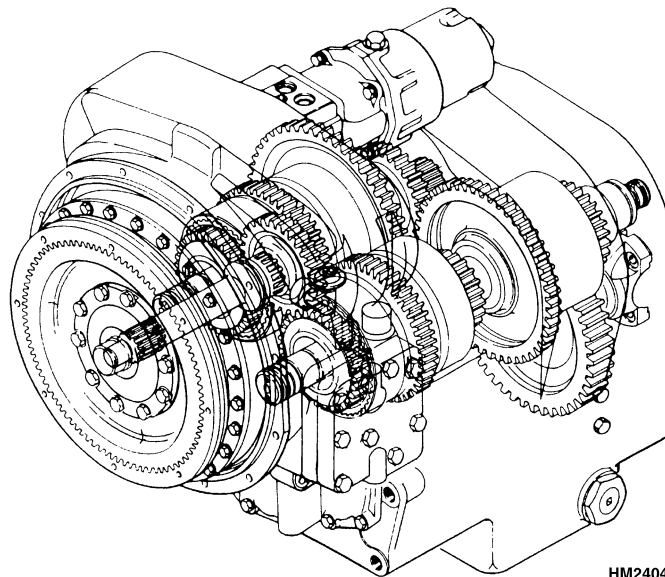


THREE-SPEED POWERSHIFT TRANSMISSION

DESCRIPTION AND OPERATION

**H17.00-32.00C (H360-700C) [C008];
H20.00-32.00F (H440-700F/FS) [E008]**



HM240402

HYSTER

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- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

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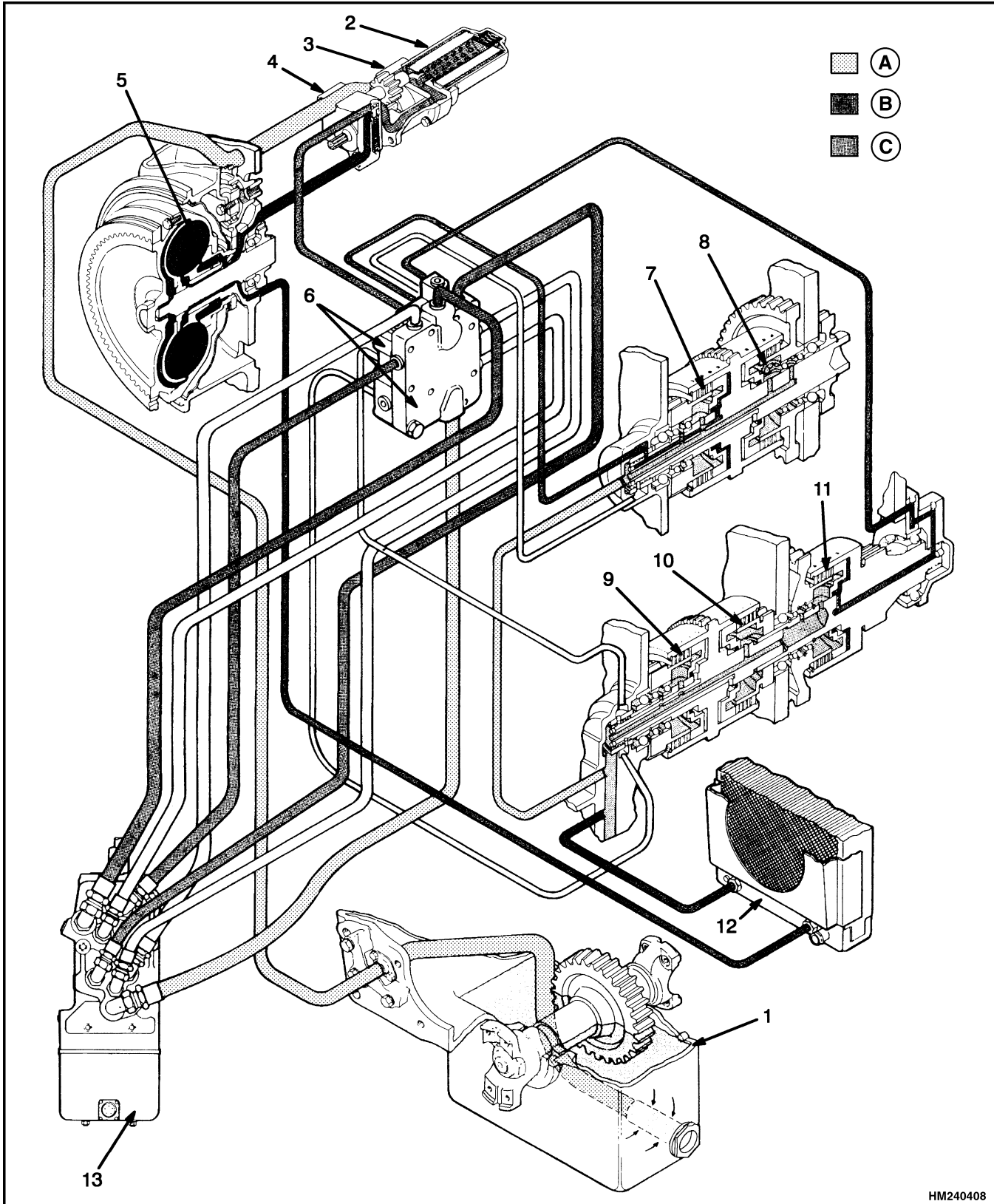


Figure 7. Hydraulic Operation of Transmission

TRANSMISSION CONTROL SYSTEM H20.00-32.00F (WITH AUTO SHIFT APC 100)

Gear Selector

The transmission control system uses one gear selector that selects both range and direction, see Figure 15. The selector is on the left side of the steering column. Push the selector **FORWARD** to begin moving forward. Pull the selector **BACK** to begin moving backward. Move the gear selector to the **CENTER** position to put the transmission in **NEUTRAL**.

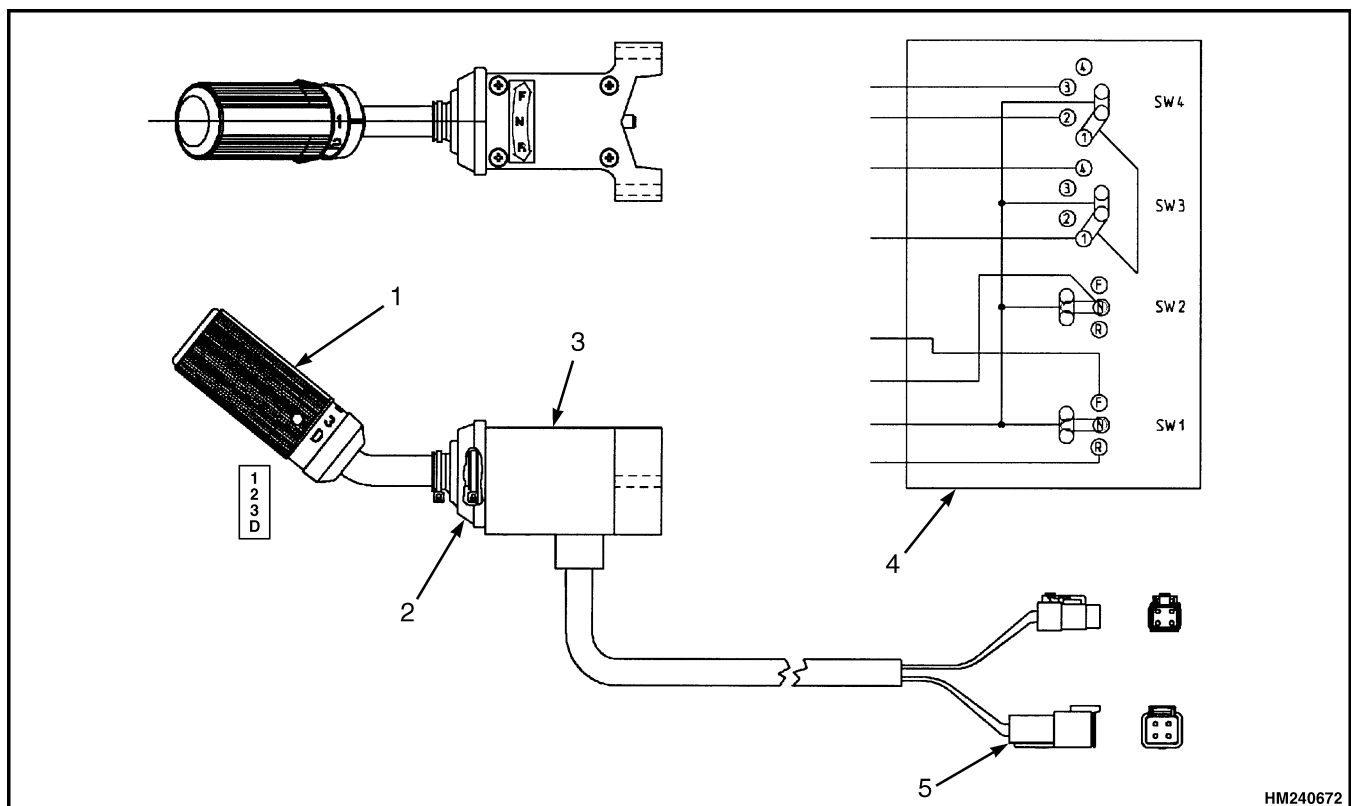
Range selection is by rotating of the handle on the gear selector. Rotate the handle for one of the following four positions:

1. First position locks transmission in first speed.
2. Second position will automatically shift from first speed to second speed and second speed to first speed, depending on speed.

3. Third position will automatically shift from second speed to third speed and from third speed to second speed, depending on speed.
4. "D" position is the same as the third position.

NOTE: All three speeds are available in the forward or reverse direction of travel as selected by the operator.

Signals from the gear selector go to the APC 100 transmission controller. The controller processes these signals together with the other input signals. The controller then sends signals to operate the solenoid valves of the transmission control valve for correct transmission operations. For further information on the APC 100, refer to the section Automatic Powershift Controller (APC 100).



1. HANDLE
2. DUST COVER
3. SWITCH

4. ELECTRICAL SCHEMATIC
5. ELECTRICAL CONNECTOR

Figure 15. Gear Selector

BYPASS BOX AND BYPASS PLUG

In the event of automatic powershift control failure, use following procedures to bypass APC 100. This will restore full manual functionality, except for the temperature lockout. Verify when moving truck that transmission oil temperature remains in green range.

1. Open the hood on the right-hand side.
2. Disconnect connector that is fitted to transmission and replace with connector attached to supply cable.

When the bypass function is utilized, the bypass box provides system protection. The parameters are as follows:

- All speeds available in **FORWARD** and **REVERSE**.
- Reversal is only permitted in first and second speed.
- When shifting from **NEUTRAL**, no third speed start is permitted.
- Depressing the declutch pedal will shift transmission to **NEUTRAL**.

APC 100 OUTPUT FUSE

Remove and Install

1. Remove the APC 100 from its mounting and disconnect the electrical connector.

WARNING

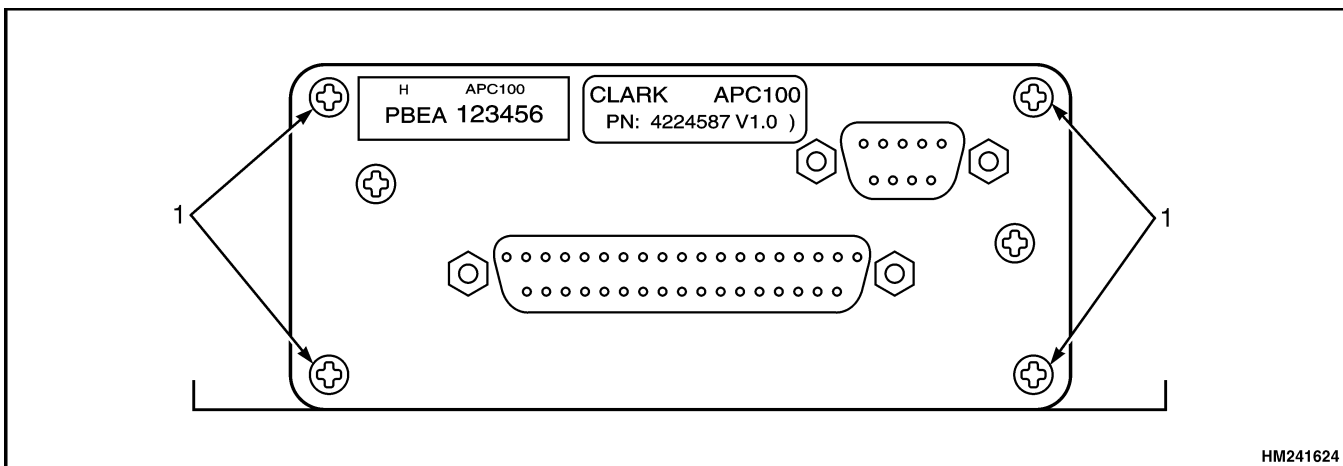
Static electricity can damage electronic components. Handle circuit boards in a static free environment.

2. Remove the four retaining screws from the connector end of the unit. See Figure 25.
3. Slide the circuit board halfway out of the housing. See Figure 26.
4. Locate the output fuse holder on the bottom circuit board.

CAUTION

Using only a slow or fast blow fuse can result in internal damage to the APC 100.

5. Remove the fuse from its holder and check for continuity. Replace, if necessary with a 10 amp fuse.
6. Push the circuit board assembly back into the housing and install retaining screws.
7. Check output circuits for short circuits before re-installing APC 100 unit into lift truck.
8. Install APC 100 unit into lift truck.

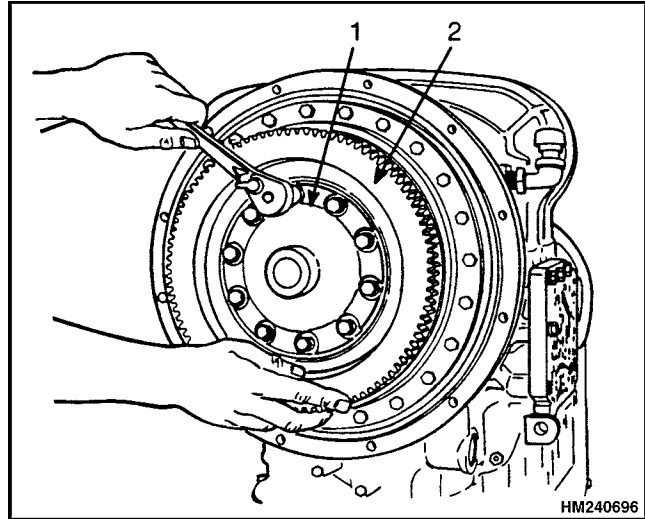


1. RETAINING SCREWS

Figure 25. APC 100

STEP 7.

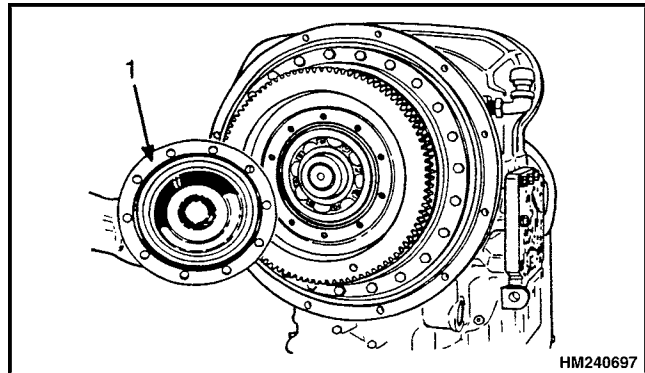
Remove capscrews for bearing cover on impeller cover.



1. BEARING COVER 2. IMPELLER COVER

STEP 8.

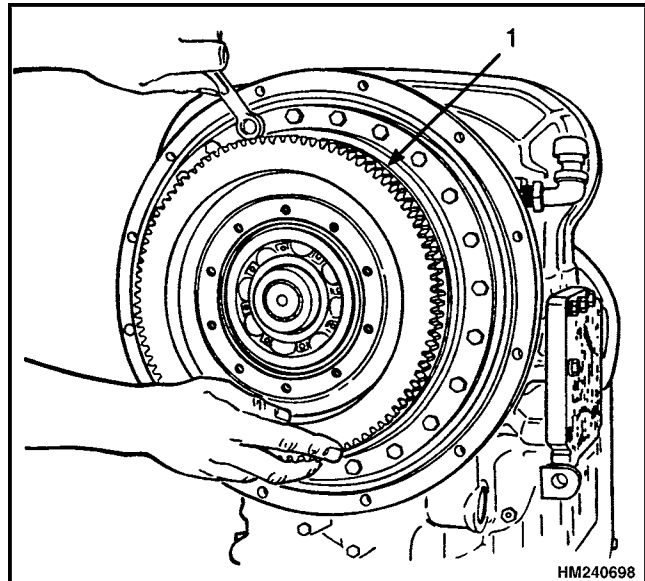
Remove bearing cover.



1. BEARING COVER

STEP 9.

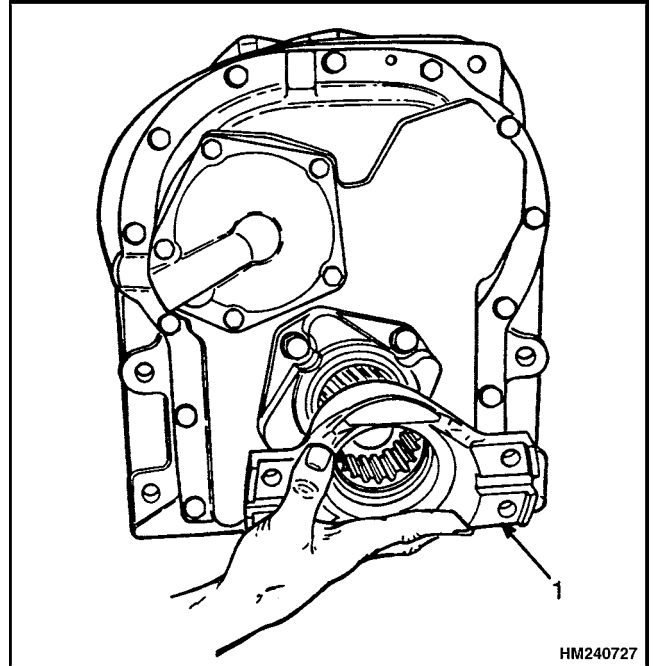
Remove capscrews for impeller cover.



1. IMPELLER COVER

STEP 36.

Remove output yoke.

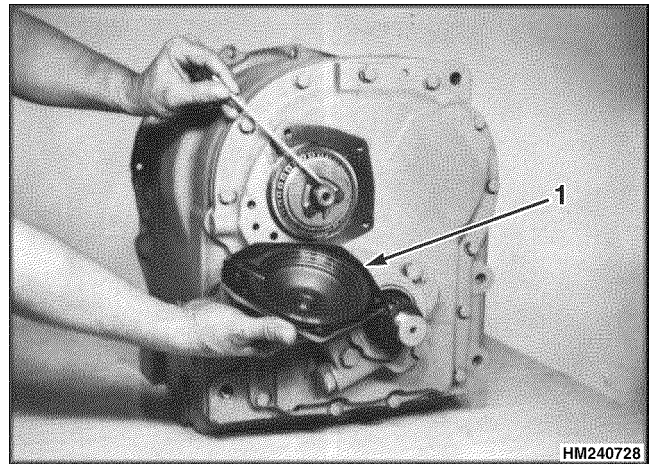


HM240727

1. OUTPUT YOKE

STEP 37.

Remove bearing cover for shaft for first speed.

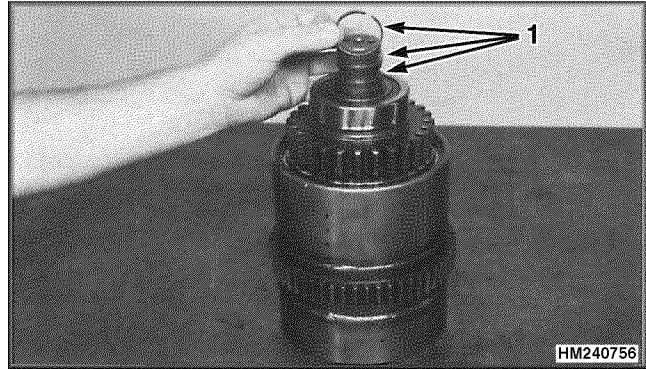


HM240728

1. BEARING COVER

STEP 63.

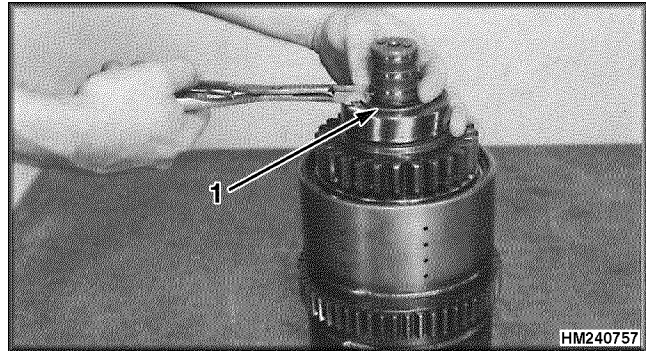
Remove seal rings from shaft.



1. SEAL RING

STEP 64.

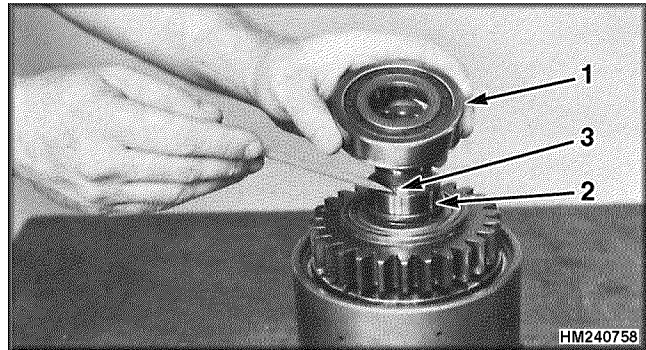
Remove retainer ring for bearing.



1. RETAINER RING

STEP 65.

Remove bearing and spacer. Do not lose lock ball.

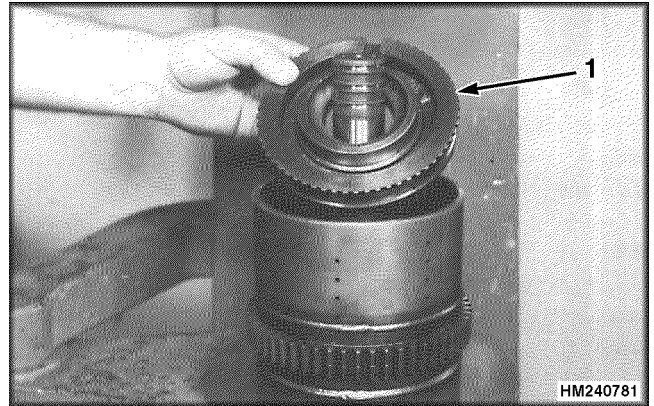


1. BEARING
2. SPACER

3. LOCK BALL

STEP 2.

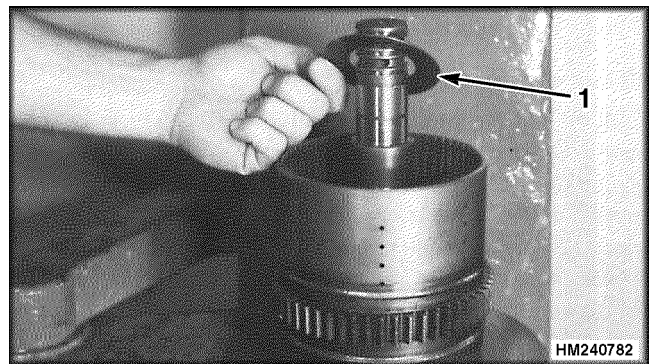
Make sure bore of piston housing is smooth. There must be no sharp edges to damage the seal rings. Carefully install piston.



1. PISTON

STEP 3.

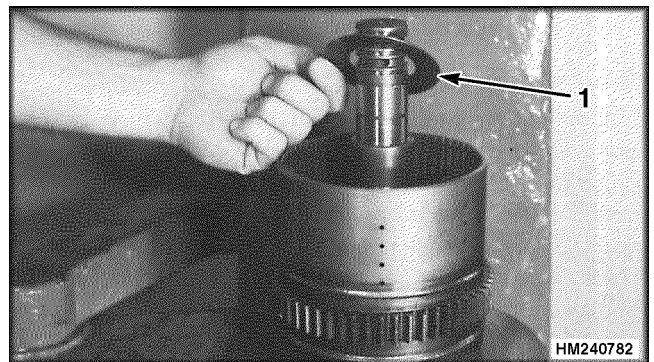
Install the first Belleville washer. Make sure large diameter of bevel is toward piston.



1. BELLEVILLE WASHER

STEP 4.

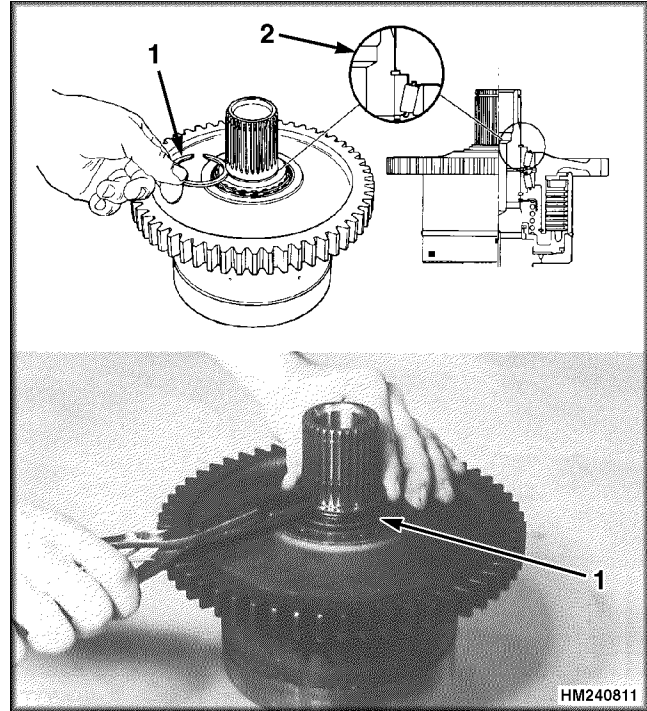
Install the second Belleville washer. Make sure large diameter of bevel is away from piston. Install remaining Belleville washers. There is total of seven washers.



1. BELLEVILLE WASHER

STEP 33.

Install snap ring on shaft. Different size snap rings are available. Use the thickest snap ring that will fit in the groove. After installation, check that bearing rollers are tight against bearing cone.

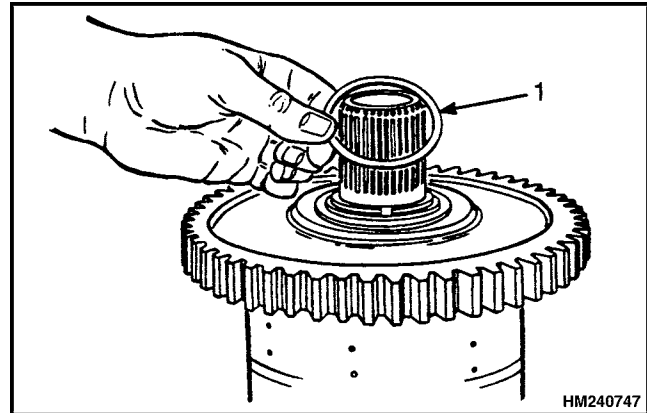


1. SNAP RING

2. BEARING CONE

STEP 34.

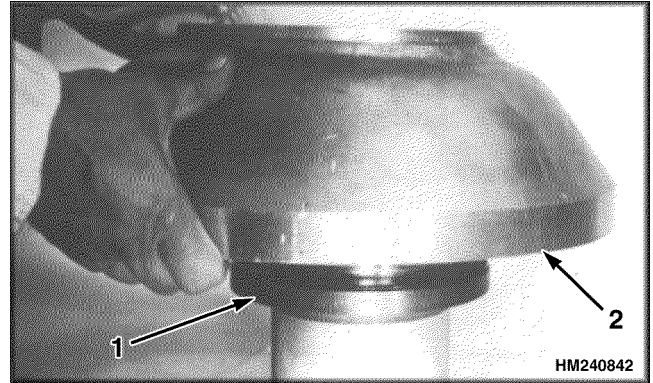
Install retainer for snap ring.



1. RETAINER

STEP 65.

Install hub in impeller. Align holes in hub, impeller, and plate.



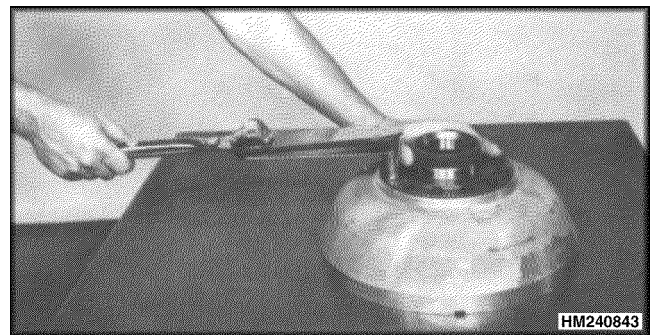
1. HUB

2. IMPELLER

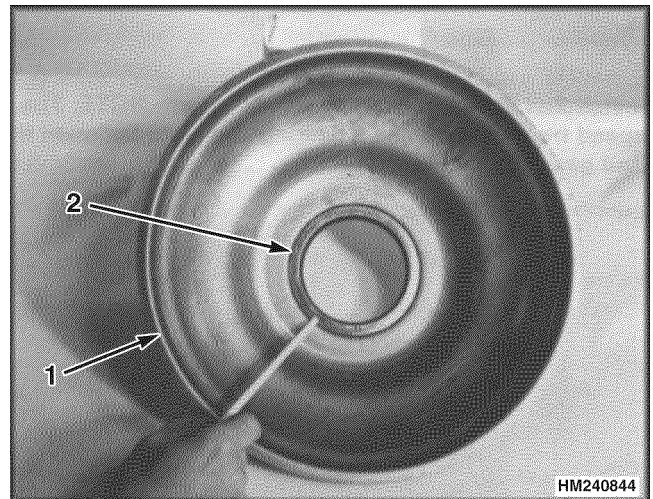
NOTE: The capscrews for the impeller hub have a special adhesive on the threads. The capscrews must be tightened within 15 minutes of installation. The capscrews can be used one time. When a capscrew is removed, the hole must be cleaned and the capscrew must be replaced.

STEP 66.

Install special capscrews until they are within approximately 1.5 mm (0.06 in.) of the plate. Use a torque wrench to tighten capscrews to 54 to 61 N•m (40 to 45 lbf ft).

**STEP 67.**

Apply a sealant to outside of seal. Install seal in oil baffle. Make sure lip of seal is toward outside of oil baffle.

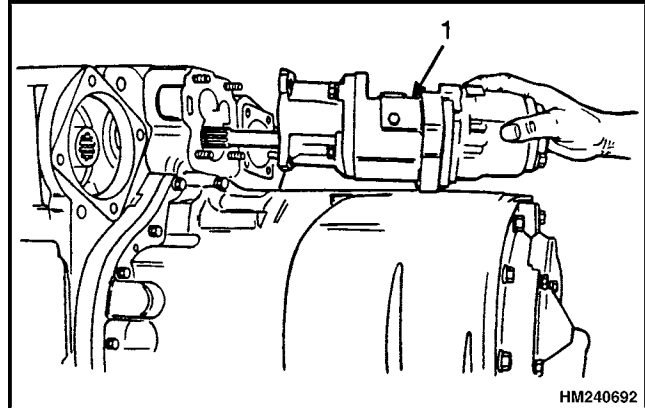


1. OIL BAFFLE

2. OIL SEAL

STEP 97.

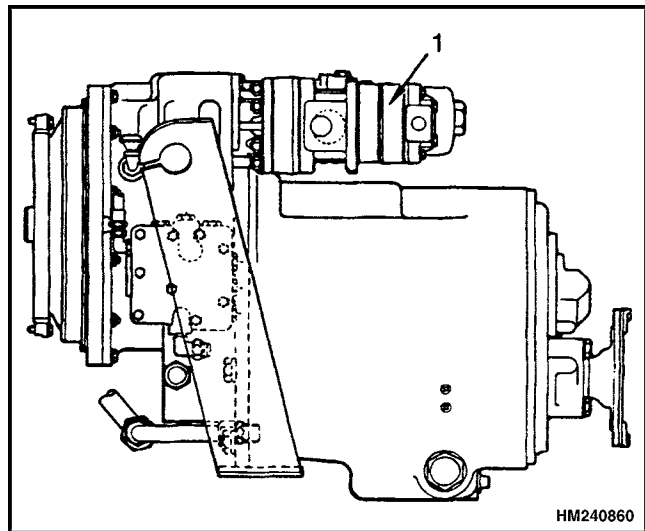
Install transmission pump assembly.



1. TRANSMISSION PUMP

STEP 98.

Install hydraulic pumps on housing.



1. HYDRAULIC PUMP

ASSEMBLE

1. Lubricate all moving parts with clean transmission oil.
2. Install the forward and the reverse spools and spring in their bore. (The forward and the reverse spools are the same parts.) Install the O-rings and the plug.
3. Install the two springs for the inching spool guide. Install the C spring and the inching spool. Install the sleeve and the snap ring. Install the O-ring and the plunger assembly.
4. Install the spool for first and second speed. Install the spring and the guide. Install the roll pin in the guide. Make sure the roll pin is below the surface of the valve body. Install the spool for third speed. Install the spring, O-ring and plug for the spool.
5. Install the solenoids with O-rings in the valve body. Connect the wires to the solenoids. See the location of the wires in Figure 14.
6. Install the seal and cover for the solenoids on the valve body.
7. The air cylinder for inching is shown in Figure 13. Tighten the capscrews that hold the cylinder together to 6.7 to 7.3 N•m (5 to 5.4 lbf ft). Make sure the stroke of the cylinder is correctly adjusted. Tighten the jam nut for the cylinder rod to 40 to 54 N•m (30 to 37 lbf ft).

INSTALL

1. Install the shift valve on the frame. See Figure 12.
2. Connect the air cylinder to the plunger. Connect the oil lines to the valve body. Connect the wiring harness at the solenoid cover.

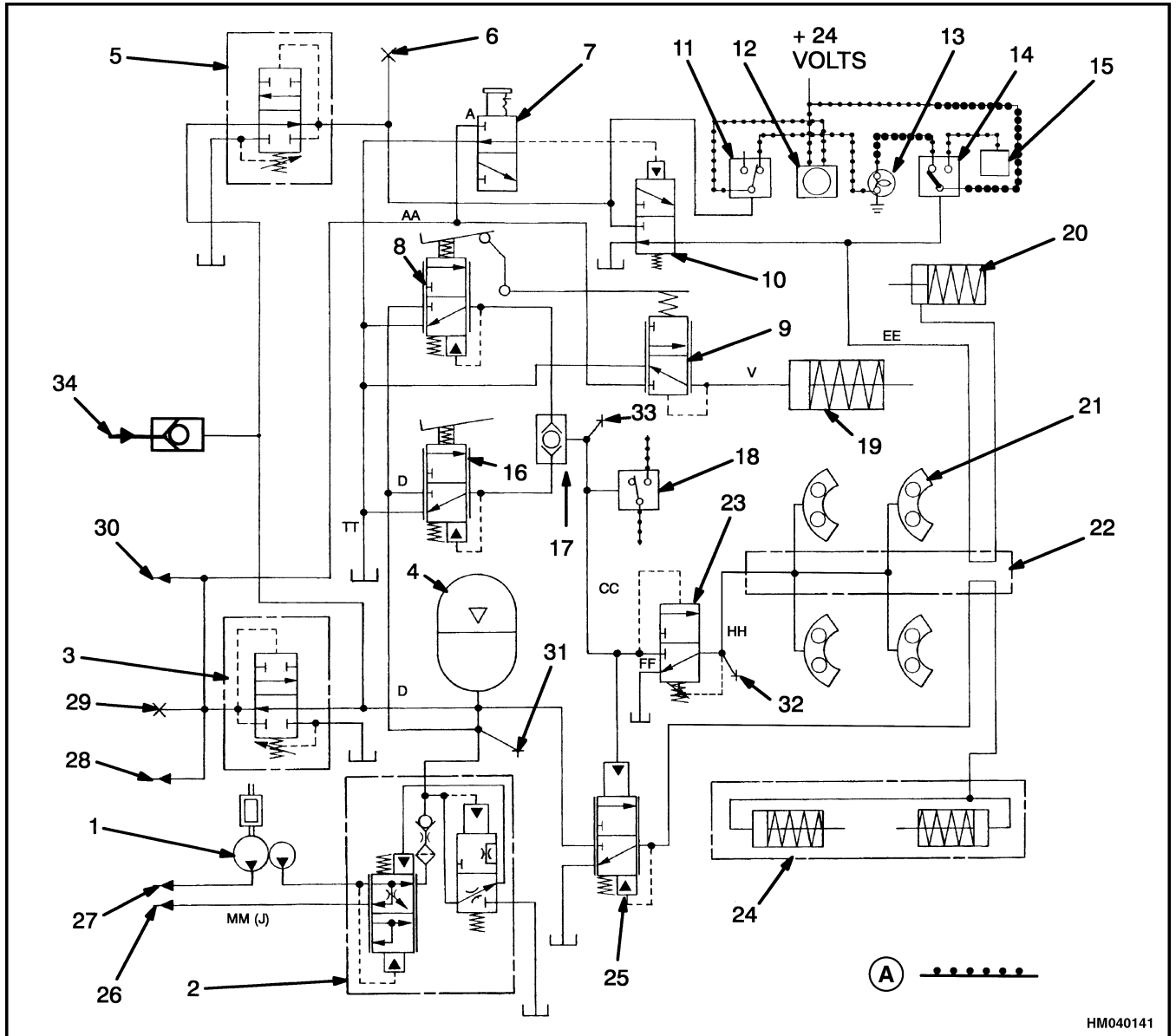
Oil Pump Repair**REMOVE**

See Step 1 of Transmission Repair, Disassemble. Remove the capscrews that hold the oil pump to the transmission housing. Remove the oil pump. Remove the sleeve from the drive gear for the pump.

DISASSEMBLE

1. Remove the filter housing from the filter adapter. See Figure 15. Remove the spring, filter element, and O-ring. Remove the bypass valve assembly from the filter adapter.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Inching operation is not smooth. (Cont.)	Inching/brake pedal or inching valve does not operate correctly.	Repair or replace inching/brake pedal or inching valve.
	Clutch piston does not move freely.	Clean clutch piston. Repair or replace as necessary.
	Control valve has leaks.	Replace all seals. Replace transmission control valve.
	Clutch discs are bent.	Replace clutch discs.
Loss of power.	Engine is not running correctly.	Run system diagnostic checks. Repair as necessary.
	Clutch that is engaged is not releasing.	Repair or replace clutch assembly.
	Torque converter is damaged.	Replace torque converter.
	Clutch does not engage completely.	Repair or replace clutch assembly.
Lift truck will not move in either direction.	Oil level is too low.	Add transmission oil.
	Parking brake is applied. There is not enough air pressure or oil pressure in the brake system to release the parking brake.	Release park brake. Run engine until air pressure increases to acceptable levels.
	Forward and reverse solenoids do not operate.	Check the electrical connections. Repair or replace solenoids.
	Direction spool will not move.	Repair or replace direction spool.
	Switches in transmission control assembly do not operate.	Replace the transmission control assembly.
	Axle shaft(s) or differential is damaged.	Repair or replace the drive shaft or the differential.
The oil pressure is not steady.	The level of the oil is not correct.	Check and adjust oil level.
	The oil suction tube is cracked or loose.	Repair or replace oil suction tube.
	The O-ring for the suction tube leaks.	Replace O-ring.



HM040141

Figure 2. Brake System Schematic H20.00-32.00F (H440-700F/FS)

Accumulator Replacement

NOTE: The accumulator is located inside the frame, near the hydraulic system components on the left-hand side of the lift truck. The accumulator cannot be repaired. If the accumulator does not charge correctly, or does not hold its charge, it must be replaced.

WARNING

The accumulator has a charge of 8.3 MPa (1200 psi). If required, it must be recharged with "oil pumped or dry nitrogen" by a trained and authorized dealer.

WARNING

Before disconnecting any hydraulic lines, release pressure from the hydraulic circuit as follows:

- a. Shut the engine off and completely lower the carriage.
 - b. Operate the lift/lower lever and the brake pedals until the hydraulic pressure is released.
1. Put tags for identification on the lines. Disconnect the lines from the accumulator. Put caps on the open lines. Remove the accumulator from the module bracket. See Figure 6.
 2. Install the new accumulator. Connect the lines.
 3. Operate the system and check for leaks.

Pressure Reduction Valves Repair

NOTE: The valves are located on the module with the hydraulic system components. The module is on the left-hand side of the lift truck. The procedures are the same for both valves. See Figure 5 and Figure 6.

REMOVE AND DISASSEMBLE

WARNING

Before disconnecting any hydraulic lines, release pressure from the hydraulic circuit as follows:

- a. Shut the engine off and completely lower the carriage.
 - b. Operate the lift/lower lever and the brake pedals until the hydraulic pressure is released.
1. Put tags for identification on the lines. Disconnect the lines from the valve. Put caps on the open lines. Remove the valve from the module bracket. See Figure 5, Figure 6 and Figure 8.
 2. Remove the cartridge from the valve body. Remove the O-rings and backup rings from the cartridge. Do not disassemble the cartridge. If it does not operate correctly, replace it.

CLEAN AND INSPECT

WARNING

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

Clean the parts in solvent. Inspect the spools and bores for scratches. If there are scratches or other damage, the parts must be replaced. Lubricate the parts with clean hydraulic oil for assembly.

ASSEMBLE AND INSTALL

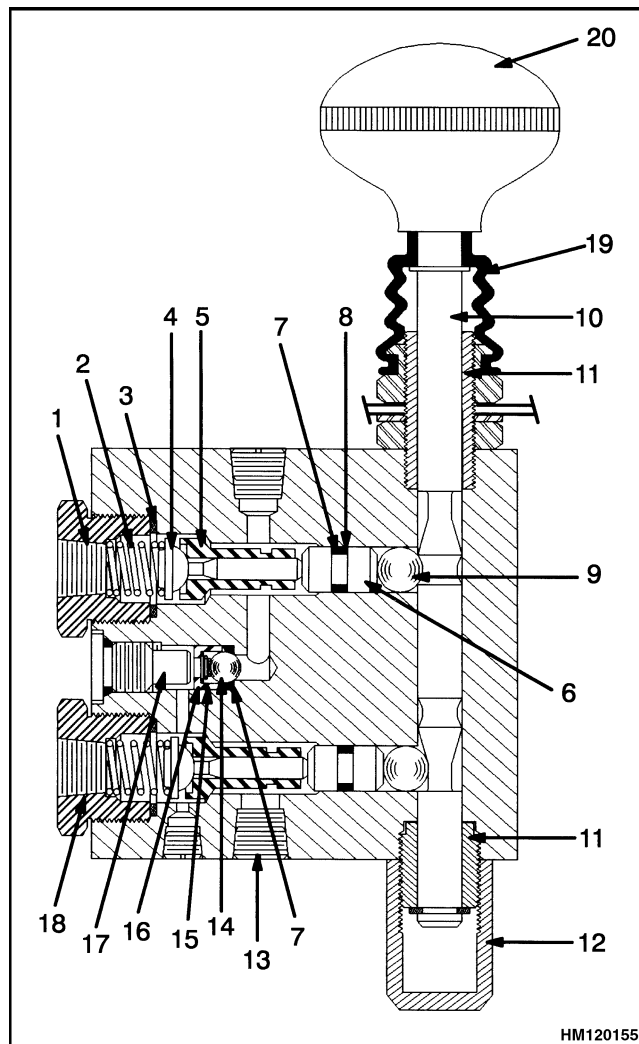
1. Install new backup rings and O-rings on the cartridge. Install the cartridge in the valve body. Tighten the cartridge to 11 to 14 N•m (8 to 10 lbf ft).
2. Install the valve on the bracket. Connect the lines to the valve.
3. Operate the system and check the valve for leaks.

ASSEMBLE

1. Install new backup rings and O-rings on the pistons. See Figure 16. Install the ball, piston, valve, valve stem, spring, gasket, and fitting in each port.
2. Install a new O-ring for the check ball. Install the check ball, cage, and spring. Install the plug.
3. Install the other plugs in the valve body.

INSTALL

1. Install the parking brake valve on the instrument panel. Install the nut to hold the valve in position. See Figure 16. Connect the lines as shown in Figure 1. Tighten the nut for the valve body. Install the rubber boot and the knob.
2. Operate the system and check for leaks and correct operation of the parking brake system.



- | | |
|----------------|----------------------|
| 1. INLET PORT | 11. BUSHING |
| 2. SPRING | 12. END CAP |
| 3. GASKET | 13. TO DRAIN CIRCUIT |
| 4. VALVE STEM | 14. BALL |
| 5. VALVE | 15. SPRING |
| 6. PISTON | 16. CAGE |
| 7. O-RING | 17. PLUG |
| 8. BACKUP RING | 18. TO PILOT VALVE |
| 9. BALL | 19. RUBBER BOOT |
| 10. ROD | 20. KNOB |

Figure 16. Parking Brake Valve

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
<p>The brakes do not stop the lift truck.</p>	<p>Oil, water or hydraulic oil is on the linings.</p> <p>The linings are worn or damaged.</p> <p>There is not enough hydraulic pressure in the system.</p> <p>The brake lines have a restriction.</p> <p>The accumulator charge valve or accumulator is damaged.</p> <p>The pressure reduction valve is not adjusted correctly.</p> <p>The brake pedal valve(s) is damaged.</p> <p>The relay valve does not operate correctly.</p> <p>The brake caliper(s) has a leak.</p> <p>The shuttle valve does not operated correctly.</p> <p>The sequence valve does not operate correctly.</p>	
<p>The brakes apply slowly.</p>	<p>There is not enough hydraulic pressure in the system.</p> <p>The hydraulic line(s) have a leak or restriction.</p> <p>The brake pedal valve(s) is damaged.</p>	
<p>Brake pedal(s) goes to the floor.</p>	<p>There is air in the hydraulic system.</p> <p>There is a leak(s) in a hydraulic line.</p>	

Tires and Wheels

WARNING

Air pressure in tires can cause tire and wheel parts to explode. The explosion of wheel parts can cause serious injury or death.

Remove the air pressure from the tires before the wheels are removed from the lift truck.

If the air pressure is less than 80% of the correct pressure, the tire and wheel must be removed before air is added. Put the tire and wheel in a safety cage when adding air pressure to the tire. Follow the procedures under Add Air to Tires.

When air is added to the tires, a remote air chuck must be used so that the person adding air can stand to the side and not in front of the tire.

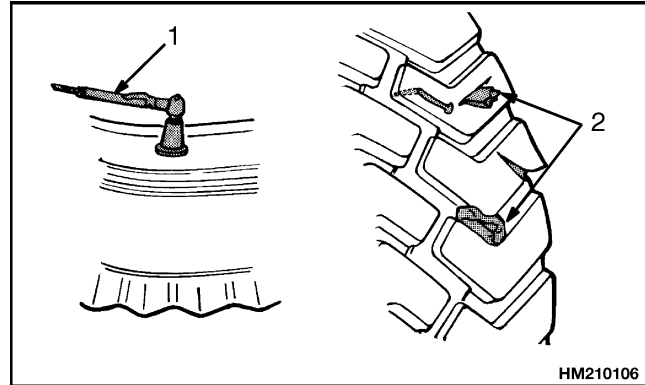
Check the tires for damage. See Figure 8. Inspect the tread and remove any objects that will cause damage. Check for bent or damaged rims. Check for loose or missing hardware. Remove any wire, strapping, or other material that is wrapped around the axle.

Keep the tires at the correct air pressure. (See the Nameplate.) Check the air pressure with a gauge when the tires are cold. If it is necessary to add air to a tire that is warm, check one of the other tires on the same axle and add air to the tire that has low pressure so the air pressures are equal. The air pressure of warm tires must always be equal to or greater than air pressures specified for cold tires.

CAUTION

When the wheels have been installed, check all wheel nuts after 2-5 hours of operation. Tighten the nuts in a cross pattern to the correct torque value shown in the Maintenance Schedule table. When the nuts stay tight for eight hours, the interval for checking the torque can be extended to 250 hours.

Make sure the wheel nuts are tight. Tighten the wheel nuts as shown in Figure 27.

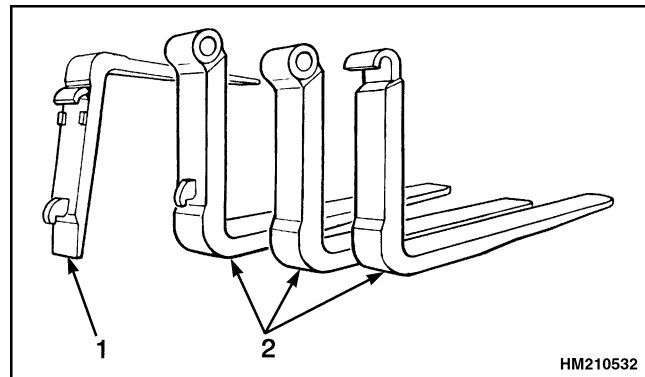


1. CHECK TIRE PRESSURE
2. CHECK FOR DAMAGE

Figure 8. Tires Check

Forks

The identification of a fork is determined by how it is connected to the carriage. See Figure 9. These lift trucks have pin forks. These forks can be Low Mount Forks or High Mount Forks.



1. HIGH MOUNT FORKS
2. LOW MOUNT FORKS

Figure 9. Types of Forks

Adjust

Pin forks are fastened to the carriage with large fork pins. The carriage can be equipped with fork positioner cylinders to move the forks.

Remove

A fork can be removed from the carriage for replacement of the fork or other maintenance.

TRANSMISSION OIL



WARNING

The transmission oil can be hot after operation of the lift truck. Do not permit the oil to touch the skin and cause a burn.

Change the oil for the transmission. The drain plug for the transmission is on the right-hand side of the transmission housing. Put a container under the transmission. Remove the drain plug, spring, and screen. Clean the screen. After the oil has drained, install the screen, spring, and plug.

When filling the transmission, start by pouring 16 liter (4 gal) of the correct oil into the dipstick tube. Start the engine and let it run for at least five minutes. Apply the brakes and shift the range selector lever through all of the ranges. Stop the engine and fill the transmission to the **FULL** mark on the dipstick. Start the engine and check the oil level when the engine is running at idle speed and the range selector lever is in the **NEUTRAL (N)** position. Check for leaks during operation.

MAST



WARNING

When working on or near the mast, see **Safety Procedures When Working Near Mast at the end of this section.**

1. Lubricate the fittings on the side rollers, load rollers, and the chain sheaves with multipurpose grease.

2. If a sideshift carriage is installed, lubricate the fittings for the rollers with multipurpose grease.

OTHER LUBRICATION

Inspect all hinges, pins, linkages, cables, pedals, and levers for wear and damage. Lubricate these parts as necessary with engine oil.

FUEL SYSTEM

Idle Speed

1. Run the engine until it is at the normal operating temperature.
2. The correct idle speed is 675 rpm. Rotate the adjustment screw as necessary to change the speed.

Governed Speed

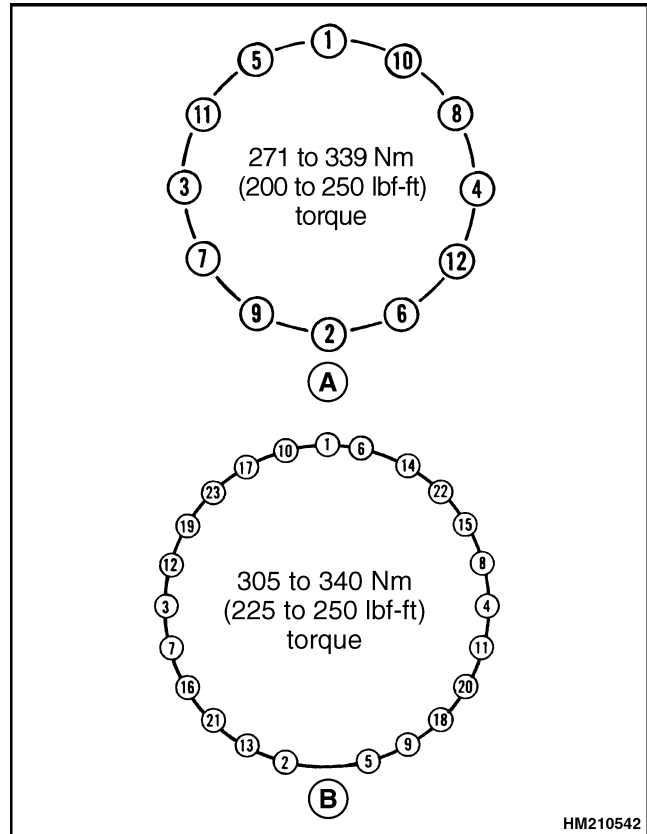
1. Adjust the idle speed to the specified speed.
2. Disconnect the throttle cable at the throttle lever on the fuel injection pump. Push the throttle pedal until it stops against the stop screw. Hold the pedal in this position with a rod.
3. Connect the rod end of the throttle cable to the throttle lever. Make sure the end of the cable is connected securely with the rod end, but the cable is not tight. Tighten the jam nut to hold the cable to the rod end. If necessary, change the position of the stop screw under the throttle pedal. The correct speed with no load is 2700 rpm.

INSTALL WHEELS

CAUTION

When the wheels have been installed, check all wheel nuts after 2 to 5 hours of operation. Tighten the nuts to the correct torque. When the nuts stay tight after an eight-hour check, the interval for checking can be extended to 250 hours.

Install the wheel(s) on the hub. Install the wheel nuts and rim clamps. Tighten the wheel nuts as shown in Figure 27.



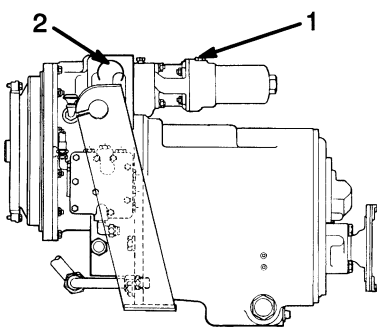
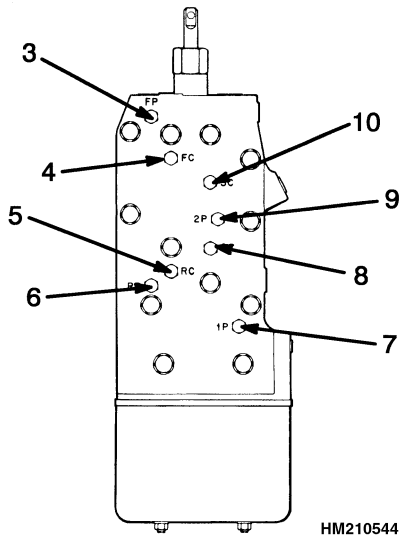
- 1. STEER WHEELS
- 2. DRIVE WHEELS

Figure 27. Install Wheels

Electrical System

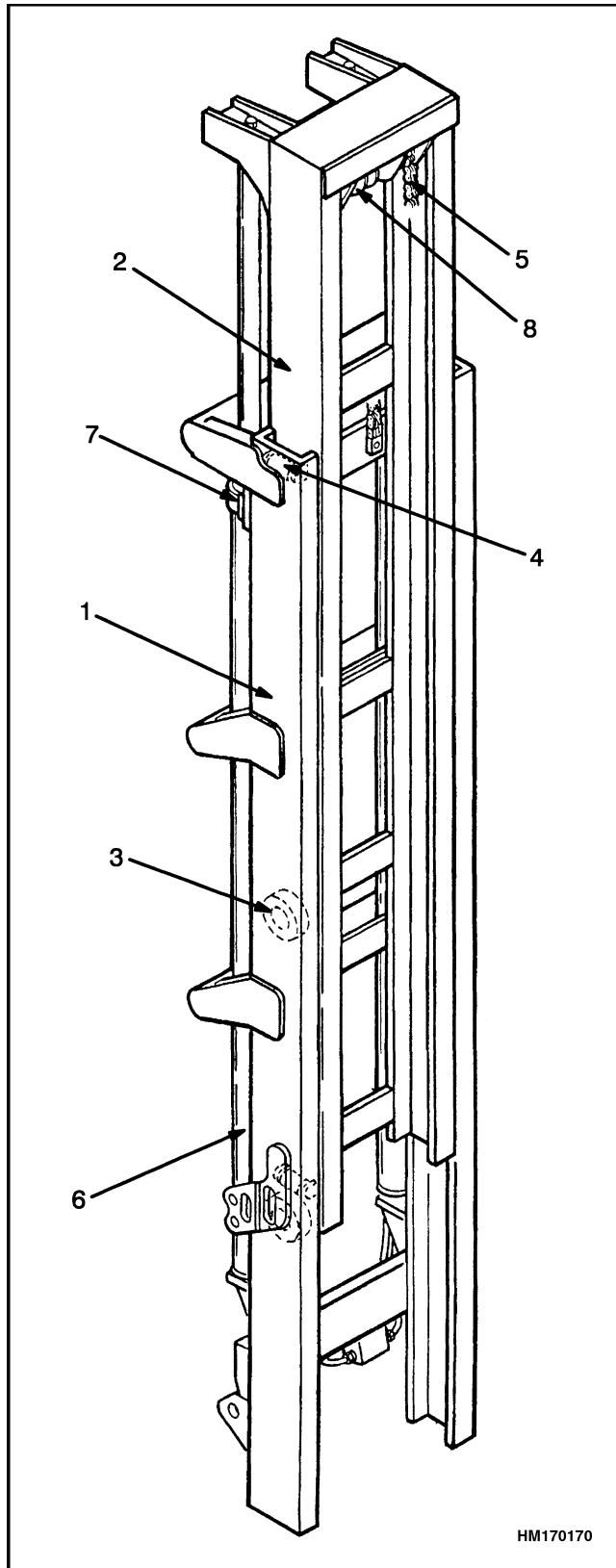
All Models - 24 Volt, Negative Ground	
Tier 1 Engine	Tier 2/3 Engine
Alternator Output 50 Amps (At Idle)	Alternator Output 70 Amps (At Idle)

Transmission Pressures

Function Pressure	Normal Pressure Range	
1. Clutch	1865 to 1930 kPa (240 to 280 psi)	 <p style="text-align: right; font-size: small;">HM210543</p> <p style="text-align: center;">Transmission</p>  <p style="text-align: right; font-size: small;">HM210544</p> <p style="text-align: center;">Shift Control Valve</p>
2. Torque Converter Out*	172 kPa (25 psi) Minimum @ 2000 rpm 482 kPa (70 psi) Maximum @ 2600 rpm	
3. Forward Pilot	1655 to 1930 kPa (240 to 280 psi)	
4. Forward Clutch	1655 to 1930 kPa (240 to 280 psi)	
5. Reverse Clutch	1655 to 1930 kPa (240 to 280 psi)	
6. Reverse Pilot	1655 to 1930 kPa (240 to 280 psi)	
7. First-Speed Pilot	1655 to 1930 kPa (240 to 280 psi)	
8. Second-Speed Clutch	1655 to 1930 kPa (240 to 280 psi)	
9. Second-Speed Pilot	1655 to 1930 kPa (240 to 280 psi)	
10. Third-Speed Clutch	1655 to 1930 kPa (240 to 280 psi)	

*Check pressure at fitting for temperature sending unit on left side of the transmission.

NOTE: All pressure checks with engine speed at 2000 rpm and transmission oil temperatures at least 83°C (180°F).



HM170170

Figure 1. Mast

Legend for Figure 1

- | | |
|-------------------|-------------------|
| 1. OUTER WELDMENT | 5. LIFT CHAIN |
| 2. INNER WELDMENT | 6. LIFT CYLINDER |
| 3. LOAD ROLLER | 7. CYLINDER CLAMP |
| 4. SIDE ROLLER | 8. CHAIN SHEAVE |

LIFTING - LOW SPEED

Oil from the control valve enters the base of the lift cylinders at the lowering control valves. See Figure 2. Because of the heavy load on the mast, the pressure in the base of the lift cylinders is higher than if there was no load.

The two-speed spool senses the higher pressure in the pilot line. The pilot pressure moves the two-speed spool and opens a drain circuit to the hydraulic tank. (The two-speed spool stays open because the spring side of the two-speed spool is open to the tank.)

As the lift cylinders extend, oil from the top of the cylinders flows through the external hoses to the manifold block. Since the return circuit to the hydraulic tank is open, the oil flows through the two-speed spool, control valves and the restriction valve to the hydraulic tank.

LOWERING

During lowering, the oil from the base of the lift cylinders flows through the lowering control valves and the hydraulic manifold to the lift spools in the control valves. See Figure 2. At the spools in the control valves, the oil can flow in two directions.

The oil can flow to the hydraulic tank and the oil can also return to the top of each lift cylinder. The restriction valve opens when the pressure in the circuit is 138 to 207 kPa (20 to 30 psi). The restriction valve gives a back pressure at high idle speed of 1380 kPa (200 psi) minimum that is used to force some of the oil to fill the rod ends of the lift cylinders. The rod ends of the lift cylinders must be filled with oil so that the two-speed lifting function will operate.

Legend for Figure 8

NOTE: FOR HYDRAULIC TUBE IDENTIFICATION, SEE TABLE 2. ARRANGEMENT FOR SIDESHIFT CARRIAGE SHOWN.

- | | |
|-----------------------------|--------------------|
| 1. FORK POSITIONER CYLINDER | 5. FORK GUIDE |
| 2. MANIFOLD | 6. COUPLING |
| 3. PIN | 7. SUPPORT BRACKET |
| 4. COTTER PIN | |

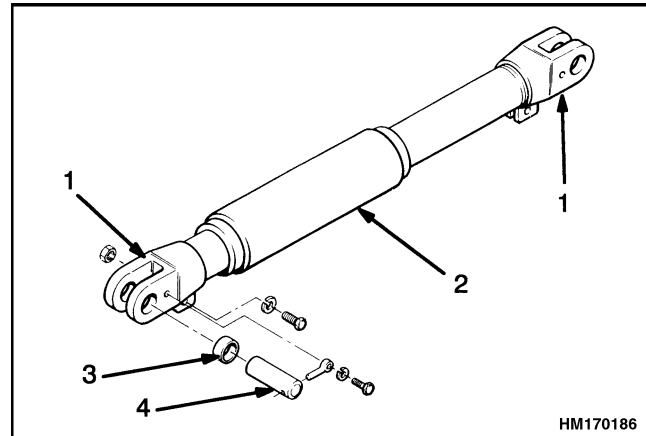
Table 2. Hydraulic Tube and Electric Wire Codes

Tube Codes	Wire Codes	Function
G	11	Sideshift Cylinder (Rod Side)
H	11	Sideshift Cylinder (Piston Side)
J	14	Left-Hand Slew Cylinder (Piston Side) or Left-Hand Fork Positioner Cylinder (Piston Side)
K	14	Left-Hand Slew Cylinder (Rode Side) or Left-Hand Fork Positioner (Rod Side)
L	13	Right-Hand Slew Cylinder (Rod Side) or Right-Hand Fork Positioner Cylinder (Rod Side)
M	13	Right-Hand Slew Cylinder (Piston Side) or Right-Hand Fork Positioner Cylinder (Piston Side)
N	12	Extension Cylinder (Rod Side)
P	12	Extension Cylinder (Piston Side)
T	15	Twist Lock (Engage)
U	15	Twist Lock (Disengage)
Y		Supply/Return
Z		Supply/Return

- b. Use a lifting device to install the fork positioner cylinders. Install the anchor pins at the carriage and fork guides. Install the support bracket for the cylinder shell. Install the hydraulic tubes and lines as shown in Figure 8. Make sure the lines have identification tags and are in the correct sequence on the bracket.
4. If the carriage has a sideshift cylinder, assemble the cylinder as described in the procedure for the Sideshift Cylinder Repair. Use the following procedure to assemble the sideshift carriage (see Figure 6):
 - a. Install the rollers on the bottom crossmember of the carriage.
 - b. Install the bushings in the bearing caps. Make sure the pins in the bushings are at opposite sides of the bearing caps. Also make sure the ends of the bushings are even with the ends of the bearing caps. Lubricate the bushings with multipurpose grease.
 - c. Connect a lifting device to the tube at the top of the sliding weldment. If chains are used, make sure they do not damage the tube. The tube has a machined surface.
 - d. Install the sliding weldment on the carriage. Make sure the hooks at the bottom of the sliding weldment are over the bars on the carriage. Make sure the bushings are in the correct position and install the bearing caps. Tighten the nuts on the bearing caps to 500 N•m (310 lbf ft). The pins on the bushings will crush as the bearing caps are tightened.

Attachment Connector

The two attachment connectors attach at the top of the carriage, between the carriage and the container attachment. See Figure 17. These connectors are non-hydraulic and are used on container attachments that are not equipped with slew cylinders. The connectors help give the load stability, and are used where slewing function is not required.



- | | |
|-------------|------------|
| 1. ROD END | 3. BUSHING |
| 2. CYLINDER | 4. PIN |

Figure 17. Attachment Connector

Header Hoses Replacement

The header hoses are the hydraulic lines that connect the cylinders on the carriage and/or attachment to the hydraulic system of the lift truck. The header hoses move on hose sheaves that are installed at the top of the outer weldment. An electrical cable (wires inside a hose) is used to connect the selector valves on the carriage to the electrical system on the lift truck. Another electrical cable is used for lights on the attachment.

When removing or installing the header hoses, make sure they are connected to the correct fittings as shown in Figure 18. Use the following procedure to install the hoses:

1. Connect the hoses to the fittings on the carriage. Run the hoses over the sheaves.
2. Fasten the hoses to the mast and lift cylinder using the clamps. Do not tighten the clamps at the top of the outer weldment.
3. Put tension on the hoses and electrical cable by pulling on them with 155 N (30 lb) of force and then tightening the clamps at the top of the outer weldment (just below hose sheave). After tightening the clamps for the hoses, make sure the wires move freely inside the hose.

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7. Put identification tags on the lines in the hose support plate.
8. Disconnect and place caps on the lines at the plate
9. Remove the nuts and bolts that fasten the hydraulic module to the frame.
10. Remove the hydraulic module and place on a workbench.

Hydraulic Module, Install

NOTE: Use new seals/O-rings where applicable.

1. Place hydraulic module on frame and fasten with nuts and bolts.
2. Remove caps and reconnect lines at the plate.
3. Remove identification tags on the lines at the hose support plate.
4. Reconnect lines at the flow amplifier, pressure reduction valves, and main control valves.
5. Remove caps and identification tags on the pilot lines.
6. Close doors of hydraulic compartment on the left side of the frame.
7. Start engine and operate system. Check for leaks.

Remote Control Valve

Remove



WARNING

When working on or near the mast, see Safety Procedures When Working Near Mast in the section Periodic Maintenance 8000 SRM 1023.

1. Lower the mast completely and tilt mast forward for access. Put blocks between the mast and the lift truck.
2. Shut off engine and apply the parking brake.



WARNING

Before disconnecting hydraulic lines, proceed as follows:

- **Shut off engine.**
 - **Lower carriage.**
 - **Operate lift/lower lever and brake pedals until hydraulic pressure is released.**
3. Remove the rear cover from the console beside the seat. See Figure 5.
 4. Put tags for identification on hydraulic lines.
 5. Disconnect the six hydraulic lines from the remote control valve.
 6. Put caps on open lines, ports, and other connectors.
 7. Remove the two screws that fasten the cover and the valve assembly as a unit.
 8. Remove the capscrews and nuts that fasten the remote control valve to the cover.
 9. Remove the cover from the valve.

Disassemble



WARNING

Compressed springs can release with great force. Wear eye protection when disassembling valves.

NOTE: Keep the parts from the bore separate. The parts must be installed in the original bores. The parts are adjusted with spacers. Make a note of the number and location of spacers in the spring set. Changing the spacers will affect the operation of the valve. See Figure 6.

1. Put identification marks on the sections of the remote control valve and the spacer block.
2. Remove the nuts and the through bolts that hold the sections and spacer block together.
3. Disassemble each valve section as follows:
 - a. Remove the rubber boot from the plate and the pivot pin for the control lever.
 - b. Put identification marks on the plates at the top of the valve section.

Clean and Inspect



WARNING

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

Compressed air can move particles so they cause injury to the user or to other personnel. Make sure compressed air path is away from all personnel. Wear eye protection.

Clean all parts in solvent and dry the parts with compressed air. Inspect the spools and bores for damage. Inspect the parts of the valve assemblies for damage. Replace damaged parts. If there are scratches or other damage, the valve must be replaced. Spools are not available as separate parts.

CHECKS AND ADJUSTMENTS

NOTE: The procedures for checking the pilot relief pressure is the same as described in the section Pilot

Pressure, Check. Refer to this section to check the pilot relief pressure for the tilt circuit.

Main Control Valve Relief Pressure, Check

NOTE: The relief valves in the control valve are not adjustable. If a relief pressure is not within specifications, replace the control valve.

1. Connect a 20 MPa (3000 psi) gauge to check port 6.
2. Start engine and operate hydraulic system until oil temperature is 54 to 65°C (130 to 150°F).



CAUTION

Do NOT hold the tilt control lever in the back-tilt position more than 30 seconds after the mast is fully in the back-tilt position.

3. Tilt mast to full back position. Pressure must be 17.6 to 18.3 MPa (2550 to 2650 psi) at 2500 rpm. If pressure is not correct, replace control valve (two-spool).

Flow Control Valves Repair

DESCRIPTION

The hydraulic system has several valves to control the flow of oil within the system. These valves are as follows: accumulator charge valve, two pressure reduction valves, and two relief valves.

Accumulator Charge Valve

The accumulator charge valve controls the charging rate and the pressure of the oil in the accumulator for the brake system. This valve also supplies oil to the two pressure reduction valves and the control valve for the carriage and attachment. See Figure 12.

The accumulator charge valve has a charging valve spool, check valve, and a pilot valve assembly. Oil

from the single pump enters the valve at the charging valve spool. A relief valve limits this oil to 22.1 MPa (3200 psi). Oil flows past the charging valve spool to the accumulator and the pressure reduction valves. Oil also flows to the control valve for the carriage and attachment. The accumulator charge valve stops charging automatically when the accumulator pressure reaches its high limit of 18.6 to 19.3 MPa (2700 to 2800 psi). When the accumulator pressure reaches its low limit of 14.1 to 14.8 MPa (2050 to 2150 psi), the accumulator charge valve allows oil from the pump to charge the accumulator. Two check valves in the circuit keep oil from flowing out of the accumulator. See the section **Brake System** 1800 SRM 472 for more information on this valve.

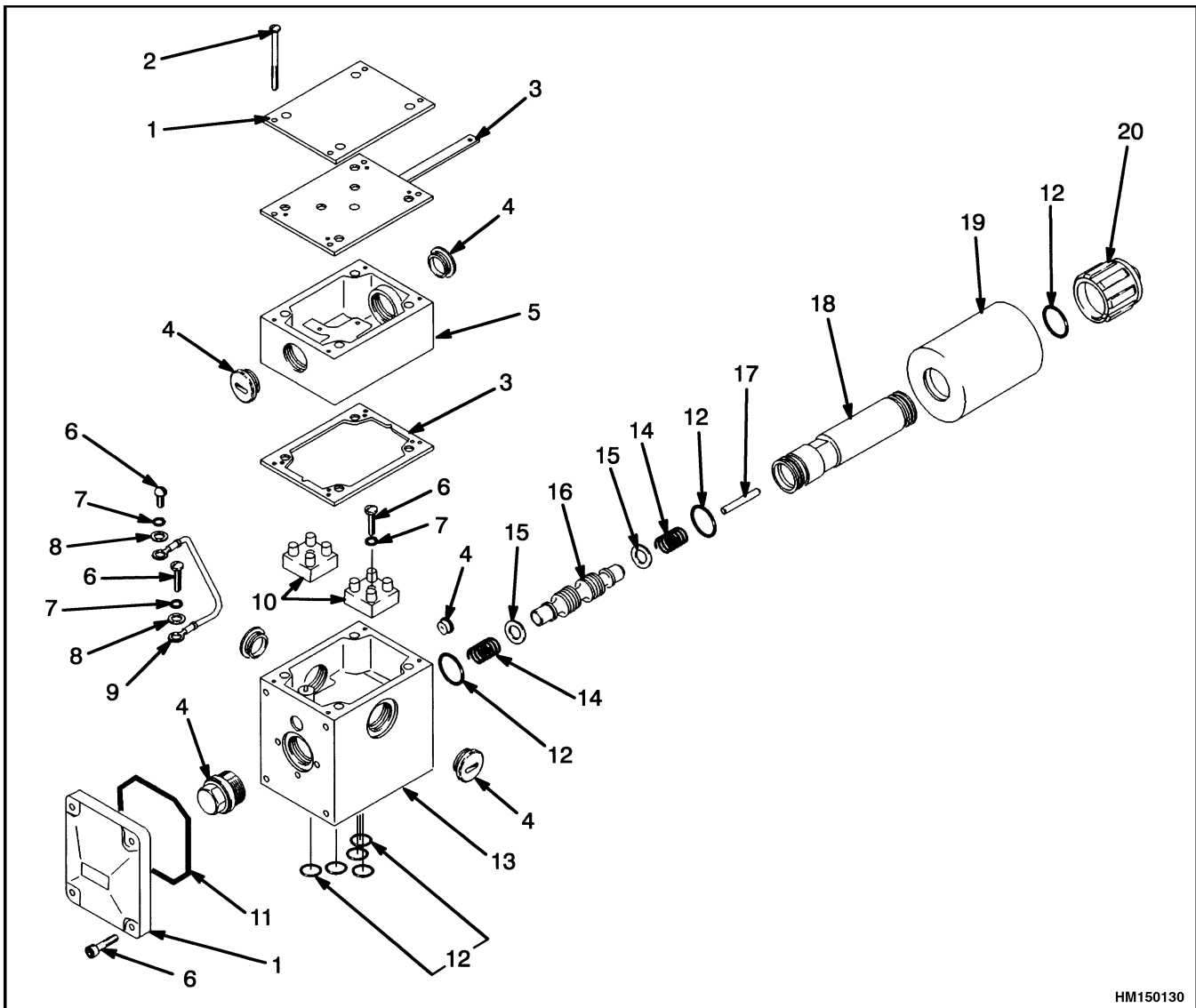
Carriage Solenoid Valves

Remove

NOTE: The carriage solenoid valves are installed on the carriage.

1. Disconnect the electrical cable for the carriage solenoid valve as follows. See Figure 21.

- a. Remove the screws. Remove the cover and the gasket from the frame.
- b. Make a note of the connections of the wires on the terminal blocks. Disconnect the wires at the terminal blocks.
- c. Remove the electrical cable with the frame. If you must remove the frame from the cable, loosen the fitting for the cable.



- | | | | |
|--------------|--------------------|--------------|-----------|
| 1. COVER | 6. SCREW | 11. SEAL | 16. SPOOL |
| 2. SCREW (4) | 7. LOCKWASHER | 12. O-RING | 17. BOLT |
| 3. GASKET | 8. WASHER | 13. HOUSING | 18. PIPE |
| 4. PLUG | 9. BRIDGE | 14. SPRING | 19. COIL |
| 5. FRAME | 10. TERMINAL BLOCK | 15. RETAINER | 20. NUT |

Figure 21. Carriage Solenoid Valve

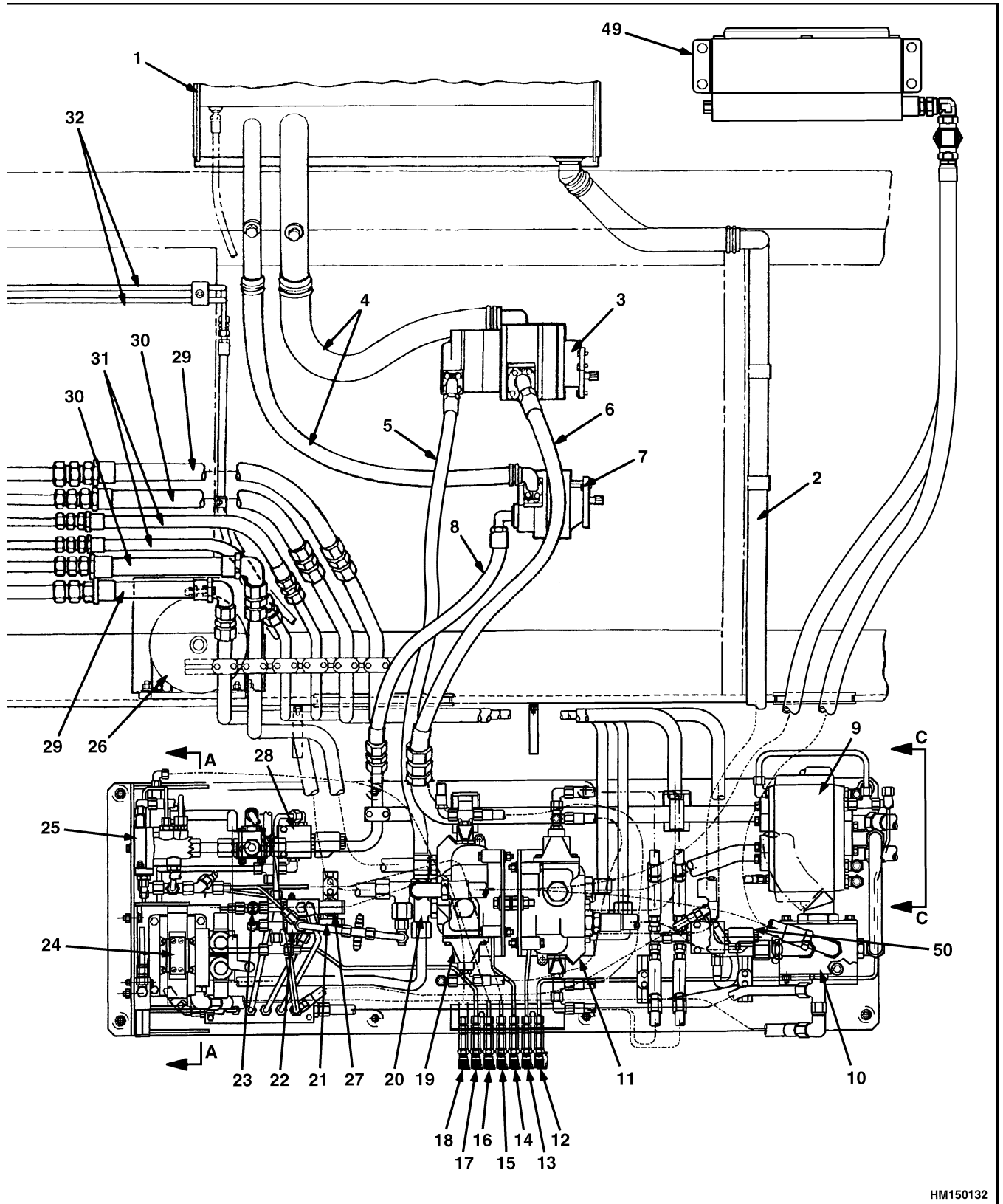
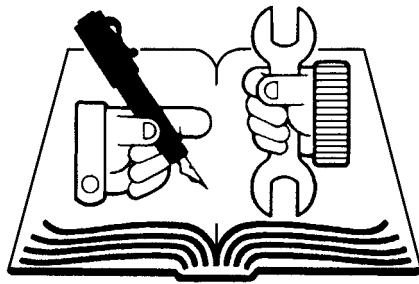


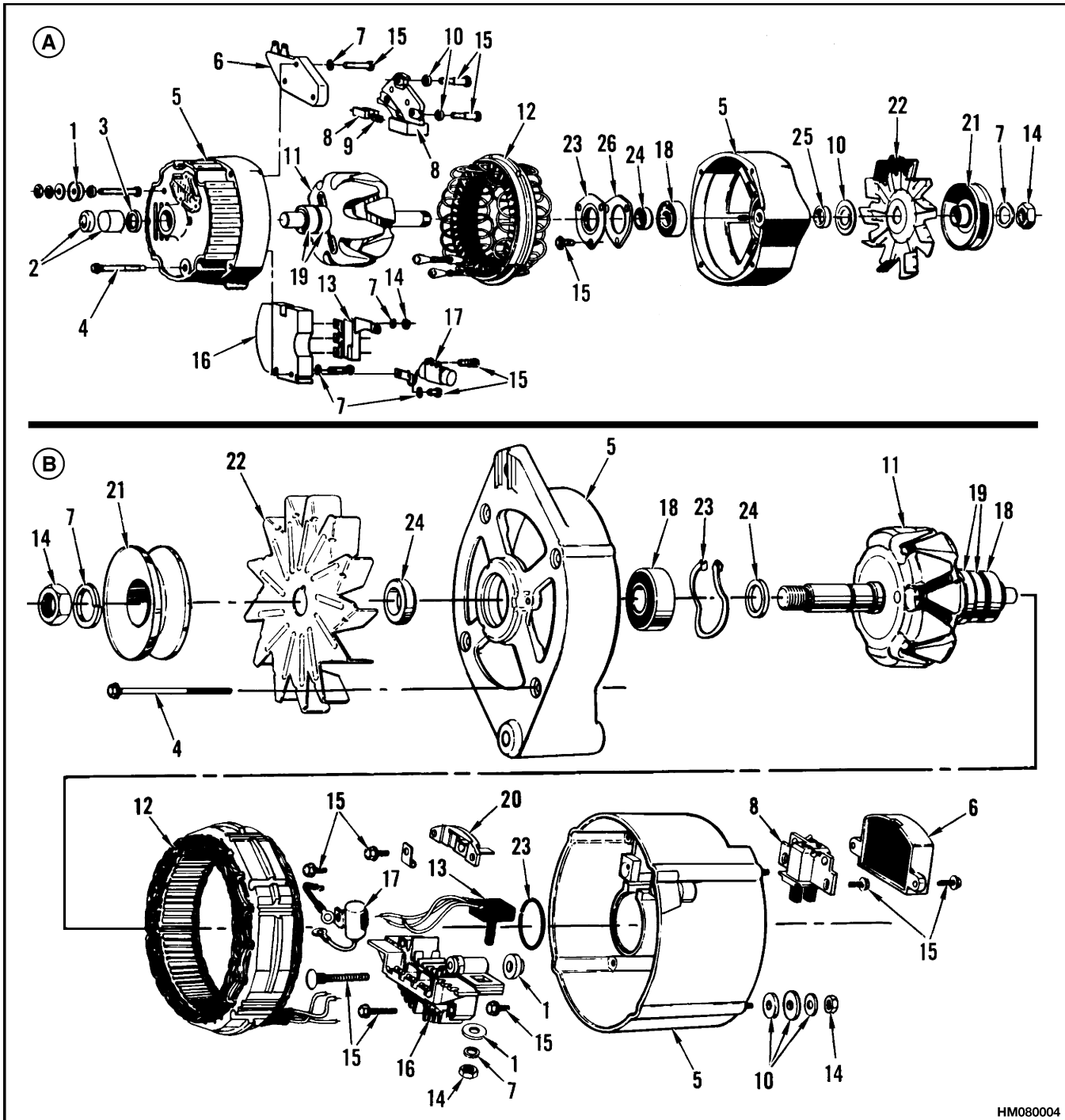
Figure 22. Hydraulic System Arrangement



Hyster Easy Language Program

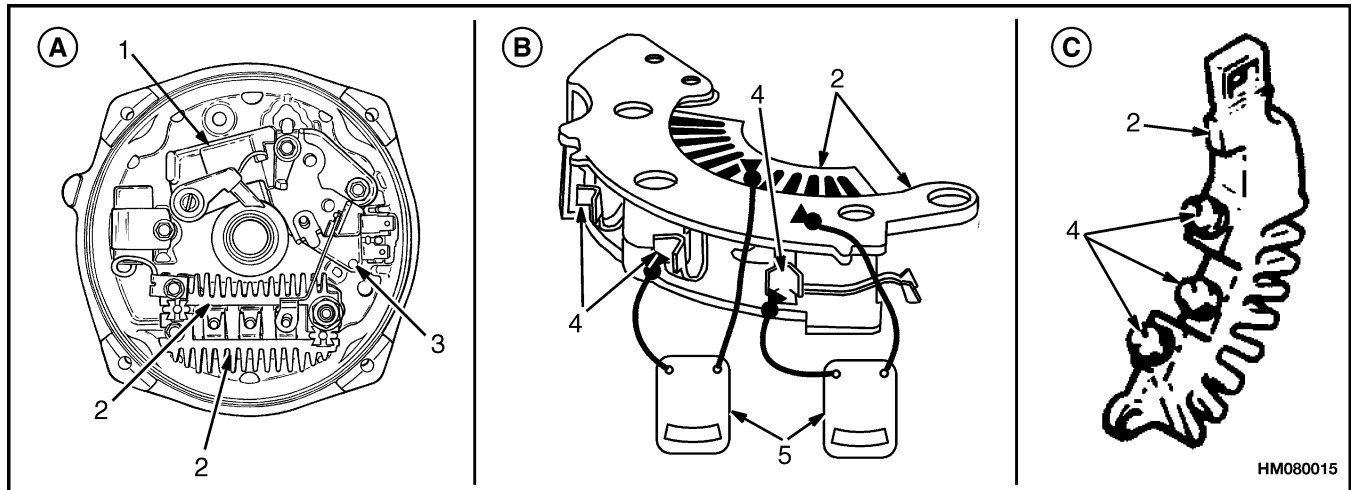
HYSTER TECHNICAL PUBLICATIONS

2. Connect all wires and the connector according to the labels made during removal. Also see the schematic diagram for your alternator in Figure 2. Make sure all wires are connected correctly and all fasteners are tight. See Figure 3.
3. Check the indicator light or the ammeter to check the operation of the alternator. The indicator light for Type A alternators will only be ON if the battery is discharged.



HM080004

Figure 4. Type A Alternators, Exploded Views



- A. DELCO TYPE A
B. DELCO TYPE B

1. BRUSH HOLDER
2. HEAT SINK
3. VOLTAGE REGULATOR

- C. LEECE-NEVILLE

4. DIODE
5. OHMMETER

Figure 15. Diode Bridge Check

Rotor Field Winding Check

Connect an ohmmeter to each slip ring and check for open circuits. If the reading is high (infinity), the winding has an open circuit. To check the resistance of the field, connect the ohmmeter to the two slip rings. The correct reading is 4.0 to 4.5 ohms. If the reading is less than specified, there is a short circuit in the windings. If the reading is more than specified, there is excessive resistance in the windings.

NOTE: Make sure the needle in the ohmmeter always returns to zero correctly. The readings will change when the temperature of the winding changes.

To check the electrical ground, connect the ohmmeter between either slip ring and the electrical ground as shown in Figure 16. Replace the rotor if the reading is less than infinity.

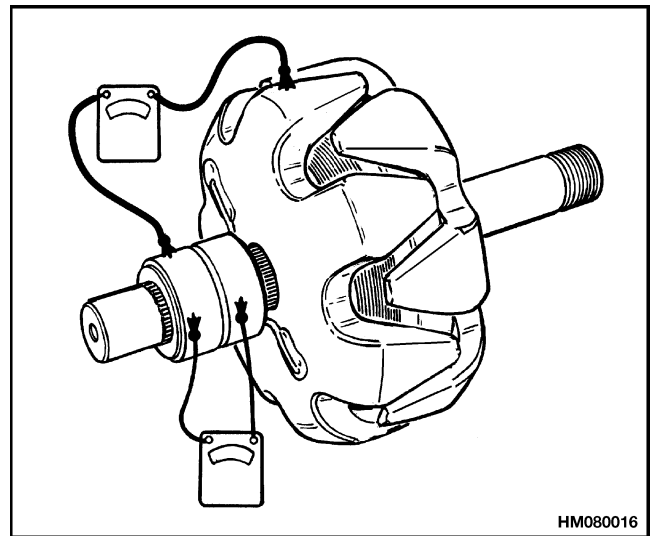
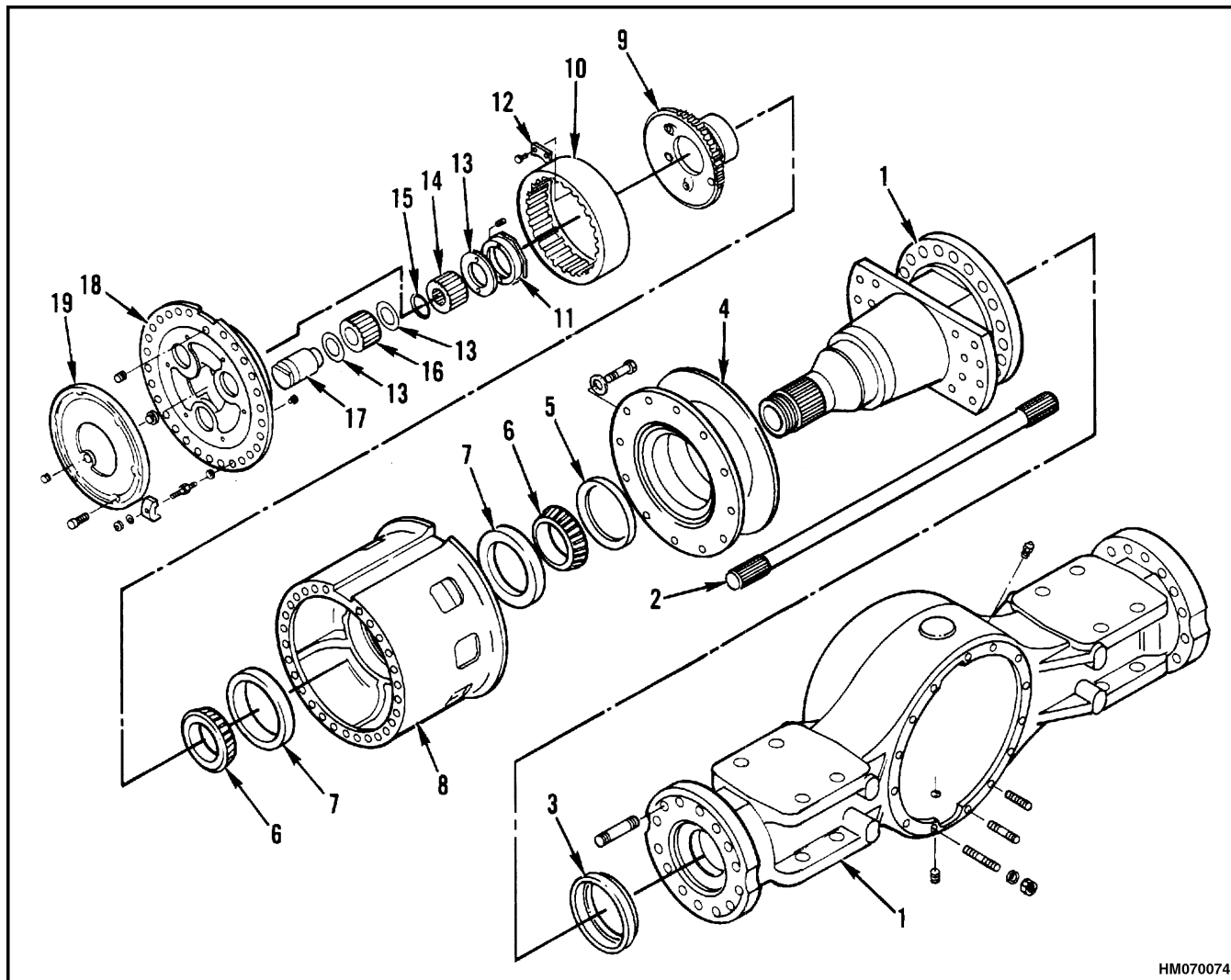


Figure 16. Rotor Coil Checks

Operation

The rotation of the differential causes the axle shafts and the sun gears to rotate. The sun gears then cause the planetary pinions to rotate. Rotation of

the pinions causes the planetary spiders to rotate the hubs and the drive wheels. The ring gear and the ring gear hub do not rotate.



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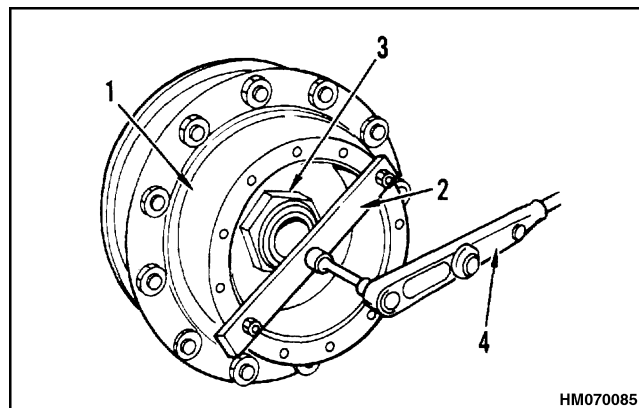
- | | |
|------------------|----------------------------|
| 1. AXLE HOUSING | 11. ADJUSTMENT NUT |
| 2. AXLE SHAFT | 12. LOCK PLATE |
| 3. SLEEVE | 13. THRUST WASHER |
| 4. BRAKE ROTOR | 14. SUN GEAR |
| 5. OIL SEAL | 15. SNAP RING |
| 6. BEARING CONE | 16. PINION (3) |
| 7. BEARING CUP | 17. PINION SHAFT (3) |
| 8. HUB | 18. PLANETARY GEAR CARRIER |
| 9. RING GEAR HUB | 19. COVER |
| 10. RING GEAR | |

Figure 2. Planetary Axle With Disc Brakes

STEP 3.

Tighten adjustment nut to 540 N•m (400 lbf ft) while rotating hub. Loosen nut and tighten it again to 540 N•m (400 lbf ft). Loosen adjustment nut until it just touches ring gear hub. Install a bar and nut on hub as shown. Use a torque wrench to check rotating torque of hub. This is the **initial** value. Make sure hub is rotating while checking the torque. Tighten adjustment nut while checking rotating torque again. Tighten adjustment nut so torque value increases by the amount shown in the following table. The **final** torque value must be the **initial** value plus the value shown in the following table.

Model	N•m (lbf ft)
H7.00-12.50H (H150-275H) P7.00-9.00B (P150-200B) H13.50-16.00B (H300-350B)	7 to 12 N•m (5 to 9 lbf ft)
H360-460B, H16.00-23.00C (H360-510C)	11 to 16 N•m (8 to 12 lbf ft)
H520-620B, H25.00-32.00C (H520-700C), H20.00-32.00F (H440-700F/FS)	14 to 19 N•m (10 to 14 lbf ft)
H700-800A H32.00-42.00B (H700-920B) H36.00-48.00C (H800-1050C)	19 to 24 N•m (14 to 18 lbf ft)



NOTE: Drum brake-type axle shown. Others similar.

1. HUB
2. BAR
3. ADJUSTMENT NUT
4. TORQUE WRENCH

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- **DISCONNECT THE BATTERY CONNECTOR** before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See **HOW TO PUT THE LIFT TRUCK ON BLOCKS** in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a **DO NOT OPERATE** tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

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



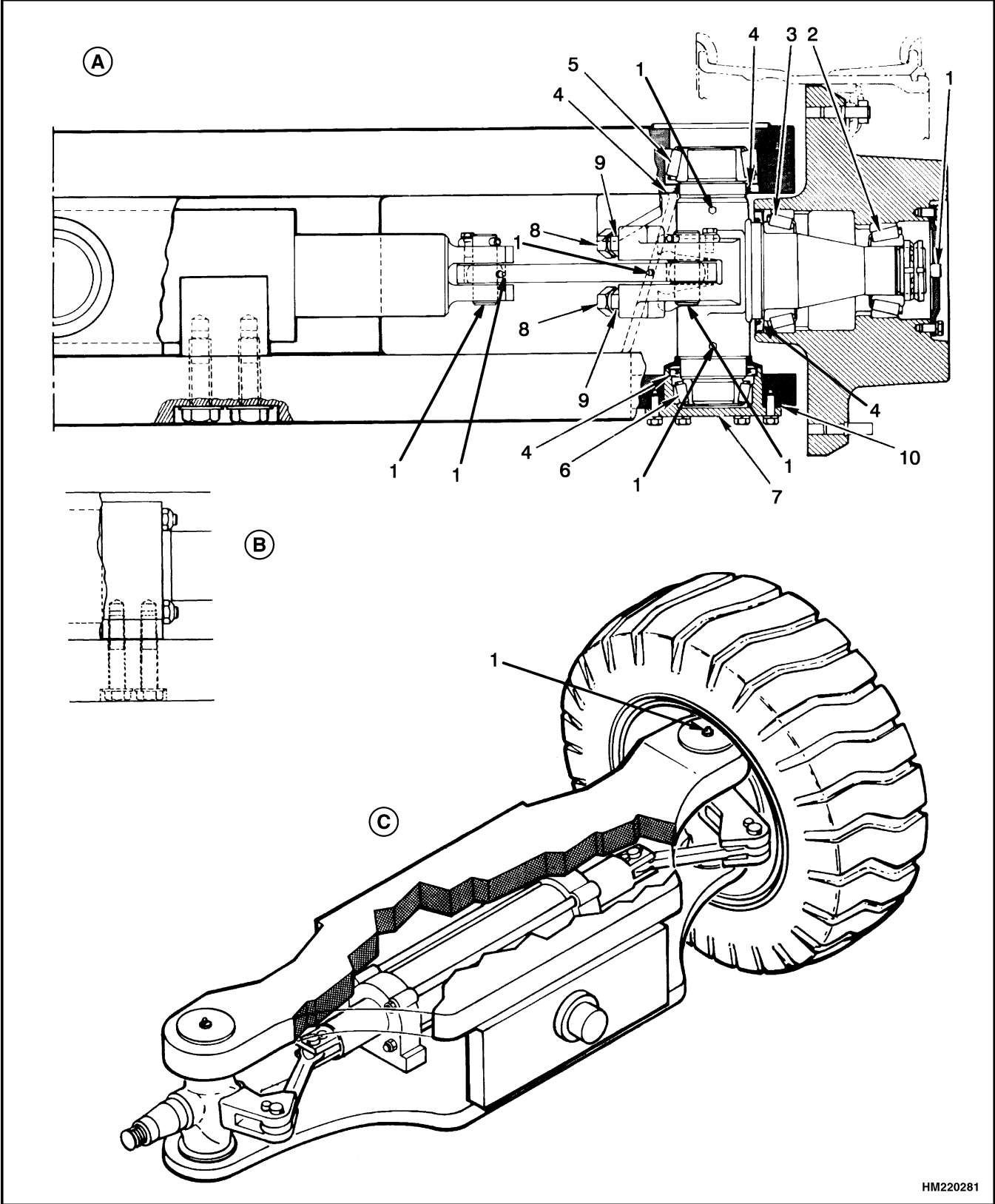
WARNING

Indicates a condition that can cause immediate death or injury!



CAUTION

Indicates a condition that can cause property damage!



HM220281

Figure 7. Axle Assembly

Legend for Figure 1

NOTE: *SOME AXLES DO NOT HAVE THE PARTS DESCRIBED.

- | | | |
|-------------------------|----------------------------------|---|
| 1. PINION NUT | 18. CAPSCREW OR RIVET* | 34. SHIM |
| 2. WASHER* | 19. RING GEAR | 35. PINION CARRIER |
| 3. INPUT YOKE* | 20. CASE HALF, FLANGE | 36. COVER |
| 4. DEFLECTOR | 21. NUT* | 37. BOLT |
| 5. TRIPLE-LIP OIL SEAL | 22. NUT | 38. SHIFT FORK |
| 6. DIFFERENTIAL CARRIER | 23. WASHER | 39. SPRING |
| 7. FILL PLUG | 24. THRUST BLOCK* | 40. SHIFT SHAFT |
| 8. ADJUSTMENT RING | 25. BEARING CAP | 41. PIN |
| 9. LOCK PLATE | 26. COTTER PIN (ADJUSTING RING)* | 42. AIR CYLINDER TUBE |
| 10. CAPSCREW | 27. JAM NUT* | 43. SCREW IN DIFFERENTIAL LOCK CYLINDER |
| 11. SIDE GEAR | 28. THRUST SCREW* | 44. CYLINDER COVER |
| 12. THRUST WASHER | 29. RETAINING RING | 45. GASKET |
| 13. CASE HALF | 30. WASHER | 46. PLUG |
| 14. BEARING CONE | 31. SPIGOT BEARING | 47. SHIFT COLLAR |
| 15. BEARING CUP | 32. PINION | 48. PISTON |
| 16. PINION | 33. SPACER | 49. O-RING |

Differential Repair

REMOVE

NOTE: The repair procedures cover all units unless otherwise indicated.

Differential Carrier From Axle Housing, Remove

NOTE: The differential assembly can normally be removed without removing the drive axle. On some trucks, including the H7.00-12.50H (H150-275H), the drive axle must be removed to remove the differential assembly. If removal of the drive axle is necessary, see the **Drive Axle** service manual for your lift truck model.

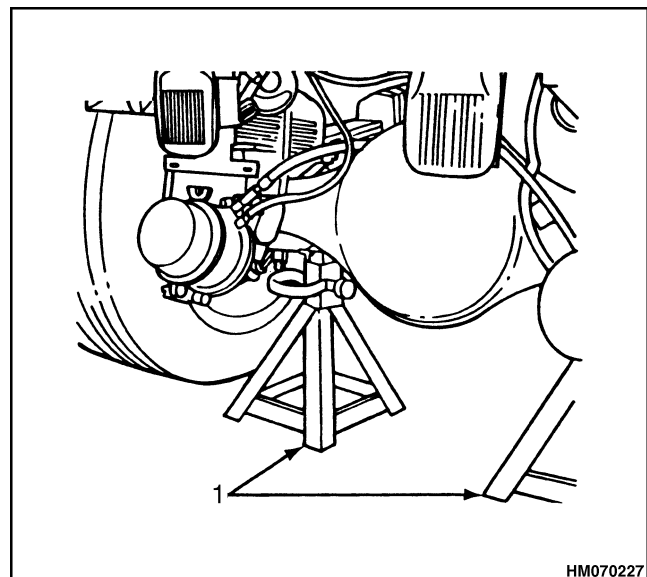
1. Remove the mast. See the **Mast** section for your lift truck model for the removal procedures.
2. Raise the end of the vehicle where the axle is mounted. Use a jack or other lifting tool, and place safety stands under each side of the axle. See Figure 2.

 **WARNING**

Block the wheels to prevent the lift truck from moving. Support the lift truck with safety stands. DO NOT work under a lift truck

supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

3. Place jack stands under each spring seat of the axle, to hold the lift truck in the raised position.



1. SAFETY STANDS

Figure 2. Lift Truck Support

ASSEMBLE

Pinion, Bearings, and Pinion Carrier, Assemble

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

1. Put differential oil on the bearings and cups. Install the cups in the pinion carrier. See Figure 1.
2. Install the inner bearing and spigot bearing against the pinion shoulders. Use a sleeve and press to push against the inner bearing race.

CAUTION

If a new pinion is installed, a new ring gear must also be installed. The pinion and ring gear are a set (see Figure 32) and must be installed together.

NOTE: During assembly at the factory, one spacer is used. Two thinner spacers are used if the pinion or bearings are replaced. These spacers are selected for correct bearing preload.

NOTE: Some spigot bearings are fastened to the pinion with a snap ring, and some are fastened with a punch. Others can have a two-piece bearing. See Figure 24.

3. Install the spigot bearing washer and snap ring. Put the pinion assembly in the pinion carrier. Install the spacers on the pinion. See Figure 19.
4. Use a press to install the outer bearing against the spacer. Rotate the carrier to make sure the bearings are installed correctly.
5. Use either the Press Method or the Yoke or Flange Method, and apply the correct preload. See Specifications, Table 6. Check the bearing preload as described in Pinion Bearings, Adjust Preload of this section.

Pinion Bearings, Adjust Preload

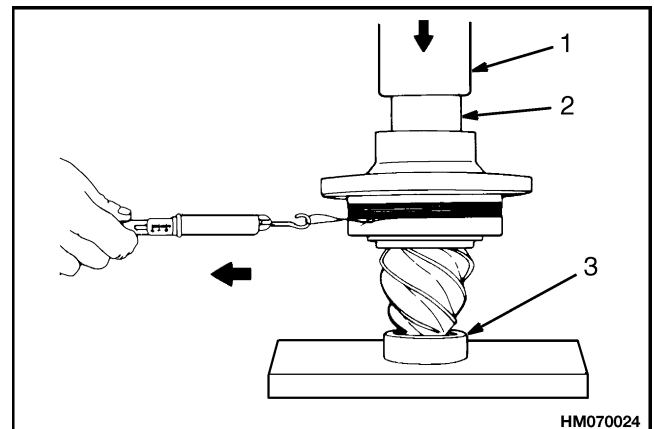
Press Method

WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

NOTE: If a press is not available, or the press does not have a pressure gauge, use the Yoke or Flange Method to adjust pinion bearing preload.

1. Place the drive pinion and carrier assembly in a press with the gear head (teeth) toward the bottom.
2. Install a sleeve of the correct size against the inner race of the outer bearing. See Figure 19.
3. Apply and hold the correct amount of pressure to the pinion bearings. See Specifications, Table 6. As pressure is applied, rotate the pinion carrier several times so that the bearings make normal contact.
4. While pressure is held against the assembly, wrap a cord several times around the pinion carrier. Fasten a Newton or pound scale to the cord. See Figure 26.



- | | |
|-----------|-------------------|
| 1. PRESS | 3. PINION BEARING |
| 2. SLEEVE | |

Figure 26. Bearing Preload Check

5. Tighten each adjustment ring one notch to obtain the preload. The maximum axial movement permitted is 0.15 to 0.33 mm (0.006 to 0.013 in.). See **NOTE** that follows. The maximum torque required to turn the differential bearings is 1.7 to 3.9 N•m (15 to 35 lbf in).

NOTE: Use 0.05 to 0.23 mm (0.002 to 0.009 in.) on Rockwell RS-140 and RS-145 axles.

6. Continue assembly and check the runout of the ring gear.

Ring Gear, Runout Check

1. Attach a dial indicator to the mounting flange of the differential carrier as shown in Figure 46.
2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Set the indicator to zero.
4. Rotate the ring gear and check the dial indicator for the maximum needle movement. The maximum movement permitted is 0.20 mm (0.008 in.).
5. If the movement exceeds the maximum limit, remove the differential and ring gear assembly from the differential carrier and find the reason for the movement. See Step 5 and Step 6 in the section Differential and Ring Gear From Differential Carrier, Remove for the removal procedures.
6. Install the differential and ring gear into the differential carrier after the parts are repaired or replaced. Use the procedure in the section Differential and Ring Gear Assembly, Install. Repeat the preload adjustment of the differential bearings.

Ring Gear Backlash, Adjust

NOTE: Measure the outer diameter of ring gear for approximate pitch diameter. See Figure 49.

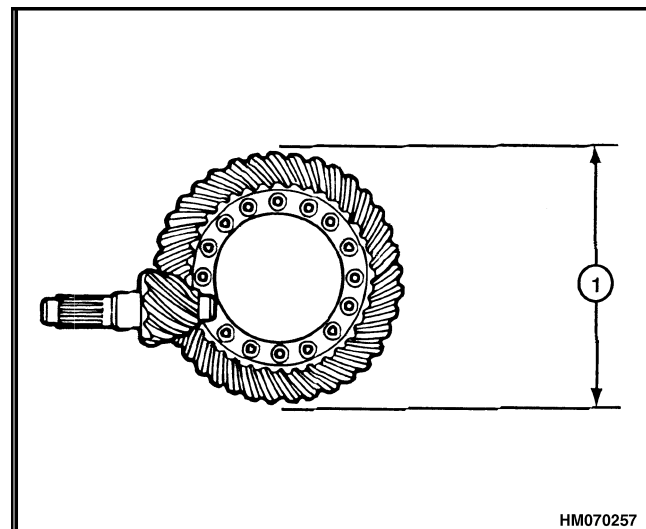
If the old gear set is installed, adjust the backlash to the setting that was measured before the differential carrier was disassembled.

If a new gear set will be installed, adjust the backlash to the correct specifications for new gear sets. See Table 1.

Check the tooth contact pattern first. See Gear Set, Tooth Contact Pattern Check. Once the gear contact pattern has been checked, backlash can be adjusted within specifications, if needed.

To change the location of the pattern, follow the steps outlined below:

1. Install a dial indicator on the mounting flange of the differential carrier as shown in Figure 50.
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. See Figure 50.
3. Adjust the indicator to zero.
4. Hold the drive pinion in position.
5. After reading the dial indicator, rotate the differential and ring gear a small amount in both directions, against the drive pinion teeth.
6. If the backlash reading is within specifications, (see Table 1), continue checking tooth contact patterns.
7. If the backlash reading is not within specifications, (see Table 1), adjust backlash as needed. Continue onto Step 8 and Step 9.



1. MEASURE OUTER DIAMETER FOR APPROXIMATE PITCH DIAMETER

Figure 49. Pitch Diameter Measurement

Table 8. Torque Specifications for Metric Hardware (Continued)

Metric Standard Threads			
Thread Size	8.8 Capscrews/8.0 Nuts	10.9 Capscrews/10.0 Nuts	12.9 Capscrews/12.0 Nuts
M22	580 N•m (430 lbf ft)	830 N•m (613 lbf ft)	970 N•m (716 lbf ft)
M24	730 N•m (540 lbf ft)	1050 N•m (750 lbf ft)	1220 N•m (900 lbf ft)
M27	1100 N•m (812 lbf ft)	1550 N•m (1144 lbf ft)	1800 N•m (1328 lbf ft)
M30	1450 N•m (1070 lbf ft)	2100 N•m (1550 lbf ft)	2450 N•m (1808 lbf ft)
*Torque values are for parts lubricated with light weight oil			

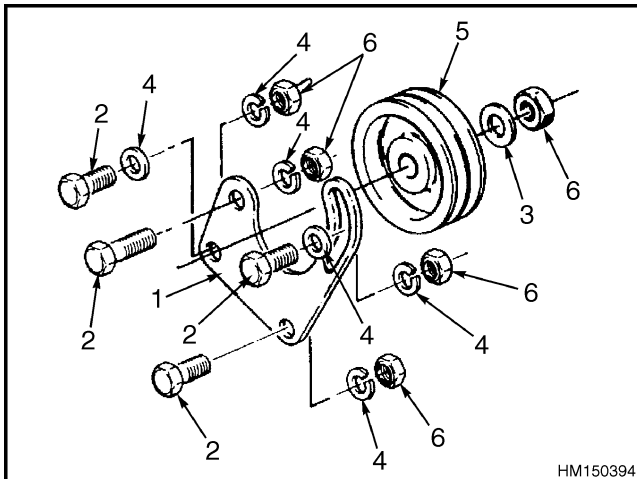
Table 9. Torque Specifications for Metric (Fine) Hardware

Metric Fine Pitch Threads			
Thread Size	8.8 Capscrews/8.0 Nuts	10.9 Capscrews/10.0 Nuts	12.9 Capscrews/12.0 Nuts
M8 × 1	27 N•m (20 lbf ft)	39 N•m (29 lbf ft)	46 N•m (34 lbf ft)
M10 × 1	55 N•m (41 lbf ft)	81 N•m (60 lbf ft)	95 N•m (70 lbf ft)
M10 × 1.25	52 N•m (38 lbf ft)	76 N•m (56 lbf ft)	90 N•m (66 lbf ft)
M12 × 1.25	93 N•m (69 lbf ft)	135 N•m (100 lbf ft)	160 N•m (118 lbf ft)
M12 × 1.5	89 N•m (66 lbf ft)	130 N•m (96 lbf ft)	155 N•m (114 lbf ft)
M14 × 1.5	145 N•m (107 lbf ft)	215 N•m (159 lbf ft)	255 N•m (188 lbf ft)
M16 × 1.5	225 N•m (166 lbf ft)	330 N•m (244 lbf ft)	390 N•m (288 lbf ft)
M18 × 1.5	340 N•m (251 lbf ft)	485 N•m (358 lbf ft)	570 N•m (421 lbf ft)
M20 × 1.5	475 N•m (351 lbf ft)	680 N•m (502 lbf ft)	790 N•m (583 lbf ft)
M22 × 1.5	650 N•m (480 lbf ft)	920 N•m (679 lbf ft)	1050 N•m (775 lbf ft)
* Torque values are for parts lubricated with light weight oil			

DISASSEMBLE

NOTE: See Figure 6, Figure 7, Figure 8, or Figure 9 for the illustration that is similar to the pump being repaired. The illustration can have parts that are different than those in the actual pump that is being repaired.

1. Remove gear or sprocket from input shaft. If equipped, remove pulley from input shaft. See Figure 5.



NOTE: NOT ALL LIFT TRUCK MODELS HAVE A PULLEY ASSEMBLY ON THE GEAR PUMP.

- | | |
|-------------|---------------|
| 1. PLATE | 4. LOCKWASHER |
| 2. CAPSCREW | 5. PULLEY |
| 3. WASHER | 6. NUT |

Figure 5. Pulley Assembly on Gear Pumps

2. Before disassembling the pump, make alignment marks on all housings. Some housings can be assembled in the wrong positions, which will cause failure or increased wear. Carefully clean the outside of the pump.

NOTE: The inlet ports in most gear pumps are larger than the outlet ports.

NOTE: If the pump is held in a vise for disassembly, make sure the vise does not hold the pump too tightly and cause distortion of the pump body.

NOTE: The position of the seals is important. In some pumps the direction of pump rotation is changed by changing the position of the seals and housings. The holes in the seals must be aligned with the oil

passages in the housing sections. The oil passage for the thrust plates is in the outlet chamber.

Make sure you make careful notes of the location and orientation of the parts and seals during disassembly. Some of the parts are similar, but not exactly the same and it can be difficult to make an identification if they are mixed.

3. Remove capscrews or nuts that hold housings together. Use a plastic hammer to separate housings. Do not damage machined surfaces.
4. Remove gears and thrust plates (if used). Make a note of the positions of the thrust plates, seals, and gaskets. Do not use a punch to mark the parts. Remove any springs and check valves.
5. Remove bearings with a puller. In some pumps, the bearing blocks or plates must be replaced with the bearings.
6. Remove front seal.

CLEAN

WARNING

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

WARNING

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

CAUTION

Any dirt that enters the hydraulic system can cause damage to the parts.

Clean all parts of the pump with solvent. Use compressed air to dry the parts. Do not use a cloth to dry the parts. Pieces of the cloth can cause restrictions in the hydraulic system. Make sure the work area and tools are very clean.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Hydraulic pump wears faster than normal.	Dirt in the hydraulic system.	Drain hydraulic tank and clean thoroughly.
	Wrong hydraulic oil.	Drain incorrect oil and fill hydraulic tank to correct level with correct oil.
	Relief valve is set wrong or is damaged.	Adjust relief valve setting. Replace relief valve if it is damaged.
	Cavitation from restriction in inlet hose.	Clear restriction from inlet hose.
	Pump drive has a problem.	Repair pump drive.
	Pump drive is not correctly aligned.	Realign pump drive.
	Pump is not installed correctly in its mount.	Install pump drive correctly.
	Pump is operating too hot.	Check hydraulic oil level and fill to correct level.
Air in the hydraulic system.	Low oil level in hydraulic tank.	Fill hydraulic oil tank to correct level.
	Leak in inlet hose.	Replace inlet hose.
	Loose inlet fitting.	Tighten inlet fitting.
	Breather on hydraulic tank has a restriction.	Replace hydraulic tank breather.
	Supply hose is twisted or has a restriction.	Remove twist or remove restriction.
	Screen in hydraulic tank has a restriction.	Clean hydraulic tank screen.
	Pump seal is damaged.	Replace pump seal.
	Check valve in pump is damaged.	Replace check valve.
	Pump housing capscrews are loose.	Tighten pump housing screws to correct torque.
	Worn or damaged hydraulic pump.	Repair or replace hydraulic pump.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Tilt cylinder movement is slow or not smooth.	Air is in the hydraulic system.	Remove air from hydraulic system.
	The hydraulic pump is worn or damaged.	Repair or replace hydraulic pump.
	Restriction in the hydraulic lines.	Repair hydraulic lines.
	Seals in tilt cylinder are damaged.	Replace seals and inspect cylinder bore for damage.
	Tilt cylinders have internal damage.	Repair or replace cylinder.
	Load is greater than capacity.	Reduce load.
	Pressure relief valve(s) is not adjusted correctly or is damaged.	Repair or adjust relief valve(s).
	Large leaks between spool and bore.	Replace valve section.
	Spool is not fully extended or retracted.	Adjust linkage to spool.
Tilt control spool is damaged.	Repair control valve.	
The tilt cylinders permit the mast to move when the Tilt control lever is in the Neutral position.	There are leaks in the hydraulic lines.	Tighten fittings or repair leaks.
	Seals in tilt cylinder are damaged.	Replace seals and inspect cylinder bore for damage.
	Tilt cylinders have internal damage.	Repair or replace cylinder.
	Tilt control spool is damaged.	Repair control valve.

2. Remove the two screws that hold the solenoid to the drive end housing. Turn the solenoid 1/4 turn and remove it from the starter.
3. Remove the two bolts that hold the commutator end frame and the field frame to the drive housing. Make alignment marks on the end frame and on the field frame for easy assembly. Pull the end frame from the field frame. On some models it is necessary to pull the brushes from the holders. Remove the field frame.
4. If used, remove the four screws holding the center bearing plate to the drive end housing.
5. Remove the armature from the drive end housing. Tilt the armature to disengage the linkage from the drive clutch. On some models it is necessary to remove the linkage before removing the armature.
6. Remove the thrust collar from the armature shaft. Put a metal tube with a 13 mm (0.5 in.) inside diameter over the end of the shaft. See Figure 4. Hit the tube to move the retainer. Remove the snap ring. Remove the drive clutch.
7. Remove the center bearing plate. Remove the seal from the plate.

4. Install the shaft assembly in the drive end housing. Make sure the linkage is engaged in the drive clutch. Install and tighten the four screws for the bearing plate.
5. Install the field frame over the armature. Retract the brush springs and slide the brushes on the commutator.
6. Align the marks and install the thrust washer and the commutator end frame. Install and tighten the through bolts.
7. Make sure the solenoid cover is not damaged. Install the plunger spring and the solenoid. Install and tighten the solenoid mount screws. Connect the field coil strap to the "M" terminal with the screw and lock washer.

CLEAN



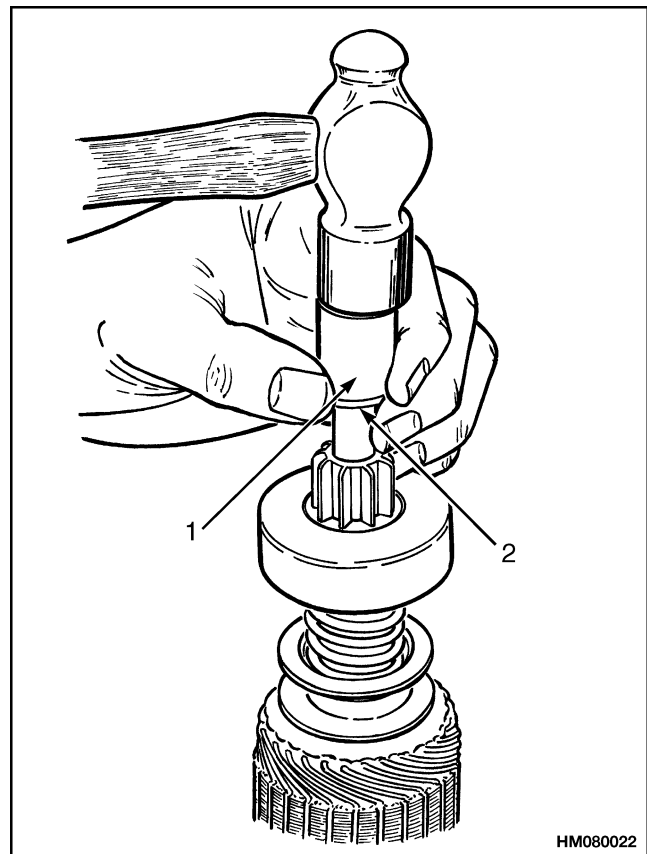
CAUTION

Never use solvent on the drive clutch, armature, or field windings. Use a cloth to clean these parts.

Use solvent to clean all parts of the starter, except the windings and the drive clutch. Dry the parts with compressed air.

ASSEMBLE

1. Install a new seal in the center bearing plate. See Figure 2 and Figure 5.
2. Lubricate the armature shaft and the bushings with a silicone lubricant.
3. Put the center bearing plate, drive clutch, retainer, snap ring, and thrust washer on the armature shaft. Install the snap ring, thrust washer, and retainer as shown in Figure 5.



1. METAL TUBE, 13 mm (0.5 in.) INSIDE DIAMETER
2. RETAINER

Figure 4. Retainer Removal

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Legend for Figure 9

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. DISPLAY UNIT 2. FOUR DIGIT DISPLAY 3. FUNCTION INDICATOR, STATUS CODE (GREEN LED) 4. FUNCTION INDICATOR, BATTERY (GREEN LED) 5. FUNCTION INDICATOR, HOURMETER (GREEN LED) 6. MOUNT FOR DISPLAY UNIT 7. INSTRUMENT PANEL 8. CONNECTOR FOR MOTOR CONTROLLER, TRACTION | <ol style="list-style-type: none"> 9. CONNECTOR FOR MOTOR CONTROLLER, LIFT PUMP 10. TO CONTROL CARD PLUG Y 11. RED* 12. WHITE 13. GREEN 14. BARE 15. GREEN |
|---|---|

*TRACTION CARD PLUG ONLY

**WARNING**

Lift truck movement can cause an injury or damage. Raise the drive wheels from the floor to prevent lift truck movement. Use the correct procedure in the Operating Manual or the Periodic Maintenance section for your lift truck to raise the drive wheels.

The operation of the motor temperature indicators can be checked during periodic maintenance. The battery must be removed from the lift truck for access to the motors. See Figure 8.

Use a jumper cable so that the battery can be connected and still have motor access. Disconnect the sensor wires from the outside of the motor case. Touch the ends of the sensor wires together. The LED indicator will illuminate if the circuit is operating correctly. The thermal switch can be replaced if it has a malfunction. However, the motor must be disassembled to replace the thermal switch.

LX SERIES DISPLAY PANEL**WARNING**

Some adjustments can cause the lift truck to operate differently than normal. This different operation of the truck can result in personal injury or damage. Do NOT try to make adjustments for the instrument panel display without using the procedures in the section EV-100LXT/LX/LXP EV-200LXT/LX Motor Controller & Diagnostic Handset, Description, Checks, Repairs, Adjustments, and Troubleshooting 2200 SRM 460.

There are two instrument panel displays used on some electric lift trucks that have the EV-100/200 "LX" series control cards. Both instrument panel displays are shown in Figure 9 and Figure 10. These instrument panel displays are optional on some electric lift trucks with the EV-100 or EV-200 LX series motor controller.

The early unit has a four digit display and three LED function indicators. The indicators show which function value is displayed by the digits. Not all functions are available on all lift truck models. Following is a list of the functions: Battery Indicator, Status Codes, Traction Hourmeter and Pump Hourmeter. Later units have the same digital display and the same function indicators with the additional motor brush wear indicator and temperature alarm indicator LEDs.

The following paragraphs describe how the circuit for each function operates. The display panel must be replaced as a complete unit. The sensors for brush wear and motor temperature can be replaced as separate parts.

The digits show the operating hours when the hourmeter function indicator is ON. When the battery indicator is ON, the digits show the charge condition of the battery. See Figure 9 and Figure 10. The status code indicator is ON when the digits show the status code number. The brush wear or temperature alarm indicators of the later units will be ON if the traction or pump motor brushes are too worn or the motor is too hot. Refer to the descriptions Brush Wear Indicators and Motor Temperature Indicators for a complete description of the operation of these indicators.

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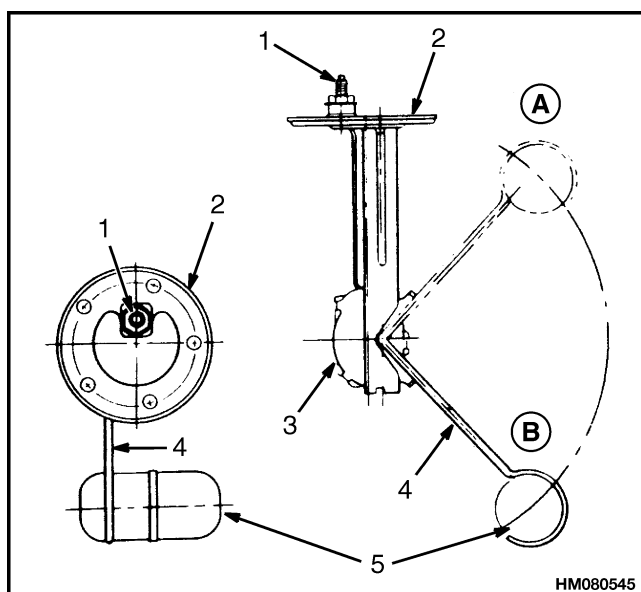
Sender Replacement

FUEL LEVEL SENDER

WARNING

All fuel vapors are extremely explosive. Do not allow sparks or flames around vehicles or fuel storage and service areas. Make sure there is no source of open flame or sparks in the vicinity. Use caution to prevent sparks from tools.

The fuel level sending unit is mounted to the fuel tank surface (usually top surface) with screws through the sender plate and gasket. See Figure 16. Correct sender operation and screw hole alignment can only be obtained with the plate mounted in one position. Replace the sender as follows:



- | | |
|-------------------------|--------------------------|
| A. FULL POSITION | B. EMPTY POSITION |
| 1. ELECTRICAL TERMINAL | 3. SENDER UNIT |
| 2. PLATE | 4. FLOAT ARM |
| | 5. FLOAT |

Figure 16. Fuel Level Sender

1. Turn key switch to **OFF** position and disconnect positive battery cable at battery. Install lock or tag on connector to prevent connection.
2. Disconnect sender wire at sender.

WARNING

Electrical shock from voltage can cause personal injury. Put electrical tape on the wire connector to electrically insulate the connector if the wire is accidentally energized.

CAUTION

Fuel level senders are not accurate if the arm is bent during removal and installation. There must also be clearance for operation. Do not bend the float arm.

3. Remove screws that fasten sender plate to fuel tank. Remove sender.
4. Carefully install new sender with new gasket.
5. Make sure screw holes are aligned and install screws. Tighten screws enough to partially compress gasket to prevent leaks.
6. Remove tape from wire connector. Install connector on sender terminal.

PRESSURE AND TEMPERATURE SENDER

Pressure senders have a hollow threaded fitting fastened to the base. See Figure 17 and Figure 18. This makes it possible for the sender to sense the pressure and also to fasten the sender to the equipment. The sender can be tightened or loosened using a wrench on the flats of the hex shape of the fitting. The body of the temperature sender has threads to fit a threaded hole in the equipment. Replace either sender as follows:

NOTE: Make sure the system fluid is drained to a level below the sender to prevent leakage when the sender is removed.

1. Turn key switch to **OFF** position.
2. Disconnect sender wire.
3. Turn sender counterclockwise with a wrench until free. Remove and discard old sender.
4. Install new sender and tighten with a wrench.
5. Connect sender wire.

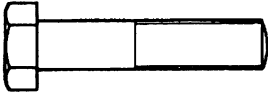
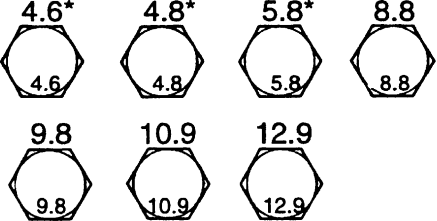

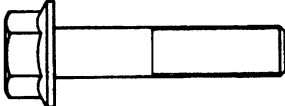

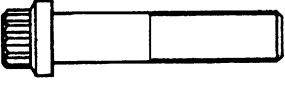

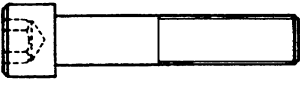


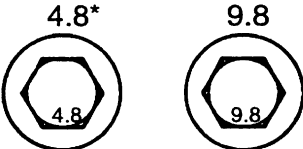

Troubleshooting for Operator Presence System

NOTE: If a fuse is blown, always check the associated circuit(s) for short to ground before replacing the fuse.

Table 1. Troubleshooting Procedure for Operator Presence Module

Symptom	Cause	Check	Result	Investigate
Truck does not move with Operator Present.	No power to Operator Presence System (OPS)	With power ON and engine OFF . Unplug the Operator Presence System connector, and check for battery voltage on Operator Presence System connector pin 2 (+) and pin 1 (-).	Battery voltage >No > Battery voltage >Yes > (Next step below).	Check ground and power wiring, connectors and left hand instrument cluster fuse for open circuit. Repair or replace.
Truck does not move with Operator Present.	Circuit disconnected from the module to the transmission solenoid's power source.	With power ON and engine OFF . Unplug Operator Presence System connector, release the park brake and select a direction. Check for battery voltage on Operator Presence System connector pin 6 (+) and pin 5 (-). Repeat for other direction selection.	Battery Voltage > No > Battery voltage >Yes> (Next step below).	Check Wiring, connectors, park brake switch, and left hand instrument cluster fuse for open circuit between battery and pin 6. Check wiring, connectors, direction switches, and direction solenoids for open circuit between pin 5 and ground. Repair or replace.
Truck does not move with Operator Present.	Operator presence not detected.	With power ON and engine OFF . Plug the Operator Presence System connector in, and check for 5 volts on Operator Presence System connector pin 10 (+) and pin 12 (-).	5 volts > no > 5 volts > yes > (Next step below).	Check circuit SA for short to ground. If there is no short to ground, replace Operator Presence System module.
Truck does not move with Operator Present.		With power ON and engine OFF . Plug the Operator Presence System connector in, and with no operator in the seat, check for approximately 0.5 volts on Operator Presence System connector pin 11 (+) and pin 12 (-).	0.5 volts > No > 0.5 volts > yes> (next step below).	Check circuit SB for short to ground or open circuit. If there is a short to ground or open circuit, repair. If there is no short to ground, or open circuit, replace faulty seat sensor.
Truck does not move with Operator Present.		With power ON and engine OFF . Plug the Operator Presence System connector in, and with operator in the seat, check for approximately 3.0 to 4.5 volts on Operator Presence System connector pin 11 (+) and pin 12 (-).	3 to 4.5 volts > No> 3 volts or more > yes > (next step below)	Faulty seat sensor.

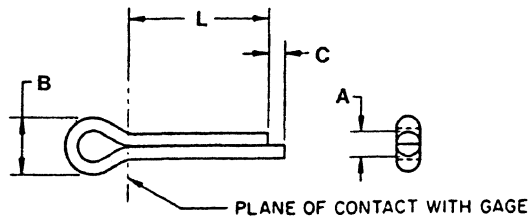
Table 1. Bolts and Screws

TYPE OF FASTENER	METRIC FASTENERS STRENGTH LEVELS: PROPERTY CLASS * MARKINGS NOT REQUIRED	INCH FASTENERS STRENGTH LEVELS: SAE GRADES * MARKINGS NOT REQUIRED
 <p>HEX HEAD BOLTS AND CAPSCREWS</p>	 <p>MARKINGS FOR SIZE M5 AND LARGER</p>	
 <p>HEX HEAD FLANGE SCREWS</p>	<p>SAME AS ABOVE</p>	
 <p>12-POINT FLANGE SCREWS</p>		
 <p>HEX SOCKET HEAD CAPSCREWS</p>		<p>MARKINGS NOT REQUIRED</p>
 <p>SEMS</p>		

HM210066

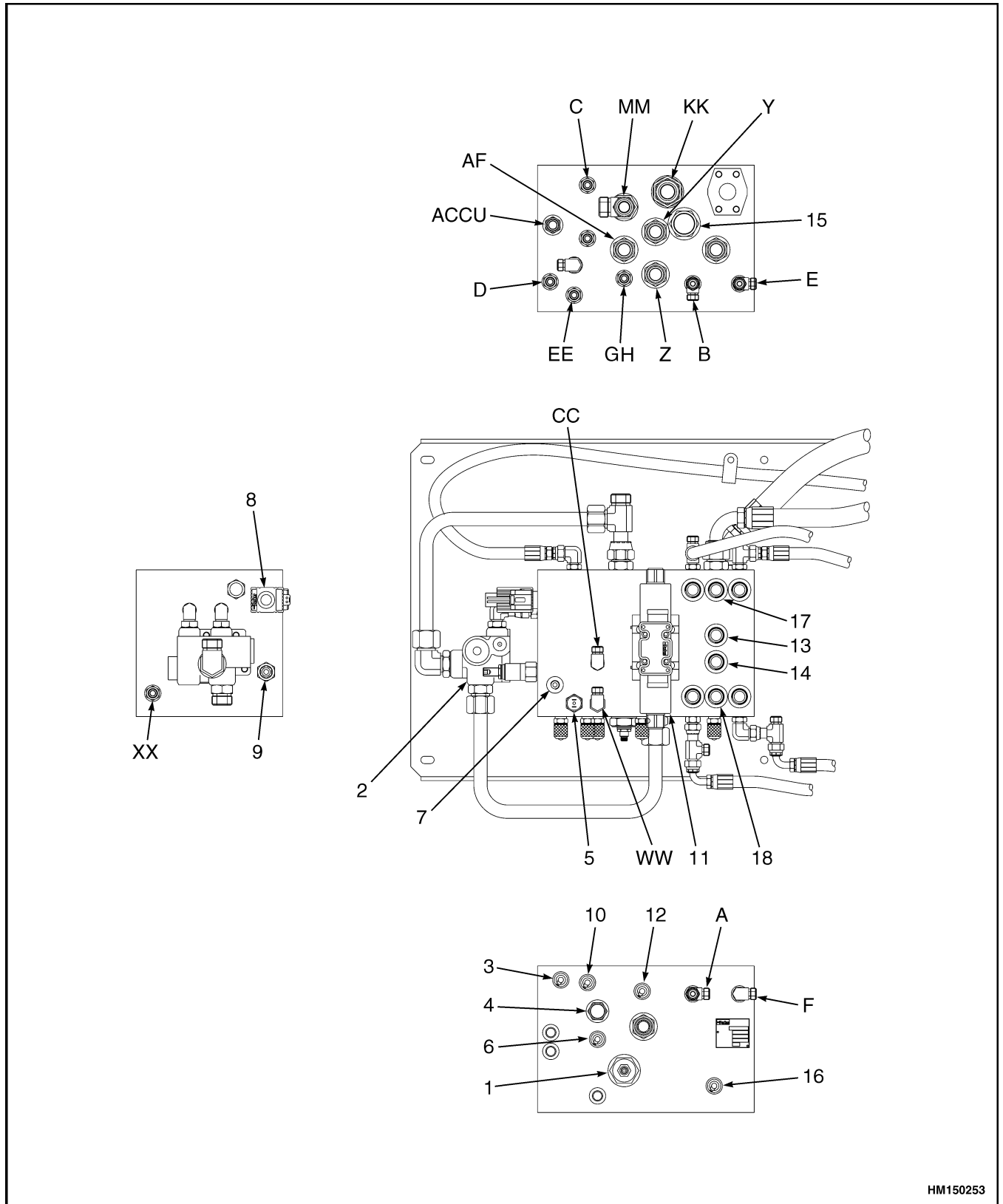
Table 11. Cotter Pin Dimensional Data

Nominal Length L	Length Range		Nominal Size - Part Numbers	
	max	min	13.0 mm (0.500 in.)	16.00 mm (0.625 in.)
19.05 mm (0.750 in.)	20.5 mm (0.807 in.)	18.3 mm (0.720 in.)		
25.4 mm (1.00 in.)	26.9 mm (1.060 in.)	23.9 mm (0.940 in.)		
31.75 mm (1.250 in.)	33.3 mm (1.310 in.)	29.2 mm (1.150 in.)		
38.1 mm (1.500 in.)	40.9 mm (1.610 in.)	36.6 mm (1.440 in.)		
44.45 mm (1.750 in.)	46.0 mm (1.810 in.)	42.9 mm (1.690 in.)	0221889	
50.8 mm (2.000 in.)	52.3 mm (2.060 in.)	49.3 mm (1.940 in.)	0221890	
57.15 mm (2.250 in.)	58.7 mm (2.310 in.)	55.1 mm (2.170 in.)	0221891	
63.5 mm (2.500 in.)	65.0 mm (2.560 in.)	62.0 mm (2.440 in.)	0221892	
69.85 mm (2.750 in.)	72.1 mm (2.840 in.)	68.3 mm (2.690 in.)	0221893	0221895
76.2 mm (3.000 in.)	81.3 mm (3.200 in.)	74.7 mm (2.940 in.)	0015291	0221896
88.9 mm (3.500 in.)	91.4 mm (3.600 in.)	87.4 mm (3.440 in.)	0015292	0221897
101.6 mm (4.000 in.)	113.3 mm (4.460 in.)	98.8 mm (3.890 in.)	0015293	0221898



EXTENDED PRONG

HM211587



HM150253

Figure 3. Brake System Components on Hydraulic Plate (D117E 01642, 01644, 01665, 01679, 01682, and After) E008 (Wet Brakes)

NOTE: When performing Step 13, use caution not to damage threads.

13. Insert pin in screw. Verify pin is aligned properly and is evenly driven into screw.
14. Install new O-ring (31) on plug (32) and install plug in housing. Tighten to 54 to 68 N•m (40 to 50 lbf ft).
15. Install new O-ring (12) on adjusting screw assembly.
16. Install washer, new O-ring (16), seat, new poppet, spring (13), and adjusting screw assembly into housing. Torque screw to 54 to 61 N•m (40 to 45 lbf ft).
17. Install nut on adjusting screw assembly and torque to 54 to 61 N•m (40 to 45 lbf ft).

INSTALL

1. Install the valve on the bracket.
2. Connect the lines to the valve.
3. Operate the system and check the valve for leaks.

ADJUST

After the accumulator charge valve is installed, check the pressure settings. See Figure 7 and Table 1.

1. Connect a 21 MPa (3000 psi) gauge to the check port, port No. 4 in the hydraulic compartment, for the accumulator charge valve.
2. Start the engine so that the pump can start charging the accumulator.
3. If after approximately 1 minute the valve does not begin to charge, do the following:
 - a. Turn screw in until the gauge indicates an increase in pressure. If necessary, turn the screw in to obtain the high limit setting of 18.6 to 19.3 MPa (2700 to 2800 psi). Check the setting (Step b) each time the screw is moved.
 - b. To check the high limit setting, shut off the engine. Operate the brake pedals and the lift/lower lever to discharge the accumulator. Start the engine and check the gauge.
 - c. After adjustment is complete, install the O-ring (31) and plug (32). Tighten the plug to 34 to 47 N•m (25 to 35 lbf ft).

Accumulator

For detailed information on the accumulator, see the section **Accumulator** 1800 SRM 1036.

Relay Valve Repair

NOTE: The following procedures are for the D117 truck.

The relay valve is located above the accumulator charge valve on the module sub panel with the hydraulic system components. See Figure 1. The module is on the left-hand side of the lift truck.

For the location of relay valve starting with D117 E 01681 and after, see the section **Hydraulic Plate** 1900 SRM 1012.

Starting with D117 E 01720 wide axle and D117 E 01724 narrow axle, the auxiliary brakes are no longer incorporated and the relay valve has been removed.

REMOVE



WARNING

Before disconnecting any hydraulic lines, release pressure from the hydraulic circuit as follows:

- a. **Shut off the engine and completely lower the carriage. Install blocks at the wheels to prevent the lift truck from moving.**
 - b. **Operate the lift/lower lever and the brake pedals until the hydraulic pressure is released.**
1. Put tags for identification on the lines.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The brake(s) does not release.	The brake linings are damaged.	Replace brake linings.
	A brake line has a restriction.	Replace line.
	The auxiliary brake rotor is damaged.	Repair or replace auxiliary rotor.
	The brake pedal valve is damaged.	Replace brake pedal valve.
	The parking brake is applied.	Release parking brake.
	A seal(s) in the brake system is damaged.	Replace seal(s).
One of the brake pedal valves does not operate the brakes.	The shuttle valve does not operate.	Repair or replace shuttle valve.
The brakes make noise.	The brake rotor(s) is damaged.	Repair or replace brake rotor(s).
	Oil or water is on the linings of the auxiliary brakes.	Clean linings.
	The linings are worn.	Replace linings.
Service brakes do not operate when the engine is not running.	There is no charge in the accumulator.	Repair or replace accumulator or accumulator charge valve.
	The accumulator charge valve does not operate correctly.	Repair or replace accumulator charge valve.
	Hydraulic lines for the accumulator circuit leak or have restrictions.	Replace lines.
The parking brake does not release.	The hydraulic pressure is too low.	Check and adjust hydraulic pressure.
	There is a leak(s) in the hydraulic lines.	Replace lines.
	The parking brake valve is damaged.	Repair or replace parking brake valve.
	The pilot valve does not operate correctly.	Repair or replace pilot valve.

General

This section has the description and repair procedure for the extendable container handling attachments ELME models 812, 813, 815, and 818. Each model is built according to a combined model and specification number (eg 813-8608), which is the key to different spreader functions and to parts and service information. The nameplate of the spreader mentions model, specification number, and serial number. The nameplate is located at the right-hand rear side of the central spreader frame.

Description

Attachment models 813, 815, and 818 have basically the same central frame and extension beams. Their difference is in the connection with the mast carriage. Model 812 and 813 rests on a dedicated carriage. Model 815 fits on the forks of the truck and model 818 is suspended by hangers attached to a gantry carriage. See Figure 1. The slew cylinders and sideshift cylinder are part of the retention of the spreader. Models 812 and 813 has in addition a bolted retainer bar that prevents the spreader from being lifted from the carriage. For models 815, the mast side of the slew cylinders are connected with a fork bracket. Model 818 has the capability to absorb differences in pile slope either by mechanical

retraction of the hangers or by the hydraulic function 'powered pile slope,' which tilts the spreader frame sideways before it even touches the container. Model 812 is identical to model 813 except for its lighter construction, which lowers its weight by 1100 kg (2425 lb), but simultaneously reduces its capacity to 28,123 kg (62,000 lb). The attachments are designed to lift either 20 or 40 ft. containers. When delivered with an optional stop kit, reinforcements have been applied to the frame allowing it to lift 30- to 35-ft containers. Another standard option is the bumper kit, designed to guide the attachment onto the container.

Operation

The attachment is operated by hydraulic pressure from the truck and by electrically-energized valves. Hydraulic pressure is provided by the auxiliary valve on the truck. Depending on the selected function and selected direction (eg: twist locks, lock) hydraulic pressure is applied to line z, and line y functions as the tank return line. When the same hydraulic function is reversed (eg: twist locks, unlock) then hydraulic pressure is applied to line y, and line z functions as the tank return line. This implies that it is not possible to operate the slew and sideshift functions in any desired direction at the same time. The relief valves also provide some protection against damage to the cylinders and solenoid valves, when the spreader hits an object. Under extreme conditions this may lead air forming in the hydraulic oil, causing improper functioning. By operating the affected function several times, the air will gradually disappear. Table 2 shows the

reference numbers for the hydraulic schematics that relate to the different ELME specification numbers. The required electric current for the solenoid valves is controlled by a printed circuit board (PCB), that verifies signals from the control switches in the operator cab and signals from various sensors. This is to prevent functions from being energized under incorrect conditions, or that conflicting functions are energized at the same time. The PCB is located inside the electric box, which is fitted at the rear side of the spreader frame. The wiring diagram shows the wiring connection between the printed circuit board and the different components. The electrical schematic shows the logic of the printed circuit board between spreader signals and truck control connections. See Table 2 for the reference numbers of the electric diagrams and schematics that relate to the different ELME specification numbers.

 **CAUTION**

Use caution not to damage the finished surface of the piston rod when installing the piston rod into the cylinder shell.

2. Lubricate the cylinder shell bore with clean hydraulic oil. Put the piston rod assembly into the cylinder shell.
3. Place the ring on the cylinder shell. Lubricate the four threads of the cylinder shell and four bolts with clean oil and install the four bolts/washers and tighten.

INSTALL

1. Completely retract the extension beam.
2. Clean the tracks and lubricate in those positions where the support wear pads for the extension cylinder will come in contact with the extension beam.
3. Verify that the cables and hoses are fitted and that the cable chain with the chain bracket are properly tied to the cylinder in two places.
4. Place a sling at the extension cylinder at the valve side of the cylinder support plate and at the valve itself. Verify that the contact areas of the cylinder support and the spreader are aligned.
5. Put the cylinder support in the spreader beam, remove the obstructing sling, and move the cylinder a few meters/feet into the spreader.

6. Pull the extension beam out approximately 50 cm (1.6 ft) until the inspection hole in the extension beam is clear of the main frame.
7. Move the cylinder into the beam until the rod end is at the level of the attaching bracket. Align the ball joint with the bracket and fit the attaching pin, washer, and cotter pin. See Figure 5.

 **WARNING**

Verify the lifting device has the rated capacity of 150 kg (331 lb) or personnel injury may occur.

8. Move the lifting device to align the ball joint at the valve end with the frame bracket. Fit the attaching pin, washer, and cotter pin. Remove the sling.
9. Retract the extension beam, remove the ropes from the cable chain, and bolt the cable chain bracket to the extension beam.
10. Connect the hoses and cables at the frame side and at the extension beam side of the extension cylinder.

 **WARNING**

Do not try to locate hydraulic leaks by putting hands on pressurized hydraulic components. Hydraulic oil can be injected into the body by pressure.

11. Start the engine and operate the extension cylinder function. Check if the functions work correctly, and check for any leaks.

Sideshift Cylinder Repair**REMOVE**

1. Place the lift truck on a solid, level surface.
2. Lower the attachment and shut down the engine.
3. Put identification tags on the hydraulic lines.

 **WARNING**

Do not disconnect any hydraulic lines when the engine is running or personnel injury may occur.

4. Disconnect the hydraulic lines to the cylinder and put caps on the open lines.
5. Remove the lock nut, washer, spacer, and pin from one end of the cylinder.
6. Remove the lock nut, washer, spacer, and pin from the other end of the cylinder.

 **WARNING**

Verify the lifting device has the rated capacity of 20 kg (44 lb)

Torque Specifications

Twist Lock Cylinder Assembly Screws

38 N•m (28 lbf ft)

Stop Cylinder Assembly Screws

38 N•m (28 lbf ft)

Stop Cylinder Piston Securing Nut

60 N•m (44 lbf ft)

Extension Cylinder Piston Securing Nut

450 N•m (332 lbf ft)

Extension Cylinder Gland Screws

60 N•m (44 lbf ft)

Sideshift Cylinder Piston Securing Nut

800 N•m (590 lbf ft)

Slew Cylinder Piston Securing Nut

800 N•m (590 lbf ft)

Sideshift Cylinder Gland Nut

800 N•m (590 lbf ft)

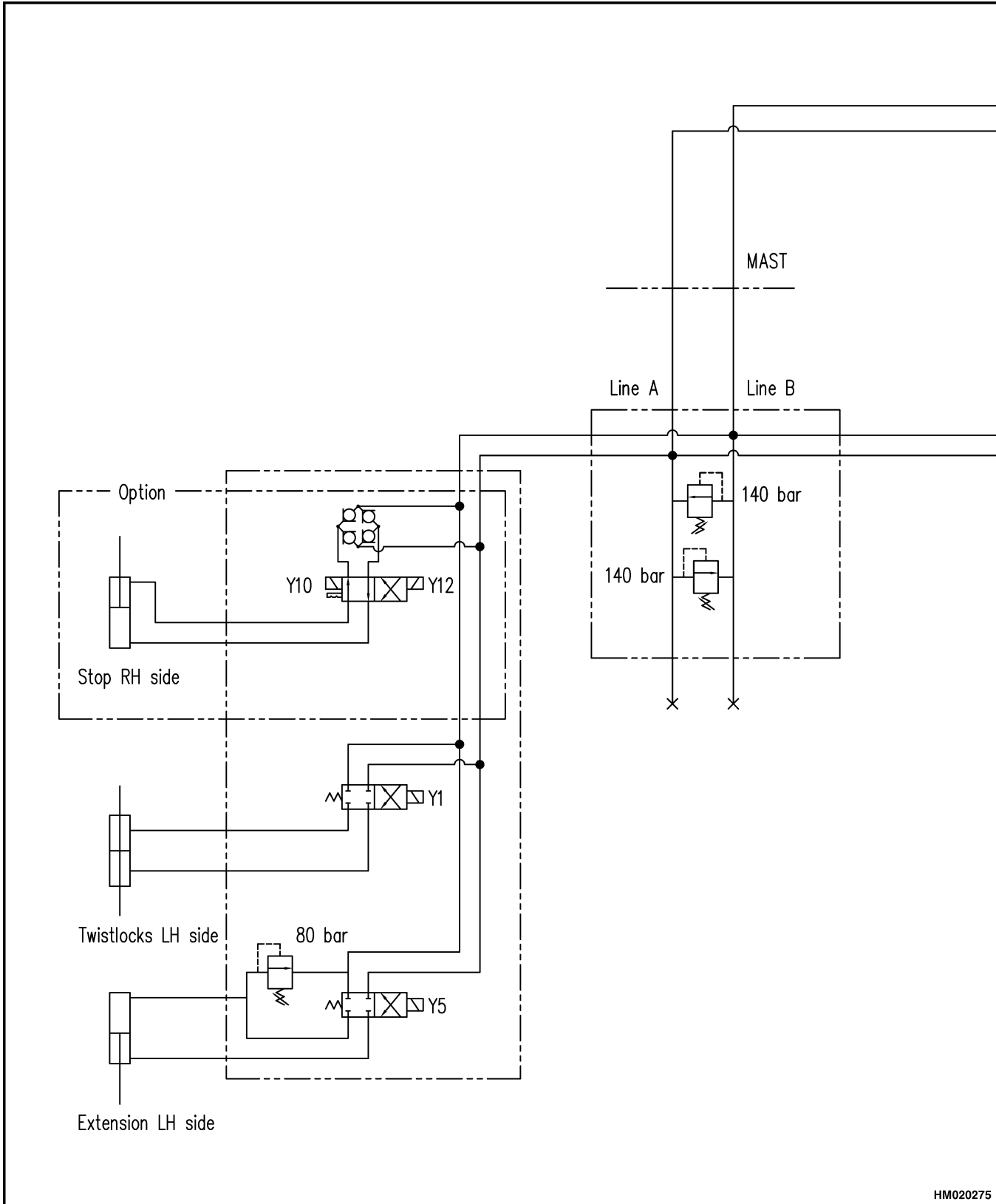
Slew Cylinder Gland Nut

800 N•m (590 lbf ft)

Standard Hardware See the section **Metric and Inch (SAE) Fasteners** 8000 SRM 231.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
No spreader functions or no spreader functions in one direction.	Check lift truck hydraulic supply valve for correct operation.	Repair the supply valve.
	Low main hydraulic pressure at the spreader main relief valve.	Adjust the pressure at the main relief valve to 140 bar (2031 psi).
	Dirt in the relief valve cartridge.	Clean or replace the relief valve.
	No electrical power at the solenoids of both the lift truck and chassis.	Check for proper voltage at the solenoids, if voltage is present, replace the solenoid. If voltage is not present check the appropriate switch.
Low spreader response time.	Low hydraulic pressure at the spreader attachment main relief valve.	Adjust the pressure at the main relief valve to 140 bar (2031 psi).
Both extension beams will not extend.	Low hydraulic pressure at the spreader attachment main relief valve.	Adjust the pressure at the main relief valve to 140 bar (2031 psi).
	No electrical power at the solenoids of both the lift truck and chassis.	Check for proper voltage at the solenoid, if voltage is present, replace the solenoid. If voltage is not present check the appropriate switch.



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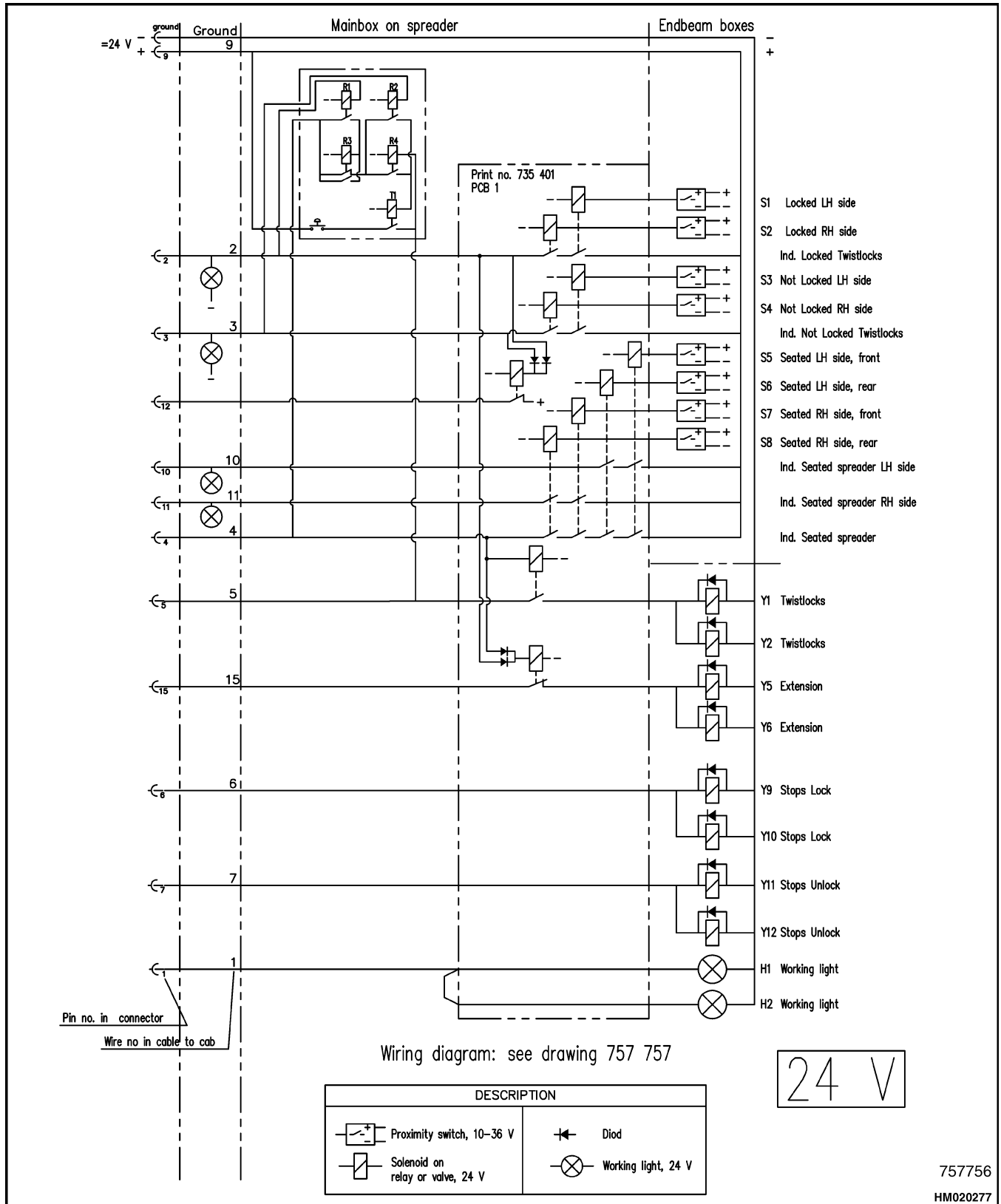
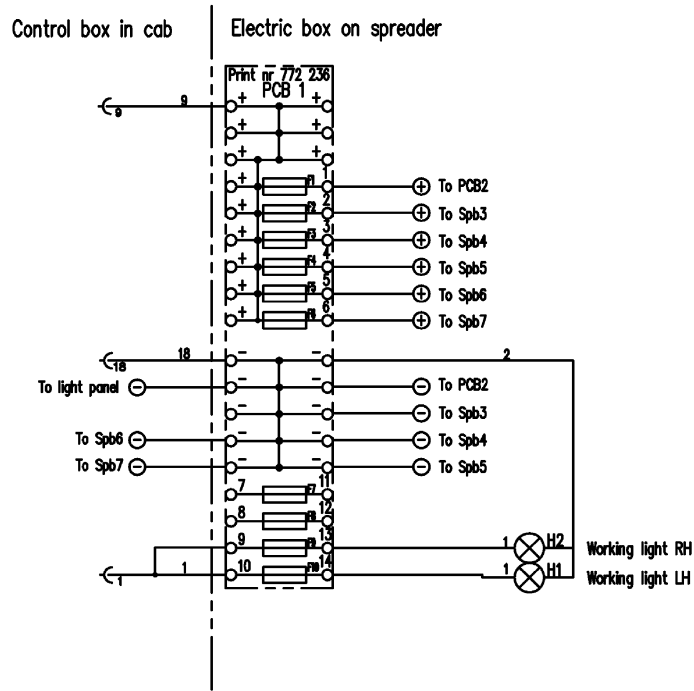






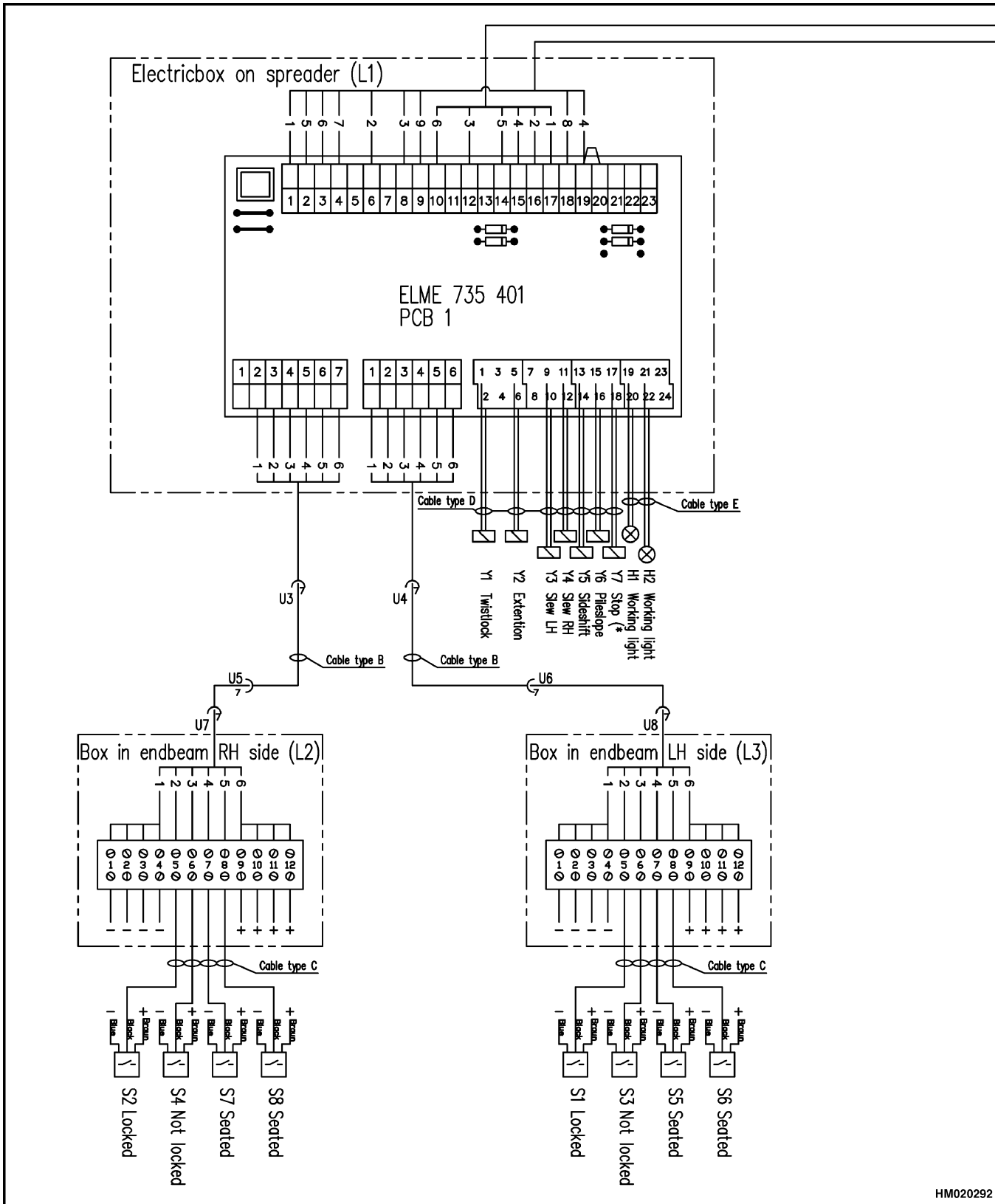
Figure 24. ELME Electrical Schematic 757756



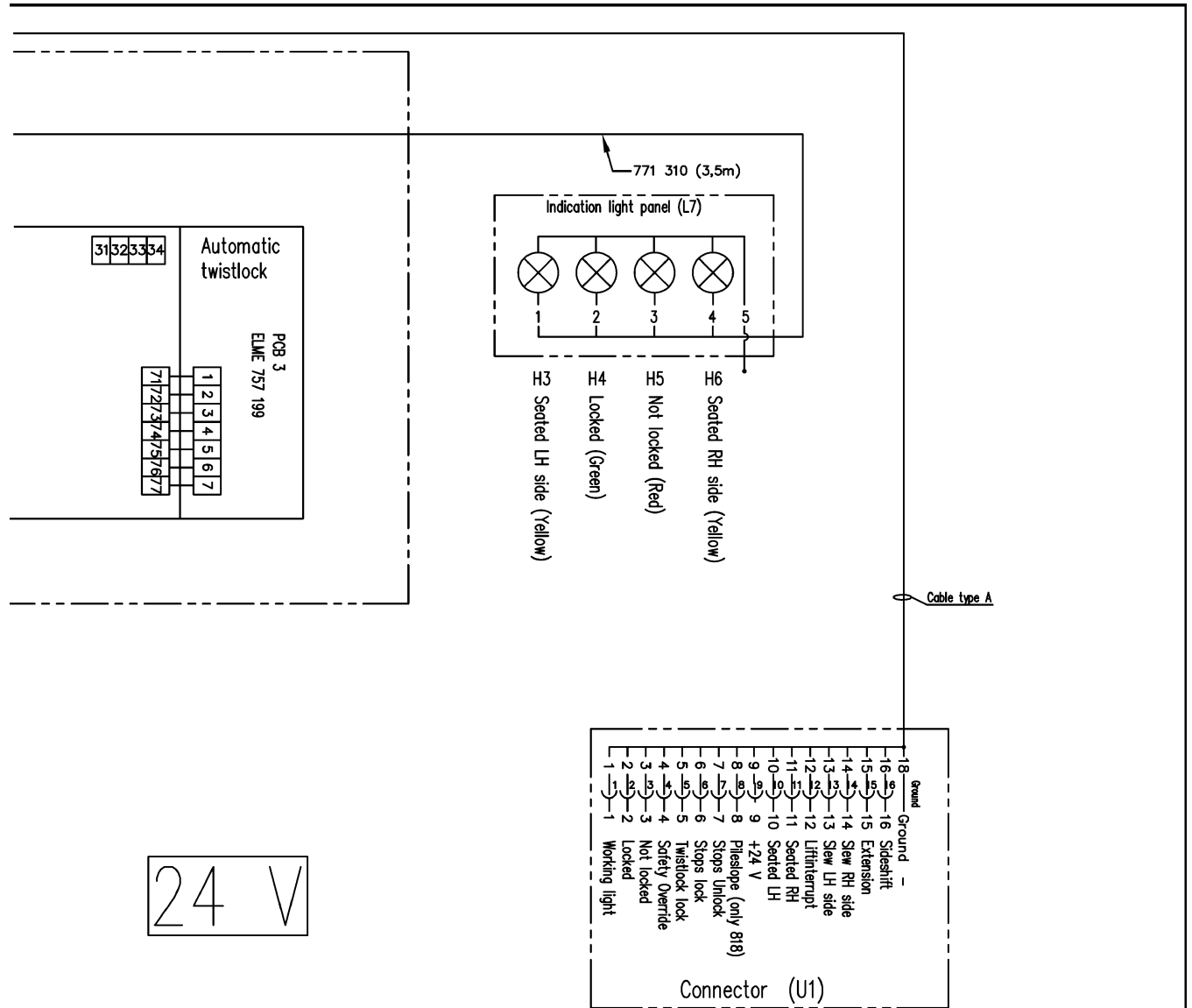
DESCRIPTION	
	Proximity switch, 10-36 V
	Solenoid on relay or valve, 24 V
	Diode
	Working light, 24 V

24 V

Wiring diagram see drawing No.775 188a.



HM020292



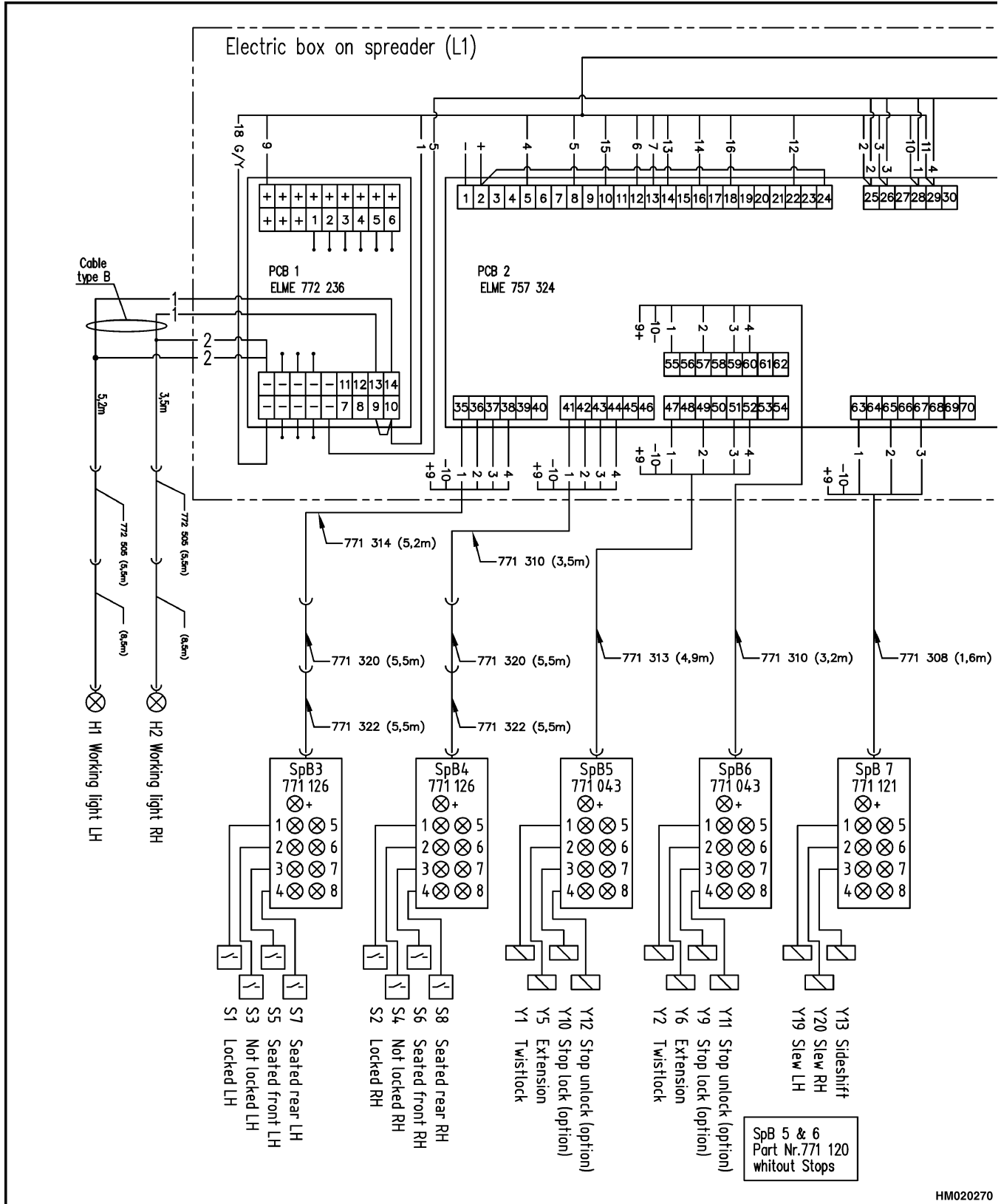
Electric schematic diagram see drawing no. 772 000B.

Wires colour code		
Violett	1	Violet
Brun	2	Brown
Gul	3	Yellow
Blå	4	Blue
Grön	5	Green
Röd	6	Red
Rosa	7	Pink
Grå	8	Grey
Svart	9	Black
Vit	10	White

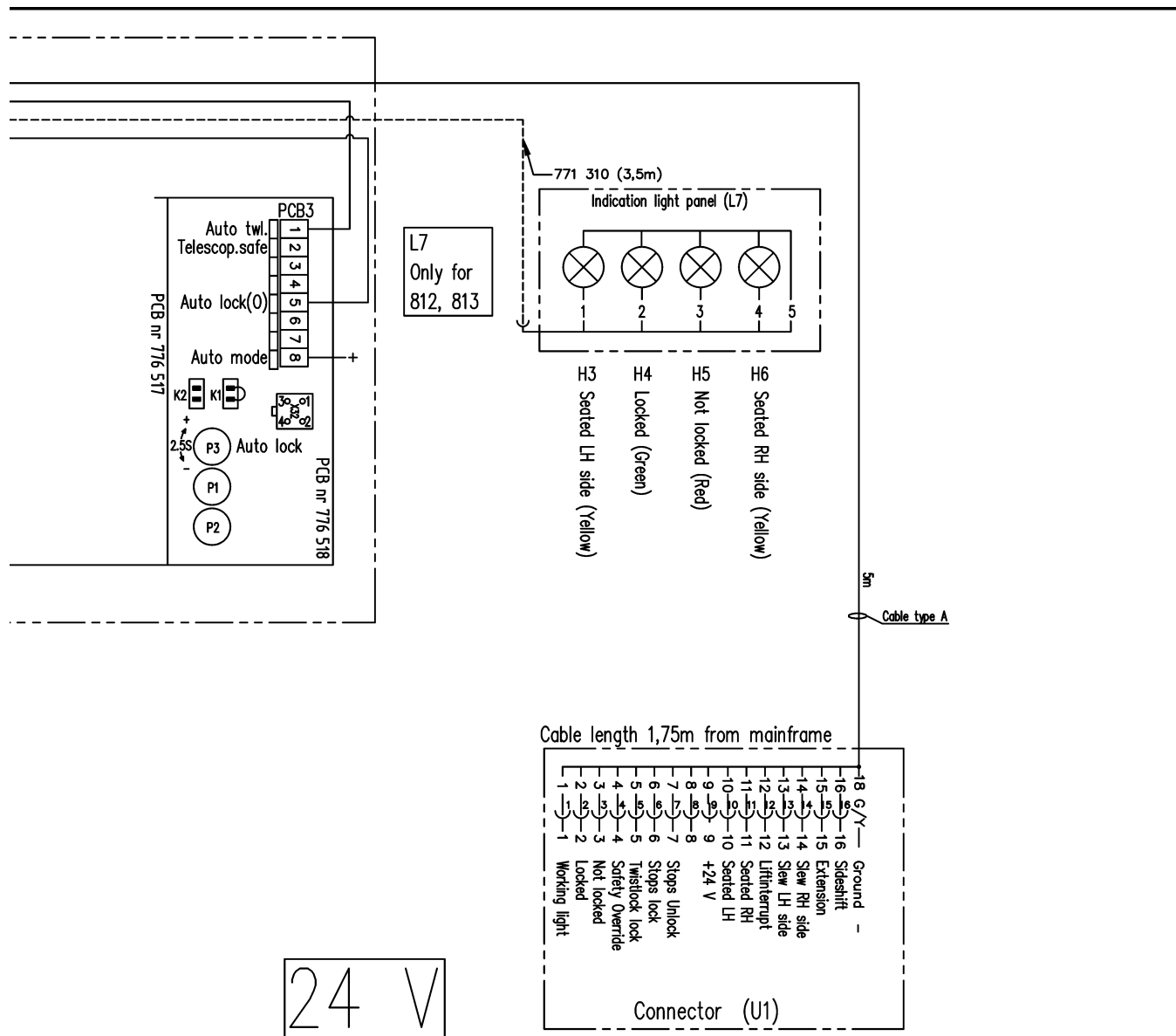
772001

HM020267

Figure 47. ELME Wiring Diagram 772001



HM020270



Electric schematic diagram see drawing no. 781 632

Wires colour code		
Violett	1	Violet
Brun	2	Brown
Gul	3	Yellow
Blå	4	Blue
Grön	5	Green
Röd	6	Red
Rosa	7	Pink
Grå	8	Grey
Svart	9	Black
Vit	10	White

781633
HM020322

Figure 58. ELME Wiring Diagram 781633

**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

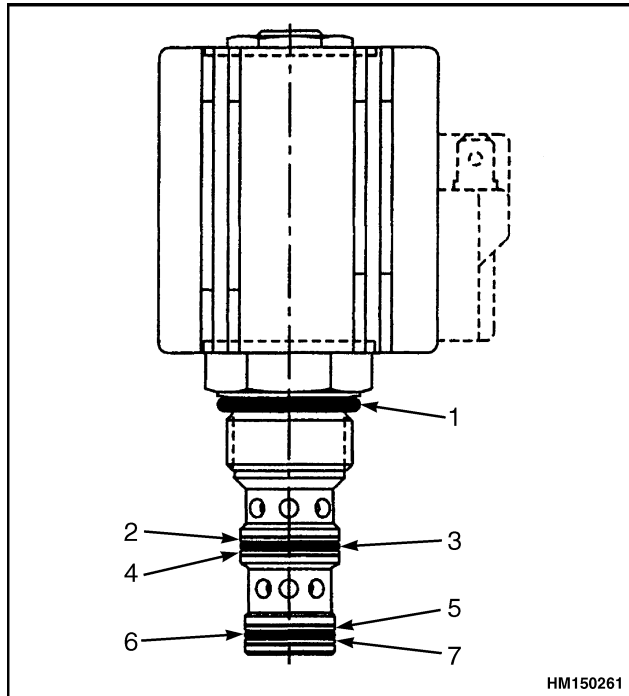


Figure 9. Solenoid Control Valve Cartridge (Lift Interrupt/Bleeder Valve)

Legend for Figure 9

- | | |
|----------------|----------------|
| 1. O-RING | 5. BACKUP RING |
| 2. BACKUP RING | 6. O-RING |
| 3. O-RING | 7. BACKUP RING |
| 4. BACKUP RING | |

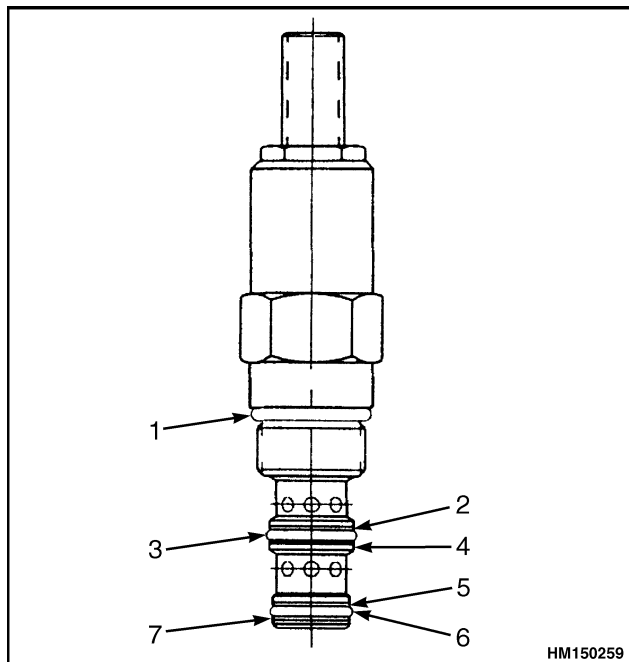


Figure 10. Pressure Reducing Valve, Regulated

Legend for Figure 10

- | | |
|----------------|----------------|
| 1. O-RING | 5. BACKUP RING |
| 2. BACKUP RING | 6. O-RING |
| 3. O-RING | 7. BACKUP RING |
| 4. BACKUP RING | |

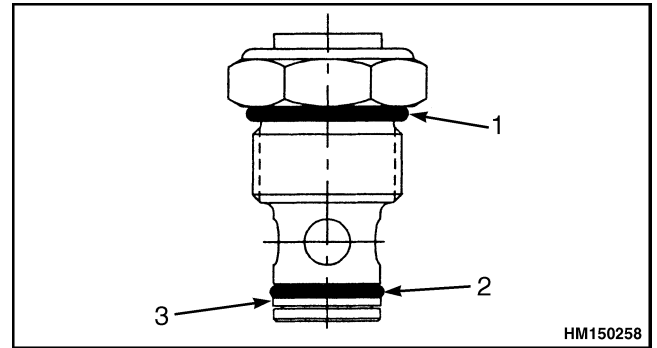


Figure 11. Check Valve Cartridge

Legend for Figure 11

- | | |
|-----------|----------------|
| 1. O-RING | 3. BACKUP RING |
| 2. O-RING | |

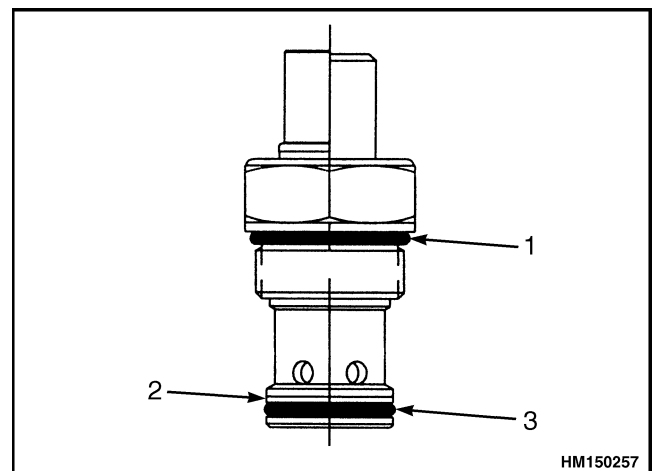


Figure 12. Relief Valve, Fixed Cap / Tamper Resistant Version

Legend for Figure 12

- | | |
|----------------|-----------|
| 1. O-RING | 3. O-RING |
| 2. BACKUP RING | |

*Legend for Figure 14***NOTE:** NUMBERS IN BOX INDICATE STAMPING ON MANIFOLD. SEE FIGURE 13.

Item	Stamping on Manifold	Description
1	114	Relief Valve
2	116	Accumulator Charge Valve
3	N/A	Check Port M4
4	232	Shuttle Valve
5	120	Brake Pressure Switch
6	N/A	Check Port M8
7	54	Pressure Switch
8	115	Solenoid Valve
9	112	Reducer Valve
10	N/A	Check Port M2
11	107	Directional Control Valve
12	N/A	Check Port M1
13	490	Solenoid Valve
14	490	Solenoid Valve
15	168	Nonreturn Valve
16	N/A	Check Port 5
17	430	Solenoid Valve
18	460	Solenoid Valve
19	N/A	Two-Spool Main Control Valve
20	N/A	Single-Spool Main Control Valve
21	N/A	Check Port M6
22	N/A	Flow Amplifier
23	N/A	Check Port M7
24	N/A	Return Manifold
25	N/A	Hydraulic Oil Cooler
26	N/A	Manual Override

General

This section contains a Maintenance Schedule and the instructions for maintenance and inspection.

The Maintenance Schedule has time intervals for inspection, lubrication, and maintenance for your lift truck. The service intervals are given in both operating hours recorded on the lift truck hourmeter and in calendar time. The recommendation is to use the interval that comes first.

The recommendation for the time intervals are for 8 hours of operation per day. The time intervals must be decreased from the recommendations in the Maintenance Schedule for the following conditions:

- If the lift truck is used more than 8 hours per day
- If the lift truck must work in dirty operating conditions



WARNING

Do not make repairs or adjustments unless you have both authorization and training. Repairs and adjustments that are not correct can make a dangerous operating condition.



WARNING

Do not operate a lift truck that needs repairs. Report the need for repairs immediately. If repair is necessary, put a DO NOT OPERATE tag in the operator's area. Remove the key from the key switch.

Your dealer for Hyster lift trucks has the equipment and trained service personnel to do a complete program of inspection, lubrication, and maintenance. A regular program of inspection, lubrication, and maintenance will help your lift truck give more efficient performance and operate for a longer period of time.

Some users have service personnel and equipment to do the inspection, lubrication, and maintenance shown in the Maintenance Schedule. Service Manuals are available from your dealer for Hyster lift trucks to help users who do their own maintenance.

SERIAL NUMBER DATA

The serial number for the lift truck is on the nameplate and also on the right-hand frame rail, near the counterweight. The serial number indicates the design series, manufacturing plant, and the year of manufacture.

Example:	E8	E	4369	N
	(1)	(2)	(3)	(4)

(1) The first letter and number of the serial number indicates the design series and the model number of the lift truck.

Examples: E8 indicates the serial code for the H20.00-32.00F (H440-700F/FS) series of lift trucks.

(2) The second letter identifies the manufacturing plant.

Examples:

- B = Northern Ireland
- D = Danville, IL, U.S.A.
- E = Nijmegen, The Netherlands
- V = Berea, KY, U.S.A.

(3) The number series indicates the sequence of manufacture where the lift truck was made.

(4) The letter indicates the year of manufacture starting with A=1980. The letter L=1990, M=1991, and N=1992. (The letters I, O, and Q are not used.)

HOW TO MOVE DISABLED TRUCK

NOTE: If there is no hydraulic pressure to release the parking brake, the parking brake caliper (located on the drive shaft) must be manually released. Put blocks on each side (front and back) of the drive tires to prevent movement of the lift truck. To manually release the parking brake, remove the cotter pin and tighten the nut to compress the spring that applies the brake.

Maintenance Procedures Every 8 Hours or Daily

HOW TO MAKE CHECKS WITH ENGINE STOPPED

WARNING

Do not operate a lift truck that needs repairs. Report the need for repairs immediately. If repair is necessary, put a **DO NOT OPERATE** tag in the operator's area. Remove the key from the key switch.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

Put the lift truck on a level surface. Lower the carriage and forks, stop the engine, and apply the parking brake. Open the hood and check for leaks and conditions that are not normal. Clean any oil or fuel spills. Verify all surfaces are free of oil, lubricants, or other foreign objects.

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 locations on the lift truck. See the **Parts Manual** or the **Frame** section of the **Service Manual** for the correct location of the safety labels.

If new labels must be installed, use the following procedures:

WARNING

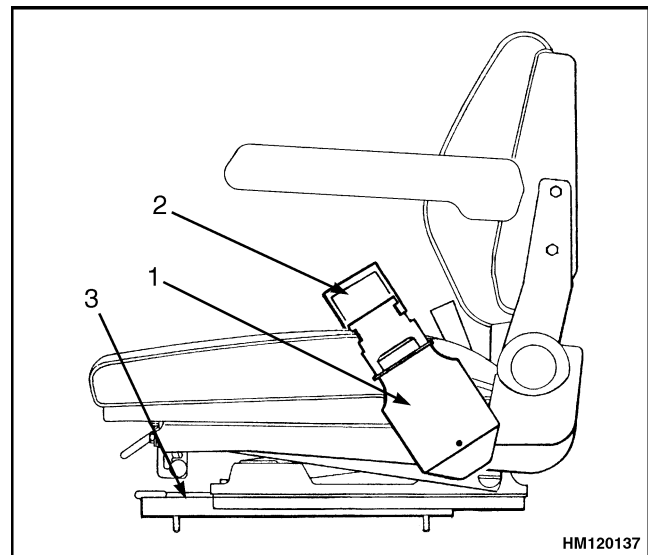
Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer.

1. Make sure the surface is dry and has no oil or grease. Do not use solvent on new paint. Clean the surface of old paint with a cleaning solvent.
2. Remove the paper from the back of the label. Do not touch the adhesive surface.

3. Carefully hold the label in the correct position above the surface. The label cannot be moved after it touches the surface. Put the label on the surface. Make sure that all air is removed from under the label and the corners and edges are tight.

Operator Restraint System

The seat belt, seat, and mounting are all part of the operator restraint system. Each item must be checked to make sure it is attached securely, functions correctly and is in good condition. See Figure 5.



- | | |
|---------------------------|--------------------|
| 1. SEAT BELT
RETRACTOR | 2. SEAT BELT LATCH |
| | 3. SEAT RAIL |

Figure 5. Seat Check

The seat belt must latch securely. Make sure the seat belt extends and retracts smoothly and is not damaged or torn. If the seat belt cannot be pulled from the retractor assembly, remove the screw that keeps the cover on the retractor. Push the bar to release the spool. Straighten the belt so that it pulls out and retracts smoothly. The belt must latch securely. See Figure 6.

Make sure the seat rails are not loose. The seat rails must lock securely in position, but move freely when unlocked. The seat rails must be securely attached to the mounting surface.

HOW TO MAKE CHECKS WITH ENGINE RUNNING

WARNING

Exhaust from internal combustion engines contains carbon monoxide and other harmful chemicals. Carbon monoxide is a colorless, odorless poison and can cause unconsciousness or death without warning. Long term exposure to exhaust or chemicals in the exhaust can cause cancer, birth defects, and other reproductive harm. Avoid exposure to engine exhaust:

- Do not use diesel engines indoors where soot can accumulate.
- If engines are operated in confined spaces, maintain adequate ventilation or vent exhaust to the outside. Do not exceed applicable air contaminant limits.
- Follow the inspection and maintenance schedule and procedures in this manual. Do not alter exhaust, ignition, or fuel systems.

WARNING

FASTEN YOUR SEAT BELT! The seat belt is installed to help the operator stay on the truck if the lift truck tips over. IT CAN ONLY HELP IF IT IS FASTENED.

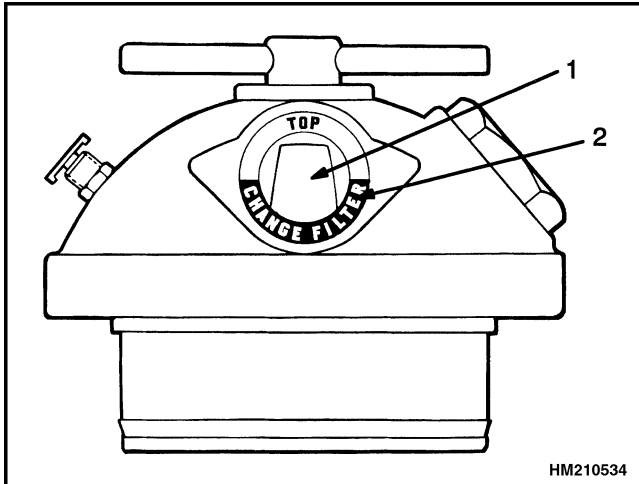
Make sure that the area around the lift truck is clear before starting the engine or making any operational checks. Be careful when making the checks. If the lift truck is stationary during a check, apply the parking brake and put the transmission in **NEUTRAL**. Make the checks carefully.

Engine Fault Codes

In case of an active fault, indicated by the stop/warning lights, turn the key switch **OFF**, then Press and hold diagnostic switch in the **ON** position. Turn the key switch to the **ON** position. If no active faults are recorded, the engine stop and limited operating conditions warning lights will come **ON** and stay **ON**. If active faults are recorded, the limited operating conditions warning light will flash once to indicate the start of the fault code sequence. The engine stop light will then flash out a three digit diagnostic code (e.g. flash, flash pause indicates the number 2). When the number has been displayed, the engine limited operating conditions warning light will come **ON** again. Each flash code is displayed three times before advancing to the next code. This process repeats until the diagnostic switch is released or the diagnostic switch increment/decrement is operated. For explanation of fault codes, see Table 10.

Table 10. Error Code Descriptions

Fault Condition Present/Maintenance Required			Fault Code Readout	
Limited Operating Conditions Warning Light	Engine Stop Warning Light	Maintenance Warning Light	Fault Code	Description
	ON		111	Engine control module, critical internal failure
	ON		115	Engine speed/position sensor circuit, lost of both signals from magnetic pickup sensor
	ON		116	Fuel timing pressure sensor circuit, shorted high
	ON		117	Fuel timing pressure sensor circuit, shorted low
ON			118	Fuel pump delivery pressure sensor, shorted high



1. INDICATOR 2. RED AREA

Figure 28. Hydraulic Filters Check

Brakes

Check that the service and parking brakes operate correctly. The service brakes (at the wheels and on the drive shaft) must apply when the brake or declutch/brake pedal is depressed. The parking brake

(caliper on the drive shaft) must apply when the knob for the parking brake is pushed. The parking brake must release when the knob is pulled.

NOTE: Full application of the declutch/brake pedal applies the service brakes and disengages the transmission.

Steering System



WARNING

The lift truck has hydraulic power steering. The steering can be difficult when the engine is not running.

Make sure the steering system operates smoothly and gives good steering control.

Attachments

Check that the controls for the attachment operate the functions of the attachment correctly. (See symbols by each of the controls.) Make sure all of the hydraulic lines are connected correctly and do not leak.

Maintenance Procedures Every 250 Hours or Monthly

NOTE: Do these procedures in addition to the 8-hour checks.

EMPTY CONTAINER ATTACHMENT

Lubricate the fittings and the wear plates on the container attachment. There are four grease fittings for

the twist locks, one at each corner of the attachment. There are also grease fittings for the fork rollers. On the extendable container attachment, lubricate the wear surfaces for the wear plates. During lubrication, always check for loose capscrews or broken wear plates. See Figure 4.

Maintenance Procedures Every 250 Hours or 2 Months

NOTE: Do these procedures in addition to the 250-hour or monthly checks.

DRIVE SHAFT

Lubricate the three fittings on the transmission drive shaft with multipurpose grease.

STEERING AXLE

Lubricate the grease fittings on the tie rods. Lubricate the two grease fittings for the steering axle pivots. These two fittings are to the right of the center pivot, on the front side of the axle frame. See Figure 29.

Tilt Cab Operation

RAISE CAB

1. Tilt the mast fully forward.
2. Close the doors on the cab.
3. Open the access door on the right-hand side of the lift truck, near the steps.
4. Make sure the lever on the pump is in the RAISE position. See Figure 46. Use the handle to operate the pump and tilt the cab forward.
5. When the hydraulic cylinder is at the end of its stroke, make sure the cab support is in position on the cylinder.

LOWER CAB

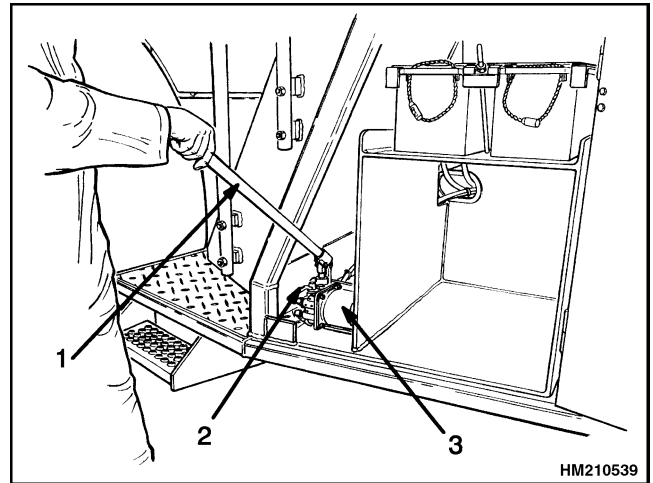


WARNING

Verify no one is under the cab when lowering the cab.

1. Raise the cab a small amount. Pull on the handle to release the cab support. See Figure 46.
2. Move the lever to the LOWER position. Use the handle to operate the pump and lower the cab.

3. Make sure the latch at the back of the cab is fully engaged with the cab when the cab is lowered.



1. HANDLE
2. LEVER
3. PUMP

Figure 46. Tilt Cab Operation

System Air Removal

The air bleed fitting on the fuel system creates a self-bleeding system during replacement of the supply-side components.

High-pressure fuel line removal and replacement will **not** require external bleeding to start the engine. The fuel pump will create high fuel pressure during cranking and purge the air in the high-pressure side through the injectors.

NOTE: If an excessive amount of air has entered the system, the system will need to be bled. See Figure 47 and Figure 48.



CAUTION

The pressure of the fuel in the line is sufficient to penetrate the skin and cause serious bodily harm.

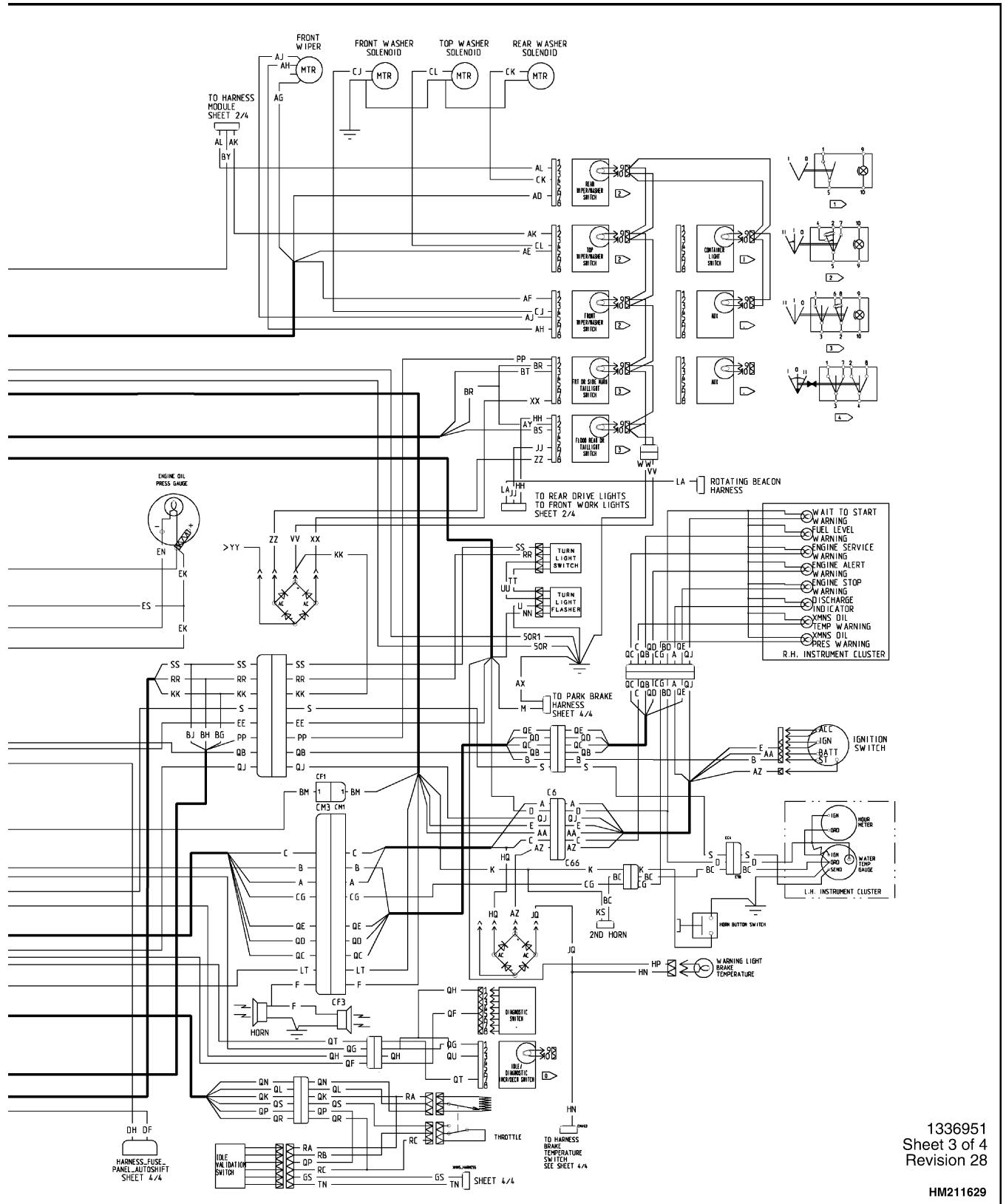
Do not bleed a hot engine as this can cause fuel to spill onto a hot exhaust manifold, creating a danger of fire.

NOTE: Operate the engine and vent one line at a time until the engine runs smoothly.

NOTE: Loosening of the fittings at the cylinder head and crank will allow trapped air to escape.

1. Loosen the fuel supply fitting at the cylinder head and crank.
2. Tighten the fitting.

HYSTER TECHNICAL PUBLICATIONS



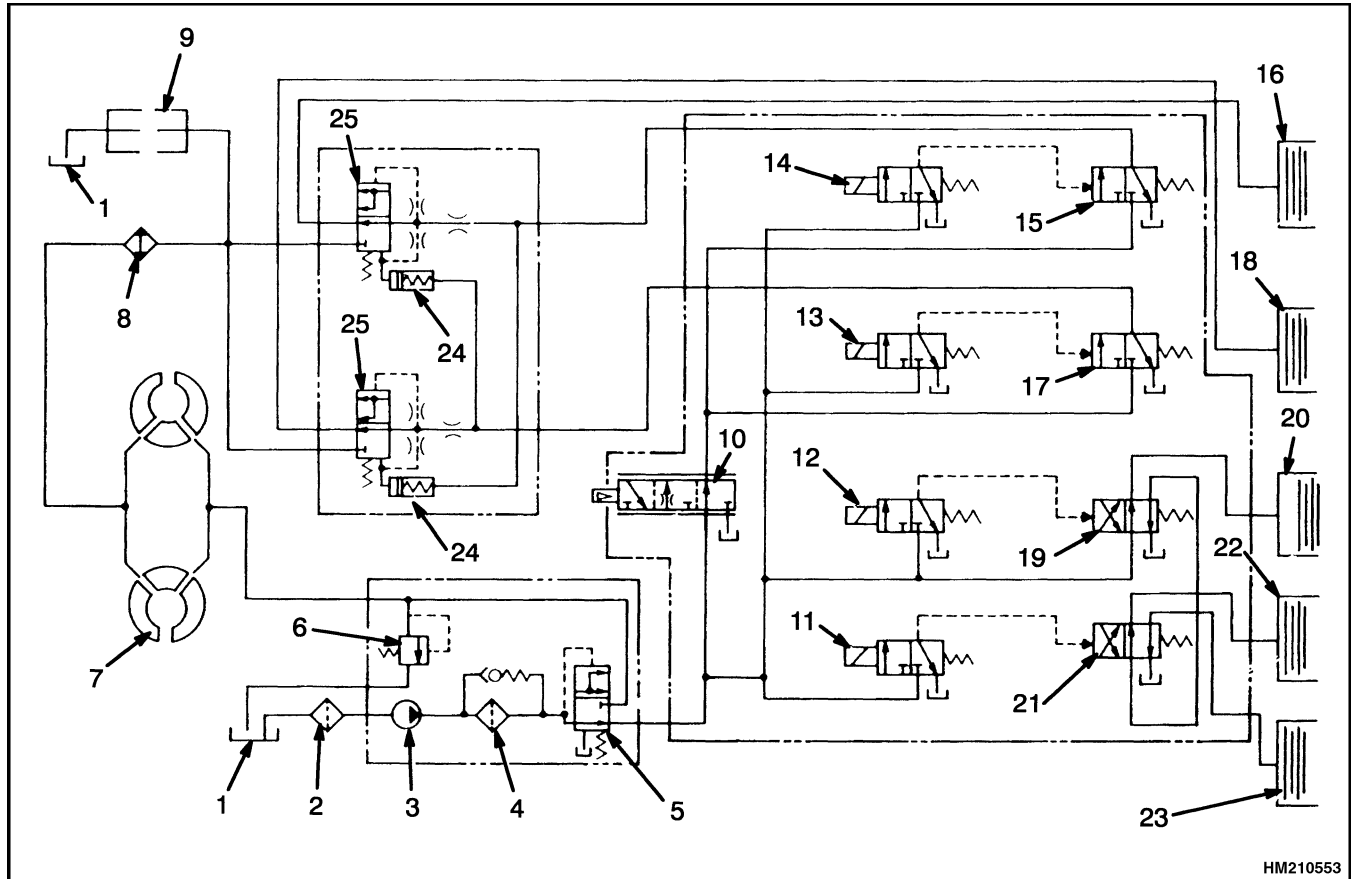
1336951
Sheet 3 of 4
Revision 28

HM211629

Figure 1. Wiring Diagram (Without Operator Presence System up to S/N 02064) (Sheet 3 of 4)



HM212400

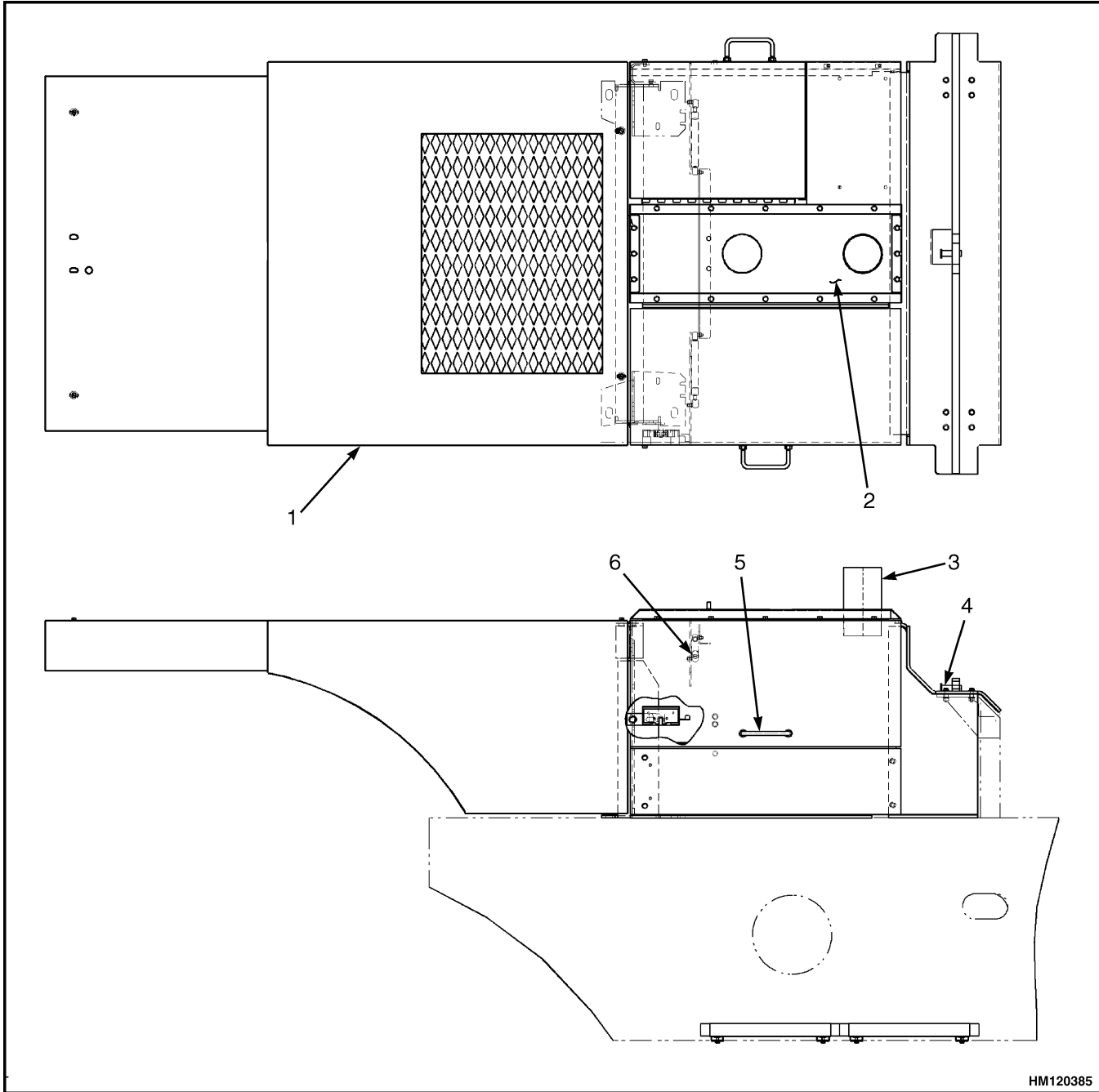


HM210553

Range	Solenoid				Clutch
	1	2	F	R	
F3			•		Fwd
F2		•	•		Fwd, 2nd
F1	•	•	•		Fwd, 1st
N					
R1	•	•		•	Rev, 1st
R2		•		•	Rev, 2nd
R3				•	Rev

- | | | |
|----------------------------------|---------------------------|-------------------------|
| 1. SUMP | 8. OIL COOLER | 17. REVERSE SPOOL |
| 2. SUCTION SCREEN | 9. LUBRICATION CIRCUIT | 18. REVERSE CLUTCH |
| 3. OIL PUMP | 10. INCHING VALVE | 19. SECOND SPEED SPOOL |
| 4. FILTER | 11. FIRST SPEED SOLENOID | 20. THIRD SPEED CLUTCH |
| 5. PRESSURE REGULATOR VALVE | 12. SECOND SPEED SOLENOID | 21. FIRST SPEED SPOOL |
| 6. TORQUE CONVERTER RELIEF VALVE | 13. REVERSE SOLENOID | 22. SECOND SPEED CLUTCH |
| 7. TORQUE CONVERTER | 14. FORWARD SOLENOID | 23. FIRST SPEED CLUTCH |
| | 15. FORWARD SPOOL | 24. ACCUMULATOR |
| | 16. FORWARD CLUTCH | 25. REGULATOR SPOOL |

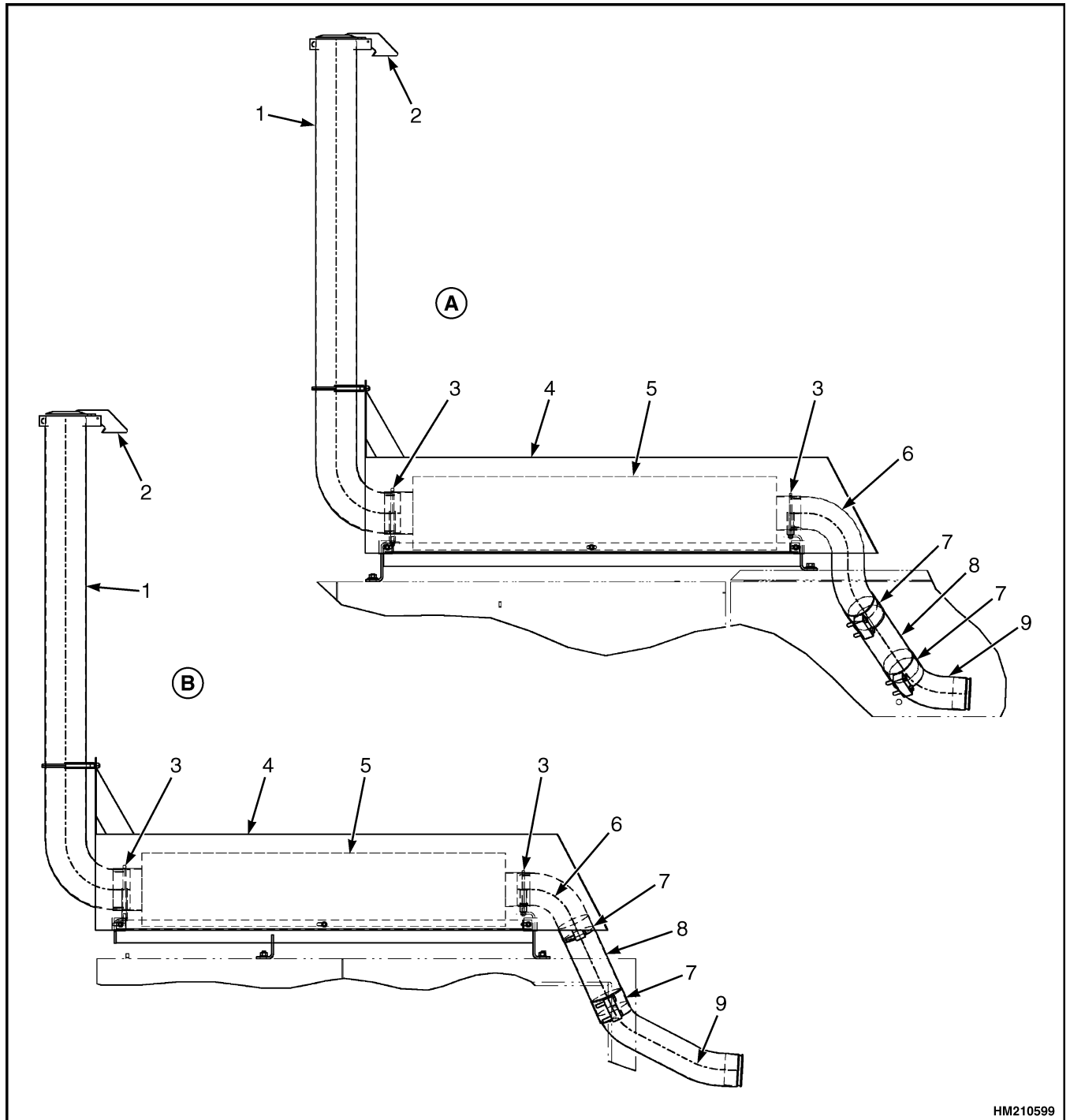
Figure 5. Hydraulic Schematic for Transmission (Neutral)



- 1. HOOD
- 2. EXHAUST COVER
- 3. AIR FILTER CONNECTION

- 4. LATCH FOR TILT CAB
- 5. HANDLE
- 6. GAS SPRING

Figure 3. Hood Assembly (Tier 2)



HM210599

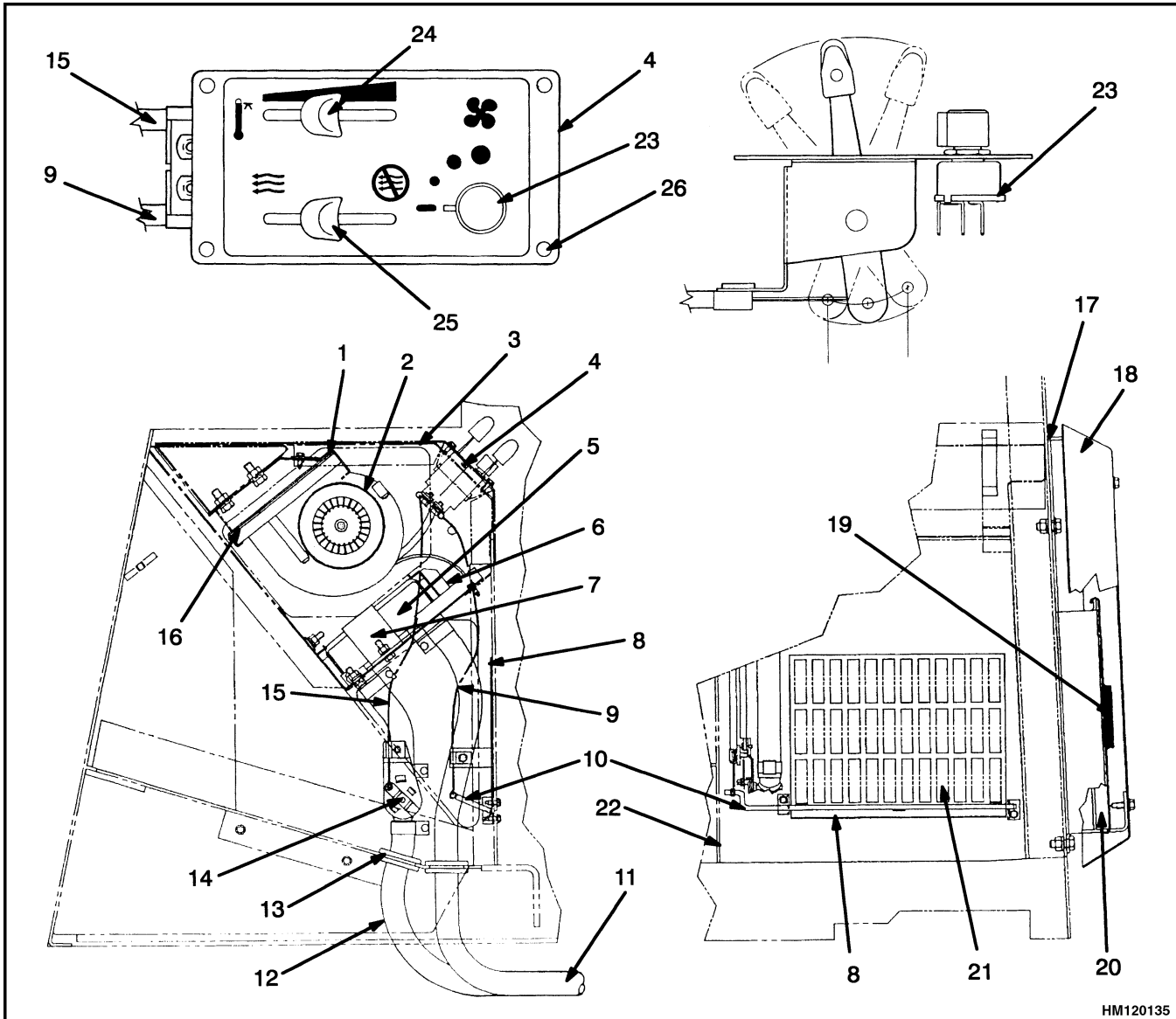
A. H20.00-32.00F (H440-700F)

B. H20.00-32.00FS (H440-700FS)

- 1. EXHAUST STACK
- 2. RAIN CAP
- 3. CLAMP
- 4. EXHAUST COVER
- 5. MUFFLER

- 6. TUBE EXHAUST
- 7. CLAMP
- 8. FLEX TUBE
- 9. TUBE EXHAUST WELDMENT

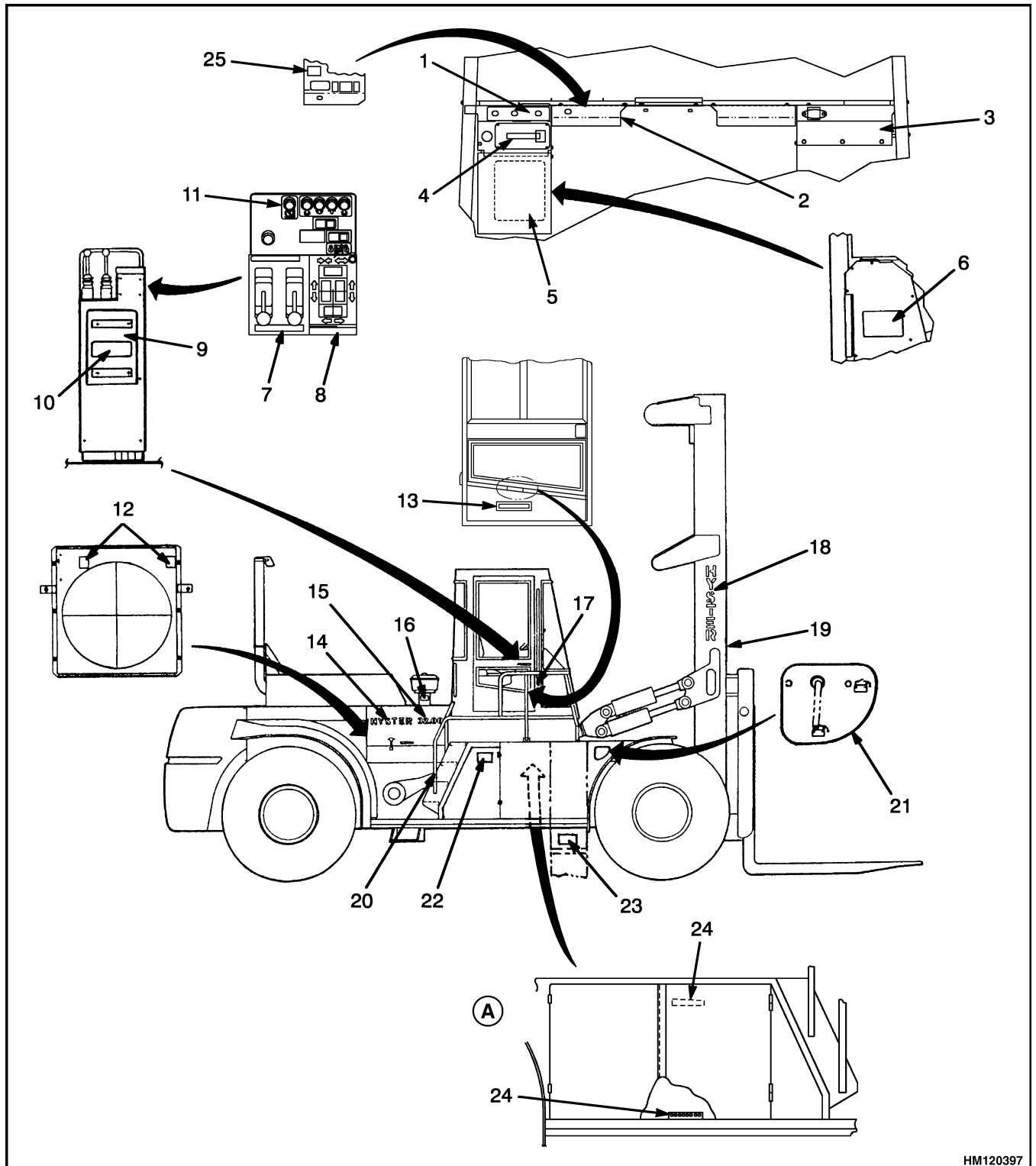
Figure 13. Exhaust System (Tier 3)



HM120135

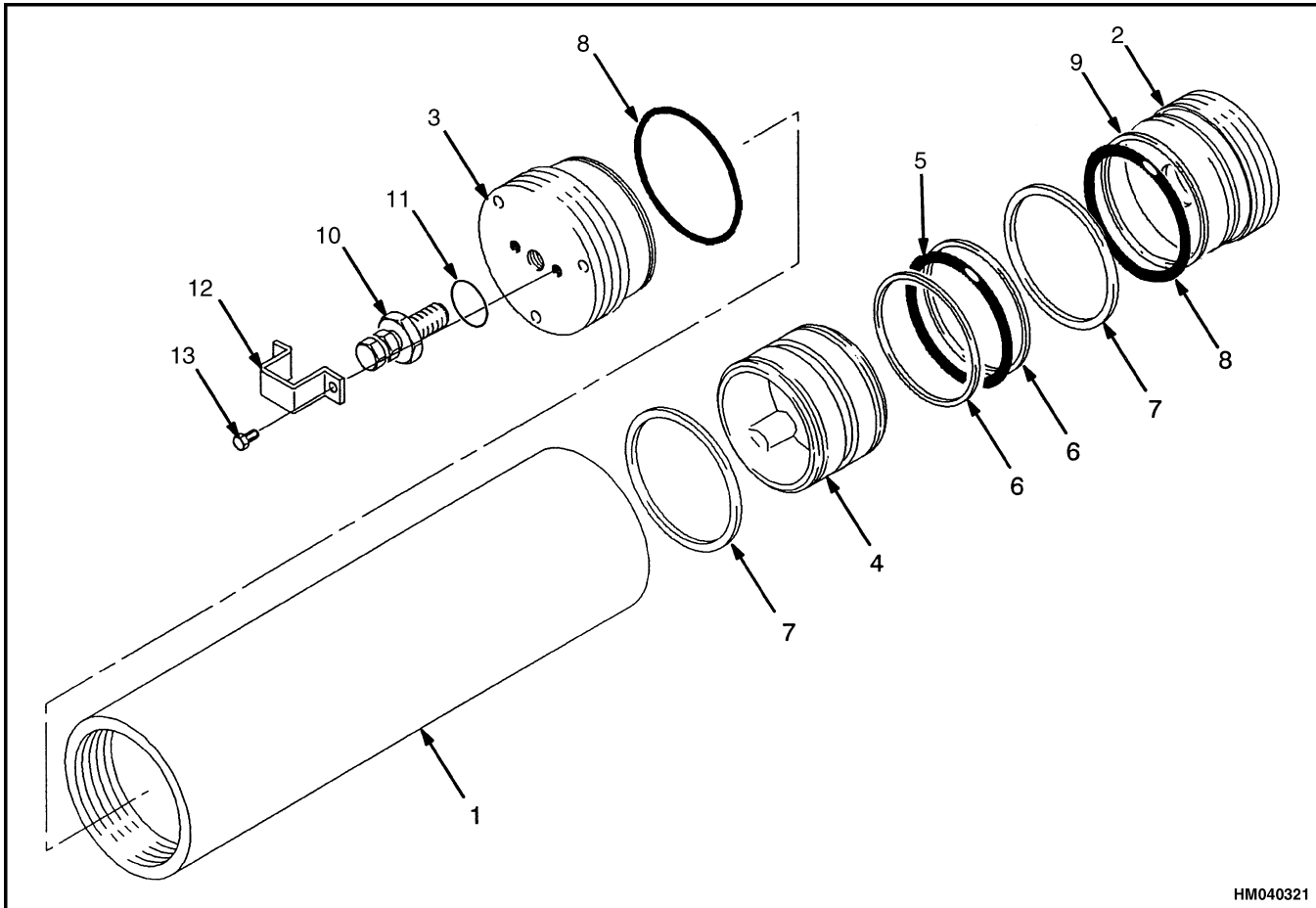
- | | |
|--------------------------|--------------------------|
| 1. RETAINER | 14. HEATER VALVE |
| 2. BLOWER ASSEMBLY | 15. HEAT CONTROL CABLE |
| 3. COVER | 16. BLOWER GASKET |
| 4. CONTROL ASSEMBLY | 17. ADHESIVE SEALANT |
| 5. HEATER CORE | 18. INTAKE COVER |
| 6. SUPPORT PLATE | 19. SPRING |
| 7. CLAMP | 20. FILTER |
| 8. DAMPER PLATE | 21. VENTS |
| 9. DAMPER CONTROL CABLE | 22. ACCESS PANEL, RH |
| 10. DAMPER ROD | 23. BLOWER CONTROL SW. |
| 11. HEATER HOSE (RETURN) | 24. HEAT CONTROL LEVER |
| 12. HEATER HOSE (SUPPLY) | 25. DAMPER CONTROL LEVER |
| 13. HOSE GROMMET | 26. SCREW (4) |

Figure 21. Heater System



HM120397

Figure 31. Label Positions



HM040321

- | | |
|----------------------|---------------------|
| 1. SHELL | 8. O-RING |
| 2. HYDRAULIC END CAP | 9. BACKUP WASHER |
| 3. GAS VALVE CAP | 10. GAS VALVE |
| 4. PISTON | 11. O-RING |
| 5. V O-RING | 12. GAS VALVE GUARD |
| 6. BACKUP WASHER | 13. SCREW |
| 7. WEAR RING | |

Figure 2. Accumulator

10. Remove O-rings and backup rings from the hydraulic end cap.

11. Remove piston by pushing from hydraulic end cap with a bar.

⚠ WARNING

Never try to remove piston by applying compressed air at opposite end.

12. Remove V O-ring by lifting seal with a smooth screwdriver or similar tool and moving the tool around the piston several times while using the other hand to work ring off the piston.

 **WARNING**

Take care when using Loctite® to avoid serious personal injury. Follow manufacturer's instructions to prevent irritation to eyes and skin. If Loctite® gets into eyes, flush them with water for 15 minutes. Have eyes checked by a doctor as soon as possible.

7. Apply Loctite® 271 to the bolt threads and reinstall the remaining end plates. Torque the bolts to 224 to 285 N•m (165 to 210 lbf ft).
8. Verify the new linings slide freely between the end plates.
9. Remove all air from the brake hydraulic system. See Bleed Brakes.
10. Adjust the brakes. See Adjust.

Bleed Brakes

 **WARNING**

Remove air from the brake system after each installation or repair of hydraulic or brake system components or hydraulic lines. The brakes will not operate correctly with air in the system and can cause injury or damage.

NOTE: This brake is designed to bleed correctly at the 12 o'clock and 6 o'clock positions.

- When mounted at the 12 o'clock position, place the two bleeders at the two upper ports. Connect the inlet line to one of the four lower ports and use the three remaining bleeders at the other three ports.
- When the brake is mounted at the 6 o'clock position, install four bleeders at the uppermost ports. Then connect the inlet line to one of the two remaining ports, and install the last bleeder at the remaining lower port.

Always start at the point that is the farthest from the master cylinder and work back toward the master cylinder. Bleed every bleeder screw on every caliper at every brake position. When you complete a caliper, go to the next closest caliper on the same wheel. When you complete a wheel, go to the furthest bleeder screw on the next closest wheel.

 **WARNING**

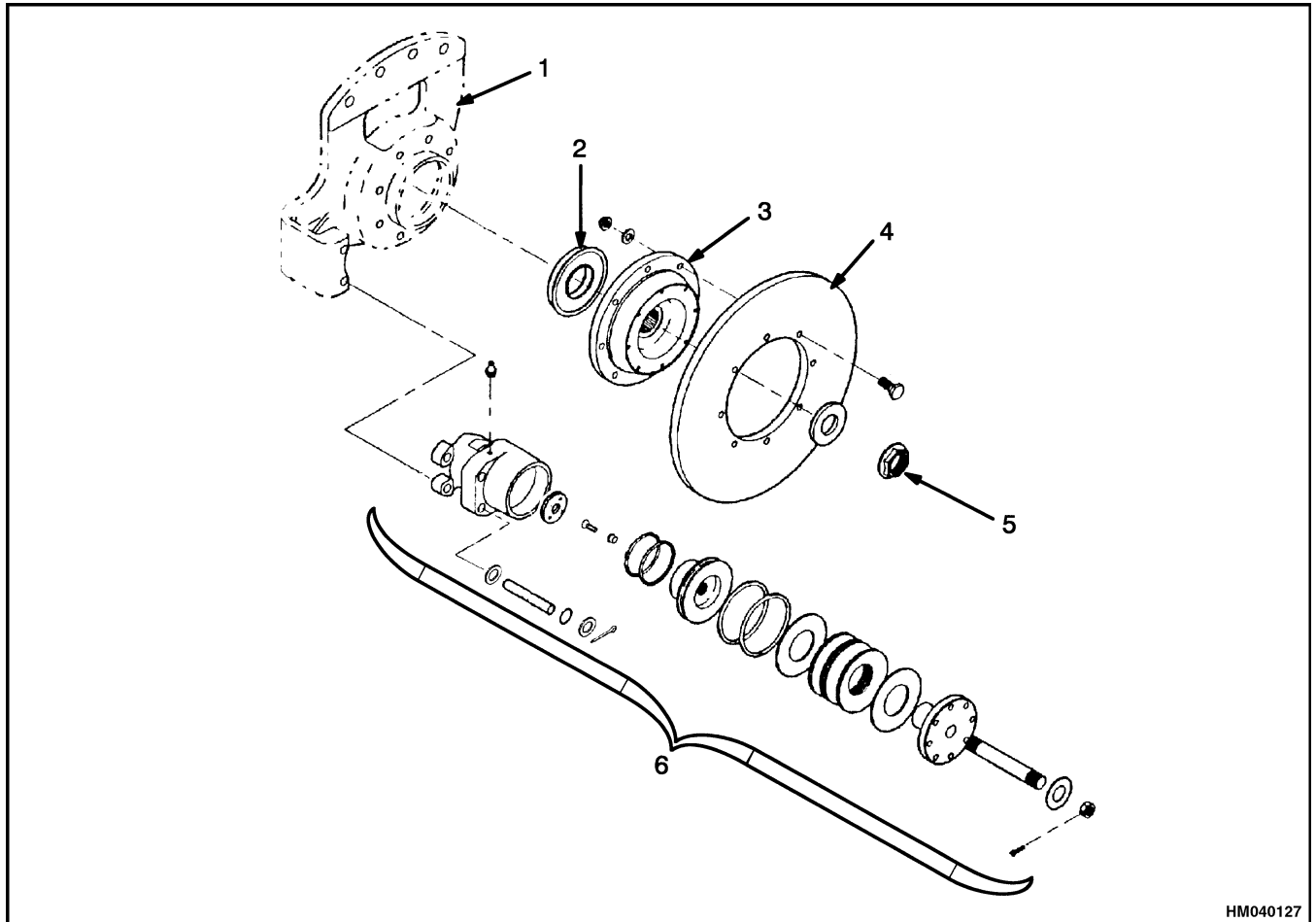
Properly discard hydraulic fluid that is removed from the brake system. Hydraulic fluid that is removed can be contaminated and

cause damage, loss of braking, and serious personal injury.

 **WARNING**

Use only the type of hydraulic fluid specified by Hyster. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid can damage rubber parts of the caliper and can cause damage, loss of braking, and serious personal injury.

1. Verify that the master cylinder is filled. Keep the master cylinder filled during bleeding so you do not draw air into the system through the master cylinder. Verify that the master cylinder is filled when you are done bleeding the system.
2. Put a clear tube on the bleeder screw. Place the other end of the clear tube in a container of clean hydraulic fluid.
3. Bleed brakes.
 - a. For full hydraulic systems:
 - (1) Slowly apply hydraulic pressure to the caliper.
 - (2) Loosen the bleeder screw and continue to apply pressure until no air bubbles appear in the container of fluid.
 - (3) Tighten the bleeder screw to 11.3 to 13.6 N•m (100 to 120 lbf in). Release the pressure to the caliper.
 - b. For air/hydraulic or mechanical actuator systems:
 - (1) Apply brake pedal, then loosen the bleeder screw.
 - (2) Tighten the bleeder screw to 11.3 to 13.6 N•m (100 to 120 lbf in) before releasing the brake so air is not pulled back into the system.
 - (3) Repeat Step (1) and Step (2) until no air bubbles appear in the container of fluid when you apply the brake pedal.
4. Apply and release the brakes three times to verify that the caliper operates correctly.
5. Check for fluid leaks.
6. Verify that the linings move freely in the caliper.



HM040127

1. CALIPER MOUNT
2. OIL SEAL
3. ROTOR FLANGE

4. ROTOR
5. NUT AND WASHER
6. CALIPER ASSEMBLY

Figure 2. Parking Brake Assembly

7. Remove the caliper from the disc.

DISASSEMBLE



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

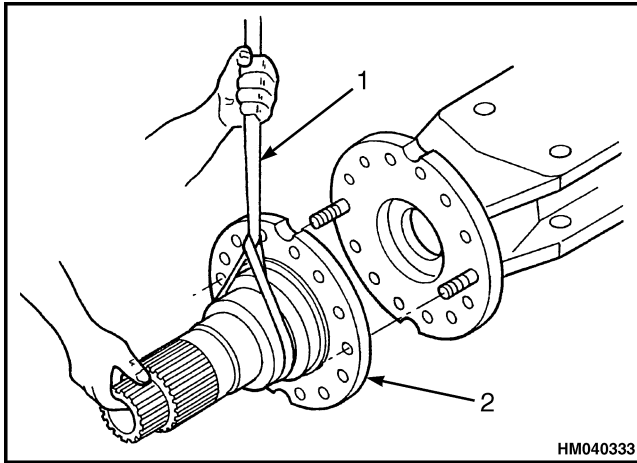


WARNING

If it is necessary to raise the vehicle to service the parking brake, support the vehicle with safety stands. Do not work under a vehicle

supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

1. Remove the inlet fitting and the O-ring from the housing. Drain and discard the fluid. See Figure 3.
2. Put a plug in the inlet to prevent contamination of the housing.
3. Remove lining fasteners. Remove linings by using a pry bar between the lining and piston or housing.



1. LIFTING DEVICE 2. SPINDLE

Figure 12. Spindle

7. Remove all gasket material from the mounting surfaces of the cover, spindle, and axle housing.

DISASSEMBLE

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

1. Put the appropriate pry bars under the inner diameter of the piston to lift the piston out of the housing. The two piston seals and the seal spacer are removed when the piston is removed from the housing. See Figure 13.

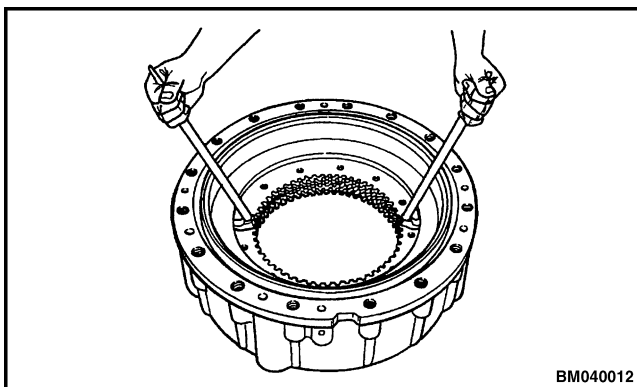
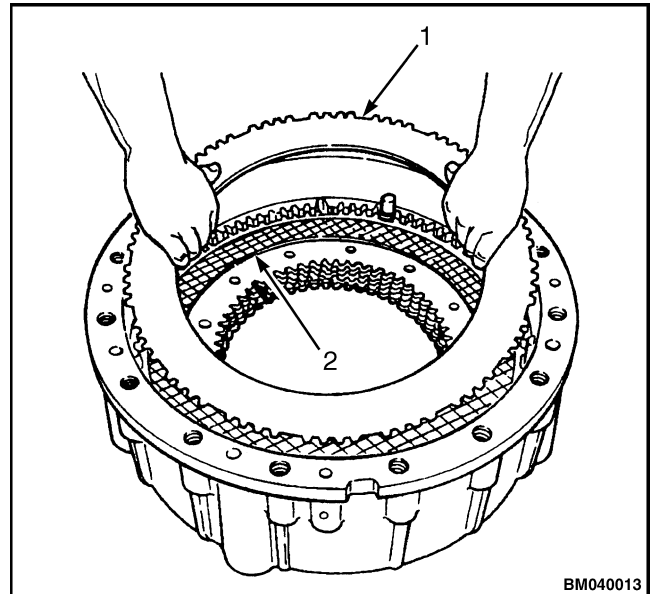


Figure 13. Piston, Piston Seals, and Seal Spacer

2. Remove the stationary discs and the friction discs from the brake housing. See Figure 14.



1. STATIONARY DISC 2. FRICTION DISC

Figure 14. Stationary and Friction Disc

NOTE: Some brake assemblies use a spacer and standard stationary disc. Some use a single thick-splined stationary disc as the first disc against the housing instead of a spacer and standard stationary disc combination. Brake housings are designed to use only one type of disc configuration. Do not interchange parts.

3. Remove the disc spacer from the bottom of the brake housing. See Figure 15.

⚠ WARNING

The piston return spring applies pressure to the plug. Use the following procedure or the spring can push the plug out of the housing with enough force to cause serious personal injury.

NOTE: If necessary, remove the four piston return spring assemblies with the following procedure.

4. Put the brake housing on a bench so that the outboard side is toward you. See Figure 16.

f. If pressure falls below 7 bar (102 psi), find the cause of the loss of pressure. See the following procedure:

- (1) Apply a soap and water solution to the capscrews, the fittings, and the joints.
- (2) Apply and hold 7 bar (102 psi) of pressure in the brake housing.
- (3) If bubbles appear at any external location, service the cause of the leak.
- (4) If bubbles do not appear at any external location, there is an internal leak. Remove the wheel hub. Inspect the spindle to hub seal, face seal, and seal surface on the spindle for possible causes of leaks. Repair or replace as necessary.
- (5) Remove the plugs from the inlet and outlet ports.
- (6) Remove the air pressure gauge and regulator assembly.

11. Install end drive. See the section **Planetary Gear Axle** 1400 SRM 47 (E008 only) or **Planetary Gear Axle** 1400 SRM 1171.

12. Connect hydraulic lines.

13. Loosen the plug in the top of the cover of the housing. When the housing is filled, the loose plug permits air to escape.

14. Put the transmission in neutral.

15. Start the engine.

16. Shut down the engine when oil leaks from the loose plug in the cover of the housing.

NOTE: The minimum torque for the pipe type plug is 27 N•m (20 lbf ft).

NOTE: The minimum torque for the O-ring type plug is 81 to 102 N•m (60 to 75 lbf ft).

17. Tighten the plug.

18. Bleed the brakes as follows for full hydraulic systems:



WARNING

When you loosen any brake system hydraulic connection, you must bleed the brakes to remove all air from the system. Air can prevent hydraulic pressure from applying the brakes properly which could increase stopping distances and result in serious personal injury.

NOTE: Always start at the point in the system that is furthest from the master cylinder and work back toward the master cylinder.

- a. Slowly apply low hydraulic pressure to the brake. Loosen the bleeder screw. Continue to apply pressure until no air bubbles appear in the container of fluid. Tighten the bleeder screw to 20 to 27 N•m (15 to 20 lbf ft); then release the pressure to the brake.

19. Bleed the brakes as follows for air/hydraulic or mechanical actuator systems:



WARNING

When you loosen any brake system hydraulic connection, you must bleed the brakes to remove all air from the system. Air can prevent hydraulic pressure from applying the brakes properly which could increase stopping distances and result in serious personal injury.

NOTE: Always start at the point in the system that is furthest from the master cylinder and work back toward the master cylinder.

- a. Apply the brake pedal; then loosen the bleeder screw. Tighten the bleeder screw to 20 to 27 N•m (15 to 20 lbf ft) before you release the brake pedal so that air is not pulled back into the system. Repeat this procedure until no air bubbles appear in the container of fluid when you apply the brake pedal.

20. Fill the axle housing and the wheel ends with fluid as described in the section **Planetary Gear Axle** for the lift truck.

Table 3. Wheel Hub and Brake Housing Torque Chart

Item Number	Description	Size	Torque
1	Cover-to-Planetary Spider Capscrew	7/16"-14	82 to 102 N•m (60 to 75 lbf ft)
		1/2"-13	116 to 156 N•m (85 to 115 lbf ft)
2	Piston Return Spring Plug		82 to 102 N•m (60 to 75 lbf ft)
3	Cover and Spindle to Axle Housing Internal, Mount	5/8"-11	244 to 312 N•m (180 to 230 lbf ft)
		3/4"-10	450 to 542 N•m (332 to 400 lbf ft)
		7/8"-9	678 to 881 N•m (500 to 650 lbf ft)
		7/8"-14	678 to 881 N•m (500 to 650 lbf ft)
		1"-12	938 to 1288 N•m (692 to 950 lbf ft)
		1-1/4"-12	2305 to 2983 N•m (1700 to 2200 lbf ft)
4	Cover and Spindle to Axle Housing capscrew, External Mount	M16 × 2.00	270 to 350 N•m (199 to 258 lbf ft)
		M20 × 2.50	500 to 650 N•m (369 to 479 lbf ft)
5	Planetary Spider to Wheel Hub Capscrew	3/8"-16	48 to 68 N•m (35 to 50 lbf ft)
		1/2"-13	116 to 156 N•m (85 to 115 lbf ft)
		3/4"-10	450 to 542 N•m (332 to 400 lbf ft)
6	Bearing Adjusting Nut Lock Plate Capscrew	3/8"-16	48 to 68 N•m (35 to 50 lbf ft)
		7/16"-14	81 to 102 N•m (60 to 75 lbf ft)
7	Cover-to-Brake Housing Capscrew	9/16"-12	169 to 224 N•m (125 to 165 lbf ft)
		M16 × 2.00	270 to 350 N•m (199 to 258 lbf ft)
		M20 × 2.50	500 to 650 N•m (369 to 479 lbf ft)
		5/8"-11	244 to 312 N•m (180 to 230 lbf ft)
		3/4"-10	450 to 542 N•m (332 to 400 lbf ft)
		3/4"-16	488 to 637 N•m (360 to 470 lbf ft)
		7/8"-9	678 to 881 N•m (500 to 650 lbf ft)
8	Brake Driver to Wheel Hub Capscrew (Not Shown)	3/4"-10	450 to 542 N•m (332 to 400 lbf ft)
		7/8"-14	780 to 1017 N•m (575 to 750 lbf ft)
		1"-14	1152 to 1491 N•m (850 to 1100 lbf ft)

**"THE
QUALITY
KEEPERS"**

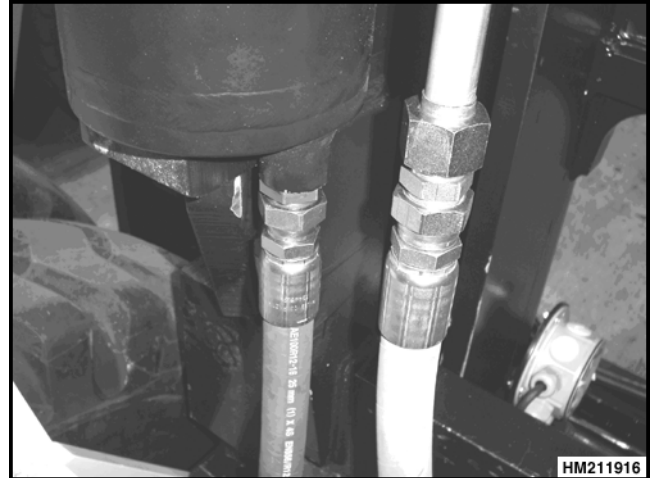
**HYSTER
APPROVED
PARTS**

HOSE/ELECTRICAL CABLE ATTACHMENT

NOTE: Always use new O-rings when attaching the hoses.

STEP 1.

Attach the lift cylinder hoses on both sides of the truck.

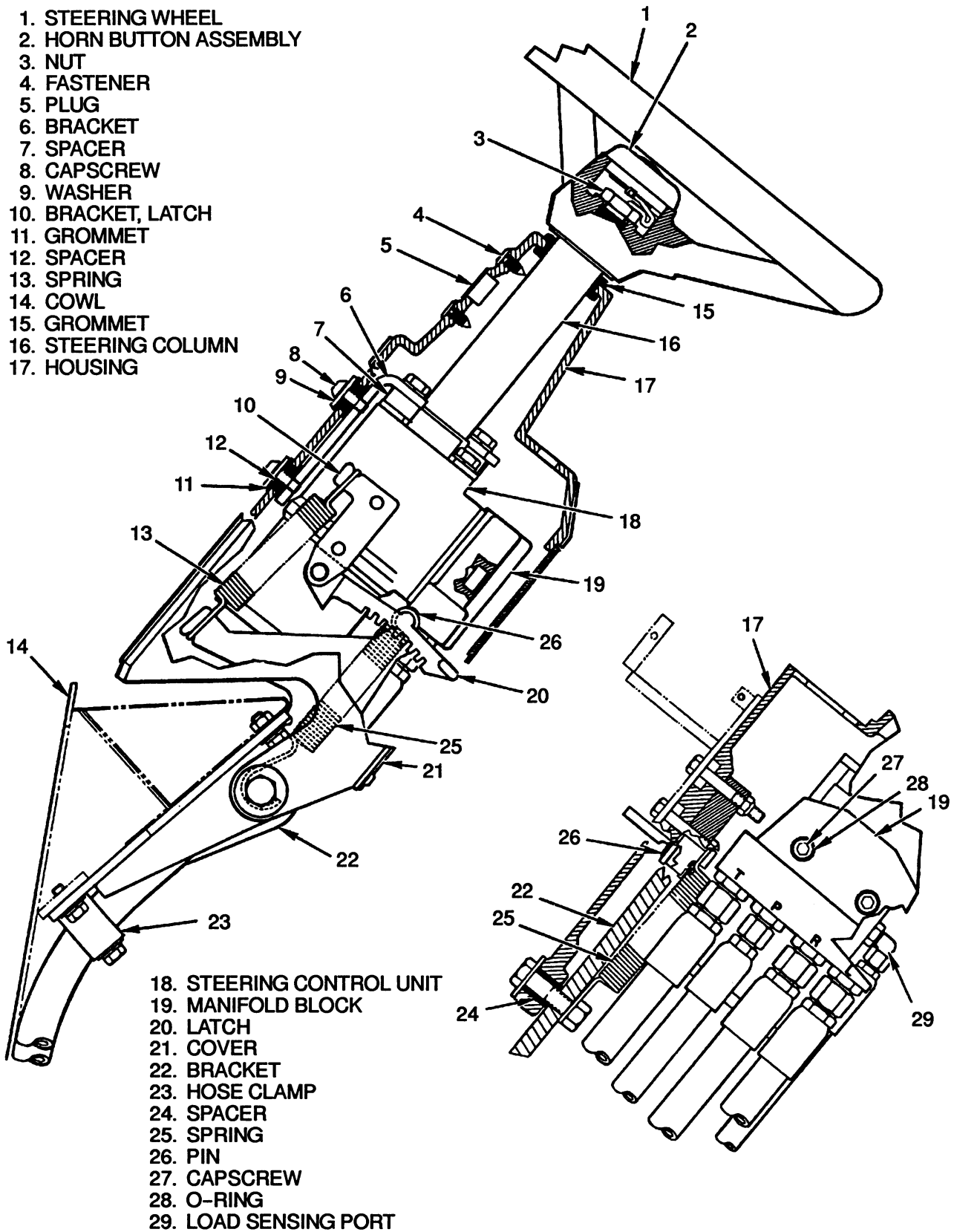


STEP 2.

Connect header hoses.



1. STEERING WHEEL
2. HORN BUTTON ASSEMBLY
3. NUT
4. FASTENER
5. PLUG
6. BRACKET
7. SPACER
8. CAPSCREW
9. WASHER
10. BRACKET, LATCH
11. GROMMET
12. SPACER
13. SPRING
14. COWL
15. GROMMET
16. STEERING COLUMN
17. HOUSING



18. STEERING CONTROL UNIT
19. MANIFOLD BLOCK
20. LATCH
21. COVER
22. BRACKET
23. HOSE CLAMP
24. SPACER
25. SPRING
26. PIN
27. CAPSCREW
28. O-RING
29. LOAD SENSING PORT

12398

FIGURE 3. STEERING WHEEL AND STEERING COLUMN ASSEMBLY

The spool shifts to a position so the pressure is the same at both ends of the spool. Oil now flows through the valve to the directional valve.

The main flow and pilot flow of oil combine, increasing the flow through the directional valve to the steering cylinder. The return oil flows from the cylinder, through the directional valve to the hydraulic tank.

The flow amplifier has cushion valves to prevent pressure peaks in the steering cylinder. Suction valves are installed to prevent cavitation in the steering cylinder.

Manual Steering Function

If the steering pump fails, or the engine loses power, the lift truck can be steered manually. The steering effort, however, will be increased.

The steering control unit has the characteristics of a hand pump when the steering wheel is turned (when there is no pressure input). The pressure developed by the steering control unit (when the steering wheel is turned) operates all the valves in the flow amplifier as if operating conditions were normal. There is no amplification because only the oil from the steering control unit flows to the steering cylinder.

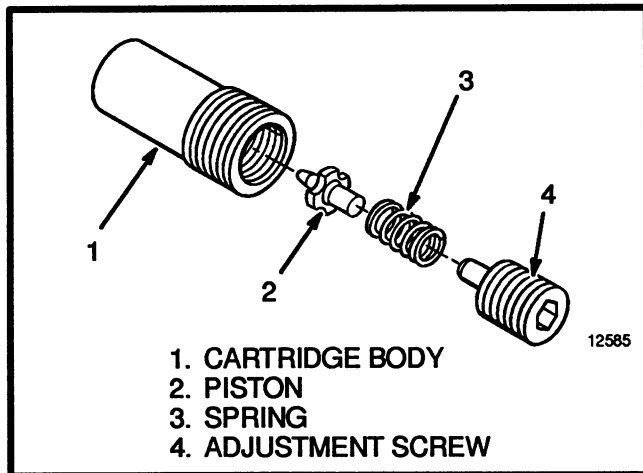


FIGURE 9. PRESSURE RELIEF VALVE

DISASSEMBLY (See FIGURE 8.)

Pressure Relief Valve (See FIGURE 9.)

1. Remove the plug and washer. Use an 8 mm allen wrench.
2. Use a 10 mm allen wrench to remove the relief valve assembly.

3. Remove the washer with a magnetic rod.

4. Hold the relief valve cartridge with a pliers and remove the adjusting screw with 5 mm allen head wrench.

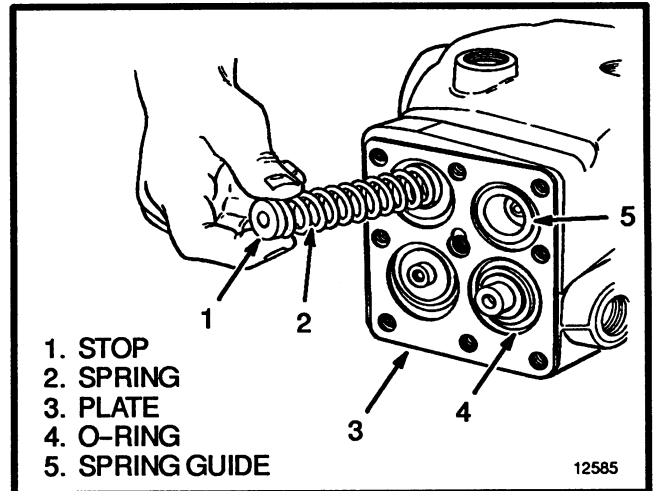


FIGURE 10. END COVER AT "PP" PORT

End Cover at PP Port (See FIGURE 10.)

1. Remove the capscrews, spring washers and end cover.
2. Remove the stop and two springs.
3. Remove the single spring.
4. Remove the plate and six O-rings (4 large, 2 small). Remove the spring guide.

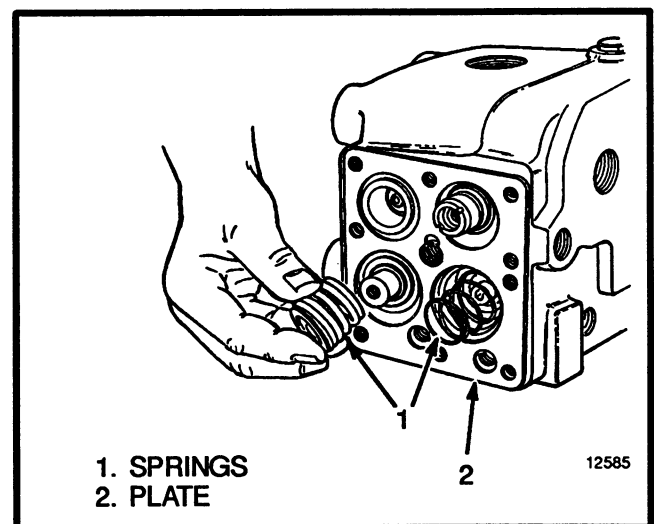


FIGURE 11. END COVER AT "LS" PORT

End Cover at LS Port (See FIGURE 11.)

1. Remove the capscrews, spring washers and end cover.
2. Remove the stop and two springs.

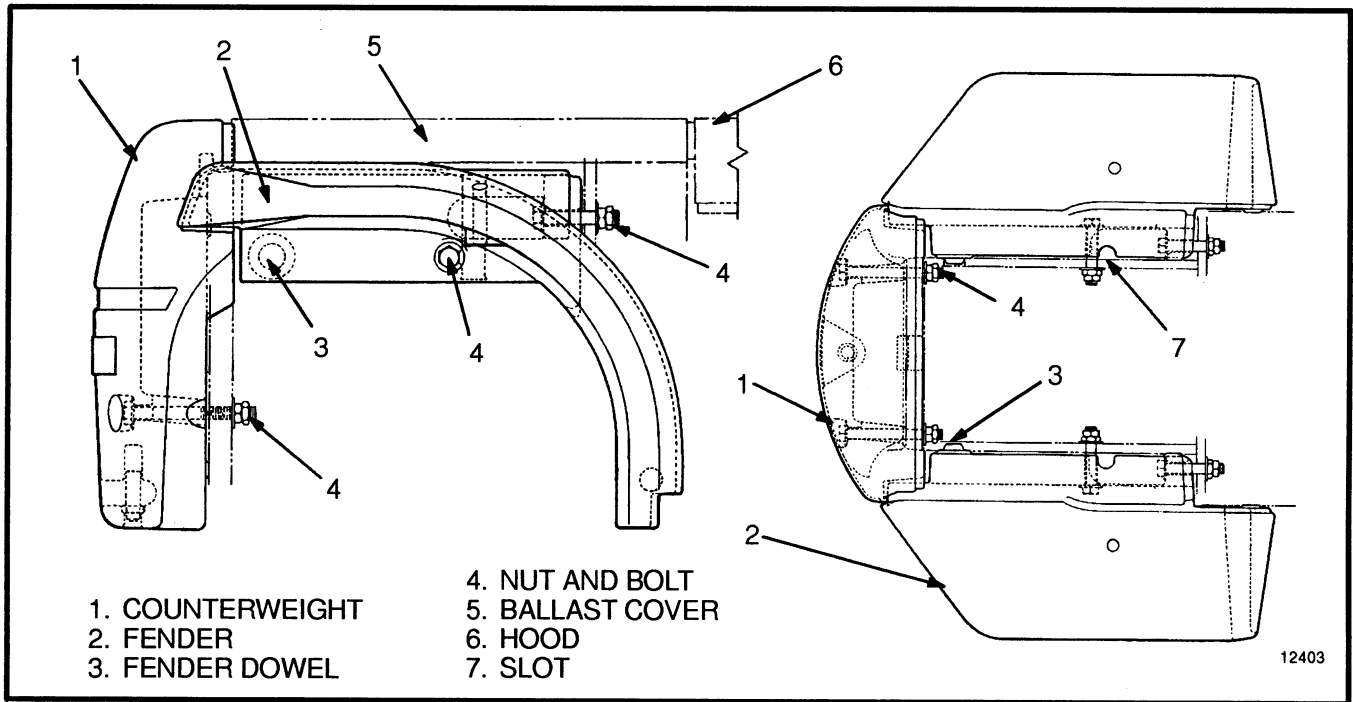


FIGURE 2. COUNTERWEIGHT MOUNTS

FENDERS

Removal (See FIGURE 2.)

WARNING

The fenders are part of the lift truck counterweight system and are very heavy. Make sure any lifting devices have the capacity to lift 1750 kg (3860 lb).

1. Remove the ballast cover from the frame.
2. Fasten a chain or cable around the middle of the fender. Put the chain or cable through the slot (7) in the fender.
3. Operate the lifting device just enough to give support to the fender. Remove the nuts, washers and bolts that hold the fender to the frame.
4. Carefully lift the fender away from the frame and lower it to the floor.

Installation (See FIGURE 2.)

1. Fasten a chain or cable around the middle of the fender. Make sure the chain or cable is in the slot (7) on the side of the fender.

2. Raise the fender to the lift truck. Align the tapered dowels (3) of the fender with the holes in the frame. Do not disconnect the chain sling.

3. Install the bolts, washers and nuts. Tighten the nuts to 814 N.m (600 lbf ft).

HOOD (See FIGURE 3.)

The hood can be removed from the frame. Disconnect the exhaust system at the flexible tube connection. (See FIGURE 8.) Disconnect the air filter at the rubber elbow connection and the hose from the air restriction indicator. (See FIGURE 7.)

To remove the hood, remove the three nuts and capscrews at the front and the three nuts and capscrews at the rear of the hood assembly. Lift the hood from the frame.

During installation, align the hood as necessary. Make sure the clamps for the air intake tubes are tight. Air leaks can cause engine damage.

To remove the ballast cover, remove the four capscrews that hold it to the frame. Lift the cover away from the frame.

2. See the section **INSTRUMENT PANEL INDICATORS AND SENDERS, 2200 SRM 143** to replace the gauges

3. The rocker switches are replaced by pressing in on the flexible tabs at the back side to release the switch assembly from the instrument panel. The replacement switch is installed from the top side of the instrument panel and pressed in until the tabs on the switch lock in the opening for the switch.

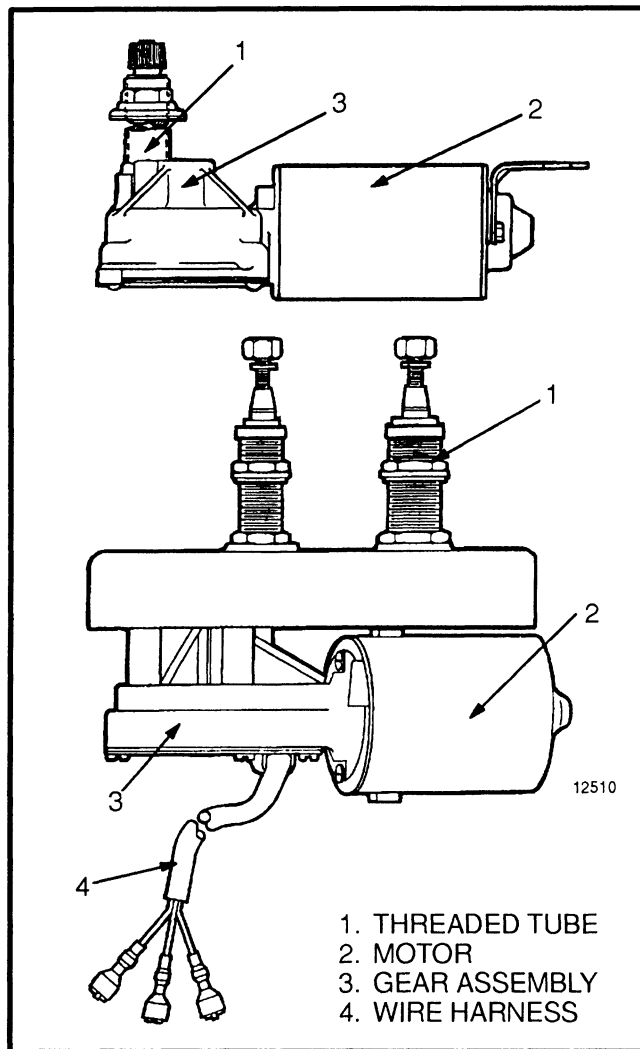


FIGURE 13. WINDOW WIPERS

4. Remove the remote control valves as described in the section **THE HYDRAULIC SYSTEM, 1900 SRM 492**.

WINDOW WIPERS (See FIGURE 13.)

Three window wiper motor assemblies are installed in the operator compartment. The front window motor assembly has two wiper arms connected to a single wiper blade. The rear window and the top (overhead) window

have wiper motor assemblies that have one wiper arm attached to a single wiper blade.

Replace the single arm unit as follows:

- a. To replace this motor assembly, first remove the arm (or arms) and the blade from the outside. Remove the nut and washers from the threaded shaft tube that passes through the metal frame of the operator compartment.
- b. Remove the one mount screw from the single arm wiper motor, disconnect the electrical wire and remove from the operator compartment.
- c. When you install the wiper motor be sure to connect the electrical wires first.

Replace the double arm unit as follows:

- a. To replace this motor assembly, first remove the arms and the blade from the outside. Remove the nuts and washers from the two threaded shaft tubes that pass through the metal frame of the operator compartment.
- b. Disconnect the electrical wires and remove the wiper motor from the front window.

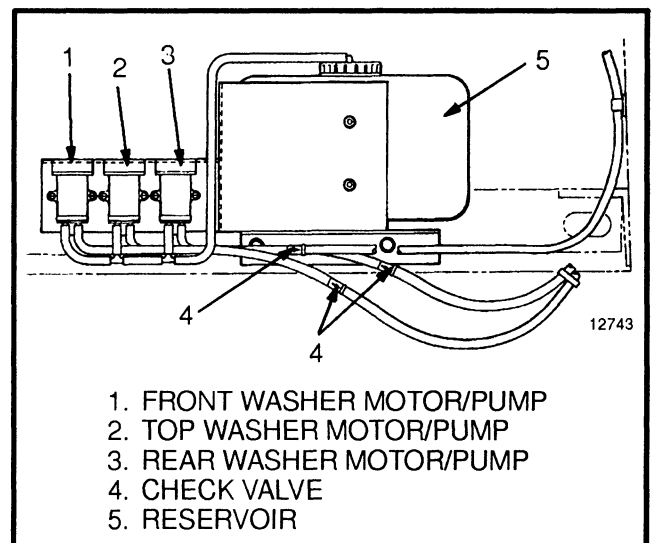


FIGURE 14. WINDOW WASHERS

Window Washer Motor/Pumps (See FIGURE 14.)

Three window washer motor/pump assemblies, and a water reservoir are installed just below and at the right rear part of the operator compartment. When cleaning or replacing any of the hoses, make sure the check valves are installed so that the arrows are toward the nozzles.

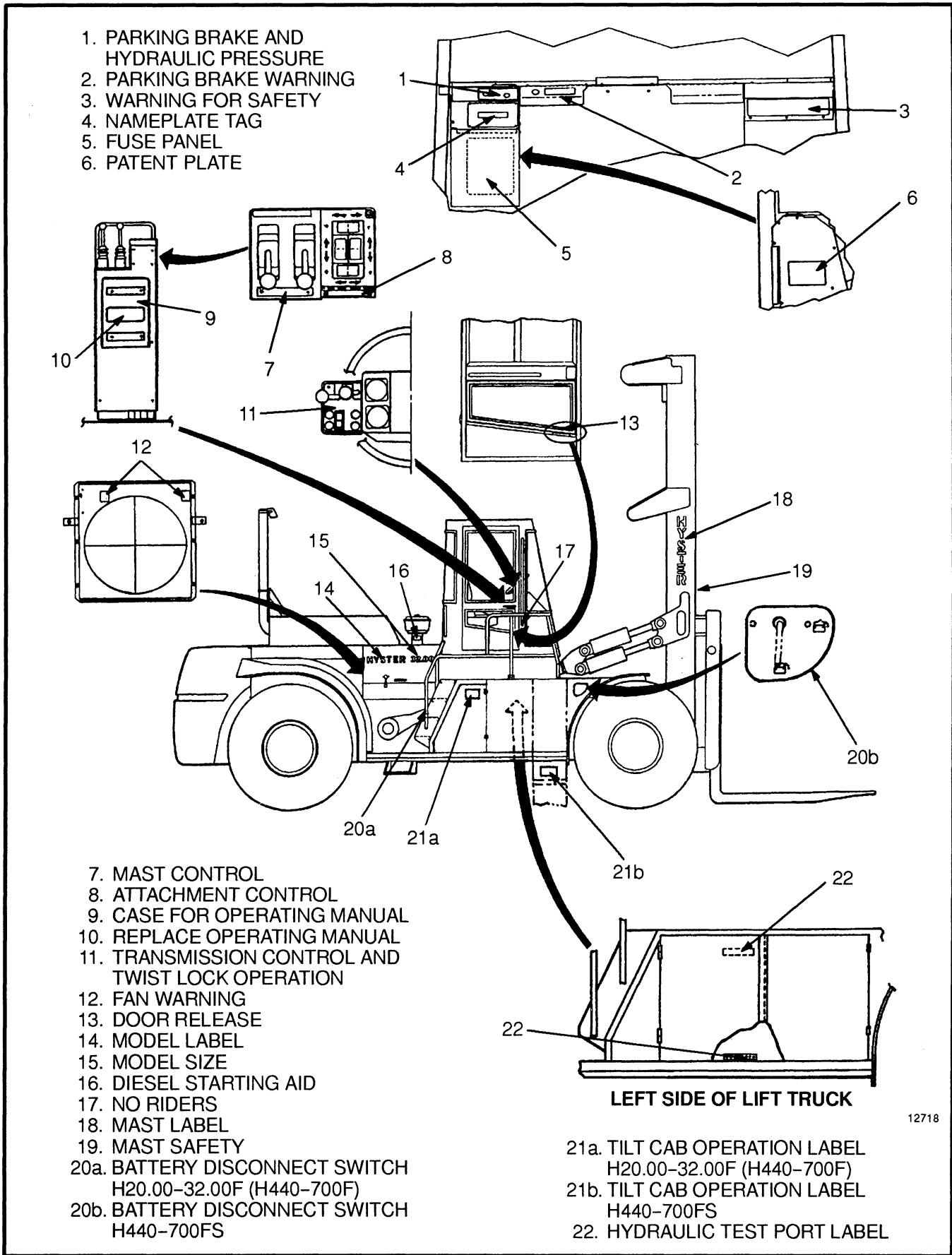


FIGURE 25. LABEL POSITIONS

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