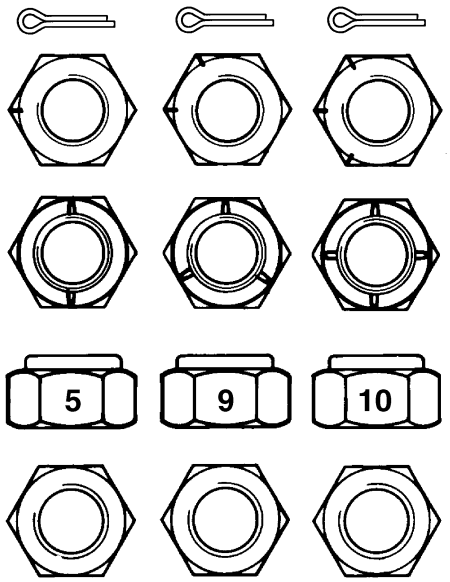
Yale®

Maintenance

METRIC AND INCH (SAE) FASTENERS



HM210064

b. For new aluminum heads, tighten the spark plugs to 20 N•m (15 lbf ft).

c. For new iron heads, tighten the spark plugs to 30 N•m (22 lbf ft).

Distributor Repair

INSPECT

1. Remove the engine cover. Refer to the **Frame** section for your lift truck.

NOTE: Discoloration of the cap and some whitish buildup around the cap terminals is normal. Yellowing of the rotor cap, darkening, and some carbon buildup under the rotor segment is normal. Replacement of the cap and the rotor is not necessary unless there is a driveability concern.

2. Inspect the cap for cracks, tiny holes, or carbon tracks between the cap terminal traces. Diagnose the carbon tracks using the following procedure:

a. Remove the cap. Refer to Distributor, Replace.

b. Place 1 lead from the DMM on a cap terminal.

c. Use the other lead in order to probe all other terminals and the center carbon ball.

d. Move the base lead to the next terminal. Probe all other leads.

e. Continue this procedure until you test all the secondary terminals.

f. If there are any non-infinite readings, replace the cap.

3. Inspect the cap for excess buildup of corrosion on the terminals. Scrape clean the terminals. Replace the cap if the corrosion is excessive. Some buildup is normal.

4. Inspect the rotor segment for excess wear. Replace the rotor if excess looseness in the rotor segment is present. See Figure 8.

5. Inspect the shaft for shaft-to-bushing looseness:

a. Inspect the housing for cracks or damage.

b. Insert the shaft in the housing.

c. If the shaft wobbles, replace the housing assembly.

6. Install the engine cover. Refer to the **Frame** section for your lift truck.

OVERHAUL

Disassemble

1. Remove the engine cover. Refer to the **Frame** section for your lift truck.

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.

2. Align 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.

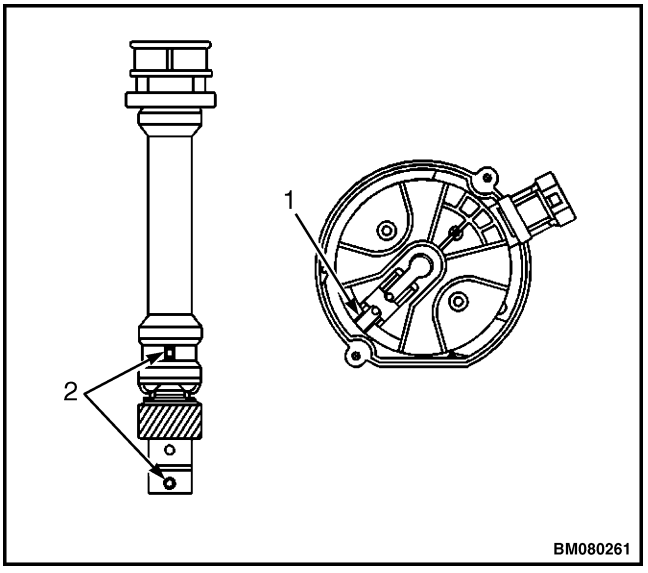


Figure 7. Rotor Segment and Distributor Alignment

CHECK	PROCEDURE	ACTION
Hydraulic Interlock Check	**NOTE:** Hydraulic Interlock message will result if operator not detected in seat or mini-levers not mechanically or electronically in the neutral position when power **ON**. While operator in seat, power truck **ON**. ***Does display show "Hydraulic Interlock?"*** *Continue:* While operator in seat and not touching MLM, power truck **ON**. ***Does display show "Hydraulic Interlock?"***	**YES:** Be sure Operational Checkout Procedures has been performed and passed, then continue. **NO:** Hydraulic Interlock is OK. **YES:** Refer to appropriate **Electrical System** manual and perform **TEST, Mini-Levers**. **NO:** Hydraulic Interlock is OK.
Armrest Hydraulic Interlock Check [If equipped and with original Configuration Data File (CDF)]	1. With engine running and seated in seat, move armrest upward. 2. Attempt to operate hydraulics (with armrest up). ***Does hydraulic control function with armrest up?***	**YES:** Go to Observed Symptoms, Electro-Hydraulics Can Still Function With Armrest Raised, Page 9030-30-23. **NO:** Go to next check.
Engine Cover Latch Sensor Check (If equipped)	1. Apply park brake. 2. Start engine and raise cover. ***Does engine stop?***	**YES:** Go to next check. **NO:** Check DSC to see if engine cover latch sensor is ON in the VSM. If engine cover latch is ON, go to Observed Symptoms, Engine Continues to Run When Engine Cover is Raised, Page 9030-30-1.
Brake and Inching Pedal Check	1. With engine running, fully depress inching pedal. 2. Release park brake. 3. Shift to forward and increase engine to governed speed. **NOTE:** There is not an exact operating procedure for the inching function, except it must disengage the transmission. Inching can be set to operator's preference to fit the lift truck application in the DSC. ***Does engine increase smoothly to governed speed?***	**YES:** Inching function is OK. Go to next check. **NO:** Operate truck to 10 full stops in each direction while fully pressing inch/brake pedal each time. The VSM will re-learn the brake characteristics.
Park Brake Sensor Check	1. With engine running, release park brake. 2. Slowly apply park brake and note when park brake light comes ON. ***Does light come on before park brake reaches first click of engagement?***	**YES:** Park brake sensor is OK. Go to next check. **NO:** Adjust park brake sensor. Refer to appropriate **Brake System** manual, depending on lift truck model.

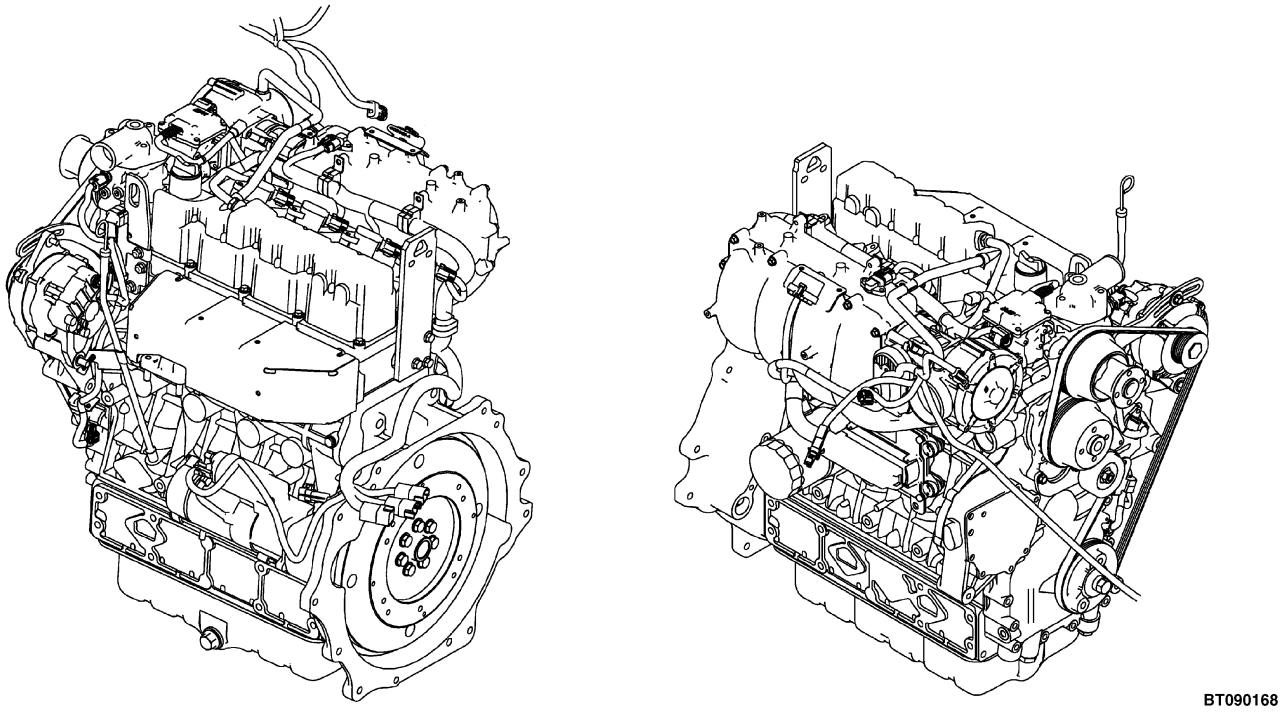


Figure 9020-10-13. Kubota Spark Ignited 3.8L

Engine Coolant Temperature Sensor (Lift Trucks Built Before January, 2007)

1. Depending on your lift truck,
   - (Lift Trucks Built Before January, 2010), GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910), GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875), GC/GLC030-035VX, GC/GLC040SVX (C809), and GLP/GDP16-18VX, GLP/GDP20SVX (GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX) (C810) go to Step 2.
   - (Lift Trucks Built After January, 2010), GC/GLC040-070VX, GC/GLC055SVX (A910), GP/GLP/GDP040-070VX (B875), GC/GLC030-035VX, GC/GLC040SVX (C809), and GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX (C810) go to Step 3.

2. The Engine Coolant Temperature (ECT) sensor is a thermistor-type sensor. The sensor is installed in the underside of the intake manifold. See Figure 9020-10-47. When the engine is cold, extra fuel is needed. The ECT sensor signals the ECU to hold the fuel injectors open longer, supplying more fuel to the engine. As the coolant temperature increases, the sensor warms causing the internal resistance of the sensor to decrease. As a result, the voltage signal that the ECU receives decreases and the extra enrichment is reduced. Common emission failures are caused by this sensor and are normally accompanied by a hard start. When the sensors fail, they normally indicate a permanent cold or hot condition, causing either too much fuel on hot starts or not enough for cold starts.

3. The Engine Coolant Temperature (ECT) sensor is a thermistor-type sensor. The sensor is installed on the underside of the thermostat housing. See Figure 9020-10-57. As the coolant temperature increases, the sensor warms causing the internal resistance of the sensor to decrease. Common emission failures are caused by this sensor and are normally accompanied by a hard start. When the sensors fail, they normally indicate a permanent cold or hot condition. See Figure 9020-10-58.

The DIS module is installed as a unit. Coil Parameters:

Primary resistance: 0.5 ±0.05 Ω

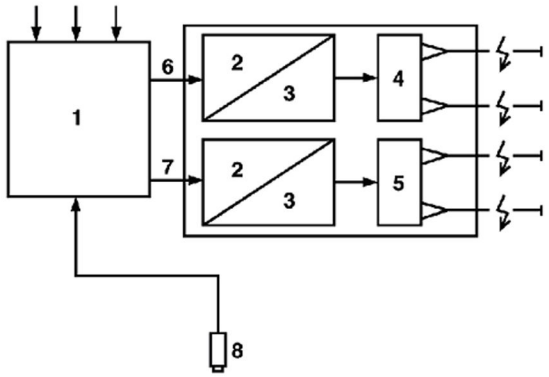
Secondary resistance: 5100 ±300 Ω

Primary inductance: 2.75 ±0.25 mH @ 3.5A, 60 Hz

Secondary inductance: 17.5 ±1.2 H @ 2.75 mA, 60 Hz

Engine speed range: 30 to 8000 rpm

The DIS module contains two ignition voltage amplifiers, each of which supplies one coil with primary current. A current limiter circuit protects against overload. The ECU starts ignition via two signal outputs. See Figure 9020-10-117. Each lead (EST A and EST B) supplies one coil. EST A ignites cylinders 1 and 4, EST B cylinders 2 and 3. When the ignition signal actuates EST A (terminal cyl 1 and cyl 4 are pulsed to ground), coil 1 induces a high voltage pulse according to Lenz's law. Each coil simultaneously ignites one cylinder with combustible mixture and one with combusted mixture.



1. ENGINE CONTROL UNIT (ECU)
2. CURRENT LIMITER
3. DARLINGTON CIRCUIT
4. COIL 1/4
5. COIL 2/3
6. EST A
7. EST B
8. CRANKSHAFT SENSOR

Figure 9020-10-117. DIS Block Diagram

Electronic Ignition Signals

EST Signal. The EST input receives a voltage signal from the control unit. The two dual ignition coils are supplied with the necessary ignition energy by the dual ignition coil driver module. This primary current builds up a magnetic field in the primary winding. When the control unit has determined the point at which ignition must occur, using the ignition map, the primary current (EST signal) is switched off (dwell angle algorithm). The magnetic field, which has flowed through the primary and the secondary winding collapses. The resulting high voltage is forwarded via the two high voltage cables of the DIS module and the spark plug electrodes to the engine ground.

Starting Mode and Operating Mode. In the starting mode, the dwell period (EST on) is dependent on a fixed angle °CA (Crank Angle) and battery voltage. In the operating mode, the dwell period is based on the relationship between engine speed and battery voltage as stored in the dwell angle map. The transition from the starting mode to the operating mode occurs at approximately 400 rpm.

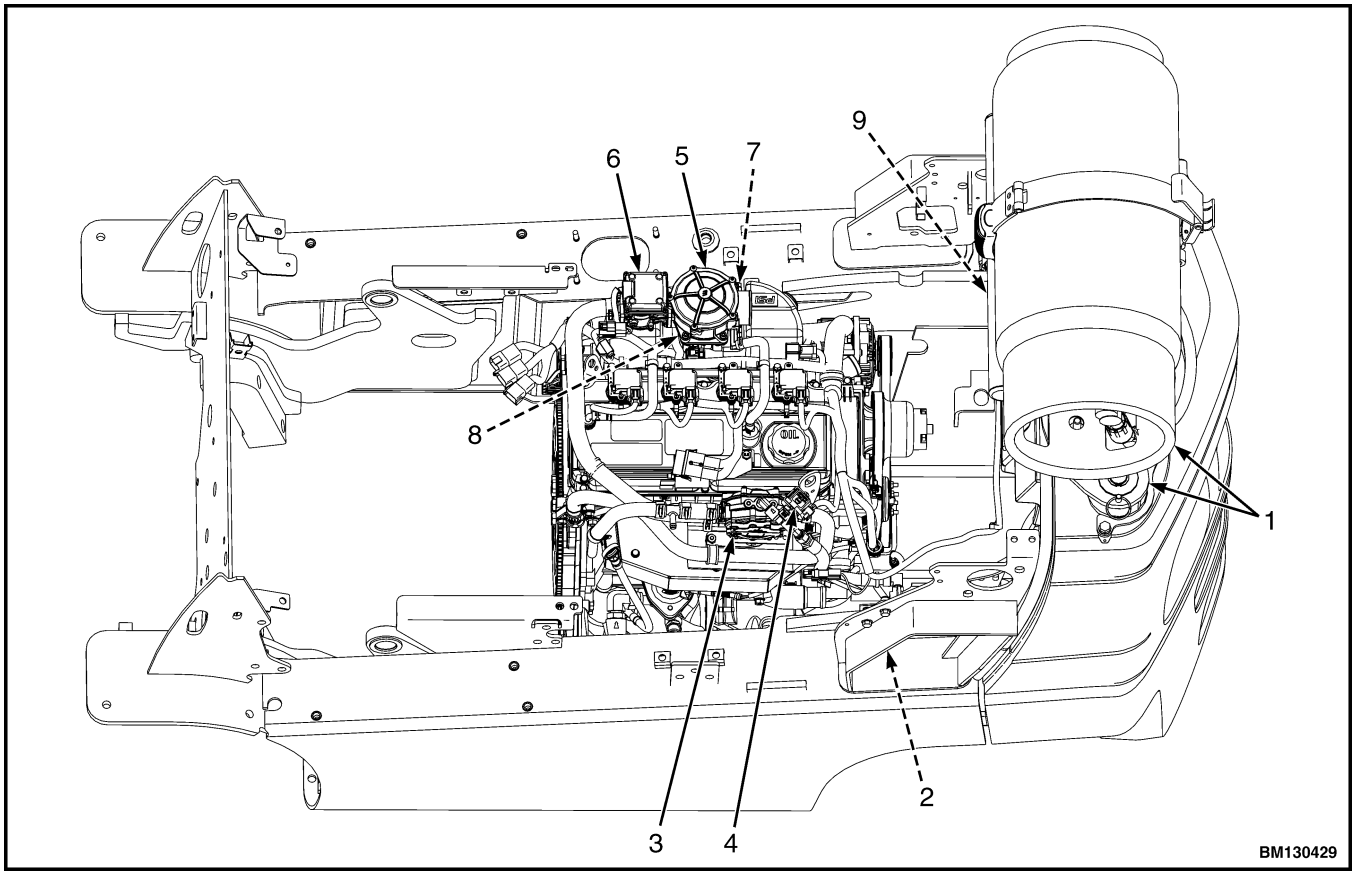
Dwell Period in Starting Mode.

Battery Voltage	Magnetic Field Starts to Build Up at
Greater than 12 Volts	18° to 24°CA before ignition point
Less than 10 Volts	36° to 42°CA before ignition point

Primary Current as a Function of the Battery Voltage in Operating Mode. If the battery voltage is higher than 9 volts, the primary current will not sink below 6.5A.

Voltage Limitation. The operating range of the DIS lies between 6 and 16 volts. However, overvoltage of up to 24 volts or reversal of the supply voltage and ground leads will not lead to damage, as long as it does not persist for longer than 60 seconds.

LPG System



1. TANK
2. FUEL FILTER
3. VAPORIZER
4. LOCK-OFF SOLENOID
5. FUEL MIXER
6. DIRECT ELECTRONIC PRESSURE REGULATOR (DEPR)
7. ELECTRONIC THROTTLE
8. ENGINE CONTROLLER
9. EXHAUST SYSTEM

Figure 9020-10-184. Key Components of LPG Fuel System, (PSI 2.0L Engine)

Engine Backfires

POSSIBLE CAUSE

A. IGNITION SYSTEM PROBLEM.
B. FUEL SYSTEM PROBLEM (GASOLINE AND LPG ENGINES ONLY).
C. ENGINE MECHANICAL PROBLEMS.

CAUSE A - IGNITION SYSTEM PROBLEM.

PROCEDURE OR ACTION:

1. For Mazda and GM engines:
    - Check for proper ignition voltage output with spark tester tool
    - Verify that the spark plugs are correct.
    - Check spark plugs for the following:
        - Fouling (wet or black coated electrodes)
        - Cracks
        - Wear
        - Improper gap
        - Burned electrodes
        - Heavy deposits
    - Check for bare or shorted spark plug cables.
2. For Mazda engines only:
    - Verify that each spark plug is connected to proper tower on the distributor.
    - Check for loose spark plug cable connections at ignition coil, distributor, and spark plugs.
    - Check distributor rotor, cap, and towers/posts for wear or damage.
    - Check ignition timing.
3. For GM engines only:
    - Verify that each spark plug is connected to proper coil terminal.
    - Check for loose spark plug cable connections at ignition coils and spark plugs.
    - Check coil and towers/posts for wear or damage.
    - Verify each coil is producing the proper ignition voltage using a spark tester.

Is ignition system in good condition?
YES: Go to CAUSE B.
NO: Repair ignition system. Refer to appropriate **GM Engines** or **Electrical System** manual, depending on lift truck model. If necessary, replace spark plugs.

Engine is Overheating

POSSIBLE CAUSE

A. AIR FLOW BLOCKAGE.
B. DAMAGED RADIATOR.
C. FAULTY THERMOSTAT.
D. DAMAGED COOLANT PUMP.
E. DAMAGED HOSES.
F. FAULTY IGNITION TIMING (MAZDA ENGINES ONLY).
G. COOLING SYSTEM PROBLEMS.
H. FUEL SYSTEM PROBLEMS (DIESEL ENGINES ONLY).
I. ENGINE MECHANICAL PROBLEMS.

CAUSE A - AIR FLOW BLOCKAGE.

PROCEDURE OR ACTION:

1. Check for the following:
   - Debris lodged in radiator fins
   - Debris lodged in removable pre-screen
   - Damaged fan
   - Loose or damaged fan belt

   Are any of these causes present?
   YES: Clean or repair components as needed. Refer to appropriate **Operating Manual** and **Cooling System** manual, depending on lift truck model.
   NO: Go to CAUSE B.

CAUSE B - DAMAGED RADIATOR.

PROCEDURE OR ACTION:

1. Check radiator for:
   - Cracks, fractures, or leaks
   - Proper coolant
   - Proper coolant level
   - Proper coolant glycol ratio
   - Proper cap sealing and operation

   Are any of these causes present?
   YES: Repair or replace radiator or cap and fill system with proper coolant. Refer to appropriate **Operating Manual** and **Cooling System** manual, depending on lift truck model.
   NO: Go to CAUSE C.

TABLE OF CONTENTS

DTC 2236-12 - CANbus Comm Error With MLM
DTC 2238-12 - CANbus Comm Error With Impact Sensor Module
DTC 521670-12 - CANbus Impact Sensor Update Failure
DTC 523527-2 - Monitoring IC Abnormal
DTC 523538-2 - Memory QR Data Abnormal
DTC 523538-7 - Memory QR Data Write Failure
DTC 523547-2 - VSM CANbus Off (Kubota equipped trucks)
DTC 523548-2 - CAN Frame Error
DTC 523596-2 - CAN Frame Error
DTC 523598-2 - CAN Frame Error
DTC 523578-2 - No Communication from EGR
DTC 523591-2 - CAN CCVS Frame Error
DTC 523592-2 - Regeneration Switch Message Error
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DTC 524268-12 - Invalid Parameter
DTC 628-13 - Engine Controller Memeory Checksum Invalid
DTC 1634-13 - Engine Controller Processor Error
DTC 1634-2 - Engine Controller Hardware ID Failure..... 9030-20-439
Redundant Microprocessor Error:
DTC 628-12 - GM ECU Program Memory Checksum Error
DTC 630-12 - GM ECU Code Checksum Error
DTC 522690-2 - Redundant Microprocessor Error (GM-ECU)
DTC 522690-12 - SPI Bus (Communications) Error
DTC 522691-2 - Redundant Microprocessor Sanity Check
DTC 522691-12 - GM ECU Checksum Error
DTC 522692-2 - GM ECU Redundant Microprocessor General A/D Error
DTC 522693-12 - Internal Central Processor or Circuitry Faults (Mazda Gas ECU)
DTC 522694-12 - GM ECU Memory Checksum (RAM) Error
DTC 522695-2 - GM ECU Redundant Throttle A/D Conversion Error
DTC 522696-2 - GM ECU Redundant Pedal A/D Conversion Error
DTC 522697-0 - Microprocessor Failure - RAM
DTC 522697-12 - Internal Central Processor or Circuitry Faults (Mazda LPG ECU/Gas GCU)
DTC 522697-12 - Internal Central Processor or Circuitry Faults
DTC 522698-2 - GM ECU Redundant Microprocessor Clock Failure
DTC 522699-2 - GM ECU Redundant Microprocessor Failure
DTC 522700-2 - GM ECU Redundant Microprocessor SDF Timeout.....9030-20-443
Engine RPM Data Erratic:

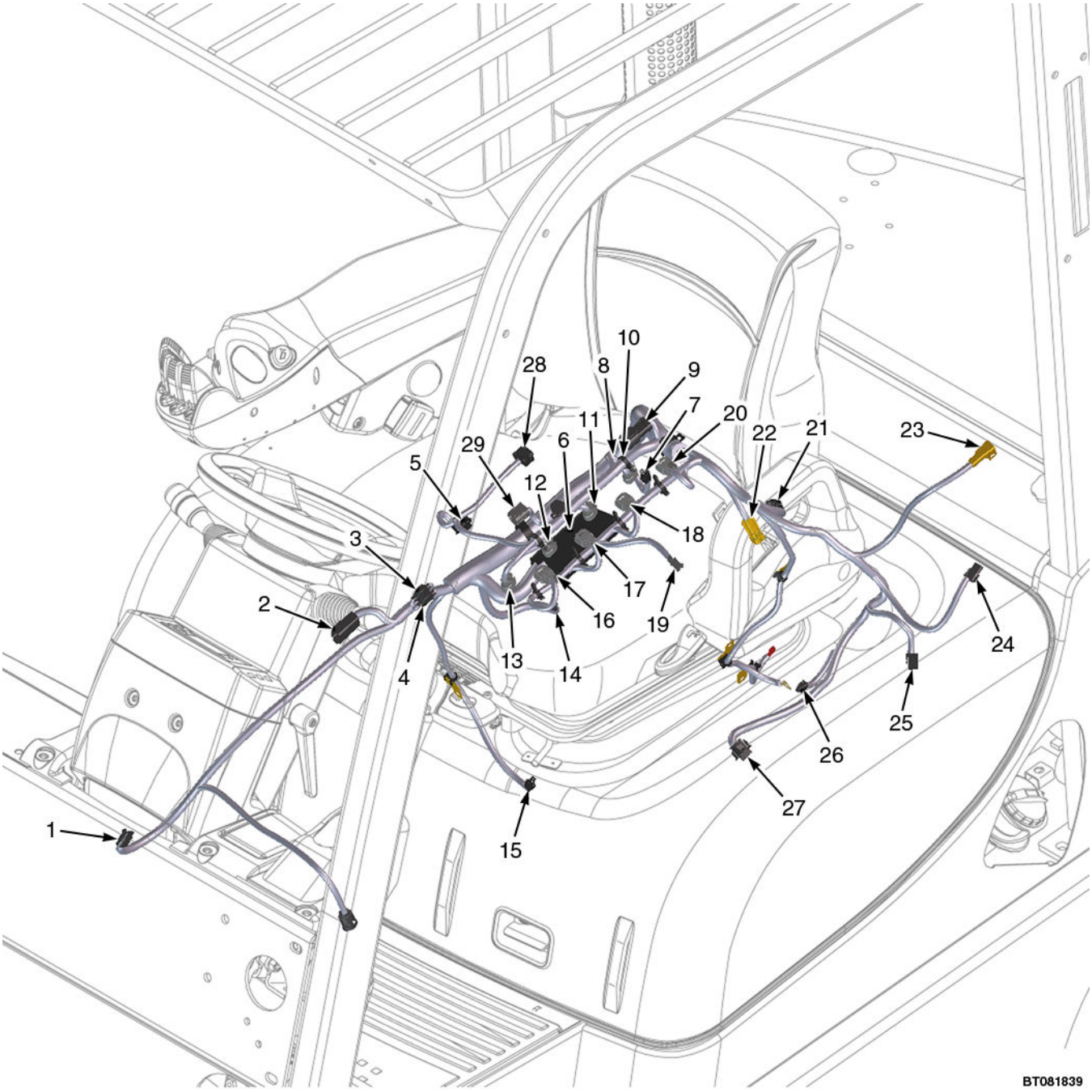


Figure 9030-03-4. Engine Harness Assembly (PSI 2.4L Bi-Fuel)

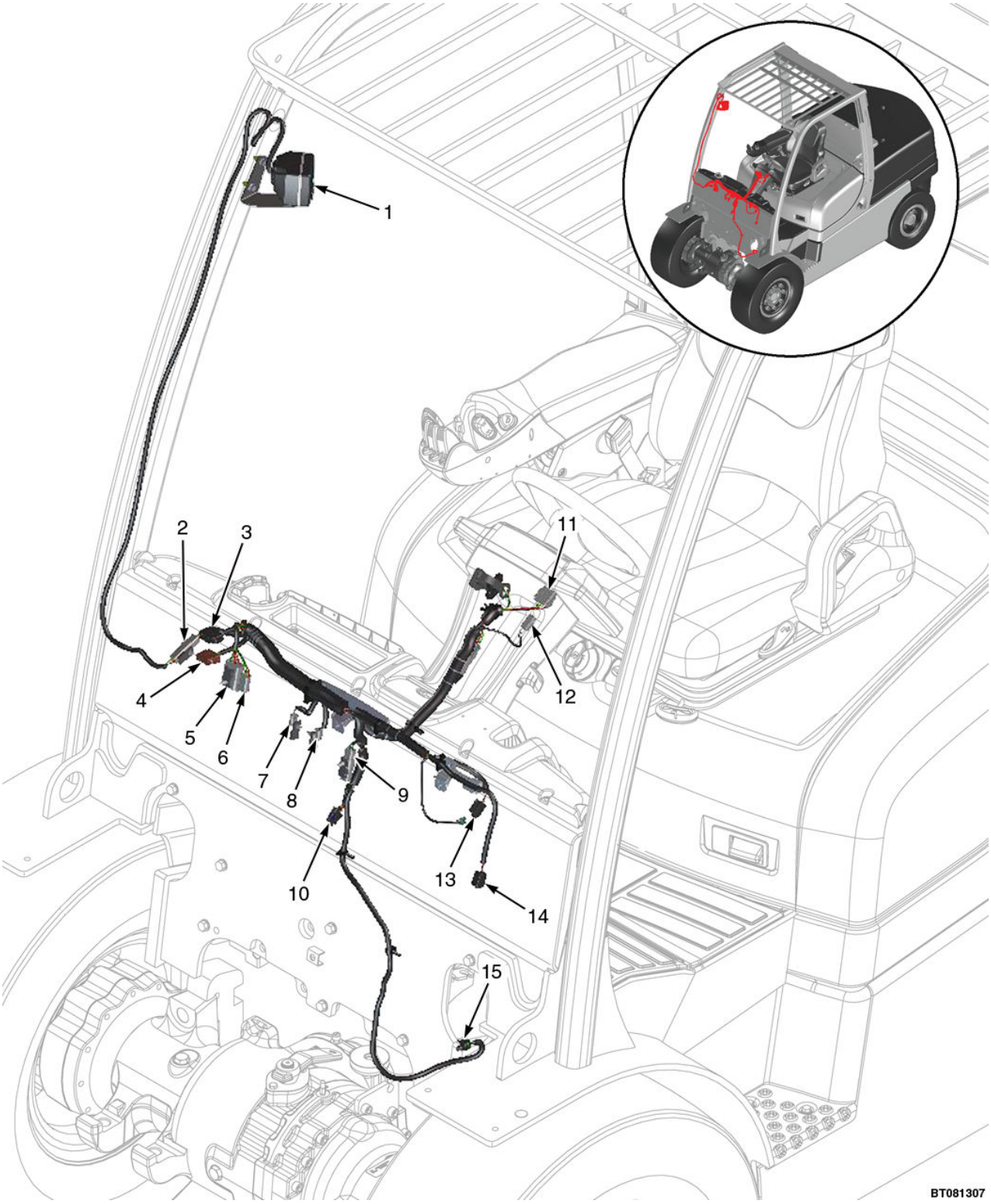
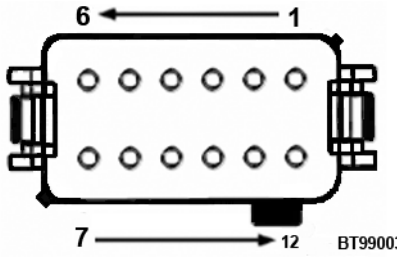
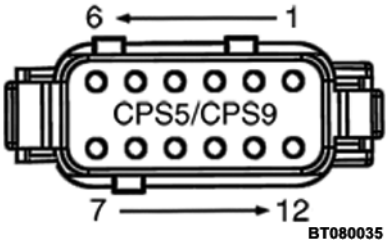


Figure 9030-03-25. Cowl Harness With Diesel Particulate Filter (Kubota 3.8L Diesel Engine)

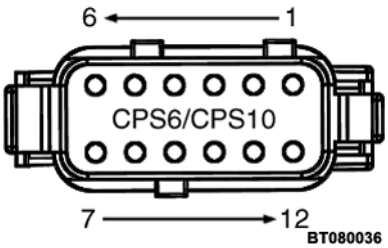
CONNECTOR(S)



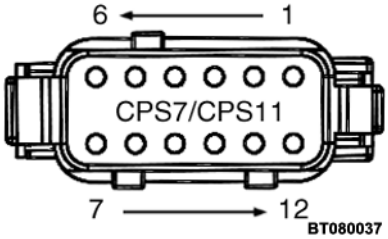
Connector CPS 3



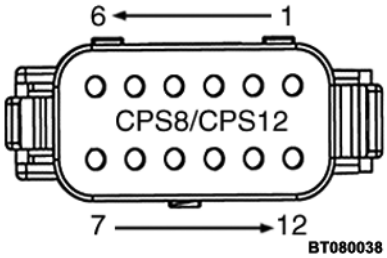
VSM Connector CPS 5



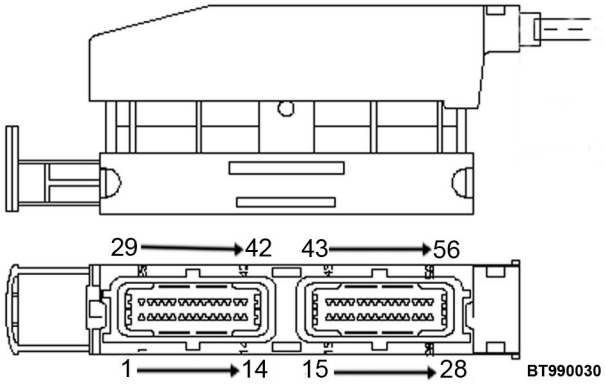
VSM Connector CPS 6



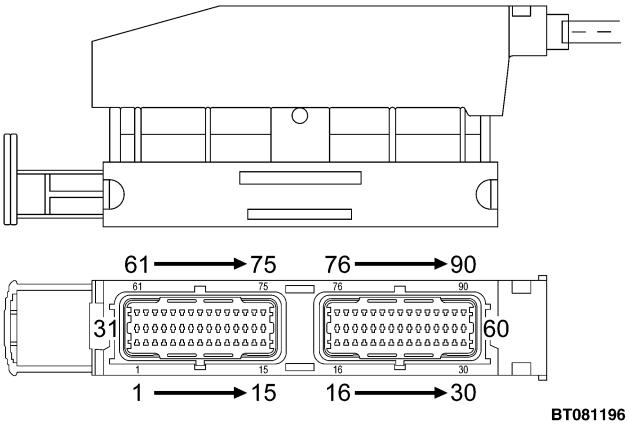
VSM Connector CPS 11



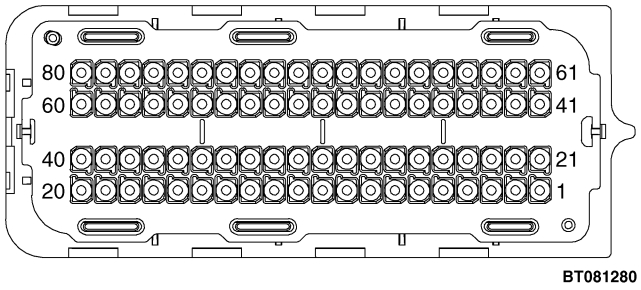
VSM Connector CPS 12



Mazda ECU Connector CPS 202

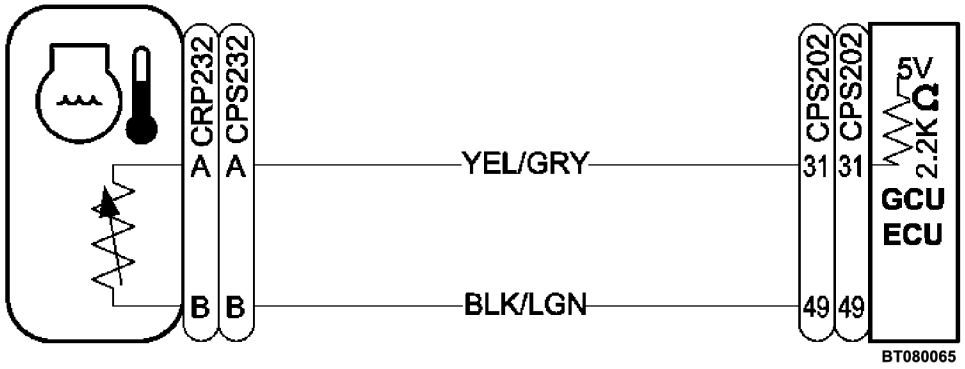


GM (2011) and Mazda ECU Connector CPS 202 (2007 Mazda EPA and 2011 LPG GM-PSI)

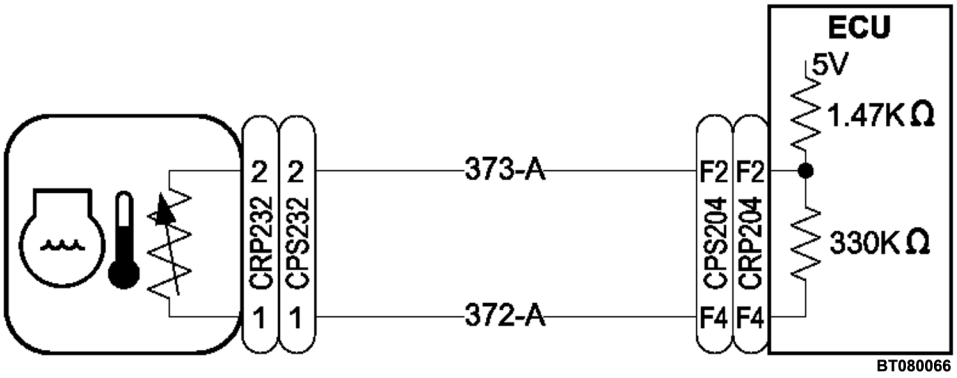


ECM Connector CPS 204 (Kubota)

DIAGRAMS



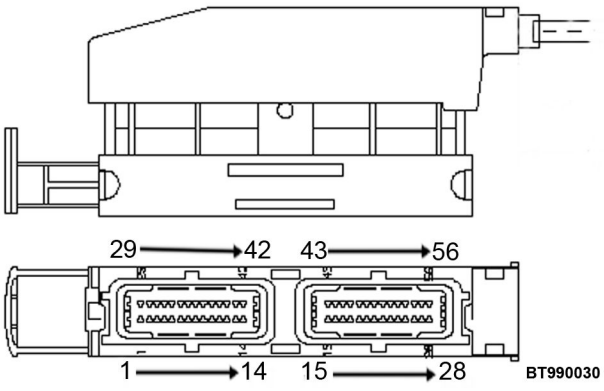
Engine Coolant Temperature Schematic (Mazda)



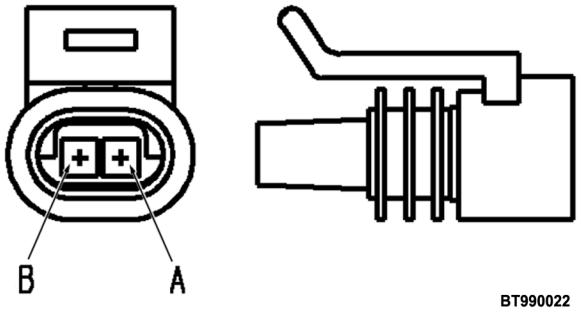
- WIRE # 372 = SENSOR SIGNAL
- WIRE # 373 = SENSOR RETURN

Engine Coolant Temperature Schematic (GM 2010)

CONNECTOR(S)



ECU Connector CPS 202



Engine Coolant Temperature Sensor Connector CPS 232

CODES

DTC 190-0 - RPM Greater Than Throttle Command
DTC 515-0 - RPM Greater Than Throttle Command
DTC 515-15 - Rev Over Governed Speed
DTC 515-16 - Rev Limit For Fuel System Exceeded

POSSIBLE CAUSE

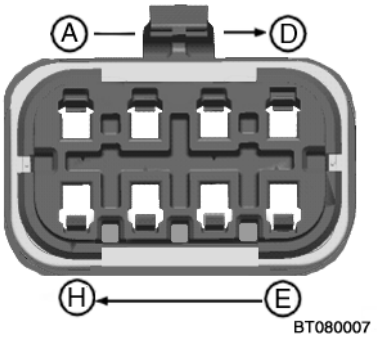
A. FUNCTIONAL FAILURE IN CONTROLLER

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

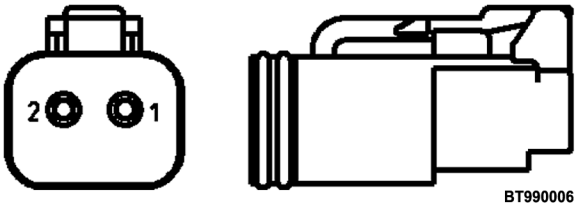
COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

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

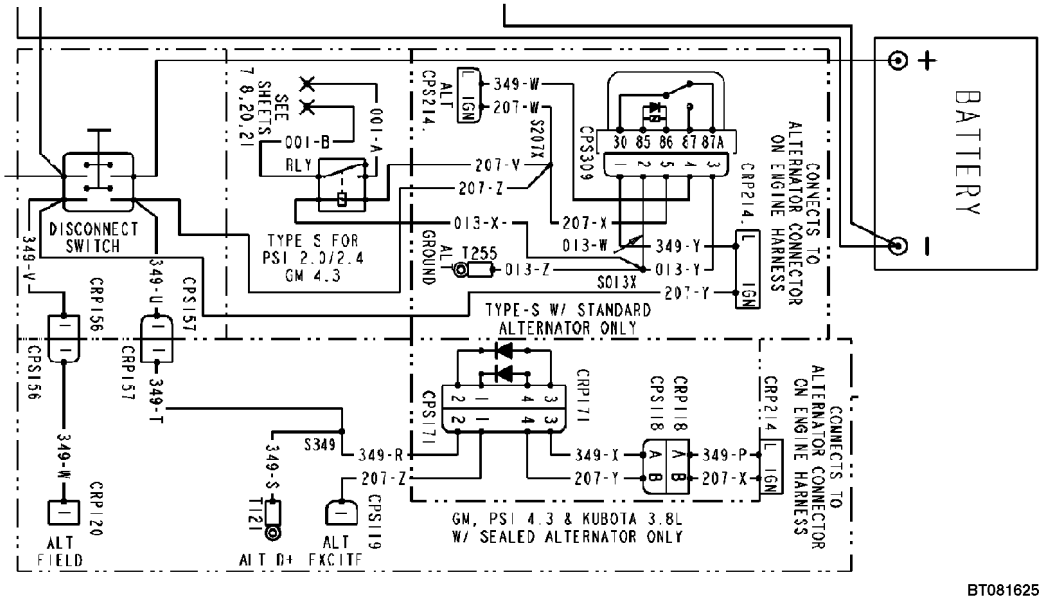


PDM Connector CPS 15



Throttle (Pull) Actuator Connector CPS 220

END FAULT



Battery and Charging System Schematic (Kubota 2.4L)

END FAULT

Coil Driver Output OORL

Low Source Driver Is Off, High Source Driver Is Off, And Feedback Current Is Less Than Threshold.

CODES

DTC 523920-4 - REV1 Circuit OORL
DTC 523925-4 - Range1/FWD2/REV1 Return Circuit OORL
DTC 523930-4 - Clutch FWD1/Return Circuit OORL
DTC 523977-4 - Aux 2 Base/Rod Coil Driver OORL
DTC 523978-4 - Aux 1 Base/Rod Coil Driver OORL
DTC 523986-4 - Aux 3 Base/Rod Coil Driver OORL
DTC 524284-4 - Lift/Lower/Return Circuit OORL
DTC 524285-4 - Tilt Base Circuit OORL

POSSIBLE CAUSE

A. COIL DRIVER/DRIVER RETURN SHORTED TO GROUND
B. FUNCTIONAL VALVE 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/DRIVER RETURN SHORTED TO GROUND

PROCEDURE OR ACTION:

NOTE: The coil drive control signals, where two valves are shown in the schematic, share a common return.

1. Ensure truck power is **OFF**.
2. Disconnect indicated connectors from the VSM and the control valves.
3. Change DMM to ohms scale. Verify DMM zero reading.
4. Measure the resistance between each indicated pin of the VSM connector (+) and the negative (-) terminal of the battery.
   Is the resistance less than 0.5 ohms on any of the pins?
   YES: The coil driver/driver return output has a short to ground in the harness. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.
   NO: Go to CAUSE B.

CAUSE A - HEATER SUPPLY/DRIVE OPEN CIRCUIT

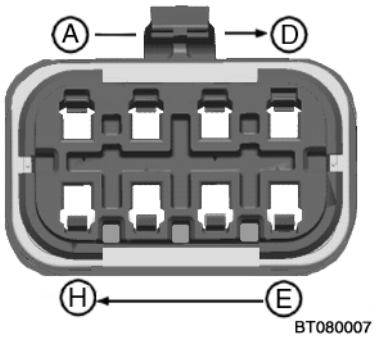
PROCEDURE OR ACTION:

WARNING

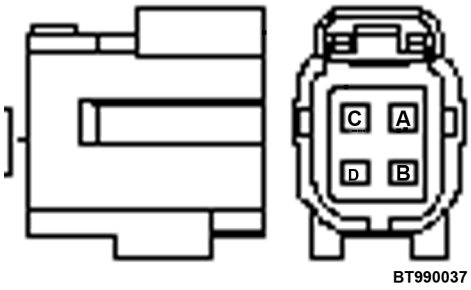
Exhaust system components are hot to touch. Be sure exhaust system components are cool before starting disassembly, or personal injury may occur.

1. Ensure truck power is **OFF**.
2. Change DMM to ohms scale. Verify DMM zero reading.
3. Disconnect the oxygen (O_2) sensor connector, the indicated PDM connector, and the indicated ECU connector.
4. At the sensor harness connector, measure the resistance on the sensor supply wire between the sensor connector and the PDM connector.
   Is resistance less than 0.5 ohms?
   YES: Go to Step 5.
   NO: The supply wire has an open circuit. Locate and repair/replace open wire/connection. Refer to appropriate **Wire Harness Repair** manual, depending on lift truck model.
5. Measure the resistance of the sensor drive wire between the sensor connector and the ECU connector.
   Is resistance less than 0.5 ohms?
   YES: Go to CAUSE B.
   NO: The supply wire has an open circuit. Locate and repair/replace open wire/connection. Check that counterweight has not crushed wire harness, if counterweight was removed. Refer to appropriate **Wire Harness Repair** manual, depending on lift truck model.

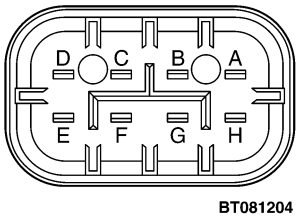
CONNECTOR(S)



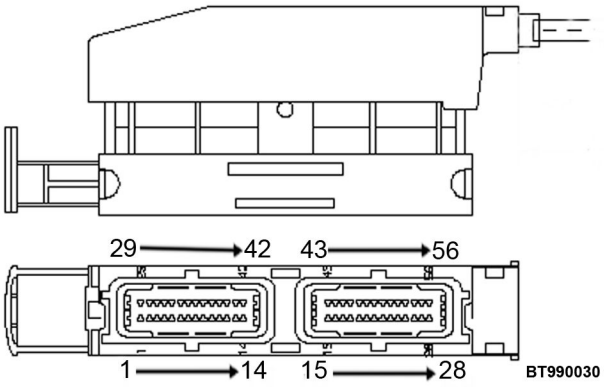
PDM Connector CSP 15



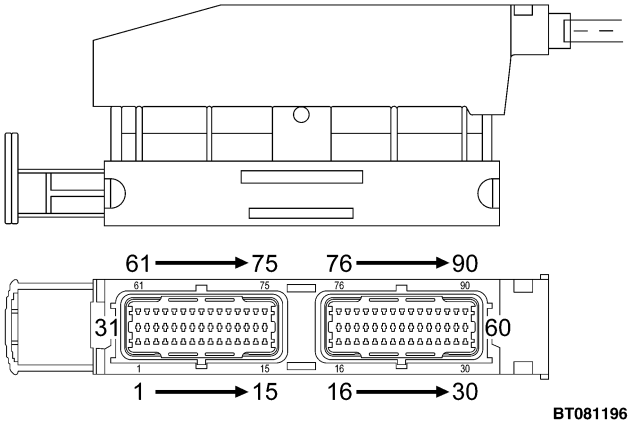
(GM 2010) and Mazda HEGO Sensor Connector CPS 218, 252



PDM Connector CSP 15 (2007 Mazda EPA)



Mazda ECU Connector CPS 202



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

CAUSE D - 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. Refer to the appropriate **Electrical System**YRM .
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.

NOTE: For DTC 524262-14, Do **NOT** disconnect the battery. Turn power to **OFF** for at least 2 hours for system to reset before reprogramming.

10. For other controllers, replace indicated controller. Refer to the appropriate **Electrical System** and **Fuel System**YRM .
11. Reinstall all removed components and ensure that all connectors are completely inserted.
12. Repeat Component Operational Check.

END POSSIBLE CAUSES

CAUSE B - SENSOR PROBE FAILURE/COATING

PROCEDURE OR ACTION:

WARNING

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

NOTE: Check coolant level in radiator before proceeding.

1. Ensure truck power is **OFF**.
2. Disconnect connector from coolant level probe.
3. Remove coolant level probe. See **Electrical System** 2200YRM1142.
4. Examine probe for corrosion or coating.
   Is probe clean and free of any foreign material?
   YES: Reinstall probe. Go to CAUSE C.
   NO: Clean or Replace probe as required. See **Electrical System** 2200YRM1142. Go to Step 5.
5. Restore all connections/components and repeat Component Operational Check.
   Does DTC reoccur?
   YES: Go to CAUSE C.
   NO: Problem is corrected. Resume operation.

CAUSE C - SIGNAL CIRCUIT STB/STS

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect indicated connectors from sensor and from VSM.
3. Select volts scale on DMM.
4. 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 5. If voltage is approximately 12Vdc, go to Step 6.
   NO: Go to CAUSE D.
5. 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.
6. Sensor signal wire is shorted to a 12-volt source. Turn power **OFF** and repeat measurement from Step 4.
   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 in **Diagrams and Schematics** 8000YRM1152 to determine possible source. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.

Speed Sensor Out of Range High/Open (TCU)

Analog Reading Above Calibrated Data Threshold

CODES

DTC 522135-3 - TISS Speed Sensor Out of Range High/Open (TCU)
DTC 522137-3 - TOSS Speed Sensor Out of Range High/Open (TCU)
DTC 522138-3 - Intermediate Shaft Speed Sensor Out of Range High/Open (TCU)
DTC 522515-3 - Vehicle speed output circuit OORH
DTC 522515-4 - Vehicle speed output circuit OORL

POSSIBLE CAUSE

A. SPEED SENSOR SIGNAL OPEN CIRCUIT
B. SPEED SENSOR SIGNAL SHORT TO BATTERY +VE /IGN3
C. SENSOR FAILURE
D. 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 - SPEED SENSOR SIGNAL OPEN CIRCUIT

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Disconnect indicated sensor connector.
3. Set DMM to volts scale.
4. Turn truck power **ON**.
5. At sensor connector, measure voltage between sensor signal pin and sensor ground pin.
   Is voltage approximately 14 Vdc?
   YES: Sensor supply and sensor ground connections are OK. Go to CAUSE B.
   NO: Go to Step 6.
6. At sensor connector, using procedure for probing the connector, measure voltage between sensor signal pin and the negative (-) terminal of battery
   Is voltage approximately 14 Vdc?
   YES: Sensor ground wire(s) has an open circuit. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.
   NO: Sensor signal wire(s) has an open circuit. Locate and repair/replace shorted wire/connection. See **Wire Harness Repair** 2200YRM1128.

DTC 1634-13
Calibration Configuration Error

POSSIBLE CAUSE

A. CALIBRATION ERROR
B. FAULTY CONTROLLER

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

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

CAUSE A - CALIBRATION ERROR

PROCEDURE OR ACTION:

1. Using the PC Service Tool, verify that the ECU has valid calibration configuration.
   Is calibration valid?
   YES: Proceed to CAUSE B.
   NO: Proceed to Step 2.
2. Using the PC Service Tool, perform calibration procedures. Refer to the Service Manual Lookup section in this manual.
   Was recalibration procedures successful?
   YES: Clear DTC and resume operation.
   NO: Proceed to CAUSE B.

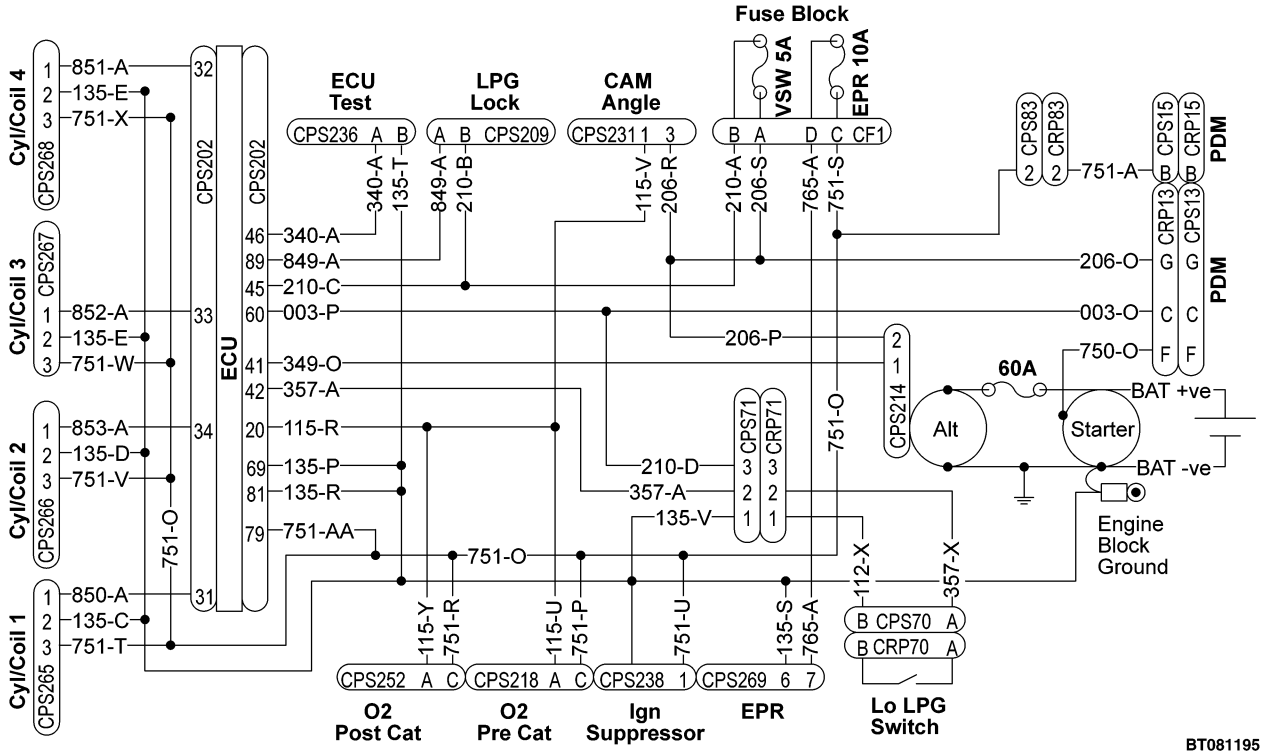
CAUSE B - FAULTY CONTROLLER

PROCEDURE OR ACTION:

1. If no faults are evident and fault code remains, suspect faulty controller.

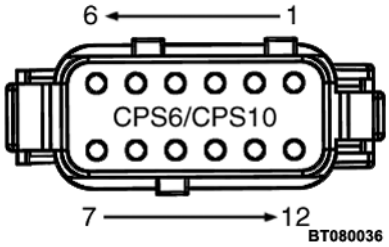
END POSSIBLE CAUSES

END FAULT

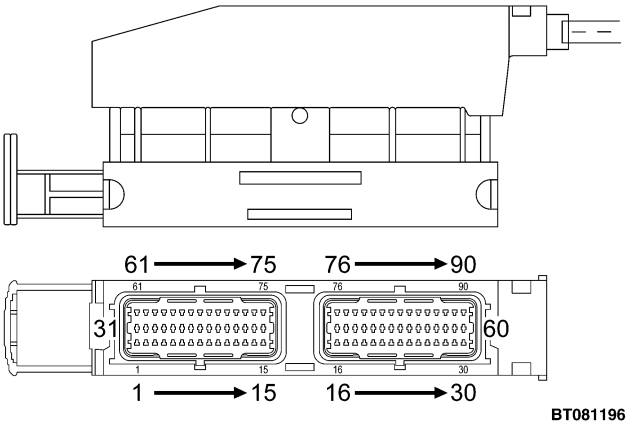


Batt & Switched Batt Distribution Injector & Spark Coils (2007 Mazda EPA)

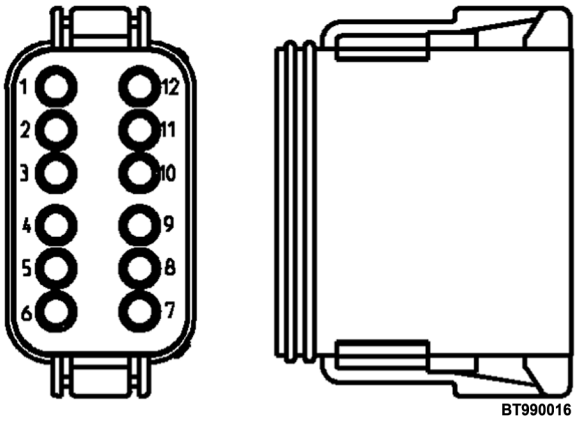
CONNECTOR(S)



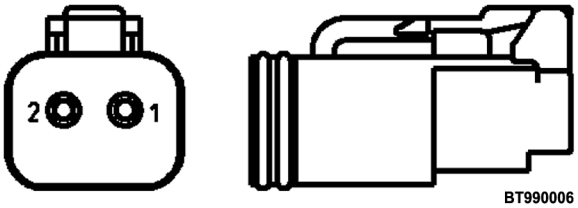
Connector CPS 6



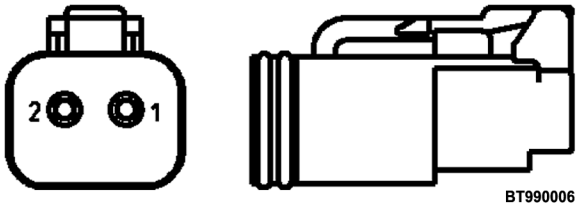
GM (2011) and Mazda ECU Connector CPS 202 (2007 Mazda EPA and 2011 GM)



Connector CPS 84



Connectors CPS 239



Connectors CPS 150, 151, 179

END FAULT

DTC 523539-2
Pump Protection Failure Flag

POSSIBLE CAUSE

A. BAD SUCTION CONTROL VALVE (SCV)
B. WIRING HARNESS FAILURE
C. FUEL LEAKS
D. BAD RAIL PRESSURE SENSOR
E. BAD FUEL PUMP

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

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

NOTE: Watch for codes similar to 157-0, 633-7, 1347-3, 1347-4, and 1347-7.

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC. Start engine.
   Does reported DTC reoccur?
   YES: Stop engine. 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 of the connectors/wiring damaged?
   YES: Repair/Replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System**YRM . Repeat Step 1.
   NO: Go to CAUSE A.

CAUSE A - BAD SUCTION CONTROL VALVE (SCV)

PROCEDURE OR ACTION:

1. Ensure truck power is **OFF**.
2. Set DMM to ohms scale. Verify DMM zero reading.
3. Disconnect wiring harness connector from SCV connector.
4. Measure resistance across each pin of the SCV and ground. Refer to the appropriate **Diagrams and Schematics** and **Wiring Harness Repair**YRM for pin out locations.
   Is resistance zero or less than specifications?
   YES: The SCV has shorted to ground. Replace SCV. Reconnect SCV connector to wiring harness. Go toStep 5.
   NO: Go to CAUSE B.
5. Turn truck power **ON** and start engine.
   Does reported DTC reoccur?
   YES: Go to CAUSE B.
   NO: Problem not verified or problem resolved. Resume operation.

Parked Regeneration Abnormality

CODES

DTC 523589-17 - Low Coolant Temperature in Parked Regeneration
DTC 523590-16 - Parked Regeneration Time Out

POSSIBLE CAUSE

A. FAULTY EGT SENSOR
B. WIRING HARNESS FAILURE
C. THERMOSTAT FAILURE
D. FUNCTIONAL FAILURE IN CONTROLLER

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

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

NOTE: Verify coolant temperature is 65°C (149°F) and EGT sensors are 300°C (572°F) or greater.

1. Turn power to **OFF** for no less than 30 seconds, and then to **ON** to clear displayed DTC. Start engine and if Diesel Particulate Filter has the appropriate soot load initiate a Parked Regeneration.
   Does reported DTC reoccur?
   YES: Stop engine. Go to Step 2.
   NO: Problem not verified or problem resolved. Resume operation.
2. Conduct a quick visual inspection of all connectors/wiring associated with the displayed fault code.
   Are any of the connectors/wires damaged?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System**YRM . Repeat Step 1.
   NO: Go to CAUSE A.

CAUSE A - FAULTY EGT SENSOR

PROCEDURE OR ACTION:

1. Change DMM to ohms scale.
2. Disconnect the sensor from the wiring harness.
3. Heat/Cool the sensor to 20°C (68°F) and measure resistance of the sensor. Refer to the appropriate **Diagrams and Schematics** and **Wiring Harness Repair**YRM to determine terminal locations.
   Is resistance approximately 2.5 K ohms?
   YES: Go to Step 4.
   NO: Replace the sensor and repeat Component Operational Check.
4. Heat/Cool the sensor to 100°C (212°F) and measure resistance of the sensor. Refer to the appropriate **Diagrams and Schematics** and **Wiring Harness Repair**YRM to determine terminal locations.
   Is resistance approximately 0.18 K ohms?
   YES: Go to CAUSE B.
   NO: Replace the sensor and repeat Component Operational Check.

DTC 523547-2
CAN2 Bus OFF
This DTC is set when CAN2 Bus is detected by the ACU.

POSSIBLE CAUSE

A. CANBUS COMMUNICATION FAULT
B. ACU FAULT

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

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

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

CAUSE A - CANBUS COMMUNICATION FAULT

PROCEDURE OR ACTION:

1. Measure voltage between the ACU connector CPS205, socket 28 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 ACU connector CPS205, socket 27 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 ACU connector CPS205, socket 28 and socket 27.
   Is resistance 60 ± 6 ohms?
   YES: No communication faults are present, connect battery and proceed to CAUSE B.
   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 B - ACU FAULT

PROCEDURE OR ACTION:

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

This DTC is set when the ACU / ECU receives a EGR system related error over the CANbus.

CODES

DTC 523632-2 - EGR System Error
DTC 523536-2 - EGR Feedback Abnormaily
DTC 523536-2 - EGR DC motor temperature abnormality
DTC 523572-4 - EGR position sensor failure
DTC 523573-2 - EGR DC Motor Temperature Error
DTC 523574-3 - EGR actuator coil open
DTC 523574-4 - EGR actuator coil short
DTC 523575-7 - Actuator valve stuck
DTC 523576-2 - EGR DC motor overheat
DTC 523577-2 - EGR DC motor temperature sensor failure
DTC 523541-3 - EGR valve position sensor voltage OORH (shorted to B+)
DTC 523541-4 - EGR valve position sensor voltage OORL (Open or grounded)
DTC 523578-2 - No communication from EGR

POSSIBLE CAUSE

A. EGR VALVE WIRING FAULT
B. EGR VALVE CANBUS COMMUNICATION FAULT
C. EGR VALVE FAULT

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

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

NOTE: The EGR valve assembly is provided 5A fused voltage from the ECU. Ground is provided via the S126 and the ECU. EGR data is communicated over the CANbus.

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

This DTC is set when the SUB CPU software version is massing or does not match.

CODES

DTC 523626-2 - SUB CPU Software Version Mismatch
DTC 628-2 - ECM Flash-ROM Abnormality
DTC 523700-13 - EEPROM Check Sum Error
DTC 1077-2 - Main IC Abnormality
DTC 523527-2 - Monitoring IC Abnormality
DTC 523538-2 - Memory QR Data Abnormality
DTC 523538-7 - Memory QR Data Write Failure
DTC 523614-2 - ECU Flash ROM Abnormality

POSSIBLE CAUSE

A. PROGRAMING DATA FAULT
B. ECU FAULT

COMPONENT OPERATIONAL CHECK

PROCEDURE OR ACTION:

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

CAUSE A - PROGRAMING DATA FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

1. Using the PC Service Tool, rewrite the ECU main programing data. Retest system and check DTCs.
   Did DTC return?
   YES: Proceed to CAUSE B.
   NO: Verify software version is current.

CAUSE B - ECU FAULT

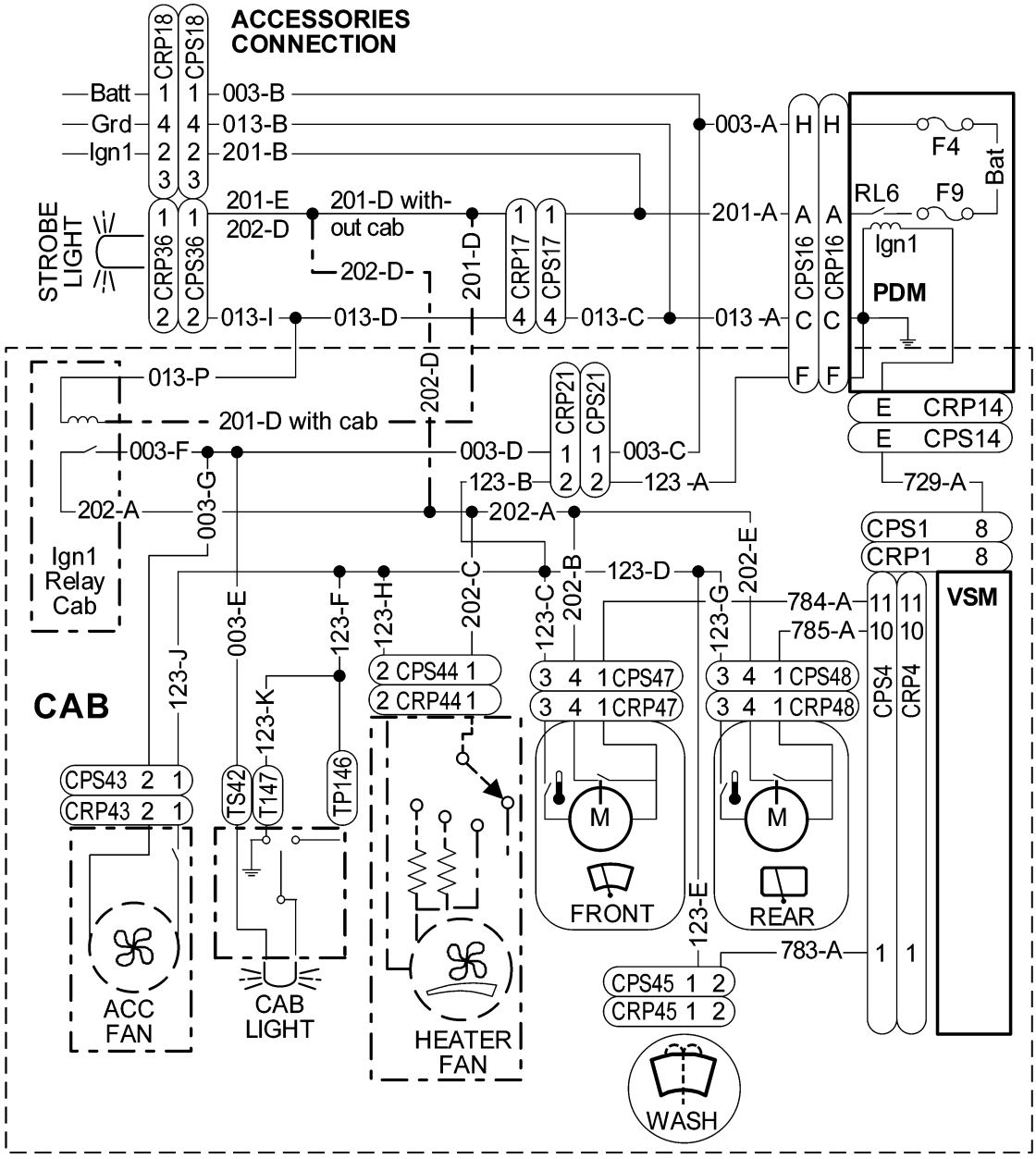
PROCEDURE OR ACTION:

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

END POSSIBLE CAUSES

END FAULT

Dome Light Inoperative



BT080255

- WIRE # 003E, (RED) = 12 VDC BATTERY SOURCE
- WIRE # 123F/K, (BLACK) = CAB GROUND

Cab Accessories Schematic

Transmission Control Software

TRANSMISSION CONTROL MODES

NOTE: For further transmission control mode identification on your lift truck, see Table 9040-10-3.

Neutral

After the power is turned on, the transmission remains in neutral until the following conditions are met:

- Engine is running
- Operator is detected in seat (Operator Present Sensor)
- Park Brake is released (Park Brake Lever Sensor)
- Direction selected is Neutral (Directional Control Lever is Neutral or Foot Directional Control pedal is released)
- Then, direction is selected Foot Directional Control pedal.

NOTE: Immediately after engine starts, the directional control lever must be in the neutral position one time or the Foot Directional Control pedal must be released one time, before the transmission will engage. This is to minimize the possibility of unintended movement.

In Neutral Mode, all clutch pack pressures are commanded to zero by the VSM and the Transmission Enable Valve is turned off.

If the truck is equipped with a Foot Directional Control pedal, the transmission is shifted to neutral when the park brake lever is applied. The transmission is not shifted to neutral just by releasing the Foot Directional Control pedal. The transmission remains in the last direction selected when the Foot Directional Control pedal is released. This enables engine compression braking or clutch pack braking when going down hill with the pedal released.

If the truck is equipped with a directional control lever, the transmission is only shifted to neutral when the directional control lever is in the neutral position. The transmission is not shifted to neutral by applying the park brake lever. This enables the operator to leave the transmission engaged while operating on grades, even with the park brake applied. This provides additional control when releasing the park brake to start traveling up slope.

Gear Engagement Control

This is a transition between neutral mode and normal forward or reverse. This feature operates differently between Standard, Techtronix 332, and Extended Feature DuraMatch Plus transmissions. During this mode, the selected clutch pack pressure is being increased from zero to a high level.

Standard Gear Engagement Mode

The operator may engage the transmission at any engine speed. The selected clutch pack pressure is increased at a fixed rate. Therefore, if the engine is operated at slow rpm when a direction is selected, the engagement will be quite smooth. If the engine is operated at a high rpm when a direction is selected, the engagement will be more abrupt.

Techtronix 332 and Extended Feature DuraMatch Plus Gear Engagement Mode

The operator may engage the transmission at any engine speed. The selected clutch pack pressure is increased at a fixed rate. However, the engine rpm will automatically be governed down during gear engagement and released to accelerate after engagement. This ensures smooth gear engagement at all engine speeds.

Normal Forward or Reverse

Normal Mode applies full control pressure to the selected clutch pack and no pressure to the opposing clutch pack. The engine rpm is controlled by the accelerator pedal position.

Standard

Engine RPM starts to increase immediately when the accelerator pedal is pressed.

Techtronix and Extended Feature DuraMatch Plus Transmission

Engine RPM does not start to increase until the accelerator pedal is pressed approximately 20%. This enables the Techtronix and Extended Feature DuraMatch Plus features, such as transmission braking to function without having to overcome engine torque.

CAUSE C - CONTROL VALVE HAS INTERNAL LEAKAGE.

PROCEDURE OR ACTION:

1. Test transmission pressure. Transmission Pressure Test.
   Is pressure out of specification?
   YES: Remove control valve and replace gaskets. 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. For 2×2 transmission, remove inching actuator spool and replace seals and guides. Remove the inching sleeve and replace the O-rings.
   NO: Go to CAUSE D.

CAUSE D - CLUTCH PISTON IS NOT MOVING FREELY OR CLUTCH DISCS ARE WARPED.

PROCEDURE OR ACTION:

1. Perform Transmission Clutch Drag Test (1.0-5.5 Ton Trucks Only).
   Does clutch have excessive drag?
   YES: Remove transmission and inspect clutch packs. 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: Install PC Service Tool and adjust calibration. Refer to appropriate **Calibration Procedures** manual, depending on lift truck model.

CAUSE E - INCORRECT TRANSMISSION OIL.

PROCEDURE OR ACTION:

NOTE: It is possible for clutch plates to absorb the wrong oil and may need to be replace with new friction plates.

1. Check transmission oil type.
   Is transmission oil the wrong type?
   YES: Flush transmission and drive axle and add the correct type oil to proper level. See **Operating Manual**.
   NO: Resume operation.

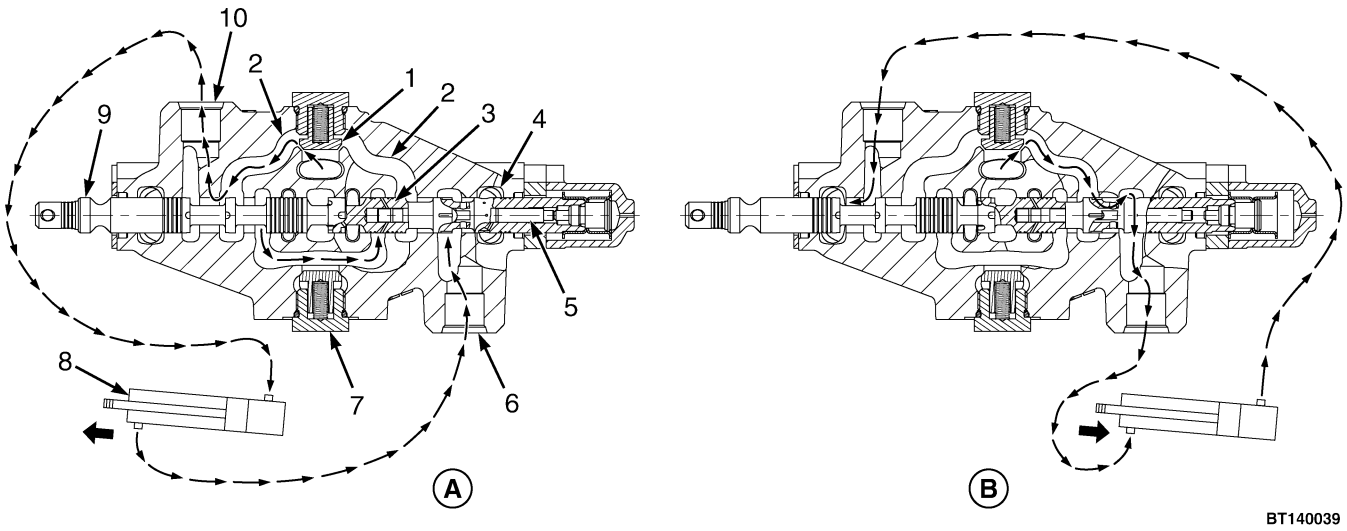
END SYMPTOM

cylinder under heavy load condition the mast could drift backward until the pressure builds to a sufficient level to move the mast forward. The maximum pressure of the tilt forward function is limited to the secondary relief valve pressure setting. See Figure 9050-10-14.

The lower load check valve prevents back flow from the secondary relief valve passage.

Tilt Forward (6.0-7.0 Ton Lift Truck)

The 6.0-7.0 accomplishes the same as the 1.0-5.5 Ton Lift Truck but uses a remote mounted Counter Balance Valve to preventing the load from "overrunning" the flow to the tilt cylinders. See Figure 9050-10-14 and Manual Control Valve Schematics.



A. TILT FORWARD

1. UPPER LOAD CHECK VALVE
2. HIGH PRESSURE BRIDGE CORE
3. TILT CONTROL SPOOL ORIFICE
4. TANK PASSAGE
5. TILT CONTROL SPOOL

B. TILT BACKWARD

6. TILT WORK PORT 2A
7. LOWER LOAD CHECK VALVE
8. TILT CYLINDER
9. SPOOL
10. TILT WORK PORT 2B

Figure 9050-10-14. Tilt Forward and Back Position Section, With Spool Lockout Mechanism

Actuation Functions With Armrest Up (E-Valve)

POSSIBLE CAUSE

A. ARMREST SWITCH IS STUCK CLOSED.
B. SHORT IN WIRING HARNESS.

CAUSE A - ARMREST SWITCH IS STUCK CLOSED.

PROCEDURE OR ACTION:

WARNING

Serious injury or death can occur if hydraulic functions are activated when operator is out of seat. Actuate control only while in the operator's seat and armrest in locked-down position. These safety devices are for your protection, do not disarm them.

1. Check armrest switch.
   Is armrest switch stuck closed?
   YES: Replace switch.
   NO: Go to CAUSE B.

CAUSE B - SHORT IN WIRING HARNESS.

PROCEDURE OR ACTION:

1. Inspect and repair harness. See **Wire Harness Repair** 2200YRM1128.

END SYMPTOM

Secondary Function Continues to Move for Awhile After Joystick or MLM Is Released (E-Valve)

POSSIBLE CAUSE

A. RAMP SETTING TOO LOW FOR FUNCTION.
B. STICKING VALVE SPOOL.
C. STICKING PPRV.

CAUSE A - RAMP SETTING TOO LOW FOR FUNCTION.

PROCEDURE OR ACTION:

WARNING

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

1. Adjust function ramp setting on DSC. See **User Interface - Service Technician** 2200YRM1131. If problem is still present, go to CAUSE B.

CAUSE B - STICKING VALVE SPOOL.

PROCEDURE OR ACTION:

1. Remove and inspect spool. See **Main Control Valve** 2000YRM1137.
   Is the spool undamaged and moves freely in bore?
   YES: Go to CAUSE C.
   NO: Clean or replace valve spool.

CAUSE C - STICKING PPRV.

PROCEDURE OR ACTION:

1. Test PPRV pressure. See PPRV Pilot Pressure Test.
   Is PPRV pressure test to specifications?
   YES: See Observed Symptoms-Gear Pump, Secondary Function or Tilt Back Moves Without Command (E-Valve), Page 9050-33-70.
   NO: Remove PPRV and clean. See **Main Control Valve** 2000YRM1137.

END SYMPTOM

Lower Functions Too Slow (All other hydraulic functions are okay)

POSSIBLE CAUSE

A. MAX FUNCTION SPEED SETTING TOO LOW.
B. RAMP SETTING TOO LOW FOR FUNCTION.
C. CALIBRATION OF OUTPUT THRESHOLD IS TOO HIGH.
D. MAST IS BINDING.
E. MLM/JOYSTICK CONTROL MALFUNCTION.
F. FAULTY MAST LOWERING CONTROL VALVE (MLCV).

CAUSE A - MAX FUNCTION SPEED SETTING TOO LOW.

PROCEDURE OR ACTION:

1. Adjust function speed setting on DSC. See **User Interface - Service Technician** 2200YRM1131. If symptom is still present, go to CAUSE B.

CAUSE B - RAMP SETTING TOO LOW FOR FUNCTION.

PROCEDURE OR ACTION:

1. Adjust function ramp setting on DSC. See **User Interface - Service Technician** 2200YRM1131. If symptom is still present, go to CAUSE C.

CAUSE C - CALIBRATION OF OUTPUT THRESHOLD IS TOO HIGH.

PROCEDURE OR ACTION:

1. Check calibration threshold at DSC. See **Calibration Procedures** 8000YRM1134.
   Does setting meet specifications for your lift truck?
   YES: Go to CAUSE D.
   NO: Decrease setting to specification or until operation is acceptable to operator.

CAUSE D - MAST IS BINDING.

PROCEDURE OR ACTION:

1. Check for mast binding.
   Is mast binding and is it in the free lift stage only?
   YES: Repair mast. 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 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.
   NO: Go to CAUSE E.

Steering Control Unit LS Pressure Test

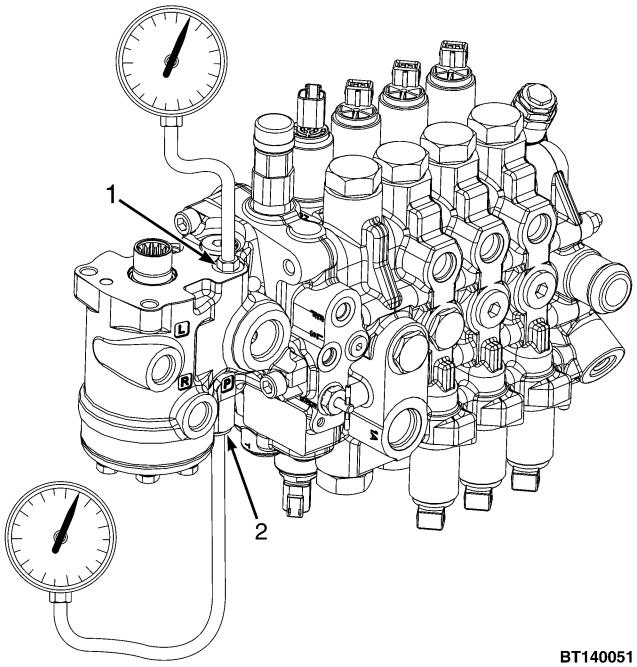
This test checks if LS (Load-Sense) pressure is correct to operate the flow divider spool functions of the Steering Control Unit (SCU). The margin pressure is the Pump pressure P minus the LS pressure. The margin pressure is required to control flow divider spool movement, which controls priority oil to steering and Excess Flow (EF) to the hydraulic control valve.

Table 9050-45-32. Test Specifications

Engine Speed	Idle Speed
Oil Temperature	50 to 65°C (122 to 150 °F)
Margin Pressure	For 2.0-3.5 Ton Trucks: 600 kPa (87 psi) For 4.0-5.5 Ton Pneumatic and 6.0-7.0 Ton Cushion Trucks: 700 kPa (102 psi)

Table 9050-45-33. Service Tools

Pressure differential gauge or switching block	
0 to 35.0 MPa (0 to 5000 psi) Pressure Gauge	
Steering Control Unit (SCU) "P" & "LS" Test Port Size	SAE #4 O-ring Port (7/16-20 UNF)



1. "P" DIAGNOSTIC PORT
2. LOAD SENSE (LS) DIAGNOSTIC PORT

Figure 9050-45-71. SCU LS Pressure Test

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 test plugs from valve.

1. Lower forks to ground and stop engine. Apply park brake.

2. Remove panel that covers Steering Control Unit (SCU).

Group 10
Principles of Operation

Front End, Mast

DESCRIPTION

This section has the Description and Principles of Operation of the front end components. Repair procedures for the 1.0-3.5 ton trucks are described in **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 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 Trucks, see **Mast Repair (S/N A513, A514, A613, A614, A643, A644, A683, A684)** 4000YRM1406. For the description and repair on the tilt cylinders for 1.0-5.5 Ton Cushion and Pneumatic Trucks, see **Cylinder Repair (Mast S/N A551, A555, A559, A661, A662, A663, A66, 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)** 2100YRM1139. For 6.0-9.0 Ton Cushion or Pneumatic Trucks, see **Cylinder Repair (Mast S/N A513, A514, A613, A614, B513, B514)** 2100YRM1328.

The mast is used to lift a load vertically. The mast has two movements controlled by hydraulic cylinders: forward and backward tilt, and the lifting and lowering of the mast and carriage. The outer mast tilts on the pivot pins at the mast mounts. The operation of the tilt cylinders causes the mast to tilt forward and backward. The tilt cylinders are fastened between the frame of the lift truck and the outer mast. Hydraulic lift cylinders are installed vertically in the mast. The lift cylinders raise and lower the intermediate/inner masts and the carriage.

There are four types of masts available:

- Two-Stage Limited Free-Lift
- Two-Stage Full Free-Lift
- Three-Stage Full Free-Lift
- Four-Stage Full Free-Lift (2.0-2.5 Ton Cushion Only).

Each type of mast is described separately in this section.

LP Tank Bracket Disengages

POSSIBLE CAUSE

A. ATTACHING HARDWARE IS LOOSE
B. FAILED LATCHES OR HINGES

CAUSE A - ATTACHING HARDWARE IS LOOSE

PROCEDURE OR ACTION:

1. Visually inspect mounting points for damage and loose or missing hardware. For 1.0-2.0 Ton Cushion and Pneumatic Trucks, see **Periodic Maintenance** 8000YRM1207. For 2.0-3.5 Ton Cushion and Pneumatic Trucks, see **Periodic Maintenance** 8000YRM1150. For 4.0-5.5 Ton Cushion and Pneumatic Trucks, see **Periodic Maintenance** 8000YRM1248. For 6.0-7.0 Ton Cushion Trucks, see **Periodic Maintenance** 8000YRM1319. For 6.0-7.0 Ton Pneumatic Trucks, see **Periodic Maintenance** 8000YRM1322. For 8.0-9.0 Ton Pneumatic Trucks, see **Periodic Maintenance** 8000YRM1407.
   Are brackets and attaching hardware in good condition?
   YES: Go to CAUSE B.
   NO: Repair or replace damaged components. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Frame** 0100YRM1120. For 4.0-5.5 Ton Cushion and Pneumatic Trucks, see **Frame** 0100YRM1243. For 6.0-7.0 Ton Cushion Trucks, see **Frame** 0100YRM1316. For 6.0-9.0 Ton Pneumatic Trucks, see **Frame** 0100YRM1321.

CAUSE B - FAILED LATCHES OR HINGES

PROCEDURE OR ACTION:

1. Inspect hinges and latches for correct operation.
   Are the hinges and latches in good condition?
   YES: Ensure LP tank is secure and resume operation.
   NO: Adjust or repair latches and hinges as required. For 1.0-3.5 Ton Cushion and Pneumatic Trucks, see **Frame** 0100YRM1120. For 4.0-5.5 Ton Cushion and Pneumatic Trucks, see **Frame** 0100YRM1243. For 6.0-7.0 Ton Cushion Trucks, see **Frame** 0100YRM1316. For 6.0-9.0 Ton Pneumatic Trucks, see **Frame** 0100YRM1321.

END SYMPTOM

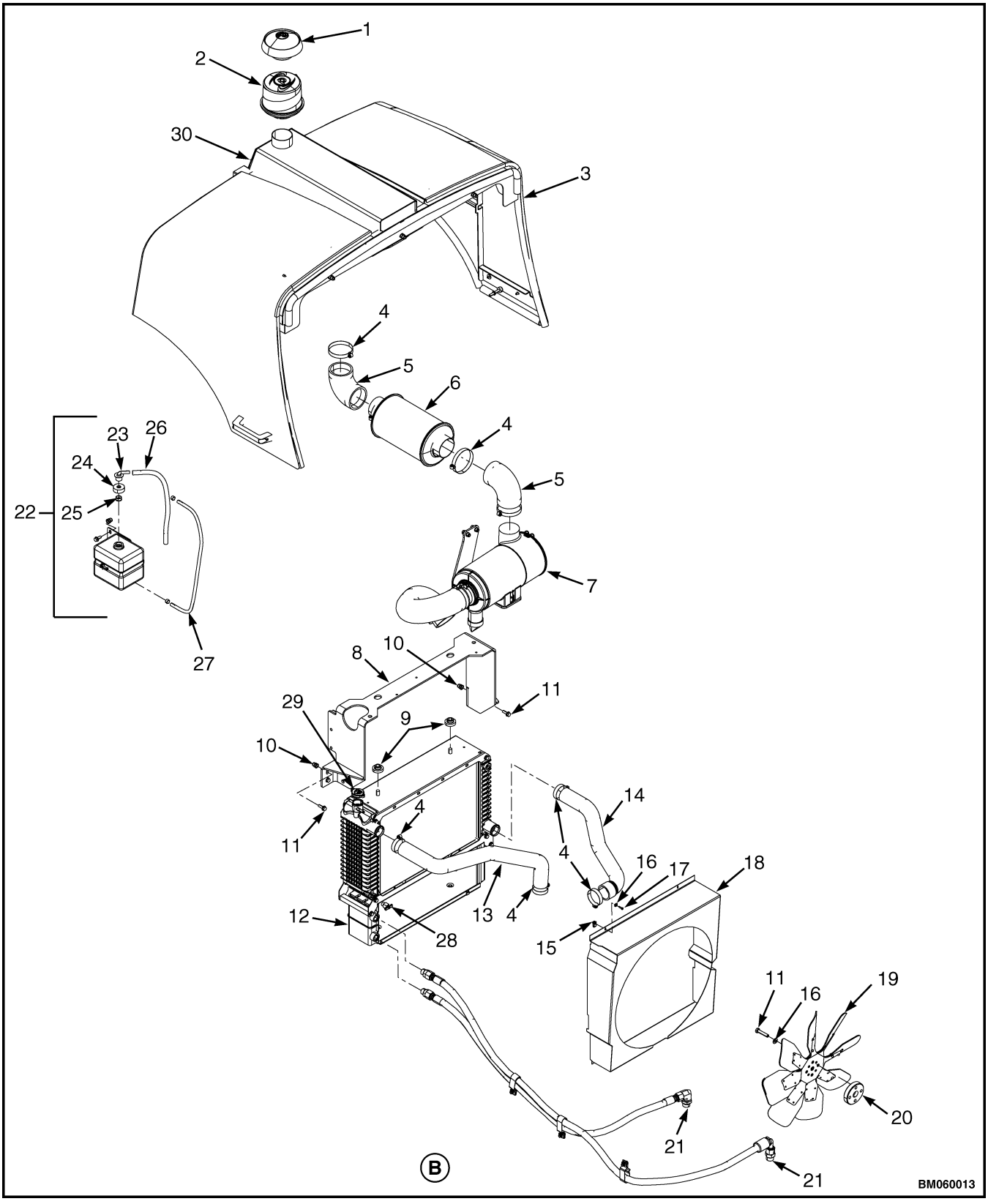
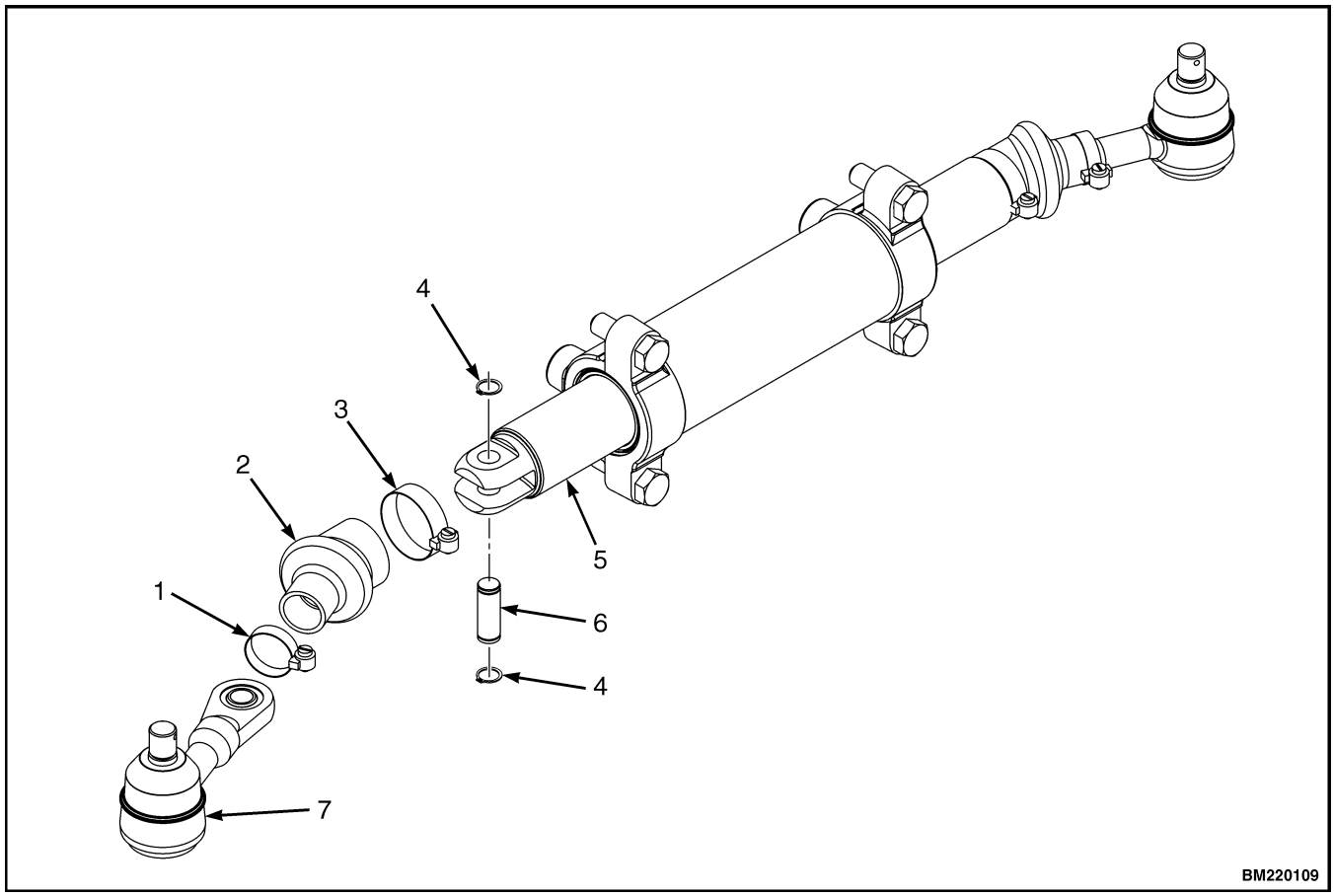


Figure 25. Cooling System for Lift Truck Models GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878) (Sheet 2 of 3)

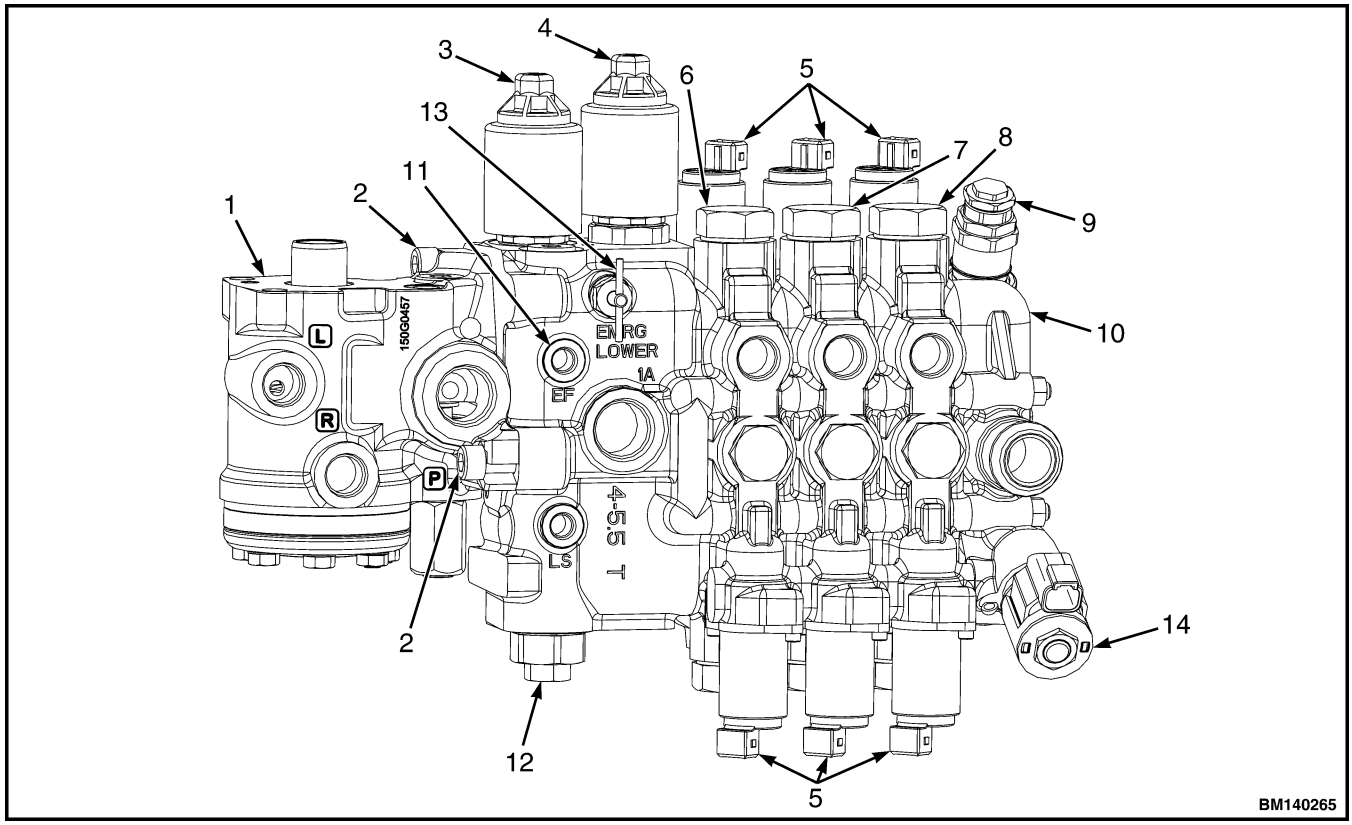


1. CLAMP
2. DUST COVER
3. CLAMP
4. SNAP RING
5. STEERING CYLINDER ROD
6. PIN
7. TIE ROD

Figure 17. Tie Rod for Lift Truck Models and GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910) GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)

Table 5. Hydraulic Gear Pumps for Lift Truck Models GLC/GDC60VX, GLC/GDC70VX, (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879) and GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878)

Model	Engine	Displacement	Governed Speed	Main Relief Valve Pressure - Mpa (PSI)	Pump Flow Rate - LPM (GPM)
GLC/GDC60VX (GC/GLC/ GDC135VX) (C879, D879, E879, F879); GLP/GDP60VX (GP/GLP/ GDP135VX) (C878, D878, E878)	GM 4.3L	41.3 cc/rev	2500 rpm	22.06 MPa (3200 psi)	144.3 liter/min (38.1 gal/min)
	Cummins 3.3L Turbo	41.3 cc/rev	2500 rpm	22.06 MPa (3200 psi)	132.3 liter/min (35.0 gal/min)
	Kubota	41.3 cc/rev	2500 rpm	22.1 MPa (3200 psi)	96.5 liter/min (25.5 gal/min)
GLC/GDC70VX, (GC/GLC/ GDC155VX) (C879, D879, E879, F879); GLP/GDP70VX (GP/GLP/ GDP155VX) (C878, D878, E878)	GM 4.3L	63.3 cc/rev	2400 rpm	22.06 MPa (3200 psi)	144.3 liter/min (38.1 gal/min)
	Kubota	41.3 cc/rev	2500 rpm	22.1 MPa (3200 psi)	96.5 liter/min (25.5 gal/min)



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

Figure 7. Electronic Control Valve With Anti-Stall Solenoid, Lift Truck Models GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818) and GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813)

14. Tighten pilot pin adjustment screw lock nut while holding the pilot pin adjustment screw to prevent slipping. Slipping of the adjustment screw will cause threshold to increase. See Figure 30.

15. Replace coil nut.

16. Repeat test to verify that fork movement occurs between 550 mA and 650 mA.

17. Install side covers, floor plates, seal plate and dash.

See **Frame** 0100YRM1120 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 **Frame** 0100YRM1243 for 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)

See **Frame** 0100YRM1316 for lift truck models

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

See **Frame** 0100YRM1321 for lift truck models

- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878)
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909)

See **Frame** 0100YRM1581 for lift truck models

- GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (E878)
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (B909)

Abnormal/Erroneous EHPV Adjustment

CAUTION

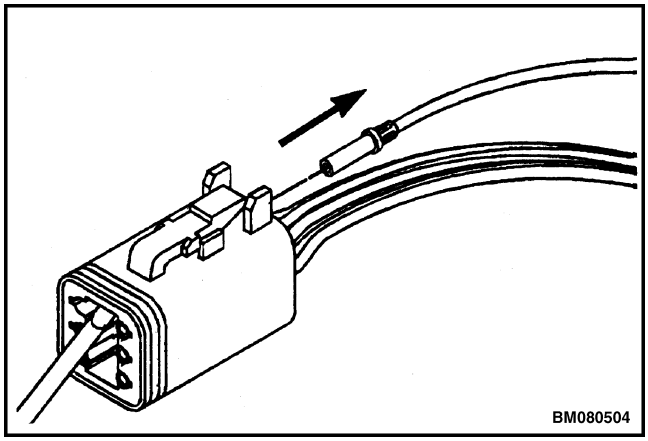
While only minor adjustments may be necessary, the design of the EHPV is such that the adjustment screw could erroneously be backed out to the point where the EHPV is normally open. This presents an extreme condition that is not likely, but is possible.

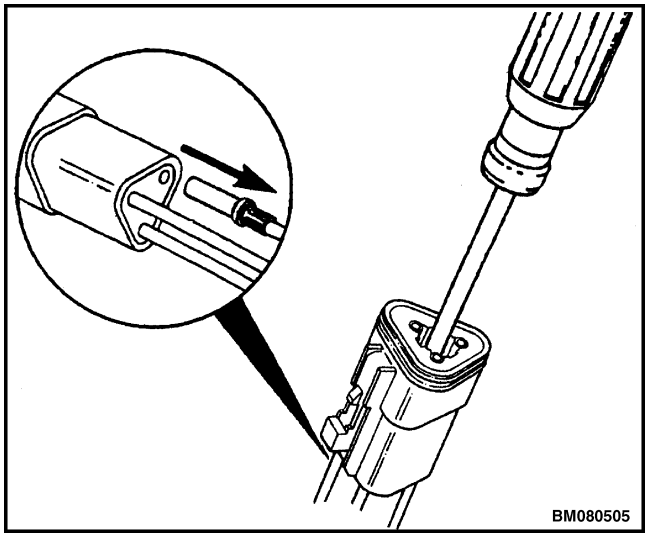
If this occurs on lift function and lower function simultaneously, the pump flow will bypass directly to tank and there will be no hydraulic functionality. If this occurs on the lift function only (with lower function calibrated correctly), the mast will raise as soon as the engine is turned on. If this occurs on the lower function only (with the lift function calibrated correctly, the auxiliary and tilt functions will be operational, but the forks will not raise. See Figure 29 or Figure 30.

Legend for Figure 63

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

STEP 4.
Gently pull the wire backward while, at the same time, releasing the locking finger with the small, flat-blade screwdriver (Yale P/N 150121838) .





Legend for Figure 31.

A. FRONT OF TOOL
B. BACK OF TOOL

1. UPPER INSERT
2. ANVIL
3. INSULATION CRIMP ADJUSTMENT LEVER
4. CONTACT SUPPORT
5. LOCATOR
6. CERTI-CRIMP RATCHET
7. STRIPPED WIRE

The insulation adjust lever regulates the crimp height. See Insulation Crimp Adjustment.

The contact support prevents the contact from bending during crimping.

The locator functions two ways:

- position the contact between the upper insert and the anvil before crimping
- limits the insertion distance of the stripped wire into the contact.

The ejector pulls the locator down, and ejects the crimped contact when the tool handles are fully opened.

CAUTION

The crimping jaws bottom before the CERTI-CRIMP ratchet releases. This is a design feature that ensures maximum electrical and tensile performance of the crimp DO NOT readjust the ratchet.

The CERTI-CRIMP ratchet assures full crimping of the contact. Once engaged, the ratchet will not release until the handles have been fully closed.

Stripping Wire for Use with AMP Hand Crimping Tool

1. Choose the correct AWG for the contact being used.
2. See Table 2 for recommended strip length.

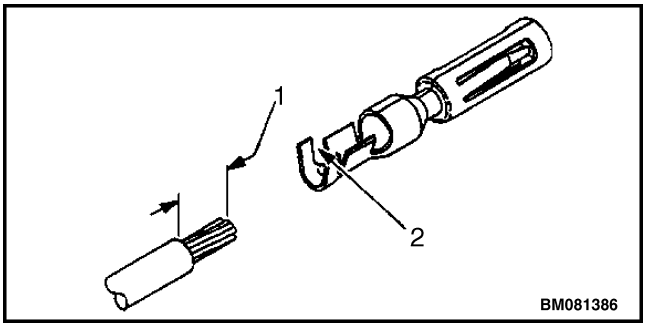
Table 2. Wire Size (AWG)

Wire Size (AWG)	Insulation Diameter Range	Tool Wire Size Marking	Contact	Wire Strip Length
16	1.7 to 2.7 mm (0.067 to 0.106 in.)	16	Yale P/N 520202601	5.5 mm (0.215 in.)
20 - 18		20 - 18		4.7 mm (0.185 in.)

CAUTION

DO NOT cut or nick the wire strands.

3. Strip wire to recommended strip length. A small piece of insulation should come off the wire after stripping. See Figure 32.



NOTE: SEE TABLE 2 FOR WIRE STRIP LENGTH.

1. STRIPPED WIRE
2. LOCATOR SLOT

Figure 32. Strip Length

AMP Fastin-Faston Receptacles and Housings

DESCRIPTION

This manual section covers FASTIN-FASTON receptacle installation. These connectors are the multiple circuit connectors use primarily as wire harness connectors.

CAUTION

DO NOT nick, scrape, or cut the wire conductor during the striping operation.

1. Install receptacles as specified in How to Use AMP Double Action Hand Tool. See Figure 73 for tool image.

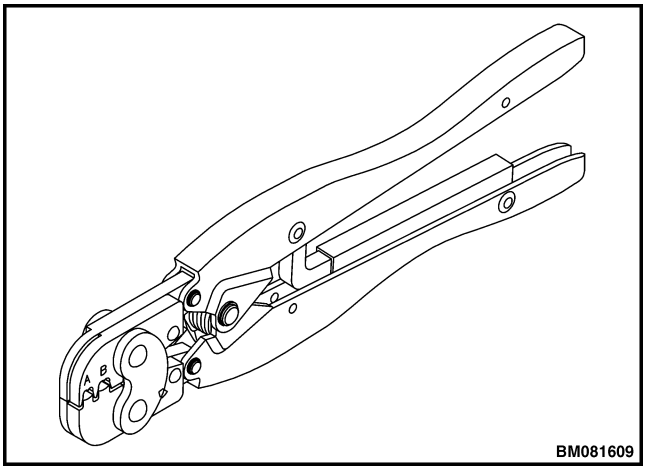
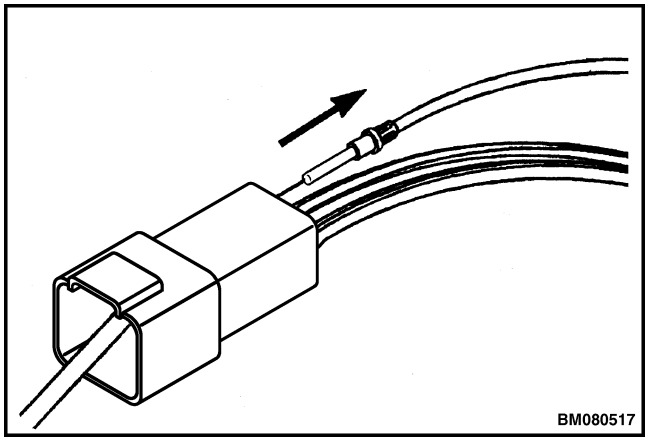
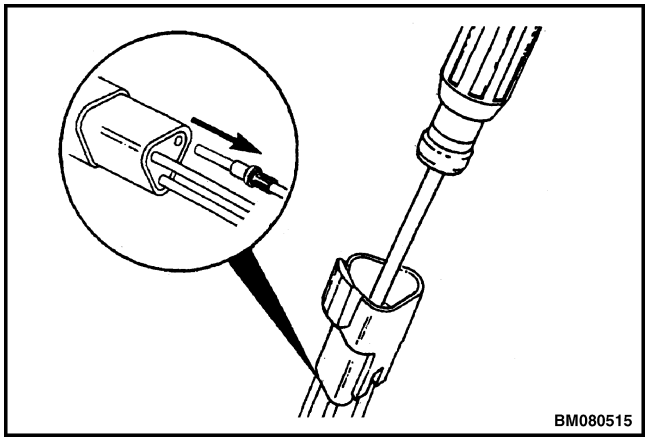


Figure 73. AMP Double Action Hand Tool

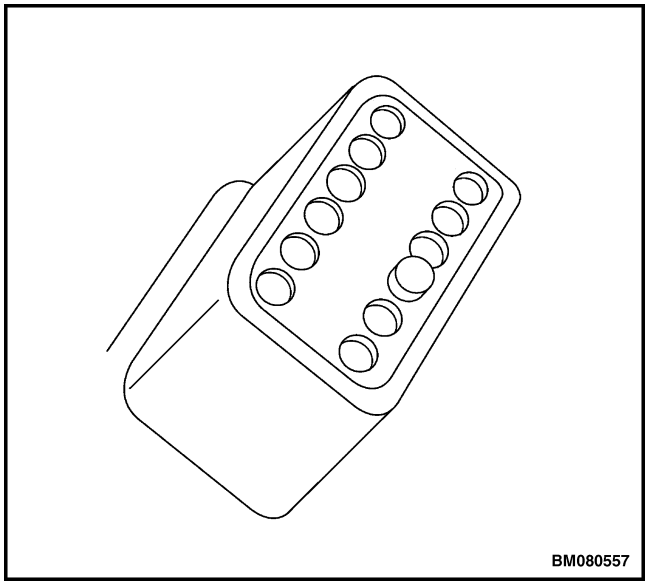
2. Receptacle contact should appear as shown in Figure 74.

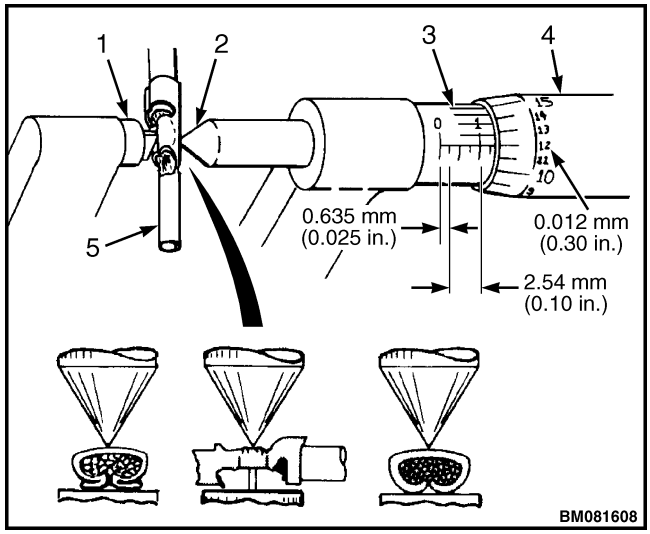
STEP 4.
Gently pull the wire backward while, at the same time, releasing the locking finger with the small, flat-blade screwdriver (Yale P/N 150121838) .





STEP 4.
Apply pressure until sealing plug is forced to stop by the connector rear grommet. Visually inspect the sealing plug to ensure it is flush with the cavity opening.





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

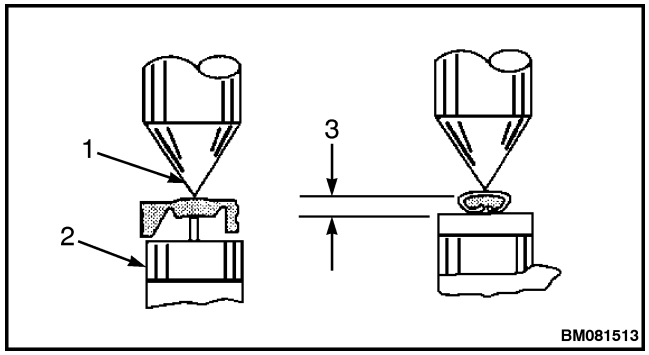
2. Use Table 11 to select **maximum** size wire for each crimping chamber.

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.

Table 24. Set Daylight Saving Time Menu (Continued)

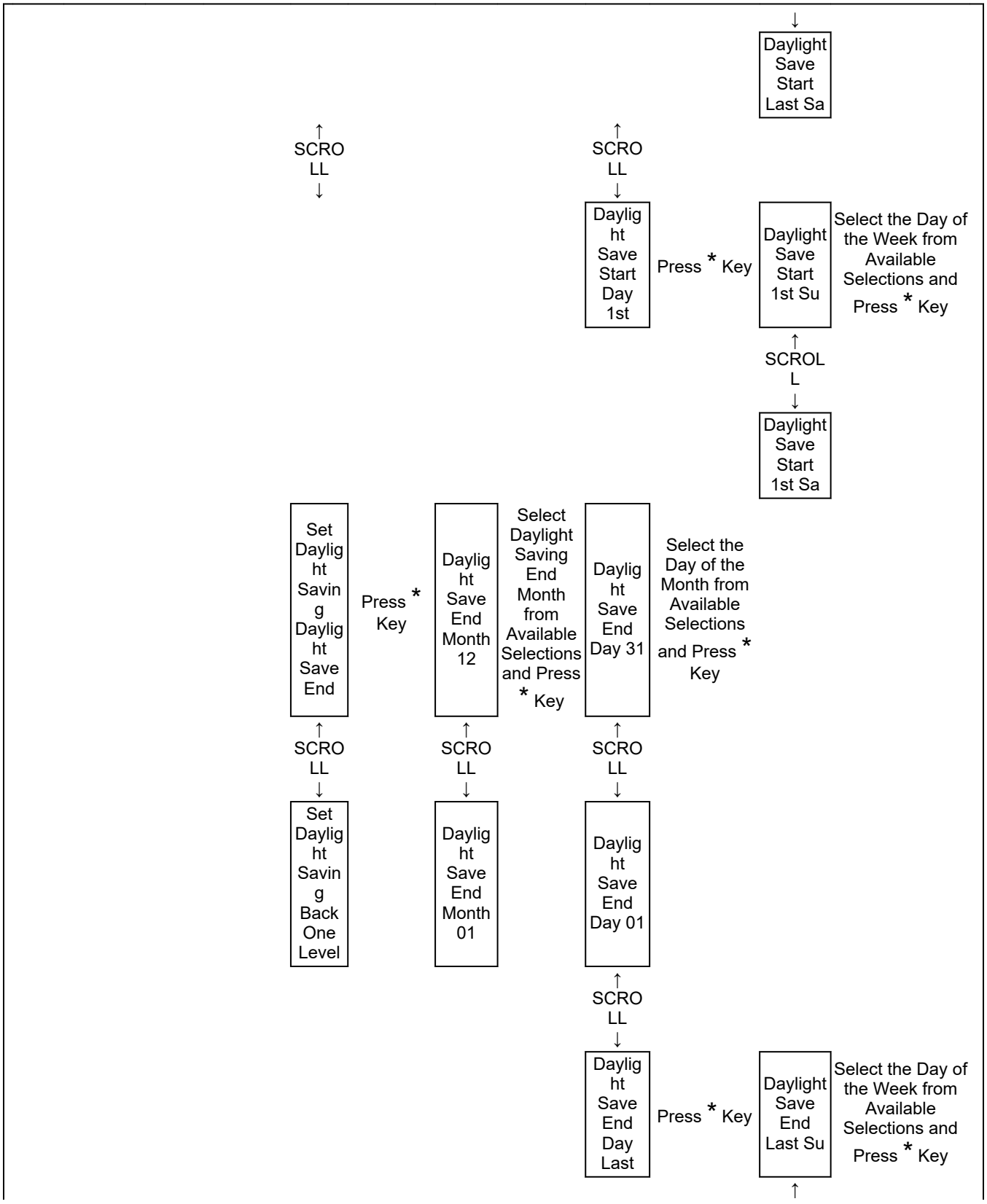
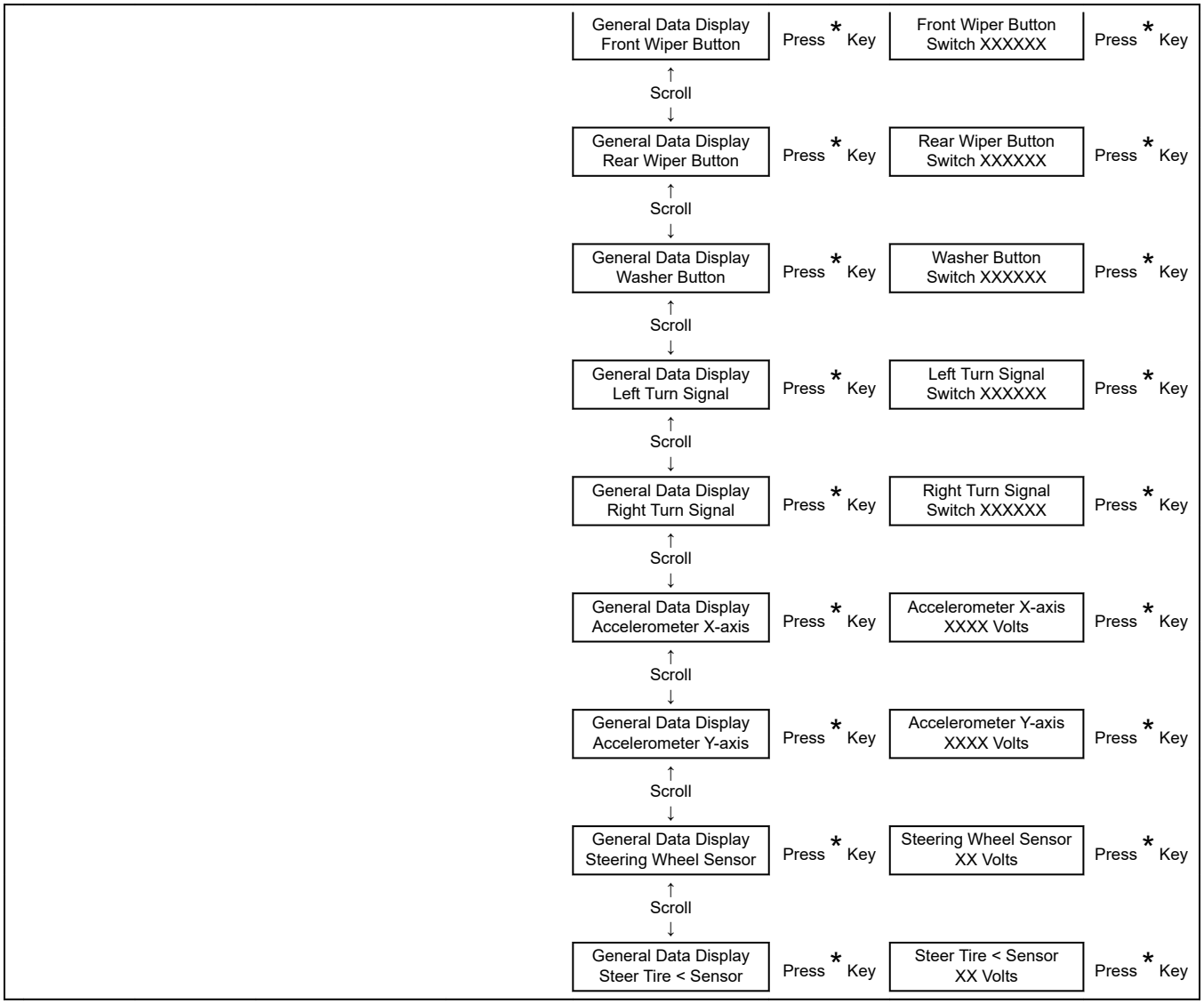


Table 20. General Truck Data Display (Continued)



Set Travel and Braking

Upon entering the Set Travel and Braking menu, the following menu functions are visible to the service technician:

- Speed Limit
- Acceleration Rate
- Auto-Deceleration Rate
- Set Power Reversal Rate
- Set Inching/Brake Overlap

Use the scroll keys to move to the desired function and press the * key to select the function.

SPEED LIMIT

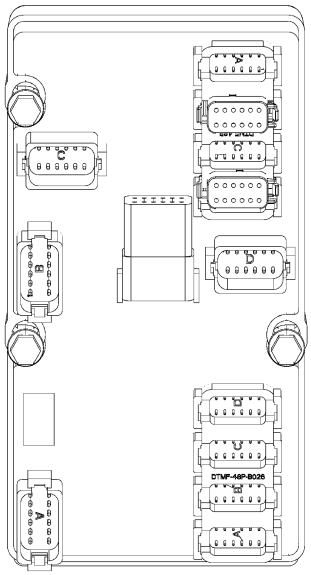
If the lift truck is configured for optional speed limit, this function can be used to adjust or deactivate the truck speed limit. Speed may be set from a minimum of 6 kph (4 mph) up to the maximum allowed for the lift truck model being adjusted. The speed may be set in 1 kph (0.5 mph) increments. Setting the speed limit

Yale®

Maintenance

ELECTRICAL SYSTEM

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];GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) [C878, D878, E878];GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) [A909, B909]



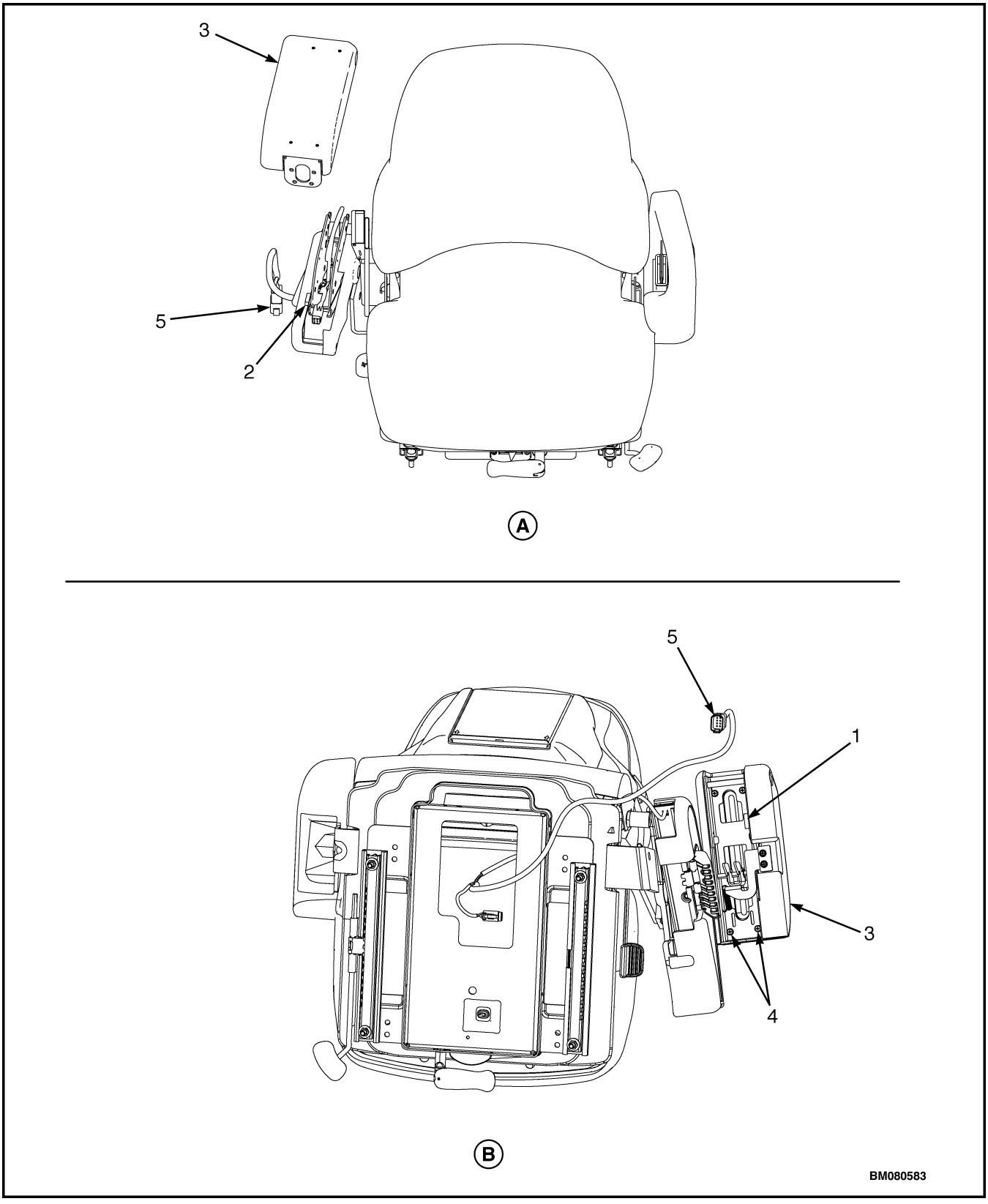


Figure 28. Armrest Switch

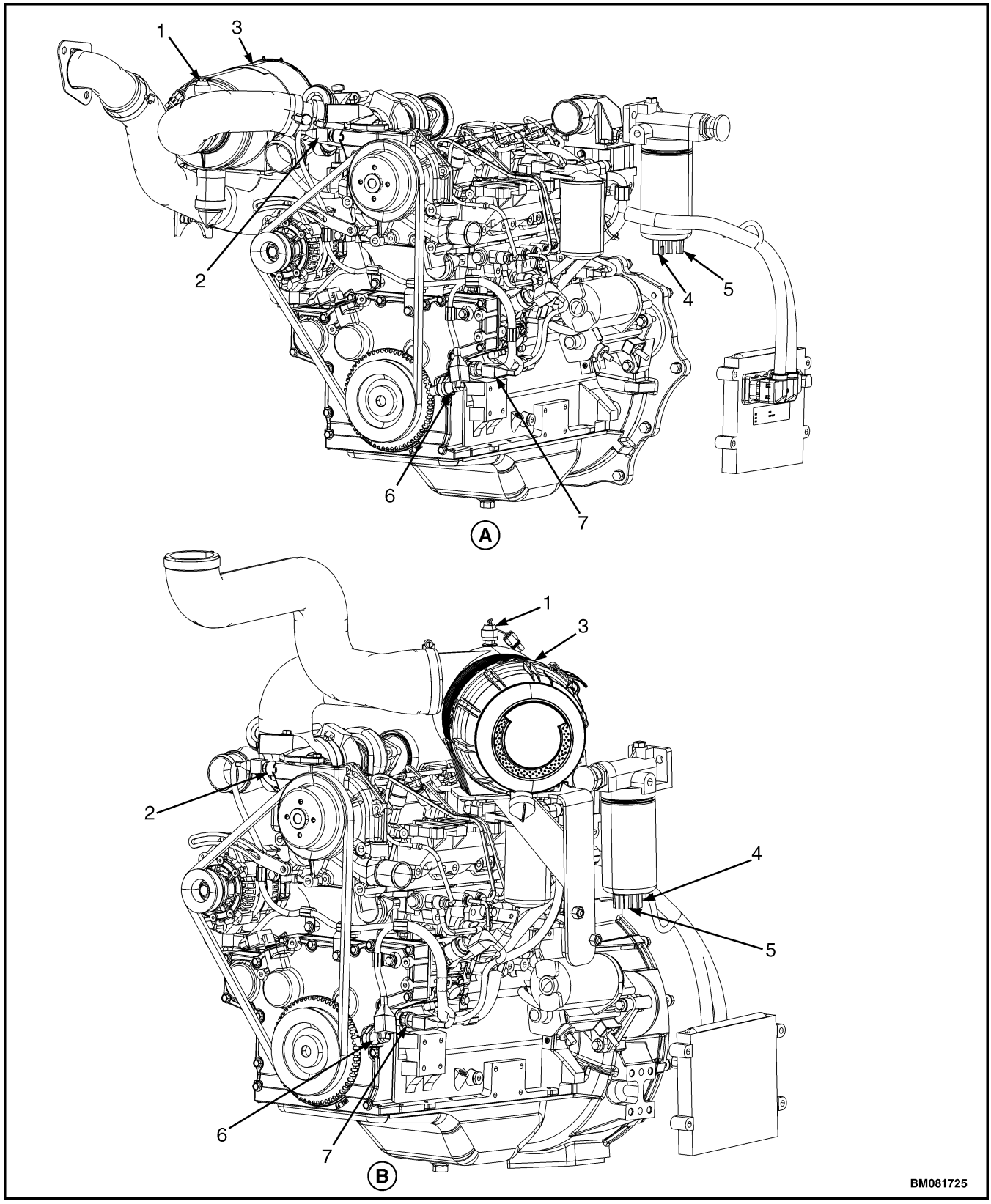
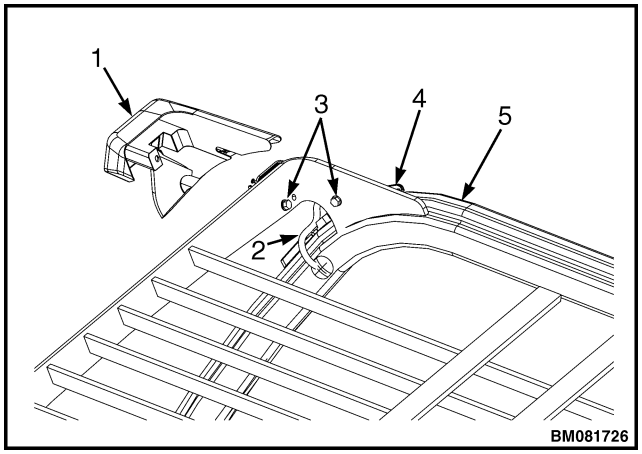


Figure 60. Cummins QSB 3.3L Diesel Engine Sensors and Switches



NOTE: RIGHT FRONT MARKER/TURN SIGNAL LIGHT ASSEMBLY SHOWN. PROCEDURES TO REMOVE AND REPLACE LEFT FRONT MARKER/ TURNS SIGNAL LIGHT ASSEMBLY ARE THE SAME.

1. FRONT MARKER/TURN SIGNAL LIGHT ASSEMBLY
2. LIGHT WIRE HARNESS
3. BOLT
4. TRIM
5. OVERHEAD GUARD

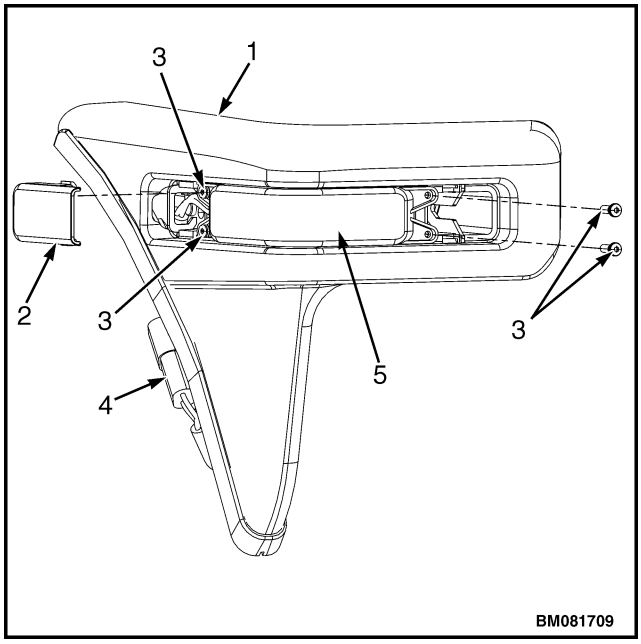
Figure 96. Front Marker/Turn Signal Light Assembly Removal

Replacing Just the Front Marker/Turn Signal Light LED Light Lens

Remove

1. Use a flat head tool and remove the two caps located on each side of the LED lens. See Figure 97.

2. Remove the four capscrews securing the LED lens in the front marker/turn signal light assembly. Remove LED lens from assembly. See Figure 97.



NOTE: RIGHT LED LENS SHOWN. PROCEDURES TO REMOVE AND REPLACE LEFT LED LENS ARE THE SAME.

1. FRONT MARKER/TURN SIGNAL LIGHT ASSEMBLY
2. CAPS
3. CAPSCREWS
4. FRONT MARKER/TURN SIGNAL LIGHT ASSEMBLY CONNECTOR
5. LED LIGHT

Figure 97. LED Lens Replace

Install

1. Install new LED light into front marker/turn signal light assembly using four capscrews. See Figure 97.

2. Install two caps on each side of LED lens. Push caps until they snap into place.

3. Connect the battery.

Diesel Particulate Filter (DPF) Display

REMOVE

NOTE: Use a flat head screwdriver to help separate the cover from base, where the bracket enters the cover pry point. See Figure 98.

1. Remove cover from base and DPF display. See Figure 98.

NOTE: Note position of lock ring during removal to help in installation.

2. Unscrew lock ring from back of DPF display and base. See Figure 98.

3. Disconnect electrical connector from back of DPF display. See Figure 98.

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.

Series Code	European Model	Americas Model
H878	GP60VX, GP70VX, GP70SVX, GP70SVX9, GP80SVX	GP135VX, GP155VX, GP155SVX, GP170SVX
J813	GLP/GDP40VX5, GLP/GDP40VX6, GLP/GDP45VX6, GLP/GDP45SVX5, GLP/GDP50VX, GLP/GDP55VX	GP/GLP/GDP80VX, GP/GLP/GDP90VX, GP/GLP/GDP100VX, GP/GLP/GDP110VX, GP/GLP/GDP120VX
K813	GLP/GDP40VX5, GLP/GDP40VX6, GLP/GDP45VX6, GLP/GDP45SVX5, GLP/GDP50VX, GLP/GDP55VX	GP/GLP/GDP80VX, GP/GLP/GDP90VX, GP/GLP/GDP100VX, GP/GLP/GDP110VX, GP/GLP/GDP120VX

Proc_Cal_025: Hydraulic Valve Pressure Gage Installation

WHEN TO PERFORM

Perform whenever any hydraulic calibration items are performed by using the pressure method.

WHY PERFORM

Installation of a pressure gage will allow for the pressure method to be used whenever any hydraulic calibration items are performed.

HOW TO PERFORM

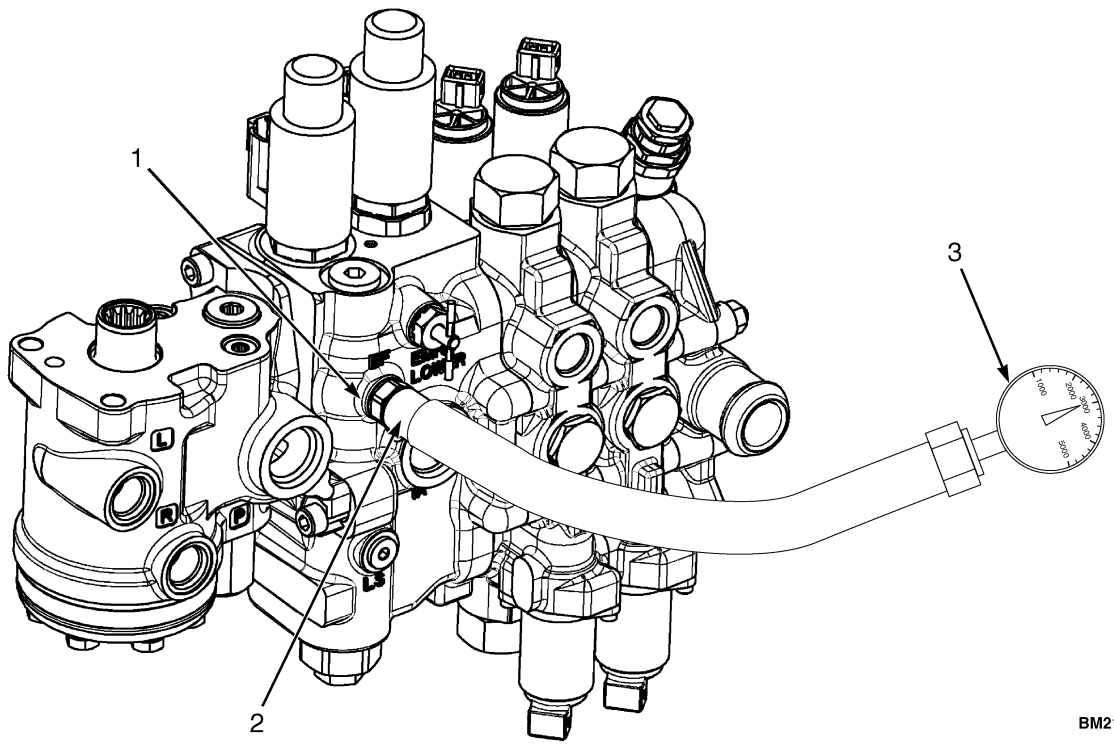
WARNING

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 22 for the procedures on how to perform Proc_Cal_025: Hydraulic Valve Pressure Gage Installation.

Table 22. Proc_Cal_025: Hydraulic Valve Pressure Gage Installation



1. EF PORT
2. DIAGNOSTIC FITTING
3. PRESSURE GAGE

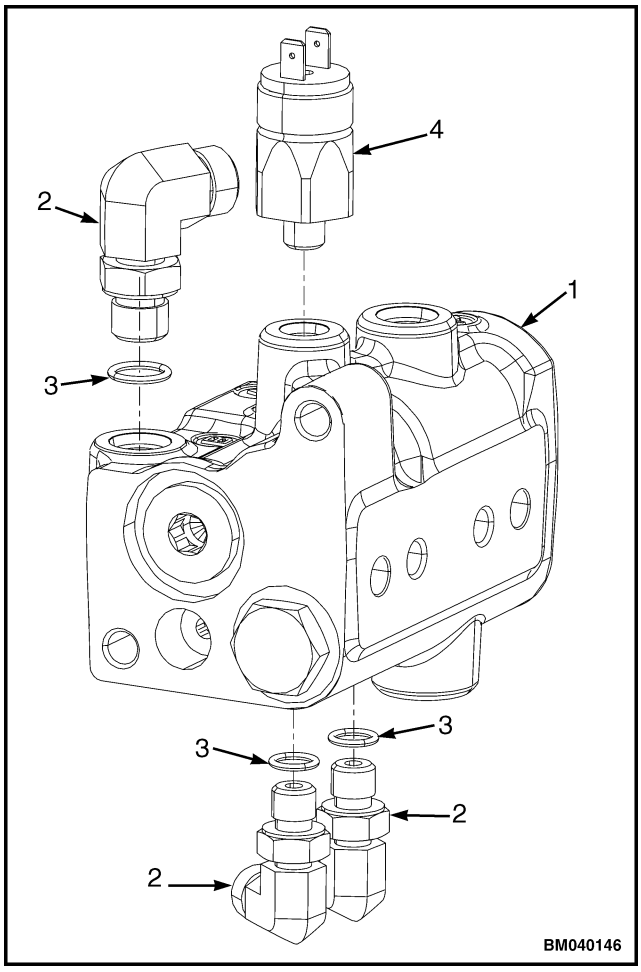
ACCUMULATOR CHARGE VALVE

Disassemble

WARNING

Due to allowable operating temperature of accumulator charge valve, avoid contact or burn injury may occur.

1. Remove pressure switch from accumulator charge valve. See Figure 34.



1. ACCUMULATOR CHARGE VALVE
2. FITTING
3. O-RING
4. PRESSURE SWITCH

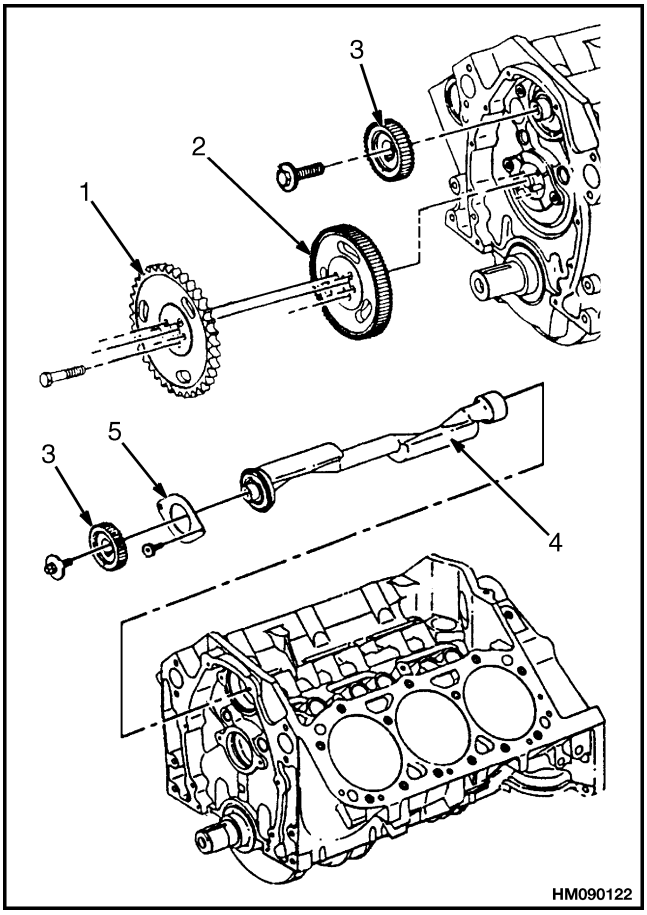
Figure 34. Accumulator Charge Valve Fittings and Pressure Switch

2. Remove fittings from accumulator charge valve. Remove and discard O-rings from fittings. See Figure 34.

CAUTION

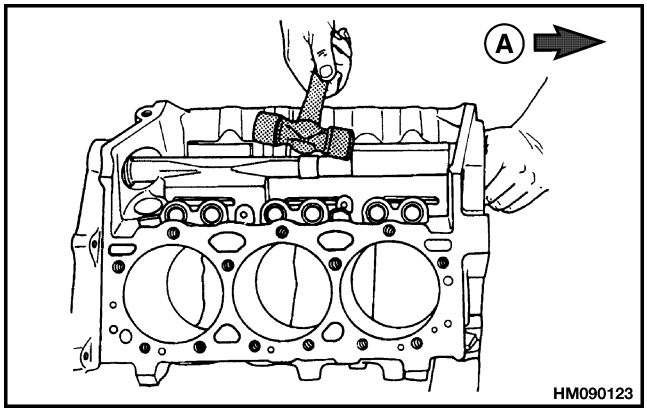
Step 3 through Step 20 must be performed in the order presented. If steps are performed out of order components may be damaged.

3. Remove plug (2) from housing (1). Remove and discard O-ring (3) from plug. See Figure 35.



1. CAMSHAFT SPROCKET
2. BALANCE SHAFT DRIVE GEAR
3. BALANCE SHAFT DRIVEN GEAR
4. BALANCE SHAFT
5. RETAINER

Figure 51. Balance Shaft Components

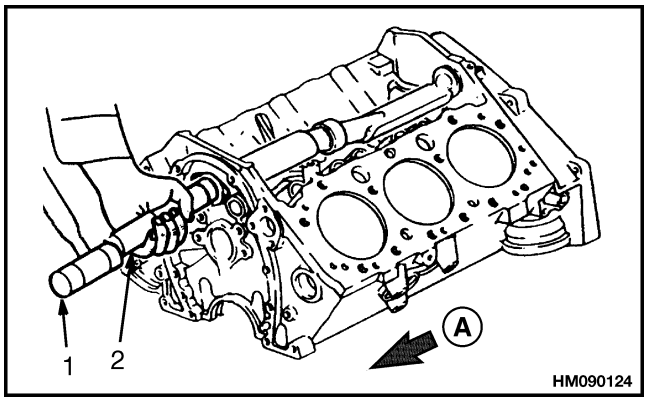


A. FRONT

Figure 52. Balance Shaft Removal

Install

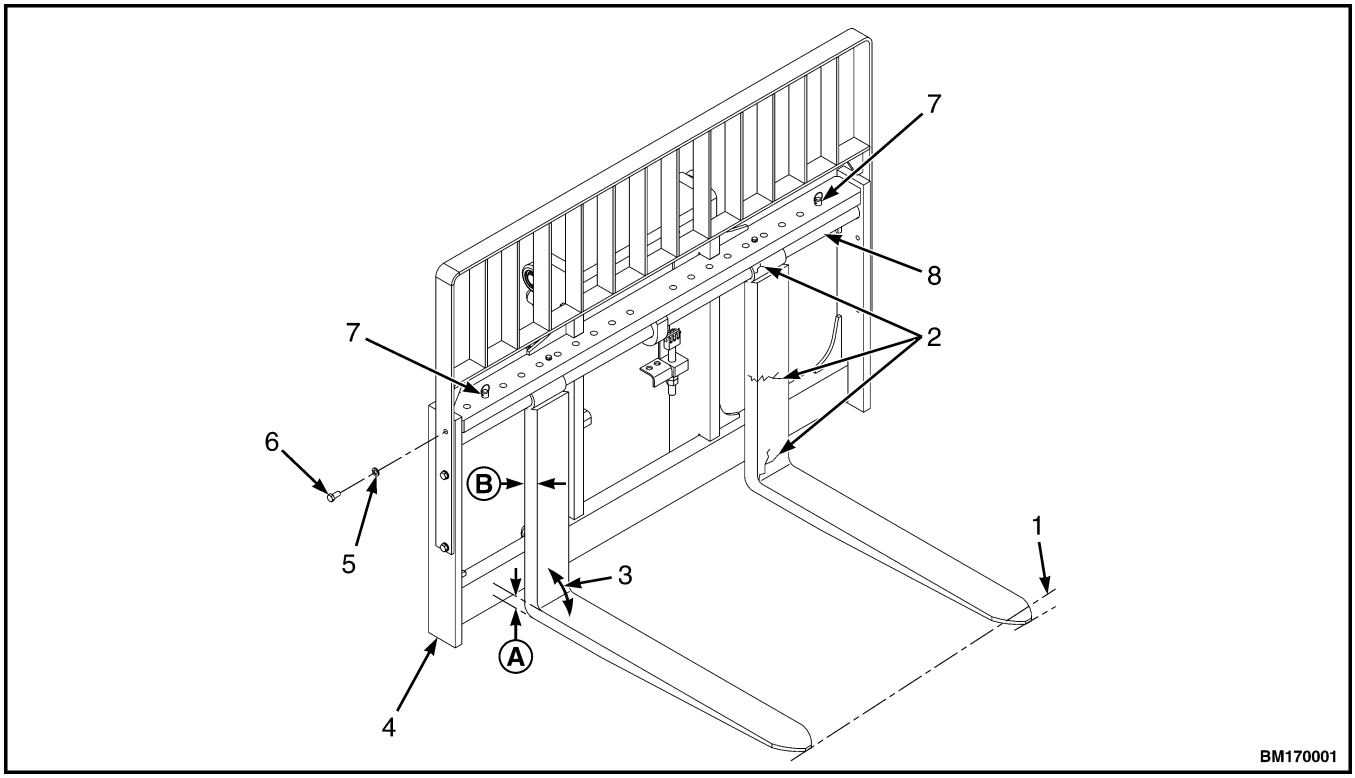
1. Lubricate rear bearing with new engine oil. Use a special tool to push rear bearing into block. See Figure 51 and Figure 53.



A. FRONT

1. HAMMER
2. BEARING DRIVER

Figure 53. Balance Shaft Installation



A. HEEL OF FORK (MUST BE 90% OF DIMENSION B)

B. ORIGINAL FORK THICKNESS (DIMENSION B)

1. TIP ALIGNMENT (MUST BE WITHIN 3% OF FORK LENGTH)
2. CRACKS
3. MAXIMUM ANGLE 89°
4. CARRIAGE
5. WASHER
6. CAPSCREW
7. PIN
8. ROD

Figure 10. Pin Type Fork Check

Fixed Carriage Replacement

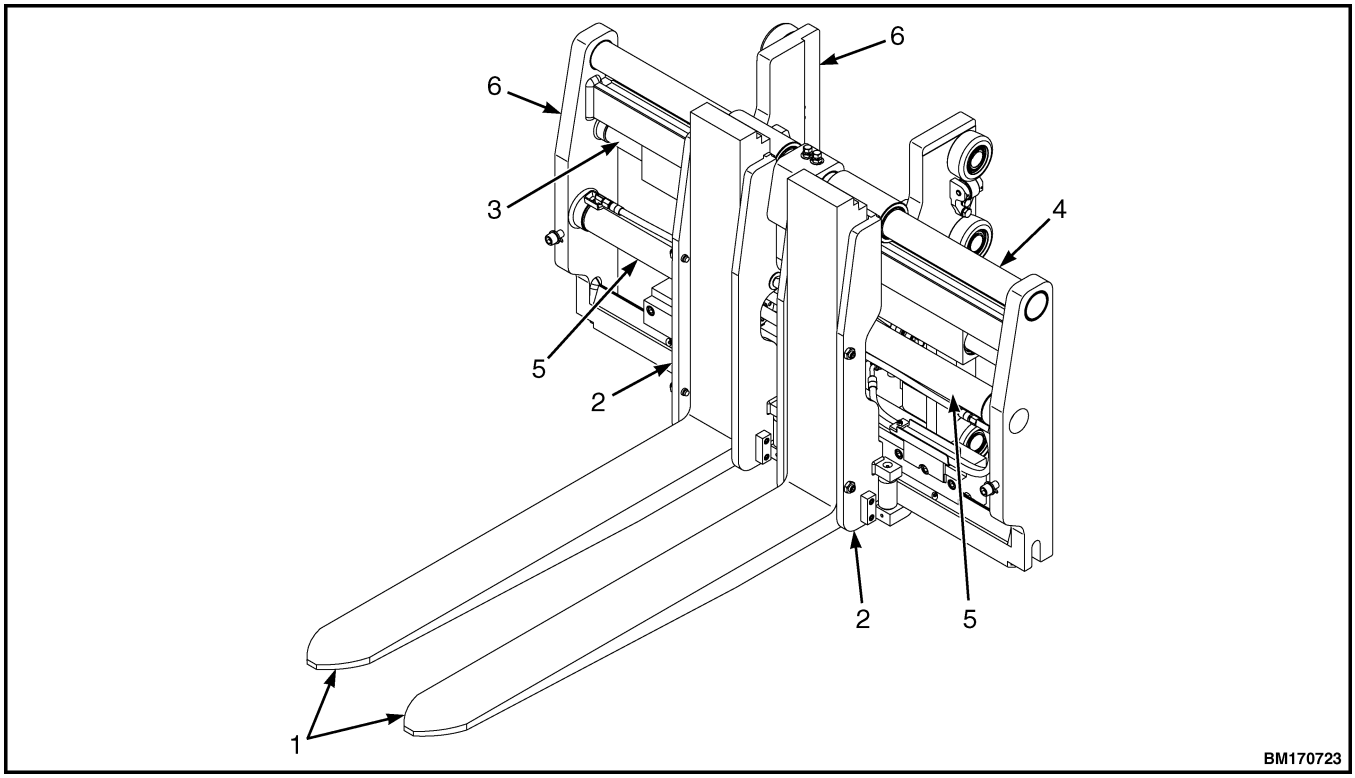
REMOVE, CARRIAGE WITH HOOK FORKS

WARNING

DO NOT work under a raised carriage. Lower the carriage or use a chain or blocks to prevent the carriage and inner mast from lowering.

NOTE: If the mast is equipped with a sideshift carriage, see the paragraphs under Integral Sideshift Carriage Repair and Hang On Sideshift Carriage Repair.

1. Tilt forks forward so carriage has stability and will not fall when it is disconnected from the mast.



1. FORKS
2. FORK SUPPORTS
3. INTEGRAL SIDESHIFT CARRIAGE CYLINDER
4. FORK SUPPORT MOUNTING BAR
5. FORK POSITIONER CYLINDER
6. INTEGRAL SIDESHIFT CARRIAGE FRAME

Figure 57. Fork Positioner Component Parts

Two-Stage Mast With Limited Free-Lift Repair

REMOVE

1. Fully lower inner mast. If mast must be disassembled, remove forks and carriage as described in section Fork Replacement and Fixed Carriage Replacement.

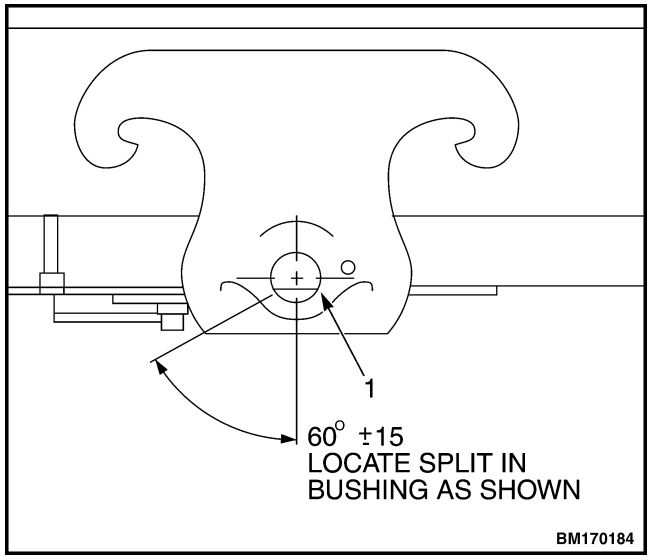
2. Connect a lifting device to all top crossmembers of the mast weldments (see Figure 1). Make sure lifting device will hold the weight of the mast. Raise lifting device so the mast has stability.

3. Remove lift and tilt cylinders following procedures found in:

Cylinder Repair (Mast S/N A551, A555, A559, A661, A662, A663, A66, 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) 2100YRM1139 for 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)
- ERC35-55HG (ERC70-120HH) (C839)

Cylinder Repair (Mast S/N A513, A514, A613, A614, B513, B514) 2100YRM1328 for lift truck models

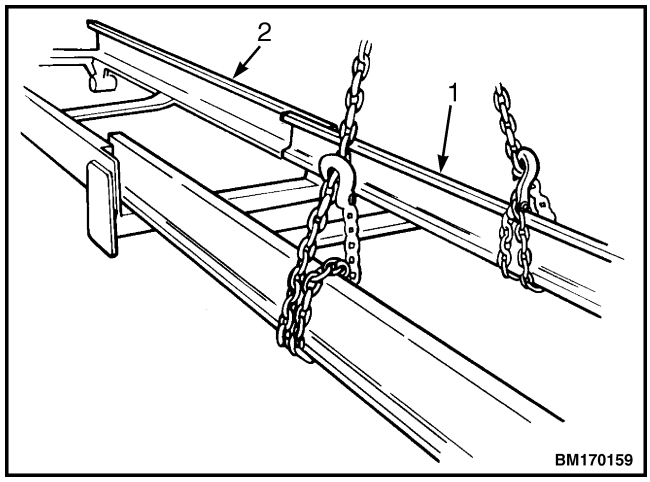


1. TILT ROD BUSHING

Figure 91. Mast Bushing Location

3. Remove lowering control valve from outer mast.

4. Slide inner mast halfway out of top of outer mast. Connect a lifting device to center of inner mast. See Figure 92. Slide inner mast out of outer mast until stub shafts are in notches of outer mast. Remove inner mast from outer mast.



1. INNER MAST
2. OUTER MAST

Figure 92. Inner Mast

5. Check that pins fit snug in outer mast. If pins can be moved up and down a minimum of 4 mm (0.157 in.), replace bushings in outer mast and/or mast pivot pins as required.

See Figure 59 for lift truck models

- GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6, GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813 and G813)

See Figure 61 for lift truck models

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

6. Remove bushings and plugs from mast mounting hangers.

See Figure 58 for lift trucks models

- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)
- ERC35-55HG (ERC70-120HH) (C839)

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

See Figure 94 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)

See Figure 95 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
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (G818)

See Figure 96 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) (F813, G813, H813)

See Figure 97 for lift truck models

Legend for Figure 122.

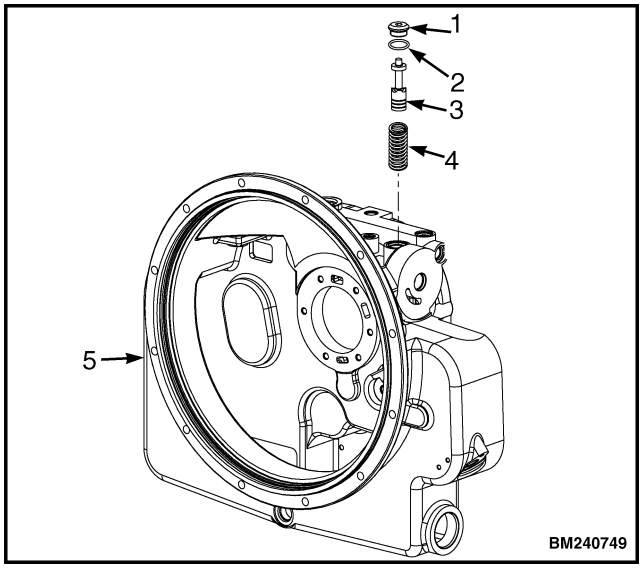
A. INNER MAST

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

B. INTERMEDIATE MAST

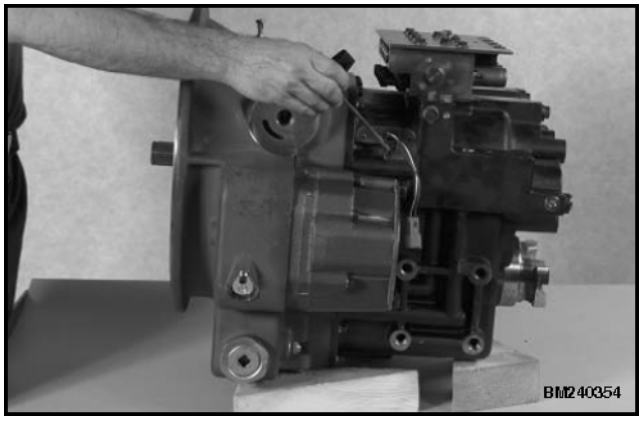
11. FREE LIFT CYLINDER
12. LIFT CHAIN
13. PIN
14. BEARING
15. CHAIN SHEAVE
16. SETSCREW
17. CROSS HEAD
18. GUARD
19. INTERMEDIATE MAST
20. BEARING STRIP

STEP 5.
Remove pressure regulator by removing plug, O-ring, spool, and spring.



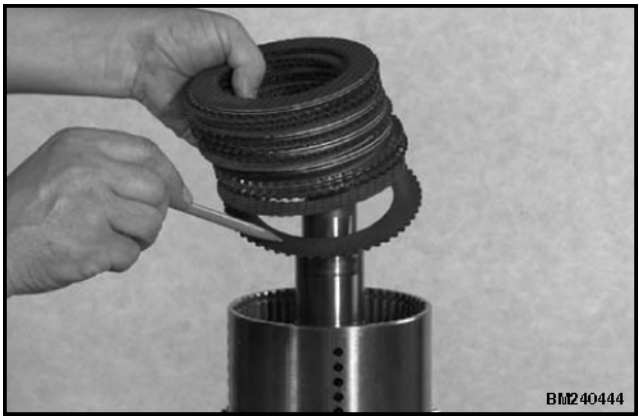
1. PLUG
2. O-RING
3. SPOOL
4. SPRING
5. CONVERTER HOUSING

STEP 6.
Remove speed sensor.

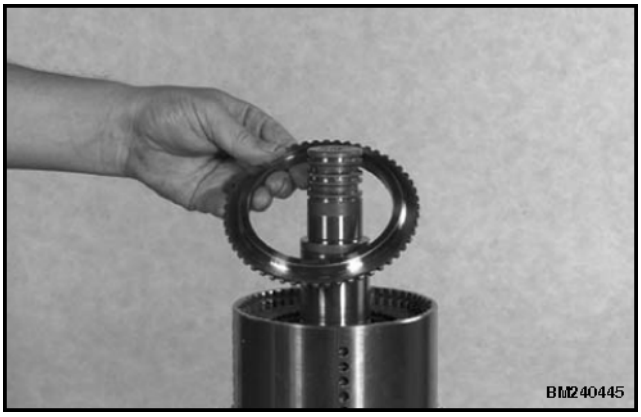


CAUTION
Disposal of lubricants and fluids must meet local environmental regulations.

STEP 5.
Install one outer disc. Install one inner disc. Alternate outer and inner disc until proper amount are installed. First disc next to the piston is outer (separator), last disc installed is inner (friction).

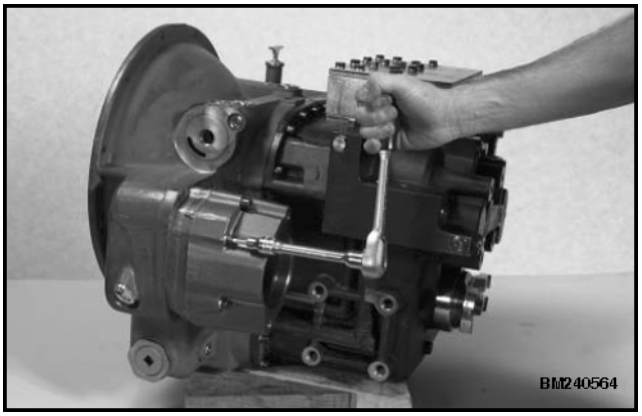


STEP 6.
Install end-plate.

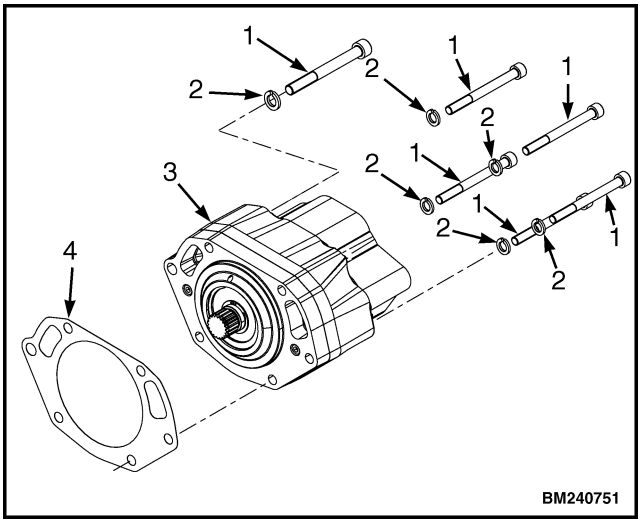


STEP 7.
Install end-plate retainer ring.

STEP 7.
Remove capscrews, lockwashers, charge pump and gasket.



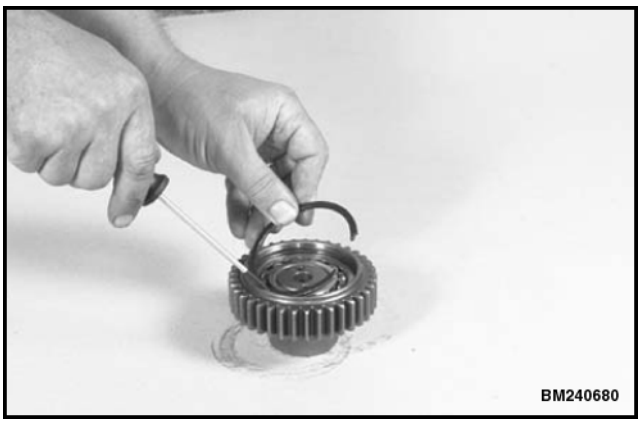
NOTE: Torque converter housing for lift trucks manufactured **Before** June 2009 shown.



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

STEP 1.
Install pump drive bearing and bearing support.

STEP 2.
Install pump drive bearing retaining ring.



Idler Gear, Assemble

Refer to Figure 7.

STEP 1.
Install idler gear bearing.

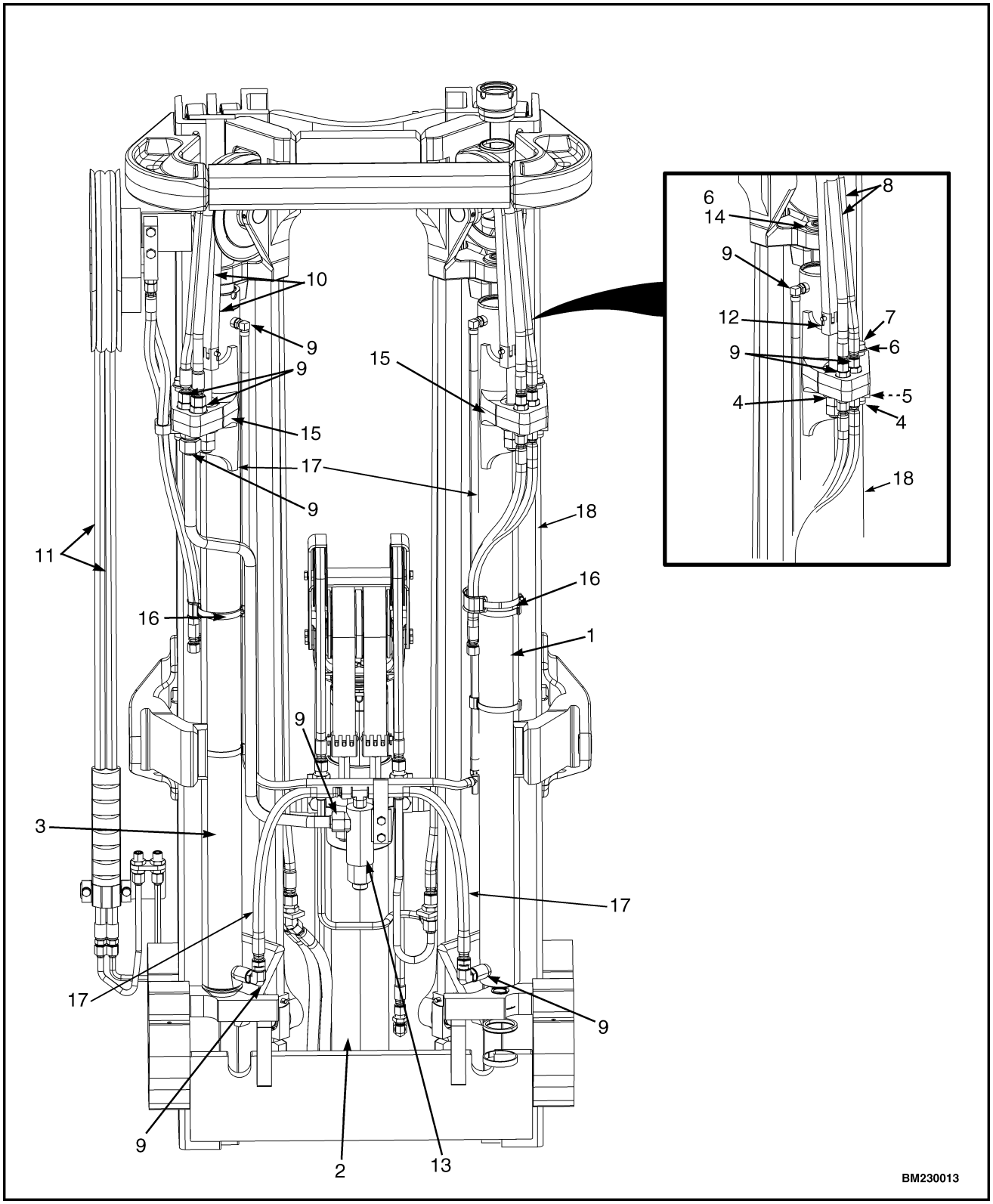


Figure 9. Three-Stage Full Free-Lift Mast, Cylinder Installation for Lift Truck Models and GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878) GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (C879, D879, E879, F879)

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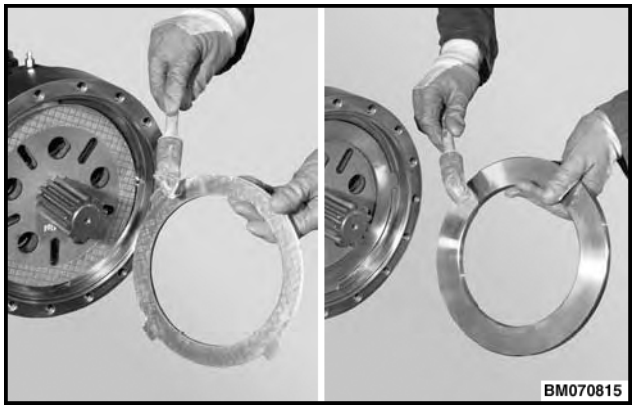
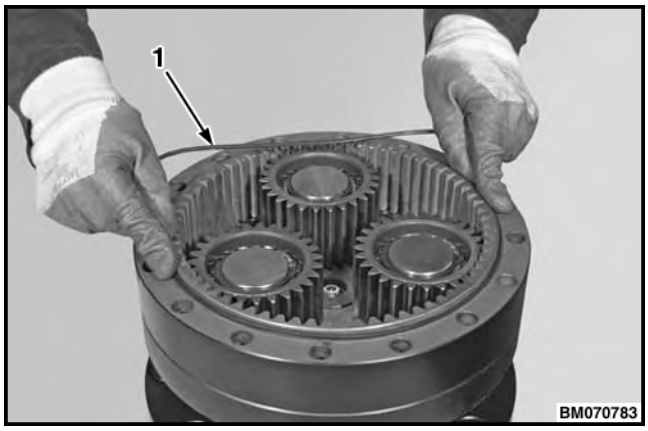
STEP 16.
Before installing the last friction plate and the intermediate disc, apply a thin coat of grease on the contact surfaces to hold them in position when mounting the planetary reduction gear assembly.



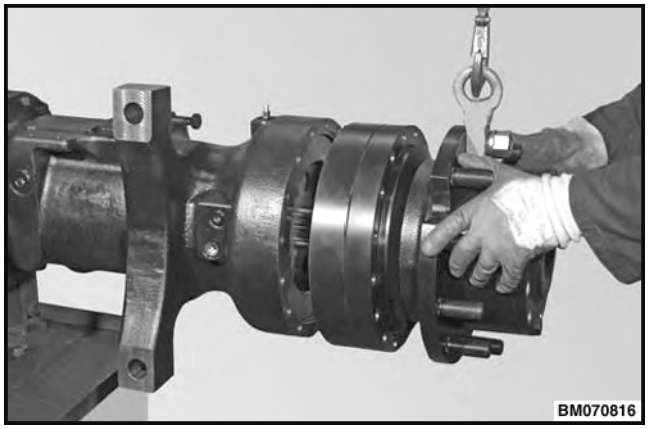
NOTE: Planetary gear images shown in Step 17 are for lift truck models GLP/GDP60VX, GLP/GDP70VX (GP/GLP/GDP135VX, GP/GLP/GDP155VX) (C878, D878, E878, F878) and GLP60VX, GLP70VX, GP70VXS6 GP70VXS9 (GP135VX, GP155VX, GP155VXS) (G878) . Lift truck models GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (A909, B909) and GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (C909, D909) have four planetary gears.

STEP 17.
Lubricate a new O-ring with a lithium based grease. Install the O-ring on the ring gear.



1. O-RING

STEP 18.
Connect an overhead lifting device to the planetary reduction gear assembly. Attach the planetary reduction gear assembly to the axle housing.



Legend for Figure 23.

A. REAR VIEW

1. MODULATING BRAKE VALVE
2. BRAKE LINE
3. LOAD SENSE IN HOSE ASSEMBLY
4. LOAD SENSE OUT HOSE ASSEMBLY
5. ACCUMULATOR CHARGE VALVE
6. HYDRAULIC PRESSURE SUPPLY HOSE
7. HYDRAULIC RETURN HOSE
8. COOLING RETURN HOSE

B. FRONT VIEW

9. MANIFOLD
10. DRIVE AXLE
11. COOLING RETURN TO TRANSMISSION HOSE
12. COOLING SUPPLY FROM TRANSMISSION HOSE
13. AXLE VENT LINE
14. COOLING SUPPLY LINES
15. SOCKET HEAD SCREW
16. BRAKE LINE

35. Install the parking brake cables. Refer to the section

Brake System - DANA 1800YRM1247 for lift truck models

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

Wet Brake System 1800YRM1977 for lift truck models

- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (C909)
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (D909)

36. Install drive axle main housing center drain plug into drive axle. See Figure 24.

37. Install right side oil drain plug and left side oil drain plug into drive axle. See Figure 24.

38. Fill the drive axle sections with the proper fluid. For the correct fluid, quantity, and fill procedure see

Periodic Maintenance 8000YRM1407 for lift truck model

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

Periodic Maintenance 8000YRM1586 for lift truck model

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

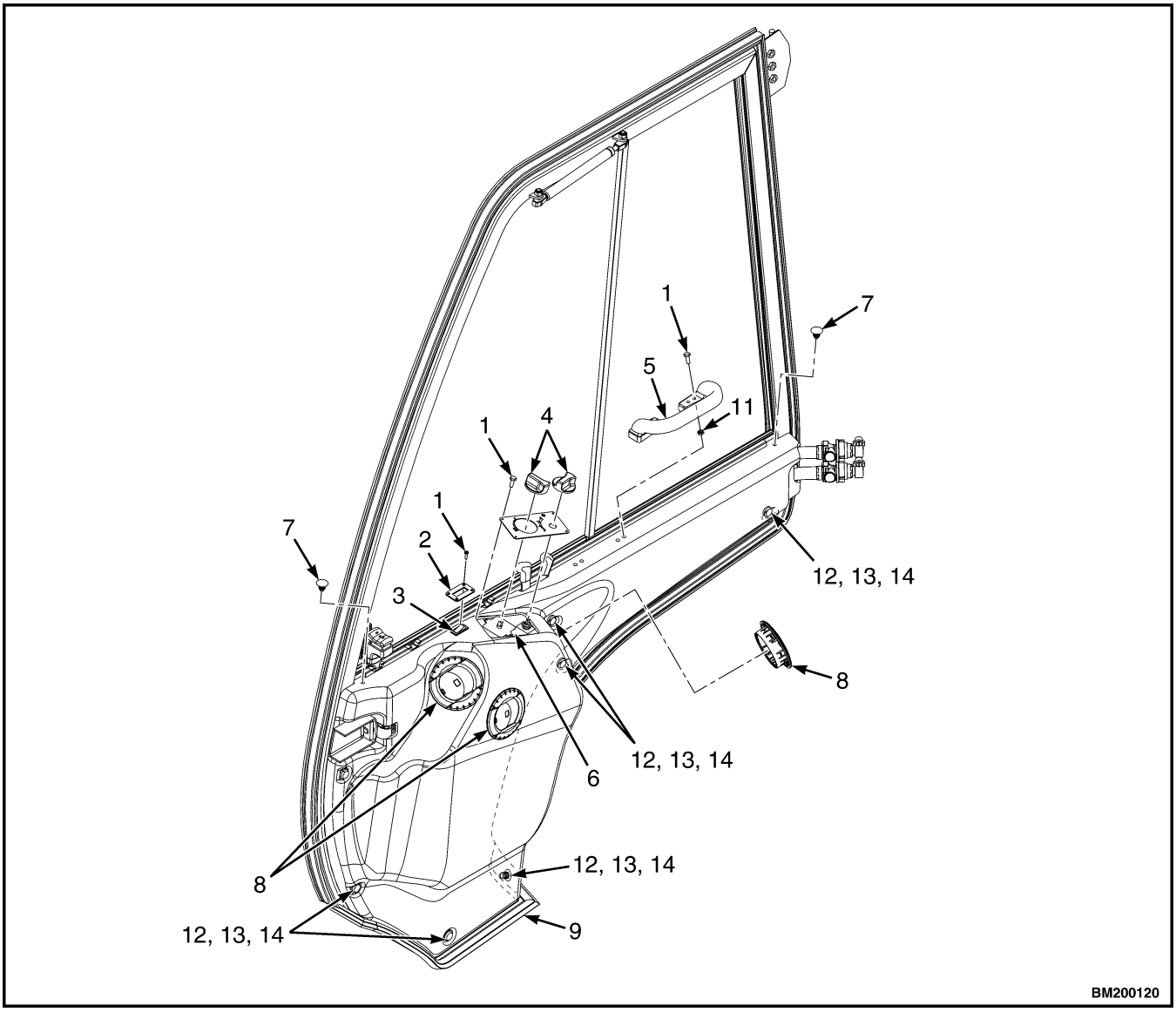
Periodic Maintenance 8000YRM1959for lift truck model

- GDP80VX, GDP80VX9, GDP90VX (GLP/GDP170VX, GLP/GDP175VX36, GLP/GDP190VX) (C909)

Periodic Maintenance 8000YRM2296

GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (D909)

39. Install drive axle main housing center fill plug. See Figure 24.



1. CAPSCREW
2. AC ROCKER SWITCH PLATE
3. AC ROCKER SWITCH
4. HEATER/AC KNOBS
5. HANDLE
6. HEATER VALVE AND SWITCH PLATE
7. FASTENER
8. HEATER, FAN, AND AC LOUVER
9. PRE-FILTER
10. DOOR COVER
11. WASHER
12. PLUG
13. WASHER
14. STAR NUT

Figure 41. Right Side Door Cover Removal, Air Conditioner/Heater Unit

FAN

Remove

1. Disconnect battery.

   To access battery, remove the floor mat and floor plate 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)

   To access battery, raise the hood, on lift truck models

   - GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
   - GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875, C875)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813)

2. Disconnect fan assembly wiring harness connector from cab wiring harness connector. See Figure 80.

3. Remove four nuts, lockwashers, capscrews, and fan assembly from mounting bracket.

Install

1. Using four nuts, lockwashers, and capscrews, install fan assembly on mounting bracket. See Figure 80.

2. Connect fan assembly wiring harness connector to cab wiring harness connector.

3. Connect 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 battery, lower the hood, on lift truck models

   - GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
   - GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875, C875)
   - GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080, 090, 100, 110, 120VX) (F813, G813, H813, J813)

MIRROR

Remove

Remove nut and mirror from the mounting bracket. See Figure 80.

Install

Using nut, install mirror on the mounting bracket. See Figure 80.

Inspect

1. Inspect the following items in the exhaust system:

   a. Inspect all exhaust pipes for damage, corrosion, and rust. Replace if damaged.

   b. If equipped, inspect all exhaust wraps for wear, proper fit, contamination with oil or antifreeze, gaps in coverage, and failed fasteners. Replace as needed.

   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.

Assemble and Install

NOTE: Install all studs with the end stamp **ISOM** or **M** away from engine.

1. Install new gasket onto exhaust pipe (13, Figure 30) and connect exhaust pipe to engine exhaust manifold. Tighten locknuts to 39 N•m (345 lbf in).

2. Install new gasket between exhaust pipe (12 and 13, Figure 30). Connect exhaust pipe (12, Figure 30) onto exhaust pipe (13. Figure 30). Tighten locknuts to 39 N•m (345 lbf in).

NOTE: Install catalytic converter so that stamped serial number is visible from rear of lift truck.

3. Place catalytic converter and muffler onto the lift truck frame and install the spacer, bracket, isolators, washers, capscrew, and locknut to attached muffler to lift truck frame. See Figure 30. Tighten locknuts to 22 N•m (195 lbf in).

4. Install spacer, isolators, capscrew, and locknut that attached muffler to lift truck frame. See Figure 30. Tighten locknuts to 22 N•m (195 lbf in).

5. Install new gasket onto exhaust pipe (12, Figure 30), place bracket onto exhaust pipe, install exhaust pipe and flange nuts onto catalytic converter. Tighten flange nuts to 22 N•m (195 lbf in).

6. Install new gaskets, washers, nuts flange nuts and exhaust pipe (17, Figure 30) to muffler and catalytic converter.

7. Install clamp and exhaust pipe (5, Figure 30) to muffler.

8. Connect three oxygen sensors to exhaust pipes (13 and 17, Figure 30).

9. Install counterweight.

   See **Frame** 0100YRM1243 for lift truck models

   - GLC40-55VX; GLC55SVX (GLC080-120VX; GLC080-100VXBCS, GLC120SVX; GLC120VXPRS) (E818, F818)
   - GLP40VX5/VX6; GLP45SVX5, GLP45VX6, GLP50-55VX (GLP080-120VX) (G813, H813, J813)

   See **Frame** 0100YRM1316 for lift truck models

   - GLC60-70VX (GLC135-155VX) (D879, E879, F879)

   See **Frame** 0100YRM1321 for lift truck models

   - GLP60-70VX (GLP135-155VX) (D878)

   See **Frame** 0100YRM1581 for lift truck models

   - GLP60-70VX (GLP135-155VX) (E878)

   See **Frame** 0100YRM1891

   - GLP40VX5/VX6; GLP45SVX5, GLP45VX6, GLP50-55VX (GLP080-120VX) (K813)

   See**Frame** 0100YRM1948 for lift truck models

   - GLP60-70VX (GLP135-155VX) (F878)

10. Install clamp (4, Figure 30) and connect exhaust pipe (1, Figure 30) to exhaust pipe (5, Figure 30).

11. Install flange cover and capscrews to secure exhaust pipe (1, Figure 30) to the counterweight.

EXHAUST MANIFOLD

Remove

WARNING

Exhaust system components are hot, they can cause sever burns. Turn OFF the engine and wait until it cools before removing exhaust system components.

1. Disconnect negative battery cable.

Legend for Figure 7

1. SEAT PLATE COVER
2. COVER
3. CAPSCREW
4. LOWER STEERING COLUMN COVER
5. UPPER STEERING COLUMN COVER
6. SEAT SUPPORT
7. FRONT FLOOR PLATE
8. REAR FLOOR PLATE
9. FLOOR PLATE
10. STRIKER BOLT
11. FLOOR PLATE LATCH
12. NUT
13. COWL
14. FLOOR MAT (FRONT)
15. FLOOR MAT (REAR)
16. UPPER TREAD PLATE (LH)
17. UPPER TREAD PLATE (RH)
18. LOWER TREAD PLATE (LH)
19. LOWER TREAD PLATE (RH)
20. LEFT SIDE FRONT COVER
21. RIGHT SIDE FRONT COVER

See Figure 30 for lift trucks equipped with GM 5.7L Engine.

13. Remove blocks from under the transmission and disconnect lifting device from transmission.

14. Lift trucks equipped with GM 4.3L, PSI 4.3L, and GM 5.7L engine, install starter motor and tighten capscrews to 18 to 24 N•m (13 to 18 lbf ft).

See Figure 25 for lift trucks equipped with GM 4.3L Engine with PSI fuel system.

See Figure 26 for lift trucks equipped with PSI 4.3L Engine.

See Figure 30 for lift trucks equipped with GM 5.7L Engine.

15. Connect the positive battery (B+) cable to starter motor. Tighten terminal nut to 8 to 11 N•m (71 to 97 lbf in).

See Figure 25 for lift trucks equipped with GM 4.3L Engine with PSI fuel system.

See Figure 26 for lift trucks equipped with PSI 4.3L Engine.

See Figure 27 for lift trucks equipped with Kubota 3.8L Diesel Engine.

See Figure 28 for lift trucks equipped with Kubota 3.6L Diesel Engine.

See Figure 29 for lift trucks equipped with Cummins QSB 3.3L Diesel Engine.

See Figure 30 for lift trucks equipped with GM 5.7L Engine.

16. Connect negative battery cable to starter motor.

17. For lift trucks equipped with GM 4.3L engine, install pin into left side engine mount until pin hits bottom of hole. See Figure 31.

NOTE: Apply Loctite® 222 or equivalent to flange bolts prior to installation.

18. For lift truck equipped with GM 4.3L or PSI 4.3L engine, using a light mallet, install crossmember onto left side engine mount. Install three flange bolts onto cross member and left side engine mount. Tighten flange bolts to 90 N•m (66 lbf ft). See Figure 31.

19. For lift truck equipped with GM 4.3L or PSI 4.3L engine, install left side engine mount and flange bolt onto flywheel housing. Tighten flange bolts to 90 N•m (66 lbf ft). See Figure 31.

20. For lift truck equipped with GM 4.3L or PSI 4.3L engine, install left side engine mount and three flange bolts onto engine block. Tighten flange bolts to 52 N•m (38.3 lbf ft). See Figure 31.

21. Uncap and connect hydraulic supply hose from hydraulic tank at hydraulic pumps. See **Hydraulic Gear Pump** 1900YRM1136 for procedures.

22. Uncap and connect brake cooling lines at the transmission.

See Figure 25 for lift trucks equipped with GM 4.3L Engine with PSI fuel system.

See Figure 26 for lift trucks equipped with PSI 4.3L Engine.

See Figure 27 for lift trucks equipped with Kubota 3.8L Diesel Engine.

See Figure 28 for lift trucks equipped with Kubota 3.6L Diesel Engine.

See Figure 29 for lift trucks equipped with Cummins QSB 3.3L Diesel Engine.

See Figure 30 for lift trucks equipped with GM 5.7L Engine.

23. Uncap and connect transmission oil lines at the transmission.

24. Connect the transmission harness to right hand chassis harness.

25. Install the power distribution module (PDM) and connect ground strap to frame.

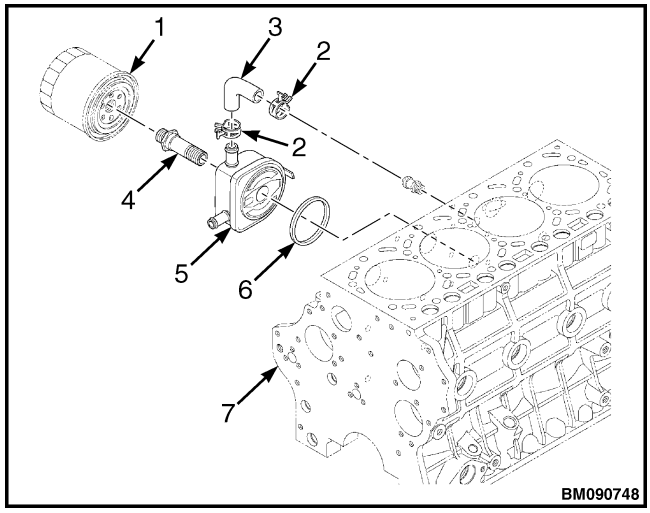
26. Check all fluid levels as described in the section

Periodic Maintenance 8000YRM1583 for lift truck model

- GLP/GDP60VX, GLP/GDP70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E878)

Periodic Maintenance 8000YRM1586 for lift truck model

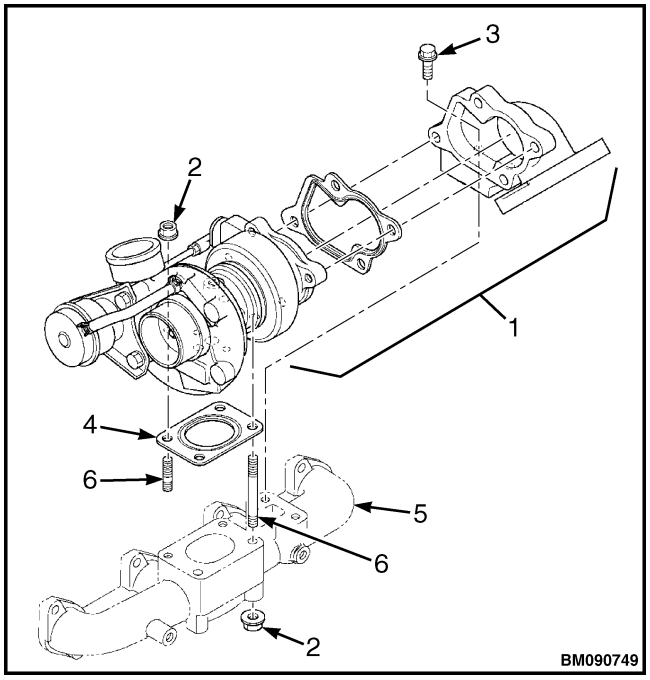
- GLP/GDP80VX, GLP/GDP80VX9, GLP/GDP90VX (GDP170VX, GDP175VX36, GDP190VX) (B909)



1. OIL FILTER
2. CLAMP
3. HOSE
4. OIL COOLER JOINT
5. OIL COOLER
6. O-RING
7. ENGINE BLOCK

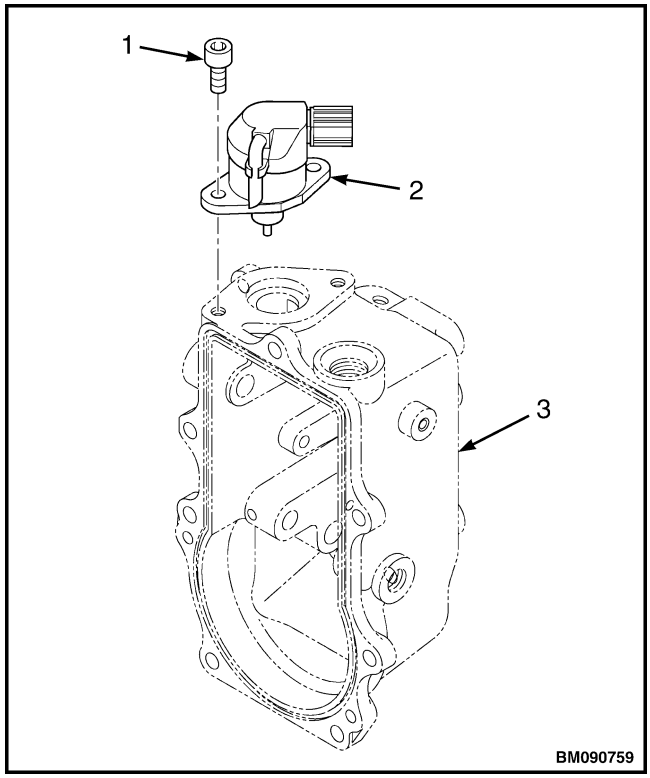
Figure 29. Oil Cooler

32. Remove six flange nuts, two flange bolts, gasket and turbocharger from exhaust manifold. Discard gasket. See Figure 30.



1. TURBOCHARGER
2. FLANGE NUT
3. FLANGE BOLT
4. GASKET
5. EXHAUST MANIFOLD
6. STUD

Figure 30. Turbocharger

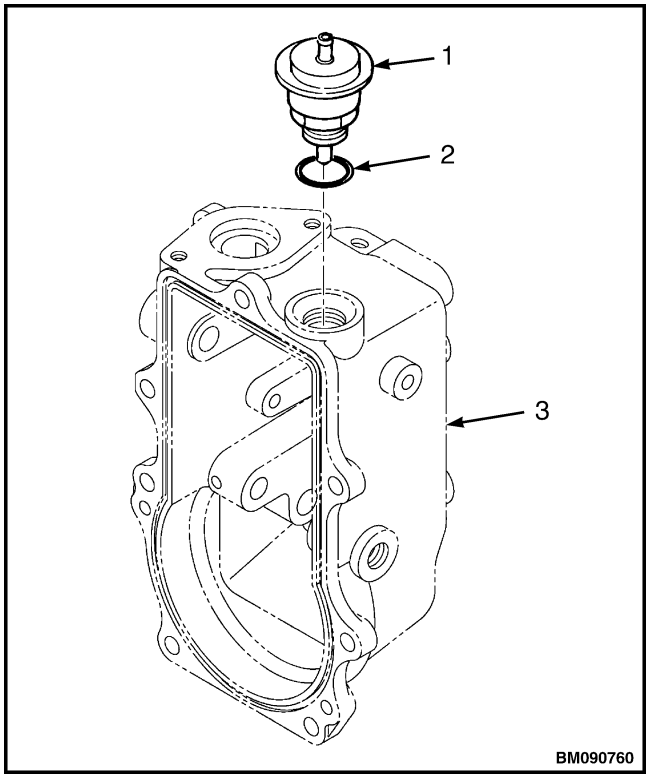


NOTE: SOME ASSEMBLY COMPONENTS REMOVED FOR CLARITY.

1. SOCKET HEAD BOLT
2. FUEL SHUT DOWN SOLENOID
3. FUEL INJECTION PUMP ASSEMBLY

Figure 112. Fuel Shut Down Solenoid

3. Remove boost actuator and O-ring from fuel injection pump assembly. Discard O-ring. See Figure 113.

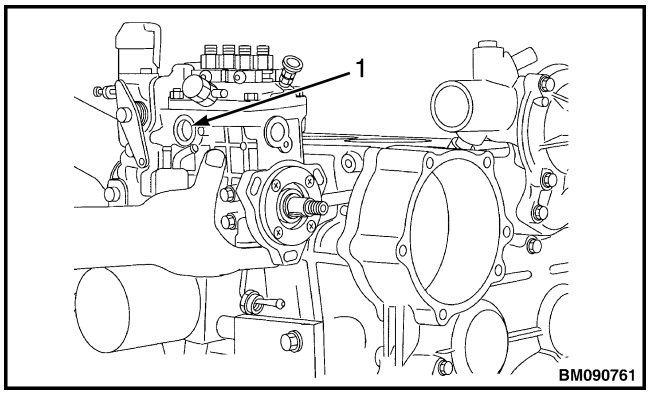


NOTE: SOME ASSEMBLY COMPONENTS REMOVED FOR CLARITY.

1. BOOST ACTUATOR
2. O-RING
3. FUEL INJECTION PUMP ASSEMBLY

Figure 113. Boost Actuator

4. Remove inspection port cover from fuel injection pump assembly housing. See Figure 114.



1. INSPECTION PORT COVER

Figure 114. Inspection Port Cover

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
27	Spark Plugs GM 4.3L Engine				C			Change Spark Plugs 6 Plugs	0.889 mm (0.035 in.) AC-R44-LTS
28	Cooling System GM 4.3L Engine	X CIL				C		15.1 liter (15.9 qt)	See **NOTE 13**
28	Cooling System Kubota Diesel Engine	X CIL				C		11 liter (11.6 qt)	See **NOTE 13**
	Clean Debris From Radiator Core			X				See **NOTE 5**.	
12	Forks	X		X		X		Check Condition	
12	Fork Latches			L				Lubricate as Necessary	Multipurpose Grease See **NOTE 7**.
	Lift System, Operate	X						Check Operation	
13	Mast Sliding Surfaces and Load Roller Surfaces			L				Lubricate As Required See **NOTE 9**.	Multipurpose Grease See **NOTE 7**.
14	Header Hoses			X				Check Condition	
15	Lift Chains	X						Check Condition/ Lube if Necessary. See **NOTE 10**.	Engine Oil SAE 30W
15	Lift Chains			L	X, L			Check for Wear Lube as Required	SAE 30W Engine Oil
	Mast Pivots			L				2 Fittings	Multipurpose Grease See **NOTE 7**.
	Mast (Before August, 2012) Hang-On Sideshift Carriage Sliding Surfaces (Upper and Lower Bearings)	X		L	X			Lube as Required (2 fittings for Upper Bearings) and (4 Lower Bearing Strips) Check Bearings for Wear.	Multipurpose Grease See **NOTE 7** and **NOTE 15**. 1.5 mm (0.06 in.) Minimum Thickness.
	Mast (After August, 2012)	X		L	X			Lube as Required (4 fittings for Upper Bearings) and	Multipurpose Grease See **NOTE 7** and **NOTE 15**.

X=Check C=Change L=Lubricate CIL=Check Indicator Light during operation

Legend for Figure 60.

1. LOCK BUTTON RELEASE
2. OFF POSITION
3. ON POSITION
4. ADJUSTMENT KNOB

Maintenance Procedures Every 1000 Hours or 6 Months

NOTE: Perform the 8-hour, 250-hour, and 500-hour checks prior to performing the procedures in this section.

VALVE CLEARANCE, CHECK AND ADJUST

The GM 4.3L engine has hydraulic valve lifters and does not require valve clearance adjustments during normal service. Additional engine information is available in the following section: **GM 4.3L V-6 Engines** 0600YRM1251.

VALVE CLEARANCE, CHECK AND ADJUST, KUBOTA 3.6L ENGINE

The Kubota 3.6L engine requires valve clearance adjustments during normal service. See the Maintenance Schedule for valve clearances.

For valve clearance procedure see the section:

- **Kubota Diesel 3.6L Engine** 0600YRM1579

VALVE CLEARANCE, CHECK AND ADJUST FOR KUBOTA 3.8L DIESEL ENGINE

The Kubota 3.8L engine requires valve clearance adjustments during normal service. See the Maintenance Schedule for valve clearances.

For valve clearance procedure see the section:

- **Kubota Diesel 3.8L Engines with Diesel Particulate Filter (DPF)** 0600YRM1590

IGNITION SYSTEM

GM 4.3L Engine

The GM 4.3L gasoline and LPG engines have an electronic control unit (ECU) that controls the ignition timing. There are no adjustments. Change the spark plugs every 1000 hours. See the section **Capacities and Specifications** 8000YRM1584 for the correct spark plug gap and type of plugs to use.

LPG FUEL FILTER ELEMENT REPLACE, GM 4.3L ENGINE

Remove

WARNING

LPG can cause an explosion and serious injury to personnel. DO NOT permit any sparks or open flames in the work area.

1. Close fuel valve on tank. Run engine until it stops.
2. Disconnect negative battery cable.

WARNING

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

3. Remove the bolt and seal washer retaining the top section of the fuel filter housing. Discard seal washer. See Figure 61.

Lift Truck Lifting Capacity

Model	Weight
GLP/GDP60VX (GP/GLP/GDP135VX)	6123 kg (13,500 lb)
GLP/GDP70VX (GP/GLP/GDP155VX)	7030 kg (15,500 lb)
NOTE: Load center at 600 mm (24 in.).	

Counterweight Weights

Model	Weight
GLP/GDP60VX (GP/GLP/GDP135VX)	2622 kg (5780 lb)
GLP/GDP70VX (GP/GLP/GDP155VX)	3135 kg (6911 lb)

Tire Sizes

Truck	Drive Tires	Steer Tires
GLP/GDP60VX GLP/GDP70VX GP/GLP/GDP135VX GP/GLP/GDP155VX	8.25 × 15	8.25 × 15

Capacities

Item	Quantity	Specifications
Fuel Capacity		
Gas	74.8 liter (19.7 gal)	87 Octane
LPG	38.6 liter (10.2 gal) **Empty** 19.0 kg (41 lb) **Full** 38.2 kg (84.51 lb)	LPG-HD 5, HD 10
Kubota Diesel 3.6L	74.8 liter (19.7 gal)	Diesel No. 2
Kubota Diesel 3.8L	74.8 liter (19.7 gal)	Low Sulfur ≤ 15 PPM Diesel No. 2

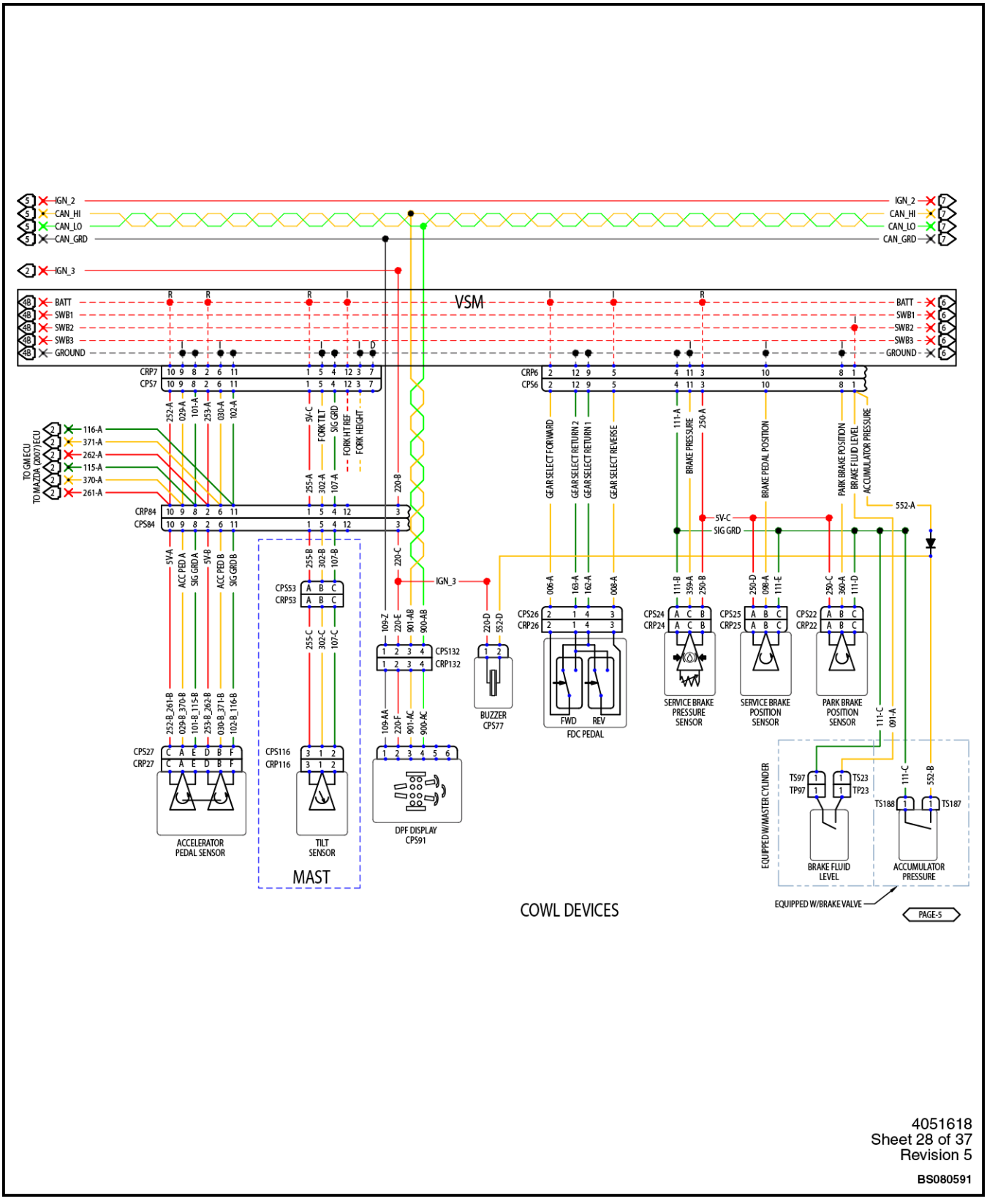


Figure 17. Cowl Devices Electrical Schematic

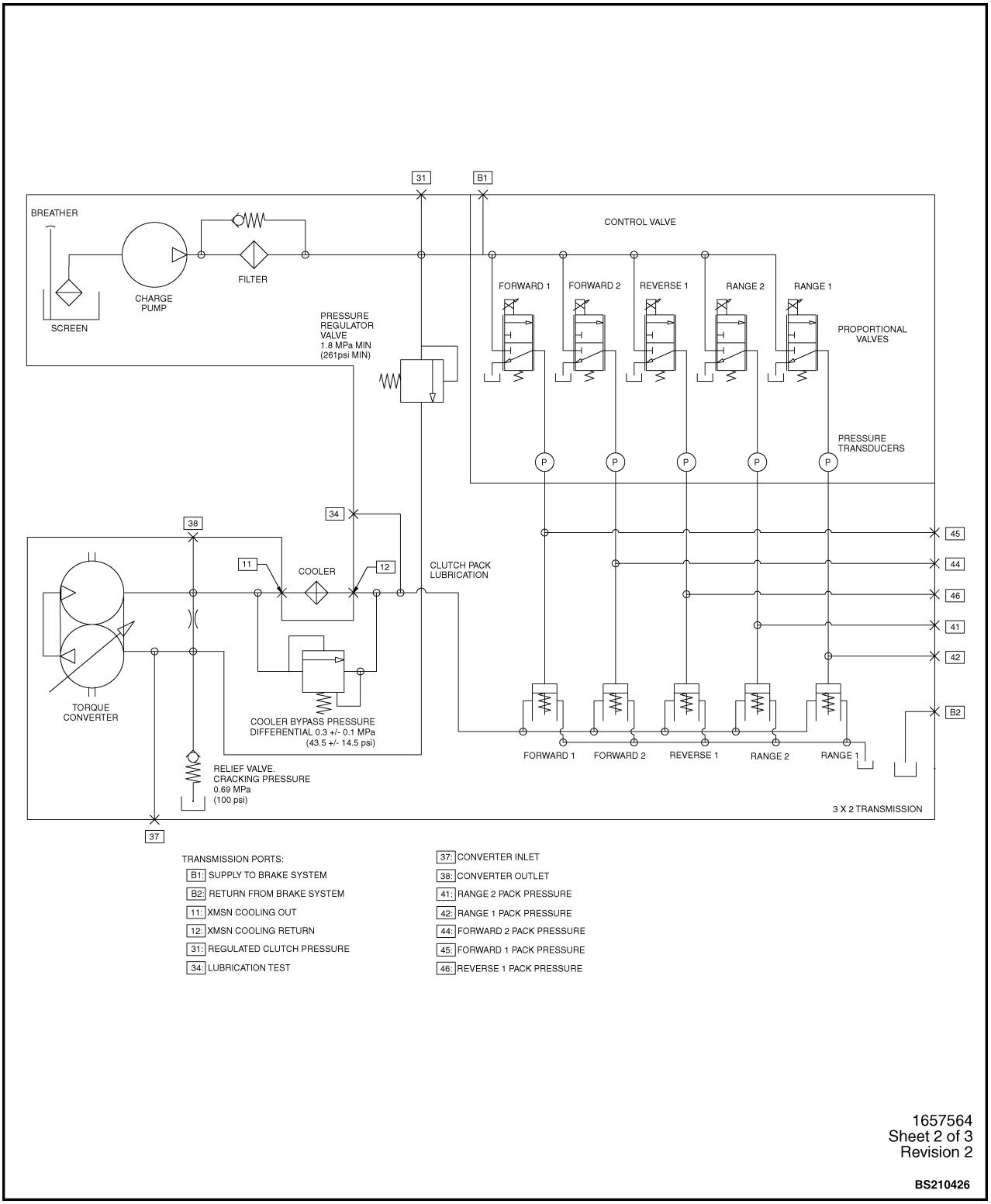
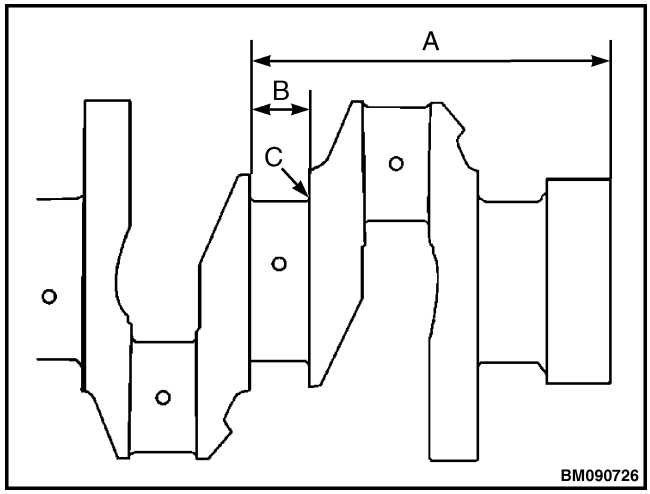


Figure 64. Transmission Hydraulic Schematic for Lift Truck Models and GLC/GDC60VX, GLC/GDC70VX (GC/GLC/GDC135VX, GC/GLC/GDC155VX) (E879, F879)GLP/GDP60VX, GLP/GDP70VX (GP/GLP/ GDP135VX, GP/GLP/GDP155VX) (E878) (Sheet 2 of 3)



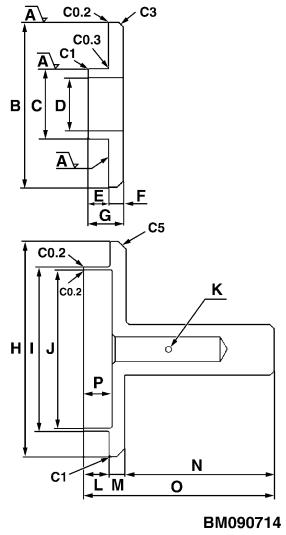
Dimension	Minimum	Maximum
Oversize Journal	0.2 mm (0.008 in.)	0.4 mm (0.016 in.)
Dimension **A**	169.10 to 169.15 mm (6.6575 to 6.6594 in.)	169.2 to 169.25 mm (6.6615 to 6.6633 in.)
Dimension **B**	29.20 to 29.25 mm (1.150 to 1.151 in.)	29.40 to 29.45 mm (1.158 to 1.159 in.)
Dimension **C**	2.8 to 3.2 mm (0.11 to 0.12 in.) radius	2.8 to 3.2 mm (0.11 to 0.12 in.) radius

Figure 55. Crankshaft Measurement With Oversize Journal

NOTE: Be sure to note the markings on the main bearing caps, or mark them yourself, so they can be reinstalled in the same location as they were removed.

NOTE: The arrows on the main bearing caps point to the flywheel end of the engine.

4. Remove the bolts holding the main bearing caps. Remove the main bearing caps. See Figure 56.

No.	Tool Name	Applicable Model and Tool Size		Illustration
8	Crankshaft Sleeve Press Tool	**A**	Rmax = 12.5 S	 BM090714
		B	94.5 to 95.0 dia. mm (3.72 to 3.74 dia. in.)	
		C	40 dia. mm (1.6 dia. in.)	
		D	30 dia. mm (1.2 dia. in.)	
		E	12 mm (0.47 in.)	
		F	7.90 to 8.10 mm (0.311 to 0.318 in.)	
		G	20 mm (0.79 in.)	
		H	130 dia. mm (5.12 dia. in.)	
		I	99.40 to 99.60 dia. mm (3.914 to 3.921 dia. in.)	
		J	95.05 to 95.20 dia. mm (3.743 to 3.748 dia. in.)	
		K	3 dia. mm (0.1 dia. in.)	
		L	15 mm (0.59 in.)	
		M	10 mm (0.39 in.)	
		N	90 mm (3.5 in.)	
		O	115 mm (4.53 in.)	
		P	16.9 to 17.1 mm (0.666 to 0.673 in.)	
		C1	Chamfer 1.0 mm (0.039 in.)	
		C3	Chamfer 3.0 mm (0.12 in.)	
		C5	Chamfer 5.0 mm (0.20 in.)	
		C0.2	Chamfer 0.2 mm (0.008 in.)	
		C0.3	Chamfer 0.3 mm (0.01 in.)	
		Locally Manufactured		

2. Use the same analysis laboratory for all similar fluid samples in order to maintain consistent results for each sample program. There are differences in results from laboratory to laboratory, no matter how reputable.

3. Consistent use of the same laboratory will provide a historical record of sample results. Trending of these results provides the ability to identify significant changes in oil condition.

4. Analysis Reports should include the following information:
   - Spectrographic analysis - Wear Metals
   - Viscosity
   - FT-IR spectroscopy - Additive condition, oxidation, TAN, fluid mixing
   - Particle counts per ISO 4406-1999
   - Water Content (% or PPM (parts per million))

5. Follow the described method for sampling in all cases to avoid contamination of the sample.

6. Minimize Data Variability.
   - Consistent sampling process produces uniform, consistent, and representative information.
   - DO NOT allow contaminant to enter the sample from outside the oil.
   - Use the same location for each sample. Not all sample locations will produce the same data.

7. The recommended frequency for hydraulic fluid samples is:
   - Every 500 hours and just prior to all oil and filter changes. Once the effects of the operating conditions have on the oil are understood, it may be possible to extend the sampling frequency.
   - High operating temperatures and severe operating conditions shorten the life of oil. For machines operating in severe duty applications with high hydraulic oil temperatures or operating in highly contaminated environments, we recommend taking oil samples every 500 hours.
   - Within one operational hour of major system service, then at 100 hours, and every 500 hours thereafter.
   - Significant changes in the system fluid condition reported by the analysis will dictate a repeat sample to validate results prior to taking corrective actions.

8. Document all hydraulic component failures or hydraulic system service performed that might have introduced contamination or new oil into the system since the last oil sample was taken.

Synopsis

1. Analysis Reports

   Spectrographic analysis

   - is used to finely measure parts per million by weight (PPM) of various elements contained in sampled oil. The process measures the concentration of wear metals, contaminant metals and additive metals in a lubricant.
   - It can identify the concentration of individual metal or alloy of a particle. Its size limit is about 8 microns or smaller, so it is blind to the larger particles that can often signal pending failure.
   - Spectrographic limits are an instrument limitation. The size limitation depends on the particle types and instrumentation used.
   - Spectrographic Analysis and Particle Count Analysis form an efficient partnership in identifying the concentration of small and large particles in the oil and the total fluid contamination level.

   Viscosity

   - is the most important physical property of oil. Viscosity determination provides a specific number to compare to the recommended oil in service. An abnormal viscosity (± 15%) is usually indicative of a problem. Standard ISO VG 46 hydraulic oil should have a viscosity between 41 and 51.

   Fourier Transform Infrared (FT-IR) Spectrometer

   - Measures the chemical composition of a lubrcant.
   - Every compound has a unique infrared signature. Using a FT-IR Spectrometer, the key signature points in a spectrum of a specific lubricant are monitored. These signatures are usually common contaminants and degradation by-products unique for a particular lubricant.

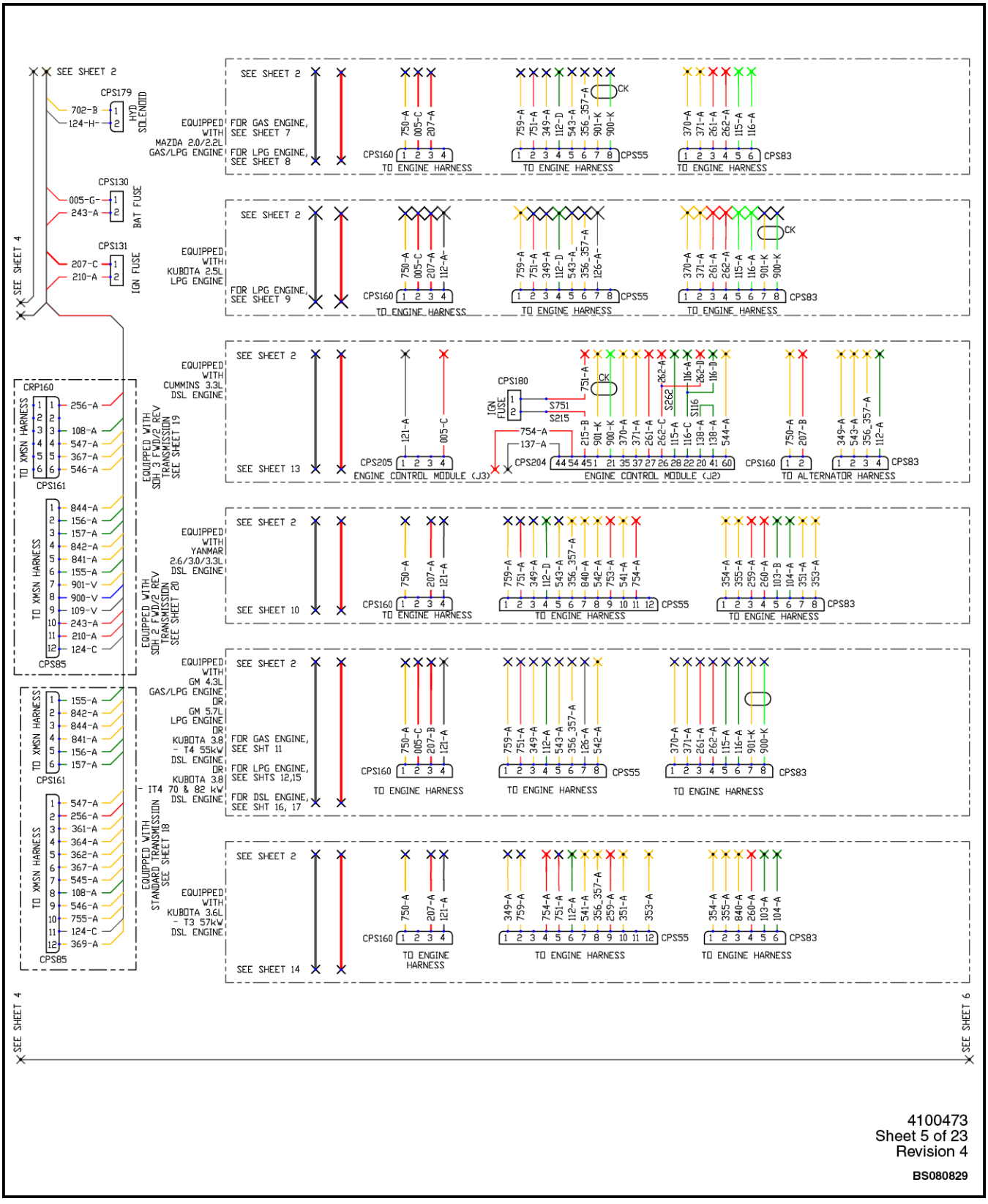


Figure 29. Engine Directory Wiring Diagram

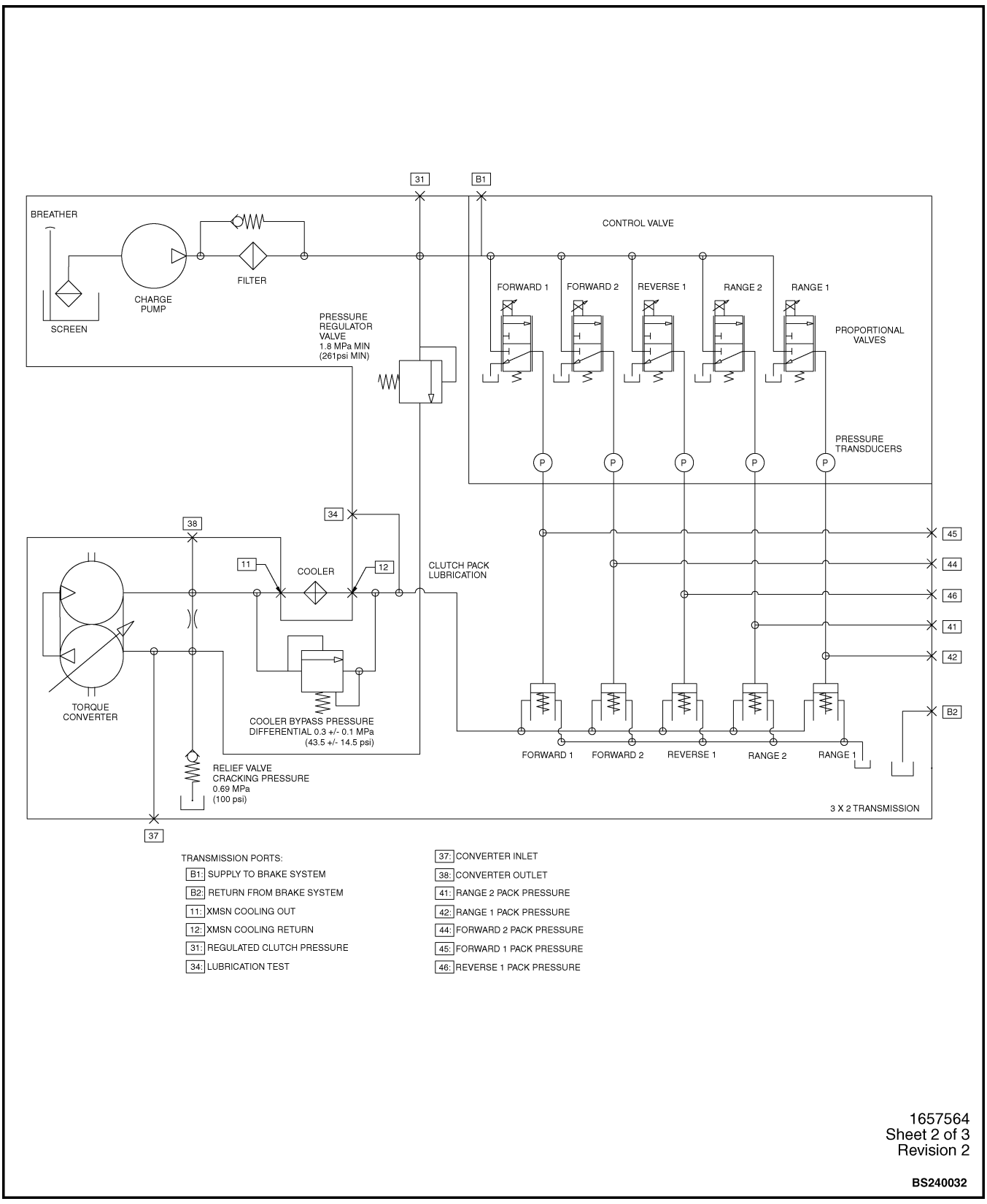


Figure 62. Transmission Hydraulic Schematic for Lift Truck Models and GLC/GDC60-70VX (GC/GLC/GDC135-155VX) (F879)GLP/GDP60-70VX (GP/GLP/GDP135-155VX) (E878) (Sheet 2 of 3)

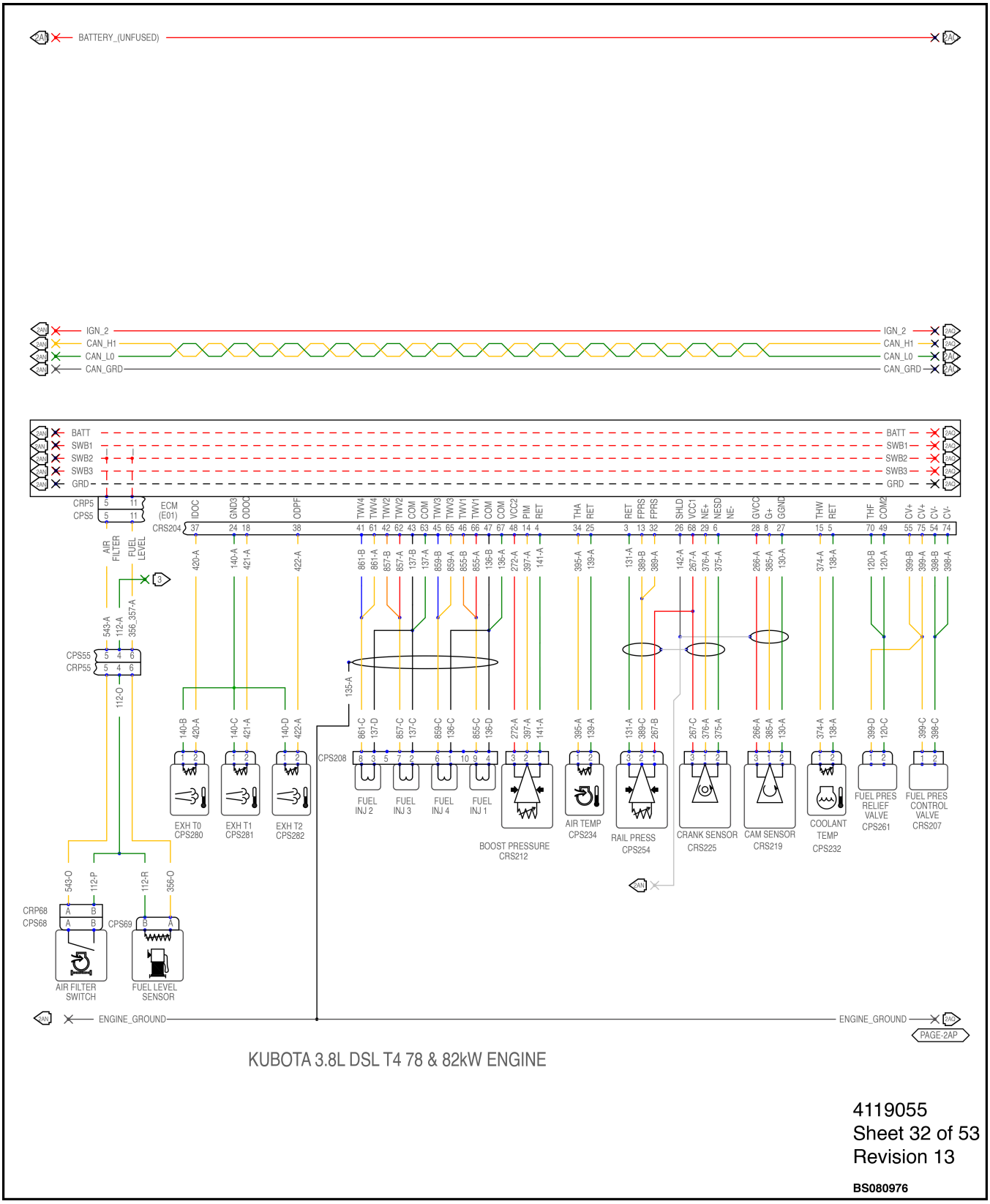


Figure 1. Electrical Schematic (Sheet 32 of 53)

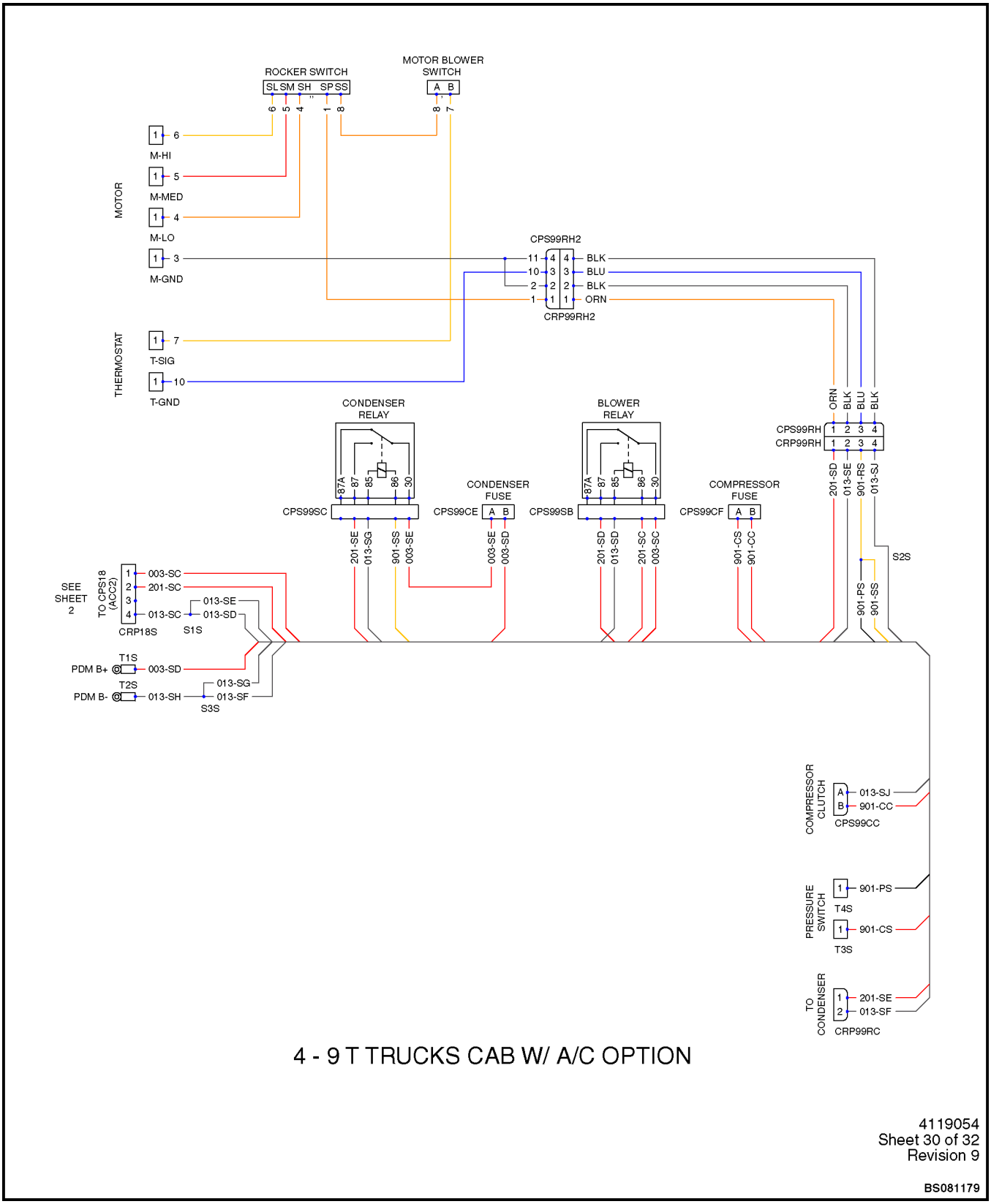


Figure 2. Wiring Diagram (Sheet 31 of 33)

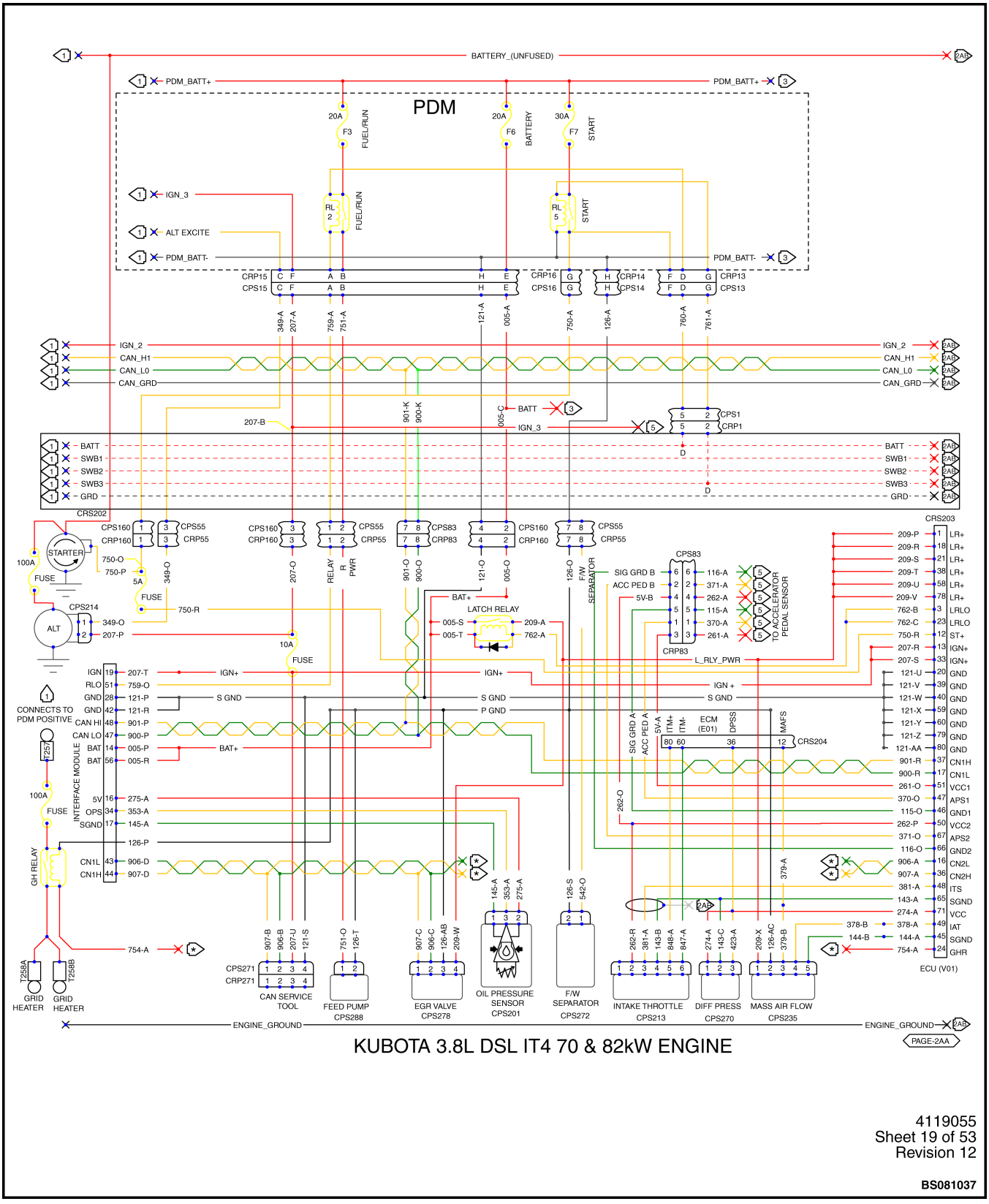


Figure 1. Electrical Schematic (Sheet 19 of 53)

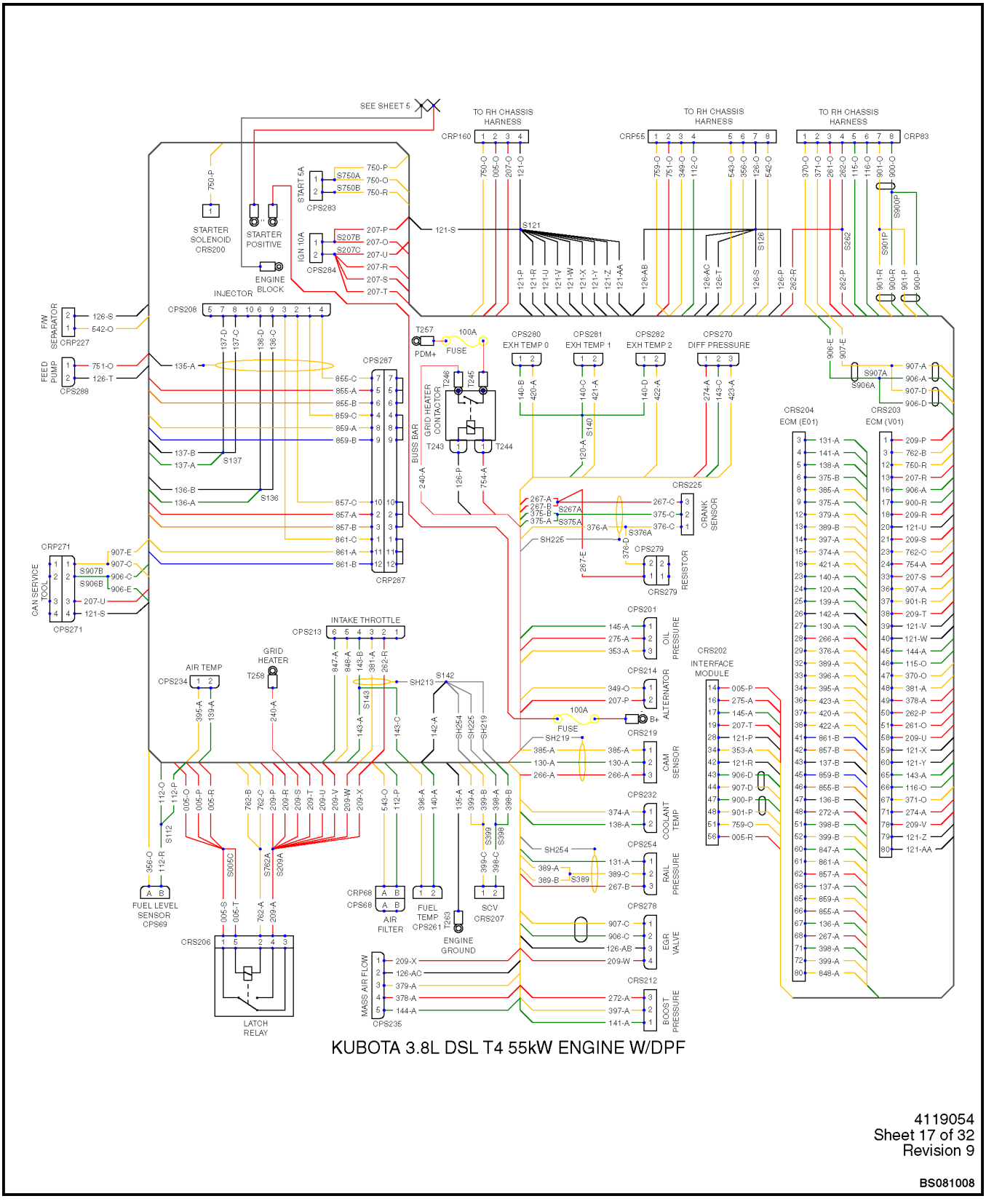
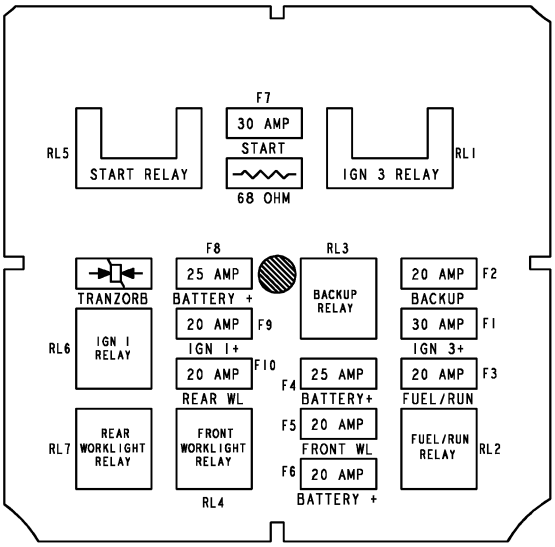


Figure 2. Wiring Diagram (Sheet 18 of 33)

Engine Speed Check	1. Scroll DSC to display engine rpm. 2. Run engine at low idle. Record engine rpm. 3. Run engine at governed speed. Record engine rpm. ***Does engine rpm match below specifications?*** • ***Low Idle - refer to Operating Manual for your lift truck.*** • ***Governed Speed - refer to Operating Manual for your lift truck.***	**YES:** Engine speed is OK. Go to next check. **NO:** Adjust throttle cable or accelerator pedal. Refer to appropriate **Frame** manual.

DTC 522810-3 (Cont)
Alternator Charge Excitation Signal OORH

CONNECTOR(S)



BT080045

PDM Component Locator Diagram

END FAULT