

54X1 Series 5411, 5421, 5431, 5441 Hydraulic Power Unit



06/2024 – Rev. 08

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02	08/2016	Modified 5.3.9 Return Back-Pressure with Sight Gauge, 9.14.3 Return Back-Pressure with Sight Gauge, 9.14.15 Return Back-Pressure
03	12/2017	Modified 9.2 Electric Motor
04	08/2021	Added section 5.13 Infrequent HPU Use and updated 9.0 Maintenance
05	03/2023	Major revision
06	07/2023	Added section 9.14.9 Hand Pump (Option M7)
07	07/2023	Modified 9.14.8 Hand Pump (Option M)
08	06/2024	Modified 9.14.10 Towing Trailer

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1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Hydraulic Power Unit

Model Number	Fluid Type
--------------	------------

5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

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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 Operation & Service 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.

2.2 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.).

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 Operation & Service Manual for details on servicing the HPU)

2.7 GENERAL COMMENTS

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

The HPU must be used in accordance with the Operation & Service Manual 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 Operation & Service 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 5.3.1 Front Panel Controls for reservoir fill location.

NOTE: Leave the Reservoir Selector Valve in the Aircraft Reservoir position (as shipped) until the Hydraulic Power Unit reservoir has been filled.

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 device, 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 Trouble Shooting 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 Operation & Service Manual
- The employer of the operator shall provide all necessary training
- 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	73.0	66.0	38.0	33.0	26.0
Locked Rotor Amps	404	365	221	182	146
Recommended Fuse Size	100	90	50	45	35
Maximum Fuse Size	110	100	60	50	40

50 Hz Applications					
Voltage	200	220	380	415	440
Full Load Amps	75.0	72.0	36.0	36.0	35.0
Locked Rotor Amps	415	382	221	200	191
Recommended Fuse Size	100	90	45	45	45
Maximum Fuse Size	110	110	50	50	50

5.2 NUMERICAL VALUES

5.2.1 Fluid

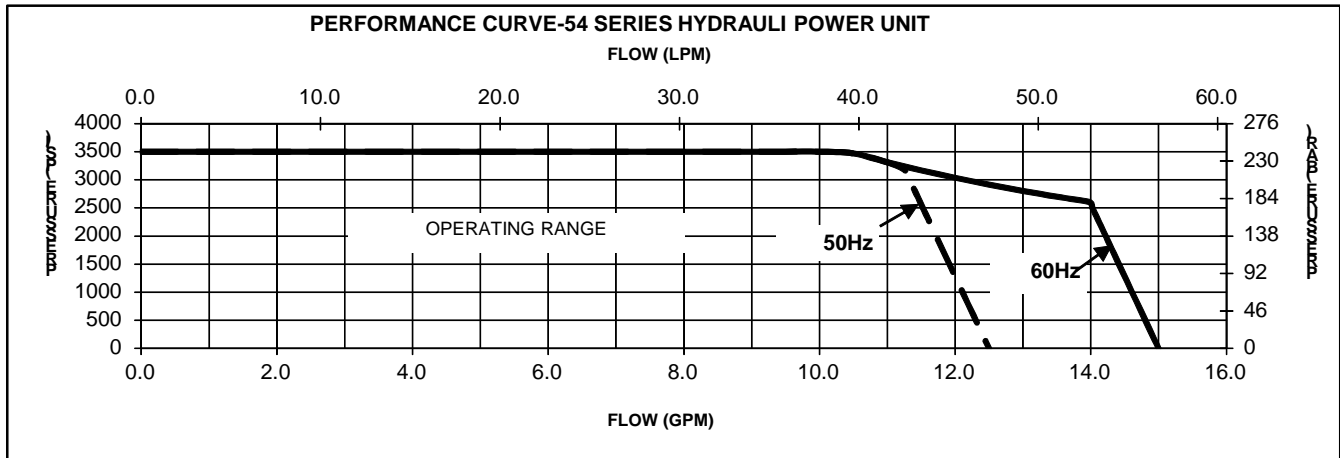
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

5.2.2 Physical

Weight (Dry)	1,450 lbs (568 kg)
Width	51 in (129.5 cm) Add 7.5 in (19 cm) for Split System
Height	48.75 in (124 cm)
Depth	55 in (140 cm)
Power Cord	50 ft (15.24 m) long
Pressure Hoses	25 ft (7.62 m) Standard Length
	50 ft (15.24 m) Optional Length
	-12 (¾ in, 19.1 mm) Working Diameter
Return Hoses	25 ft (7.62 m) Standard Length
	50 ft (15.24 m) Optional Length
	-16 (1 in, 25.4 mm) Working Diameter
Hand Pump Hose	15 ft (4.57 m) Standard Length
	-4 (1/4 in, 6.4 mm) Working Diameter

5.2.3 Motor Driven Hydraulic Pump

A pressure compensated, adjustable maximum volume piston pump.
 Maximum flow at 60 Hz 15 gpm (56.7 lpm)
 Maximum flow at 50 Hz 12 gpm (47.3 lpm)
 Maximum operating pressure at 50 Hz and 60 Hz 3,500 psi (241 bar)
 System pressure relief valve setting 3,750 psi (258 bar)
 Performance Curve for 50 Hz and 60 Hz



5.2.4 Electric Motor

A 25 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	
Voltage	Full Load Amps
208	73.0
230	66.0
380	38.0
460	33.0
575	26.0

50 Hz Applications	
Voltage	Full Load Amps
200	75.0
220	72.0
380	36.0
415	36.0
440	35.0

5.2.5 Filters

Pressure.....2 micron rating, non-bypass high collapse microglass type. Non-cleanable element
Return5 micron rating, 15 psi (1.03 bar) bypass microglass type. Non-cleanable element
Hand Pump (Option M)2 micron rating, non-bypass microglass type. Non-cleanable element
Air/Desiccant3 micron filter, silica gel desiccant type. Non-cleanable element

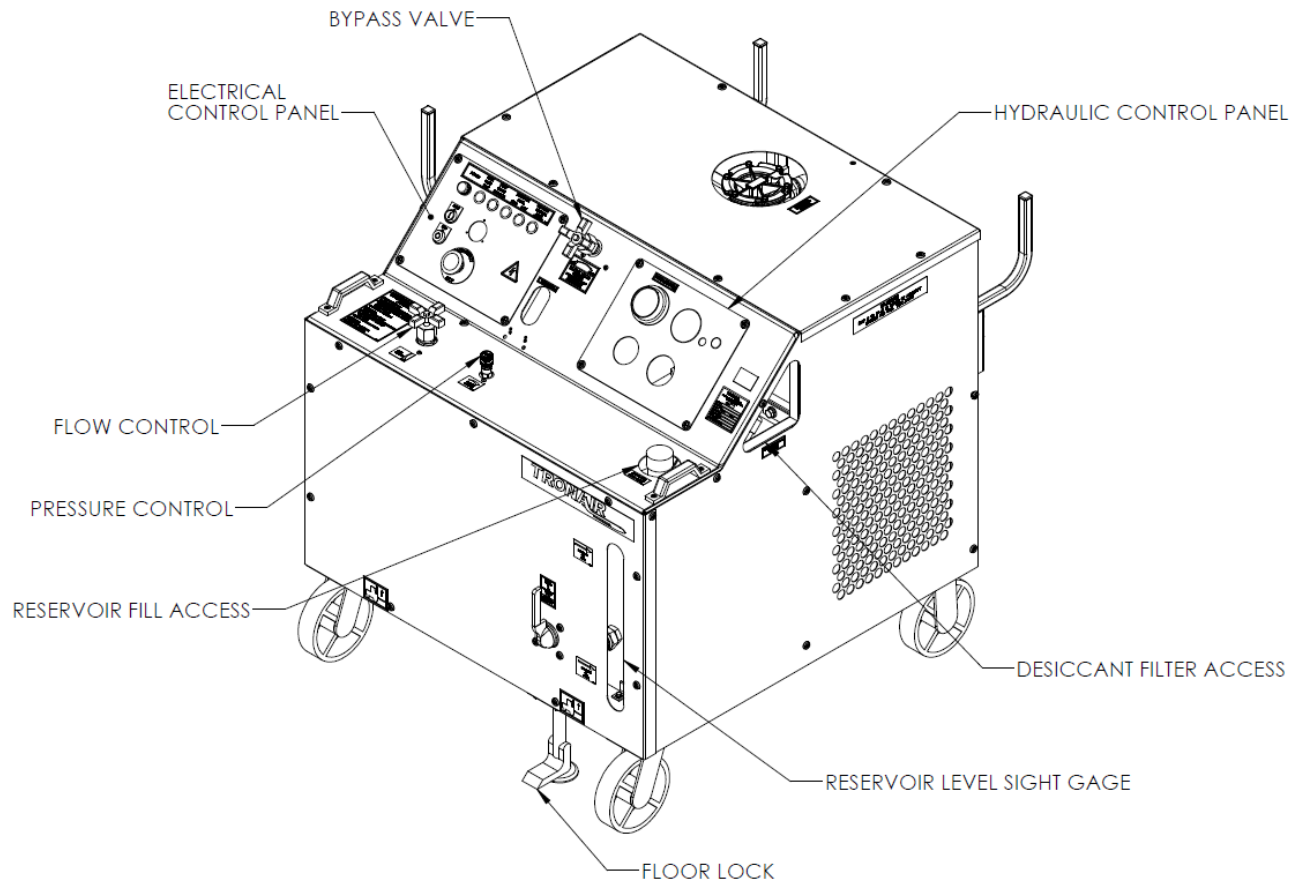
5.2.6 Hand Pump (Option M)

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

Low Pressure StagePiston Diameter 1½ in (38.1 mm)
Working Pressure 0–500 psi (0–34.47 bar)
Displacement/Stroke 2.1 in³ (34.4 cm³)
Force/100 psi (6.89 bar) 12.0 lbs/100 psi (7.74 N/bar)
High Pressure StagePiston Diameter 5/8 in (15.88 mm)
Working Pressure 500–5000 psi (34.47–344.74)
Displacement/Stroke 0.4 in³ (6.55 cm³)
Force/100 psi (6.89 bar) 2.2 lbs/100 psi (1.42 N/bar)
Pressure Relief Setting5,250 psi (362.0 bar)

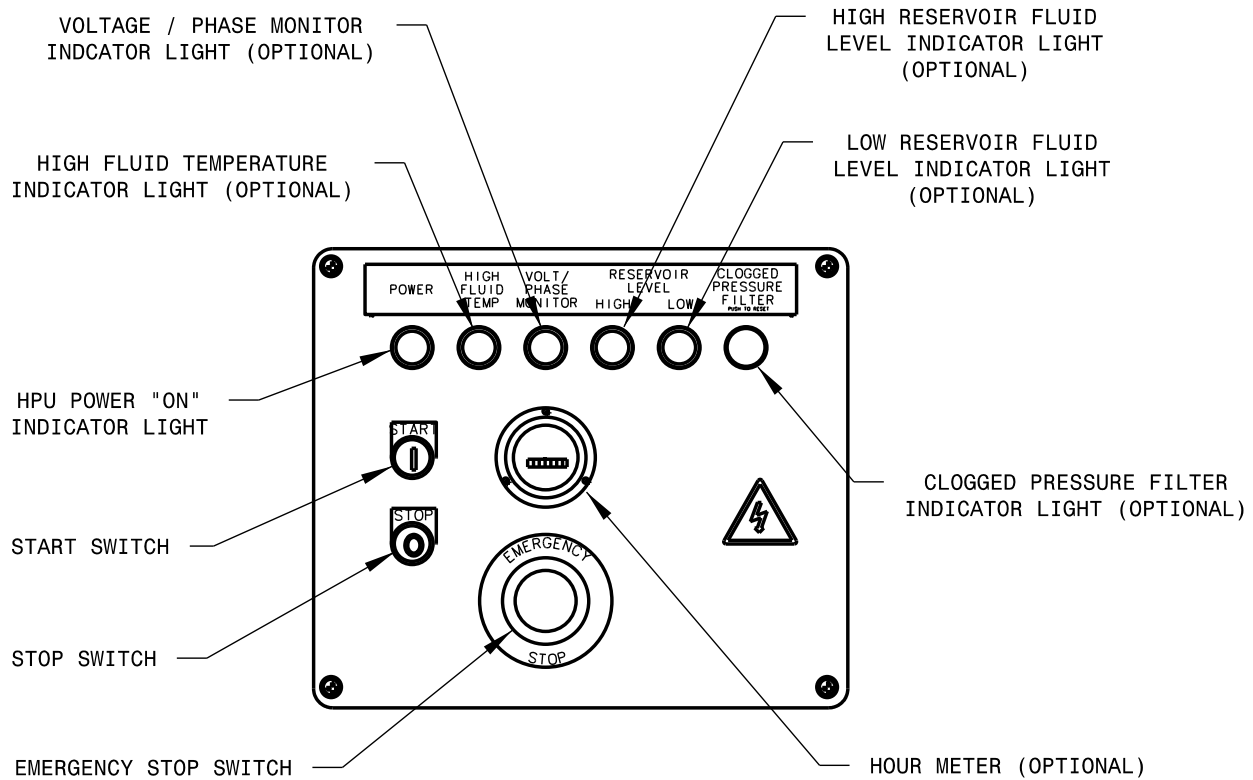
5.3 LOCATION & LAYOUT OF CONTROLS

5.3.1 Front Panel Controls



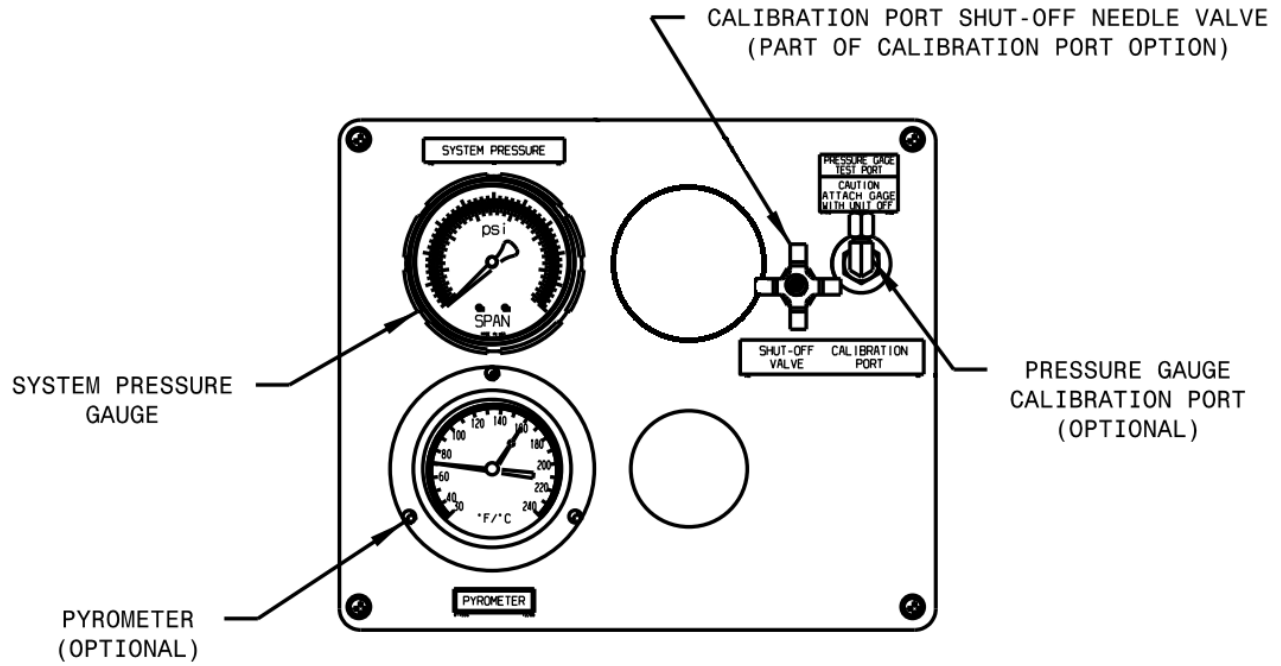
Electrical Control Panel	See Section 5.3.2
Hydraulic Control Panel	See Section 5.3.3
Bypass Valve	For loading and unloading the motor driven hydraulic pump
Flowmeter	Displays the flow from the motor driven hydraulic pump
Pump Control Access	See Figure 5.3.5 - Hydraulic Pump Controls
Reservoir Selector	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 (<i>Option M</i>)	Access for hand pump and relief screw, handle stored inside
Floor Lock	Locking/unlocking, foot actuated and released floor lock

5.3.2 Electrical Control Panel



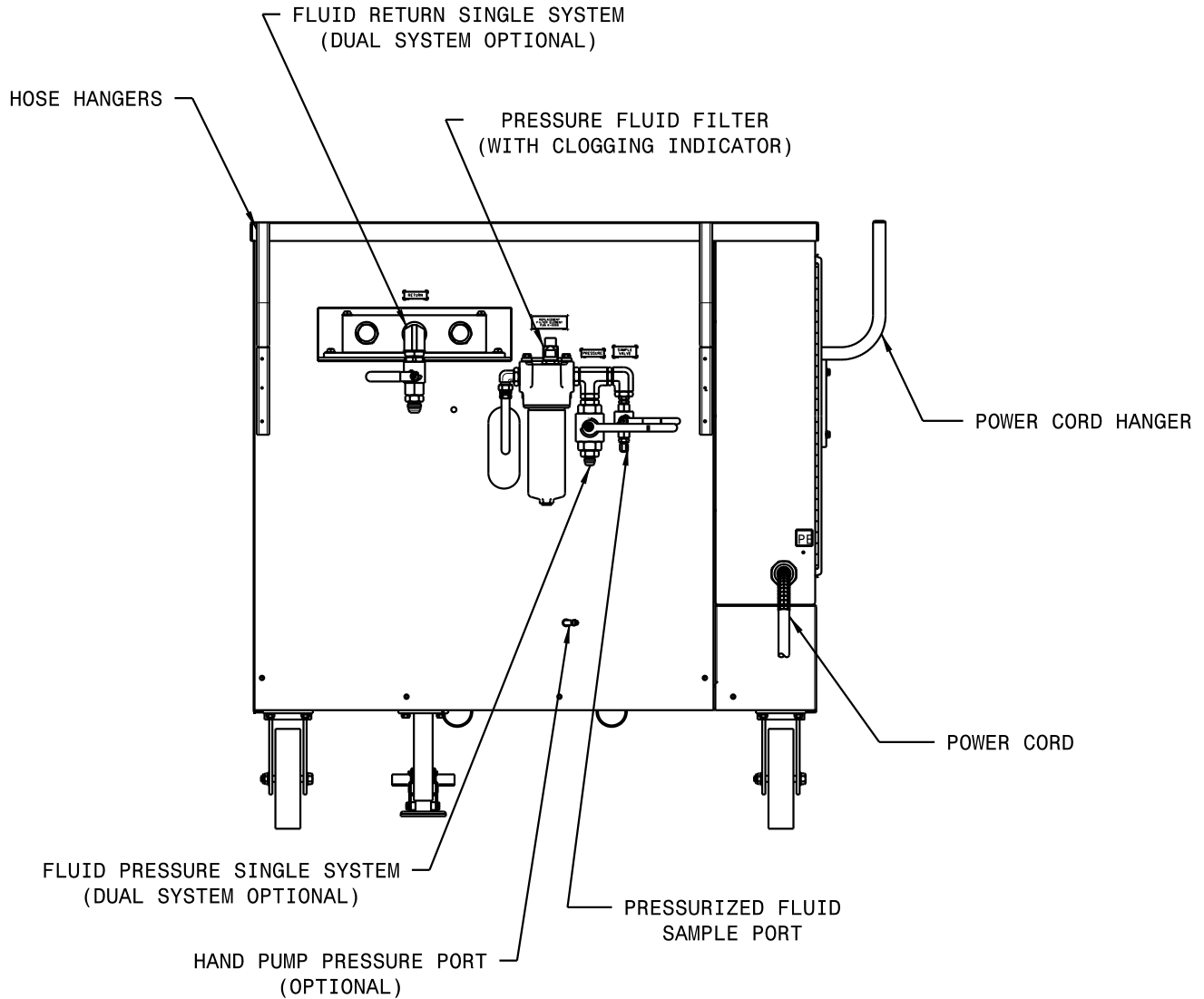
Emergency Stop	Removes power to all electrical devices, must turn to reset
Stop Switch	Turns off the electric motors driving the hydraulic pump and cooling fan
Start Switch	Turns on the electric motors driving the hydraulic pump and cooling fan
HPU Power "On" Indicator Light	Light is illuminated when the electric motors driving the hydraulic pump and cooling fan are on
High Fluid Temperature Indicator Light (<i>Option S</i>)	Light is illuminated when the return fluid temperature reaches 170° F (77° 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 Indicator Light (<i>Option L</i>)	Light is illuminated when the fluid level in the reservoir is above the normal operating range. The HPU will shut down until the fluid level is restored to a normal operating level
Low Reservoir Fluid Level Indicator Light (<i>Option L</i>)	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 (<i>Options G – J</i>)	Light is illuminated if any of the following conditions occur <ul style="list-style-type: none"> - 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 (<i>Option R</i>)	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

5.3.3 Hydraulic Control Panel



System Pressure Gauge	Displays the system pressure on an analog fluid dampened gauge
Pyrometer (<i>Option K</i>)	Displays the fluid temperature in the return system on an analog gauge. A warning indicator preset to 170° F (77° C) warns of high operating temperature
Pressure Gauge Calibration Port	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	Used to shut off pressure to the calibration port. This valve should only be opened when the external standard gage is attached. (See Operation & Service Manual for proper procedure)
Hand Pump Pressure Gauge (<i>Option M</i>)	Displays the hand pump system pressure on an analog fluid dampened gauge

5.3.4 Rear Panel Controls

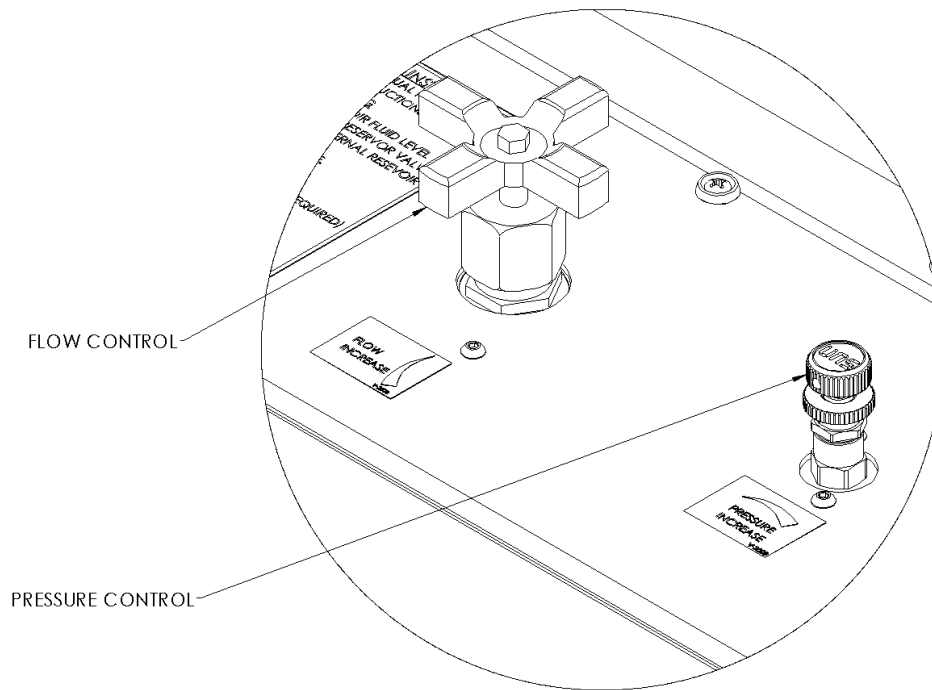


* Fluid Pressure System	The source of pressurized fluid from the HPU that flows to the aircraft pressure system through the pressure hose
* Fluid Return System	Fluid returning to the HPU from the aircraft that flows through the return hoses
Pressure Fluid Filter	Filters the pressurized fluid before it flows to the aircraft pressure system
Pressurized Fluid Sample Port	A sample valve is provided to obtain a fluid sample for analysis. In order to obtain a representative sample
Hand Pump Pressure Port (Option M)	Filters the pressurized fluid before it flows to the aircraft system
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

* **Split System (Optional) consists of two (2) each of these items.**

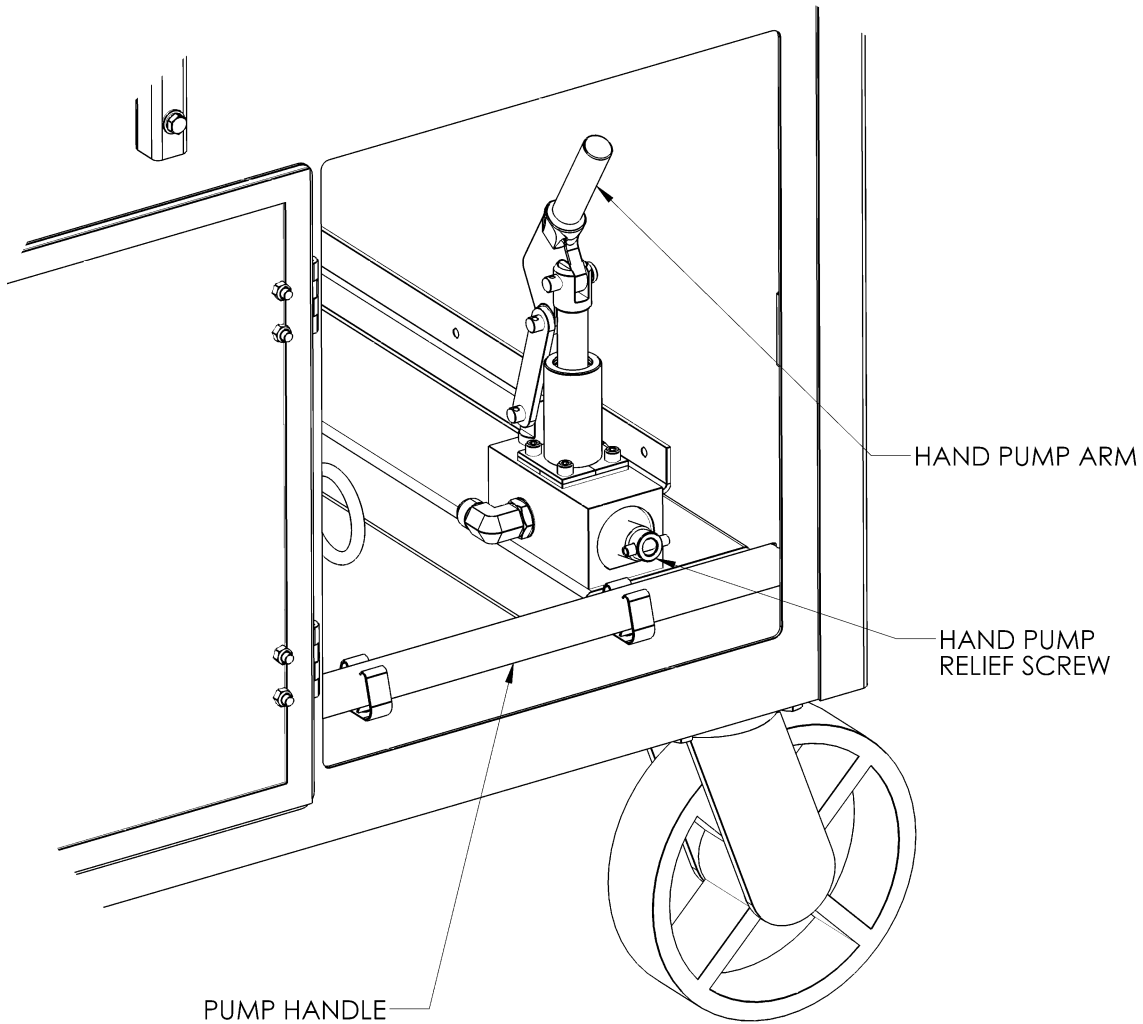
5.3.5 Hydraulic Pump Controls

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



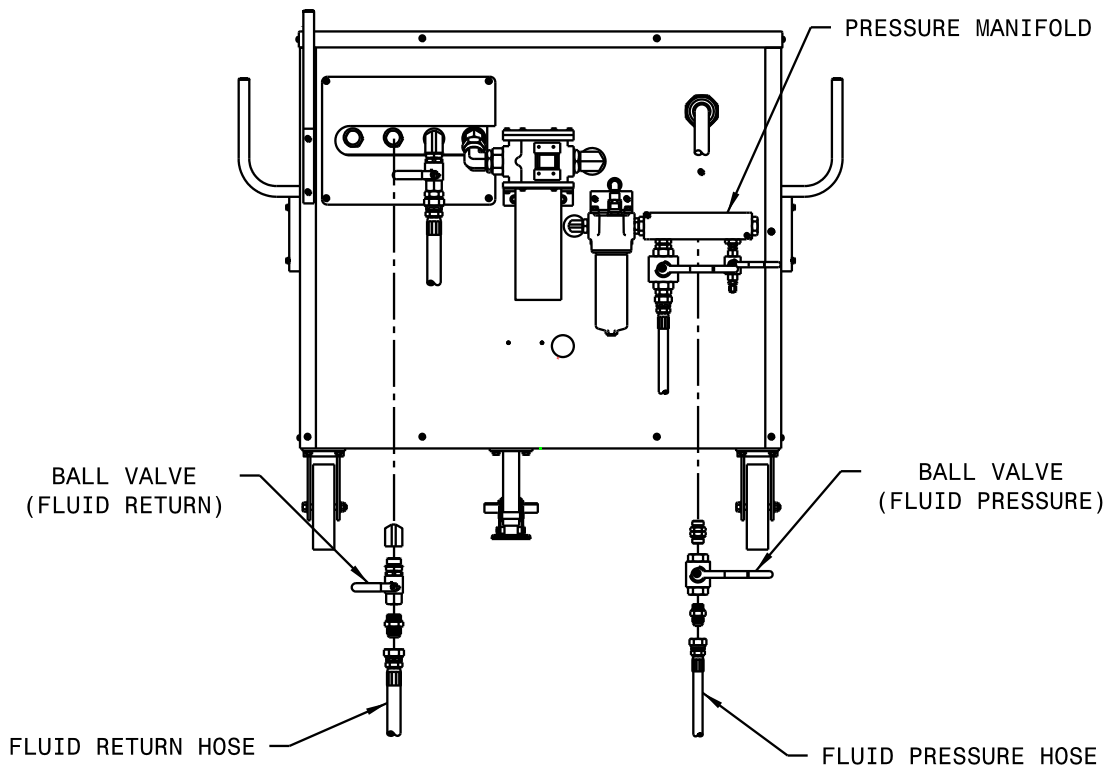
Flow Control	This control is used to set the maximum flow required from the HPU
Pressure Control	The pressure control is used to set the system pressure of the HPU during operation

5.3.6 Hand Pump Controls (*Option M*)
Reference 5.9 Hand 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

5.3.7 Split System Controls (*Option C*)
Reference 5.7 Split System Operation



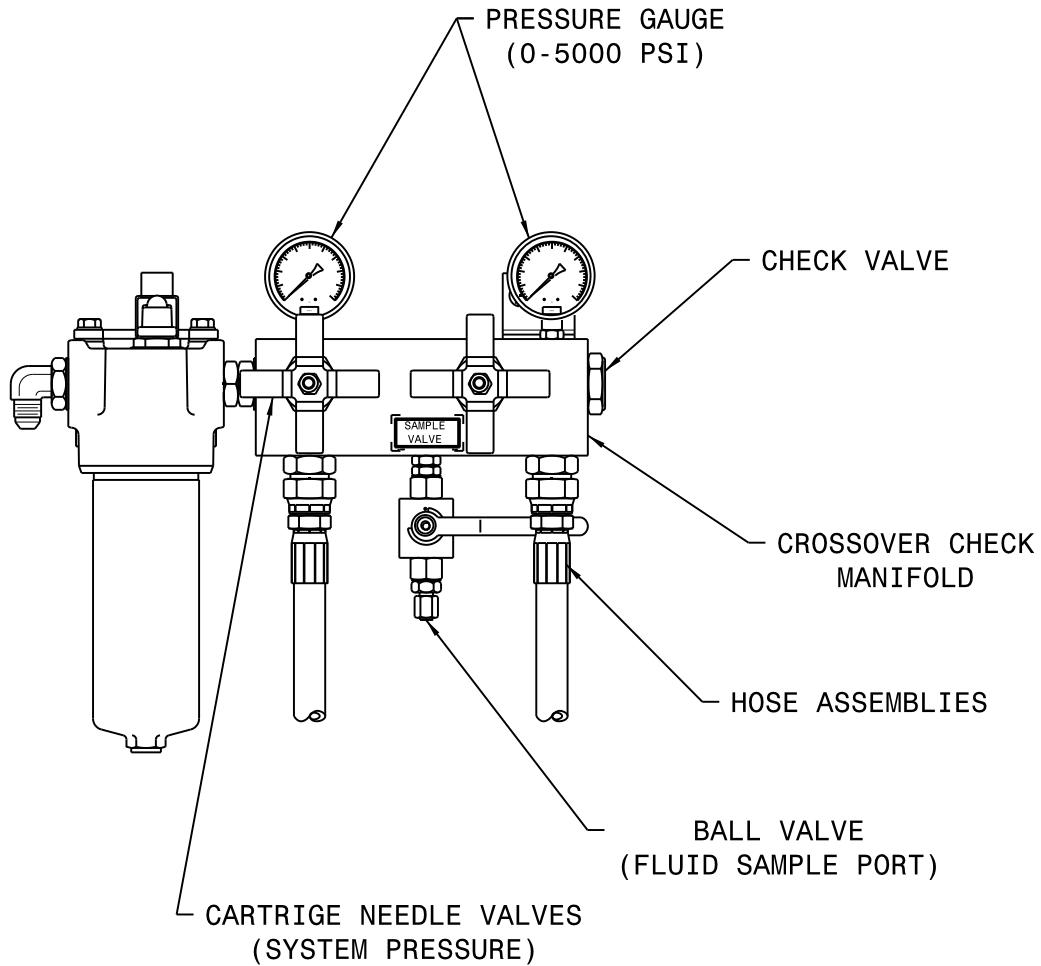
Pressure Manifold	Houses the pressure valves
Fluid Pressure Ball Valve	Used to turn on and off the flow to separate aircraft systems. Always use in either fully open or fully closed position; never use in a partially open position
Fluid Pressure Hose	Connects HPU to aircraft pressure systems
Fluid Return Hose	Connects HPU to aircraft return systems
Fluid Return Ball Valve	Used to turn on and off the flow from separate aircraft systems. Always use in either fully open or fully closed position; never use in a partially open position



WARNING!

NEVER open or close split system valves without shutting off the Hydraulic Power Unit. Damage to the aircraft system or reservoir may result if either return line valve is closed while the machine is running.

5.3.8 Split System Crossover Check Controls (*Option D*)
Reference 5.8 Split System Crossover Check Operation



Pressure Gauge	Displays the pressure in each aircraft system
Hose Assembly	Connects HPU to aircraft pressure system
Ball Valve	Turns on and off the fluid for taking contamination samples
Crossover Check Manifold	Houses the valves and gauges
Cartridge Needle Valve	Used to turn on and off the flow to the separate aircraft pressure systems. Always use in either fully open or fully closed position; never use in a partially open position
Check Valve	Prevents cross flow from System 2 pressure line to System 1 pressure line

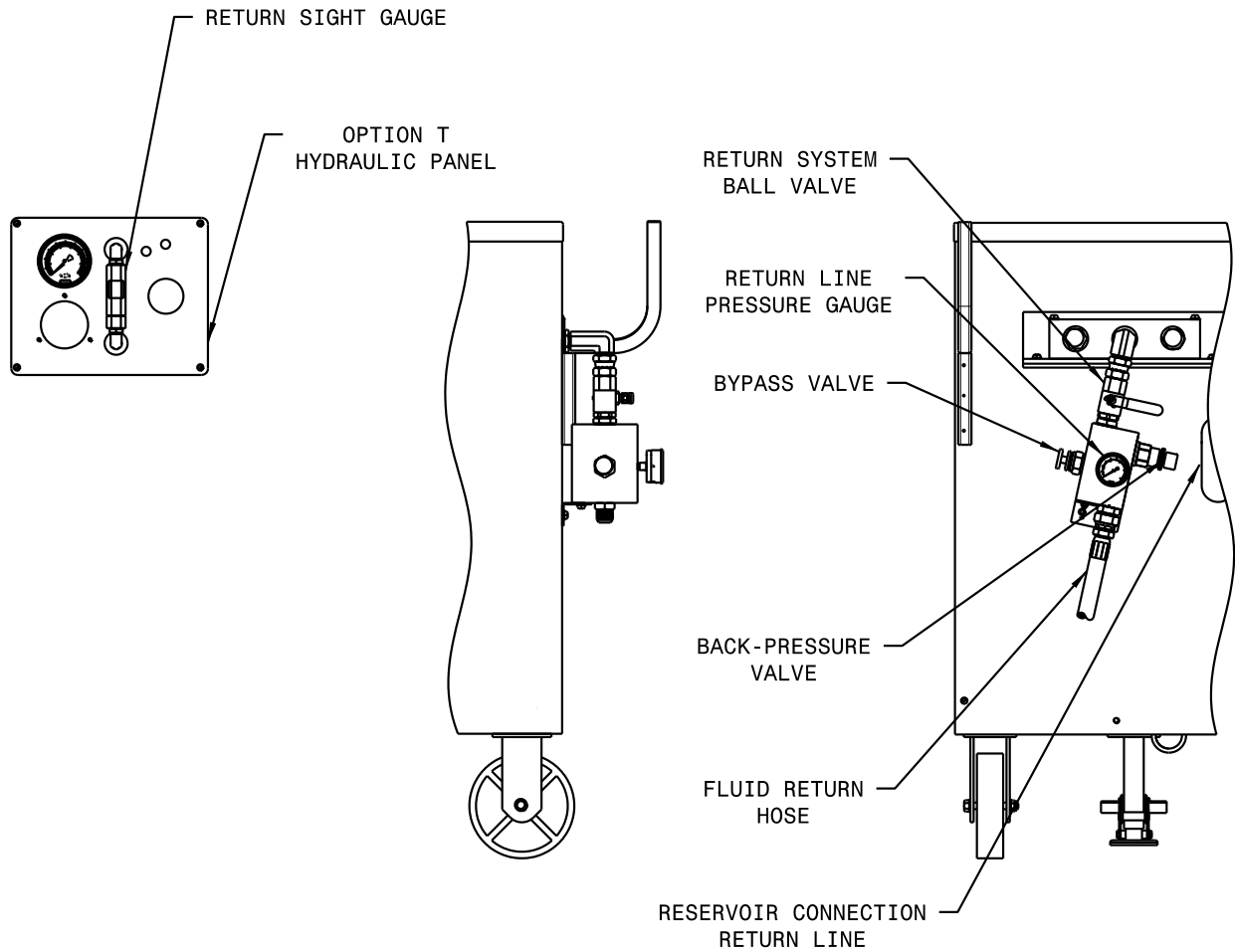


WARNING!

NEVER open or close split system valves without shutting off the Hydraulic Power Unit. Damage to the aircraft system or reservoir may result if either return line valve is closed while the machine is running.

5.3.9 Return Back-Pressure with Sight Gauge (*Option T*)
This option is only available on 5431 models

Reference 5.10 Return Back-Pressure with Sight Gauge Operation



Return Sight Gauge	Allows viewing of fluid returned through the reservoir connection line (third hose)
Return Line Pressure Gauge (Panel Mounted)	Indicates the pressure in the main return hose (back-pressure). The panel gauge is positioned for ease of operation
Hydraulic Panel (<i>Option T</i>)	Added for the back-pressure Option (<i>Option T</i>). It varies slightly from the standard panel
Return System Ball Valve	The return system ball valve has been added for normal operation when combined with a Split System Option (<i>Options C or D</i>). The ball valve is not used when the back-pressure feature is being utilized and must remain open while the machine is running
Return Line Pressure Gauge (Manifold Mounted)	Indicates the pressure in the main return hose (back-pressure) The manifold mounted gauge is positioned for ease of valve adjustment
Back-Pressure Valve	Adjustable check valve, used for creating back-pressure in the main return line
Bypass Valve	Allows fluid to bypass the back-pressure valve
Fluid Return Hose	Connects HPU to aircraft return systems
Reservoir Connection Return Line	Connects HPU to aircraft reservoir overflow line



WARNING!

Never close the return system ball valve while the machine is operating. Damage to the aircraft system or reservoir may result.

5.4 START UP PROCEDURES

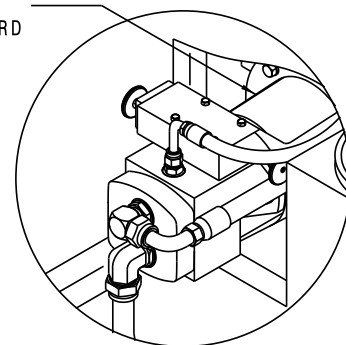
5.4.1 Procedure for First Time or Different Electrical Supply ONLY

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.

To check rotation (with or without Phase Monitor):

- Close the fluid pressure ball valve(s) at the rear of the HPU. Reference 5.3.4 Rear Panel Controls for location of ball valve.
- Open the bypass valve on the instrument panel fully counter-clockwise.
- Set the flow control to maximum flow (fully counter-clockwise).
- Place the reservoir selector valve in HPU Reservoir position.
- Remove the pump/motor coupling guard
Reference Pump/Motor Coupling Access figure.

PUMP/MOTOR
COUPLING GUARD



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.



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.**

- 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 Us.)
- Keeping hands clear of the pump/motor coupling area, momentarily press the start button and immediately press the stop button
- 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
- 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
- Replace the pump/motor coupling guard

5.4.2 Initial Start Up of the HPU

- 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
- Operator must be familiar with this manual and be properly trained prior to starting the HPU
- Close the fluid pressure ball valve(s) at the rear of the HPU. Reference 5.3.4 for location of ball valve.
- Open the bypass valve on the instrument panel fully counter-clockwise
- Set the flow control to maximum flow (fully counter-clockwise)
- Place the reservoir selector valve in HPU Reservoir position
- Press the start switch; the flowmeter should show full flow immediately. If no flow displays on the flow meter, press the stop switch immediately and reference 9.2 No Flow in Trouble Shooting section
- Adjust the flow down to approximately 6 gpm (22.71 lpm)
- Close the bypass valve, adjust the pressure control until 3,000 psi (206.84 bar) is displayed on the pressure gauge. (If no pressure displays on the system pressure gauge after adjusting the pressure control, reference Trouble Shooting 8.4 No Pressure or Reduced Pressure)
- Open the bypass valve; press the stop switch

NOTE: Maintenance and Trouble Shooting 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

- Open bypass valve
- Select "Hydraulic Power Unit" position with reservoir selector valve
- Start HPU
- 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

5.5.2 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 (bar). 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.

5.5.4 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 8.2 No Flow in Trouble Shooting section

- 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 bar). 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.

5.7 SPLIT SYSTEM OPERATION (Option C)

The split 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 and return systems. The valves are mounted on the rear of the hydraulic power unit and are of the 90o 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.

5.7.1 To Operate the Split System

- a. Before starting machine, open pressure and return valves of the same system



WARNING!

Ensure pressure and return hoses of the same system are paired and used together.

- b. After completing tests on one system, shut the machine off before selecting the second system



WARNING!

NEVER open or close split system valves without shutting off the Hydraulic Power Unit. Damage to the aircraft system or reservoir may result if either return line valve is closed while the machine is running.

5.8 SPLIT SYSTEM CROSSOVER CHECK (Option D)

The Split System feature of this option allows control of fluid flow to the aircraft with two hydraulic systems. The systems consist of two sets of hoses and valves located at the rear of the unit on the pressure and return manifolds. The return system valves are of the 90° ball type and are open when the handle is in line with the valve. The pressure system valves are cartridge type needle valves.

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.

The Split System Crossover Check option adds a check valve and pressure gauges to the split system feature. The check valve prevents cross flow from System 2 pressure line to System 1 pressure line, while the gauges allow bleed down pressure in each line to be read when the needle valves are closed.

To Operate the Split System with Crossover Check

1. Before starting the machine, open pressure and return valves of the same system



WARNING!

Ensure pressure and return hoses of the same system are paired and used together.

2. After completing tests on one system, shut the machine off before selecting the second system.

WARNING!

NEVER open or close split system valves without shutting off the Hydraulic Power Unit.



Damage to the aircraft system or reservoir may result if either return line valve is closed while the machine is running.

3. Follow the aircraft manufacturer's instructions for proper use of the crossover check capabilities.

5.9 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.

5.9.1 To Operate the Hand Pump

- a. Remove the pump handle from inside the side access door. (Reference 5.3.6 – Hand Pump Controls)
- b. Insert the end of the pump handle 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 mounted on hand pump. The pump is an automatic two stage pump. 500 psi (34.47 bar) can be produced with high fluid flow and 5,000 psi (344.74 bar) 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.

5.10 SAMPLE VALVE

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



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

5.11 EMERGENCY SHUT DOWN PROCEDURE

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

5.12 DESCRIPTION OF ALARM SYSTEMS

Reference 5.3.2 – Electrical Control Panel

5.12.1 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 170° F (77° 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.

5.12.2 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.

5.12.3 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.

5.12.4 Clogged Filter Indicator Light *(Option R)*

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 9.13.11 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 Trouble Shooting are to be performed by a skilled and trained technician.

5.13 INFREQUENT HPU USE

If the unit is not used frequently Tronair recommends operating the unit monthly. Operating regularly assures that the seals are kept lubricated, eliminates air pockets in the system, reduces moisture in the fluid and helps extend the hose life.

5.13.1 Infrequent HPU Use Start Up Procedure

1. Assure that the HPU reservoir is filled between the minimum and maximum level
2. Connect the unit to a proper electrical power source
3. If unit is equipped with a run around kit, connect the pressure and return hoses together
4. Place the reservoir selector valve in "HPU Reservoir" position
5. Open the return ball valves on the back of the unit
6. Pressure ball valves
 - a. If unit **IS** equipped with a runaround kit **ensure the hoses are connected to each other**, open the pressure ball valves on the back of the unit
 - b. If the hoses **are not connected to each other**, close the pressure ball valves on the back of the unit
7. Verify the return ball valves on the back of the unit are open
8. Fully open the bypass valve
9. Adjust the pressure control to the minimum setting (CCW)
10. Start the unit and verify the flow is above "0" on the flowmeter
 - a. If flow is present: adjust the flow control to increase flow (CW)
 - b. If no flow is immediately present: turn unit off, verify the motor rotation (see 5.4.1 Procedure for First Time or Different Electrical Supply ONLY), correct rotation if necessary
11. Set flow to ½ the maximum flow capacity of the unit. You may need to increase the pressure adjustment to achieve flow.
12. Bypass valve
 - a. If unit **IS** equipped with a runaround kit **ensure the hoses are connected to each other**, fully close the bypass valve
 - b. If the hoses **are not connected to each other**, leave the bypass valve fully open
13. Operate the unit for 15-30 minutes in this condition. Fluid temperature should reach 100°-130° F (37.8°-54.4° C)
14. At the completion of the 15-30 minute circulation run, open the bypass valve and shut off the unit
15. Remove the electric power
16. Place the selector valve in the Aircraft Reservoir position
17. Close the pressure and return ball valves on the back of the unit

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 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

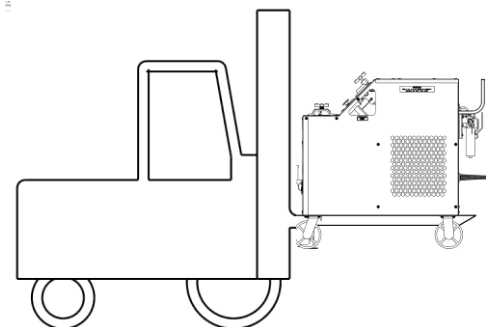
Weight (Dry) 1,200 lbs (544 kg)
 Width 51 in (129.5 cm) Add 7.5 in (19 cm) for Split System
 Height 48.75 in (124 cm)
 Depth 55 in (140 cm)

7.0 TRANSPORTATION

- 1 Do not stack Hydraulic Power Units
- 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 HPU on Forklift.

Weight (Dry) 1,200 lbs (544 kg)



8.0 TROUBLE SHOOTING

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 trouble shooting information, call the manufacturer for Technical Assistance (See Section 1.3 Manufacturer).

NOTE: Maintenance and Trouble Shooting 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
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.

Possible Cause	Solution
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

8.3 REDUCED FLOW

Possible Cause	Solution
Flow control 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 Appendices – Electrical Schematic INS-2016).
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.

8.6 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 – <i>Pump Diagram</i>). Slowly stroke the pump until fluid is present at the bleed screw. Replace the bleed screw.

9.0 MAINTENANCE

If the unit is not used frequently Tronair recommends operating the unit monthly. Operating regularly assures that the seals are kept lubricated, eliminates air pockets in the system, reduces moisture in the fluid and helps extend the hose life. If the unit is not used frequently see 5.13 Infrequent Use Procedure.

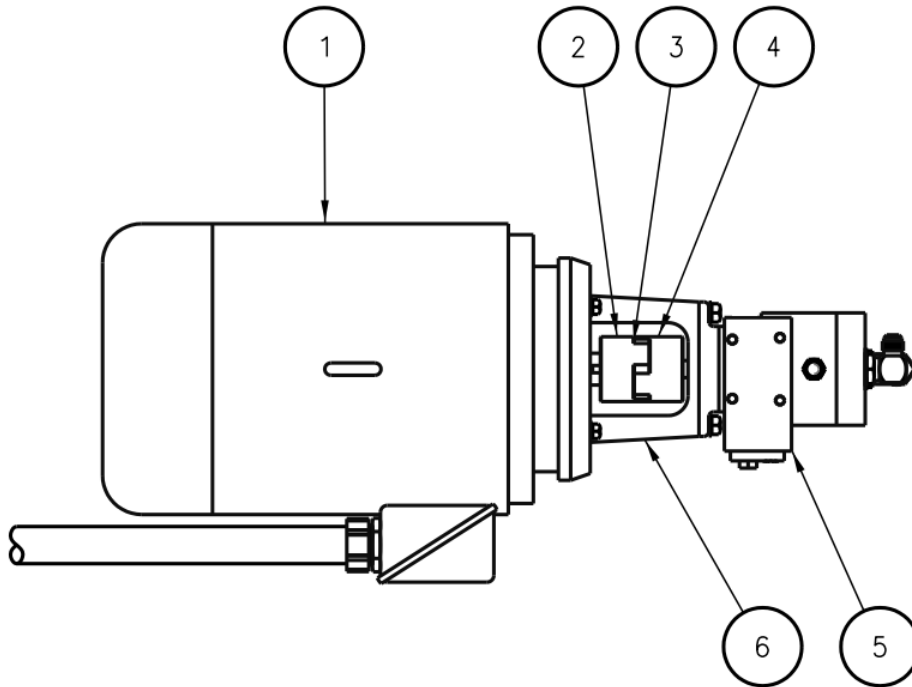
9.1 GENERAL

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 – 9.14 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.



Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	Reference table below	ELECTRIC MOTOR	1
2	H-2225-01	COUPLING (MOTOR HALF)	1
3	H-2228	SPIDER (HYTREL)	1
4	H-2225-02	COUPLING (PUMP HALF)	1
5	Reference 9.3 and 9.3.1	MOTOR DRIVEN HYDRAULIC PUMP	1
6	HC-1810-03	PUMP/MOTOR ADAPTER	1

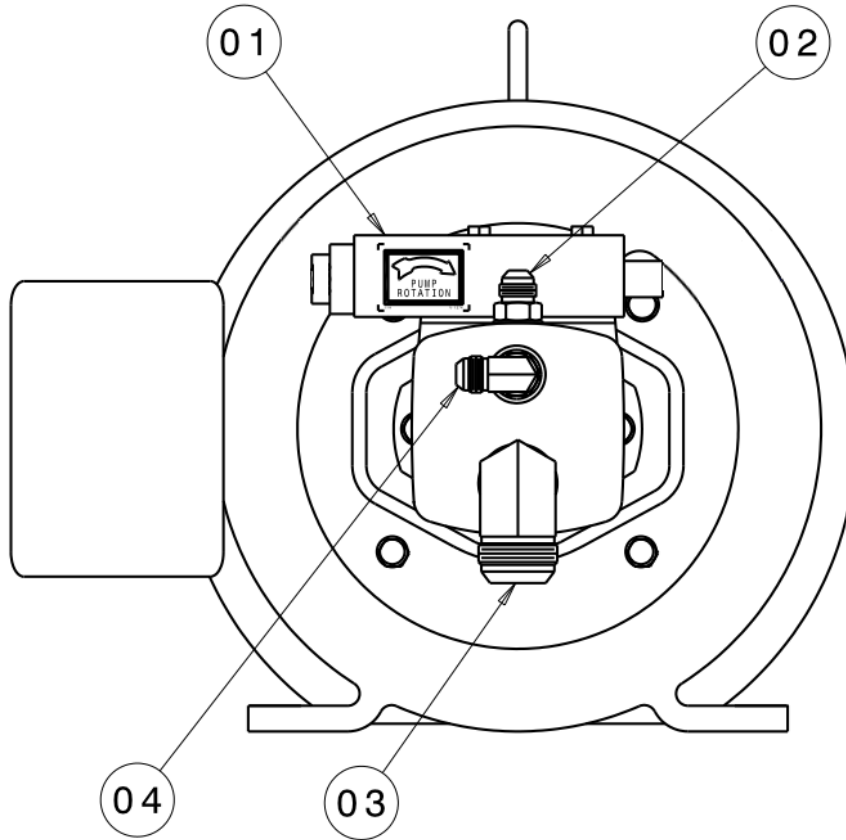
60 Hz Applications	
Voltage	Part Number
208	EC-1224-02
230	EC-1224-02
380	EC-1224-02
460	EC-1224-02
575	EC-1224-03

50 Hz Applications	
Voltage	Part Number
200	EC-1224-02
220	EC-1224-02
380	EC-1224-02
415	EC-1224-02
440	EC-1224-02

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.

9.3.1 Motor Driven Hydraulic Pump Assembly



Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-2906-00	HC-2913-00	HC-2906-00	ASSEMBLY, HYDRAULIC PUMP (painted pump with knobs does not include fittings, labels or coupling half)	1
2	N-2007-20-S-B	N-2007-20-S-E	N-2007-19-S-V	CONNECTOR, MALE #8 SAE X #12 JIC	1
3	N-2001-28-S-B	N-2001-28-S-E	N-2001-36-S-V	ELBOW, 90° MALE #12 SAE X #20 JIC	1
4	N-2001-21-S-B	N-2001-21-S-E	N-2001-11-S-V	ELBOW, 90° MALE #8 SAE X #8 JIC	1

9.3.2 Motor Driven Hydraulic Pump Replacement Kits List

For replacement parts and seals, contact Tronair with hydraulic pump part number and serial number.

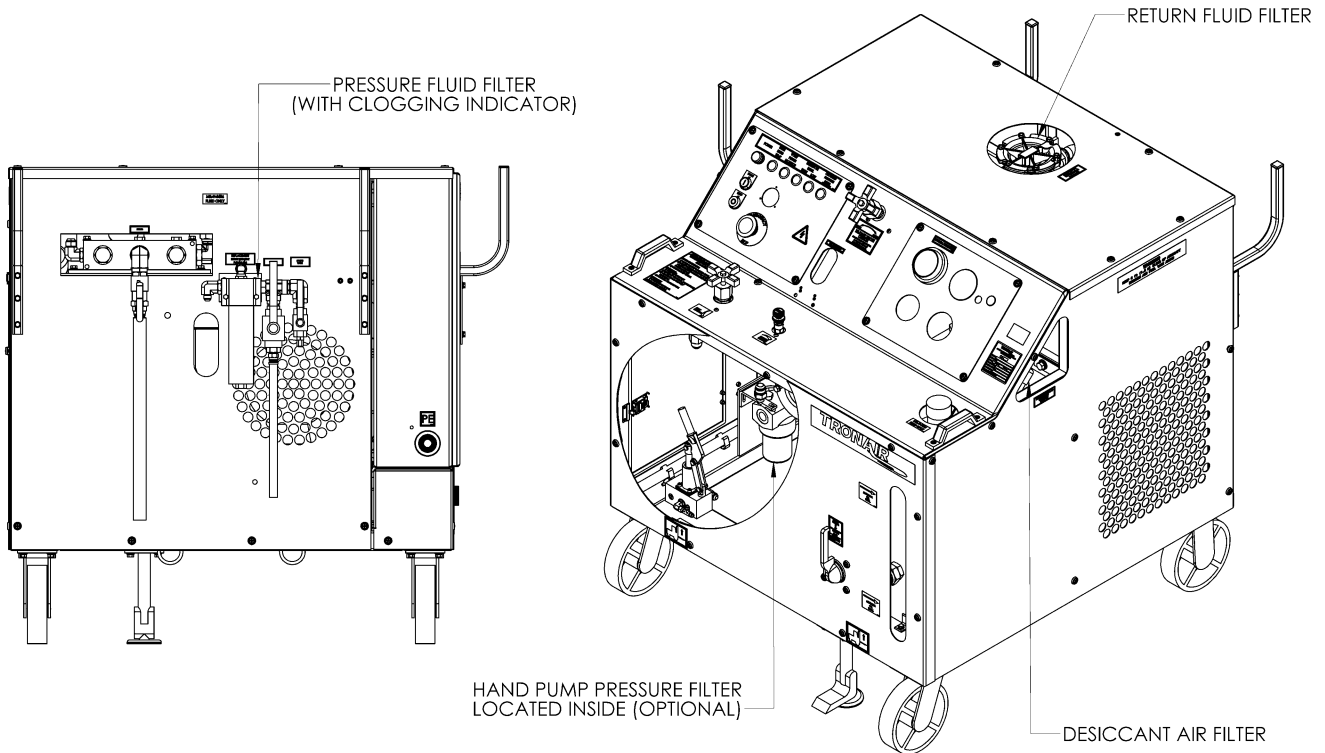
9.4 HYDRAULIC FLUID

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 5.11 – Sample Valve Operation)

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

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

9.5 FILTERS

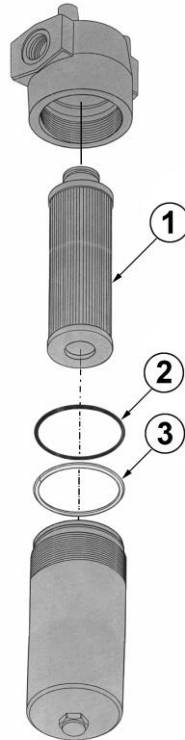


9.5.1 Pressure Filter

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.



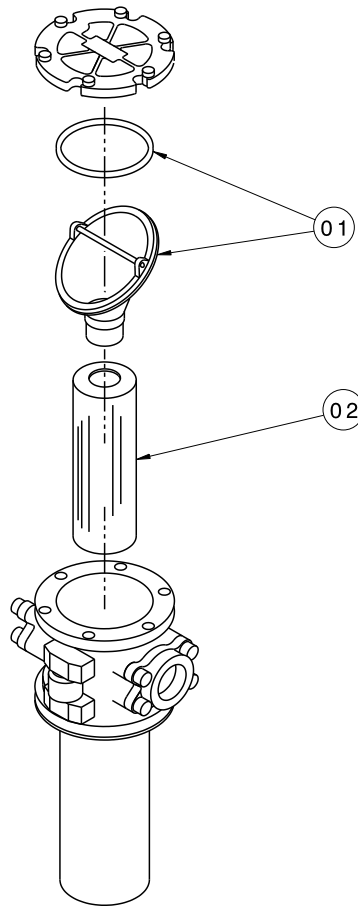
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
2, 3	K-3796	K-3797	K-3796	KIT, SEAL	1
1, 2, 3	K-3492	K-3428	K-3492	KIT, REPLACEMENT FILTER ELEMENT	1

9.5.2 Return Filter

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



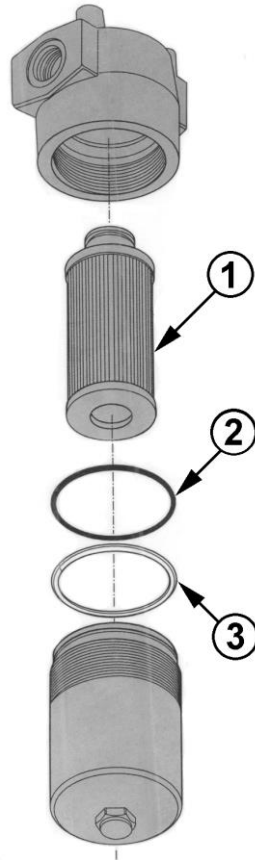
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-2000-350	HC-2006-350	HC-2007-350	O-RING	2
1, 2	K-3493	K-3494	K-3805	KIT, REPLACEMENT FILTER ELEMENT	1

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.



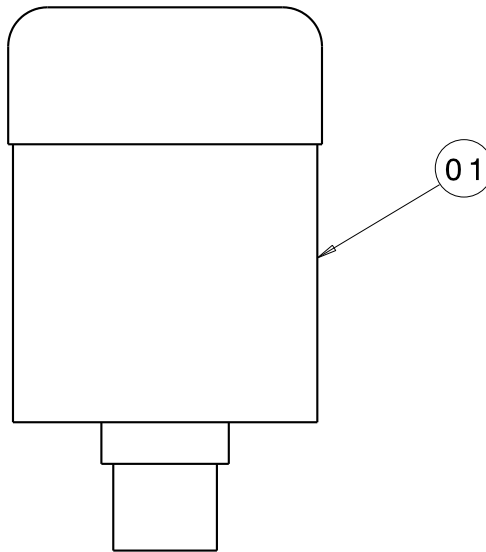
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
2, 3	K-3796	K-3797	K-3832	KIT, SEAL	1

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).



Parts List

All Models - All Fluid Types

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

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.

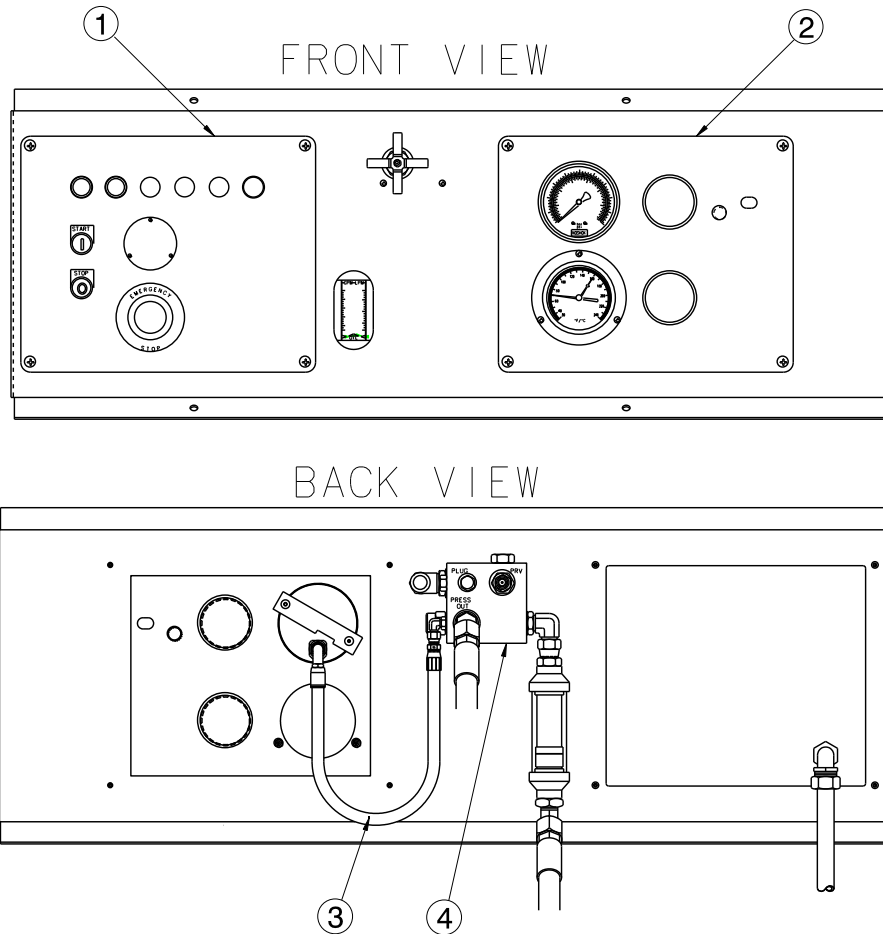
Parts List

Model Number	Fluid Type
5411.....	MIL-PRF-5606
5421.....	MIL-PRF-83282
5431.....	Aviation Phosphate Ester, Type IV and V
5441.....	MIL-PRF-87257

Item	5411 & 5421	5431	5441	From	To	Qty
	Part Number	Part Number	Part Number			
1	TF-1039-11*12.8	TF-1040-39*12.8	TF-1039-18*12.8	SELECTOR VALVE	PUMP INLET	1
2	TF-1038-01*37.0	TF-1040-01*37.0	TF-1038-10*37.0	PUMP OUTLET	FLOWMETER	1
3	TF-1038-33*32.8	TF-1040-11*32.8	TF-1038-33*32.8	CONTROL MANIFOLD	PRESSURE FILTER	1
4	TF-1038-16*23.0	TF-1040-42*23.0	TF-1038-16*23.0	CONTROL MANIFOLD	PRESSURE GAUGE	1
5	TF-1039-16*38.3	TF-1041-55*38.3	TF-1039-19*38.3	CASE DRAIN	COOLER (REAR)	1
6	TF-1039-15*16.3	TF-1040-45*16.3	TF-1039-20*16.3	COOLER (FRONT)	RETURN MANIFOLD	1
7	TF-1038-01*31.3	TF-1041-15*31.3	TF-1038-01*31.3	CONTROL MANIFOLD	RETURN MANIFOLD	1
8	TF-1039-11*35.3	TF-1040-39*35.3	TF-1039-18*35.3	RETURN FILTER	SELECTOR VALVE (TOP)	1
9	TF-1038-08*17.5	TF-1134-02*17.5	TF-1039-17*17.5	RETURN PRESSURE RELIEF VALVE	RESERVOIR	1
N/S	TF-1038-10*300	TF-1040-01*300	TF-1038-10*300	EXTERNAL PRESSURE HOSE		1
N/S	TF-1039-02*300	TF-1041-01*300	TF-1039-02*300	EXTERNAL RETURN HOSE		1

9.7 INSTRUMENT PANEL

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



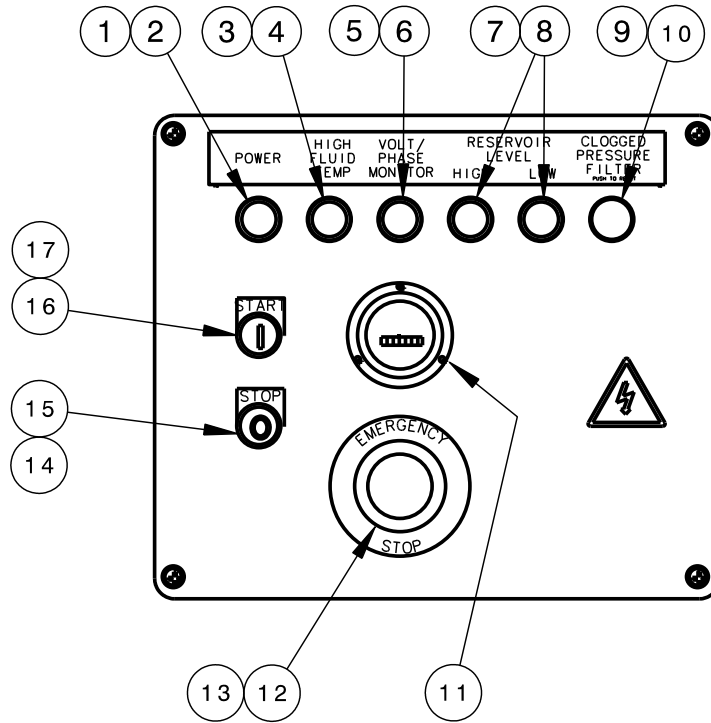
Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	See Section 9.7.1	Electric Panel	1
2	See Section 9.7.2	Hydraulic Panel	1
3	See Section 9.6	Assembly, Hose #4	1
4	See Section 9.7.3	Control Block/Flowmeter	1

9.7.1 Electric Panel

The Electric Panel does not require regular general maintenance.



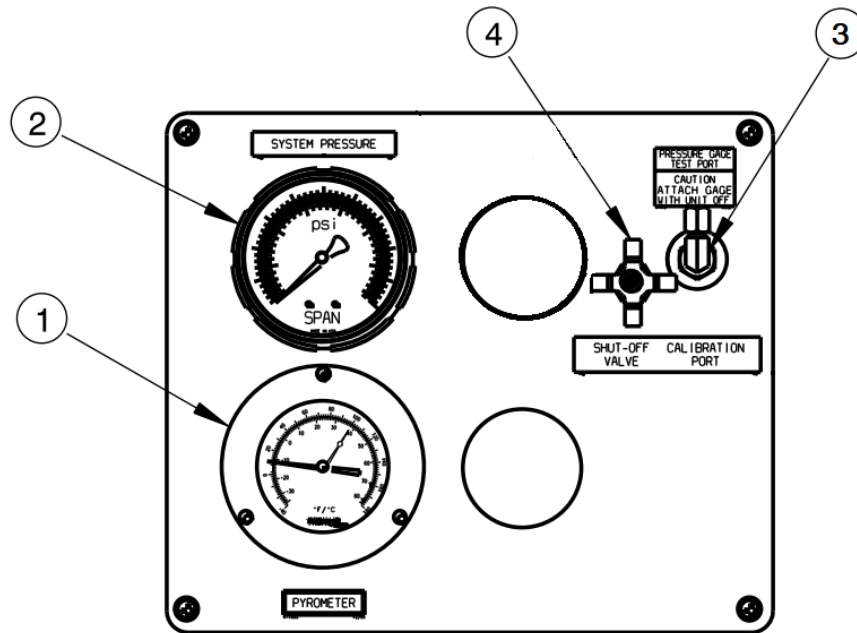
Parts List

All Models - All Fluid Types

Item	Component	Part Number	Description	Qty
1	Standard	EC-1945-01	Light, Diffused Pilot	1
2	Standard	EC-1951-MN5G	Power, Module w/Latch	1
3	Option	EC-1945-03	Light, Diffused Pilot	1
4	Option	EC-1951-MN5Y	Power, Module w/Latch	1
5	Option	EC-1945-03	Light, Diffused Pilot	1
6	Option	EC-1951-MN5Y	Power, Module w/Latch	1
7	Option	EC-1945-04	Light, Diffused Pilot	2
8	Option	EC-1951-MN5B	Power, Module w/Latch	2
9	Option	EC-1952	Push Button, Illuminated/Flush	1
10	Option	EC-1944	Power, Module w/Contact/Latch	1
11	Option	EC-1577	Hour Meter (50 Hz Operation)	1
		EC-1578	Hour Meter (60 Hz Operation)	1
12	Option	EC-1948	Switch, Emergency Stop	1
13	Standard	EC-1946-MX02	Contact Block w/Latch	1
14	Standard	EC-1953-ME205	Push Button, Non-Illuminated	1
15	Standard	EC-1946-MX01	Contact Block w/Latch	1
16	Standard	EC-1953-MF306	Push Button, Non-Illuminated	1
17	Standard	EC-1946-MX10	Contact Block w/Latch1	1

9.7.2 Hydraulic Panel

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



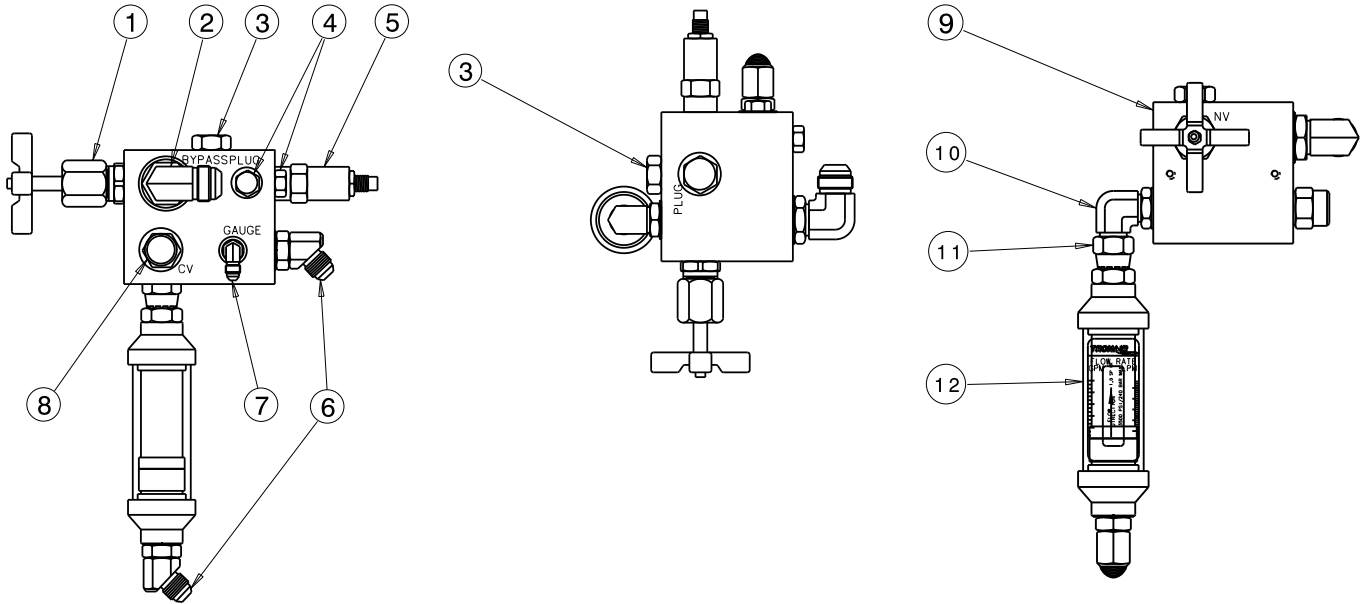
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-2268-01	HC-2268-02	HC-2268-03	PYROMETER (OPTIONAL)	1
2	HC-2144	HC-2144	HC-2144	SYSTEM PRESSURE GAUGE	1
3	HC-2146	HC-2146	HC-2146	PRESSURE GAUGE (HAND PUMP OPTION ONLY)	1
4	HC-1900-01	HC-1900-02	HC-1900-03	SHUT OFF NEEDLE VALVE (CALIBRATION PORT OPTION ONLY)	1
5	See Section 9.13.10			CALIBRATION PORT (OPTIONAL)	1

9.7.3 Control Block/Flowmeter

The Control Block components do not require regular general maintenance.



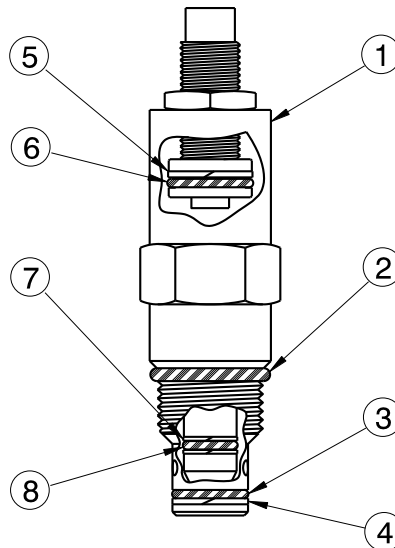
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-1254-04	HC-1927-05	HC-1254-04	NEEDLE VALVE	1
2	N2042-09-S-B	N2042-09-S-E	N2042-09-S-V	ELBOW, 45° STRAIGHT THREAD (#12)	1
3	N-2066-10-S-B	N-2066-10-S-E	N-2066-10-S-V	O-RING HEX PLUG (#10)	2
4	N-2066-06-S-B	N-2066-06-S-E	N-2066-06-S-V	PLUG, O-RING HEX (#6)	2
5	HC-2127	HC-2149	HC-2207	PRESSURE RELIEF VALVE	1
6	N-2007-20-S-B	N-2007-20-S-E	N-2007-20-S-V	CONNECTOR, STRAIGHT THREAD (#12-10)	2
7	N-2001-03-S-B	N-2001-03-S-E	N-2001-03-S-V	ELBOW, STRAIGHT THREAD (#4)	1
8	HC-1673	HC-1677	HC-2208	CHECK VALVE	1
9	N-2001-20-S-B	N-2001-20-S-B	N-2001-20-S-V	ELBOW, 45° STRAIGHT THREAD (#12-10)	
10	J-3399	J-3399	J-3399	PRESSURE MANIFOLD	1
11	N-2001-15-S-B	N-2001-15-S-E	N-2001-15-S-V	ELBOW, STRAIGHT THREAD (#10)	1
12	N-2036-07-S-B	N-2036-07-S-E	N-2036-07-S-V	SWIVEL, 37° FEMALE (#10)	1
13	HC-2129	HC-2132	HC-2251	FLOWMETER, 15 GPM/3,500 PSI	1
	HC-2129-A1	HC-2132-A1	HC-2254-A1	FLOWMETER (CALIBRATED)	1

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.



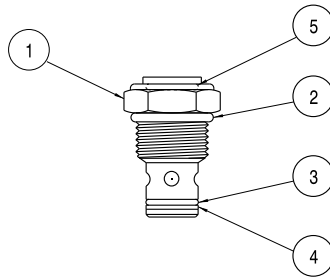
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-2127	HC-2149	HC-2207	PRESSURE RELIEF VALVE (NOT SET)	1
2	HC-2010-910	HC-2013-910	HC-2014-910	O-RING, SERIES 3	1
3	HC-2000-014	HC-2006-014	HC-2007-014	O-RING, SERIES 2	1
4	HC-2020-014	HC-2020-014	HC-2020-014	BACKUP RING (TEFLON)	1
5	HC-2020-015	HC-2020-015	HC-2020-015	BACKUP RING (TEFLON)	1
6	HC-2000-015	HC-2006-015	HC-2007-015	O-RING, SERIES 2	1
7	HC-2020-011	HC-2020-011	HC-2020-011	BACKUP RING (TEFLON)	2
8	HC-2000-011	HC-2006-011	HC-2007-011	O-RING, SERIES 2	1

9.7.3.b Check Valve

The Check Valve does not require regular general maintenance.



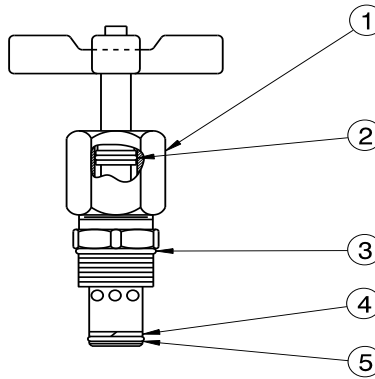
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	HC-1673	HC-1677	HC-2208	CHECK VALVE	1
2	HC-2010-910	HC-2013-910	HC-2014-910	O-RING, SERIES 3	1
3	HC-2000-014	HC-2006-014	HC-2007-014	O-RING, SERIES 2	1
4	HC-2020-014	HC-2020-014	HC-2020-014	BACKUP RING	1
5	HC-2010-905	HC-2013-905	HC-2014-905	O-RING, SERIES 3	1

9.7.3.c Bypass Valve

The Bypass Valve does not require regular general maintenance.

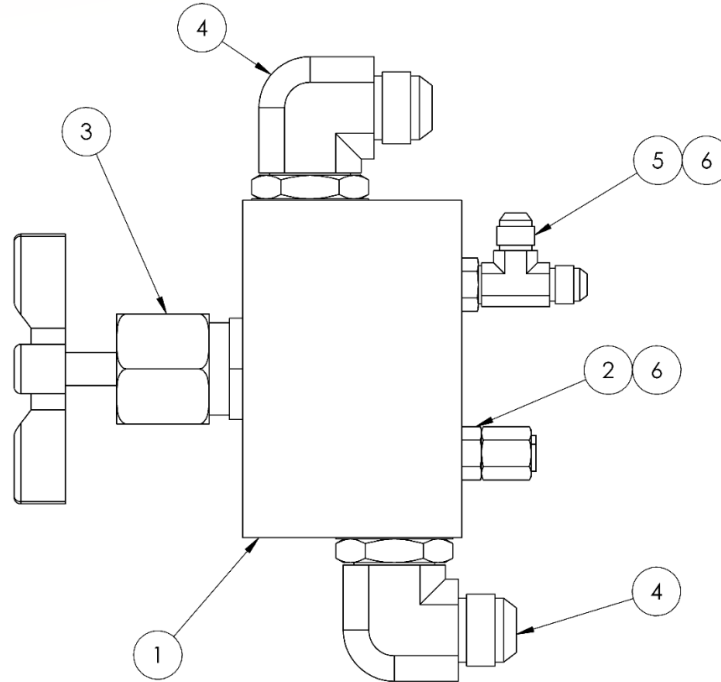


Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	HC-1254-04	HC-1927-05	HC-1254-04	NEEDLE VALVE	1
2	HC-2000-111	HC-2006-111	HC-2007-111	O-RING	1
3	HC-2010-912	HC-2013-912	HC-2014-912	O-RING	1
4	HC-2020-114	HC-2020-114	HC-2020-114	BACKUP RING	1
5	HC-2000-114	HC-2006-114	HC-2007-114	O-RING	1

9.7.4 Flow Control

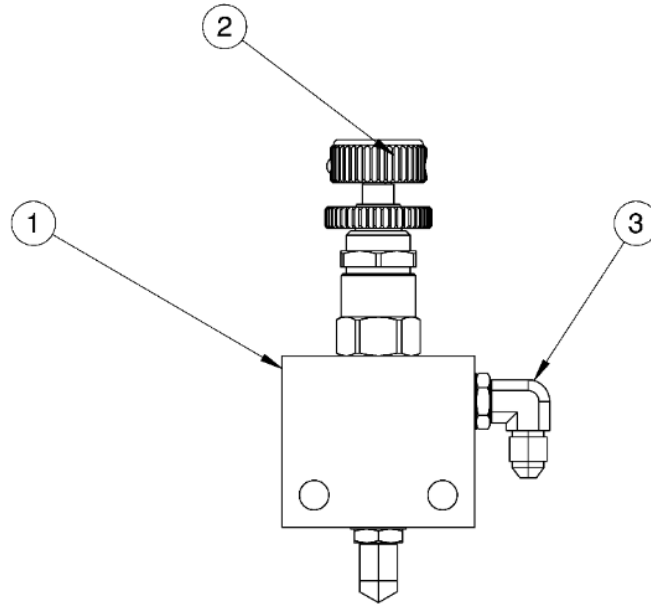


Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	J-8108	J-8108	J-8108	MANIFOLD, FLOW CONTROL	1
2	N-2007-08-S-B	N-2007-08-S-E	N-2007-08-S-V	CONNECTOR, STR THREAD	1
3	HC-1254-04	HC-1927-05	HC-1254-04	VALVE, NEEDLE	1
4	N-2001-18-S-B	N-2001-18-S-E	N-2001-18-S-V	ELBOW, STR THREAD	2
5	N-2015-08-S-B	N-2015-08-S-E	N-2015-08-S-V	TEE, RUN STR THREAD	1
6	N-2008-05-S	N-2008-05-S	N-2008-05-S	CAP, 3/8	2

9.7.5 Pressure Control



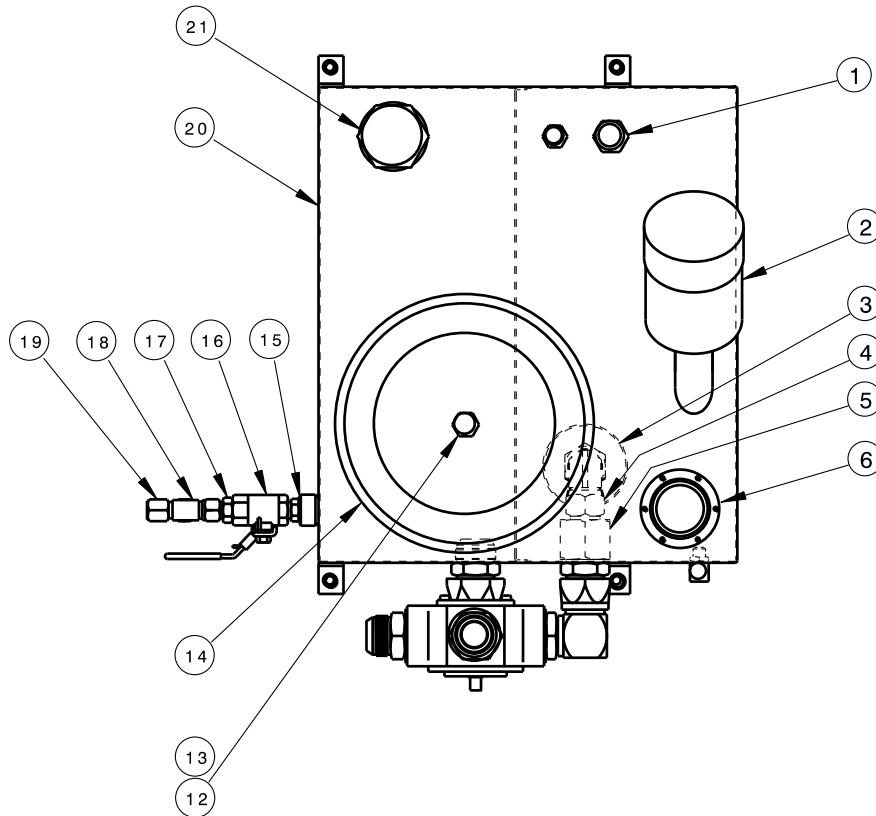
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	J-6603-1	J-6603-1	J-6603-1	MANIFOLD, PRESSURE CONTROL	1
2	HC-2793	HC-2827	HC-2793	VALVE, PRESSURE CONTROL	1
3	N-2001-03-S-V	N-2001-03-S-E	N-2001-03-S-V	ELBOW, STR THREAD	2

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.

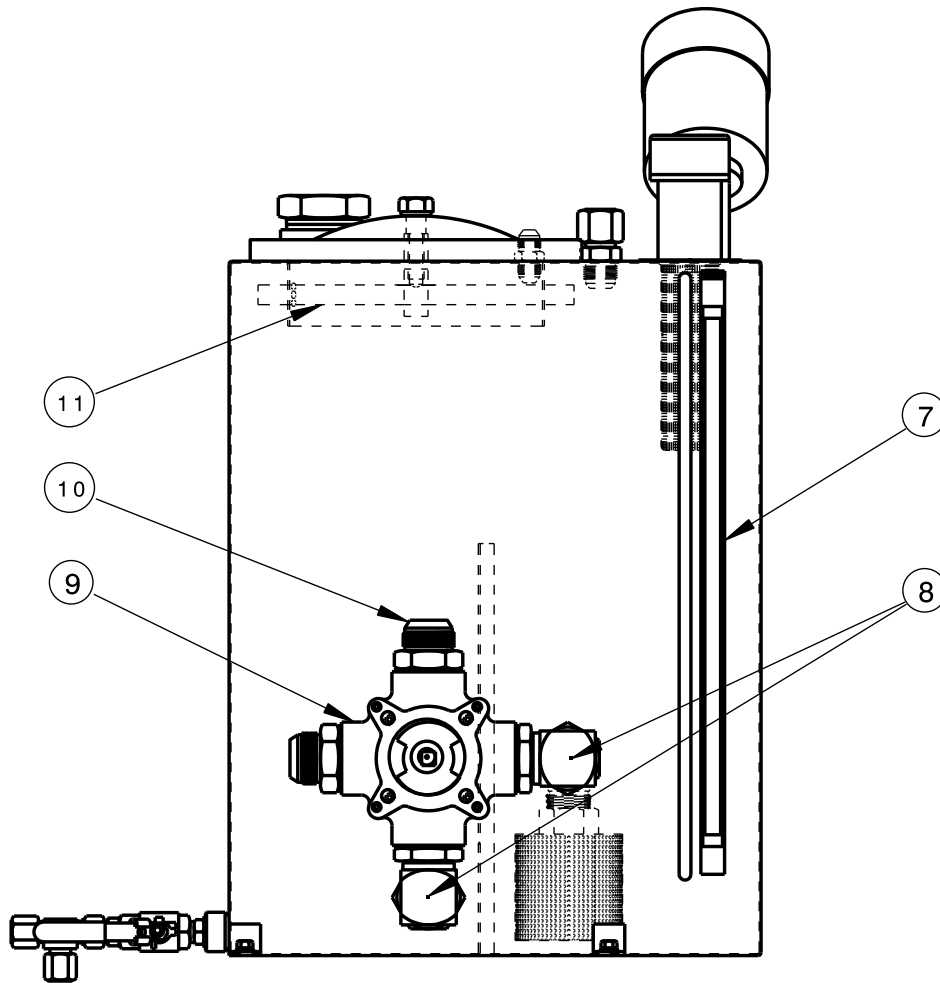


Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	N-2008-08-S	N-2008-08-S	N-2008-08-S	CAP, #12	1
2	HC-1763	HC-1763	HC-1763	DESICCANT FILTER	1
3	HC-1397-02	HC-1397-02	HC-1397-02	DIFFUSER, 1" NPT	1
4	N-2035-08-S	N-2035-08-S	N-2035-08-S	ELBOW, SWIVEL MALE, #16 JIC X 1" NPT	1
5	N-2055-25-S	N-2055-25-S	N-2055-25-S	TUBE REDUCER, #20 X #16 JIC	1
6	HC-2193-06	HC-2193-06	HC-2193-06	FILLER, NON-VENTED	1
12	H-1735-02	H-1735-02	H-1735-02	WASHER, NYLON	1
13	G-1202-1100	G-1202-1100	G-1202-1100	ESN, 5/8 - 11	1
14	H-1740	H-1741	H-1740	COVER ASSEMBLY	1
15	HC-2013-908	HC-2013-908	HC-2014-908	O-RING, SERIES 3	1
16	HC-1761	HC-1761	HC-1761	BALL VALVE, SAE #8 LOCKABLE	1
17	N-2007-11-S-B	N-2007-11-S-E	N-2007-11-S-V	CONNECTOR, STR THREAD #8 SAE X #8 JIC	1
18	N-2016-06-S	N-2016-06-S	N-2016-06-S	TEE, SWIVEL RUN, #8 JIC	1
19	N-2008-06-S	N-2008-06-S	N-2008-06-S	CAP, #8	3
20	Z-2728	H-2728	H-2728	RESERVOIR, 30 GALLON (113.4 LT)	1
21	N-2206-09-S	N-2206-09-S	N-2206-09-S	PLUG, HEX HEAD, 2" NPT	1

9.8 RESERVOIR ASSEMBLY (continued)



Parts List

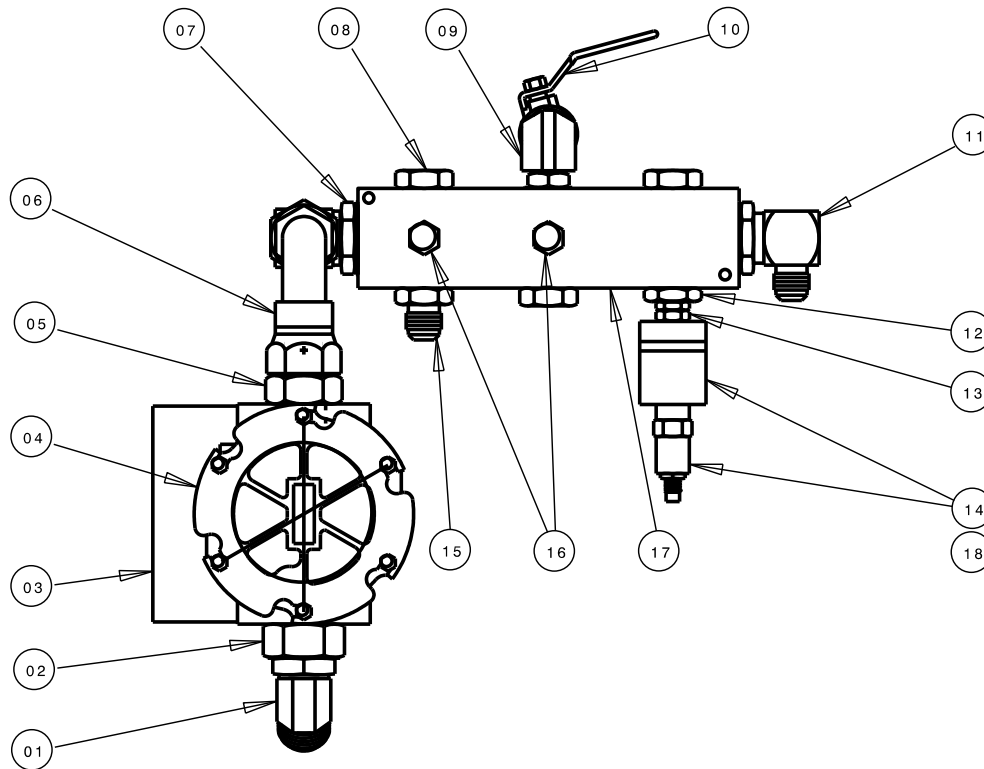
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
7	HC-1382-18	HC-1383-18	HC-2212	SIGHT GAUGE	1
8	N-2049-20-S-B	N-2049-20-S-E	N-2049-20-S-V	ELBOW, 90° SWIVEL, #20	2
9	HC-1764-01	HC-1764-02	HC-1764-03	SELECTOR VALVE, #20 SAE	1
10	N-2007-28-S-B	N-2007-28-S-E	N-2007-28-S-V	CONNECTOR, STRAIGHT THREAD #20 SAE	2
11	Z-2199	Z-2199	Z-2199	CLAMP ASSEMBLY	1

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.



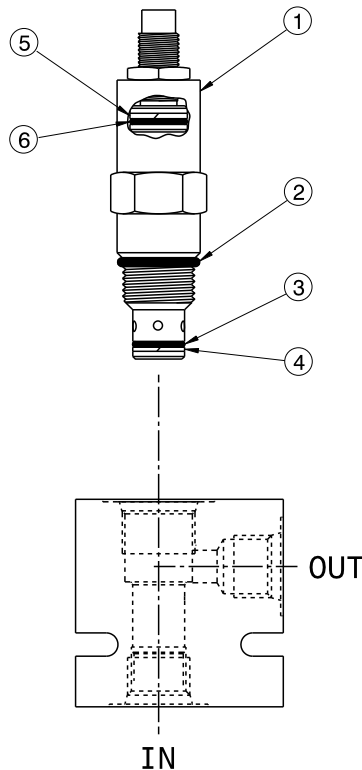
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	N-2042-13-S-B	N-2042-13-S-E	N-2042-13-S-V	ELBOW, 45° STR THREAD #20 JIC X #20 SAE	1
2	N-2463-25-S-B	N-2463-25-S-E	N-2463-25-S-V	FITTING, REDUCER/EXPANDER 24/20 SAE	1
3	H-1581	H-1581	H-1581	BRACKET, FILTER	1
4	HC-1906-01	HC-1906-02	HC-1906-02	FILTER, RETURN	1
5	N-2007-30-S-B	N-2007-30-S-E	N-2007-30-S-V	CONNECTOR, STR THREAD, #20 JIC X #24 SAE	1
6	N-2063-04	N-2063-04	N-2063-04	ELBOW, BENT SWIVEL NUT	1
7	N-2049-20-S-B	N-2049-20-S-E	N-2049-20-S-V	ELBOW, 90° SWIVEL, #20 SAE X #20 JIC	1
8	N-2053-10-S-B	N-2053-10-S-E	N-2053-10-S-V	PLUG, HEX HEAD, #16 O-RING	3
9	N-2661-06-S-B	N-2661-06-S-E	N-2661-06-S-V	ELBOW, 90° #16 SAE X #16 SAE	1
10	HC-1766-05	HC-1770-05	HC-2209-05	VALVE, BALL	1
11	N-2001-37-S-B	N-2001-37-S-E	N-2001-37-S-V	ELBOW, 90° #12 JIC X #20 SAE	1
12	N-2463-16-S-B	N-2463-16-S-E	N-2463-16-S-V	FITTING, REDUCER/EXPANDER 16/8 SAE	1
13	N-2464-06-S-B	N-2464-06-S-E	N-2464-06-S-V	UNION, STR THREAD #8 X #8 SAE	1
14	HC-2199	HC-2200	HC-2211	VALVE, PRESSURE RELIEF (PRE-SET)	1
15	N-2007-21-S-B	N-2007-21-S-E	N-2007-21-S-V	CONNECTOR, STR THREAD, #12 JIC X #16 SAE	1
16	N-2053-06-S-B	N-2053-06-S-E	N-2053-06-S-V	PLUG, HEX HEAD, #8 O-RING	2
17	HC-2205	HC-2205	HC-2205	MANIFOLD, RETURN	1
18	N-2001-11-S-B	N-2001-11-S-E	N-2001-11-S-V	ELBOW, STR THREAD #8 SAE X #8 JIC	1

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.

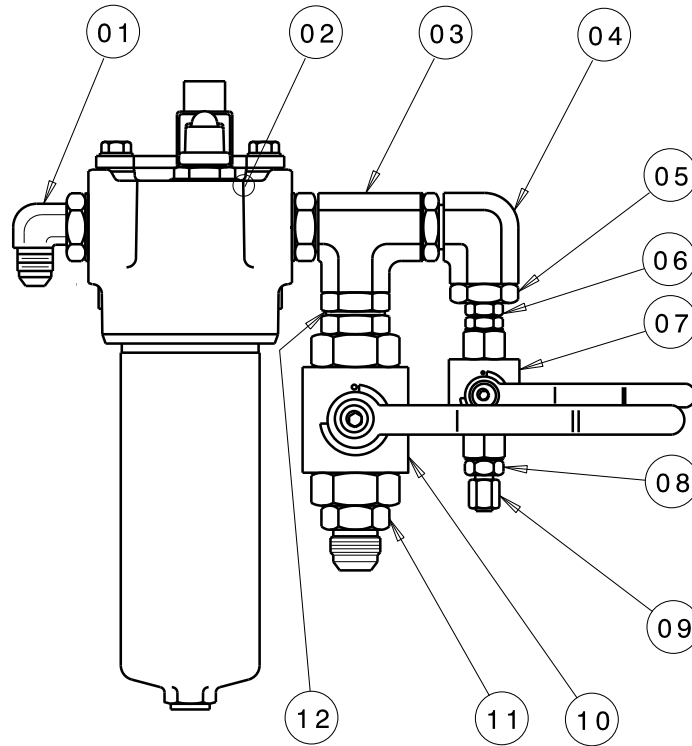


Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	HC-2199	HC-2200	HC-2211	PRESSURE RELIEF VALVE (INCLUDES VALVE BLK)	1
2	HC-2010-910	HC-2013-910	HC-2014-910	O-RING, SERIES 3	1
3	HC-2000-014	HC-2006-014	HC-2007-014	O-RING, SERIES 2	1
4	HC-2020-014	HC-2020-014	HC-2020-014	BACKUP RING (TEFLON)	1
5	HC-2020-015	HC-2020-015	HC-2020-015	BACKUP RING (TEFLON)	1
6	HC-2000-015	HC-2006-015	HC-2007-015	O-RING, SERIES 2	1

9.10 PRESSURE FILTER ASSEMBLY (Single System)
Refer to Section 9.5.1 for information on changing filter element.



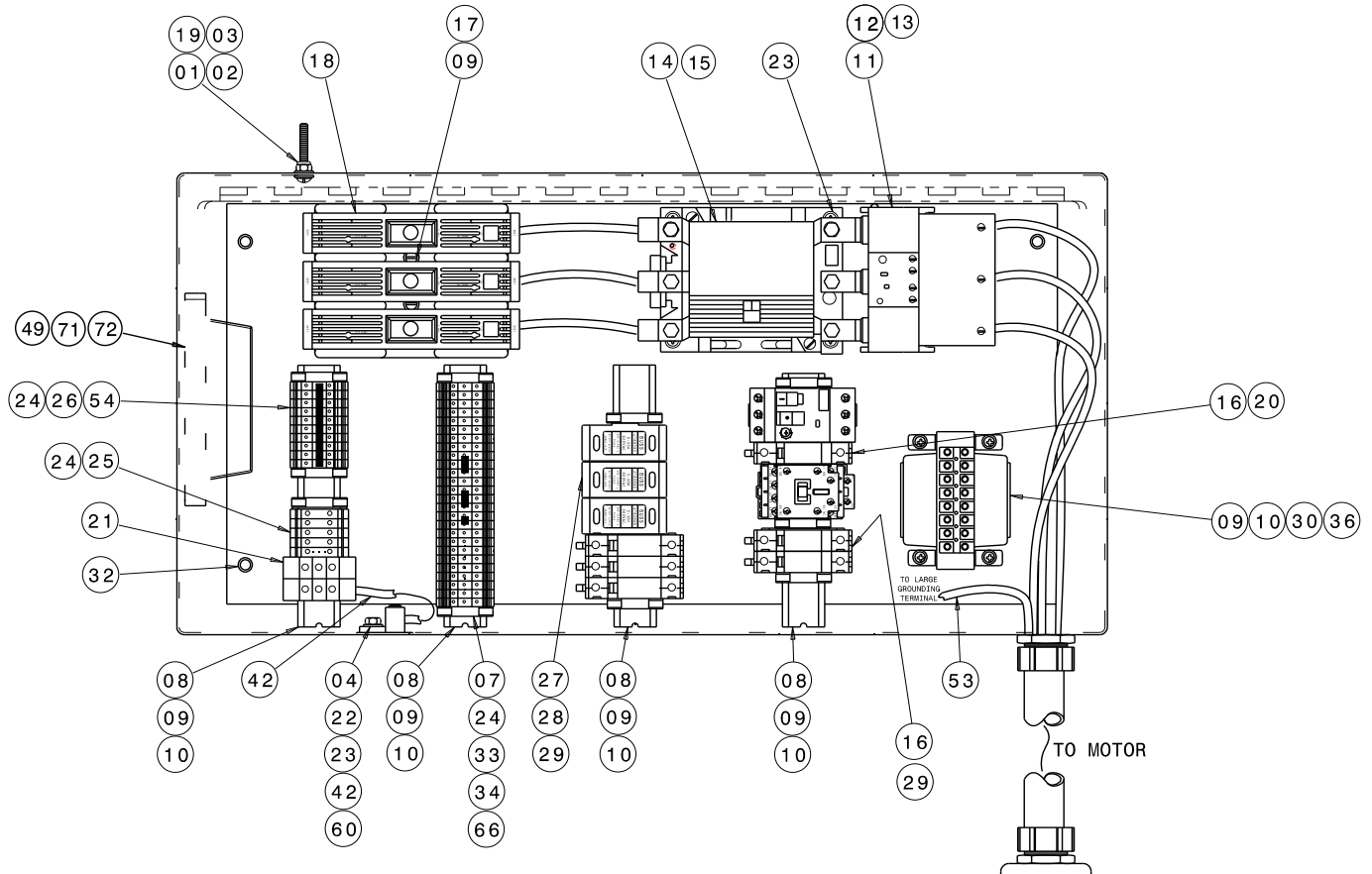
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	N-2001-18-S-B	N-2001-18-S-E	N-2001-18-S-V	ELBOW, STR THREAD #8-12	1
2	HC-1907-01	HC-1907-02	HC-1907-03	FILTER, PRESSURE	1
3	N-2660-05-S-B	N-2660-05-S-E	N-2660-05-S-V	TEE, STR THREAD #12	1
4	N-2661-05-S-B	N-2661-05-S-E	N-2661-05-S-V	ELBOW, STR THREAD #12	1
5	N-2463-35-S-B	N-2463-35-S-E	N-2463-35-S-V	UNION, STR THREAD #12 MALE X #6 FEMALE	1
6	N-2464-05-S-B	N-2464-05-S-E	N-2464-05-S-V	UNION, MALE STRAIGHT THREAD #6	1
7	HC-1768-02	HC-1771-02	HC-2206-02	VALVE, BALL SAE #6	1
8	N-2007-05-S-B	N-2007-05-S-E	N-2007-05-S-V	CONNECTOR, STR THREAD #6 SAE X 1/4 JIC	1
9	N-2008-03-S	N-2008-03-S	N-2008-03-S	CAP, #4 FEMALE	1
10	HC-1768-04	HC-1771-04	HC-2206-04	VALVE, BALL SAE #12	1
11	N-2007-18-S-B	N-2007-18-S-E	N-2007-18-S-V	CONNECTOR, STR THREAD #12	1
12	N-2464-08-S-B	N-2464-08-S-E	N-2464-08-S-V	UNION, MALE STR THREAD #12	1

9.11 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.



Set Item 11 to Automatic Reset position. Wire per Electrical Schematic INS-2016. Reference Wiring Diagram INS-2144.

Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	G-1159-105516	SCREW, RD HD CRS REC, ¼ - 28 X 1 ¾ LONG	1
2	G-1250-1050N	FLATWASHER, ¼ NARROW	2
3	G-1202-1055	ESN, ¼ - 28	1
4	G-1180-105006	SCREW, ¼ HH TYPE F	1
7	EC-1956-02	BLOCK, IEC TERMINAL (RED)	26
8	EC-1803	RAIL, DIN	4
9	G-1150-103506	SCREW, #10-32 HH MACH X ¾ LONG	14
12	EC-1603	SHIELD, ANTI-TAMPER	1
16	EC-1541-01	FUSE HOLDER, IEC CLASS CC	3
19	EC-1180-24	TERMINAL, RING TONGUE ¼ BOLT HOLE	1
20	EC-1542-04	FUSE, LP-CC-LOW PEAK 1-6/10A	1
21	EC-1957	BLOCK, IEC GROUND	2
22	EC-1532-02	LUG, GROUND	1
23	G-1251-1050R	LOCKWASHER, ¼ REGULAR	5
24	EC-1959	ANCHOR, IEC END	10

9.11 ELECTRICAL COMPONENTS (continued)

Parts List
All Models - All Fluid Types

Item	Part Number	Description	Qty
25	EC-1958	BLOCK, IEC GROUND	5
26	EC-1960-01	BARRIER, END	2
27	EC-1596-01	FUSE HOLDER, CLASS J	3
30	EC-1804-02	TRANSFORMER, CONTROL (100 W)	1
31	EC-1956-03	BLOCK, IEC TERMINAL (BLUE)	10
32	G-1202-1070	ESN, 3/8 - 16	4
33	EC-1961-04	JUMPER, CENTER	1
34	EC-1961-02	JUMPER, CENTER	2
35	EC-1961-01	JUMPER, CENTER	1
36	EC-1826	GUARD, FINGER TOUCHPROOF	1

THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

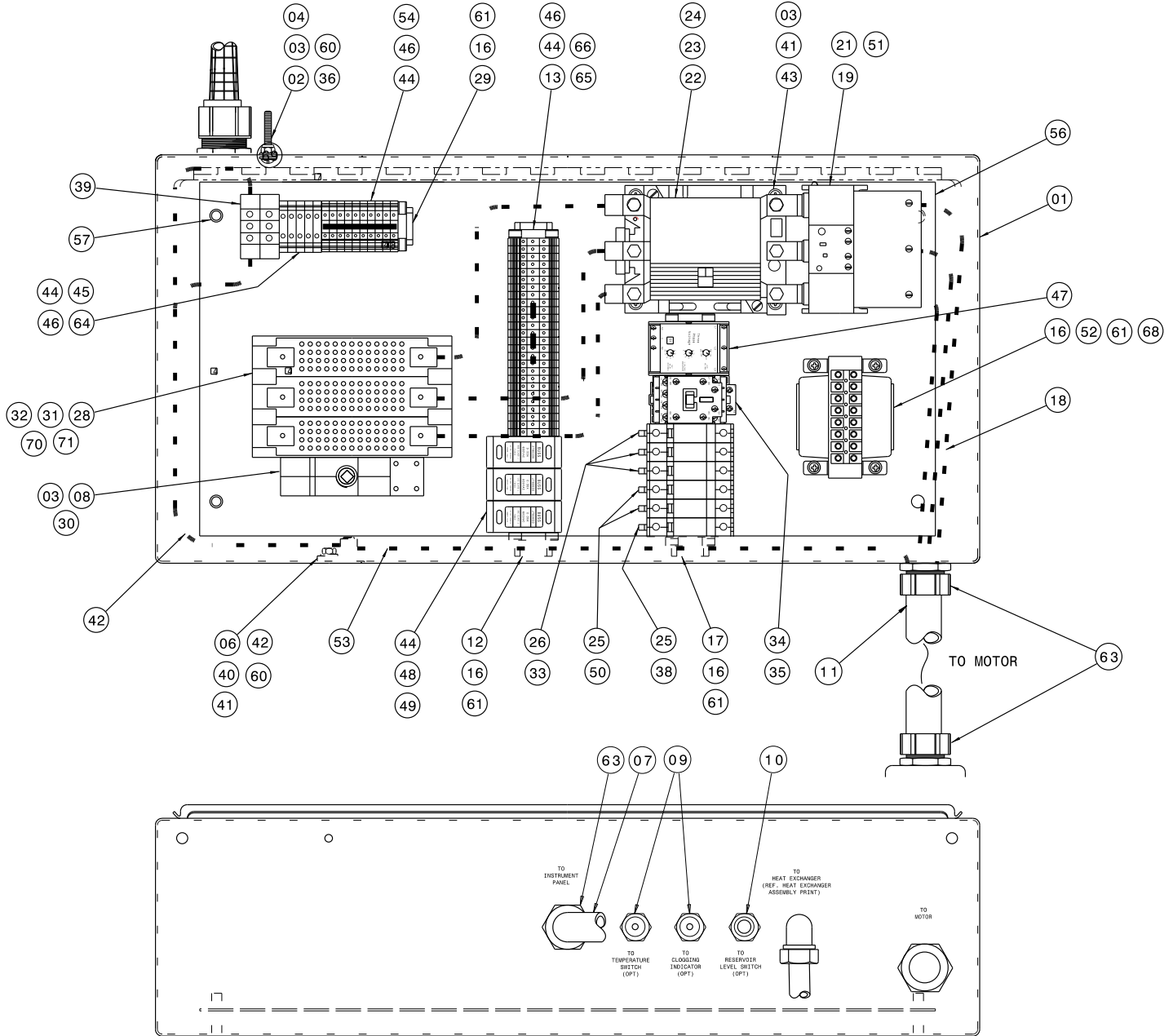
Be sure to locate the correct voltage and hertz of the unit before selecting the part

Item	60 Hz Applications					Description	Qty
	208	230	380	460	575		
5	G-1250-1030N	N/A	N/A	N/A	N/A	Flatwasher, #10 Narrow	6
6	G-1251-1030R	N/A	N/A	N/A	N/A	Lockwasher, #10 Regular	6
10	EC-1924-02	N/A	N/A	N/A	N/A	Lug Set, Terminal	1
11	EC-1920	EC-1525	EC-1525	EC-1589	EC-1589	Relay, Overload	1
13	EC-1965	EC-1604	EC-1604	EC-1604	EC-1604	Shield, Current Adjustment	1
14	EC-1922	EC-1587	EC-1587	EC-1586	EC-1586	Contact, IEC Motor	1
15	EC-1924-02	EC-1607	EC-1607	EC-1607	EC-1607	Lug Set, Terminal	1
17	EC-1559	EC-1559	EC-1563	EC-1563	EC-1563	Fuse Block, Class J	1
18	EC-1556-04	EC-1556-03	EC-1557-30	EC-1557-29	EC-1557-27	Fuse, Class J	3
28	EC-1557-02	EC-1557-02	EC-1557-01	EC-1557-01	EC-1557-04	Fuse, Class J	3
29	EC-1726-09	EC-1726-08	EC-1726-05	EC-1726-04	EC-1726-04	Fuse, Class CC	2

Item	50 Hz Applications					Description	Qty
	200	220	380	415	440		
5	N/A	N/A	N/A	N/A	N/A	Flatwasher, #10 Narrow	6
6	N/A	N/A	N/A	N/A	N/A	Lockwasher, #10 Regular	6
10	N/A	N/A	N/A	N/A	N/A	Lug Set, Terminal	1
11	EC-1920	EC-1525	EC-1589	EC-1589	EC-1589	Relay, Overload	1
13	EC-1965	EC-1604	EC-1604	EC-1604	EC-1604	Shield, Current Adjustment	1
14	EC-1922	EC-1587	EC-1586	EC-1586	EC-1586	Contact, IEC Motor	1
15	EC-1924-02	EC-1607	EC-1607	EC-1607	EC-1607	Lug Set, Terminal	1
17	EC-1559	EC-1559	EC-1563	EC-1563	EC-1563	Fuse Block, Class J	1
18	EC-1556-04	EC-1556-03	EC-1557-29	EC-1557-29	EC-1557-29	Fuse, Class J	3
28	EC-1557-04	EC-1557-04	EC-1557-01	EC-1557-01	EC-1557-01	Fuse, Class J	3
29	EC-1726-10	EC-1726-09	EC-1726-05	EC-1726-05	EC-1726-04	Fuse, Class CC	2

9.11.1 Electrical Components With 100 ft. Input Cord Option

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.



Set Item 09 to "Auto" and set "A2" to its corresponding full load amps. Wire per Appendix - Electrical Schematic INS-1608 and wire diagram INS-1746.

9.11.1 Electrical Components With 100 ft. Input Cord Option (continued)

Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	G-1159-105516	SCREW, RD HD CRS REC, ¼ - 28 X 1 ¼ LONG	1
2	G-1250-1050N	FLATWASHER, ¼ NARROW	10
3	G-1202-1055	ESN, ¼ - 28	1
6	G-1180-105006	SCREW, ¼ HH TYPE F	1
7	EC-1540-04*16.0	CONDUIT, FLEXIBLE WIRING, 1"	1
11	EC-1540-04*21.8	CONDUIT, FLEXIBLE WIRING, 1"	1
12	EC-1895-008.90	RAIL, DIN	1
13	EC-1956-02	BLOCK, IEC TERMINAL (RED)	26
15	EC-1803	RAIL, DIN	4
16	G-1150-103504	SCREW, #10-32 HH MACH X ¼ LONG	10
17	EC-1895-012.25	RAIL, DIN	1
18	EC-1263-06*50.0	WIRE, POWER (4 AWG, BLACK)	3
25	EC-1541-01	FUSE HOLDER, IEC CLASS CC	3
27	EC-1263-06*18.0	WIRE, POWER (4 AWG, BLACK)	3
29	EC-1895-006.90	RAIL, DIN	1
30	G-1250-1020N	FLATWASHER, #8 NARROW	4
36	EC-1180-24	TERMINAL, RING TONGUE ¼ BOLT HOLE	1
38	EC-1542-09	FUSE, LP-CC-LOW PEAK 1-6/10A	1
39	EC-1957	BLOCK, IEC GROUND	2
40	EC-1532-02	LUG, GROUND	1
41	G-1251-1050R	LOCKWASHER, ¼ REGULAR	5
42	EC-1572-08*24.0	WIRE, GROUND (2 AEG, GREEN/YELLOW)	1
43	G-1159-103510	SCREW, RD HD CRS REC, #10-32 X 1 ¼ LONG	6
44	EC-1959	ANCHOR, IEC END	5
45	EC-1958	BLOCK, IEC GROUND	5
46	EC-1960-01	BARRIER, END	2
48	EC-1596-01	FUSE HOLDER, CLASS J	3
53	EC-1572-08*120	WIRE, GROUND (2 AEG, GREEN/YELLOW)	1
54	EC-1956-03	BLOCK, IEC TERMINAL (BLUE)	10
56	S-2012	PANEL, INNER	1
57	G-1202-1070	ESN, ⅜ - 16	4
60	V-1665	LABEL, GROUND	2
61	G-1250-1030N	FLATWASHER, #10 NARROW	10
63	EC-1167-04	CONNECTOR, CONDUIT	4
64	EC-1961-04	JUMPER, CENTER	1
65	EC-1961-02	JUMPER, CENTER	2
66	EC-1961-01	JUMPER, CENTER	1
68	EC-1826	GUARD, FINGER TOUCHPROOF	1
N/S	H-2432-06	PLUG, SHEETMETAL	3
N/S	EC-1666	HARNESS, WIRING	1
N/S	V-1978	LABEL, COMPONENT GROUP	1



9.11.1 Electrical Components With 100 ft. Input Cord Option *(continued)*

THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

Be sure to locate the correct voltage and hertz of the unit before selecting the part

ITEM	60 HZ Applications					Description	Qty
	208	230	380	460	575		
1	EC-1896	EC-1896	EC-1897	EC-1897	EC-1897	ENCLOSURE, ELECTRICAL	1
8	EC-1159-105505	EC-1159-105505	EC-1159-102006	EC-1159-102006	EC-1159-102006	HARDWARE, MOUNTING	4
19	EC-1920	EC-1525	EC-1525	EC-1589	EC-1589	RELAY, OVERLOAD	1
22	EC-1922	EC-1587	EC-1587	EC-1586	EC-1586	CONTACTOR, IEC MOTOR	1
23	EC-1924-02	N/A	N/A	N/A	N/A	LUG SET, TERMINAL	2
24	N/A	EC-1606	EC-1606	N/A	N/A	COVER, TERMINAL CONTACTOR	1
28	EC-2653	EC-2653	EC-2669	EC-2669	EC-2669	SWITCH, FUSED DISCONNECT	1
31	EC-1898	EC-1898	N/A	N/A	N/A	SHIELD, DISCONNECT SWITCH	3
32	EC-1556-04	EC-1556-03	EC-1557-30	EC-1557-29	EC-1557-27	FUSE, CLASS J	3
49	EC-1557-02	EC-1557-02	EC-1557-01	EC-1557-01	EC-1557-01	FUSE, CLASS J	3
50	EC-1726-09	EC-1726-08	EC-1726-05	EC-1726-04	EC-1726-04	FUSE, CLASS CC	2
51	EC-1964-01	N/A	N/A	N/A	N/A	COVER, TERMINAL	3
52	EC-1804-02	EC-1676-02	EC-1804-02	EC-1676-02	EC-1804-02	TRANSFORMER, CONTROL (100 VA)	1
69	N/A	EC-1607	EC-1607	EC-1607	EC-1607	AUXILIARY SWITCH, BLACK	1
70	EC-2654	EC-2654	N/A	N/A	N/A	HANDLE, OPERATING	1
71	EC-2655	EC-2655	N/A	N/A	N/A	SHAFT, EXTENSION	1



9.11.1 Electrical Components With 100 ft. Input Cord Option *(continued)*

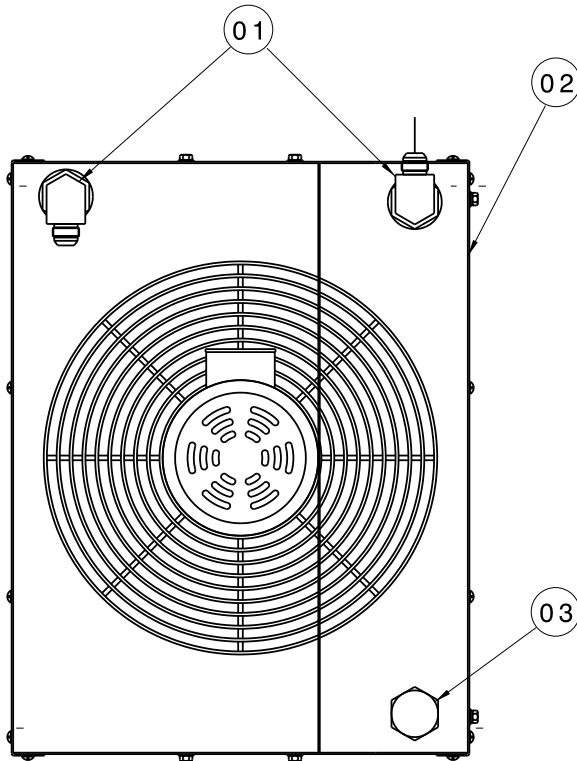
THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

Be sure to locate the correct voltage and hertz of the unit before selecting the part

ITEM	50 HZ Applications					Description	Qty
	200	220	380	415	440		
1	EC-1896	EC-1896	EC-1897	EC-1897	EC-1897	ENCLOSURE, ELECTRICAL	1
8	EC-1159-105505	EC-1159-105505	EC-1159-102006	EC-1159-102006	EC-1159-102006	HARDWARE, MOUNTING	4
19	EC-1920	EC-1525	EC-1525	EC-1589	EC-1589	RELAY, OVERLOAD	1
22	EC-1922	EC-1587	EC-1586	EC-1586	EC-1586	CONTACTOR, IEC MOTOR	1
23	EC-1924-02	N/A	N/A	N/A	N/A	LUG SET, TERMINAL	2
24	N/A	EC-1606	N/A	N/A	N/A	COVER, TERMINAL CONTACTOR	1
28	EC-2653	EC-2653	EC-2669	EC-2669	EC-2669	SWITCH, FUSED DISCONNECT	1
31	EC-1898	EC-1898	N/A	N/A	N/A	SHIELD, DISCONNECT SWITCH	3
32	EC-1556-04	EC-1556-04	EC-1557-30	EC-1557-30	EC-1557-29	FUSE, CLASS J	3
49	EC-1557-04	EC-1557-04	EC-1557-01	EC-1557-01	EC-1557-01	FUSE, CLASS J	3
50	EC-1726-10	EC-1726-09	EC-1726-05	EC-1726-05	EC-1726-04	FUSE, CLASS CC	2
51	EC-1964-01	N/A	N/A	N/A	N/A	COVER, TERMINAL	3
52	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	EC-1804-02	TRANSFORMER, CONTROL (100 VA)	1
69	N/A	EC-1607	EC-1607	EC-1607	EC-1607	AUXILIARY SWITCH, BLACK	1
70	EC-2654	EC-2654	N/A	N/A	N/A	HANDLE, OPERATING	1
71	EC-2655	EC-2655	N/A	N/A	N/A	SHAFT, EXTENSION	1

9.12 HEAT EXCHANGER ASSEMBLY

The Heat Exchanger Assembly does not require regular general maintenance.



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

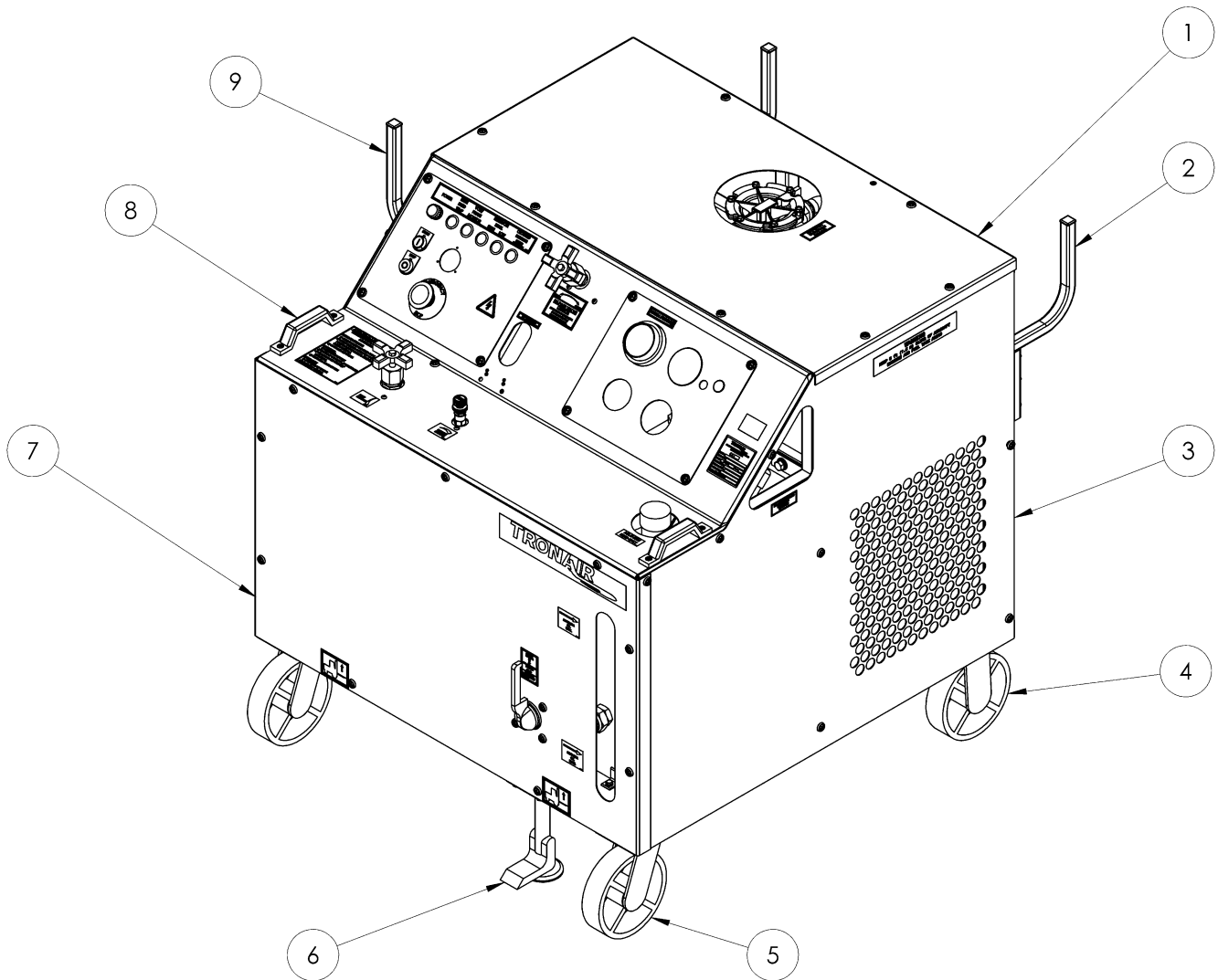
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	2001-37-S-B	2001-37-S-E	2001-37-S-V	ELBOW, STRAIGHT THREAD (12-20)	1
2	Reference Table			HEAT EXCHANGER	1
3	N-2066-20-S-B	N-2066-20-S-E	N-2066-20-S-V	PLUG, #20 SAE (HIDDEN)	1

9.13 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.



Parts List

All Models - All Fluid Types

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	2
9	Z-5549-01	CORD HANGER	1
N/S	S-1884-01	LEFT SIDE PANEL	1
N/S	Z-5775-01	FRAME	1

9.14 ADDITIONAL FEATURES

9.14.1 50 ft (15.2 m) Hoses (Option B)

Refer to Section 9.6 Hydraulic Hoses concerning hose inspection.

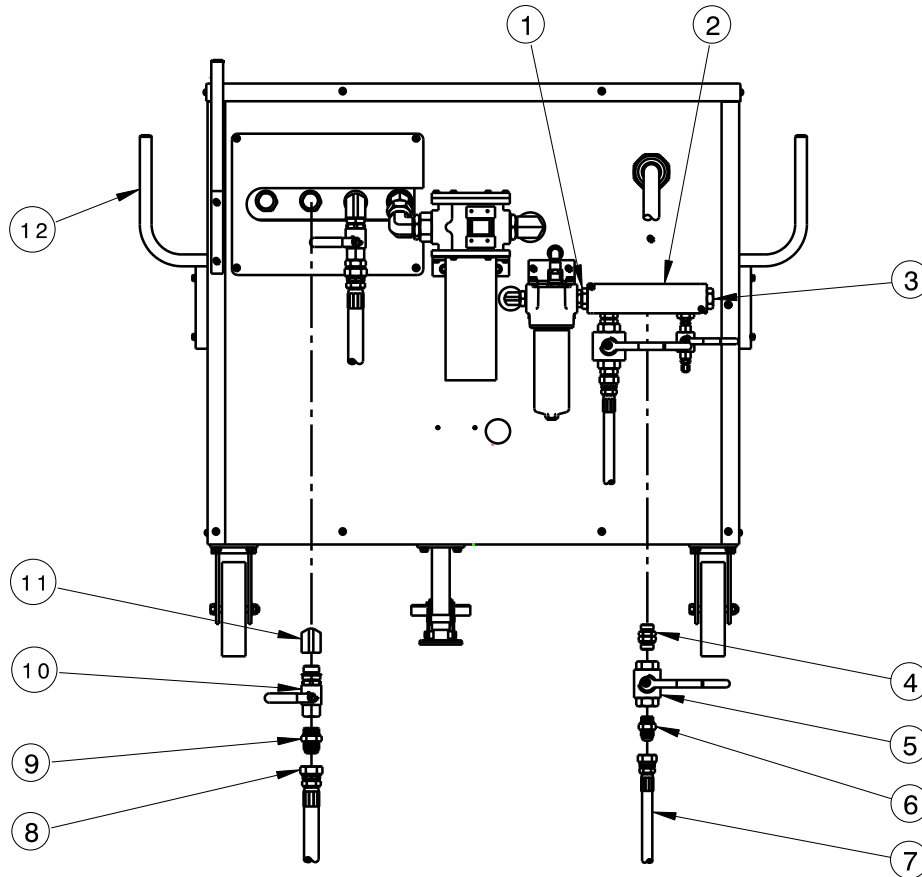
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

5411 & 5421	5431	5441		
Part Number	Part Number	Part Number	Description	Qty
TF-1038-10*300	TF-1040-01*300	TF-1038-10*300	PRESSURE HOSE, 25 FT/7.6 M	2 per Option
TF-1039-02*300	TF-1041-01*300	TF-1039-22*300	RETURN HOSE, 25 FT/7.6 M	2 per Option
N-2011-10-S	N-2011-10-S	N-2011-10-S	UNION, #16	1 per Option
N-2011-08-S	N-2011-08-S	N-2011-08-S	UNION, #12	1 per Option

9.14.2 Split System (Option C)

Refer to Section 9.6 Hydraulic Hoses concerning hose inspection.



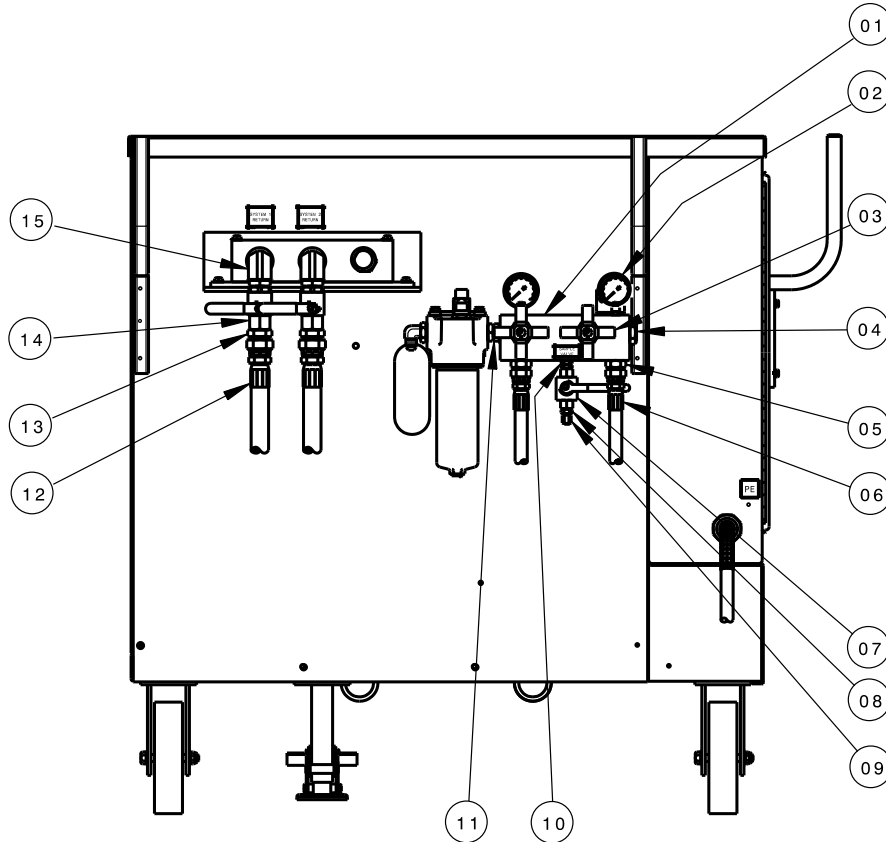
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	N-2464-14-S-B	N-2464-14-S-E	N-2464-14-S-V	UNION, MALE STRAIGHT THREAD #12 X #16	1
2	HC-1903	HC-1903	HC-1903	PRESSURE MANIFOLD (PLATED)	1
3	N-2053-10-S-B	N-2053-10-S-E	N-2053-10-S-V	PLUG, MALE STRAIGHT THREAD #16	1
4	N-2464-08-S-B	N-2464-08-S-E	N-2464-08-S-V	UNION, MALE STRAIGHT THREAD #12	1
5	HC-2206-04	HC-1771-04	HC-2206-04	BALL VALVE	1
6	N-2007-18-S-B	N-2007-18-S-E	N-2007-18-S-V	CONNECTOR, STRAIGHT THREAD #12 X #12 JIC	1
7	TF-1038-10*300	TF-1040-01*300	TF-1038-10*300	PRESSURE HOSE ASSEMBLY, #12	1
8	TF-1039-02*300	TF-1041-01*300	TF-1039-22*300	RETURN HOSE ASSEMBLY, #16	1
9	N-2007-24-S-B	N-2007-24-S-E	N-2007-24-S-E	CONNECTOR, STRAIGHT THREAD #16 X #16 JIC	1
10	HC-1770-05	HC-1770-05	HC-2209-05	BALL VALVE, #16 SAE	1
11	N-2661-06-S-B	N-2661-06-S-E	N-2661-06-S-V	ELBOW, 90° #16 M-SAE X #16 F-SAE	1

9.14.3 Crossover Check (Option D)

Refer to Section **9.6 Hydraulic Hoses** concerning hose inspection. Annual calibration of instrumentation is recommended. See Section **12.0 – Calibration of Instrumentation** for details of gauge calibration.



Parts List

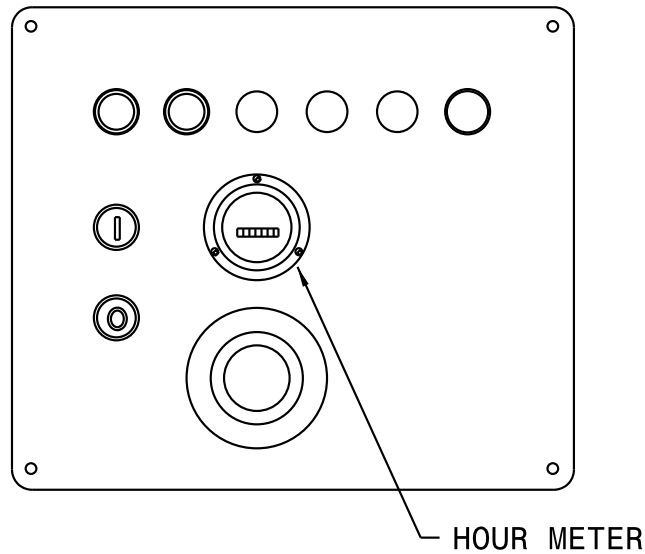
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	J-3516	J-3516	J-3516	CROSSOVER CHECK MANIFOLD	1
2	HC-1257	HC-1928	HC-2310	PRESSURE GAUGE	2
3	HC-1254-05	HC-1927-06	HC-1254-05	CARTRIDGE NEEDLE VALVE	2
4	HC-1437	HC-1436	HC-1437	CHECK VALVE	1
5	N-2007-18-S-B	N-2007-18-S-E	N-2007-18-S-V	CONNECTOR, STRAIGHT THREAD	2
6	TF-1038-10*300	TF-1040-01*300	TF-1038-10*300	PRESSURE HOSE ASSEMBLY	2
7	HC-1768-02	HC-1771-02	HC-2206-02	BALL VALVE (#6)	1
8	N-2007-05-S-B	N-2007-05-S-E	N-2007-05-S-V	CONNECTOR, STRAIGHT THREAD	1
9	N-2008-03-S	N-2008-03-S	N-2008-03-S	CAP, #4 FEMALE	1
10	N-2464-05-S-B	N-2464-05-S-E	N-2464-05-S-V	UNION, STRAIGHT THREAD #6 SAE	1
11	N-2464-08-S-B	N-2464-08-S-E	N-2464-08-S-V	UNION, STRAIGHT THREAD #12 SAE	1
12	TF-1039-02*300	TF-1041-01*300	TF-1039-22*300	RETURN HOSE ASSEMBLY	2
13	N-2007-24-S-B	N-2007-24-S-E	N-2007-24-S-V	CONNECTOR, STRAIGHT THREAD	2
14	HC-1766-05	HC-1770-05	HC-2209-05	BALL VALVE (#16)	2
15	N-2661-06-S-B	N-2661-06-S-E	N-2661-06-SV	ELBOW, 90° (#16 SAE)	2

9.14.4 Hour Meter (Options E and F)

The Hour Meter does not require regular general maintenance.

NOTE: Wire Hour Meter per Electrical Schematic INS-2016. Reference Wiring Diagram INS-2144.



Parts List

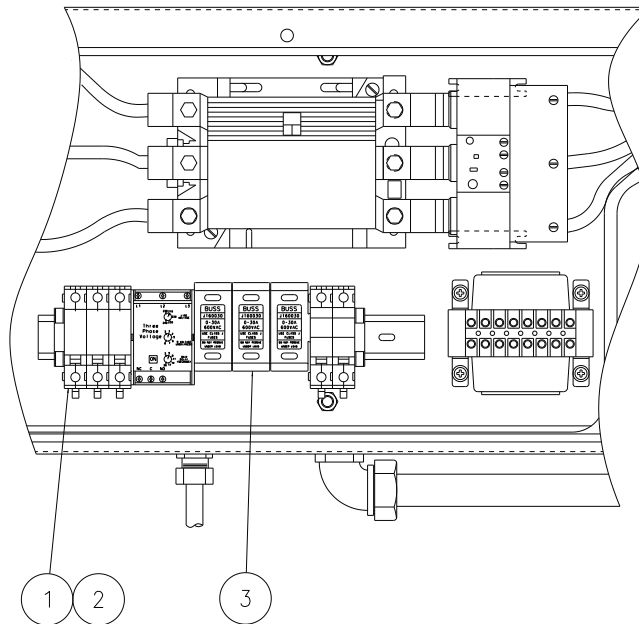
All Models - All Fluid Types

Part Number	Application	Description	Qty
EC-1577	50 Hz Operation	HOUR METER	1
EC-1578	60 Hz Operation	HOUR METER	1

9.14.5 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.

NOTE: Wire per Electrical Schematic INS-2016. Reference Wiring Diagram INS-2144. Reference Section 9.7.1 Electrical Panel for Panel Light.



Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	EC-1541-05	FUSE HOLDER, IEC CLASS CC	3
2	EC-1675-12	FUSE, KTK-R, 2 AMP	3
3	See Table below	PHASE MONITOR	1

Phase Monitor

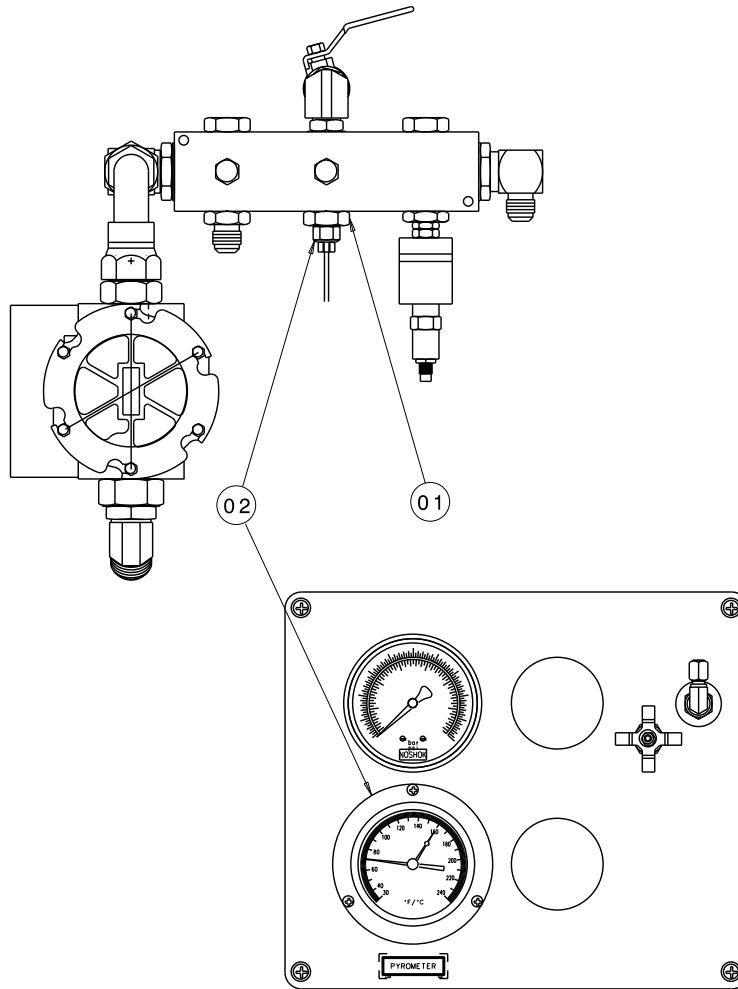
Option	Voltage	Frequency	Part Number
G	200 – 230	50/60 Hz	EC-1543-02
H	380	50/60 Hz	EC-1543-03
I	415 – 460	50/60 Hz	EC-1543-04
J	575	60 Hz	EC-1543-05

♦ 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.

9.14.6 Pyrometer (Option K)

Refer to Section 11.7 – Analog Temperature Gauge when calibration of the pyrometer is desired.



Parts List

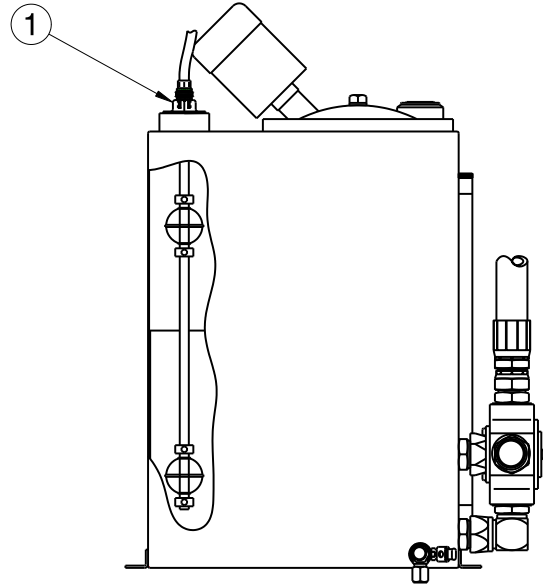
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	N-2463-16-S-B	N-2463-16-S-E	N-2463-16-S-V	REDUCER FITTING	1
2	HC-2268-01	HC-2268-02	HC-2268-03	PYROMETER	1

9.14.7 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-2016. Reference Wiring Diagram INS-2144. Reference 9.7.1 Electrical Panel for Panel Light.



Parts List

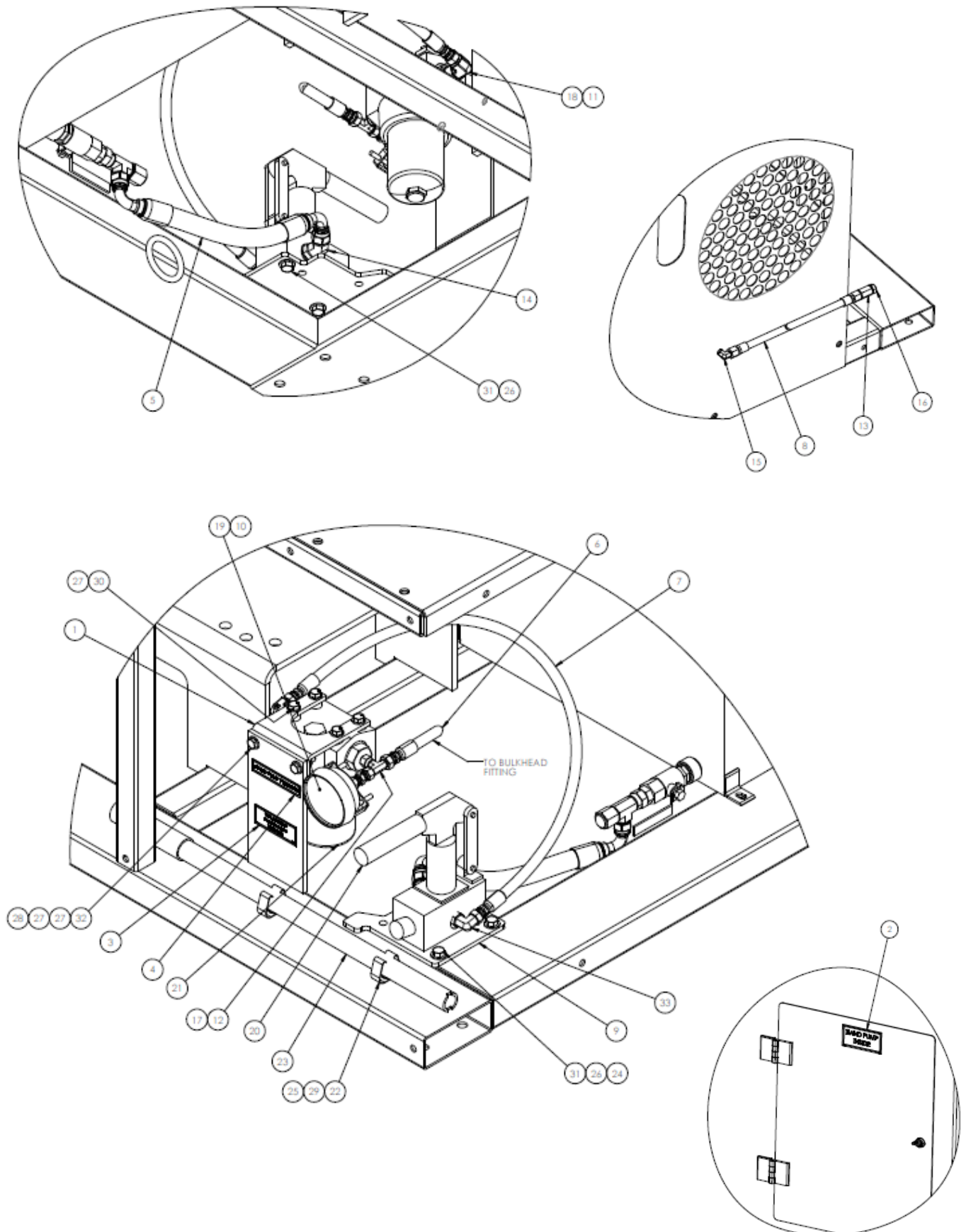
All Models - All Fluid Types

Item	Part Number	Description	Qty
1	EC-1798	MULTI-LEVEL SWITCH (INCLUDES PLUG-IN CABLE)	1

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9.14.8 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



9.14.8 Hand Pump (Option M) (continued)

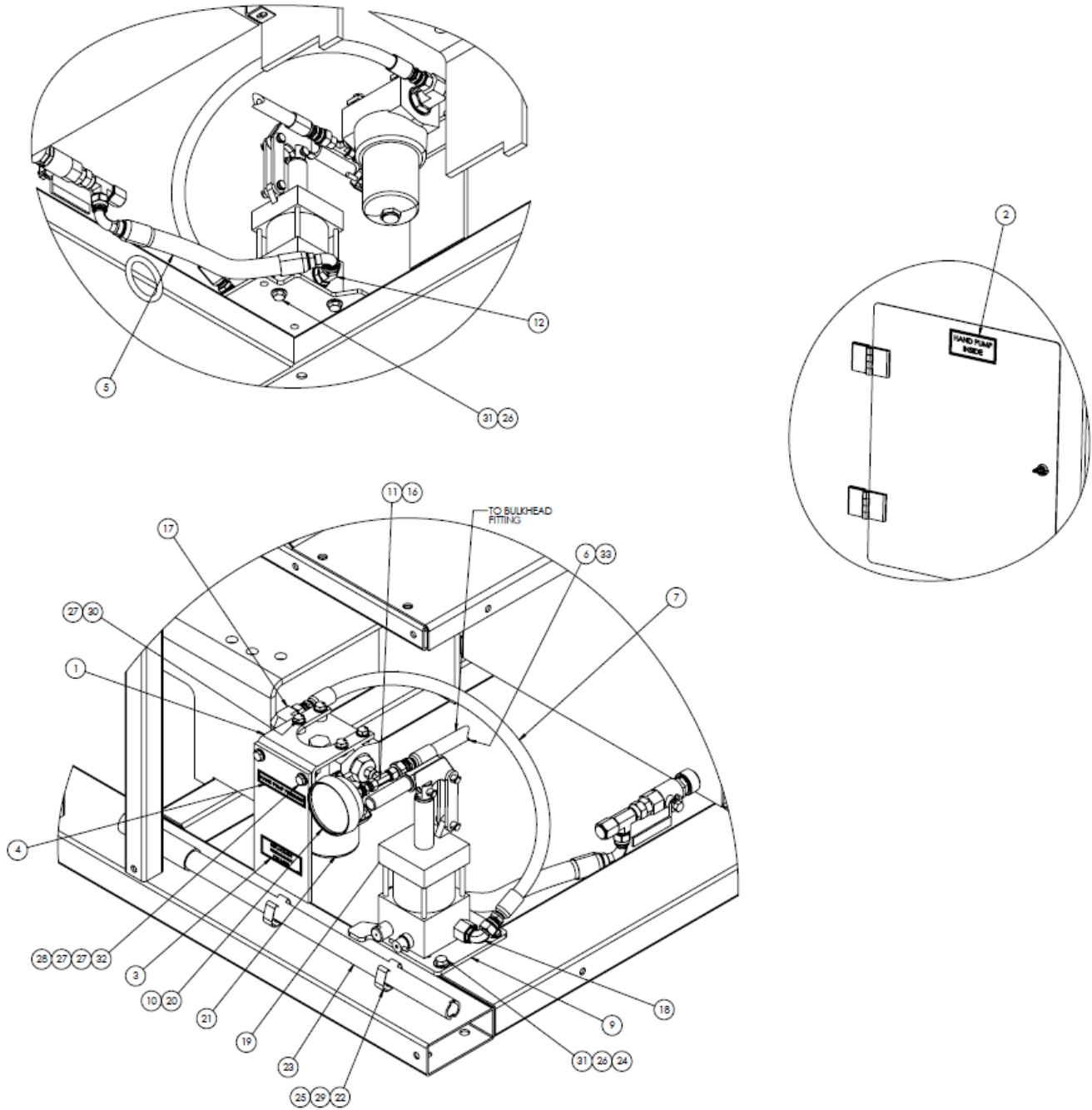
Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	Z-5093-00	Z-5093-00	Z-5093-00	BRACKET, FILTER (P)	1
2	V-2929	V-2929	V-2929	LABEL, HAND PUMP INSIDE	1
3	V-1988	V-1989	V-2050	LABEL, FILTER REPLACEMENT	1
4	V-1887	V-1887	TF-1038-62-14.3	LABEL, HAND PUMP PRESSURE	1
5	TF-1038-62-14.3	TF-1041-26-14.3	TF-1038-62-14.3	HOSE ASSEMBLY, #8	1
6	TF-1038-14-41.0	TF-1041-05-41.0	TF-1038-14-41.0	HOSE ASSEMBLY, #4	1
7	TF-1038-14-33.8	TF-1041-05-33.8	TF-1038-14-33.8	HOSE ASSEMBLY, #4	1
8	TF-1038-14-180	TF-1041-05-180	TF-1038-14-180	HOSE ASSEMBLY, #4	1
9	S-4085-00	S-4085-00	S-4085-00	MOUNTING PALTE, HAND PUMP	1
10	N-2697-01-S	N-2697-01-S	N-2697-01-S	UNION, SWIVEL NUT	1
11	N-2463-10-S-B	N-2463-10-S-E	N-2463-10-S-V	FITTING, REDUCER/EXPANDER	1
12	N-2091-01-SS	N-2091-01-SS	N-2091-01-SS	SWIVEL, BRANCH TEE (-4)	1
13	N-2055-01-S	N-2055-01-S	N-2055-01-S	REDUCER, TUBE	1
14	N-2042-06-S-B	N-2042-06-S-E	N-2042-06-SV	ELBOW, 45° STR THD	1
15	N-2022-03-S	N-2022-03-S	N-2022-03-S	ELBOW, BLKHD, #4 JIC	1
16	N-2014-05-S	N-2014-05-S	N-2014-05-S	PLUG	1
17	N-2007-14-S-B	N-2007-14-S-E	N-2007-14-S-V	CONNECTOR, STR THD	1
18	N-2001-06-S-B	N-2001-06-S-E	N-2001-06-S-V	ELBOW, STR THD	1
19	HC-2146	HC-2146	HC-2146	GAUGE, PRESSURE 10,000 PSI	1
20	HC-1778	HC-1779	HC-2249	PUMP, 2 STAGE HYDRAULIC HAND	1
21	HC-1776	HC-1777	HC-2250	FILTER, PRESSURE	1
22	H-1438-02	H-1438-02	H-1438-02	HOLDER, SPRING CLIP	2
23	H-1009-01	H-1009-01	H-1009-01	HANDLE, PUMP (P)	1
24	G-1439-1070-S	G-1439-1070-S	G-1439-1070-S	NUTSERT, 3/8-16 OPEN END	2
25	G-1439-1035-S	G-1439-1035-S	G-1439-1035-S	NUTSERT, #10-32 OPEN END	2
26	G-1250-1070N	G-1250-1070N	G-1250-1070N	FLATWASHER, 3/8 NARROW	4
27	G-1250-1060N	G-1250-1060N	G-1250-1060N	FLATWASHER, 5/16 NARROW	8
28	G-1202-1060	G-1202-1060	G-1202-1060	STOPNUT, 5/16-18 ELASTIC	2
29	G-1157-13504	G-1157-13504	G-1157-13504	SCREW, #10-32 X 1/2 LG PAN HD CRS REC	2
30	G-1114-080016	G-1114-080016	G-1114-080016	BOLT, M8-1.25 X 16MM LG CLASS 8.8	4
31	G-1100-107010	G-1100-107010	G-1100-107010	BOLT, 3/8-16 X 1.0 HEX HD GR 5	4
32	G-1100-106012	G-1100-106012	G-1100-106012	BOLT, 5/19-18 X 1-1/4 LG HEX HD GR 5	2
33	N-2001-05-S-B	N-2001-05-S-E	N-2001-05-S-V	ELBOW, STRAIGHT THREAD	1

9.14.9 Hand Pump (Option M-7)

Refer to Section **9.6 Hydraulic Hoses** concerning hose inspection for general maintenance on hose assemblies.
Refer to Section **9.5.3 – Hand Pump Filter**.



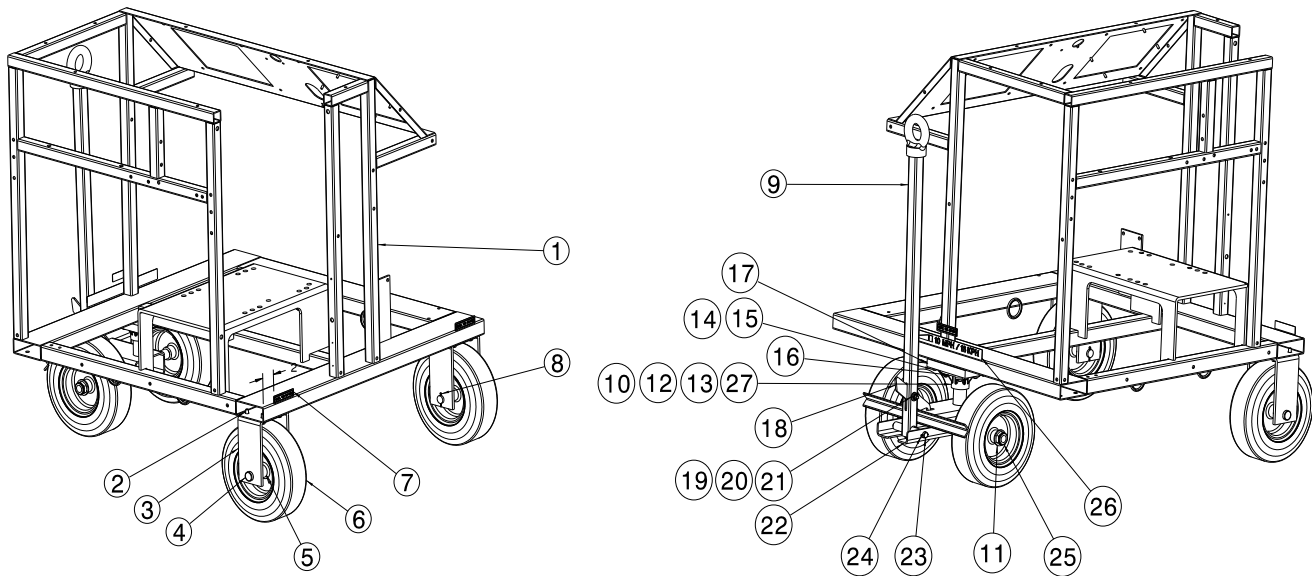
9.14.9 Hand Pump (Option M-7) (continued)

Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	Z-5093-00	Z-5093-00	Z-5093-00	BRACKET, FILTER (P)	1
2	V-2929	V-2929	V-2929	LABEL, HAND PUMP INSIDE	1
3	V-1988	V-1989	V-2050	LABEL, FILTER REPLACEMENT	1
4	V-1887	V-1887	TF-1038-62-14.3	LABEL, HAND PUMP PRESSURE	1
5	TF-1038-62-14.3	TF-1041-26-14.3	TF-1038-62-14.3	HOSE ASSEMBLY, #8	1
6	TF-1038-18-41.0	TF-1041-66-41.0	TF-1038-18-41.0	HOSE ASSEMBLY, #6	1
7	TF-1038-18-26.0	TF-1041-66-33.8	TF-1038-18-26.0	HOSE ASSEMBLY, #4	1
8	TF-1038-04-300	TF-1041-02-300	TF-1038-04-300	HOSE ASSEMBLY, #6	2
9	S-4085-00	S-4085-00	S-4085-00	MOUNTING PALTE, HAND PUMP	1
10	N-2697-01-S	N-2697-01-S	N-2697-01-S	UNION, SWIVEL NUT	1
11	N-2091-01-SS	N-2091-01-SS	N-2091-01-SS	SWIVEL, BRANCH TEE (-4)	1
12	N-2042-06-S-B	N-2042-06-S-E	N-2042-06-SV	ELBOW, 45° STR THD	1
13	N-2022-05-S	N-2022-05-S	N-2022-05-S	ELBOW, BLKHD, #4 JIC	1
14	N-2014-05-S	N-2014-05-S	N-2014-05-S	PLUG	1
15	N-2011-05-S	N-2011-05-S	N-2011-05-S	UNION, -06 JIC M X -06 JIC M	1
16	N-2007-47-S-B	N-2007-47-S-E	N-2007-47-S-V	CONNECTOR, STR THD	1
17	N-2001-39-S-B	N-2001-39-S-E	N-2001-39-S-V	ELBOW, STR THD	1
18	N-2001-08-S-B	N-2001-08-S-E	N-2001-08-S-V	ELBOW, STR THD	1
19	HC-2577	HC-2970	HC-2971	PUMP, HYDRAULIC HAND	1
20	HC-2188	HC-2188	HC-2188	GAUGE, PRESSURE 300 PSI	
21	HC-1776	HC-1777	HC-2250	FILTER, PRESSURE	1
22	H-1438-02	H-1438-02	H-1438-02	HOLDER, SPRING CLIP	2
23	H-1009-01	H-1009-01	H-1009-01	HANDLE, PUMP (P)	1
24	G-1439-1070-S	G-1439-1070-S	G-1439-1070-S	NUTSERT, 3/8-16 OPEN END	2
25	G-1439-1035-S	G-1439-1035-S	G-1439-1035-S	NUTSERT, #10-32 OPEN END	2
26	G-1250-1070N	G-1250-1070N	G-1250-1070N	FLATWASHER, 3/8 NARROW	4
27	G-1250-1060N	G-1250-1060N	G-1250-1060N	FLATWASHER, 5/16 NARROW	8
28	G-1202-1060	G-1202-1060	G-1202-1060	STOPNUT, 5/16-18 ELASTIC	2
29	G-1157-13504	G-1157-13504	G-1157-13504	SCREW, #10-32 X 1/2 LG PAN HD CRS REC	2
30	G-1114-080016	G-1114-080016	G-1114-080016	BOLT, M8-1.25 X 16MM LG CLASS 8.8	4
31	G-1100-107010	G-1100-107010	G-1100-107010	BOLT, 3/8-16 X 1.0 HEX HD GR 5	4
32	G-1100-106012	G-1100-106012	G-1100-106012	BOLT, 5/19-18 X 1-1/4 LG HEX HD GR 5	2
33	N-2052-06	N-2052-06	N-2052-06	ADAPTER, -04 F JIC X -06 M JIC	1

9.14.10 Towing Trailer (Option N)
Air Pressure: 55 psi



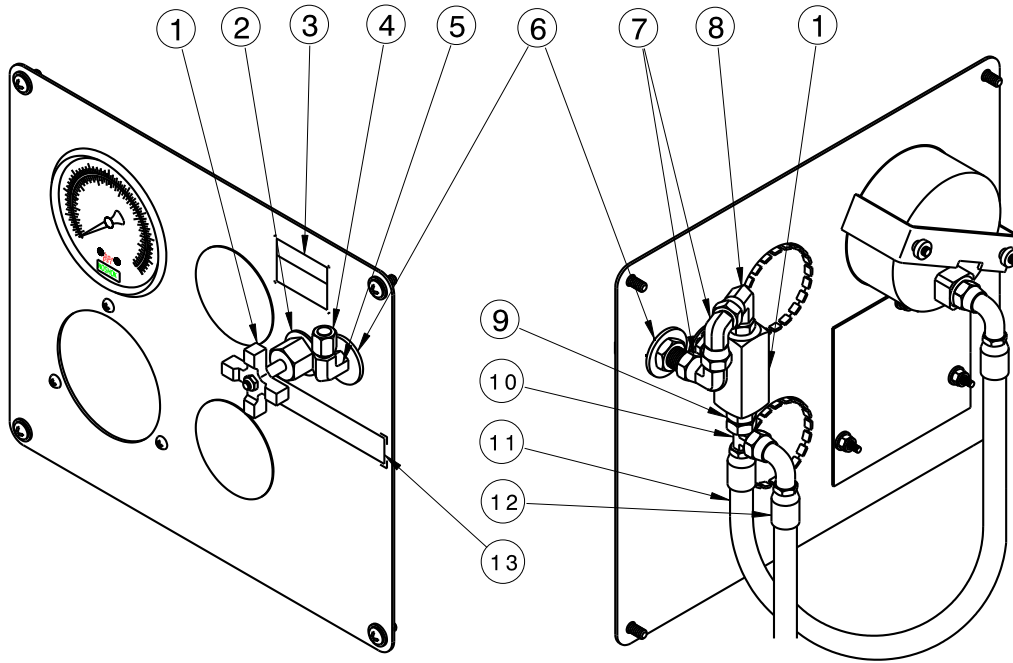
Parts List

All Models - All Fluid Types

Item	Part Number	Description	Qty
1	Z-5775-01	WELDMENT, FRAME	Ref
2	G-1100-107010	BOLT, HH, 3/8 – 16 X 1 LONG	8
3	J-3669-01	BRACKET, FIXED WHEEL	2
4	G-1302-21	PIN, CLEVIS 1 OD X 6	2
5	TR-1894-01	SPACER, WHEEL	4
6	U-1113	ASSEMBLY, TIRE/RIM	4
7	V-1392	LABEL, TIRE PRESSURE	3
8	G-1301-03	PIN, COTTER, 1/8 X 1 ½ LONG	2
9	Z-5584-03	WELDMENT, TOWBAR	1
10	H-2789	HUB, IDLER	1
11	G-1250-1130N	FLATWASHER, 1" NARROW	3
12	G-1230-01	NUT, AXLE, 1-14 UNS	1
13	G-1301-01	PIN, COTTER, 3/16 X 1 ½ LONG	1
14	G-1100-107016	BOLT, HH, 3/8 – 16 X 1 ¼ LONG	4
15	G-1250-1070N	FLATWASHER, 3/8 NARROW	4
16	G-1151-109514	SCREW, ½ - 20 HEX SOC HD CAP	4
17	J-3670-01	PLATE, STEERING MOUNT	1
18	J-3427	LEVER	1
19	G-1100-109522	BOLT, HH, ½ - 20 X 2 ½ LONG	1
20	G-1250-1090N	FLATWASHER, ½ NARROW	2
21	G-1203-1095	JAMNUT, ELASTIC, ½ - 20	1
22	Z-6044-01	WELDMENT, STEER AXLE	1
23	R-2096	PIN, TOWBAR	1
24	G-1301-02	PIN, COTTER, 1/8 X 1 LONG	2
25	G-1203-1120	JAMNUT, ELASTIC, 1 - 14	2
26	V-2074	LABEL, MAX TOWING	1
27	G-1283	WASHER, SPINDLE	1

9.14.11 Calibration Port (Option Q)

Refer to Section 9.6 Hydraulic Hoses concerning hose inspection.



Parts List

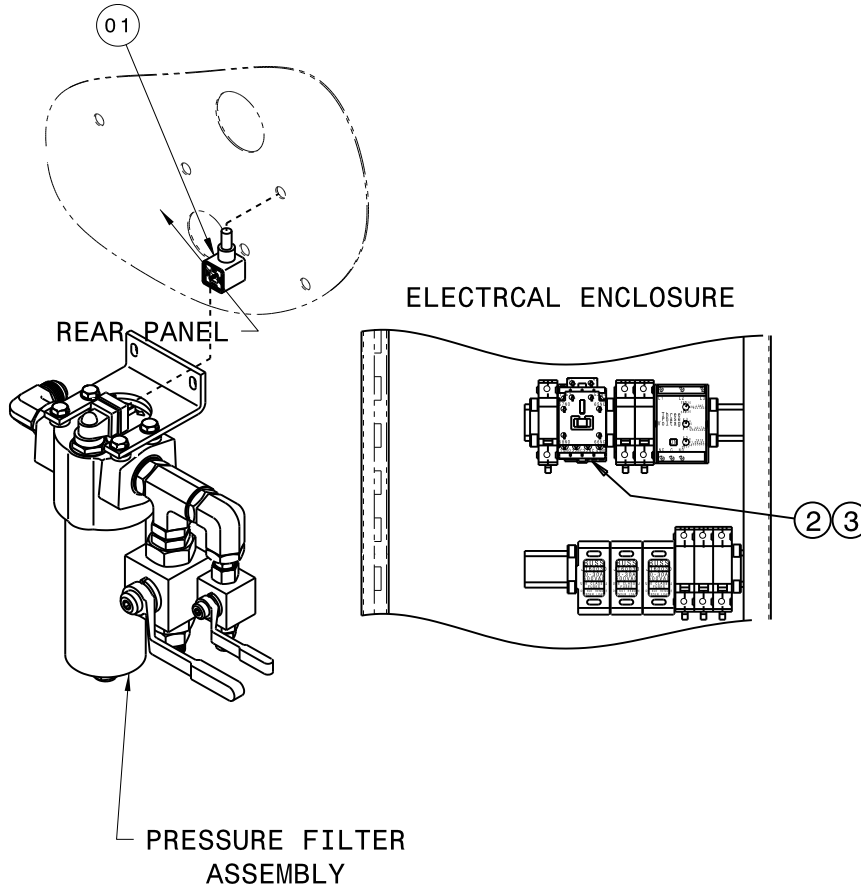
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

Item	5411 & 5421	5431	5441	Description	Qty
	Part Number	Part Number	Part Number		
1	HC-1900-01	HC-1900-02	HC-1900-03	NEEDLE VALVE	1
2	HC-1122	HC-1122	HC-1122	KIT, PANEL MOUNTING (MVK-4)	1
3	V-1470	V-1470	V-1470	LABEL, CAUTION	1
4	N-2008-03-S	N-2008-03-S	N-2008-03-S	CAP, 1/4, #4 JIC	1
5	N-2022-03-S	N-2022-03-S	N-2022-03-S	ELBOW, BULKHEAD UNION W/ LOCKNUT #4	1
6	G-1250-1080W	G-1250-1080W	G-1250-1080W	FLATWASHER, 7/16 WIDE	2
7	N-2002-03-S	N-2002-03-S	N-2002-03-S	ELBOW, SWIVEL NUT #4	2
8	N-2049-07-S-B	N-2049-07-S-E	N-2049-07-S-V	ELBOW, 90° SWIVEL & O-RING #4 X #6	1
9	N-2007-05-S-B	N-2007-05-S-E	N-2007-05-S-V	CONNECTOR, STRAIGHT THREAD #4	1
10	N-2016-03-S	N-2016-03-S	N-2016-03-S	TEE, SWIVEL NUT RUN, #4	1
11	TF-1038-16*23.0	TF-1040-42*32.0	TF-1038-16*23.0	HOSE ASSEMBLY, #4	1
12	TF-1038-16*23.0	TF-1040-42*32.0	TF-1038-16*23.0	HOSE ASSEMBLY, #4	REF
13	V-1888	V-1888	V-1888	LABEL, SHUT-OFF CALIBRATION	1

9.14.12 Electric Filter Clogging Indicator (Option R)

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-2016. Reference Wiring Diagram INS-2144. Reference 9.7.1 Electrical Panel for Panel Light.



Parts List

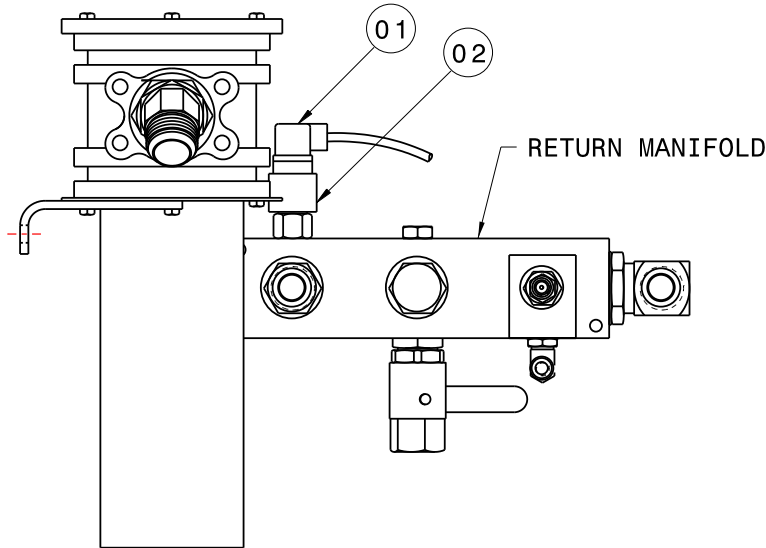
All Models - All Fluid Types

Item	Part Number	Description	Qty
1	EC-2198	DIN CONNECTOR CABLE	1
2	EC-1591-04	LATCH, MECHANICAL	1
3	EC-1564	RELAY, CONTROL	1

9.14.13 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 an indication that maintenance or training may be needed elsewhere.

NOTE: Wire per Electrical Schematic INS-2016. Reference Wiring Diagram INS-2144. Reference 9.7.1 Electrical Panel for Panel Light.



Parts List

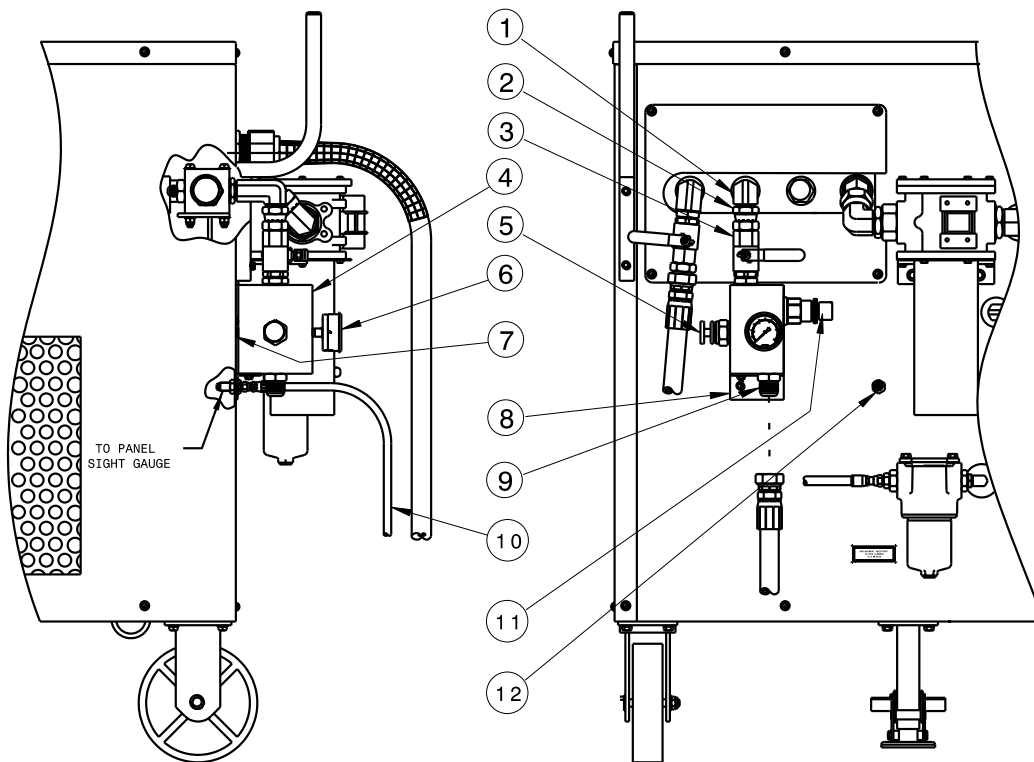
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	EC-2198	EC-2198	EC-2198	DIN CONNECTOR CABLE	1
2	EC-1782-01	EC-1782-02	EC-1782-03	TEMPERATURE SWITCH	1

9.14.14 Return Back-Pressure with Sight Gauge (*Option T*)

Annual calibration of instrumentation is recommended. See Section **12.0 – Calibration of Instrumentation** for details of gauge calibration. Refer to Section **9.6 – Hydraulic Hoses** concerning hose inspection.

This option is only available on 5431 models

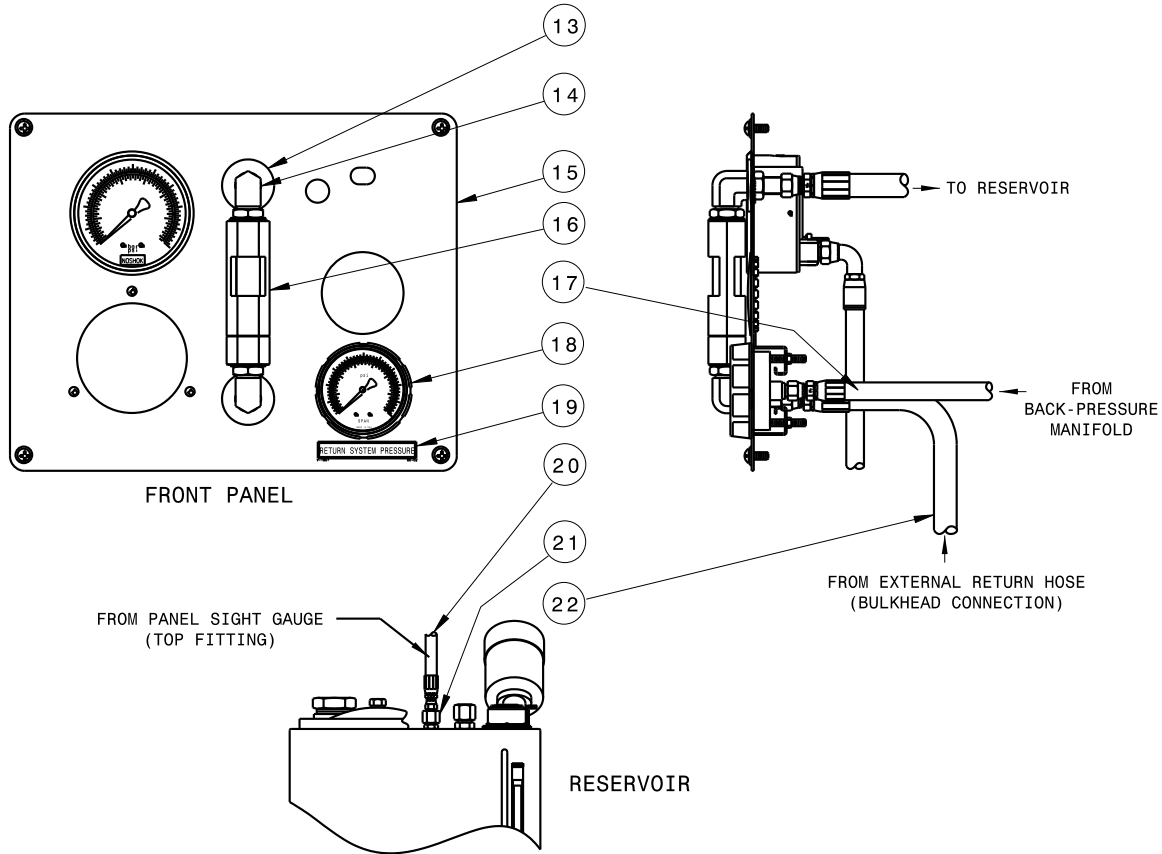


Model 5431 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	N-2706-06-S-E	ELBOW, LONG STRAIGHT THREAD (#16)	1
2	N-2036-10-S-E	SWIVEL, 37° FEMALE (#16)	1
3	HC-1770-05	BALL VALVE #16 SAE	REF
4	J-3445	BACK-PRESSURE MANIFOLD	1
5	HC-2190	BYPASS VALVE	1
6	HC-2260	PRESSURE GAUGE (0-300 PSI/20.7 BAR)	1
7	N-2042-03-S-E	ELBOW, 45° STRAIGHT THREAD (#4)	1
8	S-1681-01	MANIFOLD BRACKET	1
9	N-2007-24-S-E	CONNECTOR, STRAIGHT THREAD (#16)	1
10	TF-1041-02*180	HOSE ASSEMBLY (#6)	1
11	HC-2733	VALVE, REDUCING/RELIEVING	1
12	N-2061-03-S	BULKHEAD UNION WITH NUT (#6)	1

9.13.14 Return Back-Pressure with Sight Gauge (Option T) *(continued)*
This option is only available on 5431 models



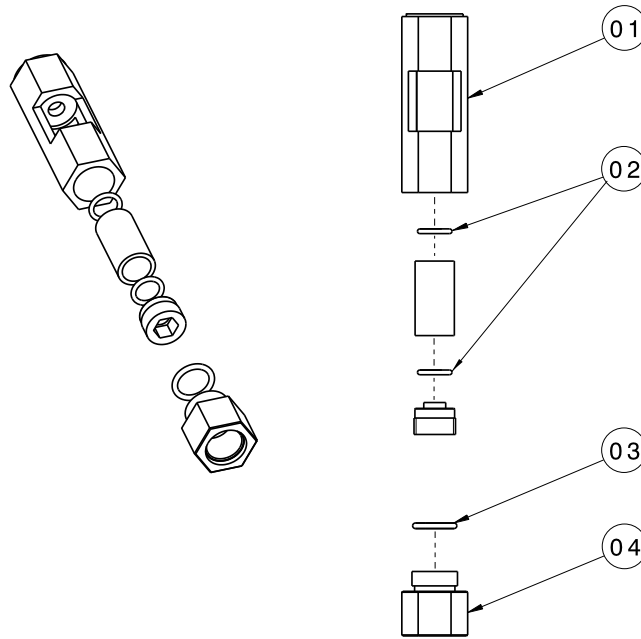
Model 5431 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
13	G-1250-1100W	FLATWASHER, 5/8 WIDE	2
14	N-2710-S-E	BULKHEAD ELBOW	2
15	S-1865-01	HYDRAULIC INSTRUMENT PANEL	1
◆ 16	Z-5635-01	SIGHT GLASS ASSEMBLY	1
17	TF-1041-05*54.0	HOSE ASSEMBLY #4	1
18	HC-2188	PRESSURE GAUGE (0-300/20.7 BAR)	1
19	V-1987	LABEL, RETURN SYSTEM PRESSURE	1
20	TF-1041-02*12.0	HOSE ASSEMBLY #6	1
21	N-2055-04	TUBE REDUCER (#10-#16)	1
22	TF-1041-02*54.0	HOSE ASSEMBLY #6	1

◆ Reference 9.13.13.a for exploded view of Sight Glass Assembly.

9.14.14.a Item 16 Sight Glass Assembly Exploded View
This option is only available on 5431 models



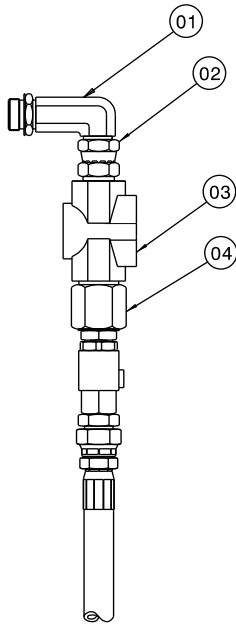
Model 5431 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

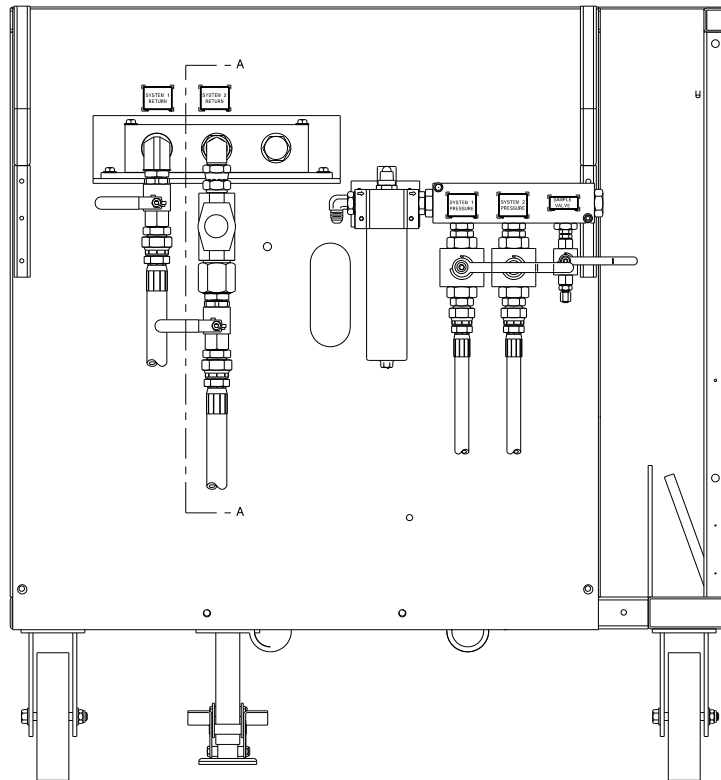
Item	Part Number	Description	Qty
1	Z-5634	SIGHT, MODIFIED FLOW	1
2	HC-2006-113	O-RING, SERIES 2	2
3	HC-2013-911	O-RING, SERIES 3	1
4	HS-1006	FLOW SIGHT END CAP	1

9.14.15 Return Sight Gauge (Option U)

Refer to Section **10.6 Hydraulic Hoses** concerning hose inspection. Annual calibration of instrumentation is recommended.



VIEW A-A



Parts List

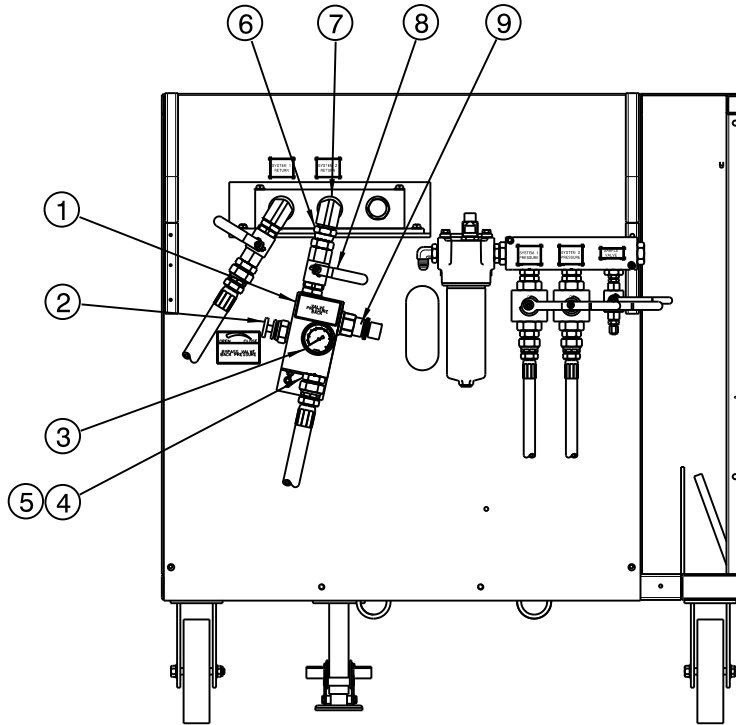
Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	N-2706-S-B	N-2706-S-E	N-2706-S-V	ELBOW, LONG STRAIGHT THREAD	1
2	N-2030-11-S	N-2030-11-S	N-2030-11-S	SWIVEL, FEMALE (-16 X 1 NPT)	1
3	HC-2261	HC-2261	HC-2261	SIGHT GAUGE, FLOW 1" NPT	1

9.14.16 Return Back Pressure (Option V)

Refer to Section **10.6 Hydraulic Hoses** concerning hose inspection. Annual calibration of instrumentation is recommended. See Section **12.0 – Calibration of Instrumentation** for details of gauge calibration.

For 5441 - Fluid Type: MIL-PRF-87257, call Tronair

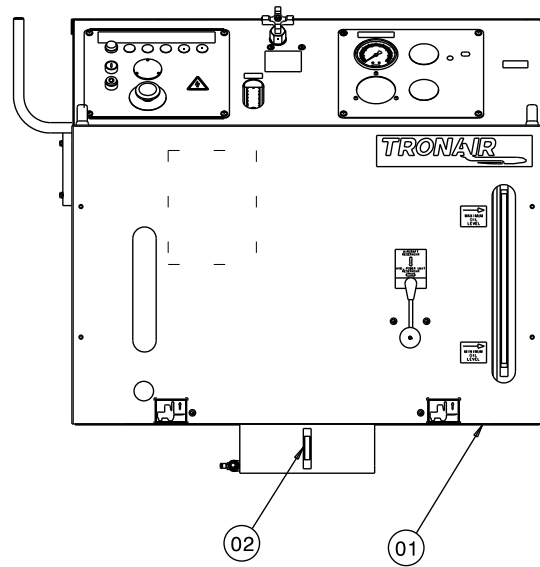
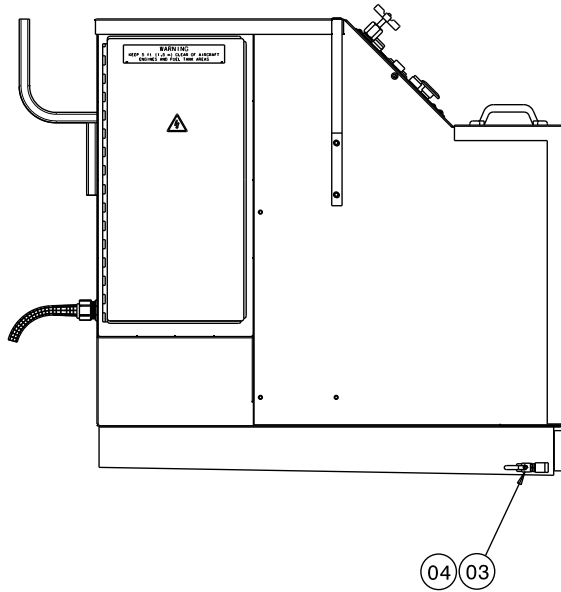


Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257 For 5441, call Tronair

Item	5411 & 5421	5431	Description	Qty
	Part Number	Part Number		
1	J-3445	J-3445	MANIFOLD, BACK PRESSURE	1
2	HC-2176	HC-2190	VALVE, FLOW CONTROL	1
3	HC-2260	HC-2260	GAUGE, PRESSURE (0-300 PSI)	1
4	N-2007-24-S-B	N-2007-24-S-E	CONNECTOR, STR THD (16)	1
	N-2007-21-S-B	N-2007-21-S-E	CONNECTOR, STR THD (12)	1
	N-2036-10-S-B	N-2036-10-S-E	SWIVEL, 37° FEMALE (16)	1
	N-2206-06-S-B	N-2706-06-S-E	ELBOW, LONG STR THD (16)	1
	HC-1766-05	HC-1766-05	VALVE, BALL (600 PSI)	REF
	HC-2729	HC-2733	VALVE, REDUCING/RELIEVING	1

9.14.17 Drip Pan (Option 4)



Parts List

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

	5411 & 5421	5431	5441		
Item	Part Number	Part Number	Part Number	Description	Qty
1	S-2508	S-2508	S-2508	PAN, DRIP	1
2	HC-1382-03	HC-1383-03	HC-2212-03	GAUGE, SIGHT	1
3	HC-1766-02	HC-1770-02	HC-2209-02	VALVE, BALL	1
4	N-2661-02-S-B	N-2661-02-S-E	N-2661-02-S-V	ELBOW, STR THREAD	1
5	G-1100-107010	G-1100-107010	G-1100-107010	BOLT, 3/8- 16 HEX HEAD GRADE 5	8
6	G-1250-1070W	G-1250-1070W	G-1250-1070W	WASHER, 3/8 REGULAR	8

9.15 REPLACEMENT LABELS PARTS LISTS

9.15.1 Base Unit

Part Number	Description	Qty
V-1001	"Made in USA"	1
V-1033	"TRONAIR"	1
V-1050	ISO Electrical Shock Symbol	2
V-1365	"SYSTEM PRESSURE"	1
V-1366	"HPU BY-PASS VALVE"	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	"MAXIMUM OIL LEVEL"	1
V-1897	"MINIMUM OIL LEVEL"	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
V-2246	Label, Pump Controls	1

9.15.2 Fluid Labels

Model	Part Number	Description	Qty
5411	V-1975	" MIL-PRF-5606 FLUID ONLY"	2
5421	V-1976	" MIL-PRF-83282 FLUID ONLY"	2
5431	V-1977	"PHOSPHATE ESTER FLUIDS ONLY"	2
5441	V-2027	" MIL-PRF-87257 FLUID ONLY"	2

9.15.3 Filter Element Kit Labels

Model	Part Number	Description	Qty
5411, 5421	V-1904	"REPLACEMENT FILTER ELEMENT K-3492"	1
5411, 5421	V-1905	"REPLACEMENT FILTER ELEMENT K-3493"	1
5411, 5421	V-1916	"REPLACEMENT DESICCANT FILTER ELEMENT HC-1763"	1
5431	V-1903	"REPLACEMENT FILTER ELEMENT K-3428"	1
5431	V-1906	"REPLACEMENT FILTER ELEMENT K-3494"	1
5431	V-1916	"REPLACEMENT DESICCANT FILTER ELEMENT HC-1763"	1
5441	V-2028	"REPLACEMENT FILTER ELEMENT K-3805"	1
5441	V-1904	"REPLACEMENT FILTER ELEMENT K-3492"	1
5441	V-1916	"REPLACEMENT DESICCANT FILTER ELEMENT HC-1763"	1

9.15.4 Split System (*Option C*) and Crossover Check (*Option D*) Labels

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

9.15.5 Pyrometer (*Option K*) Label

Part Number	Description	Qty
V-1886	"PYROMETER"	1

9.15.6 Hand Pump (*Option M*) Labels

Model	Part Number	Description	Qty
5411, 5421	V-1887	"HAND PUMP PRESSURE"	1
5411, 5421	V-1915	"HAND PUMP"	1
5411, 5421	V-1988	"REPLACEMENT FILTER ELEMENT K-3751"	1
5431	V-1887	"HAND PUMP PRESSURE"	1
5431	V-1915	"HAND PUMP"	1
5431	V-1989	"REPLACEMENT FILTER ELEMENT K-3752"	1
5441	V-1887	"HAND PUMP PRESSURE"	1
5441	V-1915	"HAND PUMP"	1
5441	V-2050	"REPLACEMENT FILTER ELEMENT K-3831"	1

9.15.7 Calibration Port (*Option Q*) Labels

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

9.15.8 Back-Pressure Valve with Sight Glass (*Option T*) Label

This option is only available on 5431 models

Part Number	Description	Qty
V-1987	"RETURN SYSTEM PRESSURE"	1

10.0 PROVISION OF SPARES

10.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.

1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301

Fax: (419) 867-0634

E-mail: sales@tronair.com

Website: www.tronair.com

For Spare Parts, Operations & Service Manuals or Service Needs:

Scan the QR code or visit Tronair.com/aftermarket



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 13	Fuse, Transformer Primary	2
EC-1542-04	Fuse, Transformer Secondary	1
Refer to Section 9.10 Electrical Components Item 15	Fuse, Heat Exchanger	3
EC-1675-12	Fuse, Phase Monitor <i>(Optional)</i>	3

10.2.2 Spare Parts

Model Number	Fluid Type
5411	MIL-PRF-5606
5421	MIL-PRF-83282
5431	Aviation Phosphate Ester, Type IV and V
5441	MIL-PRF-87257

5411 & 5421	5431	5441		
Part Number	Part Number	Part Number	Description	Qty
HC-1763	HC-1763	HC-1763	DESICCANT FILTER ELEMENT	1
TBD	TBD	TBD	KIT, GASKETS AND O-RINGS FOR MAIN PUMP	1
K-3492	K-3428	K-3492	KIT, PRESSURE FILTER ELEMENT	1
K-3493	K-3494	K-3805	KIT, RETURN FILTER ELEMENT	1
TBD	TBD	TBD	KIT, SHAFT SEAL AND RETAINER FOR MAIN PUMP	1
K-3751	K-3752	K-3831	KIT, HAND PUMP FILTER ELEMENT <i>(OPTIONAL)</i>	1

11.0 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.

11.1 SOURCE OF CALIBRATION

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

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

12.0 IN SERVICE SUPPORT

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

13.0 GUARANTEES/LIMITATION OF LIABILITY

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 is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

- a) Parts required for normal maintenance
- b) Parts covered by a component manufacturers warranty
- c) Replacement parts have a 90-day warranty from date of shipment

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, any action may affect 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. Failure to obtain a RMA in advance of returning an item will result in a service fee. 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 only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied and Tronair disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse.**

14.0 APPENDICES

APPENDIX I	Hydraulic Schematic (INS-2620)
APPENDIX II	Electrical Schematic (INS-2016, INS-1608)
APPENDIX III	Wiring Diagram (INS-2144, INS-1746)
APPENDIX IV	Instrument Certification Notice

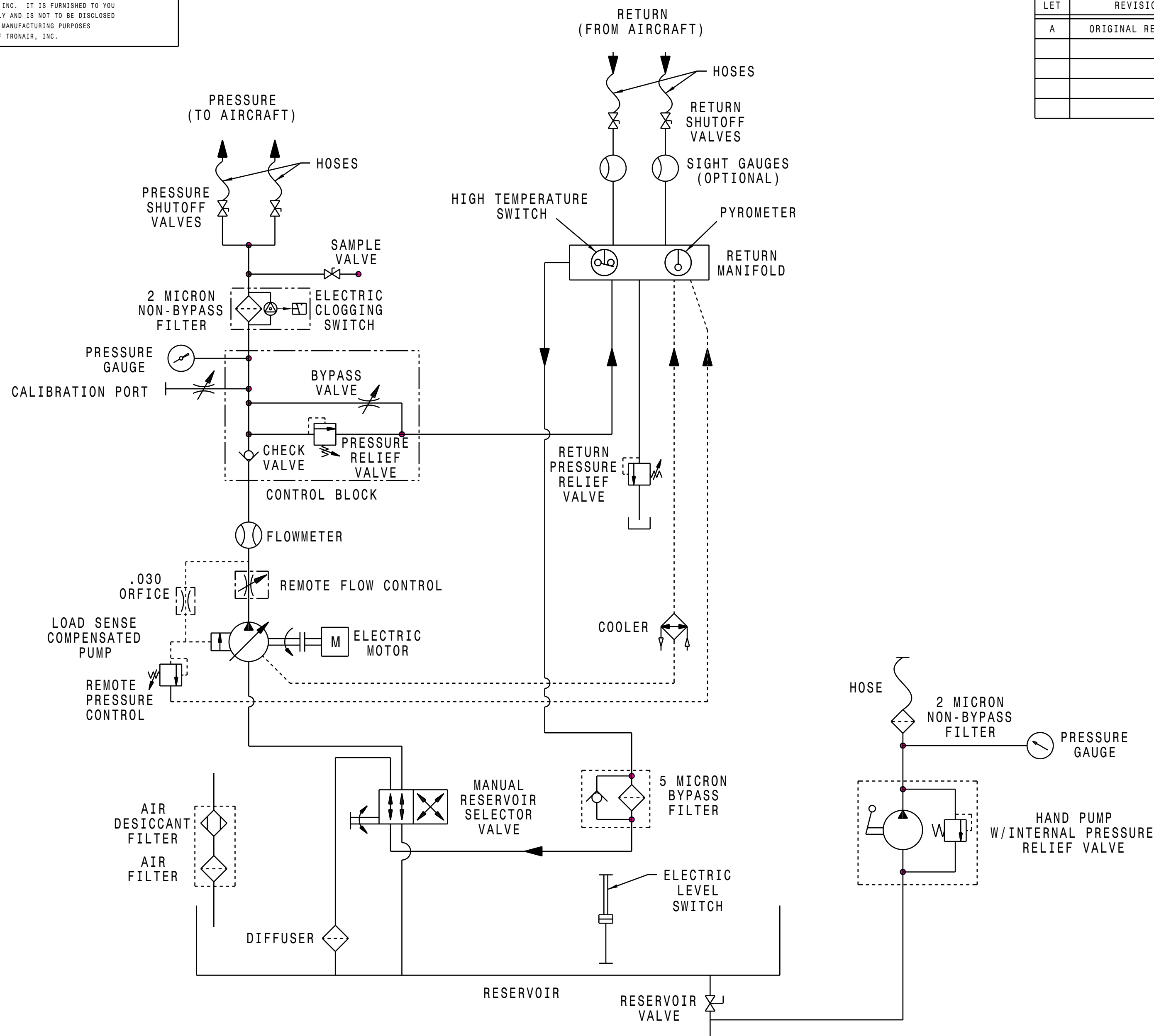


APPENDIX I

Hydraulic Schematic (INS-2620)

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LET	REVISION	ECN	DWN	CHK	DATE
A	ORIGINAL RELEASE	22155	-	-	09-10-20



MAKE FROM: N / A	TYPE: N / A
MATERIAL: N / A	FINISH: N / A
REFERENCE: N / A	SIZE: C
SCALE: FULL	DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND CORNERS
TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMAL	.X	± .100
	.XX	± .030
	.XXX	± .010
FRACTION	X/XX	± 1/16

ANGLES: ± 1/2 DEGREE
< > INDICATES CRITICAL DIMENSIONS
() INDICATES REFERENCE DIMENSIONS

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT	
DWN BY PEH	CKD BY ADO 09-10-20
SCHEMATIC, HYDRAULIC	
05	INS-2620
	REV A



APPENDIX II

**Electrical Schematic
(INS-2016, INS-1608)**

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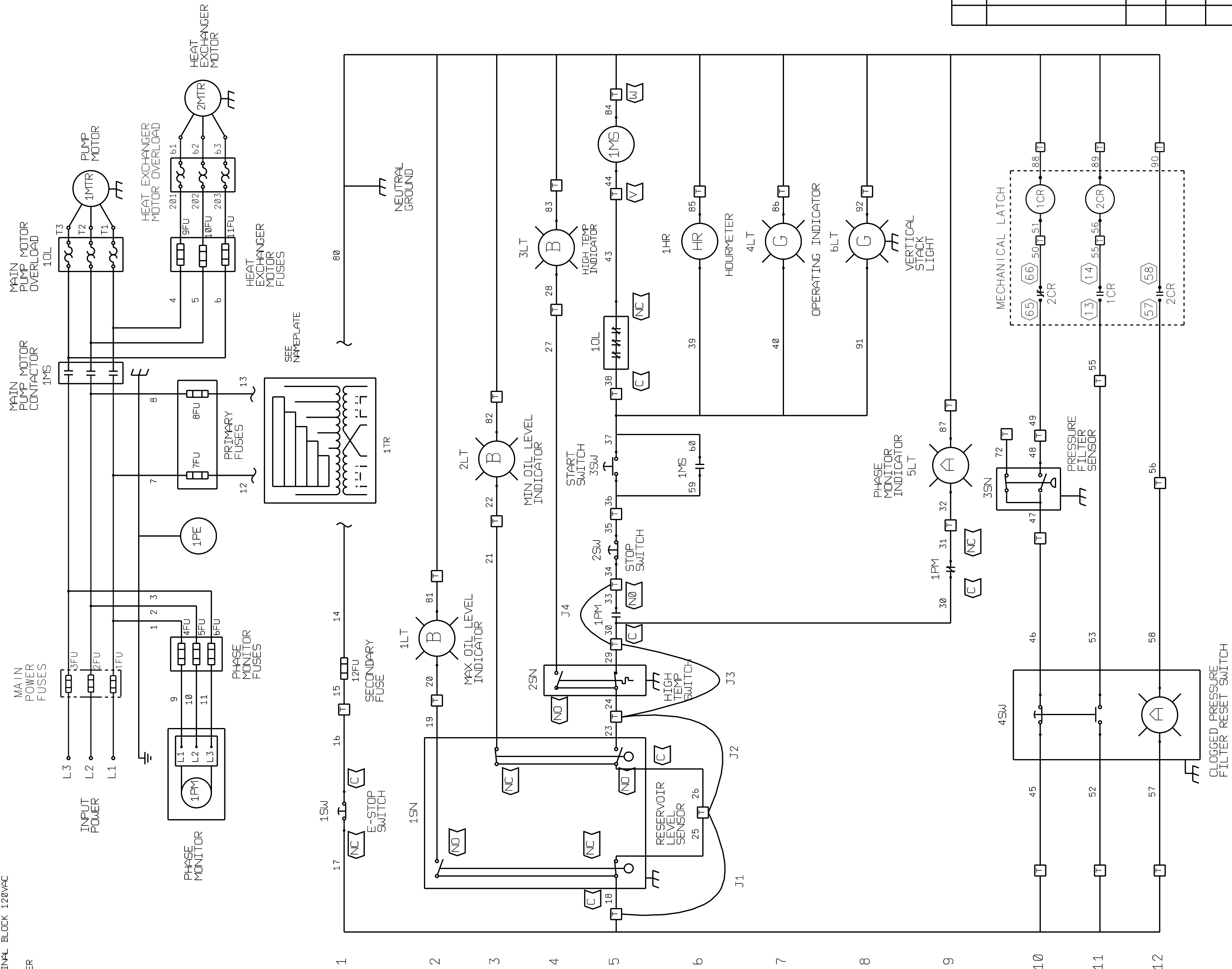
LET	REVISION	ECN	DWN	CHK	DATE
01	ORIGINAL RELEASE	16922	-	-	06-08-09

COMPONENT ABBREVIATION
 MS - MOTOR STARTER
 OL - OVERLOAD
 MTR - MOTOR
 SW - SWITCH
 PM - PHASE MONITOR
 CR - CONTROL RELAY
 SOL - SOLENOID
 HR - HOURMETER
 FU - FUSE
 TR - TRANSFORMER
 LT - LIGHT
 SN - SENSOR
 ML - MECHANICAL LATCH

WIRE COLORS:
 - LT, BLUE
 - RED
 - BLACK
 - GREEN/YELLOW

☒ - DEVICE TERMINATION
 □ - TERMINAL BLOCK CONNECTION
 1TB - GROUND TERMINAL BLOCK
 2TB - NEUTRAL TERMINAL BLOCK
 3TB - CONTROL TERMINAL BLOCK 120VAC

— OPTIONS JUMPER



MAKE FROM: N / A	TYPE: N / A
MATERIAL: N / A	FINISH: MILL
REFERENCE: INS-1725	SCALE: N. S. R.
DO NOT SCALE DRAWING	

BREAK ALL SHARP EDGES AND CORNERS
 TOLERANCES UNLESS OTHERWISE SPECIFIED
 DECIMAL .X ± .100
 .XX ± .030
 .XXX ± .010
 FRACTION XXX ± 1/16
 ANGLES: ± 1/2 DEGREE
 < > INDICATES CRITICAL DIMENSIONS
 () INDICATES REFERENCE DIMENSIONS

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY JMB CRD BY PEH 06-08-09

SCHEMATIC, HPU ELECTRICAL (K-4321)

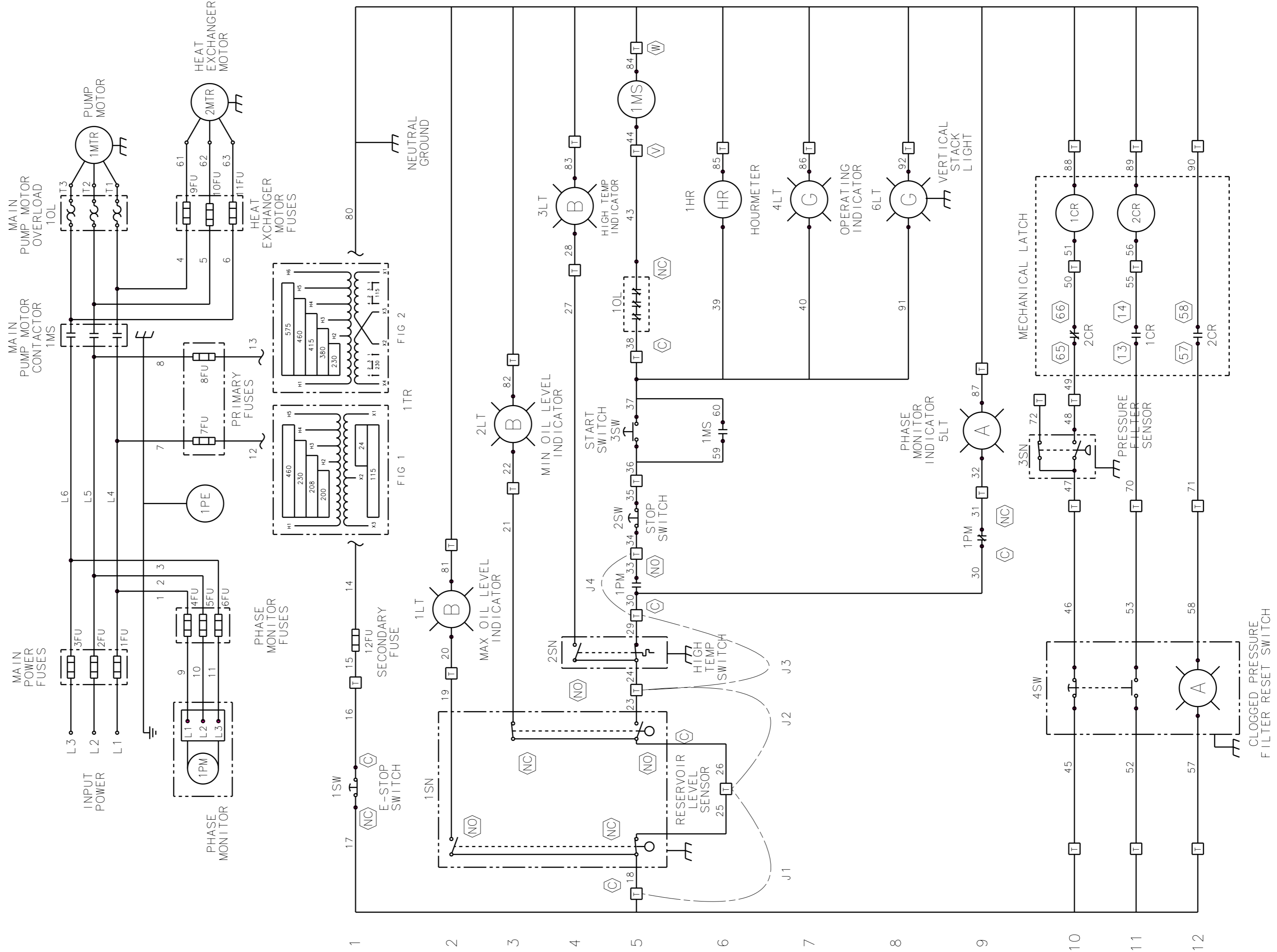
05 INS-2016 REV 01

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LET	REVISION	ECN	DWN	CHK	DATE
C	1. ADDED J1 2. ADDED J2 3. ADDED J3 4. ADDED J4	12912	WCG	PEH	03-06-03
D	REVISED	12979	DEP	PEH	04-03-03
E	REVISED	13159	MAH	PEH	08-29-03

COMPONENT ABBREVIATION
 MS - MOTOR STARTER
 OL - OVERLOAD
 MTR - MOTOR
 SW - SWITCH
 PM - PHASE MONITOR
 CR - CONTROL RELAY
 SOL - SOLENOID
 HR - HOURMETER
 FU - FUSE
 TR - TRANSFORMER
 LT - LIGHT
 SN - SENSOR
 PE - POTENTIAL EARTH

WIRE COLORS:
 - LT - BLUE
 - RB - RED
 - BK - BLACK
 - GRN/YEL - GREEN/YELLOW
 (XX) - DEVICE TERMINATION
 □ - TERMINAL BLOCK CONNECTION
 1TB - GROUND TERMINAL BLOCK
 2TB - NEUTRAL TERMINAL BLOCK
 3TB - CONTROL TERMINAL BLOCK 120VAC
 --- OPTIONS JUMPERS



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MATERIAL: N / A	FINISH: MILL
REFERENCE: E-546-271 (REV A)	SIZE: C
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BREAK ALL SHARP EDGES AND CORNERS
 TOLERANCES UNLESS OTHERWISE SPECIFIED
 DECIMAL .X ± .100
 .XX ± .030
 .XXX ± .010
 FRACTION X/XX ± 1/16
 ANGLES: ± 1/2 DEGREE
 < > INDICATES CRITICAL DIMENSIONS
 () INDICATES REFERENCE DIMENSIONS

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY MAB CKD BY XXX 05-25-00

SCHEMATIC, HPU ELECTRICAL (CE)

05 INS-1608 REV E

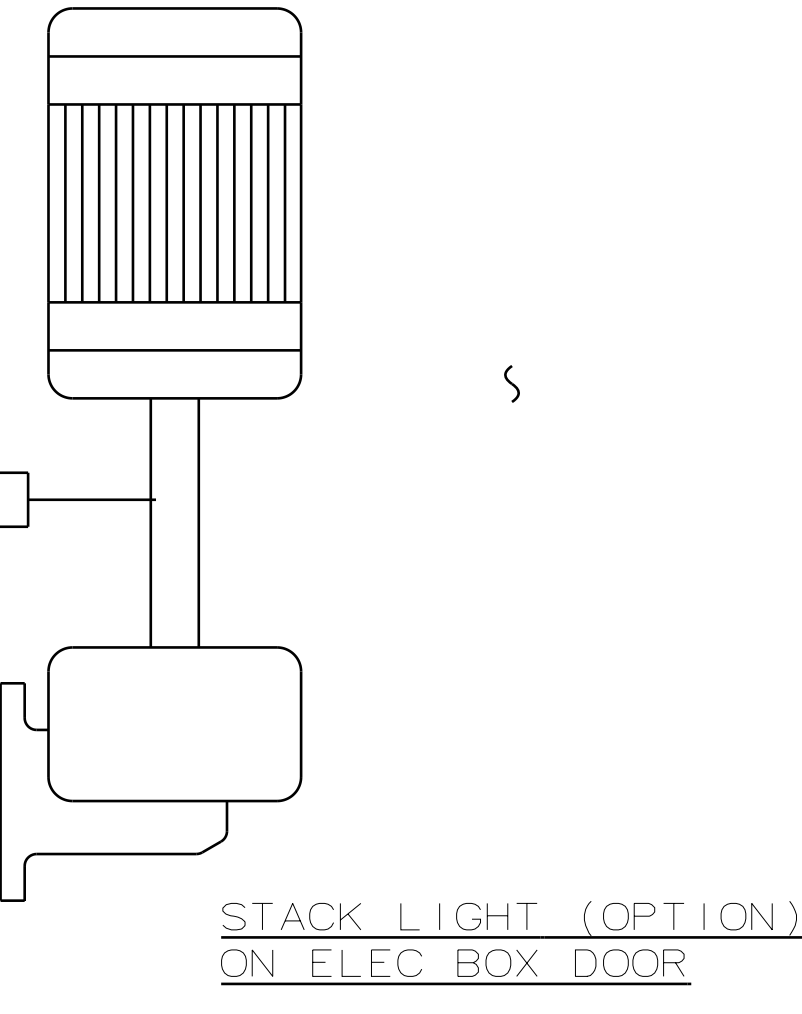
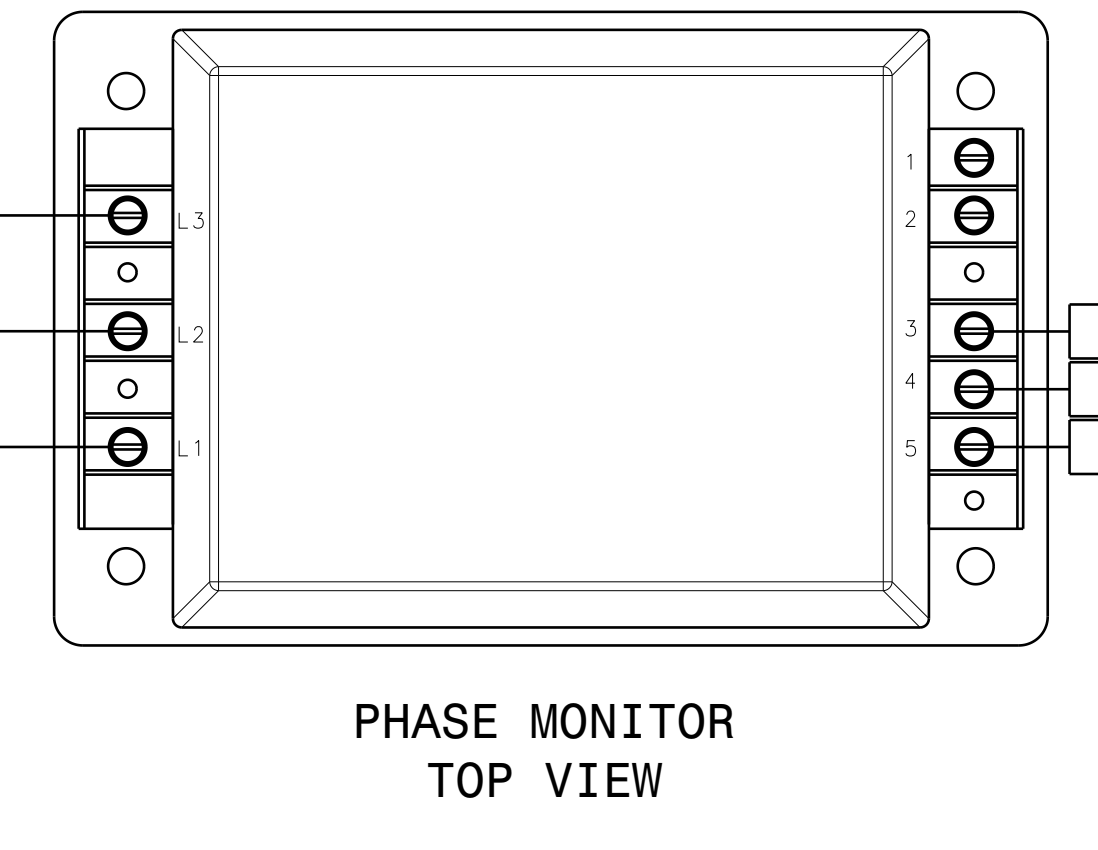
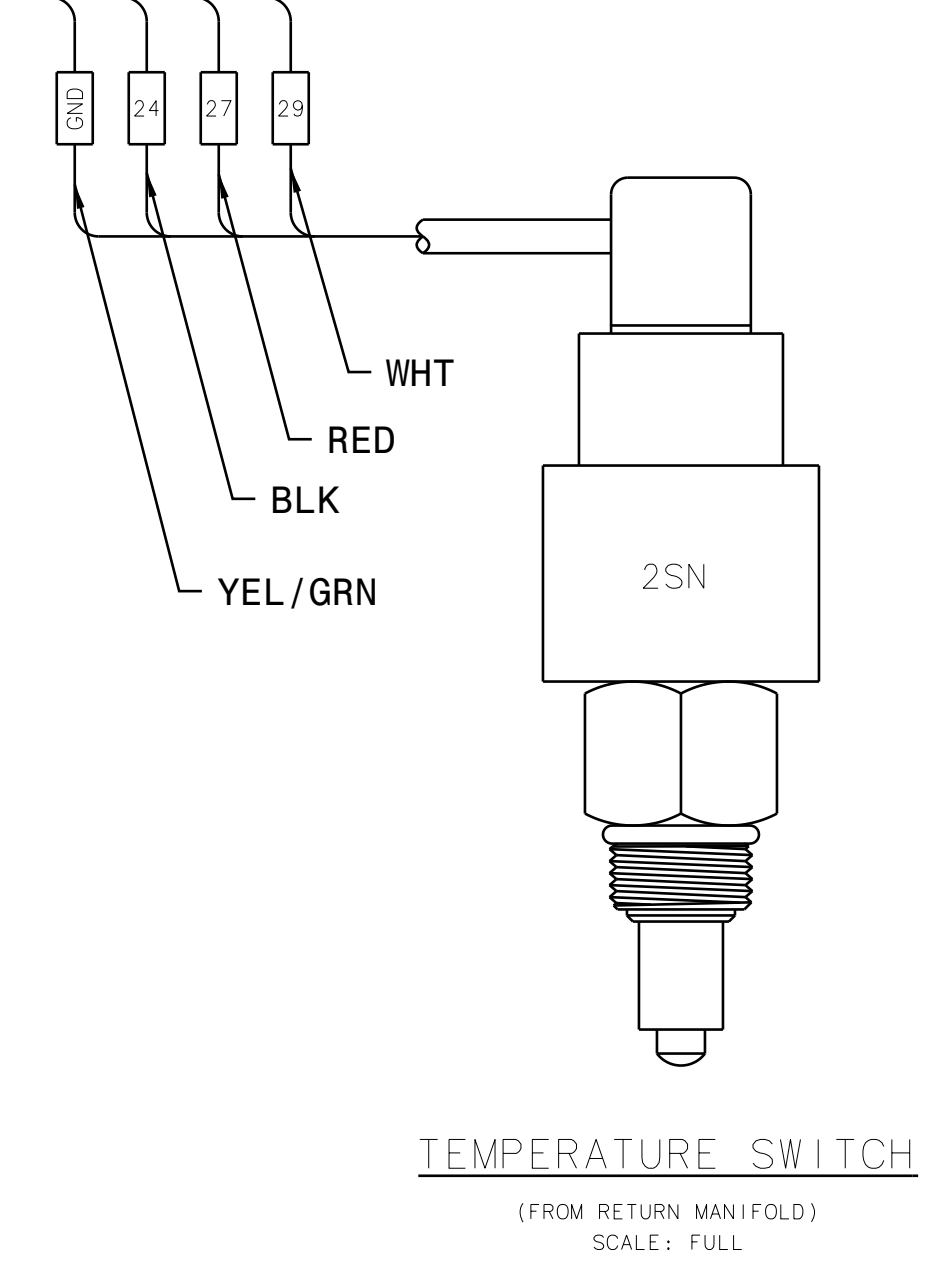
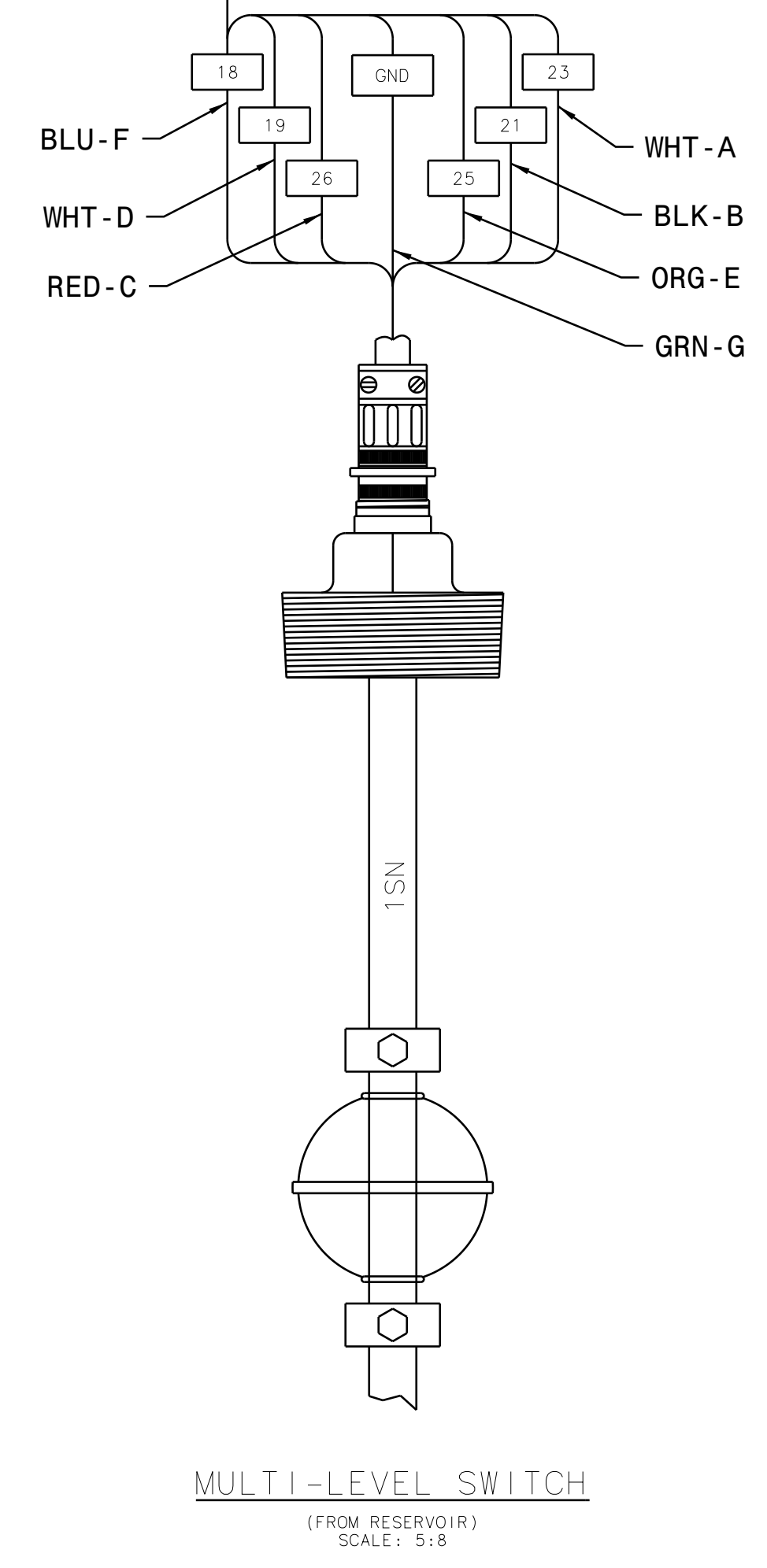
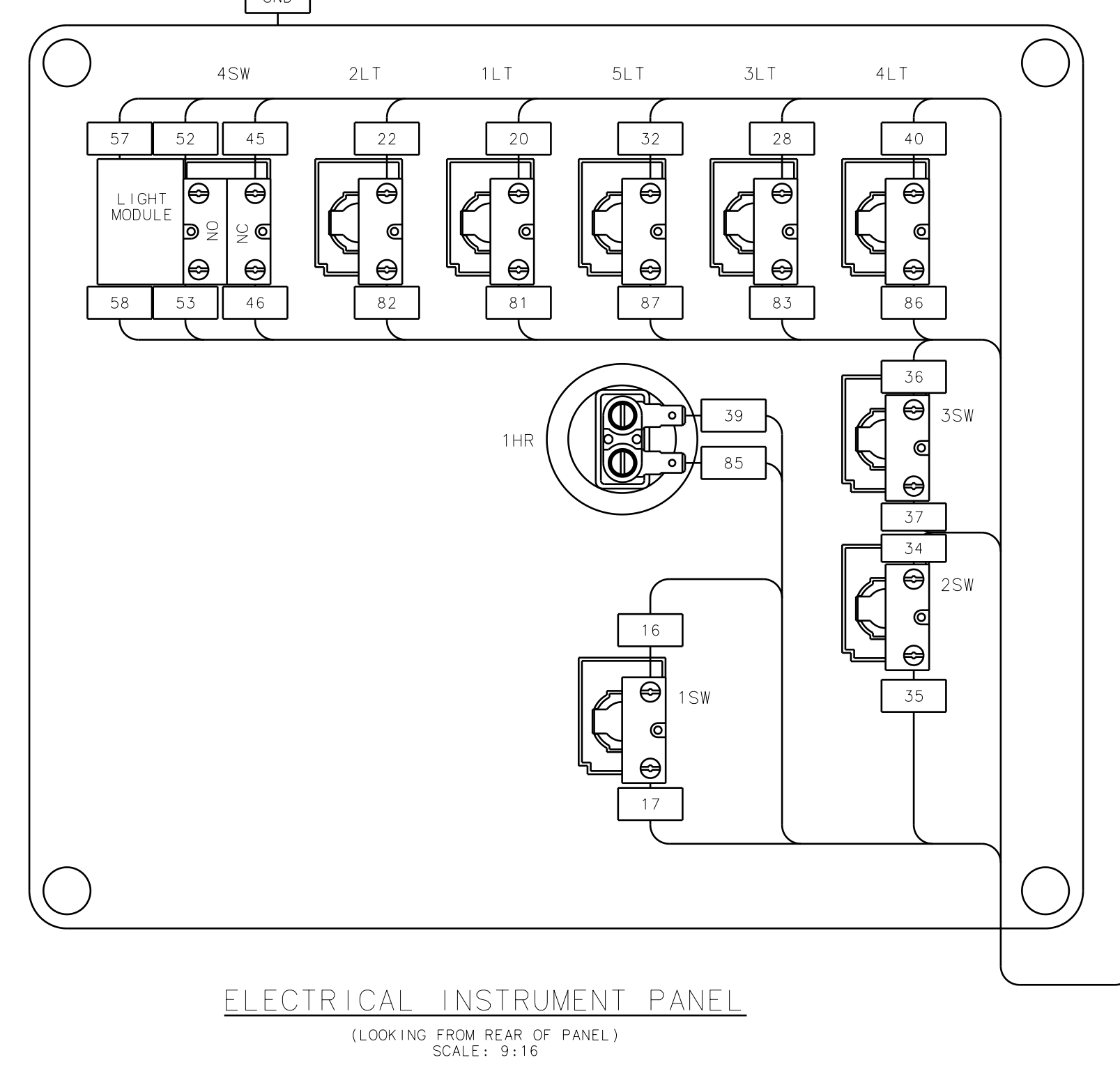
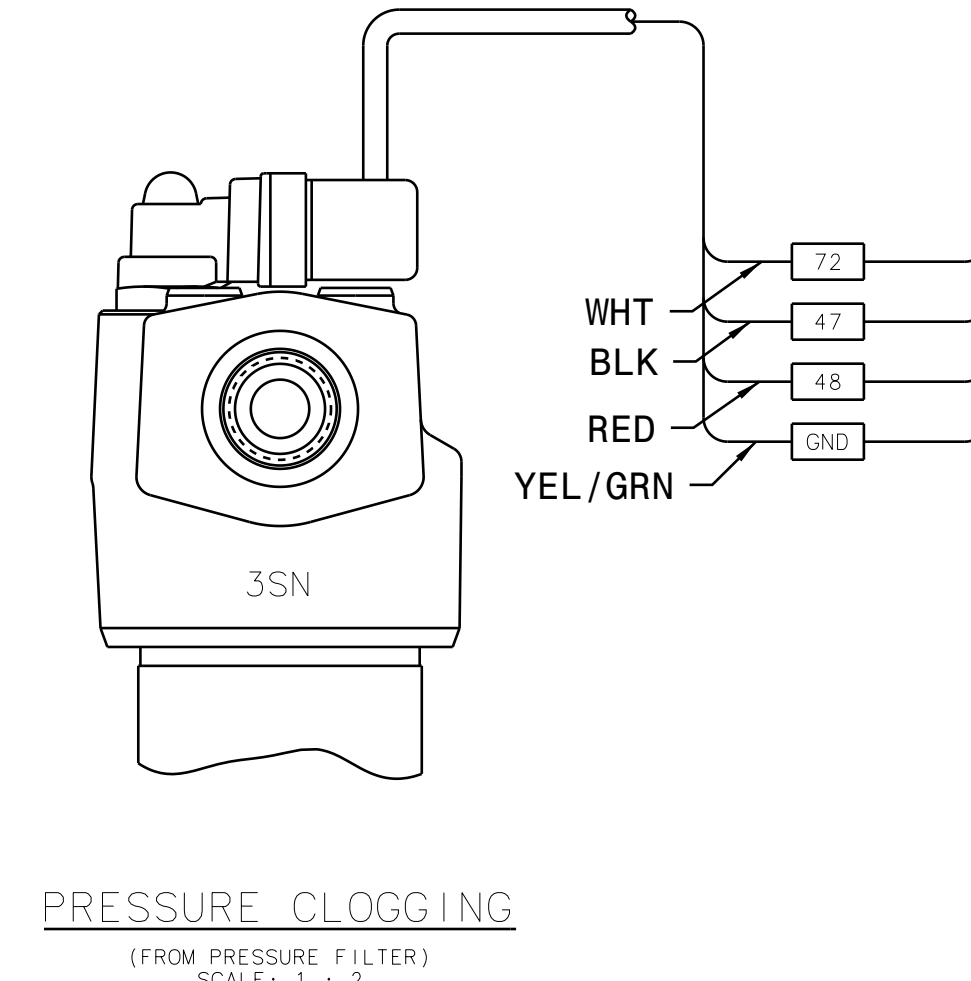
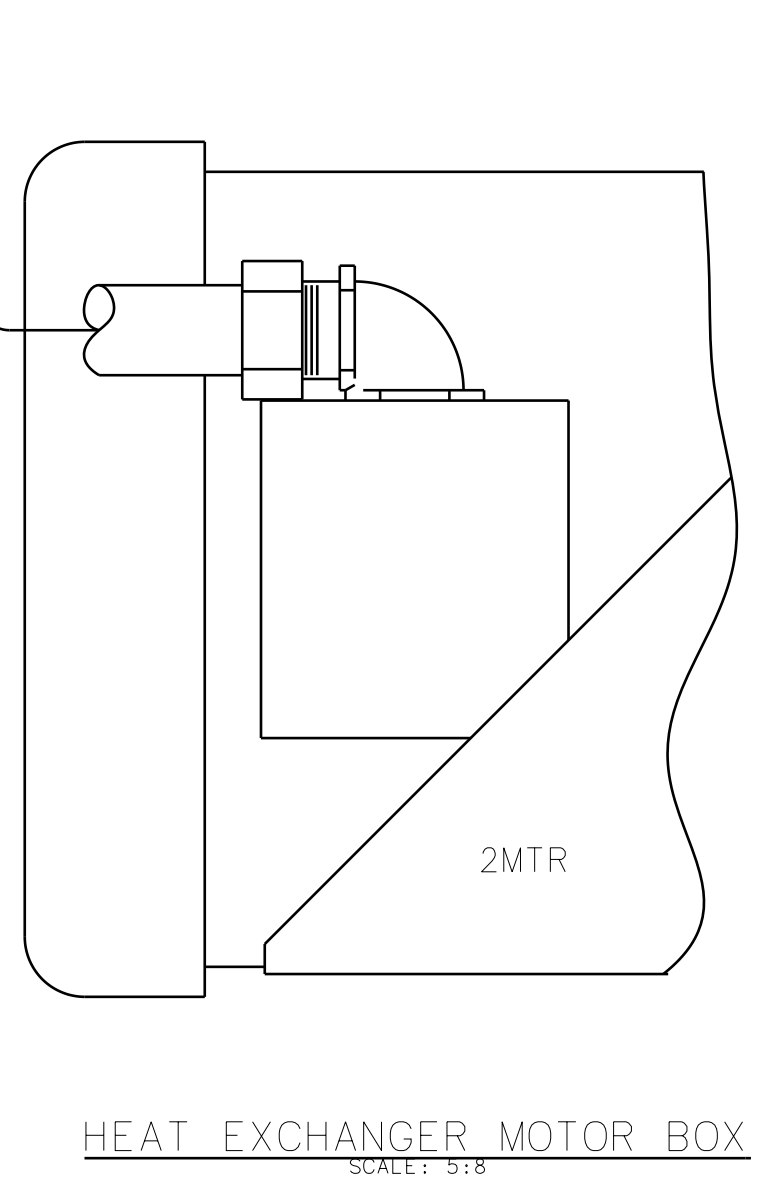
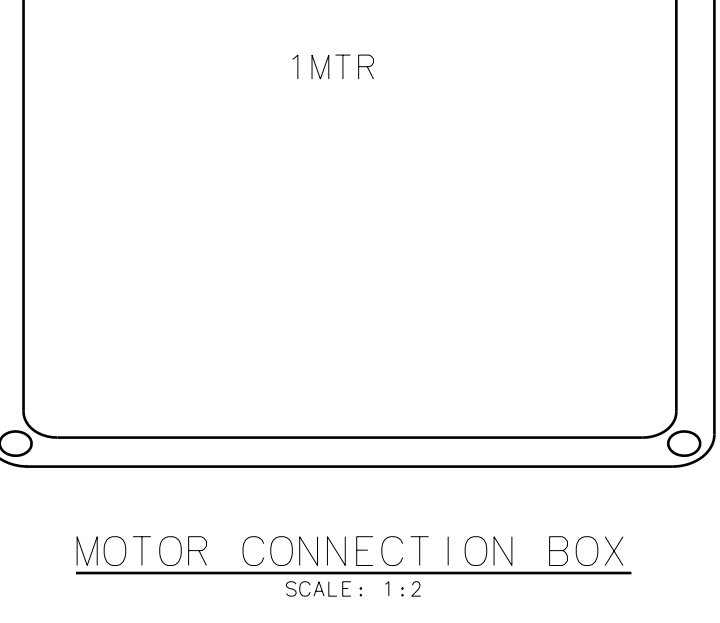
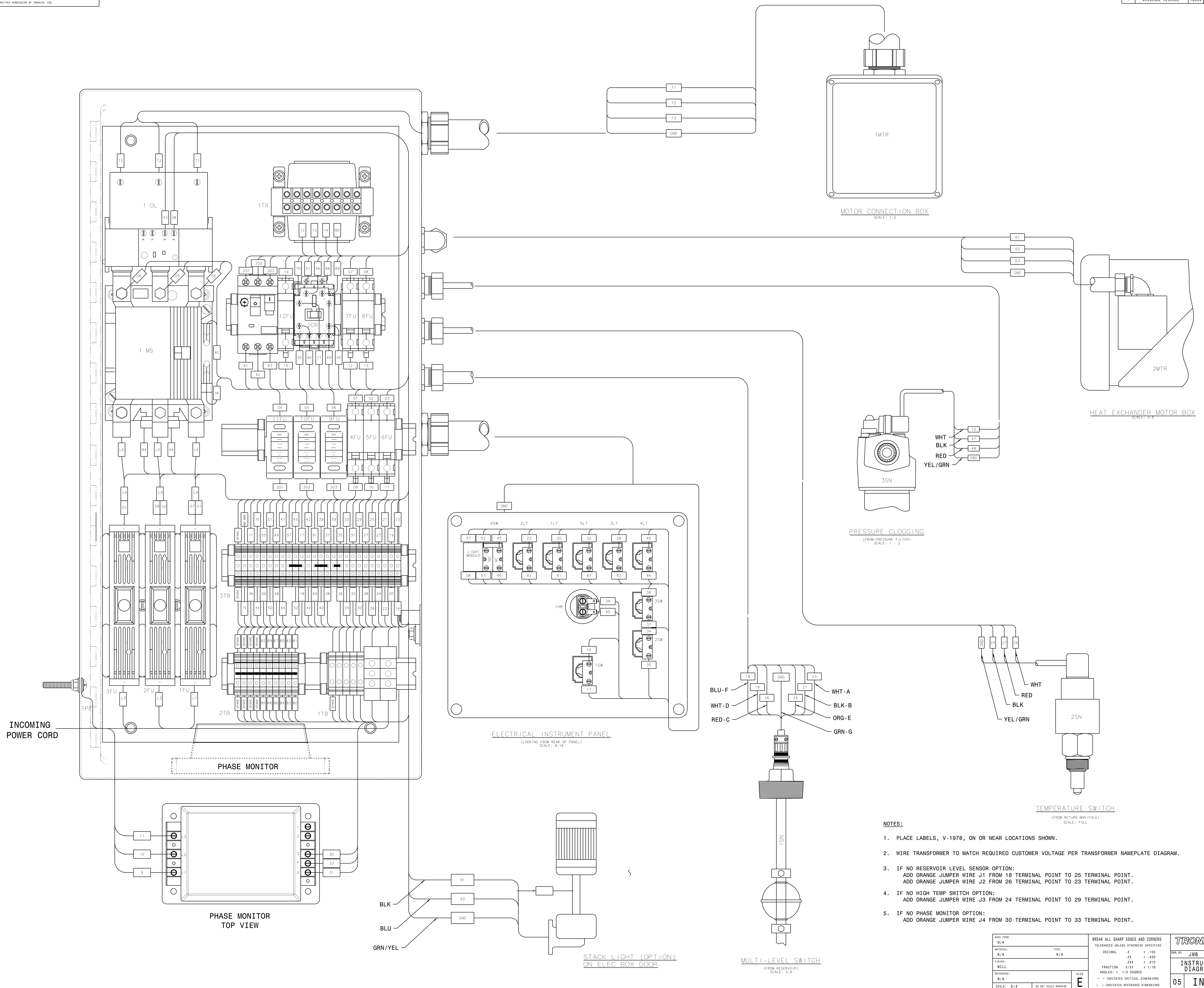


APPENDIX III

**Wiring Diagram
(INS-2144, INS-1746)**

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LET	REVISION	ECN	DWN	CHK	DATE
-	ORIGINAL RELEASE	18824	-	-	05-03-12

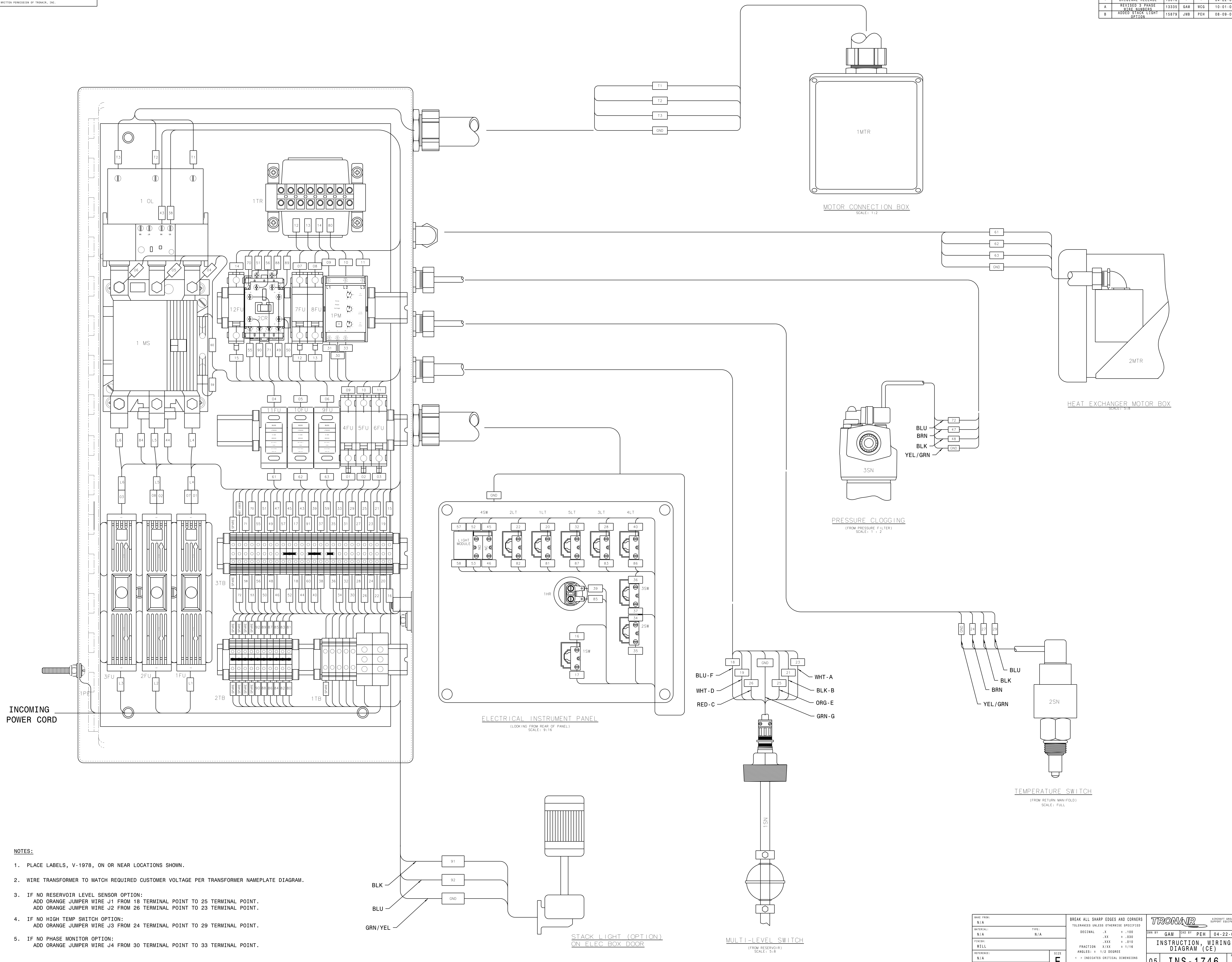


- NOTES:**
- PLACE LABELS, V-1978, ON OR NEAR LOCATIONS SHOWN.
 - WIRE TRANSFORMER TO MATCH REQUIRED CUSTOMER VOLTAGE PER TRANSFORMER NAMEPLATE DIAGRAM.
 - IF NO RESERVOIR LEVEL SENSOR OPTION:
ADD ORANGE JUMPER WIRE J1 FROM 18 TERMINAL POINT TO 25 TERMINAL POINT.
ADD ORANGE JUMPER WIRE J2 FROM 26 TERMINAL POINT TO 23 TERMINAL POINT.
 - IF NO HIGH TEMP SWITCH OPTION:
ADD ORANGE JUMPER WIRE J3 FROM 24 TERMINAL POINT TO 29 TERMINAL POINT.
 - IF NO PHASE MONITOR OPTION:
ADD ORANGE JUMPER WIRE J4 FROM 30 TERMINAL POINT TO 33 TERMINAL POINT.

NAME FROM: N/A	TYPE: N/A	BREAK ALL SHARP EDGES AND CORNERS TOLERANCES UNLESS OTHERWISE SPECIFIED	
MATERIAL: N/A	FINISH: MILL	DECIMAL .X ± .100 .XX ± .000 .XXX ± .010 FRACTION X/XX ± 1/16 ANGLES: ± 1/2 DEGREE < > INDICATES CRITICAL DIMENSIONS () INDICATES REFERENCE DIMENSIONS	
REVISIONS: N/A	SCALE: 3:4	NO HOT SCALE DRAWING	DWN BY: JMB CKD BY: PEH DATE: 05-22-12 INSTRUCTION WIRING DIAGRAM (CE) (CSA) 05 INS-2144

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LET	REVISION	ECN	DWN	CHK	DATE
	ORIGINAL RELEASE	13016			04-22-03
A	REVISED 3 PHASE WIRE NUMBER	13325	GAM	WGO	10-01-03
B	ADDED STACK LIGHT OPTION	15879	JMB	PEH	08-09-07



- NOTES:**
- PLACE LABELS, V-1978, ON OR NEAR LOCATIONS SHOWN.
 - WIRE TRANSFORMER TO MATCH REQUIRED CUSTOMER VOLTAGE PER TRANSFORMER NAMEPLATE DIAGRAM.
 - IF NO RESERVOIR LEVEL SENSOR OPTION:
ADD ORANGE JUMPER WIRE J1 FROM 18 TERMINAL POINT TO 25 TERMINAL POINT.
ADD ORANGE JUMPER WIRE J2 FROM 26 TERMINAL POINT TO 23 TERMINAL POINT.
 - IF NO HIGH TEMP SWITCH OPTION:
ADD ORANGE JUMPER WIRE J3 FROM 24 TERMINAL POINT TO 29 TERMINAL POINT.
 - IF NO PHASE MONITOR OPTION:
ADD ORANGE JUMPER WIRE J4 FROM 30 TERMINAL POINT TO 33 TERMINAL POINT.

DATE PLEN:	N/A	TYPE:	N/A	BREAK ALL SHARP EDGES AND CORNERS TOLERANCES UNLESS OTHERWISE SPECIFIED	
MATERIAL:	N/A	FINISH:	WILL	DECIMAL .X ± .000 .XX ± .000 .XXX ± .010 FRACTION X/XX ± 1/16	
REVISIONS:	N/A	SIZE:	E	ANGLE: ± 1/2 DEGREE < > INDICATES CRITICAL DIMENSIONS () INDICATES REFERENCE DIMENSIONS	DWN BY: GAM CKD BY: PEH DATE: 04-22-03 INSTRUCTION, WIRING DIAGRAM (CE) 05 INS-1746 B



APPENDIX IV

Instrument Certification Notice



Instrument Certification Notice

The gauge Certificates of Calibration supplied for the gauge(s) on this unit contain the calibration data for the actual instrument calibrated, along with the calibration date of the **STANDARD** used to perform the calibration check.

The due date for re-calibration of the instrument should be based upon the date the instrument was placed in service in your facility. Re-calibration should be done on a periodic basis as dictated by the end user's quality system or other overriding requirements.

Note that Tronair, Inc. does not supply certificates of calibration on flow meters or pyrometers unless requested at the time of placed order. These instruments are considered reference indicators only and are not critical to the test(s) being performed on the aircraft.