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   (In order of appearance)

FUNCTIONAL HYDRAULIC SCHEMATICS
   S/N 690025 and Above .......................................................................................... 69A-55 (97690002 – Rev D)
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EMERGENCY PUMP USE – ELECTRIC PUMP

Tools And Equipment Required For These Procedures:

- 3/8-Inch Combination Wrench
- Company Furnished Padlock
- Pump Hose (Found In Toolbox)
- Lockpins (Found In Toolbox)

For All Components Except Brakes:

1. Turn ignition switch to the OFF position.
2. Attach one end of the hose (found in the toolbox) to the port on the emergency pump. Attach the other end of the hose to the quick disconnect at the brake valve.
3. Pressurize the hydraulic system by turning on the emergency pump.
4. Raise all components to the point where you can insert lockups. Insert lockup pins.
5. Continue on to lock off brakes for towing.

For the Hydraulic Brakes:

6. With the machine on level track, chock ALL wheels to prevent movement.
7. Close the ball valve at the brake valve stack (see photo to right) and lock in the CLOSED position. (CLOSED is perpendicular to the hose line, OPEN is parallel to the hose line.)
8. Attach one end of the hose (found in the toolbox) to the electric pump. Attach the other end of the hose to the quick disconnect at the brake valve.
9. Turn on the emergency pump at the control box until the hydraulic brake cylinder has collapsed and has released the brakes.
10. Install the lockpins (1) and hairpin cotters (2) as shown in drawing to right.
11. Turn off emergency pump, remove hose and wheel chocks, and perform towing as required.
12. Once you have towed to a site to perform maintenance on the hydraulic system, open the ball valve (closed under step 7) and lock in the OPEN position.
EMERGENCY PUMP USE – MANUAL PUMP

Tools And Equipment Required For These Procedures:

- ¾-Inch Combination Wrench
- Company Furnished Padlock
- Hand Pump Hose (Found In Toolbox)
- Lockpins (Found In Toolbox)

For All Components Except Brakes:

1. Turn ignition switch to the OFF position.
2. Attach one end of the hose (found in the toolbox) to hand pump and the other end of the hose to the quick disconnect at the brake lock valve.
3. Pressurize the hand pump by moving the hand valve lever (lever with round knob) on the pump toward the pump.
4. Continue pumping until all components are raised to the point where you can insert lockups. Insert lockup pins.
5. Continue on to lock off brakes for towing.

For the Hydraulic Brakes:

8. With the machine on level track, chock ALL wheels to prevent movement.
9. Close the ball valve at the brake valve stack (see photo to right) and lock in the CLOSED position. (CLOSED is perpendicular to the hose line, OPEN is parallel to the hose line.)
10. Attach one end of the hose (found in the toolbox) to the electric pump. Attach the other end of the hose to the quick disconnect at the brake valve.
11. Turn on the emergency pump at the control box.
12. Once the hydraulic brake cylinder has collapsed and has released the brakes, install the lockpins as shown.
13. Release hand pump pressure by moving the hand valve lever on the pump away from the pump, remove hose and wheel chocks, and perform towing as required.
14. Once you have towed to a site to perform maintenance on the hydraulic system, open the ball valve (closed under step 9) and lock in the OPEN position.
HYDRAULIC PRESSURE SETTINGS

- Main System Pressure: 2250 psi
- Crossover Relief: 2900 psi
- Tool Flip & Boxing PRV's: 1000 psi
- Bulk Loader Kick Down Relief: 2000 psi
- Main Relief Valve: 3000 psi
- Guide Roller PRV: 600 psi
- Feed Grip PRV: 650 psi
MAIN SYSTEM PRESSURE & RELIEF SETTINGS

Install the pressure gauge on the pressure tap for the main system pump as shown in the picture at the left.

Turn relief valve adjustment screw to full clockwise (CW) position (maximum pressure).

Turn pump compensator screw counterclockwise (CCW) (about 2-3 turns), but do not remove screw. Leave enough thread engagement to prevent leakage. Start engine and turn on the Pump.

Turn pump compensator clockwise (CW) until 3000 psi has been reached. Read this pressure at the main system gage on the propulsion manifold.

Adjust relief counterclockwise (CCW) until pressure at gauge just begins to drop. This is considered cracking pressure. Turn back 1/8 of a turn and tighten locknut.

DO NOT ADJUST THE RELIEF VALVE FOR FULL FLOW PRESSURE!

Refer to next page to set Crossover Relief Valves.
CROSSOVER RELIEF SETTINGS

**WARNING**

MAKE CERTAIN BRAKES ARE FULLY ENGAGED AND CAN HOLD MACHINE STATIONARY BEFORE CONTINUING WITH THESE ADJUSTMENTS. FAILURE TO DO SO MAY CAUSE SEVERE BODILY HARM

With the pressure gauge on the pressure tap for the main system pump still attached:

Turn both crossover relief valve adjustments screws to full clockwise (CW) position (maximum pressure).

Back out compensator until system pressure reaches 2900 psi.

Manually override FWD relief valve.

Adjust valve counterclockwise (CCW) until pressure at gauge just begins to drop. This is considered cracking pressure. Turn back 1/8 of a turn and tighten locknut.

Manually override REV relief valve.

Adjust valve counterclockwise (CCW) until pressure at gauge just begins to drop. This is considered cracking pressure. Turn back 1/8 of a turn and tighten locknut.

Adjust pump compensator counterclockwise (CCW) to system operating pressure (2500 psi).
<table>
<thead>
<tr>
<th>TOOL FLIP PRESSURE REDUCING VALVE SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Image with instructions" /></td>
</tr>
</tbody>
</table>

Plug in gage at pressure port as shown in picture.

Turn on pump. Read pressure.

If pressure is higher than 1000 psi, loosen nut on spotting valve adjusting screw and turn counterclockwise (CCW) until pressure reads 1000 psi. Tighten nut at new location.

If pressure is lower than 1000 psi, loosen nut on spotting valve adjusting screw and turn clockwise (CW) until pressure reads 1000 psi. Tighten nut at new location.
Plugging in gage at pressure port as shown in picture.

Turn on pump. Read pressure.

If pressure is higher than 1000 psi, loosen nut on spotting valve adjusting screw and turn counterclockwise (CCW) until pressure reads 1000 psi. Tighten nut at new location.

If pressure is lower than 1000 psi, loosen nut on spotting valve adjusting screw and turn clockwise (CW) until pressure reads 1000 psi. Tighten nut at new location.
<table>
<thead>
<tr>
<th>BULK LOADER KICK-DOWN RELIEF VALVE SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.jpg" alt="Image of valve settings" /></td>
</tr>
<tr>
<td>Plug in gage at pressure port as shown in picture.</td>
</tr>
<tr>
<td>Turn on pump. Read pressure.</td>
</tr>
<tr>
<td>If pressure is higher than 2000 psi, loosen nut on spotting valve adjusting screw and turn counterclockwise (CCW) until pressure reads 2000 psi. Tighten nut at new location.</td>
</tr>
<tr>
<td>If pressure is lower than 2000 psi, loosen nut on spotting valve adjusting screw and turn clockwise (CW) until pressure reads 2000 psi. Tighten nut at new location.</td>
</tr>
</tbody>
</table>
GUIDE ROLLER PRESSURE REDUCING VALVE SETTING

Plug in gage as shown in picture.

Turn on pump. Read pressure.

If pressure is higher than 600 psi, loosen nut on spotting valve adjusting screw and turn counterclockwise (CCW) until pressure reads 600 psi. Tighten nut at new location.

If pressure is lower than 600 psi, loosen nut on spotting valve adjusting screw and turn clockwise (CW) until pressure reads 600 psi. Tighten nut at new location.
FEED GRIP PRESSURE REDUCING VALVE SETTING

Plug in gage in RH or LH port as shown in picture. (Attach gage to valve stack being adjusted.)

Turn on pump. Read pressure.

If pressure is higher than 650 psi, loosen nut on spotting valve adjusting screw and turn counterclockwise (CCW) until pressure reads 650 psi. Tighten nut at new location.

If pressure is lower than 650 psi, loosen nut on spotting valve adjusting screw and turn clockwise (CW) until pressure reads 650 psi. Tighten nut at new location.

Repeat for other side.
## RETURNING HYDRAULICS TO FACTORY SETTINGS
(To be used in the event that valves were incorrectly set)

<table>
<thead>
<tr>
<th>VALVE</th>
<th>HOW TO ADJUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workhead Lift Counterbalance Valve</td>
<td>With the <strong>WORKHEAD LIFT</strong> lock-up rocker switch unlocked, set the counter-balance valve on <strong>WORKHEAD LIFT</strong> (bottom valve in stack) by turning the adjusting screw CCW and stopping just before the workhead starts to drift down (approximately 2-1/2 turns CCW from closed). The Workhead is not to drift down when the machine is shut down.</td>
</tr>
<tr>
<td>Workhead Lift Flow Control Valve</td>
<td>Remove the slow speed valve DIN connector and set <strong>WORKHEAD LIFT</strong> slow speed valve (2nd valve from bottom) such that the travel time to fully retract the lift cylinder from its extended length is approximately 1 second (approximately 7 turns CCW from closed).</td>
</tr>
<tr>
<td>Workhead Lift Slow Speed Valve</td>
<td>Re-install the slow speed valve DIN connector and set the <strong>WORKHEAD LIFT</strong> slow speed valve (3rd valve from the bottom) such that the travel time to extend the lift cylinder 1” is approximately 1 second (approximately ¾ turn from closed).</td>
</tr>
</tbody>
</table>
## RETURNING HYDRAULICS TO FACTORY SETTINGS
(To be used in the event that valves were incorrectly set)

<table>
<thead>
<tr>
<th>VALVE</th>
<th>HOW TO ADJUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workhead Rotate Counterbalance Valve</td>
<td>With the WORKHEAD ROTATE lock-up rocker switch unlocked, set the counter-balance valve on WORKHEAD ROTATE (bottom valve in stack) by turning the adjusting screw CCW and stopping just before the workhead starts to drift down (approximately 1-1/2 turns CCW from closed). The workhead is not to drift down when the machine is shut down.</td>
</tr>
<tr>
<td>Workhead Rotate Flow Control Valve</td>
<td>Set WORKHEAD ROTATE flow control (2nd valve from bottom) such that the travel time to fully retract the rotate cylinders is approximately ½ second (approximately 7 turns CCW from closed).</td>
</tr>
</tbody>
</table>
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.

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.

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, cramped, brittle, cracked, or leaking hoses. Hoses with their outer cover worn through or otherwise damaged should be considered unfit for further service.
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.

If your visual inspection does not indicate the possible malfunction, refer to the troubleshooting guide that follows.

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.

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.
## HYDRAULIC SYSTEM TROUBLESHOOTING GUIDE

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<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.)  &lt;br&gt;  &lt;br&gt; Shut-off valve closed. (NOTE: if pump is run with valve closed, pump damage will occur.)  &lt;br&gt;  &lt;br&gt; Main relief valve bypassing. (NOTE: oil blowing past any relief valve can cause oil to overheat.)  &lt;br&gt;  &lt;br&gt; Main pump compensator setting is too low.  &lt;br&gt;  &lt;br&gt; Pump is defective.  &lt;br&gt;  &lt;br&gt; Destroke valve stuck.  &lt;br&gt;  &lt;br&gt; Pump switch turned off.</td>
<td>Check oil level. Refill tank.  &lt;br&gt;  &lt;br&gt; Open valve completely.  &lt;br&gt;  &lt;br&gt; Increase pressure setting on relief valve. (See Pressure checks)  &lt;br&gt;  &lt;br&gt; Adjust compensator setting. (See Pressure Checks)  &lt;br&gt;  &lt;br&gt; Refer to pump manual or replace pump.  &lt;br&gt;  &lt;br&gt; Repair or replace.  &lt;br&gt;  &lt;br&gt; Turn on.</td>
</tr>
<tr>
<td>Hydraulic pump excessively noisy</td>
<td>Cold oil.  &lt;br&gt;  &lt;br&gt; Low oil level.  &lt;br&gt;  &lt;br&gt; Oil viscosity too high (oil too thick)  &lt;br&gt;  &lt;br&gt; System relief valve set too low.  &lt;br&gt;  &lt;br&gt; Intake hose to pump restricted.  &lt;br&gt;  &lt;br&gt; Defective pump.</td>
<td>Allow unit to warm up.  &lt;br&gt;  &lt;br&gt; Check and add oil.  &lt;br&gt;  &lt;br&gt; Drain and add correct oil as specified under &quot;RECOMMENDED LUBRICANTS&quot;.  &lt;br&gt;  &lt;br&gt; Increase pressure setting on relief valve (see Pressure Checks)  &lt;br&gt;  &lt;br&gt; Inspect and repair.  &lt;br&gt;  &lt;br&gt; See pump manual, repair or replace pump.</td>
</tr>
<tr>
<td>Machine will not propel</td>
<td>Main pump not developing pressure.  &lt;br&gt;  &lt;br&gt; Propulsion relief setting too low.  &lt;br&gt;  &lt;br&gt; Nippers not retracted or nipper work up switch not actuated.</td>
<td>See above.  &lt;br&gt;  &lt;br&gt; Increase relief setting. (See Pressure checks)  &lt;br&gt;  &lt;br&gt; Check nipper up switch, repair or replace.</td>
</tr>
<tr>
<td>Hydraulic Oil Overheats</td>
<td>Oil viscosity too high (oil too thick)  &lt;br&gt;  &lt;br&gt; System relief valve set too low.</td>
<td>Drain and add correct oil as specified under &quot;RECOMMENDED LUBRICANTS&quot;.  &lt;br&gt;  &lt;br&gt; Increase pressure setting on relief valve (see Pressure checks)</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>POSSIBLE CAUSE</td>
<td>SOLUTION</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Oil lines damaged causing excessive internal restriction</td>
<td>Checks)</td>
<td>Inspect and repair.</td>
</tr>
<tr>
<td>Travel relief set too low</td>
<td></td>
<td>Check and reset.</td>
</tr>
</tbody>
</table>

| Hydraulic Oil Foams                      | Water in oil                                        | Inspect oil for water. Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS". |
|                                          | Using wrong oil                                     |                                              |
|                                          | Low hydraulic level                                 |                                              |
|                                          | Damaged hydraulic oil lines                         |                                              |
|                                          | Air leak in suction line to hydraulic pump or pump shaft seal leaking |                                              |
|                                          |                                                    | Fill                                          |
|                                          |                                                    | Inspect, repair or replace.                  |

| Hydraulic Oil Filter Restriction Indicator Light stays on all the time (optional equipment) | Restricted hydraulic oil filter. | Replace filter. |
|                                                                                         | Hydraulic oil filter restriction switch | Replace switch. |