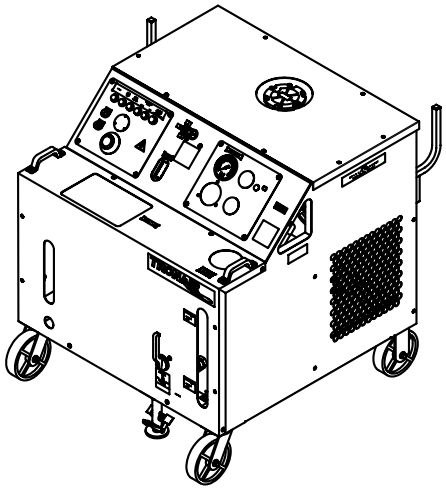
Operation & Service Instructions



TECHNICAL MANUAL
Model: 5H31
Hydraulic Power Unit

CE

09/2004 – AC – Rev. OR

Tronair, Inc.
1740 Eber Road
Holland, Ohio 43528-9794
USA
Telephone: (419) 866-6301 • 800-426-6301
Fax: (419) 867-0634
Web Site: www.tronair.com E-mail: mail@tronair.com

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Model: 5H31
Hydraulic Power Unit

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Hydraulic Power Unit

Model Number: **Fluid Type:**
5H31..... Aviation Phosphate Ester, Type IV

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit.

1.3 MANUFACTURER

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA
Website: www.tronair.com

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
Email: mail@tronair.com

1.4 FUNCTION

The Hydraulic Power Unit (HPU) provides a source of clean, pressurized hydraulic fluid for performing required aircraft maintenance. An electric motor drives a pressure compensated piston pump. Filters are provided on the pressure and return systems. A bypass (dump) valve allows starting and stopping of the unit under a no-load, safe condition. The unit may use either the aircraft or on-board HPU reservoir. Cooling is provided for continuous operation.

1.5 REQUIREMENTS

Adequate electrical power must be provided for proper functioning of the HPU. See the unit nameplate for proper voltage and frequency. See the Technical Manual for proper sizing of electrical supply and protection equipment in the facility.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

The HPU provides pressurized hydraulic fluid for performing aircraft maintenance.

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING! — Warning is used to indicate the presence of a hazard that ***can cause severe personal injury, death, or substantial property damage*** if the warning notice is ignored.

CAUTION! — Caution is used to indicate the presence of a hazard that ***will or can cause minor personal injury or property damage*** if the caution notice is ignored.

2.0 Safety Information continued on following page.

2.0 SAFETY INFORMATION *(continued)*

2.2 EXPLANATION OF WARNING & DANGER SIGNS

Accidental Starts! Before servicing the HPU or equipment, always disconnect electrical power supply to prevent accidental starting.

Rotating Parts! Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the HPU with covers, shrouds, or guards removed.

Electrical Shock! Never touch electrical wires or components while the HPU is attached to the power source. They can be sources of electrical shock. DO NOT operate HPU with cabinet panels removed.

Pressurized Fluid! Before servicing the HPU or equipment, always open the bypass valve to relieve any residual pressure in the hydraulic system.

2.3 COMPONENT SAFETY FEATURES

- Pump/Motor coupling guard
- Sheet metal panels
- Pressure and return system relief valves
- Control circuit fuses
- Motor overload protection

2.4 FUNCTIONAL SAFETY FEATURES

- Emergency shut off switch
- Floor lock
- Calibration port shut off valve
- Fluid sample shut off valve

2.5 PERSONAL PROTECTION EQUIPMENT

- Safety glasses must be worn when operating the HPU.
- Additional equipment recommended by the fluid manufacturer (gloves, etc.). ***Reference Appendix of Material Safety Data Sheet pertaining to fluid(s).***

2.6 SAFETY GUIDELINES

- Operator must be properly trained prior to operating the HPU.
- HPU power switch must be in "Off" position when connecting or disconnecting hoses to the aircraft.
- Bypass valve must be in the "Open" position when starting or stopping the HPU.
- Electrical power must be disconnected from the HPU and the bypass valve must be in the "Open" position before servicing the HPU. (Reference Technical Manual for details on servicing the HPU.)

2.0 SAFETY INFORMATION *(continued)*

2.7 GENERAL COMMENT

The HPU is intended to be operated by personnel trained in the proper use in conjunction with the aircraft maintenance manual.

2.8 GENERAL COMMENT

The HPU must be used in accordance with the Technical and Operator Manuals and the intended aircraft.

3.0 PREPARATION PRIOR TO FIRST USE

3.1 GENERAL

Prior to operating the HPU, the user should become familiar with this Operator Manual.

3.2 SERVICING RESERVOIR

Fill the reservoir with the correct fluid (see label next to reservoir fill for correct type of fluid) until fluid level is above the minimum fluid level mark but below the maximum fluid level. See ***Figure 5.3.1 Front Panel Controls*** for reservoir fill location.

3.3 CONNECTING ELECTRICAL LEADS

Electrical Shock!..... Never touch electrical wires or components while electrical power is attached. Only qualified electricians should connect the electrical leads.

Install plug onto the electrical cord. If motor rotation is not correct, change any two of the three leads at the plug. **Reference 11.0 Electrical Power and Protection Requirements** for power requirements and fuse sizes**.** (See ***5.4 Start up Procedures*** before starting HPU.)

WARNING!

Balanced three phase voltage must be available to prevent overheating and damage to the motor.

Voltage unbalanced between phases occurs when the voltages differ from one another.

Some reasons for imbalance are:

1. **Unequal loading of each phase**
2. **Poor connections in the supply**
3. **Single phase condition caused by blown fuses or bad connections**

If these conditions occur in the incoming power system, a protective devise, such as a voltage monitor, should be installed on the machine to prevent motor damage.

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the HPU.

4.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the HPU in and around the intended aircraft at the intended aircraft servicing location.

4.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the HPU.

NOTE: Maintenance and Troubleshooting are to be performed by a skilled and trained technician.

5.0 OPERATION

5.1 OPERATING PARAMETERS

- The user shall use the HPU in accordance with the aircraft manufacturer's instructions.
- The user shall operate the HPU in accordance with the Technical and Operator Manuals.
- The employer of the operator shall provide all necessary training.

5.2 NUMERICAL VALUES

5.2.1 Fluid

(See Nameplate on unit for Model Number.)

Fluid Type:	**Model:**
Aviation Phosphate Ester, Type IV	5H31

5.2.2 Physical

- Weight (Dry)**:** 1,200 lbs (544 kg)
- Dimensions**:** Width = 53 inches (134.6 cm)
  Add 7.5 inches (19 cm) for Dual System
  Height = 53 inches (134.6 cm)
  Depth = 74-7/8 inches (191.0 cm)
- Power Cord: 50 ft (15.24 m) long
- Pressure Hoses: 25 ft (7.62 m) .....Standard Length
  50 ft (15.24 m) .....Standard Length
  -8 (½ inch, 12.7 mm).....Working Diameter
- Return Hoses: 25 ft (7.62 m) .....Standard Length
  50 ft (15.24 m) .....Standard Length
  -12 (¾ inch, 19.1 mm).....Working Diameter
- Hand Pump Hose: 15 ft (4.57 m) .....Standard Length
  -6 (3/8 inch, 9.53 mm) .....Working Diameter

5.2 NUMERICAL VALUES *(continued)*

5.2.3 Motor Driven Hydraulic Pump

- A pressure compensated, adjustable maximum volume piston pump.
- Maximum flow at 60 Hz: .....11 gpm (41.6 lpm)
- Maximum flow at 50 Hz: .....9 gpm (34.6 lpm)
- Maximum operating pressure at 50 Hz and 60 Hz:.....3,500 psi (241 bars)
- System pressure relief valve setting: .....3,550 psi (258 bars)
- Performance Curve for 50 Hz and 60 Hz:.....Reference ***Figure 5.2.3***

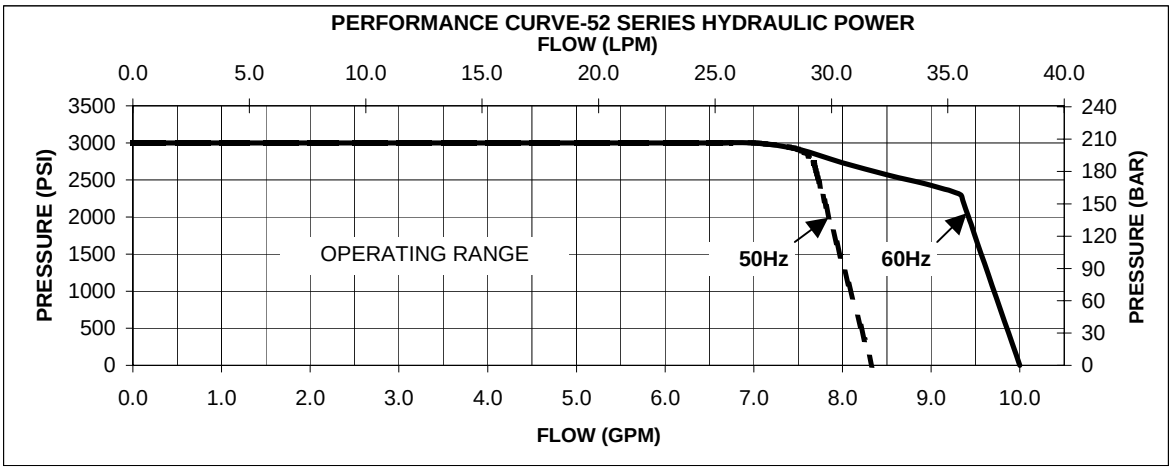

FIGURE 5.2.3 **– Performance Curve (50 Hz and 60 Hz)**

5.2.4 Electric Motor

A 15 horsepower, TEFC electric motor is the prime mover for the HPU. This is attached to the hydraulic pump using a pump/motor adapter and a spider/coupling rotating interface.

MOTOR POWER REQUIREMENTS			
60 Hz Applications		**50 Hz Applications**	
Voltage	**Full Load Amps**	**Voltage**	**Full Load Amps**
208	44.2	200	48.0
230	40.0	220	41.0
380	24.2	380	23.7
460	20.0	415	23.0
575	16.0	440	22.0

FIGURE 5.2.4 **–Motor Power Requirements**

5.2 Numerical Values continued on following page.

5.2 NUMERICAL VALUES *(continued)*

5.2.5 Filters

- Pressure: .....2 micron rating, non-bypass high collapse microglass type. Non-cleanable element.
- Return:.....5 micron rating, 25 psi (1.72 bars) bypass microglass type. Non-cleanable element.
- Hand Pump *(Option M)*:.....2 micron rating, non-bypass microglass type. Non-cleanable element.
- Air/Desiccant:.....3 micron filter, silica gel desiccant type. Non-cleanable element.

5.2.6 Hand Pump *(Option M)*

Two stage hand pump, low pressure stage 0–500 psi (0–34.47 bars) and 500–5,000 psi (34.47–344.74 bars) high pressure stage. Pump automatically changes stage internally based on system pressure.

Low Pressure Stage:	Piston Diameter:	1½ inches.....(38.1 mm)
	Working Pressure:	0–500 psi.....(0–34.47 bars)
	Displacement/Stroke:	2.1 in^3 .....(34.4 cm^3)
	Force/100 psi (6.89 bars):.....	12.0 lbs/100 psi .....(7.74 N/bars)
High Pressure Stage:	Piston Diameter:	5/8 inch.....(15.88 mm)
	Working Pressure:	500–5000 psi.....(34.47–344.74)
	Displacement/Stroke:	0.4 in^3 .....(6.55 cm^3)
	Force/100 psi (6.89 bars):.....	2.2 lbs/100 psi .....(1.42 N/bars)

Pressure Relief Setting: 5,250 psi (362.0 bars)

5.0 OPERATION *(continued)*

5.3 LOCATION & LAYOUT OF CONTROLS

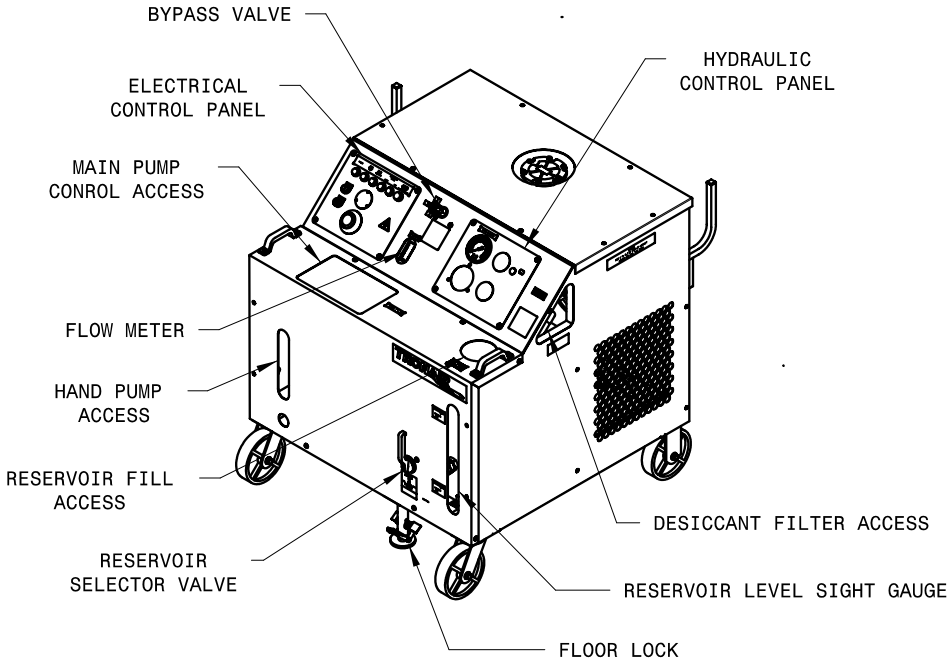

FIGURE 5.3.1 **– Front Panel Controls**

5.3.1 Front Panel Controls

- Electrical Control Panel:..... See Section 5.3.2
- Hydraulic Control Panel: .... See Section 5.3.3
- Bypass Valve: ..... For loading and unloading the motor driven hydraulic pump.
- Flowmeter:..... Displays the flow from the motor driven hydraulic pump.
- Pump Control Access: ..... See Figure 5.3.5 - Hydraulic Pump Controls.
- Reservoir Selector:..... For selecting between using the aircraft reservoir or the HPU reservoir.
- Sight Gauge: ..... Visual indicator displays the fluid level in the reservoir.
- Reservoir Fill Access:..... Locking cap for servicing the HPU reservoir.
- Desiccant Filter:..... Access to the reservoir air filter/desiccant filter.
- Hand Pump (Option M):..... Access for hand pump and relief screw, handle stored inside.
- Floor Lock: ..... Locking/unlocking, foot actuated and released floor lock.

5.3.2 Location & Layout of Controls continued on following page.

5.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

5.3.2 Electrical Control Panel

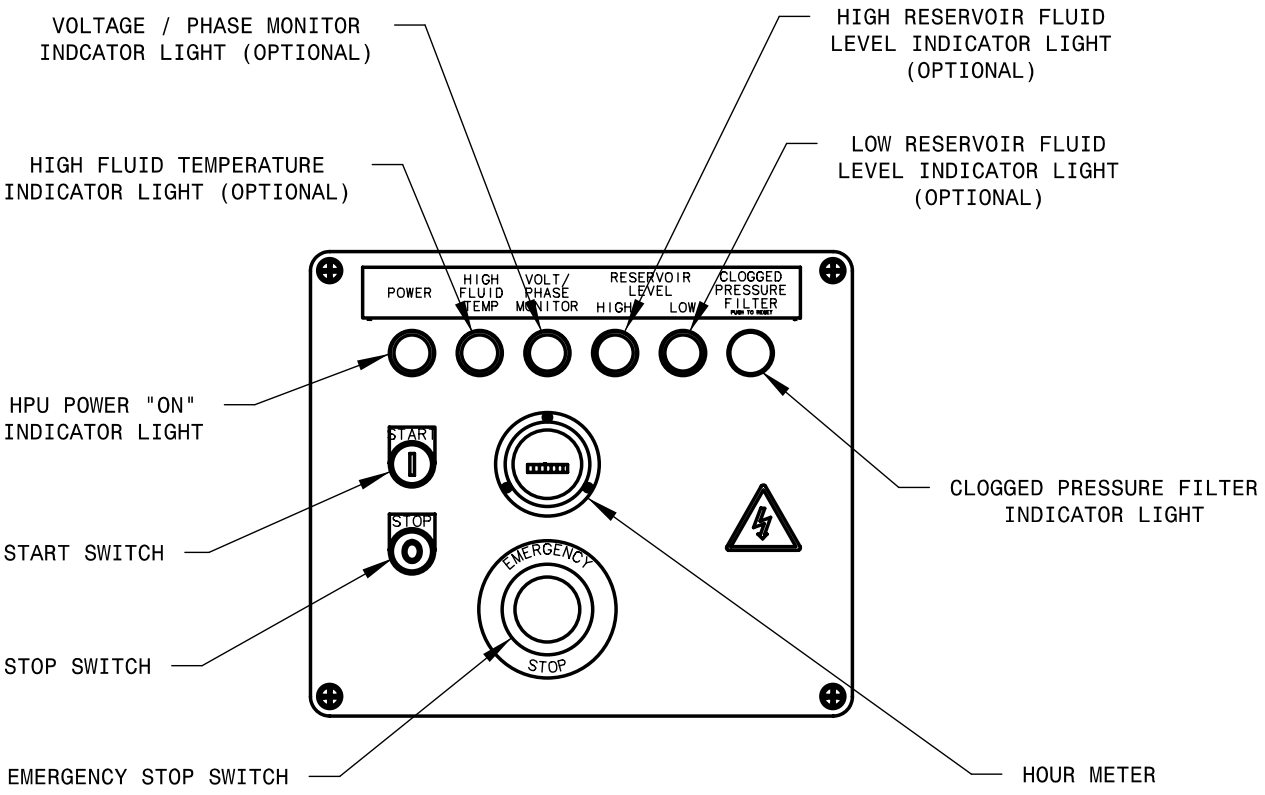

Figure 5.3.2 **– Electrical Control Panel**

- Emergency Stop: ..... Removes power to all electrical devices, must turn to reset.
- Stop Switch: ..... Turns off the electric motors driving the hydraulic pump and cooling fan.
- Start Switch: ..... Turns on the electric motors driving the hydraulic pump and cooling fan.
- HPU Power "On" Indicator Light: ... Light is illuminated when the electric motors driving the hydraulic pump and cooling fan are on.
- High Fluid Temperature ..... Light is illuminated when the return fluid temperature Indicator Light *(Option S)*: reaches 160° F (71° C) or above. The HPU will shut down when light is illuminated. The HPU can be re-started when the fluid has cooled and the indicator light is off.
- High Reservoir Fluid Level..... Light is illuminated when the fluid level in the reservoir is Indicator Light *(Option L)*: above the normal operating range. The HPU will shut down until the fluid level is restored to a normal operating level.

5.3.2 Electrical Control Panel *(continued)*

- Low Reservoir Fluid Level Indicator Light (Option L): ..... Light is illuminated when the fluid level in the reservoir is below the normal operating range. The HPU will shut down until the fluid level is restored to a normal operating level.

- Voltage/Phase Monitor Indicator Light (Options G – J): ..... Light is illuminated if any of the following conditions occur
  - — Voltage imbalance between L1, L2, L3, greater than 5%
  - — Loss of voltage from L1, L2, L3
  - — Over voltage from L1, L2, L3, greater than 5%
  - — Change in phase orientation between L1, L2, L3. The HPU will shut down until the electrical problem is corrected.

- Clogged Pressure Filter Indicator Light: ..... Light is illuminated when the pressure filter element requires changing. The HPU will not shut down when illuminated. Pressing the illuminated button will reset the light.

5.3 Location & Layout of Controls continued on following page.

5.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

5.3.3 Hydraulic Control Panel

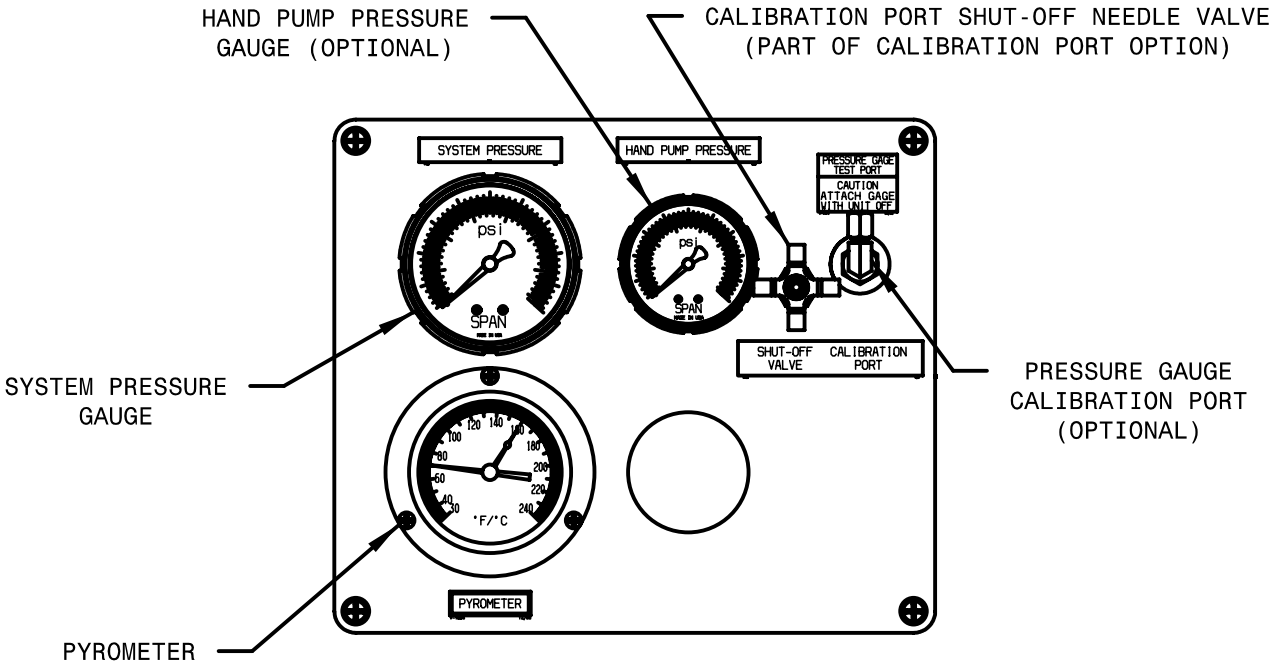

FIGURE 5.3.3 **– Hydraulic Control Panel**

- System Pressure Gauge: ..... Displays the system pressure on an analog fluid dampened gauge.
- Pyrometer: ..... Displays the fluid temperature in the return system on an analog gauge. A warning indicator preset to 160° F (71° C) warns of high operating temperature.
- Pressure Gauge Calibration Port *(Option Q)*: ..... Allows for calibration of the system pressure gauge up to the operating pressure of HPU. Calibration port shut off valve must be used in conjunction with the calibration port.
- Calibration Port Shut Off Valve: ..... *(Part of Calibration Port Option Q)* Used to shut off pressure to the calibration port. This valve should only be opened when the external standard gage is attached. (See Technical Manual for proper procedure.)
- Hand Pump Pressure Gauge (Option M): ..... Displays the hand pump system pressure on an analog fluid dampened gauge.

5.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

5.3.4 Rear Panel Controls

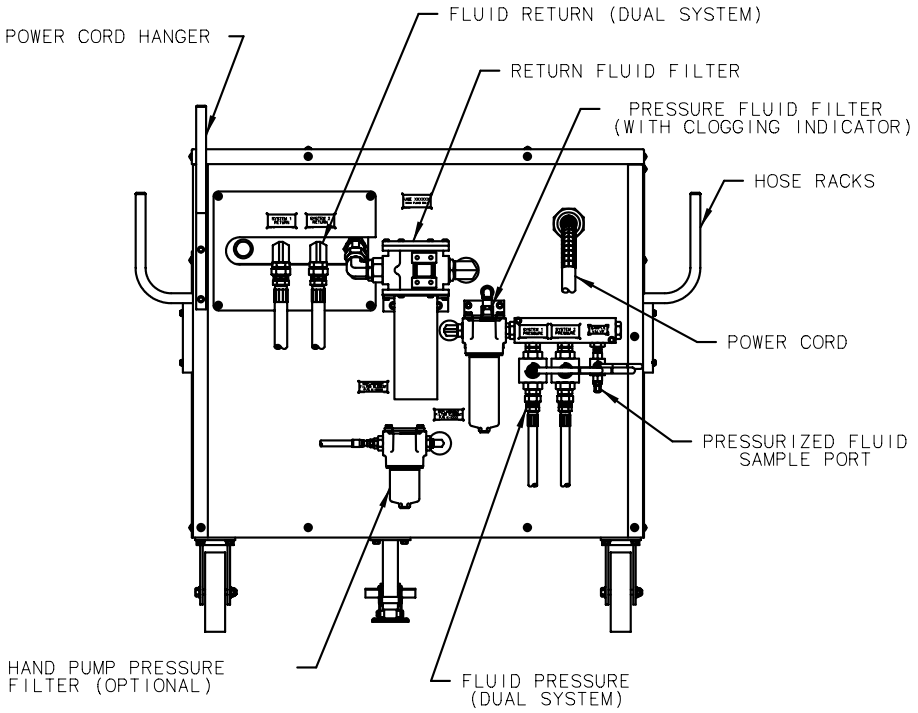

FIGURE 5.3.4 **– Rear Panel Controls**

- Fluid Pressure System: ..... The source of pressurized fluid from the HPU that flows to the aircraft pressure system through the pressure hose.
- Fluid Return System: ..... Fluid returning to the HPU from the aircraft that flows through the return hoses.
- Pressure Fluid Filter: ..... Filters the pressurized fluid before it flows to the aircraft pressure system.
- Return Fluid Filter: ..... Filters the fluid returning from the aircraft before it enters the HPU.
- Pressurized Fluid Sample Port: ..... A sample valve is provided to obtain a fluid sample for analysis. In order to obtain a representative sample, it is suggested that ANSI/B93.19M-1972(R1993) be followed.
- Hand Pump Pressure Filter: ..... Filters the pressurized fluid before it flows to the aircraft system. *(Option M)*
- Hose Racks: ..... Location for storing the pressure, return and optional hand pump hoses when not in use.
- Power Cord Hanger: ..... Location for storing the power cord when not in use.

5.3 Location & Layout of Controls continued on following page.

5.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

5.3.5 Hydraulic Pump Controls

The hydraulic pump flow control and pressure control are located through the pump control access door.

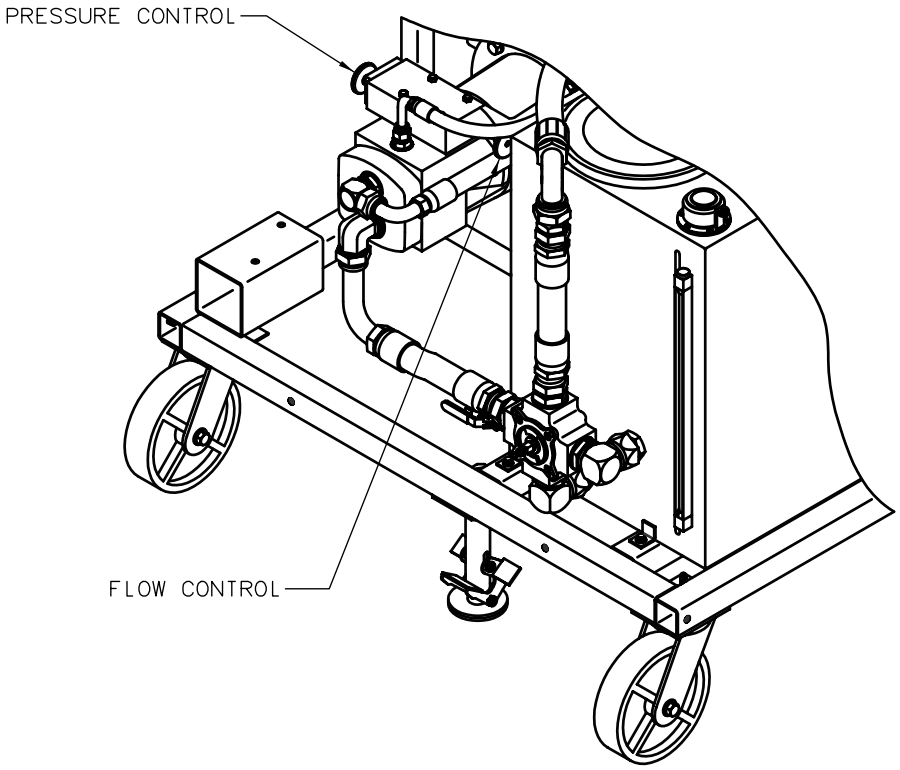

FIGURE 5.3.5 **– Hydraulic Pump Controls**

- Flow Control: ..... This control is used to set the maximum flow required from the HPU.
- Pressure Control: ..... The pressure control is used to set the system pressure of the HPU during operation.

5.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

5.3.6 Hand Pump Controls *(Option M)*

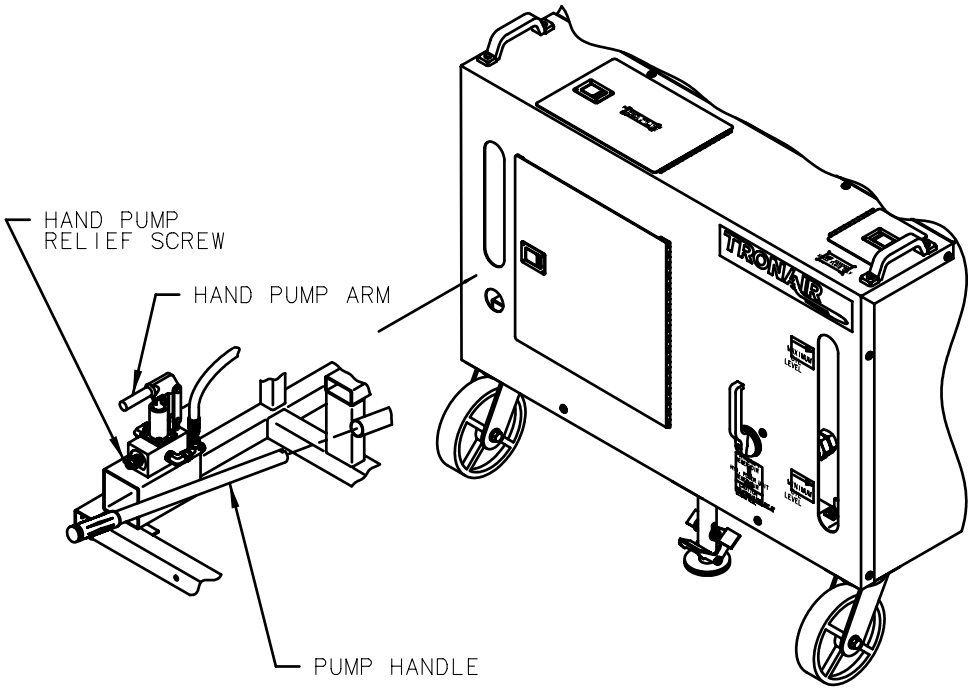

FIGURE 5.3.6 **– Hand Pump Controls**

Reference 5.9Hand Pump Operation.

- Pump Handle:..... Located inside the front access door is the hand pump handle used for opening and closing the hand pump relief screw and stroking the hand pump arm.
- Hand Pump Relief Screw:..... Accessed through the front panel opening, this screw allows opening and closing of the hand pump hydraulic circuit using the hand pump handle.
- Hand Pump Arm:..... The handle is used to access the hand pump arm used for up and down motion to produce hydraulic flow and pressure.

5.0 Operation continued on following page.

5.0 OPERATION *(continued)*

5.4 START UP PROCEDURES

5.4.1 Procedure for First Time or Different Electrical Supply ONLY

Phase Monitor (Options G – J Only): Check that the phase monitor light on the instrument panel is not illuminated. If the light is illuminated, change any two of the three input leads at the plug. Once the phase monitor light is not illuminated with power attached, check for proper motor rotation.

a. Remove the pump/motor coupling guard. Reference ***Figure 5.4.1 – Pump/Motor Coupling Access***.

Rotating Parts! Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the HPU with covers, shrouds, or guards removed.

b. Verify that the unit has been prepared for use by connecting electrical leads and servicing the reservoir. (Reference section *3.0 Preparation Prior to First Use*.)

c. Keeping hands clear of the pump/motor coupling area, momentarily press the start button and immediately press the stop button.

d. Observe direction of rotation of the pump/motor coupling. When the Operator is facing the front panel, the pump/motor coupling should be rotating in a clockwise direction.

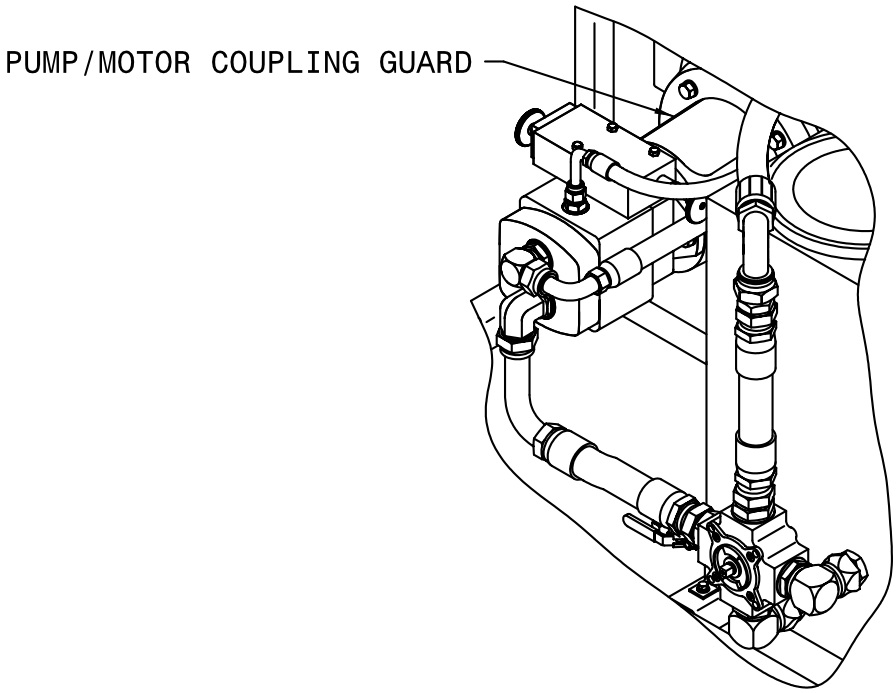

FIGURE 5.4.1 **– Pump/Motor Coupling Access**

Electrical Shock! Never touch electrical wires or components while the HPU is attached to the power source. They can be sources of electrical shock.
Do not operate HPU with cabinet panels removed.

5.4.1 Procedure for First Time or Different Electrical Supply ONLY *(continued)*

e. If the pump/motor coupling is rotating in a counter-clockwise direction, change any two of the three leads at the plug. Observe direction of rotation to verify that pump/motor is rotating in a clockwise direction.

f. Replace the pump/motor coupling guard.

5.4.2 Initial Start Up of the HPU

a. Unit must be prepared per section *3.0 Preparation Prior to First Use* and section *5.4.1 First Time or Different Electrical Supply ONLY* before starting the HPU.

b. Operator must be familiar with this manual and be properly trained prior to starting the HPU.

c. Connect quick disconnects to hose ends or cap the pressure and return hose ends.

d. Place the reservoir selector valve in "HPU Reservoir" position.

e. Place the bypass valve in the "Open" position.

f. Press the start switch and adjust the flow control until 6 gpm (22.71 lpm) is displayed on the flowmeter. (If no flow displays on the flowmeter after adjusting the flow control, reference *Troubleshooting8.2 No Flow*).

g. Close the bypass valve, adjust the pressure control until 3,000 psi (206.84 bars) is displayed on the pressure gauge. (If no pressure displays on the system pressure gauge after adjusting the pressure control, reference *Troubleshooting8.4 No Pressure or Reduced Pressure)*.

h. Open the bypass valve; press the stop switch.

NOTE: ***Maintenance and Troubleshooting are to be performed by a skilled and trained technician.***

5.5 PRELIMINARY ADJUSTMENTS FOR OPERATION

The following are basic to the operation of the HPU and should be thoroughly understood. The pressure and flow controls have lock nuts to prevent rotation of the control shaft during operation. These nuts should be moved away from the pump during adjustment of flow or pressure in order to eliminate binding of the control shafts.

5.5.1 Flow Control Adjustment

a. Open bypass valve.

b. Select "Hydraulic Power Unit" position with reservoir selector valve.

c. Start HPU.

d. Adjust flow control on pump for maximum desired flow. Observing the flowmeter, read flow in gallons (liters) per minute directly from flowmeter. Be sure the control shaft lock nut is loose during adjustment. Tighten after adjustment to maintain setting.

5.5 Preliminary Adjustments For Operation continued on following page.

5.5 PRELIMINARY ADJUSTMENTS FOR OPERATION *(continued)*

5.5.2 Pressure Control Adjustment

a. Open bypass valve.

b. Select "Hydraulic Power Unit" position with reservoir selector valve.

c. Start HPU.

d. Close bypass valve.

e. Adjust pressure control for desired pressure; observing the system pressure gauge, read in psi (bars). Be sure the control shaft lock nut is loose during adjustment. Tighten after adjustment to maintain setting.

NOTE: ***Once the flow and pressure controls have been adjusted, it is not necessary to change these settings after each operation unless desired.***

5.5.3 Reservoir Selector Valve Operation

Operation of the reservoir selector valve allows the operator to select either the aircraft reservoir (closed loop) or the HPU reservoir (open loop).

CAUTION!

The reservoir selector valve should only be operated when the HPU is not running. The operation of the reservoir selector valve should be done prior to starting the HPU.

a. Aircraft Reservoir Position (Closed Loop)

In this position, the HPU is dependent on the aircraft reservoir and system for an adequate supply of fluid. Cavitation, due to an inadequate fluid supply from the aircraft, may be indicated by erratic fluctuation of the system pressure gauge or flowmeter. At times, the aircraft fluid supply will be restricted due to small return oil lines in the aircraft. If this is a problem, decrease the flow control setting until the cavitation is eliminated.

b. HPU Reservoir Position (Open Loop)

In this position, the HPU reservoir supplies fluid to the pump and accepts return fluid from the aircraft. It is desirable to operate the HPU in this mode since it eliminates any possibility of cavitation.

Since the HPU reservoir is vented to atmosphere and the aircraft is at a higher level, it is normal for the aircraft reservoir to drain into the HPU reservoir. It is, therefore, necessary to be sure that sufficient room is available in the HPU reservoir to accommodate the additional fluid.

CAUTION!

The aircraft system reservoir must be serviced after completion of operational testing.

In the "HPU Reservoir" position, faster landing gear swings are usually possible since there is no restriction to flow at the pump inlet.

5.5 PRELIMINARY ADJUSTMENTS FOR OPERATION *(continued)*

5.5.4 Bypass Valve Operation

The bypass valve is used for unloading the pump. The valve should be either in the fully open or fully closed position only. Do not operate the valve in a partially open position.

a. Start Up Operation: The bypass valve must be opened prior to starting the HPU in order to allow the motor to start under a no load condition and not pressurize the aircraft hydraulic system.

b. Shut Down Operation: Prior to shutdown, the bypass valve must be opened to bleed off any residual system pressure.

CAUTION!

Excessive heat, which could damage machine components, will be generated if the bypass valve is partially open or is used for regulating flow or pressure.

- **Use the flow and pressure controls for regulation.**
- **Use the bypass valve for unloading the system only.**

5.6 BLEEDING AIR FROM SYSTEM

Rapid fluctuations of the pressure gage and flow-meter are indications of cavitation or entrapped air in the hydraulic lines and/or components. Air may enter the system when:

- Operating the unit with insufficient oil in the reservoir.
- Changing a component on the aircraft.
- Changing hose connections and/or couplings.

5.6.1 To Easily Purge the Unit of Air

a. Fill reservoir to recommended level.

b. Open bypass valve.

c. Place reservoir selector valve in “Hydraulic Power Unit” position.

d. Start unit and adjust flow control to maximum position.

NOTE: ***If fluid is not flowing, shut off HPU and reference section 8.2 No Flow in Troubleshooting section of Technical Manual***

e. Run unit for five (5) minutes and shut off.

f. If additional bleeding is required, connect the pressure and return hoses together and open all pressure and return ball valves at the rear of the HPU. Start the HPU and slowly close the bypass valve (**system pressure should remain under 200 psi (approximately 14 bars)**. Allow fluid to flow at full flow for five (5) minutes, then shut the HPU off.

WARNING!

Failure to open the return ball valves will cause hose or valve rupture. Property damage and personal injury can result.

5.0 Operation continued on following page.

5.0 OPERATION *(continued)*

5.7 DUAL SYSTEM OPERATION

The dual system option allows control of fluid flow to aircraft with two hydraulic systems. The systems consist of two sets of hoses and valves located in the pressure system. The valves are mounted on the rear of the hydraulic power unit and are of the 90° ball type. The valves are open when the operating handle is in line with the valve.

Although both systems may be operated simultaneously, usually only one system is required at any one time. If both valve sets are open simultaneously, the pump output will be divided between the two systems. Also, cross flow between aircraft reservoirs may occur if a reservoir level or pressure differential exists. Select valve positions prior to starting machine.

5.8 HAND PUMP OPERATION *(Option M)*

The Hand Pump Option allows for filling the reservoir (low pressure) or static testing of components or system (high pressure). The hand pump circuit is separate from the main hydraulic system; a separate filter and hose are attached to the back panel of the HPU.

5.8.1 To Operate the Hand Pump

a. Remove the pump handle from inside the front access door. (Reference ***Figure 5.3.6 – Hand Pump Controls***)

b. Insert the end of the pump handle through the front panel opening into the hand pump relief screw.

c. Turn the pump handle clockwise to close the relief screw.

d. Insert the pump handle onto the hand pump arm through the front panel slot.

e. Pump the handle using an up and down motion. Observe the hand pump system pressure on the hydraulic control panel (***Figure 5.3.3 Hydraulic Control Panel***). The pump is an automatic two stage pump. 500 psi (34.47 bars) can be produced with high fluid flow and 5,000 psi (344.74 bars) can be produced with low fluid flow.

f. Turning the relief screw in a counter-clockwise direction releases hydraulic pressure in the hand pump system.

Pressurized Fluid! Before disconnecting the hand pump pressure hose, ALWAYS open the relief screw valve to relieve any residual pressure in the hydraulic system.

5.9 SAMPLE VALVE

A sample valve is provided on the rear of the unit to obtain a fluid sample for analysis or inspection.

In order to obtain a representative fluid sample, it is suggested that ANSI/B93.19M-1972 (R1993) be followed. *Reference Appendix VII.*

Pressurized Fluid! Before servicing the HPU or equipment, ALWAYS open the bypass valve to relieve any residual pressure in the hydraulic system.

5.0 OPERATION *(*continued)

5.10 EMERGENCY SHUT DOWN PROCEDURE

In the event an emergency shut down is necessary, press the emergency stop switch located on the electrical panel. (Reference ***Figure 5.3.2 – Electrical Control Panel***) Open the bypass valve to remove any system pressure.

5.11 DESCRIPTION OF ALARM SYSTEMS

Reference ***Figure 5.3.2 – Electrical Control Panel***.

5.11.1 High Fluid Temperature Indicator *(Option S)*

The indicator light for high fluid temperature is an active light which will illuminate when the return fluid temperature is 160° F (71° C) or above. The HPU will shut down if the light is illuminated. The HPU can be re-started when the fluid has cooled sufficiently and the light has shut off.

If the high temperature light is illuminated reference section ***8.0 Trouble Shooting***.

5.11.2 Voltage/Phase Monitor Indicator *(Options G – J)*

The indicator light for the voltage/phase monitor is an active light which will illuminate if there is a problem with the incoming electrical power source. The HPU will shut down if the light is illuminated.

If the voltage/phase monitor light is illuminated, reference section ***8.0 Trouble Shooting***.

5.11.3 High and Low Reservoir Level Indicator *(Option L)*

The indicator lights for high and low reservoir level are active lights which will illuminate when the reservoir fluid level is either above the maximum level or below the minimum level. The HPU will shut down if either of the lights are illuminated.

If the light on either of the reservoir level indicator lights, restore the fluid level in the reservoir to a normal operating range.

5.11.4 Clogged Filter Indicator Light *(Standard)*

The indicator light for the clogged filter is a passive light which will illuminate if the pressure filter element becomes clogged or is in need of replacement. The HPU will not shut down if the light is illuminated.

If the clogged filter indicator light is illuminated, the pressure filter element requires changing. Reference section ***9.14 Electric Filter Clogging Indicator*** *(Option R)* for maintenance procedure. Pressing the clogging filter indicator light will reset the light and the light will turn off.

NOTE: Maintenance and Troubleshooting are to be performed by a skilled and trained technician.

6.0 PACKAGING AND STORAGE

6.1 PACKAGING REQUIREMENTS

a. Drain hydraulic fluid until level is below the minimum fluid level indicator.

b. Block up the unit on a pallet so the wheels are not touching the pallet or shipping container.

c. Plug all hose ends.

d. Strap unit to pallet or shipping container using the tie down rings located on the frame bottom.

NOTE: Use at least four (4) straps with a minimum 2,000 lb (907.2 kg) capacity each.

6.2 HANDLING

The unit is designed to be moved by hand using the handles located on the front of the unit. The unit can be lifted by means of a fork truck from the center of the machine. Lifting must be from the motor side of the unit only.

NOTE: Be sure the forks are long enough to reach the frame cross members for stability during lifting. Spread the forks to their maximum width for stability. Reference Figure 7.0 – HPU on Forklift.

6.3 PACKAGING PROTECTION

No special packaging material for cushioning or suspension is required.

6.4 LABELING OF PACKAGING

Packaging should be labeled as follows:

DO NOT DROP
THIS SIDE UP
DO NOT STACK

6.5 STORAGE COMPATIBILITY

No special considerations for short term storage (less than three months).

6.6 STORAGE ENVIRONMENT

Cover HPU with a suitable, non-abrasive tarp if storing outside. For storage periods greater than three months, drain hydraulic fluid from all hoses and the reservoir. Cover unit to protect outside surface.

If storing outside, protect unit from freezing water, sand, dirt, and direct sunlight. A cover is highly recommended.

6.7 STORAGE SPACE AND HANDLING FACILITIES

- Weight (Dry)**:** 1,200 lbs (544 kg)
- Dimensions**:** Width = 53 inches (134.6 cm)
  Add 7.5 inches (19 cm) for Dual System.
  Height = 53 inches (134.6 cm)
  Depth = 74 ⅞ inches (191.0 cm)

7.0 TRANSPORTATION

7.1 Do not stack Hydraulic Power Units.

7.2 The unit can be lifted by means of a fork truck from the motor side center of the HPU.

NOTE: Be sure the forks are long enough to reach frame cross members for stability during lifting. Spread the forks to their maximum width for stability. Reference Figure 7.0 – HPU on Forklift.

- Weight**:** 1,200 lbs (544 kg)

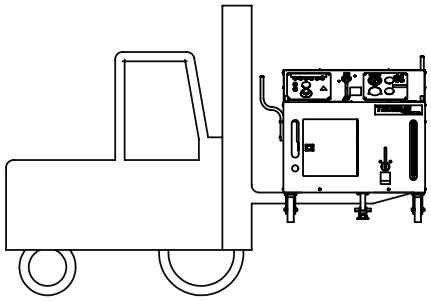

***FIGURE 7.0* – HPU on Forklift**

8.0 TROUBLESHOOTING

The following is a guide to solutions of common problems associated with the HPU. See related Appendix for Hydraulic and Electrical Schematics.

If the problem is not resolved using the Troubleshooting information, call the manufacturer for Technical Assistance (See Section ***1.3 Manufacturer***).

NOTE: Maintenance and Troubleshooting are to be performed by a skilled and trained Technician.

8.1 HPU WILL NOT START

Possible Cause	Solution
Supply power off	Check incoming power and restore power. Check across-the-line voltage on all three phase legs.
Supply power fuses are blown/ Circuit breakers tripped	Check and replace. Check across-the-line voltage on all three phase legs.
Control Transformer fuses blown	Check and replace.
Supply power phase or voltage incorrect *(Phase/Voltage Monitor Option G – J only)*	Voltage/Phase Monitor Indicator light will be illuminated. Refer to Section ***3.3 Connecting Electrical Leads***.
Reservoir fluid level is too high or too low. *(Electric Reservoir Level Option L only)*	One reservoir level indicator light (Low or High) will be illuminated. Fill the reservoir above the Minimum Fluid Level arrow to extinguish the Low Level light. Drain fluid below the Maximum Fluid Level arrow to extinguish the High Level light.

8.1 HPU Will Not Start continued on following page.

8.0 TROUBLE SHOOTING

8.1 HPU WILL NOT START *(continued)*

High return fluid temperature *(Electric Over-Temperature Option S only)*	High Fluid Temperature indicator light will be illuminated. Allow the hydraulic fluid to cool until the light goes out. Refer to Section 8.5 for over-heated causes.
Motor has tripped thermal overload device	Allow the motor to cool. The thermal overload device (motor starter) will reset automatically after sufficient cooling. The tripped condition is usually caused by loading the motor beyond its rated capacity, however, any condition (such as unbalanced voltage) that causes an increase in amperage can result in a tripped condition. ***NOTE: Using the bypass valve to meter flow or pressure will increase the motor load and may cause the thermal overload device to trip. Refer to section 5.5.4 Bypass Valve Operation for proper use of the bypass valve.***

8.2 NO FLOW

Possible Cause	Solution
Motor turning in wrong direction	See Section ***3.3 Connecting Electrical Leads.***
Flow control set too low	Increase flow setting.
Fluid level in reservoir too low	Service the HPU reservoir.
Air in pump inlet lines	Disconnect the HPU from the aircraft. Fill the HPU reservoir to a level above the pump inlet port. Set the reservoir selector valve to the HPU Reservoir position. **Fully open the Bypass Valve.** Close the Pressure and Return ball valves at the rear of the unit. Adjust the pump flow to maximum and "bump" the start and stop switches to "jog" the motor. Flow should be indicated at the Flowmeter on first or second "jog".

NOTE: Under some conditions where a large amount of air has entered the system, the pump may not be able to draw an initial prime. If this occurs, loosen the inlet hose near the pump and allow air to escape. Re-tighten the hose when fluid appears.

Motor is turning but pump is not	Check pump and motor couplings to ensure they are tight.
Flow path does not exist	A flow path (such as a moving actuator or an open circuit) must exist for flow to be present. When system pressure exceeds the compensator control setting, or when the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure.

8.0 TROUBLESHOOTING*(continued)*

8.3 REDUCED FLOW

Possible Cause	Solution
Flow control is set too low	Increase flow setting.
Pressure adjustment is set too low.	Slightly increase pressure setting.
Pressure compensator control is reducing pump output.	When system pressure exceeds the compensator control setting, or when the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure.
Pump inlet is not receiving enough fluid (cavitation)	Follow the procedure for “Air in pump inlet lines” in Section 8.2.
Motor is “Single Phasing”	Motor is not getting power on all three phase legs. Check across-the-line voltage on all three phase legs.
Supply voltage is 50 Hz	Pumps used on 50 Hz units will flow at only 83% of the pump nameplate rating. An HPU designed to run on 50 Hz will supply flow as stated in the specifications for that unit.

8.4 NO PRESSURE or REDUCED PRESSURE

Possible Cause	Solution
Pressure adjustment is set too low	Increase pressure adjustment.
Motor is “Single Phasing”	Motor is not getting power on all three phase legs. Check across-the-line voltage on all three phase legs.
Pump inlet is not receiving enough fluid (cavitation)	Follow the procedure for “Air in pump inlet lines” in section 8.2.
Flow path is open	Pressure is resistance to flow. The HPU will reach full pressure as flow paths (such as moving actuators and open valves) are closed.

8.5 FLUID OVERHEATS

Possible Cause	Solution
Fan is not functioning properly	Check the cooler fan output. Forced air should be easily detected at the right hand side of the HPU. Check the fuses for the fan motor (See Appendix Electrical Schematic INS-1725).
Bypass valve or rear ball valve is being used in a partially closed position	The bypass valve and all ball valves must be used in a fully open or fully closed position. These valves are not intended for metering flow. All flow adjustments must be made using the pump flow control.

8.0 Troubleshooting continued on following page.

8.0 TROUBLESHOOTING*(continued)*

8.6 HAND PUMP (*Option M)* IS NOT PUMPING FLUID

Possible Cause	Solution
Release screw is open	Use the slotted end of the pump handle to close the release screw located at the base of the pump.
Ball valve is closed	Open the ball valve for the pump inlet line located at the bottom of the reservoir.
Pump piston is filled with air	If the pump is not primed after several strokes, remove the bleed screw from the top of the pump piston (see section *9.13.9.a – Pump Diagram*). Slowly stroke the pump until fluid is present at the bleed screw. Replace the bleed screw.

9.0 MAINTENANCE

9.1 GENERAL

Periodically inspect the HPU for loose fasteners, hose fittings, damaged hoses, and worn electrical cables. Make repairs as needed for safe operation.

Reference Sections **9.2 – 9.16** for Parts Lists, Descriptions and Illustrations.

9.2 ELECTRIC MOTOR

The Electric Motor is pre-greased by the manufacturer. Periodic greasing is necessary on a frequently used HPU. Reference ***Appendix – Lincoln Motor Manual*** for details.

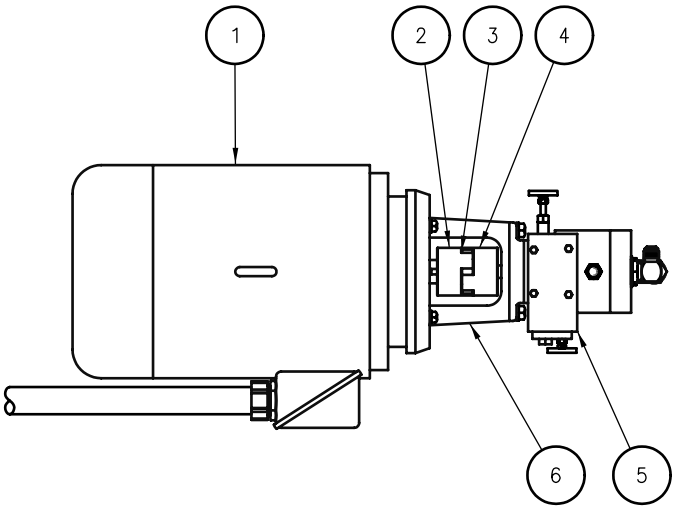

FIGURE 9.2 **– Electric Motor/Hydraulic Pump Assembly**

9.2 ELECTRIC MOTOR *(continued)*

PARTS LIST

Item	Part Number	Description	Qty
1	*Reference following Hz Applications:*	Electric Motor	1

60 Hz Applications		50 Hz Applications	
Voltage	**Part Number**	**Voltage**	**Part Number**
208	EC-1186-11	200	EC-1186-11
230	EC-1186-11	220	EC-1555-09
380	EC-1186-10	380	EC-1555-09
460	EC-1186-11	415	EC-1186-11
575	EC-1186-12	440	EC-1555-10

2	H-2424-15	Coupling (Motor Half)	1
3	H-2427	Spider (Hytrel)	1
4	H-2424-04	Coupling (Pump Half)	1
5	*Reference 9.3 and 9.3.1*	Motor Driven Hydraulic Pump	1
6	HC-1775-06	Pump/Motor Adapter	1

9.3 MOTOR DRIVEN HYDRAULIC PUMP

The hydraulic pump does not require regular maintenance. Under normal operating conditions, the pump will perform for thousands of hours of use without rebuilding. See ***Appendix – Oil Gear Pump Manual*** for further details.

9.3.1 Motor Driven Hydraulic Pump Replacement Kits List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description
K-2404	Kit, Shaft Seal and Retainer
K-1995	Kit, Gaskets and O-rings
*	Kit, Shaft and Bearing Assembly

* *Kit not released at time of publishing. Call Tronair for Part Number.*

9.4 HYDRAULIC FLUID

Any time an unusual color, smell or visual indicator is noticed with the hydraulic fluid, a sample analysis should be performed to determine the condition of the fluid. (See Section ***5.9 – Sample Valve Operation***)

Refer to the manufacturer of the specific fluid for your unit to obtain additional information:

Model Number:	**Fluid Type:**
5H31	Aviation Phosphate Ester, Type IV

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.5 FILTERS

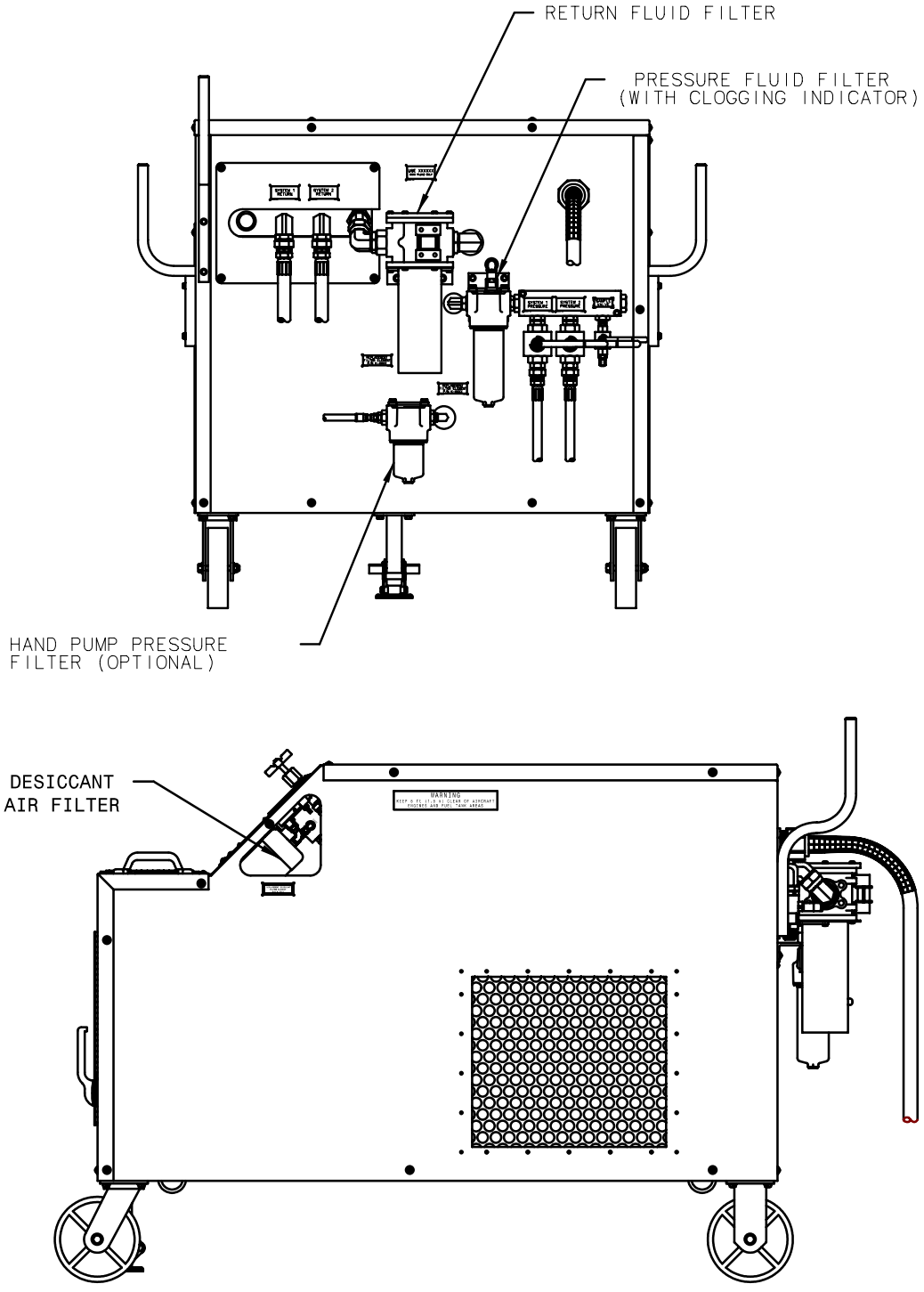

FIGURE 9.5 **– Filters**

9.5 FILTERS *(continued*)

9.5.1 Pressure Filter

Replace the filter element any time the clogged filter indicator light *(Option R)* is triggered or when the pop-up indicator located on the filter head changes to red during operation.

Replace the filter element annually to ensure proper cleanliness of the hydraulic system. This is a minimum requirement.

Standard filter changes depend on how frequently the HPU is used and the cleanliness of the fluid, along with the environment to which the HPU is exposed. Periodic fluid analysis is recommended to properly determine the optimum frequency of filter element changes.

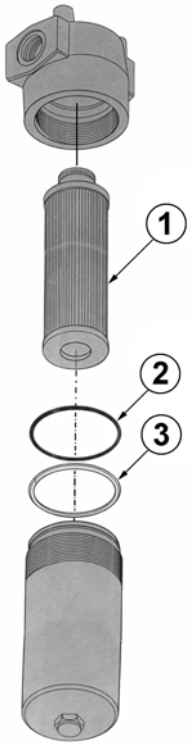

FIGURE 10.5.1 **– Pressure Filter**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
2 & 3	K-3797	Kit, Seal	1
1, 2 & 3	K-3428	Kit, Replacement Filter Element	1

9.5 Filters continued on following page.

9.5 FILTERS *(continued)*

9.5.2 Return Filter

Replace the return filter element at the same time the pressure filter element is being replaced.

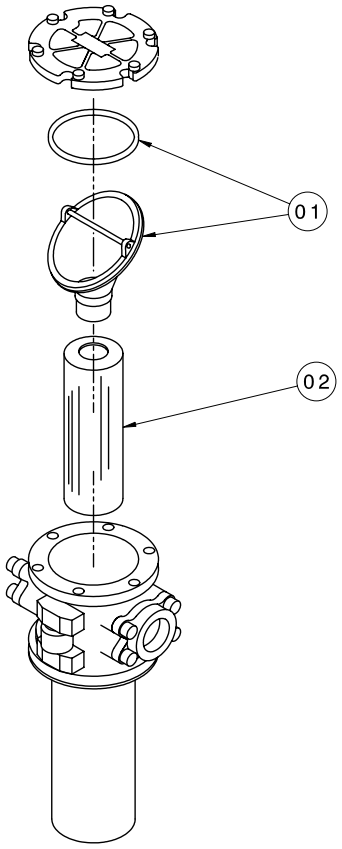

FIGURE 9.5.2 **– Return Filter**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2006-350	O-ring	2
1 & 2	K-3494	Kit, Replacement Filter Element	1

9.5 Filters continued on following page.

9.5 FILTERS *(continued)*

9.5.3 Hand Pump *(Option M)* Filter

Replacement of the hand pump filter element is dictated by frequency of use and the cleanliness of the fluid, along with the environment to which the HPU is exposed. Changing the hand pump filter element at the same time as the pressure filter element will ensure a regular maintenance schedule.

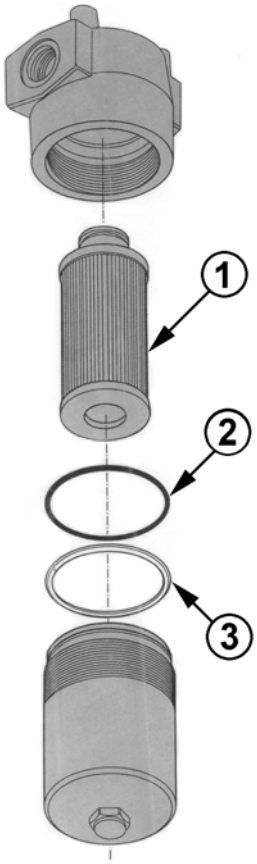

FIGURE 9.5.3 **– Hand Pump (Option M) Filter**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
2	HC-2006-144	O-ring (Bowl)	1
3	*	Backup Ring (Bowl)	1
1 & 2 & 3	K-3752	Kit, Replacement Filter Element	1

* *Part number not released at time of publish. Call Tronair for Part number.*

9.5 Filters continued on following page.

9.5 FILTERS *(continued)*

9.5.4 Desiccant Air Filter

Replace the desiccant/air filter whenever the material inside the element is pink or reddish in color (see Element Label for details).

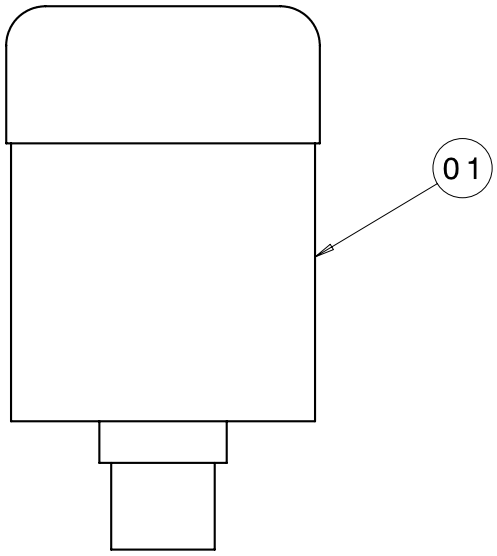

FIGURE 9.5.4 **– Desiccant Air Filter**

PARTS LIST

Item	Part Number	Description	Qty
1	HC-1763	Filter Element	1

9.0 MAINTENANCE *(continued)*

9.6 HYDRAULIC HOSES

Hoses used on the HPU must be periodically inspected for damage, blisters, leaks, or hose end problems. Any damaged or defective hose should be replaced as soon as possible.

Hoses used on Aviation Phosphate Ester, Type IV units have a shorter useful life than hoses used on Mineral Base units. Surface moisture is normal with Aviation Phosphate Ester, Type IV hoses as long as the fluid does not form into drops.

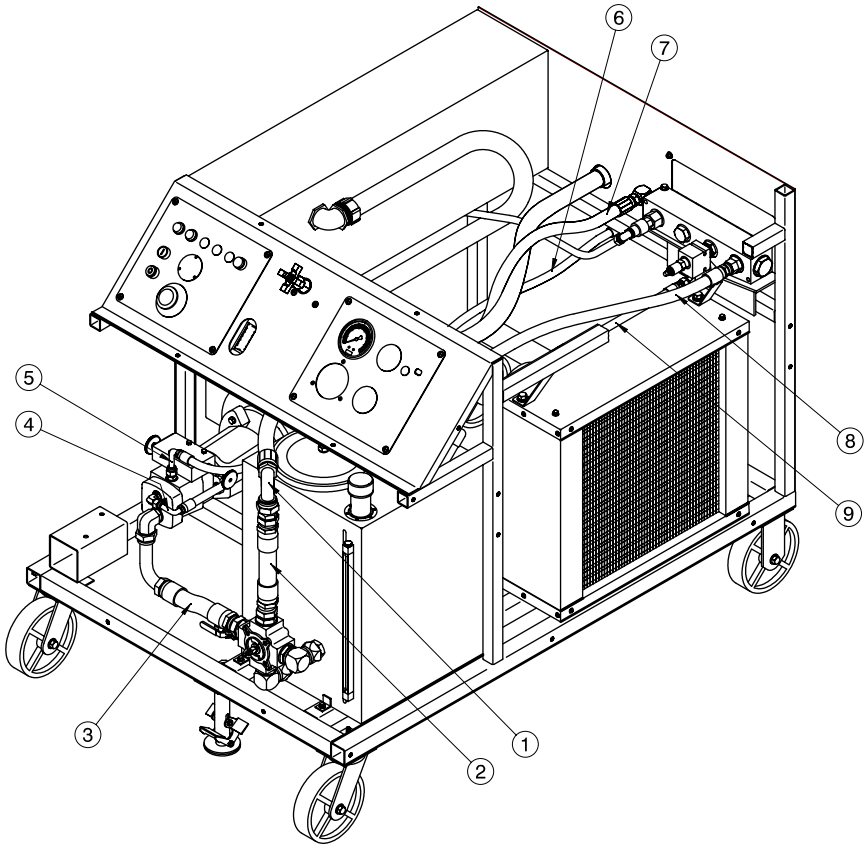

***FIGURE 9.6* – Hydraulic Hoses**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	TF-1040-40*70.0	Assembly, Hose #20	1
2	TF-1041-03*11.0	Assembly, Hose #20	1
3	TF-1040-39*13.3	Assembly, Hose #20	1
4	TF-1041-21*56.5	Assembly, Hose #8	1
5	TF-1041-51*74.0	Assembly, Hose #12	1
6	TF-1041-09*53.0	Assembly, Hose #8	1
7	TF-1040-11*49.0	Assembly, Hose #12	1
8	TF-1040-45*31.0	Assembly, Hose #12	1
9	TF-1041-21*37.5	Assembly, Hose #8	1
Not Shown	TF-1041-09*300	External Pressure Hose	1
Not Shown	TF-1041-15*300	External Return Hose	1

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.7 INSTRUMENT PANEL

Refer to Section ***9.6 Hydraulic Hoses*** concerning hose inspection for general maintenance on Item 3 Hose Assembly.

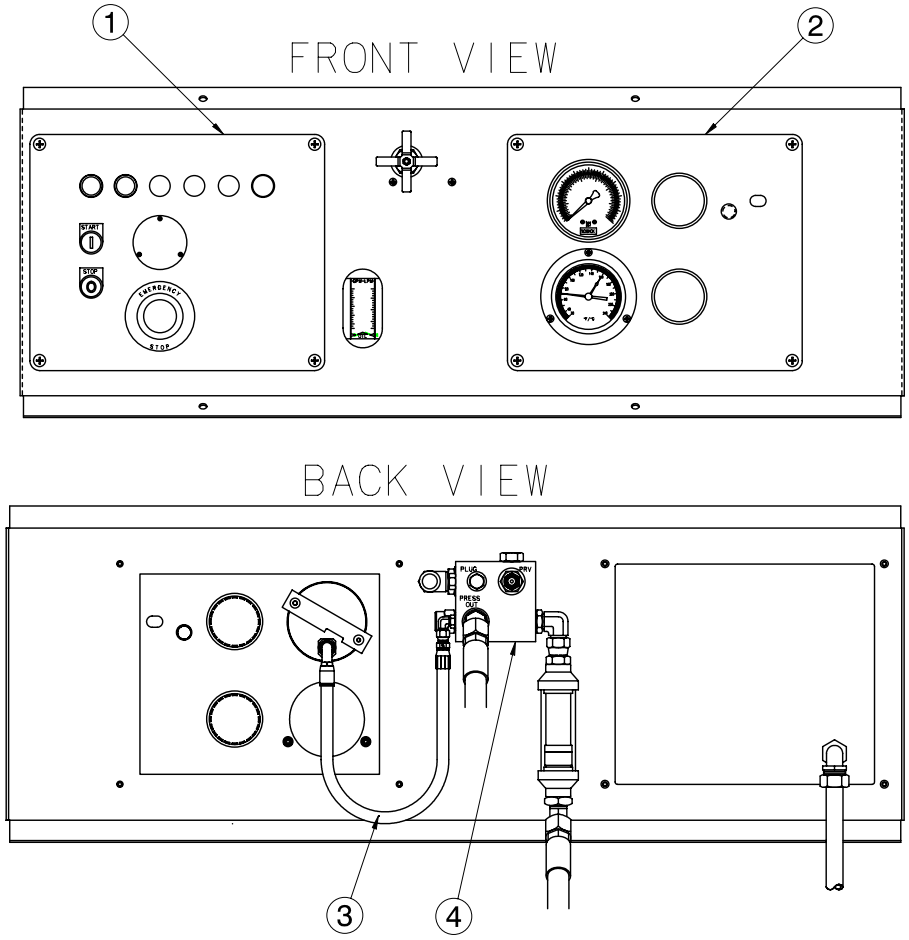

FIGURE 9.7 **– Instrument Panel**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	*See Page 33*	Electric Panel	1
2	*See Page 34*	Hydraulic Panel	1
3	TF-1040-42*32.0	Assembly, Hose #4	1
4	*See Page 35*	Control Block/Flowmeter	1

9.7 INSTRUMENT PANEL *(continued)*

9.7.1 Electric Panel

The Electric Panel does not require regular general maintenance.

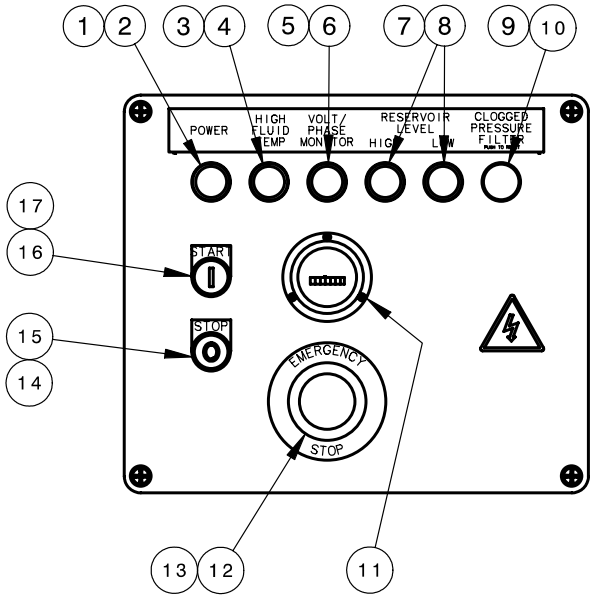

***FIGURE 9.7.1* – Electric Panel**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Component	Part Number	Description	Qty
1	Standard	EC-1521	Power Light Lens	1
2	Standard	EC-1579-03	Power Light (Back)	1
3	Option	EC-1534	High Temperature Light Lens	1
4	Option	EC-1579-04	High Temperature Light (Back)	1
5	Option	EC-1534	Volt/Phase Monitor Light Lens	1
6	Option	EC-1579-04	Volt/Phase Monitor with Indicator Light	1
7	Option	EC-1522	Reservoir Level Light Lens	2
8	Option	EC-1579-05	Reservoir Level Light (Back)	2
9	Standard	EC-1524	Clogged Filter Light Lens	1
10	Standard	EC-1584	Clogged Filter Light (Back)	1
11	Standard	EC-1578	Hour Meter (60 Hz Operation)	1
12	Standard	EC-1523	IEC E-Stop Switch	1
13	Standard	EC-1581	IEC Contact Block (2 N.C.)	1
14	Standard	EC-1526	IEC Stop Switch	1
15	Standard	EC-1582	IEC Contact Block (1 N.C.)	1
16	Standard	EC-1527	IEC Start Switch	1
17	Standard	EC-1583	IEC Contact Block (1 N.O.)	1

9.7 Instrument Panel continued on following page.

9.7 INSTRUMENT PANEL *(continued)*

9.7.2 Hydraulic Panel

Annual calibration of instrumentation is recommended. See Section ***12.0 – Calibration of Instrumentation*** for details of calibration.

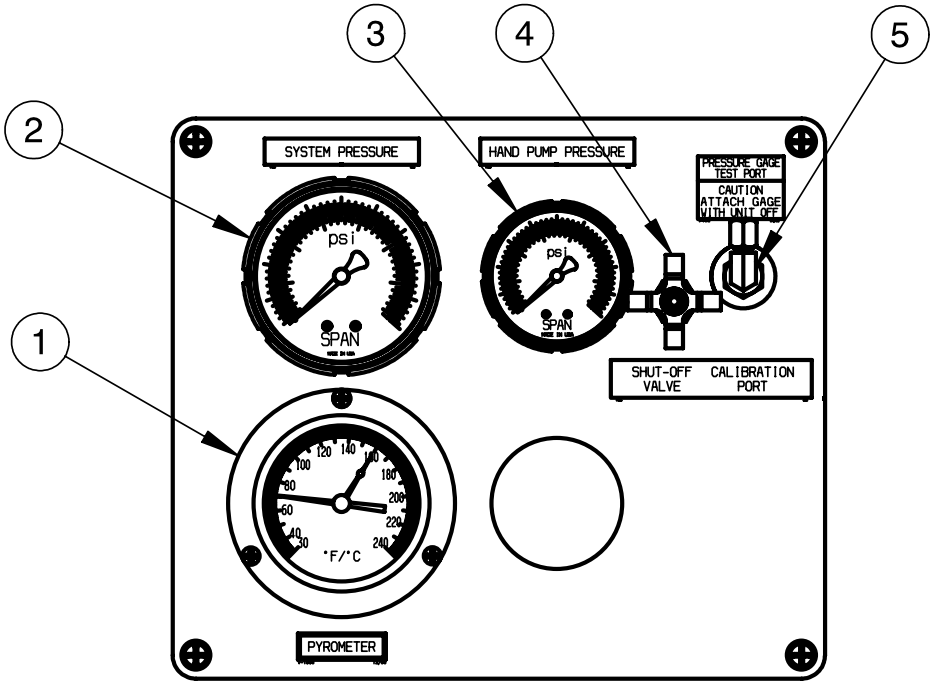

FIGURE 9.7.2 **– Hydraulic Panel**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1769-02	Pyrometer	1
2	HC-2144	System Pressure Gauge	1
3	HC-2146	Pressure Gauge *(Hand Pump Option Only)*	1
4	HC-1900-02	Shut Off Needle Valve*(Calibration Port Option Only)*	1
5	*See Section 9.13.10*	Calibration Port *(Optional)*	1

9.7 INSTRUMENT PANEL *(continued)*

9.7.3 Control Block/Flowmeter

The Control Block components do not require regular general maintenance.

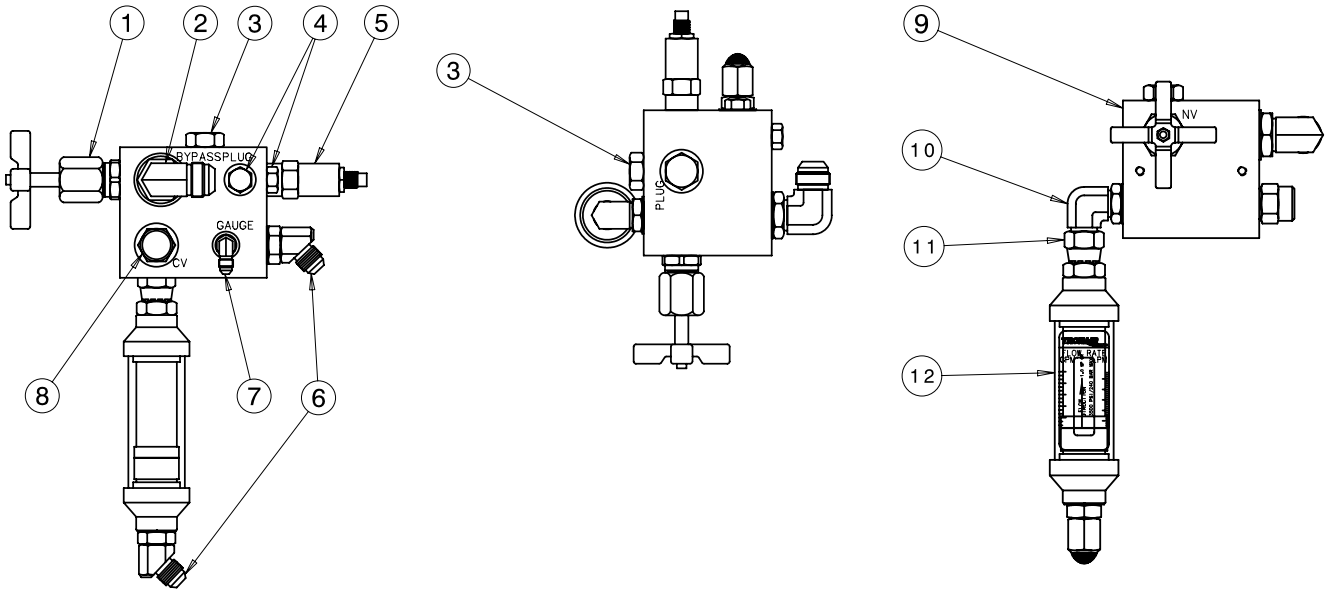

***FIGURE 9.7.3* – Control Block/ Flowmeter**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1927-05	Needle Valve	1
2	N-2001-18-S-E	Elbow, Straight Thread (#12)	1
3	N-2066-10-S-E	O-ring Hex Plug (#10)	2
4	N-2066-06-S-E	Plug, O-ring Hex (#6)	2
5	HC-2149	Pressure Relief Valve	1
6	N-2042-07-S-E	Elbow, 45 Straight Thread (#8-10)	2
7	N-2001-03-S-E	Elbow, Straight Thread (#4)	1
8	HC-1677	Check Valve	1
9	J-3399	Pressure Manifold	1
10	N-2001-15-S-E	Elbow, Straight Thread ((#10)	1
11	N-2036-07-S-E	Swivel, 37° Female (#10)	1
12	HC-2131	Flowmeter, 10 gpm/3,000 psi	1

9.7.3 Control Block/Flowmeter continued on following page.

9.7 INSTRUMENT PANEL *(continued)*

9.7.3.a System Pressure Relief Valve

The System Pressure Relief Valve does not require regular general maintenance. It is possible however, for a contaminant to hold the relief valve in a partially open condition. If service is required, the new or repaired relief valve must be reset to 3,250 psig.

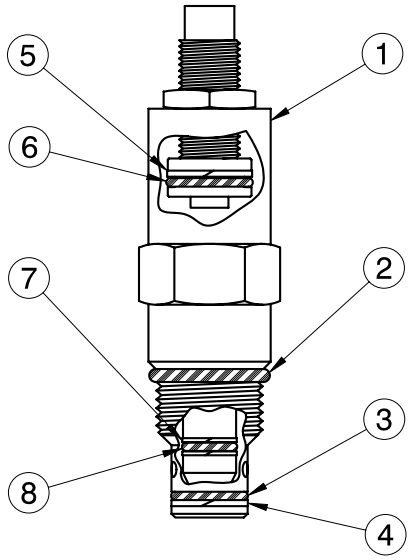

***FIGURE 9.7.3.a* – System Pressure Relief Valve**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2149	Pressure Relief Valve *(Not Set)*	1
2	HC-2013-910	O-ring, Series 3	1
3	HC-2006-014	O-ring, Series 2	1
4	HC-2020-014	Backup Ring *(Teflon)*	1
5	HC-2020-015	Backup Ring *(Teflon)*	1
6	HC-2006-015	O-ring, Series 2	1
7	HC-2020-011	Backup Ring *(Teflon)*	2
8	HC-2006-011	O-ring, Series 2	1

9.7 INSTRUMENT PANEL *(continued)*

9.7.3.b Check Valve

The Check Valve does not require regular general maintenance.

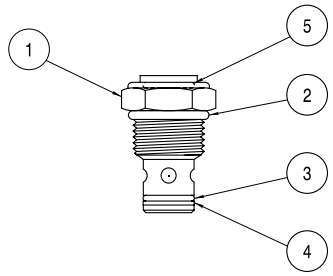

***FIGURE 9.7.3.b* – Check Valve**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1677	Check Valve	1
2	HC-2013-910	O-ring, Series 3	1
3	HC-2006-014	O-ring, Series 2	1
4	HC-2020-014	Backup Ring	1
5	HC-2013-905	O-ring, Series 3	1

9.7.3.c Bypass Valve

The Bypass Valve does not require regular general maintenance.

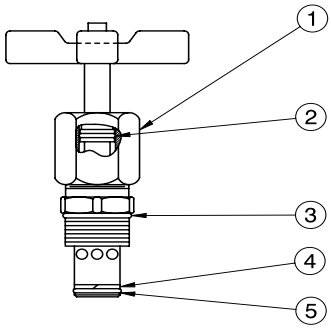

***FIGURE 9.7.3.c* – Bypass Valve**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1927-05	Needle Valve	1
2	HC-2006-111	O-ring	1
3	HC-2013-912	O-ring	1
4	HC-2020-114	Backup Ring	1
5	HC-2006-114	O-ring	1

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.8 RESERVOIR ASSEMBLY

Replace the desiccant air filter whenever the material inside the element is pink or reddish in color (See Element label for details). The Reservoir Assembly does not require regular general maintenance. If periodic inspections for silt are desired, be certain to thoroughly clean the dome cover and surrounding area before removing the dome cover. The Selector Valve (Item 9) is not field serviceable.

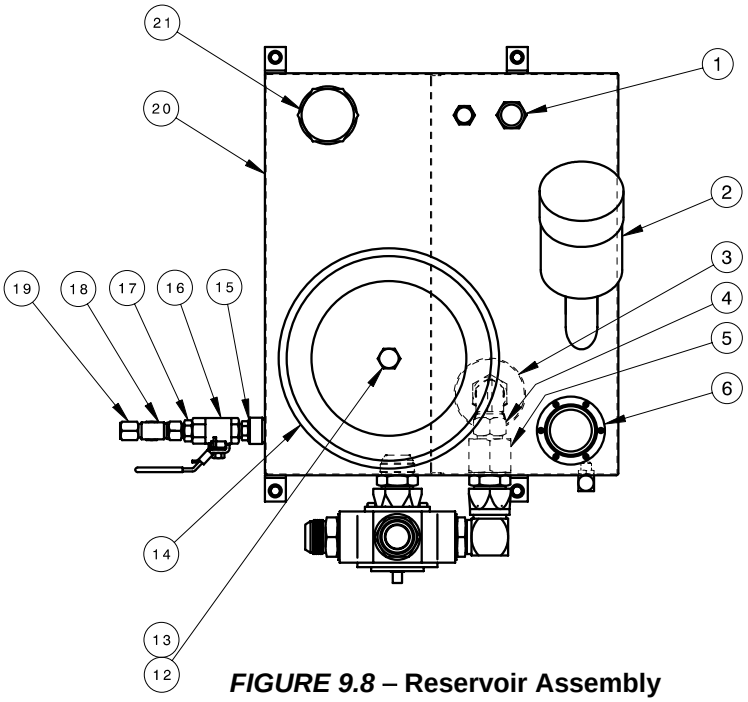

FIGURE 9.8 **– Reservoir Assembly**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	N-2008-08-S	Cap, #12	1
2	HC-1763	Desiccant Filter	1
3	HC-1397-02	Diffuser, 1" NPT	1
4	N-2035-08-S	Elbow, Swivel Male, #16 JIC x 1" NPT	1
5	N-2055-25-S	Tube Reducer, #20 x #16 JIC	1
6	HC-2193-06	Filler, Non-vented	1
12	H-1735-02	Washer, Nylon	1
13	G-1100-110016	Bolt, Hex Head, Grade 5, 5/8-11 x 1 ¾" long	1
14	H-1741	Cover Assembly	1
15	HC-2013-908	O-ring, Series 3	1
16	HC-1761	Ball Valve, SAE #8 Lockable	1
17	N-2007-11-S-E	Connector, Straight Thread #8 SAE x #8 JIC	1
18	N-2016-06-S-E	Tee, Swivel Run, #8 JIC	1
19	N-2008-06-S	Cap, #8	3
20	Z-5525	Reservoir, 30 gallon (113.4 lt)	1
21	N-2206-09-S	Plug, Hex Head, 2" NPT	1

9.0 MAINTENANCE *(continued)*

9.8 RESERVOIR ASSEMBLY

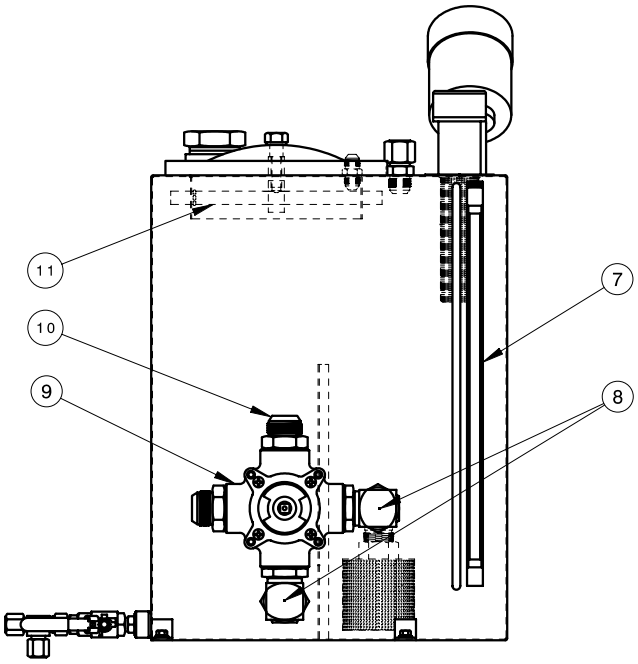

FIGURE 9.8 **– Reservoir Assembly**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
7	HC-1383-18	Sight Gauge	1
8	N-2049-20-S-E	Elbow, 90° Swivel, #20	2
9	HC-1764-02	Selector Valve, #20 SAE	1
10	N-2007-28-S-E	Connector, Straight Thread #20 SAE	2
11	Z-2394-01	Clamp Assembly	1

9.0 MAINTENANCE *(continued)*

9.9 RETURN MANIFOLD ASSEMBLY

The Return Manifold does not require regular general maintenance.

NOTE: DO NOT attempt to adjust the Return System Pressure Relief Valve. See Section 9.9.1 – Return System Pressure Relief Valve for details.

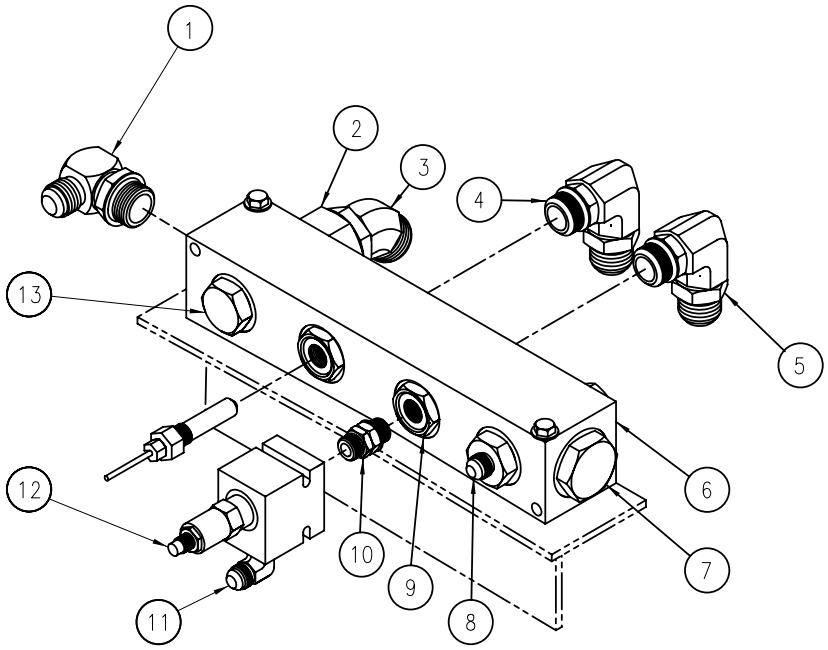

***FIGURE 9.9* – Return Manifold Assembly**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	N-2001-37-S-E	Elbow, Straight #12 JIC x #20 SAE	1
2	N-2463-18-S-E	Reducer/Expander Fitting, 16/20 SAE	1
3	N-2042-13-S-E	Elbow, 45° Straight Thread #20 SAE x #20 JIC	1
4	N-2638-06-S-E	Elbow, 90° #16 SAE x #16 SAE	2
5	N-2007-21-S-E	Connector, Straight Thread #16 SAE x #12 JIC	2
6	HC-1916	Return Manifold	1
7	N-2053-11-S-E	O-ring Plug, Hex Head, #20	1
8	N-2007-21-S-E	Connector, Straight Thread #16 SAE x #12 JIC	1
9	N-2463-16-S-E	Reducer/Expander Fitting, 16/8 SAE	2
10	N-2464-06-S-E	Union, Straight Thread #8 x #8 SAE	1
11	N-2001-11-S-E	Elbow, Straight Thread, #8 SAE x #8 JIC	1
12	HC-2200	Pressure Relief Valve (Pre-set)	1
13	N-2053-10-S-E	O-ring Plug, Hex Head #16	2

9.9 RETURN MANIFOLD ASSEMBLY *(continued)*

9.9.1 Return System Pressure Relief Valve

The Return System Pressure Relief Valve can be purchased as a preset assembly. If the relief valve is serviced by the end user, the valve must be set to crack at 150+/-7 psig **before** being re-installed on the HPU.

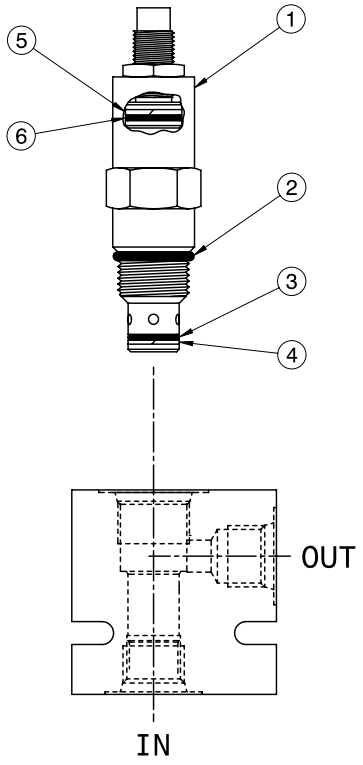

FIGURE 9.9.1 **– Return System Pressure Relief Valve**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2200	Pressure Relief Valve *(includes Valve Block)*	1
2	HC-2013-910	O-ring, Series 3	1
3	HC-2006-014	O-ring, Series 2	1
4	HC-2020-014	Backup Ring (Teflon)	1
5	HC-2020-015	Backup Ring (Teflon)	1
6	HC-2006-015	O-ring, Series 2	1

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.10 ELECTRICAL COMPONENTS

Regularly inspect the external power cord for nicks, cuts, abrasion, and fluid damage. Replace power cord if damage is found. See Section ***10.0 – Provision of Spares*** for recommended spare fuses.

Reference Pages 44 & 45 for Parts List.

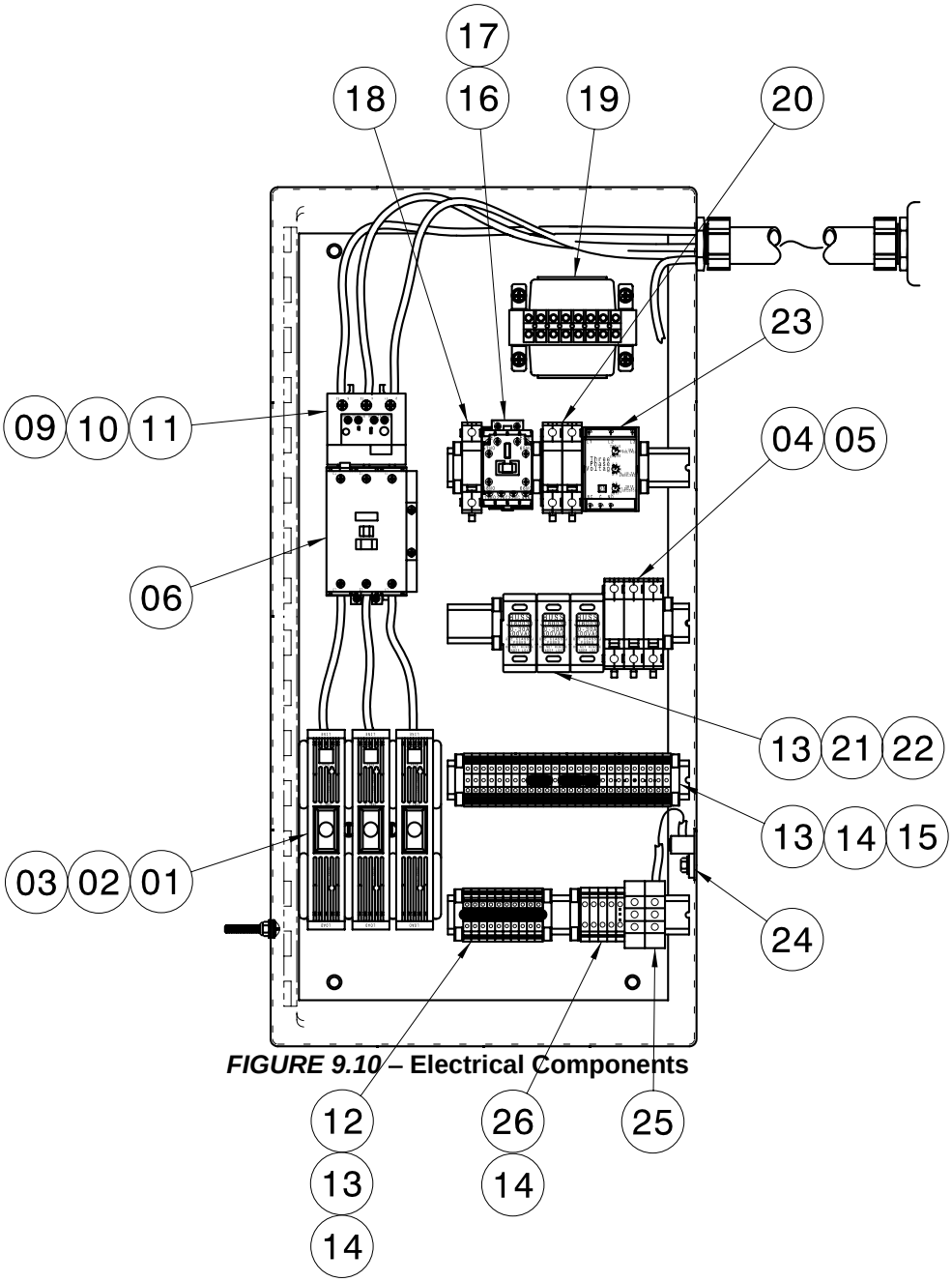

FIGURE 9.10 **– Electrical Components**

1 Set Item 06 to "Auto" and set "A2" to its corresponding full load amps. Wire per Appendix - Electrical Schematic INS-1725 and wire diagram INS-1747.

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9.10 ELECTRICAL COMPONENTS *(continued)*

PARTS LIST

Item	60 Hz Applications					Description	Qty
	208	230	380	460	575		
1	EC-1585-12	EC-1585-12	EC-1585-12	EC-1585-02	EC-1585-02	Cover, SAMI Fuse	3
2	EC-1557-30	EC-1557-30	EC-1557-27	EC-1557-25	EC-1557-24	Fuse, Class J	3
3	EC-1563	EC-1563	EC-1563	EC-1674	EC-1674	Fuse Block, Class J	1
4	EC-1541-01	EC-1541-01	EC-1541-01	EC-1541-01	EC-1541-01	Fuse Holder, IEC Class CC	*Ref*
5	EC-1675-12	EC-1675-12	EC-1675-12	EC-1675-12	EC-1675-12	Fuse, KTK-R 2 amp (*Optional*)	*Ref*
6	EC-1587	EC-1586	EC-1586	EC-1586	EC-1586	Contactor, IEC Motor	1
7	-	-	-	-	-	Not Applicable	-
8	-	-	-	-	-	Not Applicable	-
9	EC-1525	EC-1589	EC-1589	EC-1589	EC-1589	Relay, Overload	1
10	EC-1604	EC-1604	EC-1604	EC-1604	EC-1604	Shield, Current Adjustment	1
11	EC-1603	EC-1603	EC-1603	EC-1603	EC-1603	Shield, Anti-Tamper	1
12	EC-1515-03	EC-1515-03	EC-1515-03	EC-1515-03	EC-1515-03	Block, IEC Terminal, Blue	10
13	EC-1588	EC-1588	EC-1588	EC-1588	EC-1588	Anchor, IEC, End	7
14	EC-1520-01	EC-1520-01	EC-1520-01	EC-1520-01	EC-1520-01	Barrier, End	3
15	EC-1515-02	EC-1515-02	EC-1515-02	EC-1515-02	EC-1515-02	Block, IEC Terminal Red	28
16	EC-1591-04	EC-1591-04	EC-1591-04	EC-1591-04	EC-1591-04	Latch, Mechanical	1
17	EC-1564	EC-1564	EC-1564	EC-1564	EC-1564	Relay, Control	1
18	EC-1542-04	EC-1542-04	EC-1542-04	EC-1542-04	EC-1542-04	Fuse, LP-CC Low Peak 1 A (*Secondary*)	1
19	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	Transformer, Control (100 W)	1
20	EC-1542-05	EC-1542-04	EC-1542-02	EC-1542-01	EC-1542-01	Fuse, Class CC (*Primary*)	2
21	EC-1596-01	EC-1596-01	EC-1596-01	EC-1596-01	EC-1596-01	Fuse Holder, Class J	3
22	EC-1557-02	EC-1557-02	EC-1557-01	EC-1557-01	EC-1557-01	Fuse, Class J (Heat Exchanger)	3
23	EC-1543-02	EC-1543-02	EC-1543-03	EC-1543-04	EC-1543-05	Monitor, Phase (*Optional*)	*Ref*
24	EC-1532-02	EC-1532-02	EC-1532-02	EC-1532-02	EC-1532-02	Lug, Ground	1
25	EC-1594	EC-1594	EC-1594	EC-1594	EC-1594	Block, IEC Ground	2
26	EC-1528	EC-1528	EC-1528	EC-1528	EC-1528	Block, IEC Ground	5
27	H-2445	H-2445	H-2445	H-2445	H-2445	Seal	1
28	EC-1227-03*0600	EC-1227-03*0600	EC-1171-03*0600	EC-1171-03*0600	EC-1171-02*0600	Power Cord (*Not Shown*)	1

9.10 Electrical Components continued on following page.

9.10 ELECTRICAL COMPONENTS *(continued)*

PARTS LIST

Item	50 Hz Applications					Description	Qty
	200	220	380	415	440		
1	EC-1585-12	EC-1585-12	EC-1585-02	EC-1585-02	EC-1585-20	Cover, SAMI Fuse	3
2	EC-1557-31	EC-1557-31	EC-1557-26	EC-1557-26	EC-1557-26	Fuse, Class J	3
3	EC-1563	EC-1563	EC-1674	EC-1674	EC-1674	Fuse block, class J	1
4	EC-1541-01	EC-1541-01	EC-1541-01	EC-1541-01	EC-1541-01	Fuse Holder, IEC Class CC	*Ref*
5	EC-1675-12	EC-1675-12	EC-1675-12	EC-1675-12	EC-1675-12	Fuse, KTK-R 2 amp (*Optional*)	*Ref*
6	EC-1586	EC-1586	EC-1586	EC-1586	EC-1586	Contactor, IEC Motor	1
7	-	-	-	-	-	Not Applicable	-
8	-	-	-	-	-	Not Applicable	-
9	EC-1589	EC-1589	EC-1589	EC-1589	EC-1589	Relay, Overload	1
10	EC-1604	EC-1604	EC-1604	EC-1604	EC-1604	Shield, Current Adjustment	1
11	EC-1603	EC-1603	EC-1603	EC-1603	EC-1603	Shield, Anti-Tamper	1
12	EC-1515-03	EC-1515-03	EC-1515-03	EC-1515-03	EC-1515-03	Block, IEC Terminal, Blue	10
13	EC-1588	EC-1588	EC-1588	EC-1588	EC-1588	Anchor, IEC, End	7
14	EC-1520-01	EC-1520-01	EC-1520-01	EC-1520-01	EC-1520-01	Barrier, End	3
15	EC-1515-02	EC-1515-02	EC-1515-02	EC-1515-02	EC-1515-02	Block, IEC Terminal Red	28
16	EC-1591-04	EC-1591-04	EC-1591-04	EC-1591-04	EC-1591-04	Latch, Mechanical	1
17	EC-1564	EC-1564	EC-1564	EC-1564	EC-1564	Relay, Control	1
18	EC-1542-04	EC-1542-04	EC-1542-04	EC-1542-04	EC-1542-04	Fuse, LP-CC Low Peak 1 A (*Secondary*)	1
19	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	Transformer, Control (100 W)	1
20	EC-1542-06	EC-1542-05	EC-1542-02	EC-1542-02	EC-1542-01	Fuse, Class CC (*Primary*)	2
21	EC-1596-01	EC-1596-01	EC-1596-01	EC-1596-01	EC-1596-01	Fuse Holder, Class J	3
22	EC-1557-04	EC-1557-04	EC-1557-01	EC-1557-01	EC-1557-01	Fuse, Class J (Heat Exchanger)	3
23	EC-1543-02	EC-1543-02	EC-1543-03	EC-1543-04	EC-1543-04	Monitor, Phase (*Optional*)	*Ref*
24	EC-1532-02	EC-1532-02	EC-1532-02	EC-1532-02	EC-1532-02	Lug, Ground	1
25	EC-1594	EC-1594	EC-1594	EC-1594	EC-1594	Block, IEC Ground	2
26	EC-1528	EC-1528	EC-1528	EC-1528	EC-1528	Block, IEC Ground	5
27	H-2445	H-2445	H-2445	H-2445	H-2445	Seal	1
28	EC-1227-05*0600	EC-1227-03*0600	EC-1171-03*0600	EC-1227-02*0600	EC-1171-03*0600	Power Cord (*Not Shown*)	1

9.0 MAINTENANCE *(continued)*

9.11 HEAT EXCHANGER ASSEMBLY

The Heat Exchanger Assembly does not require regular general maintenance.

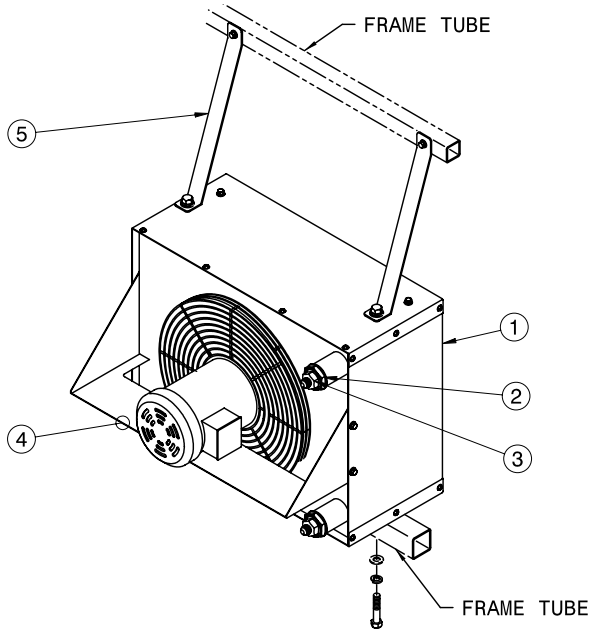

FIGURE 9.11 **– Heat Exchanger Assembly**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	*Reference Table below*	Heat Exchanger	1
2	N-2463-20-S-E	Reducer, #20 x #12 SAE	1
3	N-2007-18-S-E	Connector, #12 JIC Flare	2
4	N-2066-20-S-E	Plug, #20 SAE *(Hidden)*	1
5	J-3403-01	Strap	2

Voltage	Frequency	Part Number
208v	60 Hz	HC-2136-01
230v	60 Hz	HC-2136-01
380v	60 Hz	HC-2136-01
460v	60 Hz	HC-2136-01
575v	60 Hz	HC-2136-02
200v	50 Hz	HC-2136-01
220v	50 Hz	HC-2136-01
380v	50 Hz	HC-2136-01
415v	50 Hz	HC-2136-01
440v	50 Hz	HC-2136-01

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.12 EXTERNAL COMPONENTS

Keep HPU clean. Do not allow labels to become damaged; thusly illegible. Regularly inspect casters and floor locks to ensure safe working condition.

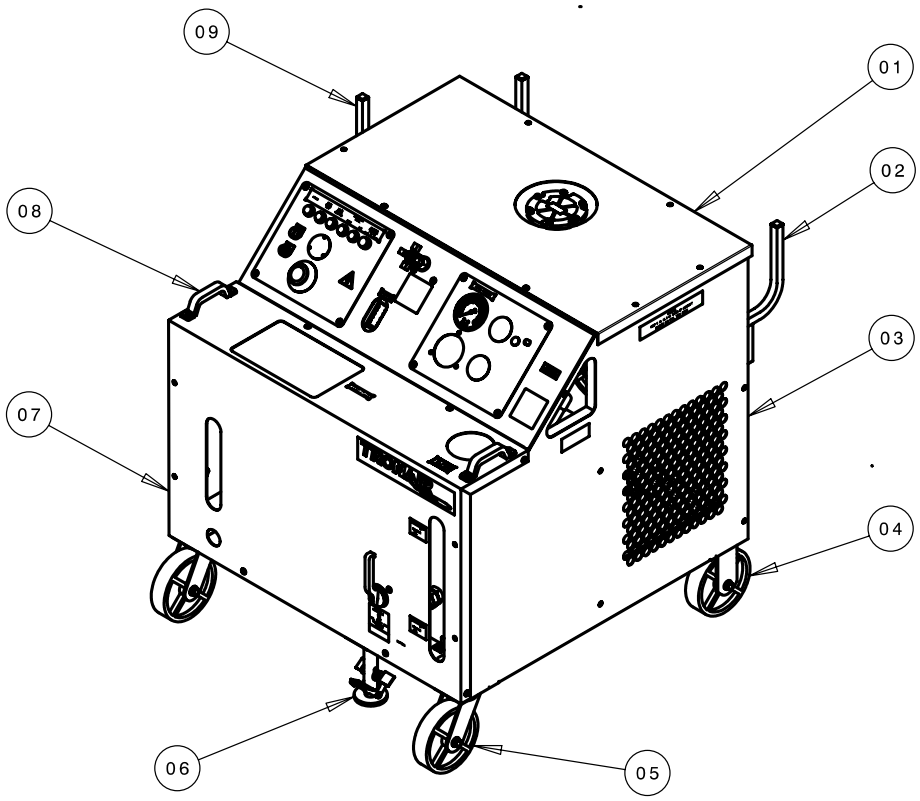

FIGURE 9.12 **– External Components**

PARTS LIST

Fluid Type: MIL-PRF-83282

Item	Part Number	Description	Qty
1	S-1889-01	Top Panel	1
2	Z-5772-01	Hanger	2
3	S-1887-01	Right Side Panel	1
4	U-1093	Rigid Caster	2
5	U-1094	Swivel Caster	2
6	H-1142	Floor Lock	1
7	S-1883-01	Front Panel	1
8	H-1780	Handle	1
9	Z-5549-01	Cord Hanger	1
Not Shown	S-1884-01	Left Side Panel	1
Not Shown	Z-5775-01	Frame	1

9.0 MAINTENANCE *(continued)*

9.13 DUAL SYSTEM ASSEMBLY

Refer to Section ***9.6 Hydraulic Hoses*** concerning hose inspection.

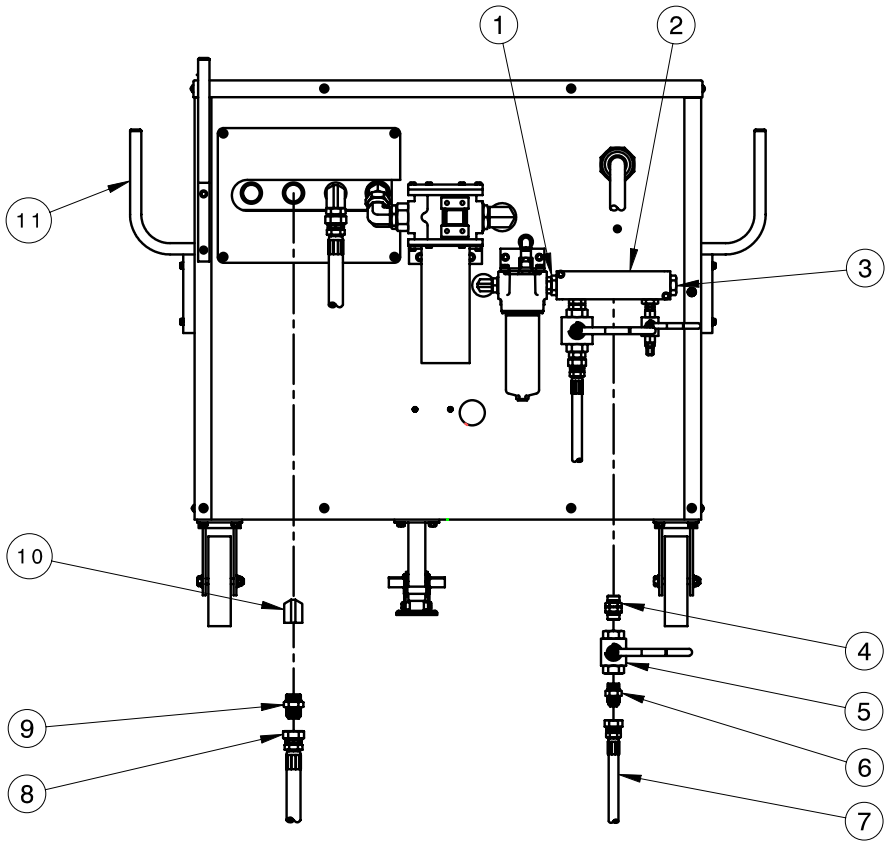

FIGURE 9.13 **– Dual System**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	N-2464-14-S-E	Union, Male Straight Thread #12 x #16	1
2	HC-1908	Pressure Manifold (Plated)	1
3	N-2053-10-S-E	Plug, Male Straight Thread #16	1
4	N-2464-08-S-E	Union, Male Straight Thread #12	2
5	HC-1771-04	Ball Valve	2
6	N-2007-14-S-E	Connector, Straight Thread #12 x #8 JIC	2
7	TF-1041-09*300	Pressure Hose Assembly, #8	3
8	TF-1041-15*300	Return Hose Assembly, #12	3
9	N-2007-21-S-E	Connector, Straight Thread #16 x #12 JIC	2
10	N-2638-06-S-E	Elbow, 90° #16 M-SAE x #16 F-SAE	2
11	Z-5549-01	Weldment, Hose Hanger	4

9.0 Maintenance continued on following page.

9.0 MAINTENANCE *(continued)*

9.14 ELECTRIC FILTER CLOGGING INDICATOR

The Electric Filter Clogging Indicator does not require regular general maintenance. The panel light will illuminate when the clogging indicator senses a 50 psi differential pressure across the filter element. Installing a new filter element will eliminate the clogged condition. Pushing the illuminated button will reset the indicator light.

NOTES: 1) Higher flow rates will result in higher differential pressures. (Example: The clogging indicator may sense a 50 psi differential pressure at a flow rate of 10 gpm but not show a clogged condition when the flow rate is reduced to 5 gpm.

2) Wire per Electrical Schematic INS-1725. Reference Wiring Diagram INS-1746. Reference 9.7.1 Electric Panel (Page 33) for Panel Light.

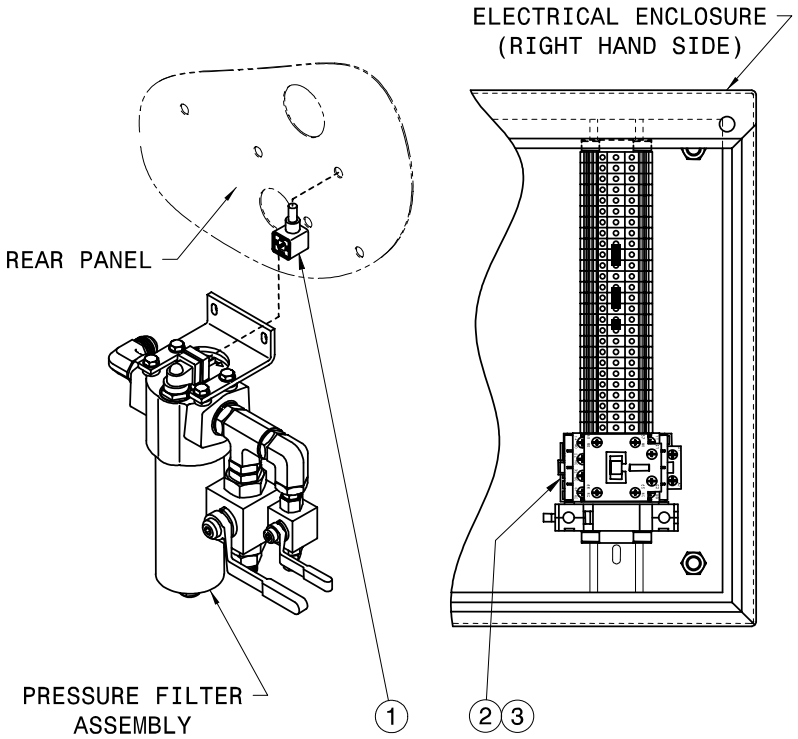

***FIGURE 9.14* – Electric Filter Clogged Indicator**

PARTS LIST

Item	Part Number	Description	Qty
1	EC-1778	DIN Connector Cable	1
2	EC-1564	Relay, Control	1
3	EC-1591-04	Latch, Mechanical	1

9.0 MAINTENANCE *(continued)*

9.15 ADDITIONAL FEATURES

9.15.1 Voltage/Phase Monitor *(Options G – J)*

The Voltage/Phase Monitor does not require regular general maintenance. The panel indicator light will illuminate if a tripped condition exists. If the Voltage/Phase Monitor is causing the HPU to shut off, verify the ♦Phase Monitor settings shown. Continued tripping may indicate a serious electrical problem. See Section ***10.0 – Provision of Spares*** for recommended spare fuses.

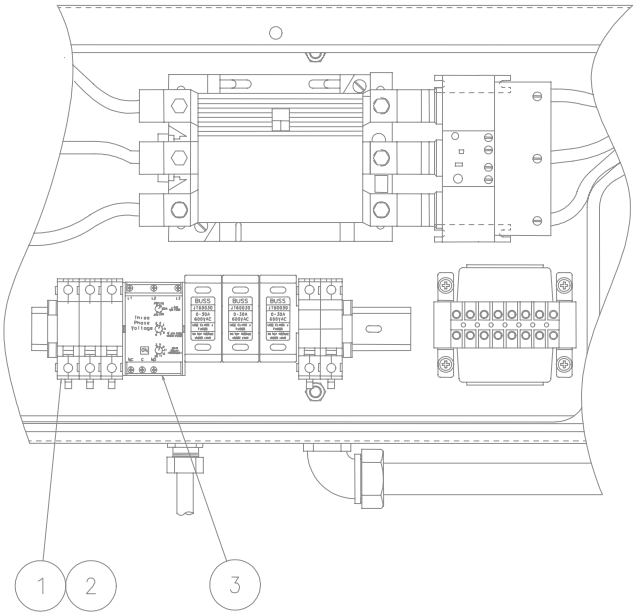

FIGURE 9.15.1 **– Voltage/Phase Monitor**

NOTE: Wire per Electrical Schematic INS-1725. Reference Wiring Diagram INS-1746. Reference Section 9.7.1 Electrical Panel (Page 33) for Panel Light.

PARTS LIST

Item	Part Number	Description	Qty
1	EC-1541-01	Fuse Holder, IEC Class CC	3
2	EC-1675-12	Fuse, KTK, 2 amp	3
♦ 3	*See Table below*	Phase Monitor	1

Phase Monitor

Option	Voltage	Frequency	Part Number
G	200 – 230	50/60 Hz	EC-1543-02
H	380	50/60 Hz	EC-1543-03
I	415 – 460	50/60 Hz	EC-1543-04
J	575	60 Hz	EC-1543-05

♦ Setting Instructions for Item 3:

1. Set ***Line Voltage*** to match the voltage rating of the Hydraulic Power Unit.
2. Set ***% Voltage Unbalanced*** to 5% for 60 Hz unit or 6% for 50 Hz unit.
3. Set ***Trip Delay*** to three (3) seconds.

9.15. Additional Features continued on following page.

9.15 ADDITIONAL FEATURES *(continued)*

9.15.2 Electric Reservoir Level *(Option L)*

The Electric Reservoir Level switch does not require regular general maintenance. Panel indicator lights will indicate low or high fluid level.

NOTE: Wire per Electrical Schematic INS-1608. Reference Wiring Diagram INS-1746. Reference 9.7.1 Electrical Panel (Page 33) for Panel Light.

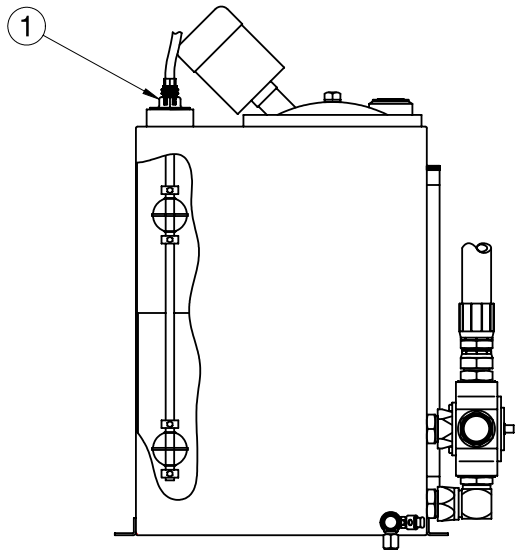

***FIGURE 9.15.2* – Electric Reservoir Level**

PARTS LIST

Item	Part Number	Description	Qty
1	EC-1798	Multi-Level Switch *(includes Plug-in Cable)*	1

9.15 ADDITIONAL FEATURES *(continued*)

9.15.3 Hand Pump *(Option M)*

Refer to Section ***9.6 Hydraulic Hoses*** concerning hose inspection for general maintenance on Items 5, 10, 12, and 14 hose assemblies. Refer to Section ***9.5.3 – Hand Pump*** *(Optional)* ***Filter*** .

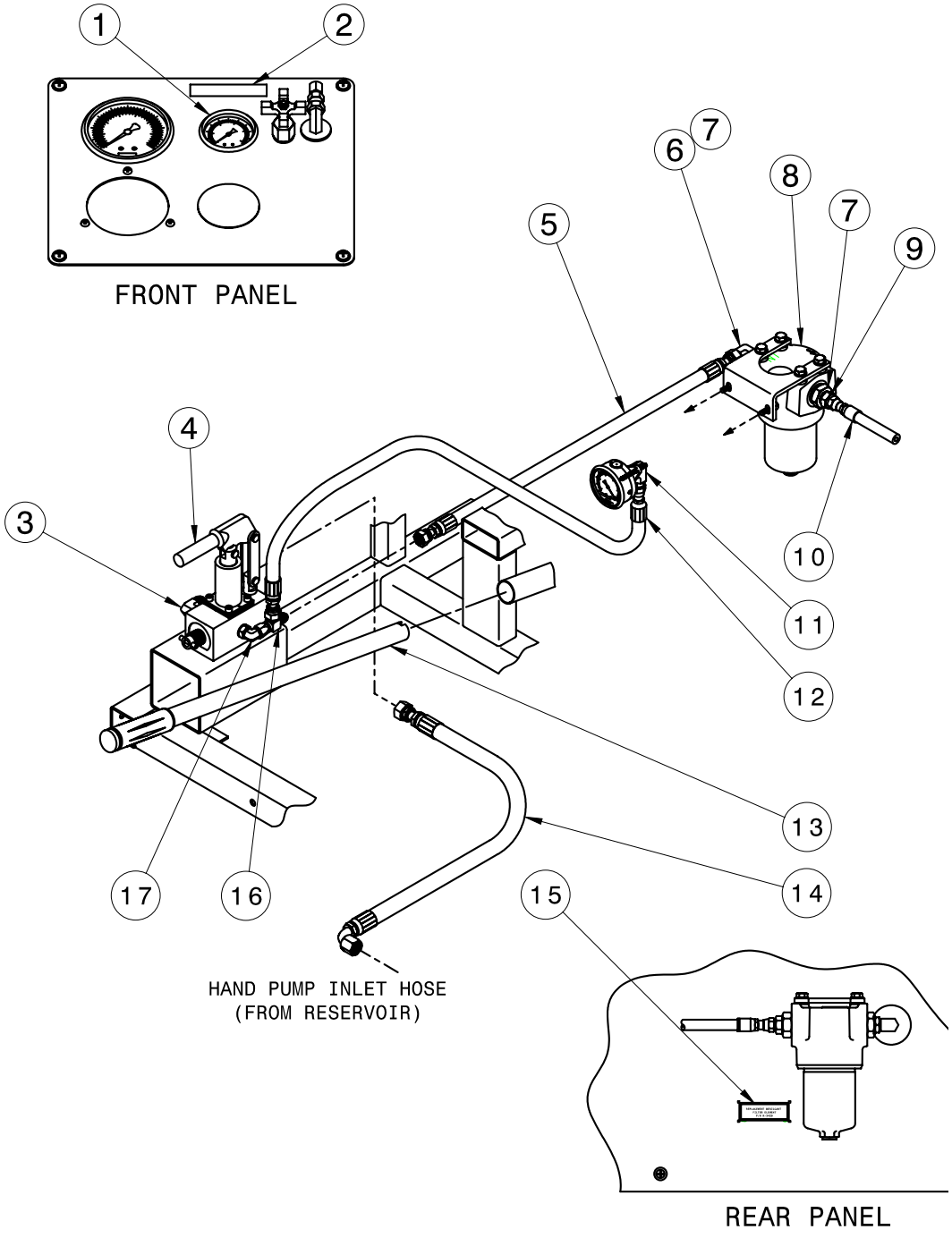

FIGURE 9.15.3 **– Hand Pump**

9.15.3 Hand Pump continued on following page.

9.15.3 Hand Pump *(Option M) (continued)*

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2146	Pressure Gauge	1
2	V-1887	Label, Hand Pump Pressure	1
3	N-2001-11-S-E	Elbow, #8 SAE x #8 JIC Flare	1
4	HC-1779	Hand Pump, Two Stage	1
5	TF-1041-05*66.0	Hose Assembly, #4	1
6	N-2001-09-S-E	Elbow, #8 SAE x #6 JIC Flare	1
7	N-2463-10-S-E	Reducer Fitting	2
8	HC-1777	Pressure Filter	1
9	N-2007-06-S-E	Fitting, Male Connector	1
10	TF-1041-05*180	Hose Assembly, #4	1
11	N-2002-03-S	Elbow, Swivel Nut	1
12	TF-1041-05*54.0	Hose Assembly, #4	1
13	H-1009-01	Pump Handle	1
14	TF-1041-25*32.5	Hose Assembly, #8	1
15	V-1989	Label, Filter Replacement	1
16	N-2016-05-S	Tee, Swivel Nut, #6	1
17	N-2001-08-S-E	Elbow, #6 SAE x #6 JIC Flare	1

9.15.3 Hand Pump *(Option M) (continued)*

9.15.3.a Two Stage Pump with Relief

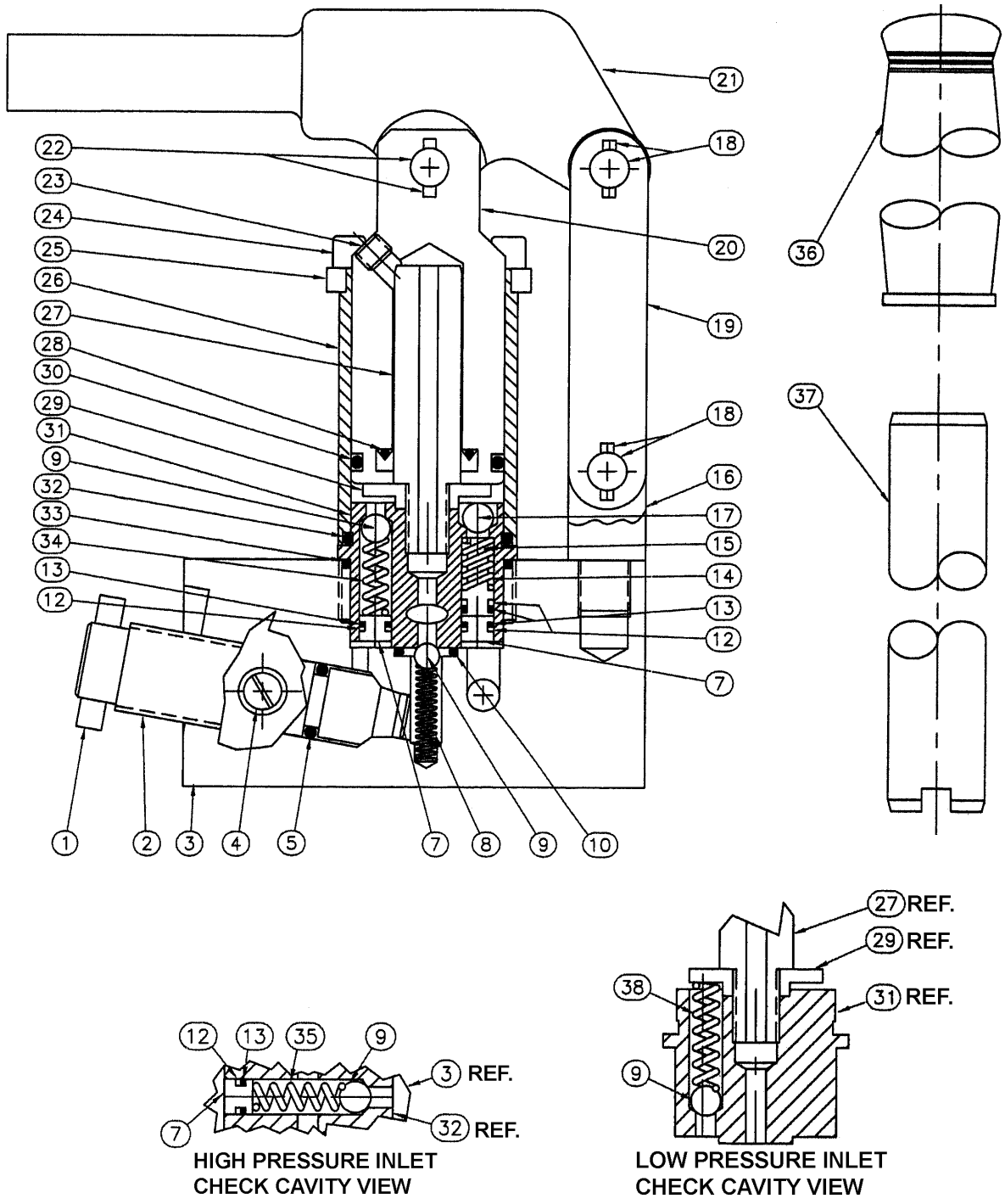

FIGURE 9.15.3.a **– Two Stage Pump with Relief**

9.15.3.a Hand Pump continued on following page

9.15.3.a Two Stage Pump with Relief *(continued)*

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	519-000	Pin	1
3	CXC-990022-001	Body	1
7	505-001	Plug, Valve Body	3
15	571-121	Piston, Bypass Assembly	1
16	508-000	Pivot	1
20	566-125	Piston L.P.	1
23	583-120	Plug	1
24	09-ADDF-04-20 X 56	Tie Rod	4
25	582-125	Flange	1
26	563-121	Tube	1
27	562-125	H.P. Piston	1
29	564-120	Retainer	1
31	560-120	Valve Body	1
36	H-1223	Grip, Handle	1
37	H-1009-01	Handle with Grip	1
	HK-1095	**Kit, Internal Parts**; *consists of*:	
6	*(Not Shown)*	Ball, Release	0
8		Spring, Outlet Check	1
9		Ball, Check	4
14		Spring, Bypass	1
17		Ball, Bypass	1
34		Spring, L.P. Outlet	1
35		Spring, H.P. Outlet	1
38		Spring, Intake L.P.	1
	HK-1030	**Kit, Pump Seal**; *consists of:*	
5		O-ring, EPR	1
10		O-ring, EPR	1
12		Backup Ring (Teflon)	4
13		O-ring, EPR	4
28		H.P. Piston Seal	1
30		O-ring, EPR	1
32		O-ring, EPR	1
33		O-ring, EPR	1
	HK-1068	**Kit, Pump Linkage**; *consists of:*	
18		Pin Linkage Assembly	2
19		Strap	2
21		Handle Bracket	1
22		Clevis Pin Assembly	1
	HK-3117	**Kit, Release Screw**; *consists of:*	
2		Screw, Release/Relief	1
4		Retainer, Release Screw	1

9.15 ADDITIONAL FEATURES *(continued)*

9.15.4 Calibration Port *(Option Q)*

Refer to Section ***9.6 Hydraulic Hoses*** concerning hose inspection.

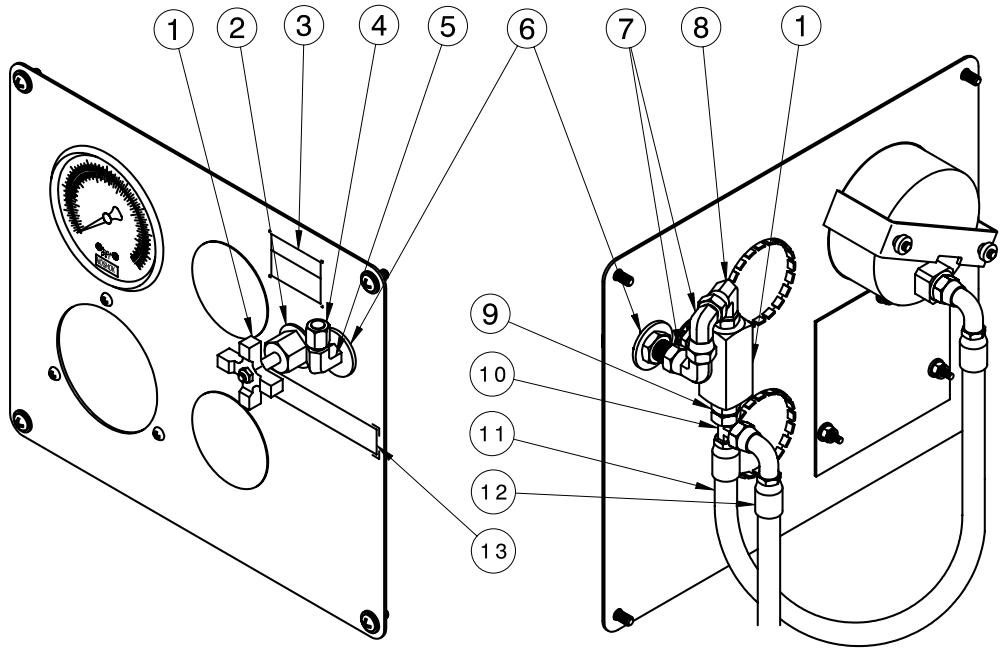

FIGURE 9.15.4 **– Calibration Port**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1900-02	Needle Valve	1
2	HC-1122	Kit, Panel Mounting (MVK-4)	1
3	V-1470	Label, Caution	1
4	N-2008-03-S	Cap, ¼, #4 JIC	1
5	N-2022-03-S	Elbow, Bulkhead Union with Locknut #4	1
6	G-1250-1080W	Flatwasher, 7/16 Wide	2
7	N-2002-03-S	Elbow, Swivel Nut #4	2
8	N-2049-07-S-E	Elbow, 90° Swivel & O-ring #4 x #6	1
9	N-2007-03-S-E	Connector, Straight Thread #4	1
10	N-2016-03-S	Tee, Swivel Nut Run, #4	1
11	TF-1041-49*16.0	Hose Assembly, #4	1
12	TF-1040-42*32.0	Hose Assembly, #4	Ref
13	V-1888	Label, Shut-Off Calibration	1

9.15 Additional Features continued on following page.

9.15 ADDITIONAL FEATURES *(continued)*

9.15.5 Electric Over-Temperature *(Option S)*

The Electric Over-Temperature switch does not require regular general maintenance. However, automatic shut down due to high fluid temperature is a indication that maintenance or training may be needed elsewhere.

NOTE: Wire per Electrical Schematic INS-1608. Reference Wiring Diagram INS-1746. Reference 9.7.1 Electric Panel (Page 33) for Panel Light.

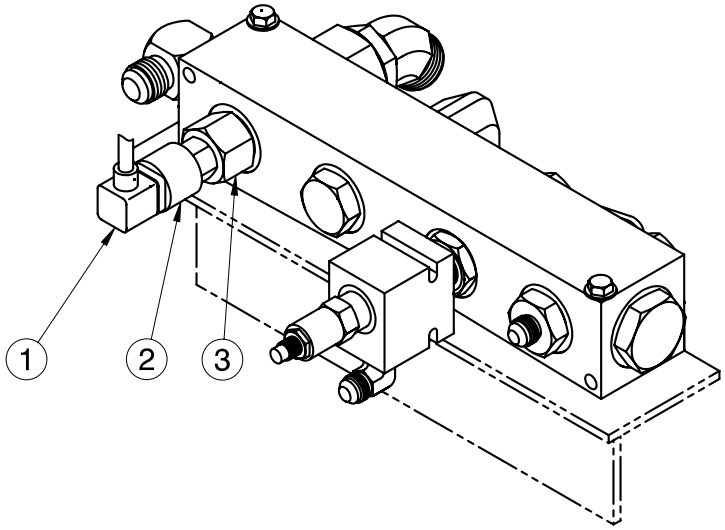

FIGURE 9.15.5 **– Electric Over-Temperature**

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	EC-1778	DIN Connector Cable	1
2	EC-1782-02	Temperature Switch	1
3	N-2463-16-S-E	Reducer Fitting	1

9.0 MAINTENANCE *(continued)*

9.16 REPLACEMENT LABELS PARTS LISTS

9.16.1 Base Unit

Part Number	Description	Qty
V-1001	"Made in USA"	1
V-1033-01	"TRONAIR"	1
V-1050	ISO Electrical Shock Symbol	2
V-1365	"SYSTEM PRESSURE"	1
V-1366	"HPU BY-PASS VALVE"	1
V-1374	"ROTATION"	1
V-1375	"PRESSURE INCREASE/FLOW INCREASE"	1
V-1882	Control Panel Lights	1
V-1884	"FLOWMETER"	1
V-1893	"SAMPLE VALVE"	1
V-1894	"PRESSURE"	1
V-1895	"RETURN"	1
V-1896	"MINIMUM OIL LEVEL"	1
V-1897	"MAXIMUM OIL LEVEL"	1
V-1898	"PRESSURE and FLOW CONTROLS INSIDE"	1
V-1900	"WARNING KEEP 5 FT CLEAR . . ."	2
V-1901	Hydraulic Schematic	1
V-1902	Electrical Schematic	1
V-1914	Reservoir Selector Valve	1
V-1918	"PE"	1
V-1919	"OPERATING INSTRUCTIONS . . ."	1

9.16.2 Fluid

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
V-1977	"PHOSPHATE ESTER FLUIDS ONLY"	2

9.16.3 Filter Element Kit

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
V-1905	"REPLACEMENT FILTER ELEMENT K-3494"	1
V-1903	"REPLACEMENT FILTER ELEMENT K-3428"	1
V-1916	"REPLACEMENT DESICCANT FILTER ELEMENT HC-1763"	1

9.16.4 Dual System

Part Number	Description	Qty
V-2004	"SYSTEM 1 PRESSURE"	1
V-2005	"SYSTEM 2 PRESSURE"	1
V-2006	"SYSTEM 1 RETURN"	1
V-2007	"SYSTEM 2 RETURN"	1

9.16 Replacement Labels Parts Lists continued on following page.

9.0 MAINTENANCE

9.16 REPLACEMENT LABELS PARTS LISTS (continued)

9.16.5 Pyrometer

Part Number	Description	Qty
V-1886	"PYROMETER"	1

9.16.6 Hand Pump *(Option M)*

Part Number	Description	Qty
V-1887	"HAND PUMP PRESSURE"	1
V-1915	"HAND PUMP"	1
V-1989	"REPLACEMENT FILTER ELEMENT K-3752"	1

9.16.7 Calibration Port *(Option Q)*

Part Number	Description	Qty
V-1470	"CAUTION . . ."	1
V-1888	"SHUT-OFF/CALIBRATION PORT"	1

10.0 PROVISION OF SPARES

10.1 SOURCE OF SPARE PARTS

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: mail@tronair.com
Website: www.tronair.com

10.2 RECOMMENDED SPARE PARTS LISTS

It is recommended that the following spare parts be kept on hand and available for immediate use during maintenance.

10.2.1 Spare Electrical Parts

Part Number	Description	Qty
Refer to Section 9.10 Electrical Components Item 20	Fuse, Transformer Primary	2
EC-1542-04	Fuse, Transformer Secondary	1
Refer to Section 9.10 Electrical Components Item 22	Fuse, Heat Exchanger	3
EC-1419-09	Fuse, Phase Monitor *(Optional)*	3

10.2.2 Spare Parts

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
HC-1763	Desiccant Filter Element	1
K-1995	Kit, Gaskets and O-rings for Main Pump	1
K-1417	Kit, Pressure Filter Element	1
K-3428	Kit, Return Filter Element	1
K-2404	Kit, Shaft Seal and Retainer for Main Pump	1
K-3752	Kit, Hand Pump Filter Element *(Optional)*	1

11.0 ELECTRICAL POWER REQUIREMENTS

11.1 The electrical power supply for the HPU must include a fused disconnect using Type J or Type R fuses or equivalent magnetic type circuit breakers designed for protecting an electrical motor. This necessary equipment is for protection of the HPU, power cord, and customer-supplied plug and receptacle. *Reference the Table below:*

ELECTRICAL POWER AND PROTECTION REQUIREMENTS

60 Hz Applications					
Voltage	208	230	380	460	575
Full Load Amps	44.2	40	24.2	20	16
Locked Rotor Amps	257	232	133	116	92.5
Recommended Fuse Size	60	50	30	25	20
Maximum Fuse Size	70	60	35	30	25

50 Hz Applications					
Voltage	200	220	380	415	440
Full Load Amps	48	41	23.7	23	22
Locked Rotor Amps	257	229	133	116	116
Recommended Fuse Size	60	50	30	30	30
Maximum Fuse Size	70	60	35	35	35

12.0 CALIBRATION OF INSTRUMENTATION

All gauges on the Hydraulic Power Unit can be either returned to Tronair for calibration or certified by the end user if proper calibration equipment is available. Gauges returned to Tronair for calibration will be tested with standards traceable to N.I.S.T. (National Institute of Standards and Technology). Tronair recommends calibration of instrumentation at yearly intervals, but actual calibration dates may be based upon frequency of use and the end users quality system. For information on returning gauges for calibration, Reference ***12.1 – Source of Calibration***.

12.1 SOURCE OF CALIBRATION

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: mail@tronair.com
Website: www.tronair.com

12.2 ANALOG PRESSURE GAUGE – System Pressure

12.2.1 Self Calibration

An accurate pressure calibration gauge is required for calibration of the System Pressure gauge. There are two methods available. Method A can be used if the HPU is equipped with a calibration port *(Option Q)*. Method B must be used if the HPU is **not** equipped with a calibration port. Follow the necessary steps below.

NOTE: Method A can only test the gauge up to the rated operating pressure of the HPU (3,000 psi).

12.2.1 Self Calibration continued on following page.

12.2.1 Self Calibration *(continued)*

Method A: Shut off HPU and disconnect from aircraft. Close the calibration port **Shut-off Valve** on the instrument panel of the HPU. Attach the "Master" calibration gauge to the **Calibration Port** on the instrument panel.

Set up the HPU as follows:

Reservoir Selector Valve ..... Set to HPU Reservoir
Bypass Valve ..... Open
Pressure Ball Valves (at rear of unit)..... Closed
Return Ball Valves (at rear of unit)..... Closed

Start the HPU. Open the calibration port Shut-off Valve. Close the Bypass valve to build system pressure. Record gauge values at the designated increments.

Open the Bypass valve.

Shut off the HPU and close the calibration port Shut-off Valve before disconnecting the "Master" calibration gauge.

Method B: Shut off the HPU and disconnect it from the power source. Remove the **Hydraulic Panel** from the front instrument panel (four screws). Disconnect the hose from the System Pressure gauge (remove gauge from panel if necessary). Attach calibration test equipment to the gauge and record gauge values at the designated increments.

SYSTEM PRESSURE GAUGE (HC-2144)

Applied Pressure (System Pressure Gauge) (psig)	Minimum Acceptable (psig)	Maximum Acceptable (psig)	Gauge Movement (Direction)	Indicated Pressure (Calibration Gauge) (psig)
1000	940	1060	Increasing	
2000	1940	2060	Increasing	
3000	2940	3060	Increasing	
4000	3940	4060	Increasing	
5000	4940	5060	Increasing	
6000	5940	6060	Increasing	
5000	4940	5060	Decreasing	
4000	3940	4060	Decreasing	
3000	2940	3060	Decreasing	
2000	1940	2060	Decreasing	
1000	940	1060	Decreasing	
Allowable operating tolerance: +/- 1% of full scale (60 psig) at room temperature (70° F).				

12.0 CALIBRATION OF INSTRUMENTATION *(continued)*

12.3 ANALOG PRESSURE GAUGE (Hand Pump Pressure- *Option M Only*)

12.3.1 Self Calibration

An accurate pressure calibration gauge is required for calibration of the Hand Pump Pressure gauge. Follow the necessary steps below.

Shut off the HPU and disconnect it from the power source. Remove the **Hydraulic Panel** from the front instrument panel (four screws). Disconnect the hose from the Hand Pump Pressure gauge (remove gauge from panel if necessary). Attach calibration test equipment to the gauge and record gauge values at the designated increments.

HAND PUMP PRESSURE GAUGE (HC-2146)

Applied Pressure (Hand Pump Pressure Gauge) (psig)	Minimum Acceptable (psig)	Maximum Acceptable (psig)	Gauge Movement (Direction)	Indicated Pressure (Calibration Gauge) (psig)
1000	700	1300	Increasing	
2000	1700	2300	Increasing	
5000	4800	5200	Increasing	
8000	7700	8300	Increasing	
10,000	9700	10,300	Increasing	
8000	5940	8300	Decreasing	
5000	4800	5200	Decreasing	
2000	1700	2300	Decreasing	
1000	700	1300	Decreasing	
Allowable operating tolerance:	+/- 3% of full scale (300 psig) at room temperature (70° F).			
	+/- 2% of full scale for middle third of scale (200 psig) at room temperature (70° F).			

12.0 Calibration Of Instrumentation continued on following page.

12.0 CALIBRATION OF INSTRUMENTATION *(continued)*

12.4 ANALOG TEMPERATURE GAUGE (Pyrometer)

12.4.1 Self Calibration

An accurate temperature calibration gauge is required for calibration of the Pyrometer. The pyrometer bulb is located in the return manifold (rear of unit) and can be accessed by removal of the HPU top panel. See Section ***9.13.7 – Pyrometer*** for location. Follow the necessary steps below.

1. Remove the pyrometer bulb from the return manifold by removing the slotted brass nut that retains the bulb in the well.
2. Connect the temperature calibration gauge to the bulb of the pyrometer.

The Temperature Value Must Be:

Pyrometer Temperature Display (° F)	Minimum Acceptable (° F)	Maximum Acceptable (° F)	Temperature Calibration gauge (° F)
140	139	141	

13.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section ***1.3 – Manufacturer***.

14.0 GUARANTEES

Tronair products *are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This warranty does not cover the following items:*

a) Parts required for normal maintenance.
b) Parts covered by a component manufacturer's warranty.

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair since any action may effect warranty coverage. When you contact Tronair, be prepared to provide the following information:

a) Product Model Number
b) Product Serial Number
c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims.

15.0 APPENDICES

I Hydraulic Schematic (INS-1602)
II Electrical Schematic (INS-1608)
III Wiring Diagram (INS-1746)
IV Lincoln Motor Manual
V Oilgear Pump Manual
VI Material Safety Data Sheet (MSDS) pertaining to Hydraulic Fluid
VII ANSI/B93.19M-1972 (R1993-Excerpt)
VIII Instrument Certification Notice

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APPENDIX I

Hydraulic Schematic (INS-1602)

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APPENDIX II

Electrical Schematic (INS-1608)

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APPENDIX III

Wiring Diagram (INS-1746)

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APPENDIX IV

Lincoln Motor Manual

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APPENDIX V

Oilgear Pump Manual

APPENDIX VI

Material Safety Data Sheet (MSDS) Hydraulic Fluid

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APPENDIX VII

ANSI/B93.19M-1972
(R1993-Excerpt)

APPENDIX VIII

Instrument Certification Notice