

**50X0 Series
5010, 5020, 5030
Hydraulic Power Units**

04/2022 - Rev. 05

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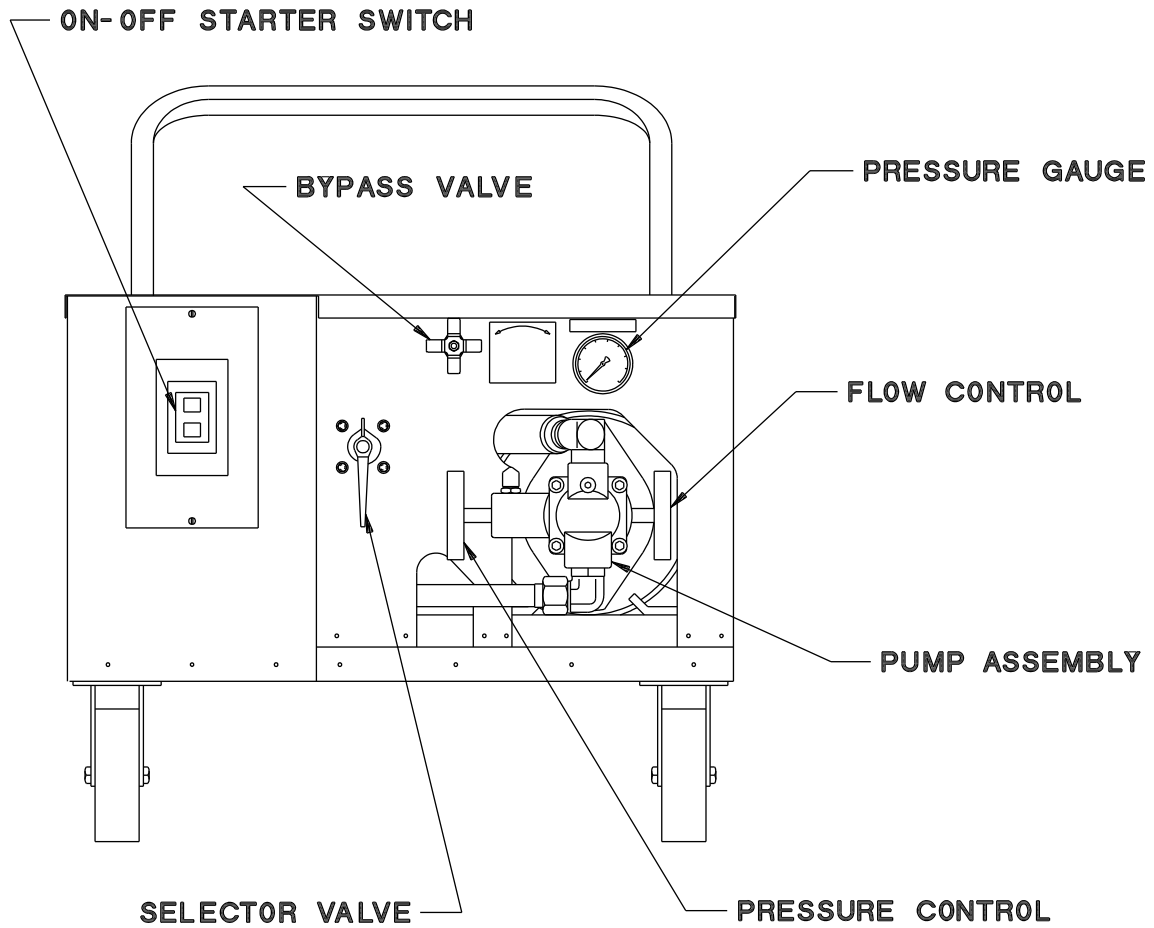


REVISION	DATE	TEXT AFFECTED
01	11/2017	Original release
02	10/2018	Added 5.6.2 Citation Option
03	12/2018	Modified parts list
04	08/2021	Added section 5.6 Infrequent HPU Use and updated 7.0 Maintenance
05	04/2022	Modified parts list

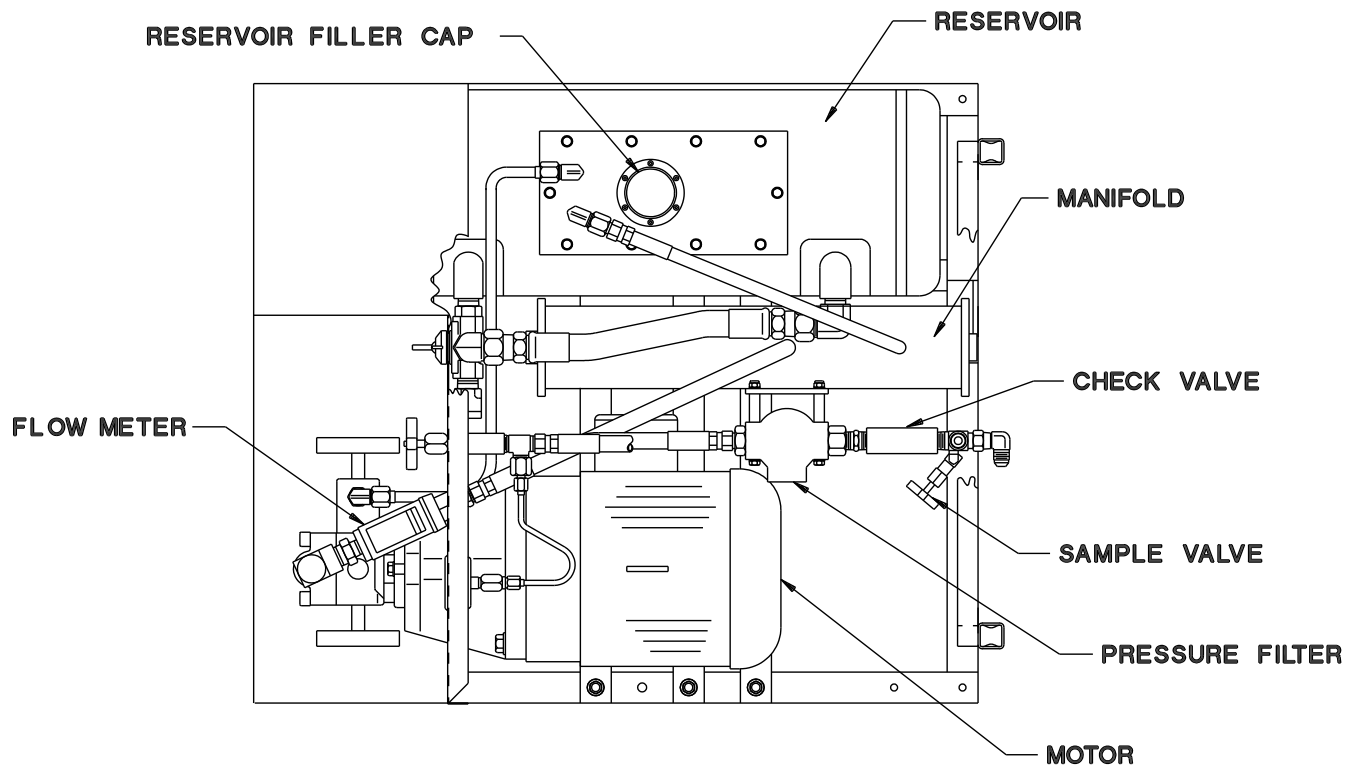
TABLE OF CONTENTS

	<u>PAGE</u>
FRONT PANEL CONTROLS	1
INTERNAL COMPONENTS	2
HYDRAULIC SCHEMATIC	3
ELECTRICAL SCHEMATIC	4
1.0 PRODUCT INFORMATION	5
1.1 DESCRIPTION.....	5
1.2 MODEL & SERIAL NUMBER.....	5
1.3 MANUFACTURER	5
1.4 FUNCTION.....	5
1.5 TECHNICAL SPECIFICATIONS	5
1.5.1 Hydraulic	5
1.5.2 Electrical	5
1.5.3 MECHANICAL.....	5
2.0 SAFETY INFORMATION	6
2.1 USAGE AND SAFETY INFORMATION	6
3.0 PREPARATION FOR USE	6
3.1 SERVICING RESERVOIR	6
3.2 CONNECTING ELECTRICAL LEADS	6
4.0 TRAINING	6
4.1 TRAINING REQUIREMENTS	6
4.2 TRAINING PROGRAM	6
4.3 OPERATOR TRAINING.....	6
5.0 OPERATION	7
5.1 GENERAL COMMENTS	7
5.1.1 Use of the HPU Reservoir	7
5.2 PRELIMINARY ADJUSTMENTS AND OPERATIONS	7
5.2.1 Flow Control Adjustment.....	7
5.2.2 Pressure Control Adjustment	7
5.2.3 Reservoir Selector Valve Operation	7
5.2.3.a Aircraft Reservoir Position (Closed Loop)	7
5.2.3.b HPU Reservoir Position (Open Loop)	8
5.2.4 Bypass Valve Operation.....	8
4.2.4.a Start Up Operation	8
4.2.4.b Shut down Operation	8
5.3 SAMPLE VALVE.....	8
5.4 BLEEDING AIR FROM SYSTEM.....	9
5.5 ABBREVIATED OPERATING INSTRUCTIONS	9
5.5.1 Initial Adjustments.....	9
5.5.2 Prior to Starting	9
5.5.3 Operation	9
5.5.4 Shut Off.....	9
5.6 INFREQUENT HPU USE	10
5.6.1 Infrequent HPU Use Start Up Procedure	10
5.7 OPTIONS.....	10
5.7.1 Split System (Option C) Operation	10
6.0 TROUBLESHOOTING	12
6.1 NO FLOW OR PRESSURE	12
6.2 FLUCTUATING PRESSURE OR FLOW.....	12
6.3 UNIT OVERHEATS.....	12
6.4 LOSS OF FLOW IN CLOSED LOOP	12
6.5 EXTERNAL LEAKAGE FROM SELECTOR VALVE	12
7.0 MAINTENANCE	13
7.1 GENERAL MAINTENANCE	13
7.2 FILTER MAINTENANCE.....	13
7.3 SELECTOR VALVE MAINTENANCE	13
7.4 LUBRICATION	13
7.5 STORAGE	13
8.0 PROVISION OF SPARES	14
8.1 SOURCE OF SPARE PARTS.....	14
8.2 RECOMMENDED SPARE PARTS LISTS	14
9.0 IN SERVICE SUPPORT	15
10.0 GUARANTEES/LIMITATION OF LIABILITY	15
11.0 APPENDICES	15

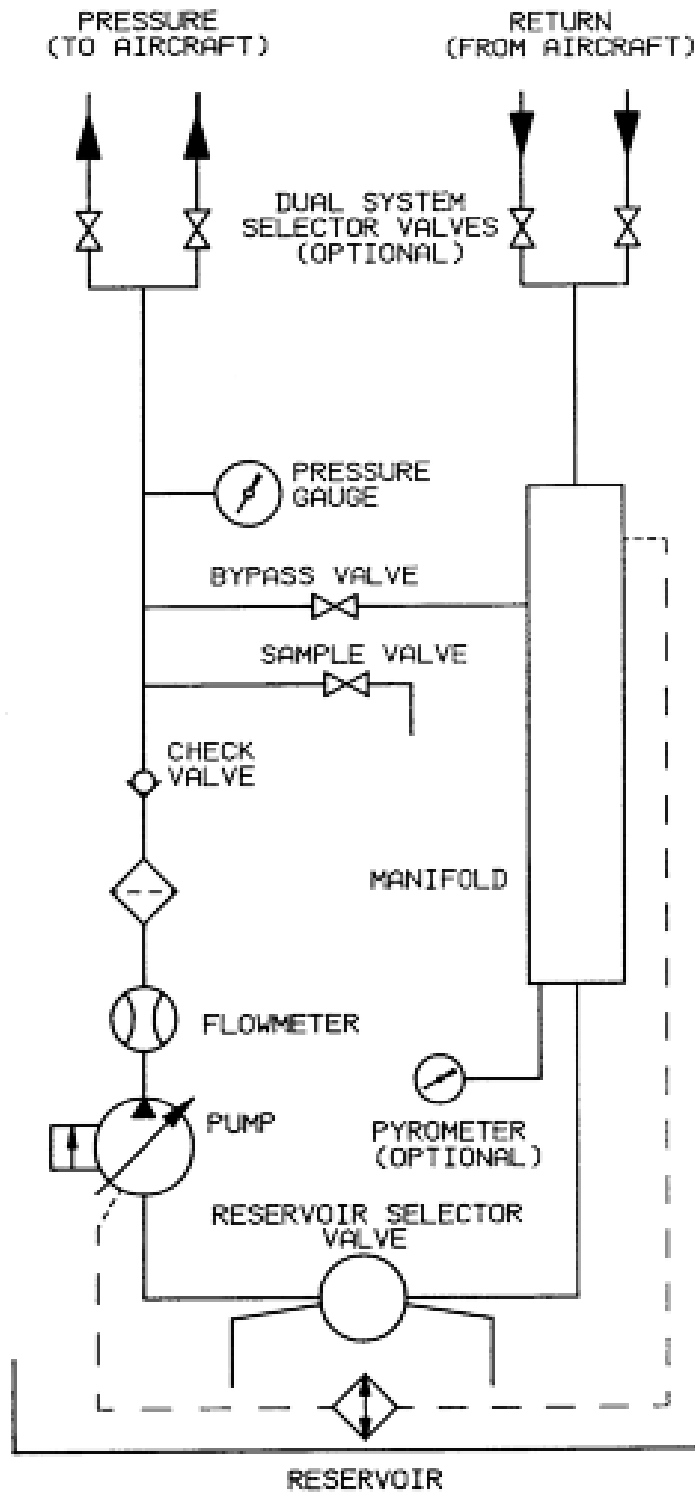
FRONT PANEL CONTROLS



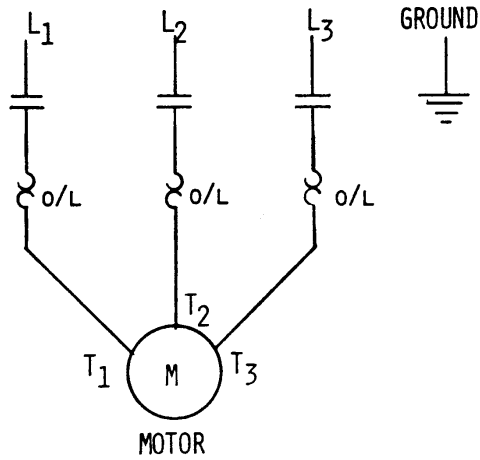
INTERNAL COMPONENTS



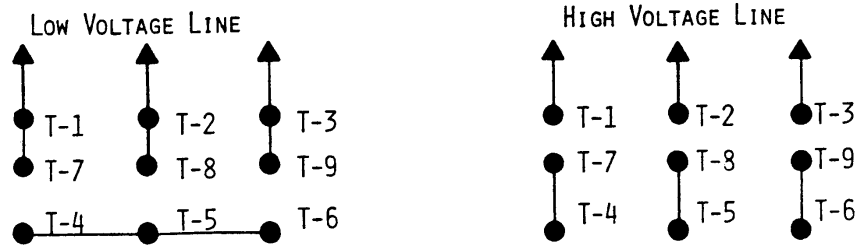
HYDRAULIC SCHEMATIC



ELECTRICAL SCHEMATIC



DUAL INPUT VOLTAGE CONNECTION



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 PRODUCT INFORMATION

1.1 DESCRIPTION

Hydraulic Power Unit

Model Number	Fluid Type
5010	MIL-PRF-5606
5020	MIL-PRF-83282
5030	Aviation Phosphate Ester, Type IV

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

<p>TRONAIR, Inc. 1 Air Cargo Pkwy East Swanton, Ohio 43558 USA</p>	<p>Telephone: (419) 866-6301 or 800-426-6301 Fax: (419) 867-0634 E-mail: sales@tronair.com Website: www.tronair.com</p>
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1.4 FUNCTION

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

1.5 TECHNICAL SPECIFICATIONS

1.5.1 Hydraulic

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 gallons (Maximum)

1.5.2 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		

1.5.3 MECHANICAL

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

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

The HPU provides pressurized hydraulic fluid for performing aircraft maintenance.

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



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

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

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



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 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.



WARNING!

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

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

Some reasons for imbalance are:

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

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

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

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

4.2 TRAINING PROGRAM

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

4.3 OPERATOR TRAINING

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

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

5.0 OPERATION

5.1 GENERAL COMMENTS

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.

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.

5.1.1 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.

5.2 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.

5.2.1 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.

5.2.2 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.

5.2.3 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.

5.2.3.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 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.



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.

5.2.3.b 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 is 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**

5.2.4 Bypass Valve Operation

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

4.2.4.a 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.

4.2.4.b Shut down Operation

Prior to shutdown, 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.**

5.3 SAMPLE VALVE

A sample valve is provided on the rear of the unit to obtain a fluid sample for analysis or inspection. In order to obtain a representative fluid sample, it is suggested that American National Standard number B93.19-1972 be followed.

5.4 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.
5. Run unit for five (5) 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.

5.5 ABBREVIATED OPERATING INSTRUCTIONS

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

5.5.1 Initial Adjustments

1. Set flow control (See Section 5.2-1).
2. Set pressure control (See Section 5.1-2).

5.5.2 Prior to Starting

1. Select reservoir valve position.
2. Open bypass valve.

5.5.3 Operation

1. Start HPU.
2. Close bypass valve.

5.5.4 Shut Off

1. Open bypass valve.
2. Stop HPU.

5.6 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.

5.6.1 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 100°-130° F (37.8°-54.4° C)
14. At the completion of the 15-30 minute circulation run, open the bypass valve and shut off the unit
15. Remove the electric power
16. Place the selector valve in the Aircraft Reservoir position
17. Close the pressure and return ball valves on the back of the unit

5.7 OPTIONS

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

5.7.1 Split System (Option C) Operation

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

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

To Operate the Split 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.



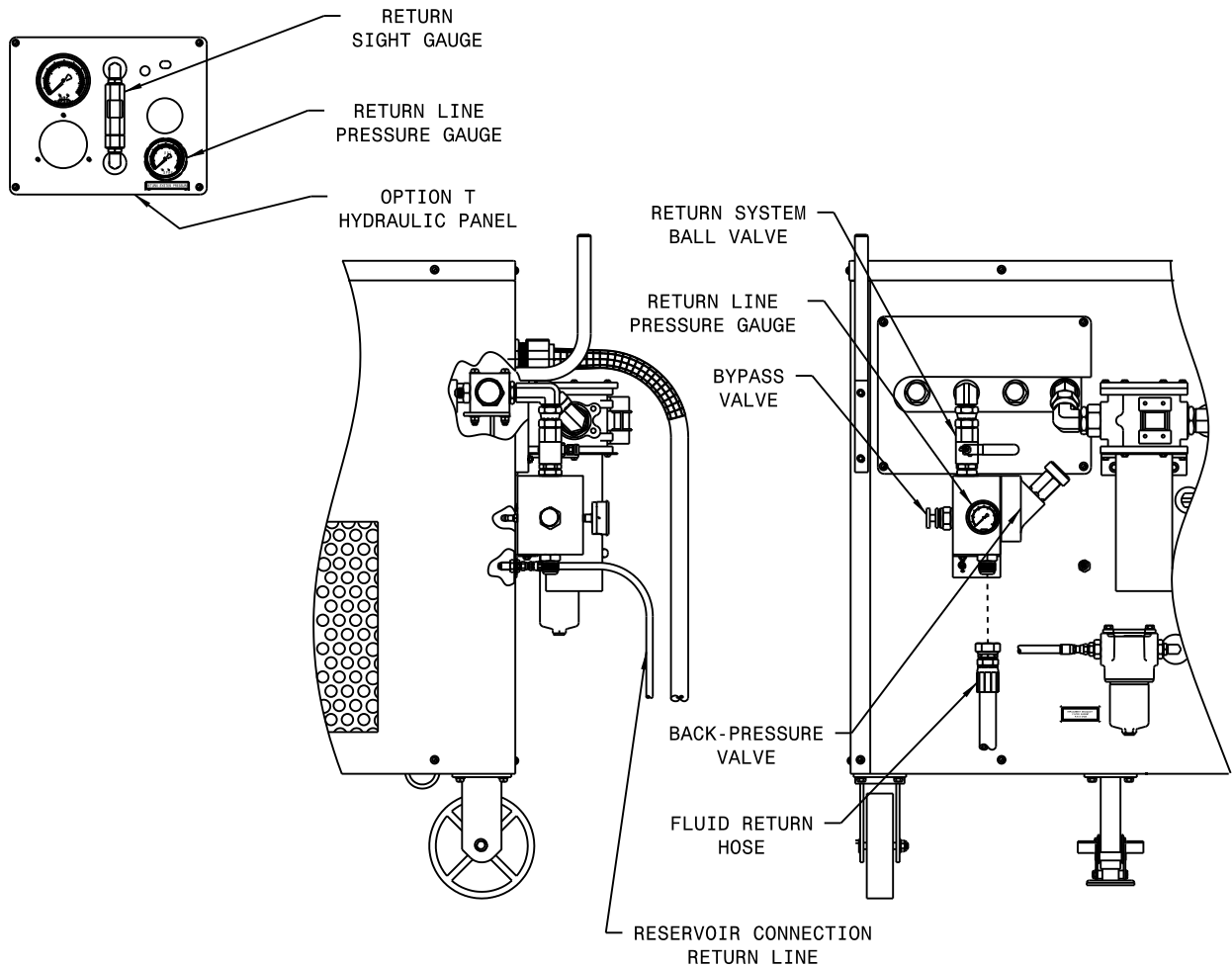
WARNING!

Never open or close split system valves without shutting off the hydraulic power unit. Damage to the aircraft system or reservoir may result if either return line valve is closed while the machine is running.

3. If equipped with the **Split 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.

5.7 OPTIONS (continued)

This option is only available on 5030 model



Return Sight Gauge	Allows viewing of fluid returned through the reservoir connection line (third hose)
Return Line Pressure Gauge (Panel Mounted)	Indicates the pressure in the main return hose (back-pressure). The panel gauge is positioned for ease of operation
Return Line Pressure Gauge (Manifold Mounted)	Indicates the pressure in the main return hose (back-pressure) The manifold mounted gauge is positioned for ease of valve adjustment
Back-Pressure Valve	Adjustable check valve, used for creating back-pressure in the main return line
Bypass Valve	Allows fluid to bypass the back-pressure valve
Fluid Return Hose	Connects HPU to aircraft return systems
Reservoir Connection Return Line	Connects HPU to aircraft reservoir overflow line



WARNING!

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

6.0 TROUBLESHOOTING

6.1 NO FLOW OR PRESSURE

Possible Cause	Solution
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 5.4 Bleeding Air From System
Faulty pump	Repair or replace pump

6.2 FLUCTUATING PRESSURE OR FLOW

Possible Cause	Solution
Pump cavitation	See Section 5.2.3.a Aircraft Reservoir Position
Air in hydraulic lines	See Section 5.4 Bleeding Air From System

6.3 UNIT OVERHEATS

Possible Cause	Solution
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 5.2.4 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 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 5.6 Infrequent Use Procedure.

7.1 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.

7.2 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.

7.3 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.

7.4 LUBRICATION

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

7.5 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.

8.0 PROVISION OF SPARES

8.1 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



8.2 RECOMMENDED SPARE PARTS LISTS

Reference the following page(s) for Replacement Parts and Kits available.

Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

PART NUMBER	DESCRIPTION	Qty
K-1414	KIT,REPL.FILTER ELEMENT	1
K-3096	KIT, FILTER ELEMENT (MB)	1
HC-1763	FILTER, DESICCANT	1
K-4008	KIT, TEST FLUID	1
HC-1385	GAUGE, PRESSURE 0-3000 PSI	1
TF-1037-01*180	ASSEMBLY, HOSE (#8 MB)	1
TF-1039-01*180	HOSE, RETURN (#12 MB)	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester

PART NUMBER	DESCRIPTION	Qty
K-1415	KIT,REPL.FILTER ELEMENT	1
K-3097	KIT, FILTER ELEMENT (PE)	1
HC-1763	FILTER, DESICCANT	1
K-4061	KIT, TEST FLUID	1
HC-1385	GAUGE, PRESSURE 0-3000 PSI	1
TF-4041-09*180	ASSEMBLY, HOSE (#8 PE)	1
TF-1041-01*180	HOSE, RETURN (#12 PE)	1

9.0 IN SERVICE SUPPORT

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

10.0 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.**

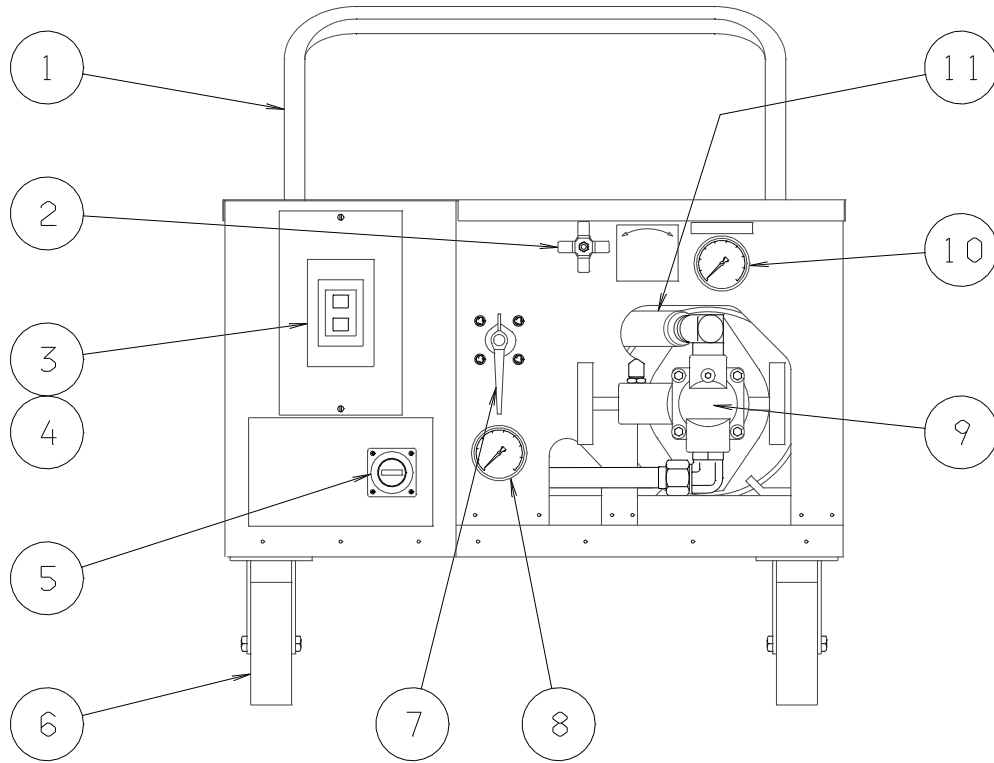
11.0 APPENDICES

APPENDIX I	Instrument Certification Notice
APPENDIX II	Lincoln Motor Manual
APPENDIX III	Continental Hydraulics Service Booklet PVR6-"G" Design Series Pumps
APPENDIX IV	Safety Data Sheet Hydraulic Fluid
APPENDIX V	Safety Data Sheet Hydraulic Fluid
APPENDIX VI	Safety Data Sheet Hydraulic Fluid

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External Components

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



All Units

Item	Part Number	Description	Qty
1	TS-1482-01	Handle	1
3	EC-1044	Switch, Starter (All Voltages)	1
4	See Page 20	Heater	3
5	Z-2145	Hourmeter (Option F)	1
6	U-1056	Caster - Rigid	2
8	HC-1114	Pyrometer (Option K)	1
10	HC-1385	Gauge, Pressure	1
	TF-1037-01*180	Hose, Pressure	1
	TF-1039-01*180	Hose, Return	1

The remaining parts are fluid specific.

External Components

Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

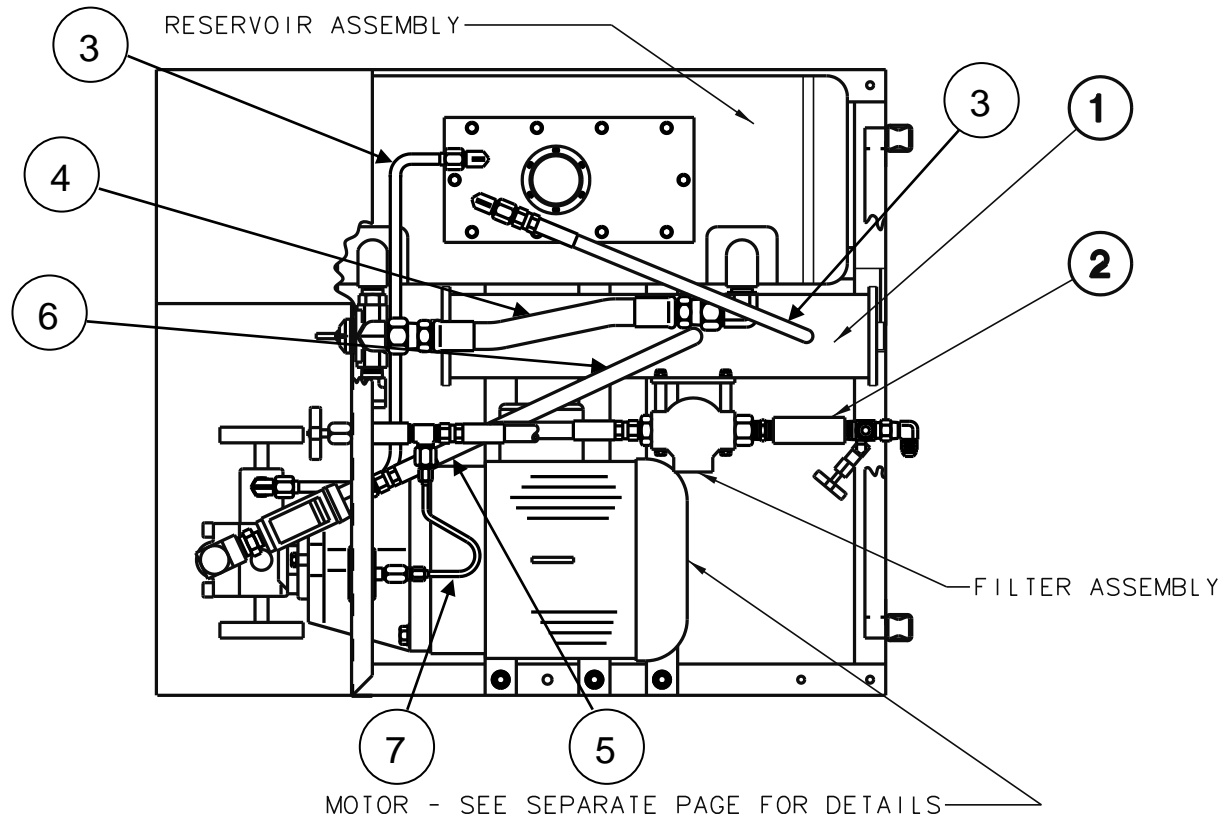
Item	Part Number	Description	Qty
2	HC-1056-01	Valve, Bypass	1
7	HC-1074	Valve, Selector 3/4	1
9	HC-1070-01	Pump	1
8	HC-2150	Flowmeter	1
	HC-2150-A1	Flowmeter (Calibrated)	1
N/S	TF-1039-01*180	Hose, Pressure	1
	TF-1037-01*180	Hose, Return	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
2	HC-1056-02	Valve, Bypass	1
7	HC-1072	Valve, Selector 3/4	1
9	HC-1072-01	Pump	1
8	HC-1114	Flowmeter	1
	HC-1114-A1	Flowmeter (Calibrated)	1
N/S	TF-1041-09*180	Hose, Pressure	1
	TF-1041-01*180	Hose, Return	1

Internal Components



Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

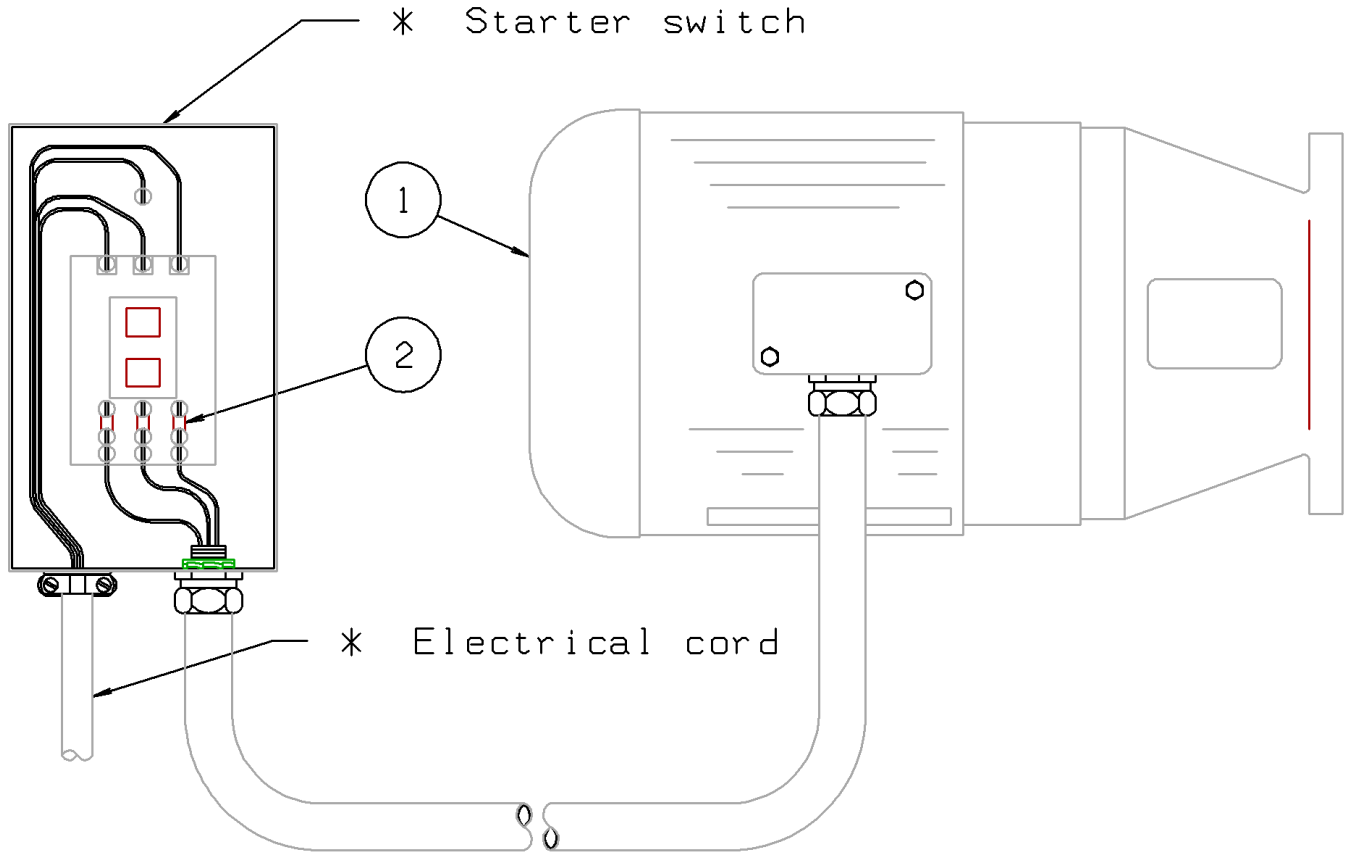
Item	Part Number	Description	Qty
1	Z-1834	Manifold	1
2	HC-1058	Valve, Check	1
3	TF-1037-16-29.0	Assembly, Hose (#6 MB)	2
4	TF-1039-15*16.3	Assembly, Hose (#12 MB)	1
5	TF-1037-01*12.3	Assembly, Hose (#8 MB)	1
6	TF-1037-01*15.0	Assembly, Hose (#8 MB)	1
7	TF-1037-01*16.0	Assembly, Hose (#8 MB)	1
N/S	TF-1037-12*20.5	Assembly, Hose (#8 MB)	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	Z-1834	Manifold	1
2	HC-1059	Valve, Check	1
3	TF-1041-02-29.0	Assembly, Hose (#6 PE)	2
4	TF-1041-16*16.3	Assembly, Hose (#12 PE)	1
5	TF-1041-09*12.3	Assembly, Hose (#8 PE)	1
6	TF-1041-09*15.0	Assembly, Hose (#8 PE)	1
7	TF-1041-05*16.0	Assembly, Hose (#8 PE)	1
N/S	TF-1041-14*20.5	Assembly, Hose (#8 PE)	1

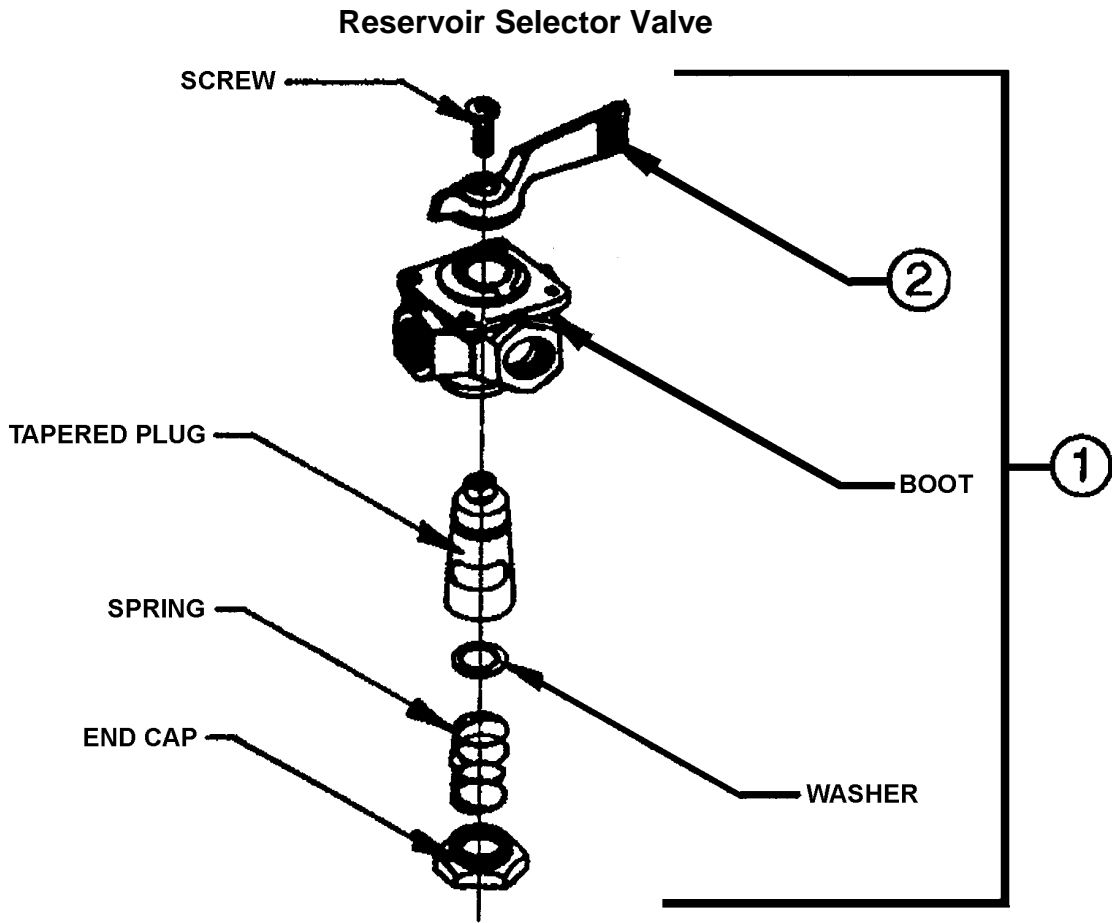
Electrical Components



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

Item	60 Hz Applications					Description	Qty
	208	230	380	460	575		
1	EC-1186-02				EC-1186-03	Motor	1
2	EC-1044					Switch, Manual Starting	1
	EC-1202-W51	EC-1202-W50	EC-1202-W45	EC-1202-W43	EC-1202-W41	Heater Element	3
	EC-1252-01*43.0					Wire	3
	EC-1170-01*0600					Power Cord	1

Item	50 Hz Applications					Description	Qty
	208	230	380	460	575		
1	EC-1186-02					Motor	1
2	EC-1044					Switch, Manual Starting	1
	EC-1202-W50	EC-1202-W50	EC-1202-W43	EC-1202-W43	EC-1202-W43	Heater Element	3
	EC-1252-01*43.0					Wire	3
	EC-1170-01*0600					Power Cord	1



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

Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

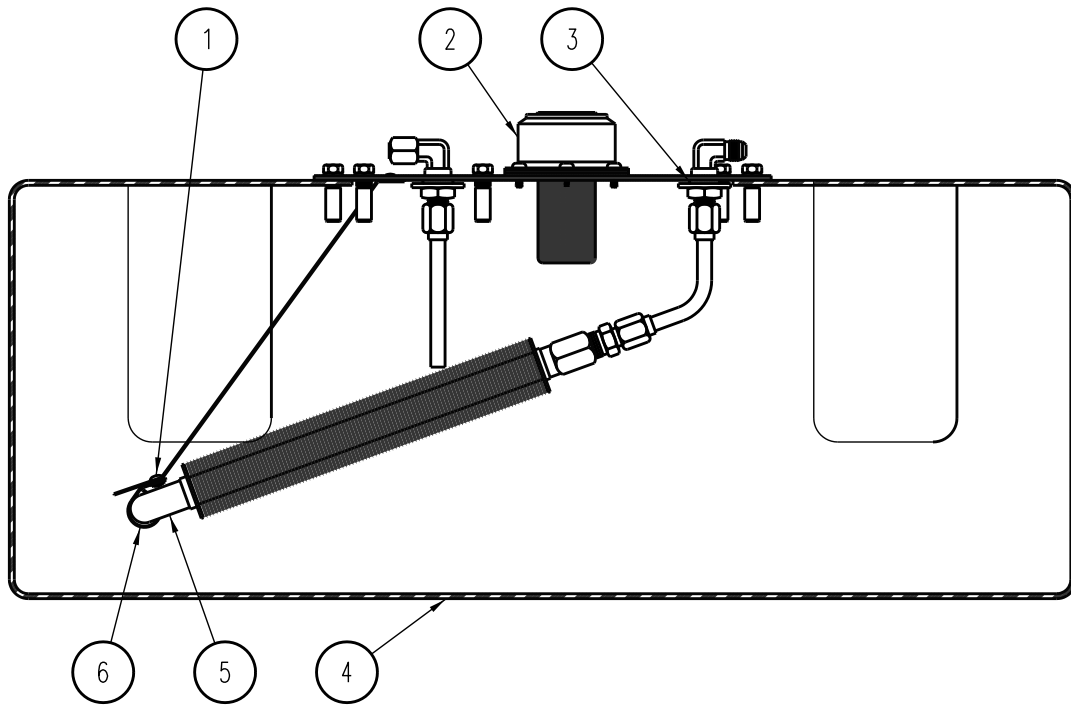
Item	Part Number	Description	Qty
1	HC-1074	Selector, Valve 3/4	1
2	HC-1075	Handle, Valve	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

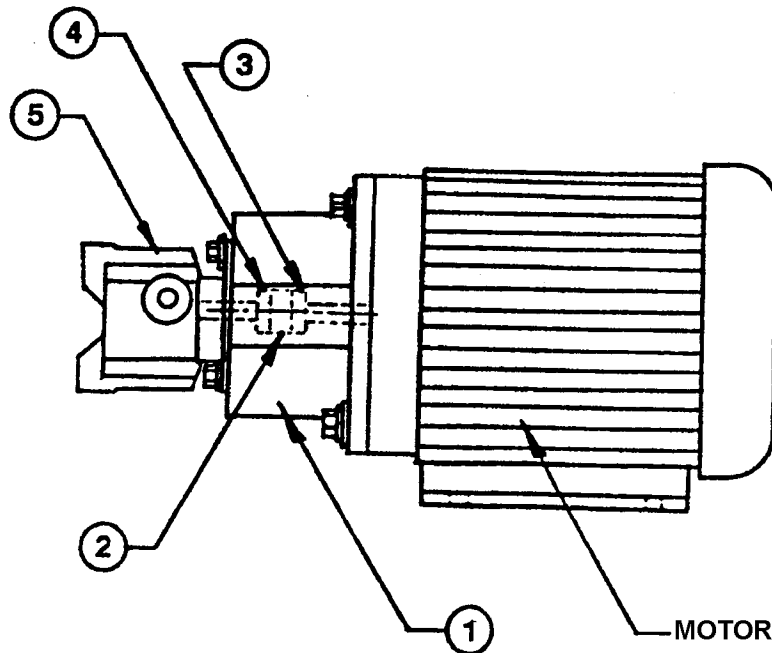
Item	Part Number	Description	Qty
1	HC-1742	Selector, Valve 3/4	1
2	HC-1075	Handle, Valve	1

Reservoir Sub-Assembly



Item	Part Number	Description	Qty
1	G-1351-04	Rivet, 1/8" diameter x 1/4" Grip	4
2	HC-1030	Assembly, Filler/Breather	1
3	HC-2010-906	O-ring	2
4	K-3708	Kit, Reservoir	1
5	HC-1878	Cooler	1
6	H-1721-04	Clamp	1

Pump/Motor Assembly



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

All Models

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

The remaining parts are fluid specific.

Model 5010 & 5020 Parts List

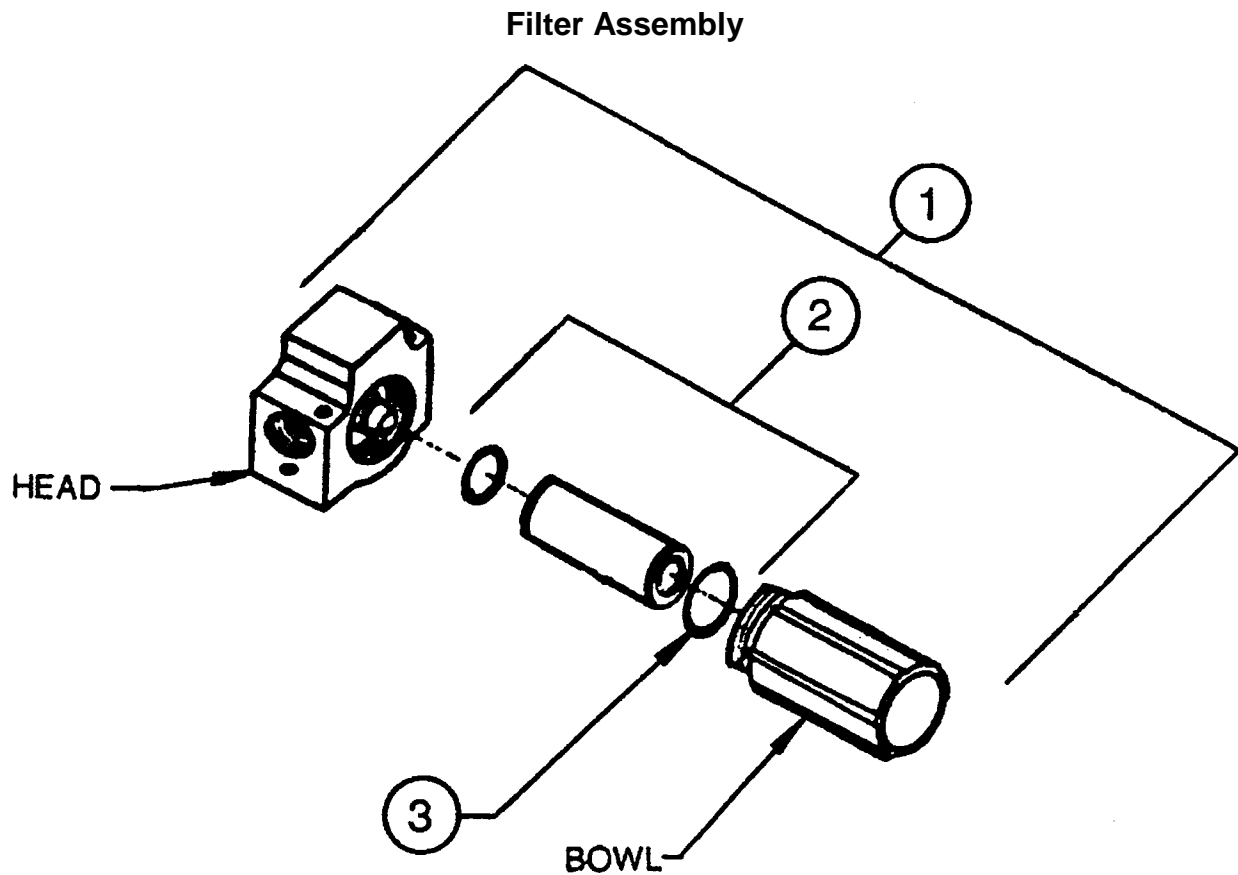
Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

Item	Part Number	Description	Qty
♦ 5	HC-1070-01	Pump, Hydraulic	1
N/S	HC-1816	Seal, Shaft	1
	K-1078	Kit, Seal (Includes Shaft Seal)	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
♦ 5	HC-1070-01	Pump, Hydraulic	1
N/S	HC-1816	Seal, Shaft	1
	K-1078	Kit, Seal (Includes Shaft Seal)	1



◆ Item 2 includes Item 3 O-ring.

Model 5010 & 5020 Parts List

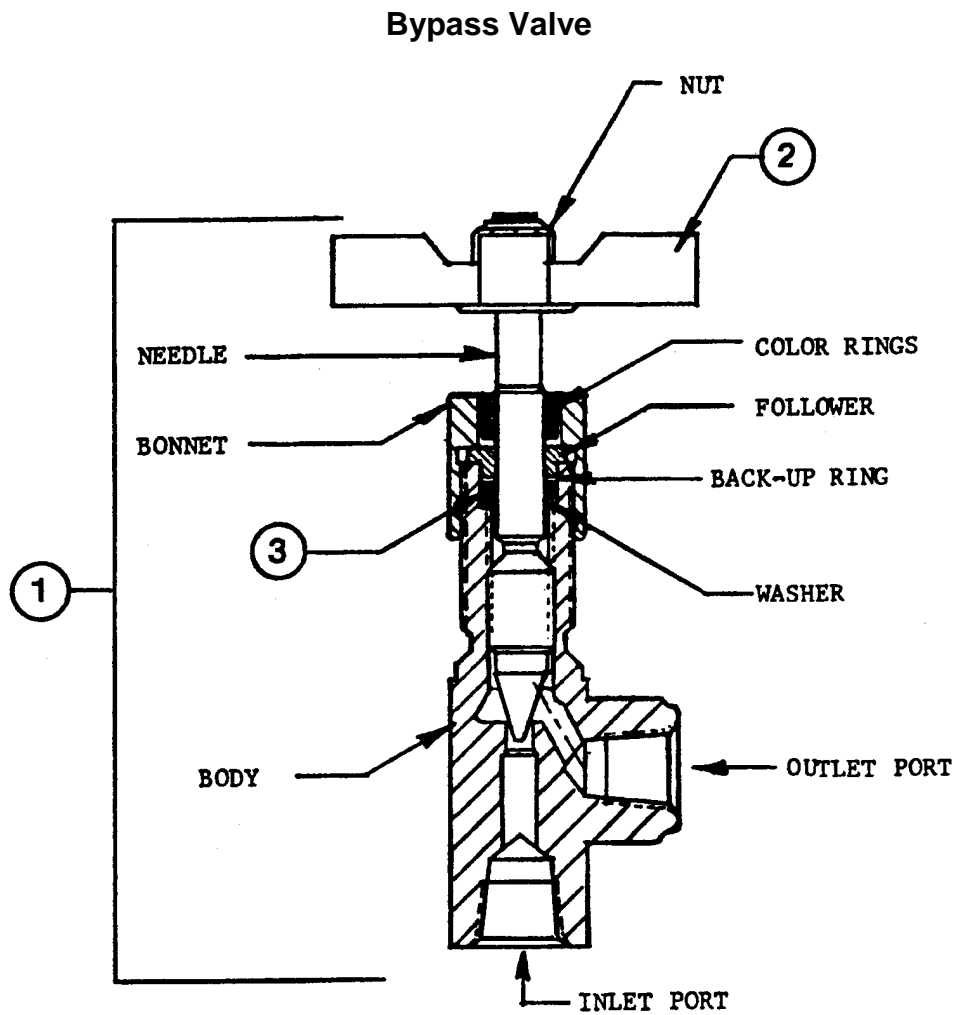
Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

Item	Part Number	Description	Qty
1	HC-1083	Assembly, Filter	1
◆ 2	K-1414	Kit, Filter Element	1
3	HC-2000-138	O-ring	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1084	Assembly, Filter	1
◆ 2	K-1415	Kit, Filter Element	1
3	HC-2006-138	O-ring	1



Model 5010 & 5020 Parts List

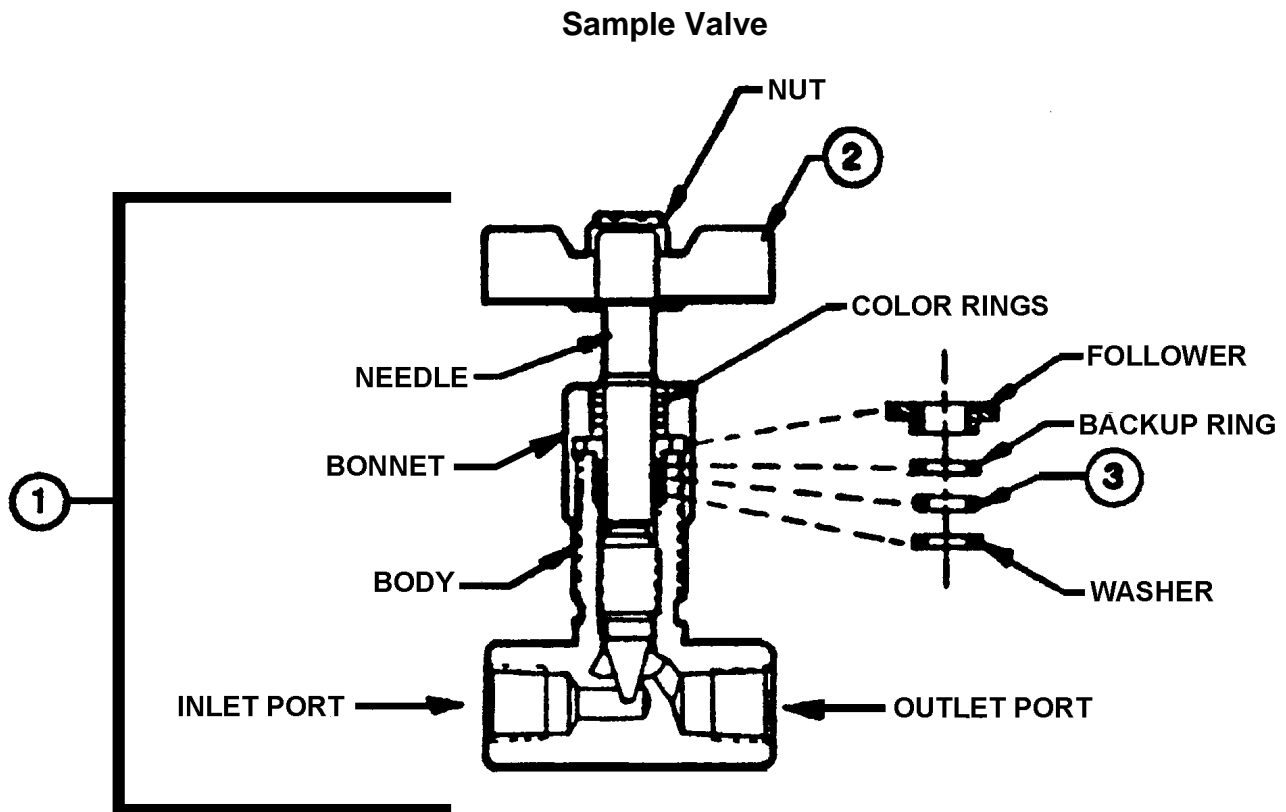
Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

Item	Part Number	Description	Qty
1	HC-1056-01	Assembly, Valve	1
2	HC-1076	Handle, Valve	1
3	HC-2000-012	O-ring	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

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



Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

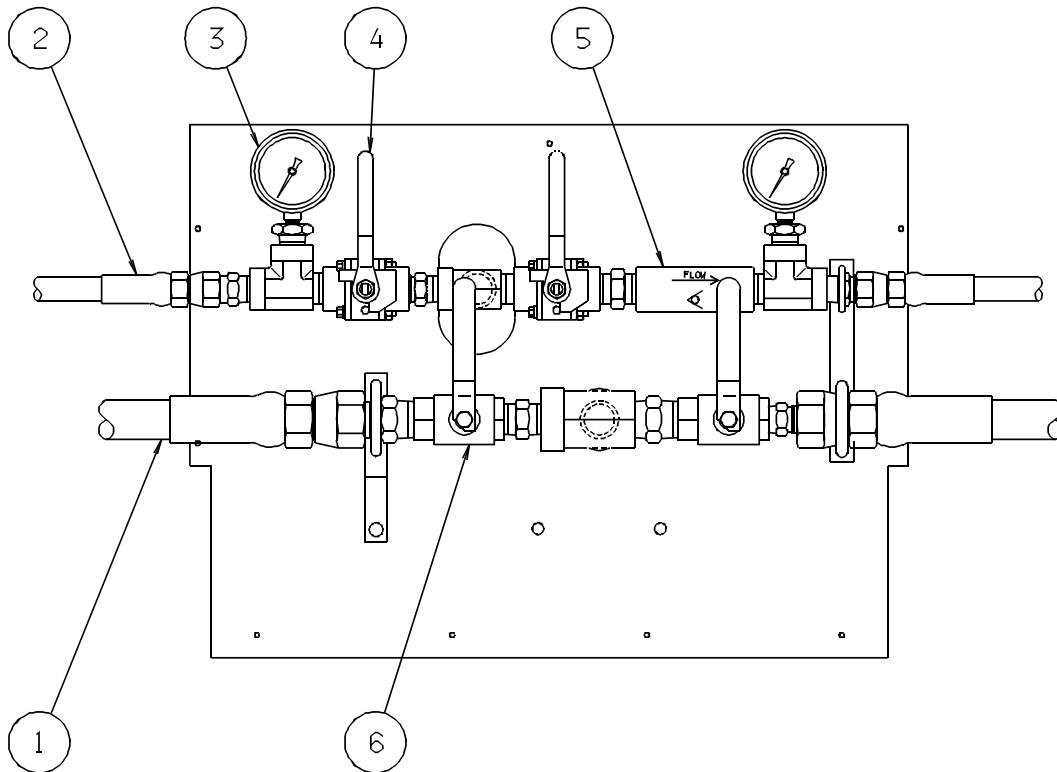
Item	Part Number	Description	Qty
1	HC-1202-01	Assembly, Valve	1
2	HC-1203	Handle, Valve	1
3	HC-2000-010	O-ring	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1202-02	Assembly, Valve	1
2	HC-1203	Handle, Valve	1
3	HC-2006-010	O-ring	1

**Split System (Option C)
Crossover Check (Option D)**



Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

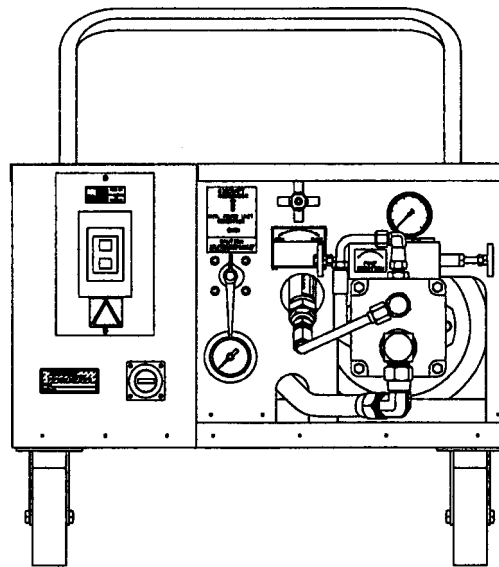
Item	Part Number	Description	Qty
1	TF-1039-01*180	Assembly, Return Hose	2
2	TF-1037-01*180	Assembly, Pressure Hose	2
3	HC-1042	Gauge, Pressure	2
4	HC-1097	Valve, Pressure Ball	2
5	HC-1059	Valve, Check	1
6	HC-1425-04	Valve, Return Ball	2

Model 5030 Parts List

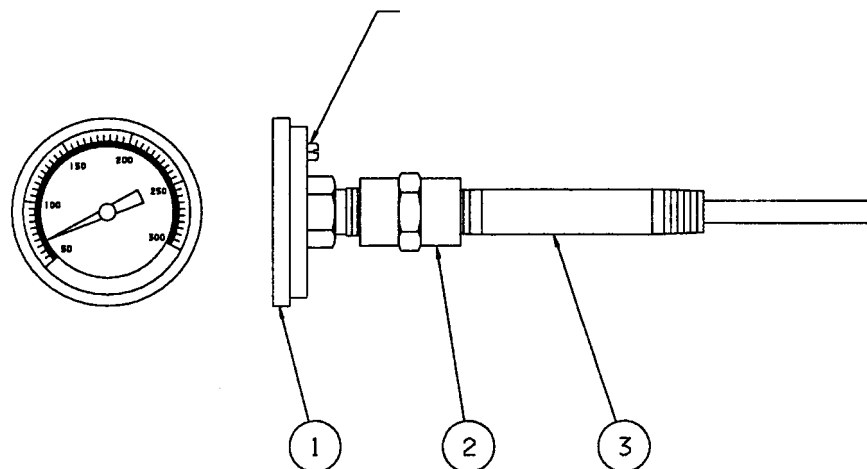
Fluid Type: Aviation Phosphate Ester, Type IV

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)



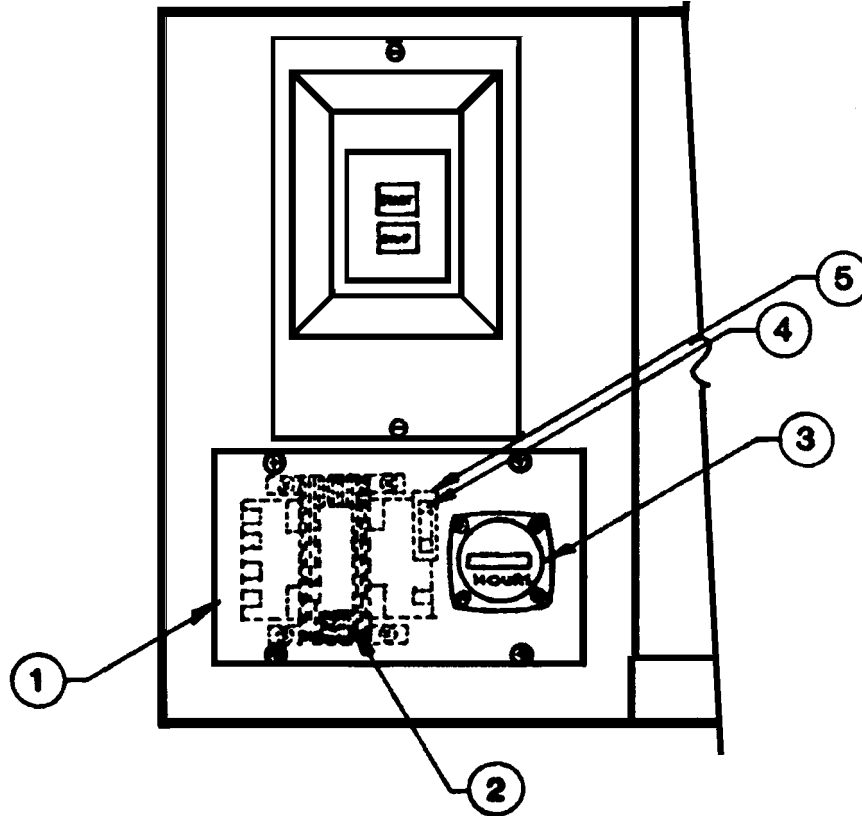
CALIBRATION ADJUSTMENT SCREW



All Models

Item	Part Number	Description	Qty
1	HC-1093	Pyrometer	1
2	N-2204-04-S	Connector, Pipe	1
3	N-2219-14	Nipple, Pipe 1/4" NPT x 3" long	1

Hourmeter (Option F)

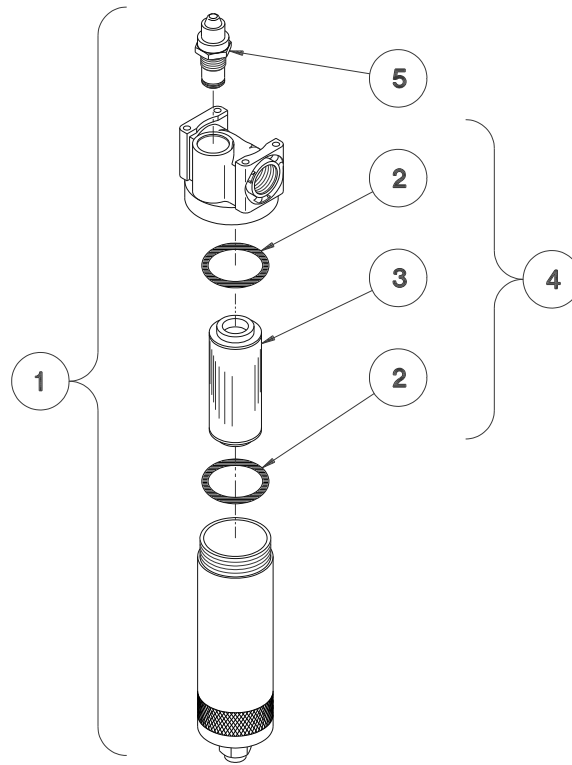


All Models

Item	Part Number	Description	Qty
1	S-1072	Cover	1
2	◆ EC-1070	Transformer: 208V/60Hz, 380V/50Hz, 575V/60Hz, 415V/50Hz	1
	◆ EC-1070	Transformer: 230V/60Hz, 220V/50Hz, 460V/60Hz, 440V/50Hz	
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 Filter Assembly (Option W)



◆ Item 4 includes corresponding Item 2—O-ring.

Model 5010 & 5020 Parts List

Fluid Type: MIL-PRF-5606 & MIL-PRF-83282

Item	Part Number	Description	Qty
1	HC-1453	Assembly, Filter	1
2	HC-2000-142	O-ring	2
3	HC-1454	Element, Filter	1
◆ 4	K-3096	Kit, Filter Element	1
5	HC-1849	Indicator, Clogging	1

Model 5030 Parts List

Fluid Type: Aviation Phosphate Ester, Type IV

Item	Part Number	Description	Qty
1	HC-1477	Assembly, Filter	1
2	HC-2006-142	O-ring	2
3	HC-1476	Element, Filter	1
◆ 4	K-3097	Kit, Filter Element	1
5	HC-1851	Indicator, Clogging	1



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.



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.
	<ul style="list-style-type: none"> ● 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.
	<ul style="list-style-type: none"> ● 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.

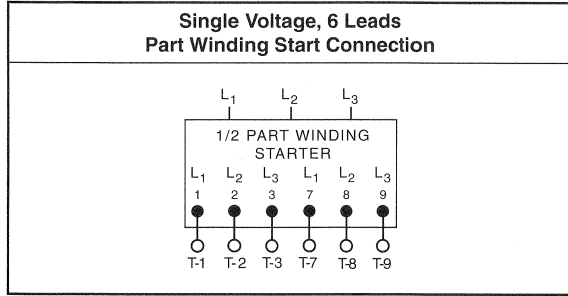
Number of Motor Leads	Number of Rated Voltages	Lead Numbers	YDS	PWS
3	Single	1-3	No	No
6	Single	1-3, 7-9	No	Yes
	Dual	1-6	Yes ⁽¹⁾	No
9	Dual	1-9	No	No
12	Single	1-12	Yes	Yes
	Dual	1-12	Yes	No ⁽²⁾

(1) YDS capability on lower voltage only.

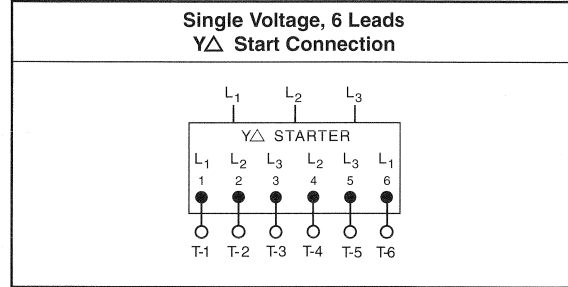
(2) PWS capability on lower voltage only, 1200 RPM, 324T-365T steel frame motors with Model Number efficiency letters of "S" or "H".

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.

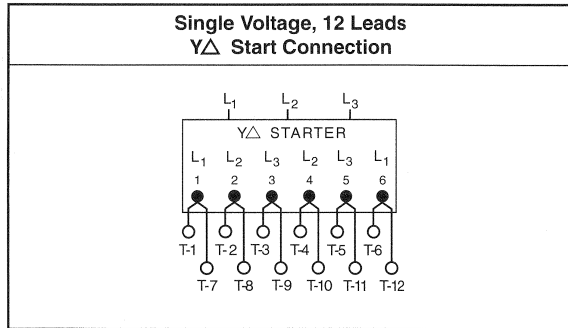
Connection Diagram 1



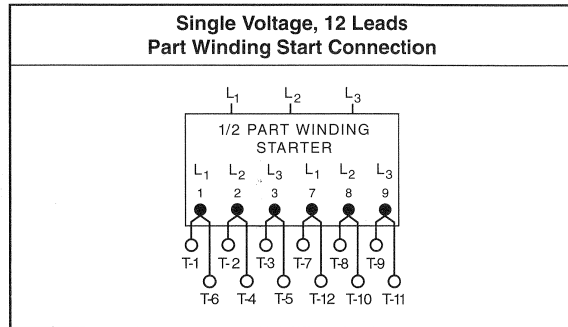
Connection Diagram 2



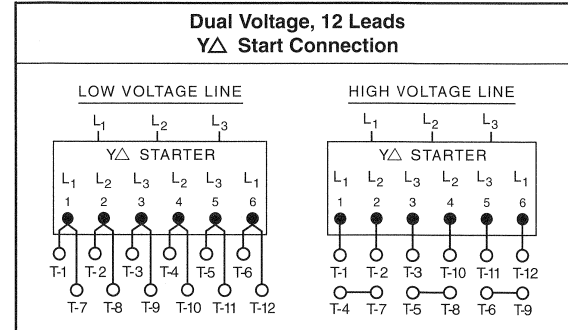
Connection Diagram 3



Connection Diagram 4



Connection Diagram 5



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.

- indicates change since last printing.



LINCOLN MOTORS
 Cleveland OH 44117-2525 USA

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 Fax: 1-888-536-6867
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 E-Mail: mailbox@lincolnmotors.com

IM566-A December 1999



APPENDIX III

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



SERVICE MANUAL

PVR6-Flanged Series Pump

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

"H" Design Series

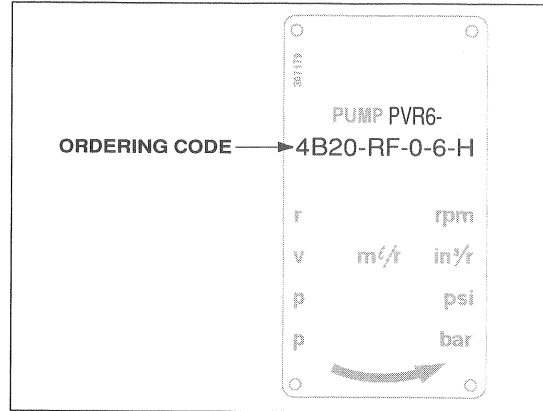
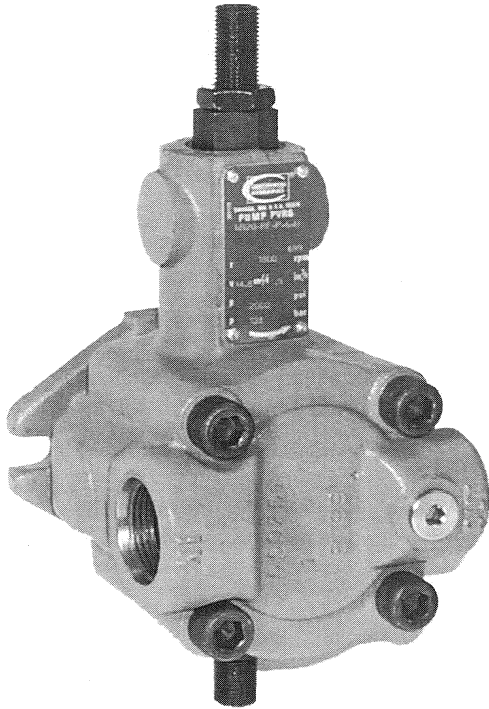
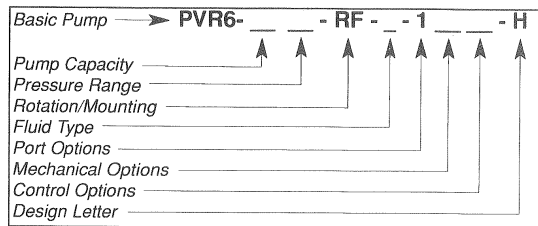


Figure 1

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.

Installation (Continued...)

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.

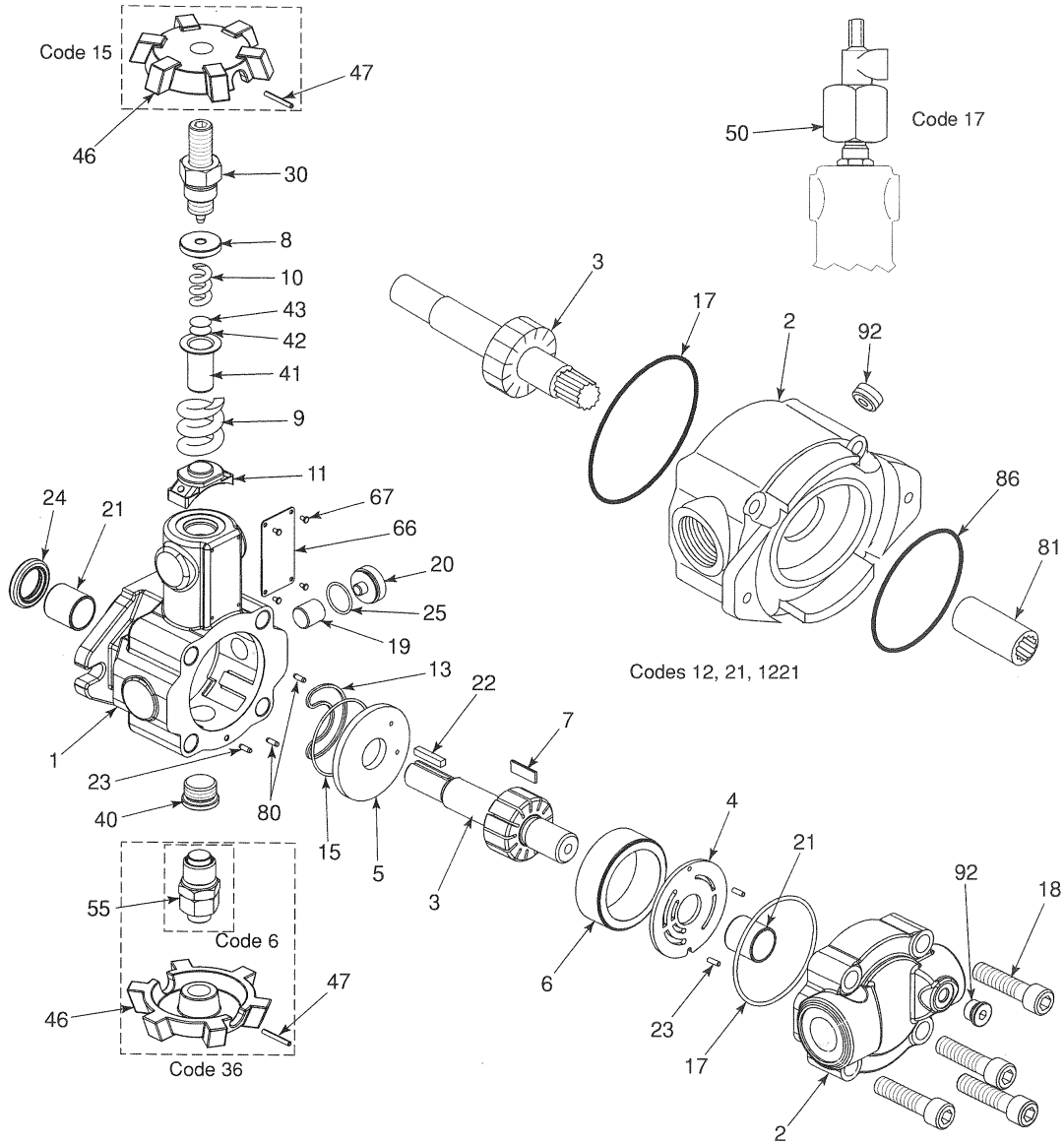
PRESSURE and VOLUME ADJUSTMENT SENSITIVITY

		PUMP SIZE		4B		6B		8B	
		PRESSURE CODE		20	06	15	06	15	
Pressure Adjustment	Pressure	psi	315	220	315	210	240		
	Change/Turn	(bar)	(21.7)	(15.2)	(21.7)	(14.5)	(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	gpm	3.4	4.6		4.6			
	Change/Turn	(lpm)	(12.9)	(17.4)		(17.4)			
	Approx. Min.	gpm	1.0	1.0		1.0			
	Flow Adjust.	(lpm)	(3.7)	(3.7)		(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.	ITEM NO.	CODE	PART NO.	DESCRIPTION	QTY. REQ.
1		550177	Pump Body	1	13		307257	Teflon Seal Ring	1
1	4B	550660	Pump Body	1	15	Buna-N	124194	O-Ring	1
2		550541	Cover	1	15	Viton	147177	O-Ring	1
2	4B	550658	Cover	1	17	Buna-N	144929	O-Ring	1
2	6B,8B,10B; 12, 1221	550547	Cover	1	17	Viton	144966	O-Ring	1
2	4B; 21	550659	Cover	1	18		198297	Soc. Hd. Cap Screw	4
3		407929	Rotorshaft	1	18	4B - 21; 6B, 8B, 10B; 21, 1221	198301	Soc. Hd. Cap Screw	4
3	4B	407930	Rotorshaft	1	19		252792	Thrust Screw	1
3	4B, 12	506066	Rotorshaft	1	20		250371	Thrust Screw Plug	1
3	6B,8B,10B; 12	506069	Rotorshaft	1	21		163797	Bushing	2
3	6B,8B,10B; 1221	550325	Rotorshaft	1	22		126225	Key	1
3	4B; 21	550326	Rotorshaft	1	23		004223	Roll Pin	3
3	6B,8B,10B; 21	550327	Rotorshaft	1	24		130795	Lip Seal	1
4	4B,6B	550101	Port Plate Assembly	1	25	Buna-N	104617	O-Ring	1
4	8B	550074	Port Plate Assembly	1	25	Viton	166069	O-Ring	1
4	10B	550280	Port Plate Assembly	1	30		309977	Pressure Adj. Screw Ass'y.	1
5		550351	Thrust Plate	1	40	Buna-N	250058	SAE O-Ring Plug	1
6	4B	114592	Pressure Ring	1	40	Viton	254789	SAE O-Ring plug	1
6	6B	112021	Pressure Ring	1	41		306466	Spring Retainer	1
6	8B	123175	Pressure Ring	1	42		144927	Shim (.005)	1
6	10B	251715	Pressure Ring	1	43		144928	Shim (.0149)	1
7	4B	250516	Vane Kit (Set of 13)	1	46	15, 36	252152	Handwheel	1
7	6B,8B,10B	250517	Vane Kit (Set of 13)	1	47	15, 36	261323	Spring Pin	1
8		306465	Spring Seat	1	50	17	350952	Dual Pressure Control Ass'y.	1
8	6B3L,6B5L, 8B3L, 8B5L	350988	Spring Seat	1	53	8, 9	256508	Flow Control Valve	1
8	10B3L,10B5L	166620	Spring Seat	1	55	6, 36	450196	Volume Adj. Screw Ass'y.	1
9	4B20	165223	Governor Spring	1	66		307179	Name Plate	1
9	6B06	149917	Governor Spring	1	67		250597	Self-Tapping Screw	4
9	8B06	251193	Governor Spring	1	80		002586	Dowel Pin	2
9	6B15,8B15	165225	Governor Spring	1	81	1221, 21	350663	Spline Coupling	1
9	6B20,8B20	165226	Governor Spring	1	85*	1221, 21	147655	Flange Cover (Shipping)	1
9	6B3L,8B3L	257653	Governor Spring	1	86	Viton	112222	O-Ring	1
9	10B3L	109792	Governor Spring	1	86	1221, 21	111298	O-Ring	1
9	6B5L,8B5L	255809	Governor Spring	1	92		256708	SAE O-Ring Plug	1
9	10B5L	113079	Governor Spring	1	93*		166288	Caplug (C-D)	1
10	6B06,8B06	165221	Follower Spring	1	94*		160259	Caplug (In)	1
10	10B10	165220	Follower Spring	1	95*		137020	Caplug (Out)	1
10	6B15,8B15	165222	Follower Spring	1	96*	1221, 21	130437	Caplug (Flange)	2
11	4B	144926	Ring Shoe Assembly	1	97*	12, 21,1221	253841	Spline Warning Tag	1
11	6B	144913	Ring Shoe Assembly	1	98*		143391	Grease	A.R.
11	8B	162770	Ring Shoe Assembly	1	99*		132779	LED Plate #250	A.R.
11	10B	350448	Ring Shoe Assembly	1	* Not Shown				
11	6B3L, 6B5L	112022	Ring Shoe Assembly	1					
11	8B3L,8B5L	123174	Ring Shoe Assembly	1					
11	10B3L,10B5L	350963	Ring Shoe Assembly	1					

PVR6 PARTS DRAWING



PVR6 KIT LIST

WEAR PLATE KITS		SEAL KITS		ROTATING KITS		COMPLETE REBUILD KITS	
Includes Items: 4 & 5		Includes Items: 13,15,16,17,24,28,30,55,99		Includes Items: 3, 6 & 21		Includes Items: All Kits Listed Here Plus Item 11.	
Model	Kit Number	Model	Kit Number	Model	Kit Number	Model	Kit Number
4B	257094	All Buna-N, HW	257093	4B	250758	4B	257095
6B	250747	All Viton	250457	4B-21	250815	4B-12	257096
8B06	250748	VANE KITS		6B	250760	6B	250822
8B15	254700			Includes Items: 7		6B-12	254763
10B10	254911	Model	Kit Number	6B-21	250817	6B-21	250834
		4B	250516	8B	250759	8B15	250823
		6B, 8B, 10B	250517	8B-12	250762	8B15-12	250827
				8B-21	250816	10B	254917
				10B	254912	10B-12	254918
						10B-21	254919

PVR6 PUMP REPAIR PROCEDURES

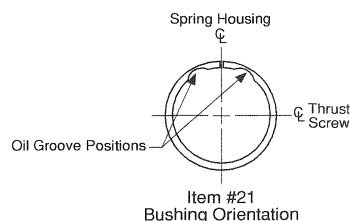
DISASSEMBLY PROCEDURE

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.



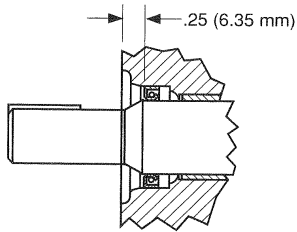
3. After the bearings are in place, check to see that the rotor shaft will fit into the bearings and provide a smooth turning fit. If the shaft turns hard, the bearings should be removed and the bore checked closely for nicks or burrs before pressing in the new bearings.
4. Check all of the replacement 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 plate must be relocated 180° on the locating pins.

PVR6 PUMP REPAIR PROCEDURES (Continued...)

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.

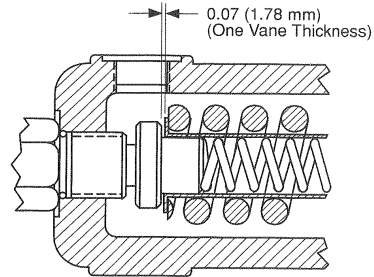
12. Lubricate the ID of the shaft seal (24) and press it into the housing to the depth shown below. Note the "lip to the inside" orientation of the seal.



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.



APPENDIX IV

**Model: 5010
Safety Data Sheet
Hydraulic Fluid**

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION**PRODUCT**

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

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION
22777 Springwoods Village Parkway
Spring, TX. 77253 USA
24 Hour Health Emergency 609-737-4411
Transportation Emergency Phone 800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information 800-662-4525
MSDS Internet Address <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2 HAZARDS IDENTIFICATION

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

CLASSIFICATION:

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

LABEL:**Pictogram:**

Signal Word: Danger

Hazard Statements:

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

Precautionary Statements:

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

Product Name: MOBIL AERO HFA
 Revision Date: 01 Oct 2015
 Page 2 of 12

Other hazard information:

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

PHYSICAL / CHEMICAL HAZARDS

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

HEALTH HAZARDS

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

ENVIRONMENTAL HAZARDS

No significant hazards.

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

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

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

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

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

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

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

SECTION 4 FIRST AID MEASURES

INHALATION

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

SKIN CONTACT

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

EYE CONTACT

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

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

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

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

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

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

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

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

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

FLAMMABILITY PROPERTIES

Flash Point [Method]: >82°C (180°F) [ASTM D-93]

Flammable Limits (Approximate volume % in air): LEL: 0.7 UEL: 7.0 [Estimated]

Autoignition Temperature: >225°C (437°F)

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

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

Product Name: MOBIL AERO HFA

Revision Date: 01 Oct 2015

Page 4 of 12

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

PROTECTIVE MEASURES

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

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

SPILL MANAGEMENT

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

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

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

ENVIRONMENTAL PRECAUTIONS

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

SECTION 7 HANDLING AND STORAGE

HANDLING

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

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

Static Accumulator: This material is a static accumulator.

STORAGE

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

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

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

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

Exposure limits/standards for materials that can be formed when handling this product: When mists/aerosols can occur the following are recommended: 5 mg/m³ - ACGIH TLV (inhalable fraction), 5 mg/m³ - OSHA PEL.

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

No biological limits allocated.

ENGINEERING CONTROLS

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

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

PERSONAL PROTECTION

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

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

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

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

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

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.

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

ENVIRONMENTAL CONTROLS

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

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

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

GENERAL INFORMATION

Physical State: Liquid
Color: Red

Product Name: MOBIL AERO HFA
 Revision Date: 01 Oct 2015
 Page 7 of 12

Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

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

OTHER INFORMATION

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

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

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

MATERIALS TO AVOID: Strong oxidizers

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

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

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

Product Name: MOBIL AERO HFA

Revision Date: 01 Oct 2015

Page 8 of 12

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

TOXICITY FOR SUBSTANCES

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

OTHER INFORMATION

For the product itself:

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

Contains:

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

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

--REGULATORY LISTS SEARCHED--

Product Name: MOBIL AERO HFA
Revision Date: 01 Oct 2015
Page 9 of 12

1 = NTP CARC
2 = NTP SUS

3 = IARC 1
4 = IARC 2A

5 = IARC 2B
6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

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

ECOTOXICITY

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

MOBILITY

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

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

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Components -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

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

SECTION 13 DISPOSAL CONSIDERATIONS

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

DISPOSAL RECOMMENDATIONS

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

REGULATORY DISPOSAL INFORMATION

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

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

Product Name: MOBIL AERO HFA
Revision Date: 01 Oct 2015
Page 10 of 12

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

SECTION 14 TRANSPORT INFORMATION

LAND (DOT)

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

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

LAND (TDG): Not Regulated for Land Transport

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

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

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

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

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

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

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

Product Name: MOBIL AERO HFA
 Revision Date: 01 Oct 2015
 Page 11 of 12

The following ingredients are cited on the lists below:

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

--REGULATORY LISTS SEARCHED--

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

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION
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N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):

H227: Combustible liquid; Flammable Liquid, Cat 4
 H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
 H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
 H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

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

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Product Name: MOBIL AERO HFA

Revision Date: 01 Oct 2015

Page 12 of 12

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MHC: 2A, 0, 0, 0, 1, 1

PPEC: C

DGN: 2005454XUS (552975)

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APPENDIX V

**Model: 5020
Safety Data Sheet
Hydraulic Fluid**

Section 1. Identification

Product name Brayco Micronic 882
SDS # 451700
Historic SDS #: 27009
Code 451700-US03

Relevant identified uses of the substance or mixture and uses advised against

Product use Hydraulic fluid
 For specific application advice see appropriate Technical Data Sheet or consult our company representative.

Supplier Castrol Industrial North America, Inc.
 150 W. Warrenville Road
 Naperville, IL 60563
 Product Information: +1-877-641-1600

BP Lubricants USA Inc.
 1500 Valley Road
 Wayne, NJ 07470
 Telephone: (973) 633-2200

EMERGENCY SPILL INFORMATION: 1 (800) 424-9300 CHEMTREC (USA)

Section 2. Hazards identification

OSHA/HCS status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms



Signal word Danger

Hazard statements May be fatal if swallowed and enters airways.

Precautionary statements

Prevention Not applicable.

Response IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.

Storage Store locked up.

Disposal Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified

Defatting to the skin.
 Note: High Pressure Applications
 Injections through the skin resulting from contact with the product at high pressure constitute a major medical emergency.
 See 'Notes to physician' under First-Aid Measures, Section 4 of this Safety Data Sheet.

Product name	Brayco Micronic 882	Product code	451700-US03	Page:	1/9
Version	2	Date of issue	03/27/2017.	Format	US
				Language	ENGLISH
					(ENGLISH)

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Synthetic lubricant and additives.

Ingredient name	CAS number	%
Decene, homopolymer, hydrogenated	68037-01-4	≥50 - ≤75

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Get medical attention.
Skin contact	Wash skin thoroughly with soap and water or use recognized skin cleanser. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if symptoms occur.
Inhalation	If inhaled, remove to fresh air. Get medical attention if symptoms occur.
Ingestion	Do not induce vomiting. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Aspiration hazard if swallowed. Can enter lungs and cause damage. Get medical attention immediately.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Most important symptoms/effects, acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	Treatment should in general be symptomatic and directed to relieving any effects. Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment. Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided. Gastric lavage should be undertaken only after endotracheal intubation. Monitor for cardiac dysrhythmias. Note: High Pressure Applications Injections through the skin resulting from contact with the product at high pressure constitute a major medical emergency. Injuries may not appear serious at first but within a few hours tissue becomes swollen, discolored and extremely painful with extensive subcutaneous necrosis. Surgical exploration should be undertaken without delay. Thorough and extensive debridement of the wound and underlying tissue is necessary to minimize tissue loss and prevent or limit permanent damage. Note that high pressure may force the product considerable distances along tissue planes.
Specific treatments	No specific treatment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.
Unsuitable extinguishing media	Do not use water jet.

Product name Brayco Micronic 882	Product code 451700-US03	Page: 2/9	
Version 2	Date of issue 03/27/2017.	Format US	Language ENGLISH
		(US)	(ENGLISH)

Section 5. Fire-fighting measures

Specific hazards arising from the chemical	In a fire or if heated, a pressure increase will occur and the container may burst.
Hazardous combustion products	Combustion products may include the following: carbon dioxide carbon monoxide
Special protective actions for fire-fighters	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Special protective equipment for fire-fighters	Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Floors may be slippery; use care to avoid falling. Contact emergency personnel.
For emergency responders	Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit. Chemical resistant boots. See also the information in "For non-emergency personnel".
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill	Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Contaminated absorbent material may pose the same hazard as the spilled product. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

Precautions for safe handling

Protective measures	Put on appropriate personal protective equipment (see Section 8). Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Do not swallow. Aspiration hazard if swallowed. Can enter lungs and cause damage. Never siphon by mouth.
Advice on general occupational hygiene	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Product name Brayco Micronic 882	Product code 451700-US03	Page: 3/9
Version 2	Date of issue 03/27/2017.	Format US
		Language ENGLISH (US) (ENGLISH)

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Decene, homopolymer, hydrogenated

None.

Appropriate engineering controls

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained. Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards.

Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.

The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Safety glasses with side shields.

Skin protection

Hand protection

Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves. Recommended: Nitrile gloves. The correct choice of protective gloves depends upon the chemicals being handled, the conditions of work and use, and the condition of the gloves (even the best chemically resistant glove will break down after repeated chemical exposures). Most gloves provide only a short time of protection before they must be discarded and replaced. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Gloves should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Body protection

Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required. Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Product name Brayco Micronic 882

Product code 451700-US03

Page: 4/9

Version 2 **Date of issue** 03/27/2017.

Format US

Language ENGLISH

(US)

(ENGLISH)

Section 8. Exposure controls/personal protection

Respiratory protection

In case of insufficient ventilation, wear suitable respiratory equipment. The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Section 9. Physical and chemical properties

Appearance

Physical state	Liquid.
Color	Red. [Dark]
Odor	Mild.
Odor threshold	Not available.
pH	Not available.
Melting point	Not available.
Boiling point	Not available.
Flash point	Open cup: 205°C (401°F) [Cleveland.]
Pour point	55 °C
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable. Based on - Physical state
Lower and upper explosive (flammable) limits	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Density	<1000 kg/m ³ (<1 g/cm ³) at 15°C
Solubility	insoluble in water.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Kinematic: 14 mm ² /s (14 cSt) at 40°C

Section 10. Stability and reactivity

Reactivity	No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information.
Chemical stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	No specific data.
Incompatible materials	Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Product name Brayco Micronic 882

Product code 451700-US03

Page: 5/9

Version 2 Date of issue 03/27/2017.

Format US
(US)

Language ENGLISH
(ENGLISH)

Section 11. Toxicological information

Information on toxicological effects

Aspiration hazard

Name	Result
 Decene, homopolymer, hydrogenated	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact	No known significant effects or critical hazards.
Skin contact	No known significant effects or critical hazards.
Inhalation	Vapor inhalation under ambient conditions is not normally a problem due to low vapor pressure.
Ingestion	Aspiration hazard if swallowed -- harmful or fatal if liquid is aspirated into lungs.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact	No specific data.
Skin contact	Adverse symptoms may include the following: irritation dryness cracking
Inhalation	No specific data.
Ingestion	Adverse symptoms may include the following: nausea or vomiting

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Long term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Potential chronic health effects

General	No known significant effects or critical hazards.
Carcinogenicity	No known significant effects or critical hazards.
Mutagenicity	No known significant effects or critical hazards.
Teratogenicity	No known significant effects or critical hazards.
Developmental effects	No known significant effects or critical hazards.
Fertility effects	No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Product name Brayco Micronic 882	Product code 451700-US03	Page: 6/9
Version 2	Date of issue 03/27/2017.	Format US
	Language ENGLISH	(US)
		(ENGLISH)

Section 12. Ecological information

Toxicity

No testing has been performed by the manufacturer.

Persistence and degradability

Not expected to be rapidly degradable.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) Not available.

Mobility Non-volatile.Liquid.insoluble in water.

Other adverse effects No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods

The generation of waste should be avoided or minimized wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-	-
Transport hazard class(es)	-	-	-	-
Packing group	-	-	-	-
Environmental hazards	No.	No.	No.	No.
Additional information	-	-	-	-

Special precautions for user Not available.

Transport in bulk according to Annex II of MARPOL and the IBC Code Not available.

Product name Brayco Micronic 882	Product code 451700-US03	Page: 7/9	
Version 2	Date of issue 03/27/2017.	Format US	Language ENGLISH
		(US)	(ENGLISH)

Section 15. Regulatory information

U.S. Federal regulations

United States inventory (TSCA 8b) All components are listed or exempted.

TSCA 12(b) one-time export: 2,2',6,6'-tetra-tert-butyl-4,4'-methylenediphenol

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 311/312

Classification Not applicable.

SARA 313

Form R - Reporting requirements This product does not contain any hazardous ingredients at or above regulated thresholds.

Supplier notification This product does not contain any hazardous ingredients at or above regulated thresholds.

State regulations

Massachusetts None of the components are listed.

New Jersey None of the components are listed.

Pennsylvania None of the components are listed.

California Prop. 65 No products were found.

Other regulations

Australia inventory (AICS) All components are listed or exempted.

Canada inventory All components are listed or exempted.

China inventory (IECSC) All components are listed or exempted.

Japan inventory (ENCS) All components are listed or exempted.

Korea inventory (KECI) All components are listed or exempted.

Philippines inventory (PICCS) All components are listed or exempted.

Taiwan Chemical Substances Inventory (TCSI) Not determined.

REACH Status The company, as identified in Section 1, sells this product in the EU in compliance with the current requirements of REACH.

Section 16. Other information

National Fire Protection Association (U.S.A.)



History

Date of issue/Date of revision 03/27/2017.

Date of previous issue 11/22/2016.

Prepared by Product Stewardship

Key to abbreviations

ACGIH = American Conference of Industrial Hygienists

ATE = Acute Toxicity Estimate

BCF = Bioconcentration Factor

CAS Number = Chemical Abstracts Service Registry Number

GHS = Globally Harmonized System of Classification and Labelling of Chemicals

IATA = International Air Transport Association

IBC = Intermediate Bulk Container

Product name	Brayco Micronic 882	Product code	451700-US03	Page:	8/9
Version	2	Date of issue	03/27/2017.	Format	US
				Language	ENGLISH
					(US)
					(ENGLISH)

Section 16. Other information

IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
OEL = Occupational Exposure Limit
SDS = Safety Data Sheet
STEL = Short term exposure limit
TWA = Time weighted average
UN = United Nations
UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.
Varies = may contain one or more of the following 101316-69-2, 101316-70-5, 101316-71-6, 101316-72-7, 64741-88-4, 64741-89-5, 64741-95-3, 64741-96-4, 64741-97-5, 64742-01-4, 64742-44-5, 64742-45-6, 64742-52-5, 64742-53-6, 64742-54-7, 64742-55-8, 64742-56-9, 64742-57-0, 64742-58-1, 64742-62-7, 64742-63-8, 64742-64-9, 64742-65-0, 64742-70-7, 72623-85-9, 72623-86-0, 72623-87-1, 74869-22-0, 90669-74-2

✔ Indicates information that has changed from previously issued version.

[Notice to reader](#)

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

Product name	Brayco Micronic 882	Product code	451700-US03	Page:	9/9
Version	2	Date of issue	03/27/2017.	Format	US
					(US)
				Language	ENGLISH
					(ENGLISH)



APPENDIX VI

**Model: 5030
Safety Data Sheet
Hydraulic Fluid**

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.

Skydrol® LD4 Fire Resistant Hydraulic Fluid

Version 2.2 Revision Date: 08/09/2016 SDS Number: 150000093409 Date of last issue: 06/02/2015
 Date of first issue: 10/24/2013
 SDSUS / PRD / 0001

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.

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

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.

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

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/m ³	ACGIH
		TWA	0.2 ppm 2.5 mg/m ³	NIOSH REL
		TWA	5 mg/m ³	OSHA Z-1
		TWA	0.2 ppm 2.5 mg/m ³	OSHA P0
Dibutylphenylphosphate	2528-36-1	TWA	0.3 ppm	ACGIH
butylated hydroxytoluene	128-37-0	TWA (Inhalable fraction and vapor)	2 mg/m ³	ACGIH
		TWA	10 mg/m ³	NIOSH REL
		TWA	10 mg/m ³	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.

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

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 mm ² /s (-54 °C)
	11.15 mm ² /s (38 °C)
	3.83 mm ² /s (99 °C)

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 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:

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

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

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

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:

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

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)

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

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, Un-scheduled 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

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

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)

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

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

Skydrol® LD4 Fire Resistant Hydraulic Fluid

Version 2.2 Revision Date: 08/09/2016 SDS Number: 150000093409 Date of last issue: 06/02/2015
 Date of first issue: 10/24/2013
 SDSUS / PRD / 0001

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

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

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

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			

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

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

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 SOCMl 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.

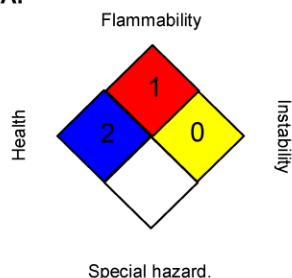
SECTION 16. OTHER INFORMATION**Full text of other abbreviations**

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

Skydrol® LD4 Fire Resistant Hydraulic Fluid

Version 2.2 Revision Date: 08/09/2016 SDS Number: 150000093409 Date of last issue: 06/02/2015
 Date of first issue: 10/24/2013
 SDSUS / PRD / 0001

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.

SAFETY DATA SHEET



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

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