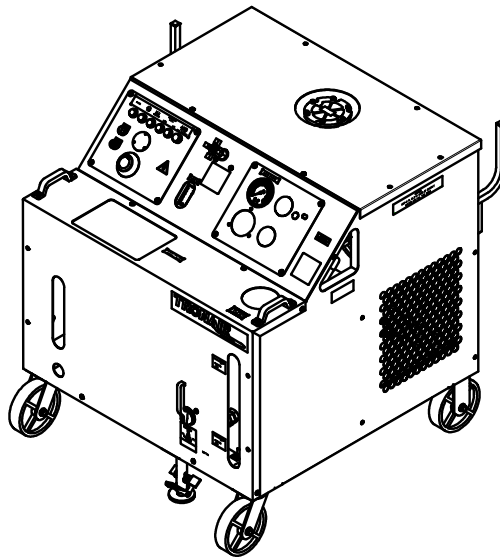




## Operation & Service Manual



**Model: 5430  
Hydraulic Power Unit**

05/2012 – Rev. 15

**Includes Illustrated Parts List**



**TABLE OF CONTENTS**

|   | <b><u>PAGE</u></b> |
|---|--------------------|
| 1.0 Product Information .....   | 1                  |
| 1.1 Description.....  | 1                  |
| 1.2 Model & Serial Number.....  | 1                  |
| 1.3 Manufacturer.....   | 1                  |
| 1.4 Function.....   | 1                  |
| 1.5 Requirements .....  | 1                  |
| 2.0 Safety Information .....  | 1                  |
| 2.1 Usage And Safety Information.....                                   | 1                  |
| 2.2 Explanation Of Warning & Danger Signs.....                          | 1                  |
| 2.3 Component Safety Features.....                                      | 2                  |
| 2.4 Functional Safety Features.....                                     | 2                  |
| 2.5 Personal Protection Equipment .....                                 | 2                  |
| 2.6 Safety Guidelines.....  | 2                  |
| 2.7 General Comment .....   | 2                  |
| 3.0 Electrical Power Requirements.....                                  | 2                  |
| 4.0 Preparation Prior To First Use.....                                 | 3                  |
| 4.1 General.....  | 3                  |
| 4.2 Servicing Reservoir.....  | 3                  |
| 4.3 Connecting Electrical Leads .....                                   | 3                  |
| 5.0 Training .....  | 3                  |
| 5.1 Training Requirements.....  | 3                  |
| 5.2 Training Program .....  | 3                  |
| 5.3 Operator Training.....  | 3                  |
| 6.0 Operation.....  | 4                  |
| 6.1 Operating Parameters.....   | 4                  |
| 6.2 Numerical Values.....   | 4                  |
| 6.2.1 Fluid.....  | 4                  |
| 6.2.2 Physical .....  | 4                  |
| 6.2.3 Motor Driven Hydraulic Pump.....                                  | 4                  |
| 6.2.4 Electric Motor.....   | 5                  |
| 6.2.5 Filters.....  | 5                  |
| 6.2.6 Hand Pump ( <i>Option M</i> ).....                                | 5                  |
| 6.3 Location & Layout Of Controls .....                                 | 6                  |
| 6.3.1 Front Panel Controls.....   | 6                  |
| 6.3.2 Electrical Control Panel .....                                    | 7                  |
| 6.3.3 Hydraulic Control Panel.....                                      | 8                  |
| 6.3.4 Rear Panel Controls .....   | 9                  |
| 6.3.5 Hydraulic Pump Controls.....                                      | 10                 |
| 6.3.6 Hand Pump Controls ( <i>Option M</i> ).....                       | 11                 |
| 6.3.7 Dual System Controls ( <i>Option C</i> ).....                     | 12                 |
| 6.3.8 Dual System Crossover Check Controls ( <i>Option D</i> ).....     | 13                 |
| 6.3.9 Return Back-Pressure With Sight Gauge ( <i>Option T</i> ) .....   | 14                 |
| 6.4 Start Up Procedures .....   | 15                 |
| 6.4.1 Procedure For First Time Or Different Electrical Supply Only..... | 15                 |
| 6.4.2 Initial Start Up Of The HPU.....                                  | 15                 |
| 6.5 Preliminary Adjustments For Operation .....                         | 16                 |
| 6.5.1 Flow Control Adjustment.....                                      | 16                 |
| 6.5.2 Pressure Control Adjustment.....                                  | 16                 |
| 6.5.3 Reservoir Selector Valve Operation.....                           | 16                 |
| 6.5.4 Bypass Valve Operation .....                                      | 17                 |
| 6.6 Bleeding Air From System .....                                      | 17                 |
| 6.6.1 To Easily Purge The Unit Of Air.....                              | 17                 |
| 6.7 Dual System Operation ( <i>Option C</i> ) .....                     | 17                 |
| 6.7.1 To Operate The Dual System .....                                  | 17                 |
| 6.8 Dual System Crossover Check ( <i>Option D</i> ).....                | 18                 |
| 6.8.1 To Operate The Dual System With Crossover Check.....              | 18                 |
| 6.9 Hand Pump Operation ( <i>Option M</i> ).....                        | 18                 |
| 6.9.1 To Operate The Hand Pump .....                                    | 18                 |
| 6.10 Return Back-Pressure With Sight Gauge ( <i>Option T</i> ) .....    | 19                 |
| 6.11 Sample Valve.....  | 19                 |
| 6.12 Emergency Shut Down Procedure.....                                 | 19                 |
| 6.13 Description Of Alarm Systems .....                                 | 19                 |
| 6.13.1 High Fluid Temperature Indicator ( <i>Option S</i> ).....        | 19                 |

**Models: 5430**  
**Hydraulic Power Unit**

|           |   |    |
|-----------|---|----|
| 6.13.2    | Voltage/Phase Monitor Indicator ( <i>Options G – J</i> ) .....  | 19 |
| 6.13.3    | High And Low Reservoir Level Indicator ( <i>Option L</i> )..... | 19 |
| 6.13.4    | Clogged Filter Indicator Light ( <i>Option R</i> ) .....        | 20 |
| 7.0       | Packaging And Storage.....                                      | 20 |
| 7.1       | Packaging Requirements.....                                     | 20 |
| 7.2       | Handling.....   | 20 |
| 7.3       | Packaging Protection.....                                       | 20 |
| 7.4       | Labeling Of Packaging.....                                      | 20 |
| 7.5       | Storage Compatibility.....                                      | 20 |
| 7.6       | Storage Environment.....  | 20 |
| 7.7       | Storage Space And Handling Facilities.....                      | 20 |
| 8.0       | Transportation .....  | 20 |
| 9.0       | Trouble Shooting.....   | 21 |
| 9.1       | HPU Will Not Start .....  | 21 |
| 9.2       | No Flow.....  | 21 |
| 9.3       | Reduced Flow.....   | 22 |
| 9.4       | No Pressure Or Reduced Pressure .....                           | 22 |
| 9.5       | Fluid Overheats .....   | 22 |
| 9.6       | Hand Pump ( <i>Option M</i> ) Is Not Pumping Fluid.....         | 22 |
| 10.0      | Maintenance.....  | 23 |
| 10.1      | General.....  | 23 |
| 10.2      | Electric Motor.....   | 23 |
| 10.3      | Motor Driven Hydraulic Pump.....                                | 24 |
| 10.3.1    | Motor Driven Hydraulic Pump Assembly .....                      | 24 |
| 10.3.2    | Motor Driven Hydraulic Pump Replacement Kits List .....         | 24 |
| 10.4      | Hydraulic Fluid.....  | 24 |
| 10.5      | Filters.....  | 25 |
| 10.5.1    | Pressure Filter .....   | 26 |
| 10.5.2    | Return Filter.....  | 27 |
| 10.5.3    | Hand Pump ( <i>Option M</i> ) Filter.....                       | 28 |
| 10.5.4    | Desiccant Air Filter.....                                       | 29 |
| 10.6      | Hydraulic Hoses.....  | 30 |
| 10.7      | Instrument Panel.....   | 31 |
| 10.7.1    | Electric Panel.....   | 32 |
| 10.7.2    | Hydraulic Panel.....  | 33 |
| 10.7.3    | Control Block/Flowmeter.....                                    | 34 |
| 10.7.3.A  | System Pressure Relief Valve .....                              | 35 |
| 10.7.3.B  | Check Valve .....   | 36 |
| 10.7.3.C  | Bypass Valve.....   | 36 |
| 10.8      | Reservoir Assembly.....   | 37 |
| 10.9      | Return Manifold Assembly.....                                   | 39 |
| 10.9.1    | Return System Pressure Relief Valve.....                        | 40 |
| 10.10     | Pressure Filter Assembly (Single System).....                   | 41 |
| 10.11     | Electrical Components.....                                      | 43 |
| 10.11.1   | Electrical Components With 100 Ft. Input Cord Option .....      | 47 |
| 10.12     | Heat Exchanger Assembly.....                                    | 52 |
| 10.13     | External Components .....                                       | 53 |
| 10.14     | Additional Features.....  | 54 |
| 10.14.1   | 50 Ft (15.24 M) Hoses ( <i>Option B</i> ).....                  | 54 |
| 10.14.2   | Dual System ( <i>Option C</i> ).....                            | 55 |
| 10.14.3   | Crossover Check ( <i>Option D</i> ).....                        | 56 |
| 10.14.4   | Hour Meter ( <i>Options E And F</i> ).....                      | 57 |
| 10.14.5   | Voltage/Phase Monitor ( <i>Options G – J</i> ).....             | 58 |
| 10.14.6   | Pyrometer ( <i>Option K</i> ).....                              | 59 |
| 10.14.7   | Electric Reservoir Level ( <i>Option L</i> ).....               | 60 |
| 10.14.8   | Hand Pump ( <i>Option M</i> ).....                              | 62 |
| 10.14.8.A | Two Stage Pump With Relief.....                                 | 64 |
| 10.14.9   | Towing Trailer ( <i>Option N</i> ) .....                        | 66 |
| 10.14.10  | Calibration Port ( <i>Option Q</i> ).....                       | 67 |
| 10.14.11  | Electric Filter Clogging Indicator ( <i>Option R</i> ).....     | 68 |
| 10.14.12  | Electric Over-Temperature ( <i>Option S</i> ).....              | 69 |
| 10.14.13  | Return Back-Pressure With Sight Gauge ( <i>Option T</i> ) ..... | 70 |
| 10.14.14  | Drip Pan ( <i>Option 4</i> ).....                               | 73 |
| 10.15     | Replacement Labels Parts Lists .....                            | 74 |
| 10.15.1   | Base Unit.....  | 74 |
| 10.15.2   | Fluid Label.....  | 74 |
| 10.15.3   | Filter Element Kit Labels.....                                  | 74 |

**Models: 5430**  
**Hydraulic Power Unit**

|         |  |    |
|---------|--|----|
| 10.15.4 | Dual System ( <i>Option C</i> ) And Crossover Check ( <i>Option D</i> ) Labels .....         | 74 |
| 10.15.5 | Pyrometer ( <i>Option K</i> ) Label .....  | 74 |
| 10.15.6 | Hand Pump ( <i>Option M</i> ) Labels .....   | 74 |
| 10.15.7 | Calibration Port ( <i>Option Q</i> ) Labels.....   | 75 |
| 10.15.8 | Back-Pressure Valve With Sight Glass ( <i>Option T</i> ) Label.....                          | 75 |
| 11.0    | Provision Of Spares.....   | 75 |
| 11.1    | Source Of Spare Parts.....   | 75 |
| 11.2    | Recommended Spare Parts Lists .....  | 75 |
| 11.2.1  | Spare Electrical Parts .....   | 75 |
| 11.2.2  | Spare Parts.....   | 75 |
| 12.0    | Calibration Of Instrumentation.....  | 76 |
| 12.1    | Source Of Calibration.....   | 76 |
| 12.2    | Analog Pressure Gauge – System Pressure .....  | 76 |
| 12.2.1  | Self Calibration .....   | 76 |
| 12.3    | Analog Pressure Gauge (Hand Pump Pressure- <i>Option M Only</i> ) .....                      | 77 |
| 12.3.1  | Self Calibration .....   | 77 |
| 12.4    | Analog Pressure Gauges (Crossover Check- <i>Option D Only</i> ) .....                        | 78 |
| 12.4.1  | Self Calibration .....   | 78 |
| 12.5    | Analog Pressure Gauges (Back-Pressure Adjustment Manifold Gauge- <i>Option T Only</i> )..... | 79 |
| 12.5.1  | Self Calibration .....   | 79 |
| 12.6    | Analog Temperature Gauge (Pyrometer- <i>Option K Only</i> ) .....                            | 79 |
| 12.6.1  | Self Calibration .....   | 79 |
| 13.0    | In Service Support.....  | 80 |
| 14.0    | Guarantees/Limitation Of Liability.....  | 80 |
| 15.0    | Appendices.....  | 80 |

**Models: 5430**  
**Hydraulic Power Unit**

| REVISION | DATE       | TEXT AFFECTED  |
|----------|------------|--|
| 01       | 06/25/2003 | Configuration change. Major revision to entire document.<br>See previous revision.   |
| 02       | 12/30/2003 | pg 48 Replaced Figure 10.11 Electrical Components; Modified comment on figure.<br>pg 49 Modified part numbers for Items 5 & 6<br>pg 50 Modified Part numbers for item 5 & 6<br>pg 51 Deleted |
| 03       | 12/2003    | Major Revision to Document   |
| 04       | 05/2004    | pg 29 Modified part numbers for 50 HZ application<br>pg 49 Modified part numbers for item 7<br>pg 50 Modified part numbers for item 7  |
| 05       | 11/2004    | pg 49 Modified part numbers for item 7<br>pg 50 Modified part numbers for item 7   |
| 06       | 02/2005    | pg 52 Modified part numbers and illustration   |
| 07       | 05/2005    | pg 48 Added Electrical Panel 100 ft cord<br>pg 50 Added items 17 & 18<br>pg 51 Added items 17 & 18   |
| 08       | 06/2007    | Modified 10.7.1 Electric Panel Parts List  |
| 09       | 12/2007    | Modified 10.7.1 Electric Panel Parts List  |
| 10       | 06/2008    | Modified 12.2.1 Self Calibration   |
| 11       | 08/2008    | Modified 10.3.1 Motor Driven Hydraulic Pump Assembly,<br>10.15.1 Base Unit, 11.2.2 Spare Parts and Appendix V  |
| 12       | 10/2009    | Modified 10.11 Electrical Components<br>Added 10.11.1 Electrical Components With 100 ft Input Cord Option<br>Added 10.14.9 Towing Trailer (Option N)   |
| 13       | 07/2010    | 10.14.2 Modified Parts List  |
| 14       | 03/2011    | Added 10.14.14 Drip Pan (Option 4)   |
| 15       | 05/2012    |  |

**Models: 5430  
Hydraulic Power Unit**

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 (HPU)

**Model Number:**

5430.....Aviation Phosphate Ester, Type IV

**Fluid Type:**

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit.

1.3 MANUFACTURER

**TRONAIR**, Inc.  
1740 Eber Road  
Holland, Ohio 43528-9794 USA

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

1.4 FUNCTION

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

1.5 REQUIREMENTS

Adequate electrical power must be provided for proper functioning of the HPU. See the unit nameplate for proper voltage and frequency. See Section 3.0 for proper sizing of electrical supply and protection equipment in the facility.

**2.0 SAFETY INFORMATION**

2.1 USAGE AND SAFETY INFORMATION

The HPU provides pressurized hydraulic fluid for performing aircraft maintenance.

To ensure safe operations, please read the following statements and understand their meaning. Also refer to your aircraft manufacturer's manual for other important safety information.

**WARNING!**



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

**CAUTION!**

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

2.2 EXPLANATION OF WARNING & DANGER SIGNS



**Accidental Starts!** Before servicing the HPU or equipment, always disconnect electrical power supply to prevent accidental starting.



**Rotating Parts!** Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the HPU with covers, shrouds, or guards removed.



**Electrical Shock!** Never touch electrical wires or components while the HPU is attached to the power source. They can be sources of electrical shock. DO NOT operate HPU with cabinet panels removed.



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

2.0 Safety Information continued on following page.



**Models: 5430  
Hydraulic Power Unit**

**2.0 SAFETY INFORMATION** *(continued)*

**2.3 COMPONENT SAFETY FEATURES**

- Pump/Motor coupling guard
- Sheet metal panels
- Pressure and return system relief valves
- Control circuit fuses
- Motor overload protection

**2.4 FUNCTIONAL SAFETY FEATURES**

- Emergency shut off switch
- Floor lock
- Calibration port shut off valve
- Fluid sample shut off valve

**2.5 PERSONAL PROTECTION EQUIPMENT**

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

**2.6 SAFETY GUIDELINES**

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

**2.7 GENERAL COMMENT**

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

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

**3.0 ELECTRICAL POWER REQUIREMENTS**

- 3.1 The electrical power supply for the HPU must include a fused disconnect using Type J or Type R fuses or equivalent magnetic type circuit breakers designed for protecting an electrical motor. This necessary equipment is for protection of the HPU, power cord, and customer-supplied plug and receptacle. *Reference the Table below:*

**ELECTRICAL POWER AND PROTECTION REQUIREMENTS**

| <b>60 Hz Applications</b> |      |      |      |      |      |
|---------------------------|------|------|------|------|------|
| Voltage                   | 208  | 230  | 380  | 460  | 575  |
| Full Load Amps            | 73.0 | 66.0 | 38.0 | 33.0 | 26.0 |
| Locked Rotor Amps         | 404  | 365  | 221  | 182  | 146  |
| Recommended Fuse Size     | 100  | 90   | 50   | 45   | 35   |
| Maximum Fuse Size         | 110  | 100  | 60   | 50   | 40   |

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



## 4.0 PREPARATION PRIOR TO FIRST USE

### 4.1 GENERAL

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

### 4.2 SERVICING RESERVOIR

Fill the reservoir with the correct fluid (see label next to reservoir fill for correct type of fluid) until fluid level is above the minimum fluid level mark but below the maximum fluid level. See **Figure 6.3.1 Front Panel Controls** for reservoir fill location.

### 4.3 CONNECTING ELECTRICAL LEADS



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

Install plug onto the electrical cord. If motor rotation is not correct, change any two of the three leads at the plug. Reference **Section 3.0 Electrical Power and Protection Requirements** for power requirements and fuse sizes. (See **6.4 Start up Procedures** before starting HPU.)

### WARNING!



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

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

**Some reasons for imbalance are:**

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

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

## 5.0 TRAINING

### 5.1 TRAINING REQUIREMENTS

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

### 5.2 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.

### 5.3 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.**

**Models: 5430  
Hydraulic Power Unit**

**6.0 OPERATION**

**6.1 OPERATING PARAMETERS**

- The user shall use the HPU in accordance with the aircraft manufacturer's instructions.
- The user shall operate the HPU in accordance with the Technical and Operator Manuals.
- The employer of the operator shall provide all necessary training.

**6.2 NUMERICAL VALUES**

**6.2.1 Fluid**

(See Nameplate on unit for Model Number.)

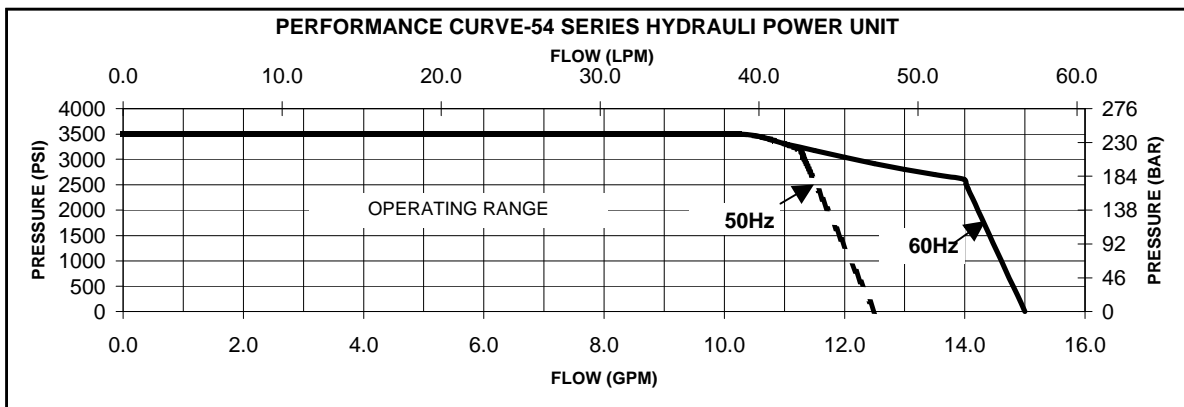
**Fluid Type:** Aviation Phosphate Ester, Type IV ..... **Model:** 5430

**6.2.2 Physical**

- Weight (Dry): 1,4,50lbs (568 kg)
- Dimensions: Width 51 in (129.5 cm)  
Height 50 in (127.0 cm)  
Depth 54 in (137.2 cm)
- Power Cord: 50 ft (15.24 m) long
- Pressure Hoses: 25 ft (7.62 m) ..... Standard Length  
50 ft (15.24 m) ..... Optional Length  
-12 (¾ in, 19.1 mm)..... Working Diameter
- Return Hoses: 25 ft (7.62 m) ..... Standard Length  
50 ft (15.24 m) ..... Optional Length  
-16 (1 in, 25.4 mm)..... Working Diameter
- Hand Pump Hose: 15 ft (4.57 m) ..... Standard Length  
-4 (¼ in, 6.4 mm)..... Working Diameter

**6.2.3 Motor Driven Hydraulic Pump**

- A pressure compensated, adjustable maximum volume piston pump.
- Maximum flow at 60 Hz ..... 15 gpm (56.7 lpm)
- Maximum flow at 50 Hz ..... 12 gpm (47.3 lpm)
- Maximum operating pressure at 50 Hz and 60 Hz ..... 3,500 psi (241 bar)
- System pressure relief valve setting ..... 3,750 psi (258 bar)
- Performance Curve for 50 Hz and 60 Hz..... Reference **Figure 5.2.3**



**FIGURE 6.2.3 – Performance Curve (50 Hz and 60 Hz)**

**Models: 5430  
Hydraulic Power Unit**

6.2 NUMERICAL VALUES *(continued)*

**6.2.4 Electric Motor**

A 25 horsepower, TEFC electric motor is the prime mover for the HPU. This is attached to the hydraulic pump using a pump/motor adapter and a spider/coupling rotating interface.

| <b>MOTOR POWER REQUIREMENTS</b> |                       |                           |                       |
|---------------------------------|-----------------------|---------------------------|-----------------------|
| <b>60 Hz Applications</b>       |                       | <b>50 Hz Applications</b> |                       |
| <b>Voltage</b>                  | <b>Full Load Amps</b> | <b>Voltage</b>            | <b>Full Load Amps</b> |
| 208                             | 73.0                  | 200                       | 75.0                  |
| 230                             | 66.0                  | 220                       | 72.0                  |
| 380                             | 38.0                  | 380                       | 36.0                  |
| 460                             | 33.0                  | 415                       | 36.0                  |
| 575                             | 26.0                  | 440                       | 35.0                  |

**FIGURE 6.2.4 - Motor Power Requirements**

**6.2.5 Filters**

- Pressure .....2 micron rating, non-bypass high collapse microglass type. Non-cleanable element.
- Return.....5 micron rating, 15 psi (1.03 bar) bypass microglass type. Non-cleanable element.
- Hand Pump (*Option M*).....2 micron rating, non-bypass microglass type. Non-cleanable element.
- Air/Desiccant .....3 micron filter, silica gel desiccant type. Non-cleanable element.

**6.2.6 Hand Pump (*Option M*)**

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

- Low Pressure Stage:
  - Piston Diameter ..... 1½ in (38.1 mm)
  - Working Pressure ..... 0 – 500 psi (0 – 34.47 bars)
  - Displacement/Stroke..... 2.1 in<sup>3</sup> (34.4 cm<sup>3</sup>)
  - Force/100 psi (6.89 bar) ..... 12.0 lbs/100 psi (7.74 N/bar)
- High Pressure Stage:
  - Piston Diameter ..... 5/8 in (15.88 mm)
  - Working Pressure ..... 500 – 5,000 psi (34.47 – 344.74)
  - Displacement/Stroke..... 0.4 in<sup>3</sup> (6.55 cm<sup>3</sup>)
  - Force/100 psi (6.89 bar) ..... 2.2 lbs/100 psi (1.42 N/bar)
- Pressure Relief Setting: 5,250 psi (362.0 bar)

6.0 Operation continued on following page.

Models: 5430  
Hydraulic Power Unit

6.0 OPERATION (continued)

6.3 LOCATION & LAYOUT OF CONTROLS

6.3.1 Front Panel Controls

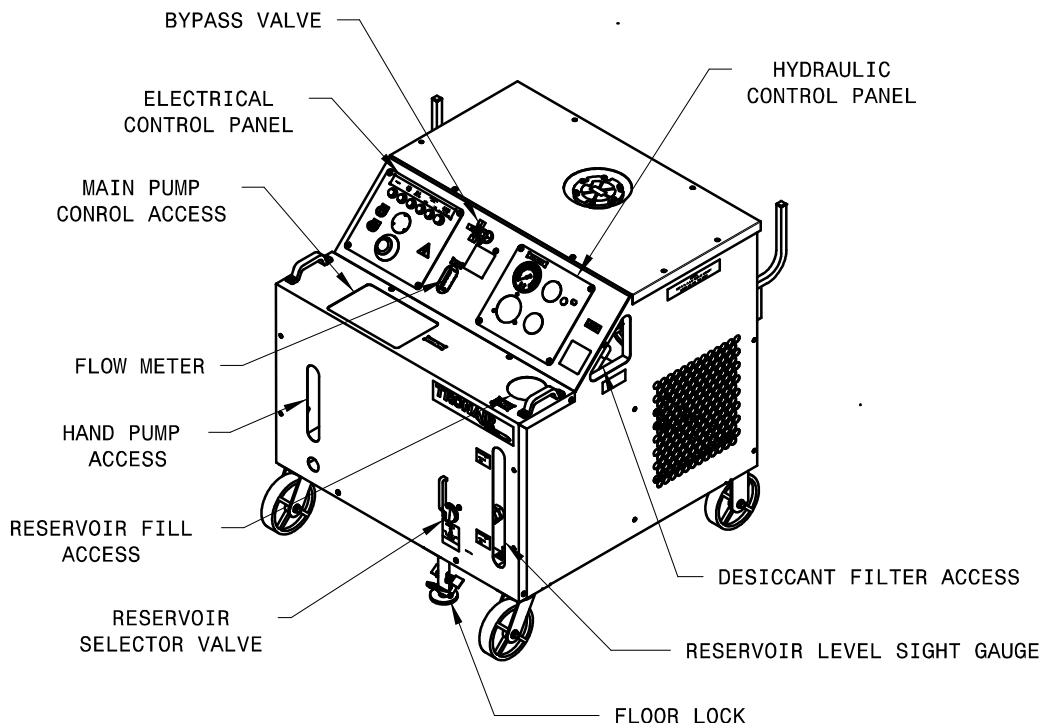


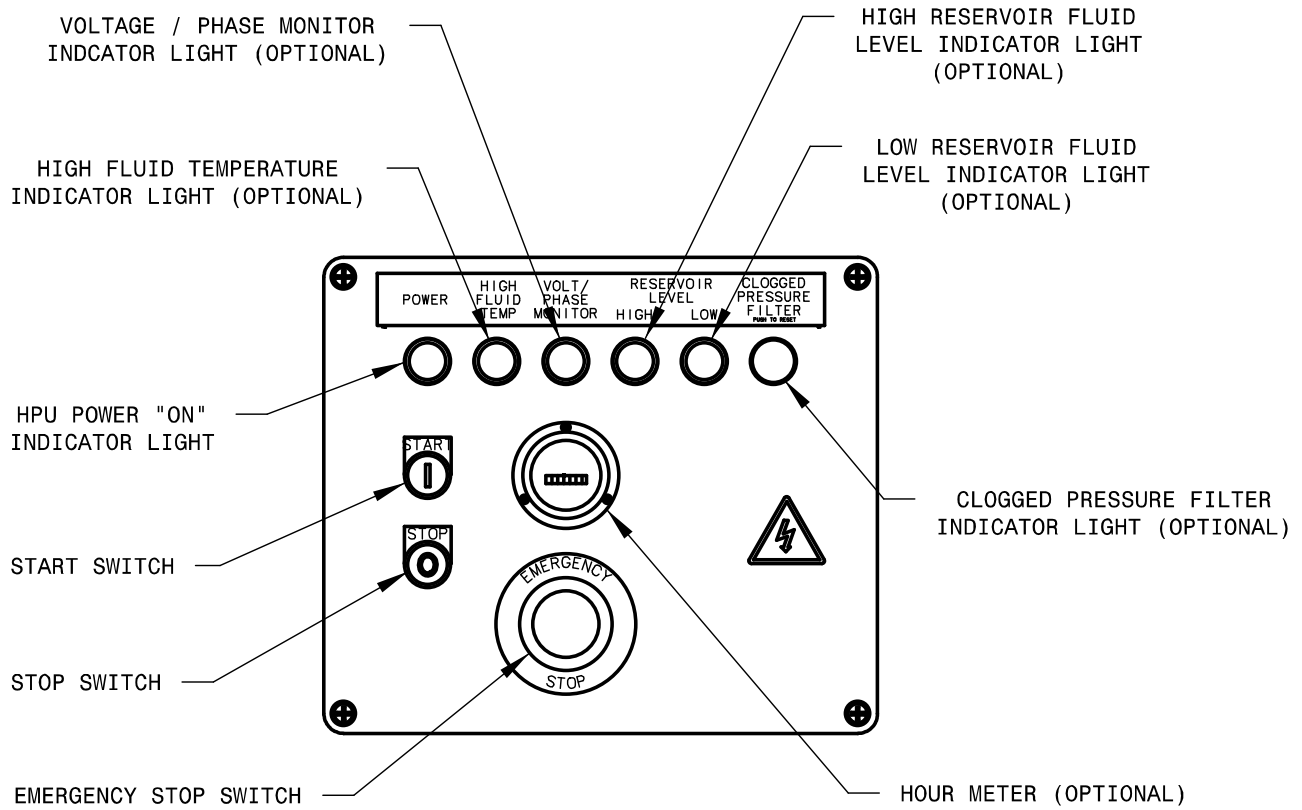
FIGURE 6.3.1 – Front Panel Controls

- Electrical Control Panel ..... See Section 6.3.2
- Hydraulic Control Panel ..... See Section 6.3.3
- Bypass Valve ..... For loading and unloading the motor driven hydraulic pump.
- Flowmeter ..... Displays the flow from the motor driven hydraulic pump.
- Pump Control Access ..... See **Figure 6.3.5 – Hydraulic Pump Controls**.
- Reservoir Selector ..... For selecting between using the aircraft reservoir or the HPU reservoir.
- Sight Gauge ..... Visual indicator displays the fluid level in the reservoir.
- Reservoir Fill Access ..... Locking cap for servicing the HPU reservoir.
- Desiccant Filter ..... Access to the reservoir air filter/desiccant filter.
- Hand Pump (*Option M*) ..... Access for hand pump and relief screw, handle stored inside.
- Floor Lock ..... Locking/unlocking, foot actuated and released floor lock.

**Models: 5430  
Hydraulic Power Unit**

6.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

**6.3.2 Electrical Control Panel**



**FIGURE 6.3.2 – Electrical Control Panel**

- Emergency Stop ..... Removes power to all electrical devices, must turn to reset.
- Stop Switch..... Turns off the electric motors driving the hydraulic pump and cooling fan.
- Start Switch ..... Turns on the electric motors driving the hydraulic pump and cooling fan.
- HPU Power "On" Indicator Light ..... Light is illuminated when the electric motors driving the hydraulic pump and cooling fan are on.
- High Fluid Temperature ..... Light is illuminated when the return fluid temperature reaches 160° F (71° C) or above. The HPU will shut down when light is illuminated. The HPU can be re-started when the fluid has cooled and the indicator light is off.
- High Reservoir Fluid Level..... Light is illuminated when the fluid level in the reservoir is above the normal operating range. The HPU will shut down until the fluid level is restored to a normal operating level.
- Low Reservoir Fluid Level ..... Light is illuminated when the fluid level in the reservoir is below the normal operating range. The HPU will shut down until the fluid level is restored to a normal operating level.
- Voltage/Phase Monitor ..... Light is illuminated if any of the following conditions occur  
 Indicator Light (Options G – J)
  - Voltage imbalance between L1, L2, L3, greater than 5%
  - Loss of voltage from L1, L2, L3
  - Over voltage from L1, L2, L3, greater than 5%
  - Change in phase orientation between L1, L2, L3. The HPU will shut down until the electrical problem is corrected.
- Clogged Pressure Filter ..... Light is illuminated when the pressure filter element requires changing. The HPU will not shut down when illuminated. Pressing the illuminated button will reset the light.

6.3 Location & layout of controls continued on following page.

Models: 5430  
Hydraulic Power Unit

6.3 LOCATION & LAYOUT OF CONTROLS *(continued)*

6.3.3 Hydraulic Control Panel

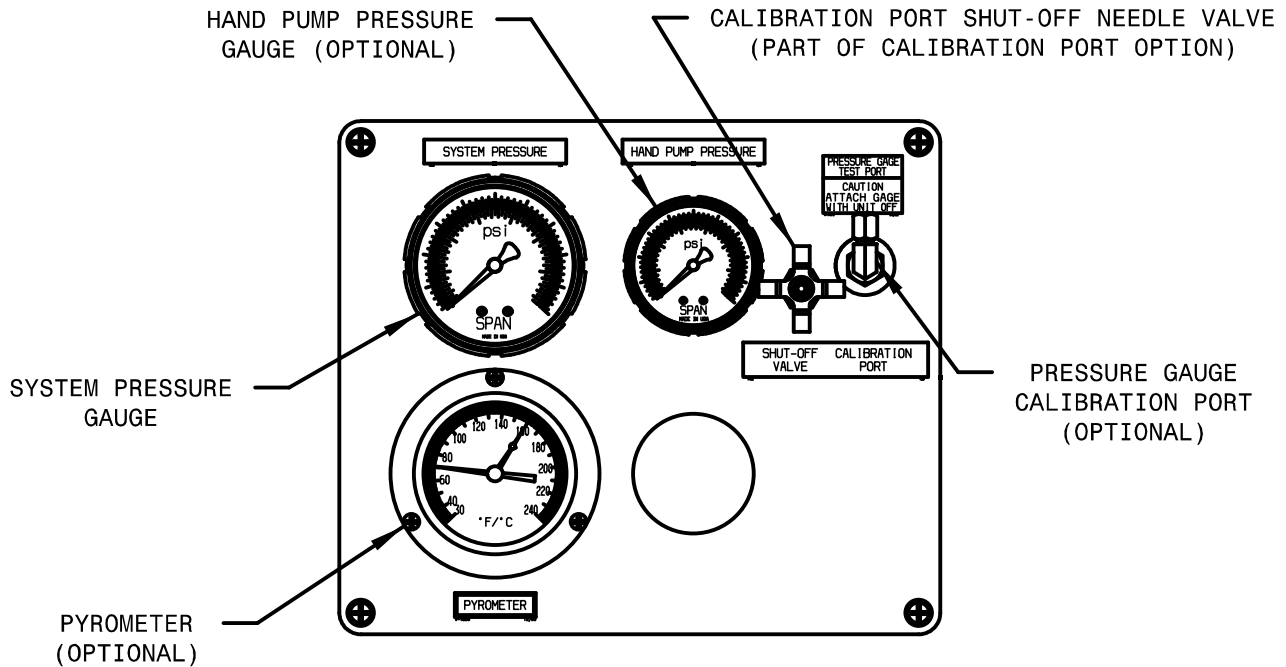


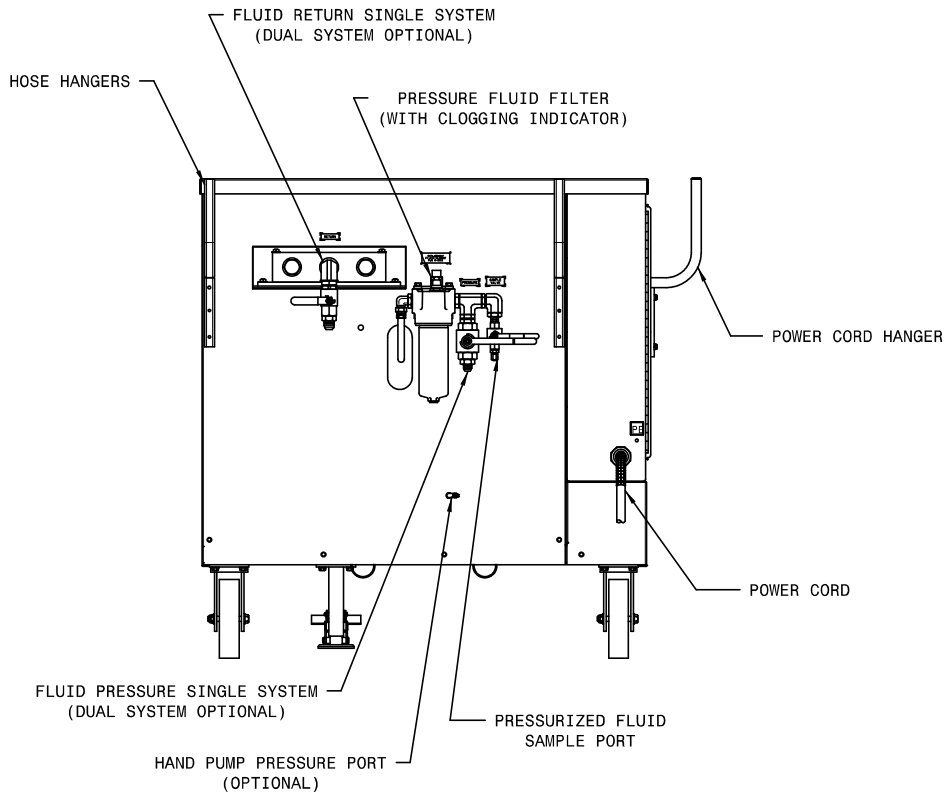
FIGURE 6.3.3 – Hydraulic Control Panel

- System Pressure Gauge.....Displays the system pressure on an analog fluid dampened gauge.
- Pyrometer *(Option K)*.....Displays the fluid temperature in the return system on an analog gauge. A warning indicator preset to 160° F (71° C) warns of high operating temperature.
- Pressure Gauge Calibration .....Allows for calibration of the system pressure gauge up to the operating pressure of HPU. Calibration port shut off valve must be used in conjunction with the calibration port.
- Calibration Port Shut Off Valve.....Used to shut off pressure to the calibration port. This valve should only be opened when the external standard gage is attached. (See Technical Manual for proper procedure.)
- Hand Pump Pressure Gauge.....Displays the hand pump system pressure on an analog fluid dampened gauge.

**Models: 5430  
Hydraulic Power Unit**

6.3 LOCATION & LAYOUT OF CONTROLS (*continued*)

**6.3.4 Rear Panel Controls**



**FIGURE 6.3.4 – Rear Panel Controls**

- \* Fluid Pressure System ..... The source of pressurized fluid from the HPU that flows to the aircraft pressure system through the pressure hose.
- \* Fluid Return System..... Fluid returning to the HPU from the aircraft that flows through the return hoses.
- Pressure Fluid Filter..... Filters the pressurized fluid before it flows to the aircraft pressure system.
- Pressurized Fluid Sample Port ..... A sample valve is provided to obtain a fluid sample for analysis. In order to obtain a representative sample, it is suggested that ANSI/B93.19M-1972(R1993) be followed.
- Hand Pump Pressure Port:..... Pressurized fluid from hand pump filter.  
(Option M)
- Hose Racks ..... Location for storing the pressure, return and optional hand pump hoses when not in use.
- Power Cord Hanger ..... Location for storing the power cord when not in use.

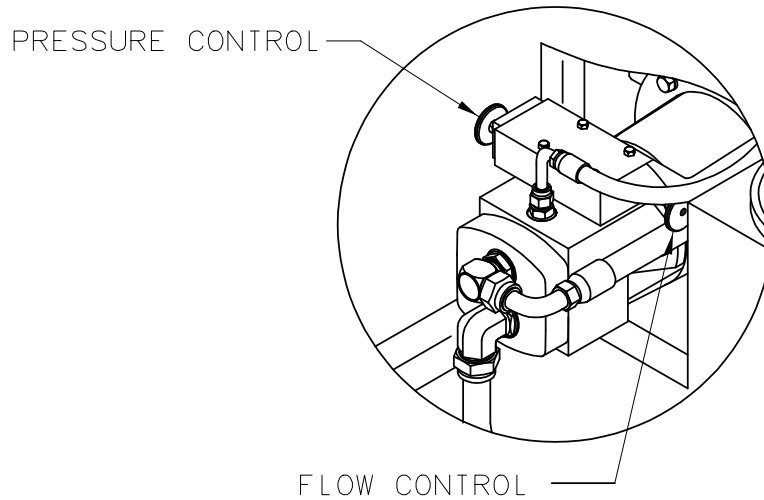
\* **Dual System (Optional) consists of two (2) each of these items.**

6.3 Location & layout of controls continued on following page.

6.3 LOCATION & LAYOUT OF CONTROLS (*continued*)

**6.3.5 Hydraulic Pump Controls**

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



**FIGURE 6.3.5 – Hydraulic Pump Controls**

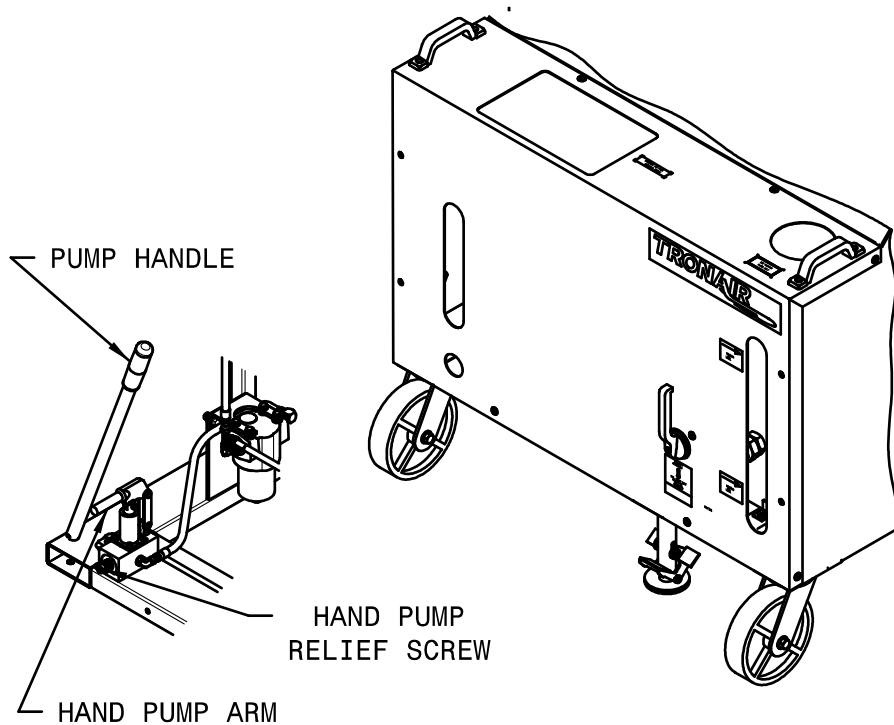
- Flow Control ..... This control is used to set the maximum flow required from the HPU.
- Pressure Control..... The pressure control is used to set the system pressure of the HPU during operation.



6.3 LOCATION & LAYOUT OF CONTROLS (*continued*)

**6.3.6 Hand Pump Controls (*Option M*)**

Reference 6.9 Hand Pump Operation.



**FIGURE 6.3.6 – Hand Pump Controls**

- Pump Handle ..... Located inside the front access door is the hand pump handle used for opening and closing the hand pump relief screw and stroking the hand pump arm.
- Hand Pump Relief Screw..... Accessed through the front panel opening, this screw allows opening and closing of the hand pump hydraulic circuit using the hand pump handle.
- Hand Pump Arm ..... The handle is used to access the hand pump arm used for up and down motion to produce hydraulic flow and pressure.

6.3 Location & layout of controls continued on following page.

Models: 5430  
Hydraulic Power Unit

6.3 LOCATION & LAYOUT OF CONTROLS (continued)

6.3.7 Dual System Controls (Option C)

Reference 6.7 Dual System Operation.

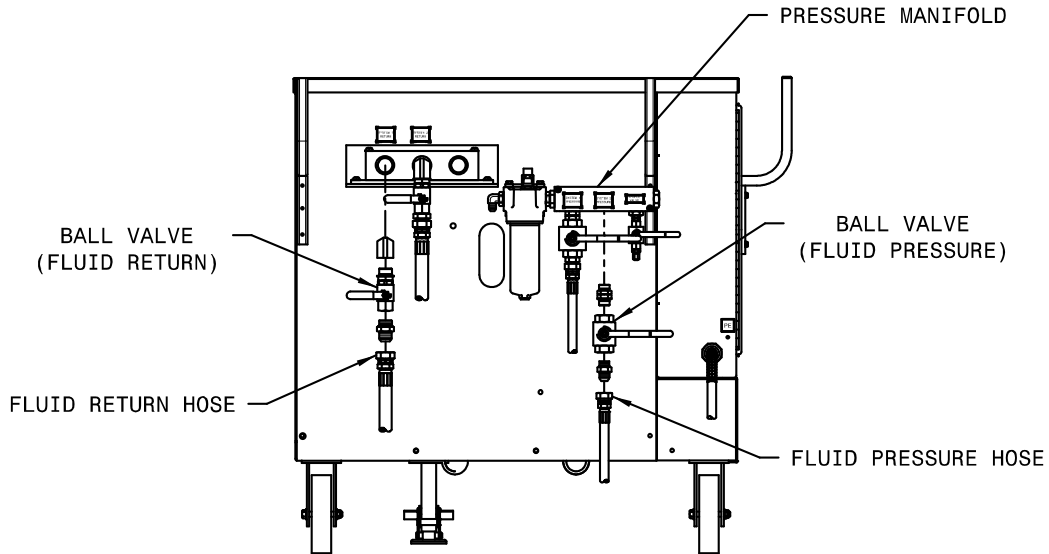


FIGURE 6.3.7 – Dual System Controls

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

**WARNING!**



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

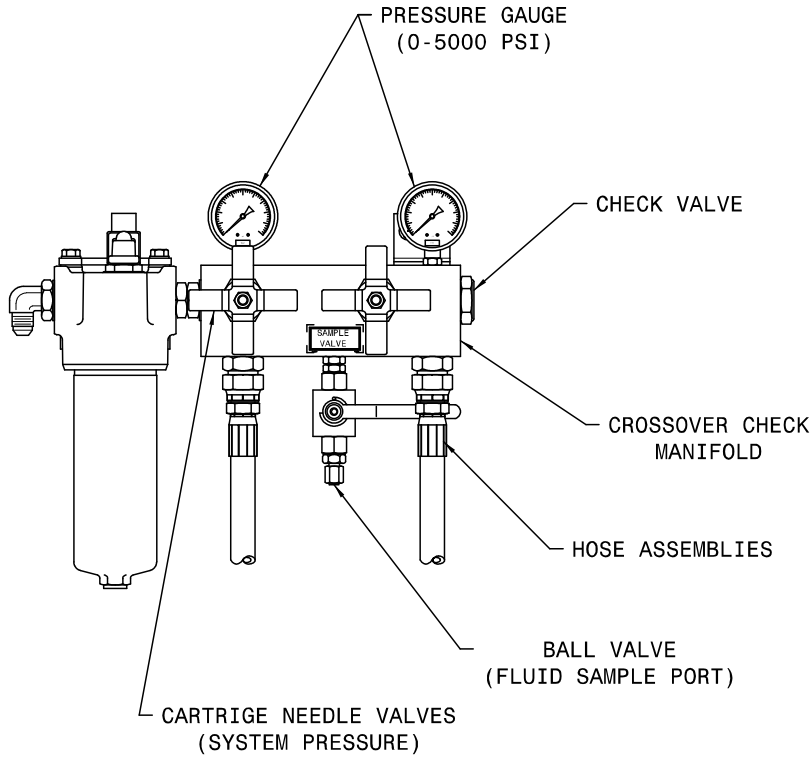
- Fluid Return Ball Valve .....Used to turn on and off the flow from separate aircraft systems. Always use in either fully open or fully closed position; never use in a partially open position.

Models: 5430  
Hydraulic Power Unit

6.3 LOCATION & LAYOUT OF CONTROLS (*continued*)

6.3.8 Dual System Crossover Check Controls (*Option D*)

Reference 6.8 Dual System Crossover Check Operation.



**FIGURE 6.3.8 – Dual System Crossover Check Controls**

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

**WARNING!**



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

6.3 Location & layout of controls continued on following page.

6.3 LOCATION & LAYOUT OF CONTROLS (continued)

6.3.9 Return Back-Pressure with Sight Gauge (Option T)

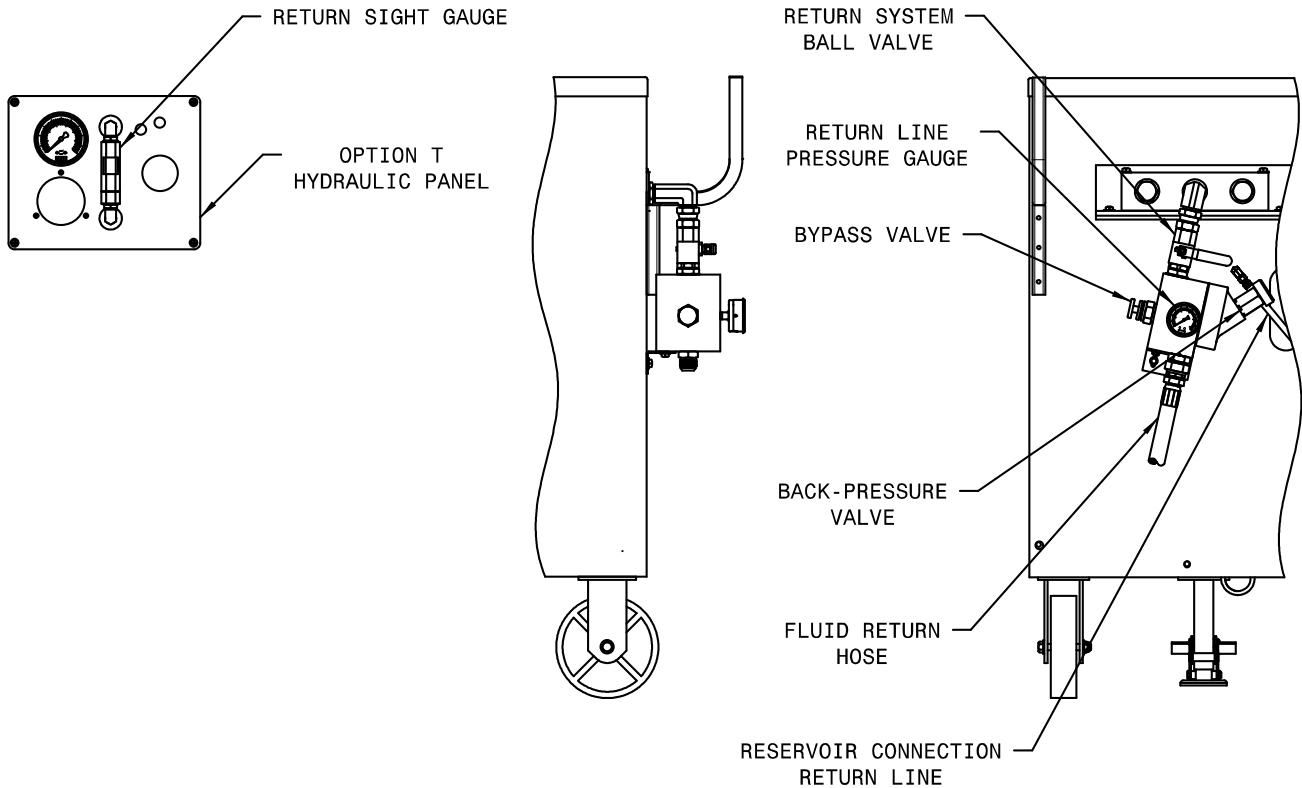


FIGURE 6.3.9 – Return Back-Pressure with Sight Gauge

- Return Sight Gauge ..... Allows viewing of fluid returned through the reservoir connection line (third hose).
- Option T Hydraulic Panel ..... Added for the Back-Pressure Option (Option T). It varies slightly from the standard panel.
- Return System Ball Valve ..... The return system ball valve has been added for normal operation when combined with a Dual System Option (Options C or D). The ball valve is **not** used when the back-pressure feature is being utilized and **must remain open while the machine is running**.

**WARNING!**



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

- Return Line Pressure Gauge ..... Indicates the pressure in the main return hose (back- pressure). (Manifold Mounted) 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.

**Reference 6.10 Return Back-Pressure with Sight Gauge Operation.**

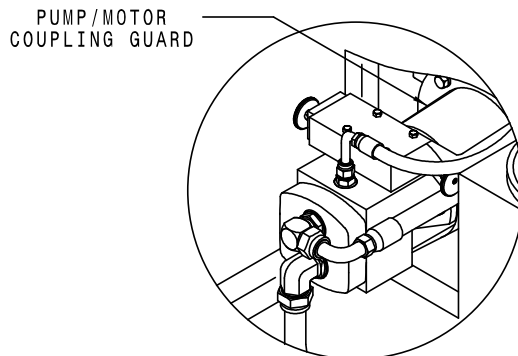
## 6.0 OPERATION (continued)

### 6.4 START UP PROCEDURES

#### 6.4.1 Procedure for First Time or Different Electrical Supply ONLY

**Phase Monitor (Options G – J Only):** Check that the phase monitor light on the instrument panel is not illuminated. If the light is illuminated, change any two of the three input leads at the plug. Once the phase monitor light is not illuminated with power attached, check for proper motor rotation.

- a. Remove the pump/motor coupling guard. Reference **Figure 6.4.1 – Pump/Motor Coupling Access**.



**FIGURE 6.4.1 – Pump/Motor Coupling Access**



**Rotating Parts!** Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the HPU with covers, shrouds, or guards removed.

- a. Verify that the unit has been prepared for use by connecting electrical leads and servicing the reservoir. (Reference Section 4.0 *Preparation Prior to First Use*.)
  - b. Keeping hands clear of the pump/motor coupling area, momentarily press the start button and immediately press the stop button.
  - c. Observe direction of rotation of the pump/motor coupling. When the Operator is facing the front panel, the pump/motor coupling should be rotating in a clockwise direction.



**Electrical Shock!** Never touch electrical wires or components while the HPU is attached to the power source. They can be sources of electrical shock.

**Do not operate HPU with cabinet panels removed.**

- d. If the pump/motor coupling is rotating in a counter-clockwise direction, change any two of the three leads at the plug. Observe direction of rotation to verify that pump/motor is rotating in a clockwise direction.
- e. Replace the pump/motor coupling guard.

#### 6.4.2 Initial Start Up of the HPU

- a. Unit must be prepared per Section 4.0 *Preparation Prior to First Use* and Section 6.4.1 *First Time or Different Electrical Supply ONLY* before starting the HPU.
- b. Operator must be familiar with this manual and be properly trained prior to starting the HPU.
- c. Connect quick disconnects to hose ends or cap the pressure and return hose ends.
- d. Place the reservoir selector valve in "HPU Reservoir" position.
- e. Place the bypass valve in the "Open" position.
- f. Press the start switch and adjust the flow control until 6 gpm (22.71 lpm) is displayed on the flowmeter. (If no flow displays on the flowmeter after adjusting the flow control, reference *Trouble Shooting 9.2 No Flow*).
- g. Close the bypass valve, adjust the pressure control until 3,000 psi (206.84 bars) is displayed on the pressure gauge. (If no pressure displays on the system pressure gauge after adjusting the pressure control, reference *Trouble Shooting 9.4 No Pressure or Reduced Pressure*).
- h. Open the bypass valve; press the stop switch.

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

6.0 Operation continued on following page.

## 6.0 OPERATION (continued)

### 6.5 PRELIMINARY ADJUSTMENTS FOR OPERATION

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

#### 6.5.1 Flow Control Adjustment

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

#### 6.5.2 Pressure Control Adjustment

- a. Open bypass valve.
- b. Select "Hydraulic Power Unit" position with reservoir selector valve.
- c. Start HPU.
- d. Close bypass valve.
- e. Adjust pressure control for desired pressure; observing the system pressure gauge, read in psi (bars). 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.

#### 6.5.3 Reservoir Selector Valve Operation

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

#### CAUTION!



The reservoir selector valve should only be operated when the HPU is not running. The operation of the reservoir selector valve should be done prior to starting the HPU.

- a. Aircraft Reservoir Position (Closed Loop)  
In this position, the HPU is dependent on the aircraft reservoir and system for an adequate supply of fluid. Cavitation, due to an inadequate fluid supply from the aircraft, may be indicated by erratic fluctuation of the system pressure gauge or flowmeter. At times, the aircraft fluid supply will be restricted due to small return oil lines in the aircraft. If this is a problem, decrease the flow control setting until the cavitation is eliminated.
- b. HPU Reservoir Position (Open Loop)  
In this position, the HPU reservoir supplies fluid to the pump and accepts return fluid from the aircraft. It is desirable to operate the HPU in this mode since it eliminates any possibility of cavitation.

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



#### CAUTION!

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

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

6.5 PRELIMINARY ADJUSTMENTS FOR OPERATION (*continued*)

**6.5.4 Bypass Valve Operation**

The bypass valve is used for unloading the pump. The valve should be either in the fully open or fully closed position only. Do not operate the valve in a partially open position.

- a. Start Up Operation:  
The bypass valve must be opened prior to starting the HPU in order to allow the motor to start under a no load condition and not pressurize the aircraft hydraulic system.
- b. Shut Down Operation:  
Prior to shutdown, the bypass valve must be opened to bleed off any residual system pressure.

**CAUTION!**



**Excessive heat, which could damage machine components, will be generated if the bypass valve is partially open or is used for regulating flow or pressure.**

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

6.6 BLEEDING AIR FROM SYSTEM

Rapid fluctuations of the pressure gage and flow-meter are indications of cavitation or entrapped air in the hydraulic lines and/or components. Air may enter the system when:

- Operating the unit with insufficient oil in the reservoir.
- Changing a component on the aircraft.
- Changing hose connections and/or couplings.

**6.6.1 To Easily Purge the Unit of Air**

- a. Fill reservoir to recommended level.
- b. Open bypass valve.
- c. Place reservoir selector valve in "Hydraulic Power Unit" position.
- d. Start unit and adjust flow control to maximum position.

**NOTE: If fluid is not flowing, shut off HPU and reference 9.2 No Flow in Trouble Shooting section of Technical Manual**

- e. Run unit for five (5) minutes and shut off.
- f. If additional bleeding is required, connect the pressure and return hoses together and open all pressure and return ball valves at the rear of the HPU. Start the HPU and slowly close the bypass valve (**system pressure should remain under 200 psi (approximately 14 bars)**). Allow fluid to flow at full flow for five (5) minutes, then shut the HPU off.



**WARNING!**

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

6.7 DUAL SYSTEM OPERATION (*Option C*)

The dual system option allows control of fluid flow to aircraft with two hydraulic systems. The systems consist of two sets of hoses and valves located in the pressure and return systems. The valves are mounted on the rear of the hydraulic power unit and are of the 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 aircraft reservoirs may occur if a reservoir level or pressure differential exists. Select valve positions prior to starting machine.

**6.7.1 To Operate the Dual System**

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

**WARNING!**

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

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



**WARNING!**

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

6.0 Operation continued on following page.

## 6.0 OPERATION (continued)

### 6.8 DUAL SYSTEM CROSSOVER CHECK (Option D)

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

Although both systems may be operated simultaneously, usually only one system is required at any one time. If both valve sets are open simultaneously, the pump output will be divided between the two systems.

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

#### 6.8.1 To Operate the Dual System with Crossover Check

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



#### WARNING!

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

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

#### WARNING!

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



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

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

### 6.9 HAND PUMP OPERATION (Option M)

The Hand Pump Option allows for filling the reservoir (low pressure) or static testing of components or system (high pressure). The hand pump circuit is separate from the main hydraulic system; a separate filter and hose are attached to the back panel of the HPU.

#### 6.9.1 To Operate the Hand Pump

- a. Remove the pump handle from inside the front access door. (Reference **Figure 6.3.6 – Hand Pump Controls**)
- b. Insert the end of the pump handle through the front panel opening into the hand pump relief screw.
- c. Turn the pump handle clockwise to close the relief screw.
- d. Insert the pump handle onto the hand pump arm through the front panel slot.
- e. Pump the handle using an up and down motion. Observe the hand pump system pressure on the hydraulic control panel (**Figure 6.3.3 – Hydraulic Control Panel**). The pump is an automatic two stage pump. 500 psi (34.47 bars) can be produced with high fluid flow and 5,000 psi (344.74 bars) can be produced with low fluid flow.
- f. Turning the relief screw in a counter-clockwise direction releases hydraulic pressure in the hand pump system.



**Pressurized Fluid!** Before disconnecting the hand pump pressure hose, ALWAYS open the relief screw valve to relieve any residual pressure in the hydraulic system.



## 6.0 OPERATION (continued)

### 6.10 RETURN BACK-PRESSURE WITH SIGHT GAUGE (Option T)

The Return Back-Pressure Manifold consists of a back-pressure valve, a return bypass valve, pressure gauge, and a return ball valve; all mounted in an aluminum manifold block at the rear of the HPU. The Instrument Panel contains a sight gauge for viewing fluid returned from the aircraft reservoir connection (third hose).

The back-pressure valve is an adjustable check valve with a range from 0 to 250 psi (0 to 17 bars). The valve can be used for holding back pressure on the aircraft reservoir while running the HPU in HPU Reservoir mode. The adjusted back-pressure is displayed on the manifold-mounted pressure gauge.

Opening the return bypass valve will allow fluid to free-flow past the back-pressure valve for normal operation. The return bypass valve is intended for use either completely open or completely closed. Do not use the return bypass valve for metering or flow control.

The return ball valve is a zero leakage valve and can be used when standard Dual System operation is desired. Reference Section 6.7 – **Dual System Operation**.



#### WARNING!

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



#### CAUTION!

**Do not use the back-pressure valve when the HPU reservoir is selected for Aircraft Reservoir position. Cavitation and pump damage will result.**

Follow aircraft manufacturer's instructions when utilizing the back-pressure valve and when filling or bleeding the aircraft reservoir.

### 6.11 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 ANSI/B93.19M-1972 (R1993) (*Reference Appendix*) be followed.



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

### 6.12 EMERGENCY SHUT DOWN PROCEDURE

In the event an emergency shut down is necessary, press the emergency stop switch located on the electrical panel. (Reference **Figure 6.3.2 – Electrical Control Panel**) Open the bypass valve to remove any system pressure.

### 6.13 DESCRIPTION OF ALARM SYSTEMS

Reference **Figure 6.3.2 – Electrical Control Panel**.

#### 6.13.1 High Fluid Temperature Indicator (Option S)

The indicator light for high fluid temperature is an active light which will illuminate when the return fluid temperature is 160° F (71° C) or above. The HPU will shut down if the light is illuminated. The HPU can be re-started when the fluid has cooled sufficiently and the light has shut off.

If the high temperature light is illuminated reference section **9.0 Trouble Shooting**.

#### 6.13.2 Voltage/Phase Monitor Indicator (Options G – J)

The indicator light for the voltage/phase monitor is an active light which will illuminate if there is a problem with the incoming electrical power source. The HPU will shut down if the light is illuminated.

If the voltage/phase monitor light is illuminated, reference section **9.0 Trouble Shooting**.

#### 6.13.3 High and Low Reservoir Level Indicator (Option L)

The indicator lights for high and low reservoir level are active lights which will illuminate when the reservoir fluid level is either above the maximum level or below the minimum level. The HPU will shut down if either of the lights are illuminated.

If the light on either of the reservoir level indicator lights, restore the fluid level in the reservoir to a normal operating range.

6.13 Description of alarm system continued on following page.

Models: 5430  
Hydraulic Power Unit

6.13 DESCRIPTION OF ALARM SYSTEMS (continued)

**6.13.4 Clogged Filter Indicator Light (Option R)**

The indicator light for the clogged filter is a passive light which will illuminate if the pressure filter element becomes clogged or is in need of replacement. The HPU will not shut down if the light is illuminated.

If the clogged filter indicator light is illuminated, the pressure filter element requires changing. Reference section **10.13.11 Electric Filter Clogging Indicator (Option R)** for maintenance procedure. Pressing the clogging filter indicator light will reset the light and the light will turn off.

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

**7.0 PACKAGING AND STORAGE**

7.1 PACKAGING REQUIREMENTS

- a. Drain hydraulic fluid until level is below the minimum fluid level indicator.
- b. Block up the unit on a pallet so the wheels are not touching the pallet or shipping container.
- c. Plug all hose ends.
- d. Strap unit to pallet or shipping container using the tie down rings located on the frame bottom.

**NOTE: Use at least four (4) straps with a minimum 2,000 lbs (907.2 kg) capacity each.**

7.2 HANDLING

The unit is designed to be moved by hand using the handles located on the front of the unit. The unit can be lifted by means of a fork truck from the center of the machine. Lifting must be from the motor side of the unit only.

**NOTE: Be sure the forks are long enough to reach the frame cross members for stability during lifting. Spread the forks to their maximum width for stability. Reference Figure 8.0 – HPU on Forklift.**

7.3 PACKAGING PROTECTION

No special packaging material for cushioning or suspension is required.

7.4 LABELING OF PACKAGING

Packaging should be labeled as follows:

**DO NOT DROP  
THIS SIDE UP  
DO NOT STACK**



7.5 STORAGE COMPATIBILITY

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

7.6 STORAGE ENVIRONMENT

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

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

7.7 STORAGE SPACE AND HANDLING FACILITIES

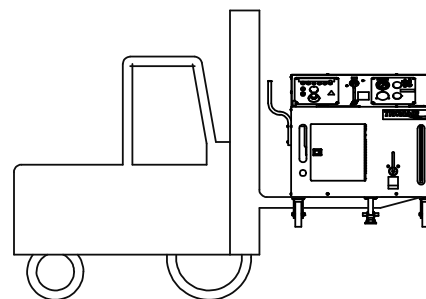
- Weight (Dry): 1,450lbs (658 kg)
- Dimensions:   Width  51 in (129.5 cm)  
                          Height 50 in (127.0 cm)  
                          Depth  54 in (137.2 cm)

**8.0 TRANSPORTATION**

1. Do not stack Hydraulic Power Units.
2. The unit can be lifted by means of a fork truck from the motor side center of the HPU.

**NOTE: Be sure the forks are long enough to reach frame cross members for stability during lifting. Spread the forks to their maximum width for stability. Reference Figure 8.0 – HPU on Forklift.**

- Weight: 1,450 lbs (658 kg)



**FIGURE 8.0 – HPU on Forklift**

## 9.0 TROUBLE SHOOTING

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

If the problem is not resolved using the trouble shooting information, call the manufacturer for Technical Assistance (See Section **1.3 Manufacturer**).

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

### 9.1 HPU WILL NOT START

| <b>Possible Cause</b>   | <b>Solution</b>  |
|---|--|
| Supply power off .....  | Check incoming power and restore power. Check across-the-line voltage on all three phase legs.   |
| Supply power fuses are blown/circuit.....<br>circuit breakers tripped                         | Check and replace. Check across-the-line voltage on all three phase legs.  |
| Control Transformer fuses blown .....   | Check and replace.   |
| Supply power phase or voltage incorrect.....<br>(Phase/Voltage Monitor Option G – J only)     | Voltage/Phase Monitor Indicator light will be illuminated. Refer to Section <b>4.3 Connecting Electrical Leads</b> .   |
| Reservoir fluid level is too high or too low.....<br>(Electric Reservoir Level Option L only) | One reservoir level indicator light (Low or High) will be illuminated. Fill the reservoir above the Minimum Fluid Level arrow to extinguish the Low Level light. Drain fluid below the Maximum Fluid Level arrow to extinguish the High Level light.   |
| High return fluid temperature .....   | High Fluid Temperature indicator light will be illuminated. Allow the hydraulic fluid to cool until the light goes out. Refer to Section 9.5 for over-heated causes.   |
| Motor has tripped thermal overload device .....   | Allow the motor to cool. The thermal overload device (motor starter) will reset automatically after sufficient cooling. The tripped condition is usually caused by loading the motor beyond its rated capacity; however, any condition (such as unbalanced voltage) that causes an increase in amperage can result in a tripped condition. |

**NOTE: Using the bypass valve to meter flow or pressure will increase the motor load and may cause the thermal overload device to trip. Refer to section 6.5.4 Bypass Valve Operation for proper use of the bypass valve.**

### 9.2 NO FLOW

| <b>Possible Cause</b>                 | <b>Solution</b>  |
|---------------------------------------|--|
| Motor turning in wrong direction..... | See Section <b>4.3 Connecting Electrical Leads</b> .   |
| Flow control set too low .....        | Increase flow setting.   |
| Fluid level in reservoir too low..... | Service the HPU reservoir.   |
| Air in pump inlet lines.....          | Disconnect the HPU from the aircraft. Fill the HPU reservoir to a level above the pump inlet port. Set the reservoir selector valve to the HPU Reservoir position. <b>Fully open the Bypass Valve.</b> Close the Pressure and Return ball valves at the rear of the unit. Adjust the pump flow to maximum and "bump" the start and stop switches to "jog" the motor. Flow should be indicated at the Flowmeter on first or second "jog". |

**NOTE: Under some conditions where a large amount of air has entered the system, the pump may not be able to draw an initial prime. If this occurs, loosen the inlet hose near the pump and allow air to escape. Re-tighten the hose when fluid appears.**

9.2 No flow continued on following page

**Models: 5430  
Hydraulic Power Unit**

9.2 NO FLOW *(continued)*

| <b>Possible Cause</b>                 | <b>Solution</b>  |
|---------------------------------------|--|
| Motor is turning but pump is not..... | Check pump and motor couplings to ensure they are tight.   |
| Flow path does not exist .....        | A flow path (such as a moving actuator or an open circuit) must exist for flow to be present. When system pressure exceeds the compensator control setting, or when the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure. |

9.3 REDUCED FLOW

| <b>Possible Cause</b>                    | <b>Solution</b>  |
|--|--|
| Flow control is set too low.....         | Increase flow setting.   |
| Pressure adjustment is set too low. .... | Slightly increase pressure setting.  |
| Pressure compensator control is .....    | When system pressure exceeds the compensator control setting, or when the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure. |
| Pump inlet is not receiving enough ..... | Follow the procedure for "Air in pump inlet lines" in Section 9.2.   |
| fluid (cavitation)                       |  |
| Motor is "Single Phasing".....           | Motor is not getting power on all three phase legs. Check across-the-line voltage on all three phase legs.   |
| Supply voltage is 50 Hz .....            | Pumps used on 50 Hz units will flow at only 83% of the pump nameplate rating. An HPU designed to run on 50 Hz will supply flow as stated in the specifications for that unit.    |

9.4 NO PRESSURE or REDUCED PRESSURE

| <b>Possible Cause</b>                    | <b>Solution</b>   |
|--|---|
| Pressure adjustment is set too low ..... | Increase pressure adjustment.   |
| Motor is "Single Phasing".....           | Motor is not getting power on all three phase legs. Check across-the-line voltage on all three phase legs.                            |
| Pump inlet is not receiving enough ..... | Follow the procedure for "Air in pump inlet lines" in section 9.2.  |
| fluid (cavitation)                       |   |
| Flow path is open.....                   | Pressure is resistance to flow. The HPU will reach full pressure as flow paths (such as moving actuators and open valves) are closed. |

9.5 FLUID OVERHEATS

| <b>Possible Cause</b>                     | <b>Solution</b>   |
|---|---|
| Fan is not functioning properly.....      | Check the cooler fan output. Forced air should be easily detected at the right hand side of the HPU. Check the fuses for the fan motor (See Appendices – Electrical Schematic INS-1725).                      |
| Bypass valve or rear ball valve is.....   | The bypass valve and all ball valves must be used in a fully open or fully closed position. (These valves are not intended for metering flow. All flow adjustments must be made using the pump flow control.) |
| being used in a partially closed position |   |

9.6 HAND PUMP (*Option M*) IS NOT PUMPING FLUID

| <b>Possible Cause</b>               | <b>Solution</b>  |
|-------------------------------------|--|
| Release screw is open.....          | Use the slotted end of the pump handle to close the release screw located at the base of the pump.   |
| Ball valve is closed .....          | Open the ball valve for the pump inlet line located at the bottom of the reservoir.  |
| Pump piston is filled with air..... | If the pump is not primed after several strokes, remove the bleed screw from the top of the pump piston (See Section 10.13.9.a – <i>Pump Diagram</i> ). Slowly stroke the pump until fluid is present at the bleed screw. Replace the bleed screw. |

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE**

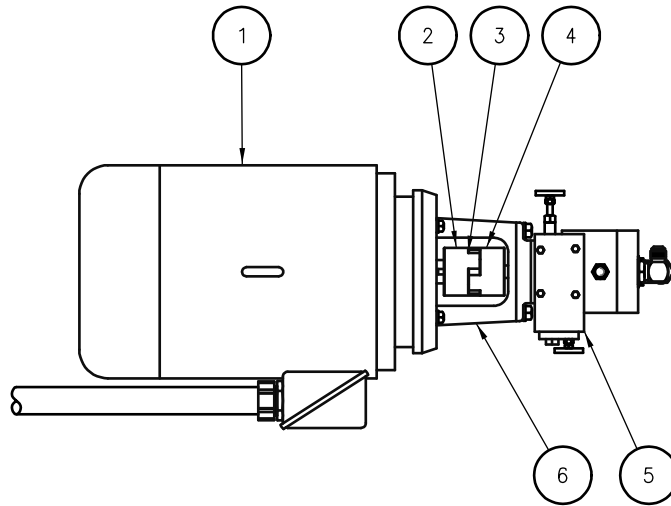
**10.1 GENERAL**

Periodically inspect the HPU for loose fasteners, hose fittings, damaged hoses, and worn electrical cables. Make repairs as needed for safe operation.

Reference Sections **10.2 – 10.14** for Parts Lists, Descriptions and Illustrations.

**10.2 ELECTRIC MOTOR**

The Electric Motor is pre-greased by the manufacturer. Periodic greasing is necessary on a frequently used HPU. Reference **Appendices – Lincoln Motor Manual** for details.



**FIGURE 10.2 – Electric Motor/Hydraulic Pump Assembly**

**PARTS LIST**

| Item  | Part Number                  | Description                      | Qty                |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
|---|------------------------------|----------------------------------|--------------------|---------------------------|--|---------------------------|--|----------------|--------------------|----------------|--------------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|
| 1.....  | Reference following:.....    | Electric Motor.....              | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| <table border="0" style="width:100%"> <tr> <td align="center" colspan="2"><b>60 Hz Applications</b></td> <td align="center" colspan="2"><b>50 Hz Applications</b></td> </tr> <tr> <td><b>Voltage</b></td> <td><b>Part Number</b></td> <td><b>Voltage</b></td> <td><b>Part Number</b></td> </tr> <tr> <td>208.....</td> <td>EC-1224-02</td> <td>200.....</td> <td>EC-1224-02</td> </tr> <tr> <td>230.....</td> <td>EC-1224-02</td> <td>220.....</td> <td>EC-1555-11</td> </tr> <tr> <td>380.....</td> <td>EC-1224-01</td> <td>380.....</td> <td>EC-1555-12</td> </tr> <tr> <td>460.....</td> <td>EC-1224-02</td> <td>415.....</td> <td>EC-1224-02</td> </tr> <tr> <td>575.....</td> <td>EC-1224-03</td> <td>440.....</td> <td>EC-1555-11</td> </tr> </table> |                              |                                  |                    | <b>60 Hz Applications</b> |  | <b>50 Hz Applications</b> |  | <b>Voltage</b> | <b>Part Number</b> | <b>Voltage</b> | <b>Part Number</b> | 208..... | EC-1224-02 | 200..... | EC-1224-02 | 230..... | EC-1224-02 | 220..... | EC-1555-11 | 380..... | EC-1224-01 | 380..... | EC-1555-12 | 460..... | EC-1224-02 | 415..... | EC-1224-02 | 575..... | EC-1224-03 | 440..... | EC-1555-11 |
| <b>60 Hz Applications</b>   |                              | <b>50 Hz Applications</b>        |                    |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| <b>Voltage</b>  | <b>Part Number</b>           | <b>Voltage</b>                   | <b>Part Number</b> |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 208.....  | EC-1224-02                   | 200.....                         | EC-1224-02         |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 230.....  | EC-1224-02                   | 220.....                         | EC-1555-11         |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 380.....  | EC-1224-01                   | 380.....                         | EC-1555-12         |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 460.....  | EC-1224-02                   | 415.....                         | EC-1224-02         |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 575.....  | EC-1224-03                   | 440.....                         | EC-1555-11         |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 2.....  | H-2225-01.....               | Coupling (Motor Half).....       | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 3.....  | H-2228.....                  | Spider (Hytrel).....             | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 4.....  | H-2225-02.....               | Coupling (Pump Half).....        | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 5.....  | Reference 10.3 & 10.3.1..... | Motor Driven Hydraulic Pump..... | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |
| 6.....  | HC-1810-03.....              | Pump/Motor Adapter.....          | 1                  |                           |  |                           |  |                |                    |                |                    |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |          |            |

10.0 Maintenance continued on following page.

10.0 MAINTENANCE (continued)

10.3 MOTOR DRIVEN HYDRAULIC PUMP

The hydraulic pump does not require regular maintenance. Under normal operating conditions, the pump will perform for thousands of hours of use without rebuilding. See **Appendices – Oil Gear Pump Manual** for further details.

10.3.1 Motor Driven Hydraulic Pump Assembly

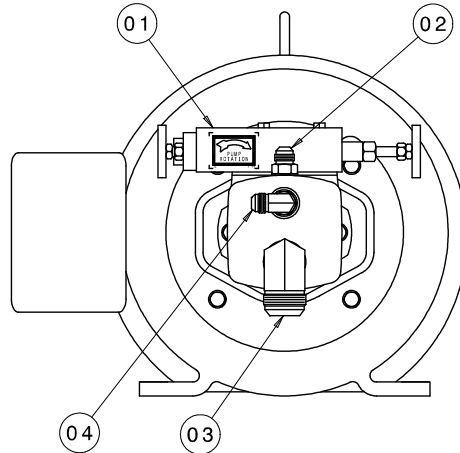


FIGURE 10.3.1 – Motor Drive Hydraulic Pump Assembly

Fluid Type: Aviation Phosphate Ester, Type IV

| Item | Part Number   | Description   | Qty |
|------|---------------|---|-----|
| ◆ 1  | K-4265        | Assembly, Hydraulic Pump (Painted pump with knobs. Does not include fittings, labels or coupling half.) | 1   |
| 2    | N-2007-20-S-E | Connector, Male #10 SAE x #12 JIC   | 1   |
| 3    | N-2001-28-S-E | Elbow, 90° Male #20 SAE x #20 JIC   | 1   |
| 4    | N-2001-21-S-E | Elbow, 90° Male #16 SAE x #12 JIC   | 1   |

◆ Refer to section 10.14 for listing of Replacement Labels.

10.3.2 Motor Driven Hydraulic Pump Replacement Kits List

Fluid Type: Aviation Phosphate Ester, Type IV

| Part Number | Description                     |
|-------------|---------------------------------|
| ◆           | Kit, Shaft Seal and Retainer    |
| ◆           | Kit, Gaskets and O-rings        |
| ◆           | Kit, Shaft and Bearing Assembly |

◆ Kit not released at time of publishing. Call Tronair for Part Number.

10.4 HYDRAULIC FLUID

Any time an unusual color, smell or visual indicator is noticed with the hydraulic fluid, a sample analysis should be performed to determine the condition of the fluid. (See Section 6.11 – **Sample Valve Operation**)

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

**Model Number:**      **Fluid Type:**

5430..... Aviation Phosphate Ester, Type IV

Models: 5430  
Hydraulic Power Unit

10.0 MAINTENANCE (continued)  
10.5 FILTERS

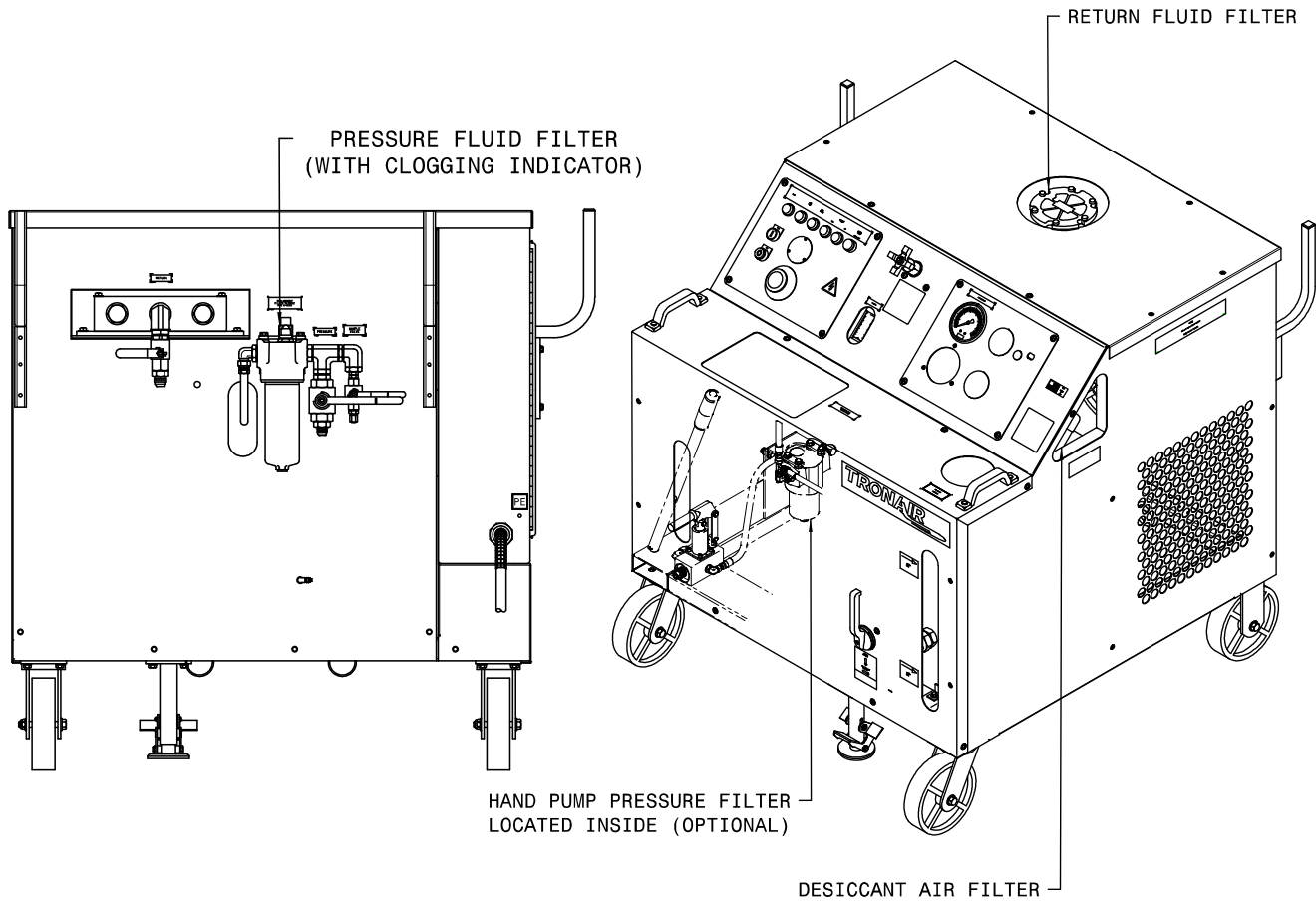


FIGURE 10.5 – Filter Locations

10.5 Filters continued on following page.

**Models: 5430  
Hydraulic Power Unit**

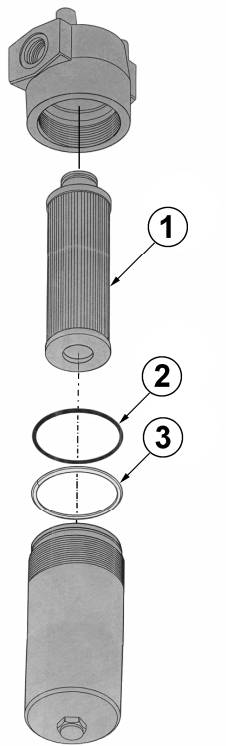
10.5 FILTERS *(continued)*

**10.5.1 Pressure Filter**

Replace the filter element any time the clogged filter indicator light (*Option R*) is triggered or when the pop-up indicator located on the filter head changes to red during operation.

Replace the filter element annually to ensure proper cleanliness of the hydraulic system. This is a minimum requirement.

Standard filter changes depend on how frequently the HPU is used and the cleanliness of the fluid, along with the environment to which the HPU is exposed. Periodic fluid analysis is recommended to properly determine the optimum frequency of filter element changes.



**FIGURE 10.5.1 – Pressure Filter**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b>   | <b>Part Number</b> | <b>Description</b>                   | <b>Qty</b> |
|---------------|--------------------|--------------------------------------|------------|
| 2 & 3.....    | K-3797.....        | Kit, Seal.....                       | 1          |
| 1, 2 & 3..... | K-3428.....        | Kit, Replacement Filter Element..... | 1          |



10.5 FILTERS (continued)

10.5.2 Return Filter

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

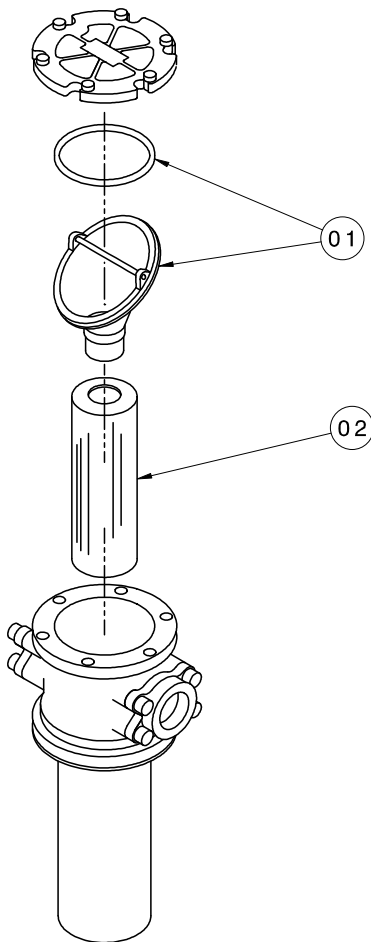


FIGURE 10.5.2 – Return Filter

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

| Item  | Part Number | Description                     | Qty |
|-------|-------------|---------------------------------|-----|
| 1     | HC-2006-350 | O-ring                          | 2   |
| 1 & 2 | K-3494      | Kit, Replacement Filter Element | 1   |

10.5 Filters continued on following page.

10.5 FILTERS (continued)

**10.5.3 Hand Pump (Option M) Filter**

Replacement of the hand pump filter element is dictated by frequency of use and the cleanliness of the fluid, along with the environment to which the HPU is exposed. Changing the hand pump filter element at the same time as the pressure filter element will ensure a regular maintenance schedule.

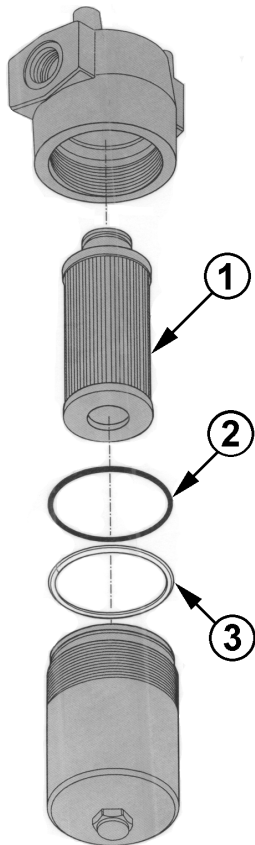


FIGURE 10.5.3 – Hand Pump (Option M) Filter

**PARTS LIST**

Fluid Type: Aviation Phosphate Ester, Type IV

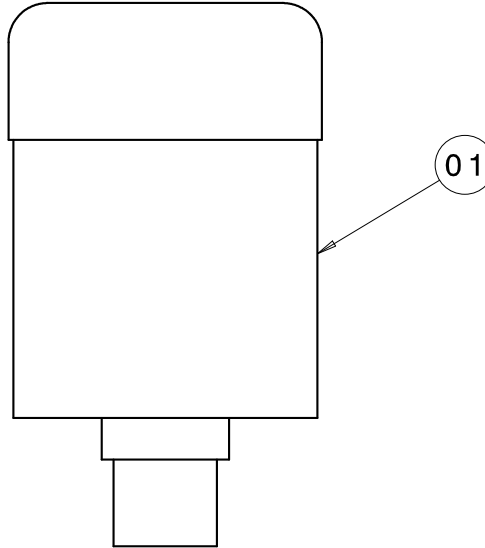
| Item           | Part Number | Description                          | Qty |
|----------------|-------------|--------------------------------------|-----|
| 2 & 3.....     | K-3797..... | Kit, Seal.....                       | 1   |
| 1 & 2 & 3..... | K-3752..... | Kit, Replacement Filter Element..... | 1   |

Models: 5430  
Hydraulic Power Unit

10.5 FILTERS (continued)

**10.5.4 Desiccant Air Filter**

Replace the desiccant/air filter whenever the material inside the element is pink or reddish in color (see Element Label for details).



**FIGURE 10.5.4 – Desiccant Air Filter**

**PARTS LIST**

| <b>Item</b> | <b>Part Number</b> | <b>Description</b>  | <b>Qty</b> |
|-------------|--------------------|---------------------|------------|
| 1.....      | HC-1763.....       | Filter Element..... | 1          |

10.0 Maintenance continued on following page

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

10.6 HYDRAULIC HOSES

Hoses used on the HPU must be periodically inspected for damage, blisters, leaks, or hose end problems. Any damaged or defective hose should be replaced as soon as possible.

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

| Hose Location |                              |                      |
|---------------|------------------------------|----------------------|
| Item          | From                         | To                   |
| 1             | Selector Valve               | Pump Inlet           |
| 2             | Pump Outlet                  | Flowmeter            |
| 3             | Control Manifold             | Pressure Filter      |
| 4             | Control Manifold             | Pressure Gauge       |
| 5             | Case Drain                   | Cooler (Rear)        |
| 6             | Cooler (Front)               | Return Manifold      |
| 7             | Control Manifold             | Return Manifold      |
| 8             | Return Filter                | Selector Valve (Top) |
| 9             | Return Pressure Relief Valve | Reservoir            |

**FIGURE 10.6 – Hydraulic Hoses**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

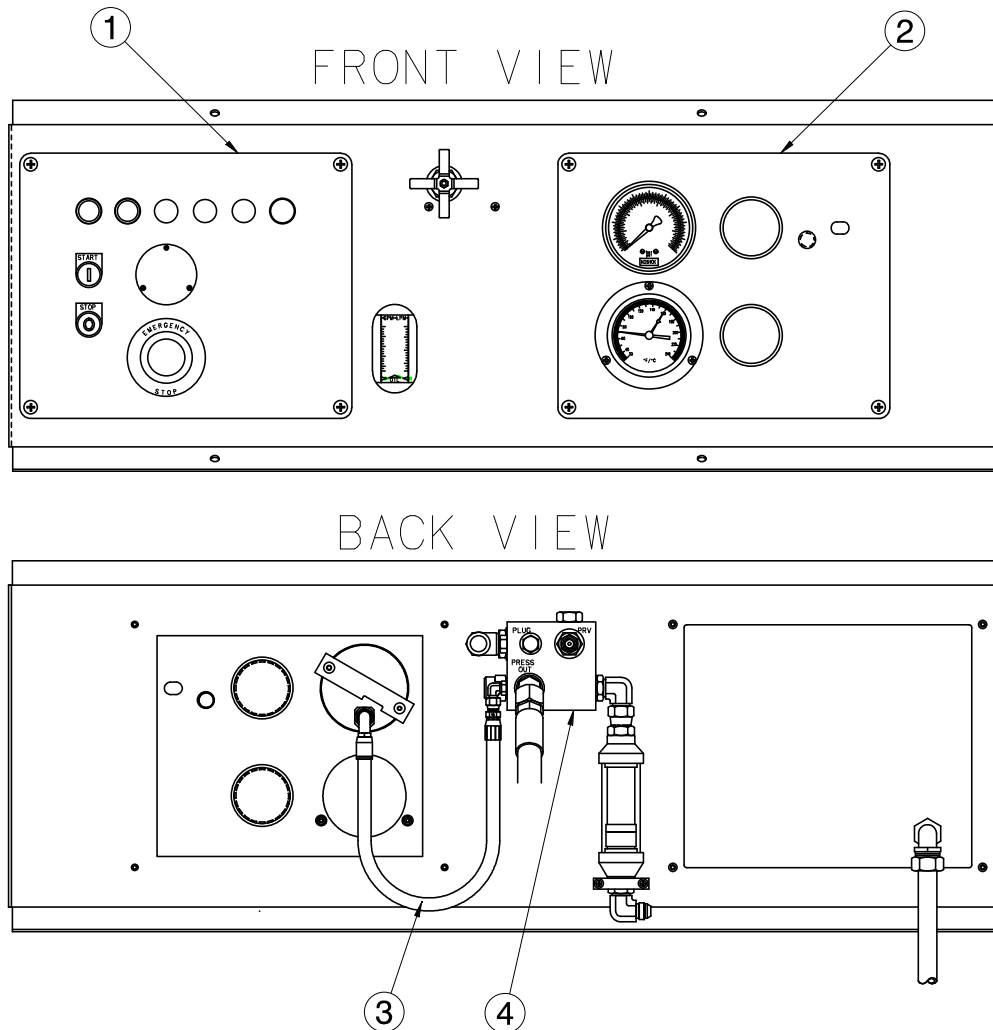
| Item                   | Part Number           | Description                      | Qty |
|------------------------|-----------------------|----------------------------------|-----|
| 1.....                 | TF-1040-39*12.8 ..... | Assembly, Hose #20 .....         | 1   |
| 2.....                 | TF-1040-01*37.0 ..... | Assembly, Hose #12 .....         | 1   |
| 3.....                 | TF-1040-11*32.8 ..... | Assembly, Hose #12 .....         | 1   |
| 4.....                 | TF-1040-42*23.0 ..... | Assembly, Hose #4 .....          | 1   |
| 5.....                 | TF-1041-55*38.3 ..... | Assembly, Hose #12 .....         | 1   |
| 6.....                 | TF-1040-45*16.3 ..... | Assembly, Hose #12 .....         | 1   |
| 7.....                 | TF-1041-15*31.3 ..... | Assembly, Hose #12 .....         | 1   |
| 8.....                 | TF-1040-39*35.3 ..... | Assembly, Hose #20 .....         | 1   |
| 9.....                 | TF-1134-02*17.5 ..... | Assembly, Hose #8 .....          | 1   |
| <i>Not Shown</i> ..... | TF-1040-01*300 .....  | External Pressure Hose #12 ..... | 1   |
| <i>Not Shown</i> ..... | TF-1041-01*300 .....  | External Return Hose #16.....    | 1   |

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

10.7 INSTRUMENT PANEL

Refer to Section **10.6 Hydraulic Hoses** concerning hose inspection for general maintenance on Hose Assembly **(Item 3 in Figure 10.7)**.



**FIGURE 10.7 – Instrument Panel**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b> | <b>Description</b>           | <b>Qty</b> |
|-------------|--------------------|------------------------------|------------|
| 1.....      | See Page 32.....   | Electric Panel.....          | 1          |
| 2.....      | See Page 33.....   | Hydraulic Panel.....         | 1          |
| 3.....      | See Page 30.....   | Assembly, Hose #4.....       | 1          |
| 4.....      | See Page 34.....   | Control Block/Flowmeter..... | 1          |

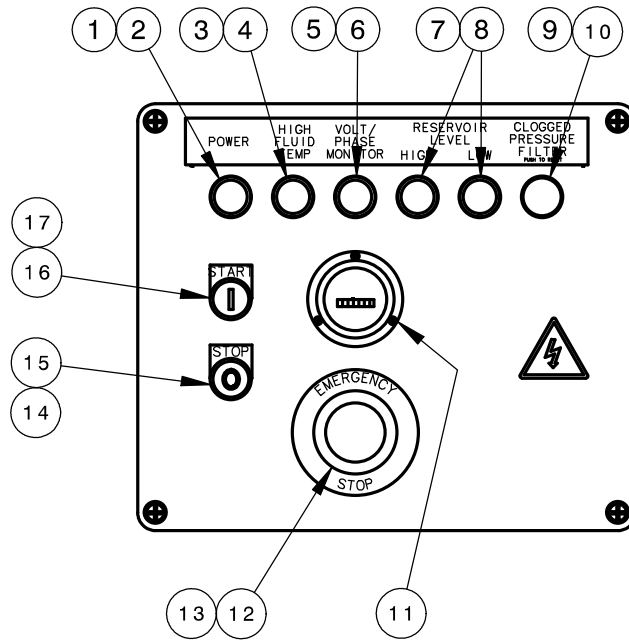
10.7 Instrument Panel continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.7 INSTRUMENT PANEL (continued)

**10.7.1 Electric Panel**

The Electric Panel does not require regular general maintenance.



**FIGURE 10.7.1 – Electric Panel**

**PARTS LIST**

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

Models: 5430  
Hydraulic Power Unit

10.7 INSTRUMENT PANEL (continued)

10.7.2 Hydraulic Panel

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

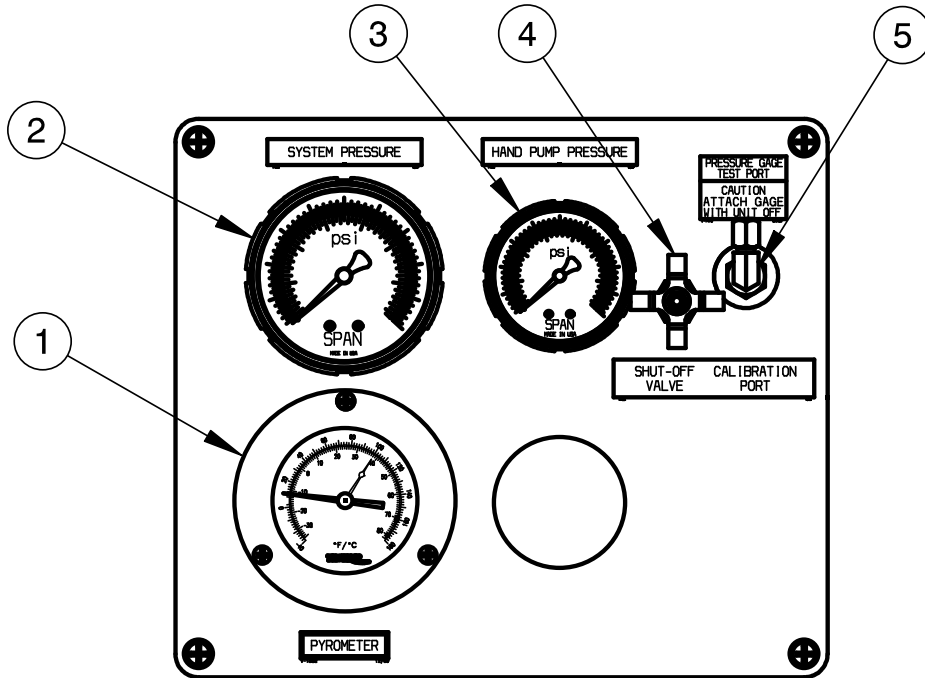


FIGURE 10.7.2 – Hydraulic Panel

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

| Item   | Part Number               | Description   | Qty |
|--------|---------------------------|---|-----|
| 1..... | HC-2268-02.....           | Pyrometer (Optional).....                                 | 1   |
| 2..... | HC-2144.....              | System Pressure Gauge.....                                | 1   |
| 3..... | HC-2146.....              | Pressure Gauge (Hand Pump Option Only).....               | 1   |
| 4..... | HC-1900-02.....           | Shut Off Needle Valve (Calibration Port Option Only)..... | 1   |
| 5..... | See Section 10.14.10..... | Calibration Port (Optional).....                          | 1   |

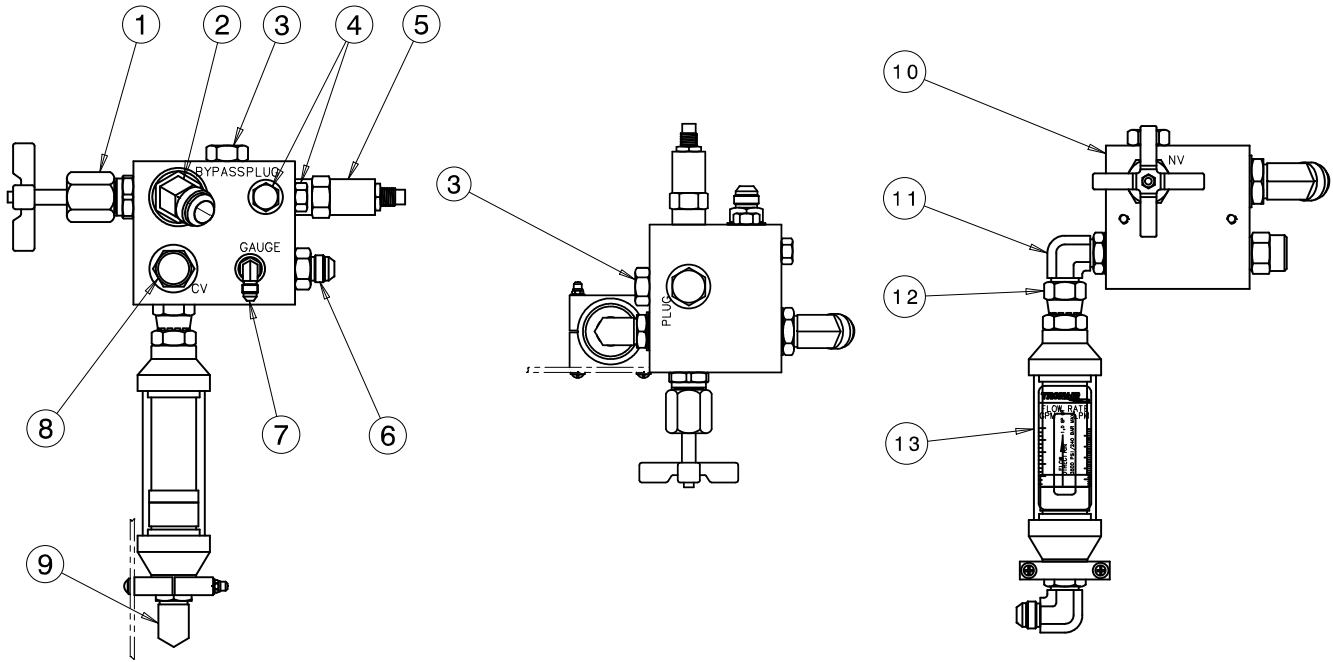
10.7 Instrument Panel continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.7 INSTRUMENT PANEL (continued)

**10.7.3 Control Block/Flowmeter**

The Control Block components do not require regular general maintenance.



**FIGURE 10.7.3 – Control Block/Flowmeter**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b>    | <b>Description</b>                       | <b>Qty</b> |
|-------------|-----------------------|--|------------|
| 1.....      | HC-1927-05.....       | Needle Valve.....                        | 1          |
| 2.....      | N-2042-09-S-E.....    | Elbow, 45° Straight Thread (#12).....    | 1          |
| 3.....      | N-2066-10-S-E.....    | O-ring Hex Plug (#10).....               | 2          |
| 4.....      | N-2066-06-S-E.....    | O-ring Hex Plug (#6).....                | 2          |
| 5.....      | HC-2149.....          | Pressure Relief Valve.....               | 1          |
| 6.....      | N-2007-20-S-E.....    | Connector, Straight Thread (#12-10)..... | 1          |
| 7.....      | N-2001-03-S-E.....    | Elbow, Straight Thread (#4).....         | 1          |
| 8.....      | HC-1677.....          | Check Valve.....                         | 1          |
| 9.....      | N-2001-20-S-E.....    | Elbow, Straight Thread (#12-10).....     | 1          |
| 10.....     | J-3399.....           | Pressure Manifold.....                   | 1          |
| 11.....     | N-2001-15-S-E.....    | Elbow, Straight Thread ((#10).....       | 1          |
| 12.....     | N-2036-07-S-E.....    | Swivel, 37° Female (#10).....            | 1          |
| 13.....     | HC-2132.....          | Flowmeter, 15 gpm/3,500 psi.....         | 1          |
|             | ..... HC-2132-A1..... | Flowmeter (Calibrated).....              | 1          |



10.7.3 Control Block/Flowmeter (continued)

10.7.3.a System Pressure Relief Valve

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

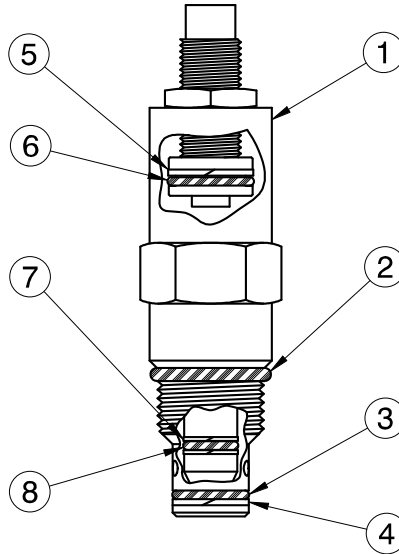


FIGURE 10.7.3.a – System Pressure Relief Valve

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

| Item   | Part Number      | Description                          | Qty |
|--------|------------------|--------------------------------------|-----|
| 1..... | HC-2149.....     | Pressure Relief Valve (Not Set)..... | 1   |
| 2..... | HC-2013-910..... | O-ring, Series 3.....                | 1   |
| 3..... | HC-2006-014..... | O-ring, Series 2.....                | 1   |
| 4..... | HC-2020-014..... | Backup Ring (Teflon).....            | 1   |
| 5..... | HC-2020-015..... | Backup Ring (Teflon).....            | 1   |
| 6..... | HC-2006-015..... | O-ring, Series 2.....                | 1   |
| 7..... | HC-2020-011..... | Backup Ring (Teflon).....            | 2   |
| 8..... | HC-2006-011..... | O-ring, Series 2.....                | 1   |

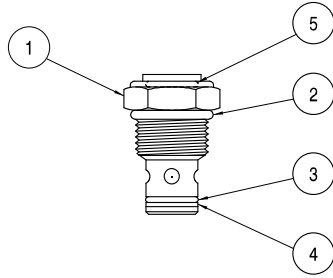
10.7.3 Control block/flowmeter continued on following page.

**Models: 5430  
Hydraulic Power Unit**

**10.7.3 Control Block/Flowmeter (continued)**

**10.7.3.b Check Valve**

The Check Valve does not require regular general maintenance.



**FIGURE 10.7.3.b – Check Valve**

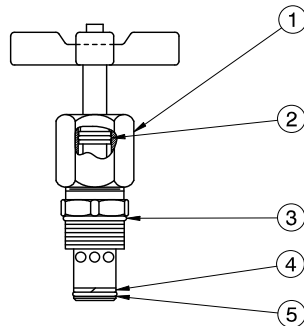
**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b> | <b>Description</b>    | <b>Qty</b> |
|-------------|--------------------|-----------------------|------------|
| 1.....      | HC-1677.....       | Check Valve.....      | 1          |
| 2.....      | HC-2013-910.....   | O-ring, Series 3..... | 1          |
| 3.....      | HC-2006-014.....   | O-ring, Series 2..... | 1          |
| 4.....      | HC-2020-014.....   | Backup Ring.....      | 1          |
| 5.....      | HC-2013-905.....   | O-ring, Series 3..... | 1          |

**10.7.3.c Bypass Valve**

The Bypass Valve does not require regular general maintenance.



**FIGURE 10.7.3.c – Bypass Valve**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

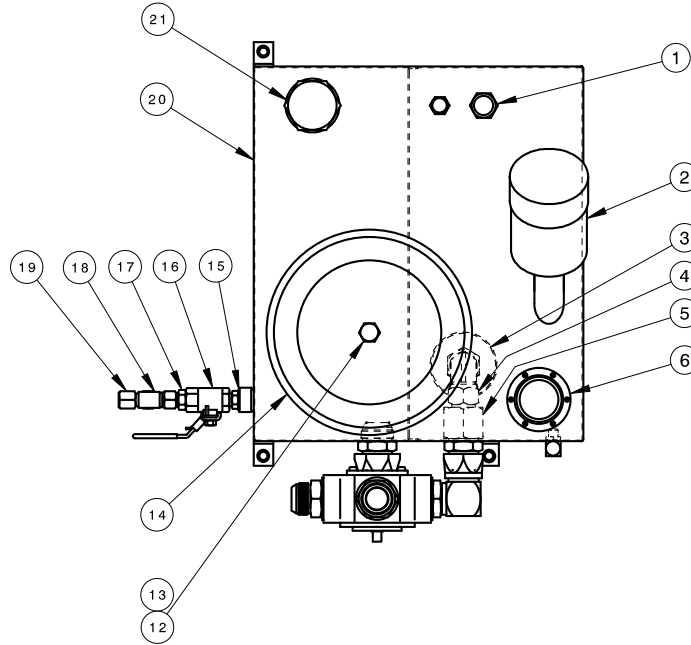
| <b>Item</b> | <b>Part Number</b> | <b>Description</b> | <b>Qty</b> |
|-------------|--------------------|--------------------|------------|
| 1.....      | HC-1927-05.....    | Needle Valve.....  | 1          |
| 2.....      | HC-2006-111.....   | O-ring.....        | 1          |
| 3.....      | HC-2013-912.....   | O-ring.....        | 1          |
| 4.....      | HC-2020-114.....   | Backup Ring.....   | 1          |
| 5.....      | HC-2006-114.....   | O-ring.....        | 1          |

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

**10.8 RESERVOIR ASSEMBLY**

Replace the desiccant air filter whenever the material inside the element is pink or reddish in color (See Element label for details). The Reservoir Assembly does not require regular general maintenance. If periodic inspections for silt are desired, be certain to thoroughly clean the dome cover and surrounding area before removing the dome cover. The Selector Valve (Item 9) is not field serviceable.



**FIGURE 10.8 – Reservoir Assembly**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b>  | <b>Description</b>                              | <b>Qty</b> |
|-------------|---------------------|---|------------|
| 1.....      | N-2008-08-S.....    | Cap, #12 .....                                  | 1          |
| 2.....      | HC-1763.....        | Desiccant Filter .....                          | 1          |
| 3.....      | HC-1397-02.....     | Diffuser, 1" NPT .....                          | 1          |
| 4.....      | N-2035-08-S.....    | Elbow, Swivel Male, #16 JIC x 1" NPT.....       | 1          |
| 5.....      | N-2055-25-S.....    | Tube Reducer, #20 x #16 JIC .....               | 1          |
| 6.....      | HC-2193-06.....     | Filler, Non-vented.....                         | 1          |
| 12.....     | H-1735-02 .....     | Washer, Nylon.....                              | 1          |
| 13.....     | G-1202-1100 .....   | ESN, 5/8 - 11 .....                             | 1          |
| 14.....     | H-1741.....         | Cover Assembly.....                             | 1          |
| 15.....     | HC-2013-908.....    | O-ring, Series 3.....                           | 1          |
| 16.....     | HC-1761 .....       | Ball Valve, SAE #8 Lockable.....                | 1          |
| 17.....     | N-2007-11-S-E ..... | Connector, Straight Thread #8 SAE x #8 JIC..... | 1          |
| 18.....     | N-2016-06-S.....    | Tee, Swivel Run, #8 JIC.....                    | 1          |
| 19.....     | N-2008-06-S.....    | Cap, #8 .....                                   | 3          |
| 20.....     | H-2728.....         | Reservoir, 30 gallon (113.4 lt) .....           | 1          |
| 21.....     | N-2206-09-S.....    | Plug, Hex Head, 2" NPT.....                     | 1          |

10.8 Reservoir assembly continued on following page.

Models: 5430  
Hydraulic Power Unit

10.8 RESERVOIR ASSEMBLY (continued)

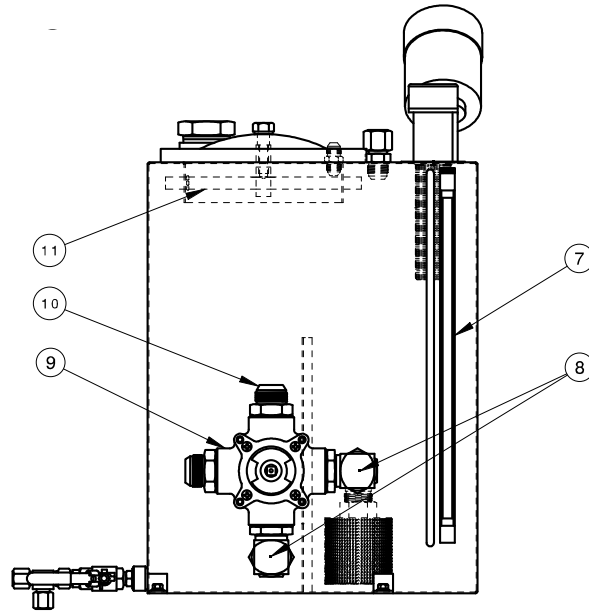


FIGURE 10.8 – Reservoir Assembly

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

| Item    | Part Number        | Description                             | Qty |
|---------|--------------------|---|-----|
| 7.....  | HC-1383-18.....    | Sight Gauge.....                        | 1   |
| 8.....  | N-2049-20-S-E..... | Elbow, 90° Swivel, #20.....             | 2   |
| 9.....  | HC-1764-02.....    | Selector Valve, #20 SAE.....            | 1   |
| 10..... | N-2007-28-S-E..... | Connector, Straight Thread #20 SAE..... | 2   |
| 11..... | Z-2199.....        | Clamp Assembly.....                     | 1   |

10.0 MAINTENANCE (continued)

10.9 RETURN MANIFOLD ASSEMBLY

Refer to Section 10.5.2 – Return Filter for information on changing filter element.

**NOTE: DO NOT attempt to adjust the Return System Pressure Relief Valve. See Section 10.9.1 – Return System Pressure Relief Valve for details.**

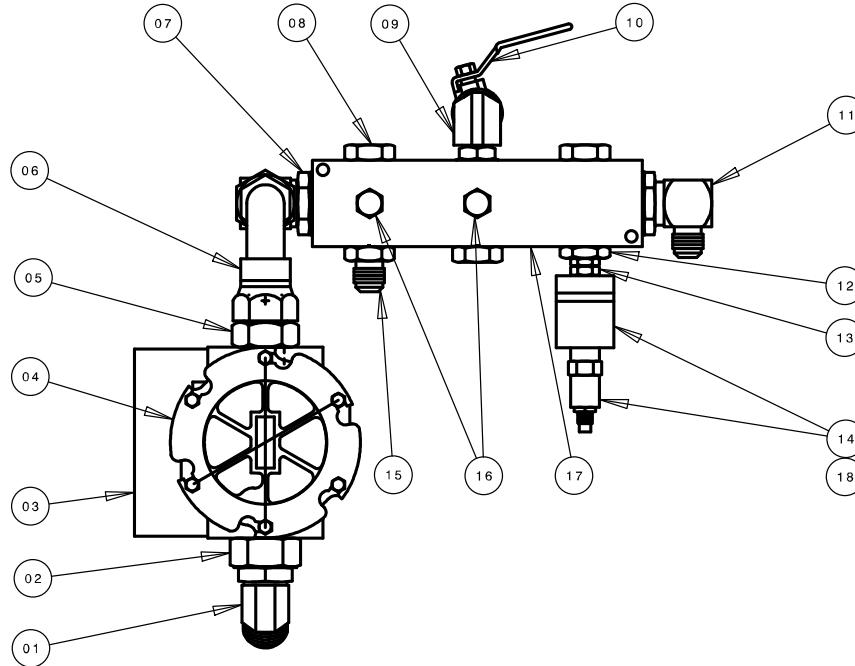


FIGURE 10.9 – Return Manifold Assembly

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

| Item | Part Number   | Description                                   | Qty |
|------|---------------|---|-----|
| 1    | N-2042-13-S-E | Elbow, 45° Straight Thread #20 JIC x #20 SAE  | 1   |
| 2    | N-2463-25-S-E | Fitting, Reducer/Expander 24/20 SAE           | 1   |
| 3    | H-1581        | Bracket, Filter                               | 1   |
| 4    | HC-1906-02    | Filter, Return                                | 1   |
| 5    | N-2007-30-S-E | Connector, Straight Thread, #20 JIC x #24 SAE | 1   |
| 6    | N-2063-04     | Elbow, Bent Swivel Nut                        | 1   |
| 7    | N-2049-20-S-E | Elbow, 90° Swivel, #20 SAE x #20 JIC          | 1   |
| 8    | N-2053-10-S-E | Plug, Hex Head, #16 O-ring                    | 3   |
| 9    | N-2638-06-S-E | Elbow, 90° #16 SAE x #16 SAE                  | 1   |
| 10   | HC-1770-05    | Valve, Ball                                   | 1   |
| 11   | N-2001-37-S-E | Elbow, 90° #12 JIC x #20 SAE                  | 1   |
| 12   | N-2463-16-S-E | Fitting, Reducer/Expander 16/8 SAE            | 1   |
| 13   | N-2464-06-S-E | Union, Straight Thread #8 x #8 SAE            | 1   |
| 14   | HC-2200       | Valve, Pressure Relief (Pre-Set)              | 1   |
| 15   | N-2007-21-S-E | Connector, Straight Thread, #12 JIC x #16 SAE | 1   |
| 16   | N-2053-06-S-E | Plug, Hex Head, #8 O-ring                     | 2   |
| 17   | HC-2205       | Manifold, Return                              | 1   |
| 18   | N-2001-11-S-E | Elbow, Straight Thread #8 SAE x #8 JIC        | 1   |

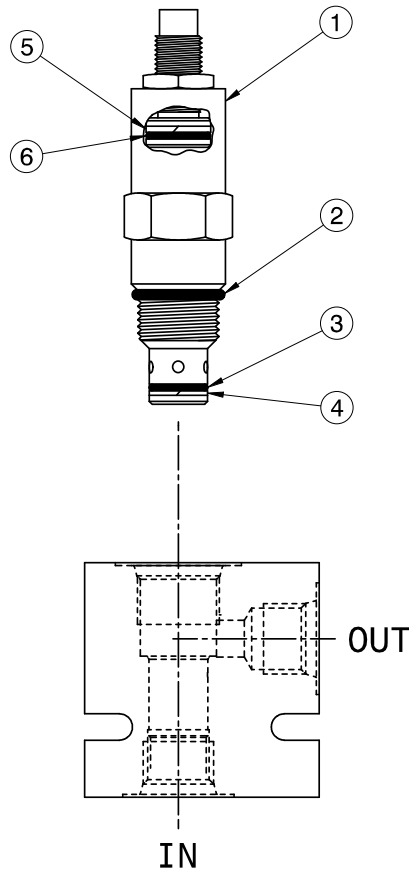
10.9 Return manifold assembly continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.9 RETURN MANIFOLD ASSEMBLY *(continued)*

**10.9.1 Return System Pressure Relief Valve**

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



**FIGURE 10.9.1 – Return System Pressure Relief Valve**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type Iv**

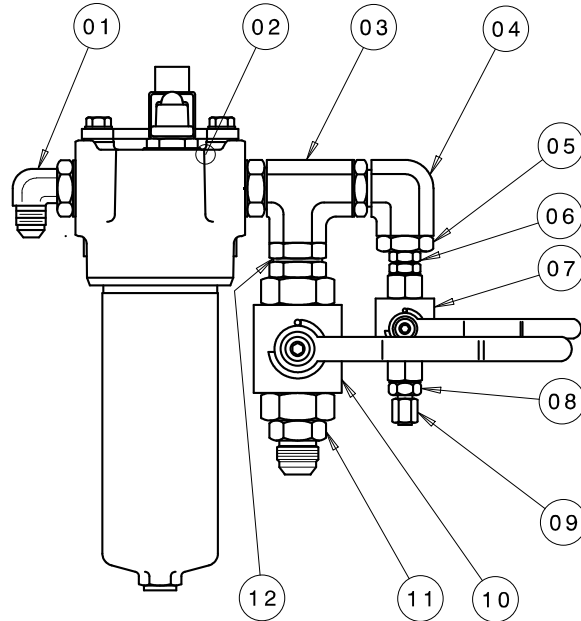
| Item   | Part Number      | Description   | Qty |
|--------|------------------|---|-----|
| 1..... | HC-2200.....     | Pressure Relief Valve <i>(includes Valve Block)</i> ..... | 1   |
| 2..... | HC-2013-910..... | O-ring, Series 3.....                                     | 1   |
| 3..... | HC-2006-014..... | O-ring, Series 2.....                                     | 1   |
| 4..... | HC-2020-014..... | Backup Ring (Teflon) .....                                | 1   |
| 5..... | HC-2020-015..... | Backup Ring (Teflon) .....                                | 1   |
| 6..... | HC-2006-015..... | O-ring, Series 2.....                                     | 1   |

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

10.10 PRESSURE FILTER ASSEMBLY (Single System)

Refer to Section 10.5.1 for information on changing filter element.



**FIGURE 10.10 – Pressure Filter Assembly**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b>  | <b>Description</b>                               | <b>Qty</b> |
|-------------|---------------------|--|------------|
| 1.....      | N-2001-18-S-E ..... | Elbow, Straight Thread #8-12 .....               | 1          |
| 2.....      | HC-1907-02.....     | Filter, Pressure.....                            | 1          |
| 3.....      | N-2660-05-S-E ..... | Tee, Straight Thread #12 .....                   | 1          |
| 4.....      | N-2661-05-S-E ..... | Elbow, Straight Thread #12.....                  | 1          |
| 5.....      | N-2463-35-S-E ..... | Union, Straight Thread #12 Male x #6 Female..... | 1          |
| 6.....      | N-2464-05-S-E ..... | Union, Male Straight Thread #6 .....             | 1          |
| 7.....      | HC-1771-02.....     | Valve, Ball SAE #6.....                          | 1          |
| 8.....      | N-2007-05-S-E ..... | Connector, Straight Thread #6 SAE x ¼ JIC.....   | 1          |
| 9.....      | N-2008-03-S.....    | Cap, #4 Female.....                              | 1          |
| 10.....     | HC-1771-04.....     | Valve, Ball SAE #12.....                         | 1          |
| 11.....     | N-2007-18-S-E ..... | Connector, Straight Thread #12.....              | 1          |
| 12.....     | N-2464-08-S-E ..... | Union, Male Straight Thread #12 .....            | 1          |

**Models: 5430  
Hydraulic Power Unit**

This page left blank intentionally.



Models: 5430  
Hydraulic Power Unit

10.0 MAINTENANCE (continued)

10.11 ELECTRICAL COMPONENTS

Regularly inspect the external power cord for nicks, cuts, abrasion, and fluid damage. Replace power cord if damage is found. See Section 11.0 – *Provision of Spares* for recommended spare fuses.

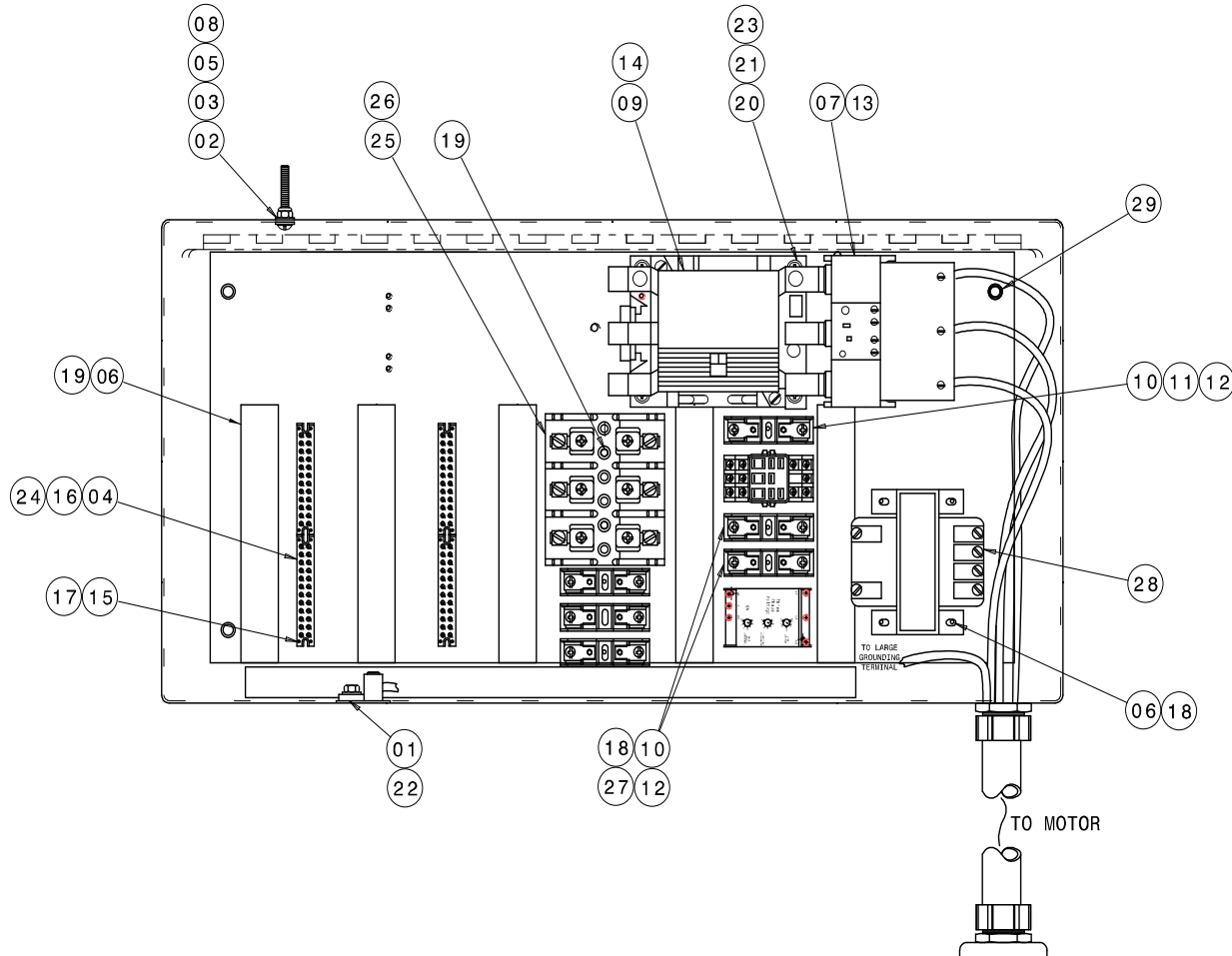


FIGURE 10.11 – Electrical Components

Set Item 07 to "Auto" and set "A2" to its corresponding full load amps. Wire per Electrical Schematic INS-1725 and wire diagram INS-1747.

10.11 Electrical Components continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.11 ELECTRICAL COMPONENTS (continued)

**PARTS LIST**

| Item | 60 Hz Applications |               |               |               |               | Description                           | Qty |
|------|--------------------|---------------|---------------|---------------|---------------|---------------------------------------|-----|
|      | 208                | 230           | 380           | 460           | 575           |                                       |     |
| 1    | G-1180-105006      | G-1180-105006 | G-1180-105006 | G-1180-105006 | G-1180-105006 | Screw, HH TPG Type F ¼                | 1   |
| 2    | G-1159-105516      | G-1159-105516 | G-1159-105516 | G-1159-105516 | G-1159-105516 | Screw, RD HD CRS REC, ¼ - 28 x 1 ¾ LG | 1   |
| 3    | G-1250-1050N       | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | Flatwasher, ¼ Narrow                  | 2   |
| 4    | EC-1784            | EC-1784       | EC-1784       | EC-1784       | EC-1784       | Terminal, Direct Mount                | 4   |
| 5    | G-1202-1055        | G-1202-1055   | G-1202-1055   | G-1202-1055   | G-1202-1055   | Stopnut, Elastic ¼ - 28               | 1   |
| 6    | G-1250-1030N       | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | Flatwasher, #10 Narrow                | 14  |
| 7    | EC-1920            | EC-1525       | EC-1525       | EC-1589       | EC-1589       | Relay, Overload                       | 1   |
| 8    | EC-1180-24         | EC-1180-24    | EC-1180-24    | EC-1180-24    | EC-1180-24    | Terminal, Ring Tongue ¼ Bolt Hole     | 1   |
| 9    | EC-1922            | EC-1587       | EC-1587       | EC-1586       | EC-1586       | Contact, IEC Motor                    | 1   |
| 10   | EC-1420            | EC-1420       | EC-1420       | EC-1420       | EC-1420       | Fuse Block, Single Pole               | 3   |
| 11   | EC-1542-04         | EC-1542-04    | EC-1542-04    | EC-1542-04    | EC-1542-04    | Fuse, LP-CC-Low Peak                  | 1   |
| 12   | EC-1326-01         | EC-1326-01    | EC-1326-01    | EC-1326-01    | EC-1326-01    | Disconnect, Female                    | 6   |
| 13   | EC-1924-02         | N/A           | N/A           | N/A           | N/A           | Lug Set, Terminal                     | 2   |
| 14   | N/A                | EC-1607       | EC-1607       | EC-1607       | EC-1607       | Contact, Auxiliary                    | 1   |
| 15   | G-1161-100012      | G-1161-100012 | G-1161-100012 | G-1161-100012 | G-1161-100012 | Screw, PAN HD SLT, #4-40 x 1 ¼ Long   | 8   |
| 16   | EC-1786            | EC-1786       | EC-1786       | EC-1786       | EC-1786       | Sleeve, Insulation                    | 1   |
| 17   | G-1251-1000R       | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | Lockwasher, #4 Regular                | 8   |
| 18   | G-1157-103504      | G-1157-103504 | G-1157-103504 | G-1157-103504 | G-1157-103504 | Screw, PAN HD, #10-32 x ½ Long        | 7   |
| 19   | G-1150-103506      | G-1150-103506 | G-1150-103506 | G-1150-103506 | G-1150-103506 | Screw, HH MAC, #10-32 x ¾ Long        | 14  |
| 20   | G-1100-105512      | G-1100-105512 | G-1100-105512 | G-1100-105512 | G-1100-105512 | Bolt, HH, ¼ - 28 x 1 ¼ Long           | 4   |
| 21   | G-1251-1050R       | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | Lockwasher, ¼ Regular                 | 5   |
| 22   | EC-1532-01         | EC-1532-01    | EC-1532-01    | EC-1532-01    | EC-1532-01    | Lug, Ground                           | 1   |
| 23   | G-1159-103510      | G-1159-103510 | G-1159-103510 | G-1159-103510 | G-1159-103510 | Screw, RD HD CRS REC, #10-32 x 1 ¾ LG | 4   |
| 24   | EC-1785            | EC-1785       | EC-1785       | EC-1785       | EC-1785       | Jumper, Comb                          | 1   |
| 25   | EC-1674            | EC-1674       | EC-1674       | EC-1674       | EC-1674       | Fuse Holder, Class J                  | 1   |
| 26   | EC-1557-02         | EC-1557-02    | EC-1557-01    | EC-1557-01    | EC-1557-01    | Fuse, Class J                         | 3   |
| 27   | EC-1726-09         | EC-1726-08    | EC-1726-05    | EC-1726-04    | EC-1726-04    | Fuse, Class CC                        | 2   |
| 28   | EC-1804-02         | EC-1676-02    | EC-1804-02    | EC-1676-02    | EC-1804-02    | Transformer, Control (100 W)          | 1   |
| 29   | G-1202-1070        | G-1202-1070   | G-1202-1070   | G-1202-1070   | G-1202-1070   | Stopnut, Elastic 3/8 - 16             | 4   |

**Models: 5430  
Hydraulic Power Unit**

10.11 ELECTRICAL COMPONENTS (continued)

**PARTS LIST**

| Item | 50 Hz Applications |               |               |               |               | Description                           | Qty |
|------|--------------------|---------------|---------------|---------------|---------------|---------------------------------------|-----|
|      | 200                | 220           | 380           | 415           | 440           |                                       |     |
| 1    | G-1180-105006      | G-1180-105006 | G-1180-105006 | G-1180-105006 | G-1180-105006 | Screw, HH TPG Type F ¼                | 1   |
| 2    | G-1159-105516      | G-1159-105516 | G-1159-105516 | G-1159-105516 | G-1159-105516 | Screw, RD HD CRS REC, ¼ - 28 x 1 ¼ LG | 1   |
| 3    | G-1250-1050N       | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | Flatwasher, ¼ Narrow                  | 2   |
| 4    | EC-1784            | EC-1784       | EC-1784       | EC-1784       | EC-1784       | Terminal, Direct Mount                | 4   |
| 5    | G-1202-1055        | G-1202-1055   | G-1202-1055   | G-1202-1055   | G-1202-1055   | Stopnut, Elastic ¼ - 28               | 1   |
| 6    | G-1250-1030N       | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | Flatwasher, #10 Narrow                | 14  |
| 7    | EC-1920            | EC-1525       | EC-1589       | EC-1589       | EC-1589       | Relay, Overload                       | 1   |
| 8    | EC-1180-24         | EC-1180-24    | EC-1180-24    | EC-1180-24    | EC-1180-24    | Terminal, Ring Tongue ¼ Bolt Hole     | 1   |
| 9    | EC-1922            | EC-1587       | EC-1586       | EC-1586       | EC-1586       | Contact, IEC Motor                    | 1   |
| 10   | EC-1420            | EC-1420       | EC-1420       | EC-1420       | EC-1420       | Fuse Block, Single Pole               | 3   |
| 11   | EC-1542-04         | EC-1542-04    | EC-1542-04    | EC-1542-04    | EC-1542-04    | Fuse, LP-CC-Low Peak                  | 1   |
| 12   | EC-1326-01         | EC-1326-01    | EC-1326-01    | EC-1326-01    | EC-1326-01    | Disconnect, Female                    | 6   |
| 13   | EC-1924-02         | N/A           | N/A           | N/A           | N/A           | Lug Set, Terminal                     | 2   |
| 14   | N/A                | EC-1607       | EC-1607       | EC-1607       | EC-1607       | Contact, Auxiliary                    | 1   |
| 15   | G-1161-100012      | G-1161-100012 | G-1161-100012 | G-1161-100012 | G-1161-100012 | Screw, PAN HD SLT, #4-40 x 1 ¼ Long   | 8   |
| 16   | EC-1786            | EC-1786       | EC-1786       | EC-1786       | EC-1786       | Insulation Sleeve                     | 1   |
| 17   | G-1251-1000R       | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | Lockwasher, #4 Regular                | 8   |
| 18   | G-1157-103504      | G-1157-103504 | G-1157-103504 | G-1157-103504 | G-1157-103504 | Screw, PAN HD, #10-32 x ½ Long        | 7   |
| 19   | G-1150-103506      | G-1150-103506 | G-1150-103506 | G-1150-103506 | G-1150-103506 | Screw, HH MAC, #10-32 x ¾ Long        | 14  |
| 20   | G-1100-105512      | G-1100-105512 | G-1100-105512 | G-1100-105512 | G-1100-105512 | Bolt, HH, ¼ - 28 x 1 ¼ Long           | 4   |
| 21   | G-1251-1050R       | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | Lockwasher, ¼ Regular                 | 5   |
| 22   | EC-1532-01         | EC-1532-01    | EC-1532-01    | EC-1532-01    | EC-1532-01    | Lug, Ground                           | 1   |
| 23   | G-1159-103510      | G-1159-103510 | G-1159-103510 | G-1159-103510 | G-1159-103510 | Screw, RD HD CRS REC, #10-32 x 1 ¼ LG | 4   |
| 24   | EC-1785            | EC-1785       | EC-1785       | EC-1785       | EC-1785       | Comb Jumper                           | 1   |
| 25   | EC-1674            | EC-1674       | EC-1674       | EC-1674       | EC-1674       | Fuse Holder, Class J                  | 1   |
| 26   | EC-1557-04         | EC-1557-04    | EC-1557-01    | EC-1557-01    | EC-1557-01    | Fuse, Class J                         | 3   |
| 27   | EC-1726-10         | EC-1726-09    | EC-1726-05    | EC-1726-05    | EC-1726-04    | Fuse, Class CC                        | 2   |
| 28   | EC-1804-02         | EC-1804-02    | EC-1804-02    | EC-1804-02    | EC-1804-02    | Transformer, Control (100 W)          | 1   |
| 29   | G-1202-1070        | G-1202-1070   | G-1202-1070   | G-1202-1070   | G-1202-1070   | Stopnut, Elastic 3/8 - 16             | 4   |

**Models: 5430  
Hydraulic Power Unit**

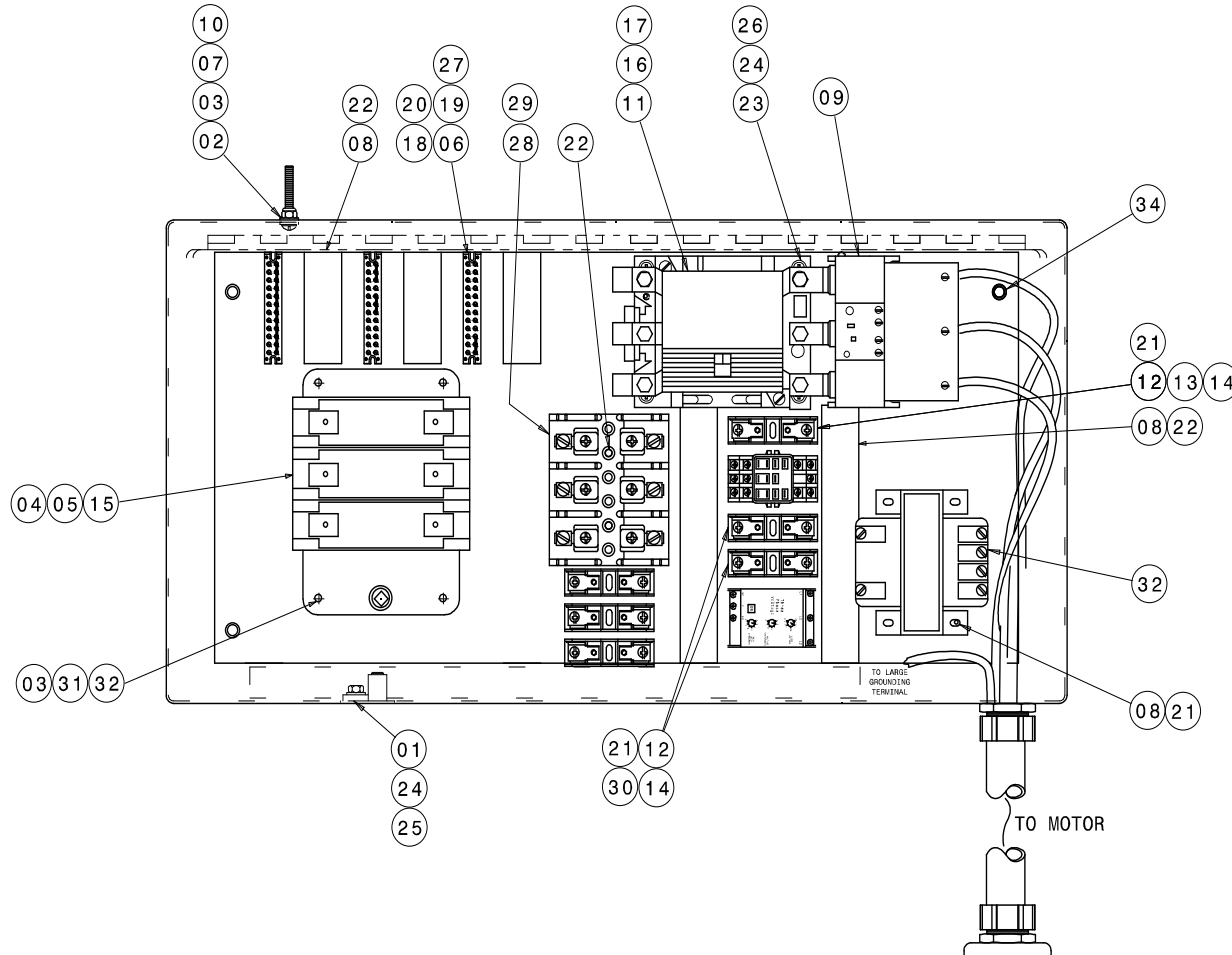
This page left blank intentionally.

**Models: 5430  
Hydraulic Power Unit**

10.11 ELECTRICAL COMPONENTS *(continued)*

**10.11.1 Electrical Components With 100 ft. Input Cord Option**

Regularly inspect the external power cord for nicks, cuts, abrasion, and fluid damage. Replace power cord if damage is found. See Section 11.0 Provision of Spares for recommended spare fuses.



**FIGURE 10.11.1 – Electrical Components**

Set Item 09 to "Auto" and set "A2" to its corresponding full load amps. Wire per Appendix - Electrical Schematic INS-1725 and wire diagram INS-1747.

10.11.1 Electrical Components with 100 ft. input cord option continued on following page.

**Models: 5430  
Hydraulic Power Unit**

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

**PARTS LIST**

| ITEM | 60 HZ Applications |               |               |               |               | Description                           | Qty. |
|------|--------------------|---------------|---------------|---------------|---------------|---------------------------------------|------|
|      | 208                | 230           | 380           | 460           | 575           |                                       |      |
| 1    | G-1180-105006      | G-1180-105006 | G-1180-105006 | G-1180-105006 | G-1180-105006 | Screw, HH TPG Type F ¼                | 1    |
| 2    | G-1159-105516      | G-1159-105516 | G-1159-105516 | G-1159-105516 | G-1159-105516 | Screw, RD HD CRS REC, ¼ - 28 x 1 ¼ LG | 1    |
| 3    | G-1250-1050N       | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | Flatwasher, ¼ Narrow                  | 6    |
| 4    | EC-1890            | EC-1890       | EC-1894       | EC-1894       | EC-1894       | Switch, Fused Disconnect              | 1    |
| 5    | EC-1556-04         | EC-1556-03    | EC-1557-30    | EC-1557-29    | EC-1557-27    | Fuse, Class J                         | 3    |
| 6    | EC-1784            | EC-1784       | EC-1784       | EC-1784       | EC-1784       | Terminal, Direct Mount                | 3    |
| 7    | G-1202-1055        | G-1202-1055   | G-1202-1055   | G-1202-1055   | G-1202-1055   | Stopnut, Elastic ¼ - 28               | 1    |
| 8    | G-1250-1030N       | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | Flatwasher, #10 Narrow                | 14   |
| 9    | EC-1920            | EC-1525       | EC-1525       | EC-1589       | EC-1589       | Relay, Overload                       | 1    |
| 10   | EC-1180-24         | EC-1180-24    | EC-1180-24    | EC-1180-24    | EC-1180-24    | Terminal, Ring Tongue ¼ Bolt Hole     | 1    |
| 11   | EC-1922            | EC-1587       | EC-1587       | EC-1586       | EC-1586       | Contact, IEC Motor                    | 1    |
| 12   | EC-1420            | EC-1420       | EC-1420       | EC-1420       | EC-1420       | Fuse Block, Single Pole               | 3    |
| 13   | EC-1542-04         | EC-1542-04    | EC-1542-04    | EC-1542-04    | EC-1542-04    | Fuse, LP-CC-Low Peak                  | 1    |
| 14   | EC-1326-01         | EC-1326-01    | EC-1326-01    | EC-1326-01    | EC-1326-01    | Disconnect, Female                    | 6    |
| 15   | EC-1898            | EC-1898       | N/A           | N/A           | N/A           | Shield, Disconnect Switch             | 1    |
| 16   | EC-1924-02         | N/A           | N/A           | N/A           | N/A           | Lug Set, Terminal                     | 2    |
| 17   | N/A                | EC-1607       | EC-1607       | EC-1607       | EC-1607       | Contact, Auxiliary                    | 1    |
| 18   | G-1161-100012      | G-1161-100012 | G-1161-100012 | G-1161-100012 | G-1161-100012 | Screw, PAN HD SLT, #4-40 x 1 ¼ Long   | 8    |
| 19   | EC-1786            | EC-1786       | EC-1786       | EC-1786       | EC-1786       | Insulation Sleeve                     | 1    |
| 20   | G-1251-1000R       | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | Lockwasher, #4 Regular                | 8    |
| 21   | G-1157-103504      | G-1157-103504 | G-1157-103504 | G-1157-103504 | G-1157-103504 | Screw, PAN HD, #10-32 x ½ Long        | 7    |
| 22   | G-1150-103506      | G-1150-103506 | G-1150-103506 | G-1150-103506 | G-1150-103506 | Screw, HH MAC, #10-32 x ¾ Long        | 14   |
| 23   | G-1100-105512      | G-1100-105512 | G-1100-105512 | G-1100-105512 | G-1100-105512 | Bolt, HH, ¼ - 28 x 1 ¼ Long           | 4    |
| 24   | G-1251-1050R       | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | Lockwasher, ¼ Regular                 | 5    |
| 25   | EC-1532-01         | EC-1532-01    | EC-1532-01    | EC-1532-01    | EC-1532-01    | Lug, Ground                           | 1    |
| 26   | G-1159-103510      | G-1159-103510 | G-1159-103510 | G-1159-103510 | G-1159-103510 | Screw, RD HD CRS REC, #10-32 x 1 ¼ LG | 6    |
| 27   | EC-1785            | EC-1785       | EC-1785       | EC-1785       | EC-1785       | Comb Jumper                           | 1    |
| 28   | EC-1674            | EC-1674       | EC-1674       | EC-1674       | EC-1674       | Fuse Holder, Class J                  | 1    |

**Models: 5430  
Hydraulic Power Unit**

| ITEM | 60 HZ Applications |               |               |               |               | Description                  | Qty. |
|------|--------------------|---------------|---------------|---------------|---------------|------------------------------|------|
|      | 208                | 230           | 380           | 460           | 575           |                              |      |
| 29   | EC-1557-02         | EC-1557-02    | EC-1557-01    | EC-1557-01    | EC-1557-01    | Fuse, Class J                | 3    |
| 30   | EC-1726-09         | EC-1726-08    | EC-1726-05    | EC-1726-04    | EC-1726-04    | Fuse, Class CC               | 2    |
| 31   | G-1100-105506      | G-1100-105506 | G-1159-102006 | G-1159-102006 | G-1159-102006 | Hardware, Mounting           | 4    |
| 32   | EC-1804-02         | EC-1676-02    | EC-1804-02    | EC-1676-02    | EC-1804-02    | Transformer, Control (100 W) | 1    |
| 33   | G-1250-1020N       | G-1250-1020N  | G-1250-1020N  | G-1250-1020N  | G-1250-1020N  | Flatwasher, #8 Narrow        | 4    |
| 34   | G-1202-1070        | G-1202-1070   | G-1202-1070   | G-1202-1070   | G-1202-1070   | Stopnut, Elastic 3/8 – 16    | 4    |

10.11.1 Electrical components with 100 ft input cord option continued on following page.

**Models: 5430  
Hydraulic Power Unit**

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

**PARTS LIST**

| ITEM | 50 HZ Applications |               |               |               |               | Description                             | Qty. |
|------|--------------------|---------------|---------------|---------------|---------------|---|------|
|      | 200                | 220           | 380           | 415           | 440           |   |      |
| 1    | G-1180-105006      | G-1180-105006 | G-1180-105006 | G-1180-105006 | G-1180-105006 | Screw, HH TPG Type F ¼                  | 1    |
| 2    | G-1159-105516      | G-1159-105516 | G-1159-105516 | G-1159-105516 | G-1159-105516 | Screw, RD HD CRS REC, ¼ - 28 x 1 ¾ Long | 1    |
| 3    | G-1250-1050N       | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | G-1250-1050N  | Flatwasher, ¼ Narrow                    | 6    |
| 4    | EC-1890            | EC-1890       | EC-1894       | EC-1894       | EC-1894       | Switch, Fused Disconnect                | 1    |
| 5    | EC-1556-04         | EC-1556-04    | EC-1557-30    | EC-1557-30    | EC-1557-29    | Fuse, Class J                           | 3    |
| 6    | EC-1784            | EC-1784       | EC-1784       | EC-1784       | EC-1784       | Terminal, Direct Mount                  | 3    |
| 7    | G-1202-1055        | G-1202-1055   | G-1202-1055   | G-1202-1055   | G-1202-1055   | Stopnut, Elastic ¼ - 28                 | 1    |
| 8    | G-1250-1030N       | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | G-1250-1030N  | Flatwasher, #10 Narrow                  | 14   |
| 9    | EC-1920            | EC-1525       | EC-1589       | EC-1589       | EC-1589       | Relay, Overload                         | 1    |
| 10   | EC-1180-24         | EC-1180-24    | EC-1180-24    | EC-1180-24    | EC-1180-24    | Terminal, Ring Tongue ¼ Bolt Hole       | 1    |
| 11   | EC-1922            | EC-1587       | EC-1586       | EC-1586       | EC-1586       | Contact, IEC Motor                      | 1    |
| 12   | EC-1420            | EC-1420       | EC-1420       | EC-1420       | EC-1420       | Fuse Block, Single Pole                 | 3    |
| 13   | EC-1542-04         | EC-1542-04    | EC-1542-04    | EC-1542-04    | EC-1542-04    | Fuse, LP-CC-Low Peak                    | 1    |
| 14   | EC-1326-01         | EC-1326-01    | EC-1326-01    | EC-1326-01    | EC-1326-01    | Disconnect, Female                      | 6    |
| 15   | EC-1898            | EC-1898       | N/A           | N/A           | N/A           | Shield, Disconnect Switch               | 1    |
| 16   | EC-1924-02         | N/A           | N/A           | N/A           | N/A           | Lug Set, Terminal                       | 2    |
| 17   | N/A                | EC-1607       | EC-1607       | EC-1607       | EC-1607       | Contact, Auxiliary                      | 1    |
| 18   | G-1161-100012      | G-1161-100012 | G-1161-100012 | G-1161-100012 | G-1161-100012 | Screw, PAN HD SLT, #4-40 x 1 ¼ Long     | 8    |
| 19   | EC-1786            | EC-1786       | EC-1786       | EC-1786       | EC-1786       | Insulation Sleeve                       | 1    |
| 20   | G-1251-1000R       | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | G-1251-1000R  | Lockwasher, #4 Regular                  | 8    |
| 21   | G-1157-103504      | G-1157-103504 | G-1157-103504 | G-1157-103504 | G-1157-103504 | Screw, PAN HD, #10-32 x ½ Long          | 7    |
| 22   | G-1150-103506      | G-1150-103506 | G-1150-103506 | G-1150-103506 | G-1150-103506 | Screw, HH MAC, #10-32 x ¾ Long          | 14   |
| 23   | G-1100-105512      | G-1100-105512 | G-1100-105512 | G-1100-105512 | G-1100-105512 | Bolt, HH, ¼ - 28 x 1 ¼ Long             | 4    |
| 24   | G-1251-1050R       | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | G-1251-1050R  | Lockwasher, ¼ Regular                   | 5    |
| 25   | EC-1532-01         | EC-1532-01    | EC-1532-01    | EC-1532-01    | EC-1532-01    | Lug, Ground                             | 1    |
| 26   | G-1159-103510      | G-1159-103510 | G-1159-103510 | G-1159-103510 | G-1159-103510 | Screw, RD HD CRS REC, #10-32 x 1 ¼ LG   | 6    |
| 27   | EC-1785            | EC-1785       | EC-1785       | EC-1785       | EC-1785       | Comb Jumper                             | 1    |
| 28   | EC-1674            | EC-1674       | EC-1674       | EC-1674       | EC-1674       | Fuse Holder, Class J                    | 1    |





**Models: 5430  
Hydraulic Power Unit**

| ITEM | 50 HZ Applications |               |               |               |               | Description                  | Qty. |
|------|--------------------|---------------|---------------|---------------|---------------|------------------------------|------|
|      | 200                | 220           | 380           | 415           | 440           |                              |      |
| 29   | EC-1557-04         | EC-1557-04    | EC-1557-01    | EC-1557-01    | EC-1557-01    | Fuse, Class J                | 3    |
| 30   | EC-1726-10         | EC-1726-09    | EC-1726-05    | EC-1726-05    | EC-1726-04    | Fuse, Class CC               | 2    |
| 31   | G-1100-105506      | G-1100-105506 | G-1159-102006 | G-1159-102006 | G-1159-102006 | Hardware, Mounting           | 4    |
| 32   | EC-1804-02         | EC-1804-02    | EC-1804-02    | EC-1804-02    | EC-1804-02    | Transformer, Control (100 W) | 1    |
| 33   | G-1250-1020N       | G-1250-1020N  | G-1250-1020N  | G-1250-1020N  | G-1250-1020N  | Flatwasher, #8 Narrow        | 4    |
| 34   | G-1202-1070        | G-1202-1070   | G-1202-1070   | G-1202-1070   | G-1202-1070   | Stopnut, Elastic 3/8 – 16    | 4    |

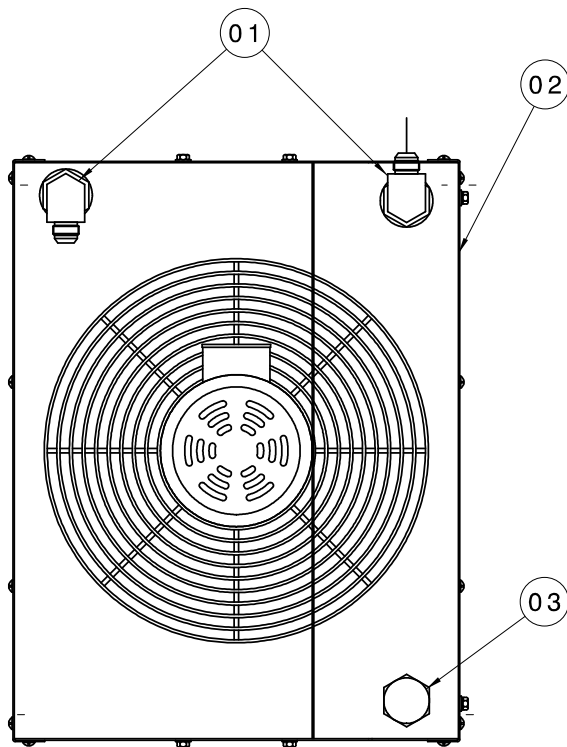
10.0 Maintenance continued on following page.

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

10.12 HEAT EXCHANGER ASSEMBLY

The Heat Exchanger Assembly does not require regular general maintenance.



**FIGURE 10.12 – Heat Exchanger Assembly**

**PARTS LIST**

**Fluid Type: MIL-H-5606**

| Item   | Part Number                        | Description                          | Qty |
|--------|------------------------------------|--------------------------------------|-----|
| 1..... | N-2001-37-S-B .....                | Elbow, Straight Thread (12-20) ..... | 1   |
| 2..... | <i>Reference Table below</i> ..... | Heat Exchanger .....                 | 1   |
| 3..... | N-2066-20-S-B .....                | Plug, O-ring #20 .....               | 1   |

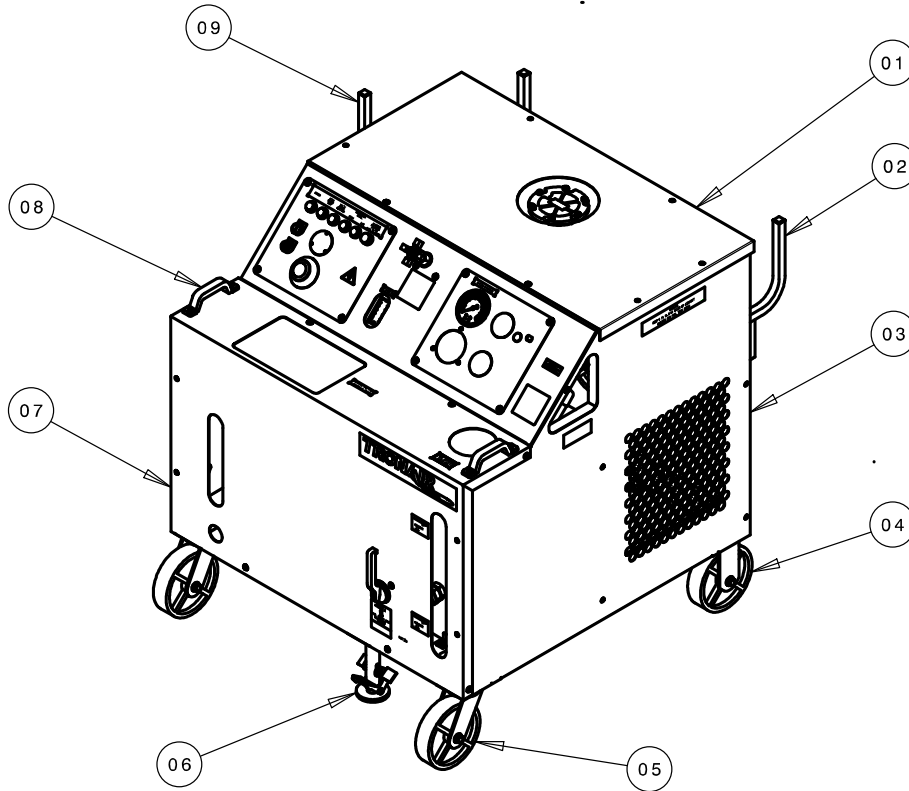
| Voltage | Frequency | Part Number |
|---------|-----------|-------------|
| 208v    | 60 Hz     | HC-2136-01  |
| 230v    | 60 Hz     | HC-2136-01  |
| 380v    | 60 Hz     | HC-2136-01  |
| 460v    | 60 Hz     | HC-2136-01  |
| 575v    | 60 Hz     | HC-2136-02  |
| 200v    | 50 Hz     | HC-2136-01  |
| 220v    | 50 Hz     | HC-2136-01  |
| 380v    | 50 Hz     | HC-2136-01  |
| 415v    | 50 Hz     | HC-2136-01  |
| 440v    | 50 Hz     | HC-2136-01  |

**Models: 5430  
Hydraulic Power Unit**

**10.0 MAINTENANCE** *(continued)*

**10.13 EXTERNAL COMPONENTS**

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



**FIGURE 10.13 – External Components**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type Iv**

| <b>Item</b>            | <b>Part Number</b>     | <b>Description</b>           | <b>Qty</b> |
|------------------------|------------------------|------------------------------|------------|
| 1.....                 | S-1889-01.....         | Top Panel.....               | 1          |
| 2.....                 | Z-5772-01.....         | Hanger.....                  | 2          |
| 3.....                 | S-1887-01.....         | Right Side Panel.....        | 1          |
| 4.....                 | U-1093.....            | Rigid Caster.....            | 2          |
| 5.....                 | U-1094.....            | Swivel Caster.....           | 2          |
| 6.....                 | H-1142.....            | Floor Lock.....              | 1          |
| 7.....                 | S-1883-01.....         | Front Panel.....             | 1          |
| 8.....                 | H-1780.....            | Handle.....                  | 1          |
| 9.....                 | Z-5549-01.....         | Cord Hanger.....             | 1          |
| <i>Not Shown</i> ..... | <i>S-1884-01</i> ..... | <i>Left Side Panel</i> ..... | <i>1</i>   |
| <i>Not Shown</i> ..... | <i>Z-5775-01</i> ..... | <i>Frame</i> .....           | <i>1</i>   |

*10.0 Maintenance continued on following page.*

Models: 5430  
Hydraulic Power Unit

10.0 MAINTENANCE (continued)

10.14 ADDITIONAL FEATURES

10.14.1 50 ft (15.24 m) Hoses (Option B)

Refer to Section 10.6 Hydraulic Hoses concerning hose inspection.

PARTS LIST

Fluid Type: Aviation Phosphate Ester, Type IV

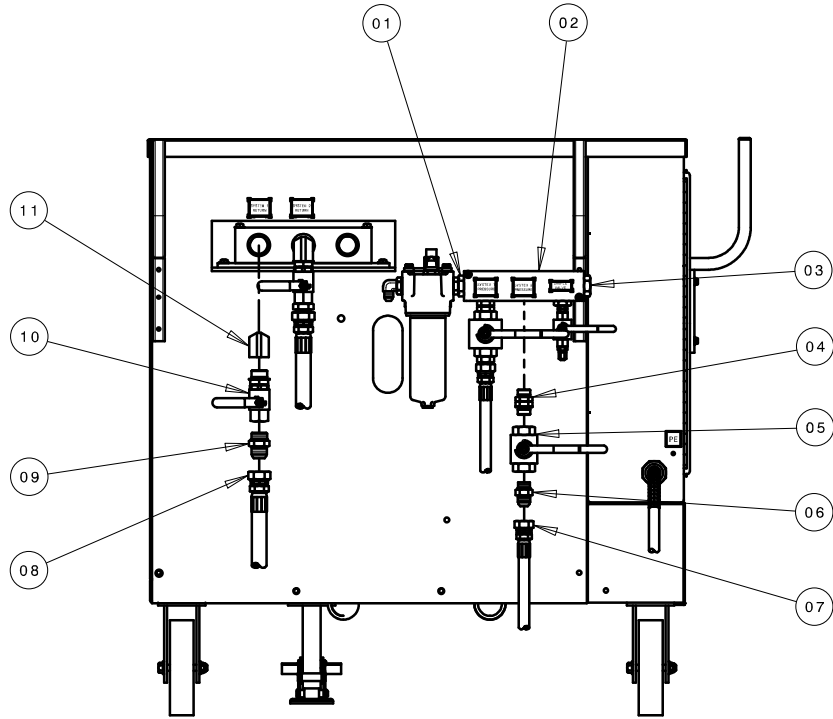
| <u>Part Number</u>   | <u>Description</u>                 | <u>Qty</u>   |
|----------------------|------------------------------------|--------------|
| TF-1040-01*300 ..... | Pressure Hose, 25 ft (7.62 m)..... | 1 per Option |
| TF-1041-01*300 ..... | Return Hose, 25 ft (7.62 m) .....  | 1 per Option |
| N-2011-08-S.....     | Union, #12 .....                   | 1 per Option |
| N-2011-10-S.....     | Union, #16 .....                   | 1 per Option |

**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

**10.14.2 Dual System (Option C)**

Refer to Section 10.6 Hydraulic Hoses concerning hose inspection.



**FIGURE 10.14.2 – Dual System**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b>   | <b>Description</b>                          | <b>Qty</b> |
|-------------|----------------------|---|------------|
| 1.....      | N-2464-14-S-E .....  | Union, Male Straight Thread #12 x #16 ..... | 1          |
| 2.....      | HC-1908 .....        | Pressure Manifold (Plated).....             | 1          |
| 3.....      | N-2053-10-S-E .....  | Plug, Male Straight Thread #16 .....        | 1          |
| 4.....      | N-2464-08-S-E .....  | Union, Male Straight Thread #12 .....       | 1          |
| 5.....      | HC-1771-04.....      | Ball Valve .....                            | 1          |
| 6.....      | N-2007-18-S-E .....  | Connector, Straight Thread #12.....         | 1          |
| 7.....      | TF-1040-01*300 ..... | Pressure Hose Assembly, #12.....            | 1          |
| 8.....      | TF-1041-01*300 ..... | Return Hose Assembly, #16 .....             | 1          |
| 9.....      | N-2007-24-S-E .....  | Connector, Straight Thread #16.....         | 1          |
| 10.....     | HC-1770-05.....      | Ball Valve, #16 SAE.....                    | 1          |
| 11.....     | N-2661-06-S-E .....  | Elbow, 90° #16 M-SAE x #16 F-SAE .....      | 1          |

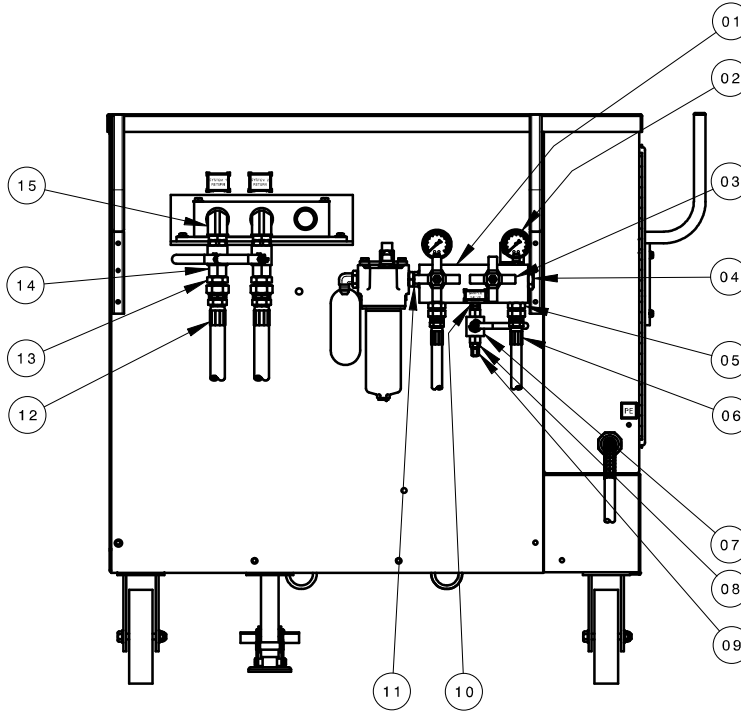
10.14 Additional Features continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

**10.14.3 Crossover Check (Option D)**

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



**FIGURE 10.14.3 – Crossover Check**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| Item    | Part Number          | Description                         | Qty |
|---------|----------------------|-------------------------------------|-----|
| 1.....  | J-3516 .....         | Crossover Check Manifold.....       | 1   |
| 2.....  | HC-1928 .....        | Pressure Gauge.....                 | 2   |
| 3.....  | HC-1927-06.....      | Cartridge Needle Valve.....         | 2   |
| 4.....  | HC-1436 .....        | Check Valve.....                    | 1   |
| 5.....  | N-2007-18-S-E .....  | Connector, Straight Thread.....     | 2   |
| 6.....  | TF-1040-01*300 ..... | Pressure Hose Assembly.....         | 2   |
| 7.....  | HC-1771-02.....      | Ball Valve (#6).....                | 1   |
| 8.....  | N-2007-05-S-E .....  | Connector, Straight Thread.....     | 1   |
| 9.....  | N-2008-03-S .....    | Cap, #4 Female .....                | 1   |
| 10..... | N-2464-05-S-E .....  | Union, Straight Thread #6 SAE.....  | 1   |
| 11..... | N-2464-08-S-E .....  | Union, Straight Thread #12 SAE..... | 1   |
| 12..... | TF-1041-01*300 ..... | Return Hose Assembly .....          | 2   |
| 13..... | N-2007-24-S-E .....  | Connector, Straight Thread.....     | 2   |
| 14..... | HC-1770-05.....      | Ball Valve (#16).....               | 2   |
| 15..... | N-2638-06-S-E .....  | Elbow, 90° (#16 SAE) .....          | 2   |

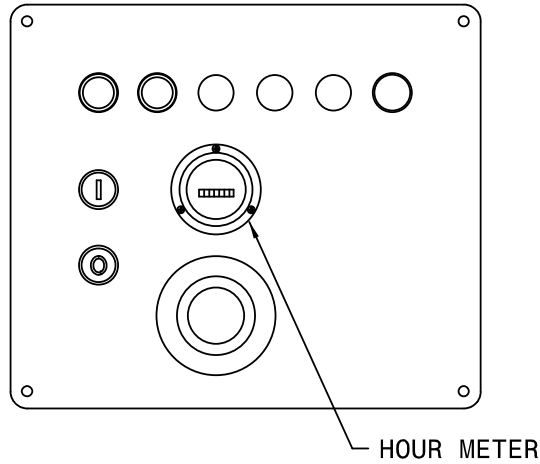
**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES *(continued)*

**10.14.4 Hour Meter (Options E and F)**

The Hour Meter does not require regular general maintenance.

**NOTE: Wire Hour Meter per Appendix – Electrical Schematic INS-1725. Reference Appendix – Wire Diagram INS-1747.**



**FIGURE 10.14.4 – Hour Meter**

**PARTS LIST**

| <b>Part Number</b> | <b>Application</b>    | <b>Description</b> | <b>Qty</b> |
|--------------------|-----------------------|--------------------|------------|
| EC-1577 .....      | 50 Hz Operation ..... | Hour Meter .....   | 1          |
| EC-1578 .....      | 60 Hz Operation ..... | Hour Meter .....   | 1          |

10.14 Additional Features continued on following page.

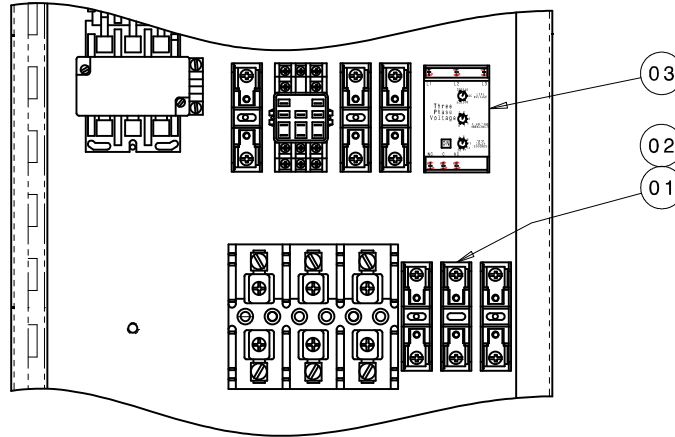
**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

**10.14.5 Voltage/Phase Monitor (Options G – J)**

The Voltage/Phase Monitor does not require regular general maintenance. The panel indicator light will illuminate if a tripped condition exists. If the Voltage/Phase Monitor is causing the HPU to shut off, verify the ♦Phase Monitor settings shown. Continued tripping may indicate a serious electrical problem. See Section 11.0 – *Provision of Spares* for recommended spare fuses.

**NOTE:** Wire per Appendix – *Electrical Schematic INS-1725*. Reference Appendix – *Wiring Diagram INS-1747*. Reference Section 10.7.1 *Electrical Panel (Page 32)* for Panel Light.



**FIGURE 10.14.5 – Voltage/Phase Monitor**

**PARTS LIST**

| Item     | Part Number          | Description                  | Qty |
|----------|----------------------|------------------------------|-----|
| 1.....   | EC-1420.....         | Fuse Block, Single Pole..... | 3   |
| 2.....   | EC-1419-09.....      | Fuse, KTK, 2 amp.....        | 3   |
| ♦ 3..... | See Table below..... | Phase Monitor.....           | 1   |

**Phase Monitor**

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

♦ Setting Instructions for Item 3:

1. Set **Line Voltage** to match the voltage rating of the Hydraulic Power Unit.
2. Set % **Voltage Unbalanced** to 5% for 60 Hz unit or 6% for 50 Hz unit.
3. Set **Trip Delay** to three (3) seconds.

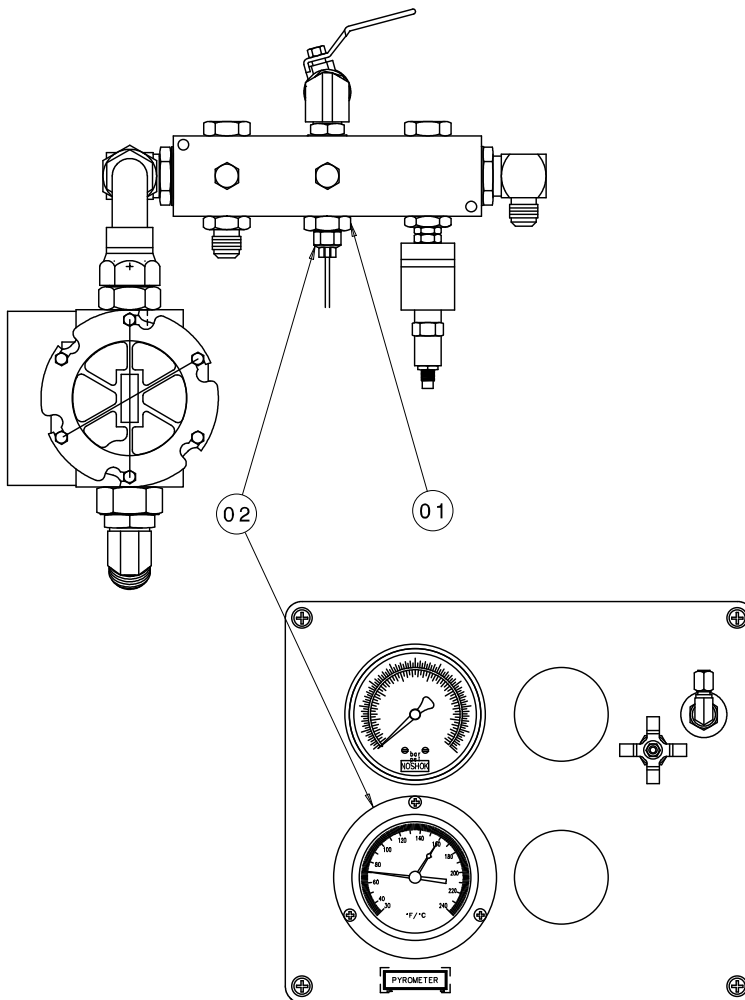


**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

**10.14.6 Pyrometer (Option K)**

Refer to Section 12.6 – *Analog Temperature Gauge* when calibration of the pyrometer is desired.



**FIGURE 10.14.6 – Pyrometer**

**PARTS LIST**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b>  | <b>Description</b>   | <b>Qty</b> |
|-------------|---------------------|----------------------|------------|
| 1.....      | N-2463-16-S-E ..... | Reducer Fitting..... | 1          |
| 2.....      | HC-1769-02.....     | Pyrometer .....      | 1          |

10.14 Additional Features continued on following page.

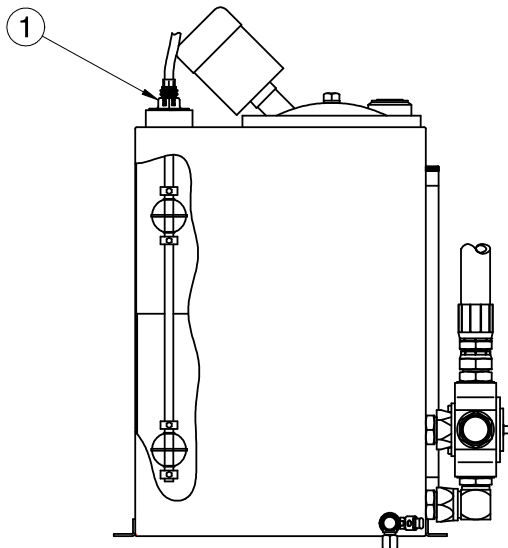
**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES *(continued)*

**10.14.7 Electric Reservoir Level (Option L)**

The Electric Reservoir Level switch does not require regular general maintenance. Panel indicator lights will indicate low or high fluid level.

**NOTE:** Wire per Appendix – Electrical Schematic INS-1725. Reference Appendix – Wiring Diagram INS-1747. Reference Section 10.7.1 Electrical Panel (Page 32) for Panel Light.



**FIGURE 10.14.7 – Electric Reservoir Level**

**PARTS LIST**

| Item   | Part Number   | Description  | Qty |
|--------|---------------|--|-----|
| 1..... | EC-1798 ..... | Multi-Level Switch <i>(includes Plug-in Cable)</i> ..... | 1   |

**Models: 5430  
Hydraulic Power Unit**

This page left blank intentionally.

Models: 5430  
Hydraulic Power Unit

10.14 ADDITIONAL FEATURES (continued)

10.14.8 Hand Pump (Option M)

Refer to Section 10.6 Hydraulic Hoses concerning hose inspection for general maintenance on Items 5, 10, 12, and 14 hose assemblies. Refer to Section 10.5.3 – Hand Pump (Optional) Filter .

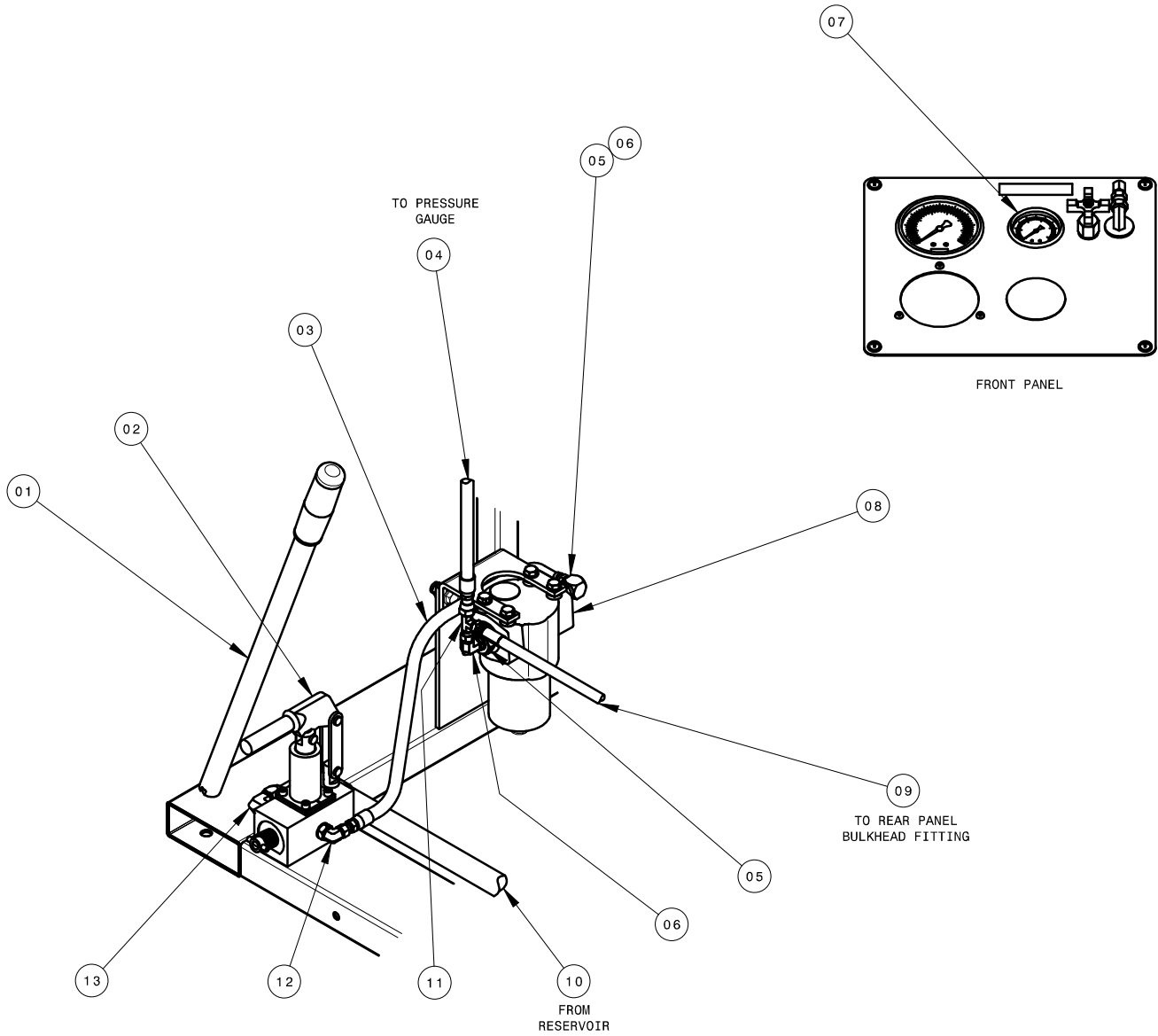


FIGURE 10.14.8 – Hand Pump

**Models: 5430  
Hydraulic Power Unit**

**10.14.8 Hand Pump (Option M) (continued)**

PARTS LIST

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b>            | <b>Part Number</b>    | <b>Description</b>                | <b>Qty</b> |
|------------------------|-----------------------|-----------------------------------|------------|
| 1.....                 | H-1009-01 .....       | Pump Handle .....                 | 1          |
| 2.....                 | HC-1779 .....         | Hand Pump, Two Stage .....        | 1          |
| 3.....                 | TF-1041-53*20.0 ..... | Hose Assembly, #4 .....           | 1          |
| 4.....                 | TF-1041-49*38.5 ..... | Hose Assembly, #4 .....           | 1          |
| 5.....                 | N-2463-10-S-E .....   | Reducer Fitting.....              | 2          |
| 6.....                 | N-2001-06-S-E .....   | Elbow, #8 SAE x #4 JIC Flare..... | 1          |
| 7.....                 | HC-2146 .....         | Pressure Gauge.....               | 1          |
| 8.....                 | HC-1777 .....         | Pressure Filter.....              | 1          |
| 9.....                 | TF-1041-05*41.0 ..... | Hose Assembly, #4 .....           | 1          |
| 10.....                | TF-1041-14*15.5 ..... | Hose Assembly, #8 .....           | 1          |
| 11.....                | N-2016-03-S.....      | Tee, Swivel Nut, #4.....          | 1          |
| 12.....                | N-2001-05-S-E .....   | Elbow, #6 SAE x #4 JIC Flare..... | 1          |
| 13.....                | N-2001-11-S-E .....   | Elbow, #8 SAE x #8 JIC Flare..... | 1          |
| <i>Not Shown</i> ..... | N-2002-03-S.....      | Elbow, Bulkhead, #4 JIC.....      | 1          |
| <i>Not Shown</i> ..... | TF-1041-05*180 .....  | Assembly, Hose #4 .....           | 1          |
| <i>Not Shown</i> ..... | N-2055-01-S.....      | Reducer, Tube (6-4).....          | 1          |
| <i>Not Shown</i> ..... | N-2014-05-S.....      | Plug, #6.....                     | 1          |

10.14.8 Hand Pump (Option M) continued on following page.

10.14.8 Hand Pump (Option M) (continued)  
10.14.8.a Two Stage Pump with Relief

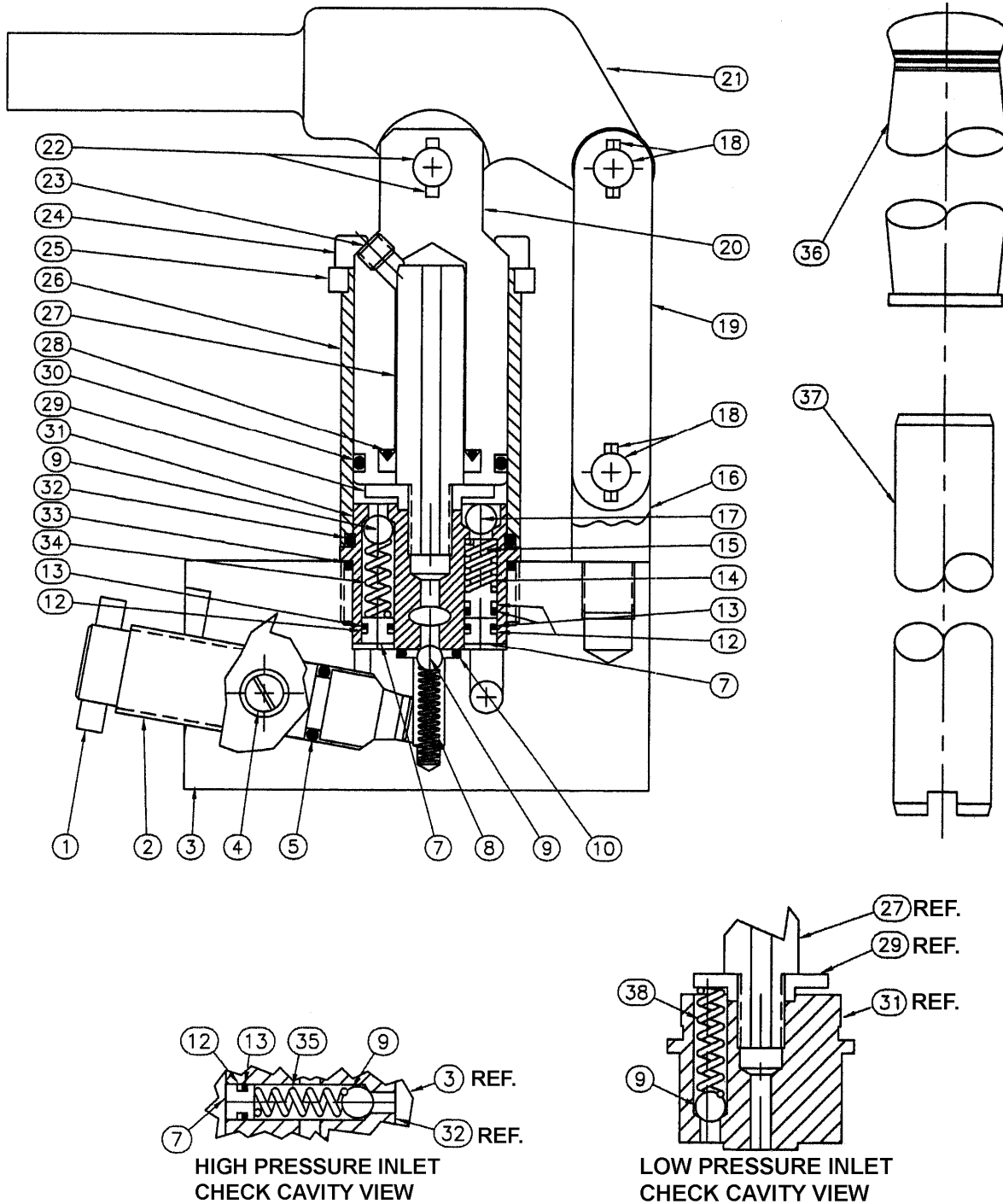


FIGURE 10.14.8.a – Two Stage Pump with Relief

**Models: 5430  
Hydraulic Power Unit**

**10.14.8.a Two Stage Pump with Relief (continued)**

**PARTS LIST  
Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Item</b> | <b>Part Number</b> | <b>Description</b>                       | <b>Qty</b> |
|-------------|--------------------|--|------------|
| 1           | 519-000            | Pin                                      | 1          |
| 3           | CXC-990022-001     | Body                                     | 1          |
| 7           | 505-001            | Plug, Valve Body                         | 3          |
| 15          | 571-121            | Piston, Bypass Assembly                  | 1          |
| 16          | 508-000            | Pivot                                    | 1          |
| 20          | 566-125            | Piston L.P.                              | 1          |
| 23          | 583-120            | Plug                                     | 1          |
| 24          | 09-ADDF-04-20 X 56 | Tie Rod                                  | 4          |
| 25          | 582-125            | Flange                                   | 1          |
| 26          | 563-121            | Tube                                     | 1          |
| 27          | 562-125            | H.P. Piston                              | 1          |
| 29          | 564-120            | Retainer                                 | 1          |
| 31          | 560-120            | Valve Body                               | 1          |
| 36          | H-1223             | Grip, Handle                             | 1          |
| 37          | H-1009-01          | Handle with Grip                         | 1          |
|             | <b>HK-1095</b>     | <b>Kit, Internal Parts; consists of:</b> |            |
| 6           | (Not Shown)        | Ball, Release                            | 0          |
| 8           |                    | Spring, Outlet Check                     | 1          |
| 9           |                    | Ball, Check                              | 4          |
| 14          |                    | Spring, Bypass                           | 1          |
| 17          |                    | Ball, Bypass                             | 1          |
| 34          |                    | Spring, L.P. Outlet                      | 1          |
| 35          |                    | Spring, H.P. Outlet                      | 1          |
| 38          |                    | Spring, Intake L.P.                      | 1          |
|             | <b>HK-1030</b>     | <b>Kit, Pump Seal; consists of:</b>      |            |
| 5           |                    | O-ring, EPR                              | 1          |
| 10          |                    | O-ring, EPR                              | 1          |
| 12          |                    | Backup Ring (Teflon)                     | 4          |
| 13          |                    | O-ring, EPR                              | 4          |
| 28          |                    | H.P. Piston Seal                         | 1          |
| 30          |                    | O-ring, EPR                              | 1          |
| 32          |                    | O-ring, EPR                              | 1          |
| 33          |                    | O-ring, EPR                              | 1          |
|             | <b>HK-1068</b>     | <b>Kit, Pump Linkage; consists of:</b>   |            |
| 18          |                    | Pin Linkage Assembly                     | 2          |
| 19          |                    | Strap                                    | 2          |
| 21          |                    | Handle Bracket                           | 1          |
| 22          |                    | Clevis Pin Assembly                      | 1          |
|             | <b>HK-3117</b>     | <b>Kit, Release Screw; consists of:</b>  |            |
| 2           |                    | Screw, Release/Relief                    | 1          |
| 4           |                    | Retainer, Release Screw                  | 1          |

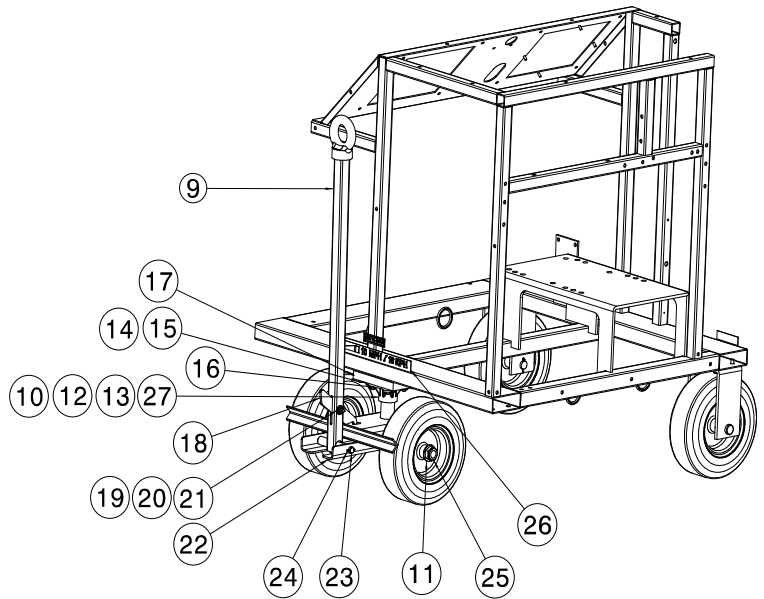
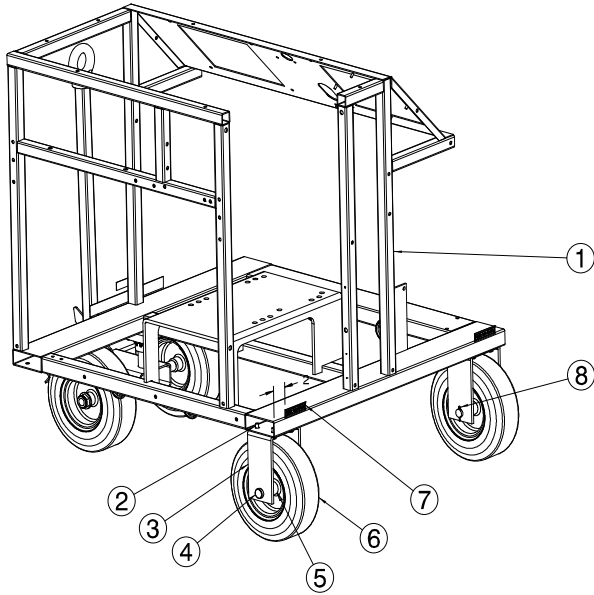
10.14. Additional Features continued on following page.

Models: 5430  
Hydraulic Power Unit

10.14 ADDITIONAL FEATURES (continued)

10.14.9 Towing Trailer (Option N)

Air Pressure: 55 psi



PARTS LIST

| Item | Part Number   | Description                    | Qty |
|------|---------------|--------------------------------|-----|
| 1    | Z-5775-01     | Weldment, Frame                | Ref |
| 2    | G-1100-107010 | Bolt, HH, 3/8 - 16 x 1 LG      | 8   |
| 3    | J-3669-01     | Bracket, Fixed Wheel           | 2   |
| 4    | G-1302-21     | Pin, Clevis 1 OD x 6           | 2   |
| 5    | TR-1894-01    | Spacer, Wheel                  | 4   |
| 6    | U-1113        | Assembly, Tire/Rim             | 4   |
| 7    | V-1392        | Label, Tire Pressure           | 3   |
| 8    | G-1301-03     | Pin, Cotter, 1/8 x 1 1/2 LG    | 2   |
| 9    | Z-5584-01     | Weldment, Towbar               | 1   |
| 10   | H-2789        | Hub, Idler                     | 1   |
| 11   | G-1250-1130N  | Flatwasher, 1" Narrow          | 3   |
| 12   | G-1230-01     | Nut, Axle, 1-14 UNS            | 1   |
| 13   | G-1301-01     | Pin, Cotter, 3/16 x 1 1/2 LG   | 1   |
| 14   | G-1100-107016 | Bolt, HH, 3/8 - 16 x 1 3/4 LG  | 4   |
| 15   | G-1250-1070N  | Flatwasher, 3/8 Narrow         | 4   |
| 16   | G-1151-109514 | Screw, 1/2 - 20 HEX SOC HD CAP | 4   |
| 17   | J-3670-01     | Plate, Steering Mount          | 1   |
| 18   | J-3427        | Lever                          | 1   |
| 19   | G-1100-109522 | Bolt, HH, 1/2 - 20 x 2 1/2 LG  | 1   |
| 20   | G-1250-1090N  | Flatwasher, 1/2 Narrow         | 2   |
| 21   | G-1203-1095   | Jamnut, Elastic, 1/2 - 20      | 1   |
| 22   | Z-6044-01     | Weldment, Steer Axle           | 1   |
| 23   | R-2096        | Pin, Towbar                    | 1   |
| 24   | G-1301-02     | Pin, Cotter, 1/8 x 1 LG        | 2   |
| 25   | G-1203-1120   | Jamnut, Elastic, 1 - 14        | 2   |
| 26   | V-2074        | Label, Max Towing              | 1   |
| 27   | G-1283        | Washer, Spindle                | 1   |

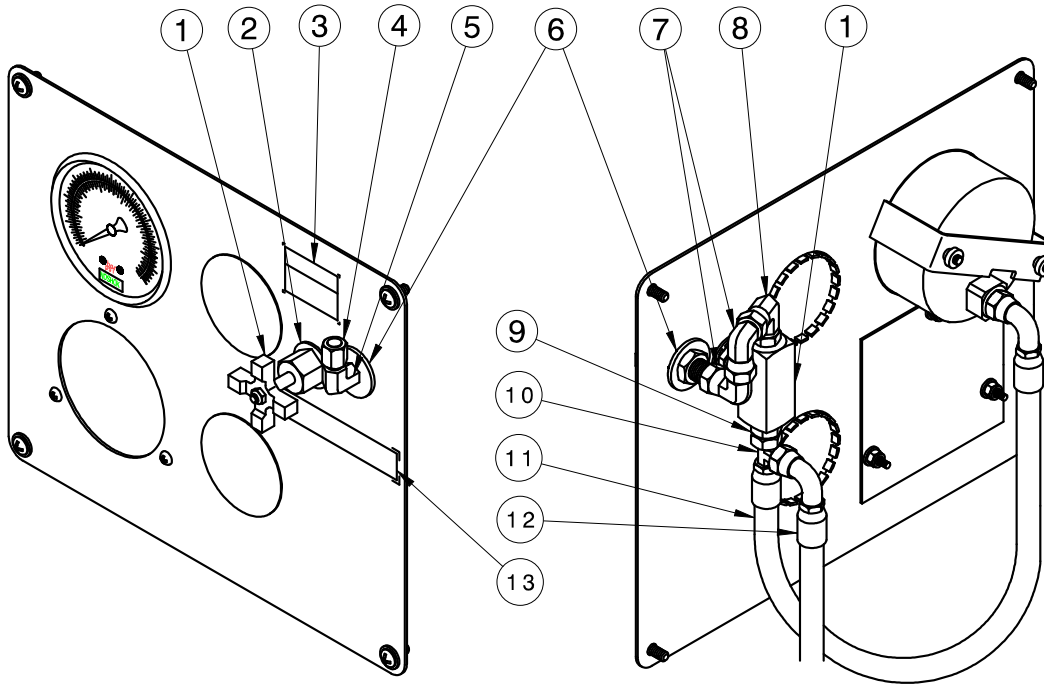


**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

**10.14.10 Calibration Port (Option Q)**

Refer to Section 10.6 Hydraulic Hoses concerning hose inspection.



**FIGURE 10.14.10 – Calibration Port**

PARTS LIST

**Fluid Type: Aviation Phosphate Ester, Type IV**

| Item | Part Number     | Description                                | Qty |
|------|-----------------|--|-----|
| 1    | HC-1900-02      | Needle Valve                               | 1   |
| 2    | HC-1122         | Kit, Panel Mounting (MVK-4)                | 1   |
| 3    | V-1470          | Label, Caution                             | 1   |
| 4    | N-2008-03-S     | Cap, ¼, #4 JIC                             | 1   |
| 5    | N-2022-03-S     | Elbow, Bulkhead Union with Locknut #4      | 1   |
| 6    | G-1250-1080W    | Flatwasher, 7/16 Wide                      | 2   |
| 7    | N-2002-03-S     | Elbow, Swivel Nut #4                       | 2   |
| 8    | N-2049-07-S-E   | Elbow, 90° Swivel & O-ring #4 x #6         | 1   |
| 9    | N-2007-05-S-E   | Connector, Straight Thread #4 JIC x #6 SAE | 1   |
| 10   | N-2016-03-S     | Tee, Swivel Nut Run, #4                    | 1   |
| 11   | TF-1040-42*23.0 | Hose Assembly, #4                          | 1   |
| 12   | TF-1040-42*23.0 | Hose Assembly, #4                          | Ref |
| 13   | V-1888          | Label, Shut-Off Calibration                | 1   |

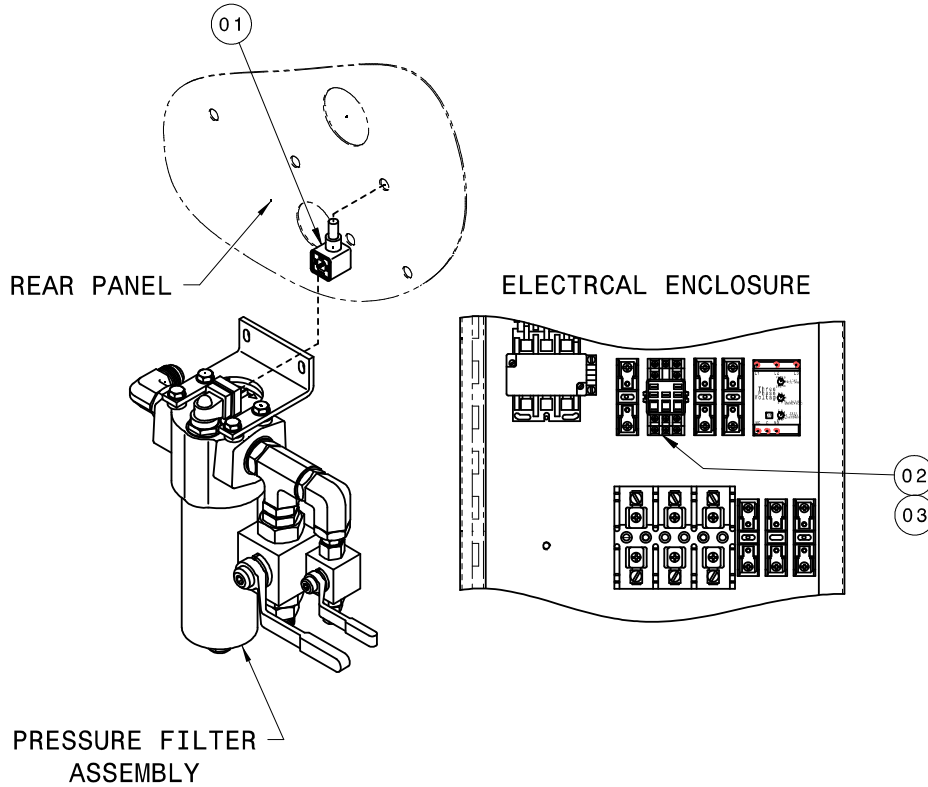
10.14. Additional Features continued on following page.

10.14 ADDITIONAL FEATURES (continued)

**10.14.11 Electric Filter Clogging Indicator (Option R)**

The Electric Filter Clogging Indicator does not require regular general maintenance. The panel light will illuminate when the clogging indicator senses a 98 psi differential pressure across the filter element. Installing a new filter element will eliminate the clogged condition. Pushing the illuminated button will reset the indicator light.

- NOTES:**
- 1) **Higher flow rates will result in higher differential pressures.**  
*Example: The clogging indicator may sense a 98 psi differential pressure at a flow rate of 10 gpm but not show a clogged condition when the flow rate is reduced to 5 gpm.*
  - 2) **Wire per Appendix – Electrical Schematic INS-1725. Reference Appendix – Wiring Diagram INS-1747. Reference 10.7.1 Electrical Panel (Page 32) for Panel Light.**



**FIGURE 10.14.11– Electric Filter Clogged Indicator**

PARTS LIST

| Item | Part Number | Description         | Qty |
|------|-------------|---------------------|-----|
| 1    | EC-1778     | DIN Connector Cable | 1   |
| 2    | EC-1677     | Relay Socket        | 1   |
| 3    | EC-1678     | Relay               | 1   |

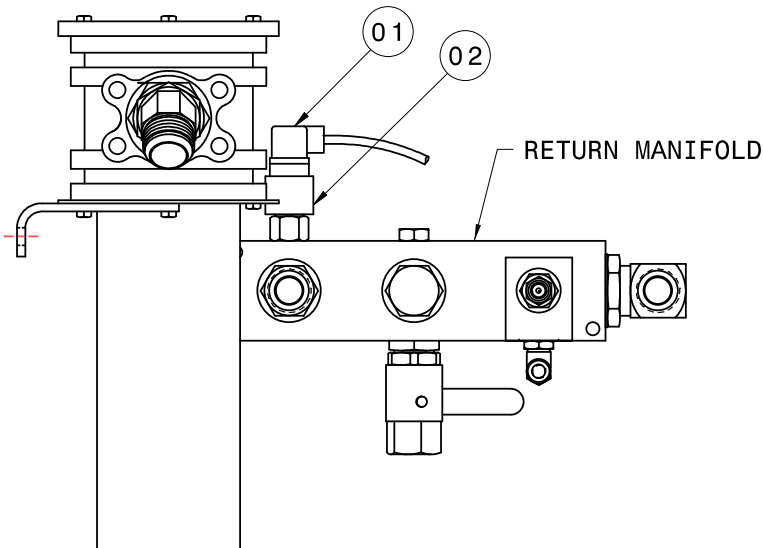
**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES *(continued)*

**10.14.12 Electric Over-Temperature (Option S)**

The Electric Over-Temperature switch does not require regular general maintenance. However, automatic shut down due to high fluid temperature is a indication that maintenance or training may be needed elsewhere.

**NOTE: Wire per Appendix – Electrical Schematic INS-1725. Reference Appendix – Wiring Diagram INS-1747. Reference 10.7.1 Electrical Panel (Page 32) for Panel Light.**



**FIGURE 10.14.12 – Electric Over-Temperature**

PARTS LIST  
Fluid Type: Aviation Phosphate Ester, Type IV

| Item   | Part Number      | Description              | Qty |
|--------|------------------|--------------------------|-----|
| 1..... | EC-1778 .....    | DIN Connector Cable..... | 1   |
| 2..... | EC-1782-01 ..... | Temperature Switch.....  | 1   |

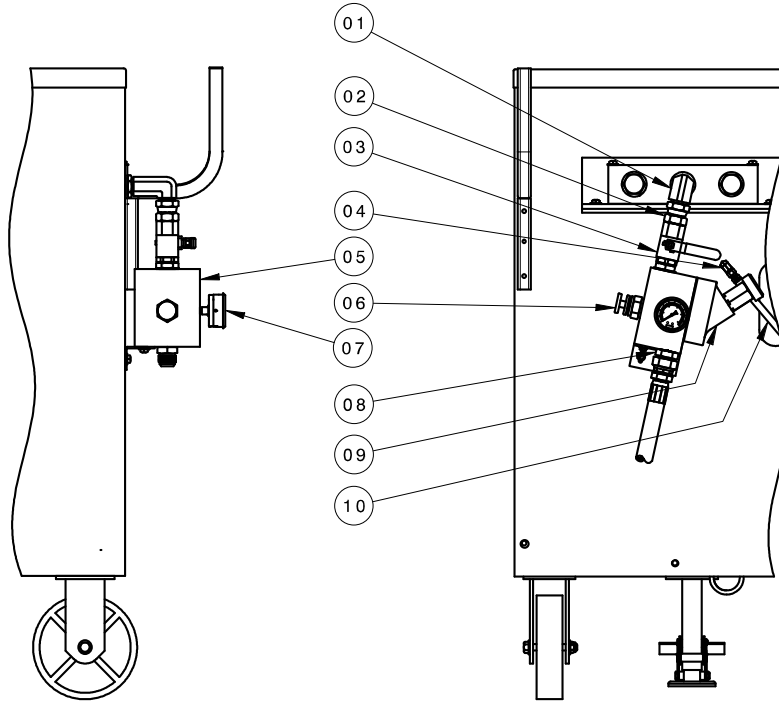
10.14 Additional Features continued on following page.

**Models: 5430  
Hydraulic Power Unit**

10.14 ADDITIONAL FEATURES (continued)

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

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



**FIGURE 10.14.13 – Return Back-Pressure with Sight Gauge**

PARTS LIST

**Fluid Type: Aviation Phosphate Ester, Type IV**

| Item    | Part Number          | Description                               | Qty |
|---------|----------------------|---|-----|
| 1.....  | N-2706-06-S-E .....  | Elbow, Long Straight Thread (#16) .....   | 1   |
| 2.....  | N-2036-10-S-E .....  | Swivel, 37° Female (#16).....             | 1   |
| 3.....  | HC-1770-05.....      | Ball Valve #16 SAE.....                   | Ref |
| 4.....  | N-2022-06-S.....     | Bulkhead, 90°Elbow with nut (6-6).....    | 1   |
| 5.....  | J-3445 .....         | Back-Pressure Manifold.....               | 1   |
| 6.....  | HC-2190.....         | Bypass Valve .....                        | 1   |
| 7.....  | HC-2260.....         | Pressure Gauge (0–300 psi/20.7 bars)..... | 1   |
| 8.....  | N-2007-24-S-E .....  | Connector, Straight Thread (12-16).....   | 1   |
| 9.....  | HC-2182.....         | Adjustable Check Valve.....               | 1   |
| 10..... | TF-1041-02*180 ..... | Hose Assembly, #6.....                    | 1   |

Models: 5430  
Hydraulic Power Unit

10.14.13 Return Back-Pressure with Sight Gauge (Option T) (continued)

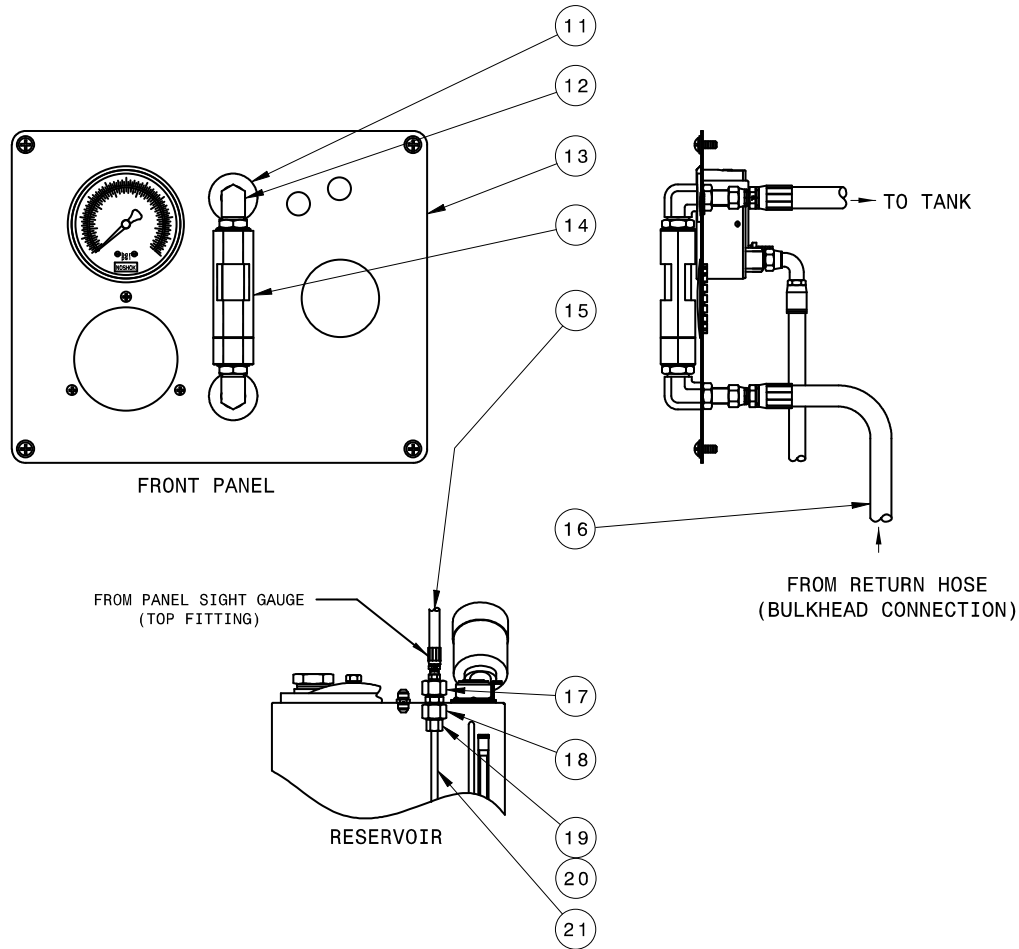


FIGURE 10.14.13 – Return Back-Pressure with Sight Gauge

PARTS LIST  
Fluid Type: Aviation Phosphate Ester, Type IV

| Item | Part Number     | Description                | Qty |
|------|-----------------|----------------------------|-----|
| 11   | G-1250-1100W    | Flatwasher, 5/8 Wide       | 2   |
| 12   | N-2710-S-E      | Bulkhead Elbow             | 2   |
| 13   | S-1865-01       | Hydraulic Instrument Panel | 1   |
| ◆ 14 | Z-5635-02       | Sight Glass Assembly       | 1   |
| 15   | TF-1134-01*14.0 | Hose Assembly #6           | 1   |
| 16   | TF-1134-01*34.0 | Hose Assembly #6           | 1   |
| 17   | N-2055-09-S     | Reducer, Tube (#12-#6)     | 1   |
| 18   | N-2055-10-S     | Reducer, Tube (#12-#8)     | 1   |
| 19   | N-2000-06-S     | Nut, 37° Flare             | 1   |
| 20   | N-2019-06-S     | Sleeve                     | 1   |
| 21   | TR-1849         | Tube, Return               | 1   |

◆ Reference Page 72 – 10.14.13.a for exploded view of Sight Glass Assembly.

10.14.13 Return Back-Pressure with Sight Gauge (Option T) continued on following page.

Models: 5430  
Hydraulic Power Unit

10.14.13 Return Back-Pressure with Sight Gauge (Option T) (continued)

10.14.13.a Item 16 Sight Glass Assembly Exploded View

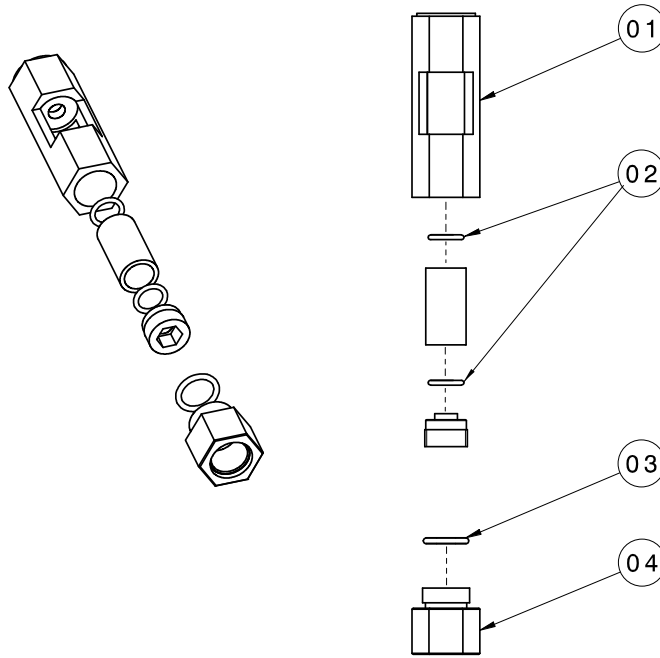


FIGURE 10.14.13.a – Sight Glass Assembly

PARTS LIST  
Fluid Type: Aviation Phosphate Ester, Type IV

| Item   | Part Number      | Description               | Qty |
|--------|------------------|---------------------------|-----|
| 1..... | Z-5634.....      | Sight, Modified Flow..... | 1   |
| 2..... | HC-2006-113..... | O-ring, Series 2.....     | 2   |
| 3..... | HC-2013-911..... | O-ring, Series 3.....     | 1   |
| 4..... | HS-1006.....     | Flow Sight End Cap.....   | 1   |

Models: 5430  
Hydraulic Power Unit

10.14 ADDITIONAL FEATURES (continued)

10.14.14 Drip Pan (Option 4)

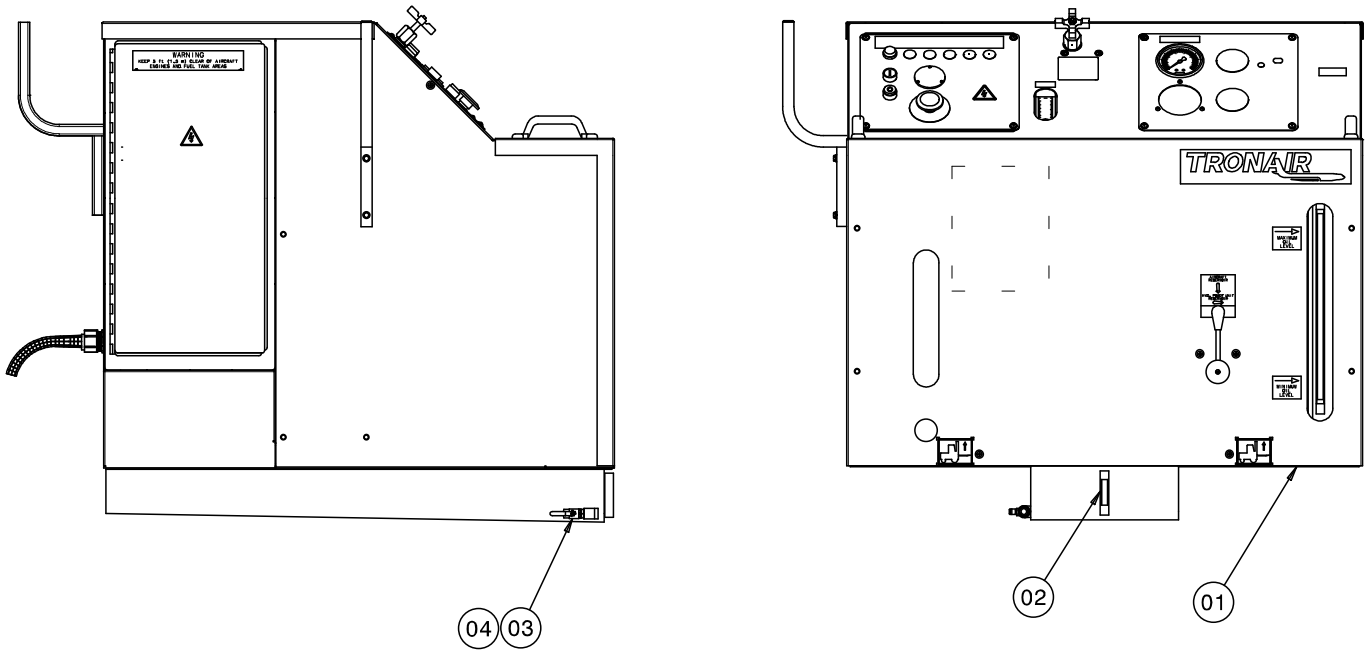


FIGURE 10.14.15 Drip Pan

PARTS LIST

| Item | Part Number   | Description                              | Qty |
|------|---------------|--|-----|
| 1    | S-2508        | Pan, Drip                                | 1   |
| 2    | HC-1382-03    | Gauge, Sight (Mineral Base)              | 1   |
|      | HC-1383-03    | Gauge, Sight (Phosphate Ester)           | 1   |
|      | HC-2340-03    | Gauge, Sight (Viton)                     | 1   |
| 3    | HC-1766-02    | Valve, Ball (Mineral Base)               | 1   |
|      | HC-1770-02    | Valve, Ball (Phosphate Ester)            | 1   |
|      | HC-2209-02    | Valve, Ball (Viton)                      | 1   |
| 4    | N-2661-02-S-B | Elbow, Straight Thread (Mineral Base)    | 1   |
|      | N-2661-02-S-E | Elbow, Straight Thread (Phosphate Ester) | 1   |
|      | N-2661-02-S-v | Elbow, Straight Thread (Viton)           | 1   |
| 5    | G-1100-107010 | Bolt, 3/8- 16 Hex Head Grade 5           | 8   |
| 6    | G-1250-1070W  | Washer, 3/8 Regular                      | 8   |

10.0 Maintenance continued on following page.



05/2012 – Rev. 15

**Models: 5430  
Hydraulic Power Unit**

10.15 REPLACEMENT LABELS PARTS LISTS

**10.15.1 Base Unit**

| <b>Part Number</b> | <b>Description</b>              | <b>Qty</b> |
|--------------------|---------------------------------|------------|
| V-1001             | "Made in USA"                   | 1          |
| V-1033             | "TRONAIR"                       | 1          |
| V-1050             | ISO Electrical Shock Symbol     | 2          |
| V-1365             | "SYSTEM PRESSURE"               | 1          |
| V-1366             | "HPU BY-PASS VALVE"             | 1          |
| V-1882             | Control Panel Lights            | 1          |
| V-1884             | "FLOWMETER"                     | 1          |
| V-1893             | "SAMPLE VALVE"                  | 1          |
| V-1894             | "PRESSURE"                      | 1          |
| V-1895             | "RETURN"                        | 1          |
| V-1896             | "MAXIMUM OIL LEVEL"             | 1          |
| V-1897             | "MINIMUM OIL LEVEL"             | 1          |
| V-1900             | "WARNING KEEP 5 FT CLEAR . . ." | 2          |
| V-1901             | Hydraulic Schematic             | 1          |
| V-1902             | Electrical Schematic            | 1          |
| V-1914             | Reservoir Selector Valve        | 1          |
| V-1918             | "PE"                            | 1          |
| V-1919             | "OPERATING INSTRUCTIONS . . ."  | 1          |
| V-2246             | Label, Pump Controls            | 1          |

**10.15.2 Fluid Label**

| <b>Part Number</b> | <b>Description</b>                             | <b>Qty</b> |
|--------------------|--|------------|
| V-1977             | "Aviation Phosphate Ester, Type IV Fluid Only" | 2          |

**10.15.3 Filter Element Kit Labels**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Part Number</b> | <b>Description</b>                             | <b>Qty</b> |
|--------------------|--|------------|
| V-1906             | "REPLACEMENT FILTER ELEMENT K-3494"            | 1          |
| V-1903             | "REPLACEMENT FILTER ELEMENT K-3428"            | 1          |
| V-1916             | "REPLACEMENT DESICCANT FILTER ELEMENT HC-1763" | 1          |

**10.15.4 Dual System (Option C) and Crossover Check (Option D) Labels**

| <b>Part Number</b> | <b>Description</b>  | <b>Qty</b> |
|--------------------|---------------------|------------|
| V-2004             | "SYSTEM 1 PRESSURE" | 1          |
| V-2005             | "SYSTEM 2 PRESSURE" | 1          |
| V-2006             | "SYSTEM 1 RETURN"   | 1          |
| V-2007             | "SYSTEM 2 RETURN"   | 1          |

**10.15.5 Pyrometer (Option K) Label**

| <b>Part Number</b> | <b>Description</b> | <b>Qty</b> |
|--------------------|--------------------|------------|
| V-1886             | "PYROMETER"        | 1          |

**10.15.6 Hand Pump (Option M) Labels**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| <b>Part Number</b> | <b>Description</b>                  | <b>Qty</b> |
|--------------------|-------------------------------------|------------|
| V-1887             | "HAND PUMP PRESSURE"                | 1          |
| V-1915             | "HAND PUMP"                         | 1          |
| V-1989             | "REPLACEMENT FILTER ELEMENT K-3752" | 1          |





**Models: 5430  
Hydraulic Power Unit**

10.15 REPLACEMENT LABELS PARTS LISTS (continued)

**10.15.7 Calibration Port (Option Q) Labels**

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

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

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

**11.0 PROVISION OF SPARES**

11.1 SOURCE OF SPARE PARTS

**TRONAIR**, Inc.  
1740 Eber Road  
Holland, Ohio 43528-9794 USA

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

11.2 RECOMMENDED SPARE PARTS LISTS

It is recommended that the following spare parts be kept on hand and available for immediate use during maintenance.

**11.2.1 Spare Electrical Parts**

| Part Number   | Description                                   | Qty |
|---|---|-----|
| <i>Refer to Section 10.11 Electrical Components Item 11</i> ..... | Fuse, Transformer Primary .....               | 2   |
| EC-1542-04 .....  | Fuse, Transformer Secondary .....             | 1   |
| <i>Refer to Section 10.11 Electrical Components Item 2</i> .....  | Fuse, Heat Exchanger .....                    | 3   |
| EC-1419-09 .....  | Fuse, Phase Monitor ( <i>Optional</i> ) ..... | 3   |

**11.2.2 Spare Parts**

**Fluid Type: Aviation Phosphate Ester, Type IV**

| Part Number   | Description  | Qty |
|---------------|--|-----|
| HC-1763 ..... | Desiccant Filter Element.....                          | 1   |
| TBD.....      | Kit, Gaskets and O-rings for Main Pump .....           | 1   |
| K-3428 .....  | Kit, Pressure Filter Element .....                     | 1   |
| K-3494 .....  | Kit, Return Filter Element .....                       | 1   |
| TBD.....      | Kit, Shaft Seal and Retainer for Main Pump .....       | 1   |
| K-3752 .....  | Kit, Hand Pump Filter Element ( <i>Optional</i> )..... | 1   |

## 12.0 CALIBRATION OF INSTRUMENTATION

All gauges on the Hydraulic Power Unit can be either returned to Tronair for calibration or certified by the end user if proper calibration equipment is available. Gauges returned to Tronair for calibration will be tested with standards traceable to N.I.S.T. (National Institute of Standards and Technology). Tronair recommends calibration of instrumentation at yearly intervals, but actual calibration dates may be based upon frequency of use and the end users quality system. For information on returning gauges for calibration, Reference **12.1 – Source of Calibration**.

### 12.1 SOURCE OF CALIBRATION

**TRONAIR**, Inc.  
1740 Eber Road  
Holland, Ohio 43528-9794 USA

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

### 12.2 ANALOG PRESSURE GAUGE – System Pressure

#### 12.2.1 Self Calibration

An accurate pressure calibration gauge is required for calibration of the System Pressure gauge. There are two methods available. Method A can be used if the HPU is equipped with a calibration port (*Option Q*). Method B must be used if the HPU is **not** equipped with a calibration port. Follow the necessary steps below.

**NOTE: Method A can only test the gauge up to the rated operating pressure of the HPU (3,500 psi).**

**Method A:** Shut off HPU and disconnect from aircraft. Close the calibration port **Shut-off Valve** on the instrument panel of the HPU. Attach the “Master” calibration gauge to the **Calibration Port** on the instrument panel.

Set up the HPU as follows:

Reservoir Selector Valve ..... Set to HPU Reservoir  
Bypass Valve ..... Open  
Pressure Ball Valves (at rear of unit) ..... Closed  
Return Ball Valves (at rear of unit) ..... Closed

Start the HPU. Open the calibration port Shut-off Valve. Close the Bypass valve to build system pressure. Record gauge values at the designated increments.

Open the Bypass valve.

Shut off the HPU and close the calibration port Shut-off Valve before disconnecting the “Master” calibration gauge.

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

**Models: 5430  
Hydraulic Power Unit**

**12.2.1 Self Calibration** *(continued)*

**SYSTEM PRESSURE GAUGE (HC-2144)**

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

**12.3 ANALOG PRESSURE GAUGE (Hand Pump Pressure- Option M Only)**

**12.3.1 Self Calibration**

An accurate pressure calibration gauge is required for calibration of the Hand Pump Pressure gauge. Follow the necessary steps below.

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

**HAND PUMP PRESSURE GAUGE (HC-2146)**

| Applied Pressure<br>(Hand Pump<br>Pressure Gauge)<br>(psig)                                 | Minimum<br>Acceptable<br>(psig) | Maximum<br>Acceptable<br>(psig) | Gauge Movement<br>(Direction) | Indicated Pressure<br>(Calibration Gauge)<br>(psig) |
|---|---------------------------------|---------------------------------|-------------------------------|---|
| 1000  | 700                             | 1300                            | Increasing                    |   |
| 2000  | 1700                            | 2300                            | Increasing                    |   |
| 5000  | 4800                            | 5200                            | Increasing                    |   |
| 8000  | 7700                            | 8300                            | Increasing                    |   |
| 10,000  | 9700                            | 10,300                          | Increasing                    |   |
| 8000  | 5940                            | 8300                            | Decreasing                    |   |
| 5000  | 4800                            | 5200                            | Decreasing                    |   |
| 2000  | 1700                            | 2300                            | Decreasing                    |   |
| 1000  | 700                             | 1300                            | Decreasing                    |   |
| Allowable operating tolerance: +/- 3% of full scale (300 psig) at room temperature (70° F). |                                 |                                 |                               |   |
| +/- 2% of full scale for middle third of scale (200 psig) at room temperature (70° F).      |                                 |                                 |                               |   |

12.0 Calibration of Instrumentation continued on following page.



**Models: 5430  
Hydraulic Power Unit**

**12.0 CALIBRATION OF INSTRUMENTATION** *(continued)*

12.4 ANALOG PRESSURE GAUGES (Crossover Check- *Option D Only*)

**12.4.1 Self Calibration**

An accurate pressure calibration gauge is required for calibration of the Crossover Check pressure gauges. See Section **10.14.4 – Crossover Check** for location. Follow the necessary steps below.

1. Shut off the HPU and disconnect it from the power source.
2. Remove the Crossover Check pressure gauges from the rear pressure manifold.
3. Attach calibration test equipment to each gauge and record gauge values at the designated increments.

**CROSSOVER CHECK PRESSURE GAUGES (HC-1257 / HC-1928)**

| Applied Pressure<br>(Crossover Check<br>Pressure Gauges)<br>(psig)                           | Minimum<br>Acceptable<br>(psig) | Maximum<br>Acceptable<br>(psig) | Gauge<br>Movement<br>(Direction) | Indicated Pressure<br>(Calibration Gauge)<br>(psig) |
|--|---------------------------------|---------------------------------|----------------------------------|---|
| 1000   | 925                             | 1075                            | Increasing                       |   |
| 2000   | 1925                            | 2075                            | Increasing                       |   |
| 3000   | 2925                            | 3075                            | Increasing                       |   |
| 4000   | 3925                            | 4075                            | Increasing                       |   |
| 5000   | 4925                            | 5075                            | Increasing                       |   |
| 4000   | 3925                            | 4075                            | Decreasing                       |   |
| 3000   | 2925                            | 3075                            | Decreasing                       |   |
| 2000   | 1925                            | 2075                            | Decreasing                       |   |
| 1000   | 925                             | 1075                            | Decreasing                       |   |
| Allowable operating tolerance: +/- 1.5% of full scale (75 psig) at room temperature (70° F). |                                 |                                 |                                  |   |

**Models: 5430  
Hydraulic Power Unit**

**12.0 CALIBRATION OF INSTRUMENTATION** *(continued)*

12.5 ANALOG PRESSURE GAUGES (Back-Pressure Adjustment Manifold Gauge- *Option T Only*)

**12.5.1 Self Calibration**

An accurate pressure calibration gauge is required for calibration of the Back-Pressure Adjustment Manifold gauge. See Section **10.14.13 – Return Back-Pressure with Sight Gauge** for location. Follow the necessary steps below.

1. Shut off the HPU and disconnect it from the power source.
2. Remove the gauge from the back-pressure adjustment manifold.
3. Attach calibration test equipment to the gauge and record gauge values at the designated increments.

**BACK PRESSURE ADJUSTMENT MANIFOLD GAUGE (HC-1622)**

| Applied Pressure<br>(Back Pressure Adjustment<br>Manifold Gauge)<br>(psig)                    | Minimum<br>Acceptable<br>(psig) | Maximum<br>Acceptable<br>(psig) | Gauge Movement<br>(Direction) | Indicated Pressure<br>(Calibration Gauge)<br>(psig) |
|---|---------------------------------|---------------------------------|-------------------------------|---|
| 50  | 45.5                            | 54.5                            | Increasing                    |   |
| 100   | 95.5                            | 104.5                           | Increasing                    |   |
| 150   | 145.5                           | 154.5                           | Increasing                    |   |
| 200   | 195.5                           | 204.5                           | Increasing                    |   |
| 250   | 245.5                           | 254.5                           | Increasing                    |   |
| 300   | 295.5                           | 304.5                           | Increasing                    |   |
| 250   | 245.5                           | 254.5                           | Decreasing                    |   |
| 200   | 195.5                           | 204.5                           | Decreasing                    |   |
| 150   | 145.5                           | 154.5                           | Decreasing                    |   |
| 100   | 95.5                            | 104.5                           | Decreasing                    |   |
| 50  | 45.5                            | 54.5                            | Decreasing                    |   |
| Allowable operating tolerance: +/- 1.5% of full scale (4.5 psig) at room temperature (70° F). |                                 |                                 |                               |   |

12.6 ANALOG TEMPERATURE GAUGE (Pyrometer- *Option K Only*)

**12.6.1 Self Calibration**

An accurate temperature calibration gauge is required for calibration of the Pyrometer. The pyrometer bulb is located in the return manifold (rear of unit) and can be accessed by removal of the HPU top panel. See Section **10.13.7 – Pyrometer** for location. Follow the necessary steps below.

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

**The Temperature Value Must Be:**

| Pyrometer Temperature Display<br>(° F) | Minimum Acceptable<br>(° F) | Maximum Acceptable<br>(° F) | Temperature<br>Calibration gauge<br>(° F) |
|--|-----------------------------|-----------------------------|---|
| 160                                    | 158                         | 162                         |   |

### 13.0 IN SERVICE SUPPORT

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

### 14.0 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.**

### 15.0 APPENDICES

|               |   |
|---------------|---|
| APPENDIX I    | Hydraulic Schematic (INS-1602)                                  |
| APPENDIX II   | Electrical Schematic (INS-1725)                                 |
| APPENDIX III  | Wiring Diagram (INS-1747)                                       |
| APPENDIX IV   | Lincoln Motor Manual  |
| APPENDIX V    | Oilgear Type PVWJ Pump Manuals                                  |
| APPENDIX VI   | Material Safety Data Sheet (MSDS) pertaining to Hydraulic Fluid |
| APPENDIX VII  | ANSI/B93.19M-1972 (R1993-Excerpt)                               |
| APPENDIX VIII | Instrument Certification Notice                                 |



## **APPENDIX I**

### **Hydraulic Schematic (INS-1602)**







**APPENDIX II**

**Electrical Schematic  
(INS-1725)**





**APPENDIX III**

**Wiring Diagram  
(INS-1747)**





**APPENDIX IV**

**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

|   |   |
|---|---|
|  <b>WARNING</b> |   |
|                | <b>FALLING EQUIPMENT can injure.</b>  |
|   | <ul style="list-style-type: none"> <li>● Lift only with equipment of adequate lifting capacity.</li> <li>● If so equipped, use lift ring(s) on the motor to lift <b>ONLY</b> the motor and accessories mounted by Lincoln.</li> </ul> |

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.

|  |  |
|--|--|
|  <b>WARNING</b> |  |
|                   | <b>MOVING PARTS can injure.</b>  |
|  | <ul style="list-style-type: none"> <li>● <b>BEFORE</b> starting motor, be sure shaft key is captive.</li> <li>● Consider application and provide guarding to protect personnel.</li> </ul> |

#### 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.

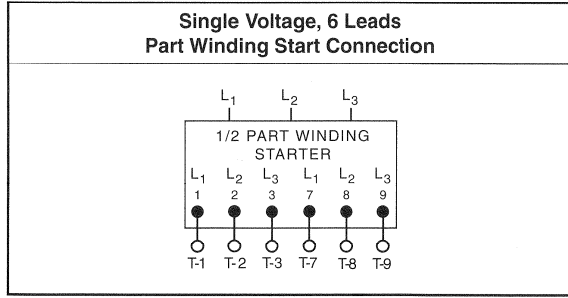
| Number of Motor Leads | Number of Rated Voltages | Lead Numbers | YDS                | PWS               |
|-----------------------|--------------------------|--------------|--------------------|-------------------|
| 3                     | Single                   | 1-3          | No            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

(1) YDS capability on lower voltage only.

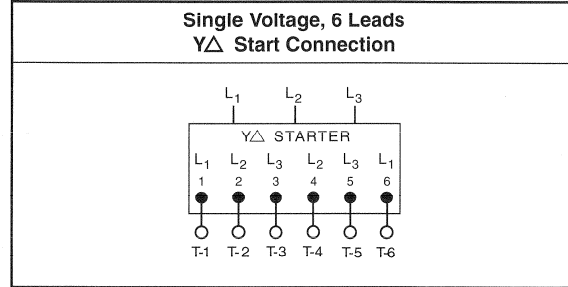
(2) PWS capability on lower voltage only, 1200 RPM, 324T-365T steel frame motors with Model Number efficiency letters of "S" or "H".

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.

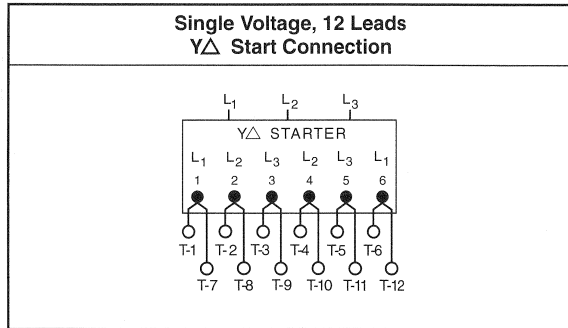
Connection Diagram 1



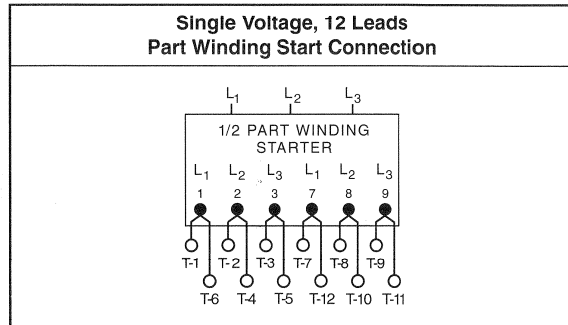
Connection Diagram 2



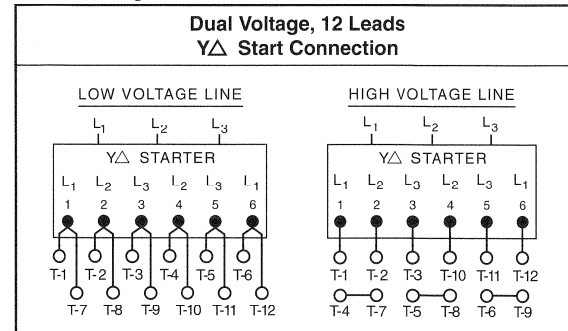
Connection Diagram 3



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  |
| <b>BALL BEARINGS</b>   |                  |                    |          |
| 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 |
| <b>ROLLER BEARINGS</b> |                  |                    |          |
| 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](http://www.lincolnmotors.com).



**LINCOLN MOTORS**  
Cleveland OH 44117-2525 USA

Tel: 1-800-MOTOR-4-U (668-6748)  
Fax: 1-888-536-6867  
Web: [www.lincolnmotors.com](http://www.lincolnmotors.com)  
E-Mail: [mailbox@lincolnmotors.com](mailto:mailbox@lincolnmotors.com)

IM566-A December 1999

**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.



**APPENDIX V**

**Oilgear  
Type PVWJ  
Pump Manuals**



# OILGEAR TYPE "PVWJ" PUMPS - PVWJ-011/-014/-022/-025/-034/-046/-064/ -076/-098/-130 SERVICE INSTRUCTIONS

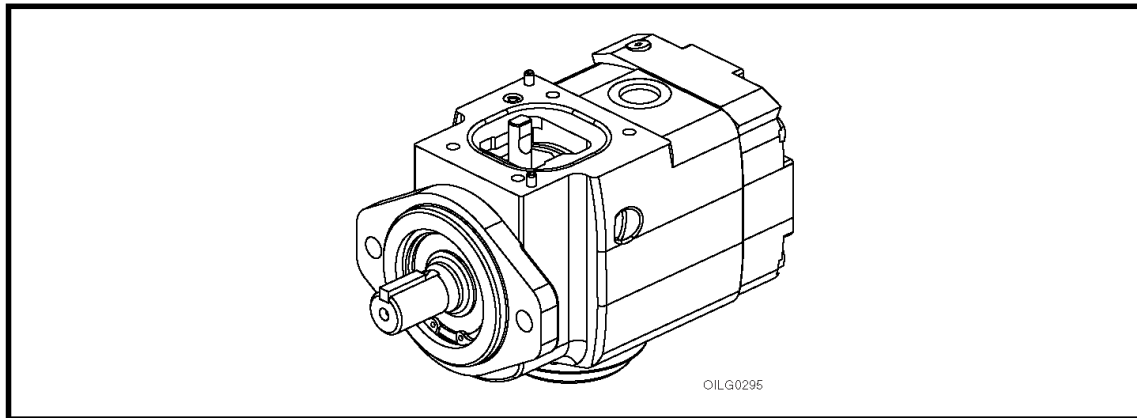


Figure 1. Typical Oilgear "PVWJ" Open Loop Pump

## PURPOSE OF INSTRUCTIONS

These instructions will simplify the installation, operation, maintenance and troubleshooting of Oilgear type "PVWJ" pumps.

Become familiar with the construction, principle of operation and characteristics of your pump to help you attain satisfactory performance, reduce shut-down and increase the pump's service life. Some pumps have been modified from those described in this bulletin and other changes may be made without notice.

## REFERENCE MATERIAL

|   |                 |
|---|-----------------|
| Fluid Recommendations .....   | Bulletin 90000  |
| Contamination Evaluation Guide.....                                     | Bulletin 90004  |
| Filtration Recommendations .....  | Bulletin 90007  |
| Piping Information .....  | Bulletin 90011  |
| Proper Installation of Vertical Pumps .....                             | Bulletin 90014  |
| Alternate Remote Compensating of Single/Multiple Load Sense Pumps ..... | DS-47974-A      |
| PVWJ Open Loop Pumps, Application Guidelines.....                       | Bulletin 847085 |
| PVWJ Open Loop Pumps, Sales .....                                       | Bulletin 47085  |

(continued)

## PVWJ BASIC PUMP INSTALLATIONS

|  |          |
|--|----------|
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Rear Ports.....                         | DS-47480 |
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Side Ports .....                        | DS-47481 |
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Side Ports & Thru Shaft .....           | DS-47482 |
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Rear Ports.....                         | DS-47483 |
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Side Ports .....                        | DS-47484 |
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Side Ports & Thru Shaft.....            | DS-47485 |
| PVWJ C Frame (PVWJ-064) w/ Rear Ports.....                                   | DS-47486 |
| PVWJ C Frame (PVWJ-064) w/ Side Ports & w/ or w/o Thru Shaft.....            | DS-47487 |
| PVWJ C Frame (PVWJ-076/-098/-130) w/ Rear Ports .....                        | DS-47488 |
| PVWJ C Frame (PVWJ-076/-098/-130) w/ Side Ports & w/ or w/o Thru Shaft ..... | DS-47489 |

## PVWJ PUMP CONTROL INSTRUCTIONS

|   |                 |
|---|-----------------|
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-011/-014/-022 .....                           | Bulletin 947633 |
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-025/-034/-046 .....                           | Bulletin 947634 |
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-064/-076/-098/-130 ..                         | Bulletin 947635 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-011/-014/-022.....       | Bulletin 947636 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-025/-034/-046 .....      | Bulletin 947637 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-064/-076/-098/-130 ..... | Bulletin 947638 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-011/-014/-022.....              | Bulletin 947639 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-025/-034/-046 .....             | Bulletin 947640 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-064/-076/-098/-130 .....        | Bulletin 947641 |
| Dual Pump Adapters for PVWJ Pumps (all sizes) .....   | DS-47490        |
| Alternate Remote Compensating of Single or Multiple Load Sense Pump .....                       | DS-47974-A      |

## PVWJ PUMP CONTROL INSTALLATIONS

|  |          |
|--|----------|
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-011/-014/-022 .....                            | DS-47984 |
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-025/-034/-046 .....                            | DS-47985 |
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-064/-076/-098/-130 .....                       | DS-47986 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-011/-014/-022.....        | DS-47987 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-025/-034/-046 .....       | DS-47988 |
| “P-1NN/F” and “P-LNN/F” Pressure Compensator w/ Load Sense for<br>PVWJ-064/-076/-098/-130 .....  | DS-47989 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-011/-014/-022.....               | DS-47990 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-025/-034/-046 .....              | DS-47991 |
| “P-CNN” and “P-KNN” Soft Start Pressure Compensator for<br>PVWJ-064/-076/-098/-130 .....         | DS-47992 |
| PVWJ Remote Circuit Drawing “P-1NN/F” or “P-LNN/F” Single Pressure<br>w/ Load Sense Control..... | DS-47491 |

Read and understand this entire instruction sheet before repairing, or adjusting your Oilgear product.

Those who use and maintain this equipment must be thoroughly trained and familiar with the product. If incorrectly used or maintained, this product and its equipment can cause severe injury.

### SAFETY SYMBOLS

The following signal words are used in this instruction sheet to identify areas of concern where your safety may be involved. Carefully read the text and observe any instructions provided to ensure your safety.

#### **DANGER**

THIS SIGNAL WORD INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

#### **WARNING**

This signal word indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

This signal word indicates that a potentially hazardous situation exists which, if not avoided, may result in damage to equipment or minor personal injury.

**NOTE** *While not directly relevant to the topic being discussed, the NOTE is used to emphasize information provided, or provide additional information which may be of benefit.*

#### **WARNING**

This service information is designed for the maintenance of your Oilgear product. It contains the information on the correct procedures determined by Oilgear for the safe manner of servicing. Always keep this instruction sheet in a location where it is readily available for the persons who use and maintain the product. Additional copies of this instruction sheet are available through the Oilgear Company. Contact us at 414-327-1700 or visit our website: [www.oilgear.com](http://www.oilgear.com). Please contact us if you have any questions regarding the information in this instruction bulletin.

#### **NOTE**

*The cleanliness of working on this pump or the hydraulic system is extremely important to the safety and reliability of the pump and the system. Always make sure the fittings are clean on the outside before removing them from their connections, are capped and plugged when removed and placed in a clean rag or container until they are reinstalled.*

#### **WARNING**

Some service operations may require special tools or equipment. If you require information on these items, please contact Oilgear before attempting these repairs and service operations.

#### **WARNING**

Read, understand, and follow the safety guidelines, dangers, and warnings contained in this instruction sheet to promote reliable operation and prevent serious personal injury.

#### **WARNING**

DO NOT attempt to service this machinery in an environment where safety regulations are not established and in place.

#### **WARNING**

DO NOT operate the hydraulic system if a leak is present. Serious injury may result.

#### **WARNING**

Hydraulic systems operate under very high-pressure. Hydraulic fluid escaping from a pressurized system can penetrate unprotected body tissue. DO NOT inspect for hydraulic leaks with bare hands or other exposed body parts. As a minimum, wear leather gloves prior to inspecting for leaks and use cardboard or wood. If leaks are present, relieve pressure and allow system to cool prior to servicing. If injured by escaping hydraulic oil, contact a physician immediately. Serious complications may arise if not treated immediately. If you have questions regarding inspecting for hydraulic leaks, please contact Oilgear prior to servicing.

### **WARNING**

Hydraulic hoses and tubing must be inspected on a daily basis for leaks, cuts, abrasions, damage and improper clearance along any mounting frame for hidden damage before the unit is put into service. Replace damaged hoses or hoses you suspect are damaged before the system is returned to service! Hoses must be replaced every two years. Failure to properly inspect and maintain the system may result in serious injury.

### **WARNING**

Hydraulic systems are hot. DO NOT TOUCH! Serious personal injury may result from hot oil. When you have completed working on the hydraulic system, thoroughly clean any spilled oil from the equipment. Do not spill any hydraulic fluids on the ground. Clean any hydraulic fluids from your skin as soon as you have completed maintenance and repairs. Dispose of used oil and system filters as required by law.

### **WARNING**

Use correct hoses, fittings, and adapters with the correct SAE rating when replacing hoses to prevent possible serious injury. Always replace hoses, fittings, and adapters with replacements that have a proper, suitable, working pressure rating. Replacement hoses must be of the correct length and must comply with the hose manufacturer's and Oilgear's installation guidelines and recommendations.

### **WARNING**

Hydraulic hoses have the SAE ratings marked on the hose to assist you in selecting the correct hose. The same manufacturer must supply any replacement hydraulic hoses and fitting assemblies. As an example: Brand "X" hose and brand "Y" fitting will not normally be compatible. No "Twist" is allowed in the hydraulic hoses. "Twist" may result in premature hose failure. This can cause serious injury. Please contact Oilgear for assistance when required.

### **WARNING**

Hydraulic cylinders can be holding a function in a certain position when the pump is OFF. An example of this is a function being held in the lift or partial lift position by the cylinders. If a hydraulic line is removed or the hydraulic circuits or controls are being worked on, gravity may allow the function being held in position to drop. All workers and personnel must remain clear of these areas when working on or operating the hydraulic system. Block and secure all devices and functions which apply before beginning work or operation. Failure to comply with this can result in serious injury or death.

### **WARNING**

Any hydraulic pipe which is replaced must conform to SAE J1065 specifications. If incorrect hydraulic pipe is installed, the hydraulic system may fail, causing serious injury. Damaged or leaking fittings, pipes or hoses must be replaced before the system is returned to service.

### **WARNING**

DO NOT heat hydraulic pipe. The carbon content of this steel tube is such that if heated for bending, and either water or air quenched, the pipe may lose its ductility and thereby be subject to failure under high-pressure conditions. Serious injury can result. Damaged or leaking pipes must be replaced before the system is returned to service. Please contact Oilgear if you require assistance or have questions.

### **WARNING**

All hydraulic pressure must be relieved from the hydraulic system prior to removing any components from the system. To relieve the hydraulic pressure from the hydraulic system, turn off the motor and operate the control panel with the key in the ON position. Failure to comply can result in serious injury. If you have any questions concerning relieving the hydraulic pressure from the system, please contact Oilgear.



**⚠ WARNING**

Hydraulic components can be heavy. Use caution while lifting these components. Serious personal injury can be avoided with proper handling of the components.

**⚠ WARNING**

Please contact Oilgear if you require assistance, when performing hydraulic test procedures, use the proper hydraulic gauges. Installing an incorrect test gauge could result in serious injury if the gauge fails. Use properly rated hydraulic hoses to allow the test gauge to be read away from moving parts and functions.

**⚠ WARNING**

Increasing hydraulic pressure beyond the recommendations may result in serious damage to the pump and system or serious personal injury and may void the Oilgear Warranty. If you have questions concerning hydraulic pressures or testing procedures, please contact Oilgear before attempting the test procedures or making adjustments.

**⚠ WARNING**

An Oilgear pump or pump control must not be modified in any way without authorization from Oilgear. Modifications may not comply with safety standards, including ANSI safety standards, and may result in serious personal injury. Please contact Oilgear if you require assistance.

**⚠ WARNING**

DO NOT enter under hydraulic supported equipment unless they are fully supported or blocked. Failure to follow this procedure can result in serious injury or death.

**⚠ WARNING**

Any Oilgear pump safety decals must be replaced anytime they are damaged, missing, or cannot be read clearly. Failure to have proper decals in place can result in serious injury or death. (If you require safety decals, please contact Oilgear for replacement safety decals, at no charge.)

**⚠ WARNING**

Be sure everyone is clear of the area around the hydraulic system before operating after servicing. Remain attentive at all times when operating to check your work until you are completely sure it is safe to return to service. Failure to heed this warning may result in serious personal injury or death.

**⚠ WARNING**

Wear the proper protective clothing when operating, servicing or maintaining the hydraulic system or the Oilgear pump. Wear the correct protective gear, safety glasses, gloves, and safety shoes. Serious injury can result without proper protective gear.

**⚠ WARNING**

Make sure to keep hands and feet and other parts of your body clear of revolving or moving parts. Failure to comply can cause serious injury.

**⚠ WARNING**

DO NOT wear watches, rings, or jewelry while working with electrical and mechanical equipment. These items can be hazardous and can cause serious and painful injuries if they come into contact with electrical wires, moving parts, or hydraulic equipment.

### PREPARATION AND INSTALLATION

#### MOUNTING

**Pump Without Reservoir** - The pump can be mounted in any position. But, the recommended mounting position is with the drive shaft on a horizontal plane and the case drain port 1 on the top side. Secure the pump to a rigid mounting surface. Refer to the referenced Oilgear Piping Information Bulletin 90011.

**Pump With Reservoir** - These pumps are usually fully piped and equipped. It may be necessary to connect to a super-charge circuit when used. Mount reservoir on level foundation with the reservoir bottom at least 6 inches (152 mm) above floor level to facilitate fluid changes.

#### PIPING AND FITTINGS

Refer to the referenced Oilgear Piping Information Bulletin 90011 and individual circuit diagram before connecting the pump to the system. Inlet velocity must not exceed 5 fps (1,5 mps). Inlet should be unrestricted and have a minimum of fittings.

**NOTE**

*DO NOT use an inlet strainer.*

Arrange line from "case drain" so the case remains full of fluid (non-siphoning). Case pressure must be less than 25 psi (1,7 bar). For higher case pressures and the special shaft seals required, contact our Customer Service. Each drain line must be a separate line, unrestricted, full sized and connected directly to the reservoir below the lowest fluid level. Make provisions for opening this line without draining (siphoning) reservoir.

### WARNING

Running the pump in NEUTRAL position (zero delivery) for extended periods without a supercharge circuit can damage the pump. The system and pump must be protected against overloads by separate high-pressure relief valves. Install bleed valve(s) at the highest point(s) in system.

#### POWER

Power is required in proportion to volume and pressure used. Motor size recommendations for specific applications can be obtained from The Oilgear Company. Standard low starting torque motors are suitable for most applications.

### CAUTION

**DO NOT start or stop unit under load unless system is approved by Oilgear. It may be necessary to provide delivery bypass in some circuits.**

#### DRIVE

Verify rotation direction plate on the pump's housing. Clockwise pumps must be driven clockwise and counterclockwise pumps must be driven counterclockwise. Use direct drive coupling. Size and install coupling per manufacturer's instructions.

### CAUTION

**DO NOT drive the coupling onto the pump drive shaft. If it is too tight, it may be necessary to heat coupling for installation. Refer to manufacturer's instructions.**

Misalignment of pump shaft to driver's shaft should not exceed 0.005 inches (0,13 mm) Total Indicator Readout (TIR) in any plane.

## FILTRATION

Keep the fluid clean at all times to ensure long life from your hydraulic system. Refer to the referenced Oilgear Filtration Recommendations bulletin 90007 and Oilgear Contamination Evaluation Guide Bulletin 90004. Oilgear recommends use of a filter in the pressure or return line. Replace filter element(s) when the filter condition indicator reaches change area at normal fluid temperature. Drain and thoroughly clean filter case. Use replacement element(s) of same beta 10 ratio (normally a ratio of 4 with hydraulic oils).

## FLUID COOLING

When the pump is operated continuously at the rated pressure or frequently at peak load, auxiliary cooling of the fluid may be necessary. Fluid temperature should not exceed limits specified in the referenced Oilgear Fluid Recommendations Bulletin 90000.

## AIR BREATHER

On most installations, an air breather is mounted on top of fluid reservoir. It is important for the breather to be the adequate size to allow air flow in and out of reservoir as fluid level changes. Keep the breather case filled to the "fluid level" mark. About once every six months, remove cover, wash screen in solvent and allow screen to dry, clean and refill case to level mark and install screen. Refer to the manufacturer's recommendations.

## FLUID, FILLING AND STARTING RECOMMENDATIONS

Refer to instruction plate on the unit, reservoir, machine and/or reference, fluid recommendations bulletin. Fire resistant fluids and phosphate ester fluids can be used in accordance with fluid manufacturer's recommendations.

1. Pump all fluid into reservoir through a clean (beta 10 ratio of 4 or more) filter. Fill reservoir to, but not above, "high level" mark on the sight gauge.
2. **Remove case drain line and fill pump case with hydraulic fluid.**
3. Turn drive shaft a few times by hand with a spanner wrench to make sure parts rotate.

| Unit                | Approximate torque to turn drive shaft |
|---------------------|--|
| -011/-014/-022      | 1.7-2.1 ft·lbs<br>(2,3-2,8 N·m)        |
| -025/-034/-046      | 2.9-3.3 ft·lbs<br>(4,0-4,5 N·m)        |
| -064/-076/-098/-130 | 7.9-8.3 ft·lbs<br>(18,8-11,3 N·m)      |

**Table 1. Torque to Turn Shaft**

With pump under "no load" or with pump control at NEUTRAL:

4. Turn drive unit ON and OFF several times before allowing pump to reach full speed. The system can usually be filled by running the pump and operating the control.
5. The fluid level in the reservoir should decrease. Stop the pump. **DO NOT** allow the fluid level to go beyond the "low level." If the level reaches the "low level" mark, add fluid and repeat step.

### NOTE

*With differential (cylinder) systems, the fluid must not be above "high level" when the ram is retracted or below "low level" when extended. Bleed air from the system by loosening connections or opening petcocks at the highest point in the system. Close connections or petcocks tightly when solid stream of fluid appears.*

## SPECIFICATIONS

**NOTE**

Refer to reference material, pump control material and individual application circuit for exceptions.

| FRAME | UNIT | THEORETICAL MAXIMUM DISPLACEMENT |        | RATED CONTINUOUS PRESSURE |       | MAXIMUM PRESSURE |       | FLOW RATE at 1800 rpm, rated continuous pressure and 14,7 psia (1.0 bar) inlet condition |       | MAXIMUM INLET PRESSURE* psia (bar) |           |             | MAXIMUM SPEED** rpm | POWER INPUT at rated continuous pressure & 1800 rpm |      |
|-------|------|----------------------------------|--------|---------------------------|-------|------------------|-------|--|-------|------------------------------------|-----------|-------------|---------------------|---|------|
|       |      | in <sup>3</sup> /rev             | ml/rev | psi                       | bar   | psi              | bar   | gpm  | l/mi  | 1200 rpm                           | 1500 rpm  | 1800 rpm    |                     | hp  | kw   |
| A     | 011  | 0.66                             | 10,8   | 5000                      | 344,8 | 5800             | 400,0 | 4.2  | 15,9  | 5.4 (.37)                          | 5.7 (.39) | 6.1 (.42)   | 3000                | 16.3  | 12,2 |
|       | 014  | 0.86                             | 14,1   | 4000                      | 275,9 | 4500             | 310,3 | 5.9  | 22,4  | 5.5 (.38)                          | 5.9 (.41) | 6.4 (.44)   | 3000                | 17.7  | 13,2 |
|       | 022  | 1.35                             | 22,1   | 3000                      | 206,9 | 3500             | 241,4 | 9.5  | 36,0  | 5.5 (.38)                          | 6.0 (.41) | 7.0 (.48)   | 3000                | 20.2  | 15,1 |
| B     | 025  | 1.55                             | 25,4   | 5000                      | 344,8 | 5800             | 400,0 | 10.9   | 41,3  | 7.0 (.48)                          | 7.3 (.50) | 8.2 (.57)   | 3000                | 36.5  | 27,2 |
|       | 034  | 2.06                             | 33,8   | 3500                      | 241,4 | 4000             | 275,9 | 14.7   | 55,7  | 7.0 (.48)                          | 7.6 (.52) | 8.4 (.58)   | 3000                | 35.5  | 26,5 |
|       | 046  | 2.83                             | 46,4   | 2500                      | 172,4 | 3000             | 206,9 | 20.6   | 78,1  | 7.2 (.50)                          | 7.9 (.54) | 9.0 (.62)   | 2400                | 35.0  | 26,1 |
| C     | 064  | 3.88                             | 63,6   | 5000                      | 344,8 | 5800             | 400,0 | 27.4   | 103,8 | 7.6 (.59)                          | 8.5 (.59) | 9.5 (.66)   | 2400                | 95.1  | 70,9 |
|       | 076  | 4.67                             | 76,5   | 3500                      | 241,4 | 4000             | 275,9 | 33.7   | 127,7 | 8.0 (.55)                          | 8.6 (.59) | 9.6 (.66)   | 2400                | 80.4  | 60,0 |
|       | 098  | 6.00                             | 98,3   | 2500                      | 172,4 | 3000             | 206,9 | 43.3   | 164,1 | 7.6 (.52)                          | 8.6 (.59) | 9.8 (.68)   | 2400                | 74.1  | 55,3 |
|       | 130  | 7.94                             | 130,2  | 1500                      | 103,4 | 2000             | 137,9 | 58.2   | 220,3 | 8.0 (.55)                          | 9.3 (.64) | 14.5 (1,00) | 1800                | 64.0  | 47,8 |

\* For higher speeds see suction curves.

\*\* Minimum speed 600 rpm

Case pressure should be less than 25 psi (1,7 bar). For higher pressure, consult factory.

Higher speeds available - consult factory.

**Table 2. Nominal Performance Data with 150-300 SSU viscosity fluids.**

| Frame | Unit               | Length |       | Width  |       | Height |       | Weight |      |
|-------|--------------------|--------|-------|--------|-------|--------|-------|--------|------|
|       |                    | inches | mm    | inches | mm    | inches | mm    | lbs.   | kg   |
| A     | 011/-014/-022      | 7.20   | 182,9 | 4.32   | 109,7 | 4.50   | 114,3 | 32     | 14,5 |
| B     | 025/-034/-046      | 8.50   | 215,9 | 5.80   | 147,3 | 6.11   | 155,2 | 68     | 30,9 |
| C     | 064/-076/-098/-130 | 10.44  | 265,2 | 6.76   | 171,7 | 7.18   | 182,4 | 103    | 46,8 |

All dimensions (without controls) are for rear ported units. For dimensions of other configurations, contact your Oilgear Representative or see the appropriate Data Sheet.

**Table 3. Nominal Dimensions and Weights without controls.**

Refer to installation drawings for more detailed dimensions and port configurations.

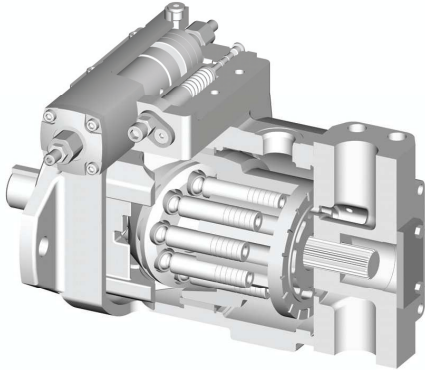
## TROUBLESHOOTING

| PROBLEM   | CAUSES  | REMEDY   |
|---|---|--|
| <b>Unresponsive or Unstable Control</b>                                     | Swashblock (201) bearing surface and/or saddle bearings (204) worn or damaged.                        | Inspect and replace if necessary.                                  |
|   | Control pin (721) and/or hole in swashblock (201) worn significantly.                                 |  |
|   | Saddle bearing locating pins (207) broken.  |  |
|   | Fluid is contaminated.  | Inspect and clean if necessary. See bulletin 90007.                |
|   | Control piston orifice plugged.   | See appropriate control service bulletin.                          |
|   | Contamination trapped between control piston and piston bore is not allowing piston to move smoothly. |  |
|   | Contamination trapped between control spool and spool bore is not allowing spool to move smoothly.    |  |
|   | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.                                  |
|   | Hydraulic line between remote pressure compensator components and RP port of control is too long.     | Shorten line length.   |
| Insufficient control flow.  | Increase size of control piston orifice (732).  |  |
| <b>Insufficient Outlet Volume</b>   | Swashblock (201) not stroking to desired displacement.  | Inspect for obstruction and remove. Replace worn or damaged parts. |
|   | Low input drive speed.  | Refer to appropriate pump performance specifications.              |
|   | Worn or grooved cylinder barrel (101) and/or valve plate (401) mating surfaces.                       | Inspect and replace if necessary.                                  |
|   | Failed drive shaft (301).   |  |
|   | Worn or damaged piston shoes (102) or swashblock (201).   |  |
|   | Worn pistons and/or piston bores.   | Adjust maximum volume stop CCW to increase outlet flow.            |
|   | Excessive wear or inadequately supported hydrodynamic bearing (202).                                  |  |
|   | Maximum volume stop adjusted incorrectly.   |  |
|   | Control piston stuck off stroke.  | See appropriate control service bulletin.                          |
| Pressure compensator is set too close to operating pressure.                |   |  |
| <b>De-strokes at Low Pressure</b>   | Pressure compensator adjustment not set correctly.  | See appropriate control service bulletin.                          |
|   | Control piston orifice (732) plugged.   |  |
|   | Damaged or fractured control spring.  |  |
|   | Severely worn control spool and/or spool bore.  |  |
|   | Damaged or fractured control piston spring.   |  |
| Faulty remote pressure compensator circuit components.                      |   |  |
| <b>Excessive Peak Pressure</b>  | Pressure compensator is set too high.   | See appropriate control service bulletin.                          |
|   | Minimum volume stop is set too high.  | Inspect and clean if necessary. See bulletin 90007.                |
|   | Fluid is contaminated.  |  |
|   | Swashblock (201) bearing surface and/or saddle bearings (204) worn or damaged.                        | Inspect and replace if necessary.                                  |
|   | Contamination trapped between control piston and piston bore is not allowing piston to move smoothly. | See appropriate control service bulletin.                          |
|   | Contamination trapped between control spool and spool bore is not allowing spool to move smoothly.    |  |
|   | Hydraulic line between remote pressure compensator components and RP port of control is too long.     | Shorten line length.   |
|   | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.                                  |
| Restriction in drilled passages between pump outlet port and control spool. | Inspect and clean if necessary.   |  |

|   |  |  |
|---|--|--|
| <b>Excessive Heating</b>                      | Operating pump above rated or peak pressure.   | Consult appropriate pump specification for pressure limitations.   |
|   | Low fluid level in reservoir.  | Verify fluid level is above reservoir suction line.  |
|   | Insufficient pump inlet pressure.  | Eliminate any obstructions or other pressure drops in pump inlet plumbing. Consult appropriate pump specification for inlet pressure requirements. |
|   | Air entering pump inlet plumbing.  | Eliminate leaks that would allow air to enter the fluid stream.  |
|   | Worn pistons (102) or cylinder barrel (101).   | Inspect and replace if necessary.  |
|   | Worn or damaged cylinder barrel (101) and/or valve plate (401) mating surfaces.          |  |
|   | Faulty circuit components (continuously blowing relief valve or a high-pressure leak).   | Eliminate leak or replace faulty components.   |
|   | Insufficient cooling provisions.   | Inspect heat exchanger for obstructions and remove.  |
| Reservoir is too small.                       | Consult Bulletin 90050-B, Reservoir Design.  |  |
| <b>Excessive Noise</b>                        | Pump stopped or started incorrectly under load.  | Verify operator procedure.   |
|   | Low fluid level in reservoir.  | Verify fluid level is above reservoir suction line.  |
|   | Air entering pump inlet plumbing.  | Eliminate leaks that would allow air to enter the fluid stream.  |
|   | Broken shoe/piston assembly (102).   | Inspect and replace if necessary.  |
|   | Worn or damaged cylinder barrel (101) and/or hydrodynamic bearing (202) running surface. |  |
|   | Faulty circuit components (continuously blowing relief valve or a high-pressure leak).   | Eliminate leak or replace faulty components.   |
|   | Insufficient pump inlet pressure.  | Consult appropriate pump specification for inlet pressure requirements.  |
|   | Excessive fluid viscosity.   | Consult Application Guidelines (Bulletin 847085) for maximum viscosity limitations.  |
|   | Insufficient pump inlet pressure.  | Eliminate any obstructions or other pressure drops in pump inlet plumbing. Consult appropriate pump specification for inlet pressure requirements. |
| Pump input shaft rotating in wrong direction. | Inspect and correct drive rotation.  |  |

## PRINCIPLE OF OPERATION

The illustrations show the pump driven clockwise (right hand) from the top (plan) view.



OILG0294

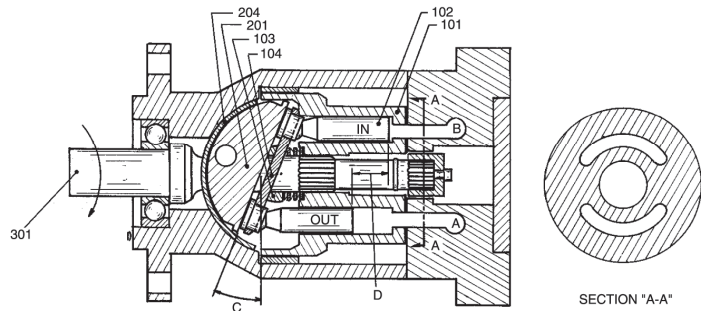
**Figure 2. Cut-a-way of a Typical “PVWJ” Pump with Typical Control**

## Position B, Pump During Full Delivery FROM PORT B - Figure 3

Rotating the drive shaft (301) clockwise turns the splined cylinder, which contains the pumping pistons (102). When the cylinder rotates, the pistons move in and out within their bores as the shoes ride against the angled (C) swashblock (201).

As the cylinder rotates, the individual piston bores are connected, alternately, to the crescent shaped upper (port A) and lower (port B) in the valve plate. While connected to the upper side (suction) port A, each piston moves outward **OUT**, drawing fluid from port A into the piston bore until its outermost stroke (D) is reached. At this point, the piston bore passes from the upper crescent port A to the lower crescent port B.

While rotating across the lower crescent, each piston moves across the angled swashblock face and then each piston is forced inward **IN**. Each piston then displaces fluid through the lower crescent to port B until its innermost stroke (D) is reached. At this point, the piston bore passes from the lower to the upper crescent again and the cycle is repeated.



OILG-0001

**Figure 3. Position B, Pump During Full Delivery From Port B**

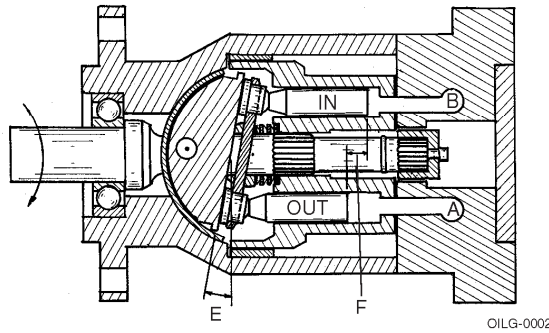
**Position B/2, Pump During One Half Delivery FROM PORT B - Figure 4**

This illustration shows that the angle (E) of the swashblock determines the length of the piston stroke (F), (the difference between outermost and innermost position) which determines the amount of delivery from the pump. In this case, the stroke angle (E) is one-half of the stroke, which means the piston stroke is one-half and the pump delivery is one-half.

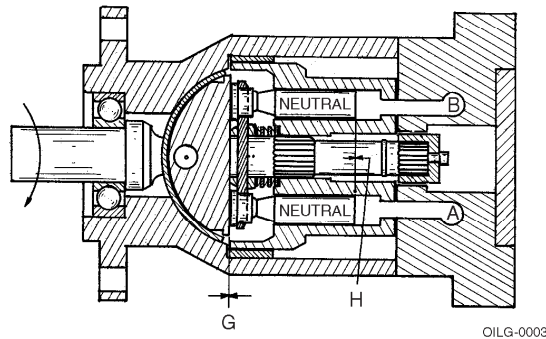
**Position N, Pump In Neutral, No Stroke, No Delivery - Figure 5**

Neutral position results when the control centers the swashblock. The swashblock angle (G) is now zero and swashblock face is parallel to the cylinder face. There is no inward or outward motion of the pump pistons as piston shoes rotate around the swashblock face. With no inward and outward motion or no stroke (H), **NEUTRAL** no fluid is being displaced from the piston bores to the crescents in the valve plate and there is no delivery from pump ports.

**NOTE** Illustration reference numbers match the part item number in the parts list.



**Figure 4. Position B/2, Pump During One Half Delivery From Port B**



**Figure 5. Position N, Pump In Neutral, No Stroke, No Delivery**



## TESTING AND ADJUSTING

### PISTON PUMP

To check for a worn piston pump, make a leak measurement test from the case drain while the pump is under pressure. After the unit is warm, either install a flow meter in the drain line or have the flow from the drain line directed into a large container or reservoir. The pump case must remain full of fluid during this test.

#### WARNING

Shut the pump OFF and release pressure from the system before disassembling components. Failure to comply with these instructions could result in personal injury or death. Blocking the pressure line between the pump and the system (or pump) high-pressure relief valve will result in damage and could result in serious personal injury.

With an accurate high-pressure gauge in the pressure line, start the pump and stall (or block) output device to raise system pressure to maximum (as set by system relief valve). Read the measurement on the flow meter or time and measure the case drain flow used to fill a known size container and calculate the flow rate in terms of cubic inches per minute (cipm). The leakage should conform to **Table 4**.

### CAUTION

**DO NOT** run a pump on stroke against a blocked output unless it is protected by a high-pressure relief valve and then run no longer than necessary to check slip. Limit discharge to prevent dropping reservoir fluid below low level.

**NOTE** Increasing shaft speed or a decrease in fluid viscosity will increase leakage. Manually or mechanically de-stroking the pump has a negligible effect on leakage.

**NOTE** Additional leakage indicates wear, but does not become critical until it impairs performance.

**NOTE** If testing a unit with a pressure compensator control, make sure the compensator setting is at least 500 psi above the pump outlet pressure to assure the pump is at full stroke.

| Unit | Full Stroke Leakage @ Pump Outlet Pressure (psi) |      |          |     |          |     |          |     |          |     |          |     |
|------|--|------|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|
|      | 1500 psi   |      | 2500 psi |     | 3000 psi |     | 3500 psi |     | 4000 psi |     | 5000 psi |     |
|      | cipm   | lpm  | cipm     | lpm | cipm     | lpm | cipm     | lpm | cipm     | lpm | cipm     | lpm |
| 011  | 50   | 2.08 | 70       | 1.1 | 80       | 1.3 | 100      | 1.6 | 120      | 2.0 | 200      | 3.3 |
| 014  | 90   | 1.5  | 120      | 2.0 | 140      | 2.3 | 165      | 2.7 | 200      | 3.3 | -        | -   |
| 022  | 120  | 2.0  | 170      | 2.8 | 200      | 3.3 | -        | -   | -        | -   | -        | -   |
| 025  | 105  | 1.7  | 135      | 2.2 | 150      | 2.4 | 175      | 2.9 | 210      | 3.4 | 300      | 4.9 |
| 034  | 150  | 2.4  | 210      | 3.4 | 250      | 4.1 | 300      | 4.9 | -        | -   | -        | -   |
| 046  | 230  | 3.8  | 300      | 4.9 | -        | -   | -        | -   | -        | -   | -        | -   |
| 064  | 150  | 2.4  | 205      | 3.4 | 240      | 3.9 | 275      | 4.5 | 320      | 5.2 | 460      | 7.6 |
| 076  | 200  | 3.3  | 305      | 5.0 | 375      | 6.1 | 460      | 7.6 | -        | -   | -        | -   |
| 098  | 270  | 4.4  | 460      | 7.6 | -        | -   | -        | -   | -        | -   | -        | -   |
| 130  | 530  | 8.7  | -        | -   | -        | -   | -        | -   | -        | -   | -        | -   |

**Table 4. Nominal Case Slip at full stroke and 1800 RPM, fluid viscosity 160 SSU.**

## DISASSEMBLY

### NOTE

The cleanliness of working on this pump or the hydraulic system is extremely important to the safety and reliability of the pump and the system.

When disassembling or assembling the pump, choose a clean, dry, dust and sand-free area where no traces of abrasive particles are in the air which can damage the pump and system. DO NOT work near welding, sandblasting, grinding benches or similar conditions.

Always make sure the fittings are clean on the outside before removing them from their connections. Make sure they are capped and plugged when removed. Place them on a clean surface and in a clean rag or container until they are reinstalled. When cleaning parts which have been disassembled, it is important to use CLEAN cleaning solvents and allow parts to dry. All tools and gauges should be clean prior to working with the system and use new, CLEAN, lint-free rags to handle and dry parts.



### WARNING

DO NOT attempt to remove or install any components or assembly while the pump and system is running. Always stop the pump, shut OFF the power and release pressure from the system before servicing or testing. Be sure provisions have been made so the case drain line can be disconnected from the unit without causing the line to drain (siphon) the reservoir.

1. Disconnect case drain line from port **1** or **1A**.
2. Drain pump case through the remaining (port **1** or **1A**) on the bottom of case. If plugs are inaccessible, it may be necessary to remove the pump from the mounting and drive motor before draining it.
3. After removing the pump from the mounting and before disassembly, cap or plug all ports and clean the outside of unit thoroughly to prevent dust from entering the system. See **Figures 10** and **18**.

### NOTE

Depending on what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies.

### CONTROL GROUP

Refer to the reference material for the information which applies to the control your pump is equipped with. Some force is required to remove the control housing.

1. Remove socket head cap screws.
2. Lift the control group assembly, with control pin, straight up from the top of the pump assembly. The control pin may or may not remain in the swashblock (**201**).
3. Remove control gasket and O-rings from the pump housing.

### VALVE PLATE GROUP

If another pump is coupled to thru-shaft pumps, remove coupling half before removing valve plate.

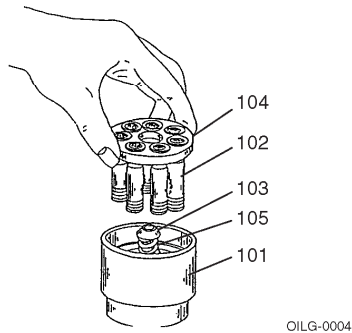
1. Block the pump on a bench with the drive shaft facing down.
2. If applicable, remove relief valve block from valve plate.
3. Remove the valve plate (**401**) by removing four hex head cap screws (**403**) and lifting it straight up.
4. Remove O-rings.

## ROTATING GROUP

### **⚠ WARNING**

The rotating group may be heavy. Be careful not to damage cylinder wear surface which mates against the valve plate, bearing diameters or piston shoes. Use proper lifting techniques and assistance from others to prevent personal injury.

1. Place the pump in a horizontal position.
2. Remove the rotating group by turning shaft (301) slowly, while pulling the cylinder barrel (101) from the housing.
3. Identify (number) each pump piston shoe assembly (102) and its respective bore in the cylinder barrel (101) and shoe retainer (104) for easy reassembly.
4. See **Figure 6**. Lift out shoe retainer (104) with pistons (102) and remove the fulcrum ball (103) and shoe retainer spring (105).



**Figure 6. Rotating Group Disassembly.**

5. Remove retaining ring (208) and pull the hydrodynamic bearing (202) and roll pins, if necessary, (205) from the housing. Note the position of roll pin (205) inside of case.

## DRIVE SHAFT GROUP

1. Remove the drive key (303), if used and the drive shaft bearing retainer ring (305).
2. Grasp outboard end of drive shaft (301) and pull it out of the pump housing.
3. Remove the shaft seal retainer (302) and shaft seal (007) from the housing only if necessary.

## SWASHBLOCK GROUP

1. Reach inside the housing and remove the swashblock (201) and saddle bearings (204).
2. If applicable, remove the saddle block (216) from the housing.

## INSPECTION

Clean all parts thoroughly and allow them to dry. Inspect all seals and O-rings for hardening, cracking or deterioration. Replace if necessary or if you suspect damage. Check all locating pins for damage and springs for cracking or signs of cracking or signs of wear.

### **⚠ WARNING**

Wear proper protective gear when using solvents or compressed air, servicing or maintaining the hydraulic system or the Oilgear pump. Wear correct protective gear, safety glasses, gloves and safety shoes. Serious injury can result without proper protective gear.

## CONTROL GROUP

Refer to the reference material on pump controls. Be sure to carefully check the control pin for cracks and/or signs of fatigue. Check fit of the pin in the swashblock. It should be a slip-fit without side-play. Replace if necessary or if you suspect damage.

## VALVE PLATE GROUP

Inspect the valve plate (401) surface which mates with the cylinder barrel (101) for excessive wear or scoring. Remove minor defects by lightly stoning the surface with a hard stone which is flat to within 0.001 inches (0,025 mm).

**NOTE** *Be sure to stone lightly. Any excessive stoning will remove the hardened surface. If wear or damage is extensive, replace the valve plate.*

## ROTATING GROUP

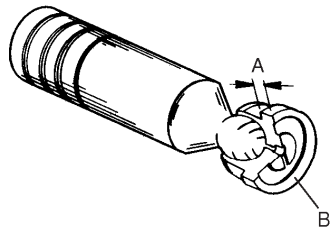
Inspect cylinder barrel (101) piston bores and the face which mate with the valve plate for wear and scoring. Remove minor defects on the face by lightly stoning or lapping the surface.

Inspect the cylinder bearing (202) for damage and replace if necessary. Check all piston and shoe assemblies (102) to be sure they ride properly on the swashblock.

**NOTE** *Be sure to stone lightly. Any excessive stoning will remove the hardened surface. If wear or damage is extensive and defects cannot be removed, replace the cylinder barrel.*

See **Figure 7**. Check each shoe face for nicks and scratches, and the shoe for smooth pivot action on the piston.

**NOTE** *If one or more piston/shoe assembly needs to be replaced, replace all the piston/shoe assemblies. When installing new piston/shoe assemblies or the rotating group, make sure the pistons move freely in their respective bores.*



**Figure 7. Piston and Shoe Inspection**

- (A) All shoes must be equal within 0.001 inches (0,025 mm) at this dimension.
- (B) All shoe faces must be free of nicks.

**NOTE** *End play should not to exceed 0.003 inches (0,076 mm) when new or 0.006 inches (0,152 mm) when worn.*

## SWASHBLOCK GROUP

Inspect the swashblock (201) for wear and scoring. If defects are minor, stone the swashblock lightly. If damage is extensive, replace the swashblock.

Check the small hole in the face of the swashblock. The hole provides "porting" for the hydrostatic balance fluid of the piston/shoe assembly to be channeled through the swashblock to the face of the saddle bearing, providing pressure lubrication.

Compare the saddle bearing (204) thickness in a worn area to thickness in an unworn area. Replace saddle bearings if the difference is greater than 0.015 inches (0,4 mm).

Check the mating surface of swashblock for cracks or excessive wear. The swashblock movement in the saddle bearings must be smooth. Replace if necessary.

**NOTE** *Be sure to stone lightly. Any excessive stoning will remove the hardened surface. If wear or damage is extensive and defects cannot be removed, replace if necessary or if you suspect them of being bad.*

## DRIVE SHAFT GROUP

Check:

- the shaft seal (007) for deterioration or cracks. Replace if necessary (push-out).
- the shaft bearing (306) for galling, pitting, binding or roughness.
- the rear shaft bushing in valve plate.
- the shaft and its splines for wear. Replace any parts necessary.
- for grooving of the shaft where the shaft seal contacts it.

## ASSEMBLY

See **Figures 8, 9 and 10**. Follow the disassembly procedures in reverse for re-assembling the pump.

During assembly, install new seals and O-rings. Apply a thin film of CLEAN grease or hydraulic fluid to sealing components to ease assembly. If a new rotating group is used, lubricate thoroughly with CLEAN hydraulic fluid. Apply fluid generously to all wear surfaces.

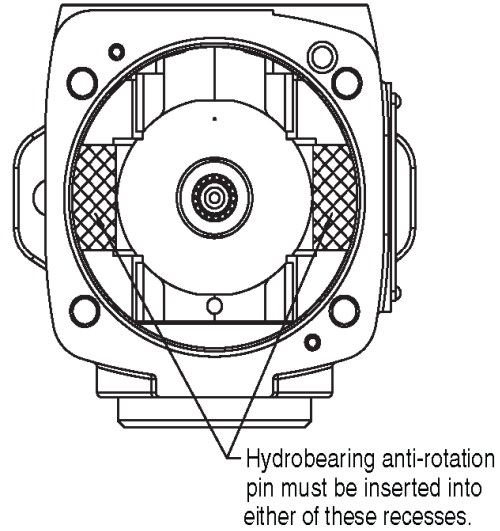
### SWASHBLOCK GROUP

If removed,

1. Press shaft seal (**007**) into front of pump housing.
2. Place housing on a bench with the mounting flange side down.
3. If applicable, install the saddle block (**216**) into the housing. Make sure the anti-rotating pin (**217**) aligns the saddle block correctly.
4. Grease the back side of each saddle bearing (**204**) and place on the pin to locate the bearings in the pump case. Make sure the pins do not protrude.
5. Insert swashblock (**201**) into the pump housing. Once in place, be sure the swashblock swivels in the saddle bearings. With new bearings, swiveling may be stiff and not always smooth.
6. Make sure the roll pin (**205**) is inserted into the cylinder bearing (**202**). Position the cylinder bearing so the pin is located at the same location as it was when the pump was disassembled. The bearing should fit into place with a little difficulty and be square to the axis of the pump.
7. Tap bearing into place if necessary using extreme care not to damage the bearing.
8. Insert retaining ring (**208**) to hold bearing in place.

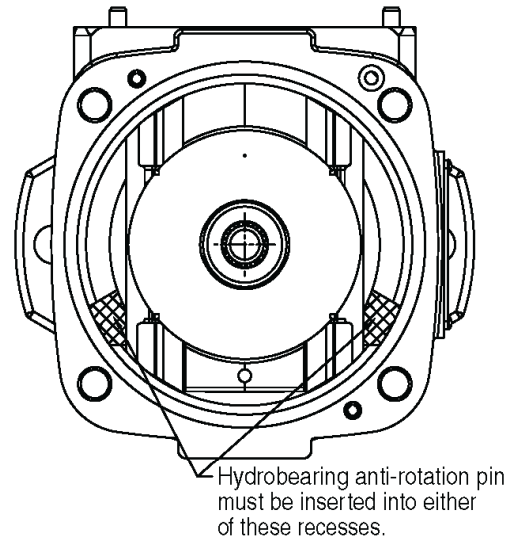
#### NOTE

Refer to **Figure 8** and **Figure 9** for the correct orientation of the pins for the appropriate frame size.



OILG0305

**Figure 8. A-Frame Orientation of Pins**



OILG0306

**Figure 9. B-Frame and C-Frame Orientation of Pins**

## DRIVE SHAFT GROUP

1. Place the housing on its side with the axis horizontal.
2. Install the seal retainer (302).
3. Lubricate the shaft seal (007) and shaft.
4. Insert the drive shaft (301) and bearing assembly into the housing.
5. Lock in place with the drive shaft bearing retainer ring (305).

## ROTATING GROUP

See Figure 6.

1. Place the cylinder barrel (101), wear surface down, on a clean cloth.
2. Place the shoe retainer spring (105) in the center of the barrel with the fulcrum ball (103) on top of it.
3. Insert the identified pistons (102) into their corresponding identified holes of the shoe retainer (104). As a unit, fit the pistons into their corresponding, identified bores in the cylinder barrel. **DO NOT FORCE**. If everything is aligned properly, the pistons will fit smoothly.

### **WARNING**

The rotating group weight may be heavy. Be careful not to damage cylinder wear surface which mates against the valve plate, bearing diameters or piston shoes. Use proper lifting techniques and assistance from others to prevent personal injury.

The rotating group can now be carefully installed over the tail of the drive shaft (301) and into the pump housing (001).

#### **NOTE**

*When installing the rotating group, support the weight of the cylinder barrel (101), as cylinder spline is passed over the tailshaft, to avoid scratching or damage.*

4. Push cylinder forward until the cylinder spline reaches the drive shaft spline and rotate slightly to engage shaft splines. Continue to slide cylinder forward until it encounters the cylinder bearing (202). Lifting the tailshaft slightly helps the cylinder (101) and the cylinder bearing (202) engagement. Continue pushing the cylinder forward until the piston shoes contact the swashblock. The back of the

cylinder should slightly protrude outside the back of the pump housing.

5. Install and torque the four control screws to the appropriate value shown in Table 5.

## RELIEF VALVE BLOCK

1. Install new O-rings on the relief block.
2. Position the relief valve block over the outlet port of the valve plate.
3. Install and torque the four screws to the appropriate value shown in Table 5.

## VALVE PLATE GROUP

1. Place the partially assembled pump housing on a bench with the open end facing up.
2. Install new O-rings on the housing.
3. Position the valve plate (401) over the tailshaft and on pins (005) and housing.
4. Install and torque the four valve plate screws to the appropriate value shown in Table 5.
5. If any plugs were removed, reinstall and torque them to the appropriate value shown in Table 5.

## CONTROL GROUP

1. Place the assembled pump on its side with the axis horizontal.
2. Install new O-rings on the housing.
3. Install the control pin into the swashblock.
4. Position the control assembly so the control pin fits into the annular slot of the control piston.
5. Assemble the control assembly to the pump assembly, making sure that both alignment pins (006) are correctly inserted into their respective holes of the control body.

#### **NOTE**

*It may be necessary to mechanically position the control piston to correctly align the control on the pump.*

## PVWJ PUMP TORQUES

|   | Item Number | Description                                       | Head Type & Size                           | Tightening Torque    |
|---|-------------|---|--|----------------------|
| A-Frame<br>PVWJ-011<br>PVWJ-014<br>PVWJ-022             | 002         | Housing Plug                                      | 3/4" Internal Hex                          | 100 ft-lbs (136 N·m) |
|   | 403         | Valve Plate Screws                                | 3/8" Internal Hex or<br>9/16" External Hex | 15 ft-lbs (20 N·m)   |
|   | 507         | Tandem Cover Screws                               | 1/2" Internal Hex                          | 325 in.-lbs (5 N·m)  |
|   | 601         | SAE #2 Plug                                       | 1/8" Internal Hex                          | 45 in.-lbs (5 N·m)   |
|   | 626         | SAE #10 Plug                                      | 1" External Hex                            | 90 ft-lbs (122 N·m)  |
| B-Frame<br>PVWJ-025<br>PVWJ-034<br>PVWJ-046             | 403         | Valve Plate Screws                                | 3/4" External Hex                          | 37 in.-lbs (50 N·m)  |
|   | 405         | SAE #2 Plug                                       | 1/8" Internal Hex                          | 45 in.-lbs (5 N·m)   |
|   | 503         | SAE A Tandem Mounting Screws                      | 9/16" External Hex                         | 28 ft-lbs (38 N·m)   |
|   |             | SAE B Tandem Mounting Screws                      | 3/4" External Hex                          | 37 ft-lbs (50 N·m)   |
|   | 507         | Cover Plate or Adapter Screws                     | 1/2" External Hex                          | 325 in.-lbs (37 N·m) |
|   | 902         | Relief Valve Block Screws                         | 3/8" Internal Hex                          | 44 ft-lbs (60 N·m)   |
| C-Frame<br>PVWJ-064<br>PVWJ-076<br>PVWJ-098<br>PVWJ-130 | 403         | Valve Plate Screws                                | 14 mm Internal Hex                         | 56 ft-lbs (76 N·m)   |
|   | 503         | SAE A Tandem Mounting Screws                      | 9/16" External Hex                         | 28 ft-lbs (38 N·m)   |
|   |             | SAE B Tandem Mounting Screws                      | 3/4" External Hex                          | 37 ft-lbs (50 N·m)   |
|   |             | SAE C Tandem Mounting Screws                      | 15/16" External Hex                        | 74 ft-lbs (100 N·m)  |
|   | 507         | Cover Plate Screws                                | 1/2" External Hex                          | 325 in.-lbs (37 N·m) |
|   |             | Adapter Screws                                    | 9/16" External Hex                         | 28 ft-lbs (38 N·m)   |
|   | 601         | SAE #2 Plug                                       | 1/8" Internal Hex                          | 45 in.-lbs (5 N·m)   |
|   | 902         | Relief Valve Block Screws<br>(PVWH-076/-098/-130) | 3/8" Internal Hex                          | 68 ft-lbs (92 N·m)   |
|   |             | Relief Valve Block Screws<br>(PVWH-064)           | 1/2" Internal Hex                          | 138 ft-lbs (187 N·m) |

**Table 5. PVWJ Pump Assembly Torques**

---

## CONTROL O-RING SEALS

| Item Number | ARP 568 Uniform Size Number | Shore A Durometer |
|-------------|-----------------------------|-------------------|
| 1008        | 008                         | 70                |
| 1010        | 010                         | 90                |
| 1012        | 012                         | 90                |
| 1042        | 042                         | 70                |
| 1138        | 138                         | 70                |
| 1145        | 145                         | 70                |
| 1155        | 155                         | 70                |
| 1159        | 159                         | 70                |
| 1219        | 219                         | 90                |
| 1222        | 222                         | 90                |
| 1225        | 225                         | 90                |
| 1228        | 228                         | 90                |
| 1237        | 237                         | 70                |
| 1242        | 242                         | 70                |
| 1252        | 252                         | 70                |
| 1257        | 257                         | 70                |
| 1500        | See note 1                  | 80                |
| 1902        | 902                         | 90                |
| 1910        | 910                         | 90                |

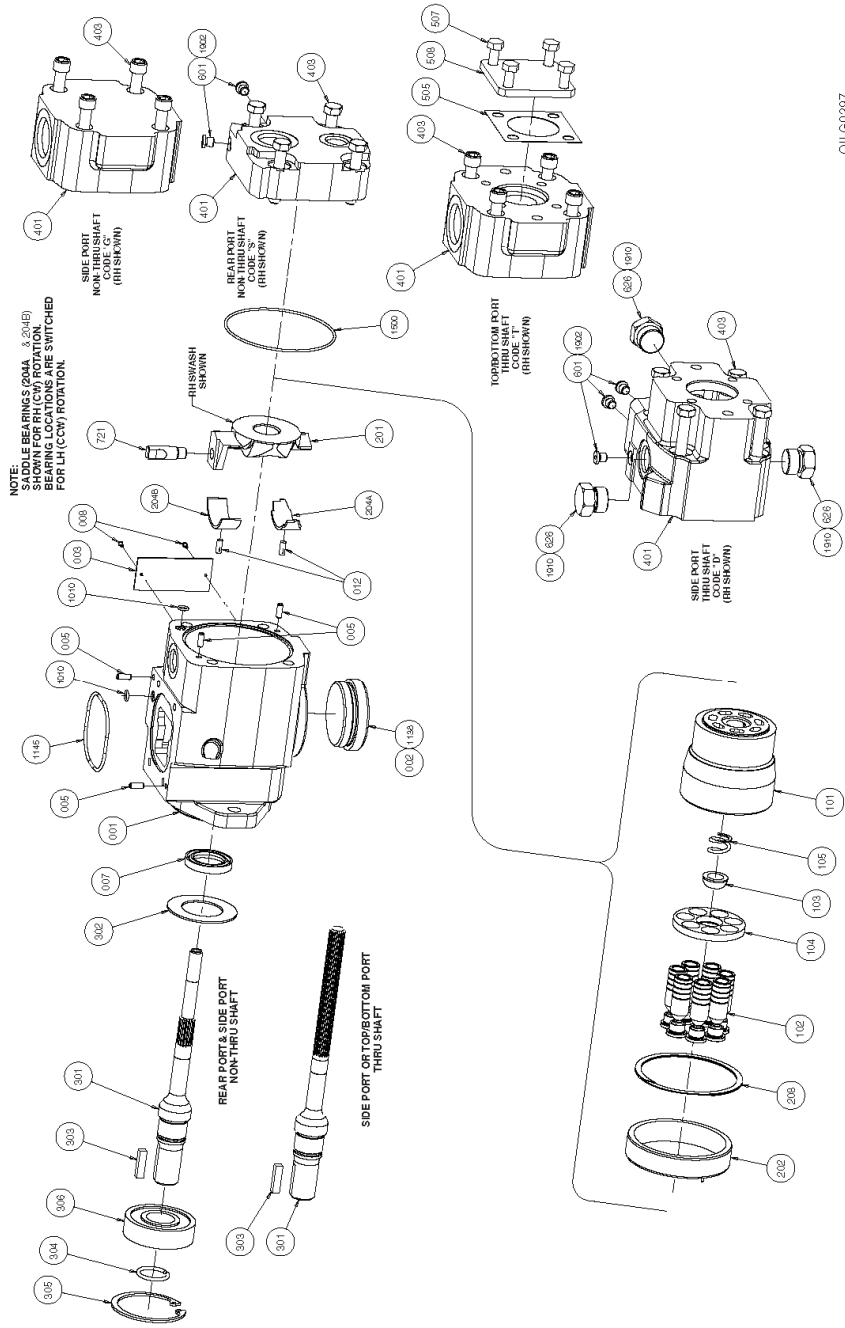
Note 1. 94 mm OD x 2.5 mm

**Table 6. PVWJ Pump O-Ring Seals**





# PVWJ-011/-014/-022 A-Frame



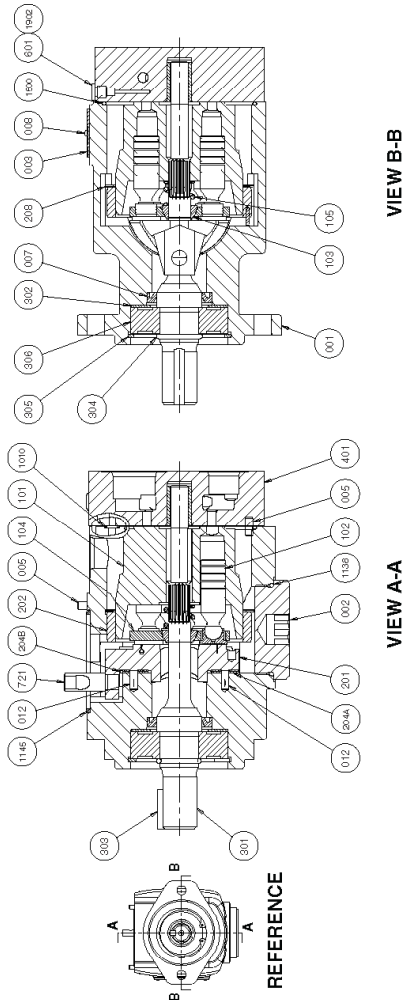


Figure 11. Cross section and plan view parts drawing, PVWJ-011/-014/-022 A-Frame (520024-101 sheet 1 of 4).

**PVWJ-011/-014/-022 A-FRAME PUMP PARTS LIST**

Parts used in these assemblies are per Oilgear specifications. Use only Oilgear parts to ensure compatibility with assembly requirements. When ordering replacement parts, be sure to include pump type and item serial number, bulletin number and item number. Specify type of hydraulic fluid to ensure seal and packing compatibility.

**NOTE** Parts drawings may not be identical to Oilgear drawings referenced.

| Item                          | Qty. | Description  |
|-------------------------------|------|--------------|
| <b>HOUSING ASSEMBLY GROUP</b> |      |              |
| 001                           | 1    | Pump Housing |
| 002                           | 1    | Plug         |
| 003                           | 1    | Name Tag     |
| 005                           | 4    | Roll Pin     |
| 007                           | 1    | Shaft Seal   |

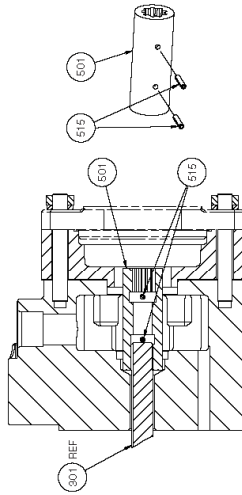
|                                  |   |                                |
|----------------------------------|---|--------------------------------|
| 008                              | 2 | Drive Screws                   |
| 012                              | 2 | Saddle Bearing Locating Pin    |
| 1010                             | 2 | O-Ring                         |
| 1138                             | 1 | O-Ring                         |
| 1145                             | 1 | O-Ring                         |
| 1500                             | 1 | O-Ring                         |
| <b>ROTARY ASSEMBLY GROUP</b>     |   |                                |
| 101                              | 1 | Barrel                         |
| 102                              | 7 | Piston & Shoe Assembly         |
| 103                              | 1 | Fulcrum Ball                   |
| 104                              | 1 | Shoe Retainer                  |
| 105                              | 1 | Shoe Retainer Spring           |
| <b>SWASHBLOCK ASSEMBLY GROUP</b> |   |                                |
| 201                              | 1 | Swashblock                     |
| 202                              | 1 | Hydrodynamic Bearing           |
| 204A                             | 1 | Saddle Bearing (pressure side) |
| 204B                             | 1 | Saddle Bearing (suction side)  |
| 208                              | 1 | Retaining Flng                 |
| 721                              | 1 | Control Pin                    |

|                                   |        |                             |
|-----------------------------------|--------|-----------------------------|
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |        |                             |
| 301                               | 1      | Drive Shaft                 |
| 302                               | 1      | Seal Retainer               |
| 303                               | 1      | Key                         |
| 304                               | 1      | Shaft Retainer Ring         |
| 305                               | 1      | Shaft Bearing Retainer Ring |
| 306                               | 1      | Front Drive Shaft Bearing   |
| <b>VALVE PLATE ASSEMBLY GROUP</b> |        |                             |
| 401                               | 1      | Valve Plate                 |
| 403                               | 4      | Screw                       |
| 601                               | Note 1 | Plug                        |
| 626                               | Note 1 | Plug                        |
| 1902                              | Note 1 | O-Ring                      |
| 1910                              | Note 1 | O-Ring                      |
| <b>COVER PLATE PARTS</b>          |        |                             |
| 505                               | 1      | Gasket                      |
| 507                               | 4      | Screw                       |
| 508                               | 1      | Cover Plate                 |

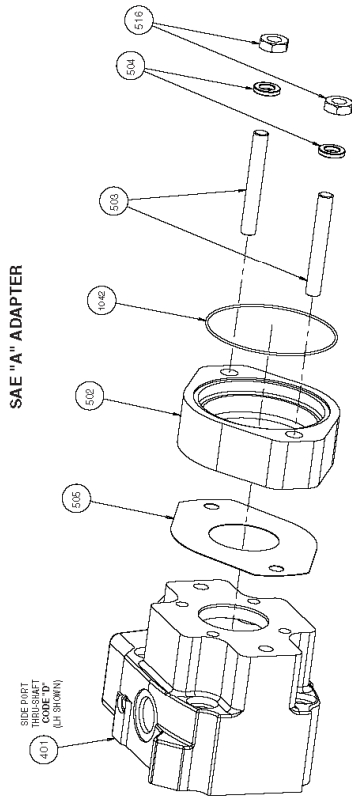
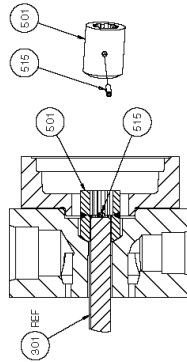
**Note 1.** Qty is 0, 1, 2 or 3 dependent on Valve Plate type.

THRU-SHAFT COUPLINGS

CODE "D" ASSEMBLY (TOP VIEW)  
SHOWING L51447-508 COUPLING



CODE "T" ASSEMBLY (SIDE VIEW)  
SHOWING L51447-508 COUPLING



SAE "A" ADAPTER

OILG0298

Figure 12. Exploded parts drawing, PVWJ-011/-014/-022 A-Frame, Thru-Shaft Couplings and SAE "A" Adapter (520024-101 sheet 3 of 4).

| Item                              | Qty. | Description |
|-----------------------------------|------|-------------|
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |      |             |
| 301                               | 1    | Drive Shaft |
| <b>VALVE PLATE ASSEMBLY GROUP</b> |      |             |
| 401                               | 1    | Valve Plate |

| <b>DUAL PUMP ADAPTER PARTS</b> |   |          |
|--------------------------------|---|----------|
| 501                            | 1 | Coupling |
| 502                            | 1 | Adapter  |
| 503                            | 2 | Stud     |
| 504                            | 2 | Washer   |
| 505                            | 1 | Gasket   |
| 515                            | 1 | Roll Pin |
| 516                            | 2 | Hex Nut  |
| 1042                           | 1 | O-Ring   |

Document Number: 520024-SK1  
 Revision: New

Reference 520024-101  
 SERVICE KIT Drawings figures 10-12

**SERVICE KITS**  
 PVWJ A-Frame Units (PVWJ-011/-014/-022)

| Description  | Kit No.    | Design Series | Items Included (quantity is 1 unless noted) |
|--|------------|---------------|---|
| <b>Housing Kits</b>                                    |            |               |   |
| All Models   | L51116-30  | A1            | 001, 005(4), 007, 012, 1010(2), 1145, 1500  |
| <b>Rotating Group Bearing Kit</b>                      |            |               |   |
| All Models   | L51203-1   | A1            | 202, 208                                    |
| <b>Shaft &amp; Bearing Kits</b>                        |            |               |   |
| Kits for Non Thru-Shaft Models                         |            |               |   |
| 3/4" Dia. Keyed (Code "Y")                             | L51128-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 7/8" Dia. Keyed (Code "B")                             | L51128-15  | A1            | 301, 302, 303, 304, 305, 306                |
| 5/8" 9T SAE Spline (Code "S")                          | L51128-13  | A1            | 301, 302, 304, 305, 306                     |
| 7/8" 13T Industrial Spline (Code "C")                  | L51128-17  | A1            | 301, 302, 304, 305, 306                     |
| Kits for Thru-Shaft Models with Code "DA" Valve Plates |            |               |   |
| 3/4" Dia. Keyed (Code "Y")                             | L51518-11A | A1            | 301, 302, 303, 304, 305, 306                |
| 7/8" Dia. Keyed (Code "B")                             | L51518-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 5/8" 9T SAE Spline (Code "S")                          | L51518-10  | A1            | 301, 302, 304, 305, 306                     |
| 5/8" 9T Industrial Spline (Code "D")                   | L51518-12Z | A1            | 301, 302, 304, 305, 306                     |
| 7/8" 13T Industrial Spline (Code "C")                  | L51518-12  | A1            | 301, 302, 304, 305, 306                     |
| Kits for Thru-Shaft Models with Code "TA" Valve Plates |            |               |   |
| 3/4" Dia. Keyed (Code "Y")                             | L51518-33A | A1            | 301, 302, 303, 304, 305, 306                |
| 7/8" Dia. Keyed (Code "B")                             | L51518-39A | A1            | 301, 302, 303, 304, 305, 306                |
| 5/8" 9T SAE Spline (Code "S")                          | L51518-35A | A1            | 301, 302, 304, 305, 306                     |
| 5/8" 9T Industrial Spline (Code "D")                   | L51518-37A | A1            | 301, 302, 304, 305, 306                     |
| 7/8" 13T Industrial Spline (Code "C")                  | L51518-57  | A1            | 301, 302, 304, 305, 306                     |
| <b>Swashblock Kits</b>                                 |            |               |   |
| LH (CCW) Models  | L50488-3   | A1            | 201, 721                                    |
| RH (CW) Models   | L50488-5   | A1            | 201, 721                                    |
| <b>Rotating Group Kits</b>                             |            |               |   |
| PVWJ-011   | L50052-8   | A1            | 101, 102(7), 103, 104, 105                  |
| PVWJ-014   | L50052-7   | A1            | 101, 102(7), 103, 104, 105                  |
| PVWJ-022   | L50053-7   | A1            | 101, 102(7), 103, 104, 105                  |
| <b>Saddle Bearing Kit</b>                              |            |               |   |
| All Models   | L51053-4   | A1            | 204A, 204B                                  |

| Valve Plate Kits                             |            |    |   |  |
|--|------------|----|---|--|
| <b>PVWJ-011</b>                              |            |    |   |  |
| LH Rear Port (Code "SA")                     | K51101-500 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| RH Rear Port (Code "SA")                     | K51101-501 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| LH Side Port, Non Thru-Shaft (Code "GA")     | K51101-502 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| RH Side Port, Non Thru-Shaft (Code "GA")     | K51101-503 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Side Port, Thru-Shaft (Code "DA")         | K51101-504 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(3) |  |
| RH Side Port, Thru-Shaft (Code "DA")         | K51101-505 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(3) |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-506 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-507 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| <b>PVWJ-014</b>                              |            |    |   |  |
| LH Rear Port (Code "SA")                     | K51101-508 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| RH Rear Port (Code "SA")                     | K51101-509 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| LH Side Port, Non Thru-Shaft (Code "GA")     | K51101-510 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| RH Side Port, Non Thru-Shaft (Code "GA")     | K51101-511 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Side Port, Thru-Shaft (Code "DA")         | K51101-512 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(3) |  |
| RH Side Port, Thru-Shaft (Code "DA")         | K51101-513 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(3) |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-514 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-515 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| <b>PVWJ-022</b>                              |            |    |   |  |
| LH Rear Port (Code "SA")                     | K51101-516 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| RH Rear Port (Code "SA")                     | K51101-517 | A1 | 401, 403(4), 601(2), 1010, 1500, 1902(2)                  |  |
| LH Side Port, Non Thru-Shaft (Code "GA")     | K51101-518 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| RH Side Port, Non Thru-Shaft (Code "GA")     | K51101-519 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Side Port, Thru-Shaft (Code "DA")         | K51101-520 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(2) |  |
| RH Side Port, Thru-Shaft (Code "DA")         | K51101-521 | A1 | 401, 403(4), 601(2), 626(3), 1010, 1500, 1902(2), 1910(3) |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-522 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| LH Top/Bottom Port, Thru-Shaft (Code "TA")   | K51101-523 | A1 | 401, 403(4), 650(2), 1010, 1500                           |  |
| <b>Pump Seal Kit</b>                         |            |    |   |  |
| All models                                   | L50824-24  | A1 | 007, 1010(2), 1138, 1145, 1500, 1902(3), 1910(3)          |  |
| <b>Piston &amp; Shoe Kits</b>                |            |    |   |  |
| PVWJ-011                                     | L51363-900 | A1 | 102(7)  |  |
| PVWJ-014                                     | L50021-900 | A1 | 102(7)  |  |
| PVWJ-022                                     | L50021-901 | A1 | 102(7)  |  |
| <b>Shoe Retainer &amp; Holddown Ball Kit</b> |            |    |   |  |
| All models                                   | L50019     | A1 | 103, 104  |  |
| <b>Tag Kit</b>                               |            |    |   |  |
| All models                                   | L50921     | A1 | 003, 008(2)   |  |

|  |            |    |  |  |  |
|--|------------|----|--|--|--|
| <b>Control Pin</b>                     |            |    |  |  |  |
| All models                             | 50623-5    | A1 | 721  |  |  |
| <b>Cover Plate Kit</b>                 |            |    |  |  |  |
| All models                             | L50671     | A1 | 505, 507(4), 508                                   |  |  |
| <b>Coupling &amp; A dapter Kits</b>    |            |    |  |  |  |
| All models using code "DA" Valve Plate | L51081-48  | A1 | 501, 502, 503(2), 504(2), 505, 506, 515(2), 516(2) |  |  |
| All models using code "TA" Valve Plate | L51081-113 | A1 | 501, 502, 503(2), 504(2), 505, 506, 515, 516(2)    |  |  |

PVWJ-025/-034/-046 B-Frame

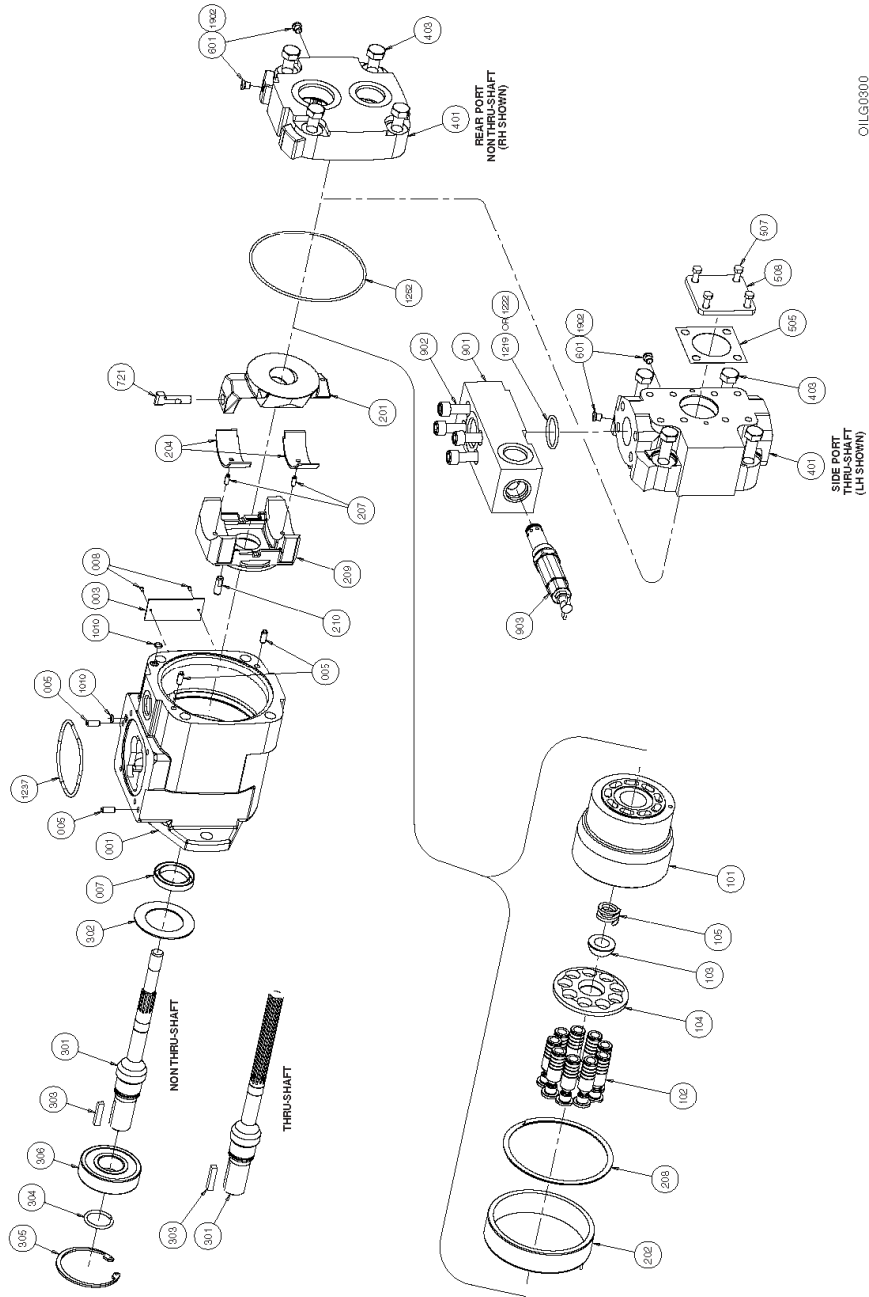
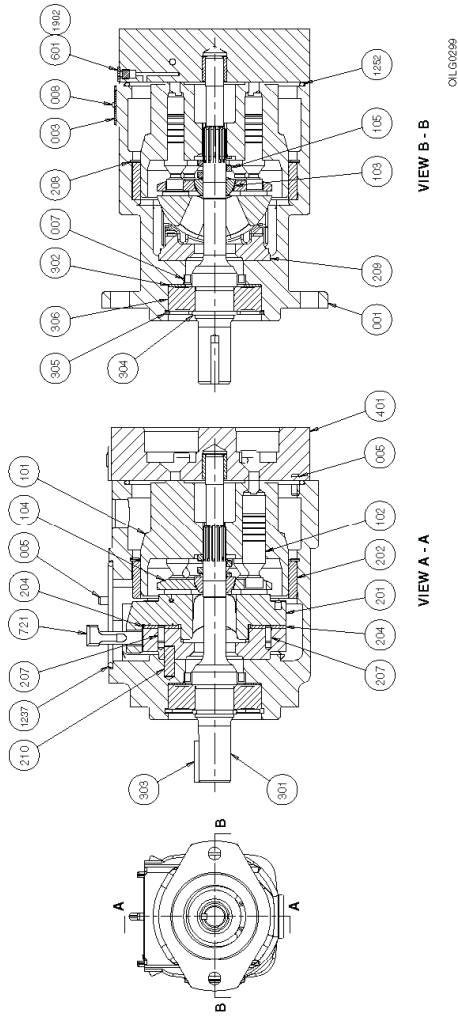


Figure 13. Exploded parts drawing, PVWJ-025/-034/-046 B-Frame (520024-201 sheet 2 of 4).





OLG0299

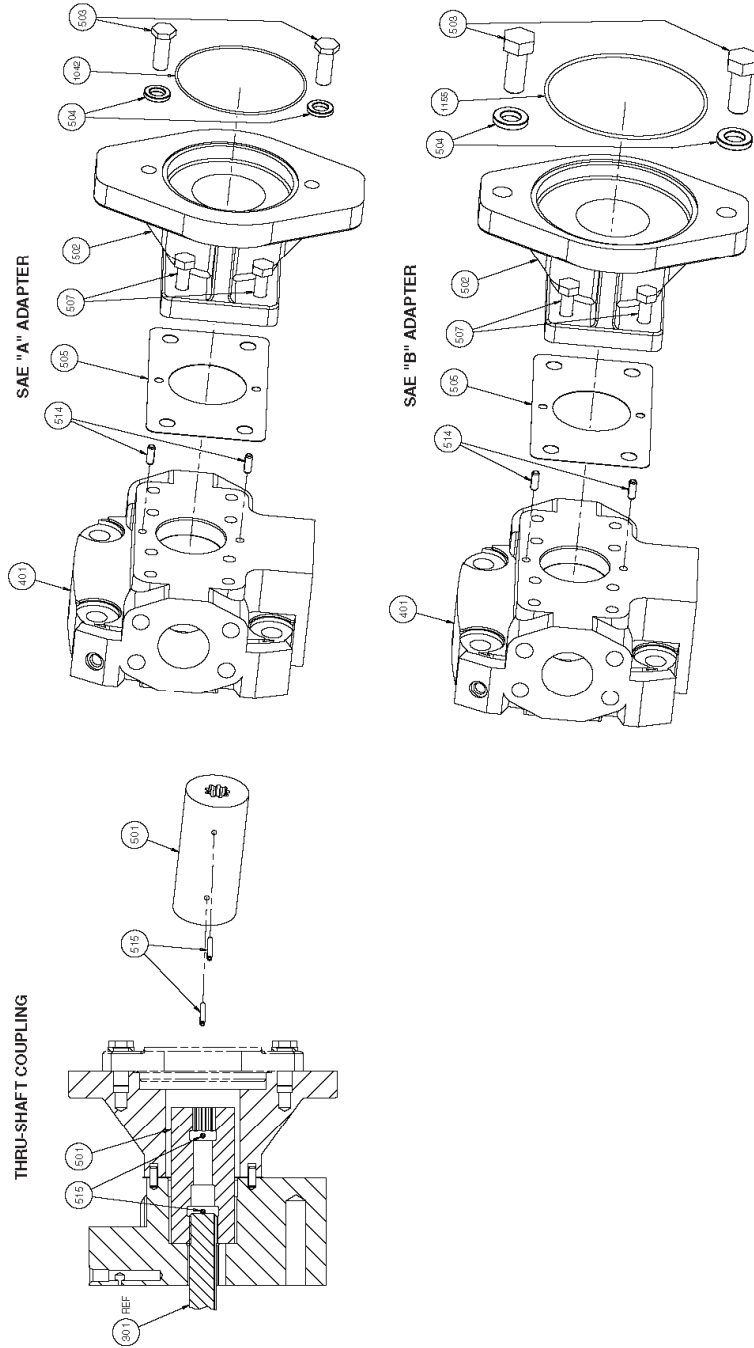
Figure 14. Cross section and plan view parts drawing, PVWJ-025/-034/-046 B-Frame (520024-201 sheet 1 of 4).

**PVWJ-025/-034/-046 B-FRAME PUMP PARTS LIST**

| Item                          | Qty. | Description            |
|-------------------------------|------|------------------------|
| <b>HOUSING ASSEMBLY GROUP</b> |      |                        |
| 001                           | 1    | Pump Housing           |
| 003                           | 1    | Name Tag               |
| 005                           | 4    | Roll Pin               |
| 007                           | 1    | Shaft Seal             |
| 008                           | 2    | Drive Screws           |
| 1010                          | 2    | O-Ring                 |
| 1237                          | 1    | O-Ring                 |
| 1252                          | 1    | O-Ring                 |
| <b>ROTARY ASSEMBLY GROUP</b>  |      |                        |
| 101                           | 1    | Barrel                 |
| 102                           | 9    | Piston & Shoe Assembly |
| 103                           | 1    | Fulcrum Ball           |
| 104                           | 1    | Shoe Retainer          |
| 105                           | 1    | Shoe Retainer Spring   |

| <b>SWASHBLOCK ASSEMBLY GROUP</b>  |   |                             |
|-----------------------------------|---|-----------------------------|
| 201                               | 1 | Swashblock                  |
| 202                               | 1 | Hydrodynamic Bearing        |
| 204                               | 2 | Saddle Bearing              |
| 207                               | 2 | Saddle Bearing Locating Pin |
| 208                               | 1 | Retaining Ring              |
| 209                               | 1 | Saddle Block                |
| 210                               | 1 | Saddle Block Locating Ring  |
| 721                               | 1 | Control Pin                 |
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |   |                             |
| 301                               | 1 | Drive Shaft                 |
| 302                               | 1 | Seal Retainer               |
| 303                               | 1 | Key                         |
| 304                               | 1 | Shaft Retainer Ring         |
| 305                               | 1 | Shaft Bearing Retainer Ring |
| 306                               | 1 | Front Drive Shaft Bearing   |
| <b>VALVE PLATE ASSEMBLY GROUP</b> |   |                             |
| 401                               | 1 | Valve Plate                 |
| 403                               | 4 | Screw                       |
| 601                               | 2 | Plug                        |
| 1902                              | 2 | O-Ring                      |

| <b>COVER PLATE PARTS</b>                    |   |                        |
|---|---|------------------------|
| 505   | 1 | Gasket                 |
| 507   | 4 | Screw                  |
| 508   | 1 | Cover Plate            |
| <b>RELIEF VALVE ASSEMBLY GROUP-OPTIONAL</b> |   |                        |
| 901   | 1 | Block                  |
| 902   | 1 | Screw                  |
| 903   | 1 | Relief Valve Cartridge |
| 1219  | 1 | O-Ring (PVWJ-025)      |
| 1222  | 1 | O-Ring (PVWJ-034/-046) |



OILG0301

Figure 15. Exploded parts drawing, PVWJ-025/-034/-046 B-Frame, Thru-Shaft Coupling, SAE "A" and SAE "B" Adapter (520024-201 sheet 3 of 4).

| Item                              | Qty. | Description |
|-----------------------------------|------|-------------|
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |      |             |
| 301                               | 1    | Drive Shaft |
| <b>VALVE PLATE ASSEMBLY GROUP</b> |      |             |
| 401                               | 1    | Valve Plate |

| <b>DUAL PUMP ADAPTER PARTS</b> |   |          |
|--------------------------------|---|----------|
| 501                            | 1 | Coupling |
| 502                            | 1 | Adapter  |
| 503                            | 2 | Screw    |
| 504                            | 2 | Washer   |
| 505                            | 1 | Gasket   |

|      |   |          |
|------|---|----------|
| 507  | 4 | Screw    |
| 514  | 1 | Roll Pin |
| 515  | 1 | Roll Pin |
| 1042 | 1 | O-Ring   |
| 1155 | 1 | O-Ring   |

Document Number: 520024-SK2  
 Revision: New

Reference 520024-201  
 SERVICE KIT Drawings figures 13-15

**SERVICE KITS**  
 PVWJ B-Frame Units (PVWJ-025/-034/-046)

| Description                           | Kit No.    | Design Series | Items Included (quantity is 1 unless noted) |
|---------------------------------------|------------|---------------|---|
| <b>Housing Kits</b>                   |            |               |   |
| All Models                            | K51121-101 | A1            | 001, 005(4), 007, 1010(2), 1237, 1252       |
| <b>Rotating Group Bearing Kit</b>     |            |               |   |
| All Models                            | L51065-1   | A1            | 202, 208                                    |
| <b>Shaft &amp; Bearing Kits</b>       |            |               |   |
| PVWJ-025/-034/-046                    |            |               |   |
| 7/8" Dia. Keyed (Code Y)              | L51129-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 1" Dia. Keyed (Code B)                | L51129-15  | A1            | 301, 302, 303, 304, 305, 306                |
| 7/8" 13T Spline (Code S)              | L51129-13  | A1            | 301, 302, 304, 305, 306                     |
| 1" 15T Spline (Code C)                | L51129-17  | A1            | 301, 302, 304, 305, 306                     |
| 7/8" 13T Spline (Code D) (Industrial) | L51129-39Z | A1            | 301, 302, 304, 305, 306                     |
| 7/8" Dia. Keyed (Code Y)              | L51519-11A | A1            | 301, 302, 303, 304, 305, 306                |
| 1" Dia. Keyed (Code B)                | L51519-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 7/8" 13T Spline (Code S)(SAE)         | L51519-10  | A1            | 301, 302, 304, 305, 306                     |
| 7/8" 13T Spline (Code D) (Industrial) | L51519-12Z | A1            | 301, 302, 304, 305, 306                     |
| <b>Swashblock Kits</b>                |            |               |   |
| LH (CW) Models                        | L50480-1   | A1            | 201, 721                                    |
| RH (CW) Models                        | L50480-2   | A1            | 201, 721                                    |
| <b>Saddle Bearing Kit</b>             |            |               |   |
| All models                            | L51053-5   | A1            | 204(2)                                      |
| <b>Rotating Group Kits</b>            |            |               |   |
| PVWJ-025                              | L50167-10  | A1            | 101, 102(9), 103, 104, 105                  |
| PVWJ-034                              | L50167-7   | A1            | 101, 102(9), 103, 104, 105                  |
| PVWJ-046                              | L50168-7   | A1            | 101, 102(9), 103, 104, 105                  |

PVWJ-064/-076/-098/-130 B-Frame

|  |  |            |    |   |  |  |  |
|--|--|------------|----|---|--|--|--|
| <b>Saddle Kit</b>                            |  |            |    |   |  |  |  |
| All models                                   |  | L51052-7   | A1 | 204(2), 207(2), 209   |  |  |  |
| <b>Valve Plate Kits</b>                      |  |            |    |   |  |  |  |
| <b>PVWJ-025</b>                              |  |            |    |   |  |  |  |
| LH Rear Port (Code "SA")                     |  | K51102-201 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Rear Port (Code "SA")                     |  | K51102-202 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| LH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-203 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-204 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| <b>PVWJ-034</b>                              |  |            |    |   |  |  |  |
| LH Rear Port (Code "SA")                     |  | K51102-205 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Rear Port (Code "SA")                     |  | K51102-206 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| LH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-207 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-208 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| <b>PVWJ-046</b>                              |  |            |    |   |  |  |  |
| LH Rear Port (Code "SA")                     |  | K51102-209 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Rear Port (Code "SA")                     |  | K51102-210 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| LH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-211 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| RH Side Port, Thru-Shaft (Code "DF" & "DR")  |  | K51102-212 | A1 | 401, 403(4), 601(2), 1010, 1252, 1902(2)                    |  |  |  |
| <b>Pump Seal Kit</b>                         |  |            |    |   |  |  |  |
| All models                                   |  | K50825-200 | A1 | 007, 1010(2), 1237, 1252, 1902(2)                           |  |  |  |
| <b>Piston &amp; Shoe Kits</b>                |  |            |    |   |  |  |  |
| PVWJ-025                                     |  | L51349-900 | A1 | 102(9)  |  |  |  |
| PVWJ-034                                     |  | L50146-900 | A1 | 102(9)  |  |  |  |
| PVWJ-046                                     |  | L50175-900 | A1 | 102(9)  |  |  |  |
| <b>Shoe Retainer &amp; Holddown Ball Kit</b> |  |            |    |   |  |  |  |
| All models                                   |  | L50132     | A1 | 103, 104  |  |  |  |
| <b>Tag Kit</b>                               |  |            |    |   |  |  |  |
| All models                                   |  | L50921     | A1 | 003, 008(2)   |  |  |  |
| <b>Control Pin</b>                           |  |            |    |   |  |  |  |
| All models                                   |  | 51339-5    | A1 | 721   |  |  |  |
| <b>Cover Plate Kit</b>                       |  |            |    |   |  |  |  |
| All models                                   |  | L50671     | A1 | 505, 507(4), 508  |  |  |  |
| <b>Coupling &amp; Adapter Kits</b>           |  |            |    |   |  |  |  |
| SAE A Adapter                                |  | L51081-53  | A1 | 501, 502, 503(2), 504(2), 505, 507(4), 514(2), 515(2), 1042 |  |  |  |
| SAE B Adapter                                |  | L51081-43  | A1 | 501, 502, 503(2), 504(2), 505, 507(4), 514(2), 515(2), 1155 |  |  |  |



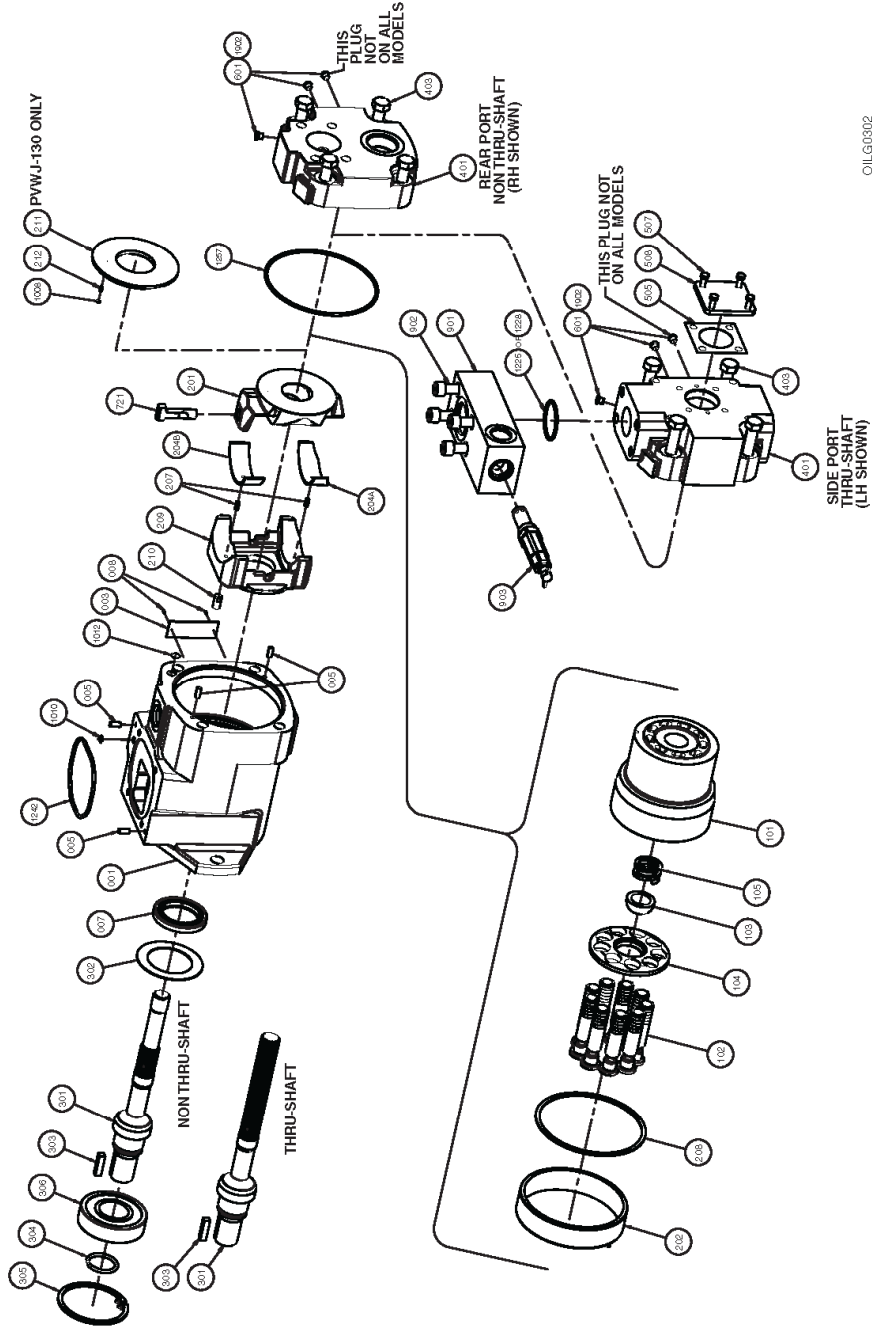
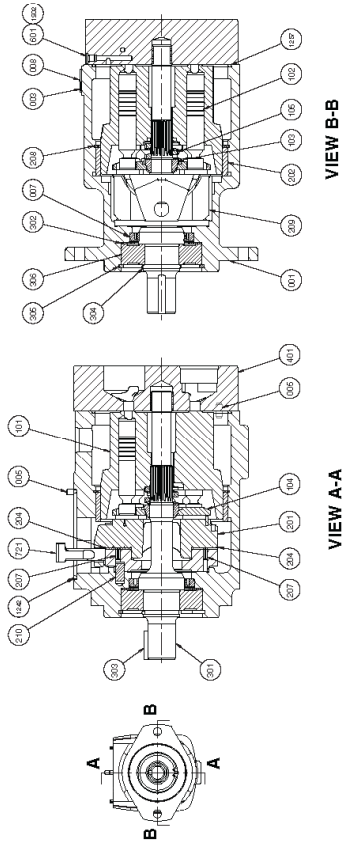


Figure 16. Exploded parts drawing, PVWJ-064/-076/-098/-130 C-Frame (520024-301 sheet 2 of 4).



OILG0803

Figure 17. Cross section and plan view parts drawing, -064/-076/-098/-130 C-Frame (520024-301 sheet 1 of 4).

**PVWJ-064-076/-098/-130 C-FRAME PUMP PARTS LIST**

| Item                          | Qty. | Description            |
|-------------------------------|------|------------------------|
| <b>HOUSING ASSEMBLY GROUP</b> |      |                        |
| 001                           | 1    | Pump Housing           |
| 003                           | 1    | Name Tag               |
| 005                           | 4    | Roll Pin               |
| 007                           | 1    | Shaft Seal             |
| 008                           | 2    | Drive Screws           |
| 1010                          | 1    | O-Ring                 |
| 1012                          | 1    | O-Ring                 |
| 1242                          | 1    | O-Ring                 |
| 1257                          | 1    | O-Ring                 |
| <b>ROTARY ASSEMBLY GROUP</b>  |      |                        |
| 101                           | 1    | Barrel                 |
| 102                           | 9    | Piston & Shoe Assembly |
| 103                           | 1    | Fulcrum Ball           |
| 104                           | 1    | Shoe Retainer          |
| 105                           | 1    | Shoe Retainer Spring   |

|                                   |        |   |
|-----------------------------------|--------|---|
| <b>SWASHBLOCK ASSEMBLY GROUP</b>  |        |   |
| 201                               | 1      | Swashblock                              |
| 202                               | 1      | Hydrodynamic Bearing                    |
| 204A                              | 1      | Saddle Bearing (PVWJ-064)               |
| 204B                              | 1 or 2 | Saddle Bearing (PVWJ-064/-076/-098)     |
| 204C                              | 2      | Saddle Bearing (PVWJ-130)               |
| 207                               | 2      | Saddle Bearing Locating Pin             |
| 208                               | 1      | Retaining Ring                          |
| 209                               | 1      | Saddle Block                            |
| 210                               | 1      | Saddle Block Locating Ring              |
| 211                               | 1      | Wear Plate (PVWJ-130 only)              |
| 212                               | 1      | Wear Plate Locating Pin (PVWJ-130 only) |
| 721                               | 1      | Control Pin                             |
| 1008                              | 1      | O-Ring (PVWJ-130 only)                  |
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |        |   |
| 301                               | 1      | Drive Shaft                             |
| 302                               | 1      | Seal Retainer                           |
| 303                               | 1      | Key                                     |
| 304                               | 1      | Shaft Retainer Ring                     |
| 305                               | 1      | Shaft Bearing Retainer Ring             |
| 306                               | 1      | Front Drive Shaft Bearing               |

|   |        |                             |
|---|--------|-----------------------------|
| <b>VALVE PLATE ASSEMBLY GROUP</b>           |        |                             |
| 401   | 1      | Valve Plate                 |
| 403   | 4      | Screw                       |
| 601   | 2 or 3 | Plug                        |
| 1902  | 2 or 3 | O-Ring                      |
| <b>COVER PLATE PARTS</b>                    |        |                             |
| 505   | 1      | Gasket                      |
| 507   | 4      | Screw                       |
| 508   | 1      | Cover Plate                 |
| <b>RELIEF VALVE ASSEMBLY GROUP-OPTIONAL</b> |        |                             |
| 901   | 1      | Block                       |
| 902   | 1      | Screw                       |
| 903   | 1      | Relief Valve Cartridge      |
| 1225  | 1      | O-Ring (PVWJ-064)           |
| 1228  | 1      | O-Ring (PVWJ-076/-098/-130) |

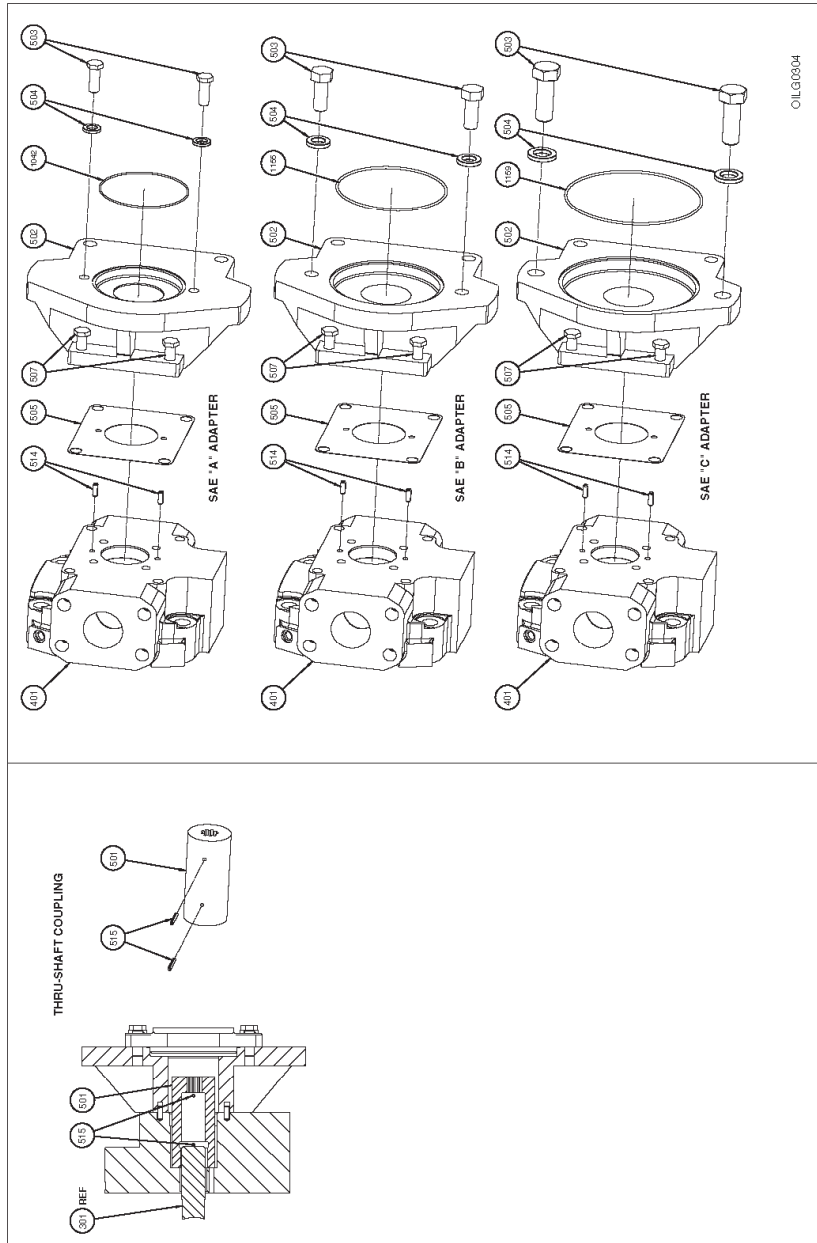


Figure 18. Exploded parts drawing, PVWJ-064/-076/-098/-130 C-Frame, Thru-Shaft Coupling, SAE "A", SAE "B" and SAE "C" Adapter (520024-301 sheet 3 of 4).

| Item                              | Qty. | Description |
|-----------------------------------|------|-------------|
| <b>DRIVE SHAFT ASSEMBLY GROUP</b> |      |             |
| 301                               | 1    | Drive Shaft |
| <b>VALVE PLATE ASSEMBLY GROUP</b> |      |             |
| 401                               | 1    | Valve Plate |

| <b>DUAL PUMP ADAPTER</b> |   |          |
|--------------------------|---|----------|
| 501                      | 1 | Coupling |
| 502                      | 1 | Adapter  |
| 503                      | 2 | Screw    |
| 504                      | 2 | Washer   |
| 505                      | 1 | Gasket   |

|      |   |          |
|------|---|----------|
| 507  | 4 | Screw    |
| 514  | 2 | Roll Pin |
| 515  | 2 | Roll Pin |
| 1042 | 1 | O-Ring   |
| 1155 | 1 | O-Ring   |
| 1159 | 1 | O-Ring   |



Reference 520024-301  
 SERVICE KIT Drawings figures 16-18  
 Document Number: 520024-SK3  
 Revision: New

**SERVICE KITS**  
 PVWJ C-Frame Units  
 (PVWJ-064/-076/-098/-130)

| Description                                      | Kit No.    | Design Series | Items Included (quantity is 1 unless noted) |
|--|------------|---------------|---|
| <b>Housing Kits</b>                              |            |               |   |
| All Models                                       | KS1114-101 | A1            | 001, 005(4), 007, 1010(2), 1242, 1257       |
| <b>Rotating Group Bearing Kit</b>                |            |               |   |
| All Models                                       | L51066-1   | A1            | 202, 208                                    |
| <b>Shaft &amp; Bearing Kits</b>                  |            |               |   |
| 1 1/4" Dia. Keyed (Code Y) Standard              | L51130-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 1 1/4" 14T Spline (Code S) Standard (SAE)        | L51130-13  | A1            | 301, 302, 304, 305, 306                     |
| 1 1/4" 14T Spline (Code D) Standard (Industrial) | L51130-13Z | A1            | 301, 302, 304, 305, 306                     |
| 1 1/4" Dia. Keyed (Code Y) T-S                   | L51520-11  | A1            | 301, 302, 303, 304, 305, 306                |
| 1 1/4" 14T Spline (Code S) T-S (SAE)             | L51520-10  | A1            | 301, 302, 304, 305, 306                     |
| 1 1/4" 14T Spline (Code D) T-S (Industrial)      | L51520-12Z | A1            | 301, 302, 304, 305, 306                     |
| <b>Swashblock Kits</b>                           |            |               |   |
| PVWJ-064/-076/-098 LH (CCW) Models               | L50481-3   | A1            | 201, 721                                    |
| PVWJ-064/-076/-098 RH (CW) Models                | L50481-5   | A1            | 201, 721                                    |
| PVWJ-130 LH (CCW) Models                         | L50481-4   | A1            | 201, 211, 212, 213, 721                     |
| PVWJ-130 RH (CW) Models                          | L50481-6   | A1            | 201, 211, 212, 213, 721                     |
| <b>Saddle Bearing Kits</b>                       |            |               |   |
| PVWJ-064   | L51053-8   | A1            | 204A, 204B                                  |
| PVWJ-076 & -098                                  | L51053-6   | A1            | 204B(2)                                     |
| PVWJ-130   | L51053-7   | A1            | 204C(2)                                     |
| <b>Rotating Group Kits</b>                       |            |               |   |
| PVWJ-064   | L50108-11  | A1            | 101, 102(9), 103, 104, 105                  |
| PVWJ-076   | L50087-7   | A1            | 101, 102(9), 103, 104, 105                  |
| PVWJ-098   | L50108-7   | A1            | 101, 102(9), 103, 104, 105                  |
| PVWJ-130   | L50108-8   | A1            | 101, 102(9), 103, 104, 105                  |
| <b>Saddle Kits</b>                               |            |               |   |
| PVWJ-064   | L51052-13  | A1            | 204A, 204B, 207(2), 209                     |
| PVWJ-076 & -098                                  | L51052-8   | A1            | 204B(2), 207(2), 209                        |
| PVWJ-130   | L51052-9   | A1            | 204C(2), 207(2), 209                        |

| Valve Plate Kits                              |            |    |  |  |  |
|---|------------|----|--|--|--|
| PVWJ-064                                      |            |    |  |  |  |
| LH Rear Port (Code "SA")                      | K51103-213 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Rear Port (Code "SA")                      | K51103-214 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| LH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-215 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-216 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| PVWJ-076                                      |            |    |  |  |  |
| LH Rear Port (Code "SA")                      | K51103-201 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Rear Port (Code "SA")                      | K51103-202 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| LH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-207 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-208 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| PVWJ-098                                      |            |    |  |  |  |
| LH Rear Port (Code "SA")                      | K51103-203 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Rear Port (Code "SA")                      | K51103-204 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| LH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-209 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-210 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| PVWJ-130                                      |            |    |  |  |  |
| LH Rear Port (Code "SA")                      | K51103-205 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Rear Port (Code "SA")                      | K51103-206 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| LH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-211 | A1 |  | 401, 403(4), 405(2), 408(2), 1012, 1257    |  |
| RH Side Port, Thru Shaft (Code "DF" & "DR")   | K51103-212 | A1 |  | 401, 403(4), 405(3), 408(3), 1012, 1257    |  |
| <b>Pump Seal Kit</b>                          |            |    |  |  |  |
| All models                                    | K50826-200 | A1 |  | 007, 1008, 1010, 1012, 1242, 1257, 1902(3) |  |
| <b>Piston &amp; Shoe Kits</b>                 |            |    |  |  |  |
| PVWJ-064                                      | L51109-900 | A1 |  | 102(9)                                     |  |
| PVWJ-076                                      | L51107-900 | A1 |  | 102(9)                                     |  |
| PVWJ-098                                      | L51109-901 | A1 |  | 102(9)                                     |  |
| PVWJ-130                                      | L51303-900 | A1 |  | 102(9)                                     |  |
| <b>Shoe Retainer &amp; Holddown Ball Kits</b> |            |    |  |  |  |
| PVWJ-064/-076/-098                            | L50071     | A1 |  | 103, 104                                   |  |
| PVWJ-130                                      | L51305-2   | A1 |  | 103, 104                                   |  |
| <b>Tag Kit</b>                                |            |    |  |  |  |
| All models                                    | L50921     | A1 |  | 003, 008(2)                                |  |
| <b>Control Pin</b>                            |            |    |  |  |  |
| All models                                    | 51339-2    | A1 |  | 721  |  |

|                                    |           |    |   |
|------------------------------------|-----------|----|---|
| <b>Cover Plate Kit</b>             |           |    |   |
| All models                         | L50671    | A1 | 505, 507(4), 508  |
| <b>Coupling &amp; Adapter Kits</b> |           |    |   |
| SAE A Adapter                      | L51081-52 | A1 | 501, 502, 503(2), 504(2), 505, 507(4), 514(2), 515(2), 1042 |
| SAE B Adapter                      | L51081-51 | A1 | 501, 502, 503(2), 504(2), 505, 507(4), 514(2), 515(2), 1155 |
| SAE C Adapter                      | L51081-49 | A1 | 501, 502, 503(2), 504(2), 505, 507(4), 514(2), 1159         |

---

## **AFTER SALES SERVICES**

At Oilgear we build products to last. It is the nature of this type of machinery to require proper maintenance regardless of the care we put into manufacturing. Oilgear has several service programs in place to help you.

### **STAY-ON-STREAM SERVICE**

By signing up for Oilgear's Stay-On-Stream program, you can prepare for problems before they happen. Certain field tests such as fluid testing, slip testing and electronic profile recording comparisons can be performed by our field service people or your own factory trained personnel. These tests can indicate problems before they become "down-time" difficulties.

## **SERVICE SCHOOLS**

Oilgear conducts training to train your maintenance personnel. "General" hydraulic or electronic training is conducted at our Milwaukee, Wisconsin plant on a regular basis. "Custom" training, specifically addressing your particular hydraulic and electro-hydraulic equipment, can be conducted at your facilities.

### **SPARE PARTS AVAILABILITY**

Prepare for your future needs by stocking Oilgear original factory parts. Having the correct parts and necessary skills "in-plant" enables you to minimize "down-time." Oilgear has developed parts kits to cover likely future needs. Oilgear Field Service Technicians are also ready to assist you and your maintenance people in troubleshooting and repairing equipment.



# SERVICE INSTRUCTIONS

## “PVWJ” A-FRAME PUMPS -011/-014/-022 FOR TYPE “P-1NN” AND “P-LNN” PRESSURE COMPENSATING CONTROLS

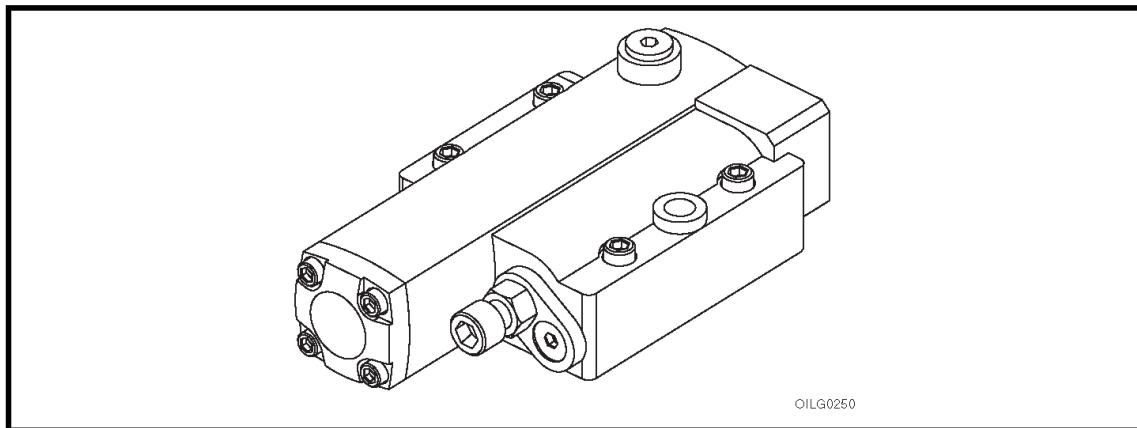


Figure 1. Typical Oilgear Type “P-1NN” and “P-LNN” Pressure Compensator Controls for “PVWJ” A-Frame Pump

### PURPOSE OF INSTRUCTIONS

These instructions will simplify the installation, operation and maintenance of Oilgear type “P-1NN” and “P-LNN” controlled units.

This material will inform you about the basic construction, principle of operation and service parts listings. Some controls may be modified for specific applications from those described in this bulletin and other changes may be made without notice.

### GENERAL REFERENCE MATERIAL

|   |                 |
|---|-----------------|
| Fluid Recommendations .....                                       | Bulletin 90000  |
| Contamination Evaluation Guide .....                              | Bulletin 90004  |
| Filtration Recommendations .....                                  | Bulletin 90007  |
| Piping Information .....  | Bulletin 90011  |
| Proper Installation of Vertical Pumps .....                       | Bulletin 90014  |
| PVWJ Open Loop Pumps, Application Guidelines .....                | Bulletin 847085 |
| PVWJ Open Loop Pumps (All Frame Sizes) Service Instructions ..... | Bulletin 947085 |
| PVWJ Open Loop Pumps, Sales .....                                 | Bulletin 47085  |

### PVWJ PUMP INSTALLATIONS

|  |          |
|--|----------|
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Rear Ports .....              | DS-47480 |
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Side Ports .....              | DS-47481 |
| PVWJ A Frame (PVWJ-011/-014/-022) w/ Side Ports & Thru Shaft ..... | DS-47482 |

### PVWJ PUMP CONTROL INSTALLATIONS

|   |          |
|---|----------|
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-011/-014/-022 ..... | DS-47984 |
|---|----------|

**THE OILGEAR COMPANY**  
2300 South 51st Street  
Milwaukee, Wisconsin 53219  
www.oilgear.com

## Safety First

Read and understand this entire instruction sheet before repairing, or adjusting your Oilgear product.

Those who use and maintain this equipment must be thoroughly trained and familiar with the product. If incorrectly used or maintained, this product and its equipment can cause severe injury.

### SAFETY SYMBOLS

The following signal words are used in this instruction sheet to identify areas of concern where your safety may be involved. Carefully read the text and observe any instructions provided to ensure your safety.

#### **DANGER**

THIS SIGNAL WORD INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

#### **WARNING**

This signal word indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

This signal word indicates that a potentially hazardous situation exists which, if not avoided, may result in damage to equipment or minor personal injury.

#### **NOTE**

*While not directly relevant to the topic being discussed, the NOTE is used to emphasize information provided, or provide additional information which may be of benefit.*

#### **WARNING**

This service information is designed for the maintenance of your Oilgear product. It contains the information on the correct procedures determined by Oilgear for the safe manner of servicing. Always keep this instruction sheet in a location where it is readily available for the persons who use and maintain the product. Additional copies of this instruction sheet are available through the Oilgear Company. Contact us at 414-327-1700 or visit our website: [www.oilgear.com](http://www.oilgear.com). Please contact us if you have any questions regarding the information in this instruction bulletin.

#### **NOTE**

*The cleanliness of working on this pump control or the hydraulic system is extremely important to the safety and reliability of the pump and the system. Always make sure the fittings are clean on the outside before removing them from their connections, are capped and plugged when removed and placed in a clean rag or container until they are reinstalled.*

#### **WARNING**

Some service operations may require special tools or equipment. If you require information on these items, please contact Oilgear before attempting these repairs and service operations.

#### **WARNING**

Read, understand and follow the safety guidelines, dangers and warnings contained in this instruction sheet to promote reliable operation and prevent serious personal injury.

#### **WARNING**

DO NOT attempt to service this machinery in an environment where safety regulations are not established and in place.

#### **WARNING**

DO NOT operate the hydraulic system if a leak is present. Serious injury may result.

#### **WARNING**

Hydraulic systems operate under very high pressure. Hydraulic fluid escaping from a pressurized system can penetrate unprotected body tissue. DO NOT inspect for hydraulic leaks with bare hands or other exposed body parts. As a minimum, wear leather gloves prior to inspecting for leaks and use cardboard or wood. If leaks are present, relieve pressure and allow system to cool prior to servicing. If injured by escaping hydraulic oil, contact a physician immediately. Serious complications may arise if not treated immediately. If you have questions regarding inspecting for hydraulic leaks, please contact Oilgear prior to servicing.

**⚠ WARNING**

Hydraulic hoses and tubing must be inspected on a daily basis for leaks, cuts, abrasions, damage and improper clearance along any mounting frame for hidden damage before the unit is put into service. Replace damaged hoses or hoses you suspect are damaged before the system is returned to service! Hoses must be replaced every two years. Failure to properly inspect and maintain the system may result in serious injury.

**⚠ WARNING**

Hydraulic systems are hot. DO NOT TOUCH! Serious personal injury may result from hot oil. When you have completed working on the hydraulic system, thoroughly clean any spilled oil from the equipment. Do not spill any hydraulic fluids on the ground. Clean any hydraulic fluids from your skin as soon as you have completed maintenance and repairs. Dispose of used oil and system filters as required by law.

**⚠ WARNING**

Use correct hoses, fittings, and adapters with the correct SAE rating when replacing hoses to prevent possible serious injury. Always replace hoses, fittings and adapters with replacements that have a proper, suitable, working pressure rating. Replacement hoses must be of the correct length and must comply with the hose manufacturer's and Oilgear's installation guidelines and recommendations.

**⚠ WARNING**

Hydraulic hoses have the SAE ratings marked on the hose to assist you in selecting the correct hose. The same manufacturer must supply any replacement hydraulic hoses and fitting assemblies. As an example: Brand "X" hose and brand "Y" fitting will not normally be compatible. No "Twist" is allowed in the hydraulic hoses. "Twist" may result in premature hose failure. This can cause serious injury. Please contact Oilgear for assistance when required.

**⚠ WARNING**

Hydraulic cylinders can be holding a function in a certain position when the pump is OFF. An example of this is a function being held in the lift or partial lift position by the cylinders. If a hydraulic line is removed or the hydraulic circuits or controls are being worked on, gravity may allow the function being held in position to drop. All workers and personnel must remain clear of these areas when working on or operating the hydraulic system. Block and secure all devices and functions which apply before beginning work or operation. Failure to comply with this can result in serious injury or death.

**⚠ WARNING**

Any hydraulic pipe which is replaced must conform to SAE J1065 specifications. If incorrect hydraulic pipe is installed, the hydraulic system may fail, causing serious injury. Damaged or leaking fittings, pipes or hoses must be replaced before the system is returned to service.

**⚠ WARNING**

DO NOT heat hydraulic pipe. The carbon content of this steel tube is such that if heated for bending, and either water or air quenched, the pipe may lose its ductility and thereby be subject to failure under high pressure conditions. Serious injury can result. Damaged or leaking pipes must be replaced before the system is returned to service. Please contact Oilgear if you require assistance or have questions.

**⚠ WARNING**

All hydraulic pressure must be relieved from the hydraulic system prior to removing any components from the system. To relieve the hydraulic pressure from the hydraulic system, turn off the motor and operate the control panel with the key in the ON position. Failure to comply can result in serious injury. If you have any questions concerning relieving the hydraulic pressure from the system, please contact Oilgear.

### **WARNING**

Hydraulic components can be heavy. Use caution while lifting these components. Serious personal injury can be avoided with proper handling of the components.

### **WARNING**

Please contact Oilgear if you require assistance. When performing hydraulic test procedures, use the proper hydraulic gauges. Installing an incorrect test gauge could result in serious injury if the gauge fails. Use properly rated hydraulic hoses to allow the test gauge to be read away from moving parts and functions.

### **WARNING**

Increasing hydraulic pressure beyond the recommendations may result in serious damage to the pump and system or serious personal injury and may void the Oilgear Warranty. If you have questions concerning hydraulic pressures or testing procedures, please contact Oilgear before attempting the test procedures or making adjustments.

### **WARNING**

An Oilgear pump or pump control must not be modified in any way without authorization from Oilgear. Modifications may not comply with safety standards, including ANSI safety standards, and may result in serious personal injury. Please contact Oilgear if you require assistance.

### **WARNING**

DO NOT enter under hydraulic supported equipment unless they are fully supported or blocked. Failure to follow this procedure can result in serious injury or death.

### **WARNING**

Any Oilgear pump safety decals must be replaced anytime they are damaged, missing or cannot be read clearly. Failure to have proper decals in place can result in serious injury or death. (If you require safety decals, please contact Oilgear for replacement safety decals, at no charge.)

### **WARNING**

Be sure everyone is clear of the area around the hydraulic system before operating after servicing. Remain attentive at all times when operating to check your work until you are completely sure it is safe to return to service. Failure to heed this warning may result in serious personal injury or death.

### **WARNING**

Wear the proper protective clothing when operating, servicing or maintaining the hydraulic system or the Oilgear pump. Wear the correct protective gear, safety glasses, gloves and safety shoes. Serious injury can result without proper protective gear.

### **WARNING**

Make sure to keep hands, feet and other parts of your body clear of revolving or moving parts. Failure to comply can cause serious injury.

### **WARNING**

DO NOT wear watches, rings or jewelry while working with electrical and mechanical equipment. These items can be hazardous and can cause serious and painful injuries if they come into contact with electrical wires, moving parts or hydraulic equipment.



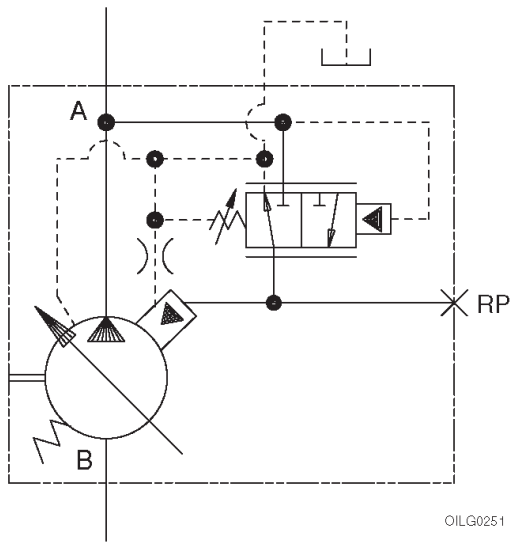


Figure 2. ASA Diagram for "P-1NN" or "P-LNN" Controls Shown with Typical Pump

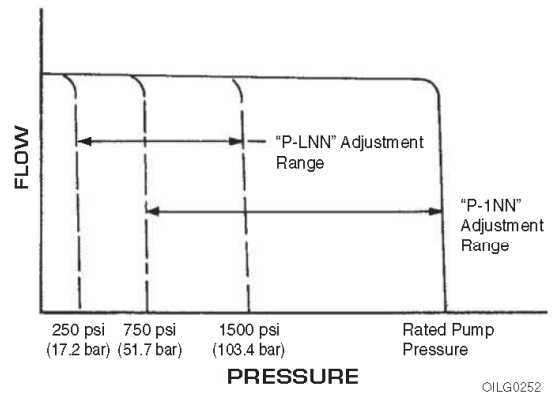


Figure 3. Curve Indicating Flow Versus Pressure for "P-1NN" or "P-LNN" Type Controls

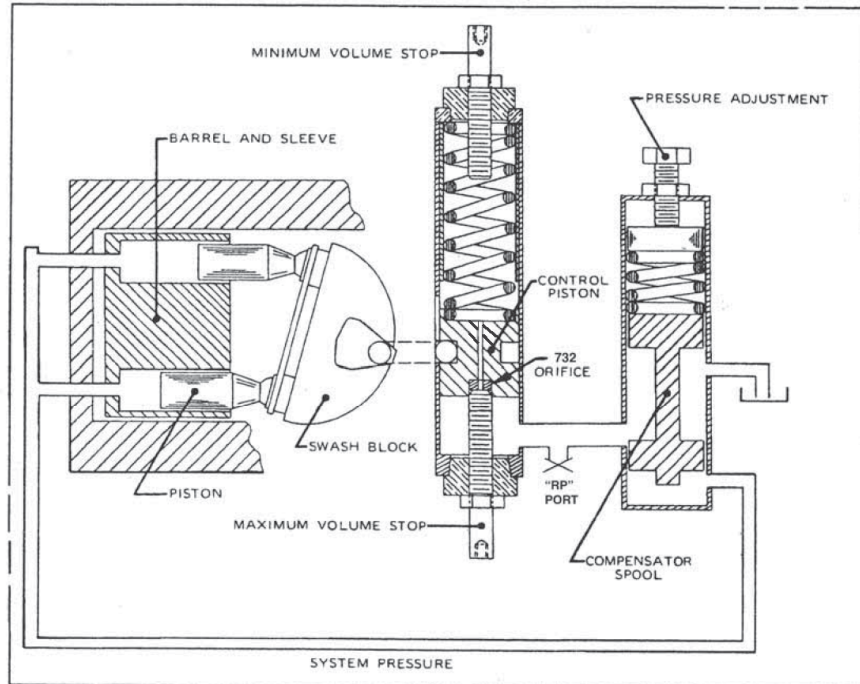
| TROUBLESHOOTING  |   |  |
|--|---|--|
| PROBLEM  | CAUSES  | REMEDY   |
| <b>Unresponsive or Unstable Control</b>                      | Swashblock bearing surface and/or Saddle Bearings worn or damaged.  | See appropriate pump service bulletin.   |
|  | Control Pin and/or hole in Swashblock worn significantly.   |  |
|  | Saddle Bearing Locating Pins broken.  |  |
|  | Fluid is contaminated.  | Inspect and clean if necessary. See bulletin 90007.                                    |
|  | Control Piston orifice (732) plugged.   | Inspect and clean if necessary.  |
|  | Contamination trapped between control piston (702) and piston bore is not allowing piston to move smoothly. | Inspect and clean if necessary. Replace scored or damaged parts.                       |
|  | Contamination trapped between control spool (706) and spool bore is not allowing spool to move smoothly.    |  |
|  | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.  |
|  | Hydraulic line between remote pressure compensator components and RP port of control is too long.           | Shorten line length.   |
|  | Insufficient control flow.  | Increase size of control piston orifice (732).   |
| <b>Insufficient Outlet Volume</b>                            | Swashblock not stroking to desired displacement.  | See appropriate pump service bulletin.   |
|  | Low input drive speed.  |  |
|  | Worn or grooved Cylinder Barrel and/or Valve Plate mating surfaces.   |  |
|  | Failed Driveshaft.  |  |
|  | Worn or damaged Piston Shoes or Swashblock.   |  |
|  | Worn Pistons and/or piston bores.   | Inspect and replace if necessary.  |
|  | Control Piston stuck off stroke.  |  |
|  | Maximum Volume Stop adjusted incorrectly.   |  |
| Pressure Compensator is set too close to operating pressure. | Adjust Pressure Compensator setting CW to increase setting.   |  |
| <b>Destrokes at low pressure</b>                             | Pressure compensator adjustment not set correctly.  | Adjust Pressure Compensator setting CW to increase setting and retorque jam nut (715). |
|  | Control Piston orifice (732) plugged.   | Inspect and clean if necessary.  |
|  | Damaged or fractured control spring (items 708 and/or 709).   | Inspect and replace if necessary.  |
|  | Severely worn control spool (706) and/or spool bore.  |  |
|  | Damaged or fractured control piston spring (item 703).  |  |
| Faulty remote pressure compensator circuit components.       |   |  |
| <b>Excessive peak pressure</b>                               | Pressure Compensator is set too high.   | Adjust Pressure Compensator setting CCW to decrease setting.                           |
|  | Minimum Volume Stop is set too high.  | Adjust Minimum Volume Stop CCW to decrease outlet flow.                                |
|  | Fluid is contaminated.  | Inspect and clean if necessary. See bulletin 90007.                                    |
|  | Swashblock bearing surface and/or Saddle Bearings worn or damaged.  | See appropriate pump service bulletin.   |
|  | Contamination trapped between control piston (702) and piston bore is not allowing piston to move smoothly. | Inspect and clean if necessary. Replace scored or damaged parts.                       |
|  | Contamination trapped between control spool (706) and spool bore is not allowing spool to move smoothly.    |  |
|  | Hydraulic line between remote pressure compensator components and RP port of control is too long.           | Shorten line length.   |
|  | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.  |
|  | Restriction in drilled passages between pump outlet port and control spool.                                 | Inspect and clean if necessary.  |

## PRINCIPLE OF OPERATION

The pressure compensator control ensures maximum pump flow until the system reaches the controls preset pressure setting. The control then regulates the pump output flow to match the flow requirements of the system, while maintaining the preset output pressure.

When the system pressure exceeds the compensator control setting, or the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure.

“P-1NN” controls can be adjusted from 750 psi (51,7 bar) working pressure up to the maximum pressure rating of the applicable pump. “P-LNN” controls can be adjusted from 250 psi (17,2 bar) up to a maximum of 1500 psi (103,4 bar).



OILG0253

Figure 4. Swashblock at Full Delivery and “P-1NN” or “P-LNN” Controls at Maximum Volume Stop

## LINE MOUNTED REMOTE PRESSURE CONTROL FOR TYPE "P-1NN" AND "P-LNN" PUMP CONTROLS - VSR (REMOTE SEQUENCE VALVE)

Remote operation of "P-1NN" and "P-LNN" controls can be accomplished by installing an Oilgear VSR Module at the location shown in the control circuit. Use module L51542 for units rated continuously for 4000 psi (275,8 bar) or less. Use L51542-1 for units rated above 4000 psi (275,8 bar).

**NOTE**

To minimize case leakage and power loss, plug the control drain port with a #10-24 UNC setscrew to maintain the standard "P-1NN" or "P-LNN" control case leakage. The plug will increase response time. Standard response time can be obtained by installing a .040 inch (1,0 mm) orifice instead of plugging it.

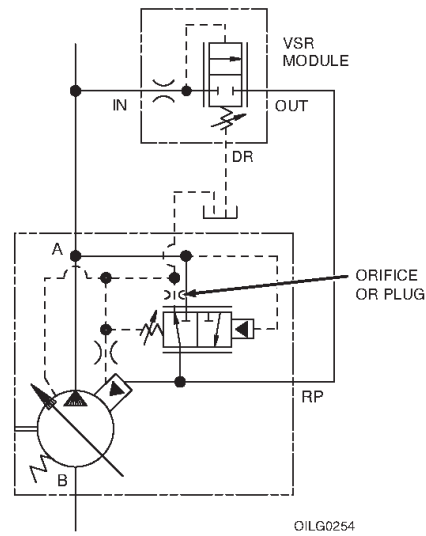


Figure 5. "P-1NN" and "P-LNN" Control Circuit with Remote Pressure Control

DRAIN PORT AS VIEWED FROM UNDERSIDE OF CONTROL BODY. NOTE: THIS IS AN ANGLED HOLE.

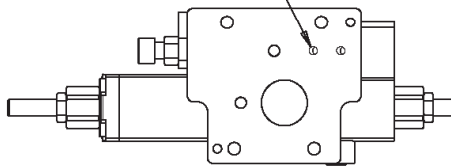


Figure 7. "P-1NN" and "P-LNN" Control Drain Port Location

**NOTE**

The compensator setting on the pump control must be set at least 200 psi (13,8 bar) higher than the required pressure setting of the remote compensator module to prevent the pump compensator control from interacting with the remote compensator module.

**SCREW AND PLUG TORQUES  
FOR CONTROLS**

| Item Number | Description                      | Head Type & Size   | Tightening Torque    |
|-------------|----------------------------------|--------------------|----------------------|
| 601         | SAE #2 Plug                      | 1/8" Internal Hex  | 45 in.-lbs (5 N·m)   |
| 603         | SAE #4 Plug                      | 3/16" Internal Hex | 120 in.-lbs (14 N·m) |
| 606         | SAE #8 Plug                      | 5/16" Internal Hex | 45 ft.-lbs (61 N·m)  |
| 711         | PC Adjuster Screw LHCS           | 3/32" Internal Hex | 57 in.-lbs (6 N·m)   |
| 714         | Adjuster Plate Screw             | 5/32" Internal Hex | 80 in.-lbs (9 N·m)   |
| 720         | Max. or Min. Volume Stop Housing | 7/8" External Hex  | 50 ft.-lbs (68 N·m)  |
| 722         | End Cap Screws                   | 5/32" Internal Hex | 80 in.-lbs (9 N·m)   |
| 723         | Control Body Screws              | 3/16" Internal Hex | 120 in.-lbs (14 N·m) |
| 732         | Control Piston Orifice           | 3/32" Internal Hex | 20 in.-lbs (2.3 N·m) |

**CONTROL O-RING SEALS**

| Item Number | ARP 568 Uniform Size Number | Shore A Durometer |
|-------------|-----------------------------|-------------------|
| 1010        | -010                        | 90                |
| 1011        | -011                        | 90                |
| 1020        | -020                        | 90                |
| 1113        | -113                        | 90                |
| 1145        | -145                        | 70                |
| 1902        | -902                        | 90                |
| 1904        | -904                        | 90                |
| 1908        | -908                        | 90                |

## A-Frame PVWJ -011/-014/-022 “P-1NN” and “P-LNN”

### PARTS LIST

Parts used in these assemblies are per Oilgear specifications. Use only Oilgear parts to ensure compatibility with assembly requirements. When ordering replacement parts, be sure to include pump type and serial number, bulletin number and item number. Specify type of hydraulic fluid to ensure seal and packing compatibility.

**NOTE**

*Parts drawings may not be identical to Oilgear drawings referenced.*

#### PVWJ A-FRAME -011/-014/-022 PRESSURE COMPENSATOR CONTROLS (“P-1NN” STANDARD & “P-LNN” LOW PRESSURE CONTROLS)

| Item                      | Description                           |
|---------------------------|---------------------------------------|
| <b>COMMON PARTS GROUP</b> |                                       |
| 601                       | SAE#2 Plug                            |
| 603                       | SAE#4 Plug                            |
| 606                       | SAE#8 Plug                            |
| 701                       | Control Block                         |
| 702                       | Control Piston                        |
| 703                       | Control Piston Spring                 |
| 705                       | End Cap                               |
| 706                       | Pressure Compensator Control Spool    |
| 707                       | Spring Seat                           |
| 708                       | Pressure Compensator Spring (Outer)   |
| 709*                      | Pressure Compensator Spring (Inner)   |
| 710                       | Control Plug                          |
| 711                       | Screw                                 |
| 712                       | Shims                                 |
| 713                       | Adjuster Plate                        |
| 714                       | Screw                                 |
| 715                       | Jam Nut                               |
| 716                       | Pressure Compensator Adjustment Screw |
| 717                       | Min. Volume Stop Stem                 |
| 718                       | Max. Volume Stop Stem                 |
| 719                       | Jam Nut                               |
| 720                       | Volume Stop Housing                   |
| 721                       | Control Pin                           |
| 722                       | Screw, End Cap                        |
| 723                       | Screw, Control Body                   |
| 732                       | Orifice                               |
| 1010                      | O-Ring                                |
| 1011                      | O-Ring                                |
| 1020                      | O-Ring                                |
| 1113                      | O-Ring                                |
| 1145                      | O-Ring                                |
| 1902                      | O-Ring                                |
| 1904                      | O-Ring                                |
| 1908                      | O-Ring                                |

\*Only used in P-1 Control.

## A-Frame PVWJ -011/-014/-022 “P-1NN” and “P-LNN”

### SERVICE KITS

Document Number: 519975-SK1

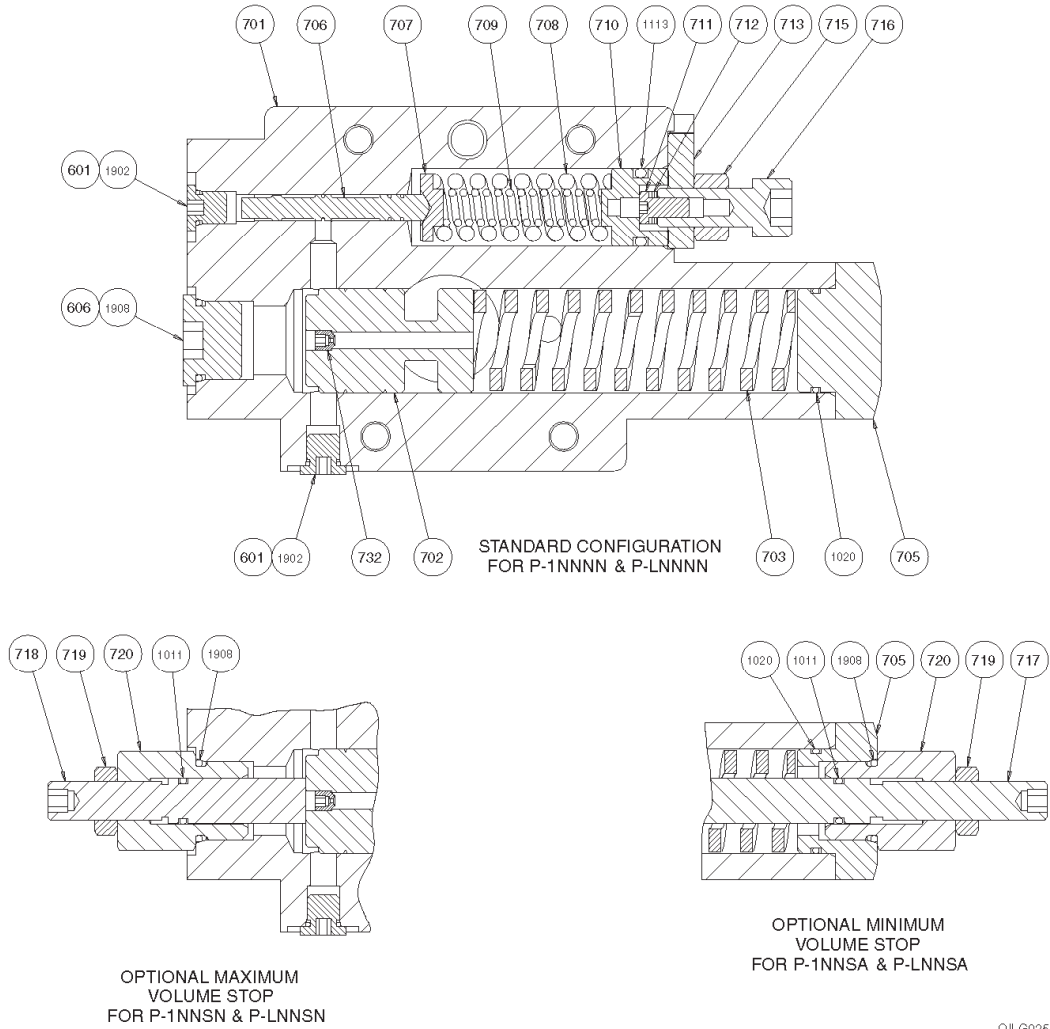
#### PVWJ Service Kits

Revision: New

Reference 519975-101  
SERVICE KIT, Figures 8 & 9

| Description                               | Kit No.    | Design Series | Items Included (quantity is 1 unless noted)    |
|---|------------|---------------|--|
| <b>Main Control Body Kits</b>             |            |               |  |
| PVWJ-011                                  | K50460-100 | A1            | 701, 706                                       |
| PVWJ-014/-022                             | K50460-200 | A1            | 701, 706                                       |
| <b>Control Piston Kits</b>                |            |               |  |
| All Models                                | K50521     | A1            | 702, 732                                       |
| <b>Pressure Compensator Spools</b>        |            |               |  |
| PVWJ-011                                  | 50015-100  | A1            | 706  |
| PVWJ-014/-022                             | 50015-200  | A1            | 706  |
| <b>Control Spring Kits</b>                |            |               |  |
| P-LNN (All Models)                        | K50036-103 | A1            | 703, 708                                       |
| PVWJ-011 P-1NN                            | K50036-106 | A1            | 703, 708                                       |
| PVWJ-014/-022 P-1NN                       | K50036-109 | A1            | 703, 708, 709                                  |
| <b>Control Pins</b>                       |            |               |  |
| All Models                                | 50623-5    | A1            | 721  |
| <b>Volume Stop Kits</b>                   |            |               |  |
| Maximum Volume Stop (All Models)          | K50590     | A1            | 718, 719, 720, 1011, 1908                      |
| Minimum Volume Stop (All Models)          | K50590-100 | A1            | 705, 717, 719, 720, 1011, 1020, 1908           |
| <b>Pressure Compensator Adjuster Kits</b> |            |               |  |
| All Models                                | K50660-100 | A1            | 710, 711, 712, 713, 715, 716, 1113             |
| <b>Control Seal Kit</b>                   |            |               |  |
| All Models                                | K50824-100 | A1            | 1010, 1011, 1020, 1113, 1145, 1902, 1904, 1908 |

# A-Frame PVWJ -011/-014/-022 "P-1NN" and "P-LNN"



OILG0256

Figure 8. Parts Drawing for "P-1NN" and "P-LNN" Control (519975-101 sheet 1)

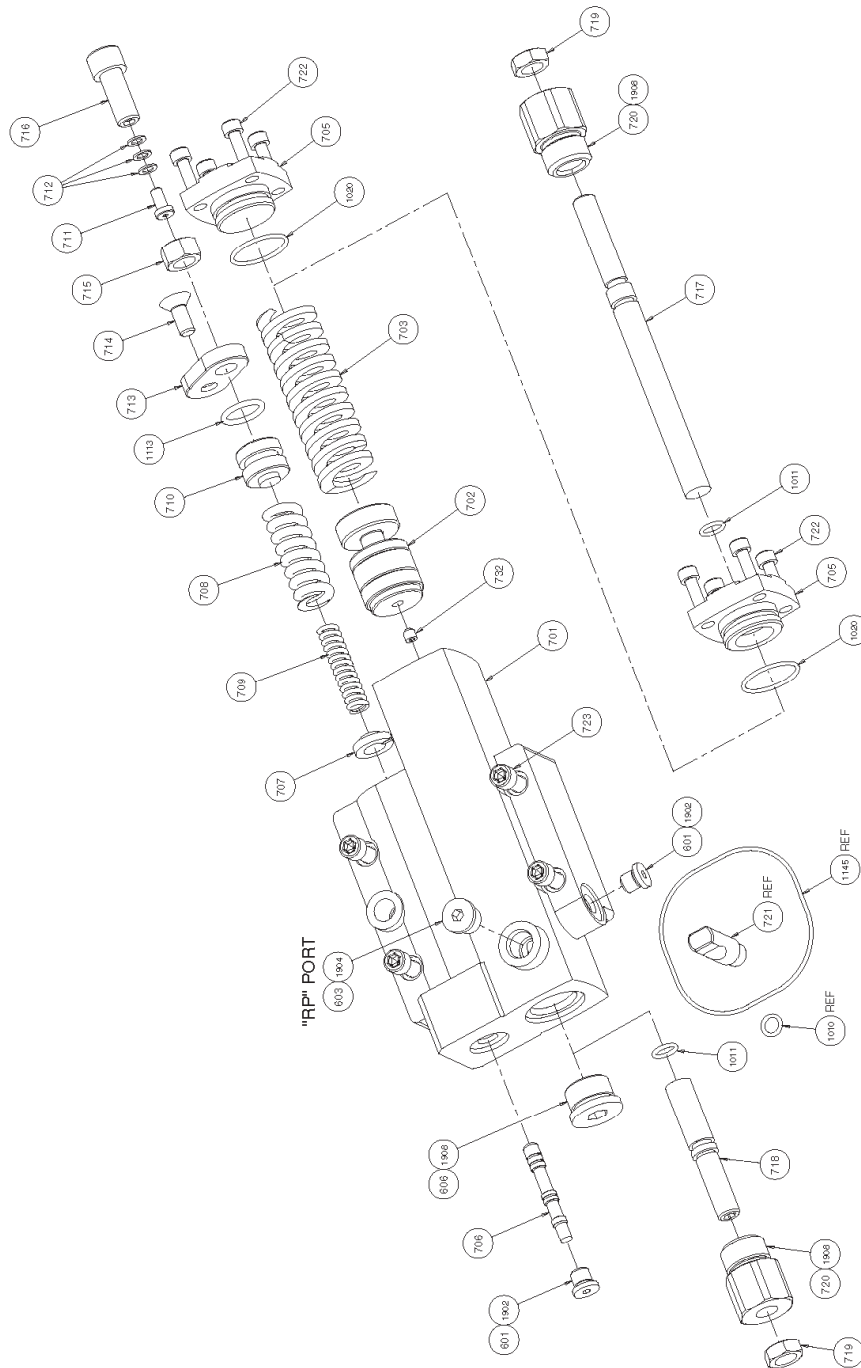
## MAXIMUM AND MINIMUM VOLUME STOP

The maximum volume stop can be adjusted to attain a maximum volume from full to 25% of full flow. The pump can be de-stroked from full to 25% flow with eight half-turns of the volume stop. One turn clockwise will decrease maximum pump outlet flow 9%.

The minimum volume stop can be adjusted to attain a minimum volume from zero to full flow. One turn clockwise will increase minimum pump outlet flow 9%.



# A-Frame PVWJ -011/-014/-022 "P-1NN" and "P-LNN"



OILG0257

Figure 9. Exploded Parts Drawing for "P-1NN" and "P-LNN" Control (519975-101 sheet 2)





---

## **AFTER SALES SERVICES**

At Oilgear we build products to last. It is the nature of this type of machinery to require proper maintenance regardless of the care we put into manufacturing. Oilgear has several service programs in place to help you.

### **STAY-ON-STREAM SERVICE**

By signing up for Oilgear's Stay-On-Stream program, you can prepare for problems before they happen. Certain field tests such as fluid testing, slip testing and electronic profile recording comparisons can be performed by our field service people or your own factory trained personnel. These tests can indicate problems before they become "down-time" difficulties.

## **SERVICE SCHOOLS**

Oilgear conducts training to train your maintenance personnel. "General" hydraulic or electronic training is conducted at our Milwaukee, Wisconsin plant on a regular basis. "Custom" training, specifically addressing your particular hydraulic and electro-hydraulic equipment, can be conducted at your facilities.

### **SPARE PARTS AVAILABILITY**

Prepare for your future needs by stocking Oilgear original factory parts. Having the correct parts and necessary skills "in-plant" enables you to minimize "down-time." Oilgear has developed parts kits to cover likely future needs. Oilgear Field Service Technicians are also ready to assist you and your maintenance people in troubleshooting and repairing equipment.



# SERVICE INSTRUCTIONS

## “PVWJ” B-FRAME PUMPS -025/-034/-046 FOR TYPE “P-1NN” AND “P-LNN” PRESSURE COMPENSATING CONTROLS

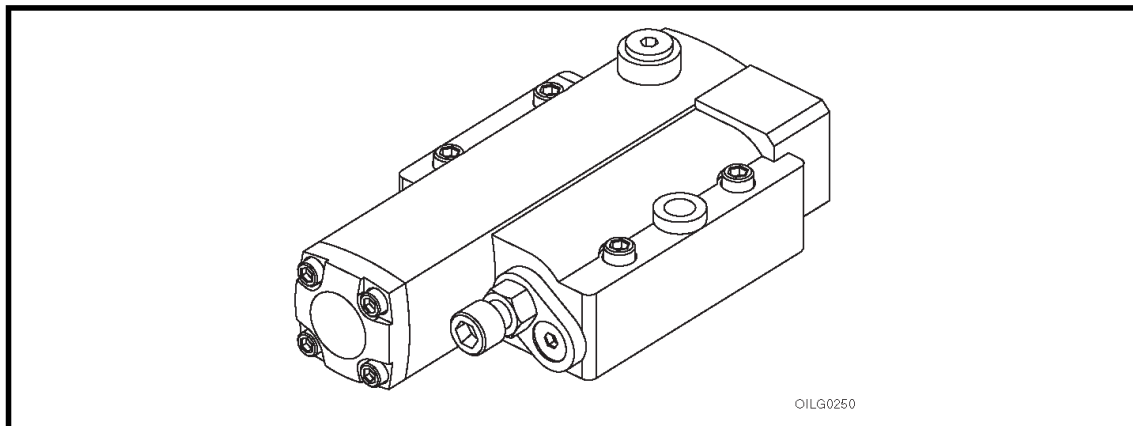


Figure 1. Typical Oilgear Type “P-1NN” and “P-LNN” Pressure Compensator Controls for “PVWJ” B-Frame Pump

### PURPOSE OF INSTRUCTIONS

These instructions will simplify the installation, operation and maintenance of Oilgear type “P-1NN” and “P-LNN” controlled units.

This material will inform you about the basic construction, principle of operation and service parts listings. Some controls may be modified for specific applications from those described in this bulletin and other changes may be made without notice.

### REFERENCE MATERIAL

|   |                 |
|---|-----------------|
| Fluid Recommendations .....                                       | Bulletin 90000  |
| Contamination Evaluation Guide .....                              | Bulletin 90004  |
| Filtration Recommendations .....                                  | Bulletin 90007  |
| Piping Information .....  | Bulletin 90011  |
| Proper Installation of Vertical Pumps .....                       | Bulletin 90014  |
| PVWJ Open Loop Pumps, Application Guidelines .....                | Bulletin 847085 |
| PVWJ Open Loop Pumps (All Frame Sizes) Service Instructions ..... | Bulletin 947085 |
| PVWJ Open Loop Pumps, Sales .....                                 | Bulletin 47085  |

### PVWJ PUMP INSTALLATIONS

|  |          |
|--|----------|
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Rear Ports .....              | DS-47483 |
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Side Ports .....              | DS-47484 |
| PVWJ B Frame (PVWJ-025/-034/-046) w/ Side Ports & Thru Shaft ..... | DS-47485 |

### PVWJ PUMP CONTROL INSTALLATIONS

|   |          |
|---|----------|
| “P-1NN” and “P-LNN” Pressure Compensator for PVWJ-025/-034/-046 ..... | DS-47985 |
|---|----------|

**THE OILGEAR COMPANY**  
2300 South 51st Street  
Milwaukee, Wisconsin 53219  
www.oilgear.com

## Safety First

Read and understand this entire instruction sheet before repairing, or adjusting your Oilgear product.

Those who use and maintain this equipment must be thoroughly trained and familiar with the product. If incorrectly used or maintained, this product and its equipment can cause severe injury.

### SAFETY SYMBOLS

The following signal words are used in this instruction sheet to identify areas of concern where your safety may be involved. Carefully read the text and observe any instructions provided to ensure your safety.

#### **DANGER**

THIS SIGNAL WORD INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

#### **WARNING**

This signal word indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

This signal word indicates that a potentially hazardous situation exists which, if not avoided, may result in damage to equipment or minor personal injury.

#### **NOTE**

*While not directly relevant to the topic being discussed, the NOTE is used to emphasize information provided, or provide additional information which may be of benefit.*

#### **WARNING**

This service information is designed for the maintenance of your Oilgear product. It contains the information on the correct procedures determined by Oilgear for the safe manner of servicing. Always keep this instruction sheet in a location where it is readily available for the persons who use and maintain the product. Additional copies of this instruction sheet are available through the Oilgear Company. Contact us at 414-327-1700 or visit our website: [www.oilgear.com](http://www.oilgear.com). Please contact us if you have any questions regarding the information in this instruction bulletin.

#### **NOTE**

*The cleanliness of working on this pump control or the hydraulic system is extremely important to the safety and reliability of the pump and the system. Always make sure the fittings are clean on the outside before removing them from their connections, are capped and plugged when removed and placed in a clean rag or container until they are reinstalled.*

#### **WARNING**

Some service operations may require special tools or equipment. If you require information on these items, please contact Oilgear before attempting these repairs and service operations.

#### **WARNING**

Read, understand and follow the safety guidelines, dangers and warnings contained in this instruction sheet to promote reliable operation and prevent serious personal injury.

#### **WARNING**

DO NOT attempt to service this machinery in an environment where safety regulations are not established and in place.

#### **WARNING**

DO NOT operate the hydraulic system if a leak is present. Serious injury may result.

#### **WARNING**

Hydraulic systems operate under very high pressure. Hydraulic fluid escaping from a pressurized system can penetrate unprotected body tissue. DO NOT inspect for hydraulic leaks with bare hands or other exposed body parts. As a minimum, wear leather gloves prior to inspecting for leaks and use cardboard or wood. If leaks are present, relieve pressure and allow system to cool prior to servicing. If injured by escaping hydraulic oil, contact a physician immediately. Serious complications may arise if not treated immediately. If you have questions regarding inspecting for hydraulic leaks, please contact Oilgear prior to servicing.

**⚠ WARNING**

Hydraulic hoses and tubing must be inspected on a daily basis for leaks, cuts, abrasions, damage and improper clearance along any mounting frame for hidden damage before the unit is put into service. Replace damaged hoses or hoses you suspect are damaged before the system is returned to service! Hoses must be replaced every two years. Failure to properly inspect and maintain the system may result in serious injury.

**⚠ WARNING**

Hydraulic systems are hot. DO NOT TOUCH! Serious personal injury may result from hot oil. When you have completed working on the hydraulic system, thoroughly clean any spilled oil from the equipment. Do not spill any hydraulic fluids on the ground. Clean any hydraulic fluids from your skin as soon as you have completed maintenance and repairs. Dispose of used oil and system filters as required by law.

**⚠ WARNING**

Use correct hoses, fittings, and adapters with the correct SAE rating when replacing hoses to prevent possible serious injury. Always replace hoses, fittings and adapters with replacements that have a proper, suitable, working pressure rating. Replacement hoses must be of the correct length and must comply with the hose manufacturer's and Oilgear's installation guidelines and recommendations.

**⚠ WARNING**

Hydraulic hoses have the SAE ratings marked on the hose to assist you in selecting the correct hose. The same manufacturer must supply any replacement hydraulic hoses and fitting assemblies. As an example: Brand "X" hose and brand "Y" fitting will not normally be compatible. No "Twist" is allowed in the hydraulic hoses. "Twist" may result in premature hose failure. This can cause serious injury. Please contact Oilgear for assistance when required.

**⚠ WARNING**

Hydraulic cylinders can be holding a function in a certain position when the pump is OFF. An example of this is a function being held in the lift or partial lift position by the cylinders. If a hydraulic line is removed or the hydraulic circuits or controls are being worked on, gravity may allow the function being held in position to drop. All workers and personnel must remain clear of these areas when working on or operating the hydraulic system. Block and secure all devices and functions which apply before beginning work or operation. Failure to comply with this can result in serious injury or death.

**⚠ WARNING**

Any hydraulic pipe which is replaced must conform to SAE J1065 specifications. If incorrect hydraulic pipe is installed, the hydraulic system may fail, causing serious injury. Damaged or leaking fittings, pipes or hoses must be replaced before the system is returned to service.

**⚠ WARNING**

DO NOT heat hydraulic pipe. The carbon content of this steel tube is such that if heated for bending, and either water or air quenched, the pipe may lose its ductility and thereby be subject to failure under high pressure conditions. Serious injury can result. Damaged or leaking pipes must be replaced before the system is returned to service. Please contact Oilgear if you require assistance or have questions.

**⚠ WARNING**

All hydraulic pressure must be relieved from the hydraulic system prior to removing any components from the system. To relieve the hydraulic pressure from the hydraulic system, turn off the motor and operate the control panel with the key in the ON position. Failure to comply can result in serious injury. If you have any questions concerning relieving the hydraulic pressure from the system, please contact Oilgear.

### **WARNING**

Hydraulic components can be heavy. Use caution while lifting these components. Serious personal injury can be avoided with proper handling of the components.

### **WARNING**

Please contact Oilgear if you require assistance. When performing hydraulic test procedures, use the proper hydraulic gauges. Installing an incorrect test gauge could result in serious injury if the gauge fails. Use properly rated hydraulic hoses to allow the test gauge to be read away from moving parts and functions.

### **WARNING**

Increasing hydraulic pressure beyond the recommendations may result in serious damage to the pump and system or serious personal injury and may void the Oilgear Warranty. If you have questions concerning hydraulic pressures or testing procedures, please contact Oilgear before attempting the test procedures or making adjustments.

### **WARNING**

An Oilgear pump or pump control must not be modified in any way without authorization from Oilgear. Modifications may not comply with safety standards, including ANSI safety standards, and may result in serious personal injury. Please contact Oilgear if you require assistance.

### **WARNING**

DO NOT enter under hydraulic supported equipment unless they are fully supported or blocked. Failure to follow this procedure can result in serious injury or death.

### **WARNING**

Any Oilgear pump safety decals must be replaced anytime they are damaged, missing or cannot be read clearly. Failure to have proper decals in place can result in serious injury or death. (If you require safety decals, please contact Oilgear for replacement safety decals, at no charge.)

### **WARNING**

Be sure everyone is clear of the area around the hydraulic system before operating after servicing. Remain attentive at all times when operating to check your work until you are completely sure it is safe to return to service. Failure to heed this warning may result in serious personal injury or death.

### **WARNING**

Wear the proper protective clothing when operating, servicing or maintaining the hydraulic system or the Oilgear pump. Wear the correct protective gear, safety glasses, gloves and safety shoes. Serious injury can result without proper protective gear.

### **WARNING**

Make sure to keep hands, feet and other parts of your body clear of revolving or moving parts. Failure to comply can cause serious injury.

### **WARNING**

DO NOT wear watches, rings or jewelry while working with electrical and mechanical equipment. These items can be hazardous and can cause serious and painful injuries if they come into contact with electrical wires, moving parts or hydraulic equipment.



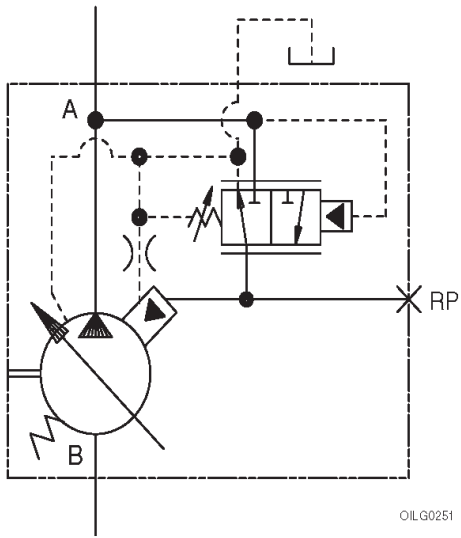


Figure 2. ASA Diagram for "P-1NN" or "P-LNN" Controls Shown with Typical Pump

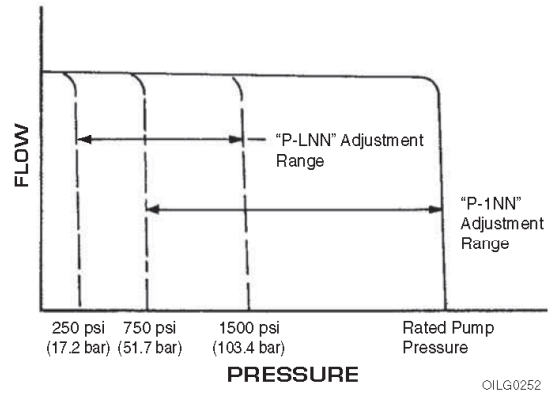


Figure 3. Curve Indicating Flow Versus Pressure for "P-1NN" or "P-LNN" Type Controls

## TROUBLESHOOTING

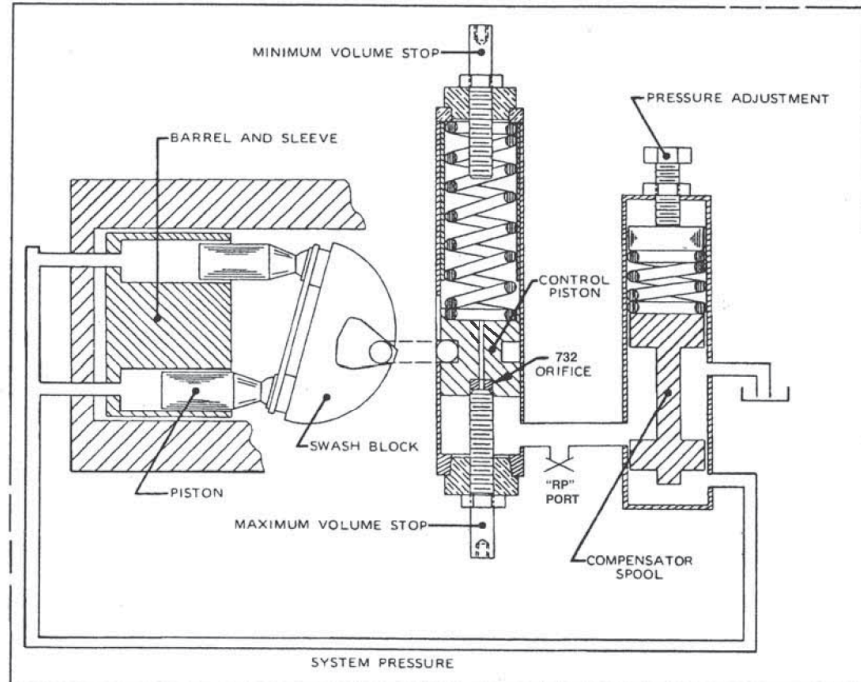
| PROBLEM  | CAUSES  | REMEDY   |
|--|---|--|
| <b>Unresponsive or Unstable Control</b>                      | Swashblock bearing surface and/or Saddle Bearings worn or damaged.  | See appropriate pump service bulletin.   |
|  | Control Pin and/or hole in Swashblock worn significantly.   |  |
|  | Saddle Bearing Locating Pins broken.  |  |
|  | Fluid is contaminated.  | Inspect and clean if necessary. See bulletin 90007.                                    |
|  | Control Piston orifice (732) plugged.   | Inspect and clean if necessary.  |
|  | Contamination trapped between control piston (702) and piston bore is not allowing piston to move smoothly. | Inspect and clean if necessary. Replace scored or damaged parts.                       |
|  | Contamination trapped between control spool (706) and spool bore is not allowing spool to move smoothly.    |  |
|  | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.  |
|  | Hydraulic line between remote pressure compensator components and RP port of control is too long.           | Shorten line length.   |
|  | Insufficient control flow.  | Increase size of control piston orifice (732).   |
| <b>Insufficient Outlet Volume</b>                            | Swashblock not stroking to desired displacement.  | See appropriate pump service bulletin.   |
|  | Low input drive speed.  |  |
|  | Worn or grooved Cylinder Barrel and/or Valve Plate mating surfaces.   |  |
|  | Failed Driveshaft.  |  |
|  | Worn or damaged Piston Shoes or Swashblock.   |  |
|  | Worn Pistons and/or piston bores.   |  |
|  | Control Piston stuck off stroke.  | Inspect and replace if necessary.  |
|  | Maximum Volume Stop adjusted incorrectly.   | Adjust Maximum Volume Stop CCW to increase outlet flow.                                |
| Pressure Compensator is set too close to operating pressure. | Adjust Pressure Compensator setting CW to increase setting.   |  |
| <b>Destrokes at low pressure</b>                             | Pressure compensator adjustment not set correctly.  | Adjust Pressure Compensator setting CW to increase setting and retorque jam nut (715). |
|  | Control Piston orifice (732) plugged.   | Inspect and clean if necessary.  |
|  | Damaged or fractured control spring (items 708 and/or 709).   | Inspect and replace if necessary.  |
|  | Severely worn control spool (706) and/or spool bore.  |  |
|  | Damaged or fractured control piston spring (item 703).  |  |
|  | Faulty remote pressure compensator circuit components.  |  |
| <b>Excessive peak pressure</b>                               | Pressure Compensator is set too high.   | Adjust Pressure Compensator setting CCW to decrease setting.                           |
|  | Minimum Volume Stop is set too high.  | Adjust Minimum Volume Stop CCW to decrease outlet flow.                                |
|  | Fluid is contaminated.  | Inspect and clean if necessary. See bulletin 90007.                                    |
|  | Swashblock bearing surface and/or Saddle Bearings worn or damaged.  | See appropriate pump service bulletin.   |
|  | Contamination trapped between control piston (702) and piston bore is not allowing piston to move smoothly. | Inspect and clean if necessary. Replace scored or damaged parts.                       |
|  | Contamination trapped between control spool (706) and spool bore is not allowing spool to move smoothly.    |  |
|  | Hydraulic line between remote pressure compensator components and RP port of control is too long.           | Shorten line length.   |
|  | Faulty remote pressure compensator circuit components.  | Inspect and replace if necessary.  |
|  | Restriction in drilled passages between pump outlet port and control spool.                                 | Inspect and clean if necessary.  |

## PRINCIPLE OF OPERATION

The pressure compensator control ensures maximum pump flow until the system reaches the controls preset pressure setting. The control then regulates the pump output flow to match the flow requirements of the system, while maintaining the preset output pressure.

When the system pressure exceeds the compensator control setting, or the system no longer requires flow, the control de-strokes the pump while maintaining the preset pressure.

“P-1NN” controls can be adjusted from 750 psi (51,7 bar) working pressure up to the maximum pressure rating of the applicable pump. “P-LNN” controls can be adjusted from 250 psi (17,2 bar) up to a maximum of 1500 psi (103,4 bar).



OILG0253

Figure 4. Swashblock at Full Delivery and “P-1NN” or “P-LNN” Controls at Maximum Volume Stop

## LINE MOUNTED REMOTE PRESSURE CONTROL FOR TYPE "P-1NN" AND "P-LNN" PUMP CONTROLS - VSR (REMOTE SEQUENCE VALVE)

Remote operation of "P-1NN" and "P-LNN" controls can be accomplished by installing an Oilgear VSR Module at the location shown in the control circuit. Use module L51542 for units rated continuously for 4000 psi (275,8 bar) or less. Use L51542-1 for units rated above 4000 psi (275,8 bar).

**NOTE** *To minimize case leakage and power loss, plug the control drain port with a #10-24 UNC setscrew to maintain the standard "P-1NN" or "P-LNN" control case leakage. The plug will increase response time. Standard response time can be obtained by installing a .040 inch (1,0 mm) orifice instead of plugging it.*

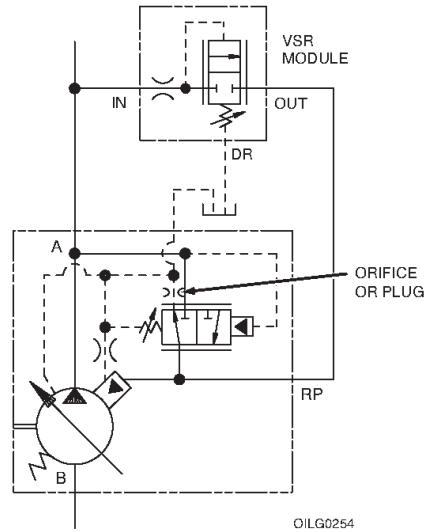
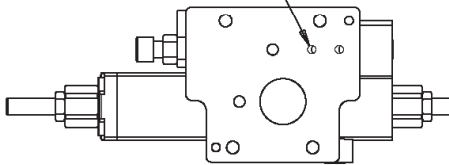


Figure 5. "P-1NN" and "P-LNN" Control Circuit with Remote Pressure Control

DRAIN PORT AS VIEWED FROM UNDERSIDE OF CONTROL BODY.



OILG0255

Figure 7. "P-1NN" and "P-LNN" Control Drain Port Location

**NOTE** *The compensator setting on the pump control must be set at least 200 psi (13,8 bar) higher than the required pressure setting of the remote compensator module to prevent the pump compensator control from interacting with the remote compensator module.*

## SCREW AND PLUG TORQUES FOR CONTROLS

| Item Number | Description                      | Head Type & Size   | Tightening Torque    |
|-------------|----------------------------------|--------------------|----------------------|
| 601         | SAE #2 Plug                      | 1/8" Internal Hex  | 45 in.-lbs (5 N·m)   |
| 603         | SAE #4 Plug                      | 3/16" Internal Hex | 120 in.-lbs (14 N·m) |
| 606         | SAE #8 Plug                      | 5/16" Internal Hex | 45 ft.-lbs (61 N·m)  |
| 711         | PC Adjuster Screw LHCS           | 3/32" Internal Hex | 57 in.-lbs (6 N·m)   |
| 714         | Adjuster Plate Screw             | 5/32" Internal Hex | 80 in.-lbs (9 N·m)   |
| 720         | Max. or Min. Volume Stop Housing | 7/8" External Hex  | 50 ft.-lbs (68 N·m)  |
| 722         | End Cap Screws                   | 3/16" Internal Hex | 120 in.-lbs (14 N·m) |
| 723         | Control Body Screws              | 3/16" Internal Hex | 120 in.-lbs (14 N·m) |
| 732         | Control Piston Orifice           | 3/32" Internal Hex | 20 in.-lbs (2.3 N·m) |

## CONTROL O-RING SEALS

| Item Number | ARP 568 Uniform Size Number | Shore A Durometer |
|-------------|-----------------------------|-------------------|
| 1010        | -010                        | 90                |
| 1011        | -011                        | 90                |
| 1113        | -113                        | 90                |
| 1125        | -125                        | 90                |
| 1237        | -237                        | 70                |
| 1902        | -902                        | 90                |
| 1904        | -904                        | 90                |
| 1908        | -908                        | 90                |

## B-Frame PVWJ -025/-034/-046 “P-1NN” and “P-LNN”

### PARTS LIST

Parts used in these assemblies are per Oilgear specifications. Use only Oilgear parts to ensure compatibility with assembly requirements. When ordering replacement parts, be sure to include pump type and serial number, bulletin number and item number. Specify type of hydraulic fluid to ensure seal and packing compatibility.

**NOTE**

*Parts drawings may not be identical to Oilgear drawings referenced.*

#### PVWJ-025/-034/-046 PRESSURE COMPENSATOR CONTROLS (“P-1NN” STANDARD & “P-LNN” LOW PRESSURE CONTROLS)

| Item                      | Description                           |
|---------------------------|---------------------------------------|
| <b>COMMON PARTS GROUP</b> |                                       |
| 601                       | SAE#2 Plug                            |
| 603                       | SAE#4 Plug                            |
| 606                       | SAE#8 Plug                            |
| 701                       | Control Block                         |
| 702                       | Control Piston                        |
| 703                       | Control Piston Spring                 |
| 704                       | Piston Stop                           |
| 705                       | End Cap                               |
| 706                       | Pressure Compensator Control Spool    |
| 707                       | Spring Seat                           |
| 708                       | Pressure Compensator Spring (Outer)   |
| 709*                      | Pressure Compensator Spring (Inner)   |
| 710                       | Control Plug                          |
| 711                       | Screw                                 |
| 712                       | Shims                                 |
| 713                       | Adjuster Plate                        |
| 714                       | Screw                                 |
| 715                       | Jam Nut                               |
| 716                       | Pressure Compensator Adjustment Screw |
| 717                       | Min. Volume Stop Stem                 |
| 718                       | Max. Volume Stop Stem                 |
| 719                       | Jam Nut                               |
| 720                       | Volume Stop Housing                   |
| 721                       | Control Pin                           |
| 722                       | Screw, End Cap                        |
| 723                       | Screw, Control Body                   |
| 732                       | Orifice                               |
| 1010                      | O-Ring                                |
| 1011                      | O-Ring                                |
| 1113                      | O-Ring                                |
| 1125                      | O-Ring                                |
| 1237                      | O-Ring                                |
| 1902                      | O-Ring                                |
| 1904                      | O-Ring                                |
| 1908                      | O-Ring                                |

\*Only used in P-1 Control.

## B-Frame PVWJ -025/-034/-046 “P-1NN” and “P-LNN”

### SERVICE KITS

Document Number: 519975-SK2

#### PVWJ Service Kits

Revision: New

Reference 519975-201  
SERVICE KIT, Figures 8 & 9

| Description                               | Kit No.    | Design Series | Items Included (quantity is 1 unless noted)    |
|---|------------|---------------|--|
| <b>Main Control Body Kits</b>             |            |               |  |
| PVWJ-025                                  | K50432-100 | A1            | 701, 706                                       |
| PVWJ-034/-046                             | K50432-200 | A1            | 701, 706                                       |
| <b>Control Piston Kits</b>                |            |               |  |
| All Models                                | K50484     | A1            | 702, 732                                       |
| <b>Pressure Compensator Spools</b>        |            |               |  |
| PVWJ-025                                  | 50015-100  | A1            | 706  |
| PVWJ-034/-046                             | 50015-200  | A1            | 706  |
| <b>Control Spring Kits</b>                |            |               |  |
| P-LNN (All Models)                        | K50036-104 | A1            | 703, 708                                       |
| PVWJ-025 P-1NN                            | K50036-107 | A1            | 703, 708                                       |
| PVWJ-034/-046 P-1NN                       | K50036-110 | A1            | 703, 708, 709                                  |
| <b>Control Pins</b>                       |            |               |  |
| All Models                                | 51339-5    | A1            | 721  |
| <b>Volume Stop Kits</b>                   |            |               |  |
| Maximum Volume Stop (All Models)          | K50590     | A1            | 718, 719, 720, 1011, 1908                      |
| Minimum Volume Stop (All Models)          | K50590-200 | A1            | 705, 717, 719, 720, 1011, 1020, 1908           |
| <b>Pressure Compensator Adjuster Kits</b> |            |               |  |
| All Models                                | K50660-200 | A1            | 710, 711, 712, 713, 715, 716, 1113             |
| <b>Control Seal Kit</b>                   |            |               |  |
| All Models                                | K50824-200 | A1            | 1010, 1011, 1113, 1125, 1237, 1902, 1904, 1908 |

## B-Frame PVWJ -025/-034/-046 "P-1NN" and "P-LNN"

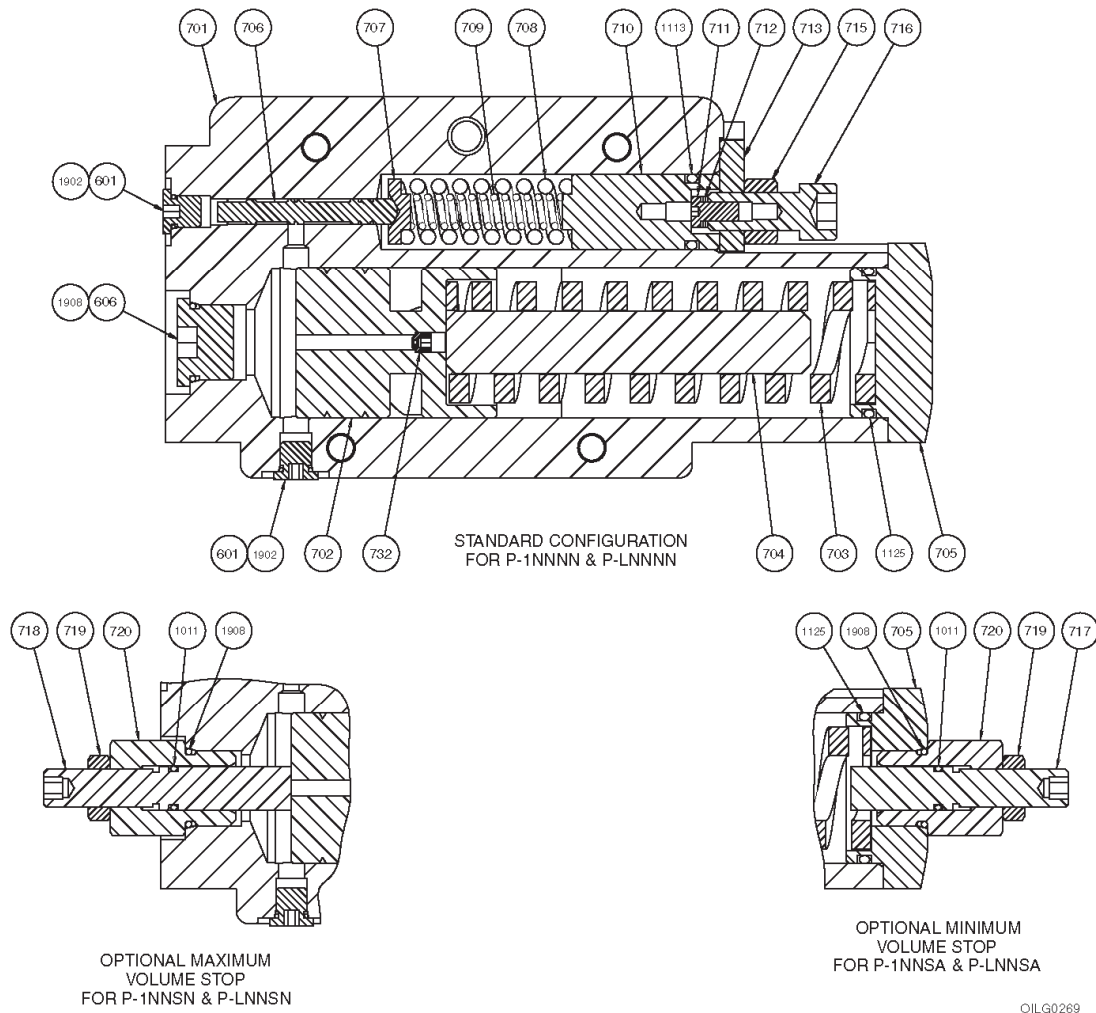


Figure 8. Parts Drawing for "P-1NN" and "P-LNN" Control (519975-201 sheet 1)

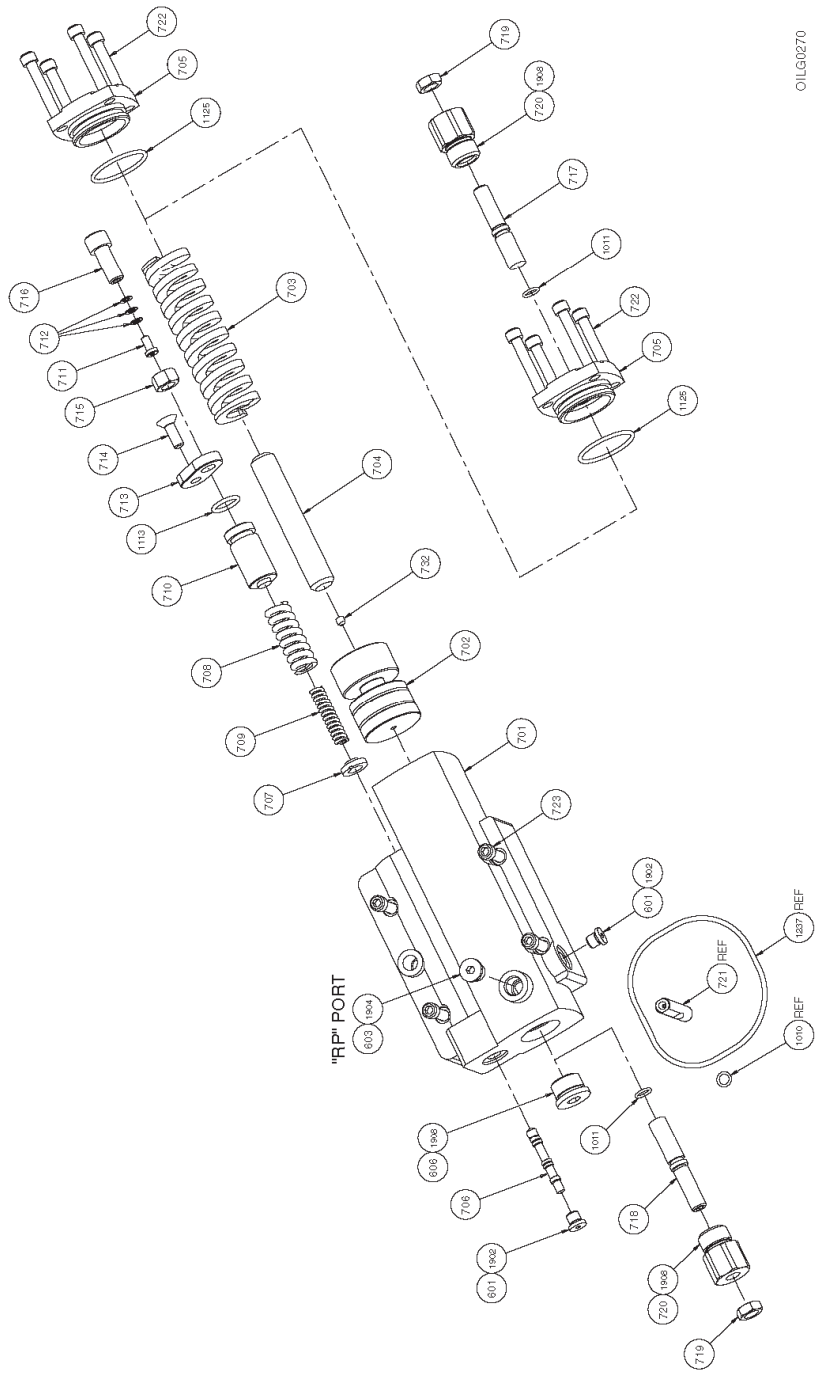
### MAXIMUM AND MINIMUM VOLUME STOP

The maximum volume stop can be adjusted to attain a maximum volume from full to 25% of full flow. The pump can be de-stroked from full to 25% flow with 11 turns of the volume stop. One turn clockwise will decrease maximum pump outlet flow 7%.

The minimum volume stop can be adjusted to attain a minimum volume from zero to full flow. The adjustment requires 14 turns to go from zero to full flow. One turn clockwise will increase minimum pump outlet flow 9%.



# B-Frame PVWJ -025/-034/-046 "P-1NN" and "P-LNN"



OILG0270

Figure 9. Exploded Parts Drawing for "P-1NN" and "P-LNN" Control (519975-201 sheet 2)





---

## **AFTER SALES SERVICES**

At Oilgear we build products to last. It is the nature of this type of machinery to require proper maintenance regardless of the care we put into manufacturing. Oilgear has several service programs in place to help you.

### **STAY-ON-STREAM SERVICE**

By signing up for Oilgear's Stay-On-Stream program, you can prepare for problems before they happen. Certain field tests such as fluid testing, slip testing and electronic profile recording comparisons can be performed by our field service people or your own factory trained personnel. These tests can indicate problems before they become "down-time" difficulties.

## **SERVICE SCHOOLS**

Oilgear conducts training to train your maintenance personnel. "General" hydraulic or electronic training is conducted at our Milwaukee, Wisconsin plant on a regular basis. "Custom" training, specifically addressing your particular hydraulic and electro-hydraulic equipment, can be conducted at your facilities.

### **SPARE PARTS AVAILABILITY**

Prepare for your future needs by stocking Oilgear original factory parts. Having the correct parts and necessary skills "in-plant" enables you to minimize "down-time." Oilgear has developed parts kits to cover likely future needs. Oilgear Field Service Technicians are also ready to assist you and your maintenance people in troubleshooting and repairing equipment.





**APPENDIX VI**

**Material Safety  
Data Sheet  
(MSDS)  
Hydraulic Fluid**



Product name: SKYDROL® LD4 Fire resistant hydraulic fluid  
Solutia Inc. Material Safety Data Sheet  
Reference Number: 000000000183

MSDS A 035

Page 1 / 8  
Date: 03/18/2003  
Version 5.1/E

# Solutia Inc.

## Material Safety Data Sheet

### 1. PRODUCT AND COMPANY IDENTIFICATION

Product name: SKYDROL® LD4 Fire resistant hydraulic fluid

Reference Number: 000000000183

Date: 03/18/2003

Company Information:

**United States:**

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

**Canada:**

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

**Mexico:**

Solutia MEXICO, S. DE R.L. DE C.V.  
Blvd. Manuel Avila Camacho No. 40 Piso 12 Colonia Lomas  
de Chapultepec  
Edificio Torre Esmeralda 11000 Mexico, D.F.  
Emergency telephone: SETIQ: (in Mexico) 01-800-002-1400  
Non-Emergency telephone: (in Mexico) 555-202-5600

**Brazil:**

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

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

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

### 3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

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

WARNING STATEMENTS

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

POTENTIAL HEALTH EFFECTS

Likely routes of exposure: eye and skin contact  
inhalation

Eye contact: Highly irritating to eyes.

Skin contact: Highly irritating to skin.  
No more than slightly toxic if absorbed.  
Repeated contact may cause a drying, solvent like action on the skin.

Inhalation: Severely irritating if inhaled.  
No more than slightly toxic if inhaled.  
Significant adverse health effects are not expected to develop under normal conditions of exposure.

Ingestion: No more than slightly toxic if swallowed.  
Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.

Signs and symptoms of overexposure: coughing  
sneezing  
headache  
nausea/vomiting

Target organs/systems: Contains material which may cause urinary bladder damage based on animal data

Refer to Section 11 for toxicological information.

**4. FIRST AID MEASURES**

If in eyes:  
If on skin: Immediately flush the area with plenty of water.  
Remove contaminated clothing.  
Wash skin gently with soap as soon as it is available.  
Get medical attention.  
Wash clothing before reuse.

If inhaled: Remove patient to fresh air.  
If not breathing, give artificial respiration.  
If breathing is difficult give oxygen.  
Remove material from eyes, skin and clothing.

If swallowed: Immediate first aid is not likely to be required.  
A physician or Poison Control Center can be contacted for advice.  
Wash heavily contaminated clothing before reuse.



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

## 5. FIRE FIGHTING MEASURES

Flash point: 160 C Cleveland Open Cup  
Fire point: 176 C ASTM D-2155  
Autoignition temperature: 398 C ASTM D-2155  
Hazardous products of combustion: None known;  
Extinguishing media: Water spray, foam, dry chemical, or carbon dioxide  
Unusual fire and explosion hazards: None known  
Fire fighting equipment: Firefighters, and others exposed, wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

## 6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Use personal protection recommended in section 8.  
Environmental precautions: Keep out of drains and water courses.  
Methods for cleaning up: Contain large spills with dikes and transfer the material to appropriate containers for reclamation or disposal. Absorb remaining material or small spills with an inert material and then place in a chemical waste container. Flush spill area with water.

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

## 7. HANDLING AND STORAGE

### Handling

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

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

### Storage

General: Stable under normal conditions of handling and storage.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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

|                            |  |
|----------------------------|--|
| Hand protection:           | Wear chemical resistant gloves.<br>Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application.<br>See Solutia Glove Facts for permeation data.   |
| Body protection:           | Wear suitable protective clothing.<br>Wear full protective clothing if exposed to splashes.<br>Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application.<br>Wash contaminated skin promptly.<br>Launder contaminated clothing and clean protective equipment before reuse.<br>Have safety shower available at locations where skin contact can occur.<br>Wash thoroughly after handling.                     |
| Respiratory protection:    | Avoid breathing vapour or mist.<br>Use approved respiratory protection equipment (full facepiece recommended) when airborne exposure limits are exceeded.<br>If used, full facepiece replaces the need for face shield and/or chemical goggles.<br>Consult the respirator manufacturer to determine the appropriate type of equipment for a given application.<br>See Solutia Respirator Facts.<br>Observe respirator use limitations specified by the manufacturer. |
| Ventilation:               | Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits.<br>If practical, use local mechanical exhaust ventilation at sources of air contamination such as processing equipment.   |
| Airborne exposure limits:  | (ml/m <sup>3</sup> = ppm)  |
| SKYDROL® LD4               | No specific occupational exposure limit has been established.  |
| tributyl phosphate         | ACGIH TLV: 0.2 ml/m <sup>3</sup> ; 2.2 mg/m <sup>3</sup> ; ; 8-hr TWA<br>OSHA PEL: 5 mg/m <sup>3</sup> ; ; 8-hr TWA<br>Mexican OEL: 0.2 ml/m <sup>3</sup> ; 2.5 mg/m <sup>3</sup> ; ; 8-hr TWA<br>Mexican OEL: 0.4 ml/m <sup>3</sup> ; 5 mg/m <sup>3</sup> ; ; 15-min STEL   |
| dibutyl phenyl phosphate   | ACGIH TLV: 0.3 ml/m <sup>3</sup> ; 3.5 mg/m <sup>3</sup> ; skin * ; 8-hr TWA<br>* skin absorption of this material may add to the overall exposure.  |
| 2,6-di-tert-butyl-p-cresol | ACGIH TLV: 2 mg/m <sup>3</sup> ; ; 8-hr TWA<br>Mexican OEL: 10 mg/m <sup>3</sup> ; ; 8-hr TWA<br>Mexican OEL: 20 mg/m <sup>3</sup> ; ; 15-min STEL   |

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

## 9. PHYSICAL AND CHEMICAL PROPERTIES

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

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

## 10. STABILITY AND REACTIVITY

|  |  |
|--|--|
| Conditions to avoid:                         | Elevated temperatures  |
| Materials to avoid -<br>Hazardous reactions: | Contact with strong oxidizing agents.<br>Hazardous polymerization does not occur.        |
| Hazardous decomposition<br>products:         | phosphorus oxides (P <sub>x</sub> O <sub>y</sub> ); carbon monoxide (CO); carbon dioxide |

## 11. TOXICOLOGICAL INFORMATION

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

### Acute animal toxicity data

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

### Components

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

|                    |   |
|--------------------|---|
| tributyl phosphate | Slightly toxic following oral administration.<br>Practically nontoxic after skin application in animal studies. |
|--------------------|---|

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

## 12. ECOLOGICAL INFORMATION

### Environmental Toxicity:

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

### Environmental fate

#### Biodegradation

Readily biodegradable.

### 13. DISPOSAL CONSIDERATIONS

- US EPA RCRA Status: This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261.
- Disposal considerations: Incineration  
Recycle
- Miscellaneous advice: This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable standards.  
Local, state, provincial, and national disposal regulations may be more or less stringent. This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

### 14. TRANSPORT INFORMATION

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

US DOT

Other: Not regulated for transport.

Canadian TDG

Other: Not regulated for transport.

### 15. REGULATORY INFORMATION

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

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

SARA Hazard Notification:

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

Section 302 Extremely Hazardous Substances:

Section 313 Toxic Chemical(s):

CERCLA Reportable Quantity:

Not applicable

Product name: SKYDROL® LD4 Fire resistant hydraulic fluid  
Solutia Inc. Material Safety Data Sheet  
Reference Number: 000000000183

Page 8 / 8  
Date: 03/18/2003  
Version 5.1/E

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

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

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

## 16. OTHER INFORMATION

Product use: Hydraulic fluids and additives

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

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

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

TM, ® is a registered trademark of Solutia Inc.

SOLUTIA is a trademark of Solutia Inc.

Responsible Care® is a registered trademark of the American Chemistry Council.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Solutia Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Solutia Inc. be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.



**APPENDIX VII**

**ANSI/B93.19M-1972  
(R1993-Excerpt)**







ANSI/B93.19M-  
1972 (R1993)  
First edition  
6 December 1972

---

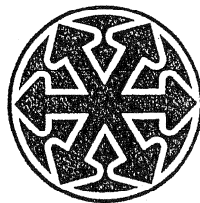
AMERICAN NATIONAL STANDARDS INSTITUTE • A NATIONAL STANDARD FOR FLUID POWER

---

# Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system

(Technically identical to ISO 4021:1977)  
(NFPA/T2.9.1-1972)  
(Metric only)

**SPONSOR**



National  
**FLUID POWER**  
Association

Descriptors: hydraulic fluid power, liquids, chemical analysis, sampling, contamination.

# Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system

## 0 Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a fluid under pressure within an enclosed circuit. The fluid is both a lubricant and a power-transmitting medium.

Reliable system performance requires control of the fluid medium. Qualitative and quantitative determination of particulate contamination in the fluid medium requires precision in obtaining the sample and determining the nature and extent of contamination.

The most representative sample is obtained from a system while the fluid is following in a turbulent manner. This standard gives the procedure for obtaining that sample, known as a dynamic sample.

## 1 Scope

This standard specifies a method of extracting dynamic fluid samples from a line of an operating hydraulic fluid power system.

The hydraulic fluid samples must be representative of the particulate contaminant in the fluid flowing at the point of sampling. (The samples are used for particulate contamination analysis.)

## 2 References

ISO 1219, *Fluid power systems and components — Graphic symbols.*

ISO 5598, *Fluid power — Vocabulary.*

## 3 Definitions

**3.1 fluid sampling, dynamic:** The extraction of a sample of fluid from a turbulent section of a flow stream.

**3.2 fluid sampling, static:** The extraction of a sample of fluid from a fluid at rest.

**3.3 sampler, turbulent:** A device for creating turbulence in the main stream while extracting a fluid sample.

**3.4** For definitions of other terms used, see ISO 5598.

## 4 Graphic symbols

Graphic symbols used are in accordance with ISO 1219.

## 5 Rules

**5.1** Use a dynamic fluid sampling method (see clause 7).

**5.2** Control the rate of sample extraction only by means of a capillary restriction.

**5.3** Attach the sampling device permanently, or by a quick disconnect coupling.

## 6 Sampling device

Note — Take normal precautions to safeguard personnel and equipment.

**6.1** Use a typical sampling device as shown in the figure if turbulent flow conditions exist in the main stream.

## ANSI/B93.19M-1972

6.1.1 Permanently attach the ball valve or the valved portion of the quick disconnect coupling to the port through which the sample is to be taken.

6.1.2 Provide a dust cap for the item in 6.1.1.

6.1.3 Use the remaining equipment only for sampling.

6.1.4 Select capillary tubing having an inside diameter and length consistent with the sampling rate desired.

6.1.4.1 Do not use capillary tubing having an inside diameter smaller than 1,25 mm. Other cross-sections (such as rectangular) may be used provided that the smallest inside dimension is not less than 1 mm.

6.1.4.2 Sharpen and deburr the ends of the capillary tube to facilitate subsequent piercing of the film covering the sampling bottle mouth.

6.2 If turbulence in the flow stream cannot be ensured, use a means of creating turbulence such as a turbulent flow sampler.

### 7 Sampling procedure

7.1 Where a sampling device incorporating a quick disconnect coupling is used, attach the separable portions of the sampling device to the permanently attached portion.

7.2 Open the ball valve.

7.3 Pass a minimum of 200 cm<sup>3</sup> of fluid through the sampling device before collecting the fluid.

7.4 Without disturbing the ball valve, place the sampling bottle in position to collect the fluid.

7.4.1 Use the sharp end of the capillary tubing to pierce the plastic film covering the bottle mouth.

7.4.2 Take a sample of not more than 75 % and not less than 50 % of the sampling bottle volume.

7.5 When a sufficient sample has been collected, remove the sampling bottle before turning off the flow with the ball valve.

7.6 Recap the sample bottle immediately after withdrawing the capillary tubing.

7.7 Where a sampling device incorporating a quick disconnect coupling is used, disconnect the separable portions of the sampling device and remove any residual fluid films by flushing with a suitable solvent.

7.8 Immediately upon disconnection, replace the dust cap on the permanently mounted section of the quick disconnect coupling.

### 8 Identification statement

Use the following statement in test reports, catalogs and sales literature when electing to comply with this standard:

"Method of extracting fluid samples conforms to ANSI/B93.19M-1972, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system.*"

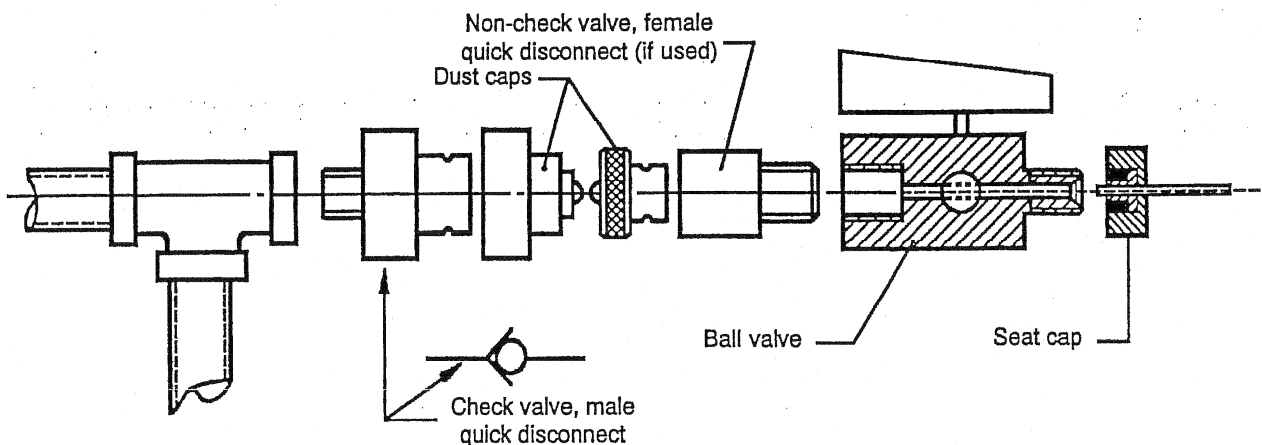


Figure 1 — Typical field type sampling device





**APPENDIX VIII**

**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.