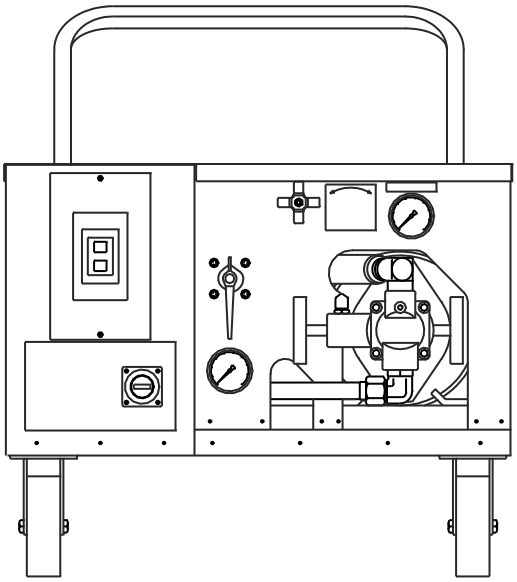
Operation & Service Manual



Model: 5030
Hydraulic Power Unit

05/2004 - Rev. 01

Includes Illustrated Parts Lists

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REVISION	DATE	TEXT AFFECTED
01	5/2004	Modified Parts :ost

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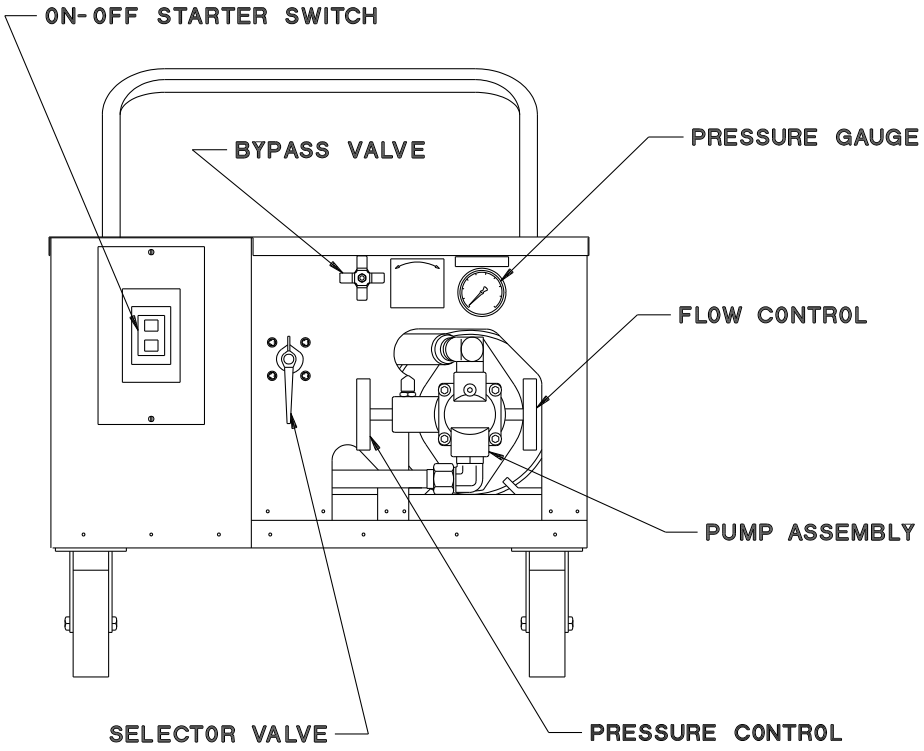


FIGURE 1 – External Components

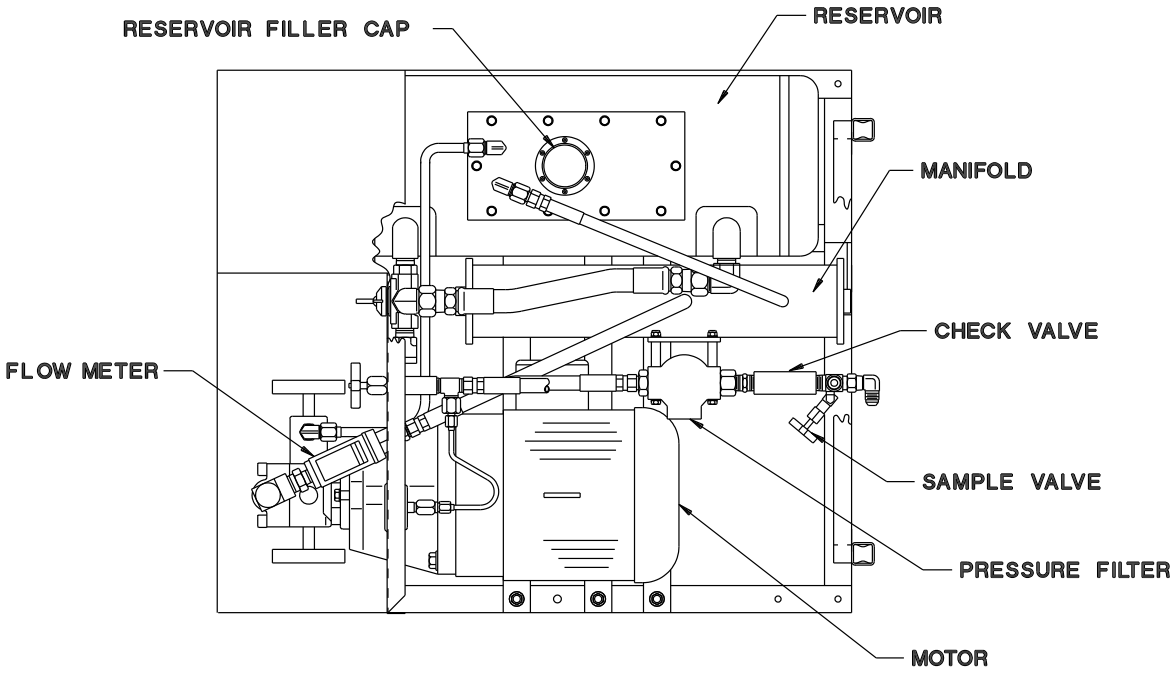
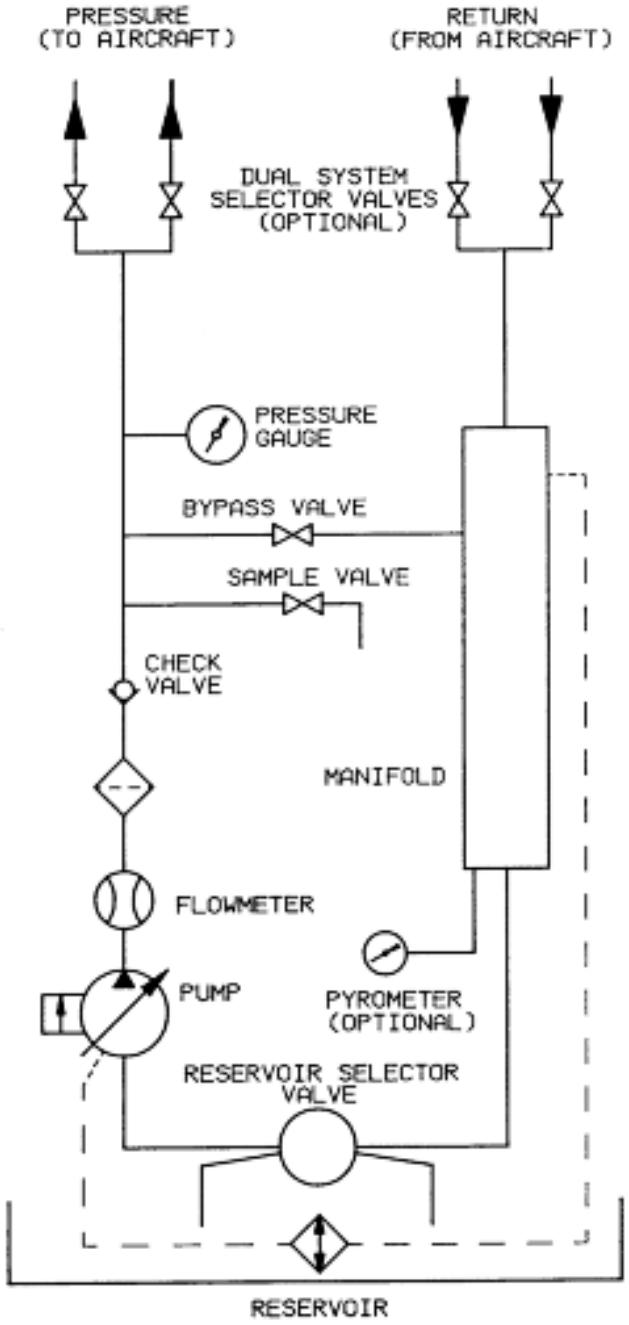


FIGURE 2 – Internal Components



Hydraulic Schematic
(Option T)
Return Back-Pressure
With Sight Gauge

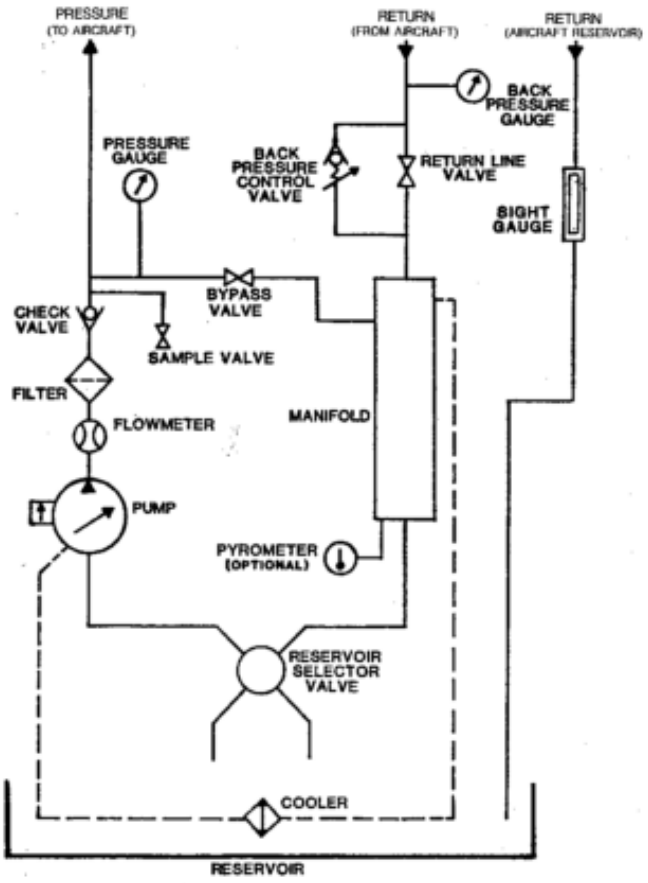
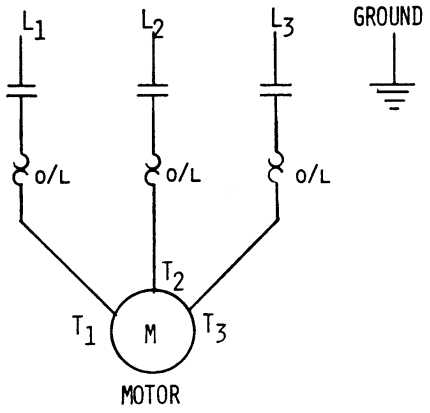


FIGURE 3 – Hydraulic Schematics



DUAL INPUT VOLTAGE CONNECTION

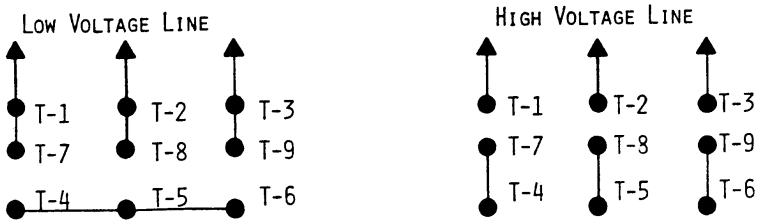


FIGURE 4 – Electrical Schematic

This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., its suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

1.0 GENERAL DESCRIPTION

The Tronair Hydraulic Power Unit (HPU) provides a source of clean, pressurized hydraulic fluid for performing required aircraft maintenance.

Important features include:

- Pressure compensated pump with integral pressure and flow controls
- 10 gallon reservoir with selector valve
- Bypass valve
- Cooler located inside reservoir
- Manual starter with overload protection
- Non bypass filter with 2 micron filter element

2.0 TECHNICAL SPECIFICATIONS

2.1 HYDRAULIC

Fluid:	Aviation Phosphate Ester, Type IV Fluids
Pressure Range:	300 – 1,750 psi
Flow Range:	0 – 6 gpm (60 Hz systems)
	0 – 5 gpm (50 Hz systems)
Filtration:	2 Micron Absolute, Non-Bypass
Reservoir Capacity:	10 gal (38 l) (Maximum)

2.2 ELECTRICAL

Power Requirements: 3 Phase, Alternating Current

60 Hz	***50 Hz***
9.2 amps @ 208 VAC	9.3 amps @ 220 VAC
8.4 amps @ 230 VAC	4.6 amps @ 380, 415, 440 VAC
4.2 amps @ 460 VAC	
3.7 amps @ 575 VAC	

2.3 MECHANICAL

Dimensions:

Length	35 in (89 cm)
Width	30 in (76 cm)
Height	24 in (61 cm)
Weight:	400 lbs (181 kg)

3.0 PREPARATION FOR USE

The HPU is shipped completely assembled and only the following steps are required to make the unit operational.

3.1 SERVICING RESERVOIR

Remove the sheet metal cover and fill the reservoir with the correct fluid until fluid level is slightly above the minimum oil level mark. Since a case drain cooler is located in the HPU reservoir, it is important that this fluid level be maintained in order to prevent excessive heat buildup.

3.2 CONNECTING ELECTRICAL LEADS

Install plug onto the electrical cord and check for proper motor rotation by "bumping" the On-Off switch. Correct motor rotation is indicated by an arrow on pump motor adapter. If rotation is not correct, change any two of the three input leads inside the on-off switch box or at the plug.

NOTE: 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.***
1. ***Single phase condition caused by blown fuses or bad connections.***

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

4.0 OPERATION

Due to the complexity, differences, and ongoing changes in aircraft hydraulic systems, no attempt has been made to relate to any specific aircraft operation. It is suggested that this manual and the HPU be studied thoroughly in order to obtain optimum benefit of the various features. By combining an understanding of the HPU and the aircraft hydraulic system, many services not mentioned in this manual may be performed. Refer to the hydraulic schematic, front panel controls, and internal components pages for clarification while reading this manual.

4.1 GENERAL COMMENTS

Most questions or problems concerning hydraulic power units are usually caused by improper training or understanding of hydraulics. The following comments are given to aid in obtaining maximum benefits from the hydraulic power unit.

4.1.1 Training

Be sure that all personnel that will use the machine read the operating manual and receive training. We encourage customers to call Tronair to discuss any operating or testing requirements.

4.1.2 Use of the HPU Reservoir

It is suggested that the integral reservoir be used whenever possible. Use of this reservoir eliminates any possibility of cavitating the pump. Most complaints of pump noises are due to fluid restrictions in the aircraft systems when using the aircraft reservoir. Also, if the integral reservoir is used, the HPU will run considerably cooler. This occurs because the pump case drain oil is directed to the reservoir instead of the pump return. The only compromise in using the HPU reservoir is that the aircraft system reservoir must be serviced after testing, which is standard procedure.

4.2 PRELIMINARY ADJUSTMENTS AND OPERATIONS

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

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4.2.1 Flow Control Adjustment

a. Open bypass valve.
b. Select "Hydraulic Power Unit" position with reservoir selector valve.
c. Start HPU.
d. Adjust flow control for maximum desired flow. Observing the flowmeter, read flow (gallons per minute) directly from flowmeter scale. Be sure the control shaft lock nut is loose during adjustment. Tighten after adjustment to maintain setting.

4.2.2 Pressure Control Adjustment

a. Open bypass valve.
b. Select "Hydraulic Power Unit" position with reservoir selector valve.
c. Start HPU.
d. Close bypass valve.
e. Adjust pressure control for desired pressure. Be sure the control shaft lock nut is loose during adjustment. Tighten after adjustment to maintain setting.

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

4.2.3 Reservoir Selector Valve Operation

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

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 indication of the system pressure gauge or flowmeter. Usually, the aircraft fluid supply will be restricted due to small return oil lines in the aircraft. Sometimes this problem can be minimized or eliminated by pressurizing the aircraft reservoir with air.

4.2.3 Reservoir Selector Valve Operation *(continued)*

CAUTION!

If the aircraft reservoir is pressurized, do not exceed the aircraft manufacturer's recommendations.

If the aircraft reservoir cannot be pressurized or the cavitation persists, decrease the flow control setting until the cavitation is eliminated.

HPU Reservoir Position (Open Loop)
In this position, the HPU reservoir supplies oil to the pump and accepts return oil from the aircraft. It is desirable to operate the HPU in this mode since it eliminates any possibility of cavitation.

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

CAUTION!

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

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

On most aircraft, the aircraft reservoir may usually be serviced by disconnecting the return hose. Normally servo leakage or operation of a hydraulic component will allow some flow to the aircraft reservoir. Caution should be observed if this method is used.

WARNING!

- **When using the HPU reservoir, it may be possible to overfill the aircraft reservoir if several landing gear swings are done in a short time period.**
- **Always wait approximately 15 seconds between gear swings to allow the aircraft reservoir to drain into the HPU.**
- **Do not change the reservoir selector valve position while the machine is running**

4.2.4 Bypass Valve Operation

The bypass valve is used for unloading the pump flow in conjunction with the flowmeter.

Start Up Operation
The bypass valve should be opened prior to starting the HPU in order to allow the motor to start under a no load condition.

Shut Down Operation
Prior to shut down, the bypass valve may 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 opened or is used for regulating flow or pressure.

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

4.3 SAMPLE VALVE

A sample 19-1972 is followed.

4.4 BLEEDING AIR FROM SYSTEM

Rapid fluctuations of the pressure gauge 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 the hose connections and/or couplings.

To Easily Purge the Unit of Air:

1. Fill reservoir to recommended level.
2. Open bypass valve.
3. Place reservoir selector valve in "Hydraulic Power Unit" position.
4. Start unit and adjust flow control to maximum position.

4.4 Bleeding air from system continued on following page.

4.4 BLEEDING AIR FROM SYSTEM *(continued)*

5. Run unit for five (5 valve is provided on the rear of the unit to obtain a fluid sample for analysis or inspection. In order to obtain a representative fluid sample, it is suggested that American National Standard number B93.) minutes and shut off.
6. If additional bleeding is required, proceed with the following steps:
   a. Connect the pressure and return hoses together. (Kits containing the necessary fitting(s) are available from Tronair)
   b. If the unit is equipped with pressure and return ball valves, open the ball valves prior to starting the unit.

WARNING!

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

   c. Place the reservoir selector valve in the “Hydraulic Power Unit” position.
   d. Open the bypass valve on the instrument panel
   e. Start unit and adjust flow control to maximum position.
   f. Close the bypass valve and allow the unit to run for 5 minutes.

Under some conditions where a large amount of air has entered the system, the pump may not be able to draw an initial prime and will not pump. If this occurs, it may be necessary to fill the pump inlet line with fluid.

4.5 ABBREVIATED OPERATING INSTRUCTIONS

These instructions may be used for fast reference after a thorough understanding of the HPU operation has been achieved.

4.5.1 Initial Adjustments

1. Set flow control (See Section 4.2-A)
2. Set pressure control (See Section 4.1-B)

4.5.2 Prior to Starting

1. Select reservoir valve position
2. Open bypass valve

4.5.3 Operation

1. Start HPU
2. Close bypass valve

4.5.4 Shut Off

1. Open bypass valve
2. Stop HPU

4.6 OPTIONS

The following options are available on some models of hydraulic power units. Refer to the appropriate option description for operation information.

4.6.1 Dual System (Option C) Operation

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

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

To Operate the Dual System

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

WARNING!

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

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

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.

3. If equipped with the ***Dual System Crossover Check Option***, separate pressure gauges are located after each system pressure shut off valve. This allows bleed down pressures to be read when the pressure valves are closed. Follow aircraft manufacturer's instructions.

4.6 OPTIONS *(continued)*

4.6.2 Return Back-Pressure with Sight Gauge (Option T) Operation

Option T consists of two valves and a pressure gauge mounted on the rear of the machine, a sight glass mounted on the control panel, and a third hose for connection to the aircraft reservoir. The two valves are connected in parallel and consists of a 90º ball valve and an adjustable pressure relief valve.

Refer to ***Figure 4 – Page 2*** HPU Option T Hydraulic Schematic. With the ball valve open, all aircraft return oil will flow through this valve. If, however, the valve is closed, the flow path will be through the pressure relief valve. The pressure relief valve may be adjusted to obtain any desired return line back-pressure as specified in the Citation maintenance manual. The return line back pressure may be read on the adjacent pressure gauge.

Since the Citation has an onboard unloading valve, ***the hydraulic power unit reservoir should be used for all tests***. This allows the pump to operate in an unload condition most of the time, therefore, extending pump life.

To Fill Aircraft Reservoir:

1. Be sure that there is sufficient oil in the HPU reservoir.
2. With both bypass valves open, start machine and adjust flow control for approximately one (1) gpm.
3. Close bypass valve and return line ball valve. This will force oil returning from the aircraft through the return pressure relief valve, causing a back pressure in the aircraft return line.
4. Be sure that the aircraft system has unloaded. If not, adjust pressure control for 1,500 psi until aircraft does unload, indicated by a drop in the panel system pressure gauge.
5. Read the back pressure gauge and adjust the back pressure valve for 20 to 25 psi, if necessary. This action, with the one (1) gpm flow rate, will fill the aircraft reservoir with an overflow visible through the HPU panel mounted sight glass.
6. When little or no air is visible in the sight glass, the aircraft reservoir is filled. The return line ball valve may now be opened and aircraft testing may start. The flow control should be adjusted for a higher desired flow.
7. For any tests requiring line back-pressure, close the return line ball valve and adjust the return line back pressure valve.

NOTE: Since the Citation reservoir is pressurized, the return line ball valve may be closed prior to shut down to prevent the aircraft reservoir from draining.

5.0 MAINTENANCE

5.1 GENERAL MAINTENANCE

- The hydraulic power unit should be maintained in a safe and clean condition at all times.
- Locate and correct the source of any and all leaks.
- Inspect hoses and electrical cord periodically for damage and wear. Replace as required.

5.2 FILTER MAINTENANCE

Replace the filter element annually to ensure proper cleanliness of the hydraulic system. This is a minimum requirement. Replace the return filter element at the same time the pressure filter element is being replaced.

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.

5.3 SELECTOR VALVE MAINTENANCE

The Reservoir Selector Valve has been assembled with special grease (Tronair #H-2132) that is compatible with Skydrol. It is recommended that this valve be disassembled and re-lubed every two (2) years, or if there is any sign of external leakage.

5.4 LUBRICATION

The swivel casters are equipped with grease fittings which should be lubricated annually.

5.5 STORAGE

In the event that the HPU will not be used for 12 months or longer, the reservoir may be drained. The unit should then be appropriately covered in order to maintain cleanliness.

6.0 TROUBLESHOOTING

6.1 NO FLOW OR PRESSURE

Flow control set too low	Increase flow setting
Motor running in wrong direction	See Section 3.0 "Preparation for Use"
Insufficient oil in reservoir	See Section 3.0 "Preparation for Use"
Air in hydraulic lines	See Section 4.4 "Bleeding Air From System"
Faulty pump	Repair or replace pump

6.2 FLUCTUATING PRESSURE OR FLOW

Pump cavitation	See Section 4.2.3.a "Aircraft Reservoir Position"
Air in hydraulic lines	See Section 4.4 "Bleeding Air From System"

6.3 UNIT OVERHEATS

Low fluid level in reservoir	See Section 3.0 "Preparation for Use"
Running unit for long time periods without operating aircraft components	Cycle landing gear or other components periodically or allow unit to cool
Bypass valve partially open	See Section 4.2.4, "Bypass Valve Operation"

NOTES: *1) **Running time under deadhead condition can be increased substantially by selecting the "Hydraulic Power Unit" position; reservoir selector valve.***

*2) **When a pressure compensated pump is required to hold pressure without any flow delivery (dead headed condition) it is normal for the pump case drain flow and temperature to increase. By selecting the "Hydraulic Power Unit" position of the selector valve, all of the oil in the reservoir is utilized for cooling.***

6.4 LOSS OF FLOW IN CLOSED LOOP

Leaking over Reservoir Selector Valve
Valve must be disassembled and thoroughly cleaned with alcohol. Re-lubricate with grease (Tronair part number H-2132) before re-assembled.

6.5 EXTERNAL LEAKAGE FROM SELECTOR VALVE

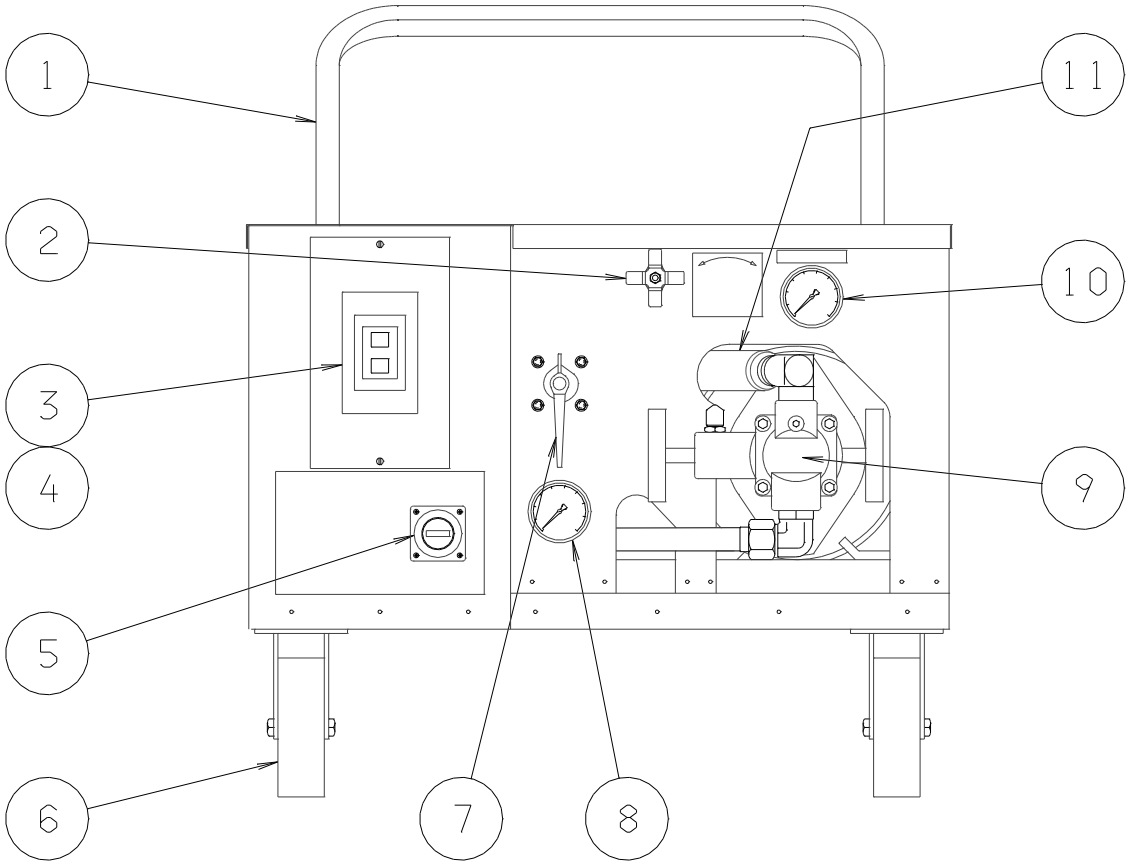
Leaking out the front of Reservoir Selector Valve
Valve must be disassembled and thoroughly cleaned with alcohol. Re-lube with grease (Tronair part number H-2132) before re-assembled.

7.0 PARTS LIST INDEX

When ordering Replacement Parts/Kits, please specify Model & Serial Number of your product. Reference the following pages for ordering information of Replacement Parts and Kits.

External Components

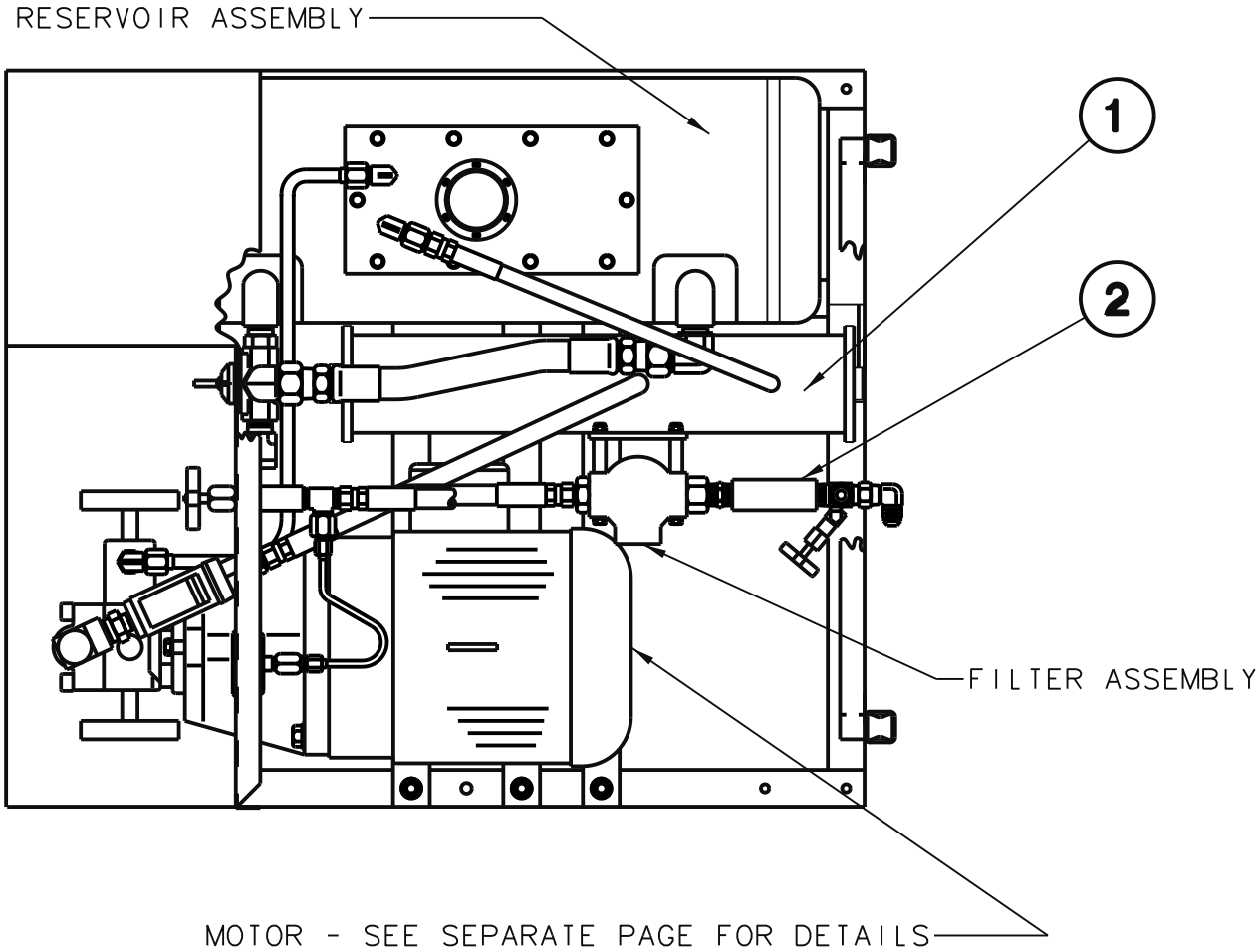
Part numbers given for Aviation Phosphate Ester, Type IV Fluid Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	TS-1482-01	Handle	1
2	HC-1056-02	Valve, Bypass	1
3	EC-1044	Switch, Starter (All Voltages)	1
4	*See Page 12*	Heater	3
5	Z-2145	Hourmeter (Option F)	1
6	V-1056	Caster - Rigid	2
7	HC-1472	Valve, Selector 3/4	1
8	HC-1114	Pyrometer (Option K)	1
9	HC-1072-01	Pump	1
10	HC-1385	Gauge, Pressure	1
11	HC-2153	Flowmeter	1
	HC-2153-A1	Flowmeter (Calibrated)	1
Not Shown	TF-1041-09*180	Hose, Pressure	1
Not Shown	TF-1041-01*180	Hose, Return	1

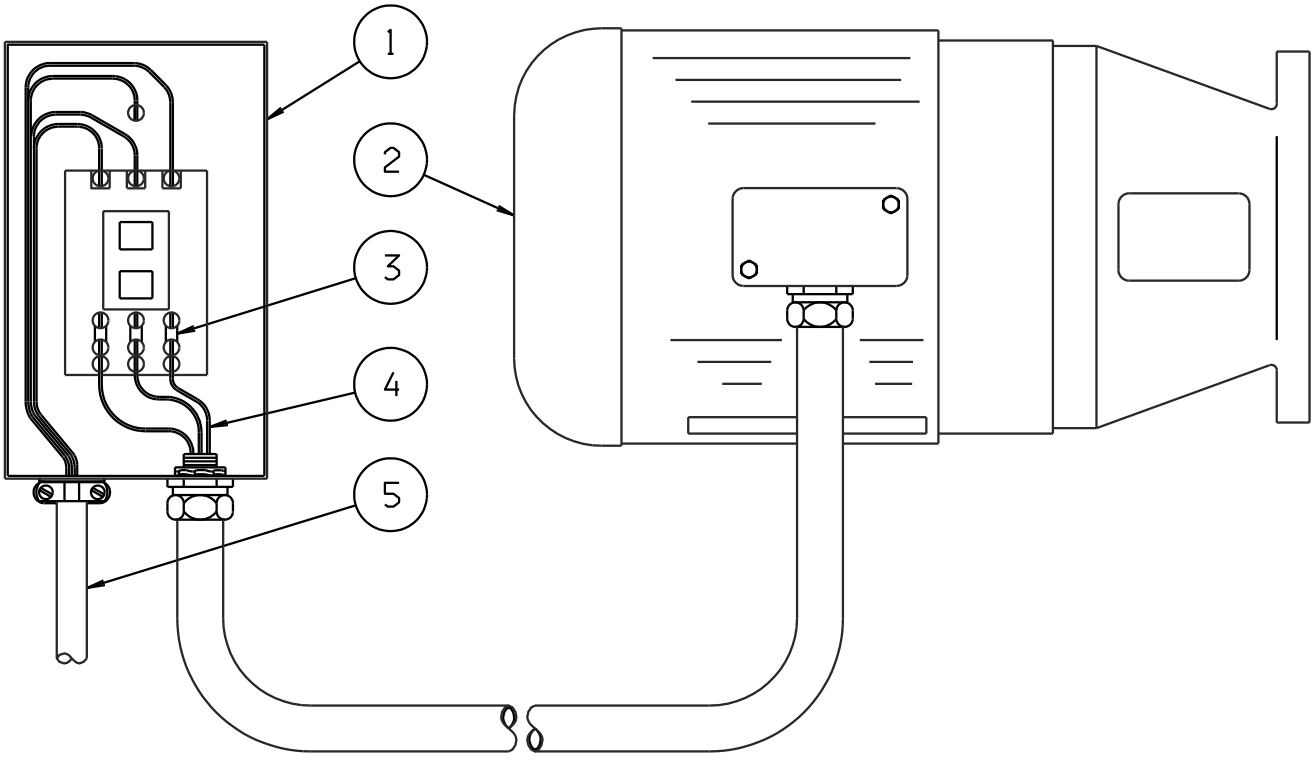
Internal Components

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	Z-1834	Manifold	1
2	HC-1059	Valve, Check	1

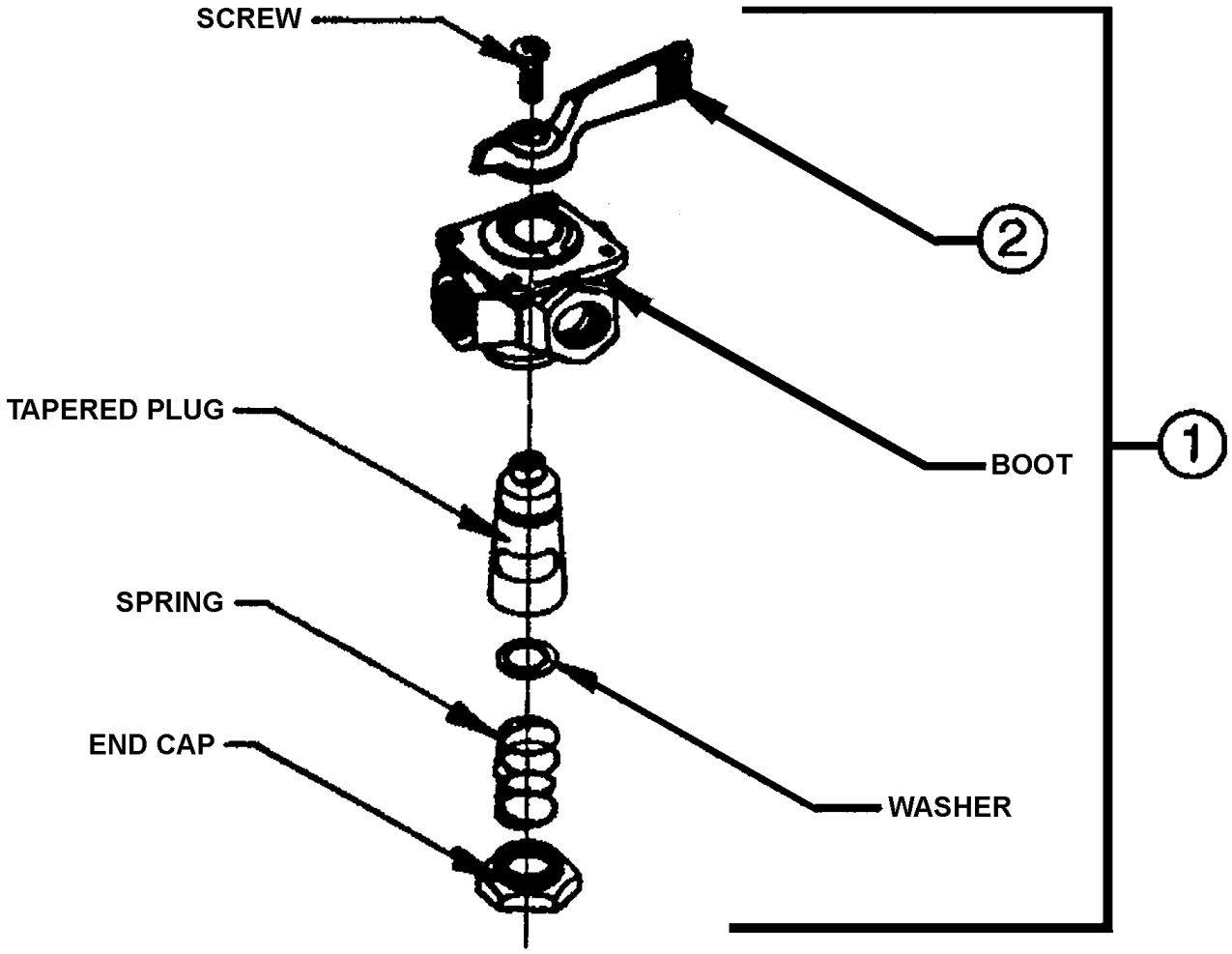
Electrical Components



VAC @ 60 Hz	(1) Starter Switch	QTY	(2) Motor	QTY	(3) Heater	QTY	(4) Wire	QTY	(5) Power Cord	QTY
208	EC-1044	1	EC-1186-01	1	EC-1202-W51	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
230	EC-1044	1	EC-1186-02	1	EC-1202-W50	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
380	EC-1044	1	EC-1186-01	1	EC-1202-W45	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
460	EC-1044	1	EC-1186-02	1	EC-1202-W43	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
575	EC-1044	1	EC-1186-03	1	EC-1202-W41	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
VAC @ 50 Hz	**(1) Starter Switch**	**QTY**	**(2) Motor**	**QTY**	**(3) Heater**	**QTY**	**(4) Wire**	**QTY**	**(5) Power Cord**	**QTY**
200	EC-1044	1	EC-1186-02	1	EC-1202-W50	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
220	EC-1044	1	EC-1186-02	1	EC-1202-W50	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
380	EC-1044	1	EC-1186-02	1	EC-1202-W43	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
415	EC-1044	1	EC-1186-02	1	EC-1202-W43	3	EC-1252-01*43.0	3	EC-1170-01*0600	1
440	EC-1044	1	EC-1186-02	1	EC-1202-W43	3	EC-1252-01*43.0	3	EC-1170-01*0600	1

Reservoir Selector Valve

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1742	Selector, Valve 3/4	

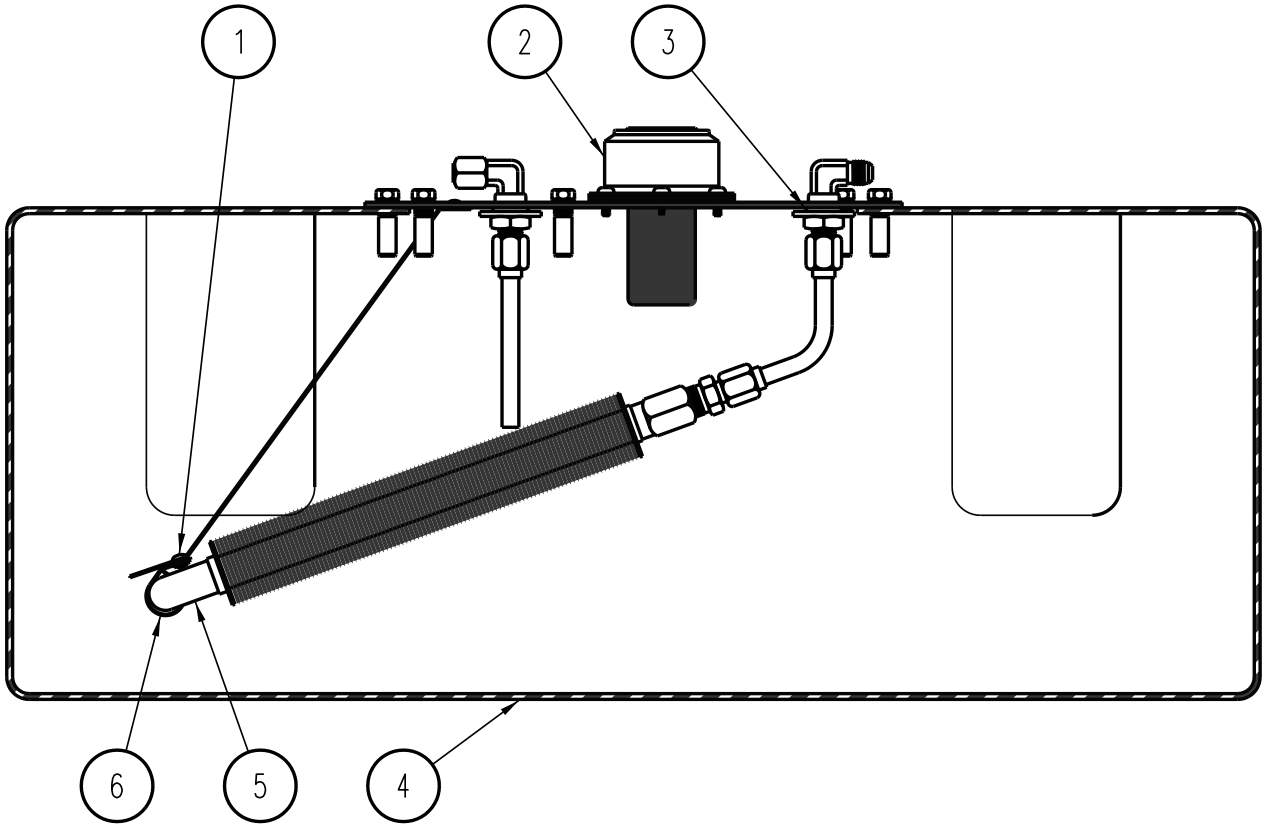
VALVE REPLACEMENT PARTS

2	HC-1075	Handle, Valve	1

NOTE: For replacement of parts other than what is listed, a complete valve (Item 1) must be purchased.

Reservoir Sub-Assembly

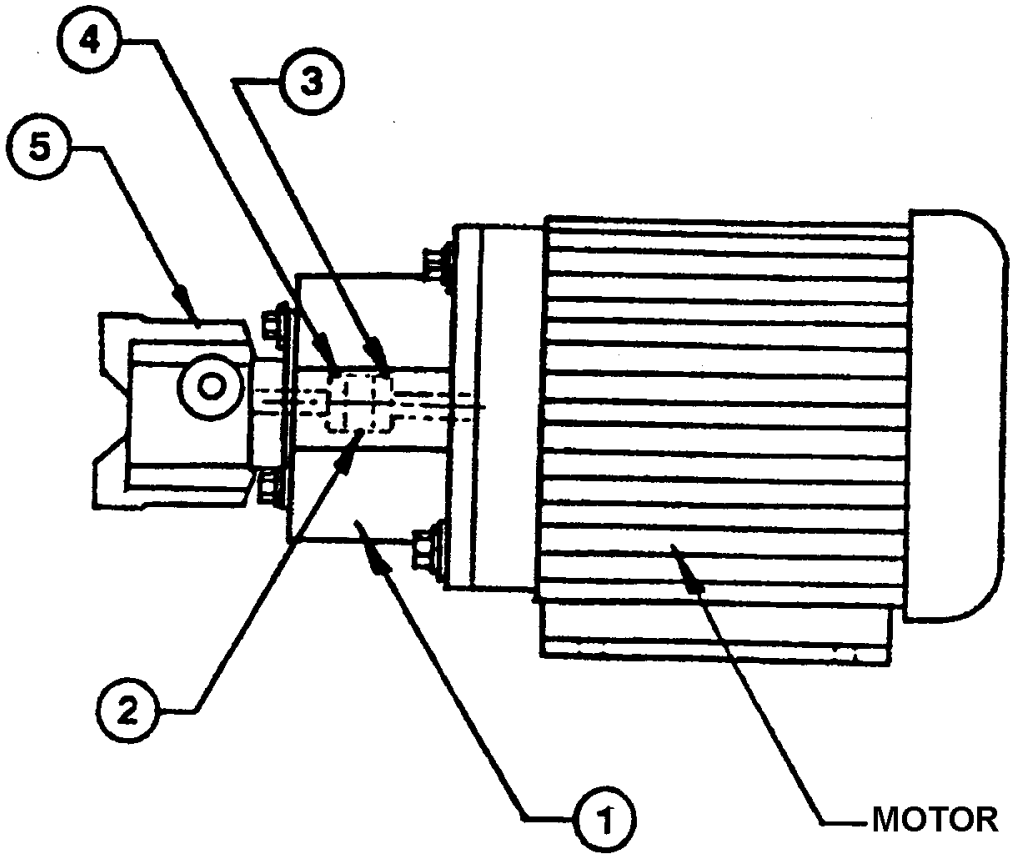
Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	G-1351-04	Rivet, 1/8" diameter x ¼" Grip	4
2	HC-1030	Assembly, Filler/Breather	1
3	HC-2013-906	O-ring	2
4	K-3708	Kit, Reservoir	1
5	HC-1878	Cooler	1
6	H-1721-04	Clamp	1

Pump/Motor Assembly

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1393-11	Mount, Pump/Motor	1
2	H-2227	Coupling – Spider	1
3	H-2224-03	Coupling – Body (Motor)	1
4	H-2224-01	Coupling – Body (Pump)	1
♦ 5	HC-1072-01	Pump, Hydraulic	1

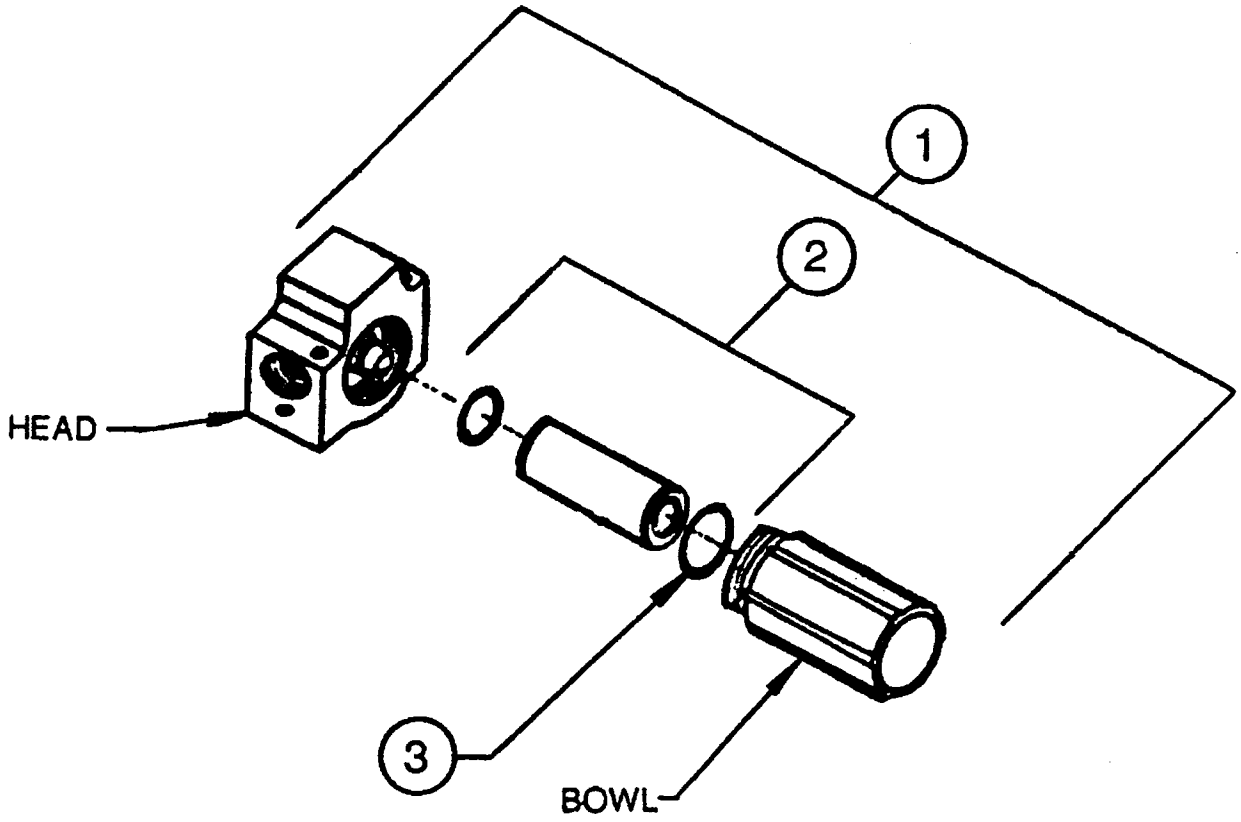
PUMP REPLACEMENT PARTS

6	HC-1077	Seal, Shaft	1
7	K-1077	Kit, Seal (Includes Item 6)	1

♦ ***See Appendix III - pump manufacturer's service booklet for servicing of Item 5 and additional repair kits.***

Filter Assembly

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1084	Assembly, Filter	1

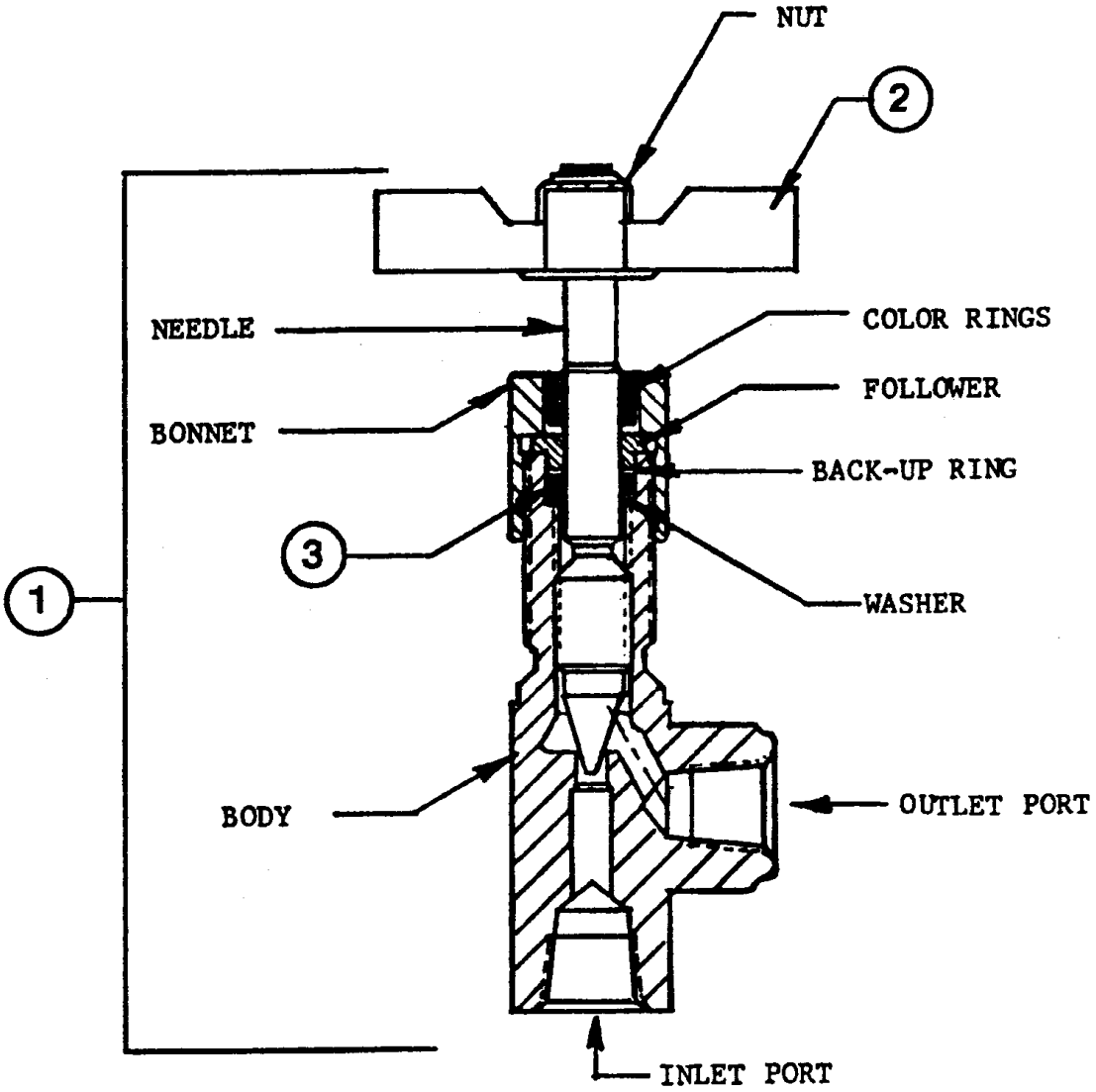
FILTER REPLACEMENT PARTS

♦ 2	K-1415	Kit, Filter Element	1
3	HC-2006-138	O-ring	1

♦ ***Item 2 includes Item 3 O-ring.***

Bypass Valve

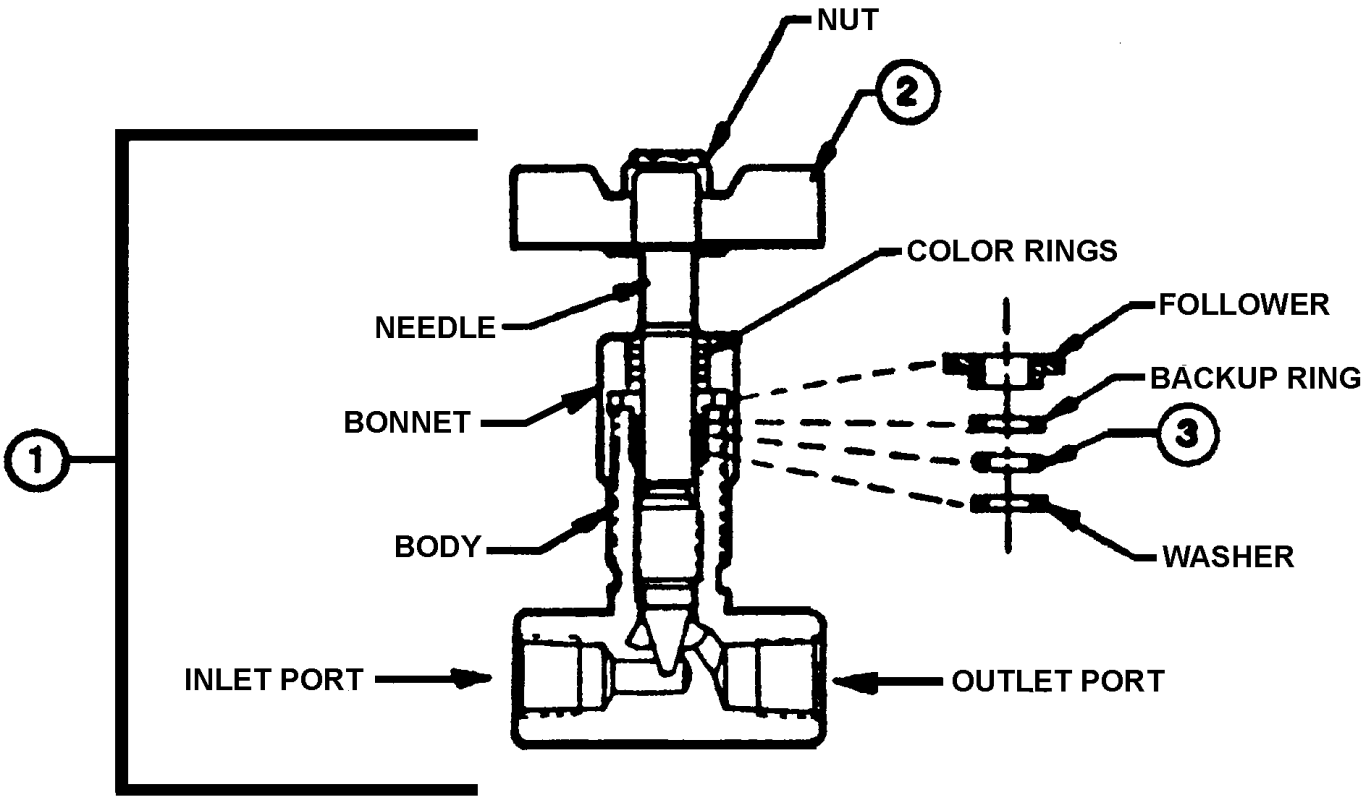
Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1056-02	Assembly, Valve	1
2	HC-1076	Handle, Valve	1
3	HC-2006-012	O-ring	1

Sample Valve

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



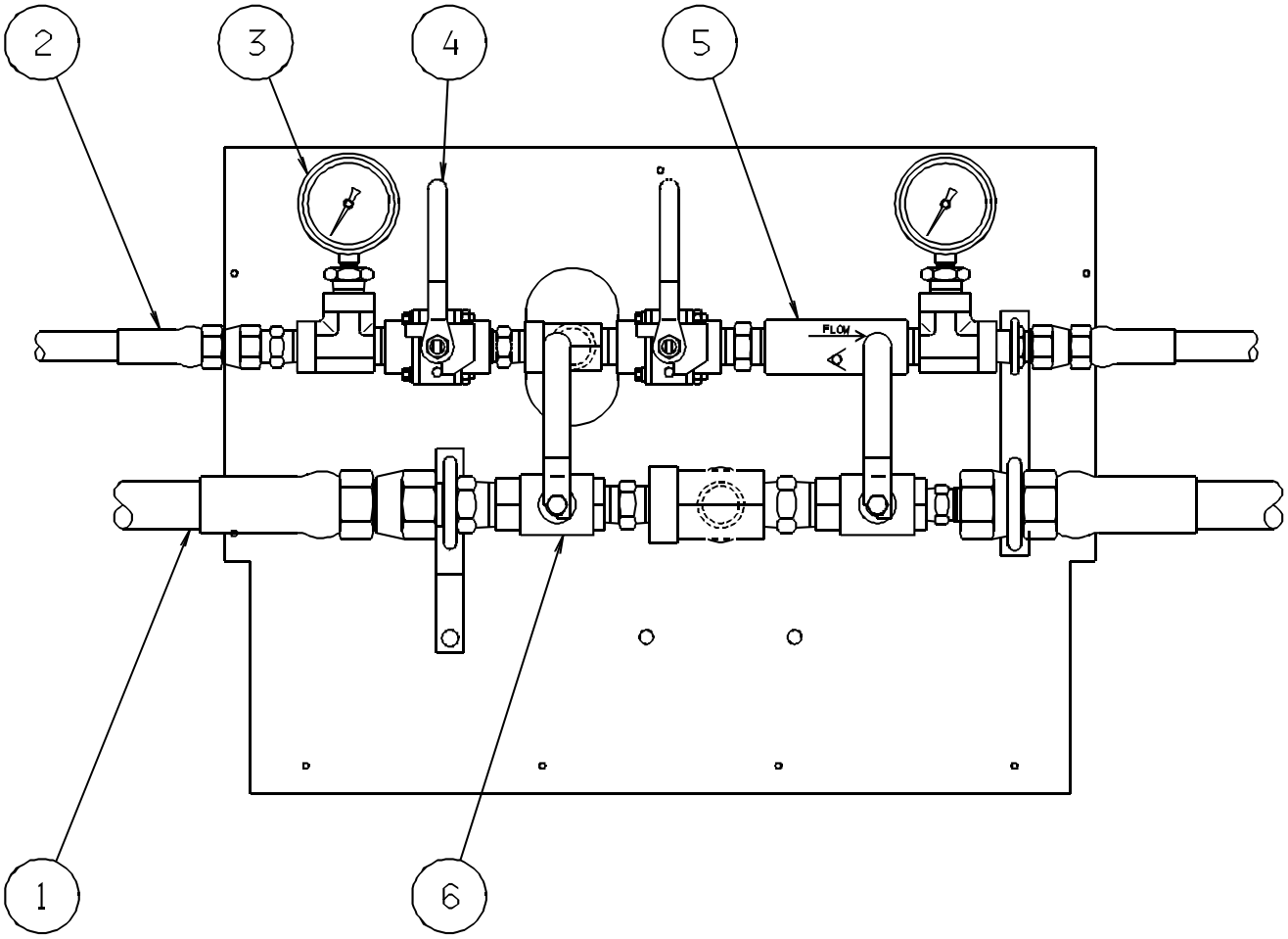
ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1202-02	Assembly, Valve	1

VALVE REPLACEMENT PARTS

2	HC-1203	Handle, Valve	1
3	HC-2006-010	O-ring	1

Dual System (Option C)
Crossover Check (Option D)

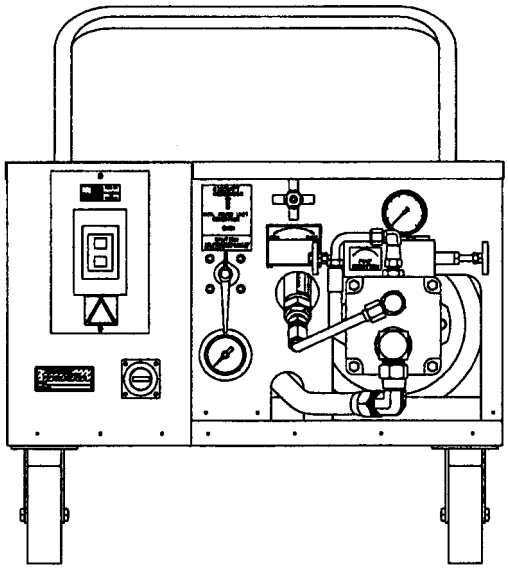
Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.

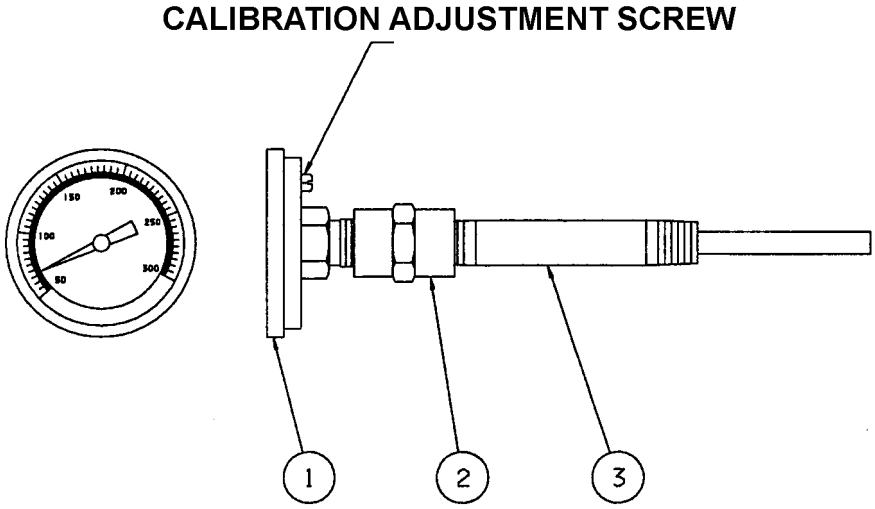


ITEM	PART NUMBER	DESCRIPTION	QTY
1	TF-1041-01*180	Assembly, Return Hose	2
2	TF-1041-09*180	Assembly, Pressure Hose	2
3	HC-1042	Gauge, Pressure	2
4	HC-1654-03	Valve, Pressure Ball	2
5	HC-1059	Valve, Check	1
6	HC-1425-04	Valve, Return Ball	2

Pyrometer (Option K)

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.

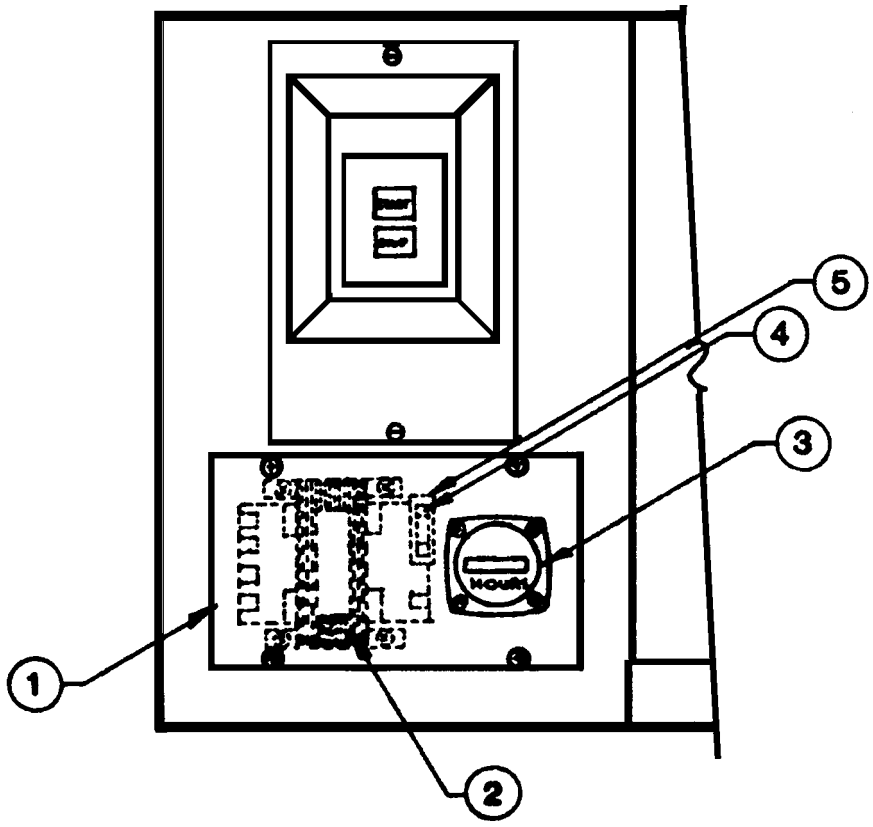




ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1093	Pyrometer	1
2	N-2204-04-S	Connector, Pipe	1
3	N-2219-14	Nipple, Pipe ¼" NPT x 3" long	1

Hourmeter (Option F)

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.

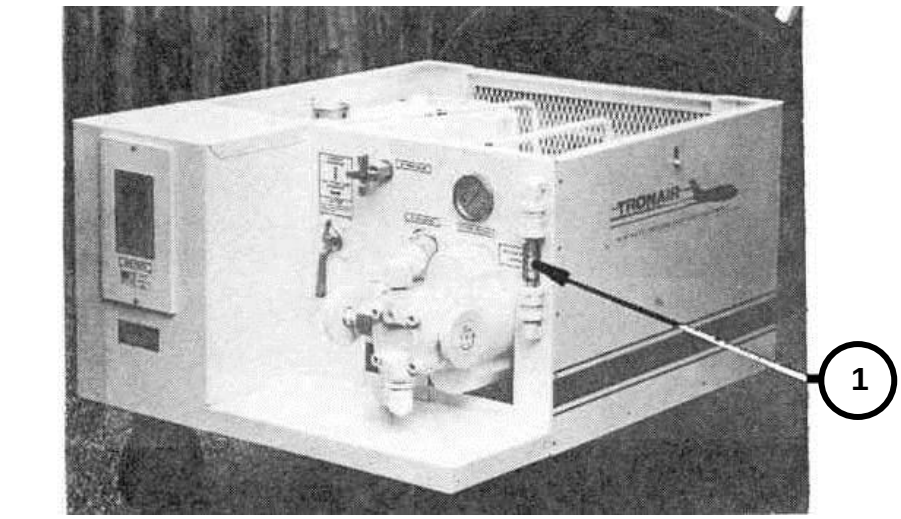


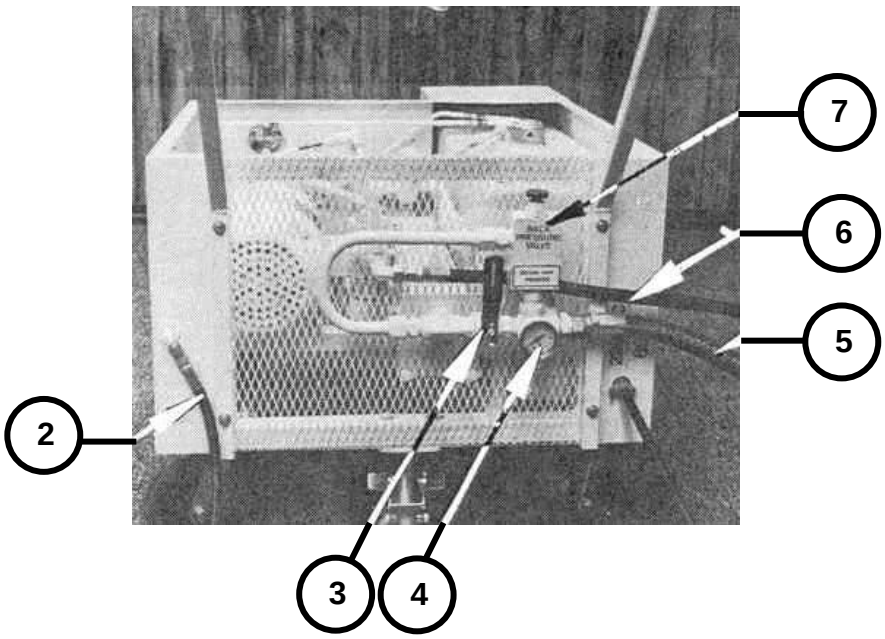
ITEM	PART NUMBER	DESCRIPTION	QTY
1	S-1072	Cover	1
2	EC-1070	♦ Transformer: 208V/60Hz, 380V/50Hz, 575V/60Hz, 415V/50Hz	1
2	EC-1070	♦ Transformer 230V/60Hz, 220V/50Hz, 460V/60Hz, 440V/50Hz	1
3	EC-1060	Hourmeter	1
4	EC-1161	Fuse 1½ amp, Glass Tube-Slo Blo	1
5	EC-1071	Fuse Holder	1

♦ ***Select one based on voltage.***

Return Back-Pressure with Sight Gauge (Option T)

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.

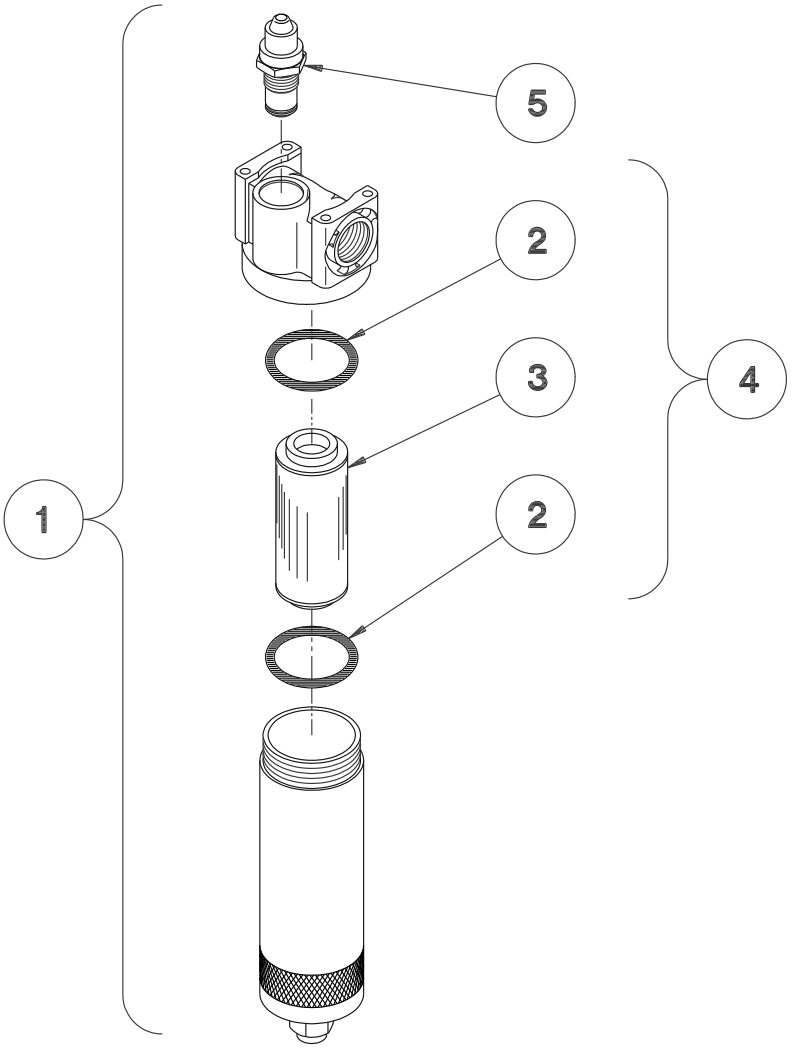




ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1115	Sight glass	1
2	TF-1041-02*180	Assembly, Return Hose (Aircraft Reservoir)	1
3	HC-1425-04	Valve, Ball	1
4	HC-1117	Gauge, Pressure	1
5	TF-1041-01*180	Assembly, Return Hose	1
6	TF-1041-09*180	Assembly, Pressure Hose	1
7	HC-1118	Valve, Back Pressure	1

Return Filter Assembly (Option W)

Part numbers given for Aviation Phosphate Ester, Type IV Fluids Type Units only.



ITEM	PART NUMBER	DESCRIPTION	QTY
1	HC-1477	Assembly, Filter	1
3	HC-1476	Element, Filter	1

FILTER REPLACEMENT PARTS

2	HC-2006-142	O-ring	2
♦ 4	K-3097	Kit, Filter Element	1
5	HC-1851	Indicator, Clogging	1

♦ ***Item 4 includes corresponding Item 2—O-ring.***

APPENDIX I

Instrument Certification Notice

INSTRUMENT CERTIFICATION NOTICE

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

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

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

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TRONAIR

APPENDIX II

Lincoln
Motor
Manual

Carefully read and fully understand this Owner's Manual prior to installation, operation and maintenance of your motor.

1. SAFETY DEPENDS ON YOU

Lincoln motors are designed and manufactured with safety in mind. However, your overall safety can be increased by properly installing, operating and maintaining the motor. Read and observe all instructions, warnings and specific safety precautions included in this manual and THINK BEFORE YOU ACT!

2. RECEIVING AND INSPECTION

Check packing list and inspect motor to make certain no damage has occurred in shipment. Claims for any damage done in shipment must be made by the purchaser against the transportation company.

Turn the motor shaft by hand to be certain that it rotates freely. Be careful not to cut yourself on the shaft keyway; it is razor sharp!

Check the nameplate for conformance with power supply and control equipment requirements.

3. HANDLING

⚠ WARNING

FALLING EQUIPMENT can injure.

- **Lift only with equipment of adequate lifting capacity.**
- **If so equipped, use lift ring(s) on the motor to lift ONLY the motor and accessories mounted by Lincoln.**

In case of assemblies on a common base, the motor lift ring(s) CANNOT be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. In all cases, care should be taken to assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

4. STORAGE

Motor stock areas should be clean, dry, vibration free and have a relatively constant ambient temperature. For added bearing protection while the motor is in storage, turn the motor shaft every six months.

A motor stored on equipment and component equipment prior to installation should be kept dry and protected from the weather. If the equipment is exposed to the atmosphere, cover the motor with a waterproof cover. Motors should be stored in the horizontal position with drains operable and positioned in the lowest point. CAUTION: Do not completely surround the motor with the protective covering. The bottom area should be open at all times.

Windings should be checked with a megohm-meter (Megger) at the time equipment is put in storage. Upon removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying. Note the sensitivity of properly connected megohm-meters can deliver erroneous values. Be sure to carefully follow the megohm-meter's operating instructions when making measurements.

All external motor parts subject to corrosion, such as the shaft and other machined surfaces, must be protected by applying a corrosion-resistant coating.

5. INSTALLATION

For maximum motor life, locate the motor in a clean, dry, well ventilated place easily accessible for inspecting, cleaning and lubricating. The temperature of the surrounding air should not exceed 104°F (40°C) except for motors with nameplates indicating a higher allowable maximum ambient temperature.

⚠ WARNING

MOVING PARTS can injure.

- **BEFORE starting motor, be sure shaft key is captive.**
- **Consider application and provide guarding to protect personnel.**

5.1 INSTALLATION – MECHANICAL

Base

Mount the motor on a firm foundation or base sufficiently rigid to prevent excessive vibration. On foot-mounted motors, use appropriately sized bolts through all four mounting holes. For frames which have six or eight mounting holes, use the two closest the drive shaft and two on the end opposite the drive shaft (one on each side of the frame). If necessary, properly shim the motor to prevent undue stress on the motor frame and to precision align the unit.

Position

Standard motors may be mounted in any position. The radial and thrust load capacity of the motor's bearing system provides for this feature.

Drains

All motors have drain holes located in the end brackets. As standard, drains are in place for the horizontal with feet down mounting position. Other positions may require either rotation of the end brackets or drilling additional holes to attain proper drainage. Be sure existing drain or vent holes do not permit contaminant entry when motor is mounted in the other positions.

Additional drain holes exist near the bearing cartridge in both end brackets of 284T thru 449T steel frame motors. The drain holes are closed with a plastic plug. When the motor is vertically mounted, the plug located in the lower end bracket must be removed. To access the plug on blower end, simply remove the shroud; on some models, it is also necessary to take off the blower.

Drive – Power Transmission

The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. Do not drive the unit on the shaft as this will damage the bearings. Coat the shaft lightly with heavy oil before installing pulley.

Belt Drive: Align the pulleys so that the belt(s) will run true. Consult the belt manufacturer's catalog for recommended tension. Properly tension the belt; excessive tension will cause premature bearing failure. If possible, the lower side of the belt should be the driving side. On multiple belt installations be sure all belts are matched for length.

Chain Drive: Mount the sprocket on the shaft as close to the shaft shoulder as possible. Align the sprockets so that the chain will run true. Avoid excessive chain tension.

Gear Drive and Direct Connection: Accurate alignment is essential. Secure the motor and driven unit rigidly to the base. Shims may be needed to achieve proper alignment.

Excessive motor vibration may result if the full length of the motor shaft key is not completely engaged by the coupling or sheave. For these situations, adjustment of the key length is required.

5.2 INSTALLATION – ELECTRICAL

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Disconnect input power supply before installing or servicing motor.**
- **Motor lead connections can short and cause damage or injury if not well secured and insulated.**
- **Use washers, lock washers and the largest bolt size which will pass through the motor lead terminals in making connections.**
- **Insulate the connection, equal to or better than the insulation on the supply conductors.**
- **Properly ground the motor — see GROUNDING.**

Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate.

Proper branch circuit supply to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

Short circuit current fuses or breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor.

Each of these should be properly sized and installed per the National Electrical Code and local codes.

Properly ground the motor – See GROUNDING.

Terminal Box

Remove the appropriate knockout. For terminal boxes without a knockout, either a threaded power-conduit entry hole is provided or the installer is responsible for supplying a correctly sized hole.

The majority of terminal boxes can be rotated in place to allow power lead entry from the 3, 6, 9 or 12 o'clock direction.

Motor Connection

All single speed and two-speed Lincoln motors are capable of across-the-line or autotransformer starting. Reference the lead connection diagram located on the nameplate or inside of the terminal box cover.

Single speed motors have reduced voltage start capability per the following chart.

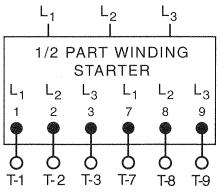
Number of Motor Leads	Number of Rated Voltages	Lead Numbers	YDS	PWS
3	Single	1-3	No	No
6	Single	1-3, 7-9	No	Yes
	Single	1-6	Yes	No
	Dual	1-6	Yes(1)	No
9	Dual	1-9	No	No
12	Single	1-12	Yes	Yes
	Dual	1-12	Yes	No(2)

(1) YDS capability on lower voltage only.
(2) PWS capability on lower voltage only, 1200 RPM, 324T-365T steel frame motors with Model Number efficiency letters of "S" or "H".

Contact Customer Service at 1-800-668-6748 (phone),
1-888-536-6867 (fax) or mailbox@lincolnmotors.com (e-mail) for a copy of across-the-line and other reduced voltage start connection diagrams.

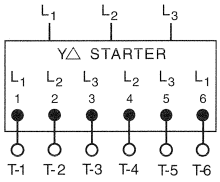
Connection Diagram 1

Single Voltage, 6 Leads
Part Winding Start Connection



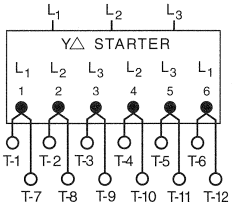
Connection Diagram 2

Single Voltage, 6 Leads
Y△ Start Connection



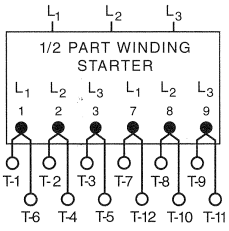
Connection Diagram 3

Single Voltage, 12 Leads
Y△ Start Connection



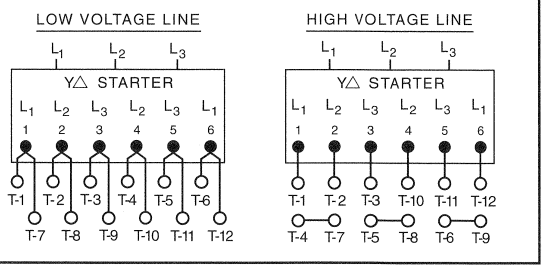
Connection Diagram 4

Single Voltage, 12 Leads
Part Winding Start Connection



Connection Diagram 5

Dual Voltage, 12 Leads
Y△ Start Connection



Space Heater (option)

Leads for space heaters are identified as H1 and H2. Heater voltage and watts are marked on the motor nameplate and should be checked prior to connection to power source.

Thermostat (option)

Leads for thermostats (normally closed, automatic reset contacts) are identified as P1 and P2. Connect these to a relay or signaling device. Motor line current cannot be handled by the thermostat.

Table 1 — Thermostat Contact Ratings

Voltage (60 Hz)	110V	220V
Max. Cont. Current (amps)	3.0	1.5
Min. Cont. Current (amps)	0.2	0.1

Thermistor (option)

Leads for thermistors are identified as P3 and P4. Thermistors require connection to Texas Instruments® Control Module Model 32AA or its equivalent for proper operation. This item may be purchased from Lincoln - see LC100 catalog.

Brake (option)

Carefully read and fully understand the instructions supplied by the brake manufacturer (see inside of brake housing or separately enclosed sheet). Contact the brake manufacturer for additional information.

GROUNDING

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Connect the motor frame to a good earth ground per the National Electrical Code and local codes to limit the potential to ground in the event of contact between live electrical parts and the metal exterior.**

Lincoln motors may be electrically connected to earth ground using a terminal box mounting screw or a separate grounding screw when provided. Both are accessible inside the mounted terminal box. When a bronze mounting screw is supplied, always use it as the grounding point. In making the ground connection, the installer should make certain that there is a good electrical connection between the grounding lead and the motor.

6. OPERATION

Three phase squirrel cage induction motors will operate successfully, but not necessarily in accordance with nameplate ratings, at voltages 10 percent above or below nameplated value at the design frequency.

⚠ WARNING

MOVING PARTS can injure.

- **Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury.**
- **Keep away from moving parts.**

ELECTRIC SHOCK can kill.

- **Do not operate with covers removed.**
- **Do not touch electrically live parts.**

After checking that the shaft key is secure, operate the motor free of load and check the direction of rotation. If the motor rotates in the wrong direction, interchange any two supply leads.

Couple the motor to its load and operate it for a minimum of one hour. During this period, check for any unusual noise or thermal conditions. Check the actual operating current to be sure that the nameplate current times service factor is not exceeded for steady continuous loads.

7. MAINTENANCE

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Internal parts of the motor may be at line potential even when it is not rotating.**
- **Disconnect all input power to the drive and motor before performing any maintenance.**

Lincoln motors have been designed and manufactured with long motor life expectancy and trouble-free operation in mind.

Periodically inspect the motor for excessive dirt, friction or vibration. Dust may be blown from an inaccessible location using compressed air. Keep the ventilation openings clear to allow free passage of air. Make sure the drain holes in the motors are kept open and the shaft slinger is positioned against the end bracket. Grease or oil can be wiped by using a petroleum solvent.

Overheating of the bearings caused by excessive friction is usually caused by one of the following factors:

1. Bent shaft.
2. Excessive belt tension.
3. Excessive end or side thrust from the gearing, flexible coupling, etc.
4. Poor alignment.

Damaging vibrations can be caused by loose motor mountings, motor misalignment resulting from the settling or distortion of the foundation, or it may be transmitted from the driven machine. Vibration may also be caused by excessive belt or chain tension.

BEARING SYSTEM

Lincoln motors have a high quality, premium design bearing system. Bearing sizes and enclosures are identified on most motor nameplates. The majority are double-shielded, deep-groove ball bearings. Double-sealed ball bearings are used on some motors in frames 56 and 143T thru 145T. A drive-end cylindrical roller bearing is standard on Crusher Duty motors, frames 405T and larger.

Lubrication instructions and/or grease specifications provided on the motor supersede the following information.

In general, the motor's bearing system has sufficient grease to last indefinitely under normal service conditions. For severe or extreme service conditions, it is advisable to add one-quarter ounce of grease to each bearing per the schedule listed in Table 2. Use a good quality, moisture-resistant, polyurea-based grease such as Chevron SRI #2. Lithium based greases are not compatible with polyurea-based greases; mixing the two types may result in the loss of lubrication.

Motors designed for low ambient applications have bearings with special low temperature grease. Use Beacon 325 lithium based grease or equivalent per the appropriate interval in Table 2.

Motors designed for high ambient applications have bearings with special high temperature grease. Use Dow Corning DC44 silicone grease or equivalent per the interval in Table 2 under "Extreme".

Severe Service: Operating horizontally, 24 hours per day, vibration, dirty, dusty, high humidity, weather exposure, or ambient temperatures from 104-130°F (40-55°C).

Extreme Service: Operating vertically, heavy vibration or shock, heavy duty cycle, very dirty or ambient temperatures from 130-150°F (55-65°C).

Table 2 : Bearing Lubrication Intervals

Motor Syn Speed	Motor Horsepower	Service Conditions	
		Severe	Extreme
BALL BEARINGS			
1800 RPM and slower	1/4 to 7-1/2 HP	2 years	6 months
	10 to 40 HP	1 year	3 months
	50 HP and up	6 months	3 months
above 1800 RPM	all sizes	3 months	3 months
ROLLER BEARINGS			
all speeds	all sizes	3 months	3 months

When adding lubricant, keep all dirt out of the area. Wipe the fitting completely clean and use clean grease dispensing equipment. More bearing failures are caused by dirt introduced during greasing than from insufficient grease.

If the motor is equipped with a relief port or tube, make certain it is open and free of caked or hardened grease. Before replacing relief plugs, allow excess grease or pressure to vent by running the motor for several minutes after lubrication.

⚠ CAUTION

- **LUBRICANT SHOULD BE ADDED AT A STEADY MODERATE PRESSURE. IF ADDED UNDER HEAVY PRESSURE BEARING SHIELD(S) MAY COLLAPSE.**
- **DO NOT OVER GREASE.**

PARTS

All parts should be ordered from Authorized Motor Warranty Stations. Call your Lincoln Motors Sales Office for location and phone number. A "Service Directory" listing all Authorized Motor Warranty Stations by geographic location is available; request Bulletin SD-6. These shops stock GENUINE Lincoln replacement parts and have factory trained personnel to service your motor.

8. WHO TO CALL

For the location and phone number of the Lincoln Motors District Sales Office nearest you, check your local Yellow Pages or call 1-800-MOTOR-4-U (1-800-668-6748) or visit our web site at
www.lincolnmotors.com.

9. WARRANTY

Lincoln Motors, the Seller, warrants all new *standard* motors and accessories thereof against defects in workmanship and material provided the equipment has been properly cared for and operated under normal conditions. All warranty periods begin on the date of shipment to the original purchaser. Warranty periods for ***low voltage (< 600 V)*** motors are defined in the following chart. The warranty period for ***medium voltage (> 600 V)*** motors is one year on sine-wave power. Contact Lincoln for warranty period on PWM power.

Model Number Prefix	Efficiency Code(s)	Frame Sizes	Warranty Period	
			Sine-Wave Power	PWM Power
AA, AF, AN	S, P, B	143T-286T	5 Yrs	2 Yrs*
CF, SD	M	143T-215T	2 Yrs	1 Yr
CF, CN, CS, CP	E, H, P, B	143T-449T	5 Yrs	2 Yrs*
		182U-449U	5 Yrs	2 Yrs*
C5, C6	H, P	M504-689	3 Yrs	Contact Lincoln #
MD, SE	S	284T-445T	5 Yrs	1 Yr
RC, RJ, SC	H	56-145T	5 Yrs	2 Yrs*
RD, RF	S	56-56H	5 Yrs	2 Yrs*
REW, SEW	S	56-256T	1 Yr	1 Yr
SD, SF	S, H, P, B	143T-449T	5 Yrs	2 Yrs*
Field Kits and Accessories			5 Yrs	

* Applies to motors with a service factor of 1.15 or higher. Motors with a 1.0 service factor have a 1 year warranty on PWM power.

If the Buyer gives the Seller written notice of any defects in equipment within any period of the warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided the Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and except as above set forth there are no guarantees or warranties with respect to accessories or equipment, either expressed or arising by option of law or trade usage or otherwise implied, including with limitation the warranty of merchantability, all such warranties being waived by the Buyer.

Lincoln™ MOTORS

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IM566-A December 1999

- indicates change since last printing.

TRONAIR

APPENDIX III

Continental Hydraulics
Service Booklet
PVR6-"G"
Design Series Pumps

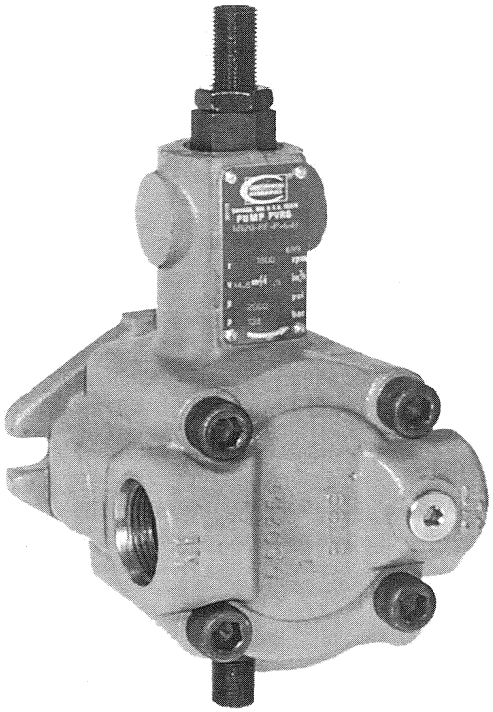
CONTINENTAL HYDRAULICS

SERVICE MANUAL

PVR6-Flanged Series Pump

Installation, Startup, Operating Instructions, Parts Pages, Repair Procedures

"H" Design Series



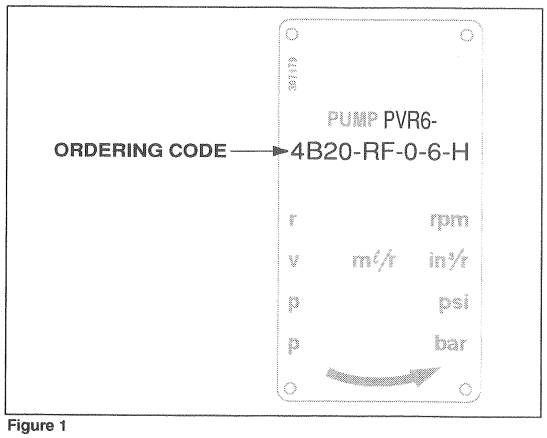
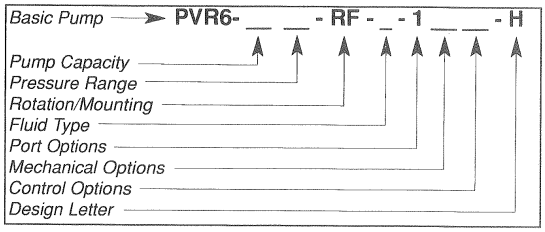


Figure 1

This service manual applies to products with Ordering Codes like the sample shown below.



CAUTION - Before performing any service operation on any pump, be sure that all pressure has been relieved from BOTH SIDES of the system.

CAUTION - Before performing any service operation on any pump, disconnect or lock off power supply.

CAUTION - Before starting pump, be sure that any resulting machine function will not endanger persons or equipment.

PRODUCT IDENTIFICATION

Each pump has an Ordering Code stamped on its nameplate. See Figure 1 above for the location of the Ordering Code.

INSTALLATION

PUMP DRIVE AND MOUNTING

When mounting the pump and motor, care must be taken to align the pump and motor shafts within .003 T.I.R. (0.076 mm) direct inline through a jaw type/flexible web coupling. This is recommended for all pumps. Tire-type flexing elements and chain-type drives are not recommended. With belt drives, please consult factory.

To avoid axial and radical end loading of the pump shaft, do not couple the pump and motor shafts rigidly. Allow freedom at the coupling for the two shafts to ride independently.

To prevent end loading, the space between the pump and motor shaft ends should be 1/2 inch (12.7 mm) for PVR6 pumps, or as the coupling manufacturer specifies.

PIPING AND RESERVOIR

The pump should be mounted with a minimum number of elbows or fittings. The pump suction should be at least 1 inch (25.4 mm) tube/pipe for PVR6 pumps.

For any system and combination of piping except High Water Based Fluids (HWBF), the vacuum at the pump inlet must not exceed seven inches of Mercury, (5 inch Hg. for fire resistant fluids). HWBF Pumps are to have a positive inlet head in the range of 0.5-inch Hg. to 20 inch Hg.

Piping should be done with pickled pipe or seamless tubing free of dirt and scale. Do not use galvanized or other pipe that tends to flake off.

A 100-mesh screen (60 mesh for fire resistant and HWBF) should be used on the pump suction line. The screen should be located approximately two inches (50.8 mm) from the bottom of the tank. All lines returning oil to the tank should discharge at least two inches (50.8 mm) below the minimum oil level and should be separated from the pump suction area by means of a baffle. These lines should also include a 10-micron return line filter, with the exception of the case drain line.

The pump case drain should be connected directly to the tank. Pressure in excess of 10 psi (0.7 bar) in the case drain line can result in shaft seal leakage. It is recommended that the case drain be returned to the tank by a separate 3/8 inch (9.5 mm) line.

STARTUP PROCEDURES

The following instructions apply for initial startup of the hydraulic pump. After an extended shutdown period, start with item 5.

CAUTION - Never start a new pump installation against a blocked system.

1. Check the nameplate for model number and rpm. The arrow on the pump casting indicates direction of rotation.

2. Pump suction line should extend below the lowest point of oil level but not less than two inches (50.8 mm) above reservoir bottom.

3. The pump and motor shafts must be aligned within .003 inches (0.076 mm). See Pump Drive and Mounting directions above for restrictions.

4. Connect the case drain directly to tank (or to a heat exchanger if the pump will be deadheading for long periods of time during operation), using a full-size line corresponding to the case drain in the pump or manifold. If connected to a heat exchanger, the case drain line should be protected with a 10 psi (0.7 bar) maximum relief valve in parallel with the heat exchanger. No other return lines should be connected in common with the case drain return.

5. Rotate pump and motor by hand to insure free rotation.

6. Set the machine controls to open the circuit and allow free flow from the pump back to tank or connect the pump outlet line directly to tank. Jog the motor on and off several times (on, two seconds, off three seconds) until the pump is primed. Check pump for proper direction of rotation during the jogging.

7. After the pump has been primed, run it for several minutes at lower than normal pressures with an open or intermittently open system which permits oil flow. This will purge entrapped air from the pump and system.

8. Neither volume adjustment nor pressure adjustment should be adjusted until the pump has been primed and running, and air is purged.

9. After air has been purged from the system, the system can be closed and the pump adjusted to the required operating pressure.

10. If necessary, the volume adjustment can be adjusted to the required operating pressure.

11. When replacing pumps, the suction screen in the reservoir must be removed and thoroughly cleaned. Also, the suction line from the reservoir to the pump should be flushed inside and out to remove any contaminants. Pieces of metal from a damaged pump can back up into this line. If they are not removed, they will be drawn into the new pump and destroy it. Start unit by using proper pump start-up procedure items 1 through 10.

CAUTION - If both pressure and volume modifications are supplied on the pump, the pressure should be adjusted before the volume. Volume should be adjusted at minimum pump pressure or at deadhead. Stop adjustment at the volume screw when pressure begins to drop.

OPERATION

PRESSURE AND VOLUME ADJUSTMENTS

Pressure Control

All pumps are adjusted to reduced pressure before shipment and must be readjusted to the required system pressure after installation and start-up.

The pressure adjusting screw is located at the end face of the compensator chamber. See parts page item number 30. The adjusting screw has a right hand thread; clockwise adjustment increases pressure; counterclockwise reduces pressure.

A pressure gauge located at the pump must be used when making adjustment to insure the pressure settings do not exceed limits specified for the particular pump of maximum system pressure.

Make all pressure settings with pump operating against a closed circuit, that is with the output of the pump blocked, and then check pressure throughout the pump flow range.

Volume Control

Adjust volume at minimum pump pressure or at pump deadhead. The volume adjusting screw is directly opposite the pressure adjusting screw, see parts page item number 55. The adjusting screw has a right hand thread, turning the screw clockwise decreases the maximum volume, turning the screw counterclockwise increases the maximum volume. Pumps are set at a maximum rated volume at the factory unless otherwise specified.

Stop adjustment of the volume screw when pressure begins to drop. See Sales Catalog for complete pump performance specifications.

ADJUSTMENT PROCEDURES

To adjust the maximum output volume, use the following steps:

1. Set the pump at minimum pressure.

2. Hand tighten the volume screw until it touches the pressure ring. **NOTE:** The pump should be at full flow for this step.

3. See Pressure and Volume Adjustment Sensitivity chart below.

4. Deadhead the pump, turn the volume screw the proper number of turns to obtain the flow desired.

5. Return pump to flow condition and check flow rate. If output flow is incorrect, switch pump to deadhead and readjust per above.

CAUTION - Turning the maximum volume control in too far can force the pressure ring over center and destroy the pump.

PRESSURE and VOLUME ADJUSTMENT SENSITIVITY

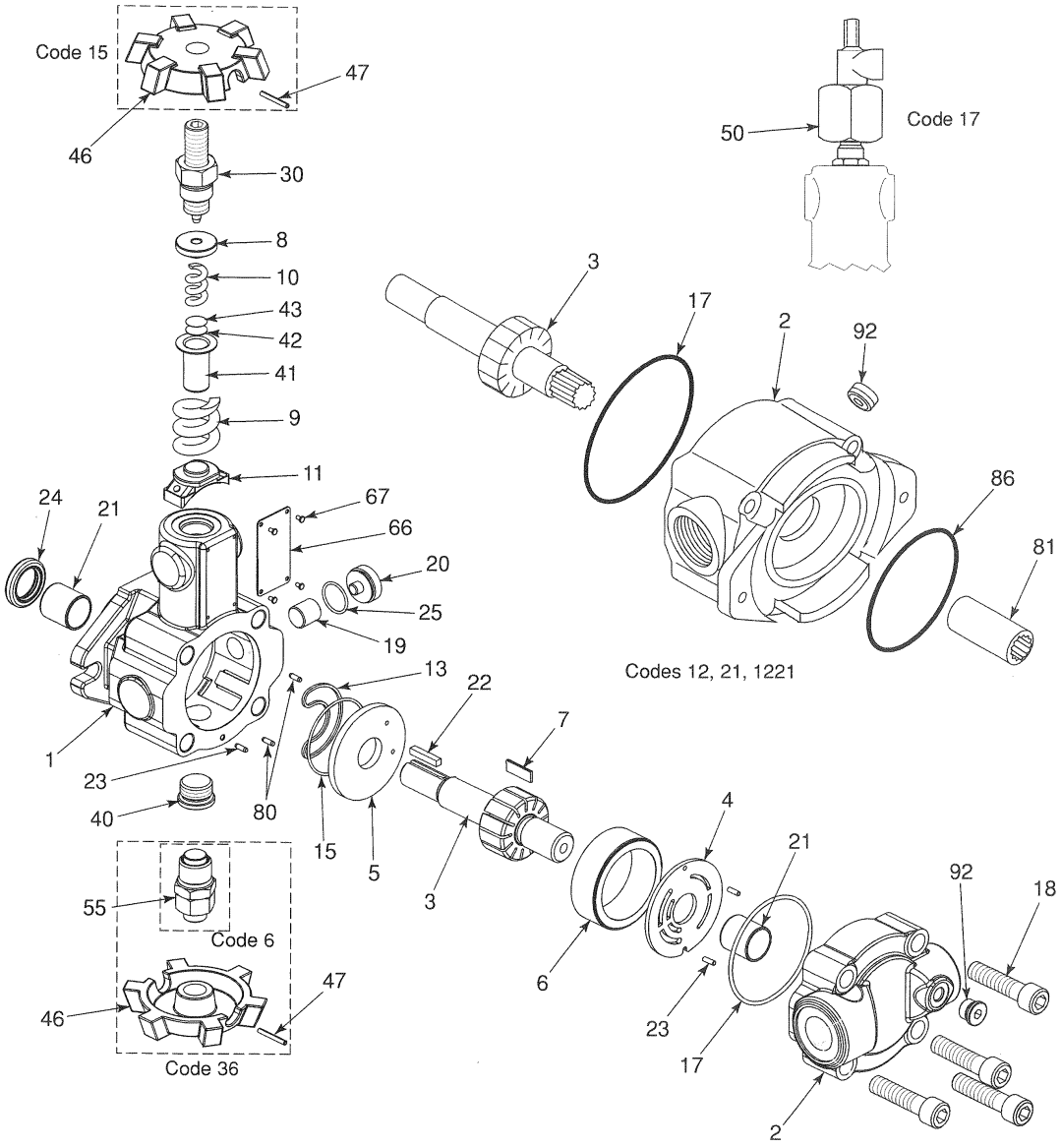
	PUMP SIZE		4B	6B		8B	
	PRESSURE CODE		20	06	15	06	15
Pressure Adjustment	Pressure Change/Turn	psi (bar)	315 (21.7)	220 (15.2)	315 (21.7)	210 (14.5)	240 (16.6)
	Maximum Torque	ft.-lbs. (m.kg)	8.0 (1.10)	2.7 (0.37)	6.8 (0.94)	2.7 (0.37)	6.8 (0.94)
Volume Adjustment	Flow Change/Turn	gpm (lpm)	3.4 (12.9)	4.6 (17.4)		4.6 (17.4)	
	Approx. Min. Flow Adjust.	gpm (lpm)	1.0 (3.7)	1.0 (3.7)		1.0 (3.7)	
	Maximum Torque	ft.-lbs (m.kg)	5.5 (0.76)	3.5 (0.48)		3.5 (0.48)	

PVR6 PARTS LIST

ITEM NO.	CODE	PART NO.	DESCRIPTION	QTY. REQ.
1		550177	Pump Body	1
1	4B	550660	Pump Body	1
2		550541	Cover	1
2	4B	550658	Cover	1
2	6B,8B,10B; 12, 1221	550547	Cover	1
2	4B; 21	550659	Cover	1
3		407929	Rotorshaft	1
3	4B	407930	Rotorshaft	1
3	4B, 12	506066	Rotorshaft	1
3	6B,8B,10B; 12	506069	Rotorshaft	1
3	6B,8B,10B; 1221	550325	Rotorshaft	1
3	4B; 21	550326	Rotorshaft	1
3	6B,8B,10B; 21	550327	Rotorshaft	1
4	4B,6B	550101	Port Plate Assembly	1
4	8B	550074	Port Plate Assembly	1
4	10B	550280	Port Plate Assembly	1
5		550351	Thrust Plate	1
6	4B	114592	Pressure Ring	1
6	6B	112021	Pressure Ring	1
6	8B	123175	Pressure Ring	1
6	10B	251715	Pressure Ring	1
7	4B	250516	Vane Kit (Set of 13)	1
7	6B,8B,10B	250517	Vane Kit (Set of 13)	1
8		306465	Spring Seat	1
8	6B3L,6B5L, 8B3L, 8B5L	350988	Spring Seat	1
8	10B3L,10B5L	166620	Spring Seat	1
9	4B20	165223	Governor Spring	1
9	6B06	149917	Governor Spring	1
9	8B06	251193	Governor Spring	1
9	6B15,8B15	165225	Governor Spring	1
9	6B20,8B20	165226	Governor Spring	1
9	6B3l,8B3L	257653	Governor Spring	1
9	10B3L	109792	Governor Spring	1
9	6B5L,8B5L	255809	Governor Spring	1
9	10B5L	113079	Governor Spring	1
10	6B06,8B06	165221	Follower Spring	1
10	10B10	165220	Follower Spring	1
10	6B15,8B15	165222	Follower Spring	1
11	4B	144926	Ring Shoe Assembly	1
11	6B	144913	Ring Shoe Assembly	1
11	8B	162770	Ring Shoe Assembly	1
11	10B	350448	Ring Shoe Assembly	1
11	6B3L, 6B5L	112022	Ring Shoe Assembly	1
11	8B3L,8B5L	123174	Ring Shoe Assembly	1
11	10B3L,10B5L	350963	Ring Shoe Assembly	1
13		307257	Teflon Seal Ring	1
15	Buna-N	124194	O-Ring	1
15	Viton	147177	O-Ring	1
17	Buna-N	144929	O-Ring	1
17	Viton	144966	O-Ring	1
18		198297	Soc. Hd. Cap Screw	4
18	4B - 21; 6B, 8B, 10B; 21, 1221	198301	Soc. Hd. Cap Screw	4
19		252792	Thrust Screw	1
20		250371	Thrust Screw Plug	1
21		163797	Bushing	2
22		126225	Key	1
23		004223	Roll Pin	3
24		130795	Lip Seal	1
25	Buna-N	104617	O-Ring	1
25	Viton	166069	O-Ring	1
30		309977	Pressure Adj. Screw Ass'y.	1
40	Buna-N	250058	SAE O-Ring Plug	1
40	Viton	254789	SAE O-Ring plug	1
41		306466	Spring Retainer	1
42		144927	Shim (.005)	1
43		144928	Shim (.0149)	1
46	15, 36	252152	Handwheel	1
47	15, 36	261323	Spring Pin	1
50	17	350952	Dual Pressure Control Ass'y.	1
53	8, 9	256508	Flow Control Valve	1
55	6, 36	450196	Volume Adj. Screw Ass'y.	1
66		307179	Name Plate	1
67		250597	Self-Tapping Screw	4
80		002586	Dowel Pin	2
81	1221, 21	350663	Spline Coupling	1
85*	1221, 21	147655	Flange Cover (Shipping)	1
86	Viton	112222	O-Ring	1
86	1221, 21	111298	O-Ring	1
92		256708	SAE O-Ring Plug	1
93*		166288	Caplug (C-D)	1
94*		160259	Caplug (In)	1
95*		137020	Caplug (Out)	1
96*	1221, 21	130437	Caplug (Flange)	2
97*	12, 21,1221	253841	Spline Warning Tag	1
98*		143391	Grease	A.R.
99*		132779	LED Plate #250	A.R.

* Not Shown

PVR6 PARTS DRAWING



PVR6 KIT LIST

WEAR PLATE KITS	
Includes Items: 4 & 5	
Model	**Kit Number**
4B	257094
6B	250747
8B06	250748
8B15	254700
10B10	254911

SEAL KITS	
Includes Items: 13,15,16,17,24,28,30,55,99	
Model	**Kit Number**
All Buna-N, HW	257093
All Viton	250457

VANE KITS	
Includes Items: 7	
Model	**Kit Number**
4B	250516
6B, 8B, 10B	250517

ROTATING KITS	
Includes Items: 3, 6 & 21	
Model	**Kit Number**
4B	250758
4B-21	250815
6B	250760
6B-12	254763
6B-21	250817
8B	250759
8B-12	250762
8B-21	250816
10B	254912

COMPLETE REBUILD KITS	
Includes Items: All Kits Listed Here Plus Item 11.	
Model	**Kit Number**
4B	257095
4B-12	257096
6B	250822
6B-12	250826
6B-21	250834
8B15	250823
8B15-12	250827
10B	254917
10B-12	254918
10B-21	254919

PVR6 PUMP REPAIR PROCEDURES

DISASSEMBLY PROCEDURE

NOTE: Disassembling pump to change components, or for any other reason, may void the warranty. Refer to Policy Statement and Discounts Summaries.

1. Remove the key (22) in the rotor shaft keyway.

2. A small amount of oil may remain in the pump. Remove the four cover bolts and slide the cover back far enough on the shaft to break the seal between the housing and cover to allow the pump to drain.

3. Remove the cover (2). Take care to avoid damage to the bearing with the end of the shaft when the cover is removed.

4. The port plate (4) may come out with the cover. Do not let it drop off the locating pins.

5. Remove the vanes (7) with a long nosed pliers or tweezers. There is one vane in each slot, 13 vanes total.

6. Remove the rotorshaft (3) from the pump. Be sure that the key (22) has been removed from the keyway so that it will not damage the shaft seals when the rotorshaft is removed.

7. Turn the pressure adjustment screw (30) counterclockwise to release the tension on the governor spring.

8. Remove the pressure ring (6), ring shoe (11), governor spring (9), retainer (41) and follower spring (10).

9. If the shaft seal (24) are to be removed they should be pushed out from the inside of the housing at this time. Care must be taken not to damage the journal bearing in the housing while the shaft seal is being removed. It is recommended that the shaft seal be replaced whenever the pump is disassembled for maintenance. The seal cannot be reused once they have been removed.

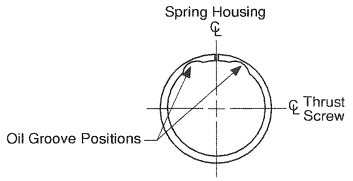
10. The bushings (21) in the pumps are assembled with a press fit. If they are to be removed at this time, the bushing in the housing should be pressed out from the front. The cover bearing should be pulled out using an expanding type puller. The bushings should not be reused once they have been removed.

11. It is unlikely that further disassembly will be necessary in order to perform routine maintenance on the pump.

REASSEMBLY PROCEDURE

1. Clean and inspect parts to determine which parts are worn enough to require replacement.

2. Assemble the new bushings (21) in the housing and cover. The bushing OD's should be lubricated before they are pressed in the bores. Care must be taken to orient the "split" and the "oil groove" in the bushing as shown in the illustration below.



Item #21
Bushing Orientation

3. After the bearings are in place, check to see that the rotor shaft will fit into the bearings and provide a smooth turning fit. If the shaft turns hard, the bearings should be removed and the bore checked closely for nicks or burrs before pressing in the new bearings.

4. Check all of the replacement parts for nicks or burrs and then lubricate them with clean oil before reassembly.

5. Worn port and thrust plates should not be reground to clean up the wear surface. If the plates are ground, the assembly clearance will become excessive and the seal rings in the thrust plate may rupture. Replace worn port and thrust plates if necessary.

6. Assemble the springs (9, 10) and ring shoe (11), pressure ring (6) and rotorshaft (3).

7. To assure proper vane assembly, place the vanes (7) with the beveled edge out against the pressure ring.

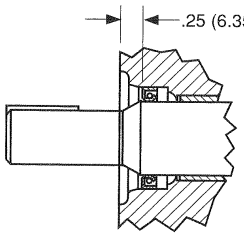
8. Assemble the square seal rings into the cavity in the back of the thrust plate. The soft rubber seal ring (15) should be assembled first and the hard seat ring (13) should be assembled on top of them. Stretch the larger soft seal ring slightly so it clings to the ID at the cavity. Apply clean oil or STP to the back of the thrust plate before it is placed in the locating pins in the body to help hold the parts together while they are assembled.

9. Before fitting the cover into the housing, check to assure that the bore in the port plate is concentric to the bearing bore in the cover. If the bores are not concentric, the port place must be relocated 180° on the locating pins.

10. Assemble the cover (2) and port plate (4) onto the housing and align the bolt holes. Rotate the shaft (3) as the bolts are tightened to assure that the vanes are not cocked.

11. Torque the cover bolts (18) to 50 lbs-ft (67.8 Nm). The shaft should turn by hand when assembly is complete.

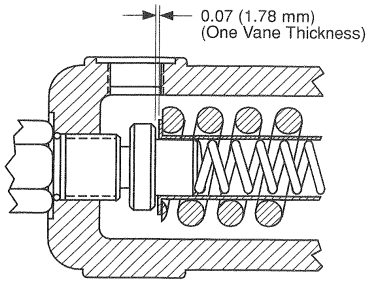
12. Lubricate the ID of the shaft seal (24) and press it into the housing to the depth shown below. Note the "lip to the inside" orientation of the seal.



13. Adjust the pressure adjustment screw (30) until it just touches the spring and then give it one more turn clockwise.

14. Turn pump upside down. Pour one cup of good grade hydraulic fluid into the intake port while slowly rotating the shaft in the direction shown by the rotation arrow.

15. The pump is now ready to test. Refer to front of this manual for start-up procedure.



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Because Continental Hydraulics is continually improving its' products, specifications and appearance are subject to change without notice.

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TRONAIR

APPENDIX IV

MSDS
Hydraulic Fluid

Solutia Inc.

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: SKYDROL® LD4 Fire resistant hydraulic fluid

Reference Number: 000000000183 Date: 03/18/2003

Company Information:

United States:
Solutia Inc.
575 Maryville Center Drive, P.O. Box 66760
St. Louis, MO 63166-6760
Emergency telephone: Chemtrec: 1-800-424-9300
Non-Emergency telephone: 1-314-674-6661

Canada:
Solutia Canada Inc.
6800 St. Patrick Street
LaSalle, PQ H8N 2H3
Emergency telephone: CANUTEC: 1-613-996-6666
Non-Emergency telephone: 1-314-674-6661

Mexico:
Solutia MEXICO, S. DE R.L. DE C.V.
Blvd. Manuel Avila Camacho No. 40 Piso 12 Colonia Lomas de Chapultepec
Edificio Torre Esmeralda11000 Mexico, D.F.
Emergency telephone: SETIQ: (in Mexico) 01-800-002-1400
Non-Emergency telephone: (in Mexico) 555-202-5600

Brazil:
Solutia Brazil Ltd.
Avenue Jorge Bei Maluf, 2105
CEP 08686-000 Suzano, SP
Emergency telephone: 0800 193-190
Non-Emergency telephone: 5511 4745-8569

2. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS No.	Average concentration	Concentration range	Units
tributyl phosphate	126-73-8	58.2		%
dibutyl phenyl phosphate	2528-36-1		30.0 - 60.0	%
butyl diphenyl phosphate	2752-95-6		5.0 - 10.0	%
2,6-di-tert-butyl-p-cresol	128-37-0		1.0 - 5.0	%
2-ethylhexyl 7-oxabicyclo[4.1.0] heptane-3-carboxylate	62256-00-2		<=10.0	%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Form: oily, liquid
Colour: clear to purple
Odour: odourless

WARNING STATEMENTS

WARNING!
Causes eye irritation
Causes skin irritation
Causes respiratory tract irritation
Contains material which may cause urinary bladder damage based on animal data

POTENTIAL HEALTH EFFECTS

Likely routes of exposure:	eye and skin contact inhalation
Eye contact:	Highly irritating to eyes.
Skin contact:	Highly irritating to skin. No more than slightly toxic if absorbed. Repeated contact may cause a drying, solvent like action on the skin.
Inhalation:	Severely irritating if inhaled. No more than slightly toxic if inhaled. Significant adverse health effects are not expected to develop under normal conditions of exposure.
Ingestion:	No more than slightly toxic if swallowed. Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.
Signs and symptoms of overexposure:	coughing sneezing headache nausea/vomiting
Target organs/systems:	Contains material which may cause urinary bladder damage based on animal data

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

If in eyes: If on skin:	Immediately flush the area with plenty of water. Remove contaminated clothing. Wash skin gently with soap as soon as it is available. Get medical attention. Wash clothing before reuse.
If inhaled:	Remove patient to fresh air. If not breathing, give artificial respiration. If breathing is difficult give oxygen. Remove material from eyes, skin and clothing.
If swallowed:	Immediate first aid is not likely to be required. A physician or Poison Control Center can be contacted for advice. Wash heavily contaminated clothing before reuse.

Notes to physicians: After flushing eyes for at least 15 minutes, opthalmic preparations of sterile mineral or castor oil may be instilled one time in the exposed eye for relief of pain.

5. FIRE FIGHTING MEASURES

Flash point:	160 C	Cleveland Open Cup
Fire point:	176 C	ASTM D-2155
Autoignition temperature:	398 C	ASTM D-2155

Hazardous products of combustion: None known;

Extinguishing media: Water spray, foam, dry chemical, or carbon dioxide

Unusual fire and explosion hazards: None known

Fire fighting equipment: Firefighters, and others exposed, wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Use personal protection recommended in section 8.

Environmental precautions: Keep out of drains and water courses.

Methods for cleaning up: Contain large spills with dikes and transfer the material to appropriate containers for reclamation or disposal. Absorb remaining material or small spills with an inert material and then place in a chemical waste container. Flush spill area with water.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling
Avoid breathing vapour or mist.
Avoid contact with eyes, skin and clothing.
Use with adequate ventilation.
Keep container closed.
Wash thoroughly after handling.

Emptied containers retain vapour and product residue. Observe all recommended safety precautions until container is cleaned, reconditioned or destroyed. Do not reuse this container.

Storage
General: Stable under normal conditions of handling and storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye protection: Wear chemical goggles.
Have eye flushing equipment available.

Hand protection:	Wear chemical resistant gloves. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. See Solutia Glove Facts for permeation data.
Body protection:	Wear suitable protective clothing. Wear full protective clothing if exposed to splashes. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Have safety shower available at locations where skin contact can occur. Wash thoroughly after handling.
Respiratory protection:	Avoid breathing vapour or mist. Use approved respiratory protection equipment (full facepiece recommended) when airborne exposure limits are exceeded. If used, full facepiece replaces the need for face shield and/or chemical goggles. Consult the respirator manufacturer to determine the appropriate type of equipment for a given application. See Solutia Respirator Facts. Observe respirator use limitations specified by the manufacturer.
Ventilation:	Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits. If practical, use local mechanical exhaust ventilation at sources of air contamination such as processing equipment.
Airborne exposure limits:	(ml/m3 = ppm)
SKYDROL® LD4	No specific occupational exposure limit has been established.
tributyl phosphate	ACGIH TLV: 0.2 ml/m3 ; 2.2 mg/m3 ; ; 8-hr TWA OSHA PEL: 5 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.2 ml/m3 ; 2.5 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.4 ml/m3 ; 5 mg/m3 ; ; 15-min STEL
dibutyl phenyl phosphate	ACGIH TLV: 0.3 ml/m3 ; 3.5 mg/m3 ; skin * ; 8-hr TWA * skin absorption of this material may add to the overall exposure.
2,6-di-tert-butyl-p-cresol	ACGIH TLV: 2 mg/m3 ; ; 8-hr TWA Mexican OEL: 10 mg/m3 ; ; 8-hr TWA Mexican OEL: 20 mg/m3 ; ; 15-min STEL

Components referred to herein may be regulated by specific Canadian provincial legislation. Please refer to exposure limits legislated for the province in which the substance will be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

Specific gravity:	1.004 - 1.014 @ 25 C
Viscosity :	10.8 - 11.6 mPa.s @ 38 C

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Conditions to avoid:	Elevated temperatures
Materials to avoid - Hazardous reactions:	Contact with strong oxidizing agents. Hazardous polymerization does not occur.
Hazardous decomposition products:	phosphorus oxides (PxOy); carbon monoxide (CO); carbon dioxide

11. TOXICOLOGICAL INFORMATION

This product has been tested for toxicity. Results from Solutia sponsored studies or from the available public literature are described below.

Acute animal toxicity data

Oral:	LD50 , rat, 2,100 mg/kg , Slightly toxic following oral administration.
Dermal:	LD50 , rabbit, > 3,160 mg/kg , Practically nontoxic after skin application in animal studies.
Inhalation:	LC50 , rat, > 5.8 mg/l , , No mortality or signs of toxicity at the highest level achievable.
Eye irritation:	rabbit , Slightly irritating to eyes (rabbit)., 24 h
Skin irritation:	rabbit , Moderately irritating to skin., 24 h
Skin sensitization:	Human experience , Predictive patch testing on human volunteers did not produce dermal sensitization.
Repeat dose toxicity:	rat, inhalation, 28 days, Repeated exposure produced eye irritation in animal models. Repeated exposure produced respiratory tract irritation in animal models. Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies.
Neurotoxicity:	chicken, gavage, acute, Brain cholinesterase inhibition.
Mutagenicity:	No genetic effects were observed in standard tests using bacterial and animal cells.

Components

Data from Solutia studies and/or the available scientific literature on the components of this material which have been identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) or the Canadian Hazardous Products Act are discussed below.

tributyl phosphate	Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies.

	Slightly irritating to eyes (rabbit). Highly irritating to skin (rabbit). Produced no dermal sensitization (guinea pigs). Repeated oral administration produced multiple systemic effects. No delayed neurotoxicity was observed in animal models. This material produced tumours in laboratory animals at dose levels that exceed the maximum tolerated dose. The weight of the evidence indicates that this material is not mutagenic in in-vitro assays.
dibutyl phenyl phosphate	Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Practically non irritating to eyes (rabbit). Practically non irritating to skin (rabbit). Produced no dermal sensitization (guinea pigs). Repeated skin exposure produced irritation in animal studies. Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Repeated oral administration produced multiple organ effects. No delayed neurotoxicity was observed in animal models. No birth defects were noted in rats given the active ingredient orally during pregnancy. This material had no effect on reproduction or fertility. Produced developmental toxicity. The weight of the evidence indicates that this material is not mutagenic in in-vitro assays.
2,6-di-tert-butyl-p-cresol	Slightly irritating to skin, eyes and respiratory system in animal models. Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Both positive and negative responses observed in standard tests for genetic changes.
2-ethylhexyl 7-oxabicyclo[4.1.0] heptane-3-carboxylate	Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Practically non irritating to eyes (rabbit). Slightly irritating to skin (rabbit). No mortality or signs of toxicity at the highest level tested. Produced dermal sensitization (guinea pigs). The weight of the evidence indicates that this material is not mutagenic in in-vitro assays. The weight of the evidence indicates that this material is mutagenic in in-vivo assays.

12. ECOLOGICAL INFORMATION

Environmental Toxicity:

Invertebrates	48 h, EC50	Water flea (Daphnia magna)	5.8 mg/l
Fish:	96 h, EC50	Rainbow trout (Oncorhynchus mykiss)	5.2 mg/l
	96 h, EC50	Fathead minnow (Pimephales promelas)	4.8 mg/l
Algae:	96 h, EC50	Algae (Selenastrum capricornutum)	10 mg/l

Environmental fate

Biodegradation

Readily biodegradable.

13. DISPOSAL CONSIDERATIONS

US EPA RCRA Status: This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261.

Disposal considerations: Incineration
Recycle

Miscellaneous advice: 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.
Local, state, provincial, and national disposal regulations may be more or less stringent. This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

US DOT
Other: Not regulated for transport.

Canadian TDG
Other: Not regulated for transport.

15. REGULATORY INFORMATION

All components are in compliance with the following inventories: U.S. TSCA, EU EINECS, Canadian DSL, Australian AICS, Korean, Japanese ENCS, Chinese

Canadian WHMIS classification: D2(B) - Materials Causing Other Toxic Effects

SARA Hazard Notification:

Hazard Categories Under Title III Rules (40 CFR 370): Immediate
Delayed

Section 302 Extremely Hazardous Substances:

Section 313 Toxic Chemical(s):

CERCLA Reportable Quantity:

Not applicable

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA/HPA Hazardous Chemical(s) and Section 13 for RCRA classification.

Safety data sheet also created in accordance with Brazilian law NBR 14725

16. OTHER INFORMATION

Product use: Hydraulic fluids and additives

Reason for revision: Significant changes to the following section(s):, Section 2, Section 8, Section 15

	Health	Fire	Reactivity	Additional Information
Suggested NFPA Rating	2	1	0	
Suggested HMIS Rating:	2	1	0	G

Prepared by the Solutia Hazard Communication Group. Please consult Solutia @ 314-674-6661 if further information is needed.