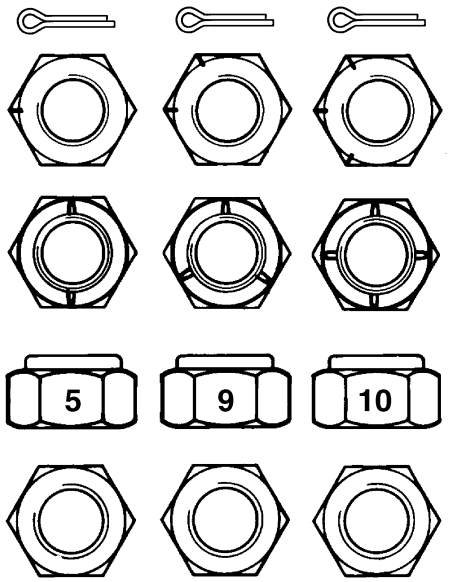
Yale®

Maintenance

METRIC AND INCH (SAE) FASTENERS



HM210064

Manifold Absolute Pressure (MAP)/ Manifold Air Temperature (MAT) Sensor

Remove

1. Remove the floor mat and floor plate; disconnect the battery for lift truck models

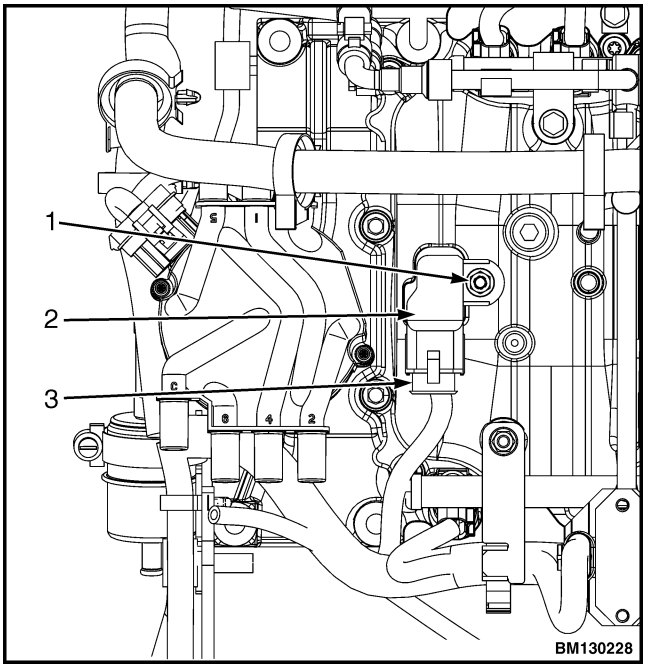
- GLP60-70VX (GC/GLC135-155VX) (C878, D878, E878, F878)
- GLP60-70VX (GLP135-155VX, GP155VXS) (G878)
- GLP80VX, GLP80VX9, GLP90VX (GLP170VX, GLP175VX36, GLP190VX) (A909, B909)
- GLP80VX, GLP80VX9, GLP90VX (C909)
- GLP80VX, GLP80VX9, GLP90VX (D909)

Raise the hood and disconnect the battery for lift truck models

- GC/GLC/GDC135-155CA (B879)
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)
- GC070-120LJ/MJ (D818)
- GLC40-55VX; GLC55SVX; (GC/GLC080-120VX; GC/GLC080-100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)
- GDP60-70CA (GP/GLC/GDP135-155CA (B878)
- GLP/GDP3.5-5.5LJ/MJ (GP/GLP/GDP70-120LJ/MJ) (E813)
- GLP40VX5/VX6; GLP45SVX5, GLP45VX6, GLP50-55VX (GP/GLP080-120VX) (F813, G813, H813, J813, K813)

2. Disconnect the electrical connector from the MAP/MAT sensor. See Figure 42.

3. Remove the nut and MAP/MAT sensor from the intake manifold.



1. RETAINING NUT
2. MAP/MAT SENSOR
3. ELECTRICAL CONNECTOR

Figure 42. MAP/MAT Sensor

Install

1. Place the MAP/MAT sensor in position on the intake manifold and install the retaining nut. Tighten retaining nut to 6 N•m (53 lbf in).

2. Connect the electrical connector to the MAP/MAT sensor. See Figure 42. Verify that the connector clicks/locks into place.

3. Connect the battery; install floor plate and floor mat for lift truck models

- GLP60-70VX (GC/GLC135-155VX) (C878, D878, E878, F878)
- GLP60-70VX (GLP135-155VX, GP155VXS) (G878)
- GLP80VX, GLP80VX9, GLP90VX (GLP170VX, GLP175VX36, GLP190VX) (A909, B909)
- GLP80VX, GLP80VX9, GLP90VX (C909)
- GLP80VX, GLP80VX9, GLP90VX (D909)

lockoff regulator has three functions. It filters the LPG fuel, it stops the flow of fuel to the LPG system when the engine is not operating and it vaporizes as well as regulates the flow of fuel to the carburetor when the engine is operating.

There are two lockoff solenoids on the filter/lockoff regulator. Both solenoids work in tandem with each other to ensure positive lockoff of fuel whenever the engine is not operating. If the engine is operating below 80 RPM, both solenoids are de-energized, halting the flow of LPG fuel into and out of the assembly. The filters, located in the inlet and filtration section, can be removed and replaced. One filter is a micron type filter and the other is porous stone.

High pressure liquid fuel is supplied to the regulator portion of the assembly. The regulator section reduces the pressure to approximately 34.5 kPa (5 psi). This drop in pressure within the regulator causes the liquid fuel to vaporize. Engine coolant is circulated through the regulator to warm it and assist in the vaporization process.

The filter/lockoff regulator operates in three modes: Start, Idle or Run. In the Start and Idle modes, when less fuel is required for combustion, the inlet valve is closed. An outlet port supplies vaporized fuel to the fuel injector assembly. During the Run mode, when the engine is operating above idle, additional fuel is required. The regulator uses engine vacuum to control the position of the diaphragm, opening the inlet valve and allowing additional fuel to flow to the carburetor.

Carburetor

The purpose of the carburetor is to mix the regulated fuel with the proper amount of air for various operating conditions. The carburetor receives fuel through two separate lines from the filter/lockoff regulator. One line provides fuel to the power adjust screw and power valve. The other supplies fuel to the fuel injector.

The carburetor operates in three modes. During, starting, and at idle, all fuel is supplied through the injector at the base of the carburetor. The throttle valve is partially open during starting and at idle to allow air flow past the throttle valve. When the engine is operating above idle, the throttle valve is open and fuel is supplied past the power adjust screw and through the injector. Under load, the power valve, operated by manifold vacuum, allows additional fuel to bypass the power adjust screw, porting it directly into the throat of the carburetor.

The solenoid controlled fuel injector is mounted in the carburetor. It is controlled by an Engine Control Unit (ECU). The ECU uses a signal from the oxygen (O_2) sensor to control the air to fuel ratio by pulsing the injector solenoid. Any time the solenoid is energized open, additional fuel is introduced into the air-fuel mixture, below the throttle plate. There are no adjustments on this carburetor. The air adjust must be closed for the system to operate properly. Although there is a power adjust screw' in this carburetor, it is NONADJUSTABLE.

Start Mode

Before any fuel is provided to the carburetor, the ignition switch must be turned to the ON position and the engine must be cranked without pressing the accelerator. The ECU senses that the engine is in start mode and provides an electrical signal to energize the main solenoid, the injector solenoid, and the fuel injector. Fuel then flows from the regulator to the injector.

Because the throttle valve is partially open, the air flows past the throttle valve and mixes with fuel supplied by the injector, to the intake manifold, and into the cylinder. The fuel injector supplies fuel to the base of the carburetor. The fuel injector is controlled by the ECU. The engine is in closed-loop mode once the oxygen (O_2) sensor is hot.

Idle Mode

Engine idle is set at the factory and is controlled by the ECU as it operates the electronic governor. The idle mixture is controlled by the ECU operating the injector and cannot be adjusted. The engine idle is operating in open-loop mode until the oxygen (O_2) sensor is heated.

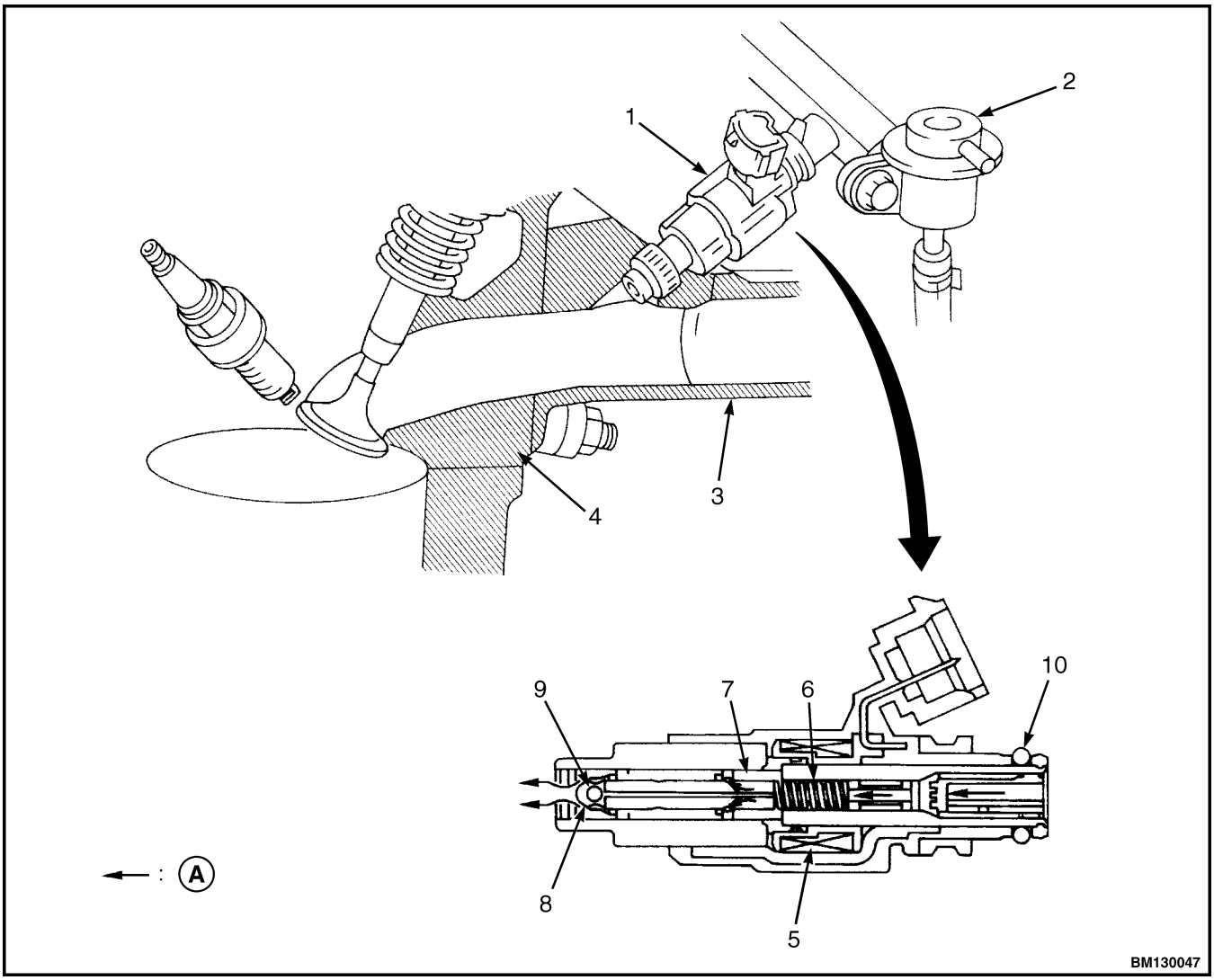
Run Mode

When the accelerator is pressed, the electronic governor opens the throttle valve, creating a slight vacuum at the output of the regulator and causing fuel to flow. Under heavy load, the vacuum in the intake manifold decreases. Decreasing the vacuum on the manifold side of the power diaphragm opens the power valve. The open power valve enriches the fuel mixture. The oxygen (O_2) sensor senses the richer fuel mixture and the ECU turns off the fuel injector. The opening and closing of the power valve according to the vacuum in the intake manifold provides optimum fuel supply to the carburetor (depending on engine load).

FUEL SYSTEM

Fuel Injector

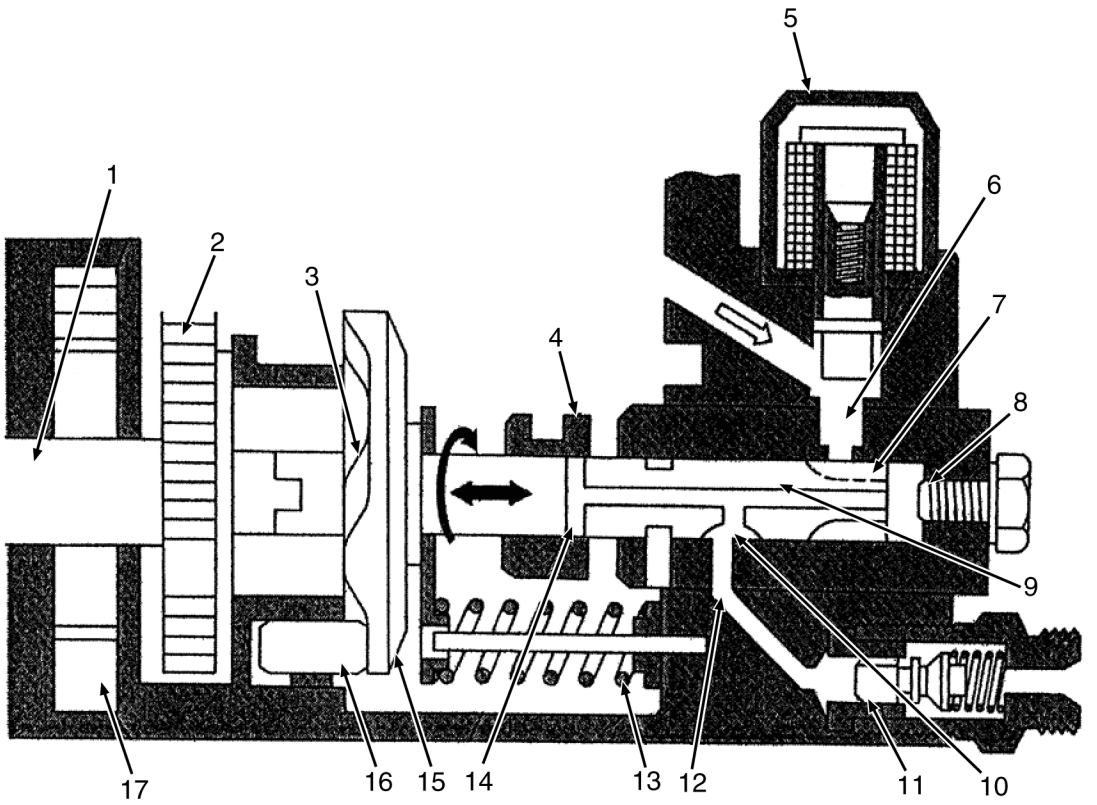
The fuel injector is located on the intake manifold. The fuel injector consists of a coil, spring, plunger, needle valve, and ball. Control signals from the ECU energize the fuel injector coil, thereby pulling in the needle valve. The ball opens and closes allowing fuel to be injected into the engine. The amount of fuel injection is determined by the open time of the needle valve (equal to the energization time of the coil). See Figure 9020-10-61.



A. FUEL FLOW

1. FUEL INJECTOR
2. PRESSURE REGULATOR
3. INTAKE MANIFOLD
4. CYLINDER HEAD
5. COIL
6. SPRING
7. PLUNGER
8. NEEDLE VALVE
9. BALL
10. O-RING

Figure 9020-10-61. Fuel Injector



1. DRIVE SHAFT
2. DRIVE GEAR
3. FACE CAM
4. CONTROL SLEEVE
5. MAGNETIC VALVE
6. INLET PORT
7. INLET SLIT
8. PLUNGER BARREL
9. PLUNGER
10. OUTLET SLIT
11. DELIVERY VALVE
12. OUTLET PORT
13. PLUNGER SPRING
14. CUTOFF PORT
15. CAM DISC
16. ROLLER
17. FEED PUMP

Figure 9020-10-148. Plunger Operation

CAUSE D - CABLE ACTUATED THROTTLE AND ELECTRONIC ACTUATED THROTTLE PROBLEMS (DIESEL ENGINES).

PROCEDURE OR ACTION:

1. For Cable Actuated Throttles:
   When accelerator pedal is fully depressed, is the fuel injection pump lever pulled against the high idle stop screw?
   YES: Go to CAUSE E.
   NO: Check and adjust throttle cable or accelerator pedal stop.

PROCEDURE OR ACTION:

2. For Electronic Actuated Throttles:

PROCEDURE OR ACTION:

3. Check for the following:
   When accelerator pedal is fully depressed, is the Fuel Injection Pump Lever pulled against the High Idle Stop Screw?
   YES: Go to CAUSE E.
   NO: Adjust E-throttle actuator's position within its mounting bracket so that the fuel injection pump lever is pulled against the high idle stop screw when the accelerator pedal is fully depressed. Refer to appropriate **Kubota Diesel Engine** or **Yanmar Diesel Engine** manual, depending on lift truck model. For Cummins diesel engines, refer to appropriate **Frame** manual, depending on lift truck model.

CAUSE E - INTAKE OR EXHAUST SYSTEM IS TOO RESTRICTIVE.

PROCEDURE OR ACTION:

1. Check intake system for excessive restriction.
   Is "Intake Restriction Indicator" lamp illuminated on DSC while engine is running?
   YES: Air cleaner element is clogged. Refer to appropriate **Periodic Maintenance** manual, depending on lift truck model.
   NO: Go to Step 2.

PROCEDURE OR ACTION:

CAUTION

Wear proper hearing protection while performing this test.

2. Check exhaust system for excessive restriction. For **Mazda and GM** engines, disconnect the exhaust pipe from the catalytic converter's inlet and attempt to start engine. For **Diesel** engines, disconnect the exhaust pipe from the diesel exhaust purifier inlet (if equipped) or muffler inlet and attempt to start the engine.
   Does engine start easier?
   YES: Exhaust system is plugged. Inspect exhaust system for damage. If not damaged, replace catalytic converter for Mazda or GM engines, refer to appropriate **GM Engines** or **Mazda Engines** manual, depending on lift truck model. For Kubota, Yanmar, and Cummins diesel engines, replace diesel exhaust purifier and/or muffler and refer to appropriate **Kubota Diesel Engine**, **Yanmar Diesel Engine** or **Frame** manual, depending on lift truck model. For Cummins 4.5L and QSB 3.3L engines, contact your local **YALE** dealer or see **Yale Axcess Online** .
   NO: Go to CAUSE G.

Group 40
Tests and Adjustments

Radiator Bubble Test

This test will check if engine compression pressure is escaping into the cooling system. Perform this test prior to doing the Engine Compression Test.

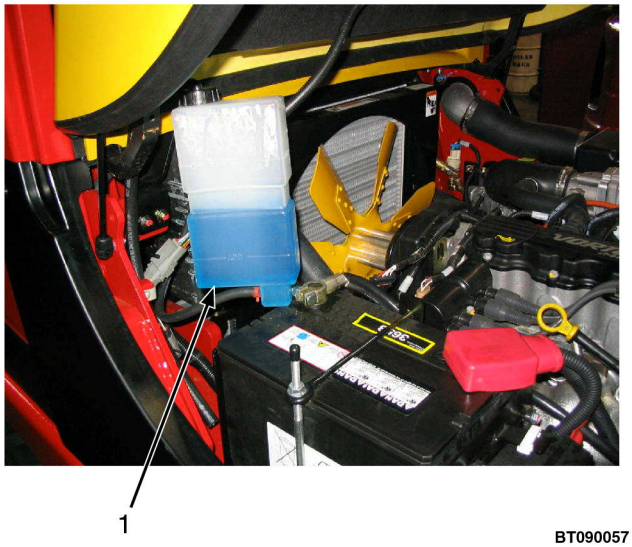
Table 9020-40-3. Test Specifications

Engine Speed	Governed Speed
Auxiliary Coolant Reservoir	No constant flow of bubbles from radiator overflow hose.

WARNING

DO NOT remove the radiator cap from the radiator when the engine is hot. When the radiator cap is removed, the pressure is released from the system. If the system is hot, the steam and boiling coolant can cause burns.

1. Check coolant level in the auxiliary coolant reservoir and adjust as required. If it is below add mark, go to Step 2. If it is at add mark or above, go to Step 3.
2. Slowly remove radiator cap and verify that radiator top tank is full with coolant. Fill radiator and radiator overflow reservoir to proper level. See **Operating Manual**. Install radiator cap.
3. Remove two cap screws from reservoir retaining bracket. Position radiator overflow reservoir so you can clearly see radiator overflow hose connection at bottom. Ensure the position of reservoir does not interfere with engine operation.
4. Start engine and operate until engine is at operating temperature.
5. Observe radiator overflow reservoir (1) for signs of air bubbles flowing from overflow hose. See Figure 9020-40-197.
   - If no constant flow of bubbles is visible, there is no engine compression leakage into the cooling system.
   - If steady stream of bubbles is visible, a leaking cylinder head gasket or cracked cylinder head is indicated. Repair engine. Refer to appropriate **GM Engine**, **Mazda Engine**, **Kubota Diesel Engine**, or **Yanmar Diesel Engine** manual, depending on lift truck model. For Cummins 4.5L and QSB 3.3L engines, contact your local **YALE** dealer or see **Yale Axcess Online** .
6. Install radiator overflow reservoir and retaining bracket. Tighten cap screws.



1. RADIATOR OVERFLOW RESERVOIR

Figure 9020-40-197. Radiator Overflow Reservoir

Diagnostic Trouble Code (DTC) Chart (Cont)

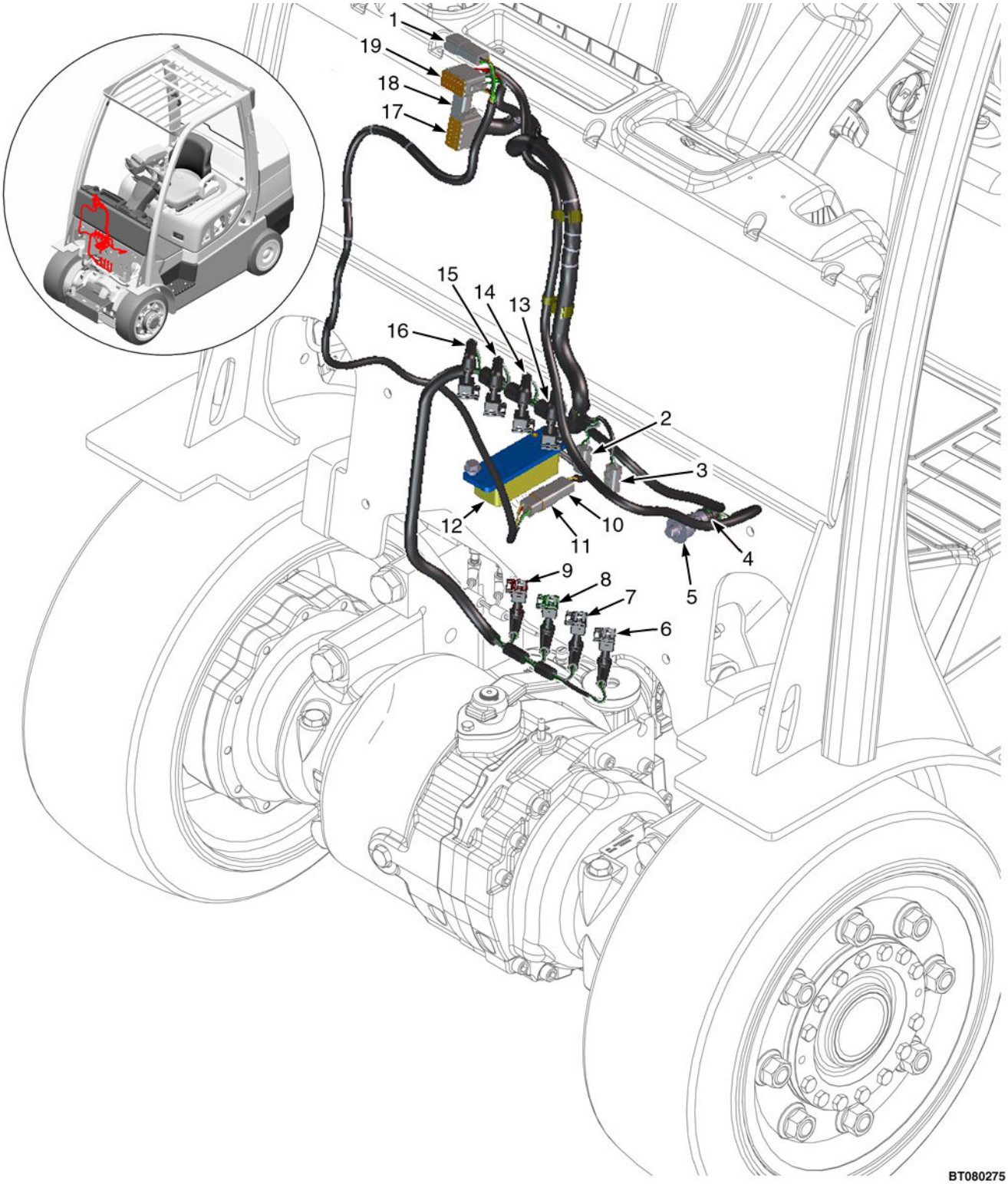
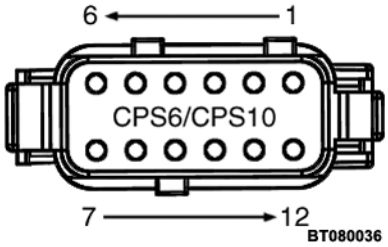
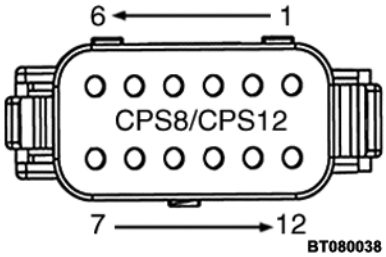


Figure 9030-03-23. 5-Function Hydraulic Harness Assembly With Impact and Load Weight Sensor

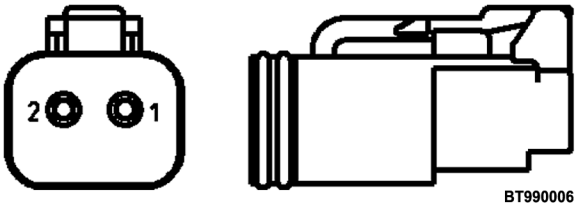
CONNECTOR(S)



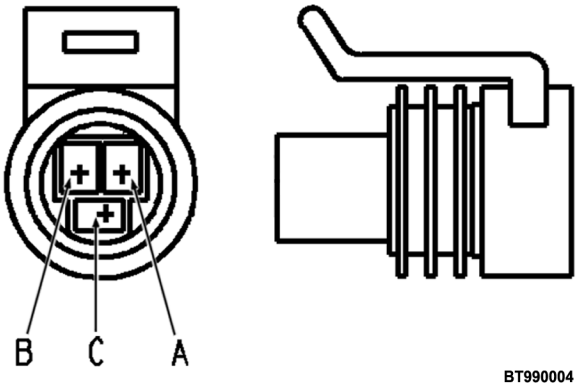
VSM Connector CPS 10



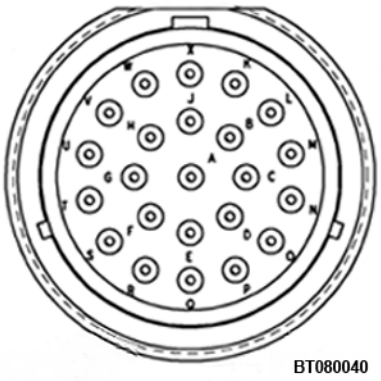
VSM Connector CPS 12



Valve Connectors CPS 56, 57, 58, and 86



XMSN Pressure Sensor Connectors CPS 59, 60, & 61



XMSN Harness Disconnect CPS 85

END FAULT

Throttle Position OORH

Throttle Position Sensor Value Above Allowable Threshold.

CODES

DTC 522708-3 - Mechanical Accelerator Position Sensor OORH (Mazda, Gas ECU)
DTC 522710-3 - Throttle A Position Sensor OORH
DTC 522711-3 - Throttle B Position Sensor OORH
DTC 522714-3 - Mechanical Accelerator Position Sensor OORH (Mazda LPG ECU, Gas GCU)
DTC 523582-3 - Throttle Position Sensor OORH
DTC 51-3 - TPS 1 Voltage OORH
DTC 520251-3 - TPS 2 Voltage OORH

POSSIBLE CAUSE

A. SENSOR GROUND OPEN CIRCUIT
B. SENSOR SIGNAL SHORTED TO SENSOR SUPPLY
C. SENSOR SIGNAL SHORTED TO BATTERY SOURCE
D. SENSOR FAILURE
E. FUNCTIONAL FAILURE IN CONTROLLER

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System**YRM .
   NO: Go to CAUSE A.

Drive Command Signal OORH

CODES

DTC 524237-3 - Front Wiper Motor Driver OORH
DTC 524238-3 - Rear Wiper Motor Driver OORH
DTC 524240-3 - Washer Pump Driver OORH

POSSIBLE CAUSE

A. WIPER ARM STUCK OUT OF PARK POSITION (OBSTRUCTED) (THERMAL SWITCH OPEN) (DTC 524237 OR 524238 ONLY)
B. PARK SWITCH SHORTED (DTC 524237 OR 524238 ONLY)
C. MOTOR/PUMP DRIVER OUTPUT SHORTED TO BATTERY
D. MOTOR/PUMP DRIVER OUTPUT OPEN CIRCUIT
E. MOTOR/PUMP DRIVER RETURN OPEN CIRCUIT
F. MOTOR/PUMP/FUNCTIONAL FAILURE IN CONTROLLER

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. See **Electrical System** 2200YRM1142.
   NO: Go to CAUSE A.

5 VDC ECU Power Supply Data Incorrect (GM)

CODES

DTC 524260-2 - ECU 5-Volt Sensor Supply B Incorrect Output
DTC 524260-11 - ECU 5-Volt Sensor Supply B Data Invalid, Cause Unknown
DTC 524261-2 - ECU 5-Volt Sensor Supply A Incorrect Output
DTC 524261-11 - ECU 5-Volt Sensor Supply A Data Invalid, Cause Unknown

POSSIBLE CAUSE

A. ECU SENSOR SUPPLY SHORTED TO BATTERY SOURCE
B. ECU SENSOR SUPPLY SHORTED TO GROUND
C. FUNCTIONAL FAILURE IN CONTROLLER

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

NOTE: The GM ECU provides two +5 Vdc outputs for device power. If the reported DTC is SPN 524260, the fault will be in output power A. If the reported DTC is SPN 524261, the fault will be in output power B.

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. See **Electrical System** 2200YRM1142.
   NO: Go to CAUSE A.

CAUSE B - BAD RAIL PRESSURE SENSOR

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Verify DMM to ohms scale. Verify DMM zero reading.
3. Disconnect wiring harness connector from rail pressure sensor connector.
4. Measure resistance across each pin of the rail pressure sensor and ground.
   Is resistance low or close to zero?
   YES: The sensor has shorted to ground. Replace sensor. Reconnect sensor connector to wiring harness. Go to Step 5.
   NO: Go to Step 6.
5. Turn truck power **ON** and start engine.
   Does reported DTC reoccur?
   YES: Go to Step 6.
   NO: Problem not verified or problem resolved. Resume operation.
6. Check fittings, fuel lines, and clamps leading to the High Pressure Pump (HPP) for tightness or damage.
   Was any evidence found of air entering the fuel system?
   YES: Tighten fittings and clamps. Replace damaged fuel lines with new fuel lines. Refer to the appropriate **Electrical System** and **Engine Fuel System**YRM . Repeat Step 5.
   NO: Go to Step 7.
7. Check fro internal fuel leaks.
   Is the fuel return line hotter than ambient engine compartment temperature?
   YES: Replace the pressure limiter on the common rail and repeat Component Operational Check.
   NO: Go to CAUSE C.

CAUSE C - BAD SUCTION CONTROL VALVE (SCV) (KUBOTA ONLY)

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Verify DMM to ohms scale. Verify DMM zero reading.
3. Disconnect wiring harness connector from SCV connector.
4. Measure resistance across each pin of the SCV and ground.
   Is resistance low or close to zero?
   YES: The SCV has shorted to ground. Replace SCV. Reconnect SCV connector to wiring harness. Go to Step 5.
   NO: Go to CAUSE D.
5. Turn truck power **ON** and start engine.
   Does reported DTC reoccur?
   YES: Go to CAUSE D.
   NO: Problem not verified or problem resolved. Resume operation.

CAUSE D - BAD FUEL PUMP

PROCEDURE OR ACTION:

1. Verify fuel pump is working properly.
   Is the fuel pump working properly?
   YES: Go to CAUSE E.
   NO: Repair or replace fuel pump. Refer to the appropriate **Electrical System** and **Engine Fuel System**YRM . Repeat Component Operational Check.

Spark Coil Primary Open or Short to Ground

CODES

DTC 1268-5 - Spark Coil #1 Primary Open or Short to Ground
DTC 1269-5 - Spark Coil #2 Primary Open or Short to Ground
DTC 1270-5 - Spark Coil #3 Primary Open or Short to Ground
DTC 1271-5 - Spark Coil #4 Primary Open or Short to Ground

POSSIBLE CAUSE

A. IGNITION COIL WIRING SHORTED TO GROUND
B. IGNITION COIL WIRING OPEN CIRCUIT
C. IGNITION COIL FAILURE

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code. Make sure electrical connection is a good physical connection (i.e. sockets and pins are seated correctly; connector "clicks" indicating locking tab works correctly). See Harness Assembly Data.
   Are any of the connectors/wiring damaged?
   YES: Repair/replace connector or wiring associated with faults found. Refer to appropriate **Electrical System** manual, depending on lift truck model.
   NO: Go to CAUSE A.

CAUSE A - IGNITION COIL WIRING SHORTED TO GROUND

PROCEDURE OR ACTION:

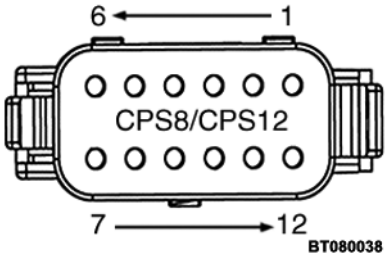
1. Disconnect ignition coil connector and measure continuity between the ignition coil connecter pins and known good ground.
   Is continuity present?
   YES: Inspect ignition coil harness for short to ground.
   NO: Proceed to CAUSE B.

CAUSE B - IGNITION COIL WIRING OPEN CIRCUIT

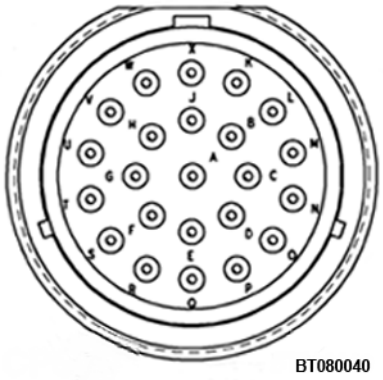
PROCEDURE OR ACTION:

1. Disconnect and isolate ignition coil harness. Measure continuity between engine ECU connector and ignition coil connector.
   Is continuity present?
   YES: Proceed to CAUSE C.
   NO: Inspect ignition coil harness for open.

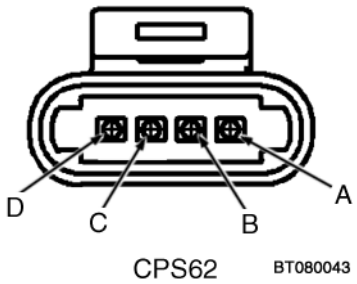
CONNECTOR(S)



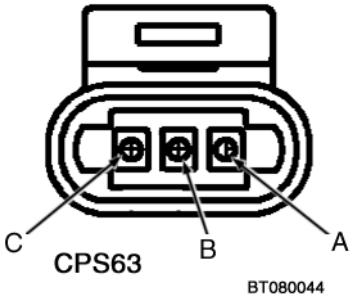
VSM Connector CPS 12



XMSN Harness Disconnect CPS 85



TOSS Sensor Connector CPS 62



TISS Sensor Connector CPS 63

END FAULT

CAUSE B - FUNCTIONAL FAILURE - MECHANICAL

PROCEDURE OR ACTION:

1. Clear fault log and ensure truck power **OFF**.
2. Turn truck power **ON**.
3. With a load on the forks, position the counterweight against a solid obstacle that will not be damaged by a very strong push from the lift truck.
4. Ensure brakes are fully released and place gear selector in Reverse and increase engine RPM to maximum.
   Does DTC TISS pulse count too high occur?
   YES: Range1 clutch is slipping. Go to **Three-Speed Powershift Transmission Repair** 1300YRM1317 or **Two-Speed Powershift Transmission Repair** 1300YRM1343.
   NO: Go to Step 5.
5. Proceed to next question.
   Does DTC TOSS pulse count too high occur?
   YES: REV1 clutch is slipping. Go to **Three-Speed Powershift Transmission Repair** 1300YRM1317 or **Two-Speed Powershift Transmission Repair** 1300YRM1343.
   NO: Go to Step 6.
6. With a load on the forks, position the front of the truck against a solid obstacle that will not be damaged by a very strong push from the lift truck.
7. Ensure brakes are fully released and place gear selector in Forward and increase engine RPM to maximum.
   Does DTC TOSS Pulse Count Too Low Occur?
   YES: FWD1 clutch is slipping.
   NO: Problem is not verified. FWD2 and Range2 clutch slipping may not be confirmed by direct test. Make a note that these diagnostics have already been performed. If the DTC for TOSS Pulse Count Too High or Too Low occurs several times after this, then suspect the FWD2 or Range2 clutch is slipping. Resume operation.

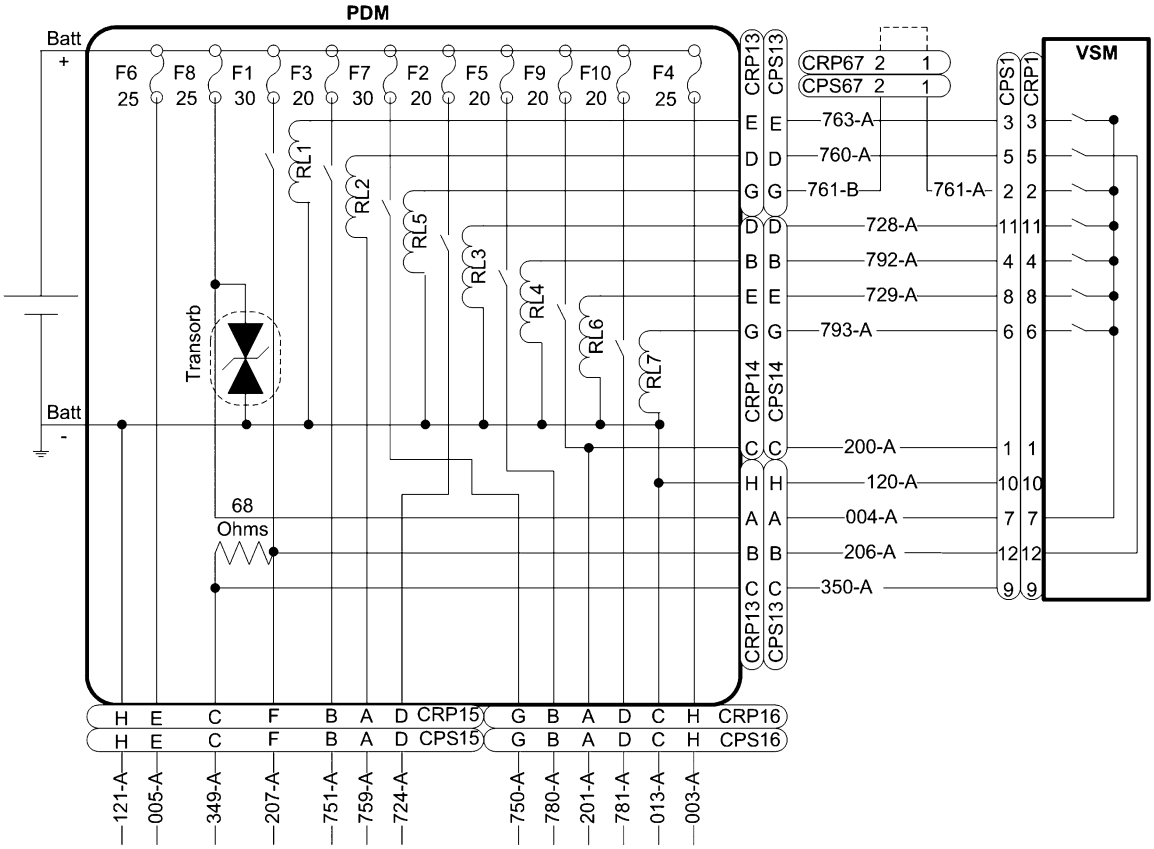
END POSSIBLE CAUSES

CAUSE E - FUNCTIONAL FAILURE IN CONTROLLER

PROCEDURE OR ACTION:

1. Ensure all previous procedures have been completed.
2. Ensure truck power is **OFF**.
3. Ensure that all connections to the controller are completely inserted.
4. Ensure truck power is **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 5.
   NO: Problem corrected. Resume operation.
5. At the DSC, press **ENTER** to access Main Menu.
6. Scroll to VIEW VERSIONS, press **ENTER**.
7. Scroll to TRUCK SERIAL NUMBER, press **ENTER**.
8. View the TRUCK SERIAL NUMBER on the display.
   Does the truck serial number on display match serial number on truck nameplate (VSM Only)?
   YES: Go to Step 9.
   NO: Controller has been substituted from another truck. Replace VSM with VSM that has the correct truck serial number or obtain new VSM with correct Serial number/ CDF. See **Electrical System** 2200YRM1142.
9. **Resident Service Approval Required prior to VSM replacement for Trucks under warranty.** Make sure to indicate the DTC code(s) on the warranty claim and include an accurate problem description leading to the controller replacement.
10. For other controllers, Replace indicated controller. (ECU-ECM/GCU/TCU). See **Electrical System** 2200YRM1142. For GM 4.3L LPG engines, see **LPG Fuel System, GM 4.3L Engine with GFI** 0900YRM1242. For GM 4.3L gasoline engines, see **Gasoline Fuel System** 0900YRM1244 for all controllers.
11. Reinstall all removed components and ensure that all connectors are completely inserted.
12. Repeat Component Operational Check.

END POSSIBLE CAUSES



- WIRE # 003 (RED) = FUSED BATTERY POWER (F4)
- WIRE # 004 (RED) = FUSED BATTERY POWER (F8)
- WIRE # 005 (RED) = FUSED BATTERY POWER (F6)
- WIRE # 013 (BLK) = BATTERY GROUND
- WIRE # 109 (BLK = VSM POWER GROUND
- WIRE # 120 (BLK) = BATTERY GROUND
- WIRE # 121 (BLK) = BATTERY GROUND
- WIRE # 200 (RED) = IGN 1 POWER (RL6) OUTPUT
- WIRE # 201 (RED) = IGN 1 POWER (RL6) OUTPUT
- WIRE # 203 (RED) = IGN 2 VSM REGULATED OUTPUT
- WIRE # 206 (RED) = IGN 3 POWER (RL1) OUTPUT
- WIRE # 207 (RED) = IGN 3 POWER (RL1) OUTPUT
- WIRE # 349 (WHITE) = ALTERNATOR EXCITE
- WIRE # 350 (WHITE) = ALTERNATOR EXCITE
- WIRE # 724 (WHITE) = BACK UP ALARM OUTPUT (RL3)
- WIRE # 728 (RED) = RELAY 3 (BACK UP ALARM) DRIVER
- WIRE # 729 (RED) = RELAY 6 (IGN 1) DRIVER
- WIRE # 750 (WHITE) = START RELAY (RL5) OUTPUT
- WIRE # 751 (RED) = FUEL RELAY (RL2) OUTPUT
- WIRE # 759 (WHITE) = FUEL RELAY RETURN (ECU)
- WIRE # 760 (RED) = RELAY 2 (FUEL PUMP) DRIVER
- WIRE # 761 (RED) = RELAY 5 (STARTER) DRIVER
- WIRE # 763, (RED) = RELAY 1 (IGN3) DRIVER
- WIRE # 780 (WHITE) = FRONT WORK LIGHTS (RL4) OUTPUT
- WIRE # 781 (WHITE) = REAR WORK LIGHTS (RL7) OUTPUT
- WIRE # 792 (RED) = RELAY 4 (FRONT WORK LIGHTS) DRIVER
- WIRE # 793 (RED) = RELAY 7 (REAR WORK LIGHTS) DRIVER

CAUSE B - WIRING HARNESS FAILURE

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect the wiring harness from the main relay and the ECM connector from the ECM.
3. Set DMM to ohms scale. Verify zero reading.
4. Measure wire harness continuity by measuring the terminals at the wiring harness connector and their corresponding terminals at the ECM connector end. Refer to the appropriate **Wiring Harness Repair**YRM for terminal locations.
   Is there continuity between the sensor connector end of the wire harness and the ECM connector end?
   YES: Reconnect the ECM connector to the ECM. Go to Step 7.
   NO: Locate and repair/replace open wire/connection. Refer to the appropriate **Wiring Harness Repair**YRM . Repeat Component Operational Check.
5. Change DMM to volts scale.
6. Disconnect wiring harness connector from sensor(s) associated with fault found.
7. Measure voltage across each pin of the wiring harness connector (+) and ground (−).
   Is voltage approximately system voltage?
   YES: The wiring harness is shorted to an unswitched battery source. Refer to the appropriate **Diagrams and Schematics**YRM to determine possible source. Locate and repair/replace shorted wire/connection. Refer to the appropriate **Wiring Harness Repair**YRM . Repeat Component Operational Check.
   NO: Go to Step 8.
8. Turn truck power **ON**.
9. Repeat measurement from Step 7.
   Is voltage approximately system voltage?
   YES: The wiring harness is shorted to a switched battery source. Refer to the appropriate **Diagrams and Schematics**YRM to determine possible source. Locate and repair/replace shorted wire/connection. Refer to the appropriate **Wiring Harness Repair**YRM . Repeat Component Operational Check.
   NO: Go to Step 10.
10. Ensure truck power is **OFF**.
11. Verify DMM to ohms scale. Verify DMM zero reading.
12. Measure terminal resistance across each pin of the wiring harness connector (+) and ground (−).
    Is resistance low or close to zero ohms?
    YES: The wire harness has shorted to ground. Refer to the appropriate **Diagrams and Schematics**YRM to determine possible source. Locate and repair/replace shorted wire/connection. Refer to the appropriate **Wiring Harness Repair**YRM . Repeat Component Operational Check.
    NO: Go to CAUSE C.

CODES

DTC 94-0 - Primary Fuel Pressure Higher Than Expected
DTC 94-1 - Primary Fuel Pressure Lower Than Expected

POSSIBLE CAUSE

A. FUEL PRESSURE SENSOR WIRING FAULT
B. FUEL PRESSURE FAULT
C. FAULTY CONTROLLER

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code. Make sure electrical connection is a good physical connection (i.e. sockets and pins are seated correctly; connector "clicks" indicating locking tab works correctly). See Harness Assembly Data.
   Are any of the connectors/wiring damaged?
   YES: Repair/replace connector or wiring associated with faults found. Refer to appropriate **Electrical System** manual, depending on lift truck model.
   NO: Go to CAUSE A.

CAUSE A - FUEL PRESSURE SENSOR WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

1. Disconnect the fuel pressure manifold connector CPS254 and measure voltage between socket C and B(-).
   Is voltage 5 ± 0.5 Vdc?
   YES: Proceed to Step 2.
   NO: Inspect five volt signal circuit for open or short.
2. Measure voltage between the fuel pressure manifold connector CPS254, socket A and socket C.
   Is voltage 5 ± 0.5 Vdc?
   YES: Disconnect battery, ECU connector CRS202, and proceed to Step 3.
   NO: Inspect ground circuit for open or short.
3. Measure resistance between the following:
   - ECU connector CRS202, socket 48 and fuel pressure manifold connector CPS254, socket B.
   - ECU connector CRS202, socket 54 and fuel pressure manifold connector CPS254, socket D.

   Is resistance <1 ohm?
   YES: Connect battery and connectors, proceed to CAUSE B.
   NO: Inspect appropriate circuit for open, short, or source of excessive resistance.

This DTC is set when DEF tank temperature (TULC) sensor data is out of range or data message has timed out.

CODES

DTC 3031-2 - DEF Tank Temperature Sensor Error
DTC 3031-4 - DEF Tank Temperature Sensor Error OORL
DTC 3031-3 - DEF Tank Temperature Sensor Error OORH
DTC 3516-11 - DEF Tank Quality Sensor Error
DTC 3516-18 - DEF Tank Quality Low
DTC 3516-16 - DEF Tank Quality High
DTC 3516-12 - DEF Tank Quality Incorrect Sensor Reading
DTC 3516-2 - Diesel in DEF Tank
DTC 1761-1 - DEF Tank Level Leakage
DTC 1761-18 - DEF Tank Level Empty
DTC 1761-17 - DEF Tank Level Low
DTC 1761-11 - DEF Tank Level Sensor Error

POSSIBLE CAUSE

A. DEF TANK CONTAMINATION
B. TULC SENSOR WIRING FAULT
C. TULC SENSOR CANBUS COMMUNICATION FAULT
D. TULC SENSOR FAULT

NOTE
Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

NOTE: The TULC Sensor is provided switched battery voltage from a 10A fuse. Ground is provided by the ECU connector V01. Sensor information is communicated over the CANbus system to the ECU and other components.

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Go to Step 2.
   NO: Problem not verified. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code. Make sure electrical connection is a good physical connection (i.e. sockets and pins are seated correctly; connector "clicks" indicating locking tab works correctly).
   Are any of the connectors/wiring damaged?
   YES: Repair/replace connector or wiring associated with faults found. Refer to appropriate **Electrical System** manual, depending on lift truck model.
   NO: Go to CAUSE A.

CAUSE A - DEF TANK CONTAMINATION

PROCEDURE OR ACTION:

1. Inspect DEF tank for contamination. Ensure DEF tank has not mixed with engine oil or diesel fuel.
   Does DEF tank only contain urea?
   YES: Proceed to .
   NO: Clean or replace DEF tank.

CAUSE A - SUCTION TUBE HEATER WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

1. Connect PC Service Tool and locate active test setting ***Suction Line Heater ON / OFF Function (ACU)***. Disconnect suction tube heater and actuate heater ON. Measure voltage between the suction tube heater connector CPS502, socket 1 and B(-).
   Is voltage 12 ± 1.5 Vdc?
   YES: Proceed to Step 2.
   NO: Inspect ACU voltage supply circuit 771-A for open or short.
2. Continue to actuate ***Suction Line Heater ON / OFF Function (ACU)***. Measure voltage between the suction tube heater connector CPS502, socket 1 and socket 2.
   Is voltage 12 ± 1.5 Vdc?
   YES: Disconnect battery and proceed to CAUSE B.
   NO: Inspect ground circuit 221-D for open or short. Inspect ground splice S221 for loose, damaged, or corroded terminals.

CAUSE B - SUCTION TUBE HEATER FAULT

PROCEDURE OR ACTION:

1. Measure resistance between the suction tube heater pin 1 and pin 2.
   Is resistance approximately 8.6 Ohms?
   YES: Proceed to CAUSE C.
   NO: Replace faulty suction tube heater.

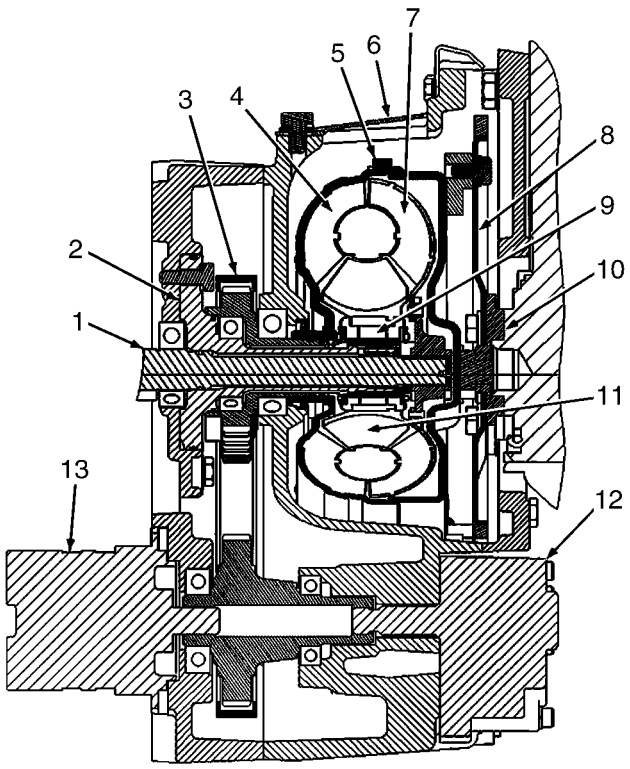
CAUSE C - ACU FAULT

PROCEDURE OR ACTION:

1. If no wiring or communication faults are present, replace faulty ACU, clear DTC and retest system.

END POSSIBLE CAUSES

turbine is going in the direction opposite of engine rotation. This oil now has a lower velocity because it has given most of its energy to rotate the turbine.



1. FORWARD (LOW) CLUTCH PACK SHAFT (INPUT SHAFT)
2. STATOR SUPPORT SHAFT
3. DRIVE CHAIN
4. IMPELLER
5. TORQUE CONVERTER
6. TORQUE CONVERTER HOUSING
7. TURBINE
8. FLEX PLATE
9. ONE-WAY CLUTCH
10. FLEXPLATE ADAPTER
11. STATOR
12. CHARGE PUMP
13. HYDRAULIC PUMP

Figure 9040-10-1. Torque Converter

Stator

The stator is between the turbine and impeller in the center of the torque converter. When the oil hits the stator blades, the stator clutch prevents the stator from turning in the direction opposite of engine rotation. The blades of the stator change the direction of the oil so that the oil enters the impeller in the direction of engine rotation. The energy that remains in the oil flow as it leaves the stator is added to the new energy being added to the impeller by the engine. This use of energy, controlled by the stator, permits the torque converter to multiply the torque of the engine.

Turbine

Resistance to the flow of oil in the turbine, because of centrifugal force, increases as the speed of the turbine increases. This resistance decreases the energy and amount of oil flow to the impeller from the stator. When the flow to the impeller decreases, the additional force added to the impeller decreases. Less torque is generated when less torque is needed. When the lift truck is traveling at a constant speed on level ground, the turbine and impeller rotate at approximately the same speed. See Figure 9040-10-2. The centrifugal force of the oil is the same for both the impeller and turbine. The oil does not flow through the stator, and torque is not multiplied. The rotating oil hits the back of the stator blades and turns the stator in the direction of engine rotation. The stator clutch permits the stator to turn with engine rotation. The impeller, turbine, stator, and oil rotate as a unit when torque multiplication is not required. See Figure 9040-10-3.

Abnormal Drive Axle Noise

POSSIBLE CAUSE

A. CHECK FOR MISSING OR LOOSE WHEEL NUTS.
B. DRIVE AXLE OIL LEVEL IS LOW.
C. DRIVE AXLE MOUNTING CAPSCREWS ARE LOOSE.
D. BRAKE ASSEMBLY IS DAMAGED.
E. DRIVE AXLE UNIVERSAL JOINT DAMAGE OR FAILURE.
F. DRIVE AXLE BEARINGS ARE DAMAGED.
G. DAMAGED DIFFERENTIAL ASSEMBLY.
H. RING AND PINION GEAR SET FAILURE.
I. REDUCTION GEAR FAILURE.

CAUSE A - CHECK FOR MISSING OR LOOSE WHEEL NUTS.

PROCEDURE OR ACTION:

1. Inspect for missing wheel nuts.
   Are wheel nuts missing?
   YES: Replace and torque wheel nuts. Refer to appropriate **Periodic Maintenance** manual, depending on lift truck model.
   NO: Go to Step 2.

PROCEDURE OR ACTION:

2. Inspect for loose wheel nuts.
   Are wheel nuts loose?
   YES: Torque wheel nuts. Refer to appropriate **Periodic Maintenance** manual, depending on lift truck model.
   NO: Go to CAUSE B.

CAUSE B - DRIVE AXLE OIL LEVEL IS LOW.

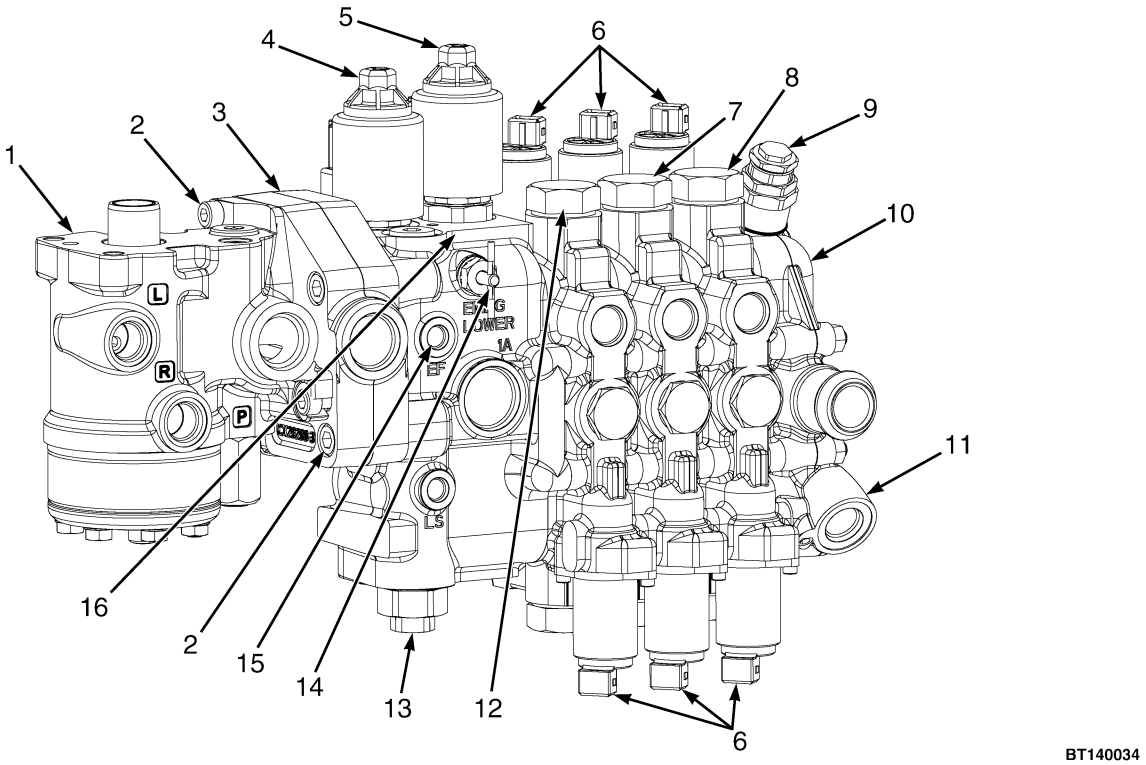
PROCEDURE OR ACTION:

1. Check drive axle oil level.
   Is drive axle oil level too low?
   YES: Fill drive axle to proper oil level. See **Operating Manual**.
   NO: Go to CAUSE C.

CAUSE C - DRIVE AXLE MOUNTING CAPSCREWS ARE LOOSE.

PROCEDURE OR ACTION:

1. Inspect drive axle mounting capscrews to see if they are loose.
   Are drive axle mounting capscrews loose?
   YES: Tighten drive axle mounting capscrews. Refer to appropriate **Capacities and Specifications** manual, depending on lift truck model.
   NO: Go to CAUSE D.



1. STEERING CONTROL UNIT (SCU)
2. SCU MOUNTING CAPSCREW
3. MID-INLET SECTION (PRIMARY PUMP INLET)
4. ELECTRO-HYDRAULIC POPPET VALVE (EHPV) (LIFT)
5. ELECTRO-HYDRAULIC POPPET VALVE (EHPV) (LOWER)
6. PROPORTIONAL PRESSURE REDUCING VALVE (PPRV)
7. AUXILIARY I SECTION
8. AUXILIARY II SECTION
9. SECONDARY RELIEF VALVE (ADJUSTABLE)
10. OUTLET SECTION
11. ANTI-STALL SOLENOID PORT
12. TILT SECTION
13. PRIMARY RELIEF VALVE (ADJUSTABLE)
14. MANUAL LOWERING VALVE
15. EF PORT
16. LIFT/LOWER SECTION

Figure 9050-10-20. Electro-Hydraulic Control Valve (6.0-9.0 Ton Shown)

PRINCIPLES OF OPERATION

Inlet Pressure Compensator/Unloader

NOTE: All standby pressures are different depending on your lift truck and are approximate measurements. See Table 9050-10-1 for proper kPa (psi) for your lift truck.

The inlet pressure compensator, commonly referred to as the unloader, is designed to maintain a standby pressure. On the 1.0-5.5 ton lift truck, oil enters the valve from the SCU through the excess flow (EF) passage. On the 6.0-9.0 ton lift truck, oil enters the valve from the (SCU) and mid inlet through the (EF) passage. The (EF) pressure gets applied to the chamber on one end of the spool through a hole running through its long axis. On the other end of the spool is a spring which is set to the desired margin of the valve. This end of the spool also serves as the load-sense (LS) chamber, since the load-sense signal produced from the rest of the valve is applied to this end of the spool. See Figure 9050-10-21.

The unloader spool finds a position such that the (EF) pressure will be higher than the load-sense pressure. The oil passes through the unloader and is either sent downstream to the functional portion of the valve or is diverted to the tank rails which exit the valve at the outlet.

Jump/Delay In Tilt Forward Actuation (E-Valve)

POSSIBLE CAUSE

A. RAMP RATE NOT SET TO DESIRED LEVEL.
B. AIR TRAPPED IN CIRCUIT.
C. OUTPUT THRESHOLD IS SET TOO HIGH.
D. COUNTERBALANCE BRIDGE PRESSURE ORIFICE PARTIALLY PLUGGED.
E. COUNTERBALANCE EXHAUST HOLES PARTIALLY PLUGGED IN VALVE.
F. COUNTERBALANCE PISTON STICKING.

CAUSE A - RAMP RATE NOT SET TO DESIRED LEVEL.

PROCEDURE OR ACTION:

WARNING
Unexpected movement of hydraulic function can cause injury or death. Do not operate the lift truck until problem has been repaired.

1. Adjust function ramp setting on DSC. If problem is still present, go to CAUSE B.

CAUSE B - AIR TRAPPED IN CIRCUIT.

PROCEDURE OR ACTION:

1. Remove air from circuit by cycling function full stroke of hydraulic hoist cylinder at one second intervals. If symptom is still present, go to CAUSE C.

CAUSE C - OUTPUT THRESHOLD IS SET TOO HIGH.

PROCEDURE OR ACTION:

1. Check current at EHPV. See **Hydraulic Gear Pump** 1900YRM1136.
   Is setting at valve correct?
   YES: Go to CAUSE D.
   NO: Decrease setting to specification or until operation is acceptable to operator.

CAUSE D - COUNTERBALANCE BRIDGE PRESSURE ORIFICE PARTIALLY PLUGGED.

PROCEDURE OR ACTION:

1. Inspect orifice. See **Main Control Valve** 2000YRM1137.
   Is bridge pressure orifice open?
   YES: Go to CAUSE E.
   NO: Clean orifice or replace valve section.

Forks Raise Without Command

POSSIBLE CAUSE

A. MLM/JOYSTICK CONTROL MALFUNCTION.
B. PPRV STUCK OPEN.
C. STUCK SPOOL IN CONTROL VALVE.

CAUSE A - MLM/JOYSTICK CONTROL MALFUNCTION.

PROCEDURE OR ACTION:

1. Check the DSC for DTC.
   Is a DTC displayed?
   YES: Go to DTC diagnostic procedure.
   NO: Check for full stroke of lever. Use DSC or install the Service Tool to monitor functions.

PROCEDURE OR ACTION:

2. Stroke each lever to full stroke and allow to snap back to center.
3. **(Do not start.)** Turn key switch to **ON** position or press power ON/OFF button.
4. See **User Interface - Service Technician** 2200YRM1131. Follow instructions to view Lever Input Value. With Service Password, view Diagnostics – Hydraulic Data Display – Hydraulic Input.
5. Operate each lever to full stroke forward and read input.
   Is lever Input = - 92%?
   YES: Go to Step 6.
   NO: Replace lever. See **Electrical System** 2200YRM1142.
6. Operate each lever to full stroke backward and read input.
   Is lever Input = + 92%?
   YES: Go to CAUSE B.
   NO: Replace lever. See **Electrical System** 2200YRM1142.

CAUSE B - PPRV STUCK OPEN.

PROCEDURE OR ACTION:

1. Perform pilot pressure test. See PPRV Pilot Pressure Test.
   Does pilot pressure meet specifications for your lift truck?
   YES: Go to CAUSE C.
   NO: Remove and clean PPRV. See **Main Control Valve** 2000YRM1457.

CAUSE C - STUCK SPOOL IN CONTROL VALVE.

PROCEDURE OR ACTION:

1. Remove and inspect spool for contamination and damaged or broken components. See **Main Control Valve** 2000YRM1457.
   Is the spool clean, undamaged, and moves freely in bore?
   YES: Resume operation.
   NO: Clean contaminated spool or replace lift section. See **Main Control Valve** 2000YRM1457.
   Resident Service Approval Required prior to control valve assembly replacement for Trucks under warranty. Make sure to indicate an accurate problem description leading to the control valve assembly replacement.

SECTION 9060

OPERATORS STATION

TABLE OF CONTENTS

CAUSE I - CHAINS LOOSE OR NOT EQUAL

PROCEDURE OR ACTION:

1. Inspect chains. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Mast Repairs (S/N A551, A555, A559, A661, A662, A663, A664, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564)** 4000YRM1148. For 4.0-7.0 Ton Cushion and Pneumatic Trucks, see **Mast Repairs, 2- and 3-Stage Masts (S/N A513, A514, A613, A614, A702, A703, A704, A705, A706, A707, A751, A752, B513, B514, B586, B587, B588, B589, B590, B591, B749, B750, B751, B752, B753, B754)** 4000YRM1250. For 8.0-9.0 Ton Cushion and Pneumatic Trucks, see **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406.
   Are chains adjusted correctly and in good condition?
   YES: Go to CAUSE J.
   NO: Adjust or repair chains. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Mast Repairs (S/N A551, A555, A559, A661, A662, A663, A664, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564)** 4000YRM1148. For 4.0-7.0 Ton Cushion and Pneumatic Trucks, see **Mast Repairs, 2- and 3-Stage Masts (S/N A513, A514, A613, A614, A702, A703, A704, A705, A706, A707, A751, A752, B513, B514, B586, B587, B588, B589, B590, B591, B749, B750, B751, B752, B753, B754)** 4000YRM1250. For 8.0-9.0 Ton Cushion and Pneumatic Trucks, see **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406.

CAUSE J - WORN LOAD ROLLERS OR STRIP BEARINGS

PROCEDURE OR ACTION:

1. Inspect load rollers and strip bearings. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Mast Repairs (S/N A551, A555, A559, A661, A662, A663, A664, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564)** 4000YRM1148. For 4.0-7.0 Ton Cushion and Pneumatic Trucks, see **Mast Repairs, 2- and 3-Stage Masts (S/N A513, A514, A613, A614, A702, A703, A704, A705, A706, A707, A751, A752, B513, B514, B586, B587, B588, B589, B590, B591, B749, B750, B751, B752, B753, B754)** 4000YRM1250. For 8.0-9.0 Ton Cushion and Pneumatic Trucks, see **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406.
   Are the load rollers and strip bearings in good condition?
   YES: Go to CAUSE K.
   NO: Adjust, repair, or replace load rollers and strip bearings as required.

CAUSE K - MAST CHANNELS ARE WORN

PROCEDURE OR ACTION:

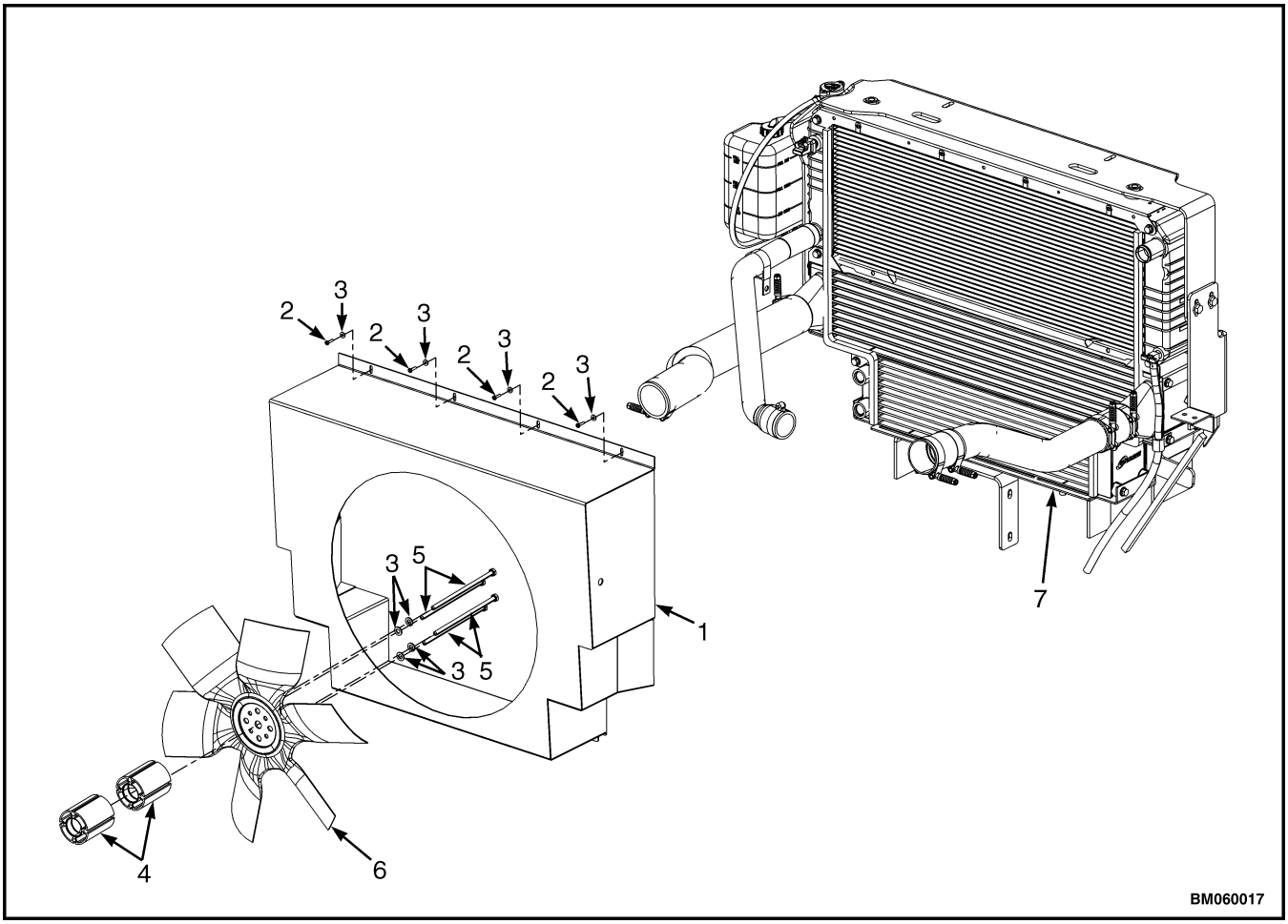
1. Inspect mast channels for wear or damage. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Mast Repairs (S/N A551, A555, A559, A661, A662, A663, A664, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564)** 4000YRM1148. For 4.0-7.0 Ton Cushion and Pneumatic Trucks, see **Mast Repairs, 2- and 3-Stage Masts (S/N A513, A514, A613, A614, A702, A703, A704, A705, A706, A707, A751, A752, B513, B514, B586, B587, B588, B589, B590, B591, B749, B750, B751, B752, B753, B754)** 4000YRM1250. For 8.0-9.0 Ton Cushion and Pneumatic Trucks, see **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406.
   Are the mast channels in good condition?
   YES: Go to CAUSE L.
   NO: Repair or replace worn mast components.

Group 80
Supplier Specification Data

TSP REFERENCE TABLES

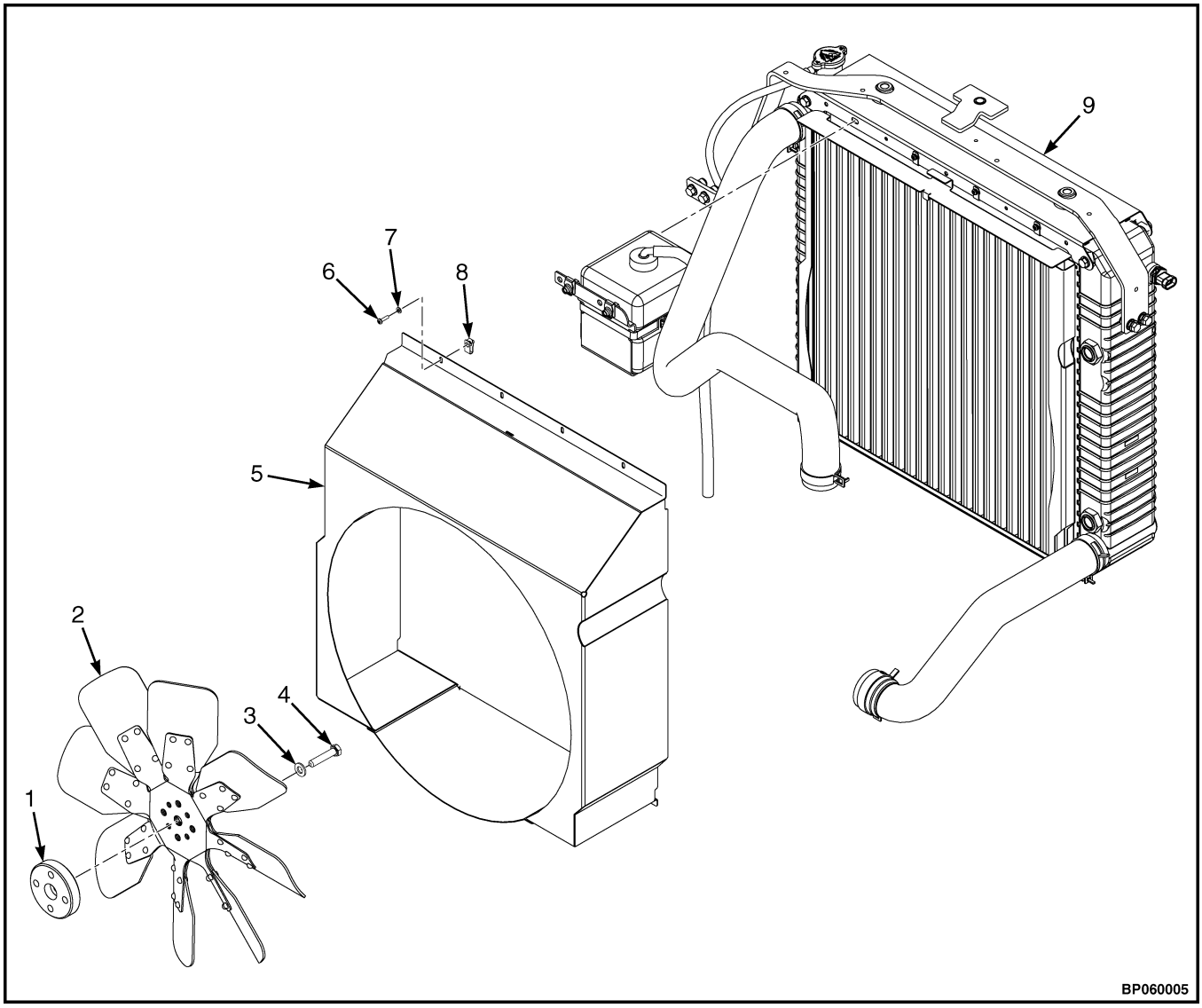
Table 9080-80-5. Resistor-Temperature Characteristics

Temperature °C (°F)	Resistance				Temperature Accuracy ±°C (°F)
	Nominal (Ω)	Tolerance (±%)	Max (Ω)	Min (Ω)	
−40 (−40)	100,865	4.87	105,777.1	95,952.9	0.7 (1.26)
−35 (−31)	72,437	4.64	75,708.1	69,075.9	0.7 (1.26)
−30 (−22)	52,594	4.43	54,923.9	50,264.1	0.7 (1.26)
−25 (−13)	38,583	4.21	40,207.3	36,958.7	0.7 (1.26)
−20 (−4)	28,582	4.00	29,725.3	27,438.7	0.7 (1.26)
−15 (5)	21,371	3.80	22,183.1	20,558.9	0.7 (1.26)
−10 (14)	16,120	3.60	16,700.3	15,539.7	0.6 (1.08)
−5 (23)	12,261	3.40	12,677.9	11,844.1	0.6 (1.08)
0 (32)	9,399	3.21	9,700.7	9,097.3	0.6 (1.08)
5 (41)	7,263	3.06	7,485.2	7,040.8	0.6 (1.08)
10 (50)	5,658	2.92	5,823.2	5,492.8	0.6 (1.08)
15 (59)	4,441	2.78	4,564.5	4,317.5	0.6 (1.08)
20 (68)	3,511	2.64	3,603.7	3,418.3	0.6 (1.08)
25 (77)	2,795	2.50	2,864.9	2,725.1	0.6 (1.08)
30 (86)	2,240	2.45	2,294.9	2,185.1	0.6 (1.08)
35 (95)	1,806	2.40	1,849.3	1,762.7	0.6 (1.08)
40 (104)	1,465	2.36	1,499.6	1,430.4	0.6 (1.08)
45 (113)	1,195	2.31	1,222.6	1,167.4	0.6 (1.08)
50 (122)	980	2.27	1,002.2	957.8	0.6 (1.08)
55 (131)	809	2.23	827.0	791.0	0.6 (1.08)
60 (140)	671	2.19	685.7	656.3	0.6 (1.08)
65 (149)	559	2.15	571.0	547.0	0.6 (1.08)
70 (158)	469	2.11	478.9	459.1	0.6 (1.08)
75 (167)	395	2.07	403.2	386.8	0.6 (1.08)
80 (176)	334	2.04	340.8	327.2	0.6 (1.08)
85 (185)	283	2.00	288.7	277.3	0.6 (1.08)
90 (194)	241.8	2.10	246.9	236.7	0.7 (1.26)
95 (203)	207.1	2.21	211.7	202.5	0.7 (1.26)
100 (212)	178.0	2.31	182.1	173.9	0.8 (1.44)



1. RADIATOR SHROUD
2. SCREW
3. WASHER
4. SPACER
5. CAPSCREW
6. FAN
7. RADIATOR

Figure 37. Fan Removal for Cummins QSB 3.3L Engine, Lift Truck Models GDP80VX, GDP80VX9, GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (A909, B909)



1. SPACER
2. FAN
3. WASHER
4. CAPSCREW
5. SHROUD
6. SCREW
7. LOCKWASHER
8. CLIP NUT
9. RADIATOR

Figure 33. Fan Removal for Cummins 4.5L Engine, Lift truck Models GDP40VX5/ VX6;GDP45SVX5,GDP45VX6; GDP50-55VX (GDP080, 090, 100, 110, 120VX) (F813)

See Figure 5 for lift truck models

- GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX (C809)
- GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX, (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)
- GLC050LX (A967)
- GLP/GDP20-25LX (GLP/GDP050LX) (A974)

7. On lift truck models GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875) equipped with a Quick-Lok™ hydraulic hose and single speed transmission, remove the adapter and hydraulic hose from gear pump assembly. See Figure 6. Disconnect all other hydraulic hoses connected to gear pump assembly. Remove pump outlet fitting from hydraulic gear pump. Put caps on all hose fittings and hydraulic gear pump ports. See Figure 5.

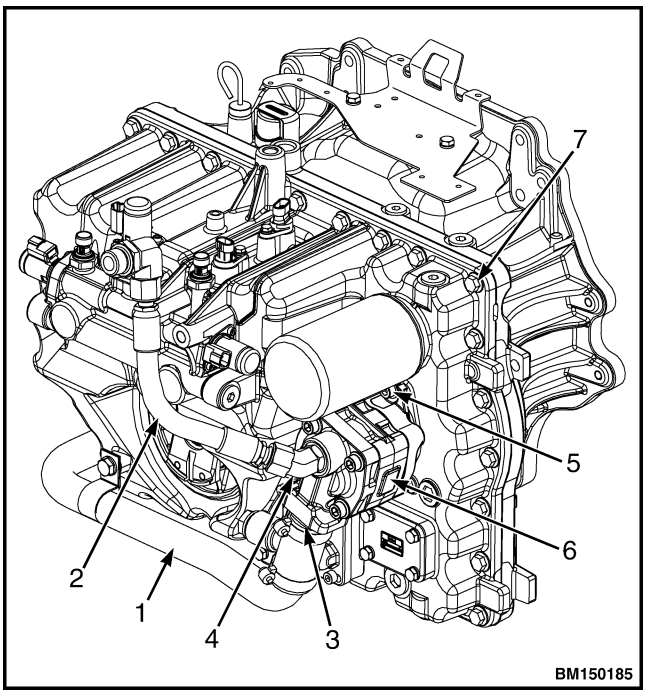
8. Hold the pump assembly to keep it from falling. Remove the two flange head capscrews that fasten the pump to the transmission housing. Remove the pump assembly.

See Figure 4 for lift truck models

- GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX (C809)
- GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX, (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)

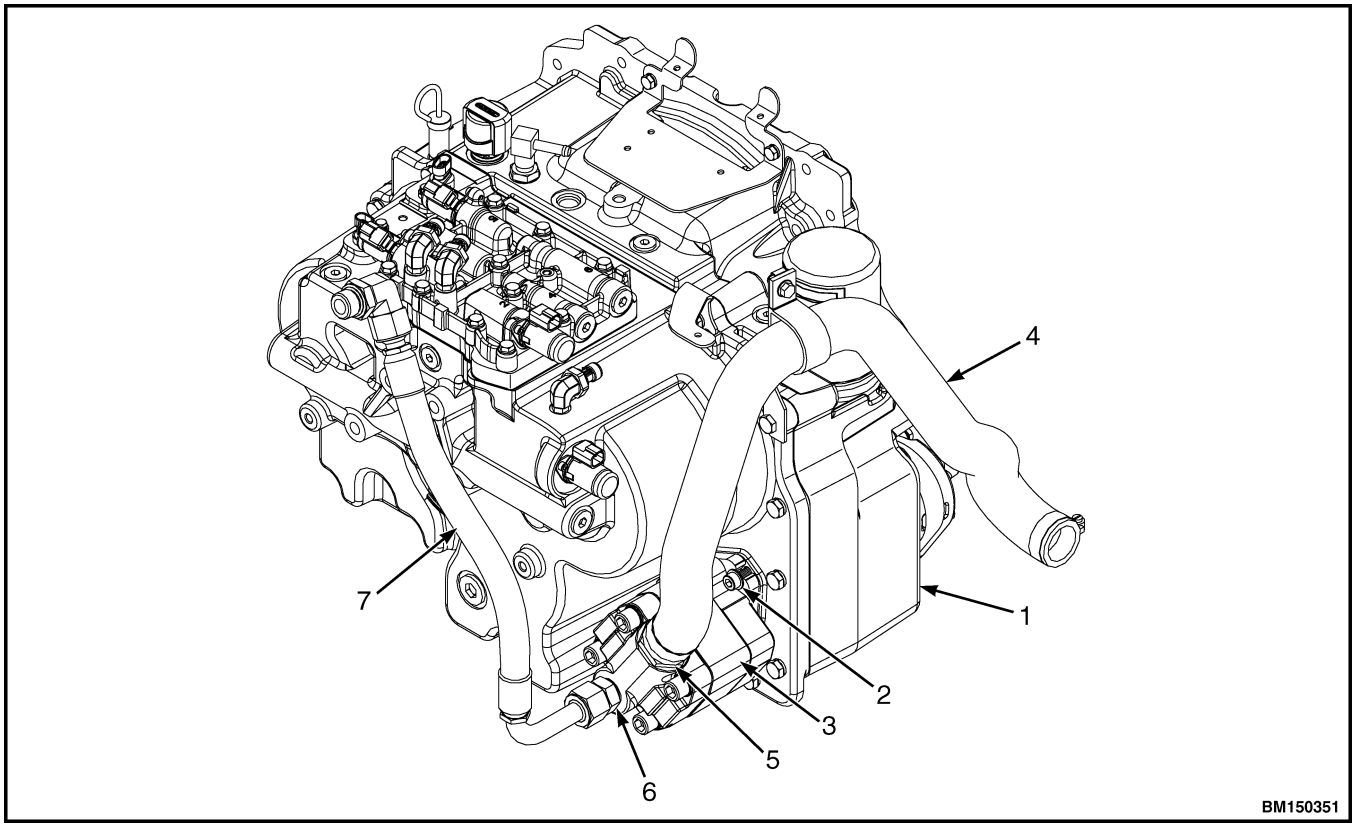
See Figure 5 for lift truck models

- GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX (C809)
- GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX, (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)
- GLC050LX (A967)
- GLP/GDP20-25LX (GLP/GDP050LX) (A974)



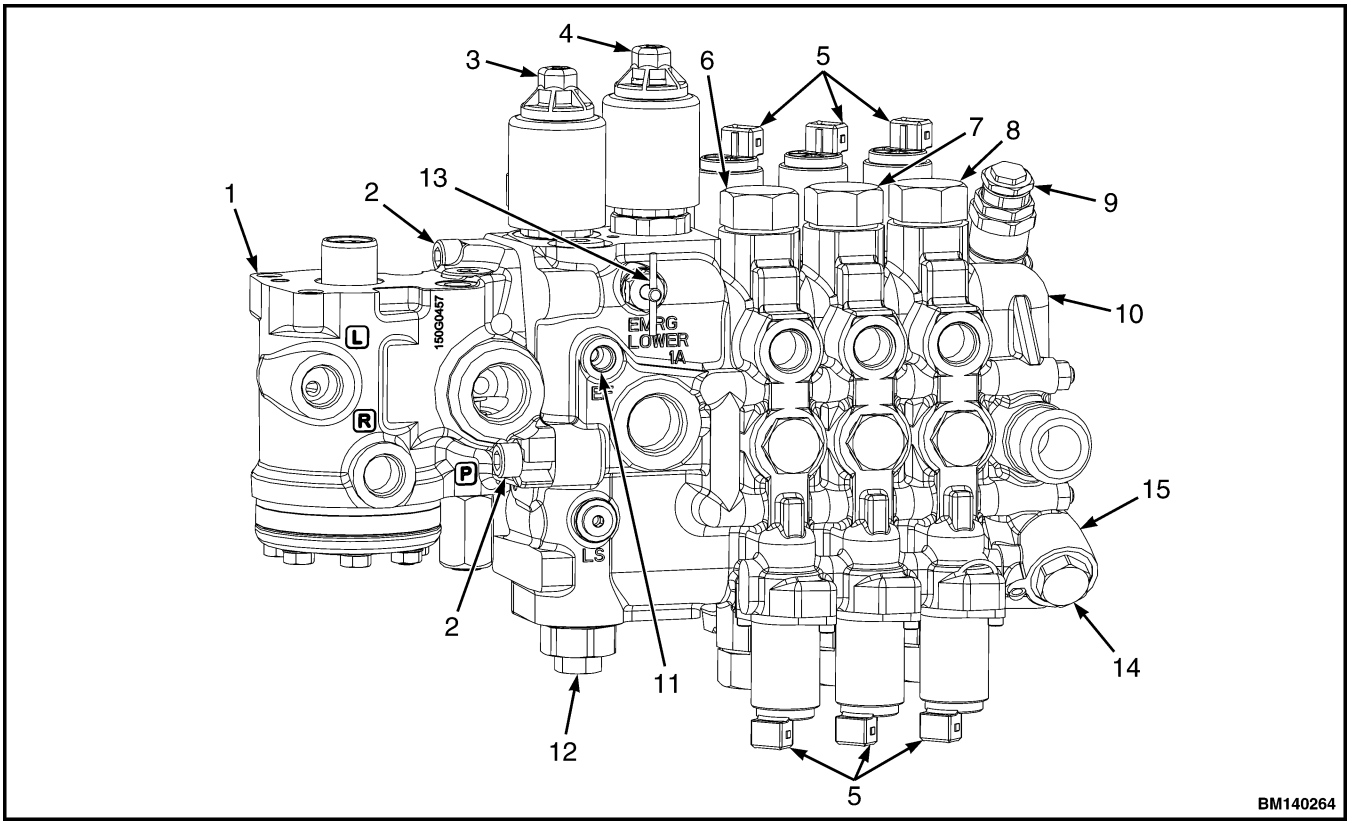
1. SUCTION HOSE
2. HYDRAULIC INLET HOSE
3. SUCTION ADAPTER
4. PUMP OUTLET FITTING
5. FLANGE HEAD CAPSCREW (2)
6. HYDRAULIC PUMP
7. TRANSMISSION

Figure 4. Hydraulic Pump for 1.5 to 3.5 Ton Lift Truck Models, Equipped With Aluminum Transmission Housing, Prior to January, 2011



1. TRANSMISSION
2. SOCKET HEAD SCREW
3. HYDRAULIC PUMP
4. SUCTION HOSE
5. SUCTION ADAPTER
6. PUMP OUTLET FITTING
7. HYDRAULIC INLET HOSE

Figure 3. Hydraulic Pump for Lift Truck Model with Dual Hydraulic Tanks GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (F818)



1. STEERING CONTROL UNIT (SCU)
2. SCU MOUNTING CAPSCREW
3. ELECTRO-HYDRAULIC POPPET VALVE (EHPV) (LIFT)
4. ELECTRO-HYDRAULIC POPPET VALVE (EHPV) (LOWER)
5. PROPORTIONAL PRESSURE REDUCING VALVE (PPRV)
6. TILT SECTION
7. AUXILIARY I SECTION
8. AUXILIARY II SECTION
9. SECONDARY RELIEF VALVE (ADJUSTABLE)
10. OUTLET SECTION
11. EF PORT
12. PRIMARY RELIEF VALVE (ADJUSTABLE)
13. EMERGENCY LOWERING VALVE
14. ANTI-STALL PLUG
15. ANTI-STALL SOLENOID PORT

Figure 6. Electronic Control Valve With Anti-Stall Plug, Lift Truck Models GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX (C809), GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810), GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910), GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875), GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818), GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813)

MANUAL CONTROL VALVE SECTIONS

General

CAUTION

While working on the manual control valve sections, place a cover over the remaining sections of the control valve to prevent the possibility of contaminants getting into the control valve openings which could cause damage to the control valve.

CAUTION

If O-rings are to be replaced between two sections that have a hydraulic oil leak, replace all O-rings between all sections. This eliminates the possibility of a subsequent oil leak or possible damage to another O-ring.

NOTE: Disassemble the manual control valve only as necessary for repairs. Most repairs to the control valve will be for the replacement of O-rings to stop leaks between sections.

The manual control valve will be disassembled starting with the outlet control valve section.

Outlet Control Valve Section

Remove

1. Remove four nuts from the control valve tie rods.

See Figure 47

- For lift trucks without OPS.

See Figure 48

- For lift trucks with OPS.

2. Remove the outlet control valve section from the four tie rods and discard three O-rings from the auxiliary control valve section.

See Figure 49

- For lift trucks without OPS.

See Figure 50

- For lift trucks with OPS.

Disassemble

1. Remove the secondary relief valve plug from the outlet control valve section and discard the O-ring.

See Figure 47

- For lift trucks without OPS.

See Figure 48

- For lift trucks with OPS.

NOTE: Perform Step 2 through Step 6 only if it is absolutely necessary to disassemble the secondary relief valve.

2. Remove the plug from the adjusting nut. Remove and discard the O-ring from the plug. Remove and discard the backup rings and O-ring from the adjusting nut.

Legend for Figure 13.

NOTE: SECONDARY RELIEF VALVE ASSEMBLY IS THE SAME FOR BOTH OUTLET SECTIONS COVERED IN FIGURE 13.

A. OUTLET SECTION USED ON LIFT TRUCK MODEL COVERED IN THIS SERVICE MANUAL THAT ARE EQUIPPED WITH AN ANTI-STALL PORT ON OUTLET SECTION.
B. OUTLET SECTION USED ON LIFT TRUCK MODELS, EXCEPT GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909) , COVERED IN THIS SERVICE MANUAL THAT ARE NOT EQUIPPED WITH AN ANTI-STALL PORT ON OUTLET SECTION.

1. O-RING
2. PLUG
3. OUTLET VALVE SECTION
4. BACKUP RING
5. SECONDARY RELIEF VALVE PLUG
6. POPPET
7. WASHER
8. SPRING
9. JAM NUT
10. ADJUSTING NUT
11. CONTROL VALVE TIE ROD
12. NUT
13. ANTI-STALL PORT
14. SECONDARY RELIEF VALVE ASSEMBLY

6. While holding the adjustment nut, loosen the jam nut.

NOTE: While performing Step 7, count and note the number of turns used to remove the adjusting nut.

7. Remove the adjusting nut and jam nut assembly from the secondary relief valve plug and discard the O-ring on the adjusting nut.

8. Remove the spring, washer, and poppet from the secondary relief valve plug.

9. Remove and discard the backup ring from the secondary relief valve plug.

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

1. If all components of the outlet control valve section have been removed, clean the outlet control valve section using cleaning solvent and dry using compressed air.

2. If all components have not been removed, clean the outlet control valve section using a lint-free cloth.

Inspect

Inspect the outlet control valve section mating surfaces and the bore of the secondary relief valve, if removed, for damage. If either the mating surface or the secondary relief valve bore are damaged, replace the outlet control valve section.

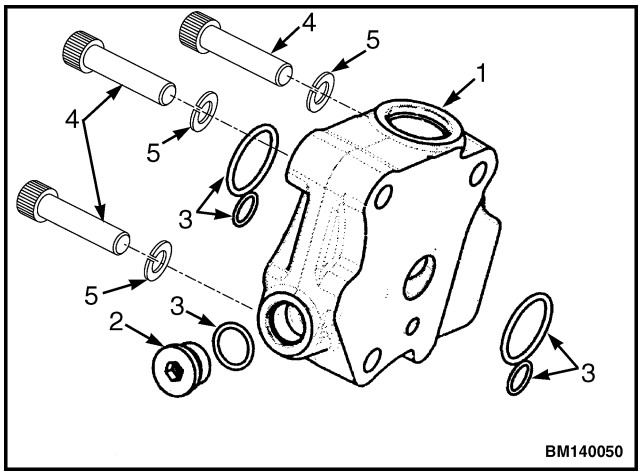
If disassembled, inspect the components of the secondary relief valve. If any components other than O-rings, backup rings, and the spring are damaged, replace the secondary relief valve.

NOTE: If the outlet control valve section is not to be reassembled immediately, coat surfaces with clean hydraulic oil to prevent the possibility of rust. Cover the outlet control valve section with a clean, dry, lint-free cloth to prevent the possibility of contaminants entering the outlet control valve section.

1. Remove three socket head capscrews and washers that secure the mid-inlet section to the lift/tilt (monoblock) section. See Figure 54.

2. Remove mid-inlet section from the lift/tilt section. Discard four O-rings.

3. Remove socket head plug and discard O-ring.



1. MID-INLET SECTION
2. SOCKET HEAD PLUG
3. O-RING
4. SOCKET HEAD CAPSCREW
5. WASHER

Figure 54. Mid-Inlet Section

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

Clean the mid-inlet control valve section using cleaning solvent and dry using compressed air.

Inspect

Inspect the mid-inlet control valve section and mating surfaces. If either the mating surfaces or mid-inlet control valve section are damaged, replace the mid-inlet control valve section.

Install

NOTE: If the mid-inlet control valve section is not to be installed immediately, coat surfaces with clean hydraulic oil to prevent the possibility of rust. Cover the mid-inlet control valve section with a clean, dry, lint-free cloth to prevent the possibility of contaminants entering the mid-inlet control valve section.

NOTE: Coat all O-rings with a light coat of clean hydraulic oil to make installation easier.

1. Install new O-ring on socket head plug. Install plug into mid-inlet section. See Figure 54.

2. Install new O-rings on mating surfaces of mid-inlet section.

3. Install mid-inlet section to lift/tilt section using three socket head capscrews and washers. Tighten capscrews to 45 to 55 N•m (33 to 41 lbf ft).

INSTALL

WARNING

The main control valve weighs approximately 30.5 kg (67 lb). Use a lifting device capable of lifting the main control valve, to avoid the possibility of injury to personnel.

1. While supporting the main control valve in place on the cowl, install three mounting capscrews, washers, and inserts through the front of the cowl into the control valve. Tighten the capscrews to 19 N•m (14 lbf ft).

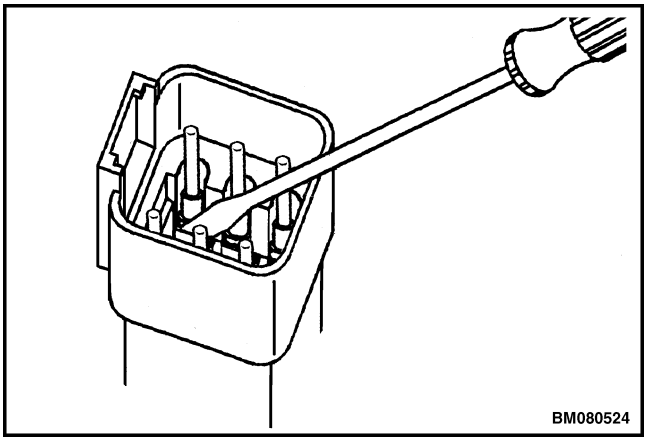
   See Figure 55

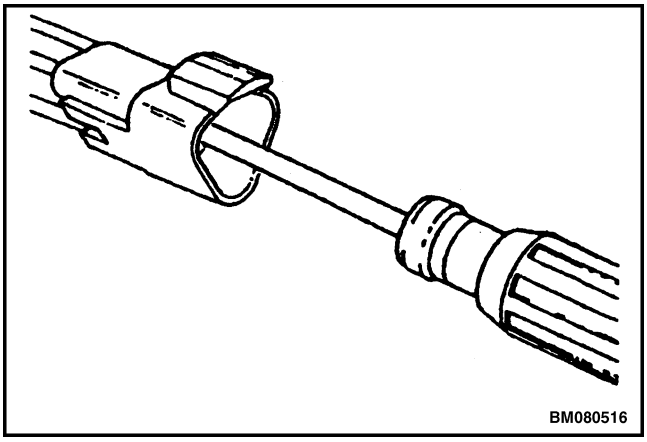
   - For lift trucks without OPS.

   See Figure 56

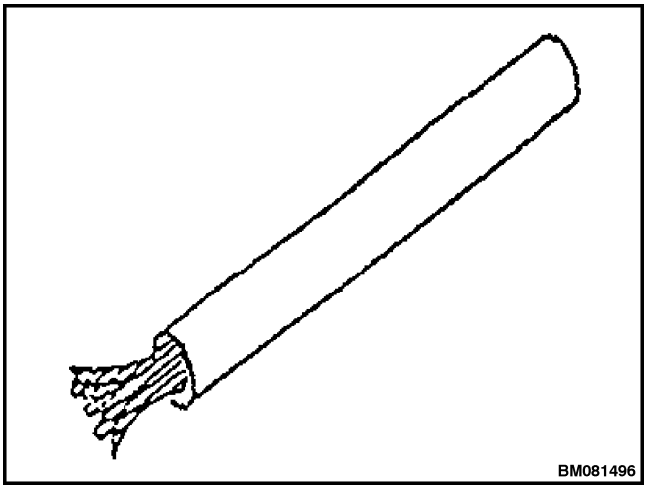
   - For lift trucks with OPS.

STEP 3.
Using a small, flat-blade screwdriver (Yale P/N 150121838) , release the locking finger by moving it away from the pin.

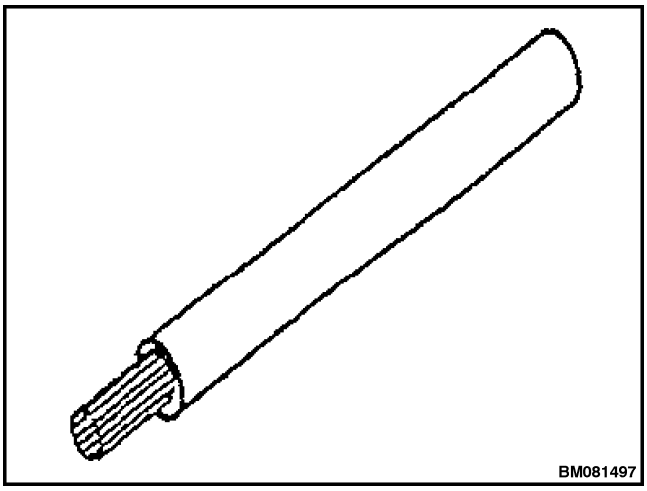




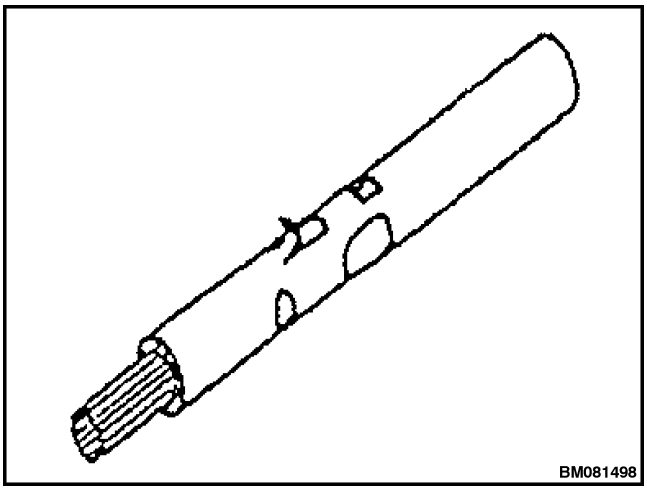
STEP 2.
Cut end of wire shall appear neat without any bend or stranded conductor.



STEP 3.
Conductor shall be free from nick, cut or scrape.



STEP 4.
Wire insulation must have smooth surface in a round form without damage, groove, or recessed surface.



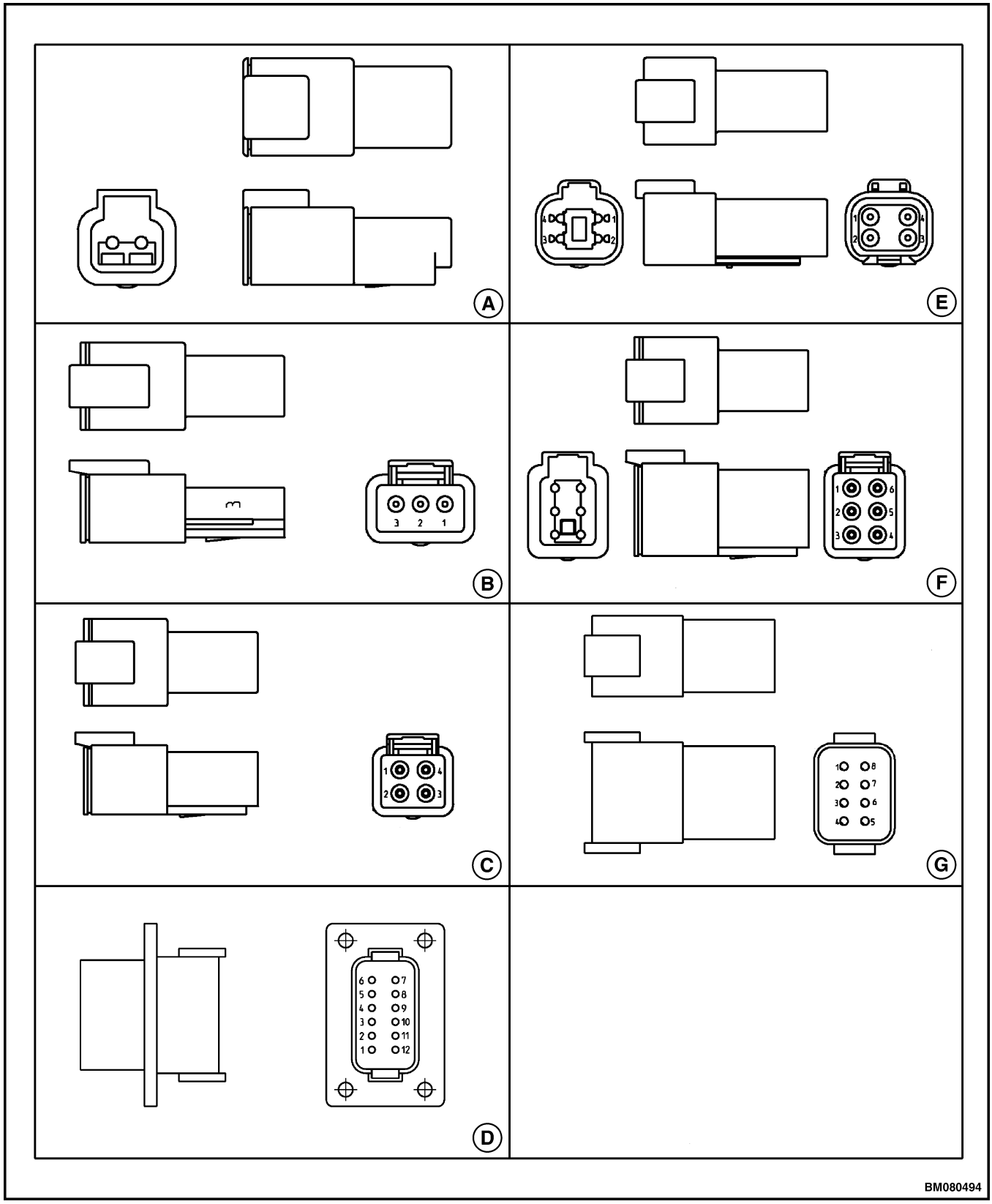
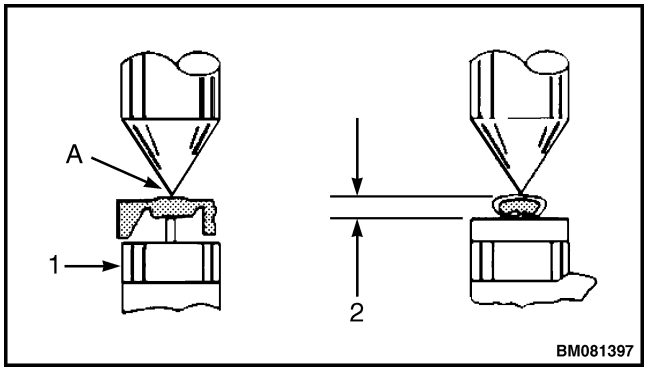


Figure 19. DTM and DTP Connector Receptacles



A. POSITION POINT ON CENTER OF WIRE BARREL OPPOSITE SEAM.

1. MODIFIED ANVIL ON MICROMETER
2. CRIMP HEIGHT, SEE TABLE 5

Figure 40. Crimp Height

2. Refer to Table 5 to select wire for each crimp section listed.

Table 5. Crimp Measurement

Wire Size (AWG)	Crimp Height
16	1.41 ±0.05 mm (0.056 ±0.002 in.)
18	1.22 ±0.05 mm (0.048 ±0.002 in.)

3. Crimp a contact onto the selected wire according to How to Use AMP PRO-CRIMPER II Tool procedure.

4. Using a modified micrometer, measure wire barrel height as shown in Figure 40. If the crimp height matches measurement shown in Table 5 the tool is correct. If not, follow Crimp Height Adjustment procedure.

HOW TO USE AMP PRO-CRIMPER II TOOL

1. Strip insulation from wire. See Stripping Wire for Use With AMP PRO-CRIMPER II Tool procedure.

2. Hold PRO-CRIMPER II tool so **BACK** side (wire side) is facing you.

3. Squeeze tool handles together, then allow to fully open.

4. Holding contact by mating end, insulation barrel first, insert contact through front of tool and into appropriate crimp section.

5. Mating end of contact should be on locator side of tool; the open "U" of wire barrel and insulation barrel should face the top of the tool. The contact to be placed to that movable locator drips into slot in the contact. Butt the front end of the wire barrel against locator.

NOTE: Make sure neither wire barrel nor insulation barrel are damaged.

6. Hold contact in position and squeeze tool handles until ratchet engages enough to hold contact.

7. Insert stripped wire into contact insulation and wire barrels until butted against wire stop.

8. Squeeze tool handles, while holding wire in position, until ratchet releases.

9. Allow tool handles to open and remove crimped contact from tool.

10. Check crimp height as described in Crimp Height Inspection.

TABLE OF CONTENTS (Continued)

IMPACT SENSOR - SOFT IMPACT SETTINGS

NOTE: The information in the following paragraphs describe how to navigate through the Setup Menu and enter the data parameters for soft impacts. For information on the recommended starting values for the impact sensor settings based on truck capacity and tire type and for procedures on how to adjust these values, see Adjust Impact Sensor Settings.

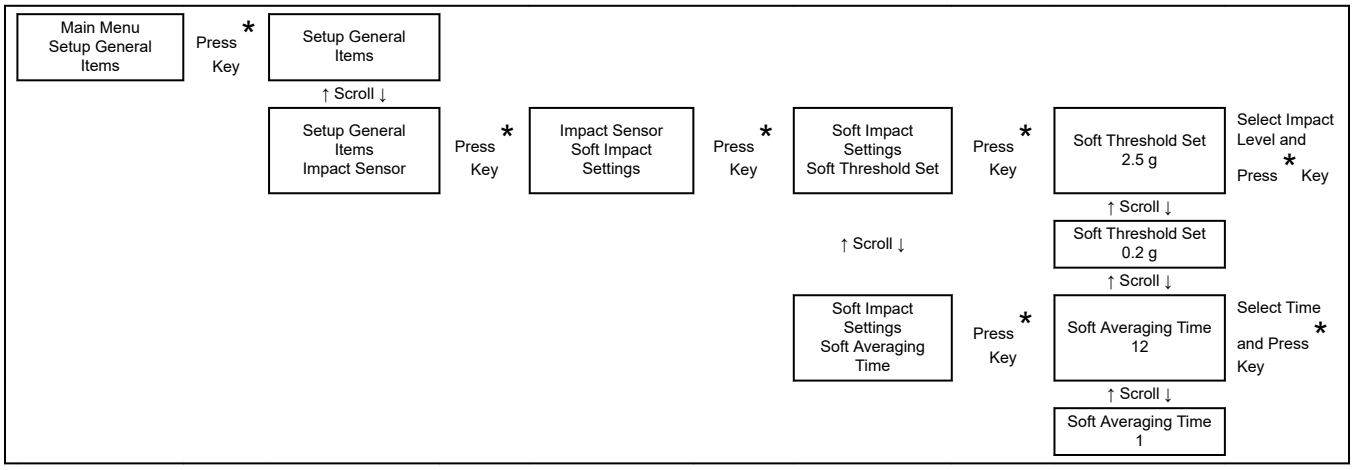
Lift trucks equipped with the optional impact sensor, leave the factory with the sensor deactivated and set with default values (see Table 33). The impact sensor is equipped with an accelerometer that measures the rate and time of truck deceleration continuously and monitors how strong the deceleration is and how long it lasts.

If your lift truck is configured for optional impact sensor, this function allows the supervisor to set the impact level and averaging time for soft (minor) impacts. See Table 34 for the recommended impact sensor settings by truck capacity and tire type.

After entering the Impact Sensor Soft Impact Settings menu, select the Soft Threshold Set menu and press the * key. See Table 31. Select the impact level from the selections listed and press the * key.

Scroll to the Soft Averaging Time menu and press the * key. Select the averaging time for the selections listed and press the * key. If you are finished making changes, scroll to the Exit Options menu and choose the appropriate action.

Table 31. Soft Impact Settings Menu



IMPACT SENSOR - HARD IMPACT SETTINGS

NOTE: The information in the following paragraphs describe how to navigate through the Setup Menu and enter the data parameters for hard impacts. For information on the recommended starting values for the impact sensor settings based on truck capacity and tire type and for procedures on how to adjust these values, see Adjust Impact Sensor Settings.

Lift trucks equipped with the optional impact sensor, leave the factory with the sensor deactivated and set with default values (see Table 33). The impact sensor is equipped with an accelerometer that measures the rate and time of truck deceleration continuously and monitors how strong the deceleration is and how long it lasts.

If your lift truck is configured for optional impact sensor, this function allows the supervisor to set the impact level and averaging time for soft (minor) impacts. See Table 34 for the recommended impact sensor settings by truck capacity and tire type.

If your lift truck is configured for optional impact sensor, this function allows the supervisor to set the impact level and averaging time for hard (major) impacts.

After entering the Impact Sensor Hard Impact Settings menu, select the Hard Threshold Set menu and press the * key. See Table 32. Select the impact level from the selections listed and press the * key.

Scroll to the Hard Averaging time menu and press the * key. Select the averaging time for the selections listed and press the * key. If you are finished making

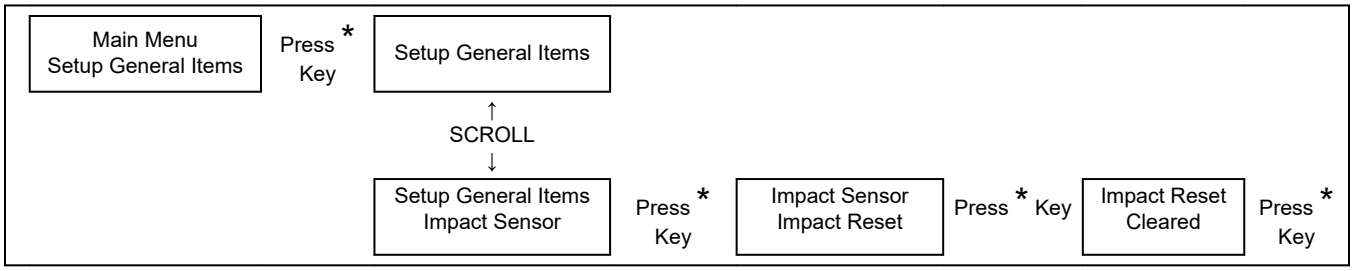
Table 51. Recommended Starting Values for Impact Sensor Settings by Truck Capacity and Tire Type

Chassis Range	Tire Type	Soft Threshold	Soft Averaging	Hard Threshold	Hard Averaging
1-2T	Cushion	0.6 g	7	0.9 g	1
1-2T	Pneumatic	0.6 g	7	0.9 g	1
2-3T	Cushion	0.6 g	7	0.9 g	1
2-3T	Pneumatic	0.6 g	7	0.9 g	1
3.5T	Cushion	0.5 g	7	0.8 g	1
3.5T	Pneumatic	0.5 g	7	0.8 g	1
4-5T	Cushion	0.5 g	7	0.8 g	1
4-5T	Pneumatic	0.5 g	7	0.8 g	1
5.5T	Cushion	0.4 g	7	0.8 g	1
5.5T	Pneumatic	0.4 g	7	0.8 g	1
6-7T	Cushion	0.4 g	7	0.8 g	1
6-7T	Pneumatic	0.4 g	7	0.8 g	1
8T	Pneumatic	0.4 g	7	0.8 g	1
9T	Pneumatic	0.3 g	7	0.7 g	1

IMPACT SENSOR - IMPACT ALARM/ SHUTDOWN RESET

If your lift truck is configured for optional impact sensor, this function allows the service technician to reset and return the lift truck to normal operation after an impact sensor shutdown. See Table 52.

Table 52. Shutdown Reset Menu



AUXILIARY FUNCTION ONE, DIRECTION B, MAXIMUM SPEED

CAUTION

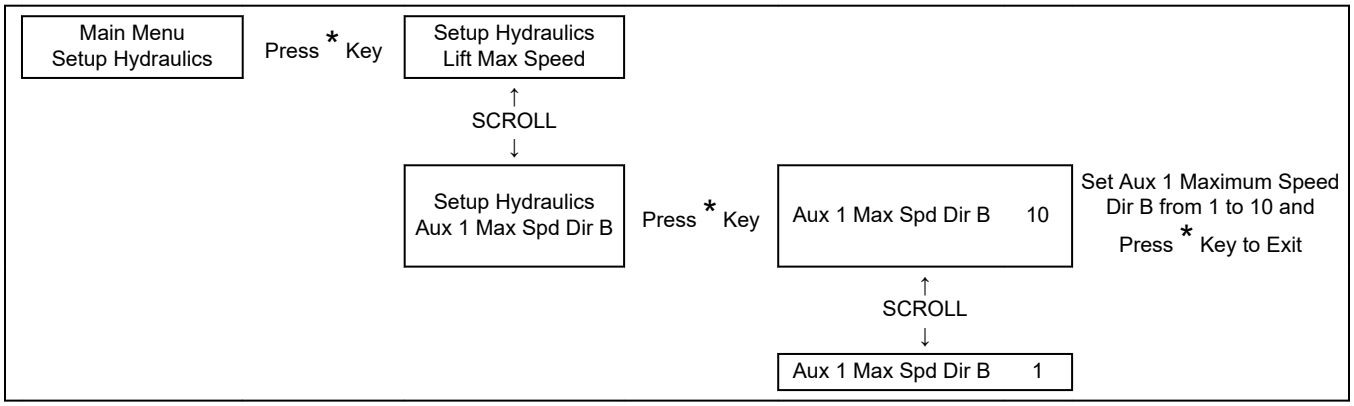
Adjusting above the recommended manufacturer's maximum is not advised. It will have minimal effect on the speed of the attachment and may result in overheating of the truck and the attachment's hydraulics.

If the lift truck is equipped with optional electro-hydraulics, this function can be used to set the maximum auxiliary function speed in direction B. The auxiliary function speed can be adjusted using a scale of 1 to 10. Using a setting of 10 will result in maximum auxiliary function speed. Using a number lower than 10 will result in a slower auxiliary function speed.

Refer to the attachment maufacturer's recommended maximum flow rate for the attachment installed. See Table 30 to determine lift truck setting (1-10) necessary to deliver the flow rate required to effectively operate the attachment.

From the Setup Hydraulics menu, select *Aux 1 Max Spd Dir* B and press the * key. See Table 31. Select a number from 1 to 10 and press the * key to save your selection and access the Exit Options menu.

Table 31. Auxiliary Function Speed Menu



AUXILIARY FUNCTION TWO, DIRECTION A, MAXIMUM SPEED

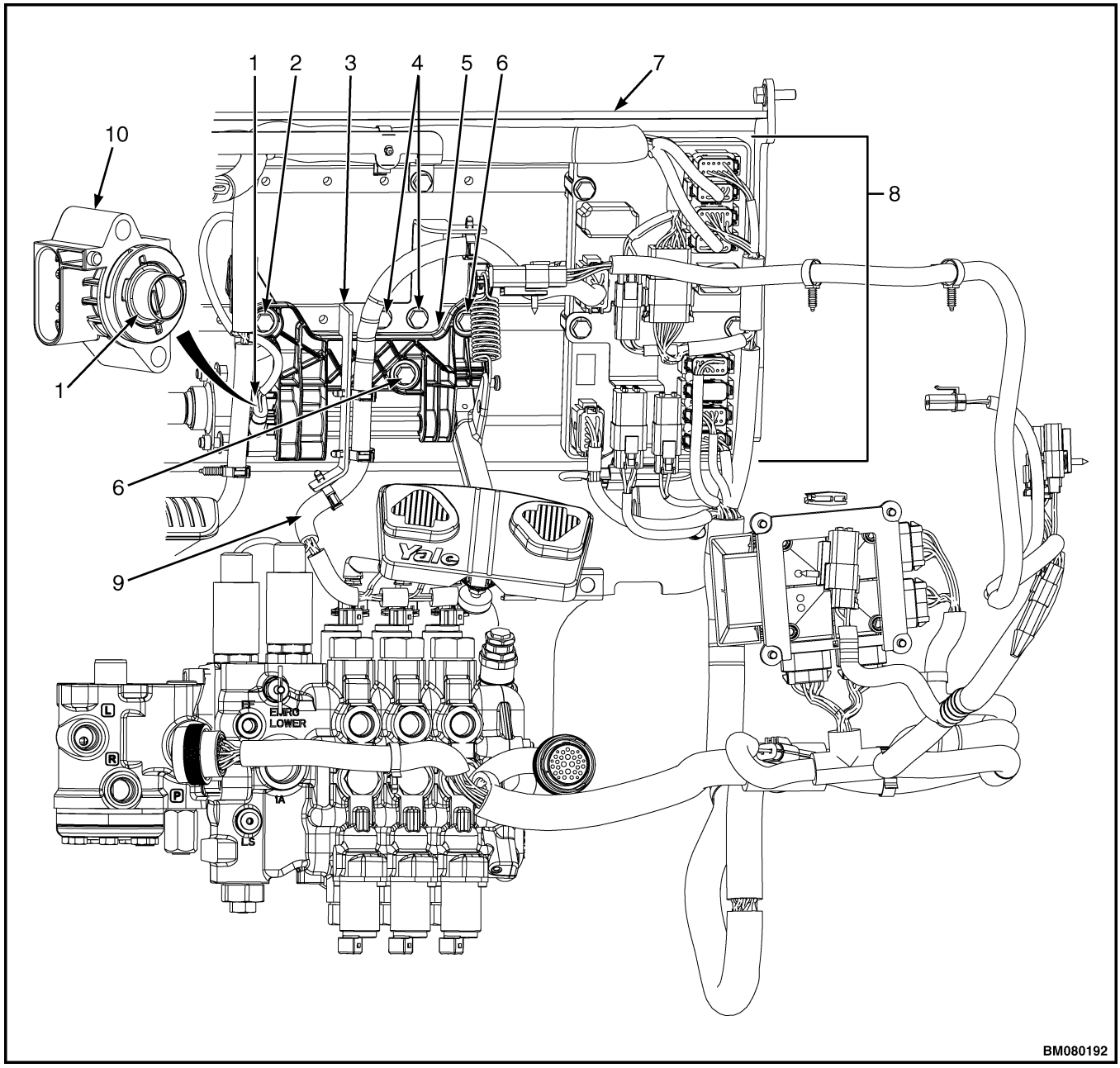
CAUTION

Adjusting above the recommended manufacturer's maximum is not advised. It will have minimal effect on the speed of the attachment and may result in overheating of the truck and the attachment's hydraulics.

If the lift truck is equipped with optional electro-hydraulics and a four- or five-function valve, this function can be used to set the maximum auxiliary function speed in direction A. The auxiliary function speed can be adjusted using a scale of 1 to 10. Using a setting of 10 will result in maximum auxiliary function speed. Using a number lower than 10 will result in a slower auxiliary function speed.

Refer to the attachment maufacturer's recommended maximum flow rate for the attachment installed. See Table 30 to determine lift truck setting (1-10) necessary to deliver the flow rate required to effectively operate the attachment.

From the Setup Hydraulics menu, select *Aux 2 Max Spd Dir A* and press the * key. See Table 32. Select a number from 1 to 10 and press the * key to save your selection and access the Exit Options menu.



NOTE: ELECTRONIC HYDRAULIC CONTROL VALVE SHOWN.

1. ACCELERATOR PEDAL POSITION SENSOR
2. BOLTS (THROTTLE BASE PLATE)
3. VALVE HARNESS MOUNTING BRACKET (ELECTRONIC VALVE)
4. BOLTS (VALVE HARNESS MOUNTING BRACKET)
5. THROTTLE BASE PLATE
6. BOLTS (THROTTLE BASE PLATE)
7. COWL
8. VEHICLE SYSTEMS MANAGER (VSM)
9. CONTROL VALVE HARNESS
10. SENSOR COVER

Figure 12. Accelerator Pedal Position Sensor

3. Install drain plug and O-ring into bottom of fuel/water separator sensor.

4. Connect the battery and close hood.

Glow Plug Relay

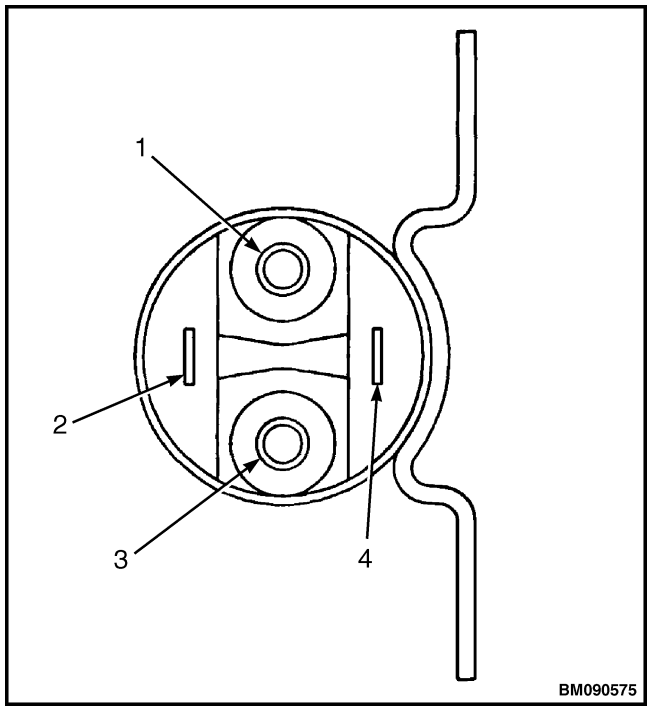
Remove

WARNING

Always disconnect the cables at the battery before you make repairs to the engine. Disconnect the cable at the negative terminal first. Install a tag on the battery terminals so that no one connects the cables on the terminals.

1. Open hood and disconnect the battery.

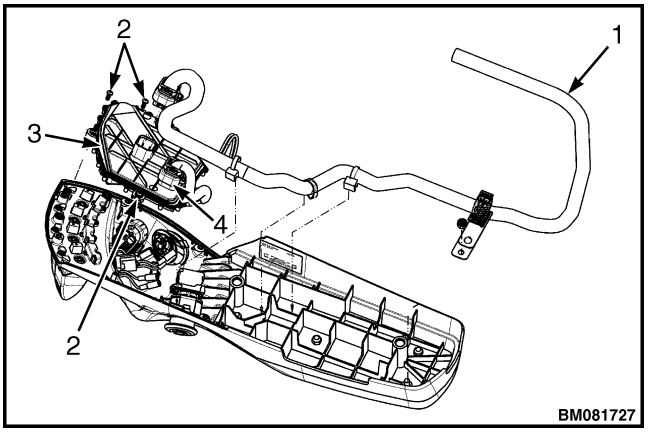
2. Tag and disconnect the wiring connectors at terminals E and S. See Figure 56.



1. M TERMINAL
2. E TERMINAL
3. B TERMINAL
4. S TERMINAL

Figure 56. Glow Plug Relay Terminals

3. Slide the protective boots back on the wires for terminals B and M. See Figure 56 and Figure 57.



1. TO E-HYDRAULIC CONTROL WIRE HARNESS
2. SOCKET HEAD SCREWS
3. PCB CASSETTE
4. PUSH (OVERRIDE) BUTTONS/TOGGLE SWITCH CONNECTOR

Figure 115. PCB Cassette Removal

Install

1. Install PCB cassette to armrest with three socket head screws. See Figure 115.

2. If lift truck is equipped, connect the push (override) buttons/toggle switch connector to PCB cassette. See Figure 115.

3. Install bottom armrest cover to armrest with six socket head screws. See Figure 114.

4. Install new armrest onto mounting bracket with flange capscrews. Tighten flange capscrews to 13 to 15 N•m (115 to 132 lbf in).

5. Connect the E-hydraulic wire harness to armrest. See Figure 113. Install seat box to cover plate with two capscrews and washers. See Figure 111. Tighten capscrews to 1.2 N•m (10.6 lbf in).

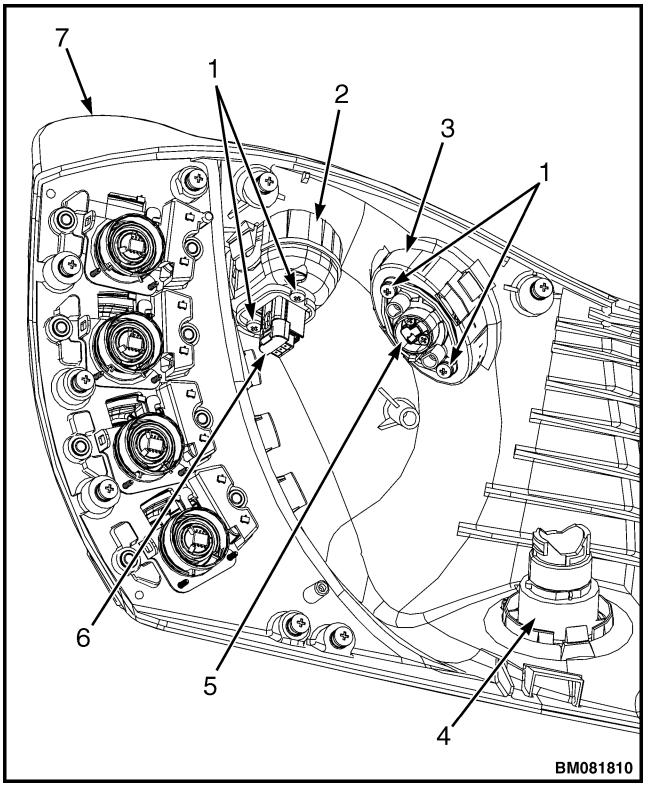
6. Connect the battery.

HORN BUTTON

Remove

1. Remove the armrest from armrest mounting bracket. Remove bottom armrest and PCB cassette. See the section Armrest Assembly for removal procedures.

2. Remove two Phillips head screws that attach horn button to armrest. See Figure 116. Remove horn button from armrest.



NOTE: PUSH (OVERRIDE) BUTTONS AND TOGGLE SWITCH CONNECTIONS NOT SHOWN FOR CLARITY.

1. PHILLIPS HEAD SCREWS
2. DIRECTION CONTROL SWITCH ADAPTER*
3. HORN BUTTON ADAPTER
4. PLUG
5. HORN SWITCH
6. DIRECTION CONTROL SWITCH CONNECTOR
7. ARMREST

*Direction Control Switch is an optional feature.

Figure 116. Switch Arrangement and Connections, E-Hydraulic Mini-Levers

Install

1. Insert new horn switch into armrest and secure switch to armrest with two Phillips head screws. See Figure 116.

2. Install armrest and PCB cassette to armrest and install armrest to armrest mounting bracket. See the section Armrest Assembly for installation procedures.

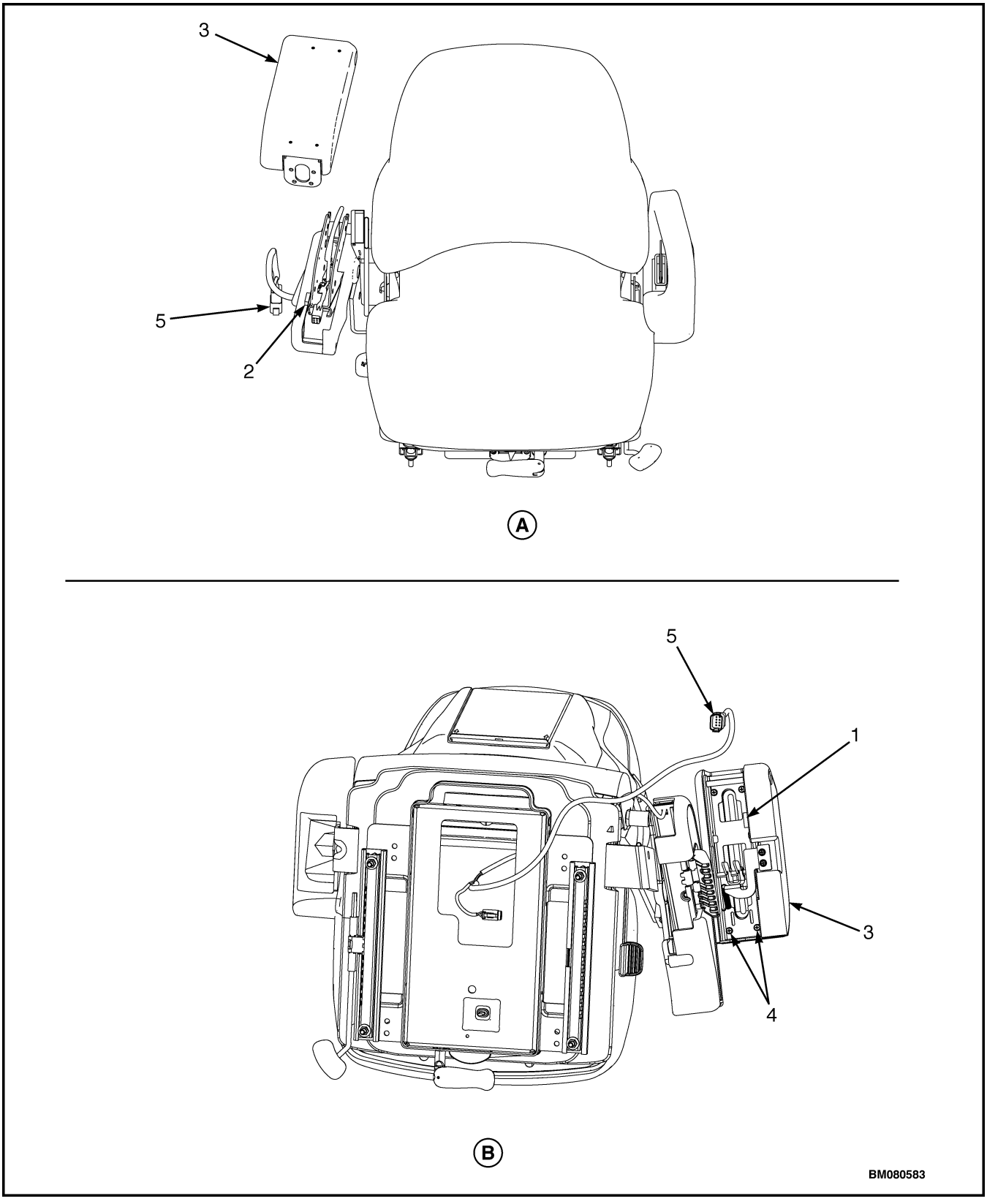


Figure 28. Armrest Switch

6. Install two flange nuts onto two studs at air intake housing. See Figure 74.

7. Connect electrical connectors to air intake heater terminal nuts. Torque nuts to 3.5 to 5.3 N•m (30.9 to 46.9 lbf in).

8. Connect electrical connectors to boost sensor and air temperature sensor.

9. Connect battery and lower the hood on lift truck models
   - GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E878)
   - GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (J813)
   - GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879, G879)

Engine Coolant Temperature (ECT) Sensor

Remove

1. To access battery, raise hood, on lift truck models below. Disconnect the battery.
   - GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E878)
   - GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (J813)
   - GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879, G879)

2. Drain engine coolant from radiator before removing ECT sensor. Refer to the section **Cooling System** 0700YRM1123.

3. Disconnect the ECT sensor electrical connector from the ECT sensor. See Figure 72.

4. Remove the ECT sensor and O-ring. Discard O-ring.

Install

NOTE: If ECT sensor has been identified as faulty, replace ECT sensor with new one.

1. Install new O-ring onto ECT sensor.

2. Install ECT sensor. Tighten sensor to 16 to 23 N•m (12 to 17 lbf ft).

3. Connect ECT sensor connector. See Figure 72.

4. Refill the radiator with engine coolant. See one of the following sections for coolant specification and procedures

   Periodic Maintenance 8000YRM1583 for lift truck models
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (E878)

   Periodic Maintenance 8000YRM1586 for lift truck model
   - GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909)

   Periodic Maintenance 8000YRM1604 for lift truck models
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (J813)

   Periodic Maintenance 8000YRM1606
   -
   -

5. Connect battery and lower the hood on lift truck models
   - GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E878)
   - GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (J813)
   - GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879, G879)

TABLE OF CONTENTS

Description

This section is written assuming no experience with electronic controllers. The menu progressions indicate how many key presses it will take to get to a given screen, versus detailing out every screen you would see. Refer to Table 1 for calibration procedures. Refer to Table 2 for an example of how to read calibration procedures.

NOTE: The calibration procedures described in this YRM may have to be repeated when any on-board controllers, sensors, or related components are replaced.

Table 1. Calibration Procedures

	When Procedure is Used:							
Proc_Cal/Procedure	**All Units**	**3 Functions Electronic-Hydraulic Valves**	**4 Functions Electronic-Hydraulic Valves**	**5 Functions Electronic-Hydraulic Valves**	**Mazda Engine w/ Electronic 1-Speed Transmission**	**Units w/ Load Weight Display**	**Electronic Transmission (Basic & L1)**	**Electronic Extended Function (L2)**
001 Service Password Entry	X							
002 Hydraulic Valve Calibration Warm Up and Air Bleed		X	X	X				
003 Save and Exit	X							
004 Lift Valve Output Threshold		X	X	X				
005 Lower Valve Output Threshold		X	X	X				
006 Tilt Back Valve Output Threshold		X	X	X				
007 Tilt Forward Valve Output Threshold		X	X	X				
008 Aux 1 Dir A Valve Output Threshold		X	X	X				
009 Aux 1 Dir B Valve Output Threshold		X	X	X				
010 Aux 2 Dir A Valve Output Threshold			X	X				
011 Aux 2 Dir B Valve Output Threshold			X	X				
012 Aux 3 Dir A Valve Output Threshold				X				
013 Aux 3 Dir B Valve Output Threshold				X				
014 Load Weight Zero Point						X		
015 Loaded Weight Calibration						X		
016 Transmission Valve Calibration (Basic & L1)							X	
016A Transmission Valve Calibration (L2)								X
016B Transmission Valve Calibration (L1 & L2)							X	X
019 Mazda LP and Gas Acceleration Pedal Adjustment					X			
025 Hydraulic Valve Pressure Gage Installation		X	X	X				
026 Travel Speed Calibration							X	X

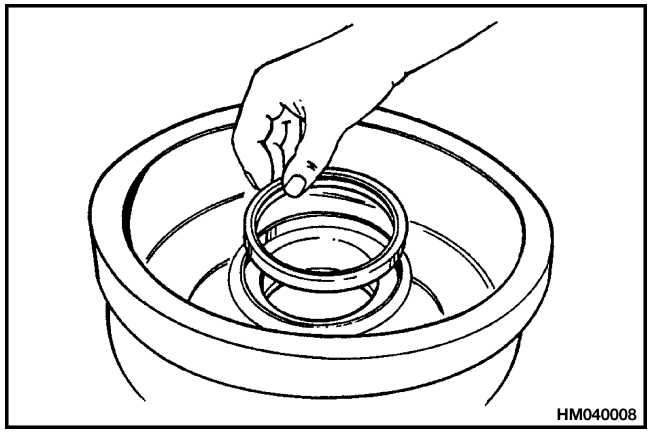


Figure 11. Inner Grease Seal Installation

NOTE: To prevent damage to the inner oil seal when installing the hub, the hub and drum assembly can be temporarily fastened to the wheel.

11. Align the height of the axle housing with hub bearings. Install the outer bearing and nut.

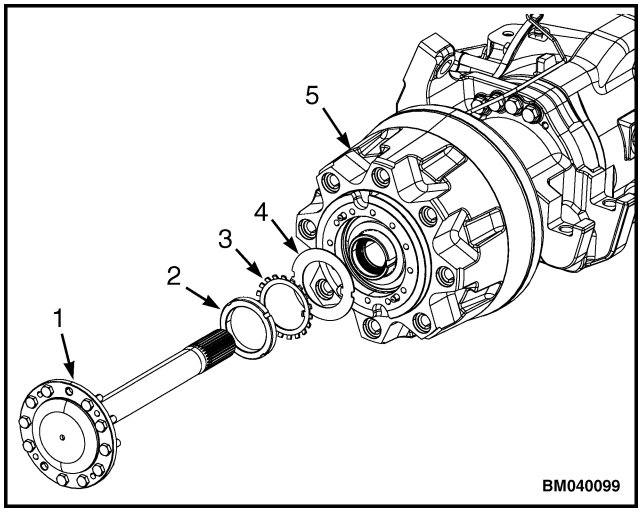
12. Install the washer, lock plate and wheel adjustment nut. See Figure 12.

To align the bearing rollers, tighten the wheel adjustment nut to 28 to 32 N•m (21 to 24 lbf ft) and rotate the hub 2 revolutions in both directions.

To seat the wheel bearings, tighten the wheel adjustment nut to 400 to 480 N•m (295 to 354 lbf ft). Back off the wheel adjustment nut to zero end play.

Preload the wheel bearings by tightening the wheel adjustment nut to 28 to 32 N•m (21 to 24 lbf ft).

Rotate the hub 3 complete revolutions in both directions. Verify the wheel adjustment nut torque is 28 to 32 N•m (21 to 24 lbf ft) and that the torque stabilizes at that specification.



1. AXLE SHAFT
2. WHEEL ADJUSTMENT NUT
3. LOCK PLATE
4. WASHER
5. HUB

Figure 12. Wheel Adjustment

CAUTION

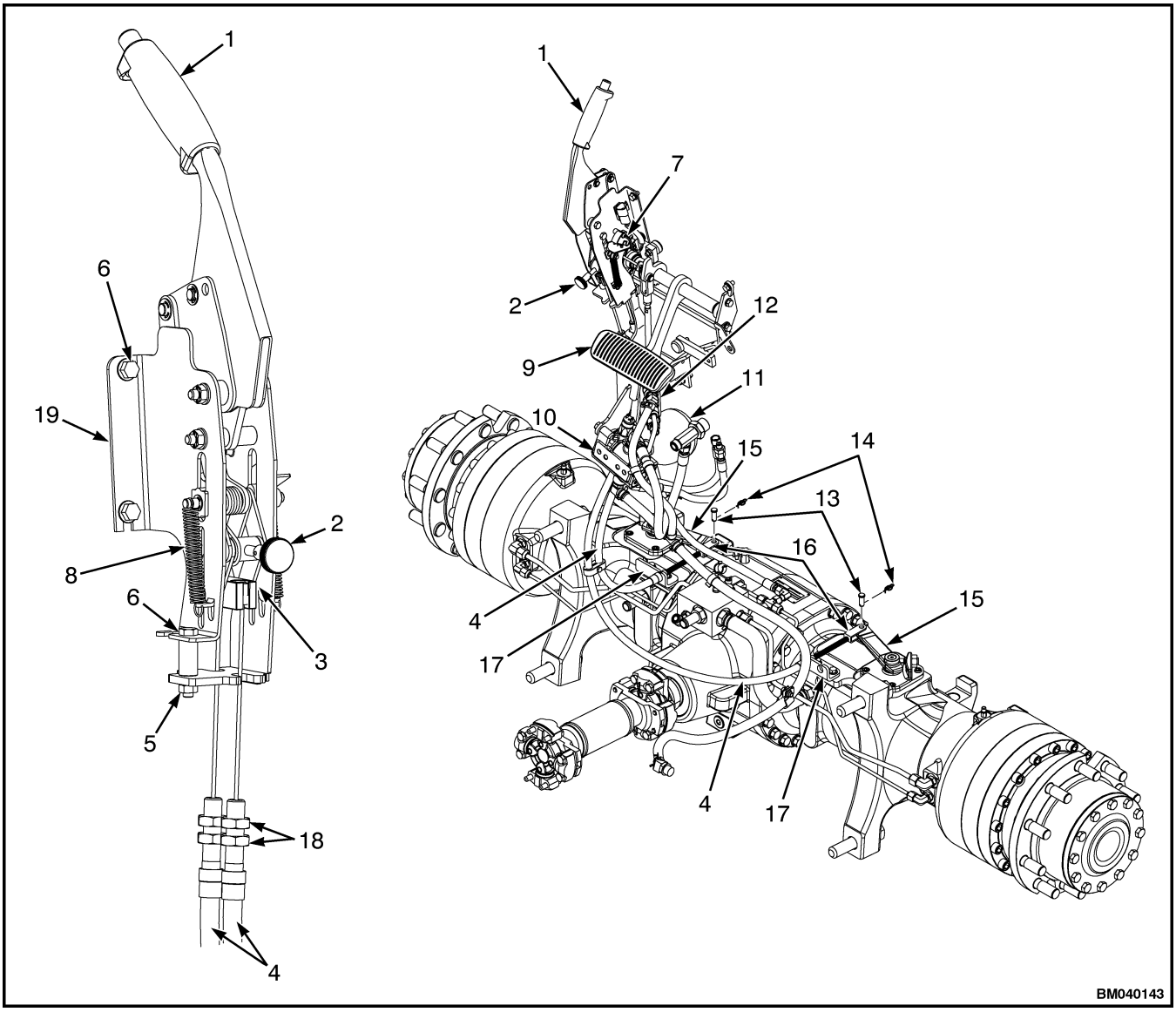
If there is too much clearance, the automatic adjusters will not operate. If the clearance is too small, the automatic adjuster cannot turn the adjuster wheel to increase the clearance, and the adjuster wheel will not turn until the brake shoes wear. If the adjuster wheel does not move for a long operating period, the adjuster link can wear a spot on the adjuster wheel so that it will not turn correctly.

NOTE: If the brake shoes were not replaced, loosen the two adjuster wheels equally, approximately 20 teeth.

13. To manually adjust the brakes, it is necessary to turn the adjuster wheels. See Figure 7.

Remove the two access plugs in the adjustment slots located on the back side of the backing plate. Place an adjuster tool and screwdriver through the slot in the backing plate. See Figure 8.

Push the adjuster lever away from the adjuster wheel, in the direction indicated in Figure 13 and turn the adjuster wheel until the brake shoe just touches the brake drum.



1. PARK BRAKE HANDLE ASSEMBLY
2. ADJUSTMENT KNOB
3. EQUALIZER LINKS
4. PARK BRAKE CABLE
5. NUT
6. CAPSCREW
7. BRAKE POSITION SENSOR
8. ADJUSTMENT SLOT (UNDER SPRING)
9. INCH/BRAKE PEDAL
10. ACCUMULATOR CHARGE VALVE
11. ACCUMULATOR
12. MODULATING BRAKE VALVE
13. CLEVIS PIN
14. COTTER PIN
15. PARKING BRAKE LEVER
16. CLEVIS
17. CABLE CLAMP/MOUNTING BRACKET
18. JAM NUTS
19. BRAKE BRACKET

Figure 20. Parking Brake Lever Adjustment for Lift Truck Model With Wet Brake SystemGLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

2. Remove timing cover as described in section Timing Cover, Remove. Align timing marks. Remove timing chain, sprockets, and camshaft retainer.

3. Install two or three 5/16-18 capscrews that are 100 to 125 mm (4 to 5 in.) long into camshaft. See Figure 48. These capscrews will make the camshaft easier to control. Carefully rotate the camshaft and remove camshaft from cylinder block. All camshaft bearings are the same size. Do not damage bearings or camshaft during removal.

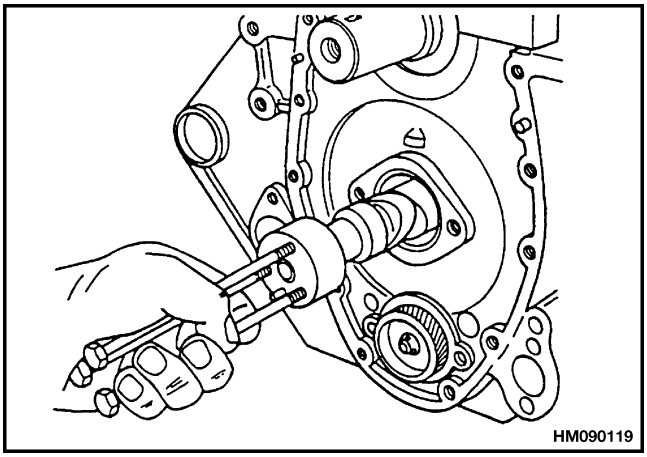
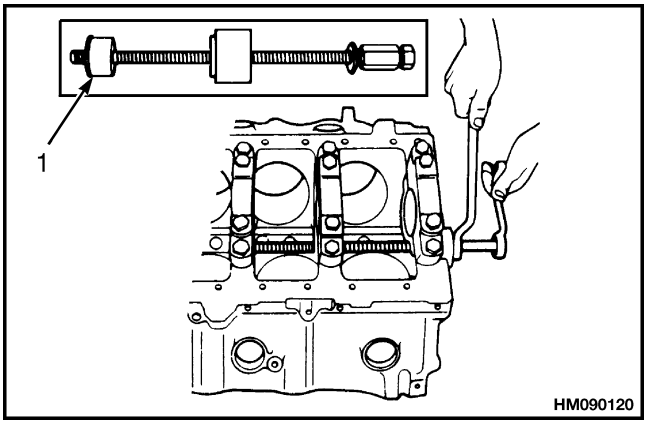


Figure 48. Camshaft

4. If necessary, use a special tool as shown in Figure 49 to remove camshaft bearings. Remove front and rear bearings last.



1. TOOL FOR CAMSHAFT BEARINGS

Figure 49. Camshaft Bearings

Inspect

Inspect entire camshaft for any signs of wear or damage. Measure diameter of each bearing surface on camshaft. Do measurement at different positions on surface of the bearing to see if they are round. If the difference of the readings for each bearing is more than 0.025 mm (0.001 in.), replace camshaft. Check for a bent camshaft or excessive camshaft runout. If runout exceeds 0.065 mm (0.0026 in.), replace camshaft.

Install

NOTE: Camshaft bearings are numbered 1-4 starting at the fan end of the engine.

NOTE: Camshaft bearings 4 and 1 must be installed first. They will serve as a guide for installation of bearings 2 and 3.

1. Use a special tool as shown in Figure 49 to install camshaft bearings. Use a sealant on rear camshaft plug and install plug in block. Make sure plug is even with or 0.80 mm (0.03 in.) below surface of block.

   a. Install number 4 camshaft bearing on installation tool. Orient bearing so that lubrication hole in camshaft bearing bore at rear of engine block and camshaft bearing are aligned. Install camshaft bearing into engine block. Remove installation tool from bearing.

   b. Install number 1 camshaft bearing on installation tool. Orient bearing so that lubrication hole in camshaft bearing bore at front of engine block and camshaft bearing are aligned. Install camshaft bearing into engine block. Remove installation tool from bearing.

   c. Slide installation tool into engine block until installation tool is located between number 2 and 3 camshaft bearing positions. Install number 3 camshaft bearing on installation tool. Orient bearing so that lubrication hole in camshaft bearing bore at front of engine block and camshaft bearing are aligned. Install camshaft bearing into engine block. Remove installation tool from bearing.

Hang On Sideshift Carriage Repair

REMOVE, LIFT TRUCK MODELS GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878) AND GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879, G879)

NOTE: The hang on sideshift carriage assembly is made up of either two or three assemblies. If the lift truck is equipped with a fork positioner, the hang on sideshift carriage assembly consists of the standard carriage (fixed frame), the hang on sideshift assembly and the fork positioner assembly.

See Figure 20 for lift trucks manufactured before August, 2012.

See Figure 21 for lift trucks below, manufactured after August, 2012

- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (E878)

See Figure 22 for lift trucks below, manufactured after August, 2012

- GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E879, F879, G879)

If the lift truck is not equipped with a fork positioner, the hang on sideshift carriage assembly is made up of the standard carriage (fixed frame) and the hang on sideshift assembly. When the word carriage is used in procedures below, it refers to the complete hang on sideshift carriage assembly; either with the fork positioner or without the fork positioner.

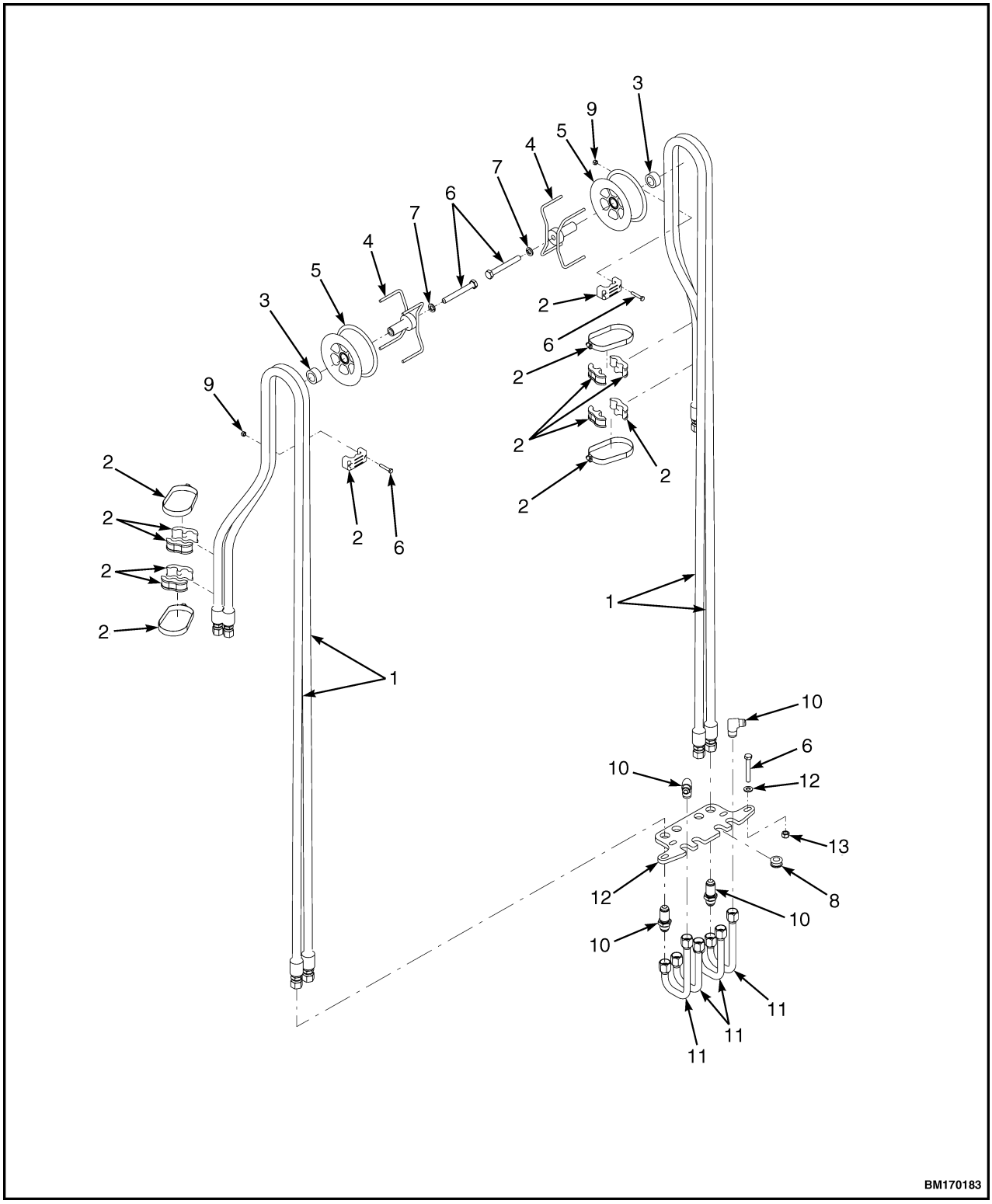


Figure 78. Two-Stage Mast With Limited Free-Lift Header Hoses for Lift Truck Models GLP/GDP40VX5/ VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813, K813)

Legend for Figure 122.

A. INNER MAST

1. INNER MAST
2. CHAIN ANCHOR
3. WASHER
4. SPACER
5. CAPSCREW
6. NUT
7. STUB SHAFT
8. LOAD ROLLER
9. SHIM
10. SNAP RING

B. INTERMEDIATE MAST

11. FREE LIFT CYLINDER
12. LIFT CHAIN
13. PIN
14. BEARING
15. CHAIN SHEAVE
16. SETSCREW
17. CROSS HEAD
18. GUARD
19. INTERMEDIATE MAST
20. BEARING STRIP

INSTALL, CARRIAGE WITH HOOK FORKS

1. Connect a lifting device to the carriage. Install load backrest and forks on the carriage. See Fork Replacement. Move lift truck up to the carriage. Make sure carriage is stable.

2. Use lift cylinders to raise inner mast until it is above the load rollers of the carriage, and carefully lower the inner mast onto the carriage.

3. The snap rings must be installed into chain anchor at the back of carriage for lift truck models listed below, equipped with two- and three-stage full free lift mast:
   - ERC35-855HG (ERC070-120HH) (C839)
   - GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818, G818)

4. The snap ring must be installed into chain anchor at the front of carriage for lift truck models listed below, equipped with two- and three-stage full free lift mast:
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813, K813)

NOTE: Install chain anchor pins so that heads of pins face inside and center of mast. Both legs of cotter pin must be bent against chain anchor pin.

5. Replace worn or unserviceable chain anchor pins and chain anchors on the carriage with new ones. Connect lift chains to the chain anchors on the carriage.

   See Figure 11 for lift truck models
   - GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)

   See Figure 12 for lift truck models
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

   See Figure 13 for lift truck models
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

   See Figure 14 for lift truck models
   - GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818, G818)
   - ERC35-855HG (ERC070-120HH) (C839)

   See Figure 15 for lift truck models
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813, K813)

6. Tighten chain anchor nuts to 120 N•m (86 lbf ft) for lift truck models
   - ERC35-855HG (ERC070-120HH) (C839)
   - GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818, G818)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813, K813)

   Tighten chain anchor nut to 370 N•m (273 lbf ft) for lift truck models
   - GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

INSTALL, CARRIAGE WITH PIN TYPE FORKS LIFT TRUCK MODELS GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

WARNING

DO NOT try to remove a fork without a lifting device. Each pin fork for these lift trucks can weigh 114 to 200 kg (250 to 440 lb).

NOTE: Forks are to be replaced in sets, not individually, by trained personnel only.

1. Put forks approximately 1 m (3.3 ft) in front of carriage.

2. Slowly move lift truck towards forks until fork lock pins can be installed.

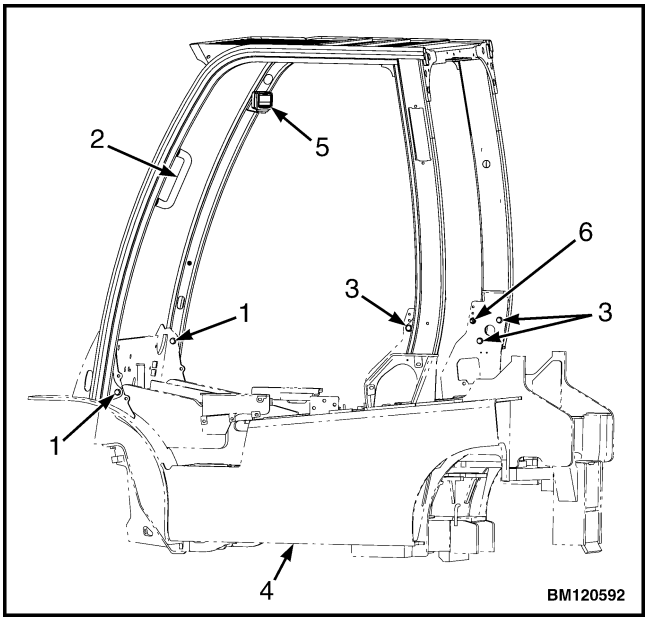
7. Adjust lift chains, carriage, and tilt cylinders as described in sections Lift Chains Adjustment, Carriage Adjustments, and Tilt Cylinder Adjustment.

NOTE: Before checking for mast side kicking, the mast must be fully assembled to include the carriage, forks, load backrest and any attachments if the lift truck is equipped with one.

8. Raise the mast, without a load to its full height and check for side kicking. Mast side kicking is when the mast moves either to the right or left as it is being raised. If the mast is side kicking, see the Mast Adjustments section for procedures to correct mast side kicking.

Legend for Figure 120.

1. INTERMEDIATE MAST
2. INNER MAST
3. STUB SHAFT
4. LOAD ROLLER
5. SHIM
6. SNAP RING
7. BEARING STRIP
8. O-RING
9. SPACER
10. CHAIN SHEAVE
11. BRACKET
12. LOCKWASHER
13. CAPSCREW
14. HOSE SHEAVE
15. FREE-LIFT CYLINDER
16. VELOCITY FUSE
17. WASHER
18. CROSSHEAD
19. PIN
20. CLAMP
21. NUT
22. HOSE
23. CHAIN ANCHOR
24. COTTER PIN
25. LIFT CHAIN
26. CHAIN GUARD
27. TIE DOWN CLAMP
28. COLLAR
29. DOUBLE SNAP RING PIN
30. NUT RETAINER BRACKET



1. CAPSCREWS - FRONT LEGS
2. HANDLE
3. CAPSCREWS - REAR LEGS
4. FRAME
5. DPF DISPLAY
6. NUT

Figure 17. Overhead Guard, Lift Truck Models GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879, G879)

LED TAIL, BACKUP, AND BRAKE LIGHTS, REPLACE

These light assemblies are nonrepairable and must be replaced as an assembly. See **Electrical System** manual listed in General section for procedures to replace these lights.

Legend for Figure 58.

1. NO ONE UNDER FORKS
2. PINCH POINT LABEL
3. YALE LABEL (VERTICAL)
4. MAST WARNING LABEL
5. DPF LABEL
6. OPERATOR WARNING LABEL
7. IMPACT WARNING LABEL
8. LPG TANK NAMEPLATE
9. LPG TANK NAMEPLATE
10. MODEL LABEL
11. ETHER WARNING LABEL (DIESEL ONLY)
12. FLAMMABLE LPG LABEL
13. FAN WARNING LABEL
14. BORON-FREE LABEL
15. FAN WARNING LABEL
16. ANTIFREEZE LABEL
17. FUEL LABEL (UNLEADED)
18. FUEL LABEL (DIESEL)
19. FUEL LABEL (DIESEL)
20. YALE LOGO PLATE
21. FASTENER
22. OPERATOR RESTRAINT LABEL
23. YALE LABEL (HORIZONTAL)
24. HOOD OPENING LABEL (LPG ONLY)
25. SWIVEL SEAT WARNING (EUROPE ONLY)
26. JOYSTICK WARNING LABEL
27. LOCKING GAS SPRING CAUTION
28. NO RIDERS LABEL

Legend for Figure 46.

1. OVERHEAD EXHAUST PIPE
2. FLANGE COVER
3. CLAMP
4. MUFFLER
5. UPPER TAILPIPE
6. UPPER TAILPIPE-EXHAUST WRAP
7. LOWER HEADER-EXHAUST WRAP
8. LOWER HEADER-EXHAUST PIPE
9. BELLOW PIPE-EXHAUST WRAP
10. BELLOW PIPE
11. UPPER HEADER-EXHAUST WRAP
12. UPPER HEADER-EXHAUST PIPE
13. TURBO EXHAUST CLAMP
14. TURBO MANIFOLD-EXHAUST WRAP
15. EXHAUST MOUNTING BRACKET
16. LOWER EXHAUST PIPE-OVERHEAD
17. CAPSCREW
18. EXHAUST PIPE

Install

1. Connect upper header exhaust pipe to turbo manifold exhaust.

2. Connect bellow pipe to upper header exhaust pipe.

3. Connect lower exhaust pipe to bellow pipe.

4. Install clamp to lower header exhaust pipe and exhaust mounting brackets.

5. Install clamp to upper tail pipe and lower header exhaust pipe, and install upper tail pipe to lower header exhaust pipe.

6. Install clamp to muffler and upper tail pipe, and install muffler to frame of lift truck.

7. Install turbo exhaust clamps.

8. Install upper tail pipe-exhaust wrap, lower header-exhaust wrap, bellow pipe-exhaust wrap, upper header-exhaust wrap, and turbo manifold-exhaust wrap.

9. Install clamp and lower overhead guard exhaust pipe to muffler.

10. Install counterweight to lift truck.

11. Install over head exhaust pipe and flange cover to counterweight.

12. Install capscrews to flange cover.

13. Install clamp attaching overhead guard exhaust pipe to lower overhead guard exhaust pipe. See Figure 46.

CUMMINS 4.5L DIESEL ENGINE FOR LIFT TRUCK MODELS GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879)

Remove

WARNING

Exhaust system components are hot to touch. Be sure exhaust system components are cool before starting disassembly, or personal injury may occur.

NOTE: Lift trucks equipped with standard exhaust follow Step 1 through Step 4. Lift trucks equipped with overhead exhaust follow Step 5 through Step 10.

1. Remove counterweight before removing muffler and other components of exhaust system.

2. Remove clamps that attach exhaust pipes (1 and 4, Figure 47) to muffler. Remove exhaust pipe (1, Figure 47) from muffler.

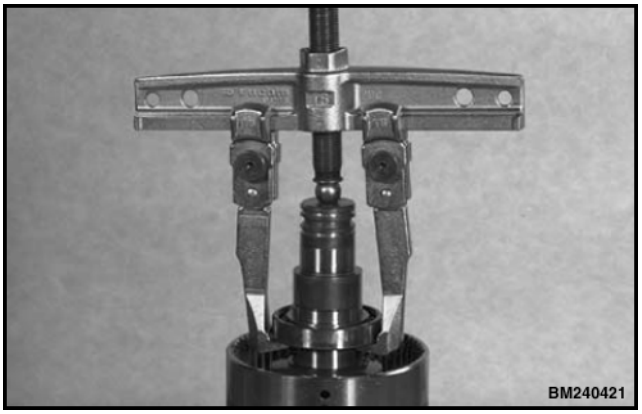
3. Remove exhaust pipe (4, Figure 47) from engine exhaust manifold and remove exhaust pipe from muffler. Discard gasket.

4. Remove washers, isolators, spacers, locknuts, and capscrews that attach muffler to lift truck frame. Remove muffler from lift truck frame.

NOTE: The exhaust pipe (13, Figure 47) must be removed before removing counterweight and other components of exhaust system.

5. Remove clamp that attaches exhaust pipe (13) to exhaust pipe (1). See Figure 47.

STEP 10.
Using a puller, remove FORWARD 2 inner bearing.

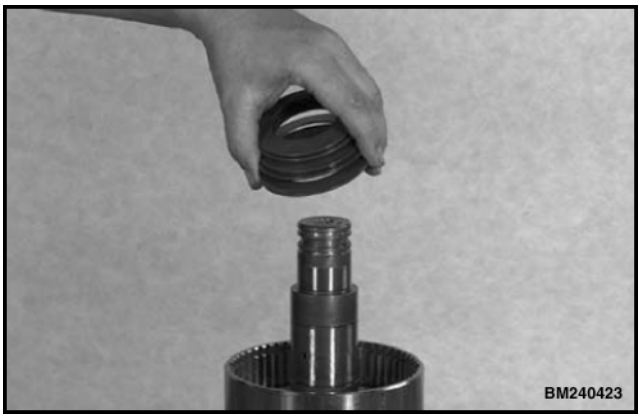


WARNING

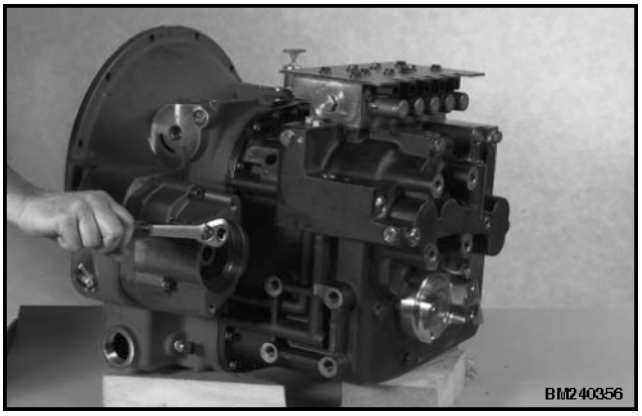
The spring has a force of 2400 N (540 lb) when properly seated, ensure spring cannot cause injury when the snap ring is installed.

STEP 11.
Using the spring compression tool (Yale P/N150121831) and a hydraulic press, compress piston return disc springs, and remove return disc spring snap ring.

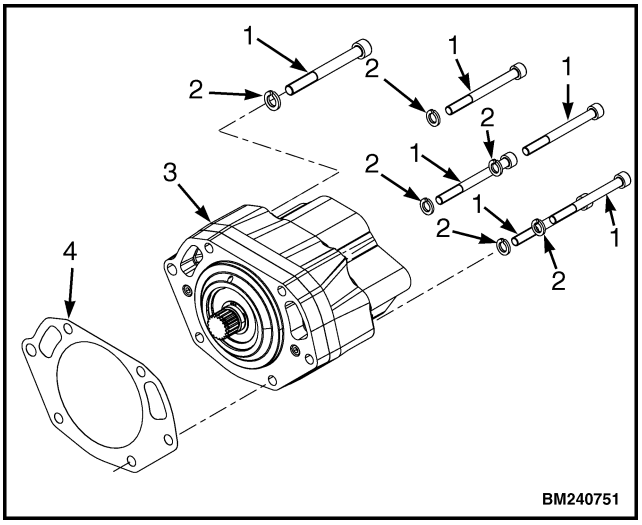
STEP 12.
Remove piston return disc springs.



STEP 8.
Remove capscrews, lockwashers, charge pump, and gasket.



NOTE: Transmission for lift truck models GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879) and GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878) manufactured **Before** October 2009 shown.

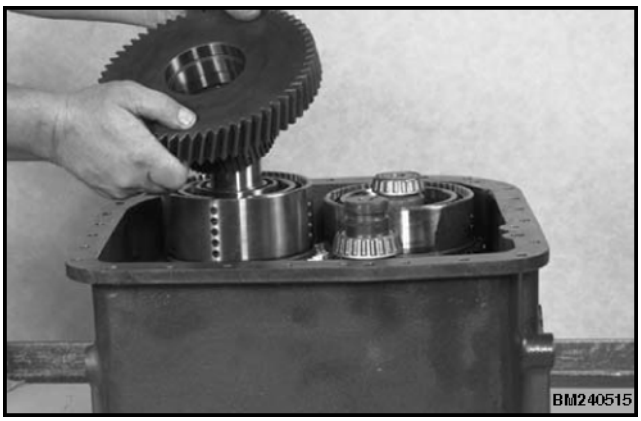


1. CAPSCREWS
2. LOCKWASHERS
3. CHARGE PUMP
4. GASKET

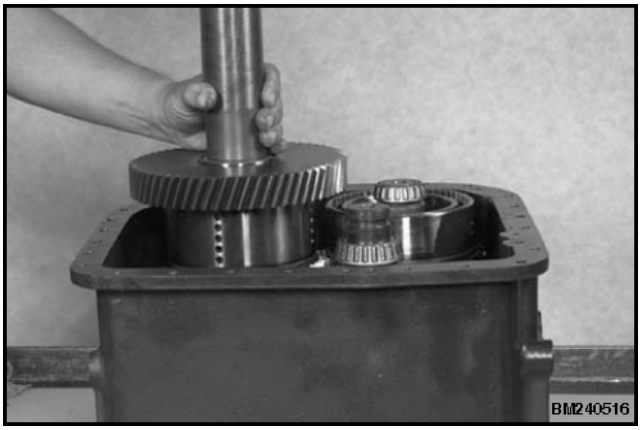
STEP 4.
Install FORWARD 1 and RANGE 2 shaft as an assembly. See FORWARD 1, Assemble and RANGE 2, Assemble procedures.

CAUTION
DO NOT force this operation, could cause damage to friction disc.

STEP 5.
Install RANGE 1 gear. Align splines on RANGE 1 gear with internal teeth of inner (friction) discs.



STEP 6.
Tap RANGE 1 gear bearing into position.

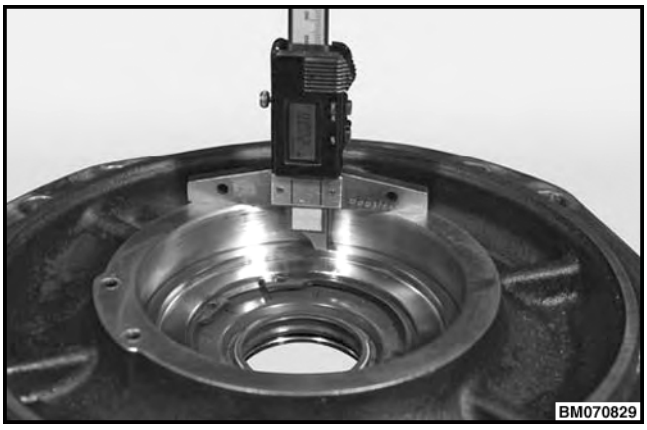


STEP 5.
If the differential carrier bearing cones need replaced, remove the bearing cup from the axle housing arm.

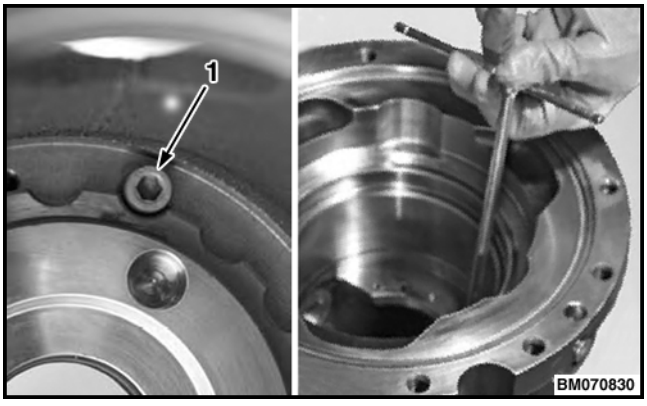
1. BEARING CUP

NOTE: Perform Step 6 through Step 8 only if the ring nut needs to be removed or adjusted.

STEP 6.
Measure the installation position of ring nut to facilitate in adjustment during installation.



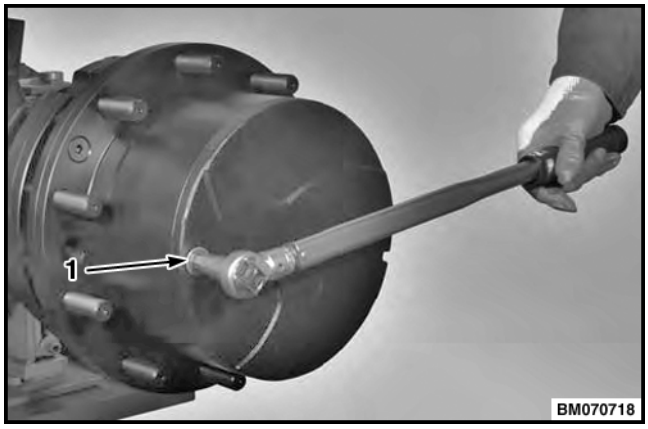
STEP 7.
Remove the socket head screw.



1. SOCKET HEAD SCREW

NOTE: After removing the ring nuts, make sure to thoroughly clean the threaded portions of the ring nuts.

STEP 18.
Install the oil level plug. Tighten the plug to 30 to 50 N•m (22 to 37 lbf ft).

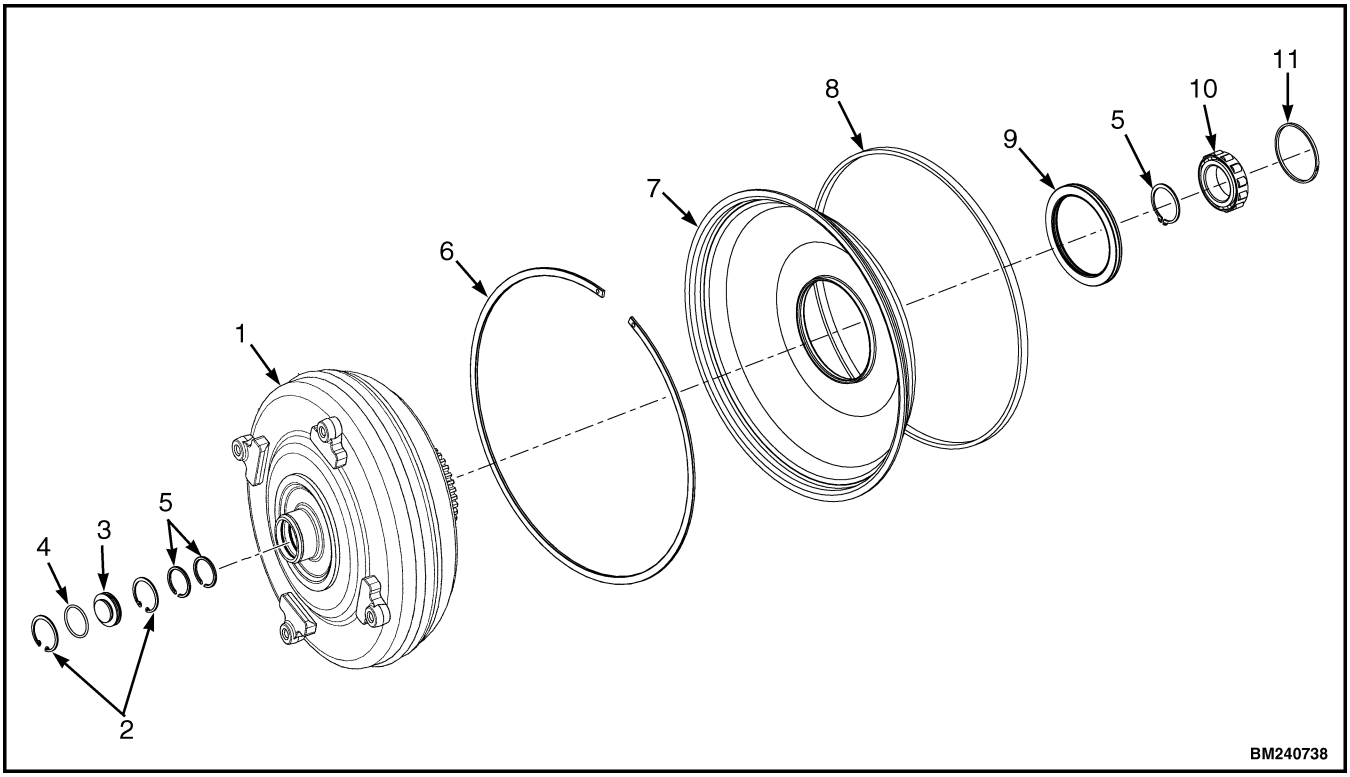


1. OIL LEVEL PLUG

Brake Repair

REMOVE AND DISASSEMBLE

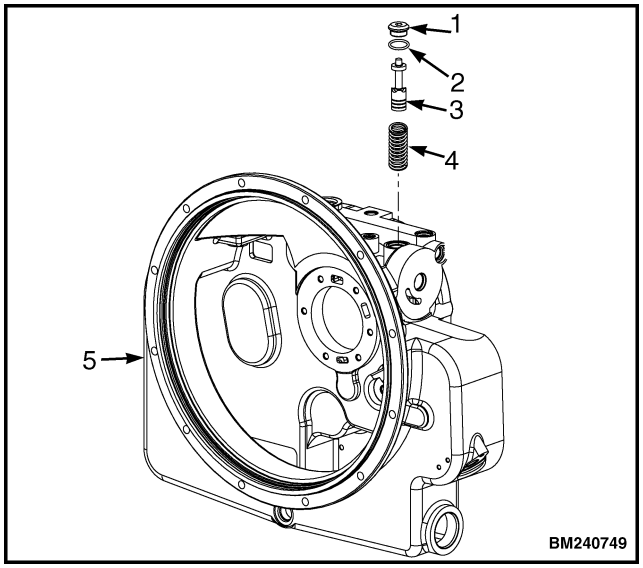
Refer to Figure 8 for the following procedures.



1. TORQUE CONVERTER ASSEMBLY
2. INTERNAL SNAP RING
3. PLUG
4. O-RING
5. EXTERNAL SNAP RING
6. SNAP RING
7. OIL BAFFLE
8. SEALING RING
9. SEAL (OIL BAFFLE)
10. BEARING
11. PISTON RING

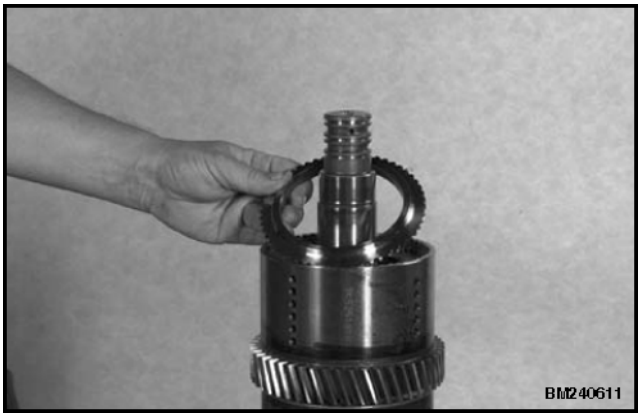
Figure 1. Torque Converter Assembly

STEP 14.
Install pressure regulator valve by installing spring, spool, O-ring, and plug.

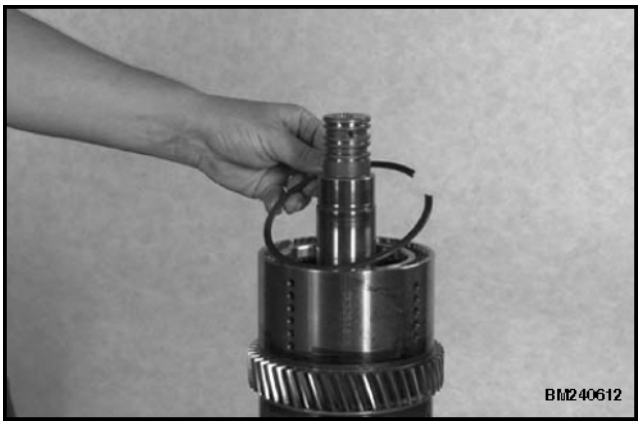


1. PLUG
2. O-RING
3. SPOOL
4. SPRING
5. CONVERTER HOUSING

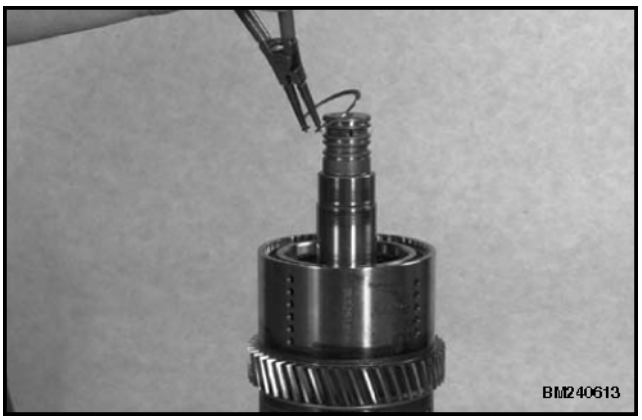
STEP 6.
Install end-plate.



STEP 7.
Install end-plate retainer ring.



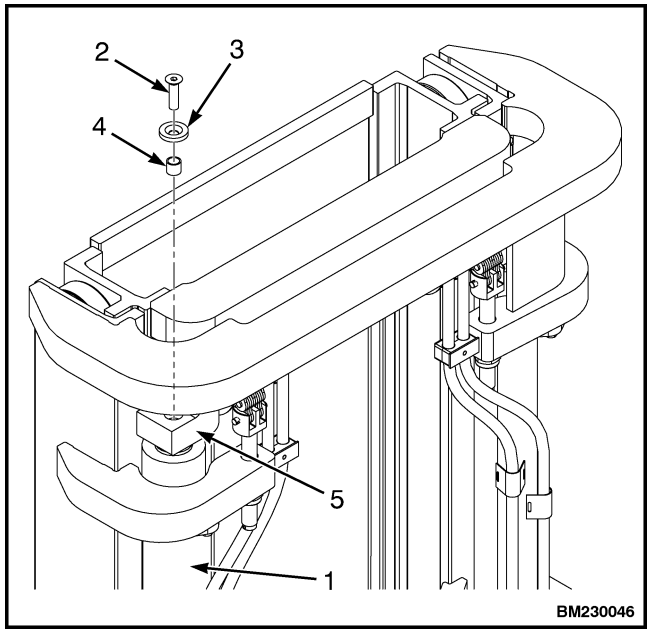
STEP 8.
Install inner bearing snap ring.



10. For lift truck model, GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909) , equipped with a two-stage limited free-lift mast, see Figure 13 and Figure 14.

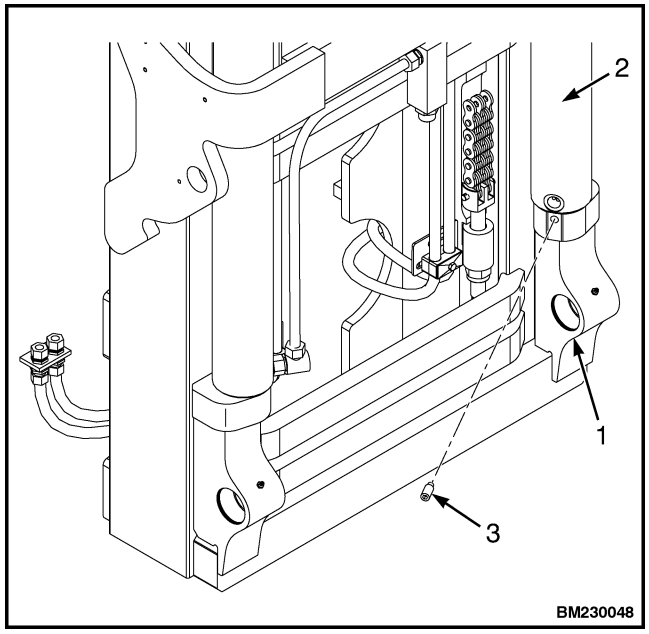
a. Remove anchor screw, washer, and spacer from top of lift cylinder and crossmember.

b. Remove retention screw from mast and bottom of lift cylinder.



1. LIFT CYLINDER
2. ANCHOR SCREW
3. WASHER
4. SPACER
5. CROSSMEMBER

Figure 13. Two-Stage Limited Free-Lift Mast, Cylinder Installation - Top for Lift Truck Model GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

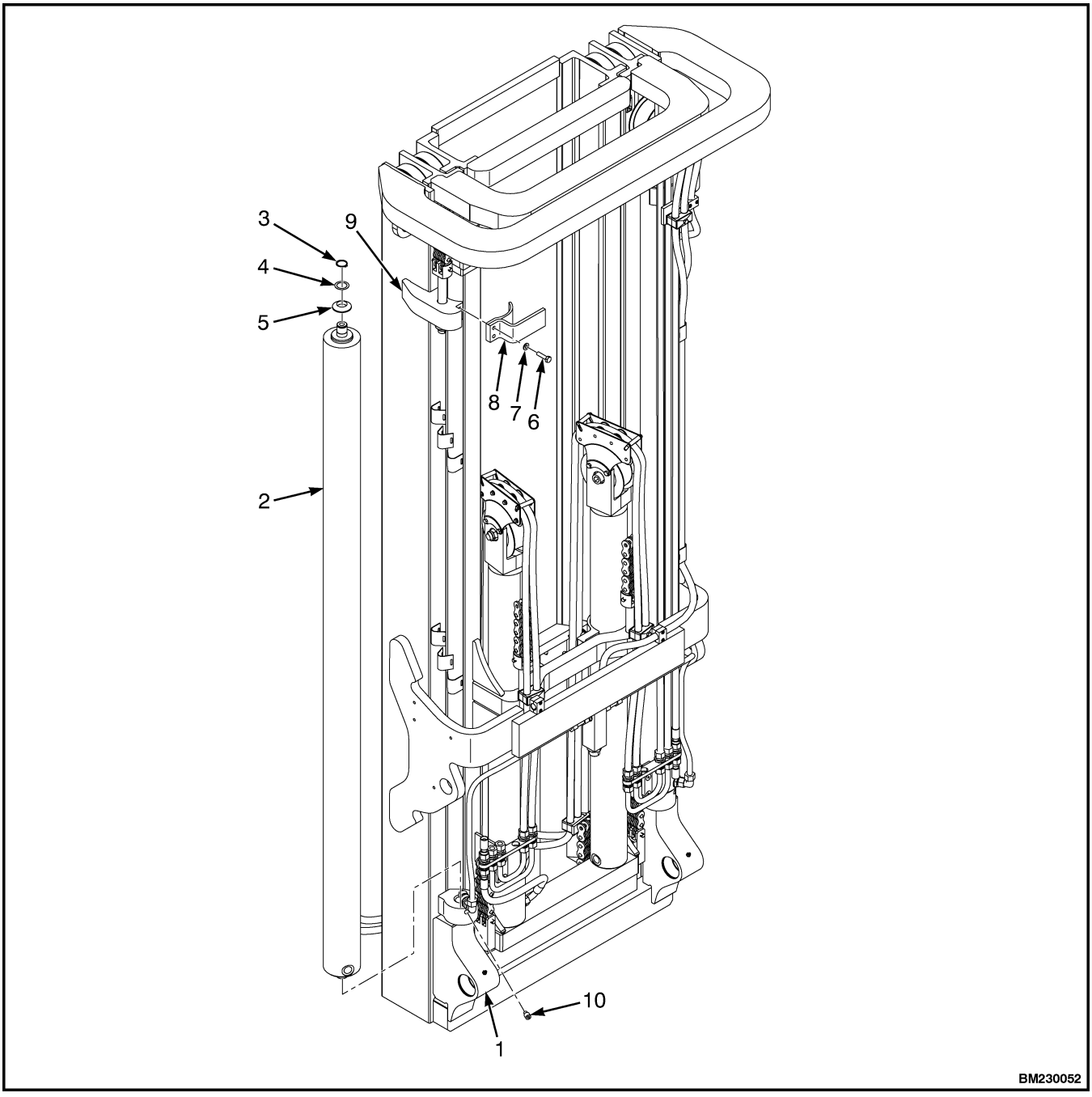


1. MAST
2. LIFT CYLINDER
3. RETENTION SCREW

Figure 14. Two-Stage Limited Free-Lift Mast, Cylinder Installation - Bottom for Lift Truck Model GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

11. Using a lifting device, remove lift cylinder from mast.

NOTE: Perform Step 12 for lift truck model GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909) .



1. MAST
2. LIFT CYLINDER
3. SNAP RING
4. WASHER
5. CONVEX WASHER
6. CAPSCREW
7. WASHER
8. BRACKET
9. ANCHOR BRACKET
10. RETENTION SCREW

Figure 12. Three-Stage Full Free-Lift Mast, Cylinder Installation for Lift Truck Model GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

Install

1. Install fuel filter housing and two capscrews onto bracket. See Figure 15 or Figure 16.

NOTE: It is not necessary to perform Step 2 on lift truck models GLP40VX5/VX6; GLP45SVX5, GLP45VX6, GLP50-55VX (GLP080, 090-120VX) (J813, K813) manufactured after June, 2013.

2. Install bracket, fold-over nuts, and capscrews onto frame. See Figure 15.

NOTE: Perform Step 3 for lift trucks equipped with optional low fuel sensor.

3. Connect low fuel sensor to wire harness. See Figure 15.

4. Connect low pressure switch to engine wire harness. See Figure 15 or Figure 16.

5. Apply pipe thread sealant (Yale P/N 505970592) to threads of outlet and inlet fittings. Connect outlet and inlet hose assemblies to outlet and inlet fittings. See Figure 15.

6. Connect negative battery cable.

NOTE: Opening the shutoff valve too quickly can cause the internal excess flow valve to close, restricting the flow of fuel. If this happens, close the shutoff valve, wait a few seconds, and then slow open the shutoff valve again. This will reset the excess flow valve.

7. Slowly open the shutoff valve on tank.

8. If truck is equipped with a key switch, turn key switch to **ON** position and back to the **OFF** position to pressurize the fuel system. If truck is equipped with a Power **ON/OFF** button, press Power **ON/OFF** button to **ON** and back **OFF** to pressurize fuel system. Check for leaks.

9. Check for leaks at connections by using soapy solution or electron leak detector. If leaks are detected, make proper repairs.

Legend for Figure 7.

A. KUBOTA DIESEL ENGINE FOR LIFT TRUCK MODELS GLP/GDP40VX5/VX6; GLP/GDP45SVX5,GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (H813) AND GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (E879)

B. KUBOTA DIESEL ENGINE FOR LIFT TRUCK MODELS GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (J813, K813) AND GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (F879)

1. CAPSCREW
2. UPPER VALVE COVER
3. GASKET
4. FUEL INJECTOR HARNESS
5. LOWER VALVE COVER
6. FUEL INJECTOR
7. TERMINAL NUT

13. Remove radiator cap.

14. Loosen hose clamp and remove lower radiator hose, draining coolant from coolant system.

15. Remove coolant drain plug and drain coolant from engine block. See Cooling System Repair in this service manual for procedures.

NOTE: Note position and location of fuel line clamps during removal to aid in installation.

16. Remove three pan head screws and six clamps from fuel injector lines. See Figure 8.

CAUTION

DO NOT loosen the fuel injection lines when the fuel is under high pressure (within five minutes of stopping the engine).

17. Loosen four fuel lines at fuel rail. Remove four fuel lines and O-rings from fuel injectors at lower valve cover. See Figure 8.

18. Remove ten lower valve cover bolts, lower valve cover and gasket from cylinder head. Discard gasket. See Figure 8.

11. Disconnect electrical connector for coolant temperature sensor.

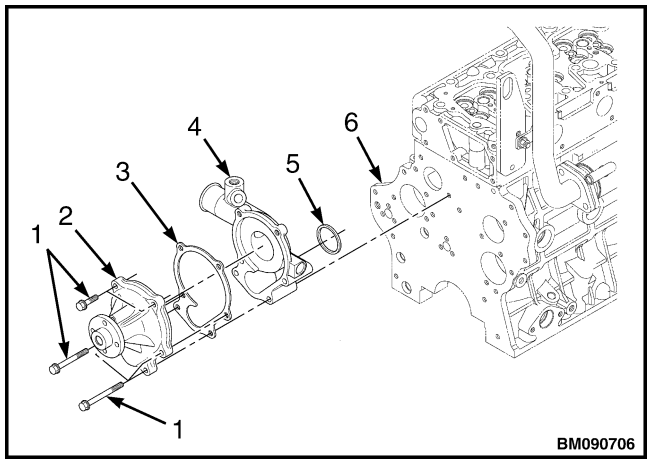
12. If necessary, remove coolant temperature sensor.

13. Disconnect coolant hoses from water pump. See Cylinder Head Assembly Repair section for procedure.

NOTE: Perform Step 14 through Step 16 for lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5,GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (H813)
- GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (E879)

14. Remove four water pump bolts and water pump. See Figure 113.



1. BOLT
2. WATER PUMP
3. GASKET
4. WATER PUMP HOUSING
5. O-RING
6. ENGINE BLOCK

Figure 113. Water Pump and for Lift Truck Models GLP/GDP40VX5/VX6; GLP/GDP45SVX5,GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (H813) GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (E879)

15. Remove two bolts, gasket, and water pump from water pump housing. Discard gasket. See Figure 113.

16. Remove and discard O-ring. See Figure 113.

NOTE: Perform for Step 17 lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (J813, K813)
- GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (F879)

17. Remove six bolts, gasket, and water pump from water pump housing. Discard gasket. See Figure 114.

14. For lift truck models GLP/GDP40VX5/VX6; GLP/GDP45SVX5,GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (H813) and GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (E879) , install new gasket, turbocharger, two flange bolts, two flange nut onto top of exhaust manifold See Figure 28.

15. For lift truck models GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (J813, K813) and GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135-155VX) (F879, G879) , install new gasket, turbocharger, and four flange nuts onto top of exhaust manifold. See Figure 28.

16. Install new gasket, EGR cooler flange, and two flange bolts onto EGR cooler. See Figure 27.

17. Install EGR cooler assembly, new gasket, and two flange bolts onto exhaust manifold. See Figure 27.

18. Install water pipe and two clamps to EGR cooler. See Figure 27.

19. Install oil drain tube, new gasket, two capscrews, two clamps, and hose onto turbocharger and block. See Figure 26.

20. Install turbocharger oil supply line, two washer sets and two banjo bolts onto turbocharger. See Figure 26.

21. Install dipstick tube guide, new O-ring, dipstick tube, and dipstick into engine block. See Figure 25.

22. Install capscrew to dipstick tube and exhaust manifold heat shield. See Figure 25.

23. Install intake manifold assembly, new gasket and nine bolts to cylinder head. See Figure 24.

24. Install common fuel rail and two nuts onto mounting bracket on side of engine block. Torque nuts to 24 to 27 N•m (18 to 20 lbf ft). See Figure 23.

25. Install fuel supply line to fuel pump and end of fuel rail. See Figure 22.

26. Install two fuel lines to fuel rail and fuel pump. See Figure 22.

27. Install fuel injectors, valve covers and related parts. See Valve Covers and Fuel Injectors, Install.

28. Install lifting eye bracket and three bolts onto cylinder head. See Figure 21.

29. Install fuel filter assembly, two capscrews, and two nuts onto lifting eye bracket. See Figure 21.

30. Remove plugs from fuel hoses and connect fuel hoses to fuel filter as noted during removal. Tighten hose clamps.

31. Install water flange assembly, new gasket, and four bolts to cylinder head. See Figure 20.

32. Install water pump. See Cooling System Repair section in this manual for procedure.

33. Install coolant by pass hose and two clamps onto water pump and water flange assembly. See Figure 20.

NOTE: Perform Step 34 through Step 36 for lift truck models GLP/GDP40VX5/VX6; GLP/GDP45SVX5,GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (H813) and GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (E879) .

34. Install new O-ring onto water pipe. Install water pipe into water pump. See Figure 18.

35. Install water pipe bolt into cylinder head. See Figure 18.

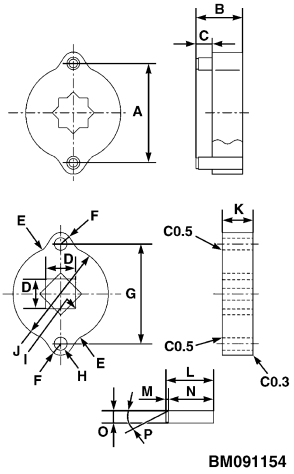
36. Install hose and two clamps onto water pipe and EGR cooler. See Figure 18.

NOTE: Perform Step 37 and Step 39 for lift truck models GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (J813, K813) and GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135-155VX) (F879, G879) .

37. Install EGR hose onto water pump. See Figure 27.

38. Install water pipe, tube, and hose clamps onto EGR cooler. See Figure 27.

39. Install two bolts securing water pipe to engine. See Figure 27.

No.	Tool Name	Applicable Model and Tool Size		Illustration
	Supply Pump Gear Reinstall Jig	**A**	43.95 to 44.05 dia. mm (1.731 to 1.734 in.)	 BM091154
		B	21 mm (0.83 in.)	
		C	8 mm (0.3 in.)	
		D	12.9 to 13.1 square mm (0.508 to 0.515 square in.)	
		E	10 radius mm (0.39 radius in.)	
		F	5 radius mm (0.2 radius in.)	
		G	43.95 to 44.05 dia. mm (1.731 to 1.734 in.)	
		H	5.240 to 5.255 dia. mm (0.2063 to 0.2068 in.)	
		I	0.4 radius mm (0.02 radius in.)	
		J	42 mm (1.7 in.)	
		K	13 mm (0.51 in.)	
		L	21 mm (0.83 in.)	
		M	1 mm (0.04 in.)	
		N	20 mm (0.79 in.)	
		O	5.265 to 5.275 dia. mm (0.2073 to 0.2076 in.)	
		P	**0.52 rad (30°)**	
		C0.3	Chamfer 0.3 mm (0.01 in.)	
		C0.5	Chamfer 0.5 mm (0.02 in.)	
		Locally Manufactured		

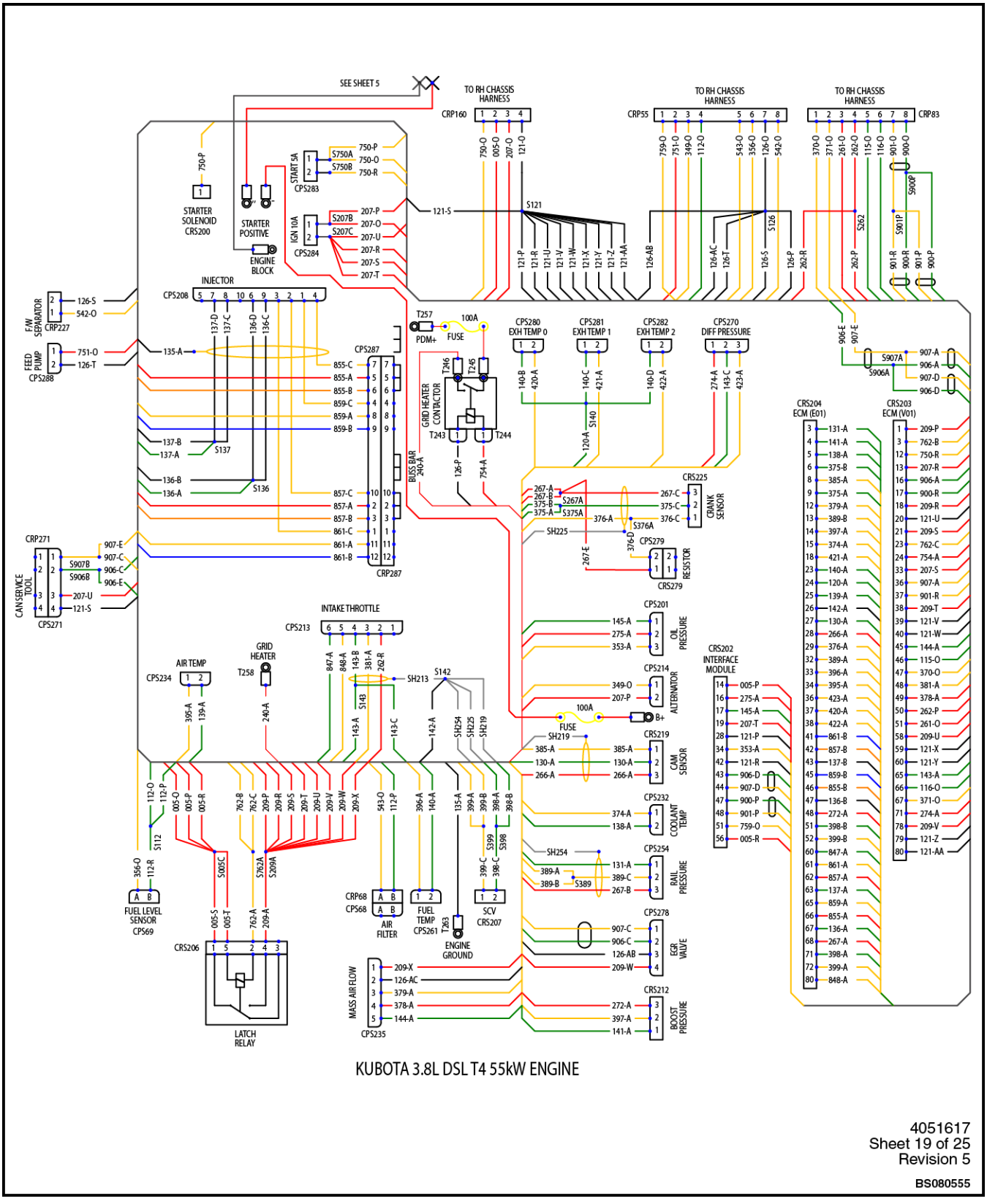


Figure 45. Kubota 3.8L Diesel T4 55kW Engine Wiring Diagram

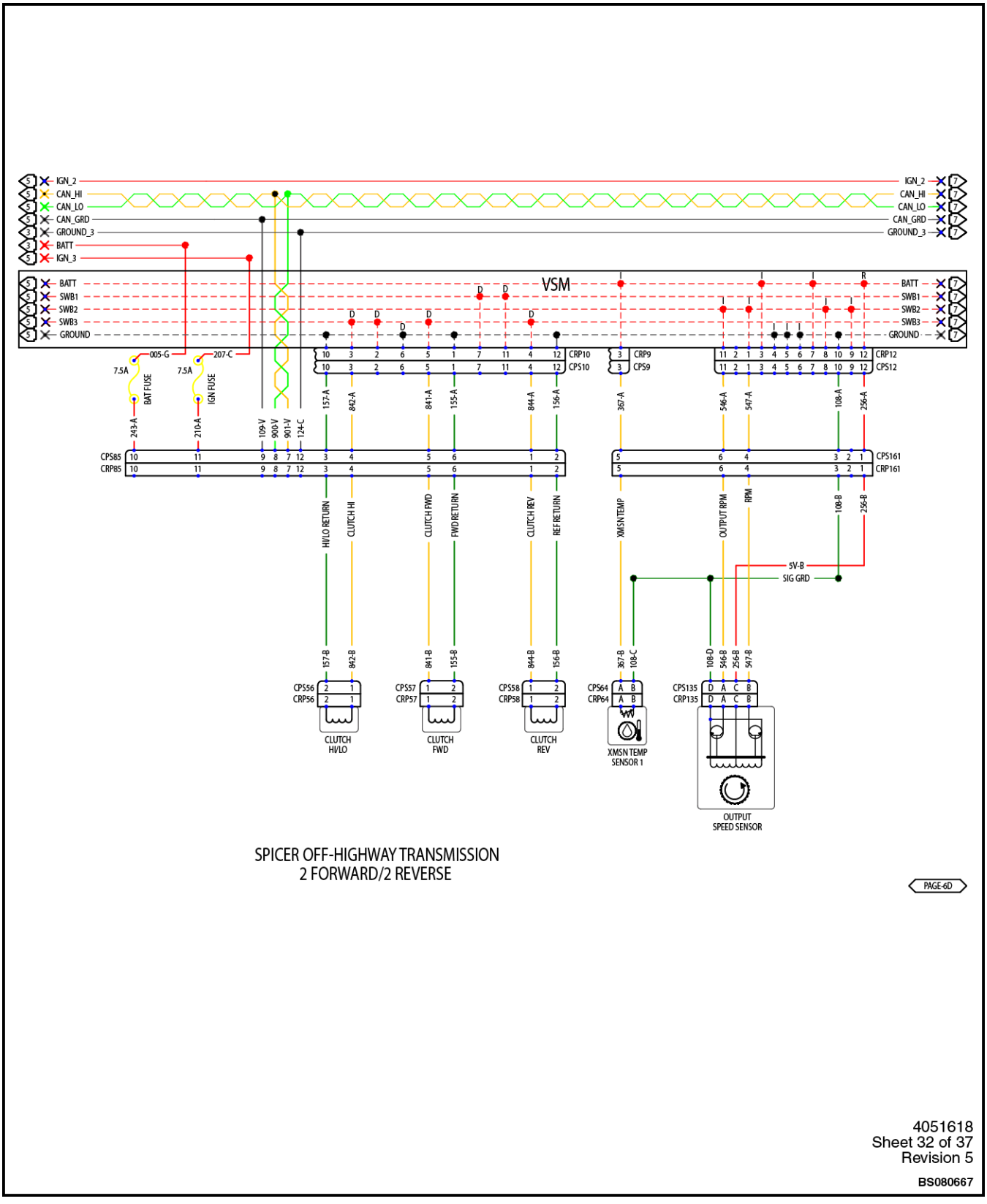


Figure 20. Spicer Off-Highway Transmission 2 Forward/2 Reverse Electrical Schematic

CAUTION

Carefully remove injector clamps so as to not lose ball bearing from rocker arm bracket.

14. Remove four injector clamps holding fuel injectors to cylinder head. See Figure 8.

15. Remove four fuel injectors, four O-rings, and four base gaskets from cylinder head. Discard gaskets. See Figure 8.

Clean and Inspect

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer.

WARNING

Compressed air can move particles so that they cause injury to the user or to other personnel. Make sure that the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

CAUTION

Use caution not to scratch the gasket mating surfaces when cleaning the valve cover and cylinder head.

Carefully remove all gasket residue from the valve cover and cylinder head.

Clean the valve cover in cleaning solvent. Dry the valve cover with compressed air. Inspect for wear, cracks, and any other damage. If necessary, replace valve cover.

Inspect all O-rings and grommets for wear, cracks, and any other damage. Replace where necessary.

Check the EGR system by performing the following steps:

- Check that the EGR valve gas passage and coolant passage are not clogged.
- Clean any soot from the gas passage so that it does not damage the EGR valve.
- Clean the coolant passage by running water through it.

Install

1. Install four O-rings and four new base gaskets onto four fuel injectors. Install four fuel injectors into cylinder head. See Figure 8.

2. Install four injector clamps to rocker arm brackets. Ensure ball bearing is present in rocker arm bracket. See Figure 8.

3. Install four flange nuts to injector clamps. Tighten to 24 to 27 N•m (18 to 20 lbf ft).

4. Install eight new washers and four banjo bolts to fuel over flow pipe and injectors. Tighten to 10 to 11 N•m (89 to 97 lbf in).

5. Lightly grease new lower valve cover gasket.

6. Place new valve cover gasket into groove of lower valve cover.

7. Install lower valve cover and ten bolts onto cylinder head. Torque to 7 to 11 N•m (62 to 97 lbf in).

8. Install four O-rings and fuel lines to fuel injectors at lower valve cover. See Figure 8.

9. Install four fuel lines to common fuel rail.

10. Install six clamps and three pan head screws on fuel injector lines as noted during removal. See Figure 8.

11. Install fuel injector harness onto fuel injectors. Install eight terminal nuts. Torque to 1.6 to 2.2 N•m (14 to 20 lbf in). See Figure 7.

12. Lightly grease new upper valve cover gasket.

13. Place new valve cover gasket into groove of upper valve cover.

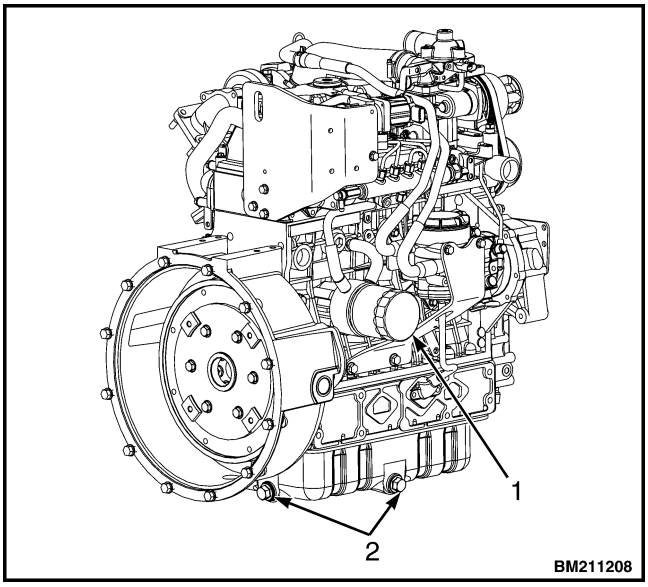
14. Install upper valve cover and thirteen capscrews onto lower valve cover. Torque to 10 to 11 N•m (89 to 97 lbf in). See Figure 7.

15. Connect wiring connector to fuel injector harness on upper cylinder head cover.

16. Install EGR tube to back of EGR valve and EGR cooler. See Figure 6.

Table 9. V3800-CR-TIE4C Engine for Lift Truck Model GDP40VX5/VX6; GDP45SVX5, GDP45VX6; GDP50-55VX (GDP080-120VX) (J813, K813)

Engine Model	1J434-00000 (Yale P/N 582022872)	
Type	Vertical Inline Diesel Engine	
Combustion System	Direct Injection	
Aspiration	Turbo Charged	
No. of Cylinders	4	
Ignition Order	1-3-4-2	
Bore × Stroke	100 × 120 mm (3.94 × 4.72 in.)	
Displacement	3.769 liter (230 cu in.)	
Max. Rated Output (Net)	rpm (min^{-1})	2200
	hp SAE	94
	kW	70
High Idle Speed (Bare Engine)	2200 ± 25 rpm	
Low Idle Speed (Bare Engine)	800 ± 25 rpm	
Engine Weight (Dry)*	308 kg (679 lb)	
Direction of Rotation	Counterclockwise Viewed From Flywheel Side	
Cooling System	Liquid-Cooled With Radiator	
Lubricating System	Forced Lubrication With Trochoid Pump	
Starting System	Electric Starting Starter Motor: DC12V, 3.0 kW (4.0 hp)	
	Alternator: DC12V, 80A	
	Recommended Battery Capacity: 12V, 2x900 CCA (Cold Cranking Amps)	
Dimensions (L × W × H)*	632 × 498 × 711 mm (24.9 × 19.6 × 28.0 in.)	
Engine Oil Pan Capacity	13.2 liter (13.9 qt)	
Engine Coolant Capacity	4.9 liter (1.3 gal) Engine Only	
*Engine Specifications do not include height of lifting eyes nor dimensions or specifications for the Cooling Fan, Radiator, Muffler, and Air Cleaner.		



1. OIL FILTER
2. DRAIN PLUG

Figure 30. Engine Oil Filter Change, Kubota 3.8L Diesel

BOLZONI HANG ON SIDESHIFT CARRIAGE CHECKS

1. Inspect lower hooks for wear and proper clearance between fixed carriage and lower hooks. Adjust if necessary. See **Mast Repairs, 2- and 3-Stage Masts (S/N A513, A514, A613, A614, A702, A703, A704, A705, A706, A707, A751, A752, B513, B514, B586, B587, B588, B589, B590, B591, B749, B750, B751, B752, B753, B754)** 4000YRM1250 for adjustment procedures. See Figure 31.

2. Tighten sockethead screws holding lower hooks to 280 N•m (207 lbf ft).

3. Tighten sockethead screws holding side rollers to 50 N•m (37 lbf ft).

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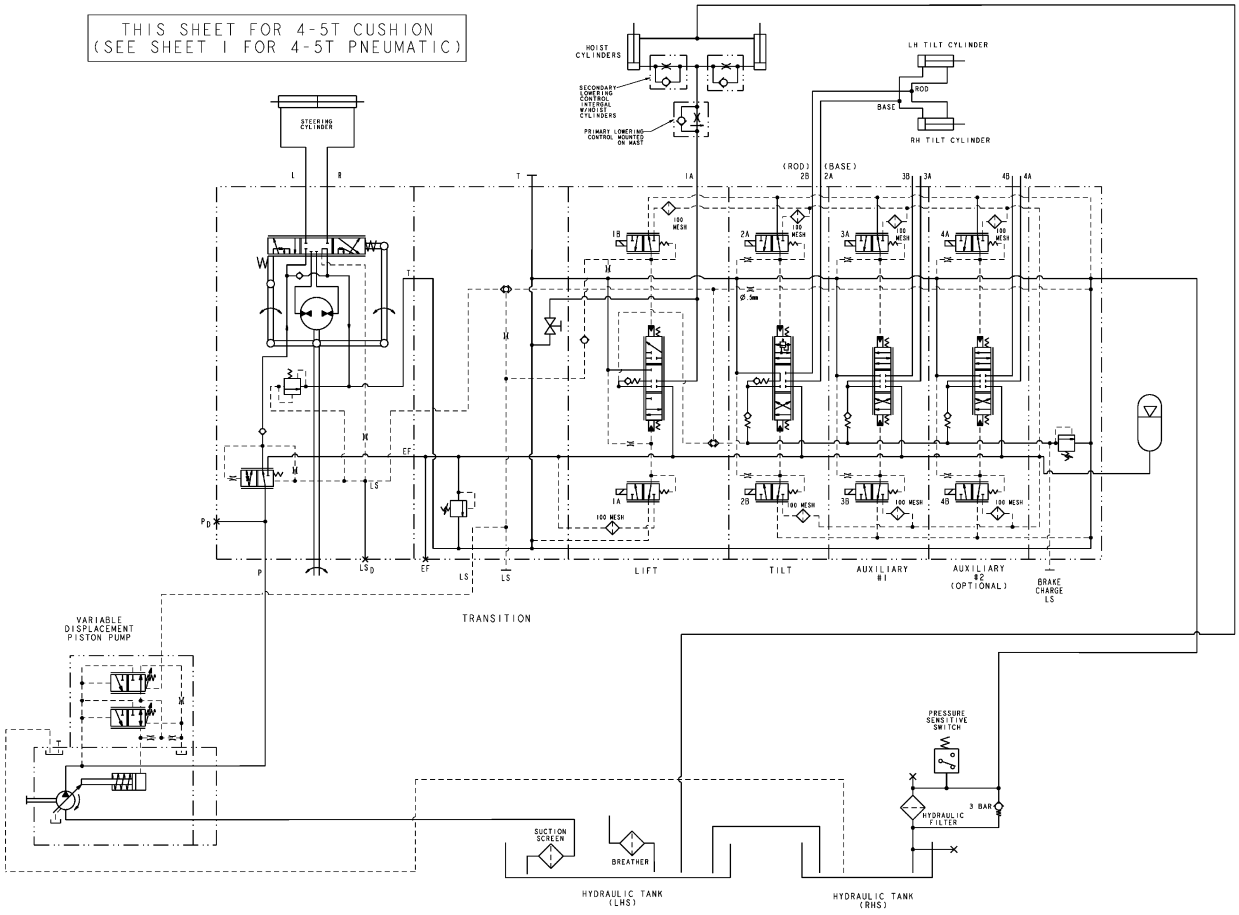

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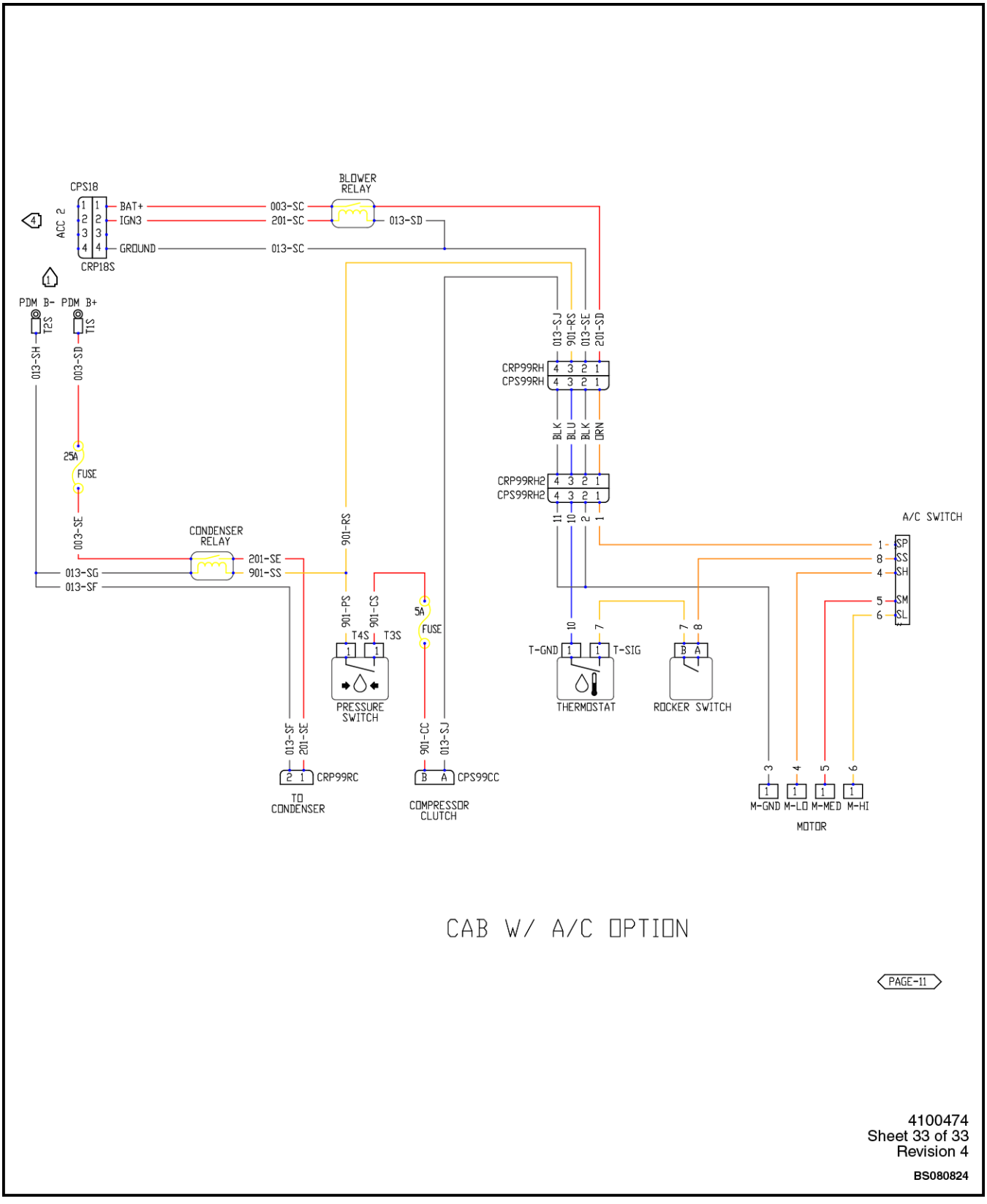


Figure 23. Cab W/ A/C Option Electrical Schematic

6. Install bracket and LPG converter to hydraulic fan drive assembly. See **LPG Fuel System** manual listed in General section of this manual for procedures.

7. Connect positive battery cable.

8. Connect negative battery cable.

9. Install radiator cover and hood and seat combination. See **Frame** manual listed in General section of manual for procedures.

LIFT TRUCK MODELS GLC40, 45, 55VX; GLC55SVX (GLC080, 100, 120VX; GLC080, 100VXBCS; GLC120SVX; GLC120VXPRS) (G818)

Remove

WARNING

The radiator or other parts of the cooling system may be hot or under pressure and can cause serious injury. Wait 30 minutes for the radiator to cool. Do a touch test by touching the radiator with your hand. If the radiator is still hot to the touch, wait another 30 minutes before attempting to check or fix any part of the cooling system.

1. Turn **OFF** lift truck.

2. Remove the hood and seat combination and radiator cover. See the **Frame** manual listed in the General section of this manual for procedures.

3. For lift truck models GLC100VXBCS and GLC120VXPRS (G818), remove the counterweight. See the **Frame** manual listed in the General section of this manual for procedures.

WARNING

Always disconnect the cable at the negative terminal first. Install a tag on the battery terminals so that no one connects the cables on the terminals.

4. Disconnect the negative battery cable.

5. Disconnect the positive battery cable.

NOTE: Let cooling system cool to ambient temperature before removing hydraulic fan drive.

6. Remove the LPG converter and bracket for enough clearance to remove the hydraulic fan drive assembly. See the **LPG Fuel System** manual listed in the General section of this manual for procedures.

NOTE: Tag hydraulic hoses prior to disconnecting them to ensure they are properly connected during installation.

7. Disconnect hydraulic hoses from hydraulic motor. Plug all open ports. See Figure 1.

8. Remove two capscrews (5, Figure 10) from left side plate.

9. Remove two capscrews (7, Figure 10) from radiator mounting bracket (4, Figure 10) on right side of hydraulic fan drive assembly.

10. Remove two capscrews (1, Figure 10) from bottom of fan drive mounting bracket.

11. Remove hydraulic fan drive assembly and mounting bracket from lift truck.

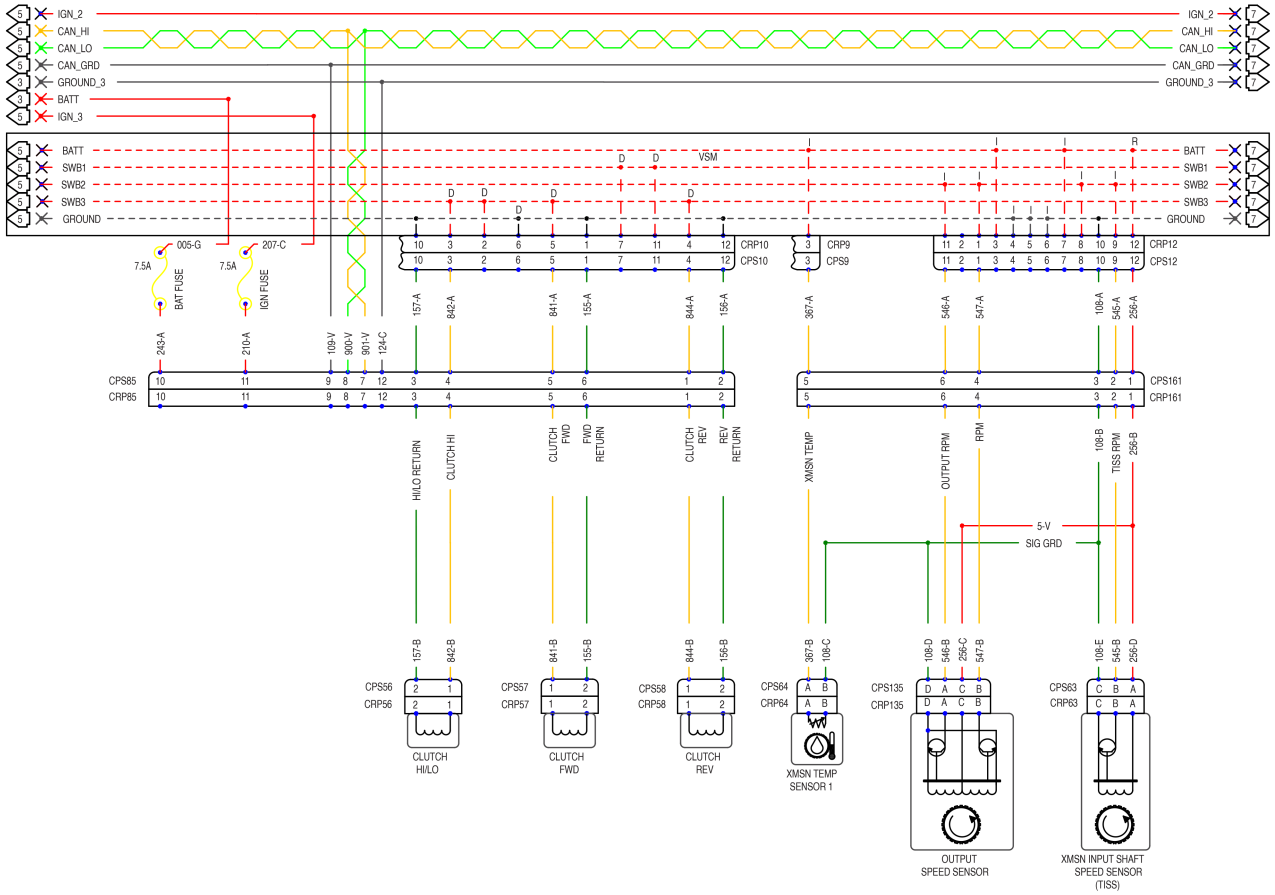


Figure 1. Electrical Schematic (Sheet 47 of 53)

Diagrams and Schematics

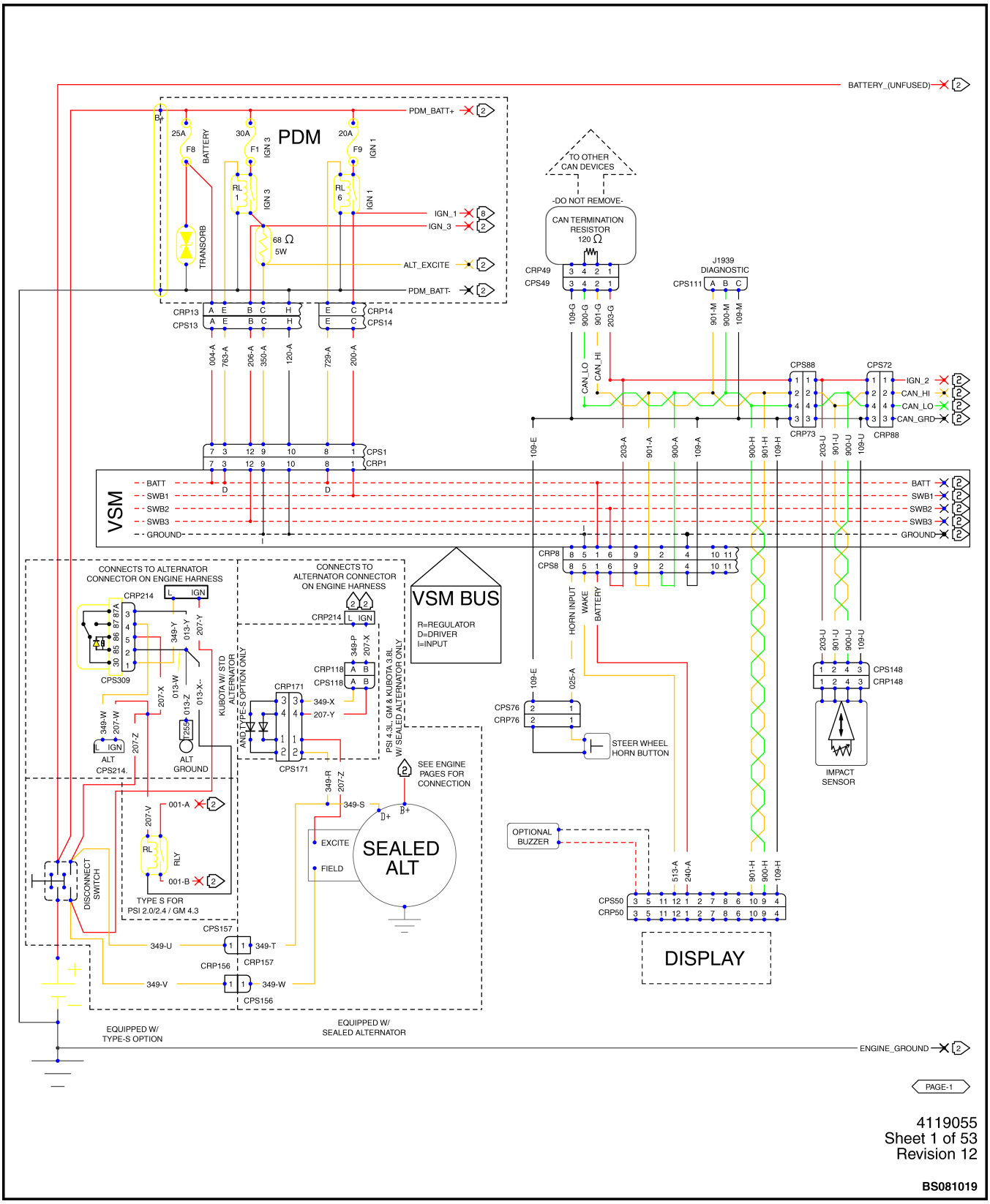


Figure 1. Electrical Schematic (Sheet 1 of 53)

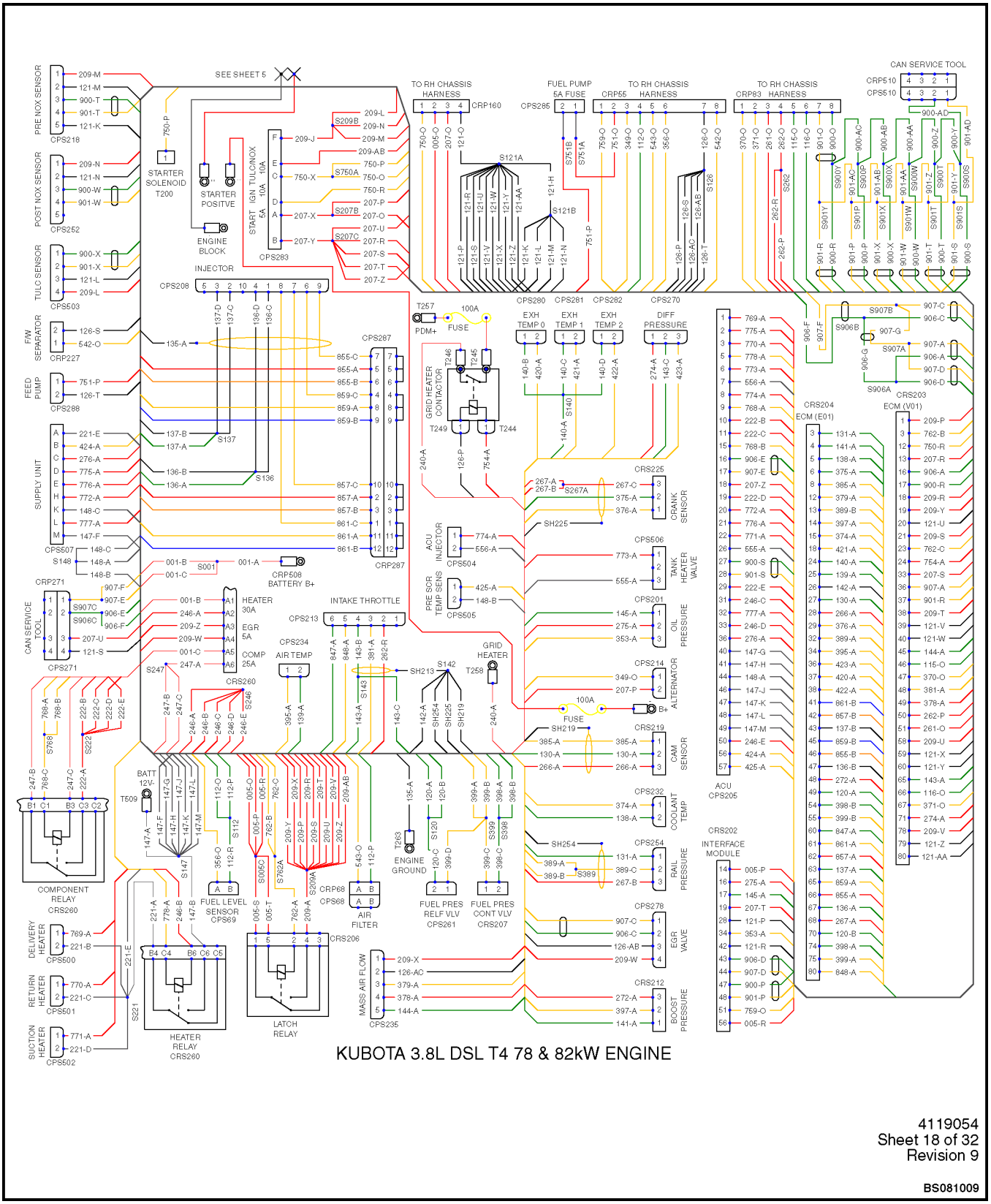
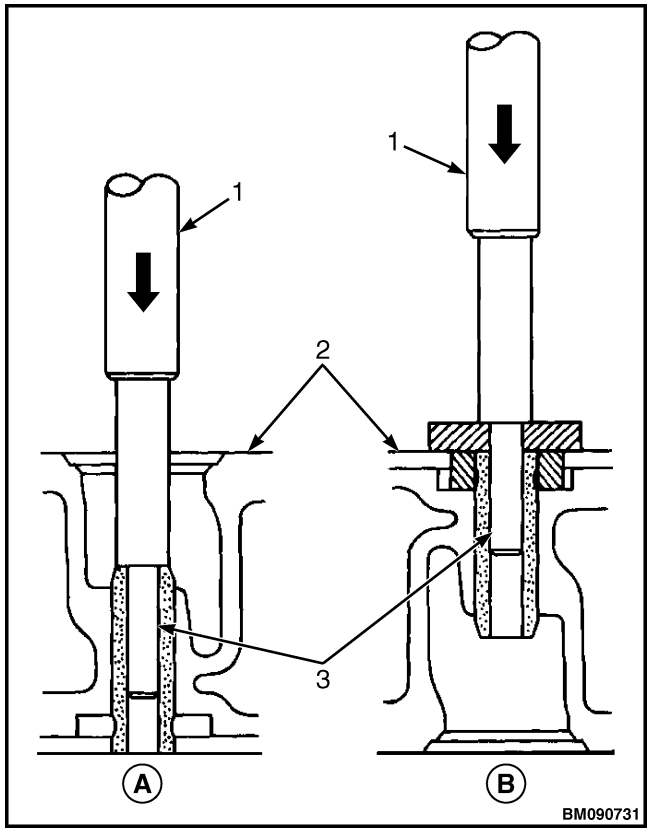


Figure 2. Wiring Diagram (Sheet 19 of 33)



A. REMOVAL
B. INSTALLATION

1. VALVE GUIDE INSTALLATION TOOL
2. CYLINDER HEAD
3. VALVE GUIDE

Figure 42. Valve Guide Installation

3. Accurately size the I.D. of valve guide to specified dimension. See Table 2.

Table 2. Valve Guide Specification

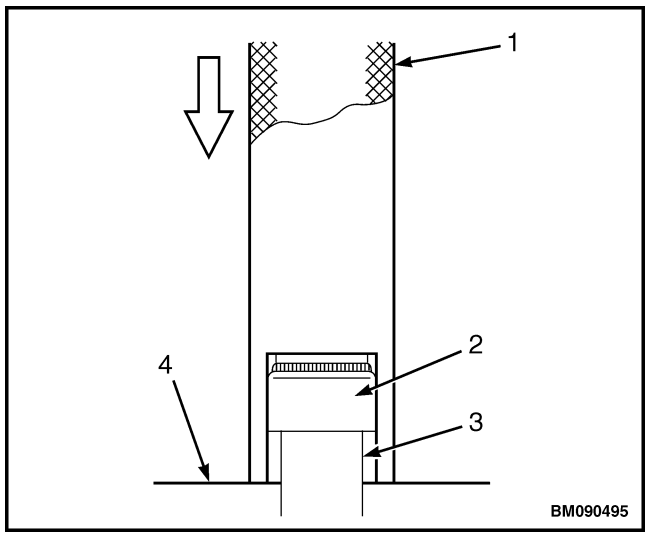
Valve Guide Inside Diameter	**Factory Specification**	**Intake Valve**	7.010 to 7.025 mm (0.2760 to 0.2765 in.)
		Exhaust Valve	7.010 to 7.025 mm (0.2760 to 0.2765 in.)

Valves and Valve Springs, Install

1. Place the cylinder head assembly on the exhaust port side.

2. Place all the valves in their proper positions, as marked when disassembled, in the cylinder head.

3. Apply clean engine oil to the lip of the valve stem seal. Using valve stem seal installation tool, insert a new valve stem seal on each of the valves. See Figure 43.



1. VALVE STEM SEAL INSTALLATION TOOL
2. VALVE STEM SEAL
3. VALVE GUIDE
4. CYLINDER HEAD

Figure 43. Valve Stem Seal Installation

4. Measure the distance from the cylinder head to the valve stem seal. See Engine Specifications for the clearance specifications. See Figure 44.

(Cont)

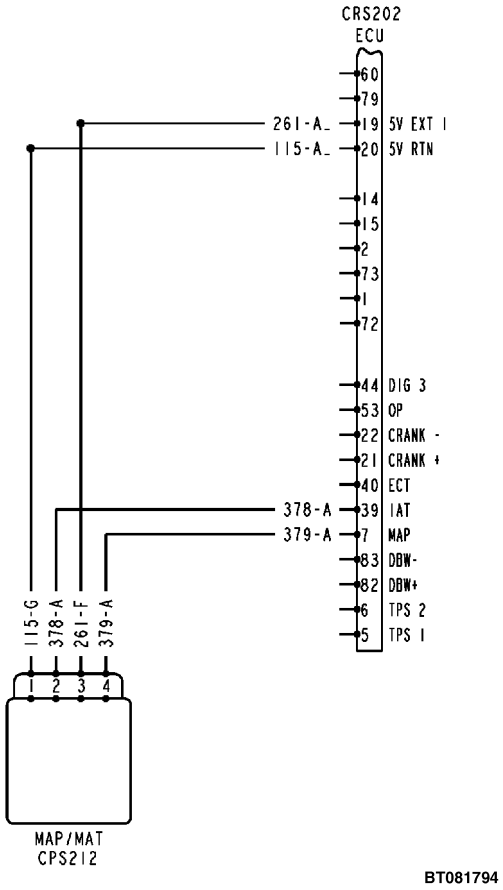
NO: Inspect signal circuit 379-A for open, short, or source of excessive resistance.

CAUSE C - MAP SENSOR FAULT

PROCEDURE OR ACTION:

1. If no wiring or communication faults are present, replace faulty MAP sensor, clear DTC and retest system.

END POSSIBLE CAUSES



END FAULT

- Restrictions in cooling system passages
- Rusted, damaged, or leaking core plugs

6. Measure cylinder head for warpage with a straight edge and feeler gauge. See Figure 6.

- A cylinder head block deck with warpage in excess of 0.10 mm (0.004 in.) within a 152.4 mm (6.0 in.) area must be repaired or replaced.
- A cylinder head exhaust manifold mounting surface with a warpage in excess of 0.05 mm (0.002 in.) within a 152.4 mm (6.0 in.) area must be repaired or replaced.
- A cylinder head intake manifold mounting surface with a warpage in excess of 0.10 mm (0.004 in.) within a 152.4 mm (6.0 in.) area must be repaired or replaced.

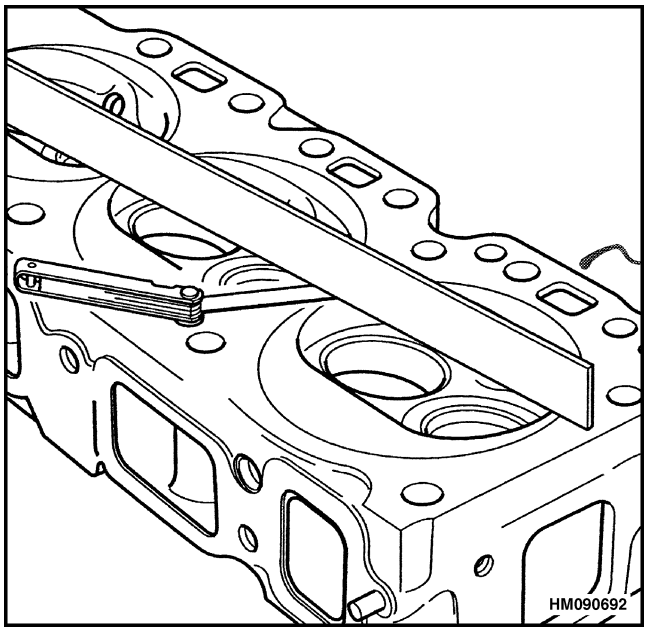
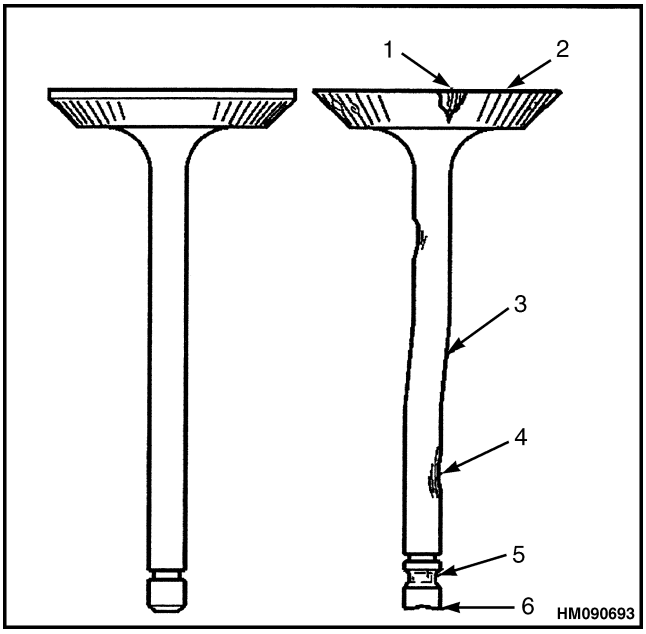


Figure 6. Cylinder Head Warpage Inspection

7. Inspect valves for:See Figure 7.

- Burnt or damaged areas
- Undersized margin
- Bent stem
- Scoring or other damage to stem
- Worn key groove
- Worn stem tip



1. BURNT OR DAMAGED AREAS
2. UNDERSIZED MARGIN
3. BENT STEM
4. SCORING/DAMAGE TO THE STEM
5. WORN KEY GROOVE
6. WORN STEM TIP

Figure 7. Valve Inspection

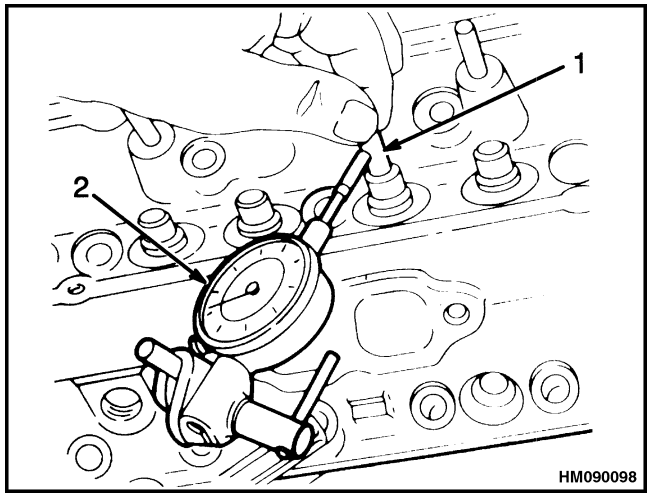
Valve stems with excessive guide clearance must be repaired or replaced. Refer to Engine Specifications.

8. Inspect valve contact surface for the following:See Figure 8.

- Undersized margin
- Pitted surface
- Burnt or eroded areas
- Acceptable edge margin

1. Clamp a dial indicator on exhaust port side of the cylinder head. See Figure 14.
2. Position dial indicator so that movement of valve stem from side to side, crosswise to cylinder head, will cause a direct movement of dial indicator stem.

   The dial indicator stem must contact side of valve stem just above valve guide.
3. Lower valve head about 1.6 mm (0.063 in.) below valve seat.
4. Using light pressure, move valve stem from side to side in order to obtain valve stem-to-guide clearance reading.



1. VALVE STEM
2. DIAL INDICATOR

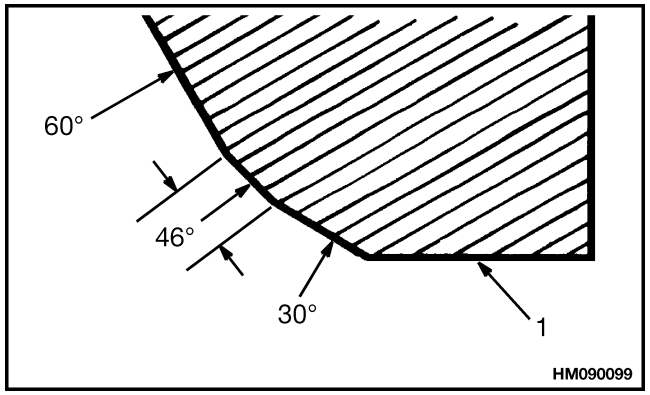
Figure 14. Valve Steam Clearance

VALVES, REPAIR

NOTE: Before any work is performed on valve faces and seats, make sure clearance of valve stems in their valve guides is within specifications.

A correction for minimum wear and damage to valve and seat can be done by a process called lapping. When th valve seats are lapped, keep valve faces and seats within the specifications. Make sure all of the lapping compound is removed from the valve and valve seat when the process is completed.

Valves with minor pits in valve faces can be machined to proper angle. There are many different types of equipment for repairing valve faces. Follow instructions of manufacturer of equipment that you are using. Valves must be machined to proper specifications. See Figure 15.



NOTE: SEAT WIDTH DIMENSION APPLIES TO THE 46° FACE ONLY.

1. CYLINDER HEAD

Figure 15. Valve Seat Specifications for Inlet and Exhaust Valves

Replace a valve if any of the following conditions are present:

- Valve stem is worn below specifications.
- Valve stem is bent.
- Valve face is warped.
- Any part of valve is cracked.
- Any wear or damage to valve face that cannot be removed by resurfacing and still meet specifications shown in Figure 16.

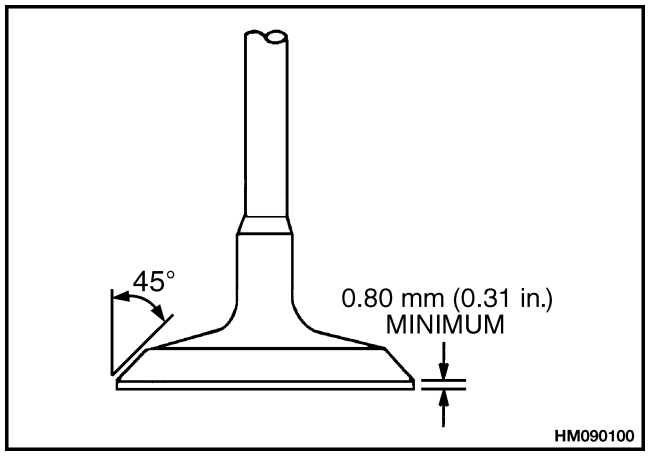


Figure 16. Valve Head Measurements

VALVE SEATS, REPAIR

NOTE: Before any work is done on valve faces and seats, make sure clearance of valve stems in their valve guides is within specifications.

FUEL FILTER HOUSING, LIFT TRUCK MODELS GLP60-70VX (GLP135-155VX) (F878), GLP60VX, GLP70VX, GP70VXS6, GP70VXS9 (GLP135VX. GLP155VX, GP155VXS) (G878), GLC60-70VX (GLC135-155VX) (F879), AND GLP40VX5, GLP40-45VX6, GLP45SVX5, GLP50-55VX (GLP80-120VX) (K813)

Remove

WARNING

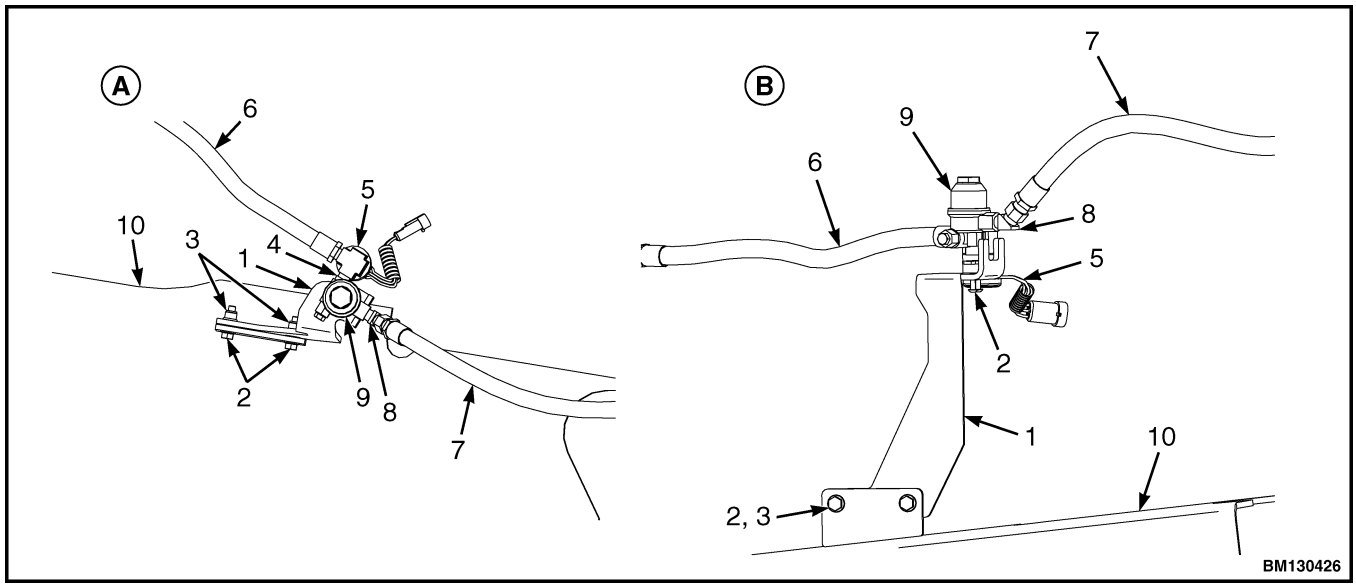
LPG can cause an explosion. DO NOT permit any sparks or open flames in the work area.

1. Close shutoff valve on tank. Run engine until it runs out of fuel and stops. If truck is equipped with a key switch, turn key switch to **OFF** position. If truck is equipped with a Power **ON/OFF** button, press the Power **ON/OFF** button to turn engine **OFF**.
2. Disconnect negative battery cable.

WARNING

A small amount of fuel may still be present in the fuel line. Use gloves to prevent burns and wear eye protection. If liquid fuel continues to flow from the connections when loosened, check to make sure the manual valve is fully closed.

3. Slowly loosen and disconnect inlet and outlet hose assemblies from inlet and outlet fittings. See Figure 13.
4. Disconnect low pressure switch from engine wire harness. See Figure 13.
5. Remove two capscrews and fuel filter housing from bracket. See Figure 13.



A. FUEL SYSTEM WITH LOW FUEL SENSOR - TOP VIEW

B. FUEL SYSTEM WITH LOW FUEL SENSOR - SIDE VIEW

1. BRACKET
2. CAPSCREW
3. FOLD-OVER NUT
4. FITTING
5. LOW FUEL SENSOR
6. OUTLET HOSE ASSEMBLY
7. INLET HOSE ASSEMBLY
8. INLET FITTING
9. FUEL FILTER HOUSING
10. FRAME

Figure 13. Fuel Filter Remove/Install