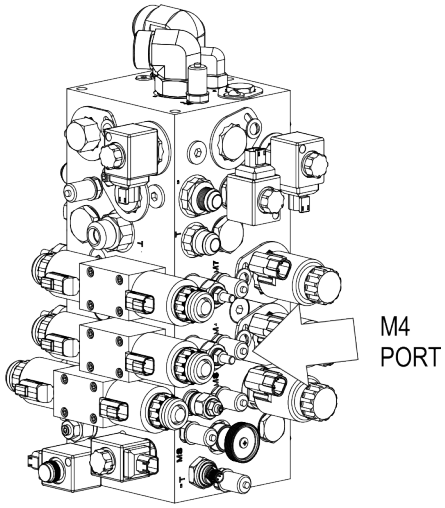
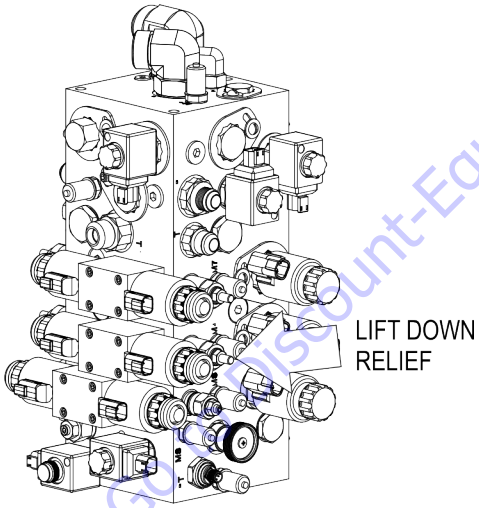
LIFT DOWN

1. Install pressure gauge 5000 psi (345 bar) at port “M4".

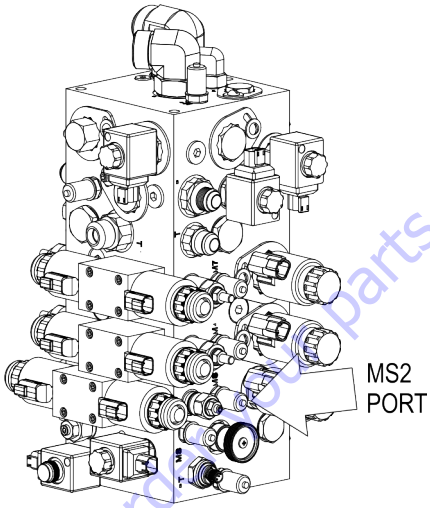


2. Using the Analyzer, go to service mode – set pressures - passcode: 14605, select Boom Lift. Activate boom lift down. The gauge should read 2850 psi (196 bar). The adjustment cartridge is located to the left of the “M4" gauge port. Turn clockwise to increase, counterclockwise to decrease.



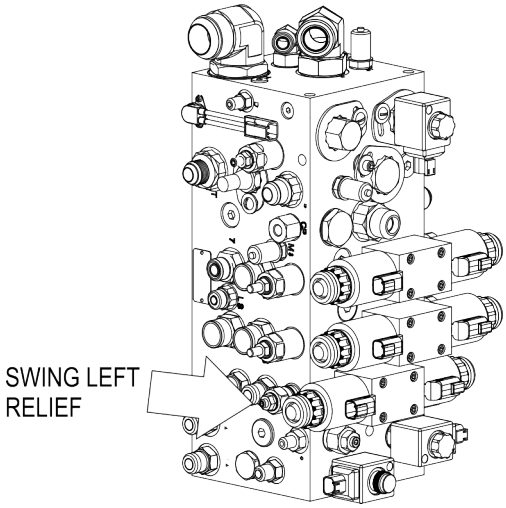
SWING

1. Install a high pressure gauge at port “MS2”.

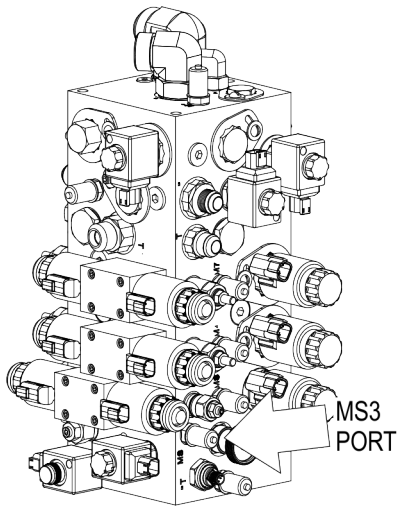


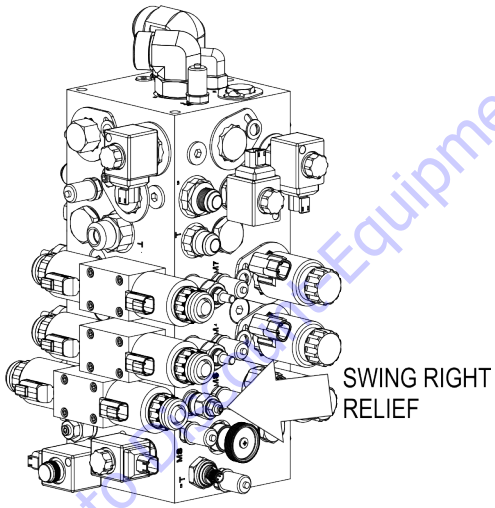
2. Install the Turntable lock pin.

3. Activate swing left, the gauge should read 2000 psi. The adjustment cartridge is located at beside the “MS2” gauge port. Turn clockwise to increase, counterclockwise to decrease.



4. Install gauge at MS3, Activate swing right, the gauge should read 2000 psi. (138 bar), the adjustment is located at 9 o'clock beside port 3, turn clockwise to increase pressure, counterclockwise to decrease pressure.

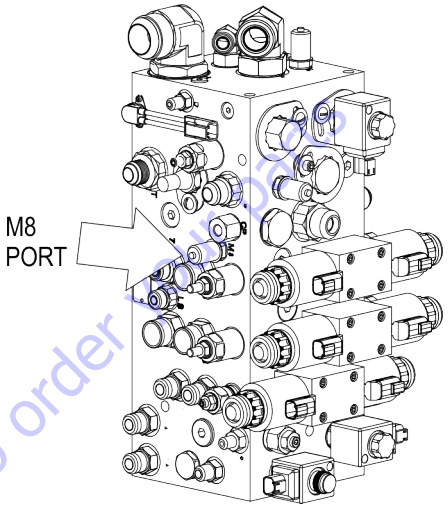




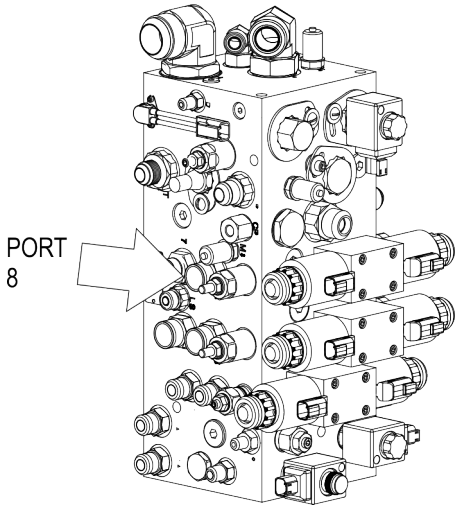
TELESCOPE OUT

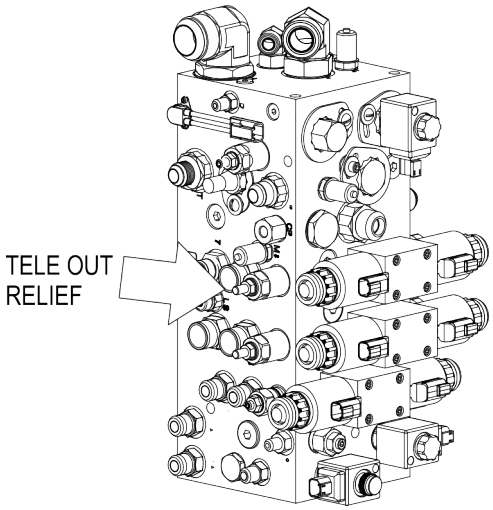
NOTE: *NEVER increase telescope out pressure to achieve desired telescope length.*

1. Install a high pressure gauge at the "M8" port of the main valve bank.



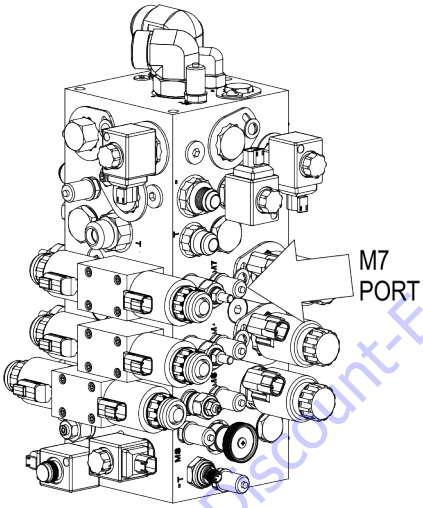
2. Plug the telescope out hose either at the valve bank (port #8) or at the inlet of the telescope cylinder (V1). Activate telescope out. The gauge should read 3000 psi (207 Bar). The adjustment cartridge is located at 2 o'clock adjacent to M8 gauge port. Turn clockwise to increase, counterclockwise to decrease.



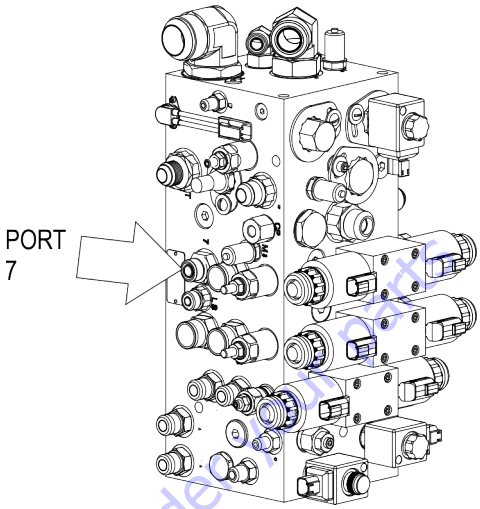


TELESCOPE IN

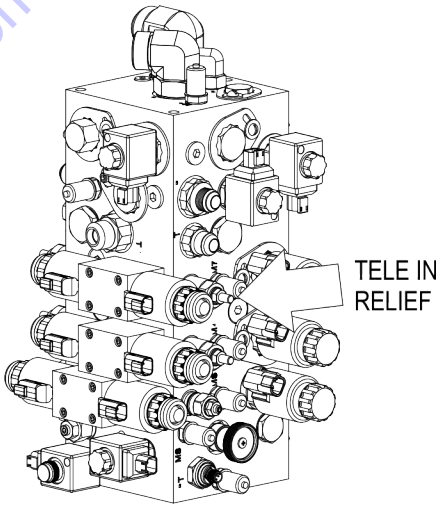
1. Install a high pressure gauge at the "M7" port of the main valve block.



2. Plug the telescope in hose either at the valve bank (port #7) or at the inlet of the telescope cylinder (V2).



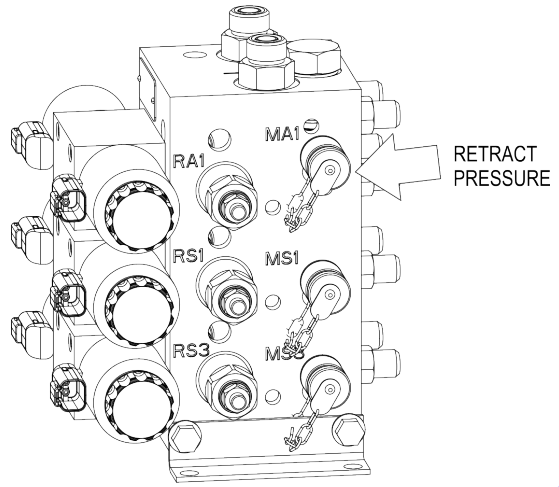
3. Activate telescope in. The gauge should read 3300 psi. (227 bar). The adjustment cartridge is located at 3 o'clock adjacent to "M7" gauge port. Turn clockwise to increase, counterclockwise to decrease.

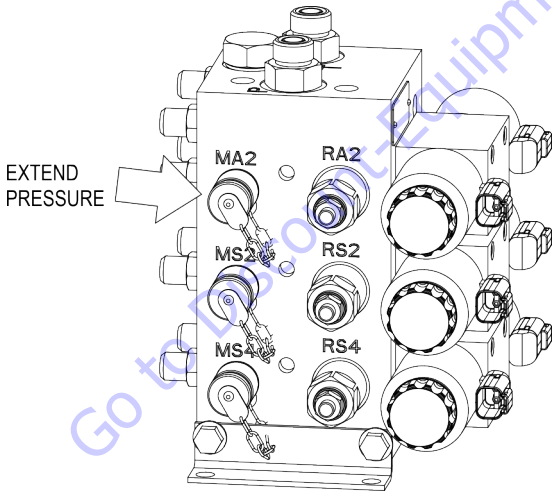


3. Adjustments Made at the Frame Valve Bank

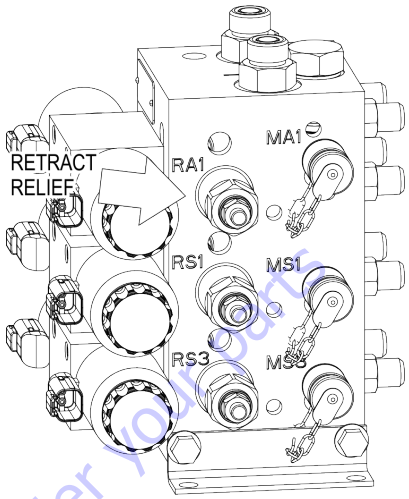
AXLE EXTEND AND RETRACT, FRONT AND REAR

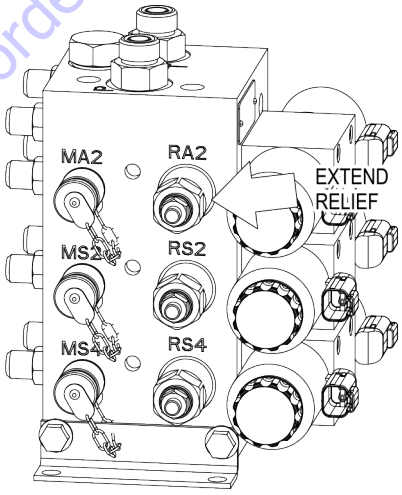
1. To extend the axles drive the machine back and forth until extended. A machine that cannot be driven must be jacked up.
2. On both the front and rear frame valve banks install a high pressure gauge on ports “MA1” for extend and “MA2” for retract. The gauge should read 2500 psi. for both directions.





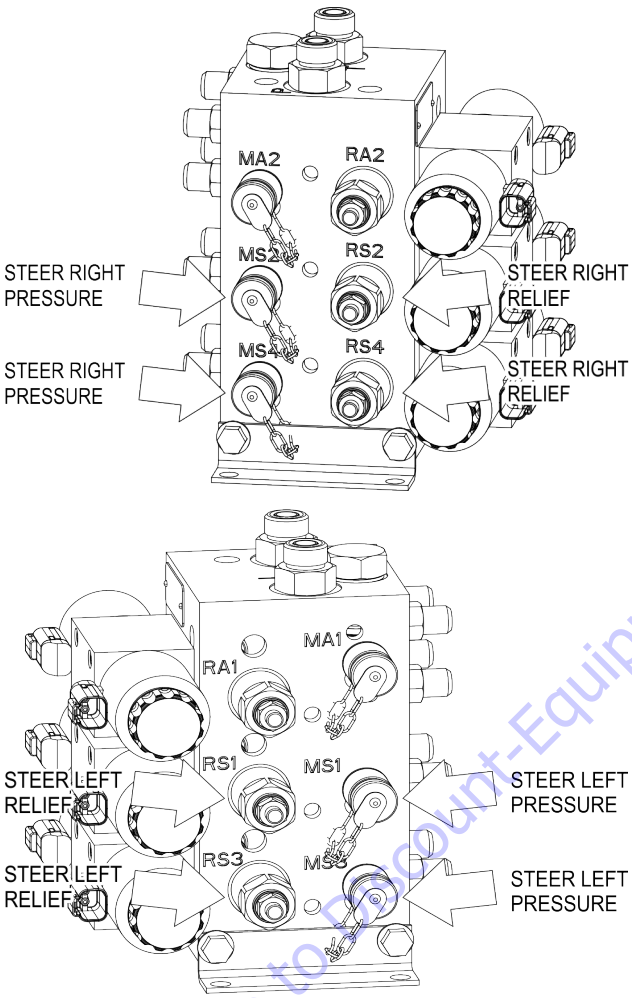
3. Turn clockwise to increase, counterclockwise to decrease.





STEERING, FRONT AND REAR

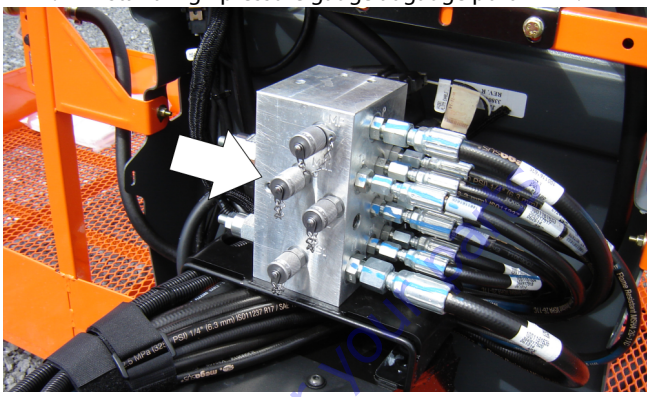
1. The axles must be extended to set the steer pressures.
2. Install a high pressure gauge at "MS2" and "MS4" gauge ports for steer right (extend), adjust to 2000 psi, and "MS1 and "MS3" for steer left (retract), adjust to 2600 psi, on both the front and rear valves. Each relief valve is located next to its own gauge port. Turn clockwise to increase, counterclockwise to decrease.



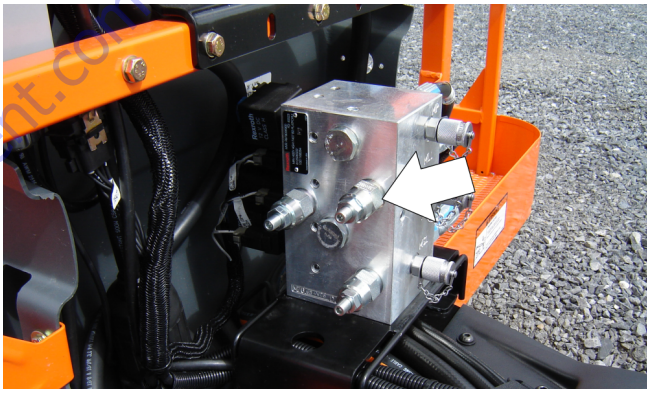
4. Adjustments Made at the Platform Valve Bank

PLATFORM LEVEL UP

1. Install a high pressure gauge at gauge port "ML1".

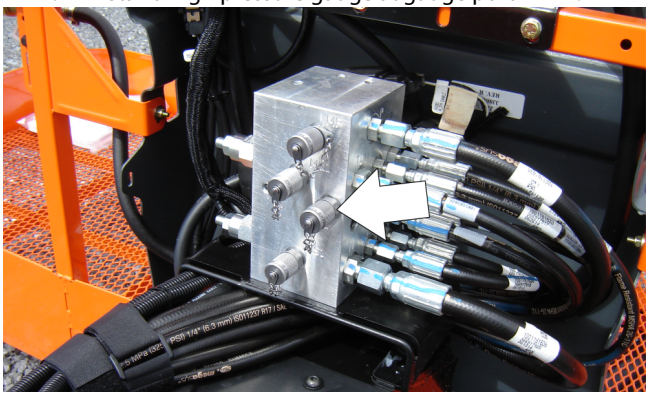


2. Activate level up to the end of stroke, the gauge should read 2500 psi.(172bar).
3. All the relief valves are located on the same face. The level up relief valve is on the top. Turn clockwise to increase, counterclockwise to decrease.

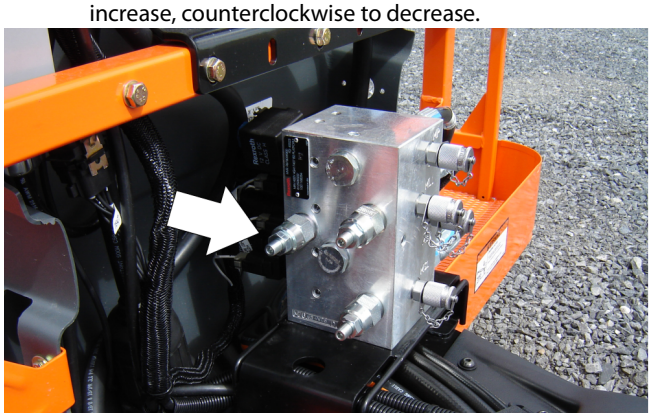


PLATFORM LEVEL DOWN

1. Install a high pressure gauge at gauge port "ML2".

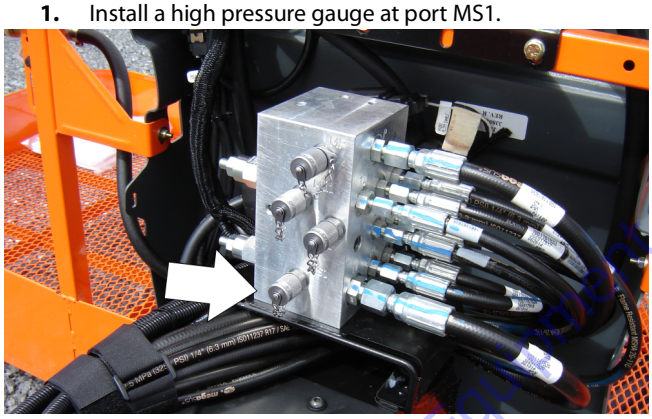


2. Activate level down to the end of stroke, the gauge should read 2000 psi. (138bar). The level down relief valve is the second from the top. Turn clockwise to increase, counterclockwise to decrease.



JIB PIN EXTEND (2500 PSI [172BAR]) PRESET

1. Install a high pressure gauge at port MS1.



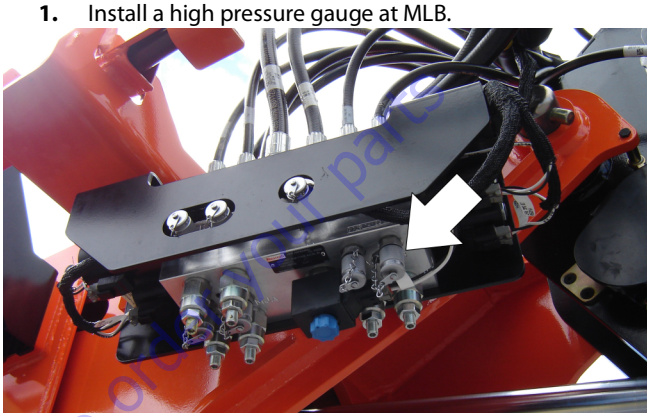
2. Using the analyzer and "set pressures" menu, select jib lock pin extend. This is the bottom relief valve on the platform valve. Turn CW to increase and CCW to decrease pressure.

5. Adjustments Made at Jib Valve

JIB LEVEL UP (2600 PSI)

NOTE: *To check or adjust the jib level up pressure setting the JLG Analyzer must be used to override the automatic jib level function.*

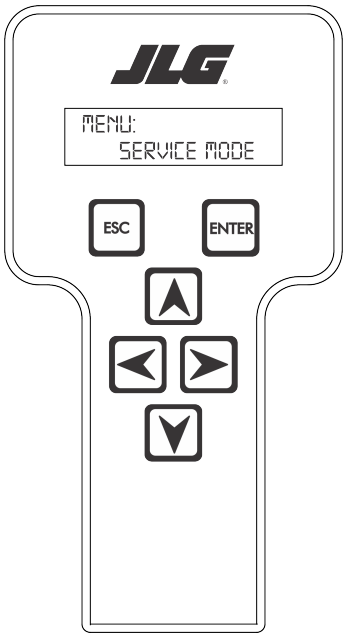
1. Install a high pressure gauge at MLB.



2. Connect the analyzer to the ground control connector.
3. Position the main boom on the boom rest and the jib to horizontal.
4. Using the analyzer, press the RIGHT  or LEFT  arrow key until ACCESS LEVEL 2 is reached. Press ENTER  .
5. Using the arrow keys, enter access code 58237 and press ENTER  .

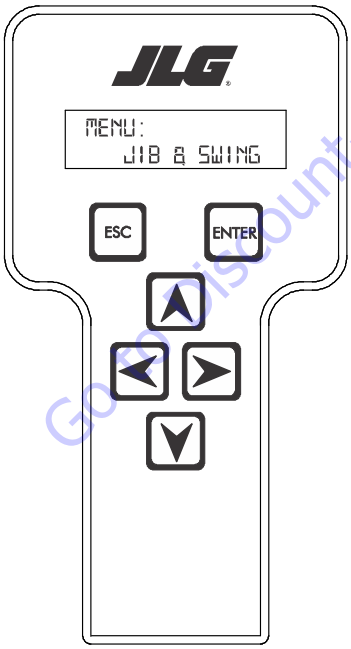
6. Using the arrow keys scroll until MENU: SERVICE MODE is reached. Press ENTER 

.



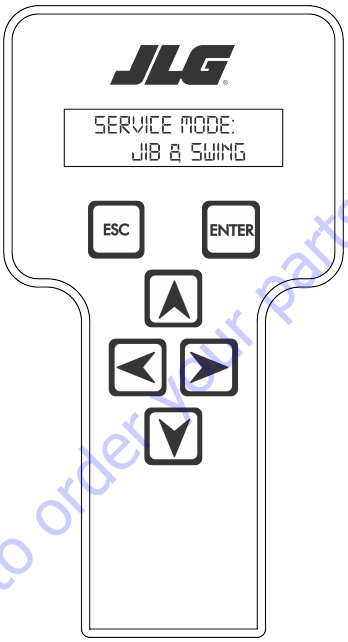
7. The analyzer should read JIB & SWING. Press ENTER 

.



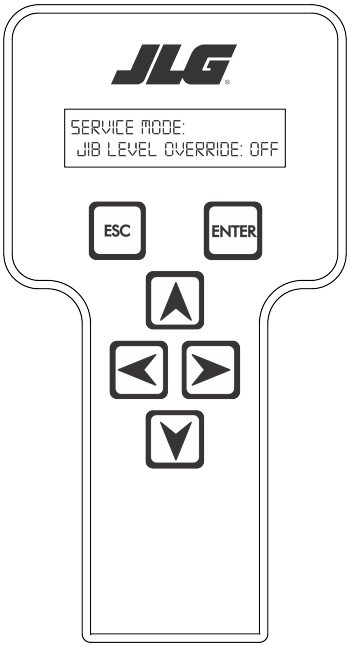
8. Enter code 58237 and Press ENTER 

. The screen should read SERVICE MODE: JIB & SWING AND JIB LEVEL.



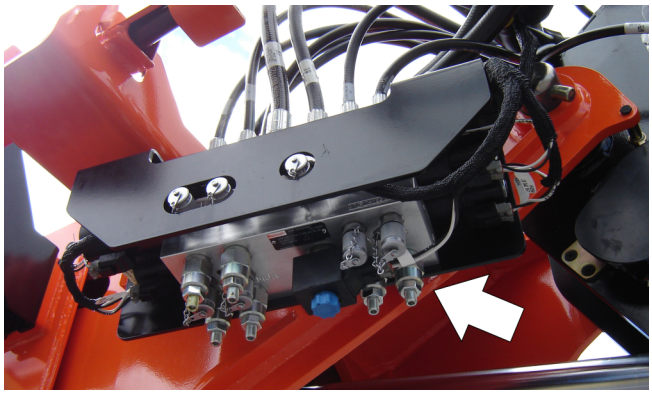
9. Press ENTER 

again. The screen will read JIB LEVEL OVERRIDE: OFF. Use the UP  or DOWN  arrow keys to toggle the override from Off to On.



10. Once turned on, operate the Jib Lift Up function. This will activate the jib level up function.

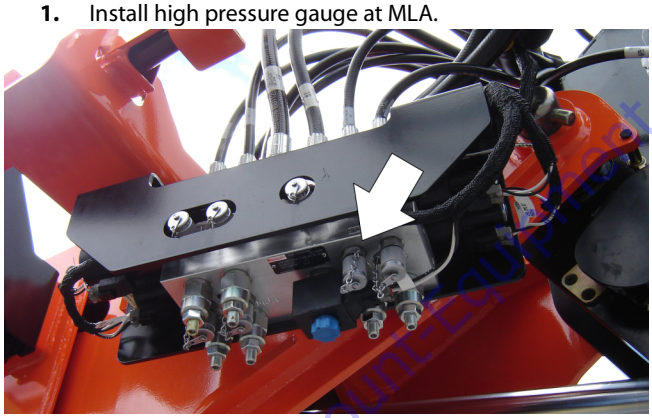
11. When the function bottoms out, pressure should read 2600 psi.(180bar).
12. If necessary to adjust pressure, CW increases and CCW decreases setting. Jib level up adjustment is adjacent to MLB.



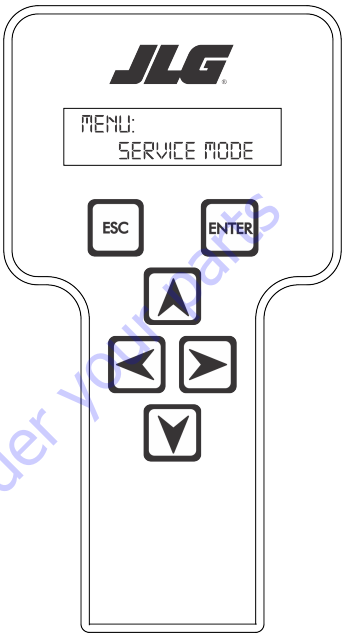
13. Make sure to reset Jib override to off after pressure is set, and cycle machine power.

JIB LEVEL DOWN (1500 PSI)

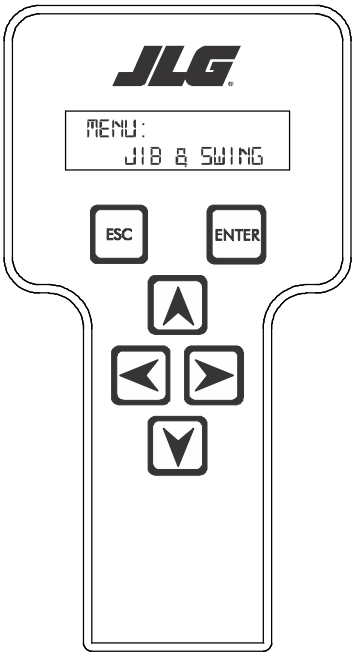
1. Install high pressure gauge at MLA.



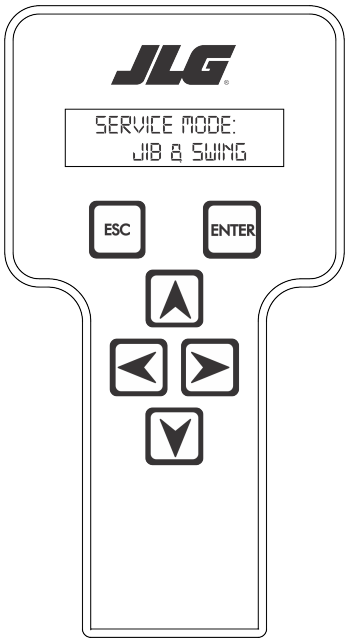
2. Connect the analyzer to the ground control connector.
3. Position the main boom on the boom rest and the jib fully elevated.
4. Using the analyzer, press the RIGHT or LEFT arrow key until ACCESS LEVEL 2 is reached. Press ENTER ENTER.
5. Using the arrow keys, enter access code 33271 and press ENTER ENTER.
6. Using the arrow keys scroll until MENU: SERVICE MODE is reached. Press ENTER ENTER.



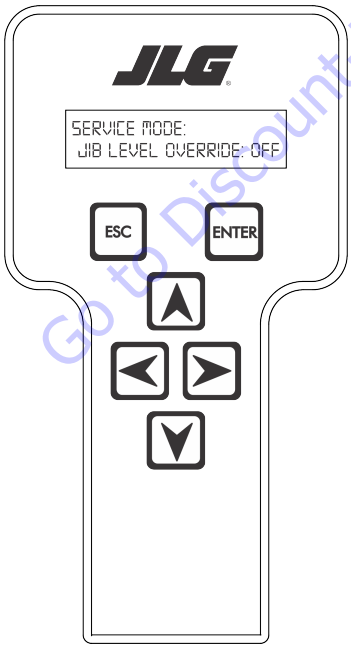
7. The analyzer should read JIB & SWING. Press ENTER ENTER.



8. Enter code 58237 and Press ENTER (ENTER). The screen should read SERVICE MODE: JIB & SWING AND JIB LEVEL.



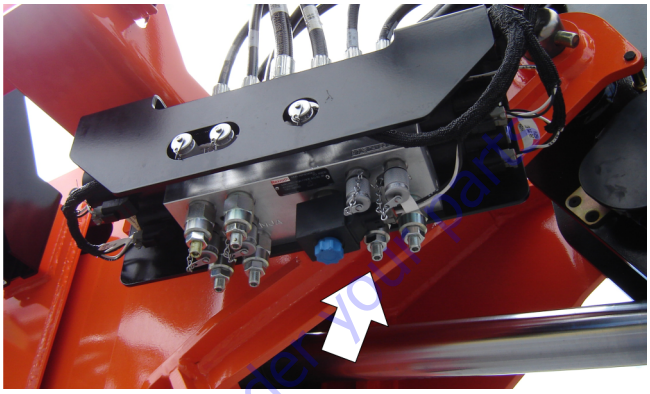
9. Press ENTER (ENTER) again. The screen will read JIB LEVEL OVERRIDE: OFF. Use the UP or DOWN arrow keys to toggle the override from Off to On.



NOTE: *Using this override may set the Jib Leveling System Fault, depending upon how far out of level the jib is moved.*

10. Once turned on, operate the Jib Lift Down function. This will activate the Jib Level Down function.

11. When the cylinder is completely retracted, the pressure should be 1500 psi. (104bar). CW increases and CCW decreases setting. Jib level down adjustment is adjacent to MLA.

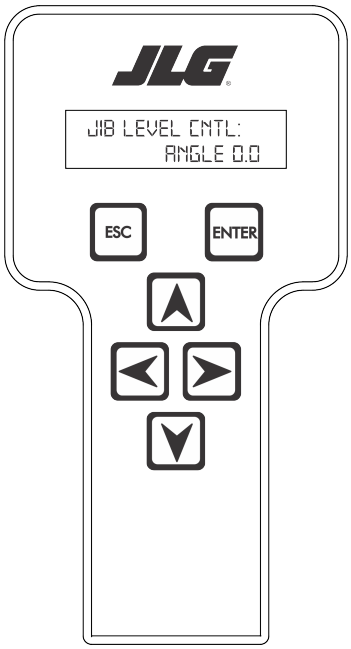


12. Make sure to reset Jib override to off after pressure is set, and cycle machine power.

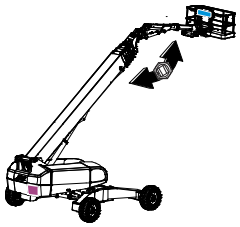
NOTE: *Steps 13 thru 17 are only necessary if the Jib Leveling System Fault has been set.*

13. To adjust the jib back to level, go into override mode for jib leveling. Turn the override mode to "On" and press the ESCAPE (ESC) key until out of the Service Modes menu.

14. Go to the Diagnostics/Boom Sensors menu. Use the Right arrow key until reaching the "Jib Level CNTL: Angle 0.0" screen.



15. Adjust the jib level using the Jib Lift function switch until the jib level control angle reads zero (0).

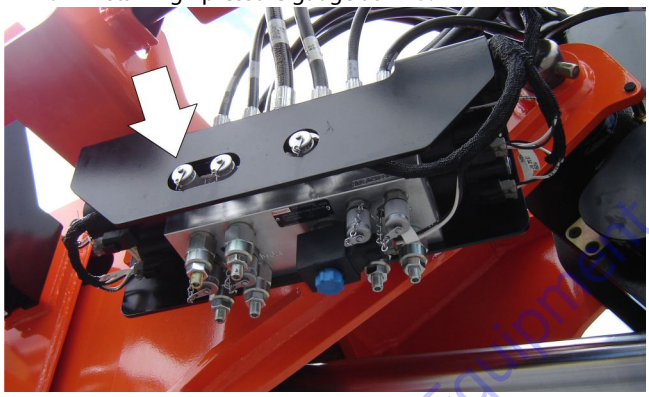


16. After the control angle is set, use the UP or DOWN arrow keys to toggle the override from On to Off.

17. Make sure to reset Jib override to off after pressure is set, and cycle machine power. Operate the main boom to verify jib level is working properly.

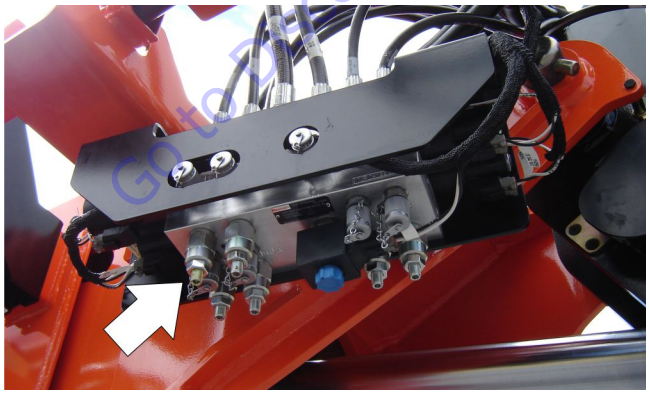
JIB TELESCOPE OUT

1. Install high pressure gauge at MTB.



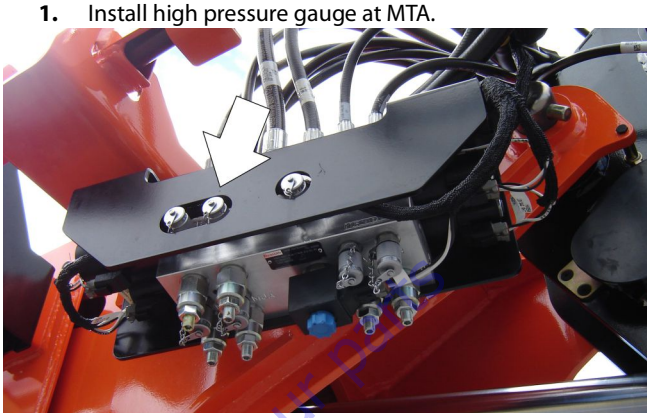
2. Extend jib telescope fully.

3. Set pressure at 2850 psi. (197bar). CW increases and CCW decreases setting. Adjustment is the one closest to MTB.



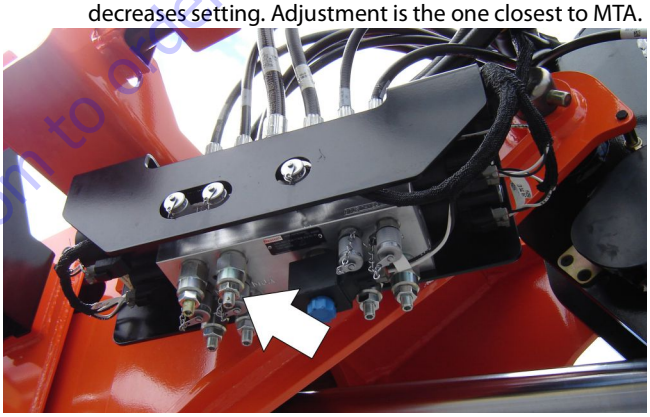
JIB TELESCOPE IN

1. Install high pressure gauge at MTA.



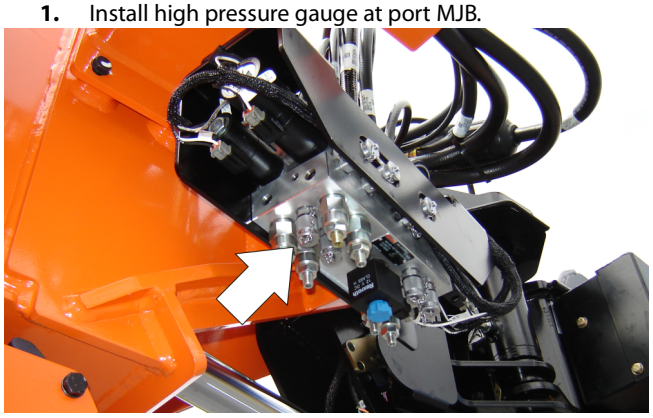
2. Retract jib telescope fully.

3. Set pressure at 2850 psi.(197bar). CW increases and CCW decreases setting. Adjustment is the one closest to MTA.

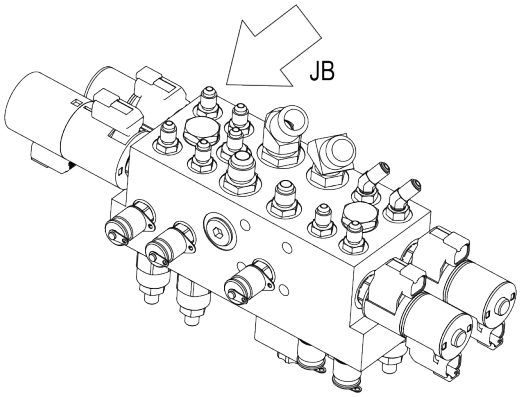


JIB LIFT UP

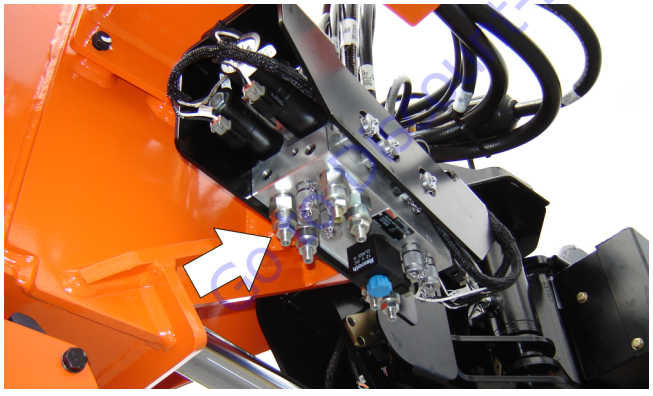
1. Install high pressure gauge at port MJB.



2. Fully extend jib lift cylinder or cap port JB.

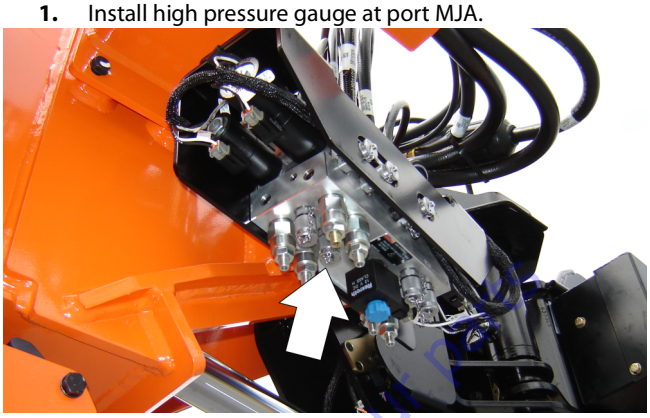


3. Set pressure to 2800 psi.(193bar). Clockwise increases and Counterclockwise decreases setting. Adjustment is on the boom side of MJB.

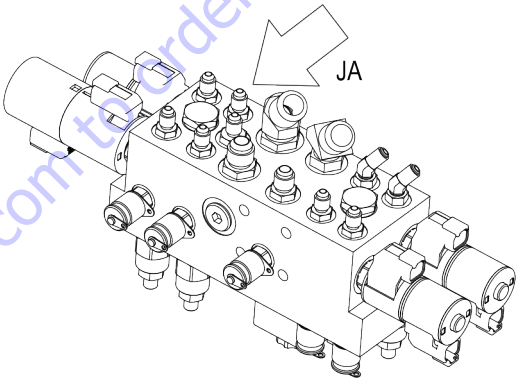


JIB LIFT DOWN

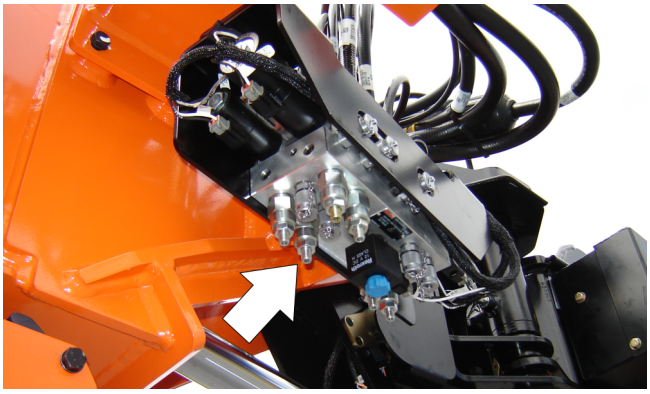
1. Install high pressure gauge at port MJA.



2. Fully retract jib lift cylinder or cap port JA. Set pressure to 1200 psi (83bar).



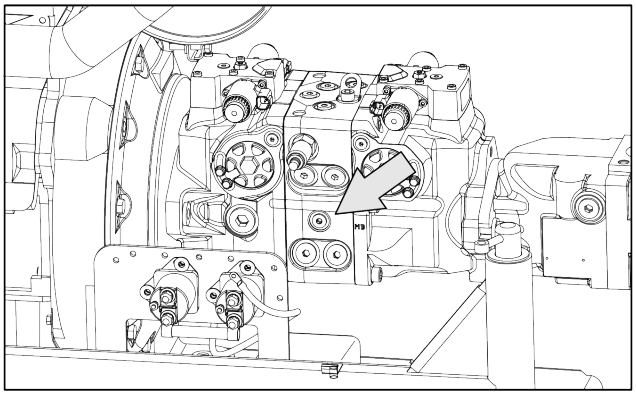
3. CW increases and CCW decreases setting. Adjustment is on the boom side of MJA.



6. Adjustments Made in Traction Circuit

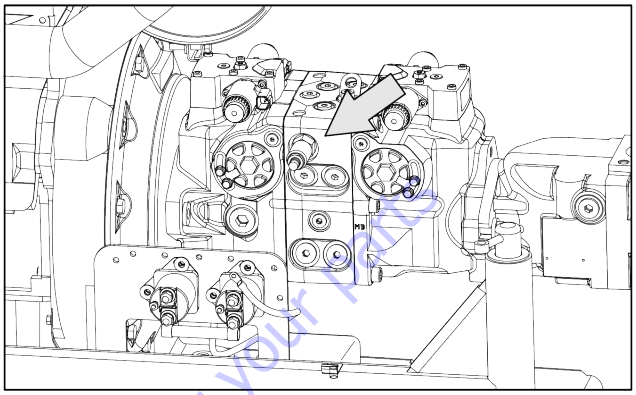
CHARGE PRESSURE RELIEF

1. Install gauge 1000psi (69bar)) at port M3 on traction pump.



2. With the drive hubs disconnected, start the engine.

3. Adjust the charge relief valve to obtain reading of 400psi (28bar). The charge relief is located on the turntable side of the pump above M3. Clockwise increases pressure, Counterclockwise decreases pressure.



LOOP FLUSHING RELIEF

1. Install pressure gauge at port MP on traction valve.
2. With hubs still disconnected energize Drive, adjust loop flushing valve to obtain gauge reading of 350psi (24bar). Clockwise increases pressure, counterclockwise decreases.

5.7 DRIVE PUMPS

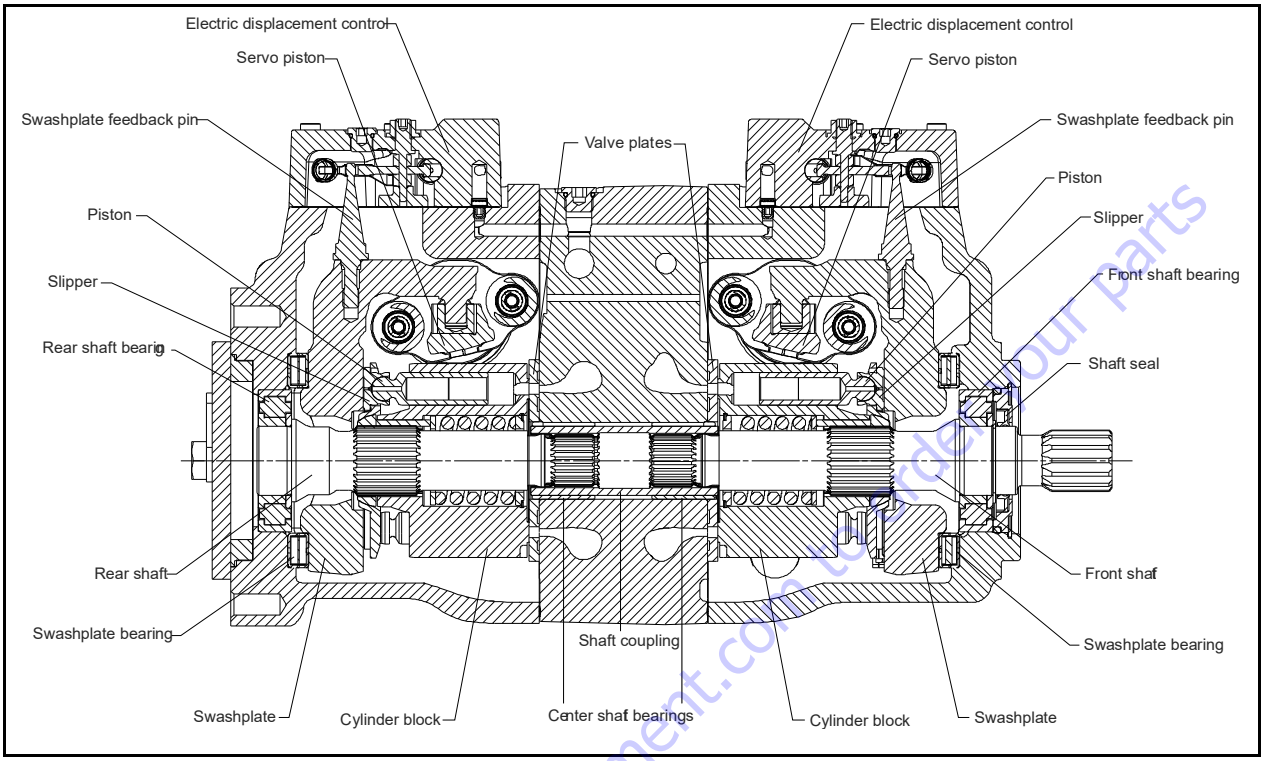


Figure 5-124. Piston Pump Cross Sectional View

Port Locations and Gauge Installation

Table 5-33. Port information

Port identifier	Port size	Wrench size	Reading	Gauge size, bar [psi]
L1, L2, L3	1 1/16-12 UNF 2B	9/16 internal hex	Case drain	10 bar [100 psi]
MA, MB, MC, MD	9/16-18 UNF	1/4 internal hex	System pressure	600 bar [10,000 psi]
M3	9/16-18 UNF 2B	1/4 internal hex	Charge pressure	50 bar [1000 psi]
M4, M5	7/16-20 UNF 2B	3/16 internal hex	Servo pressure	50 bar [1000 psi]
X7	9/16-18 UNF 2B	1/4 internal hex	Brake pressure	50 bar [1000 psi]

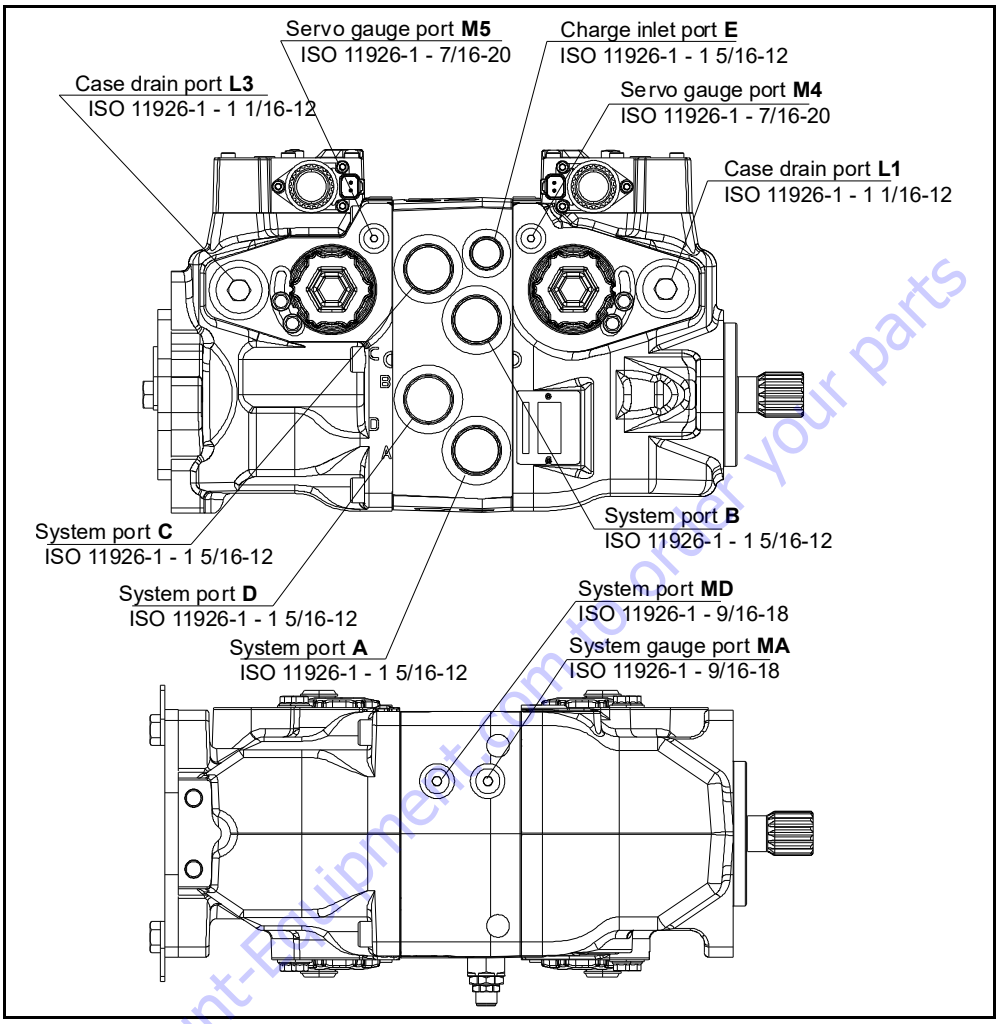


Figure 5-125. Port locations - Sheet 1 of 2

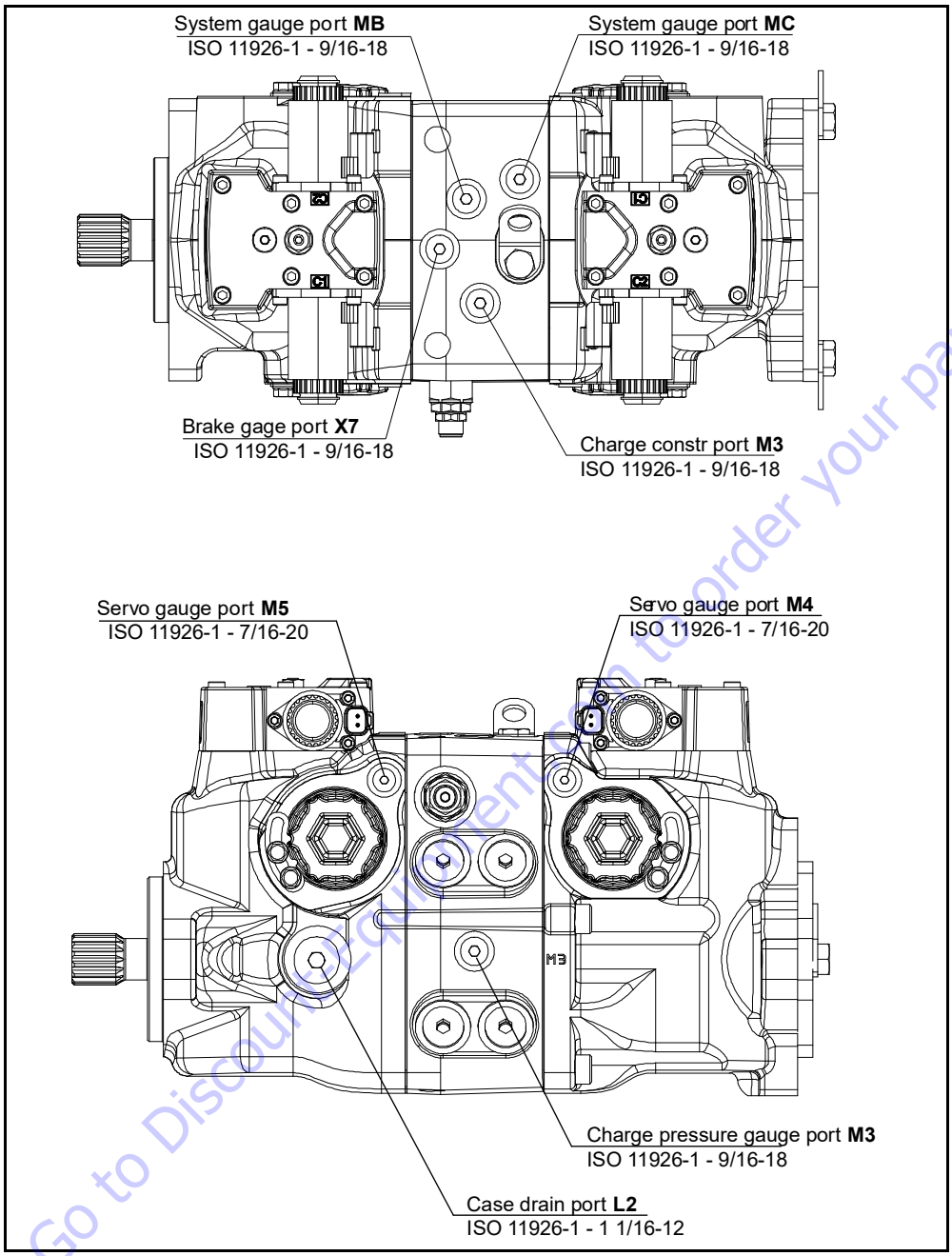


Figure 5-126. Port locations - Sheet 2 of 2

Initial Startup Procedures

Follow this procedure when starting-up a new pump or when restarting a pump that has been removed. Ensure the pump is thoroughly tested on a test stand before installing.

Prior to installing the pump, inspect for damage that may have occurred during shipping.

1. Ensure that the machine hydraulic oil and system components (reservoir, hoses, valves, fittings, and heat exchanger) are clean and free of any foreign material.
2. Install new system filter element(s) if necessary. Check that inlet line fittings are properly tightened and free of air leaks.
3. Install the pump. Install a 50 bar [1000 psi] gauge in the charge pressure gauge port M3.
4. Fill the housing by adding filtered hydraulic fluid to the upper case drain port. If the controls are installed on top, open the construction plugs in the top of the controls to assist in air bleed.
5. Fill the reservoir with hydraulic fluid of the recommended type and viscosity. Use a 10-micron filler filter. Ensure construction plug is closed after filling is complete.
6. Disconnect the pump from all control input signals.

⚠ CAUTION

AFTER START-UP THE FLUID LEVEL IN THE RESERVOIR MAY DROP DUE TO SYSTEM COMPONENTS FILLING DAMAGE TO HYDRAULIC COMPONENTS MAY OCCUR IF THE FLUID SUPPLY RUNS OUT. ENSURE RESERVOIR REMAINS FULL OF FLUID DURING START-UP.

⚠ CAUTION

AIR ENTRAPMENT IN OIL UNDER HIGH PRESSURE MAY DAMAGE HYDRAULIC COMPONENTS. CHECK CAREFULLY FOR INLET LINE LEAKS.

⚠ CAUTION

DO NOT RUN AT MAXIMUM PRESSURE UNTIL SYSTEM IS FREE OF AIR AND FLUID HAS BEEN THOROUGHLY FILTERED.

7. Use a common method to disable the engine to prevent it from starting. Crank the starter for several seconds. Do not to exceed the engine manufacturer's recommendation. Wait 30 seconds and then crank the engine a second time as stated above. This operation helps remove air from the system lines. Refill the reservoir to recommended full oil level.
8. When the gauge begins to register charge pressure, enable and start engine. Let the engine run for a minimum of 30 seconds at low idle to allow the air to work itself out of the system. Check for leaks at all line connections and listen for cavitation. Check for proper fluid level in reservoir.
9. When adequate charge pressure is established (as shown in model code), increase engine speed to normal operating rpm to further purge residual air from the system.
10. Shut the off engine. Connect the pump control signal. Start the engine, checking to be certain the pump remains in neutral. Run the engine at normal operating speed and carefully check for forward and reverse control operation.
11. Continue to cycle between forward and reverse for at least five minutes to bleed all air and flush system contaminants out of the system loop.

NOTE: *Normal charge pressure fluctuation may occur during forward and reverse operation.*

12. Check that the reservoir is full. Remove charge pressure gauge and cap port. The pump is now ready for operation.

Troubleshooting

⚠ CAUTION

HIGH INLET VACUUM CAUSES CAVITATION WHICH CAN DAMAGE INTERNAL PUMP COMPONENTS.

⚠ WARNING

ESCAPING HYDRAULIC FLUID UNDER PRESSURE CAN HAVE SUFFICIENT FORCE TO PENETRATE YOUR SKIN CAUSING SERIOUS INJURY AND/OR INFECTION AND MAY BE HOT ENOUGH TO CAUSE BURNS. RELIEVE PRESSURE IN THE SYSTEM BEFORE REMOVING HOSES, FITTINGS, GAUGES, OR COMPONENTS. SEEK IMMEDIATE MEDICAL ATTENTION IF YOU ARE CUT OR BURNED BY HYDRAULIC FLUID.

⚠ CAUTION

CONTAMINATION CAN DAMAGE INTERNAL COMPONENTS. TAKE PRECAUTIONS TO ENSURE SYSTEM CLEANLINESS WHEN REMOVING AND REINSTALLING SYSTEM COMPONENTS AND LINES

Table 5-34. Electrical Troubleshooting

Item	Description	Action
Control operates pump in one direction only	Control coil failure.	Measure resistance at coil pins. Resistance should be 14.2W (24V) or 3.66W (12V) at 20°C [70°F]. Replace coil.
No pump function	No power to controller.	Restore power to controller.
Erratic pump function	Electrical connection to pump is bad.	Disconnect connection, check wires, reconnect wires.
Erratic or no machine function	External controller malfunction or hydraulic system problem.	Verify external controller problem using spare controller. Replace controller. Check hydraulic system fluid level/pressures/filters/etc. Fix hydraulic system problems.

Table 5-35. Neutral Difficult or Impossible to find

Item	Description	Action
Input to pump control	Input to control module is operating improperly.	Disconnect input and check to see if pump comes back to neutral. If Yes, input fault, replace/repair external controller. If No, go to next step.
Pump control neutral	Neutral set improperly.	Shunt servo gauge ports M4 and M5 together with external hose and see if pump comes back to neutral. If Yes: control neutral improperly set. If no: balance swashplate (see Mechanical neutral adjustment). If you still cannot set neutral, replace control.

Table 5-36. System Operating Hot

Item	Description	Action
Oil level in reservoir	Insufficient hydraulic fluid will not meet cooling demands of system.	Fill reservoir to proper level.
Heat exchanger	Heat exchanger not sufficiently cooling the system.	Check air flow and input air temperature for heat exchanger. Clean, repair or replace heat exchanger.
Charge pressure	Low charge pressure will overwork system.	Measure charge pressure. Inspect and adjust or replace charge relief valve. Inspect charge pump. Repair or replace charge pump.
Charge pump inlet vacuum	High inlet vacuum will overwork system. A dirty filter will increase the inlet vacuum. Inadequate line size will restrict flow.	Check charge inlet vacuum. If high, inspect inlet filter and replace as necessary. Check for adequate line size, length or other restrictions.
System relief pressure settings	If the system relief valves are worn, contaminated, or valve settings are too low, the relief valves will be overworked.	Verify settings of high pressure relief valves and replace valves as necessary.
System pressure	Frequent or long term operation over system relief setting will create heat in system.	Measure system pressure. If pressure is too high, reduce loads.

Table 5-37. System Will Not Operate

Item	Description	Action
Oil level in reservoir	Insufficient hydraulic fluid to supply system loop.	Fill reservoir to proper level.
Control orifices	Control orifices are blocked.	Clean control orifices.
Control screens	Control screens are blocked.	Clean or replace control screens.
Charge pressure with pump in neutral	Low charge pressure insufficient to recharge system loop.	Measure charge pressure with the pump in neutral. If pressure is low, go to next step.
Pump charge relief valve	A pump charge relief valve that is leaky, contaminated, or set too low will depressurize the system.	Adjust or replace pump charge relief valve as necessary.
Charge pump inlet filter	A clogged filter will under supply system loop.	Inspect filter and replace if necessary.
Charge pump	A malfunctioning charge pump will provide insufficient charge flow.	Repair or replace the charge pump.
System pressure	Low system pressure does not provide enough power to move load.	Measure system pressure. Continue to next step.
Charge check / HPRVs	Defective charge check / HPRVs cause system pressure to be low.	Repair or replace charge check / HPRVs.
Input to control	Input to control module is operating improperly.	Repair or replace control.
Optional control cutoff valve	Control cutoff valve coil not energized.	Ensure charge pressure to control via port X7. If none, confirm control cutoff valve coil is energized. If still no pressure, repair or replace control cutoff valve.

Table 5-38. System Noise or Vibration

Item	Description	Action
Reservoir oil level	Low oil level leads to cavitation.	Fill reservoir.
Aeration of the oil/pump inlet vacuum	Air in system decreases efficiency of units and controls. Air in system is indicated by excessive noise in pump, foaming in oil, and hot oil.	Find location where air is entering into the system and repair. Check that inlet line is not restricted and is proper size.
Cold oil	If oil is cold, it may be too viscous for proper function and pump cavitates.	Allow the oil to warm up to its normal operating temperature with engine at idle speed.
Pump inlet vacuum	High inlet vacuum causes noise/cavitation.	Check that inlet line is not restricted and is proper size. Check filter and bypass switch.
Shaft couplings	A loose input shaft to prime mover coupling will cause excessive noise.	Replace loose shaft coupling.
Shaft alignment	Misaligned input and prime mover shafts create noise.	Correct misalignment.
Charge/system relief valves	Unusual noise may indicate sticking valves. Possible contamination.	Clean/replace valves and test pump. May be a normal condition.

Table 5-39. Sluggish system response

Item	Description	Action
Oil level in reservoir	Low oil level will cause sluggish response.	Fill reservoir.
Charge check / HPRVs	Incorrect pressure settings will affect system reaction time.	Replace charge check / HPRVs.
Low prime mover speed	Low engine speed will reduce system performance.	Adjust engine speed.
Charge and control pressures	Incorrect pressures will affect system performance.	Measure and adjust charge and control pressures.
Air in system	Air in system will produce sluggish system response.	Fill tank to proper level. Cycle system slowly for several minutes to remove air from system.
Contaminated control orifices	Control orifices are plugged.	Clean control orifices.
Contaminated control screens	Control screens are plugged.	Clean or replace control screens.
Pump inlet vacuum	Inlet vacuum is too high resulting in reduced system pressure.	Measure charge inlet vacuum. Inspect line for proper sizing. Replace filter. Confirm proper bypass operation.

Adjustments

⚠ CAUTION

CONTAMINATION CAN DAMAGE INTERNAL COMPONENTS AND VOID YOUR WARRANTY. TAKE PRECAUTIONS TO ENSURE SYSTEM CLEANLINESS WHEN REMOVING AND REINSTALLING SYSTEM LINES

1. Thoroughly clean the outside of the pump.
2. If removing the pump, tag each hydraulic line. When you disconnect hydraulic lines, cap them and plug each open port to prevent contamination.
3. Ensure the surrounding area is clean and free of contaminants like dirt and grime.
4. Inspect the system for contamination.
5. Check the hydraulic fluid for signs of contamination: oil discoloration, foam in the oil, sludge, or metal particles.
6. If there are signs of contamination in the hydraulic fluid, replace all filters and drain the hydraulic system. Flush the lines and refill the reservoir with the correct filtered hydraulic fluid.
7. Before reinstalling the pump, test for leaks.

CHARGE PRESSURE RELIEF VALVE.

1. Install a 50 bar [1000 psi] pressure gauge in charge pressure gauge port M3. Install a 10 bar [100 psi] gauge at case pressure port L1, L2, or L3. Operate the system with the pump in neutral (zero displacement) when measuring charge pressure.
2. The table below shows the acceptable pump charge pressure range for some nominal charge relief valve settings (refer to model code located on serial number plate). These pressures assume 1800 min-1 (rpm) pump speed and a reservoir temperature of 50°C [120°F], and are referenced to case pressure.

NOTE: *Listed pressures assume a pump speed of 1800 min-1 (rpm) and charge flow of 26.5 l/min [7 US gal/min]. At higher pump speeds or higher charge flows the charge pressure will rise over the rated setting.*

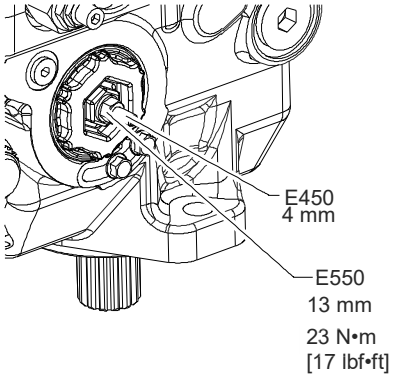
3. Loosen the locknut and rotate the adjusting screw clockwise to increase the setting; counterclockwise to decrease it. Subtract the case pressure reading to compute the actual charge pressure.

NOTE: *Pressure change per turn is dependent on charge flow entering pump.*

4. While holding the adjusting screw, torque locknut to 12 Nm [9 lbft].
5. When you achieve the desired charge pressure setting, remove the gauges and plug the ports.

DISPLACEMENT LIMITER ADJUSTMENT

1. Mark servo cylinder location in case it rotates during displacement limiter adjustment.
2. Loosen the locknut (E550).



3. Rotate the adjusting screw (E450) based on the following table. Rotating the adjusting screw clockwise decreases the maximum displacement of the pump while rotating the adjusting screw counterclockwise increases the maximum displacement.

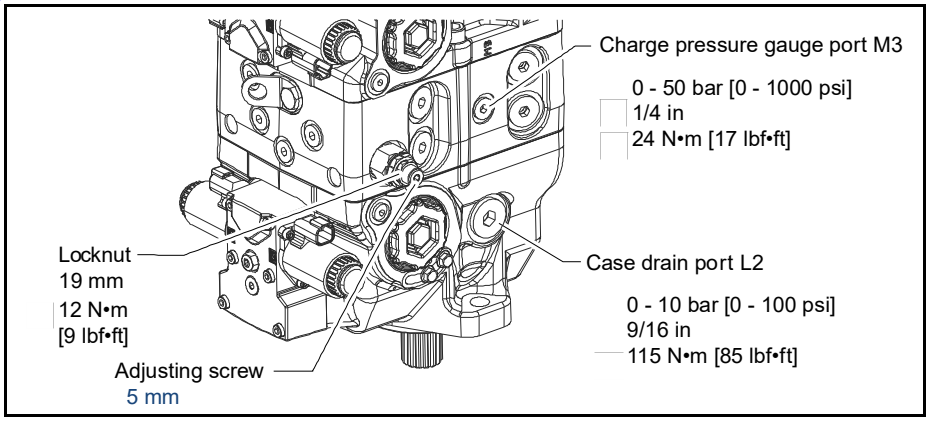


Figure 5-127. Charge Pressure Adjustment

4. After establishing the desired maximum displacement setting, hold adjusting screw in place and tighten the locknut. Torque to 23 Nm [17 lbft].

⚠ CAUTION

BE SURE SERVO CYLINDER DOES NOT ROTATE WHEN DISPLACEMENT LIMITER LOCKNUT (E550) IS TORQUED.

5. One turn of the adjusting screw will change the maximum displacement approximately as follows.

Table 5-40. Displacement Limiter Adjustment Data

Displacement	Locknut wrench size and torque	Adjusting screw size	Approximate displacement change per revolution of adjusting screw
45	13 mm 23 Nm [17 lbft]	4 mm internal hex	5.1 cc/turn

CONTROL NEUTRAL ADJUSTMENT

All functions of the Electric Displacement Control (EDC) are preset at the factory. Adjust the pump to neutral with the pump running on a test stand or on the vehicle/machine with the prime mover operating. If adjustment fails to give satisfactory results, you may need to replace the control or coils.

1. Install a 50 bar [1000 psi] gauge in each of the two servo gauge ports (M4 and M5). Disconnect the external control input (electrical connections) from the control. Start the prime mover and operate at normal speed.

2. Use a 4mm internal hex wrench to hold the neutral adjusting screw stationary while loosening the locknut with a 13mm wrench.

3. Observe pressure gauges. If necessary, turn adjusting screw to reduce any pressure differential.

NOTE: *Adjustment of the EDC is very sensitive. Be sure to hold the hex wrench steady while loosening the locknut. Total adjustment is less than 120 degrees.*

4. Rotate the neutral adjusting screw clockwise until the pressure increases on the gauge. Note the angular position of the wrench. Then rotate the neutral adjusting screw counterclockwise until the pressure increases by an equal amount on the other gauge. Again note the angular position of the wrench.

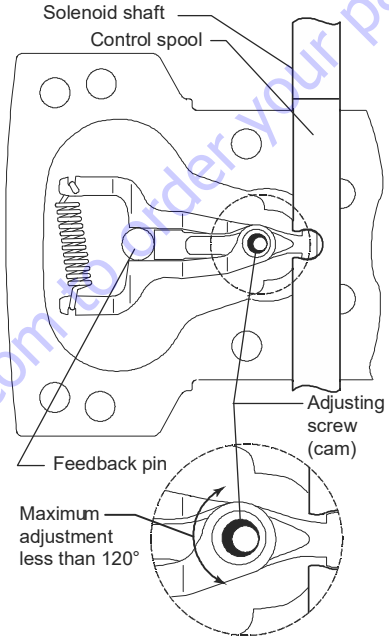


Illustration shows how eccentric cam on adjusting screw rotates to adjust neutral.

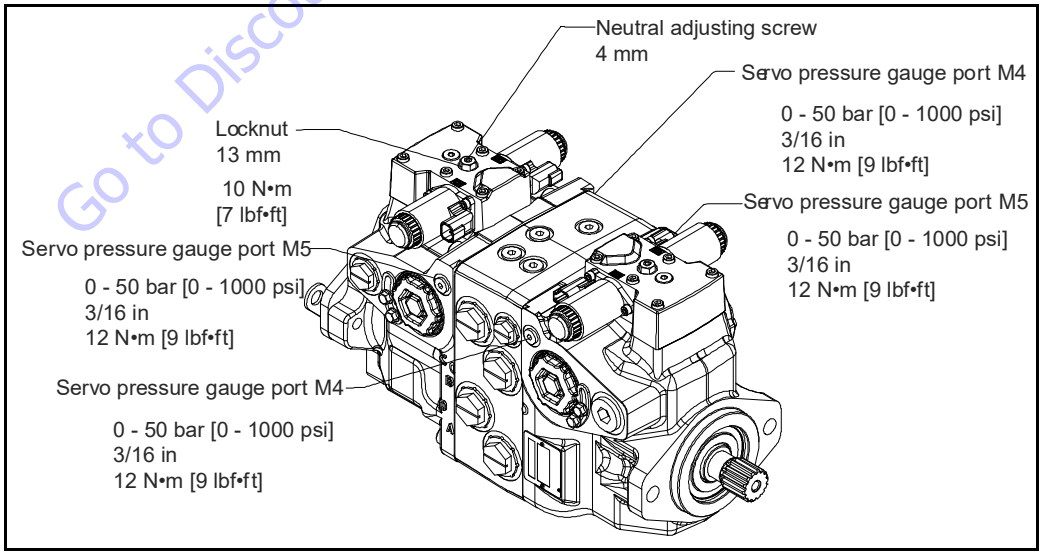


Figure 5-128. Control Neutral Adjustment

5. Rotate the neutral adjusting screw clockwise half the distance between the wrench positions noted above. The gauges should read the same pressure, indicating that the control is in its neutral position.

6. Hold the neutral adjusting screw stationary and tighten the lock nut. Torque to 10.Nm [7 lbft]. Do not over torque the nut.

7. When the neutral position is set, stop the prime mover, remove the gauges, and install the gauge port plugs. Reconnect the external control input.

NOTE: *A small pressure differential of 1.5 bar [22 psi] or less is acceptable. Zero differential is usually not possible.*

MECHANICAL NEUTRAL ADJUSTMENT

Mechanical neutral is set with the pump running at 1800 min (rpm). To set neutral, you must stroke the pump in each direction.

This procedure details setting neutral for the entire pump, one side at a time. The procedure is the same for each side of each pump so you will need to repeat it four times to set mechanical neutral for both the front and rear sections. Alternate M4/M5 and MA/MB to zero out forward and reverse directions of the front unit, then move the gauges to M4/M5 of the rear unit and MC/MD (system gauge ports for the rear unit). Refer to the drawing that follows to identify all ports. The front and rear sections are basically mirror images of each other. The control solenoids C1 and C2 are marked on each control.

While performing this adjustment, you monitor the following pressures.:

- Servo pressure at M4 and M5
- System pressure at MA and MB or MC and MD
- Pressure differential between M4 and M5 (optional)
- Pressure differential between A and B or C and D (optional)

PUMP SETUP

1. Attach a 50 bar [1000 psi] gauge to each servo pressure port M4 and M5.

2. Attach a 600 bar [10 000 psi] gauge to each system pressure port (MA and MB for front pump, MC and MD for rear pump).

3. Remove servo cylinder locking screws (E350) and plates (E300) from both sides of the pump.

4. Disconnect the control solenoids from the vehicle wiring harness.

5. If using a PWM signal to set mechanical neutral, connect the control solenoids C1 and C2 to the signal source. Ensure the source supplies no current to the solenoids until required in the following procedure.

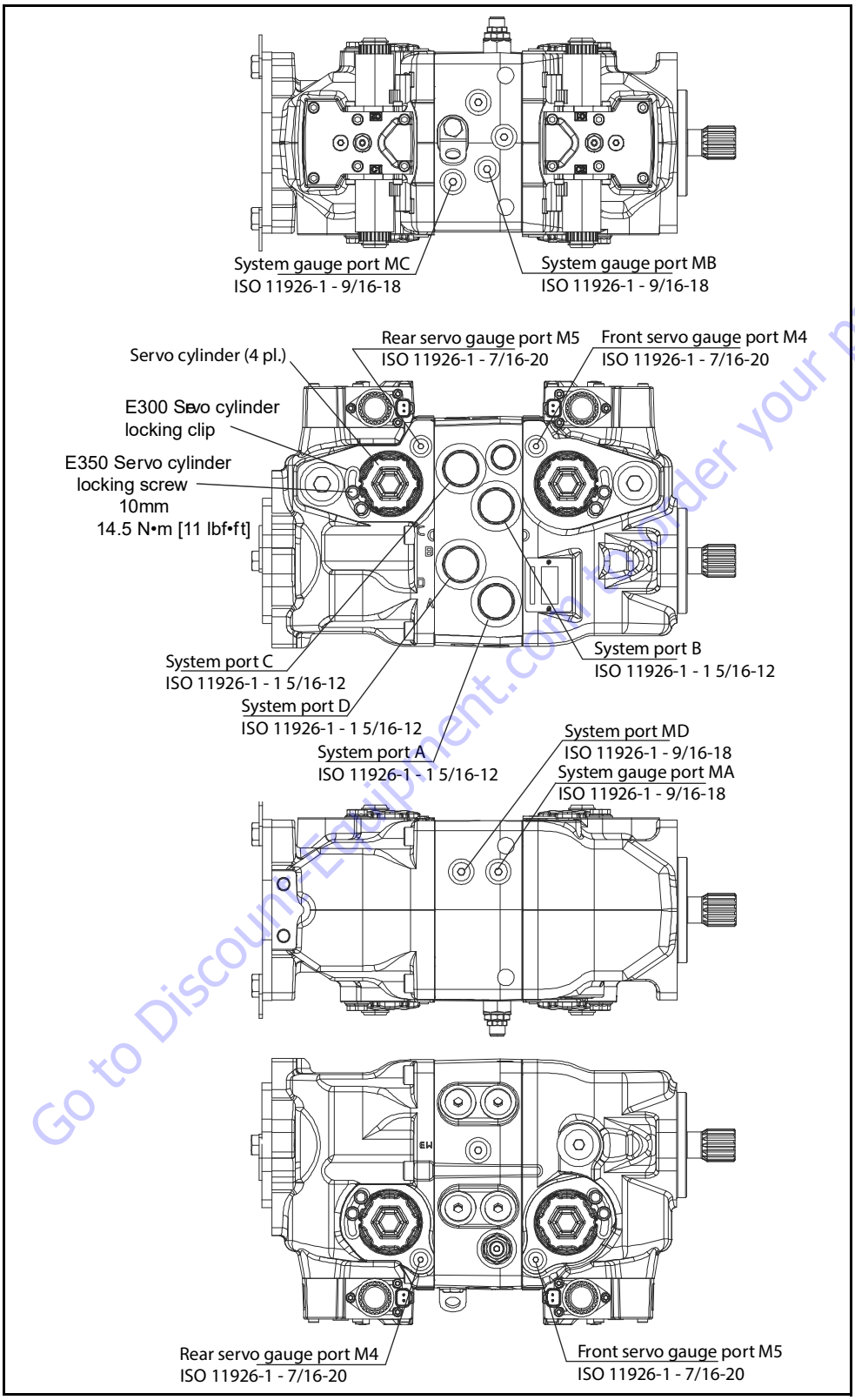


Figure 5-129. Servo and System Pressure Gauge Port Locations

SERVO ADJUSTMENT

6. Run prime mover at 1800 min (rpm).

7. If using a PWM signal, ensure the signal is off. Check the servo pressure gauges. Ensure the differential between M4 and M5 is less than 1.5 bar [22 psi].

8. Using a 3/4 in deep socket, unthread both servo cylinders 2-3 turns. This step ensures the servo cylinders have no contact with the servo piston.

9. Stroke the pump by turning the control eccentric screw (or supplying current to solenoid C1) until the servo pressure at port M4 is 1 to 2 bar [14 -29 psi] greater than at port M5 and the system pressure gauges indicate displacement. Pressure should be greater at port MA for clockwise rotation, or MB for counterclockwise rotation. This also indicates the servo piston is in contact with the servo cylinder on side M5.

10. Slowly thread the servo cylinder on the M5 side in until the system pressure differential starts to decrease. Maintain servo pressure differential between 1-2 bar [14-29 psi] during this step. Continue turning the servo cylinder in until the system pressure differential (between ports MA/MB or MC/MD) is less than 1.5 bar [22 psi]. This procedure sets the servo and swashplate to mechanical neutral on the M5 side.

11. To complete setting neutral, repeat steps 1-5 but stroke the pump in the opposite direction by turning the eccentric screw in the opposite direction, or by supplying current to solenoid C2. Reverse gauge locations (M4 for M5, MB for MA etc.) from those stated above since the pump is now stroking the other direction.

12. Set neutral for the rear pump by repeating steps 1-6 on the rear pump. Remember that the rear pump is a mirror image of the front pump and therefore the locations of the servo gauge ports (M4/M5) and the control solenoids (C1/C2) are opposite.

13. Remove all gauges and replace gauge port plugs.

Removing The Pump

Before working on the pump, thoroughly clean the outside. If the pump has an auxiliary pump attached, remove both pumps as a single unit. Tag and cap all hydraulic lines as you disconnect them, and plug all open ports to ensure that dirt and contamination do not get into the system.

⚠ CAUTION

CONTAMINATION CAN DAMAGE INTERNAL COMPONENTS. TAKE PRECAUTIONS TO ENSURE SYSTEM CLEANLINESS WHEN REMOVING AND INSTALLING SYSTEM LINES.

1. Thoroughly clean all dirt and grime from the outside of the pump.
2. Tag, disconnect, and cap each hydraulic line connected to the pump. As hydraulic lines are disconnected, plug each open port, to ensure that dirt and contamination do not get into the pump.
3. Remove the pump and its auxiliary pump (if applicable) as a single unit.

NOTE: *Be careful, do not damage solenoids and electrical connections when using straps or chains to support the pump.*

Inspection

1. Ensure the work surface and surrounding area are clean and free of contaminants such as dirt and grime.
2. Inspect the system for contamination.
3. Look at the hydraulic fluid for signs of system contamination, oil discoloration, foam in the oil, sludge, or metal particles.

Replacement

1. Before replacing the pump, replace all filters and drain the hydraulic system. Flush the system lines and fill the reservoir with the correct, filtered hydraulic fluid.
2. Fill the pump with clean, filtered hydraulic fluid.
3. Attach the pump to the prime mover. Torque mounting screws according to the manufacturers recommendation.
4. Replace all hydraulic lines. Ensure the charge inlet line is filled with fluid.

Electric Control Module

REMOVAL

Refer to exploded diagram, next page.

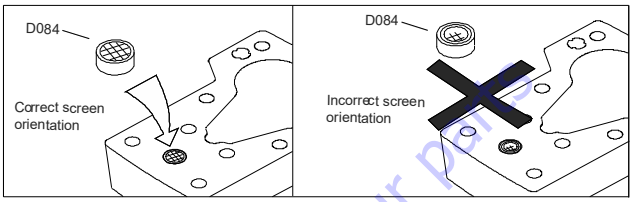
1. Using a 5 mm internal hex wrench, remove the six capscrews (D250).
2. Remove the control module and gasket (D150). Discard the gasket.
3. If necessary, remove orifices (F100) using a 3 mm internal hex wrench. Tag and number them for reinstallation.
4. Inspection
5. Inspect the machined surfaces on the control and top of the pump. If you find any nicks or scratches, replace the component.

NOTE: *Remove plug on top of control to ensure the swashplate feedback pin is properly positioned in the center of the control module when installing control.*

REASSEMBLY

NOTE: *Ensure you install dowel pins (D300) in housing before installing control.*

1. Install a new gasket (D150).
2. If you removed screen (D084), install a new one. Install with the mesh facing outward.



3. If previously removed, install orifices (F100) using a 3 mm internal hex wrench. Torque to 2.5 Nm [1.8 lbft].
4. Install the control module and six capscrews (D250).
5. Using a 5 mm internal hex wrench, torque the capscrews (D250) to 13.5 Nm [10.lbft].

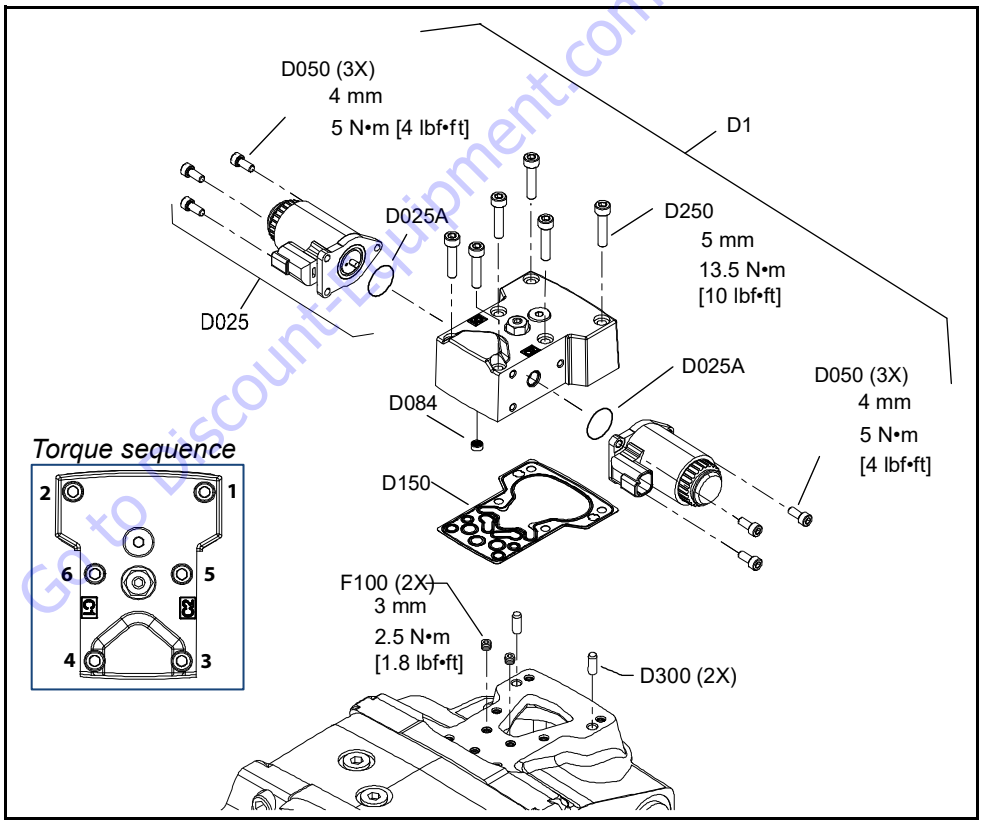


Figure 5-130. Control Module And Solenoid Removal/installation

CONTROL SOLENOIDS REMOVAL

1. Disconnect electrical connection and remove the three capscrews (D050) using a 4.mm internal hex wrench.
2. Remove the solenoid (D025) and O-ring (D025A). Discard the O-ring.
3. If necessary, remove the coil using a 12 point 26 mm socket.

CONTROL SOLENOIDS INSPECTION

1. Inspect the machined surface on the control. If you find any nicks or scratches, replace the component.

CONTROL SOLENOIDS REASSEMBLY

1. Lubricate new O-ring (D025A) using petroleum jelly and install.
2. Install solenoid with three capscrews (D050) using a 4 mm internal hex wrench. Torque screws to 5 Nm [4 lbft].
3. Install coil using a 12 point 26 mm socket. Torque coil nut to 5 Nm [3.7 lbft].
4. Reconnect electrical connections and test the pump for proper operation.

Shaft, Seal, and Bearing

The front pump input shaft assembly is serviceable without disassembling the pump, the rear shaft is not. Orient the pump on the work surface so the shaft is pointing to the side.

REMOVAL

1. Unwind the spiral ring (J300) from the housing to release the shaft/seal/bearing subassembly.
2. Pry on the lip of the seal carrier (J275) to remove it from the pump. Remove the seal carrier. Remove and discard O-ring (J260). Press the seal (J250) out of the carrier and discard.
3. Pull the shaft (J100) with bearing (J150) out of the pump. If necessary, tap lightly on the shaft to dislodge it from the cylinder block. C

⚠ CAUTION

DO NOT DAMAGE THE HOUSING BORE, SHAFT OR BEARING WHEN REMOVING THE SHAFT AND BEARING.

4. Remove the retaining ring (J200) using retaining ring pliers. Press the bearing off the shaft.

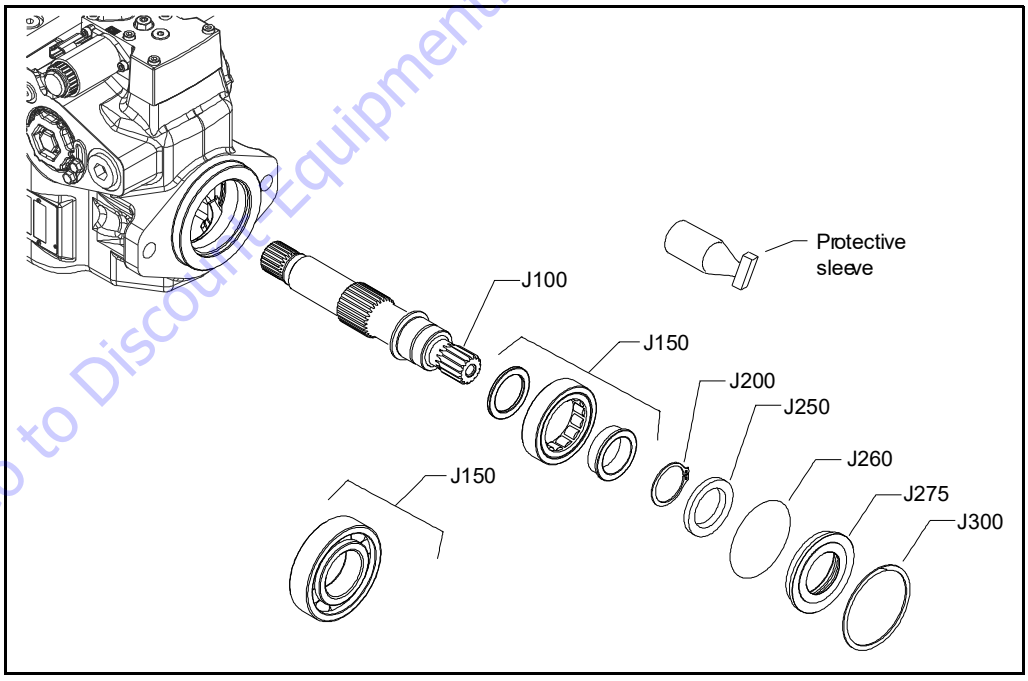


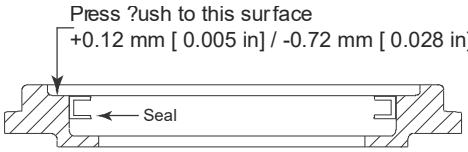
Figure 5-131. Shaft Assembly

INSPECTION

1. Inspect the shaft journals for wear, scratching, and pits. Check the splines for fretting; replace if damaged. Rotate the bearing, if it does not rotate smoothly, replace it.

REASSEMBLY

1. Press the bearing (J150) onto the shaft (J100) and replace the retaining ring (J200). Ensure the retaining ring diameter is less than 38.84 mm [1.53.in] when installed on the shaft.
2. Install the shaft/bearing assembly into the pump.
3. Lubricate and install a new O-ring (J260) onto seal carrier (J275). Press a new seal (J250) into the seal carrier. Press the seal until it is flush within +0.12mm [0.005 in] or -0.72 mm [0.0028 in] of the inside lip of the carrier: see illustration.



4. Cover the shaft with a protective sleeve while installing the seal carrier. Hand press the seal carrier into the housing. Ensure the seal carrier clears the spiral ring groove in the housing. Remove the protective sleeve.
5. Wind the spiral ring into the housing. Ensure the inside diameter of the spiral ring is greater than 68 mm [2.677 in] after installation.

Charge Pump

Position pump with front shaft pointing downward. Attach securely to a proper work stand. If an auxiliary pump is attached, remove auxiliary pump before servicing charge pump.

REMOVAL

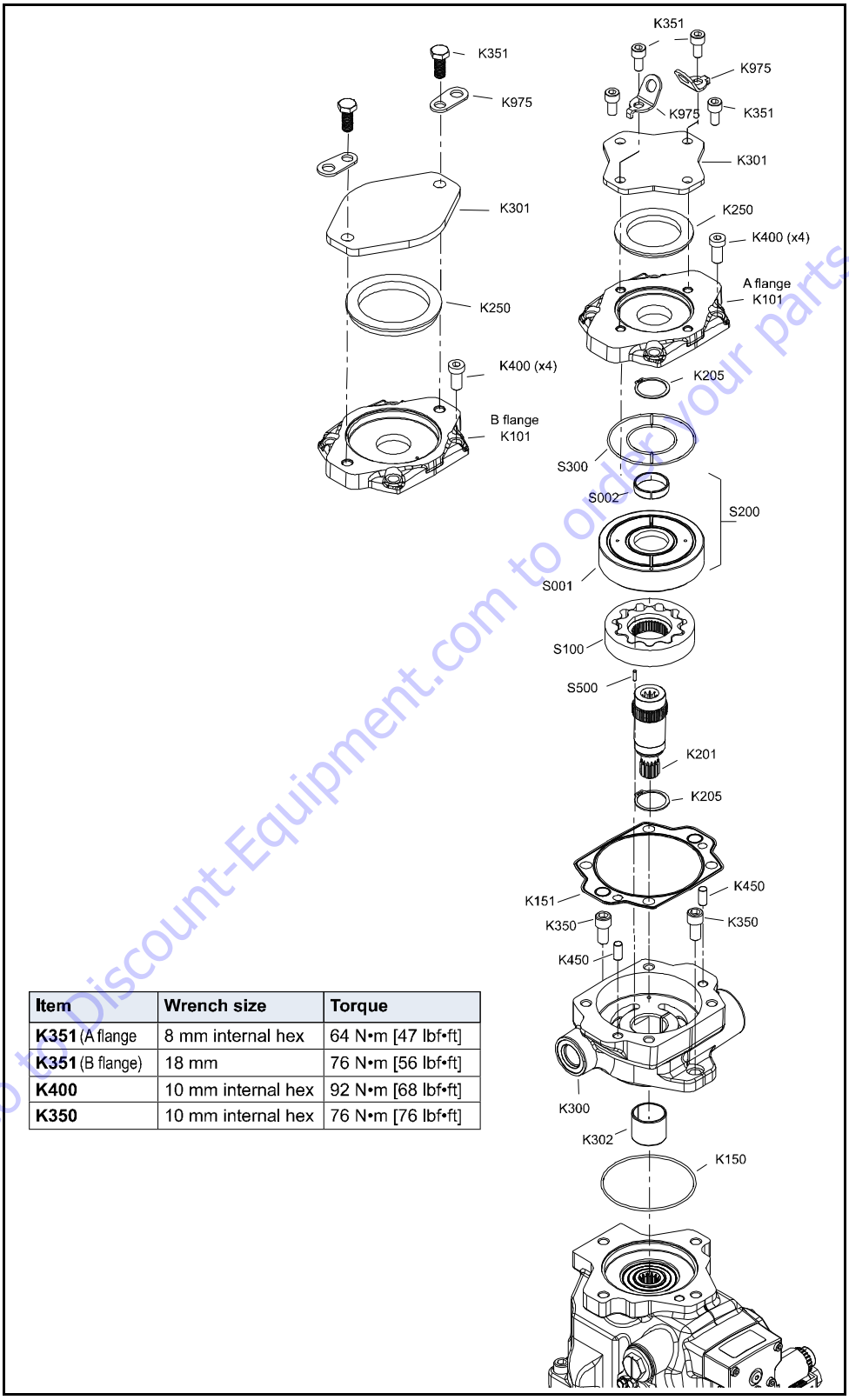
1. Remove screws (K351), and hangers (K975).
2. Remove running cover (K301). Remove and discard seal ring (K250).
3. Using a 10 mm internal hex, remove screws (K400). Remove cover (K101).
4. Remove charge pump assembly with shaft.

NOTE: *Note position of alignment pin (S500) in housing. Alignment pin position will change for clockwise or counter-clockwise rotation.*

5. Remove and discard seal (S300).
6. Using a snap ring pliers, remove two clips (K205).
7. Remove geroter cover (S200). Remove geroter assembly (S100).
8. Remove and discard gasket (K151). Remove alignment pins (K450).
9. If it is necessary to remove housing (K300), use a 10 mm internal hex to remove screws (K350).
10. Remove housing (K300).
11. Remove and discard seal (K150).

INSPECTION

1. Inspect all machined surfaces. If you find any nicks or scratches, replace the component.
2. Inspect geroter and cover for wear or damage. If wear or damage is found, replace geroter kit.
3. Inspect shaft for wear or damage. If found, replace shaft.
4. Inspect journal bearings in aux pad and housing. If worn or damaged, replace journal bearings or aux pad or housing assembly.

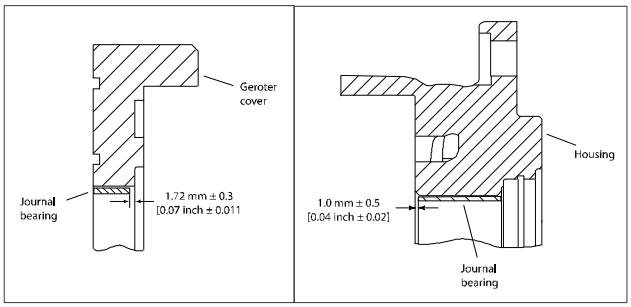


Item	Wrench size	Torque
K351 (A flange	8 mm internal hex	64 N•m [47 lbf•ft]
K351 (B flange)	18 mm	76 N•m [56 lbf•ft]
K400	10 mm internal hex	92 N•m [68 lbf•ft]
K350	10 mm internal hex	76 N•m [76 lbf•ft]

Figure 5-132. Charge Pump

REPLACING CHARGE PUMP JOURNAL BEARINGS

Use a suitable press to remove and replace the journal bearings. Refer to the drawings below for installation dimensions.



ASSEMBLY

1. Lubricate and install new seal (K150).
2. Install housing (K300). Install screws (K350). Using a 10 mm internal hex, torque screws per listing in table.
3. Install alignment pins (K450). Install new gasket (K151).
4. Lubricate and reassemble charge pump assembly [shaft (K201), pin (S500), geroter (S100), cover (S200), two clips (K205)].
5. Install charge pump assembly into housing in original position.
6. Lubricate and install seal (S300).
7. Install aux pad (K101).
8. Using a 10 mm internal hex, install screws (K400). Torque screws per listing in table.
9. Lubricate and install seal (K250). Install running cover (K301).
10. Install screws (K351) and brackets (K975). Torque screws per listing in the table.

Charge Check / HPRV

The high pressure relief and charge check valve assembly may be removed for cleaning and replacement of the O-rings. These valves are factory set and are not field adjustable. Refer to the pump model code for the factory setting when ordering replacements.

REMOVAL

1. Using an 8 mm internal hex wrench, remove the valve seat plugs (K007).
2. Carefully lift the valve (H002) and spring (H003) assemblies from the center section using a magnet.

INSPECTION

1. Inspect the valves and mating seats in the valve seat plugs (K007) for damage or foreign material.

REASSEMBLY

1. Lubricate and install new O-rings (K008, K010) and backup ring (K009) on valve seat plug (K007).
2. Verify that the conical springs (H003) are properly retained on the check relief valves (H002). Install the valve assemblies into the center section. Ensure each valve assembly moves freely in its bore.
3. Install the valve seat plugs into the center section and torque to 80 Nm [59.lbft].
4. Operate machine through full range of controls to ensure proper operation. Check for leaks.

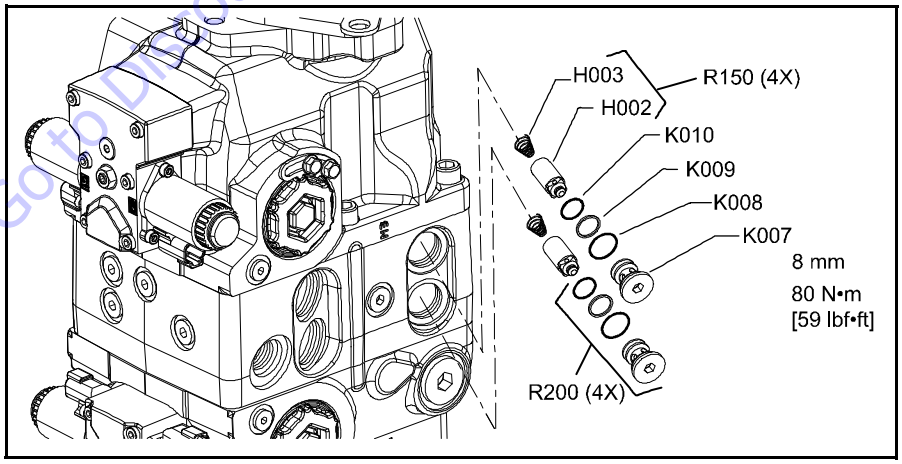


Figure 5-133. Charge Check / HPRV

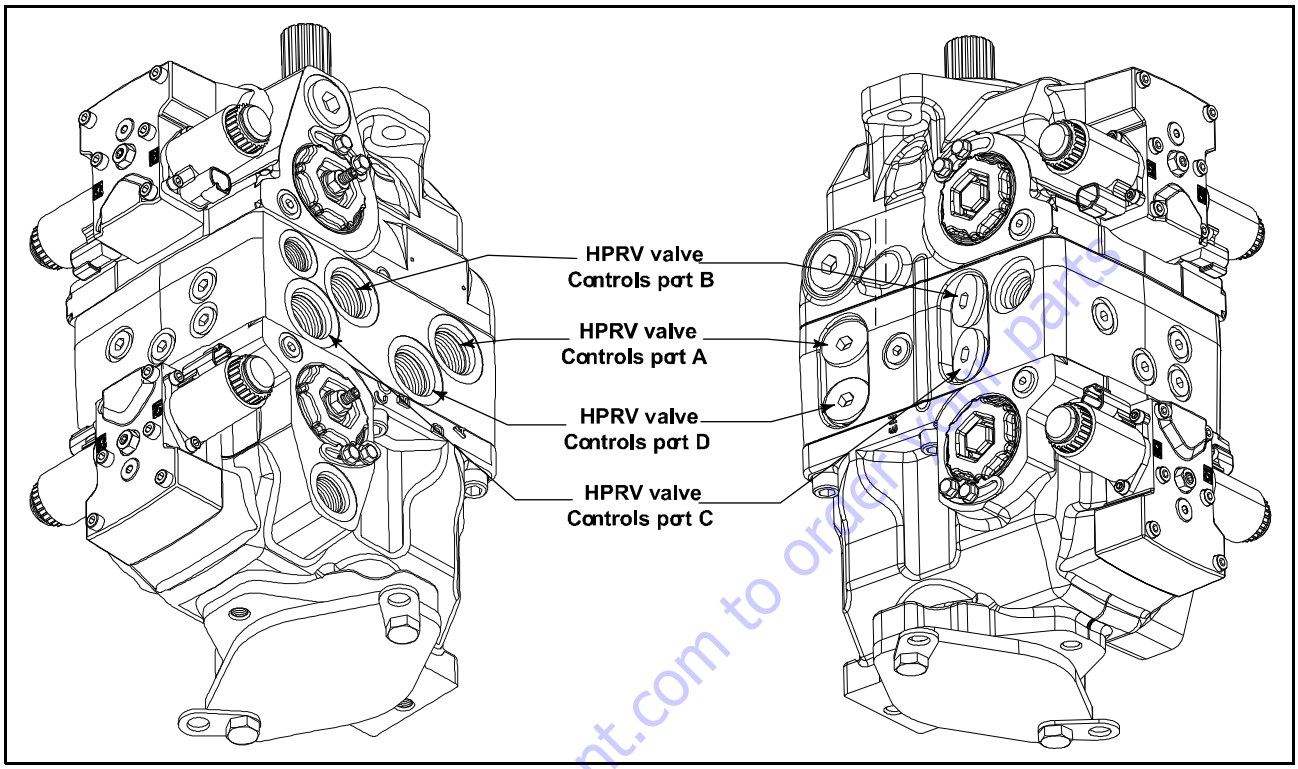


Figure 5-134. Charge Check / HPRV

Charge Pressure Relief Valve

Replace the charge pressure relief valve (V10-1) or (V10-2) as a complete unit. Do not attempt to repair the internal components of the valve.

REMOVAL

1. Using a 27 mm (V10-1) or a 1 in (V10-2) wrench, remove the charge pressure relief valve. Discard the O-rings (V10A).

INSPECTION

1. Inspect the sealing surfaces of the pump and charge pressure relief valve for nicks or scratches, replace components as necessary.

REASSEMBLY

1. Lubricate and install new O-rings (V10A).
2. Install the charge pressure relief valve (V10). Torque to 52 Nm [38 lbft].
3. Operate vehicle/machine through full range of controls to ensure proper operation.

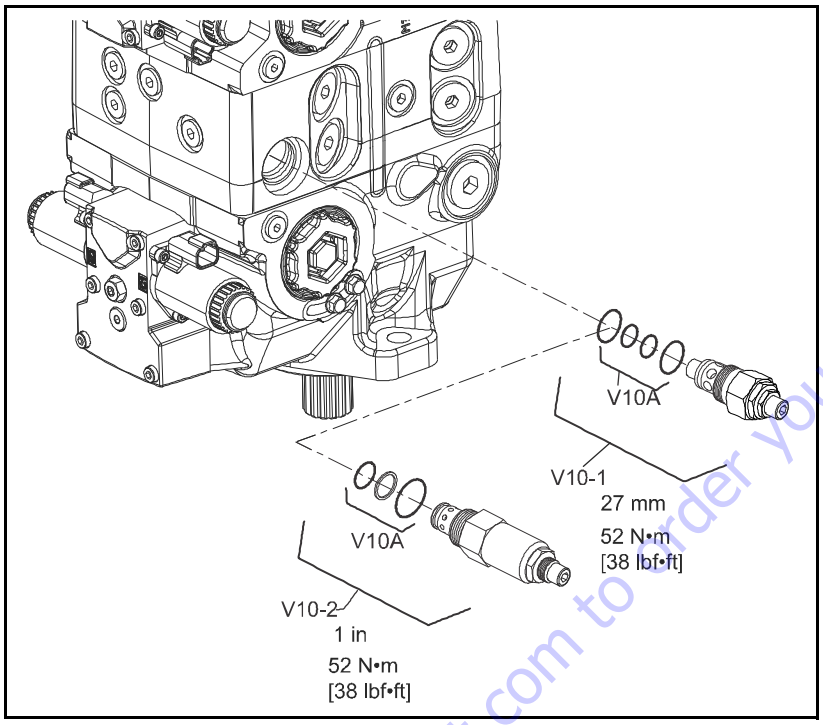


Figure 5-135. Charge Pressure Relief Valve

Control Cutoff Valve

Replace the control cutoff valve as a complete unit. Do not attempt to repair the internal components of the valve.

REMOVAL

1. Disconnect the coil from the vehicle/machine wire harness.
2. Using a 24 mm hex wrench, remove the control cutoff valve coil nut (G30). Remove the coil (G20).
3. Use a 1 1/16 in hex wrench to remove the control cutoff valve (G10). Remove and discard the O-rings and backup rings (G10A).

INSPECTION

1. Inspect the sealing surfaces of the pump and control cutoff valve for nicks or scratches. Replace components as necessary.

REASSEMBLY

1. Lubricate and install new O-rings (G10A) onto the valve.
2. Install the control cutoff valve (G10). Torque to 46 Nm [34 lbft]. Slide the coil (G20) onto the valve.
3. Install the coil nut (G30). Torque to 9 Nm [7.lbft]. Do not overtorque.
4. Operate vehicle/machine through full range of controls to ensure proper operation

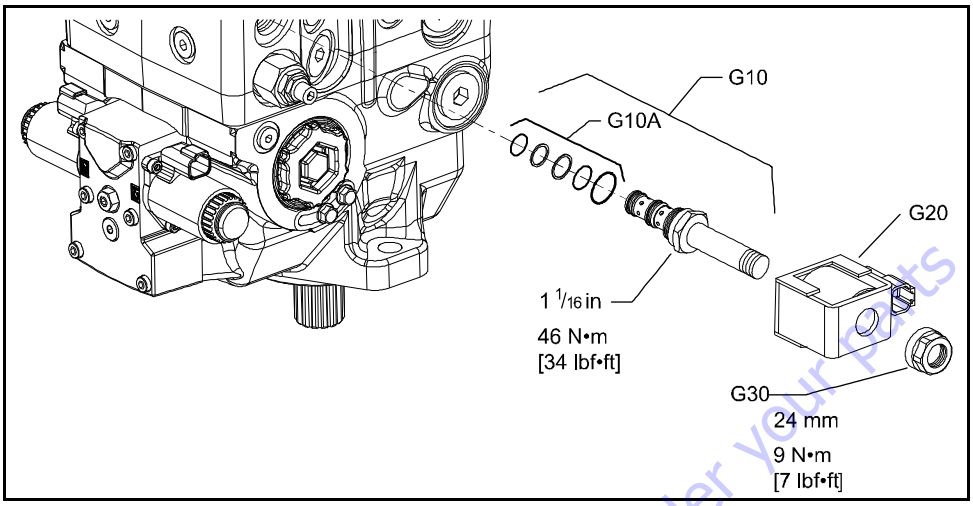


Figure 5-136. Control Cutoff Valve

Table 5-41. Fastener Size and Torque Chart

Item	Fastener	Wrench size	Torque
D015	Neutral adjust screw	4 mm internal hex	NA
D050	Control coil mounting screw	4 mm internal hex	8 Nm [5.9 lbft]
D060	Neutral adjust locking nut	13 mm hex	10 Nm [7 lbft]
D200	Swash plate feedback pin (not shown)	13 mm hex	25 Nm [18.4 lbft]
D250	Electric control mounting screw	5 mm internal hex	13 Nm [9.5 lbft]
E350	Servo cylinder locking screw	10 mm hex	14.5 Nm [11 lbft]
G10	Control cutoff valve	1 1/16 in hex	45 Nm [33 lbft]
G10B	Control cutoff valve coil nut	24 mm hex	9 Nm [7 lbft]
K007	Charge check / HPRV	8 mm internal hex	80 Nm [60 lbft]
K350	A pad cover mounting screw	17 mm hex	70 Nm [52 lbft]
	B pad cover mounting screw	8 mm hex	111 Nm [82 lbft]
V10-1	Charge relief valve	27 mm hex	52 Nm [38 lbft]
V10-2	Charge relief valve	1 in hex	52 Nm [38 lbft]

Table 5-42. Plug Size and Torque Chart

Item	O-ring plug	Wrench size	Torque
B015	7/16 - 20	3/16 internal hex	20 Nm [15 lbft]
B020	1-1/16 - 12	9/16 internal hex	48 Nm [35 lbft]
D065	7/16 - 20	3/16 internal hex	12 Nm [9 lbft]
G250	9/16 - 18	1/4 internal hex (hardened plug)	45 Nm [33 lbft]

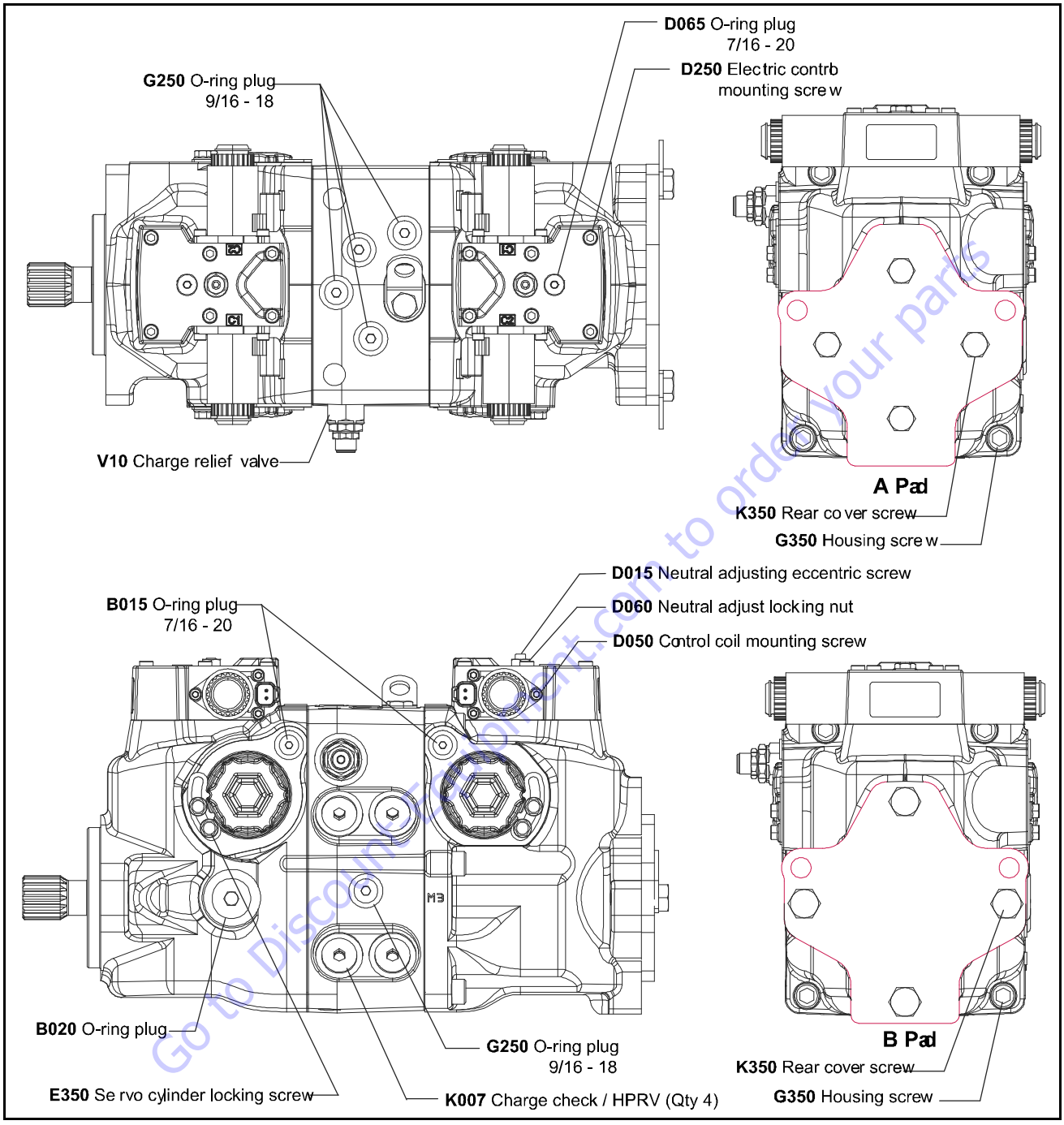
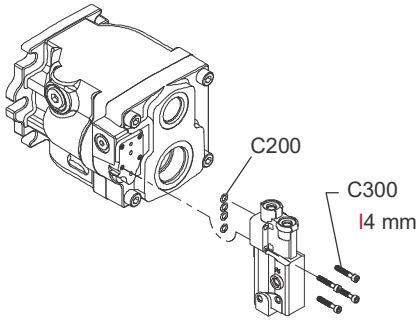


Figure 5-137. Fastener and Plug Locations

5.8 FUNCTION PUMP

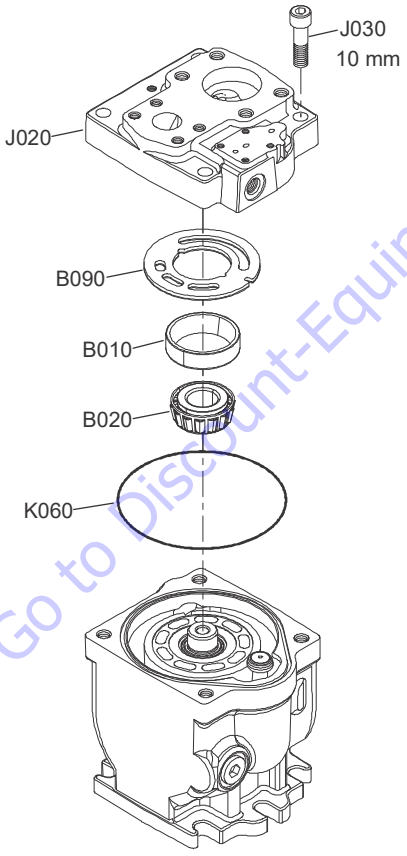
Disassembly

1. Remove the control from the endcap by removing the 4 control bolts (C300), using a 4 mm internal hex wrench.



2. Remove and discard the 4 O-rings (C200).

3. Remove the 4 endcap screws (J030) using a 10 mm internal hex wrench.



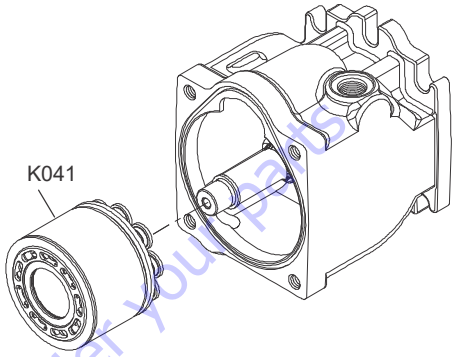
4. Carefully remove the endcap (J020). Prevent the valve (B090) plate from falling off.

5. Place the endcap and valve plate in a clean area, protecting them from contamination.

6. Remove the bearing cup (B010), bearing cone (B020) and housing O-ring (K060). Discard the O-ring.

7. Tilt the housing on its side to allow fluid to drain.

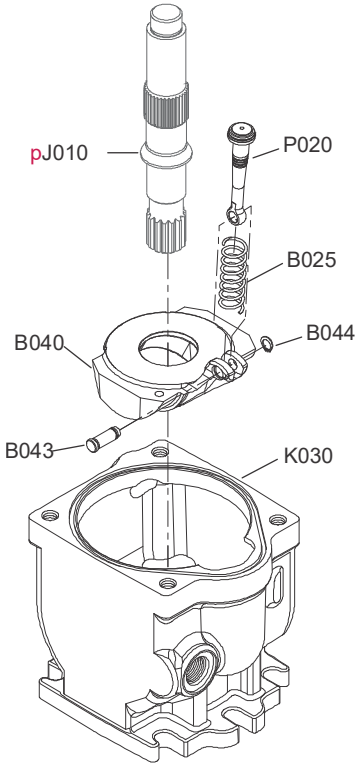
8. Remove the cylinder block kit while holding onto the front shaft.



9. Set cylinder block on a clean dry surface.

10. Rotate pump back to a position so that the shaft is pointing down.

11. Pull the shaft (J010) from the shaft seal.

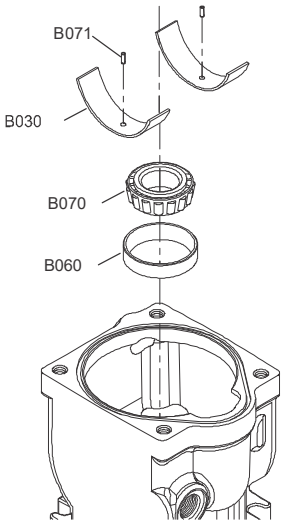


12. Compress the bias spring (B025) and rotate the servo piston assembly (P020) towards the swashplate (B040).

13. Lift the swashplate/servo piston assembly up at an angle and remove it from the housing.

14. Remove the servo piston (P020) and bias spring (B025) from the swashplate by removing the clevis pin (B043) and snap ring (B044). Discard the snap ring.

15. Pull to remove the front tapered roller bearing cup (B060) and cone (B070).



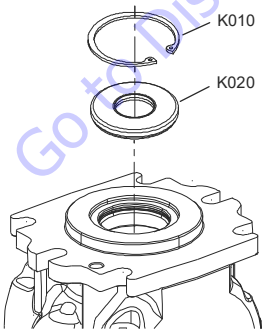
16. Examine the cradle bearings (B030) to determine if they need replacement.

NOTE: *Removing the pins (B071) will likely damage the cradle bearings, so make sure you have replacement bearings before you remove them.*

17. If cradle bearings need replacing, remove the 2 pins (B071) holding the cradle bearings, and then remove the cradle bearings. Note the location and orientation of the bearings for re-installation.

18. Orient the housing with the flange facing up.

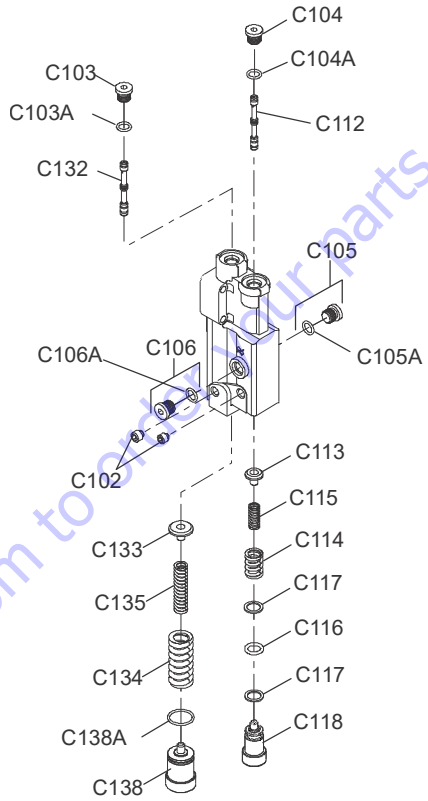
19. Using snap-ring pliers, remove the snap ring (K010).



20. Carefully pry out the shaft seal (K020).

If you are unable to pull the shaft seal out, try to push the seal out by going through the inside of the housing.

21. Remove the 4 plugs (C103, C104, C105, C106) and their O-rings (C103A, C104A, C105A, C106A). Discard the O-rings. Remove the 2 set screws (C102). Remove the spools (C112, C132). Note which bore each spool came out of. Also note the orientation of each spool for reinsertion. There may be differences in reinserting into the same bore.

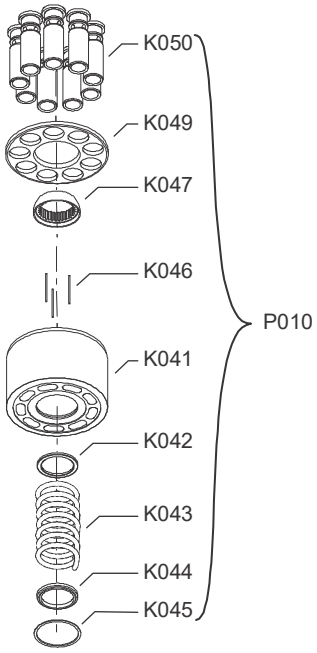


22. Remove the adjusting screw (C138) and the O-ring (C138A). Discard the O-ring. Remove the springs (C134, C135) and spring guide (C133).

23. Remove the adjusting screw (C118), O-ring (C116) and 2 backup rings (C117). Discard the O-ring and backup rings. Remove the springs (C114, C115) and spring guide (C113).

24. Pull to remove the slipper retainer (K049) with the pistons (K050) from the cylinder kit.

NOTE: *The pistons are not selectively fitted, however units with high hourly usage may develop wear patterns. Number the pistons and bores for reassembly if they are to be reused.*



25. Remove the ball guide (K047).

26. Remove the 3 pins (K046).

NOTE: *Most repairs do not require block spring removal. Perform this procedure only if you suspect problems with the block spring.*

27. Turn the block over. Using a press, apply pressure on the block spring washer (K044) to compress the block spring (K043). Compress the spring enough to safely remove the spiral retaining ring (K045). While maintaining pressure, unwind the spiral retaining ring. Carefully release the pressure and remove the outer block spring washer, block spring, and inner block spring washer (K042) from the cylinder block.

⚠ WARNING

RISK OF PERSONAL INJURY: COMPRESSING THE BLOCK SPRING REQUIRES ABOUT 350 TO 400 N [80 TO 90.LBF]. USE A PRESS SUFFICIENT TO MAINTAIN THIS FORCE WITH REASONABLE EFFORT. ENSURE THE SPRING IS SECURE BEFORE ATTEMPTING TO REMOVE. THE SPIRAL RETAINING RING. RELEASE THE PRESSURE SLOWLY AFTER THE RETAINING.RING IS REMOVED.

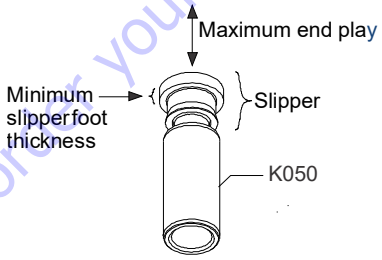
Inspection

After disassembly, wash all parts (including the end-cap and housing) thoroughly with clean solvent and allow to air dry. Blow out oil passages in the housing and endcap with compressed air. Conduct inspection in a clean area and keep all parts free from contamination. Clean and dry parts again after any rework or resurfacing.

PISTONS AND SLIPPERS

Inspect the pistons for damage and discoloration. Discolored pistons may indicate excessive heat; do not reuse.

Inspect the running surface of the slippers. Replace any piston assemblies with scored or excessively rounded slipper edges. Measure the slipper foot thickness. Replace any piston assemblies with excessively worn slippers. Check the slipper axial end-play. Replace any piston assemblies with excessive end-play.

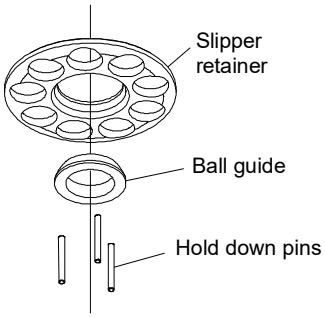


Minimum slipper foot thickness and maximum axial end-play are given in the table below.

J Frame	
Slipper foot thickness	3.23 mm [0.127 in]
Piston/slipper end play	0.05 mm [0.002 in]

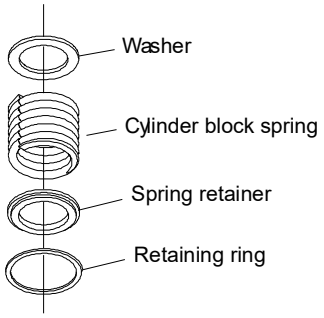
BALL GUIDE, SLIPPER RETAINER, AND HOLD-DOWN PINS

The ball guide should be free of nicks and scratches, and should not be excessively scored. Examine for discoloration that may indicate excessive heat or lack of lubrication. The slipper retainer should be flat, and slippers should fit in the retainer with minimal side play. Place the hold-down pins on a flat surface and roll them to make sure they are straight. Discard and replace any damaged parts.



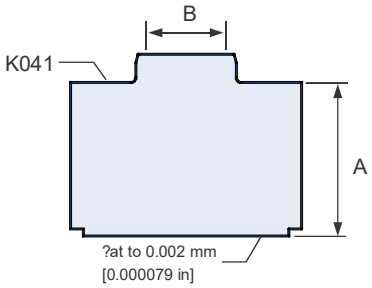
BLOCK SPRING, AND WASHERS

If cylinder kit was fully dissembled, visual inspection of the cylinder block, spring, and washers should indicate minimal wear. Replace if cracks or other damage is present.



CYLINDER BLOCK

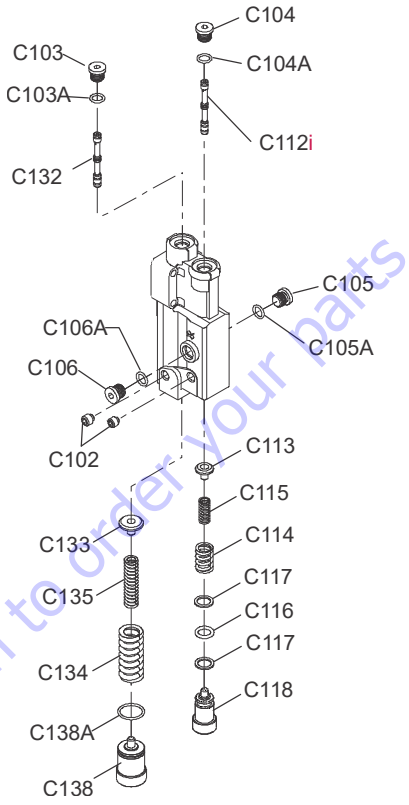
Examine the running face of the cylinder block. The surface should be smooth and free of nicks and burrs. Ensure that no scratches or grooves exist; these may drastically reduce output flow.



J Frame	45-60 cc	65-75 cc
Minimum cylinder block height (A)	62.25 mm [2.45 in]	
Maximum block bore diameter (B)	19.8 mm [0.785 in]	21.57 mm [0.85 in]

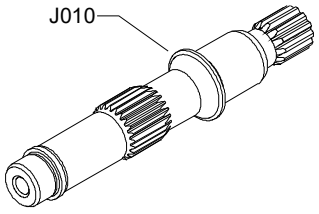
CONTROL

Carefully examine the plug(s) for signs of wear. Also check the small tip of the plug(s) for heavy wear and replace if necessary. Inspect each spool's springs to make sure they are intact. Check the inside and outside surfaces of the springs for wear and replace if necessary. Check the spool's outside diameter for scratches and / or burrs. Clean and coat all spools, bores, and seals with a light coating of hydraulic oil.



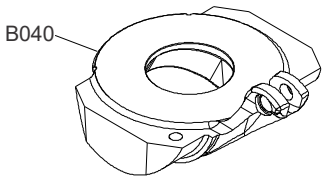
INPUT SHAFT

Check to see that the shaft (J010) and its splines are straight and free of damage or heavy wear. Inspect the shaft surface where it meets the shaft seal. Replace the shaft if a groove exists at the sealing land surface that may let dirt into or hydraulic fluid out of the unit. Clean the sealing area with a nonabrasive material if necessary. Lubricate the shaft with a light coat of hydraulic fluid.



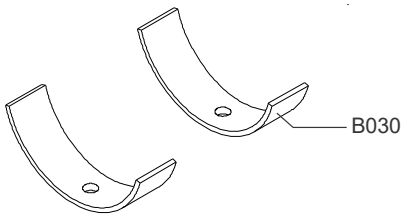
SWASHPLATE

Carefully inspect each surface of the swashplate for wear. All swashplate surfaces should be smooth. Inspect the swashplate's slipper running surface for damage and brass transfer. Excessive brass transfer from slippers may indicate that the slippers should be replaced. Finally, check the swashplate bearing journal for scratches. Replace swashplate if necessary.



JOURNAL BEARINGS

Inspect the journal bearings for damage or excessive wear. Replace journal bearings if scratched, warped, or excessively worn. The polymer wear layer must be smooth and intact.

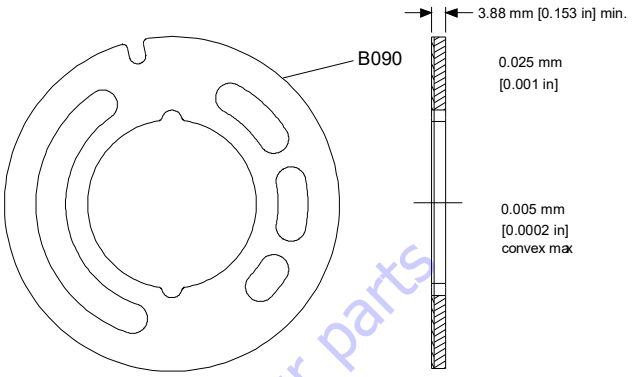


VALVE PLATE

Inspect the valve plate for scratches and grooves. Check the plate for evidence of any cavitation along the running face of the valve plate. If pitting from cavitation exists, replace the valve plate. Check for excess wear on the brass running face. If any discoloration or burn marks are observed, replace the valve plate.

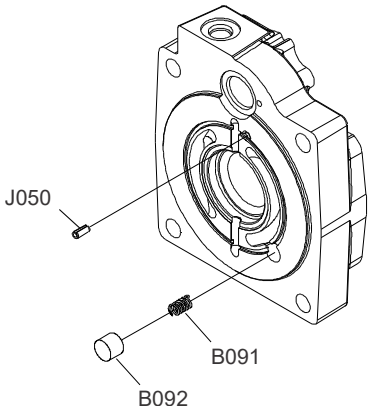
Run a fingernail or pencil tip across the diameter of the sealing land surface (see illustration). No deep or outstanding grooves should be felt, as these may decrease pump flow. Lap or replace if grooves or nicks are present. Inspect the mating surfaces of the endcap and valve plate for any possible contamination; even a few thousandths of an inch may affect pump operation.

Measure the thickness of the valve plate. Ensure that valve plate parallelism is equal to or less than 0.025 mm [0.001 in]. Appearance should be flat and smooth on both the running face and the bottom surface. The valve plate should be flat to 0.005 mm [0.0002.in] convex. A magnetic particle inspection is recommended to detect cracks. The valve plate must be replaced if any cracks exist.



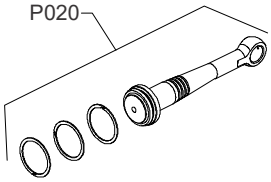
ENDCAP

Inspect the endcap. Remove the check valve (B092) to expose the spring (B091). Check and record orientation of the timing pin (J050) The split in the timing pin should be facing into or out of the slot in the valve plate. Inspect the check valve for wear on its sealing face and replace if necessary. Make sure the spring is undamaged. Replace any components if excess wear is present.



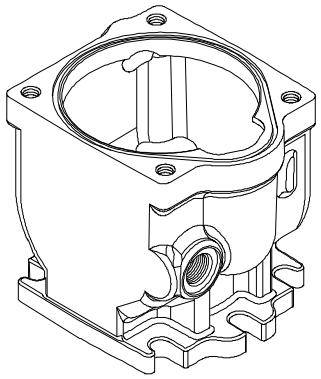
SERVO PISTON

Check the servo piston assembly (P020) for any obvious wear or damage. Check the corresponding endcap bore for galling or excessive wear. Discard the piston if damaged. Replace the servo piston-rings.



HOUSING

Inspect the housing to ensure that it is clean and free of foreign material. Inspect the swashplate bearing surfaces, and endcap mating surfaces.

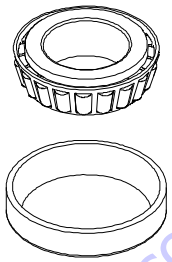


SHAFT BEARING KITS

The tapered roller bearing kit consists of a cup and cone. Make sure the cup and cone are free of excessive wear or contamination. Rotate the bearings to check for smoothness. If a contaminated bearing is suspected, clean with a solvent and lubricate with hydraulic fluid.

NOTE: *Replace the bearing if the problem is not remedied by cleaning.*

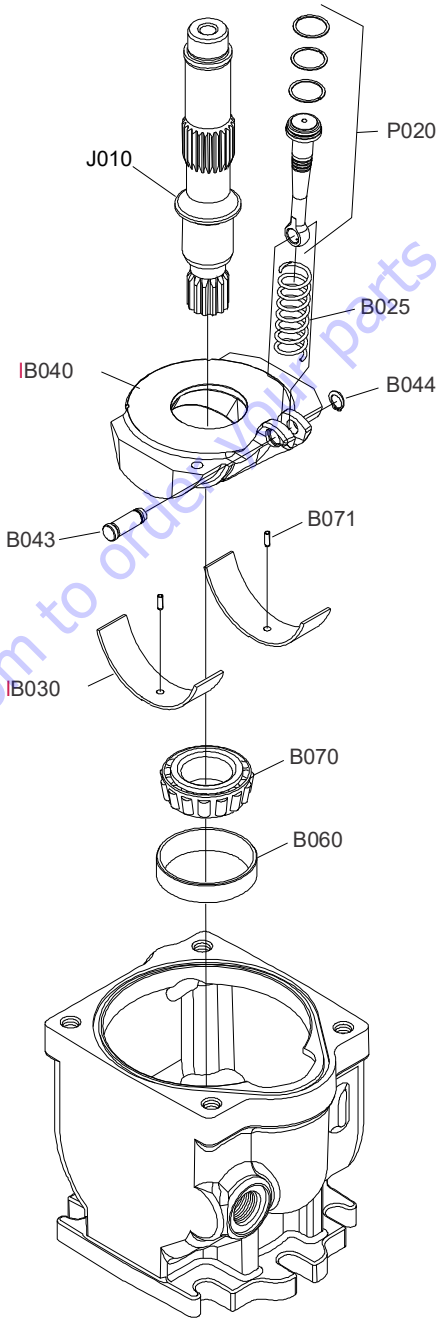
Inspect for uneven wear. If abnormal wear is found, replace the bearing kit.



Assembly

1. Coat the journal bearings (B030) with hydraulic fluid and install them into the pump housing. Punch in retaining pins (B071) a minimum of 0.5 mm [0.002 in] below the bearing surface.

NOTE: *If journal bearings are reused, reinstall them in their original orientation and position.*



2. Reinstall shaft bearing cup (B060) and cone (B070). Before replacing the bias spring (B025), coat the curved surface of the swashplate with hydraulic fluid.

3. Reinstall the swashplate/servo piston/bias spring assembly in its original orientation in the housing. Rotate the servo piston perpendicular to the swashplate, and at the same time compress the bias spring to fit into housing pocket. Lubricate all sides of the servo piston and its respective bore liberally with hydraulic oil. Also, lubricate the flat face of the swashplate to prevent premature wear during start-up.

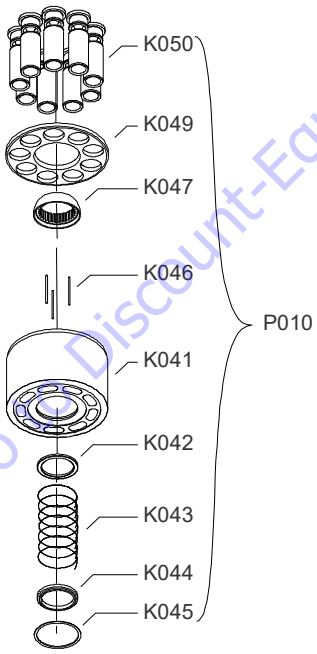
4. Insert the input shaft (J010) through the bearing into the housing. You may need to push on the servo piston to rotate the swashplate in order to put the shaft in properly.

5. Coat all parts with hydraulic fluid prior to reassembly.

⚠ WARNING

COMPRESSING THE BLOCK SPRING REQUIRES ABOUT 350 TO 400 N [80 TO 90 LBF]. USE A PRESS SUFFICIENT TO MAINTAIN THIS FORCE WITH REASONABLE EFFORT. ENSURE THE SPRING IS SECURE BEFORE ATTEMPTING TO INSTALL.THE SPIRAL RETAINING RING. RELEASE THE PRESSURE SLOWLY AFTER THE RETAINING RING IS INSTALLED.

6. Install the inner block spring washer (K042), block spring (K043), and outer washer (K044) into the cylinder block. Using a press, compress the block spring enough to expose the retaining ring groove. Wind the spiral retaining ring (K045) into the groove in the cylinder block.

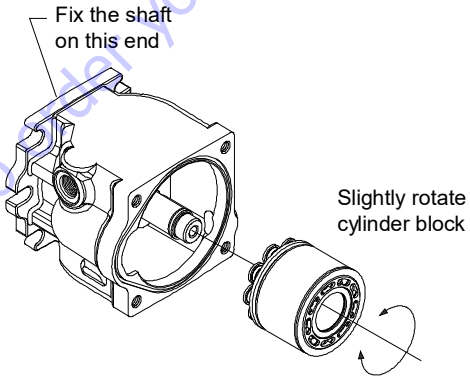


7. Turn the block over and install the hold-down pins (K046), and ball guide (K047) to the cylinder block.

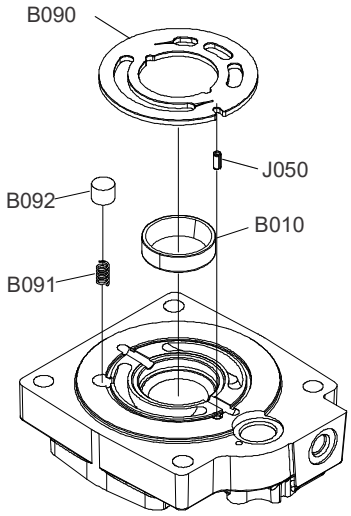
8. Install the pistons (K050) to the slipper retainer (K049). Install the piston/retainer assembly into the cylinder block. Ensure the concave surface of the retainer seats on the ball guide. If you're reusing the pistons, install them to the original block bores. Lubricate the pistons, slippers, retainer, and ball guide before assembly. Set the cylinder kit aside on a clean surface until needed.

NOTE: *Be sure to install the slipper retainer so it mates correctly with the ball guide (concave side of the slipper retainer against the convex side of the ball guide).*

9. Set the pump on its side. Secure the end of the shaft with one hand and keep it horizontal. Insert the cylinder kit onto the shaft. While holding the shaft still, slightly rotate the cylinder block kit to help start the shaft splines over the ball guide and align it with the block splines. When the cylinder block kit slides completely over the shaft splines, reposition the unit with the flange facing downward.

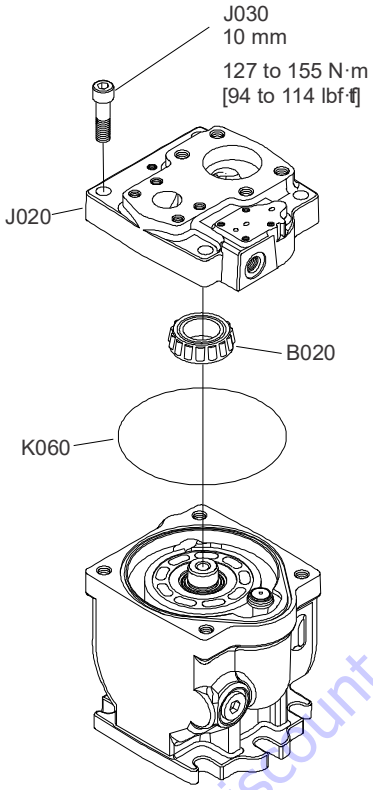


10. Clean the valve plate (B090) and endcap. Install the timing pin (J050) in the endcap and verify that it is properly oriented with the split facing into or out of the slot in the valve plate. The timing pin should be installed to 3.61 ? 0.25.mm [0.14.?.0.01 in] above the valve plate surface. Apply a liberal amount of assembly grease to the backside of the valve plate surface to hold it in position. Install the valve plate over the timing pin, check valve (B092), and bearing cup (B010).

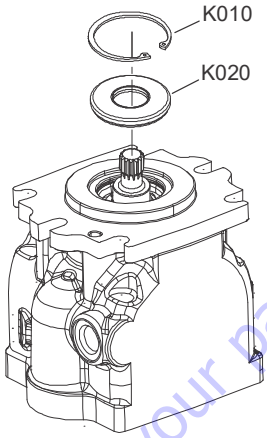


NOTE: *To insure proper pump operation, it is extremely important to ensure that there is no contamination between the end-cap and valve plate.*

11. Install the bearing cone (B020) onto the shaft. Using assembly grease to hold the seal (K060), install the end-cap to the housing. Ensure that seals remain properly seated and are not pinched during assembly. With a 10 mm internal hex wrench, install and torque endcap screws at 127 to 155 Nm [94.to.114.lbft], using the criss cross pattern. Retorque the first screw to ensure proper torque retention.

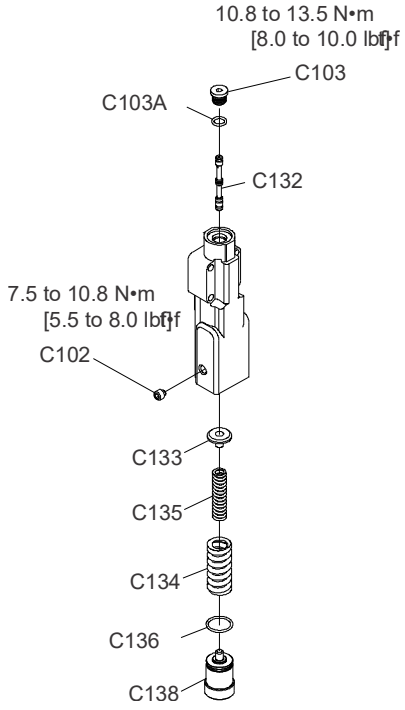


12. Lubricate the lip of the new shaft seal (K020) with clean hydraulic fluid. Place a protective sleeve over the shaft end to prevent damage to the seal during installation. Keeping the seal perpendicular to the shaft, press the new seal into the housing just far enough to clear the retaining ring groove. Install seal with the cupped side toward the shaft bearing. Do not damage the seal during installation. Using the appropriate snap ring pliers, install the seal retaining ring (K010). Remove the installation sleeve.

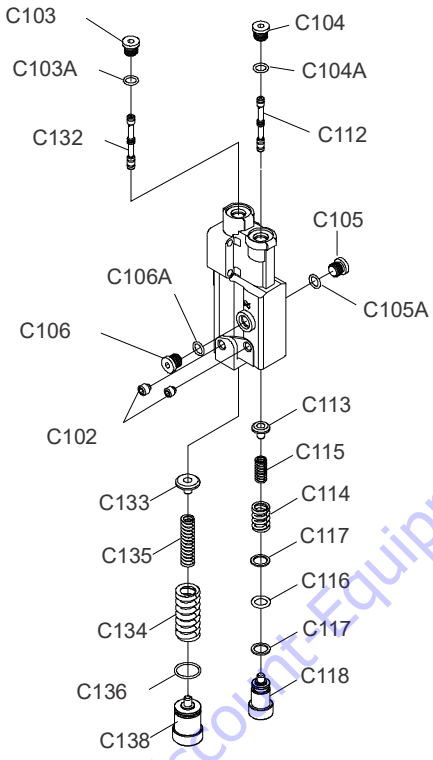


13. Clean all control parts and cover with a light coating of hydraulic fluid prior to reassembly.

14. Install the spherical end of the PC spool (C132) into the PC bore (refer to illustration). Install the PC plug (C103) using a new O-ring (C103A). Torque at 10.8 to 13.5 Nm [8.to.10.lbft]. Place the two PC springs (C134, C135) onto the PC spring guide (C133) and install into the PC bore. Place a new O-ring onto the PC plug and install it so that it sits one turn below the surface of the control housing. Install and tighten set screw (C102) at 7.5 to 10.8 Nm [5.5 to 8.0 lbft] to retain the adjusting plug.

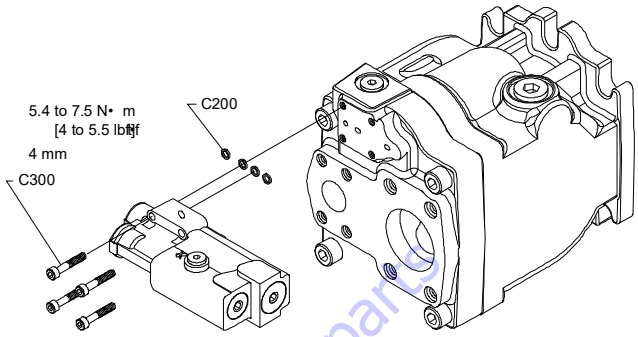


15. Hold the control in a horizontal position. Install the spherical end of the LS spool (C112) into the LS bore (see illustration). Using a new O-ring, install the LS plug (C104), torque at 10.8 to 13.5 Nm [8 to 10 lbft]. Place the 2 LS springs (C114, C115) onto the LS spring guide (C113) and install into the LS bore. Place a new O-ring (C116) and backup rings (C117) onto the LS adjustment screw (C118). Install the LS plug assembly so that it sits one turn below the surface of the control housing. Install and tighten set screw (C102) at 7.5 to 10.8 Nm [5.5.to 8.0 lbft]. Also, install the plugs (C105, C106) with new O-rings. Torque the plugs at 10.8 to 13.5 Nm [8 to 10 lbft].



NOTE: *PC and LS spools need to be adjusted to proper setting according to tag nomenclature.*

16. Using petroleum jelly to retain them, install 4 new seal rings (C200) in the recesses on the control housing. Install the control assembly onto the endcap using the 4 screws (C300). Torque at 5.4 to 7.5 Nm [4.0 to 5.5 lbft] using a criss cross pattern and retorque the first screw to ensure proper torque retention.



5.9 GEAR PUMP

Disassembly

Prior to proceeding it may be necessary to prepare some subassemblies separately.

The details for preparing each subassembly are given in the following section.

Also, some general recommendations are given below.

CLEANLINESS
Cleanliness is a primary factor for reliable pump performance. Wash the outside of the pump thoroughly before disassembly and all pieces prior to assembly. Cleaning parts with clean shop solvent and air drying is usually adequate.

LUBRICATION OF MOVING PARTS
During assembly, it is imperative to provide lubrication with clean hydraulic oil to all the running parts of the pump.

It is also necessary to coat the seals with grease. The absence of lubrication during assembly can cause the unit to seize after a few minutes of running.

CARE OF SURFACE TREATMENT
Be careful when handling all the internal surfaces, especially bearings, gears, and body faces. Do not touch or score them with metal tools or cutting edges.

MARKING THE PARTS
Mark the parts before completely disassembling a pump. The marks allow components to be reassembled in the same relative position. This action should be applied to the body, bearings, and gears. Scribing, bluing, or using a felt tip pen to mark the outside of the body on the inlet side is suggested to indicate the relative position of the front flange and the rear cover to the body. Mark the bearing blocks also on the inlet side and the gears position relative to each other. DO NOT scribe internal surfaces.

PROCEDURE

1. Clamp the unit.

   Clamp the unit in a vice from the flange side.

   Make sure the vice jaws are clean and have smooth surfaces to prevent damage to the pump.

NOTE: *Clamping the pump on the body is not recommended because serious damage to the surfaces, on which the ports are located, may occur.*

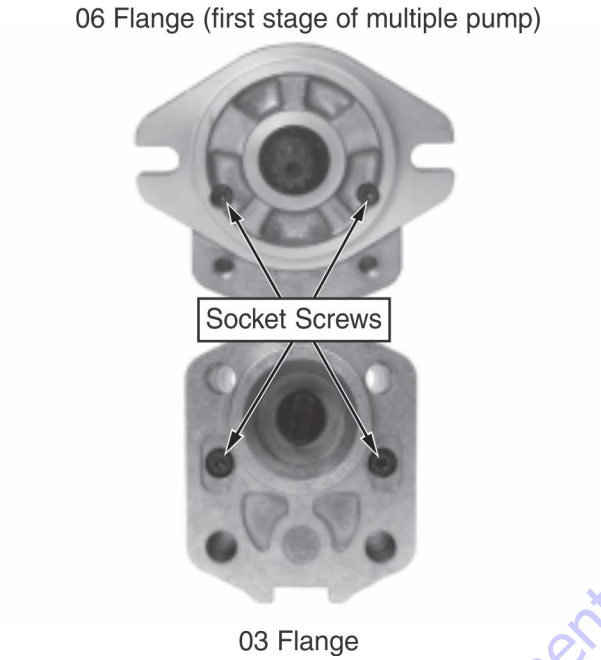
2. Remove capscrews. (Except Units with 03 Flange).

   Use a 17 mm socket wrench and loosen the four capscrews on the cover. Next completely unscrew the capscrews and remove them.

   Inspect the threads of the capscrews for damage.

3. Remove socket head capscrews. (03 Flange or Multiple Pump Stages Only).

Using a 4 mm internal hex wrench, loosen and remove the two small socket screws placed in the center of the cover. Repeat the same operation for the corresponding screws on the rear flange.



4. Remove front flange.

Place the pump on the table and slowly remove the front flange.

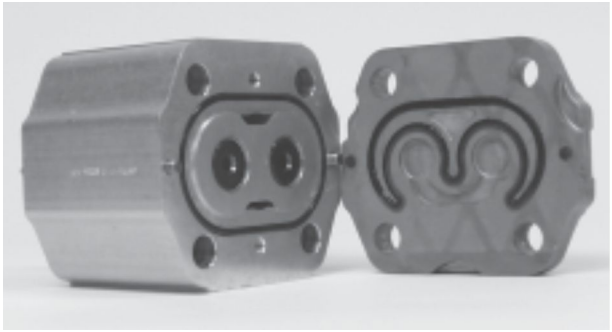
Be careful not to damage the shaft seal when removing the flange. Avoid contact of the shaft seal lips with key-way edges (in tapered and parallel shafts) or splined shaft teeth.

Inspect the front flange and seal area.

Clean with shop solvent, dry, and set aside.

5. Remove rear cover.

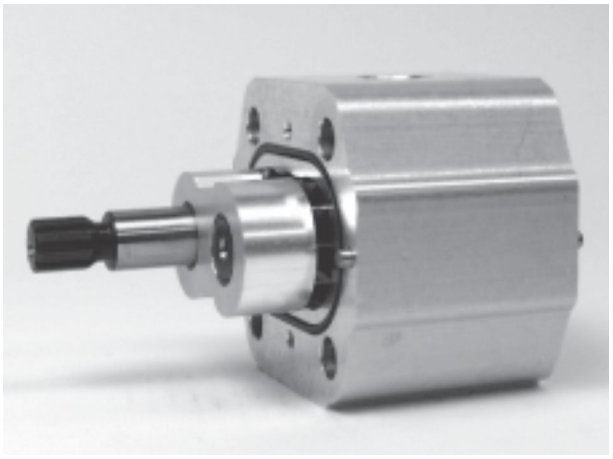
Remover rear cover. Clean with shop solvent, dry, and set aside. Visually inspect rear cover and seal area.



6. Remove bearing blocks and gears.

Place the pump on its side and carefully remove the bearing block and gear set. To accomplish this, hold the pump body and push with your fingers on the rear bearing block.

Mark the relative positions of the gear mesh (drive gear tooth to idler gear tooth) and the bearing blocks to the body so they can be reas?sembled in the same position.

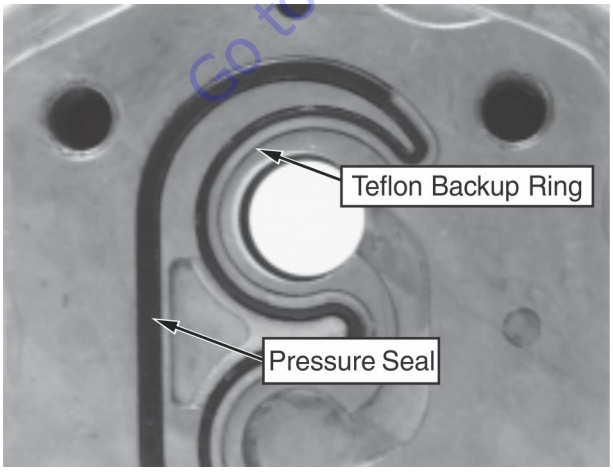


7. Remove pressure seals.

Check the seal quality. Replacement is recommended whenever there are burrs, evidence of extrusion, or marks caused by overheating. If the seals need to be replaced, carefully remove them from the flange cover, beginning with the backup ring and then the pressure seal.

Do not use tools with sharp edges to remove the seals, as damage to the cover can result.

After removal, dispose of damaged seals.

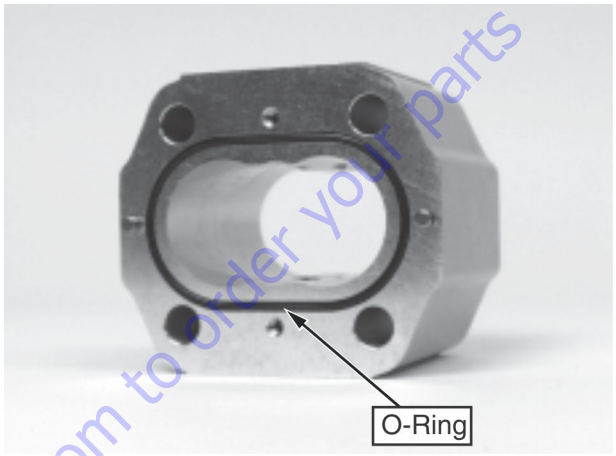


8. Remove Outer O-Ring Seal

Check the quality of this seal. If necessary, replace it. Follow the same removal recommenda?tions given in step 7.

After removal, discard the damaged seal.

Do not use tools with sharp edges to remove the seals, as damage to the cover can result.



9. Remove the snap ring.

Place the flange on the work surface. Using internal snap ring pliers, remove the snap ring.

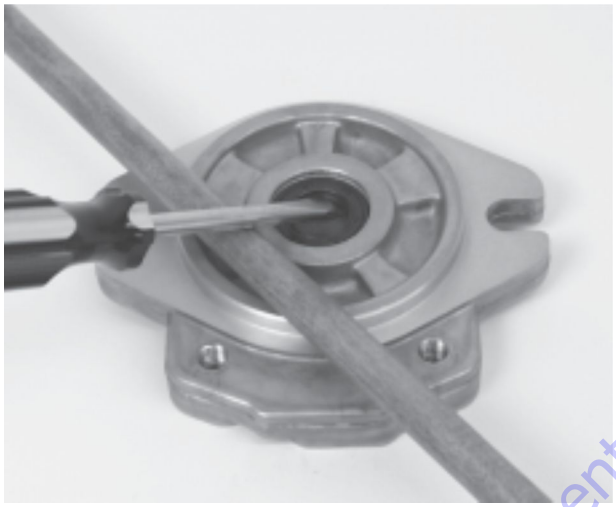
10. Remove the shaft seal.

Check the shaft seal quality and remove if necessary.

To remove, pry the bottom of the shaft seal and force it out while rotating the flange to lift it out evenly.

Do not use the flange pilot to gain leverage, damage may result. Use a plastic rod or wooden dowel as a fulcrum.

After removal, dispose of damaged seal.



Assembly

1. Prepare the seals.

Have the entire seal kit available.

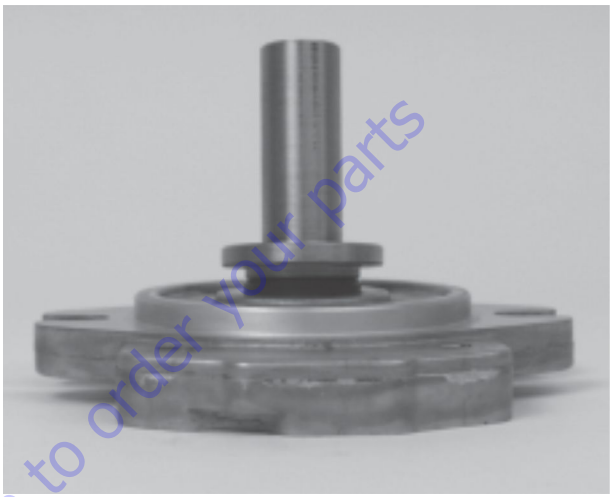
Lightly coat all seals with seal grease. The grease is needed to adhere the seals to their grooves.

Do not install dry seals.

2. Install shaft seal into front flange.

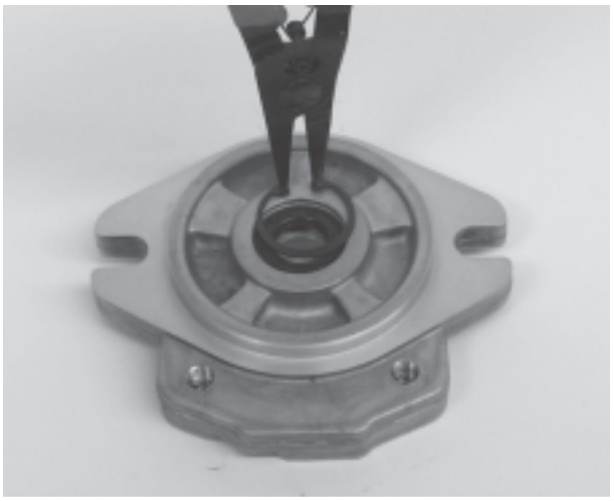
Prepare the flange and shaft seal by lightly lubricating with grease.

Seat the seal in the flange by hand. Then, using the shaft seal installation tool, press the seal until the tool stops on the flange. This will insure the seal is inserted to the proper depth.



3. Install snap ring.

Install the snap ring using internal snap ring pliers. Ensure the snap ring fits securely in its groove. This is necessary to retain the shaft seal.

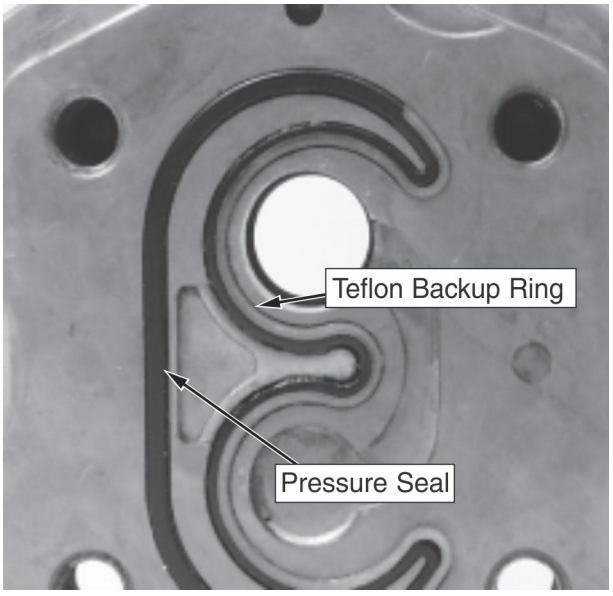


4. Install pressure seals.

   Prepare the pressure seals by lightly lubricating them with grease.

   Install pressure seals into the grooves on the front flange and rear cover. Then install the teflon backup ring.

   Ensure that the seals are located in the grooves, as shown.



5. Prepare the body.

   Clean the body.

   Inspect the internal and mating surfaces. Ensure the surfaces are free of burrs and scratches. Check both the bearing block mating surface and the cut-in path. The cut-in path should be no deeper than 0.1 mm (0.004 in).

6. Install outer seal.

   Prepare the outer seal by lightly lubricating with grease.

   Install outer seals in the grooves on both sides of the body.

7. Prepare the gears.

⚠ CAUTION

THE GEAR SURFACES ARE SUPER-FINISHED. RESIDUE ON HANDS AND FINGERS MAY BE CORROSIVE TO THIS SURFACE. DO NOT TOUCH.

Carefully clean the two gears. If the gears are new, wash them with shop solvent to remove any anticorrosive grease on the surfaces.

Inspect the journals and the flat faces on the top and bottom of the gears. Ensure these surfaces are free from burrs or scratches. If scratches or burrs are found, clean them with a flat stone and/or very fine emery paper. Rewash the gears after this operation.

8. Prepare the bearing blocks.

Clean the two bearing blocks.

Inspect the flat surfaces of the bearing blocks for burrs or scratches on the edges. If necessary, remove burrs with very fine emery paper. Then rewash the bearings.

Inspect the DU bushings for wear. There should be no bronze showing.

Using clean hydraulic oil, lubricate the internal and external surfaces of the bearing blocks.

9. Assemble the bearing blocks and gears.

Lubricate the journals and the gear faces.

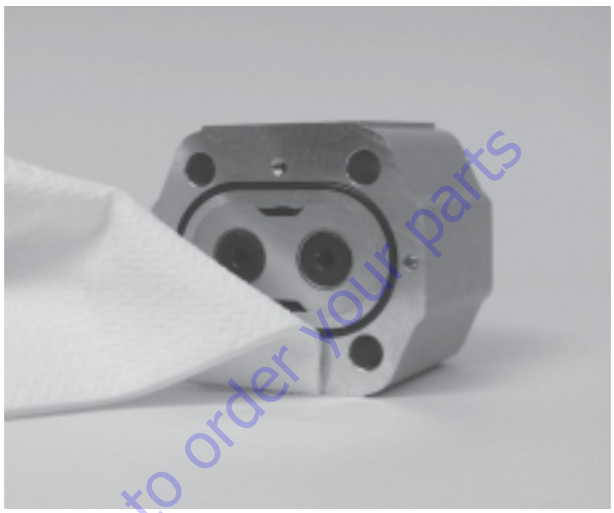
Assemble the bearing blocks and gears. Ensure that the recessed bearing faces are installed adjacent to the gear faces. Align all assembly marks made during disassembly. Ensure the front and rear bearing blocks occupy the same location with respect to the housing as before disassembly. Ensure that the relative position of the gear mesh is maintained as before disassembly. Misalignment of the gear teeth may increase operating noise.

10. Install the gear block assembly.

Install the bearing block and gear assembly into the body cavity. Align the assembly marks to ensure that the gear block assembly is installed with the same orientation as before disassembly.

11. Clean the mating surfaces.

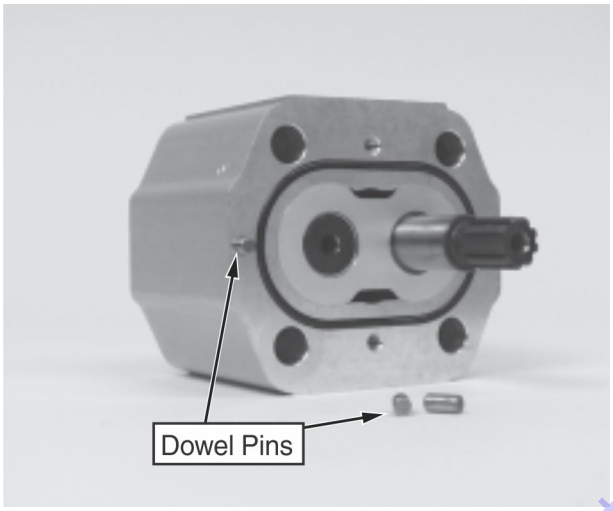
Remove any excess lubrication and grease from the mating surfaces of the pump body. Ensure that these surfaces are dry and free of contamination before moving on to the next step.

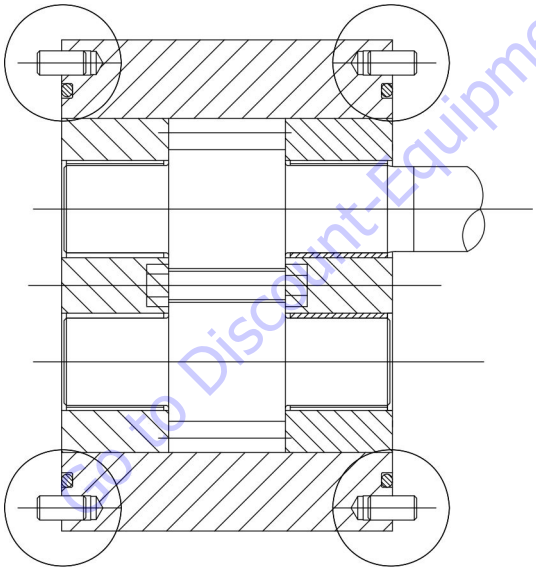


12. Install the dowel pins.

Install four 5 mm dowel pins into the proper cavities on both sides of the body (refer to the illustration). Swab the pins with assembly grease or petroleum jelly to retain them during assembly.

Do not install dowel pins to the rear cover or flange, as one of them may drop inside the pump during assembly.





13. Clean the mating surfaces.

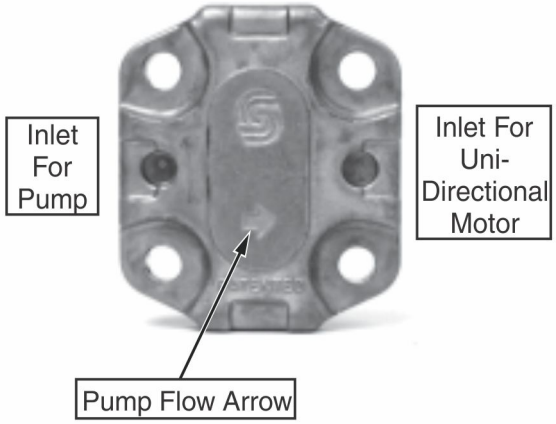
Remove any excess lubrication and grease from the mating surfaces of the front flange and rear cover. Ensure that these surfaces are dry and free of contamination before moving on to the next step.

Ensure the pressure seals are seated properly after this operation.

14. Install Rear Cover.

Mount the cover on the body. Ensure the arrow on the back is oriented properly. The arrow should be In the same direction as the flow.

Ensure that all the pressure seals stay in place during this operation.



15. Prepare pump for front flange assembly.

Place the pump with the rear cover downwards.

Ensure that the assembly marks on the bearing block / body are properly aligned.

16. Install the front flange.

Install a protective sleeve over the shaft. The sleeve is used to protect the shaft seal from damage by the shaft splines / keyway during front flange assembly.

Install the flange onto the body, then remove the protective sleeve.

Ensure that the seals remain seated in their grooves during this operation.

17. Torque sequence.

When assembling units with 01 flange and short coupled tandems, wash the capscrews and apply Medium strength threadlocking compound or equivalent thread lock compound to the threads before assembly.

Install capscrews. While observing the torque sequence shown, pre tighten the capscrews. Then, using a torque wrench, tighten them to the proper torque.

Torque 44-54 Nm (32-40 ft.lbs.).

18. Install socket head capscrews. (03 flange and first stage of multiple).

Using a 4 mm internal hex wrench, install the socket head capscrews to the front flange and rear cover.

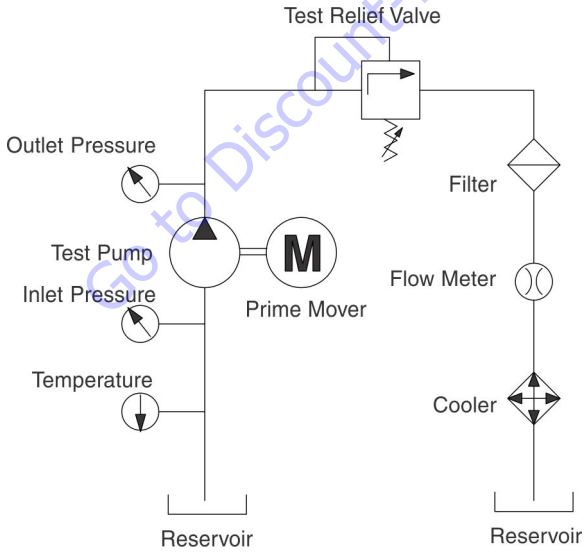
Torque 2.5-3.4 Nm (22-30 ft.lbs.).

If used, install new o-ring to flange pilot.

19. Testing

After pump has been disassembled and reassembled, it is suggested that the pump be run in and tested on an appropriate test stand. This is done to verify the volumetric efficiency and the integrity of the unit.

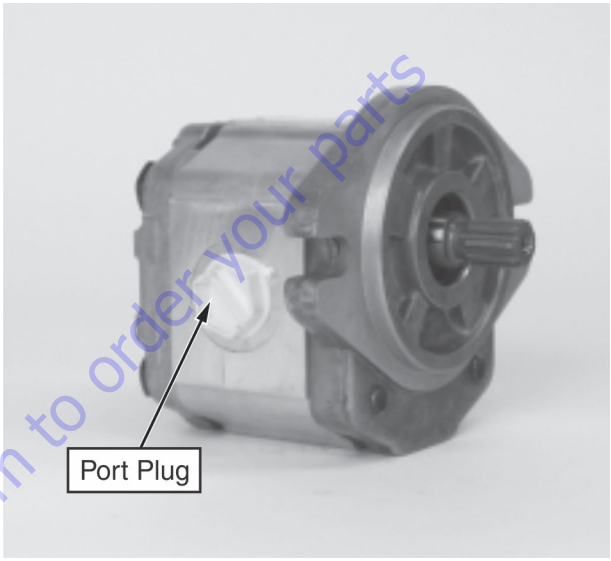
Test specifications and procedure are given in Testing the Pump.



20. Prepare the unit for shipment or storage.

Clean the exterior of the pump and install the following:

- **a.** Port Plugs
- **b.** Key (CI and CO shafts)
- **c.** Shaft protective cap (CI and CO shafts)
- **d.** Nut and washer (CO shaft)



Trouble Shooting

Table 5-43. Troubleshooting

Low or No Flow From Gear Pump		
Item	Description	Action
1. Check oil level in reservoir.	Description Insufficient oil to supply gear pump.	Fill reservoir to proper level.
2. Check input spline condition.	Input shaft broken or stripped.	Repair or replace gear pump.
3. Check pressure at pump inlet. Recommended inlet pressure: 0.8 to 3.0 bar absolute. 0.6 Minimum at cold start.	Clogged suction filter or inlet screen.	Replace filter or clean suction screen.
4. Check condition of gear faces and bearing blocks.	Scored bearing block and gear faces will reduce pump efficiency.	Repair or replace gear pump.
5. Check bushings.	Overpressure of gear pump will cause idler gear bushing to fail.	Repair or replace gear pump.
Excessive Noise		
Item	Description	Action
1. Check oil level in reservoir.	Excessive air will cause cavitation sound.	Fill reservoir to proper level.
2. Check inlet line for leaks.	Excessive air will cause cavitation sound.	Repair inlet line.
3. Check pressure at pump inlet. Recommended inlet pressure: 0.8 to 3.0 bar absolute. 0.6 Minimum at cold start.	Lower than normal inlet pressure causes excessive pump noise.	Return inlet pressure to recommended levels.
External Leakage		
Item	Description	Action
1. Check for pinched o-rings or backup ring seal.	Pinched seal will allow leakage.	Replace pinched seal.
2. Check pressure seals.	Damage to pressure seals is typically caused by reduced stack-up in the pump assembly. This may be due to under-torqued assembly fasteners, or more commonly is attributed to excessive wear on the bearing blocks. Reduced stack-up will affect seal efficiency possibly to the point of seal extrusion.	Inspect condition of bearing blocks. If they are found to be worn, repair or replace the pump. If bearing blocks are not worn, replace pressure seals and re-torque pump assembly fasteners.

5.10 DRIVE & FUNCTION PUMP START UP PROCEDURES

Start-Up Procedure

The Boom Lift utilizes a Triple Combination Pump coupled to the Deutz diesel engine. The pumps are connected in-line to each other as follows:

1. The front hydrostatic transmission pump, or drive pump, is coupled directly to the diesel engine and provides oil flow to operate the machine's right side wheels.
2. The middle hydrostatic transmission pump, or drive pump, is coupled to the back of the front pump and provides oil flow to operate the machine's left side wheels.
3. The third or rear pump is the function pump. It is coupled to the back of the middle pump and provides oil flow to operate the boom, axle, steer and platform functions.

The transmission pumps share some common connections. Each pumps charge oil suction ports are connected by steel tubing, the charge pumps discharge oil flows are connected and flow to a common charge pump inline oil filter, cleaned & filtered oil flows back to the transmission pumps “G” ports. The pumps case drain ports are connected (T1 & T2), oil flow from the middle pumps T1 port also provides flows to the oil cooler. The charge pumps oil pressure is regulated by a single boost oil pressure relief valve installed in the middle pump. The front pump has an orifice cartridge (0.047" diameter) installed in place of a charge oil pressure relief cartridge. This insures that only one valve controls charge pressure & provides an amount of charge oil flow to the front pump's case to insure flushing & removal of hot oil.

Each pump has its own separate electrical proportional directional control valve to control oil flow and direction. The signals or command values to each pump are similar except when steering. During steering and propel of the machine the pump supplying oil to the “inside turning radius” has a command less than the pump supplying oil flow to the “outside turning radius” pump.

“Posi-Traction” control, front to rear on a given side of the machine, is accomplished by a flow divider/combiner cartridge installed in the Traction Control Manifold. There is a flow divider/combiner for each side. Each flow divider/combiner also has a “bleed orifice” to limit the amount of flow splitting or combining.

The middle transmission pump also supplies oil to a hot oil flushing valve cartridge, #120, in the Traction Control Manifold. This cartridge provides a means to obtain brake release oil pressure. The brake release pressure is controlled by a pressure relief valve cartridge # 130 and a solenoid operated brake release directional control cartridge, #170, also located in the Traction Control Manifold. This is important to note as the brake release oil pressure must be set 25 psi (1.7 bar) below the boost oil pressure relief valve. If the brake release pressure is set too low, brake drag and pump control will be affected. If set too high, damage to the wheel drive parking brakes could result. Prior to start, connect appropriate pressure gauges to the unit.

FOR THE START-UP OF NEW OR OVERHAULED INSTALLATIONS:

1. Insure all electrical checks have been performed & the machine is set up correctly with the JLG Analyzer.
2. Insure the machine has all four wheels jacked & blocked off the ground per JLG procedures.
3. Insure the triple pump assembly is installed and connected correctly per the hydraulic circuit diagram.
4. Disconnect the electrical connector from the diesel's throttle actuator, to prevent engine start.
5. Crank the engine until charge pressure reaches 50 psi or more.
6. Re-connect throttle actuator electrical connector and start engine. Allow engine to run at idle speed only for at least 5 minutes. This will allow the hydrostatic system to filled.
7. Listen for any abnormal noises.
8. Check for oil leaks.
9. Check charge pressure (500 psi +50psi, - 0 psi [34.4 bar +3.4 bar, - 0 bar]). Pressure can be measured a pump ports Ma & Mb or by “teeing” into the inlet for the charge oil filter. Charge pressure is checked with the joystick in neutral. A 0-1000 psi (0-70 bar) pressure gauge must be used. (If pressure gauges were installed in Ma & Mb to check charge pressure, disconnect the gauges installed in Ma & Mb, as they will be damaged if loop pressure rises above 1000 psi [34.4 bar].)

10. Operate the drive system in the “turtle mode”, forward and reverse.
11. De-aerate the system by bleeding fluid from the Ma & Mb ports.
12. Switch the drive mode speed control from “turtle” to “rabbit”. Gradually increase drive speed forward & reverse, still with no load - wheels off the ground.
13. With the joystick in neutral, check for creep in neutral. If evident, most likely dirt is present in the proportional pump control, an incorrect electrical signal is present on the pump's electrical control(s) or the control was not centered properly when overhauled. See service manual for centering instructions.
14. Check that the controls are connected so that the transmissions operate in the correct direction related to control input.
15. Continue to monitor all pressure gauges & correct any irregularities.
16. Remove the brake coil (leaving the electrical connection intact) from the brake release solenoid cartridge located on the Traction Manifold. This disables the machine's ability to release the brakes! Stroke the transmission pumps slightly (less than 20%) and check the setting of the high pressure cross port relief valves. Setting should be 5000 psi +50 psi, - 0 psi (344.7 bar +3.4 bar, -0 bar). Install 0-6000 psi (0 - 415 bar) gauges on Pump ports Ma & Mb.
17. Check oil level & temperature.
18. Remove and inspect charge pressure oil filter, replace with new element.
19. Operate the transmission under no load conditions for about 15 minutes to stabilize the temperature and remove any residual air from the fluid.
20. Set the machine back on the ground. Operate the transmissions under full and normal conditions.
21. Erratic operation may indicate there is still air trapped in the system. By working the pump controls forward and reverse the remaining air can be eliminated. The system is free of air when all functions can be operated smoothly and when the oil in the reservoir is no longer aerated. (Usually less than one hour of operation)

NOTE: *If the transmissions do not perform correctly after following the pre-start & start-up procedures, refer to the relevant sections of the trouble-shooting procedures.*

5.11 HYDRAULIC SCHEMATIC

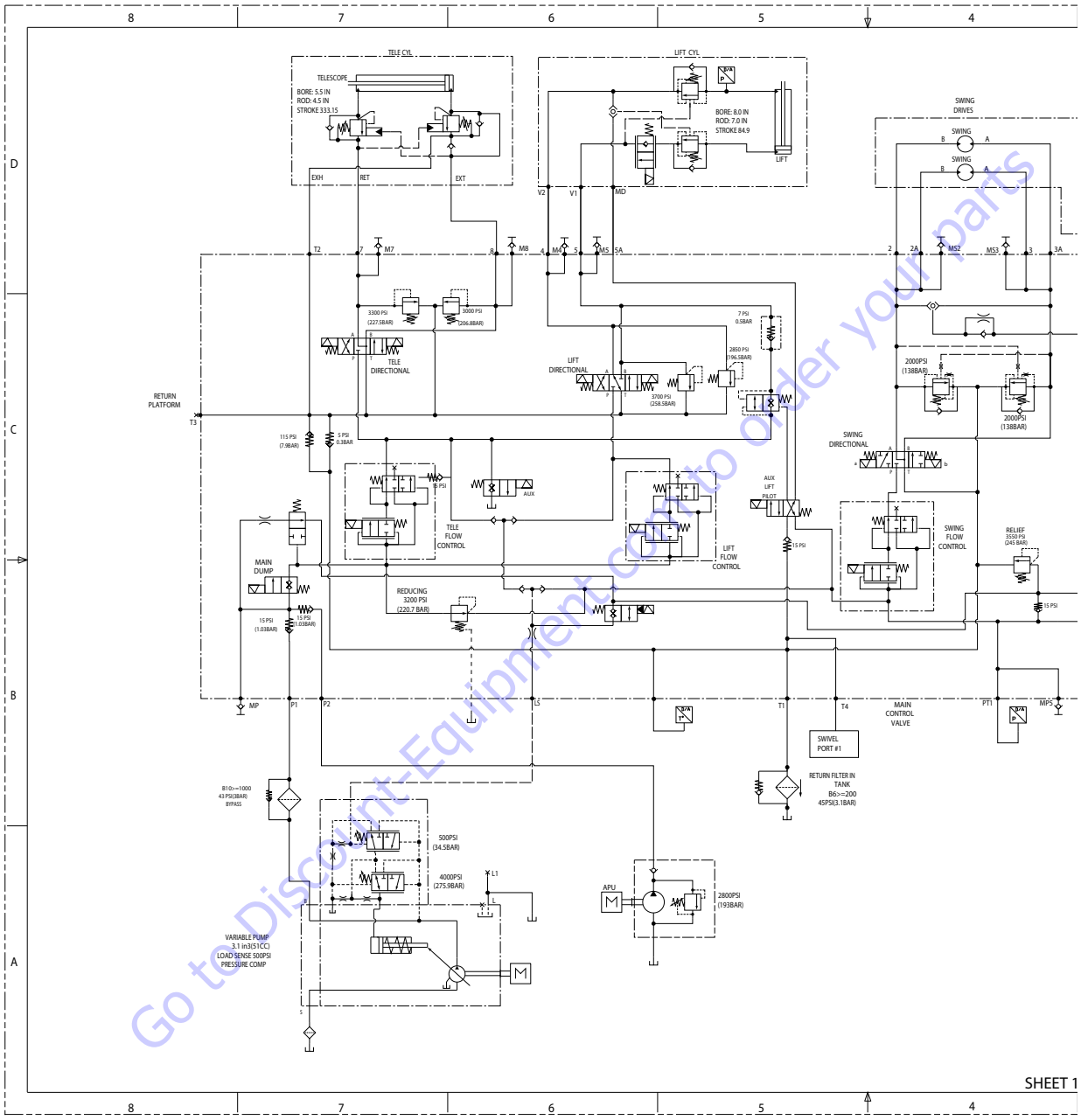


Figure 5-138. Hydraulic Schematic - Sheet 1 of 8

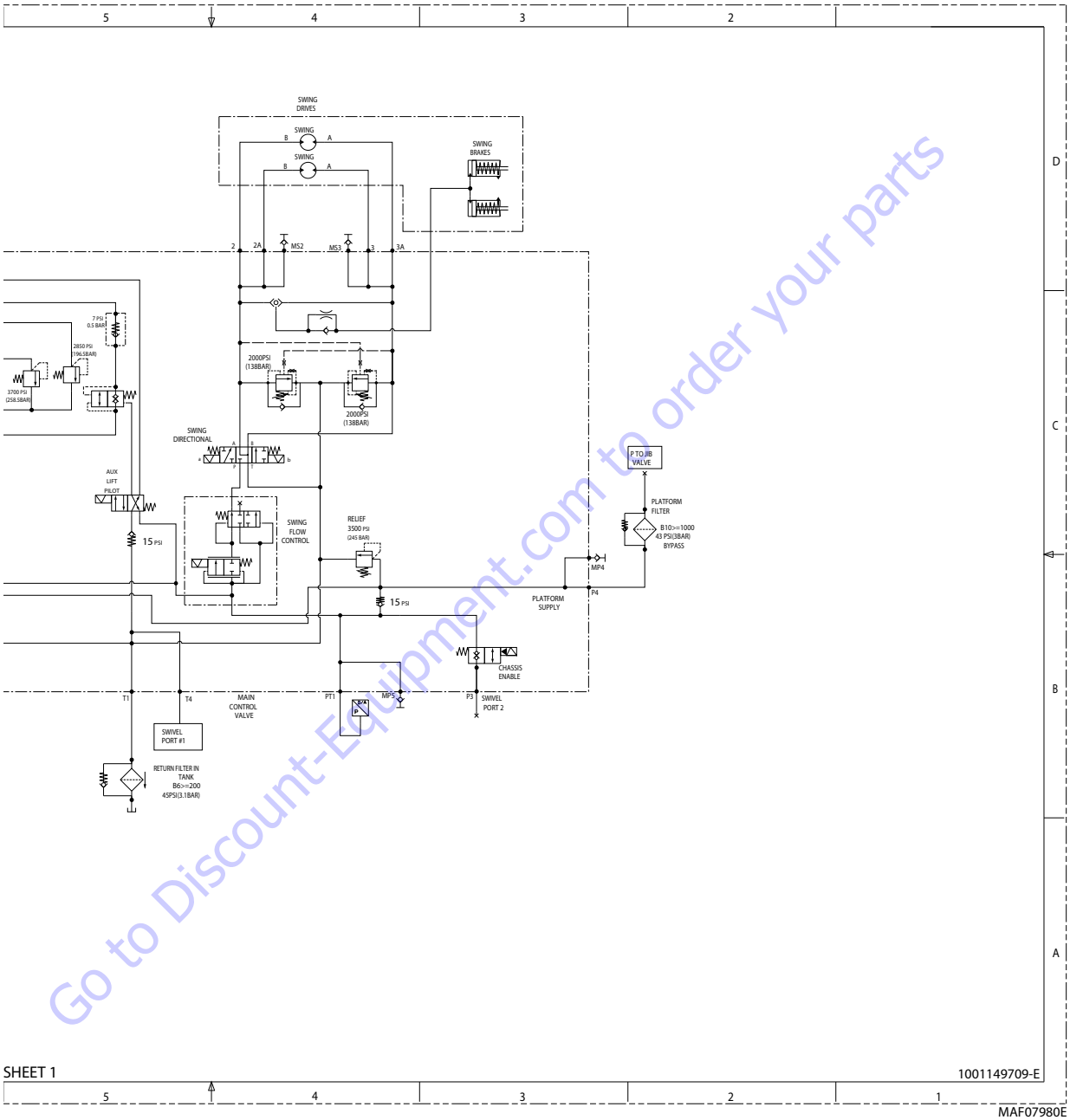


Figure 5-139. Hydraulic Schematic - Sheet 2 of 8

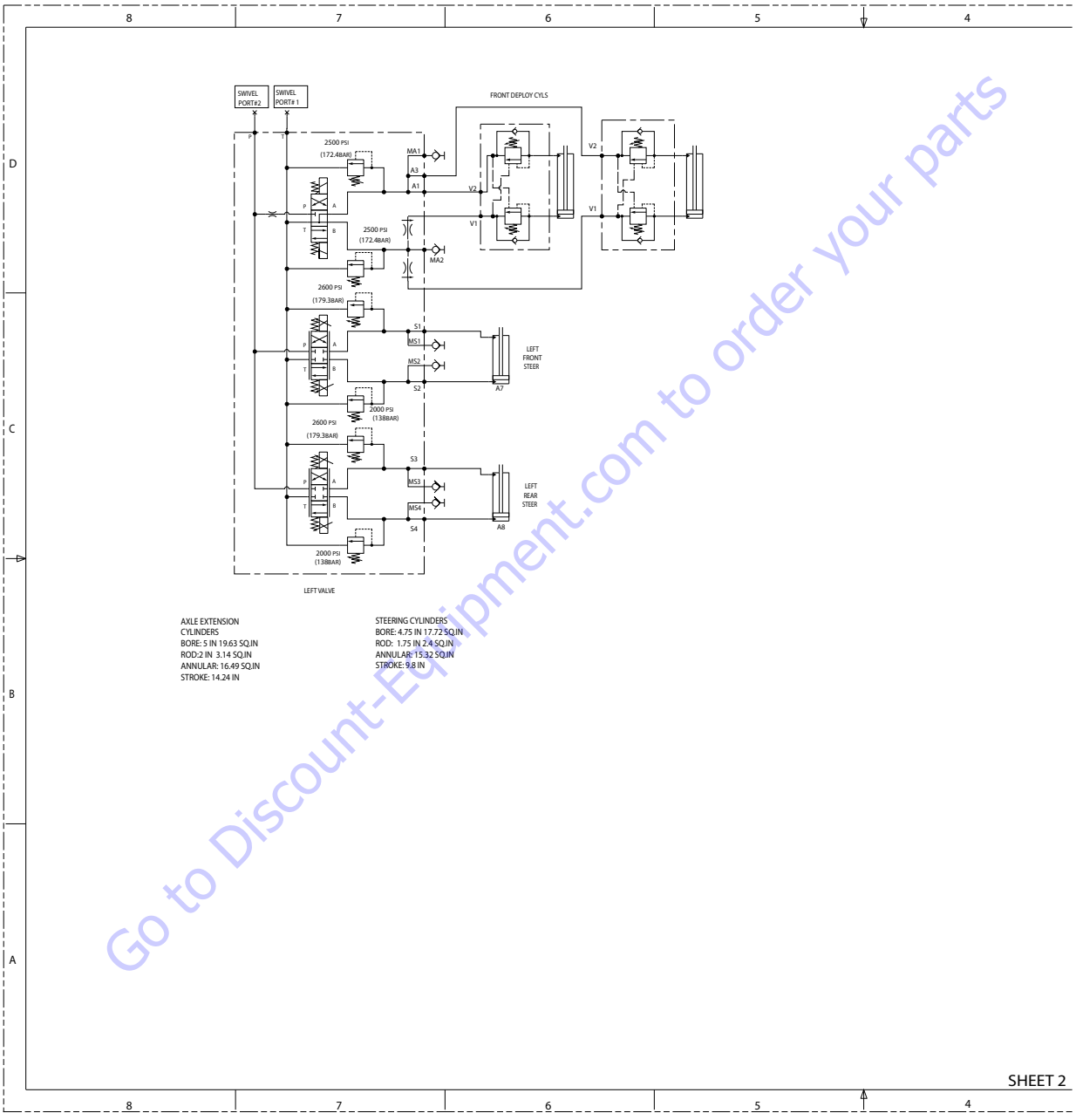


Figure 5-140. Hydraulic Schematic - Sheet 3 of 8

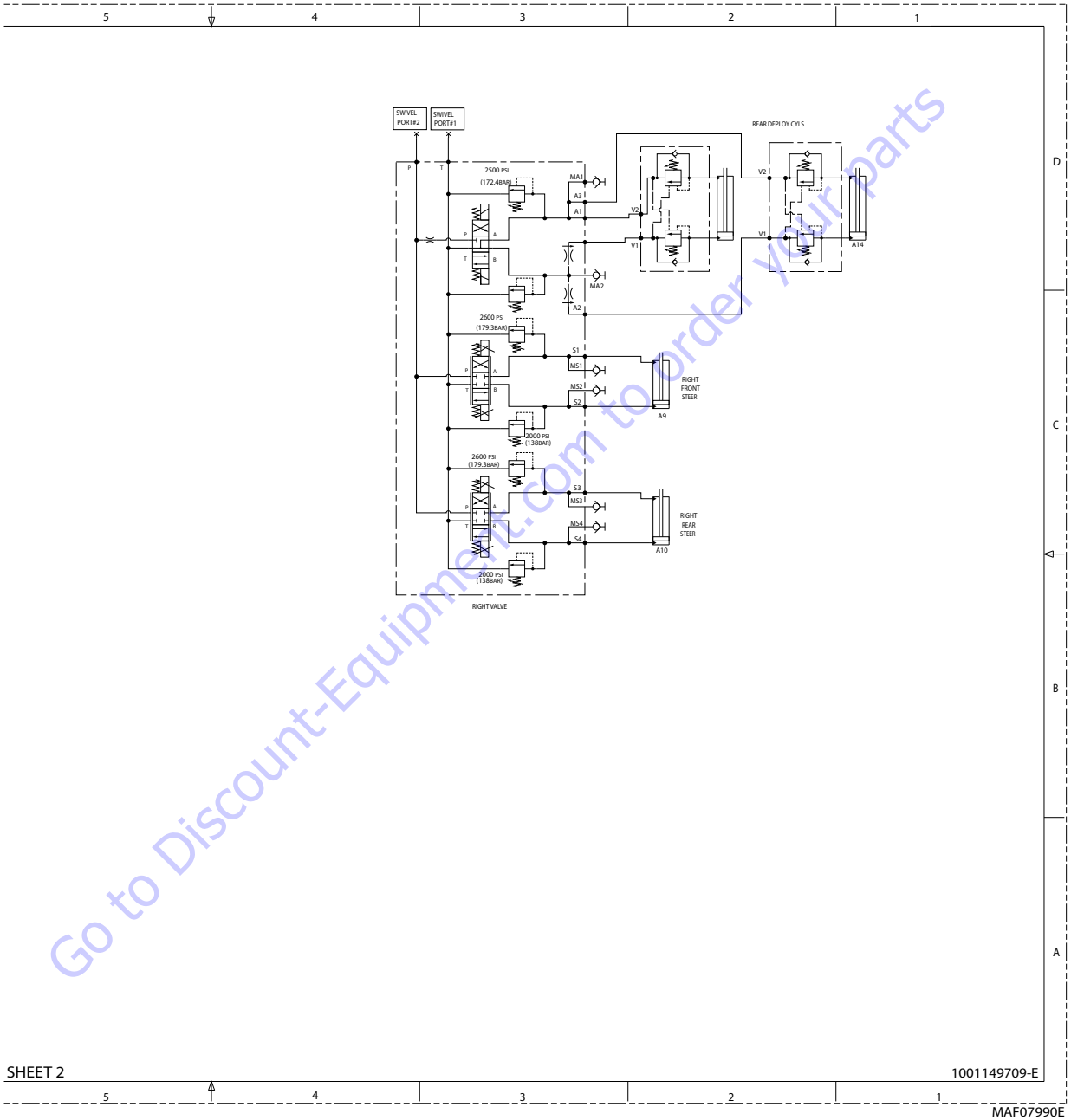


Figure 5-141. Hydraulic Schematic - Sheet 4 of 8

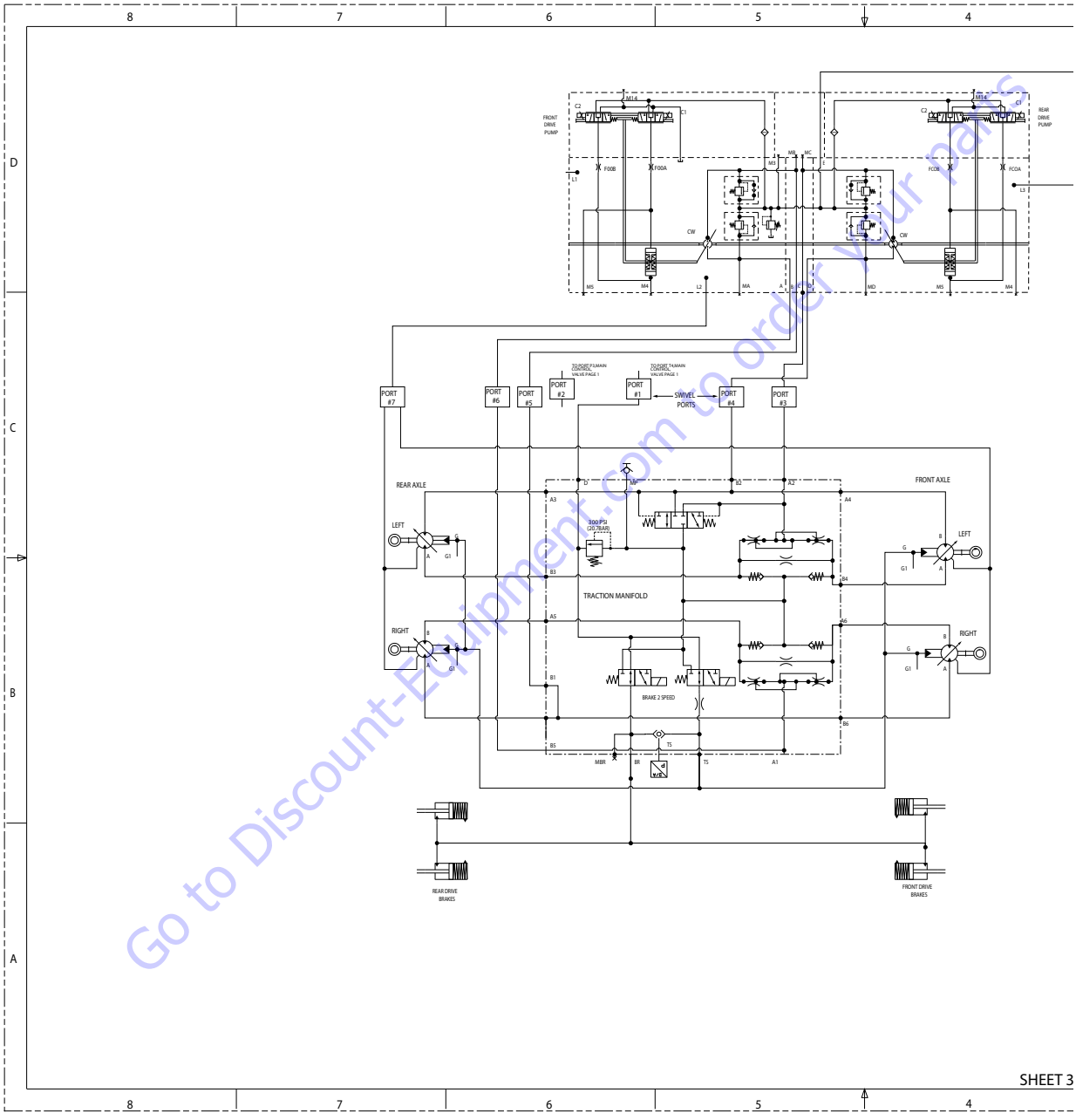


Figure 5-142. Hydraulic Schematic - Sheet 5 of 8

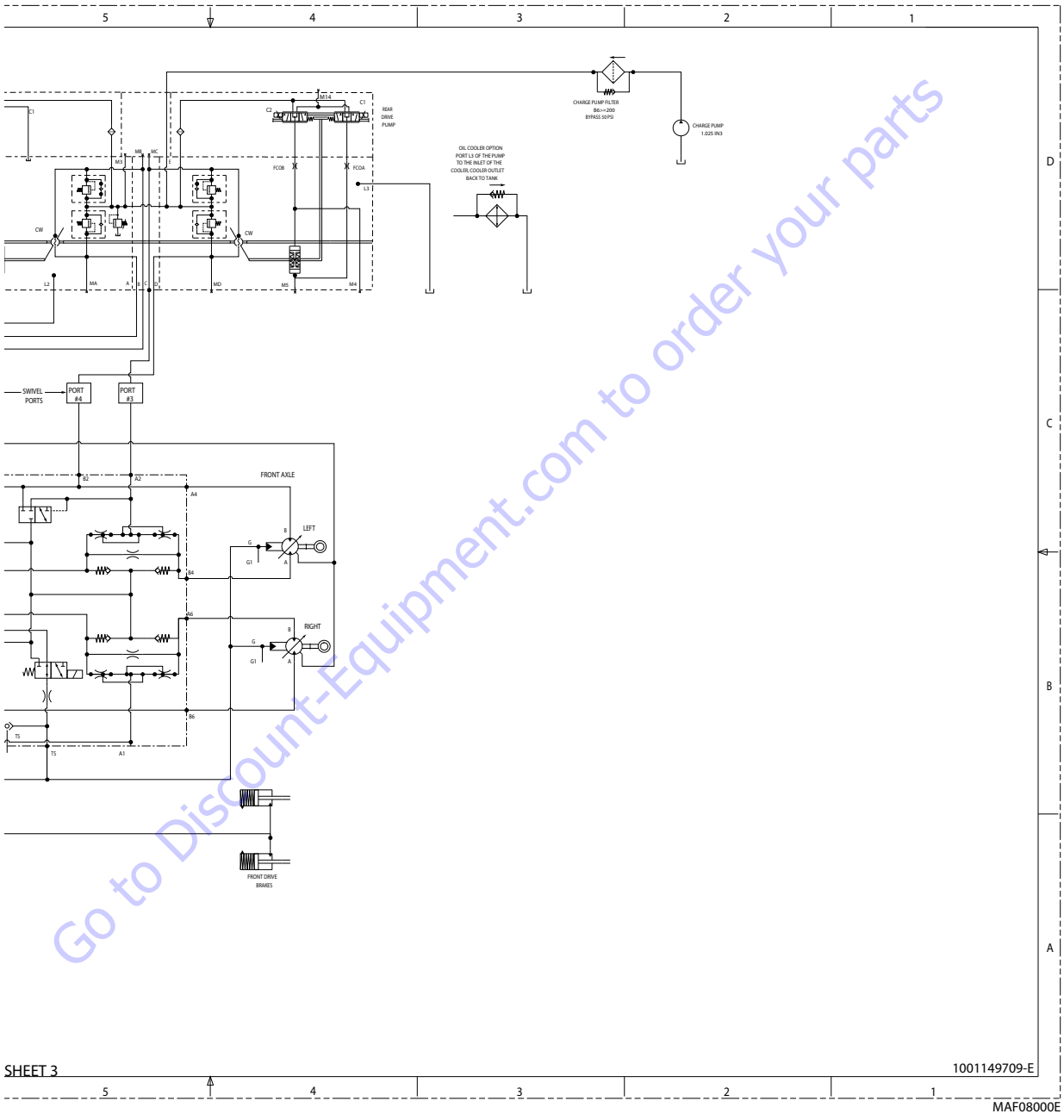


Figure 5-143. Hydraulic Schematic - Sheet 6 of 8

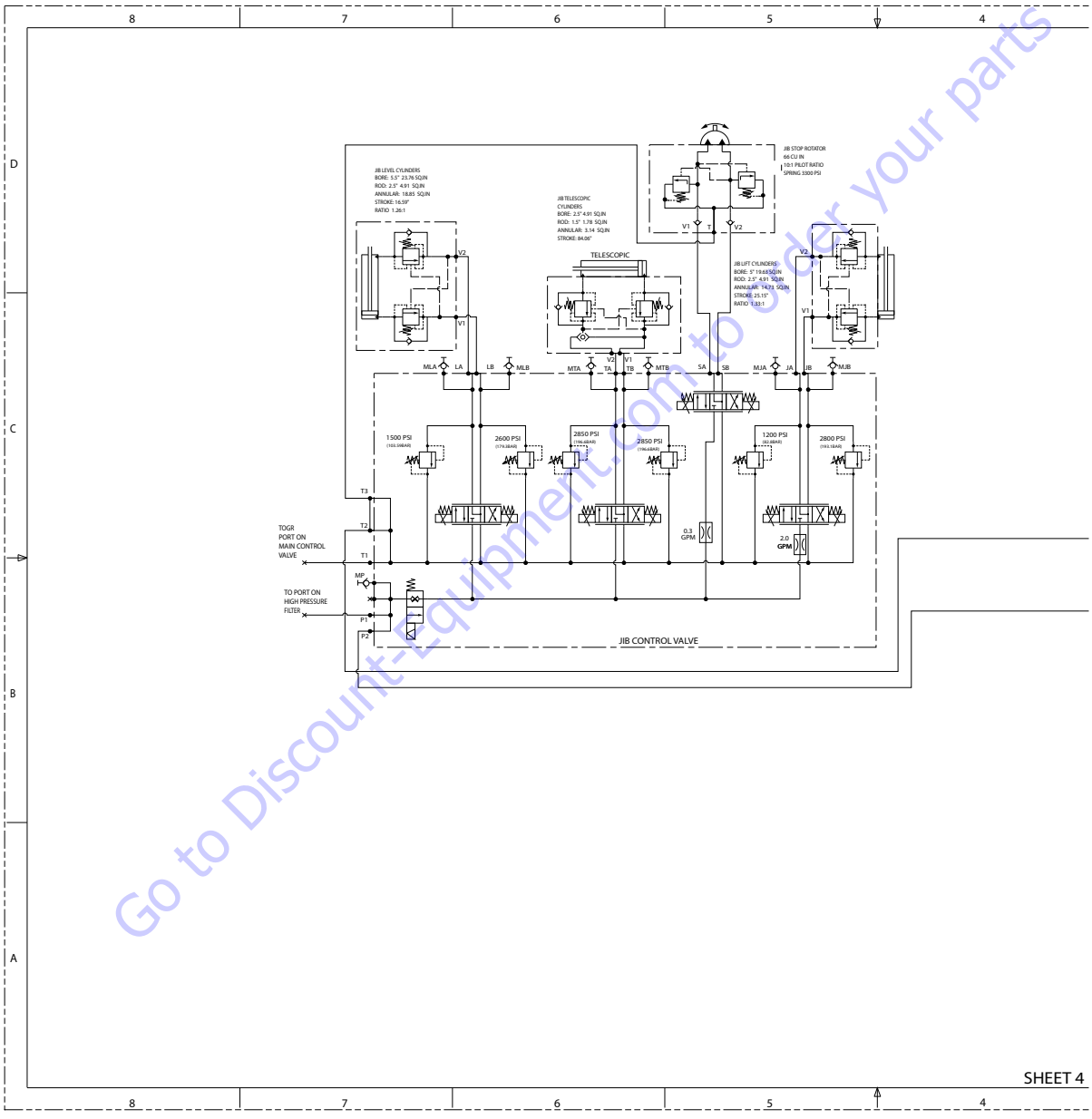


Figure 5-144. Hydraulic Schematic - Sheet 7 of 8

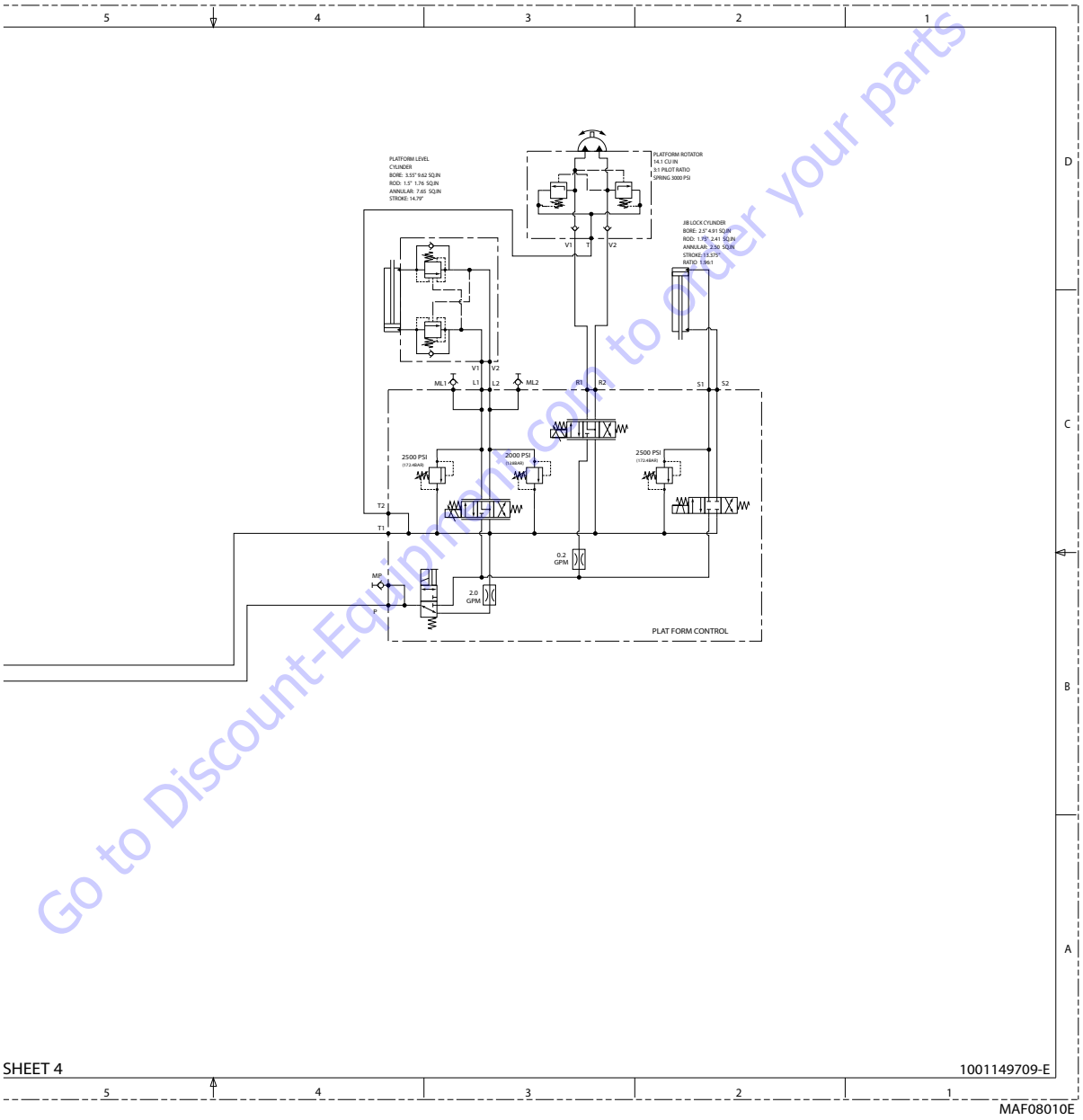
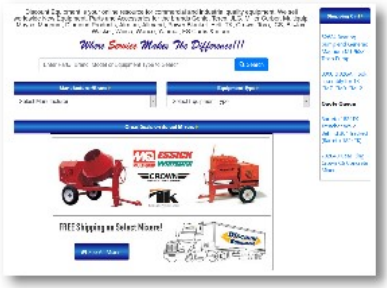


Figure 5-145. Hydraulic Schematic - Sheet 8 of 8

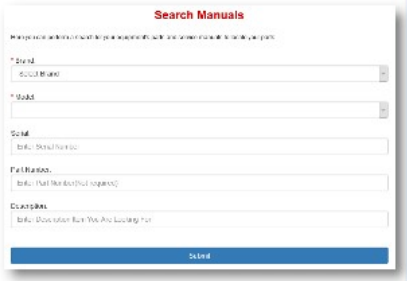
PARTS FINDER

Search Website by Part Number

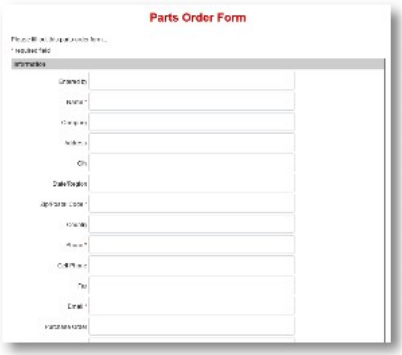
Discount Equipment



Search Manual Library For Parts Manual & Lookup Part Numbers – Purchase or Request Quote



Can't Find Part or Manual? Request Help by Manufacturer, Model & Description



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Click on this link: http://www.discount-equipment.com/category/5443-parts/ and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

SECTION 6. JLG CONTROL SYSTEM

6.1 JLG CONTROL SYSTEM ANALYZER KIT INSTRUCTIONS

Introduction

NOTICE

WHEN INSTALLING A NEW POWER MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS.

NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG designed Control System is a 12 volt based control unit installed on the boom lift.

The JLG Control System has reduced the need for exposed terminal strips, diodes and trimpots and provides simplicity in viewing and adjusting the various personality settings for smooth control of: acceleration, deceleration, creep, min speed, and max.-speed for all boom, drive, and steering functions.

The main lift, swing, and drive are controlled by individual joysticks, with steering being controlled by a rocker switch built into the top the drive joystick. To activate Drive, Lift, and Swing simply pull up on the slide lock location on the joystick and move the handle into the direction desired.

The control system will control the voltage output to the valves and pump, as programmed for smooth operation and maximum cycle time. Ground control speeds for all boom functions can also be programmed into the control system.

The JLG Control System controller has a built in LED to indicate any faults. The system stores recent faults which may be accessed for troubleshooting. Optional equipment includes a soft touch system, head and tail lights, and ground alarm. These options may be added later but must be programmed into the control system when installed.

The Control System may be accessed utilizing a custom designed, hand held analyzer (Analyzer Kit, JLG part no. 2901443) which will display two lines of information at a time, by scrolling through the program.

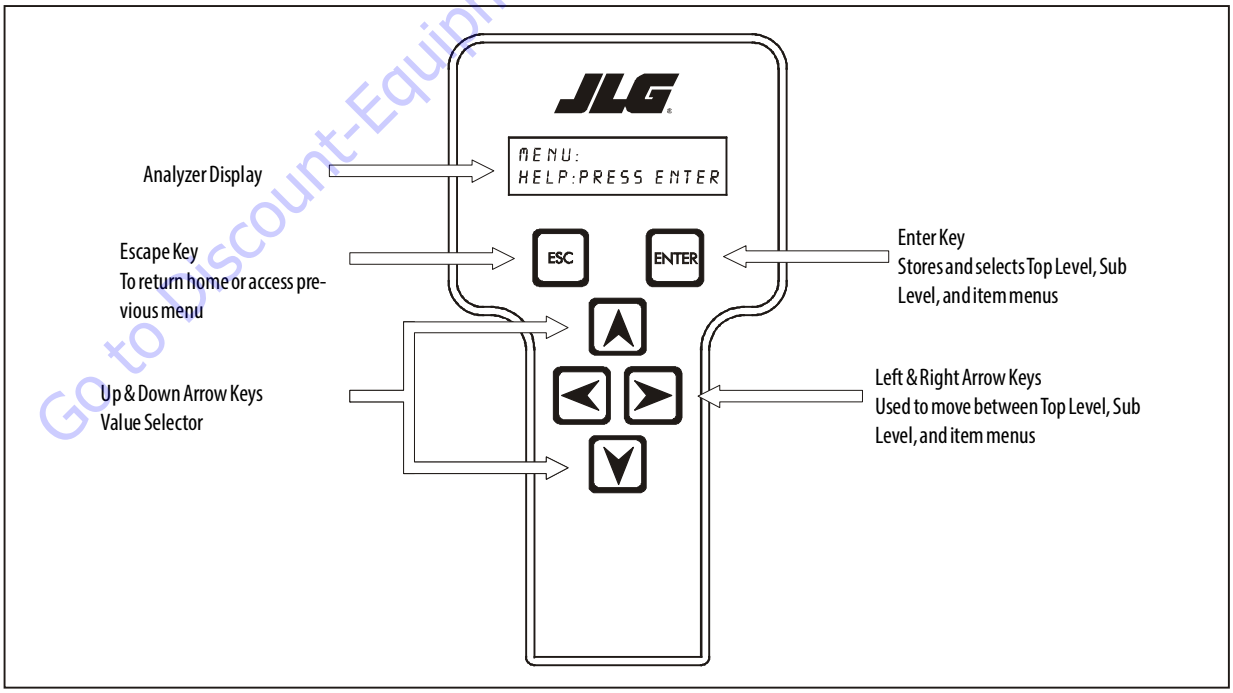


Figure 6-1. Hand Held Analyzer

To Connect the JLG Control System Analyzer

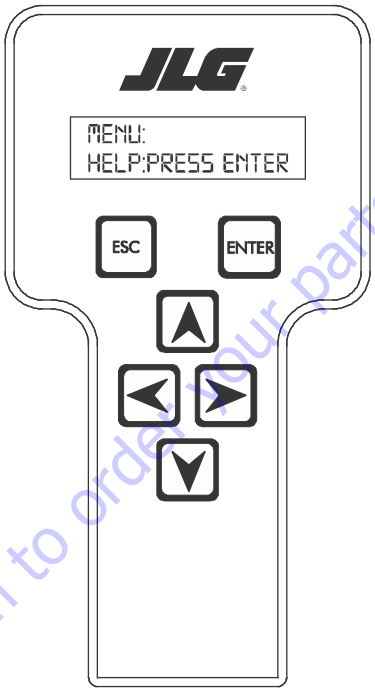
1. Connect the four pin end of the cable supplied with the analyzer, to the motor controller module located in the platform box or at the power module and connect the remaining end of the cable to the analyzer.

NOTE: *The cable has a four pin connector at each end of the cable; the cable cannot be connected backwards.*

2. Power up the Control System by turning the lower key to the platform or ground position and pulling both emergency stop buttons on.

Using the Analyzer

With the machine power on and the analyzer connected properly, the analyzer will display the following:



HELP:
PRESS ENTER

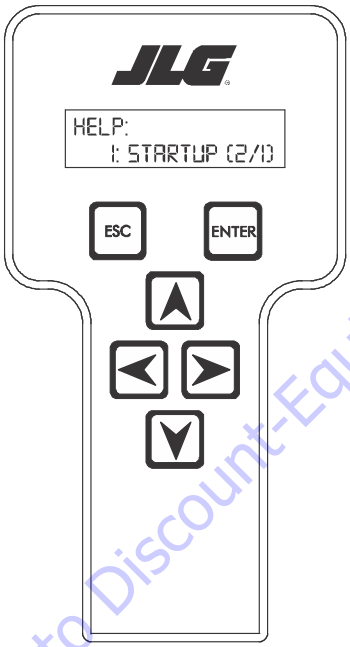
At this point, using the RIGHT  and LEFT  arrow keys, you can move between the top level menu items. To select a displayed menu item, press ENTER  . To cancel a selected menu item, press Escape  ; then you will be able to scroll using the right and left arrow keys to select a different menu item.

The top level menus are as follows:

HELP
DIAGNOSTICS
ACTIVATE TEST
ACCESS LEVEL
PERSONALITIES
MACHINE SETUP
LEVEL VEHICLE (level 1 only)
CALIBRATIONS (view only)

If you press **ENTER** ENTER, at the **HELP: PRESS ENTER** display, and a fault is present, the analyzer display will scroll the fault across the screen. If there was no fault detected, the display will read: **HELP: EVERYTHING OK.** If powered up at the ground station, the display will read: **GROUND OK.**

If **ENTER** ENTER is pressed again, the display moves to the following display:



LOGGED HELP
1: STARTUP (2/1)

At this point, the analyzer will display the last fault the system has seen, if any are present. You may scroll through the fault logs to view what the last 25 faults were. Use the right and left arrow keys to scroll through the fault logs. To return to the beginning, press **ESCAPE** ESC two times. **STARTUP (2/1)** indicates a power up.

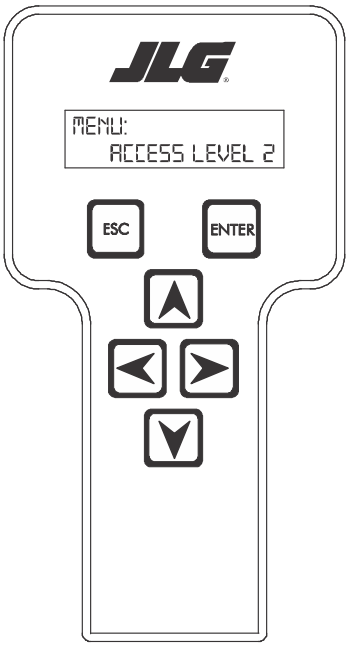
When a top level menu is selected, a new set of menu items may be offered: for example:

DRIVE
BOOM
SYSTEM
DATALOG
VERSIONS

Pressing **ENTER** ENTER with any of the above displayed menus, will display additional sub-menus within the selected menu. In some cases, such as **DRIVE**, the next level is the parameter or information to be changed. Refer to the flow chart for what menus are available within the top level menus. You may only view the personality settings for selected menus while in OPERATOR ACCESS. Remember, you may always cancel a selected menu item by pressing the **ESCAPE** ESC key.

Changing the Access Level of the Hand Held Analyzer

When the analyzer is first connected, you will be in OPERATOR ACCESS which enables you to only view most settings which cannot be changed until you enter a password to advance to a lower level. This ensures that a setting cannot be accidentally altered. To change the access level, the correct password must be entered. To enter the password, scroll to the **ACCESS LEVEL** menu. For example:



ACCESS LEVEL:
CODE 00000

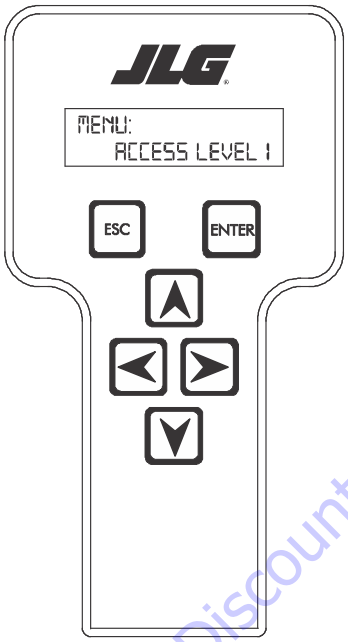
Press **ENTER** to select the **ACCESS LEVEL** menu.

Using the **UP** or **DOWN** arrow keys, enter the first digit of the password, 3.

Then using the **RIGHT** arrow key, position the cursor to the right one space to enter the second digit of the password.

Use the **UP** or **DOWN** arrow key to enter the second digit of the password which is 33271.

Once the correct password is displayed, press **ENTER**. The access level should display the following, if the password was entered correctly:

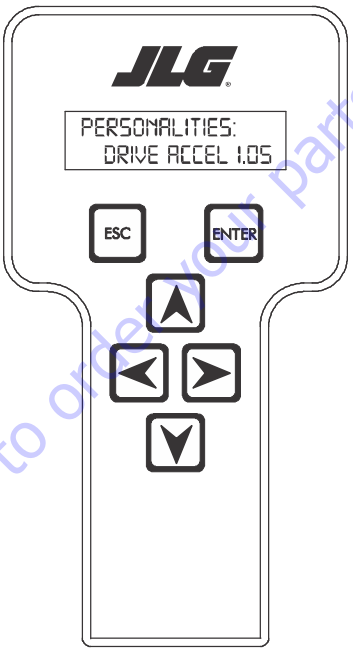


MENU:
ACCESS LEVEL 1

Repeat the above steps if the correct access level is not displayed or you can not adjust the personality settings.

Adjusting Parameters Using the Hand Held Analyzer

Once you have gained access to level 1, and a personality item is selected, press the **UP** or **DOWN** arrow keys to adjust its value, for example:

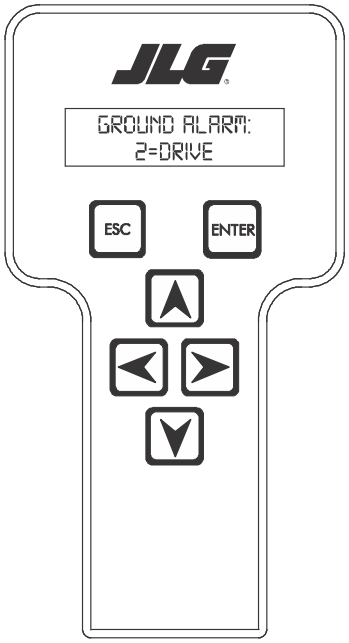


DRIVE:
ACCEL 1.5s

There will be a minimum and maximum for the value to ensure efficient operation. The Value will not increase if the **UP** arrow is pressed when at the maximum value nor will the value decrease if the **DOWN** arrow is pressed and the value is at the minimum value for any particular personality. If the value does not change when pressing the up and down arrows, check the access level to ensure you are at access level 1.

Machine Setup

When a machine digit item is selected, press the **UP** or **DOWN** arrow keys to adjust its value, for example:



GROUND ALARM:
2 = DRIVE

The effect of the machine digit value is displayed along with its value. The above display would be selected if the machine was equipped with a ground alarm and you wanted it to sound when driving. There are certain settings allowed to install optional features or select the machine model.

When selection the machine model to match the size of the machine, the personality settings will all default to the factory recommended setting.

NOTE: *Refer to Personality Ranges/Defaults for the recommended factory settings.*

NOTE: *Password 33271 will give you access to level 1, which will permit you to change all machine personality settings.*

There is a setting that JLG strongly recommends that you do not change. This setting is so noted below:

ELEVATION CUTBACK

⚠ WARNING

CHANGING THIS SETTING MAY ADVERSELY AFFECT THE PERFORMANCE OF YOUR MACHINE.

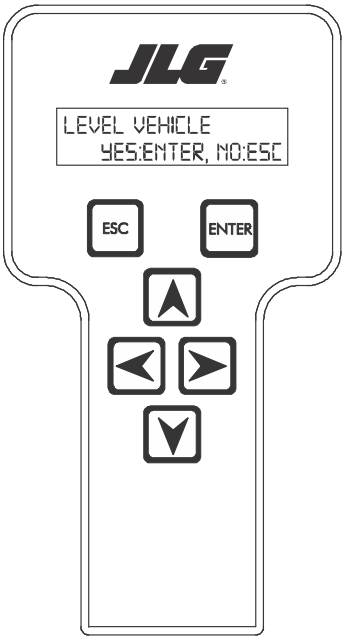
NOTICE

ITS IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

Level Vehicle Description

⚠ WARNING

DO NOT LEVEL VEHICLE EXCEPT ON A LEVEL SURFACE.



LEVEL VEHICLE
YES:ENTER, NO:ESC

Not available at password level 2 ENTER confirms that vehicle is currently level, and zeroes the tilt sensor measurements

Ground Control Console Display Gauge - Machines using Diesel Exhaust Fluid (DEF)

(See Figure 6-5., Ground Control Console Display Gauge)

The Display Gauge shows engine hours, fuel level (if applicable), and Diagnostic Trouble Codes (DTCs) from both the JLG Control System and the engine control system. During machine start up, with no active DTCs in the control system, the splash screen will show for 3 seconds and then switch to main screen. If there is an active DTC while powering up the machine, the splash screen will show for 3 seconds, and then launch the Diagnostics Screen. The indicator lamp will light when there is an active DTC in the Fault Log.

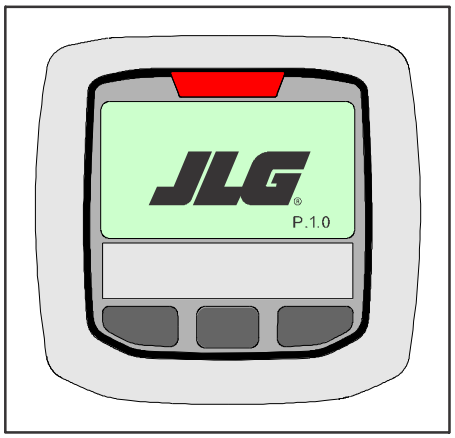


Figure 6-2. Splash Screen

The Diagnostic Screen will show active and inactive faults from the JLG Control System on the screen. An asterisk (*) will be displayed to show active faults.

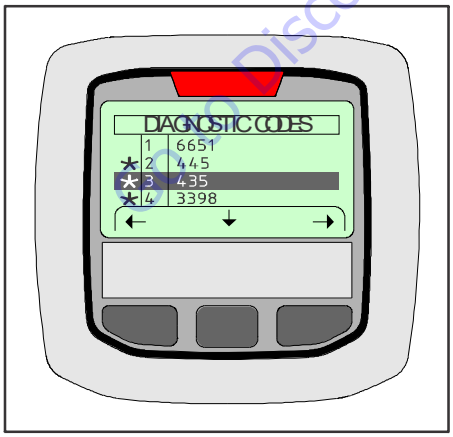


Figure 6-3. Diagnostic Screen

The Engine Diagnostics Screen will show SPN (Suspect Parameter Number), FMI (Failure Mode Identifier), and Occurrence count information. Engine SPN text is not scrollable. If there is more than one engine trouble code, the operator must exit from the Engine DTC Screen to see other SPN and FMI information.

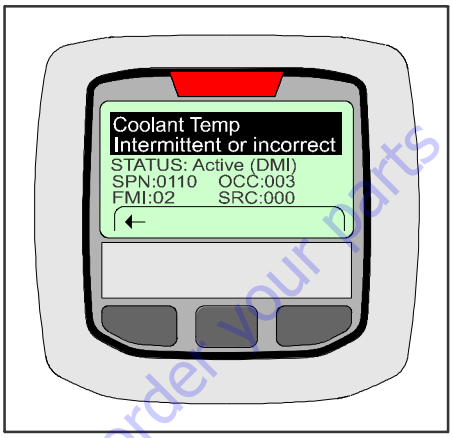


Figure 6-4. Engine Diagnostic Screen

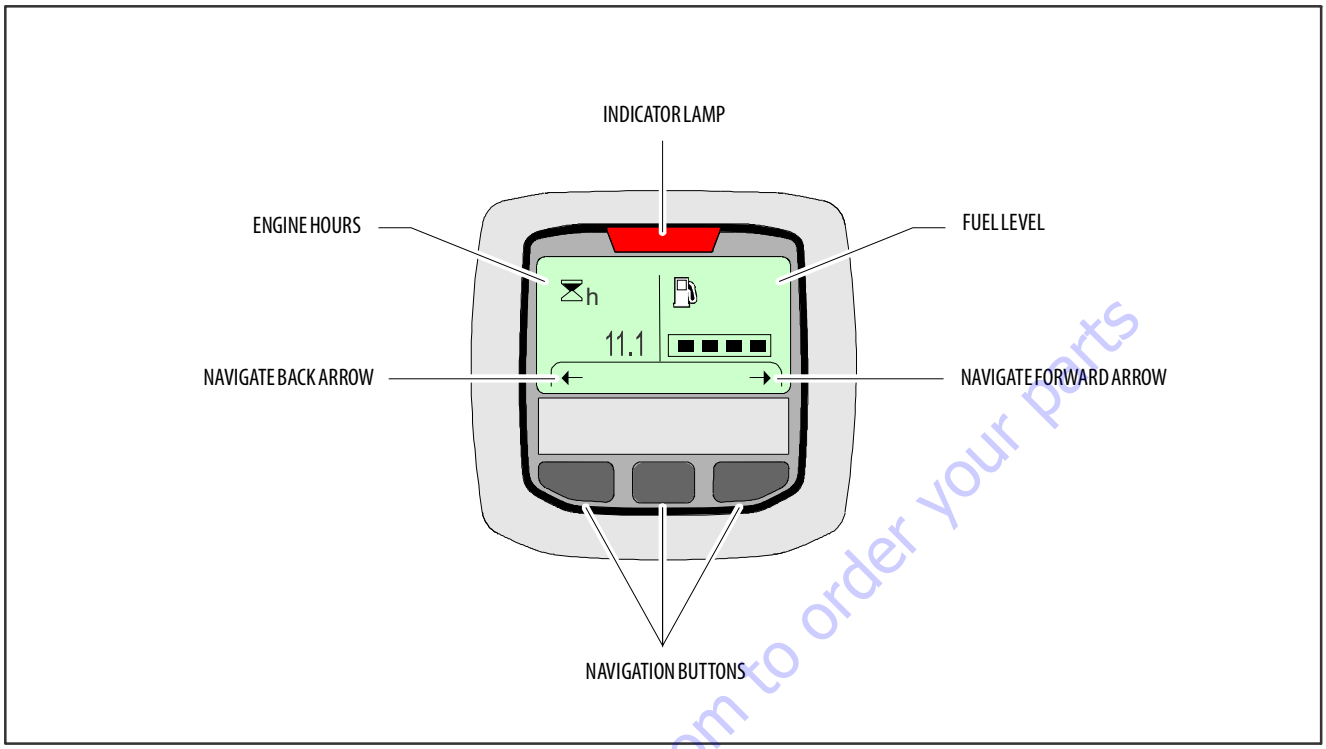


Figure 6-5. Ground Control Console Display Gauge

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
ACCEL	ACCELERATE
ACT	ACTIVE
A/D	ANALOG DIGITAL CONVERTER COUNT
AMB.	AMBIENT
ANG	ANGLE
AUX	AUXILIARY
BCS	BOOM CONTROL SYSTEM
BM	BOOM LENGTH ANGLE MODULE
BLAM	BOOM LENGTH ANGLE MODULE
BR	BROKEN
BSK	BASKET
CAL	CALIBRATION
CL	CLOSED
CM	CHASSIS MODULE
CNTL	CONTROL
CNTRL	CONTROL
C/O	CUT OUT
CONT(S)	CONTRACTOR(S)
COOR	COORDINATED
CRK PT	CRACK POINT
CRP	CREEP
CUT	CUTOUT
CYL	CYLINDER
DECEL	DECELERATE
D	DOWN
DN	DOWN
DWN	DOWN
DEG.	DEGREE
DOS	DRIVE ORIENTATION SYSTEM
DRV	DRIVE
E	ERROR
E&T	ELEVATED & TILTED
ELEV	ELEVATION
ENG	ENGINE
EXT	EXTEND
F	FRONT
FL	FLOW
FNT	FRONT
FOR	FORWARD
FWD	FORWARD
FSW	FOOT SWITCH
FUNC	FUNCTION
G	GROUND

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
GND	GROUND
GRN	GREEN
GM	GROUND MODULE
H	HOURS
HW	HARDWARE
HWFS	HARDWARE FAILSAFE
I	IN or CURRENT
JOY	JOYSTICK
L	LEFT
LB	POUND
LEN	LENGTH
LIM	LIMIT
LT	LEFT
LVL	LEVEL
M	MINUTES
MIN	MINIMUM
MAX	MAXIMUM
M	MAIN
MN	MAIN
NO	NORMALLY OPEN or NO
NC	NORMALLY CLOSED
O	OUT
O/C	OPEN CIRCUIT
OP	OPEN
O/R	OVERRIDE or OUTRIGGER
O//R	OVERRIDE
OSC	OSCILLATING
OVRD	OVERRIDE
P	PLATFORM
P	PRESSURE
PCV	PROPORTIONAL CONTROL VALVE
PLAT	PLATFORM
PLT	PLATFORM
PM	PLATFORM MODULE
POT	POTENTIOMETER
PRES	PRESSURE
PRS	PRESSURE
PT	POINT
R	REAR or RIGHT
REV	REVERSE or REVISION
RET	RETRACT
ROT.	ROTATE
RT	RIGHT

Table 6-1. Analyzer Abbreviations

ABBREVIATION	MEANING
S/C	SHORT CIRCUIT
SEL	SELECTOR
SN	SERIAL NUMBER
SPD	SPEED
STOW	STOWED
STOWD	STOWED
SW	SWITCH or SOFTWARE
TELE	TELESCOPE
TEMP	TEMPERATURE
TORQ.	TORQUE
TRN	TRANSPORT
T/T	TURNTABLE
T	TOWER
TURNTBL	TURNTABLE
TWR	TOWER
U	UPPER or UP
V	VOLT
VER	VERSION
VLV	VALVE
WIT	WITNESS
YEL	YELLOW

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
NOTE: *The machine configuration must be completed before any personality settings can be changed. Changing the personality settings first and then changing the model number of the machine configuration will cause the personality settings to return to default values.* *The items marked in* **BLUE bold** *text on this sheet represent a new board that has never been configured.*			
MODEL NUMBER: 1	0 **1** 2	No Model **1500SJ** 1850SJ	**0**
ENVELOPE HEIGHT: 2	**0** 1	**1500SJ: 150' MAX** 1850SJ: 185' MAX	**0**
Note: The default settings (bold) will vary depending on the model selection with selection #0 being the initial default setting.			
MARKET: 3	**0** 1 2 3 4 5 6	**ANSI USA** ANSI EXPORT CSA CE AUSTRALIA JAPAN GB	**0**
ENGINE: 4	0 1 2 3 4 **5**	DEUTZ F4 TIER1: Deutz BF4M1011 Diesel (Tier 1) DEUTZ F4 TIER2: Deutz BF4M2011 Diesel (Tier 2) DEUTZ ECM: Engine Control Module CAT Engine DEUTZ ECM T4i: Engine Control Module (Tier 4 Interim) **DEUTZ ECM T4F: Engine Control Module (Tier 4 Final)**	**5**

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
GLOW PLUG: 5	0 1 **2**	NO GLOW PLUGS: No glow plugs installed. AIR INTAKE: Glow plugs installed in the air intake on the manifold. **IN-CYLINDER: Glow plugs installed in each cylinder.**	**2**
STARTER LOCKOUT: 6	**0** 1	**DISABLED: Automatic pre-glow time determined by ambient air temperature; engine start can be attempted at any time during pre-glow.** ENABLED: Automatic pre-glow time determined by ambient air temperature; engine start is NOT permitted until pre-glow is finished.	**0**
ENGINE SHUTDOWN: 7	0 **1**	DISABLED: No engine shutdown. **ENABLED: Shutdown engine when coolant temperature is greater than 110 deg. C or the oil pressure is less than 8 PSI.**	**1**
FUEL CUTOUT: 8*	**0** 1 2	**RESTART: Engine allowed to be restarted multiple times when very low fuel level is reached** ONE RESTART: Engine allowed to be restarted once for 2 minutes when very low fuel level is reached ENGINE STOP: Engine not able to restart when very low fuel level is reached	**0**
*This menu item is only visible if non dual fuel engines are selected.			
CHASSIS TILT: 9*	**0** 1 2 3 4 5	**5 DEGREES + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also cuts out drive.** 4 DEGREES + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also cuts out drive. 3 DEGREES + DRV CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also cuts out drive. 4 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 4 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up. 3 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 3 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up. 5 DEGREES + CUT: Reduces the maximum speed of all boom functions to creep when tilted more than 5 degrees and above elevation; also disallows tower lift up, tower telescope out, drive, main telescope out and main lift up.	**0**
Note: Any of the selections above will light the tilt lamp when a tilted condition occurs and will sound the platform alarm when the machine is also above elevation. *Certain market selections will alter default setting.			

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
JIB: 10	0 1 **2**	NO: No Jib installed. YES: Jib installed. **SIDESWING: Jib with Sideswing installed.**	**2**
4WS: 11	0 **1**	NO: 2WS mode enabled. **YES: 4WS mode enabled.**	**1**
DRIVE: 12	0 **1**	2WD drive mode enabled. **4WD drive mode enabled.**	**1**
SOFT TOUCH: 13	**0** 1	**NO: Soft touch is disabled.** YES: Soft Touch is enabled.	**0**
SKYGUARD OPTION: 14	0 **1** 2	NO: Skyguard is disabled **BAR/SKYLINE: SkyGuard Bar or SkyLine installed and enabled** SKYEYE: SkyEye installed and enabled	**1**
GEN SET/WELDER: 15	0 **1** 2	NO: No generator installed. **BELT DRIVE: Belt driven setup.** HYDRAULIC DRIVE: Hydraulic driven setup.	**1**
GEN SET CUTOUT: 16*	**0** 1	**MOTION ENABLED: Motion enabled when generator is ON.** MOTION CUTOUT: Motion cutout in platform mode only.	**0**
* Only visible if Gen Set / Welder Menu selection is not 0.			
H & T LIGHTS: 17	**0** 1	**NO: No head and tail lights installed.** YES: Head and tail lights installed.	**0**

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
LOAD SYSTEM: 18*	**0** **1** **2**	NO: No load sensor installed. **CUTOUT PLATFORM: All functions cutout, overload lamp lit, platform alarm beeps (5 sec ON, 2 sec OFF).** CUTOUT ALL: All functions cutout, flash overload light (500mS on, 500mS off), platform alarm beeps (5 sec ON, 2 sec OFF).	**1**
* Only visible under certain market selections. * Certain market selections will limit load system options or alter default setting.			
LOAD TYPE 19	0 **1**	NON CAN LSS: Non CAN based LSS installed **CAN LSS: CAN based LSS installed**	**1**
FUNCTION CUTOUT: 20*	0 1 2 **3**	NO: No drive cutout. BOOM CUTOUT: Boom function cutout while driving above elevation. DRIVE CUTOUT: Drive cutout above elevation. **DRIVE CUT E&T: Drive cutout above elevation and tilted.**	**3**
* Only visible under certain market selections. * Certain market selections will limit function cutout options or alter default setting.			
GROUND ALARM: 21*	0 1 2 **3**	NO: No ground alarm installed. DRIVE: Travel alarm sounds when the drive function is active. DESCENT: Descent alarm sounds when lift down is active. **MOTION: Motion alarm sounds when any function is active.**	**3**
* Certain market selections will alter default setting.			
FLYWHEEL TEETH 22*	**0** 1 2	**110 TEETH: Engine speed is calculated using 110 flywheel teeth** 133 TEETH: Engine speed is calculated using 110 flywheel teeth 112 TEETH: Engine speed is calculated using 110 flywheel teeth	**0**
* Only visible when Deutz F4 Tier 1 or Tier 2 engines selected			
OSCILLATING AXLE: 23	0 **1**	NO: No oscillating axle system installed. **YES: Oscillating axle system installed.**	**1**
Note: The default settings (bold) will vary depending on the model selection with selection #0 being the initial default setting.			

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
DISPLAY UNITS: 24*	0 **1**	METRIC: units selection. (Deg. C, KPA, Kg.) **IMPERIAL: units selection. (Deg. F, PSI, Lb)**	**1**
* Certain market selections will alter default setting.			
LEVELING MODE: 25	0 **1**	LIFT: Platform leveling during lift only. **ALL: Platform leveling during all functions.**	**1**
CLEARSKY: 26	**0** 1	**NO: ClearSky Telematics system not installed.** YES: ClearSky Telematics system installed.	**0**
FUEL TANK: 27	0 1 **2**	31 Gallon Fuel tank. 52 Gallon Fuel tank. **45 Gallon Fuel tank.**	**2**
ALERT BEACON: 28	**0** 1	**OFF FOR CREEP** 20FPS FOR CREEP	**0**
DISPLAY LANGUAGE: 29	**0** 1 2 3 4 5 6 7 8 9 10	**ENGLISH** SPANISH EURO PORTUGUESE BRAZILIAN PORTUGUESE FRENCH GERMAN DUTCH ITALIAN SIMPLIFIED CHINESE JAPANESE KOREAN	**0**
TEMP CUTOUT: 30*	**0** 1	**NO: No temperature cutout** YES: Temperature cutout enabled	**0**
* Certain market selections will alter default setting.			

Table 6-2. Machine Configuration Programming Information (Software Version P7.32)

Configuration Digit	Number	Description	Default Number
PLAT LVL OVR CUT: 31	**0** 1	**NO: No platform cutout** YES: Platform cutout enabled	**0**
CRIBBING: 32*	**0** 1	**NO: Cribbing is not installed** YES: Cribbing is installed	**0**
* Only visible under certain market selections.			
WATER IN FUEL SENSOR: 33*	**0** 1	**NO: Water in Fuel Sensor Option not installed** YES: Water in fuel sensor option installed	**0**
*Only visible under certain market selections.			
ALARM/HORN: 34*	**0** 1	**COMBINED: The white noise alarm option is not installed** SEPARATE: The white noise alarm option is installed	**0**
* Only visible under certain market selections.			

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Table 6-3. Machine Configuration Programming Settings (Software Version P7.32)

1850SJ	ANSI USA	ANSI Export	CSA	CE	Australia	Japan	GB
Model Number	2	2	2	2	2	2	2
Envelope Height	1	1	1	1	1	1	1
Market	0	1	2	3	4	5	6
Engine	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	4	4	4	4	4	4	4
	5	5	5	5	5	5	5
Glow Plug	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	2	2	2	2	2	2	2
Starter Lockout	X	X	X	X	X	X	X
	1	1	1	1	1	1	1
Engine Shutdown	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Fuel Cutout	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
Chassis Tilt	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
	4	4	4	4	4	4	4
Jib	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
4 Wheel Steer	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Drive Type	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Soft Touch	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
SKYGUARD OPTION	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2

Table 6-3. Machine Configuration Programming Settings (Software Version P7.32)

1850SJ	ANSI USA	ANSI Export	CSA	CE	Australia	Japan	GB
Gen Set / Welder	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
Gen Set Cutout	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Head & Taillights	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Load System	X	0	X	X	X	X	X
	1	1	1	X	1	1	X
	2	2	2	2	X	2	2
Load Type	X	X	X	X	X	X	X
	1	1	1	1	1	1	1
Function Cutout	X	0	0	0	0	0	0
	X	1	1	0	1	1	1
	X	2	2	X	2	2	X
	3	3	3	X	3	3	X
Ground Alarm	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
Flywheel Teeth	0	0	0	0	0	0	0
	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
Oscillating Axle	0	0	0	0	0	0	0
	X	X	X	X	X	X	X
Display Units	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Leveling Mode	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Clearsky	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
Fuel Tank	X	X	X	X	X	X	X
	X	X	X	X	X	X	X
	2	2	2	2	2	2	2
Alert Beacon	0	0	0	0	0	0	0
	1	1	1	1	1	1	1

Table 6-3. Machine Configuration Programming Settings (Software Version P7.32)

1850SJ	ANSI USA	ANSI Export	CSA	CE	Australia	Japan	GB
Display Language	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
	4	4	4	4	4	4	4
	5	5	5	5	5	5	5
	6	6	6	6	6	6	6
	7	7	7	7	7	7	7
	8	8	8	8	8	8	8
	9	9	9	9	9	9	9
	10	10	10	10	10	10	10
Temp Cutout	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	X	1	X	1	X	X	1
PLAT LVL OVR CUT	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1	1	1	1	1	1	1
Cribbing	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1	1	1	X	X	1	1
Water In Fuel Sensor	**0**	**0**	**0**	**0**	**0**	**0**	0
	1	1	1	1	1	1	**1**
Alarm/Horn	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1	1	1	1	1	1	1

BOLD BLUE text indicates the default setting. Plain text indicates another available selection. SHADED CELLS indicate hidden menu or selection.

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6.2 MACHINE PERSONALITY SETTINGS AND FUNCTION SPEEDS

NOTE: *Personality settings can be adjusted within the adjustment range in order to achieve optimum machine performance.*

Table 6-4. Machine Personality Settings and Function Speeds (Software Version P7.32)

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES	TIME RANGE (SEC)
DRIVE:	ACCEL X.Xs	Displays/adjusts drive acceleration	0.1 to 5.0 sec	2	
	DECEL X.Xs	Displays/adjusts drive deceleration	0.1 to 3.0 sec	1.3	
	MIN forward XX%	Displays/adjusts minimum forward drive speed	0 to 35%	1	
	MAX forward XXX%	Displays/adjusts maximum forward drive speed	0 to 100%	100	54-58 (see orientation)
	MIN reverse XX%	Displays/adjusts minimum reverse drive speed	0 to 35%	1	
	MAX reverse XXX%	Displays/adjusts maximum reverse drive speed	0 to 100%	100	
	ELEV. MAX XX%	Displays/adjusts maximum drive speed NOTE: used when elevation cutout switches are limiting maximum speed	0 to 50%	25	110-112 (see orientation)
	CREEP MAX XX%	Displays/adjusts maximum drive speed NOTE: used when creep switch on pump pot is active	0 to 50%	35	79-87 (see orientation)
STEER:	MAX SPEED XXX%	Displays/adjusts maximum steer speed.	0 to 100%	100	
MAIN LIFT:	ACCEL X.Xs	Displays/adjusts main lift acceleration	0.1 to 5.0 sec	1	
	DECEL X.Xs	Displays/adjusts main lift deceleration	0.1 to 3.0 sec	1	
	MIN UP XX%	Displays/adjusts minimum main lift up speed	0 to 60%	20	
	MAX UP XX%	Displays/adjusts maximum main lift up speed	0 to 100%	80	130-160 (see orientation)
	CREEP UP XX%	Displays/adjusts maximum main lift up speed NOTE: used when creep switch on pump pot is active	0 to 65%	50	
	MIN DOWN XX%	Displays/adjusts minimum main lift down speed	0 to 60%	10	
	MAX DOWN XXX%	Displays/adjusts maximum main lift down speed	0 to 100%	60	145-175 (see orientation)
	CREEP DOWN XX%	Displays/adjusts maximum main lift down speed NOTE: Used when creep switch on pump pot is active	0 to 75%	45	

Table 6-4. Machine Personality Settings and Function Speeds (Software Version P7.32)

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES	TIME RANGE (SEC)
SWING:	ACCEL X.Xs	Displays/adjusts swing acceleration	0.1 to 5.0 sec	3	
	DECEL X.Xs	Displays/adjusts swing deceleration	0.1 to 3.0 sec	1.5	
	MIN LEFT XX%	Displays/adjusts minimum swing left speed	0 to 50%	15	
	MAX LEFT XXX%	Displays/adjusts maximum swing left speed	0 to 100%	75	110-130 (see orientation)
	CREEP LEFT XX%	Displays/adjusts maximum swing left speed NOTE: Used when creep switch on pump pot is active	0 to 65%	40	
	MIN RIGHT XX%	Displays/adjusts minimum swing right speed	0 to 50%	22	
	MAX RIGHT XXX%	Displays/adjusts maximum swing right speed	0 to 100%	81	110-130 (see orientation)
	CREEP RIGHT XX%	Displays/adjusts maximum swing right speed NOTE: Used when creep switch on pump pot is active	0 to 65%	47	
MAN TELESCOPE:	ACCEL X.Xs	Displays/adjusts main telescope acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts main telescope deceleration	0.1 to 3.0 sec	1	
	MIN IN XX%	Displays/adjusts minimum main telescope in speed. Same as Creep speed	0 to 65%	15	
	MAX IN XXX%	Displays/adjusts maximum main telescope in speed	0 to 100%	65	45-65 (see orientation)
	MIN OUT XX%	Displays/adjusts minimum main telescope out speed. Same as Creep speed	0 to 65%	15	
	MAX OUT XXX%	Displays/adjusts maximum main telescope out speed	0 to 100%	60	45-65 (see orientation)
PLATFORM LEVEL:	ACCEL X.Xs	Displays/adjusts basket level acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts basket level deceleration	0.1 to 3.0 sec	0.5	
	MIN UP XX%	Displays/adjusts minimum basket level up speed. Same as Creep speed	0 to 65%	55	
	MAX UP XXX%	Displays/adjusts maximum basket level up speed	0 to 100%	70	
	MIN DOWN XX%	Displays/adjusts minimum basket level down speed. Same as Creep speed	0 to 65%	50	
	MAX DOWN XXX%	Displays/adjusts maximum basket level down speed	0 to 100%	70	

Table 6-4. Machine Personality Settings and Function Speeds (Software Version P7.32)

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES	TIME RANGE (SEC)
PLATFORM ROTATE:	ACCEL X.Xs	Displays/adjusts basket rotate acceleration	0.1 to 5.0 sec	1	
	DECEL X.Xs	Displays/adjusts basket rotate deceleration	0.1 to 3.0 sec	0.5	
	MIN LEFT XX%	Displays/adjusts minimum basket rotate left speed. Same as Creep speed	0 to 100%	60	
	MAX LEFT XXX%	Displays/adjusts maximum basket rotate left speed	0 to 100%	60	15-20 (180°)
	MIN RIGHT XX%	Displays/adjusts minimum basket rotate right speed. Same as Creep speed	0 to 100%	60	
	MAX RIGHT XXX%	Displays/adjusts maximum basket rotate right speed	0 to 100%	60	15-20 (180°)
JIB LIFT:	ACCEL X.Xs	Displays/adjusts jib lift acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts jib lift deceleration	0.1 to 3.0 sec	1	
	MIN UP XX%	Displays/adjusts minimum jib up speed. Same as Creep speed	0 to 65%	46	
	MAX UP XXX%	Displays/adjusts maximum jib up speed	0 to 100%	65	70-120
	MIN DOWN XX%	Displays/adjusts minimum jib down speed. Same as Creep speed	0 to 65%	46	
	MAX DOWN XXX%	Displays/adjusts maximum jib down speed	0 to 100%	76	65-100
JIB SWING:	ACCEL X.Xs	Displays/adjusts jib swing acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts jib swing deceleration	0.1 to 3.0 sec	0.5	
	MIN LEFT XX%	Displays/adjusts minimum jib left speed. Same as Creep speed	0 to 65%	48	
	MAX LEFT XXX%	Displays/adjusts maximum jib left speed	0 to 100%	70	60-68 (180°)
	MIN RIGHT XX%	Displays/adjusts minimum jib right speed. Same as Creep speed	0 to 65%	55	
	MAX RIGHT XXX%	Displays/adjusts maximum jib right speed	0 to 100%	70	60-68 (180°)
JIB TELESCOPE:	ACCEL X.Xs	Displays/adjusts jib tele acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts jib tele deceleration	0.1 to 3.0 sec	1	
	MIN IN XX%	Displays/adjusts minimum jib tele in speed. Same as Creep speed	0 to 65%	45	
	MAX IN XXX%	Displays/adjusts maximum jib tele in speed	0 to 100%	70	20-25 (see orientation)
	MIN OUT XX%	Displays/adjusts minimum jib right speed. Same as Creep speed	0 to 65%	40	
	MAX OUT XXX%	Displays/adjusts maximum jib right speed	0 to 100%	70	20-25 (see orientation)

Table 6-4. Machine Personality Settings and Function Speeds (Software Version P7.32)

SUBMENU (DISPLAYED ON ANALYZER 1ST LINE)	PARAMETER (DISPLAYED ON ANALYZER 2ND LINE)	DESCRIPTION	RANGE	DEFAULT VALUES	TIME RANGE (SEC)
JIB LEVEL:	ACCEL X.Xs	Displays/adjusts jib level acceleration	0.1 to 5.0 sec	1.5	
	DECEL X.Xs	Displays/adjusts jib level deceleration	0.1 to 3.0 sec	0.5	
	MIN UP XX%	Displays/adjusts minimum jib level up speed. Same as Creep speed	0 to 65%	60	
	MAX UP XXX%	Displays/adjusts maximum jib level up speed	0 to 100%	100	
	MIN DOWN XX%	Displays/adjusts minimum jib level down speed. Same as Creep speed	0 to 65%	60	
	MAX DOWN XXX%	Displays/adjusts maximum jib level down speed	0 to 100%	100	
GROUND MODE:	M. LIFT UP XXX%	Displays/adjusts fixed main lift up speed	0 to 50%	50	
	M. lift DN XXX%	Displays/adjusts main lift down speed	0 to 100%	60	
	SWING XXX%	Displays/adjusts fixed swing speed	0 to 100%	60	
	PLATFORM LVL XXX%	Displays/adjusts fixed basket level speed	0 to 100%	75	
	PLATFORM ROT XXX%	Displays/adjusts fixed basket rotate speed	0 to 100%	75	
	MAIN TELE XXX%	Displays/adjusts fixed main telescope speed	0 to 100%	60	
	JIB (U/D) XXX%	Displays/adjusts jib lift speed	0 to 100%	80	
		Not displayed if JIB = 0			
	JIB (L/R) XXX%	Displays/adjusts jib swing speed	0 to 100%	80	
		Displayed if JIB = 2			
	JIB TELE XXX%	Displays/adjusts jib tele speed	0 to 100%	80	
	JIB LEVEL XXX%	Displays/adjusts jib level speed	0 to 100%	100	
GEN SET/WELDER:	Engine XXXX RPM	Control generator/welder RPM. Not displayed if GEN SET/WELDER = 0	1200-2800	1800	1800 for 60Hz, 1900 for 50Hz

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6.3 MACHINE ORIENTATION WHEN SETTING FUNCTION SPEEDS

LIFT UP, from platform control, lowest elevation up to maximum elevation, boom retracted, jib retracted.

LIFT DOWN, from platform control, maximum elevation down to minimum elevation, boom retracted, jib retracted.

JIB LIFT UP, from platform control, lowest jib elevation up to maximum jib elevation, boom retracted, jib retracted.

JIB LIFT DOWN, from platform control, maximum jib elevation down to minimum jib elevation, boom retracted, jib retracted.

SWING RIGHT(Max),360 Degrees, from platform control, boom approximately 45° elevation, boom retracted, jib retracted.

SWING LEFT(Max),360 Degrees, from platform control, boom approximately 45° elevation, boom retracted, jib retracted.

TELESCOPE OUT, from platform control, boom @ 0 degrees, 500 lb. capacity selected.

TELESCOPE IN, from platform control, boom @ 0 degrees, 500 lb. capacity selected.

JIB TELESCOPE IN, from platform control, boom horizontal, jib horizontal, 500 lb. capacity selected.

JIB TELESCOPE OUT, from platform control, boom horizontal, jib horizontal, 500 lb. capacity selected.

DRIVE FORWARD (Max), high speed - low torque setting, drive 200 ft. front wheels to front wheels.

Timed after machine has obtained maximum speed.

DRIVE FORWARD (Creep Max), high torque - low speed setting, platform speed knob at full creep, drive forward 50 ft.

DRIVE REVERSE (Creep Max), high torque - low speed setting, platform speed knob at full creep, drive reverse 50 ft.

DRIVE FORWARD (Elevated Max - Boom Beyond Transport), high speed - low torque setting, platform speed knob out of creep, Lift boom above transport, drive forward 50 ft.

DRIVE REVERSE (Elevated Max - Boom Beyond Transport), high speed - low torque setting, platform speed knob out of creep, Lift boom above transport, drive backward 50 ft.

Test Notes

1. Personality settings can be adjusted anywhere within the adjustment range in order to achieve optimum machine performance
2. Stop watch should start when the function is activated. Not with the controller or switch.
3. Unless noted, function speeds should be measured from platform.
4. Platform speed knob must be at full speed (fully clockwise).
5. All test should be done with the oil temp above 100° F (38° C).

6.4 CANBUS COMMUNICATIONS

CANbus: CAN (Control Area Network) is a two wire differential serial link between the Platform Module, Jib Module, Ground Module, Boom Length Angle Module and the Chassis Module providing bi-directional communications.

Two-wire: One wire (yellow) is driven high (5v) and the other low (green) (0v) to send a signal; both wires "float" (2.5v) when no signal is being sent.

Differential: Any electrical line noise can affect the high or the low wires but never both, so communications is not corrupted.

Serial Link: Messages are being sent bit by bit along the wires; the high bus speed allow all modules to be constantly updated around 20 times per second. Typical traffic is 300 - 500 messages per second.

A complete CANbus circuit is approximately 60 ohms, which can be verified at the "T" fitting below the BLAM. Each individual circuit from the modules is approximately 120 ohms.
This machine has 3 CAN Networks. The UGM and BLAM are on the side sheet.

- CAN1 - Unplug MDI and check for 60 Ohms
- CAN2 - Verify 60 Ohm at Diagnostic connector.
- CAN3 - Verify 60 Ohm at Deutz Diagnostic Connector

The GROUND MODULE (UGM) is the master system controller. Most functions are dispatched and coordinated from this module, all other system modules (PLATFORM, JIB, BLAM, CHASSIS) handle sub-tasks. All characterized information (values) are stored into the ground module (i.e., Personalities or Calibrations).

Interlocks: Any device that sends an electrical input. (For an example a limit switch, proximity switch, etc;)

Platform Level: The GROUND MODULE stores the default values and handles interlocks. The PLATFORM MODULE reads the sensors mounted on the platform assembly and controls the Level Up / Down valves to maintain setpoint sent from the GROUND MODULE.

Steer: The GROUND MODULE stores crack points, sends desired drive direction, sends steering mode and sends axle extend / retract commands. The PLATFORM MODULE reports the steering switch position to the GROUND MODULE. The CHASSIS MODULE modulates each steer left / right valve to maintain commanded wheel position.

Drive: The GROUND MODULE stores crack points, sends commands for each drive pump to the CHASSIS MODULE. (Command is computed from drive joystick input, interlocks, wheel angle, etc). CHASSIS MODULE maintains proper current for the drive pumps by modulating PWM outputs.

Lift, Tele, & Swing: The GROUND MODULE stores default values, handles interlocks and calibration information. Lift, Telescope and Swing commands are dependent upon interlocks through out the machine. Boom angle, length and swing are controlled by the GROUND MODULE. The BLAM monitors and communicates (CANbus) to the GROUND MODULE boom angle and boom length via two angle sensors, a length sensor and a load moment pin.

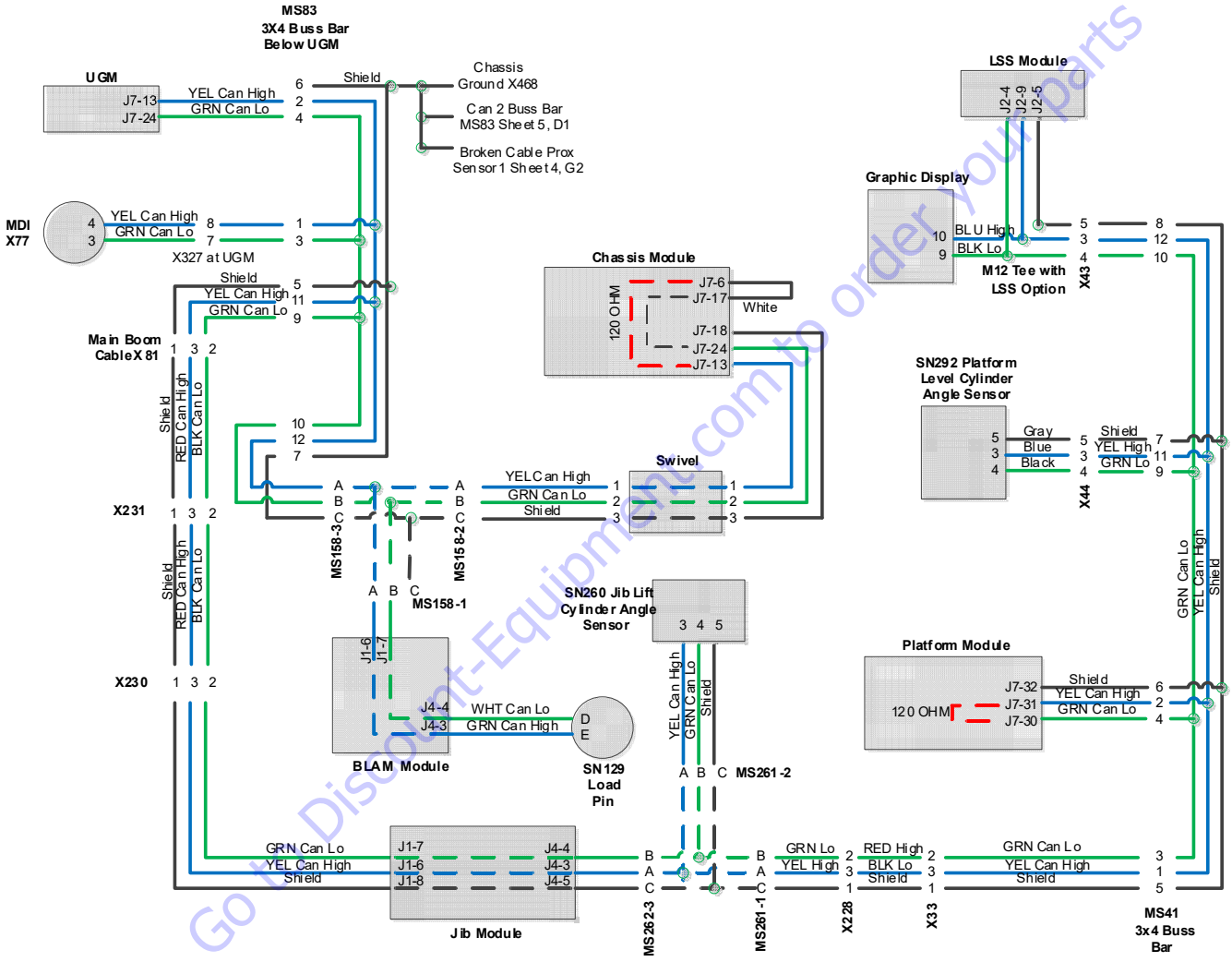


Figure 6-6. Control System CAN Circuit 1 of 2

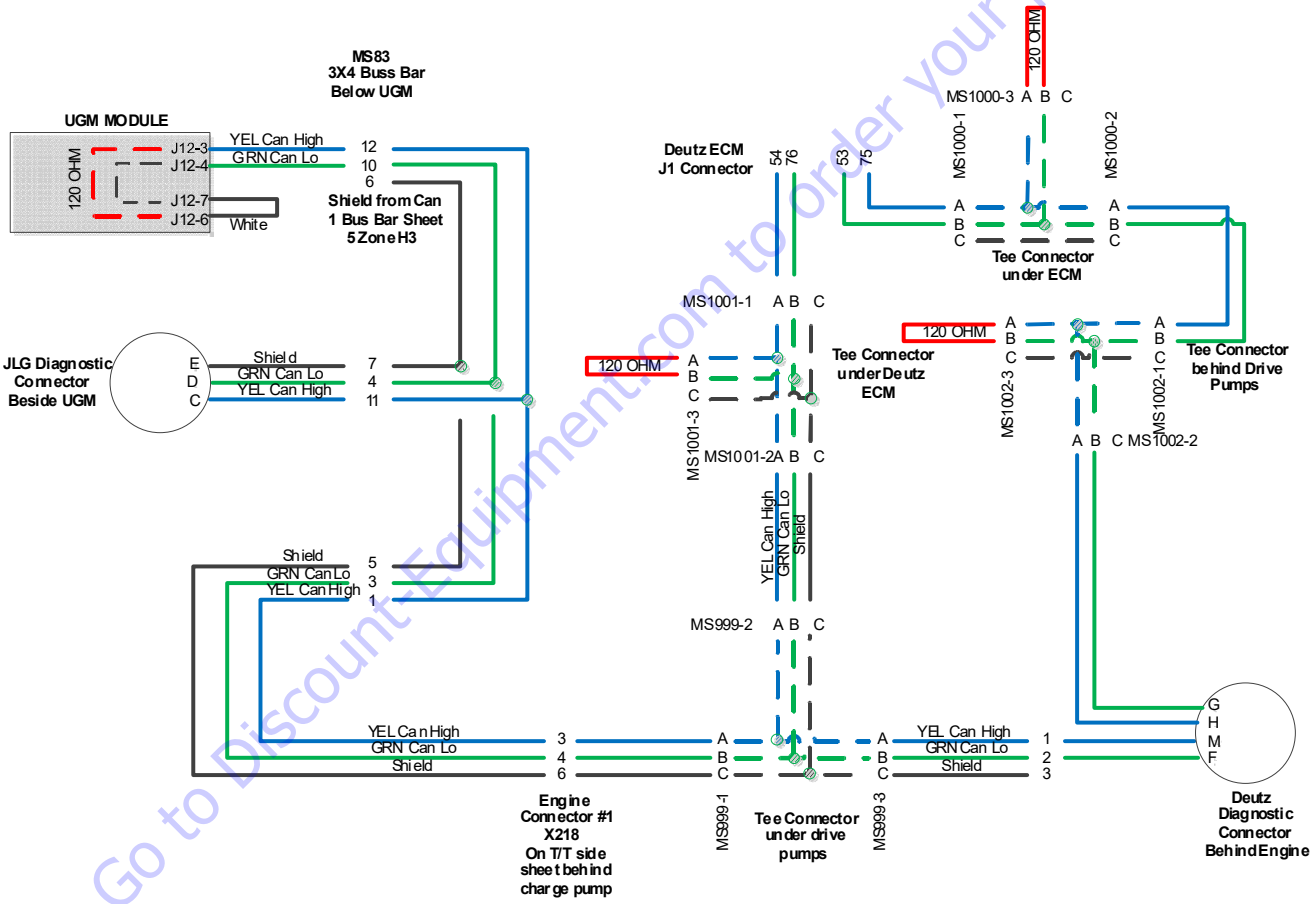


Figure 6-7. Control System CAN Circuit 2 of 2

6.5 CALIBRATION INSTRUCTIONS

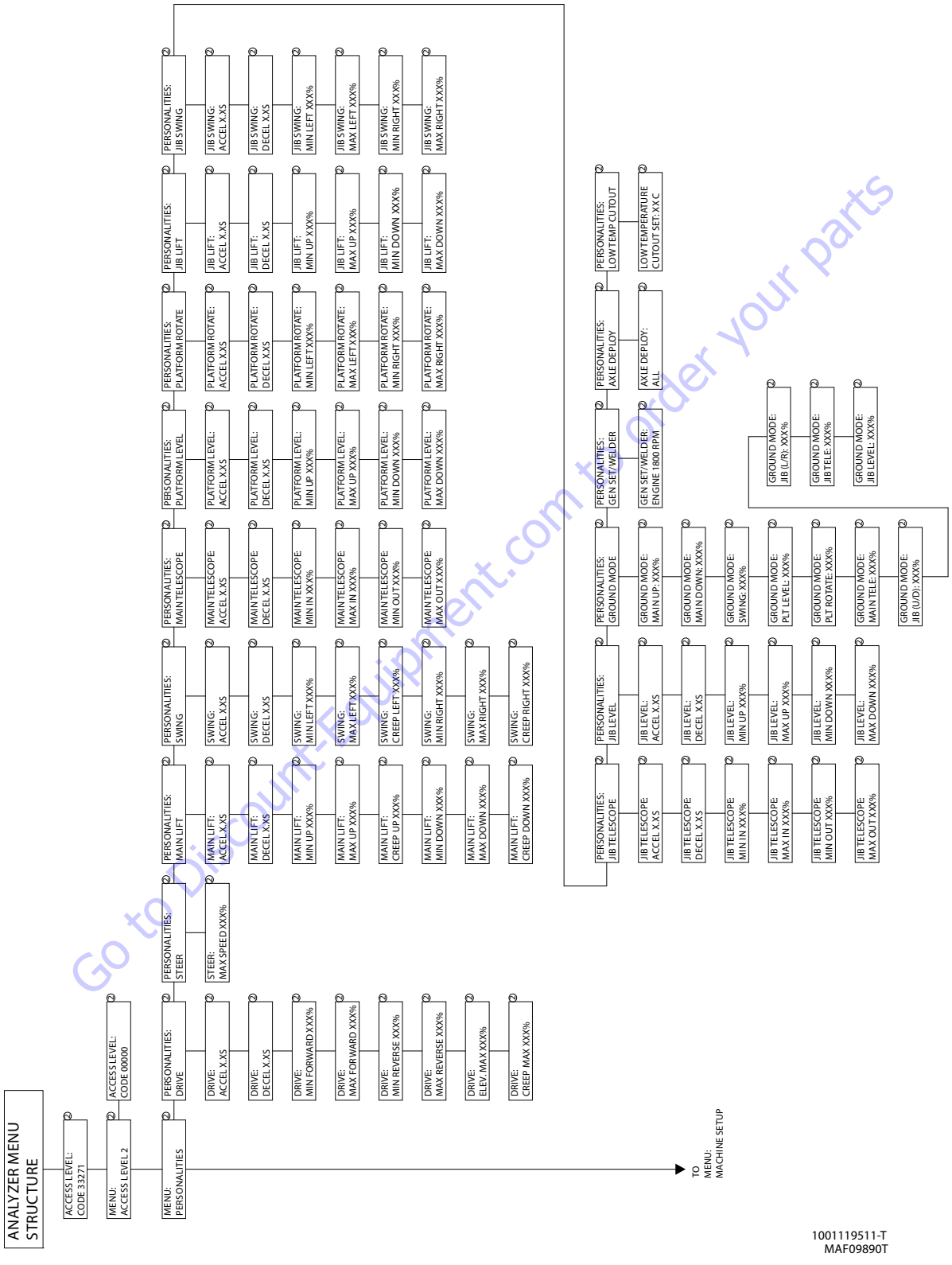
This machine incorporates a variety of sensors and a high degree of function interaction. For safety and proper machine functionality, the calibration procedures must be repeated for any control module replacement, system calibration related fault, or removal or replacement of any sensors, valves, coils, motors, or pumps. The chart below lists the calibrations required and potential reasons for re-calibration. All calibration procedures are menu driven through the use of the standard analyzer. With the exception of steering calibration, no external tools are required to complete the calibration procedures. The user is prompted to exercise the machine in a specific order to use the machines physical properties to consistently establish sensor response and the interaction of valves, pumps, and motors. Steering calibration also uses the analyzer and is performed on one side of the machine at a time requiring the use of a string or other means to determine when the tires are in line with each other. With the exception of the load control calibration, all calibrations are accessed by connecting the analyzer into the control system inside the main terminal box or on the bottom of the platform control box.

Table 6-5. Calibration Instructions

Calibration Procedure	Reasons for Re-calibration
Steering Calibration	Ground module replacement Chassis module replacement Steer sensor removal or replacement Persistent wheel misalignment
Drive Calibration	Ground module replacement BLAM module replacement Drive pump/coil replacement Drive pulls to one side Drive lugs engine Poor slow speed control
Platform Leveling Calibration	Ground module replacement Platform module replacement Platform level sensor removal or replacement Platform level sensor calibration fault
Platform Level Crack Point Calibration	Platform module replacement Ground module replacement Platform level valve/coil replacement Erratic platform leveling
Jib Level Crack Point Calibration	Ground Module replacement Jib Control Module replacement Jib Level Sensor replacement Jib Level valve/coil replacement Erratic Jib leveling

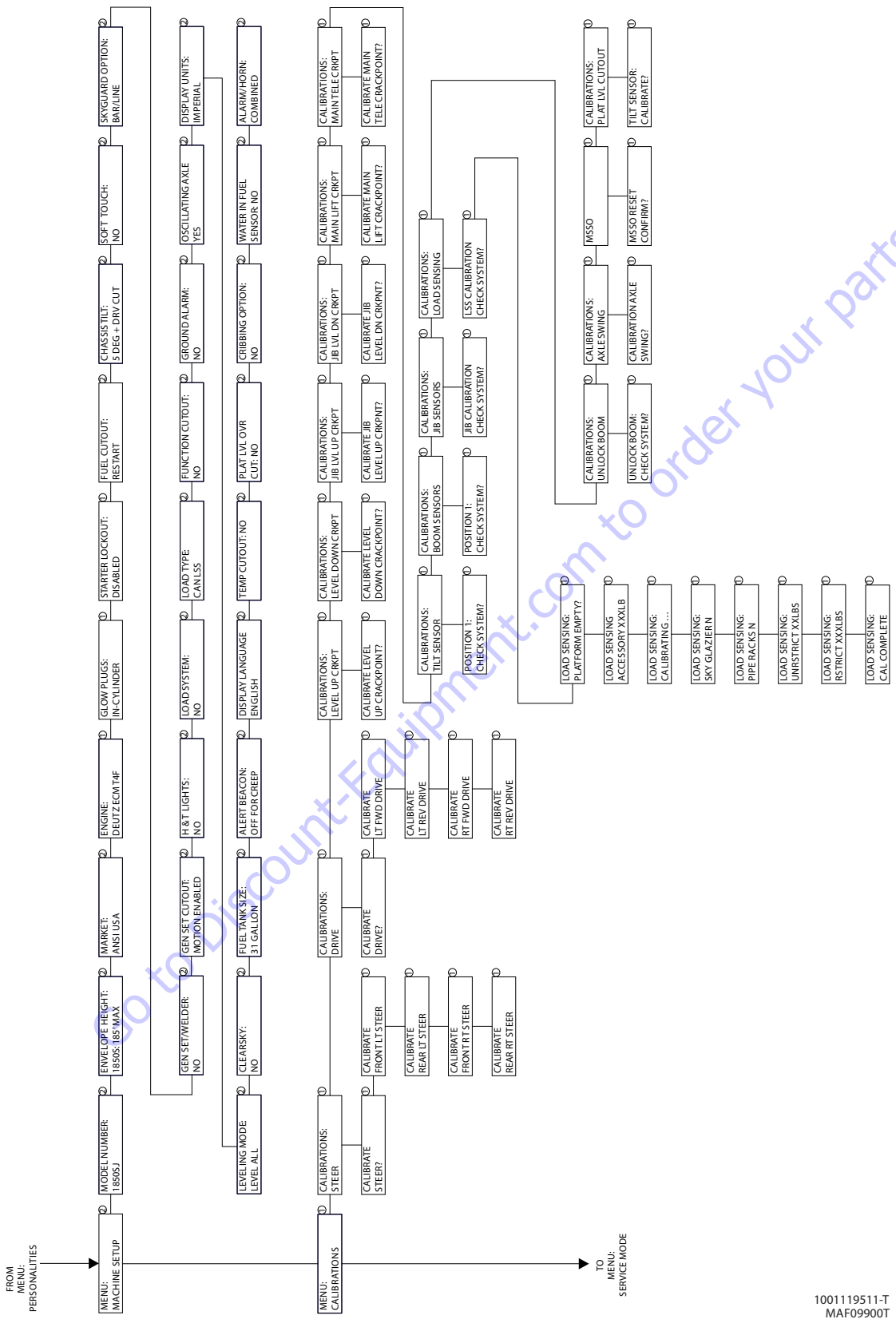
Table 6-5. Calibration Instructions

Lift Crack Point Calibration	Ground module replacement Lift proportional valve/coil replacement Erratic controlled arc operation Erratic controlled boom angle operation
Telescope Crack Point Calibration	Ground module replacement Telescope proportional valve replacement Erratic controlled arc operation Erratic controlled boom angle operation
Jib Level Crack Point Calibration	Jib Control Module replacement Jib level proportional valve replacement
Chassis Tilt Calibration	Ground module removal or replacement Main terminal box removal or replacement Tilt indication inaccuracy External tilt sensor removal or replacement
Boom Sensors Calibration	Ground module removal or replacement BLAM module removal or replacement Main Boom angle sensor removal or replacement Main Boom length sensor removal or replacement Moment pin removal or replacement Main Boom angle sensor calibration fault Main Boom length sensor calibration fault Moment pin fault Failed BCS functional check Boom control system inaccuracies
Jib Sensor Calibration	Ground module removal or replacement Replacement of any Jib sensor Replacement of the Jib Control Module
Platform Load Control Calibration	LSS module replacement Load cell removal or replacement Load control inaccuracy
Axle Extend/Retract Sensors Calibration	Ground module replacement Chassis module replacement Axle extend/retract sensor removal or replacement Axle extend out of range fault



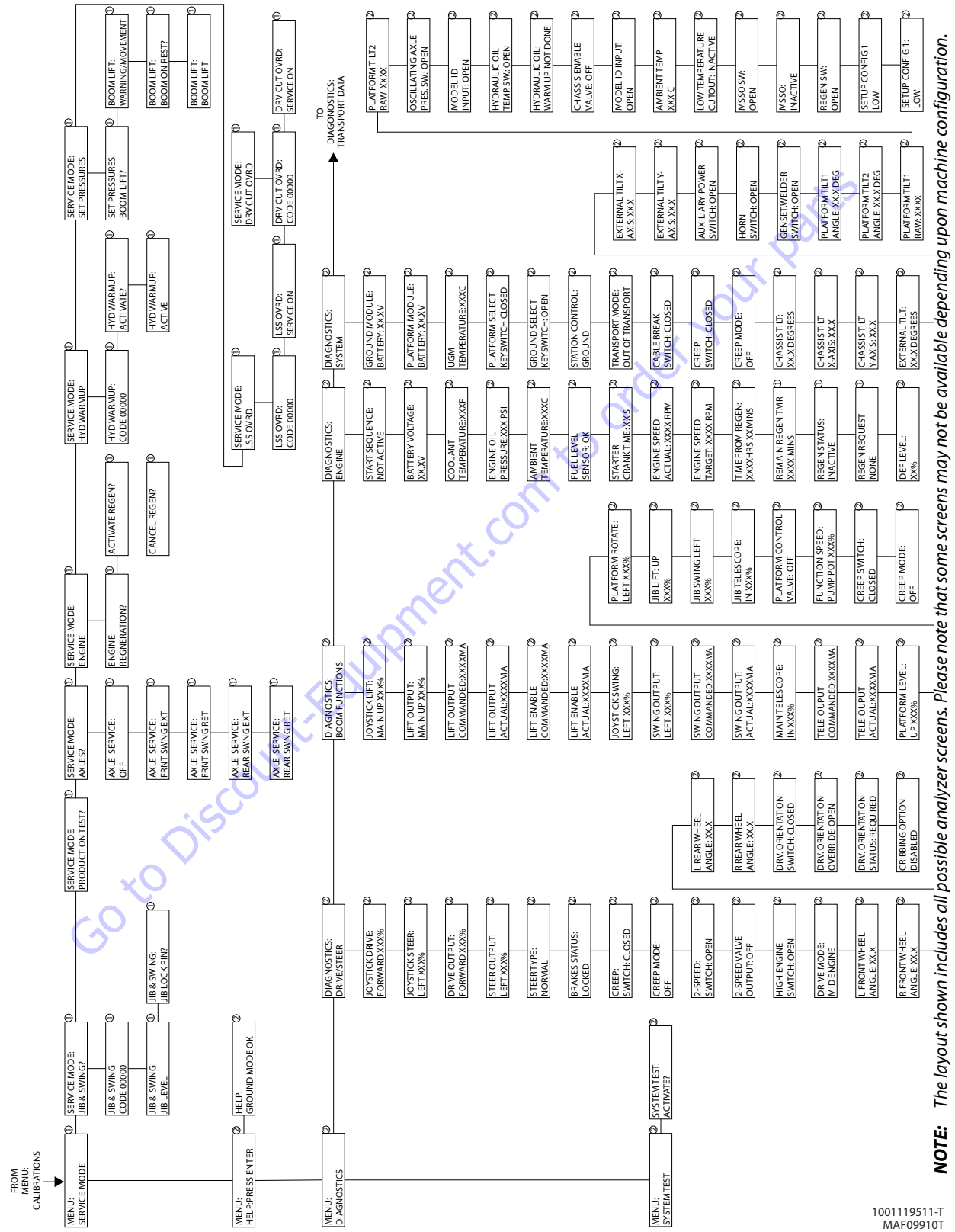
NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-8. Analyzer Flow Chart - Sheet 1 of 5 (Software Version P7.32)



NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-9. Analyzer Flow Chart - Sheet 2 of 5 (Software Version P7.32)



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NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available depending upon machine configuration.*

Figure 6-10. Analyzer Flow Chart - Sheet 3 of 5 (Software Version P7.32)