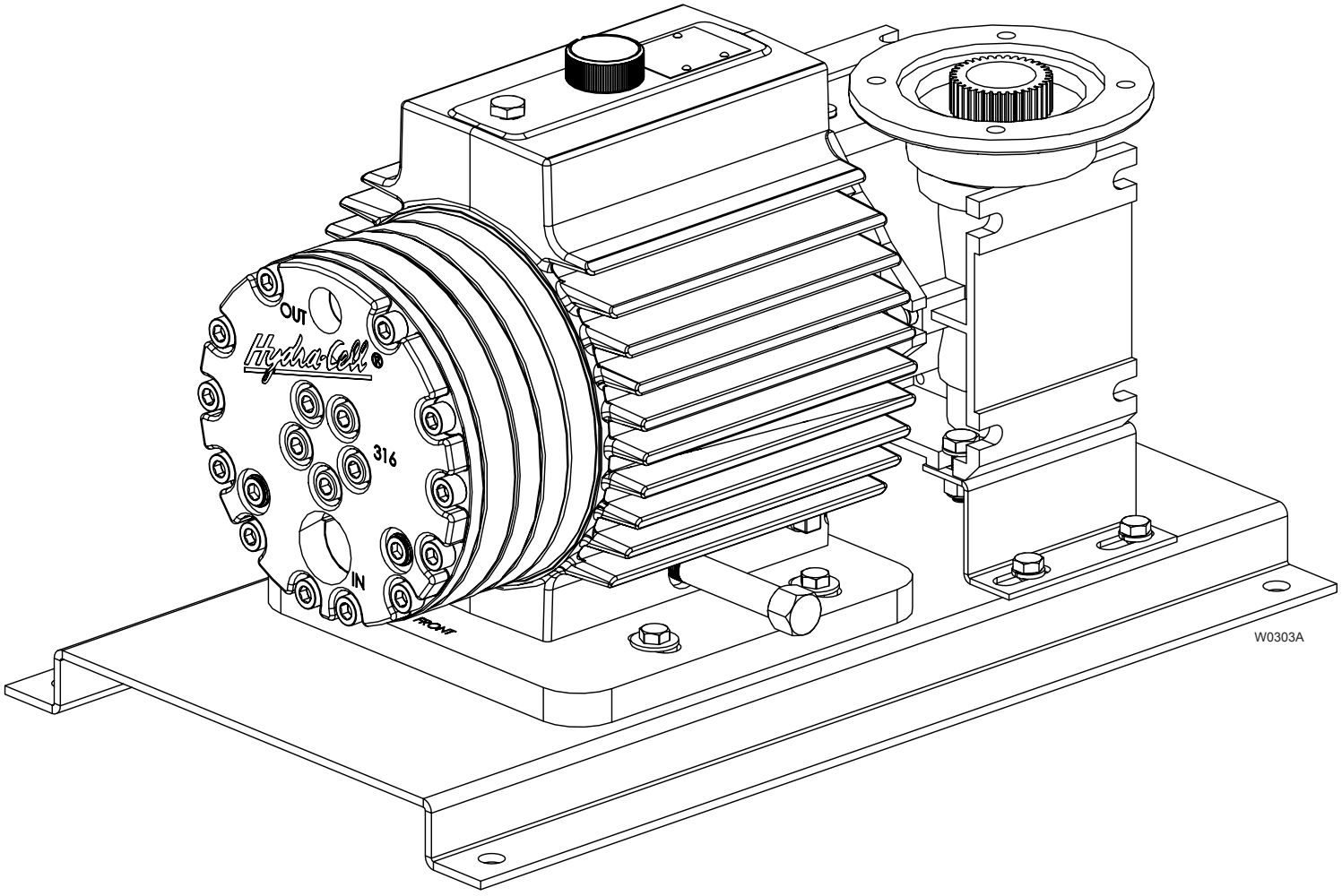
Hydra-Cell®
METERING SOLUTIONS™

P500 Metering Pump

Installation, Operation & Maintenance

P500-991-2400 Rev B



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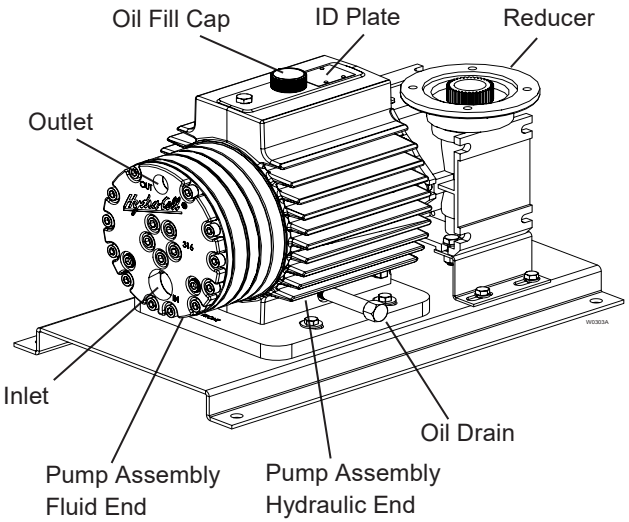
Component Identification



P500 Operation

Hydra-Cell Metering Solutions Pumps are hydraulically-actuated, hydraulically-balanced diaphragm metering pumps that exceed API 675 performance standards of ±1% steady state accuracy, ±3% linearity and ±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 (MT8, P100, P200, P300) or wobble plate (P400, P500, P600, P700). 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.

P500 Specifications

Diaphragms per Liquid End	5
Flow Control	Electronic variable speed drive
Steady State Accuracy	±1%
Linearity	±3%
Repeatability	±3%
Maximum Pressure	
Metallic Head:	2500 psi (173 bar)
Maximum Inlet Pressure	500 psi (35 bar)
Fluid Operating Temperatures*	
Metallic Head:	250°F (121°C)
* Consult factory for correct component selection for temperatures from 160˚F (71˚C) to 250˚F (121˚C).	
Inlet Port	1 1/4 inch NPT or BSPT
Discharge Port	3/4 inch NPT or BSPT
Maximum Solids	500 microns
Shaft Rotation	Bi-directional
Materials Used	See Replacement Parts Kits Section for individual pump materials.
Oil Capacity	2.2 US quart (2.1 liters)
Weight	
Metallic Head:	192.1 lbs (87.1 kg)

Note: All P500 pumps with serial number 411940 and above are equipped with Wanner Engineering's new generation diaphragm position control technology (DPC). Pumps with serial numbers lower than 411940 do not have DPC, please contact Wanner Engineering for support.

P500 Specifications (Cont'd)

Performance Maximum Flow at Designated Pressure - Imperial *

Metallic Pump Heads (gph)				Pump	Gear	Motor
100 psi	500 psi	1500 psi	2500 psi	rpm	Ratio	rpm
17.48 (¼)	16.96 (½)	15.74 (1½)	14.47 (1½)	30	60:1	1800
20.97 (¼)	20.43 (½)	19.11 (1½)	17.71 (2)	36	50:1	
26.39 (¼)	25.73 (¾)	24.20 (1½)	22.67 (3)	45	40:1	
35.27 (¼)	34.47 (¾)	32.63 (2)	30.80 (3)	60	30:1	
42.37 (¼)	41.47 (¾)	39.37 (2)	37.31 (3)	72	25:1	
53.03 (¼)	51.97 (¾)	49.49 (2)	47.07 (3)	90	20:1	
70.78 (½)	69.46 (1)	66.35 (3)	63.34 (5)	120	15:1	
106.3 (½)	104.4 (1½)	100.1 (3)	95.88 (5)	180	10:1	
141.8 (½)	139.4 (1½)	133.8 (5)	128.4 (7½)	240	7.5:1	
212.8 (1)	209.4 (2)	201.2 (7½)	193.5 (10)	360	5:1	
283.9 (1½)	279.4 (3)	268.7 (7½)	258.6 (15)	480	7.5:1	3600
425.9 (1½)	419.3 (5)	403.6 (15)	388.7 (20)	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 *

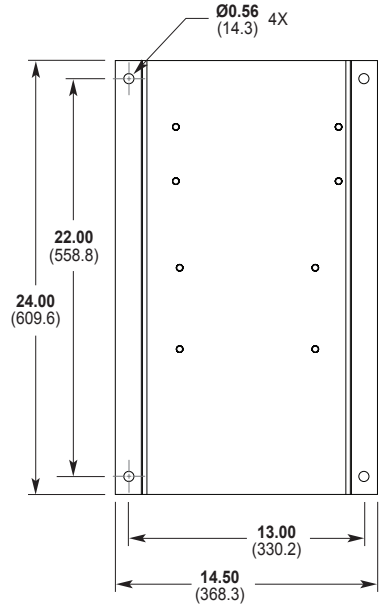
Metallic Pump Heads (lph)				Pump	Gear	Motor
7 bar	34 bar	103 bar	172 bar	rpm	Ratio	rpm
55.14 (0.37)	53.50 (0.75)	49.66 (2.2)	45.641 (3)	25	60:1	1500
66.16 (0.37)	64.44 (0.75)	60.28 (2.2)	55.85 (3)	30	50:1	
83.25 (0.37)	81.16 (0.75)	76.32 (2.2)	71.50 (3)	37.5	40:1	
111.26 (0.37)	108.75 (0.75)	102.92 (2.2)	97.16 (4)	50	30:1	
133.66 (0.37)	130.82 (1.1)	124.19 (2.2)	117.69 (4)	60	25:1	
167.27 (0.37)	163.93 (1.1)	156.11 (2.2)	148.49 (4)	75	20:1	
223.28 (0.55)	219.11 (1.1)	209.29 (3)	199.81 (4)	100	15:1	
335.31 (0.75)	329.47 (1.5)	315.67 (4)	302.45 (5.5)	150	10:1	
447.33 (1.1)	439.83 (2.2)	422.05 (4)	405.10 (7.5)	200	7.5:1	
671.4 (1.5)	660.6 (3)	634.8 (7.5)	610.4 (11)	300	5:1	
895.4 (3)	881.3 (5.5)	847.6 (7.5)	815.7 (11)	400	7.5:1	3000
1343.5 (4)	1322.7 (7.5)	1273.1 (11)	1226.3 (11)	600	5:1	

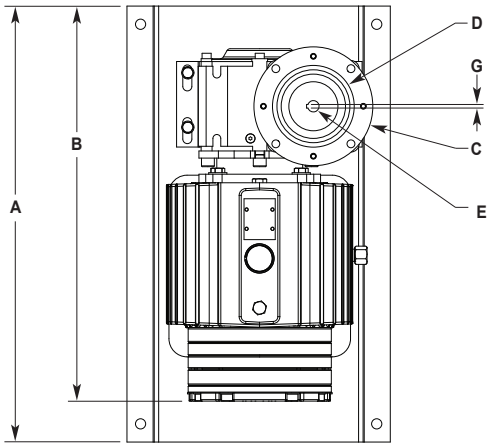
**Capacity data shown is for pumps with elastomeric diaphragms. Consult factory for performance characteristics of pumps with PTFE diaphragms.*

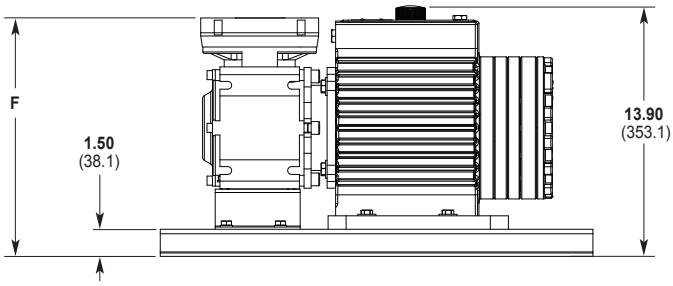
( ) Required Motor kW

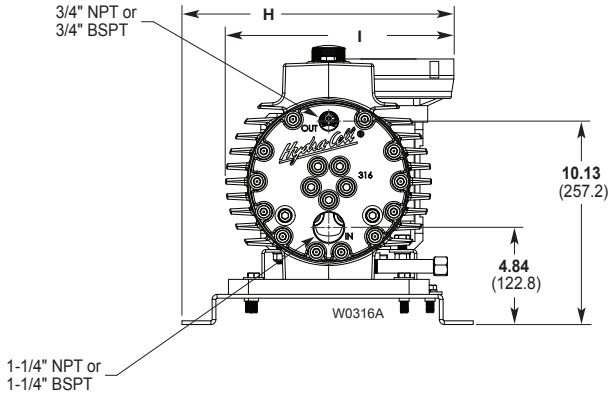
P500 Dimensions

P500 Models with Metallic Pumping Head









Dimensions in Inches (Millimeters)

Input Frame Size	A	B	C	D	E	F	G (Square Key)	H	I
NEMA 56C	21.76 (552.6)	19.05 (495.3)	Ø 6.54 (Ø 166)	Ø 4.50 (Ø 114.3)	Ø 0.62 (Ø 15.7)	13.22 (335.9)	0.187 (4.75)	13.53 (343.7)	11.36 (288.5)
NEMA 143/145 TC	21.76 (552.6)	19.05 (495.3)	Ø 6.54 (Ø 166)	Ø 4.50 (Ø 114.3)	Ø 0.87 (Ø 22.2)	13.22 (335.9)	0.187 (4.75)	13.53 (343.7)	11.36 (288.5)
NEMA 182/183 TC	26.07 (585)	20.36 (517.1)	Ø 9.17 (Ø 233)	Ø 8.50 (Ø 218.9)	Ø 1.12 (Ø 26.6)	13.77 (349.75)	0.25 (6.35)	14.84 (376.9)	12.68 (322)
IEC 71 B5	21.64 (549.7)	18.93 (480.8)	Ø 6.54 (Ø 166)	Ø 4.33 (Ø 110)	Ø 0.55 (Ø 14)	13.42 (340.7)	0.196 (5)	13.41 (340.6)	11.24 (285.4)
IEC 80 B5	22.42 (569.6)	19.71 (500.6)	Ø 7.87 (Ø 200)	Ø 5.12 (Ø 130)	Ø 0.75 (Ø 19)	13.42 (340.7)	0.236 (6)	14.20 (360.6)	12.02 (305.3)
IEC 90 B5	22.42 (569.6)	19.71 (500.6)	Ø 7.87 (Ø 200)	Ø 5.12 (Ø 130)	Ø 0.94 (Ø 24)	13.42 (340.7)	0.314 (8)	14.20 (360.6)	12.02 (305.3)
IEC 100/112 B14	21.64 (549.7)	18.93 (480.8)	Ø 6.30 (Ø 160)	Ø 4.33 (Ø 110)	Ø 1.10 (Ø 28)	13.42 (340.7)	0.314 (8)	13.41 (340.6)	11.24 (285.4)

P500 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**.

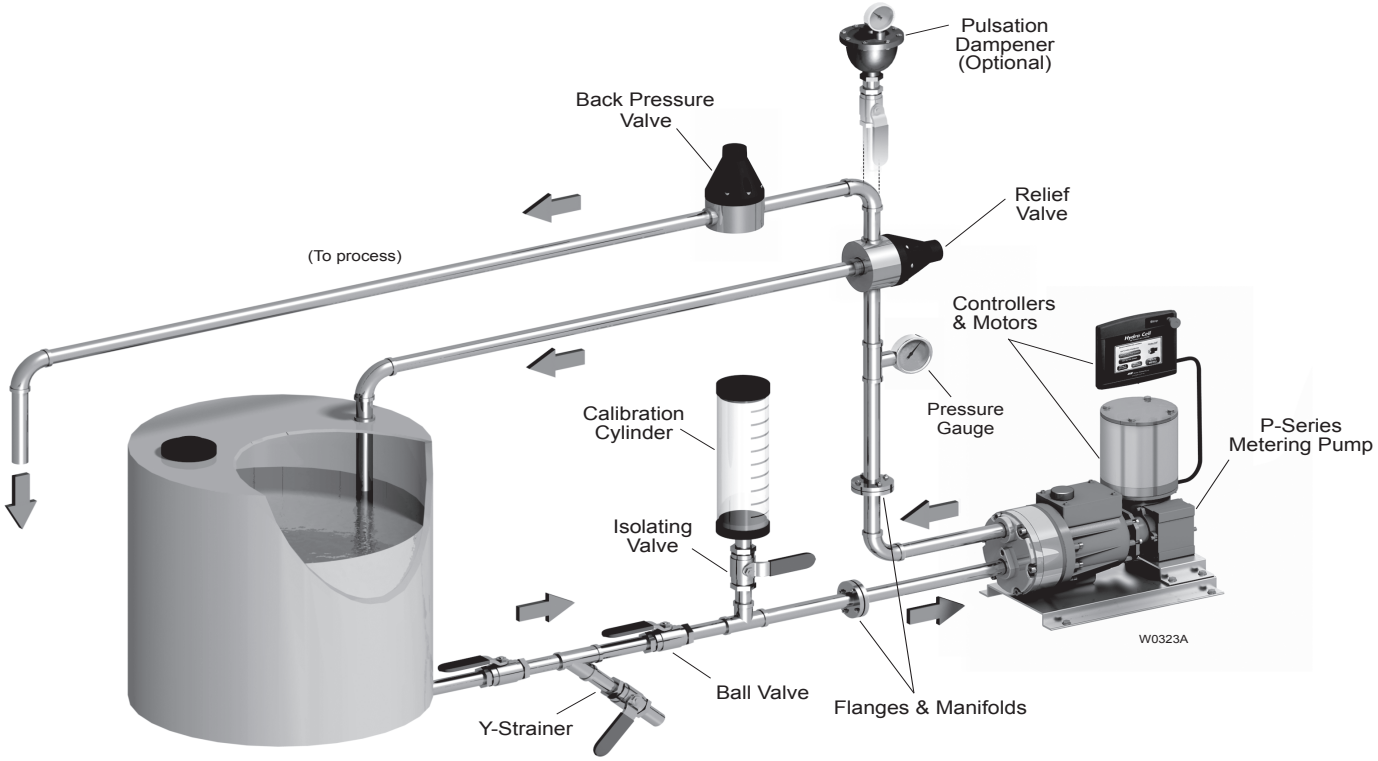
Positive Displacement. This is a positive-displacement pump. To avoid severe system damage if the discharge line ever becomes blocked, install a relief valve downstream from the pump. See **Discharge Piping**.

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

P500 Installation (Cont'd)

Safety Precautions

General remarks

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

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

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

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

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

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

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

Inlet Piping

Provide for permanent or temporary installation of a compound pressure gauge to monitor the inlet pressure. To maintain maximum flow, the pump inlet should be under flooded suction conditions at all times. **Do not supply more than one pump from the same inlet line.**

Supply Tank

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

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

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

Hose Sizing and Routing

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

Recommendations:

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

Inlet Piping (Pressure Feed)

Provide for permanent or temporary installation of a pressure gauge to monitor the inlet pressure. Pressure at the pump inlet should not exceed 500 psi (35 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 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.

P500 Installation (Cont'd)

Initial Start-Up Procedure

Before you start 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. The oil level is 1/4 inch (6 mm) above the cast surface in the upper oil reservoir.
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 500 psi (35 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.

P500 Maintenance

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

Periodically

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

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

1. Check inlet pressure periodically with gauge.
2. Change oil according to hours guidelines in table.
3. Change oil as follows:
   a. Remove brass cap (27), and allow oil and contaminants to drain completely. Catch oil and dispose of properly.
   b. Use suitable Hydra-Oil for the application and pump components.

Pump Operation Hours Between Oil Changes at Various Process Fluid Temperatures

Pressure	<90°F (32°C)	<139°F (60°C)	<180°F (82°C)
Metallic Pump Head			
<1500 psi (104 bar)	4,000	3,000	2,000
<2500 psi (173 bar)	1,500	1,250	1,000

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.

P500 Fluid End Service

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

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

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

CAUTION: Do not remove the four socket-head capscrews (29) that go through the cylinder housing (23), unless you are repairing the hydraulic end of the pump.

1. Remove Manifold (4), Valve Plate (26)

a. **Manifold (4.)** Use 8 mm hex bit socket included in Wanner Tool Kit to remove 12 capscrews (2) and five capscrews (1) at front of manifold. Remove and inspect manifold for warping or wear around inlet and outlet ports and flow channels. If wear is excessive replace manifold. To check if manifold is warped, place straightedge across it; check both sides. A warped manifold should be replaced.

b. **Valve Plate (26)** Using 8 mm hex bit socket remove capscrew (24). Remove and inspect valve plate (in like manner as manifold) for excessive wear or warping. Replace if necessary.

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

2. Remove and Inspect Valves (9-20)

Note: Wanner Valve Kits include items and all O-rings for sealing the manifold to the valve plate. The five inlet and five outlet valve assemblies are different in size and face in opposite directions.

a. Remove inlet valve seat (10) using seat puller tool included in Wanner Tool Kit. Inspect valve seat for wear, and replace if necessary.

   Note: Whenever any valve or seat is replaced it is recommended to replace all valve assemblies to ensure the most reliable operation. All necessary parts are included in a replacement Valve Kit.

b. Remove remaining inlet valve components (11-14) and outlet valve components (18-20) by hand or with small needle nose pliers.

c. Check spring retainers (14, 20) and replace if worn, cracked, or damaged.

d. Check valve springs (12, 19) and replace if worn, broken, or shorter than new spring. Never attempt to stretch old spring.

e. Check valves (11, 18) for wear or damage and replace if necessary. Polishing of valves during operation is normal. If you can feel a ridge in valve surface, valve should be replaced.

f. Reinstall valve assemblies:

   • Clean valve ports and shoulders in valve plate (24) with Scotch-Brite pad or fine emery cloth. Wash valve plate after cleaning, and lubricate valve ports with compatible grease, oil, or petroleum jelly.

   • Install new O-rings (9, 15) on seats (10, 16) and lubricate all O-rings.

   • Inlet Valves (five center, larger valves). Insert spring retainer (14) into valve plate (26). Insert spring (12) into retainer, followed by valve (11) on spring. Finally, insert seat (10) with new O-ring into valve bore with larger I.D. chamfer (seating surface) facing down, towards valve.

   • Outlet Valves (five outer, smaller valves). Insert outlet seat (16) with new O-ring into valve bore with larger I.D. chamfer (seating surface) facing up. Insert valve (18) and spring (19) on seat. Finally, insert spring retainer (20) into valve bore.

   • Make sure springs are all properly nested into spring retainers to ensure proper valve performance.

P500 Fluid End Service (Cont'd)

3. Inspect and Replace Diaphragms (22)

a. Lift a diaphragm by one edge, and turn the pump shaft until the diaphragm moves up to "top dead center". This will expose machined cross-holes in the spool valve (55) behind the diaphragm.

b. Insert a 3/32 x 6 in. hex wrench through one of the machined cross-holes, to hold the diaphragm up and to keep the valve plunger from rotating. The proper size tool is included in the Wanner Tool Kit. (Don't remove the tool until the new diaphragm is installed in step "f" below.)

c. Unscrew the diaphragm. Use a T30 Torx bit, and turn counterclockwise.

d. Inspect the diaphragm carefully. A damaged diaphragm generally indicates a pumping system problem and replacing only the diaphragm will not solve the larger problem. Inspect the diaphragm for the following:

- **Half-moon marks**. Usually caused by cavitation of pump (See Troubleshooting section).
- **Concentric circular marks.** Usually caused by cavitation of pump (See Troubleshooting section).
- **Small puncture**. Usually caused by sharp foreign object in fluid, or by ice particle.
- **Diaphragm pulled away** from center screw or from cylinder sides. Usually caused by fluid being frozen in pump, or by overpressurization of pump.
- **Diaphragm stiff and inflexible**. Usually caused by pumping fluid incompatible with diaphragm material, or diaphragm operated at temperatures below rated capability.
- **Diaphragm edge chewed away**. Usually caused by overpressurizing system.

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.

e. Clean away any spilled oil.

f. Install a new diaphragm and tighten to 18 in.-lbs (203 N-cm).

g. Repeat the above inspection procedure (and replacement, if necessary) with the other four diaphragms.

4. Flush Contaminant from Hydraulic End

(only if a diaphragm has ruptured)

a. With valve plate and manifold still removed (see above), remove the brass cap (26) 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. A03-175-1103). 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.

P500 Fluid End Service (Cont'd)

5. Prime Hydraulic Cells

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

b. All air in oil within hydraulic cell (behind diaphragm) must be forced out by turning shaft (thus pumping piston). Shaft Rotator is included in Wanner Tool Kit. Rotate shaft two revolutions and refill reservoir. Rotate it two more revolutions and refill again. Continue to do this until oil that is being pumped from back of all five diaphragms is free of air.

c. Wipe excess oil from cylinder housing (25) and diaphragms (22).

d. Ensure that oil level is 1/4 in (6 mm) above cast surface in upper oil reservoir.

e. Replace oil fill cap (30).

6. Reinstall Valve Plate (26), Manifold (4)

a. Reinstall valve plate (26), with valve assemblies installed as outlined above, on cylinder housing center spud and alignment pin (8).

b. Install capscrew (24) with flat washer (3) through center hole in valve plate and torque to 45 ft-lbs (60 N-m).

c. Install new O-rings (5, 6, 7) into grooves in front side of valve plate. Use grease or petroleum jelly to hold in place.

d. Reinstall manifold (4) over alignment pin (8), engaging center spud of manifold into center of valve plate.

e. Install capscrews (1) with flat washers (3) through five center holes in manifold. Thread each capscrew in several turns, but do not torque.

f. Install capscrews (2) with flat washers (3) through twelve outer holes at perimeter of manifold. Thread each capscrew in several turns, but do not torque.

g. Return to five capscrews at center of manifold and alternately tighten opposite bolts until all are secure. Torque to 45 ft-lbs (60 N-m).

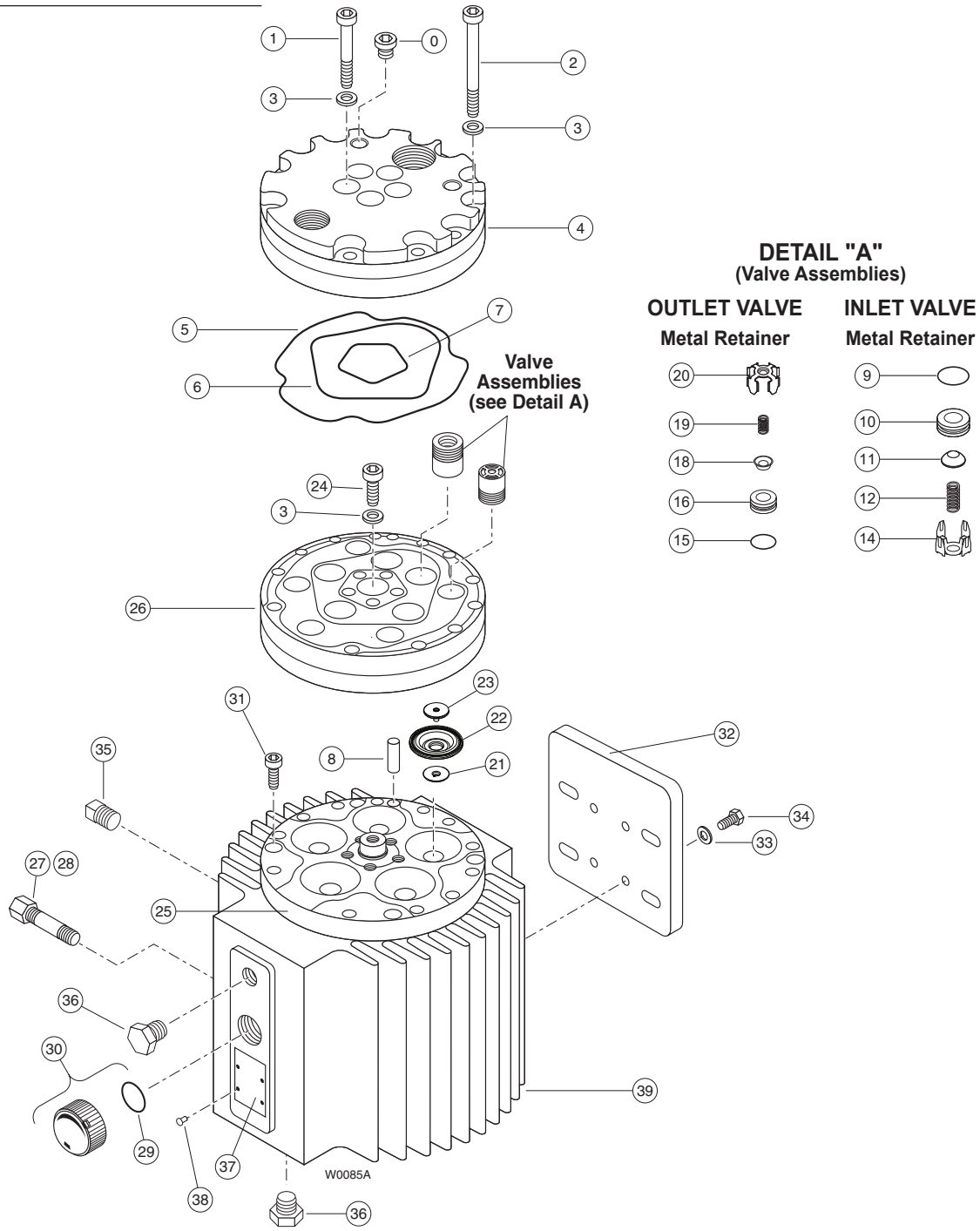
h. Return to twelve capscrews at perimeter of manifold and alternately tighten opposite bolts until all are secure. Torque to 45 ft-lbs (60 N-m).

i. Recheck all capscrews for tightness and proper torque, starting with five at center of manifold, then twelve at perimeter.

P500 Fluid End Parts List

Bolt Torque Specifications

Ref. No.	Assembly Torque
1	45 ft-lbs (60 N-m)
2	45 ft-lbs (60 N-m)
23	18 in-lbs (203 N-cm)
24	45 ft-lbs (60 N-m)
31	15 ft-lbs (20 N-m)
34	45 ft-lbs (60 N-m)



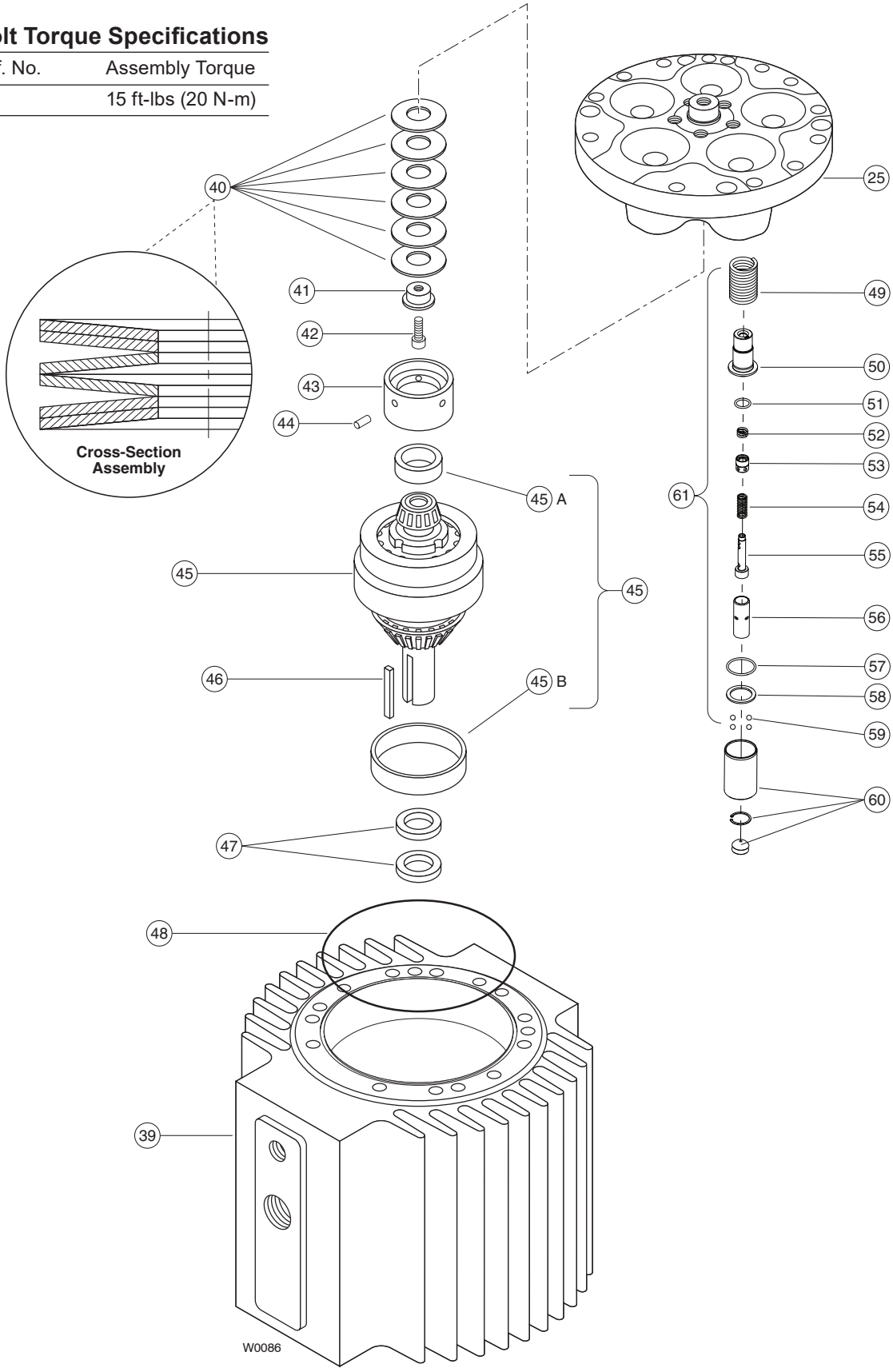
P500 Fluid End Parts List (Cont'd)

Ref. No.	Part Number	Description	Quantity/ Pump
0	D25-038-2017	Plug, Hastelloy C, NPT	2
	D25-038-2211	Plug, 316 SST, NPT	2
	G25-038-2017	Plug, Hastelloy C, BSPT	2
	G25-038-2211	Plug, 316 SST, BSPT	2
1	G15-081-2012	Screw, Cap, soc-hd, SST	5
2	G10-024-2012	Screw, Cap, soc-hd, SST	12
3	100-037	Washer, Flat, SST	18
4	D15-004-1010	Manifold, Brass, NPT	1
	D15-004-1012	Manifold, 316L SST, NPT	1
	D15-004-1018	Manifold, Hastelloy C, NPT	1
	G15-004-1010	Manifold, Brass, BSPT	1
	G15-004-1012	Manifold, 316L SST, BSPT	1
	G15-004-1018	Manifold, Hastelloy C, BSPT	1
5	D40-073-2110	O-ring, Outer manifold, Buna-N	1
	D40-073-2111	O-ring, Outer manifold, FKM	1
	D40-073-2118	O-ring, Outer manifold, PTFE	1
6	D15-073-2110	O-ring, Middle manifold, Buna-N	1
	D15-073-2111	O-ring, Middle manifold, FKM	1
	D15-073-2118	O-ring, Middle manifold, PTFE	1
7	D35-080-2120	O-ring, Inner manifold, Buna-N	1
	D35-080-2118	O-ring, Inner manifold, PTFE	1
	D35-080-2121	O-ring, Inner manifold, FKM	1
8	D15-026-2210	Pin, Dowel	1
9	D10-035-2110	O-ring, Inlet valve seat, Buna-N	5
	D10-035-2111	O-ring, Inlet valve seat, FKM	5
	D10-035-2118	O-ring, Inlet valve seat, PTFE	5
10	D15-020-1011	Valve Seat, Inlet, Nitronic 50	5
	D15-020-1016	Valve Seat, Inlet, Tungsten carbide	5
	D15-020-1017	Valve Seat, Inlet, Hastelloy C	5
11	D10-021-1011	Valve, Inlet, Nitronic 50	5
	D10-021-1016	Valve, Inlet, Tungsten carbide	5
	D10-021-1017	Valve, Inlet, Hastelloy C	5
12	D10-022-3117	Valve Spring, Inlet, Elgiloy	5
	D10-022-3123	Valve Spring, Inlet, Hastelloy C	5
14	D10-023-1017	Retainer, Inlet valve spring, Hastelloy C	5
15	D25-046-2110	O-ring, Outlet valve seat, Buna-N	5
	D25-046-2111	O-ring, Outlet valve seat, FKM	5
	D03-035-2118	O-ring, Outlet valve seat, PTFE	5
16	D15-020-2011	Valve Seat, Outlet, Nitronic 50	5
	D15-020-2016	Valve Seat, Outlet, Tungsten carbide	5
	D15-020-2017	Valve Seat, Outlet, Hastelloy C	5
18	D03-021-1011	Valve, Outlet, Nitronic 50	5
	D03-021-1016	Valve, Outlet, Tungsten carbide	5
	D03-021-1017	Valve, Outlet, Hastelloy C	5
19	D15-022-3113	Valve Spring, Outlet, Hastelloy C	5
	D15-022-3114	Valve Spring, Outlet, Elgiloy	5
20	D03-023-1017	Retainer, Outlet valve spring, Hastelloy C	5
21	K15-017-1015	Plunger	5
22	K15-018-2320	Diaphragm, Buna-N	5
	K15-018-2315	Diaphragm, FKM	5
	K15-018-2325	Diaphragm, Aflas	5
23	K15-017-1010	Single Piece Follower	5
24	G10-089-2010	Screw, Cap, soc-hd	1
25	K15-002-1010	Cylinder Housing	1
26	D15-003-1010	Valve Plate, Brass	1
	D15-003-1012	Valve Plate, 316L SST	1
	D15-003-1018	Valve Plate, Hastelloy C	1
27	D25-077-2210	Pipe, Brass	1
28	D25-078-2210	Pipe Cap, Brass	1
29	D10-080-2110	O-ring, Buna-N	1
30	D10-039-1210	Cap with O-ring, Oil fill	1
31	C22-015-2014	Screw, Cap, soc-hd	4
32	D15-025-1033	Base Plate	1
33	G35-084-2010	Lockwasher	4
34	G35-087-2010	Screw, Cap hex-hd	4
35	D35-111-2010	Plug, Magnetic	1
36	D25-038-2210	Plug, Brass	2
39	G15-001-1033	Pump Housing	1

P500 Hydraulic End Parts List

Bolt Torque Specifications

Ref. No.	Assembly Torque
42	15 ft-lbs (20 N-m)



P500 Hydraulic End Parts List (Cont'd)

Ref. No.	Part Number	Description	Quantity/ Pump
40	D15-075-3110	Spring, Disk	6
41	D15-112-1010	Guide, Disk spring	1
42	G15-115-2010	Screw, Cap, soc-hd	1
43	K15-012-1010	Plate, Bearing adjustment	1
44	D15-110-2210	Pin, Dowel	1
45	K15-007-1210	(X) Cam Assembly (1)	1
46	112-055	Key, Shaft	1
47	H25-031-2112	Seal shaft	2
48	D15-037-2110	O-ring, Buna-N	1
49	D10-019-3110	Spring, Piston return	5
50	K15-042-1010	Retainer, Spring	5
51	K15-046-2110	O-ring, Buna-N	5
52	K15-045-3110	Spring, Sleeve valve	5
53	K15-150-1000	Bias Spring Spacer	5
54	K15-045-3111	Priming Spring	5
55	K15-044-1010	Plunger, Valve	5
56	K15-043-1010	Cylinder, Valve	5
57	D10-034-2110	O-ring, Buna-N	5
58	D10-041-1010	Washer, Retaining	5
59	D10-015-3010	Ball, Steel	20
60	D15-014-1209	Piston (with foot, retainer and balls)	5
61	K15-014-1210	Piston Assembly, Buna-N (2)	5

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

(2) Piston Assembly includes items 47 through 55.

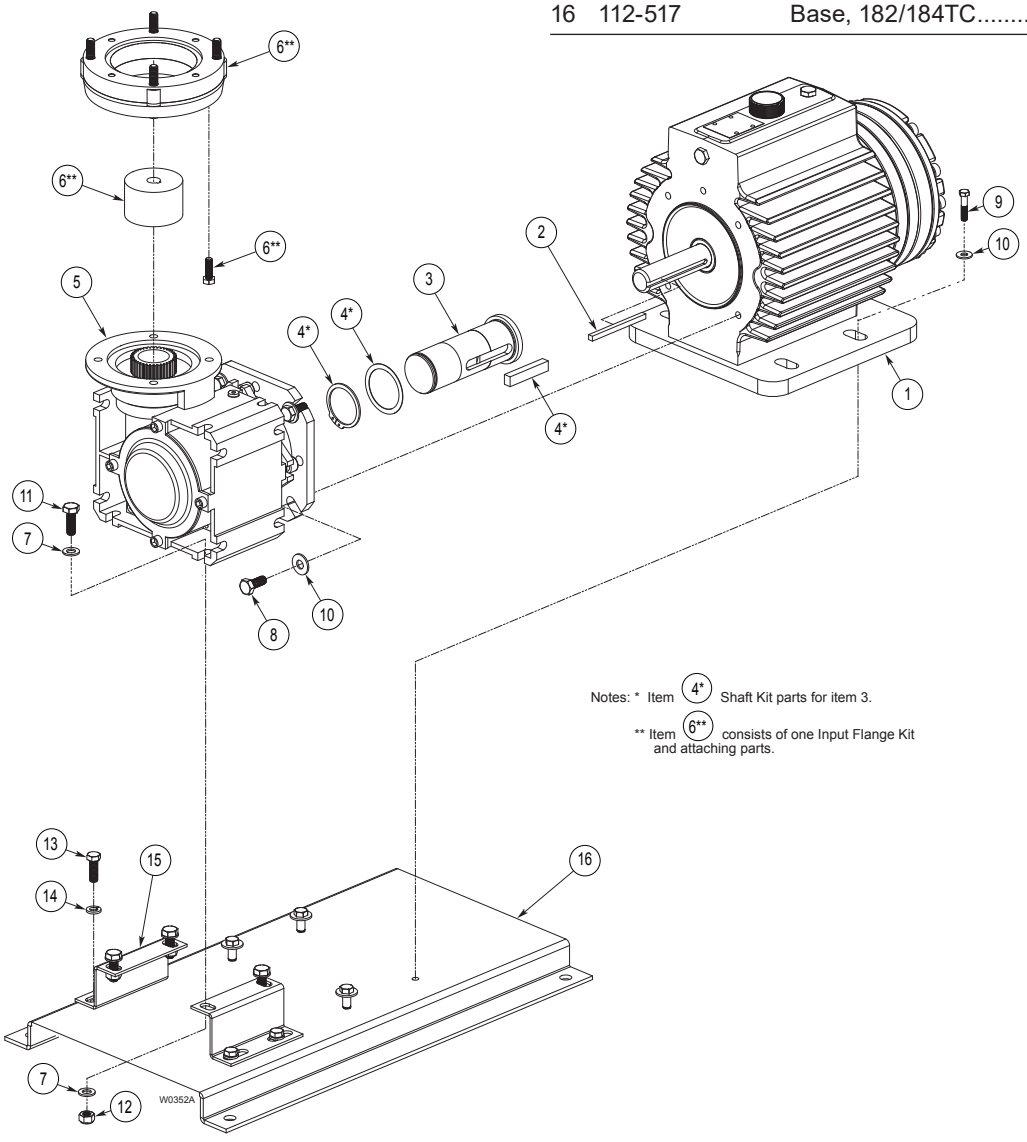
Hydraulic End Service

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.

P500 Reducer Parts List (1 of 2)

Ref No.	Part Number	Description	Quantity/ Pump
1	P5-N-PUMP	P500 Pump Assembly, NPT	
	P5-M-PUMP	P500 Pump Assembly, BSPT	
2	112-055	Key, 1/4 sq x 3.5	1
3	112-528	Shaft	1
4	112-035	Shaft Kit	1
5	112-500	Reducer, 5:1 ratio	1
	112-501	Reducer, 7.5:1 ratio	1
	112-502	Reducer, 10:1 ratio	1
	112-503	Reducer, 15:1 ratio	1
	112-537	Reducer, 20:1 ratio	1
	112-538	Reducer, 25:1 ratio	1
	112-549	Reducer, 30:1 ratio	1
	112-539	Reducer, 40:1 ratio	1
	112-540	Reducer, 50:1 ratio	1
	112-541	Reducer, 60:1 ratio	1

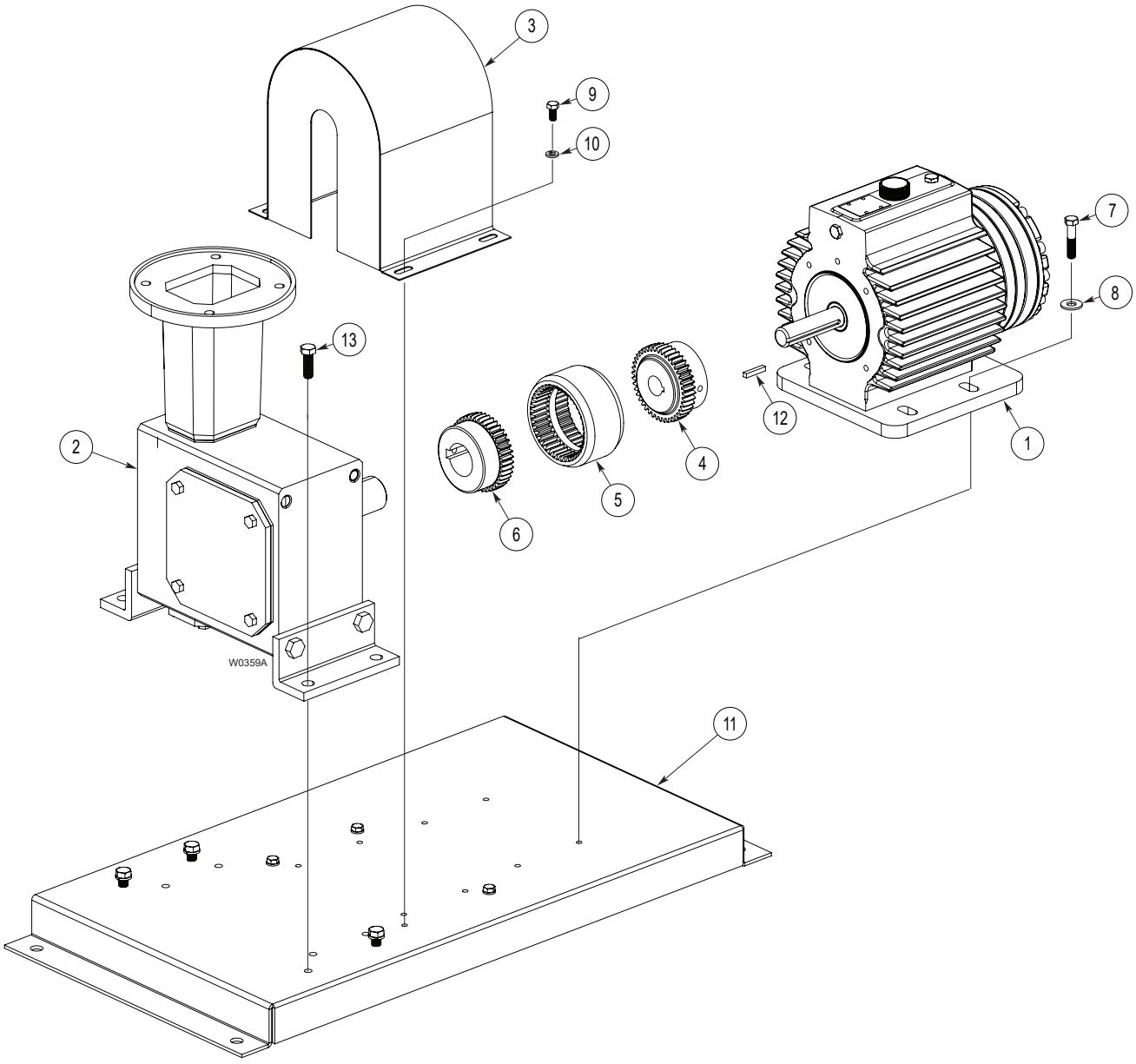
Ref No.	Part Number	Description	Quantity/ Pump
6	112-520	Flange Kit, Input, NEMA 56C	1
	112-521	Flange Kit, Input, NEMA 143/145TC	1
	112-522	Flange Kit, Input, NEMA 182/184 TC	1
	112-562	Flange Kit, Input, IEC 71 B5	1
	112-506	Flange Kit, Input, IEC 80 B5	1
	112-551	Flange Kit, Input, IEC 90 B5	1
	112-552	Flange Kit, Input, IEC 100/112 B14	1
7	112-526	Washer, Flat, M10, SST	8
8	G25-029-2011	Screw, M10, 1.5 x 25 mm, HHCS	4
9	100-989	Screw, 3/8-16 x 1.75, HHCS	4
10	G10-029-2022	Screw, M10, 1.5 x 30 mm, HHCS	4
11	112-031	Washer, Flat, wide, type A, 3/8	8
12	112-032	Locknut, M10 x 1.5, SST	5
13	D10-087-2012	Screw, 3/8-16 x 1.125, HHCS	4
14	D10-048-2012	Lockwasher, SST, 182/184TC	4
15	112-519	Support, SST, 182/184TC	2
16	112-517	Base, 182/184TC	1



P500 Reducer Parts List (2 of 2)

Ref No.	Part Number	Description	Quantity/ Pump
1	P5-N-PUMP	P500 Pump Assembly, NPT	
2	112-700	Reducer, 5:1 ratio, 213/215TC	1
	112-701	Reducer, 7.5:1 ratio, 213/215TC	1
	112-800	Reducer, 5:1 ratio, 254/256TC	1
3	104-385	Guard, 213/215TC	1
	104-315	Guard, 254/256TC	1
4	A04-116-2201	Hub, Coupling, 213/215TC.	1
	A04-118-2201	Hub, Coupling, 254/256TC.	1
5	A04-115-2200	Sleeve, Coupling, 213/215TC	1
	A04-117-2200	Sleeve, Coupling, 254/256TC	1

Ref No.	Part Number	Description	Quantity/ Pump
6	A04-116-2205	Hub, Coupling, 213/215TC	1-
	A04-118-2203	Hub, Coupling, 254/256TC	1
7	100-989	Screw, 3/8-16 x 1.75, HHCS	4
8	112-031	Washer, Flat, wide, 3/8”, Type A	4
9	100-913	Screw, SST	8
10	D10-048-2012	Lockwasher, 3/8”, SST	8
11	112-717	Base	1
12	112-055	Key, 1/4 sq x 3.5	1
13	S1258-028	Screw, 1/2-13 UNC x 1.75, HHCS,SST	4



P500 Troubleshooting

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

P500 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**
	P5	For all P500 Pumps
3		**Kit Designator**
	K	Complete Fluid End Kit*
	D	Diaphragm Kit*
	V	Valve Kit (diaphragm not included)
4-5		**Pump Head Version**
	51	Standard
6		**Spring Retainers (Dampening Washers)**
	B	For brass pump head (Hastelloy C)
	S	For 316L Stainless Steel pump head (Hastelloy C)
	T	For Hastelloy C pump head (Hastelloy C)
	X	Not included in Diaphragm Kit
7		**Diaphragm & O-ring Material**
	A	Aflas (Synthetic oil)
	G	FKM (Standard oil)
	S	FKM (Food-contact oil)
	X	FKM (Synthetic oil)
	T	Buna-N (Standard oil)
	F	Buna-N (Food-contact oil)
	Y	Buna-N (Synthetic oil)
8-9		**Check Valve Material (Spring/ Valve Seat / Valve)**
	SS	Elgiloy/ Nitronic 50 / Nitronic 50
	TT	Hastelloy C / Hastelloy C/ Hastelloy C
	SD	Elgiloy / Tungsten Carbide / Tungsten Carbide
	TD	Hastelloy C /Tungsten Carbide / Tungsten Carbide
	XX	Not included in Diaphragm Kit

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

Kit Contents

Part Number*	Description	Qty	Kit Designator K	D	V
K15-018-___	Diaphragm	5	•	•	
D40-073-___	O-ring, outer manifold	1	•	•	•
D15-073-___	O-ring, middle manifold	1	•	•	•
D35-080-___	O-ring, inner manifold	1	•	•	•
D10-035-___	O-ring, valve seat, inlet	5	•		•
D15-020-___	Valve seat, inlet	5	•		•
D10-021-___	Valve, inlet	5	•		•
D10-022-___	Valve spring, inlet	5	•		•
D10-023-___	Retainer, valve spring, inlet	5	•		•
D25-046-___	O-ring, valve seat, outlet	5	•		•
D15-020-___	Valve seat, outlet	5	•		•
D03-021-___	Valve, outlet	5	•		•
D03-022-___	Valve spring, outlet	5	•		•
D10-023-___	Retainer, valve spring, outlet	5	•		•
A01-113-3400	Threadlocker	1	•	•	
	Hydraulic End Oil	(2.5 qt)			

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

P500 Tool Kit

The P500 Tool Kit (Part No. A03-175-1103) contains the tools listed below. These tools are used to assist in the repair and maintenance of the P500. See the maintenance sections of this manual for specific application.

Ref. No.	P500 Tool Part No.	Tool Description	Quantity/ Kit
1	A03-125-1010	Holder, Plunger	1
2	A03-195-1200	Rotator, Shaft	1
3	A03-162-1010	Lifter, Plunger guide	1
4	A03-124-1200	Lever Assembly	1
5	A03-156-1200	Assembly studs	1
6	A03-158-1002	Seal Protector	1
8	A03-155-1200	Inserter/Rotator	1
7	A03-126-1500	Tool Box	1

P500 Warranty

Limited Warranty

Wanner Engineering, Inc. (“Wanner”) extends to the original purchaser of equipment supplied or manufactured by Wanner and bearing its name, a limited one-year warranty from the date of purchase against defects in material or workmanship, under normal use and service, and provided the equipment is installed, operated and maintained in accordance with instructions supplied by Wanner. Wanner will repair or replace, at its option, defective parts without charge if: (a) you provide written notice of any defect within thirty (30) days from the discovery of the defect; (b) the claim is received by Wanner before the expiration of the warranty period; and (c) such parts are returned with transportation charges prepaid to Wanner Engineering, Inc., 1204 Chestnut Avenue, Minneapolis, Minnesota 55403. A return goods authorization must be received prior to the return of the defective part. No allowance will be made for repairs undertaken without Wanner written consent or approval.

Notwithstanding anything to the contrary, this warranty does not cover:

1. Electric motors (if applicable) not manufactured by Wanner. The warranties, if any, on such equipment are assigned to you by Wanner (without recourse) at the time of purchase.

2. Normal wear and/or damage caused by or related to abrasion, corrosion, abuse, negligence, accident, faulty installation or tampering which impairs normal operation.

3. Transportation costs.

This limited warranty is exclusive, and is in lieu of any other warranties (oral, express, implied or statutory) including, but not limited to, implied warranties of merchantability and fitness for a particular purpose; warranties of non-infringement; warranties arising from course of dealing or usage of trade or any other matter. Any descriptions of the equipment, drawings, specifications, and any samples, models, bulletins, or similar material used in connection with the sale of equipment are for the sole purpose of identifying the equipment and are not to be construed as an express warranty that the equipment will conform to such description. Any field advisory or installation support is advisory only. Every form of liability for direct, special, incidental or consequential damages or loss is expressly excluded and denied. All liability of Wanner shall terminate one (1) year from the date of purchase of the equipment.

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