



An Oshkosh Corporation Company

Service and Maintenance Manual

Model ***450A Series II*** ***450AJ Series II***

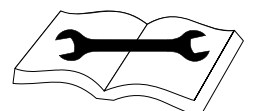
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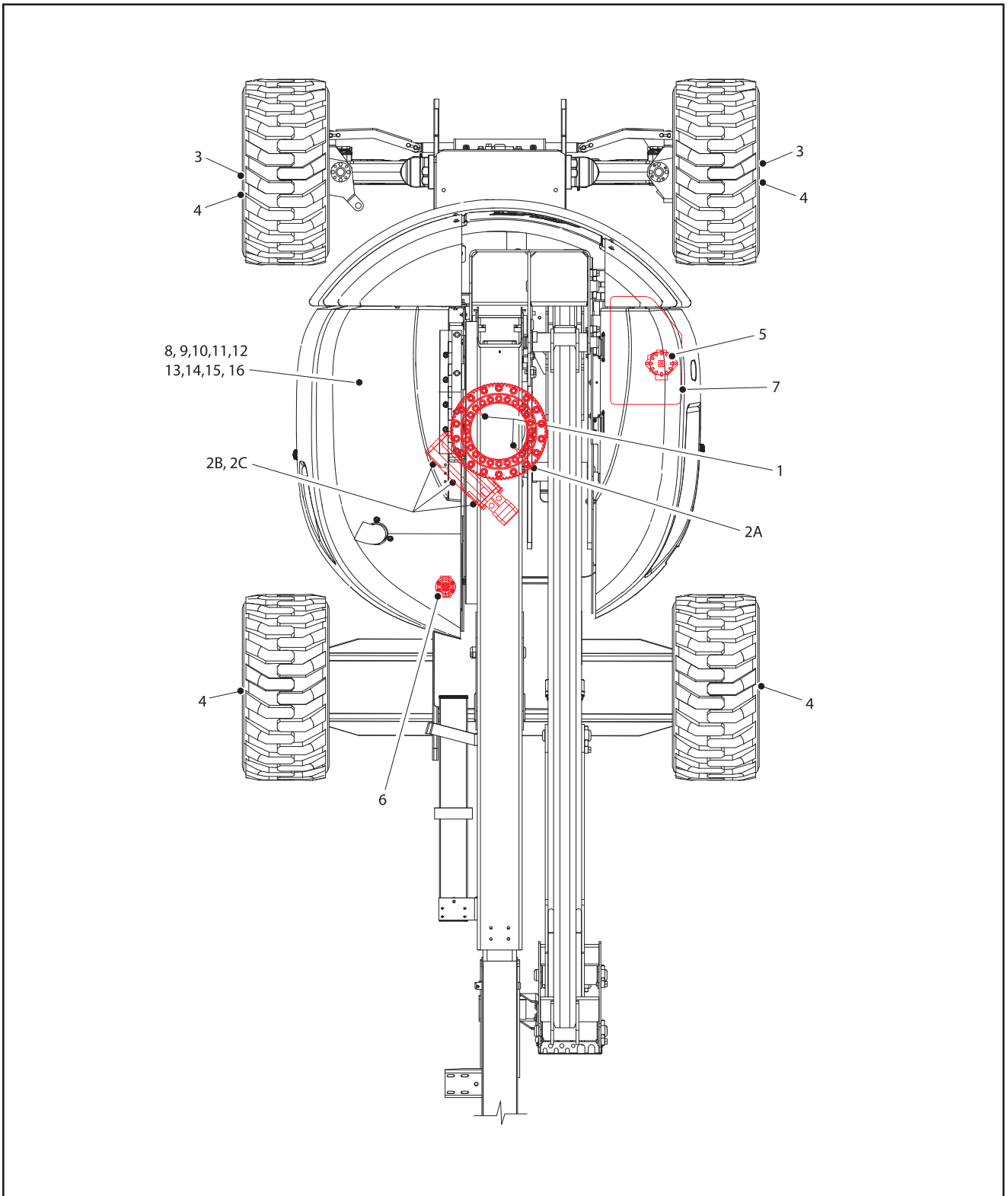


Figure 1-2. Operator Maintenance and Lubrication Diagram

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)						
CLASS 10.9 METRIC BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*						
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.20	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.18	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5			
7	1	28.90	18.0	25.2	22.7	18.9
8	1.25	36.60	22.8	36.5	32.8	27.4
10	1.5	58.00	36.1	70	65	55
12	1.75	84.30	52.5	125	115	95
14	2	115	71.6	200	180	150
16	2	157	97.8	315	280	235
18	2.5	192	119.5	430	385	325
20	2.5	245	152.5	610	550	460
22	2.5	303	189.0	830	750	625
24	3	353	222.0	1065	960	800
27	3	459	286.0	1545	1390	1160
30	3.5	561	349.5	2095	1885	1575
33	3.5	694	432.5	2855	2570	2140
36	4	817	509.0	3665	3300	2750
42	4.5	1120	698.0	5865	5275	4395

NO. 500059 REV. J

- NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
 2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
 *3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM
 4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

Figure 1-9. Torque Chart (METRIC Fasteners - Sheet 6 of 7)

SECTION 3. CHASSIS & TURNTABLE

3.1 TIRES AND WHEELS

Tire Inflation

Pneumatic tire air pressure must be equal to air pressure stenciled on side of JLG product or rim decal for safe and proper machine operation.

Tire Damage

PNEUMATIC TIRES

JLG Industries, Inc. recommends when any cut, rip, or tear is discovered that exposes sidewall or tread area cords in the tire, measures must be taken to remove the JLG product from service immediately. Arrangements must be made for replacement of the tire or tire assembly.

POLYURETHANE FOAM FILLED TIRES

JLG Industries, Inc. recommends when any of the following are discovered, measures must be taken to remove the JLG product from service immediately and arrangements made for replacement of tire or tire assembly:

- Smooth, even cut through cord plies which exceeds 3" (7.5 cm) in total length.
- Tears or rips (ragged edges) in cord plies which exceeds 1" (2.5 cm) in any direction.
- Punctures which exceed 1" in diameter.
- Damage to bead area cords.

NOTE: *If tire is damaged but within above criteria, tire must be inspected daily to ensure damage does not exceed allowable criteria.*

Tire Replacement

JLG recommends replacement tire be the same size, ply, and brand as originally installed on machine. Refer to the JLG Parts Manual for part number of approved tires for a particular machine model. If not using a JLG approved replacement tire, we recommend replacement tires have the following characteristics:

- Equal or greater ply/load rating and size of original
- Tire tread contact width equal or greater than original
- Wheel diameter, width, and offset dimensions equal to original
- Approved for the application by the tire manufacturer (including inflation pressure and maximum tire load)

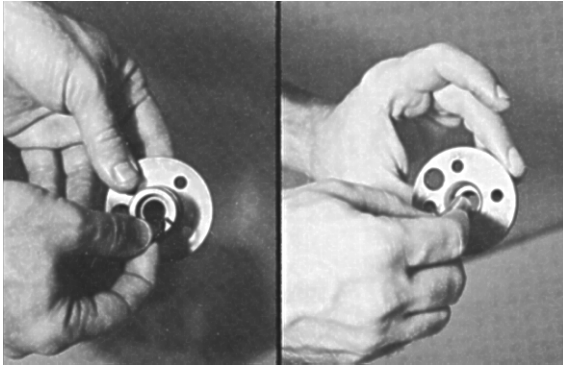
Unless specifically approved by JLG Industries Inc. do not replace a foam filled or ballast filled tire assembly with a pneumatic tire. When selecting and installing a replacement tire, ensure all tires are inflated to pressure recommended by JLG. Due to size variations between tire brands, both tires on the same axle should be identical.

Wheel Replacement

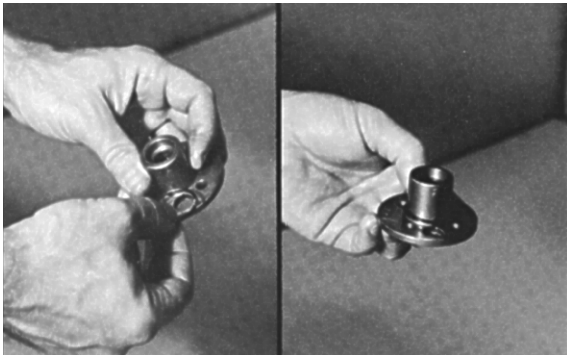
Rims installed on each product model are designed for stability requirements which consist of track width, tire pressure, and load capacity. Size changes such as rim width, center piece location, larger or smaller diameter, etc., without written factory recommendations, may result in unsafe stability conditions.

Cover Sub-Assembly

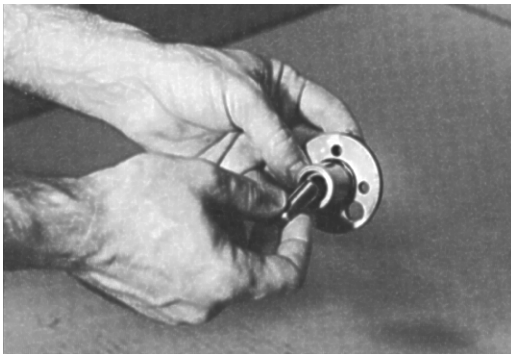
1. Using disconnect rod, push O-ring (6F) into groove inside cover cap (6B).



2. Place O-ring (6G) onto cover cap (6B) so it rests against flange of cover cap.



3. Insert disconnect rod (6E) into cover cap (6B).



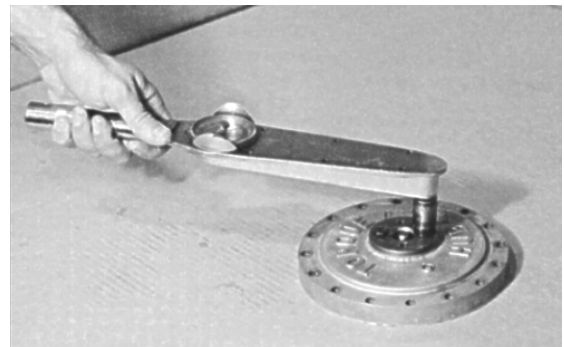
4. Set cover (6A) on table, exterior side up. Place cover cap (6B) on cover (6A). Align pipe plug hole in cover cap over pipe plug hole in cover.



5. Place two cover cap bolts (6C) in any two bolt holes 180° apart on cover cap (6B) and tighten bolts.



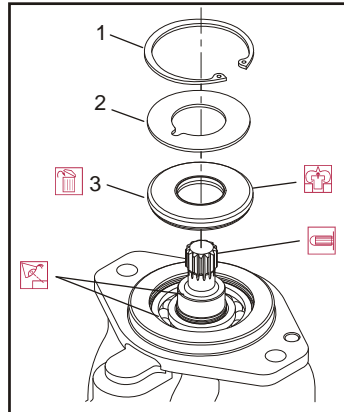
6. Using a torque wrench, apply 36 to 49 in-lb (4 to 5 Nm) of torque to both bolts (6C).



Shaft Seal Replacement

REMOVAL

1. Remove snap ring (1) and support washer (2).



1. Snap Ring
2. Support Washer
3. Shaft Seal

Figure 3-7. Removing Shaft Seal

NOTE: To avoid damaging shaft during removal, install a large sheet metal screw into chuck of a slide hammer. Drive screw into seal surface and use slide hammer to pull seal.

2. Carefully pry out and discard shaft seal (3).

INSPECT COMPONENTS

Inspect new seal, motor housing seal bore, and sealing area on shaft for rust, wear, and contamination. Polish shaft and clean housing if necessary.

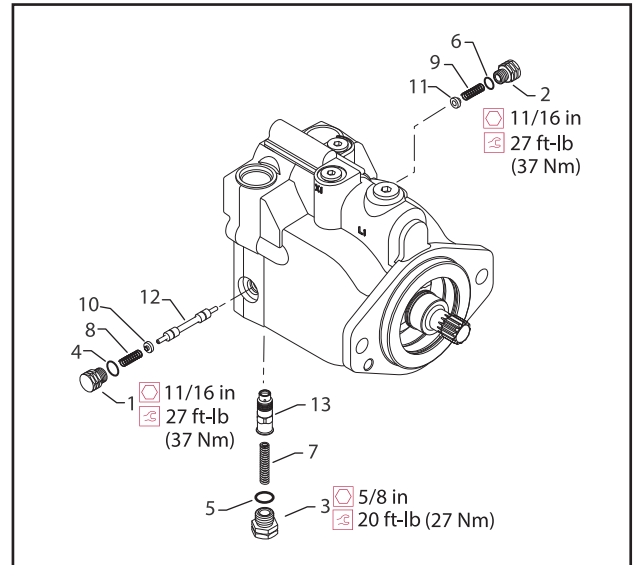
INSTALLATION

1. Cover shaft splines with an installation sleeve to protect shaft seal during installation.
2. Install a new shaft seal (3) with cupped side facing motor. Press seal into housing until it bottoms out. Press evenly to avoid binding and damaging seal.
3. Install seal support washer (2).
4. Install snap ring (1).
5. Remove installation sleeve.

Loop Flushing Valve

REMOVAL

1. Remove plug (1) and (2) with 11/16" internal hex wrench.



1. Plug
2. Plug
3. Plug
4. O-ring
5. O-ring
6. O-ring
7. Spring
8. Spring
9. Spring
10. Washer
11. Washer
12. Shift Spool
13. Orifice Poppet

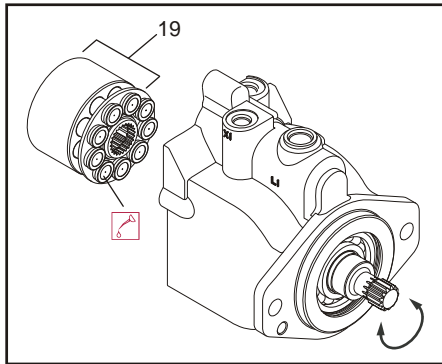
Figure 3-8. Loop Flushing Spool

2. Use 1/4" in hex wrench to remove plug (3).
3. Remove O-rings (4, 5, and 6).
4. Use pliers to remove centering springs (7, 8, and 9).
5. Remove spring retaining washers (10 and 11).
6. Remove shift spool (12).
7. Remove orifice poppet (13).
8. Inspect new O-rings and sealing area for rust, wear, or contamination. Check springs and poppet for wear.

INSTALLATION

1. Install orifice poppet (13).
2. Install shift spool (12).
3. Install spring retaining washers on springs (10 and 11).
4. Carefully install centering springs (7, 8, and 9).
5. Install new O-rings (6, 4, and 5).
6. Use 1/4" hex wrench to torque plug (3) to 20 ft-lb (27 Nm).
7. Use 11/16" internal hex and torque plugs (2 and 1) to 27 ft-lb (37 Nm).

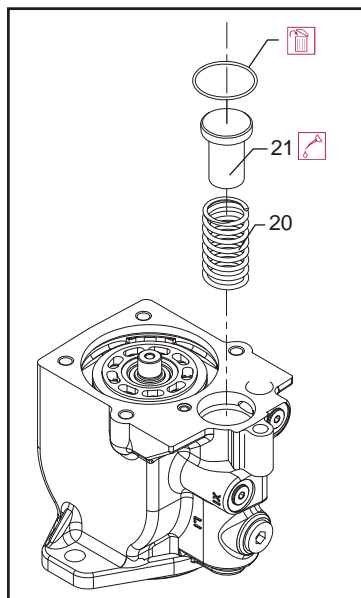
10. Verify swashplate and bearings are properly seated. Install cylinder kit (19) onto shaft. Install with slippers facing swashplate. Rock shaft to align block splines and slide cylinder kit into place. Orient motor with shaft pointing downward and verify cylinder kit, swashplate, journal bearings, and servo piston are all secure and properly installed.



19. Cylinder Kit

Figure 3-22. Cylinder Kit Installation

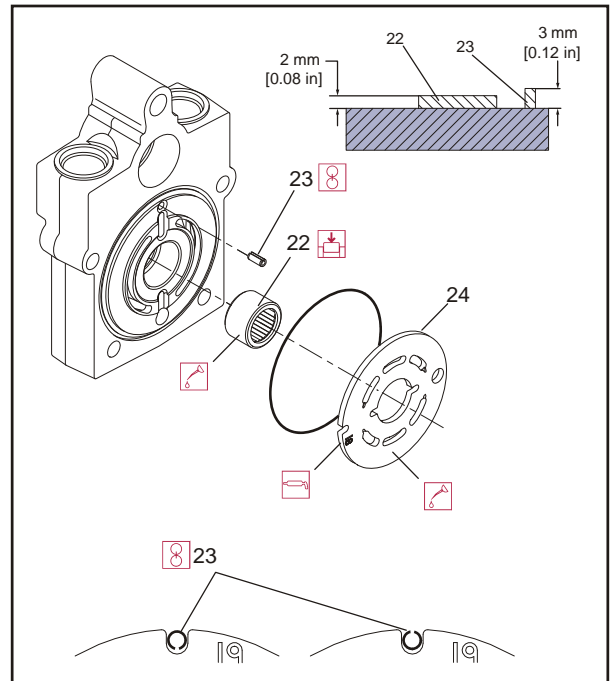
11. Lubricate and install servo spring (20), and minimum angle stop (21) into housing bore.



20. Servo Spring
21. Minimum Angle Stop

Figure 3-23. Servo Spring and Minimum Angle Stop

12. Press rear shaft bearing (22) into endcap. Install bearing with letters facing out. Press until bearing surface is 0.08 ± 0.01 in (2 ± 0.25 mm) above endcap surface.



22. Rear Shaft Bearing
23. Timing Pin
24. Valve Plate

Figure 3-24. Valve Plate and Rear Bearing

13. Install timing pin (23) into bore in endcap. Install pin with groove facing toward or away from shaft. Press pin until end protrudes 0.12 ± 0.01 in (3 ± 0.25 mm) above endcap surface.
14. Install valve plate (24) on endcap. Install valve plate with yellow surface toward cylinder block. Align slot in valve plate with timing pin. Apply a liberal coat of assembly grease to endcap side of valve plate to keep it in place during installation.

5. Use suitable lift equipment and install bearing/rotation box assembly to frame with soft spot (red) 90 degree relative to load axis. If reusing old bearing, align scribed line of outer bearing race with scribed mark on frame.

⚠ WARNING

SWING BEARING IS THE ONLY STRUCTURAL LINK BETWEEN FRAME AND TURNTABLE. JLG INDUSTRIES RECOMMENDS ALL REMOVED GRADE 8 BEARING NUTS AND BOLTS BE DISCARDED AND REPLACED WITH NEW NUTS AND BOLTS. IT IS IMPERATIVE THAT REPLACEMENT HARDWARE MEETS JLG SPECIFICATIONS. USE OF GENUINE JLG HARDWARE IS HIGHLY RECOMMENDED.

6. Apply a light coating of thread locking compound JLG PN 0100019 to new bearing bolts. Loosely install bolts and washers through frame and outer bearing race.

NOTICE

IF COMPRESSED AIR OR ELECTRICALLY OPERATED IMPACT WRENCH IS USED TO TIGHTEN BEARING ATTACHMENT BOLTS, CHECK TORQUE SETTING ACCURACY OF TOOL BEFORE USE.

7. Tighten bolts to initial torque of 130 ft-lb (176 Nm) following torque sequence shown in Figure 3-34., Swing Bearing (Dohi) Torque Sequence. Tighten to final torque of 190 ft-lb (257 Nm) following same sequence.

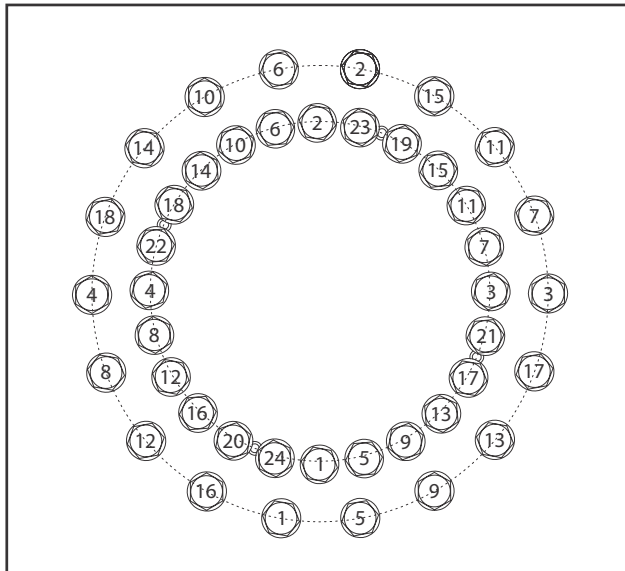


Figure 3-34. Swing Bearing (Dohi) Torque Sequence

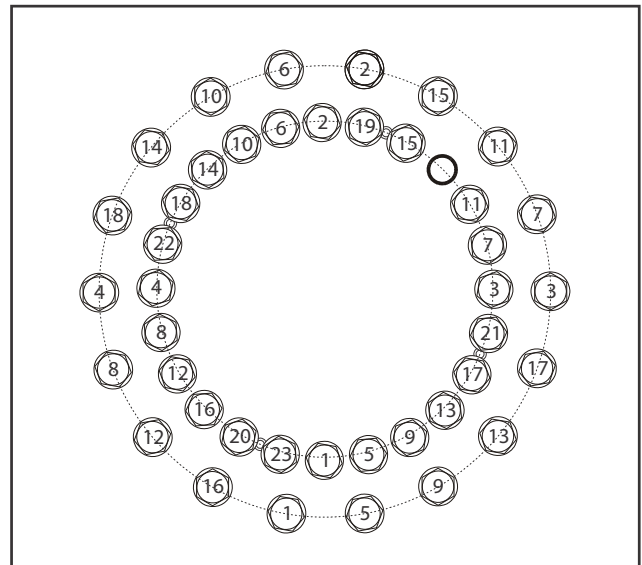


Figure 3-35. Swing Bearing (Jing Wei) Torque Sequence

8. Remove lifting equipment from bearing.
9. Use suitable lift equipment to carefully position turntable assembly above machine frame.
10. Carefully lower turntable onto swing bearing. Align scribed line of inner race of bearing with scribed mark on turntable. If a new swing bearing is used, align 1/8" NPT holes with notches in frame.

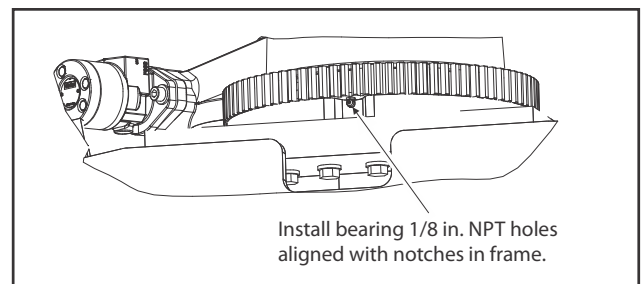


Figure 3-36. Swing Bearing Alignment

11. Apply light coating of JLG Thread Locking Compound PN 0100019 to new bearing bolts and install through turntable and inner race of bearing.
12. Tighten bolts to an initial torque of 130 ft-lb (176 Nm) following torque sequence shown in Figure 3-34., Swing Bearing (Dohi) Torque Sequence. Tighten to a final torque of 190 ft-lb (257 Nm) following same sequence.
13. Remove lift equipment.
14. Route hydraulic lines through center of turntable and frame. Connect as tagged prior to removal.
15. Activate hydraulic system following all safety precautions. Check swing system for proper and safe operation.

- 14.** Measure and note depth or location of bearing/bushing (13) in relation to housing wear plate surface, and depth or location of bearing/bushing (19) in relation to beginning of bearing/bushing counter bore before removing bearings/bushings. This ensures correct reassembly of new bearings/bushings.



- 15.** Use a suitable size bearing puller to remove bearing/bushings (19) and (13) from housing (18) If Bearings, bushing or thrust washers must be replaced without damaging housing. Remove thrust washers (14) and thrust bearing (15) if previously retained in housing by bearing (13).



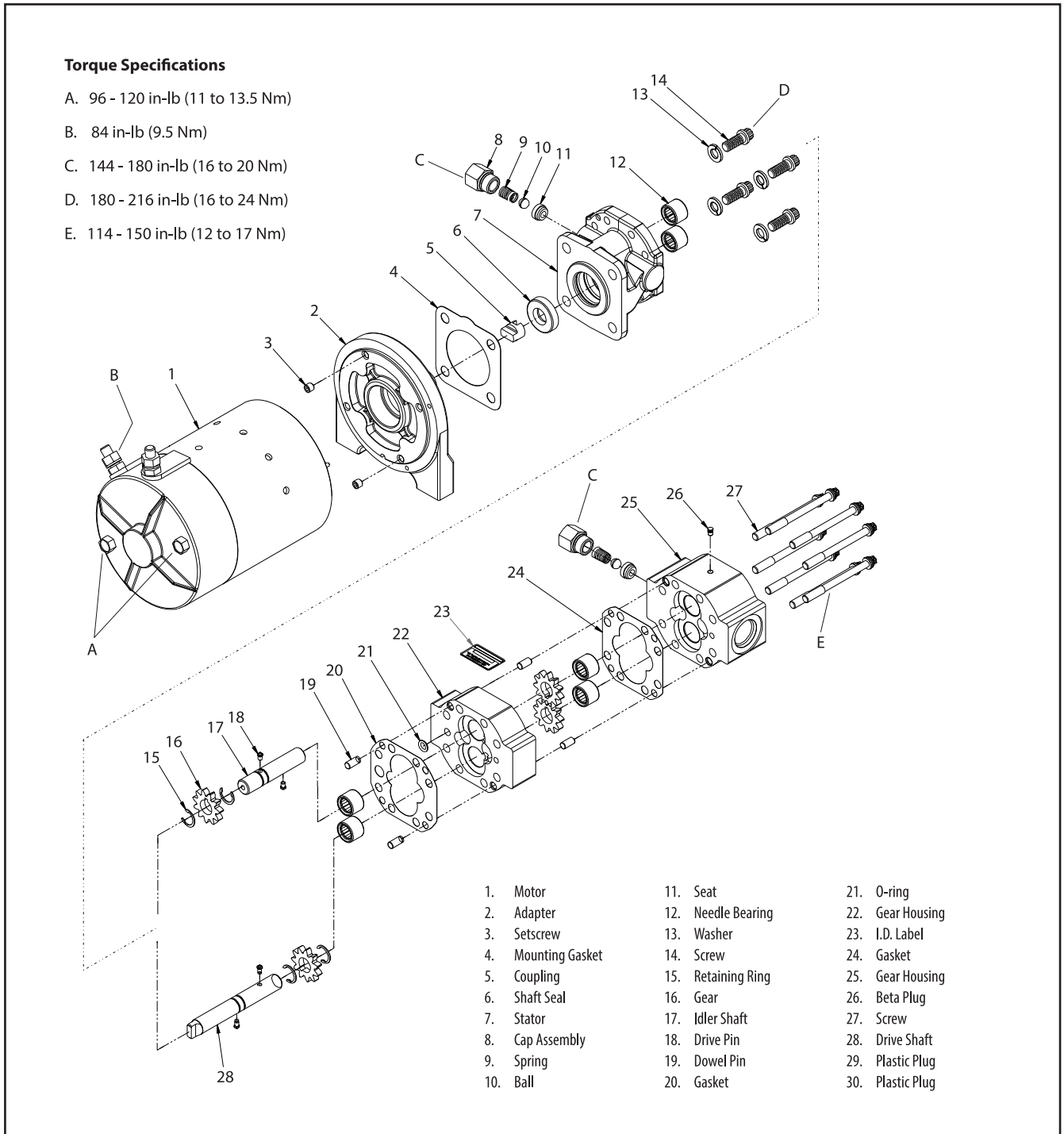
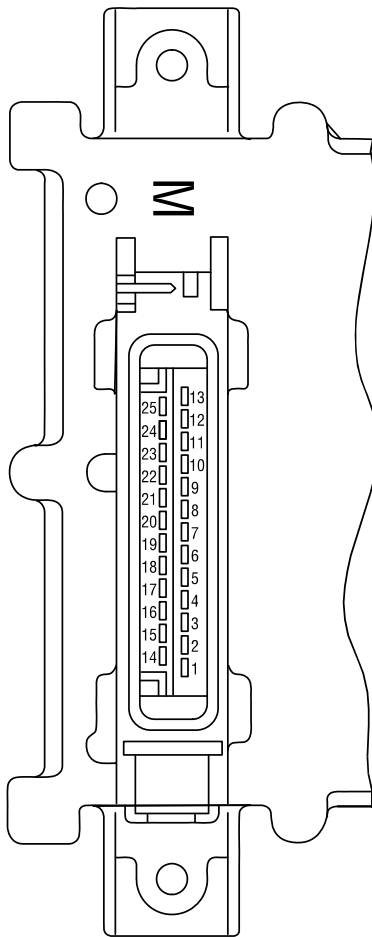


Figure 3-42. Auxiliary Pump



Pin No.	Designation	Description
1	Reserve	Reserve
2	Output: digital 3	Digital output for solenoid ¹⁾
3	Output: digital 4	For heating flange (optional)/ glow plug (optional)
4	Input (optional) Temp 1	Fuel temperature ²⁾
5	Input (optional) Temp 2	Charge air temperature
6	Input (optional) DigIn 5	Coolant level / oil level
7	Output: PWM2/digital 6	
8	GND	Reference potential for analog signal at pin 9
9	Input: analog 7	Analog input for Coolant temperature sensor (NTC)
10	GND	Reference potential for analog signal at pin 11
11	Multi-function input: speed 2/DigIn 2	Digital input second engine speed (crankshaft) (optional) and speed signal (optional)
12	GND	Reference potential for analog signal at pin 13
13	Input: speed 1	Digital input first engine speed (camshaft)
14	STG -	PWM output, signal for actuator coil
15	STG +	PWM output, signal for actuator coil
16	Screen	Screening regulating rod travel sensor (for lines 17, 18, 19)
17	RF -	General connection for reference and measuring coil
18	RF REF	Analog input, reference signal of the reference coil
19	RF MESS	Analog input, measuring signal of the measuring coil
20	GND	Reference potential for signal at pin 21
21	Input: analog 4/digital 9	Analog input 4 (sensor signal oil pressure sensor) or digital input 9
22	+5 V REF	+5 V Reference voltage for signal at pin 21 (max. 15 mA)
23	GND	Reference potential for signal at pin 24
24	Input: analog 2/digital 7	Analog input 2 (sensor signal charge air) or digital input 7
25	+5 V LDA	+5 V Reference potential for signal at pin 24 (max. 15 mA)

1) For continuous power: < 4 A

2) Corresponds to special function "fuel temperature compensation at the EMR (0211 2571)

Figure 3-51. EMR 2 Engine Plug Pin Identification

Change Engine Oil

NOTICE

ALWAYS CHANGE OIL FILTER WHEN CHANGING OIL. CHANGE OIL WHEN ENGINE IS WARM FROM OPERATION AS OILS WILL FLOW FREELY AND CARRY AWAY MORE IMPURITIES.

To change oil:

1. Start engine and run until it reaches normal operating temperature.
2. Stop engine.
3. Remove drain plug and allow oil to drain.
4. Remove and discard oil filter and its sealing ring.
5. Coat sealing ring on filter with clean engine oil and wipe sealing surface on filter mounting surface to remove dust, dirt and debris. Tighten filter securely (follow filter manufacturers instructions). Do not over tighten.
6. Check sealing ring on drain plug for damage, replace if necessary, wipe plug with a clean rag, and wipe sealing surface on pan and reinstall pan plug. Do not over tighten.
7. Fill crankcase with oil.
8. Start engine and check for oil leaks.
9. Stop engine and check oil level is at "FULL".
10. Properly dispose of oil and filter.

Coolant Fill Procedure - Dual Fuel Engine

NOTICE

DAMAGE TO ENGINE COULD OCCUR IF NOT PROPERLY FILLED WITH COOLANT. LPG FUELED ENGINES ARE MOST PRONE TO CREATING AN AIR LOCK DURING A COOLANT FILL OPERATION DUE TO THE ELECTRONIC PRESSURE REGULATOR (EPR) BEING THE HIGHEST POINT IN THE COOLING SYSTEM. AN EPR THAT APPEARS TO HAVE FROST FORMING ON IT IS A SIGN THE ENGINE COOLING SYSTEM CONTAINS AIR. APPEARANCE AND TEMPERATURE OF THE EPR SHOULD BE MONITORED DURING COOLANT FILL OPERATION. A WARM EPR IS AN INDICATION THAT THE COOLING SYSTEM IS PROPERLY FILLED AND FUNCTIONING.

CAUTION

MAKE SURE ENGINE IS COOL BEFORE PERFORMING ANY MAINTENANCE WORK.

1. Loosen worm gear clamp on coolant line to EPR as shown below and remove hose from EPR. Place a rag under hose to prevent coolant from running onto engine/machine.



2. Remove radiator cap. Fill radiator with coolant until coolant starts to appear from previously removed hose at EPR. Reinstall hose to EPR and continue to fill radiator with coolant.



3. With radiator cap still removed, start engine and run until thermostat opens. Thermostat opens at 170° F (77° C), which can be checked using the JLG handheld analyzer.

NOTICE

WHILE ENGINE IS RUNNING, AIR AND/OR STEAM MAY BE PRESENT COMING FROM RADIATOR. THIS IS NORMAL.

4. Run engine for 5 minutes after it reaches operating temperature. Shut engine off and continue to step 5.

Electronic Pressure Regulator (EPR) Replacement

REMOVAL

NOTE: Refer to Figure 3-59. GM 3.0 Dual Fuel System Components.

1. Unplug EPR (102) electrical connector.
2. Remove hoses from EPR.
3. Remove four flange nuts (107) and EPR from Mixer (104).
4. If new EPR is being installed, remove and retain hose adapter (103) and four bolts (105).

INSTALLATION

1. If new EPR is being installed, install adapter (103) and four bolts (105) to EPR.
2. Install EPR (102) on Mixer (104). Secure with four flange nuts (107).
3. Reattach all hoses.
4. Start engine and leak check all fittings and connections.

Regulator Replacement

NOTE: Refer to Figure 3-59. GM 3.0 Dual Fuel System Components.

REMOVAL

1. Disconnect and remove Lock-Off Valve (12) from Regulator (16).
2. Remove hoses from regulator.
3. Remove regulator from engine.

INSTALLATION

1. Install Regulator (16) on engine.
2. Install hoses on regulator.
3. Install Lock-Off Valve (12) to Regulator. Reconnect Lock-Off Valve.
4. Start engine and leak check all fittings and connections.

Coolant Hose Replacement

REMOVAL

1. Drain coolant.
2. Using hose clamp pliers, disconnect both hose clamps on each hose.
3. Remove hose from fittings.

INSTALLATION

NOTE: Use hose material and lengths specified by JLG.

1. Install hose clamps to each hose and set clamp back on each hose to make installation easier.
2. Fit hose to fittings.
3. Secure by positioning each of the clamps.

Vapor Hose Replacement

REMOVAL

1. Disconnect both hose clamps using hose clamp pliers.
2. Remove vapor hose from each fitting.

INSTALLATION

NOTICE

VAPOR SUPPLY HOSE IS SPECIFICALLY DESIGNED FOR THIS EQUIPMENT. DO NOT USE HOSE MATERIAL OR LENGTH OTHER THAN JLG SPECIFIED PARTS.

1. Install hose clamps and set back on each hose.
2. Reinstall vapor hose to each fitting.
3. Reset clamps.
4. Start engine and check for leaks.

Table 3-13. Symptom Diagnosis

Checks	Action
Lack of Power, Sluggishness, or Sponginess	
DEFINITION: Engine delivers less than expected power. There is little or no increase in speed when partially applying accelerator pedal.	
Preliminary Checks	<ol style="list-style-type: none"> 1. Refer to Important Preliminary Checks. 2. Refer to LPG Fuel system OBD System Check 3. Compare customer's vehicle with a similar unit. Make sure customer has an actual problem. Do not compare power output of vehicle operating on LPG to a vehicle operating on gasoline as fuels have different drive feel characteristics. 4. Remove air filter and check for dirt or restriction. 5. Check vehicle transmission Refer to OEM transmission diagnostics.
Fuel System Checks	<ol style="list-style-type: none"> 1. Check for a restricted fuel filter, contaminated fuel, or improper fuel pressure. Refer to LPG Fuel System Diagnosis. 2. Check for the proper ignition output voltage with the spark tester J 26792 or the equivalent. 3. Check for proper installation of the mixer module assembly. 4. Check all air inlet ducts for condition and proper installation. 5. Check for fuel leaks between the LPR and the mixer. 6. Verify that the LPG tank manual shut-off valve is fully open. 7. Verify that liquid fuel (not vapor) is being delivered to the LPR.
Sensor Checks	<ol style="list-style-type: none"> 1. Check Heated Exhaust Gas Oxygen Sensor (HEGO) for contamination and performance. 2. Check proper operation of MAP sensor. 3. Check proper operation of TPS sensor.
Exhaust System Checks	<p>Check exhaust system for a possible restriction:</p> <ul style="list-style-type: none"> - Inspect exhaust system for damaged or collapsed pipes. - Inspect muffler for signs of heat distress or for possible internal failure. - Check for possible plugged catalytic converter.
Engine Mechanical Check	<p>Check the engine for the following:</p> <ul style="list-style-type: none"> - Engine compression - Valve timing - Improper or worn camshaft. Refer to Engine Mechanical in the Service Manual.
Additional Check	<ol style="list-style-type: none"> 1. Check ECM grounds for being clean, tight, and in their proper locations. 2. Check generator output voltage. 3. If all procedures have been completed and no malfunction has been found, review and inspect the following items: <ul style="list-style-type: none"> - Visually and physically inspect all electrical connections within suspected circuit and/or systems. - Check scan tool data.
Poor Fuel Economy	
DEFINITION: Economy is noticeably lower as shown by refueling records.	
Preliminary Checks	<ol style="list-style-type: none"> 1. Refer to Important Preliminary Checks. 2. Check air cleaner element (filter) for dirt or restriction. 3. Visually (Physically) check vacuum hoses for splits, kinks, and proper connections. 4. Check operator driving habits for the following items: <ul style="list-style-type: none"> - Is there excessive idling or stop and go driving? - Are tires at correct air pressure? - Are excessively heavy loads being carried? - Is there often rapid acceleration? 5. Suggest to owner to fill fuel tank and recheck fuel economy. 6. Suggest a different operator use equipment and record results.
Fuel System Checks	<ol style="list-style-type: none"> 1. Check LPR fuel pressure. Refer to LPG Fuel System Diagnosis. 2. Check fuel system for leakage.
Sensor Checks	Check Temperature Manifold Absolute Pressure (TMAP) sensor.

The desired action is set by OEM calibration engineers.

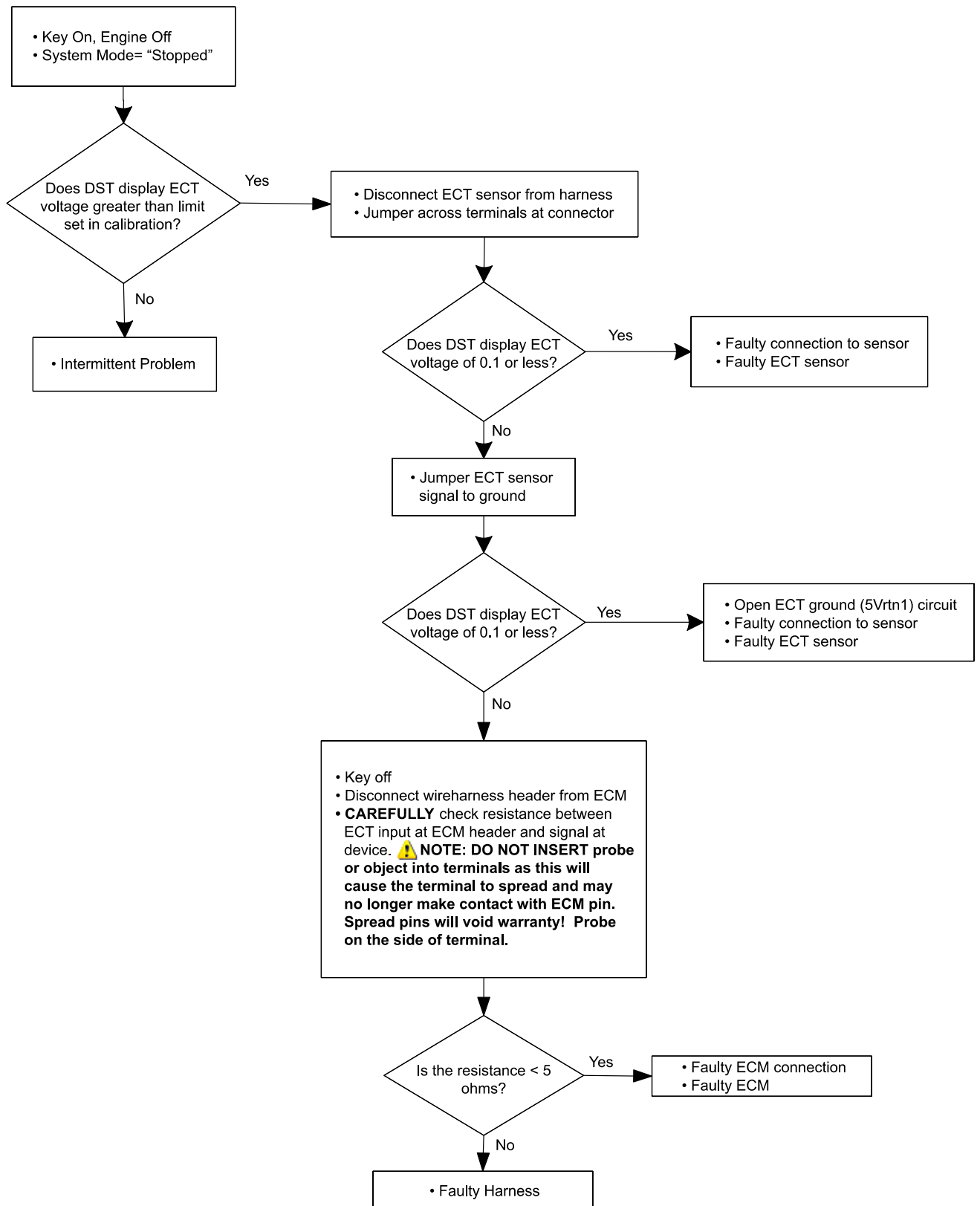
Table 3-16. Diagnostic Corrective Actions

CORRECTIVE ACTION	DESCRIPTION
Enable	Enables the fault for fault detection
Shutdown	Cause an engine shutdown when fault becomes active
Never Forget	Retain fault as historic/previously active until cleared by a technician and does not allow historic fault to be "auto-cleared"
Turn on MIL	Turn on MIL output when fault becomes active
CL Disable	Disable closed-loop while the fault is active
CL Disable Key-Cyc	Disable closed-loop while the fault is active and for the remainder of the key cycle
AL Disable	Disable adaptive learn while the fault is active
AL Disable Key-Cyc	Disable adaptive learn while the fault is active and for the remainder of the key cycle
Power Derate 1	Limit TPS to the Power Derate 1 percent set in the diagnostic calibration while the fault is active. The Power Derate 1 TPS percent should be set higher than Power Derate 2 as Power Derate 2 adds a higher level of protection.
Power Derate 2	Limit TPS to the Power Derate 2 percent set in the diagnostic calibration while the fault is active. If the calibration is set to "Latched for Key-Cycle" Power Derate 2 remains active until engine speed and FPP conditions are satisfied. The Power Derate 2 TPS percent should be set lower than Power Derate 1 as Power Derate 2 adds a higher level of protection.
Low Rev Limit	Limit RPM to the Low Rev Limit speed set in the diagnostic calibration while the fault is active. If the calibration is set to "Latched for Key-Cycle" Low Rev Limit remains active until engine speed and FPP conditions are satisfied.
Forced Idle	Limit RPM to the Forced Idle speed set in the diagnostic calibration while the fault is active and for the remainder of the key cycle
Soft Warning	Turn on the soft warning output when the fault becomes active
Hard Warning	Turn on the hard warning output when the fault becomes active
Stopped Check	Run fault detection/checking while the engine is in a key-on, engine-off condition. NOTE: It is recommended that this feature only be used for general sensor faults (high/low voltage) and some output drivers

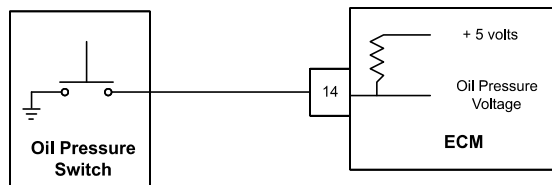
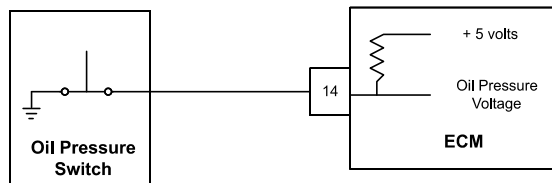
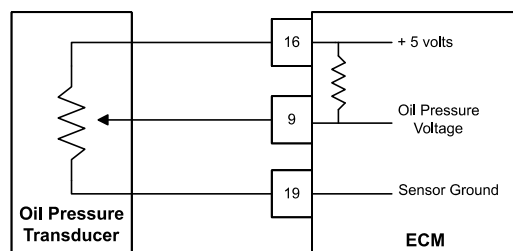
Fault/Diagnostic Trouble Code Interaction

All fault and diagnostic information is managed through the Faults page. Interaction includes viewing fault messages, downloading fault data (fault snapshot and flight data recorder), erasing faults from memory, and defining variables for fault data logging.

Faults are separated into two categories, Active and Historic. Active faults are active in real-time and historic faults have been generated at some instance in time that may or may not be active in real-time. Once a fault has become active, it is immediately logged as historic and a snapshot and flight data log is saved. Figure 3-72. shows an example of the fault page when an active fault has been generated. Notice fault is present in active and historic lists and the Malfunction Indicator Lamp (MIL) has been illuminated. Figure 3-73. shows an example of the fault page with a historic fault stored in memory.



DTC 521- Oil Pressure Sender/Switch High Pressure

Normally-Open
Switch-TypeNormally-Closed
Switch-Type

Sensor-Type

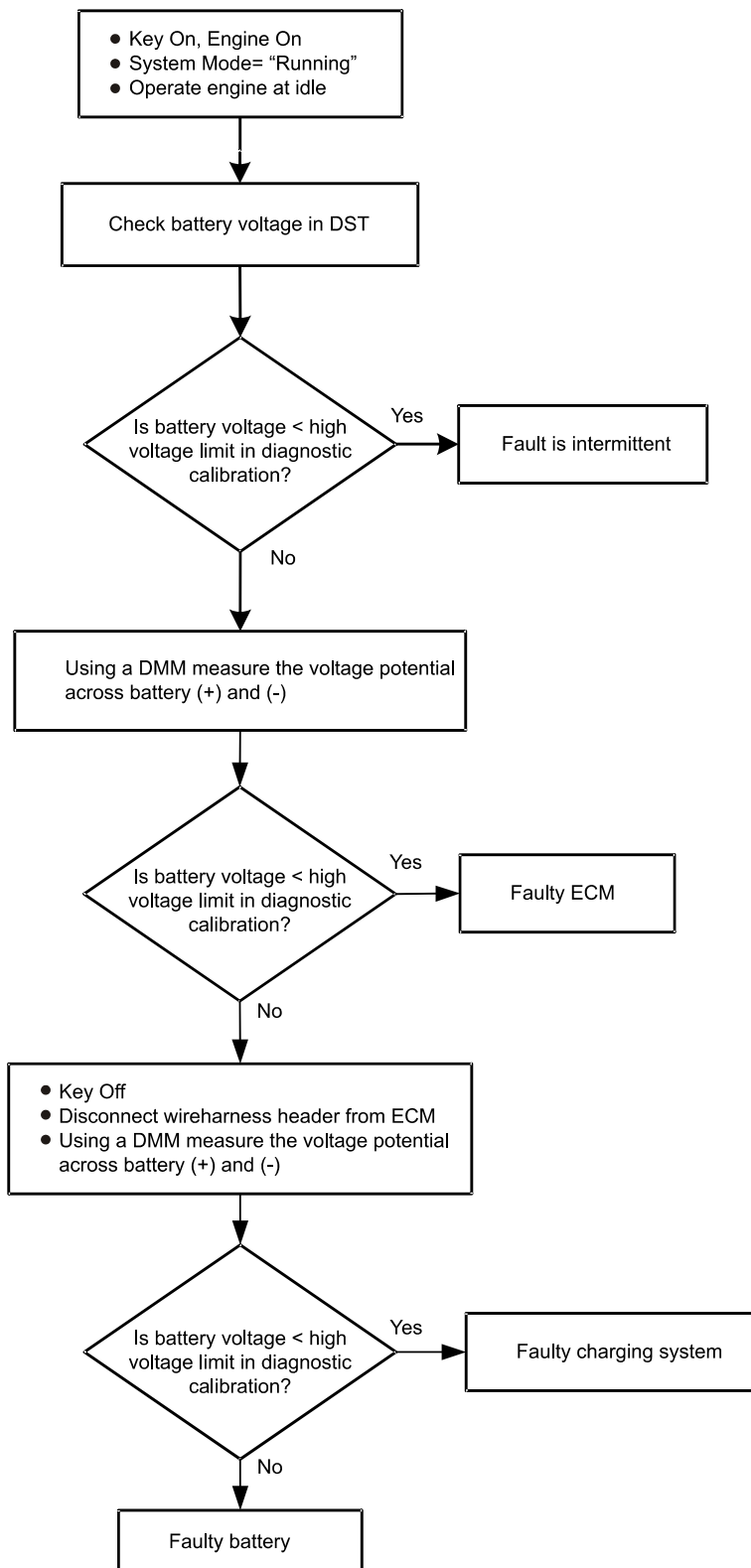
- Engine Oil Pressure
- Check Condition- Key on, Engine on (or Engine off)
- Fault Condition- For sender types, oil pressure higher than x psia while engine speed is greater than y RPM. For switch types, oil pressure is indicating high when the engine has been stopped for more than n seconds.
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, possibly configure for power derate 1 or low rev limit
- Non-emissions related fault

The ECM can be configured to monitor oil pressure through a proportional transducer or through a switch. Oil pressure monitoring is important to prevent engine damage due to low oil pressure resulting in higher friction and lack of lubrication. In addition, high oil pressure can be undesirable because it can cause oil to leak past seals and rings, can be a result of a restriction in the oil flow path, or can be a sign of a malfunctioning oiling system.

For normally-open type oil pressure switches, a high pressure indication while engine is off is a symptom of a failed oil pressure switch. The ECM can monitor oil pressure indication when engine is stopped for this failure mode.

For sender types, this fault sets if engine oil pressure is higher than x psia and engine speed greater than y RPM as defined in diagnostic calibration.

For switch types, this fault sets if engine oil pressure is indicating high when engine is stopped for more than n seconds. Recommend a power derate and/or low rev limit to help prevent possible engine damage and reduce oil pressure.



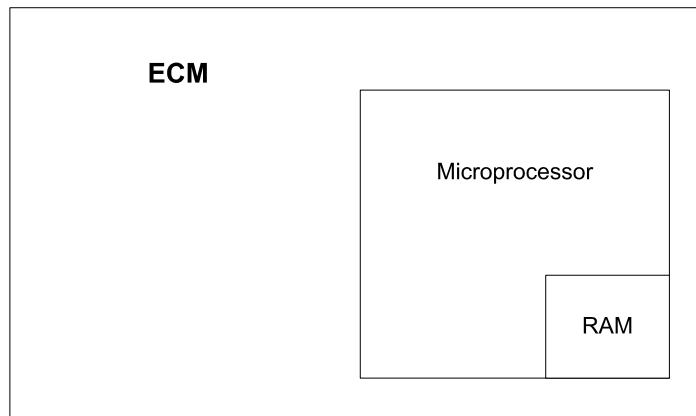
CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

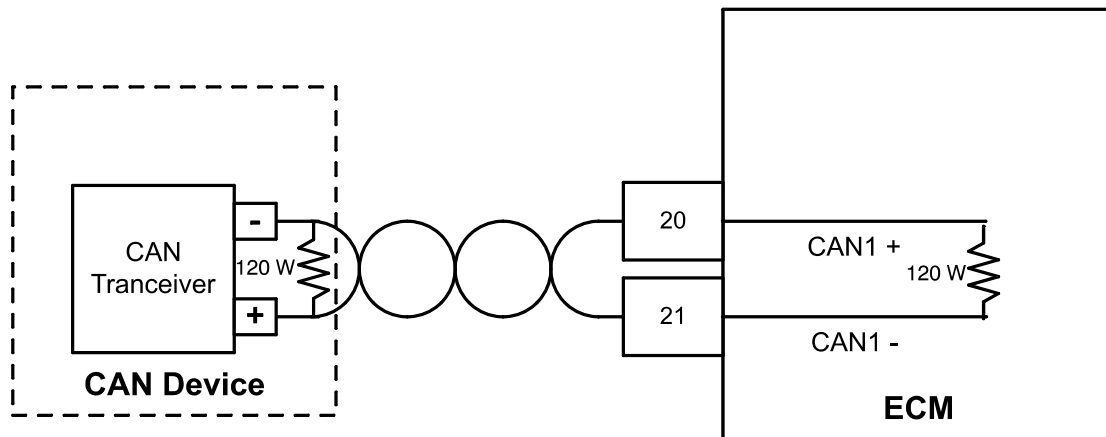
CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

DTC 1613- Microprocessor Failure - RTI 2

- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

DTC 1627- CAN J1939 Receive (Rx) Fault

- Controller Area Network.
- Check Condition- Key On, Engine Off and/or Running.
- Fault Condition- ECM CAN transceiver receive error counts greater than the limit defined in the diagnostic calibration (must be < 125 failures).
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp.
- Non-emissions related fault.

The Controller Area Network (CAN) is a serial communication network used to transmit and receive data between intelligent devices. Systems that utilize CAN communication include smart actuators, smart sensors, dash panels and gauges, and other microcomputers. Each smart sensor, actuator, or controller incorporates a CAN transceiver that interprets logic level signals on the network and translates the information into digital data.

This fault will set if CAN communication is enabled and the ECM transceiver is expecting to see network traffic and either does not see traffic (as defined in the diagnostic calibration, must be set to less than 125 failures).

Diagnostic Aids

- Verify all CAN devices are powered and are properly grounded
- Verify CAN network is properly terminated
- Check CAN wire routing with respect to noise sources (ignition coils, spark plug coil wires, etc.) and shield if necessary
- Check CAN (+) and (-) wires for short circuits

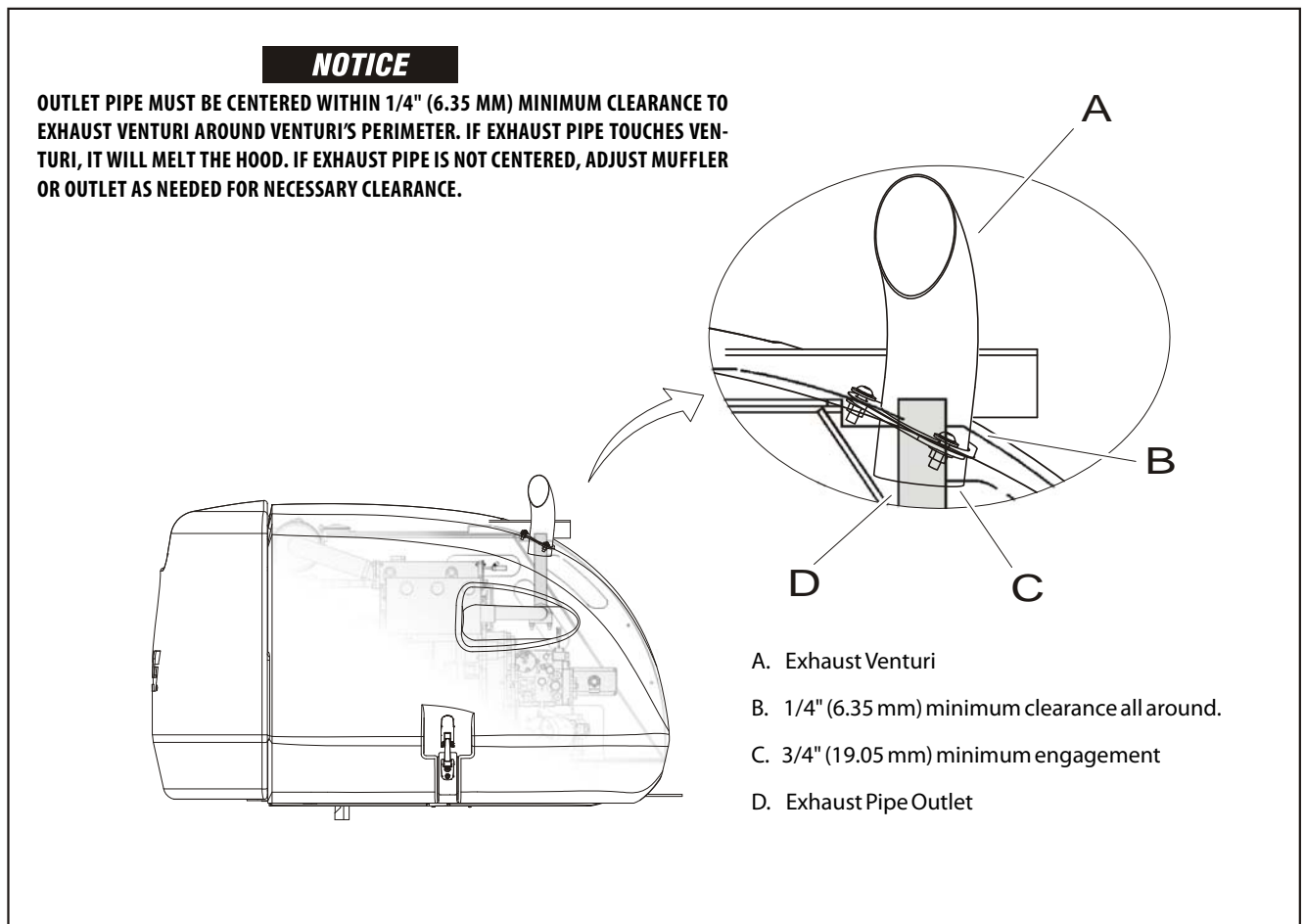
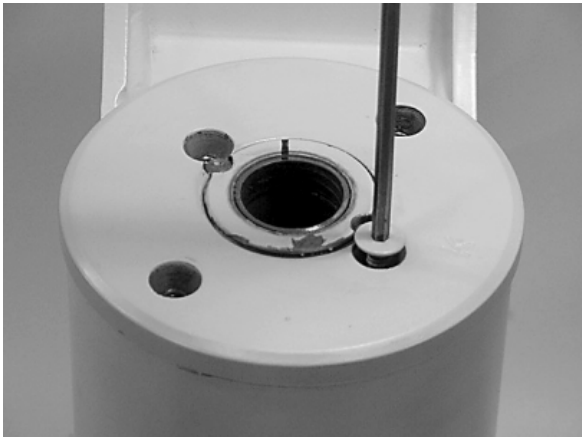


Figure 3-79. Exhaust Venturi Adjustment

Disassembly

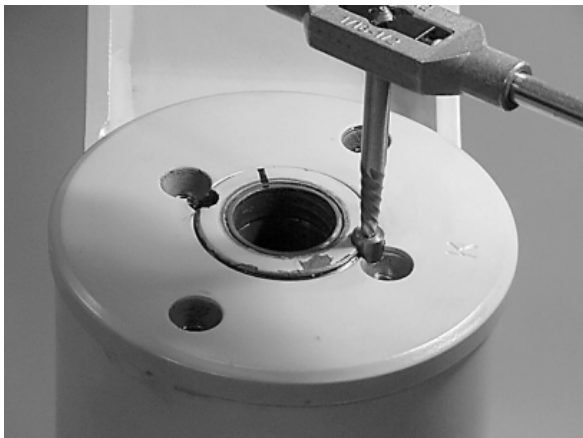
1. Remove capscrews (54) over end cap lock pins (53).



2. Using a 1/8" (3.18mm) drill bit, drill hole in center of each lock pin to a depth of approximately 3/16" (4.76mm).

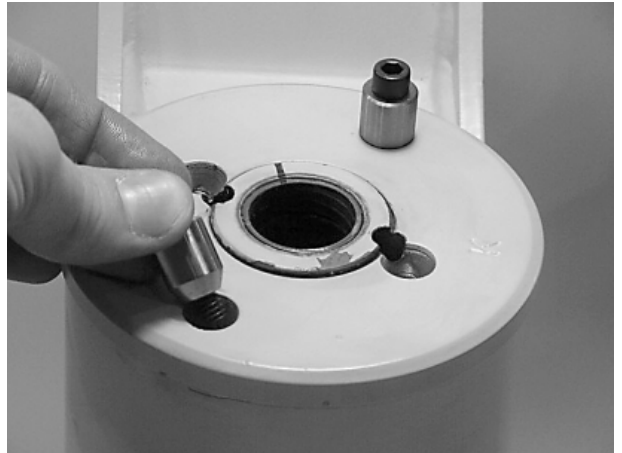


3. Remove lock pins using an "Easy Out" (#2 shown).



If pin will not come out with "Easy Out", use 5/16" drill bit to a depth of 1/2" (12.7mm) and drill out entire pin.

4. Install end cap (4) removal tools provided with Helac seal kit.

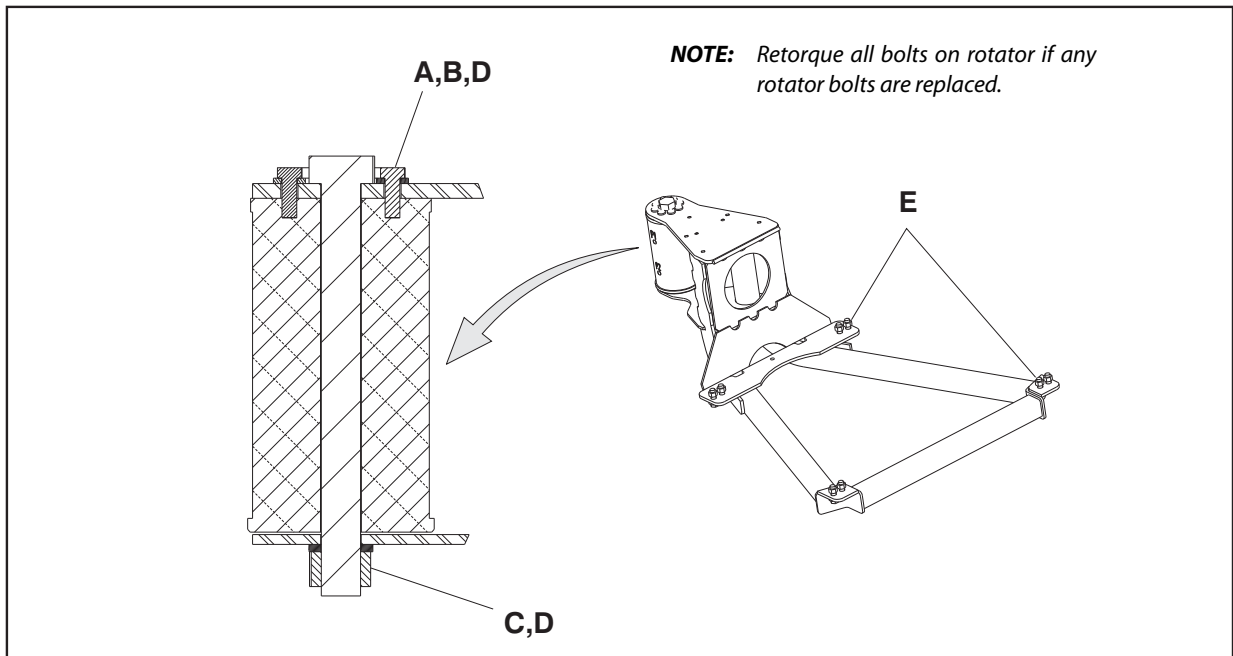


5. Using a metal bar or similar, unscrew end cap (4) by turning it counter clockwise.



6. Remove end cap (4) and set aside.





- A Torque to 50 ft-lb (68 Nm)
- B Loctite #242
- C Torque to 480 ft-lb (650 Nm)
- D Check torque every 150 hours of operation
- E Torque to 85 ft-lb (115 Nm)

Figure 4-6. Platform Support Torque Values

SECTION 5. HYDRAULICS

5.1 O-RING LUBRICATION

All fittings with O-rings must be lubricated with hydraulic oil before assembly using one of the following four methods:

- Cup and Brush
- Dip
- Spray
- Brush-On

Cup and Brush

Tools needed:

- Small container for hydraulic oil
- Small paint brush



1. Hold fitting in one hand and dip brush into container with other hand. Remove excess hydraulic oil from brush so an even film of oil is applied to O-ring.



2. Hold fitting over hydraulic oil container and brush an even film of oil around entire O-ring in fitting. Make sure O-ring is completely saturated.



3. Turn over fitting repeat previous step to O-ring on other side of fitting. Make sure entire O-ring is coated with hydraulic oil.



CLEANING AND INSPECTION

1. Clean all parts in approved cleaning solvent.
2. Inspect cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage, scoring, and distortion. Dress piston surface or replace piston as needed.
7. Inspect seal and O-ring grooves in piston for burrs and sharp edges. Dress surfaces as necessary.
8. Inspect cylinder head inside diameter for scoring or other damage, ovality, and tapering. Replace as needed.
9. Inspect seal and O-ring grooves in head for burrs and sharp edges. Dress surfaces as necessary.
10. Inspect cylinder head outside diameter for scoring or other damage, ovality, and tapering. Replace as needed.

11. Inspect rod and barrel bushings for excessive wear or damage. Replace rod or barrel as necessary.
 - a. Thoroughly clean rod and barrel steel bushing of burrs and contamination.
 - b. Lubricate inside of bushing housing with WD40 before installing composite bushings.
 - c. Using correct size arbor, press composite bushing into barrel or rod steel bushing.

NOTE: Lubrication is not required with nickel plated pins and bearings. Install pin in composite bushings dry.

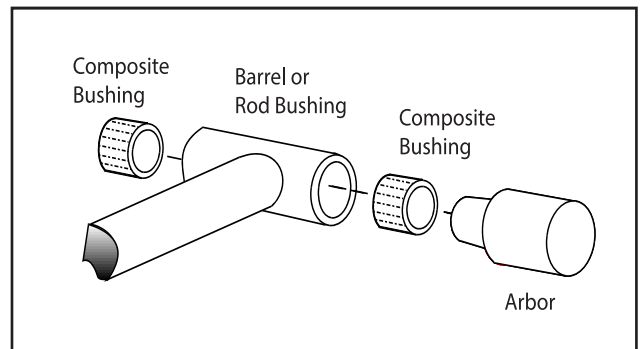


Figure 5-18. Composite Bushing Installation

12. Inspect travel limiting spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
13. Inspect port block fittings and holding valve. Replace as necessary. Torque valve to 30-35 ft-lb (41-48 Nm).
14. Inspect oil ports for blockage or presence of dirt or other contamination. Clean and repair as necessary.

ASSEMBLY

NOTE: Use proper cylinder seal kit for cylinder assembly. See your JLG Parts Manual.

Apply a light film of hydraulic oil to all components before assembly.

1. Use seal tool to install new seal in cylinder head groove.

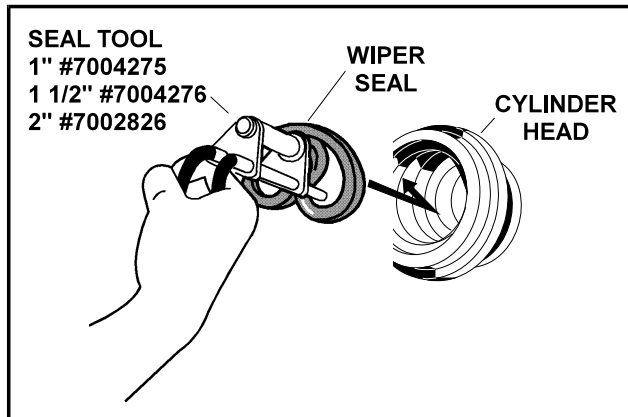


Figure 5-38. Rod Seal Installation

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE 'POLY-PAK' PISTON SEALS ARE PROPERLY INSTALLED. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION.

2. Use a soft mallet to tap new wiper seal into applicable cylinder head gland groove. Install new wear ring into applicable cylinder head gland groove.
3. Install wear ring in cylinder head.
4. Place new O-ring and back-up seal in outside diameter grooves of cylinder head.

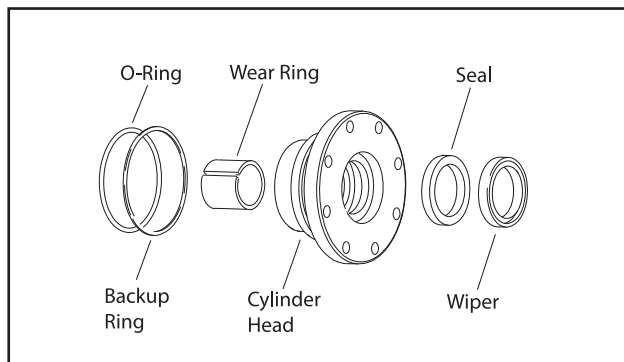


Figure 5-39. Cylinder Head Seal Installation

5. Install washer ring on rod. Carefully install cylinder head assembly head on rod. Do not damaged or dislodge wiper and rod seals. Push head to rod end.
6. Place a new O-ring and back-up rings in inner piston diameter groove.

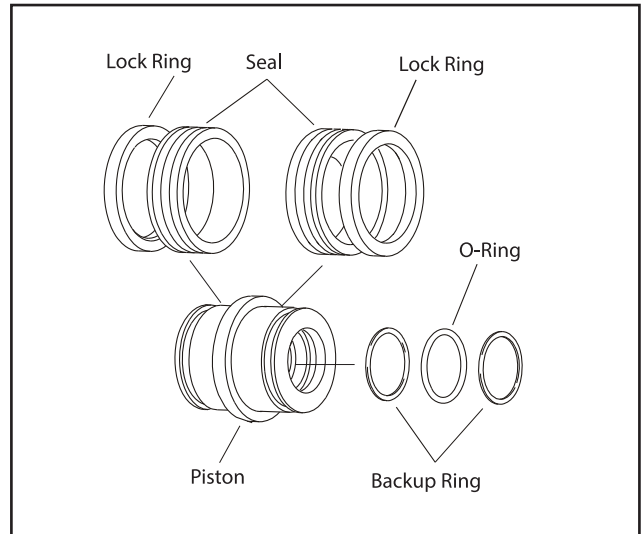


Figure 5-40. Piston Seal Installation

7. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
8. Carefully thread piston on cylinder rod hand tight. Do not damage or dislodge O-ring and back-up rings.

NOTE: Tapered bushing, piston, and mating end of rod must be free of oil.

9. Thread piston onto rod until it aligns with spacer end and install tapered bushing.

NOTICE

IMPROPER SEAL INSTALLATION CAN CAUSE CYLINDER LEAKS AND IMPROPER CYLINDER OPERATION. ENSURE 'POLY-PAK' PISTON SEALS ARE PROPERLY INSTALLED. REFER TO WIPER SEAL INSTALLATION FOR CORRECT SEAL ORIENTATION.

2. Place new wiper in cylinder head with flat side facing inside. Use a soft mallet to seat wiper in cylinder head groove.
3. Install retainer in cylinder head groove.
4. Install O-ring in cylinder head groove.
5. Place new O-rings and back-up ring in outside diameter cylinder head grooves.

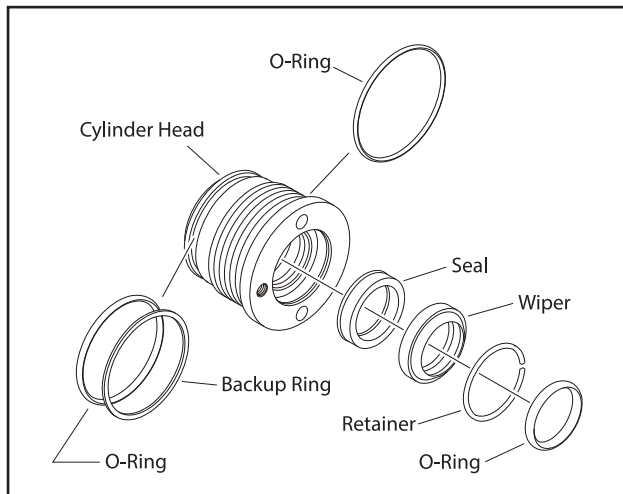


Figure 5-57. Installation of Head Seal Kit

6. Carefully install head on rod, ensuring wiper and rod seals are not damaged or dislodged. Push head along rod to rod end, as applicable.

NOTE: Upper telescope cylinder piston has an O-ring installed inside spacer.

7. Place new O-ring and in inner piston diameter groove.
8. Using suitable protection, clamp cylinder rod in a vise or similar holding fixture as close to piston as possible.
9. Carefully thread piston on cylinder rod. Do not damage or dislodge O-ring. Torque to 295 ft-lb (400 Nm).
10. Install retaining ring on end of rod.
11. Install seal and wear rings in outside piston grooves.

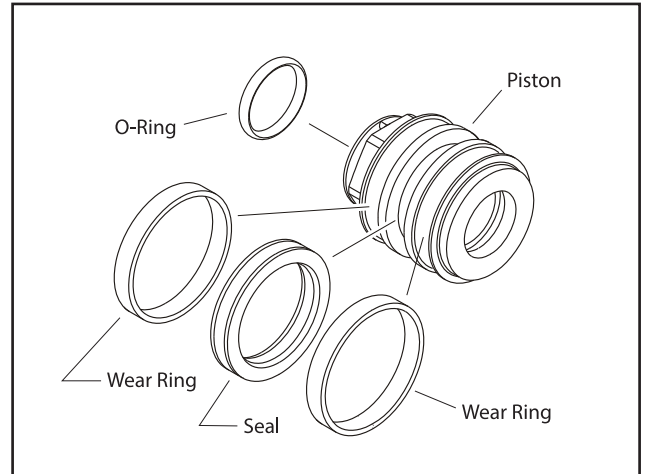


Figure 5-58. Piston Seal Installation

12. Remove cylinder rod from holding fixture.
13. Position cylinder barrel in suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

14. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston O-rings and backup ring.
15. Continue pushing rod into barrel. Screw in cylinder head. Torque to 442 ft-lb (600 Nm).

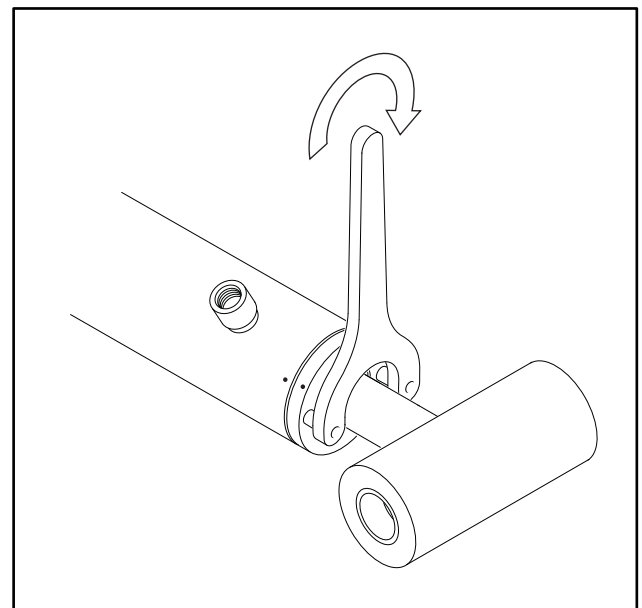


Figure 5-59. Cylinder Head Installation

NOTE: Marks made during disassembly should line up.

14. Remove cylinder rod from holding fixture.
15. Position cylinder barrel in suitable holding fixture.

NOTICE

INSERTING ROD OFF-CENTER CAN DAMAGE PISTON AND CYLINDER BARREL SURFACES. USE EXTREME CARE WHEN INSTALLING CYLINDER ROD, HEAD, AND PISTON.

16. Clamp barrel securely and support rod. Insert piston end into barrel cylinder. Do not damage or dislodge piston O-rings and backup ring.
17. Continue pushing rod into barrel. Screw in cylinder head. Torque to 368 ft-lb (500 Nm).

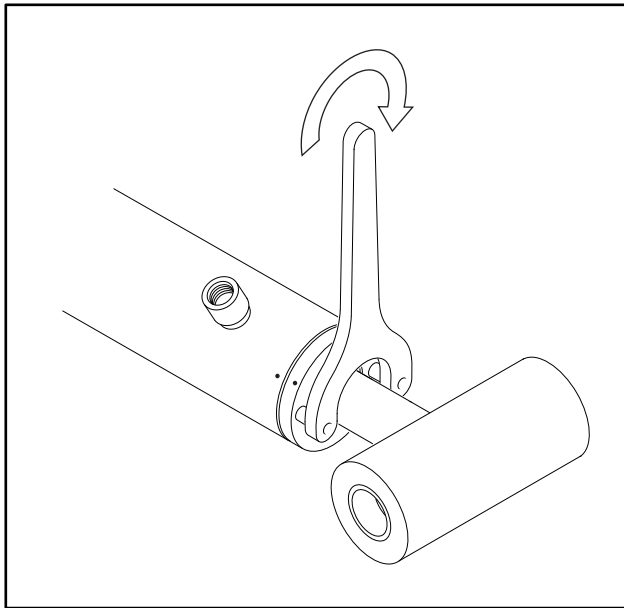


Figure 5-81. Cylinder Head Installation

NOTE: Marks made during disassembly should line up.

Axle Lockout Cylinder

Refer to Figure 5-106., Axle Lockout Cylinder.

DISASSEMBLY

NOTICE

CONTAMINATION MAY DAMAGE EQUIPMENT. DISASSEMBLE CYLINDER ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

CAUTION

PISTON CAN FALL OUT OF HOUSING AND CAUSE INJURY OR DAMAGE TO EQUIPMENT. BE CAREFUL WHEN REMOVING AXLE CYLINDER. OPENING BLEED VALVE CAN CAUSE PISTON TO FALL OUT OF HOUSING.

1. Open bleed valve (8). Rotate piston (2) and remove from housing (1).
2. Remove wiper (6). Do not scratch housing bore.
3. Remove two wear rings (5) and rod seal (7) from grooves in piston bore. Do not scratch housing bore.
4. Remove check valve (9), if required.

CLEANING AND INSPECTION

1. Inspect bore and piston for scoring, pitting, or excessive wear.
2. Remove minor surface blemishes with wet 2000-grit sandpaper. Pitting requires replacement of housing or piston.
3. Clean all parts with approved solvent and dry with compressed air.

ASSEMBLY

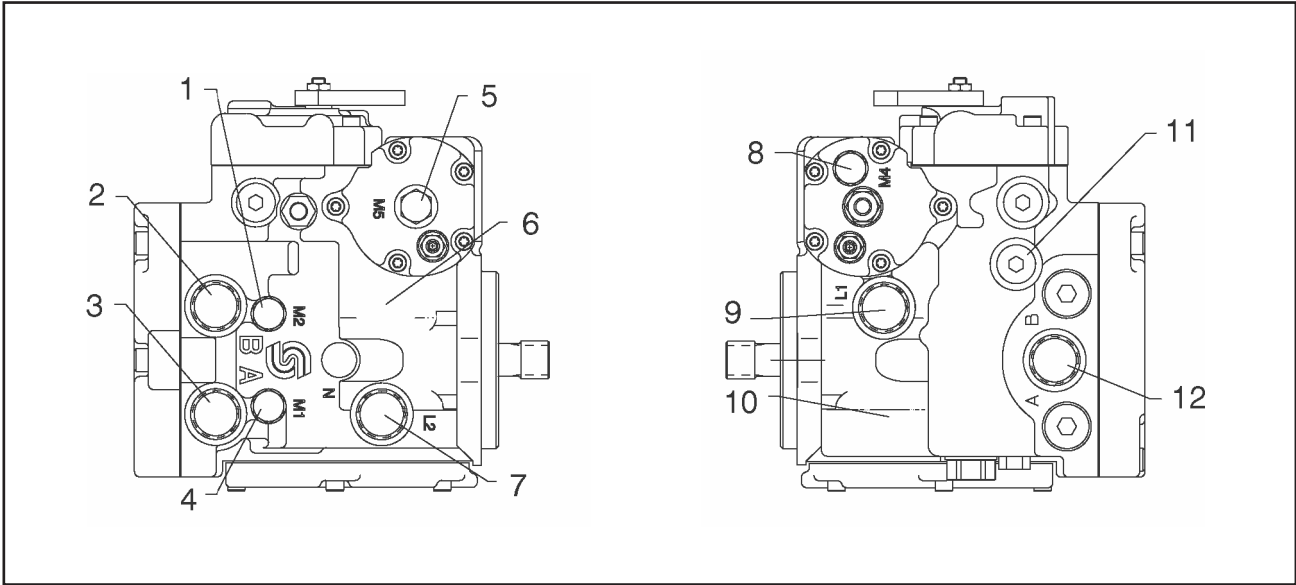
Refer to Figure 5-106., Axle Lockout Cylinder.

1. Install two new wear rings (5) and rod seal (7) in piston bore grooves. Make sure they are not twisted.
2. Install new wiper (6) in housing.
3. Lubricate piston bore with clean hydraulic fluid.

NOTICE

INSERTING PISTON OFF-CENTER CAN DAMAGE PISTON AND PISTON BORE SURFACES. USE EXTREME CARE WHEN INSTALLING PISTON.

4. Install piston (2) in bore and push to top of bore.
5. Install check valve (9). Torque to 25 - 27 ft-lb (33 - 36 Nm).
6. Bleed system. Refer to 3.6, Oscillating Axle Bleeding Procedure and Lockout Test.



- | | |
|--------------------------------------|---------------------------------------|
| 1. System Pressure Gauge Port M2 | 7. Case Drain Port L2 |
| 2. System Pressure Port B | 8. Servo Pressure Gauge Port L4 |
| 3. System Pressure Port A | 9. Case Drain Port L1 |
| 4. System Pressure Gauge Port M1 | 10. Case Drain Port L1 (non-feedback) |
| 5. Servo Pressure Gauge Port M5 | 11. Charge Pressure Gauge |
| 6. Case Drain Port L2 (non-feedback) | 12. Charge Pump Inlet Port S |

Figure 5-108. Gauge Port Locations

SECTION 6. JLG CONTROL SYSTEM

6.1 INTRODUCTION

NOTICE

WHEN INSTALLING A NEW GROUND MODULE CONTROLLER IT IS NECESSARY TO PROGRAM THE CONTROLLER FOR PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS.

NOTICE

AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. IF PRESSURE-WASHING IS USED 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) FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG designed Control System is a 12 volt based motor 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.

Upper lift, swing, and drive are controlled by individual joysticks. Steering is controlled by a rocker switch built in the top of the drive joystick. To activate Drive, Lift, and Swing; pull up the slide lock on the joystick and move the handle in the desired direction.

The control system provides 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 in 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 with a custom designed, direct connect hand held analyzer or wireless adapter using an app on your Android or iPhone/iPad device. The analyzer or wireless output displays two lines of information at a time, by scrolling through the program.

Each module has a label with JLG part number and a serial number containing a date code.

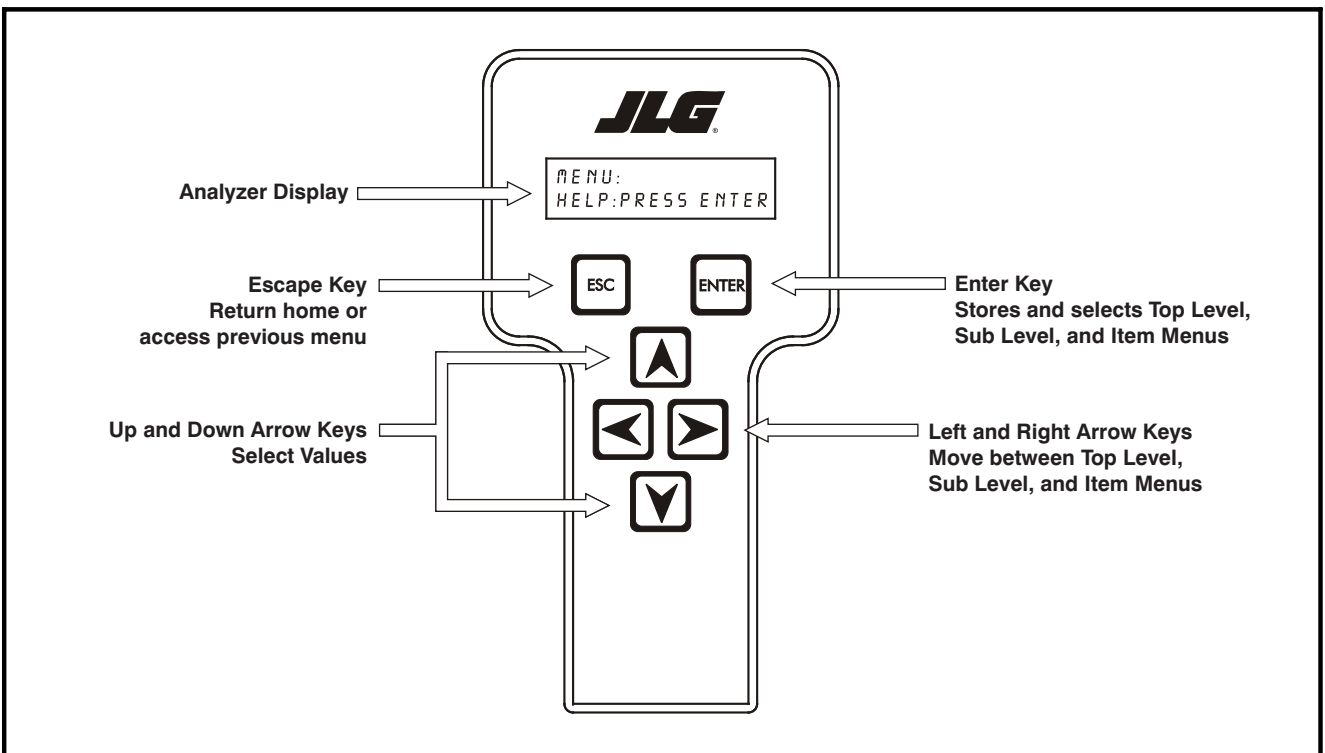


Figure 6-1. Hand-Held Analyzer (WANALYZER Controls and Display Similar)

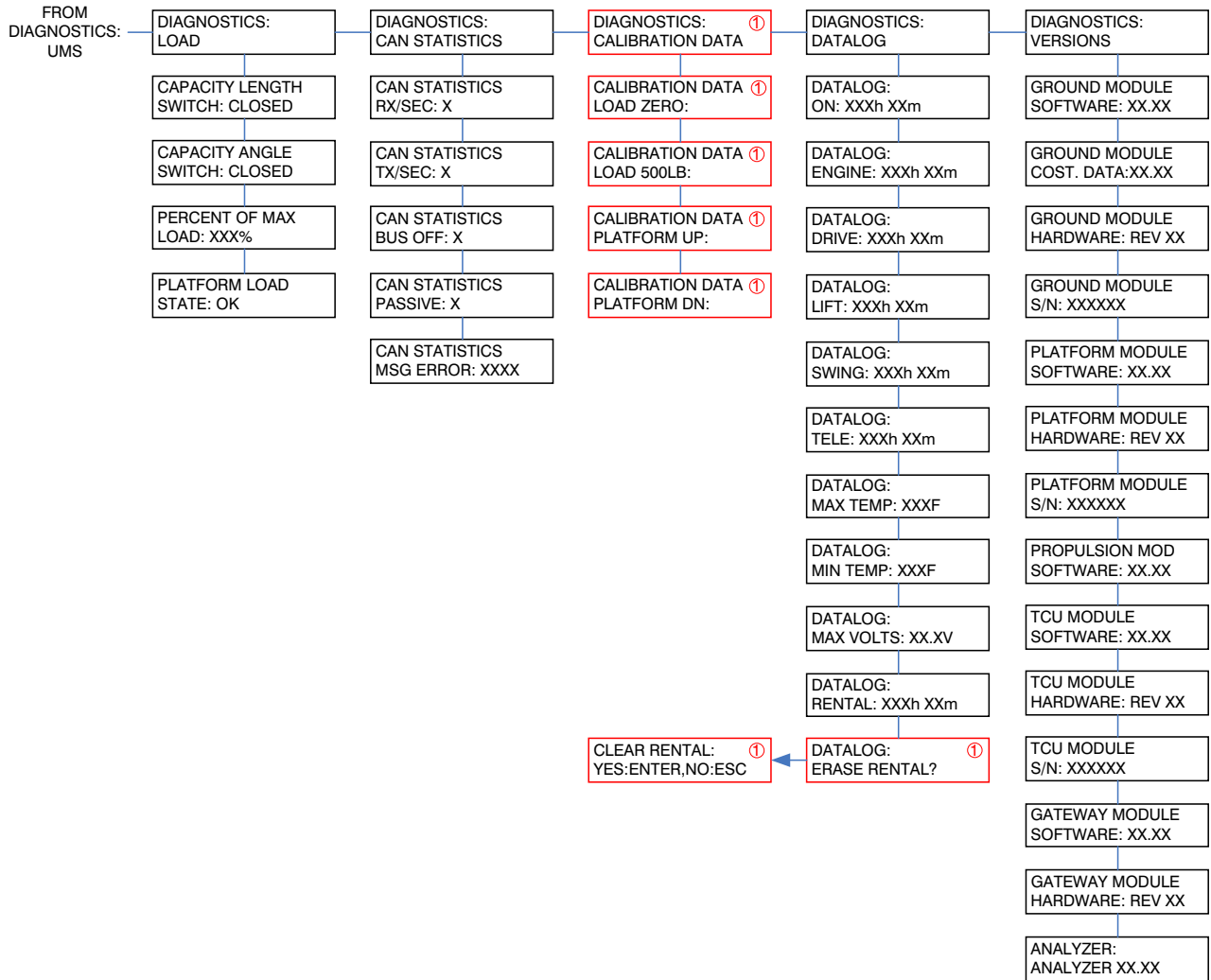


Figure 6-7. Analyzer Software Version 6.8 - Sheet 3 of 6

Table 6-3. Machine Configuration Programming Information Software Version P6.1 to Present

Configuration Label/ Digit	Number	Description	Default Number
STOUCH/SKYGUARD: 11	0	None: No soft touch or SkyGuard system installed.	0
	1	SOFT TOUCH - Soft touch only installed.	
	2	SKYGUARD - Skyguard only installed.	
	3	BOTH(CUTOUT) - Soft Touch and Skyguard installed.	
GEN SET/WELDER: 12	0	NO: No generator installed.	0
	1	BELT DRIVE: Belt driven setup.	
GEN SET CUTOUT: 13* * Only visible if Gen Set / Welder Menu selection is not 0.	0	MOTION ENABLED: Motion enabled when generator is ON.	0
	1	MOTION CUTOUT: Motion cutout in platform mode only.	
H & T LIGHTS: 14	0	NO: No head and tail lights installed.	0
	1	YES: Head and tail lights installed.	
CABLE SWITCH: 15* * Only visible under certain model selections. * Certain market and model selections will alter the default setting.	0	NO: No broken cable switch installed.	0
	1	YES: Broken cable switch installed.	
LOAD SYSTEM: 16* * Only visible under certain market selections. * Certain market selections will limit load system options or alter default setting.	0	NO: No load sensor installed.	0
	1	WARN ONLY: Functions in creep, overload lamp lit, platform alarm beeps (5 sec ON, 2 sec OFF).	
	2	CUTOUT PLATFORM: All functions cutout, overload lamp lit, platform alarm beeps (5 sec ON, 2 sec OFF).	
	3	CUTOUT ALL: All functions cutout, flash overload light (500mS on, 500mS off), platform alarm beeps (5 sec ON, 2 sec OFF).	
	4	SPECIAL 1: Functions in creep, overload lamp lit, disables main telescope out & main lift up, platform alarm beeps (5 sec ON, 2 sec OFF).	

Table 6-4. System Test Messages

Message Displayed on Analyzer	Message Displayed on Analyzer	Description
TESTING VALVES		Indicates valve test is beginning. Each valve is alternately energized and de-energized; checks are made for open- and short- circuit valve coils. NOTE: In platform mode, the footswitch must be closed. NOTE: Tower lift valves are not tested if TOWER LIFT=NO. Tower telescope valves are not tested if TOWER TELE=NO. Jib valves are not tested if JIB = NO. Extendable axle valves are not tested if EXT AXLES=NO. Four wheel steer valves are not tested if 4WS=NO. NOTE: Left/right jib valves are not tested unless JIB = SIDESWING. Problems that can be reported include below messages.
	CANT TEST VALVES	There is a wiring problem, which prevents the valve test from functioning correctly. Check valve wiring. Check ground alarm & hour meter wiring.
	XXXXXXX S/C	Named valve is drawing too much current so is presumed to be short-circuited. Check valve wiring.
	XXXXXXX O/C	Named valve is drawing too little current so is presumed to be open-circuit. Check valve wiring.
CHECKING INPUTS		Indicates inputs test is beginning. Every input is checked to ensure that it is in its "normal" position; function switches should be open, cutout switches should be closed, joysticks should be in neutral. In platform mode any non-neutral platform switch or joystick is reported; any active cutouts are reported. In ground mode any non-neutral ground switches is reported; any active cutouts are reported. NOTE: Switches not in use (due to the settings of machine digits), are not checked. NOTE: Pump pot is checked only for a wire-off condition; it can be at any demand from creep to maximum. Problems that can be reported include below messages.
	CHECKXXXXXXXX	The named switch is not in its "normal" position. Check switch & wiring.
	CHECKXXXXXXXX JOY	The named joystick appears to be faulty. Check joystick.
TESTING LAMPS		Indicates lamps test is beginning. Each lamp is energized in turn; a prompt asks for confirmation the lamp is lit. ENTER must be pressed or clicked to continue the test. NOTE: Lamps, which are not in use (due to the settings of machine digits), are not checked. NOTE: Platform Lamps are only tested in platform mode. NOTE: The GM overload lamp and 500# capacity lamp are not tested. NOTE: Head and tail lamps are tested in both platform and ground mode if enabled by a machine digit.
TESTING ALARMS		Indicates alarms test is beginning. Each alarm is energized in turn; a prompt asks for confirmation the alarm is sounding. ENTER must be pressed or clicked to continue test. NOTE: Platform alarm and horn are only tested in platform mode. NOTE: Ground alarm is not tested if GROUND ALARM = NO.

Table 6-6. Help Fault Codes, Displayed Faults, and Descriptions

Flash Code	Fault Displayed on Analyzer	Description	Priority
None		No flash code indicated for the following help messages. They indicate a possible problem if vehicle is not operating as expected.	1
	EVERYTHING OK	"Normal" help message in platform mode	
	GROUND MODE OK	"Normal" help message in ground mode	
	FSW OPEN	A drive or boom function has been selected but footswitch is open.	
	RUNNING AT CREEP – CREEP SWITCH OPEN	All function speeds limited to creep because creep switch is open.	
	RUNNING AT CREEP – TILTED AND ABOVE ELEVATION	All boom function speeds limited to creep because vehicle is tilted and above elevation.	
	RUNNING AT CUTBACK – OUT OF TRANSPORT POSITION	Drive speed is limited to "ELEVATED MAX" because vehicle is out of transport position.	
	CHASSIS TILT SENSOR OUT OF RANGE	Chassis tilt sensor has indicated a tilt angle greater than 19 degrees for more than 4 seconds. Not reported during 2 second power-up.	
	LOAD SENSOR READING UNDER WEIGHT	Load sensor is reading 20% or more under calibrated zero point. This fault may occur if basket is resting on ground. Not reported during 2 second power-up.	
	ENVELOPE ENCROACHED – HYDRAULICS SUSPENDED	Machines with envelope control ONLY. System has detected an envelope violation	
	OVER MOMENT – HYDRAULICS SUSPENDED	Only occurs on machines with moment control. System has detected an over moment violation.	
	UNDER MOMENT – HYDRAULICS SUSPENDED	Machines with moment control ONLY. System has detected an under moment violation.	
1/1		Flash code 1/1 indicates a "sleep" mode. NOT REQUIRED	
2/1		Flash code 2/1 indicates problems with footswitch.	2
	FSW FAULTY	Two footswitch inputs have read the same state for more than one second. An EMS cycle is required.	
	KEYSWITCH FAULTY	Platform and ground modes selected simultaneously	
2/2		Flash code 2/2 indicates problems with drive & steer selection. Except where noted, these faults are not reported during 2 second power-up sequence.	3
	DRIVE LOCKED – JOYSTICK MOVED BEFORE FOOTSWITCH	Drive selected before and during footswitch closure. Can be reported during power-up sequence.	
	FSW INTERLOCK TRIPPED	Footswitch closed for seven seconds with no function selected. Can be reported during power-up sequence.	
	STEER LOCKED – SELECTED BEFORE FOOTSWITCH	Steer was selected before and during footswitch closure.	
	STEER SWITCHES FAULTY	Both steer switches are active at same time.	
	D/S JOY. OUT OF RANGE LOW	Resistive joysticks: These faults do not occur.	
	D/S JOY. OUT OF RANGE LOW	Resistive joysticks: These faults do not occur.	
	D/S JOY. OUT OF RANGE HIGH	Resistive joysticks: These faults do not occur if Vref voltage is below 8.1 volts. If Vref is above 7.7 volts, Vref is operating out of tolerance or a short to battery has occurred.	

Table 6-6. Help Fault Codes, Displayed Faults, and Descriptions

Flash Code	Fault Displayed on Analyzer	Description	Priority
4/5 (Continued)	MAIN LIFT PVG VALVE STUCK RETRACTED	Main boom lift pvg valve spool stuck in retracted position.	
	TOWER LIFT PVG VALVE STUCK RETRACTED	Tower boom lift pvg valve spool stuck in retracted position.	
	TOWER TELESCOPE PVG VALVE STUCK RETRACTED	Tower boom telescope pvg valve spool stuck in retracted position.	
	MAIN LIFT PVG VALVE OBSTRUCTED	Main boom lift pvg valve spool could not achieve command.	
	TOWER LIFT PVG VALVE OBSTRUCTED	Tower boom lift pvg valve spool could not achieve command.	
	TOWER TELESCOPE PVG VALVE OBSTRUCTED	Tower boom telescope pvg valve spool could not achieve command.	
	MAIN LIFT PVG VALVE COMMAND IMPROPER	Main boom lift pvg valve received invalid control system command.	
	TOWER LIFT PVG VALVE COMMAND IMPROPER	Tower boom lift pvg valve received invalid control system command.	
	TOWER TELESCOPE PVG VALVE COMMAND IMPROPER	Tower boom telescope pvg valve received invalid control system command.	
	MAIN LIFT PVG VALVE TIMEOUT	Main boom lift pvg valve has not received a position command in 250mS.	
	TOWER TELESCOPE PVG VALVE TIMEOUT	Tower boom lift pvg valve has not received a position command in 250mS.	
	TOWER TELESCOPE PVG VALVE TIMEOUT	Tower boom telescope pvg has not received a position command in 250mS.	
	MAIN LIFT PVG VALVE SETUP FAULT	Main boom lift pvg valve setup data is incorrect. Requires valve calibration.	
	TOWER LIFT PVG VALVE SETUP FAULT	Incorrect tower boom lift pvg valve setup data. Requires valve calibration.	
	TOWER TELESCOPE PVG VALVE SETUP FAULT	Incorrect tower boom telescope pvg valve setup data. Requires valve calibration.	
	MAIN LIFT PVG VALVE SENT UNRECOGNIZED FAULT	Main boom lift pvg valve sent unrecognized fault.	
	TOWER LIFT PVG VALVE SENT UNRECOGNIZED FAULT	Tower boom lift pvg valve sent an unrecognized fault.	
	TOWER TELESCOPE PVG VALVE SENT UNRECOGNIZED FAULT	Tower boom telescope pvg valve sent an unrecognized fault.	
	MAIN LIFT PVG VALVE PARAMETERS INCORRECT	Main lift pvg valves spool data is incorrect. Requires valve calibration.	
	TOWER LIFT PVG VALVE PARAMETERS INCORRECT	The tower lift pvg valves spool data is incorrect. Requires valve calibration.	
TOWER TELESCOPE PVG VALVE PARAMETERS INCORRECT	The tower telescope pvg valves spool data is incorrect. Requires valve calibration.		
MAIN LIFT PVG VALVE LOCATION IMPROPER	Main lift pvg valve was hosed wrong or wiring incorrect during calibration.		
TOWER LIFT PVG VALVE LOCATION IMPROPER	Tower lift pvg valve was hosed wrong or wiring incorrect during calibration.		
TOWER TELESCOPE PVG VALVE LOCATION IMPROPER	Tower telescope pvg valve was hosed wrong or wiring incorrect during calibration.		

SECTION 7. BASIC ELECTRICAL INFORMATION & SCHEMATICS

7.1 GENERAL

This section contains basic electrical information and schematics for locating and correcting most electrical problems. If a problem develops which is not presented in this section or corrected by listed corrective actions, obtain technically qualified guidance before proceeding with any additional maintenance.

NOTE: Some procedures/connectors shown in this section may not apply to all models.

7.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the Voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

"Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

Polarity

Getting a negative Voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, location of the signal and leads are correctly connected to the device under test. Also check the lead on the "COM" port goes to the ground or negative side of the signal and lead on the other port goes to the positive side of the signal.

Scale

M = Mega = 1,000,000 * (Displayed Number)

k = kilo = 1,000 * (Displayed Number)

m = milli = (Displayed Number) / 1,000

μ = micro = (Displayed Number) / 1,000,000

Example: 1.2 k Ω = 1200 Ω

Example: 50 mA = 0.05 A

Voltage Measurement

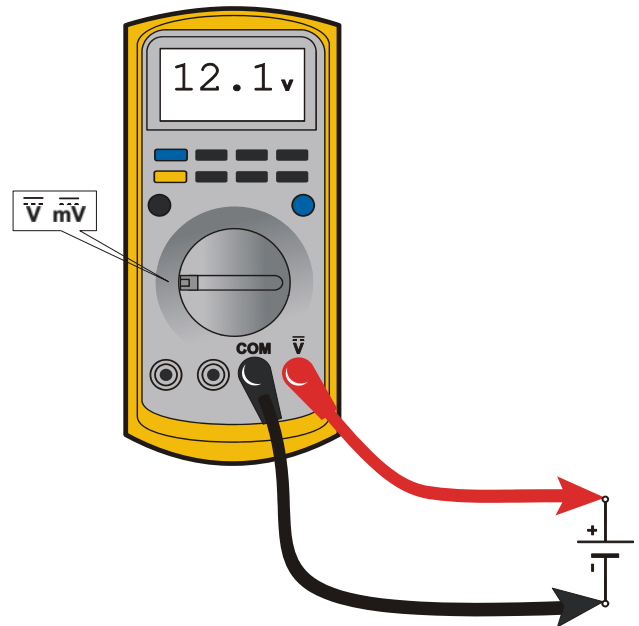


Figure 7-1. Voltage Measurement (DC)

- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- Use firm contact with meter leads

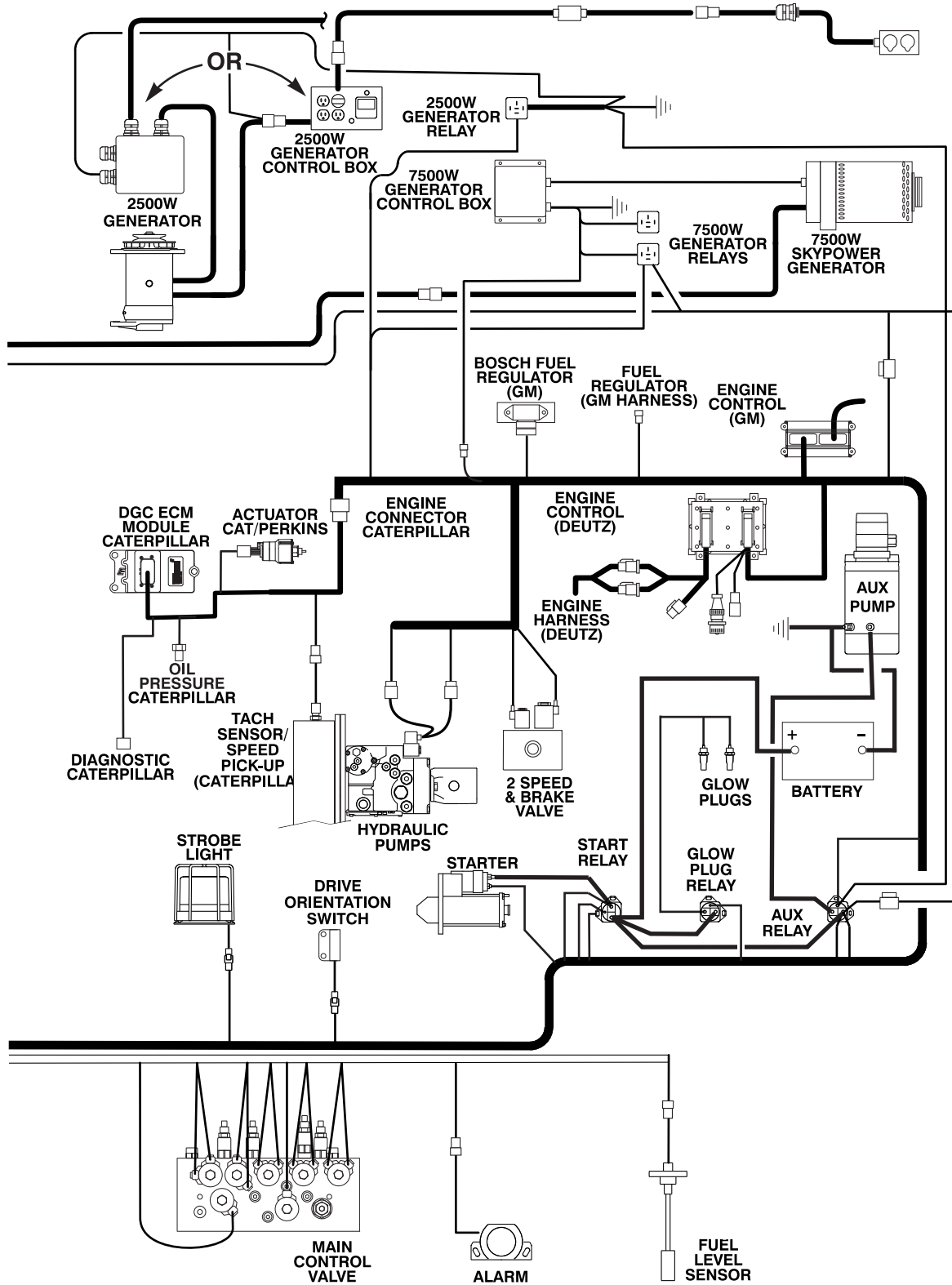


Figure 7-27. Electrical Components 2 of 2

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