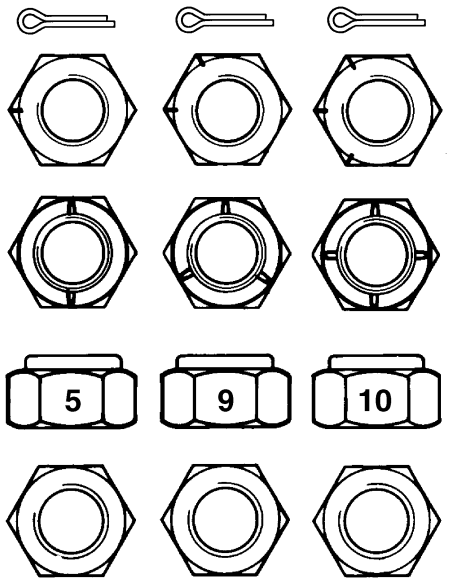
Yale®

Maintenance

METRIC AND INCH (SAE) FASTENERS

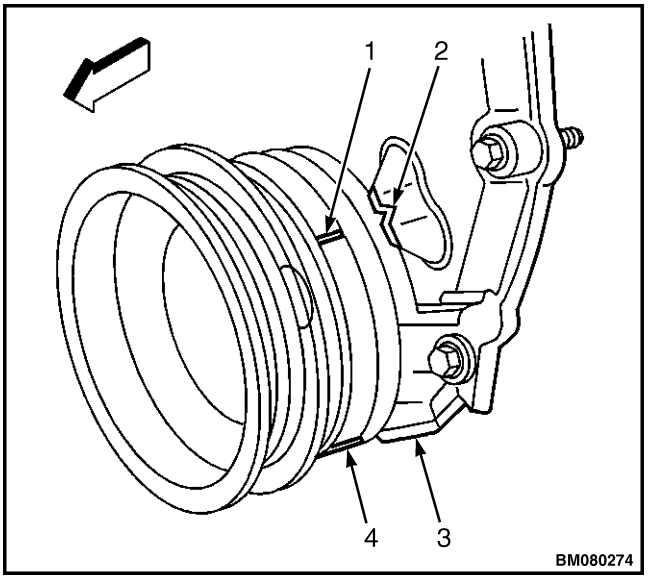


HM210064

Install Procedure 2

NOTE: Rotate the number 1 cylinder to top dead center (TDC) of the compression stroke. The engine front cover has two alignment tabs and the crankshaft balancer has two alignment marks spaced 90 degrees apart which are used for positioning the number 1 piston at TDC. See Figure 22. With the piston on the compression stroke and at TDC, the crankshaft balancer alignment mark (1) must align with the engine front cover tab (2) and the crankshaft balancer alignment mark (4) must align with the engine front cover tab (3).

1. Rotate the crankshaft balancer clockwise until the alignment marks on the crankshaft balancer are aligned with the tabs on the engine front cover and the number 1 piston is at TDC of the compression stroke. See Figure 22.



1. CRANKSHAFT BALANCER ALIGNMENT MARK
2. ENGINE FRONT COVER TAB
3. ENGINE FRONT COVER TAB
4. CRANKSHAFT BALANCER ALIGNMENT MARK

Figure 22. Crankshaft Balancer and Engine Front Cover Alignment Marks

2. Align the white paint mark on the bottom stem of the distributor and the pre-drilled indent hole in the bottom of the gear. See Figure 7.

NOTE: The ignition system distributor driven gear and rotor may be installed in multiple positions. In order to avoid mistakes, mark the distributor on the following components in order to ensure the same mounting position upon reassembly:

- Distributor driven gear
- Distributor shaft
- Rotor holes

Installing the driven gear 180 degrees out of alignment or locating the rotor in the wrong holes, will cause a no-start condition. Premature engine wear or damage may result.

3. With the gear in this position, the rotor segment should be positioned as shown in Figure 7.

4. Use a long screw driver in order to align the oil pump drive shaft to the drive tab of the distributor.

5. Guide the distributor into the engine. See Figure 21.

Ensure the flat portion of the distributor housing is facing toward the front of the engine.

6. Once the distributor is fully seated, the rotor segment should be aligned with the pointer cast into the distributor base. See Figure 23.

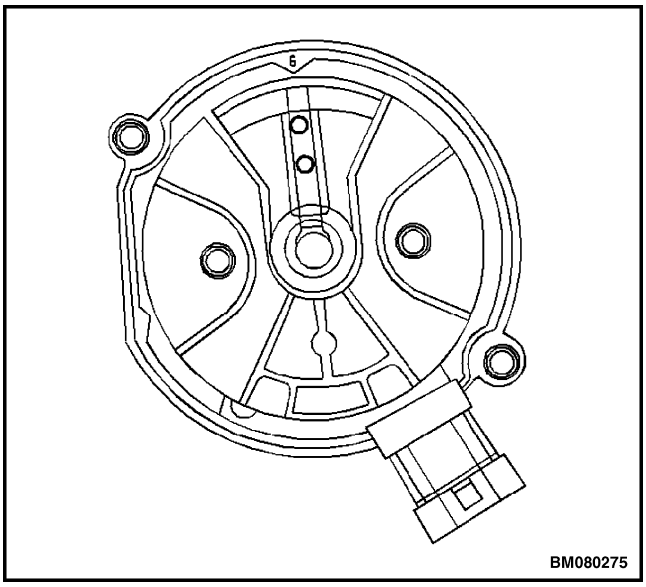


Figure 23. Rotor Segment in Distributor Base

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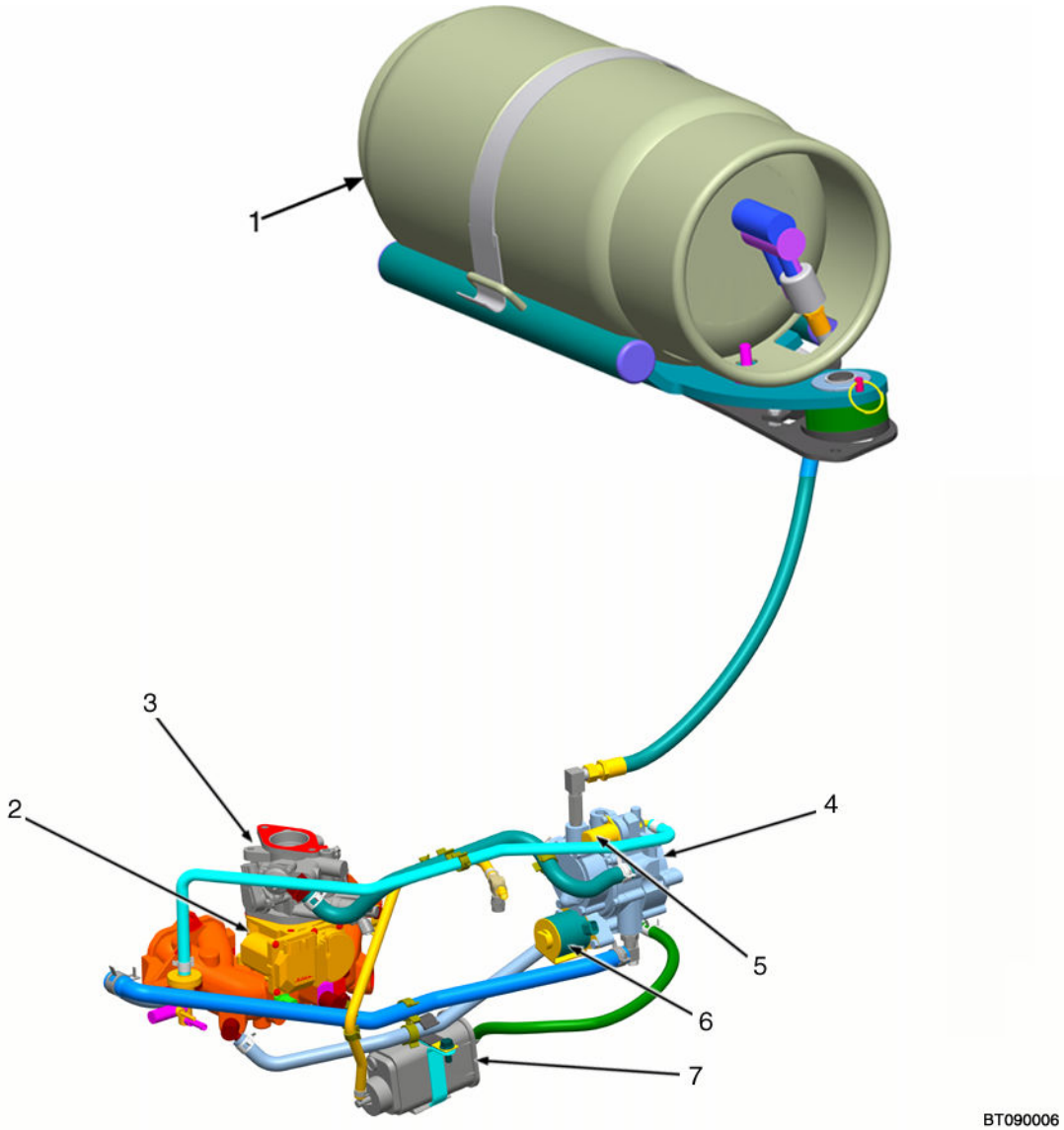
Mazda (LPG) Engine Controls

LPG SYSTEM (AISAN/E-CONTROLS-MECHANICAL)

Description

The key components of the Mazda LPG system are the LPG fuel tank, regulator, carburetor with LPG injector, electronic governor, and resonator. The Mazda LPG system uses a trim injector to control the fueling of the engine. See Figure 9020-10-32.



1. FUEL TANK
2. GOVERNOR
3. CARBURETOR
4. REGULATOR
5. INJECTOR FUEL SHUTOFF SOLENOID
6. MAIN FUEL SHUTOFF SOLENOID VALVE
7. RESONATOR

Figure 9020-10-32. LPG System Component Location

Legend for Figure 9020-10-88

A. LPG OUTLET
B. LPG INLET
C. INLET MANIFOLD CONNECTION
D. COOLANT CONNECTIONS

1. FUEL LOCKOFF SOLENOID VALVE
2. VAPORIZER/REGULATOR
3. SLUDGE DRAIN PLUG

The ECU controls power to the vaporizer/regulator fuel lockoff solenoid relay. Power to the relay is turned on when the key is turned to the **ON** position. If the engine is not cranked within 2 seconds of key **ON**, the ECU will cut power to the relay. Power is maintained while engine is cranking or running, and is cut when the key is turned to the **OFF** position.

LPG is supplied from the tank to the vaporizer/regulator. The LPG fuel lockoff solenoid valve is integrated into the vaporizer/regulator. When this valve is open, the pressure in the vaporizer/regulator is pressurized to a value that is dependent on the engine load. To achieve this, a vacuum hose must be connected between the inlet manifold and the vaporizer/regulator. This maintains the pressure across the injectors at a constant value. See Figure 9020-10-89.

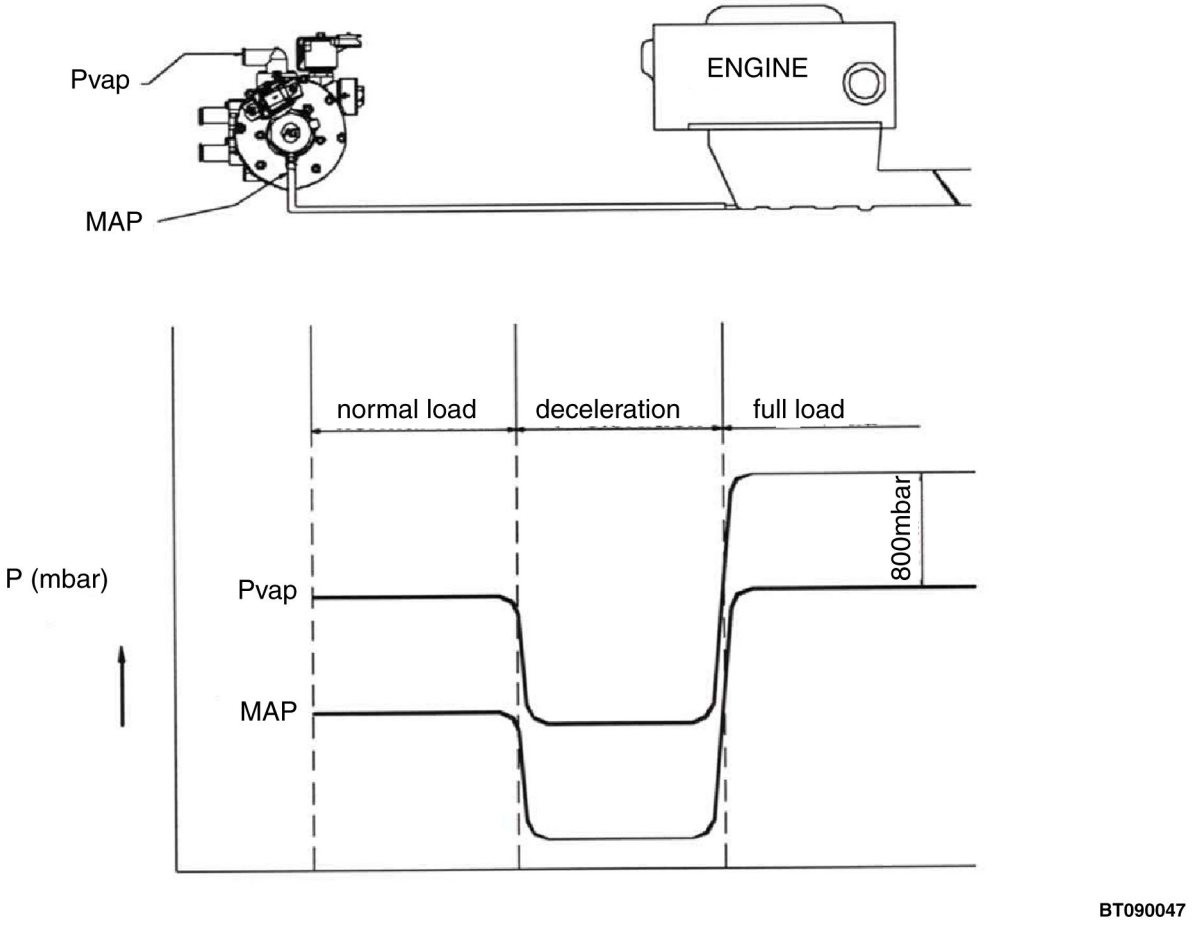


Figure 9020-10-89. Maintained Vaporizer/Regulator Pressure

Full-Load Position Adjustment Mechanism

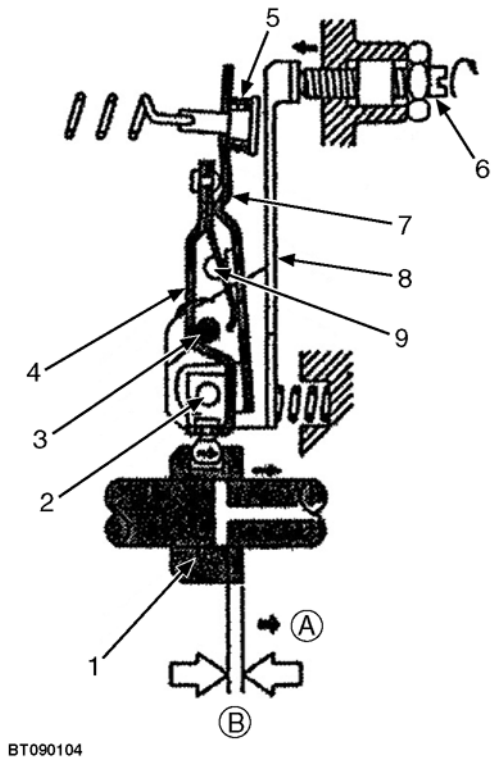


Figure 9020-10-164. Full-Load Adjustment

Legend for Figure 9020-10-164

A. FUEL INCREASE DIRECTION
B. EFFECTIVE STROKE

1. CONTROL SLEEVE
2. M2 (FULCRUM)
3. M1 (FIXED)
4. START LEVER
5. IDLE SPRING
6. FULL LOAD ADJUSTING SCREW
7. TENSION LEVER
8. CORRECTOR LEVER
9. M3

The full-load position is determined by the amount the full-load adjusting screw is driven. When the screw is driven, the corrector lever turns counterclockwise with M1 being the fulcrum to move the control sleeve to the fuel increase direction. When the screw is loosened, the control sleeve moves to the fuel decrease direction.

- Check fuel tank level. Fill tank if necessary.
- Verify diesel fuel in tank is correct.
- Verify fuel tank shutoff valves are fully open.

NOTE: Perform the following checks when **ordinary** exhaust color is observed.

- Check for air in fuel system.
- Check for clogged fuel filter and clogged fuel strainers.
- Check for clogged or cracked fuel lines.
- Verify supply fuel to injection pump is sufficient.

NOTE: Perform the following checks when **white** colored exhaust is observed.

- Check for air in fuel system.
- Check fuel injection pump timing is correct.
- Check for clogged fuel filter and clogged fuel strainers.
- Check for water in fuel system.
- Check fuel injection nozzles for any uneven spray patterns and injection volume.

NOTE: Perform the following checks when **black** colored exhaust is observed.

- Check fuel injection pump timing is correct.
- Check fuel injection nozzles for poor spray patterns and uneven injection volume.

Is fuel system working properly?
YES: Go to CAUSE C for GM and Mazda engines, or go to CAUSE D for Yanmar diesel engines.
NO: Repair fuel system. Refer to appropriate **LPG Fuel System**, **Gasoline Fuel System**, **Kubota Diesel Engine**, **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** .

CAUSE C - ENGINE SENSOR PROBLEMS (GM AND MAZDA ENGINES ONLY).

PROCEDURE OR ACTION:

1. Use the DSC or PC Service Tool and check operation of engine sensors as follows:
   - Check and verify engine Manifold Absolute Pressure sensor. At sea level, the MAP sensor should read approximately 100 kPa (14.5 psi) with the truck off and the ignition on. Once the truck starts, the MAP sensor should drop to a lower value. Check sensor wiring for shorts or broken wires.
   - Check and verify the Throttle Position Sensor is working properly. With the truck off, the sensor should read 0. Applying pedal to the stop will show approximately 70% throttle for the GM and approximately 100% throttle for the Mazda. Check sensor wiring for shorts or broken wires.
   - For Mazda gasoline engines only, check and verify the Mass Air Flow sensor is operating correctly. When the engine is off the sensor should read approximately zero. Then as the engine cranks and starts, the value of the sensor should rise. At idle, the MAF reading will be between 11-18 kg/hr (24-40 lb/hr). At governed speed, the MAF reading will be between 46-58 kg/hr (106-128 lb/hr). Check sensor wiring for shorts or broken wires.
   - Check and verify the Heated Exhaust Oxygen sensor (HEGO) is toggling. When first starting the truck the HEGO sensor will not toggle until the engine is partially warmed up. Once the truck is warmed up, the HEGO sensor should toggle between approximately 0.2 – 0.8 Volts. Check sensor wiring for shorts or broken wires.

   Are sensors not working properly?
   YES: Replace failed sensors. Refer to appropriate **Gasoline Fuel System** or **LPG Fuel System** manual, depending on lift truck model.
   NO: Go to CAUSE E.

CAUSE C - ENGINE SENSOR PROBLEMS.

PROCEDURE OR ACTION:

1. Use the DSC or PC Service Tool and check operation of engine sensors as follows:
    - Check and verify engine cranking speed is greater than 0 rpm during cranking while viewing Engine Speed sensor data. Check sensor wiring for shorts or broken wires.
    - Check and verify engine Manifold Absolute Pressure sensor. At sea level, the MAP sensor should read approximately 100 kPa (14.5 psi) with the truck off and the ignition on. Once the truck starts, the MAP sensor should drop to a lower value. Check sensor wiring for shorts or broken wires.
    - Check and verify the Coolant sensor is operating correctly. If the truck has not been running the coolant temperature should be approximately the same as the ambient air temperature. As the truck is started, the coolant temperature should rise until reaching approximately 185°C (85°F). Check sensor wiring for shorts or broken wires.
    - Check and verify the Intake Air sensor is operating correctly. If the truck has been setting for an extended period of time the intake air temperature should be approximately the same as the ambient air temperature. As the truck is started the intake air temperature should rise slightly. Check sensor wiring for shorts or broken wires.
    - Check and verify the Heated Exhaust Oxygen sensor (HEGO) is toggling. When first starting the truck the HEGO sensor will not toggle until the engine is partially warmed up. Once the truck is warmed up, the HEGO sensor should toggle between approximately 0.2 – 0.8 Volts. Check sensor wiring for shorts or broken wires.
    - For Mazda gasoline engines only, check and verify the Mass Air Flow sensor is operating correctly. When the engine is off the sensor should read approximately zero. Then as the engine cranks and starts, the value of the sensor should rise. At idle, the MAF reading will be between 11-18 kg/hr (24-40 lb/hr). At governed speed, the MAF reading will be between 46-58 kg/hr (106-128 lb/hr). Check sensor wiring for shorts or broken wires.

Are sensors not working properly?
YES: Replace failed sensors. Refer to appropriate **Electrical System**, **GM Engines**, **Gasoline Fuel System** or **LPG Fuel System** manual, depending on lift truck model.
NO: Go to CAUSE D.

CAUSE D - EXHAUST SYSTEM.

PROCEDURE OR ACTION:

1. Check the following:
    - Check for exhaust leaks before the O_2 sensor. If an exhaust leaks occurs before the O_2 sensor, the fuel system will tend to go rich because of the additional oxygen in the exhaust system.
    - Check for exhaust leaks between the O_2 sensor and the catalytic converter. If a leak occurs between the O_2 sensor and the catalytic converter, damage to the catalytic converter can occur.
    - Check for a proper operating catalytic converter. Use a shop emission analyzer to determine if the catalytic converter is operating correctly.

Is the exhaust system damaged?
YES: Replace damaged components. Refer to appropriate **Frame**, **GM Engines** or **Mazda Engine** manual, depending on lift truck model.
NO: Go to CAUSE E.

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Legend for Figure 9030-03-7

1. CSP 92, ARMREST CONNECTOR
2. CPS 54, BACK UP ALARM HARNESS CONNECTOR
3. CPS 98, BACK UP ALARM CONNECTOR
4. T115, SEAT GROUND TERMINAL
5. CPS 93, SEAT OCCUPANCY SENSOR CONNECTOR
6. CRP 67, KEYSWITCH HARNESS CONNECTOR/ JUMPER CAP
7. T113, KEYSWITCH RING TERMINAL
8. T114, KEYSWITCH RING TERMINAL
9. CPS 112, JOYSTICK CONNECTOR
10. CPS 52, SEAT HARNESS CONNECTOR
11. CPS 90, E-HYDRAULIC CONTROLS CONNECTOR
12. CRP 90, E-HYDRAULIC CONTROLS RECEPTACLE

CAUTION

Only replace blown fuses with fuses of the same value, after the fuse-blowing fault has been detected and cleared.

All switched operations are controlled and monitored by the VSM. All distributed circuits are fused.

CAUTION

Accessory Power connections are provided at the PDM and VSM. These connectors have unswitched and switched battery along with a heavy duty ground

When connecting accessories check the current rating of the new device to ensure it will not exceed the fused capacity of the circuit.

a. Other PDM Interfaced Devices

(1) Back Up Alarm. This device is controlled by the VSM detecting the selection of reverse direction. The circuit is designed to allow a customer to connect their desired audible warning device. A connection is provided in the counterweight.

(2) Fuel Relay. This device is controlled by two controllers:

- The VSM turns on the high side of the relay coil at Power On
- The ECU turns on the low side of the coil at Power On but will turn off this driver if no engine cranking is detected within 2 seconds. This is to prevent continued operation of the fuel pump or the flow of LPG to an engine that is not running. Activating the start operation will turn this driver on again.

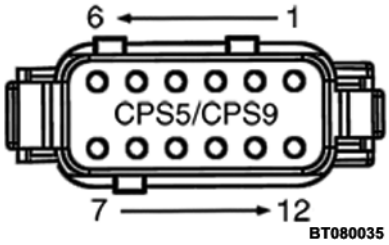
(3) Lights (Lift Trucks Without Cab). The Lights are controlled from the DSC in the same manner as the starter. Pushing the relevant button will activate the selected lights based on the software configuration options that have been chosen. Front Work Lights can also be turned on without activating System Power On but they will turn off after a preselected time. If the lights are operating at the time the system is Powered Off then the Lights will time out in like manner. The work lights are halogen lamps. The Front Marker/Turn and Rear Lamp Assembly (Tail/Stop/Turn/Backup) are all LED assemblies.

CAUTION

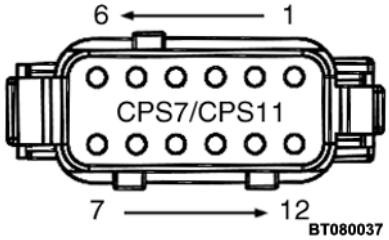
Do not replace LED assemblies with incandescent lamp assemblies.

The individual LEDs are not serviceable, only the assemblies. See Figure 9030-10-41.

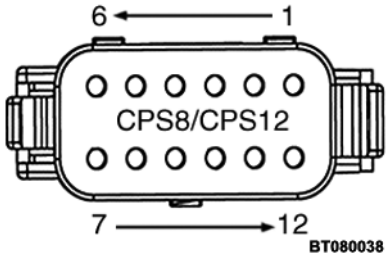
CONNECTOR(S)



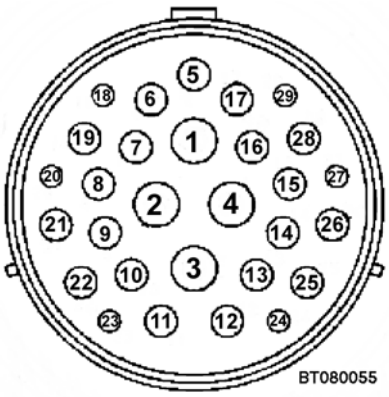
VSM Connector CPS 5 and 9



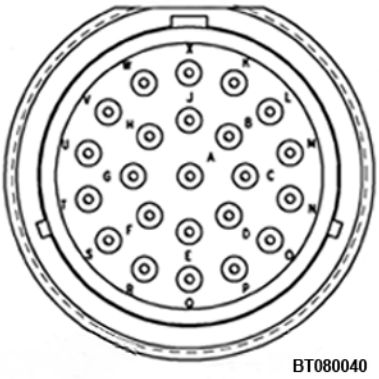
VSM Connector CPS 11



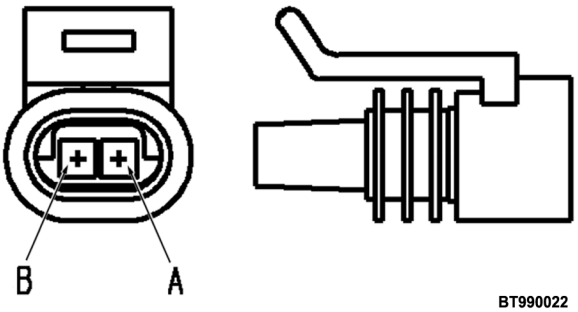
VSM Connector CPS 12



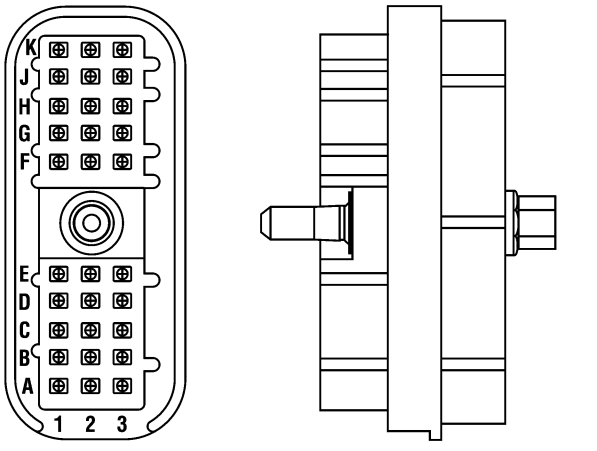
Engine Harness Connector CPS 55



XMSN Disconnect CPS 85



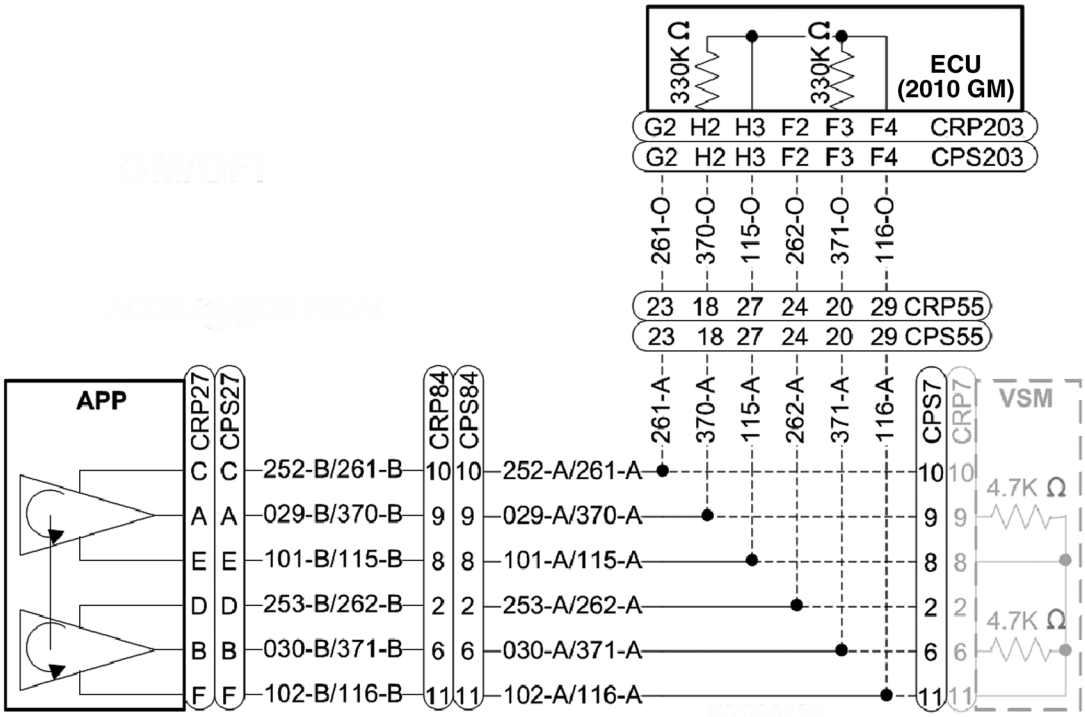
Wet Disk Brake Temperature Sensor Connector CPS 51



APC 214-CPS 128 Connector

• WIRE # 101/115 (DK GRN) = ACCELERATOR PEDAL POSITION A SENSOR GROUND

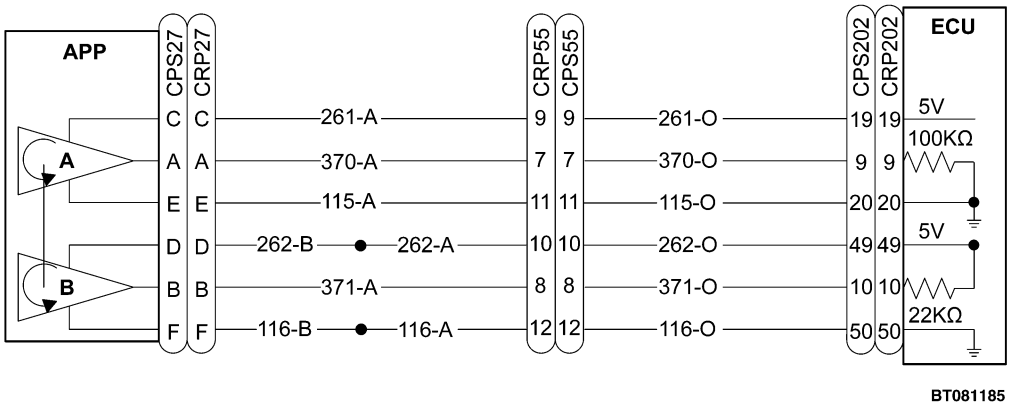
Accelerator A and B Sensor Schematic (Cummins/Mazda/Yanmar - VSM)



BT080156

• WIRE # 029/370 (WHITE) = ACCELERATOR PEDAL POSITION A SENSOR SIGNAL
• WIRE # 030/371 (WHITE) = ACCELERATOR PEDAL POSITION B SENSOR SIGNAL
• WIRE # 101/115 (DK GRN) = ACCELERATOR PEDAL POSITION A SENSOR GROUND
• WIRE # 102/116 (DK GRN) = ACCELERATOR PEDAL POSITION A SENSOR GROUND
• WIRE # 252/261 (RED) = SENSOR A SUPPLY
• WIRE # 253/262 (RED) = SENSOR B SUPPLY

Accelerator A and B Sensor Schematic (GM)



BT081185

• WIRE # 370 = ACCELERATOR PEDAL POSITION A SENSOR SIGNAL
• WIRE # 371 = ACCELERATOR PEDAL POSITION B SENSOR SIGNAL
• WIRE # 116 = ACCELERATOR PEDAL POSITION A SENSOR GROUND
• WIRE # 261 = SENSOR A SUPPLY
• WIRE # 262 = SENSOR B SUPPLY

Relay/Valve Coil Driver Output OORL

Output Driver Feedback is Low When Circuit Is Commanded On.

CODES

DTC 676-4 - Glow Plug Relay Driver Output OORL
DTC 523544-4 - Air Heater Circuit Shorted To Ground
DTC 524195-4 - Cold Start Relay Driver Output OORL
DTC 524269-4 - Transmission Enable Valve Coil Driver OORL

POSSIBLE CAUSE

A. COIL DRIVER OUTPUT SHORTED TO GROUND
B. RELAY/VALVE COIL/ FAILURE
C. FUNCTIONAL FAILURE IN CONTROLLER

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

COMPONENT OPERATIONAL CHECK

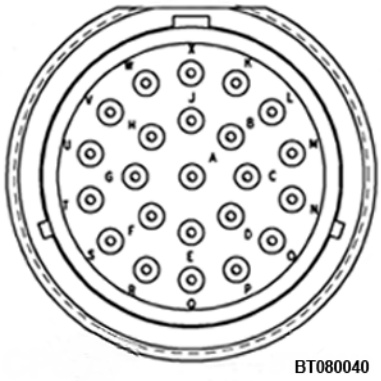
PROCEDURE OR ACTION:

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.

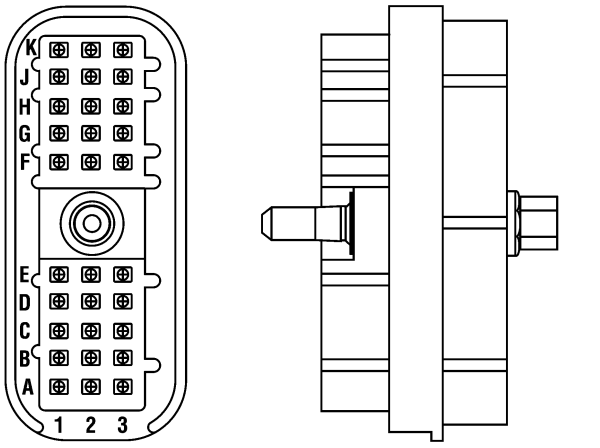
CAUSE A - COIL DRIVER OUTPUT SHORTED TO GROUND

PROCEDURE OR ACTION:

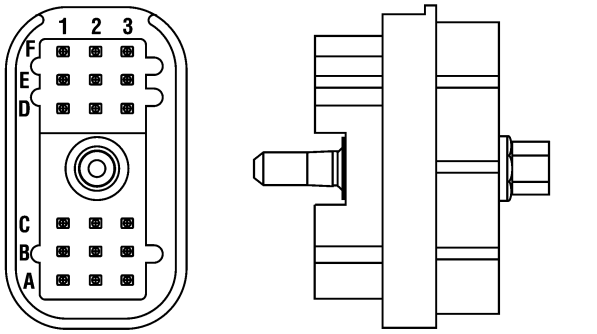
1. Ensure truck power is **OFF**.
2. Change DMM to ohms scale. Verify DMM zero reading.
3. Disconnect indicated connectors at VSM and valve.
4. At valve harness connector, measure resistance between driver output pin and the negative terminal of battery.
   Is resistance less than 0.5 ohms?
   YES: Coil driver output wire is shorted to ground. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.
   NO: Go to CAUSE B.



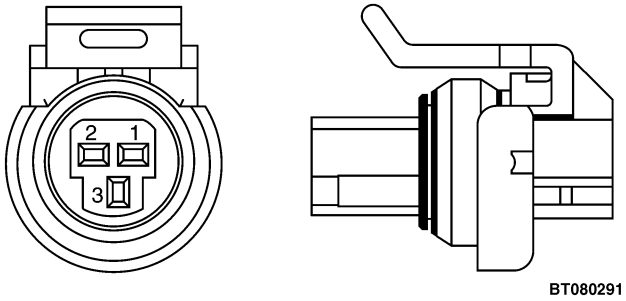
XMSN Harness Disconnect CPS 85



APC 214-CPS 128 Connector

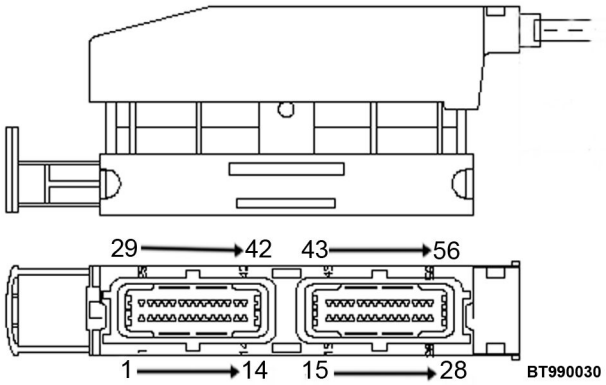


APC 214-CPS 129 Connector

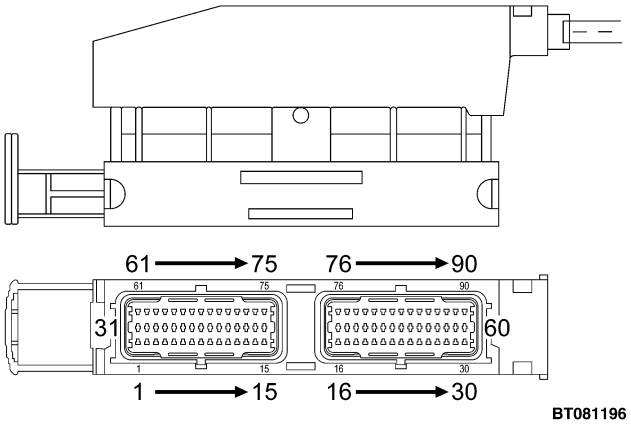


- **FWD HI PRESSURE CPS 141 CONNECTOR**
- **FWD2 PRESSURE CPS 142 CONNECTOR**
- **FWD LOW PRESSURE CPS 143 CONNECTOR**
- **REV1 PRESSURE CPS 144 CONNECTOR**
- **REV PRESSURE CPS 145 CONNECTOR**

Pressure Connector



Mazda ECU Connector CPS 202



GM (2011) and Mazda ECU Connector CPS 202 (2007 Mazda EPA and 2011 GM)

CAUSE B - FUNCTIONAL VALVE FAILURE

PROCEDURE OR ACTION:

1. At the valve connector(s), measure resistance between the coil pin(s).
   Is the resistance less than 0.5 ohms?
   YES: The base control valve coil is internally shorted. Replace valve coil. See **Main Control Valve** 2000YRM1137. Depending on your lift truck see, **One And Two Speed Powershift Transmissions** 1300YRM1129 or **Single Speed PowerShift, Aluminum Gear Drive Transmission** 1300YRM1421.
   NO: Go to CAUSE C.

CAUSE C - 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

CAUSE A - SENSOR HEATER DRIVER RETURN SHORTED TO GROUND

PROCEDURE OR ACTION:

WARNING

DO NOT attempt to remove the HEGO sensor while exhaust system is HOT. Damage to personnel or equipment may occur.

CAUTION

Use care when removing the O_2 sensor. Due to repeated heating and cooling cycles and high operating temperatures it is possible to damage the O_2 sensor or exhaust port threads during removal.

If reusing a HEGO sensor be sure NO anti-seize is on the sensor head to be in exhaust gas stream.

1. Ensure truck power is **OFF**.
2. Select ohms on DMM scale. Verify DMM zero reading.
3. Disconnect the sensor connector and the indicated connector from the ECU. See Harness Assembly Data.
4. At the sensor connector, measure the resistance between the sensor heater return pin and ground.
   Is the resistance less than 0.5 ohms?
   YES: The sensor heater return wire is shorted to ground. Locate and repair/replace shorted wire/connection. Refer to appropriate **Electrical System** manual, depending on lift truck model.
   NO: Replace sensor. Refer to appropriate **Electrical System** manual, depending on lift truck model. Go to Step 5.
5. Restore all connections/components. Repeat Component Operational Check.
   Does DTC reoccur?
   YES: Go to CAUSE B.
   NO: Problem has been corrected. Resume operation.

CAUSE E - 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 connector from SCV and measure terminal resistance on the SCV and ground.
   Is resistance low or close to zero ohms?
   YES: The SCV has shorted to ground. Replace SCV. Reconnect SCV connector to wiring harness. Go to Step 4.
   NO: Go to CAUSE F.
4. Turn truck power **ON** and start engine.
   Does reported DTC reoccur?
   YES: Go to CAUSE F.
   NO: Problem not verified or problem resolved. Resume operation.

CAUSE F - WIRE HARNESS SHORT

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Set DMM to ohms scale.
3. Disconnect wiring harness from component/sensor connector associated with DTC.
4. Measure the terminal resistance of the wire harness.
   Is resistance low or close to zero ohms?
   YES: There is a short wiring harness. Refer to the appropriate **Diagrams and Schematics** manual, depending on lift truck model, to determine possible source. Locate and repair/replace shorted wire/connection. Refer to the appropriate **Wiring Harness Repair** manual, depending on lift truck model. Repeat Component Operational Check.
   NO: Problem not verified or problem resolved. Resume operation.

END POSSIBLE CAUSES

CAUSE D - SENSOR SIGNAL(S) SHORTED TO +5VDC OR BATTERY

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect indicated connectors from sensor and from VSM.
3. Turn truck power **ON**.
4. Change DMM to volts scale.
5. At sensor harness connector, measure voltage across sensor signal pin (+) and the negative (-) terminal of battery.
   Is voltage approximately 5Vdc or 12Vdc?
   YES: If voltage is approximately 5Vdc, go to Step 6. If voltage is approximately 12Vdc, go to Step 7.
   NO: Go to CAUSE E.
6. Sensor signal wire is shorted to a 5-volt source. Refer to electrical schematic in **Diagrams and Schematics** 8000YRM1152 to determine possible source. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.
7. Sensor signal wire is shorted to a 12-volt source. Turn power **OFF** and repeat measurement from Step 5.
   Is voltage approximately system voltage?
   YES: Sensor signal wire is shorted to an unswitched 12-volt source. Refer to electrical schematic in **Diagrams and Schematics** 8000YRM1152 to determine possible source. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.
   NO: Sensor signal wire is shorted to a switched 12-volt source. Refer to electrical schematic to determine possible source. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.

CAUSE E - SENSOR FAILURE

PROCEDURE OR ACTION:

1. Replace sensor. See **Electrical System** 2200YRM1142.
2. Repeat Component Operational Check.

WARNING

This operational check requires that the truck be driven. Be sure that the area is clear of personnel and equipment and that it is safe to operate lift truck.

NOTE: A TOSS or TISS sensor failure will derate the transmission to basic mode. If truck will not drive, go to **Observed Symptoms** and examine for a mechanical failure.

3. Start truck, release brake, drive truck at normal speed for at least 30 seconds.
   Does DTC reoccur?
   YES: Go to CAUSE F.
   NO: Problem has been corrected. Resume operation.

CAUSE B - TRANSMISSION SUPPLY PRESSURE LOW

PROCEDURE OR ACTION:

1. Check transmission supply pressure. For 6.0-7.0 Ton Cushion and Pneumatic Trucks, see **Three-Speed Powershift Transmission Repair** 1300YRM1317 or **Two-Speed Powershift Transmission Repair** 1300YRM1343.
   Is transmission supply pressure low?
   YES: Identify and correct low pressure problem. For 6.0-7.0 Ton Cushion and Pneumatic Trucks, see **Three-Speed Powershift Transmission Repair** 1300YRM1317 or **Two-Speed Powershift Transmission Repair** 1300YRM1343.
   NO: Go to CAUSE C.

CAUSE C - FAILED PROPORTIONAL VALVE

PROCEDURE OR ACTION:

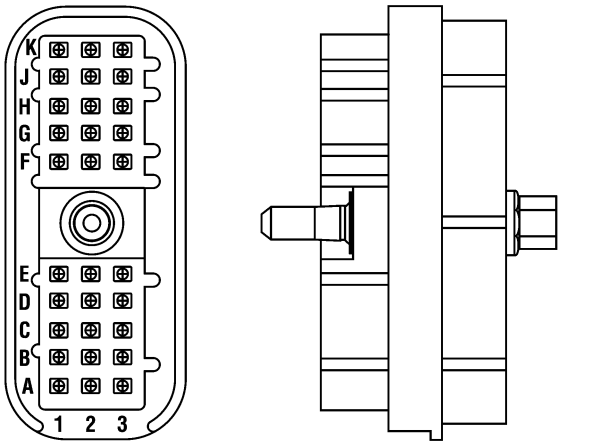
1. Ensure truck power is **OFF**.
2. Disconnect indicated valve connector.
3. Replace valve. For 6.0-7.0 Ton Cushion and Pneumatic Trucks, see **Three-Speed Powershift Transmission Repair** 1300YRM1317 or **Two-Speed Powershift Transmission Repair** 1300YRM1343.
4. Turn truck power **ON**.
5. Operate truck.
   Does DTC reoccur?
   YES: Replace original valve and go to CAUSE D.
   NO: Fault has been corrected. Resume operation.

CAUSE D - SENSOR SUPPLY OPEN CIRCUIT

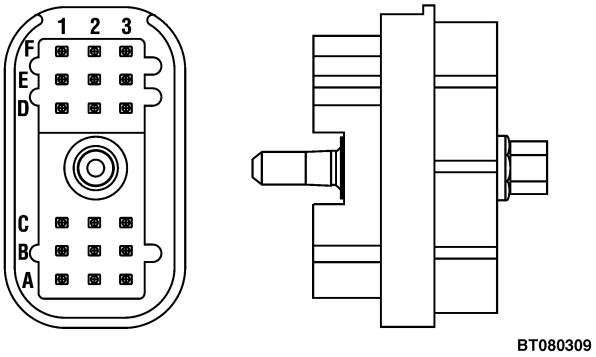
PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect indicated sensor connector.
3. Turn truck power **ON**.
4. Set DMM to volts scale.
5. At sensor connector, using procedure for probing the connector, measure voltage across sensor supply pin (+) and sensor ground pin (-).
   Is voltage equal to or greater than sensor supply voltage (approximately 5 Vdc)?
   YES: Supply sensor circuit is OK. Go to CAUSE E.
   NO: The sensor supply wire has an open circuit. Locate and repair/replace open wire/connection. See **Wire Harness Repair** 2200YRM1128.

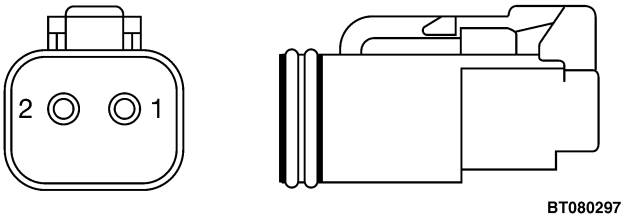
CONNECTOR(S)



APC 214-CPS 128 Connector



APC 214-CPS 129 Connector

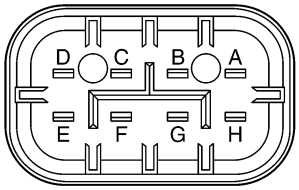


1. **FWD HI SOLENOID CPS 136 CONNECTOR**
2. **FWD2 SOLENOID CPS 137 CONNECTOR**
3. **FWD LOW SOLENOID CPS 138 CONNECTOR**
4. **REV1 SOLENOID CPS 139 CONNECTOR**
5. **REV SOLENOID CPS 140 CONNECTOR**

Solenoid Connector

END FAULT

CONNECTOR(S)



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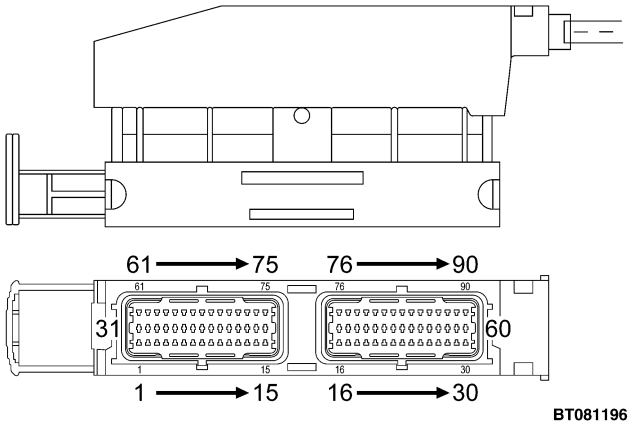
PDM Connector CSP 13, 14, 15, 16 (2007 Mazda EPA)



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GM (2011) and Mazda ECU Connector CPS 202 (2007 Mazda EPA and 2011 LPG GM-PSI)

END FAULT

CAUSE C - 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

CAUSE B - WIRING HARNESS FAILURE

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect the wiring harness from the sensor 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 5.
   NO: Locate and repair/replace open wire/connection. Refer to the appropriate **Wiring Harness Repair**YRM . Repeat Component Operational Check.
5. Disconnect wiring harness from SCV.
6. Measure resistance across each pin of the wiring harness.
   Is resistance low or close to zero?
   YES: The wiring harness has a short. Refer to the appropriate **Wiring Harness Repair**YRM to determine possible source. Locate and repair/replace shorted wire/connection.
   NO: Go to Step 7.
7. Repeat measurement from Step 6.
   Is resistance higher than 100M ohms?
   YES: The wiring harness has an open condition. Refer to the appropriate **Wiring Harness Repair**YRM to determine possible source. Locate and repair/replace open wire/connection.
   NO: Go to Step 8.
8. Restore all connections. Turn truck power **ON** and start engine.
   Does reported DTC reoccur?
   YES: Go to CAUSE C.
   NO: Problem not verified or problem resolved. Resume operation.

CAUSE C - FUEL LEAKS

PROCEDURE OR ACTION:

1. Check fittings, fuel lines, and clamps leading to the High Pressure Pump (HPP) to 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 Component Operational Check.
   NO: Go to Step 2.
2. Check for 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 Step 3.
3. Check for external fuel leaks.
   Does engine have a fuel leak?
   YES: See Observed Symptoms, Fuel Leaks, Page 9020-30-67.
   NO: Go to CAUSE D.

DTC 523600-0
Initial Pump Calibration Incomplete
Fuel Pump Calibration Not Performed For New ECM

POSSIBLE CAUSE

END POSSIBLE CAUSES

CAUSE A - FUEL PUMP CALIBRATION INCOMPLETE

PROCEDURE OR ACTION:

NOTE: This DTC is only active if a new ECM has not had the fuel pump calibration performed.

1. Follow the procedures outlined in the section Fuel Pump Learning, PC Service Tool Test and Adjustments (Kubota).
2. Turn truck power to **OFF** for no less than 30 seconds and then to **ON** to clear displayed DTC.
   Does reported DTC reoccur?
   YES: Replace ECM and repeat Step 1.
   NO: Problem resolved. Resume operation.

END FAULT

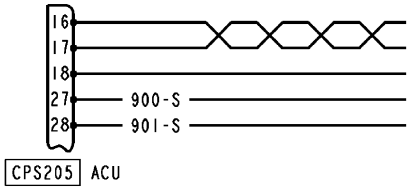
CAUSE B - ACU FAULT

PROCEDURE OR ACTION:

1. Using the PC Service Tool, locate ***Injector Compensation (ACU)*** value. Register correct injector QR data to ACU. Cycle key switch OFF and then turn key to ON.
   Has injector QR successfully been set?
   YES: Clear DTC and retest system.
   NO: Replace faulty ACU.

END POSSIBLE CAUSES

DIAGRAMS



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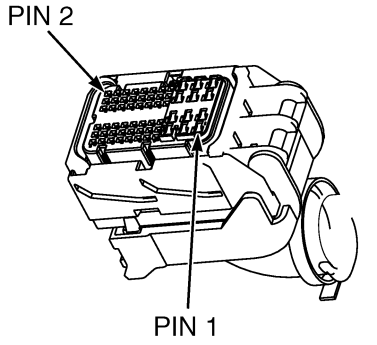
Troubleshooting Scenes

CONNECTOR(S)



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ACU

END FAULT

CAUSE B - TULC SENSOR CANBUS COMMUNICATION FAULT

PROCEDURE OR ACTION:

1. Measure voltage between the TULC sensor connector CPS503, socket 2 and B(-).
   Is CAN HI voltage approximately 2.5 Vdc?
   YES: Proceed to Step 2.
   NO: Inspect CAN HI circuit for open or short. If voltage is 0 volts, the CAN HI circuit is shorted to ground or open. If voltage is above 5 volts, the CAN HI circuit is shorted to power.
2. Measure voltage between the TULC sensor connector CPS503, socket 1 and B(-).
   Is CAN LO voltage approximately 2.5 Vdc?
   YES: Disconnect battery and proceed to Step 3.
   NO: Inspect CAN LO circuit for open or short. If voltage is 0 volts, the CAN LO circuit is shorted to ground or open. If voltage is above 5 volts, the CAN LO circuit is shorted to power.
3. Measure resistance between the TULC sensor connector CPS503, socket 2 and socket 1.
   Is resistance 60 ± 6 ohms?
   YES: No communication faults are present, connect battery and proceed to CAUSE C.
   NO: If resistance is 120 ohms, the CANbus has an open circuit or a missing or damaged termination resistor. If resistance is 0 ohms, the CANbus circuits are shorted together.

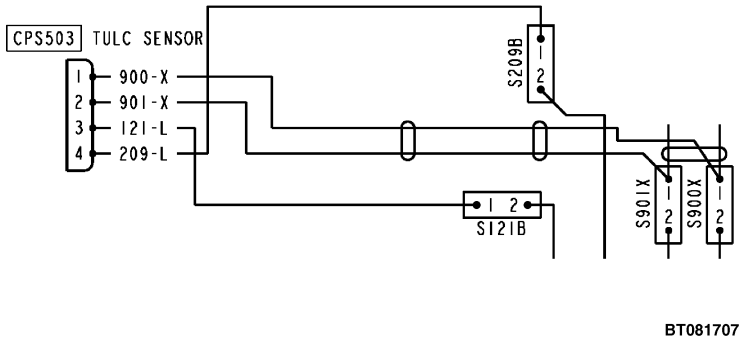
CAUSE C - TULC SENSOR FAULT

PROCEDURE OR ACTION:

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

END POSSIBLE CAUSES

DIAGRAMS



Troubleshooting Scenes

Electro-Hydraulics Do Not Function With Armrest Down

CAUSE B - SWITCH SIGNAL OR SIGNAL GROUND OPEN CIRCUIT

PROCEDURE OR ACTION:

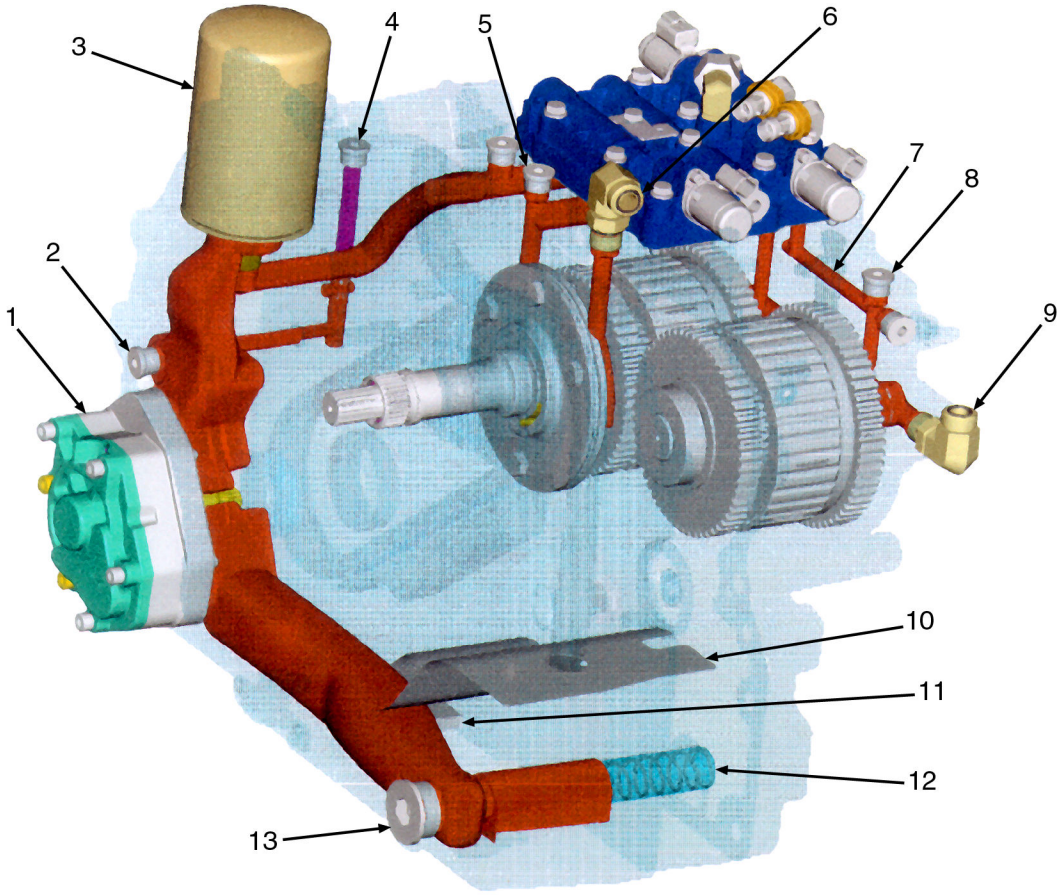
1. Turn power **ON**.
2. Using a DMM, measure voltage between CPS92 pin 1 and CPS90 pin 5.
   Is voltage approximately equal to 5 Volts?
   YES: Go to CAUSE C.
   NO: Locate and repair/replace open circuit wire. See **Wire Harness Repair** 2200YRM1128.

CAUSE C - FAULTY MLM/JOYSTICK

PROCEDURE OR ACTION:

1. Disconnect connector CPS112.
2. Using a DMM, measure voltage across armrest switch connections to MLM/Joystick as shown in schematic.
   Is voltage approximately equal to 5 Volts?
   YES: Repeat Component Operational Check Step 4.
   NO: Replace MLM/Joystick.

END SYMPTOM



NOTE: FIGURE 9040-10-16 SHOWS HOW OIL IS PULLED INTO THE PUMP AND DELIVERED TO THE CONTROL VALVE.

1. CHARGE PUMP
2. CHARGE PUMP PRESSURE PORT
3. FILTER
4. CHARGE PUMP PRESSURE REGULATOR
5. FLOW TO TORQUE CONVERTER
6. LINE TO COOLER (FROM TORQUE CONVERTER)
7. ACTIVATION LINE (REVERSE)
8. REVERSE PRESSURE CHECK PORT
9. LINE FROM COOLER (LUBE FLOW TO COOL CLUTCH PACKS)
10. BAFFLE
11. MAGNET
12. INLET SCREEN
13. SERVICE PLUG

Figure 9040-10-16. Transmission Oil Flow

6.0-9.0 TON LIFT TRUCK TRANSMISSIONS

Description

Two-Speed

The two-speed transmission is a constant mesh counter shaft transmission that has two forward speeds and two reverse speeds. The transmission has four clutch assemblies (Forward 1, Range 1, Range 2, and Reverse 1) that are applied hydraulically and released by spring force. The transmission valve controls clutch pack operation with three independent solenoid valves. The control valve assembly is mounted directly on top of the transmission.

Three-Speed

The three-speed transmission is a constant mesh counter shaft transmission that has three forward and two reverse speeds. The transmission has five clutch assemblies (Forward 1, Forward 2, Range 1, Range 2, and Reverse 1) that are applied hydraulically and

CAUSE D - SUCTION SCREEN RESTRICTED OR CLOGGED.

PROCEDURE OR ACTION:

CAUTION

Excess contamination in oil will increase component wear. If excess debris is found in screen, an oil sample should be taken for further analysis of problem.

1. Remove transmission suction screen and inspect for contamination or debris.
   Does the suction screen contain excess debris?
   YES: Clean suction screen. Refer to appropriate **Powershift Transmission, Repair**, **Single Speed Powershift, Aluminum Transmission**, **Three-Speed Powershift Transmission Repair**, or **Two-Speed Powershift Transmission Repair** manual, depending on lift truck model.
   NO: Go to CAUSE E.

CAUSE E - AIR LEAK IN SUCTION SIDE OF CHARGE PUMP/CHARGE PUMP FAILURE.

PROCEDURE OR ACTION:

1. If equipped, remove the Main Hydraulic Pump. Remove and inspect charge pump and gasket. Refer to appropriate **Powershift Transmission, Repair**, **Single Speed Powershift, Aluminum Transmission**, **Three-Speed Powershift Transmission Repair**, or **Two-Speed Powershift Transmission Repair** manual, depending on lift truck model.
   Is charge pump or gasket worn or damaged?
   YES: Replace gasket and if necessary, replace charge pump. Refer to appropriate **Powershift Transmission, Repair**, **Single Speed Powershift, Aluminum Transmission**, **Three-Speed Powershift Transmission Repair**, or **Two-Speed Powershift Transmission Repair** manual, depending on lift truck model.
   NO: Go to CAUSE F for 1.0-5.5 Ton Lift Trucks. Go to CAUSE G for 6.0-7.0 Ton Lift Trucks.

CAUSE F - MISSING TRANSMISSION SUMP BAFFLE (1.0 - 5.5 TON LIFT TRUCKS ONLY).

PROCEDURE OR ACTION:

1. Verify that transmission sump baffle is present and properly secured. See Transmission Oil Flow to identify sump baffle.
   Is the transmission sump baffle missing or loose?
   YES: Remove transmission from lift truck and repair or replace sump baffle. Refer to appropriate **Powershift Transmission, Repair** or **Single Speed Powershift, Aluminum Transmission** manual, depending on lift truck model.
   NO: Go to CAUSE G.

Anti-Stall Feature

The manual valve incorporates an anti-stall feature for the lift, tilt, and auxiliary functions. The purpose of the anti-stall feature is to prevent the engine from stalling when deadheading a lift, tilt, and auxiliary function at engine idle.

For the 1.0-3.5 Ton Trucks, the anti-stall feature is achieved by an orifice in the lift, tilt, and auxiliary spools (refer to the Manual Control Valve Hydraulic Schematic). When the lift, tilt, and auxiliary function is deadheaded, a small amount of oil is allowed to bleed-off from the blocked open center passage downstream to the tank passage. This bleed-off oil effectively reduces the pressure rise rate or load demand on the engine, thereby allowing the engine to continue to run without stalling.

For the 4.0-7.0 Ton Trucks, an anti-stall valve is added to bleed off flow at low engine speed to reduce pressure increase or load demand on the engine. This allows the engine to continue running without stalling.

Relief Valves

Main Relief Valve

The Main Relief Valve (MRV) limits the maximum pressure of the lift function. If the lift function is actuated simultaneously with the tilt and/or auxiliary function, the maximum pressure of the lift function is limited by the secondary relief pressure setting.

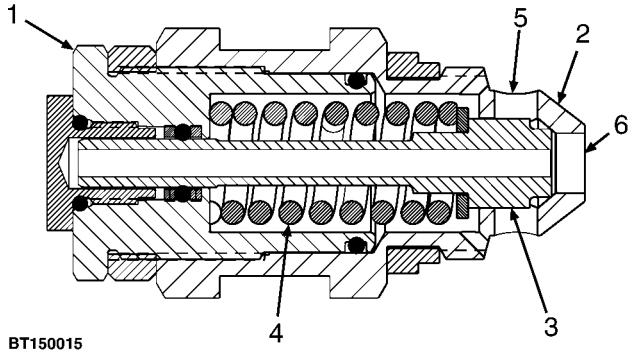
The MRV is a direct acting differential area type relief valve. The relief valve consists of a poppet on a seat with a spring and adjustment screw. See Figure 9050-10-16.

Typically the main relief valve would not require any field adjustment. If adjustment is necessary, refer to Main Relief Valve Test and Adjustment.

Secondary Relief Valve

NOTE: The secondary relief valve is the same one used in the electro-hydraulic control valve

The secondary relief valve limits the maximum pressure to the tilt and auxiliary functions. The valve is a direct acting differential area type relief valve. The relief valve consists of a poppet on a seat with a spring and adjustment screw. See Figure 9050-10-16. On occasions, the secondary relief valve may require pressure adjustment due to different types of attachments. If adjustment is necessary, refer to Secondary Relief Valve Test and Adjustment.



1. ADJUSTMENT SCREW
2. VALVE BODY
3. POPPET
4. SPRING
5. TO TANK
6. LOAD SENSE

Figure 9050-10-16. Relief Valve

CAUSE E - FAULTY MLCV FOR LOWERING FUNCTION ONLY.

PROCEDURE OR ACTION:

1. Check the lowering cycle times.
   Are the lowering cycle times too fast?
   YES: Repair or replace Mast Lowering Control Valve (MLCV). Depending on your lift truck, 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 or **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406.
   NO: Go to CAUSE F.

CAUSE F - UNLOADER VALVE PRODUCING TOO MUCH MARGIN PRESSURE.

PROCEDURE OR ACTION:

1. Test unloader valve.
   Is margin pressure too high?
   YES: Replace unloader valve spool spring. See **Main Control Valve** 2000YRM1137.
   NO: Perform operational check.

END SYMPTOM

Steering Wheel Turns By Itself or Does Not Return To Neutral

POSSIBLE CAUSE

A. STEERING RELIEF PRESSURE SET TOO LOW.
B. BINDING IN STEERING COLUMN OR NO RESISTANCE.
C. FAILED CENTERING SPRINGS IN SCU.
D. DEFLECTION OF SPOOL AND SLEEVE CAUSED BY HIGH SYSTEM PRESSURE.
E. STEERING CONTROL UNIT IS ASSEMBLED INCORRECTLY OR IS DAMAGED.

CAUSE A - STEERING RELIEF PRESSURE SET TOO LOW.

PROCEDURE OR ACTION:

1. Perform Operational Diagnostic Procedures, Operational Checkout, Page 9010-05-12.
   Is steering relief pressure set too low?
   YES: Adjust steering relief pressure. See Steering Relief Pressure Test and Adjustment.
   NO: Go to CAUSE B.

CAUSE B - BINDING IN STEERING COLUMN OR NO RESISTANCE.

PROCEDURE OR ACTION:

1. Turn steering wheel stop to stop with engine running at slow idle.
   Is linkage binding in steering column?
   YES: Inspect and repair steering column. See **Steering Axle** 1600YRM1133.
   NO: Go to CAUSE C.

CAUSE C - FAILED CENTERING SPRINGS IN SCU.

PROCEDURE OR ACTION:

1. Inspect SCU.
   Are the centering springs in good condition?
   YES: Springs are OK. Go to CAUSE D.
   NO: Replace centering springs. See **Main Control Valve** 2000YRM1137.

CAUSE D - DEFLECTION OF SPOOL AND SLEEVE CAUSED BY HIGH SYSTEM PRESSURE.

PROCEDURE OR ACTION:

1. Perform Steering Relief Pressure Test and Adjustment.
   Does steering relief pass check?
   YES: Go to CAUSE E.
   NO: Adjust relief pressure. See Steering Relief Pressure Test and Adjustment.

4. Remove the Lift EHPV coil from valve. Do not disconnect from harness.

WARNING

Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.

WARNING

Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing EHPV assembly.

CAUTION

Do not permit dirt or other contaminants to enter the hydraulic system. Disconnected hoses, tubes, open valves, cylinder fittings, and ports should be protected with clean caps or plugs.

5. Using EHPV removal/installation tool P/N 580057794 , remove tube assembly.

6. Remove lift poppet in valve housing bore using a magnetic rod.

CAUTION

Care should be taken to prevent overtightening of EHPV shutoff plug. Overtightening of shutoff plug may result in permanent damage to corresponding valve seat.

7. Install lift EHPV shutoff plug P/N 580057774 and tighten to 24.4 ±2 N•m (18 ±1.5 lbf ft).

8. Tighten jam-nut on EHPV shutoff plug assembly to 10.9 ±1.4 N•m (8 ±1 lbf ft).

9. Start engine.

NOTE: Actuating the MLM or joystick will not allow the carriage to be raised.

10. Operate the hydraulic system until the oil temperature is at test specifications. See Hydraulic Warm-Up Procedure.

11. Tilt the mast back and hold lever over relief with engine at high idle.

12. Measure drift rate of upward carriage travel and compare to test specifications.

    • If upward drift rate is within test specifications, replace lift poppet. See **Main Control Valve** 2000YRM1137.

    • If upward drift rate exceeds test specifications, replace valve section. See **Main Control Valve** 2000YRM1137.

13. Lower forks to ground and stop engine. Turn truck power **OFF** and apply park brake. Remove test shutoff plug. Reinstall lift poppet and tube assembly. Tighten tube assembly to 100 ±5.4 N•m (74 ±4 lbf ft).

14. Install lift EHPV coil. Tighten retaining nut to 2.26 N•m (20 lbf in).

NOTE: The following steps are for checking the **Lower EHPV** assembly.

15. Lower forks to ground and stop engine. Turn truck power **OFF** and apply park brake.

NOTE: Lower EHPV coil electrical connector must be connected to harness to avoid generating a Diagnostic Trouble Code (DTC) and disabling the hydraulic system.

16. Remove the Lower EHPV coil from valve. Do not disconnect from harness.

WARNING

Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.

WARNING

Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing EHPV assembly.

CAUTION

Do not permit dirt or other contaminants to enter the hydraulic system. Disconnected hoses, tubes, open valves, cylinder fittings, and ports should be protected with clean caps or plugs.

E-Hydraulic System Interface

GENERAL DESCRIPTION

The Electro-Hydraulic (E-Hydraulic) system of the 1.0-9.0 ton series lift trucks controls hydraulic operation of the mast lift/lower, tilt, and auxiliary functions. This E-Hydraulic option replaces the manual control levers with simple, single-handed integrated electronic controls, either a joystick or a finger-operated lever module, located on the right-hand armrest. The E-Hydraulic system is controlled by the VSM that provides drive commands to the hydraulic valves based on the operator inputs. This system automatically adjusts the flow control based on conditions such as engine speed, load, and functions activated, etc., to provide better ergonomics, controllability, and flexibility. The VSM also monitors the performance of the system and reports faults to the operator via the DSC.

SYSTEM COMPONENTS

The E-Hydraulic operator input device can be a Joystick or Mini-Lever Module (MLM), depending on lift truck configuration or option. Either device, as installed on the right-hand armrest, provides the operator with the controls necessary to operate the E-Hydraulics.

For the E-Hydraulic system to operate, certain conditions must exist. Mini-levers must be both mechanically and electronically in neutral position at power **ON**. If equipped, the raisable armrest must be locked down. The armrest latch release is located on the outboard of the armrest. The armrest also has a release handle at the aft outboard end that allows the armrest to be moved fore and aft in relation to the seat position.

The joystick or MLM commands are sent to the VSM via the CANbus. The VSM supplies proportional commands to drive the electro-hydraulic valves. The VSM monitors the input and output signals, armrest position, engine parameters, and hydraulic response, and adjusts the system performance as required. Faults or interlock conflicts are detected by the VSM which sends the error messages (fault codes) to the display for operator awareness and correction.

E-HYDRAULIC CONTROL INPUT DEVICE

The E-Hydraulic control input device is offered in two options: Joystick (Multi-Function Control Handle) or Mini-Lever Module (MLM). The Joystick is a two-axis lever with two proportional rollers and one momentary switch. In addition, a toggle switch may be incorporated to provide dual-function selection. The MLM consists of up to four individual proportional levers and may have additional toggle and momentary switches.

Joystick

The E-Hydraulic joystick is a two-axis joystick (forward-back and left-right) with two proportional rollers, and one push-button switch. The joystick may be operated in any combination of the four quadrants bounded by these axes. With a joystick, the system can be configured for 3 or 4 electro-hydraulic functions. The operator controls for the E-Hydraulics system on the 1.0-8.0 ton series lift truck are shown in the figure that follows. See Figure 9060-10-14.

CAUSE D - CARRIAGE BINDING IN INNER MAST

PROCEDURE OR ACTION:

1. Observe carriage travels to the end of free lift cylinder stroke.
   Does the carriage go to end of free lift cylinder stroke?
   YES: Go to CAUSE E.
   NO: Shim carriage rollers. 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 E - CARRIAGE CONTACTS STOP AT TOP OF INNER MAST

PROCEDURE OR ACTION:

1. Inspect free lift 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.
   Can lift chains be adjusted?
   YES: Adjust chains.
   NO: Replace free lift 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.

END SYMPTOM

Table 9080-60-3. Special Tools (Continued)

Description	Part Number	1.0-2.0 Ton	2.0-3.5 Ton	4.0-5.5 Ton	6.0-7.0 Ton	8.0-9.0 Ton
Wet Brake Axle Service Tool T3 Hub Seal Pneumatic	580086530			X		
Wet Brake Axle Service Tool T4 Pinion Preload Nut	580074303			X		
Wet Brake Axle Service Tool T5 Pinion Bearing Cup	580074304			X		
Wet Brake Axle Service Tool T6 Pinion Gauge Block	580074305			X		
Wet Brake Axle Service Tool T7 Pinion Seal	580074306			X		
Wet Brake Axle Service Tool T8 Differential Nut	580074307			X		
Wet Brake Axle Service Tool T9 Differential Nut Seal	580074308			X		
Service Tool T3 - Differential Nut	580082460				X	
Service Tool T4 - Differential Seal	580082461				X	
Service Tool T5 - Pinion Wrench	580082462				X	
Service Tool T6 - Pinion Bearing Cup	580082463				X	
Service Tool T7 - Pinion Bearing Inspection	580082464				X	
Service Tool T8 - Pinion Seal	580082465				X	
Service Tool T9 - Pneumatic Hub Bearing Cup	580082466				X	
Service Tool T10 - Pneumatic Hub Seal	580082467				X	
Service Tool - Handle	580082468			X	X	
Yanmar 2.6L Fuel Injection Pump Timing Tool	580064716	X	X			
Yanmar 2.6L Valve Spring Compressor	580064717	X	X			
Yanmar 2.6L Flex Hone	580064718	X	X			
Yanmar 2.6L Flex Horn	580062800	X	X			
Yanmar 2.6L Piston Ring Compressor	580064719	X	X			
Yanmar 2.6L Compressor Test Adaptor	580064720	X	X			

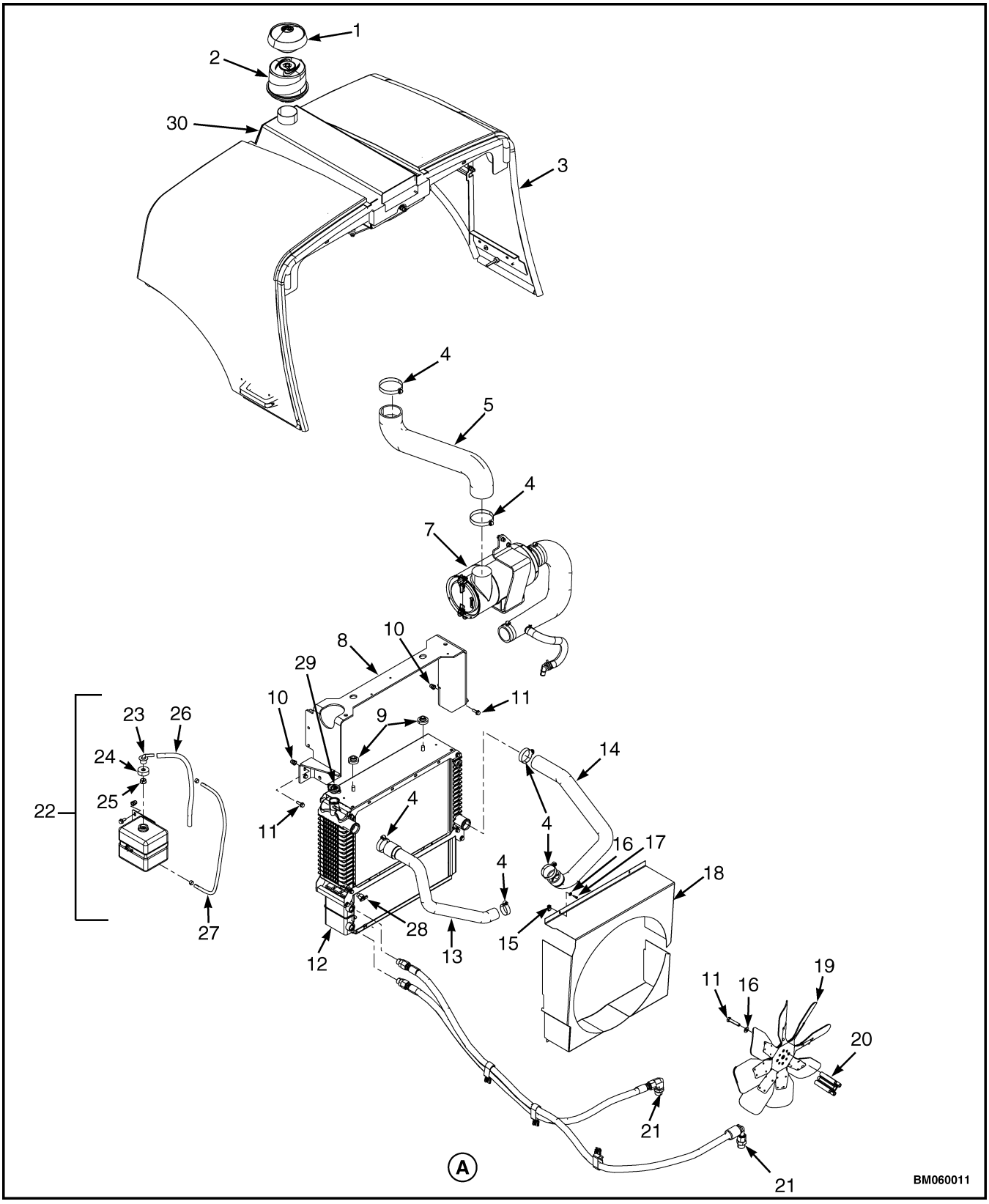
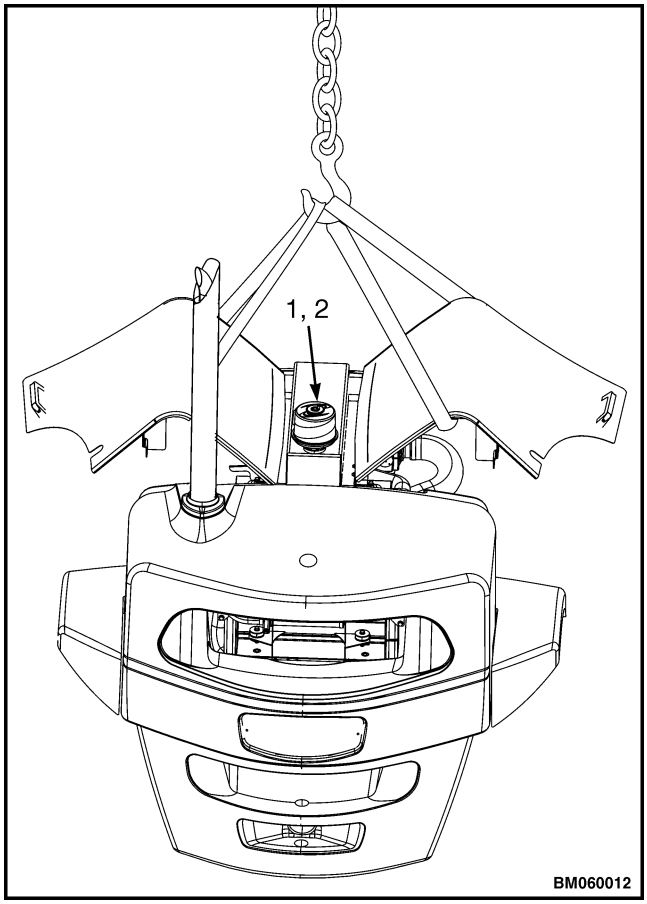


Figure 25. Cooling System for Lift Truck Models GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878) (Sheet 1 of 3)



1. PRE-CLEANER
2. STRAP CLAMP

Figure 12. Hood Assembly Removal

14. Place a radiator guard shield between radiator and fan so damage to radiator does not occur during fan removal.

NOTE: Perform Step 15 for lift truck models GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878).

15. Remove capscrews, washers, fan, fan spacer, and shroud. See Figure 25.

16. Remove capscrews, washer, fan, fan spacers, and fan shroud.

See Figure 13 for lift truck models below equipped with Cummins QSB 3.3L diesel engine

- GDP80VX, GDP80VX9, GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (A909, B909)

See Figure 14 for lift truck models below equipped with GM 5.7L LPG engine

- GLP80VX, GLP80VX9, GLP90VX (GLP170VX, GLP175VX36, GLP190VX) (A909 B909)

See Figure 15 for lift truck models equipped with Kubota 3.8L Diesel engine

- GDP80VX, GDP80VX9, GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (B909)

17. Remove radiator guard shield.

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.

18. Let coolant cool to ambient temperature. Place a drain pan with a capacity equal to or greater than the capacity of the cooling system under the radiator. Remove radiator cap.

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 is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.
2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.
3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

INSPECT

1. Inspect for loose, burned, missing, cracked or damaged hardware.
2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion or marred finish.

NOTE: If the spindle, bearings or tie rods need to be repaired, go to Spindles, Bearings, and Tie Rods Repair.

ASSEMBLE

NOTE: For specified lubricant to use, refer to one of the following sections:

Periodic Maintenance 8000 YRM 1150 for lift truck models
- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)

Periodic Maintenance 8000 YRM 1207 for lift truck models
- GC/GLC030-035VX, GC/GLC040SVX (C809)
- GLP/GDP16-18VX, GLP/GDP20SVX (GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX) (C810)

Periodic Maintenance 8000 YRM 1248 for lift truck models
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818)
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813)

Periodic Maintenance 8000 YRM 1558 for lift truck models
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)

Periodic Maintenance 8000 YRM 1604 for lift truck models
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (J813)

Periodic Maintenance 8000 YRM 1319 for lift truck models
- GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879)

Periodic Maintenance 8000 YRM 1571 for lift truck models
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E879)

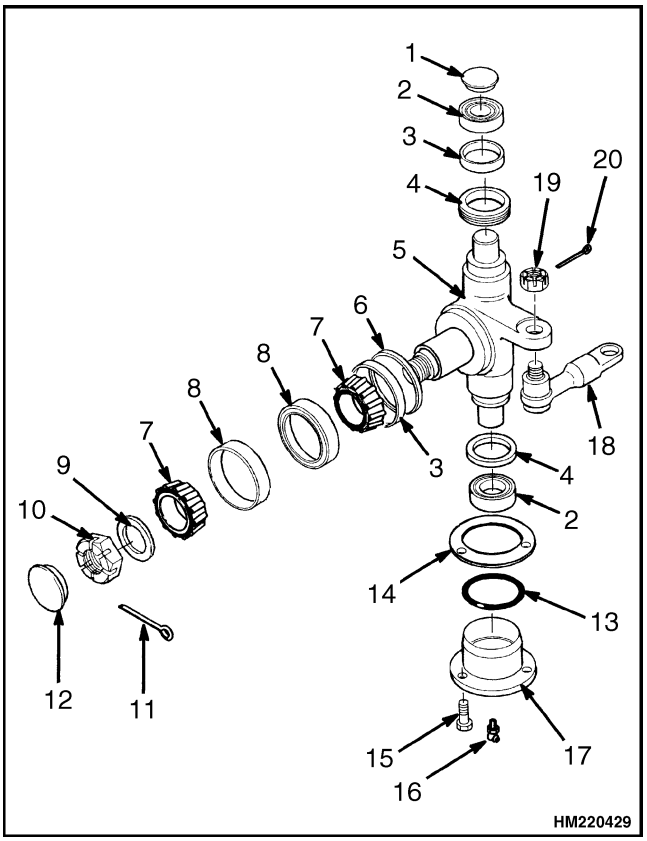
Periodic Maintenance 8000 YRM 1606 for lift truck models
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879)

Periodic Maintenance 8000 YRM 1322 for lift truck models
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878)

Periodic Maintenance 8000 YRM 1407 for lift truck model
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP170VX36, GLP/GDP190VX) (A909)

Periodic Maintenance 8000 YRM 1586 for lift truck model
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (B909)

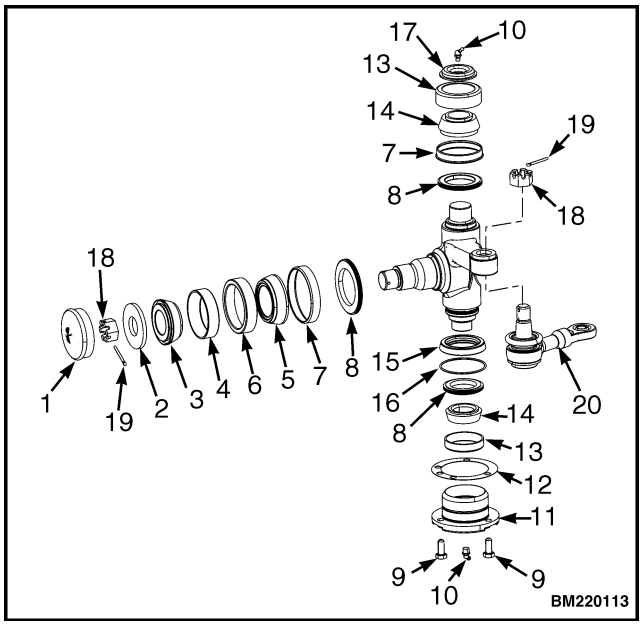
Periodic Maintenance 8000 YRM 1583 for lift truck model
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (E878)



NOTE: THE LUBRICATION FITTING NEEDS TO BE ORIENTED TOWARDS THE CENTERLINE OF THE LIFT TRUCK.

1. GREASE CAP
2. BEARING ASSEMBLY
3. WEAR SLEEVE
4. SEAL
5. SPINDLE
6. OIL SEAL
7. BEARING CONE
8. BEARING CUP
9. WASHER
10. CASTLE NUT
11. COTTER PIN
12. HUB CAP
13. O-RING
14. SHIMS (AS REQUIRED)
15. CAPSCREW AND LOCKWASHER ASSEMBLY
16. LUBRICATION FITTING
17. BEARING CAP
18. TIE ROD
19. CASTLE NUT
20. COTTER PIN

Figure 19. Spindle Assembly for Lift Truck Models GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)



NOTE: THE LUBRICATION FITTING NEEDS TO BE ORIENTED 45° TO CENTERLINE AND REAR OF LIFT TRUCK.

1. HUB CAP
2. WASHER
3. BEARING CONE (OUTER)
4. BEARING CUP (OUTER)
5. BEARING CONE (INNER)
6. BEARING CUP (INNER)
7. WEAR SLEEVE
8. OIL SEAL
9. CAPSCREW
10. LUBE FITTING
11. CAP ASSEMBLY
12. SHIM
13. BEARING CUP
14. BEARING CONE
15. SEAL
16. O-RING
17. CAP
18. CASTLE NUT
19. COTTER PIN
20. TIE ROD

Figure 20. Spindle Assembly for Lift Truck Models GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)

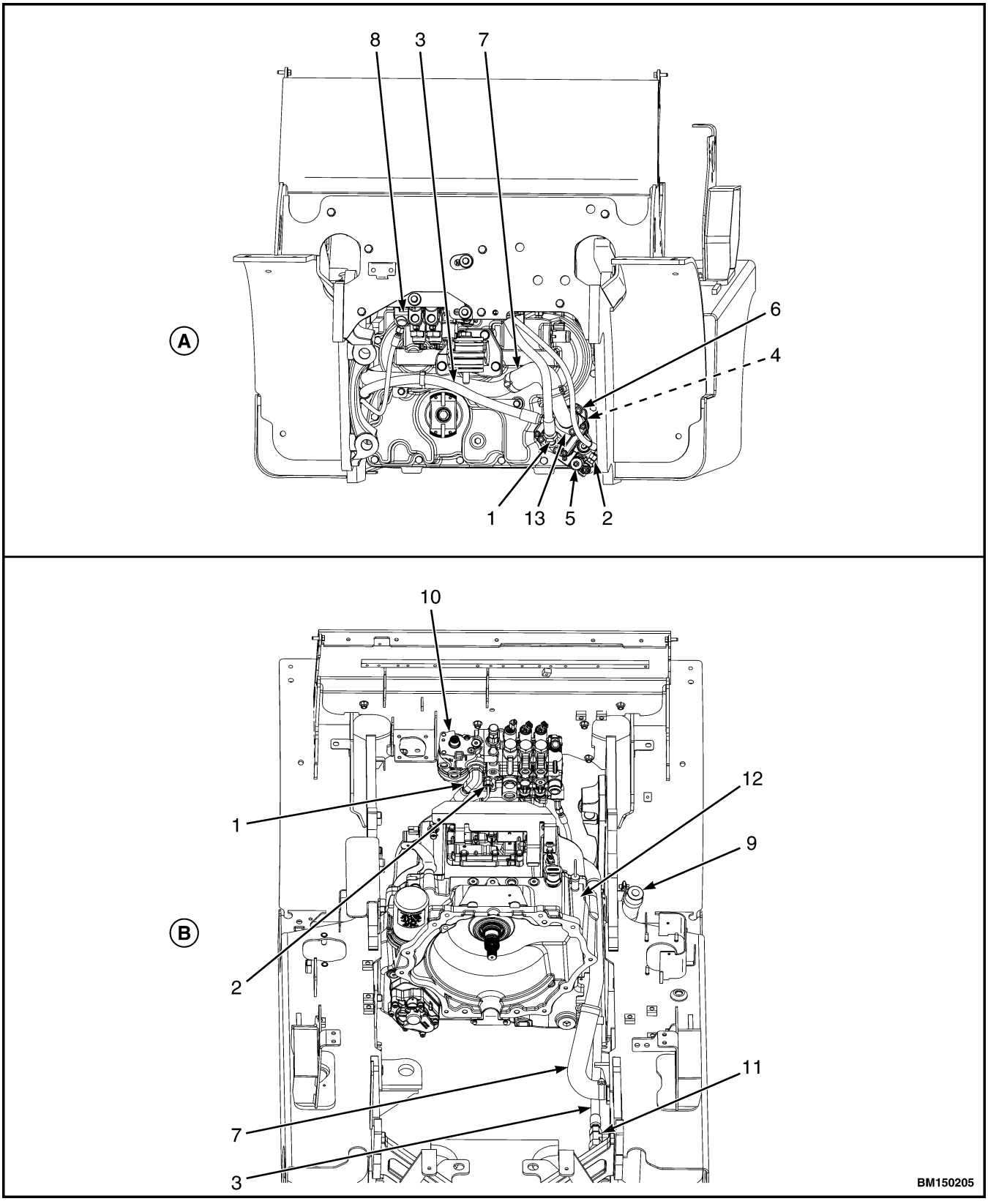


Figure 19. Variable Displacement Pump Arrangement, Lift Truck Models GLP/GDP20-35VX (B875) With 2-Speed Transmission

Table 3. Hydraulic Gear Pumps for Lift Truck Model GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)

Model	Engine	Displacement	Governed Speed	Main Relief Valve Pressure - Mpa (PSI)	Pump Flow Rate - LPM (GPM)
GLC40VX (GC/GLC080VX, GC/GLC080VXBCS) (E818, F818)	GM 4.3L	32.5 cc/rev	2400 rpm	22.06 MPa (3200 psi)	75.9 liter/min (20.1 gal/min)
		41.3 cc/rev			96.5 liter/min (25.5 gal/min)
GLC45, 55VX; GLC55SVX; (GC/GLC100, 120VX; GC/GLC100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)					96.5 liter/min (25.5 gal/min)
		51.6 cc/rev			120.5 liter/min (31.8 gal/min)

8. Remove the two SCU mounting capscrews and move the SCU approximately 1.3 cm (0.5 in.) to the left, and lower the SCU until the steering shaft is disengaged. Remove the SCU from the lift truck.

See Figure 2 and Figure 6 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)
- 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)

See Figure 3 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)

See Figure 4 for lift truck models

- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (D879, E879)
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (D878, E878)

See Figure 5 for the following lift truck models

- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

See Figure 7 for the following lift truck models

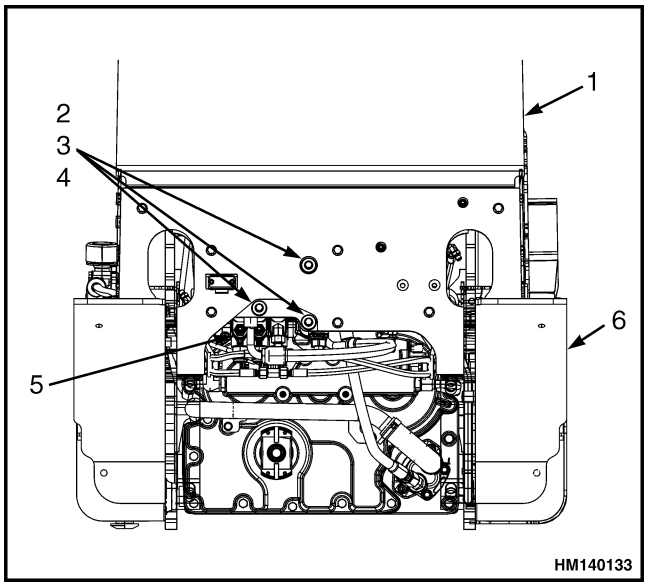
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813)

9. Remove and discard two O-rings located between the control valve and the SCU.

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.

10. Support the main control valve. Remove three mounting capscrews, washers, inserts, and the main control valve from the lift truck. See Figure 11.



1. COWL
2. INSERT
3. WASHER
4. MOUNTING CAPSCREW
5. MAIN CONTROL VALVE
6. FRAME

Figure 11. Main Control Valve Removal

7. Remove the two SCU mounting capscrews, and move the SCU approximately 1.3 cm (0.5 in.) to the left. Lower the SCU until the steering shaft is disengaged. Remove the SCU from the lift truck.

See Figure 31 for lift truck models without OPS

- 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)

See Figure 32 for lift truck models without OPS

- 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)

See Figure 33

- For lift truck models with OPS.

8. Remove and discard two O-rings from the main control valve. For lift truck models equipped with manual control valve, with or without OPS, the two O-rings are located between the SCU and control valve.

9. For lift truck models equipped with manual control valve with OPS, disconnect solenoid assemblies from cowl wire harness.

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.

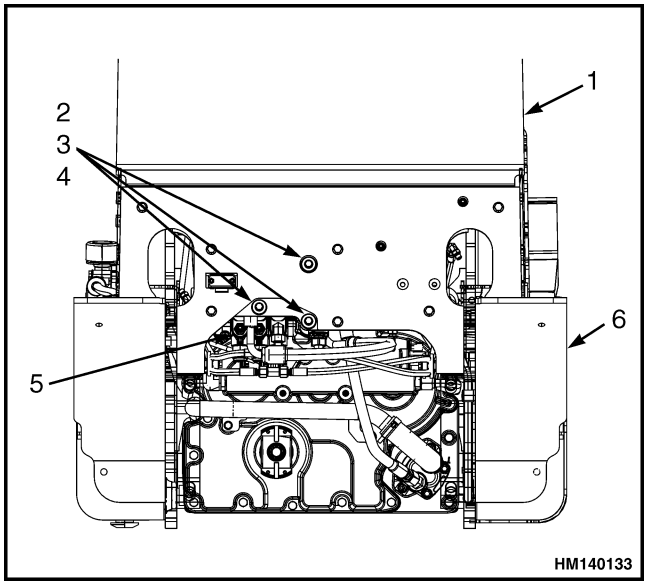
10. Support the main control valve. Remove three mounting capscrews, washers, inserts and the manual control valve from the lift truck.

See Figure 41

- For lift truck models without OPS.

See Figure 42

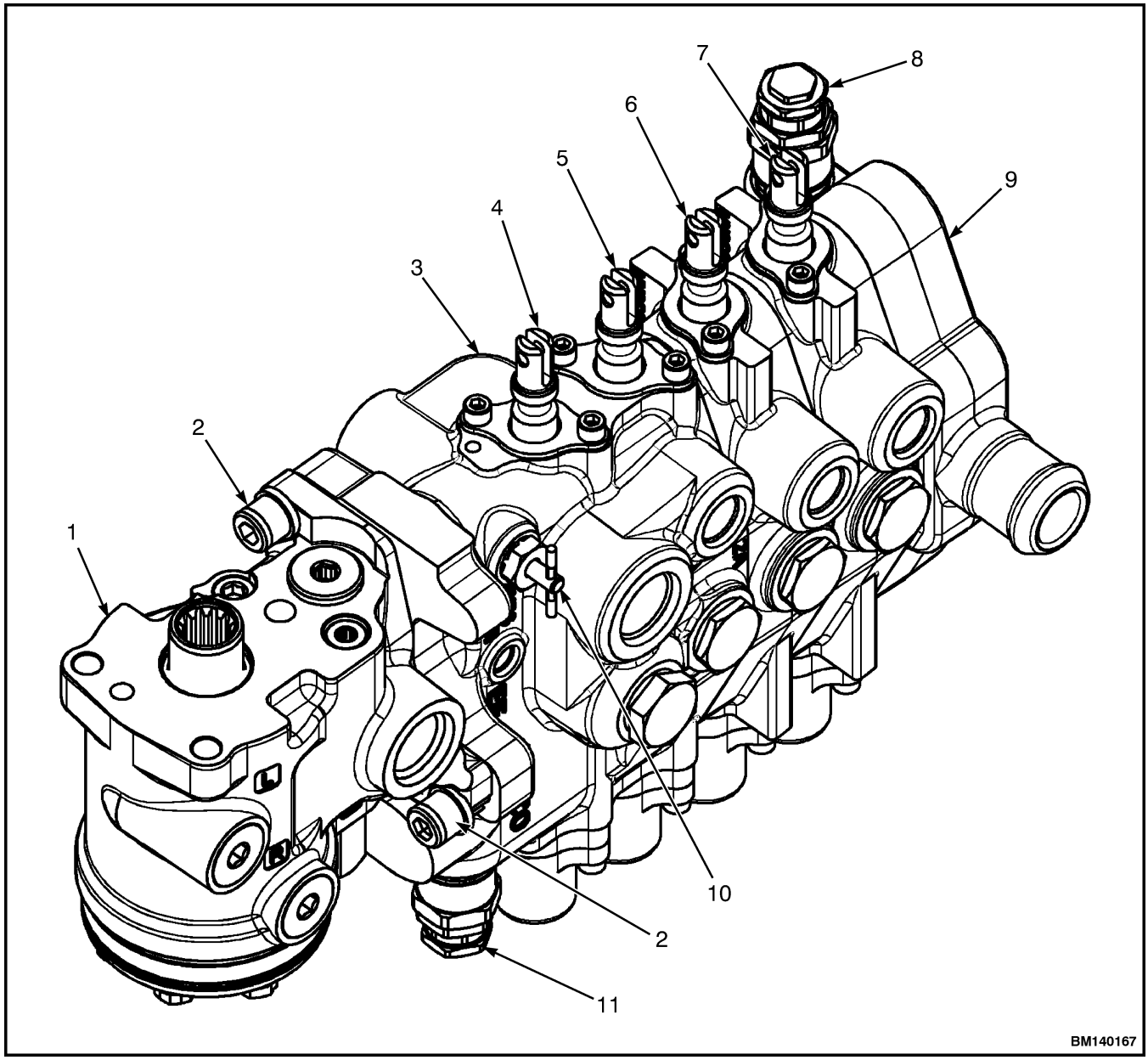
- For lift truck models with OPS.



1. COWL
2. INSERT
3. WASHER
4. CAPSCREW
5. MAIN CONTROL VALVE
6. FRAME

Figure 41. Manual Main Control Valve Without OPS Removal

TABLE OF CONTENTS (Continued)



NOTE: FOUR-FUNCTION MAIN CONTROL VALVE SHOWN.

1. STEERING CONTROL UNIT (SCU)
2. SCU MOUNTING CAPSCREW
3. MONOBLOCK VALVE SECTION
4. LIFT/LOWER SPOOL
5. TILT SPOOL
6. AUXILIARY I VALVE SECTION/SPOOL
7. AUXILIARY II VALVE SECTION/SPOOL
8. SECONDARY RELIEF VALVE
9. OUTLET SECTION
10. MANUAL LOWERING VALVE
11. PRIMARY RELIEF VALVE

Figure 33. Manual Main Control Valve With OPS

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Yale® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **YALE ® APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

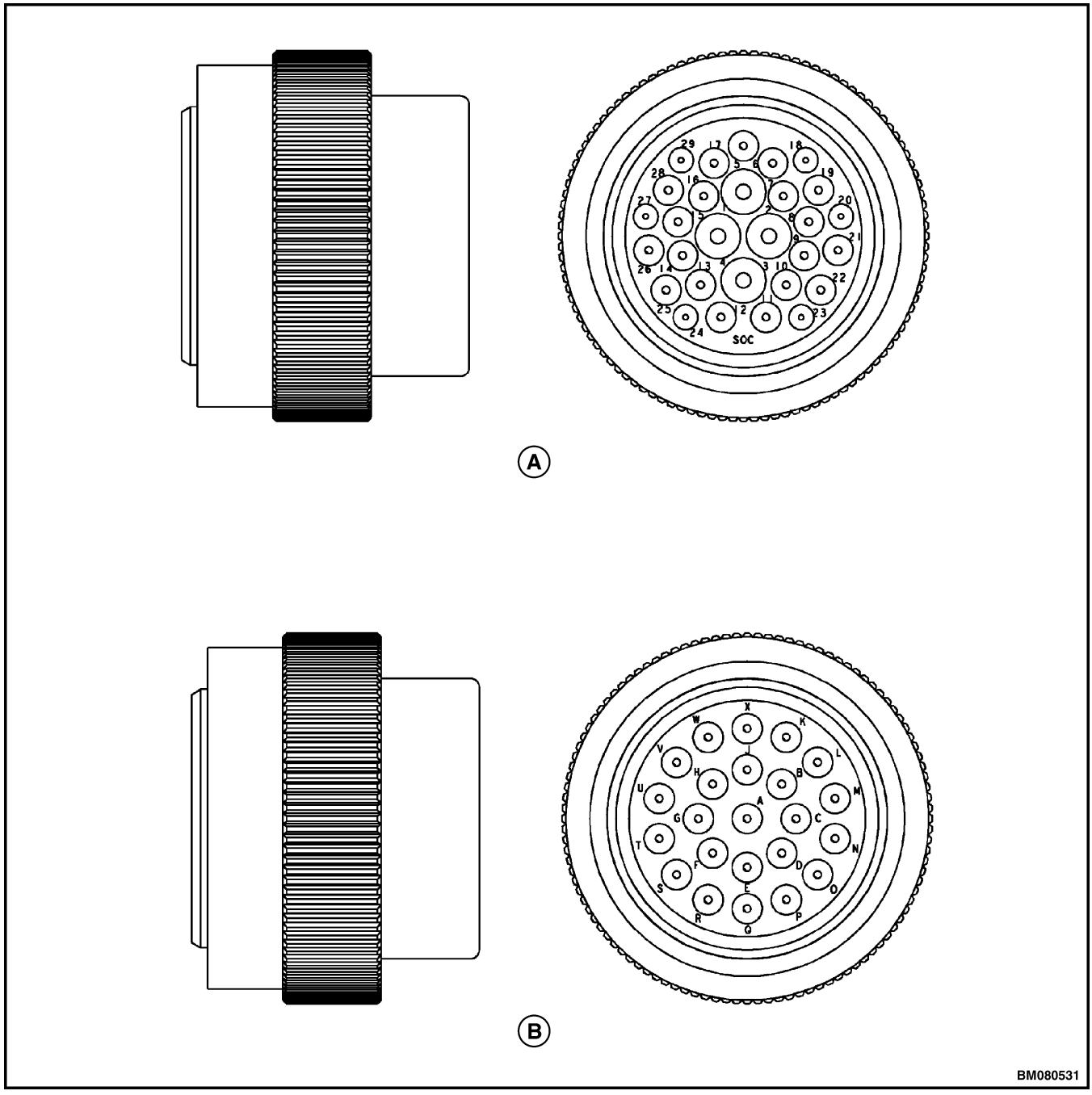
WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the WARNING symbol and word are on orange background. The CAUTION symbol and word are on yellow background.

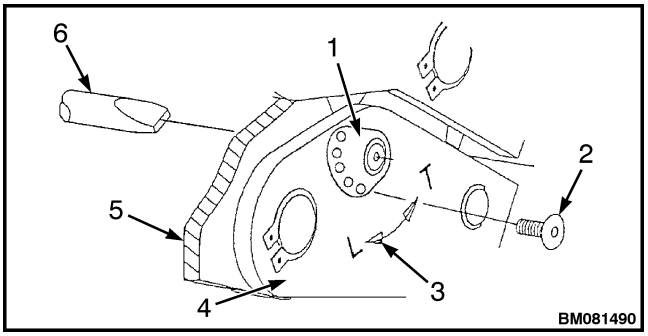


A. TYPE 1 B. TYPE 2

Figure 24. HD Connector Plugs

Crimp Height Adjustment

1. Remove lockscrew from ratchet adjustment wheel. See Figure 55.



1. RATCHET ADJUSTMENT WHEEL
2. LOCKSCREW
3. LOOSEN-TIGHTEN
4. BACK OF TOOL
5. FRONT OF TOOL
6. SCREWDRIVER

Figure 55. Ratchet Wheel Adjustment

2. Using a screwdriver, adjust ratchet wheel from front of tool. See Figure 55.

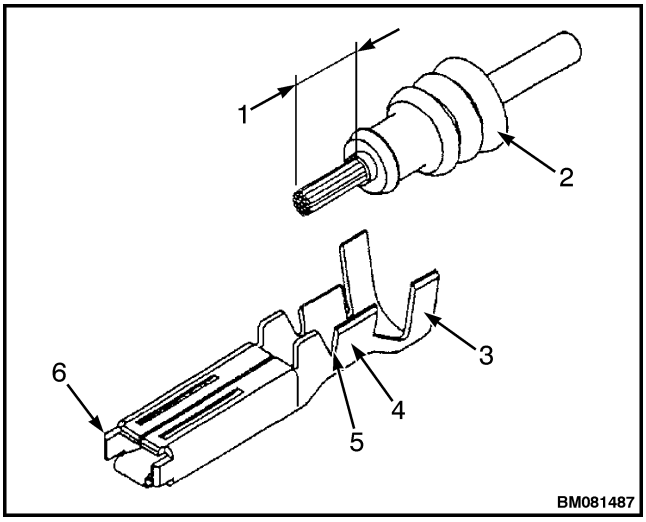
3. To tighten crimp, rotate ratchet adjustment wheel **COUNTERCLOCKWISE**. See Figure 55.

4. To loosen crimp, rotate ratchet adjustment wheel **CLOCKWISE**. See Figure 55.

5. Make a sample crimp and measure crimp height. If crimp height is acceptable, replace and tighten lockscrew. If crimp height is unacceptable, follow Step 3 or Step 4 until acceptable crimp height is achieved.

HOW TO USE AMP HAND APPLICATION TOOL

1. Strip insulation from wire. See Figure 56 and Table 9.



1. WIRE STRIP LENGTH
2. WIRE SEAL
3. INSULATION BARREL
4. WIRE BARREL
5. WIRE STOP SLOT
6. MATING END

Figure 56. Wire and Receptacle

Table 9. Wire Strip Lengths

Wire Size (AWG)	Insulation Diameter	Strip Length
20-16	1.7 to 2.4 mm (0.07 to 0.09 in.)	3.0 to 3.5 mm (0.12 to 0.13 in.)
22-20	1.7 to 2.4 mm (0.07 to 0.09 in.)	3.0 to 3.5 mm (0.12 to 0.13 in.)

2. Hold tool so **BACK** (wire side) faces you.

3. Release tool handles by squeezing them together then allowing them to open fully.

NOTE: Insert contact with open side of insulation and wire barrel toward movable crimping jaw.

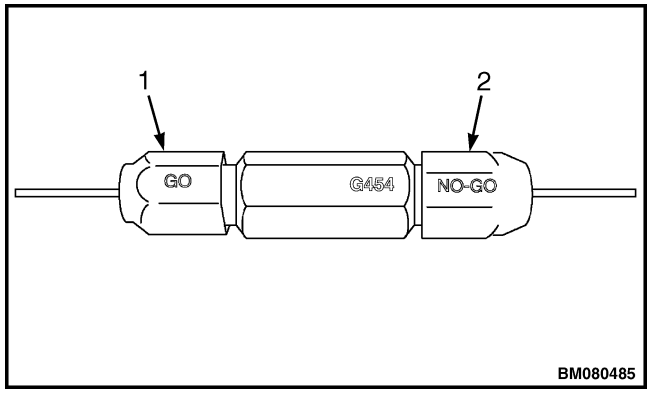
4. Holding contact by insulation barrel, insert it through back of tool into appropriate crimp section, receptacle/tab end first.

NOTE: Ensure both sides of insulation barrel are started evenly into the crimper jaws. DO NOT attempt to crimp improperly positioned contacts.

10. If any of the conditions in Step 9 are not met, discard the contact, re-cut and strip the wire, and start the crimping process over.

CALIBRATION TEST FOR THE DEUTSCH CRIMPING TOOL

The G454 testing tool is needed for the following procedures. The G454 testing tool is for use with the Deutsch hand crimping tool only. See Figure 9.

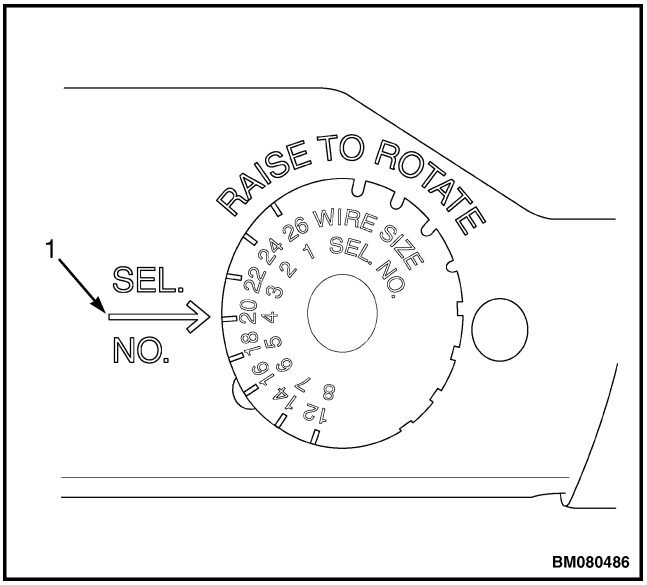


1. GO END (GREEN)
2. NO-GO END (RED)

Figure 9. G454 Testing Tool

NOTE: Testing for all wire sizes should be #20 wire size, selector number 4. This ensures proper calibration for all settings and further testing is not needed for the other selections.

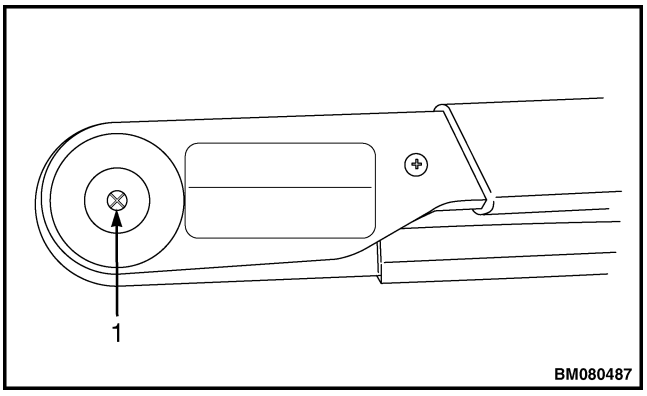
1. Set the Deutsch hand crimp tool to #20 wire size, selector number 4. See Figure 10.



1. SELECTOR SET AT #20 WIRE SIZE, SELECTOR NUMBER 4

Figure 10. Selector Test Setting

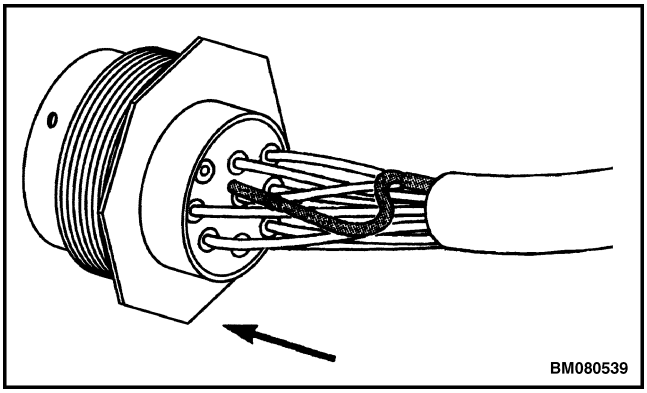
2. Squeeze the handles of the crimp tool completely together. See Figure 11.



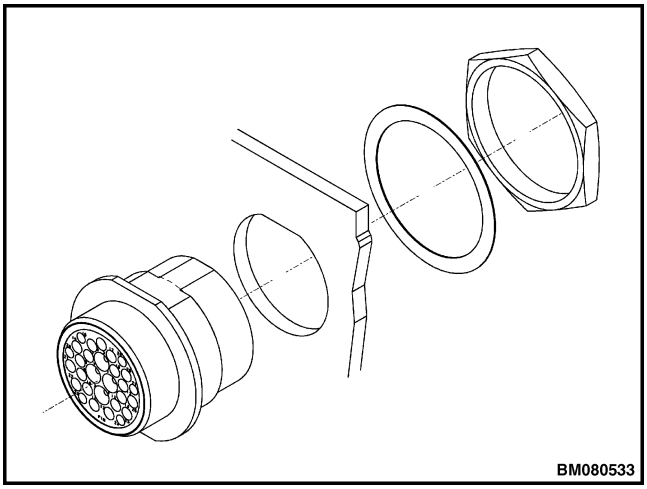
1. INSERTION POINT

Figure 11. Insertion Point

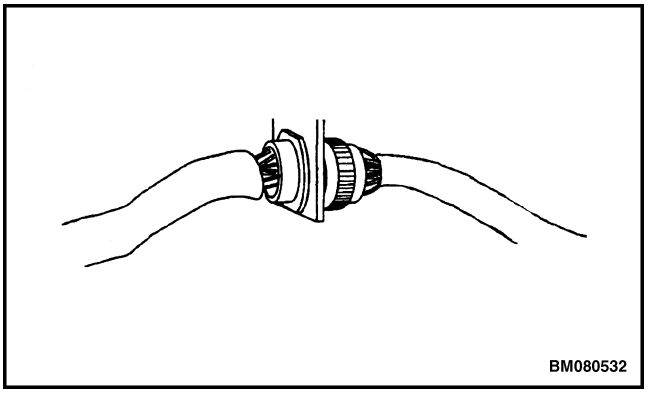
STEP 10.
Insert the wires into the back of the new connector receptacle according to the number or letter on the tag and connector receptacle. Push the wire straight into the back of the receptacle until a click is felt. Slightly tug each wire to verify the wire is properly locked in place. Remove tags.

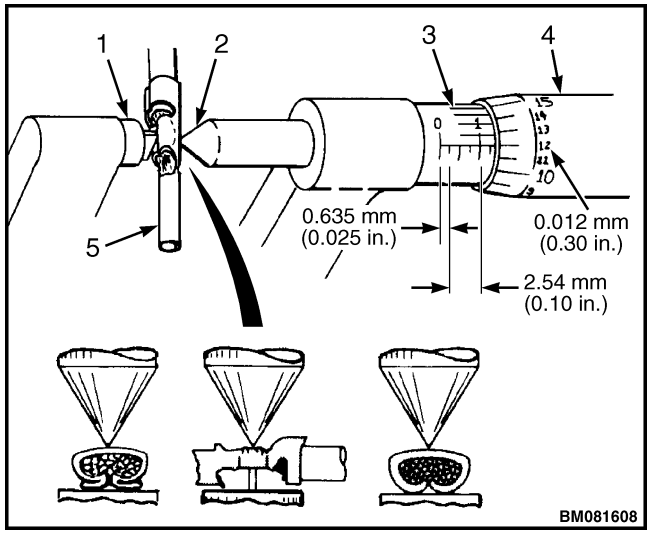


STEP 11.
Install receptacle into mounting structure. Install the lock nut and washer to retain the receptacle to the mounting structure.



STEP 12.
Connect the connector plug to the connector receptacle.





NOTE: SAMPLE READING SHOWN IN ILLUSTRATION EQUALS 3.489 mm (0.1374 in.).

1. ANVIL
2. SPINDLE
3. STATIONARY HANDLE
4. MOVABLE HANDLE
5. TYPICAL CONTACT

Figure 66. Modified Micrometer

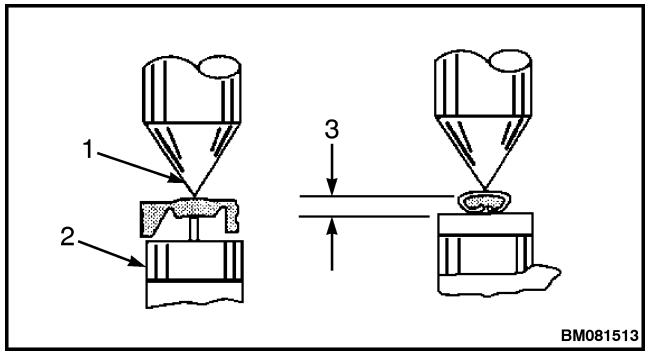
2. Use Table 11 to select **maximum** size wire for each crimping chamber.

Table 11. Wire Size and Crimp Height

Crimp Chamber	Wire Size (AWG)	Crimp Height
A	18-20	1.27 ±0.076 mm (0.05 ±0.003 in.)
B	14-16	1.65 ±0.076 mm (0.065 ±0.003 in.)

3. Crimp receptacle onto selected wire according to How to Use AMP Double Action Hand Tool procedure.

4. Using modified micrometer, measure wire barrel crimp height as shown in Figure 67. If crimp height matches measurement in Table 11, the tool is considered dimensionally correct. If not, follow manufacturers' replacement and repair procedure.



1. POSITION POINT ON CENTER OF WIRE BARREL OPPOSITE SEAM
2. MODIFIED ANVIL
3. CRIMP HEIGHT (SEE TABLE 11)

Figure 67. Crimp Height

Certi-Crimp Ratchet Inspection

The ratchet on this tool should be checked to ensure it does not release prematurely, allowing jaws to open before they have fully bottomed. Use a 0.025 mm (0.001 in.) shim suitable for checking clearance between bottoming surfaces of crimping jaws.

1. Select receptacle and **maximum** size wire for tool.

2. Position receptacle and wire between jaws as shown in Figure 68.

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.

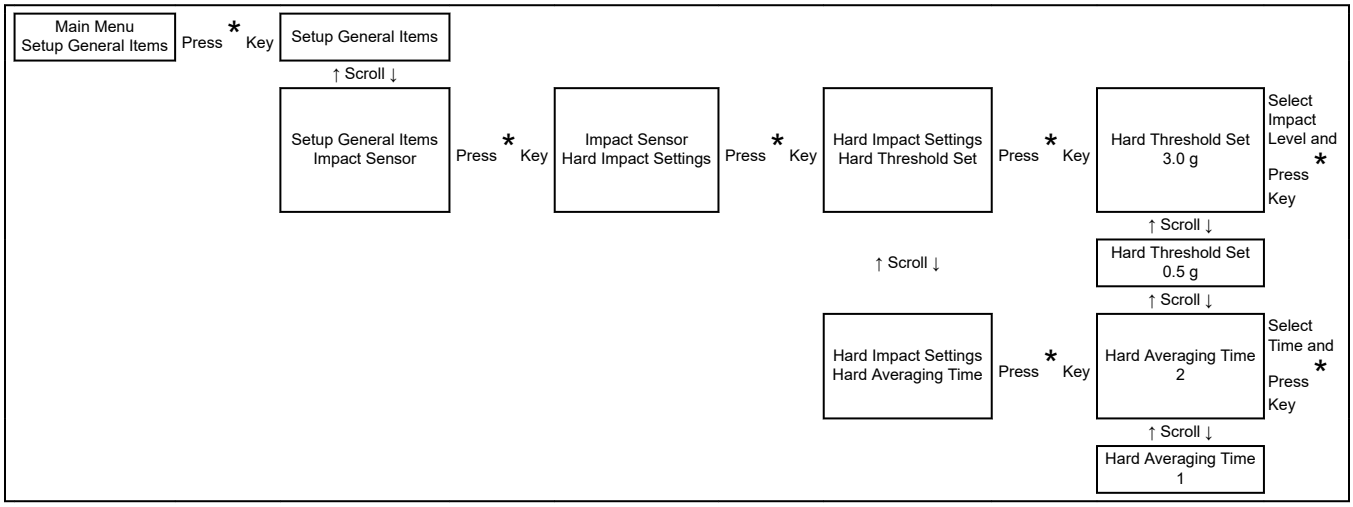
If your lift truck is configured for optional impact sensor, this function allows the supervisor to set the impact level and averaging time for soft (minor) impacts. See Table 34 for the recommended impact sensor settings by truck capacity and tire type.

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 changes, scroll to the Exit Options menu and choose the appropriate action.

Table 32. Hard Impact Settings Menu



ADJUST IMPACT SENSOR SETTINGS

The supervisor can enable the impact sensor and set and adjust the impact levels and averaging times.

The information in Table 34 is the recommended starting values for impact sensor settings based on lift truck capacity and tire type. In Table 33 and Table 34, the figures in the **Soft Threshold** and **Hard Threshold** columns represent: (see Figure 2)The figures in the **Soft Averaging** and **Hard Averaging** columns represent the amount of time the selected deceleration rate of gravity (soft or hard threshold) must be sustained in order for an impact to be recorded.

- Deceleration during impact at the rate of gravity (g) = 32ft/sec^2 or 9.8m/sec^2

Table 33. Impact Sensor Default Settings

Soft Threshold	Soft Averaging	Hard Threshold	Hard Averaging
0.5 g	7	0.8 g	1

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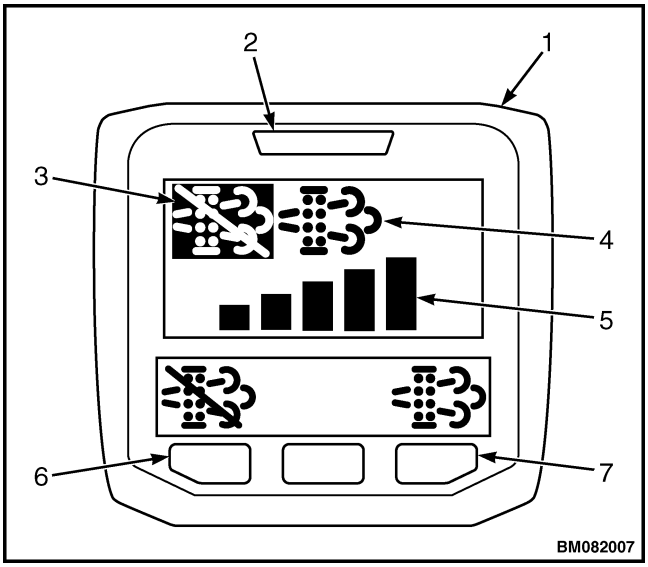
Diesel Particulate Filter (DPF) Display

Lift truck models GLC/GDP60-70VX (GP/GLP/GDP135-155VX) (E878), GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909) and GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080-120VX) (J813, K813) may be equipped with the Kubota 3.8L Diesel engines. If lift truck has this engine, the lift truck may also be equipped with an operator's display for the DPF mounted to the overhead guard in the upper right hand corner.

See Figure 4.



1. DPF DISPLAY
2. LED INDICATOR
3. AUTO/ACTIVE REGENERATION INHIBIT ICON
4. PARKED REGENERATION AVAILABLE ICON
5. SOOT LEVEL METER
6. AUTO/ACTIVE REGENERATION INHIBIT ON/OFF BUTTON
7. PARKED REGENERATION INITIATE BUTTON

Figure 4. DPF Display

GENERAL DESCRIPTION

The DPF Display will illuminate the appropriate icon(s) according to regeneration level that the lift truck is operating at:

- Passive Regeneration Only (Regeneration Level 0)
- Active Regeneration Inhibited (Regeneration Level 1)
- Auto/Active Regeneration (Regeneration Level 1)
- Parked Regeneration Request Level (Regeneration Level 2)
- Warning Request Level (Regeneration Level 3)
- Service Request Level (Regeneration Level 4)

PASSIVE REGENERATION ONLY

Regeneration Level 0

1. Soot Meter is blank to show DPF soot level is empty. See Figure 5.

2. Empty Soot Meter will also flash if no soot level data is available from ECU. See Figure 5.

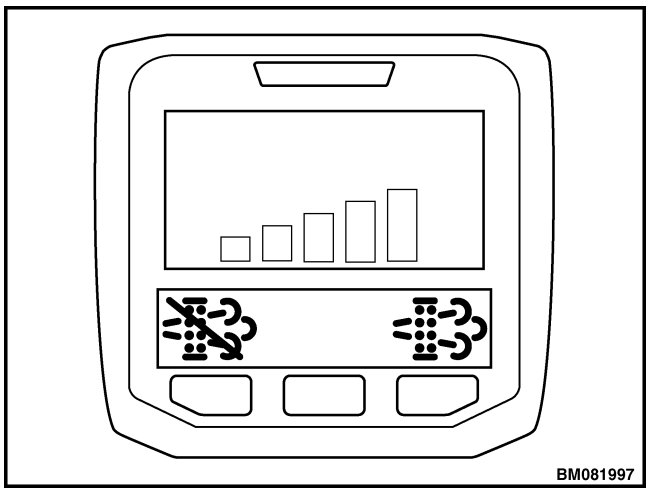


Figure 5. Empty Soot Meter

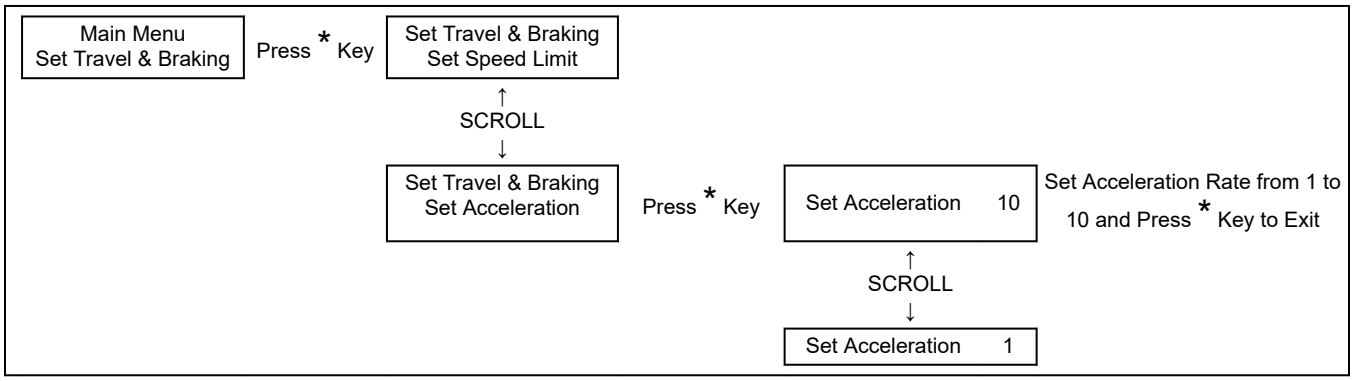
3. Soot Meter bars fill with increasing soot load. This is an estimate based on multiple ECU parameters. See Figure 6.

ACCELERATION RATE

If the lift truck is configured for optional Techtronix 100X, Techtronix 200X, Techtronix 332, or Techtronix 332 ASH transmissions, this function can be used to adjust the travel rate of acceleration. The rate of acceleration can be adjusted using a scale of 1 to 10. Using a setting of 10 will result in the fastest rate of acceleration. Using a number lower than 10 will result in a slower rate of acceleration.

From the Travel and Braking menu, select *Set Acceleration* and press the * key. See Table 22. Select a number from 1 to 10 and press the * key to save your selection and access the Exit Options menu.

Table 22. Acceleration Rate Menu

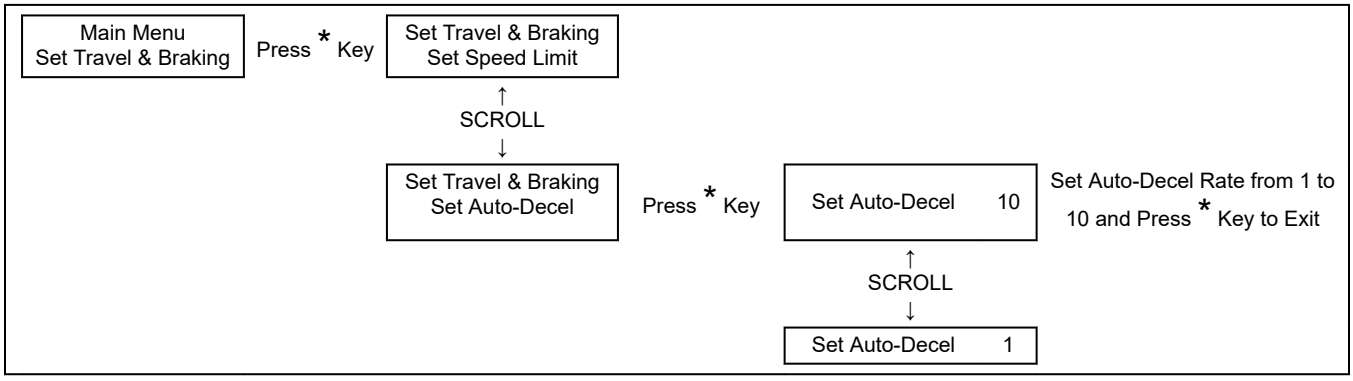


AUTO-DECELERATION RATE

If the lift truck is configured for optional Techtronix, Techtronix 100X, Techtronix 200X, Techtronix 332, or Techtronix 332 ASH transmissions, this function can be used to adjust the travel rate of deceleration when the accelerator pedal is released. The rate of deceleration can be adjusted using a scale of 1 to 10. Using a setting of 10 will result in the fastest rate of deceleration. Using a number lower than 10 will result in a slower rate of deceleration.

From the Travel and Braking menu, select *Set Auto-Decel* and press the * key. See Table 23. Select a number from 1 to 10 and press the * key to save your selection and access the Exit Options menu.

Table 23. Auto-Decel Menu



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- 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)
- 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 38 for lift truck models

- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)
- GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C878, D878, E878)
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

NOTE: Perform Step 2 and Step 3 for lift trucks equipped with an aluminum transmission housing.

2. Install new O-ring on sensor. Install sensor, washer, and capscrew on transmission housing.

See Figure 39 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 40 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)

3. Connect sensor to transmission harness.

NOTE: Perform Step 4 for lift trucks built prior to January, 2011 equipped with an aluminum transmission housing.

4. Install shield, washer, and capscrew onto top of transmission housing. See Figure 39.

5. Connect the battery, install the floor plate and floor mat, on lift truck models

- GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C878, D878, E878)
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

Connect the battery and lower the hood, on 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)
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)

TRANSMISSION PRESSURE SENSORS

Remove

1. To access the battery, remove the floor mat and floor plate, on lift truck models below. Disconnect the battery.

- GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C878, D878, 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)
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879)

2. Disconnect electrical connector from oil pressure sensor.

3. Unscrew and remove oil pressure sensor and O-ring from adapter. See Figure 72.

4. Discard O-ring.

Install

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

1. Lubricate new O-ring with multipurpose grease, and install on oil pressure sensor.

2. Apply thread locker to threads of oil pressure sensor. Install oil pressure sensor into adapter. Tighten to 15 to 19 N•m (11 to 14 lbf ft).

3. Connect electrical connector for oil pressure sensor. See Figure 64.

4. 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)
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879)

Crankshaft Position 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)
- GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879)

2. Disconnect crankshaft position sensor electrical connector from the crankshaft position sensor. See Figure 72.

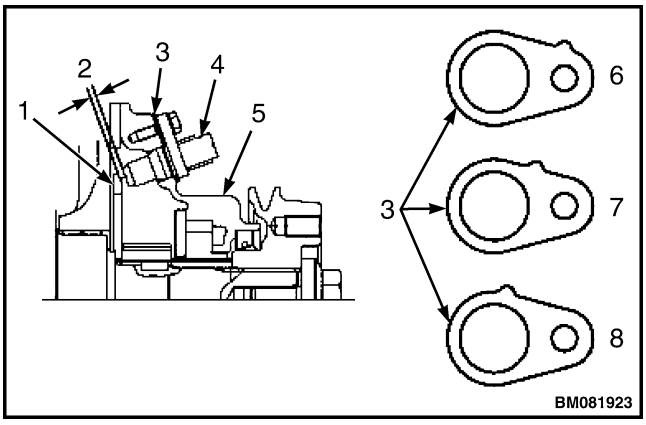
3. Remove crankshaft position sensor mounting capscrew.

4. Remove crankshaft position sensor and O-ring. Discard O-ring.

Install

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

1. Lubricate new O-ring with multipurpose grease. Install O-ring on crankshaft position sensor. See Figure 75.



1. PULSAR GEAR
2. AIR GAP
3. SHIM
4. CRANKSHAFT POSITION SENSOR
5. GEAR CASE
6. SHIM 0.25 mm (0.0098 in.)
7. SHIM 0.50 mm (0.020 in.)
8. SHIM 1.00 mm (0.0394 in.)

Figure 75. Crankshaft Position Sensor Air Gap

Install

1. If installing a new toggle switch:
   a. Insert black cylinder portion of toggle switch through armrest housing.
   b. Slide blue connector onto cylinder. See Figure 132.
   c. Rotate red screw to right stop.
   d. Adjust position of yellow, rectangular toggle switch. See Figure 131. Install and tighten knurl nut to secure toggle switch to armrest.
   e. Apply Nye 760G grease (supplied in kit) to toggle switch connector. Push toggle switch connector to wire harness. See Figure 132.
2. If installing a push (override) button:
   a. Install new green, round push (override) button assembly through armrest housing.
   b. Install and tighten lock nut to secure push (override) button to armrest. See Figure 132.
   c. Push the push (override) button connector to wire harness. See Figure 132.
3. Install armrest and PCB cassette to armrest and install armrest to armrest mounting bracket. See the section Armrest Assembly for installation procedures.
4. Connect the E-hydraulic wire harness to armrest. See Figure 113.

2. Connect new seat sensor to seat harness.

3. Install seat onto seat plate using four flange nuts. Tighten flange nuts to 18 N•m (156 lbf in) See Figure 31.

4. Install seat harness to bracket on seat surround plate.

5. Connect seat harness to chassis harness.

6. Connect the battery and install the floor plate and floor mat.

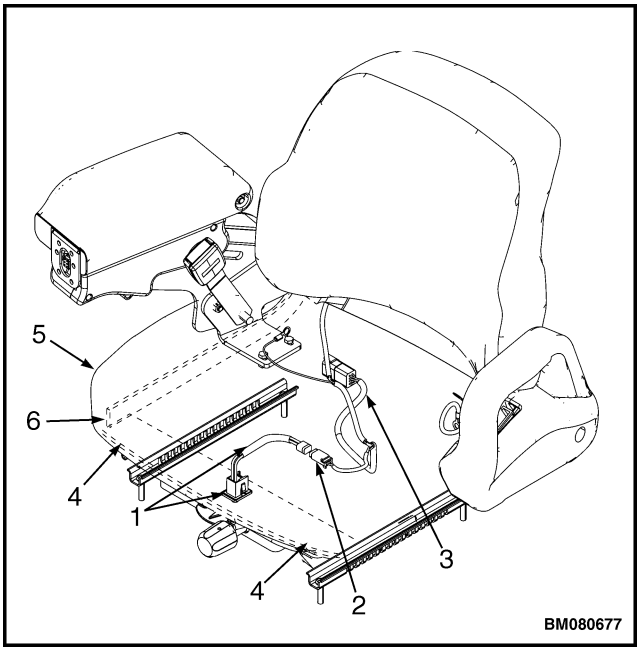
Full Suspension Seats; All Lift Truck Models

Remove

1. Remove two clips that secure the bottom seat cushion to seat base. See Figure 32.

2. Lift bottom seat cushion up and disconnect the seat sensor from harness.

3. Use a small, flat-bladed screwdriver and remove the seat sensor from bottom seat cushion.



1. SEAT SENSOR
2. SEAT HARNESS
3. TO CHASSIS HARNESS
4. CLIPS
5. BOTTOM SEAT CUSHION
6. SEAT BASE

Figure 32. Seat Sensor, Full-Suspension Seat

Install

1. Install new seat sensor into bottom seat cushion.

2. Connect seat sensor to seat harness. See Figure 32.

3. Place bottom seat cushion onto seat base and secure cushion to base with two clips.

Table 1. Adjustment Shim Combinations

Protrusion	Thickness and Number of Shims		
	0.25 mm (0.0098 in.)	0.50 mm (0.020 in.)	1.00 mm (0.0394 in.)
2.25 to 2.50 mm (0.0886 to 0.0984 in.)	1		2
2.00 to 2.25 mm (0.0788 to 0.0885 in.)			2
1.75 to 2.00 mm (0.0689 to 0.0787 in.)	1	1	1
1.50 to 1.75 mm (0.0591 to 0.0688 in.)		1	1
1.25 to 1.50 mm (0.0493 to 0.0590 in.)	1		1
1.00 to 1.25 mm (0.0394 to 0.0492 in.)			1
0.750 to 1.00 mm (0.0296 to 0.0393 in.)	1	1	
0.500 to 0.750 mm (0.0197 to 0.0295 in.)		1	
0.250 to 0.500 mm (0.00985 to 0.0196 in.)	1		

Camshaft Position Sensor

Remove

1. To access battery, raise hood, on lift truck models below. Disconnect the battery.
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)
   - GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E879)
2. Disconnect camshaft position sensor electrical connector from camshaft position sensor. See Figure 64.
3. Remove camshaft position sensor mounting capscrew.
4. Remove camshaft position sensor and O-ring. Discard O-ring.

Install

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

1. Lubricate new O-ring with multipurpose grease. Install O-ring on camshaft position sensor. See Figure 64.
2. Install camshaft position sensor.
3. Install camshaft position sensor mounting capscrew. Tighten to 4 to 5 N•m (35 to 45 lbf in).
4. Connect camshaft position sensor electrical connector to camshaft position sensor.
5. Connect battery and lower the hood on lift truck models
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)
   - GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E879)

Air Flow Restriction Sensor

Remove

1. To access battery, raise hood, on lift truck models below. Disconnect the battery.

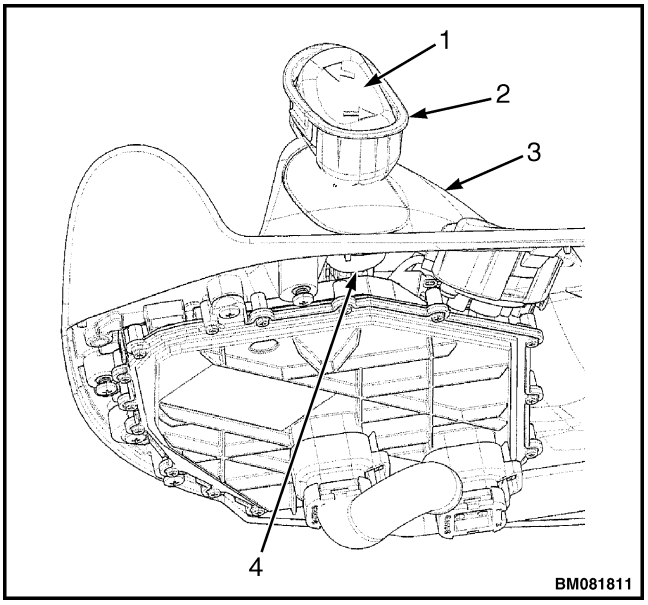
DIRECTION CONTROL SWITCH

NOTE: The Direction Control Switch (DCS) is an optional feature on lift trucks covered in this manual that are equipped with electro-hydraulic controls and built **after** January 2010.

Remove

1. Remove armrest from armrest mounting bracket. Remove bottom armrest cover. See section Armrest Assembly for removal procedures.

2. Remove Direction Control Switch assembly from armrest by compressing the clips on either side of the bezel and carefully pulling the assembly out. Disconnect the E-Hydraulic control wiring harness from the Direction Control Switch. See Figure 121.



1. DIRECTION CONTROL SWITCH
2. BEZEL
3. ARMREST
4. E-HYDRAULIC CONTROL VALVE WIRING HARNESS

Figure 121. Direction Control Switch Replacement

3. Remove the Direction Control Switch from the bezel. See Figure 121.

Install

1. Insert new Direction Control Switch into bezel. See Figure 121.

2. Connect the E-Hydraulic control valve wiring harness to the Direction Control Switch. Install the Direction Control Switch assembly into the armrest by compressing the clips on either side of the bezel and pushing the assembly into the armrest until the clips latch. See Figure 121.

3. Install armrest cover to armrest, and install armrest to armrest mounting bracket. See the section Armrest Assembly for installation procedures.

PUSH (OVERRIDE) BUTTONS AND TOGGLE SWITCH

On lift trucks equipped with E-Hydraulic controls, there may be two optional push (override) buttons (green buttons) and a toggle switch (yellow button) located behind the second, third, or fourth mini-lever. See Figure 122. The push (override) button located behind the second mini-lever is used to override the Return To Set Tilt (RTST) function. By pressing this button, the RTST parameters are overridden and the mast is allowed to tilt unrestricted.

If the lift truck is equipped with three mini-levers and a four function control valve, there will be a toggle switch behind the third mini-lever. Pressing this switch allows the third mini-lever to switch between the third and fourth functions. If the lift truck is equipped with four mini-levers and a five function control valve, the toggle switch will be located behind the fourth mini-lever. Pressing the switch allows the fourth mini-lever to switch between the fourth and fifth functions.

If the lift truck is equipped with a clamp attachment, the last mini-lever on the right controls the clamp function. Behind this lever will be a push (override) button. To engage the clamp, move the mini-lever backward. To disengage the clamp, push the push (override) button behind the mini-lever and move mini-lever forward.

The different configurations of switches and buttons discussed in this section may not be found on your lift truck.

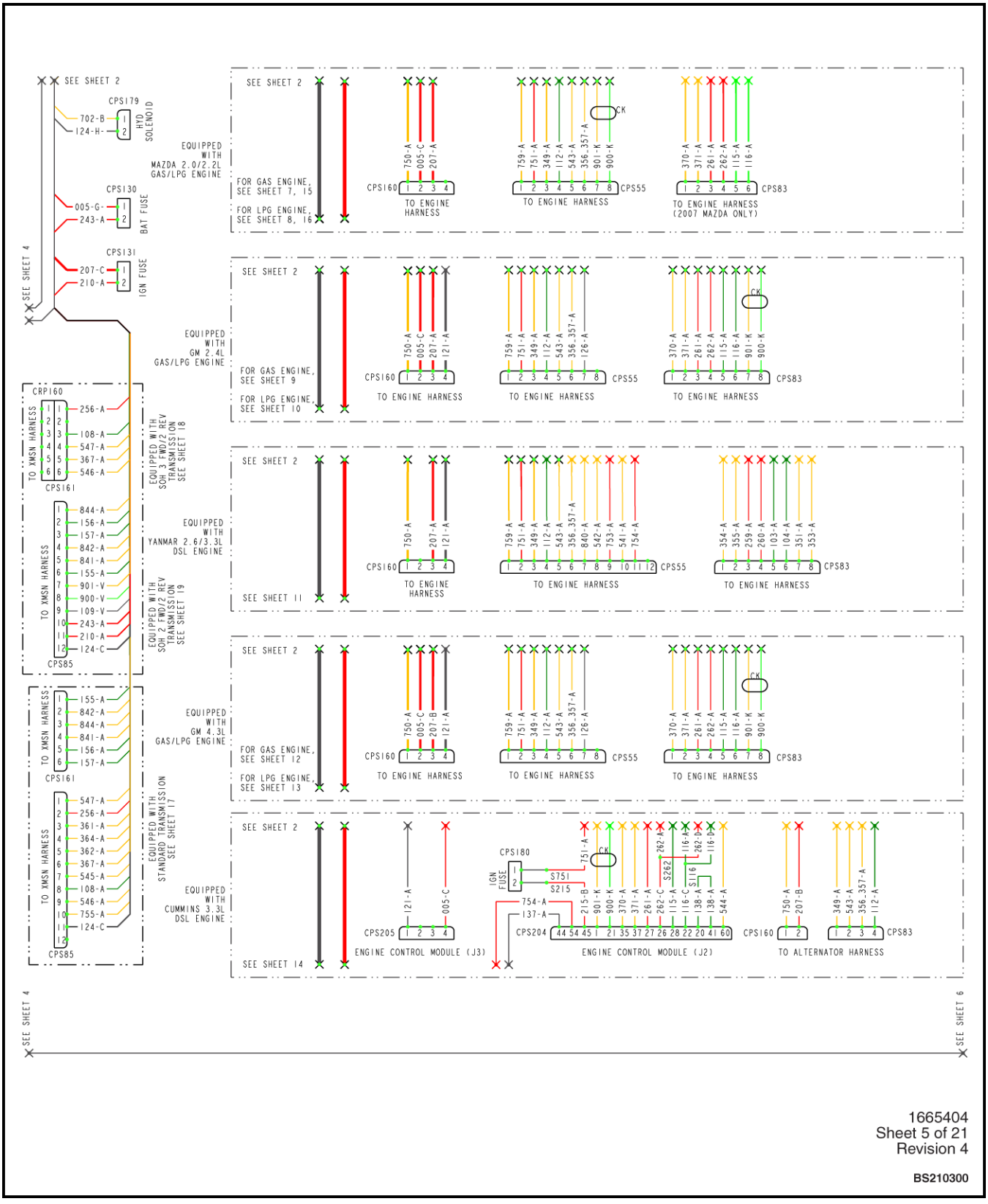


Figure 23. Engines Directory Wiring Diagram

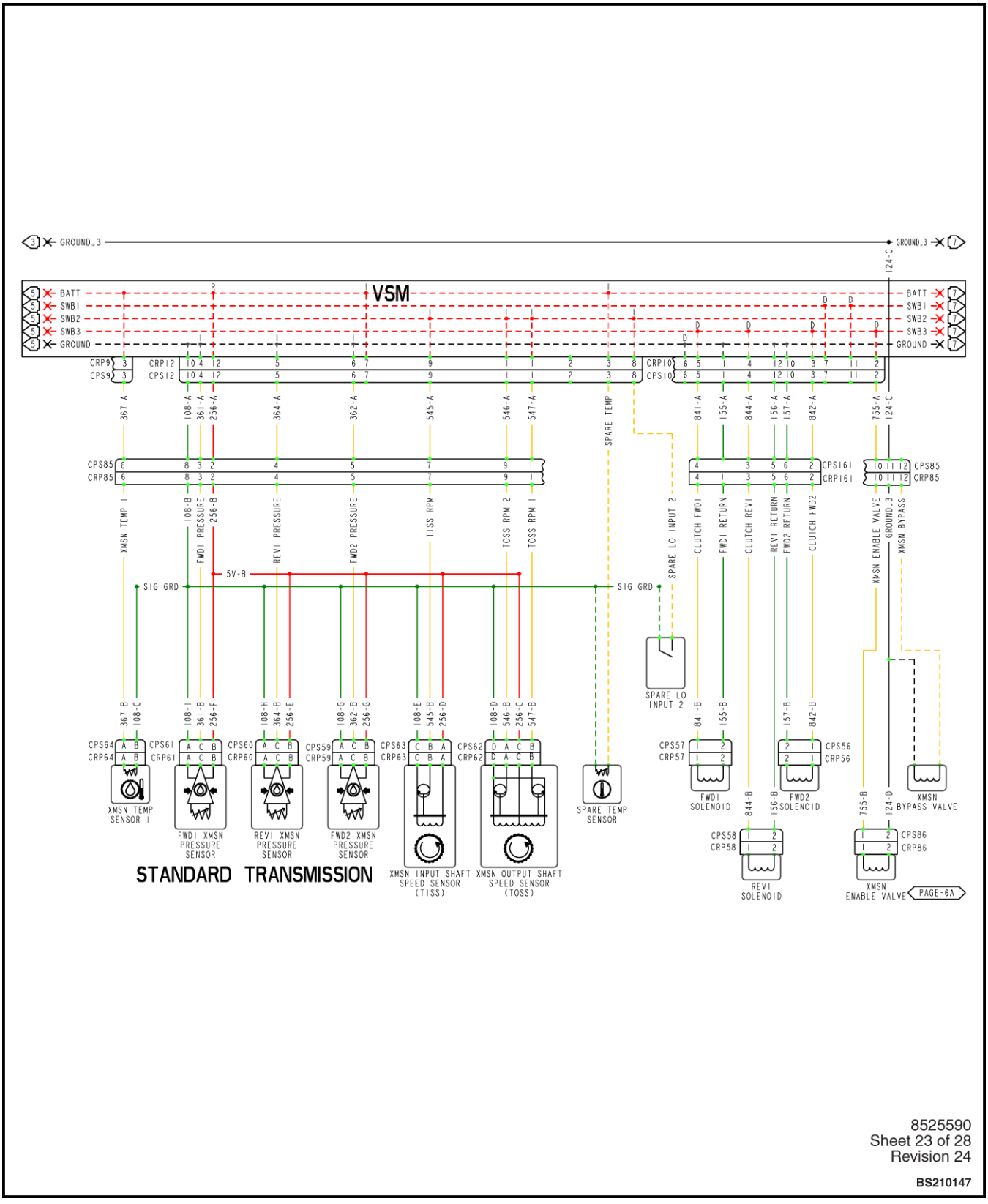


Figure 15. Standard (Powershift) Transmission Electrical Schematic

Table 7. Proc_Cal_005: Lower Valve Output Threshold (Continued)

Go to Action 3 of Proc_Cal_006.		
To Quit and Save....		
Step 1: Press ⇧ or ⇩	**Until You See:**	Tilt Bk Valve Output Back 1 Level
Step 2: Press * One Time	**You Will See:**	Calibrations Back 1 Level
Perform Proc_Cal_003: Save and Exit.		

Proc_Cal_006: Tilt Back Valve Output Threshold

WHEN TO PERFORM

Performed when troubleshooting procedures indicate, when tilt back valve components have been serviced, or when the tilt back valve is replaced.

CALIBRATION ORDER

1. Proc_Cal_025
2. Proc_Cal_001
3. Proc_Cal_002
4. Proc_Cal_006

WHY PERFORM

All electro-hydraulic valves have different operating characteristics. One of the key characteristics is the point at which hydraulic flow begins for a given command current. This cracking' current is determined by this process.

HOW TO PERFORM

WARNING

Keep yourself and all others clear of the lift mechanism. Never allow anyone under or on the forks.

Never put hands, arms, head, or legs through the mast or near the carriage or lift chains. This warning applies not only to the operator but also the helper. A helper must not be near the load or the lift mechanism while the operator is attempting to handle a load. The lift mechanism has moving parts with close clearances that can cause serious injury.

Refer to Table 8 for the procedures on how to perform Proc_Cal_006: Tilt Back Valve Output Threshold.

Proc_Cal_004: Lift Valve Output Threshold

WHEN TO PERFORM

Performed when troubleshooting procedures indicate, when lift valve components have been serviced, or when the lift valve is replaced.

CALIBRATION ORDER

1. Proc_Cal_025
2. Proc_Cal_001
3. Proc_Cal_002
4. Proc_Cal_004

WHY PERFORM

All electro-hydraulic valves have different operating characteristics. One of the key characteristics is the point at which hydraulic flow begins for a given command current. This cracking' current is determined by this process.

HOW TO PERFORM

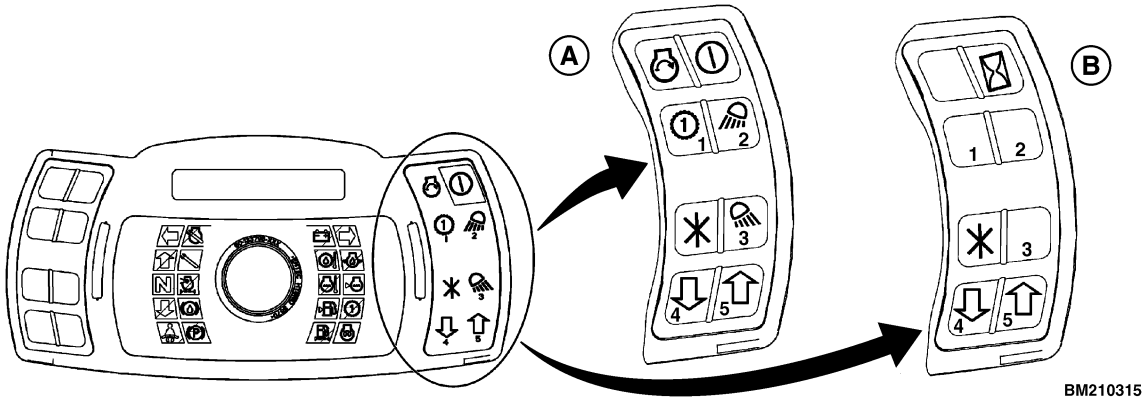
WARNING

Keep yourself and all others clear of the lift mechanism. Never allow anyone under or on the forks.

Never put hands, arms, head, or legs through the mast or near the carriage or lift chains. This warning applies not only to the operator but also the helper. A helper must not be near the load or the lift mechanism while the operator is attempting to handle a load. The lift mechanism has moving parts with close clearances that can cause serious injury.

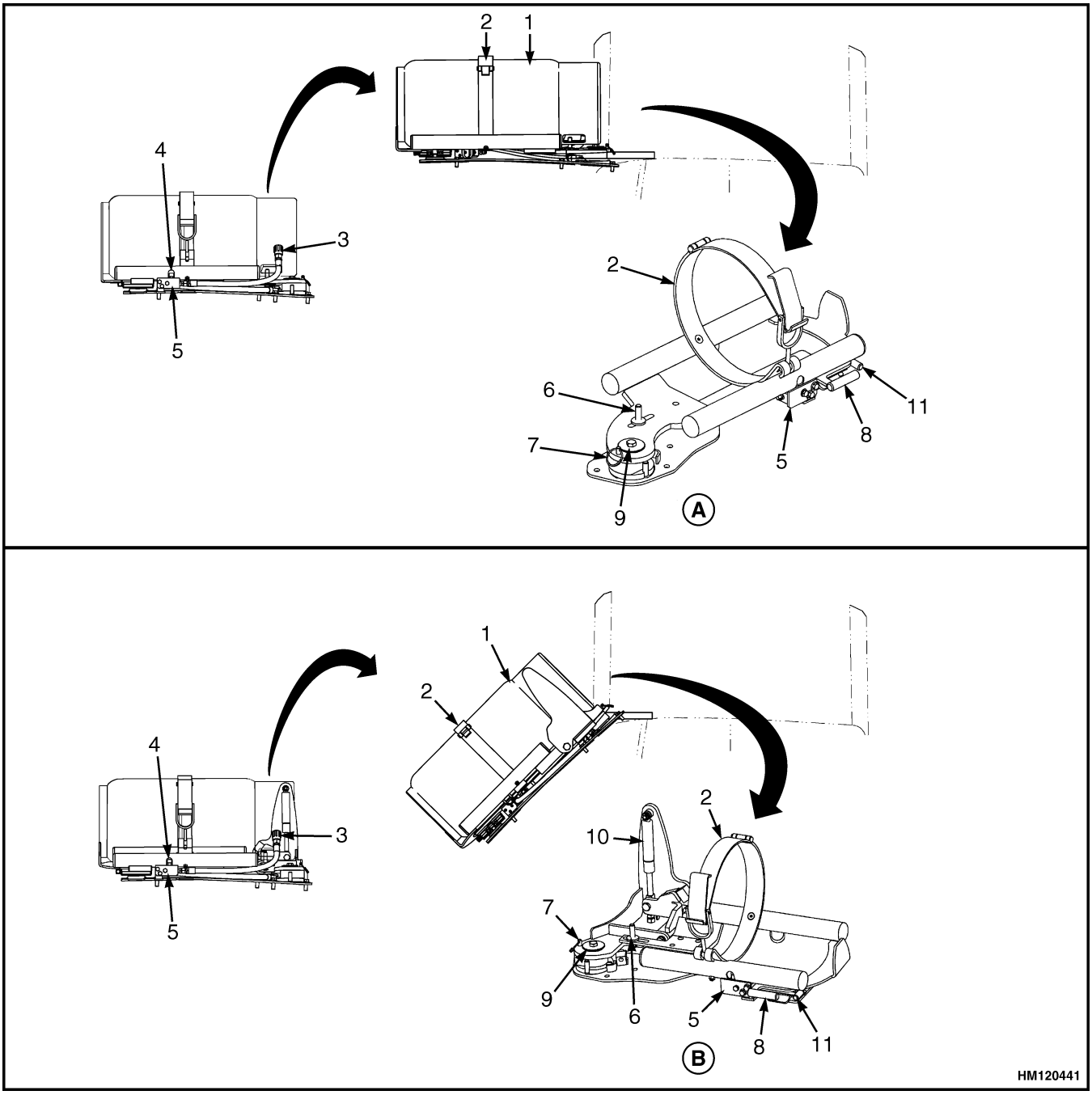
Refer to Table 6 for the procedures on how to perform Proc_Cal_004: Lift Valve Output Threshold.

Table 6. Proc_Cal_004: Lift Valve Output Threshold



A. TYPICAL DISPLAY WITHOUT KEY, WITH OPTIONS
B. TYPICAL DISPLAY WITH KEY, WITHOUT OPTIONS

Perform Proc_Cal_025: Hydraulic Valve Pressure Gage Installation, Proc_Cal_001: Service Password Entry, and Proc_Cal_002: Hydraulic Valve Calibration Warm Up and Air Bleed before proceeding.
Information: "Creep" is defined as the threshold when a function first starts to move very slowly (barely perceptible motion). The identification of this motion is defined as the "visual method." The method that provides more consistent calibration is by monitoring the change in pressure when the function is activated; this is defined as the "pressure method."
Information: Pressure Method: Perform actions 1, 2, 3, 4, and 6. Visual Method: Perform actions 2, 3, 5, and 6.
Information: Leave truck running at idle after performing Proc_Cal_002.



A. SWING-OUT LPG BRACKET

B. SWING-OUT AND DROP-DOWN LPG BRACKET (EZ TANK BRACKET)

1. LPG TANK
2. TANK STRAP
3. QUICK DISCONNECT FITTING
4. HYDROSTATIC RELIEF VALVE
5. MANIFOLD BLOCK
6. ALIGNMENT PIN
7. STOP PIN
8. BRACKET HANDLE
9. BRACKET PIVOT
10. GAS SPRING (DROP-DOWN BRACKET ONLY)
11. BRACKET RELEASE PIN (BUTTON)

Figure 1. LPG Tank and Bracket

c. If replacing an exhaust pipe section that has a wrap, also replace the wrap. DO NOT reuse wraps if they have been removed for a service operation.

d. Inspect catalytic converter and muffler for damage, corrosion, and rust. Replace if damaged.

Install for Lift Trucks Built Before January, 2010

NOTE: Lift trucks equipped with standard exhaust follow Step 1 through Step 7. Lift trucks equipped with overhead exhaust follow Step 8 through Step 16.

1. Install new gasket onto exhaust pipe (16, Figure 43) and connect exhaust pipe (16, Figure 43) to engine exhaust manifold. Tighten locknuts to 39 N•m (345 lbf in).

2. Install new gasket between exhaust pipe (15 and 16, Figure 43). Connect exhaust pipe (15) onto exhaust pipe (16). Tighten locknuts to 39 N•m (345 lbf in).

3. Place the muffler onto the lift truck frame and install the washers, isolators, spacers, locknuts, and capscrews to attach the muffler to the lift truck frame. 22 N•m (195 lbf in).

4. Install new gasket onto exhaust pipe (15, Figure 43). Connect exhaust pipe (15, Figure 43) to muffler. Tighten nuts to 39 N•m (345 lbf in).

5. Install clamp and exhaust pipe (8, Figure 43) to muffler.

6. Install the oxygen sensors in exhaust pipe (16, Figure 43).

7. Install the counterweight. See the **Frame** section for your lift truck model for installation procedures for the counterweight.

NOTE: The following procedures is for lift trucks equipped with overhead exhaust.

8. Install new gasket onto exhaust pipe (16, Figure 43) and connect exhaust pipe (16, Figure 43) to engine exhaust manifold. Tighten locknuts to 22 N•m (195 lbf in).

9. Install new gasket between exhaust pipe (15 and 16, Figure 43). Connect exhaust pipe (15) onto exhaust pipe (16). Tighten locknuts to 39 N•m (345 lbf in).

10. Place the muffler onto the lift truck frame and install the washers, isolators, spacers, locknuts, and capscrews to attach the muffler to the lift truck frame. 22 N•m (195 lbf in).

11. Install new gasket onto exhaust pipe (15, Figure 43). Connect exhaust pipe (15, Figure 43) to muffler. Tighten nuts to 39 N•m (345 lbf in).

12. Install clamp and exhaust pipe (7, Figure 43) to muffler.

13. Connect the oxygen sensors to exhaust pipe (16, Figure 43).

14. Install the counterweight. See the **Frame** section for your lift truck model for installation procedures for the counterweight.

15. Install clamp (6) and connect exhaust pipe (1) to exhaust pipe (7). See Figure 43.

16. Install flange bolts and flange cover to secure exhaust pipe (1, Figure 43) to the counterweight.

Install for Lift Trucks Built After January, 2010

NOTE: Lift trucks equipped with standard exhaust follow Step 1 through Step 7. Lift trucks equipped with overhead exhaust follow Step 8 through Step 15.

1. Install new gaskets, exhaust pipe (18, Figure 44), washers, and locknuts onto exhaust manifold.

2. Install new gasket, exhaust pipe (18, Figure 44), flange bolts, and locknuts onto exhaust pipe (17, Figure 44).

3. Place muffler onto lift truck frame. Install spacers, isolators, capscrews, and locknuts onto muffler and lift truck frame. See Figure 44.

4. Install new gasket, exhaust pipe (17, Figure 44), capscrews, and locknuts onto muffler.

5. Install exhaust pipe (7, Figure 44) and clamp onto muffler.

6. Connect three oxygen sensors (10, Figure 44) to exhaust pipe (18, Figure 44) and muffler.

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SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Yale® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **YALE APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

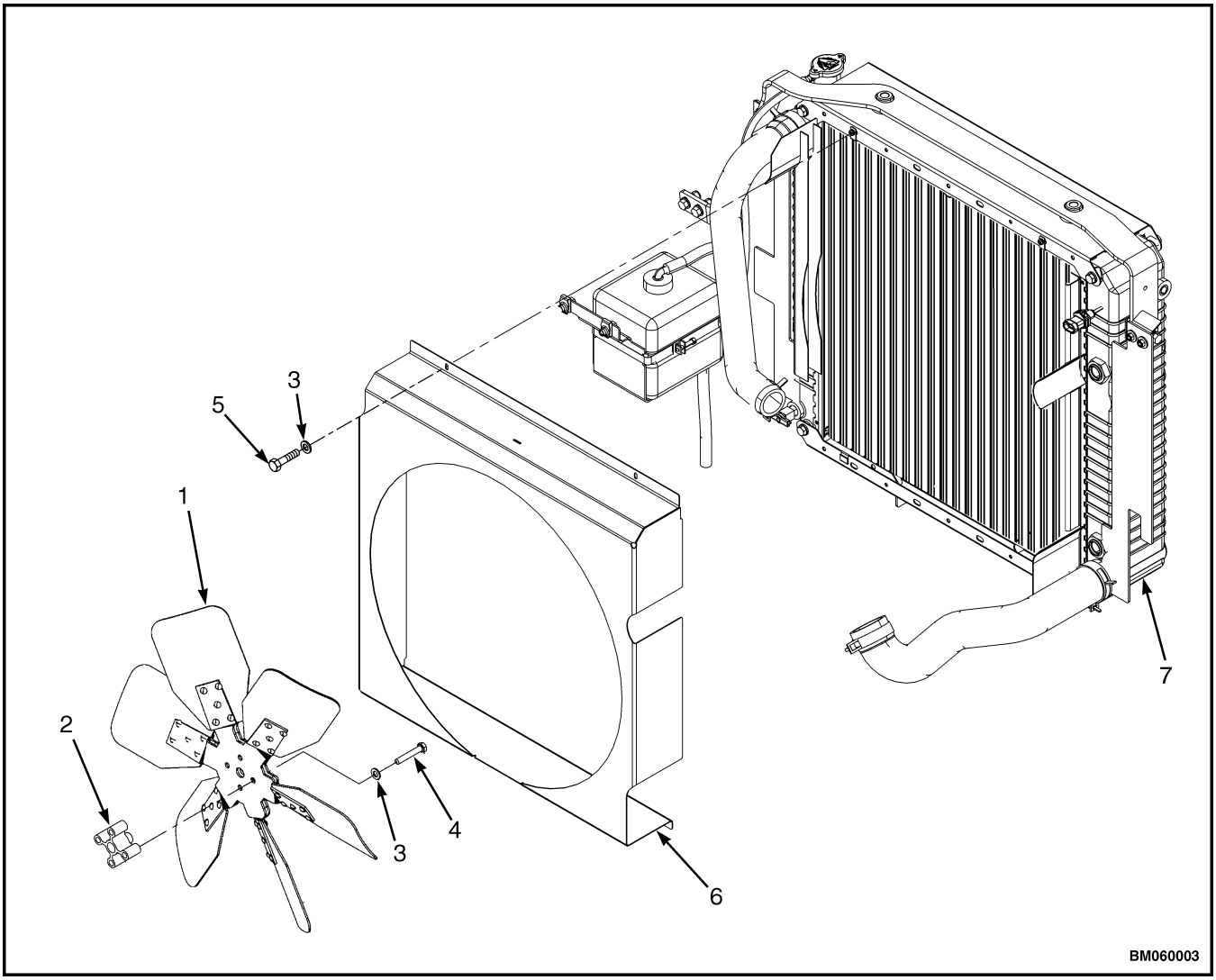
 **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the WARNING symbol and word are on orange background. The CAUTION symbol and word are on yellow background.



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

Figure 83. GM 4.3L Fan Removal

WARNING

Before disconnecting hydraulic hoses, relieve pressure in the hydraulic system. Serious injury can occur if pressure is not relieved from hydraulic system prior to disconnecting hydraulic hoses.

NOTE: Tag hydraulic hoses and fittings prior to disconnecting to aid in connecting during installation

NOTE: If lift truck is equipped with quick disconnect hoses, see Disconnecting Attachment Hydraulic Quick Disconnect Hoses.

i. Relieve hydraulic pressure to fork positioner cylinders by moving the auxiliary lever in both directions several times.

j. Disconnect hydraulic hoses from fork positioner manifold. Put caps and plugs on the open lines and cylinder ports. See Figure 30.

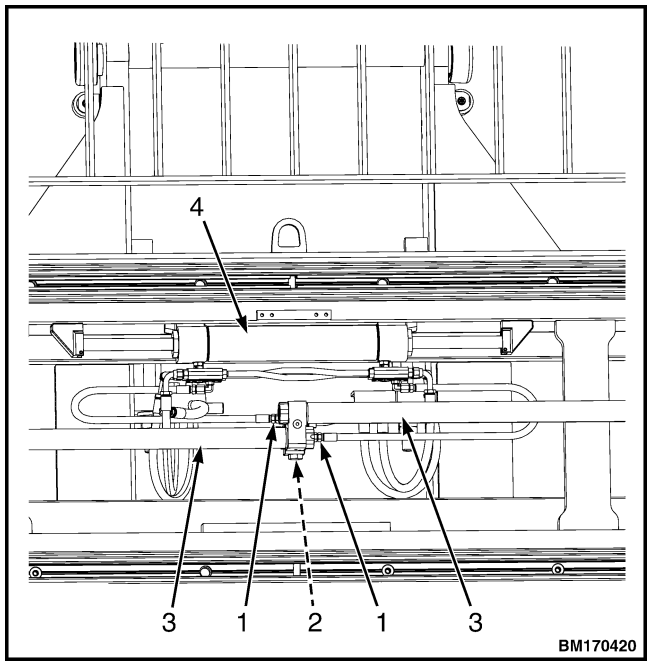


Figure 30. Fork Positioner Hydraulic Hoses, Lift Trucks Manufactured After August, 2012

Legend for Figure 30.

1. FORK POSITIONER HYDRAULIC HOSES
2. MANIFOLD
3. FORK POSITIONER CYLINDER
4. SIDESHIFT CYLINDER

NOTE: Note number of shims removed to ensure correct number of shims are used during installation.

k. Remove capscrews, lockwashers, and shims holding fork positioner to sideshifter frame. Remove fork positioner through front of sideshifter frame. See Figure 31.

Legend for Figure 77.

1. HOSES
2. CLAMP
3. SPACER
4. STUB SHAFT
5. SHEAVE
6. CAPSCREW
7. LOCKWASHER
8. GROMMET
9. NUT
10. FITTING
11. TUBE
12. PLATE
13. WASHER
14. NUT
15. STRAIN RELIEF
16. BRACKET
17. HOSE REEL (OPTIONAL)
18. JUNCTION BOX

- GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)

9. Remove mast mounting snap rings and bushings from outer mast.

See Figure 59 for lift trucks models.

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813, K813)
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

10. If equipped with a nut retainer bracket, remove capscrew, washer, nut retainer bracket, chain anchor plate (if equipped).

See Figure 117 for lift trucks manufactured before April, 2013 on lift truck models

- 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)

See Figure 118 for lift truck models

- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818) manufactured after April, 2013
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (G813) manufactured after April, 2013
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (G818)

See Figure 119 for lift trucks manufactured before April, 2013 on lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)

See Figure 120 for lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813, J813) manufactured after April, 2013
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (K813)

See Figure 122 for lift trucks manufactured before April, 2013 on lift truck models

- GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879)
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

See Figure 123 for lift trucks manufactured after April, 2013 on lift truck models

- GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (D879, E879, F879)
- GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879, G879)
- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (D878, E878)

11. Remove and disassemble chain sheaves and load rollers as necessary for cleaning and repair.

See Figure 117 for lift trucks manufactured before April, 2013 on lift truck models

- 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)

See Figure 118 for lift truck models

- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818) manufactured after April, 2013
- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813) manufactured after April, 2013
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (G818)

See Figure 119 for lift trucks manufactured before April, 2013 on lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)

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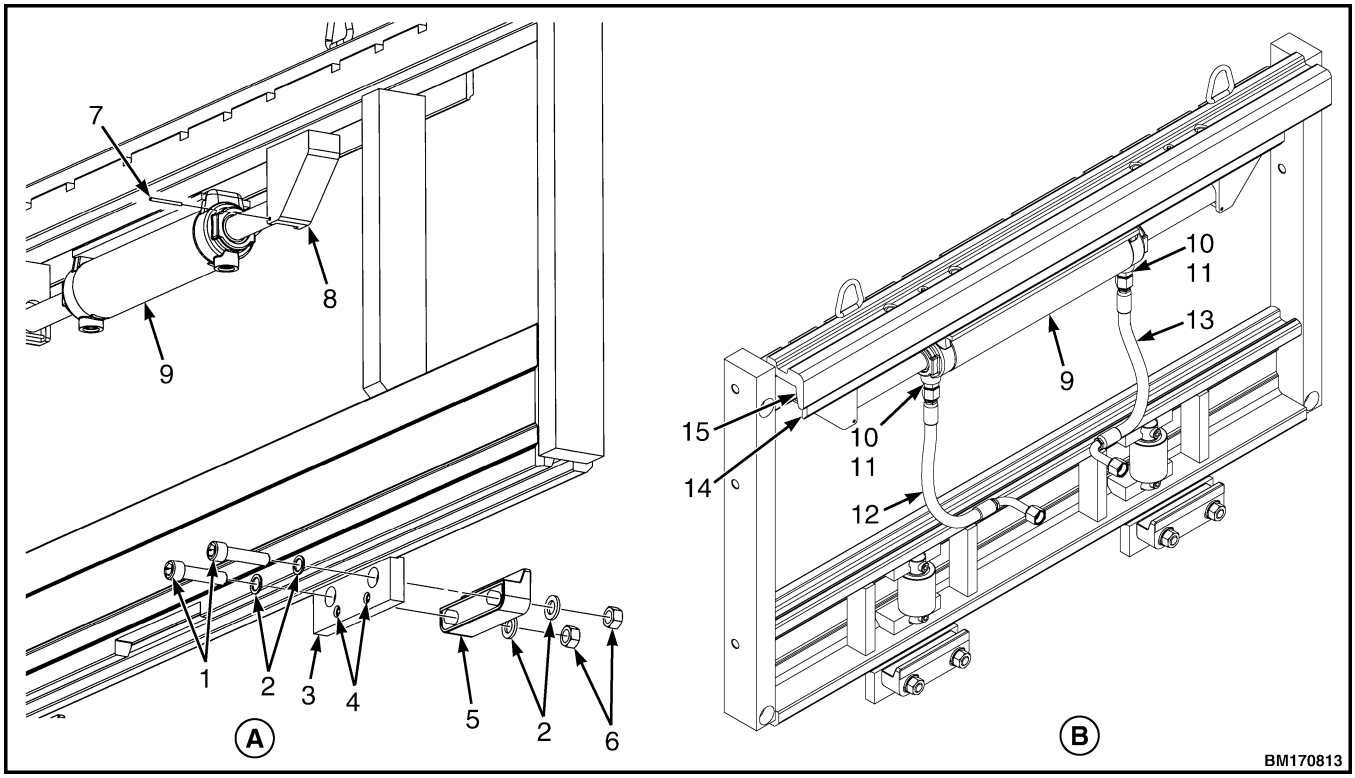


NOTE: CARRIAGE ASSEMBLY FOR 3-STAGE FFL SHOWN, 2-STAGE FFL SIMILAR.

A. REAR VIEW

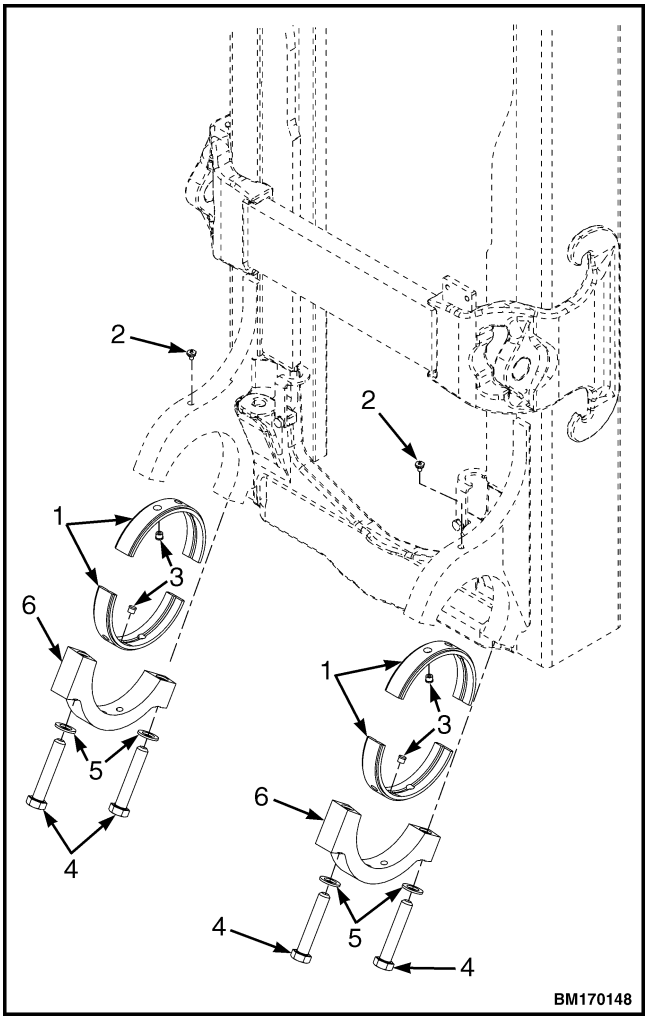
1. SOCKETHEAD SCREW
2. WASHER
3. LOWER RETENTION PLATE
4. SET SCREW
5. LOWER HOOK
6. NUT
7. ROLL PIN
8. CYLINDER STOP BLOCK

B. FRONT VIEW

9. SIDESHIFT CYLINDER
10. FITTING
11. O-RINGS
12. HOSE ASSEMBLY LEFT-HAND
13. HOSE ASSEMBLY RIGHT-HAND
14. UPPER CARRIAGE HOOK
15. UPPER FORK BAR

Figure 44. Bolzoni Hang On Sideshift Assembly

3. Remove sockethead screws and lower rollers from side roller block in lower fork bar. See Figure 45.



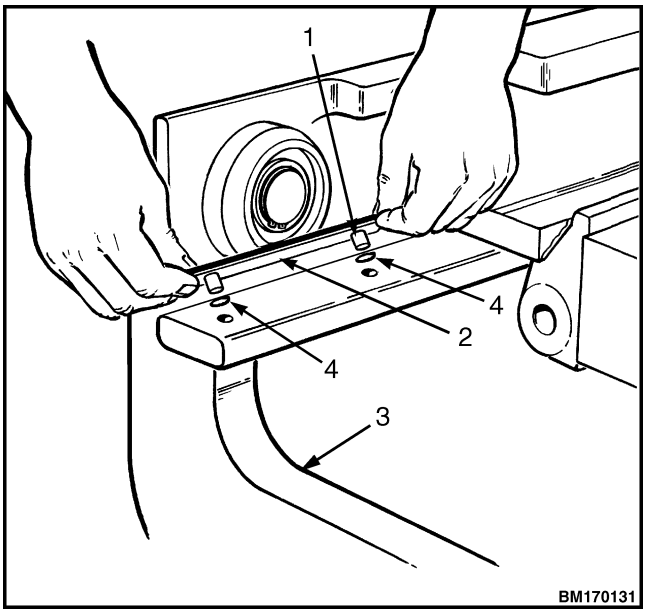
NOTE: MAST MOUNTS FOR GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818) SHOWN. MAST MOUNTS FOR ARE SIMILAR.

1. MAST HANGER BUSHING
2. LUBE FITTINGS
3. MAST BUSHING PLUGS
4. CAPSCREW
5. WASHER
6. MAST MOUNTING CAP

Figure 89. Mast Mounts Removal

DISASSEMBLE

1. Slide inner mast from bottom of outer mast approximately 30 cm (12 in.). Remove strip bearings. See Figure 90. Remove load rollers from both weldments. Make a note of shim arrangement. Shim arrangement will be approximately the same during assembly procedures.



1. STRIP BEARING
2. SHIMS
3. TOP OF OUTER MAST
4. O-RINGS

Figure 90. Strip Bearings

2. Using a brass drift, remove tilt rod bushing from outer mast. Discard tilt rod bushing. See Figure 91.

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813, J813, K813)

7. Install hose sheaves on the intermediate mast.

8. Connect lift chains to the chain anchors at the bottom of the inner mast. Use wire to hold the other end of the lift chains to the top of the outer mast.

9. If equipped install capscrew, washer, nut retainer bracket, chain anchor plate.

   See Figure 117 for lift trucks manufactured before April, 2013 on lift truck models

   - 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)

   See Figure 118 for lift truck models

   - GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818) manufactured after April, 2013
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813) manufactured after April, 2013
   - GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (G818)

   See Figure 119 for lift trucks manufactured before April, 2013 on lift truck models

   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813)

   See Figure 120 for lift truck models

   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (H813, J813) manufactured after April, 2013
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (K813)

   See Figure 122 for lift trucks manufactured before April, 2013 on lift truck models

   - GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879)
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

   See Figure 123 for lift trucks manufactured after April, 2013 on lift truck models

   - GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (D879, E879, F879)
   - GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (D878, E878)

10. Connect a lifting device to the center of the inner mast (see Figure 106). Put stub shafts through the notches in the intermediate mast. Slide inner mast into the intermediate mast so stub shafts are seen at the top and bottom of the weldments.

11. Install strip bearings, O-rings and shims on the outer mast. Apply grease to bearing surface. See Figure 125.

12. Install load rollers and shims on both weldments. Check clearance of the load rollers and strip bearings as described in Mast Adjustments and Carriage Adjustments.

13. Connect lift chains to the mounts at the top of the outer mast.

14. Connect lift chains to the chain anchors at the mount on the inner mast. Attach wires between the ends of the lift chains and the bottom crossmember to control the lift chains during installation.

15. If equipped install capscrew, washer, nut retainer bracket, chain anchor plate.

    See Figure 117 for lift trucks manufactured before April, 2013 on lift truck models

    - 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)

    See Figure 118 for lift trucks

Overhead Guard Replacement

REMOVE

WARNING

DO NOT operate the lift truck without the overhead guard correctly fastened to the lift truck.

WARNING

DO NOT weld mounts for lights or accessories to legs of the overhead guard. Changes that are made by welding, or by drilling holes that are too big or in the wrong location, can reduce the strength of the overhead guard.

See your dealer for Yale lift trucks BEFORE performing any changes to the overhead guard.

NOTE: The lift trucks covered in this YRM are equipped with either a high or low overhead guard. The removal and installation procedures for both types of overhead guards are the same.

No welding or drilling on legs of overhead guard is permitted as per previous **WARNING**.

NOTE: The lifting device can be connected to any number of positions on overhead guard depending upon lifting device available. The ideal choices are a four point sling connected to all four corners on top of overhead guard, or a two point sling connected to two opposite corners of overhead guard. If a single point hoist is used, make sure that lift point is in center of overhead guard. If during initial start of lift, the overhead guard is off balance, lower immediately and move hoist to a more centered point.

1. Connect a lifting device to remove overhead guard. Loosen clamp and disconnect air intake hose from elbow. Remove bolts, elbow, retainer, and grommet from overhead guard rear leg. See Figure 15.

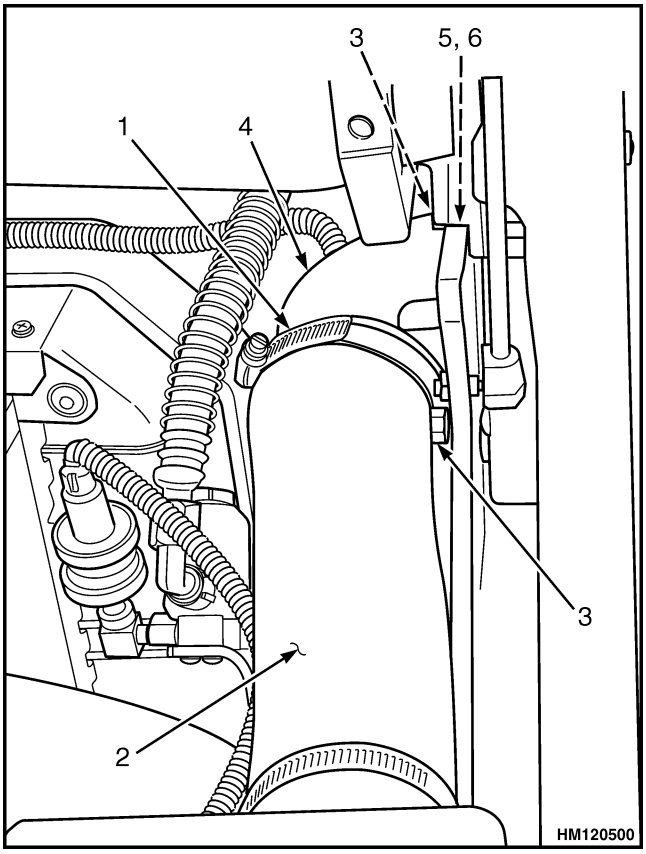
NOTE: Perform Step 2 for lift truck models GC/GLC/GDC60VX, GC/GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (F879, G879) equipped with Diesel Particulate Filter (DPF).

2. Disconnect wires from back of DPF display. See Figure 17.

3. Disconnect wires between frame and overhead guard. When overhead guard is lifted from frame, make sure that electrical wires are moved through holes in overhead guard so that they are not damaged.

NOTE: Perform Step 4 for lift truck models GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879).

4. The rear legs of overhead guard have two capscrews that are located under hood inside engine compartment, next to radiator. Remove capscrews. See Figure 16.



1. CLAMP
2. AIR INTAKE HOSE
3. BOLTS
4. ELBOW
5. RETAINER
6. GROMMET

Figure 15. Disconnect Air Intake Hose

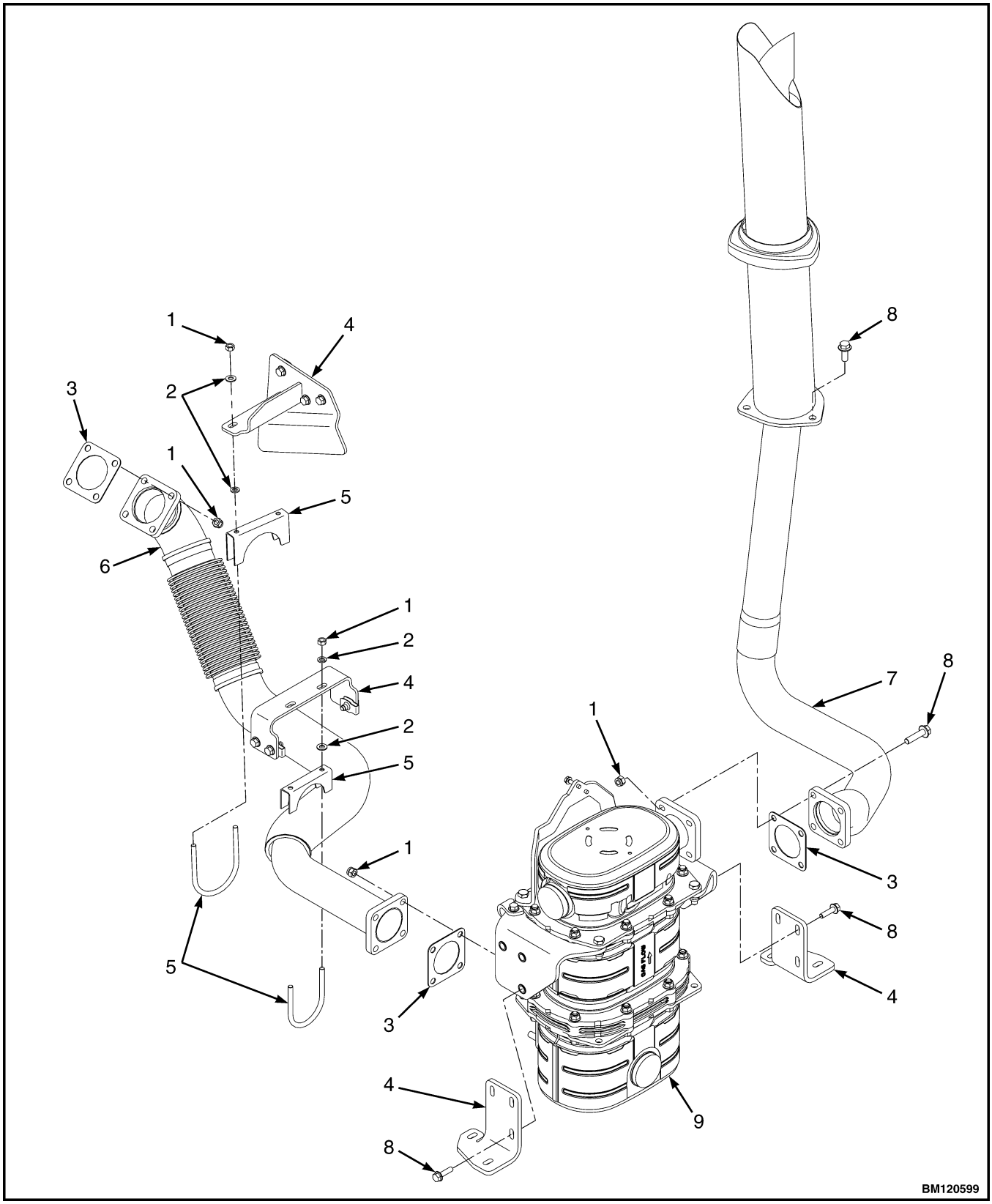


Figure 51. Kubota 3.8L Diesel Engine Exhaust System

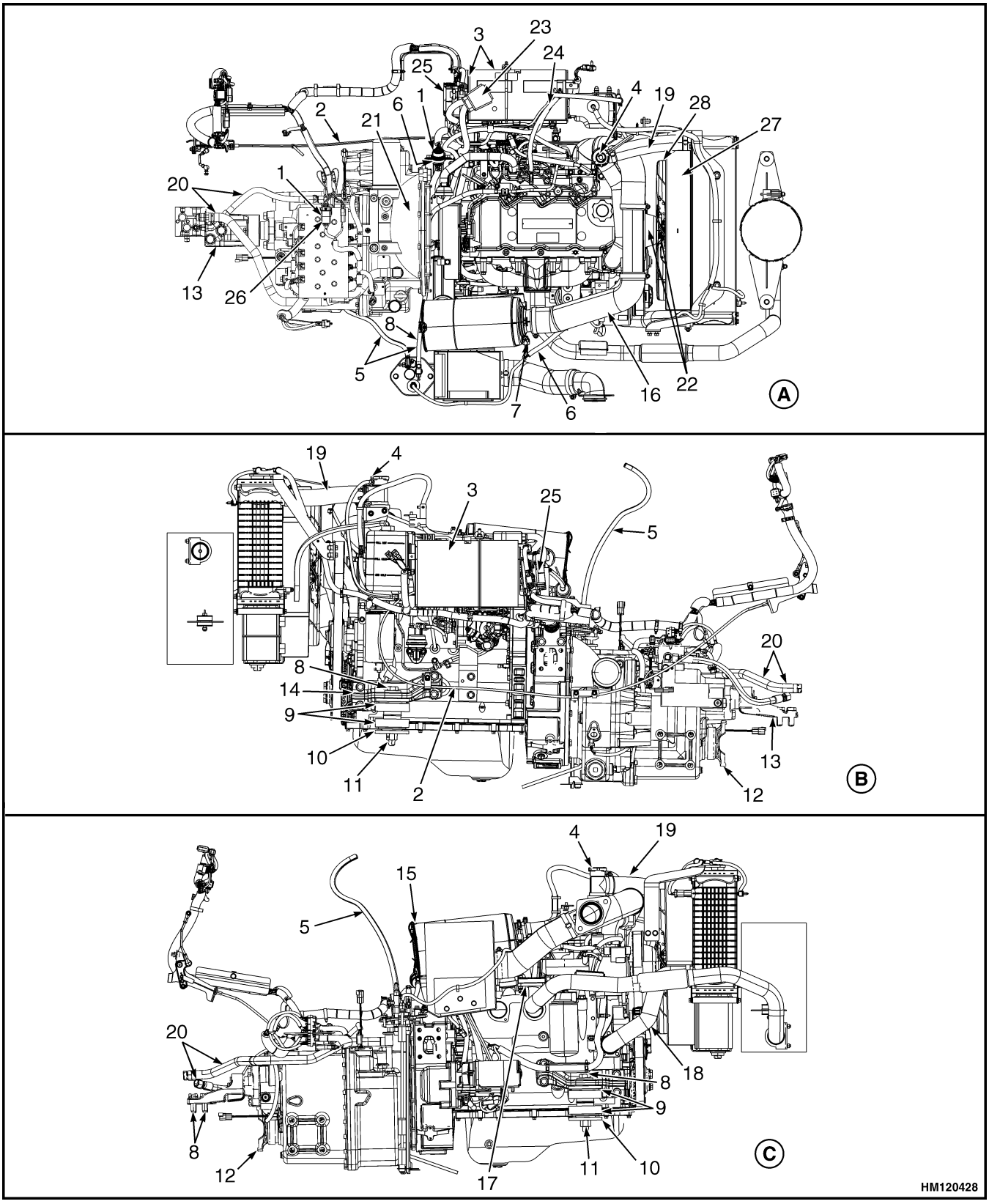
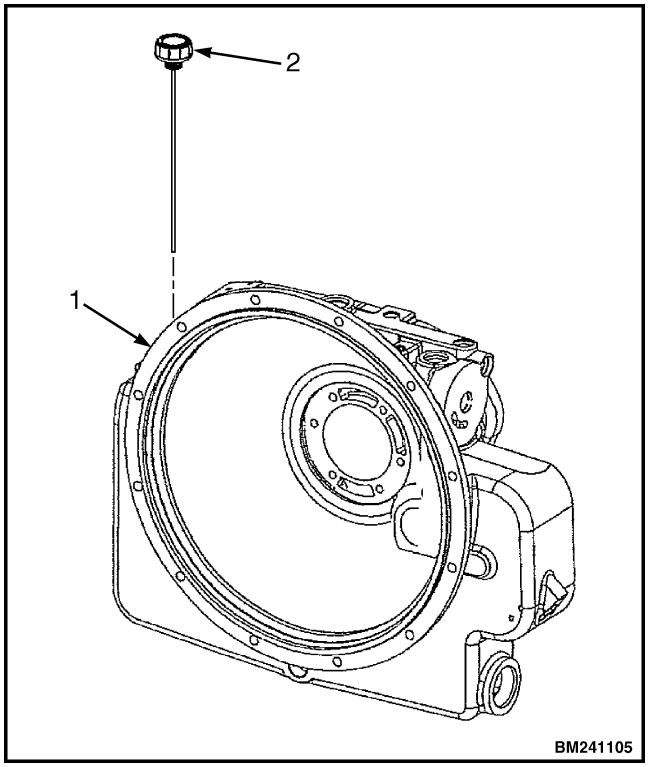


Figure 26. Cummins 4.5L Diesel Engine and Transmission

NOTE: Perform Step 3 on lift trucks GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (D879, E879, F879) and GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (D878, E878) , GLP/GDP60VX, GLP/GDP70VX (GLP/GDP135VX, GLP/GDP155VX) (F878) and GLP/GDP60VX, GLP/GDP70VX, GP70VXS6, GP70VXS9 (GLP/GDP135VX. GLP/GDP155VX, GP155VXS) (G878) manufactured **After** October 2009 and for lift truck models GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909), GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (C909, D909) .

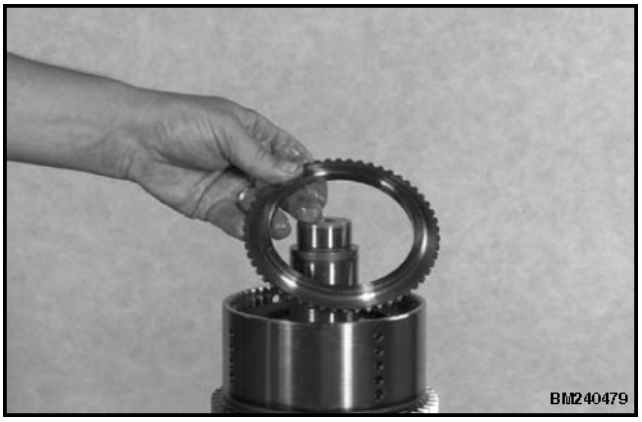
STEP 3.
Remove transmission oil dipstick and breather.



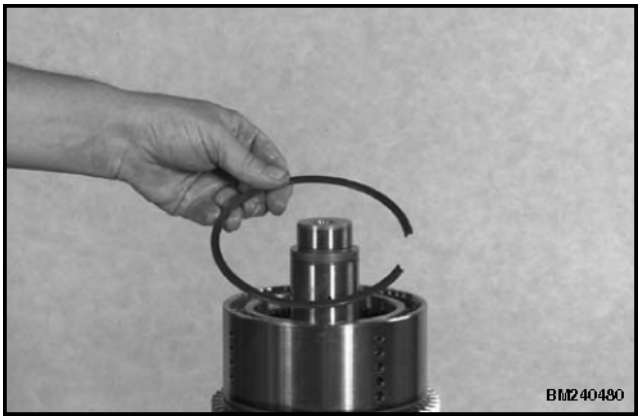
1. CONVERTER HOUSING
2. DIPSTICK/ BREATHER

NOTE: Place a suitable container below the oil filter to catch remaining oil in filter.

STEP 5.
Install end-plate.



STEP 6.
Install end-plate retainer ring.



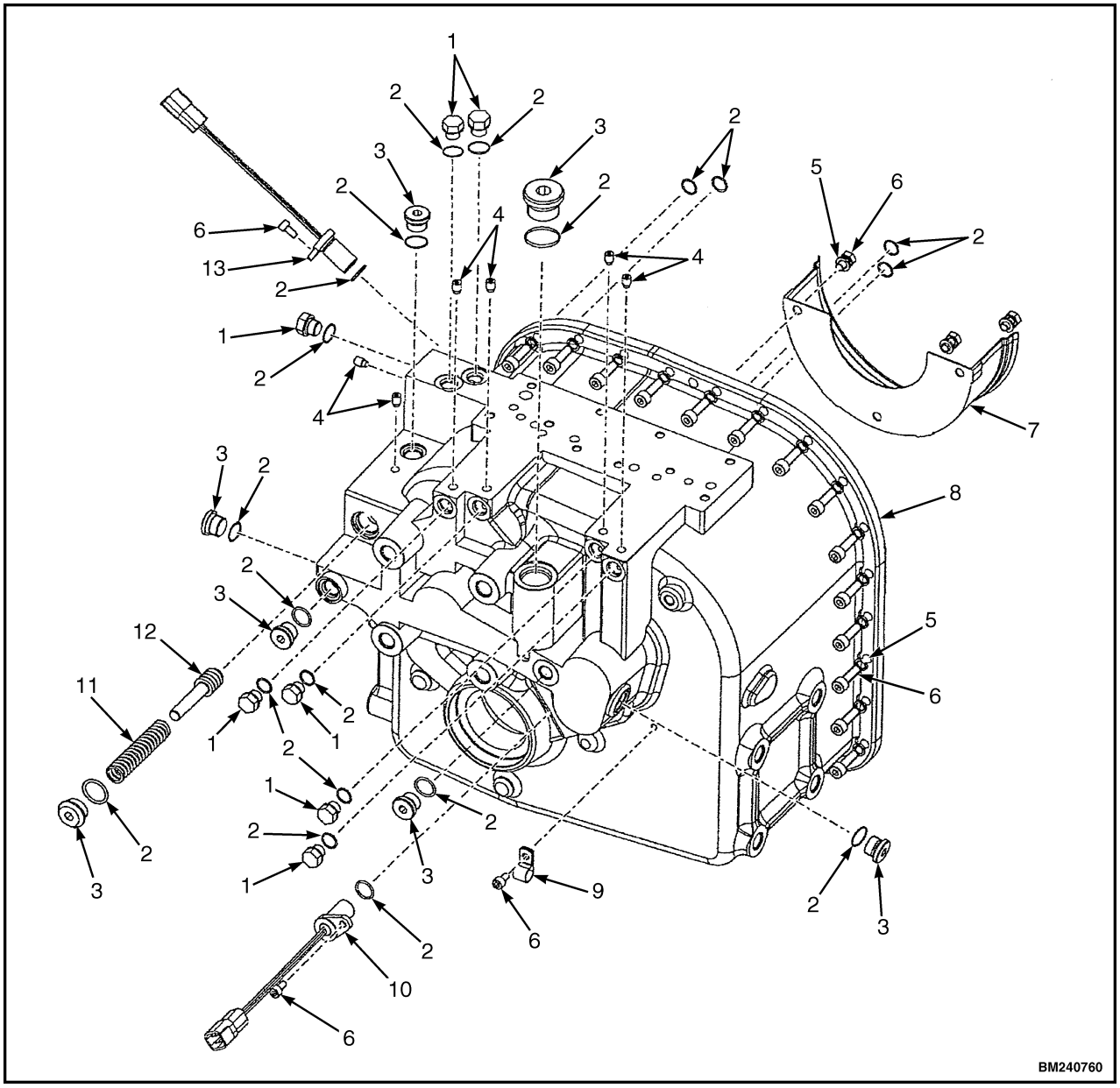
WARNING
Hot parts. Wear protective clothing and gloves to prevent burns.

CAUTION
DO NOT use an open flame to warm bearings. Using an open flame could cause damage to bearing.

STEP 7.
Heat RANGE 1 gear inner bearing to 120°C (248°F), and install bearing on shaft.

Transmission Case, Disassemble

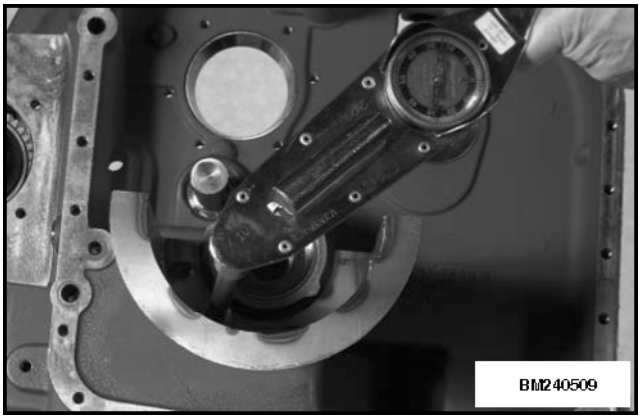
Refer to Figure 4.



1. FITTING
2. O-RING
3. PLUG
4. INSERT
5. LOCKWASHER
6. CAPSCREW
7. BAFFLE
8. CASE
9. CLIP
10. OUTPUT SPEED SENSOR (TOSS)
11. SPRING (SAFETY VALVE)
12. SPOOL (SAFETY VALVE)
13. INTERMEDIATE SPEED SENSOR

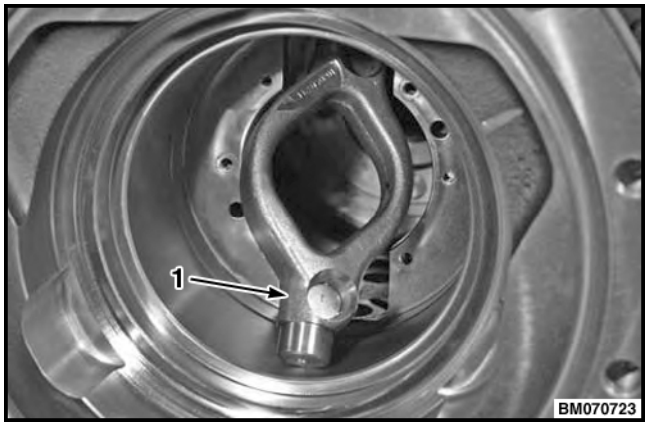
Figure 4. Transmission Case

STEP 5.
Install oil baffle, and tighten capscrews to 25 N•m (18 lbf ft).



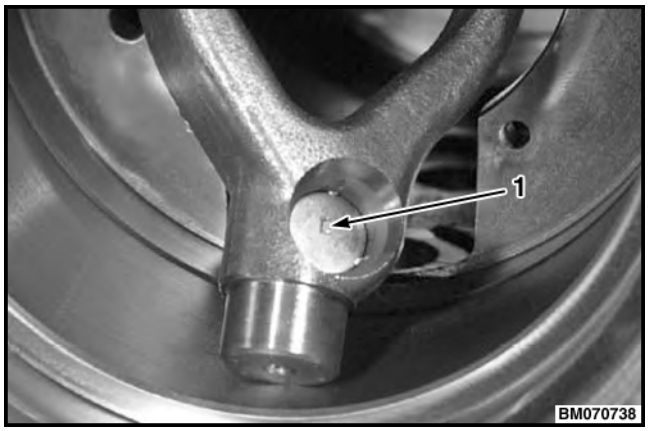
NOTE: Make sure that the pin for the bearing support is in the right hole.

STEP 16.
Remove the thrust lever and check the condition of the contact points of the thrust lever.



1. THRUST LEVER

STEP 17.
Check the condition of the thrust washers mounted in the thrust lever. If the thrust washers are severely worn or damaged, replace the complete thrust lever.



1. THRUST WASHER

CLEAN AND INSPECT

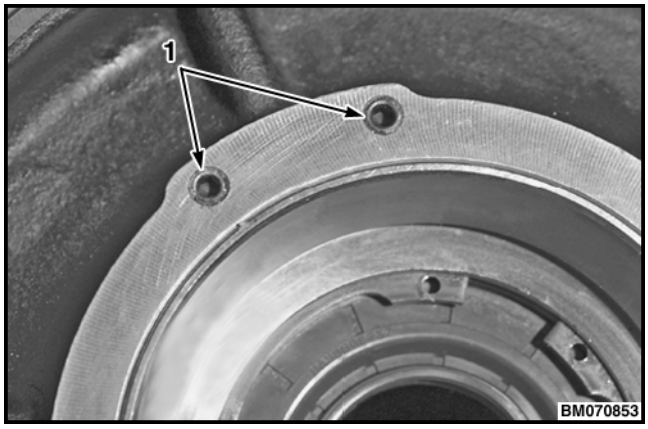
WARNING

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

1. Clean all the parts with solvent.
2. Inspect the bearings for wear or damage. Replace as needed.
3. Inspect the all parts for wear, damage, and rust. Replace parts as needed.
4. Inspect the brake disc(s). Replace discs when the groove depth thickness is less than 0.1 mm (0.0039 in.).

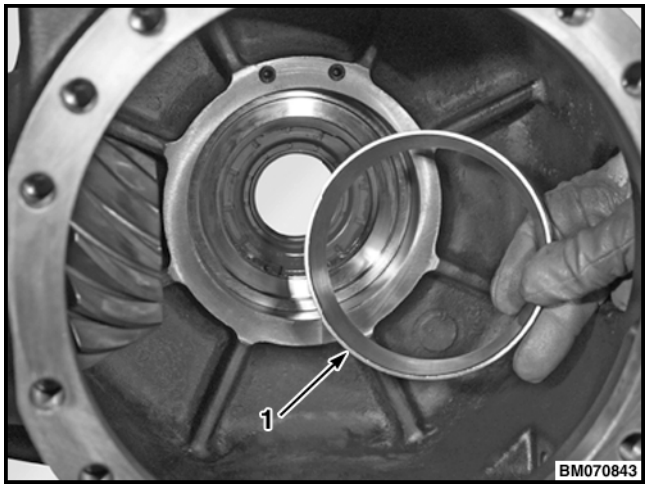
   The groove depth thickness for a new disc is 0.3 to 0.5 mm (0.0118 to 0.0197 in.).

STEP 6.
If the axle housing arms are replaced, apply Loctite® 510 to two new setscrews. Install the setscrews in the holes on the opposite side of the ring nut socket head screws. Tighten setscrews until they are flush with the axle housing.



1. SETSCREWS

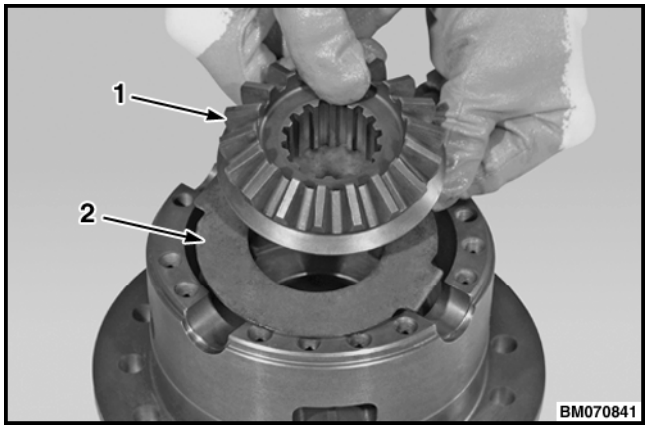
STEP 7.
If the bearing cones and cups are being replaced, install the bearing cup.



1. BEARING CUP

STEP 8.
Lubricate the thrust washer and planetary gear with John Deere JDM J20C.

Install the thrust washer and planetary gear into the differential carrier half.



1. PLANETARY GEAR
2. THRUST WASHER

Table 1. Maintenance Schedule (Continued)

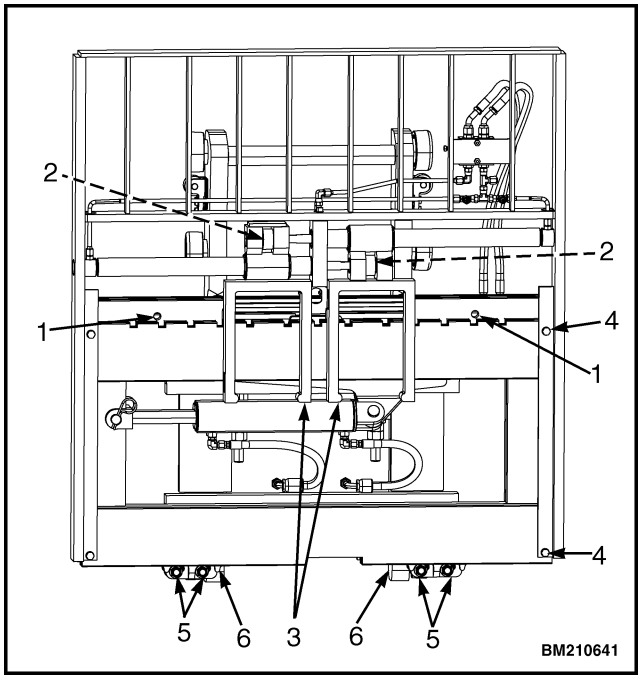
Item No.	Item	8 hr/ 1 day	250 hr/ 6 mo	500 hr/ 6 mo	1000 hr/ 6 mo	2000 hr/ 1 yr	4000 hr/ 2 yr	Procedure or Quantity	Specification
5	Spark Plugs GM 4.3L Engine				C			Change Spark Plugs 6 Plugs	1.5 mm (0.059 in.) AC 41-993
12, 14	Cooling System GM 4.3L Engine	X CIL				C		15.1 liter (15.9 qt)	See **NOTE 14**
12, 14	Cooling System Cummins 4.5L Diesel Engine	X CIL				C		13.5 liter (14.2 qt)	See **NOTE 14**
12, 14	Cooling System Cummins QSB 3.3L Diesel Engine	X CIL				C		10.4 liter (11 qt)	See **NOTE 14**
	Clean Debris From Radiator Core			X				See **NOTE 5**.	
21	Transmission Oil Filter and Breather				C			1 Filter 1 Breather See **NOTE 4**.	See **Parts Manual**
40	Transmission Oil Filter (Trucks With Two-Speed Transmission Manufactured After June 2009, or Three-Speed Transmission Manufactured After October 2009)				C			1 Filter See **NOTE 4**.	See **Parts Manual**
39	Transmission Oil Breather/Dipstick (Trucks With Two-Speed Transmission Manufactured After June 2009, or Three-Speed Transmission Manufactured After October 2009)			X				Check Breather 1 Breather	See **Parts Manual**
26	Forks	X		X		X		Check Condition	
26	Fork Latches			L				Lubricate as Necessary	Multipurpose Grease See **NOTE 7**.
X=Check C=Change L=Lubricate CIL=Check Indicator Light during operation									

Remove the lift chains. Clean the lift chains by soaking them in a solvent that has a petroleum base for at least 30 minutes. Use compressed air, adjusted to a maximum output of 103 kPa (15 psi), to completely dry the chains when they are clean.

Lubricate the lift chains by soaking them in 30W engine oil for at least 30 minutes. Remove the chains from the oil. Hang the chains for one hour so excess oil will drain from the chains.

HANG ON SIDESHIFT CARRIAGE, CHECK SLIDING SURFACES

1. Check the sideshift carriage sliding surfaces. If necessary, lubricate sliding surfaces (upper bearings) at grease fittings and lower bearing strips with multipurpose grease shown in the Maintenance Schedule. See Figure 71.



1. UPPER BEARINGS GREASE FITTINGS
2. GREASE FITTINGS FOR FORK POSITIONER CARRIER AND FORK CYLINDER ROD ANCHORS
3. FORK POSITIONERS
4. FORK POSITIONER MOUNTING CAPSCREWS
5. LOWER HOOK CAPSCREWS
6. LOWER BEARING STRIPS

Figure 71. Hang On Sideshift Carriage, Lubricate, Lift Trucks Manufactured Before August, 2012

2. If lift truck is equipped with a fork positioner, lubricate fork positioner carrier at grease fittings and the fork cylinder rod anchors with multipurpose grease shown in the Maintenance Schedule.

See Figure 71 for fork lift trucks manufactured before August, 2012.

See Figure 73 for lift trucks manufactured after August, 2012.

NOTE: Perform Step a and Step b for lift trucks equipped with hang on sideshift carriage with fork positioner manufactured before August, 2012.

3. Clean the bearing areas. Inspect the hang on sideshift bearings for wear as follows:

a. Remove upper bearings from the upper carriage bar. If any upper bearings are worn to less than 1.5 mm (0.06 in.) thickness, replace all upper bearings by driving upper bearings from upper carriage bar. Install new upper bearings into upper carriage bar. See Figure 72.

b. Remove lower bearings from the lower carriage bar. If any lower bearings are worn to less than 1.5 mm (0.06 in.) thickness, replace all lower bearings by prying lower bearings from the lower carriage bar. Install new lower bearings onto lower carriage bar. See Figure 72.

Table 1. Maintenance Schedule (Continued)

Item No.	Item	8 hr/ 1 day	500 hr/ 1 yr	1000 hr/ 1 yr	2000 hr/ 1 yr	4000 hr/ 2 yr	Procedure or Quantity	Specification
9, 33	Engine Oil Fill/Dip Stick GM 4.3L Engine (LPG)	X CIL	C Every 6 mos				5.0 liter (4.7 qt) See **NOTE 4**, **NOTE 5**, and **NOTE 16**.	-7°C (20°F) and Below SAE 5W-20 16°C (60°F) and Below SAE 5W-30 -18°C (0°F) and Above SAE 10W-30 API SM ILSAC GF4 SAE J2362
9, 33	Engine Oil Fill/ Dipstick Cummins 4.5L Engine (Diesel)	X CIL	C Every 6 mos				13.0 liter (13.7 qt) See **NOTE 4**, **NOTE 5**, and **NOTE 16**.	0°C (32°F) and Below SAE 0W-30 -25 to 20°C (-13 to 68°F) SAE 5W-30 -20 to 20°C (-4 to 68°F) SAE 10W-30 -15°C (5°F) and Above SAE 5W-40 or 15W-40 API CH-4 or CI-4
9, 33	Engine Oil Fill/ Dipstick Cummins QSB 3.3L Engine (Diesel)		C Every 6 mos				7.5 liter (8 qt) See **NOTE 4**, **NOTE 5**, and **NOTE 16**.	0°C (32°F) and Below SAE 0W-30 -25 to 20°C (-13 to 68°F) SAE 5W-30 -20 to 20°C (-4 to 68°F) SAE 10W-30 -15°C (5°F) and Above SAE 5W-40 or 15W-40 API CH-4 or CI-4
19	Engine Oil Filter GM 4.3L Engine		C Every 6 mos				1 Filter See **NOTE 4**, **NOTE 5**, and **NOTE 16**.	See **Parts Manual**
19	Engine Oil Filter Cummins 4.5L and QSB 3.3L Diesel Engine		C Every 6 mos				1 Filter See **NOTE 4**, **NOTE 5**, and **NOTE 16**.	See **Parts Manual**
18	Air Filter (With Premium Monitoring)	CIL			C		1 Filter See **NOTE 5**, **NOTE 6**, **NOTE 11**, and **NOTE 16**.	See **Parts Manual**
18	Air Filter	X			C		1 Filter See **NOTE 5**, **NOTE 6**, **NOTE 11**, and **NOTE 16**.	See **Parts Manual**
X=Check C=Change L=Lubricate CIL=Check Indicator Light during operation								

CONTROL LEVERS AND PEDALS

Lubricate linkages, pedal shafts, control cables (throttle, hood hinges, parking brake), and seat rails. Use a silicone spray lubricant, Yale Part No. 504236201 .

INSPECT ENGINE ELECTRICAL SYSTEM, CONNECTORS

NOTE: Turn engine OFF before inspecting engine electrical system.

When inspecting the electrical system, check the following:

- Check and clean battery connection. Ensure that connections are tight.
- Check battery for damage or cracks to the case. Replace if necessary.
- Check positive and negative cables for corrosion, rubbing, and chaffing. Tighten connections at both ends.
- Check engine wire harness for rubbing, chaffing, pinching, and cracks or breaks in the wiring.
- Check engine harness connectors. Check to ensure connectors are fitted and locked by pushing the connectors together. Pull on the connector halves to make sure they are locked.
- Check ignition coil wire and spark plug wires for hardening, cracking, arching, chaffing, separation, split boot covers, and proper fit. Replace spark plugs at the recommended interval as shown in the Maintenance Schedule.
- Check that all electrical components are securely mounted and retained to the engine or chassis.
- Check the Malfunctioning Indicator Light (MIL), charging, and oil pressure lights for operation by starting the engine and checking that the light illuminates before turning out.

TRANSMISSION OIL, FILTER, BREATHER CHANGE AND WET BRAKE DRIVE AXLE OIL CHANGE

WARNING

At operating temperature, the transmission and wet brake axle oil is HOT. DO NOT permit the hot oil to touch the skin and cause a burn.

CAUTION

The oil used for the wet brake drive axle or transmission should not be contaminated. If either the wet brake drive axle and/or transmission oil becomes contaminated, the oil must be drained and replaced with new oil.

CAUTION

DO NOT permit dirt to enter the transmission or wet brake drive axle when the oil level is checked or the transmission filter is changed. Dirt will contaminate the oil and cause damage to the transmission and wet brake drive axle components.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

NOTE: Change the transmission oil filter at the first 500 hours of operation on new lift trucks.

NOTE: Turn engine OFF before changing transmission oil, filter, and breather.

1. The drain plug for the transmission is located on the bell housing side of the transmission sump. Remove drain plug. Be sure container is large enough to hold all the oil. See Maintenance Schedule for transmission oil quantity. Once oil is completely drained, reinstall drain plug.

   See Figure 66 for lift truck models with two-speed transmission manufactured before June 2009, or three-speed transmission manufactured before October 2009.

   See Figure 67 for lift truck models with two-speed transmission manufactured after June 2009, or three-speed transmission manufactured after October 2009.

Item	Cummins 4.5L Diesel
Governed Speed High Idle (No Load)	2250 ±50 rpm
Thermostat Range	
STARTS TO OPEN	82°C (180°F)
FULL OPEN	95°C (203°F)
Cooling System Pressure	103 kPa (15 psi)

Item	Cummins QSB 3.3L Diesel
No. of Cylinders	4
Firing Order	1-3-4-2
Bore and Stroke	95 mm × 115 mm (3.74 in. × 4.53 in.)
Displacement	3261 cc
Compression Ratio	17.3:1
Horsepower/rpm (basic transmission)	80 @ 2200 rpm
Horsepower/rpm (Duramatch transmission)	99 @ 2200 rpm
Oil Pressure	49 kPa (7 psi)
Valve Clearance	
Intake	0.35 mm (0.014 in.)
Exhaust	0.50 mm (0.02 in.)
Idle Speed	800 ±25 rpm
Governed Speed High Idle (No Load)	2230 ±25 rpm
Thermostat Range	
START TO OPEN	82°C (180°F)
FULL OPEN	95°C (203°F)
Cooling System Pressure	103 kPa (15 psi)

Torque Specifications

FRAME

Overhead Guard Mount Capscrews
66 N•m (49 lbf ft)

Cowl-to-Overhead Guard Legs
66 N•m (49 lbf ft)

Steering Column Nut
40 to 54 N•m (30 to 40 lbf ft)

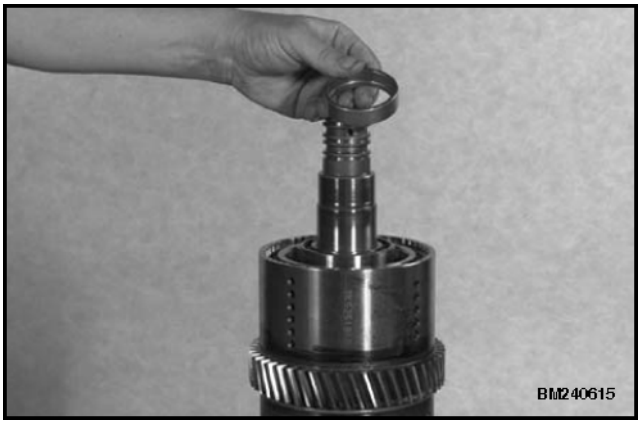
Counterweight Capscrews
1020 N•m (750 lbf ft)

MAST, LIFT TRUCK MODELS GLC/ GDC60VX, GLC/GDC70VX (GC/GLC/ GDC135VX, GC/GLC/GDC155VX) (C879, D879)

Mast Mounting Capscrews
Mast to Drive Axle 320 N•m (236 lbf ft)
Tilt/Cylinder Adjust 90 N•m (66 lbf ft)
Pivot Pin Retainer 68 N•m (50 lbf ft)

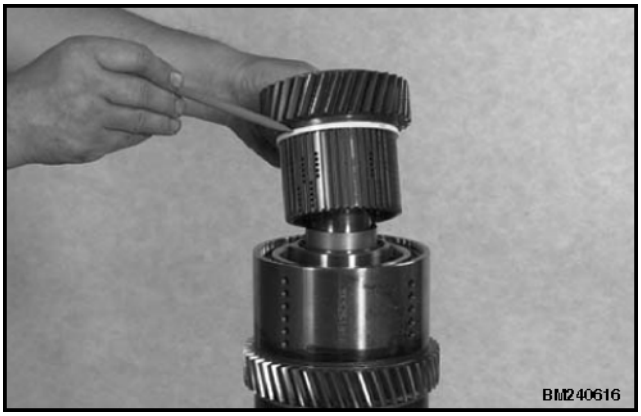
Chain Anchor Nut
370 N•m (273 lbf ft)

STEP 10.
Install spacer.



CAUTION
DO NOT force this operation, could cause damage to seal rings.

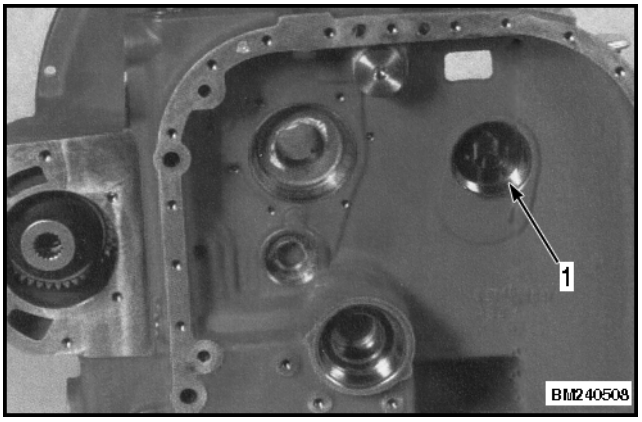
STEP 11.
Install new clutch sealing ring and install forward low clutch gear and bearing as an assembly. Align splines on forward low with internal teeth of inner (friction) discs.



WARNING
Hot Parts. Wear protective clothing and gloves to prevent burns.

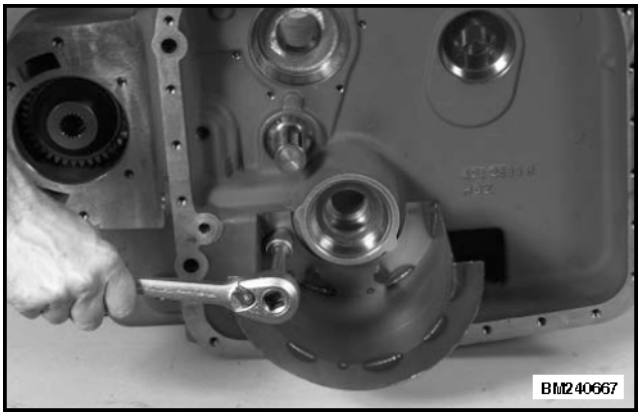
CAUTION
DO NOT use an open flame to warm bearings. Using an open flame could cause damage to bearing.

STEP 18.
Remove REVERSE 1 and RANGE 1 gear shaft cup.

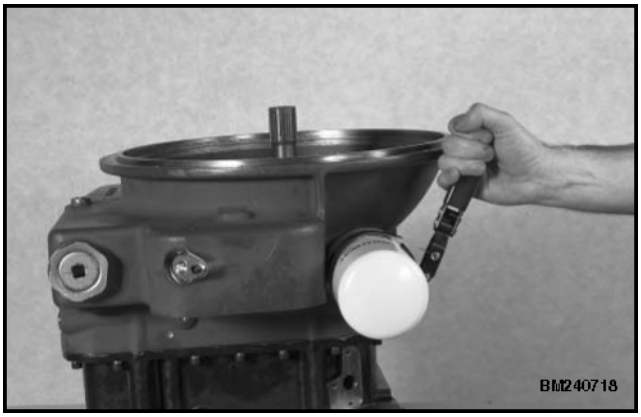


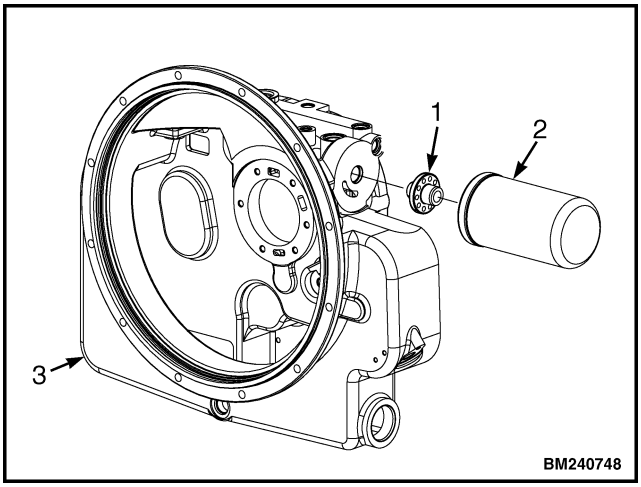
1. REVERSE 1 AND RANGE 1 GEAR SHAFT CUP

STEP 19.
Remove three capscrews and oil baffle.



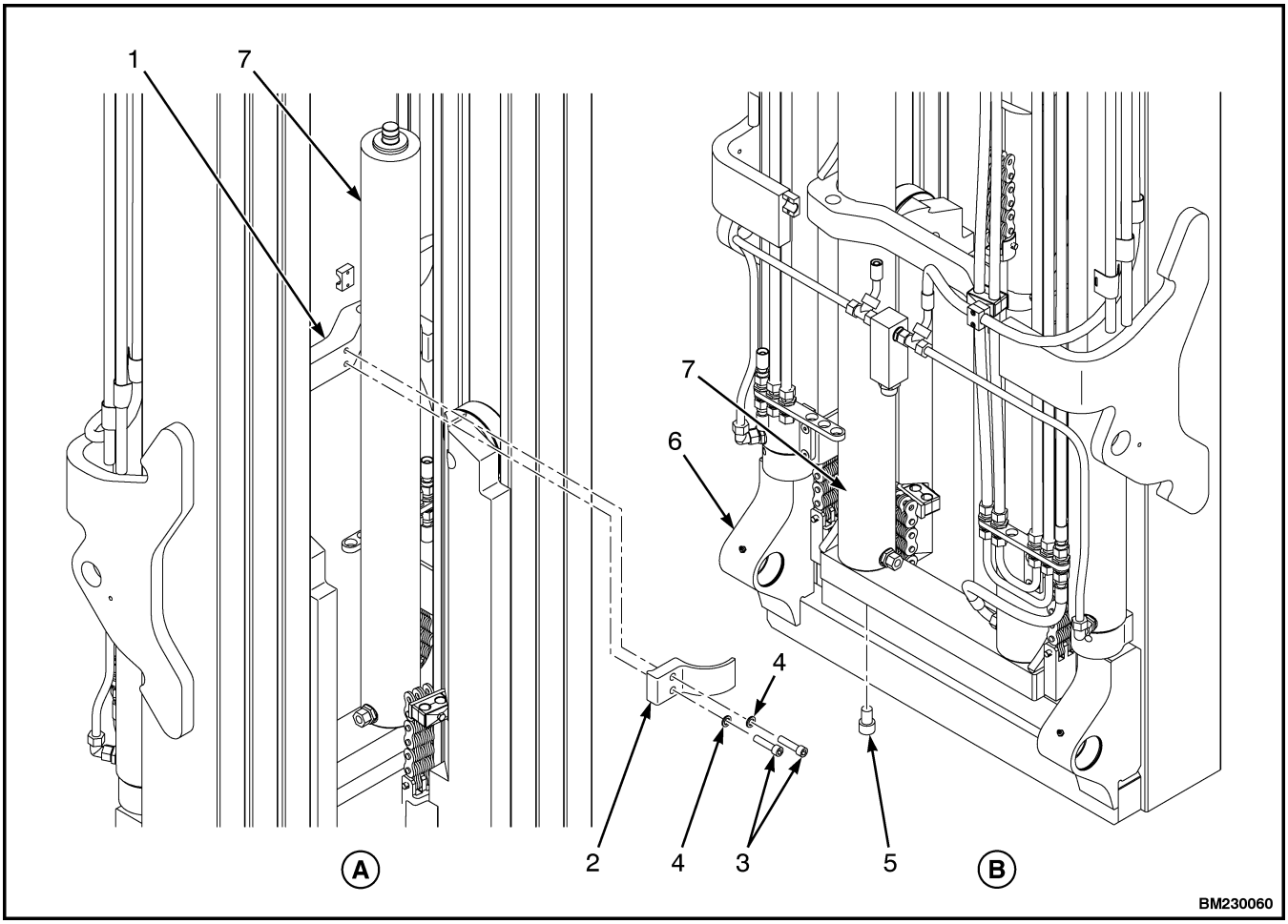
STEP 15.
If necessary, install filter adapter. Install new oil filter element. Tighten oil filter element hand tight. Turn addition 1/4 turn.





1. FILTER ADAPTER
2. OIL FILTER ELEMENT
3. CONVERTER HOUSING

STEP 16.
Install turbine shaft bearing cap.



A. FRONT VIEW

1. CROSSMEMBER
2. BRACKET
3. SCREW
4. WASHER

B. REAR VIEW

5. RETENTION SCREW
6. MAST
7. FREE-LIFT CYLINDER

Figure 25. Free-Lift Cylinder Mount for Lift Truck Model GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)

DISASSEMBLE

CAUTION

Carefully disassemble the free-lift cylinder so the piston rods and sliding surfaces are not damaged.

NOTE: To prevent damage to sealing surfaces, use brass tools when removing or installing seal and O-rings.

1. Loosen gland with spanner wrench.

2. Remove gland from shell.

See Figure 26 for lift truck models

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

See Figure 27 for lift truck model

- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909)