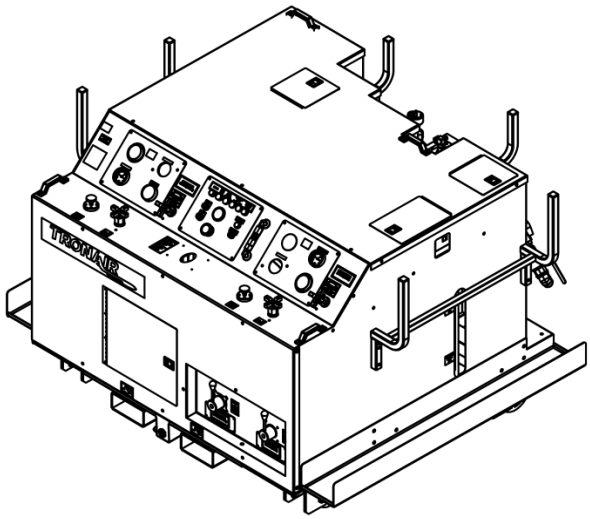
OPERATION & SERVICE MANUAL



Model: TADHPU-5FJ
Dual Hydraulic Power Unit

CE

11/2024 – Rev. 12

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REVISION	DATE	TEXT AFFECTED
01	12/2017	Original release
02	07/2018	Added 5.7 Self Circulation Kit & 5.8 Contamination Monitor Controls
04	08/2021	Added section 5.13 Infrequent HPU Use and updated 9.0 Maintenance
05	01/2022	Modified 9.5.6 Return Filter Assembly, 9.6 Hydraulic Hoses, 9.10 Electrical Components, and Appendices
06	07/2022	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.5.6 Return Filter Assembly
07	07/2023	Modified 9.10 Electrical Components
08	08/2023	Modified 9.10 Electrical Components
09	02/2024	Modified 9.2 Electric Motor
10	05/2024	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.6 Hydraulic Hoses
11	06/2024	Modified 9.6 Hydraulic Hoses
12	11/2024	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.6 Hydraulic Hoses

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1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Hydraulic Power Unit
Model Number..... TADHPU-5FJ
Fluid Type MIL-PRF-5606

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit.

1.3 MANUFACTURER

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1.4 FUNCTION

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

1.5 REQUIREMENTS

Adequate electrical power must be provided for proper functioning of the HPU. See the unit nameplate for proper voltage and frequency. See the technical section 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
- Fluid sample shut off valve

2.5 PERSONAL PROTECTION EQUIPMENT

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

2.6 SAFETY GUIDELINES

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

2.7 GENERAL COMMENT

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

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

3.0 PREPARATION PRIOR TO FIRST USE

3.1 GENERAL

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

3.2 SERVICING RESERVOIR

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

3.3 CONNECTING ELECTRICAL LEADS

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

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

A voltage monitor is installed on this 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 Operator 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

Voltage	60Hz/480 V	60Hz/380 V	50 Hz/380-440 V	60Hz/575 V
Full Load Amps	92	103.8	105	73.6
Locked Rotor Amps	543	543	528	413
Recommended Fuse Size	125	150	125	90
Maximum Fuse Size	125	150	150	100

5.2 NUMERICAL VALUES

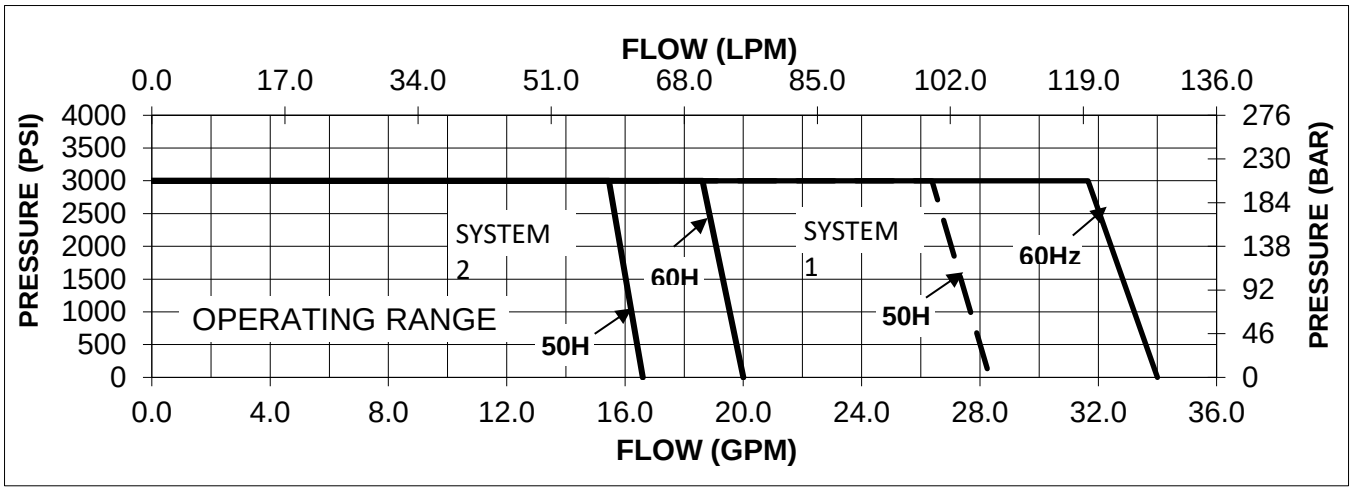
5.2.1 Model

Model Number..... TADHPU-5FJ
Fluid Type MIL-PRF-5606

5.2.2 Physical

Weight (Dry) .....5,000 lbs (2,268 kg)
Width .....90 in (162 cm)
Height.....58 in (147 cm)
Depth.....76 in (193 cm)
Power Cord .....50 ft (15.24 m) long
Electric Fill Pump Hose .....25 ft (7.62 m) ..... Standard Length
-6 (3/8 in, 9.53 mm) ..... Working Diameter
Pressure Hoses.....25 ft (7.62 m) ..... Standard Length
-12 (¾ in, 19 mm) ..... Working Diameter
Return Hoses .....25 ft (7.62 m) ..... Standard Length
-16 (1 in, 25.4 mm) ..... Working Diameter

5.2.3 Hydraulic Pump



SYSTEM 1:

- A pressure compensated, adjustable maximum volume piston pump, split into two sets of hoses
- Maximum flow at 60 Hz ..... 34 gpm (129 lpm)
- Maximum flow at 50 Hz ..... 28 gpm (107 lpm)
- Maximum operating pressure at 50 Hz and 60 Hz ..... 3,000 psi (207 bar)
- System pressure relief valve setting ..... 3,250 psi (224 bar)
- Performance Curve for 50 Hz and 60 Hz

SYSTEM 2:

- A pressure compensated, adjustable maximum **volume** piston pump
- Maximum flow at 60 Hz ..... 20 gpm (95 lpm)
- Maximum flow at 50 Hz ..... 17 gpm (76 lpm)
- Maximum operating pressure at 50 Hz and 60 Hz ..... 3,000 psi (64 bar)
- System pressure relief valve setting ..... 3,250 psi (224 bar)
- Performance Curve for 50 Hz and 60 Hz

5.2.4 Electric Motor

A 75 horsepower, TEFC electric motor is the prime mover for the HPU. This is attached to the tandem hydraulic pumps using a pump/motor adapter and a spider/coupling rotating interface.

MOTOR POWER REQUIREMENTS

Voltage	60Hz/480 V	60Hz/380 V	50 Hz/380-440 V	60Hz/575 V
Full Load Amps	92	104	105	74
Locked Rotor Amps	543	543	528	413

5.2.5 Filters

- Pressure ..... 2 micron rating, non-bypass high collapse microglass type. Non-cleanable element
- Return ..... 5 micron rating, 25 psi (1.72 bar) bypass microglass type. Non-cleanable element
- Electric Fill Pump ..... 2 micron rating, non-bypass microglass type. Non-cleanable element
- Air/Desiccant ..... 3 micron filter, silica gel desiccant type. Non-cleanable element

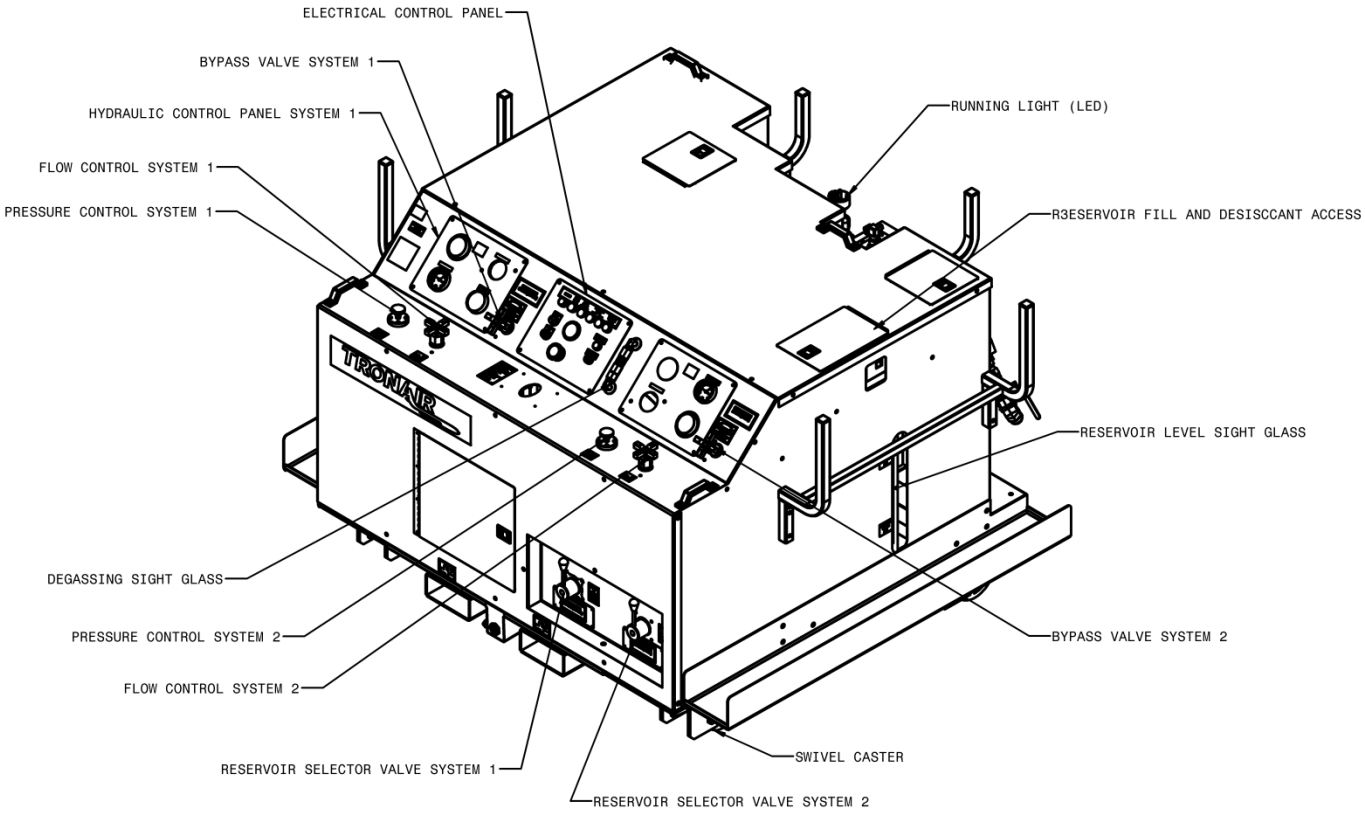
5.2.6 Electric Fill Pump

A ½ HP electric motor drives a vane pump to supply pressurized fluid for servicing aircraft reservoirs.

- Flow ..... 1 gpm (4 lpm)
- Pressure ..... 65 psi (4.5 bar)
- Pressure Relief ..... 70 psi (4.8 bar)

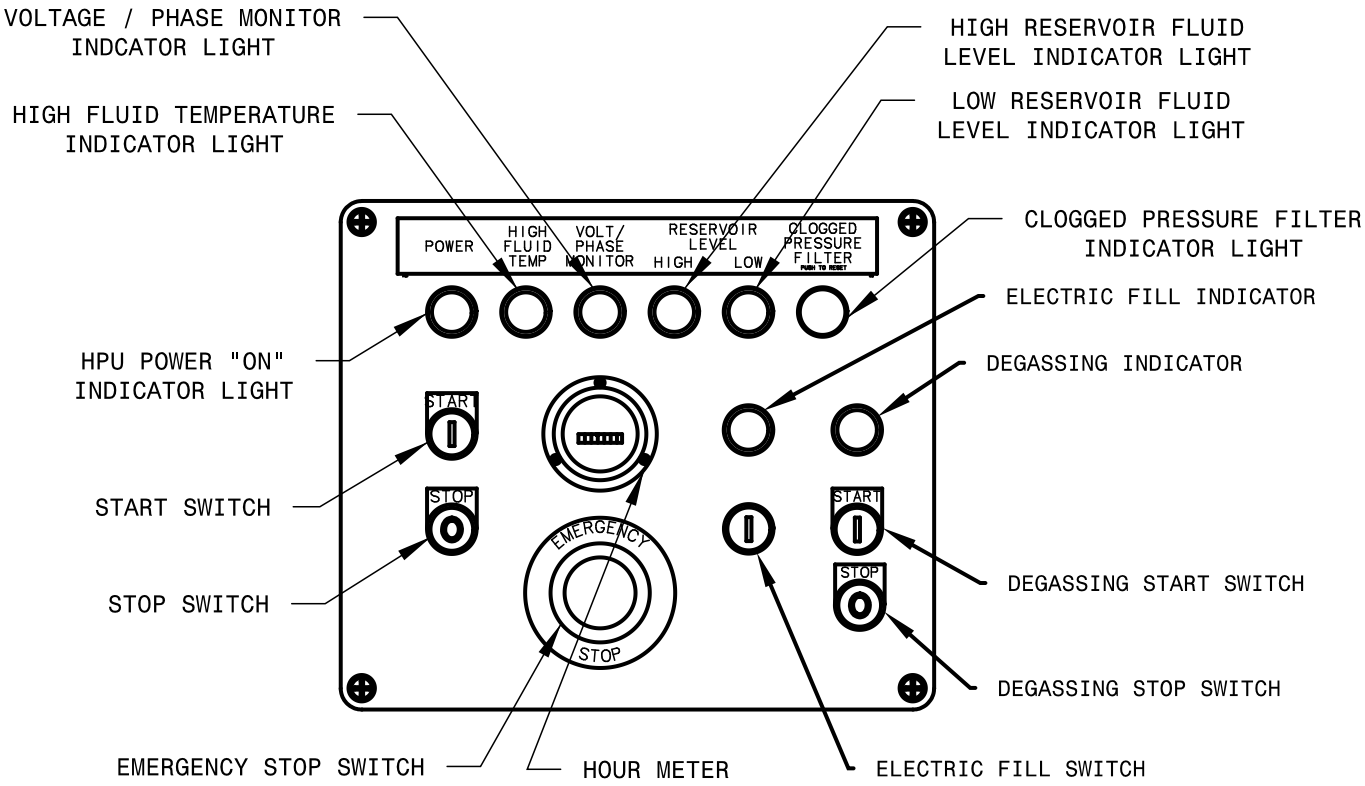
5.3 LOCATION & LAYOUT OF CONTROLS

5.3.1 Front Panel Controls



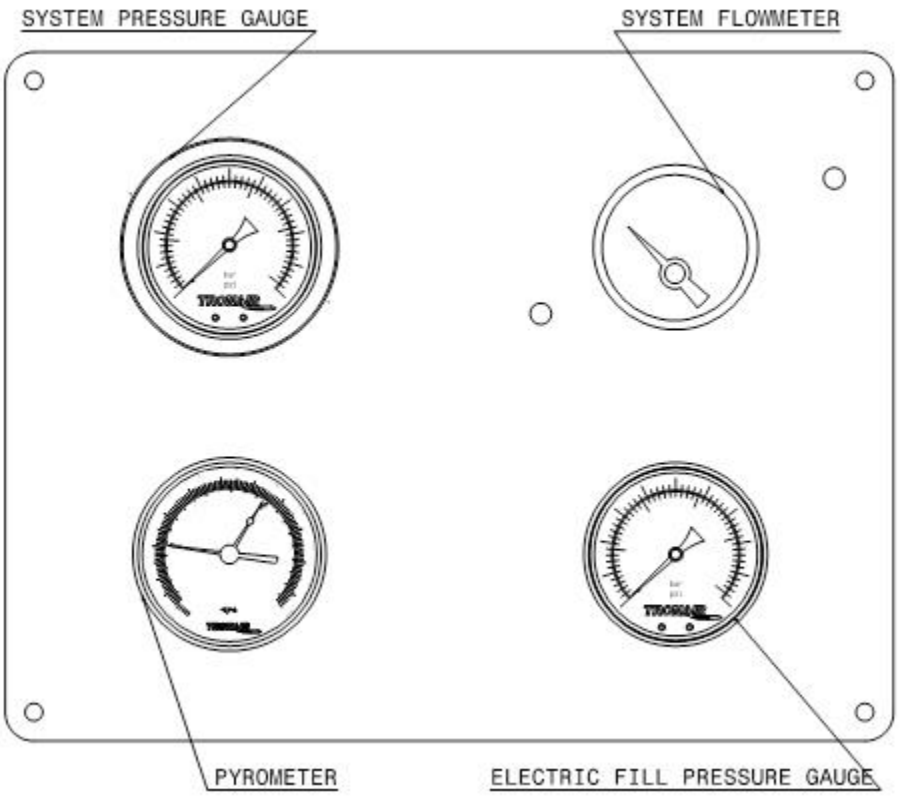
Electrical Control Panel	See Section 5.3.2
Hydraulic Control Panel	See Section 5.3.3
Bypass Valve	For loading and unloading the motor driven hydraulic pump
Flow Control	For setting the maximum flow required from the system
Pressure Control	For setting the system pressure of the HPU during operation
Reservoir 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
Locking Swivel Caster	Locking/unlocking, foot actuated and released locking caster
Running Light	Illuminated green LED light when unit is running
Degassing Sightglass	Fluid sight glass to observe air bubbles

5.3.2 Electrical Control Panel



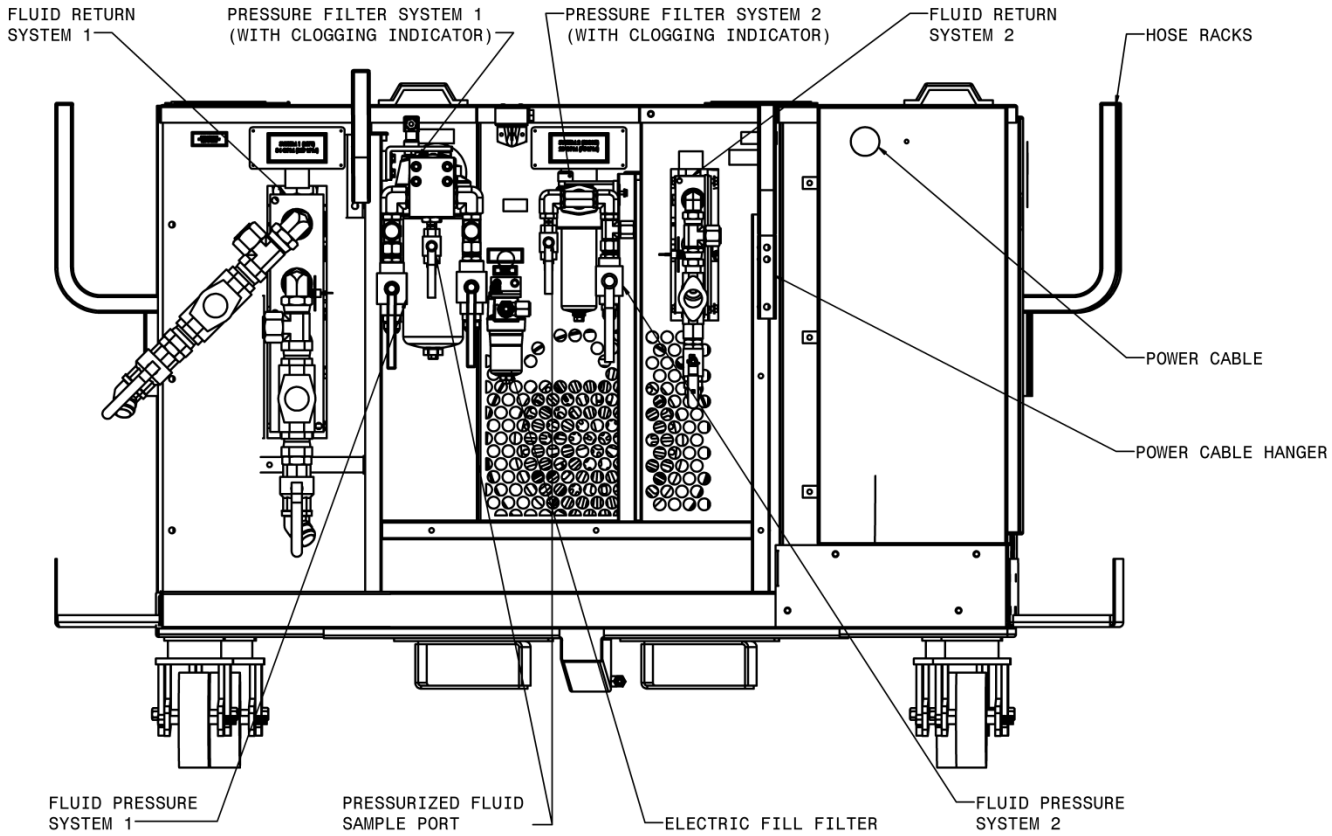
Emergency Stop	Removes power to all electrical devices, must turn to reset
Stop Switch	Turns off the electric motors driving the hydraulic pump and cooling fan
Start Switch	Turns on the electric motors driving the hydraulic pump and cooling fan
HPU Power "On" Indicator Light	Light is illuminated when the electric motors driving the hydraulic pump and cooling fan are on
High Fluid Temperature Indicator Light	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	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	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	Light is illuminated if any of the following conditions occur - Voltage imbalance between L1, L2, L3, greater than 5% - Loss of voltage from L1, L2, L3 - Over voltage from L1, L2, L3, greater than 5% - Change in phase orientation between L1, L2, L3. The HPU will shut down until the electrical problem is corrected
Clogged Pressure Filter Indicator Light	Light is illuminated when the pressure filter element requires changing. The HPU will not shut down when illuminated. Pressing the illuminated button will reset the light
Electric Fill Switch	Hold to operate electric fill pump to service aircraft reservoir from HPU reservoir
Electric Fill Indicator	Light is illuminated when the electric fill motor is on
Degassing Start Switch	Turns on the electric motor driving the hydraulic pump on degassing system
Degassing Stop Switch	Turns off the electric motor driving the hydraulic pump on degassing system
Degassing Indicator Light	Light is illuminated when the degassing electric motor is on

5.3.3 Hydraulic Control Panel



System Pressure Gauge	Displays the system pressure on an analog fluid dampened gauge
Pyrometer	Displays the fluid temperature in the return system on an analog gauge. A warning indicator preset to 170° F (77° C) warns of high operating temperature
Electric Pump Pressure Gauge	Displays the hand pump system pressure on an analog fluid dampened gauge
System Flowmeter	Displays the system flow on an analog fluid dampen 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
Return Fluid Filter	Filters the fluid returning from the aircraft before it enters the HPU
Pressurized Fluid Sample Port	A sample valve is provided to obtain a fluid sample for analysis. In order to obtain a representative sample
Electric Fill Pump Pressure Filter	Filters the pressurized fluid before it flows to the aircraft system
Hose Racks	Location for storing the pressure and return hoses when not in use
Power Cord Hanger	Location for storing the power cord and electric fill hose when not in use

5.4 START UP PROCEDURES

5.4.1 Procedure for First Time or Different Electrical Supply ONLY

Phase Monitor: 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. Verify that the correct voltage is connected; make sure all three phases are connected. Once the phase monitor light is not illuminated with power attached unit will start.

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.

5.4.2 Initial Start Up of the HPU

a. Unit must be prepared per section *3.0 Preparation Prior to First Use* and section *5.4.1 First Time or Different Electrical Supply ONLY* before starting the HPU.
b. Operator must be familiar with this manual and be properly trained prior to starting the HPU.
c. Close all pressure and return valves on the back of the unit.
d. Place both reservoir selector valves in "HPU Reservoir" position.
e. Place the bypass valves in the "Open" position.
f. Press the start switch and adjust the flow control on System 1 until approximately 10 - 12 gpm (38 - 45 lpm) is displayed on the flowmeter. (If no flow displays on the flowmeter after adjusting the flow control, reference *Trouble Shooting 8.2 No Flow*). Immediately repeat for System 2.
g. Allow to run for two to five minutes until flow is steady and no hammering sounds.
h. Close the bypass valve; adjust the pressure control on System 1until 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)*. Repeat for System 2.
i. Open the bypass valve on System 1 and System 2.
j. Press the stop switch.

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

WARNING!

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

WARNING!

NEVER open or close dual 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.

5.5 PRELIMINARY ADJUSTMENTS FOR OPERATION

The following are basic to the operation of the HPU and should be thoroughly understood.

5.5.1 Flow Control Adjustment

a. Open bypass valve.
b. Select "Hydraulic Power Unit" position with reservoir selector valve.
c. Start HPU.
d. Adjust flow control on System 1 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. (Pressure may need to be increased to reach higher valve flows.)
e. Repeat for System 2.

5.5.2 Pressure Control Adjustment

a. Make sure all pressure ball valves on the back of the HPU are closed.
b. Open bypass valve.
c. Select "Hydraulic Power Unit" position with reservoir selector valve.
d. Start HPU.
e. Close bypass valve System 1.
f. 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.
g. Repeat for System 2.

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

h. Open the bypass valve on System 1 and System 2.
i. Shut off HPU.

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. The aircraft reservoir will probably need to be serviced after using the HPU in “HPU Reservoir” position.

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.**

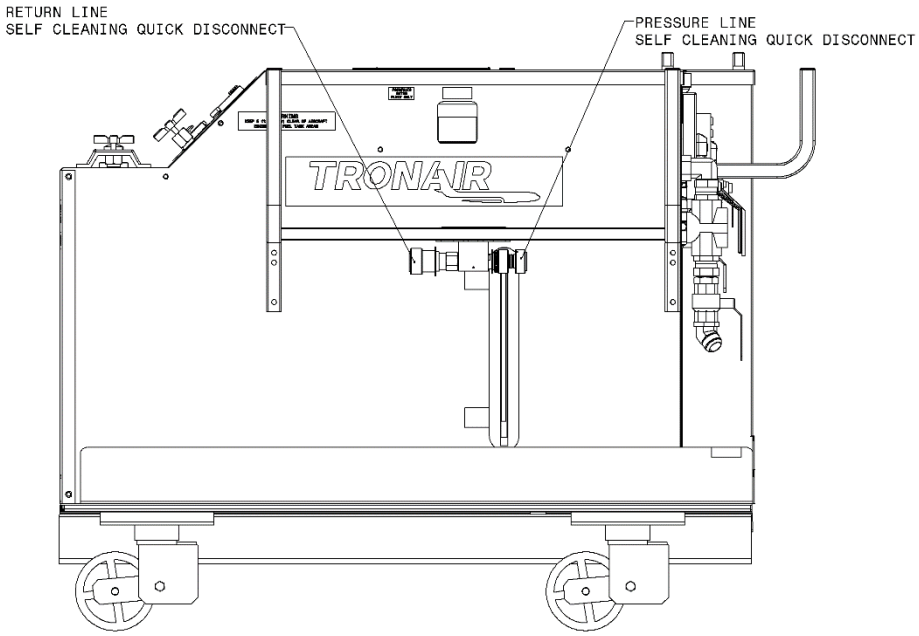
5.6 BLEEDING AIR FROM SYSTEM

Rapid fluctuations of the pressure gage and flowmeter 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. Connect pressure and return hoses to optional quick disconnect self-cleaning coupling kit, both systems.



c. Open all pressure and return ball valves on the back of the unit.
d. Open bypass valve.
e. Place reservoir selector valves in “Hydraulic Power Unit” position.
f. Start unit and adjust flow controls to maximum position.
g. Slowly close the bypass valves (pressure should never exceed 200 psi).

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

h. Run unit for ten (10) minutes.
i. Open bypass valves.
j. Shut off HPU.

WARNING!

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

5.6.2 Operating One System Only

When only operating one system it is important to set the unused system correctly. Setting the unused system correctly will assure that the pump still receives proper lubrication and cooling.

Setting Unused System:

Reservoir Selector Valve ..... HPU position
Both pressure and return ball valves on the back of the unit ..... Closed position
Bypass valve ..... Fully open
Flow control ..... Set to ½ max
(ex. System 1 at 17 gpm, System 2 at 10 gpm)

5.7 SELF CIRCULATION KIT OPTION

To operate the self-circulation kit:

- Connect all sets of pressure and return hoses to the self-circulation kit using the quick disconnect couplings.
- Open all pressure and return ball valves
- Set the reservoir selector valve to HPU mode

WARNING!

Failure to open return ball valves may over pressurize return system

- Start unit, set each system to desired flow rate, and close bypass valves to circulate fluid through the pressure and return filters on each system

5.8 CONTAMINATION MONITOR CONTROLS OPTION

To operate the contamination monitor:

- Connect all sets of pressure and return hoses to the self-circulation kit using the quick disconnect couplings.
- Open all pressure and return ball valves
- Set the reservoir selector valve to HPU mode

WARNING!

Failure to open return ball valves may over pressurize return system

- Start unit, set each system to desired flow rate, and close bypass valves to circulate fluid through each pressure and return systems
- The contamination monitor can be connected to quick disconnect fittings on each pressure and return system to monitor contamination in each system
- The contamination monitor will take live readings and report in NAS or ISO codes to the front panel
- For accurate readings annual calibration is required.
  To calibrate the contamination monitor:

1. Disconnect power cable and secure to unit
2. Disconnect hoses, cap and secure to unit
3. Remove contamination monitor from the unit for calibration
4. The unit is still fully operable without the contamination monitor, follow standard operation procedures

5.9 ELECTRIC FILL PUMP OPERATION

The Electric Fill and Degassing Pump allows for filling the aircraft reservoir. The electric fill and degassing pump circuit is separate from the main hydraulic system; a separate filter and hose are attached to the back panel of the HPU.

To operate the pump, connect the external hose to the aircraft reservoir fill port, and hold down the electric fill pump switch located on the center electrical control panel. An indicating light will illuminate if the fill pump motor is running. Observe the fill system pressure on the fill pump pressure gauge.

To operate the degassing pump system, push the degassing On switch and observe flow through the sight glass.

5.10 SAMPLE VALVE

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

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

5.11 EMERGENCY SHUT DOWN PROCEDURE

In the event an emergency shutdown is necessary, press the emergency stop switch located on the electrical panel. (Reference *5.3.2 – Electrical Control Panel*) Open each 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

The indicator light for high fluid temperature of either system 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 ***8.0 Trouble Shooting***.

5.12.2 Voltage/Phase Monitor Indicator

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 ***8.0 Trouble Shooting***.

5.12.3 High and Low Reservoir Level Indicator

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

The indicator light for the clogged filter is a passive light which will illuminate if either of the pressure filters becomes clogged or are 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 *9.13.11 Electric Filter Clogging Indicator 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 3.3 Connecting Electrical Leads), 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 100º-130º F (37.8º-54.4º 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 5,500 lb (2,495 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 front of the HPU. Lifting must be from the front of the unit only.

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

6.3 PACKAGING PROTECTION

No special packaging material for cushioning or suspension is required.

6.4 LABELING OF PACKAGING

Packaging should be labeled as follows: **DO NOT DROP**
THIS SIDE UP
DO NOT STACK

6.5 STORAGE COMPATIBILITY

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

6.6 STORAGE ENVIRONMENT

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

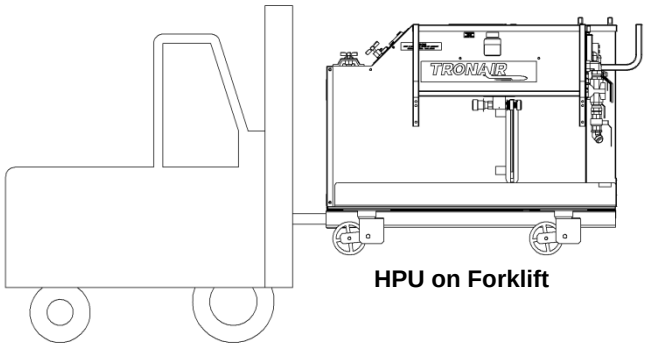
If storing outside, protect unit from freezing water, sand, dirt, and direct sunlight. A cover is highly recommended.

6.7 STORAGE SPACE AND HANDLING FACILITIES

Weight (Dry) .....5,000 lbs (2,268 kg)
Width .....90 in (229 cm)
Height.....58 in (147 cm)
Depth.....76 in (193 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 front of the HPU.



HPU on Forklift

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 – HPU on Forklift.

8.0 TROUBLE SHOOTING

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

If the problem is not resolved using the trouble shooting information, call the manufacturer for Technical Assistance (See *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	Voltage/Phase Monitor Indicator light will be illuminated Refer to 3.3 Connecting Electrical Leads
Reservoir fluid level is too high or too low	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	High Fluid Temperature indicator light will be illuminated. Allow the hydraulic fluid to cool until the light goes out. Refer to 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 5.5.4 Bypass Valve Operation for proper use of the bypass valve.

8.2 NO FLOW

Possible Cause	Solution
Flow control set too low	Increase flow setting or pressure control needs to be increased
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 8.2 No Flow
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 8.2 No Flow
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 left hand side of the HPU. Check the fuses for the fan motor and the motor overloads (See Appendices – Electrical Schematic INS-2314, INS-2375)
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 ELECTRIC PUMP IS NOT PUMPING FLUID

Possible Cause	Solution
No flow	Check fuses and motor overload on the fill pump motor
Not filling reservoir	Observe the electric fill pressure gauge. If pressure is above 65 psi check the coupling connection or remove aircraft reservoir pressure
Low flow	Change the electric fill filter element

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.

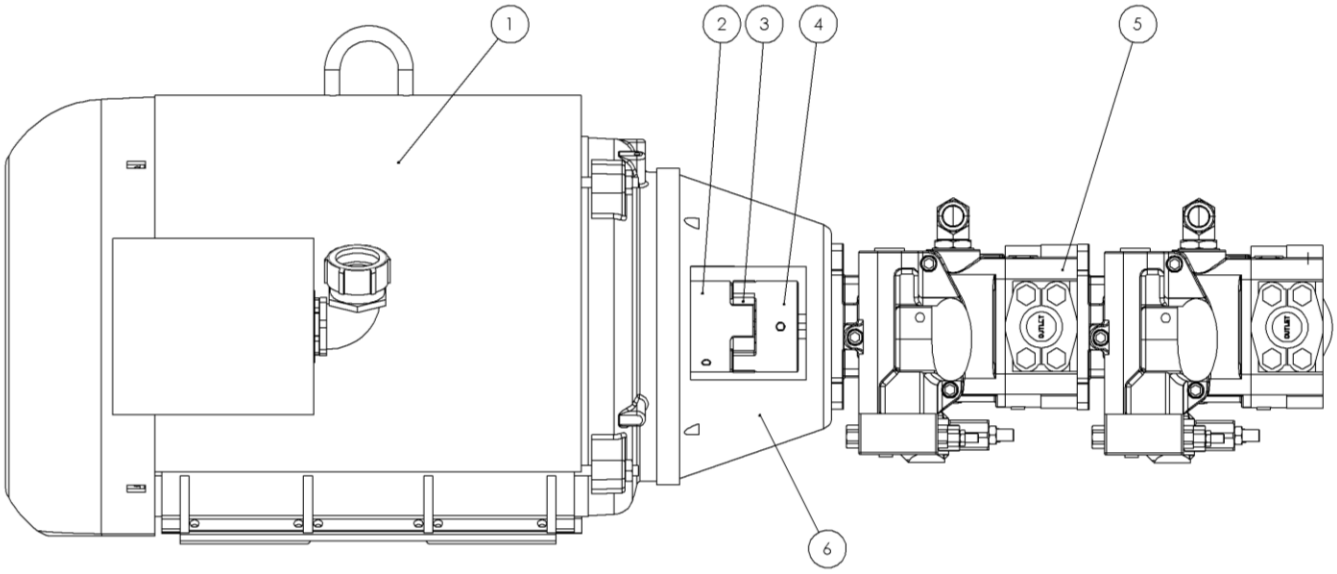
9.1 GENERAL

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

Item	Part Number	Description	Qty
1	See table below	Electric Motor	1
2	H-2223-03	Coupling (Motor Half)	1
3	H-2229	Spider (Hytrel)	1
4	H-2226-14	Coupling (Pump Half)	1
5	Reference 9.3 and 9.3.1	Tandem Hydraulic Pump	1
6	HC-1427-02	Pump/Motor Adapter	1

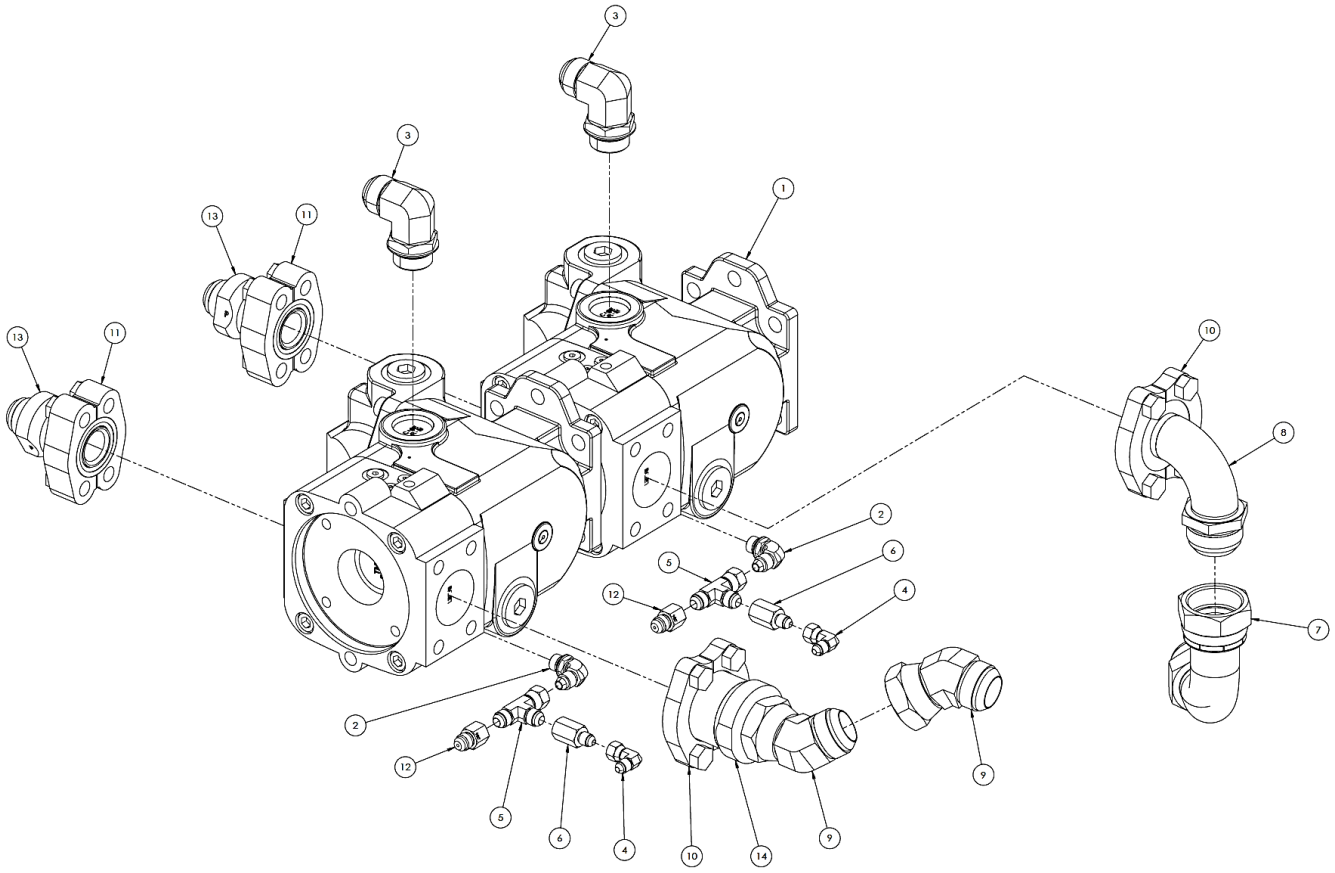
60 Hz Applications	
Voltage	**Part Number**
380	EC-1224-34
480	EC-1224-34
575	EC-1224-15

50 Hz Applications	
Voltage	**Part Number**
380	EC-1224-34
415	EC-1224-34
440	EC-1224-34

9.3 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 Hydraulic Pump Replacement Parts



Parts List

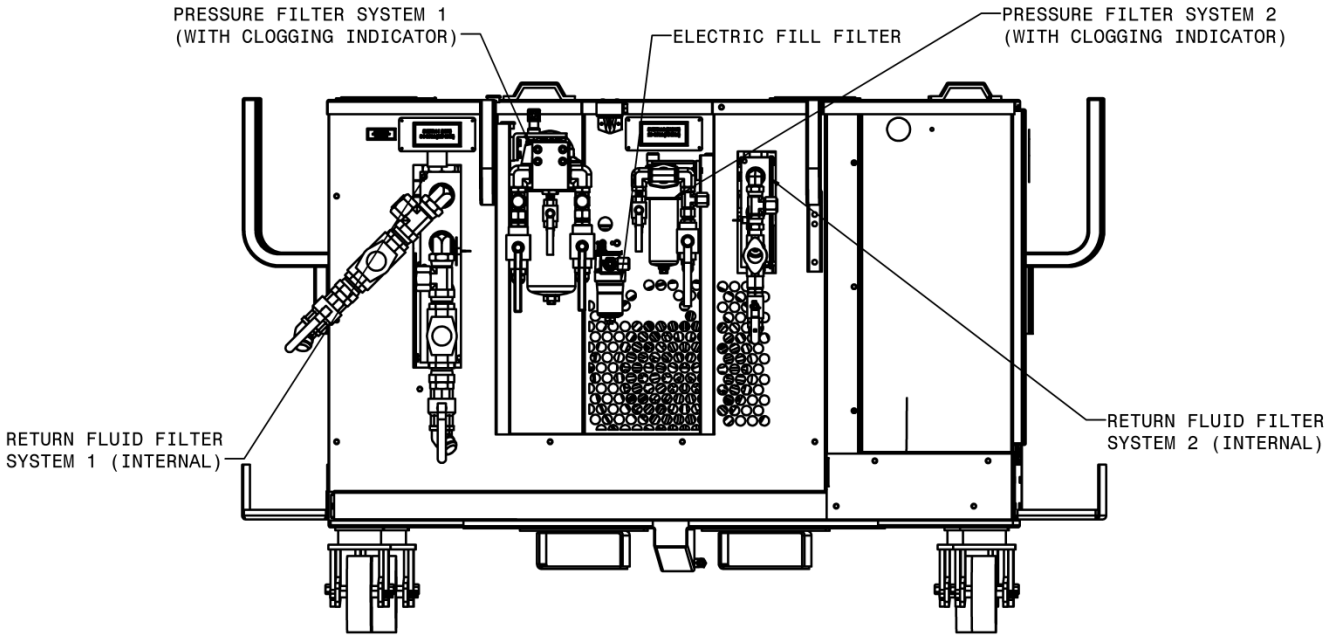
Item	Part Number	Description	Qty
1	HC-2679-01	PUMP, TANDEM HYDRAULIC	1
2	N-2001-08-S-B	ELBOW, STRAIGHT THREAD	2
3	N-2001-24-S-B	ELBOW, STRAIGHT THREAD	2
4	N-2002-03-S	ELBOW, SWIVEL NUT	2
5	N-2016-05-S	TEE, RUN SWIVEL NUT	2
6	N-2055-01-S	REDUCER, TUBE	2
7	N-2063-05	ELBOW, JIC SWEPT	1
8	N-2078-11	FLANGE, 90 DEG. ELBOW	1
9	N-2081-09-S	ELBOW, 45 DEG SW. #20 JIC	2
10	N-2545-06-S-B	KIT, FLANGE	2
11	N-2664-03-S-B	KIT, FLANGE	2
12	N-2924	CONNECTOR, IN-LINE ORIFICE	2
13	N-2932-05-S-B	FLANGE, CODE 62 CONNECTOR	2
14	N-2993-06-S-B	FLANGE, CODE 61 CONNECTOR (MB)	1

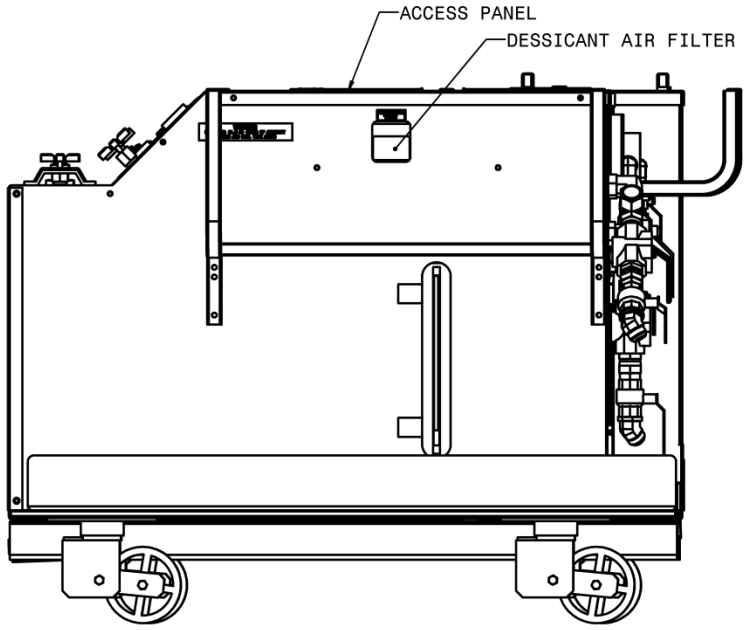
9.4 HYDRAULIC FLUID

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 ***5.8 – Sample Valve Operation***)

Refer to the manufacturer of the specific fluid for your unit to obtain additional information:
Model Number..... TADHPU-5FJ
Fluid Type MIL-PRF-5606

9.5 FILTERS



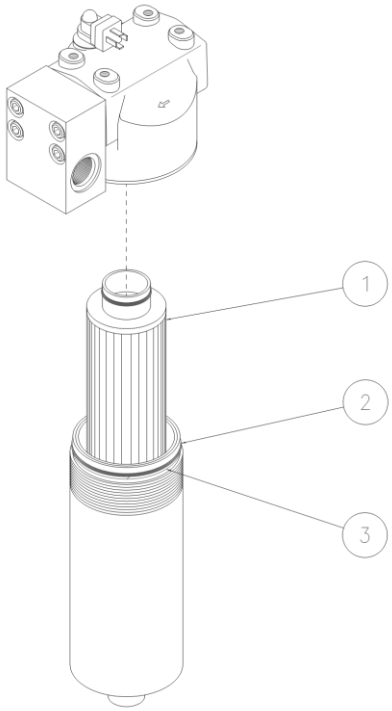


9.5.1 Pressure Filter Element

Replace the filter element any time the clogged filter indicator light is triggered.

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.



System 1 - Parts List

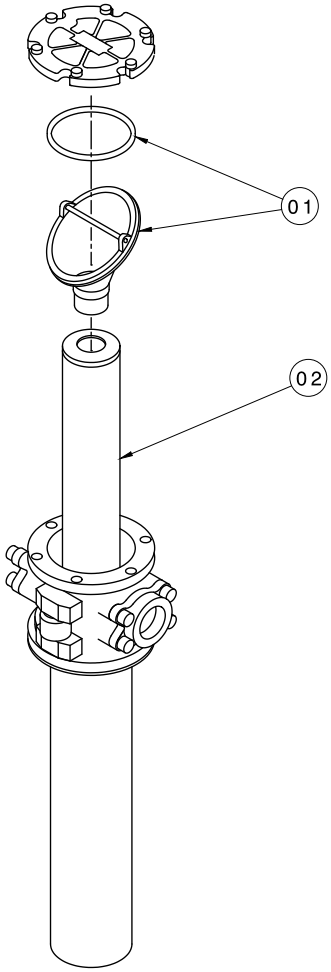
Item	Part Number	Description	Qty
1, 2, 3	K-5244	Kit, Replacement Filter Element	1
2, 3	TBD	O-ring & Backup Ring	1

System 2 - Parts List

Item	Part Number	Description	Qty
1, 2, 3	K-5243	Kit, Replacement Filter Element	1
2, 3	TBD	O-ring & Backup Ring	1

9.5.2 Return Filter Element

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



System 1 - Parts List

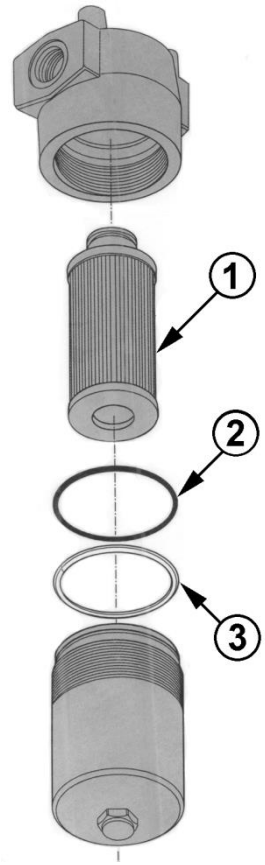
Item	Part Number	Description	Qty
1, 2	K-3615	Kit, Replacement Filter Element	1
1	HC-2000-350	O-ring	2

System 2 - Parts List

Item	Part Number	Description	Qty
1, 2	K-3493	Kit, Replacement Filter Element	1
1	HC-2000-350	O-ring	2

9.5.3 Electric Fill Pump Filter Element

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.

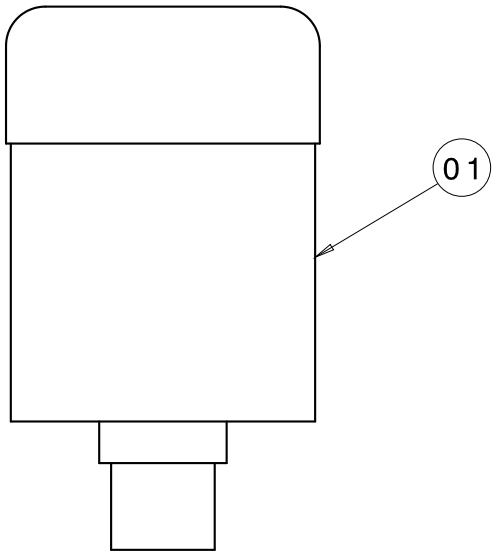


Parts List

Item	Part Number	Description	Qty
1, 2, 3	936698Q	Kit, Replacement Filter Element	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).



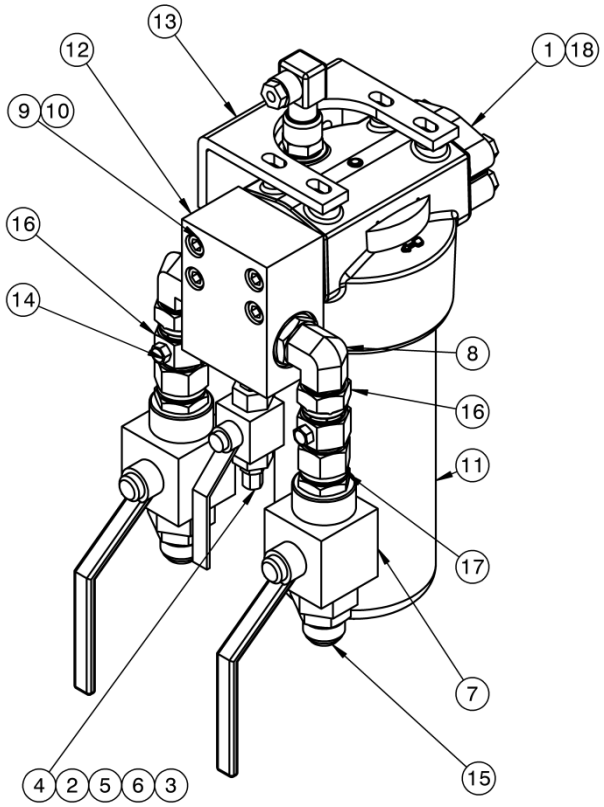
Parts List

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

9.5.5 Pressure Filter Assembly with Electric Filter Clogging Indicator

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

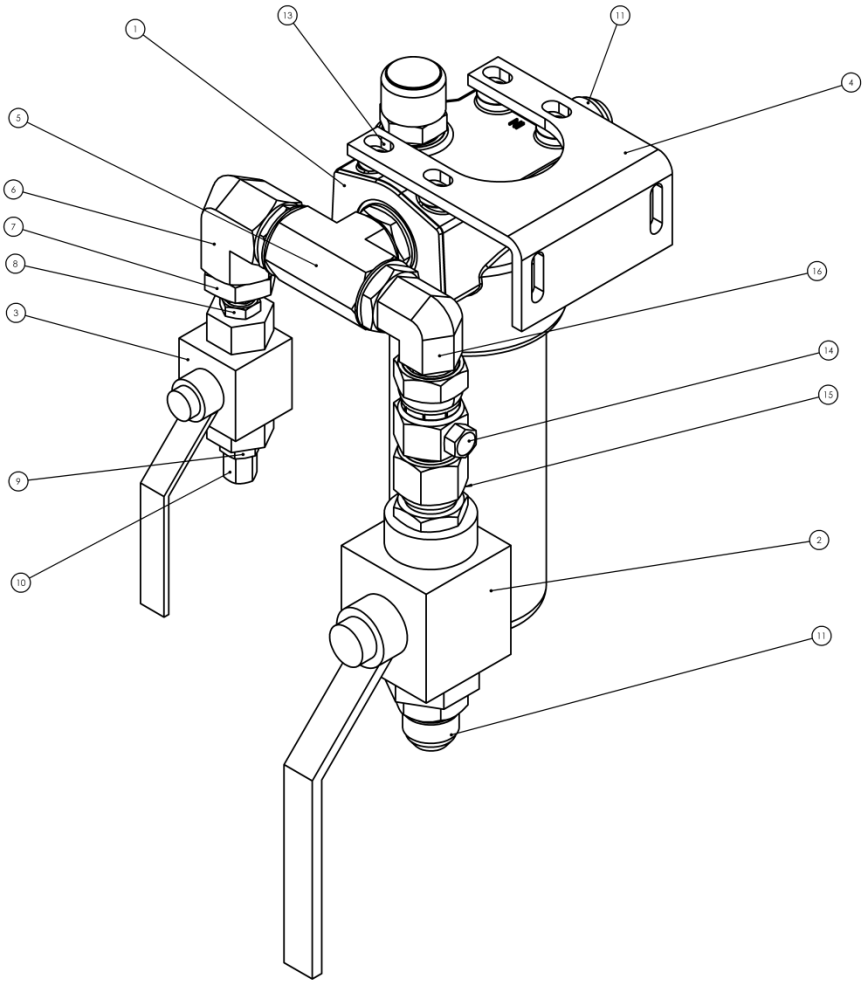
NOTE: Higher flow rates will result in higher differential pressures. (Example: The clogging indicator may sense a 98 psi differential pressure at a flow rate of 34 gpm but not show a clogged condition when the flow rate is reduced to 10 gpm.



System 1 - Parts List

Item	Part Number	Description	Qty
1	N-2664-03-S-B	KIT, FLANGE	1
2	HC-2206-02	VALVE, BALL	1
3	N-2007-05-S-B	CONNECTOR, STR THD	1
4	N-2008-03-S	CAP, 1/4	1
5	N-2464-05-S-B	UNION, #6 STRAIGHT THREAD	1
6	N-2463-31-S-B	FITTING, REDUCER/EXPANDER	1
7	HC-2206-05	VALVE, BALL	2
8	N-2001-24-S-B	ELBOW, STRAIGHT THREAD	2
9	G-1151-109224	SCR, 1/2-13 HEX SOC HD CAP	4
10	G-1251-1090HC	LOCKWASHER, HELICAL SPRING	4
11	HC-2798	FILTER, PRESSURE	1
12	H-2584	FLANGE, SAE ADAPTER	1
13	H-3865-00	BRACKET, FILTER (P)	1
14	N-2053-03-S-B	PLUG, HEX. HD W/ O-RING	2
15	N-2007-24-S-B	CONNECTOR, STR THD	2
16	N-3023-06	TEE, GAUGE PORT	2
17	N-2036-10-S-B	SWIVEL, 37 DEG FEMALE	2
18	HC-2000-222	O-RING, SERIES 2	1

9.5.5 Pressure Filter Assembly with Electric Filter Clogging Indicator *(continued)*



System 2 - Parts List

Item	Part Number	Description	Qty
1	HC-2796	FILTER, PRESSURE	1
2	HC-2206-04	VALVE, BALL	1
3	HC-2206-02	VALVE, BALL	1
4	Z-5093-01	BRACKET, FILTER	1
5	N-2740-12-S-B	TEE, STR THD BRANCH	1
6	N-2661-05-S-B	ELBOW, STRAIGHT THREAD	1
7	N-2463-35-S-B	FITTING, REDUCER/EXPANDER	1
8	N-2464-05-S-B	UNION, #6 STRAIGHT THREAD	1
9	N-2007-05-S-B	CONNECTOR, STR THD	1
10	N-2008-03-S	CAP, 1/4	1
11	N-2007-18-S-B	CONNECTOR, STR THD	2
12	G-1114-080016	BOLT, METRIC M8 HEX HD	4
13	N-3023-05	TEE, GAUGE PORT	1
14	N-2053-03-S-B	PLUG, HEX. HD W/ O-RING	REF
15	N-2036-08-S-B	SWIVEL, 37° FEMALE	1
16	N-2001-18-S-B	ELBOW, STRAIGHT THREAD	1

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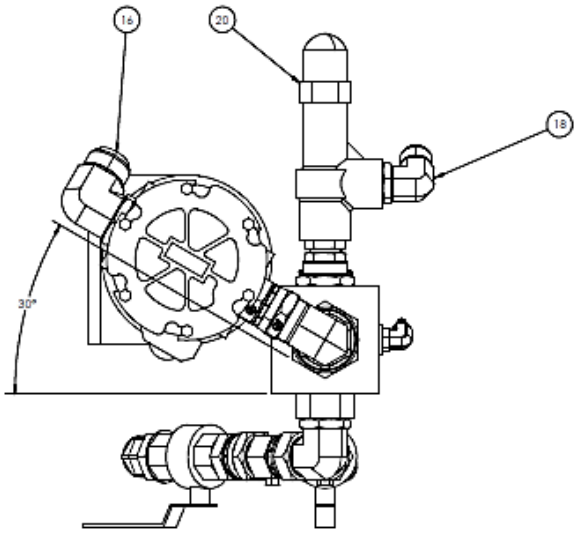
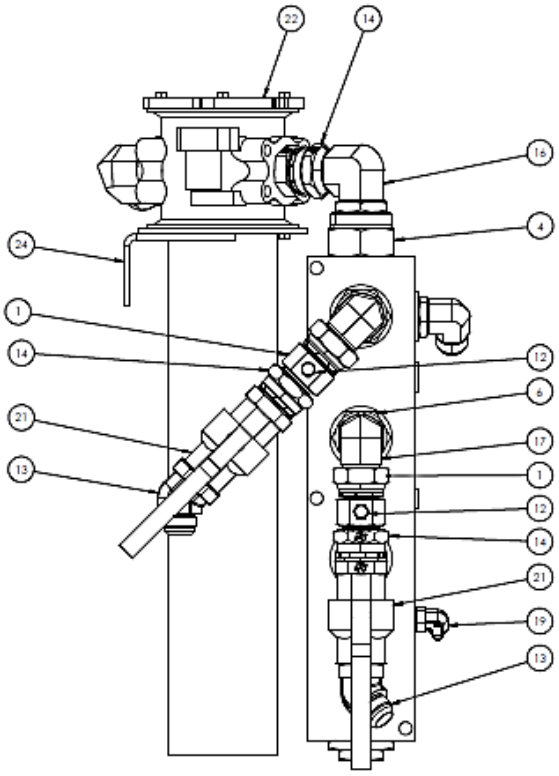
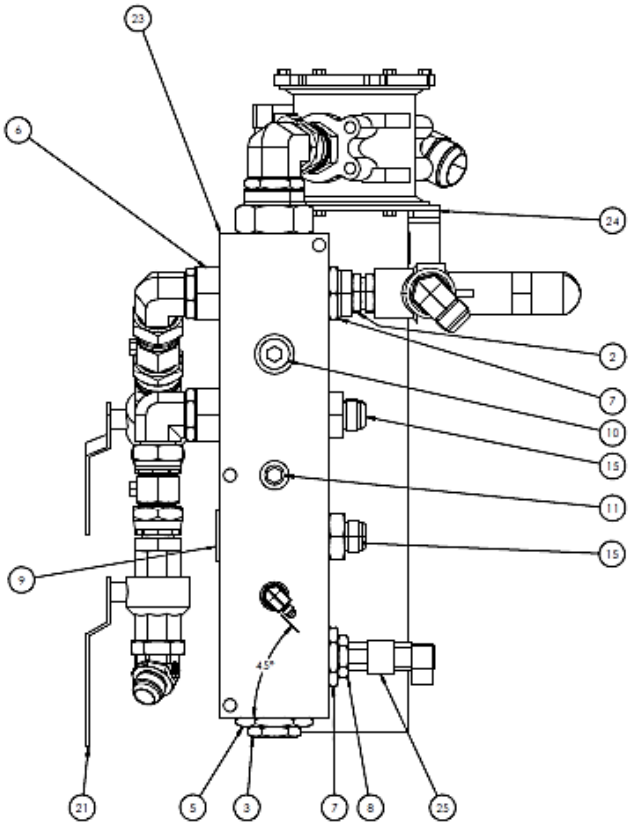
9.5.6 Return Filter Assembly





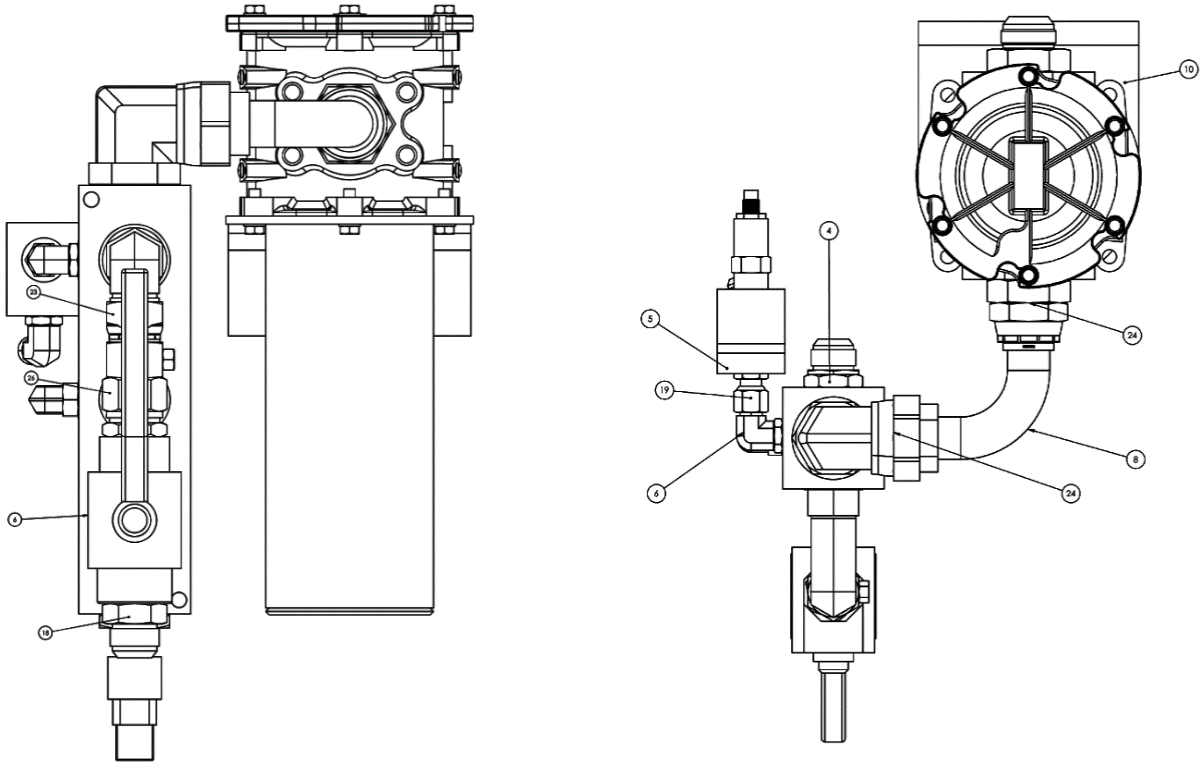


9.5.6 Return Filter Assembly *(continued)*

System 1 - Parts List

Item	Part Number	Description	Qty
1	N-3023-07	TEE, GAUGE PORT	2
2	N-2464-10-S-B	UNION, #16 STRAIGHT THREAD	1
3	N-2463-40-S-B	FITTING, REDUCER/EXPANDER	1
4	N-2463-28-S-B	FITTING, REDUCER/EXPANDER	1
5	N-2463-27-S-B	FITTING, REDUCER/EXPANDER	1
9	N-2463-25-S-B	ADAPTOR, FEM PIPE/STR THD	2
7	N-2463-24-S-B	FITTING, REDUCER/EXPANDER	2
8	N-2463-16-S-B	FITTING, REDUCER/EXPANDER	1
9	N-2066-24-S-B	PLUG, O-RING HEX	1
10	N-2066-12-S-B	PLUG, O-RING HEX	1
11	N-2066-08-S-B	PLUG, O-RING HEX	1
12	N-2053-03-S-B	PLUG, HEX. HD W/ O-RING	2
13	N-2042-25-S-B	ELBOW. 45 DEG STR THD (20-24)	2
14	N-2036-12-S-B	SWIVEL, 37 DEG FEMALE	3
15	N-2007-34-S-B	CONNECTOR, STR THD	2
16	N-2001-31-S-B	ELBOW, STRAIGHT THREAD	2
17	N-2001-28-S-B	ELBOW, MALE	2
18	N-2001-24-S-B	ELBOW, STRAIGHT THREAD	1
19	N-2001-06-S-B	ELBOW, STRAIGHT THREAD	1
20	HC-2201	VALVE, PRE-SET PRESS RELIEF	1
21	HC-2058-01	VALVE, BALL (6000 PSI)	2
22	HC-2045-01	FILTER, RETURN	1
23	HC-2043	MANIFOLD, RETURN	1
24	H-3864-00	BRACKET, FILTER	1
25	EC-1782-01	SWITCH, TEMPERATURE	1

9.5.6 Return Filter Assembly *(continued)*

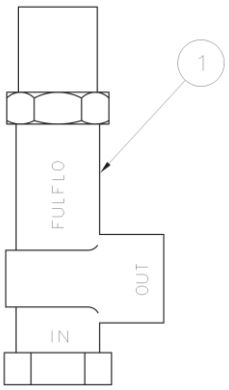


System 2 - Parts List

Item	Part Number	Description	Qty
1	HC-1906-01	FILTER, RETURN	1
2	HC-2205	MANIFOLD, RETURN	1
3	N-2007-21-S-B	CONNECTOR, STR THD	1
4	N-2463-16-S-B	FITTING, REDUCER/EXPANDER	1
5	HC-2199	VALVE, PRESS RELIEF	1
6	HC-2058-02	VALVE, BALL	1
7	N-2063-04	ELBOW, BENT SWIVEL NUT	1
8	N-2001-11-S-B	ELBOW, STRAIGHT THREAD	2
9	N-2007-30-S-B	CONNECTOR, STRAIGHT THREAD	2
11	N-2007-24-S-B	CONNECTOR, STR. THD.	1
13	N-2706-06-S-B	ELBOW, LONG STR THD	1
14	N-2001-06-S-B	ELBOW, STRAIGHT THREAD	1
15	EC-1782-01	SWITCH, TEMPERATURE	1
16	N-2463-40-S-B	FITTING, REDUCER/EXPANDER	1
17	N-2066-16-S-B	PLUG, O-RING HEX	2
18	N-2007-34-S-B	CONNECTOR, STR THD	2
19	N-2049-20-S-B	ELBOW, 90 DEG SWIVEL	1
20	N-2053-03-S-B	PLUG, HEX. HD W/ O-RING	1
21	H-3863-01	BRACKET, FILTER (P)	1
22	N-2036-05-S-B	SWIVEL, 37 DEG FEMALE	1
23	N-3023-06	TEE, GAUGE PORT	1
24	HC-1951-20	SEAL, CONICAL (-20)	1
26	N-2036-10-S-B	SWIVEL, 37~ FEMALE	1
27	N-2463-24-S-B	FITTING REDUCER/EXPANDER	1

9.5.6 Return Filter Assembly *(continued)*

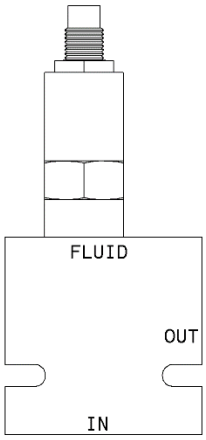
The Return System Pressure Relief Valve can be purchased as a preset assembly. If the relief valve is serviced by the end user, the valve must be set to crack at 150+/-7 psig **before** being re-installed on the HPU.



System 1 - Parts List

Item	Part Number	Description	Qty
1	HC-2201	Valve, Pressure Relief (*Pre-set*)	1
Not Shown	♦ HC-2000-220	O-ring, Series 2	1

♦ ***Included with Item 1***

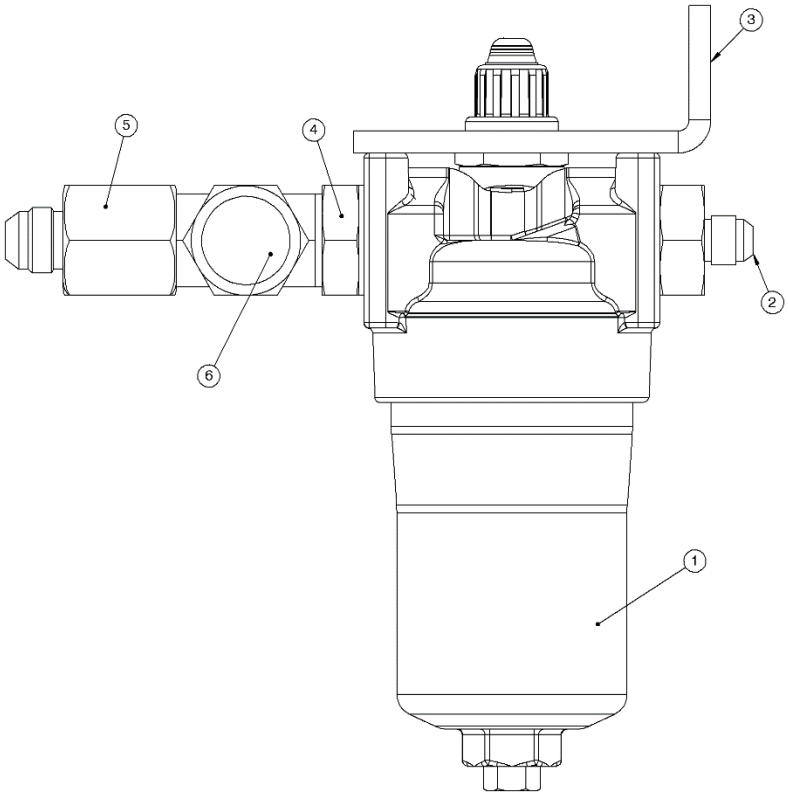


System 2 - Parts List

Item	Part Number	Description	Qty
1	HC-2201	Valve, Pressure Relief (*Pre-set*)	1

♦ ***Included with Item 1***

9.5.7 Electric Fill filter



Parts List

Item	Part Number	Description	Qty
1	HC-2800	ASSEMBLY, FILTER 15CN 2 MICRON (PE)	1
2	N-2007-46-S-B	CONNECTOR, STRAIGHT THREAD	1
3	J-6203	BRACKET, FILTER MOUNTING	1
4	N-2008-08-S	CAP, 3/4"	1
5	N-2015-18-S-B	TEE, RUN, STR THD	1
6	N-2055-09	REDUCER, TUBE	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.

9.6.1 Internal Hoses

System 1 - Parts List

Item	Hose Size	End Size	Part Number	From	To	Qty
1	-24	-24	TF-1117-40-53.4	Selector Valve	Pump Inlet	1
2	-16	-16	TF-1038-47-31.4	Pump Outlet	Flow Control	1
3	-16	-16	TF-1038-44-23.1	Flow Control	Flowmeter	1
4	-16	-16	TF-1038-46-48.0	Manifold	Pressure Filter	1
5	-16	-16	TF-1039-37-64.8	Manifold	Return Manifold	1
6	-16	-16	TF-1039-02-15.8	Pump Case	Heat Exchanger Bottom	1
7	-6	-6	TF-1038-42-45.1	Flow Control Sense	Orifice Fitting	1
8	-4	-4	TF-1038-16-44.4	Pressure Control	Pump Load Sense	1
9	-4	-4	TF-1038-14-116	Pressure Control	Return Manifold	1
10	-16	-16	TF-1039-37-47.5	Heat Exchanger Top	Return Manifold	1
11	-16	-16	TF-1039-09-27.0	Return PRV	Reservoir	1
12	-24	-24	TF-1039-12-49.8	Return Filter	JIC Union	1
13	-24	-24	TF-1039-13-17.0	JIC Union	Selector Valve	1

System 2 - Parts List

Item	Hose Size	End Size	Part Number	From	To	Qty
16	-20	-20	TF-1117-39.18.6	Selector Valve	Pump Inlet	1
17	-12	-12	TF-1038-5-44.4	Pump Outlet	Flow Control	1
18	-12	-12	TF-1038-33-25.1	Flow Control	Flowmeter	1
19	-12	-12	TF-1038-10-54.6	Manifold	Pressure Filter	1
20	-12	-12	TF-1039-36-62.9	Manifold	Return Manifold	1
21	-16	-16	TF-1039-02-52.6	Pump Case	Heat Exchanger Bottom	1
22	-6	-6	TF-1038-42-44.6	Flow Control Sense	Orifice Fitting	1
23	-4	-4	TF-1037-03-35.8	Pressure Control	Pump Load Sense	1
24	-4	-4	TF-1038-14-126	Pressure Control	Return Manifold	1
25	-16	-16	TF-1039-02-60.3	Heat Exchanger Top	Return Manifold	1
26	-8	-8	TF-1038-12-40.4	Return PRV	Reservoir	1
27	-20	-20	TF-1039-35-61.8	Return Filter	JIC Union	1
28	-20	-20	TF-1039-08-16.5	JIC Union	Selector Valve	1

9.6.2 External Hoses

System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
TF-1038-28*300	ASSEMBLY, HOSE	1
TF-1038-10*300	ASSEMBLY, HOSE	1

System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
TF-1038-28*300	ASSEMBLY, HOSE	1
TF-1038-10*300	ASSEMBLY, HOSE	1

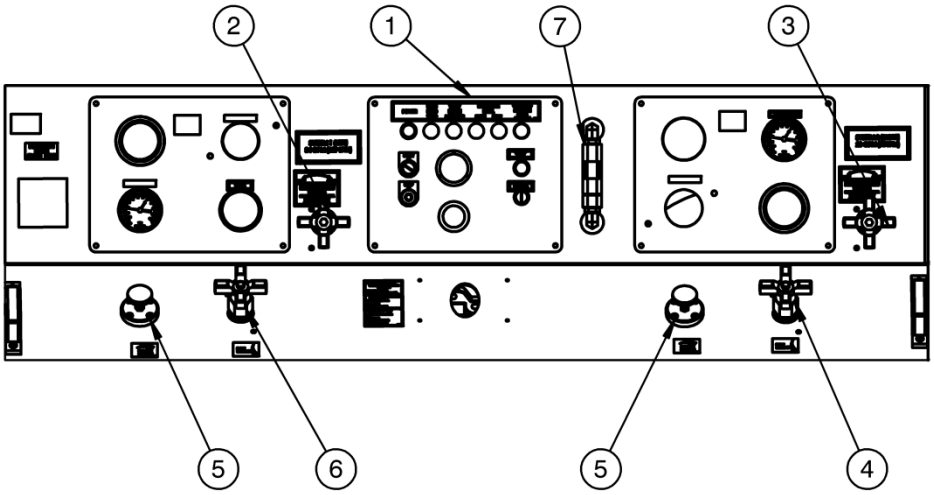
Electric Fill Pump - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
TF-1038-04*300	ASSEMBLY, HOSE	1

9.7 INSTRUMENT PANEL

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

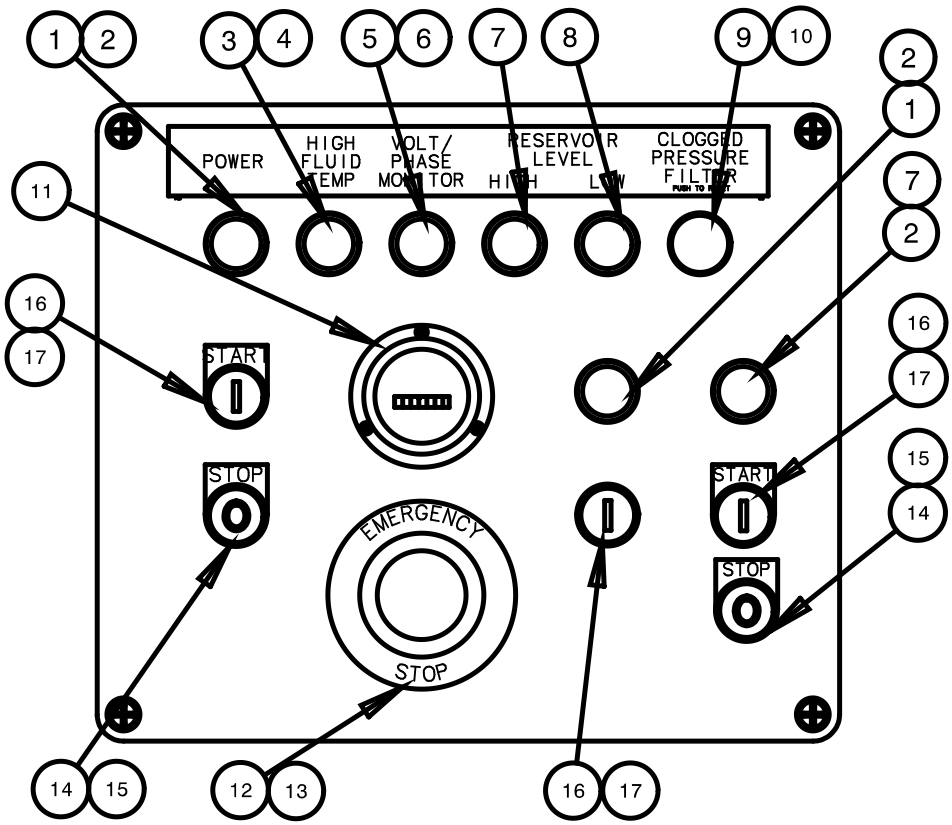


Parts List

Item	Part Number	Description	Qty
1	*See Page 36*	Electric Panel	1
2	*See Page 39*	Assembly, System 1 Pressure Manifold	1
3	*See Page 39*	Assembly, System 2 Pressure Manifold	1
4	*See Page 37*	Assembly, System 2 Flow Control Manifold	1
5	HC-2108-02	Valve, Pressure Control	1
6	*See Page 37*	Assembly, System 1 Flow Control Manifold	1
7	*See Page 32*	Assembly, Degassing Sightglass	1

9.7.1 Electric Panel

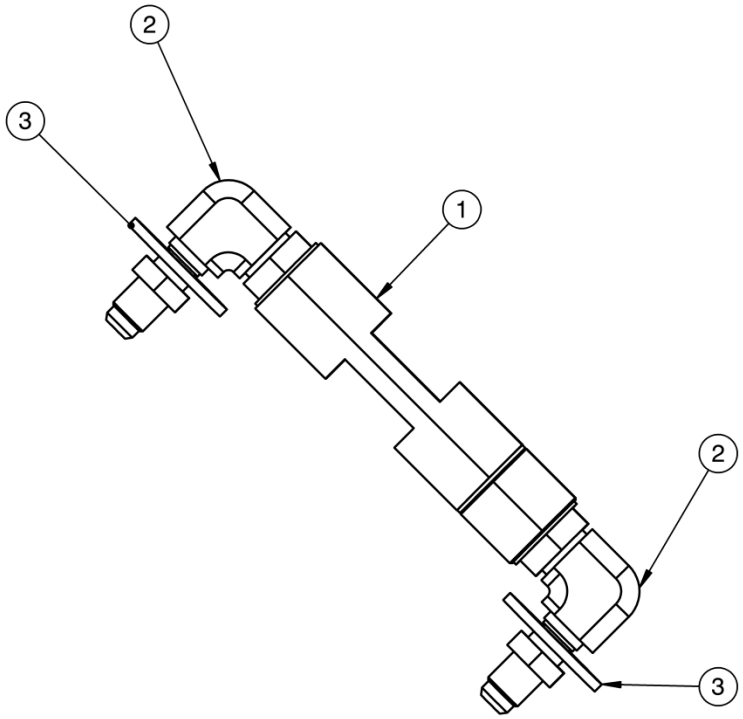
The Electric Panel does not require regular general maintenance.



Parts List

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

9.7.2 Degassing Sightglass

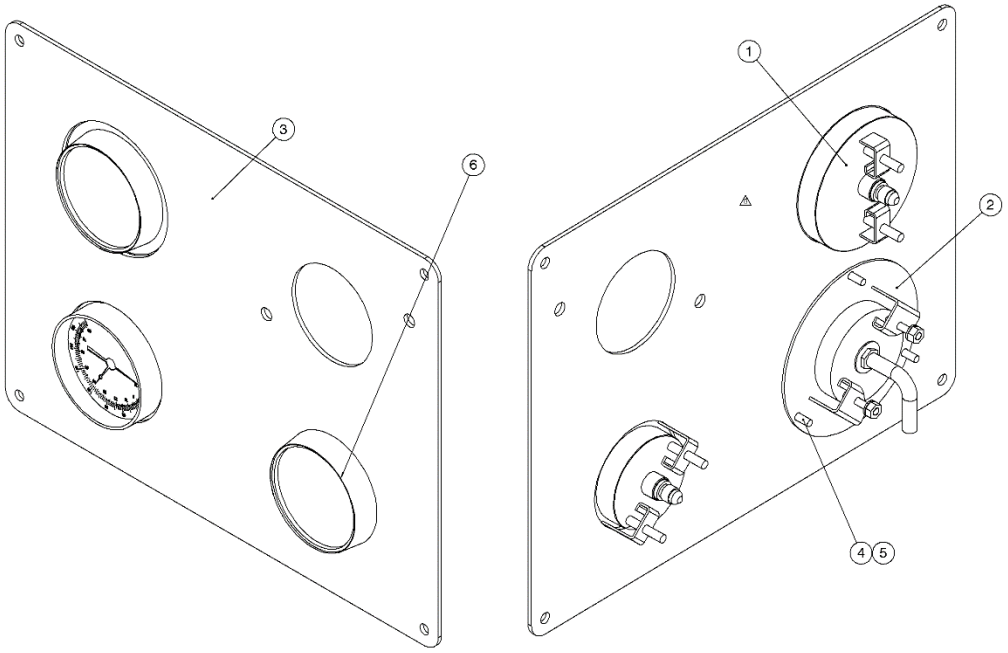


Parts List

Item	Part Number	Description	Qty
1	Z-5635-01	ASSY, FLOW SIGHT (MB)	1
2	N-2710-S-B	ELBOW, BULKHEAD	2
3	G-1250-1100W	FLATWASHER. 5/8 WIDE	2

9.7.3 Hydraulic Panel

Annual calibration of instrumentation is recommended. See Section ***12.0 – Calibration of Instrumentation*** for details of calibration. (System 1 pictured)

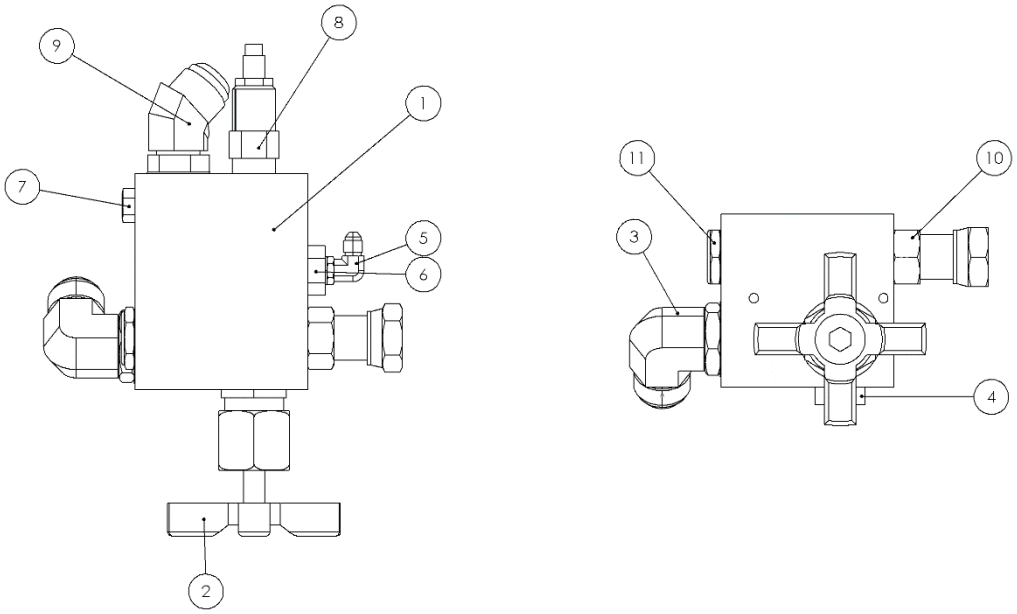


Parts List

Item	Part Number	Description	Qty
1	HC-2143	GAUGE, PRESSURE, 0-6000 PSI	1
2	HC-2268-01	GAUGE, PYROMETER	1
3	S-2898-01	PANEL, HYDRAULIC	1
4	G-1250-1030N	FLATWASHER #10 NARROW	3
5	G-1202-1035	STOPNUT, ELASTIC	3
System 1			
6	HC-2702	GAUGE, PRESSURE. 0-100 PSI	1
System 2			
6	H-2432-15	Plug	1

9.7.4 Pressure Manifold Assembly

The Pressure Manifold components do not require regular general maintenance. (System 1 pictured)



System 1 - Parts List

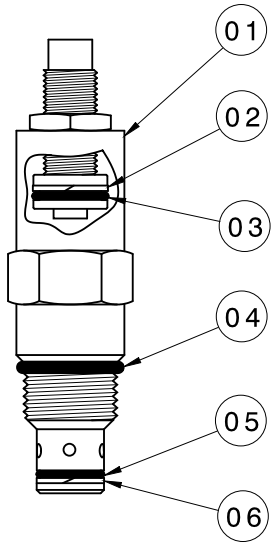
Item	Part Number	Description	Qty
1	J-3245	MANIFOLD, PRESSURE	1
2	HC-1245-05	VALVE, NEEDLE	1
3	N-2001-24-S-**B**	CONNECTOR, STR THD, #16 SAE X #16 JIC	1
4	N-2053-07-S-B	PLUG, O-RING HEX HEAD	1
5	N-2001-03-S-B	CONNECTOR, STRAIGHT THREAD	1
6	N-2463-36-S-B	FITTING, REDUCER-EXPANDER	1
7	N-2053-05-S-B	PLUG, HEX HEAD WITH O-RING	2
8	HC-1442	VALVE, PRESSURE RELIEF	1
9	N-2042-16-S-B	CONNECTOR, 45 ° STR THD	1
10	N-2650-05-S-B	CONNECTOR, ORFS SWIVEL	1
11	HC-2158	VALVE, CHECK	1

System 2 - Parts List

Item	Part Number	Description	Qty
1	J-3245	MANIFOLD, PRESSURE	1
2	HC-1245-05	VALVE, NEEDLE	1
3	N-2053-07-S-B	PLUG, O-RING HEX HEAD	1
4	N-2001-03-S-B	CONNECTOR, STRAIGHT THREAD	1
5	N-2463-36-S-B	FITTING, REDUCER-EXPANDER	1
6	N-2053-05-S-B	PLUG, HEX HEAD WITH O-RING	2
7	HC-1442	VALVE, PRESSURE RELIEF	1
8	N-2650-05-S-B	CONNECTOR, ORFS SWIVEL	1
9	N-2001-21-S-B	ELBOW, STRAIGHT THREAD	1
10	HC-2158	VALVE, CHECK	1
11	N-2042-09-S-B	ELBOW, 45 DEG STR THD	1

9.7.4.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 3,750 psig.



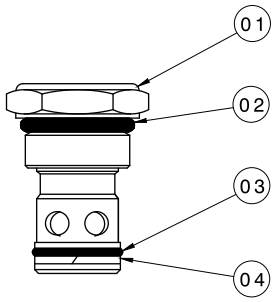
Parts List

Item	Part Number	Description	Qty
♦ 1	HC-1442	Pressure Relief Valve *(Not Set)*	1
2	HC-2020-015	Backup Ring, *(Teflon)*	1
3	HC-2000-015	O-ring, Series 2	1
4	HC-2010-910	O-ring, Series 3	1
5	HC-2000-014	O-ring, Series 2	1
6	HC-2020-014	Backup Ring, *(Teflon)*	1

♦ ***Item 1 consists of Items 2 – 6.***

9.7.4.b Check Valve

The Check Valve does not require regular general maintenance.



Parts List

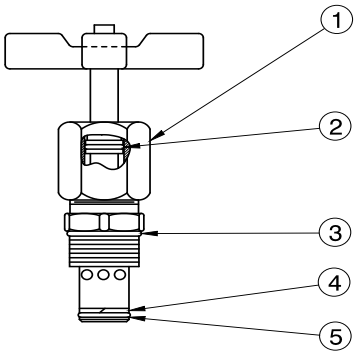
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 1	HC-2158	Check Valve	1
2	HC-2010-912	O-ring, Series 3	1
3	HC-2000-015	O-ring, Series 2	1
4	HC-2020-015	Backup Ring	1

♦ ***Item 1 consists of Items 2 – 4.***

9.7.4.c Bypass Valve

The Bypass Valve does not require regular general maintenance.



Parts List

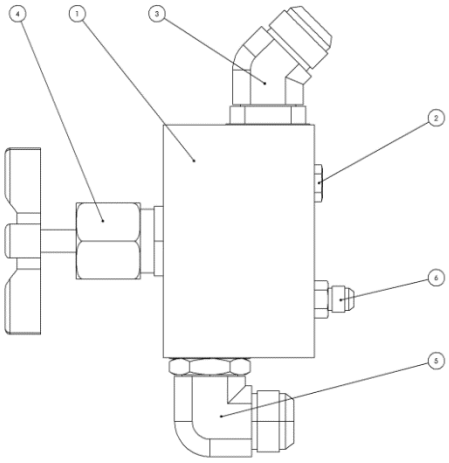
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 1	HC-1254-05	Needle Valve	1
2	HC-2000-112	O-ring	1
3	HC-2010-916	O-ring	1
4	HC-2020-118	Backup Ring	1
5	HC-2000-118	O-ring	1

♦ ***Item 1 consists of Items 2 – 5.***

9.7.5 Flow Control Assembly

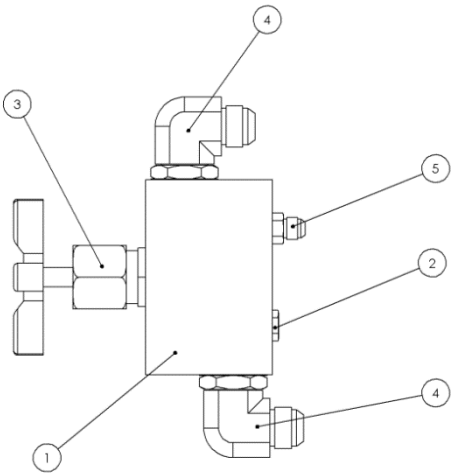
The Flow Control Assembly does not require regular general maintenance.



System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-5128	MANIFOLD, FLOW CONTROL	1
2	N-2053-05-S-B	PLUG, HEX HEAD WITH O-RING	2
3	N-2042-12-S-B	ELBOW, 45 DEG STR THD	3
4	HC-1254-05	VALVE, NEEDLE	4
5	N-2001-24-S-B	CONNECTOR, STR THD, #16 SAE X #16 JIC	5
6	N-2007-08-S-B	CONNECTOR, STRAIGHT THREAD	6

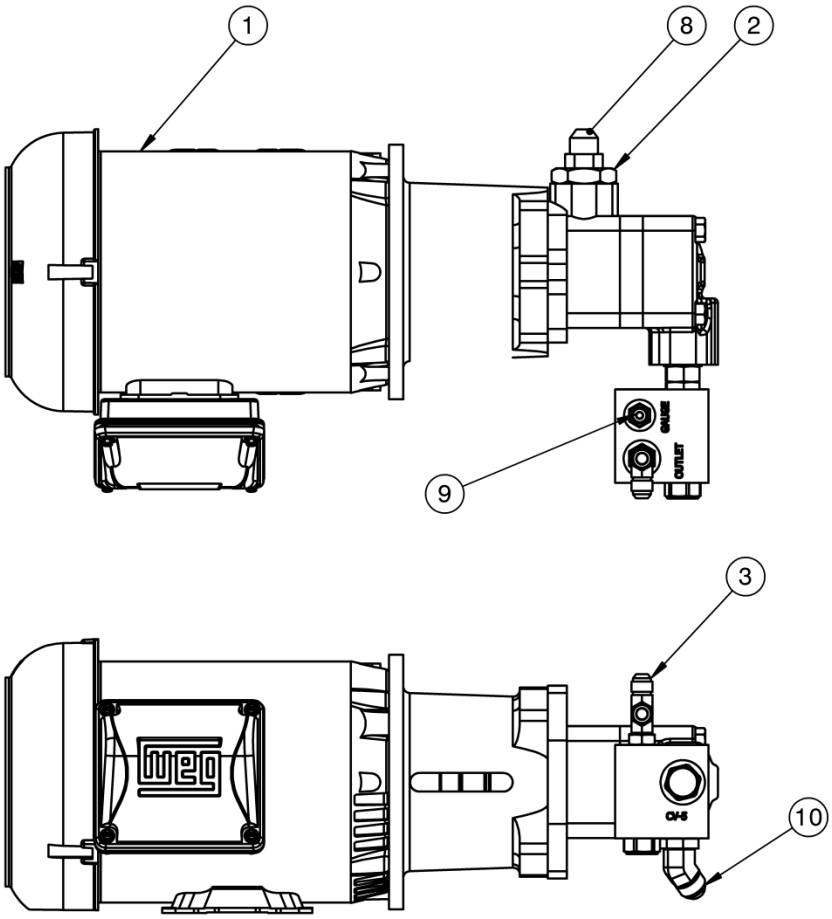


System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-5128	MANIFOLD, FLOW CONTROL	1
2	N-2053-05-S-B	PLUG, HEX HEAD WITH O-RING	1
3	HC-1254-05	VALVE, NEEDLE	1
4	N-2001-21-S-B	ELBOW, STRAIGHT THREAD	2
5	N-2007-08-S-B	CONNECTOR, STRAIGHT THREAD	1

9.8 ELECTRIC FILL AND DEGASSING PUMP

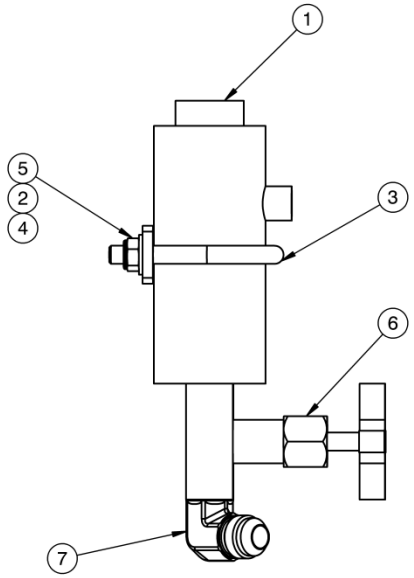


Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2797	PUMP/MOTOR, ELECTRIC FILL	REF
2	N-2463-16-S-B	FITTING, REDUCER/EXPANDER	1
3	N-2015-08-S-B	TEE, RUN, STR THD	1
4	TBD	ASSEMBLY, HOSE	1
5	TBD	ASSEMBLY, HOSE	1
6	TBD	ASSEMBLY, HOSE	1
7	TBD	ASSEMBLY, HOSE	1
8	N-2007-03-S-B	CONNECTOR, STR THD	1
9	N-2001-08-S-B	CONNECTOR, STRAIGHT THREAD	1
10	N-2042-06-S-B	ELBOW, 45º STRAIGHT THREAD	1
N/S	EC-1180-08	TERMINAL, RING TONGUE	13

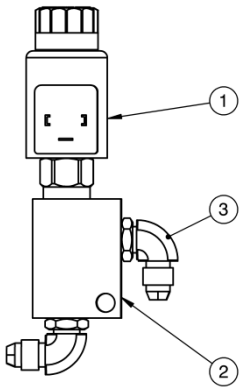
9.8.1 Degasser



Parts List

Item	Part Number	Description	Qty
1	HC-2808	BUBB-LESS, BM-10	1
2	S-3311-00	PLATE, BUBB-LESS MOUNT	1
3	G-1009-18	U-BOLT	1
4	G-1250-1060N	FLATWASHER. 5/16 NARROW	2
5	G-1202-1060	STOPNUT, 5/16-18 ELASTIC	2
6	HC-1081-01	VALVE, NEEDLE	1
7	N-2005-13-S	ELBOW, MALE	1

9.8.2 Degassing System Solenoids

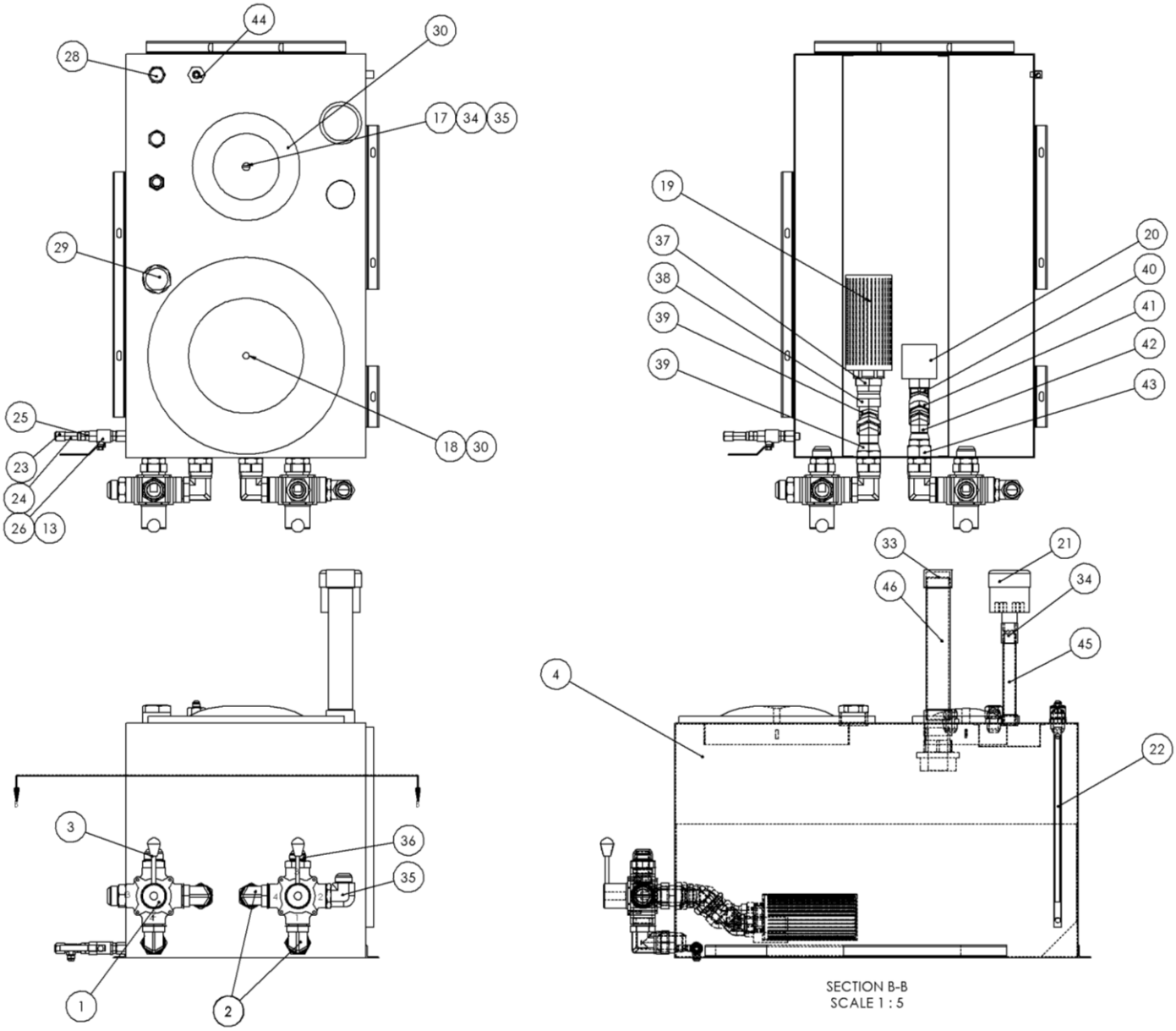


Parts List

Item	Part Number	Description	Qty
1	HC-2807	SOLENOID, N.C. W/ 115VAC COIL	1
2	J-6702	MANIFOLD, T-13A	1
3	N-2001-08-S-B	ELBOW, STRAIGHT THREAD	2

9.9 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 19) is not field serviceable.



9.9 RESERVOIR ASSEMBLY *(continued)*

Parts List

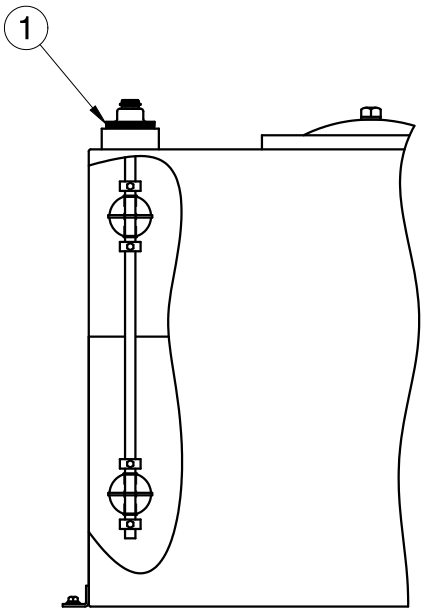
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2042-01	VALVE, SELECTOR, #24 SAE	2
2	N-2049-24-S-B	ELBOW, 90°, SWIVEL & O-RING	4
3	N-2007-31-S-B	CONNECTOR, STR THD #24	2
4	H-3867	RESERVOIR, 90 GAL	1
5	HC-1397-05	DIFFUSER	1
6	HC-1397-03	DIFFUSER	1
7	HC-1763	FILTER, DESICCANT	1
8	HC-1383-18	GAUGE, SIGHT, 18"	1
9	N-2008-06-S	CAP	1
10	N-2016-06-S	TEE, RUN, SWIVEL NUT	1
11	N-2007-11-S-B	CONNECTOR, STRAIGHT THREAD	1
12	HC-1761	VALVE, BALL SAE #8, LOCKABLE	1
13	HC-2010-908	O-RING, 3 SERIES	1
14	N-2008-10-S	CAP	2
15	N-2206-09-S	PLUG, HEX HEAD	1
16	H-1741	ASSY, COVER (PLATED)	1
17	Z-2199	WELDMENT, CLAMP	1
18	H-1740	ASSEMBLY, COVER (PE)	1
19	N-2245-06	COUPLING, STAINLESS STEEL PIPE	1
20	N-2965	NIPPLE, PIPE	1
21	N-2964	NIPPLE, PIPE	1
22	N-2001-30-S-B	ELBOW, STRAIGHT THREAD	1
23	N-2007-30-S-B	CONNECTOR, STRAIGHT THREAD	1
24	N-2210-25-S	REDUCER, PIPE THREAD	1
25	N-2081-10-S	SWIVEL, 45° ELBOW	2
26	N-2213-21-S	ELBOW, STREET 45°	1
27	N-2030-12-S	SWIVEL, FEMALE 37°	1
28	N-2081-09-S	SWIVEL, 45° ELBOW	1
29	N-2055-27-S	REDUCER, TUBE	1
30	Z-5337	WELDMENT, CLAMP	1
31	N-2244-09	CAP, PIPE	1
32	N-2055-18-S	REDUCER, TUBE	1
33	N-2030-15-S	SWIVEL, FEMALE 37°	1
34	G-1202-1100	STOPNUT, ELASTIC 5/8-11	2
35	H-1735-02	WASHER, NYLON	2

9.9.1 Electric Reservoir Level

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-2314, INS-2375. Reference 9.7.1 Electrical Panel for Panel Light.



Parts List

Item	Part Number	Description	Qty
1	EC-1783	Multi-Level Switch *(includes Plug-in Cable)*	1

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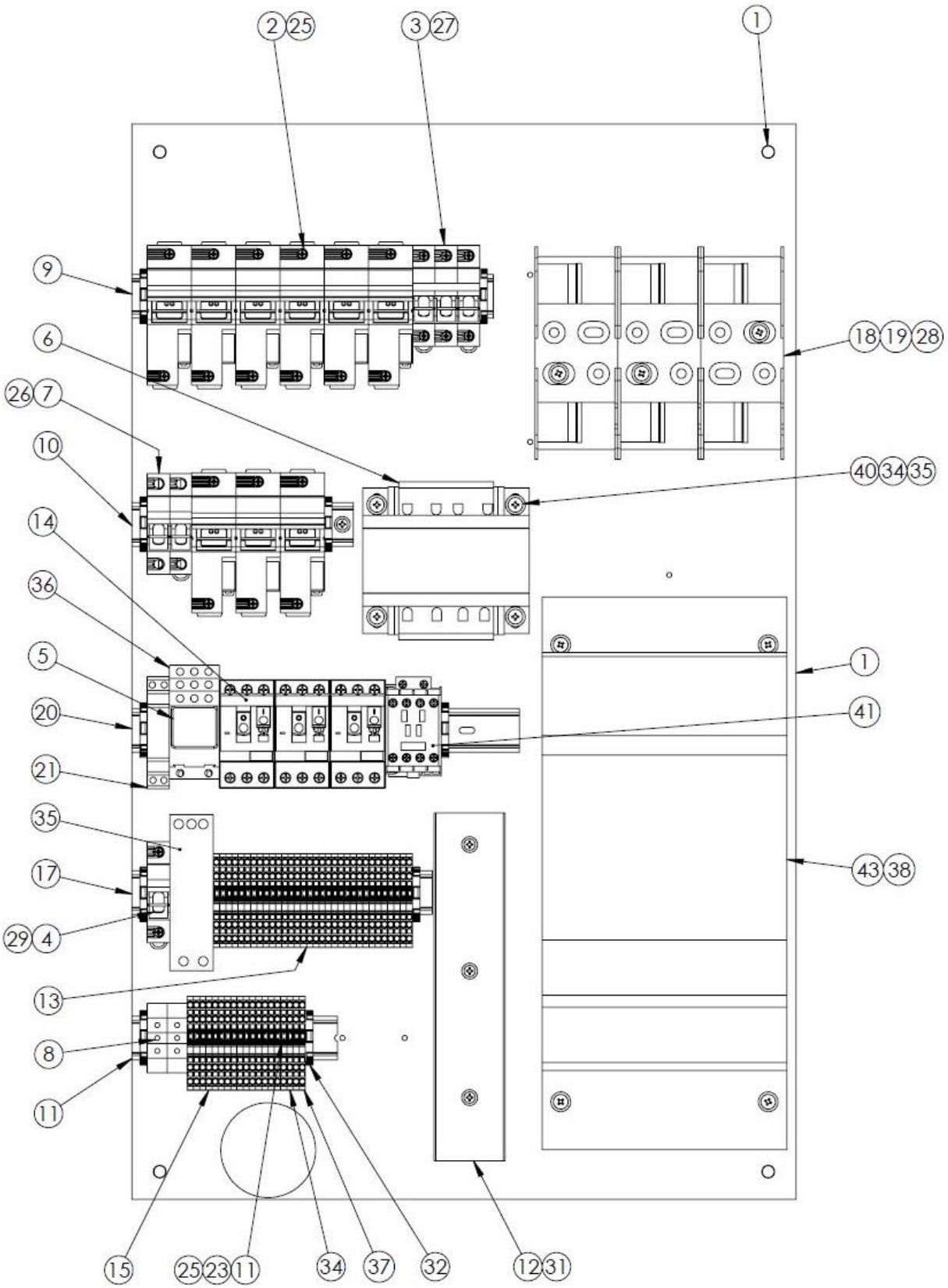
9.10 ELECTRICAL COMPONENTS

9.10.1 Electrical Components with Soft Start Option

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



Set Item 04 to Automatic Reset position. Wire per Electrical Schematic INS-2375.

9.10.1 Electrical Components with Soft Start Option *(continued)*

Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	S-2827	PANEL, INNER ELECTRICAL	1
2	EC-2881	FUSEHOLDER, TRIPLE J30	3
3	EC-2882	FUSEHOLDER	1
4	EC-2884	BLOCK, FUSE	1
5	EC-1678	RELAY	1
6	EC-1804-04	TRANSFORMER, 250VA	1
7	EC-2883	FUSEHOLDER	1
8	EC-1957	BLOCK, GROUNDING	2
9	EC-1895-011.43	RAIL, DIN	1
10	EC-1895-007.00	RAIL, DIN	1
11	EC-1895-006.50	RAIL, DIN	1
12	EC-1710-20-11.00	DUCT, WIRING (11IN)	1
13	EC-2084	TERMINAL BLOCK, 4 COND (RED)	32
14	EC-2465	STARTER, MOTOR	3
15	EC-2923	BLOCK, TERMINAL GROUNDING	5
16	EC-2062	TERMINAL BLOCK, 4 COND (BLUE)	10
17	EC-1895-009.50	RAIL, DIN	1
18	EC-2695	FUSEBLOCK, CLASS J 110-TO 200A	1
19	EC-2697	COVER, FINGER SAFE	1
20	EC-1895-012.25	RAIL, DIN	1
21	EC-2690	RELAY, TIME DELAY ON	1
22	EC-1542-14	SECONDARY FUSE	1
23	G-1159-103504	SCR, #10-32 RD HD CRS REC	26
24	G-1159-105516	SCR, 1/4-20 RD HD CRS REC	4
25	G-1250-1030N	FLATWASHER, #10	27
29	G-1250-1050N	FLATWASHER, 1/4 NARROW	11
30	G-1202-1070	STOPNUT, 3/8-16 ELASTIC	4
31	EC-1711-05-011.0	COVER, WIRING DUCT	1
32	13070	ANCHOR, DIN RAIL END	10
33	EC-1675-12	FUSE, KTF, PHASE MONITOR	3
34	EC-2065	TERMINAL BLOCK, 4 COND (BLACK)	2
35	EC-2951	POWER SUPPLY, 12 VDC	REF
36	EC-2807	SOCKET, RELAY 11PIN (TPDT)	1
37	EC-2083	TERMINAL BLOCK, 4 COND LT GRAY	2
39	EC-1836	CONTACTOR, IEC MOTOR	1
40	G-1159-105505	SCR, 1/4-20 RD HD CRS REC	7
42	EC-3184	HARNESS, WIRING (NOT SHOWN)	1
43	EC-2833	COVER, TERMINAL	2
44	EC-2072	JUMPER	17
45	EC-2077	CARD, MARKING TERMINAL BLOCK	1
46	EC-2078	CARD, MARKING TERMINAL BLOCK	1
47	EC-2079	CARD, MARKING TERMINAL BLOCK	1

9.10.1 Electrical Components with Soft Start 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				
	380 V	**480 V**	**575V**	**Description**	**Qty**
26	EC-1557-03	EC-1557-03	EC-1557-02	FUSE, CLASS J, FAN/PUMP	9
27	EC-1556-07	EC-1556-07	EC-1556-04	FUSE, CLASS J, MAIN	3
28	EC-1726-14	EC-1726-14	EC-1726-08	FUSE, CLASS CC, PRIMARY	2
38	EC-2727-01	EC-2727-01	---	LUG, TERMINAL	2
41	EC-1974	EC-1974	EC-2022	SOFTSTART, 110-240V HPU	1

Item	50 Hz Applications				
	380 V	**415 V**	**440**	**Description**	**Qty**
26	EC-1557-03	EC-1557-03	EC-1557-03	FUSE, CLASS J, FAN/PUMP	9
27	EC-1556-07	EC-1556-07	EC-1556-07	FUSE, CLASS J, MAIN	3
28	EC-1726-14	EC-1726-14	EC-1726-14	FUSE, CLASS CC, PRIMARY	2
38	EC-2727-01	EC-2727-01	EC-2727-01	LUG, TERMINAL	2
41	EC-1974	EC-1974	EC-1974	SOFTSTART, 110-240V HPU	1

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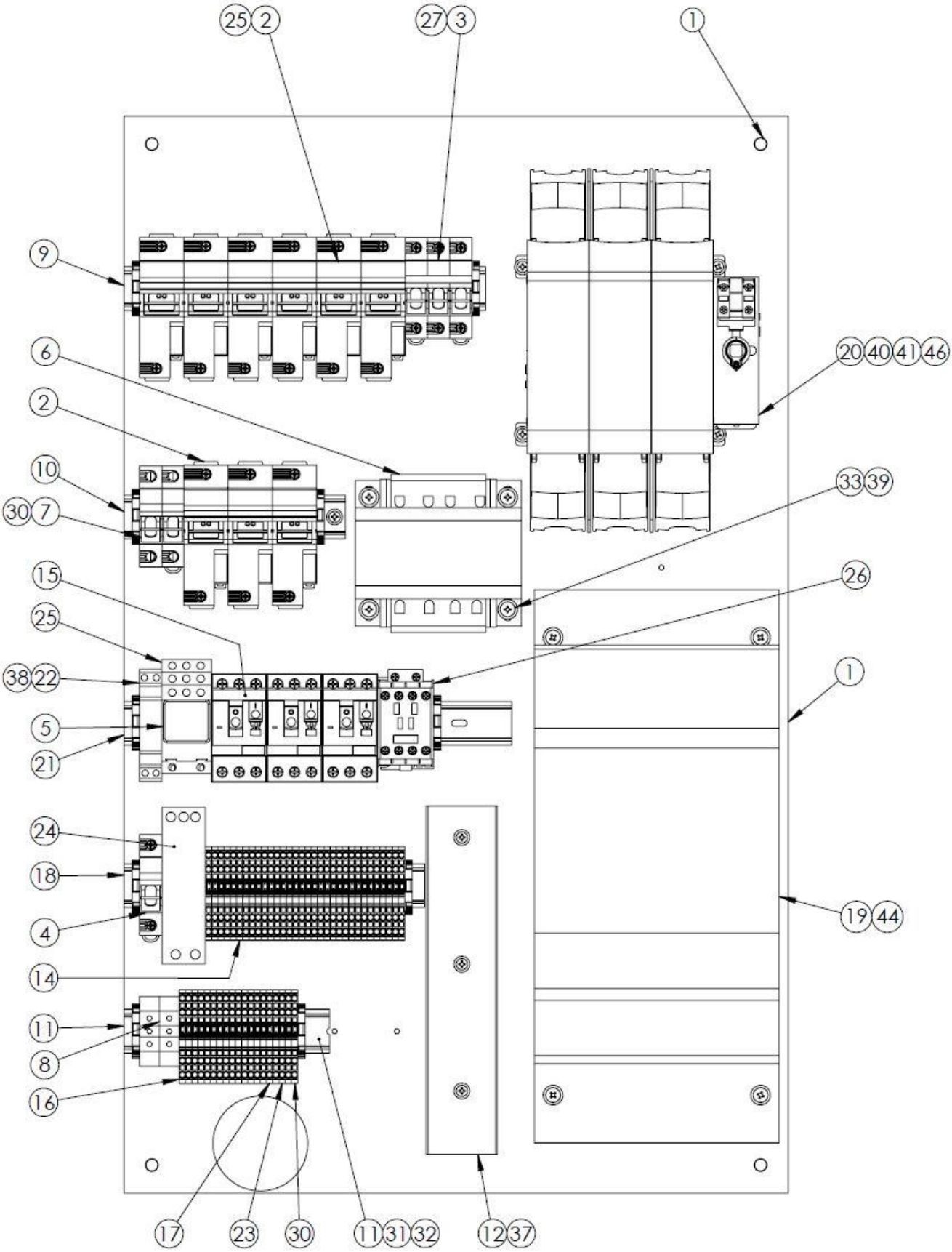
9.10.2 Electrical Components with Softstart and 100 ft Input Cord option



9.10.2 Electrical Components with Softstart and 100 ft Input Cord Option *(continued)*

Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	S-2827	PANEL, INNER ELECTRICAL	1
2	EC-2881	FUSEHOLDER, TRIPLE J30	3
3	EC-2882	FUSEHOLDER	1
4	EC-2884	BLOCK, FUSE	1
5	EC-1678	RELAY	1
6	EC-1804-04	TRANSFORMER, 250VA	1
7	EC-2883	FUSEHOLDER	1
8	EC-1957	BLOCK, GROUNDING	2
9	EC-1895-011.43	RAIL, DIN	1
10	EC-1895-007.00	RAIL, DIN	1
11	EC-1895-006.50	RAIL, DIN	1
12	EC-1710-20-011.00	DUCT, WIRING (11IN)	1
13	13070	ANCHOR, DIN RAIL END	10
14	EC-2084	TERMINAL BLOCK, 4 COND (RED)	32
15	EC-2465	STARTER, MOTOR	3
16	EC-2923	BLOCK, TERMINAL GROUNDING	5
17	EC-2062	TERMINAL BLOCK, 4 COND (BLUE)	10
18	EC-1895-009.50	RAIL, DIN	1
21	EC-1895-012.25	RAIL, DIN	1
22	EC-2690	RELAY, TIME DELAY ON	1
23	EC-2065	TERMINAL BLOCK, 4 COND (BLACK)	2
24	EC-2951	POWER SUPPLY, 12 VDC	REF
25	EC-2807	SOCKET, RELAY 11PIN (TPDT)	1
26	EC-1836	CONTACTOR, IEC MOTOR	1
30	EC-2083	TERMINAL BLOCK, 4 COND LT GRAY	2
31	G-1159-103504	SCR, #10-32 RD HD CRS REC	30
32	G-1250-1030N	FLATWASHER, #10	31
33	G-1159-105505	SCR, 1/4-20 RD HD CRS REC	4
34	G-1159-105516	SCR, 1/4-20 RD HD CRS REC	4
36	G-1202-1070	STOPNUT, 3/8-16 ELASTIC	4
37	EC-1711-05-11.0	COVER, WIRING DUCT	1
38	EC-1542-14	FUSE, SECONDARY	1
39	G-1250-1050N	FLATWASHER, 1/4 NARROW	8
40	EC-2654	HANDLE, DISCONNECT	1
41	EC-2655	SHAFT, EXTENSION	1
42	EC-3184	HARNESS, WIRING (NOT SHOWN)	1
44	EC-2833	COVER, TERMINAL	2
45	EC-2072	JUMPER	17
47	EC-2077	CARD, MARKING TERMINAL BLOCK	1
48	EC-2078	CARD, MARKING TERMINAL BLOCK	1
49	EC-2079	CARD, MARKING TERMINAL BLOCK	1

9.10.2 Electrical Components with Softstart and 100 ft Input Cord Option *(continued)*

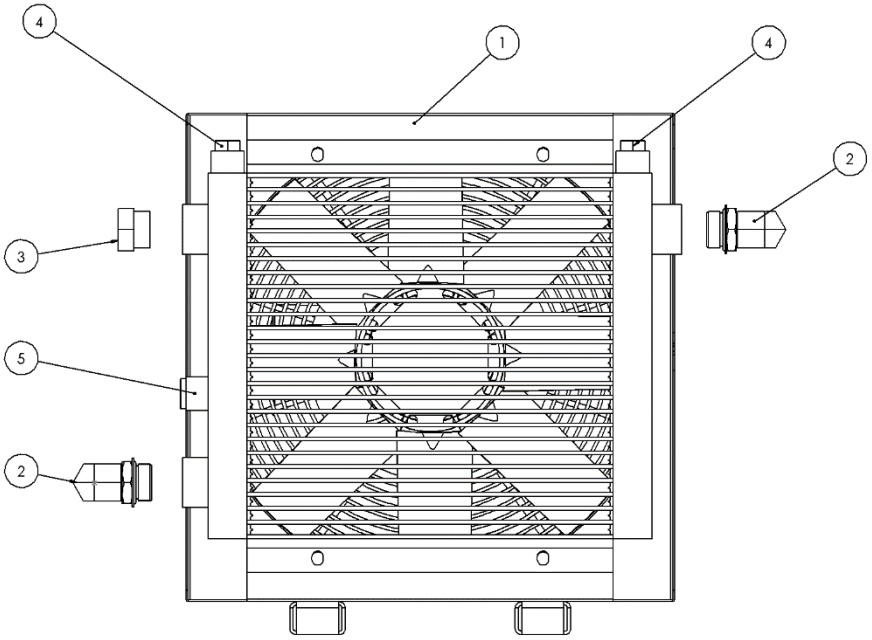
THE FOLLOWING PARTS ARE APPLICATION SPECIFIC
Be sure to locate the correct voltage and hertz of the unit before selecting the part

Item	60 Hz Applications				
	380 V	**480 V**	**575V**	**Description**	**Qty**
19	EC-1974	EC-1974	EC-2022	SOFTSTART, 110-240V HPU	1
20	EC-2670	EC-2670	EC-2653	DISCONNECT, FUSED 100A	1
27	EC-1557-03	EC-1557-03	EC-1557-02	FUSE, CLASS J, FAN/PUMP	9
28	EC-1556-06	EC-1556-06	EC-1556-04	FUSE, CLASS J, MAIN	3
29	EC-1726-14	EC-1726-14	EC-1726-08	FUSE, CLASS CC, PRIMARY	2
46	EC-2727-01	EC-2727-01	---	LUG, TERMINAL	2

Item	50 Hz Applications				
	380 V	**415 V**	**440**	**Description**	**Qty**
19	EC-1974	EC-1974	EC-1974	SOFTSTART, 110-240V HPU	1
20	EC-2670	EC-2670	EC-2670	DISCONNECT, FUSED 100A	1
27	EC-1557-03	EC-1557-03	EC-1557-03	FUSE, CLASS J, FAN/PUMP	9
28	EC-1556-06	EC-1556-06	EC-1556-06	FUSE, CLASS J, MAIN	3
29	EC-1726-14	EC-1726-14	EC-1726-14	FUSE, CLASS CC, PRIMARY	2
46	EC-2727-01	EC-2727-01	EC-2727-01	LUG, TERMINAL	2

9.11 HEAT EXCHANGER ASSEMBLY

The Heat Exchanger Assembly does not require regular general maintenance.



Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	*Reference table below*	EXCHANGER, HEAT	1
2	N-2001-24-S-B	CONNECTOR, STR THD, #16 SAE X #16 JIC	2
3	N-2053-10-S-B	PLUG, H H, #16 O-RING	1
4	HC-2010-908	O-RING SERIES 3	2
5	HC-2010-910	O-RING SERIES 3	1

Lower

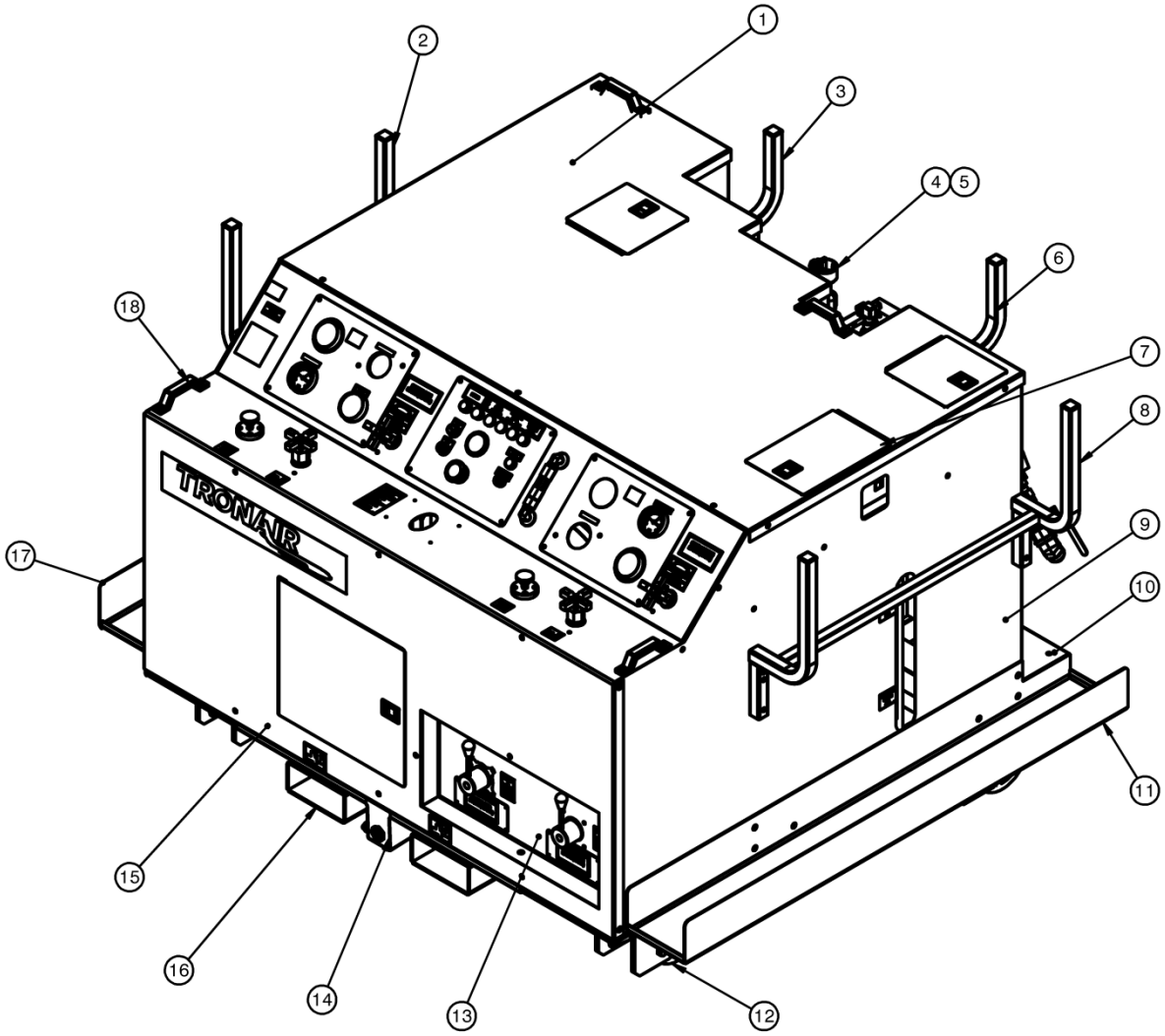
Voltage	Part Number
460 V	HC-2693
575 V/60 Hz	HC-2708

Upper

Voltage	Part Number
460 V	HC-2735
575 V/60 Hz	HC-2737

9.12 EXTERNAL COMPONENTS

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



Parts List

Item	Part Number	Description	Qty
1	Z-8957-01	TOP PANEL	1
2	Z-8847-01	HOSE HANGER	1
3	Z-8860-01	ELECTRICAL CORD HANGER	1
4	EC-1794	BOX, VERTICAL MOUNT JUNCTION	1
5	EC-1791	LIGHT, POLE MOUNTED STACK	1
6	Z-8894-01	ELECTRICAL CORD HANGER	1
7	Z-4783	RESERVOIR FILL ACCESS PANEL	1
8	Z-8846-01	HOSE HANGER	1
9	Z-8864-01	RIGHT SIDE PANEL	1
10	S-2834-01	REAR PANEL	1
11	J-6051	RIGHT SIDE HOSE PAN	1
12	U-1177	SWIVEL CASTER W/ 90° LOCKING	4
13	S-2837	SELECTOR VALVE PANEL	1

9.12 EXTERNAL COMPONENTS *(continued)*

Parts List

Item	Part Number	Description	Qty
14	S-2847	DRIP PAN	1
15	Z-8863	FRONT PANEL	1
16	Z-8868-01	FORKLIFT TUBE	2
17	J-6052	LEFT SIDE HOSE PAN	1
18	H-1780	HANDLE	4
N/S	Z-8942-01	FILTER PANEL	1
N/S	Z-8865-01	LEFT SIDE PANEL	1
N/S	S-2836	SKIRT PANEL	1
N/S	EC-2879	ELECTRICAL BOX COVER	1
N/S	Z-8820-01	FRAME	1

9.13 REPLACEMENT LABELS PARTS LISTS

9.13.1 Base Unit

Part Number	Description	Qty
V-1001	LABEL, MADE IN USA	1
V-1033	LABEL, TRONAIR	1
V-1050	LABEL, ISO ELECTRICAL SHOCK	1
V-1340	LABEL, TRONAIR	2
V-1366	LABEL, BYPASS INSTRUCTION	2
V-1826	LABEL, NO STEP	2
V-1845	LABEL, SERIAL NO. (CE)	1
V-1884	LABEL, FLOWMETER	2
V-1886	LABEL, PYROMETER	2
V-1893	LABEL, SAMPLE VALVE	1
V-1896	LEBEL, MAXIMIM OIL LEVEL	1
V-1897	LABEL, MINIMUM OIL LEVEL	1
V-1919	LABEL, OPER. INST.	1
V-1900	LABEL, WARNING KEEP 5' FT CLEAR	2
V-1914	LEBEL, HPU RES. SELECTOR	2
V-2004	LABEL, SYSTEM 1 PRESSURE	1
V-2005	LABEL, SYSTEM 2 PRESSURE	1
V-2006	LABEL, SYSTEM 1 RETURN	1
V-2007	LABEL, SYSTEM 2 RETURN	1
V-2008	LABEL, FLOW INCREASE	2
V-2009	LABEL, PRESSURE INCREASE	2
V-2075	LABEL, FORKLIFT POINT	2
V-2293	LABEL, CIRCUIT CAPABLE	1
V-2294	LABEL, DANGER	1
V-2639	LABEL, SYSTEM 1 34GPM	3
V-2640	LABEL, SYSTEM 2, 20 GPM	3

9.13.2 Fluid Labels

Fluid Type: MIL-PRF-5606

Part Number	Description	Qty
V-1975	LABEL, MIL-PRF-5606	2

9.13.3 Filter Element Kit Labels

Fluid Type: MIL-PRF-5606

Part Number	Description	Qty
V-2717	LABEL, REPLACEMENT FILTER ELEMENT K-5244	1
V-1961	LABEL, REPLACEMENT FILTER ELEMENT K-3615	1
V-1916	LABEL, REPLACEMENT DESICCANT FILTER ELEMENT HC-1763	1
V-1905	LABEL,REPLACEMENT FILTER ELEMENT K-3493	1
V-2718	LABEL,REPLACEMENT FILTER ELEMENT K-5243	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 9.9 Electrical Components Item 20	Fuse, Transformer Primary	2
EC-1542-09	Fuse, Transformer Secondary	1
Refer to Section 9.9 Electrical Components Item 22	Fuse, Heat Exchanger	3
EC-1675-12	Fuse, Phase Monitor	3
Refer to Section 9.9 Electrical Components Item 2	Fuse, Main Power	3
	Fuse, Fill Pump Motor	3

10.2.2 Spare Parts

Fluid Type: MIL-PRF-5606

Part Number	Description	Qty
HC-1763	Desiccant Filter Element	1
K-5244	Kit, Pressure Filter Element	1
K-5243	Kit, Pressure Filter Element	1
K-3615	Kit, Return Filter Element	1
K-3493	Kit, Return Filter Element	1
936698Q	Kit, Fill Pump Filter Element	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

11.2 ANALOG PRESSURE GAUGE – System Pressure

11.2.1 Self Calibration

An accurate pressure calibration gauge is required for calibration of the System Pressure gauge.

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

SYSTEM PRESSURE GAUGE (HC-2144) Systems 1 & 2

Applied Pressure (System Pressure Gauge) (psig)	Minimum Acceptable (psig)	Maximum Acceptable (psig)	Gauge Movement (Direction)	Indicated Pressure (Calibration Gauge) (psig)
1000	910	1090	Increasing	
2000	1910	2090	Increasing	
3000	2910	3090	Increasing	
4000	3910	4090	Increasing	
5000	4910	5090	Increasing	
6000	5910	6090	Increasing	
5000	4910	5090	Decreasing	
4000	3910	4090	Decreasing	
3000	2910	3090	Decreasing	
2000	1910	2090	Decreasing	
1000	910	1090	Decreasing	
Allowable operating tolerance: +/- 1.5% of full scale (90 psig) at room temperature (70° F).				

11.3 ANALOG TEMPERATURE GAUGE *(Pyrometer)*

11.3.1 Self Calibration

An accurate temperature calibration gauge is required for calibration of the Pyrometer. The pyrometer bulb is located in the return manifold (rear of unit) and can be accessed by removal of the HPU top panel. See Section ***9.7.2 – Pyrometer*** for location. Follow the necessary steps below.

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

THE TEMPERATURE VALUE MUST BE:

Pyrometer Temperature Display (° F)	Minimum Acceptable (° F)	Maximum Acceptable (° F)	Temperature Calibration gauge (° F)
160	158	162	

11.4 ELECTRIC FILL PUMP PRESSURE GAUGE

11.4.1 Self Calibration

Applied Pressure (Electric Fill Pressure Gauge) (psig)	Minimum Acceptable (psig)	Maximum Acceptable (psig)	Increasing/Decreasing
25	24	26	Increasing
50	49	51	Increasing
75	73	77	Increasing
100	97	103	Increasing
75	73	77	Decreasing
50	49	51	Decreasing
25	24	26	Decreasing

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	Declaration of Conformity
APPENDIX II	Hydraulic Schematic (INS-2315)
APPENDIX III	Electrical Schematic (INS-2431)
APPENDIX IV	Wiring Diagram (INS-2694)
APPENDIX V	Safety Data Sheet (SDS) pertaining to Hydraulic Fluid MIL-PRF-5606
APPENDIX VI	Instrument Certification Notice

APPENDIX I

Declaration of Conformity

Declaration of Conformity

The design, development and manufacture is in accordance with European Community guidelines

Dual Hydraulic Power Unit
(Electric Motor Driven)

Relevant draft complied with by the machinery:
prEN 1915-1:1995

Relevant standards complied with by the machinery:
prEN 982:1996
prEN 60204-1:1997
HFPA/JIC T2.24.1-1990
ISO 4021:1997
ARP 1247B
NFPA 70/NEC 1999

Identification of person empowered to sign on behalf of the Manufacturer:

Patrick Finch

Quality Assurance Representative

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

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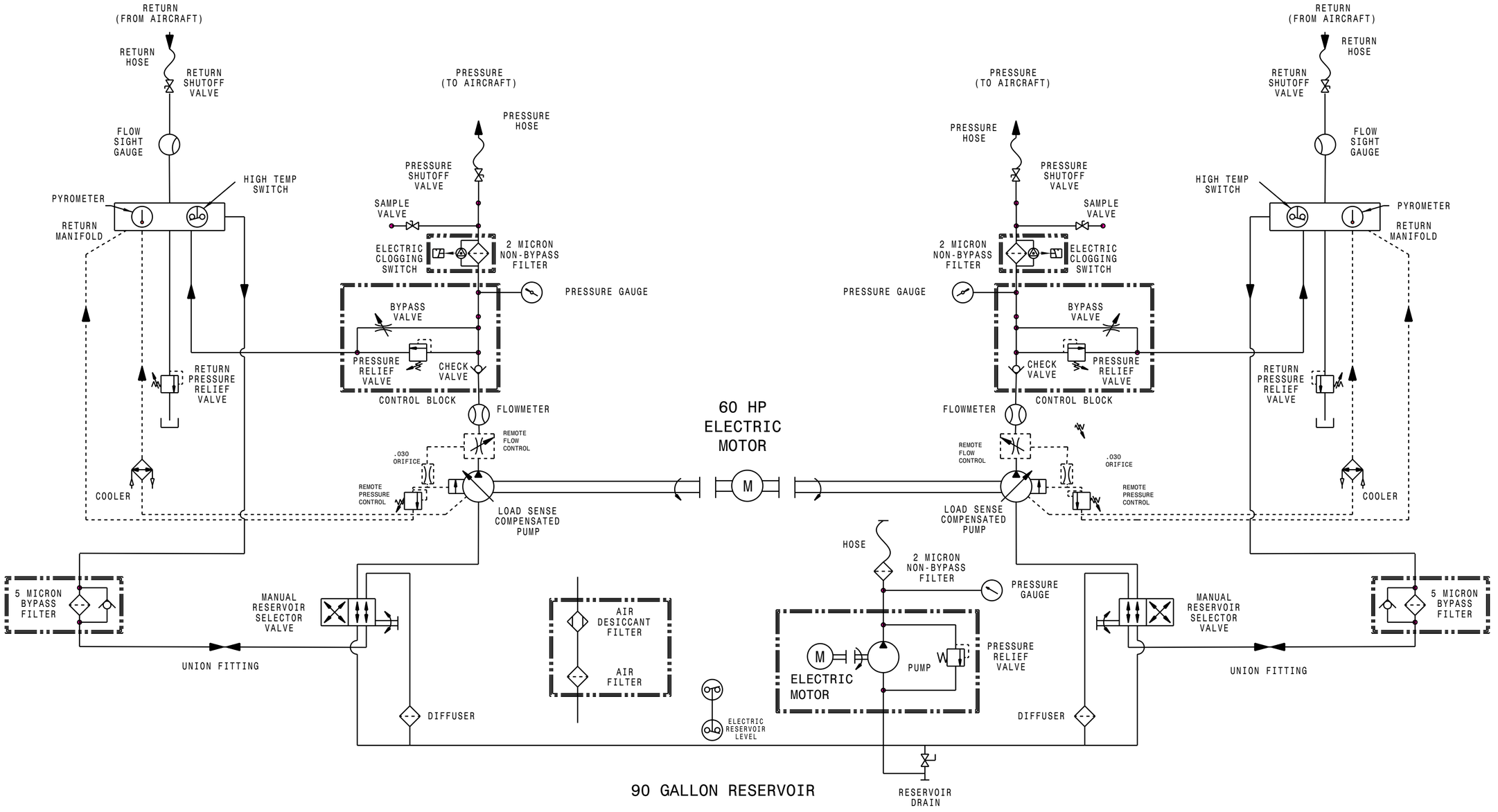
APPENDIX II

Hydraulic Schematic
(INS-2315)

LET	REVISION	EC	DWN	CHK	DATE
A	ORIGINAL RELEASE	19932	-	-	12/5/16



MAKE FROM: N/A		BREAK ALL SHARP EDGES AND CORNERS () INDICATES REFERENCE DIMENSIONS ITEM NUMBER ABOVE, QUANTITY BELOW	TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT
MATERIAL: N/A	TYPE:	TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL INCH[mm]: .X[X] ± .100[3] .XX[.X] ± .030[0.8] .XXX[.XX] ± .010[0.25] .XXXX[.XXX] ± .003[0.076] FRACTION INCH[mm]: 1/XX[1/X] ± 1/16[1.6] ANGLES DEGREE[RADIANS] X[XX] ± .5[0.01]	DWN BY KAG · CKD BY PEH · 12/5/16
FINISH: N/A			SCHEMATIC, HYDRAULIC
THIRD ANGLE PROJECTION	SIZE C		05 INS-2315 REV A
SCALE: XX	DO NOT SCALE DRAWING		

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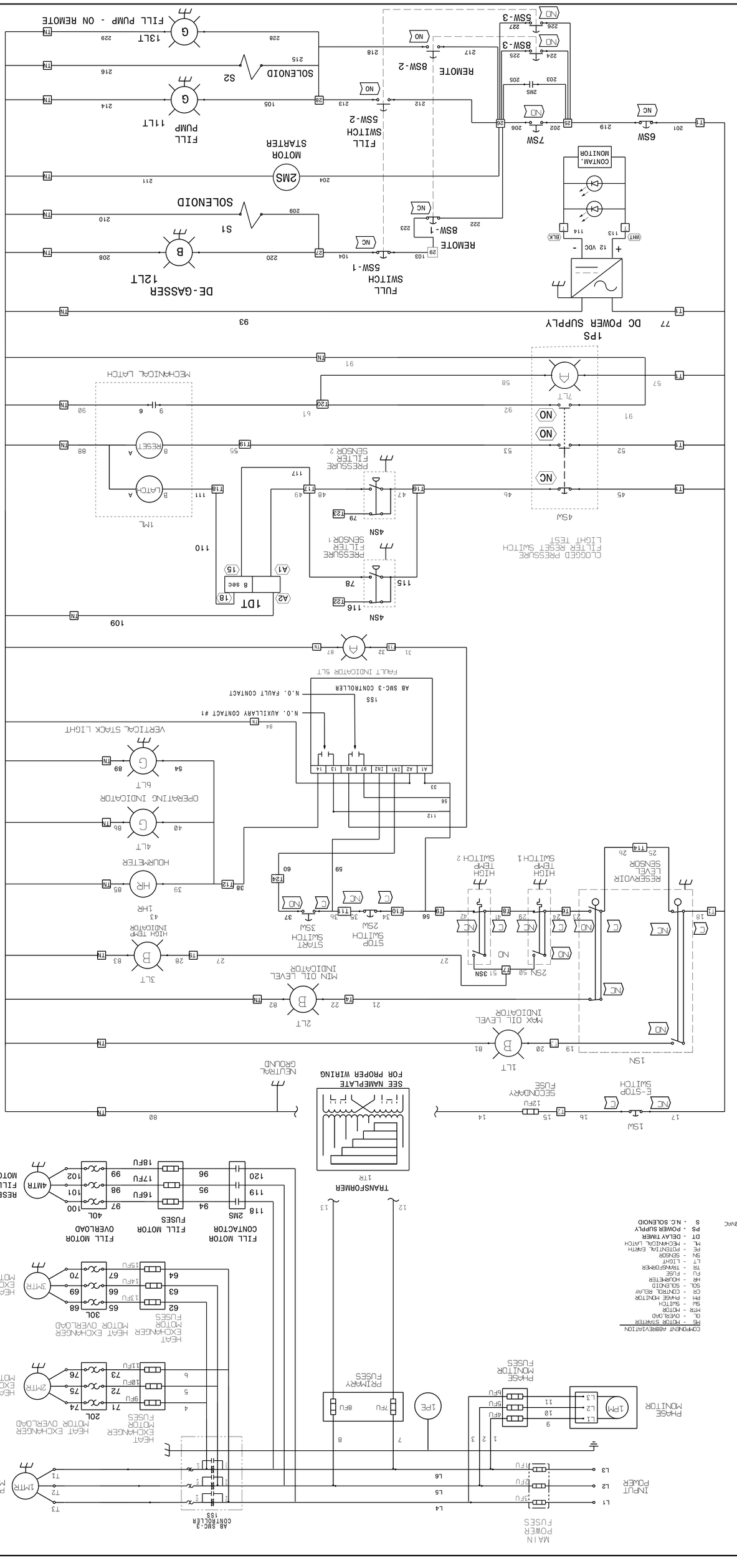
APPENDIX III

Electrical Schematic
(INS-2431)

LET	REVISION	EC	DWN	CHK	DATE
A	ORIGINAL RELEASE	20634			12-11-17
B	DIAGRAM CHANGE	20902	ADO	PEH	07-25-18
C	REMOTE PENDANT ADDED	21056	ADO	PEH	01-24-19
D	ADDED CONT. MONITOR	23066	NCS	ADO	10-18-21



WIRE COLORS:

NEUTRAL	- LT. BLU
POWER	- RED
INTERCONNECTION	- RED
3 PHASE	- BLK
GROUND	- GRN/YEL
DC+	- BRN

- XX - DEVICE TERMINATION
- [T] - TERMINAL BLOCK CONNECTION
- 1TB - GROUND TERMINAL BLOCK
- 2TB - NEUTRAL TERMINAL BLOCK
- 3TB - CONTROL TERMINAL BLOCK 120VAC
- 4TB - DDC TERMINAL BLOCK - 24VDC

COMPONENT ABBREVIATION

MS	- MOTOR STARTER
OL	- OVERLOAD
MP	- MOTOR
SW	- SWITCH
PM	- PHASE MONITOR
CR	- CONTROL RELAY
SOL	- SOLENOID
HR	- HOURMETER
TR	- TRANSFORMER
FU	- FUSE
LT	- LIGHT
PE	- POTENTIAL EARTH
ML	- MECHANICAL LATCH
SN	- SENSOR
DT	- DELAY TIMER
PS	- POWER SUPPLY
S	- N.C. SOLENOID

TRONAIR — AIRCRAFT GROUND SUPPORT EQUIPMENT

DWG BY: EMB | CHKD BY: CDG | 12-11-17

SCHEMATIC, ELECTRICAL

05 | INS-2431 | REV D

BREAK ALL SHARP EDGES AND CORNERS
REMOVE BURRS AND FOREIGN MATERIAL
UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE AS FOLLOWS:
DECIMAL INCH[mm]:
X[X] ± .100[3]
.XX[.X] ± .080[2.0]
.XXX[.XX] ± .010[0.25]
.XXXX[.XXX] ± .008[0.076]
FRACTION INCH[mm]:
1/2X[1/4] ± 1/16[1.6]
ANGLES ± 1° BEND RADIUS .010[0.25]
X[XX] ± .5[0.01]

MATERIAL: SEE BOM | FINISH: | SIZE: D

FINISH: MILL

TREAT ANNEAL PASSIVATE

SCALE: NA | DO NOT SCALE DRAWING

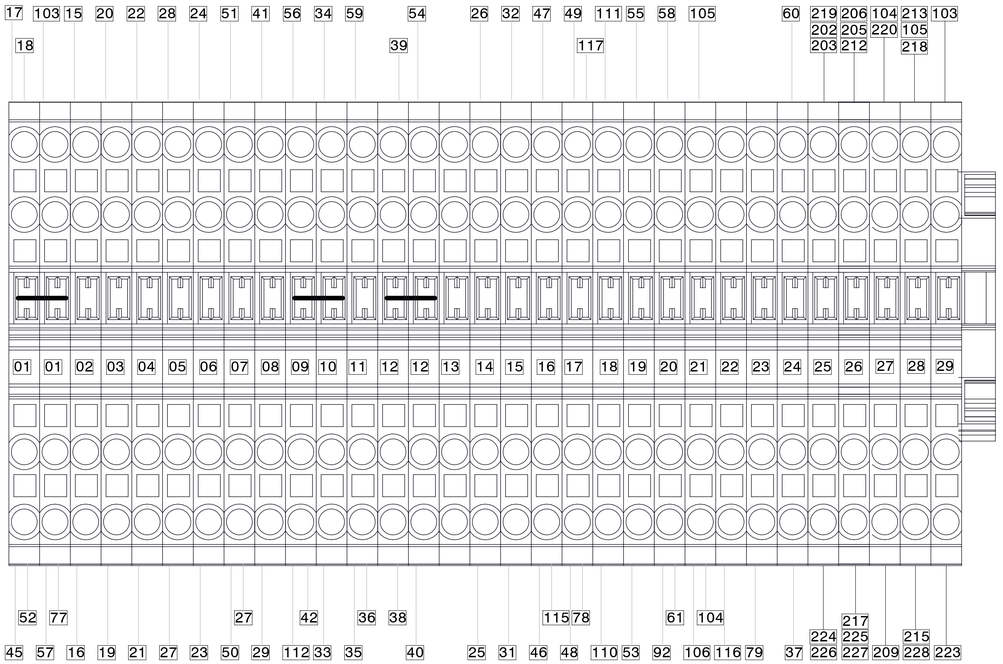
TRONAIR®

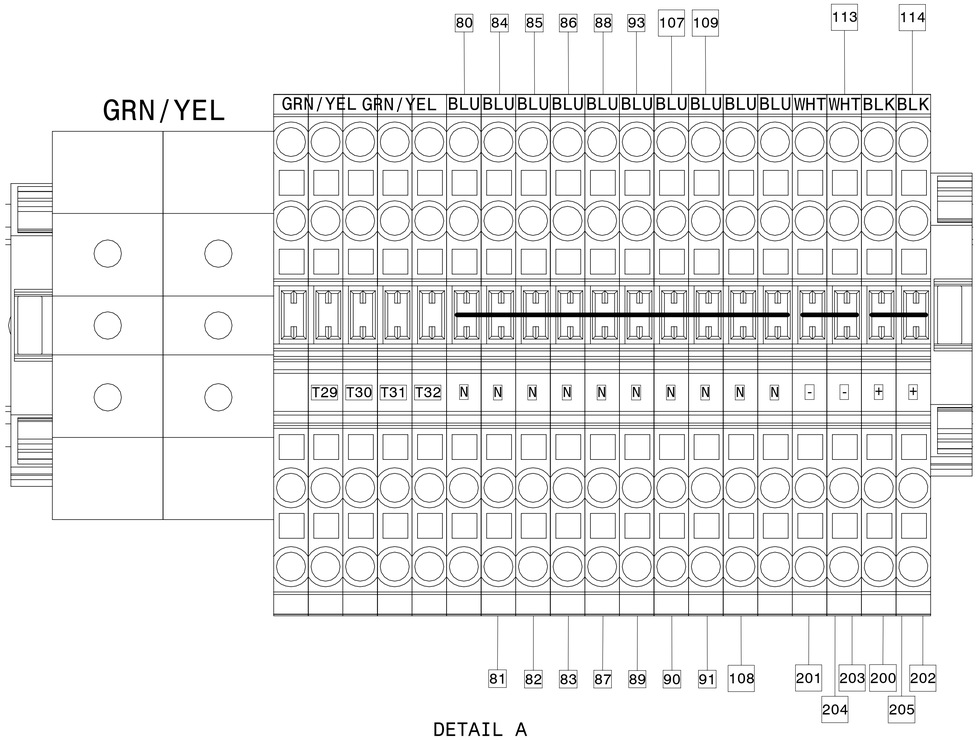
APPENDIX IV

Wiring Diagram
(INS-2694)

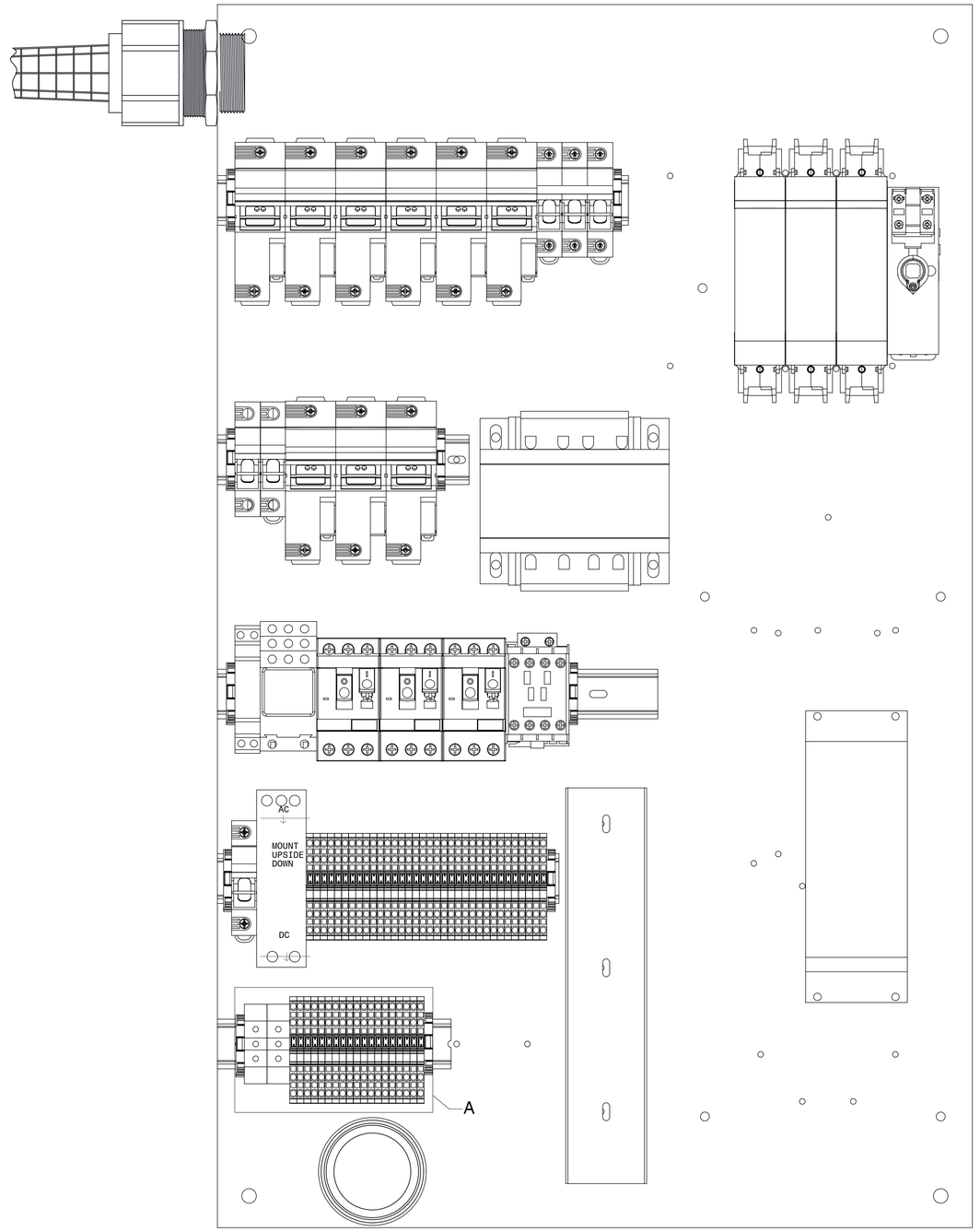
RED TERMINALS

REVISIONS					
LET	REVISION	EC	BY	CHK	DATE
A	ORIGINAL RELEASE	23066	-	-	12-29-21



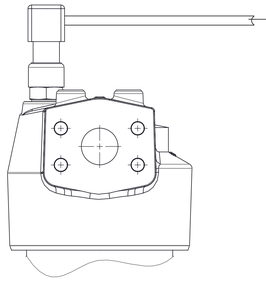


DETAIL A
SCALE 3 : 1



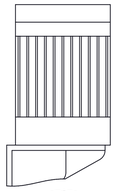
ELECTRICAL OPTIONS 15-18, & 23-26, SOFT START ONLY

MADE FROM: SEE BOM	BREAK ALL SHARP EDGES AND CORNERS INTERPRET PER ASME Y14.5-2009	TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT	
MATERIAL: N/A	DIMENSIONS IN INCHES AND TOLERANCES PER BELOW UNLESS OTHERWISE SPECIFIED: **DIMENSION INCH (mm):** .X [X] ± .1 [3] .XX [.X] ± .03 [0.8] .XXX [.XX] ± .010 [0.25] .XXXX [.XXX] ± .0030 [0.076] **FRACTION INCH (mm):** 1/XX [1/X] ± 1/16 [1.2] **ANGULAR DEGREE (RADIANS):** X [XXX] ± .5 [.001]	DWN BY: PEH	CKD BY: XXX	DATE: 12-29-21
FINISH: MILL		ASSEMBLY, ELECTRICAL	
THIRD ANGLE PROJECTION	SCALE: 1:4	SIZE: E	05 INS-2694 REV: A
DO NOT SCALE DRAWING		WEIGHT: 56.78 LB	SHEET 1 OF 2



PRESSURE CLOGGING
(FROM PRESSURE FILTER SYSTEM 2)

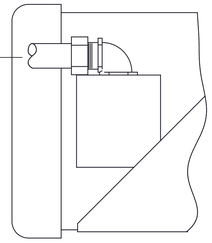
(BLK) 47
(RED) 48
(WHT) 79
(GRN) GND



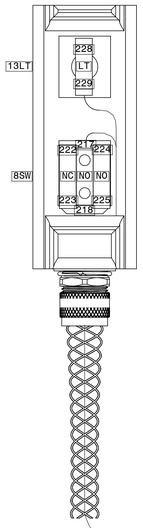
GND
NEU
HOT
89
54

VERTICAL MOUNT
STACK LIGHT

(BLK) 68
(BLK) 69
(BLK) 70
(GRN/YEL) GND



HEAT EXCHANGER MOTOR BOX
(SYSTEM 2)



MULT-CABLE	COLORS
228	WHT/B
229	WHT
222	RED/B
223	RED
217	ORG
218	ORG/B
224	BLU
225	BLK

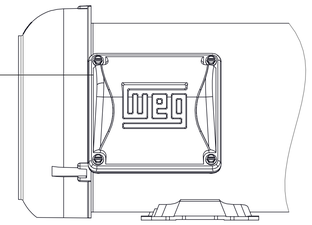
PENDANT
(LOOKING FROM OPEN BACK)

+(RED) +(BLK) 200
-(BLK) -(WHT) 201
+(RED) +(BLK) 202
-(BLK) -(WHT) 203

SIGHTGAUGE BACKLIGHT

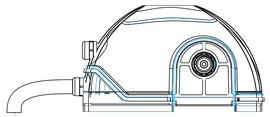
XXX
XXX
XXX
XXX

(BLK) 100
(BLK) 101
(BLK) 102
(GRN/YEL) GND



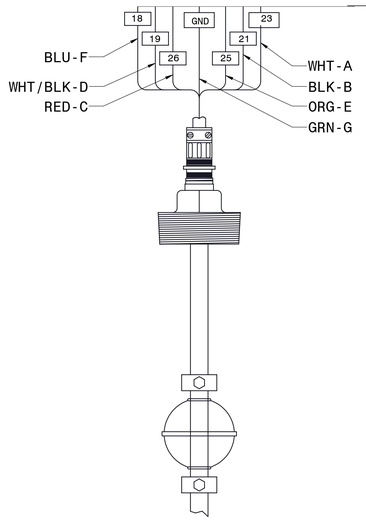
FILL PUMP MOTOR BOX

+(RED) 205
-(BLU) 204



OPTION, ICOUNT

plug



MULTI-LEVEL SWITCH
(FROM RESERVOIR)

YEL/GRN GND
WHT 29
BLK 24
RED 50

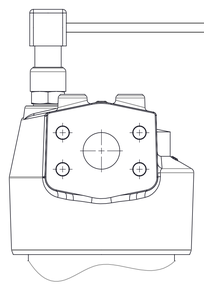
TEMPERATURE SWITCH
(FROM RETURN MANIFOLD 1)

YEL/GRN GND
WHT 42
BLK 41
RED 51

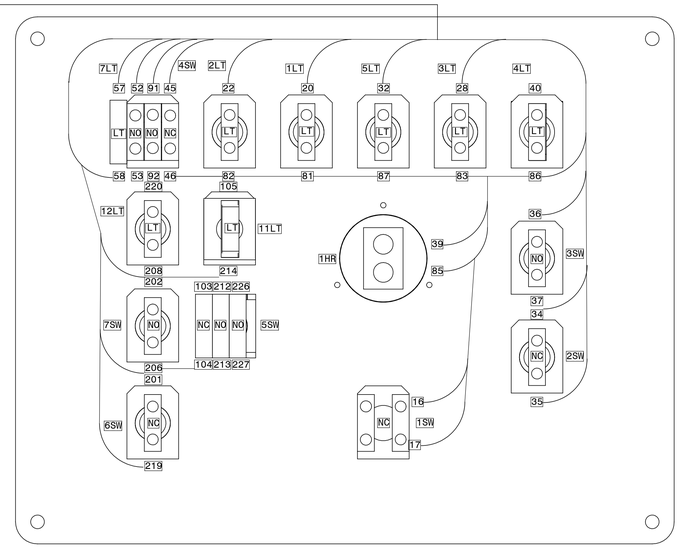
TEMPERATURE SWITCH
(FROM RETURN MANIFOLD 2)

(BLK) 74
(BLK) 75
(BLK) 76
(GRN/YEL) GND

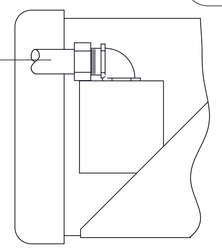
(BLK) 115
(RED) 78
(WHT) 116
(GRN) GND



PRESSURE CLOGGING
(FROM PRESSURE FILTER SYSTEM 1)



ELECTRICAL INSTRUMENT PANEL
(LOOKING FROM REAR OF PANEL)



HEAT EXCHANGER MOTOR BOX
(SYSTEM 1)

REF: INS-2431 ELECTRICAL SCHEMATIC (softstart)

TADHPU-5FJ

THIRD ANGLE PROJECTION
SCALE: 1:4 DO NOT SCALE
SIZE E
TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT
ASSEMBLY, ELECTRICAL
INS-2694 REV A
WEIGHT:
SHEET 2 OF 2

APPENDIX V

Safety Data Sheet (SDS)
Hydraulic Fluid – MIL-PRF-5606

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **MOBIL AERO HFA**
Product Description: Base Oil and Additives
Product Code: 201550401020, 490110-00, 970584
Intended Use: Aviation hydraulic oil

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
22777 Springwoods Village Parkway
Spring, TX. 77253 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information	800-662-4525
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Flammable liquid: Category 4.
Aspiration toxicant: Category 1.

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H227: Combustible liquid. H304: May be fatal if swallowed and enters airways.

Precautionary Statements:
P210: Keep away from flames and hot surfaces. -- No smoking. P273: Avoid release to the environment. P280: Wear protective gloves and eye / face protection.P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P331: Do NOT induce vomiting. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1910.1200.

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an ignition. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited. Combustible.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Excessive exposure may result in eye, skin, or respiratory irritation.

ENVIRONMENTAL HAZARDS

No significant hazards.

NFPA Hazard ID:	Health:	1	Flammability:	2	Reactivity:	0
HMIS Hazard ID:	Health:	1*	Flammability:	2	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
2,6-DI-TERT-BUTYL-P-CRESOL	128-37-0	0.1 - < 1%	H400(M factor 1), H410(M factor 1)
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	64742-47-8	5 - < 10%	H304
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	50 - < 70%	H227, H304
HYDROTREATED MIDDLE DISTILLATE (PETROLEUM)	64742-46-7	20 - < 30%	H304
TRIPHENYL PHOSPHATE	115-86-6	0.1 - < 0.25%	H400(M factor 1), H410(M factor 1)

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Combustible. Pressurized mists may form a flammable mixture.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Oxides of carbon, Phosphorus oxides, Smoke, Fume, Sulfur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: >82°C (180°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.7 UEL: 7.0 [Estimated]
Autoignition Temperature: >225°C (437°F)

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable

regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: respiratory protection will be necessary only in special cases, e.g., formation of mists. Half-face or full-face respirator with filter(s) for dust/organic vapor or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to hydrocarbons are recommended. Gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid contact with skin. Avoid prolonged breathing of mists and heated vapor. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static

accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The container choice, for example storage vessel, may effect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Storage containers should be grounded and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit / Standard			NOTE	Source
2,6-DI-TERT-BUTYL-P-CRESOL	Inhalable fraction and vapor	TWA	2 mg/m3		N/A	ACGIH
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT [total hydrocarbon vapor]	Non-Aerosol	TWA	200 mg/m3		Skin	ACGIH
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	Mist.	TWA	5 mg/m3		N/A	OSHA Z1
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	Inhalable fraction.	TWA	5 mg/m3		N/A	ACGIH
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	Mist.	TWA	5 mg/m3		N/A	ACGIH
HYDROTREATED MIDDLE DISTILLATE (PETROLEUM)	Mist.	TWA	5 mg/m3		N/A	OSHA Z1
HYDROTREATED MIDDLE DISTILLATE (PETROLEUM)	Inhalable fraction.	TWA	5 mg/m3		N/A	ACGIH
TRIPHENYL PHOSPHATE		TWA	3 mg/m3		N/A	OSHA Z1
TRIPHENYL PHOSPHATE		TWA	3 mg/m3		N/A	ACGIH

Exposure limits/standards for materials that can be formed when handling this product: When mists/aerosols can occur the following are recommended: 5 mg/m^3 - ACGIH TLV (inhalable fraction), 5 mg/m^3 - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions.

Control measures to consider:
Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:
No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:
If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Color: Red

Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.88
Flammability (Solid, Gas): N/A
Flash Point [Method]: >82°C (180°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.7 UEL: 7.0 [Estimated]
Autoignition Temperature: >225°C (437°F)
Boiling Point / Range: N/D
Decomposition Temperature: N/D
Vapor Density (Air = 1): N/D
Vapor Pressure: [N/D at 20 °C]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: 13.8 cSt (13.8 mm2/sec) at 40 °C | 5.1 cSt (5.1 mm2/sec) at 100°C [ASTM D 445]
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -60°C (-76°F) [ASTM D97]
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Open flames and high energy ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.

Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	May dry the skin leading to discomfort and dermatitis. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitization	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	May be fatal if swallowed and enters airways. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Not expected to be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Not expected to cause organ damage from prolonged or repeated exposure. Based on assessment of the components.

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
2,6-DI-TERT-BUTYL-P-CRESOL	Oral Lethality: LD50 0.89 g/kg (Rat)

OTHER INFORMATION

For the product itself:

Repeated and/or prolonged exposure may cause irritation to the skin, eyes, or respiratory tract. Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema.

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Components -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Majority of components -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be

completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT)

Proper Shipping Name: COMBUSTIBLE LIQUID, N.O.S. (Distillates (Petroleum), Hydrotreated Light)
Hazard Class & Division: COMBUSTIBLE LIQUID
ID Number: NA1993
Packing Group: III
ERG Number: 128
Label(s): NONE
Transport Document Name: NA1993, COMBUSTIBLE LIQUID, N.O.S. (Distillates (Petroleum), Hydrotreated Light), COMBUSTIBLE LIQUID, PG III

Footnote: This material is not regulated under 49 CFR in a container of 119 gallon capacity or less when transported solely by land, as long as the material is not a hazardous waste, a marine pollutant, or specifically listed as a hazardous substance.

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AICS, DSL, ENCS, IECSC, KECI, PICCS, TCSI, TSCA

EPCRA SECTION 302: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: Fire. Immediate Health. Delayed Health.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	64742-47-8	1, 17, 18
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	1, 4, 13, 17, 18
HYDROTREATED MIDDLE DISTILLATE (PETROLEUM)	64742-46-7	1, 4, 17, 18

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H227: Combustible liquid; Flammable Liquid, Cat 4
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Revision Changes:
Section 01: Company Mailing Address information was modified.
Section 05: Hazardous Combustion Products information was modified.
Section 15: List Citations Table information was modified.
Section 15: National Chemical Inventory Listing information was modified.
Section 14: Marine Pollutant information was modified.
Composition: Component Table information was modified.
Section 08: Exposure Limits Table information was modified.
Section 16: Revision Information - Implementation of GHS requirements phrase. information was deleted.

Internal Use Only

MHC: 2A, 0, 0, 0, 1, 1 PPEC: C

DGN: 2005454XUS (552975)

APPENDIX VI

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 pyrometers unless requested at the time of placed order. This instrument is considered a reference indicator only and is not critical to the test(s) being performed on the aircraft.

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