



An Oshkosh Corporation Company

Service and Maintenance Manual

Models
400S
460SJ

P/N - 3120895

December 6, 2012



An Oshkosh Corporation Company

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SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Table 1-1. Capacities

Fuel Tank	26 gallons (98.4 liters)
Hydraulic Tank	40.0 gallons (152 liters)
Hydraulic System (Including Tank)	52 gallons (196.8 liters)
Drive Hub	17 ounces (0.5 liters)
Engine Oil Capacity	
Ford	4.5 Quarts (4.25 L) w/Filter
Deutz	6.3 qts. (6 L) w/Filter
Caterpillar	3.8 quarts (3.6 L) crankcase only
GM	4.5 qts. (4.25 L) w/Filter

1.2 ENGINE SPECIFICATIONS

NOTE: RPM Tolerances are ± 100 .

Table 1-2. Ford LRG-425 (Gas or Dual Fuel)

Type	4 cylinder, 4 stroke, spark ignition
Fuel	Gasoline or Gasoline/LP Gas
Bore	3 in. (96 mm)
Stroke	3.4 in. (86.4 mm)
Displacement	153 cu. in. (2.5 L)
Firing Order	1-3-4-2
BHP at Max. RPM	82
Oil Capacity	4.5 quarts (4.26 L)
Low RPM	1000
Mid RPM	1800
High RPM	3000
Fuel Consumption: Gasoline	
Intermittent	6 gal. hr.
Continuous	5 gal. hr.
Fuel Consumption: LPG	
Intermittent	26 lbs. hr.
Continuous	23 lbs. hr.
Spark Plug	AWSF-52-C
Spark Plug Gap	0.044 in. (1.117 mm)

Table 1-3. Deutz F3M1011F/F3M2011F

Fuel	Diesel
No. of Cylinders	3
Bore	3.6 in. (91 mm)
Stroke	4.4 in. (112 mm)
Displacement	133 cu. in. (2184 cm ³)
BHP at Max. RPM	48
Oil Capacity	
crankcase	6.3 quarts (6 L)
cooler	4.75 quarts (4.5 L)
total capacity	11 quarts (10.5 L)
Low RPM	1200
Mid RPM	1800
High RPM	2800

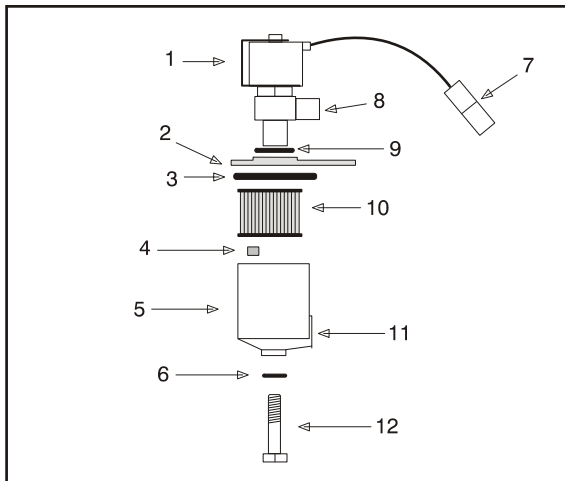
Table 1-4. Isuzu 4LE1

Fuel	Diesel
No. of Cylinders	4
BHP at Max. RPM	45
Low RPM	1000
Mid RPM	1500
High RPM	2800

Table 1-5. Caterpillar 3024/C2.2

Fuel	Diesel
No. of Cylinders	4
BHP	46.5 hp (34 kW)
Bore	3.307 in. (84 mm)
Stroke	3.9370 in. (112 mm)
Displacement	134.3 cu. in. (2.2L)
Oil Capacity	3.8 quarts (3.6 L) crankcase only
Compression Ratio	19:1
Firing Order	1-3-4-2
Max. RPM	2800

Propane Fuel Filter Replacement



- | | |
|-------------------------------|-------------------------|
| 1. Electric Lock Off Solenoid | 7. Electrical Connector |
| 2. Mounting Plate | 8. Fuel Outlet |
| 3. Housing Seal | 9. O-ring |
| 4. Filter Magnet | 10. Filter |
| 5. Filter Housing | 11. Fuel Inlet |
| 6. Seal | 12. Retaining Bolt |

Figure 1-4. Filter Lock Assembly

REMOVAL

1. Relieve the propane fuel system pressure. Refer to Propane Fuel System Pressure Relief.
2. Disconnect the negative battery cable.
3. Slowly loosen the Filter housing retaining bolt and remove it.
4. Pull the filter housing from the Electric lock off assembly.
5. Locate Filter magnet and remove it.
6. Remove the filter from the housing.
7. Remove and discard the housing seal.
8. Remove and discard the retaining bolt seal.
9. Remove and discard mounting plate to lock off O-ring seal.

INSTALLATION

NOTICE

BE SURE TO REINSTALL THE FILTER MAGNET INTO THE HOUSING BEFORE INSTALLING NEW SEAL

1. Install the mounting plate to lock off O-ring seal.
2. Install the retaining bolt seal.
3. Install the housing seal.
4. Drop the magnet into the bottom of the filter housing.
5. Install the filter into the housing.
6. Install the retaining bolt into the filter housing.
7. Install the filter up to the bottom of the electric lock off.
8. Tighten the filter retaining bolt to 106 in lbs (12 Nm).
9. Open manual shut-off valve. Start the vehicle and leak check the propane fuel system at each serviced fitting. Refer to Propane Fuel System Leak Test.

Propane Fuel System Pressure Relief

CAUTION

THE PROPANE FUEL SYSTEM OPERATES AT PRESSURES UP TO 312 PSI (21.5 BAR). TO MINIMIZE THE RISK OF FIRE AND PERSONAL INJURY, RELIEVE THE PROPANE FUEL SYSTEM PRESSURE (WHERE APPLICABLE) BEFORE SERVICING THE PROPANE FUEL SYSTEM COMPONENTS.

To relieve propane fuel system pressure:

1. Close the manual shut-off valve on the propane fuel tank.
2. Start and run the vehicle until the engine stalls.
3. Turn the ignition switch OFF.

CAUTION

RESIDUAL VAPOR PRESSURE WILL BE PRESENT IN THE FUEL SYSTEM. ENSURE THE WORK AREA IS WELL VENTILATED BEFORE DISCONNECTING ANY FUEL LINE.

Component Disassembly and Reassembly

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

Pressure-Fit Parts

When assembling pressure-fit parts, use an anti-seize or molybdenum disulfide base compound to lubricate the mating surface.

Bearings

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

Gaskets

Check that holes in gaskets align with openings in the mating parts. If it becomes necessary to hand-fabricate a gasket, use gasket material or stock of equivalent material and thickness. Be sure to cut holes in the right location, as blank gaskets can cause serious system damage.

Bolt Usage and Torque Application

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See Torque Chart Section 1.)

Hydraulic Lines and Electrical Wiring

Clearly mark or tag hydraulic lines and electrical wiring, as well as their receptacles, when disconnecting or removing them from the unit. This will assure that they are correctly reinstalled.

Hydraulic System

1. Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
2. Disassemble and reassemble parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

Lubrication

Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified intervals. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

Battery

Clean battery, using a non-metallic brush and a solution of baking soda and water. Rinse with clean water. After cleaning, thoroughly dry battery and coat terminals with an anti corrosion compound.

Lubrication and Servicing

Components and assemblies requiring lubrication and servicing are shown in the Lubrication Chart in Section 1.

2.3 LUBRICATION AND INFORMATION

Hydraulic System

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up or leaks in the pump supply (suction) lines.
2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be checked,

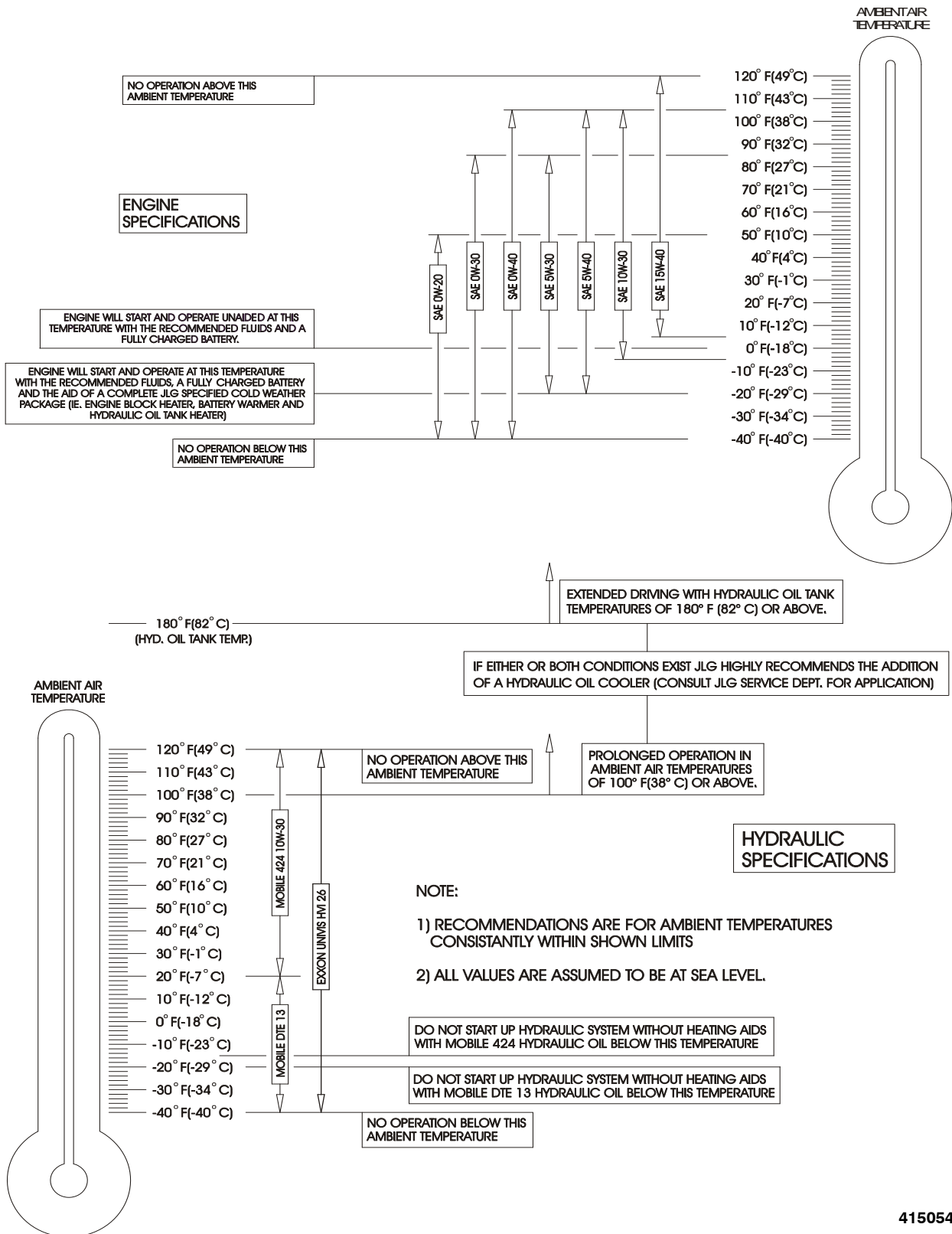


Figure 2-5. Engine Operating Temperature Specifications - Perkins

4150548 D

11. Lift input shaft sub-assembly (7) out of middle of spindle (1A), and stand input shaft (7A) on its splined end.

⚠ CAUTION

WEAR SAFETY GLASSES DURING THIS STEP, AND BE AWARE THAT SPRING AND SPACERS COMPRESSED BY RETAINING RING MAY POP SUDDENLY OFF SHAFT WHEN YOU REMOVE THE RETAINING RING.

12. Using retaining ring pliers, remove retaining ring (7B) from the groove on input shaft (7A).
13. Remove one spacer (7D), one spring (7C), and other spacer (7D) from input shaft (7A).
14. Remove thrust washer (11) from around spindle (1A).
15. Lift internal gear (2) out of hub (1G).

⚠ CAUTION

BEWARE OF SHARP EDGES IN COUNTERBORE WHEN YOU REMOVE THE O-RING.

16. Remove o-ring (5) from the counterbore in hub (1G). Discard the o-ring.
17. At this point the main disassembly for "B" drives is complete.

Hub-Spindle Disassembly

NOTE: Start with large end of hub facing up, large end of spindle facing down.

⚠ CAUTION

WEAR SAFETY GLASSES DURING THIS STEP.

1. Remove retaining ring (1I) from around spindle (1A) in hub (1G).
2. Remove spacer (1H) from around spindle (1A) in hub (1G).
3. Set hub (1G), small end/spindle facing down, up on something that will support the hub's flange while it lifts hub up so spindle is not resting on anything. Carefully press or hammer spindle (1A) down out of hub (1G).

NOTE: If seal (1B) and bearing cone (1D) come out of hub and rest on spindle, remove these parts from the spindle and set them aside. Discard the seal.

4. If seal and bearing cone did not come out of the small end of hub (1G) when you pressed spindle out of hub, remove seal (1B) and bearing cone (1D) from the small end of hub (1G). Discard the seal.

5. Bearing cone (1F) should be lying loose in wide end of hub (1G). Remove bearing cone (1F) from inside hub (1G).

NOTE: If you use a punch and hammer, make sure you do not strike the counterbore with the punch when you remove the bearing cup.

6. Remove bearing cup (1C) from the counterbore in the small end of hub (1G).

NOTE: If you use a punch and hammer, make sure you do not strike the counterbore with the punch when you remove the bearing cup.

7. Turn hub (1G) over and lift it out of the flange-support. Remove bearing cup (1E) from the counterbore in the wide end of hub (1G).
8. Turn hub (1G) over onto its small end. Remove two pipe plugs (1J) from the two pipe plug holes in the side of hub (1G).

NOTE: If your unit does not have studs, skip this step:

9. Press the nine studs (1N) out of the stud holes in hub (1G).
10. At this point the hub-spindle disassembly is complete.

Cover Disassembly

1. Remove the two bolts (6C) holding disconnect cap (6D) to cover (6A).
2. Remove disconnect cap (6D) from on top of cover cap (6B) and cover (6A).
3. Remove the two bolts (6C) holding cover cap (6B) to cover (6A).
4. Remove cover cap (6B) from cover (6A).
5. Remove disconnect rod (6K) from cover cap (6B).
6. Pry o-ring (6F) out of the groove inside cover cap (6B). Discard the o-ring.
7. Remove o-ring (6G) from the flange of cover cap (6B). Discard the o-ring.
8. Remove pipe plug (6H) from cover (6A).
9. At this point the cover disassembly is complete.

Carrier Disassembly

NOTE: When you remove the needle rollers from the cluster gears, discard the old needle rollers and use new ones during re-assembly.

1. Using a punch and hammer, drive roll pin (3G) into planet shaft (3E).

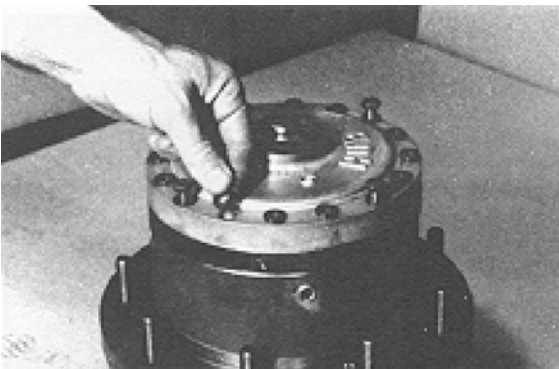
- 19.** Place shoulder bolts (13) into the four shoulder bolt holes in cover (6) and tighten by hand.



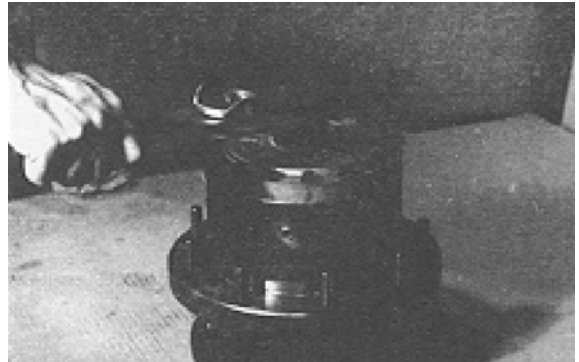
- 21.** Place the 12 bolts into the remaining bolt holes in cover (6) and tighten.

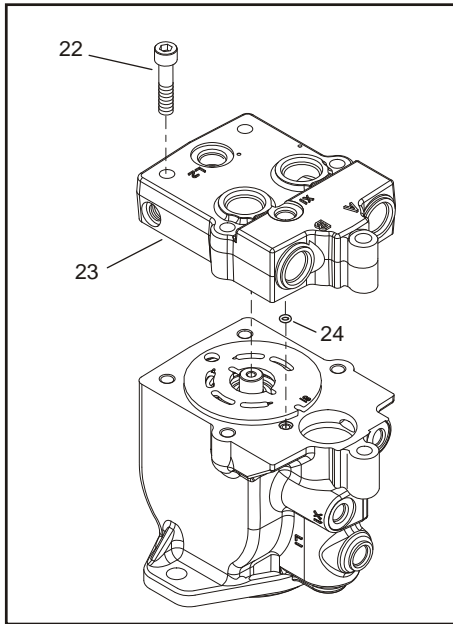


- 20.** Place the remaining 12 flatwashers (16) onto the remaining bolt holes in cover (6).



- 22.** Torque the shoulder bolts (13) 18 to 25 ft.lbs. (25 to 34 Nm). Torque bolts (12) 18 to 25 ft.lbs. (25 to 34 Nm).



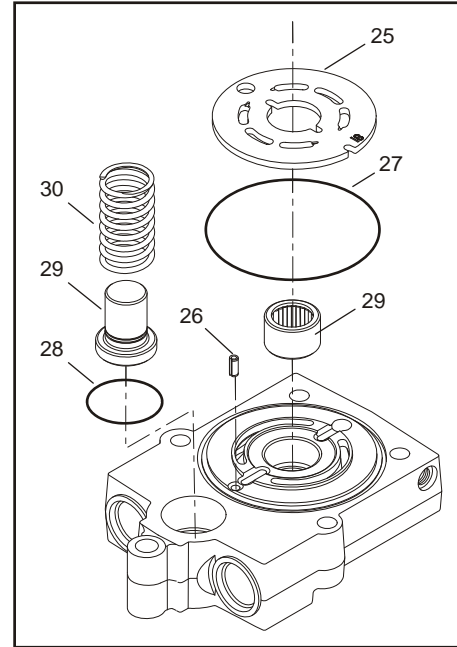


- 22. Screw
- 23. End Cap
- 24. O-ring

Figure 3-11. End Cap

13. Using an 8 mm internal hex wrench, remove the endcap screws (22).
14. Remove the endcap (23). Remove O-ring (24) from the housing or endcap.

When the endcap screws are removed, pressure from the servo spring will cause the endcap to bind on the shaft. Press down on the portion of the endcap covering the servo piston and hold the endcap level while removing.



- 25. Valve Plate
- 26. End Cap
- 27. O-ring
- 28. O-ring
- 29. Angle Stop
- 30. Servo Spring

Figure 3-12. Valve Plate & Rear Shaft Bearing

CAUTION

TAKE CARE NOT TO SCRATCH THE SURFACE OF THE VALVE PLATE.

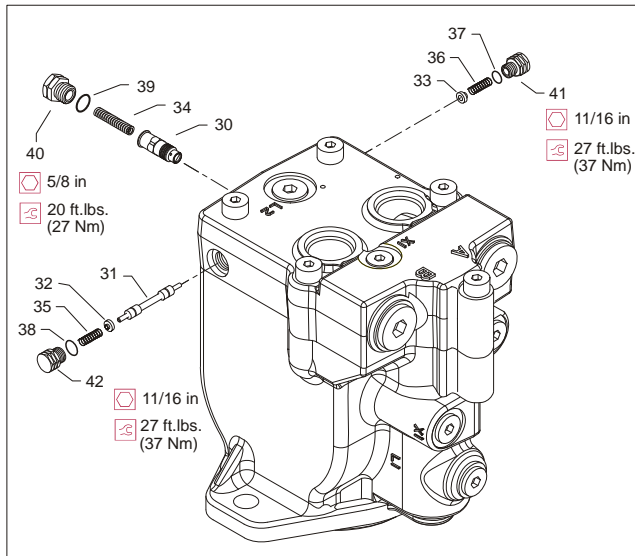
15. Remove the valve plate (25) and timing pin (26) from the endcap.

Each displacement has a unique valve plate. For identification, the last two digits of the valve plate part number are stamped on its surface.

16. Remove and discard the O-rings (27, 28).
17. Remove the rear shaft bearing (29) from the endcap with a bearing puller.

The bearing may be difficult to remove with a puller. Try this as an alternative: Pack the bearing cavity with heavy grease. After the shaft is removed, insert it into the bearing cavity and tap lightly with a soft mallet on the splined end. The grease will force the bearing out. Use caution not to drive the bearing past the rear shaft journal as the bearing may become trapped on the shaft and damaged.

20. Install orifice poppet (30).



- | | | | |
|--------------------|------------|------------|----------|
| 30. Orifice Poppet | 34. Spring | 37. O-ring | 40. Plug |
| 31. Shift Spool | 35. Spring | 38. O-ring | 41. Plug |
| 32. Spring | 36. Spring | 39. O-ring | 42. Plug |
| 33. Spring | | | |

Figure 3-28. Loop Flushing Spool

21. Install shift spool (31).
22. Install spring retaining washers onto springs (32 and 33).
23. Carefully install centering springs (34, 35, and 36).
24. Install new O-rings (37, 38, and 39).
25. Using a 5/8 in wrench torque plug (40) to 20 ft.lbs. (27 Nm).
26. Using a 11/16 in wrench, torque plugs (41 and 42) to 27 ft.lbs. (37 Nm).

Initial Start-up Procedures

Follow this procedure when starting-up a new motor or when installing a motor that has been removed.

Prior to installing the motor, inspect for damage incurred during shipping. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

1. Fill the reservoir with recommended hydraulic fluid. Always filter fluid through a 10 micron filter when pouring into the reservoir. Never reuse hydraulic fluid.
2. Fill the inlet line leading from the pump to the reservoir. Check the inlet line for properly tightened fittings and be certain it is free of restrictions and air leaks.
3. Fill the pump and motor housing with clean hydraulic fluid. Pour filtered oil directly into the upper most case drain port.
4. To ensure the pump and motor stay filled with oil, install case drain lines into the upper most case drain ports.
5. Install a 0 to 500 psi (0 to 35 bar) gauge in the charge pressure gauge port of the pump to monitor system pressure during start up.
6. While watching the pressure gauge, run the engine at the lowest possible speed until system pressure builds to normal levels (minimum 160 psi [11 bar]). Once system pressure is established, increase to full operating speed. If system pressure is not maintained, shut down the prime mover, determine cause, and take corrective action.
7. Operate the hydraulic system for at least fifteen minutes under light load conditions.
8. Check and adjust control settings as necessary after installation.
9. Shut down the prime mover and remove the pressure gauge. Replace plug at the charge pressure gauge port.
10. Check the fluid level in the reservoir; add clean filtered fluid if necessary. The motor is now ready for operation.

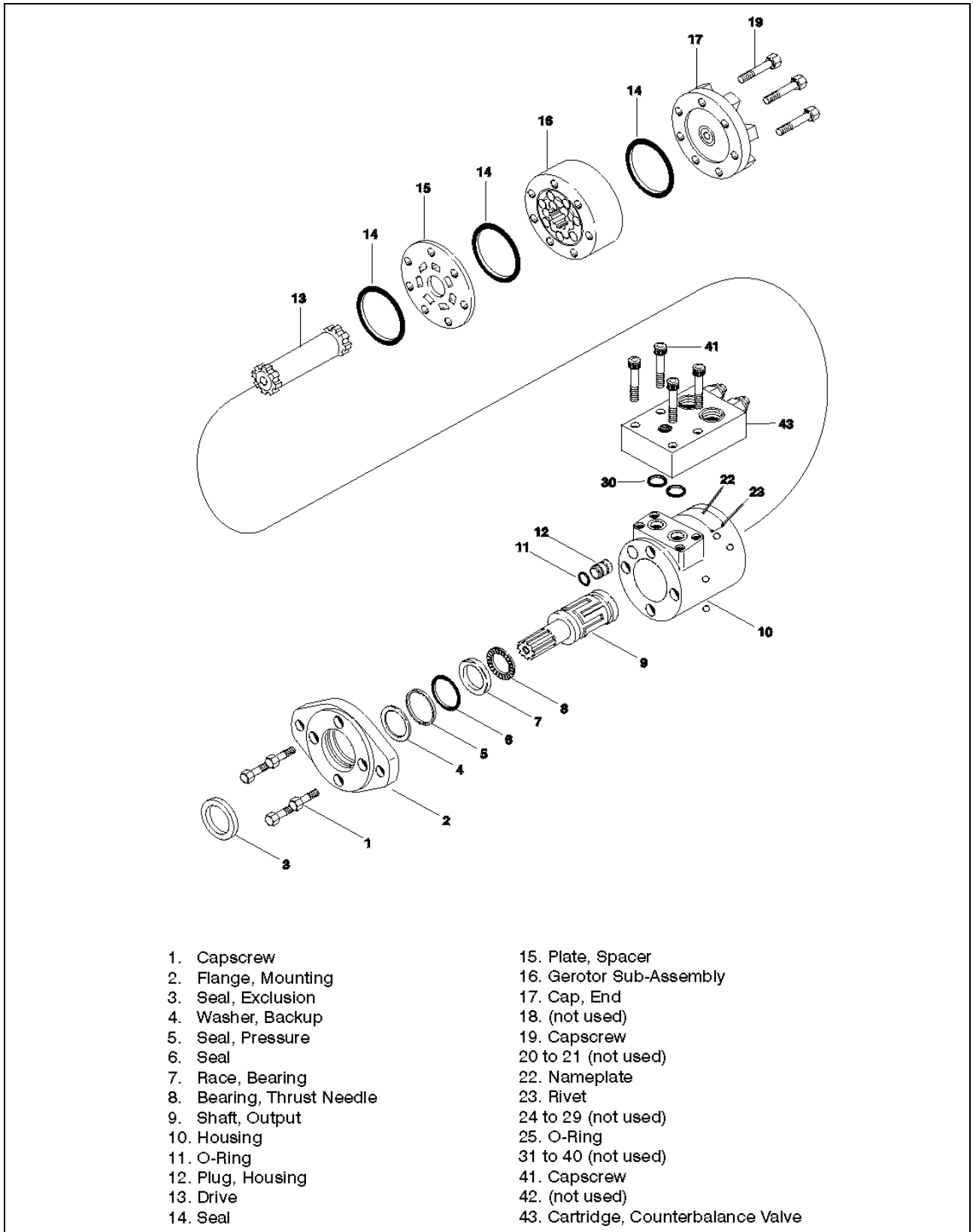
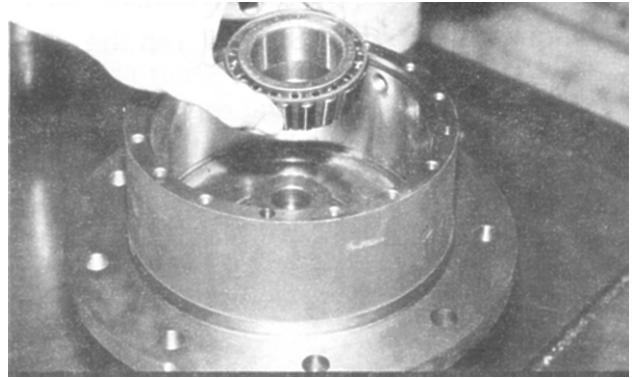


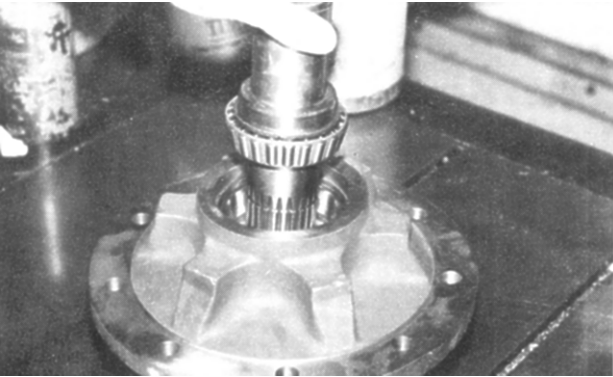
Figure 3-36. Swing Motor



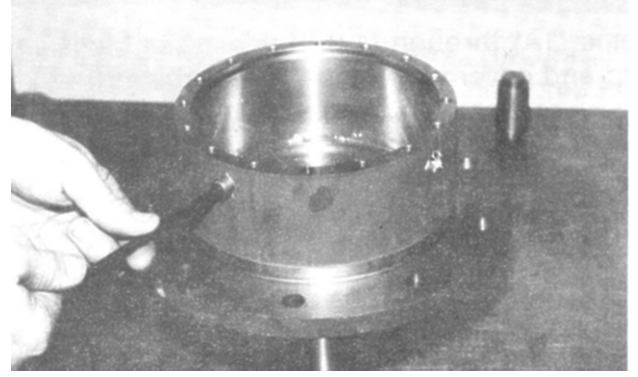
- 3.** Invert Hub (1G) and press Bearing Cup (1E) into counterbore of Hub (1G).



- 6.** The Bearing Cone (1F) is an interference fit and has to be pressed or tapped on.



- 4.** Returning the Hub (1G) to locate on the large diameter end, the Output Shaft (1A) is carefully installed into the Hub (1G).



- 7.** Pipe Plugs (1J 7 1K) should be checked and/or installed at this time in the assembly.



- 5.** The Shaft Seal (1B) is installed over the Output Shaft (1A) and into the counterbore of the Hub (1G). Care should be taken to insure the seal (1B) is being correctly installed (smooth face up and located just flush with the counterbore face).



- 8.** Bearing Spacer (1H) is installed around the Output Shaft (1A) and locates on Bearing Cone (1F).

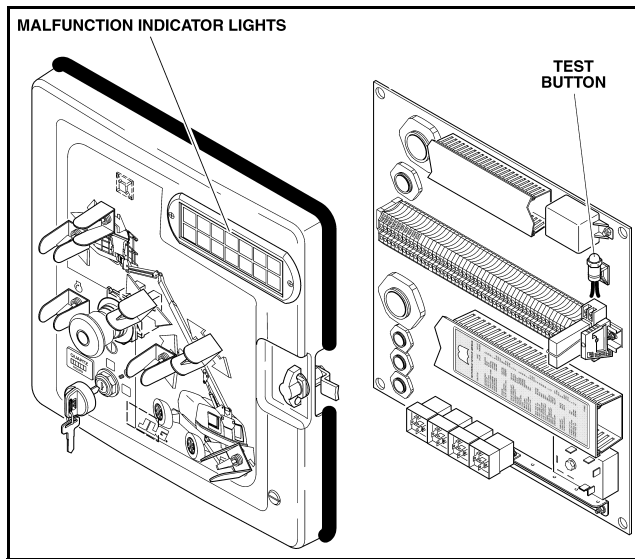


Figure 3-43. Malfunction Indicator Light and Test Button

When reading Diagnostic Trouble Codes thru the MIL, the following conditions apply:

- The flashing MIL is on for 0.4 second and off for 0.4 second.
- The MIL is off for 1.2 seconds between digits of two digit DTCs.
- The MIL is off for 2.4 seconds between DTCs.
- Each DTC repeats 3 times before the next stored DTC begins flashing.
- Up to 6 DTCs can be stored.
- Once all stored DTCs are flashed, the process repeats with the first stored DTC.
- DTCs are stored in the order in which they were set.

CLEARING TROUBLE CODES

To clear the trouble codes from the ECM, the electrical current running to the ECM must be shut off. To do this, disconnect the negative terminal from the battery for a period of approximately 15 minutes.

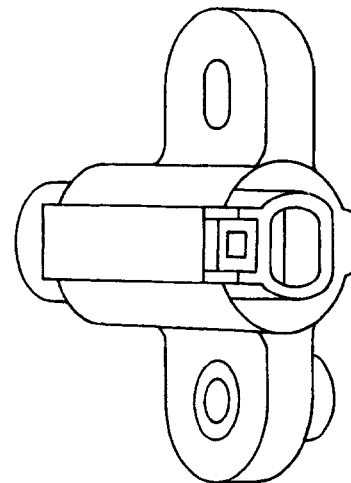
ECM and Sensors

CRANKSHAFT POSITION (CKP) SENSOR

The crankshaft position (CKP) sensor provides a signal used by the engine control module (ECM) to calculate the ignition sequence. The CKP sensor initiates the reference pulses which the ECM uses to calculate RPM and crankshaft position.

CAMSHAFT POSITION (CMP) SENSOR AND SIGNAL

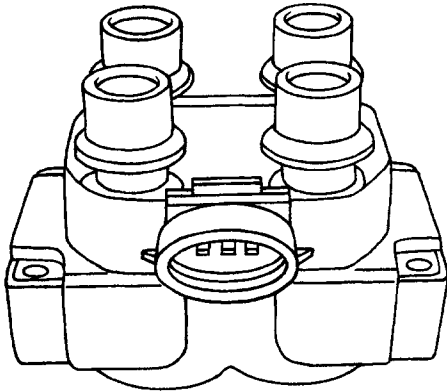
The camshaft position (CMP) sensor sends a CMP signal to the ECM. The ECM uses this signal as a “sync pulse” to trigger the injectors in the proper sequence. The ECM uses the CMP signal to indicate the position of the #1 piston during its power stroke. The CMP uses a Hall Effect sensor to measure piston position. This allows the ECM to calculate true sequential fuel injection (SFI) mode of operation. If the ECM detects an incorrect CMP signal while the engine is running, DTC 53 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the previously established injection sequence.



IGNITION COIL

The electronic ignition system uses a coil pack with one ignition coil for each two cylinders in the engine. Each cylinder is paired with its opposing cylinder in the firing order, so that one cylinder on compression fires simultaneously with the opposing cylinder on exhaust. The spark that occurs in the cylinder on the exhaust stroke is referred to as a "waste spark."

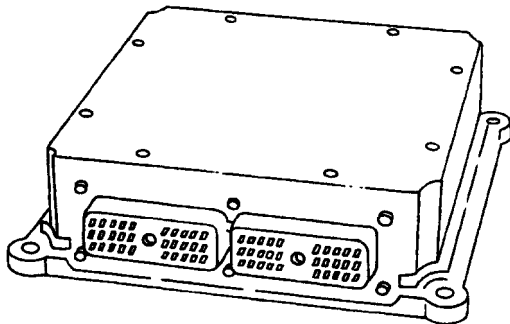
The primary coils in the coil pack are triggered by the "Ignition Coil Feed #1" and "Ignition Coil Feed #2" Signals from the ECM.



ENGINE CONTROL MODULE (ECM)

The ECM is responsible for maintaining proper spark and fuel injection timing for all operating conditions. To provide optimum operation and emissions, the ECM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor
- Intake air temperature (IAT) sensor
- Throttle position sensor
- Crankshaft position sensor



3.20 THROTTLE CHECKS AND ADJUSTMENTS - DEUTZ ENGINE (PRIOR TO S/N 61718)

General

The throttle control system on the Deutz engine includes the positional controller and the actuator.

Four LEDs are incorporated in the controller. They are as follows:

- Red - failure: signals a problem with the system - needs service or adjustment
- Green - clutch engaged; operation normal while system is powered.
- Amber - motor extend
- Amber - motor retract

The controller is designed so that when the system voltage reaches 10.5 volts, the actuator clutch will be released and the motor drive turned off in order to prevent unpredictable operation from occurring.

When a failure condition occurs (i.e. position time-out) the controller will release the clutch and turn off the actuator motor. This will prevent unnecessary motor wear.

Table 3-10. Position Controller Truth Table

TRIM POT #	Control Wiring				Actuator Position
	Black	Red	White	Green	
	GND	OFF	X	X	OFF POSITION (FREEWHEEL)
1	GND	+12 VDC	OFF	OFF	IDLE - 1200 rpm
2	GND	+12 VDC	+12 VDC	OFF	MID - 1800 rpm
3	GND	+12 VDC	OFF	+12 VDC	NOT USED
4	GND	+12 VDC	+12 VDC	+12 VDC	HIGH - 2900 RPM

GND = POWER SUPPLY OR BATTERY GROUND

OFF = GROUND OR OPEN CIRCUIT

X = DON'T CARE

+12 VDC = +12 VOLT POWER SUPPLY OR BATTERY SYSTEM, VIA A 5 AMP FUSE OR CIRCUIT BREAKER

TRIMMER ADJUSTMENTS

- 1 - POSITION 1 CW=RETRACT
- 2 - POSITION 2 CW=RETRACT
- 3 - POSITION 3 CW=RETRACT
- 4 - POSITION 4 CW=RETRACT

LED INDICATORS

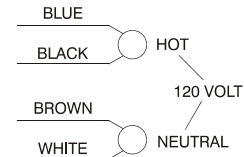
- R - RETRACT INDICATOR (AMBER)
- E - EXTEND INDICATOR (AMBER)
- C - CLUTCH INDICATOR (GREEN)
- F - FAILURE INDICATOR (RED)

Replacement of Couplings

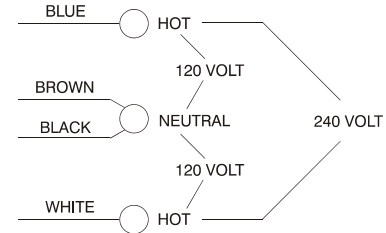
1. Remove coupling held by two 10/32 screws and nuts.
2. Un-bolt hydraulic motor from motor mount. (Two each 3/8-16 screws and nuts.)
3. Remove motor mount from welder four each 5/16-18 screws.
4. Loosen setscrews in both couplings.
5. Remove both couplings with gear puller.
6. Push new coupling onto hydraulic motor shaft (.625 bore).
7. Heat 24mm bore coupling to about 300 degrees and slide on generator shaft.
8. Let generator coupling cool.
9. Install sox spider on welder coupling.
10. Re-install motor mount onto welder, do not over tighten, the threads are aluminum.
11. Re-align hydraulic motor coupling with welder coupling and re-install hydraulic motor on motor mount.
12. Push couplings together and tighten setscrews in both couplings.
13. Re-install coupling guard.

Voltage Change Over - 120/240 Volt

1. The welder/generator has a connector with 4 wires, located in the lower portion of the welder.
2. The wire colors are blue, black, white, and brown.
3. For 120 volt only, connect the blue & black together. This is the hot leg. Connect brown & white together. This is neutral.



4. For 120/240 volt, use the blue wire as the hot leg. Use the white wire as the other hot leg (white to blue = 240 volt). Connect the black & brown together. This is neutral.



6. If the oil level is below the "ADD" mark, proceed to Step 7 and 8 and reinstall the dipstick into the dipstick tube.
7. Remove the oil filter cap from the valve rocker arm cover.
8. Add the required amount of oil to bring the level up to but not over "FULL" mark on the dipstick.
9. Reinstall the oil fill cap to the valve rocker cover and wipe away any excess oil.

Changing The Engine Oil

NOTICE

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

To change the oil use the following steps:

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

Coolant Fill Procedure - Dual Fuel Engine

NOTICE

DAMAGE TO THE 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 THAT THE ENGINE COOLING SYSTEM CONTAINS AIR. THE APPEARANCE AND TEMPERATURE OF THE EPR SHOULD BE MONITORED DURING THE 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 the worm gear clamp on the coolant line running into the EPR as shown below and remove the hose from the EPR. Place a rag under the hose to prevent coolant from running onto the engine/machine.



Electronic Throttle Control Replacement

See Figure 3-78.

REMOVAL

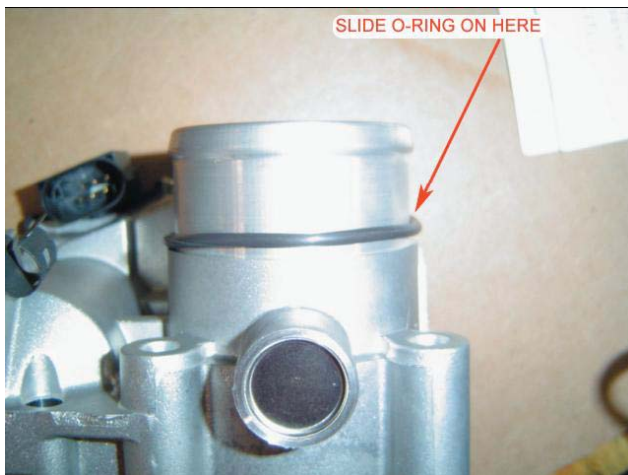
1. Disconnect the negative battery cable.
2. Remove the air intake duct.
3. Release the hose clamp on the vapor fuel line and remove the vapor hose.
4. Disconnect the TMAP electrical connector.
5. Disconnect the electronic throttle control connector.
6. Remove the manifold to throttle body adapter bolts and remove the throttle body mixer assembly.
7. Pull the throttle body assembly from the adapter.
8. Remove electronic throttle control device.
9. Remove the O-rings gasket and discard.

INSTALLATION

NOTICE

LIGHTLY LUBRICATE BOTH THROTTLE CONTROL DEVICE TO ADAPTER O-RINGS.

1. Install the O-ring on throttle body. Press it down to the bottom of the surface.



2. Install the two quad seals. Install one seal at a time to insure the seal does not roll. The seal must sit flat on the throttle body.

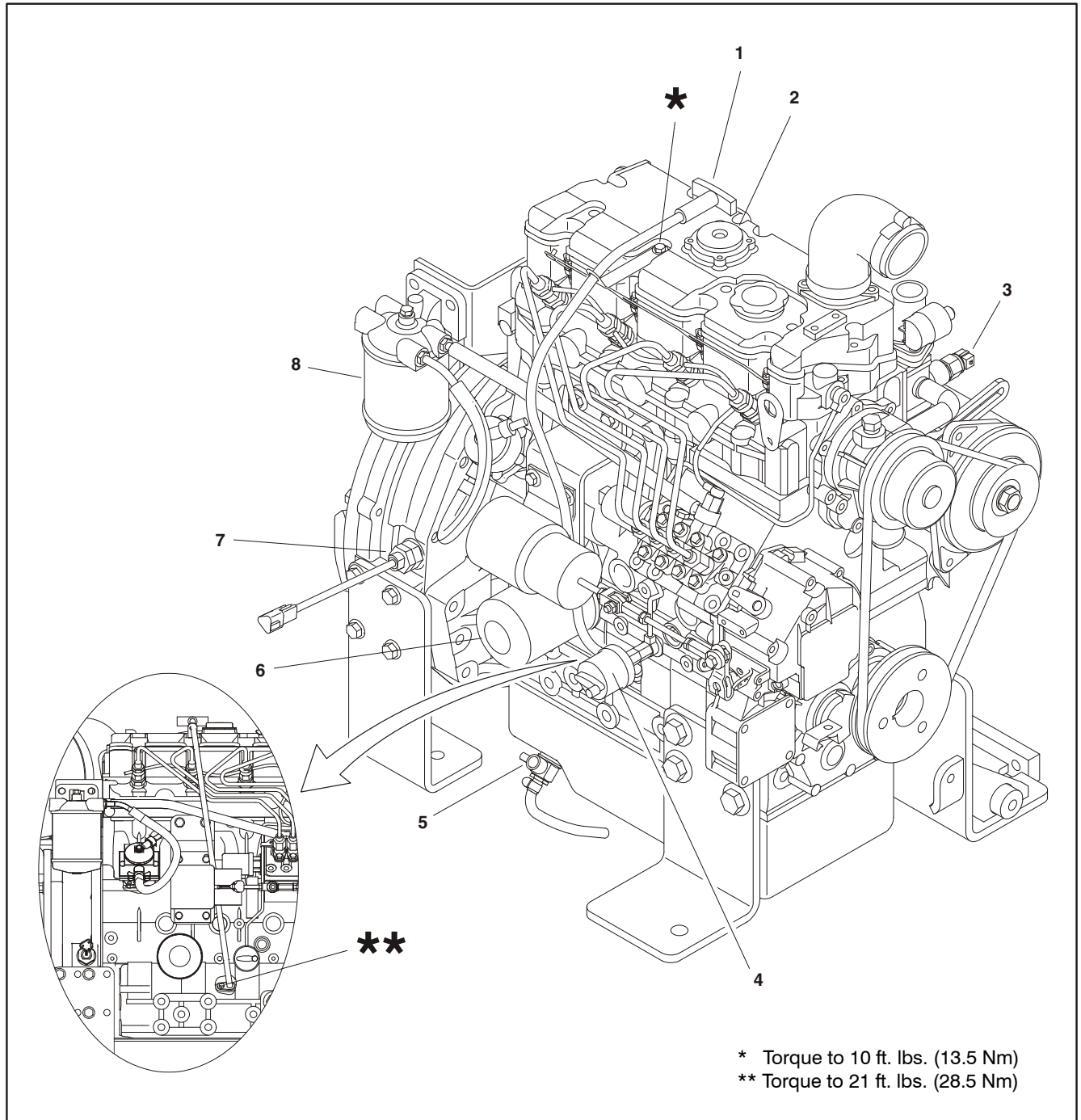


3. Attach mixer and throttle body together. The two parts do not bolt together; they will be secured when you mount it on the intake. Notice the orientation of the air inlet and throttle body cover.



Table 3-12. Symptom Diagnosis

Checks	Action
Exhaust System Checks	<input type="checkbox"/> Check the exhaust system for a possible restriction: <ul style="list-style-type: none"> - Inspect the exhaust system for damaged or collapsed pipes - Inspect the muffler for signs of heat distress or for possible internal failure. <input type="checkbox"/> Check for possible plugged catalytic converter. Refer to Restricted Exhaust System Diagnosis or Exhaust System in the GM Base Engine Service Manual
Additional Checks	<input type="checkbox"/>
Cuts Out, Misses	
DEFINITION: A surging or jerking that follows engine speed, usually more pronounced as the engine load increases which is not normally felt above 1500 RPM. The exhaust has a steady spitting sound at idle, low speed, or hard acceleration for the fuel starvation that can cause the engine to cut-out.	
Preliminary Checks	<input type="checkbox"/> Refer to Important Preliminary Checks.
Ignition System Checks	<input type="checkbox"/> Start the engine. <input type="checkbox"/> Wet down the secondary ignition system with water from a spray bottle, and look/listen for arcing or misfiring as you apply water. <input type="checkbox"/> Check for proper ignition output voltage with spark tester J 26792. <input type="checkbox"/> Check for a cylinder misfire. <input type="checkbox"/> Verify that the spark plugs are correct for use with LPG (R42LTS) <input type="checkbox"/> Remove the spark plugs in these cylinders and check for the following conditions: <input type="checkbox"/> Insulation cracks <input type="checkbox"/> Wear <input type="checkbox"/> Improper gap <input type="checkbox"/> Burned electrodes <input type="checkbox"/> Heavy deposits <input type="checkbox"/> Visually/Physically inspect the secondary ignition for the following: <input type="checkbox"/> Ignition wires for arcing, cross-firing and proper routing <input type="checkbox"/> Ignition coils for cracks or carbon tracking
Engine Mechanical Checks	<input type="checkbox"/> Perform a cylinder compression check. <input type="checkbox"/> Check the engine for the following: <ul style="list-style-type: none"> - Improper valve timing - Bent pushrods - Worn rocker arms - Worn camshaft lobes. - Broken or weak valve springs. <input type="checkbox"/> Check the intake and exhaust manifold passages for casting flash.
Fuel System Checks	<input type="checkbox"/> Check the fuel system - plugged fuel filter, low fuel pressure, etc. Refer to LPG Fuel System Diagnosis. <input type="checkbox"/> Check the condition of the wiring to the low pressure lock-off solenoid.
Additional Check	Check for Electromagnetic Interference (EMI). <input type="checkbox"/> EMI on the reference circuit can cause a missing condition. <input type="checkbox"/> Monitoring the engine RPM with a scan tool can detect an EMI. <input type="checkbox"/> A sudden increase in the RPM with little change in the actual engine RPM, indicates EMI is present. <input type="checkbox"/> If the problem exists, check the routing of the secondary wires and the ground circuit.



- | | |
|------------------------|--------------------|
| 1. Dipstick | 5. Oil Drain Valve |
| 2. Crankcase Breather | 6. Oil Filter |
| 3. Coolant Sensor | 7. Speed Sensor |
| 4. Oil Pressure Sensor | 8. Fuel Filter |

Figure 3-84. Perkins Engine

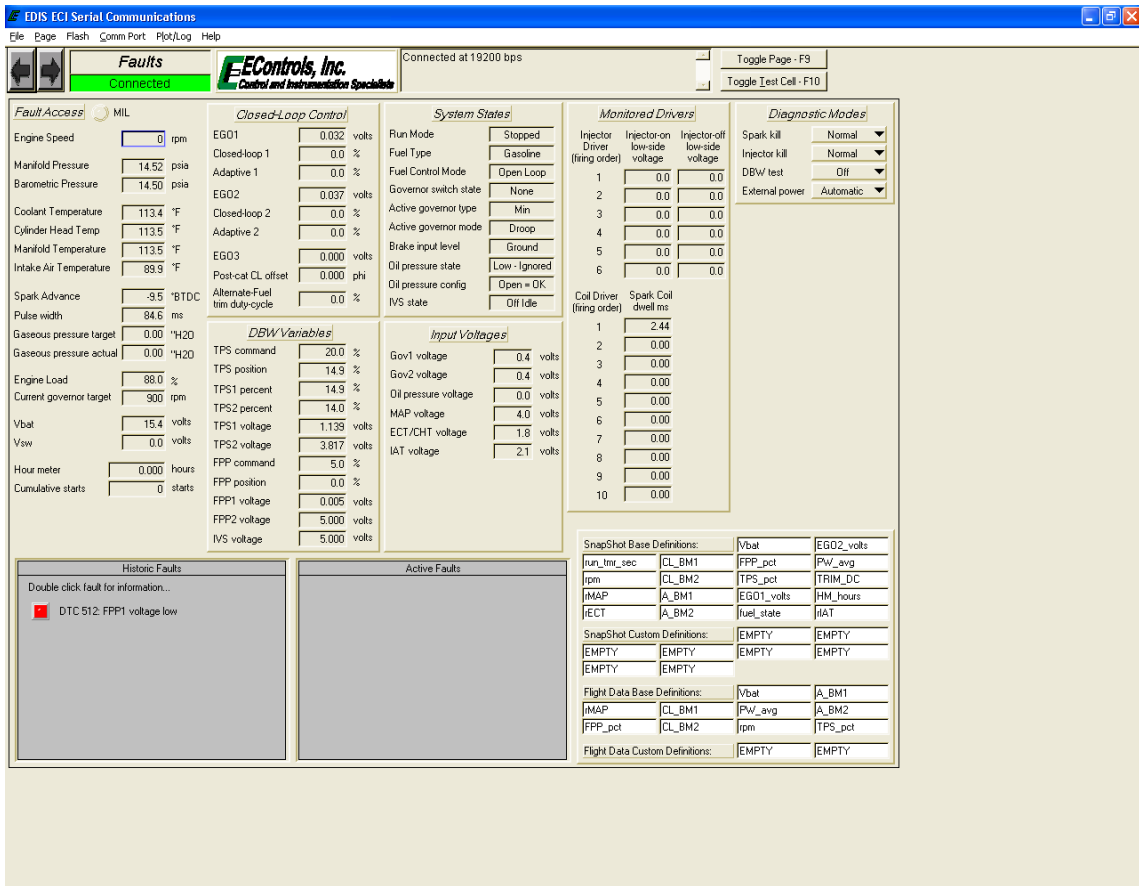


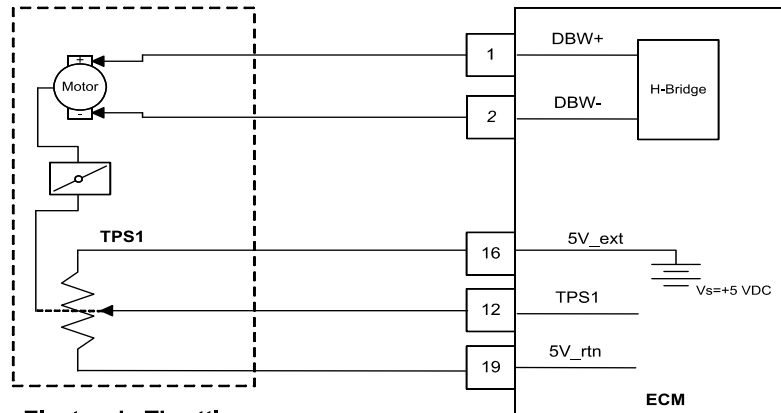
Figure 3-87. Faults Page with Historic Fault Message

Once an active fault has occurred two sets of data are recorded, fault snapshot and flight data recorder. The fault snapshot (FSS) is a sample of data taken at the instance the fault triggered. Variables included in the FSS are defined in the Snapshot Base and Snapshot Custom Definition fields found on the Faults Page. A FSS is saved with each of the first eight (8) faults for the first time the fault becomes active. Conversely, the flight data recorder (FDR) is a ten-second stream of data that includes eight-seconds prior and two-seconds after triggering the fault. An FDR is saved for each of the first two (2) faults for the first time the fault becomes active. Variables included in the FDR are defined in the Flight Data Base and Flight Data Custom Definition fields found on the Faults Page.

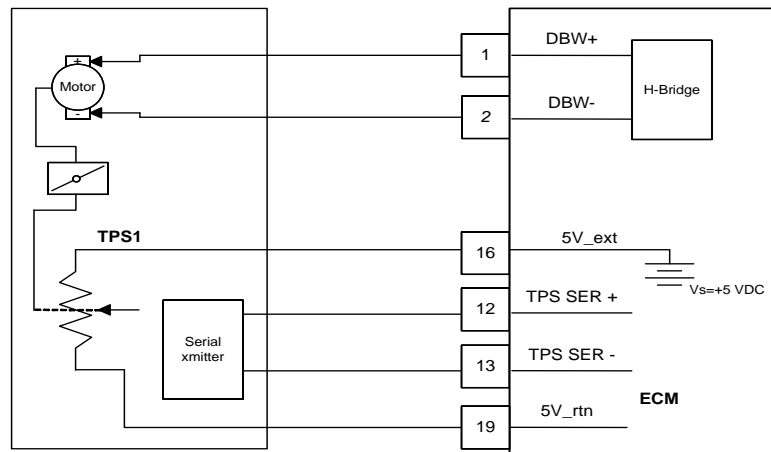
The memory location of the FDR is RAM, therefore this data is only available if the ECM has not lost battery power. In addition, if there is a "Dirty Flash Page" in the ECM, the FDR data will not be available. The memory location of the FSS data is EEPROM and is retained when the ECM loses battery power.

Both sets of data are accessed from the Historic Fault Information interface and can be saved to the PC upon retrieval. Base variables for FSS and FDR are generally defined by the OEM to include variables most often referenced during fault diagnosis. The base definitions are not fault dependent. Additional variables may be selected for capture during a fault occurrence through a single, left-click of the custom table and selecting the desired variables from a list. An example of custom fault variable definitions is shown in Figure 3-88.

DTC 122- TPS1 Signal Voltage Low

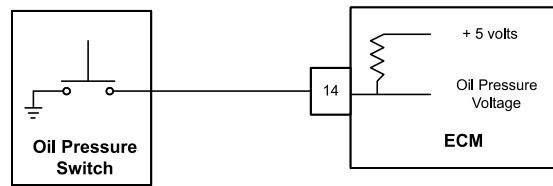


Electronic Throttle Actuator w/Analog Position Feedback

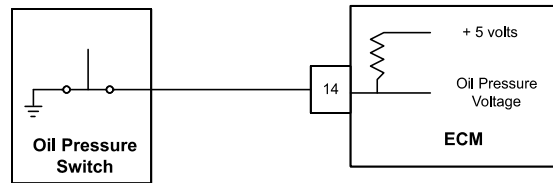


Electronic Throttle Actuator w/Serial Position Feedback

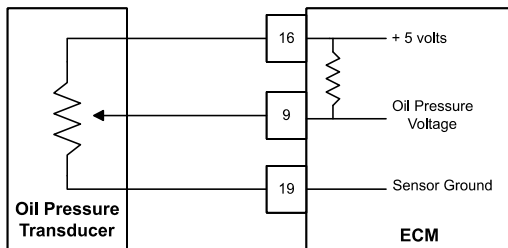
DTC 521- Oil Pressure Sender/Switch High Pressure



Normally-Open
Switch-Type



Normally-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 \underline{x} psia while engine speed is greater than \underline{y} RPM. For switch types, oil pressure is indicating high when the engine has been stopped for more than \underline{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.

Additionally for normally-open type oil pressure switches, a high pressure indication while the engine is off is a

symptom of a failed oil pressure switch. The ECM can monitor oil pressure indication when the engine is stopped for this failure mode.

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

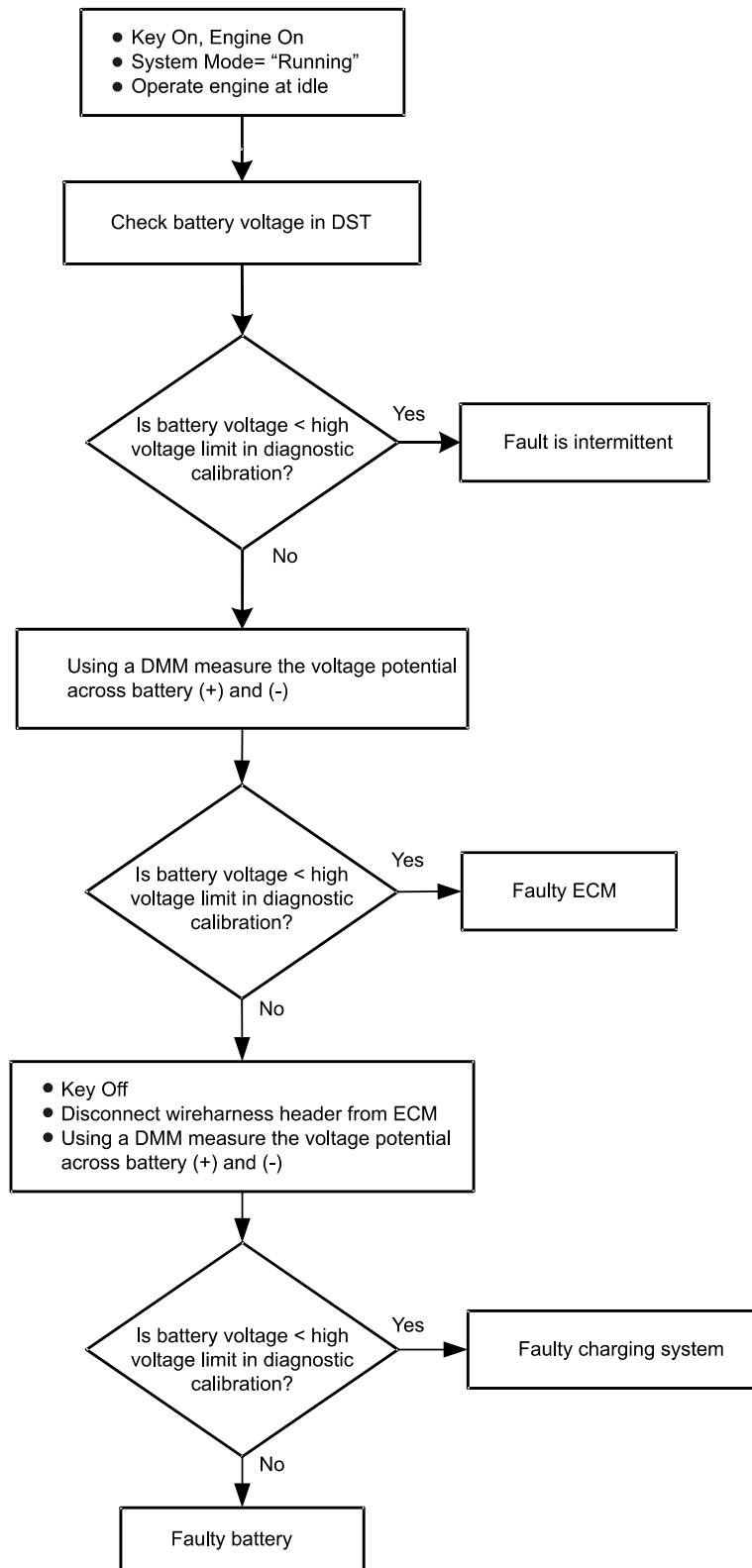
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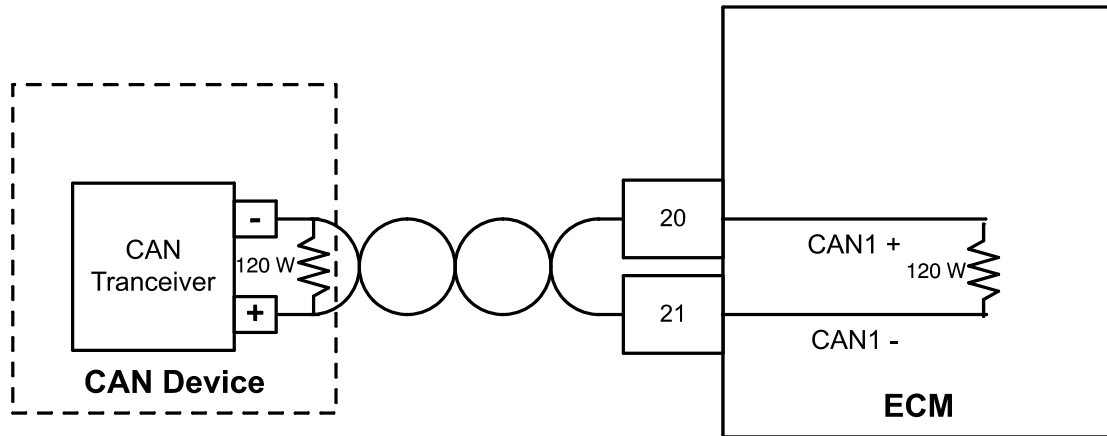
- Engine Control Module
- Check Condition- Key on
- Fault Condition- ECM 5-volt output is above the acceptable limit
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The ECM supplies 5-volt power to sensors, switches, and actuators external to the ECM. By supplying the power to these devices, the ECM can accurately measure their output relative to its own ground reference. The ECM can also control when the devices are active and put the devices in a low or no power state based on the current operating condition of the engine or vehicle.

If this fault sets, something other than the ECM is drawing the 5-volt power output of the ECM above an acceptable threshold. This may be due to a short in the wire harness, malfunctioning device, or failure of the ECM power output circuitry.

Diagnostic Aids

- Measure the 5-volt output of the ECM while cycling the key on and the engine stopped. Verify that the output is lower than the fault thresholds configured in the diagnostic calibration.
- Inspect the 5-Volt output circuit in the wire harness and look for shorts to ground or other harness circuits.
- Disconnect each device powered by the 5-volt output of the ECM one-at-a-time. Powered devices may include the throttle actuator, smart sensors, smart actuators, etc. After disconnecting device, observe the system fault and determine if the fault has cleared. If the fault clears, troubleshoot the disconnected device for failures.
- With all 5-volt powered devices disconnected, look for a change in the fault state and measure the 5-volt output of the ECM and verify it is within acceptable limits.

DTC 1625- CAN J1939 Shutdown Request

- Controller Area Network
- Check Condition- Key On, Engine Off and/or Running
- Fault Condition- ECM has received shutdown message from another CAN device and is shutdown on request.
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

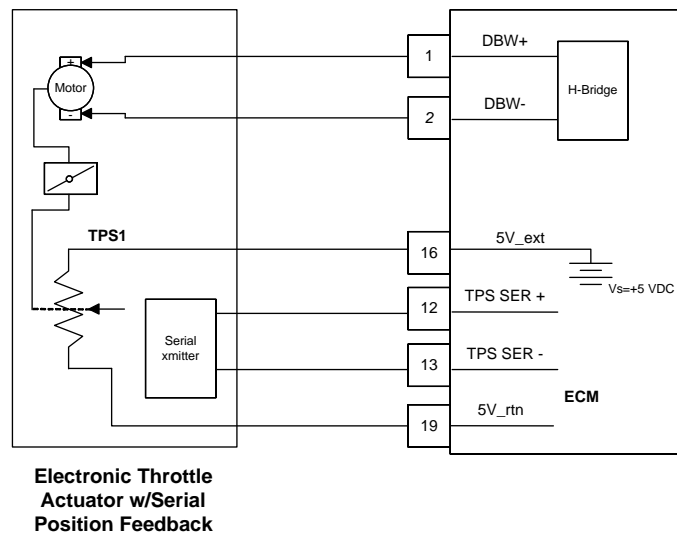
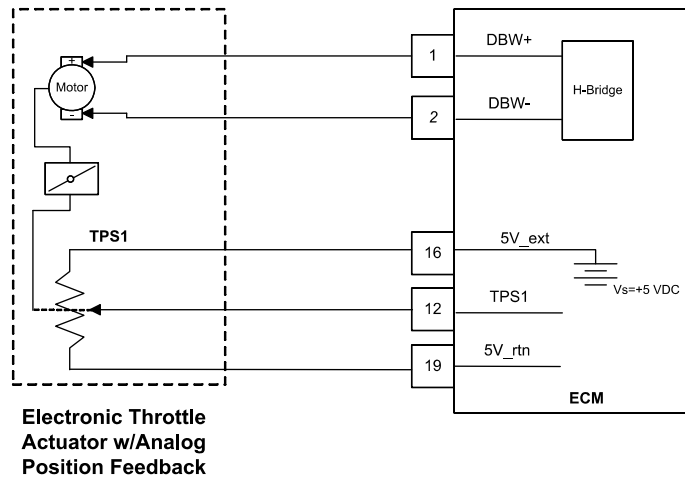
In some situations, external controllers may send a request to the ECM to shutdown engine operation and stop the engine. This request may be sent in response to a safety related condition in the vehicle.

This fault will set if the ECM receives the J1939 shutdown request via the CAN interface. This is the expected behavior.

Diagnostic Aids

- The ECM has shutdown the engine upon command by a external controller. This is the requested and expected behavior.

DTC 9999- Throttle Actuator Failsafe Spring Failure



- Throttle Actuator
- Check Condition- Key Off, Engine Stopped
- Fault Condition- When the key is off (or the actuator is unpowered), the ECM is expecting the failsafe spring in the actuator to return the throttle position to near 0%. If the throttle does not reach this position when the actuator is powered, a fault is generated.
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp. Govern the engine speed to a forced idle speed.
- Non-emissions related fault

The throttle actuator has a return spring that causes the throttle to move to a near 0% position when powered off. This causes the engine to shutdown following a key off. If

the ECM detects the throttle position to be above \underline{x} volts when the key is off (as determined by the diagnostic calibration), it will power up the actuator and attempt to drive it to a zero position. This should ensure that the engine is stopped.

This fault will set if the throttle does not return to a near 0% position with the key is off.

Diagnostic Aids

- Disconnect the throttle actuator from the wire harness. Remove the throttle actuator from the engine and manually move it. Verify that the internal spring forces the throttle back to near 0% position.
- Inspect the throttle arm or fuel rack on the fuel pump. Verify that it is not stuck.

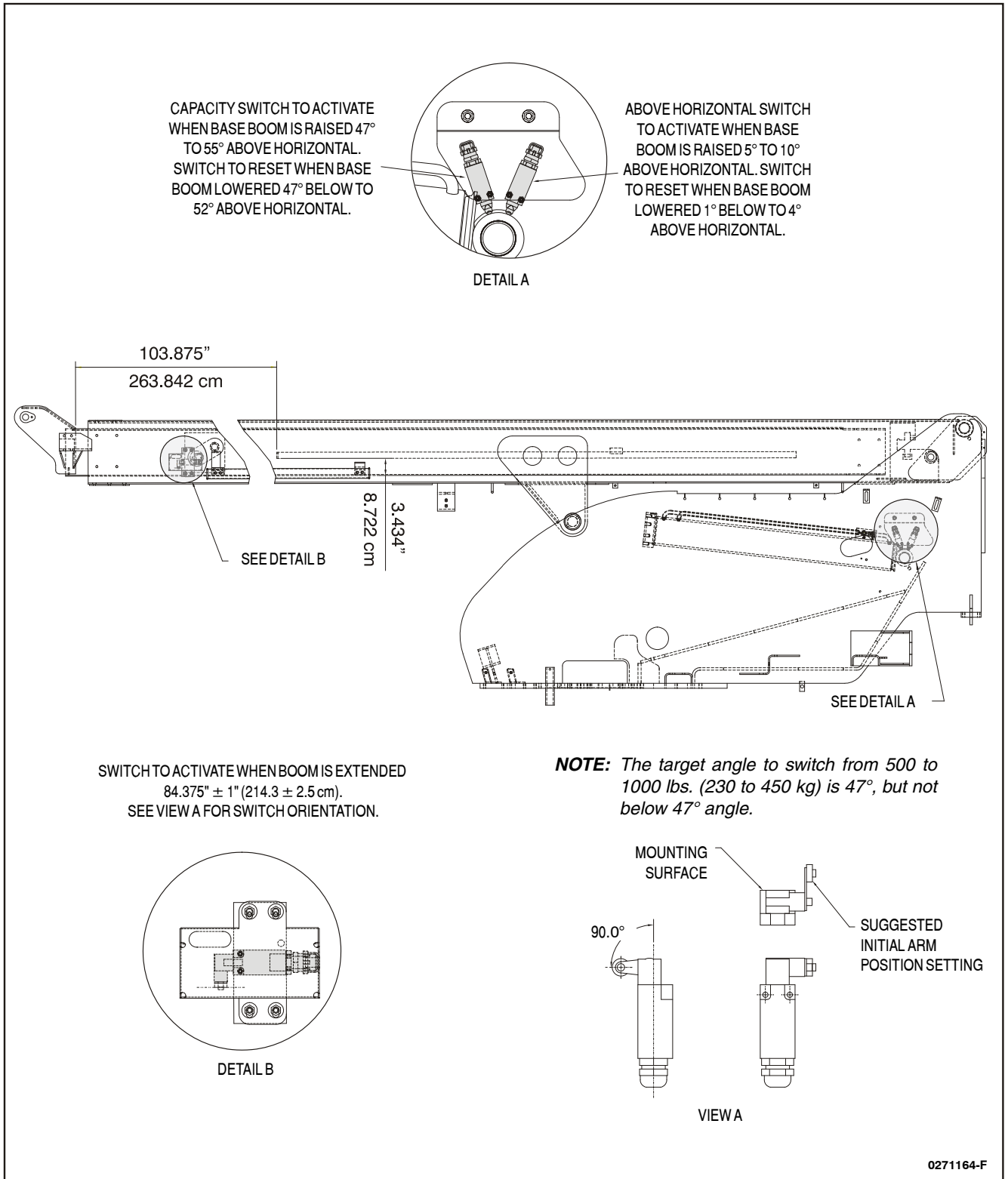


Figure 4-5. Limit Switches - 500 / 1000 LB (230 / 450 kg) Capacity



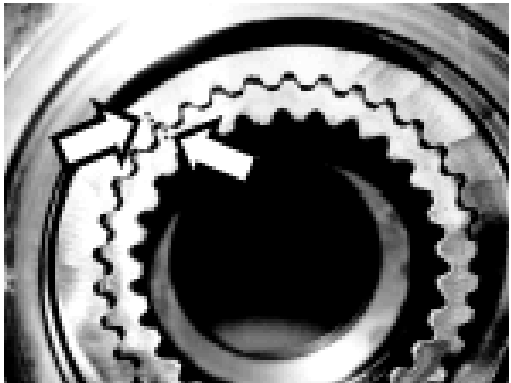
4. Install the end cap (4) removal tools provided with the Helac seal kit.



7. Remove the stop tube if included. The stop tube is an available option to limit the rotation of the actuator.



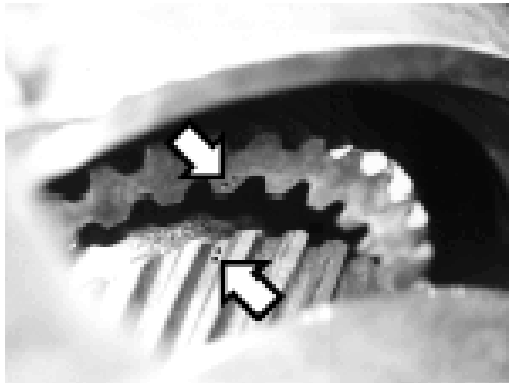
5. Using a metal bar, or something similar, un-screw the end cap (4) by turning it counter clock-wise.



8. Every actuator has timing marks for proper engagement.



6. Remove the end cap (4) and set aside for later inspection.



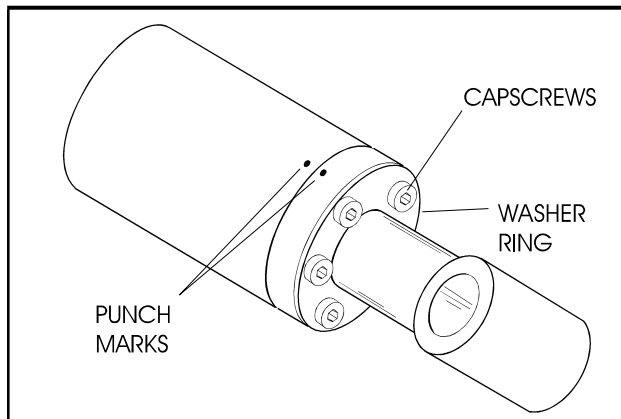


Figure 5-3. Capscrew Removal

6. Attach a suitable pulling device to the cylinder rod port block end or cylinder rod end, as applicable.

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

7. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel

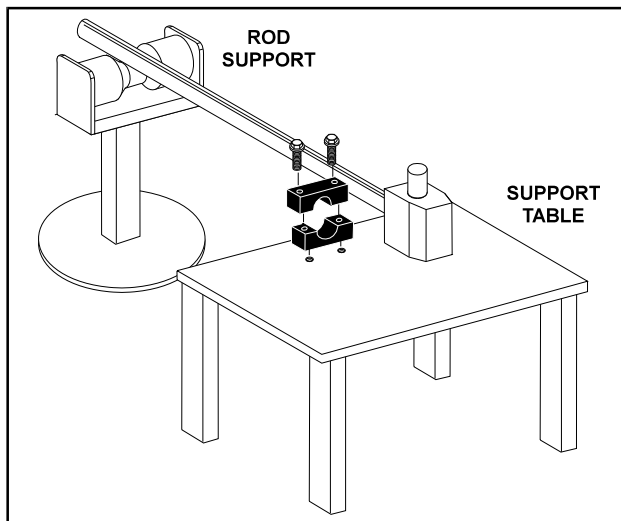


Figure 5-4. Cylinder Rod Support

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
9. Loosen and remove the cap screw(s), if applicable, which attach the tapered bushing to the piston.

10. Insert the cap screw(s) in the threaded holes in the outer piece of the tapered bushing. Progressively tighten the cap screw(s) until the bushing is loose on the piston.
11. Remove the bushing from the piston.

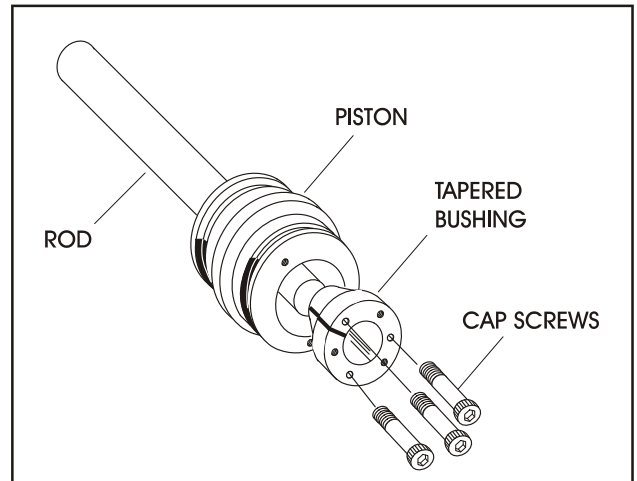


Figure 5-5. Tapered Bushing Removal

12. Screw the piston CCW, by hand, and remove the piston from cylinder rod.
13. Remove and discard the piston o-rings, seal rings, and backup rings.
14. Remove piston spacer, if applicable, from the rod.
15. Remove the rod from the holding fixture. Remove the cylinder head gland and retainer plate, if applicable. Discard the o-rings, back-up rings, rod seals, and wiper seals.

Cleaning and Inspection

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the 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 and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. Inspect threaded portion of piston for damage. Dress threads as necessary.

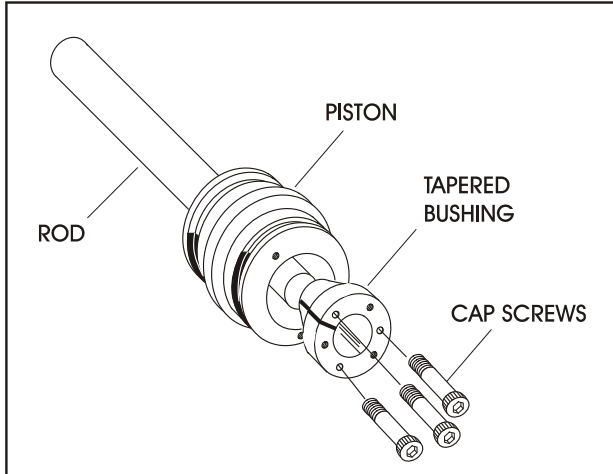


Figure 5-18. Tapered Bushing Installation

12. Tighten the capscrews evenly and progressively in rotation to the specified torque value. (See Table 5-1, Cylinder Head and Tapered Bushing Torque Specifications.)
13. After the screws have been torqued, tap the tapered bushing with a hammer (16 to 24 oz.) and brass shaft (approximately 3/4" in diameter) as follows;
 - a. Place the shaft against the cylinder rod and in contact with the bushing in the spaces between the capscrews.
 - b. Tap each space once; this means the tapered bushing is tapped 3 times as there are 3 spaces between the capscrews.

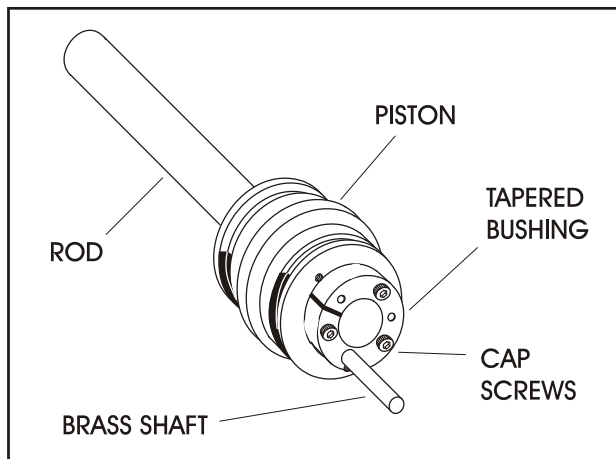


Figure 5-19. Seating the Tapered Bearing

14. Retorque the capscrews evenly and progressively in rotation to the specified torque value. (See Table 5-1, Cylinder Head and Tapered Bushing Torque Specifications.)

15. Remove the cylinder rod from the holding fixture.
16. Place new guide locks and seals in the applicable outside diameter grooves of the cylinder piston. (See Figure 5-17., Piston Seal Kit Installation.)

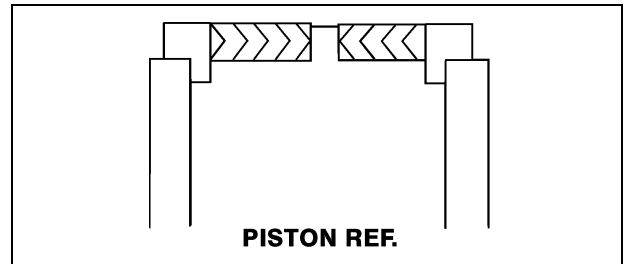


Figure 5-20. Poly-Pak Piston Seal Installation

17. Position the cylinder barrel in a suitable holding fixture.

NOTICE

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

18. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.
19. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder.
20. Secure the cylinder head gland using the washer ring and socket head bolts. See Figure 5-1, Cylinder Head and Tapered Bushing Torque Specifications

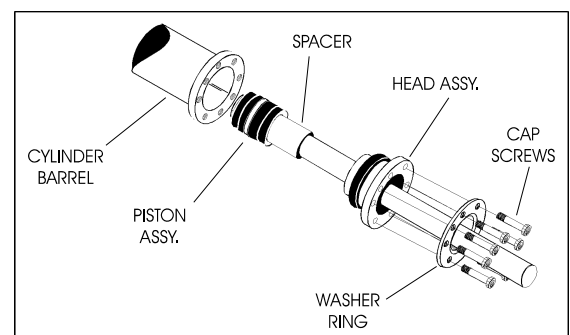


Figure 5-21. Rod Assembly Installation

21. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any holding valve or valves.

Timing Procedure

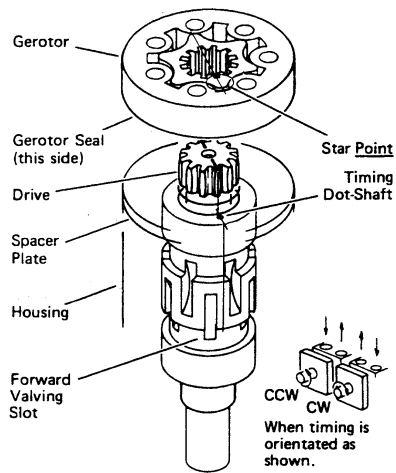
- a. Install drive. Use felt tip marker to mark one tooth. Align this tooth with timing dot on shaft.

NOTE: If drive is not symmetrical, install larger splined end into shaft.

- b. Install spacer plate.
- c. Install 2 7/8 in. (73 mm) I.D. seal in gerotor seal groove. Carefully place gerotor on spacer plate, seal side toward spacer plate.

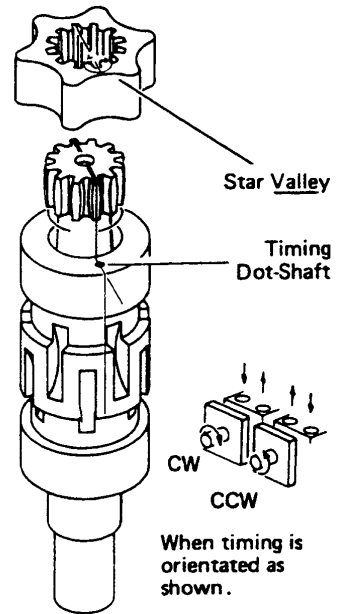
Standard Rotation

Align any star point with tooth marked on drive.



Reverse Rotation

Align any star valley with marked tooth.



15. Rotate gerotor to line up with bolt holes. Be careful not to disengage star from drive or disturb gerotor seal.

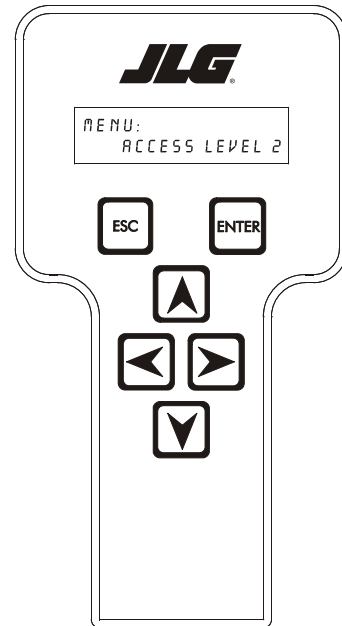
When a top level menu is selected, a new set of menu items may be offered: for example:

DRIVE
BOOM
SYSTEM
DATALOG
VERSIONS

Pressing **ENTER** 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 access level 2. Remember, you may always cancel a selected menu item by pressing the **ESC**. key.

6.4 CHANGING THE ACCESS LEVEL OF THE HAND HELD ANALYZER

When the analyzer is first connected, you will be in access level 2 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:



MENU:
ACCESS LEVEL 2

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.

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

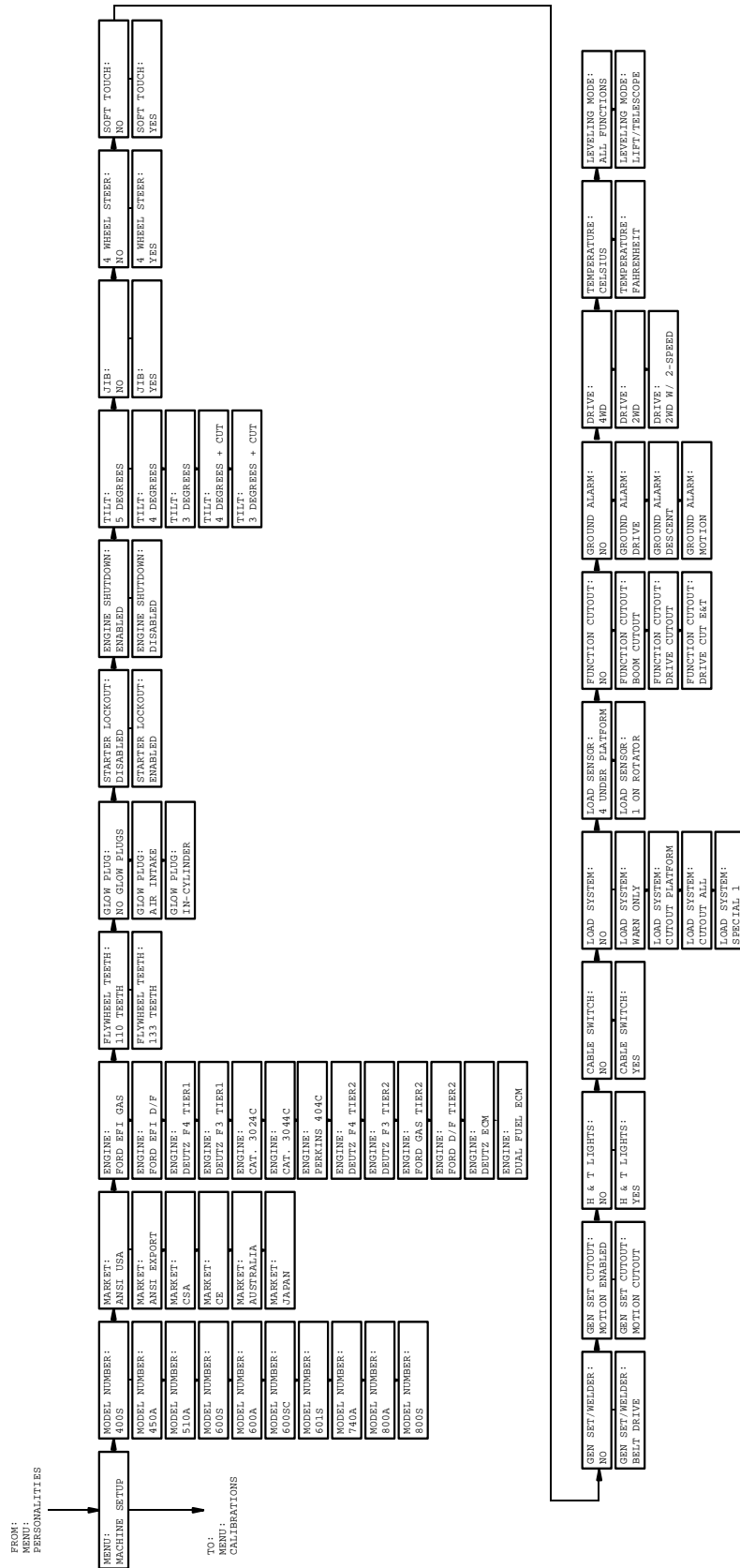


Figure 6-11. Analyzer Flow Chart, Version 5.X Software - Sheet 3 of 4

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

Table 6-3. Help Fault Codes, Displayed Faults, and Descriptions - S/N 66995 to Present

Fault Flash Code	Communicated (Displayed on Analyzer) Fault	Description	Priority
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 was selected before and during footswitch closure. Can be reported during power-up sequence.	
	FSW INTERLOCK TRIPPED	Footswitch was 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 the 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 the 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.	
	D/S JOY. CENTER TAP BAD	Resistive joysticks: These faults occur when the center tap voltage is not between 3.08 volts and 3.83 volts. Due to resistor tolerances there is a +/- .1 volt range around these values where the fault may be indicated.	
	WAITING FOR FSW TO BE OPEN	Footswitch was closed when platform mode was selected. Can be reported during power-up sequence.	
FOOTSWITCH SELECTED BEFORE START	The user attempted to start the machine with the footswitch engaged.		
2/3		Flash code 2/3 indicates problems with boom function selection.	3
	LIFT/SWING LOCKED – JOYSTICK MOVED BEFORE FOOTSWITCH	Platform upper lift or swing was selected before and during footswitch closure.	
	PUMP SWITCHES FAULTY – CHECK DIAGNOSTICS/BOOM	A boom function (lower lift, telescope, basket level, basket rotate, jib) has both directions selected together.	
	PUMP SWITCHES LOCKED – SELECTED BEFORE FOOTSWITCH	A platform boom function (lower lift, telescope, basket level, basket rotate, jib) was selected before key switch or footswitch closure.	
	PUMP SWITCHES LOCKED – SELECTED BEFORE AUX POWER	A ground boom function (lower lift, telescope, basket level, basket rotate, jib) was selected before aux power.	
	l/s joy. out of range low	Resistive joysticks: These faults do not occur.	
	l/s joy. out of range high	Resistive joysticks: These faults do not occur if the 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.	
	l/s joy. center tap bad	Resistive joysticks: These faults occur when the center tap voltage is not between 3.08 volts and 3.83 volts. Due to resistor tolerances there is a +/- .1 volt range around these values where the fault may be indicated.	
	PUMP SWITCHES LOCKED – SELECTED BEFORE START SWITCH	This fault occurs when a hydraulic function switch is closed before the start switch is closed.	
	FOOTSWITCH SELECTED BEFORE START	The user attempted to start the machine with the footswitch engaged.	
2/4		Flash code 2/4 indicates that steering digital inputs are faulty. NOT REQUIRED	

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

Table 6-3. Help Fault Codes, Displayed Faults, and Descriptions - S/N 66995 to Present

Fault Flash Code	Communicated (Displayed on Analyzer) Fault	Description	Priority
	MAIN LIFT PVG VALVE COMMAND IMPROPER	Main boom lift pvg valve received an invalid command from the control system.	
	TOWER LIFT PVG VALVE COMMAND IMPROPER	Tower boom lift pvg valve received an invalid command from the control system.	
	TOWER TELESCOPE PVG VALVE COMMAND IMPROPER	Tower boom telescope pvg valve received an invalid command from the control system.	
	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 a valve calibration.	
	TOWER LIFT PVG VALVE SETUP FAULT	Tower boom lift pvg valve setup data is incorrect. Requires a valve calibration.	
	TOWER TELESCOPE PVG VALVE SETUP FAULT	Tower boom telescope pvg valve setup data is incorrect. Requires a valve calibration.	
	MAIN LIFT PVG VALVE SENT UNRECOGNIZED FAULT	Main boom lift pvg valve sent an 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	The main lift pvg valves spool data is incorrect. Requires a valve calibration.	
	TOWER LIFT PVG VALVE PARAMETERS INCORRECT	The tower lift pvg valves spool data is incorrect. Requires a valve calibration.	
	TOWER TELESCOPE PVG VALVE PARAMETERS INCORRECT	The tower telescope pvg valves spool data is incorrect. Requires a valve calibration.	
	MAIN LIFT PVG VALVE LOCATION IMPROPER	Main lift pvg valve was hosed wrong or the wiring was incorrect during calibration.	
	TOWER LIFT PVG VALVE LOCATION IMPROPER	Tower lift pvg valve was hosed wrong or the wiring was incorrect during calibration.	
	TOWER TELESCOPE PVG VALVE LOCATION IMPROPER	Tower telescope pvg valve was hosed wrong or the wiring was incorrect during calibration.	
	MAIN LIFT PVG VALVE WIRING INCORRECT	The power wire for the main lift pvg valve is not wired to that valve.	
	TOWER LIFT PVG VALVE WIRING INCORRECT	The power wire for the tower lift pvg valve is not wired to that valve.	
	TOWER TELESCOPE PVG VALVE WIRING INCORRECT	The power wire for the tower telescope pvg valve is not wired to that valve.	

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

Table 6-4. Machine Configuration Programming Information Prior to Software Version P5.3

Configuration Digit	Number	Description	Default Number
MODEL NUMBER: 1	1	400S	1
	2	450A	
	3	510A	
	4	600S	
	5	600A	
	6	600SC	
	7	601S	
	8	740A	
	9	800A	
	10	800S	
MARKET: 2	0	ANSI USA	0
	1	ANSI EXPORT	
	2	CSA	
	3	CE	
	4	AUSTRALIA	
ENGINE: 3* * Engine selections vary depending on model selection.	1	FORD EFI GAS: Ford LRG425 EFI Gas (Tier 1)	7
	2	FORD EFI D/F: Ford LRG425 EFI dual fuel (Tier 1)	
	3	DEUTZ F4 TIER1: Deutz F4M1011F Diesel (Tier 1)	
	4	DEUTZ F3 TIER1: Deutz F3M1011F Diesel (Tier 1)	
	5	CAT. 3024C: CAT 3024C Diesel (Tier 2)	
	6	CAT. 3044C: CAT 3044C Diesel (Tier 2)	
	7	PERKINS 404C (Tier 2)	
	8	DEUTZ F4 TIER2: Deutz F4M2011 Diesel (Tier 2)	
	9	DEUTZ F3 TIER2: Deutz F3M2011 Diesel (Tier 2)	
	10	FORD GAS TIER2: Ford LRG425 EFI Gas (Tier 2)	
	11	FORD D/F TIER2: Ford LRG425 EFI Dual Fuel (Tier 2)	
	12	DEUTZ ECM: Engine Control Module - ECM	
	13	DUAL FUEL ECM: GM/PSI 3.0L Dual Fuel (Tier 2)	
FLYWHEEL TEETH: 4* * This menu item is only visible if Deutz engine selections 3 or 4 are selected.	0	133 TEETH: 133 flywheel teeth.	1
	1	110 TEETH: 110 flywheel teeth.	

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

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

Configuration Label/ Digit	Number	Description	Default Number
ENGINE: 3* * Engine selections vary depending on model selection.	1	FORD EFI GAS: Ford LRG425 EFI Gas (Tier 1)	14
	2	FORD EFI D/F: Ford LRG425 EFI dual fuel (Tier 1)	
	3	DEUTZ F4 TIER1: Deutz F4M1011F Diesel (Tier 1)	
	4	DEUTZ F3 TIER1: Deutz F3M1011F Diesel (Tier 1)	
	5	CAT. 3024C: CAT 3024C Diesel (Tier 2)	
	6	CAT. 3044C: CAT 3044C Diesel (Tier 2)	
	7	PERKINS 404C (Tier 2)	
	8	DEUTZ F4 TIER2: Deutz F4M2011 Diesel (Tier 2)	
	9	DEUTZ F3 TIER2: Deutz F3M2011 Diesel (Tier 2)	
	10	FORD GAS TIER2: Ford LRG425 EFI Gas (Tier 2)	
	11	FORD D/F TIER2: Ford LRG425 EFI Dual Fuel (Tier 2)	
	12	DEUTZ ECM: Engine Control Module - ECM (Tier 2 and Tier 3)	
	13	DUAL FUEL ECM: GM/PSI 3.0L Dual Fuel (Tier 2)	
	14	PERKINS ECM	
	15	CAT ECM	
FLYWHEEL TEETH: 4* * This menu item is only visible if Deutz engine selections 3 or 4 are selected.	0	133 TEETH: 133 flywheel teeth.	1
	1	110 TEETH: 110 flywheel teeth.	
GLOW PLUG: 5	0	NO GLOW PLUGS: No glow plugs installed.	2
	1	AIR INTAKE: Glow plugs installed in the air intake on the manifold.	
	2	IN-CYLINDER: Glow plugs installed in each cylinder.	

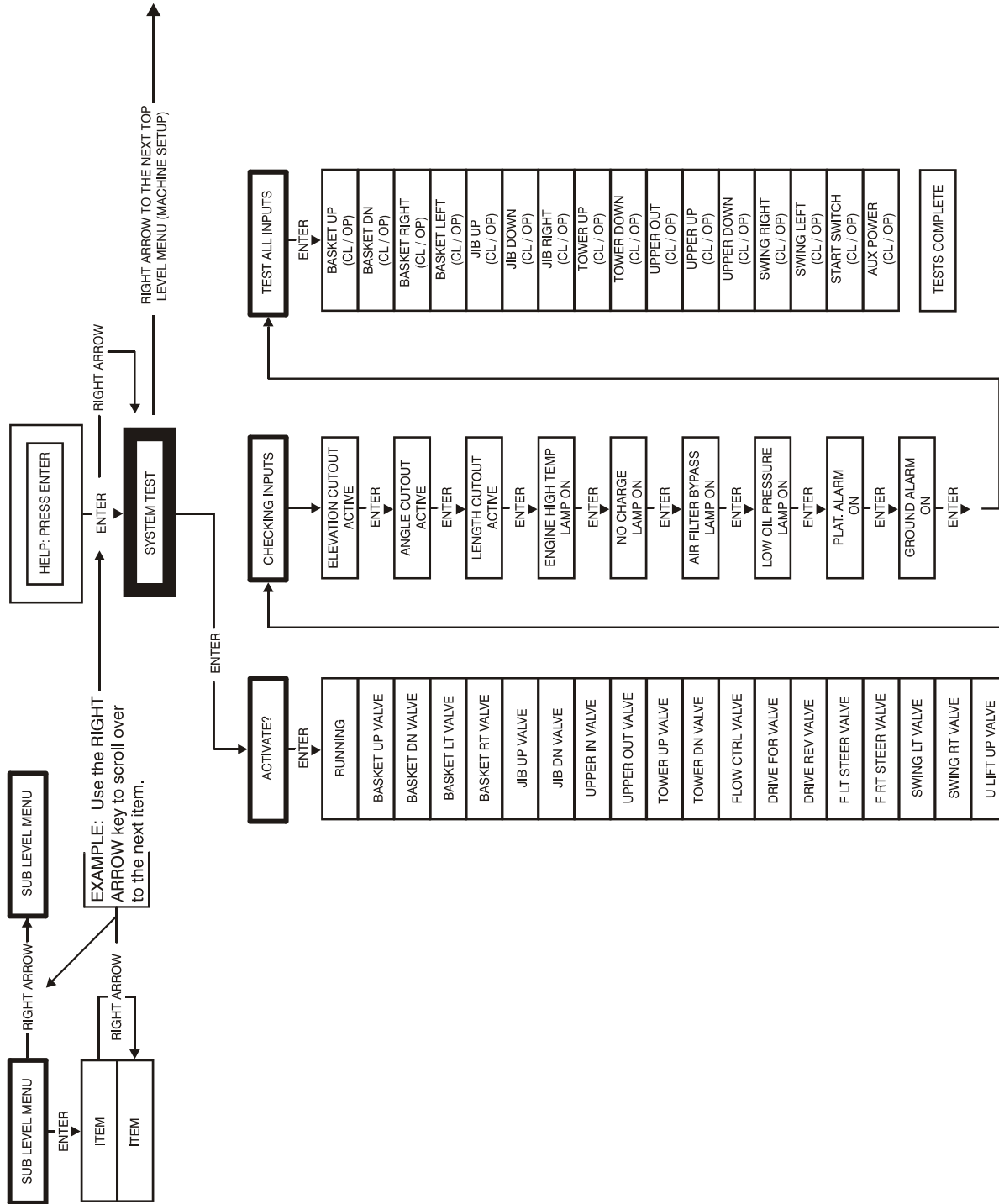


Figure 6-14. System Test Flow Chart - Ground Station Tests

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

Table 6-9. Analyzer Fault Code Listing

DTC	Analyzer Text
3370	TWO SPEED VALVE - SHORT TO BATTERY
3371	GROUND ALARM - SHORT TO GROUND
3372	GROUND ALARM - OPEN CIRCUIT
3373	GEN SET/WELDER - SHORT TO GROUND
3374	GEN SET/WELDER - OPEN CIRCUIT
3375	GEN SET/WELDER - SHORT TO BATTERY
3376	HEAD TAIL LIGHT - SHORT TO GROUND
3377	HEAD TAIL LIGHT - OPEN CIRCUIT
3378	HEAD TAIL LIGHT - SHORT TO BATTERY
3379	HOURLY METER - SHORT TO GROUND
3382	PLATFORM LEVEL UP VALVE - SHORT TO GROUND
3383	PLATFORM LEVEL UP VALVE - OPEN CIRCUIT
3384	PLATFORM LEVEL UP VALVE - SHORT TO BATTERY
3385	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO GROUND
3386	PLATFORM LEVEL UP OVERRIDE VALVE - OPEN CIRCUIT
3387	PLATFORM LEVEL UP OVERRIDE VALVE - SHORT TO BATTERY
3388	PLATFORM LEVEL DOWN VALVE - SHORT TO GROUND
3389	PLATFORM LEVEL DOWN VALVE - OPEN CIRCUIT
3390	PLATFORM LEVEL DOWN VALVE - SHORT TO BATTERY
3391	PLATFORM LEVEL DOWN OVERRIDE VALVE - SHORT TO GROUND
3392	PLATFORM LEVEL DOWN OVERRIDE VALVE - OPEN CIRCUIT
3393	PLATFORM LEVEL DOWN OVERRIDE VALVE - SHORT TO BATTERY
3394	PLATFORM ROTATE LEFT VALVE - SHORT TO GROUND
3395	PLATFORM ROTATE LEFT VALVE - OPEN CIRCUIT
3396	PLATFORM ROTATE LEFT VALVE - SHORT TO BATTERY
3397	PLATFORM ROTATE RIGHT VALVE - SHORT TO GROUND
3398	PLATFORM ROTATE RIGHT VALVE - OPEN CIRCUIT
3399	PLATFORM ROTATE RIGHT VALVE - SHORT TO BATTERY
33100	JIB LIFT UP VALVE - SHORT TO GROUND
33101	JIB LIFT UP VALVE - OPEN CIRCUIT
33102	JIB LIFT UP VALVE - SHORT TO BATTERY
33103	JIB LIFT DOWN VALVE - SHORT TO GROUND
33104	JIB LIFT DOWN VALVE - OPEN CIRCUIT
33105	JIB LIFT DOWN VALVE - SHORT TO BATTERY
33106	TOWER LIFT UP VALVE - SHORT TO GROUND
33107	TOWER LIFT UP VALVE - OPEN CIRCUIT
33108	TOWER LIFT UP VALVE - SHORT TO BATTERY
33109	TOWER LIFT DOWN VALVE - SHORT TO GROUND
33110	TOWER LIFT DOWN VALVE - OPEN CIRCUIT
33111	TOWER LIFT DOWN VALVE - SHORT TO BATTERY
33112	TOWER TELESCOPE IN VALVE - SHORT TO GROUND
33113	TOWER TELESCOPE IN VALVE - OPEN CIRCUIT
33114	TOWER TELESCOPE IN VALVE - SHORT TO BATTERY

SECTION 6 - JLG CONTROL SYSTEM (S/N 61718 TO PRESENT)

Table 6-11. Diagnostic Menu Descriptions

PM BATTERY ...	Displays battery voltage at platform module
TEMP..	Displays ground module temperature
ELEV. CUTOUT ...	Displays elevation cutout switch status
FUNC. CUTOUT ...	Displays function cutout switch status
CREEP...	Displays creep switch status
TILT ...	Displays measured vehicle tilt
AUX POWER ...	Displays status of auxiliary power switch
HORN ...	Displays status of horn switch
R FILTER ...	Displays status of return filter switch
C FILTER ...	Displays status of charge pump filter
LOAD LENGTH ...	Displays length switch status
ANGLE ...	Displays angle switch status
LOAD ...	Displays load sensor value NOTE: Not displayed if load = 0.
DATALOG	
ON ...	Displays total controller on (EMS) time
ENGINE ...	Displays engine run time
DRIVE ...	Displays total controller drive operation time
LIFT ...	Displays total controller lift operation time
SWING ...	Displays total controller swing operation time
TELE ...	Displays total controller tele operation time
MAX.TEMP ...	Displays maximum measured heat sink temp.
MIN.TEMP ...	Displays minimum measured heat sink temp.
MAX.VOLTS ...	Displays maximum measured battery voltage
RENTAL ...	Displays total controller operation time NOTE: can be reset
ERASE RENTAL	Not available at password level 2
YES:ENTER, NO:ESC	ENTER resets rental datalog time to zero
VERSIONS	
GROUND ...	Displays ground module software version
PLATFORM ...	Displays platform module software version
ANALYSER ...	Displays Analyzer software version

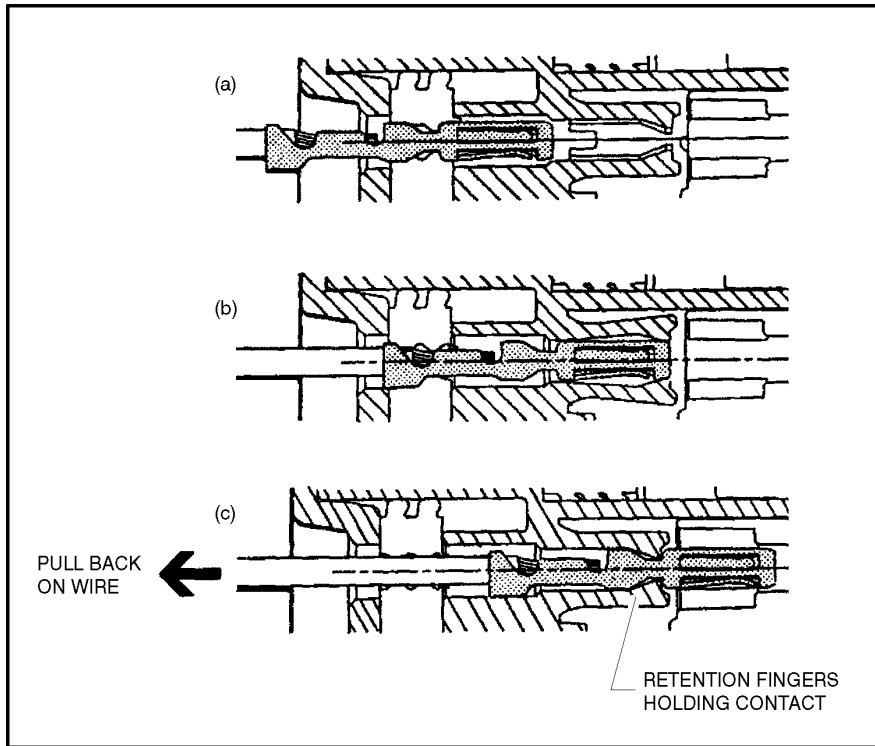


Figure 7-9. Connector Assembly Figure 2

3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 7-10.).

4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 7-11.).

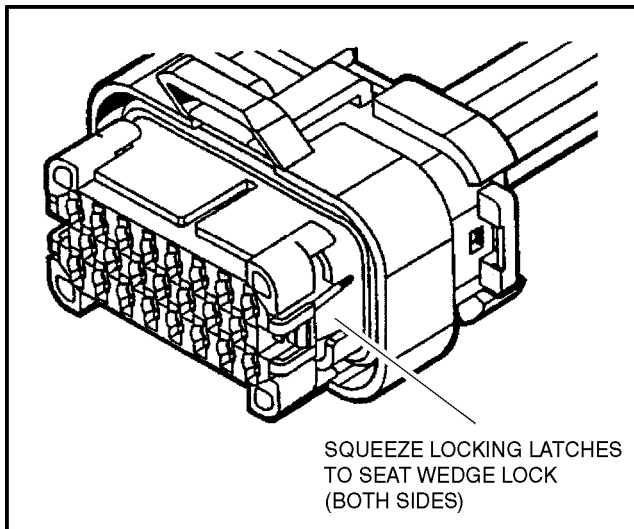


Figure 7-10. Connector Assembly Figure 3

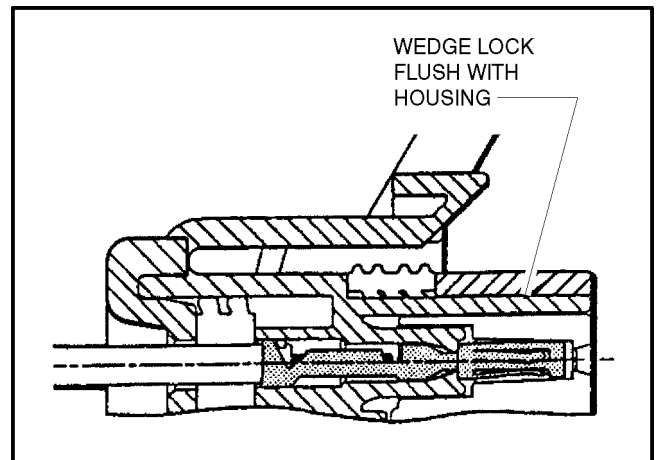


Figure 7-11. Connector Assembly Figure 4

SECTION 7 - BASIC ELECTRICAL INFORMATION & SCHEMATICS

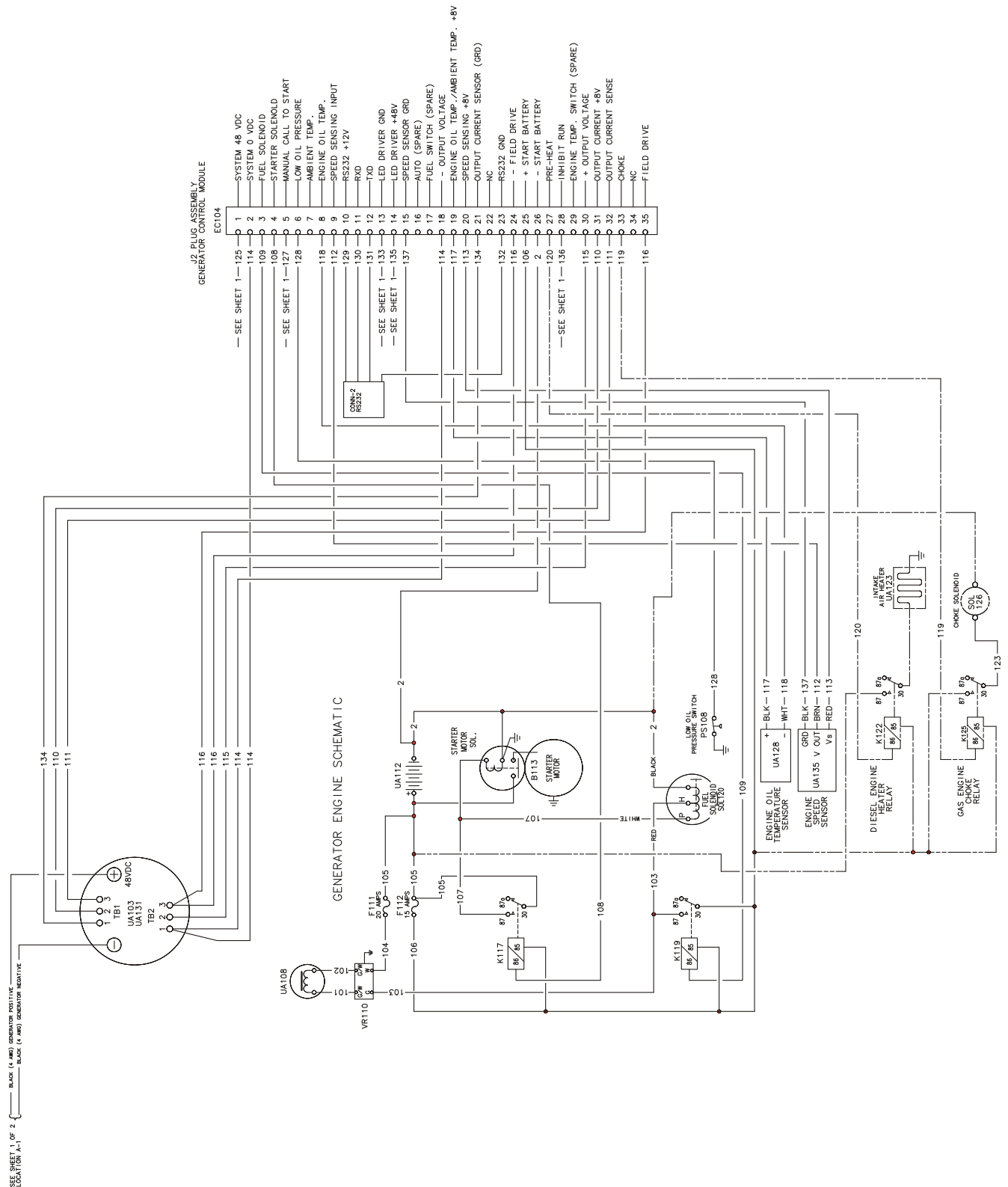
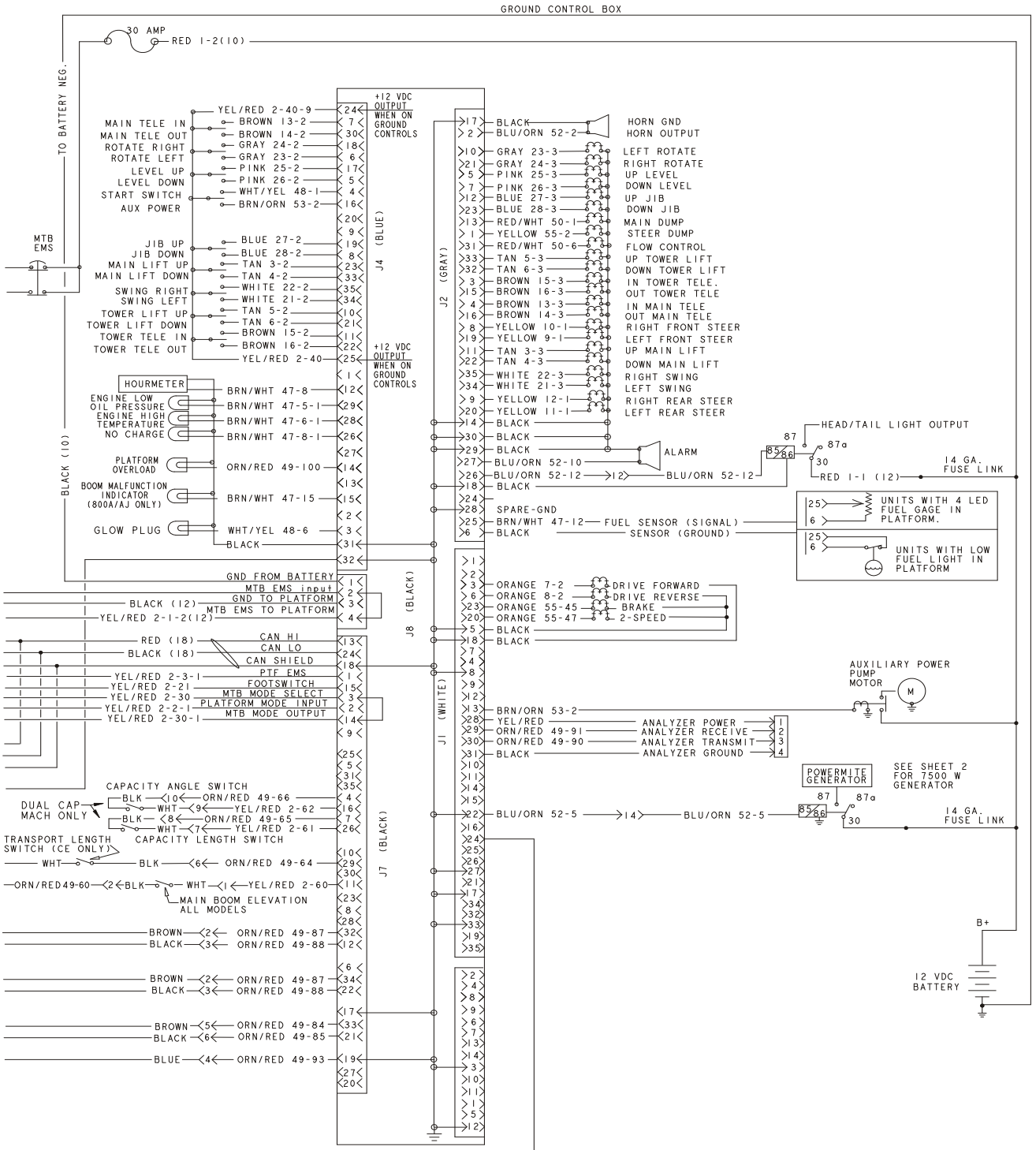


Figure 7-24. On Board Generator Electrical Schematic. (if equipped)

SECTION 7 - BASIC ELECTRICAL INFORMATION & SCHEMATICS



1870191 G

Figure 7-44. Electrical Schematic - Deutz EMR2 & GM Engine - Sheet 2 of 6

SECTION 7 - BASIC ELECTRICAL INFORMATION & SCHEMATICS

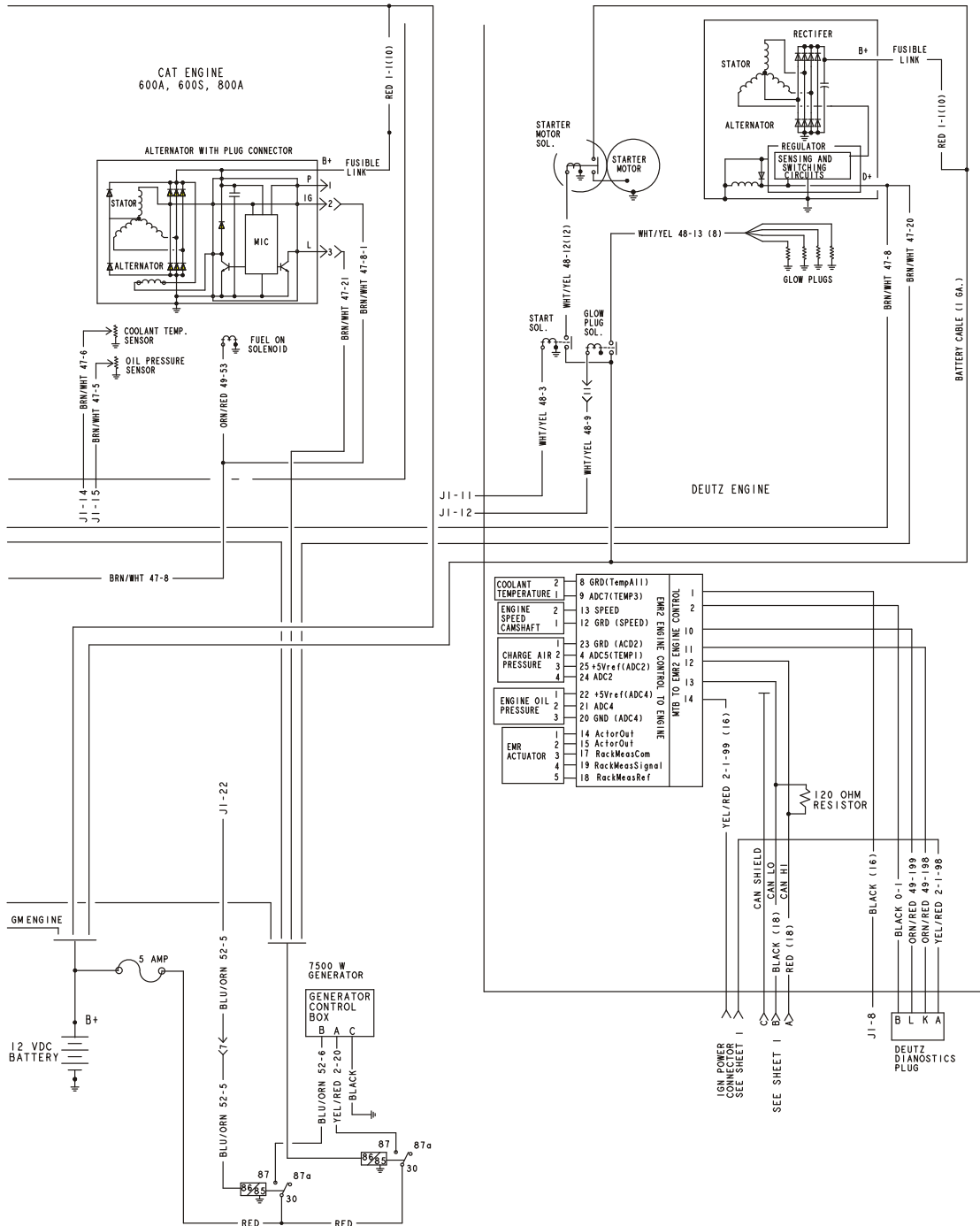


Figure 7-53. Electrical Schematic - Deutz, GM, & CAT Engine - Sheet 4 of 6

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