna**	1	31	D10-028-2010	Nut, hex	6
	D10-109-2111	O-ring, outer manifold, Viton**	1	32	D10-076-2210	Elbow, brass, 1/8" npt	1
	D10-109-2112	O-ring, outer manifold, Neoprene**	1	33	D10-077-2210	Pipe, brass, 1/8" npt	1
	D10-109-2113	O-ring, outer manifold, EPDM**	1	34	D10-078-2210	Cap, brass, 1/8" npt	1
	D10-109-2118	O-ring, outer manifold, PTFE**	1	39	D10-125-2327	Washer, dampening, polypropylene**	6
10	D10-035-2110	O-ring, valve seat, Buna	6		D10-125-2328	Washer, dampening, Kynar**	6
	D10-035-2111	O-ring, valve seat, Viton	6	41	D10-088-2010	Screw, cap, socket head	2
	D10-035-2112	O-ring, valve seat, neoprene	6	42	D10-100-1010	Support, face plate**	1
	D10-035-2113	O-ring, valve seat, EPDM	6	44	D10-106-2310	Gasket, cover	1
	D10-035-2118	O-ring valve seat, PTFE	6	45	D10-105-1010	Cover	1
11	D10-020-1011	Valve seat, 316 SST	6	46	G10-090-2010	Screw, M4 x 12	4
	D10-020-1017	Valve seat, Hastelloy C	6				
	D10-020-3300	Valve seat, ceramic	6				
12	D10-021-1011	Valve, Nitronic	6				
	D10-021-1017	Valve, Hastelloy C	6				
	D10-021-3300	Valve, ceramic	6				
13	D10-022-3117	Valve Spring, Elgiloy	6				
	D10-022-3123	Valve Spring, Hastelloy C	6				

1 Cylinder Housing Assembly includes cylinder housing (24), bearing cup, adjusting plate (61), O-ring (60), and set screws (22).

* For use with Metallic Pump Head models only.

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

P400 Hydraulic End Parts Lists

Ref No.	Part Number	Description	Quantity/ Pump
50	D10-019-3110	Spring, piston return.....	3
51	K10-042-1010	Retainer, spring, Kel-Cell	3
52	C23-009-2110	O-ring, valve cylinder, Buna, Kel-Cell	3
53	K10-045-3110	Spring, sleeve valve, Kel-Cell	3
54	K10-044-1010	Valve Plunger, Kel-Cell	3
55	K10-043-1010	Cylinder, valve, Kel-Cell	3
56	D10-034-2110	O-ring, Buna.....	3
57	D10-041-1010	Washer, ball retainer	3
58	D10-015-3010	Ball	12
59	D10-014-1209 K10-014-1210	Piston, with foot and retainer	3
60	D10-075-2110	O-ring, bearing adjusting plate, Buna.	1
61	D10-012-1010	Bearing Adjusting Plate.....	1

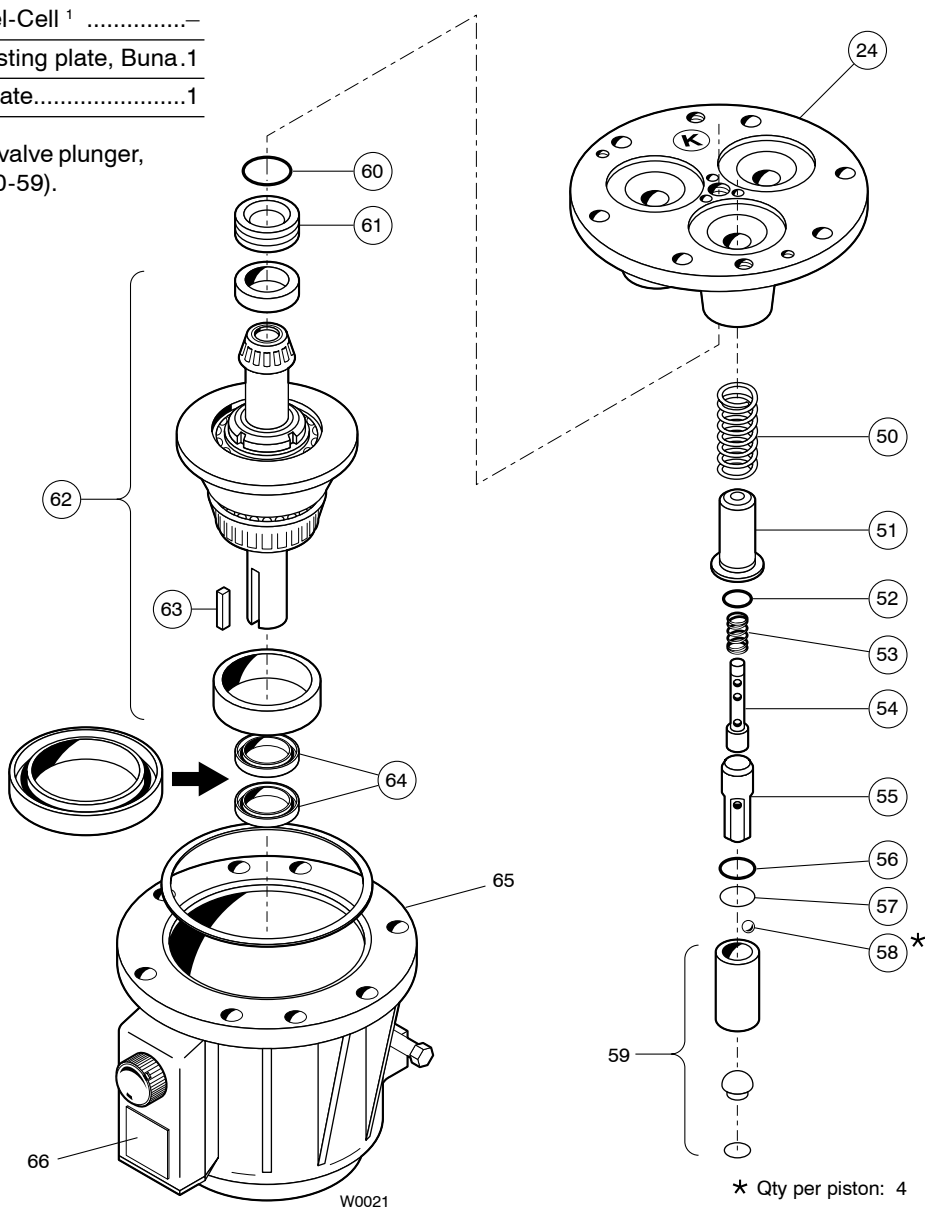
Ref No.	Part Number	Description	Quantity/ Pump
62	D10-007-1210	(X) Cam Assembly	1
63	D10-085-2210	Key, shaft	1
64	D10-031-2210	Seal , Buna.....	2
65	D10-037-2110	O-ring, pump housing, Buna.....	1
66	D10-040-2421	Nameplate.....	1

Hydraulic End Service

CAUTION: Do not disassemble or service the hydraulic end.

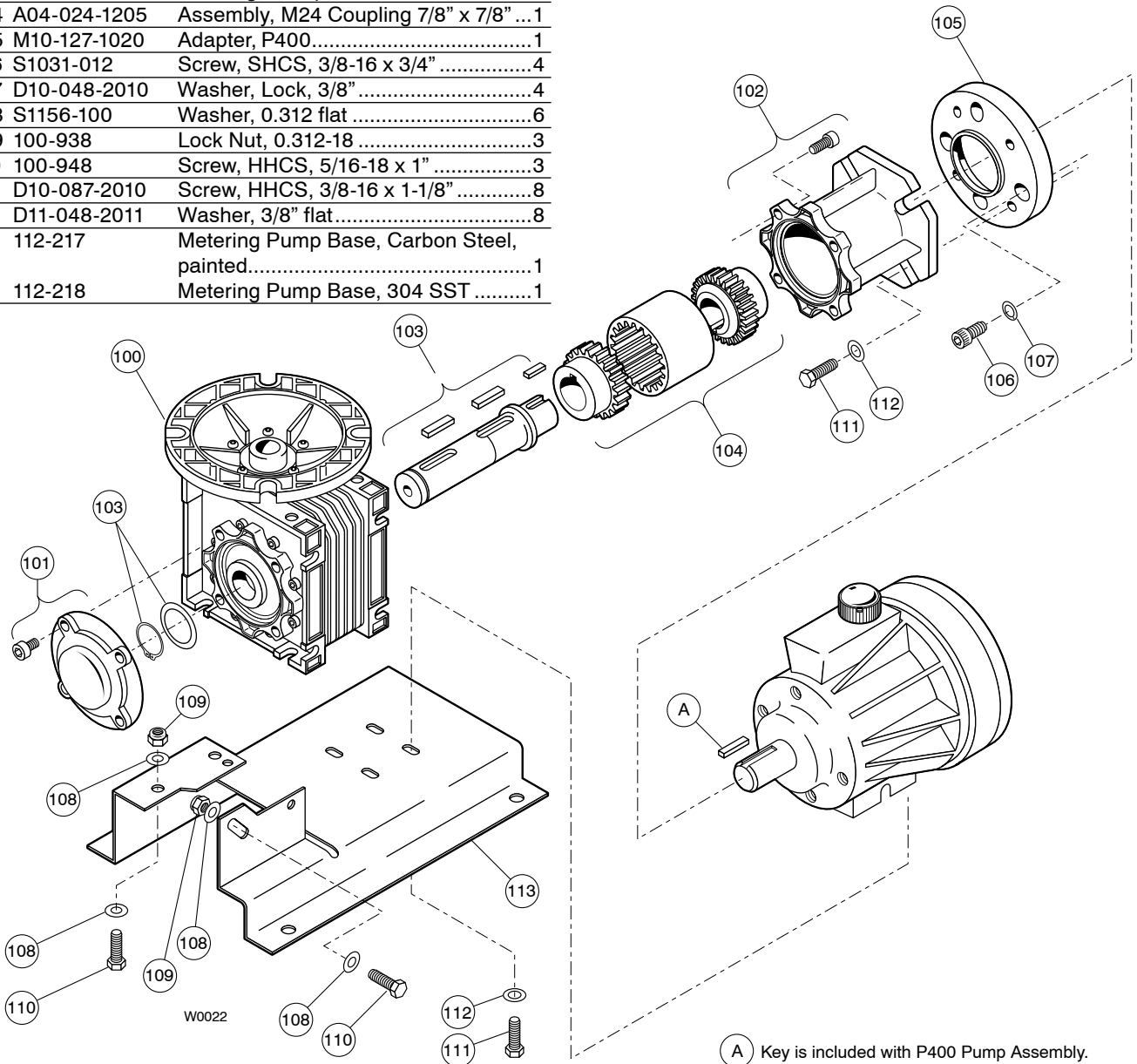
For assistance, contact Wanner Engineering at (612)332-5681 for the distributor in your area.

¹ Piston Assembly includes cylinder, foot, valve plunger, O-rings, spring retainer, and springs (50-59).



P400 Reducer/Base Parts List

Ref No.	Part Number	Description	Quantity/Pump
100	112-200	Reducer, 5:1 ratio, 56C	1
	112-201	Reducer, 7.5:1 ratio, 56C	1
	112-202	Reducer, 10:1 ratio, 56C	1
	112-203	Reducer, 15:1 ratio, 56C	1
	112-204	Reducer, 20:1 ratio, 56C	1
	112-205	Reducer, 25:1 ratio, 56C	1
	112-206	Reducer, 30:1 ratio, 56C	1
	112-207	Reducer, 40:1 ratio, 56C	1
	112-208	Reducer, 50:1 ratio, 56C	1
	112-209	Reducer, 60:1 ratio, 56C	1
	112-210	Reducer, 80:1 ratio, 56C	1
	112-211	Reducer, 100:1 ratio, 56C	1
101	112-212	Kit, Protective Cover	1
102	112-213	Kit, Output Flange, FB	1
103	112-225	Kit, Single Output Shaft, EPM-P300 ..	1
104	A04-024-1205	Assembly, M24 Coupling 7/8" x 7/8" ...	1
105	M10-127-1020	Adapter, P400.....	1
106	S1031-012	Screw, SHCS, 3/8-16 x 3/4"	4
107	D10-048-2010	Washer, Lock, 3/8"	4
108	S1156-100	Washer, 0.312 flat	6
109	100-938	Lock Nut, 0.312-18	3
110	100-948	Screw, HHCS, 5/16-18 x 1"	3
111	D10-087-2010	Screw, HHCS, 3/8-16 x 1-1/8"	8
112	D11-048-2011	Washer, 3/8" flat.....	8
113	112-217	Metering Pump Base, Carbon Steel, painted.....	1
	112-218	Metering Pump Base, 304 SST	1



P400 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.
	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).

P400 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		Pump Configuration
	P4	For all P400 Pumps
3		Kit Designator
	K	Complete Fluid End Kit*
	D	Diaphragm Kit*
	V	Valve Kit
4-5		Pump Head Version
	52	Metallic Pump Head
	55	Non-Metallic Pump Head
6		Spring Retainers/Dampening Washers
	C	For Cast Iron pump head
	M	For Kynar® pump head
	P	For Polypropylene pump head
	S	For 316 Stainless Steel pump head
	T	For Hastelloy® C pump head
	X	Not included in Diaphragm Kit
7		Diaphragm & O-ring Material
	E	EPDM
	G	Viton®-XT
	J	PTFE
	P	Neoprene
	T	Buna-N-XS
8-9		Check Valve Material (Valve Spring / Valve & Seat)
	SS	316 SST / 316 SST
	TT	Hastelloy® C / Hastelloy® C
	SC	316 SST / Ceramic
	TC	Hastelloy® C / Ceramic
	XX	Not included in Diaphragm Kit

* Includes Hydraulic End Oil

Metallic Pump Head Kit Contents

Part Number*	Description	Qty	Kit Designator		
			K	D	V
D10-018-___	Diaphragm	3	•	•	
D10-047-___	O-ring, follower	3	•	•	
D10-074-___	O-ring, outer manifold	1	•	•	•
D10-073-___	O-ring, inner manifold	1	•	•	•
D10-083-___	O-ring, center bolt	1	•	•	•
D10-035-___	O-ring, valve seat	6	•		•
D10-020-___	Valve seat	6	•		•
D10-021-___	Valve	6	•		•
D10-022-___	Valve spring	6	•		•
D10-023-___	Retainer, valve spring	6	•		•
A01-113-3400	Threadlocker	1	•	•	
	Hydraulic End Oil (1.5 qt)		•	•	

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

Non-Metallic Pump Head Kit Contents

Part Number*	Description	Qty	Kit Designator		
			K	D	V
D10-018-___	Diaphragm	3	•	•	
D10-047-___	O-ring, follower	3	•	•	
D10-109-___	O-ring, outer manifold	1	•	•	•
D10-073-___	O-ring, inner manifold	1	•	•	•
D10-083-___	O-ring, center bolt	1	•	•	•
D10-035-___	O-ring, valve seat	6	•		•
D10-020-___	Valve seat	6	•		•
D10-021-___	Valve	6	•		•
D10-022-___	Valve spring	6	•		•
D10-092-___	Tetra seal	6	•		•
D10-023-___	Retainer, valve spring	6	•		•
D10-125-___	Washer, dampening	6	•		•
A01-113-3400	Threadlocker	1	•	•	
	Hydraulic End Oil (1.5 qt)		•	•	

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

P400 Notes

P400 Notes

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.



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.epmpump.com
email: sales@wannereng.com

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