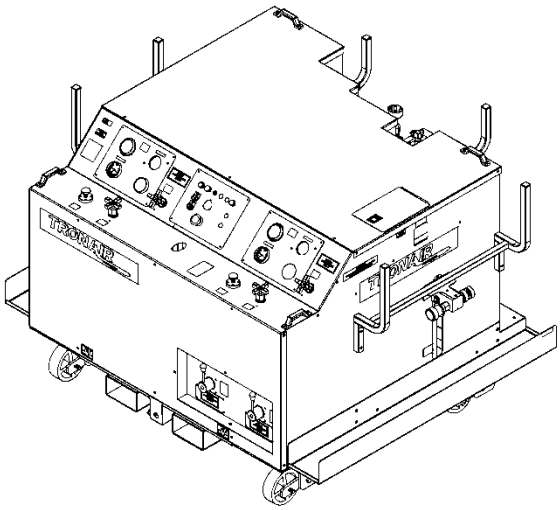
OPERATION & SERVICE MANUAL



Model: TADHPU-5GS
Dual Hydraulic Power Unit

CE

05/2025 – Rev. 18

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REVISION	DATE	TEXT AFFECTED
01	01/2016	Original release
02	11/2016	Modified 9.6 Hydraulic Hoses
03	03/2017	Modified 8.5 Fluid Overheats, 9.10.1 Electric Reservoir Level, 9.11.1 Electrical Components with Soft Start Option, 14.0 Appendices
04	12/2017	Modified 9.2 Electric Motor
05	07/2018	Added 5.7 Self Circulation Kit & 5.8 Contamination Monitor Controls
06	12/2019	Modified 9.8 Couplings
07	08/2021	Added section 5.13 Infrequent HPU Use and updated 9.0 Maintenance
08	07/2022	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.5.6 Return Filter Assembly
09	07/2023	Modified 9.11 Electrical Components
10	08/2023	Modified 9.11 Electrical Components
11	02/2024	Modified 9.2 Electric Motor
12	05/2024	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.6 Hydraulic Hoses
13	06/2024	Modified 9.6 Hydraulic Hoses
14	08/2024	Modified 9.6 Internal Hoses
15	09/2024	Modified 9.6 Internal Hoses
16	11/2024	Modified 9.3.1 Hydraulic Pump Replacement Parts and 9.6 Hydraulic Hoses
17	02/2025	Modified 9.13 External Components
18	05/2025	Modified 5.2.2 Physical and 9.6.2 External Hoses

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1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Hydraulic Power Unit
Model Number..... TADHPU-5GS
Fluid Type ..... Aviation Phosphate Ester, Type IV or Type V

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 ensure 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 Technical and Operator Manuals.
- 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	73	84	84	58
Locked Rotor Amps	582	546	546	400
Recommended Fuse Size	100	100	100	80
Maximum Fuse Size	110	125	125	90

5.2 NUMERICAL VALUES

5.2.1 Model

Model Number..... TADHPU-5GS
Fluid Type ..... Aviation Phosphate Ester, Type IV or Type V

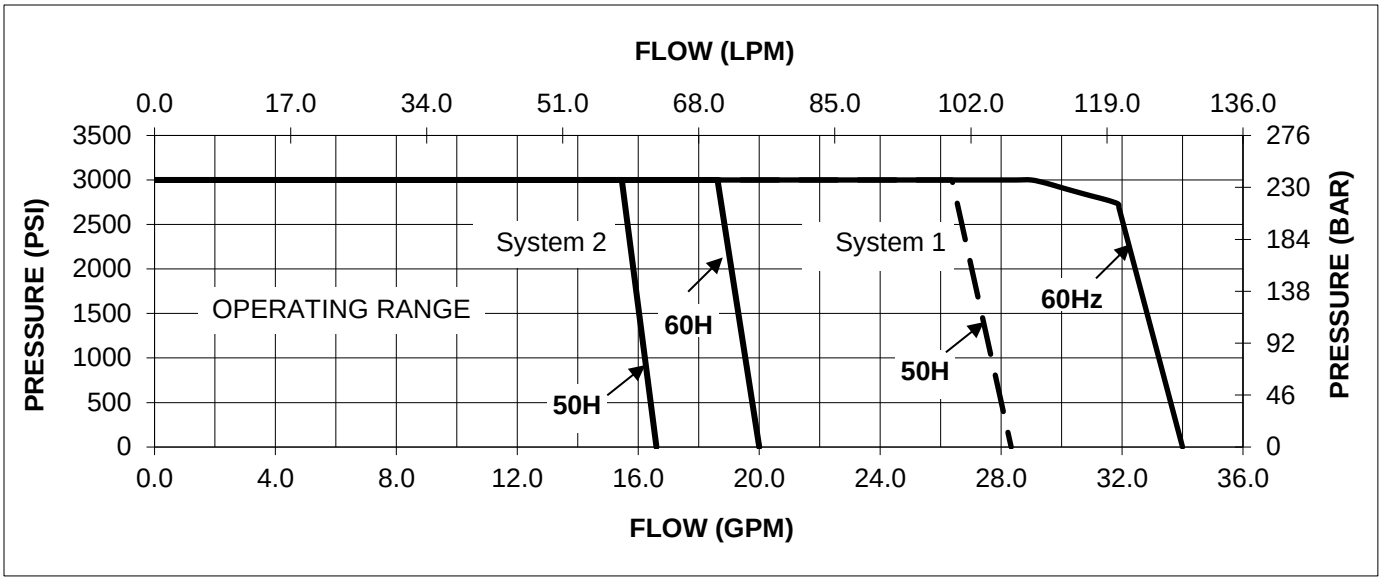
5.2.2 Physical

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

SYSTEM 1: (34 gpm, 3000 psi)
Pressure Hoses.....25 ft (7.62 m) ..... Standard Length
-12 (3/4 in, 19.05 mm) ... Working Diameter
Return Hoses .....25 ft (7.62 m) ..... Standard Length
-16 (1 in, 25.4 mm) ..... Working Diameter

SYSTEM 2: (20 gpm, 3000 psi)
Pressure Hose: .....25 ft (7.62 m) ..... Standard Length
-12 (3/4 in, 19.05 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
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 60 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	73	84	84	58
Locked Rotor Amps	582	546	546	400

5.2.5 Filters

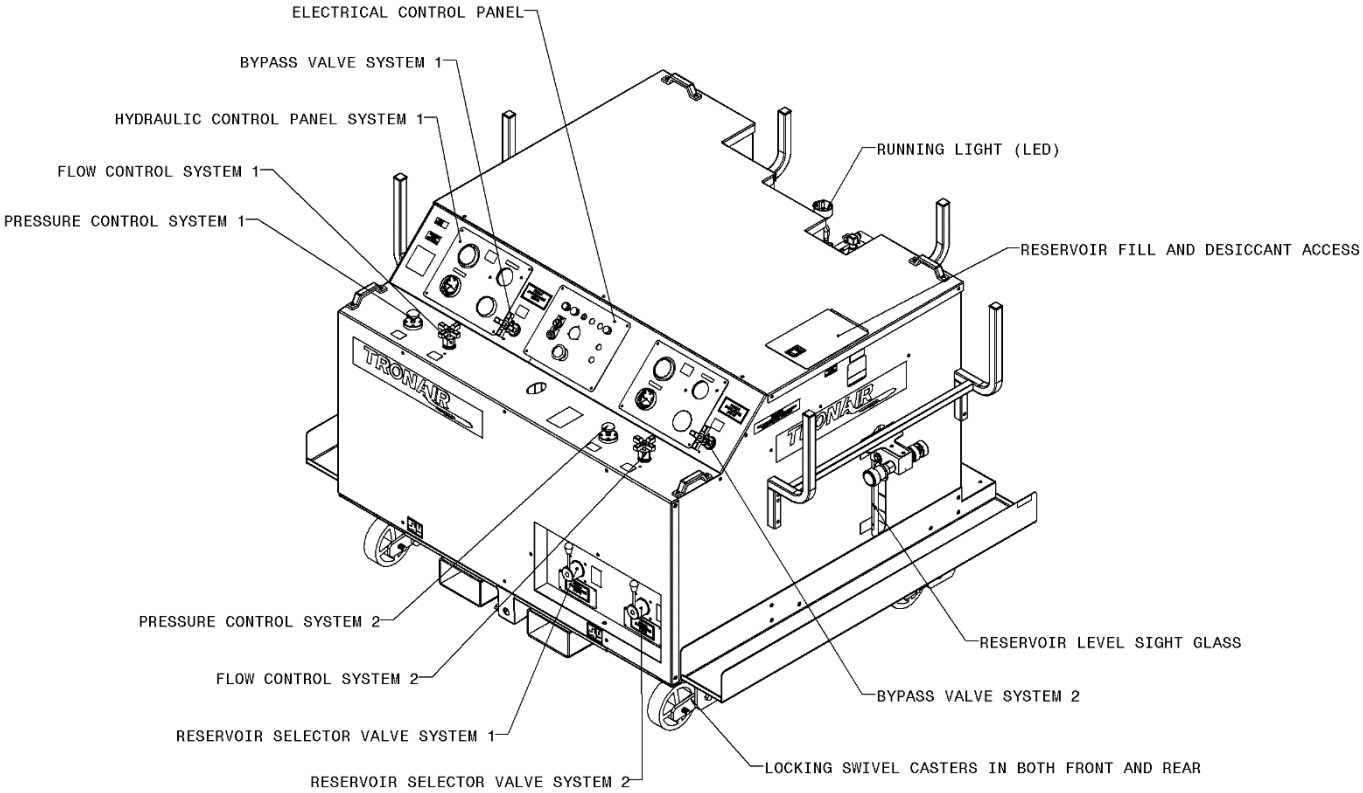
Pressure..... 2 micron rating, non-bypass high collapse microglass type. Non-cleanable element.
Return ..... 5 micron rating, 25 psi (1.72 bar) bypass microglass type. Non-cleanable element.
Electric Fill Pump..... 2 micron rating, non-bypass microglass type. Non-cleanable element.
Air/Desiccant.....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

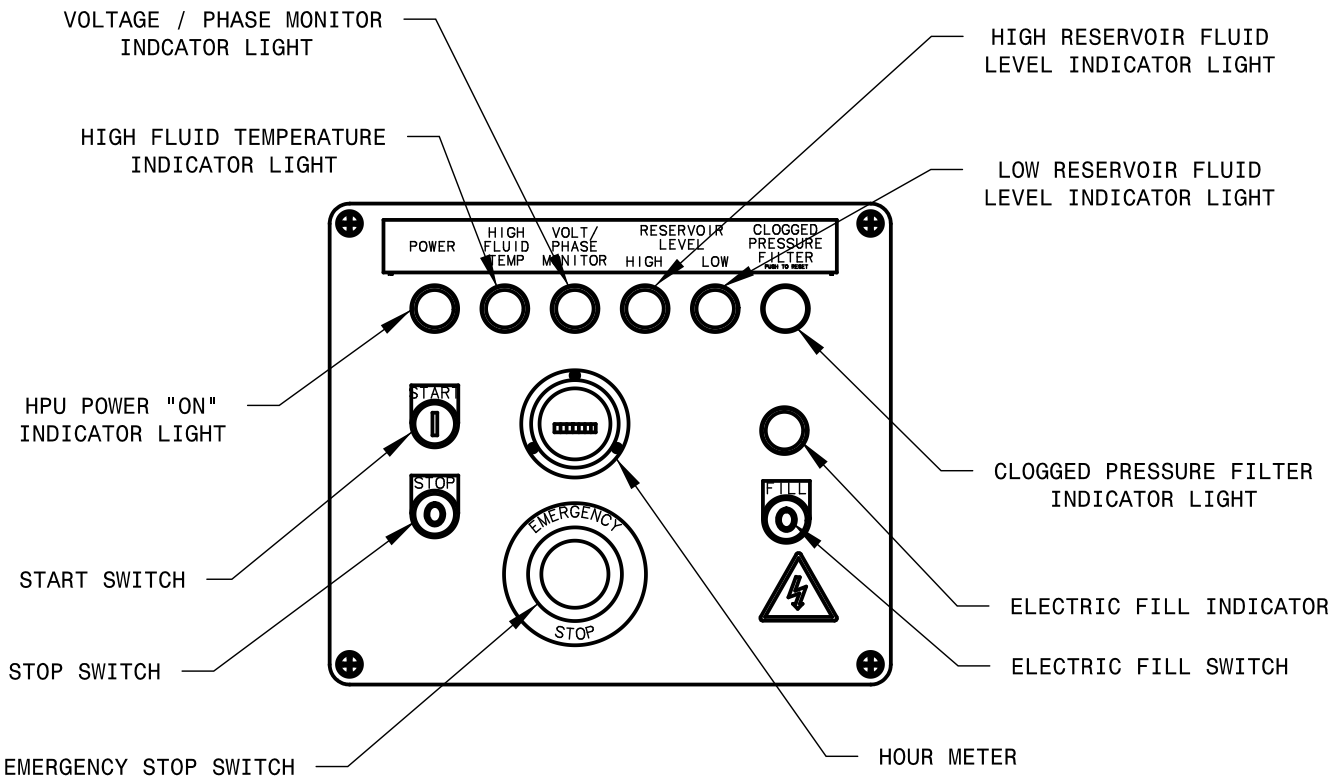
5.3 LOCATION & LAYOUT OF CONTROLS

5.3.1 Front Panel Controls



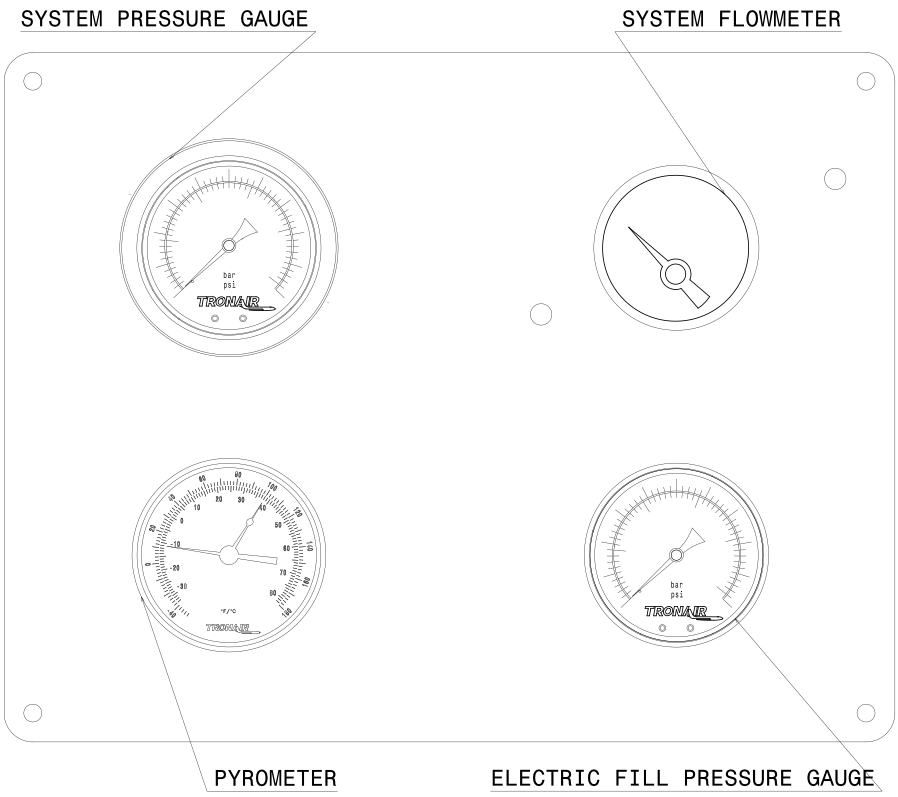
Electrical Control Panel	See Section 5.3.2
Hydraulic Control Panel	See Section 5.3.3
Bypass Valve	For loading and unloading the motor driven hydraulic pump
Flow Control	For setting the maximum flow required from the system
Pressure Control	For setting the system pressure of the HPU during operation
Reservoir 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

5.3.2 Electrical Control Panel



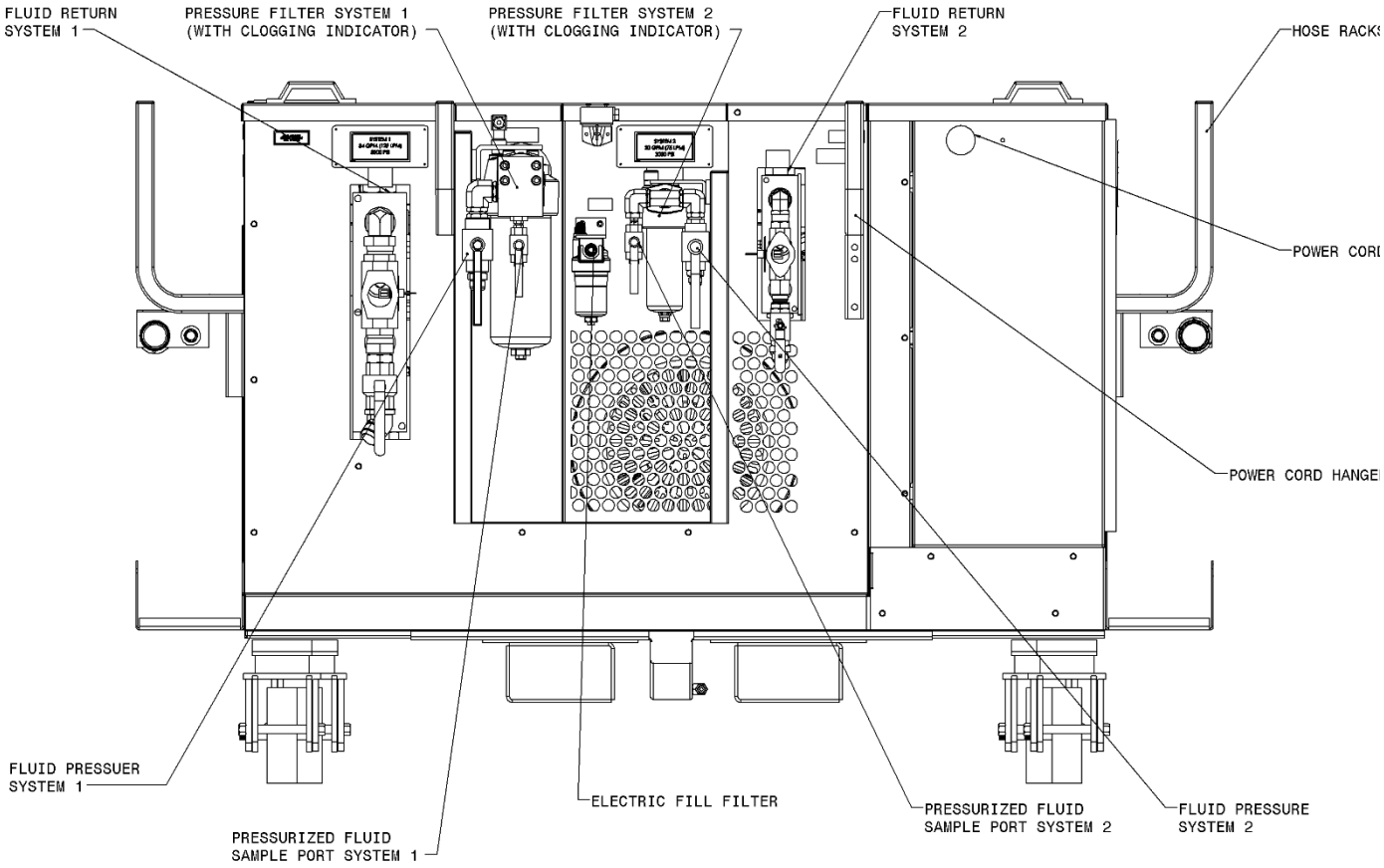
Emergency Stop	Removes power to all electrical devices, must turn to reset
Stop Switch	Turns off the electric motors driving the hydraulic pump and cooling fan
Start Switch	Turns on the electric motors driving the hydraulic pump and cooling fan
HPU Power "On" Indicator Light	Light is illuminated when 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

5.3.3 Hydraulic Control Panel



System Pressure Gauge	Displays the system pressure on an analog fluid dampened gauge
Pyrometer	Displays the fluid temperature in the return system on an analog gauge. A warning indicator preset to 160° F (71° C) warns of high operating temperature
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.**

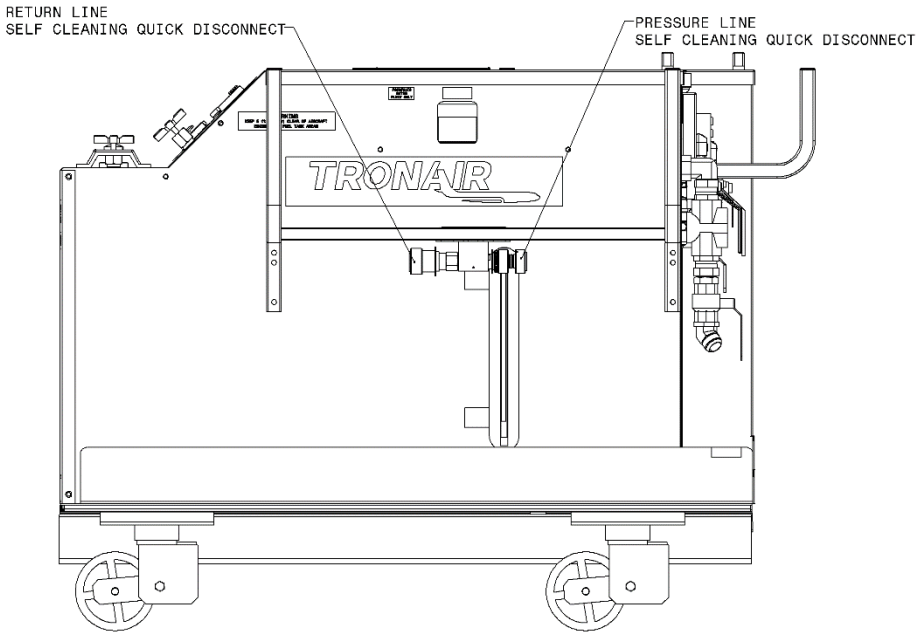
5.6 BLEEDING AIR FROM SYSTEM

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 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.

To avoid draining the aircraft reservoir when using only System 1, it is recommended to operate System 2 in "Aircraft Reservoir" Position per the below procedure.

Setting Unused System (HPU reservoir selector in "Aircraft Reservoir" Position):
The unused system should be thoroughly purged of air before placing the reservoir selector valve in "aircraft reservoir" position. (see section 5.6.1 To Easily Purge the Unit of Air). No cavitation sounds should be heard from the pump while running in this mode. If cavitation sounds are detected, immediately shut down the unit and switch the unused system to "HPU reservoir" and operate the system in this mode.

Setting Unused System:
Reservoir Selector Valve ..... Aircraft 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 systems
- 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 Pump allows for filling the aircraft reservoir. The electric fill 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.

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.

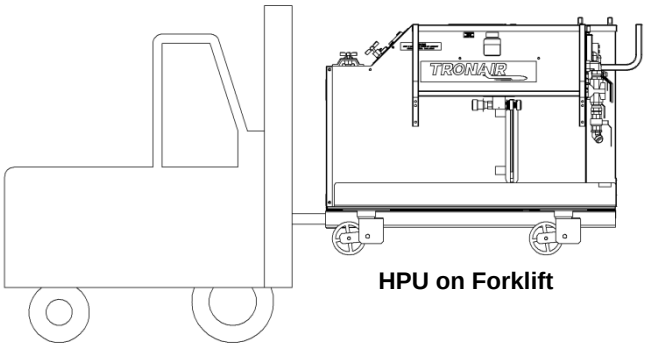
If storing outside, protect unit from freezing water, sand, dirt, and direct sunlight. A cover is highly recommended.

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.

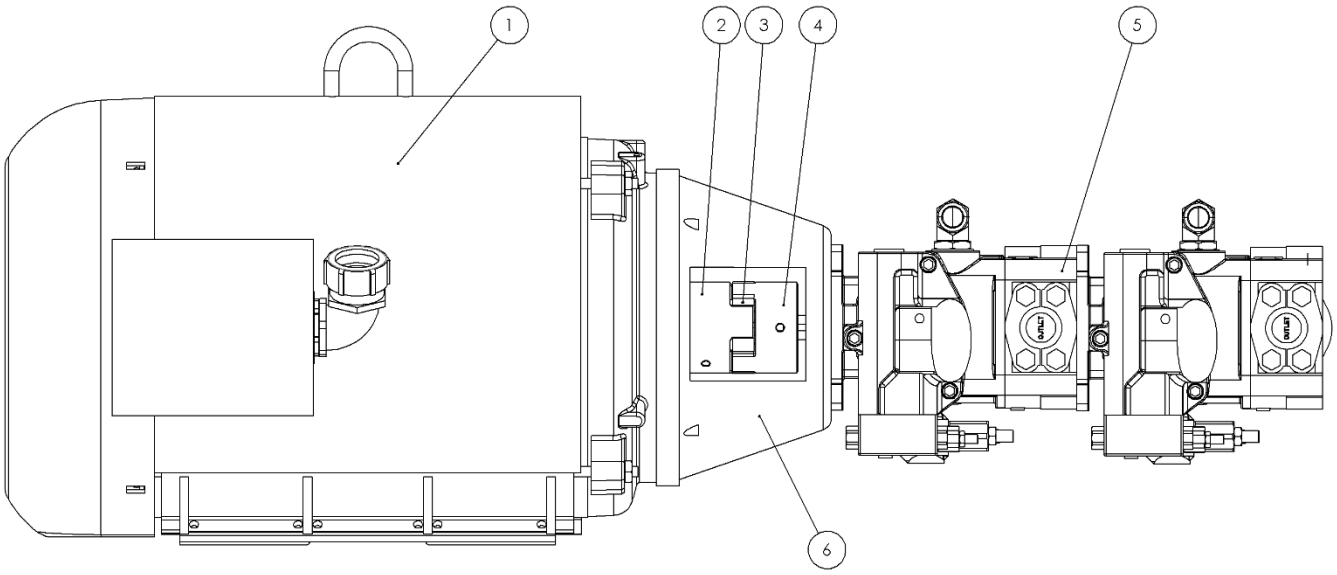
9.1 GENERAL

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

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	Reference Table below	Electric Motor	1
2	H-2226-03	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

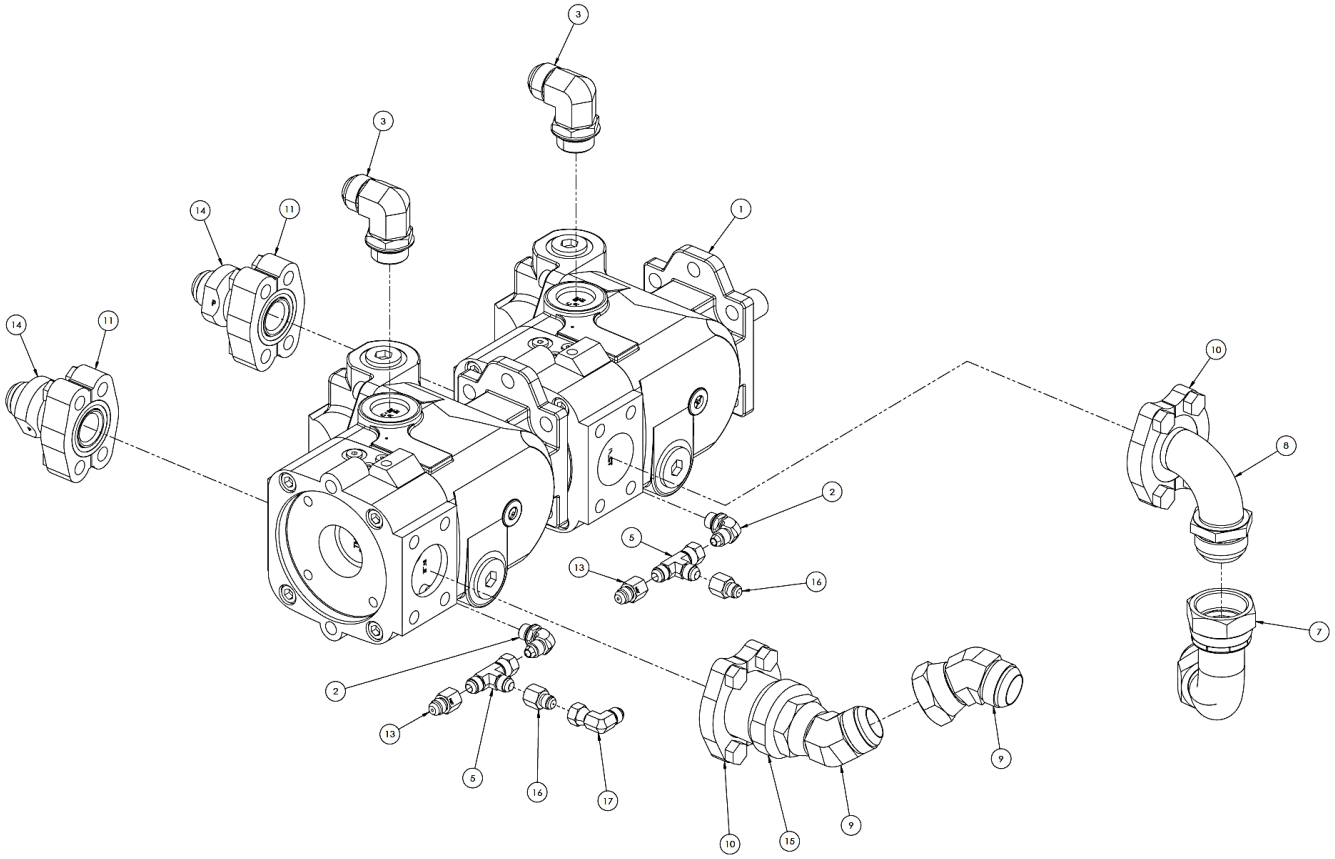
60 Hz Applications	
Voltage	**Part Number**
380	EC-1224-34
480	EC-1224-34
575	EC-1224-12

50 Hz Applications	
Voltage	**Part Number**
400	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

Fluid Type: Aviation Phosphate Ester, Type IV

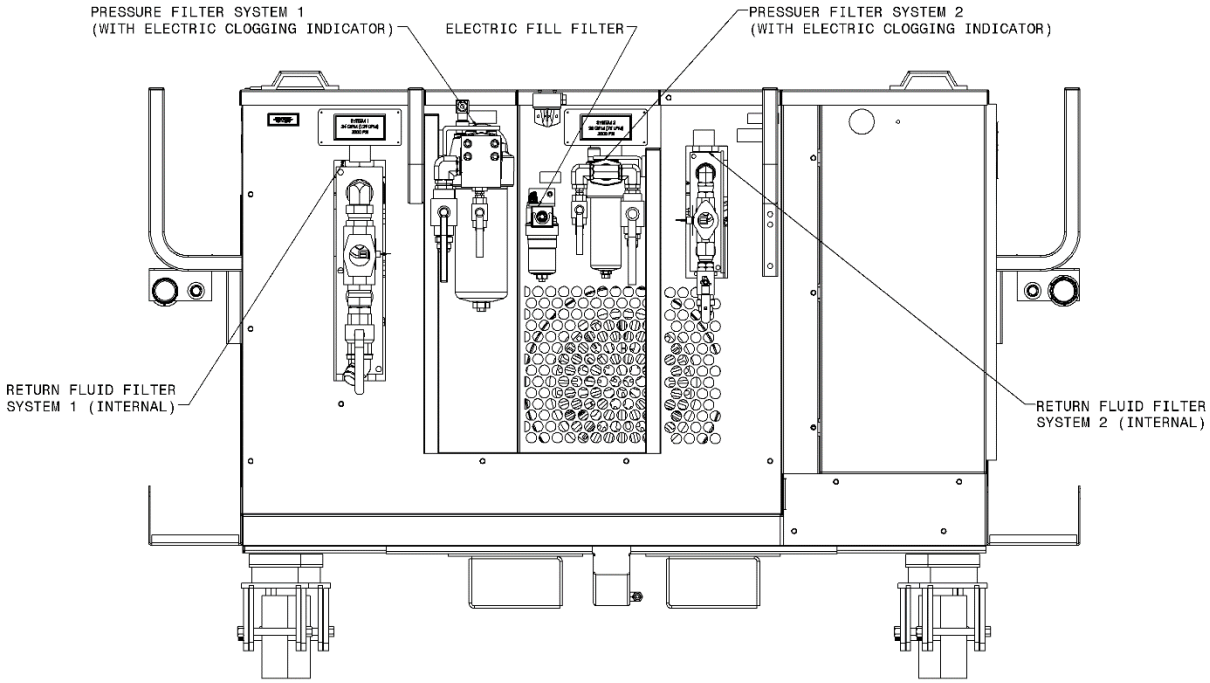
Item	Part Number	Description	Qty
1	HC-2680-01	PUMP, TANDEM HYDRAULIC	1
2	N-2001-08-S-E	ELBOW, STRAIGHT THREAD	2
3	N-2001-24-S-E	ELBOW, STRAIGHT THREAD	2
5	N-2016-05-S	TEE, RUN SWIVEL NUT	2
7	N-2063-05	ELBOW, JIC SWEPT	1
8	N-2078-11	FLANGE, 90 DEG. ELBOW	1
9	N-2081-09-S	ELBOW, 45 DEG SW. #20 JIC	2
10	N-2545-06-S-E	KIT, FLANGE	2
11	N-2664-03-S-E	KIT, FLANGE	2
12	N-2924	CONNECTOR, IN-LINE ORIFICE	2
13	N-2932-05-S-E	FLANGE, CODE 62 CONNECTOR	2
14	N-2993-06-S-E	FLANGE, CODE 61 CONNECTOR (MB)	1
15	N-3237	ORIFICE, MODIFIED (.040)	2
16	N-2002-05-S	ELBOW, -06 M JIC X -06 F JIC	1

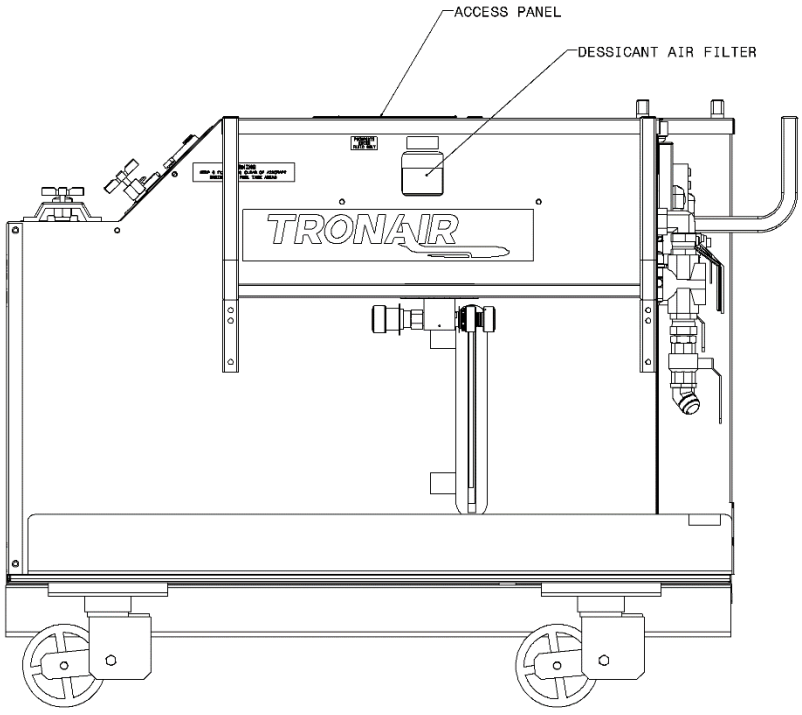
9.4 HYDRAULIC FLUID

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-5GS
Fluid Type ..... Aviation Phosphate Ester, Type IV or Type V

9.5 FILTERS



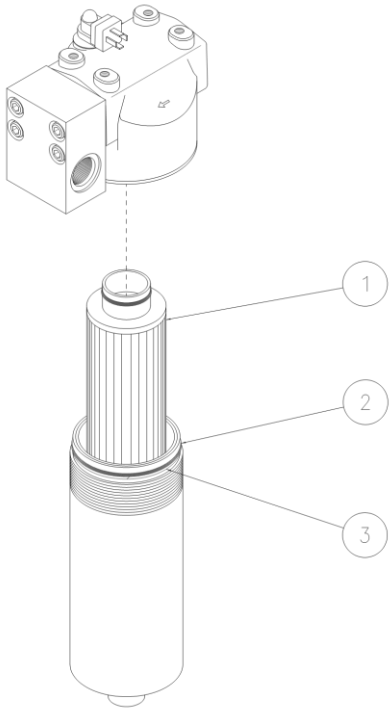


9.5.1 Pressure Filter Element

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

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	K-5084	Kit, Replacement Filter Element	1
2, 3	K-5122	O-ring & Backup Ring	1

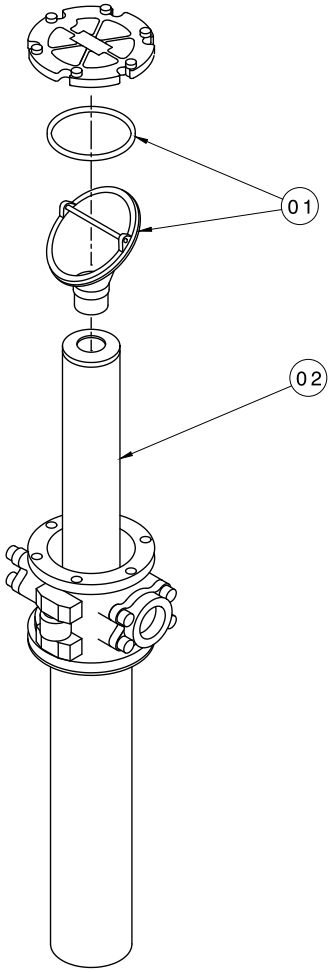
System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	K-5083	Kit, Replacement Filter Element	1
2, 3	K-5123	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

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1, 2	K-3616	Kit, Replacement Filter Element	1
1	HC-2006-350	O-ring	2

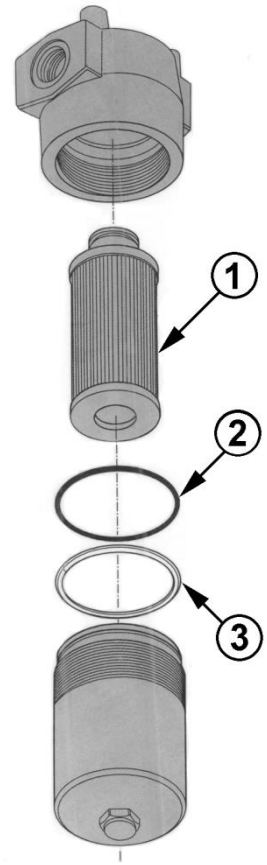
System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

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



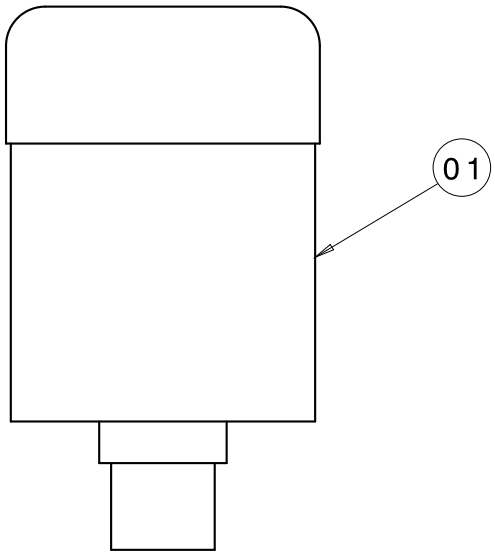
Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1, 2, 3	940832Q	Kit, Replacement Filter Element	1
2, 3	HC-2006-142	O-ring	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).



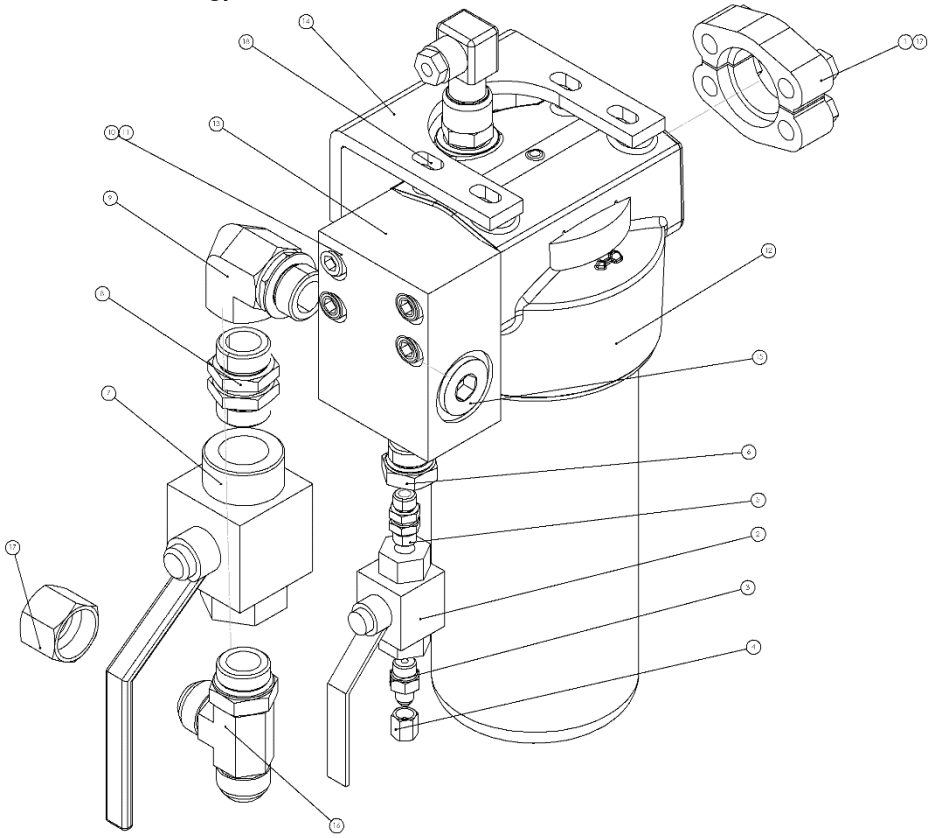
Parts List

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.

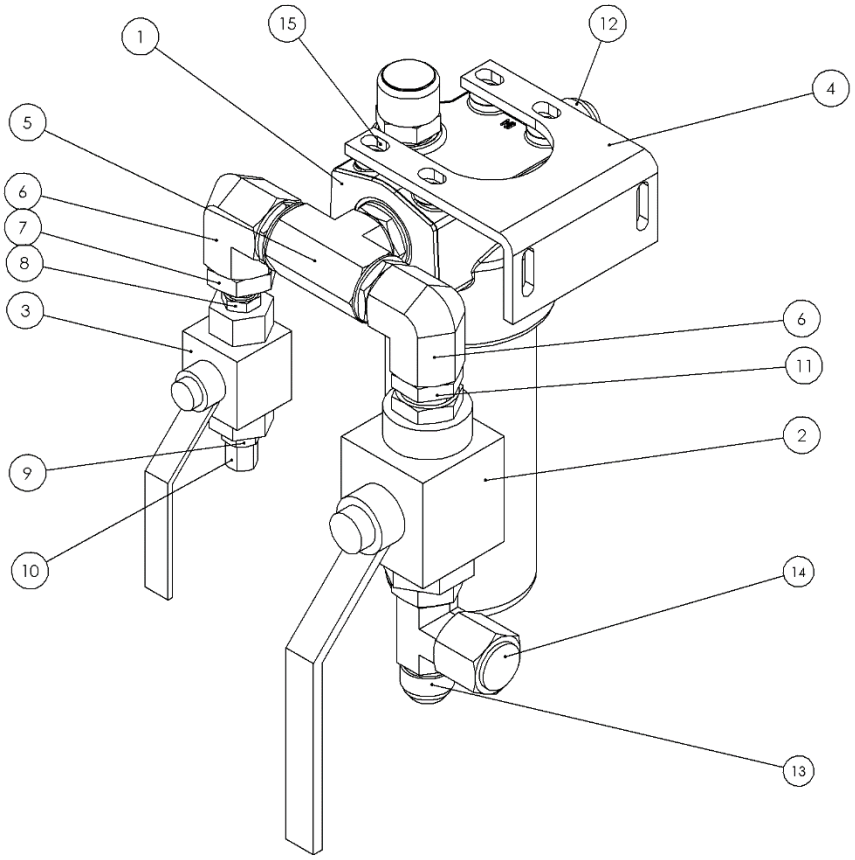


System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	N-2664-03-S-E	KIT, FLANGE	1
2	HC-1771-02	VALVE, BALL	1
3	N-2007-05-S-E	CONNECTOR, STR THD	1
4	N-2008-03-S	CAP #4	1
5	N-2464-05-S-E	UNION, #6 STR THD	1
6	N-2463-31-S-E	FITTING, REDUCER/EXPANDER	1
7	HC-1771-05	VALVE, BALL	1
8	N-2464-10-S-E	UNION, #16 SAE STR THD	1
9	N-2661-06-S-E	ELBOW, STR THD	1
10	G-1151-109224	SCR, 1/2-13 HEX SOC HD CAP	4
11	G-1251-1090HC	LOCKWASHER, HELICAL SPRING	4
12	HC-2686	FILTER, PRESSURE	1
13	H-2584	FLANGE, SAE ADAPTER	1
14	H-3865	BRACKET, FILTER	1
15	N-2066-16-S-E	PLUG, O-RING HEX	1
16	N-2015-24-S-E	TEE, RUN STR THD	1
17	N-2008-10-S	CAP	1
18	HC-2006-222	O-RING SERIES 2	1
19	G-1114-100025	BOLT, METRIC CLASS 8.8	4

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

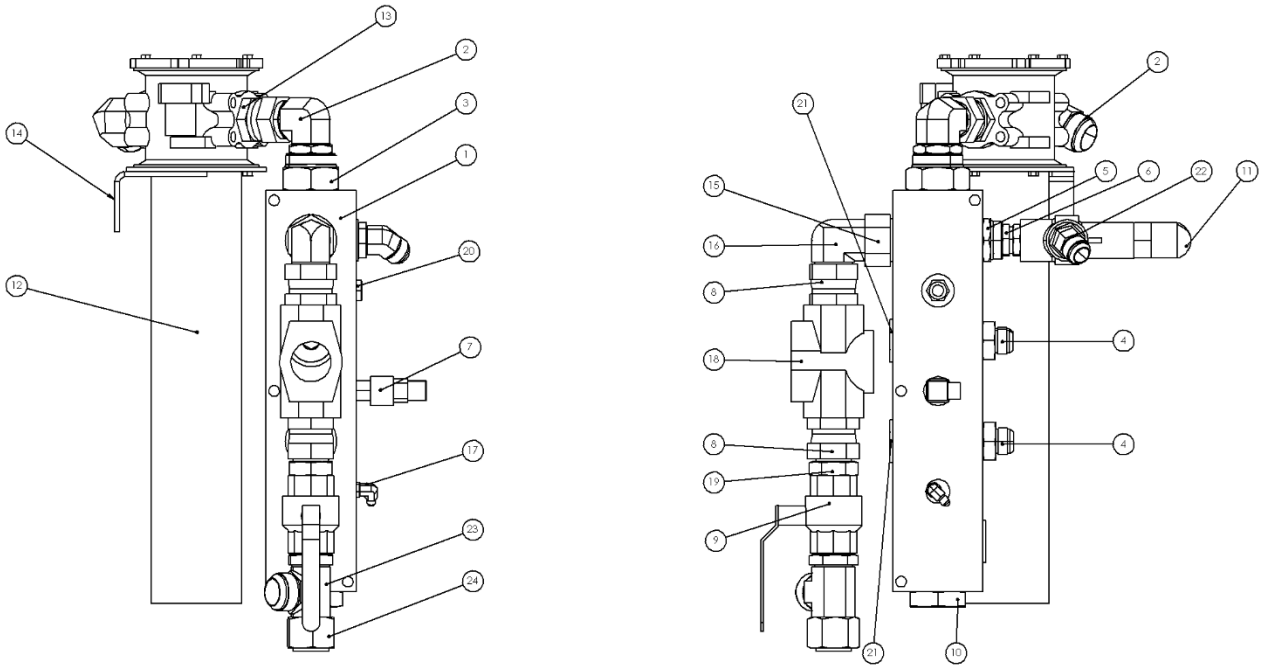


System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2684	FILTER, PRESSURE (PE)	1
2	HC-1771-04	VALVE, BALL, #12 SAE	1
3	HC-1771-02	VALVE, BALL	1
4	Z-5093	BRACKET, FILTER	1
5	N-2740-12-S-E	TEE, STR THD	1
6	N-2661-05-S-E	ELBOW, STR THREAD	2
7	N-2463-35-S-E	FITTING, REDUCER EXPANDER	1
8	N-2464-05-S-E	UNION, #6 STR THD	1
9	N-2007-05-S-E	CONNECTOR, STR THD	1
10	N-2008-03-S	CAP #4	1
11	N-2464-08-S-E	UNION, STR THD	1
12	N-2007-18-S-E	CONNECTOR, STR THD	1
13	N-2015-18-S-E	TEE, RUN, STR THD	1
14	N-2008-08-S	CAP, 3/4"	1
15	G-1114-080016	BOLT, METRIC M8 HEX HD	4

9.5.6 Return Filter Assembly

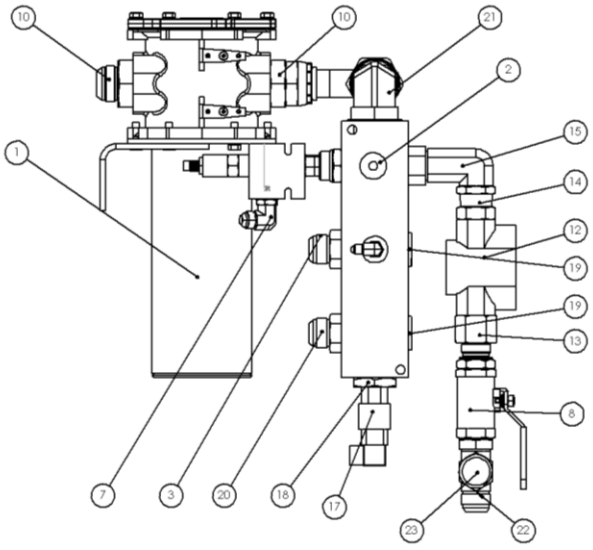


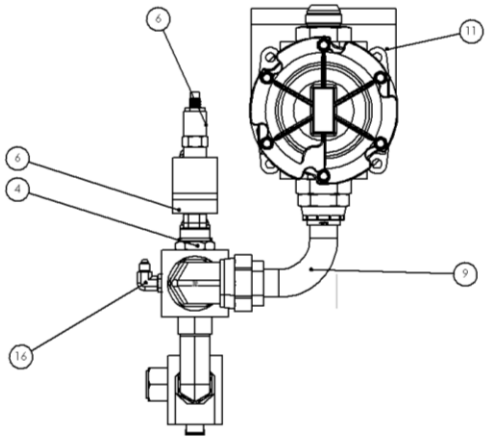
System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2043	MANIFOLD, RETURN	1
2	N-2001-31-S-E	ELBOW, STRAIGHT THREAD	2
3	N-2463-28-S-E	FITTING, REDUCER-EXPANDER	1
4	N-2007-34-S-E	CONNECTOR, STRAIGHT THREAD	2
5	N-2463-24-S-E	FITTING, REDUCER/EXPANDER 16/24 SAE	1
6	N-2464-10-S-E	UNION, #16 SAE STR THD	1
7	EC-1782-02	SWITCH, TEMPERATURE	1
8	N-2030-15-S	SWIVEL, FEMALE 37°	2
9	HC-2058-02	VALVE, BALL	1
10	N-2053-13-S-E	PLUG, HEX HD W/ O-RING	1
11	HC-2202	VALVE, PRESSURE RELIEF, PRESET	1
12	HC-2045-02	FILTER, RETURN	1
13	N-2036-13-S-E	SWIVEL, 37° FEMALE	1
14	H-3864	BRACKET, RETURN FILTER	1
15	N-2007-31-S-E	ADAPTOR, FEMALE PIPE STR THD	1
16	N-2002-12-S	ELBOW, MALE	1
17	N-2001-06-S-E	ELBOW, STRAIGHT THD	1
18	HC-2235	SIGHTGAUGE, FLOW 1-1/2"	1
19	N-2007-31-S-E	CONNECTOR, STR THD #24	1
20	N-2463-10-S-E	FITTING, REDUCER-EXPANDER	1
21	N-2066-24-S-E	PLUG, O-RING HEX	3
22	N-2042-12-S-E	ELBOW, 45 DEG STR THD	1
23	N-2015-31-S-E	TEE, RUN, STR THD	1
24	N-2008-12-S	CAP	1

9.5.6 Return Filter Assembly *(continued)*





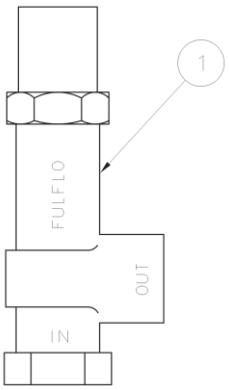
System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1906-02	FILTER, RETURN	1
2	HC-2205	MANIFOLD, RETURN	1
3	N-2007-21-S-E	CONNECTOR, STRAIGHT THREAD #12 JIC X #16 SAE	1
4	N-2463-16-S-E	FITTING, REDUCER/EXPANDER	1
5	N-2464-06-S-E	UNION, #8 STR THD	1
6	HC-2200	VALVE, PRESSURE RELIEF, PRESET	1
7	N-2001-11-S-E	ELBOW, STR THD #8 SAE X #8 JIC	1
8	HC-1770-05	VALVE, BALL	1
9	N-2063-04	ELBOW, BENT SWIVEL NUT	1
10	N-2007-30-S-E	CONNECTOR, STRAIGHT THREAD	2
11	H-3863	BRACKET, FILTER	1
12	HC-2296	SIGHTGAUGE, FLOW (PE)	1
13	N-2226-08-S	CONNECTOR, MALE PIPE	1
14	N-2030-11-S	SWIVEL, FEMALE 37 DEG	1
15	N-2706-06-S-E	ELBOW, LONG STRAIGHT THREAD	1
16	N-2001-06-S-E	ELBOW, STRAIGHT THD	1
17	EC-1782-02	SWITCH, TEMPERATURE	1
18	N-2463-40-S-E	FITTING, REDUCER/EXPANDER	1
19	N-2066-16-S-E	PLUG, O-RING HEX	2
20	N-2007-24-S-E	CONNECTOR, STR THD	1
21	N-2049-20-S-E	ELBOW, 90 DEG SWIVEL, #20 SAE X #20 JIC	1
22	N-2015-24-S-E	TEE, RUN STR THD	1
23	N-2008-10-S	CAP	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.

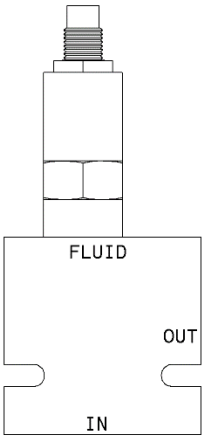


System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2202	Valve, Pressure Relief (*Pre-set*)	1
Not Shown	♦ HC-2006-220	O-ring, Series 2	1

♦ ***Included with Item 1***



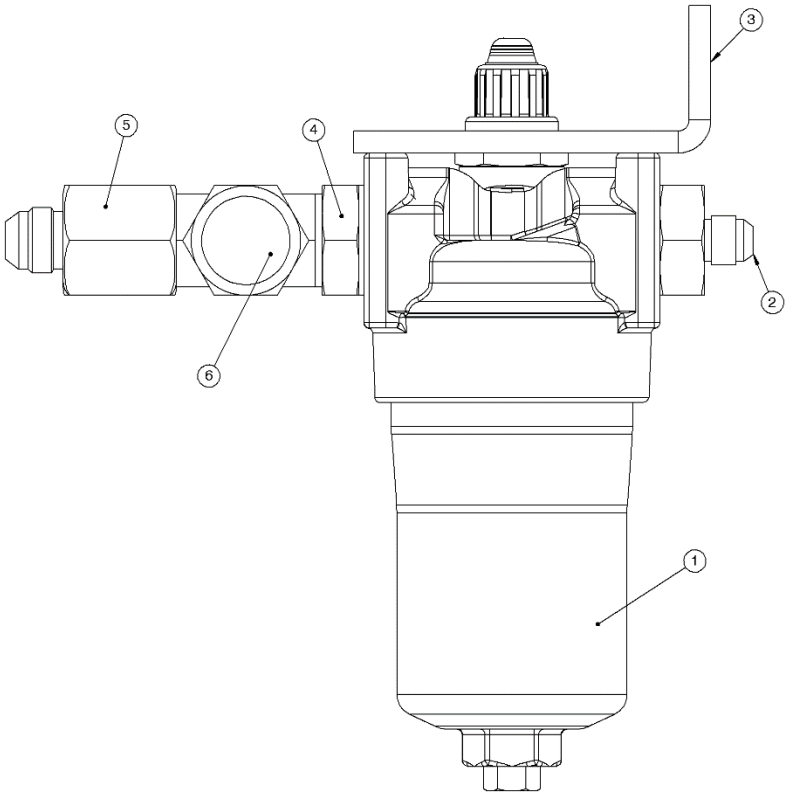
System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2200	Valve, Pressure Relief (*Pre-set*)	1

♦ ***Included with Item 1***

9.5.7 Electric Fill filter



Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1954	ASSEMBLY, FILTER 15CN 2 MICRON (PE)	1
2	N-2007-46-S-E	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-E	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.

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

9.6.1 Internal Hoses

System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

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-1040-17-31.4	Pump Outlet	Flow Control	1
3	-16	-16	TF-1040-19-23.1	Flow Control	Flowmeter	1
4	-16	-16	TF-1040-24-48.0	Manifold	Pressure Filter	1
5	-16	-16	TF-1041-52-64.8	Manifold	Return Manifold	1
6	-16	-16	TF-1041-01-15.8	Pump Case	Heat Exchanger Bottom	1
7	-6	-6	TF-1040-25-45.1	Flow Control Sense	Orifice Fitting	1
8	-4	-4	TF-1041-66-56.5	Pressure Control	Pump Load Sense	1
9	-4	-4	TF-1041-05-116	Pressure Control	Return Manifold	1
10	-16	-16	TF-1041-52-47.5	Heat Exchanger Top	Return Manifold	1
11	-16	-16	TF-1041-16-27.0	Return PRV	Reservoir	1
12	-24	-24	TF-1041-04-49.8	Return Filter	JIC Union	1
13	-24	-24	TF-1041-17-17.0	JIC Union	Selector Valve	1
15	-4	-4	TF-1040-42*23.0	Calibration Port	Gauge	1

System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

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-1040-49-45.4	Pump Outlet	Flow Control	1
18	-12	-12	TF-1040-11-25.1	Flow Control	Flowmeter	1
19	-12	-12	TF-1040-01-54.6	Manifold	Pressure Filter	1
20	-12	-12	TF-1041-64-62.9	Manifold	Return Manifold	1
21	-16	-16	TF-1041-01-52.6	Pump Case	Heat Exchanger Bottom	1
22	-6	-6	TF-1040-25-44.6	Flow Control Sense	Orifice Fitting	1
23	-4	-4	TF-1041-02-33.3	Pressure Control	Pump Load Sense	1
24	-4	-4	TF-1041-05-126	Pressure Control	Return Manifold	1
25	-16	-16	TF-1041-01-60.3	Heat Exchanger Top	Return Manifold	1
26	-8	-8	TF-1041-38-40.4	Return PRV	Reservoir	1
27	-20	-20	TF-1041-39-61.8	Return Filter	JIC Union	1
28	-20	-20	TF-1041-54-16.5	JIC Union	Selector Valve	1
30	-4	-4	TF-1040-42*23.0	Calibration Port	Gauge	1

9.6.2 External Hoses

Systems 1 & 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
TF-1040-01*300	ASSEMBLY, HOSE (PRESSURE)	2
TF-1040-05*300	ASSEMBLY, HOSE (RETURN)	2

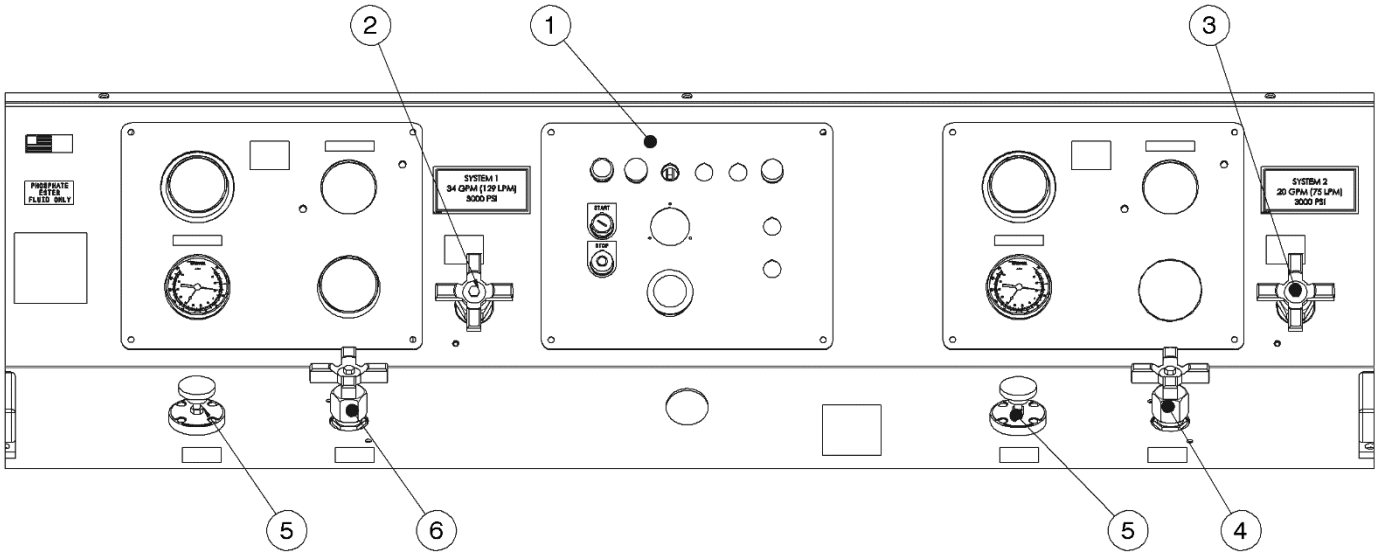
Electric Fill Pump - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
TF-1041-02*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.



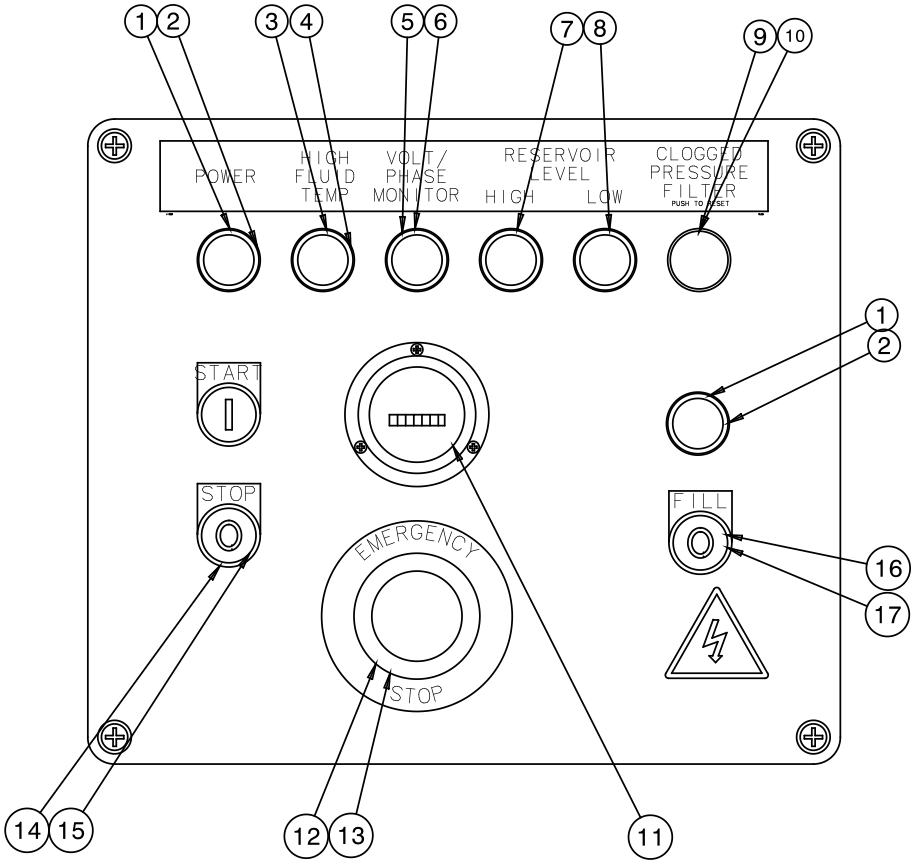
Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	*See Page 35*	Electric Panel	1
2	*See Page 37*	Assembly, System 1 Pressure Manifold	1
3	*See Page 37*	Assembly, System 2 Pressure Manifold	1
4	*See Page 36*	Assembly, System 2 Flow Control Manifold	1
5	HC-2108-02	Valve, Pressure Control	1
6	*See Page 36*	Assembly, System 1 Flow Control Manifold	1

9.7.1 Electric Panel

The Electric Panel does not require regular general maintenance.



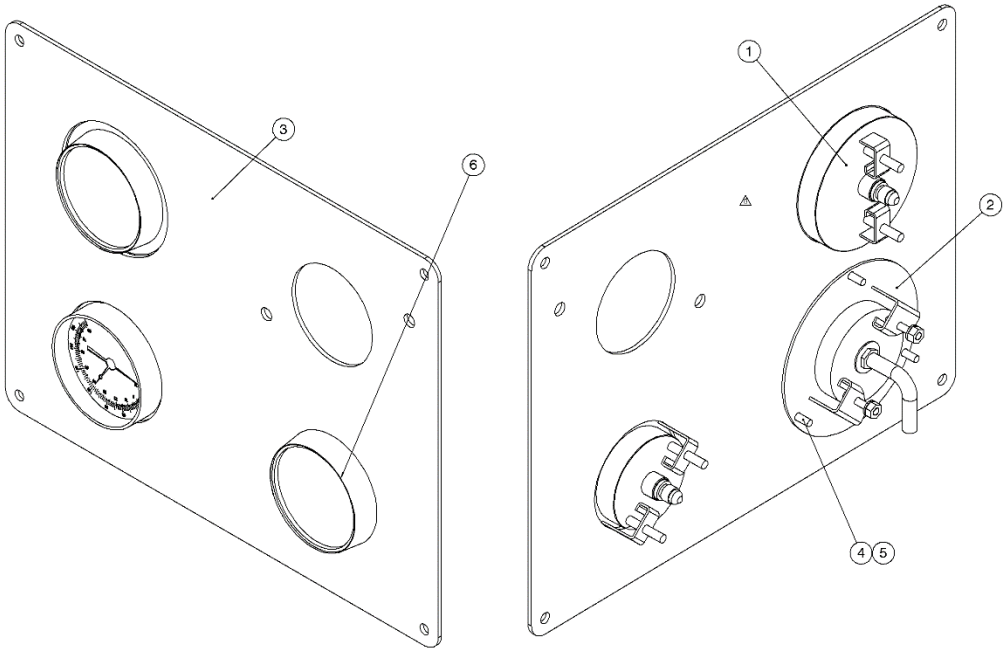
Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	EC-1945-01	Light, Diffused Pilot	2
2	EC-1951-MN5G	Power, Module w/Latch	2
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	2
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	1
17	EC-1946-MX10	Contact Block w/Latch1	1

9.7.2 Hydraulic Panel

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



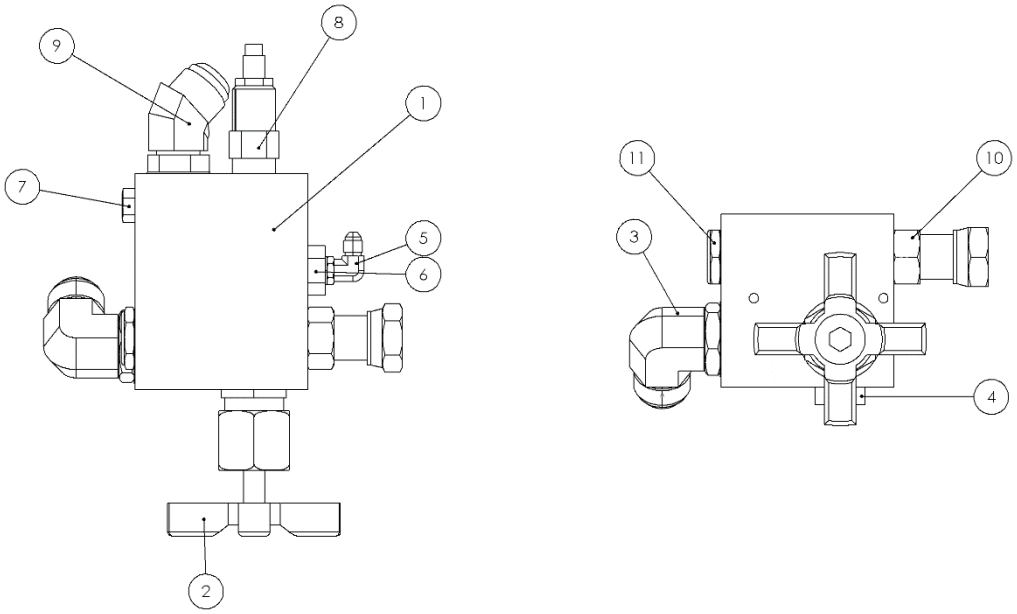
Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2143	GAUGE, PRESSURE, 0-5000 PSI (PE)	1
2	HC-2268-02	GAUGE, PYROMETER (PE)	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

9.7.3 Pressure Manifold Assembly

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



System 1 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-3245	MANIFOLD, PRESSURE	1
2	HC-1927-06	VALVE, NEEDLE	1
3	N-2001-24-S-E	CONNECTOR, STR THD, #16 SAE X #16 JIC	1
4	N-2053-07-S-E	PLUG, O-RING HEX HEAD	1
5	N-2001-03-S-E	CONNECTOR, STRAIGHT THREAD	1
6	N-2463-36-S-E	FITTING, REDUCER-EXPANDER	1
7	N-2053-05-S-E	PLUG, HEX HEAD WITH O-RING	2
8	HC-1445	VALVE, PRESSURE RELIEF	1
9	N-2042-16-S-E	CONNECTOR, 45 ° STR THD	1
10	N-2650-05-S-E	CONNECTOR, ORFS SWIVEL	1
11	HC-2159	VALVE, CHECK	1

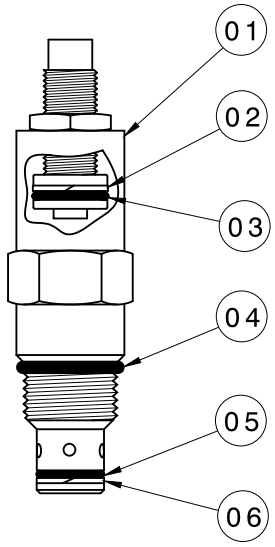
System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-3245	MANIFOLD, PRESSURE	1
2	HC-1927-06	VALVE, NEEDLE	1
3	N-2053-07-S-E	PLUG, O-RING HEX HEAD	1
4	N-2001-03-S-E	CONNECTOR, STRAIGHT THREAD	1
5	N-2463-36-S-E	FITTING, REDUCER-EXPANDER	1
6	N-2053-05-S-E	PLUG, HEX HEAD WITH O-RING	2
7	HC-1445	VALVE, PRESSURE RELIEF	1
8	N-2650-05-S-E	CONNECTOR, ORFS SWIVEL	1
9	N-2001-21-S-E	ELBOW, STRAIGHT THREAD	1
10	HC-2159	VALVE, CHECK	1
11	N-2042-09-S-E	ELBOW, 45 DEG STR THD	1

9.7.3.a System Pressure Relief Valve

The System Pressure Relief Valve does not require regular general maintenance. It is possible however, for a contaminant to hold the relief valve in a partially open condition. If service is required, the new or repaired relief valve must be reset to 3,750 psig.



Parts List

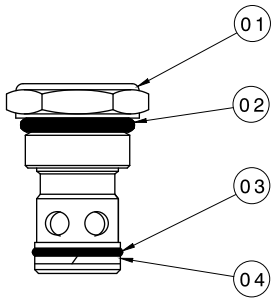
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 1	HC-1445	Pressure Relief Valve *(Not Set)*	1
2	HC-2020-015	Backup Ring, *(Teflon)*	1
3	HC-2006-015	O-ring, Series 2	1
4	HC-2013-910	O-ring, Series 3	1
5	HC-2006-014	O-ring, Series 2	1
6	HC-2020-014	Backup Ring, *(Teflon)*	1

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

9.7.3.b Check Valve

The Check Valve does not require regular general maintenance.



Parts List

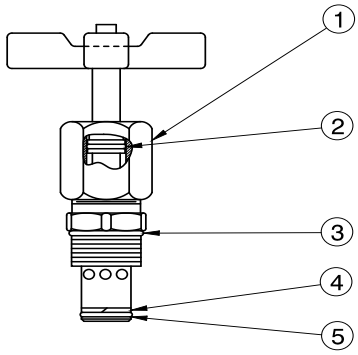
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 1	HC-2159	Check Valve	1
2	HC-2013-912	O-ring, Series 3	1
3	HC-2006-015	O-ring, Series 2	1
4	HC-2020-015	Backup Ring	1

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

9.7.3.c Bypass Valve

The Bypass Valve does not require regular general maintenance.



Parts List

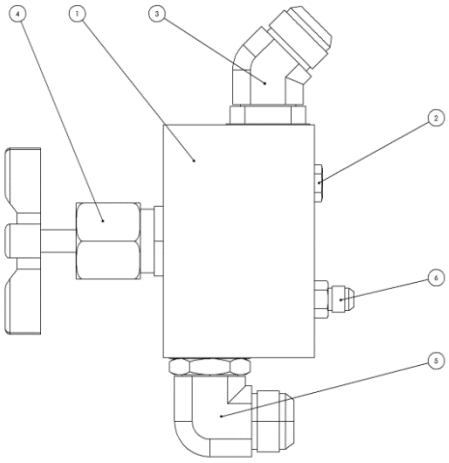
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 1	HC-1927-06	Needle Valve	1
2	HC-2006-112	O-ring	1
3	HC-2013-916	O-ring	1
4	HC-2020-118	Backup Ring	1
5	HC-2006-118	O-ring	1

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

9.7.4 Flow Control Assembly

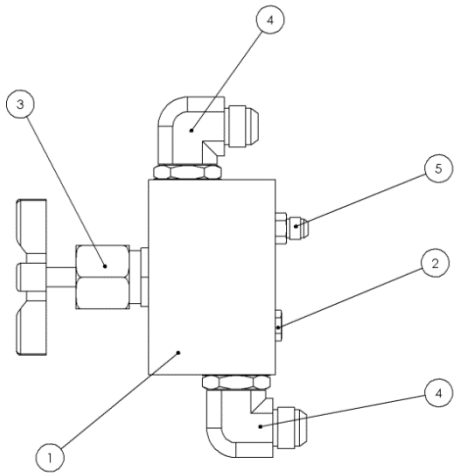
The Flow Control Assembly does not require regular general maintenance.



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-E	PLUG, HEX HEAD WITH O-RING	2
3	N-2042-12-S-E	ELBOW, 45 DEG STR THD	3
4	HC-1927-06	VALVE, NEEDLE	4
5	N-2001-24-S-E	CONNECTOR, STR THD, #16 SAE X #16 JIC	5
6	N-2007-08-S-E	CONNECTOR, STRAIGHT THREAD	6

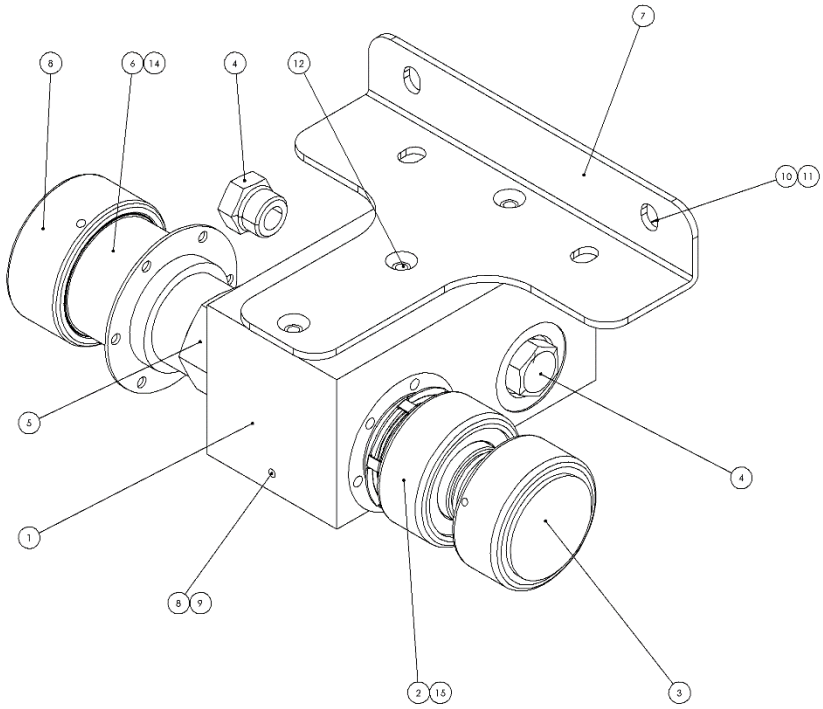


System 2 - Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-5128	MANIFOLD, FLOW CONTROL	1
2	N-2053-05-S-E	PLUG, HEX HEAD WITH O-RING	1
3	HC-1927-06	VALVE, NEEDLE	1
4	N-2001-21-S-E	ELBOW, STRAIGHT THREAD	2
5	N-2007-08-S-E	CONNECTOR, STRAIGHT THREAD	1

9.8 COUPLINGS

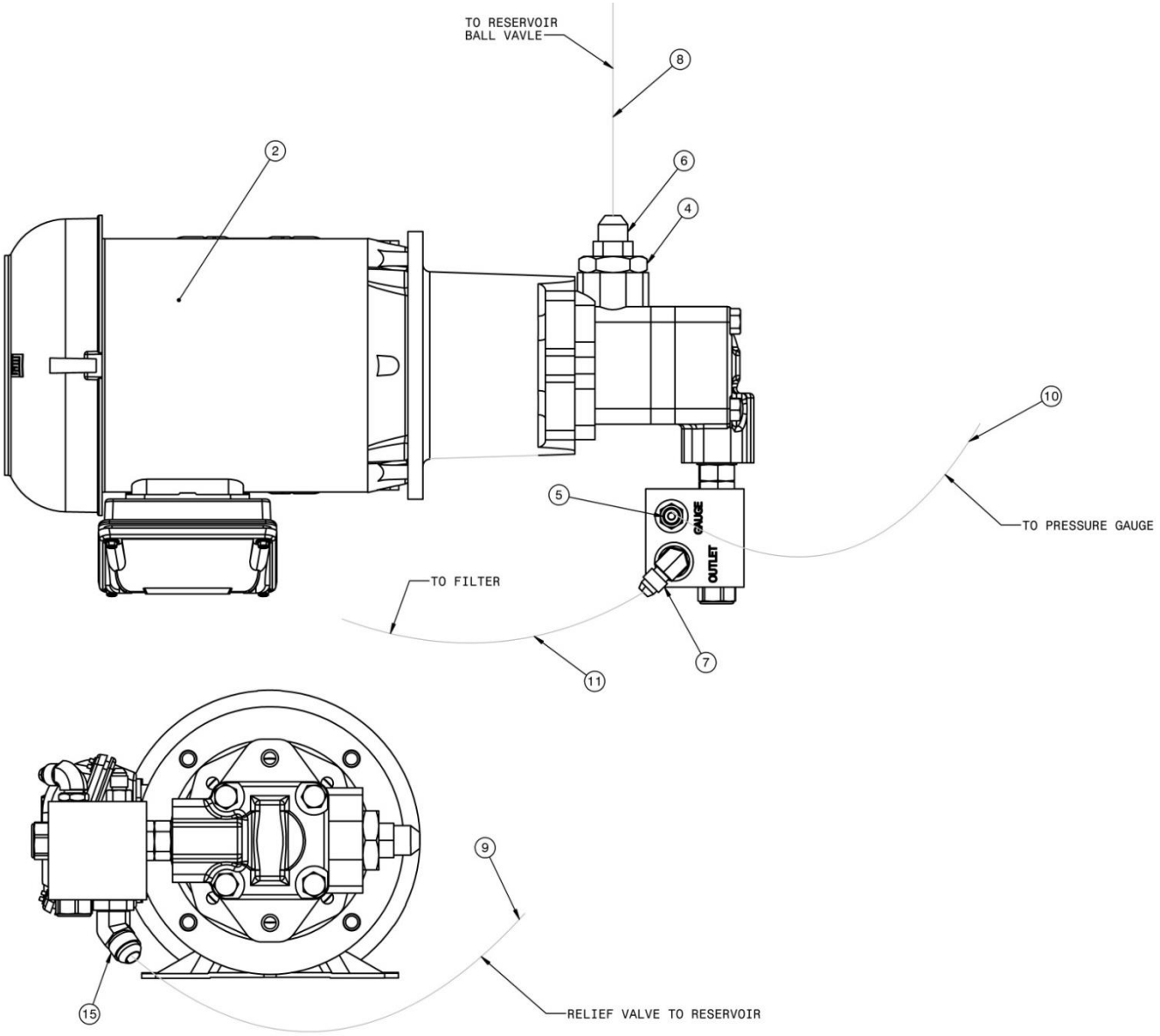


Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	J-4243	MANIFOLD (-12 SAE PORTS)	1
2	N-2608-01	COUPLING, Q.D	1
3	N-2685-12	CAP, DUST	1
4	N-2053-08-S-E	PLUG, H H, #12 O-RING	2
5	N-2463-13-S-E	FITTING, EXPANDER (12-16)	1
6	N-2608-01	COUPLING, Q.D	1
7	J-5541-01	BRACKET, COUPLING KIT	1
8	G-1250-1030N	FLATWASHER, #10 NARROW	2
9	G-1157-103006	SCR, PAN HD CRS REC	2
10	G-1250-1050W	FLATWASHER, 1/4 WIDE	4
11	G-1100-105012	BOLT, HH 1/4-20	4
12	G-1152-105206	SCR, SOC FLT HD CAP 1/4-20	3
13	N-2685-12	CAP, DUST	1
14	HC-2013-916	O-RING SERIES 3	1
15	HC-2013-912	O-RING SERIES 3	1

9.9 ELECTRIC FILL PUMP



Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2701	PUMP/MOTOR, ELECTRIC FILL	REF
2	N-2463-16-S-E	FITTING, REDUCER/EXPANDER	1
3	N-2015-11-S-E	TEE, RUN, STR THD	1
8	TF-1041-09*25.5	ASSEMBLY, HOSE	1
9	TF-1041-09*90.0	ASSEMBLY, HOSE	1
10	TF-1041-05*29.0	ASSEMBLY, HOSE	1
11	TF-1041-02*110	ASSEMBLY, HOSE	1
12	N-2007-03-S-E	CONNECTOR, STR THD	1
13	N-2001-08-S-E	CONNECTOR, STRAIGHT THREAD	1
15	N-2042-06-S-E	ELBOW, 45º STRAIGHT THREAD	1
N/S	EC-1180-08	TERMINAL, RING TONGUE	13

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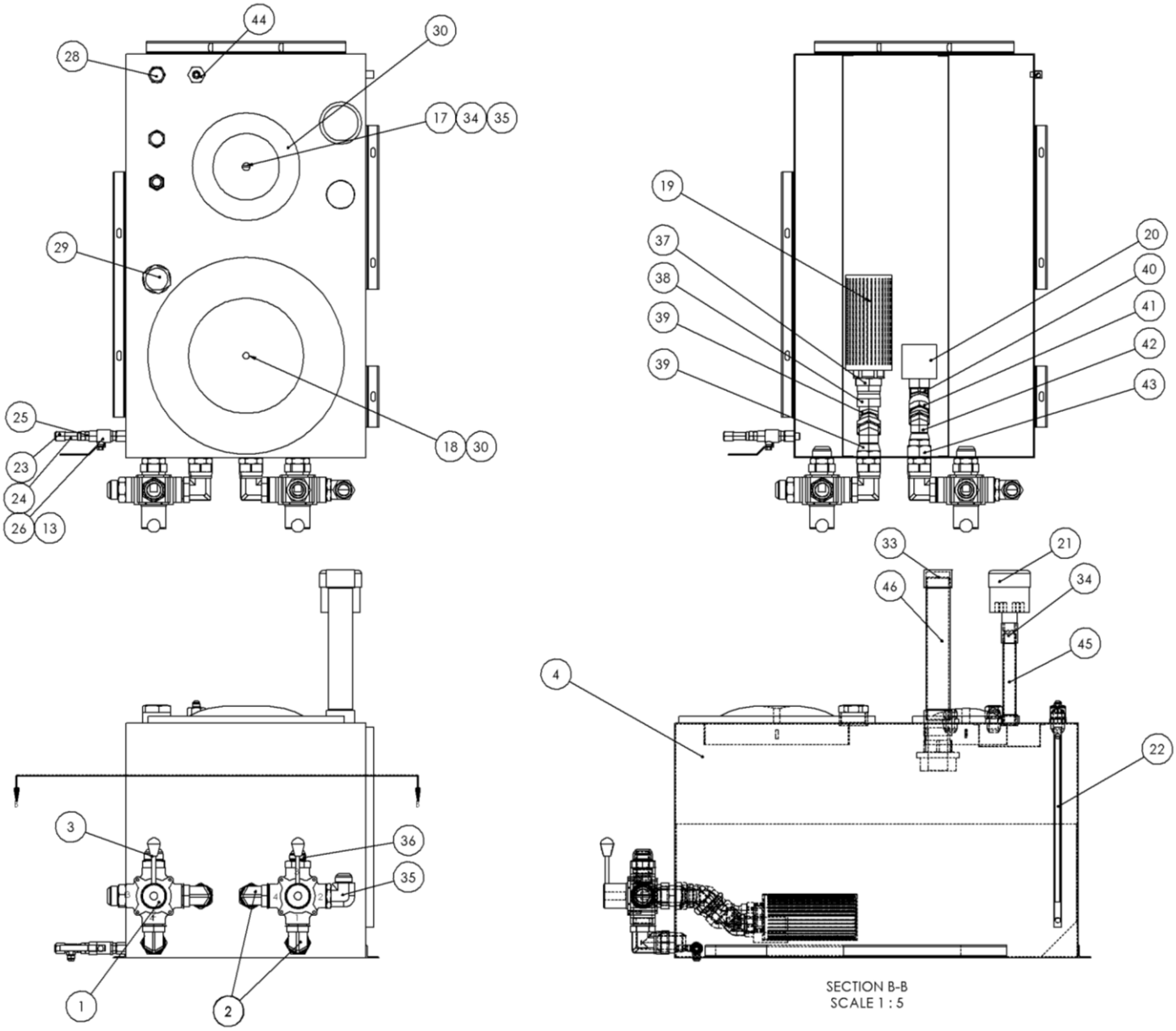
9.10 RESERVOIR ASSEMBLY

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.



9.10 RESERVOIR ASSEMBLY *(continued)*

Parts List

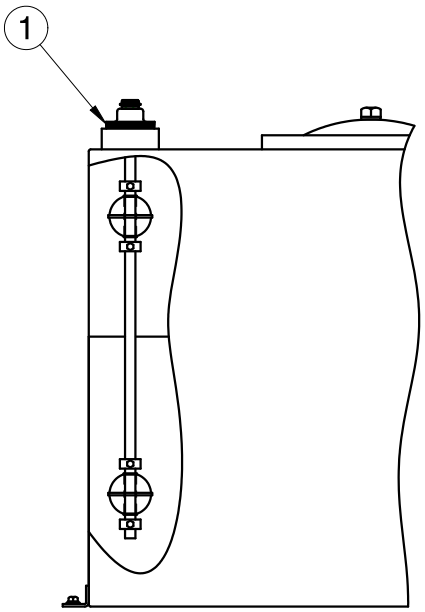
Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-2042-02	VALVE, SELECTOR, #24 SAE	2
2	N-2049-24-S-E	ELBOW, 90°, SWIVEL & O-RING	4
3	N-2007-31-S-E	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-E	CONNECTOR, STRAIGHT THREAD	1
12	HC-1761	VALVE, BALL SAE #8, LOCKABLE	1
13	HC-2013-908	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-2562	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-E	ELBOW, STRAIGHT THREAD	1
23	N-2007-30-S-E	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

9.10.1 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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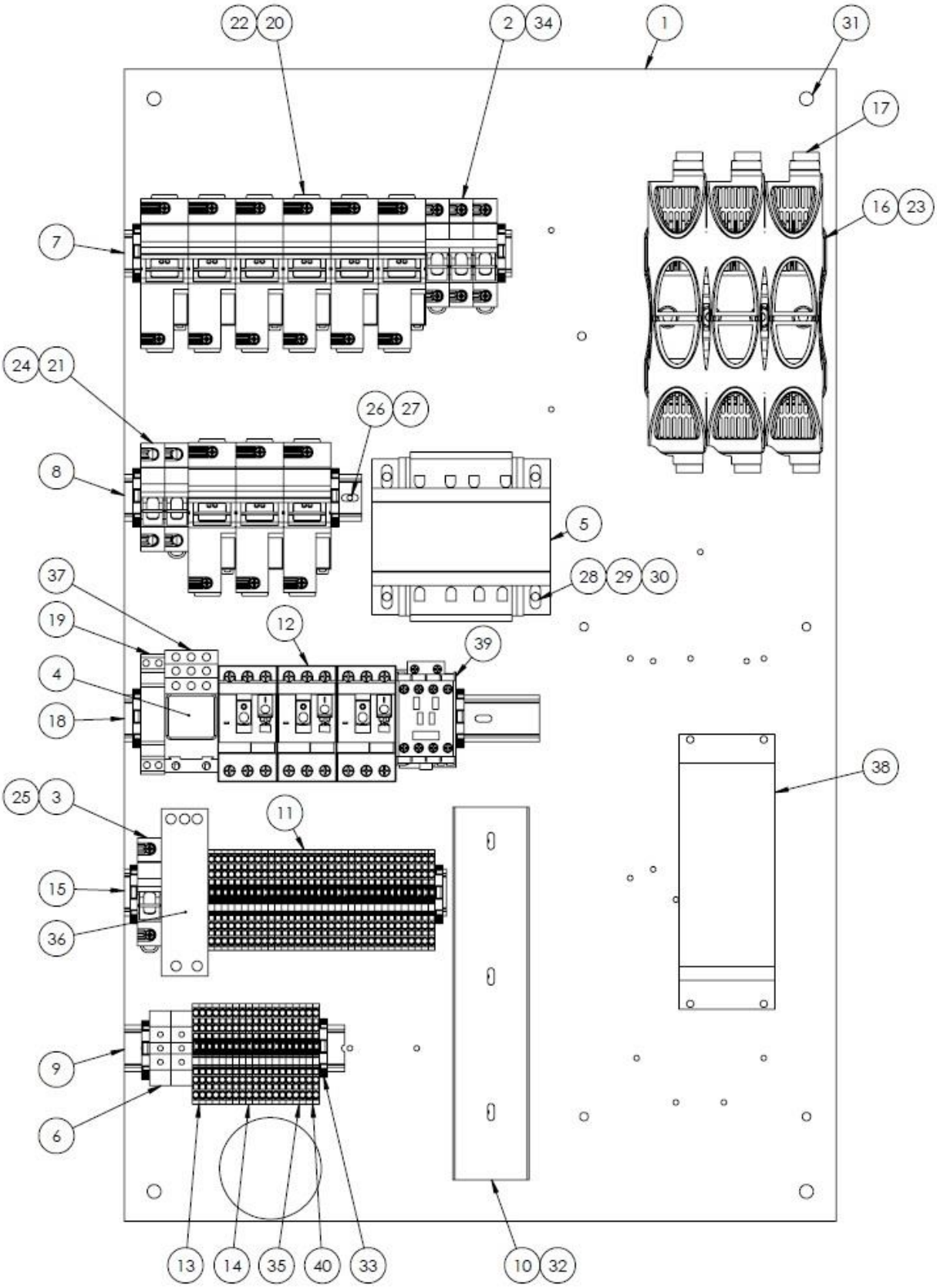
9.11 ELECTRICAL COMPONENTS

9.11.1 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.

9.11.1 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-2882	FUSEHOLDER	1
3	EC-2884	BLOCK, FUSE	1
4	EC-1678	RELAY	1
5	EC-1804-04	TRANSFORMER, 250VA	1
6	EC-1957	BLOCK, GROUNDING	2
7	EC-1895-011.43	RAIL, DIN	1
8	EC-1895-007.00	RAIL, DIN	1
9	EC-1895-006.50	RAIL, DIN	1
10	EC-1710-20-011.00	DUCT, WIRING (11IN)	1
11	EC-2084	TERMINAL BLOCK, 4 COND (RED)	34
12	EC-2465	STARTER, MOTOR	3
13	EC-2923	BLOCK, TERMINAL GROUNDING	5
14	EC-2062	TERMINAL BLOCK, 4 COND (BLUE)	10
15	EC-1895-009.50	RAIL, DIN	1
16	EC-1559	FUSEBLOCK, CLASS J	1
17	EC-1585-06	COVER, FUSE	3
18	EC-1895-012.25	RAIL, DIN	1
19	EC-2690	RELAY, TIME DELAY ON	1
20	EC-2881	FUSEHOLDER, TRIPLE J30	3
21	EC-2883	FUSEHOLDER	1
25	EC-1542-14	SECONDARY FUSE	1
26	G-1159-103504	SCR, RND HD CR REC, #10-32 X 1/2"	44
27	G-1250-1030N	FLATWASHER, #10 NARROW	44
28	G-1159-105516	SCR, RND HD 1/4-28X 1-3/4 LONG	15
29	G-1202-1055	ESN, 1/4-28	15
30	G-1250-1050N	FLATWASHER, 1/4 NAROW	15
31	G-1202-1070	STOPNUT, ELASTIC 3/8-16	4
32	EC-1711-03-011.00	COVER, WIRING DUCT	1
33	13070	ANCHOR, DIN RAIL END	10
34	EC-1675-12	FUSE, KTK, PHASE MONITOR	3
35	EC-2065	TERMINAL BLOCK, 4 COND (BLACK)	2
36	EC-2951	POWER SUPPLY, 12 VDC	1
37	EC-2807	SOCKET, RELAY 11PIN (TPDT)	1
39	EC-1836	CONTACTOR, IEC MOTOR	1
40	EC-2083	TERMINAL BLOCK, 4 COND LT GRAY	2
42	EC-2833	COVER, TERMINAL	1
43	EC-2072	JUMPER	14
44	EC-2077	CARD, MARKING TERMINAL BLOCK	1
45	EC-2078	CARD, MARKING TERMINAL BLOCK	1
46	EC-2079	CARD, MARKING TERMINAL BLOCK	1

9.11.1 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**
22	EC-1557-03	EC-1557-03	EC-1557-02	FUSE, CLASS J, FAN/PUMP	9
23	EC-1556-04	EC-1556-04	EC-1556-02	FUSE, CLASS J, MAIN	3
24	EC-1726-14	EC-1726-14	EC-1726-08	FUSE, CLASS CC, PRIMARY	2
38	EC-2629	EC-2629	EC-2942	SOFTSTART, 110-240V HPU	1

Item	50 Hz Applications				
	380 V	**415 V**	**440**	**Description**	**Qty**
22	EC-1557-03	EC-1557-03	EC-1557-03	FUSE, CLASS J, FAN/PUMP	9
23	EC-1556-04	EC-1556-04	EC-1556-04	FUSE, CLASS J, MAIN	3
24	EC-1726-14	EC-1726-14	EC-1726-14	FUSE, CLASS CC, PRIMARY	2
38	EC-2629	EC-2629	EC-2629	SOFTSTART, 110-240V HPU	1

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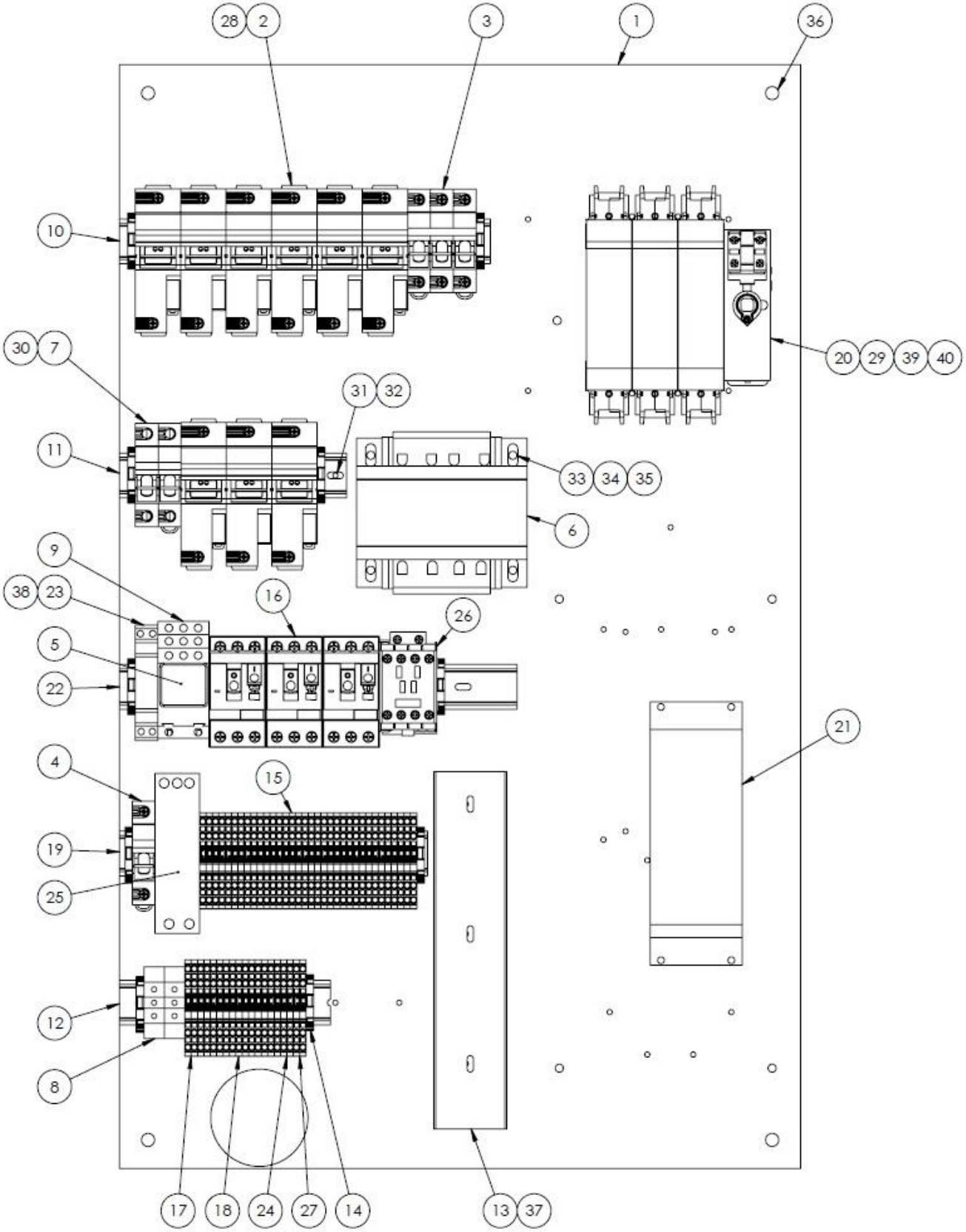
9.11.2 Electrical Components with Softstart and 100 ft Input Cord option



9.11.2 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-2807	SOCKET, RELAY 11PIN (TPDT)	1
10	EC-1895-011.43	RAIL, DIN	1
11	EC-1895-007.00	RAIL, DIN	1
12	EC-1895-006.50	RAIL, DIN	1
13	EC-1710-20-011.00	DUCT, WIRING (11IN)	1
14	13070	ANCHOR, DIN RAIL END	10
15	EC-2084	TERMINAL BLOCK, 4 COND (RED)	34
16	EC-2465	STARTER, MOTOR	3
17	EC-2923	BLOCK, TERMINAL GROUNDING	5
18	EC-2062	TERMINAL BLOCK, 4 COND (BLUE)	10
19	ec-1895-009.50	RAIL, DIN	1
22	EC-1895-012.25	RAIL, DIN	1
23	EC-2690	RELAY, TIME DELAY ON	1
24	EC-2065	TERMINAL BLOCK, 4 COND (BLACK)	2
25	EC-2951	POWER SUPPLY, 12 VDC	1
26	EC-1836	CONTACTOR, IEC MOTOR	1
27	EC-2083	TERMINAL BLOCK, 4 COND LT GRAY	2
31	G-1159-103504	SCR, RND HD CR REC, #10-32 X 1/2"	44
32	G-1250-1030N	FLATWASHER, #10 NARROW	44
33	G-1159-105516	SCR, RND HD 1/4-28 X 1-3/4 LONG	15
34	G-1202-1055	ESN, 1/4-28	15
35	G-1250-1050N	FLATWASHER, 1/4 NARROW	15
36	G-1202-1070	STOPNUT, ELASTIC	4
37	EC-1711-03-011.00	COVER, WIRING DUCT	1
38	EC-1542-14	FUSE, SECONDARY	1
42	EC-2072	JUMPER	14
43	EC-2077	CARD, MARKING TERMINAL BLOCK	1
44	EC-2078	CARD, MARKING TERMINAL BLOCK	1
45	EC-2079	CARD, MARKING TERMINAL BLOCK	1

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

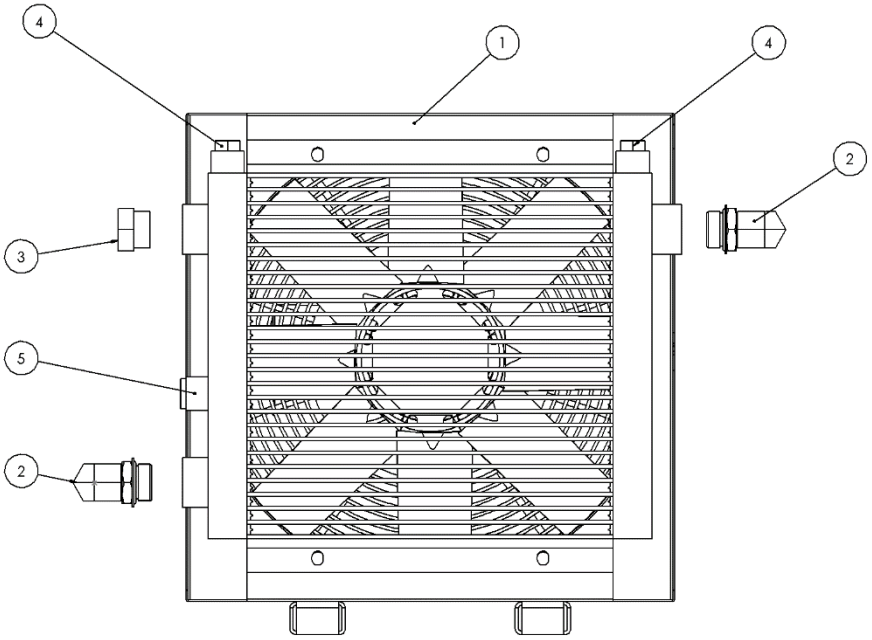
THE FOLLOWING PARTS ARE APPLICATION SPECIFIC
Be sure to locate the correct voltage and hertz of the unit before selecting the part

Item	60 Hz Applications				
	380 V	**480 V**	**575V**	**Description**	**Qty**
20	EC-2653	EC-2653	EC-2669	DISCONNECT, FUSED 100A	1
21	EC-1976	EC-2629	EC-2942	SOFTSTART, 110-240V HPU	1
28	EC-1557-03	EC-1557-03	EC-1557-02	FUSE, CLASS J, FAN/PUMP	9
29	EC-1556-04	EC-1556-04	EC-1556-02	FUSE, CLASS J, MAIN	3
30	EC-1726-14	EC-1726-14	EC-1726-08	FUSE, CLASS CC, PRIMARY	2
39	EC-2655	EC-2655	---	SHAFT, EXTENSION	1
40	EC-2654	EC-2654	---	HANDLE, OPERATING	1

Item	50 Hz Applications				
	380 V	**415 V**	**440**	**Description**	**Qty**
20	EC-2653	EC-2653	EC-2669	DISCONNECT, FUSED 100A	1
21	EC-1976	EC-2629	EC-2942	SOFTSTART, 110-240V HPU	1
28	EC-1557-03	EC-1557-03	EC-1557-02	FUSE, CLASS J, FAN/PUMP	9
29	EC-1556-04	EC-1556-04	EC-1556-02	FUSE, CLASS J, MAIN	3
30	EC-1726-14	EC-1726-14	EC-1726-08	FUSE, CLASS CC, PRIMARY	2
39	EC-2655	EC-2655	EC-2655	SHAFT, EXTENSION	1
40	EC-2654	EC-2654	EC-2654	HANDLE, OPERATING	1

9.12 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-E	CONNECTOR, STR THD, #16 SAE X #16 JIC	2
3	N-2053-10-S-E	PLUG, H H, #16 O-RING	1
4	HC-2013-908	O-RING SERIES 3	2
5	HC-2013-910	O-RING SERIES 3	1

Lower

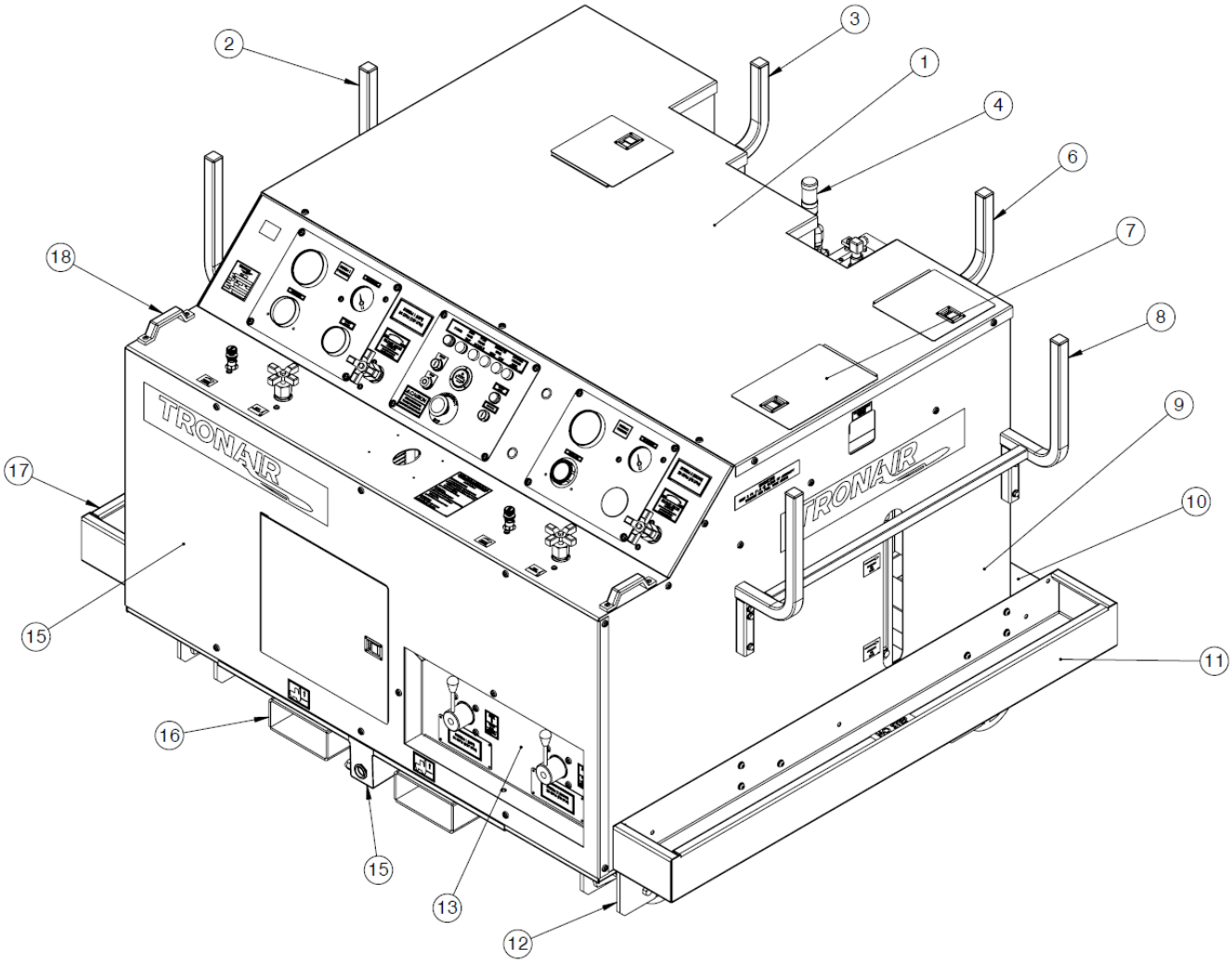
Voltage	Part Number
460 V	HC-2693
575 V/60 Hz	HC-2708

Upper

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

9.13 EXTERNAL COMPONENTS

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



Parts List

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-3733	LIGHT, VERTICAL MOUNT	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

9.13 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

9.14 REPLACEMENT LABELS PARTS LISTS

9.14.1 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 RETURE	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

9.14.2 Fluid Labels

Fluid Type: Aviation Phosphate Ester, Type IV

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

9.14.3 Filter Element Kit Labels

Fluid Type: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
V-2631	LABEL, REPLACEMENT FILTER ELEMENT K-5083	1
V-1962	LABEL, REPLACEMENT FILTER ELEMENT K-3428	1
V-1916	LABEL, REPLACEMENT DESICCANT FILTER ELEMENT HC-1763	1
V-1906	LABEL, REPLACEMENT FILTER ELEMENT K-3419	1
V-2632	LABEL, REPLACEMENT FILTER ELEMENT K-5084	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: Aviation Phosphate Ester, Type IV

Part Number	Description	Qty
HC-1763	Desiccant Filter Element	1
K-5083	Kit, Pressure Filter Element	1
K-5084	Kit, Pressure Filter Element	1
K-3616	Kit, Return Filter Element	1
K-3494	Kit, Return Filter Element	1
940832Q	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-2314, INS-2375)
APPENDIX IV	Wiring Diagram (INS-2329)
APPENDIX V	Safety Data Sheet (SDS) pertaining to Hydraulic Fluid
APPENDIX VI	Instrument Certification Notice

APPENDIX I

Declaration of Conformity

EU Declaration of Conformity

Model Number(s) TADHPU-5GS
Product Type/Name: Dual Hydraulic Power Unit (Electric Motor Driven)

Declaration: Tronair has assessed the equipment described above against the Essential Health and Safety Requirements of one or more Directives. Based on this assessment, the equipment described above is deemed to comply with the directive(s) listed below.

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Directives: European Machinery Directive 2006/42/EC

Standards:

EN 60204-1:1997	Safety of machinery – Electrical equipment of machines - Part 1: General requirements
EN 982:1996	Safety of machinery – Safety requirements for fluid power systems and their components - Hydraulics
ISO 4021:1997	Hydraulic fluid power – Particulate contamination analysis - Extraction of fluid samples from lines of an operating system
NFPA 70/NEC 1999	National electric code
NFPA/JIC T2.24.1-1990	Hydraulic fluid power – Systems standard for stationary industrial machinery – Supplement to ISO 4413:1998
SAE ARP 1247B	Aircraft ground support equipment – General requirements

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Markings: CE

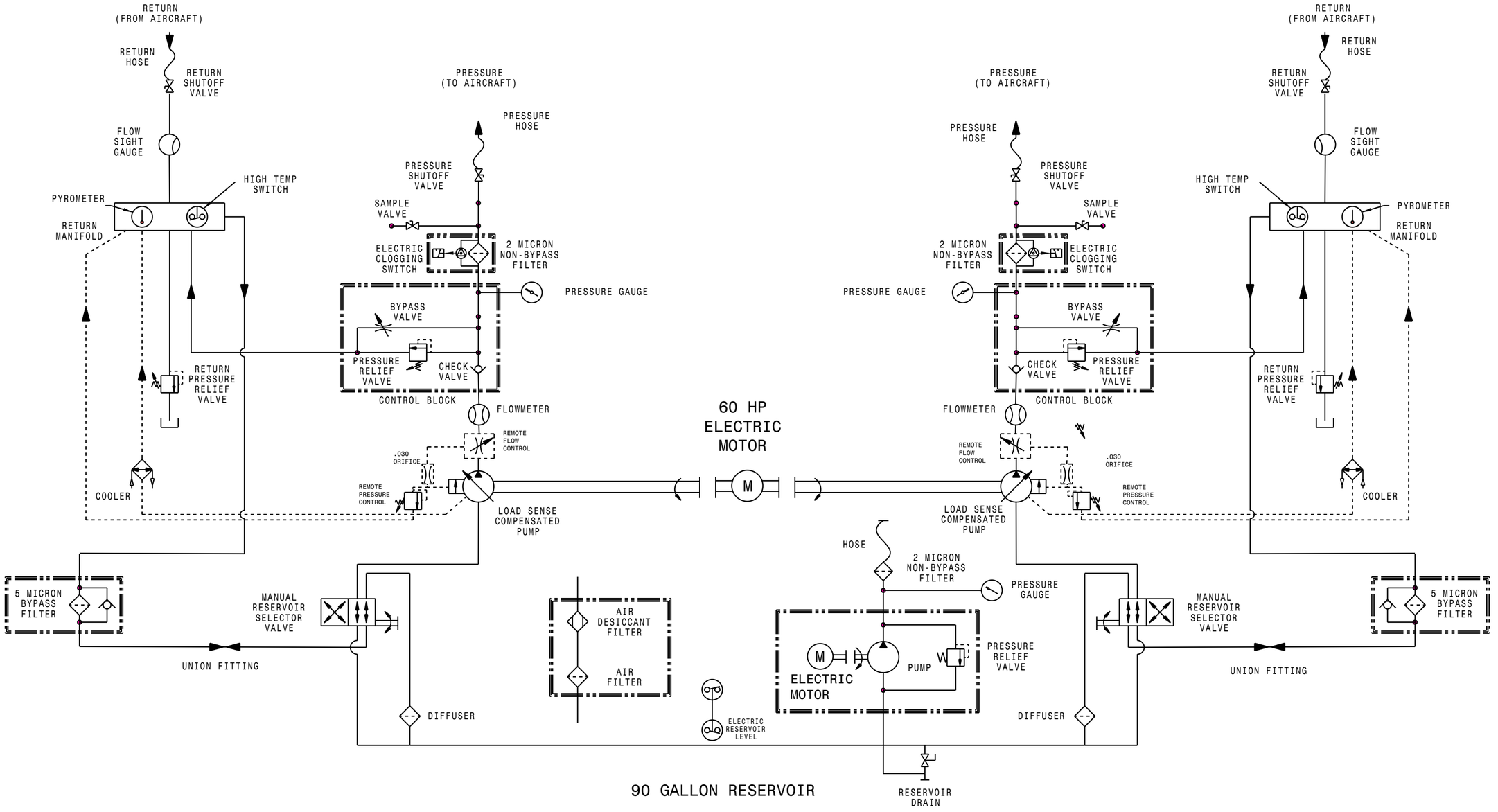
Location of Issue: Tronair, 1 Air Cargo Parkway East, Swanton, OH 43558

Identification of person empowered to sign on behalf of the Manufacturer: Quality Assurance Representative

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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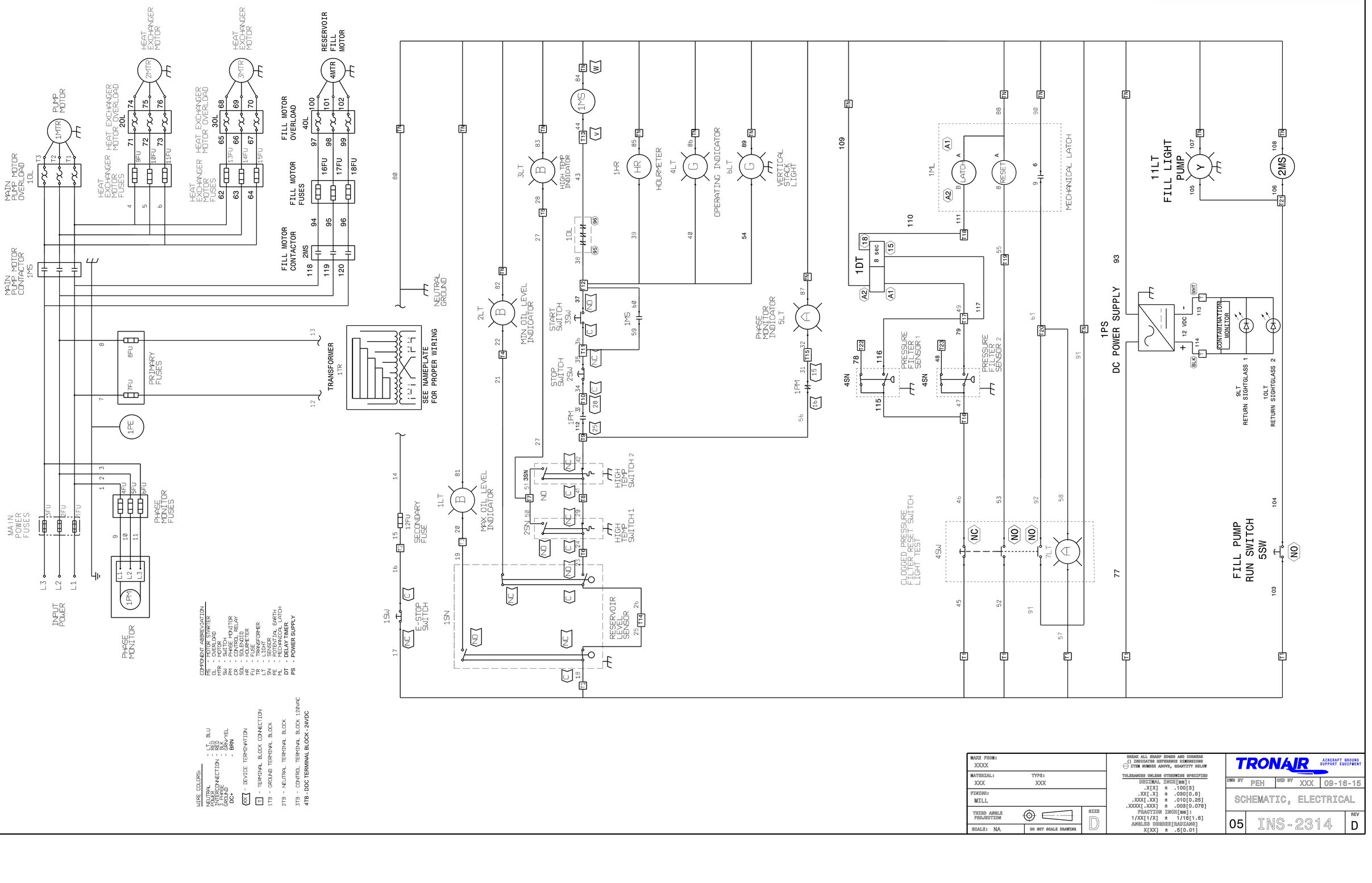
APPENDIX III

Electrical Schematic
(INS-2314, INS-2375)

LET	REVISION	EC	DWN	CHK	DATE
A	ORIGINAL RELEASE	19828	-	-	09-16-15
B	ADDED 1DT & TB #	19828	PEH	KB	04-24-16
C	ADDED WIRE 120	20280	CDG	JMB	12-20-16
D	SWAPPED 78 AND 116 SWAPPED 79 AND 48	22416	AS	PEH	02-01-21



WIRE COLORS:

NEUTRAL - LT. BLU
GROUND - GRN/YEL
INTERCONNECTION - RED
CONTROL - 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
MTR - MOTOR
SW - SWITCH
PM - PHASE MONITOR
CR - CONTROL RELAY
SOL - SOLENOID
HR - HOURMETER
TU - TUBE
TX - TRANSFORMER
LT - LIGHT
SN - SENSOR
PE - EQUIPMENTAL EARTH
ML - MECHANICAL LATCH
DT - DELAY TIMER
PS - POWER SUPPLY

MACH FROM: XXXX		BREAK ALL SHARP EDGES AND CORNERS () INDICATES REFERENCE DIMENSIONS XTEM NUMBER ABOVE, QUANTITY BELOW	TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT
MATERIAL: XXX	TYPE: XXX	TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL XXX[mm]: .X[X] ± .100[3] .XX[.X] ± .030[0.8] .XXX[.XX] ± .010[0.25] .XXXX[.XXX] ± .003[0.076] FRACTION XX[mm]: 1/XX[1/X] ± 1/16[1.6] ANGLES DEGREE[RADIANS] X[XX] ± .5[0.01]	DWN BY PEH CKD BY XXX 09-16-15
FINISH: MILL			SCHEMATIC, ELECTRICAL
THIRD ANGLE PROJECTION	SIZE D		05 INS-2314 REV D
SCALE: NA	DO NOT SCALE DRAWING		

LET	REVISION	EC	DWN	CHK	DATE
A	ORIGINAL RELEASE	20378	-	-	03-29-17
B	SWAPPED 78 AND 116 SWAPPED 79 AND 48	22416	AS	PEH	02-01-21
C	ADD CONTAMINATION MONITOR	22799	JMW	ADO	06-30-21


PUMP MOTOR
HEAT EXCHANGER MOTOR
RESERVOIR FILL MOTOR
HEAT EXCHANGER MOTOR OVERLOAD
HEAT EXCHANGER MOTOR FUSES
FILL MOTOR OVERLOAD
FILL MOTOR FUSES
FILL MOTOR CONTACTOR
AB SMC-3 CONTROLLER
PRIMARY FUSES
TRANSFORMER
SEE NAMEPLATE FOR PROPER WIRING
NEUTRAL GROUND
MAIN POWER FUSES
INPUT POWER
SECONDARY FUSE
E-STOP SWITCH
HIGH TEMP INDICATOR
MIN OIL LEVEL INDICATOR
MAX OIL LEVEL INDICATOR
START SWITCH
STOP SWITCH
HIGH TEMP SWITCH 1
HIGH TEMP SWITCH 2
RESERVOIR LEVEL SENSOR
HOURMETER
OPERATING INDICATOR
VERTICAL STACK LIGHT
N.O. AUXILLARY CONTACT #1
N.O. FAULT CONTACT
AB SMC-3 CONTROLLER
FAULT INDICATOR
MECHANICAL LATCH
PRESSURE FILTER SENSOR 1
PRESSURE FILTER SENSOR 2
CLOGGED PRESSURE FILTER RESET SWITCH LIGHT TEST
DC POWER SUPPLY
CONTAMINATION MONITOR
RETURN SIGHTGLASS 1
RETURN SIGHTGLASS 2
FILL LIGHT PUMP
FILL PUMP RUN SWITCH
COMPONENT ABBREVIATION
MS - MOTOR STARTER
OL - OVERLOAD
MTR - MOTOR
SW - SWITCH
PM - PHASE MONITOR
CR - CONTROL RELAY
SOL - SOLENOID
HR - HOURMETER
FU - FUSE
TR - TRANSFORMER
LT - LIGHT
SN - SENSOR
PE - POTENTIAL EARTH
ML - MECHANICAL LATCH
DT - DELAY TIMER
PS - POWER SUPPLY
WIRE COLORS:
NEUTRAL - LT. BLU
POWER - RED
INTERCONNECTION - BLK
3 PHASE - BLK
GROUND - GRN/YEL
DC+ - BRN
- DEVICE TERMINATION
- TERMINAL BLOCK CONNECTION
1TB - GROUND TERMINAL BLOCK
2TB - NEUTRAL TERMINAL BLOCK
3TB - CONTROL TERMINAL BLOCK 120VAC
4TB - DDC TERMINAL BLOCK - 24VDC

MAKE FROM: XXXX	
MATERIAL: XXX	TYPE: XXX
FINISH: MILL	
THIRD ANGLE PROJECTION	SIZE D
SCALE: NA	DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND CORNERS
() INDICATES REFERENCE DIMENSIONS
ITEM NUMBER ABOVE, QUANTITY BELOW

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]

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY CDG	CKD BY KWB	03-29-17

SCHEMATIC, ELECTRICAL

05 INS-2375 REV C

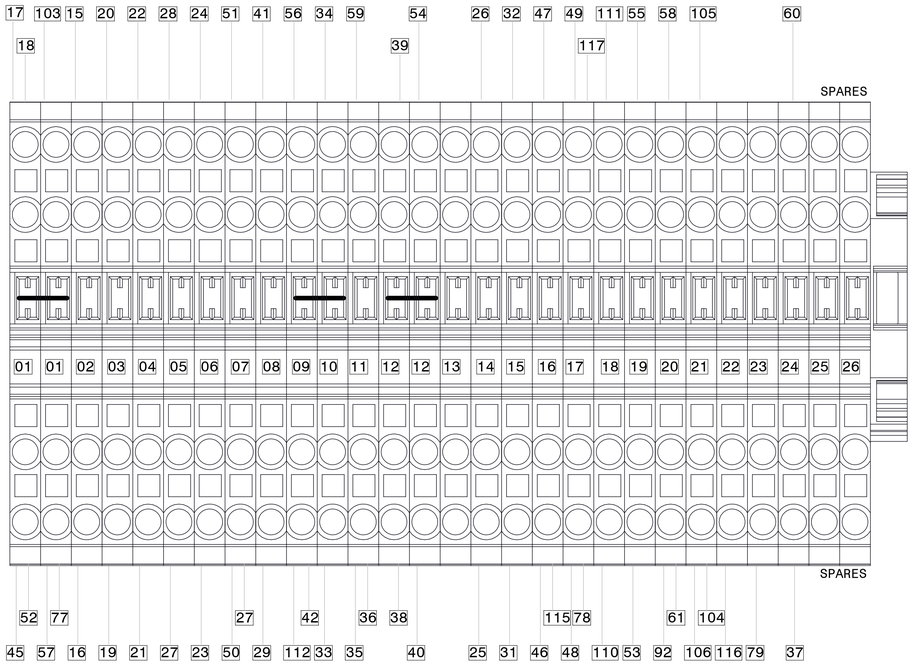
TRONAIR®

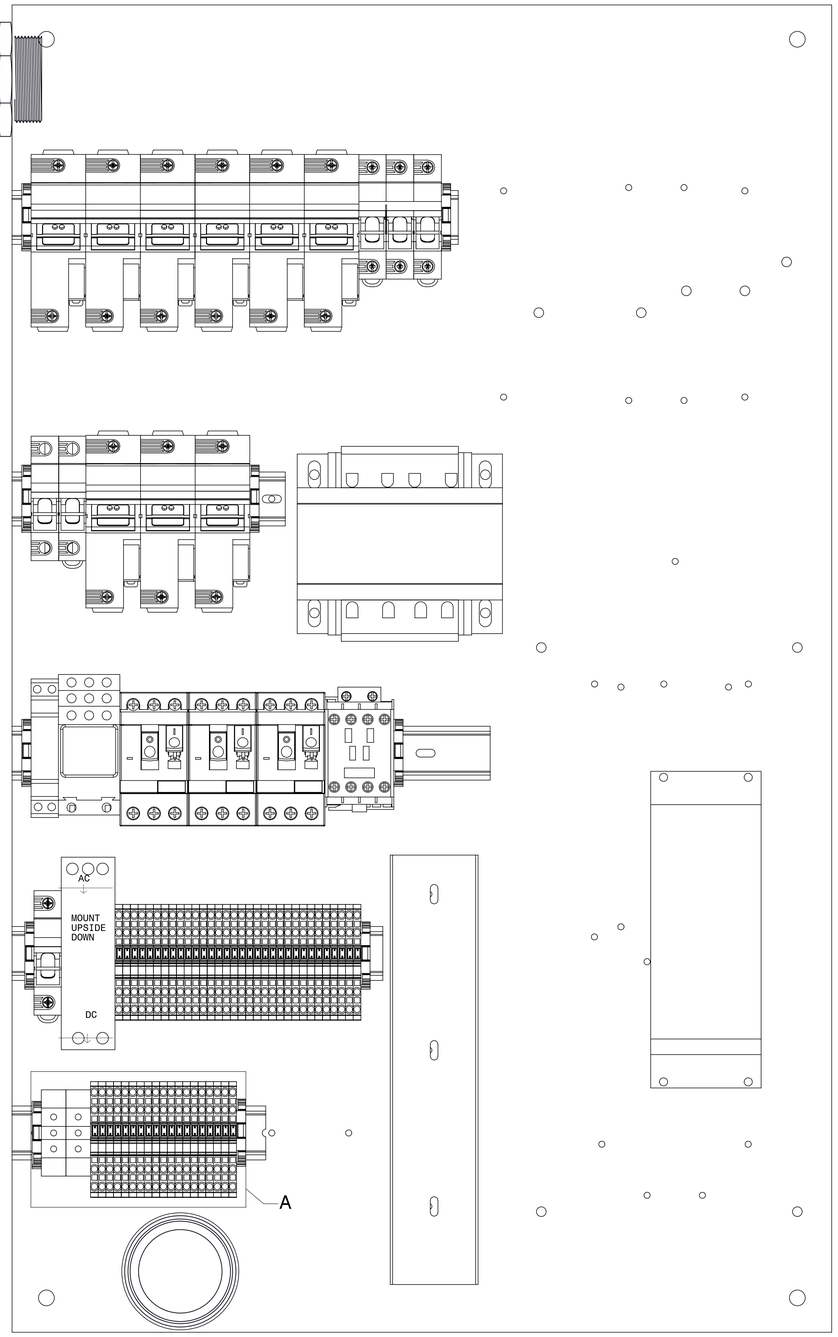
APPENDIX IV

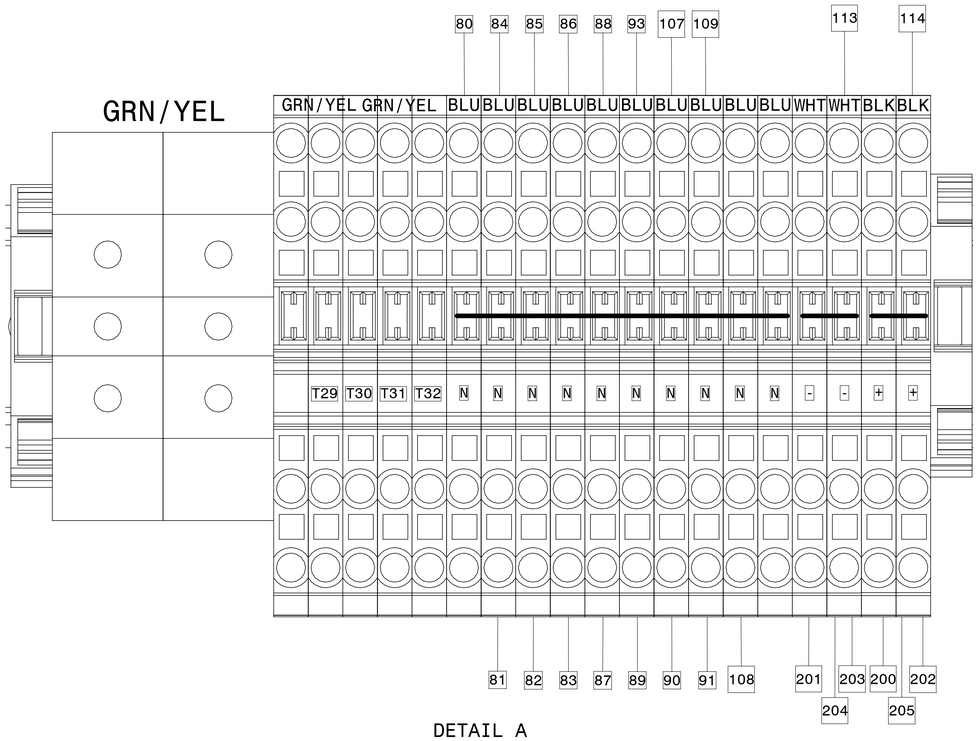
Wiring Diagram
(INS-2329)

RED TERMINALS

REVISIONS					
LET	REVISION	EC	BY	CHK	DATE
A	ORIGINAL RELEASE	19932	PEH	-	05-27-16
B	MODIFY CONTAMINATION MONITOR WIRING	22799	JMW	ADO	07-02-21
C	UPDATE TERMINAL DRAWING. ADD WIRE LABELS	22827	JMW	PEH	08-03-21





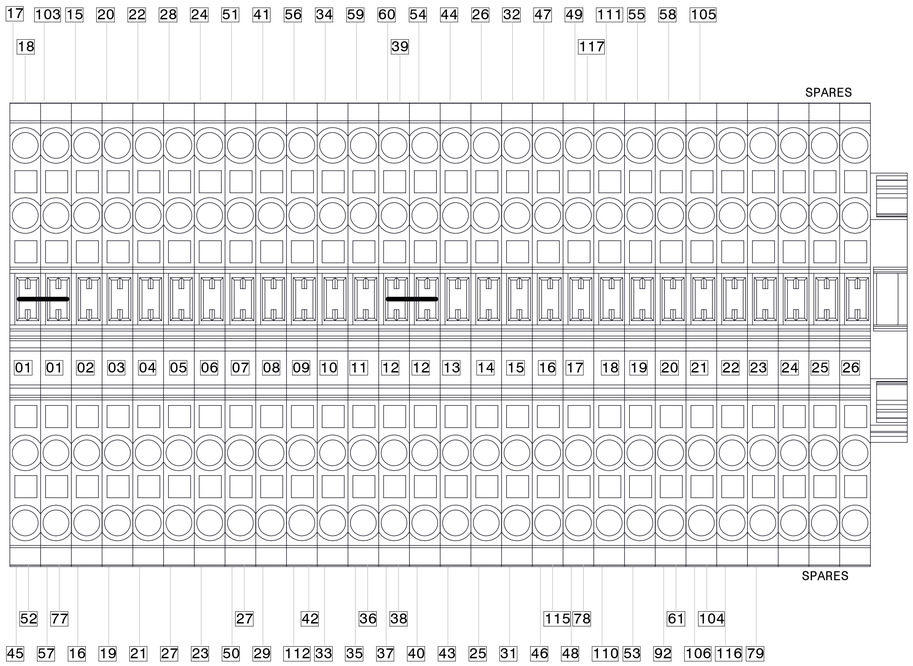


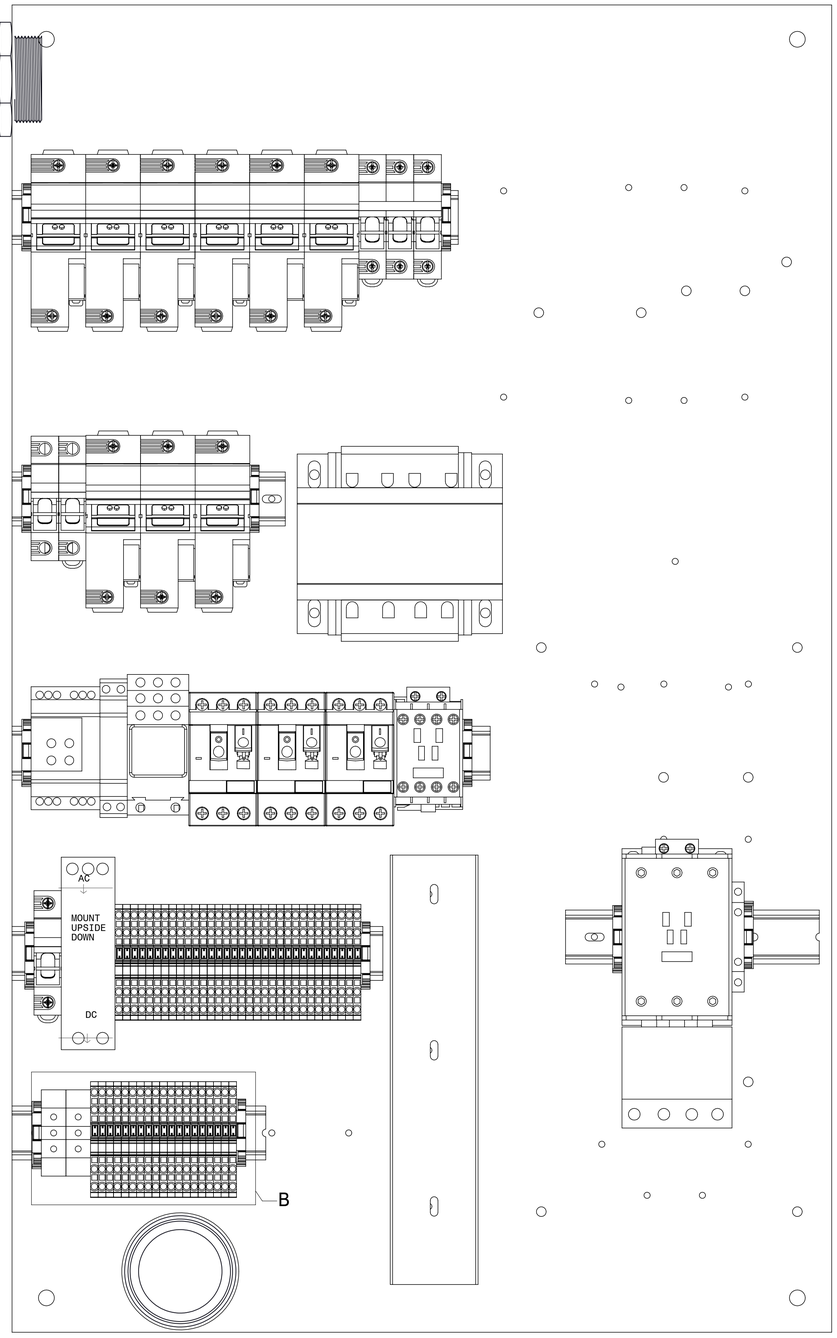
DETAIL A
SCALE 3 : 1

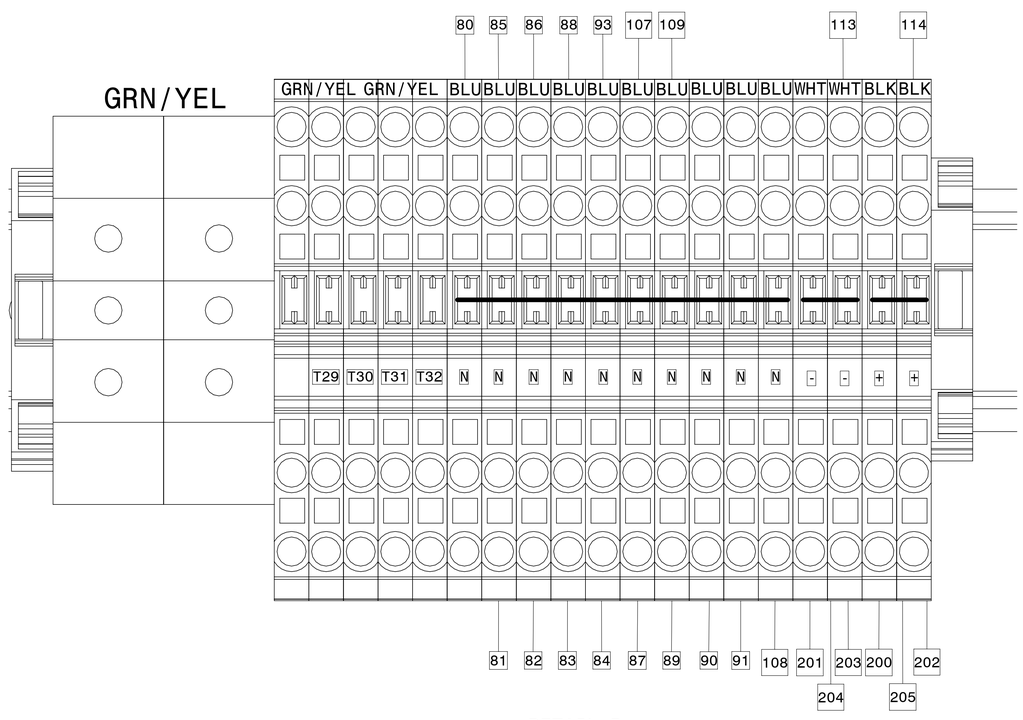
ELECTRICAL OPTIONS 15-18, & 23-26, SOFT START ONLY

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 [XX] ± .5 [.001]	DWN BY: CDG CKD BY: JCF DATE: 12/21/2016	
FINISH: MILL		ASSEMBLY, ELECTRICAL	
THIRD ANGLE PROJECTION SCALE: 1:4	SIZE: E	05 INS-2329 REV: C	
DO NOT SCALE DRAWING		WEIGHT: 52.18 LB	SHEET 1 OF 3

RED TERMINALS





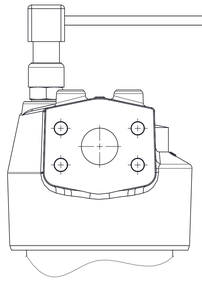


DETAIL B
SCALE 3 : 1

ELECTRICAL OPTIONS 11-14, & 19-22, NON-SOFT START ONLY

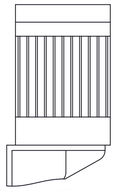
Z-8870

THIRD ANGLE PROJECTION	TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT	
SCALE: 1:4 DO NOT SCALE	ASSEMBLY, ELECTRICAL	
SIZE E	Z INS-2329	REV C
	WEIGHT: 52.75 LB	SHEET 2 OF 3



PRESSURE CLOGGING
(FROM PRESSURE FILTER SYSTEM 2)

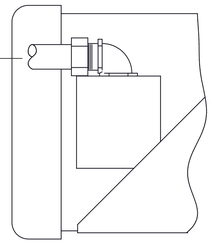
(BLK) 47
(RED) 48
(WHT) 79
(GRN) GND



GND
NEU
HOT
89
54

VERTICAL MOUNT
STACK LIGHT

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



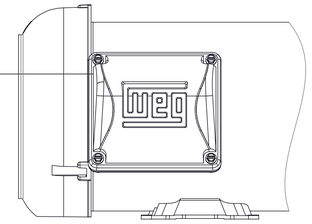
HEAT EXCHANGER MOTOR BOX
(SYSTEM 2)

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

SIGHTGAUGE BACKLIGHT

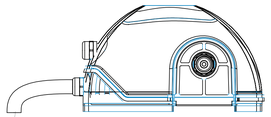
XXX
XXX
XXX
XXX

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



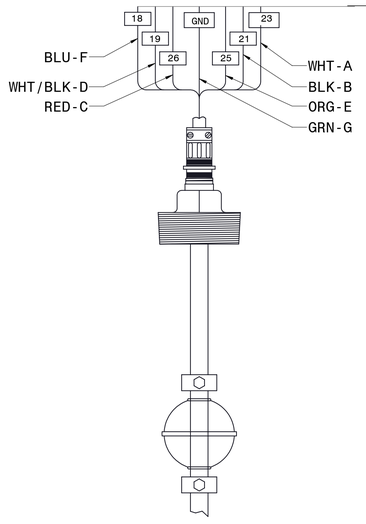
FILL PUMP MOTOR BOX

+(RED) 205
-(BLU) 204



OPTION, ICOUNT

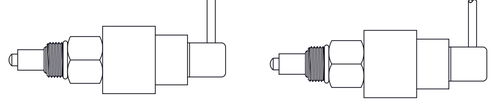
plug



MULTI-LEVEL SWITCH
(FROM RESERVOIR)

YEL/GRN GND
WHT 29
BLK 24
RED 50

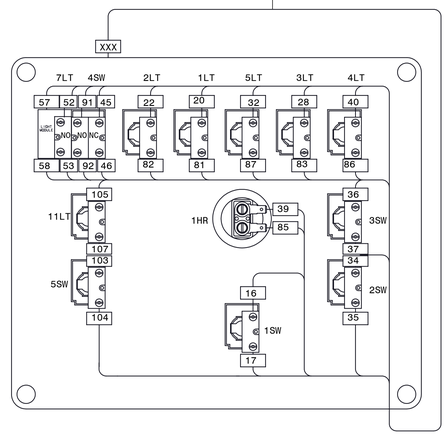
YEL/GRN GND
WHT 42
BLK 41
RED 51



TEMPERATURE SWITCH
(FROM RETURN MANIFOLD 1)

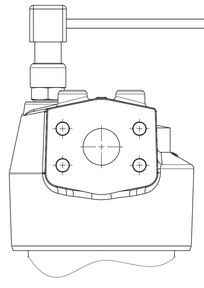
TEMPERATURE SWITCH
(FROM RETURN MANIFOLD 2)

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

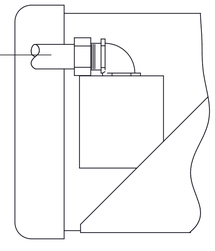


ELECTRICAL INSTRUMENT PANEL
(LOOKING FROM REAR OF PANEL)

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



PRESSURE CLOGGING
(FROM PRESSURE FILTER SYSTEM 1)



HEAT EXCHANGER MOTOR BOX
(SYSTEM 1)

REF: INS-2375 ELECTRICAL SCHEMATIC (softstart)
INS-2314 ELECTRICAL SCHEMATIC (non-softstart)

TADHPU-5GS

THIRD ANGLE PROJECTION
SCALE: 1:4 DO NOT SCALE
SIZE E
TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT
ASSEMBLY, ELECTRICAL
Z INS-2329 REV C
WEIGHT:
SHEET 3 OF 3

APPENDIX V

Safety Data Sheet (SDS)
Hydraulic Fluid – Phosphate Ester, Type IV or V

Skydrol® LD4 Fire Resistant Hydraulic Fluid

Version	Revision Date:	SDS Number:	Date of last issue: 06/02/2015
2.2	08/09/2016	150000093409	Date of first issue: 10/24/2013

SDSUS / PRD / 0001

SECTION 1. IDENTIFICATION

Product name : Skydrol® LD4 Fire Resistant Hydraulic Fluid

Product code : P3410201

Manufacturer or supplier's details

Company name of supplier : Eastman Chemical Company

Address : 200 South Wilcox Drive
Kingsport TN 37660-5280

Telephone : (423) 229-2000

Emergency telephone number : CHEMTREC: +1-800-424-9300, +1-703-527-3887 CCN7321
For emergency transportation information, in the United States: call CHEMTREC at 800-424-9300 or call 423-229-2000.

Recommended use of the chemical and restrictions on use

Recommended use : Hydraulic fluids

Restrictions on use : None known.

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Skin irritation : Category 2

Carcinogenicity : Category 2

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : H315 Causes skin irritation.
H351 Suspected of causing cancer.

Precautionary statements : **Prevention:**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
Storage:
P405 Store locked up.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Chemical name	CAS-No.	Concentration (% w/w)
Tributyl phosphate	126-73-8	55 - 65
Dibutylphenylphosphate	2528-36-1	20 - 30
Butyl diphenyl phosphate	2752-95-6	5 - 10
7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester	62256-00-2	< 10
butylated hydroxytoluene	128-37-0	1

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
If breathing is difficult, give oxygen.
Consult a physician if necessary.

In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes.
Get medical attention if symptoms occur.
Wash contaminated clothing before reuse.

In case of eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.
Get medical attention if symptoms occur.

If swallowed : Call a physician or poison control centre immediately.
Do not induce vomiting without medical advice.
Rinse mouth.
Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed : Causes skin irritation.
Suspected of causing cancer.

Notes to physician	:	Treat symptomatically.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Water spray Carbon dioxide (CO2) Dry chemical Foam
Unsuitable extinguishing media	:	Do not use a solid water stream as it may scatter and spread fire.
Hazardous combustion products	:	carbon dioxide, carbon monoxide oxides of phosphorus
Further information	:	Use a water spray to cool fully closed containers. Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for firefighters	:	Wear an approved positive pressure self-contained breathing apparatus in addition to standard fire fighting gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Ventilate the area. Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. Avoid contact with skin and eyes. Material can create slippery conditions. Wear appropriate personal protective equipment. Local authorities should be advised if significant spillages cannot be contained.
Environmental precautions	:	Clear up spills immediately and dispose of waste safely. Avoid release to the environment. Collect spillage.
Methods and materials for containment and cleaning up	:	Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	Do not breathe vapours or spray mist. Handle product only in closed system or provide appropriate exhaust ventilation at machinery. In case of insufficient ventilation, wear suitable respiratory equipment. Wear appropriate personal protective equipment. Avoid contact with skin, eyes and clothing.

Wash thoroughly after handling.
Wash contaminated clothing before reuse.
Drain or remove substance from equipment prior to break-in or maintenance.
Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage : Store locked up.
Keep container tightly closed in a dry and well-ventilated place.
Keep in a cool place away from oxidizing agents.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Tributyl phosphate	126-73-8	TWA (Inhalable fraction and vapor)	5 mg/m3	ACGIH
		TWA	0.2 ppm 2.5 mg/m3	NIOSH REL
		TWA	5 mg/m3	OSHA Z-1
		TWA	0.2 ppm 2.5 mg/m3	OSHA P0
Dibutylphenylphosphate	2528-36-1	TWA	0.3 ppm	ACGIH
butylated hydroxytoluene	128-37-0	TWA (Inhalable fraction and vapor)	2 mg/m3	ACGIH
		TWA	10 mg/m3	NIOSH REL
		TWA	10 mg/m3	OSHA P0

Hazardous components without workplace control parameters

Components	CAS-No.
7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester	62256-00-2

Engineering measures : Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal protective equipment

Respiratory protection : Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.

Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable.
If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Hand protection

Remarks : Wear suitable gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. After contamination with product change the gloves immediately and dispose of them according to relevant national and local regulations.

Eye protection : Wear safety glasses with side shields (or goggles).

Skin and body protection : Wear suitable protective clothing.

Protective measures : Ensure that eye flushing systems and safety showers are located close to the working place.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	oily
Colour	:	purple
Odour	:	odourless
pH	:	No data available
Melting point/range	:	< -62 °C
Flash point	:	160 °C Method: Cleveland open cup
Vapour pressure	:	0.27 hPa (25 °C)
Relative density	:	1.004 - 1.014 (25 °C)
Viscosity		
Viscosity, kinematic	:	< 2000 mm2/s (-54 °C)
		11.15 mm2/s (38 °C)
		3.83 mm2/s (99 °C)

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None reasonably foreseeable.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	None known.
Conditions to avoid	:	None known.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products	:	Emits acrid smoke and fumes when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Not classified based on available information.

Product:

Acute oral toxicity	:	LD50 (Rat, Male and Female): 2,100 mg/kg
Acute inhalation toxicity	:	LC50 (Rat, male): > 5.8 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity Remarks: (highest concentration tested)
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 3,160 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Components:

Tributyl phosphate:

Acute oral toxicity	:	LD50 Oral (Rat, Male and Female): 1,553 mg/kg Method: Acute Oral Toxicity Assessment: Harmful if swallowed.
Acute inhalation toxicity	:	LC50 (Rat, Male and Female): > 4.242 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 3,100 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Dibutylphenylphosphate:

Acute oral toxicity : Acute toxicity estimate (Rat, Male and Female): 2,400 - 3,000 mg/kg
Assessment: Not classified

Acute inhalation toxicity : LCLo (Rat, Male and Female): > 5 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

LC50 (Rat, Male and Female): > 5 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist
Assessment: Not classified

Acute dermal toxicity : LD50 Dermal (Rabbit, Male and Female): > 5,000 mg/kg
Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Acute oral toxicity : LD50 Oral (Rat, Male and Female): 4,470 mg/kg

Acute dermal toxicity : LD50 Dermal (Rabbit, Male and Female): > 7,940 mg/kg

butylated hydroxytoluene:
Acute oral toxicity : LD50 Oral (Rat): > 6,000 mg/kg

Acute dermal toxicity : LD50 Dermal (Guinea pig): > 20,000 mg/kg

Skin corrosion/irritation

Causes skin irritation.

Product:

Species: Rabbit
Exposure time: 24 h
Assessment: irritating
Result: moderate irritation

Components:

Tributyl phosphate:
Species: Rabbit
Exposure time: 4 h
Assessment: Causes skin irritation.
Method: Acute Dermal Irritation / Corrosion
Result: irritating

Dibutylphenylphosphate:
Species: Rabbit
Assessment: Not classified

Species: Humans
Exposure time: 24 h
Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Species: Rabbit

Exposure time: 24 h
Assessment: Not classified as hazardous.
Result: slight to moderate irritation

butylated hydroxytoluene:
Species: Rabbit
Exposure time: 24 h
Result: very slight

Serious eye damage/eye irritation

Not classified based on available information.

Product:

Species: Rabbit
Result: slight
Exposure time: 24 h
Assessment: Not classified

Components:

Tributyl phosphate:
Species: Rabbit
Result: slight irritation
Exposure time: 24 h
Assessment: Not classified
Method: Acute Eye Irritation / Corrosion

Dibutylphenylphosphate:
Species: Rabbit
Result: slight
Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Species: Rabbit
Result: slight irritation
Exposure time: 24 h
Assessment: Not classified

butylated hydroxytoluene:
Species: Rabbit
Result: none

Respiratory or skin sensitisation

Skin sensitisation: Not classified based on available information.
Respiratory sensitisation: Not classified based on available information.

Product:

Test Type: Human experience
Assessment: Not classified
Method: Human Repeat Insult Patch Test
Result: Does not cause skin sensitisation.

Components:

Tributyl phosphate:
Test Type: Skin Sensitization
Species: Guinea pig
Assessment: Not classified
Result: Does not cause skin sensitisation.

Test Type: Skin Sensitization
Species: Humans
Assessment: Not classified
Result: Does not cause skin sensitisation.

Dibutylphenylphosphate:
Test Type: Human experience
Species: Humans
Assessment: Not classified
Result: non-sensitizing

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Test Type: Skin Sensitization
Species: Guinea pig
Result: May cause sensitisation by skin contact.

butylated hydroxytoluene:
Test Type: Skin sensitisation
Species: Guinea pig
Result: non-sensitizing

Germ cell mutagenicity

Not classified based on available information.

Product:

Genotoxicity in vitro	:	Test Type: Salmonella typhimurium assay (Ames test) Metabolic activation: +/- activation Result: negative
	:	Test Type: Mutagenicity - Mammalian Metabolic activation: +/- activation Method: In vitro Mammalian Chromosome Aberration Test Result: negative

Components:

Tributyl phosphate:

Genotoxicity in vitro	:	Test Type: Mutagenicity - Bacterial Metabolic activation: +/- activation Method: Bacterial Reverse Mutation Assay Result: negative
	:	Test Type: Mutagenicity - Mammalian Metabolic activation: +/- activation Method: In vitro Mammalian Chromosome Aberration Test Result: equivocal
Genotoxicity in vivo	:	Species: Rat (Male and Female)

Application Route: oral: gavage
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: negative

Dibutylphenylphosphate:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Cell Gene Mutation Test
Result: negative

: Test Type: Chromosome aberration test in vitro
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: - activation
Method: Genetic Toxicology: DNA Damage and Repair, Unscheduled DNA Synthesis in Mammalian Cells In Vitro
Result: negative

Genotoxicity in vivo : Species: Rat (Male and Female)
Application Route: intraperitoneal injection
Result: negative

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: equivocal

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Cell Gene Mutation Test
Result: negative

Genotoxicity in vivo : Species: Rat (Male and Female)
Application Route: intraperitoneal injection
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: equivocal

Carcinogenicity

Suspected of causing cancer.

Components:

Tributyl phosphate:
Species: Rat, (Male and Female)
Application Route: Ingestion
Method: EPA OTS 798.3300
Remarks: Limited evidence of a carcinogenic effect.
May cause cancer.

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

Components:

Tributyl phosphate:

Effects on fertility	:	Test Type: Two Generation Reproductive Toxicity Study Species: Rat Sex: Male and Female Application Route: Ingestion NOAEL: 225 mg/kg, Method: EPA OTS 798.4900
Effects on foetal development	:	Species: Rat Application Route: Oral 750 mg/kg Method: EPA OTS 798.4900

Dibutylphenylphosphate:

Effects on fertility	:	Species: Rat Sex: Male and Female Application Route: Ingestion NOAEL: 5 mg/l, F1: Lowest observed adverse effect level 50 mg/kg, F2: Lowest observed adverse effect level 50 mg/kg, Method: EPA OTS 798.4900
Effects on foetal development	:	Species: Rat Application Route: oral (gavage)

300 mg/kg
3 mg/kg

STOT - single exposure

Not classified based on available information.

Components:

Tributyl phosphate:
Assessment: Based on available data, the classification criteria are not met.

Dibutylphenylphosphate:
Assessment: Not classified

STOT - repeated exposure

Not classified based on available information.

Components:

Tributyl phosphate:
Assessment: Based on available data, the classification criteria are not met.

Dibutylphenylphosphate:
Exposure routes: inhalation (dust/mist/fume)
Target Organs: Respiratory system
Assessment: Not classified

Repeated dose toxicity

Product:

Species: Rat, Male and Female
NOAEL: 40 mg/m3
Application Route: Inhalation
Exposure time: 28 days
Target Organs: Blood, Respiratory system
Remarks: Irritating to eyes and respiratory system.

Components:

Tributyl phosphate:
Species: Mouse, Male and Female
NOEL: 75 mg/kg
Application Route: in feed
Exposure time: 90 days

Dibutylphenylphosphate:
Species: Rat, Male and Female
NOAEL: 5 mg/kg
LOAEL: 50 mg/kg
Application Route: oral (feed)
Exposure time: 90 days

Species: Rat, Male and Female
NOAEC: 5 mg/m3
Application Route: Inhalation

Exposure time: 90 days

Species: Rabbit, Male and Female
No observed adverse effect level: 100 mg/kg bw/day
Application Route: Dermal Study
Exposure time: 21 d

Aspiration toxicity

Not classified based on available information.

Product:

Not applicable

Components:

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Not applicable

Experience with human exposure

Product:

Inhalation	:	Remarks: None known.
Skin contact	:	Remarks: Causes skin irritation.
Eye contact	:	Remarks: Contact with the eyes may be very painful but does not cause damage.
Ingestion	:	Remarks: None known.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 5.2 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	LC50 (Daphnia magna (Water flea)): 5.8 mg/l Exposure time: 48 h
Toxicity to algae	:	EC50 (Selenastrum capricornutum (green algae)): 8.2 mg/l Exposure time: 96 h

Components:

Tributyl phosphate:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 4.2 mg/l Exposure time: 96 h
Toxicity to daphnia and other	:	EC50 (Daphnia magna (Water flea)): 1.8 mg/l

aquatic invertebrates		Exposure time: 48 h
Toxicity to algae	:	EC50 (Desmodesmus subspicatus (Scenedesmus subspicatus)): 1.1 mg/l Exposure time: 72 h
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): 0.82 mg/l Exposure time: 95 d 1.7 mg/l
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 1.3 mg/l Exposure time: 21 d

Dibutylphenylphosphate:

Toxicity to fish	:	LL50 (Cyprinus carpio (Carp)): 1.8 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 1.4 mg/l Exposure time: 48 h
Toxicity to algae	:	EL50 (Selenastrum capricornutum (green algae)): 9.6 mg/l Exposure time: 72 h Method: EL50 method of the water accommodated fraction (W.A.F.) NOELR (Selenastrum capricornutum (green algae)): 3.5 mg/l Exposure time: 72 h Method: EL50 method of the water accommodated fraction (W.A.F.)
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): > 0.11 mg/l Exposure time: 60 d
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 0.106 mg/l Exposure time: 21 d

butylated hydroxytoluene:

Toxicity to fish	:	LC50 (Fish): 0.199 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia (water flea)): 0.48 mg/l Exposure time: 48 h
Toxicity to algae	:	EC50 (Chlorella pyrenoidosa (aglae)): 0.758 mg/l Exposure time: 96 h

Persistence and degradability

Product:

Biochemical Oxygen Demand (BOD)	:	Remarks: not determined

Chemical Oxygen Demand (COD) : Remarks: not determined

Components:

Tributyl phosphate:

Biodegradability : Result: Readily biodegradable

Dibutylphenylphosphate:

Biodegradability : Method: Ready Biodegradability: Manometric Respirometry Test
Remarks: Readily biodegradable

Method: Ready Biodegradability: Modified MITI Test (I)
Remarks: Not readily biodegradable.

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Biodegradability : Concentration: 100 mg/l
Method: Ready Biodegradability: Modified MITI Test (I)
Remarks: Readily biodegradable

Bioaccumulative potential

Components:

Tributyl phosphate:

Bioaccumulation : Species: Cyprinus carpio (Carp)
Bioconcentration factor (BCF): 20
Exposure time: 56 d
Method: OECD Test Guideline 305

Bioconcentration factor (BCF): 35
Exposure time: 38 d

Partition coefficient: n-octanol/water : Pow: 10,100

Dibutylphenylphosphate:

Bioaccumulation : Species: Cyprinus carpio (Carp)
Bioconcentration factor (BCF): 35
Method: OECD Test Guideline 305

Mobility in soil

No data available

Other adverse effects

Product:

Ozone-Depletion Potential :

Regulation: 40 CFR Protection of Environment; Part 82 Protection of Stratospheric Ozone - CAA Section 602 Class I Substances

Remarks: This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable standards. Dispose of in accordance with local regulations.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

National Regulations

49 CFR
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

The components of this product are reported in the following inventories:

DSL	:	All components of this product are on the Canadian DSL
AICS	:	On the inventory, or in compliance with the inventory
ENCS	:	On the inventory, or in compliance with the inventory
KECI	:	Not listed
PICCS	:	Not listed
IECSC	:	On the inventory, or in compliance with the inventory
TSCA	:	On TSCA Inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16. OTHER INFORMATION

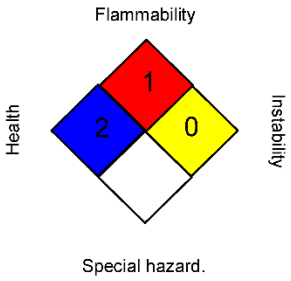
Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport

Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Further information

NFPA:



HMIS III:

HEALTH	2*
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Sources of key data used to compile the Safety Data Sheet	:	www.EastmanAviationSolutions.com
Revision Date	:	08/09/2016

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US / EN

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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