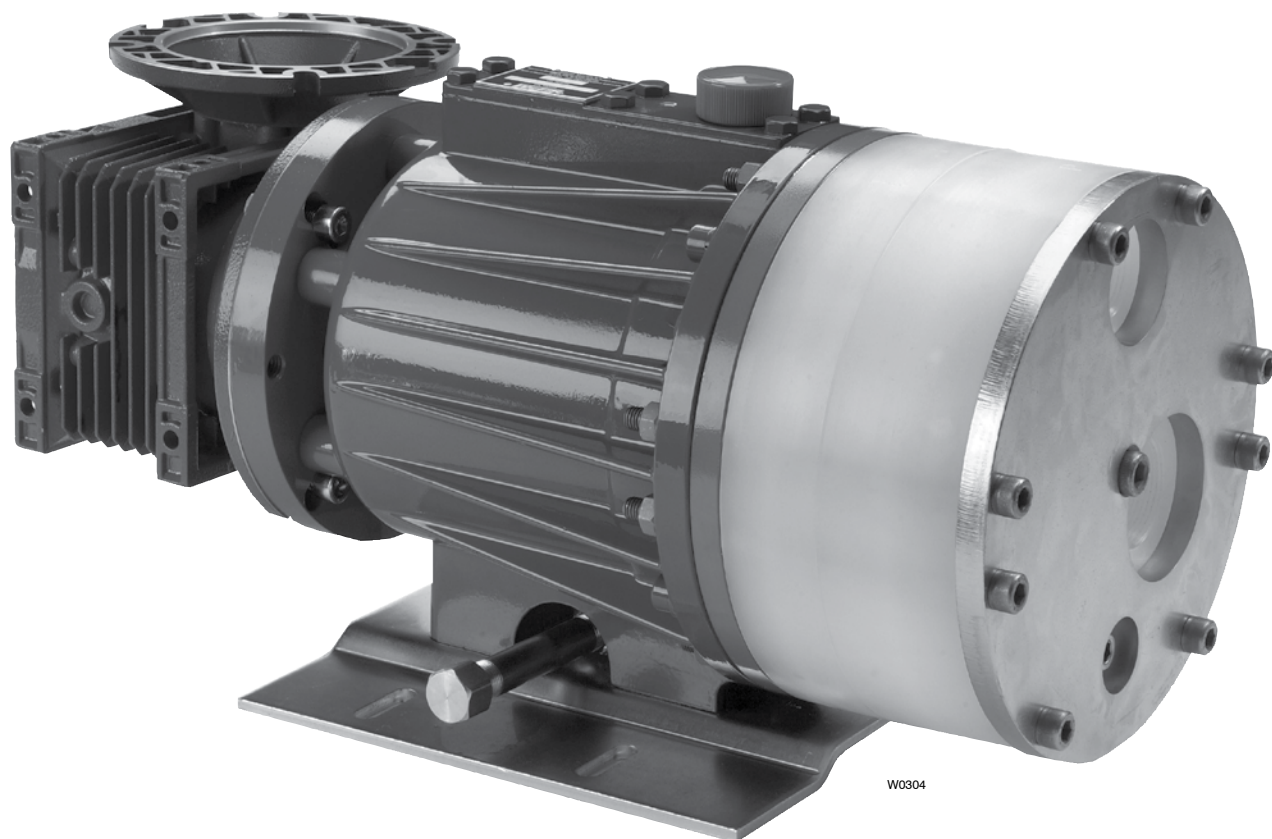


Hydra·Cell[®]
METERING SOLUTIONS™

P600 Metering Pump

Installation & Service

P600-991-2400



W0304

Non-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

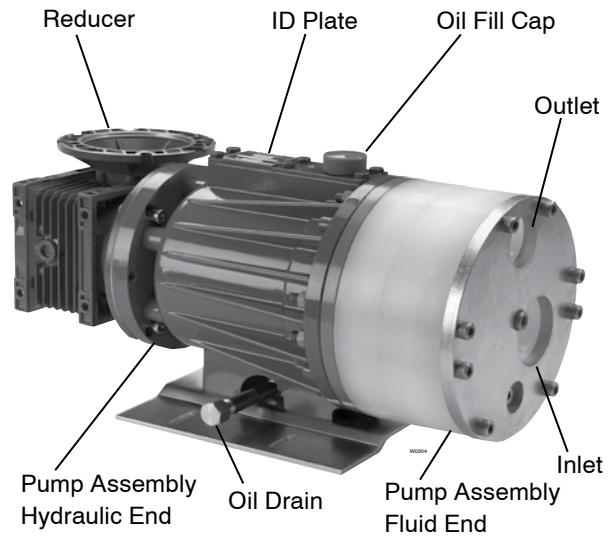
www.hydra-cell.com/metering

email: sales@wannereng.com

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Component Identification



P600 Specifications

Steady State Accuracy	±1%
Linearity	±3%
Repeatability	±3%
Maximum Pressure	
Metallic Head:	1000 psi (70 bar)
Non-Metallic Head: Polypropylene:	250 psi (17 bar)
Kynar:	350 psi (24 bar)
Maximum Inlet Pressure	250 psi (17 bar)
Maximum 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 1/2 inch NPT or BSPT
Discharge Port	1 inch NPT or BSPT
Shaft Rotation	Bi-directional
Oil Capacity	2.5 US quart (2.4 liters)
Weight	
Metallic Head:	141 lbs (64 kg)
Non-Metallic Head:	106 lbs (48 kg)

Gallons Per Hour (GPH) Maximum Flow at Designated Pressure

GPH All Pumps		GPH Metallic Pump Heads Only		Pump RPM	Gear Ratio	Motor RPM	
100 PSI (*)	250 PSI (*)	500 PSI (*)	1000 PSI (*)				
22.43 (1/4)	22.27 (1/4)	21.89 (1/4)	20.77 (1/2)	18	100:1	1800	
28.03 (1/4)	27.79 (1/4)	27.31 (1/4)	26.05 (1/2)	22.5	80:1		
37.34 (1/4)	36.99 (1/4)	36.34 (1/4)	34.84 (1/2)	30	60:1		
44.80 (1/4)	44.35 (1/4)	43.57 (1/2)	41.87 (3/4)	36	50:1		
55.98 (1/4)	55.39 (1/4)	54.40 (1/2)	52.42 (3/4)	45	40:1		
74.62 (1/4)	73.79 (1/4)	72.46 (1/2)	70.01 (1)	60	30:1		
89.52 (1/4)	88.51 (1/2)	86.91 (3/4)	84.07 (1 1/2)	72	25:1		
111.9 (1/4)	110.6 (1/2)	108.6 (3/4)	105.2 (1 1/2)	90	20:1		
149.2 (1/4)	147.4 (1/2)	144.7 (1)	140.3 (2)	120	15:1		
223.7 (1/2)	221.0 (3/4)	216.9 (1 1/2)	210.7 (3)	180	10:1		
298.2 (1/2)	294.6 (1)	289.2 (2)	281.0 (5)	240	7.5:1		
447.3 (3/4)	441.8 (1 1/2)	433.7 (3)	421.7 (7 1/2)	360	5:1		
596.4 (1)	589.0 (2)	578.1 (5)	562.4 (7 1/2)	480	7.5:1		3600
894.6 (1 1/2)	883.4 (3)	867.1 (7 1/2)	843.7 (10)	720	5:1		

*Required Motor HP

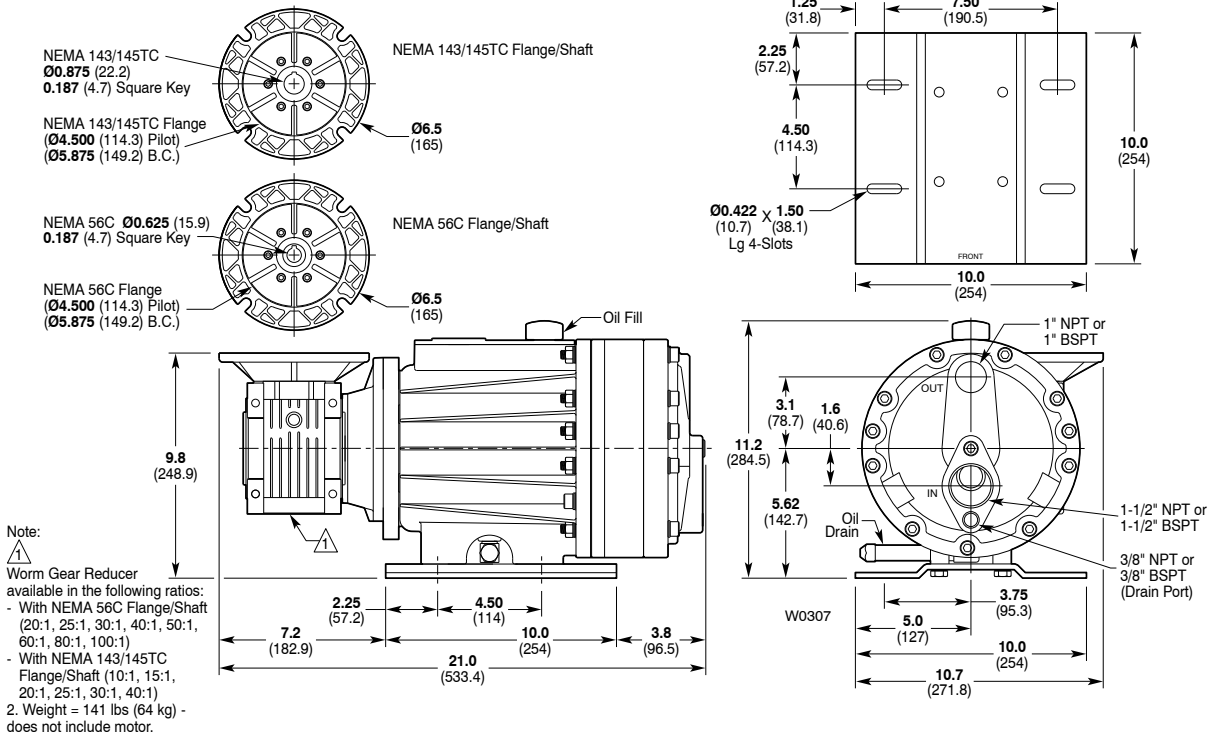
P600 Dimensions

P600 Models with Metallic Pumping Head

P600 Model

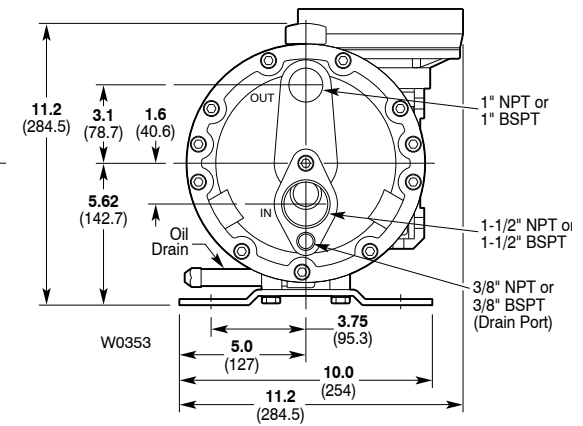
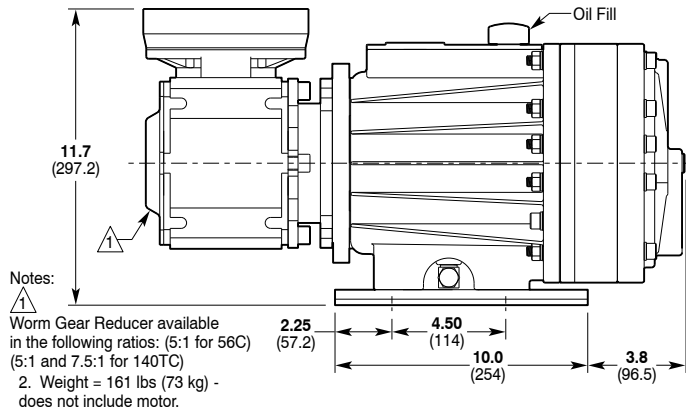
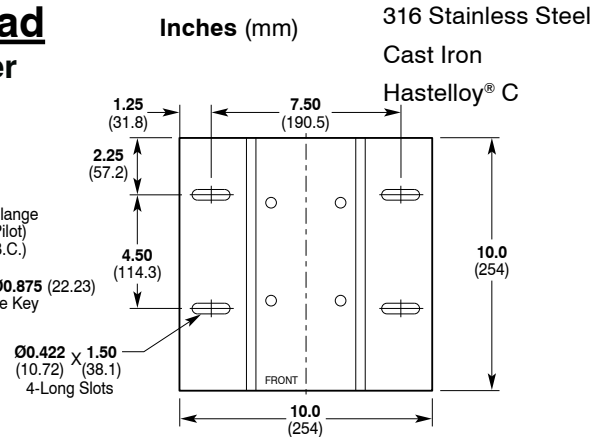
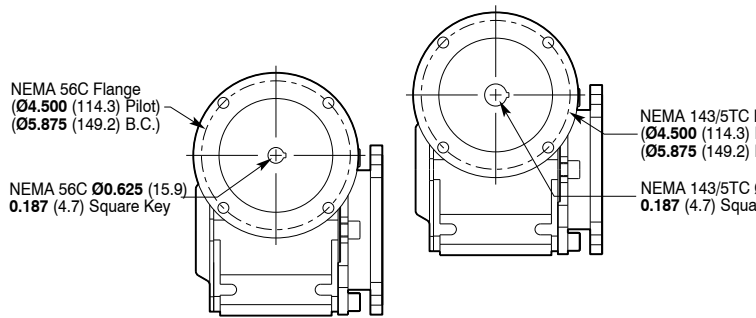
Inches (mm)

316 Stainless Steel
Cast Iron
Hastelloy® C

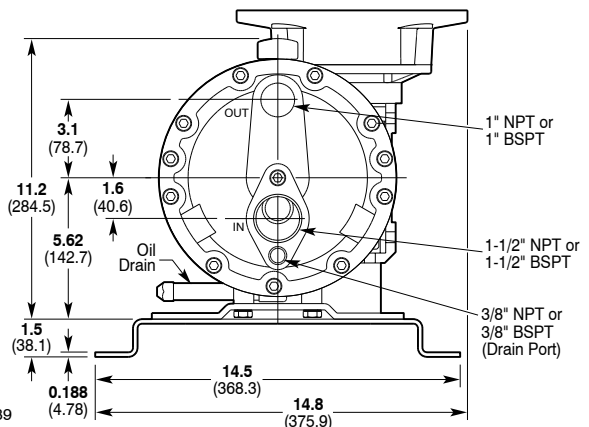
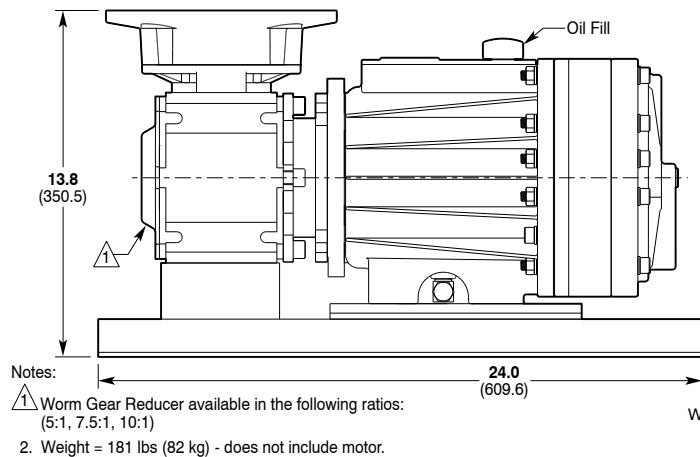
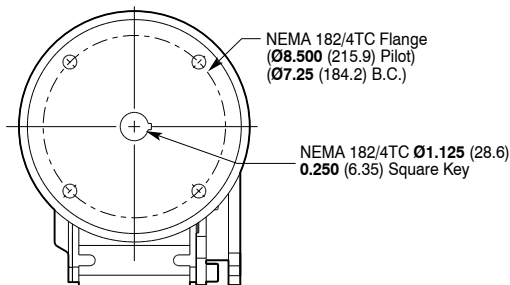


P600 Dimensions

P600 Models with Metallic Pumping Head P600 Model FB75 with 56C or 140TC Flange Adapter



P600 Model FB75 with 180TC Flange Adapter and Base



P600 Dimensions

P600 Models with Metallic Pumping Head

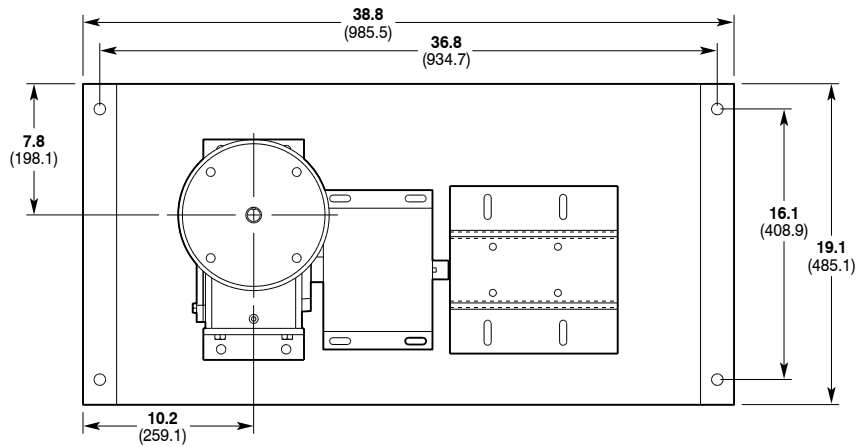
P600 Model FL232 with 210TC Flange Adapter and Base

Inches (mm)

316 Stainless Steel

Cast Iron

Hastelloy® C

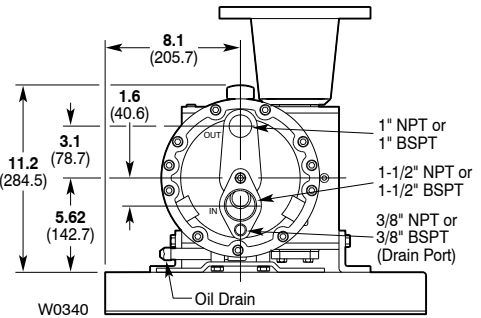
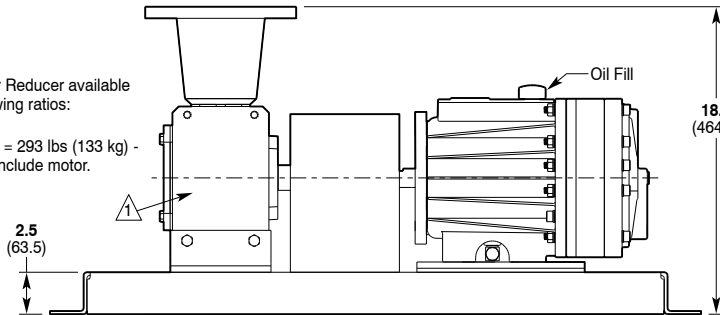


Notes:



Worm Gear Reducer available in the following ratios: (5:1, 7.5:1)

2. Weight = 293 lbs (133 kg) - does not include motor.



P600 Dimensions

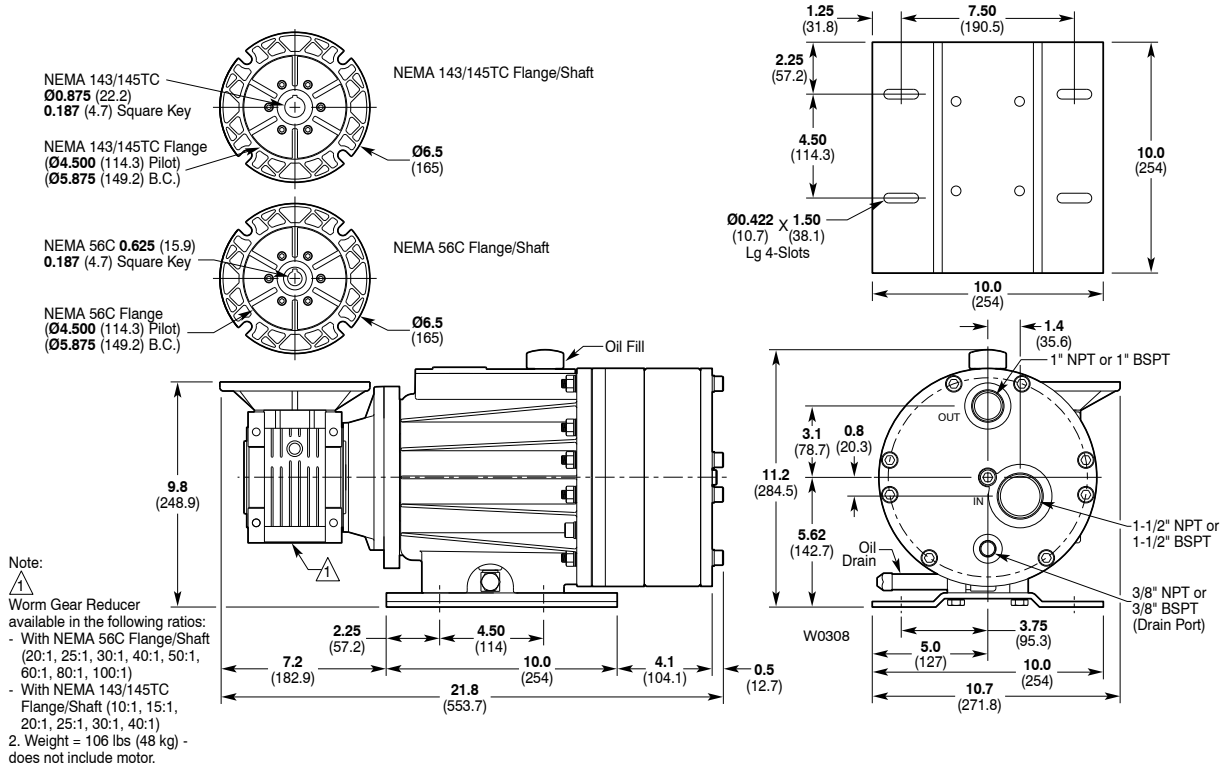
P600 Models with Non-Metallic Pump Head

Inches (mm)

Kynar

Polypropylene

P600 Model

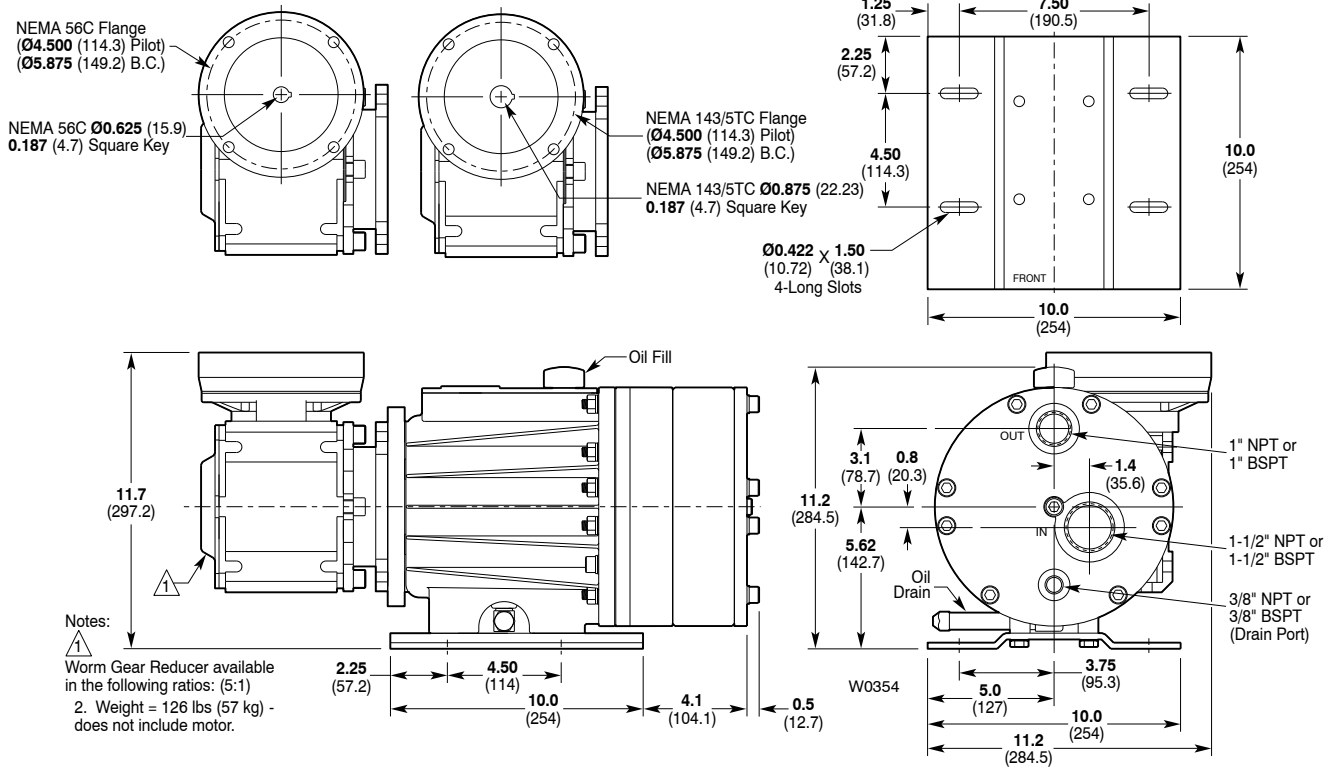


P600 Dimensions

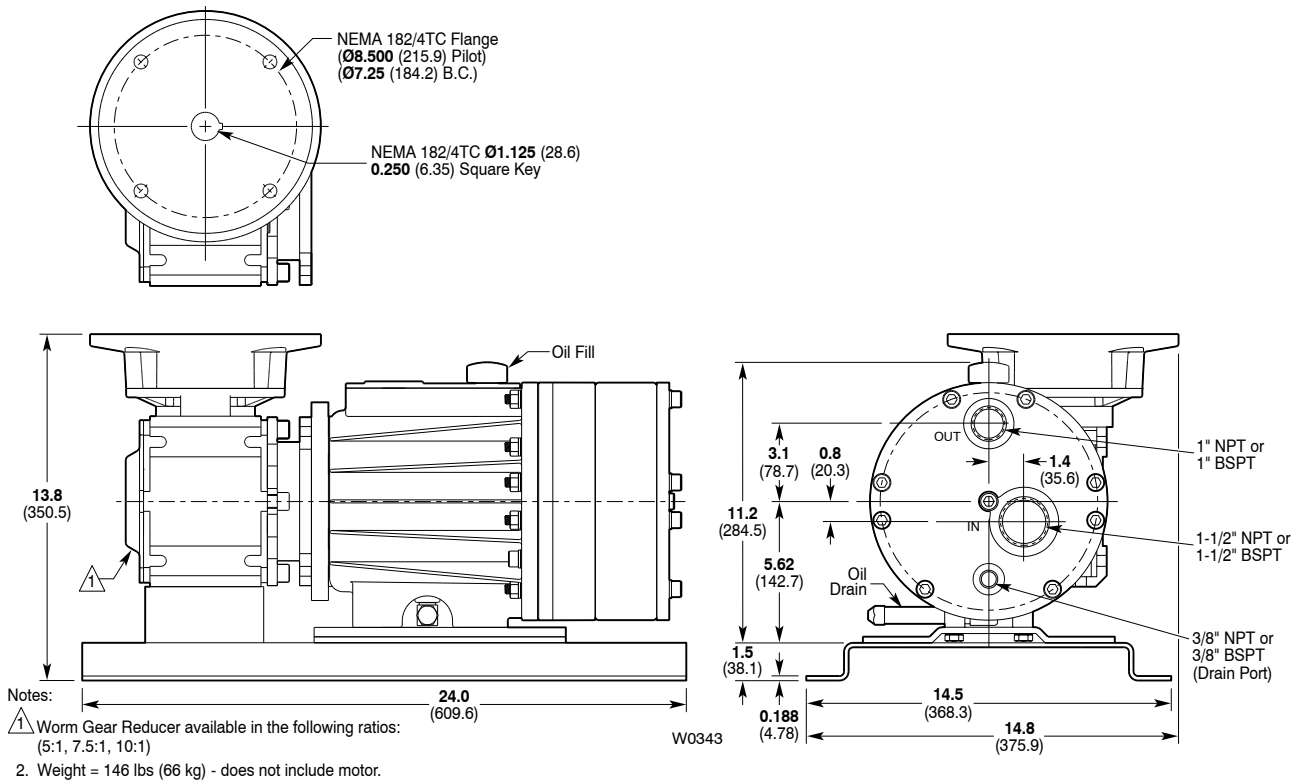
P600 Models with Non-Metallic Pump Head P600 Model FB75 with 56C or 140TC Flange Adapter

Inches (mm)

Kynar
Polypropylene



P600 Model FB75 with 180TC Flange Adapter and Base



P600 Dimensions

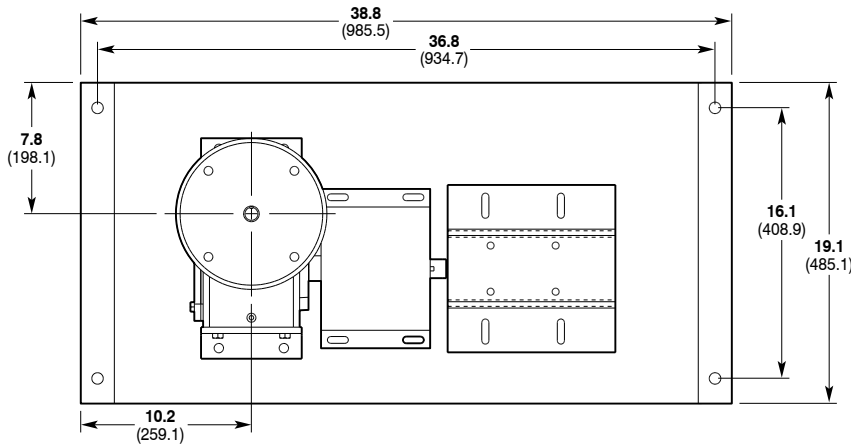
P600 Models with Non-Metallic Pump Head

Inches (mm)

Kynar

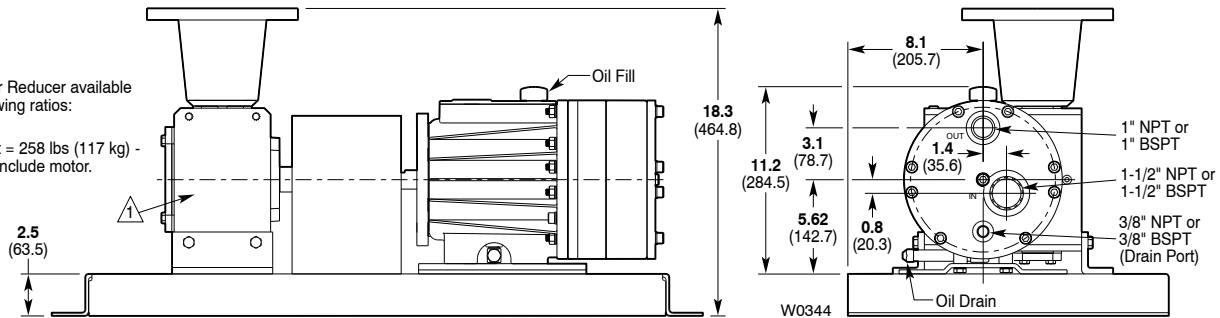
Polypropylene

P600 Model FL232 with 210TC Flange Adapter and Base



Notes:

- 1. Worm Gear Reducer available in the following ratios: (5:1, 7.5:1)
- 2. Weight = 258 lbs (117 kg) - does not include motor.



P600 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 Wannier 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.

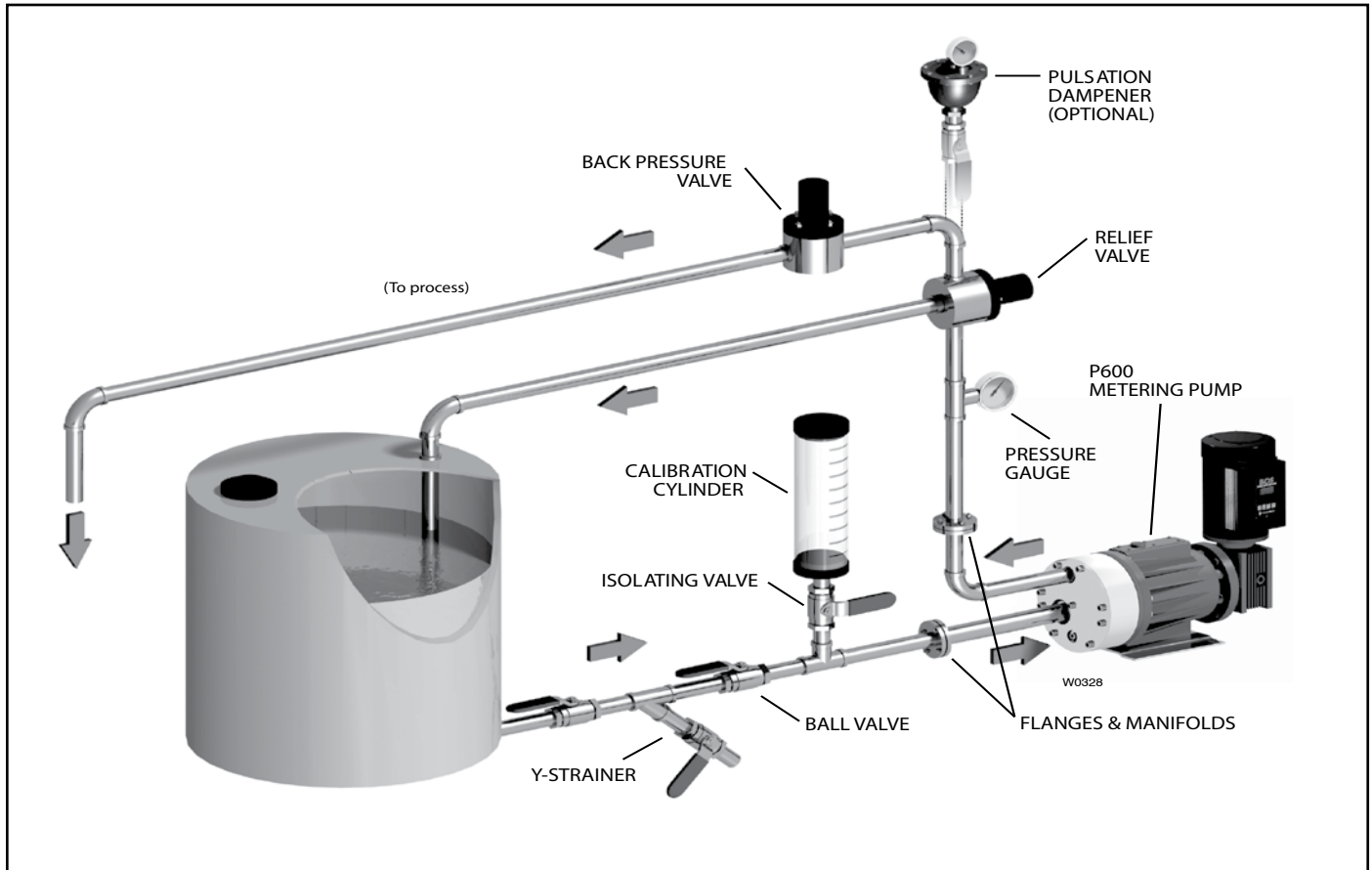
Safety Guards. Follow all codes and regulations regarding installation and operation of the pumping system.

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)

P600 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.

P600 Installation

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.

Initial Start-Up Procedure

Before you start pump, be sure that:

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

P600 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).

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

Note: as pump discharge pressure increases, capacity decreases slightly. 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.

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.

P600 Fluid End Service

NOTE: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

This section explains how to disassemble and inspect all easily-serviceable parts of the pump. Repair procedures for the hydraulic end (oil reservoir) of the pump are included in a later section of the manual.

CAUTION: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (TEL 612-332-5681 or FAX 612-332-6937) or the distributor in your area.

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

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

a. Remove all nuts (31) and bolts (5) around manifold (7). Do not remove four bolts (26) installed through back of pump housing.

b. With 3/8-in (10-mm) hex Allen wrench, remove centerbolt (1) and washer (2) in center of manifold.

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

c. Remove manifold (7) and support plate (43). (Support plate (43) is used only with non-metallic pump head.)

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

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

e. Remove three socket-head cap screws (39) with 3/16-in. (5-mm) hex Allen wrench.

f. Inspect valve plate (18) in same manner as manifold.

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

2. Inspect Valves (11-16, 38)

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

- Check spring retainer (16), and replace if worn.
- Check valve spring (14). If shorter than new spring, replace (don't stretch old spring).
- Check valve poppet (13). If worn excessively, replace.

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

- Remove valve seat (12). Seat remover is included in Wanner Tool Kit. On cast iron valve plates, be careful not to break metal ridge around O-ring groove. Inspect valve seat for wear, and replace if necessary. Install new O-ring (11).

e. Reinstall valve assemblies:

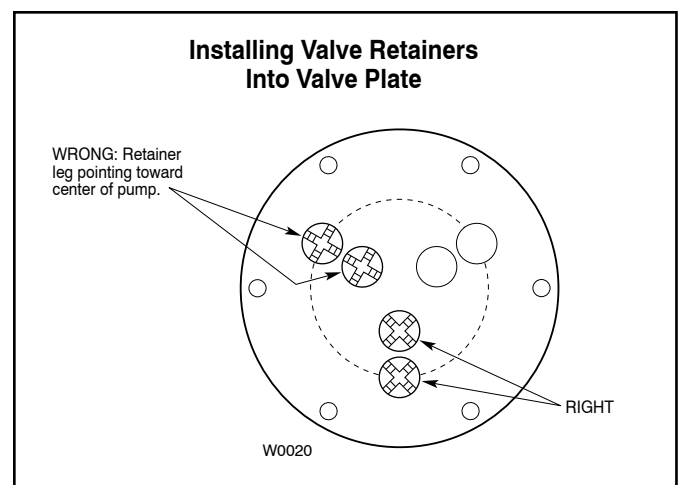
- Clean valve ports and shoulders with emery cloth, and lubricate with lubricating gel or petroleum jelly.

- Install O-ring (11) on valve seat (12).

NOTE: Some pumps use plastic dampening washers (38) between the valve seat (12) and the manifold (7) or valve plate (18). Refer to the illustrations on page 11, and fluid-end exploded views in the Parts list.

- Inlet (3 center valves).** Insert spring retainer (16) into valve plate, then insert spring, valve, and valve seat (14,13,12). If pump has plastic spring retainers, flat O-ring (15) goes between retainer and seat.

- Outlet (3 outer valves).** Insert valve seat, valve, and spring, then retainer. If pump has plastic retainers, install flat O-ring between retainer and seat. If pump has metal spring retainers in outlet valves, position them so leg does not point toward center of pump (refer to illustration below).



P600 Fluid End Service

3. Inspect and Replace Diaphragms (22)

- a. Lift diaphragm (22) by one edge, and turn pump shaft until diaphragm pulls up. This will expose machined cross holes in valve plunger shaft behind diaphragm.
- b. Insert Allen wrench through one of the holes, to hold diaphragm up. Proper size tool is included in Wanner Tool Kit.
- c. Remove screw (19), O-ring (20), and follower (21) in center of diaphragm.
- d. Remove diaphragm and inspect diaphragm carefully. A damaged diaphragm generally indicates pumping system problems and replacing diaphragm will not solve overall problem. Inspect diaphragm for the following:
 - **Half-moon marks.** Usually caused by cavitation of the pump (refer to the “Troubleshooting” section).
 - **Concentric circular marks.** Usually caused by cavitation of the pump (refer to the “Troubleshooting” section).
 - **Small puncture.** Usually caused by a sharp foreign object in the fluid, or by an ice particle.
 - **Diaphragm pulled away** from the center screw or from the cylinder sides. Usually caused by fluid being frozen in the pump, or by overpressurization of the pump.
 - **Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping a fluid that is incompatible with the diaphragm material.
 - diaphragm is operated at temperatures below its rated capability.
 - **Diaphragm edge chewed away.** Usually caused by overpressurizing the system.
- f. Inspect plunger (23) for any rough surfaces or edges. Do not remove plunger from valve plunger (54). Smooth surfaces and edges as necessary with emery cloth or fine file.

CAUTION: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely (as outlined below) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.
- g. Install new diaphragm (22, or reinstall old one, as appropriate), ridge side out.
- h. Clean screw (19) and remove any oil from it. Apply medium-strength threadlocker to screw. Reinstall screw, follower (21), and new O-ring (20). Tighten to 18 in.-lbs (2.0 N-m).
- i. Repeat above inspection procedure (and replacement, if necessary) with other two diaphragms.

4. Flush Contaminant from Hydraulic End (only if diaphragm has ruptured)

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

CAUTION: If you have EPDM diaphragms, or if food grade oil is in the reservoir, do not use kerosene or solvents. Instead, flush with the same lubricant that is in the reservoir. Pumps with EPDM diaphragms have an “E” as the 7th digit of the Model No.
- c. Repeat flushing procedure (step b).
- d. Fill reservoir with fresh oil, manually turn pump shaft to circulate oil, and drain once again.
- e. Refill reservoir. If oil appears milky, there is still contaminant in reservoir. Repeat flushing procedure until oil appears clean.

5. Priming Hydraulic Cells

NOTE: Providing oil prime to 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 most suitable procedure.

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

- a. Install valve plate (18) without outlet valves installed (or else remove outlet valves; leave seats installed) on cylinder housing. Tighten three socket-head screws (39).
- b. Fill reservoir with appropriate Hydra-oil to fill port.
- c. With blunt pointer (eraser end of pencil), reach in through each outlet valve port and push follower-diaphragm backwards. Note air bubbles coming out at oil fill port. Now turn shaft about 1/2 turn.
- d. Repeat depressing diaphragms and rotating shaft (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.
- e. Install outlet valve assemblies in each outlet valve port. See Parts for correct assembly order. If needed, tip pump (head upward) to keep valve centered on seat and allow retainer to fit flush with port.
- f. Install manifold (7) and complete installation.

P600 Fluid End Service

5. Priming Hydraulic Cells (Cont'd)

Alternative Method #1:

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

- a. All air in oil within hydraulic piston behind diaphragms must be forced out by turning shaft (and thus pumping piston). Shaft rotator is included in Hydra-Cell Tool Kit. Keep pressure on diaphragms while turning shaft until bubble-free flow of oil comes from behind all diaphragms. Maintain oil level in reservoir. Do not allow oil level to be lower than reservoir.
- b. Quickly attach loaded valve plate (18) with socket head screws (39, before oil runs out past diaphragms), do not tighten completely. Leave gap between valve plate and cylinder housing. Turn shaft 2-3 turns to finish forcing out air behind diaphragms. Hydraulic cells are now primed. Finish tightening valve plate with socket head screws and add pump manifold.
- c. Wipe excess oil from around the pump head.
- d. Check that oil level is 1 inch (25 mm) from the top of fill port.
- e. Replace oil fill cap and complete installation.

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

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

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

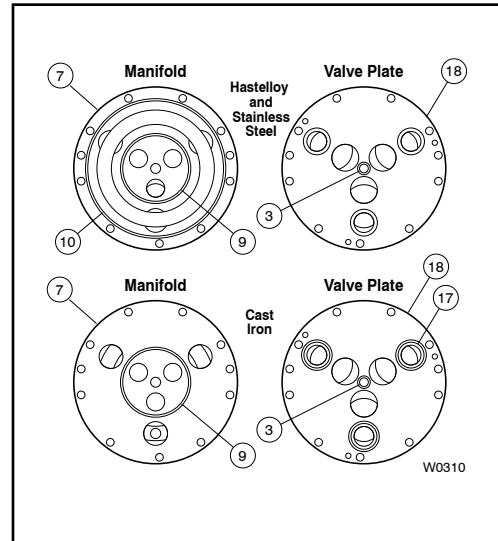
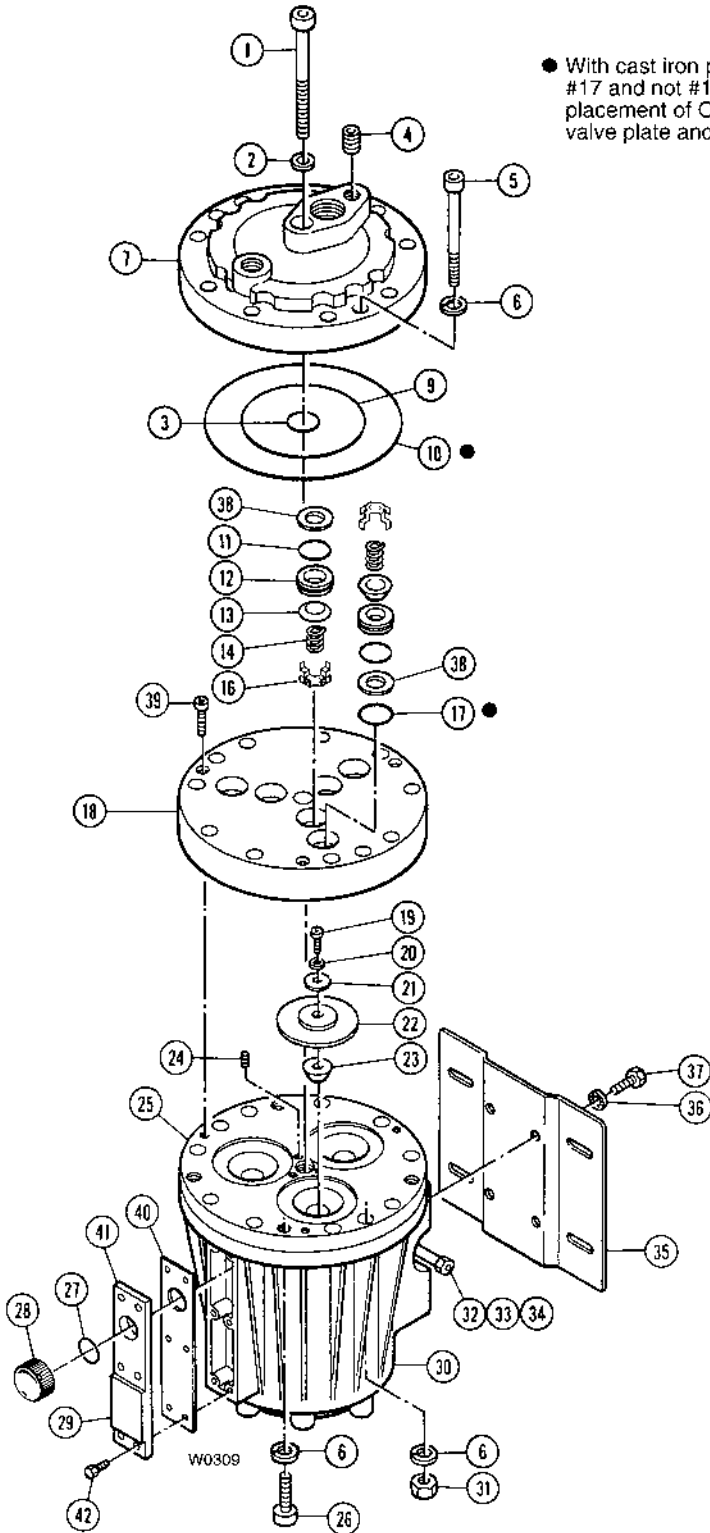
- a. **When tank head pressure is being used to prime**, install pump back into system and connect tank supply line to pump inlet. Pump discharge line may be connected at this time, but end of line must be open to allow air to pass out.
- b. Slowly turn pump shaft by hand and watch for bubbles exiting oil reservoir fill opening. This will take several rotations; when no more bubbles come out and reservoir level has dropped about 1" (25 mm), hydraulic cells are primed.
- c. Replace oil fill cap and complete installation.
- d. **When compressed air is being used to prime**, insert clean air hose to pump inlet and restrict pump outlet. Turn shaft quarter turn and then apply air pressure into manifold to put pressure on diaphragms. This will force air out from inside pistons and bubbles will be seen 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.
- e. Replace oil fill cap and complete installation.

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

- a. Reinstall valve plate (18), with valve assemblies installed as outlined above, on cylinder casting.
- b. Reinstall O-rings between valve plate and manifold. (See illustrations to determine which O-rings to use depending on pumping head material.) Use petroleum jelly or lubricating gel to hold in place.
- c. Reinstall manifold onto valve plate. Be sure drain plug (4) is at bottom of manifold. If pumping head is non-metallic, support plate (43) is also required.
- d. Insert all bolts (5), washers (6), and nuts (31) around edge of manifold, and centerbolt (1) with washer (2). Hand tighten.
- e. Install centerbolt (1), with washer (2), and tighten. Torque to 45 ft-lbs (60 N-m).
- f. Alternately tighten opposite bolts (5) until all are secure. Torque to 45 ft-lbs (60 N-m)
- g. Recheck all bolts for tightness.

P600 Fluid End Parts (w/metallic pump head)

● With cast iron pump heads use #17 and not #10. See inset for placement of O-rings between valve plate and manifold.



Ref. No.	Part Number	Description	Quantity/ Pump
1	G25-081-2019	Screw, cap, socket head, sst	1
2	G10-084-1010	Washer, flat, sst	1
3	D25-083-2110	O-ring, centerbolt, Buna	1
	D25-083-2111	O-ring, centerbolt, Viton	1
	D25-083-2112	O-ring, centerbolt, Neoprene	1
	D25-083-2113	O-ring, centerbolt, EPDM	1
	D25-083-2118	O-ring, centerbolt, PTFE	1
4	D25-038-2017	Plug, Hastelloy C, NPT	1
	D25-038-2211	Plug, 316 SST, NPT	1
	G25-038-2017	Plug, Hastelloy C, BSPT	1
	G25-038-2211	Plug, 316 SST, BSPT	1
5	G25-024-2019	Screw, cap, socket head, sst	11
6	G25-048-2012	Washer, split lock, sst	25
7	D25-004-1022	Manifold, 316 SST, NPT	1
	D25-004-1026	Manifold, cast iron, NPT	1
	D25-004-1029	Manifold, nickel alloy, Hastelloy CW12MW, NPT	1
	G25-004-1022	Manifold, 316 SST, BSPT	1
	G25-004-1026	Manifold, cast iron, BSPT	1
	G25-004-1029	Manifold, nickel alloy, Hastelloy CW12MW, BSPT	1

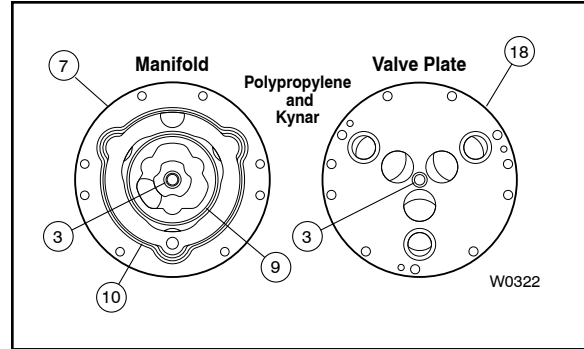
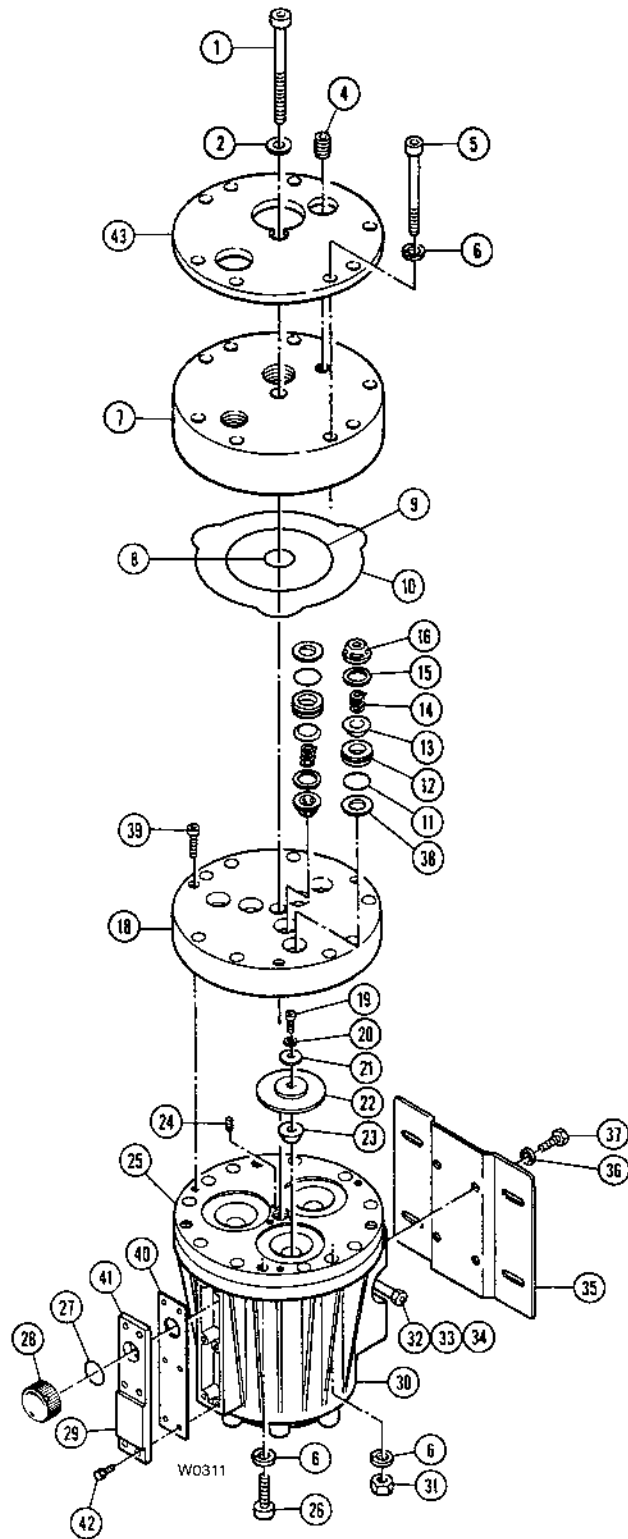
P600 Fluid End Parts (w/metallic pump head)

Ref. No.	Part Number	Description	Quantity/ Pump
9	D25-073-2110	O-ring, inner manifold, Buna.....	1
	D25-073-2111	O-ring, inner manifold, Viton.....	1
	D25-073-2112	O-ring, inner manifold, Neoprene.....	1
	D25-073-2113	O-ring, inner manifold EPDM.....	1
	D25-073-2118	O-ring, inner manifold, PTFE.....	1
(Use on SST and Hastelloy Pumping Heads only)			
10	D25-097-2110	O-ring, outer manifold, Buna.....	1
	D25-097-2111	O-ring, outer manifold, Viton.....	1
	D25-097-2112	O-ring, outer manifold Neoprene.....	1
	D25-097-2113	O-ring, outer manifold EPDM.....	1
	D25-097-2118	O-ring, outer manifold, PTFE.....	1
11	D25-035-2110	O-ring, valve seat, Buna.....	6
	D25-035-2111	O-ring, valve seat, Viton.....	6
	D25-035-2112	O-ring, valve seat, Neoprene.....	6
	D25-035-2113	O-ring, valve seat, EPDM.....	6
	D25-035-2118	O-ring valve seat, PTFE.....	6
12	D25-020-1012	Valve Seat, Nitronic 50.....	6
	D25-020-1017	Valve Seat, Hastelloy C.....	6
	D25-020-3300	Valve Seat, ceramic.....	6
13	D25-021-1011	Valve, Nitronic 50.....	6
	D25-021-1017	Valve, Hastelloy C.....	6
	D25-021-3300	Valve, ceramic.....	6
14	D25-022-3114	Valve Spring, Elgiloy.....	6
	D25-022-3115	Valve Spring, Hastelloy C.....	6
15	D25-092-2110	Tetra Seal, Buna.....	6
	D25-092-2111	Tetra Seal, Viton.....	6
	D25-092-2112	Tetra Seal, Neoprene.....	6
	D25-092-2113	Tetra Seal, EPDM.....	6
	D25-092-2118	O-ring, PTFE (not a "Tetra Seal").....	6
16	D25-023-1017	Retainer, valve spring, Hastelloy C.....	6
(Use on Cast Iron Pumping Heads only)			
17	D25-074-2110	O-ring, outlet valve, Buna.....	3
	D25-074-2111	O-ring, outlet valve, Viton.....	3
	D25-074-2112	O-ring, outlet valve, Neoprene.....	3
	D25-074-2113	O-ring, outlet valve, EPDM.....	3
	D25-074-2118	O-ring, outlet valve, PTFE.....	3
18	D25-003-1012	Valve Plate, 316 SST.....	1
	D25-003-1016	Valve Plate, cast iron.....	1
	D25-003-1029	Valve Plate, nickel alloy C series.....	1
19	D25-030-2010	Screw, flat-head, 316 SST.....	3
	D25-030-2011	Screw, flat-head, Hastelloy C.....	3

Ref. No.	Part Number	Description	Quantity/ Pump
20	D25-047-2110	O-ring, follower, Buna.....	3
	D25-047-2111	O-ring, follower, Viton.....	3
	D25-047-2112	O-ring, follower, Neoprene.....	3
	D25-047-2113	O-ring, follower, EPDM.....	3
	D25-047-2118	O-ring, follower, PTFE.....	3
21	D25-017-1010	Follower, 316 SST.....	3
	D25-017-1011	Follower, Hastelloy C.....	3
22	D25-018-2312	Diaphragm, Neoprene.....	3
	D25-018-2313	Diaphragm, EPDM.....	3
	D25-018-2315	Diaphragm, Viton-XT.....	3
	D25-018-2318	Diaphragm, PTFE.....	3
	D25-018-2320	Diaphragm, Buna-N-XS.....	3
23	D25-016-1010	Plunger.....	3
24	G25-082-2010	Set Screw.....	3
25	K25-002-1020	Cylinder Housing, Kel-Cell.....	1
	K25-002-1220	Cylinder Housing Assembly, Kel-Cell ¹	—
26	G25-024-2020	Screw, cap, socket head, sst.....	4
27	D10-080-2110	O-ring, oil fill, Buna.....	1
28	D03-039-1030	Cap with O-ring, oil fill.....	1
29	D10-040-2420	Nameplate.....	1
30	H25-001-1033	Pump Housing.....	1
31	G10-028-2011	Nut, hex, sst.....	10
32	D25-076-2210	Elbow, 3/8".....	1
33	D25-077-2210	Pipe, 3/8".....	1
34	D25-078-2210	Cap, 3/8".....	1
35	D25-025-1033	Base.....	1
36	G25-054-2010	Washer, shakeproof, M10.....	4
37	G10-029-2010	Cap Screw, hex-hd.....	4
38	D25-125-1017	Washer, dampening, Hastelloy C.....	6
39	G25-088-2010	Cap Screw, socket-hd.....	3
40	G25-106-2318	Gasket, cover.....	1
41	H25-105-1018	Cover, housing.....	1
42	G25-090-2010	Cap Screw, hex-head.....	6

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

P600 Fluid End Parts (w/non-metal pump head)



Ref. No.	Part Number	Description	Quantity/ Pump
1	G25-081-2018	Screw, cap, socket head, sst	1
2	G10-084-1010	Washer, flat, sst	1
4	D25-038-2017	Plug, Hastelloy C, NPT	1
	D25-038-2211	Plug, 316 SST, NPT	1
	G25-038-2017	Plug, Hastelloy C, BSPT	1
	G25-038-2211	Plug, 316 SST, BSPT	1
5	G25-024-2018	Screw, cap, hex-head, sst	8
6	G25-048-2012	Washer, split lock, sst	16
7	D25-004-1054	Manifold, polypropylene, NPT	1
	D25-004-1057	Manifold, Kynar, NPT	1
	G25-004-1054	Manifold, polypropylene, BSPT	1
	G25-004-1057	Manifold, Kynar, BSPT	1
8	D10-083-2110	O-ring, center manifold, Buna	1
	D10-083-2111	O-ring, center manifold, Viton	1
	D10-083-2112	O-ring, center manifold, Neoprene	1
	D10-083-2113	O-ring, center manifold, EPDM	1
	D10-083-2118	O-ring, center manifold, PTFE	1
9	D25-073-2110	O-ring, inner manifold, Buna	1
	D25-073-2111	O-ring, inner manifold, Viton	1
	D25-073-2112	O-ring, inner manifold, Neoprene	1
	D25-073-2113	O-ring, inner manifold, EPDM	1
	D10-073-2118	O-ring, inner manifold, PTFE	1
10	D25-109-2110	O-ring, outer manifold, Buna	1
	D25-109-2111	O-ring, outer manifold, Viton	1
	D25-109-2112	O-ring, outer manifold, Neoprene	1
	D25-109-2113	O-ring, outer manifold, EPDM	1
	D25-109-2118	O-ring, outer manifold, PTFE	1

P600 Fluid End Parts (w/non-metal pump head)

Ref. No.	Part Number	Description	Quantity/ Pump
11	D25-035-2110	O-ring, valve seat, Buna	6
	D25-035-2111	O-ring, valve seat, Viton	6
	D25-035-2112	O-ring, valve seat, Neoprene.....	6
	D25-035-2113	O-ring, valve seat, EPDM	6
	D25-035-2118	O-ring, valve seat, PTFE	6
12	D25-020-1012	Valve Seat, Nitronic 50	6
	D25-020-1017	Valve Seat, Hastelloy C	6
	D25-020-3300	Valve Seat, ceramic	6
13	D25-021-1011	Valve, Nitronic 50	6
	D25-021-1017	Valve, Hastelloy C.....	6
	D25-021-3300	Valve, ceramic.....	6
14	D25-022-3114	Valve Spring, Elgiloy	6
	D25-022-3115	Valve Spring, Hastelloy C	6
15	D25-092-2110	Tetra Seal, Buna	6
	D25-092-2111	Tetra Seal, Viton	6
	D25-092-2112	Tetra Seal, Neoprene.....	6
	D25-092-2113	Tetra Seal, EPDM	6
	D25-092-2118	O-ring, PTFE.....	6
16	D25-023-2317	Retainer, valve spring, polypropylene	6
	D25-023-2318	Retainer, valve spring, Kynar.....	6
18	D25-003-1054	Valve Plate, polypropylene	1
	D25-003-1057	Valve Plate, Kynar.....	1
19	D25-030-2010	Screw, flat-head, 316 SST	3
	D25-030-2011	Screw, flat-head, Hastelloy C	3
20	D25-047-2110	O-ring, follower, Buna	3
	D25-047-2111	O-ring, follower, Viton	3
	D25-047-2112	O-ring, follower, Neoprene.....	3
	D25-047-2113	O-ring, follower, EPDM	3
	D25-047-2118	O-ring, follower, PTFE	3
21	D25-017-1010	Follower, 316 SST	3
	D25-017-1011	Follower, Hastelloy C	3
22	D25-018-2312	Diaphragm, Neoprene.....	3
	D25-018-2313	Diaphragm, EPDM	3
	D25-018-2315	Diaphragm, Viton-XT	3
	D25-018-2320	Diaphragm, Buna-N-XS	3
	D25-018-2318	Diaphragm, PTFE	3
23	D25-016-1010	Plunger	3
24	G25-082-2010	Set Screw	3
25	K25-002-1020	Cylinder Housing, Kel-Cell.....	1
	K25-002-1220	Cylinder Housing Assembly, Kel-Cell ¹ -	
26	G25-024-2020	Screw, cap, socket head, sst	4
27	D10-080-2110	O-ring, oil fill, Buna.....	1
28	D03-039-1030	Cap, oil fill (includes breather and O-ring)	1
29	D10-040-2420	Nameplate	1
30	H25-001-1033	Pump Housing.....	1
31	G10-028-2011	Nut, hex, sst	8

Ref. No.	Part Number	Description	Quantity/ Pump
32	D25-076-2210	Elbow, 3/8"	1
33	D25-077-2210	Pipe, 3/8"	1
34	D25-078-2210	Cap, 3/8".....	1
35	D25-025-1033	Base	1
36	G25-054-2010	Washer, shakeproof, M10	4
37	G10-029-2010	Cap Screw, hex-hd.....	4
38	D25-125-2317	Washer, dampening, polypropylene ...	6
	D25-125-2318	Washer, dampening, Kynar.....	6
39	G25-088-2010	Cap Screw, socket-hd	3
40	G25-106-2318	Gasket, cover	1
41	H25-105-1018	Cover, housing	1
42	G25-090-2010	Cap Screw, hex-head.....	6
43	D25-100-1033	Support, manifold.....	1

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

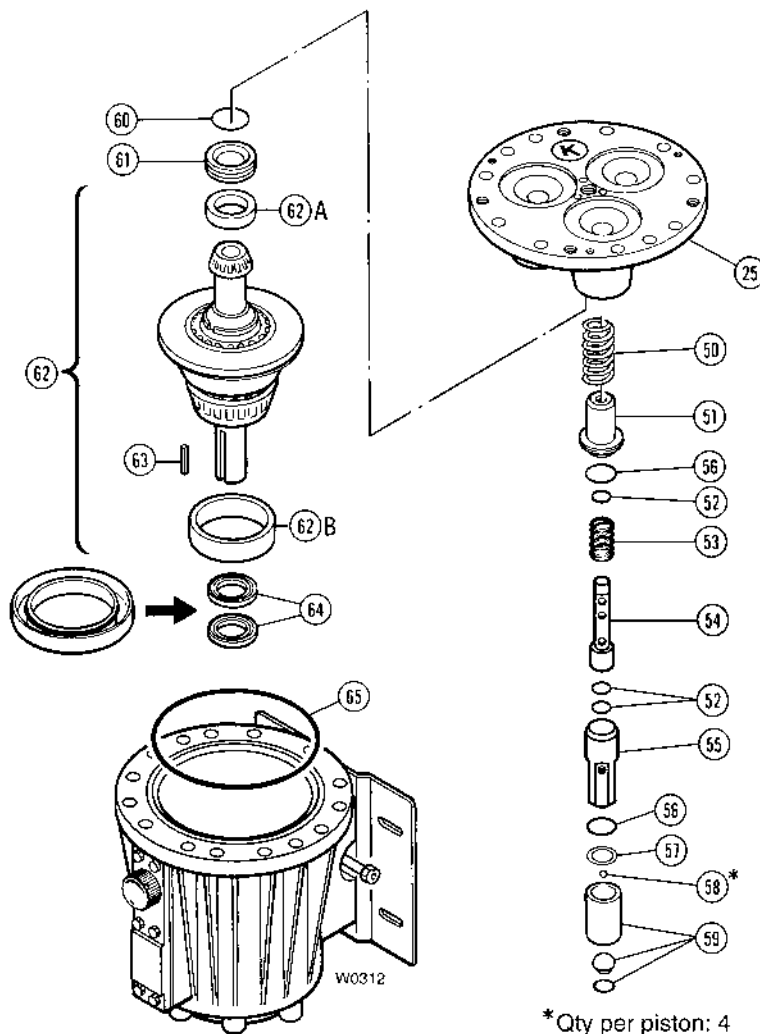
P600 Hydraulic End Parts List

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
50	D25-019-3111	Spring, piston return.....	3	63	D25-085-2210	Key, shaft	1
51	D25-042-1010	Retainer, piston return spring	3	64	H25-031-2112	Seal, Buna.....	2
52	D25-046-2110	O-ring, valve cylinder, Buna.....	9	65	H25-037-2110	O-ring, pump housing, Buna.....	1
53	K25-045-3110	Spring, sleeve valve, Kel-Cell.....	3	-	D25-111-2400	Label, caution.....	1
54	K25-044-1010	Valve Plunger, Kel-Cell	3	1 Piston Assembly includes items 50 through 59. 2 Cam Assembly includes cam, shaft, wobble plate, bearings, and cups. It is only available as an assembly.			
55	K25-043-1010	Cylinder, valve, Kel-Cell.....	3				
56	D25-034-2110	O-ring, Buna.....	6				
57	D25-041-1010	Washer, ball retainer	3				
58	D25-015-3010	Ball	12				
59	D25-014-1209	Piston, with foot and retainer	3				
	K25-014-1210	Piston Assembly, Kel-Cell ¹	-				
60	D25-075-2110	O-ring, bearing adjusting plate, Buna.1					
61	D25-012-1010	Bearing Adjusting Plate.....	1				
62	H25-007-1210	(X) Cam Assembly ²	1				

Hydraulic End Service

CAUTION: Do not disassemble or service the hydraulic end.

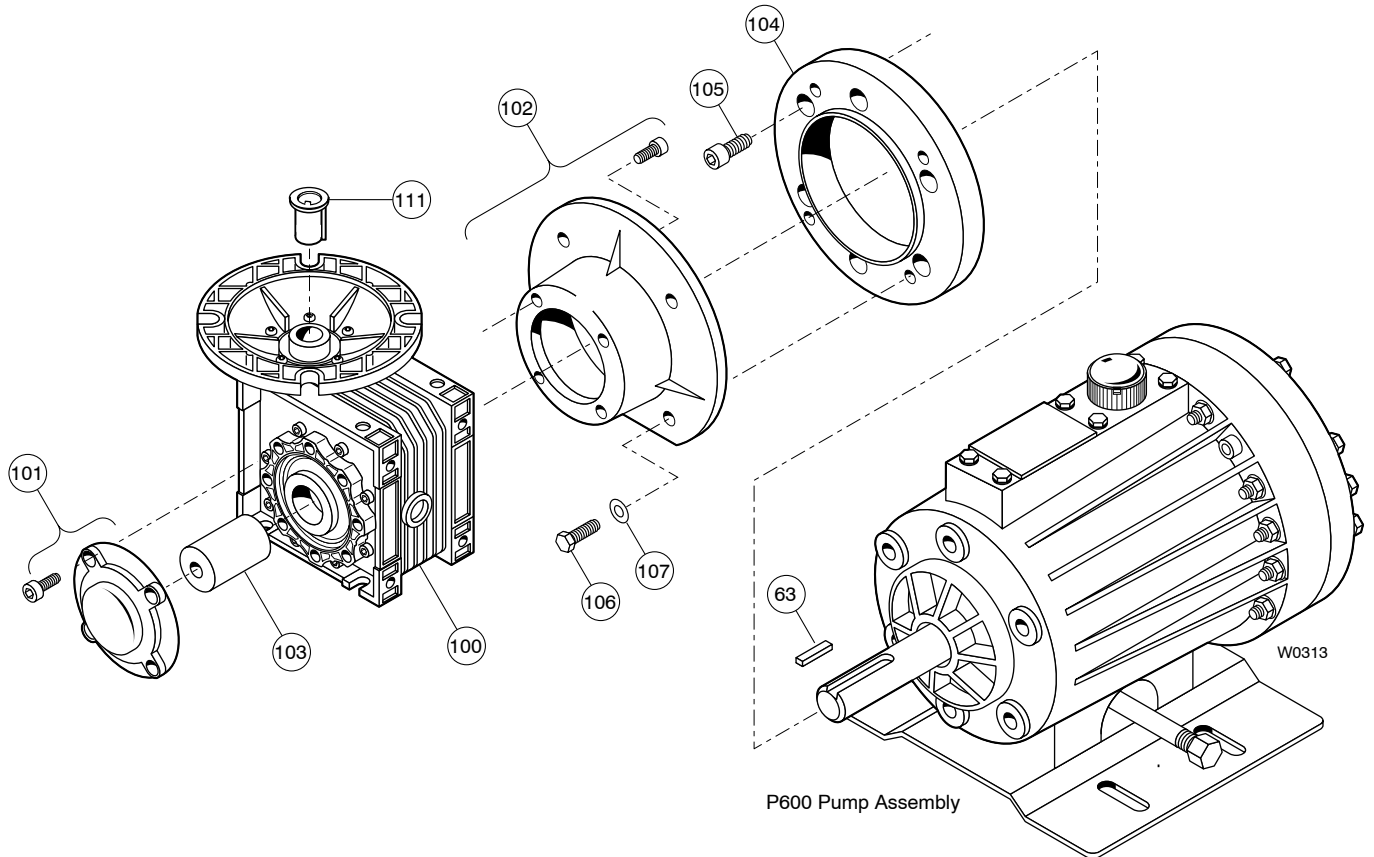
For assistance, contact Wanner Engineering at (612)332-5681 for the distributor in your area.



P600 Reducer Parts List (1 of 3)

Ref No.	Part Number	Description	Quantity/ Pump
100	112-331	Reducer, 7.5:1 ratio, 56C (requires item 111).....	1
	112-332	Reducer, 10:1 ratio, 56C (requires item 111).....	1
	112-333	Reducer, 10:1 ratio, 143/145TC	1
	112-333	Reducer, 15:1 ratio, 56C (requires item 111)	1
	112-333	Reducer, 15:1 ratio, 143/145TC	1
	112-304	Reducer, 20:1 ratio, 56C	1
	112-334	Reducer, 20:1 ratio, 143/145TC	1
	112-305	Reducer, 25:1 ratio, 56C	1
	112-335	Reducer, 25:1 ratio, 143/145TC	1
	112-306	Reducer, 30:1 ratio, 56C	1
	112-336	Reducer, 30:1 ratio, 143/145TC	1
	112-307	Reducer, 40:1 ratio, 56C	1
	112-337	Reducer, 40:1 ratio, 143/145TC	1
	112-308	Reducer, 50:1 ratio, 56C	1
	112-309	Reducer, 60:1 ratio, 56C	1
	112-310	Reducer, 80:1 ratio, 56C	1
	112-311	Reducer, 100:1 ratio, 56C	1

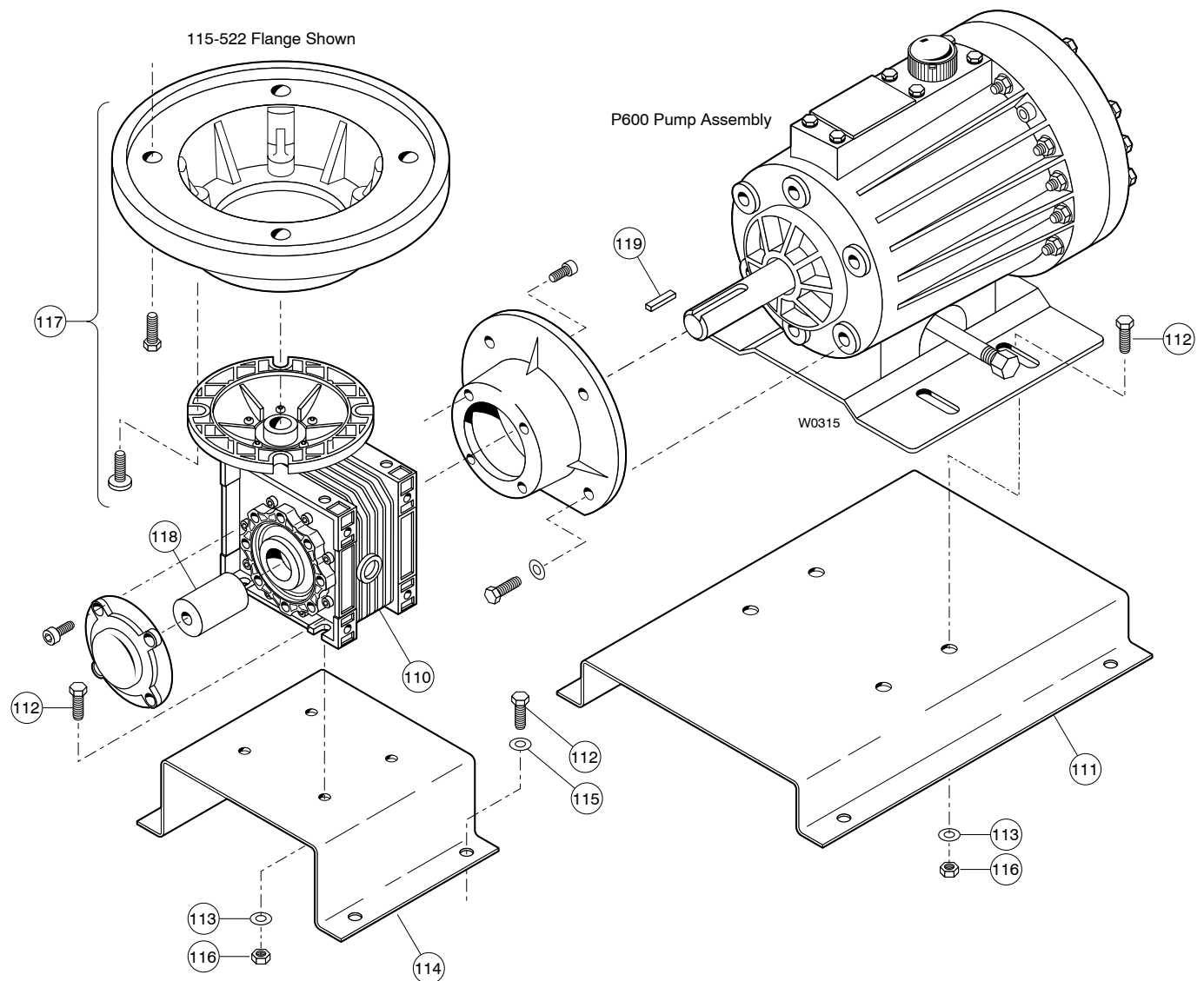
Ref No.	Part Number	Description	Quantity/ Pump
101	112-312	Kit, Protective Cover	1
102	112-313	Kit, Output Flange, FC	1
103	112-320	Shaft Key Retainer.....	1
104	H25-100-1012	Adapter, P600	1
105	H25-101-2012	Screw, cap soc hd.....	6
106	G10-029-2010	Screw, hex hd.....	4
107	D40-048-2010	Washer, flat	4
111	112-350	Motor Adapter	1
63	D25-085-2210	Key, shaft	Ref



P600 Reducer Parts List (2 of 3)

Ref No.	Part Number	Description	Quantity/ Pump	Ref No.	Part Number	Description	Quantity/ Pump
110	112-500	Reducer, 5:1 ratio, 56C	1	117	112-520	Flange, input, 56C.....	1
		Reducer, 5:1 ratio, 143/145TC	1		112-521	Flange, input, 140TC.....	1
		Reducer, 5:1 ratio, 182/184TC	1		112-522	Flange, input, 180TC.....	1
	112-501	Reducer, 7.5:1 ratio, 143/145TC	1			Screw, cap, 1/2 in. (part of 117)	4
		Reducer, 7.5:1 ratio, 182/184TC	1			Screw, cap, M8 (part of 117)	4
	112-502	Reducer, 10:1 ratio, 182/184TC	1	118	112-525	Shaft.....	1
	112-503	Reducer, 15:1 ratio, 182/184TC	1	119	D25-085-2211	Key, 2 inch.....	1
111*	112-517	Base, 182/184TC	1				
112*	S1256-014	Screw, SST, 182/184TC.....	12				
113*	100-657	Washer, flat, SST, 182/184TC.....	12				
114*	112-519	Support, SST, 182/184TC.....	2				
115*	D10-048-2012	Washer, lock, SST, 182/184TC.....	4				
116*	100-036	Nut, lock, SST, 182/184TC.....	4				

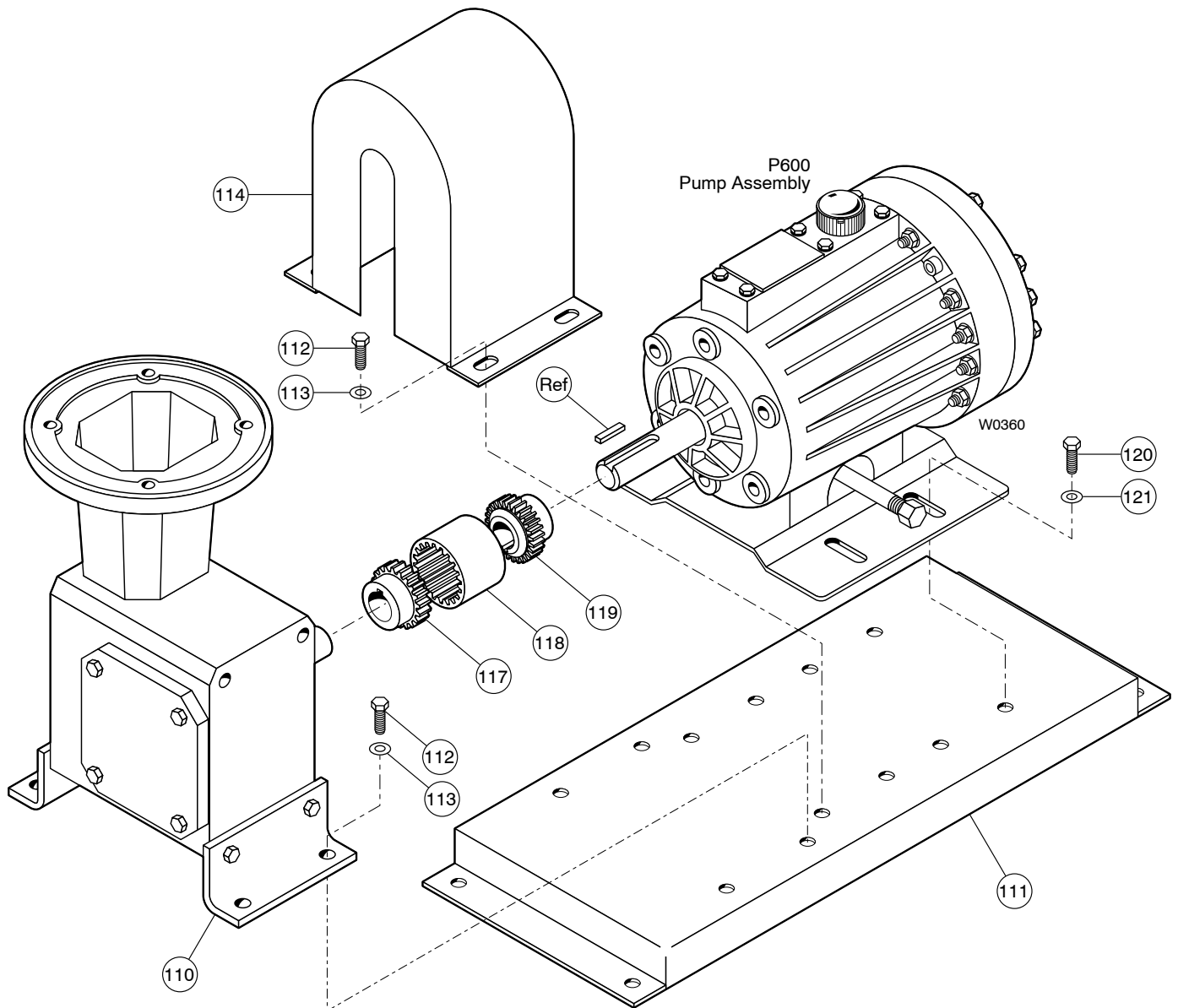
* Used with 182/184TC reducers only.



P600 Reducer Parts List (3 of 3)

Ref No.	Part Number	Description	Quantity/ Pump
110	112-700	Reducer, 5:1 ratio, 213/215TC	1
	112-701	Reducer, 7.5:1 ratio, 213/215TC.....	1
111	112-717	Base	1
112	100-913	Screw, SST	8
113	D10-048-2012	Washer, flat, SST	8
114	112-821	Guard	1
117	A04-116-2205	Hub, coupling, 213/215TC.....	1
118	A04-115-2200	Sleeve, coupling, 213/215TC.....	1

Ref No.	Part Number	Description	Quantity/ Pump
119	A04-116-2201	Hub, coupling, 213/215TC.....	1
120	100-989	Screw, SST	4
121	C22-018-3102	Washer, flat, SST	4



P600 Troubleshooting

Problem	Probable Cause	Solution
Motor/Pump Does Not Operate:	No power.	Supply correct power according to motor requirements.
	Blown fuse/tripped circuit breaker.	Replace/reset, eliminate circuit overload.
	Shaft coupling to pump not in place.	Install proper coupling hardware (see parts list).
	Current overload - motor.	Motor not rated for pump operating conditions - install proper motor.
	Thermal overload - motor.	Motor not rated for pump and/or ambient operating conditions - supply cooling or install proper motor.
	Faulty motor drive/controller.	Repair/replace.
	Faulty motor.	Repair/replace.
	Low liquid level in supply tank (if low-level shut-off is used).	Fill tank.
No Delivery	Supply tank empty.	Fill tank.
	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.
	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.

P600 Replacement Parts Kits

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

1	2	3	4	5	6	7	8	9	10	11
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Digit	Order Code	Description
1-2	P6	Pump Configuration For all P600 Pumps
3		Kit Designator
	K	Complete Fluid End Kit*
	D	Diaphragm Kit*
	V	Valve Kit (diaphragm not included)
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
	S	Viton®-XT (Food Contact Oil)
	X	Viton®-XT (Synthetic Oil)
	J	PTFE (Food Contact Oil)
	W	PTFE (Synthetic Oil)
	P	Neoprene
	R	Neoprene (Food Contact Oil)
	Z	Neoprene (Synthetic Oil)
	T	Buna-N-XS
	F	Buna-N-XS (Food Contact Oil)
	Y	Buna-N-XS (Synthetic Oil)
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

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

Metallic Pump Head Kit Contents

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

Non-Metallic Pump Head Kit Contents

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

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

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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