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EMERGENCY PUMP
(24 Volts)

**WARNING**

If engine power is lost, stop and set the manual brakes. Failure to do so could result in a runaway train, which may cause severe injury and death as well as serious machine damage.

Used when there is a diesel engine & or a hydraulic circuit failure.

Emergency Pump (Figure 1) is located on the rear right corner of the center area of the machine, you will need to use the rear cab access door.

The emergency pump has a relief valve that is set to 2200 PSI. To check or adjust the emergency pump relief valve go to page H-20.

To lower the boom:

1. Turn the emergency boom lower ball valve to the open position. The valve is located to the left and above the emergency pump (Figure 1).
2. Turn on battery master switch located on right side of center console.
3. Make certain all personnel are away from the area before proceeding.
4. Turn the emergency pump ball valve to the close position (Figure 1).
5. The boom winch brake will reapply when the emergency pump switch is released.

**CAUTION**

Operate the 24 volt emergency pump in intervals for a maximum of 30 seconds to one minute, let electric motor cool for one minute before using again.

The 24 volt emergency pump is designed for emergency use ONLY and is NOT to be run continuously.

To raise / lower main winch or swing the machine:

1. Turn the emergency boom lower ball valve to the open position. The valve is located to the left and above the emergency pump (Figure 1).
2. Turn on battery master switch located on right side of center console.
3. Verify that both the emergency stop and the interlock buttons are pulled out.
4. Turn the ignition switch to the ON position.
5. On the center console press & hold the "EMERGENCY PUMP" rocker switch. While holding the switch, use the joysticks to manipulate the swing or main winch function.
6. Close the emergency pump ball valve (Figure 1).

**WARNING**

Make certain all personnel are away from the area before proceeding.

3. On the center console press & hold the "EMERGENCY PUMP" rocker switch.

4. This will release the hydraulic brake on the boom winch for as long as the rocker switch is pressed.

5. The boom winch brake will reapply when the emergency pump switch is released.

**CAUTION**

There is no provision for raising the booms with the emergency pump, so do not lower the booms more than necessary.
### HYDRAULIC COMPONENT MAINTENANCE SCHEDULE

<table>
<thead>
<tr>
<th>Item</th>
<th>10 Hours (Day)</th>
<th>50 Hours (Week)</th>
<th>250 Hours (Month)</th>
<th>750 Hours (3 Months)</th>
<th>1500 Hours (6 Months)</th>
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</thead>
<tbody>
<tr>
<td>Hydraulic Oil</td>
<td>I/F</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Oil Cleanliness</td>
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<td></td>
<td></td>
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<td>I/T</td>
</tr>
<tr>
<td>Return Line Filter</td>
<td></td>
<td>I*</td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Suction Line Filter</td>
<td></td>
<td>I*</td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Pressure Filter</td>
<td></td>
<td>I*</td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Hoses and Fittings</td>
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<td></td>
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<td></td>
<td>I</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td></td>
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<td></td>
<td></td>
<td>CL</td>
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<td>Pressure Checks</td>
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<td>Traction Pump</td>
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<td></td>
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<td>Transmission RPL</td>
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<td>Main Winch/Swing</td>
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<td>Swing Brake Reliefs</td>
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<td>Compressor Drive</td>
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<td>I/A</td>
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<td>Generator Drive</td>
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<td>Emergency Pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I/A</td>
</tr>
</tbody>
</table>

**Key:**

Some maintenance requires that a two step procedure be performed. For example, I/F requires inspection and Filling.

- **A** = Adjust
- **C** = Change
- **CL** = Clean
- **I** = Inspect
- **L** = Lube
- **R** = Replace
- **S** = Service
- **T** = Test
- **F** = Fill

* Hydraulic filters require inspection during the first 40 hours of service and at designated intervals thereafter.

Ο Monthly pressure checks are recommended. Fluctuation of hydraulic power may require more frequent checks.
<table>
<thead>
<tr>
<th>Description</th>
<th>NORDCO Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pressure Filter</strong></td>
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</tr>
<tr>
<td>Pressure Filter</td>
<td>3880252</td>
</tr>
<tr>
<td>Element Only</td>
<td>3894289</td>
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<tr>
<td>Pressure Switch Only</td>
<td>5193970</td>
</tr>
<tr>
<td><strong>Suction Strainer</strong></td>
<td></td>
</tr>
<tr>
<td>Strainer</td>
<td>500619</td>
</tr>
<tr>
<td>Element Only</td>
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<td><strong>Return Filter</strong></td>
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<td>Pressure Switch Only</td>
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</tr>
<tr>
<td>Gasket Kit Only</td>
<td>ALFT503</td>
</tr>
<tr>
<td><strong>Reservoir Breather</strong></td>
<td></td>
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<tr>
<td>Element</td>
<td>1673251</td>
</tr>
<tr>
<td>Relief Valve</td>
<td>1677206</td>
</tr>
<tr>
<td><strong>Hydraulic Tank Oil Level Sight Glass</strong></td>
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<tr>
<td></td>
<td>7030872</td>
</tr>
<tr>
<td><strong>Hydraulic Oil Cooler</strong></td>
<td></td>
</tr>
<tr>
<td>Hydraulic Oil Cooler Assembly</td>
<td>26740210</td>
</tr>
<tr>
<td>Oil Cooler Core</td>
<td>60570039</td>
</tr>
<tr>
<td>Temperature Switch</td>
<td>5194800</td>
</tr>
<tr>
<td>24 Volt Motor &amp; Fan</td>
<td>50211530</td>
</tr>
<tr>
<td><strong>Dual Top-Off w/Electric Pump (option)</strong></td>
<td></td>
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<tr>
<td>Top-Off Electric Pump</td>
<td>3875040</td>
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<tr>
<td>Element Only</td>
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<tr>
<td>Spin On Breather Only</td>
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</table>
Top Off (Push-Pull)

Pump (Push –Pull) .......................................................... 59424140
Element Only ............................................................... 3874980

24 Volt Emergency Pump

24 Volt Emergency Pump Assembly .................................. 59420465
Little Giant Hydraulic Pump ........................................... 59420430
Little Giant 24 Volt Motor ............................................. 50210210
PRESSURE SETTINGS

GENERAL

Pressure to the various devices in the hydraulic system is controlled by the Compensator, Pressure Reducing Valves, Counterbalance Valves, and Relief Valves. It is important for the proper operation of the machine that pressures are maintained at the correct levels as shown below. Adjustments may also be necessary anytime the machine is not operating normally. Test and adjust pressure as shown on the following pages.

Pressure checks can be performed anytime. Flow controls adjustments are performed after the hydraulics oil is warmed up (oil temperature has reached 100°F minimum).

Before performing these checks, read and understand all OPERATION instructions, warnings and cautions. These testing procedures require at least two workers in order to be performed correctly.

All checks should be performed with the machine’s MANUAL TRAIN BRAKE HANDWHEEL SET and wheels chocked.

![DANGER]

Serious personal injury or death may result if hydraulic oil penetrates the skin. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines.

Tighten all connections before applying pressure. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately.

PRESSURE CHECKS

<table>
<thead>
<tr>
<th>Device</th>
<th>Pressure (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Winch &amp; Swing Drive Pump Standby Pressure</td>
<td>580</td>
</tr>
<tr>
<td>Main Winch &amp; Swing Drive Pump Pressure Compensator</td>
<td>2175</td>
</tr>
<tr>
<td>Main Winch &amp; Swing Drive Pressure Relief Valve</td>
<td>2200</td>
</tr>
<tr>
<td>Boom Winch Pressure Relief Valve</td>
<td>2200</td>
</tr>
<tr>
<td>Boom Winch Counterbalance Valve (9000 lb load)</td>
<td>600-625</td>
</tr>
<tr>
<td>Boom Winch Counterbalance Valve (9000 lb load)</td>
<td>600-625</td>
</tr>
<tr>
<td>Swing Drive Counterbalance “Cushion” Valve</td>
<td>2600</td>
</tr>
<tr>
<td>Swing Gear Box Brake Release Pressure Reducing Valve</td>
<td>600</td>
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<tr>
<td>Air Compressor Pressure Relief Valve</td>
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</tr>
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<td>Valve Type</td>
<td>Pressure (PSI)</td>
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<tr>
<td>Generator Pressure Reducing Valve</td>
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<td>Emergency Pump Pressure Reducing Valve</td>
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<td>Traction Pump Pressure Limiter</td>
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<tr>
<td>Traction Pump Charge Pressure Relief Valve</td>
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<tr>
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<tr>
<td>Traction Remote Pressure Limiter (3B &amp; 3D)</td>
<td>1500</td>
</tr>
</tbody>
</table>

**WARNING**

Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.
Main Winch & Swing Drive Pump Standby Pressure

1. Turn off engine

2. Open inner door at rear rider compartment to gain access to valve.

3. Install a pressure gage at the main winch & swing drive pressure tap (Figure 2).

4. Start engine but DO NOT engage either the main winch or swing drive.

5. Read pressure.

6. If pressure is higher than 580 psi loosen set screw to standby pressure adjusting screw (do not remove) (Figure 4).

7. Turn adjusting screw counterclockwise (CCW) until pressure reads 580 psi.

8. Tighten set screw at new location.

9. If pressure is lower than 580 psi loosen turn adjusting screw clockwise (CW) until pressure reads 580 psi.

10. Tighten set screw at new location.
Main Winch & Swing Drive
Load Sense Pump
Pressure Compensator

1. Install pressure gauge to main winch & swing drive pressure tap (Figure 6).

2. Install positive swing lock block between rear counterweight and lower deck.

3. Start engine and move left joystick (Figure 7) fully to one side to activate swing drive motor, the load sense pump (Figure 8) will ramp up to the pressure compensator setting.

4. If pressure is higher than 2175 psi loosen the load sense pump pressure compensator set screw (do not remove)(Figure 9).

5. Turn load sense pump pressure compensator adjusting screw (Figure 10) counterclockwise (CCW) until pressure reads 2175 psi.

6. Tighten set screw at new location.

7. If pressure is lower than 2175 psi loosen the load sense pump pressure compensator set screw (do not remove) (Figure 9).

8. Turn load sense pump pressure compensator adjusting screw (Figure 10) clockwise (CW) until pressure reads 2175 psi.
Main Winch & Swing Drive Pressure Relief Valve

1. Turn off engine

2. Open inner door at rear rider compartment to gain access to valve.

3. Install a pressure gauge to the load sense pressure port (Figure 11).

4. Install positive swing lock block between rear counterweight and lower deck.

5. Loosen the main winch & swing drive (load sense) pump pressure compensator set screw (Figure 9).

6. Turn load sense pump pressure compensator adjusting screw (Figure 10) one full turn clockwise (CW).

7. Start engine and move left joystick (Figure 12) fully to one side for swing drive, the load sense pump will ramp up to pressure compensator setting.

8. The pressure gauge should read 2200 psi.

9. The main winch/swing drive circuit pressure relief valve (Figure 12) located above load sense pressure port near the top of the machine’s frame. Climb the step assembly in front of the fuel tank onto the primary boom to gain access to the pressure relief valve (Figure 13).

11. If pressure is less than 2200 psi loosen the lock nut and turn Allen screw clockwise until 2200 psi is reached.

12. If pressure is more than 2200 psi, loosen lock nut and turn Allen screw out counterclockwise till 2200 psi is reached.

14. Move left joystick fully to one side to activate swing drive load sense pump so the pump pressure compensator setting can be adjusted.

15. Turn the pump pressure compensator adjusting screw (Figure 10) counterclockwise (CCW) until pressure gauge reads 2175 psi.

16. Tighten set screw at new location (Figure 9).

When adjusting the pressure relief valve for the main winch & swing brake pump circuits (2200 psi) always return the Pump Pressure Compensator back to 2175 psi.

13. When the pressure relief is set at 2200 psi, RETURN the load sense pump pressure compensator back to 2175 psi.
Boom Winch Pressure Relief Valve

1. Turn off engine

2. Open inner door at rear rider compartment to gain access to valve.

3. Install a pressure gauge to the test port on the boom winch directional control valve (Figure 15).

4. Remove either hose at the boom winch drum hydraulic motor (figure 16) and use # 12 JIC plug the hose and cap the motor fitting.

5. Have operator start engine and pull the left hand controller (boom winch “UP”) (Figure 17) while you read pressure gauge.

6. Turn Allen screw (Figure 18) in clockwise (CW) till 2200 psi is reached.

7. Turn Allen screw (Figure 18) out counterclockwise until 2200 psi is reached.
Main Winch Counterbalance Valve

1. Purpose of counterbalance valve is to provide backpressure to prevent chatter when lowering a load with the main winch.

2. Alert personnel or bystanders that maintenance is being performed on the main winch circuit and to stay clear of the winch supported load.

3. Start engine and position machine to safely pick up a 9000 pound load.

4. Pull the right hand controller rearward (Figure 19) and slowly lift the 9000 pound load ten feet in the air.

5. Loosen the main winch counterbalance valve adjusting screw lock nut (Figures 20 & 21).

6. Turn the main winch counterbalance valve adjusting screw IN clockwise one full turn.

7. Push the right hand controller forward (Figure 2) to slowly lower the 9000 pound load and adjust the main winch counterbalance valve adjusting screw lock counterclockwise until the chatter stops.

8. Turning the main winch counterbalance valve adjusting screw counterclockwise increases the pressure setting and release load.

9. Turning the main winch counterbalance valve adjusting screw clockwise decreases the pressure setting and if turn in far enough will release the main winch held load.

10. If a hydraulic gauge is installed inline with the pilot line of the main winch circuit, the pressure should read 600-625 psi during the above 9000 lb load procedure.
Boom Winch Counterbalance Valve

1. Purpose of counterbalance valve is to provide back pressure to prevent chatter when lowering a load with the boom.

WARNING

2. Alert personnel or bystanders that maintenance is being performed on the main winch circuit and to stay clear of the winch supported load.

3. Start engine and position machine to safely pick up a 9000 pound load.

4. Pull the right hand controller reward (Figure 22) and slowly lift the 9000 pound load ten feet in the air.

5. Loosen the boom winch counterbalance valve adjusting screw lock nut (Figure 24).

6. Turn the boom winch counterbalance valve adjusting screw IN clockwise one full turn.

7. Push the left hand controller forward (Figure 22) to slowly lower the 9000 pound load and adjust the boom winch counterbalance valve adjusting screw counterclockwise until the chatter stops.

8. Turning the boom winch counterbalance valve adjusting screw counterclockwise increases the pressure setting.

9. Turning the boom winch counterbalance valve adjusting screw clockwise decreases the pressure setting and if turn in far enough will release the main winch held load.

10. If a hydraulic gauge is installed inline with the pilot line of the boom winch circuit, the pressure should read 600-625 psi during the above 9000 lb load procedure.
Swing Drive ‘Cushion’ Valves

1. The swing drive cushion valves are mounted behind hydraulic tank (Figure 25).

2. The swing drive ‘cushion valves are counterbalance valves set to 2600 psi.

3. The swing drive cushion valve is used as work port reliefs to provide over-running load control and includes a load sense shuttle for brake release. The cushion valves minimize the shock experienced in stopping the swing motion with a load hanging from the end of a winch. This causes sudden excess pressure that would cause damage to the swing gear box components.

Normally Closed Air Pilot Solenoid Cartridge

1. The normally closed air pilot solenoid cartridge is within the air compressor hydraulic manifold located inside of the right frame behind the hydraulic tank (Figures 27 & 28).

2. During machine operation when the reservoir has 125 – 145 psi. This air pressure pushes the valve spool of the normally closed air pilot solenoid cartridge (Figure 28) to the OPEN position where the hydraulic oil circulates from the air compressor gear pump back to hydraulic reservoir.

3. When the air pressure in the reservoir is below 125 psi the air compressor governor (Figure 29) CUT-IN setting will exhaust to the unload position. The drop in air pressure will return the air pilot solenoid cartridge valve spool to the normally CLOSED position. Oil flow from the air compressor pump through the air compressor hydraulic valve assembly is blocked. The compressor gear pump oil now flows through air compressor’s hydraulic motor. The air compressor now runs until the governor (Figure 29) CUT-OUT setting (145 psi).

4. To adjust the normally closed air pilot operated hydraulic valve:
   a. Use a 1/8” pin spanner or a 3/16” face spanner wrench.
   b. Turn the turn the cartridge valve bonnet (Figure 30) IN clockwise (CW) to increase pilot set point (125 psi).
   c. Turn the turn the cartridge valve bonnet (Figure 30) OUT counterclockwise (CCW) to decrease the pilot pressure set point (125 psi).

NOTE:
The air compressor pressure setting of 145 psi (Cut Off) is controlled by a governor. When diagnosing problems in the air compressor / pneumatic circuit refer also to the pneumatic section of this operator manual for the air compressor governor.
1. The air compressor gear pump relief valve cartridge is within the air compressor manifold located inside of the right frame behind the hydraulic tank (Figures 31 & 32).

2. The air compressor gear pump relief valve is a nonadjustable cartridge factory set to 2500 psi.

3. To check for proper operation, turn off the engine and open the valve at bottom of upper air reservoir (Figure 33) to drain the air from the pneumatic circuit.

4. Install a pressure gauge on the air compressor gear pump pressure port (Figure 34).

5. Remove the hydraulic hose located at the air compressor manifold return to tank tee (Figure 35) and install a #12 cap on the motor fitting. Install a #12 plug in the removed hose fitting.

6. While someone starts engine observe pressure gauge at air compressor pump it should relief at 2500 psi.

7. A low pressure reading may indicate a problem with debris in the pressure relief cartridge or a problem at the normally closed air solenoid valve.

8. When done testing the air compressor gear pump relief valve circuit, reinstall the return hose on the air compressor manifold return to tank tee and remove the pressure gauge.
Generator Pressure Relief Valve

Both the generator pressure relief valve and the generator rpm cartridge needs to be checked and adjusted if there is a problem with the magnet.

**WARNING**

Generator electrical output is 230 – 250 Volts DC

1. The following procedure will require 2 or more persons.

2. Check that the magnet is attached and the electrical cable is connected.

**CAUTION**

Do NOT turn the generator ON until the magnet is attached and connected.

3. Attach a hydraulic pressure gage on the generator circuit pressure located to the rear of the dual Permco gear pump (Figure 36).

4. Have someone start engine, on the overhead panel push the generator on/off toggle switch to on position, and read the generator’s voltmeter located on the left- front (Figure 37) during the following test procedures.

5. At the rear of the crane on the right side loosen the generator pressure relief valve adjusting screw lock nut (Figure 38).

6. Turn the generator pressure relief valve (Figure 38) adjusting screw counterclockwise (CCW) all the way out.

7. Turn the generator pressure relief valve (Figure 38) adjusting screw clockwise (CW) while watching the voltage indicator on the generator (230 – 250 Volt DC). Stop when there is a drop in the voltage.

8. Pressure gauge reading should be around 2400 psi

9. Loosen generator pressure relief valve adjusting screw by ½ turn counterclockwise (CCW) (voltage should rise and stabilize).

10. Tighten generator pressure relief valve adjusting screw lock nut.
24 Volt Emergency Pump Pressure Relief Valve

NOTE: Emergency pump pressure relief valve is also the main winch & swing drive pressure relief valve

1. Turn off engine and leave battery master switch in ON position.

2. Install positive swing lock block between rear counterweight and lower deck.

3. Open inner door at rear rider compartment to gain access to emergency pump.

4. Install a pressure gauge to the emergency pump pressure port on (Figure 39).

5. Turn the emergency boom lower ball valve to the OPEN position (located to the left and above the emergency pump) (Figure 40).

6. On the center console turn on ignition switch, press & hold the “EMERGENCY PUMP” rocker switch (Figure 41) and move left joystick fully to one side for swing drive motor.

7. The pressure gauge at the emergency pump should read 2200 psi.

CAUTION

Operate the 24 volt emergency pump in intervals for a maximum of 30 seconds to one minute, and then let electric motor cool for one minute before using again.

The 24 volt emergency pump is designed for emergency use ONLY and is NOT to be run continuously.

8. If pressure is NOT 2200 psi.

9. The emergency pump pressure relief is located above load sense pressure port near the top of the machine’s frame. Climb the step assembly in front of the fuel tank onto the primary boom to gain access to the pressure relief valve (Figure 42). Note that this relief valve is used for the main winch / swing drive circuit also.

10. If pressure is less than 2200 psi loosen the lock nut and turn Allen screw clockwise until 2200 psi is reached.

11. If pressure is more than 2200 psi remove protective cap and turn Allen screw out counterclockwise till 2200 psi is reached.
Swing Gear Box Circulation Supply Line Flow Control

There is a 3.5 gallons per minute flow control in the line (Figure 43) and is non-adjustable.

Boom Winch Emergency Pump Flow Control Valve

1. The boom winch emergency pump flow control valve (Figure 44), controls the reaction time of the boom winch brake when the emergency pump is used to lower the boom.

2. Turn the emergency boom winch LOWER ball valve (Figure 45) to the OPEN position.

3. Have the machine operator press and hold the emergency pump rocker switch located on the engine control panel inside of the cab. The boom should not move. With the emergency pump switch held, slowly close the flow control valve (Figure 46) until the boom starts to lower. When you let go of the emergency pump switch, the brakes should reengage quickly and hold the boom.

4. Return the emergency boom winch LOWER ball valve (Figure 47) to the CLOSE position.
Boom Winch Gear Pump Test Mate (Option)

1. There are two Schroeder test mate assemblies (Figure 48) located on the right side of the hydraulic tank to the left of the two high pressure filter assemblies.

2. Turn off engine and perform lock out – tag out procedures.

3. Remove the test mate cover assembly (Figure 49).

4. Install the test mate diagnostic unit onto the base station (Figure 50).

5. Start engine, push engine speed toggle switch towards HIGH until 2100 rpms is set.

6. The boom winch gear pump flow should be approximately 45 gallons per minute.

7. When measurements are completed, shut down engine and remove testing apparatus.
Main Winch / Swing Drive Piston Pump Test Mate (Option)

1. There are two Schroeder test mate bases (Figure 51) that are located on the right side of the hydraulic tank to the left of the two high pressure filter assemblies.

2. Turn off engine and perform lock out – tag out procedures.

3. Remove the test mate cover assembly (Figure 52).

4. Install the test mate diagnostic unit onto the base station (Figure 53).

5. Fully open the needle valve (Fig 54).

6. Start engine, push engine speed toggle switch towards HIGH until 2100 rpms is set.

7. The main winch / swing drive piston pump flow should be approximately 78 gallons per minute.

8. When measurements are completed, shut down engine, close needle valve and remove testing apparatus.

**NOTE:** The needle valve has no other purpose beyond this test.
Both the generator pressure relief valve and the generator rpm cartridge need to be checked and adjusted if there is a problem with the magnet.

**WARNING**

Generator electrical output to the magnet is 230 – 250 Volts DC when energized.

NEVER disconnect the magnet from its power source when energized! Electrical arcing will occur and may cause serious injury or death.

1. The following procedure may require 2 or more persons.

2. Check that the magnet is attached and the electrical cable is connected.

**CAUTION**

Do NOT turn the generator ON until the magnet is attached and connected.

3. Start engine, on the overhead panel push the generator on/off toggle switch to on position, and read the generator’s voltmeter located on the left-front (Figure 55) during the following test procedures.

4. If voltage is out of 230 – 250 volts DC range.

5. Loosen the generator rpm cartridge adjusting screw lock nut (Figure 56).

6. Turn the generator rpm cartridge adjusting screw in clockwise (CW) to reduce the DC volt readings on the generator voltmeter.

7. Turn the generator rpm cartridge adjusting screw in counterclockwise (CCW) to increase the DC volt readings on the generator voltmeter.

8. When making adjustment, the hydraulic fluid should be at normal operating temperature.

9. If a flow meter is installed inline between the permco hydraulic pump to generator, the flow reading should be 24 gallons per minute at 2500 psi.
Transmission Charge Pressure Reducing Valve

1. Open inner door at rear rider compartment to gain access to the transmission charge pressure reducing valve.

2. The transmission charge pressure reducing valve is located along the back frame in front of the engine (Figure 57).

3. Install a pressure gauge on the transmission charge pressure tap (Figure 58).

4. Start the engine, engine idle at 1100 rpm, and leave the crane in PARK (1st gear). The bidirectional travel foot pedal is disabled.

5. Check the pressure on the transmission pressure gauge in the cab. It should read 230 to 290 psi.

In cold weather operation until the transmission oil is warmed up to (40 – 51 degrees Celsius / 105 – 125 degrees Fahrenheit) pressure above 290 can be expected.

6. If adjustment is needed, the transmission pressure should be around 270 psi, set the pressure ½ turn past the point where the transmission pressure gauge levels off (around 270 psi).

Traction Charge Pump Pressure Relief Valve

1. Open access door on left side at the rear of the crane. The traction pump pressure relief valve is located at the bottom of the series 90 closed circuit traction pump (Figure 59 & 60).

2. The traction charge pump pressure relief regulates the charge pressure to operate the swashplate and to maintain minimum pressure in the low side of the traction loop.

3. Install a 1000 psi pressure gauge on the traction charge pressure tap (Figure 61).

4. Start the engine, engine idle at 1100 rpm, and leave the crane in PARK (1st gear). The bidirectional travel foot pedal is disabled.

5. Check the pressure on the traction charge pump pressure gauge in the cab. It should read 350 psi.

6. If the pressure reading is below 350 psi, loosen the traction charge pump pressure relief valve lock nut and turn the adjusting screw (Figure 62) IN clockwise (CW) until the gauge reads 350 psi.

7. If the pressure reading is above 350 psi, loosen the traction charge pump pressure relief valve lock nut and turn the adjusting screw (Figure 62) OUT counterclockwise (CCW) until the gauge reads 350 psi.

8. Tighten the traction charge pump pressure relief valve lock nut.
1. All personnel need to be aware of safety concerns & their individual responsibility prior to proceeding.

2. The following procedure requires 2 or more persons to perform.

3. On the series 90 closed circuit traction pump (Figure 63), install 2 (10,000 psi) pressure gauges in the SYSTEM (HIGH) PRESSURE GAUGE PORTS (M1 & M2) (Figure 64).

4. Start machine, check that the park LED is ON, machine will be in 1st gear, pull the A-9 brake hand control all the way back.

5. Leave cab and set manual train brake (hand wheel & chock wheels).

6. Push engine speed toggle switch towards high until 2100 rpm.

7. On the left hand controller push the gear UP toggle switch (Figure 65) until the transmission is in 3rd gear.
9. Press the top half of the bi-directional propulsion pedal (forward direction).

10. The M1 gauge pressure should be 4650 psi

11. If a pressure reading in forward does not read 4650 psi:

12. To increase pressure for FORWARD direction turn the (M1) Traction Pump Pressure Limiter Adjuster (Figure 66 & 67) clockwise till the M1 gauge reads 4650 psi (each complete rotation of pressure limiter adjusting screw will change pressure by 1100 psi).

13. To decrease pressure for FORWARD direction turn the (M1) Traction Pump Pressure Limiter Adjuster (Figure 66 & 67) counterclockwise till the M1 gauge reads 4650 psi (each complete rotation of pressure limiter adjusting screw will change pressure by 1100 psi).

14. Verify that transmission is still in 3rd and engine is at 2100 rpms.

15. Press the bottom half of the bi-directional propulsion pedal (reverse direction).

16. The M2 gauge pressure should be 4650 psi

17. To increase pressure for REVERSE direction turn the (M2) Traction Pump Pressure Limiter Adjuster (Figure 66 & 67) clockwise till the M2 gauge reads 4650 psi (each complete rotation of pressure limiter adjusting screw will change pressure by 1100 psi).

18. To decrease pressure for REVERSE direction turn the (M2) Traction Pump Pressure Limiter Adjuster (Figure 66 & 67) counterclockwise till the M2 gauge reads 4650 psi (each complete rotation of pressure limiter adjusting screw will change pressure by 1100 psi).

19. Remove foot from the bi-directional propulsion and use the left hand controller and push the gear down to the 1st gear.

NOTE: There is a Traction Pump Remote Pressure Limiter in the crane propulsion hydraulic circuit. When the speed of the transmission output shaft is below 380 rpms, both the high & mid speed solenoids are energized the maximum working pressure is control by Traction Pump Limiter. If during the above procedure a problem develops adjusting traction pump limiter proceed to the test and repair procedures for the Traction Remote Pressure Limiter.
3. Limiting the traction motor torque is controlled by two normally open relief valves (Figure 69) in the forward M1 and by two normally open relief valves in the reverse M2 circuits. Each of these 4 relief valves is controlled by a 24 volt 2 way solenoid valve (Figure 70).

Traction Remote Pressure Limiter Manifold

1. The traction remote pressure limiter manifold is located directly above traction pump (figure 68).

2. The traction remote pressure limiter manifold prevents damage to the engine and transmission when slowing down the travel speed of the crane. Due to the crane’s weight in addition to the weight of towed rail cars the amount of inertia the crane can develop, the transmission must not be shifted to a lower gear at a speed in excess allowed for a given ratio.
Traction Remote Pressure Limiter “Operation” FORWARD DIRECTION

1. Make certain all brakes (brake valve in cab, manual train brake wheel on side of lower frame) are released and you are applying the foot brake.

2. Make certain that suspension lockups have been removed and properly stored.

3. Set engine speed to HIGH using the engine speed (throttle) control switch on the center control console.

4. Release the brake foot pedal.

5. Using the rocker switch on the LEFT hand controller (Figure 71) and looking at gear selection LEDs on the center control console, press the switch in the GEAR UP direction once.

6. Slowly press UPPER half of the propulsion pedal (FORWARD direction). As the machine travels in low speed (transmission output shaft under 380 rpm) both forward (M1) the (2A & 2B) traction remote pressure limiter normally open solenoid valves (Figure 72) are energized so hydraulic flow to (3A & 3B) traction remote pressure limiter pressure relief valves (Figure 73) are blocked. The maximum working pressure in the forward propulsion circuit is limited by traction pump pressure limiter set at 4640 psi. The crane's propel will have maximum torque available.

7. NOTE: In first gear, pressing the creep button located on top of the left hand controller (Figure 85) will allow scaling of the propulsion pedal (finite control). The maximum working pressure in the forward propel circuit is limited by traction pump pressure limiter set at 4640 psi. The crane's propel will have maximum torque available.

8. When the crane reaches its top speed in 1st gear, return the propulsion pedal halfway and press the gear up toggle switch on the left hand controller (Figure 71) once to shift transmission into 2nd gear. When ever the transmission output shaft is over 380 rpm the Forward (M1) the traction remote pressure limiter normally open solenoid valve (2A) is de-energized so there is hydraulic flow to traction remote pressure limiter pressure relief valve (3A). The maximum working pressure in the forward circuit now is 4400 psi.

9. When the crane reaches its top speed in 2nd gear, return the propulsion pedal halfway and press the gear up toggle switch on the left hand controller (Figure 71) to shift transmission into 3rd gear. The transmission output shaft is over 380 rpm so the maximum working pressure remains 4400 psi.

10. The crane is equipped with a hydrostatic drive system in which the pump and motor work together to control the speed of the machine. Dynamic (engine braking) is a feature of this type of system, but is hydraulically limited on this machine because of potential damage to the engine caused by inertia. When the propulsion pedal is slowly return to the center position, dynamic braking will take place.

11. During dynamic braking the Forward (M1) the normally open solenoid valve (2B) is de-energized so there is hydraulic flow to traction remote pressure relief valve (3B). The maximum working pressure in the forward circuit now is 1500 psi.
Traction Remote Pressure Limiter Operation REVERSE DIRECTION

1. Make certain all brakes (brake valve in cab, manual train brake wheel on side of lower frame) are released and you are applying the foot brake.

2. Make certain that suspension lockups have been removed and properly stored.

3. Set engine speed to HIGH using the engine speed (throttle) control switch on the center control console.

4. Release the brake foot pedal.

5. Using the rocker switch on the LEFT hand controller (Figure 74) and looking at gear selection LEDs on the center control console, press the switch in the GEAR UP direction once.

6. Slowly press LOWER half of the propulsion pedal REVERSE direction). As the machine travels in low speed (transmission output shaft under 380 rpms) both reverse (M2) the (2C & 2D) traction remote pressure limiter normally open solenoid valves (Figure 75) are energized so hydraulic flow to (3C & 3D) traction remote pressure limiter pressure relief valves (Figure 76) are blocked. The maximum working pressure in the reverse propulsion circuit is limited by traction pump pressure limiter set at 4640. The crane’s propel circuit will have maximum torque available.

7. NOTE: In first gear, pressing the creep button located on top of the left hand controller (Figure 74) will allow scaling of the propulsion pedal (finite control). The maximum working pressure in the forward propel circuit is limited by traction pump pressure limiter set at 4640 psi. The crane’s propel circuit will have maximum torque available.

8. When the crane reaches its top speed in 1st gear, return the propulsion pedal halfway and press the gear up toggle switch on the left hand controller (Figure 74) once to shift transmission into 2nd gear. When ever the transmission output shaft is over 380 rpms the Reverse (M2) the traction remote pressure limiter normally open solenoid valve (2C) is de-energized so there is hydraulic flow to traction remote pressure limiter pressure relief valve (3C). The maximum working pressure in the reverse circuit now is 4400 psi.

9. When the crane reaches its top speed in 2nd gear, return the propulsion pedal halfway and press the gear up toggle switch on the left hand controller (Figure 74) to shift transmission into 3rd gear. The transmission output shaft is over 380 rpms so the maximum working pressure remains 4400 psi.

10. The crane is equipped with a hydrostatic drive system in which the pump and motor work together to control the speed of the machine. Dynamic (engine braking) is a feature of this type of system, but is hydraulically limited on this machine because of potential damage to the engine caused by inertia. When the propulsion pedal is slowly return to the center position, dynamic braking will take place.

11. During dynamic braking the Reverse (M2) the normally open solenoid valve (2D (Figure 75) is de-energized so there is hydraulic flow to traction remote pressure relief valve (3D) (Figure 76). The maximum working pressure in the reverse circuit now is 1500 psi.
1. All personnel need to be aware of safety concerns & their individual responsibility prior to proceeding.

2. The following procedure requires 2 or more persons to perform.

3. On the series 90 closed circuit traction pump (Figure 77), install 2 (10,000 psi) pressure gauges in the SYSTEM (HIGH) PRESSURE GAUGE PORTS (M1 & M2) (Figure 78).

4. Start machine, check that the park LED is ON, machine will be in 1st gear, pull the A-9 brake hand control all the way back.

5. Leave cab and set manual train brake (hand wheel & chock wheels).

6. Push engine speed toggle switch towards high until 2100 rpm.

7. On the left hand controller push the gear UP toggle switch (Figure 79) until the transmission is in 3rd gear.

8. Press the top half of the bi-directional propulsion pedal (forward direction).

9. The M1 gauge pressure should be 4650 psi.

10. Slowly return the bi-directional propulsion pedal (forward direction) to the center (Neutral) position.

11. If pressure adjustment is needed refer to Traction Pressure Limiter adjustment procedure see page H-30.

**Forward Propel**

12. To check the maximum working pressure during dynamic braking in the FORWARD (M1) direction, remove both normally open solenoid valve (2B & 2A) din plugs (Figure 80-81). This will de-energize both forward traction remote pressure relief valve (3A & 3B) (Figure 82).

13. Press the top half of the bi-directional propulsion pedal (forward direction).

14. The M1 gauge pressure should be 1500 psi.

15. Slowly return the bi-directional propulsion pedal to the center (Neutral) position.

16. If the (M1) pressure gauge reads UNDER 1500 psi, loosen the (3B) dynamic braking forward pressure relief adjusting screw lock nut (Figure 82) and turn adjusting screw IN clockwise (CW) 1/4 of a turn.

17. Press the top half of the bi-directional propulsion pedal (forward direction). If the (M1) pressure reading is not 1500 psi the repeat above adjustment.

18. If the (M1) pressure gauge reads ABOVE 1500 psi loosen the dynamic braking forward pressure relief valve (3B) adjusting screw lock nut (Figure 82) and turn adjusting screw OUT counterclockwise (CW) 1/4 of a turn.

19. Press the top half of the bi-directional propulsion pedal (forward direction). If pressure reading is not 1500 psi repeat adjustment.
Reverse Propel

Do procedures 1 through 11 on proceeding page.

12. To check the maximum working pressure during dynamic braking in the REVERSE (M2) direction remove the normally open solenoid valve din plug (2C & 2D) (Figure 83-84). This will de-energize the (3C & 3D) reverse traction remote pressure relief valve (Figure 85).
13. Press the bottom half of the bi-directional propulsion pedal (reverse direction).

14. The M2 gauge pressure should be 1500 psi.

15. If the (M2) pressure gauge reads UNDER 1500 psi, loosen the (3D) dynamic braking (high range) reverse pressure relief adjusting screw lock nut (Figure 85) and turn adjusting screw IN clockwise (CW) 1/4 of a turn.

16. If the (M2) pressure gauge reads ABOVE 1500 psi loosen the dynamic braking (high range) reverse pressure relief valve (3D) (Figure 85) adjusting screw lock nut and turn adjusting screw OUT counterclockwise (CW) 1/4 of a turn.

17. Press the bottom half of the bi-directional propulsion pedal (forward direction). If pressure reading is not 1500 psi repeat adjustment.

**Bottom View of Traction Remote Pressure Limiter Manifold**

**Traction Remote Pressure Limiter Mid Range Diagnose /Repair**

**WARNING**

1. All personnel need to be aware of safety concerns & their individual responsibility prior to proceeding.

2. The following procedure requires 2 or more persons to perform.

3. On the series 90 closed circuit traction pump (Figure 86), install 2 (10,000 psi) pressure gauges in the SYSTEM (HIGH) PRESSURE GAUGE PORTS (M1 & M2) (Figure 87).

4. Start machine, check that the park LED is ON, machine will be in 1st gear, pull the A-9 brake hand control all the way back.

5. Leave cab and set manual train brake (hand wheel & chock wheels.

6. Push engine speed toggle switch towards high until 2100 rpm.

7. On the left hand controller push the gear UP toggle switch (Figure 88) until the transmission is in 3rd gear.

8. Press the top half of the bi-directional propulsion pedal (forward direction).

9. The M1 gauge pressure (Forward) should be 4650 psi.

10. Slowly return the bi-directional propulsion pedal (forward direction) to the center (Neutral) position.
11. Press the bottom half of the bi-directional propulsion pedal (forward direction).

12. The M2 gauge pressure (Reverse) should be 4650 psi.

13. If pressure adjustment is needed refer to Traction Pressure Limiter adjustment procedure see page H-29.

**Forward Propel**

14. To check the maximum working pressure during Mid Range in the FORWARD (M1) direction, remove the forward normally open solenoid valve (2A) din plug (Figure 89-90). This will de-energize the (3A) (dynamic braking) high range forward traction remote pressure relief valve (Figure 91).

15. Press the top half of the bi-directional propulsion pedal (forward direction).

16. The M1 gauge pressure should be 4400 psi.

17. Slowly return the bi-directional propulsion pedal to the center (Neutral) position.

18. If the (M1) pressure gauge reads UNDER 4400 psi, loosen the (3A) (Mid Range) forward pressure relief adjusting screw lock nut (Figure 91) and turn adjusting screw IN clockwise (CW) 1/4 of a turn.

19. If the (M1) pressure gauge reads ABOVE 1500 psi loosen the dynamic braking (high range) forward pressure relief valve (3A) adjusting screw lock nut and turn adjusting screw OUT counterclockwise (CW) 1/4 of a turn.

21. Press the top half of the bi-directional propulsion pedal (forward direction). If pressure reading is not 4400 psi repeat adjustment.

**Reverse Propel**

22. To check the maximum working pressure during Mid Range in the REVERSE (M2) direction remove the normally open solenoid valve din plug (2C) (Figure 89-90). This will de-energize the (3C) Mid Range reverse traction remote pressure relief valve (Figure 91).

23. Press the bottom half of the bi-directional propulsion pedal (reverse direction).

24. The M2 gauge pressure should be 4400 psi.

25. If the (M2) pressure gauge reads UNDER 4400 psi, loosen the (3C)(midrange) reverse pressure relief adjusting screw lock nut (Figure 91) and turn adjusting screw IN clockwise (CW) 1/4 of a turn.

26. If the (M2) pressure gauge reads ABOVE 4400 psi loosen the (mid range) reverse pressure relief valve (3C) (Figure 91) adjusting screw lock nut and turn adjusting screw OUT counterclockwise (CW) 1/4 of a turn.

27. Press the bottom half of the bi-directional propulsion pedal (forward direction). If pressure reading is not 4400 psi repeat adjustment.
Loosen lock nut on flow control adjusting screw (Figure 92) and turn the adjusting screw all the way OUT counterclockwise (CCW).
Transmission Charge
Flow Control Valve

1. Install a flow meter in line with the hose between the Swivel “E” Port and the transmission charge pump suction connection.

2. Start the engine.

3. Push engine speed toggle switch towards high until 2100 rpm.

4. The in line flow meter should be 13.5 gpm.

5. Open inner door at rear rider compartment to gain access to the transmission charge flow control valve (Figure 94).

6. The transmission charge flow control is non adjustable – and should be replaced if problems develop in the flow to the transmission charge pump circuit.
ACCUMULATOR
90 Cubic Inch

The accumulator (Figure 95) is installed in the machine travel circuit to absorb pressure spikes when changing the transmission gear or when switching direction of travel.

CAUTION
READ & UNDERSTAND ALL INSTRUCTIONS PRIOR TO SERVICING & MAINTAINING ACCUMULATOR!
Accumulators, gas bottles and hydraulic systems are inherently dangerous due to high pressure gases and fluids.

DO NOT ATTEMPT to maintain these systems unless adequately trained, have experience with the items and systems in question and can recognize the potential risks involved if mishandled.

Always wear safety glasses.

DO NOT USE automotive-type valve cores in high pressure accumulator gas valves.

WARNING!
Always use dry inert gas (dry nitrogen – N2) for pre-charging – NEVER USE AIR OR OXYGEN, due to the danger of combustion/explosion.

Accumulator Pre-Charge

CAUTION
Never operate accumulator without nitrogen gas precharge.

The following procedure will require the use of a nitrogen charging assembly (Figure 96) with a “T” handle gas cock in order to depress the valve core, allowing the entry or exhaust of nitrogen gas.

The “T” handle of the gas cock also opens and closes the flow of gas through the gas cock. Turning the “T” handle clockwise opens the valve, turning counter-clockwise closes the valve.

1. If you have not already done so, place all machine mechanical systems or work heads in the full up and locked positions.

2. Turn the ignition switch to the OFF position.

3. Turn the battery disconnect switch to the OFF position.


This will cut off electrical power supply to the machine and prevent accidental startup of engine while servicing.

5. Install a pressure gauge on the traction charge manifold pressure tap (M-3) (Figure 97).

6. Check that the pressure gauge installed in step 5 reads zero psi before proceeding. If not release hydraulic pressure before proceeding by opening a hose fittings (1/8 – 1/4) of a turn (CCW) at the manifold to allow the pressurized oil to bleed off.

7. Recheck that the pressure gauge installed in step 5 now reads zero psi before proceeding.

WARNING!
Hydraulic pressure on fluid end of the accumulator MUST BE REDUCED TO ZERO.

8. Remove the protective cap (gas valve guard) for the gas valve (Figure 98) from top of the accumulator (Figure 95), located behind the hydraulic reservoir suction filter on the left side the crane.

9. Remove the cap (item 3) from the gas valve, location shown in figure 98.

10. Verify that the T-handle of the gas cock is retracted by turning fully counter-clockwise before installing (Figure 96).

11. Attach the charging gauge assembly to the valve stem on the valve (item 5) figure 98 by turning the gas cock nut clockwise by hand till tight.
12. Using a wrench turn the gas cock nut ONE flat clockwise (DO NOT OVER TORQUE).

13. Insure the bleed off valve on the gauge assembly (Figure 96) is closed (Turn in clock wise fully).

14. Depress (OPEN) the gas valve core by turning the T-handle of the gas cock clockwise to depress the valve core in the accumulator gas valve.

15. If the gas pre charge pressure on the gauge reads above 200 psi open the bleed valve (Figure 96) allowing the nitrogen gas to escape until 200 psi is reached then close the bleed valve.

16. Close the valve core by turning the T-handle counterclockwise fully.

17. If the gas pre charge pressure on the gauge reads below 200 psi retract the valve core by turning the gas cock fully counter-clockwise (Figure 96).

18. Obtain an adequate supply of pressurized dry nitrogen (normally a compressed gas bottle with regulator) and connect the accumulator charge gauge using a nitrogen hose assembly adapter (Figure 96).

19. Open the valve on the nitrogen bottle and then depress the gas valve core by turning the T-handle of the gas cock clockwise to depress the valve core in the accumulator gas valve.

20. Read the pressure on the accumulator charge gauge and when above 200 psi close the nitrogen bottle shut off valve.

21. Open the bleed valve by turning counterclockwise (Figure 96) allowing the nitrogen gas to escape until 200 psi is reached then close the bleed valve.

22. CLOSE the valve core by turning the T-handle counterclockwise fully.

23. Allow the accumulator to rest approx. 10-15 minutes after adding nitrogen gas pre-charge. This will allow the nitrogen gas temperature to adjust and to check for leaks in the bladder.

24. Recheck the accumulator pressure is 200 psi.

25. Close the valve core by turning the T-handle counterclockwise fully.

26. Check the accumulator valve stem (Figure 98) for leak with soapy water…if none observed, complete disconnection procedure and reassemble by re-installing the gas valve cap and protective gas guard.
Accumulator Disassembly

NOTE:
It is good practice to disassemble and assemble accumulators in a clean area to keep all parts free of foreign matter.

The following procedure will require the use of a nitrogen charging assembly (Figure 99) with a “T” handle gas cock in order to depress the valve core, allowing the entry or exhaust of nitrogen gas. The “T” handle of the gas cock also opens and closes the flow of gas through the gas cock. Turning the "T" handle clockwise opens the valve, turning counter-clockwise closes the valve.

1. If you have not already done so, place all machine mechanical systems or work heads in the full up and locked positions.

2. Turn the ignition switch to the OFF position.

3. Turn the battery disconnect switch to the OFF position.


5. Install a pressure gauge the M3 pressure tap (Figure 100).

6. Check that the pressure gauge installed in step 5 reads zero psi before proceeding.

WARNING!

Hydraulic pressure on fluid end of the accumulator MUST BE REDUCED TO ZERO.
7. Remove the protective guard (item 2) for the gas valve from top of accumulator, location shown in figure 98.

8. Remove the cap (item 3) from the gas valve, location shown in figure 98.

9. Verify that the T-handle of the gas cock is retracted by turning fully counter-clockwise before installing (Figure 99).

10. Attach the charging gauge assembly to the gas valve stem by turning the gas cock nut clockwise by hand till tight.

11. Using a wrench turn the gas cock nut ONE flat clockwise (DO NOT OVER TORQUE).

12. Insure the bleed off valve on the gauge assembly is closed (Turn in clock wise fully).

13. Depress (OPEN) the gas valve core by turning the T-handle of the gas cock clockwise to depress the valve core in the accumulator gas valve.

14. Open the bleed valve (Figure 99) to allow all the pressurized nitrogen gas in the bladder to escape.

15. Turn the T-handle fully counter-clockwise so that the gas cock is retracted.

16. Remove the charging valve and gauge assembly.

17. Place a container under the accumulator to collect the hydraulic oil before proceeding.

18. Remove the hydraulic hose connected to the bottom of the accumulator and drain balance of hydraulic fluid that may be remaining in accumulator when it is disconnected from system. Put a hydraulic plug into the end of the hose to protect the hydraulic circuit to prevent any contamination from entering.

19. Remove the valve stem (item 4) from inside the gas valve (item 5) figure 98 by using a core tool (A tire core tool will work).

20. Turn the gas valve (item 5) counterclockwise and remove from the bladder assembly (item 6) figure 98.

21. Remove bolt and nut on left side of accumulator mounting band (Figure 98).

22. Loosen the bolt to the band assembly on right side of accumulator (Figure 98) so that accumulator assembly can be lifted off the base mounting plate.

23. Place the accumulator in a vise large enough to hold & clamp the bottom mounting.

24. Use a strap wrench and unscrew the upper portion of the accumulator.

25. Carefully remove the bladder (item 10), check for and remove any o-rings and back up washers noting their locations.

26. Thoroughly inspect the interior of the accumulator shells sections for possible contaminants and then clean/flush thoroughly.
Accumulator Reassembly

1. Lubricate the inside of the accumulator shells sections and the outside of the bladder with clean hydraulic oil (Figure 98).

2. Place the accumulator in a vise large enough to hold & clamp the bottom mounting.

3. Apply a small amount of grease on the new o-ring, new bladder lip, and the shell seat area (Figure 98).

4. Install the bladder carefully paying careful attention to the shell seat area.

5. Assemble the accumulator shell sections, making sure the bladder and o-ring are seated correctly as you hand tighten the accumulator assembly.

6. Using a strap wrenches tighten the accumulator assembly.

7. Install a new o-ring (item 6) on the gas valve (item 5) figure 98.

8. Install a new valve core (item 4) in the gas valve.

9. Install gas valve on the top of the accumulator.

10. Place accumulator on the base mounting plate.

11. Install the bolt and nut on left side of accumulator mounting band (Figure 42).

12. Tighten the accumulator mounting band’s (Figure 101) two bolts and nuts.

13. Remove the plug and install the hydraulic hose to the bottom of the accumulator.

14. Attach the charging gauge assembly (Figure 99) to the valve stem by turning the gas cock nut clockwise by hand till tight.

15. Using a wrench turn the gas cock nut ONE flat clockwise (DO NOT OVER TORQUE).

16. Insure the bleed off valve on the gauge assembly (Figure 99) is closed (Turn in clockwise fully).

17. Obtain an adequate supply of pressurized dry nitrogen (normally a compressed gas bottle with regulator) and connect the accumulator charge gauge using a nitrogen hose assembly adapter.

18. Turn the T-handle of the gas cock clockwise to depress the valve core in the accumulator gas valve.

19. Open the valve on the nitrogen bottle.

20. Read the pressure on the accumulator charge gauge (Figure 99) and when above 200 psi close the nitrogen bottle shut off valve.

21. Open the bleed valve by turning counterclockwise (Figure 99) allowing the nitrogen gas to escape until 200 psi is reached then close the bleed valve.

22. CLOSE the valve core by turning the T-handle counterclockwise fully.

23. Allow the accumulator to rest approx. 10-15 minutes after adding nitrogen gas pre-charge. This will allow the nitrogen gas temperature to adjust, and to check for leaks in the bladder.

24. Following recheck the accumulator pressure.

25. Close the valve core by turning the T-handle counterclockwise fully.

26. Check the accumulator valve stem (Figure 99) for leak with soapy water...if none observed, complete disconnection procedure and reassemble by re-installing the gas valve cap and protective gas guard.
HYDRAULIC RESERVOIR

Oil Level

Inspect the oil level on a daily basis (or every 10 hours of operation) by reading the sight gauge located on the left side of the reservoir. At full level, the oil should be to the top of the sight gauge. The M7 hydraulic system uses SAE-20 (ISO 46) oil (UNLESS OTHERWISE STENCILLEd ON THE HYDRAULIC TANK). See recommend lubricants in the maintenance section of this manual. Before filling the system with hydraulic oil, be sure that the fluid is as specified and that it is clean. Do not use cloth strainers or fluid that has been stored in contaminated containers.

Inspection of Oil

Care should be taken to keep the hydraulic oil free of dust, water, sealing compounds and other foreign matter. While using the sight gauge, verify oil quality. If oil becomes dark or milky colored, it should be changed as soon as possible.

NOTE: Never add hydraulic oil to reservoir by any other means than through a manual/electric pump and filter.

NEVER OVERFILL RESERVOIR.

Never use hydraulic brake fluid in lieu of hydraulic oil.

Suction Line Filter

This machine is equipped with a lockout device as a replacement for a handle on the suction strainer. This lockout prevents the valve from being opened or closed without the operator’s knowledge.

The suction line strainer (Figure 102) is located on the reservoir, remove and inspect the filter after the first 40 hours of operation and refer to Hydraulic Component Maintenance Schedule inspection for designated intervals.

To access suction line filter cartridge:

1. Turn off engine.
2. Remove Lock out device & plug (Figure 103).
3. Turn internal socket head cap screw (Figure 104) out counterclockwise OUT) till it stops.

Do not try removing screw!

4. Remove the six front cover cap screws (Figure 104) and lift off the front cover.
5. Remove and clean suction line strainer.
6. When suction line strainer is cleaned reinstall.
7. Install front cover and six cap screws.
8. Turn suction line socket head lock screw clockwise (IN) till it stops.
9. Replace the plug.
10. Put padlock (Lockout) back on.

If for any reason removal of suction line filter for any length of time necessary, you must seal the hydraulic tank to prevent external contamination.

Contamination on the outlet side of the filters can be flushed into the system and cause malfunctions. Contamination on the inlet side reduces the life of the filter element.
Suction Filter is located at suction line manifold

Lock Out Device

1 of 6 Front Cover Socket Head Screw

Internal Socket Head Screw
HYDRAULIC Rail Crane

TROUBLESHOOTING - GENERAL

Troubleshooting is a matter of quickly and logically isolating the cause of a problem and taking corrective action. Operating experience, a thorough understanding of the information in this manual, and accurate maintenance and operation records are the best troubleshooting tools an operator can have. The Model M7 Machine is a group of rather simple systems. If you understand the basic workings of these systems individually and how they relate to each other, troubleshooting becomes a relatively simple task.

This is intended to give you basic troubleshooting guidelines for the hydraulic systems on this machine.

Local conditions and operating methods may result in problems, causes and remedies not covered in this guide. To use the guide most efficiently, locate a problem that matches the one being experienced and, in a step-by-step method, check the causes listed until the correct remedy is found and the problem solved.

Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.

To avoid possible personal injury and/or engine damage from accidental engine startup, always disconnect the battery before servicing this machine.

HYDRAULIC SYSTEM - GENERAL

Hydraulic components are precision devices. Careless handling of them or other parts of the system can result in malfunction or failure. In order to ensure efficient operation of components, it is essential, if repairs become necessary, to follow the instructions supplied in the Component Data section of this manual for a particular component. Whether assembling or taking apart, it is important that the internal parts of the component be kept clean. Maintenance and operation are dependent on the conditions under which the equipment is working.

INSPECTION

Inspect the hydraulic system for clues to the malfunction. Check to see if the unit can be operated without further damage. If not, shut down machine immediately. Always check these items before starting the machine:

1. Check hydraulic oil level.
2. Look for loose or disconnected hoses. An oil spot below the machine is a good indication of a loose hose or hydraulic component.
3. Make certain shut-off valve on suction strainer is OPEN. Opening valve can often correct what appears to be a malfunction.
4. Inspect all vital hose connections, especially at main pump and the main pump hose connection at the manifold.

Loosen fittings only when system is not pressurized. High pressure leaks can cause personal injury.
5. Look for cover damage and/or indications of twisted, worn, crimped, brittle, cracked, or leaking hoses. Hoses with their outer cover worn through or otherwise damages should be considered unfit for further service.

6. Cap off all disconnected lines and open ports.

7. Use only recommended replacement parts.

8. Examine all prematurely worn or malfunctioned parts for clues as to the cause of the failure.

9. Discard all used O-rings to avoid re-uses.

10. Lubricate all sliding parts during assembly.

11. Cover sharp grooves and threads with thimble or shim stock when installing O-rings and other seals.

To avoid creating problems when installing or repairing hydraulic components, follow these tips:

1. Clean away the dirt in and around equipment before taking apart lines and removing parts.

2. Cap off all disconnected lines and open ports.

3. Protect the overhaul area from grinding dust, machining chips, and wind driven dirt.

4. Work only on metal or hard finished bench tops, that are easy to keep clean.

5. Handle parts carefully to avoid nicks and burrs.

6. Use lint-free cloths to wipe parts.

7. Use smooth burr-less tools, especially when working with O-rings.

8. Make certain that seals are of the right size and material.

9. Test the overhauled device before reinstalling it, if possible.

While machine is running, and before working, inspect for leaks. If the machine has not been run for some time, oil may thicken causing a variety of malfunctions. If this is true, make certain that the oil tank has been properly drained, cleaned and refilled.

FLUID CONTAMINATION

Contamination comes in many forms. It may be air, water and cutting oils, rust, chips and grit. It is usually easier to keep contaminants out of a system rather than remove them after they are in the system.

Bulk handling and the re-use of oil containers almost guarantees you that "new" oil will be dirty. Make it a practice to filter all "new" oil before adding it to your system. Make it another practice to change filters on a regular basis before they become clogged.

Old and contaminated oil cannot be improved by topping off with fresh oil. It is more practical to drain the system while the oil is still at working temperature, clean the reservoir and replace with fresh oil.

Contamination on the outlet side of the filters can be flushed into the system and cause malfunctions. Contamination on the inlet side reduces the life of the filter element.
LOCATING LEAK SOURCES

Petroleum oils are used in most hydraulic application to lubricate parts as well as transmit power. As oil temperature increases, however, the lubricating film thins out. The result is rubbing parts supported by the oil film move closer together; friction and wear increase; seal materials age more quickly, become stiff and hard, and may readily permit leakage.

The first step in locating leaks is to eliminate the possibility that an over-filled reservoir or spill created the "suspected" leak. The next step would be to clean the suspected area and watch. Leaks usually occur in fittings, hoses, O-rings, and other seals.

Most leaks occur at fittings, but too often, finding the fitting that is leaking is difficult because the fluid runs along the hose and drips off at some other point. Leaks in high pressure lines sometimes are difficult to pin-point because the fluid comes out as a mist.

Once you find the location of a leak, the specific cause has to be determined before it can be corrected. A scratch in a fitting seat or a cut in a seal lip that is big enough to leak excessively can still be too small to find with the naked eye. The use of a magnifying glass would assist you.

HOSE LIFE

Hose leakage or failure many times occurs where the end fitting grips the hose. Check the system for pressure spikes or surge. If bulges or bubbles occur on a flexible hose, a leak is taking place within the layers. The hose should be replaced.

High oil temperatures (over 200 degrees Fahrenheit, 93 degrees Celcius) quickly harden or stiffen a rubber hose. When pressure pulses flex a hardened hose, it fails by cracking. Every increase of 25 F (14 C) cuts hose life in half. Use a replacement hose rated for actual fluid temperatures. Keep a log of hose use so replacement can be made before failure occurs.

If a hose is installed with a twist in it, high operating pressures tend to force it straight. This can loosen the fitting or even burst the hose at the point of the strain.

DISPOSING OF WATSE OIL

Dispose of used hydraulic and lubricating oil and filters in an environmentally responsible manner, according to recommendations of the Environmental Protection Agency (EPA), your local and/or State laws, and the recommendations of your employer. Store waste oil only in properly designated containers and dispose of only in authorized fills. Do not pour waste onto the ground, down a sewerage drain, or into any water source. Ground contamination by toxic waste is costly both to you and to the environment.
### HYDRAULIC SYSTEM TROUBLESHOOTING GUIDE

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<th>SOLUTION</th>
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<td>Hydraulic pump does not develop pressure</td>
<td>No hydraulic oil in tank (NOTE: if pump is run without oil in tank, pump damage will occur.)</td>
<td>Check oil level. Refill tank.</td>
</tr>
<tr>
<td></td>
<td>Shut-off valve closed. (NOTE: if pump is run with valve closed, pump damage will occur.)</td>
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<td>Relief valve bypassing. (NOTE: oil blowing past any relief valve can cause oil to overheat.)</td>
<td>Increase pressure setting on relief valve. (See Pressure checks)</td>
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<td>Allow unit to warm up.</td>
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<td></td>
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<td></td>
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<td>Drain and add correct oil as specified under &quot;RECOMMENDED LUBRICANTS&quot;.</td>
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<td></td>
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<td>Increase relief setting. (See Pressure checks)</td>
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<td></td>
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<tr>
<td>Hydraulic Oil Overheats</td>
<td>Oil viscosity too high (oil too thick)</td>
<td>Drain and add correct oil as specified under &quot;RECOMMENDED LUBRICANTS&quot;.</td>
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<td>Relief valve set too low.</td>
<td>Increase pressure setting on relief valve (see Pressure Checks).</td>
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<tr>
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<tr>
<td></td>
<td>Voltage to all solenoids</td>
<td>Check wiring &amp; connectors</td>
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<tr>
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<td>Solenoid valve spool stuck</td>
<td>Inspect, clean, and replace if necessary. Replace oil &amp; filter</td>
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