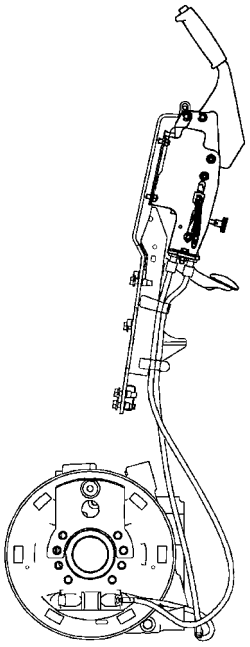
BRAKE SYSTEM

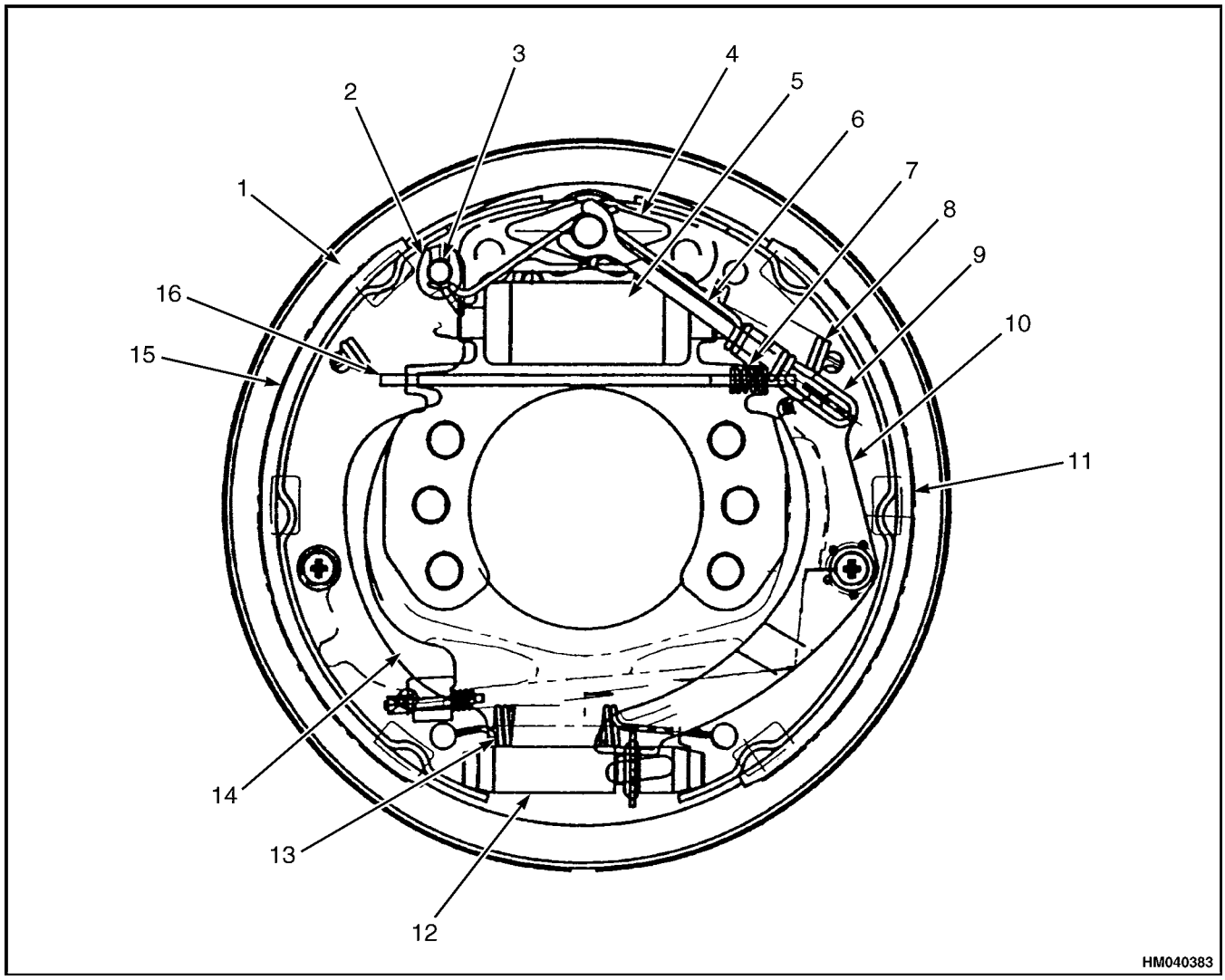
S30FT, S35FT, S40FTS [E010]; H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) [F001]; S2.0-3.5FT (S40-70FT, S55FTS) [F187]; H2.0-3.5FT (H40-70FT) [L177]; S50CT [A267]; H50CT [A274]



HYSTER

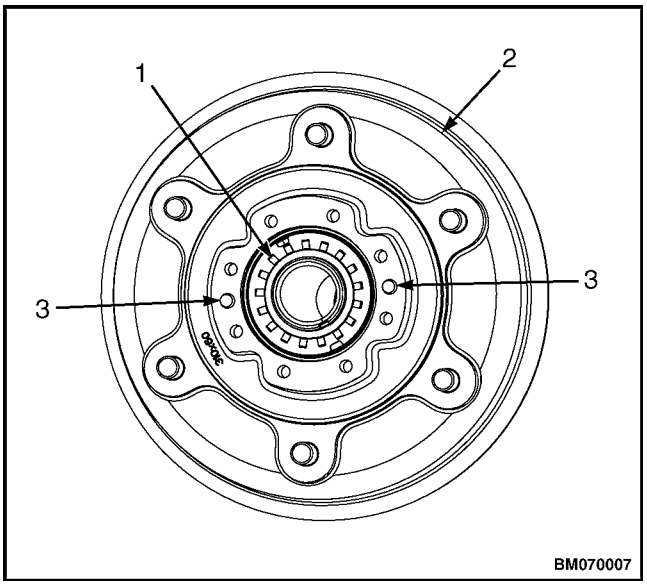
PART NO. 1580513

1800 SRM 1135



1. BACKING PLATE
2. RETAINING RING
3. LEVER PIN
4. GUIDE PLATE
5. WHEEL CYLINDER
6. PAWL LEVER STOPPER
7. SPRING (ANTI-RATTLE)
8. RETURN SPRING
9. SPRING (ACTUATOR)
10. PAWL LEVER
11. SECONDARY BRAKE SHOE
12. ADJUSTER ASSEMBLY
13. ADJUSTER SPRING
14. PARK BRAKE LEVER
15. PRIMARY BRAKE SHOE
16. STRUT

Figure 6. Brake Assembly (Left Hand Side), S30FT, S35FT, S40FTS (E010), H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) [F001], S50CT [A267], and H50CT [A274]



1. LOCK PLATE
2. HUB/BRAKE DRUM ASSEMBLY
3. DOWEL PIN

Figure 14. Lock Plate

CAUTION

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

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

21. Adjust the clearance of the brake shoes. Put a brake adjustment tool or a screwdriver through the slot in the back plate. Use the tool to rotate the adjuster wheel. The actuator for the adjuster wheel will only permit rotation in one direction. Turn the adjuster wheel until the brake shoes have expanded against the brake drum and the hub will not turn. Use a small screwdriver to lift the actuator away from the adjuster wheel and turn the adjuster wheel approximately 20 teeth in the opposite direction. The brakes will adjust to the correct clearance when they are applied while the lift truck is traveling in the reverse direction.

22. Put liquid sealant, Hyster Part Number 264159, on the flange of the axle shaft. Install the axle shaft and capscrews. Tighten the capscrews in cross pattern to a torque specified below for your lift truck.

a. Tighten between 90 to 99 N•m (66 to 73 lbf ft). See Figure 15 for lift truck models
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)

b. Tighten between 90 to 108 N•m (66 to 80 lbf ft). See Figure 16 for lift truck models
- H2.0-3.5FT (H40-70FT) (L177)

c. Tighten between 52 to 62 N•m (39 to 46 lbf ft).

See Figure 15 for lift truck models:
- S30FT, S35FT, S40FTS (E010)
- H1.6FT, H1.8FT, 2.0FTS (H30FT, H35FT, H40FTS) (F001)
- S50CT (A267)

See Figure 16 for lift truck model:
- H50CT (A274)

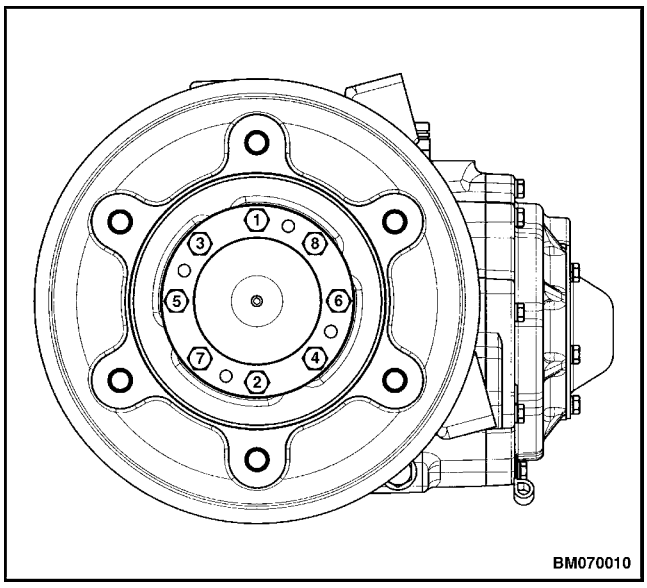


Figure 15. Axle Shaft Tightening Sequence, S2.0-3.5FT (S40-70FT, S55FTS) [F187], S50CT (A267), S30FT, S35FT, S40FTS (E010) and H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) [F001]

REMOVE (WET BRAKE)

NOTE: The removal procedure in this section is for H2.0-3.5FT (H40-70FT) (L177) lift trucks equipped with wet brake systems.

1. Remove the floor plate, kick plate, and seal plate from the lift truck for access to the master cylinder and booster assembly.

2. Remove and tag the brake booster supply and return hoses from the master cylinder and booster assembly. Plug hoses to prevent hoses from draining. Disconnect the connector at the brake pressure transducer, and remove brake pressure transducer. See Figure 22.

3. Disconnect the upper brake oil supply hose from the manifold. Plug hose to prevent brake oil reservoir from draining.

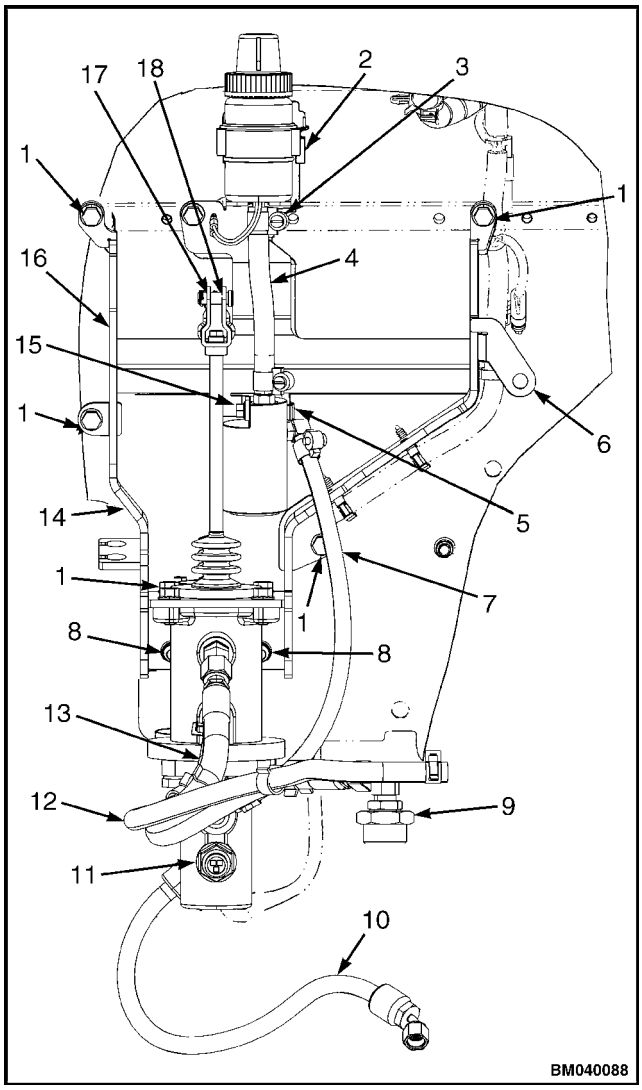
4. Remove the brake oil reservoir and upper brake oil supply hose from the lift truck.

5. Remove the lower brake oil supply hose from the manifold and the master cylinder and booster assembly.

6. Remove the manifold from the manifold mount.

7. Remove the cotter pin and rod end pin from the clevis that is attached to the brake linkage lever arm.

8. Remove capscrews and nuts that hold master cylinder and booster assembly to bracket assembly.



1. CAPSCREW
2. BRAKE FLUID RESERVOIR
3. CLAMP
4. UPPER BRAKE OIL SUPPLY HOSE
5. MANIFOLD
6. MOUNT
7. LOWER BRAKE OIL SUPPLY HOSE
8. INSERT
9. BOOSTER RETURN HOSE
10. BRAKE HOSE
11. BRAKE PRESSURE TRANSDUCER
12. BOOSTER SUPPLY HOSE
13. MASTER CYLINDER AND BOOSTER ASSEMBLY
14. MOUNTING BOLT
15. MANIFOLD MOUNT
16. BRACKET
17. COTTER PIN
18. PIN

Figure 22. Master Cylinder and Reservoir Assembly (Wet Brake)

Item	Quantity	Specifications
Transmission		
Basic Powershift Transmission (Iron Housing)	20 liter (21.0 qt)	John Deere JDM J20C
Single Speed PS Transmission (Aluminum Housing)	13 liter (14.0 qt)	John Deere JDM J20C
DuraMatch™ Transmission (Iron Housing)	20 liter (21.0 qt)	John Deere JDM J20C
DuraMatch™ Transmission (Aluminum Housing)	13 liter (14.0 qt)	John Deere JDM J20C
Brake Fluid (Dry Brake) Master Cylinder	0.25 liter (0.53 pt)	SAE J-1703, DOT 3
Brake Oil (Wet Brake) Master Cylinder	0.35 liter (0.74 pt)	Dexron III
Differential and Drive Axle Oil (Dry Brake) S2.0-3.5FT (S40-70FT, S55FTS (F187)	5.0 liter (5.3 qt)	SAE 80W-90 or 85W-140
Differential and Drive Axle Oil (Dry Brake) H2.0-3.5FT (H40-70FT) (L177)	6.5 liter (6.9 qt)	SAE 80W-90 or 85W-140
Drive Axle (Wet Brake)		
Planetary Housing, Left Side H2.0-3.5FT (H40-70FT) (L177)	0.5 liter (0.5 qt)	SAE 80W-90
Planetary Housing, Right Side H2.0-3.5FT (H40-70FT) (L177)	2.0 liter (2.1 qt)	SAE 80W-90
Wet Brake Portion Of Drive Axle Center Section H2.0-3.5FT (H40-70FT) (L177)	1.0 liter (1.1 qt)	John Deere JDM J20C

Table 4. Lift Truck Models H2.0-3.5FT (H40-70FT) (L177) (Continued)

Model/ Engine	Mast	Lowering M/Sec		Lifting M/Sec				
		No Load	Rated Load	No Load	H2.0FT (H40FT)	H2.5FT (H50FT)	H3.0FT (H60FT)	H3.5FT (H70FT)
H3.0-3.5FT (H60-70FT) GM 2.4L	2-Stage LFL	0.42	0.50	0.54	N/A	N/A	0.54	0.54
	2-Stage FFL	0.42	0.50	0.53	N/A	N/A	0.53	0.53
	3-Stage FFL	0.42	0.50	0.52	N/A	N/A	0.52	0.52
H2.0-2.5FT (H40-50FT) Yanmar 2.6L	2-Stage LFL	0.42	0.50	0.69	0.67	0.63	N/A	N/A
	2-Stage FFL	0.42	0.50	0.62	0.61	0.58	N/A	N/A
	3-Stage FFL	0.42	0.50	0.66	0.63	0.59	N/A	N/A
H3.0-3.5FT (H60-70FT) Yanmar 2.6L	2-Stage LFL	0.42	0.50	0.57	N/A	N/A	0.54	0.39
	2-Stage FFL	0.42	0.50	0.56	N/A	N/A	0.53	0.40
	3-Stage FFL	0.42	0.50	0.54	N/A	N/A	0.52	0.39
H2.0-2.5FT (H40-50FT) Yanmar 3.3L	2-Stage LFL	0.42	0.50	0.72	0.71	0.71	N/A	N/A
	2-Stage FFL	0.42	0.50	0.64	0.63	0.63	N/A	N/A
	3-Stage FFL	0.42	0.50	0.68	0.67	0.67	N/A	N/A
H3.0-3.5FT (H60-70FT) Yanmar 3.3L	2-Stage LFL	0.42	0.50	0.63	N/A	N/A	0.62	0.62
	2-Stage FFL	0.42	0.50	0.62	N/A	N/A	0.61	0.61
	3-Stage FFL	0.42	0.50	0.61	N/A	N/A	0.60	0.60

Fuel Return Line Retaining Nuts
44 N•m (33 lbf ft)

Engine Mount to Engine
52 N•m (38 lbf ft)

Isolator Lock Nut
150 N•m (111 lbf ft)

Alternator Adjustment Bracket Bolt
26 N•m (230 lbf in)

Alternator Pivot Bolt
30 N•m (22 lbf ft)

Flywheel Adapter Capscrews
52 N•m (38 lbf ft)

Flywheel to Torque Converter Capscrew
155 N•m (114 lbf ft)

Torque Converter Housing
55 N•m (41 lbf ft)

Thermostat Cover Capscrews
23 to 28 N•m (17 to 21 lbf ft)

Engine Oil Drain Plug
20 to 24 N•m (177 to 212 lbf in)

Fuel Filter/Water Separator Retaining Ring
15 to 20 N•m (133 to 177 lbf in)

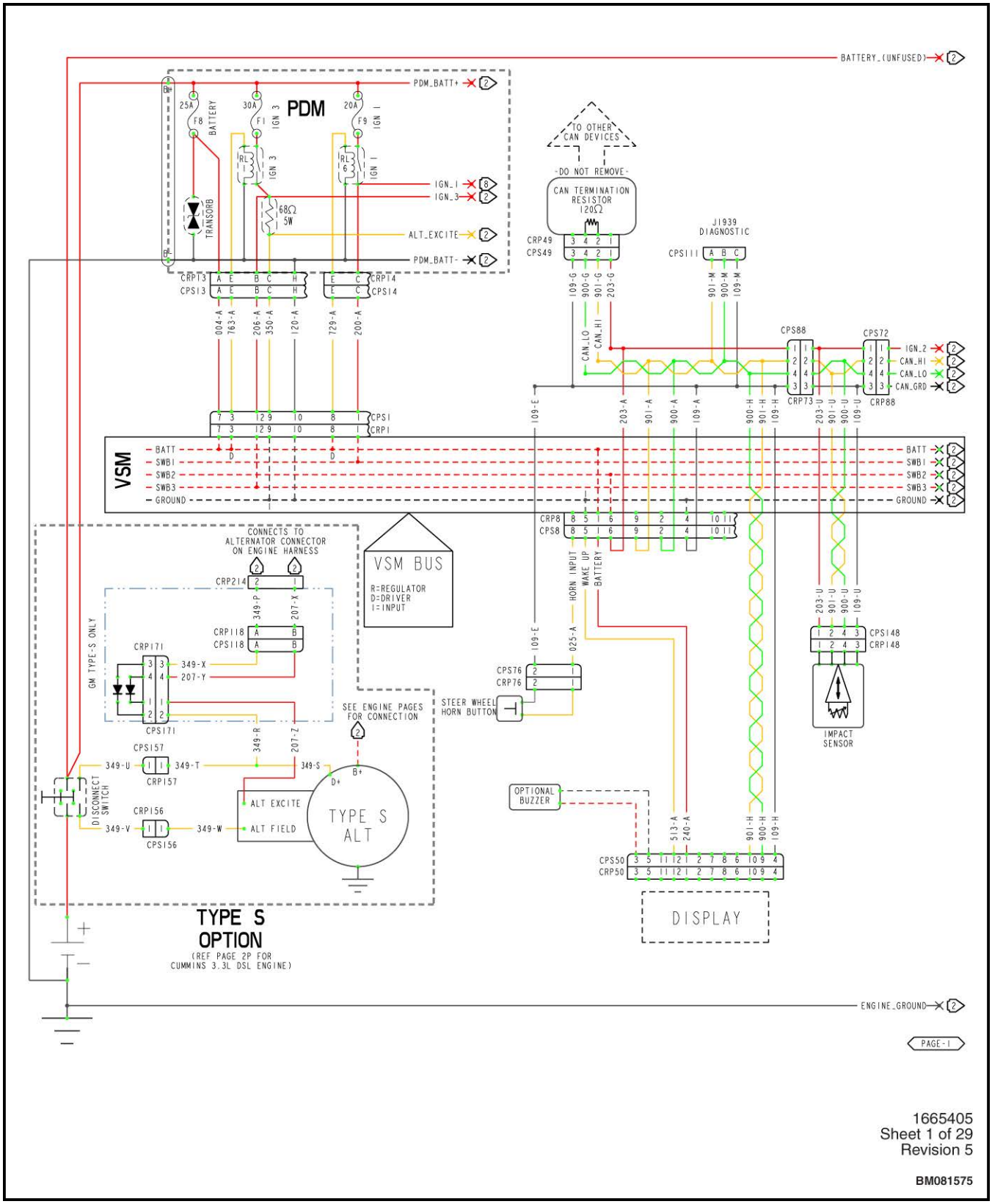


Figure 1. Type S Option Electrical Schematic

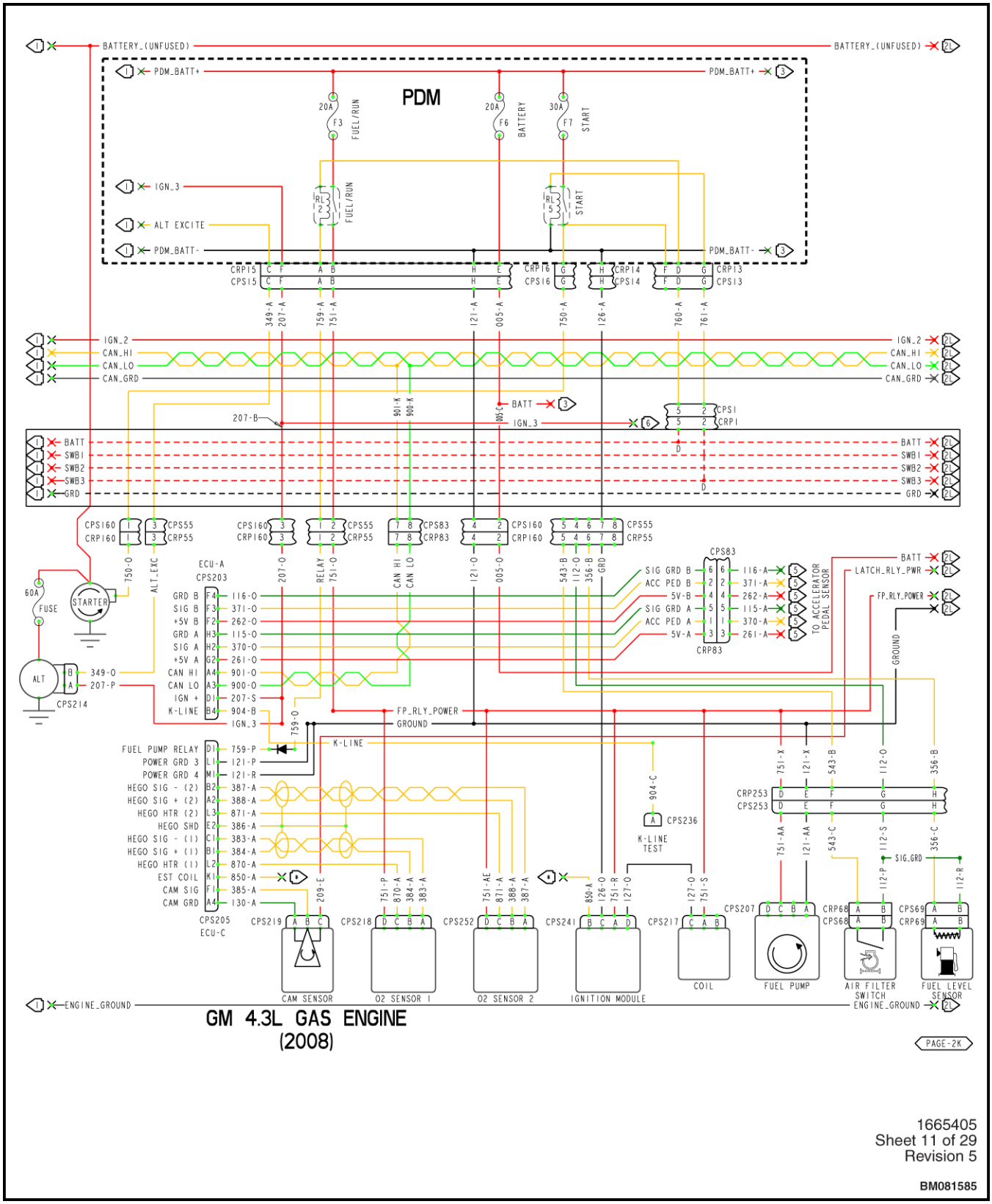


Figure 7. GM 4.3L Gas Engine Electrical Schematic (Sheet 1 of 2)

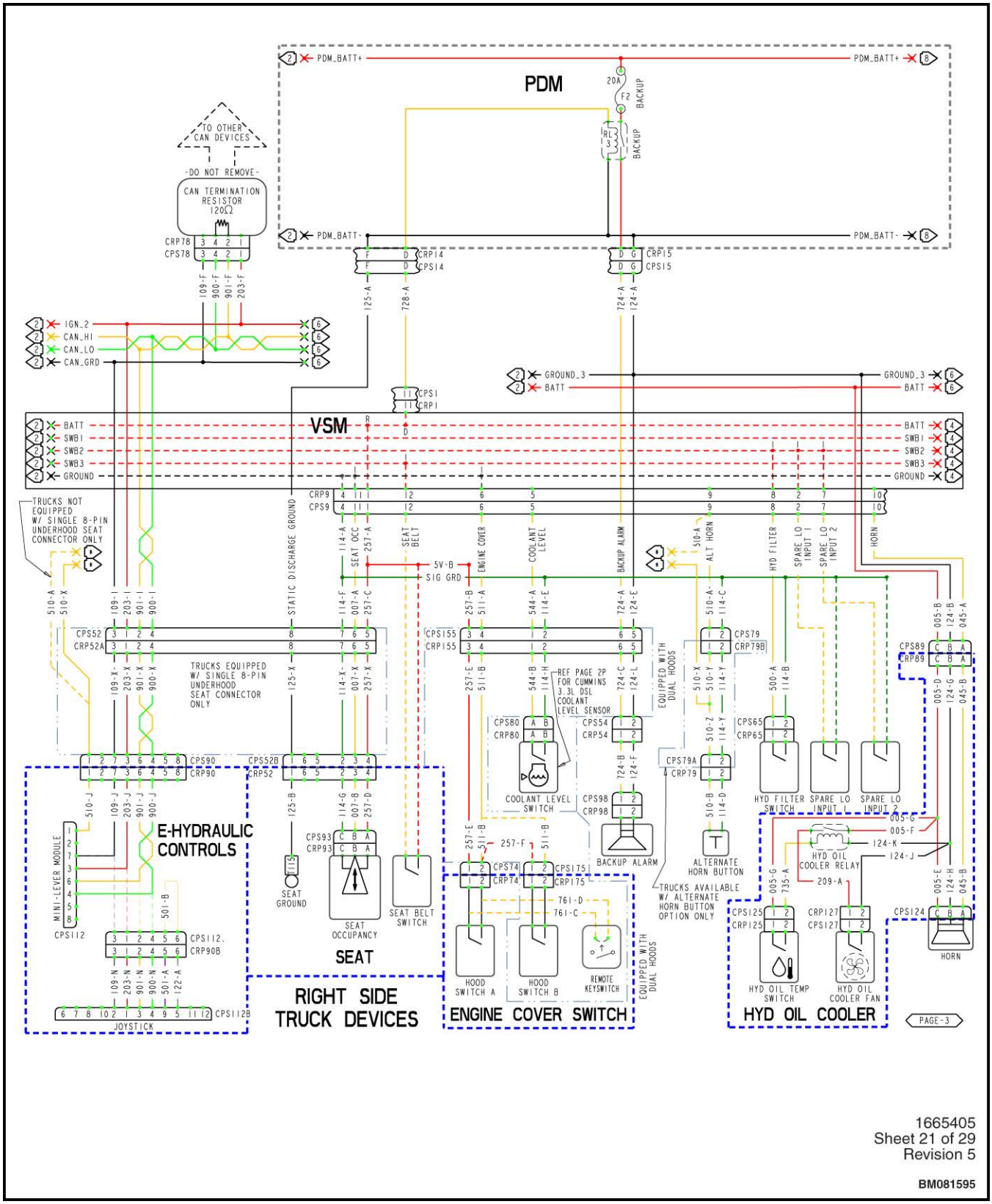


Figure 12. Right Side Truck Devices Electrical Schematic

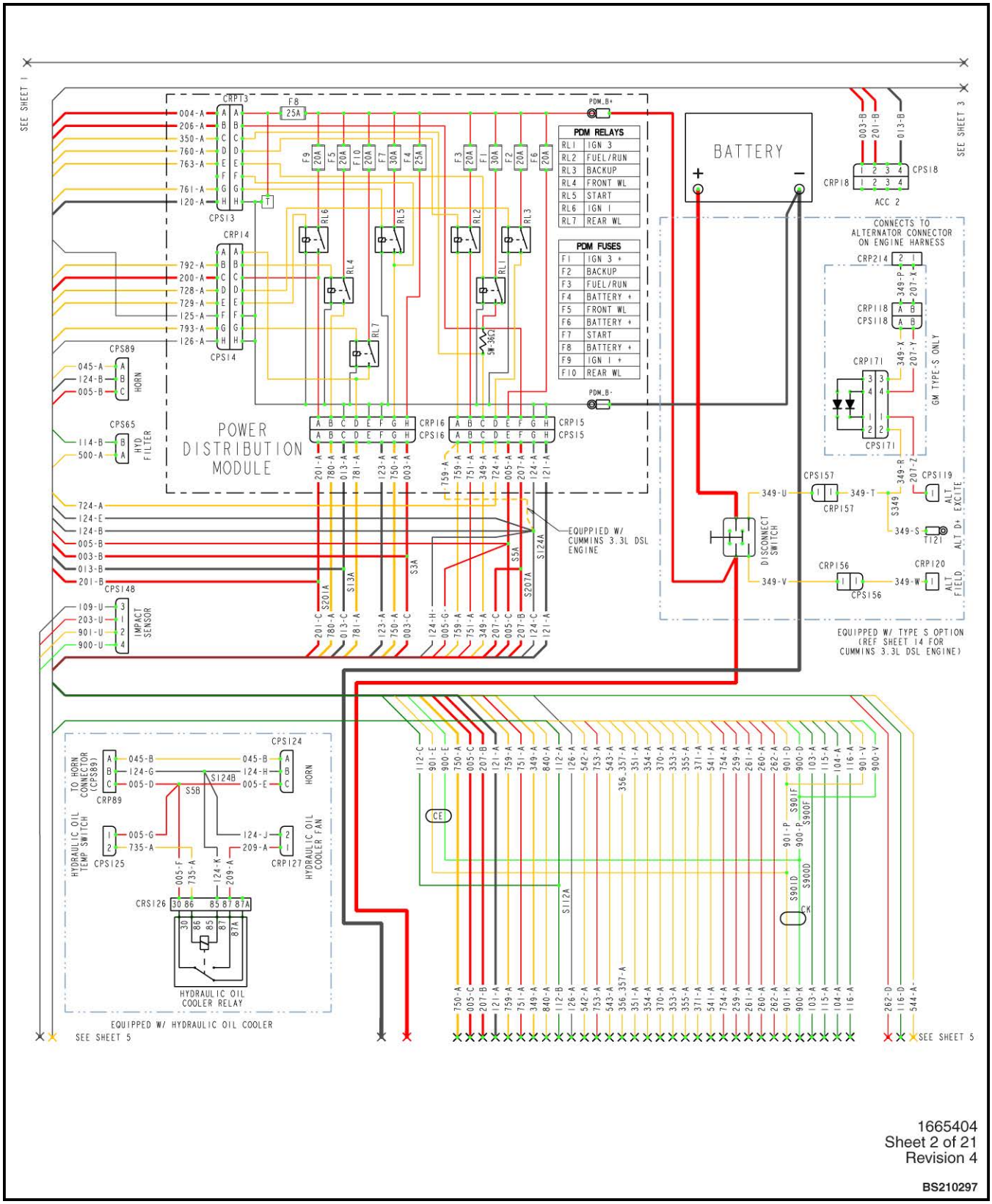


Figure 20. Power Distribution Module (PDM) Wiring Diagram

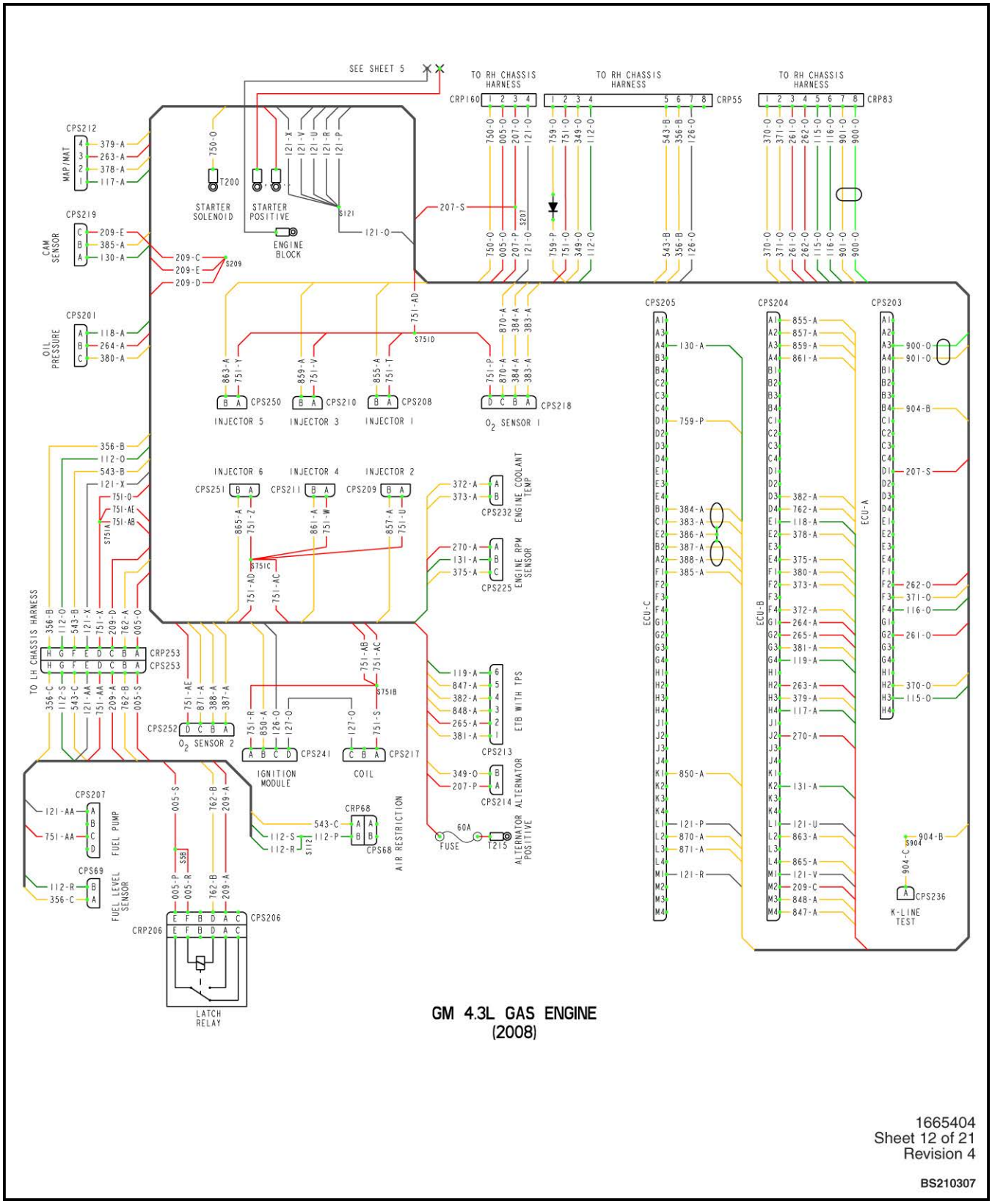


Figure 30. GM 4.3L Gas Engine Wiring Diagram

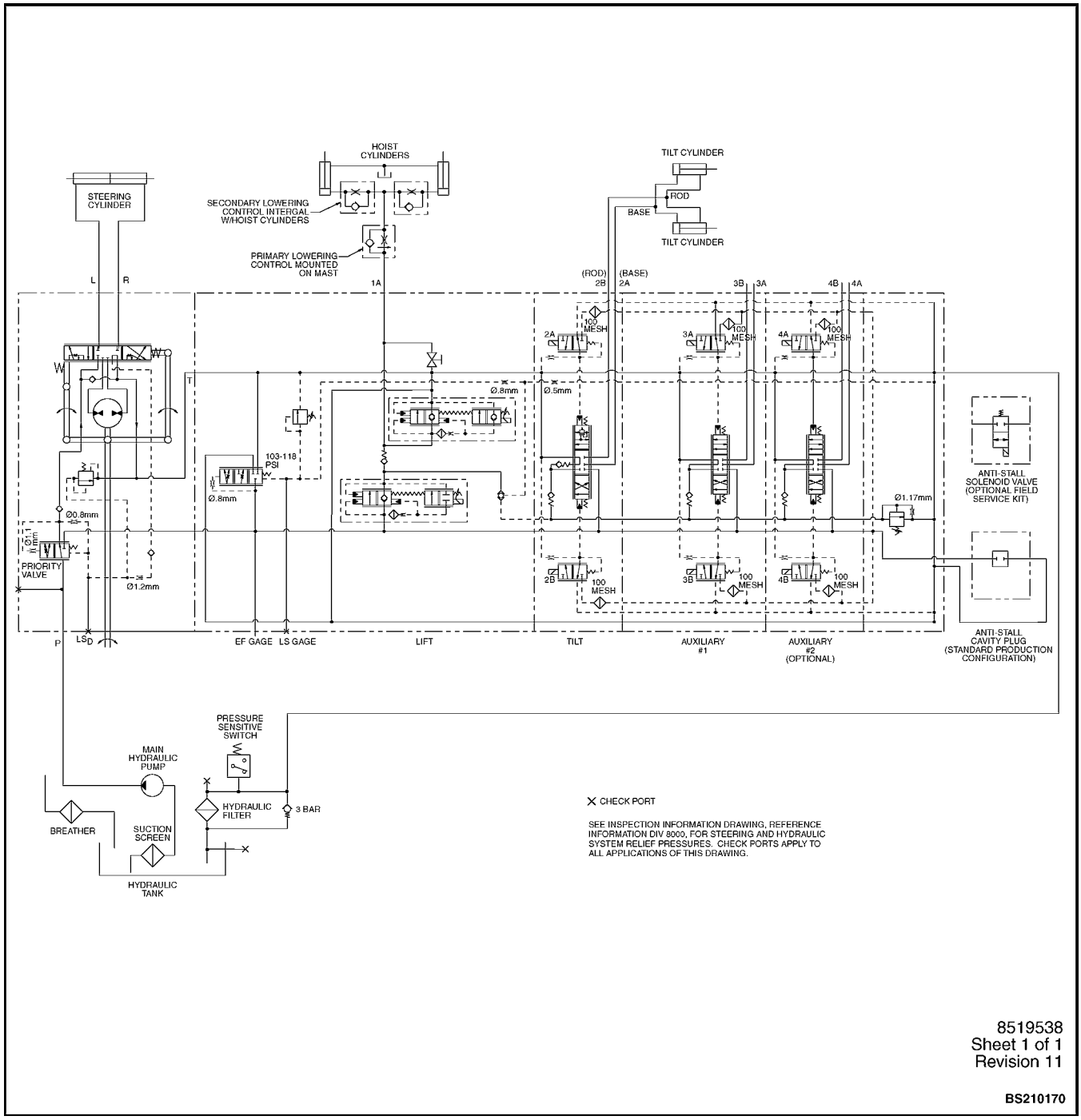


Figure 40. Electronic Control Valve Hydraulic Schematic for Lift Truck Models S30FT, S35FT, S40FTS (E010); H1.6FT, H1.8FT, 2.0FTS (H30FT, H35FT, H40FTS) (F001); S2.0-3.5FT (S40-70FT, S55FTS) (F187); H2.0-3.5FT (H40-70FT) (L177); S4.0, 4.5, 5.5FT, S5.5FTS (S80, 100, 120FT, S80, 100FTBCS, S120FTS, S120FTPRS) (G004); and H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005)

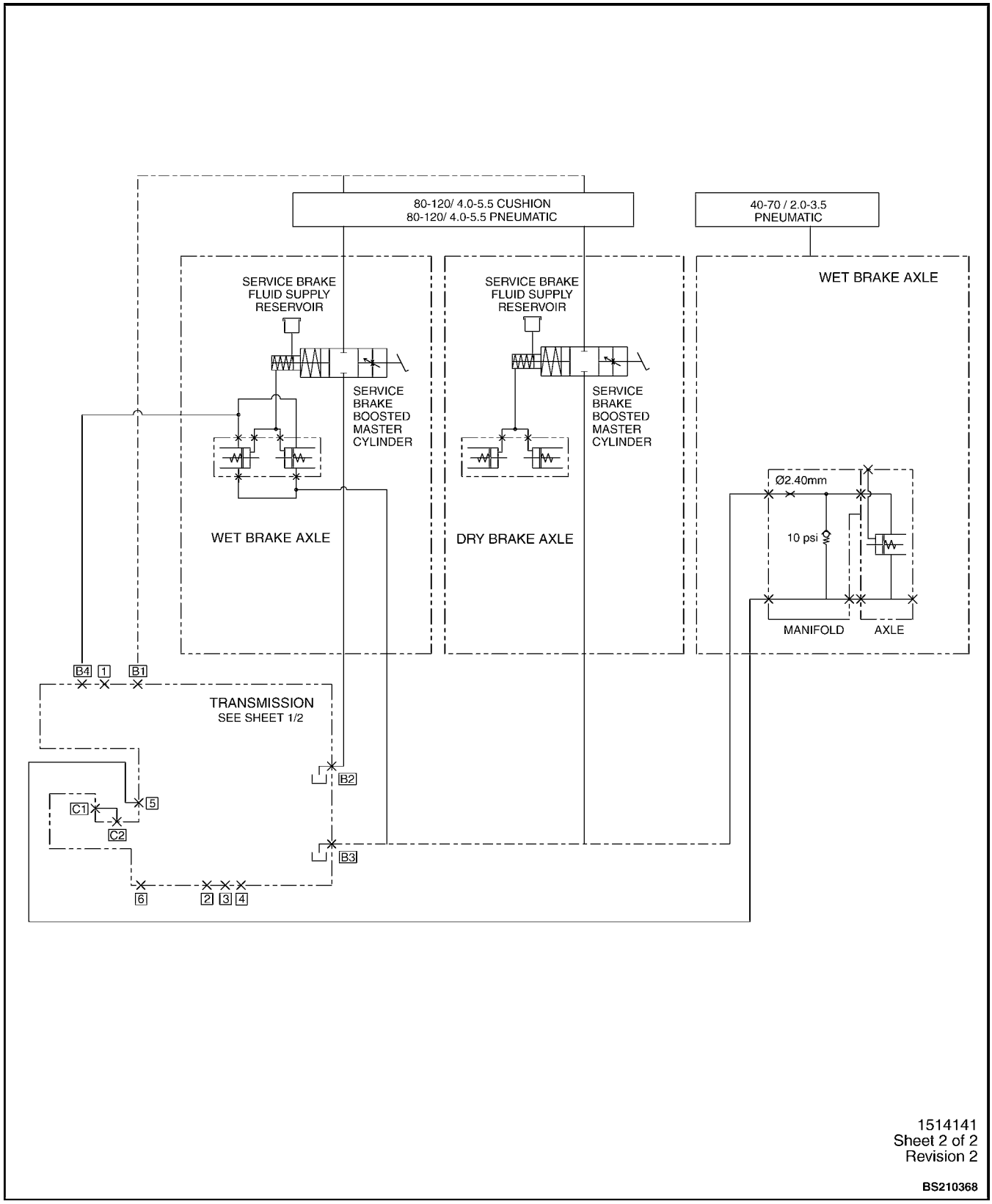
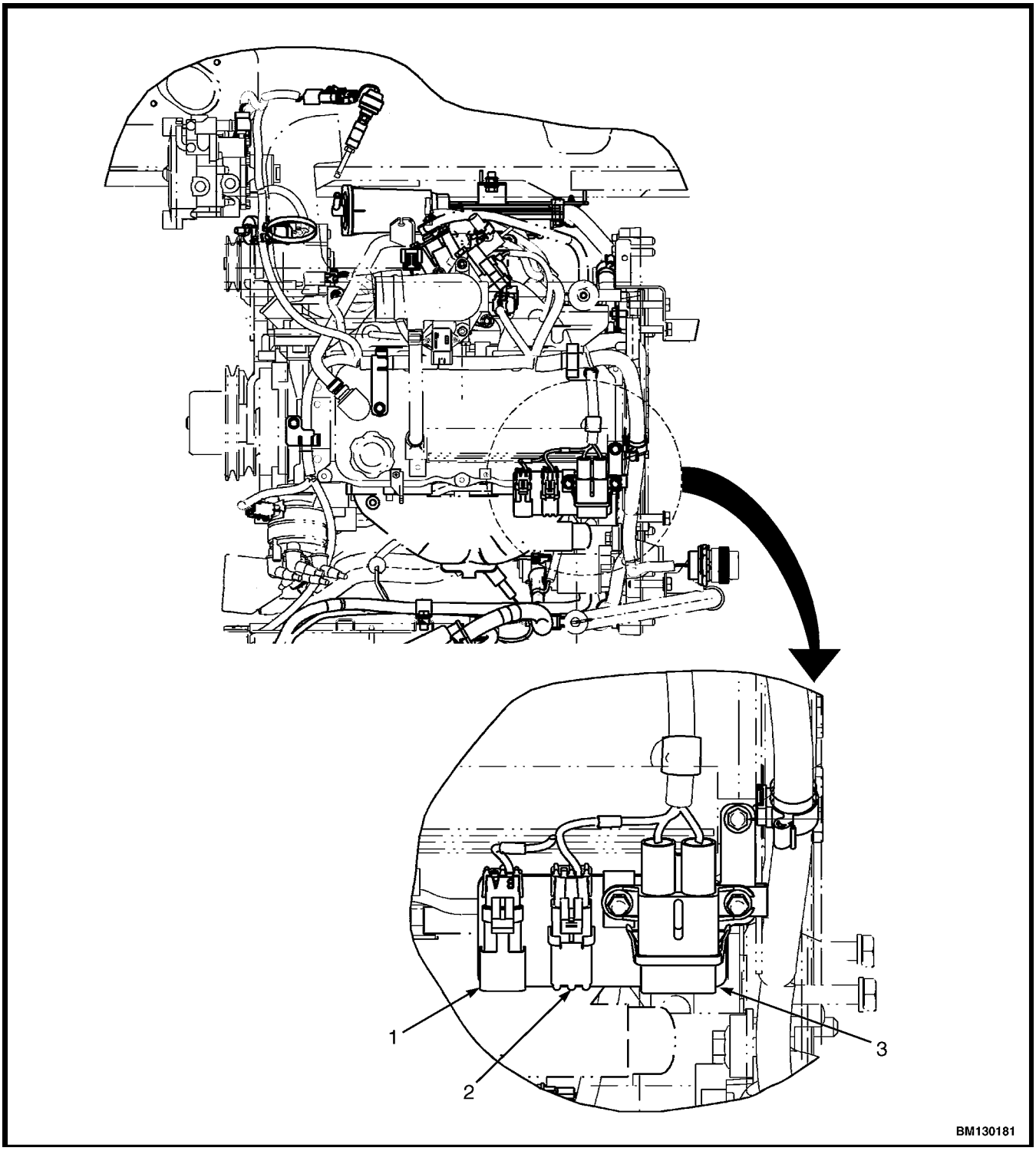


Figure 49. Transmission Hydraulic Schematic (Sheet 2 of 2)



1. ECU TEST PORT
2. ECU INTERFACE
3. 50-AMP FUSE, ALTERNATOR

Figure 2. LPG Relays and Test Connectors

Alternator Repair

GENERAL

⚠ CAUTION

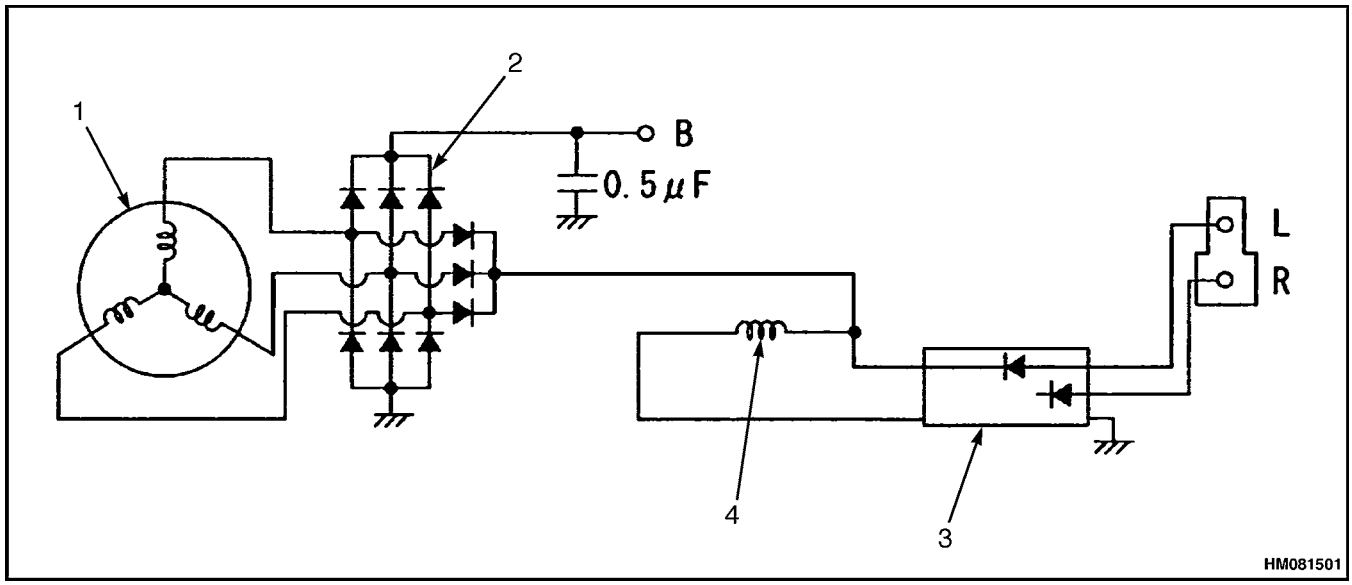
- **Connecting the battery in reverse polarity allows high current to flow from the battery to the alternator, damaging the diodes and regulator.**
- **Do not remove the battery terminal while engine is operating. This procedure may sometimes cause a surge in voltage, damaging the diodes and regulator.**
- **Do not use a high-voltage tester such as a Megger because it may damage the diodes and regulator.**
- **Always disconnect the battery terminal when charging the battery with a quick charger. If the terminals are not disconnected during rapid charging, the diodes or regulator may be damaged.**
- **When steam cleaning, take care not to spray steam directly on the alternator.**
- **If the L and B terminals are short-circuited during operation, the rectifier (diode trio) may be damaged.**
- **Do not connect a load over 1 A on the L terminal.**
- **Do not ground the L terminal while engine is operating.**

NOTE: Always use a fully-charged battery.

The alternator is connected as shown in Figure 19.

CHARGING SYSTEM INSPECTION

1. Connect a voltmeter between the alternator L terminal and ground. See Figure 20.
2. If voltage is present between the L terminal and ground with the ignition switch turned to **OFF**, the alternator is faulty. Repair or replace the alternator.
3. If the voltage is 0 volts with the ignition switch turned to **ON**, the alternator or the wiring is faulty. Perform wiring continuity and connection checks. If no problems are found, repair or replace the alternator.



B. BATTERY TERMINAL POST
L. FIELD TERMINAL
R. REGULATOR TERMINAL

1. STATOR COIL
2. RECTIFIER
3. IC REGULATOR
4. FIELD COIL

Figure 19. Alternator Schematic

General

This service manual covers the repair and replacement of electrical components used on the Mazda 2.0L and 2.2L gas and LPG 2007 emissions compliant engines and on lift trucks built after January, 2010 that are equipped with a Mazda 2.0L and 2.2L gas and LPG engine.

Ignition System

GENERAL

A CAM angle sensor is adopted for this ignition system. See Figure 1. This sensor incorporates a crank position sensor that detects SGT signal (crank angle signal) and SGC signal (cylinder discrimination signal).

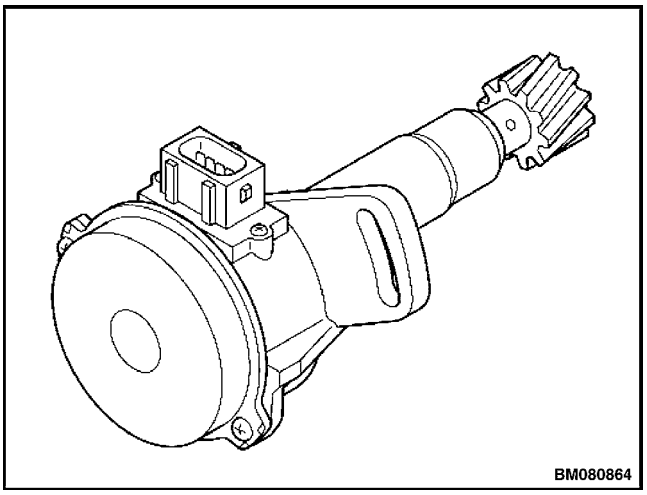


Figure 1. CAM Angle Sensor

IGNITION TIMING ADJUSTMENT, GASOLINE AND LPG

The base ignition timing is adjustable by rotating the cam angle sensor housing. To check or set the timing, perform the following procedures:

1. Warm up the engine to normal operating temperature.
2. Make sure all accessories are OFF.
3. Verify the engine speed is between 500 to 900 rpm.
4. Install a jumper wire across the engine control unit (ECU) timing test port connector terminals. See Figure 2, Figure 3, Figure 4, and Figure 5.
5. Connect the timing light to the spark plug wire of the No. 1 cylinder.

NOTE: Do not use the BTDC timing marks on the timing cover when timing the engine.

6. Verify that the timing mark (orange mark) on the crankshaft pulley aligns with the indicator on the oil pump. See Figure 6. If not as specified, loosen the CAM angle sensor housing mounting bolt and turn the CAM angle sensor housing to adjust the ignition timing to 6 ±1° BTDC. See Figure 7.

NOTE: When the orange timing mark aligns with the indicator on the oil pump, the ignition timing is set to 6 degrees BTDC.

7. If timing is correct, tighten the CAM angle sensor mounting bolt to 19 to 25 N•m (14 to 18 lbf ft). See Figure 7.
8. Repeat Step 6 to verify the CAM angle sensor housing did not move when tightening the mounting bolt.
9. Remove the jumper wire from the ECU timing test port connector.

⚠ CAUTION

Do not apply current for more than 10 seconds.

2. Apply voltage between the M terminal and the body of the magnetic switch, and pry the pinion out with a screwdriver. See Figure 16. Make sure the pinion returns when released.

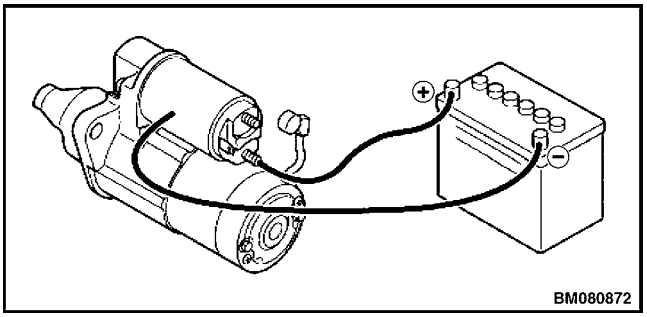


Figure 16. Return Test

Pinion Movement Inspection

1. Disconnect the lead wire between the M terminal and the starter.

⚠ CAUTION

Do not apply current for more than 20 seconds.

2. Apply voltage between the S terminal and the body of the starter. This will cause the pinion to extend out. With the pinion extended, measure the pinion gap. See Figure 17. If the pinion gap is not within specification, repair or replace the clutch shaft assembly.

INSTALL

1. Place starter in position in flywheel housing. Install two capscrews to fasten the starter to the flywheel housing. Tighten capscrews to 38 N•m (28 lbf ft).
2. Connect wires and cables as labeled in removal.
3. Connect battery cable at negative terminal.

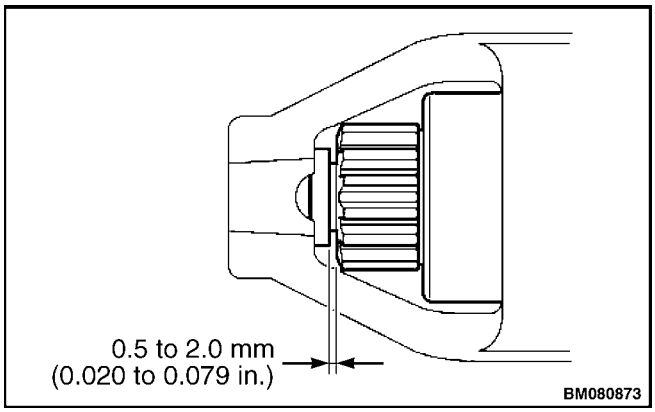


Figure 17. Pinion Gap

Alternator Repair

GENERAL

⚠ CAUTION

- **Connecting the battery in reverse polarity allows high current to flow from the battery to the alternator, damaging the diodes and regulator.**
- **Do not remove the battery terminal while engine is operating. This procedure may sometimes cause a surge in voltage, damaging the diodes and regulator.**
- **Do not use a high-voltage tester such as a Megger because it may damage the diodes and regulator.**
- **Always disconnect the battery terminal when charging the battery with a quick charger. If the terminals are not disconnected during rapid charging, the diodes or regulator may be damaged.**
- **When steam cleaning, take care not to spray steam directly on the alternator.**
- **If the L and B terminals are short-circuited during operation, the rectifier (diode trio) may be damaged.**
- **Do not connect a load over 1 A on the L terminal.**
- **Do not ground the L terminal while engine is operating.**

NOTE: Always use a fully-charged battery.

The alternator is connected as shown in Figure 18 and Figure 19.

Legend for Figure 32

1. RETAINING SCREWS
2. MAP SENSOR
3. INTAKE MANIFOLD
4. VACUUM HOSE

INTAKE AIR TEMPERATURE (IAT) SENSOR, LPG ENGINES

Remove

1. Disconnect the battery.

2. Disconnect the wiring harness connector from the sensor connector.

3. Remove the sensor and aluminum seal washer. See Figure 33.

Install

1. Install the IAT sensor and new aluminum seal washer. Tighten the IAT sensor to 7.9 to 11.7 N•m (70 to 104 lbf in).

2. Connect the wiring harness connector to the sensor connector.

3. Connect the battery.

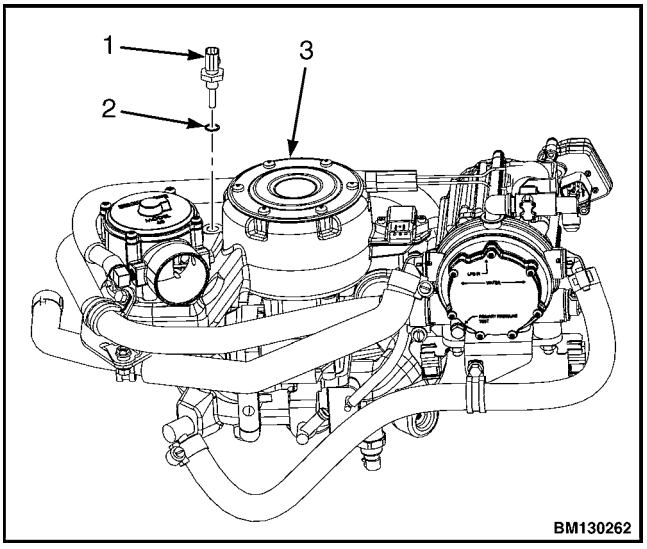


Figure 33. IAT Sensor

Legend for Figure 33

1. IAT SENSOR
2. ALUMINUM SEAL WASHER
3. AIR BOX

INTAKE AIR TEMPERATURE (IAT) SENSOR, GAS ENGINES

Remove

1. Disconnect the battery.

2. Disconnect the wiring harness connector from the sensor connector.

3. Remove the IAT sensor and aluminum seal washer from the spacer/housing bracket. See Figure 34.

4. If necessary, remove the nuts and capscrew retaining the spacer/housing plate and remove the spacer/housing plate and gasket. See Figure 35. Discard the old gasket.

Install

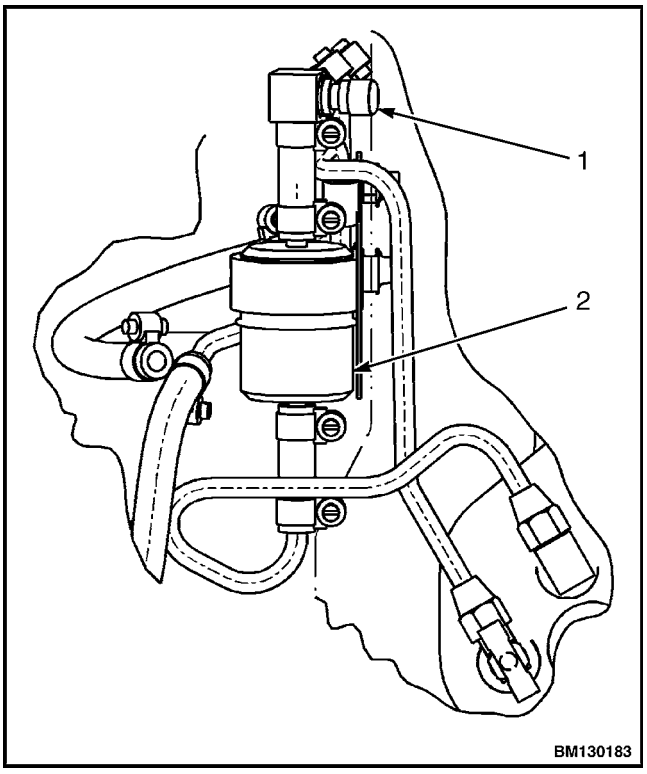
1. If removed, verify the mating surface of the spacer/housing plate and the intake manifold are clean. Place a new gasket in position on the intake manifold. Install the nuts and capscrew. Tighten the nuts to 8.9 to 12.7 N•m (79 to 112 lbf in). Tighten the capscrew to 7.9 to 10.7 N•m (69.5 to 95.4 lbf in). See Figure 35.

2. Install the IAT sensor and new aluminum seal washer. Tighten sensor to 8 to 12 N•m (71 to 106 lbf in). See Figure 34.

3. Connect the wiring harness connector to the sensor connector.

4. Connect the battery.

3. Connect a fuel pressure gauge to the schrader valve located on the outlet side of the fuel filter. See Figure 5 and Figure 6.



1. SCHRADER VALVE 2. FUEL FILTER

Figure 5. Schrader Valve Location for Lift Trucks Built Before January, 2010

4. Connect the negative battery cable.

5. Turn the key switch to **ON** position to prime the fuel pump.

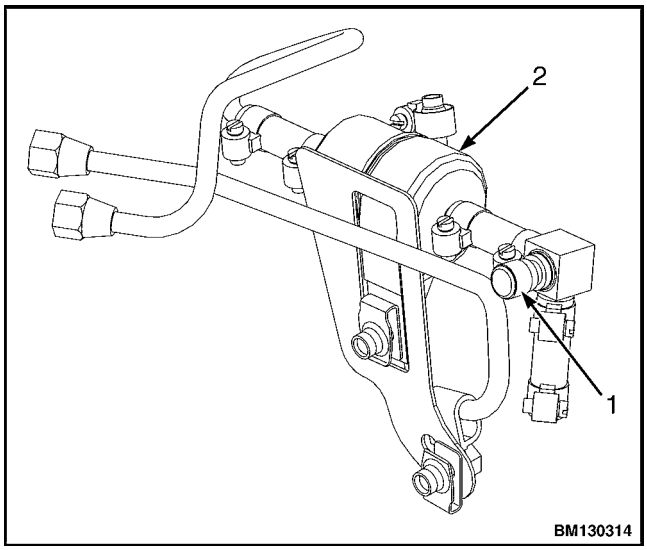
6. Measure the fuel line pressure. If less than the specification, inspect the fuel pump for fuel line leakage. If fuel line pressure exceeds the specification, inspect the pressure regulator for fuel line clogging.
   Specification: 379 to 448 kPa (55 to 65 psi)

7. Turn the key switch to **OFF** position to stop the fuel pump.

8. Measure the fuel hold pressure after 5 minutes. If not within the specification, inspect the fuel line for clogging or leakage.
   Specification: More than 300 kPa (43.5 psi)

9. Disconnect the fuel pressure gauge.

10. Complete the After Repair Procedure.



1. SCHRADER VALVE 2. FUEL FILTER

Figure 6. Schrader Valve Location for Lift Trucks Built After January, 2010

FUEL INJECTORS

Remove

1. Complete the Before Repair Procedure.

2. Disconnect the negative battery cable.

3. Disconnect the positive crankcase ventilation (PCV) valve hose from the intake manifold. See Figure 7 and Figure 8.

INSPECT

Inspect the following items in the exhaust system:
- Exhaust pipes for damage, corrosion, and rust. Replace as needed.
- If equipped, inspect all exhaust wraps for wear, proper fit, contamination with oil or antifreeze, gaps in coverage, and failed fasteners. Replace as needed. 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.
- Catalytic converter and muffler for damage, corrosion, and rust. Replace as needed.

ASSEMBLE AND INSTALL

1. Place muffler onto frame of lift truck and install plain flanged nuts. Tighten nuts to 39 N•m (29 lbf ft).

2. Install exhaust pipes (8 and 11, Figure 22) onto muffler. Install clamps onto pipes to hold them onto muffler.

3. Install new gasket onto engine exhaust adapter. Install engine exhaust adapter onto exhaust manifold. See Figure 22.

4. Install new gasket onto exhaust pipe. Install exhaust pipe (15, Figure 22) onto engine exhaust adapter (18, Figure 22).

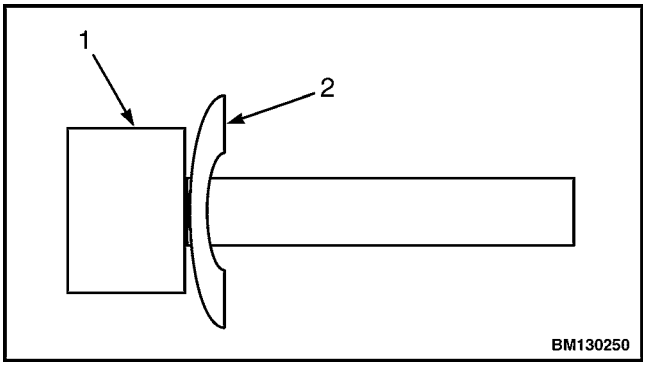
5. Place catalytic converter onto lift truck frame. Install new gaskets onto catalytic converter and install exhaust pipes (11 and 15, Figure 22) onto catalytic converter.

6. Install bracket attaching catalytic converter to lift truck frame. See Figure 22. Connect oxygen sensor.

7. Install counterweight. See the section **Frame** 100 SRM 1120 for counterweight installation procedures.

Install

1. Verify that the mounting surface of the throttle body and the intake manifold are clean and free of debris.
2. Install new conical washers on the socket head screws as shown in Figure 3.
3. Place the throttle body and a new gasket in position on the intake manifold and install the socket-head screws and conical washers. Tighten the socket-head screws to 9.5 to 12 N•m (84 to 108 lbf in).
4. Connect the electrical connector to the throttle body.
5. Connect the air-intake hose.
6. Connect the negative battery cable.



1. SOCKET HEAD SCREW
2. CONICAL WASHER

Figure 3. Conical Washer Positioning

INTAKE MANIFOLD

Remove

For the following procedures, refer to Figure 2.

1. Drain the coolant from the radiator.
2. Disconnect the fuel line from the fuel rail. See Before Repair Procedure.
3. Remove the throttle body. See Throttle Body, Remove.
4. Remove the capscrews retaining the front bracket (6) to the intake manifold and remove the bracket.
5. Remove the IAT sensor. See **Electrical System**, **Mazda 2.0L and 2.2L Emission Compliant Engines** 2200 SRM 1327.
6. Tag and disconnect the vacuum hoses on the intake manifold.
7. Tag and disconnect the coolant hoses from the intake manifold.
8. Remove the ECT sensor. See **Electrical System**, **Mazda 2.0L and 2.2L Emission Compliant Engines** 2200 SRM 1327.
9. Remove the MAP sensor. See **Electrical System**, **Mazda 2.0L and 2.2L Emission Compliant Engines** 2200 SRM 1327.
10. Remove the capscrews retaining the rear bracket (11) to the intake manifold and the cylinder head. Remove the bracket.
11. Remove the capscrews retaining the lower support bracket (14) to the intake manifold and remove the bracket.
12. Remove the nuts and the capscrews retaining the intake manifold to the cylinder head.
13. Remove the coolant line (15) from the intake manifold.
14. Remove the intake manifold and gasket. Discard the gasket.
15. Remove the fuel pressure regulator. See Pressure Regulator, Remove.
16. Remove the fuel injectors and the fuel rail. See Fuel Injectors, Remove.

Install

For the following procedures, refer to Figure 2.

1. Verify that the mounting surfaces of the intake manifold and the cylinder head are clean and free from dirt or debris.
2. Install the fuel injectors and the fuel rail. See Fuel Injectors, Install.
3. Install the fuel pressure regulator. See Pressure Regulator, Install.
4. Place a new gasket in position on the cylinder head.

Assemble and Install

1. Place the muffler onto the frame of the truck and install flanged nuts. Tighten the nuts to 39 N•m (29 lbf ft).
2. Install the exhaust pipe (8, Figure 11) onto the muffler. Install the clamp on the pipe to hold it onto the muffler.
3. Place a new gasket on the muffler and install the exhaust pipe (14, Figure 11) onto the muffler. Install nuts and tighten to 39 N•m (29 lbf ft).
4. Install the exhaust pipe (21 in Figure 11) onto the engine exhaust manifold.
5. Place the catalytic converter on the lift truck frame. Make sure that the embossed **F** is facing up. Install new gaskets onto the catalytic converter and install the exhaust pipes onto the catalytic converter.
6. Install the bracket that attaches the catalytic converter to the frame. See Figure 11. Connect oxygen sensors.
7. Install the counterweight. See section **Frame** 100 SRM 1120 for procedures.

OVERHEAD EXHAUST SYSTEM

NOTE: Remove the counterweight before removing the muffler and other parts of the exhaust system. See section **Frame** 100 SRM 1120 for procedures.

In an overhead exhaust system, the muffler is installed inside the cavity of counterweight. A long exhaust pipe, located above the overhead guard, sends exhaust gases out of lift truck.

Remove and Disassemble

WARNING

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

1. Lift cover and remove three capscrews that attach the overhead exhaust pipe to counterweight. Remove clamp between overhead exhaust pipe and exhaust pipe (13 in Figure 12) and remove overhead exhaust pipe.
2. Remove clamp that attaches exhaust pipe to muffler (13 in Figure 12). Remove exhaust pipe.

NOTE: Lift trucks equipped with Mazda 2007 emissions compliant engine and lift trucks built **after** January, 2010 are equipped with two oxygen sensors; a pre-catalytic oxygen sensor and a post-catalytic oxygen sensor.

3. Remove bracket that attaches the catalytic converter to the frame. Disconnect the oxygen sensors.
4. Disconnect upper and lower exhaust pipes from catalytic converter and remove and discard the gaskets from catalytic converter. Remove catalytic converter from lift truck. See Figure 12.
5. Remove engine exhaust pipe from engine exhaust manifold.
6. Remove the flange nuts that hold the exhaust pipe (20, Figure 12) to the muffler. Remove the exhaust pipe and gasket. Discard gasket.
7. Remove the washers, isolators, spacers, and capscrews that fasten the muffler to the lift truck frame and remove muffler from lift truck.

Inspect

Inspect the following items in the exhaust system:

- Inspect all exhaust pipes for damage, corrosion, and rust and replace as needed.
- If equipped, inspect all exhaust wraps for wear, proper fit, contamination with oil or antifreeze, gaps in coverage, failed fasteners and replace as needed. 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.
- Inspect the catalytic converter and muffler for damage, corrosion, and rust. Replace as needed.
- Start the engine and inspect the exhaust system component for exhaust gas leakage. If leakage is found, repair or replace components as necessary.

Technical Data

Table 2 shows the technical data specifications for the Mazda 2.0L and 2.2L gasoline fuel systems.

Table 2. Gasoline Fuel Systems Technical Data

Item		Engine	
		2.0L	**2.2L**
Idle speed		775 to 825 (800 ±25) rpm	
Fuel pressure	Fuel line pressure	260 to 310 kPa (37 to 45 psi)	
	Fuel hold pressure	More than 140 kPa (20 psi)	
Fuel injector	Resistance (20°C (68°F))	14.2 to 14.8 Ohms	
	Fuel leakage	Less than 1 drop/2 minutes	
	Injection volume	56 to 61 ml (1.9 to 2.0 oz)/15 seconds (using a fuel injector tester).	
Pressure regulator	Fuel line pressure (At vacuum **ON**)	200 to 240 kPa (29 to 35 psi)	
	Fuel line pressure (At vacuum **OFF**)	260 to 310 kPa (37 to 45 psi)	

5. Push in the bracket release pin, grab the bracket handle, and swing the tank and bracket out to the side of the lift truck. If your truck is equipped with a swing-out and drop-down LPG tank bracket (EZ-Xchange™), drop the tank down to the side of the truck for ease of removal. See Figure 1.

6. Unlatch the tank strap and remove the LPG tank from the bracket.

INSTALL LPG TANK

NOTE: The LPG bracket must be in the swing-out position to install the LPG tank. If your lift truck has the swing-out and drop-down bracket (EZ-Xchange™), position the bracket in the drop-down position.

WARNING

When closing the LPG tank strap, DO NOT wrap your fingers around the strap handle. The strap can close quickly and with enough force to cause injury to the fingers and hand.

1. Place the LPG tank into the bracket. Secure the tank strap around the tank and close the strap.

2. Pull the stop pin (see Figure 1) and swing the LPG tank bracket into the resting position on the counterweight. Be sure that the bracket locks into position.

3. Connect the hose to the LPG fuel lock-off connection on the LPG regulator. See Figure 1.

4. Connect the quick-disconnect fitting on the LPG tank. See Figure 1.

5. Turn the fuel valve counterclockwise to open the fuel valve.

6. Inspect the fuel system for leaks when the fuel valve is open. There are four methods used to inspect the fuel system for leaks:

   a. **Sound -** Listen for sound of LPG escaping from a tank fitting or hose connection.

   b. **Smell -** LPG has a very distinctive odor. If you smell LPG, **DO NOT** start the engine.

   c. **Soapy Water -** This method is used in conjunction with Step b above. If the odor of LPG is present, but escaping fuel cannot be heard, apply soapy water to the fittings and observe for bubbles.

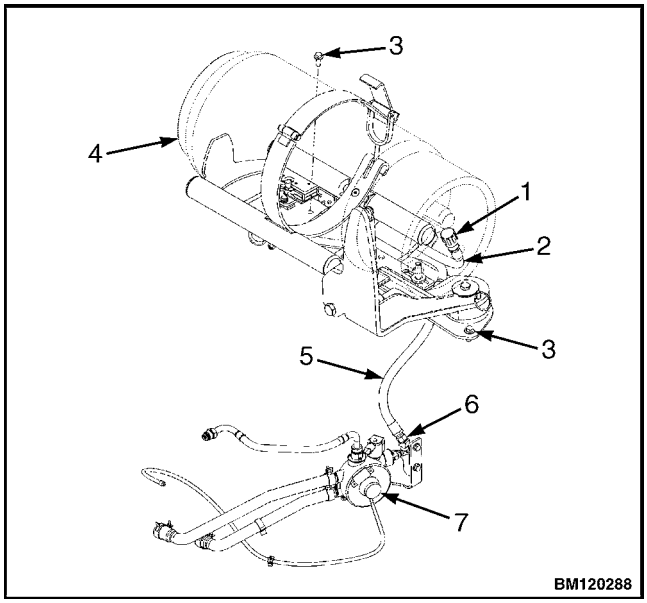
   d. **Frost -** If the amount of LPG escaping is sufficient, frost may appear on the fittings.

REMOVE LPG BRACKET

NOTE: The LPG tank must be removed from the lift truck before removing the LPG tank bracket. See section Remove LPG Tank.

1. **Lift trucks built before 2010, equipped with GM 2.4L engine -** Disconnect the hose from the LPG lock-off connection on the LPG regulator, and remove hose through hole in counter weight. See Figure 2.

2. **Lift trucks built after January, 2010 equipped with GM 2.4L engines -** Disconnect the hose from the LPG fuel filter and remove hose through hole in counterweight. See Figure 3.



1. FITTING
2. HOSE ASSEMBLY
3. CAPSCREW
4. LPG TANK
5. HOSE ASSEMBLY TO LPG REGULATOR/LOCK-OFF
6. LPG REGULATOR CONNECTION
7. LPG REGULATOR

Figure 2. LPG Tank Hose Connections (Lift Trucks Built Before 2010, Equipped with GM 2.4L Engine)

Clean

WARNING

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

CAUTION

DO NOT use any solvents or cleaners when cleaning the fuel injectors.

Remove any debris on the open end (outlet toward engine) of the fuel injector. Cleaning is only done by carefully inserting a pick type tool into the passage and scraping out debris. Only use compressed air for blowing away any loose particles.

Install

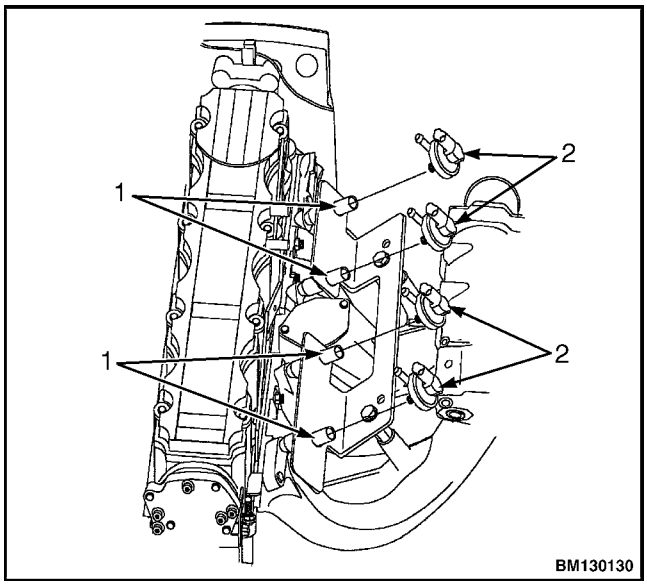
CAUTION

When installing the fuel injectors, install using hand pressure only. DO NOT use an object or tool to hit the injectors to force them into the adapters.

1. Install the fuel injectors into the fuel injector adapters. Push the injectors into the adapters using hand pressure only. See Figure 15.
2. Place the fuel rail in position on the mounting bracket.
3. Install two capscrews and washers to retain the fuel rail to the mounting bracket. Tighten capscrews to 10 N•m (88.5 lbf in).
4. Place new screw-type clamps over each of the hoses. Insert the hoses onto the fuel injector barbs.
5. Verify that all fuel hoses are in correct position and not kinked. Tighten each clamp screw to 2.45 to 2.77 N•m (40 to 45 lbf in).
6. Connect the four electrical connectors to the fuel injectors. Verify that the connectors click/lock into place.
7. Connect the two PCV hoses.
8. Connect the fuel line to the fuel rail.
9. Connect the negative battery cable.

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

10. Slowly open the fuel valve on tank.
11. Turn the key to the **ON** position and back to the **OFF** position to pressurize the fuel system. Check for leaks.
12. Check for leaks at connections by using soapy solution or electron leak detector. If leaks are detected, make proper repairs.



1. ADAPTERS
2. FUEL INJECTORS

Figure 15. Fuel Injectors and Adapters

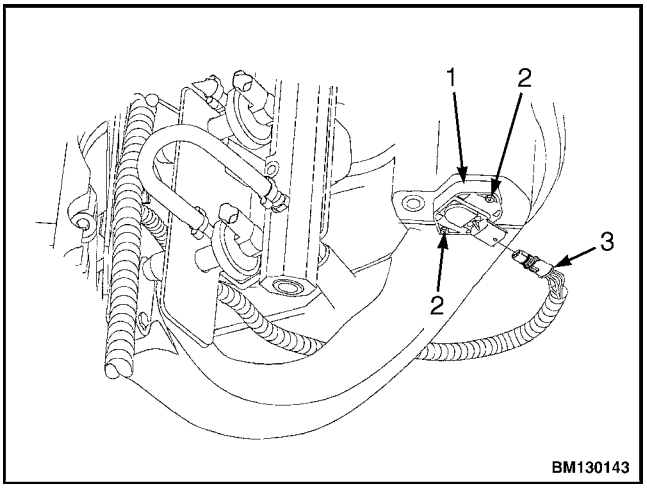
MANIFOLD ABSOLUTE PRESSURE (MAP)/MANIFOLD AIR TEMPERATURE (MAT) SENSOR

Remove

1. Raise the hood. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP/MAT sensor. See Figure 30.
3. Remove the two screws retaining the MAP/MAT sensor to the intake manifold. Remove MAP/MAT sensor.

Install

1. Place the MAP/MAT sensor in position on the intake manifold and install the two retaining screws. Tighten retaining screws to 6 N•m (53 lbf in).
2. Connect the electrical connector to the MAP/MAT sensor. Verify that the connector clicks/locks into place.
3. Connect the negative battery cable. Close the hood.



1. MAP/MAT SENSOR
2. SCREW
3. ELECTRICAL CONNECTOR

Figure 30. MAP/MAT Sensor

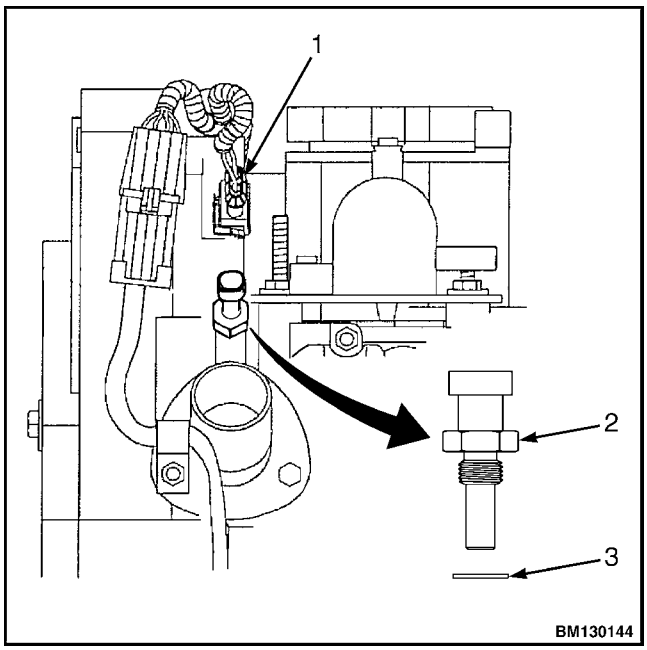
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Remove

1. Raise the hood. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the ECT sensor. See Figure 31.
3. Remove the ECT sensor and washer.

Install

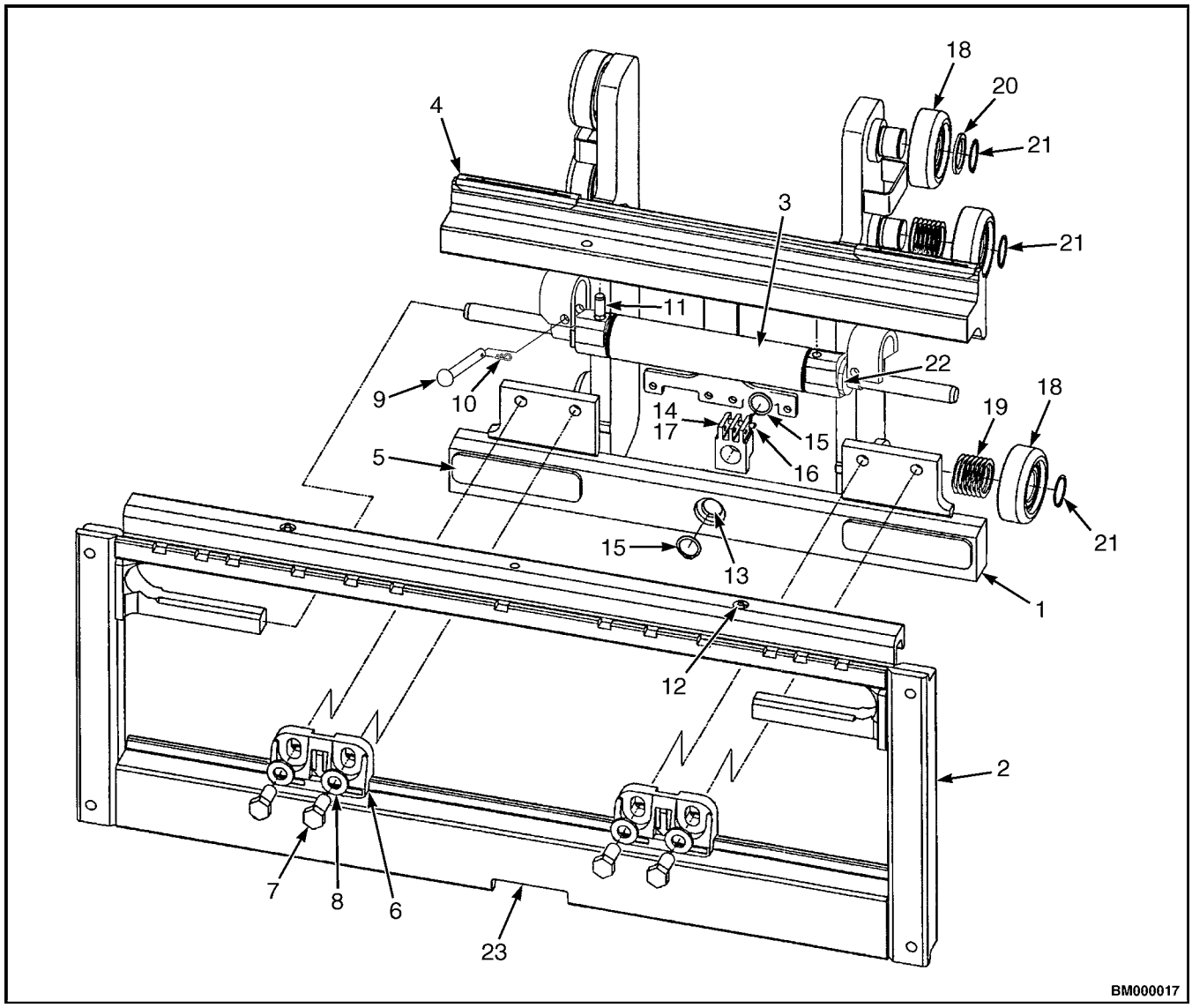
1. Install the new ECT sensor and washer. Tighten the sensor to 20 N•m (14.75 lbf ft).
2. Connect the electrical connector to the ECT sensor.
3. Connect the negative battery cable. Close the hood.



1. ELECTRICAL CONNECTOR
2. ECT SENSOR
3. WASHER

Figure 31. ECT Sensor

TABLE OF CONTENTS



NOTE: TWO- AND THREE-STAGE FFL IS SHOWN.

1. INNER CARRIAGE
2. OUTER FRAME
3. SIDESHIFT CYLINDER
4. UPPER BEARING
5. LOWER BEARING
6. LOWER HOOK
7. CAPSCREW
8. WASHER
9. CLEVIS PIN
10. HAIRPIN
11. PIN
12. LUBE FITTING
13. PIN
14. CHAIN ANCHOR
15. SNAP RING
16. PIN
17. COTTER PIN
18. LOAD ROLLER
19. SHIMS
20. SPACER
21. SNAP RING
22. SPACER
23. FORK REMOVAL NOTCH

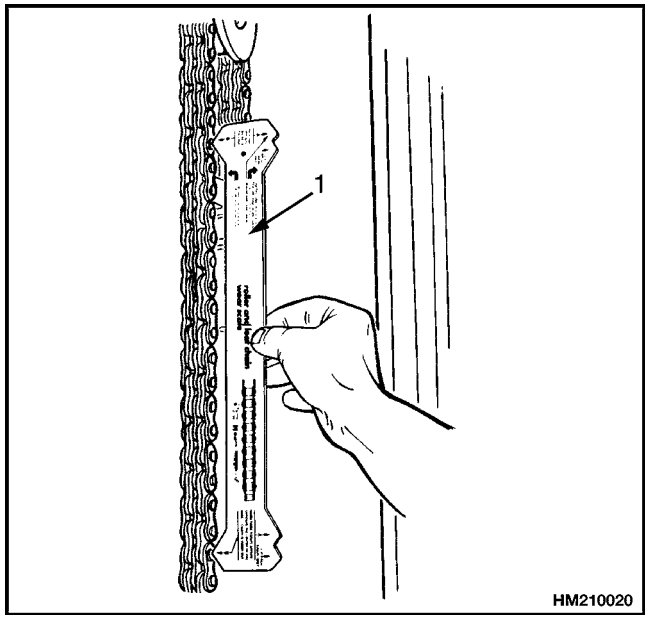
Figure 7. Integral Sideshift Carriage for Lift Truck Models S30FT, S35FT, S40FTS (E010); E1.50-2.00XM (E25-35Z, E40ZS) (E114/F114); J1.60-2.00XMT (J30-40ZT) (J160); and H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)

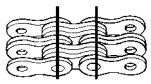
Legend for Figure 18

1. OUTER MAST
2. STUBSHAFT
3. BEARING STRIP
4. SHIM(S)
5. O-RING
6. LOAD ROLLER
7. SHIM
8. CHAIN
9. COTTER PIN
10. PIN
11. CHAIN ANCHOR
12. WASHER
13. NUT
14. MAIN CYLINDERS
15. SPRING
16. FITTING
17. CAPSCREW
18. HOUSING
19. HOSE
20. NUT
21. LOWERING CONTROL VALVE
22. LOCK NUT
23. SPACER
24. SNAP RING
25. INNER MAST
26. CHAIN SHEAVE ASSEMBLY
27. CHAIN SHEAVE
28. BEARING
29. LOWER MAST MOUNT (J1.60-2.00XMT (J30-40ZT) (J160) ONLY)

Legend for Figure 25

1. OUTER MAST
2. LOAD ROLLER
3. SHIM
4. SNAP RING
5. STUBSHAFT
6. O-RING
7. SHIM
8. BEARING STRIP
9. CHAIN
10. COTTER PIN
11. PIN
12. CHAIN ANCHOR
13. WASHER
14. NUT
15. FREE-LIFT CYLINDER
16. MAIN LIFT CYLINDER
17. SPRING
18. FITTING
19. HOSE
20. LOWERING CONTROL VALVE
21. CAPSCREW
22. CLAMP
23. TUBE
24. SPACER
25. LOCK NUT
26. INTERMEDIATE MAST
27. BEARING
28. CHAIN SHEAVE ASSEMBLY
29. CHAIN SHEAVE
30. INNER MAST
31. CHAIN GUARD
32. CROSSHEAD
33. BRACKET
34. VALVE ASSEMBLY (FLOW LIMITING)
35. LOWER MAST MOUNT (J1.60-2.00XMT (J30-40ZT) (J160) ONLY)



Pitch 	Total length of 20 links (pitch) of new chain	Wear Limit The maximum length of 20 links
12.7 mm (0.5 in.)	254.0 mm (10.0 in.)	261.6 mm (10.3 in.)
15.9 mm (0.6 in.)	317.5 mm (12.5 in.)	327.0 mm (12.9 in.)
19.1 mm (0.8 in.)	381.0 mm (15.0 in.)	392.4 mm (15.4 in.)
25.4 mm (1.0 in.)	508.0 mm (20.0 in.)	523.3 mm (20.6 in.)

NOTE: THE INSTRUCTIONS FOR MEASURING CHAIN WEAR ARE SHOWN ON THE CHAIN WEAR SCALE (HYSTER PART NO. 599737).

1. CHAIN WEAR SCALE

Figure 26. Lift Chains Check

TWO-STAGE LFL AND TWO-STAGE FFL MAST

Assemble

WARNING

The mast is heavy. The mast can weigh approximately 907 kg (2000 lb). Make sure all lifting devices (hoists, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the mast.

NOTE: The shims for the load rollers keep the mast weldments parallel and give correct clearance. During assembly, the shim arrangement will be approximately the same as before disassembly. Check the clearance and adjust the shims for wear or for changes caused by repairs. The strip bearings are also adjusted by using shims. See Carriage Adjustments in this section for the adjustment procedures.

NOTE: When the mast has header hoses, see the procedures for Header Hose Arrangement.

1. Connect a crane with a capacity of at least 907 kg (2000 lb) to the center of the inner mast. Fit the stub shafts through the notches in the outer mast. Slide the inner mast into the outer mast so the stub shafts are seen at the top and bottom of the weldments.

See Figure 17 for lift truck models:
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)
- H2.0-3.5FT (H40-70FT) (L177)
- J2.00-3.20XM (J40-65Z (B416)
- E2.00-3.20XM (E45-65Z) (G108)

FOUR-STAGE FFL MAST - MANUFACTURED AFTER JULY, 2009

NOTE: The information in this section is for four-stage FFL mast manufactured **AFTER** July, 2009. For four-stage FFL mast manufactured **BEFORE** July, 2009, go to Four-Stage FFL Mast - Manufactured Before July, 2009

Disassemble

NOTE: If only the lift, tilt, or free-lift cylinders need to be removed and repaired, see the section **Cylinder Repair** 2100 SRM 1139. When the mast has header hoses, see the procedures for the Header Hose Arrangements.

1. Disconnect lift chains at bottom of inner mast and top of first intermediate mast. Remove lift chains. Push inner mast toward bottom of mast assembly until bottom load rollers are seen. See Figure 35 and Figure 36.

2. Remove strip bearings at top of second intermediate mast. Remove load rollers at bottom of inner mast. Remove load rollers at top of second intermediate mast. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

3. Slide inner mast halfway out of top of second intermediate mast. Connect crane to center of inner mast. See Figure 37. Slide inner mast out until stub shafts are in notches of second intermediate mast. Remove inner mast from second intermediate mast.

4. Disconnect lift chains at bottom of second intermediate mast and top of outer mast. Remove lift chains. Push second intermediate mast toward bottom of mast assembly until bottom load rollers are seen. See Figure 35 and Figure 36.

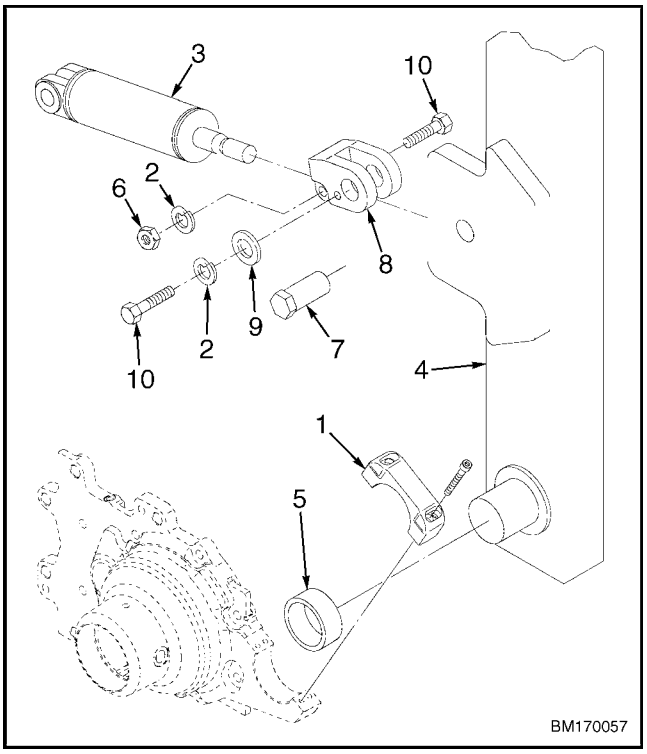
5. Remove strip bearings and spacers at top of first intermediate mast. Remove load rollers at bottom of second intermediate mast. Remove load rollers at top of first intermediate mast. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly. See Figure 35 and Figure 36.

6. Slide second intermediate mast halfway out of top of first intermediate mast. Connect crane to center of second intermediate mast. See Figure 37. Slide second intermediate mast out until stub shafts are in notches of first intermediate mast. Remove second intermediate mast.

7. Slide first intermediate mast from bottom of outer mast approximately 30 cm (12 in.). Remove strip bearings at top of outer mast. Remove snap rings and load rollers from both mast uprights. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

8. Slide intermediate mast halfway out of top of outer mast. Connect crane to center of first intermediate mast. See Figure 37. Slide first intermediate mast out of outer mast until stub shafts are in notches of outer mast. Remove first intermediate mast from outer mast.

9. Remove nut, washer, and capscrew from outer mast crossmember and bracket weldment and remove hose channels from outer mast. See Figure 38.



1. RETAINER CAP
2. LOCKWASHER
3. TILT CYLINDER
4. OUTER MAST WELDMENT
5. BUSHING
6. NUT
7. PIN
8. ROD END
9. WASHER
10. CAPSCREW

Figure 44. Mast Mounting (Stub Shaft Connections) for Lift Truck Models J1.60-2.00XMT (J30-40ZT) (J160) and E1.50-2.00XM (E25-35Z, E40ZS) (E114/F114)

3. Use crane to position mast assembly onto its lower mounts:

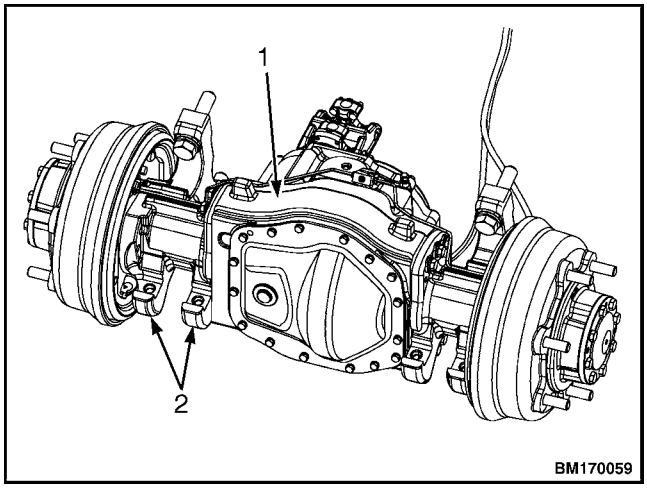
a. Pivot Pin Connection - Position mast so pivot pins seat into hanger mounts on drive axle. Install capscrews that hold mast pivot pins to drive axle hangers. Tighten capscrews to 270 N•m (199 lbf ft).

See Figure 45 for lift truck models:
- S30FT, S35FT, S40FTS (E010)
- H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)
- H2.0-3.5FT (H40-70FT) (L177)

See Figure 46
- J2.00-3.20XM (J40-65Z) (B416)
- E2.00-3.20XM (E45-65Z) (G108)

b. Stub Shaft Connection - Position mast stub shafts into the drive unit hangers. Install retainer caps over stub shaft bushings. Apply Loctite® 290 or equivalent to capscrew threads and install capscrews. Tighten to 35 N•m (26 lbf ft).

See Figure 44 for lift truck models:
- J1.60-2.00XMT (J30-40ZT) (J160)
- E1.50-2.00XM (E25-35Z, E40ZS) (E114/F114)



1. DRIVE AXLE
2. HANGER MOUNTS

Figure 45. Mast Mounts, Drive Axle, for Lift Truck Models S30FT, S35FT, S40FTS (E010), H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001), S2.0-3.5FT (S40-70FT, S55FTS) (F187), and H2.0-3.5FT (H40-70FT) (L177)

TWO-STAGE FFL

WARNING

Before working on or near the mast, see Safety Procedures When Working Near Mast in this section.

NOTE: This procedure is for the four-function option. The three-function option will have hoses **A** and **B** only.

NOTE: The lift chains and carriage height must be correctly adjusted before the header hoses can be adjusted. See the section Lift Chains Adjustment for adjustment procedures.

1. Mark each hose with a single letter: **A**, **B**, **C**, and **D**.

2. Dimensions **E** and **G** are determined by the height of the outer mast channel from the ground and the length of the outer mast channel. See dimensions **Y** and **Z** and to calculate **E** and **G** (see tables associated with figures) see the following figures:

   Figure 52 for lift truck models:
   - S2.0-3.5FT (S40-70FT, S55FTS) (F187)
   - H2.0-3.5FT (H40-70FT) (L177)
   - J2.00-3.20XM (J40-65Z (B416)
   - E2.00-3.20XM (E45-65Z) (G108)

   Figure 53 for lift truck models:
   - S30FT, S35FT, S40FTS (E010)
   - E1.50-2.00XM (E25-35Z, E40ZS) (E114/F114)
   - J1.60-2.00XMT (J30-40ZT) (J160)
   - H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)

Legend for Figure 55

NOTE: THREE-FUNCTION MAST SHOWN.

A. ALIGN MARK E AT BOTTOM OF THIS CLAMP.

B. ALIGN MARK G AT TOP OF THIS CLAMP.

1. CHANNEL
2. COWL HOSES
3. HEADER HOSES
4. STRAP CLAMP
5. CLAMP
6. CLAMP
7. FITTING
8. TUBE
9. FITTING
10. CLAMP
11. BRACKET
12. FREE-LIFT BRACKET
13. FREE-LIFT CHAIN
14. CARRIAGE BRACKET
15. LOWER CLAMP
16. HOSE GUIDE
17. SNAP RING
18. CLIP
19. CAPSCREW
20. HOSE GUARD
21. STUB SHAFT
22. FITTING
23. SPACER
24. WASHER
25. NUT

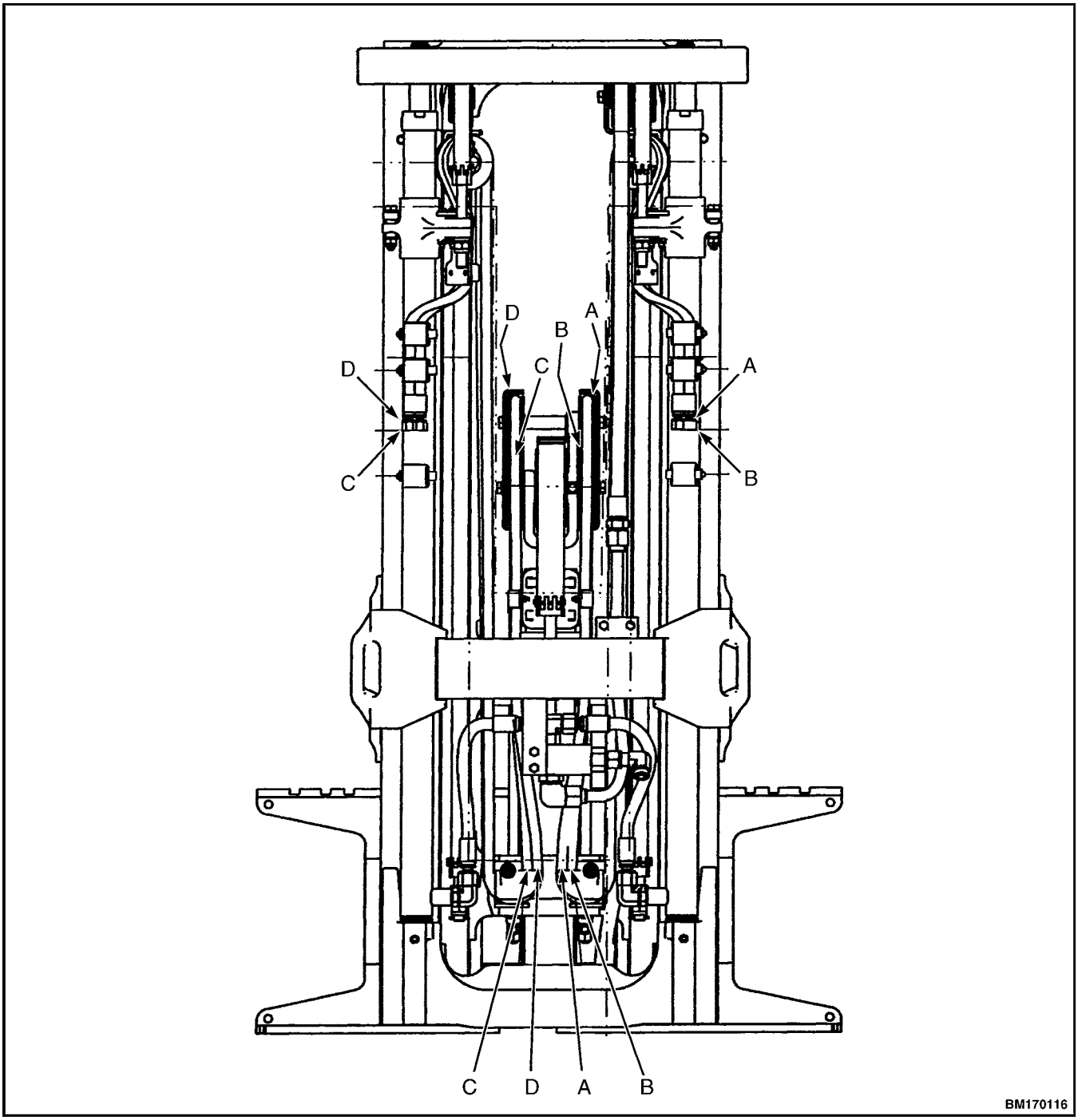


Figure 60. Header Hose Alignment for Three-Stage Full Free-Lift Mast Lift Truck Models S30FT, S35FT, S40FTS (E010); E1.50-2.00XM (E25-35Z, E40ZS) (E114/F114); J1.60-2.00XMT (J30-40ZT) (J160); and H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001) (Sheet 2 of 3)

Legend for Figure 63

1. HOSE
2. NUT
3. CLAMP
4. CAPSCREW
5. CAPSCREW
6. RESTRAINT
7. WASHER
8. NUT
9. WASHER
10. CAPSCREW
11. SHEAVE
12. CAPSCREW
13. TUBE
14. CAPSCREW
15. CLAMP
16. PLATE
17. CLAMP
18. CLAMP
19. SNAP RING
20. HOSE GUIDE
21. BRACKET
22. NUT
23. STUB SHAFT
24. HOSE GUIDE AND SHEAVE
25. SPACER
26. WASHER
27. CAPSCREW
28. BRACKET (RH)
29. STUB SHAFT
30. SHEAVE
31. WASHER
32. BRACKET (LH)

FOUR-STAGE FFL MAST - MANUFACTURED AFTER JULY, 2009

NOTE: The information in this section applies to four-stage FFL mast manufactured **AFTER** July, 2009. For header hose information on four-stage FFL mast manufactured **BEFORE** July, 2009, go to Four-Stage FFL Mast - Manufactured Before July, 2009.

⚠ WARNING

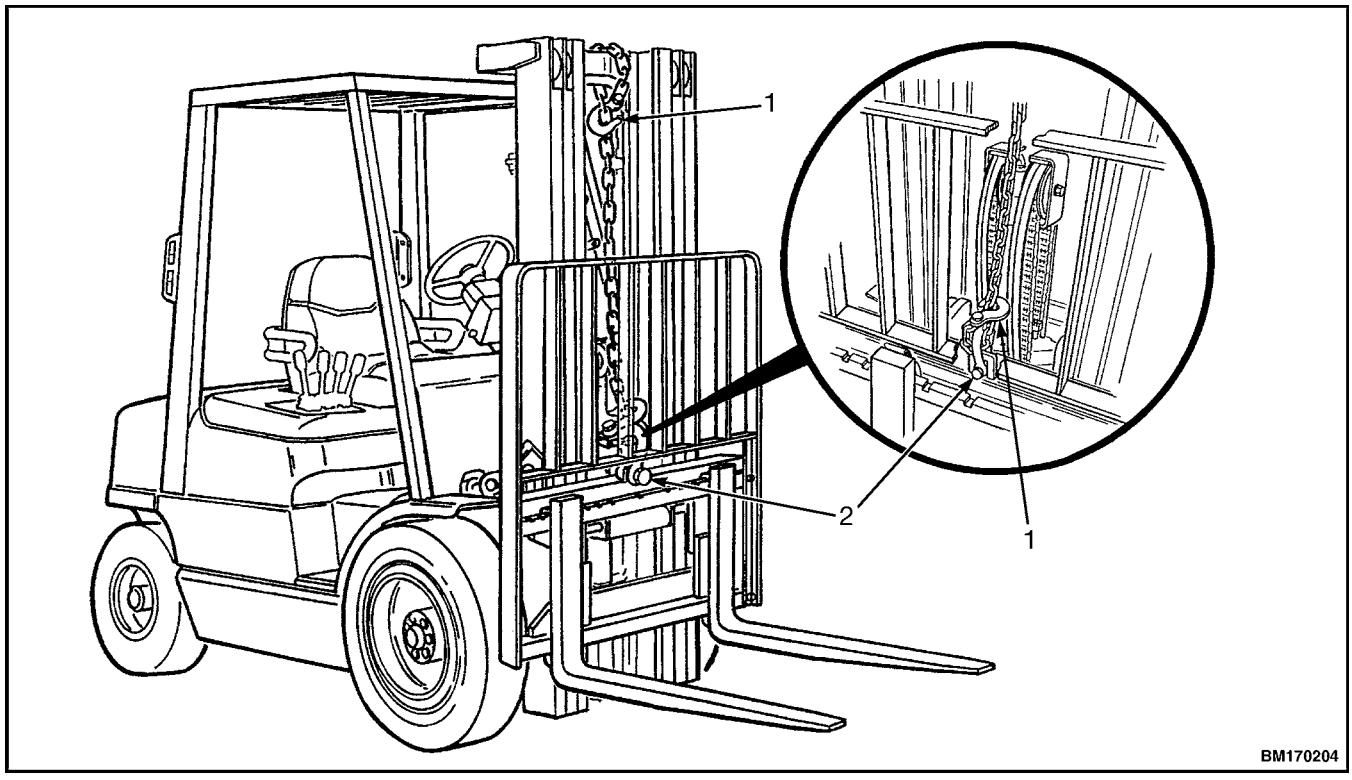
Before working on or near the mast, see Safety Procedures When Working Near Mast.

NOTE: This procedure is for the four-function option. The three-function option will have hoses A and B only.

NOTE: The lift chains and carriage height must be correctly adjusted before the header hoses can be adjusted. See the section Lift Chains Adjustment for adjustment procedures.

NOTE: If the header hoses were removed, use this procedure to install the header hoses. See Table 11. If the mast components have not been assembled, assemble the mast as described in the previous procedure.

1. Raise carriage so free-lift chains are not tight. Raise inner channel so main-lift chains are not tight. Install chains to prevent inner channel and carriage from moving. The chains must not be in the path of the header hose. See Figure 68.
2. Install all hose sheaves loosely. **DO NOT** tighten capscrews and nuts until header hoses are installed.
3. Make sure replacement header hose is correct part number for your mast assembly. Make sure header hoses are straight on a flat surface. Mark header hose at points **E, G** and **H** (mm) as shown in Table 11. Measure from end of hose with small fitting.



1. HOOK
2. SHACKLE

Figure 68. Chaining the Carriage

Carriage Adjustments

1. Install the load rollers on the carriage. Install the shims for the load rollers onto the stubshaft in the same sequence as when disassembled. On carriages equipped with six load rollers, there are no shims under the top load rollers.

2. Use a lifting device to raise carriage. Find the point of tightest fit between the carriage load rollers and inner mast channels.

3. Remove carriage from mast. Adjust shim arrangement for each roller for clearance between roller and inner channel. Repeat Step 1 and Step 2 until there is zero clearance at the point of tightest fit.

4. Keep shim arrangement on each side of carriage approximately equal. The carriage must be centered within the inner mast within +1.50 mm (0.06 in.).

5. Check lateral movement of carriage:

   a. Fully lower carriage to ground.

   b. Place hand or small pry bar between top of carriage side plate and the inner channel flange. See Figure 74.

   c. Move carriage back and forth and check movement.

   d. Carriage lateral movement must not be greater than 2.5 mm (0.10 in.).

   e. If carriage lateral movement is greater than 2.5 mm (0.10 in.), add or remove shims and repeat Step a through Step d until correct movement is achieved.

CAUTION

Too much grease will cause the rollers to slide and wear flat areas on the rollers and introduce contamination into and on mast channels.

6. After adjustment, lubricate channels with a thin layer of grease. Adjust hydraulic hoses and make sure connections are correct, if the carriage is equipped with hydraulic attachments.

TABLE OF CONTENTS (Continued)

This section is for the following models:

H1.6FT, H1.8FT, 2.0FTS [F001];
H2.0-3.5FT (H40-70FT) [L177];
H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) [N005, P005];
H6.0FT, H7.0FT (H135FT, H155FT) [H006, J006];
H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) [A299]

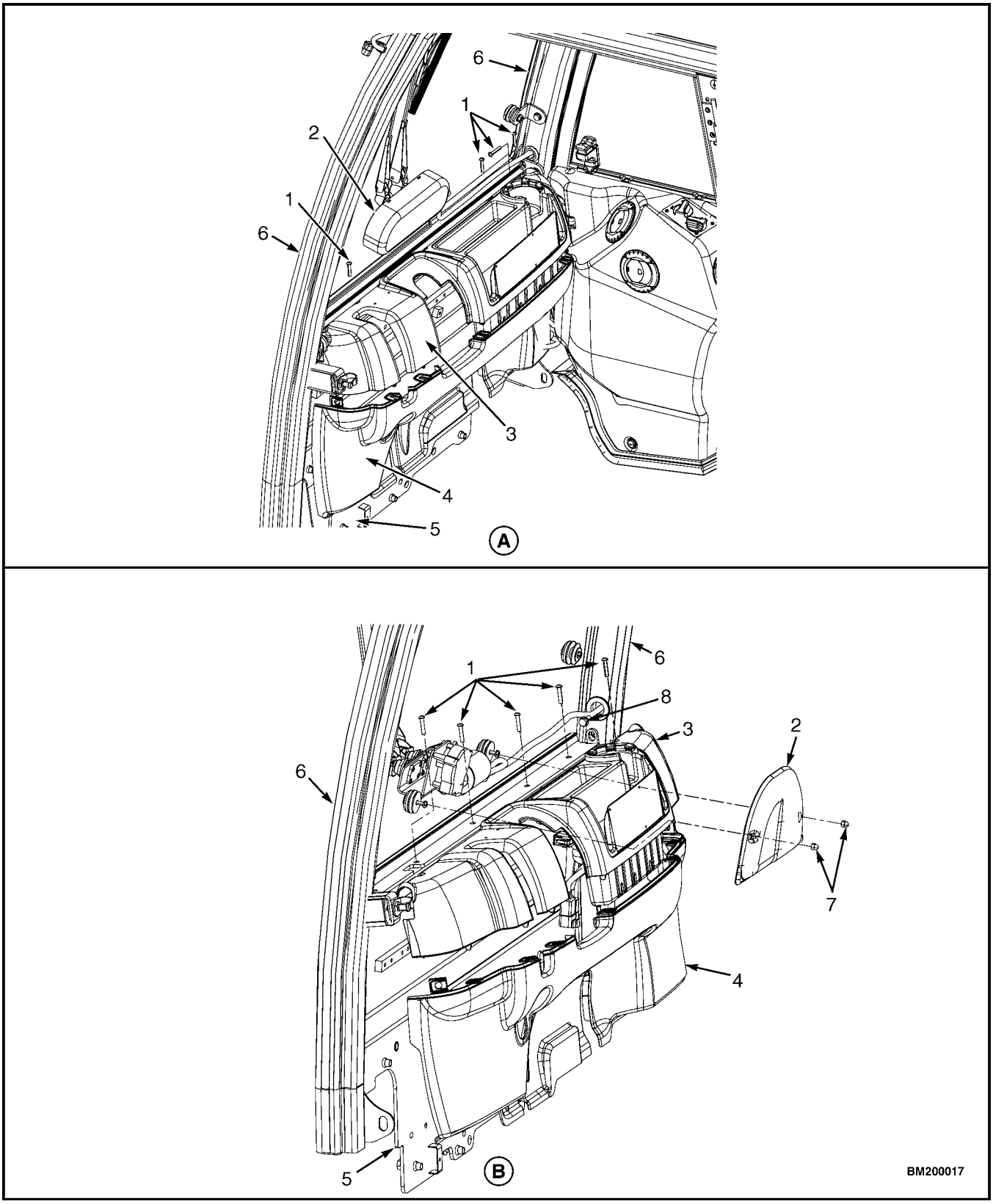
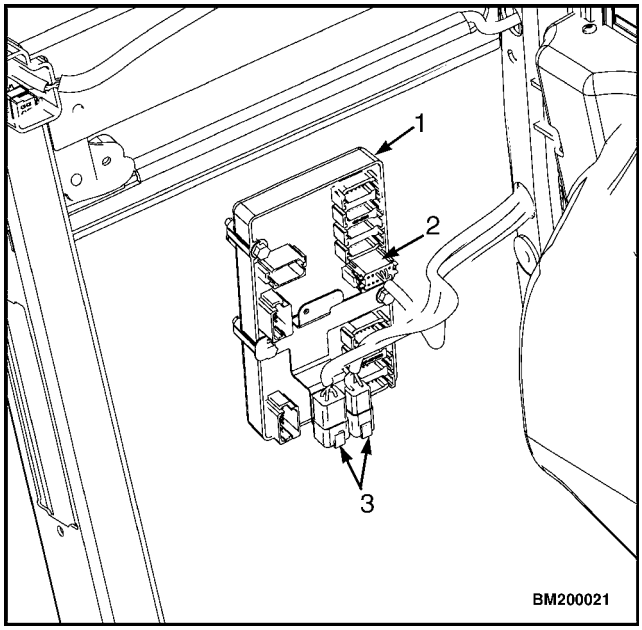


Figure 10. Dash Installation



NOTE: KICK PANEL REMOVED FOR CLARITY.

1. VSM
2. HARNESS CONNECTOR (TO VSM)
3. HARNESS CONNECTOR (TO RIGHT HAND CHASSIS HARNESS)

Figure 22. Light Harness Connection to Vehicle System Manager (VSM)

Legend for Figure 23

NOTE: RIGHT SIDE SHOWN. WIPER COVER AND ASSEMBLY FOR EARLY MODEL H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006) LIFT TRUCKS SHOWN. THE FRONT AND REAR CAB MOUNTING IS THE SAME FOR LATER MODEL H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006) LIFT TRUCKS AND ON H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (A299) LIFT TRUCK MODELS.

A. REAR VIEW **B.** FRONT VIEW

1. FLANGE BOLTS
2. REAR OPERATOR CAB LEG
3. REAR LIGHT HARNESS
4. WASHER PUMP HARNESS CONNECTOR
5. WASHER FLUID RESERVOIR
6. MODULE
7. COWL PANEL

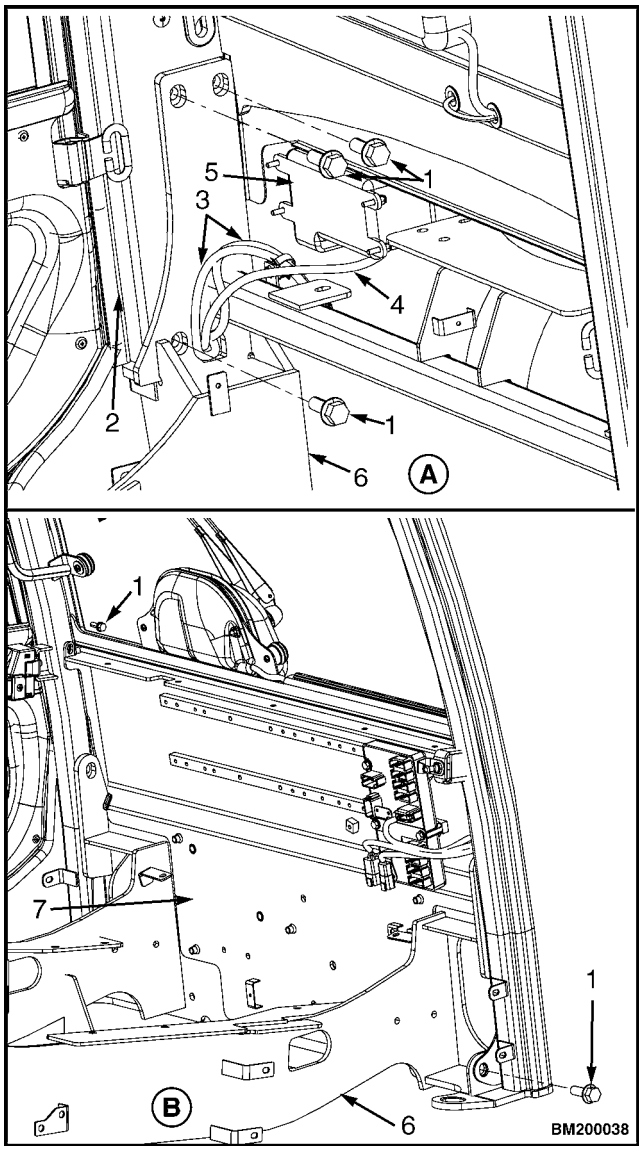


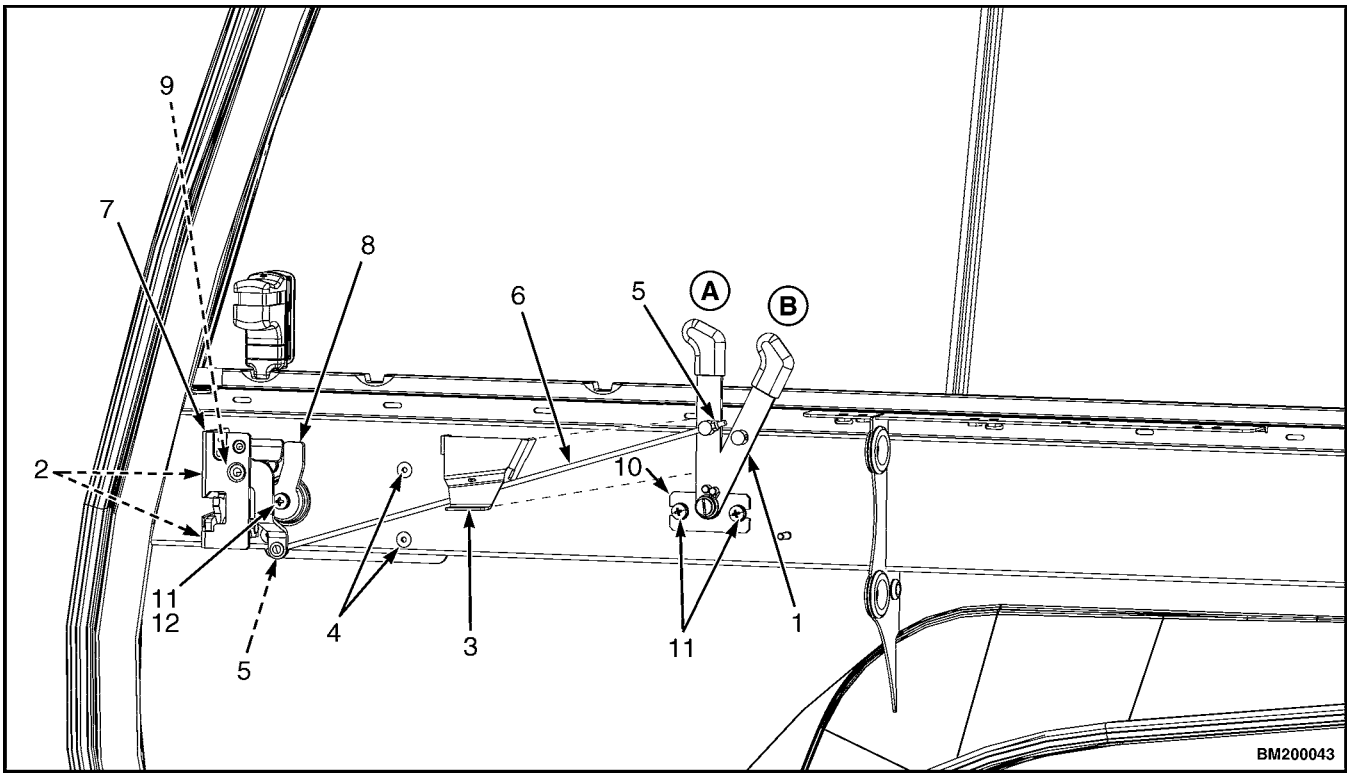
Figure 23. Front and Rear Cab Mounting

Door Lock Assembly

1. Remove inside lever handle cover. See Figure 32.
2. Place the inside lever handle in the closed position. Remove the lock nut from the release bar at the inside lever handle. Pull inside lever handle to open position. Remove release bar from inside lever handle.
3. Remove two capscrews and inside lever handle and mounting plate.
4. Remove lock nut from release bar and release bar from door lock assembly.
5. Remove two nuts and capscrews from door lock assembly. Remove door lock assembly from door frame.
6. Remove the screw and washer from the release lever and release lever from outside door handle assembly. See Figure 32 and Figure 33.
7. Remove four capscrews that fasten the outside door handle to door. Remove outside door handle from door.
8. Remove seal and grip from outside handle assembly. Discard seal. See Figure 33.

Windows

For procedures to remove and install door windows, see the section Window Replacement.



A. LEVER IN CLOSED POSITION

B. LEVER IN OPEN POSITION

1. INSIDE LEVER HANDLE
2. CAPSCREWS
3. INSIDE LEVER HANDLE COVER
4. CAPSCREW (OUTSIDE HANDLE)
5. LOCK NUT
6. RELEASE BAR
7. DOOR LOCK ASSEMBLY
8. RELEASE LEVER
9. NUT
10. MOUNTING PLATE
11. SCREWS
12. WASHER

Figure 32. Door Lock and Lever Disassembly

Remove, Lift Truck Models H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005), H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006), and H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (A299)

1. Open hardware covers at base of wiper arms and remove two nuts and external tooth lockwashers from wiper arms. See Figure 41 and Figure 42.
2. Remove wiper blade and wiper arm from wiper motor threaded shafts.
3. Remove the two hardware covers, nuts, washers, and lockwashers from two threaded shafts that pass through two holes in the wiper motor housing. Remove wiper arms from front window.
4. On lift trucks:
   - H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)
   - Early model H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)

   Remove the two lock nuts that secure front wiper motor cover to wiper motor housing. Remove cover. See Figure 41
5. On later model lift trucks:
   - H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)
   - H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (A299)

   Remove the three lock nuts that secure front wiper motor cover to wiper motor housing. Remove cover. See Figure 42.
6. Disconnect cab harness from wiper motor harness.
7. Remove wiper motor and bracket from wiper motor housing.
8. Remove three capscrews and external tooth lockwashers and remove wiper motor from wiper motor bracket assembly. See Figure 41 and Figure 42.

Install, Lift Truck Models H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005), H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006), and H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (A299)

1. Install wiper motor to wiper motor bracket using three capscrews and external tooth lockwashers. See Figure 41 and Figure 42.
2. Install wiper motor and bracket into wiper motor housing.
3. Connect wiper motor harness to cab harness.
4. On lift truck models:
   - H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)
   - Early model H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)

   Attach front wiper motor cover to wiper motor housing with two lock nuts. See Figure 41.
5. On later model lift trucks:
   - H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)
   - H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (A299) lift trucks

   Attach front wiper motor cover to wiper motor housing with three lock nuts. See Figure 42.
6. Install two washers, nuts, and hardware covers onto threaded shafts.

NOTE: Inspect the wiper blade. If it is cracked, split, or worn, replace with new blade before installing wiper arms onto front window.

7. Install wiper arms onto wiper motor threaded shafts, using two external tooth lockwashers and nuts. Close hardware cover at base of wiper arms.

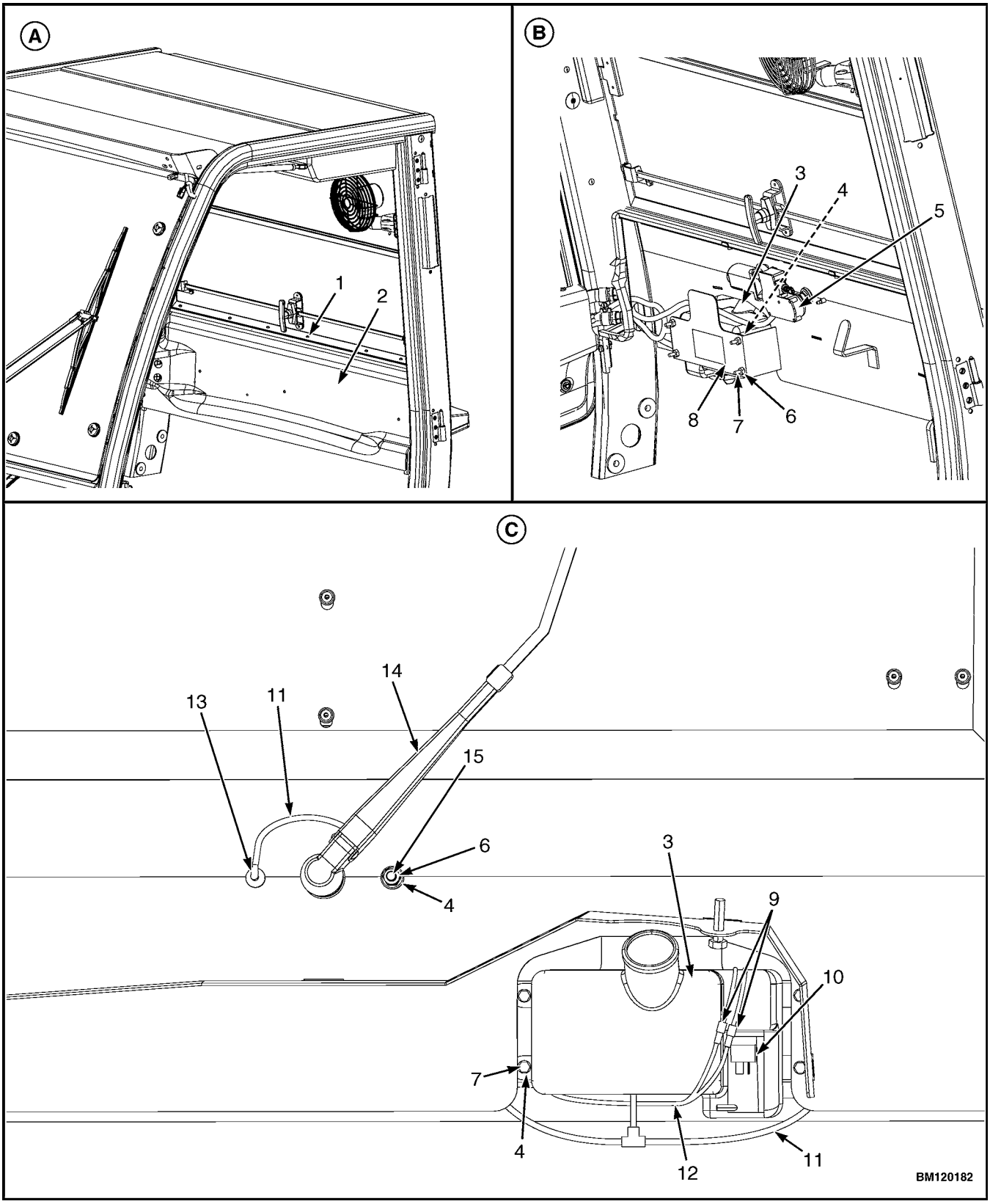


Figure 46. Washer Reservoir and Rear Wiper Removal, Lift Truck Models H4.0FT5/FT6, H4.5FTS5, H4.5FT6, H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)

Legend for Figure 54

1. LOUVERS
2. TOP VENT ADAPTERS
3. STRAP CLAMPS
4. REAR DUCT HEATER HOSE
5. FRONT DUCT HEATER HOSE
6. SCREWS
7. HEATER CONTROL
8. CLIPS
9. RETURN HOSE
10. SUPPLY HOSE
11. SWIVEL CLAMP
12. CLAMP
13. CAPSCREWS
14. HEATER BOX
15. HEATER CONTROL HARNESS
16. CONNECTOR TO CAB HARNESS
17. CONNECTOR TO HEATER
18. FLOOR VENT DUCT HOSE
19. NUT
20. FLOOR VENT
21. INSERT
22. BRACKET
23. RECTANGLE ADAPTER
24. FORMED HOSE
25. CLIP NUTS
26. FRESH AIR INTAKE VENT
27. SURROUND COVER

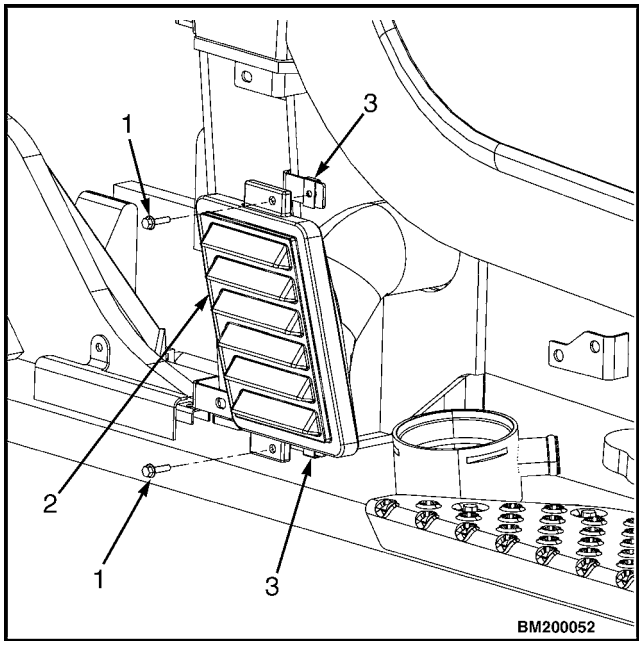
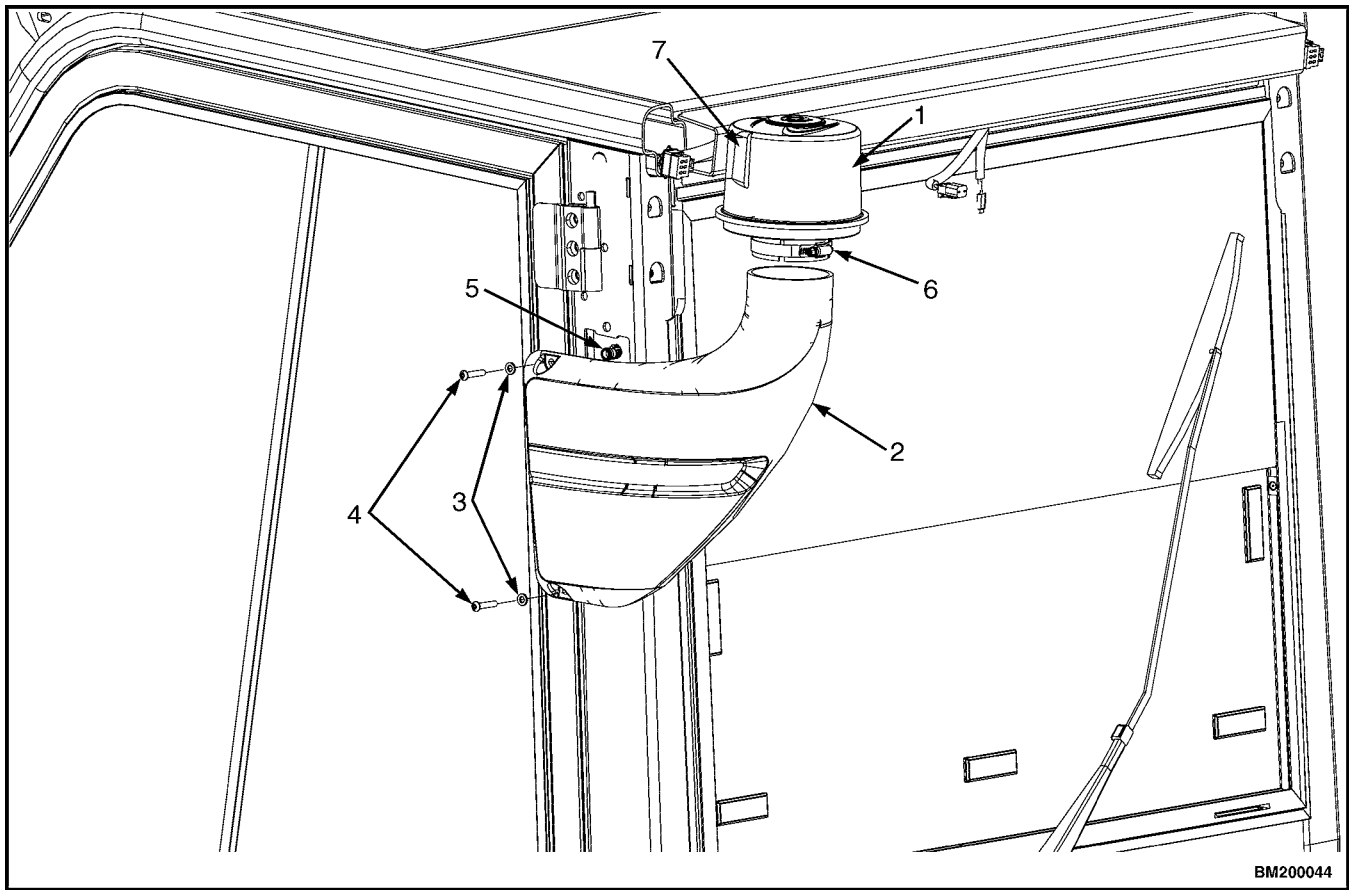


Figure 55. Fresh Air Intake Vent

Legend for Figure 55

1. FLANGE BOLTS
2. FRESH AIR INTAKE VENT
3. CLIP NUTS



1. PRE-CLEANER
2. AIR DUCT
3. WASHER
4. SOCKET HEAD CAPSCREW
5. INSERT
6. HOSE CLAMP
7. INJECTION PORT

Figure 62. Heavy Duty Pre-Cleaner

TABLE OF CONTENTS (Continued)

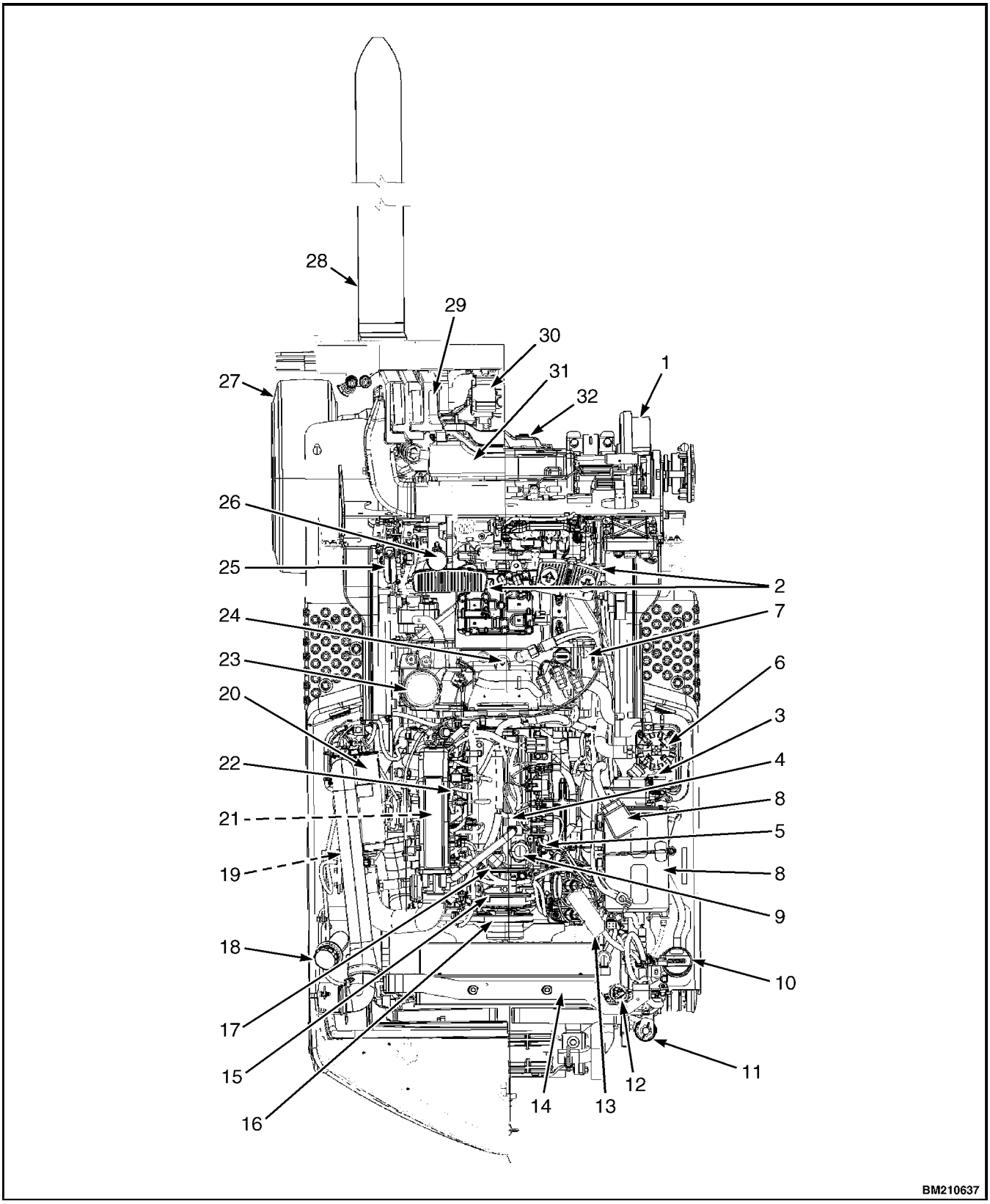


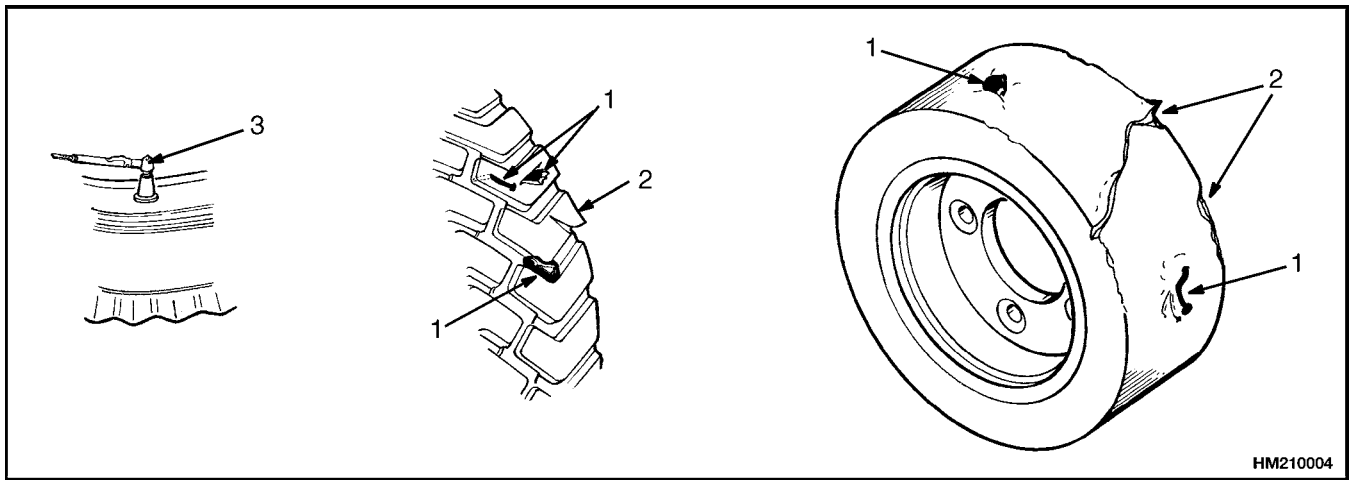
Figure 7. Mazda 2.0L and 2.2L Gas Trucks (2007 Emission Compliant Engines Only)

Maintenance Schedule

NOTE: The lift trucks shown in Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 9, Figure 8, and Figure 10 represent S40-70FT, S55FTS (F187) lift trucks, H40-70FT (L177) are similar. The lift truck shown in Figure 11 represents H40-70FT (L177) lift trucks only.

Table 1. Maintenance Schedule

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	Tires	X						Check Condition	See Nameplate
	Safety Labels	X						Replace as Necessary	See **Parts Manual**
30, 31	Mast, Carriage, Header Hoses, Lift Chains, Attachment	X						Check Condition and Lubrication	See **Parts Manual**
	Seat Belt, Hip Restraints, and Seat Rails	X						Check Condition and Operation	
	Hood and Seat Latches	X						Check Condition and Operation	
	Engine Compartment	X						Remove Combustible Materials See NOTE 5	
	Paper Application: Engine Compartment, Truck Components, Exhaust Wraps, Radiator, Radiator Screen if equipped, Belly Pan if equipped	X						Check Condition Clean as Required Replace as Required See NOTE 10	
	Check for Leaks - Fuel, Oil, Water	X						Check for Leaks See NOTE 1	
	Hydraulic Hoses	X						Check Condition	See **Parts Manual**
13	Coolant Hoses	X						Check Condition	See **Parts Manual**
18	Fuel Tank (Gas) S40-70FT, S55FTS (F187)	CIL						40.5 liter (10.7 gal)	85 Octane Gasoline Minimum
18	Fuel Tank (Gas) H40-70FT (L177)	CIL						52 liter (13.7 gal)	85 Octane Gasoline Minimum
18	Fuel Tank (LPG)	CIL						29.9 liter (7.9 gal) 15.2 kg (33.5 lb)	LPG - HD 5, HD 10
18	Fuel Tank (Diesel) H40-70FT (L177)	CIL						52 liter (13.7 gal)	Diesel No. 2
X=Check C=Change L=Lubricate CIL=Check Indicator Light during operation									



1. CHECK FOR DAMAGE (REMOVE NAILS, GLASS AND OTHER OBJECTS FROM THE TREAD)
2. MAKE SMOOTH EDGES
3. CHECK TIRE PRESSURE (PNEUMATIC TIRES)

Figure 17. Tire Check

Safety Labels

WARNING

Safety labels are installed on the lift truck to give information about operation and possible hazards. It is important that all safety labels are installed on the lift truck and can be read.

Check that all safety labels are installed in the correct location on the lift truck. See the **Parts Manual**, **Model Description** section in the **Operating Manual** or the section **Frame** 100 SRM 1120 for the correct location of the safety labels. See the **Parts Manual** for the part numbers of the safety labels.

Mast, Carriage, Lift Chains, Header Hoses, Attachment

WARNING

Lower the lift mechanism completely. Never allow any person under a raised carriage. DO NOT put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED. DO NOT try to correct the alignment of the fork tips by bending the forks or adding shims. Never repair damaged forks by heating or welding. Forks are made of special steel using special procedures. If either fork is damaged, replace the forks as a set.

1. Inspect the welds on the mast and carriage for cracks. Make sure that the capscrews and nuts are tight.
2. Inspect the channels for wear in the areas where the rollers travel. Inspect the rollers for wear or damage.
3. Inspect the load backrest extension for cracks and damage.
4. If the lift truck is equipped with an integral sideshift carriage or attachment, inspect the parts for cracks and wear. Make sure the parts that fasten the integral sideshift carriage or attachment to the carriage are in good condition.
5. Visually inspect hoses/fittings for hydraulic leaks; hose cover for cuts, cracks or exposed reinforcement; defective/broken clamping devices or sheaves; proper tracking during operation. Adjust/repair/replace hose/components as necessary. See **Mast Repairs**, **2-, 3-, and 4-Stage Masts** 4000 SRM 1148 for quick disconnect procedures.
6. Check that the lift chains are correctly lubricated. Use SAE 30 engine oil as necessary to lubricate the lift chains.
7. Inspect the lift chains for cracks or broken links, and worn or turned pins. See Figure 18.
8. Inspect the chain anchors and pins for cracks and damage.

Legend for Figure 25

A. GAS ENGINE

1. DIPSTICK ENGINE OIL
2. BATTERY
3. AUXILIARY COOLANT RESERVOIR
4. RADIATOR CAP
5. ENGINE OIL FILL
6. DRIVE BELT

B. LPG ENGINE

7. AIR FILTER
8. FUEL FILTER
9. ENGINE OIL FILTER
10. PCV VALVE
11. SPARK PLUGS
12. FUEL INJECTOR

and check the oil level. See Figure 24 Figure 25, Figure 26, and Figure 27. Do not restart the engine until the low pressure condition has been corrected.

Cooling System

WARNING

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

NOTE: The engine will enter shutdown mode after a warning buzzer sounds and a 30-second countdown, if coolant temperature reaches 121°C (250°F) or above on lift trucks with powertrain protection system. Lift trucks equipped with a CumminsYanmar diesel engine will enter the shutdown mode when the coolant temperature reaches 110°C (230°F) or above on lift trucks with powertrain protection system. See the ENGINE SHUTDOWN procedures in the **Operating Manual**.

There is an indicator light on the Display Switch Cluster for the coolant temperature. The red light is on when the key switch is in the **START** position or the Power **ON/OFF** button is pressed, and must go off when the engine is running. If the light is on when the engine is running, the coolant and engine are too hot. Stop the engine and check the coolant level in the coolant recovery reservoir.

Make sure the coolant level is between the **ADD** and **FULL** marks on the auxiliary coolant reservoir. See Figure 34. The coolant will expand as it is heated and the level in the auxiliary coolant reservoir will increase.

CAUTION

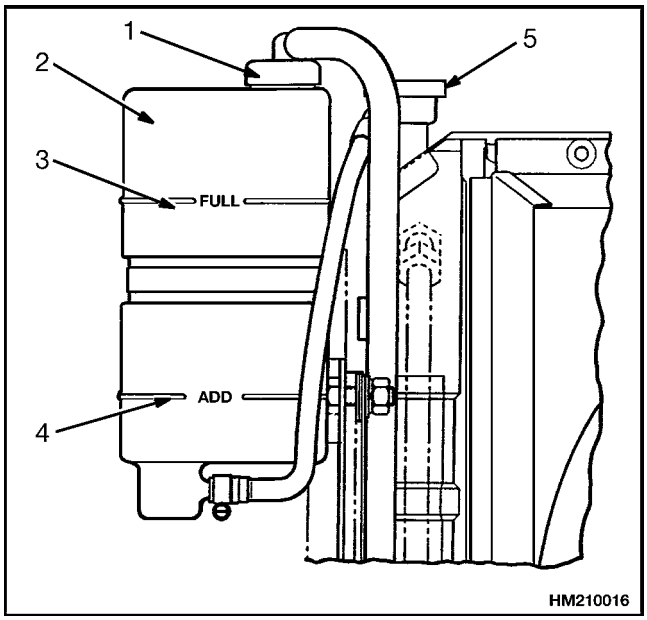
Additives may damage the cooling system. Before using additives, contact your local Hyster dealer.

If coolant is added, see Maintenance Schedule for correct solution.

WARNING

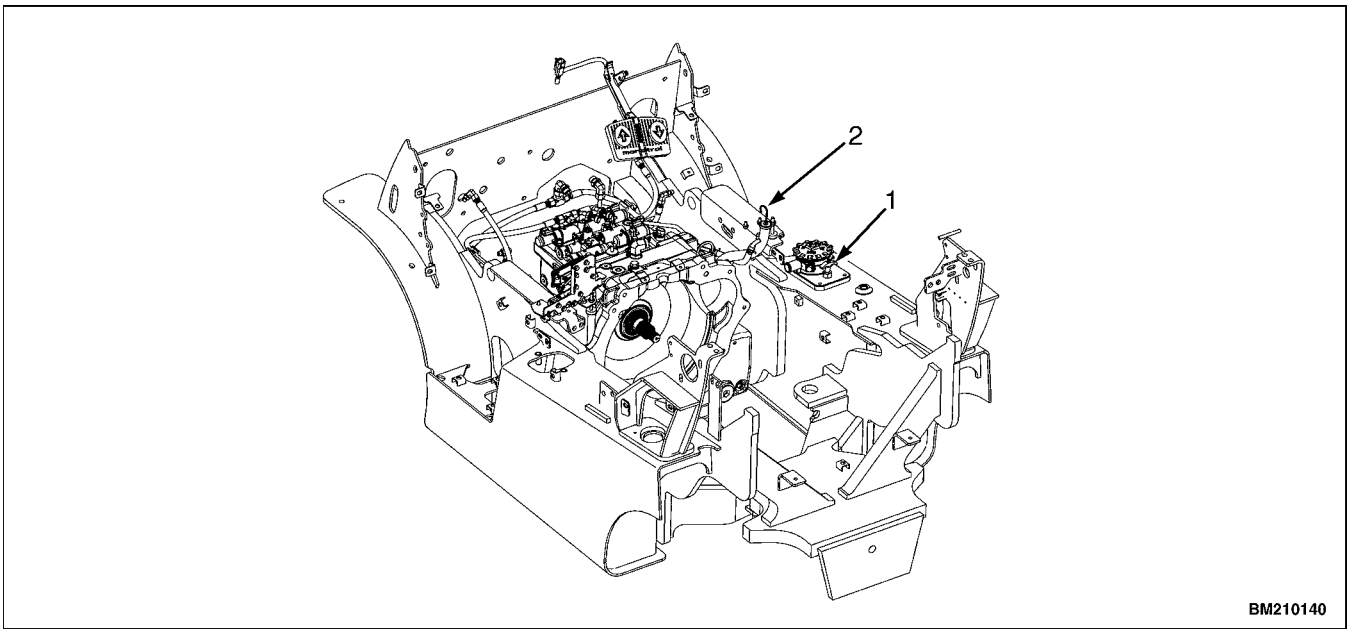
Compressed air can move particles so that they cause injury to the user or to other personnel. Make sure that the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

Check the radiator fins. Clean the radiator with compressed air or water as needed. Check for and remove any debris on the radiator core. If the indicator light turns on again after restarting, shut down the lift truck and do not operate the lift truck until the problem is corrected.



1. FILL CAP
2. AUXILIARY COOLANT RESERVOIR
3. FULL MARK
4. ADD MARK
5. RADIATOR CAP

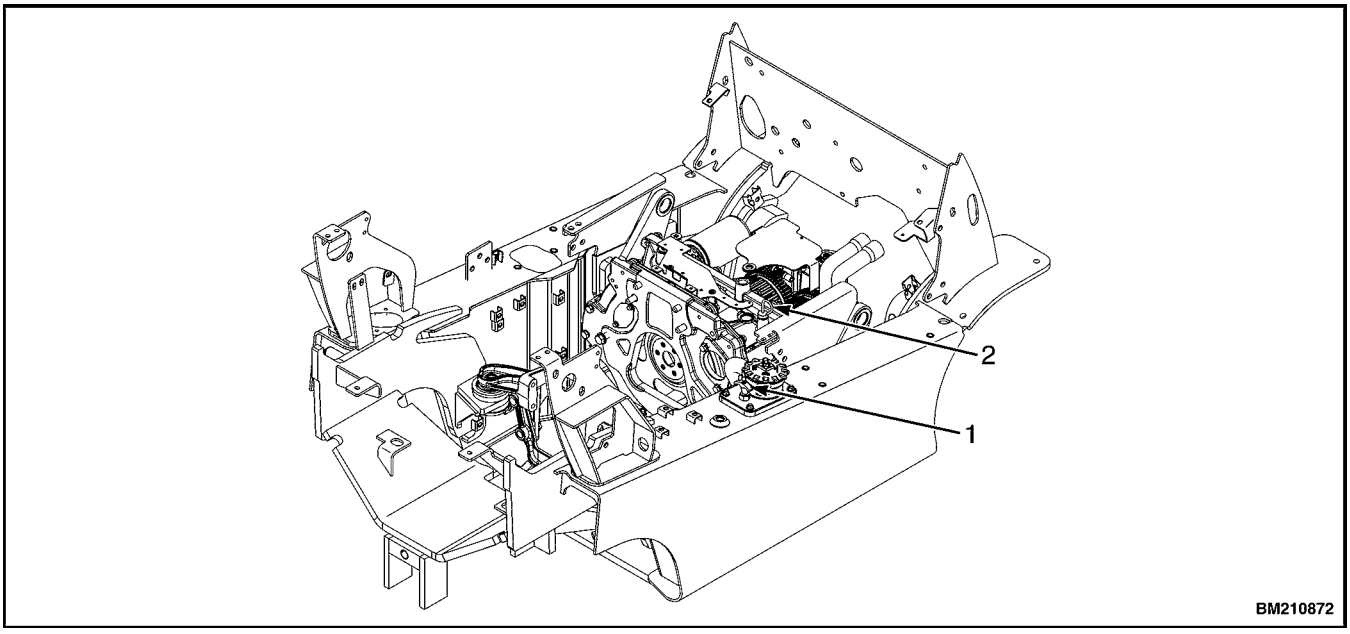
Figure 34. Auxiliary Coolant Reservoir



NOTE: IRON TRANSMISSION HOUSING SHOWN.

1. HYDRAULIC OIL DIPSTICK
2. TRANSMISSION OIL DIPSTICK

Figure 47. Transmission and Hydraulic Oil Check



NOTE: ALUMINUM TRANSMISSION HOUSING SHOWN.

1. HYDRAULIC OIL DIPSTICK
2. TRANSMISSION OIL DIPSTICK

Figure 48. Transmission and Hydraulic Oil Check

IGNITION SYSTEM

GM 2.4L Engine

The GM 2.4L 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. The correct spark plug gap is 0.8 to 0.9 mm (0.032 to 0.035 in.).

Mazda 2.0L and 2.2L Engines

The Mazda 2.0L and 2.2L engines have an electronic ignition system. Change the spark plugs and check the timing every 1000 hours. The correct spark plug gap is 0.8 ±1 mm (0.032 ±0.04 in.).

The correct timing for the Mazda 2.0L and 2.2L engines is as follows:
- Gasoline = 6° ±1° BTDC at 800 ±25 rpm (Orange mark)
- LPG = 6° ±1° BTDC at 800 ±25 rpm (Orange mark)

For all Mazda engines except 2007 emission compliant engines, see **Electrical System**, **Mazda 2.0L and 2.2L** 2200 SRM 1143. For 2007 Mazda emission compliant engines, see **Electrical System**, **Mazda 2.0L and 2.2L Emission Compliant Engines** 2200 SRM 1327.

LPG FUEL FILTER ELEMENT REPLACE, GM 2.4L ENGINE

Remove

WARNING

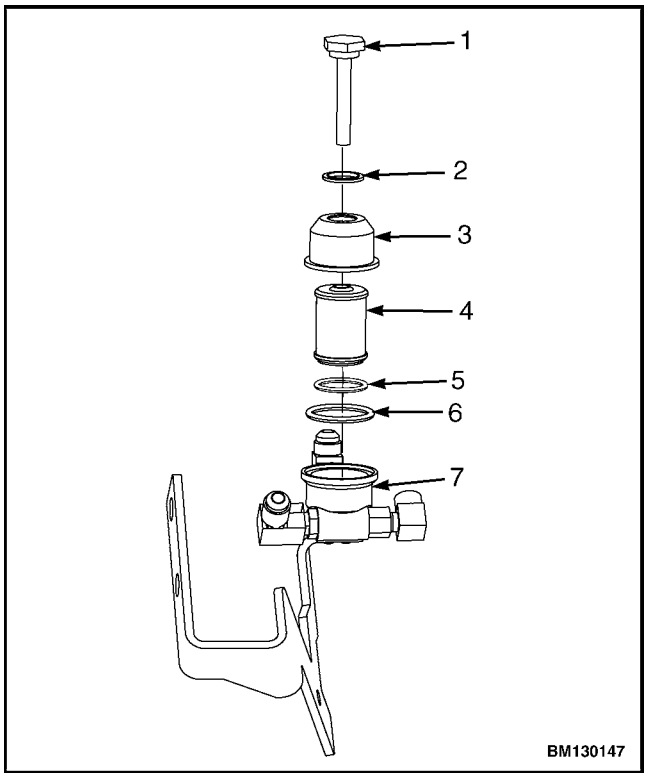
LPG can cause an explosion. DO NOT permit any sparks or open flames in the work area.

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 64.



1. BOLT
2. SEAL WASHER
3. FUEL FILTER HOUSING TOP SECTION
4. FUEL FILTER
5. FUEL FILTER O-RING
6. HOUSING O-RING
7. FUEL FILTER HOUSING BOTTOM SECTION

Figure 64. Fuel Filter Removal and Installation

4. Remove top section of fuel filter housing.
5. Remove and discard housing O-ring.
6. Remove fuel filter and fuel filter O-ring.

Install

1. Clean and inspect the fuel filter housing for contamination or damage.
2. Install the new fuel filter and fuel filter O-ring. See Figure 64.
3. Install new housing O-ring.
4. Install top section of fuel filter housing.
5. Install bolt and new seal washer. Tighten bolt to 13 N•m (115 lbf in).

2. Unlatch and remove the cover. To remove filter element, press and rotate filter element counterclockwise about 1/8 turn until the filter element is free. To assist removal, gently move the end back and forth to help break the seal. See Figure 76.

3. Gently pull the filter element from the canister. Avoid dislodging contaminants from the element or knocking it against the canister.

4. With a clean, soft rag, clean the inside surface of the canister. Remove the liner assembly to make cleaning easier. Clean well around the locking tabs that retain the element. Clean tabs make new filter element installation easier. Be careful not to knock any contaminants into the outlet tube to the engine.

5. Inspect the liner and O-ring assembly for damage. If damaged, replace the liner and O-ring assembly.

6. Install the liner assembly into the canister by pushing in. Make sure the liner assembly is properly seated in the canister. It will fit snugly into and be centered in the canister.

   If your air filter assembly is equipped with a secondary element in place of the liner assembly, replace the secondary element with every 2 to 3 primary element replacements.

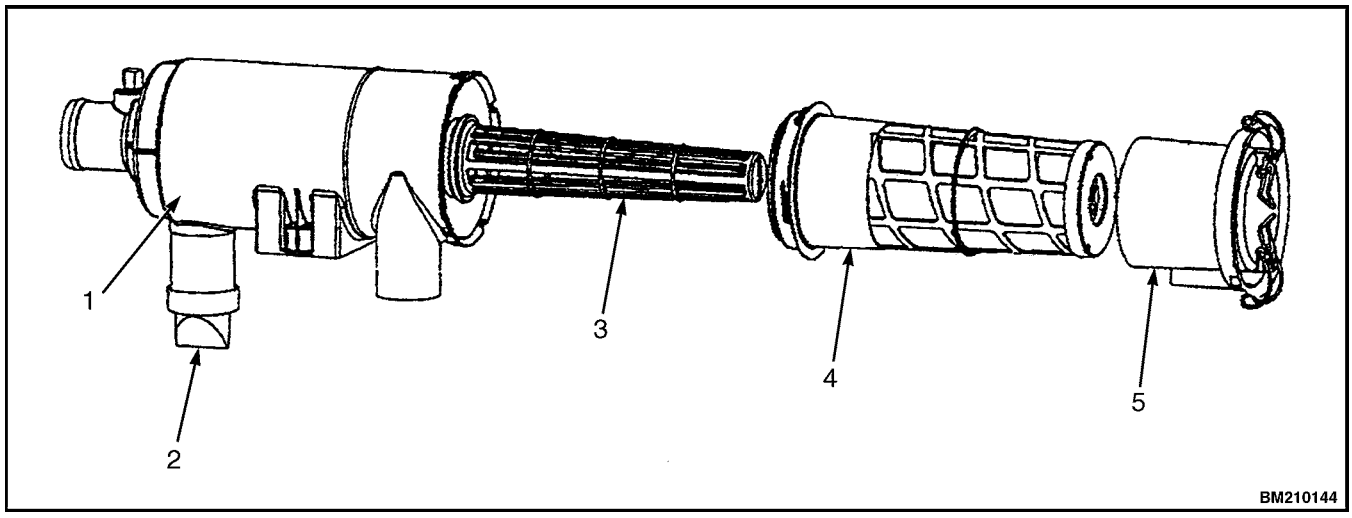
7. Inspect the new filter element for voids, cuts, tears or indentations in the urethane-sealing surfaces. Do not use if damage is detected.

CAUTION

The element must be properly installed to ensure adequate engine protection. An improperly installed element may allow dirt and dust to enter and damage the engine.

NOTE: Proper element installation is required to allow the cover to be installed correctly. Never reinstall a used element. Never install a damaged element. Always use a Hyster-approved filter element.

8. Install the new filter element into the canister. Press and rotate the filter element 1/8 turn clockwise until fully engaged in the canister. See Figure 77.



1. CANISTER
2. DUST EVACUATION VALVE
3. LINER ASSEMBLY
4. FILTER ELEMENT
5. COVER

Figure 76. Air Filter

8. Drain oil from left planetary housing as described below:
   a. Place container under left planetary housing.
   b. Remove drain plug from housing. See Figure 90. Remove and discard O-ring from drain plug.
   c. Remove fill/level plug from housing. Removing fill/level plug allows oil to drain at a faster rate. See Figure 89.
   d. Drain oil into container. When oil has completely drained, install new O-ring on drain plug then install drain plug in housing. Tighten drain plug to40 N•m (29.5 lbf ft)

WARNING

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

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

9. Clean screen with cleaning solvent, and dry with compressed air, adjusted to a maximum output of 103 kPa (15 psi).

NOTE: Perform Step 10 and Step 11 for lift trucks equipped with an iron transmission housing.

10. When oil has drained, first install screen, then spring, and drain plug.

11. Remove and discard old oil filter. Apply clean oil to gasket of new filter. Install new filter and hand tighten.

NOTE: Perform Step 12 through Step 16 for lift trucks equipped with an aluminum transmission housing.

12. Install new transmission breather. See Figure 87 and Figure 88.

13. Install suction screen and suction screen spring. See Figure 87 and Figure 88.

14. Using seven washers and seven capscrews install new charge pump gasket and charge pump. See Figure 87 and Figure 88. Tighten capscrews to 19 N•m (168 lbf in).

15. Apply a 3 to 5 mm (0.12 to 0.20 in.) bead of sealant to either hydraulic gear pump or transmission housing face. Hold pump in the correct position on the transmission. Install flange head capscrews into pump and transmission housing. See Figure 87 and Figure 88. Tighten capscrews to 38 N•m (28 lbf ft).

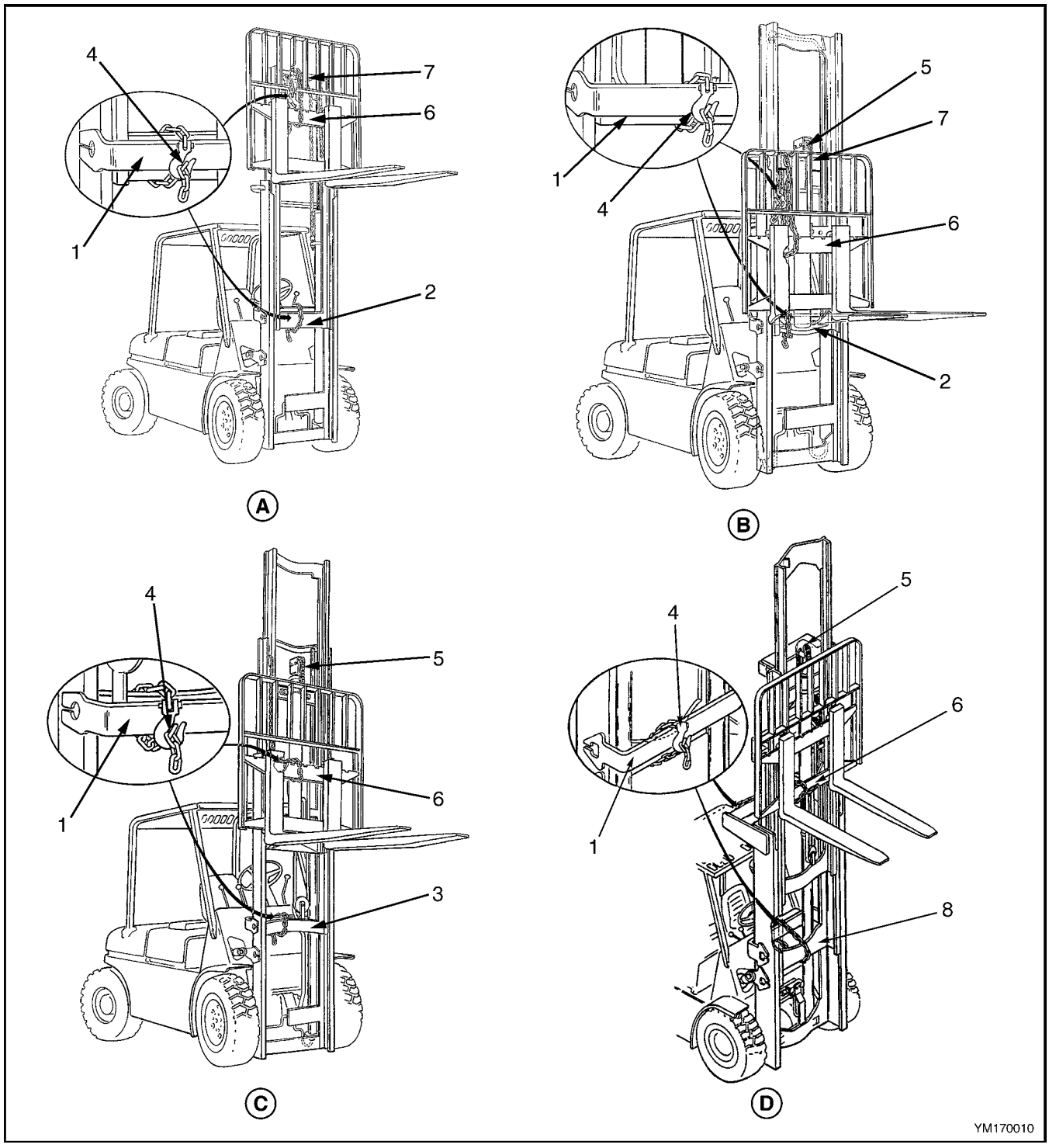
16. Apply clean oil to gasket of new transmission oil filter and install filter. See Figure 87 and Figure 88.

17. Add transmission oil to transmission at the dipstick tube. The correct oil and volume is shown in the Maintenance Schedule.

NOTE: Transmission oil temperature should be at least 50°C (120°F) when checking oil level.

18. Start and run the engine for approximately five minutes after fill to allow oil to lubricate parts within the transmission. Add transmission oil to transmission at the dipstick tube as needed.

19. Turn the key to the **OFF** position and check for leaks and check oil level.



A. TWO-STAGE LFL MAST
B. TWO-STAGE FFL MAST
C. THREE-STAGE FFL MAST
D. FOUR-STAGE FFL MAST

1. OUTER MAST
2. INNER MAST
3. INTERMEDIATE MAST
4. HOOK
5. FREE-LIFT CYLINDER
6. CARRIAGE BAR
7. CROSSMEMBER
8. FIRST INTERMEDIATE MAST

Figure 100. Two-Stage, Free-Lift, Three-Stage, and Four-Stage Masts

CAUTION

DO NOT use pneumatic-shaped, solid tires on two-piece bolt together drive wheels. Spinning may occur.

6. Install the three-piece or four piece wheel in the tire a shown in Install Three-Piece or Four-Piece Wheel in Tire.
7. Install the two-piece wheel in the tire as shown in Install Tire on Two-Piece Wheel.

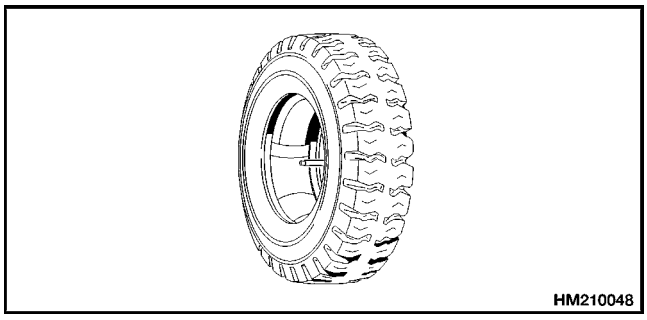
Install Three-Piece or Four-Piece Wheel in Tire

WARNING

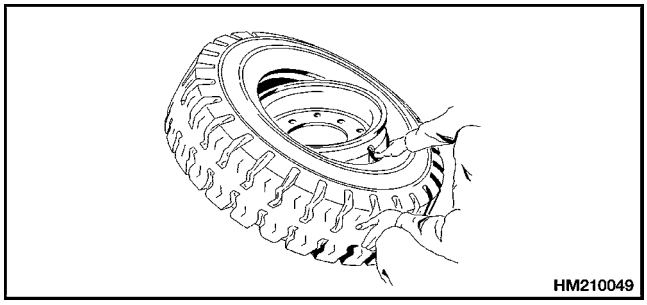
Make sure all of the air pressure is removed from the tire before a wheel is disassembled. Air pressure in the tires can cause the tire and rim parts to explode causing serious injury or death.

Keep tire tools in firm contact with the wheel parts. If the tool slips, it can move with enough force to cause an injury.

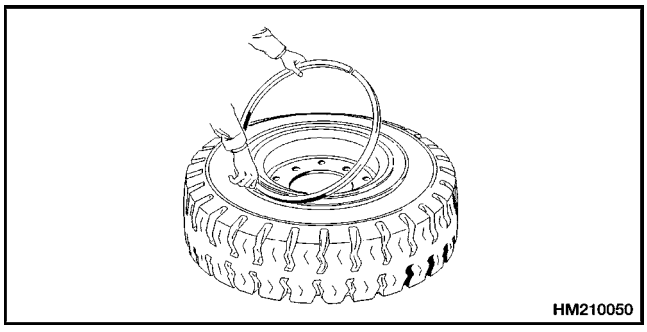
STEP 1.
Install inner tube and rubber flap in tire.



STEP 2.
Install wheel rim in tire. Make sure stem of inner tube is aligned with slot in rim.



STEP 3.
Turn over rim and tire. Put blocks under rim so rim is 8 to 10 cm (3 to 4 in.) above floor. Install flange seat (if used) and lock ring.



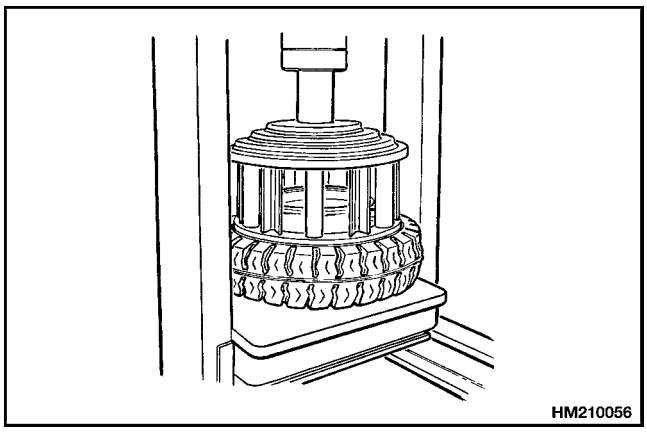
Remove Wheel From Tire

NOTE: When you disassemble the wheels, see Figure 105. There are several types of wheels used on these series of lift trucks.

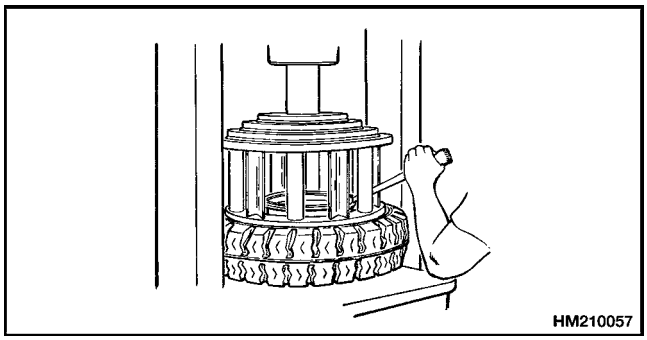
WARNING

Keep tire tools in firm contact with the wheel. If the tool slips, it can move with enough force to cause serious injury. Always wear safety glasses.

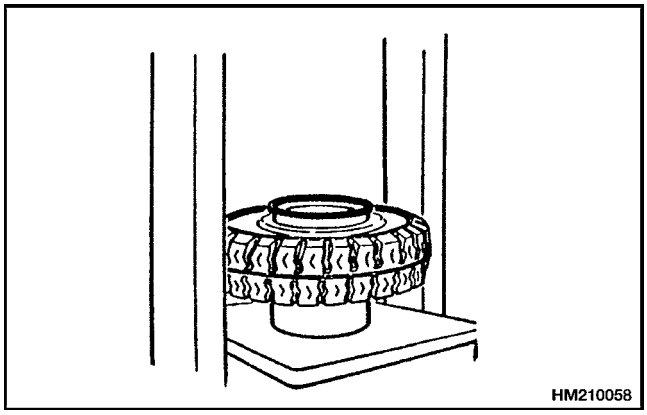
STEP 1.
Put wheel rim on bed of press. Put cage in position on tire. Use press to push tire away from side flange.



STEP 2.
Put tire tool into slot between lock ring and wheel rim. Remove lock ring and side flange.



STEP 3.
Turn tire over. Put a support under wheel rim. Make sure wheel rim is at least 150 to 200 mm (6 to 8 in.) from bed of press.

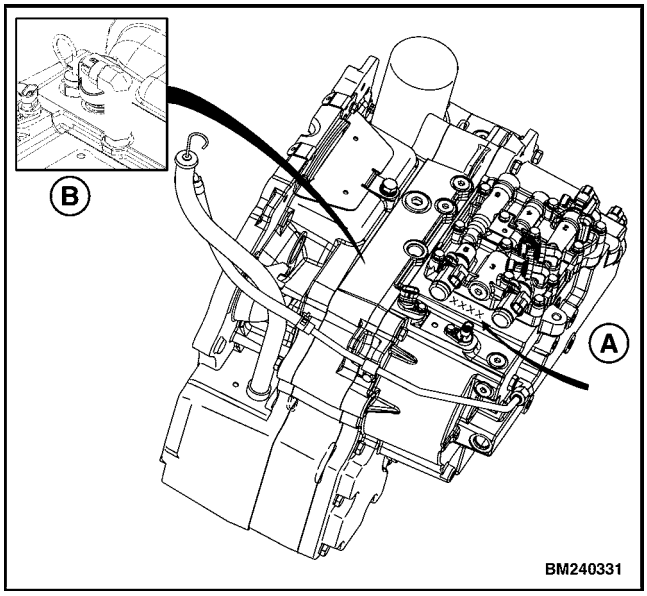


General

This section has the repair procedures for the transmission.

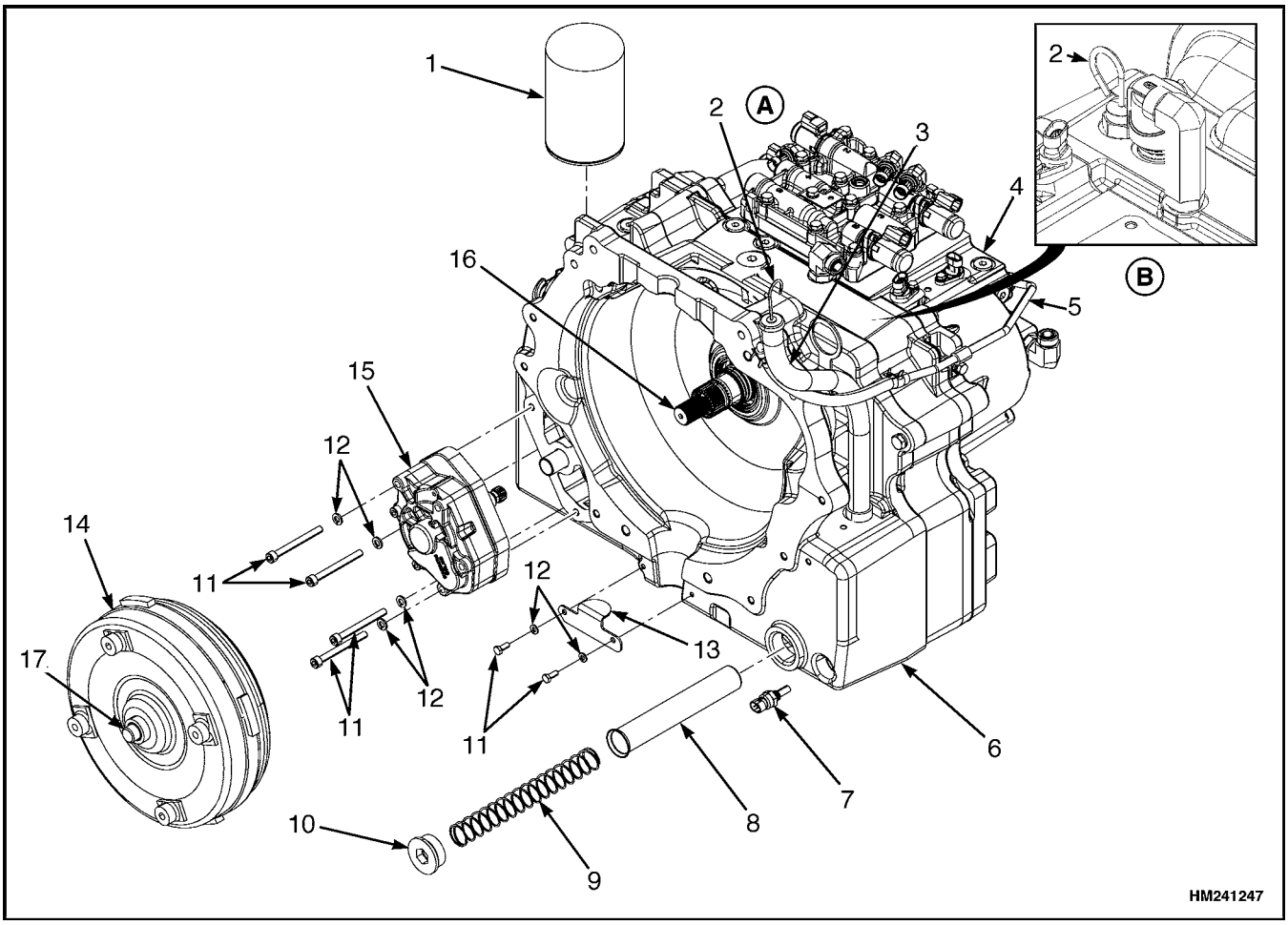
SERIAL NUMBER

The transmission serial number is located on the right side of the transmission control valve directly below the floor plate. See Figure 1.



A. EARLY LIFT TRUCK MODELS EXCEPT H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005) MODELS
B. NEWER LIFT TRUCK MODELS

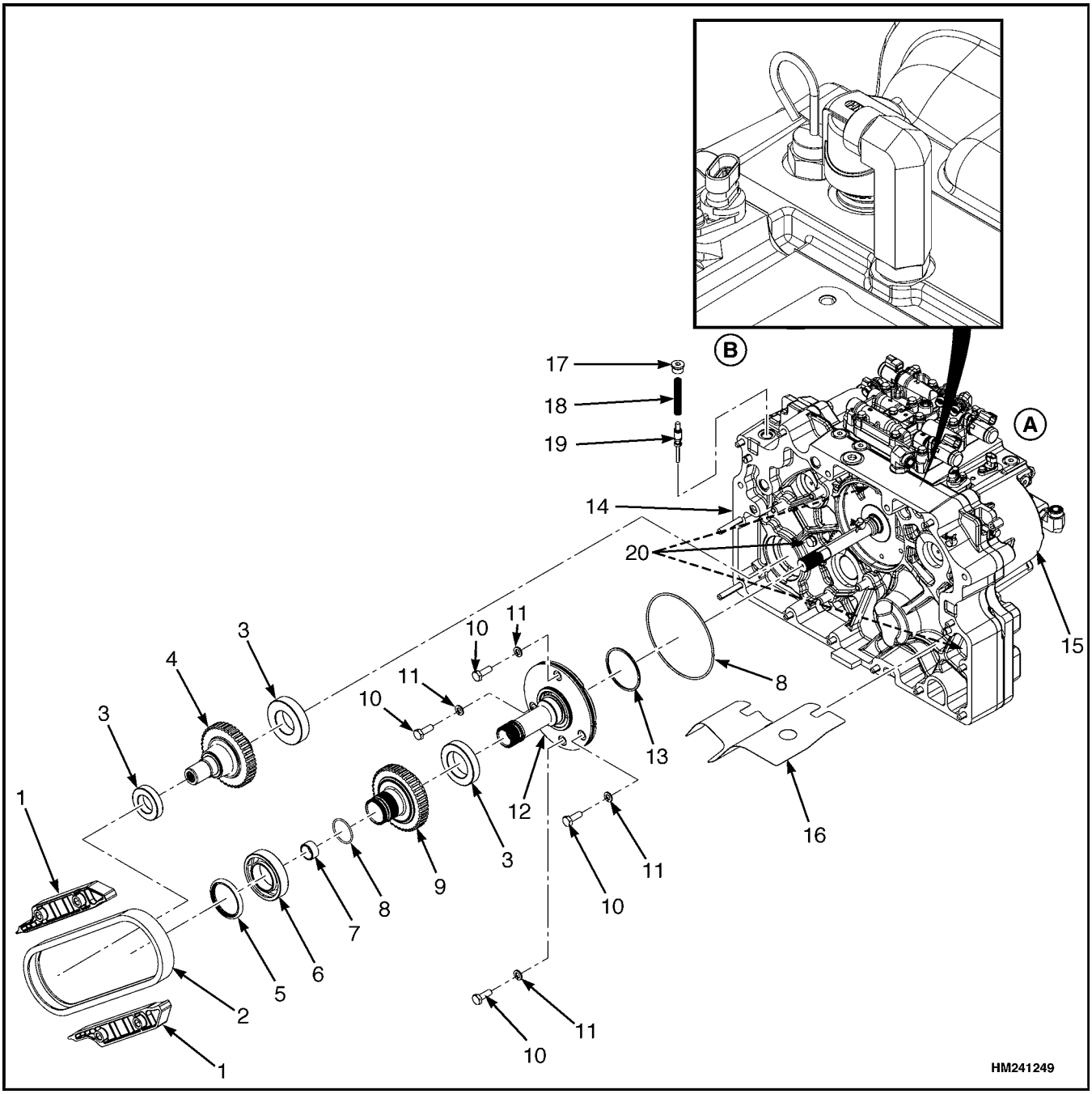
Figure 1. Transmission Serial Number Location



A. EARLY LIFT TRUCK MODELS EXCEPT H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005) MODELS
B. NEWER LIFT TRUCK MODELS

1. TRANSMISSION OIL FILTER
2. DIPSTICK
3. DIPSTICK TUBE
4. TRANSMISSION HOUSING
5. VENT TUBE ASSEMBLY
6. TORQUE CONVERTER HOUSING
7. TRANSMISSION OIL TEMPERATURE SENSOR
8. SUCTION SCREEN
9. SUCTION SCREEN SPRING
10. PLUG
11. CAPSCREW
12. WASHER
13. SMALL ACCESS COVER
14. TORQUE CONVERTER
15. TRANSMISSION CHARGE PUMP
16. STATOR SUPPORT
17. PILOT HUB

Figure 8. Torque Converter Installation



A. EARLY LIFT TRUCK MODELS EXCEPT H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005) MODELS

B. NEWER LIFT TRUCK MODELS

1. SNUBBER
2. PUMP DRIVE CHAIN
3. BEARING
4. DRIVEN SPROCKET
5. OIL SEAL
6. ANGULAR CONTACT BEARING
7. BUSHING
8. O-RING
9. DRIVING SPROCKET
10. CAPSCREW
11. LOCKWASHER
12. STATOR SUPPORT
13. SEALING RING
14. FRONT COVER HOUSING
15. TRANSMISSION HOUSING
16. BAFFLE
17. PLUG
18. REGULATOR COMPRESSION SPRING
19. REGULATOR SPOOL
20. FRONT COVER HOUSING MOUNTING CAPSCREWS

Figure 15. Chain Drive

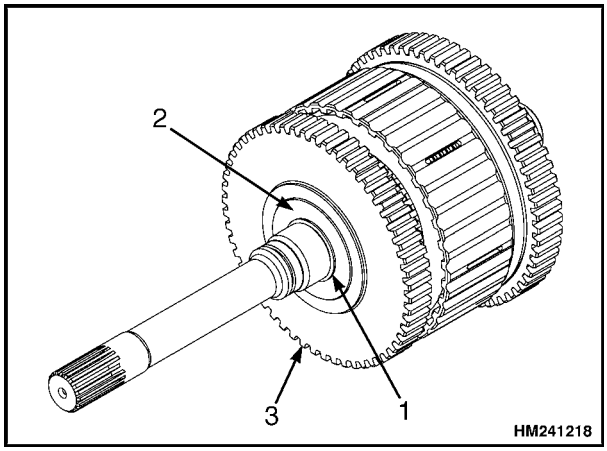
WARNING

Make sure that the engine/transmission assembly is stable before attempting to rotate the engine.

Use a flashlight to see the bolts as they are rotated into view through the access hole. Do not use your fingers to check for alignment of the bolts with the access hole.

3. Move each bolt into view through the access hole of the flywheel housing by rotating the crankshaft. Remove the four capscrews that attach the flywheel to the torque converter. See Figure 21.

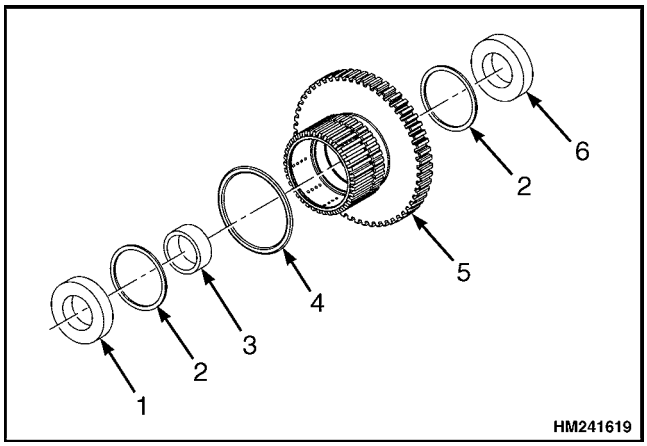
STEP 3.
Remove the snap ring from the output gear. Remove the output gear from the input shaft



1. SNAP RING
2. BEARING
3. OUTPUT GEAR

NOTE: Before removing the seal bearing, note the position of the seal on the bearing.

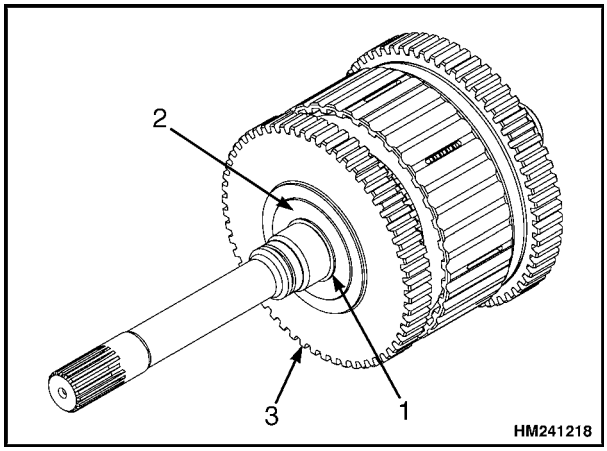
STEP 4.
Remove seal from the output gear. Remove seal bearing, snap ring, spacer, snap ring, and bearing from the output gear.



1. SEAL BEARING
2. SNAP RING
3. SPACER
4. SEAL
5. OUTPUT GEAR
6. BEARING

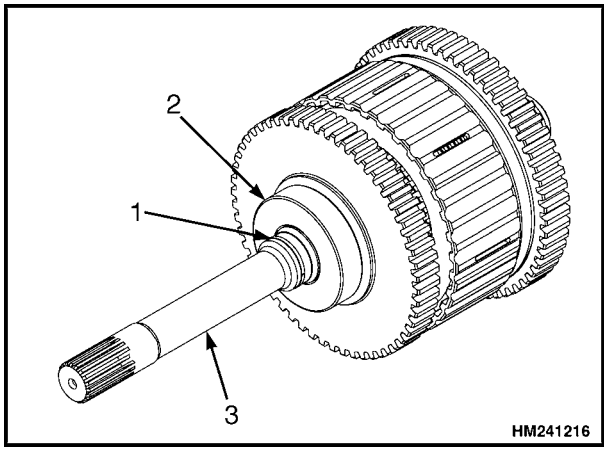
NOTE: On 2-speed transmissions, there will be a back plate in front of the pressure plate.

STEP 10.
Install the output gear on the input shaft. Install bearing and snap ring in the output gear.



1. SNAP RING
2. BEARING
3. OUTPUT GEAR

STEP 11.
Install the bearing and shaft seal on the input shaft.



1. SHAFT SEAL
2. BEARING
3. INPUT SHAFT

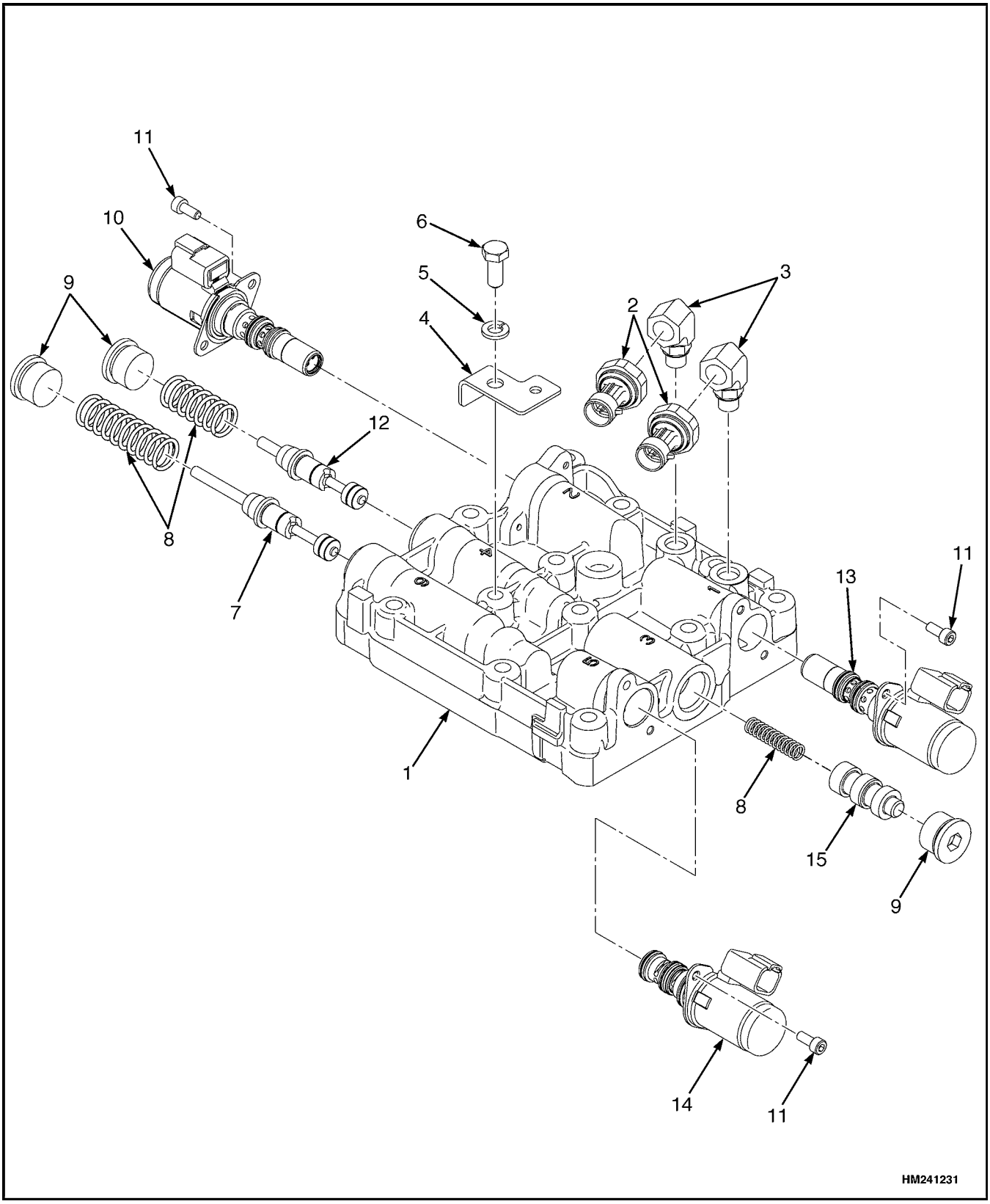


Figure 32. Control Valve Arrangement

Charge Pump Repair

REMOVE

WARNING

Make sure engine and transmission are held in position so that they will not fall and cause an injury and damage to equipment.

WARNING

The engine and transmission are heavy. Make sure that any lifting device has enough capacity to lift the engine and transmission.

The engine can weigh approximately 194 kg (428 lb).

The transmission can weigh approximately 84 kg (185 lb).

NOTE: Charge pump can be removed from transmission while it is still in lift truck. However, for the sake of clarity, illustrations in following steps are shown with transmission removed from lift truck.

NOTE: Perform Step 1 through Step 4 if engine and transmission are removed from lift truck.

1. Using a lifting device, remove engine from lift truck.

   See section **Frame** 100 SRM 1120 for removal procedures for lift truck models listed below:
   - S30FT, S35FT, S40FTS (E010)
   - H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
   - S2.0-3.5FT (S40-70FT) (F187)
   - H2.0-3.5FT (H40-70FT) (L177)

   See section **Frame** 100 SRM 1423 for removal procedures for lift truck models listed below:
   - S50CT (A267)
   - H50CT (A274)

2. Using a lifting device, remove transmission from lift truck.

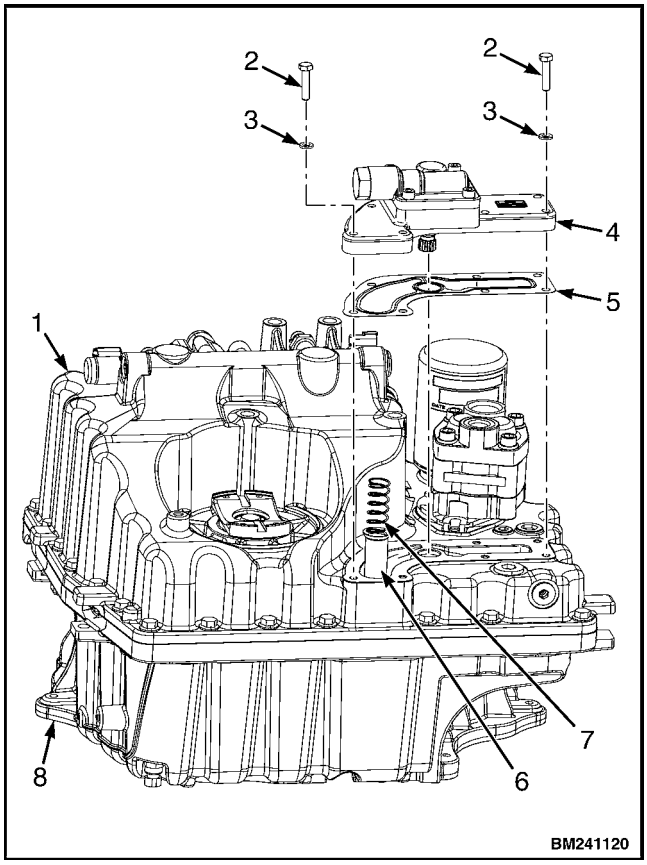
   See section **Frame** 100 SRM 1120 for removal procedures for lift truck models listed below:
   - S30FT, S35FT, S40FTS (E010)
   - H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
   - S2.0-3.5FT (S40-70FT) (F187)
   - H2.0-3.5FT (H40-70FT) (L177)

   See section **Frame** 100 SRM 1423 for removal procedures for lift truck models listed below:
   - S50CT (A267)
   - H50CT (A274)

3. Remove torque converter from torque converter housing. See Torque Converter Replacement in this manual for procedure.

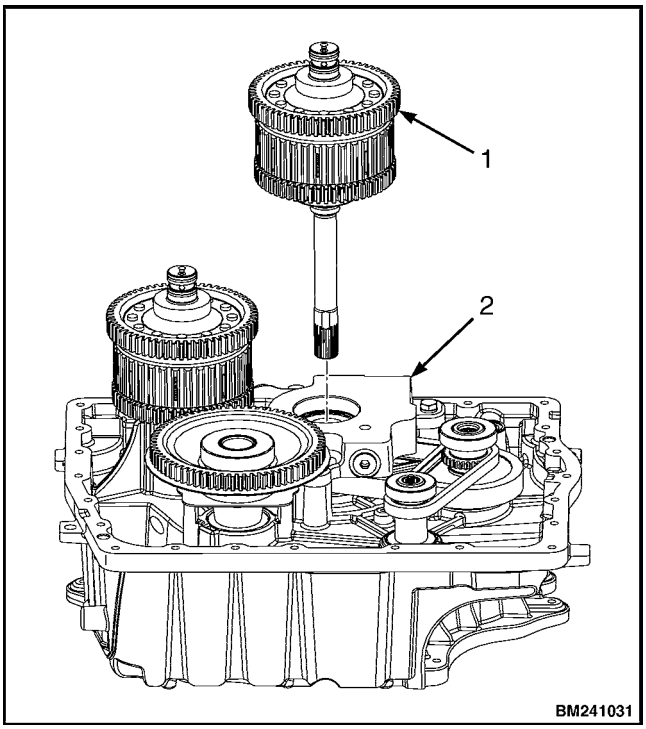
4. Place transmission on torque converter housing face. See Figure 4.

5. Remove seven capscrews, seven washers, charge pump, and charge pump gasket from transmission housing. See Figure 4. Discard charge pump gasket.



1. TRANSMISSION HOUSING
2. CAPSCREW
3. WASHER
4. CHARGE PUMP
5. CHARGE PUMP GASKET
6. SUCTION SCREEN
7. SUCTION SCREEN SPRING
8. TORQUE CONVERTER HOUSING

Figure 4. Charge Pump



1. FORWARD CLUTCH ASSEMBLY
2. STATOR SUPPORT ASSEMBLY

Figure 13. Forward Clutch

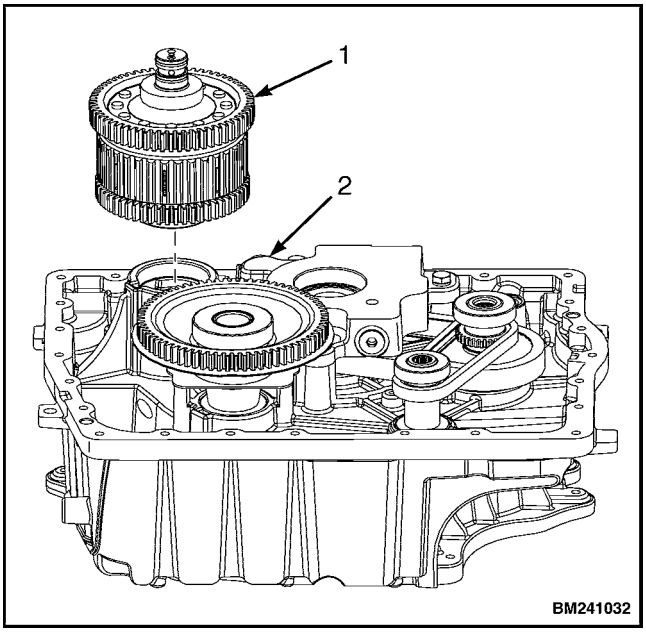


Figure 14. Reverse Clutch

Legend for Figure 14

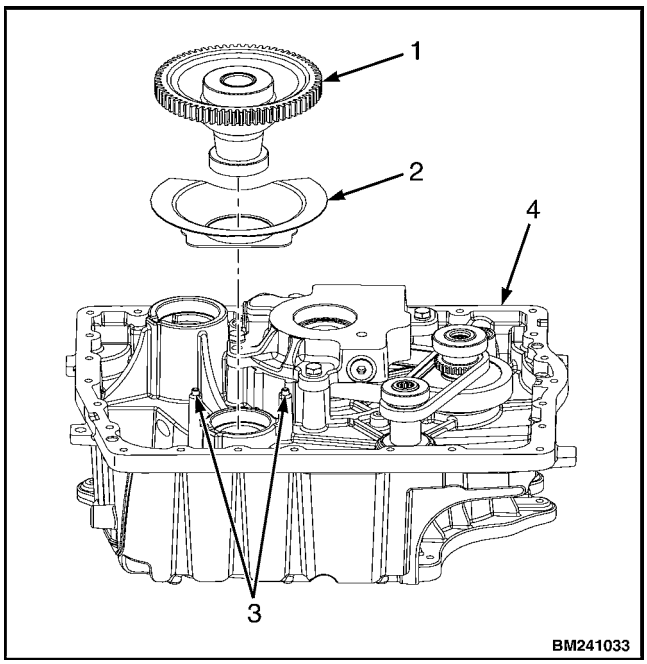
1. REVERSE CLUTCH ASSEMBLY
2. CONVERTER HOUSING

20. Remove output gear from output gear cover. See Figure 15.

21. Remove output gear cover from pins in converter housing. See Figure 15.

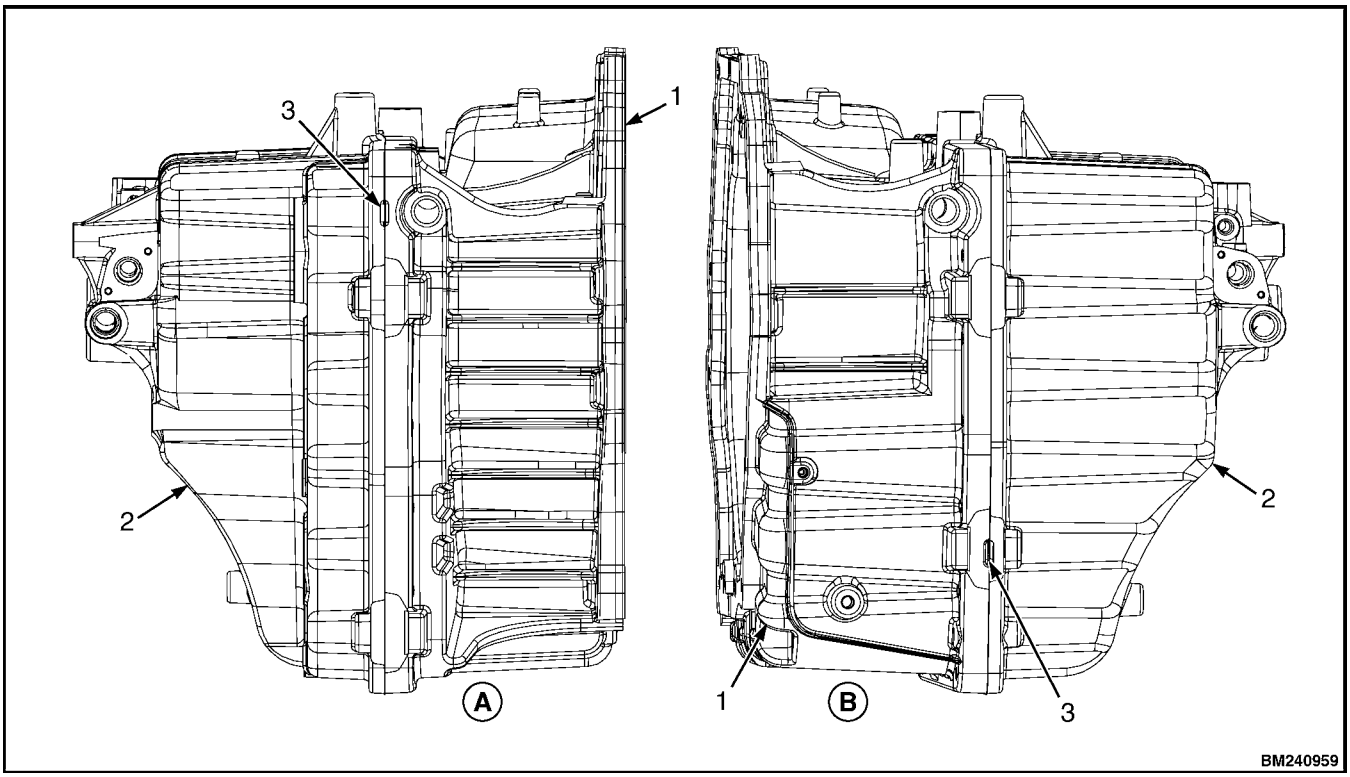
NOTE: Be careful when removing stator support, input gear may hang up.

22. Remove four capscrews, four lockwashers, stator support assembly, and sealing ring from input gear. Remove and discard O-rings from converter housing. Remove and discard sealing ring from stator support assembly. See Figure 16.



1. TRANSMISSION OUTPUT GEAR
2. OUTPUT GEAR COVER
3. PIN
4. CONVERTER HOUSING

Figure 15. Output Gear



A. LEFT SIDE AS VIEWED FROM DRIVERS SEAT

1. CONVERTER HOUSING
2. TRANSMISSION HOUSING

B. RIGHT SIDE AS VIEWED FROM DRIVERS SEAT

3. PRY POINT

Figure 26. Pry Points

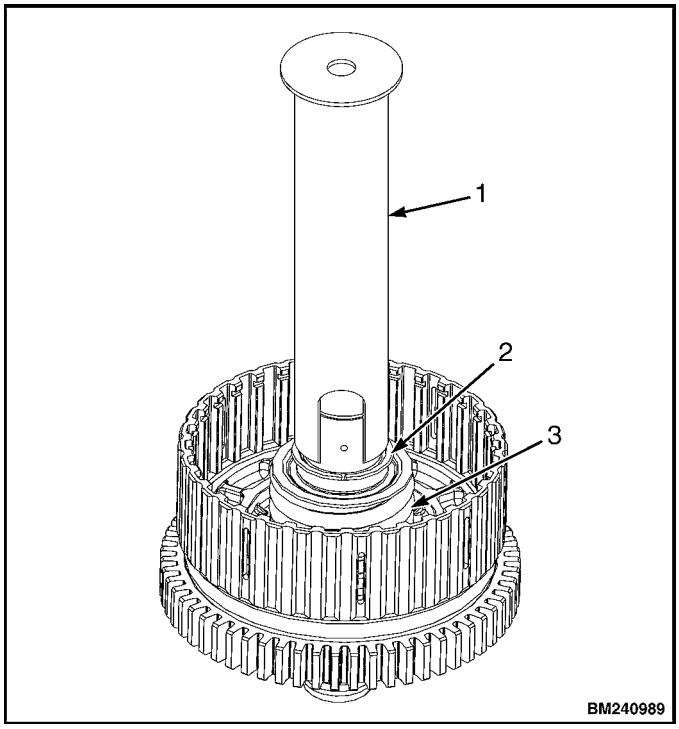
WARNING

The springs for the piston are compressed. Make sure the springs and spring retainer cannot cause injury when the snap ring is removed.

NOTE: Remove the piston only if there is a problem with the piston or piston seals.

STEP 8.

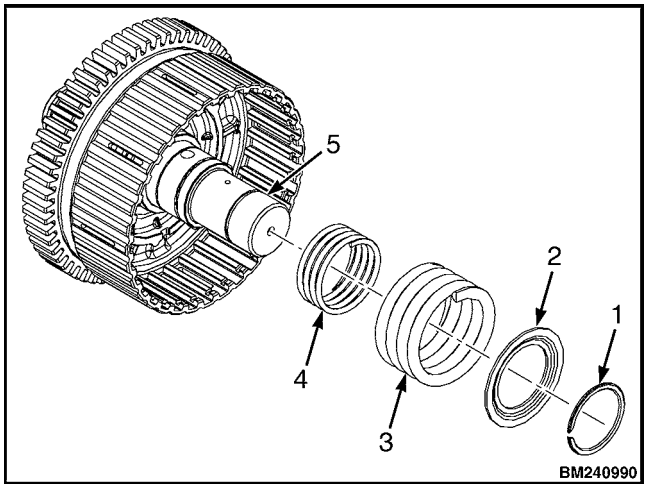
Using spring compression tool Hyster P/N 867890 and a press, place spring compression tool on spring guide with the opening of the tool above the opening of snap ring, and compress large and small springs just enough to allow removal of snap ring from spring guide. Slowly release the press to decompress springs.



1. SPRING COMPRESSION TOOL
2. SNAP RING
3. SPRING GUIDE

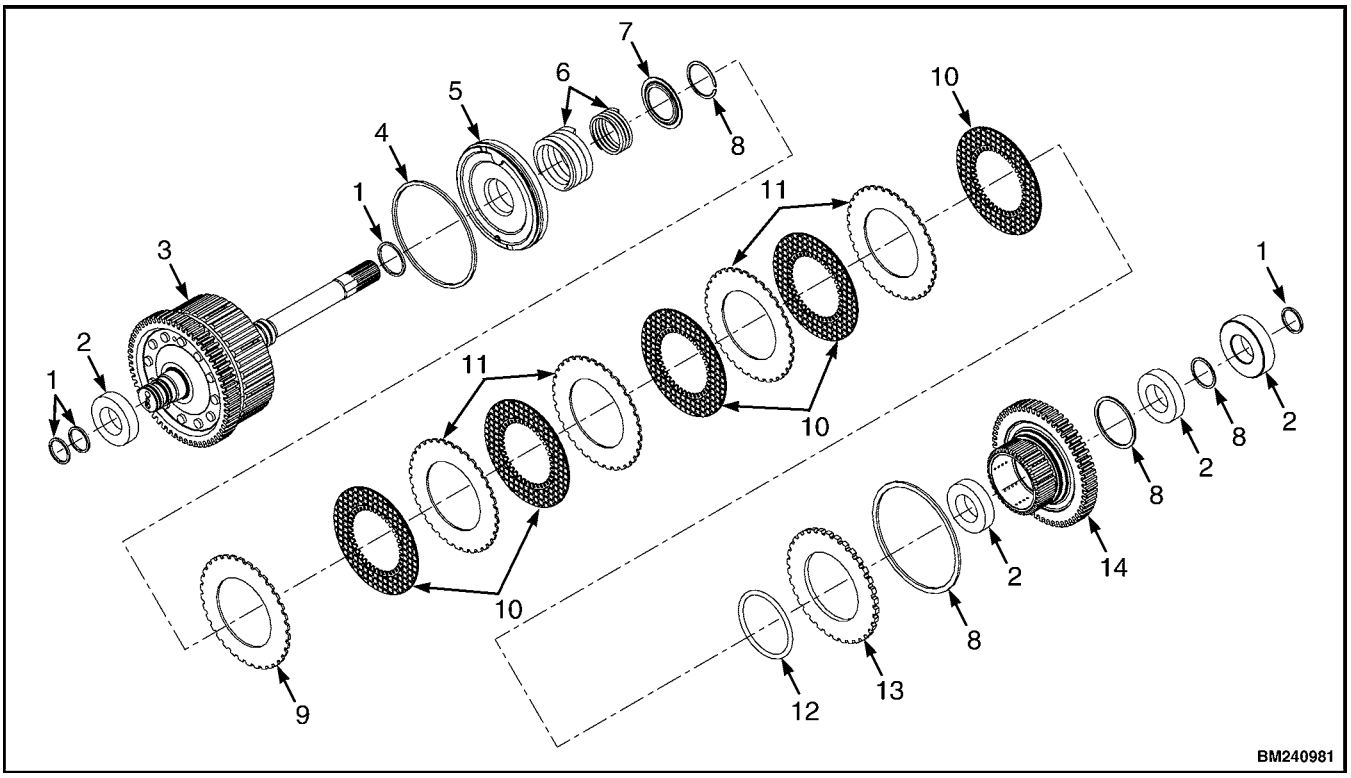
STEP 9.

Remove snap ring, spring guide, large spring, and small spring from center shaft.



1. SNAP RING
2. SPRING GUIDE
3. LARGE SPRING
4. SMALL SPRING
5. CENTER SHAFT

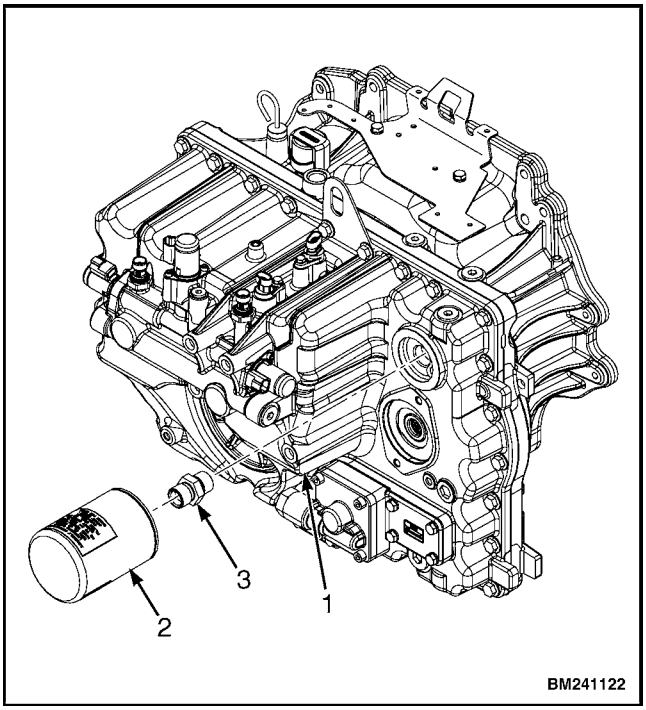
Forward Clutch Pack



1. SEAL
2. BEARING
3. GEAR ASSEMBLY DRUM
4. PISTON SEAL
5. PISTON
6. SPRING
7. SPRING GUIDE
8. SNAP RING
9. CONICAL PLATE
10. FRICTION DISK
11. SEPARATOR PLATE
12. PRESSURE PLATE O-RING
13. PRESSURE PLATE
14. OUTPUT GEAR

Figure 29. Forward Clutch Pack Assembly

10. Install filter post fitting and transmission filter on transmission housing. See Figure 35.



1. TRANSMISSION HOUSING
2. TRANSMISSION FILTER
3. FILTER POST FITTING

Figure 35. Transmission Filter and Fitting

11. Install charge pump on transmission housing. See section Charge Pump Repair for installation procedures.

12. Install torque converter on stator support. See Torque Converter Replacement for procedures.

13. If removed, connect a lifting device to eyebolt bracket.

WARNING

Make sure the engine and transmission are held in position so that they will not fall and cause injury and damage to equipment.

WARNING

The engine and transmission are heavy. Make sure that any lifting device has enough capacity to lift the engine and transmission.

The engine can weigh approximately 194 kg (428 lb).

The transmission can weigh approximately 84 kg (185 lb).

14. Using a lifting device, carefully install transmission on lift truck frame. Place blocks under transmission for stability.

See section **Frame** 100 SRM 1120 for install procedures for lift truck models listed below:
- S30FT, S35FT, S40FTS (E010)
- H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
- S2.0-3.5FT (S40-70FT) (F187)
- H2.0-3.5FT (H40-70FT) (L177)

See section **Frame** 100 SRM 1423 for install procedures for lift truck models listed below:
- S50CT (A267)
- H50CT (A274)

15. Install hydraulic gear pump or variable displacement pump. See section Hydraulic Gear Pump for installation procedures.

WARNING

Make sure the engine and transmission are held in position so that they will not fall and cause an injury and damage to equipment.

WARNING

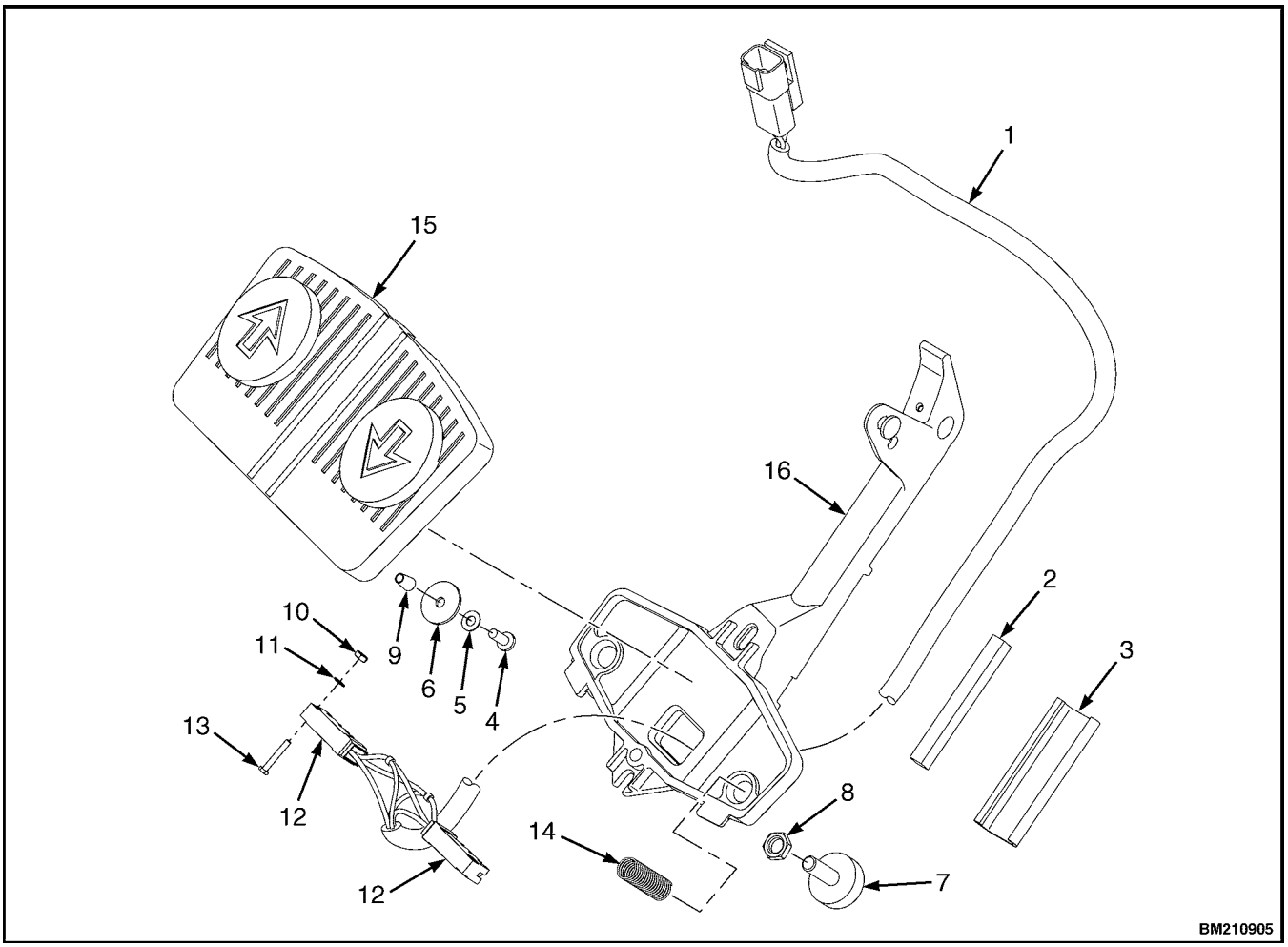
The engine and transmission are heavy. Make sure that any lifting device has enough capacity to lift the engine and transmission.

The engine can weigh approximately 194 kg (428 lb).

The transmission can weigh approximately 84 kg (185 lb).

16. Using a lifting device, install engine into lift truck.

See section **Frame** 100 SRM 1120 for lift truck models listed below:
- S30FT, S35FT, S40FTS (E010)
- H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)
- H2.0-3.5FT (H40-70FT) (L177)



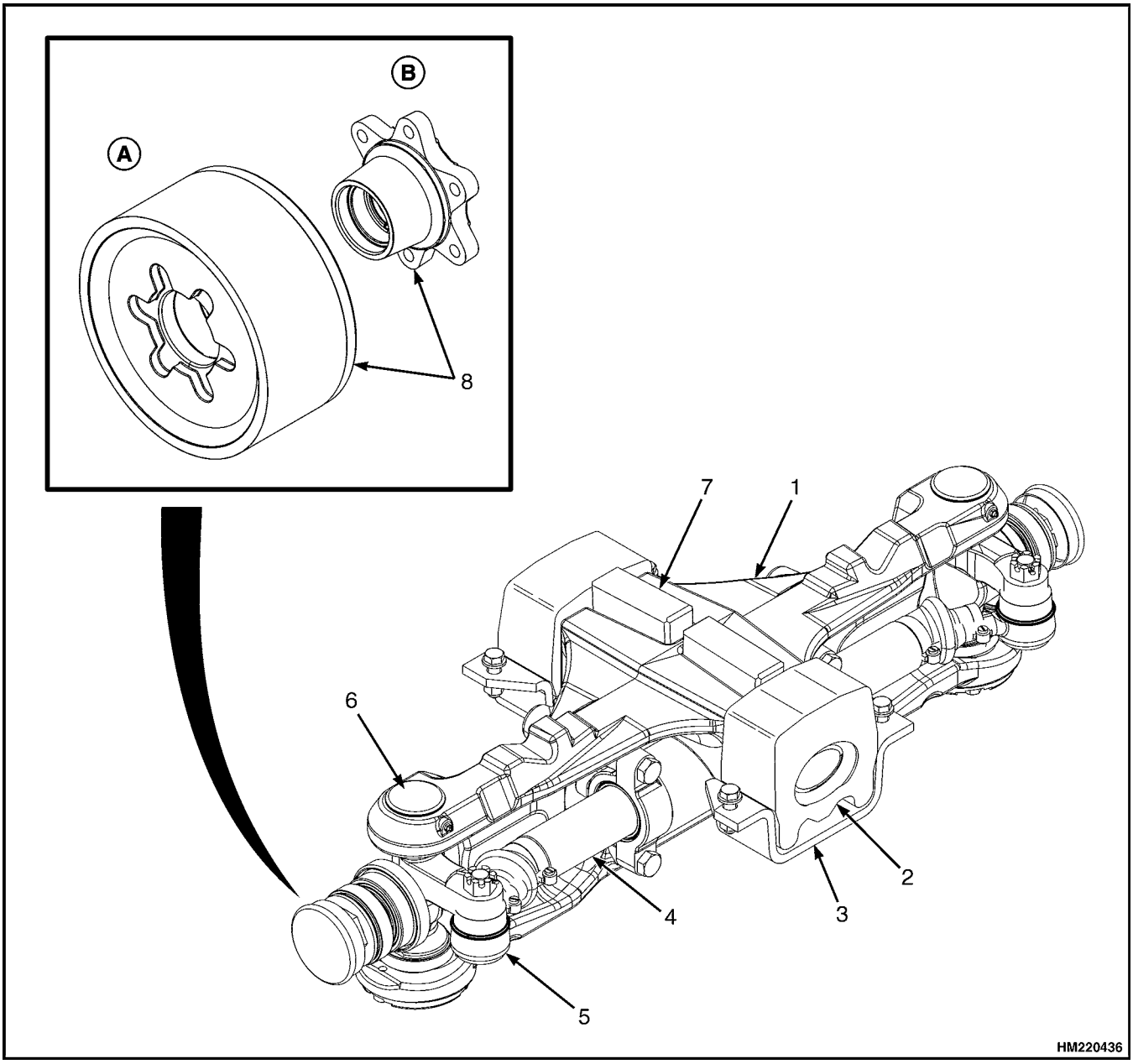
1. WIRING HARNESS
2. FOAM LOCK SEAL
3. U-CLIP
4. PAN HEAD SCREW
5. LOCKWASHER
6. WASHER
7. STOP SCREW
8. NUT
9. METAL INSERT
10. NUT
11. LOCKWASHER
12. MICROSWITCH
13. HEX HEAD SCREW
14. SPRING
15. PEDAL PAD
16. PEDAL FRAME

Figure 52. MONOTROL Pedal

11. Remove four pan head screws, lockwashers, washers, pedal pad and springs from pedal frame. If any metal inserts in pedal pad are damaged, replace as necessary. See Figure 52.

12. Remove two hex head screws, lockwashers, nuts, and microswitch from pedal pad. Repeat for remaining microswitch and remove wiring harness from pedal frame. See Figure 52.

13. If damaged, remove stop screw and nut from pedal frame. See Figure 52.



A. CUSHION TRUCKS ONLY

B. PNEUMATIC TRUCKS ONLY

1. AXLE FRAME
2. MOUNT
3. BRACKET
4. STEERING CYLINDER
5. TIE ROD
6. SPINDLE
7. MOUNT
8. HUB ASSEMBLIES

Figure 1. Steering Axle

INSPECT

1. Inspect for loose, burned, missing, cracked or damaged hardware.

2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion or marred finish.

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

ASSEMBLE

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

Periodic Maintenance 8000 SRM 1150 for lift truck models
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)
- H2.0-3.5FT (H40-70FT) (L177)

Periodic Maintenance 8000 SRM 1207 for lift truck models
- S30FT, S35FT, S40FTS (E010)
- H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)

Periodic Maintenance 8000 SRM 1248 for lift truck models
- S4.0, 4.5, 5.5FT, S5.5FTS, (S80, 100, 120FT; S80, 100FTBCS; S120FTS; S120FTPRS) (G004)
- H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)

Periodic Maintenance 8000 SRM 1319 for lift truck models
- S6.0FT, S7.0FT, (S135FT, S155FT) (D024, E024)

Periodic Maintenance 8000 SRM 1322 for lift truck models
- H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)

Periodic Maintenance 8000 SRM 1407
- H8.0FT, H8.0FT9, H9.0FT (H170FT, H170FT36, H190FT) (A299)

1. If necessary, use a press to install new bearing cups in wheel or hub.

   See Figure 9 for lift truck model
   - S2.0-3.5FT (S40-70FT, S55FTS) (F187)

   See Figure 10 for lift truck model
   - H2.0-3.5FT (H40-70FT) (L177)

   See Figure 11 for lift truck model
   - H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)

   See Figure 12 for lift truck model
   - S30FT, S35FT, S40FTS (E010)

   See Figure 13 for lift truck model
   - S4.0, 4.5, 5.5FT, S5.5FTS, (S80, 100, 120FT; S80, 100FTBCS; S120FTS; S120FTPRS) (G004)

   See Figure 15 for lift truck models
   - S6.0FT, S7.0FT, (S135FT,S155FT) (D024, E024)

   See Figure 14 for lift truck models
   - H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)

   See Figure 16 for lift truck models
   - H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)
   - H8.0FT, H8.0FT9, H9.0FT (H170FT, H170FT36, H190FT) (A299)

   Lubricate bearing cones with multipurpose grease. Verify bearings are filled with grease. Install oil seal, wear sleeve (if removed) and inner bearing cone on spindle.

NOTE: The spindle bearings must have no clearance. Install shims 0.00 to 0.13 mm (0.000 to 0.005 in.) less than the measured gap.

4. Install the O-ring on the bearing cap. Apply Loctite® 242 to threads of capscrews. Install the bearing cap and capscrews.

Tighten the capscrews to 44 N•m (32 lbf ft) for lift truck model
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)

Tighten the capscrews to 52 N•m (38 lbf ft) for lift truck models
- S4.0, 4.5, 5.5FT, S5.5FTS, (S80, 100, 120FT; S80, 100FTBCS; S120FTS; S120FTPRS) (G004)
- S6.0FT, S7.0FT, (S135FT, S155FT) (D024, E024)

Tighten capscrews to 45 to 50 N•m (33 to 37 lbf ft) for lift truck models
- H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)

Tighten capscrews to 47 N•m (35 lbf ft) for lift truck models
- H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)
- H8.0FT, H8.0FT9, H9.0FT (H170FT, H170FT36, H190FT) (A299)

5. If necessary, repeat the procedure for the other spindle and tie rod.

Install

NOTE: Tie rod end may be attached to spindle arm by one of two methods, castle nut and cotter pin or with snap rings, washers and pins.

1. Install the tie rod to the spindle arm and steering cylinder.

If removed, tighten the castle nut to 163 N•m (120 lbf ft) for lift truck model
- S2.0-3.5FT (S40-70FT, S55FTS) (F187)

If removed, tighten the castle nut to 175 N•m (129 lbf ft) for lift truck model
- S4.0, 4.5, 5.5FT, S5.5FTS, (S80, 100, 120FT; S80, 100FTBCS; S120FTS; S120FTPRS) (G004)

Tighten the castle nut until the new cotter pin can be installed.

2. Install tie rod end to spindle arm and steering cylinder with pins, washers and snap rings (see Figure 27) for lift truck models:
- H4.0FT5/FT6; H4.5FTS5, H4.5FT6; H5.0-5.5FT (H80, 90, 100, 110, 120FT) (N005, P005)
- S6.0FT, S7.0FT, (S135FT, S155FT) (D024, E024)
- H6.0FT, H7.0FT (H135FT, H155FT) (H006, J006)
- H8.0FT, H8.0FT9, H9.0FT (H170FT, H170FT36, H190FT) (A299)

3. Install the grease cap on the top of the steering axle.

4. Install the bearings and wheel. See Steering Axle Assembly Repair, Assemble.

5. If necessary, repeat the procedure for the other spindle and tie rod.

6. Remove the lift truck from blocks.

Steering Cylinder Repair

REMOVE AND DISASSEMBLE

NOTE: The end caps of the steering cylinder are held in the shell by the installation of cylinder mount capscrews into the axle frame. To prevent oil leaks at the caps, hold the caps on the shell during removal.

NOTE: Hydraulic oil is to be disposed of in accordance with local directives.

1. Disconnect and tag hydraulic lines at steering cylinder. See Figure 28. Install caps in fittings on cylinder and put fittings on hydraulic lines.
2. Remove the tie rods. See Spindles, Bearings, and Tie Rods Repair, Tie Rods.
3. Remove capscrews that fasten cylinder to axle frame. Hold end caps on shell and remove steering cylinder.
4. Hold end of steering cylinder over a container. Remove plug for hydraulic fitting from each end cap. Push rod toward end of shell that is over container. Oil will drain from cylinder. Repeat procedure for other end.
5. Carefully remove one end cap from shell and slide off of rod. Carefully pull rod out of shell, keeping rod centered in shell during removal. Remove other end cap from shell. Remove all seals, wipers, and O-rings. See Figure 28.
6. Remove piston seal. If present, remove two guide rings.

CLEAN AND INSPECT

WARNING

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

1. Clean all metal parts in solvent.
2. Inspect piston rod for grooves or damage. Remove small scratches with fine emery cloth.
3. Inspect cylinder bore for damage
4. Inspect mounts for cracks.

ASSEMBLE AND INSTALL

CAUTION

Do not damage the O-rings, seals, or wipers during installation.

1. Put O-rings, seals, guide rings, and wipers in warm hydraulic oil. Install O-rings, seals, guide rings, and wipers as shown in Figure 28.
2. Lubricate O-rings, seals, and wipers with O-ring lubricant and carefully install one end cap on cylinder rod.
3. Carefully slide cylinder rod into shell and end onto into shell. Keep cylinder rod aligned in center of shell during installation so the parts are not damaged. Install other end cap into shell. Put caps on hydraulic fittings of end caps.
4. Hold end caps and install cylinder on axle frame using capscrews. Tighten capscrews to 225 N•m (166 lbf ft).
5. Install tie rods. See Spindles, Bearings, and Tie Rods Repair, Tie Rods.
6. Remove plugs and caps and connect hydraulic lines as tagged during removal, to steering cylinder. Operate steering system to remove air from cylinders and system. Turn steering wheel several times from one stop to the other. Check that the steer cylinder operates lock to lock.

Menu Navigation

Upon successful entry of your service technician password, you will be directed to the Main Menu. Using the scroll keys #4 and #5, scroll through the menu selections until you see the menu selection you want to access. Press the * key to access that selection.

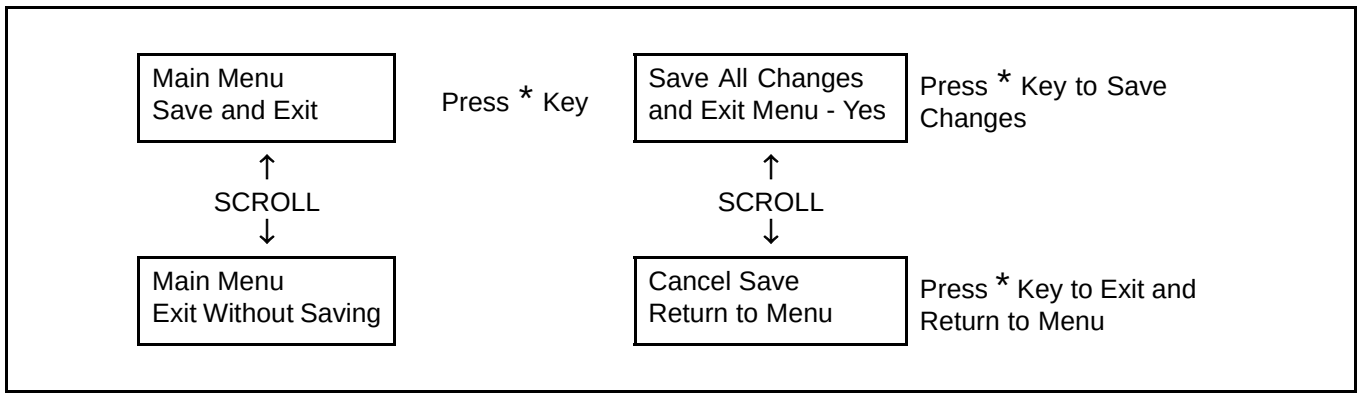
The * key allows you to move within menus and is used to make selections within a menu. The #4 and #5 scroll keys allow you to move up and down within a menu.

Each menu (except the Main Menu) will have a *Back 1 Level* option within the menu options at that level. Use the scroll keys #4 and #5 to access this option. Press the * key to select this option and return to the previous menu.

Any time an optional value is changed within a menu, pressing the * key will take you to the Exit Menu where you will have the opportunity to return to the previous menu, exit the menu system without saving any changes, or save your changes and exit the menu system. See Table 2.

Some menus may contain several optional values that can be adjusted. It is not necessary to exit the menu after each adjustment and re-enter the menu to make multiple changes within a menu. After making a change to an optional value, use the Back 1 Level option to re-enter the menu, scroll to the next option to be adjusted, and make the change. After all adjustments have been made, press the * key to access the Exit Menu and save your changes.

Table 2. Exit Menu



Diagnostics

Upon entering the Diagnostics Menu from the Main Menu, the following menu functions are visible to the service technician:

- Clear Fault Log
- View Fault Log
- No-Run Data Display
- Engine Accelerator and Throttle Data Display
- Engine Speeds and Governor Data Display
- Engine Fuel and Emission Data Display
- Engine General Data Display
- XMSN/Brake Data Display
- Hydraulic Data Display
- General Truck Data Display

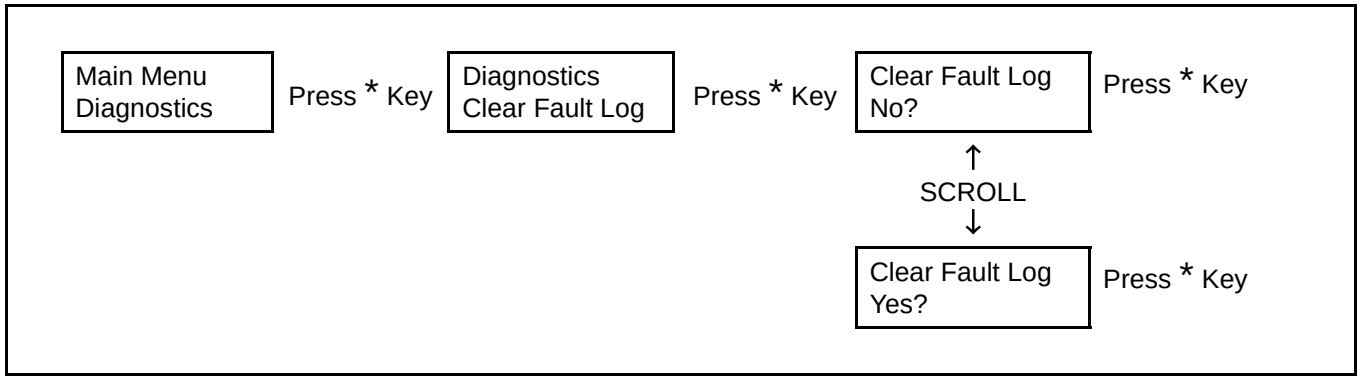
For a complete description of the Diagnostic functions accessible through the Dash Display. See the **Diagnostic Troubleshooting Manual** 9000 SRM 1112.

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

CLEAR FAULT LOG

This function will allow the service technician to clear all fault log entries from the VSM. See Table 11.

Table 11. Clear Fault Log

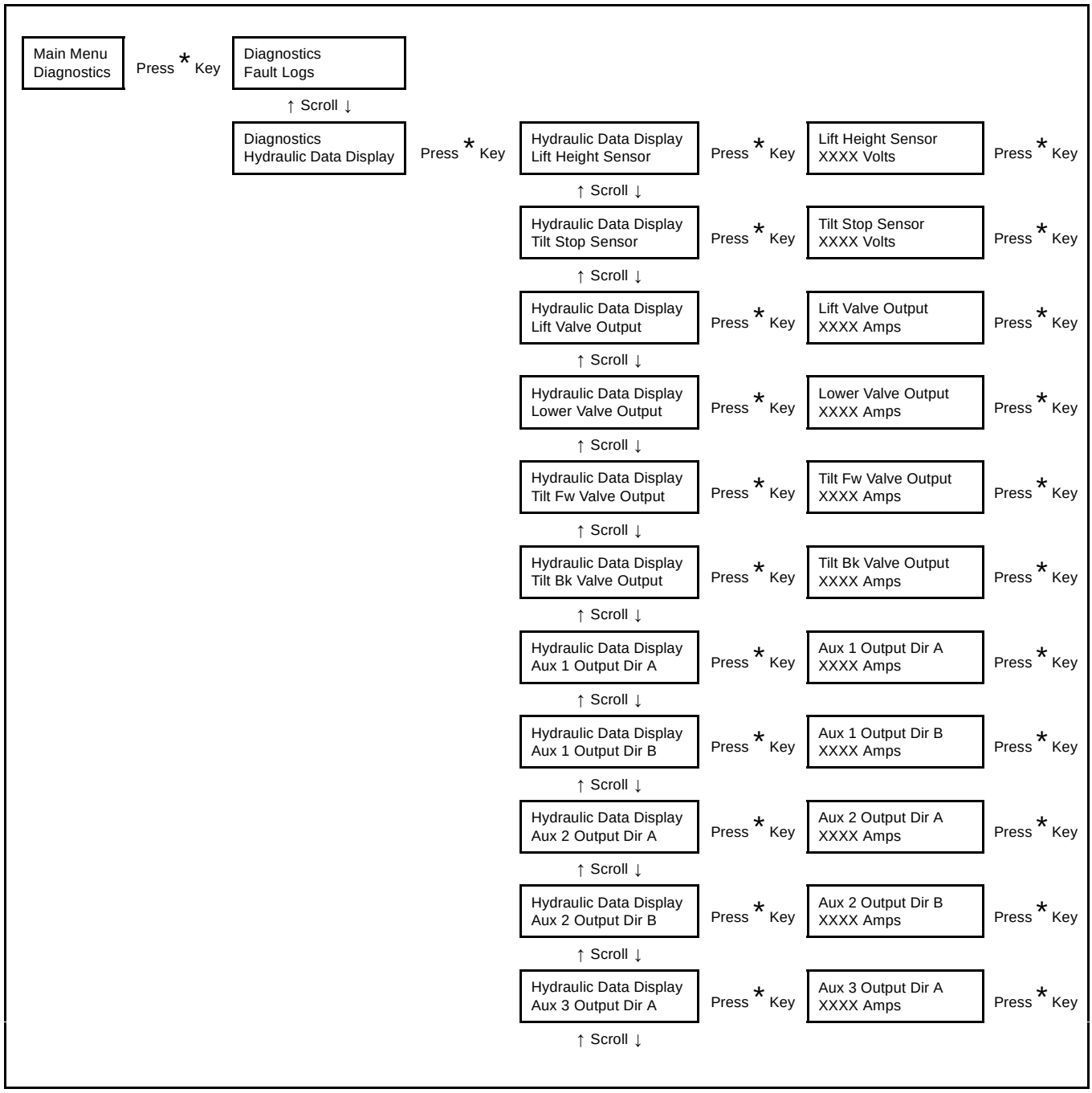


HYDRAULIC DATA DISPLAY

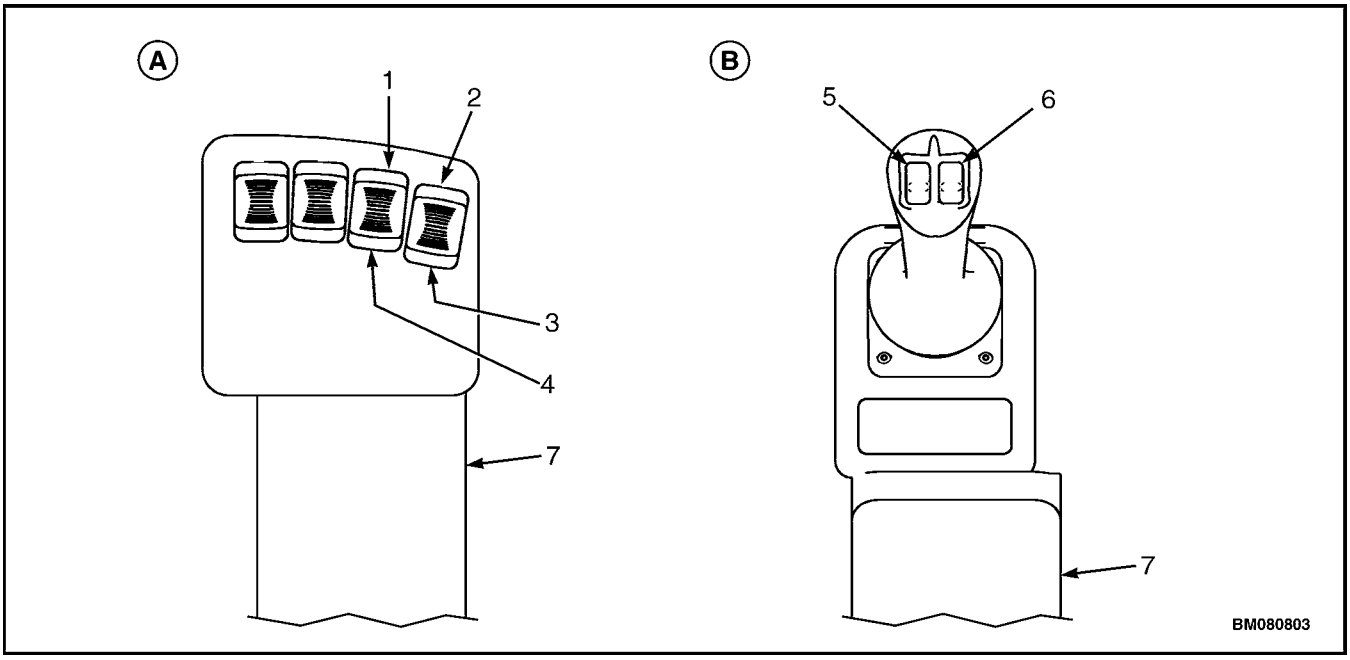
This function will allow the service technician to view inputs and values from the hydraulic system while the engine is running. Use the scroll keys to move to the desired function and press the * key to select the function. See Table 19. When finished viewing an input or value, press the * key to return to the previous menu.

NOTE: Depending on how an individual lift truck is equipped, some functions shown in the menu may not be available for viewing.

Table 19. Hydraulic Data Display



For the setting of auxiliary functions and definitions of Direction A and Direction B, see Figure 2.



A. E-HYD CONTROLS

1. AUX 1 OR AUX 2 - DIRECTION A (↑) / DIRECTION B (↓)
2. AUX 2 OR AUX 3 - DIRECTION A (↑) / DIRECTION B (↓)
3. FOURTH LEVER

B. JOYSTICK CONTROLS

4. THIRD LEVER
5. AUX 1 - DIRECTION A (↑) / DIRECTION B (↓)
6. AUX 2 - DIRECTION A (↑) / DIRECTION B (↓)
7. SEAT ARMREST

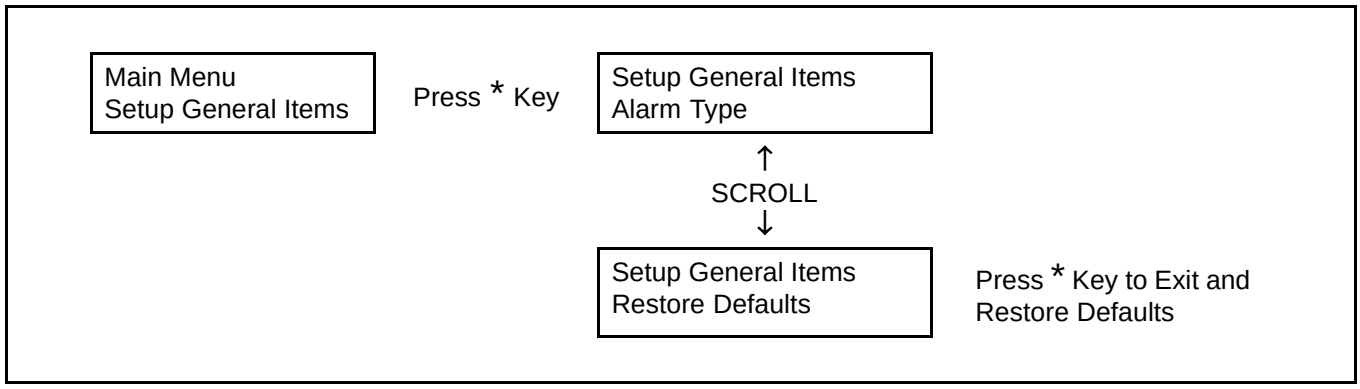
Figure 2. Auxiliary Functions

RESTORE DEFAULT SETTINGS

This function is used to restore all service technician adjustable truck settings to the factory default settings. This function will not change any calibration settings.

From the Setup General Items menu, select *Restore Defaults*. See Table 41. Press the * key and proceed to the Exit Options menu.

Table 41. Restore Defaults Menu



RESTORE ENGINE CONTROLLER DEFAULT CALIBRATION

If the lift truck is equipped with a GM engine, this function can be used to restore the system to the factory default values.

From the Setup General Items menu, select *Restore ECU Defaults*. Press the * key, scroll to the Exit Options menu, and choose the *Save and Exit* menu item. See Table 42. Press the * key to restore default values.

Table 42. Restore Settings Menu