

Electric-Powered
**400 Series
Hydraulic Pump**



MODEL SHOWN FOR PE4004S

TABLE OF CONTENTS

DESCRIPTION	2
SAFETY SYMBOLS AND DEFINITIONS	3
SAFETY PRECAUTIONS	3
SET-UP INSTRUCTIONS.....	7
1. Filling the Pump Reservoir.....	7
2. Hydraulic Connections.....	7
3. Electric Motor Operation.....	8
4. Bleeding Air from the System.....	9
5. Hydraulic Pressure Gauge (optional)	9
DIRECTIONAL CONTROL VALVES	10
OPERATION	11
1. Priming the Pump.....	11
2. Motor Control Operation.....	11
3. Pressure Regulating Controls.....	12
PERFORMANCE SPECIFICATIONS	13
GENERAL MAINTENANCE	14
1. System Evaluation	14
2. Inspection.....	14
3. Periodic Cleaning.....	14
4. Hydraulic Fluid Level	14
5. Draining and Flushing the Reservoir.....	15
6. Adding Hydraulic Fluid to the Reservoir.....	16
7. Sound Reduction - Electrically Powered Motor.....	16
8. Hose Connections.....	16
9. Storage	16
10. Checking Brushes on Electric Motors.....	16
TROUBLESHOOTING GUIDE.....	17
PARTS LIST.....	20
POWER TEAM FACILITIES AND CONTACT	34

DESCRIPTION

The 400 series hydraulic pumps are designed to have a maximum of 690 bar (10,000 psi) at a flow rate of 6,554.8 cc/min (400 cu. in./min). A pump can be valved for use with either single- or double-acting cylinders. All pumps come fully assembled, less fluid, and ready for work.

Electric Motor

The electric motor on the PE400 series is available in a 1.1 kW (10 hp,) 208/230/460 volt 60 Hz, 3-phase. It is also available in 220/380V, 50Hz and 575V, 60Hz. The weight can be up to 290kg (639 lbs).

Reservoir

20 gallon (3,927 cu. in. usable) reservoir has a low oil level sight gauge.

NOTE:

- **Carefully inspect the pump upon arrival. The carrier, not the manufacturer, is responsible for any damage resulting from shipment.**
- **Do not change motors without consulting the pump manufacturer's Technical Services Department.**

SAFETY SYMBOLS AND DEFINITIONS

Safety symbols are used to identify any action or lack of action that can cause personal injury. Your reading and understanding of these safety symbols is very important.

 **DANGER** : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION** : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION: Used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

IMPORTANT: Important is used when action or lack of action can cause equipment failure, either immediate or over a long period of time.

SAFETY PRECAUTIONS

These instructions are intended for end-user application needs. For a detailed parts list or to locate a Power Team Authorized Hydraulic Service Center contact your nearest Power Team facility. A list of all Power Team facilities is located at the end of this document.

 **WARNING** : To help prevent personal injury,



- The following procedures must be performed by qualified, trained personnel who are familiar with this equipment. Operators must read and understand all safety precautions and operating instructions included with the device. If the operator cannot read these instructions, operating instructions and safety precautions must be read and discussed in the operator's native language.
- These components are designed for general use in normal environments. These components are not specifically designed for lifting and moving people, agri-food machinery, certain types of mobile machinery or special work environments such as: explosive, flammable, or corrosive. Only the user can decide the suitability of this machinery in these conditions or extreme environments. Power Team will supply information necessary to help make these decisions. Consult your nearest Power Team facility.

General



- Safety glasses must be worn at all times by the operator and anyone within sight of the unit. Additional personal protection equipment may include: face shield, goggles, gloves, apron, hard hat, safety shoes, and hearing protection.



- Operation, repair, or maintenance of hydraulic equipment should be performed by a qualified person who understands the proper function of hydraulic equipment per local directives and standards.
- Hydraulic equipment must be assembled correctly and then checked for proper function before use. Use hydraulic components of the same hydraulic pressure ratings. An appropriate hydraulic pressure gauge is recommended to monitor pressure.
- Never place your hands or other body parts near a hydraulic fluid leak. Never use your hands or other body parts to check for a possible leak. High pressure fluid can be injected under your skin causing serious injury and/or infection.
- Always shut off the electric motor before breaking any connections in the system.

Safety Precautions Continued



- The owner of this tool must ensure that safety-related decals are installed, maintained, and replaced if they become hard to read.
- High pressure fluid is present throughout a hydraulic system. Always use caution when operating, repairing, or maintaining this equipment. Before beginning any work on any hydraulic system component, stop the equipment, disconnect from its power source, and relieve all pressure in all parts of the system. Do not tamper with the internal hydraulic relief valve settings.
- Avoid exposing hydraulic equipment (especially hoses) to extreme high or low temperatures. Damage to equipment or failure may result and cause loss of control or injury to the operator.



- Exercise caution to avoid the risk of fire.
- Do not drop any hydraulic system components. Damage to the equipment and/or injury may result.
- Avoid slipping or falling by cleaning up any oil spills.
- Avoid back injury by always lifting equipment carefully.
- It is strongly recommended to view the Power Team Hydraulic Safety video tape before using hydraulic equipment.

Pump

- Do not exceed the hydraulic pressure rating noted on the pump nameplate or tamper with the internal high pressure relief valve. Creating pressure beyond rated capacities can result in personal injury.
- Before replenishing the oil level, retract the system to prevent overfilling the pump reservoir. An overfill can cause personal injury due to excess reservoir pressure created when the wrenches are retracted.
- The load must be under operator control at all times.
- Do not connect pump to hydraulic system powered by another pump.

Electrical Shock or Electrocution



- Electrical work must be performed and tested by a qualified electrician per local directives and standards.
- Disconnect the pump from the power supply and relieve pressure before removing the motor case cover or performing maintenance or repair.
- Check the total amperage draw for the electrical circuit you will be using. For example: Do not connect a pump that may draw 25 amps to a 20 amp fused electrical circuit.
- Never use an ungrounded power supply with this unit.
- Changing the voltage is an involved and, if incorrectly performed, hazardous procedure. Consult the manufacturer for specific information before attempting rewiring.
- Wire pump motors for counterclockwise rotation when viewed from the shaft end of the motor.



- Do not attempt to increase the power line capacity by replacing a fuse with another fuse of higher value. Overheating the power line may result in fire.
- Exposing electric pumps to rain or water could result in an electrical hazard.
- Avoid conditions that can cause damage to the power cord, such as abrasion, crushing, sharp cutting edges, or corrosive environment. Damage to the power cord can cause an electrical hazard.

Safety Precautions Continued

Hydraulic Hose



- Before operating the pump, all hose connections must be tightened with the proper tools. Do not overtighten. Connections should only be tightened securely and leak-free. Overtightening can cause premature thread failure or high pressure fittings to split at pressures lower than their rated capacities.
- Should a hydraulic hose ever rupture, burst, or need to be disconnected, immediately shut off the pump. Never attempt to grasp a leaking pressurized hose with your hands. The force of escaping hydraulic fluid could cause serious injury.
- Do not subject the hose to potential hazard, such as fire, sharp surfaces, heavy impact, or extreme heat or cold. Do not allow the hose to kink, twist, curl, or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear, because any of these conditions can damage the hose and possibly result in personal injury.
- Do not use the hose to move attached equipment. Stress can damage the hose, causing personal injury.
- Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive materials such as creosote-impregnated objects and some paints. Consult the manufacturer before painting a hose. Never paint the couplers. Hose deterioration due to corrosive materials can result in personal injury.
- Avoid straight line tubing connections in short runs (See Figure 1). Straight line runs do not provide for expansion and contraction due to pressure and/or temperature changes.
- Eliminate stress in the tube lines. Long tubing runs should be supported by brackets or clips. Tubes through bulkheads must have bulkhead fittings. This makes easy removal possible and helps support the tubing.
- Carefully inspect all hoses and fittings prior to use. Before each use, check entire hose for cuts, leaks, abrasion or bulging of cover, or damage or movement of couplings. If any of these conditions exist, replace the hose immediately. NEVER attempt to repair the hose.

Cylinder or Tools



- Do not exceed rated capacities of the cylinders. Excess pressure may result in personal injury.
- Avoid off-center loads that could damage the cylinder and/or cause loss of the load.
- Read and understand all safety and warning decals and instructions for devices attached.
- Inspect each cylinder and coupler before each shift or usage to prevent unsafe conditions from developing.
- Do not use cylinders if they are damaged, altered or in poor condition.
- Do not use cylinders with bent or damaged couplers or damaged port threads.
- Under certain conditions, the use of an extension with a hydraulic cylinder may not be advisable and could present a dangerous condition.
- Avoid pinch points or crush points that can be created by the load or parts of the cylinder.
- To help prevent material fatigue if the cylinder is to be used in a continuous application, the load should not exceed 85% of the rated capacity or stroke.
- Cylinder must be on a stable base which is able to support the load while pushing or lifting.

Safety Precautions Continued

- To help prevent personal injury, use shims, friction material or constraints to prevent slippage of the base or load.
- Do not set poorly-balanced or off-center loads on a cylinder.
- The load can tip or the cylinder can “kick out” and cause personal injury.
- Do not use the locking collar on a threaded piston as a stop. The threads may shear resulting in loss of the load.
- If this component is used to lift or lower loads, be certain that the load is under operator control at all times and that others are clear of the load.
- Do not drop the load.
- As the load is lifted, use blocking and cribbing to guard against a falling load.
- To help prevent personal injury, do not allow personnel to go under or work on a load before it is properly cribbed or blocked. All personnel must be clear of the load before lowering.
- Never use extreme heat to disassemble a hydraulic cylinder. Metal fatigue and/or seal damage will result and can lead to unsafe operating conditions.



IMPORTANT

- Keep the cylinder clean at all times.
- While at a job site, when the cylinder is not in use, keep the piston rod fully retracted and upside down.
- Use an approved, high-grade pipe thread sealant to seal all hydraulic connections. PTFE tape can be used if only one layer of tape is used and it is applied carefully (two threads back) to prevent the tape from being pinched by the coupler and broken off inside the pipe end. Any loose pieces of tape could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.
- Always use protective covers on disconnected quick couplers.
- When mounting cylinders using the internal piston rod threads, collar threads, threaded tie rods or base mounting holes, the threads must be fully engaged. Always use SAE grade 8 or better fasteners when attaching components to cylinders and tighten securely.
- Limiting the stroke and pressure on all cylinders will prolong their life.

⚠ DANGER : A double-acting cylinder or ram must have both hoses and all couplers securely connected to both ports. If one of the two ports is restricted or becomes disconnected, pressure will build and the cylinder, hose or coupler can burst, possibly causing serious injury or death.

Hydraulic Fluids

- Properly dispose of all fluids, components and assemblies at the end of their useful life according to the applicable local waste-treatment and environmental regulations.
- Hydraulic fluid should be compatible with all hydraulic components.

Transport



- Do not lift hydraulic pump by any electrical cord, hose or coupler. To safely transport, always use the carrying handle, roll cage or suitable lifting aid, along with assistance and proper lifting techniques.

Note: The guide cannot cover every hazard or situation so always do the job with **SAFETY FIRST**.

SET-UP INSTRUCTIONS

1. Filling the Pump Reservoir

NOTE: Most pumps are shipped without hydraulic fluid in the reservoir. Hydraulic fluid may have been shipped in a separate container, but if hydraulic fluid is needed, use only approved Power Team hydraulic fluid rated at AW 46 47 cSt @ 38°C (237 SUS @ 100°F). If low temperature requirements are needed, use hydraulic fluid 5.1 cSt @ 100°C (451 cSt @ -40°C).

- A. Clean the area around the filler cap to remove all debris. Any debris in the fluid can damage the polished surfaces and precision parts of this pump.
- B. Retract all cylinders to the return position.
- C. Remove the filler cap and insert a clean funnel with a filter. Fill with hydraulic fluid to the bottom of the filler screen approximately 57.2 mm (2.25 inches) below the cover plate. Replace the filler cap, leaving the breather-hole open.
- D. Cycle the pump several times with the cylinders attached. Retract the cylinders and check the fluid level in the pump reservoir.

2. Hydraulic Connections

- A. Clean the areas around the fluid ports of the pump and cylinders.
- B. Inspect all threads and fittings for signs of wear or damage, replace as needed.
- C. Clean all hose ends, couplers or union ends.
- D. Remove the thread protectors from the hydraulic fluid outlets.
- E. Connect the hose assembly to the hydraulic fluid outlet, and couple the hose to the cylinder.

CAUTION : To prevent personal injury from leaking hydraulic fluid, seal all hydraulic connections with a high-quality, non-hardening, pipe thread sealant.



IMPORTANT: Sealant tape or non-hardening sealer tape can be used to seal hydraulic connections if only one layer of tape is used. Apply tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the system. Loose pieces of sealant could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.

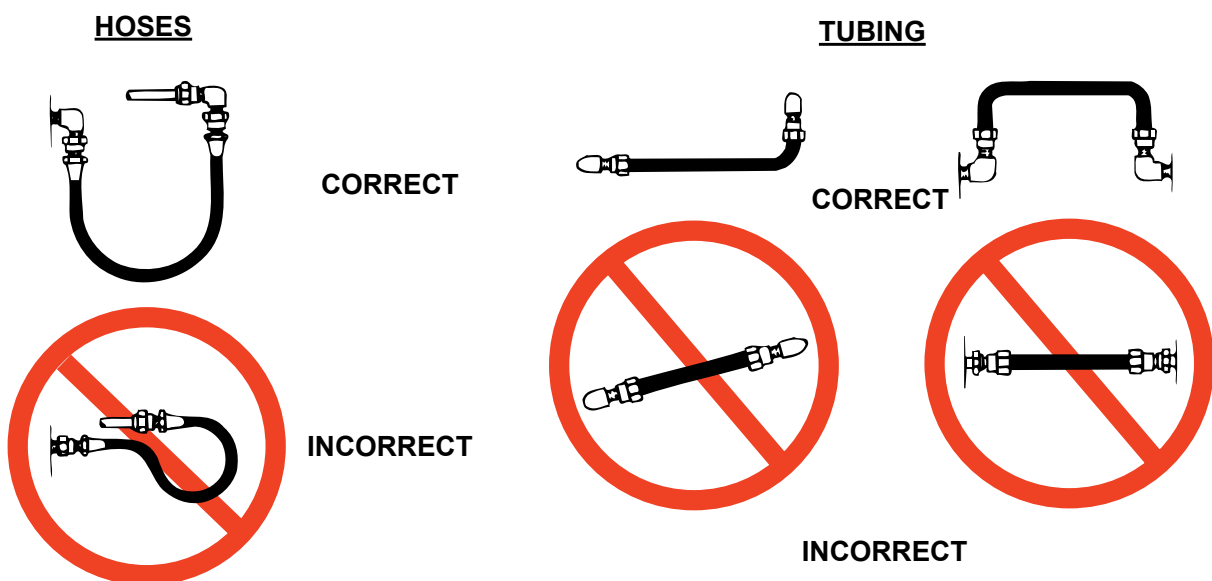


Fig. 1. Hoses and Tubing Connections

Set-Up Instructions Continued

3. Electric Motor Operation

⚠ WARNING : Any electrical work should be done by a qualified electrician. Disconnect power supply before removing electrical box cover. All voltages must be wired for counterclockwise rotation viewed from lead end of motor.

- A. The electric motor is a three phase 60 cycle motor and can be wired for 230 or 460 volt. This pump may also be ordered with a 50 cycle 220 or 380 volt motor. If the unit is prewired at the factory, there will be a tag on the motor that will indicate what the motor voltage is. This unit is supplied without a power cord or plug.* The motor leads are located on the magnetic starter inside the electrical box (refer to the electrical schematic decal on inside of box cover).
- B. Carefully check your line voltage to ensure that it is compatible with the voltage required by the pump. Plug cord into proper electrical outlet or provide wiring as required. To rewire motor from one voltage to another, see diagram on motor nameplate and electrical schematic and heater elements sections in parts list.

⚠ WARNING : Changing the voltage on this unit is an involved, and if improperly performed, potentially hazardous procedure. Consult the manufacturer for specific information before attempting any rewiring.

- C. When a valve is changed either from manual to solenoid or from solenoid to manual, reference should be made to the schematic decal inside the electrical box cover.

NOTE: It is not advisable to start and stop the motor to control flow of the pump. Instead, flow should be controlled by valve only.

- D. Reset switch: When overheating occurs, the thermal overload will kick out. To restart the motor, place valve in neutral and push the start switch once the unit is cooled.
- E. Power outage: The electrical design of this unit is such that when the unit is in operation and the power goes off and back on again, the unit's start switch must again be pushed before it will run. Place valve in neutral before restarting.

NOTE: An appropriately rated power cord and plug should be selected for the current rating of the motor found on the specifications decal on the motor.

AMPS at Maximum Hyd. Pressure	Electrical Cord Size AWG (mm ²) 3.2 Volt Drop			
	Length of Electrical Cord			
	0-25 ft. (0-8 m)	25-50 ft. (8-15 m)	50-100 ft. (15-30 m)	100-150 ft. (30-46 m)
6	18 (.82)	16 (1.33)	14 (2.09)	12 (3.32)
10	18 (.82)	14 (2.09)	12 (3.32)	10 (5.37)
14	16 (1.33)	12 (3.32)	10 (5.37)	8 (8.37)
18	14 (2.09)	12 (3.32)	8 (8.37)	8 (8.37)
22	14 (2.09)	10 (5.37)	8 (8.37)	6 (13.30)
26	12 (3.32)	10 (5.37)	8 (8.37)	6 (13.30)
30	12 (3.32)	10 (5.37)	6 (13.30)	4 (21.29)

Table 1. Minimum Recommended Gauge Table

Set-Up Instructions Continued

3. Bleeding Air from the System

After all connections are made, the hydraulic system must be bled of any trapped air. See Figure 2. With no load on the system and the pump vented and positioned higher than the hydraulic device, cycle the system several times. Check the reservoir fluid level and fill to proper level with Power Team hydraulic fluid as necessary. If there is a problem contact Power Team.

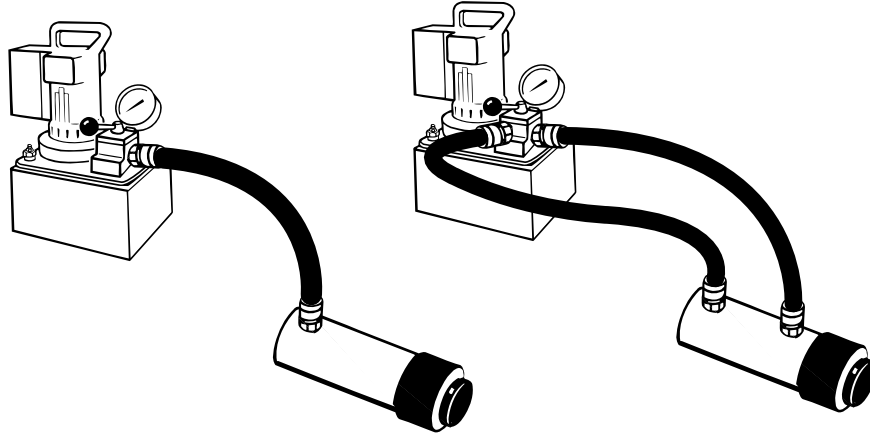


Figure 2. System Bleeding

IMPORTANT: Some spring return cylinders have a cavity in the rod which forms an air pocket. This type of cylinder should be bled when positioned upside down or lying on its side with the port facing upward.

4. Hydraulic Pressure Gauge (optional)

Automatic Dump Valve

To monitor line pressure when using an automatic dump valve, a T-adaptor is used between the valve and the pressure switch to adapt a hydraulic pressure gauge.

Posi-Check Valve

If a Posi-Check valve is used, a hydraulic gauge shows zero pressure when the valve is switched to the neutral (hold) position. Cylinder pressure, however, is held without loss.

To install a hydraulic pressure gauge:

- See Figure 3. Remove the pipe plug from the valve's gauge port.
- See Figure 4. Install sealant tape or non hardening sealer to a 45 degree elbow (PN 9678). Install the elbow as shown.
- Install sealant tape or non hardening sealer to the gauge.
- See Figure 5. Install the pressure gauge.

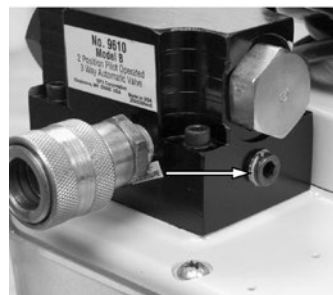


Figure 3. Gauge Port



Figure 4. Elbow Installation

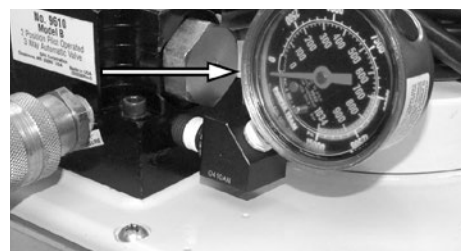


Figure 5. Pressure Gauge Installation

DIRECTIONAL CONTROL VALVES

Max. Capacity: 690 bar (10,000 psi)

PE4004	Valve Function	Use with Cylinder Type	Valve No.
	Position "A" Center Position Position "B"	Double-acting	9506 4-way advance hold return
	Diagrams		
PE4004S	Valve Function	Use with Cylinder Type	Valve No.
	Solenoid "A" ON Solenoid "A/B" OFF Solenoid "B" ON	Double-acting	9512 4-way solenoid advance hold return
	Diagrams		
PE4003	Valve Function	Use with Cylinder Type	Valve No.
	POSITION "A" CENTER POSITION RELEASE POSITION	Single-acting	9520 3-way, 3-position, advance hold return
	Diagrams		

Table 2. Pump Configurations

OPERATION

1. Priming the Pump

The following instructions should be followed when operating the pump for the first time.

- A. Make sure all valve and hose connections are tight, and then plug in the electric motor.
- B. Set valve in the neutral or return position. Switch pump on and off several times. Depress the start switch and let pump idle for a few minutes.
- C. Run cylinder out to its full travel several times to eliminate air from the system.
- D. Pump is ready now to be put into regular operation.

NOTE: If a large double acting cylinder is being operated, after eliminating the air from the system, refill the pump reservoir to the bottom of the filler screen with the cylinder in the retracted position, since the forward part of the cylinder acts as a reservoir in this instance.

Bleeding Air from the System

- A. Cycle the hydraulic system until operation is smooth and consistent.
- B. Check the pump reservoir level. Add Power Team hydraulic fluid as needed.

2. Motor Control Operation

- A. Connect the power cord to an appropriate power source.
- B. See Figure 6. Push the START switch.

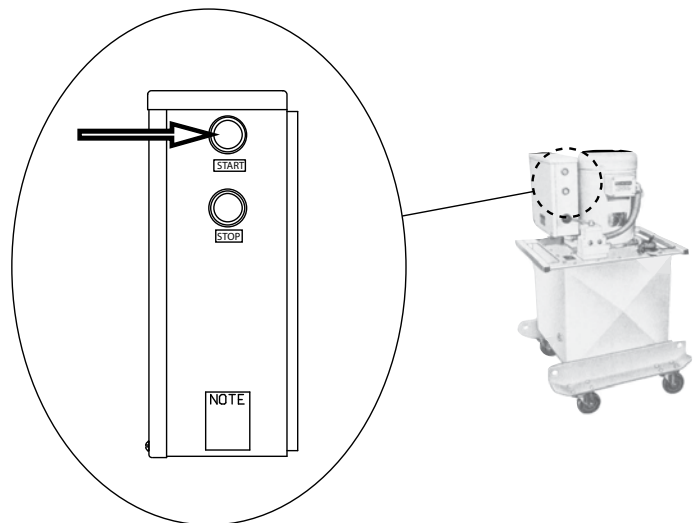


Figure 6. Electric Motor Control Switches

See Figure 7. This remote will start and run the pump motor to advance or retract of the cylinder. When released, it allows the pressure to be held.

- C. Press the rocker switch toward the Advance side of the switch and hold to extend the cylinder.
- D. Press the rocker switch toward the Retract side of the switch and hold to retract the cylinder.
- E. Release the rocker switch and the pump will stop but the system will hold. Generally used on 4-Way- 2-Position valves.



Figure 7. Advance-Hold-Retract Remote

Operation Continued

3. Pressure Regulating Controls

To ensure accuracy and low pressure differential (approx. 20 bar 300 psi) throughout the pressure range 69-690 bar (1,000-10,000 psi) depending on the pump model), the pressure switch should be used with the pressure regulating valve. The pressure switch must be set at a pressure lower than the pressure regulating valve to work correctly.

- The pressure regulating valve can be adjusted to bypass fluid at a given pressure setting while the pump continues to run.
- The pressure switch can be adjusted to stop the pump at a given pressure setting.

Adjusting The Pressure Regulating Valve:

NOTE: For easy adjustment of the pressure regulating valve, always adjust the pressure by **INCREASING** it to a desired pressure setting. The pressure range for this unit is from 1,000 psi to 10,000 psi. Loosen the locknut on the pressure regulating valve.

- See Figure 8. Loosen the locknut on the pressure regulating valve, and turn the adjusting screw a few turns counterclockwise (CCW) to decrease the pressure setting to a lower than desired pressure.
- With the engine running, shift the valve into the operating position.
- Slowly turn the adjusting screw in a clockwise (CW) direction to gradually increase the pressure setting. When the desired pressure setting is reached, lock the adjusting screw into position by tightening the locknut.

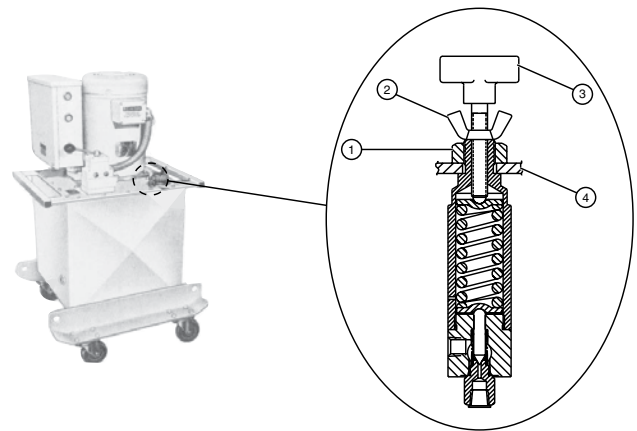
IMPORTANT: The pressure range is from 1,000 to 10,000 PSI (70 to 700 BAR) depending on the pump model.

Adjusting the Pressure Switch:

This unit is a two stage, high pressure pump. The low pressure, high volume stage provides fast cylinder piston travel. The unloading valve pressure is preset at the factory at 1550-1650 psi. In the event this valve needs to be reset.

- Loosen the locknut on the pressure switch, and turn the adjusting screw in a clockwise direction. This increases the pressure setting to a higher than desired pressure.
- Adjust the pressure regulating valve to the desired pressure setting by using the procedure previously outlined.
- With the pump running and bypassing fluid at the desired pressure, slowly turn the pressure switch adjusting screw in a counterclockwise direction, decreasing the pressure switch setting until the pump motor shuts off.
- Lock the adjusting screw in position by tightening the locknut.
- Release pressure. Run the pump to check the pressure setting and cut-out of the motor. It may be necessary to make a second adjustment.

Note: When the pressure switch setting is reached, the motor shuts off. However, the “coast” of the motor continues to deliver fluid for a brief period. The pressure regulating valve bypasses this surplus fluid, preventing it from going into the system. As a result, the pressure differential can be held to approximately 20 bar (300 psi).



Item	Description
1	Lock Nut
2	Wing Nut
3	Tee Knob
4	Cover Plate

Figure 8. Pressure Regulating Valve

PERFORMANCE SPECIFICATIONS

The information in the following charts can be used as a basis to determine if the system is performing as expected during operation.

Pump	RPM	Amp Draw at 690 bar (10,000 psi) (115V)	Amp Draw at 690 bar (10,000 psi) (230V)	dBa at Idle and 690 bar (10,000 psi)	Air Supply Req'd bar (psi)
PE400	1,725	-	34	73/80	N/A
* Requires 1.4 M ³ /min. (49 CFM) at 5.5 bar (80 psi) shop air pressure at pump.					

Table 3. Drive Unit Requirements

Pump	Max. Pressure Output bar (psi)	Fluid Delivery* (cu. in./min. @)					
		0 bar (0 psi)	7 bar (100 psi)	50 bar (700 psi)	70 bar (1,000 psi)	345 bar (5,000 psi)	690 bar (10,000 psi)
PE400	690 bar (10,000 psi)	-	-	-	-	450	420
* Typical delivery. Actual flow varies with field conditions.							

Table 4. Fluid Pressure Chart

GENERAL MAINTENANCE

⚠ WARNING : To prevent personal injury,



- Disconnect the unit from the power supply before performing maintenance or repair procedures.
- Repairs and maintenance are to be performed in a dust-free area by a qualified technician.

1. System Evaluation

The components of your hydraulic system — cylinders, pumps, hoses, and couplings — all must be:

- Rated for the same maximum operating pressure.
- Correctly connected.
- Compatible with the hydraulic fluid used.

A system that does not meet these requirements can fail, possibly resulting in serious injury. If you are in doubt about the components of your hydraulic system, contact Power Team Technical Support.

2. Inspection

Keep a dated and signed inspection record of the equipment. Before each use, the operator or other designated personnel should visually inspect for the following conditions:

- Cracked or damaged cylinder.
- Excessive wear, bending, damage, or insufficient thread engagement.
- Leaking hydraulic fluid.
- Scored or damaged piston rod.
- Incorrectly functioning or damaged heads and caps.
- Loose bolts or cap screws.
- Damaged or incorrectly assembled accessory equipment.
- Modified, welded, or altered equipment.
- Bent or damaged couplers or port threads.

3. Periodic Cleaning

⚠ WARNING : Contamination of the hydraulic fluid could cause the valve to malfunction. Loss of the load or personal injury could result.

Establish a routine to keep the hydraulic system as free from debris as possible.

- Seal unused couplers with dust covers.
- Keep hose connections free of debris. Equipment attached to a cylinder must be kept clean.
- Keep the breather-hole in the filler cap clean and unobstructed.
- Use only Power Team hydraulic fluid. Replace hydraulic fluid as recommended, or sooner if the fluid becomes contaminated. Never exceed 300 hours of use between fluid changes.

4. Hydraulic Fluid Level

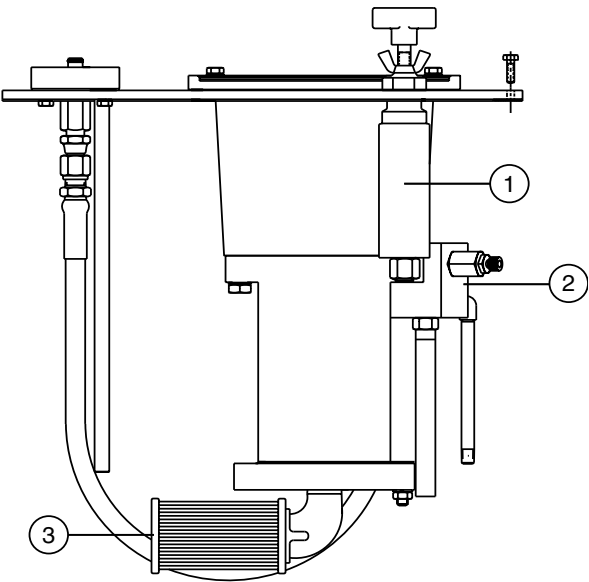
- A. Check the fluid level in the reservoir after each 10 hours of use. The fluid level should be to the bottom of the filler screen approximately 57.2 mm (2.25 inches) below the cover plate when all cylinders are retracted.
- B. Drain, flush, and refill the reservoir with an approved Power Team hydraulic fluid after every 300 hours of use. The frequency of fluid changes depends upon general working conditions, severity of use, the overall cleanliness and care given to the pump. Fluid should be changed more frequently when the system is not operated regularly indoors.

5. Draining and Flushing the Reservoir

- A. Clean the pump exterior before the pump interior is removed from the reservoir.
- B. See Figure 9. Remove the (20) cap screws fastening the motor and pump assembly to the reservoir.

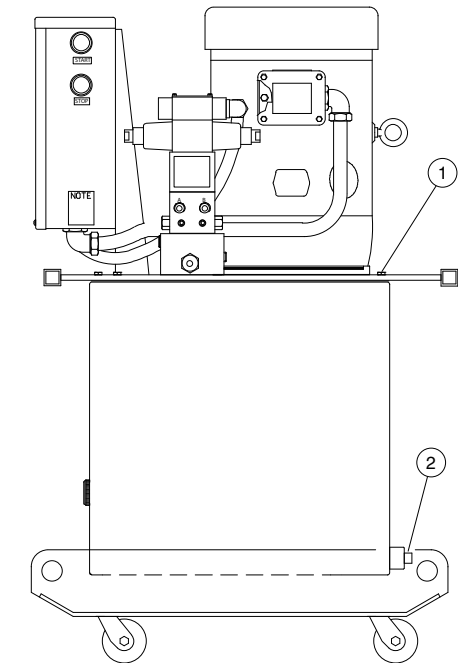
Caution: Do not damage the pump filter or pressure regulating valves when lifting the pump and motor off the reservoir. See Figure 10.

- C. Clean the inside of the reservoir, and fill with Power Team hydraulic fluid. Rinse the filter clean.
- D. Place the pump and motor assembly back onto the reservoir, and secure with two machine screws assembled on opposite corners of the housing.
- E. Place the hydraulic flow control valve in the neutral position. If the pump is equipped with a valve that has only an advance or retract position, place the valve in the advance position.
- F. Run the pump for several minutes.
- G. Disconnect the motor and pump assembly, and drain and clean the inside of the reservoir.
- H. Fill the reservoir with Power Team hydraulic fluid.
- I. Place the pump and motor assembly (with new gasket) on the reservoir, and thread the cap screws. Tighten cap screws securely and evenly.
- J. Run the pump for several minutes.
- K. Disconnect the motor and pump assembly, and drain and clean the inside of the reservoir.
- L. Fill the reservoir with Power Team hydraulic fluid.
- M. Place the pump and motor assembly (with new gasket) on the reservoir, and thread the new screws. Tighten screws securely and evenly.



Item	Description
1	Pressure Regulating Valve
2	High Pressure Relief Valve
3	Filter

Figure 9. Pump Assembly



Item	Description
1	Cover Plate Cap Screws (20)
2	Drain Plug

Figure 10. Pump and Motor Assembly

6. Adding Hydraulic Fluid to the Reservoir

- A. Retract the cylinder(s) devices.
- B. Disconnect the power supply.
- C. Clean the entire area around the filler plug.
- D. Remove the filler plug, and install a clean funnel with a filter.
- E. Use only Power Team hydraulic fluid AW 46 47 cSt @ 38°C (237 SUS @ 100°F).

7. Sound Reduction - Electrically Powered Motor

The electrically powered hydraulic pump operates in the 73–80 dBA range. If further sound reduction is desired contact Power Team Hydraulic Technology technical support for products more suitable to your application.

8. Hose Connections

CAUTION : To prevent personal injury from leaking hydraulic fluid, seal all hydraulic connections with a high-quality, non-hardening, pipe thread sealant.



IMPORTANT : Pipe thread sealant tape can be used to seal hydraulic connections if only one layer of tape is used. Apply tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the system. Loose pieces of tape could travel through the system and obstruct the flow of fluid or cause interference of precision-fit parts.

9. Storage

Store the unit in a dry, well-protected area where it will not be exposed to corrosive vapors, debris, or other harmful elements. If a unit has been stored for an extended period of time, it must be thoroughly inspected before it is used.

10. Checking Brushes on Electric Motors

To help prevent premature failure of the armature, check the brushes periodically:

- A. Remove the metal brush cover plates.
- B. Remove the brush holder caps and brush assemblies.
- C. The brush assemblies must be replaced if they are 4.7mm (3/16") long or less. See Figure 11.
- D. Install brush assemblies, brush holder caps, and metal brush cover plates.

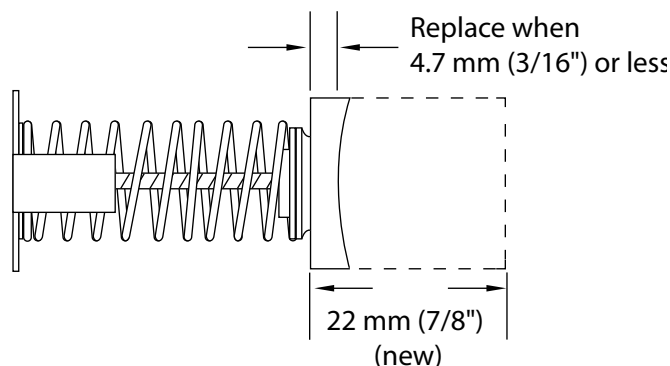


Figure 11. Brush Inspection

TROUBLESHOOTING GUIDE

⚠ WARNING : To prevent personal injury,



- Repair work or troubleshooting must be performed by qualified personnel who are familiar with this equipment.



- Disconnect the power supply before removing the electrical cover. Electrical work should be performed by a qualified electrician.
- Check for system leaks by using a hand pump to apply pressure to the suspect area. Watch for leaking fluid and follow it back to its source. Never use your hand or other body parts to check for a possible leak.

Notes:

- For a detailed parts list or to locate a Power Team Authorized Hydraulic Service Center, contact your nearest Power Team facility.
- Plug the outlet ports of the pump when checking for leakage to determine if the leakage is in the pump, in the cylinder, or in the tool.

PROBLEM	CAUSE	SOLUTION
Electric motor does not run. ⚠ WARNING Disconnect power supply before removing cover. Any electrical work should be performed by a qualified electrician.	1. Unit is not plugged in.	1. Plug in unit.
	2. No voltage supply.	2. Check line voltage. Check reset switch on power panel.
	3. Broken lead wire or defective power cord plug.	3. Replace defective parts.
	4. Defective switches.	4. Replace switches.
	5. Defective starter relay.	5. Replace defective parts.
	6. Circuit breaker tripped because total amperage draw too high for existing circuit.	6. Add an additional circuit or use alternate circuit.
	7. Overheated motor.	7. Wait for motor to cool before restarting. Thermal protector will reset automatically, or push red reset switch on top of the motor (if so equipped).
	8. Faulty thermal protector.	8. Replace.
	9. Defective motor.	9. Replace or repair motor.

Troubleshooting Guide Continued

PROBLEM	CAUSE	SOLUTION
Pump is not delivering fluid or delivers only enough fluid to advance cylinder(s) partially or erratically. WARNING: The force of escaping hydraulic fluid could cause serious injury. Keep hands, face, etc. clear of any hydraulic leaks.	1. Fluid level too low.	1. Fill reservoir to bottom of the filler screen with all cylinders retracted.
	2. Loose fitting coupler to cylinder.	2. Check quick-disconnect couplings to cylinders. Inspect couplers to insure that they are completely coupled. Occasionally couplers have to be replaced because the ball check does not stay open due to wear.
	3. Air in the system.	3. Bleed the system.
	4. Air leak in suction line.	4. Check and tighten the suction line.
	5. Debris in pump or filter plugged.	5. Pump filter should be cleaned and if necessary, pump should be dismantled and all parts inspected and cleaned.
	6. Cold fluid or fluid is too heavy (Hydraulic fluid is of a higher viscosity than necessary).	6. Change to lighter fluid.
	7. Relief valve or low pressure unloading valve out of adjustment.	7. Readjust as needed.
	8. Reservoir capacity is too small for the size of the cylinder(s) used.	8. Use smaller cylinder(s) or larger reservoir.
	9. Defective directional valve.	9. Inspect all parts carefully and replace if necessary.
	10. Release poppet not seating in solenoid valve.	10. Disassemble, inspect, and clean pump to remove any debris.
	11. Sheared drive shaft key(s).	11. Replace after checking pump cavity for broken pieces.
	12. Motor rotating in wrong direction.	12. Refer to electrical schematic on motor.
	13. Vacuum in reservoir.	13. Check for plugged vent in filler plug.
	14. Low pressure pump worn.	14. Repair or replace gerotor pump.
Pump builds pressure but cannot maintain pressure.	1. Check to see if there are any external leaks. If no fluid leakage is visible, the problem is internal.	1. Reseal leaking pipe fittings with pipe sealant.
	2. To test for a leaking control valve, lift the pump from the reservoir but keep the filter in the fluid. Remove the drain line to see if the fluid is leaking from the valve. If the valve is not leaking, the internal check valve could be leaking. Refer to the note concerning checking for fluid leaks at the beginning of this Trouble- shooting Guide.	2. Clean, reseal or replace control valve parts. If the internal check valve is leaking, the check valve must be disassembled and the seat area repaired, poppet replaced, etc.

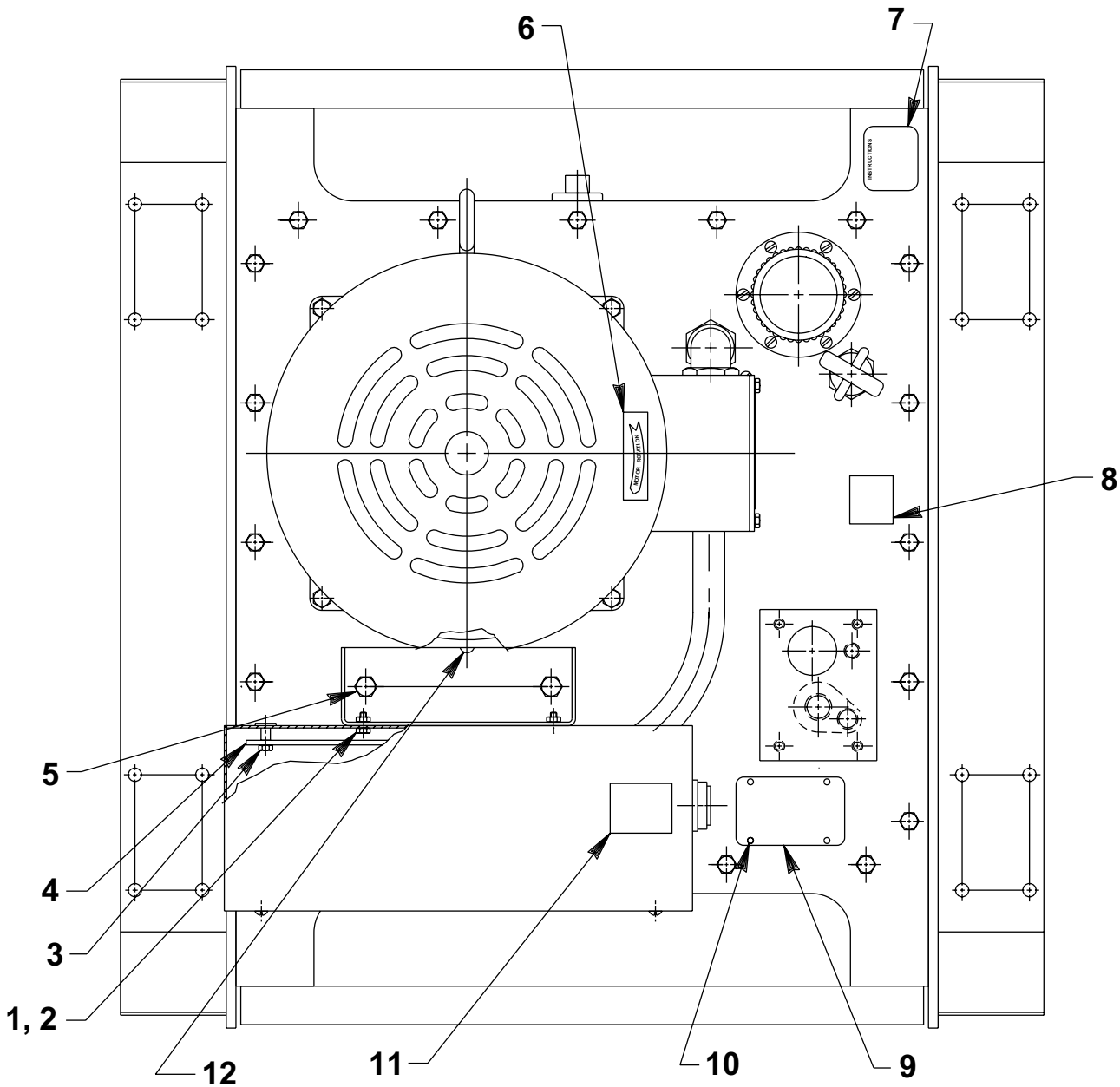
Troubleshooting Guide continued

PROBLEM	CAUSE	SOLUTION
Pump will not build full pressure.	1. Faulty pressure gauge.	1. Calibrate gauge.
	2. Check for external leakage.	2. Seal any faulty pipe fitting with pipe sealant.
	3. Check the relief valve setting.	3. Lift the pump from the reservoir but keep the filter immersed in fluid. Note the pressure reading when the relief valve begins to open up. If functioning normally, it should start to leak off just prior to relief valve pressure.
	4. Check for leaks in the solenoid valve.	4. Clean and reseal or replace parts.
	5. Inspect the pump for internal leakage. Check high pressure pump inlet or outlet ball checks.	5. Same procedure as above but look for leaks around the entire inner mechanism. If there are no visible leaks the high pressure pump subassembly may be leaking. Remove all parts. Check the valve head assembly for any damage to the seat area. Clean and reseal if necessary. Inspect for damage and replace parts if necessary, then reassemble.
	6. Sheared key(s).	6. Replace after checking pump cavity for broken pieces.
Cylinder(s) will not retract.	1. Check the system pressure; if the pressure is zero, the solenoid valve is releasing pressure and the problem may be in the cylinder, (mechanical linkage connected to cylinders), or quick-disconnect couplings.	1. Check the cylinders for broken return springs and check couplers to insure that they are completely coupled. Occasionally couplers have to be replaced because one check does not stay open in the coupled position.
	2. Defective valve.	2. Check valve operation and inspect parts. Replace if necessary.

PARTS LIST

**50/60 CYCLE
HIGH PRESSURE POWER UNIT**

TOP VIEW



Parts List Continued

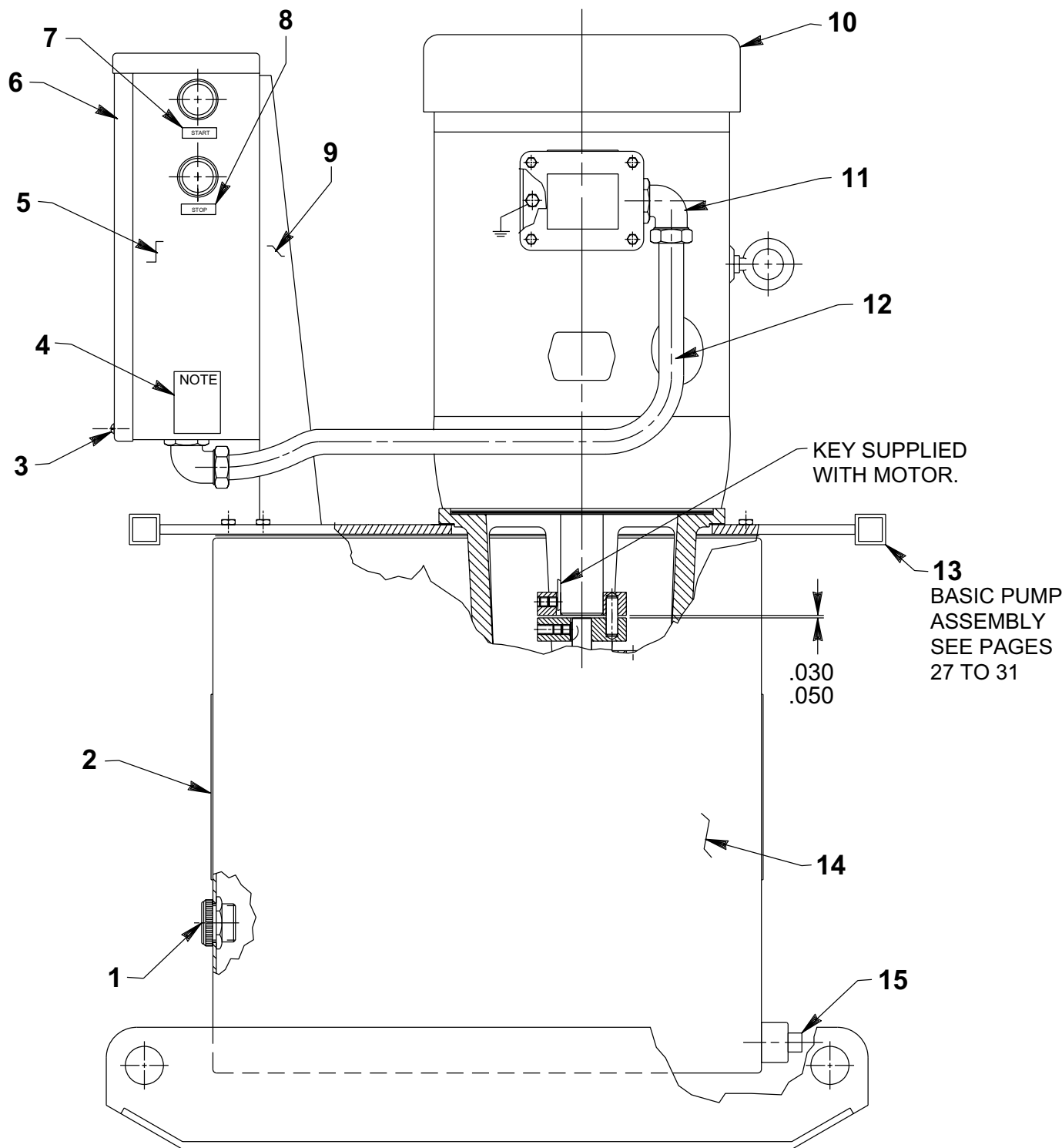
ITEM	PART NO	DESCRIPTION	QTY.
1	12809	LOCKNUT (1/4-20 UNC)	5
2	10005	CAP SCREW (1/4-20 UNC X 1/2 LG.)	3
3	10004	CAP SCREW (1/4-20 UNC X 3/8 LG.)	4
4	60557	BASIC ELECTRICAL ASSEMBLY	1
5	15273	CAP SCREW (5/16-18 UNC X 1/2 LG.)	6
6	27556	ROTATION DECAL	1
7	203755	INSTRUCTION DECAL	1
8	205112	PATENT DECAL	1
9	202120	NAMEPLATE	1
10	10575	DRIVE SCREW (#2 X 3/16 LG.)	4
11	203756	WARNING DECAL	1
12	10820	DRIVE SCREW	1
PARTS INCLUDED BUT NOT SHOWN			
	214486	SWIVEL CASTER (4" DIA.)	4
	10027	CAP SCREW (5/16-18 UNC X 5/8 LG.)	16
	13116	HEX NUT (5/16-18 UNC)	16
	37800	ELECTRICAL SCHEMATIC DECAL (60 CYCLE)	1
	38591	ELECTRICAL SCHEMATIC DECAL (50 CYCLE)	1

Refer to any operating instructions included with this product for detailed information about operation, testing, disassembly, reassembly, and preventive maintenance.

Items found in this parts list have been carefully tested and selected. **Therefore: Use only genuine Power Team replacement parts!**

Additional questions can be directed to our Technical Services Department.

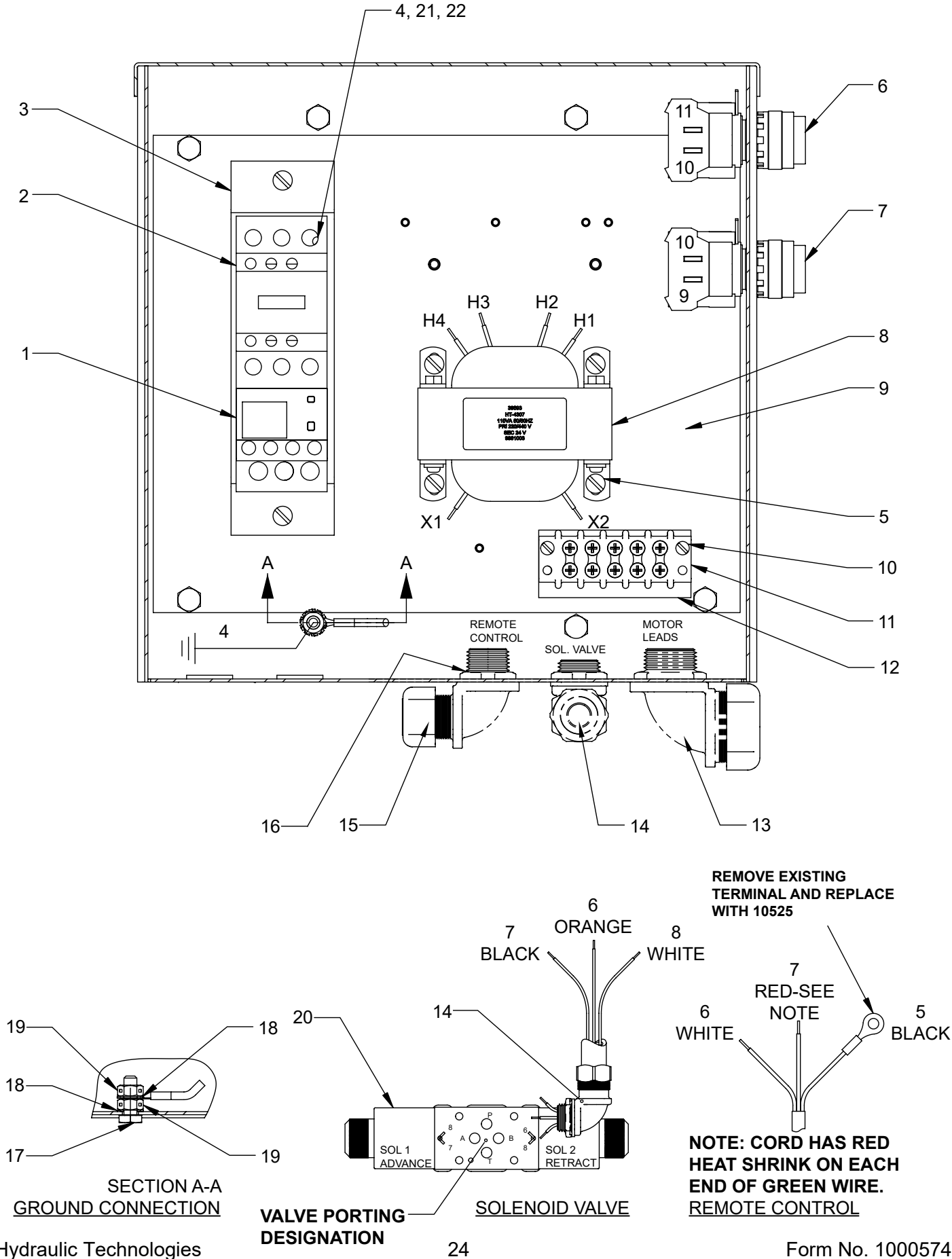
SIDE VIEW



Parts List Continued

ITEM	PART NO	DESCRIPTION	QTY.
1	17586	LIQUID LEVEL SIGHT GAUGE	1
2	309221	TRADE NAME DECAL	1
3	13534	SELF-TAPPING SCREW (10-16 X 3/8" LG.)	2
4	204015	ELECTRICAL DECAL	2
5	60439WH2	ELECTRICAL BOX BODY	1
6	51107WH2	ELECTRICAL BOX COVER	1
7	203808	DECAL (START)	1
8	203769	DECAL (STOP)	1
9	51099WH2	MOUNTING BRACKET (FOR ELECTRICAL BOX)	1
10	19326WH2	ELECTRIC MOTOR (10 HP WITH KEY; 230/460 VAC, 60 HZ.)	1
	39537WH2	ELECTRIC MOTOR (10 HP WITH KEY; 220/380 VAC, 50 HZ.)	1
11	13343	90° ELBOW FOR 3/4" SEALTITE CONDUIT	2
12	13340	SEALTITE CONDUIT (3/4")	1.3 FT
13	60556	BASIC PUMP ASSEMBLY (5 GPM; SEE PAGES 27-31)	1
	65252	BASIC PUMP ASSEMBLY (FOR PE4004S-LM)	1
	64541	BASIC PUMP ASSEMBLY (FOR PE4004S-BAR)	1
14	60430OR9	RESERVOIR ASSEMBLY	1
15	11049	DRAIN PLUG	1
PARTS INCLUDED BUT NOT SHOWN			
	200188	WARNING DECAL	1

ELECTRICAL ASSEMBLY

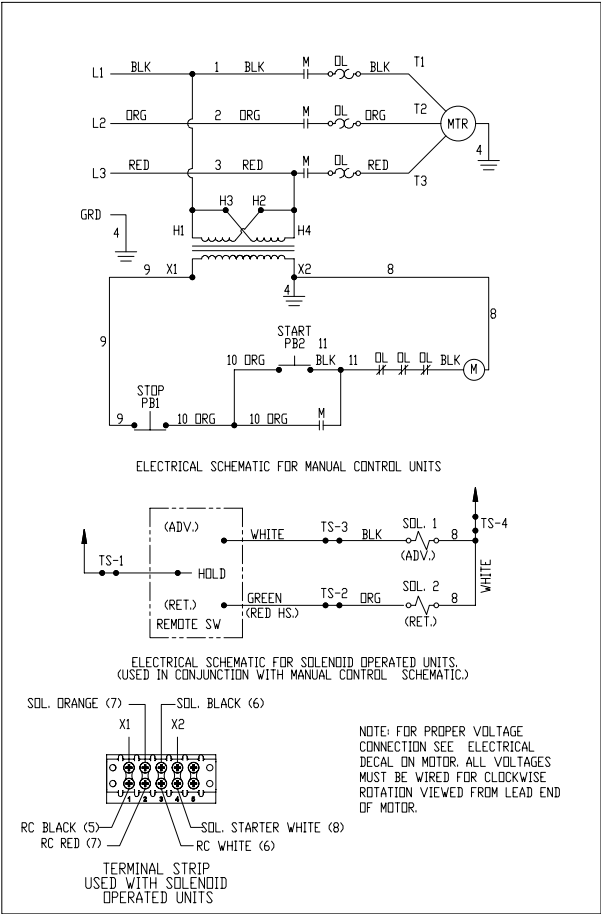


Parts List Continued

ITEM	PART NO	DESCRIPTION	QTY.
1	360022	OVERLOAD RELAY (460VAC, 60HZ, SET AT 15.1 AMPS)	1
	360013	OVERLOAD RELAY (380VAC, 50HZ, SET AT 19.6 AMPS)	1
	2002401	OVERLOAD RELAY (FOR PE4004S, 460VAC, 60HZ)	1
2	422011	CONTACTOR (FOR 360022 & 360013)	1
	2002398	CONTACTOR (FOR 2002401 & 2002403)	1
3	2002397	CONTACTOR BRACKET	1
4	16099	SCREW (#6-20 X 3/4 LG.)	2
5	13063	MACHINE SCREW (10-24 UNC X 1/4 LG.)	6
6	39282	PUSH BUTTON SWITCH (GREEN)	1
7	39283	PUSH BUTTON SWITCH (RED)	1
8	39693	TRANSFORMER (230/460 VAC, 60 HZ.)	1
	39750	TRANSFORMER (220/380 VAC, 50 HZ.)	1
9	51106OR9	STAND-OFF PLATE	1
10	11426	MACHINE SCREW (6-32 UNC X 1/2 LG.)	2
11	17841	TERMINAL BLOCK	1
12	17842	IMPRINTED MARKER STRIP	1
13	13343	90° ELBOW FOR 3/4" SEALTITE CONDUIT	2
14	17840	90° FOR 3/8" CONDUIT	2
15	13529	CORD GRIP (REMOTE CONTROL)	1
16	11362	CONDUIT LOCKNUT	1
17	10009	CAP SCREW	1
18	11351	LOCKWASHER (1/4 EXTERNAL TOOTH)	2
19	12809	LOCKING NUT (1/4-20 UNC)	5
20	16664-4	4-WAY SOLENOID VALVE (24 VOLT, 50/60 HZ)	1
21	10195	NUT (#6-32 UNC)	2
22	17656	WASHER	2
VALVE AND SWITCH OPTIONS			
	9506	4-WAY MANUAL VALVE (SEE PARTS LIST NO. 100628)	1
	9512	4-WAY SOLENOID VALVE (SEE PARTS LIST NO. 101653)	1
	202778	REMOTE CONTROL HAND SWITCH (FOR 4-WAY SOLENOID VALVES; SEE PARTS LIST NO. 101644)	1
	9520	3-WAY MANUAL VALVE (SEE PARTS LIST NO. 101377)	1

ELECTRICAL SCHEMATIC

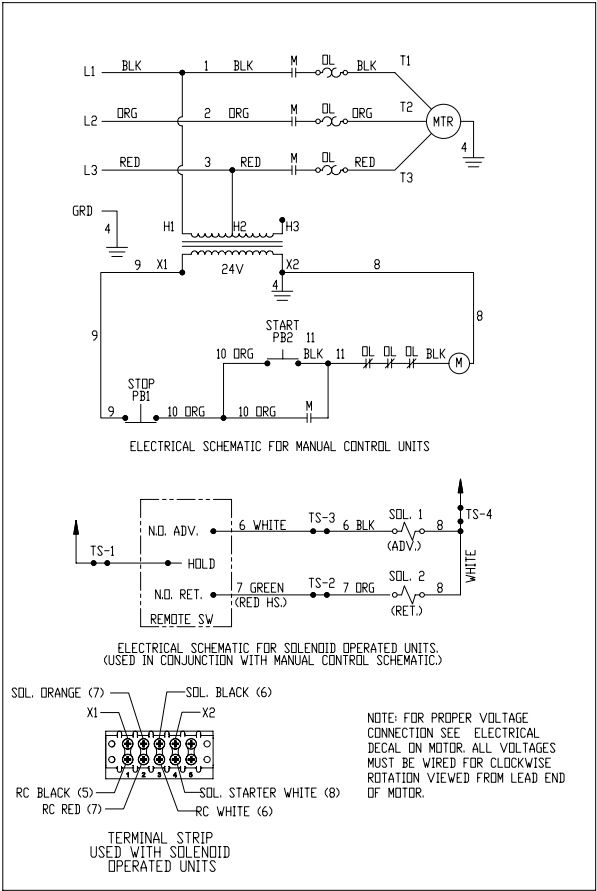
230/460 V.A.C., 60 CYCLE



TRANSFORMER CONNECTIONS

230 V.A.C., 60 HZ	460 V.A.C., 60 HZ
H1 and H3 to L1	H2 and H3
H2 and H4 to L3	H1 to L1
	H4 to L3

220/380 V.A.C., 50 CYCLE

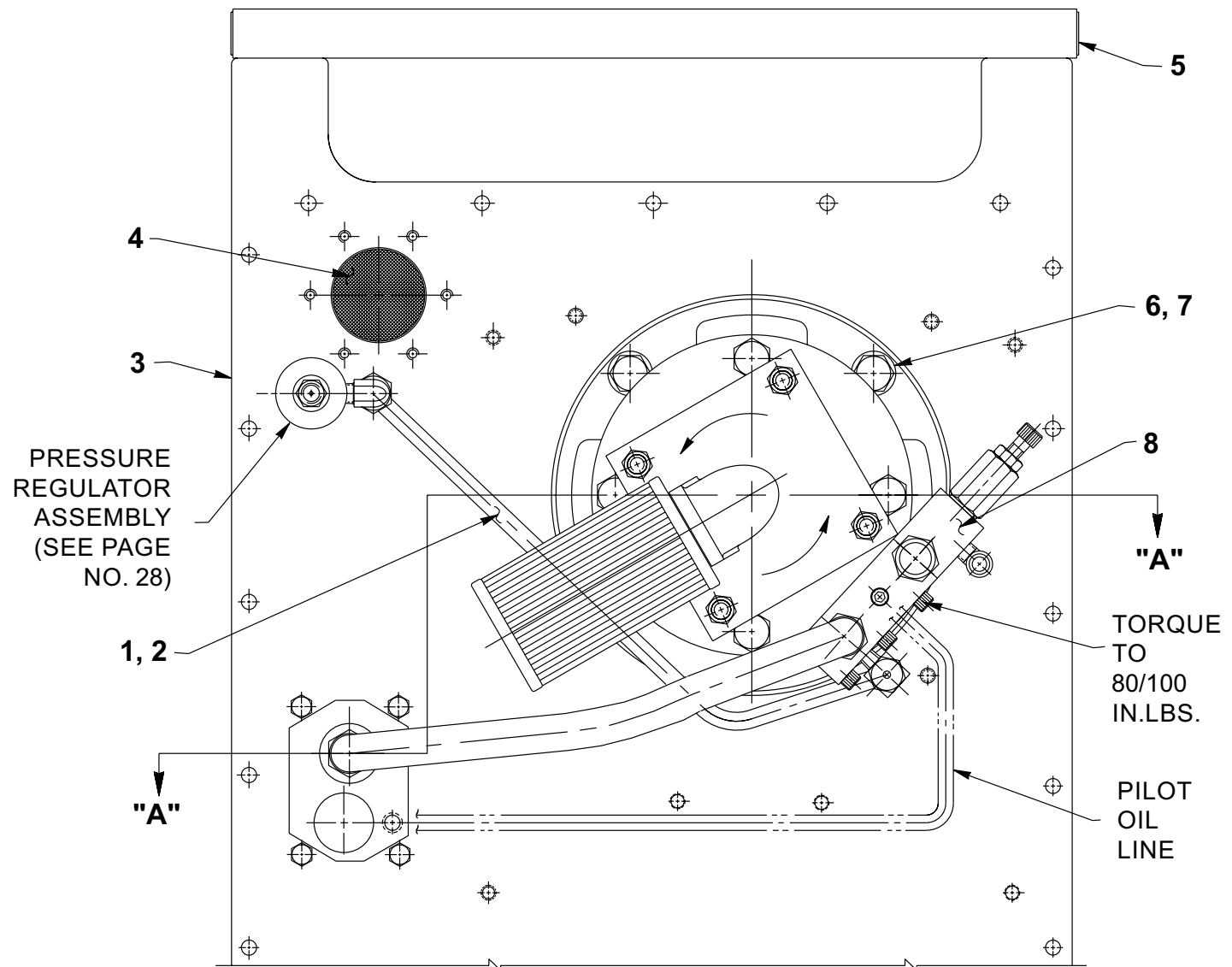


TRANSFORMER CONNECTIONS

220 V.A.C., 50 HZ	380 V.A.C., 50 HZ
H1 to L1	H1 to L1
H2 to L3	H3 to L3

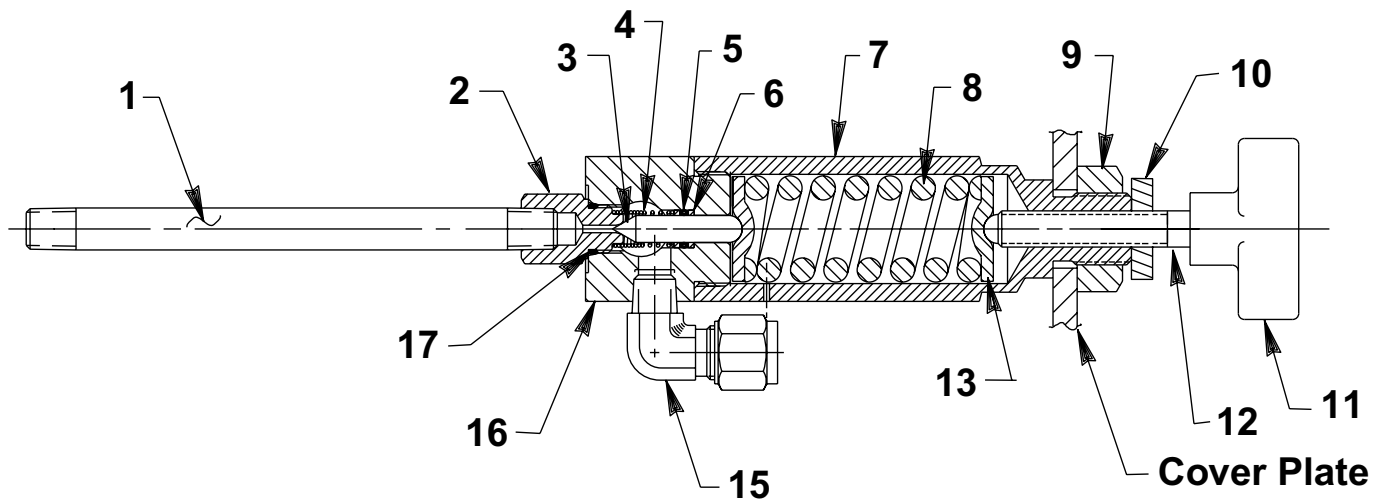
NOTE: Unused lead to be capped with splice cap.

BASIC PUMP ASSEMBLY - TOP VIEW



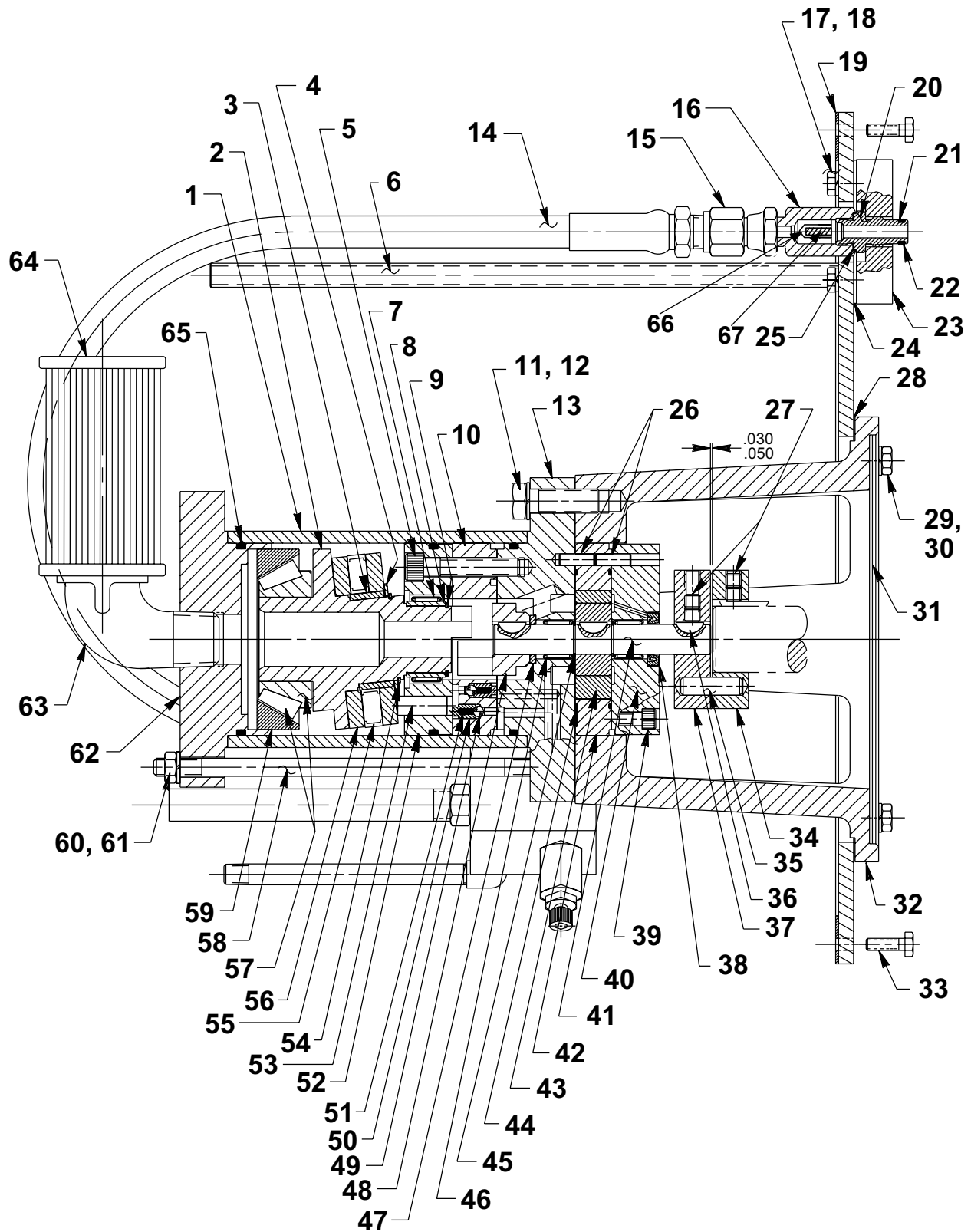
ITEM	PART NO	DESCRIPTION	QTY.
1	43647	REGULATOR OIL LINE ASSEMBLY	1
2	12696	STRAIGHT FITTING	1
3	51098WH2	COVER PLATE WELDMENT	1
	65253WH2	COVER PLATE WELDMENT (FOR PE4004S-LM)	1
4	13167	FILLER/BREATHER ASSEMBLY	1
5	12126	SQUARE PLASTIC INSERT	4
6	11623	CAP SCREW (1/2-13 UNC X 1-1/4 LG.)	4
7	10249	SPRING LOCKWASHER	8
8	42795	UNLOADING VALVE ASSEMBLY (SEE PAGES 32-33)	1

PRESSURE REGULATOR ASSEMBLY SECTION B-B



ITEM	PART NO	DESCRIPTION	QTY.
1	14463	DRAIN TUBE	1
2	309078	SEAT FITTING	1
3	309079	POPPET	1
4	215431	COMPRESSION SPRING	1
5	10266	O-RING (3/8 X 1/4 X 1/16)	1
6	215430	BACKUP WASHER (3/8 X 9/32 X 3/64)	2
7	309077	SPRING HOUSING	1
8	215429	COMPRESSION SPRING (1.100 O.D. X 2-1/2 LG.)	1
9	10396	JAM NUT (3/4-16 UNF)	1
10	215683	REGULATOR LOCKING NUT	1
11	215693	TEE KNOB	1
12	215721	STEM (NOTE: ASSEMBLE TO KNOW [ITEM #11] WITH LOCTITE NO. 242 OR EQUIV.)	1
13	215428	SPRING RETAINER	2
14	10475	90° ELBOW FITTING	1
15	47648	REGULATOR BODY	1
16	13755	O-RING (9/16 X 13/32 X 5/64)	1

BASIC PUMP ASSEMBLY - SIDE VIEW



SECTION "A"-"A"

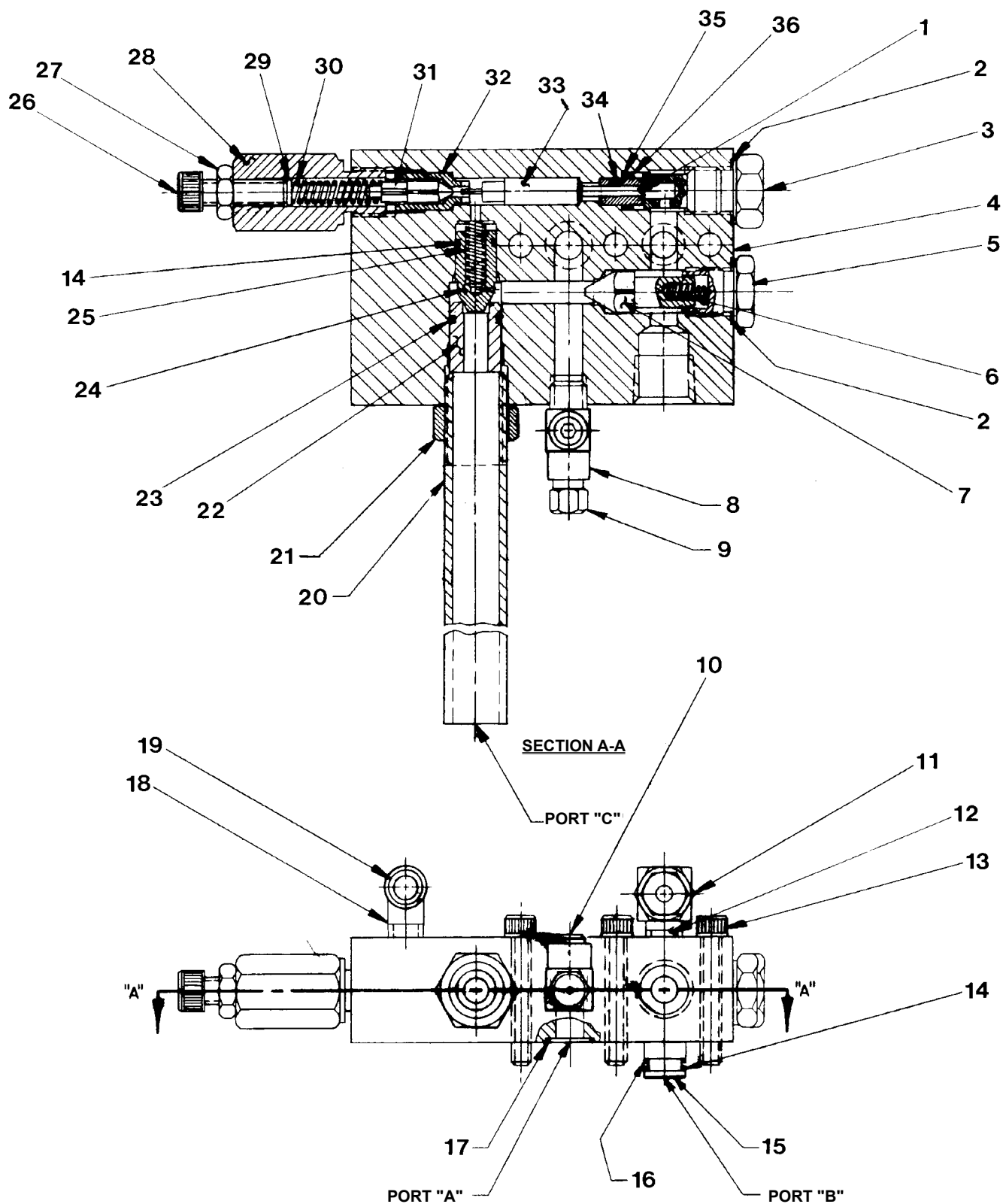
Parts List Continued

ITEM	PART NO	DESCRIPTION	QTY.
1	37384	PUMP HOUSING	1
2	51059	ANGLE PLATE	1
3	203476	BUSHING	1
4	17566	STEEL WASHER (FOR 1-3/4 BOLT)	1
5	11531	CAP SCREW (3/8-16 UNC X 2" LG.; CROSS TORQUE IN INCREMENTS OF 100 IN. LBS. TO 340/360 IN. LBS. NOTE: USED ON PUMPS BUILT BEFORE 2-21-97.)	8
	12866	CAP SCREW (3/8-16 UNC X 2-1/4" LG.; CROSS TORQUE IN INCREMENTS OF 100 IN. LBS. TO 460/480 IN. LBS. NOTE: USED ON PUMPS BUILT AFTER 2-21-97.)	8
6	204265	DRAIN TUBE	1
7	17505	NEEDLE BEARING	1
8	17504	RACE BEARING	1
9	17312	RETAINER RING	1
10	42732	VALVE HEAD (8 PISTON)	1
11	10249	SPRING LOCKWASHER	8
12	10083	CAP SCREW (1/2-13 UNCX1-1/2 LG.;TORQUE TO 80/100 IN. LBS.)	4
13	60415	PUMP END PLATE	1
14	351316	HYD. HOSE	1
15	17582	SWIVEL FITTING	1
16	21566	VALVE BODY	1
17	10009	CAP SCREW (1/4-20 UNC X 3/4 LG.)	4
18	10245	SPRING LOCKWASHER	4
19	42779	RESERVOIR GASKET	1
20	201817	VALVE CONNECTOR	1
21	11863	BACKUP WASHER	1
22	10268	O-RING (1/2 X 3/ X 1/16)	2
23	43110	VALVE MOUNTING BLOCK	1
24	200395	GASKET	1
25	10261	SOFT COPPER WASHER (3/4 X 19/32 X 1/32)	1
26	17567	SPRING PIN	4
27	10141	SET SCREW (5/16-18 UNC X 5/16 LG.)	4
28	42796	GASKET (MOUNTING BRACKET)	1
29	10032	CAP SCREW (5/16-18 UNC X 1" LG.)	4
30	10246	SPRING LOCKWASHER	4
31	42757	GASKET (ELECTRIC MOTOR)	1
32	51089	MOUNTING BRACKET	1
33	10009	CAP SCREW (1/4-20 UNC X 3/4 LG.)	20
34	37387	COUPLING	1
35	203485	NYLON PIN	2

Parts List Continued

ITEM	PART NO	DESCRIPTION	QTY.
36	204537	WOODRUFF KEY	3
37	37386	COUPLING	1
38	12194	OIL SEAL	1
39	10854	CAP SCREW (1/4-20UNC X 1-3/4 LG.; CROSS TORQUE TO 80/100 IN. LBS.)	6
40	51064	FRONT END PLATE	1
41	37376	PUMP SHAFT	1
42	42782	ECCENTRIC RING	1
43	17313	GEROTOR SET	1
44	17315	O-RING (2-7/8 X 2-3/4 X 1/16)	2
45	12178	RETAINER RING	2
46	15430	NEEDLE BEARING	2
47	17435	THRUST WASHER	1
48	37378	DRIVE COUPLING	1
49	10374	STEEL BALL (7/32 DIA.)	16
50	203477	BALL GUIDE	16
51	17319	COMPRESSION SPRING (1/8 O.D. X 1/2 LG.)	17
52	43313	PUMP BARREL	1
53	204578	PISTON (.399 DIA.; INSTALL PISTON WITH 6° ANGLE TOWARD ANGLE PLATE.)	8
54	14368	RETAINER RING	1
55	17316	RACE BEARING	2
56	17317	THRUST BEARING	1
57	17311	CONE BEARING	1
58	17318	RACE BEARING	1
59	203542	TIE ROD	4
60	10204	STEEL NUT (3/8-16 UNC)	4
61	10247	SPRING LOCKWASHER	4
62	42737	END CAP	1
63	10706	PIPE ELBOW	1
64	17491	FILTER	1
65	11931	O-RING (4" X 3-3/4 X 1/8)	3
66	20771	POPPET	1
67	10425	COMPRESSION SPRING	1
PARTS INCLUDED BUT NOT SHOWN (FOR PE4004S-LM)			
	252239	BULKHEAD FITTING	1
	252240	STRAIGHT FITTING	1
	12546	PLASTIC CAP	1
	14993	STRAIGHT FITTING	1
	10682	STRAIGHT FITTING	1
	12360	STRAIGHT FITTING	1
	212998	STRAIGHT FITTING	1

UNLOADING VALVE ASSEMBLY



Parts List Continued

ITEM	PART NO	DESCRIPTION	QTY.
1	12149	DOWEL PIN (1/8 DIA. X 3/4 LG.)	1
2	10261	COPPER WASHER (3/4 X 19/32 X 1/32)	2
3	37430	ADAPTER (TORQUE TO 35/40 FT. LBS.)	1
4	60414	VALVE BODY	1
5	205394	VALVE PLUG (TORQUE TO 35/40 FT. LBS.)	1
6	15141	COMPRESSION SPRING (3/16 O.D. X 5/8 LG.)	1
7	205393	POPPET	1
8	18969	TEE FITTING	1
9	306957	AIR BLEED VALVE	1
10	10427	PIPE PLUG (1/8 NPTF)	1
11	21278	RELIEF VALVE ASSEMBLY (SET AT 10,100/10,700 PSI)	1
	21278-105	RELIEF VALVE ASSEMBLY (SET AT 10,600/11,100 PSI; FOR PE4004S-BAR)	1
12	24702	TEE	1
13	10022	CAP SCREW (1/4-20 UNC X 1-1/2 LG.)	3
14	10268	O-RING (1/2 X 3/ X 1/16)	3
15	21094	BUSHING	1
16	11863	BACKUP WASHER	2
17	12098	O-RING (9/16 X 7/16 X 1/16)	1
18	13229	90° ELBOW	1
19	14463	DRAIN TUBE	1
20	203620	DRAIN TUBE	1
21	10396	JAM NUT (3/4-16 UNF)	1
22	203621	BUSHING	1
23	10301	O-RING (5/8 X 1/2 X 1/16)	1
24	37423	POPPET	1
25	11221	COMPRESSION SPRING (1/4 O.D. X 1" LG.)	1
26	11013	CAP SCREW (5/16-18 X 1" LG.)	1
27	10385	JAM NUT (5/16-18 UNC)	1
28	36545	FITTING (UNLOADING; TORQUE TO 25/30 FT. LBS.)	1
29	16528	SPACER	1
30	17413	COMPRESSION SPRING (5/16 O.D. X 1-1/2 LG.)	1
31	203541	POPPET	1
32	37427	GUIDE	1
33	203540	PLUNGER ASSEMBLY	1
34	17414	BUSHING	1
35	15085	BACKUP WASHER (7/16 X 5/16 X 3/64 THK.)	1
36	10267	O-RING (7/16 X 5/16 X 1/16)	1

POWER TEAM FACILITIES AND CONTACT

Rockford, Illinois USA

Customer Service/Order Entry

Tel: +1 800 541 1418

Fax: +1 800 288 7031

European Headquarters

Tel: +31 45 567 8877

Fax: +31 45 567 8878

Asia Pacific Headquarters

Tel: +65 6265 3343

Fax: +65 6265 6646

Technical Services

Tel: + 1 800 477 8326

Shanghai, China

Tel: +86 21 2208 5888

Fax: +86 21 2208 5682