Model 30400 EHPU
Tubing Tong Electric Hydraulic Power Unit
Installation, Operation, Service and Parts Book Manual

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Terms and Conditions

1. All WPI WELLKIN packing slips and invoices must show Buyer's purchase order number.

2. All shipments MUST contain packing slips.

3. CONTRACT: This order will become a binding contract upon receipt by WPI WELLKIN of Buyer's PO, receipt by Buyer of a written acknowledgement by WPI WELLKIN and receipt by WPI WELLKIN of a down payment in the amount specified in the contract.

4. This contract may be modified as mutually agreed by the Buyer and WPI WELLKIN.

5. PAYMENT TERMS: The payment terms are specified on the commercial offer from WPI WELLKIN. The Buyer agrees to the payment terms by acceptance of the bid.

6. DELIVERY: Time is of the essence. WPI WELLKIN will attempt to deliver the material early if possible. WPI WELLKIN will make best efforts to supply all material on a timely basis. If the delivery will run over the contract delivery date, WPI WELLKIN will notify the Buyer giving reason for delay. The current delivery estimate is specified on the commercial offer. The Buyer agrees to the delivery terms by acceptance of the bid.

When necessary, WPI WELLKIN will notify the Buyer in advance of completion of the order and Buyer will appoint an authorized representative or employee to inspect the material on a date and site as designated by WPI WELLKIN. Transportation, lodging and all other expenses portal to portal for Buyer representative or employee to witness and accept the material is the expense of the Buyer.

All costs associated with preparation, crating, insurance and ocean freight of the goods to the final destination to be at Buyer's expense.

7. CANCELLATION: This contract is considered to be special order and not subject to cancellation. Both parties hereto shall be given consideration in case of delays in delivery caused by fire, strike, riot, war, act of God, delay of carriers, governmental order or regulation, complete or partial shutdown of plant by reason of inability to obtain sufficient raw materials or power or any other similar or different contingency beyond the reasonable control of the respective parties.

8. WARRANTIES AND REMEDIES: WPI WELLKIN expressly warrants that all supplies, materials and parts covered by this contract will conform to the specifications in the contract as applicable and will meet or exceed industry standards for such equipment. WPI WELLKIN will supply Buyer with operations manuals and parts books for the material where applicable. Certificates of Compliance are available upon request.

MANUFACTURED ITEMS: WPI WELLKIN manufactured items must be free of material and workmanship defects for a period of 12 months from the date of delivery. If any items fail because of a manufacturing defect within that period of time, then that item will be replaced by WPI WELLKIN. Expendable / wear items are not covered under warranty. Examples of such items include, but are not limited to, the following - dies, inserts, brake bands, rollers, gears, chains, filters, belts, flexible couplings, slip bodies, spider bowls.
Replacement of parts will be accomplished at WPI WELLKIN's facility or at a designated service point. WPI WELLKIN's liability is limited to replacement of defective parts only and does not include the cost of labor, communications, transportation or handling connected to the

replacement of these parts. WPI WELLKIN will in no event be liable for consequential damages or contingent liabilities arising out of the failure of any parts to operate properly. No expressed, implied or statutory guarantee other than herein set forth is made or authorized to be made by WPI WELLKIN.

DISTRIBUTED ITEMS: Items distributed by WPI WELLKIN are subject to the warranty provided by the Original Equipment Manufacturer (OEM). Upon request, WPI WELLKIN will furnish Buyer with a warranty statement from the OEM for the applicable material. The OEM warranty will start on the items' delivery date.

9. COMMISSIONING: On request, WPI WELLKIN can supply a representative for material commissioning. The Buyer is responsible for portal to portal transportation costs and the current WPI WELLKIN day rate.

10. BUYER'S PROPERTY: All equipment or material furnished by WPI WELLKIN shall be the property of the Buyer after the WPI WELLKIN invoice is paid in full.

11. PATENTS: WPI WELLKIN holds the Buyer harmless from all claims, for infringement or alleged infringement of any patents arising out of the sale or use of the goods furnished pursuant to this contract.

12. INDEPENDENT CONTRACT: In the event that any goods ordered hereunder require in connection with the installation thereof, the services of a contractor engaged by WPI WELLKIN or a supervisor, engineer, or other employee connected with or employed by WPI WELLKIN, and WPI WELLKIN agrees to furnish same, either with or without charge, such contractor, supervisor, engineer, or other employee in performing such services shall not be deemed to be the agent or employee of the Buyer.

13. INSURANCE: WPI WELLKIN agrees to carry General Operations and Liability Insurance and other coverage as required in accordance with applicable state and federal laws of the U.S.A.

14. COMPLIANCE WITH LAWS: WPI WELLKIN warrants that in its performance of this contract it will comply with all applicable Federal, State and Local laws, regulations, rulings and orders of the U.S.A.

15. ASSIGNMENT: This contract may not be assigned without the written consent of the Buyer and any attempted assignment thereof shall be void.

16. PROPRIETARY INFORMATION: All plans, drawings, specification and the subject matter contained therein and all other information given to WPI WELLKIN in connection with performance on this Purchase Order involve valuable property rights of the Buyer and shall be held confidential by WPI WELLKIN, shall remain the property of the Buyer and shall not be used by WPI WELLKIN for any purpose other than those for which they have been prepared or supplied. WPI WELLKIN agrees that, as far as possible, it will keep confidential the making of this order and the terms hereof. WPI WELLKIN agrees not to use for publicity purposes any information as to notice of receipt of order, photographs, drawings and/or materials in connection with performance of the Order without obtaining the prior written consent of the Buyer.

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Warnings

The Electric Hydraulic Power Unit (EHPU) design integrates several safety features. However, the power unit is only as safe as the operator using it. Therefore, it is imperative that the operator and all other workers around the power unit observe the warnings below as well as read and understand this manual. Failure to follow the instructions could result in **death, serious injury or equipment damage.** The manufacturer is not responsible for any damages resulting from misuse of the equipment. The risks and consequences of misuse are the responsibility of the user.

- Observe, understand and follow all safety warnings.
- This power unit is built strictly for generating hydraulic power for tubing tongs. Any use of the power unit contrary to the design is absolutely prohibited.
- Never operate the power unit above the rated design pressure.
- Always check the pressure setting of the power unit before operating to prevent equipment damage.
- Never add, remove or convert equipment on the power unit without the prior consent of WPI.
- Never defeat or remove any of the power unit's integral safety features.
- If a leak is observed, then halt the operation of the power unit and repair the leak immediately.
- Use the recommended size of interconnect hose with the proper pressure rating.
- Keep all body parts and clothing away from moving machinery.
- Only trained personnel should operate, adjust or repair this equipment. No weld repair on any components is allowed. Any attempts to repair these items by welding will void all WPI warranties and liability.
- The electrical voltage and amperage utilized to power the unit can be lethal. Take appropriate precautions.
- Prior to servicing the unit (maintenance, repairs, valve adjustment, etc.), shut down and disconnect or kill power to the unit. **(The service disconnect on the starter box only kills power to the downstream components, i.e. motor, switches, etc.**

The incoming power is still live. Before opening the enclosure, ensure that the incoming power has been disconnected from the power source. Lock out and tag the power per company standard protocol.) Then, disconnect the hydraulic connections from the power unit before performing any of the following. Allow the components to cool down before working around it to make repairs.

- All personnel working around the power unit shall wear protective clothing including but not limited to the following.
  - Hard hat
  - Eye protection
  - Safety boots with steel toe
  - Safety gloves
  - Ear protection
  - Coverall

- Never use excessive force when coupling the wingstyle quick disconnects to the system.

- Never disconnect any hose on the power unit when it is in operation. All hoses must be pressure free before they are disconnected.

- Use only the identified areas on the power unit for lifting the unit. Ensure that any lifting equipment is rated for the power unit weight and that all equipment used in lifts is current with its inspection paper work.

General Information

Description

The model 30400 EHPU is an open frame type power unit designed to provide hydraulic power to a tubing tong or other open-centered circuits. The unit is self contained with exception of the incoming power.

The EHPU is powered by a 30 HP, 3 phase, 60 Hz TEFC electric motor with 120 VAC space heater (Note: The motor is dual rated for 25 HP, 3 phase, 50 Hz). Attached to the motor is a two section gear pump with an integral high/low circuit. Both sections of the pump deliver fluid to the circuit in a high flow/low pressure application. At a set pressure, the rear section of the pump is removed from the fluid circuit providing a low flow/high pressure mode. Also included within the unit are the following items.

- NEMA 4 starter box for electric motor, start and stop buttons, service disconnect, motor reset button, power on lamp, running lamp, low oil level lamp
- 0 to 3000 PSI pressure gauge
- System relief valve
- 75 gallon hydraulic reservoir with baffle, level gauge, oil temperature gauge, cleanout cover, suction strainer with isolation ball valve, return filter, return pressure gauge, drain port with ball valve and filler/breather
- Air/oil heat exchanger, electric motor driven
- Temperature switch to control heat exchanger motor
- Low oil level switch for reservoir
- Oilfield base skid with drip pan, drain ports, fork lift pockets and drag bar
- Lift cage with hose basket
- Pressure and return quick disconnect bulkhead

Specifications

Fluid Power

High pressure/low flow	@60 Hz	2500 PSI @ 12 GPM (172 bar @ 45 LPM)
	@50 Hz	2500 PSI @ 10 GPM (172 bar @ 37 LPM)
Low pressure/high flow	@60 Hz	1200 PSI @ 25 GPM (82 bar @ 94 LPM)
	@50 Hz	1200 PSI @ 20 GPM (82 bar @ 75 LPM)

Weight

Dry (without hydraulic fluid)	2300 lbs (1043 Kg)
Wet (with hydraulic fluid)	2900 lbs (1315 Kg)

Connections (5100 series wing style disconnect)

Pressure	1" male nipple
Return	1" female coupler

Dimensions

Length	92" (2336.8 mm)
Width	48" (1219.2 mm)
Height	60" (1524.0 mm)

Transportation and Installation

Before any attempt is made to operate the power unit, the following section should be read, understood and then followed.

Transportation

The power unit has several options for transportation as demonstrated in the picture below. No special regulations apply to the transportation of the power unit.

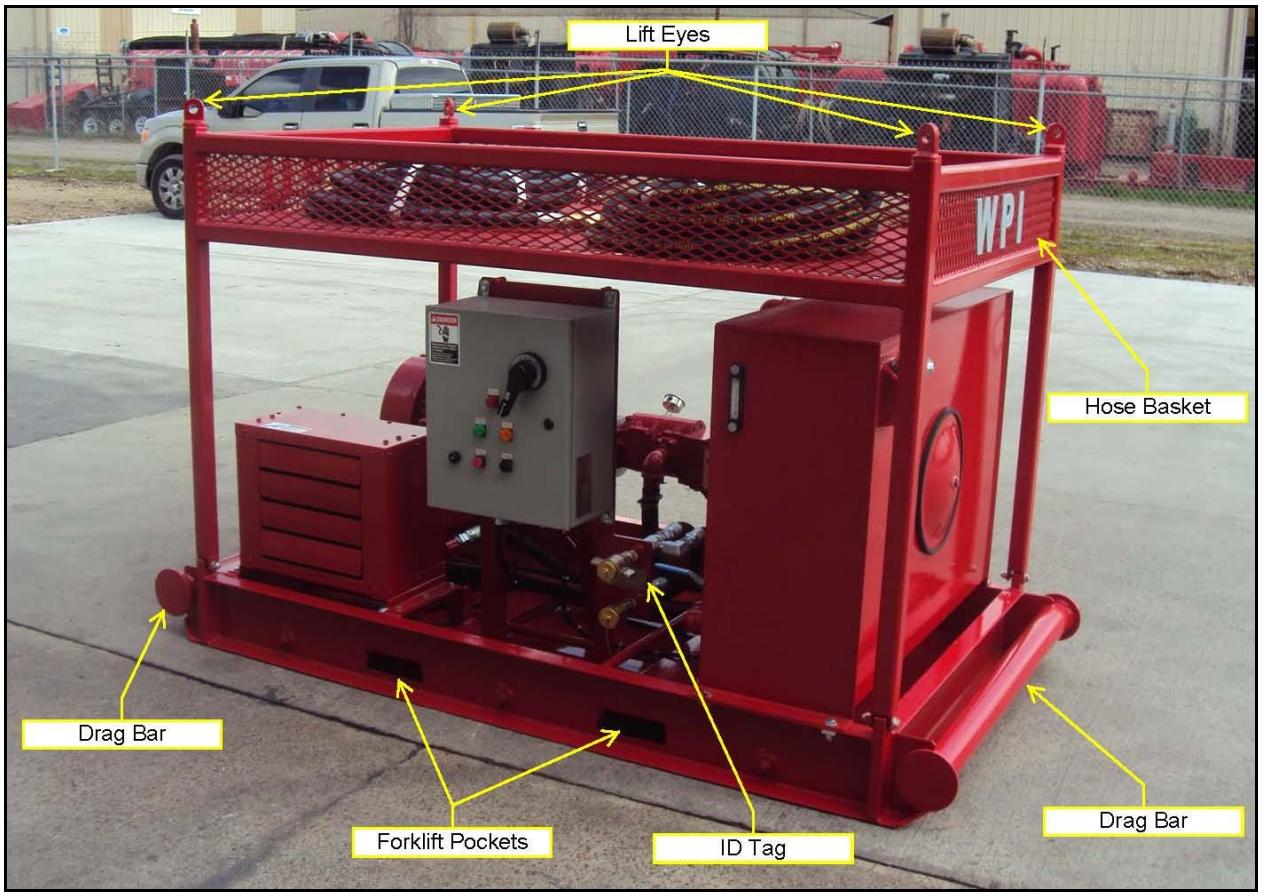

Figure 1: Transportation Points

Lift Eyes

The power unit is designed to be lifted by the four lift eyes on top of the hose basket. When lifted, a sling with four legs is required, and the sling must, at a minimum, be rated for the gross weight of the power unit. The lifting equipment should also be inspected to ensure it is in adequate condition. Normal rules and safety precautions apply when lifting the unit.

Drag Bars

Drag bars are located on each end of the power unit for conventional dragging of the unit on and off of a flat bed truck.

Forklift Pockets

Incorporated into the base skid are two fork lift pockets. Ensure the forklift used to lift the unit has long enough forks to span the entire width of the pocket and is rated to lift the unit.

Hose Basket

The hose basket provides a storage area for the hydraulic hoses as well as spare components for the power unit or tong.

ID Tag

Each unit has an identification tag installed on the skid. Use the ID tag information (weight, model, serial number, etc.) for transportation documentation.

Installation

Once the power unit is on location, then the installation process gets the unit ready for operation.

Location of the Unit

Remember the following points when positioning the power unit for installation.

- The physical space required for the unit is detailed in the general specifications page. Consideration should also be given for access around the power unit for startup procedures and maintenance activities.
- The power unit should be located on an area that is relatively flat. Installing the unit on an incline could adversely affect the hydraulic fluid level.
- The power unit requires an adequate power source to provide the required amperage and voltage. Locate the power unit as close as possible to the power source to prevent voltage line loss.
- Also, take into account the location of the power unit to keep it as close as possible to the hydraulic tong in order to reduce pressure losses in the line. Pressure losses from long hose lengths can reduce the system performance and generate significant heat.
- All electrical work should be performed by a licensed electrician.
- Ensure the intake air path to the electric motor fan is unobstructed.
- The unit will require hydraulic fluid to be added prior to operation or removed during maintenance. Take precautions when adding new fluids to avoid spills and dispose of used fluids according to the applicable local environmental laws.
- This unit is not rated for operation in areas where flammable gases are present. Ensure the power unit is placed outside zones where these gases exist.

Hydraulic System Inspection

The following steps review the hydraulic system to ensure it is ready for operation.

- Check the fluid level of the hydraulic tank. For operation, the fluid level should be seen in the level gauge as detailed in the following photo. If the level is low, then add hydraulic fluid through the filler/breather until the level reaches the top of the level gauge. When the filler/breather cap is removed, take care to avoid the passage of contaminants into the hydraulic reservoir. The use of a premium hydraulic fluid such as Shell Tellus® 32 for average ambient operating temperatures below 45°F (7°C), Shell Tellus® 46 for 45° to 85°F (7° to 30°C) operation and Shell Tellus® 68 for operation above 85°F (30°C) is recommended.
- The level gauge has a built in thermometer that displays the temperature of the oil in the reservoir. The power unit should not be operated when the oil temperature is above 160°F (71°C).

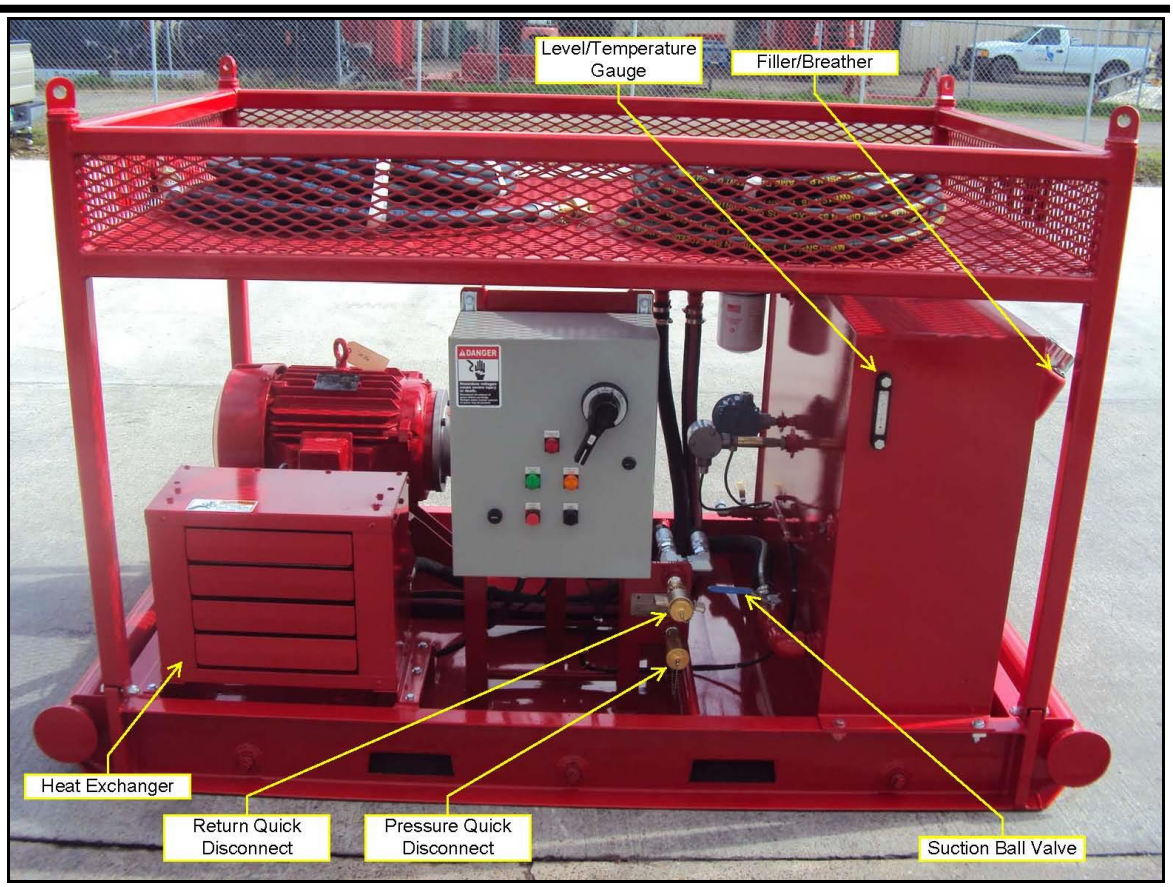

Figure 2: Tank Level Gauge, Fill Location and External Connections

- Ensure the suction line ball valve is in the open position. Starting the unit with the ball valve closed will cause serious damage to the hydraulic pump. The ball valve is mounted on the suction port of the reservoir.
- Verify the interconnect hoses or piping is adequate for the maximum flow generated from the power unit. Undersized lines will lead to a buildup of heat and a decrease in system performance. A hose set can be purchased separately with connectors matching the power unit installed.
- For quick installation and to reduce spills on connection, the power unit is equipped with quick disconnects. Never connect or disconnect the lines when the power unit is running. Before connecting the quick disconnects to the unit, ensure that the faces of the connectors are free from debris. Remove any particles with a lint free rag. Dust plugs and caps are included with the connectors to prevent contamination during transportation and storage. Connect the pressure and return lines using the quick disconnects. The connectors are threaded with a wing style construction. Full thread engagement must be met before the integral check valve in the connector is forced to open. The previous photo shows the location of the pressure and return quick disconnects.
- Open the louvers on the heat exchanger prior to operation. They are closed for transport to protect the heat exchanger core. The picture above shows the louvers in the closed position.

Electrical System Inspection

Examine the following areas.

- The system is dual rated for 460/380 VAC and 60/50 Hz. The system shipped configured for 480 VAC at 60 HZ. For a 380 VAC at 50 Hz setup, move the transformer lead from H4 to H3. Refer to the electrical schematic for more information.
- After the power source is connected up and the system is properly configured, the motor direction needs to be checked. Bump start (start and then stop quickly) the unit while someone is watching the electric fan motor. The correct motor rotation is clockwise as viewed from the fan end. Disconnect the power and reverse one of the legs of the incoming power if the motor is turning counter-clockwise. Then, check the rotation again. Following is a picture of the motor rotation sticker.

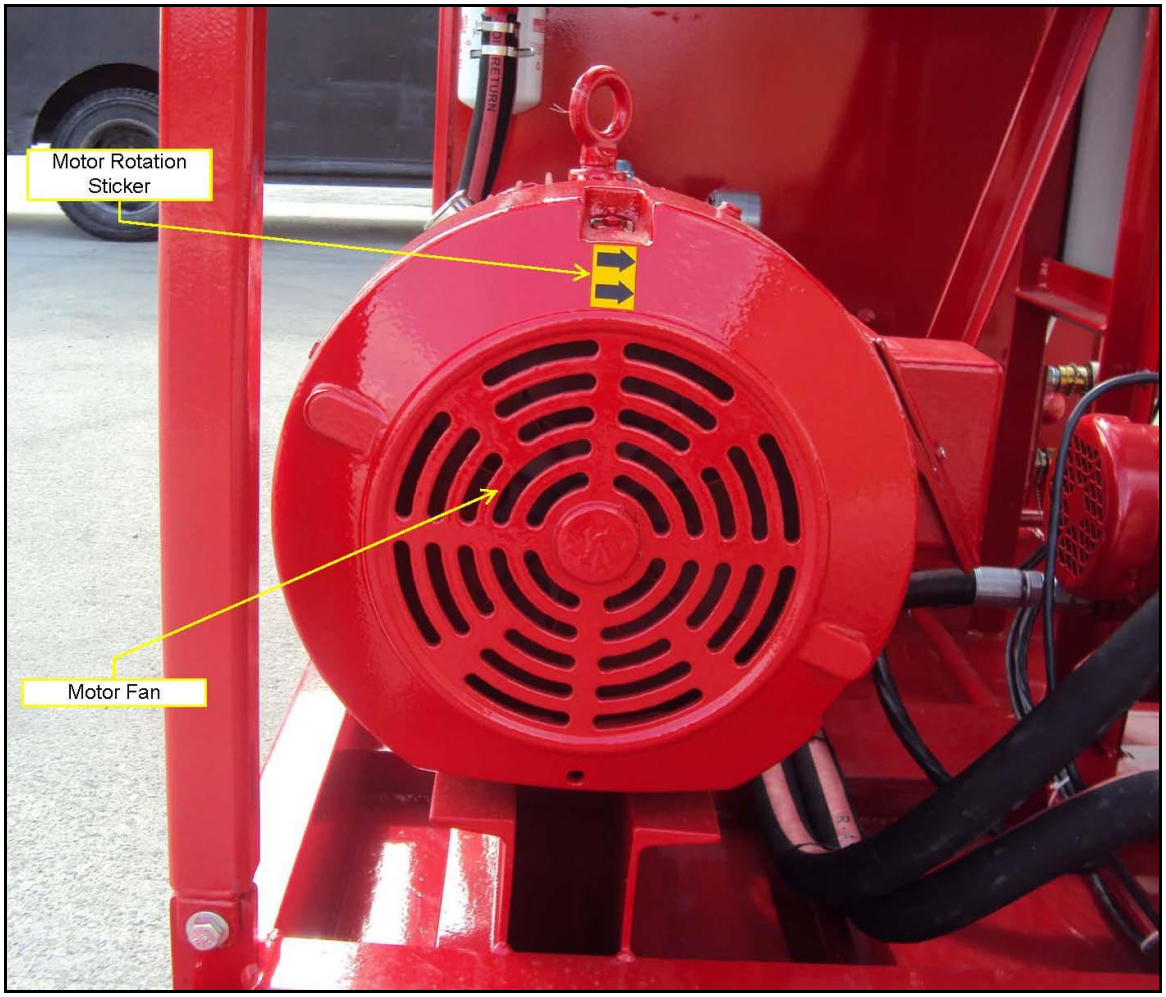

Figure 3: Motor Rotation

Operation

The EHPU is a simple unit that provides pressure and flow for an open center hydraulic circuit such as a tong. This unit is not intended to work in conjunction with closed center valves. Closed center valves have the pressure port blocked in the neutral position. Heat builds up in the system quickly as the full flow of the system is dumped over the system relief since the flow cannot return to tank through the valve.

The prime mover for the hydraulic pump is the electric motor. The motor rotates the pump shaft at a fixed speed (1800 RPM for 60 Hz, 1500 RPM for 50 Hz), and the torque output is dictated by the load on the pump. This model has a two section fixed displacement gear pump coupled to the motor, which provides hydraulic power to the open center circuit.

The following sequences assume the necessary installation steps have been completed, and the unit is ready for start up.

Modes

The EHPU has a high flow/low pressure and low flow/high pressure mode of operation. Switching between these two modes is automatically done by the pump's control circuit.

In the high flow/low pressure application, both sections of the pump deliver fluid to the circuit until a set pressure. After this pressure, the rear section of the pump is shifted out of the circuit and circulates fluid internally. Therefore, less flow leaves the pump, but the maximum pressure that can be achieved is higher.

Start Up

Ensure that the installation section has been followed and that the tong control valve handle is in neutral. The motor starter box can be seen in the picture at right. First, turn the power disconnect handle from the off to the on position. The power on lamp should illuminate to let the operator know power is applied to the power unit. To start the power unit, press the start button. The run light will light up when the motor is running. The power unit is stopped by pressing the stop button. If the motor overload is tripped, then use the motor reset button to reset the switch. If the low oil lamp is lit, then oil must be added to the reservoir before the unit can start.

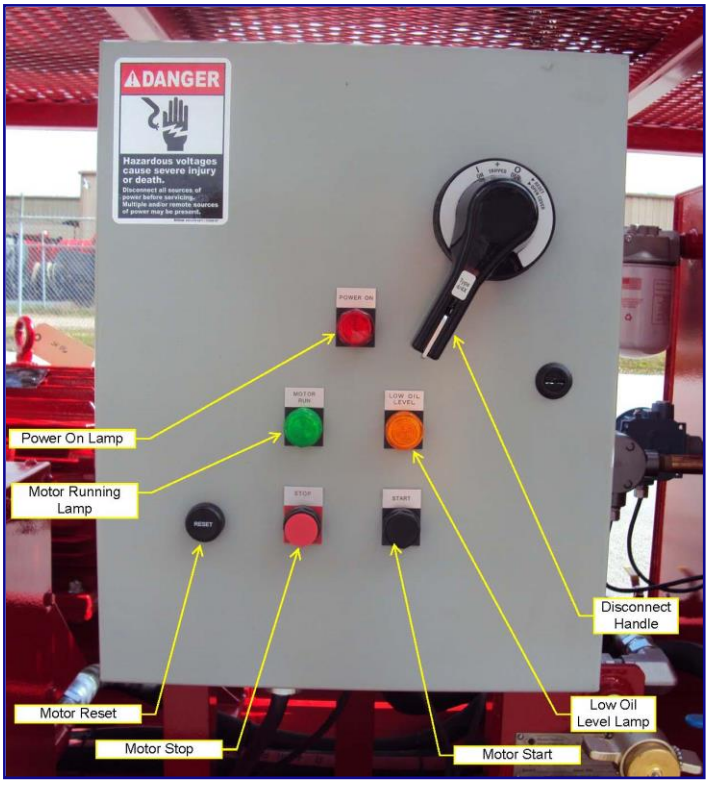

Figure 4: Starter Box

Observe the oil pressure gauges. The system pressure gauge will show a low value when the hydraulic oil is circulating directly back to tank. Pressure readings will only occur when the tong is operated. Check the pressure gauge on the return filter assembly at start up. As the filter collects more debris, the pressure drop across the filter increases. If the indicator on the pressure gauge is in the red area, then the return filter element needs replacement.

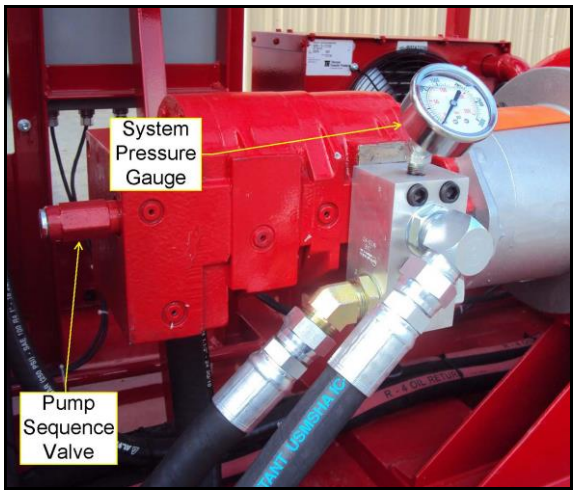

Figure 5: System Pressure Gauge

Figure 6: Return Filter Pressure Gauge

Safety Features

The power unit is equipped with several safety features, which are explored in more detail in the following sections.

Circuit Breaker

The circuit breaker is located inside the motor enclosure. It protects the power unit from seeing too much current or amperage. If the circuit breaker trips, then the power disconnect handle will move to the tripped position. To reset, move the handle to the off position before turning the handle back to the on position.

Motor Overload

The motor overload is also located inside the motor enclosure. The overload prevents the motor from seeing a continuous high current, a loss of one of the phase legs and an underbalanced phase leg. If the overload trips, then wait five minutes to allow the overload to cool. Then, reset it using the motor reset button.

Low Oil Level Shutdown

The power unit is equipped with a low level switch mounted to the reservoir. If the fluid level drops below the switch, then the power unit is automatically shut down. Fluid must be added to the tank prior to restart, and inspection is needed to determine the cause of the fluid loss. This switch is a mechanical device and can be seen in the following picture.

System Relief Valve

The system hydraulic pressure relief valve (RV-1 on the hydraulic schematic) is shown in the photo following. This valve limits the maximum pressure from the power unit hydraulic pump. It is factory set to relieve at 2500 PSI (172 bar). To adjust the valve setting, loosen the jam nut at the bottom of the valve stem. Turn the knob clockwise to increase the

pressure setting and counter clockwise to reduce the setting. Lock the jam nut back down after adjusting the valve setting. To develop pressure in the circuit, either the tong needs to grip and stall on a tool joint or the pressure line can be removed at the power unit disconnect (while the unit is off).

WARNING: DO NOT SET THE RELIEF VALVE HIGHER THAN THE POWER UNIT DESIGN PRESSURE OR THE ALLOWABLE PRESSURE TO THE COMPONENTS.

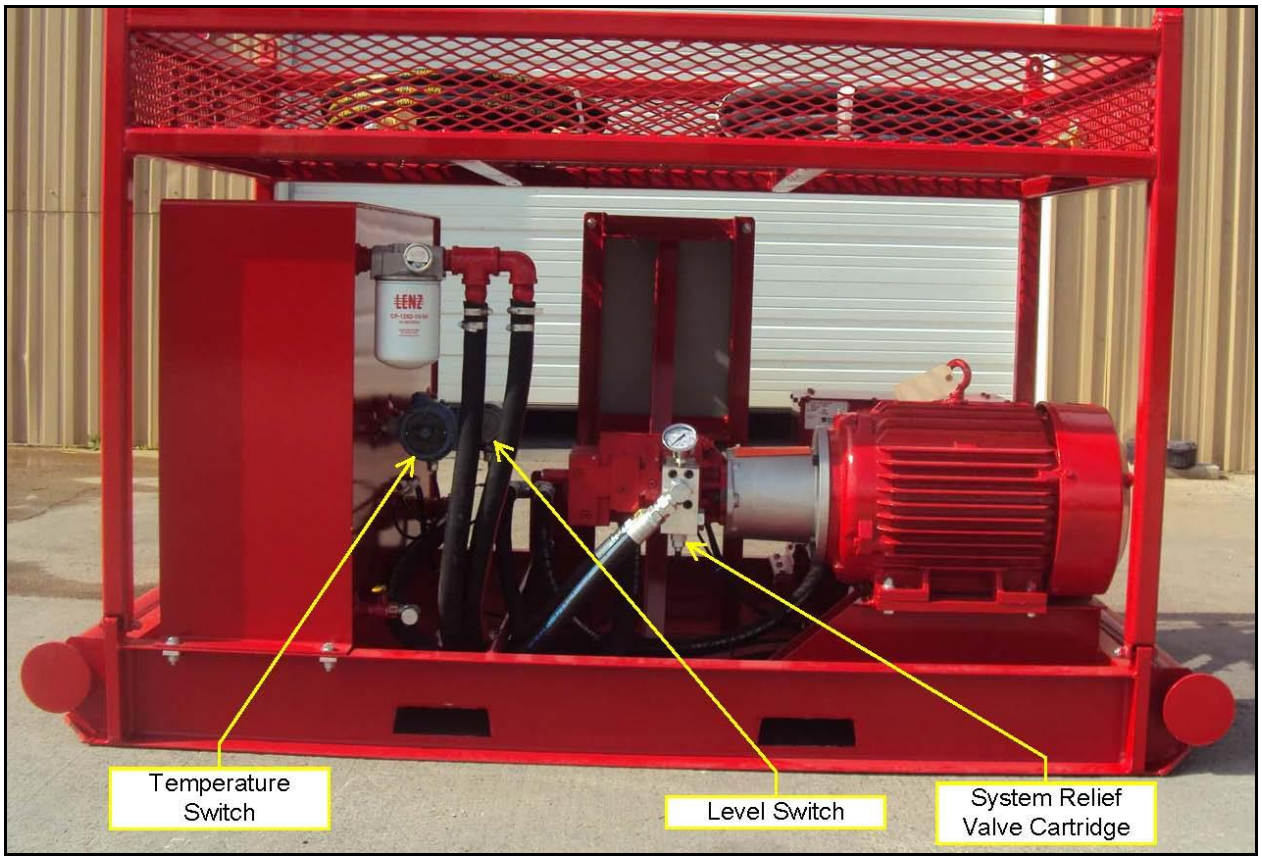

Figure 7: Switches and System Relief Valve

Components

The following sections will explain the major components in the hydraulic system to help the user familiarize themselves with the operation of the power unit. Examine the hydraulic schematic in conjunction with the text below. The assembly drawings will also help identify the physical locations of the components.

Hydraulic Pump

In the schematic, the hydraulic pump is referenced by HP-1. The pump is a fixed displacement gear pump with two sections, which is connected to the motor (EM-1) using a pump adapter (PA-1) and pump coupling (PC-1, PC-2 and PC-3).

The pump has an integral high/low circuit as previously discussed. The valve is factory set at 1200 PSI (82 bar) and should not be adjusted in the field. However, the following procedure can be used to set a replacement cartridge in the field.

WARNING: DO NOT ATTEMPT TO ADJUST THE PUMP SEQUENCE VALVE WHILE THE UNIT IS RUNNING.

WARNING: DO NOT INCREASE THE SEQUENCE VALVE SETTING PAST 1200 PSI.

The sequence valve can be seen in Figure 5. With the unit off, remove the plug from the end of the cartridge with an Allen wrench while holding back up on the hexagon stem. Hydraulic fluid will leak out of the cartridge when the plug is removed. Insert the correct size allen wrench into the center of the hexagon stem. To increase the shift pressure, turn the wrench clockwise. Turning the wrench counter-clockwise will decrease the setting. Upon completion, insert the plug back into the cartridge stem. Ensure the plug's o-ring is intact and correctly positioned.

To check the valve setting, block the pressure port by disconnecting the pressure line at the disconnect. Loosen the jam nut on the system pressure relief valve (RV-1). Lower RV-1's pressure setting by turning the set screw counter-clockwise. Next, start the power unit. Increase the system pressure by turning the RV-1 set screw clockwise. Around 1200 PSI, the pump should shift from high flow to low flow. If it does not shift at 1200 PSI, then turn off the power unit and repeat the adjustment on the HP-1 sequence valve. Continue this trial and error method until the correct setting is achieved. The maximum valve setting is determined by the maximum power the motor can deliver. Increasing the valve setting would increase the required torque from the motor at a higher flow (more power); raising it too high would cause the motor to draw too much current.

Relief Valve

A relief valve (RV-1) is directly bolted onto the pump's output. This valve limits the maximum pressure on the circuit as mentioned in the system's safety feature section.

Heat Exchanger and Temperature Switch

The unit incorporates an air over oil heat exchanger (HX-1) driven by an electric motor. When the fluid temperature exceeds 110° F (43° C) in the reservoir, the temperature switch (TS-1) activates the heat exchanger motor. The fan will turn until the temperature decreases below the set point.

Level Switch

Installed in the reservoir side wall is a level switch (LS-1). As discussed, this switch will stop the power unit when the reservoir fluid level drops too low.

Suction Strainer

The suction strainer (STR-1) is mounted inside the reservoir. The strainer filters the hydraulic fluid going to the pump inlet.

Return Filter

Before fluid reenters the reservoir, it passes through the return filter (FL-1).

Shutdown

The proper way to stop the motor is to push the stop button on the enclosure. Ensure the following prior to shutdown.

- Verify that all operations that the power unit is driving are complete. Do not shutdown the unit while equipment is working.

- Try to avoid stopping the motor when it is running at full load.

Storage

Follow the steps below when removing the power unit from operation.

- Stop the motor.
  Note: Ensure that the tong control handle is in neutral when the power unit is stopped so there is not any pressure built up and trapped in the hydraulic lines.
- Disconnect the pressure and return lines from the hydraulic unit and from the tong. Install the dust plugs and caps onto the exposed quick disconnects. Coil the hydraulic lines and place them into the storage basket on the lift frame.
- Move the power unit to its storage location. This location should be clean, dry and protected from temperature fluctuations.
- Clean and remove all debris from the power unit. Afterwards, inspect the unit for any damage. Address all problems identified.
- Perform any required routine maintenance on the power unit.
- If the motor is stored long term, then turn the motor shaft once a month by hand.

Before the power unit is returned to operation, check the following.

- Measure the insulation resistance of the stator winding. Refer to the electrical section appendix for further instruction.
- Check that the motor is properly lubricated. Procedures are found in the electrical section appendix.
- Verify the motor is dry, and allow the motor heater sufficient time to remove any condensation prior to start up.
- Only repair the motor at licensed repair shops.

Troubleshooting

The following table addresses possible solutions to problems that may occur during operation. When a problem occurs, take note of the problem as well as the operation being performed when the malfunction happened. Also, note if there has been any recent maintenance or adjustments to the power unit. All these items will be helpful in diagnosing the problem. Use the problem information to search the following tables of symptoms and troubleshoot the hydraulic power unit. Always follows safety guidelines while troubleshooting the unit.

Table 1: Troubleshooting the Power Unit Motor

Problem	Solution
Motor will not start	1) Verify the power on light is lit. If not, then try turning on power at the circuit breaker. 2) Ensure the motor overload relay is not tripped. If it is, then wait approximately 5 minutes for cooling time. Push the motor reset button and then start. The relay will keep tripping repeatedly if there is an excessive load on the motor. This load is caused by a high relief pressure, defective electric motor or hydraulic pump. It might be necessary to replace the hydraulic elements. 3) See if the circuit fuse is blown and replace. If the fuse continues to blow, then see if the motor is short circuiting

	across the stator. If so, then the motor needs replacement. 4) Check the control wiring for the start stop circuit and tighten any loose connections. Ensure the buttons are operable and replace if they are not. 5) Inspect the starter relay and coil and replace if damaged. 6) Verify the correct power is applied to the unit. 7) If a humming noise is observed, then there might be an open circuit in the winding or control switch. Make sure there are no loose wires and the control contacts close. 8) Attempt to turn the motor shaft by hand. Ensure it turns freely. If it does not, then the motor could have failed mechanically.
Motor stalls	1) Inspect the incoming power lines for an open phase. 2) The motor could be overloaded, which could be due to a high relief setting or mechanical issue with the pump. Adjust or replace as necessary. 3) Verify the proper voltage is applied to the unit and it is not low. 4) Look for an open electrical circuit by checking the fuses, overload relay, stator and push buttons.
Motor runs and then abruptly stops or slows or stops	1) Investigate if a power failure occurred. Check the circuit for loose connections.
Motor speed does not ramp up	1) Verify the proper voltage is applied to the unit and it is not too low. 2) Ensure the motor is not overloaded. Attempt to the start the unit with the hoses connected to the tool allowing oil to circulate at low pressure. Decrease the relief valve setting.
Motor spins the wrong direction	1) The incoming power leads are in the wrong phase/sequence. Reverse connections at the breaker.
Motor runs too hot/noisy operation	1) The motor is overloaded. Adjust the hydraulic pressure relief valve setting lower. 2) The fan is obstructed. Try cleaning out the fan cover to provide proper ventilation. 3) Inspect the electrical connections, and make sure the motor is not single phasing. 4) Look at the terminal voltage to verify it is balanced. Check for loose leads or bad connections. 5) See if the fan blade is hitting its cover. 6) Ensure the pump and motor shafts are aligned. 7) Inspect the grease in the motor. Lubricate as required. Replace the lubricant if it has deteriorated by removing the old grease, washing and repacking the bearings. 8) Remove excess grease. The bearings should not be more than 50% filled. Run the motor at no load with the

	grease plugs removed to expel the excess grease. Replace the plugs. 9) Examine the motor shaft to ensure there is not a side load or end thrust applied to the motor bearings.
Motor vibrates excessively	1) Verify the motor mount bolts are tight. 2) Ensure the pump coupling is installed correctly and balanced. 3) Inspect the electrical connections, and make sure the motor is not single phasing.

Table 2: Troubleshooting the Power Unit Hydraulic Circuit

Problem	Solution
Power unit performance is poor	1) Inspect the hydraulic system for an excessive pressure drop, which could be caused by any of the following. a) Verify the quick disconnects are completely tightened and engaged. b) Inspect the return filter pressure gauge. Replace the filter element if required. c) Ensure the interconnect hoses are adequate for the power unit flow (1" for pressure, 1" for return). 2) Examine the pump suction line. Verify it is not clogged and the suction ball valve is fully opened. 3) Verify the correct viscosity of fluid is utilized for the operating temperature. Change fluids if necessary. 4) Check the hydraulic fluid temperature. If too hot, then allow the unit to cool. Inspect the heat exchanger fins, and clean if clogged with debris. Verify the fan motor is spinning. Make sure the oil viscosity is not too low. 5) Check the relief valve setting to make sure fluid is not dumping across back to tank. 6) The pump could be damaged or worn. Inspect the internal parts. 7) The motor speed is too low (reference the electrical troubleshooting section for more information).
Hydraulic pump operation is excessively noisy	1) Verify the correct viscosity of hydraulic fluid is being utilized for the operating temperature. Change fluids if necessary. 2) Ensure that air is not entering the suction lines of the pump. Check for leaks in the line. 3) Inspect the fluid level of the hydraulic reservoir. If the level is below the sight glass, then add hydraulic fluid. 4) Excessive noise, vibration and heat would be generated from the pump if the bearings are worn or damaged. Rebuild or replace the pump. Ensure the oil is clean and free from abrasive contaminants. 5) Adjust the relief valve setting lower if it is set too high. 6) Verify the motor/pump coupling is aligned and that the clamp and set screw are tight.

	7) Ensure the motor is turning the correct direction.
Reservoir level gauge or pressure gauge is showing contamination	1) If the ambient temperature is low, then warm up the power unit to raise the hydraulic fluid temperature and lower the viscosity. 2) Inspect the return filter element. Replace if it is contaminated. 3) Take a sample from the tank drain port. If contaminated, then replace the hydraulic fluid in the tank after cleaning the tank's interior.
Hydraulic fluid temperature is too high	1) Verify the correct viscosity of hydraulic fluid is being utilized for the operating temperature. Change fluids if necessary. 2) Inspect the heat exchanger fins, and clean if clogged with debris. Verify the fan motor is spinning. 3) Inspect the fluid level of the hydraulic reservoir. If the level is below the sight glass, then add hydraulic fluid. 4) Inspect the hydraulic system for an excessive pressure drop, which could be caused by any of the following. a) Verify the quick disconnects are completely tightened and engaged. b) Inspect the return filter pressure gauge. Replace the filter element if required. c) Ensure the hoses are adequate for the power unit flow (1" for pressure, 1" for return). 5) Ensure the power unit is connected to an open center valve not a closed center valve. 6) Check the relief valve setting to make sure fluid is not dumping across back to tank. 7) The pump could be damaged or worn. Inspect the internal parts.
Tong torque is low	1) Verify the setting of the pressure relief valve (RV-1) is not set too low. Adjust to the desired pressure. Increase the valve setting while applying torque to the joint. 2) Inspect the pressure gauge for correct operation. Check the tong torque output against a tension type tong torque gauge if available. 3) If the hydraulic pump is damaged, then rebuild or replace the pump.
Tong rotates slowly	1) Inspect the hydraulic system for an excessive pressure drop, which could be caused by any of the following. a) Verify the quick disconnects are completely tightened and engaged. b) Inspect the return filter pressure gauge. Replace the filter element if required. c) Ensure the interconnect hoses are adequate for the power unit flow (1" for pressure, 1" for return). 2) Examine the pump suction line. Verify it is not clogged and the suction ball valve is fully opened.

	3) Verify the correct viscosity of fluid is utilized for the operating temperature. Change fluids if necessary. 4) Check the hydraulic fluid temperature. If too hot, then allow the unit to cool. Inspect the heat exchanger fins, and clean if clogged with debris. Verify the fan motor is spinning. Make sure the oil viscosity is not too low. 5) Check the relief valve setting to make sure fluid is not dumping across back to tank. 6) The pump could be damaged or worn. Inspect the internal parts. 7) The motor speed is too low (reference the electrical troubleshooting section for more information).

Maintenance

It is important to maintain the power unit in a condition that will provide continued safe operation. The following sections highlight items that need to be addressed over the life of the unit.

Each Job

1. Inspect the unit visually, and look for signs of damage. Check all components (electric, hydraulic and mechanical). Ensure all hydraulic hoses and electrical wires (including the interconnects) are free of damage.
2. Check the fluid level of the hydraulic reservoir.
3. Clean the heat exchanger fins.
4. Set the system relief pressure to the required level for the job.
5. Inspect the system for hydraulic leaks and correct as required.
6. Drain water accumulation from the bottom of the reservoir.

Each 500 Hour Interval

1. Replace the hydraulic return filter element.

Each 1000 Hour Interval

1. Replace the hydraulic oil in the reservoir. When the tank is empty, clean the interior with a lint free cloth to remove any debris deposited in the bottom. Also, clean or replace the suction strainers if contaminated.
2. Replace the hydraulic return filter element.

Each Year Interval

1. Lubricate the electric motor.
   Note: Lubrication may be required more frequently if the climate is dusty, hot or wet. If the motor is stored without use for 6 months or more, lubricate the motor prior to start up.

Hoses

Replace the hoses within appropriate intervals regardless of the condition. Every five years is the usual hose manufacturer time frame.

One Year Spares

Below is a list of recommended spares for one year of operation.

Table 3: Power Unit One Year Spares

Part Number	Qty.	Description
81068-SK	1	Pump seal kit
81068-SVC	1	Pump sequence valve cartridge
81066-C	1	Relief valve cartridge
81070-RE	4	Return filter element
81023	2	Suction strainer
81069	1	System pressure gauge
81070-RG	1	Return pressure gauge
30431-LG	1	Level gauge for hydraulic tank
30431-FB	1	Filler/breather cap for hydraulic tank
80008	1	Pump shaft coupling
80007	1	Shaft coupling insert

Appendices

The following appendices contain further detailed information about the power unit. Cut sheets for the major components are also included.

- Section 2: Power Unit Mechanical Drawings
- Section 3: Power Unit Hydraulic Drawings and Cut Sheets
- Section 4: Power Unit Electrical Drawings and Cut Sheets
- Section 5: Test Sheet and Material Reports