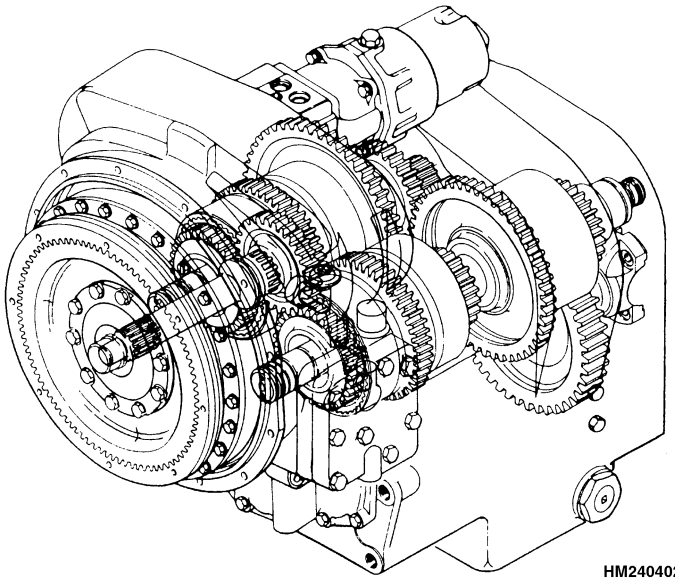
THREE-SPEED POWERSHIFT TRANSMISSION

DESCRIPTION AND OPERATION

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



HM240402

HYSTER

PART NO. 897240

1300 SRM 375

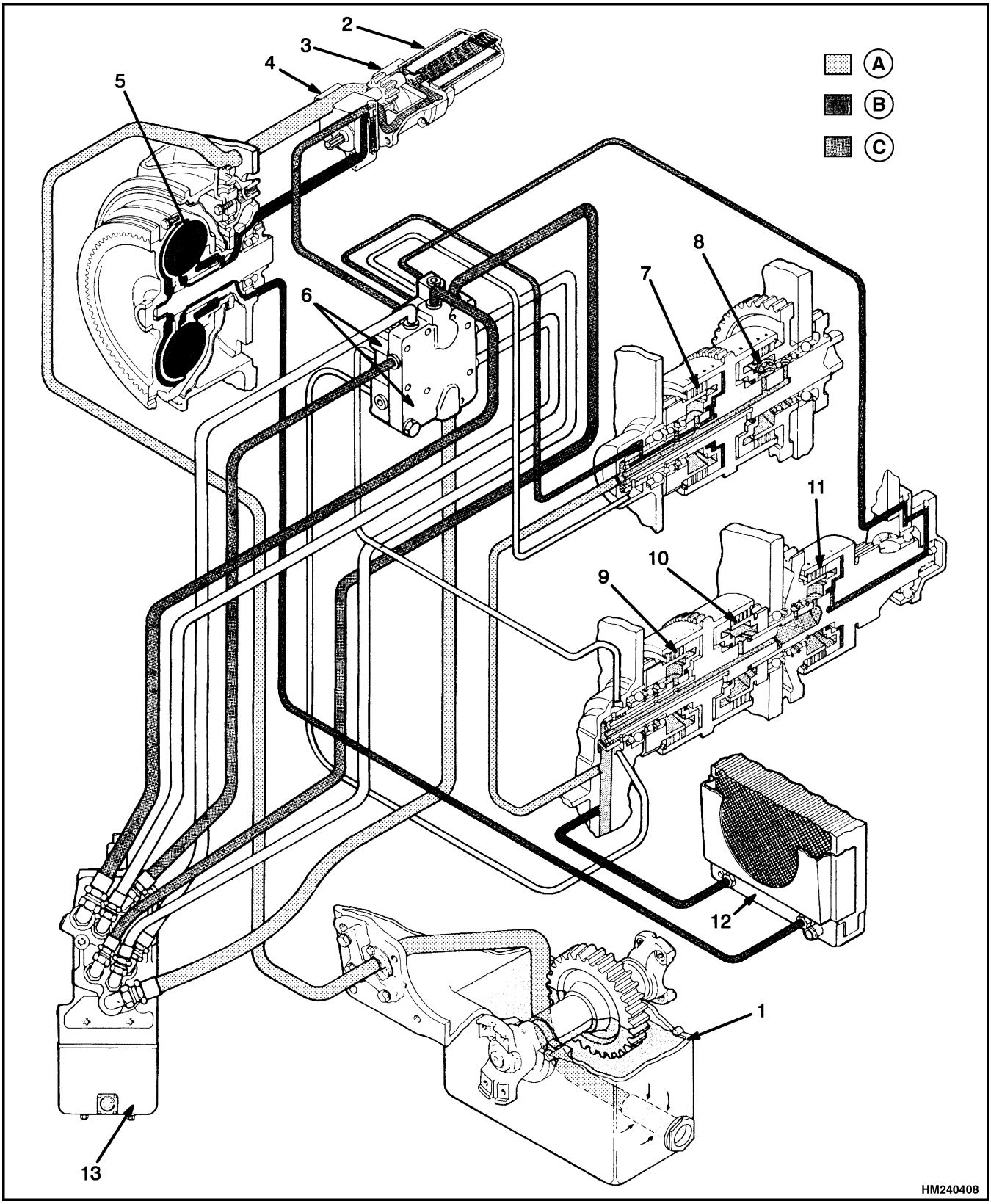


Figure 7. Hydraulic Operation of Transmission

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

Gear Selector

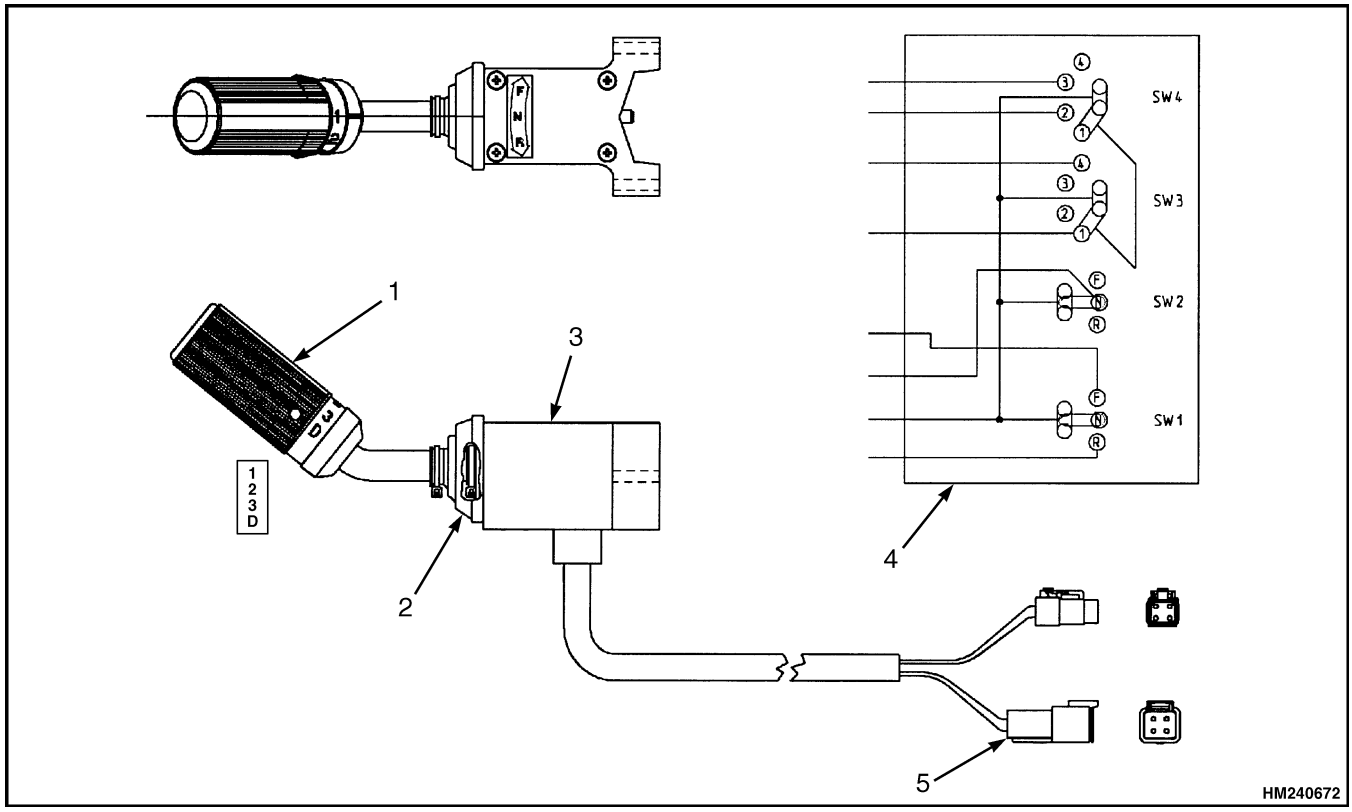
The transmission control system uses one gear selector that selects both range and direction, see Figure 15. The selector is on the left side of the steering column. Push the selector **FORWARD** to begin moving forward. Pull the selector **BACK** to begin moving in backward. Move the gear selector to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

WARNING

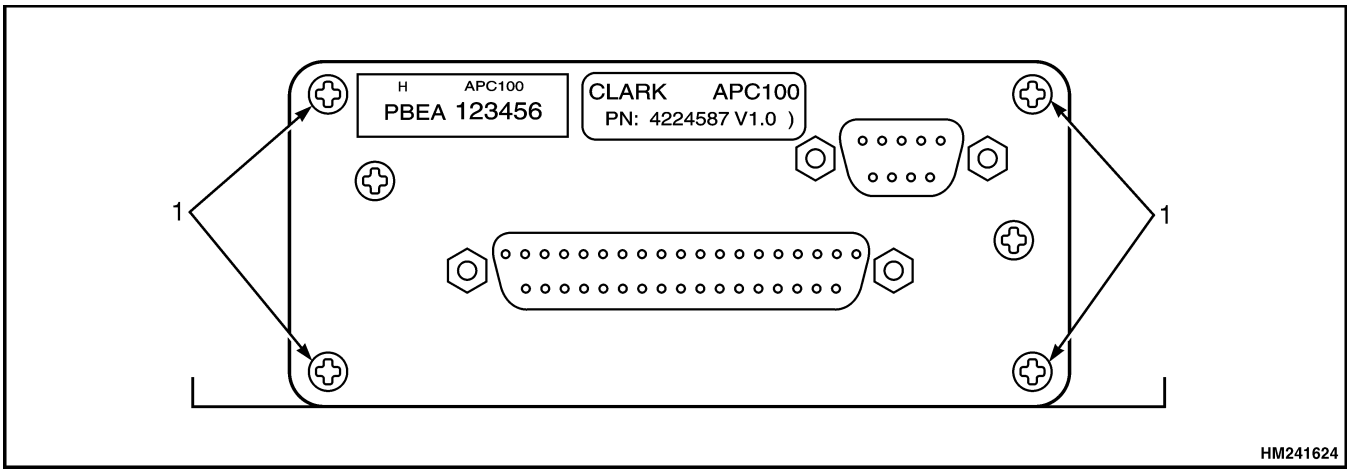
Static electricity can damage electronic components. Handle circuit boards in a static free environment.

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.

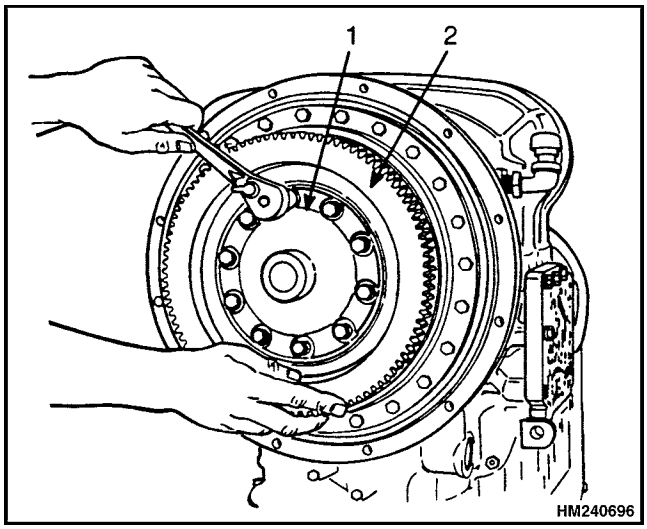
5. Remove the fuse from its holder and check for continuity. Replace, if necessary with a 10 amp fuse.
6. Push the circuit board assembly back into the housing and install retaining screws.
7. Check output circuits for short circuits before reinstalling APC 100 unit into lift truck.
8. Install APC 100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



1. RETAINING SCREWS

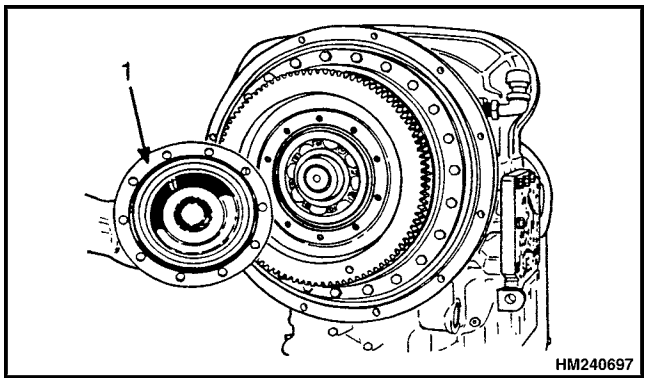
Figure 25. APC 100

STEP 7.
Remove capscrews for bearing cover on impeller cover.



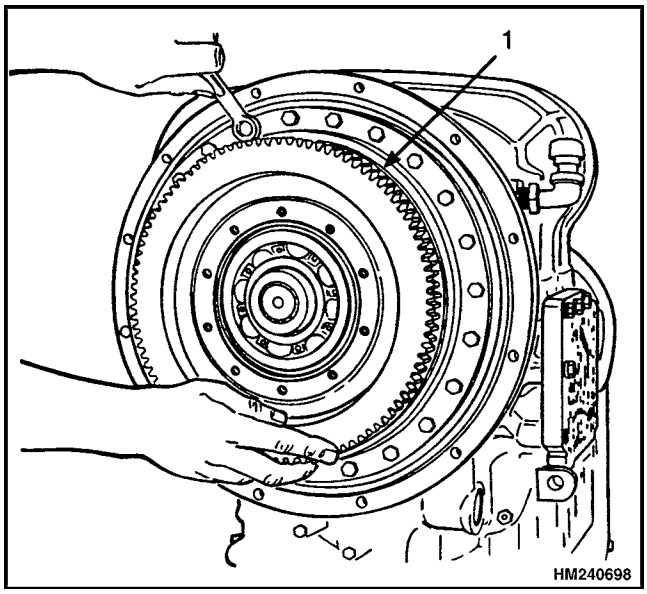
1. BEARING COVER 2. IMPELLER COVER

STEP 8.
Remove bearing cover.



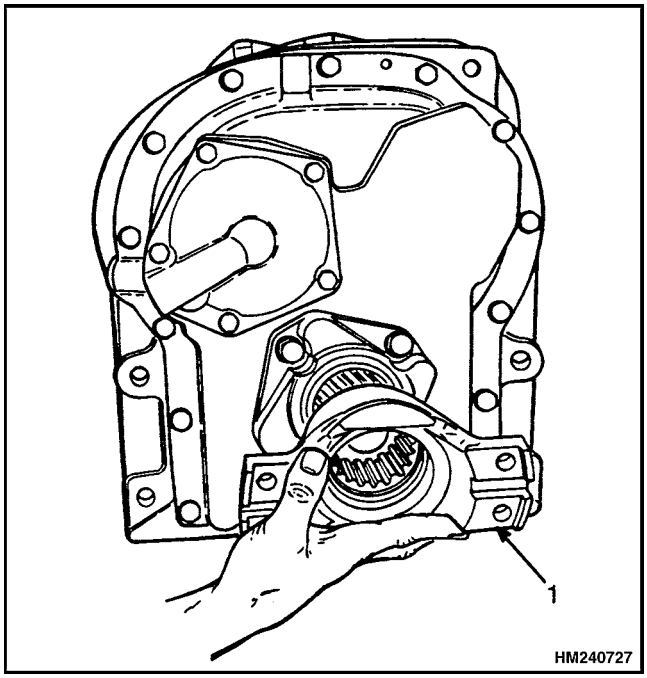
1. BEARING COVER

STEP 9.
Remove capscrews for impeller cover.



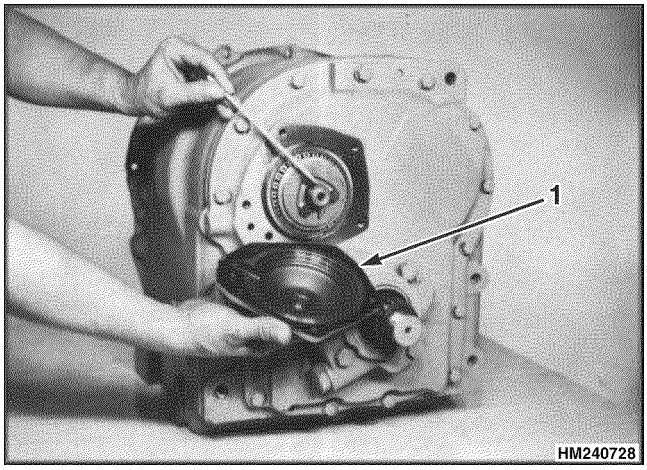
1. IMPELLER COVER

STEP 36.
Remove output yoke.



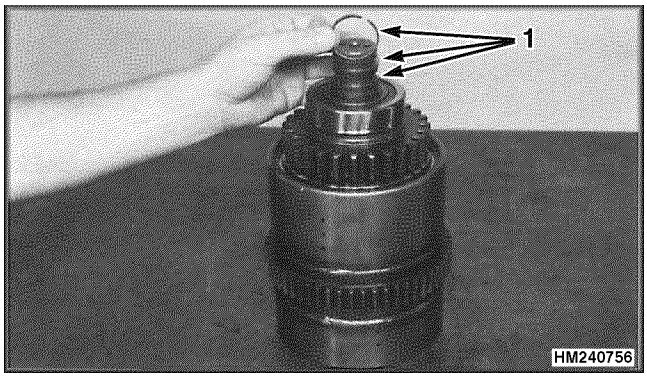
1. OUTPUT YOKE

STEP 37.
Remove bearing cover for shaft for first speed.



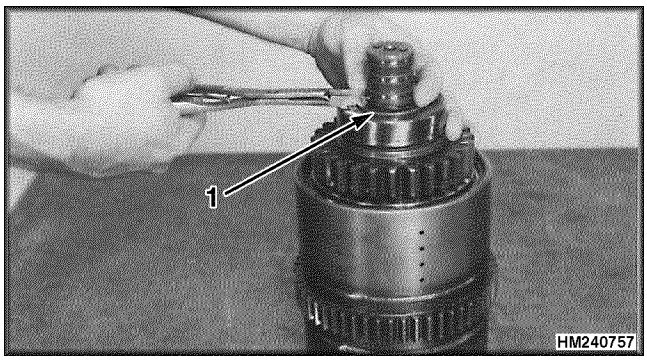
1. BEARING COVER

STEP 63.
Remove seal rings from shaft.



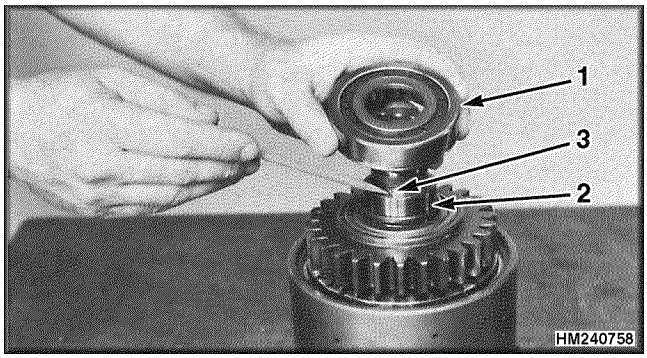
1. SEAL RING

STEP 64.
Remove retainer ring for bearing.



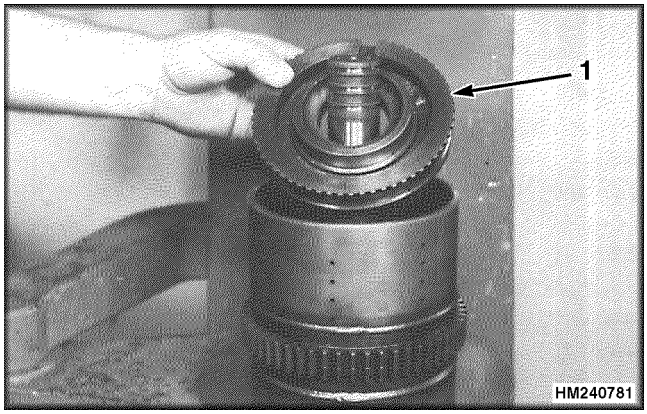
1. RETAINER RING

STEP 65.
Remove bearing and spacer. Do not lose lock ball.



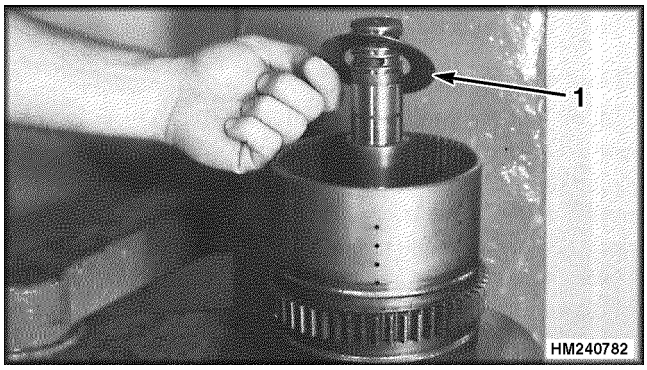
1. BEARING
2. SPACER
3. LOCK BALL

STEP 2.
Make sure bore of piston housing is smooth. There must be no sharp edges to damage the seal rings. Carefully install piston.



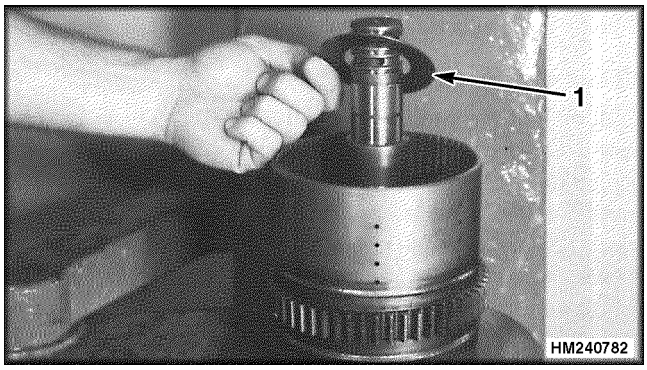
1. PISTON

STEP 3.
Install the first Belleville washer. Make sure large diameter of bevel is toward piston.



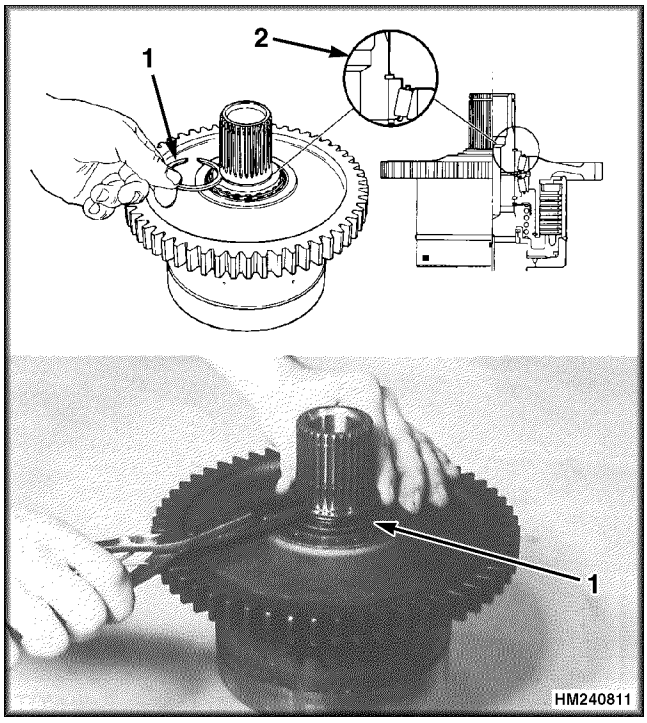
1. BELLEVILLE WASHER

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.



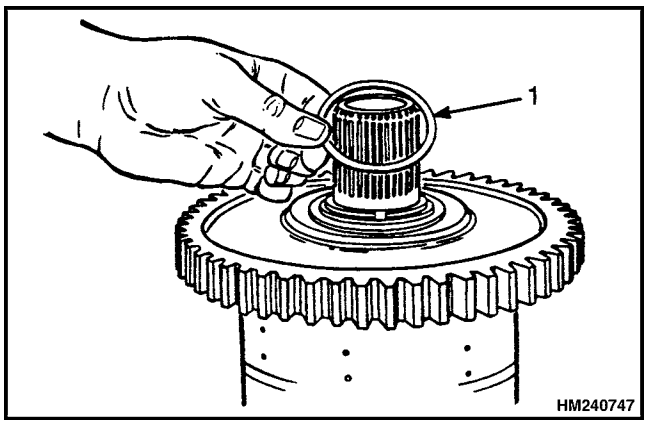
1. BELLEVILLE WASHER

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.



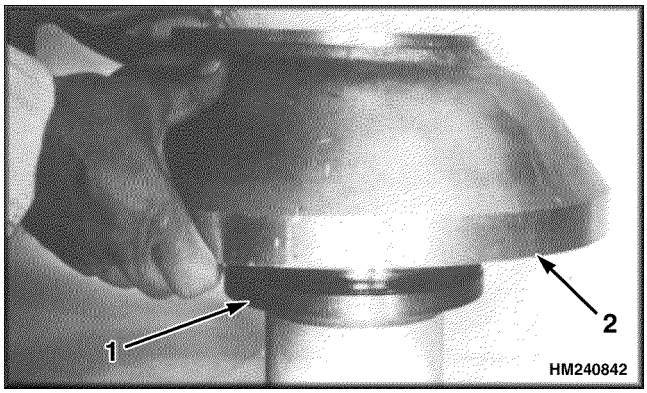
1. SNAP RING 2. BEARING CONE

STEP 34.
Install retainer for snap ring.



1. RETAINER

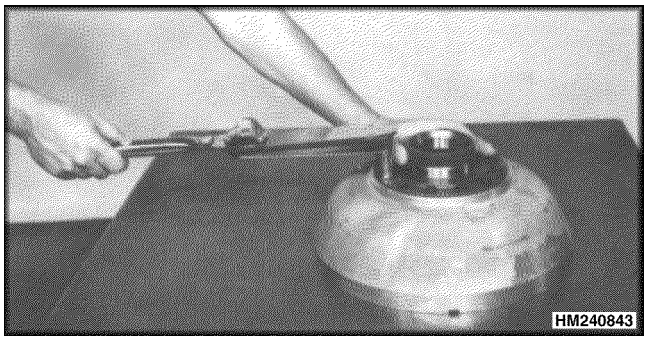
STEP 65.
Install hub in impeller. Align holes in hub, impeller, and plate.



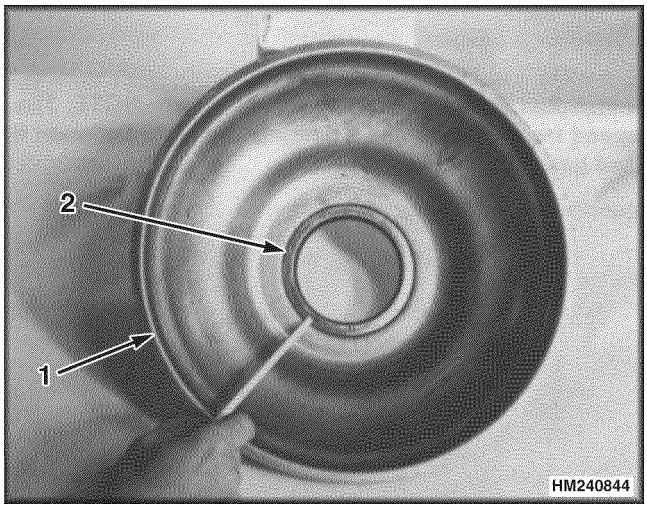
1. HUB 2. IMPELLER

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 Nï m (40 to 45 lbf ft).

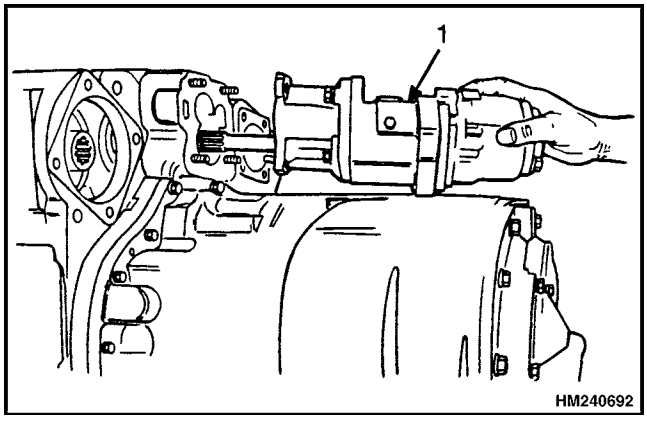


STEP 67.
Apply a sealant to outside of seal. Install seal in oil baffle. Make sure lip of seal is toward outside of oil baffle.



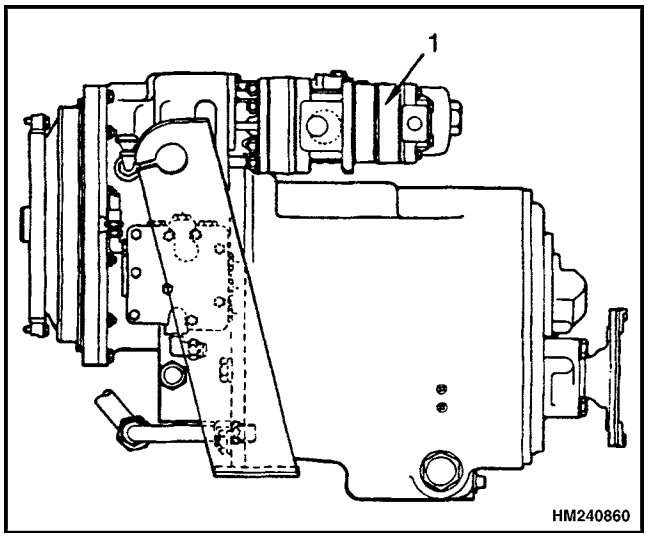
1. OIL BAFFLE 2. OIL SEAL

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 Nï 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 Nï 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

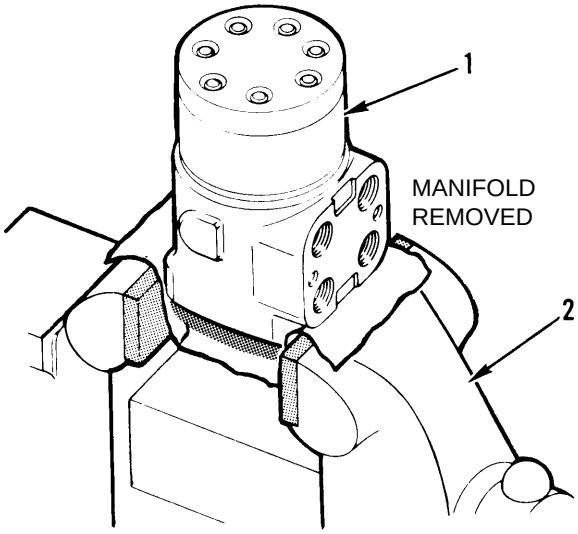
See Step 1 of Transmission Repair, Disassemble. Remove the capscrews that hold the oil pump to the transmission housing. Remove the oil pump. Remove the sleeve from the drive gear for the pump.

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.

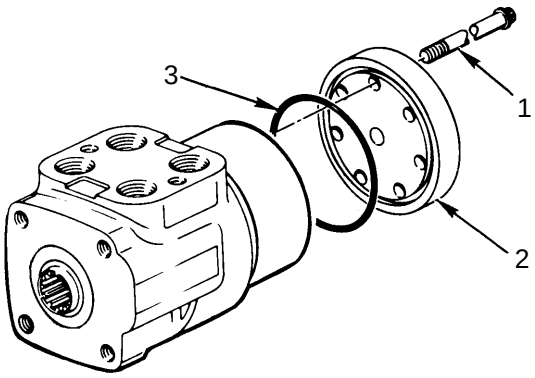
STEP 1. Put the control unit in a vise with soft jaws. Make an identification mark on the length of the control unit. Remove the manifold block.



1. STEERING CONTROL UNIT
2. VISE

11877

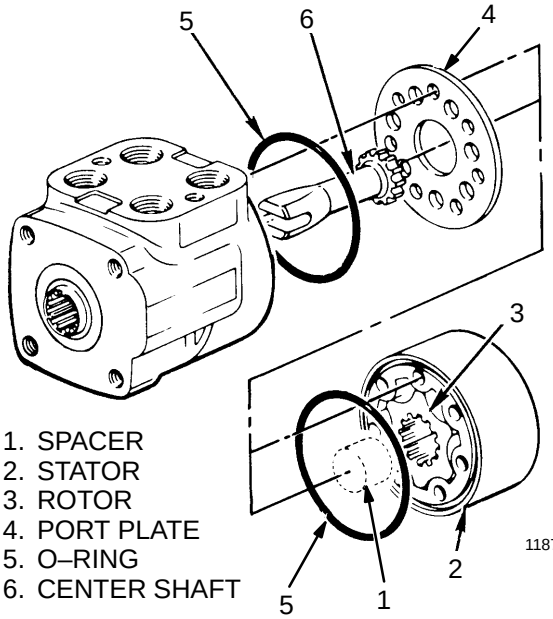
STEP 2. Remove the cover on the bottom of the steering control unit.



1. CAPSCREW
2. COVER
3. O–RING

11876

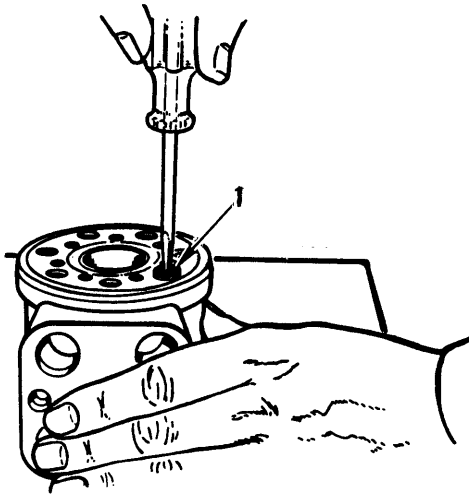
STEP 3. Remove the spacer, the stator, rotor and port plate. Put a mark on the sta–tor so that the same side is toward the body of the control unit. Remove the O–rings. Remove the center shaft.



1. SPACER
2. STATOR
3. ROTOR
4. PORT PLATE
5. O–RING
6. CENTER SHAFT

11877

STEP 4. Remove the screw for the check ball. Remove the check ball.



1. SCREW

11885

FIGURE 5. DISASSEMBLY OF THE STEERING CONTROL UNIT (1 OF 2)

CLEANING

⚠ 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 all the parts in solvent. Dry the parts with compressed air. Do not dry the parts with a cloth. Make sure all surfaces are free of scratches and sharp edges.

ASSEMBLY (See FIGURE 8.)

1. Use new seals, O–rings and neutral position springs during assembly. Lubricate all parts with clean hydraulic oil.

2. Assemble the flow amplifier assembly using the reverse of the procedure as described in DISASSEMBLY. See FIGURE 8. through FIGURE 16.

CHECKS AND ADJUSTMENTS

REMOVE AIR FROM THE SYSTEM

Air can enter the system when a hydraulic line is disconnected. If the operation is rough, start the engine and rotate the steering wheel stop to stop several times in each direction. The air will be removed without disconnecting any lines. If the operation is still rough, air can be entering the system at a loose fitting.

ADJUST RELIEF VALVE FOR STEERING SYSTEM

⚠ WARNING

Before disconnecting any hydraulic lines or fittings, 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.

The relief valve for the steering system is in the flow amplifier. Adjust the setting of the relief valve for the steering system as follows:

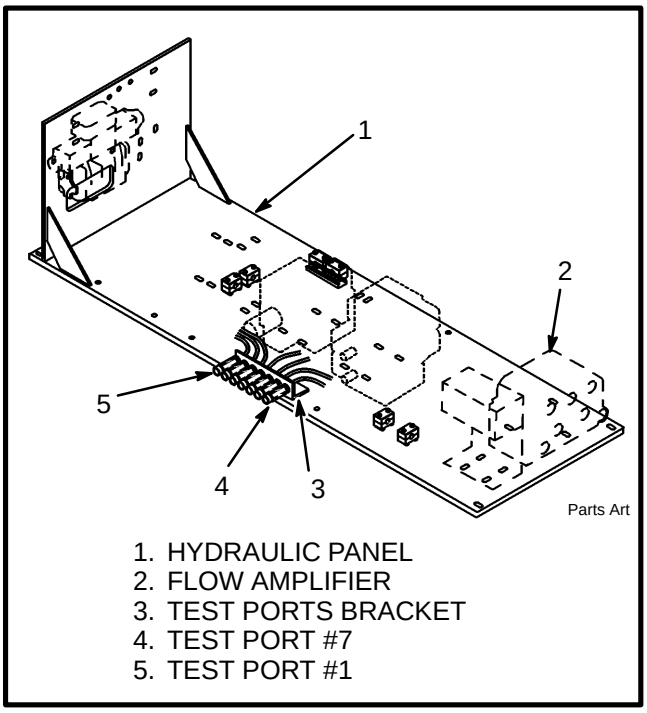
1. Release all hydraulic pressure as described in the WARNING above.

2. Remove the cap at Test Port # 6 and connect a pressure gauge. See FIGURE 17. The pressure gauge must have a minimum capacity of approximately 20 MPa (3000 psi).

⚠ CAUTION

Make sure the relief pressure of the lift valve is correctly adjusted before making this adjustment. Steering pump pressure must be 345 to 690 kPa (50 to 100 psi) greater than the pressure setting of the lift valve. See TABLE 1.

3. Start the engine and check for the correct relief setting of the lift valve as shown in TABLE 1. If the setting is correct, do step 4. If the setting is NOT correct adjust the relief setting of the lift valve as described in the section **HYDRAULIC SYSTEM, 2000 SRM 682**.



1. HYDRAULIC PANEL
2. FLOW AMPLIFIER
3. TEST PORTS BRACKET
4. TEST PORT #7
5. TEST PORT #1

FIGURE 17. PRESSURE RELIEF VALVE

4. Release the system pressure as described in the WARNING and remove the cap at Test Port # 7. Connect the pressure gauge. See FIGURE 17.

PRESSURE SWITCHES (See FIGURE 5. and FIGURE 6.)

NOTE: The pressure switches are located on the module with the hydraulic system components. The module is on the left–hand side of the lift truck.

Replacement (See FIGURE 5. and FIGURE 6.)

⚠ 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 switch. Put caps on the open lines. Remove the two capscrews that hold the switch to the module. Remove the switch.

2. Install the new switch on the module. Connect the hydraulic lines and wire at the switch.

3. Remove the air from the hydraulic system and check the pressure at the switch as described in CHECKS AND ADJUSTMENTS.

ACCUMULATOR CHARGE VALVE

⚠ 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.

Removal and Disassembly (See FIGURE 4., FIGURE 5., FIGURE 6. and FIGURE 7.)

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.

2. Remove the plugs from the valve body one at a time. Remove the parts from each bore and keep them together. Before removing the screw (4), measure its depth in the valve body. Make a note of this for assembly. To remove the screw (4), first pull the pin (3) from the valve body, then remove the screw.

Cleaning and Inspection

⚠ 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, springs and bores for scratches. If there are scratches or other damage, the parts must be replaced. Clean the filter. Make sure the internal passages are clean. Lubricate the parts with clean hydraulic oil for assembly.

Assembly and Installation (See FIGURE 5., FIGURE 6. and FIGURE 7.)

1. Do the following while assembling the parts in the valve body as shown in FIGURE 7.

a. Tighten the screw assembly (17) to 24 to 30 N.m (18 to 22 lbf ft). Install the nut (18) and tighten it to 24 to 30 N.m (18 to 22 lbf ft).

b. Install the screw (4) until the hole in the screw is aligned with the hole in the valve body. Check the depth of the screw (4) with the measurement made during disassembly. Install the pin (3) to keep the screw in position. Install the O–ring and plug (1).

2. Install the valve on the bracket.

3. Connect the lines to the valve.

4. Operate the system and check the valve for leaks.

Adjustment (See FIGURE 7.)

After the accumulator charge valve is installed, check the pressure settings.

1. Connect a 21 MPa (3000 psi) gauge to the check port for the accumulator charge valve. This is check port No. 4 in the hydraulic compartment.

⚠ 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.

3. Release pressure from the accumulator. Disconnect the hydraulic line at the caliper. Put a cap on the open line.

4. Remove the pins that hold the caliper to the bracket. Remove the caliper and brake linings.

⚠ DANGER

Brake linings contain dangerous fibers. Breathing the dust from these linings can be a cancer or lung disease hazard. Do not create dust! Do not clean brake parts with compressed air or by brushing. Follow the cleaning procedure in this section.

Do not sand, grind, chisel, hammer or change linings in any way that will create dust. Any changes to linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

Disassembly (See FIGURE 18.)

1. Remove the nut from the stud (10). Carefully remove the cover from the caliper housing. Remove the washers and springs from the housing.

2. Pull the piston from the bore.

Cleaning

1. Do not release brake lining dust from the brake linings into the air.

2. Use a solvent approved for cleaning of brake parts to wet the brake lining dust. Follow the instructions and cautions of the manufacturer for the use of the solvent. If a solvent spray is used, do not disturb brake lining dust with the spray.

3. When the brake lining dust is wet, clean the parts. Put any cloth or towels in a plastic bag or an airtight container while they are still wet. Put a "DANGEROUS FIBERS" warning label on the plastic bag or airtight container.

4. Any cleaning cloths that will be washed must be cleaned so that brake lining fibers are not released into the air.

Inspection

Inspect the parts and bores for scratches. If there are scratches or other damage, replace the damaged parts. Inspect the rotor as shown in FIGURE 17.

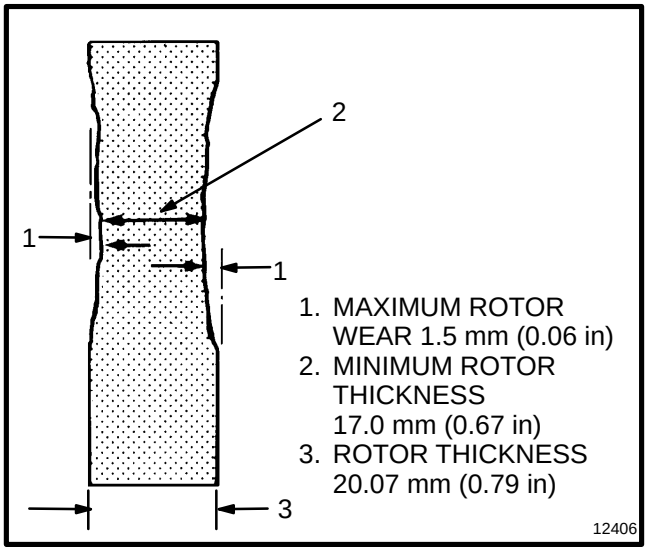


FIGURE 17. INSPECT THE ROTOR FOR THE PARKING BRAKE AND AUXILIARY CALIPERS

Assembly (See FIGURE 18.)

1. Lubricate the piston with clean hydraulic oil. Install the O–rings and back–up rings on the piston. Install the piston in the housing.

2. Install the washers and spring assembly in the housing. Install the spring cover in the housing.

3. Install the washer and nut on the stud. Tighten the nut to retract the piston.

Installation and Adjustment (See FIGURE 18.)

1. Install the caliper on the bracket. Install the alignment pins, O–rings and cotter pins.

2. Connect the hydraulic line to the caliper. Loosen the nut (12).

3. Adjust the brake linings as follows:

a. Put blocks in front and back of the tires so that the lift truck cannot move.

TYREL'S BASEBALL SCHEDULE

APRIL 18	SAT	2:00 pm
APRIL 20	MON	5:30 pm
APRIL 25	SAT	2:00 pm
APRIL 29	WED	7:45 pm
MAY 2	SAT	9:00 am
MAY 4	MON	5:30 pm
MAY 9	SAT	11:30 am
MAY 15	FRI	5:30 pm
MAY 16	SAT	4:30 pm
MAY 20	WED	5:30 pm
MAY 27	WED	5:30 pm
MAY 30	SAT	11:30 am
JUNE 1	MON	5:30 pm
JUNE 4	THUR	5:30 pm
JUNE 6	SAT	9:00 am
JUNE 11	THUR	5:30 pm
JUNE 13	SAT	11:30 am
JUNE 17	WED	5:30 pm
JUNE 20	SAT	4:30 pm

All games at EAST Gresham (900 S.E. 5th) except April 29th which is at JC field.

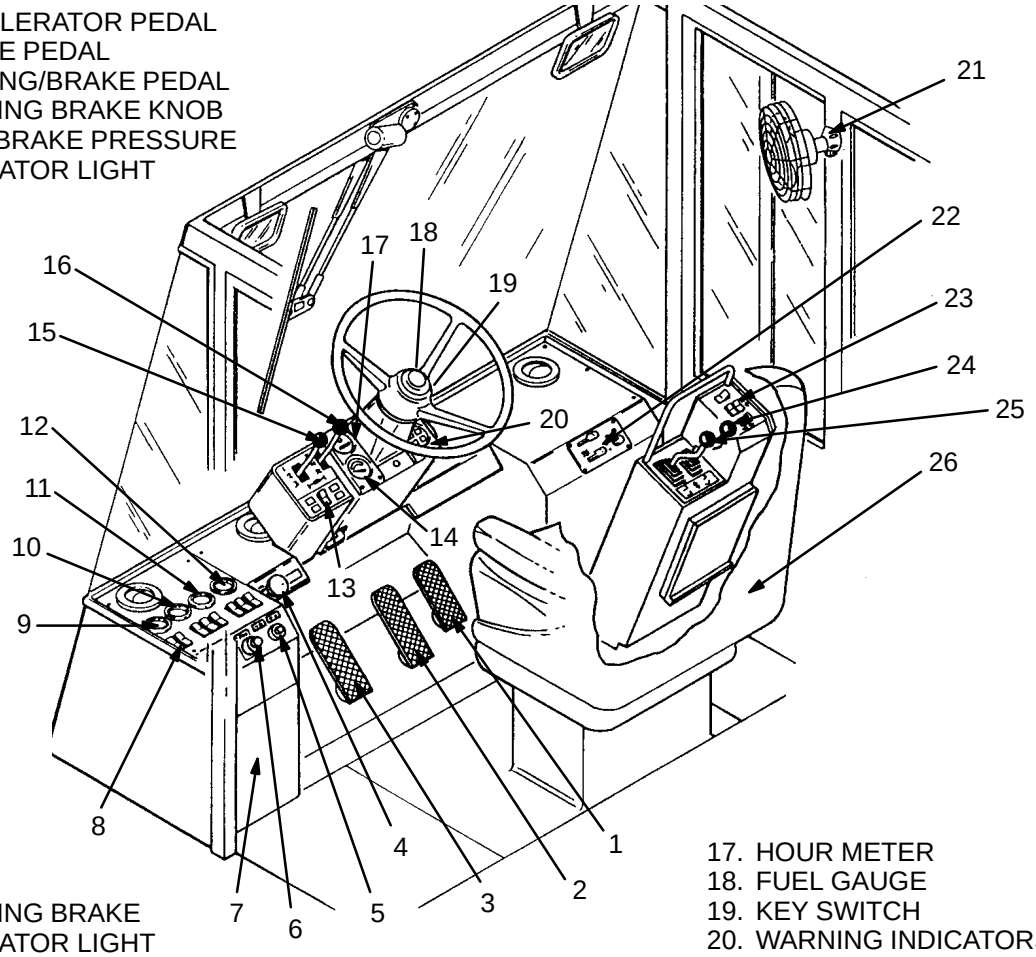


FIGURE 10. OPERATOR COMPARTMENT AND CAB

Removal (See FIGURE 11. and FIGURE 22.)

NOTE: If the operator compartment/cab needs repair or replacement, remove it using the following procedures.

1. Remove the doors from the cab. Remove the capscrews for the floor plates. Remove the center floor plate and seat.

2. Remove the panel from the hydraulic control console. Put tags for identification on the hydraulic lines. Disconnect the hydraulic lines at the control valves. Disconnect the wiring harness at the switches. Remove the floor plate and console.

3. Put tags for identification on the hydraulic lines. Disconnect the hydraulic lines at the steering control unit.

4. Disconnect the hydraulic lines at the parking brake valve. Disconnect the hydraulic lines at the brake pedal valves or move the floor plate and pedals out of the way. If necessary, disconnect the throttle cable at the accelerator pedal.

Repairs (See FIGURE 22., FIGURE 23. and FIGURE 24.)

⚠ WARNING

Make sure the cab support is engaged before you place any part of your body under the raised cab.

Make sure no one is under the cab when lowering the cab.

TILT CYLINDER
(See FIGURE 22., FIGURE 23. and FIGURE 24.)

1. Raise the cab. Connect a safety chain between a hand rail on the cab and a crossmember on the mast. The safety chain must hold the cab in the raised position when the tilt cylinder is removed.

2. Remove the pins at the ends of the tilt cylinder. Remove the pin for the cable at the cab platform.

3. Disconnect the hydraulic lines at the tilt cylinder. Put tags on the lines for identification.

4. Disassemble the tilt cylinder assembly and repair as necessary.

5. Install the tilt cylinder in the correct position. Make sure the cab support is installed correctly. Install the pins and snap rings for the tilt cylinder and cable.

6. Connect the hydraulic lines to the tilt cylinder.

7. Operate pump in the RAISE position. Make sure the cab support is in the correct position then remove the safety chain. Lower the cab and raise it again to check for leaks and correct operation.

LATCH (See FIGURE 23. and FIGURE 24.)

1. Remove the access panel at the back of the operator's compartment. Disconnect the hydraulic line at the latch.

2. Remove the capscrews that hold the latch to the cab platform.

3. Disassemble and repair the latch as necessary.

4. Install the latch and connect the hydraulic line. Operate the pump to make sure the latch opens and closes correctly.

PUMP (See FIGURE 23. and FIGURE 24.)

1. Disconnect the hydraulic lines at the pump. Put tags on the lines for identification.

2. Remove the capscrews that hold the pump to the mount.

3. Disassemble and repair the pump as necessary.

4. Install the pump and connect the hydraulic lines. Operate the pump to make sure the cab raises and lowers correctly.

Maintenance Schedule

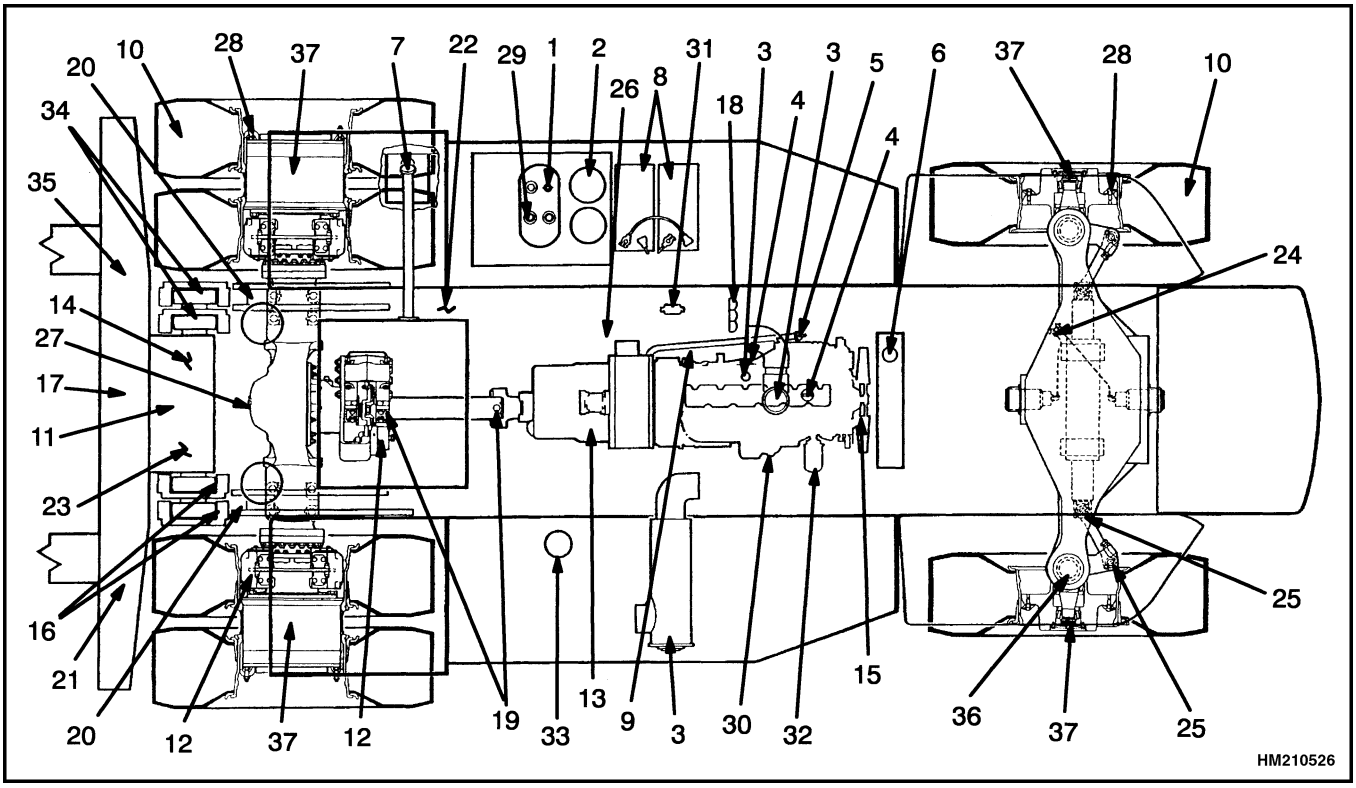
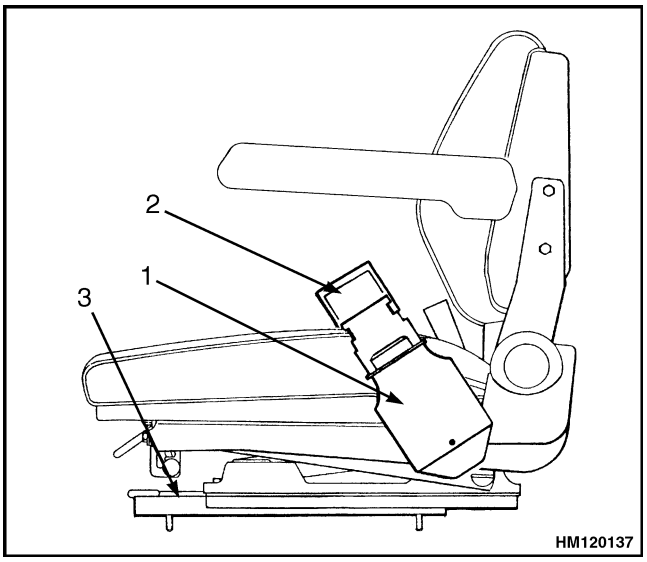


Figure 2. Maintenance Points

Table 1. Maintenance Schedule

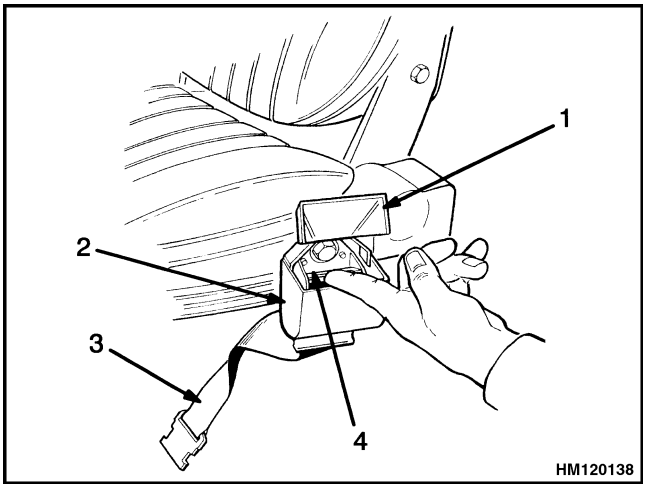
Item No.	Item	8 hr/ 1 day	250 hr/ 2 mo	1000 hr/ 6 mo	2000 hr/ 1 yr	Procedure or Quantity	Specification
1	Hydraulic System (Total Capacity)	X			C	325 liter (85.8 gal)	−18°C (0°F) and Above SAE 10W API CC or CC/SE
2	Hydraulic Oil Filters	X			C	2 See NOTE 1	See Parts Manual
3	Air Filter, Restriction Indicator and Precleaner	X				Check and Clean as Necessary	See Parts Manual
4	Engine Oil	X	C			22.4 liter (23.7 qt)	0°C (32°F) and above SAE 20W-40 API CE/SF or CE/SG
X=Check C=Change L=Lubricate							
NOTE 1: Change filters after first 100 hours on a new lift truck.							
NOTE 2: Multipurpose grease with 2 to 4% Molybdenum Disulfide.							
NOTE 3: Change filter every 500 hours.							



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

Figure 12. 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 13.



1. COVER OPEN
2. SEAT BELT RETRACTOR
3. SEAT BELT
4. BAR

Figure 13. Release Jammed Seat Belt

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

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.

Gauges, Lights, Horn, Fuses, Control Levers, and Pedals

Start the engine. Check that the gauges, lights, horn, fuses, switches, control levers, pedals, and reverse warning alarm operate correctly. See Figure 14. See the **Operating Manual** for a description of the correct operation.

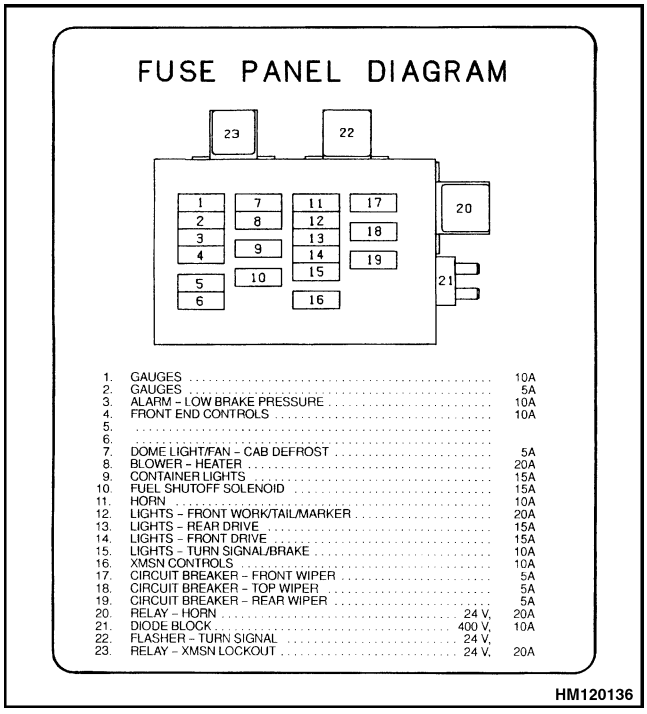
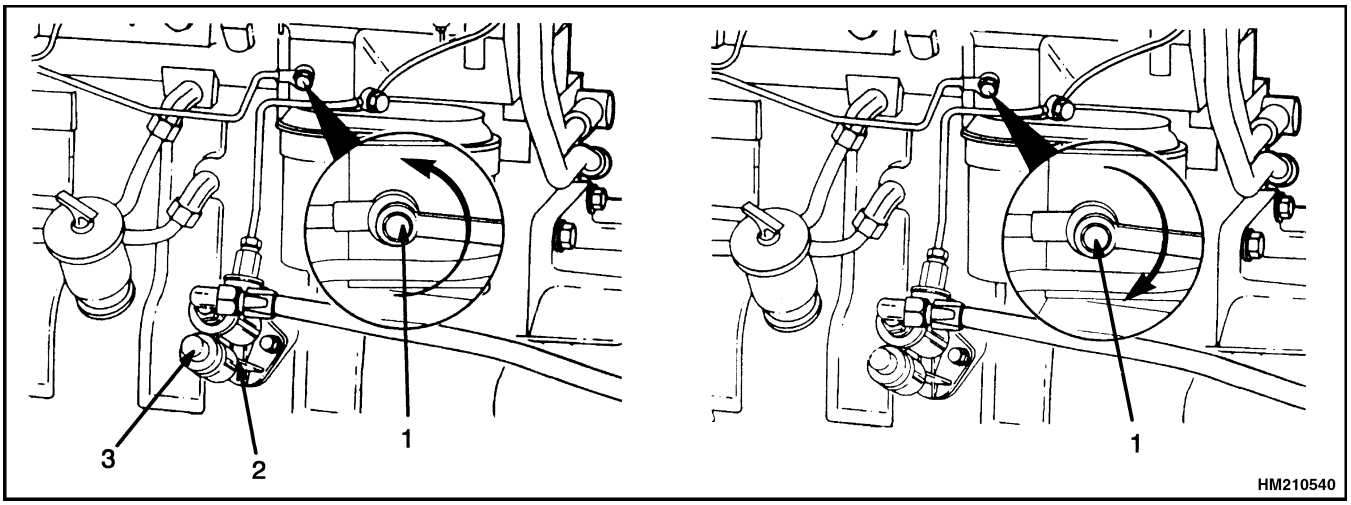


Figure 14. Fuse Panel

Fuel System Air Removal

The air must be removed from the fuel system when any of the following have occurred: any part of the fuel system has been disconnected; the engine has been run out of fuel; the engine has not run in a long period of time. See Figure 23. Also remove the air if there was a leak in the low pressure part of the fuel system while the engine was running.

1. Clean area around vent port. Loosen vent plug.
2. Operate plunger on fuel pump until fuel, free of bubbles, flows from the vent port. Tighten vent plug.



1. VENT PLUG 2. FUEL PUMP 3. PLUNGER

Figure 23. Fuel System Air Removal

Safety Procedures When Working Near Mast

The following procedures must be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.

WARNING

Mast parts are heavy and can move. Distances between parts are small. Serious injury or death can result if part of the body is hit by parts of the mast or the carriage.

- **Never put any part of the body into or under mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that power is off and key is removed. Put a DO NOT OPERATE tag in operator's compartment. Disconnect the battery on electric lift trucks and put a tag or lock on the battery connector.**
- **Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.**
- **DO NOT climb on mast or lift truck at any time. Use a ladder or personnel lift to work on mast.**
- **DO NOT use blocks to support the mast weldments nor to restrain their movement.**
- **Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct Service Manual section for the mast.**

WHEN WORKING NEAR THE MAST ALWAYS:

1. Lower mast and carriage completely. Push lift/lower control lever forward and make sure there is no movement in mast. Make sure all parts of mast that move are fully lowered.

OR

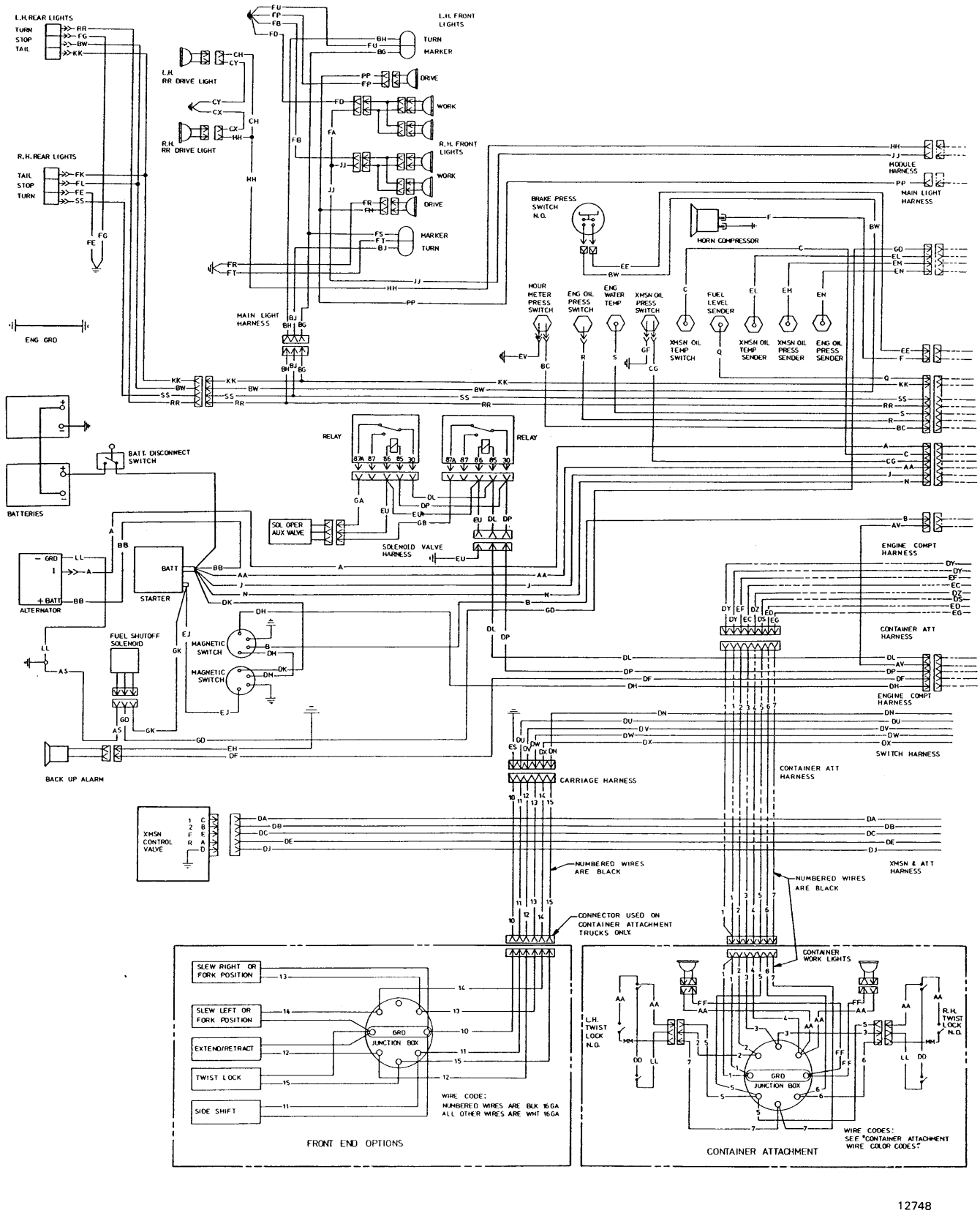

L.H. REAR LIGHTS
TURN
STOP
TAIL
R.H. REAR LIGHTS
TAIL
STOP
TURN
L.H. RR DRIVE LIGHT
R.H. RR DRIVE LIGHT
L.H. FRONT LIGHTS
TURN
MARKER
DRIVE
WORK
R.H. FRONT LIGHTS
WORK
DRIVE
MARKER
TURN
ENG GRD
MAIN LIGHT HARNESS
BRAKE PRESS SWITCH N.O.
HORN COMPRESSOR
MODULE HARNESS
MAIN LIGHT HARNESS
HOUR METER PRESS SWITCH
ENG OIL PRESS SWITCH
ENG WATER TEMP
XMSN OIL PRESS SWITCH
XMSN OIL TEMP SWITCH
FUEL LEVEL SENDER
XMSN OIL TEMP SENDER
XMSN OIL PRESS SENDER
ENG OIL PRESS SENDER
BATT. DISCONNECT SWITCH
BATTERIES
RELAY
RELAY
SOL OPER AUX VALVE
SOLENOID VALVE HARNESS
ENGINE COMPT HARNESS
ALTERNATOR
STARTER
FUEL SHUTOFF SOLENOID
MAGNETIC SWITCH
MAGNETIC SWITCH
CONTAINER ATT HARNESS
ENGINE COMPT HARNESS
SWITCH HARNESS
BACK UP ALARM
CARRIAGE HARNESS
CONTAINER ATT HARNESS
XMSN CONTROL VALVE
NUMBERED WIRES ARE BLACK
NUMBERED WIRES ARE BLACK
XMSN & ATT HARNESS
CONNECTOR USED ON CONTAINER ATTACHMENT TRUCKS ONLY
SLEW RIGHT OR FORK POSITION
SLEW LEFT OR FORK POSITION
EXTEND/RETRACT
TWIST LOCK
SIDE SHIFT
JUNCTION BOX
WIRE CODE:
NUMBERED WIRES ARE BLK 16GA
ALL OTHER WIRES ARE WHT 16GA
FRONT END OPTIONS
CONTAINER WORK LIGHTS
L.H. TWIST LOCK N.O.
R.H. TWIST LOCK N.O.
JUNCTION BOX
WIRE CODES:
SEE "CONTAINER ATTACHMENT WIRE COLOR CODES"
CONTAINER ATTACHMENT
12748

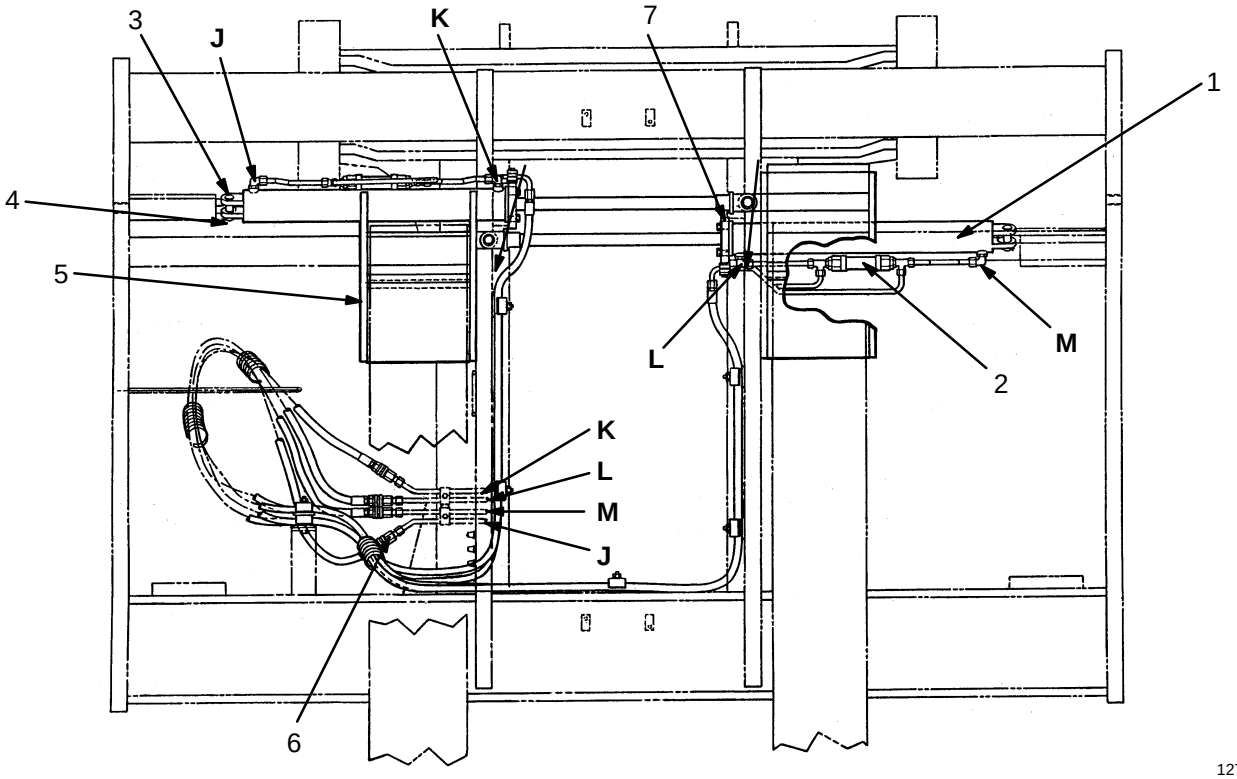
TABLE OF CONTENTS

This section is for the following models:

H20.00-32.00F/FS (H440-700F/FS) [E008]

HYSTER TECHNICAL PUBLICATIONS

8000 SRM 489 7/06 (2/02)(8/92) Printed in United Kingdom



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

NOTES: For hydraulic tube identification, see TABLE 2**.**
Arrangement for Side–Shift Carriage shown

FIGURE 7. CARRIAGE WITH FORK POSITIONERS

4. If the carriage has a side–shift cylinder, assemble the cylinder as described in the procedure for the Side–Shift Cylinder**.** Use the following procedure to assemble the side–shift carriage (see FIGURE 5.):

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 multi–purpose 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.

e. Install the side–shift cylinder in the carriage. Install the anchor pins. Connect the hydraulic lines at the cylinder.

Installation

Install the carriage as follows:

1. Connect a lifting device to the top crossmember. See TABLE 1 for the weight of the parts. If chains are used, do not damage the tube at the top of the side–shift carriage.

ADJUST THE TILT CYLINDERS (See FIGURE 18.)

1. Put the lift truck on a horizontal surface. Lower the mast completely.

⚠ WARNING

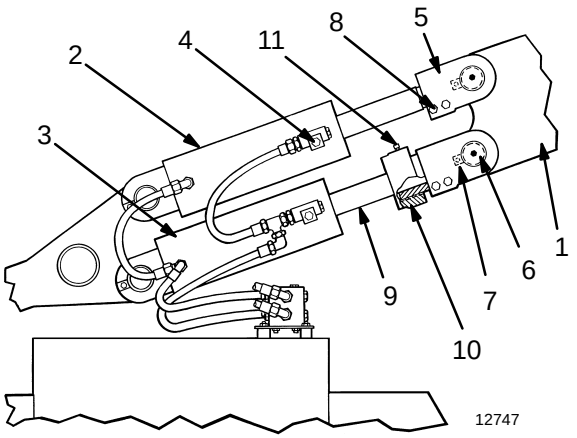
Do not use your finger to push the anchor pins. The tilt cylinder can drop and cause injury.

2. Disconnect the lower tilt cylinders at the mast. Remove the capscrews and keeper plates for the anchor pins. Use a driver to remove the anchor pins. Put a block of wood under each tilt cylinder.

3. Use the hydraulic controls to completely retract the tilt cylinders. Adjust the rod ends of the upper tilt cylinders for 10° back tilt. Loosen the clamp bolts at the rod ends and rotate the rod(s) to change the adjustment. Tilt the mast forward and backward several times to make sure the upper tilt cylinders are adjusted equally. Tighten the clamp bolts to 65 N.m (48 lbf ft).

4. Tilt the mast forward so that both tilt cylinders are fully extended. Adjust the rod ends of the lower tilt cylinders so that the anchor pins fit easily into the holes in the mast. Install the anchor pins and keeper plates in the rod ends. Tighten the clamp bolts to 65 N.m (48 lbf ft).

5. Tilt the mast backward until the upper tilt cylinders are fully retracted. Adjust each tilt spacer on the lower tilt cylinders so that there is zero clearance between the end of the tilt cylinder and the rod end. Tighten the set screws to hold the adjustment. Turn each set screw one complete turn after it touches the threads of the spacer.



1. MAST
2. UPPER TILT CYLINDER
3. LOWER TILT CYLINDER
4. RELIEF VALVE
5. ROD END
6. ANCHOR PIN
7. KEEPER PLATE
8. CLAMP BOLT
9. CYLINDER ROD
10. SPACER
11. SET SCREW

FIGURE 18. TILT CYLINDER ADJUSTMENT

TROUBLESHOOTING

PROBLEM	CAUSE
No movement of the lift cylinders.	Load is more than the capacity of the lift truck.
	Check valve(s) do not operate correctly.
	No oil or not enough oil to the lift cylinders.
	Relief valve(s) adjustment is not correct.
	Pilot line(s) is damaged.
	Pilot pressure is not correct.
	Spool(s) in control valve(s) does not operate correctly.
Slow action of the lift cylinders.	No oil or not enough oil to the lift cylinders.
	Lift cylinder seals are damaged.
	Lift cylinders have internal or external leaks.
	Relief valve(s) adjustment is not correct.

STEERING CONTROL SYSTEM

The steering control system has a steering control unit and a flow amplifier. Oil flow and pressure is from the 96.0 ml (5.86 in.^{3}) per revolution pump. The steering unit is actuated by the steering wheel. Hydraulic pilot lines connect the steering unit in the cab to the flow amplifier on the hydraulic module on the frame. Two large hydraulic lines connect the flow amplifier and the steering cylinder. See **Steering System** 1600 SRM 429.

The steering control unit is a manual metering pump that gives hydraulic control of several valves in the flow amplifier. The action of steering sends hydraulic signals from the control unit to the flow amplifier. The flow amplifier responds by sending a regulated flow of oil to the steering cylinder. The output from the flow amplifier to the steering cylinder is five times larger than the input from the steering unit.

Oil that is not used for steering flows to the inlet of the two spool main control valve. Oil that returns from the steering cylinder flows to the flow amplifier and back to the tank.

BRAKE SYSTEM

Oil from the 41.62 ml (2.54 in.^{3}) per revolution hydraulic pump goes via the accumulator charge valve to an accumulator to ensure that the brake system has enough pressure to operate the brakes. A pressure switch connected to the brake circuit operates a warning light for the operator when brake pressure is low. The pump, accumulator charge valve, and accumulator maintain the brake pressure and oil flow to operate the brakes at each drive wheel. The system also supplies oil flow and pressure to operate the parking brake and auxiliary brake on the drive line near the differential.

Oil pressure from the accumulator is supplied to declutch/brake treadle and brake treadle. The right-hand pedal only activates the brakes. The left-hand pedal first activates the brakes and further pushing of the pedal will also fully disengage the transmission. When activating either the left-hand or right-hand pedal, hydraulic oil flows to the shuttle valve and then through the sequence valve to the caliper brakes and through the 4.5 MPa (650 psi) relay valve to the auxiliary brakes. The brake and declutch/brake treadle are set at 13.8 MPa (2000 psi). See Figure 23.

The parking brake is controlled by a solenoid valve operated by a switch in the operator compartment.

Lift and Lower Circuit

DESCRIPTION

A remote control valve in the operator compartment operates spools in the main control valves that control the lifting and lowering functions. See Figure 2 and Figure 3.

The remote control valve is installed in the console at the right-hand side of the seat. The remote control valve is an assembly of two sections with spools and a spacer block. One section controls the lift and lower functions. The other section controls the tilt function.

The remote control valve has two spool assemblies actuated by a hand lever. One spool assembly actuates the lift function, and the other spool assembly actuates the lower function. The spool assemblies are the same. The lift/lower spool assembly controls the pilot pressure to the lift/lower spools in the main control valves. Springs move the spool to close the passage that supplies pilot pressure when the operator releases the hand lever.

Two main control valves control the flow and direction of the oil to the lift cylinders. Each main control valve has a lift spool, two relief valve assemblies with restrictions, and two load check valves. There is a 16.9 MPa (2450 psi) relief valve in each control valve. There is also a 690 kPa (100 psi) cylinder relief valve in each control valve.

A two-speed valve on the lift manifold lets the mast lift at two different speeds, depending upon the weight of the load being lifted. This two-speed valve operates with the main control valves.

Lift Manifold

Remove

The lift manifold is mounted on top of the fuel tank. This manifold has four check valves, a differential sensing valve, and an unloading valve. All of these valves are cartridge valves in bores of the housing block of the two-speed lift valve. There are also several plugs of different sizes in the housing block. The housing block is fastened to the fuel tank with four small brackets. See Figure 9.

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.**

1. Lower mast and close shutoff valves on bottom of hydraulic tank.
2. Shut down engine and apply parking brake. Apply brake 8 to 10 times to relieve hydraulic pressure.
3. Remove hydraulic lines and put tags for identification on lines. Put caps on open lines.
4. Remove O-rings and discard.
5. Loosen four screws and brackets from the fuel tank. Remove valve from the fuel tank.
6. Loosen four screws and brackets from plate. Remove valve from plate.

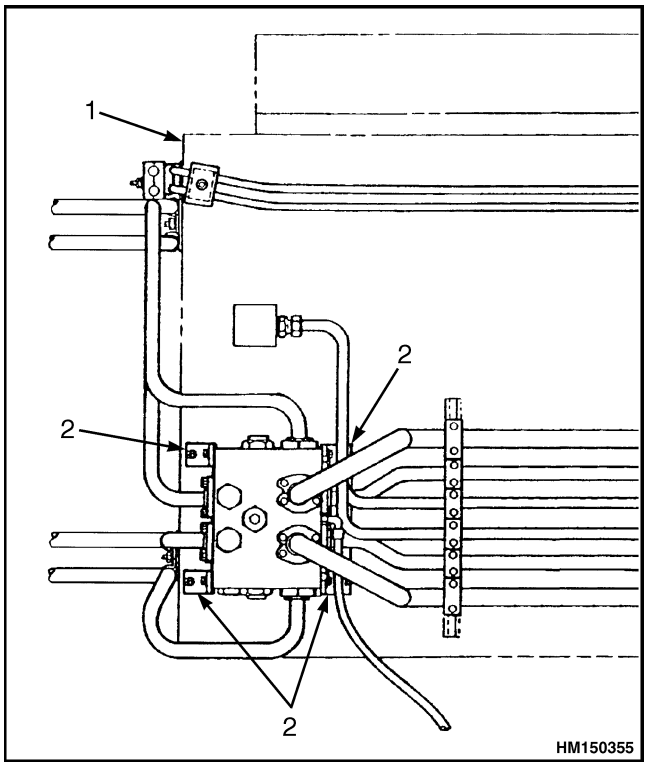
Clean and Inspect

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 and 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 parts with compressed air. Inspect the spools and bores for damage. Replace damaged parts. If there are any scratches or other damage, the valve must be replaced. Spools are not available as separate parts.



1. FUEL TANK 2. BRACKET (4)

Figure 9. Lift Manifold, Removal

Assemble and Install

NOTE: All cartridge valves (check, differential sensing, and unloading) are part of seal kits with necessary O-rings. Install new cartridge valve kits if old valves were removed. Always use new O-rings when installing plugs and fittings.

1. Install all cartridge valve kits and plugs removed during disassembly.
2. Install the lift manifold on the fuel tank using the four small brackets and capscrews. See Figure 10.
3. Connect hydraulic lines as removed during the removal procedure. Check identification tags to make sure all lines are correctly connected to ports.
4. Start engine and operate lift and lower control lever. Check for leaks at valve ports.

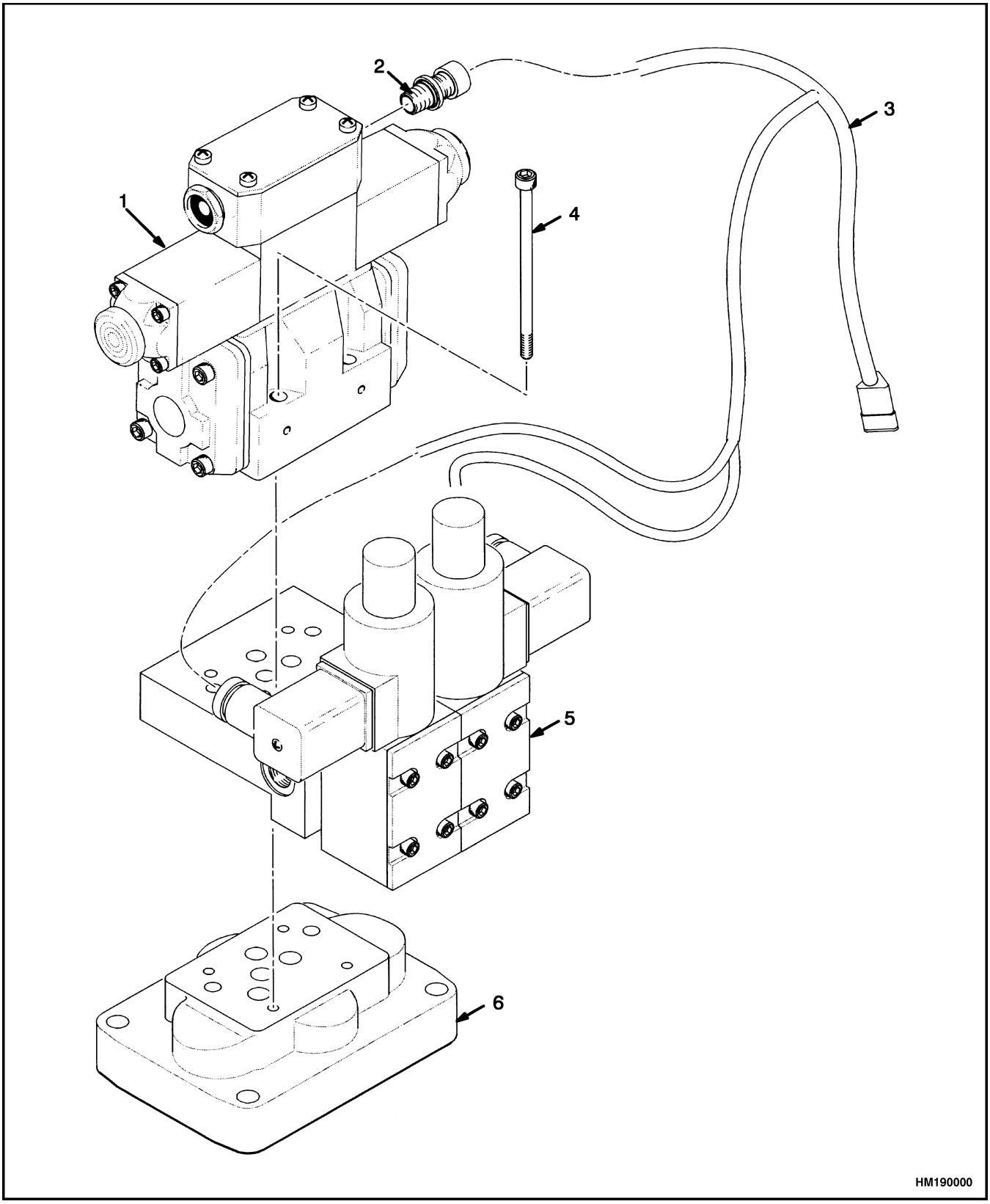


Figure 17. Directional Control Valve, Return Control Solenoid Valve Assembly

REMOTE CONTROL VALVE

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The cylinders that are controlled by the remote control valve do not move or move slowly.	A spool or spools in the remote control valve do not move completely.	Replace valve.
	Pilot pressure from the pressure reduction valve is not correct.	Adjust pressure. Replace valve.
	The pilot lines are damaged or have leaks.	Replace lines.

FLOW CONTROL VALVES

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
ACCUMULATOR CHARGE VALVE AND ACCUMULATOR		
Remote control valve does not operate correctly.	Accumulator charge valve does not operate correctly.	Replace the valve.
Carriage/attachment functions do not operate.	Accumulator charge valve does not operate correctly.	Replace valve.
	Electrical wires are damaged or disconnected.	Connect or replace wires.
Mast does not lower when the engine is not running.	Accumulator does not operate correctly.	Replace accumulator.
	Check valve from base of lift cylinder does not operate.	Replace valve.
PRESSURE REDUCTION VALVE 2.1 MPa (300 psi)		
Remote control valve does not operate correctly.	Pressure reduction valve is not adjusted correctly.	Adjust or replace valve.
	Pressure reduction valve is damaged.	Replace valve.
	Hydraulic line(s) has a restriction.	Replace lines.

NOTES

Description

The purpose of the cooling system is to control the operating temperature of the engine (and in some units, the transmission, brakes, and hydraulic system). A centrifugal water pump circulates coolant through passages in the engine block and the radiator. A thermostat is installed in the water outlet fitting on the engine. As the coolant flows through the radiator, the fan moves air through the radiator to help cool the system.

The coolant is a mixture of water and antifreeze. The antifreeze prevents the coolant from freezing in cold weather, and thereby preventing damage to the engine and radiator. The antifreeze also prevents rust and lubricates the water pump.

RADIATOR

The radiator is the heat exchanger for the cooling system. The fan causes air to flow through the radiator and reduces the temperature of the coolant. The auxiliary coolant reservoir is connected to the radiator by a hose. As the engine gets hot, the coolant expands. During expansion, coolant moves from the radiator to the reservoir. When the engine stops, the coolant becomes cool and contracts. The coolant in the reservoir flows back into the radiator. In this way, the radiator is kept filled with coolant during normal operation.

On units with a powershift transmission, an oil cooler is built into the radiator. Oil from the transmission flows through coils in the radiator tank to help control the oil temperature.

RADIATOR CAP

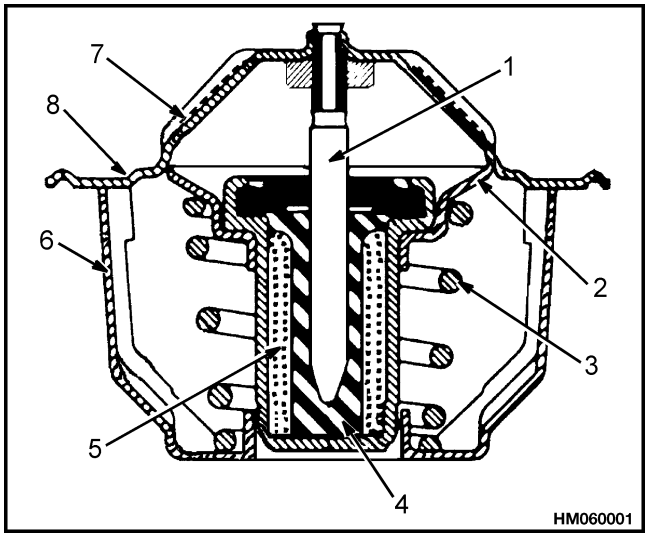
The radiator cap is a pressure-vent type that lets the pressure in the cooling system increase to 103 kPa (15 psi). The pressure in the system prevents vapor from forming in the coolant flowing to the water pump. This action maintains the efficiency of the water pump and the performance of the cooling system. The increase in pressure also raises the boiling point of the coolant mixture to approximately 125°C (257°F) at sea level.

The radiator cap has a pressure valve and a vacuum valve. The pressure valve is held against its seat by a spring. The pressure valve opens when the pressure in the cooling system exceeds 103 kPa (15 psi). The vacuum valve is held against its seat by another spring. The vacuum valve opens to relieve the vacuum created when the coolant temperature decreases. In certain conditions this vacuum can cause the radiator or top hose to collapse.

THERMOSTAT

The thermostat is a device that controls coolant flow by opening and closing to regulate coolant temperature. The thermostat uses a wax pellet to control its operation. The wax pellet expands when it is heated and contracts when it is cold. When heated, the wax pellet pushes on the piston, causing the valve in the thermostat to open. As the wax pellet cools, it contracts and lets a spring close the valve. When the engine is first started and the coolant is cold, the thermostat remains closed. During this time the coolant circulates through the engine, letting it warm quickly. As the engine becomes warm the thermostat opens, letting coolant circulate through the radiator.

The opening and closing of the thermostat helps keep the coolant within the operating limits of the system. The same thermostat is used for summer and winter seasons. Do not operate the engine without a thermostat. The engine will take longer to get warm and may run improperly. See Figure 2.



1. PISTON
2. VALVE SEAT
3. SPRING
4. DIAPHRAGM
5. WAX PELLET
6. FRAME
7. FLANGE
8. VENT HOLE

Figure 2. Typical Thermostat

General

CAUTION

When using an arc welder, always disconnect the ground lead from the lift truck battery to prevent alternator or battery damage. Attach the welding ground clamp as close to the weld area as possible to prevent welding current from damaging the bearings.

The diodes and resistors in the electrical system can be damaged if the following cautions are not followed:

- **Do not disconnect the battery when the engine is running. The voltage surge can damage the diodes and resistors in the electrical system.**
- **Do not disconnect an electric wire before the engine is stopped and the switches are OFF.**
- **Do not cause a short circuit by connecting the electric wires to the wrong terminals. Make sure a correct identification is made of the wire before it is connected.**
- **Make sure a battery is the correct voltage and polarity before it is connected.**
- **Do not check for current flow by making a spark because the electronic components can be damaged.**

NOTE: Information on alternators manufactured outside the United States is in the SRM (Service Repair Manual) sections for lift trucks that use those alternators.

This section has a description and the repair procedures for the alternator with a voltage regulator as part of the alternator.

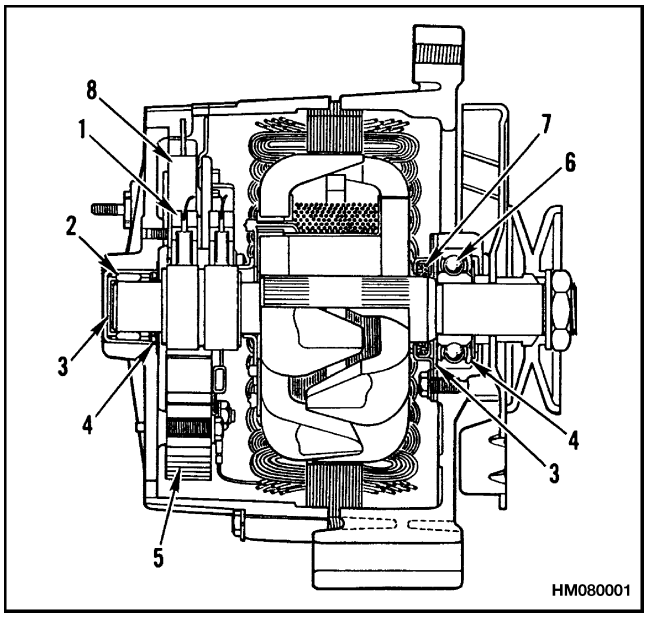
Description

NOTE: For this SRM section, the alternators are in two groups: Type A and Type B. The two types are very similar, but the Type A alternators have a set of three diodes (diode set) as well as the diode bridge. The Type B alternator has zener diodes as part of the diodes in the diode bridge. This alternator does not have a diode set, but does have an additional fan inside the rear housing. The basic operation of both types is very similar.

The alternator generates an alternating current when the engine is running. The alternator is either **ON** or **OFF**. The alternator generates maximum current when it is **ON** and no current when it is **OFF**. The regulator switches the alternator between **ON** and **OFF** to get the average current needed to charge the battery. Alternator output is directly changed by engine speed and rotor field current. The alternating current is changed to a direct current by the diode bridge inside the alternator.

The alternator has these parts (see Figure 1 and Figure 2):

A stator
A rotor
A diode bridge
A diode set (Type A only)
Two end housings or frame halves
A solid-state voltage regulator



NOTE: DELCO TYPE A SHOWN.

1. BRUSH ASSEMBLY
2. ROLLER BEARING
3. GREASE RESERVOIR
4. LIP SEAL
5. DIODE BRIDGE
6. BALL BEARINGS
7. FELT SEAL
8. REGULATOR

Figure 1. Alternator Cross Section

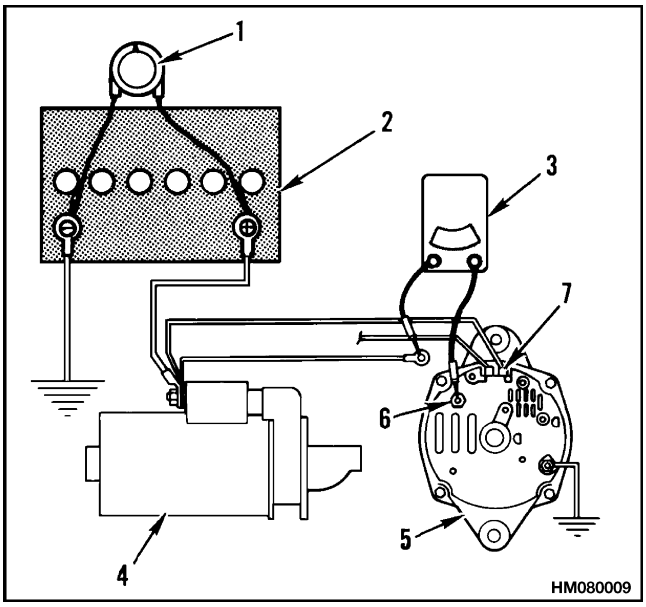
5. Make connections to the Type A alternator as shown in Figure 9. Make connections to the Type B alternator as shown in Figure 10.

6. Connect the cable for the electrical ground on the battery.

7. Connect a carbon pile across the terminals of the battery.

8. Run the engine at 2000 to 2500 rpm. Adjust the carbon pile until the maximum charging rate is reached.

9. Read the value of the maximum charging rate shown on the alternator housing or in the section **Capacities and Specifications** for your lift truck. Read the ammeter. The reading on the ammeter must be within 10% of the maximum value.



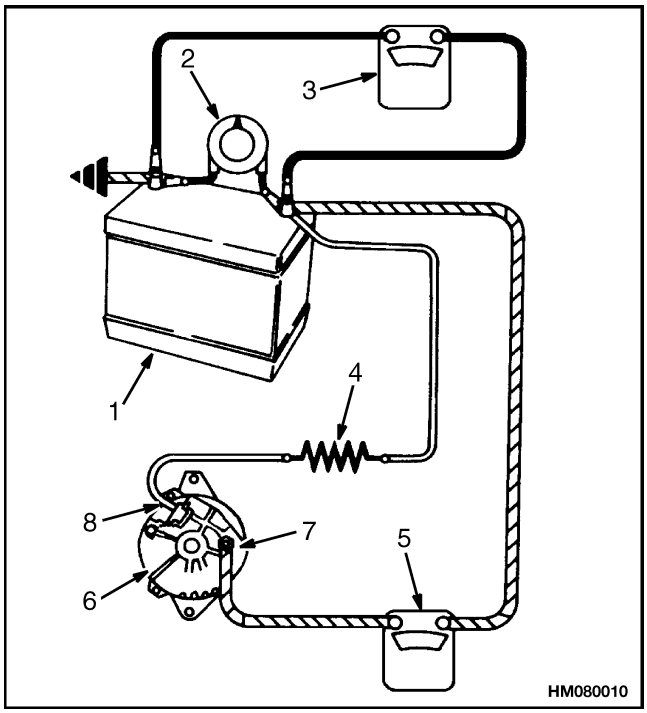
NOTE: TYPE A ONLY.

1. CARBON PILE
2. BATTERY
3. AMMETER
4. STARTER
5. ALTERNATOR
6. BAT TERMINAL
7. FIELD TERMINAL

Figure 9. Alternator Output Check

10. If the ammeter reading is within 10%, the alternator is in good condition. Check the starter or wires for problems. Some alternators on larger lift trucks have a voltage adjustment. See Figure 12. For alternators with the voltage adjustment, do Step a to set the voltage:

a. The voltage setting can be increased by changing the position of the adjustment plug. LO is the lowest voltage setting. 2 is medium low and 3 is the medium setting. The voltage setting is highest when HI is aligned with the arrow on the alternator. Change the setting as necessary.



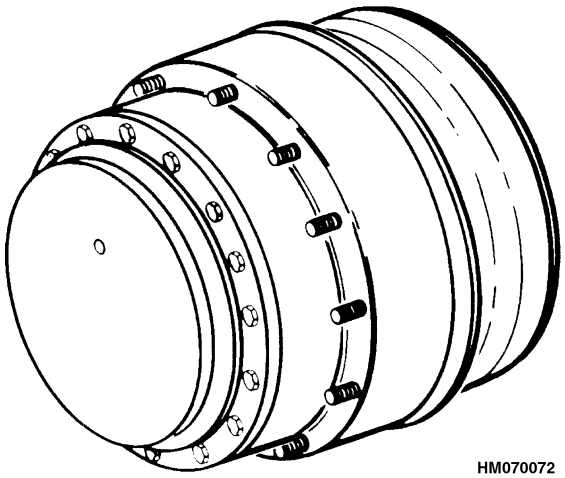
NOTE: TYPE B ONLY.

1. BATTERY
2. CARBON PILE
3. VOLTMETER
4. RESISTOR (35 OHM 5 WATT TO 500 OHM 1/2 WATT)
5. AMMETER
6. ALTERNATOR
7. BAT TERMINAL
8. CONNECT TO L TERMINAL

Figure 10. Alternator Output Check

PLANETARY GEAR AXLE

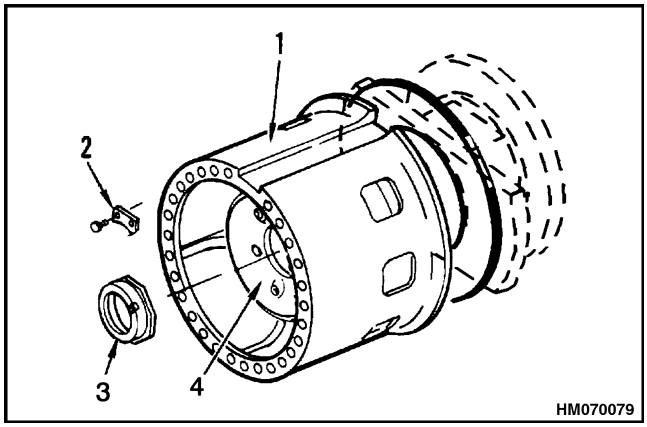
H7.00-12.50H (H150-275H) [C007];
P7.00-9.00B (P150-200B) [C007];
H13.50-16.00B (H300-350B) [B019];
H360-620B [B008];
H16.00-30.00C (H360-650C) [C008];
H17.00-32.00C (H370-700C) [C008];
H700-800A [A117];
H32.00-42.00B (H700-920B) [B117];
H36.00-48.00C (H800-1050C) [C117];
H20.00-32.00F (H440-700F/FS) [E008]



HM070072

HYSTER

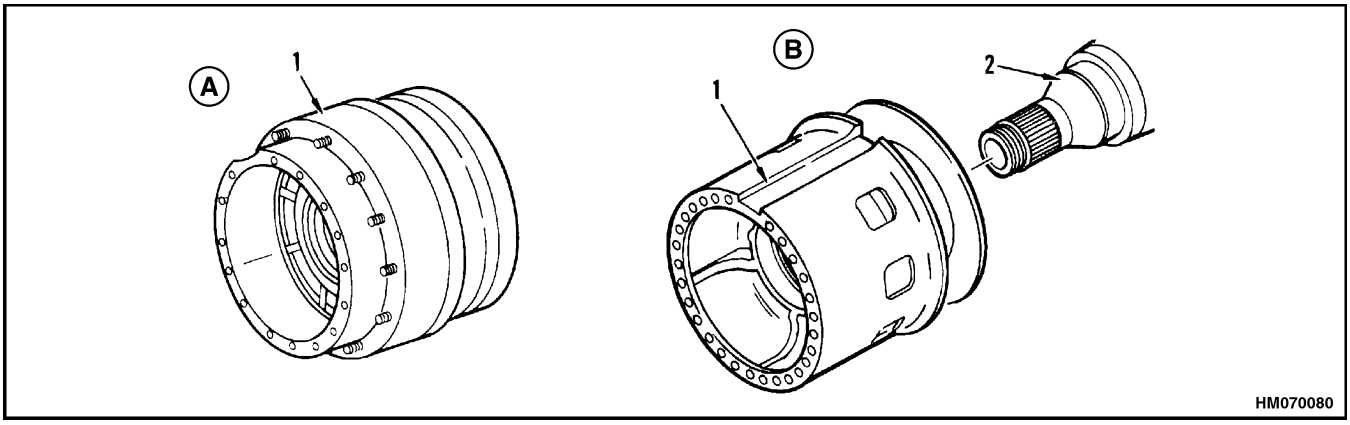
STEP 4.
Remove lock plate for adjustment nut. Remove adjustment nut. Connect a lifting device to hub for support. Use a puller to remove ring gear hub.



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

1. HUB
2. LOCK PLATE
3. ADJUSTMENT NUT
4. RING GEAR HUB

STEP 5.
Attach a lifting device to hub. Carefully remove hub from spindle. Driver splines of hub engage brake discs of oil-cooled brake. See Figure 4.



A. DRUM BRAKE-TYPE AXLE SHOWN. OTHERS SIMILAR.

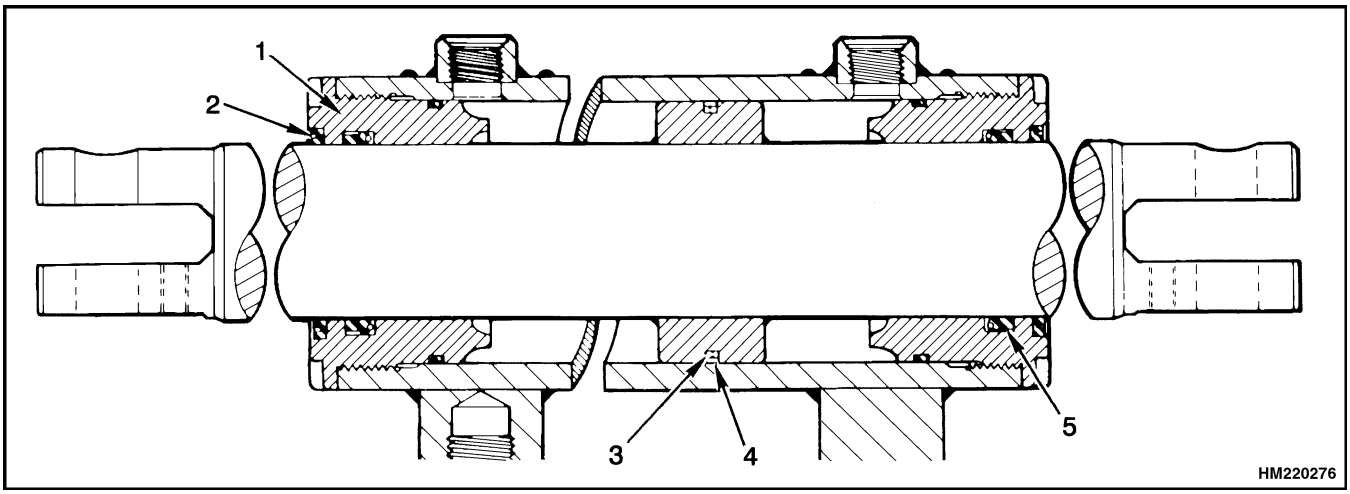
1. HUB

B. DISC BRAKE-TYPE AXLE SHOWN. OTHERS SIMILAR.

2. SPINDLE

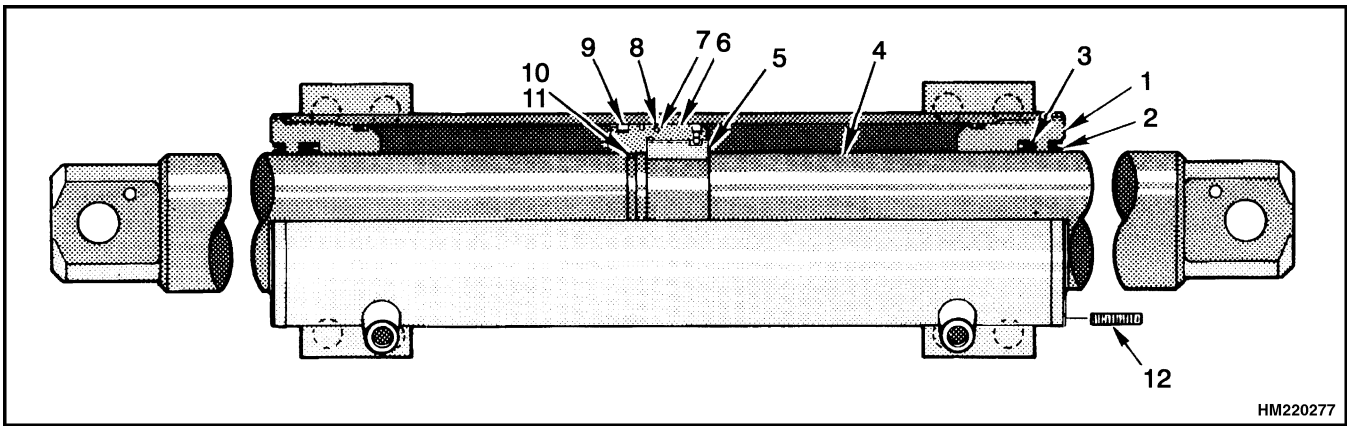
Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The lift truck will not move.	The axle shaft is broken.	Replace axle shaft.
	The gears in the final drive are damaged.	Replace gears.
The final drive makes noise.	The gears or shafts in the final drive are damaged.	Replace gears.
	There is no oil in the axle.	Fill axle with oil.
The final drive has leaks.	There is no sealant between the joints of the planetary assembly.	Replace sealant.
	There are capscrews missing from the cover of the planetary assembly.	Replace missing capscrews.
	There are plugs missing from the cover or housing of the planetary axle.	Replace missing plugs.
	Oil seals are worn or damaged.	Replace oil seals.
	Fittings or oil lines are loose or damaged (units with oil-cooled brakes only).	Tighten fittings or oil lines.



1. END PLUG
2. ROD WIPER
3. SQUARE RING SEAL
4. PISTON SEAL
5. ROD SEAL

Figure 2. Steering Cylinder [H7.00-12.50H (H150-275H), H13.50-16.00B (H300-350B), and P7.00-8.00B (P150-200B)]



1. END PLUG
2. ROD WIPER
3. ROD SEAL
4. ROD
5. RETAINER
6. PISTON
7. PISTON SEAL
8. O-RING
9. PISTON RING
10. O-RING
11. BACKUP RING
12. SETSCREW

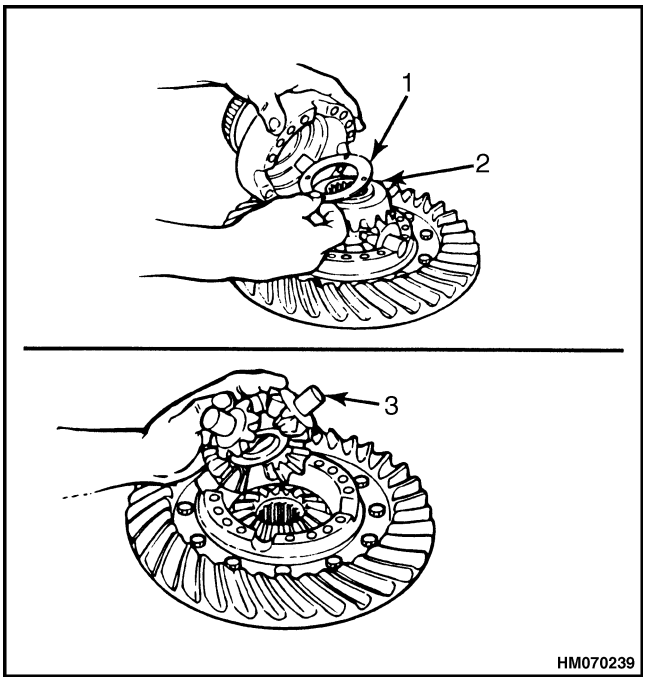
Figure 3. Steering Cylinder [H360-620B, H16.00-30.00C (H360-650C), and H36.00-44.00B (H700-920B)]

DIFFERENTIAL

H16.00-18.00XM/XMS-12 (H400-450HD/HDS) [A236]; H40.00-48.00XM-12 (H800-1050HD/HDS) [A917]; H60-80C; H110-150F; HR45-25, HR45-27, HR45-31, HR45-40S, HR45-36L, HR45-40LS, HR45-45LSX [A227, B227, C227]; HR45-EC, HR48-EC [A228]; S/H6.00-7.00XL (S/H135-155XL, S/H135-155XL$_2$) [B024, C024, F006, G006]; H8.00-12.00XL (H165-280XL) [E007]; H13.00-16.00XL (H300-360XL) [D019]; H8.00-12.00XM (H170-280HD) [F007, G007, H007]; H13.00-14.00XM (H300-330HD) [E019, F019, G019]; H16.00XM-6 (H360HD) [E019, F019, G019]; H10.00-12.00XM-12EC (H360HD-EC) [E019, F019, G019]H17.00CS-32.00C (H370CS-700C) [C008]; H14.00-20.00XM (H400-450H) [A214]; H250-300A; H13.50-16.00B (H300-350B) [B019]; H360-620B [B008]; H16.00-32.00C (H360-650C, H370-700C) [C008]; H700-800A [A117]; H36.00-44.00B (H700-920B) [B117]; H36.00-48.00C (H800-1050C) [C117]; H36.00-48.00E (H800-1050E) [D117]; H40.00-52.00XM-16CH (H1050HD-CH,-1150HD-CH) [E117, F117]; S125-150A [A024]; P40-50A [A119]; P60-80A [A018]; P125-150A [B007]; P7.00-9.00B (P150-200B) [C007]; RS45-27CH, RS45-30CH, RS45-27IH, RS46-33CH, RS46-30IH, RS46-36CH, RS46-33IH [A222]; H16.00-22.00XM-12EC (H400-500HD/HDS-EC) [B214]; RS45-27CH, RS45-31CH, RS46-36CH, RS46-40CH, RS46-41S CH, RS46-41L CH, RS46-41LS CH, RS45-24IH, RS45-28IH, RS46-33IH, RS46-37IH, RS46-38S IH, RS46-38L IH, RS46-38LS IH (HR45-27, HR45-31, HR45-36, HR45-40, HR45-41S, HR45-41L, HR45-41LS) [B222]

HYSTER

2. Remove the differential spider, four pinion gears, two side gears, and six thrust washers from inside the case halves. See Figure 14.



1. THRUST WASHER
2. SIDE GEAR
3. SPIDER, PINIONS, AND THRUST WASHERS

Figure 14. Ring Gear Disassembly

3. If the ring gear needs to be replaced, remove bolts, nuts, and washers holding the ring gear to the flange case half.

CAUTION

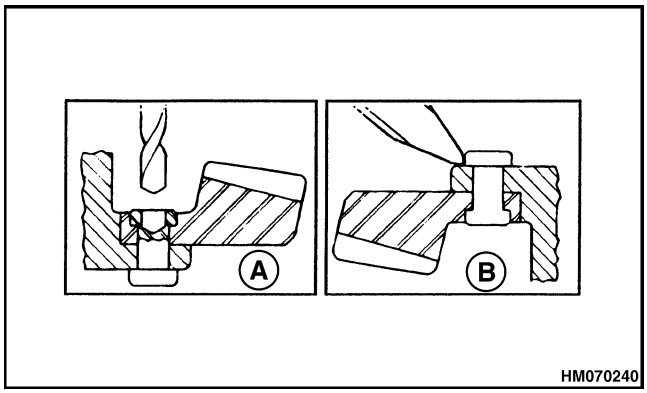
Do not remove the rivets or rivet heads with a chisel and hammer. Using a flat edge tool can cause damage to the flange case. See Figure 15.

4. If your differential model uses rivets to hold the ring gear to the flange case half, remove the rivets as follows:

a. Center punch each rivet head in the center, on the ring gear side of the assembly.

b. Drill each rivet head on the ring gear side of the assembly to a depth equal to the thickness of one rivet head. Use a drill bit that is 1/32 of an inch smaller than the body diameter of the rivets. See Figure 15.

c. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.



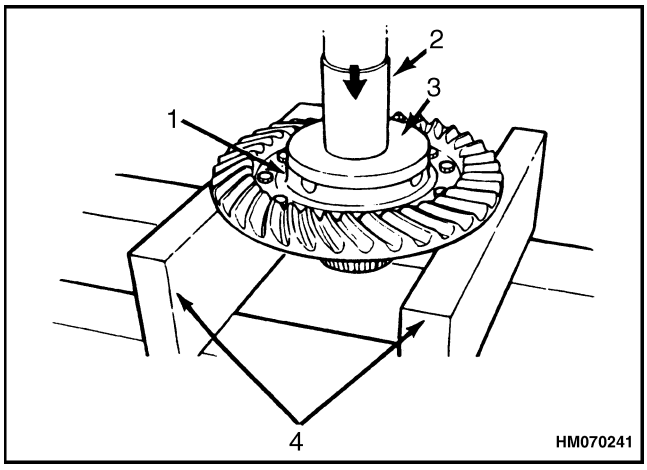
A. CORRECT DRILLING RIVETS FROM HEAD
B. WRONG CHISELING RIVETS FROM HEAD

Figure 15. Rivet Removal

WARNING

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

5. Separate the case half and ring gear using a press. Support the assembly under the ring gear with metal or wood blocks and press the case half through the gear. See Figure 16.



1. CASE HALF
2. PRESS
3. PLATE
4. SUPPORTS

Figure 16. Case Half and Ring Gear Separation

case half because of the close tolerance. Metal particles between the parts will cause gear runout that will exceed the specification of 0.2 mm (0.008 in.).

1. Heat the ring gear in 71 to 82°C (160 to 180°F) water for approximately ten minutes. Heating the gear makes it fit easier on the differential case.

WARNING

Wear protective clothing to prevent injury when handling the hot ring gear.

CAUTION

Never use a press or hammer to install the ring gear.

2. Lift the ring gear from the water using a lifting tool.

3. Install the ring gear on the flange case half immediately after the gear is heated. If the ring gear does not fit easily on the case half, heat the gear again.

4. Align fastener holes of the ring gear and flange case half. Rotate the ring gear as needed.

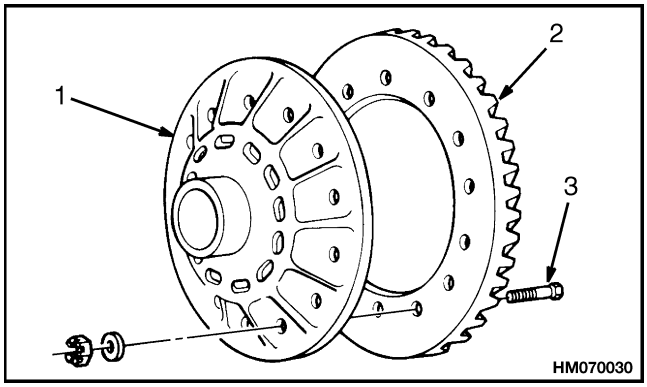
5. If special capscrews are used to fasten the ring gear to the flange case half, install the capscrews, washers, and nuts as shown in Figure 36. The capscrew heads must be against the ring gear. Use pairs of capscrews opposite each other to tighten the case and ring gear together. For capscrew torque specifications, see Specifications, Table 7.

NOTE: On S/H6.00-7.00XL (S/H135-155XL, S/H135-155XL$_2$) (B024, C024, F006, G006) lift truck models, if rivets were use to hold the ring gear and flange case half together, replace them with bolts, nuts, and washers

6. If rivets are used to fasten the ring gear to the flange case half, install the rivets cold. Do not heat the rivets. For the correct pressure to press the rivets, see Specifications, Table 4. The maximum pressure must be applied for approximately one minute at the end of the press cycle. Do not use more than the maximum pressure. Damage to the holes can occur. A correctly installed rivet will have a head at least 3.18 mm (0.125 in.) larger than the hole diameter. Install the rivets in pairs opposite each other (A-A, B-B), from the case half side of the assembly. See Figure 37.

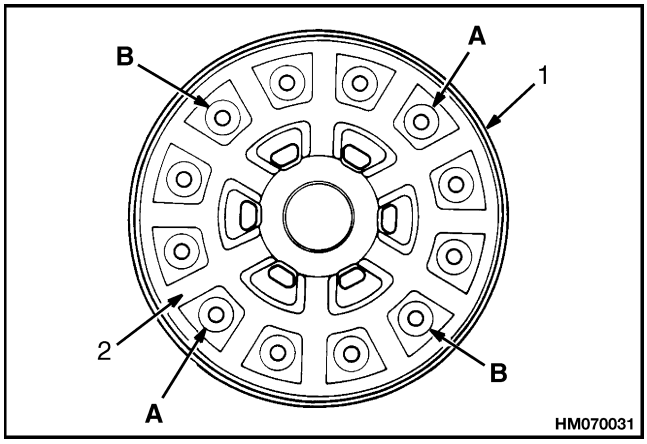
7. Use a thickness gauge that has a thickness of 0.08 mm (0.003 in.) to check for correct installation. Put the gauge between the ring gear and the case at four points that are separated by 90 degrees. The gauge cannot go in more than half the distance between the flange outer diameter and the pilot diameter for the gear. If the gauge goes more than half the distance, the ring gear must be removed and installed again. See Figure 38.

8. Install the bearing cones on both of the case halves. Use a press and a sleeve of the correct size.



1. FLANGE CASE HALF
2. RING GEAR
3. BOLT HEAD AGAINST GEAR

Figure 36. Installation With Capscrews



1. RING GEAR 2. CASE HALF

Figure 37. Installation With Rivets

3. Do the following as required:

   a. **On units with air-operated disc brakes**, install mounting brackets for slack adjusters. Install the air chamber rod pins and the cotter pin in the splined coupling.

   b. **On units with hydraulic disc brakes**, install the parts of the brake as described in the **Brake** section for your unit. Connect the drive shaft and tighten the capscrews at the yoke to 120 N•m (90 lbf ft).

   c. **On H7.00-12.50H (H150-257H) units**, assemble the axle. Install the axle in the lift truck if it was removed. Connect the drive shaft. Use a 11 mm (0.4375 in.) spacer between the speed reducer gear and the pinion nut. Use a new nut and tighten the nut to 1342 to 1790 N•m (990 to 1320 lbf ft) without lubricant.

   d. **On Straddle Trucks™**, install the bearing and seal in the bearing retainer. Install the universal joint yoke in the bearing retainer. Install the snap ring to hold the yoke. Install the stub shaft in the differential. Use a new gasket and install the yoke and bearing retainer. Install the capscrews for the bearing retainer. Install the yoke capscrew. Tighten the capscrews.

4. **For H26.00-32.00C (H550-700C) and H36.00-48.00C (H800-1050C) units with a drum brake installed on the differential**, do the following

NOTE: Special tools (a pilot shaft, a collar, and an installation nut) are required to install the yoke correctly. See Figure 54.

   a. Apply axle lubricant on the yoke seal.

   b. Check all surfaces of the yoke hub for damage. If necessary, polish the yoke hub with emery cloth or crocus cloth.

   c. Install the pilot shaft on the input shaft of the differential. See Figure 54.

CAUTION

Do not use a hammer or mallet to install the yoke onto the shaft. A hammer or mallet can damage the yoke.

   d. Slide the yoke over the pilot shaft. Align the yoke splines with the shaft splines. Slide the collar onto the pilot shaft and against the yoke. See Figure 54.

CAUTION

Do not use the yoke assembly nut for the installation procedure. Use a similar nut for the procedure described in Figure 54.

   e. Install the nut on the pilot shaft. Tighten the nut against the collar until the yoke is in the correct position on the input shaft. The nut can require torque up to 271 N•m (200 lbf ft) to install the yoke correctly.

CAUTION

Make sure the seal is not damaged as the yoke passes through the seal.

   f. Remove the nut, collar, and pilot shaft. Install the assembly nut for the yoke on the end of the input shaft. Tighten the assembly nut to 1627 N•m (1200 lbf ft).

   g. Install the brake drum and fasten with the eight capscrews.

   h. Attach the linkage to the brake adjuster arm. Connect the drive shaft from the yoke flange on the brake drum.

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This section is for the following models:

H40.00-48.00XM-12 (H1050HD) [A917];
S3.50-5.50XL (S70-120XL) [D004];
S3.50-5.50XM (S70-120XM) [E004, F004];
H3.50-5.00XL (H70-110XL); S30-60E/ES; S40-50F; H40-60H; H2.00-3.00J (H40-60J); H16.00-30.00C (H360-650C); P40-50A [A119];
S6.00-7.00XL (S135-155XL, S135-155XL$_2$) [B024, C024];
S3.00-5.50E (S60-120E); H60-110E; H360-620B; H16.00-30.00C (H360-650C); H36.00-48.00C/E (H800-1050C/E) [D117];
H7.00-12.50H (H150-275H); H13.50-16.00B (H300-350B); H32.00-42.00B (H700-920B); J25-35A/AS; J40-60A; E20-50B; E3.00-5.50B (E60-120B);
H6.00-7.00XL (H135-155XL, H135-155XL$_2$) [F006, G006];
H40-60H; R30XMS2; [D174];
H40.00-52.00XM-16CH (H1050HD-CH, 1150HD-CH) [E117, F117];
R30XM2, R30XMA2, R30XMF2; [G118];
H2.00-3.00J (H40-60J)

INSTALL

CAUTION

Before the gear pump is installed, loosen the lock nut on the adjustment screw for the relief valve. Loosen the adjustment screw until the spring is not compressed. If the relief valve was adjusted for a worn pump, the setting will not be correct for a new pump. Damage to the hydraulic system can occur if the setting of the relief valve is too high.

Always install a new filter when repairs are made to the hydraulic system. Drain and replace the hydraulic oil if the oil is dirty or burned.

1. Install new gasket or O-ring on front cover of pump. Put a thin layer of Never-Seez® on splines of drive shaft. Fill inlet port of the pump with hydraulic oil. Turn drive shaft in the direction of rotation until oil comes out of the outlet port.

WARNING

Some of the pumps are very heavy. Use a lifting device to help install the pump.

2. Install pump in lift truck.

3. Install and tighten capscrews. Remove caps from fittings. Connect hoses.

CAUTION

Do not permit hot oil to enter a cold pump. Make sure the relief valve in each system is at the lowest setting.

4. Remove plug from breather on tank. Install breather. Open valve on tank. Fill tank with clean hydraulic oil.

5. Install a 0 to 20 MPa (0 to 3000 psi) pressure gauge to a tee fitting at the pump outlet port. Start engine and run it at idle speed for 3 minutes.

CAUTION

Do not operate any valve until the pump has run for 3 minutes at low pressure and low speed.

6. Touch pump with your hand. If pump is hot, it has a problem. If pump is not hot, then increase engine speed to high limit. Momentarily increase pressure to relief setting. Repeat this procedure for 3 minutes.

7. Look at pressure gauge and adjust relief valve. See Checks and Adjustments for the lift truck for which you are making repairs.

Pump Output Check

Two methods are given for checking the volume of flow from the hydraulic pump. The first method uses a flow meter, a pressure gauge, and a needle valve. The second method uses a needle valve, a pressure gauge, a container, and a timer.

NOTE: If the pump has two outlet ports, do separate flow tests. Add the results of both tests to find the total output rate.

METHOD NO. 1

WARNING

Hydraulic oil can be hot. Do not touch the oil during the tests.

1. If the flow meter is available, install flow meter between needle valve and outlet port of pump. See Figure 11. The pressure gauge must be between the needle valve and the pump. Make a separate check for each system if pump is tandem or if flow regulator is part of pump. When the hydraulic oil is at operating temperature, run engine at 2800 RPM with no load on hydraulic system. Note the reading of the flow meter. Compare output rate of pump with specification found in the **Capacities and Specifications** section of the **Service Manual** for your lift truck.

2. Run engine at high limit. Slowly close needle valve until gauge indicates pressure just below specification for relief valve setting. The pump output at high or pressure must be within 25% of the output with no load. If the output at high pressure is less than 75% of the low pressure output, the pump has a problem.

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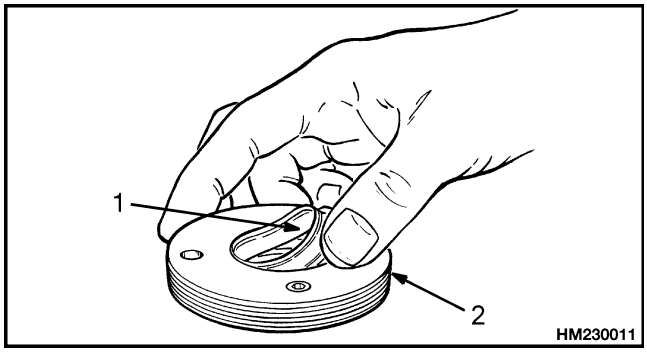
This section is for the following models:

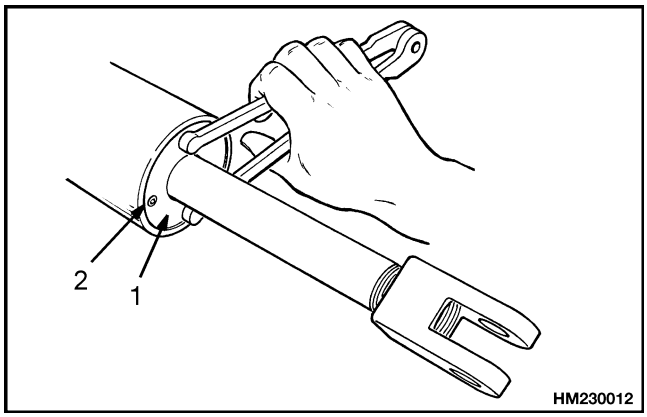
All Models except H3.50-5.50XM (H70-120XM) [K005, L005];S3.50-5.50XM (S70-120XM) [E004, F004];
H40.00-52.00XM-16CH (H1050HD-CH, 1150HD-CH) [E117, F117];
E30-40HSD [A219];
W25-30-40ZC [B454]

STEP 6.
Install a new wiper seal in the retainer. Turn the retainer into the cylinder shell until the threads have started. Push the piston in and out several times to make sure the alignment is correct.



1. WIPER SEAL
2. RETAINER

STEP 7.
Tighten the retainer to the specifications given in Torque Specifications. Tighten the setscrew.



1. RETAINER
2. SETSCREW

Tilt Cylinder Leak Check

WARNING

Never allow anyone under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED.

Do not try to find hydraulic leaks by putting your hand on hydraulic components under pressure. Hydraulic oil can be injected into the body by the pressure.

1. Put a capacity load on the forks. Use a safety chain to hold the load to the carriage. Raise the load approximately 2.5 m (8 ft). Put the mast in a vertical position.

2. Measure the distance that the rod for tilt cylinder extends from the shell. Check the distance the rod moves in five or ten minutes. Multiply the rate in Table 1 by the time of the test and compare the numbers.

3. If the tilt rate is greater than the specifications, lower the mast and remove the load from the forks. Install a gate valve between the port at the front of the tilt cylinder and the hydraulic line. Put the load on the forks again. Close the gate valve. Tilt the mast forward just past the vertical position. If the mast continues to tilt slowly forward, the seals on the piston are leaking.

TABLE OF CONTENTS

This section is for the following models:

Delco Starters used on Hyster Lift Trucks

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The starter makes too much noise.	The solenoid has damage.	Replace solenoid.
	The ring gear has damage.	Install new parts.
	The drive clutch has damage.	Install new parts.
	The battery is discharged or has damage.	Recharge or replace battery.
	The starter brushes are worn or dirty.	Replace brushes.

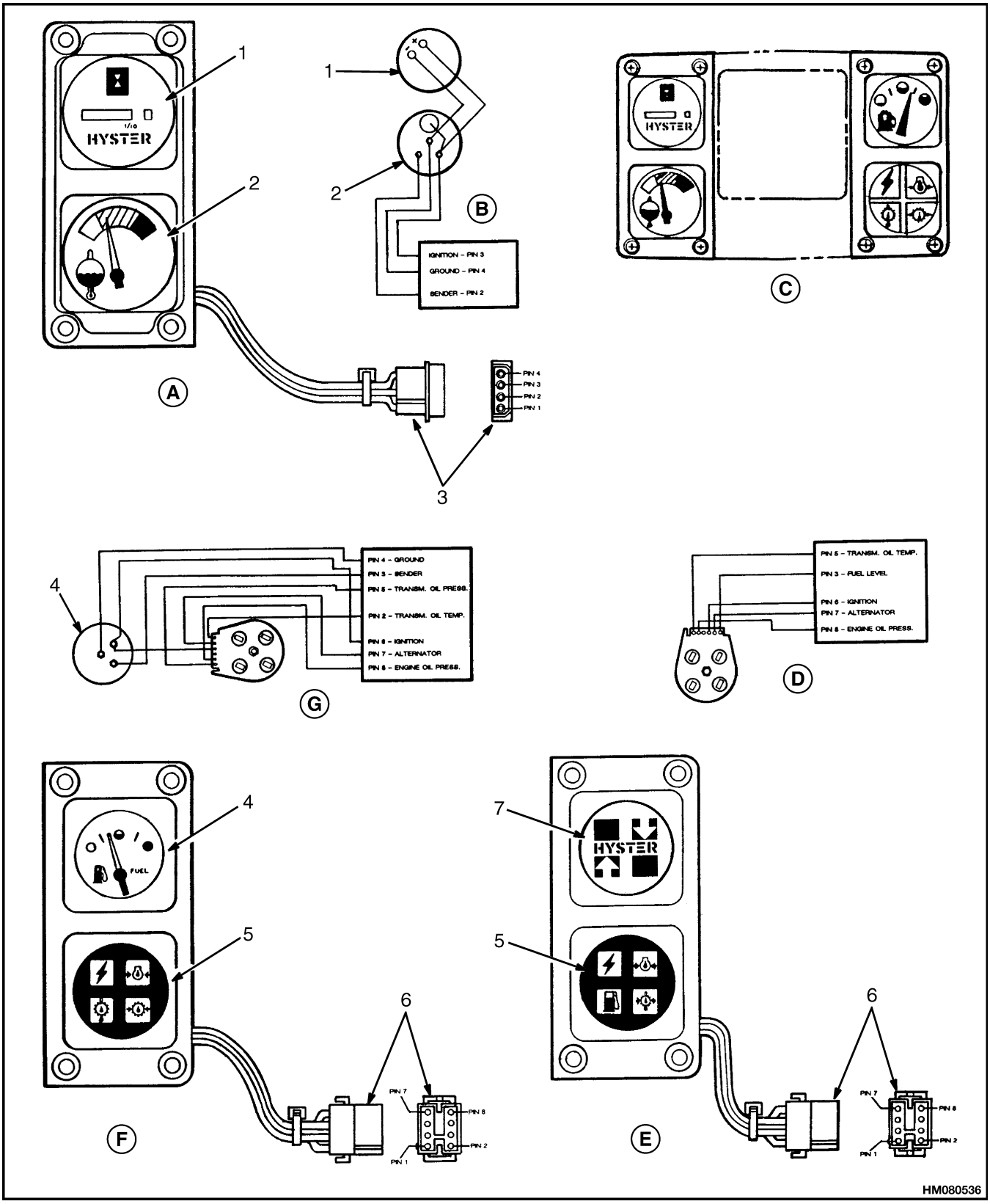
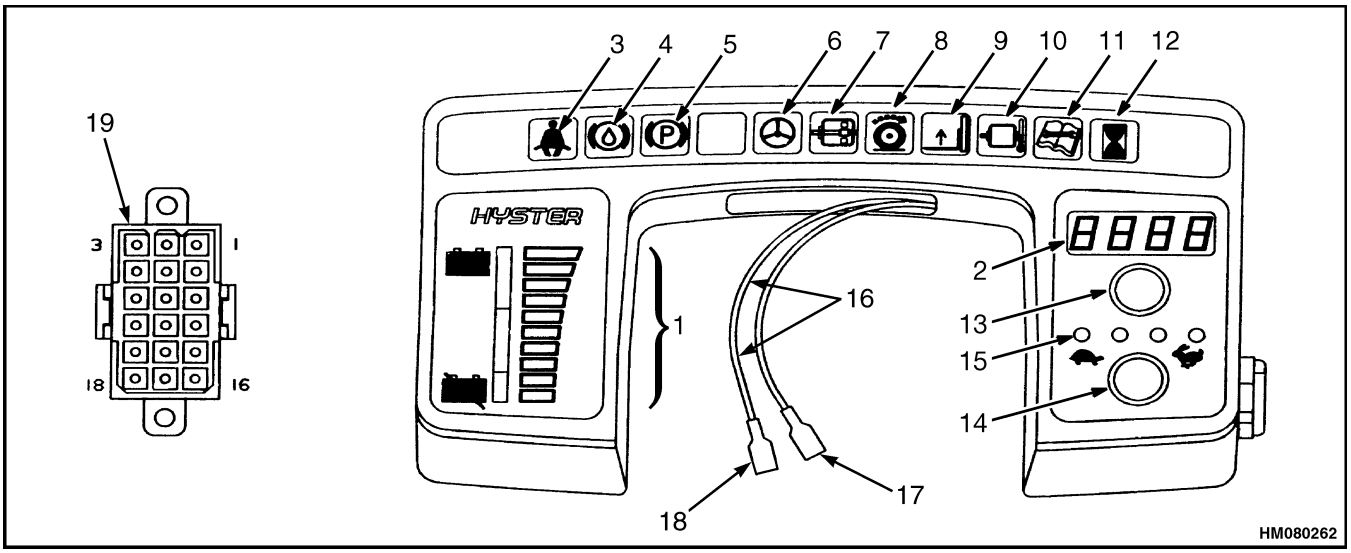


Figure 4. Typical Meters on Steering Column Assembly for Lift Trucks With Engines



Enhanced Display 18-Pin Connector	
Pin	**Function**
1	Traction Card PY 5
2	Pump Card PY 5
3	No Connection
4	Traction Card PY 14
5	Traction Card PY 13
6	Pump Card PY 14
7	Pump Card PY 13
8	No Connection
9	Traction Card PY 4
10	Pump Card PY 4
11	Brush Wear Indicator & Temperature Jumper*
12	*
13	Parking Brake Switch
14	Brake Fluid Switch
15	No Connection
16	No Connection
17	Key Switch (IGN)
18	No Connection
*Pin 11 to 12 Jumper (In Wire Harness). BWI and Temperature LEDs Disabled if Cut.	

1. BATTERY DISCHARGE INDICATOR
2. DIGITAL DISPLAY
3. FASTEN SEAT BELT INDICATOR
4. BRAKE FLUID TOO LOW INDICATOR
5. PARKING BRAKE INDICATOR
6. STEERING PUMP MOTOR INDICATOR
7. BRUSH WEAR INDICATOR
8. TRACTION MOTOR INDICATOR
9. LIFT PUMP MOTOR INDICATOR
10. MOTOR TEMPERATURE INDICATOR
11. STATUS CODE/MAINTENANCE INDICATOR
12. HOURMETER INDICATOR
13. STATUS CODE BUTTON
14. PERFORMANCE LEVEL BUTTON
15. PERFORMANCE LEVEL LEDS
16. KEY SWITCH LEADS
17. RED/BRN IGN TERMINAL
18. BRN BAT TERMINAL
19. 18-PIN CONNECTOR

Figure 13. Early Performance Display Panels for EV-100/200ZX Motor Controllers

STATUS CODE OR PERFORMANCE LEVEL SWITCHES AND INDICATOR LEDS (PERFORMANCE DISPLAY PANEL ONLY)

NOTE: These switches of the Performance display panel cannot be replaced as separate components. The switches must be replaced as part of the Performance display panel. See Display Panel Assembly, Replace of this section.

BASIC DISPLAY PANEL, REPLACE PARTS

NOTE: The parts of the Basic Display Panel can be replaced with the display panel on the steering column. If the assembly housing will be replaced, remove the complete assembly from the steering column as described in Display Panel Assembly, Replace.

NOTE: The following is a complete disassembly procedure. Do ONLY those steps necessary to replace the part you want replaced.

Remove and replace the components of the Basic display panel as follows:

1. Disconnect the battery and remove the key.

2. Remove the eight screws that fasten the top cover to the panel housing. The screws are at the bottom of the housing. See Figure 23. The hourmeter is fastened to the top cover with the electrical connector on the circuit board inside the housing. Carefully lift the top cover up off the housing and the indicator LEDs without damaging the O-ring gasket. The gasket for the LED indicators can stick to the LED housing as the top cover is removed. Do not lose or damage the gasket. Disconnect the three wire connector for the hourmeter.

3. If the housing or filter for the indicators will be replaced, remove the screws that fasten the LED housing to the cover. If the hourmeter or hourmeter gasket will be replaced, remove the screws that fasten it to the top cover. Install the replacement parts to the top cover. Make sure that the hourmeter is installed so that it can be read after the cover is installed.

4. Remove the nut that fastens the key switch. Remove the key switch from the housing. Make a note of which wires are on which terminals and disconnect the wires. Install the wires on the same terminals of the replacement switch.

5. Align the notch in the shaft housing of the key switch with the tab in the housing of the display panel. Install the replacement switch. Tighten the nut and connect the wires.

NOTE: It is not necessary to do Step 6 if only the meter movement of the battery indicator will be replaced on the existing circuit board. Carefully lift the meter movement up off the pins of the circuit board without bending the pins. See Figure 23. Carefully install the replacement meter movement on the pins. Make sure the pins are correctly aligned on the back of the meter before pushing the meter on the pins.

6. If the battery indicator, circuit board for the hourmeter or the buzzer will be replaced, remove the screws that fasten the circuit board to the housing. Disconnect the connector from the circuit board. Remove the buzzer from the bottom of the circuit board. Make sure to install the fiber washer when installing the replacement buzzer on the replacement circuit board. If necessary, carefully lift the meter movement up off the pins of the circuit board without bending the pins. See Figure 23. Carefully install the replacement meter movement on the pins of the replacement circuit board. Make sure the pins are correctly aligned on the back of the meter before pushing the meter on the pins. Connect the electrical connector to the circuit board and install the circuit board assembly in the housing.

7. If the LED indicator assembly will be replaced, first remove the 18-pin connector. It is necessary to remove the front steering column cover with the display panel assembly attached for access to the connector. After removing the screws that fasten the front cover, carefully disconnect the connector. It can be necessary to disconnect the key switch wires (Step 4) and the two wire connector for enough clearance to disconnect the 18-pin connector. Remove the two screws that fasten the LED assembly to the housing. Install the replacement LED assembly, carefully connect all connectors and wires. Install the front steering column cover with the display panel assembly attached. Install the LED gasket over the LED indicators.

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!

CONVERSION TABLE

Table 7. Conversion Table for Metric and English Units

Multiply	By	To Get	Multiply	By	To Get
Area					
inches ^{2} (in. ^{2})	× 6.452	= centimeters ^{2} (cm ^{2})	centimeters ^{2} (cm ^{2})	× 0.155	= inches ^{2} (in. ^{2})
feet ^{2} (ft ^{2})	× 0.093	= meters ^{2} (m ^{2})	meters ^{2} (m ^{2})	× 10.764	= feet ^{2} (ft ^{2})
Linear					
inches (in.)	× 25.4	= millimeters (mm)	millimeter (mm)	× 0.039	= inches (in.)
feet (ft)	× 0.305	= meters (m)	meter (m)	× 3.281	= feet (ft)
yards (yd)	× 0.914	= meters (m)	meter (m)	× 1.094	= yards (yd)
miles (mi)	× 1.609	= kilometers (km)	kilometer (km)	× 0.621	= miles (mi)
Mass					
ounces (oz)	× 28.35	= grams (g)	grams (g)	× 0.035	= ounces (oz)
pounds (lb)	× 0.454	= kilograms (kg)	kilograms (kg)	× 2.205	= pounds (lb)
tons (2,000 lb)	× 907.18	= kilograms (kg)	kilograms (kg)	× 0.001	= tons (2,000 lb)
tons (2,000 lb)	× 0.907	= metric ton (t)	metric ton (t)	× 1.102	= tons (2,000 lb)
Power					
horsepower (hp)	× 0.746	= kilowatts (kW)	kilowatts (kW)	× 1.34	= horsepower (hp)
Pressure					
pounds/in. ^{2} (psi)	× 6.895	= kilopascal (kPa)	kilopascals (kPa)	× 0.145	= pounds/in. ^{2} (psi)
pounds/in. ^{2} (psi)	× 0.007	= megapascal (MPa)	megapascals (MPa)	× 145.04	= pounds/in. ^{2} (psi)
Temperature					
(°Fahrenheit−32)	× 0.56	= °Celsius (C)	(°Celsius × 1.8) +32		= °Fahrenheit
Torque					
pound inches (lbf in.)	× 0.113	= Newton meter (N•m)	Newton meter (N•m)	× 8.851	= pound inches (lb $_f$ in.)
pound feet (lbf ft)	× 1.356	= Newton meter (N•m)	Newton meter (N•m)	× 0.738	= pound feet (lb $_f$ ft)
Velocity					
miles/hour (mph)	× 1.609	= kilometer/hour (km/h)	kilometer/hr (km/h)	× 0.621	= miles/hour (mph)
Volume					
inches ^{3} (in. ^{3})	× 16.387	= centimeters ^{3} (cm ^{3})	centimeters ^{3} (cm ^{3})	× 0.061	= inches ^{3} (in. ^{3})
inches ^{3} (in. ^{3})	× 0.016	= liters (l)	liters (l)	× 61.024	= inches ^{3} (in. ^{3})
quarts, U.S. (qt)	× 0.946	= liters (l)	liters (l)	× 1.057	= quarts, U.S. (qt)
quarts, U.S. (qt)	× 0.83	= quarts, Imp. (qt)	quarts, Imp. (qt)	× 1.205	= quarts, U.S. (qt)
gallons, U.S. (gal)	× 3.785	= liters (l)	liters (l)	× 0.264	= gallons, U.S. (gal)
gallons, U.S. (gal)	× 0.83	= gallons, Imp. (gal)	gallons, Imp. (gal)	× 1.205	= gallons, U.S. (gal)
ounces (oz)	× 29.57	= milliliters (ml)	milliliters (ml)	× 0.034	= ounces (oz)

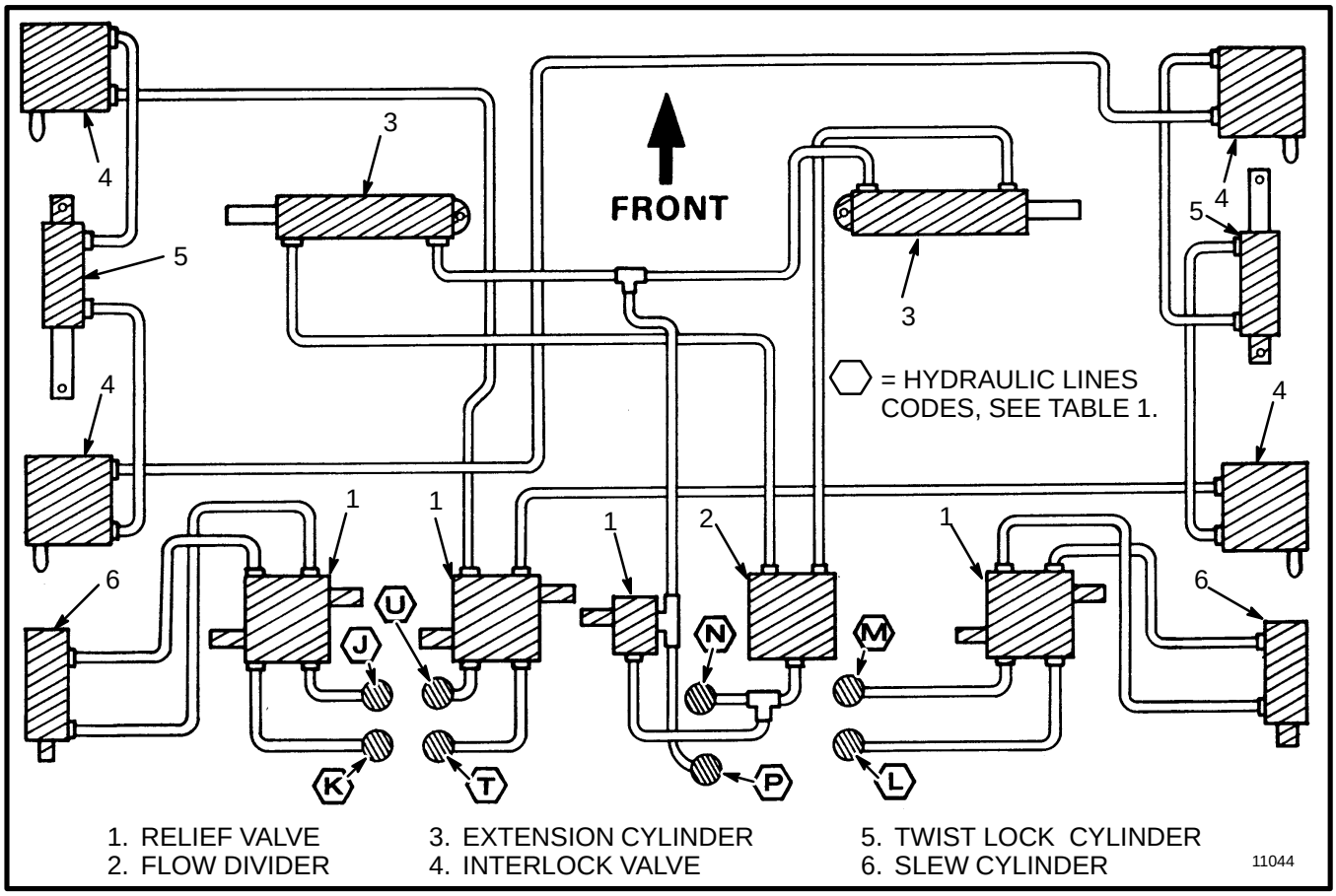


FIGURE 2. HYDRAULIC DIAGRAM FOR THE ATTACHMENT (1 of 2)

TABLE 1. HYDRAULIC LINE CODES FOR DIAGRAMS

CODE	FUNCTION
J	LEFT–HAND SLEW CYLINDER (PISTON SIDE) **or** LEFT–HAND FORK POSITIONER CYLINDER (PISTON SIDE)
K	LEFT–HAND SLEW CYLINDER (ROD SIDE) **or** LEFT–HAND FORK POSITIONER CYLINDER (ROD SIDE)
L	RIGHT–HAND SLEW CYLINDER (ROD SIDE) **or** RIGHT–HAND FORK POSITIONER CYLINDER (ROD SIDE)
M	RIGHT–HAND SLEW CYLINDER (PISTON SIDE) **or** RIGHT–HAND FORK POSITIONER CYLINDER (PISTON SIDE)
N	EXTENSION CYLINDER (ROD SIDE)
P	EXTENSION CYLINDER (PISTON SIDE)
T	TWIST LOCK (ENGAGE)
U	TWIST LOCK (DISENGAGE)

Twist Lock Circuit

Oil from the attachment control valve or the selector valve enters the attachment at the relief valve for the twist lock circuit. When the attachment is set on a container, the four twist lock interlock valves are actuated (opened). Actuation of two of these valves opens the hydraulic circuit between the relief valve and the twist lock cylinders. Actuation of the other two interlock valves opens the hydraulic circuit that connects the twist lock cylinders. The oil flows in series from the interlock valve to the twist lock cylinder and then to another interlock valve. When the twist lock cylinders are actuated, they rotate the twist locks. Each of the ports on the twist lock cylinders have two internal holes; a primary port and an orifice. When oil flows into a port, it will go through both holes. The oil can also flow from both holes at the other end of the cylinder until the piston is completely against the retainer. When the piston is against the retainer, oil can continue to flow from the orifice so that the other cylinder can complete its stroke.

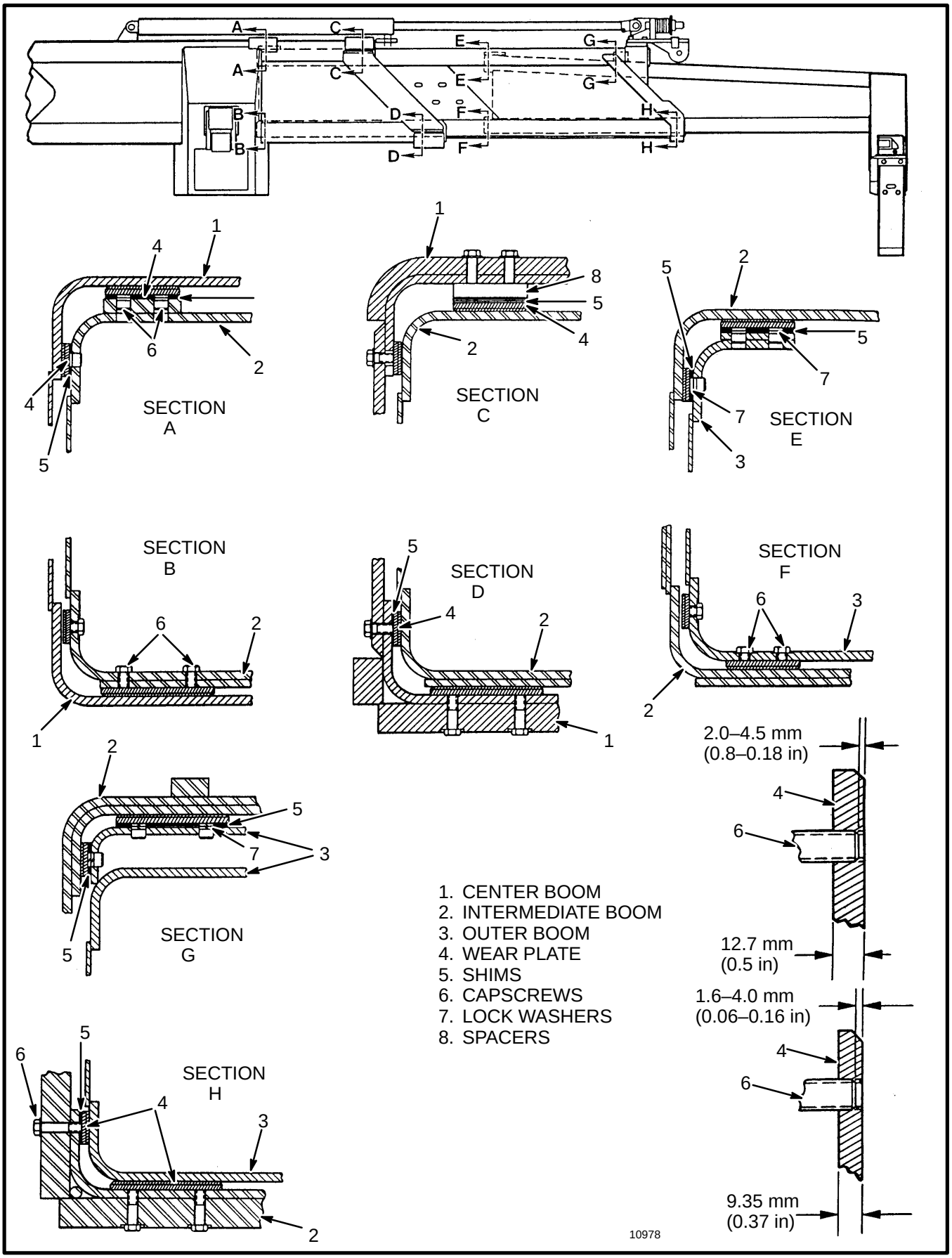


FIGURE 13. ARRANGEMENT OF THE WEAR PLATES

INTRODUCTION

GENERAL

This section has the description and repair procedures for the fixed length container handling attachment.

DESCRIPTION

The fixed length container attachment can be either 6.1 m (20 feet) or 12.2 m (40 feet) wide. The attachment fits on the forks of the lift truck. The slew cylinders or the connector links connect the attachment to the carriage. Both attachments operate the same and have the same hydraulic and electrical circuit components. The hydraulic cylinders on the attachment are actuated by hydraulic pressure from the attachment control valve or the selector valve.

OPERATION

The attachment has the following hydraulic components: relief valves, slew cylinders, twist lock interlock valves and twist lock cylinders and slew cylinders. There are also six electric switches that are actuated by the twist lock linkage and the interlock valves. The switches are used to show if the attachment is correctly attached to a container.

Twist Lock Circuit

Oil from the attachment control valve enters the attachment at the relief valve for the twist lock circuit. When the attachment is set on a container, the twist lock interlock valves are actuated (opened). Actuation of two of these valves opens the hydraulic circuit between the relief valve and the twist lock cylinders. Actuation of the other two interlock valves opens the hydraulic circuit that connects the twist lock cylinders.

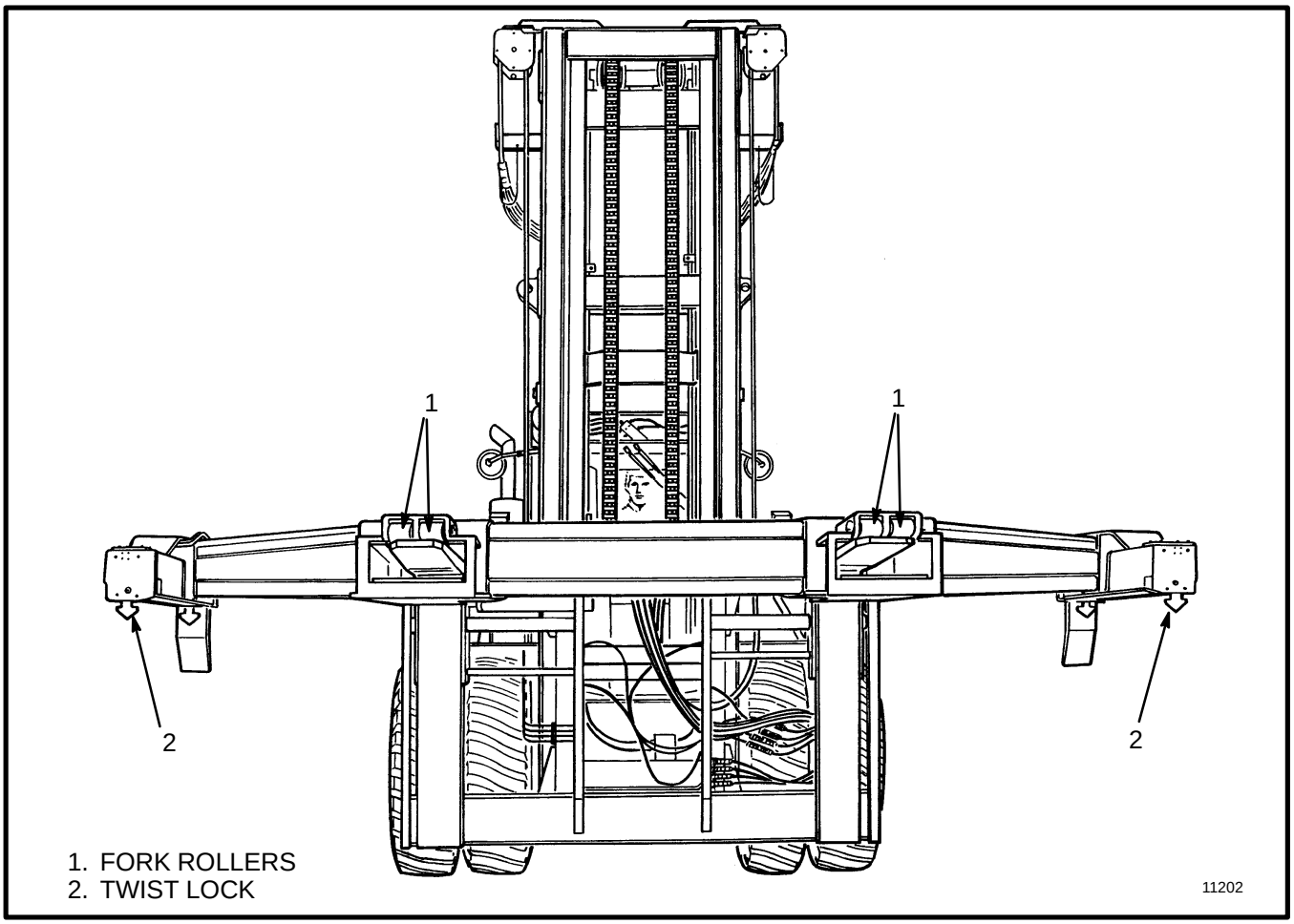


FIGURE 1. FIXED LENGTH ATTACHMENT

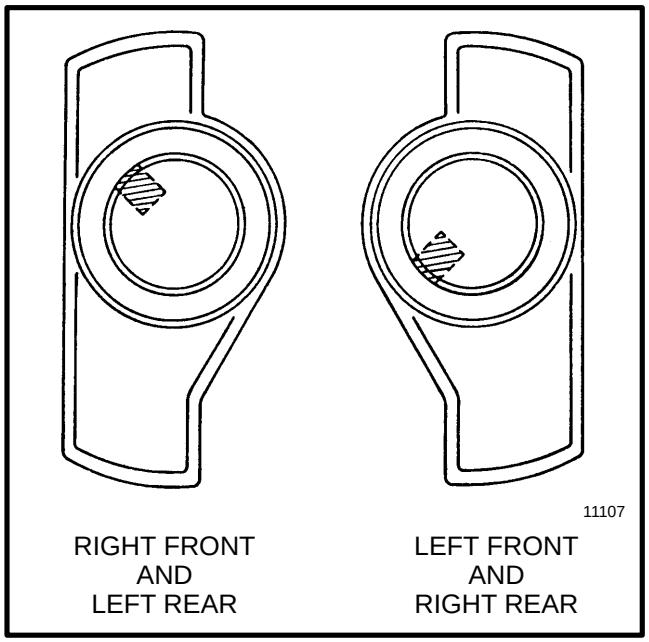


FIGURE 13. UNIVERSAL TWIST LOCKS

7. Install the links between the twist lock cylinder and the twist locks. Connect the links to the cylinder and twist locks using the pins.

8. Connect the hydraulic lines to the interlock valves and the twist lock cylinder.

9. Adjust the links for the twist locks as follows:

a. Rotate the twist locks to the unlocked position. Make sure the cylinder rod is extended all the way in the unlocked position.

b. Adjust each of the rod ends on the links so that the crank on the twist lock is at 45 degrees.

c. Also check that each twist lock is aligned with the guides on the bottom of the outer boom (disengaged position).

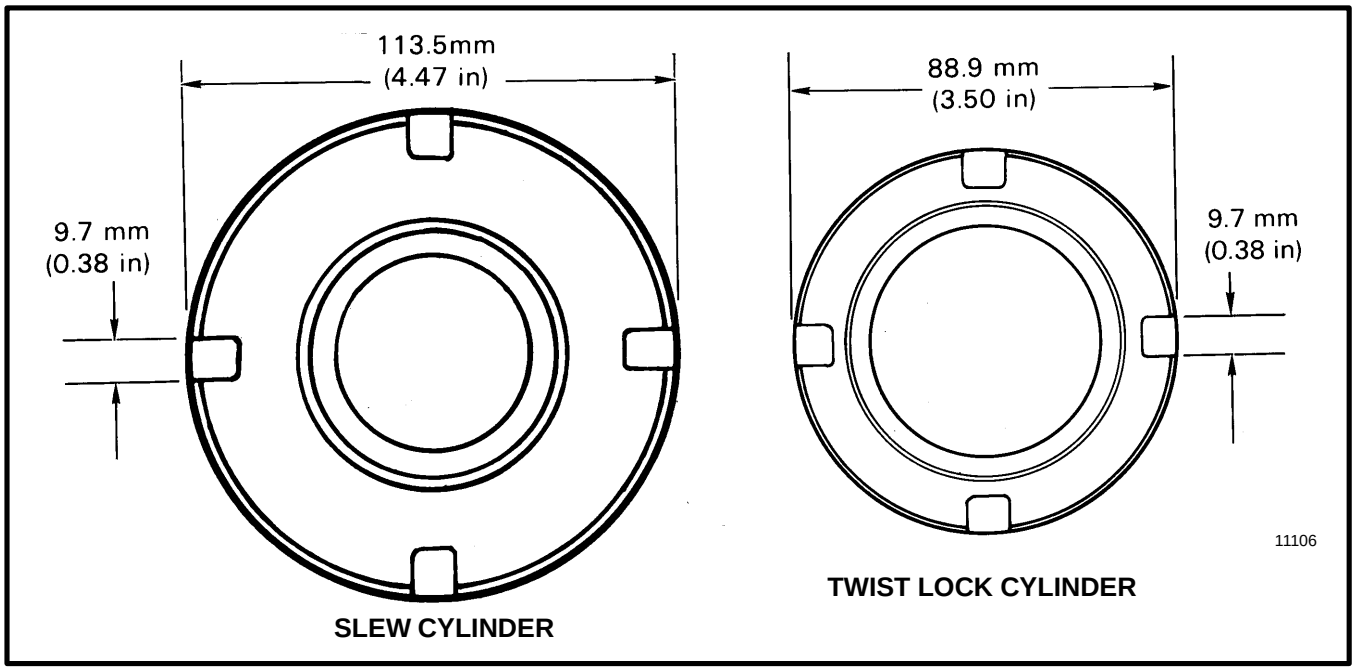


FIGURE 14. DIMENSION OF RETAINERS

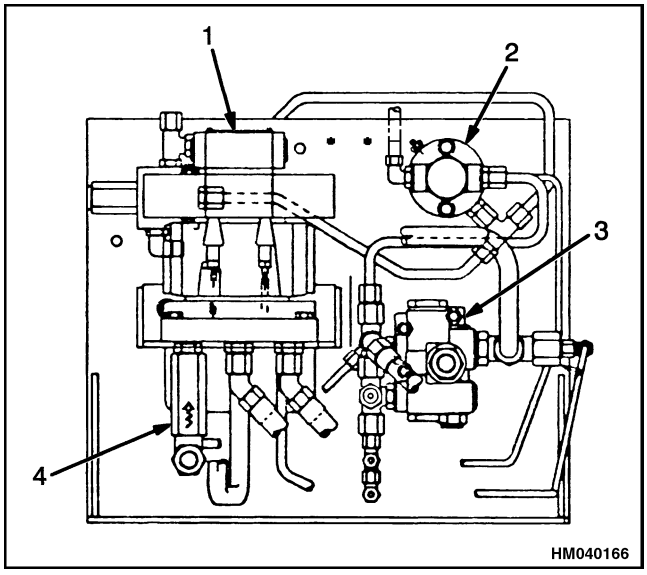
D117

The main parts of the systems are the cover end section 42.4 cm^3 (2.59 $in.^3$) hydraulic pump, accumulator charge valve, accumulator, relief valve, two pressure reducing valves, and two brake pedal valves. See Figure 1, Figure 2, Figure 3, Figure 13 and Figure 14. For the service brake system, there are oil-cooled brakes at the drive wheels. Oil for cooling the oil-cooled brakes comes from the other 48.18 cm^3 (2.94 $in.^3$) hydraulic pump. There is also an auxiliary brake on the drive shaft at the differential. Regulation of pressure for this brake is done by a relay valve. For the parking brake system, there is a parking brake switch, solenoid valve, and a caliper on the drive shaft.

Starting with serial numbers D117E 01642, 01644, 01665, 01679, 01682, and after, the brake system hydraulic components have been installed on a hydraulic manifold. See Figure 3 and the section **Hydraulic Plate** 1900 SRM 1012. From serial number D117E 01720 wide axle and D117 E 01724 narrow axle, the auxiliary disc brakes are no longer incorporated and the relay valve has been removed.

E008

The main parts of the system are the cover end 36 cm^3 (2.2 $in.^3$) hydraulic pump, accumulator charge valve, accumulator, 221 bar (3200 psi) relief valve, 2068 kPa (300 psi) pressure reducing valve, and two brake pedals. See Figure 3, and Figure 15. For the service brake system, there are oil-cooled brakes at the drive wheels. Oil for the cooling of the brakes comes from the 48 cm^3 (2.93 $in.^3$) hydraulic pump. For the parking brake system, there is a parking brake switch, solenoid valve, and a caliper on the drive shaft. With the introduction of the oil cooled brakes, the auxiliary brake on the drive shaft and the relay valve have been removed. The hydraulic components have been installed on a hydraulic Plate. See the section **Hydraulic Plate** 1900 SRM 1012.



1. DIRECTIONAL CONTROL VALVE
2. RELAY VALVE (RATIO 1:3.2)
3. ACCUMULATOR CHARGE VALVE
4. CHECK VALVE

Figure 2. Brake System Components on Hydraulic Sub Panel (D117)

7. Remove O-ring (12) from adjusting screw assembly.

8. Remove spring (13), poppet, seat, O-ring (16), and washer from housing.

9. Remove plug (32) from housing.

10. Remove O-ring (31) from plug.

NOTE: When removing pin in Step 11, use caution not to damage threads.

11. Remove pin from screw using a drive pin punch.

NOTE: Before removing screw in Step 12, accurately measure its depth from the end of housing and record for reassembly purposes.

12. Remove screw from housing.

NOTE: Be sure to keep the upper limit ball separate from lower limit ball for reassembly.

13. Remove spring (29), retainer, and ball (27).

14. Remove plug (18) from housing. Remove O-ring (19) from plug.

15. Remove spring (20), stop, and ball lower limit ball from housing.

16. Place housing on bench with plug (18) end down. The pilot valve spool may or may not fall out at this point.

NOTE: When performing Step 17, be careful not to scratch or mar valve seats on insert.

NOTE: The insert must come out of plug (18) end of housing.

17. Using a 6.35 to 7.94 mm (0.25 to 0.313 in.) diameter wood or plastic dowel, carefully remove the insert and pilot valve spool from housing.

18. Remove pilot valve spool from the insert.

19. Remove O-rings (25 and 26) from the insert.

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, springs, and bores for scratches. Replace the parts if there are scratches or other damage. Make sure the internal passages are clean. Lubricate the parts with clean hydraulic oil for assembly.

ASSEMBLE

1. Install new O-ring (8) on plug (9) and torque into housing 54 to 68 N•m (40 to 50 lbf ft). See Figure 7.

NOTE: When performing Step 2, verify seal does not twist in groove.

2. Install new O-ring (5) on the charging valve spool.

3. Lubricate the charging valve spool and properly insert into housing.

4. Install spring (4) and rod into housing.

5. Install new O-ring (2) on plug (1) and torque into housing 54 to 68 N•m (40 to 50 lbf ft).

NOTE: Verify direction of assembly. Seat insert with 12.7 mm (0.50 in.) diameter wood dowel.

6. Install new O-rings (25 and 26) on insert and place into housing.

NOTE: Verify direction of spool. Long shoulder end is up toward end plug (18).

7. Install pilot valve spool into insert in housing.

8. Install lower limit ball on insert in housing. Install stop over ball and spring (20) over stop correctly.

9. Install new O-ring (19) on plug (18) and carefully install into housing, centering spring (20). Torque to 54 to 68 N•m (40 to 50 lbf ft).

10. Turn housing so plug (9) is vertically upward. Install upper limit ball. Verify ball is centered in bottom of hole in housing.

11. Drop retainer and spring (29) into housing.

12. Thread screw in housing to the depth recorded during disassembly.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The brakes do not stop the lift truck.	The linings are worn or damaged.	Replace linings.
	There is not enough hydraulic pressure in the system.	Check and adjust hydraulic pressure.
	The brake lines have a restriction.	Replace lines.
	The accumulator charge valve or accumulator is damaged.	Repair or replace accumulator charge valve.
	The relief valve is not adjusted correctly.	Adjust relief valve.
	The brake pedal valve(s) is damaged.	Replace brake pedal valve(s).
	The relay valve does not operate correctly.	Repair or replace relief valve.
	The auxiliary caliper or piston area of service brakes have a leak.	Repair or replace the auxiliary caliper.
	The shuttle valve does not operate correctly.	Repair or replace shuttle valve.
The brakes apply slowly.	Oil, water, or hydraulic oil is on the auxiliary brake linings.	Clean or replace brake linings.
	There is not enough hydraulic pressure in the system.	Check and adjust hydraulic pressure.
	The hydraulic line(s) have a leak or restriction.	Replace lines.
	The brake pedal valve(s) is damaged.	Replace brake pedal valve.
Brake pedal(s) goes to the floor.	There is air in the hydraulic system.	Remove air from hydraulic system.
	There is a leak(s) in a hydraulic line.	Replace line.
The service brakes do not operate equally.	The linings are worn or damaged.	Replace linings.
	The brake line(s) have a restriction.	Replace line(s).
	The brake rotor(s) is damaged or not smooth.	Repair or replace brake rotor(s).

NOTES

"THE
QUALITY
KEEPERS"

HYSTER
APPROVED
PARTS

Legend for Figure 5

1. PISTON ROD
2. SEAL KIT
3. WASHER
4. RETENTION RING
5. CAPSCREW
6. GUIDE RING
7. BUSHING
8. GLAND
9. SPACER
10. O-RING
11. PISTON
12. NUT
13. SETSCREW
14. BOLT
15. CABLE CHAIN BRACKET
16. BOLT
17. SCREW
18. NUT

12. Put a sling around the valve of the extension cylinder and attach it to a crane or lifting device capable of supporting 150 kg (331 lbf).

13. Remove the cotter pin, washer, and pin from the valve end of the extension cylinder.

14. Carefully lift the cylinder from its supporting bracket and pull the cylinder horizontally out of the spreader until the cylinder support reaches the edge of the spreader frame.

15. Support the cylinder with a second strap close to the cylinder support.

16. Remove the cylinder and put it on a support that allows sufficient clearance to not damage the cable chain.

DISASSEMBLE

1. Disassemble and remove the ring by removing the four bolts and washers. See Figure 5.

CAUTION

Use caution not to damage the finished surface of the piston rod when removing the piston rod from the cylinder shell.

2. Pull the piston rod out until the spacer has come out of the cylinder together with the gland. Support the spacer and complete the removal of the piston rod.

CAUTION

Use caution not to damage the grooves when removing seals and other parts from the piston rod.

3. Disassemble and remove all seals, screw, nut, piston, bushing, gland, guide ring, and washer.

CLEAN

WARNING

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

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

Clean all parts in solvent and remove residual solvent or allow the solvent to evaporate.

INSPECT

Inspect the parts of the extension cylinder for damage, rust, or wear. Carefully inspect the rod surface for dents and scratches. Verify that the internal stroke surfaces of the cylinder shell and the grooves for the seals do not show any nicks, scratches, or other damage. Repair or replace parts as needed.

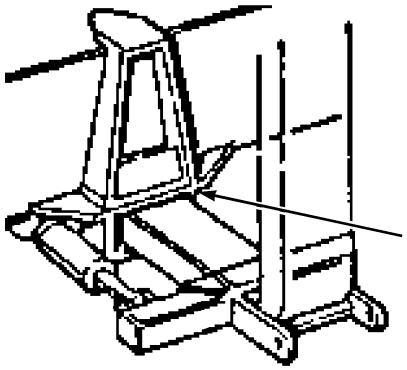
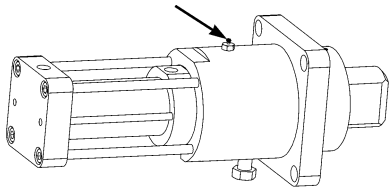
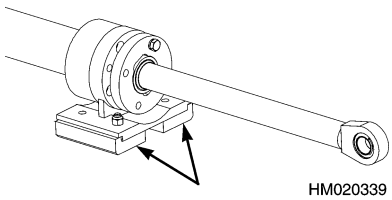
ASSEMBLE

NOTE: Verify that all parts are clean before assembly.

NOTE: Always use new seals. Lubricate all parts with clean hydraulic oil.

1. Assemble the new seals, screw, nut, piston, bushing gland, guide ring, and washer.

Table 1. Maintenance Schedule (Continued)

Item No.	Item	Interval	Quantity	Procedure
N/A	Forkpocket (Not Shown)  HM020338	500 hr/3 mo	2 grease points. **NOTE:** Grease the surface of the forks where the spreader rests on the bronze wear pads.	Lube with multipurpose grease with 2-4% molybdenum disulfide additive.
4	Stop Cylinders  HM020337	1000 hr/6 mo	2 grease points. **NOTE:** One grease nipple on each stop cylinder.	Lube with multipurpose grease with 2-4% molybdenum disulfide additive.
5	Extension Cylinder Support Wear Pads and Tracks  HM020339	1000 hr/6 mo	4 grease points. **NOTE:** Two tracks in each extension beam.	Lube with multipurpose grease with 2-4% molybdenum disulfide additive.
See Figure 12 for Item Nos.				

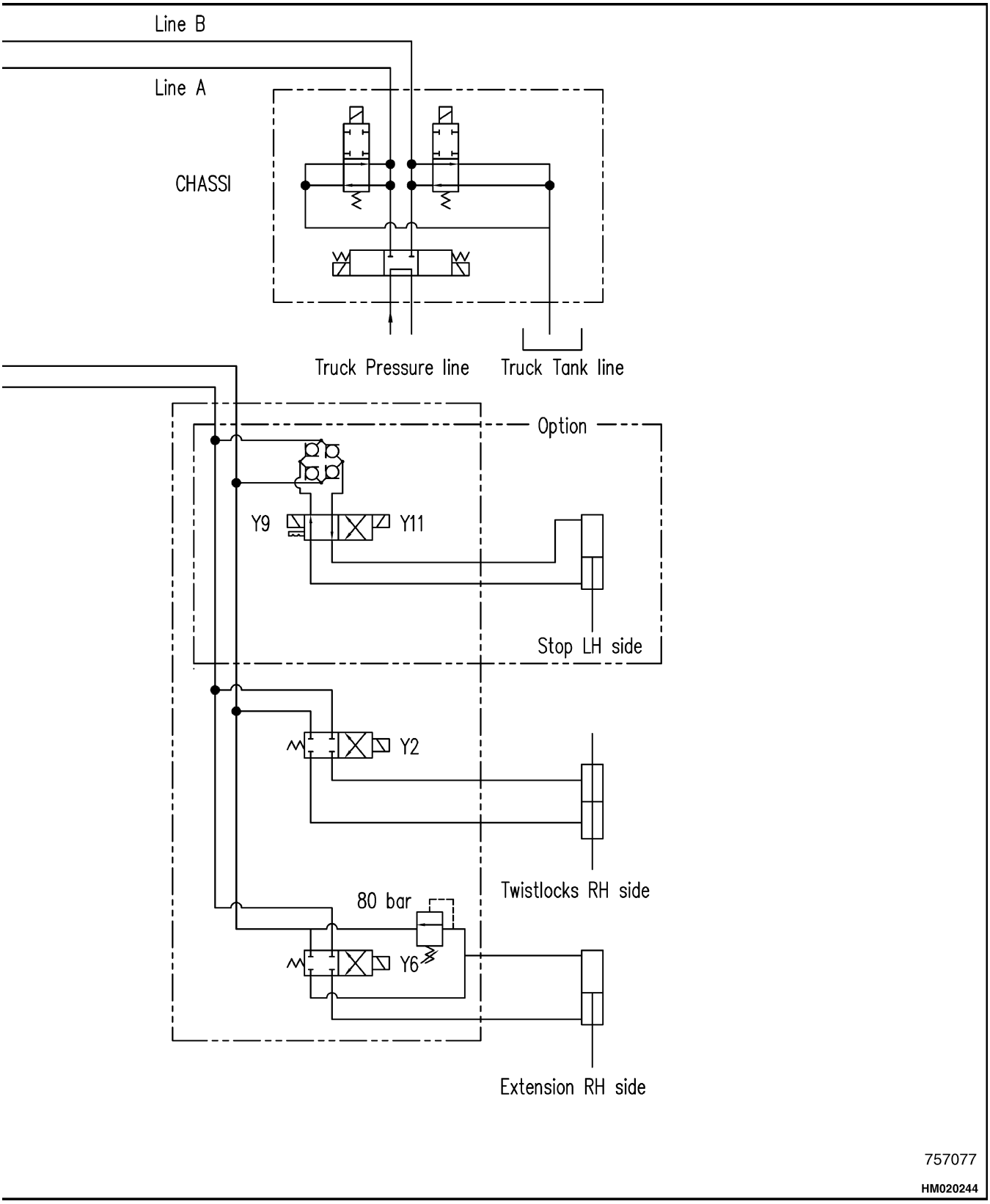


Figure 16. ELME Hydraulic Schematic 757077

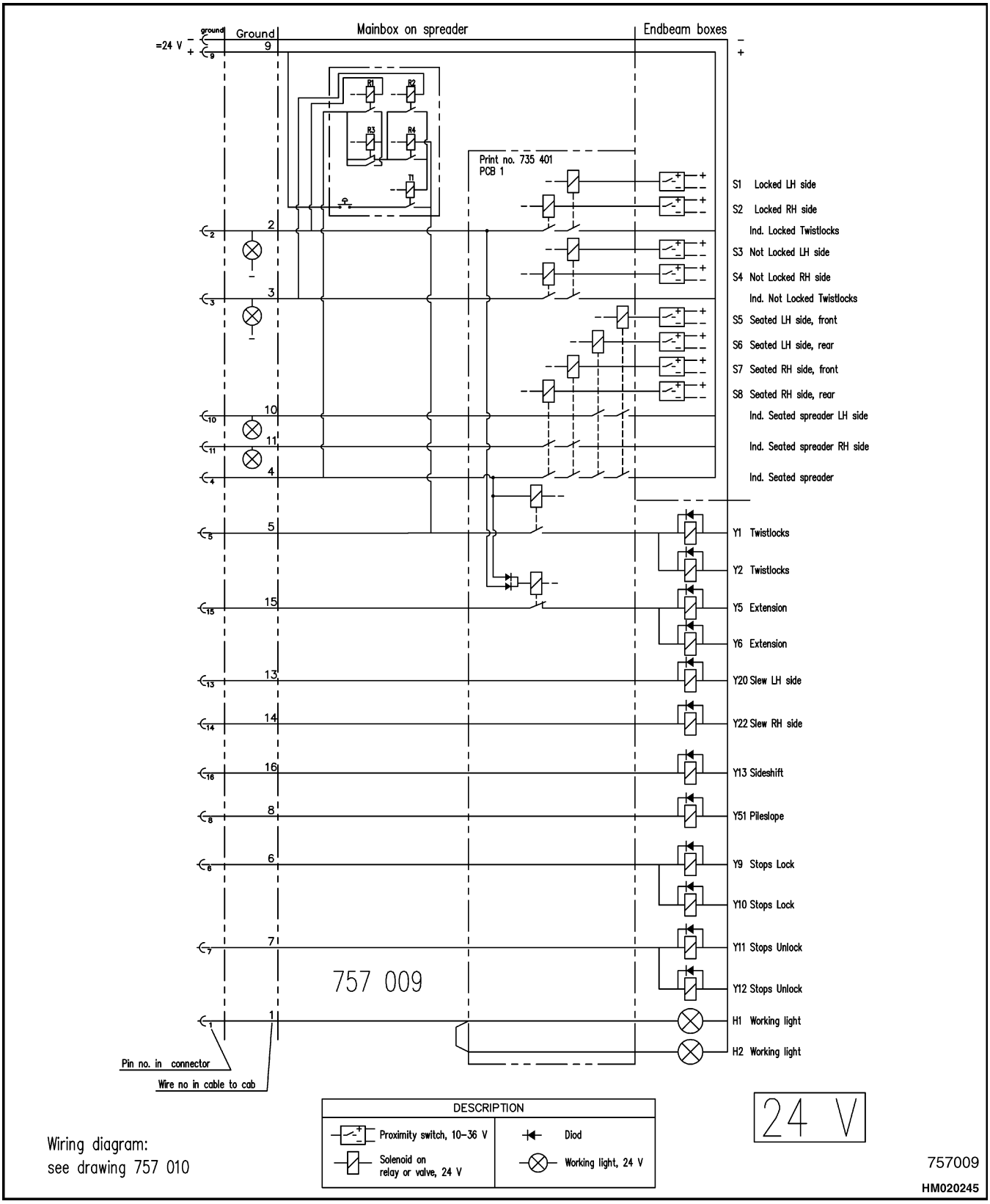


Figure 23. ELME Electrical Schematic 757009

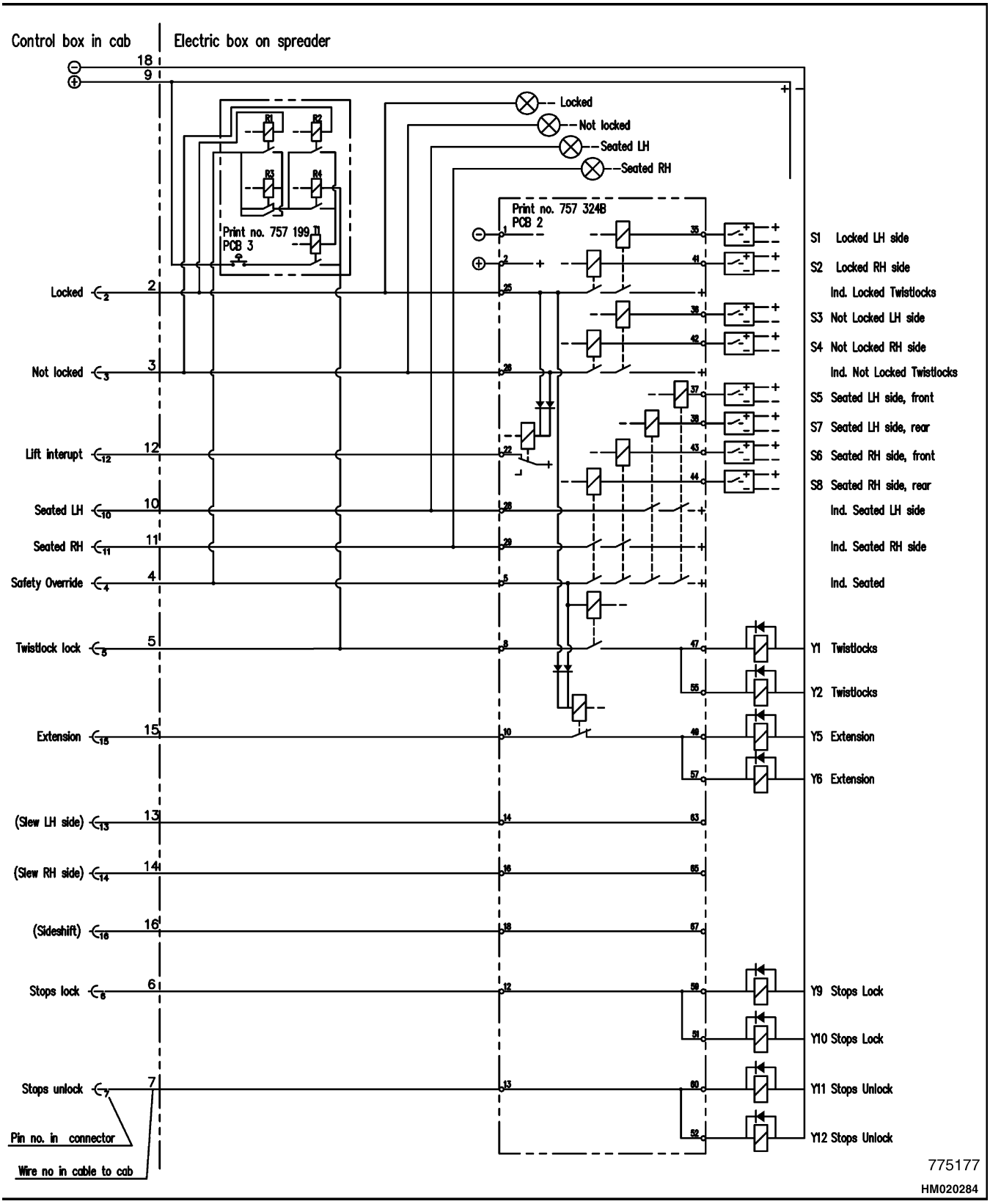


Figure 29. ELME Electrical Schematic 775177

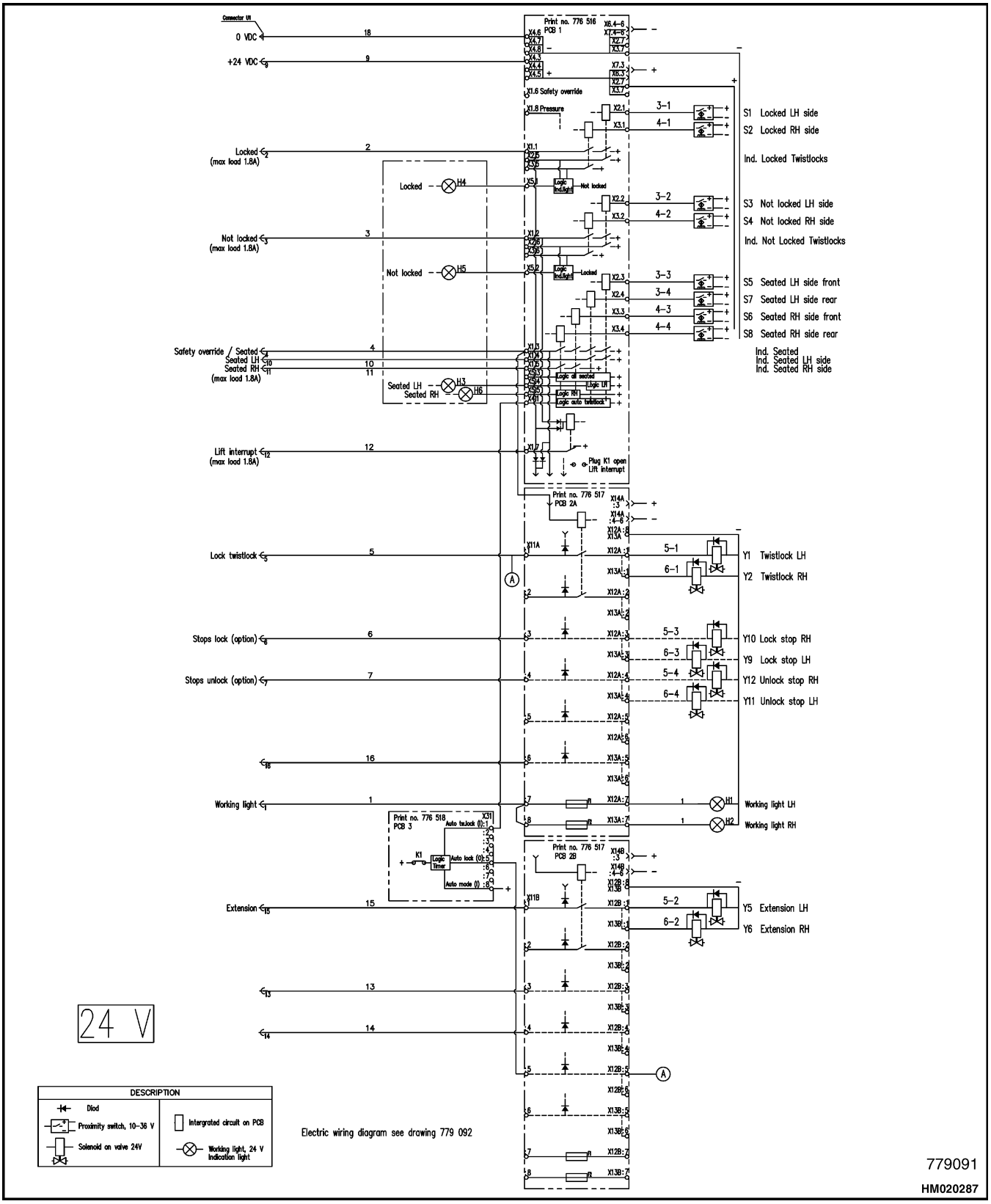


Figure 36. ELME Electrical Schematic 779091

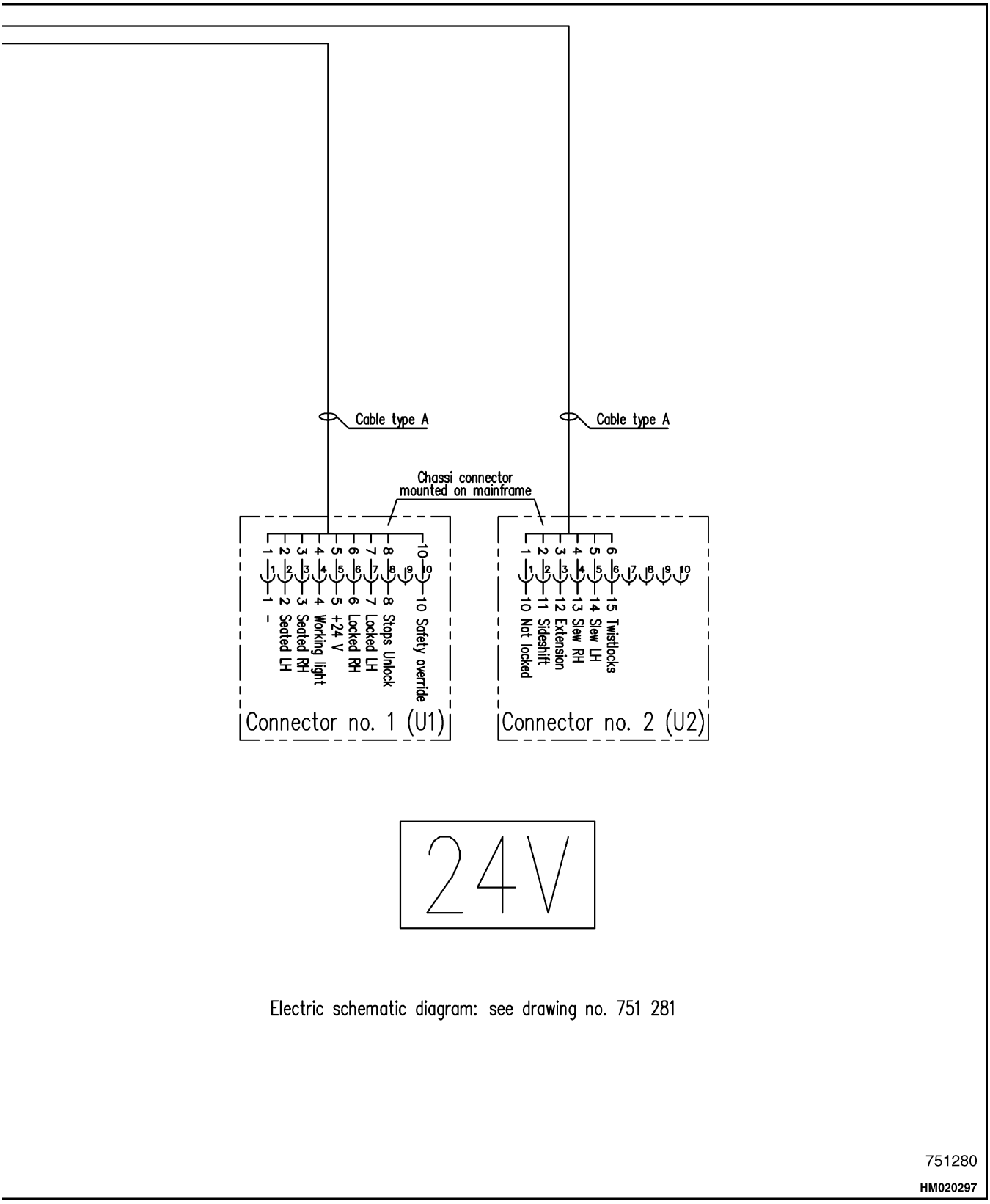
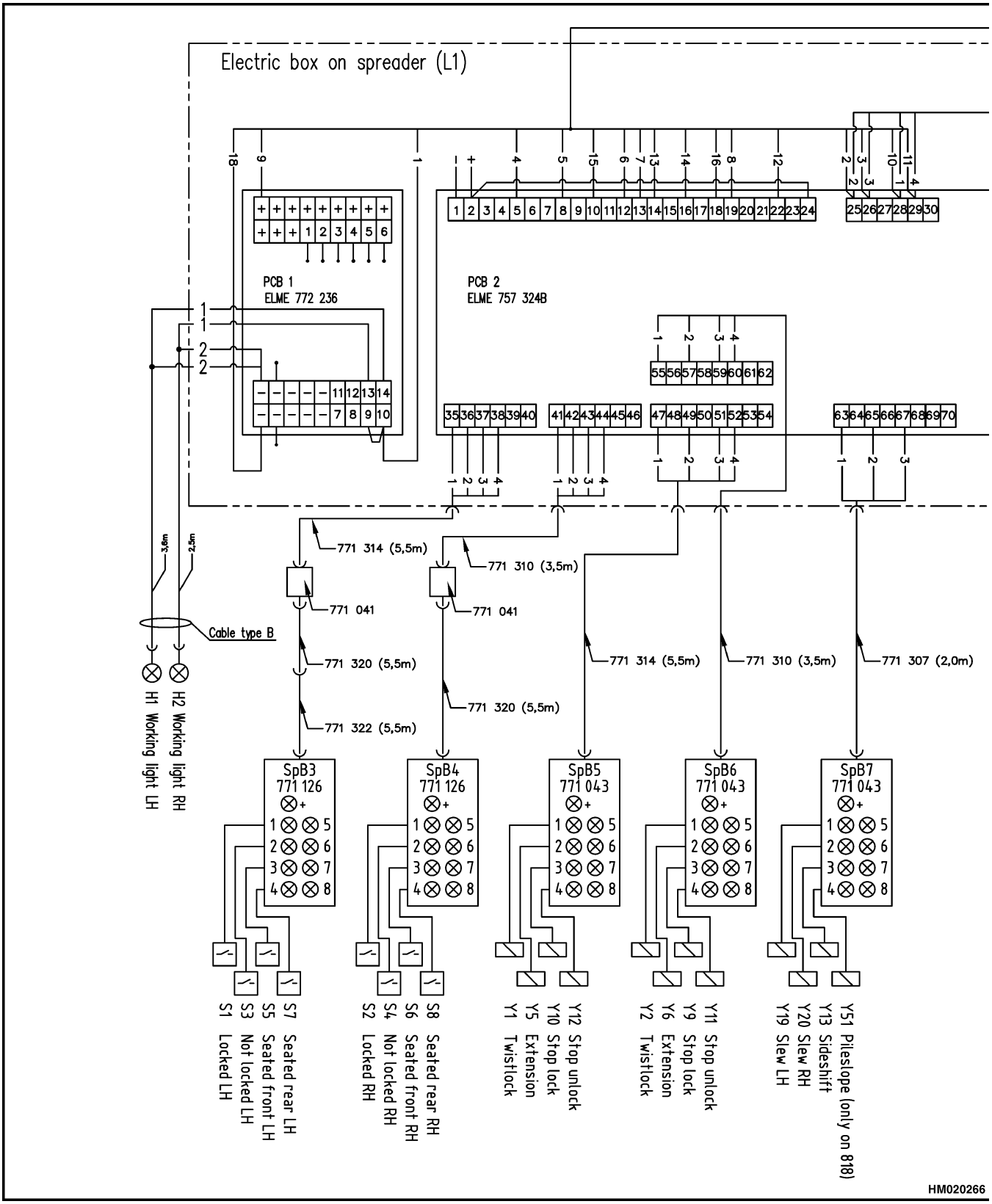


Figure 41. ELME Wiring Diagram 751280


Electric box on spreader (L1)
PCB 1
ELME 772 236
PCB 2
ELME 757 324B
771 314 (5,5m)
771 310 (3,5m)
771 041
771 041
Cable type B
771 320 (5,5m)
771 322 (5,5m)
771 320 (5,5m)
771 314 (5,5m)
771 310 (3,5m)
771 307 (2,0m)
H1 Working light LH
H2 Working light RH
SpB3 771 126
SpB4 771 126
SpB5 771 043
SpB6 771 043
SpB7 771 043
S1 Locked LH
S3 Not locked LH
S5 Seated front LH
S7 Seated rear LH
S2 Locked RH
S4 Not locked RH
S6 Seated front RH
S8 Seated rear RH
Y1 Twistlock
Y5 Extension
Y10 Stop lock
Y12 Stop unlock
Y2 Twistlock
Y6 Extension
Y9 Stop lock
Y11 Stop unlock
Y19 Slew LH
Y20 Slew RH
Y13 Sideshift
Y51 Pileslope (only on 818)
HM020266

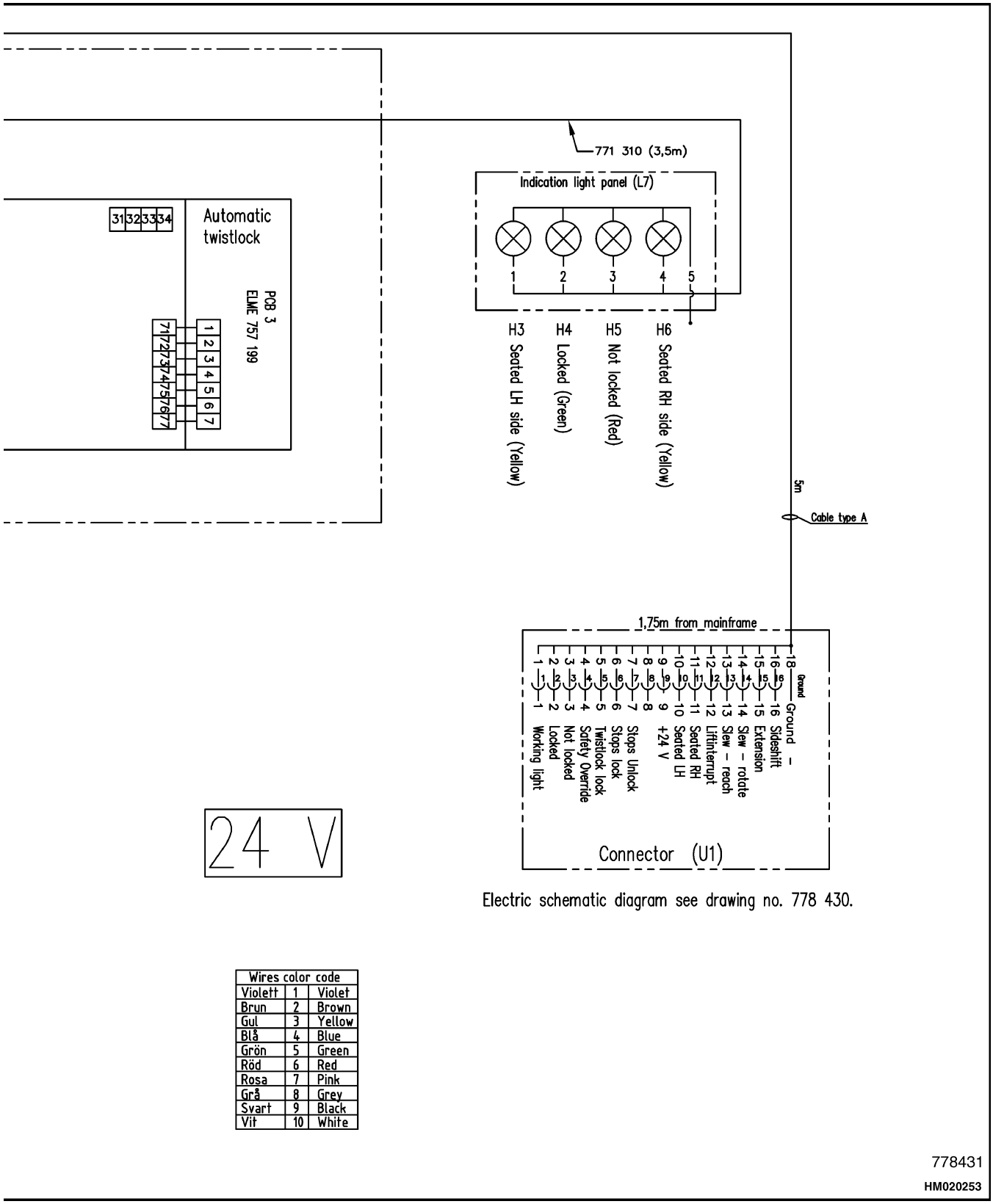


Figure 52. ELME Wiring Diagram 778431

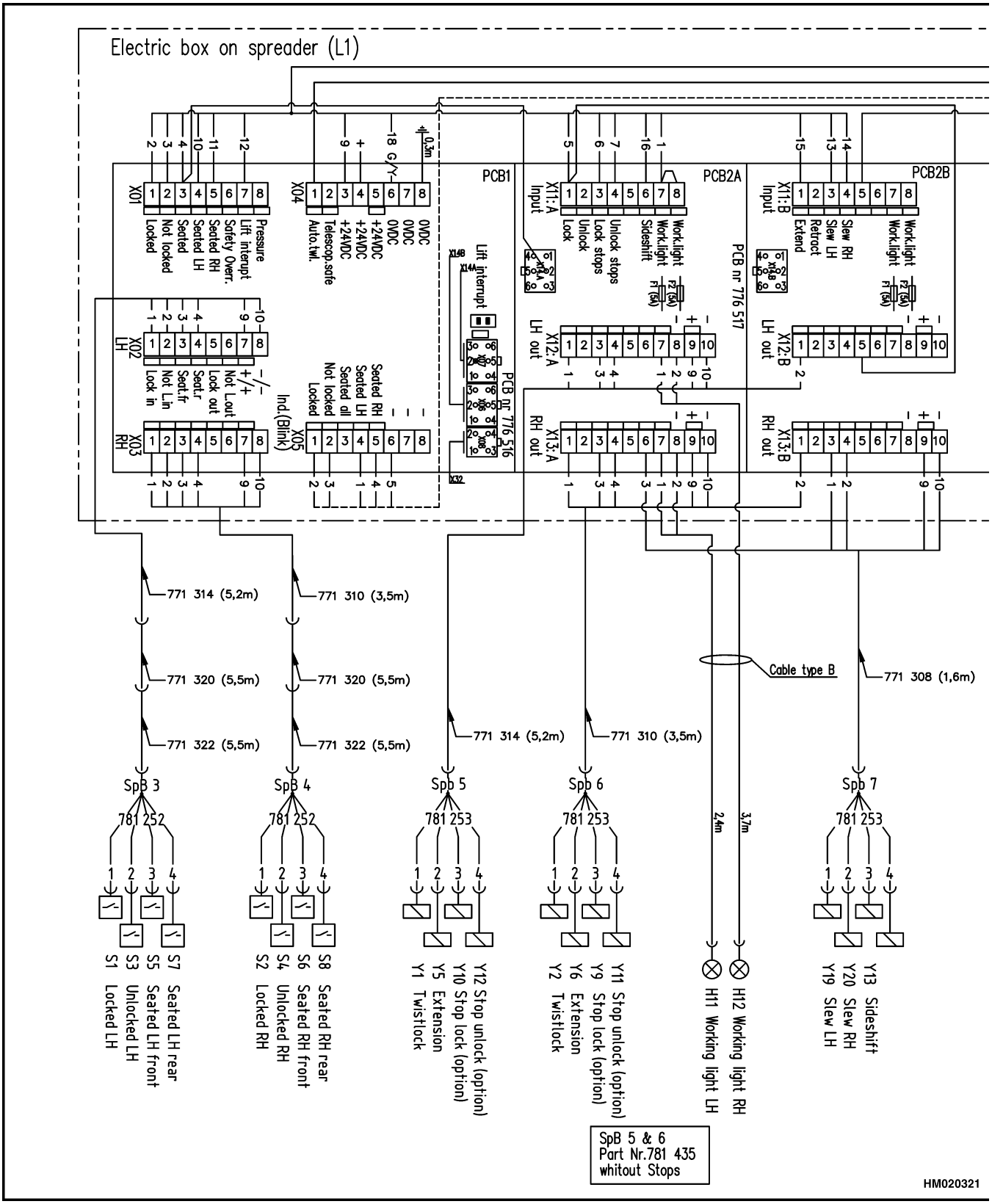

Electric box on spreader (L1)
PCB1
PCB2A
PCB2B
PCB nr 776 517
PCB nr 776 516
X01
X04
X02 LH
X03 RH
X05 Ind.(Blink)
X11:A Input
X11:B Input
X12:A LH out
X12:B LH out
X13:A RH out
X13:B RH out
Pressure
Lift interupt
Safety Overr.
Seated RH
Seated LH
Seated
Not locked
Locked
Telescop.safe
Auto.twl.
+24VDC
0VDC
Lock
Unlock
Lock stops
Unlock stops
Sideshift
Work.light
Extend
Retract
Slew LH
Slew RH
Lift interupt
Lock in
Not Lin
Seat.fr
Seat.r
Lock out
Not Lout
Seated RH
Seated LH
Seated all
Not locked
Locked
771 314 (5,2m)
771 310 (3,5m)
771 320 (5,5m)
771 322 (5,5m)
771 308 (1,6m)
Cable type B
SpB 3
SpB 4
SpB 5
SpB 6
SpB 7
781 252
781 253
2,4m
3,7m
S1 Locked LH
S3 Unlocked LH
S5 Seated LH front
S7 Seated LH rear
S2 Locked RH
S4 Unlocked RH
S6 Seated RH front
S8 Seated RH rear
Y1 Twistlock
Y5 Extension
Y10 Stop lock (option)
Y12 Stop unlock (option)
Y2 Twistlock
Y6 Extension
Y9 Stop lock (option)
Y11 Stop unlock (option)
H11 Working light LH
H12 Working light RH
Y19 Slew LH
Y20 Slew RH
Y13 Sideshift
SpB 5 & 6
Part Nr.781 435
whitout Stops
HM020321

TABLE OF CONTENTS

This section is for the following models:

H36.00-48.00E (H800-1050E) [D117];
H20.00-32.00F (H440-700F/FS) [E008]

VALVES AND PRESSURE SWITCHES

WARNING

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

NOTE: Only use plugs that have been cleaned in solvent.

NOTE: In the event that seals are missing, check manifold for missing seals and remove.

NOTE: Cartridge valves and switches are not field-serviceable with exception of external seals and electrical solenoids. In event of a defective component, completely replace valve of switch.

NOTE: Check manifold for cracks. If there are cracks in manifold, the manifold should be replaced.

The valves and pressure switch seals are serviceable parts of the manifold. Use the following procedures for repair:

1. Unscrew the cartridge valve of switch from manifold.
2. Check that all seals are attached to cartridge valve or switch.
3. Install a temporary plug in place of cartridge valve or switch.
4. Clean cartridge valve or switch in solvent and inspect component for damage.
5. Install new seals. For correct order of backup rings and O-rings. See Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, and Figure 12.
6. Lubricate component/valve with clean hydraulic oil before installation.
7. Remove temporary plug.
8. Install and torque component/valve or switch to value listed in Torque Values.

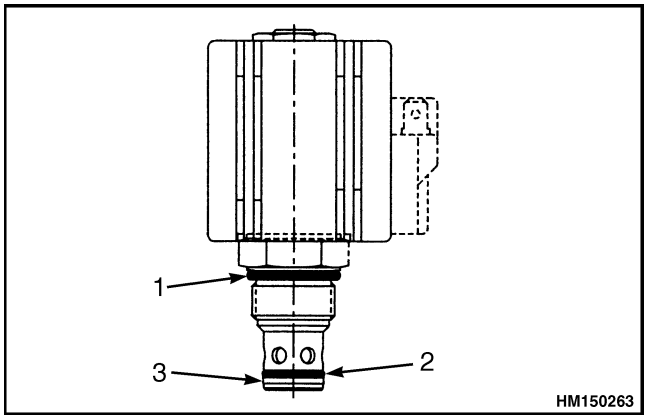


Figure 7. Solenoid Control Valve Cartridge (Lower Interrupt Valve)

Legend for Figure 7

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

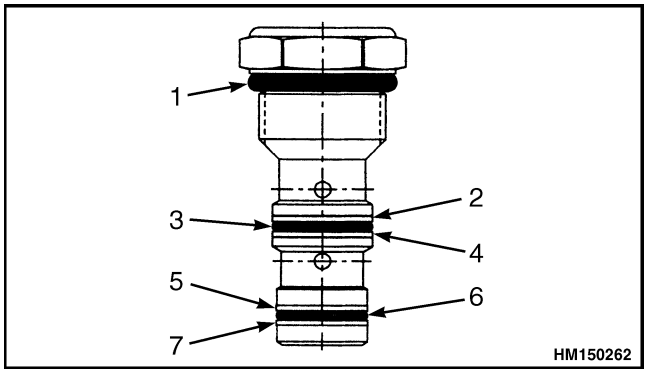


Figure 8. Shuttle Valve Cartridge

Legend for Figure 8

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

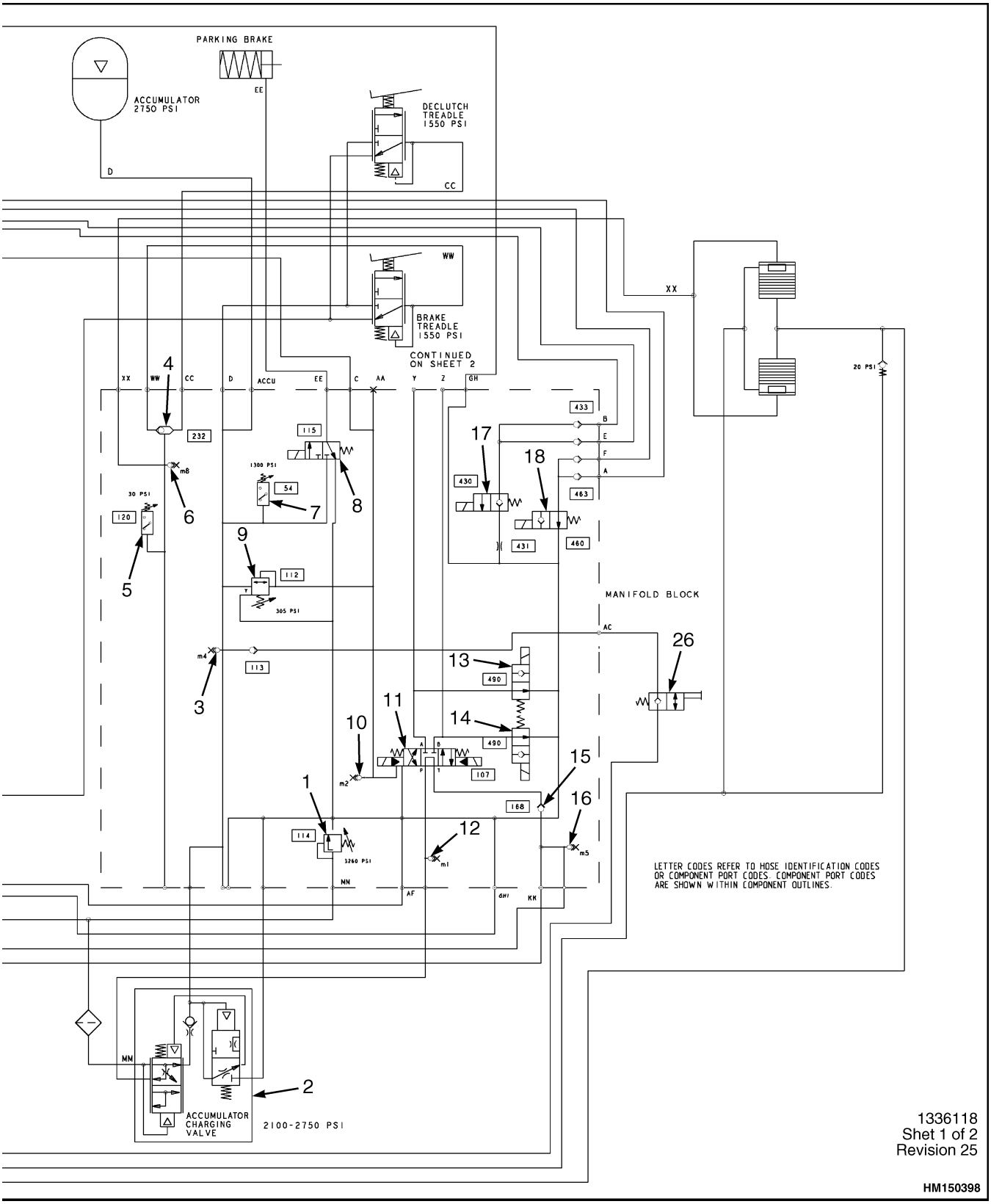


Figure 14. Hydraulic Schematic (E008)

"THE
QUALITY
KEEPERS"

HYSTER
APPROVED
PARTS

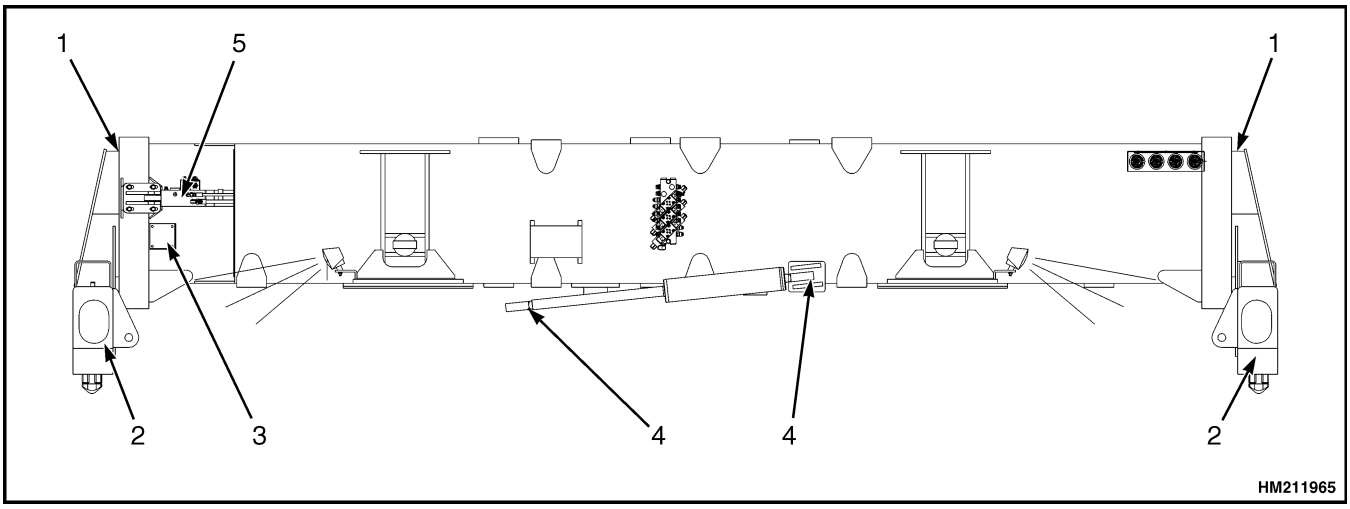


Figure 4. Container Attachment Maintenance

Table 8. Container Attachment Maintenance — Lubricate

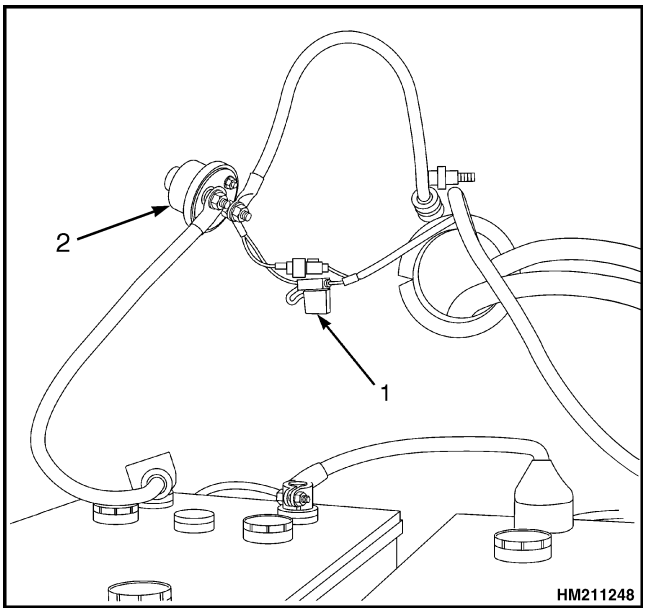
Item No.	Item	Interval	Quantity	Specification
2	End Beams and Twist Locks	250 hr/1 mo	8 fittings	Multipurpose grease with 2 to 4% molybdenum disulfide.
1	Wear Pads for Main Extension Beams and Extending Beams	500 hr/3 mo	24 lube points	Multipurpose grease with 2 to 4% molybdenum disulfide.
4	Slew/Sideshift Cylinders	500 hr/3 mo	6 fittings	Multipurpose grease with 2 to 4% molybdenum disulfide.
3	Stop Cylinders	1000 hr/6 mo	2 lube points	Multipurpose grease with 2 to 4% molybdenum disulfide.
5	Tracks and Wear Pads for Extension Cylinder Support	1000 hr/6 mo	4 tracks	Multipurpose grease with 2 to 4% molybdenum disulfide.
See Figure 4 for Item Nos.				

Table 9. Container Attachment Maintenance — Replace

Item No.	Item	Interval	Quantity	Specification
2	Twist Locks	5000	2	See **Parts Manual**.
See Figure 4 for Item Nos.				

Sealed Fuses

NOTE: The power supply to the ECM (Electronic Control Module) is protected by splash proof sealed fuses. See Figure 24.



1. FUSES (3-24V-7.5 AMPS AND 1-24V-10 AMPS FOR ECM) (1-24V-10 AMPS FOR DIAGNOSTIC TOOLS).
2. BATTERY DISCONNECT SWITCH

Figure 24. Fuses

Fuel System

WARNING

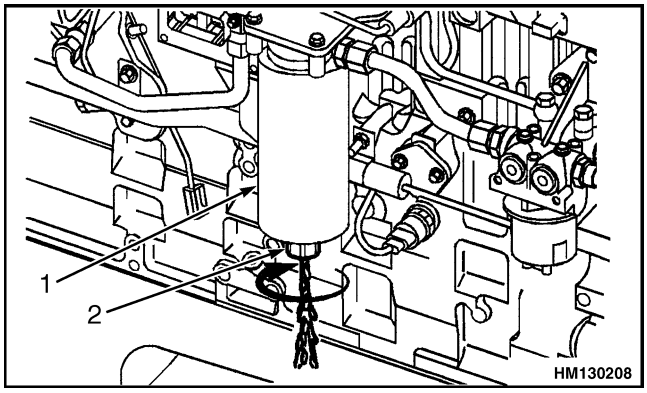
All fuels are very flammable and can burn or cause an explosion. Do not operate the lift truck until any leak is corrected. Do not use an open flame to check the fuel level or to check for leaks in the fuel system. If there is a leak in the fuel system extra care must be used during the repair.

Check the fuel system for leaks and the condition of parts. When adding fuel to the lift truck, refer to the **How to Add Fuel to the Lift Truck** procedures in the **Operating Manual**.

Fuel Filter/Water Separator

Drain the water from the water separator. See Figure 25.

1. Open valve on the bottom of the filter canister. Drain some fuel (and any water) into a cup until clean fuel flows from the filter.
2. Close the valve.



1. FUEL FILTER/WATER SEPARATOR
2. DRAIN

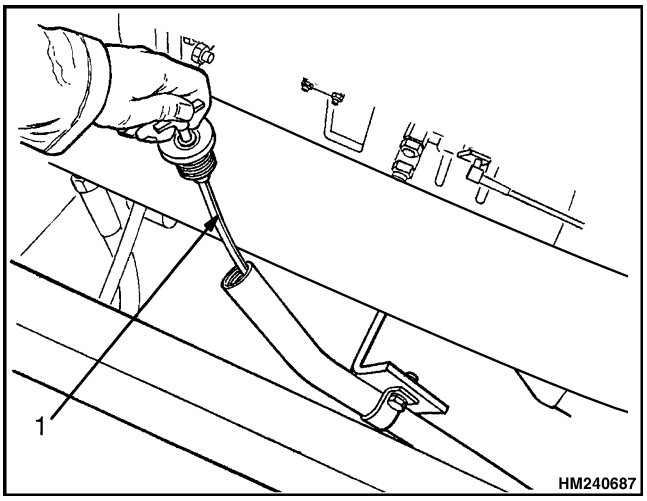
Figure 25. Fuel Filter/Water Separator

Transmission Oil

WARNING

When removing the dipstick, take care not to touch the inter cooler tube. This tube can become very hot and cause serious burns.

Apply the parking brake. Check the oil level in the powershift transmission when the engine is running at idle speed and the Range Selector lever is in the NEUTRAL (**N**) position. See Figure 27. Use the correct oil as shown in the Maintenance Schedule. Keep the oil level at the **FULL** mark on the dipstick. Add oil to the transmission at the dipstick tube.



1. TRANSMISSION DIPSTICK

Figure 27. Transmission Dipstick

Lift System Operation

WARNING

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

Before making any repairs, use chains on the mast weldments and carriage so that they cannot move. Make sure the moving parts are attached to a part that does not move.

Lower the lift mechanism completely. Never allow anyone under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED.

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

Do the following checks and inspections:

1. Check for leaks in the hydraulic system. Check the condition of the hydraulic hoses and tubes.
2. Slowly raise and lower the mast several times without a load. Raise the mast to its full extension height at least once. The mast components must raise and lower smoothly in the correct sequence.

NOTE: Some parts of the mast move at different speeds during lifting and lowering.

3. The inner weldment and the carriage must lower completely.
4. Raise the mast 1 m (3 ft) with a capacity load. The inner weldment and the carriage must raise smoothly. Lower the mast. All moving components must lower smoothly.
5. Lower the load to approximately 0.3 m (1 ft) from the floor. Tilt the mast forward and backward. The mast must tilt smoothly and all tilt cylinders must stop evenly.

Hydraulic Oil Filters

WARNING

Never allow anyone under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED.

Check the filter indicators in the hydraulic oil filters as follows (see Figure 28):

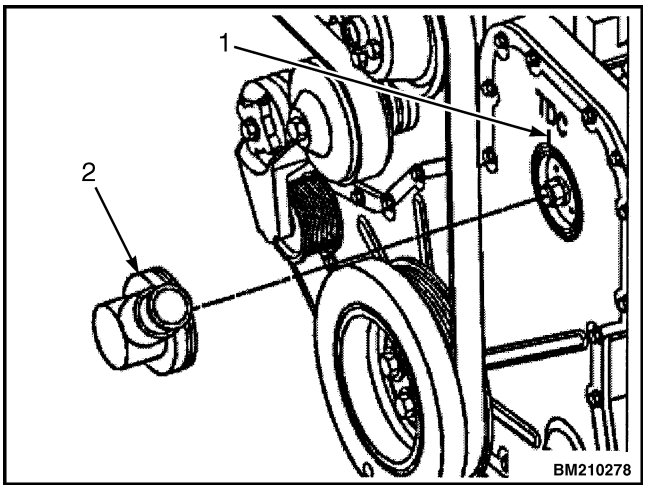
1. Run the engine at governed speed and lower the mast. Have a helper observe the filter indicators while the mast is lowering.
2. The operation is correct when the indicators do not move downward into the red area.
3. If the top edge of the indicator(s) moves into the red area of the filter indicator, replace the filter(s).

Maintenance Procedures Every 5000 Hours or 4 Years

VALVE ADJUSTMENT

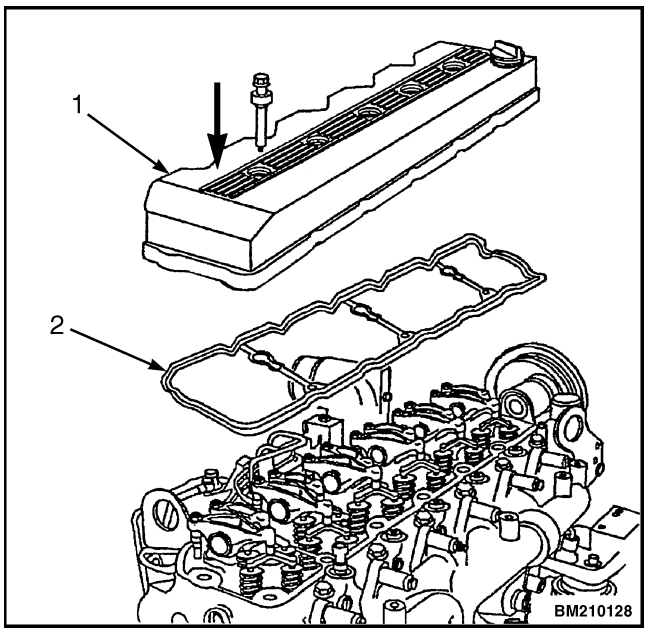
NOTE: Check valve clearance at engine coolant temperature 60°C (140°F) or less.

1. Remove the plastic fuel pump drive cover located on the front of the engine. See Figure 43.
2. Rotate the crankshaft to align with the top dead center (TDC) marks on the gear cover and fuel pump gear.
3. Remove the rocker arm cover and gasket. See Figure 44.
4. Measure valve clearance of rocker arms 1I, 1E, 2I, 3E, 4I, and 5E, by inserting a feeler gauge between the crosshead and the rocker arm socket. If the clearance is out of specifications, loosen the lock nut and adjust nominal specifications. See Figure 45 and Table 12.
5. Rotate the crankshaft 360 degrees and measure valve clearance of rocker arms 2E, 3I, 4E, 5I, 6I and 6E. If the clearance is out of specifications, loosen the lock nut and adjust nominal specifications. See Figure 45 and Table 12.
6. Install new gasket and rocker arm cover.
7. Install fuel pump drive cover.



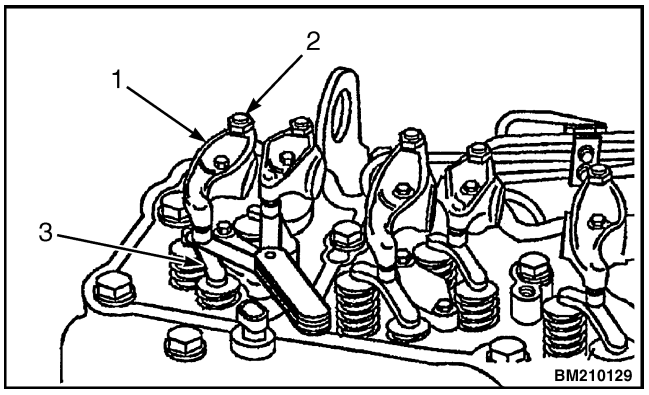
1. TOP DEAD CENTER MARK
2. PLASTIC CAP

Figure 43. Valve Adjustment



1. COVER
2. GASKET

Figure 44. Rocker Arm Cover and Gasket

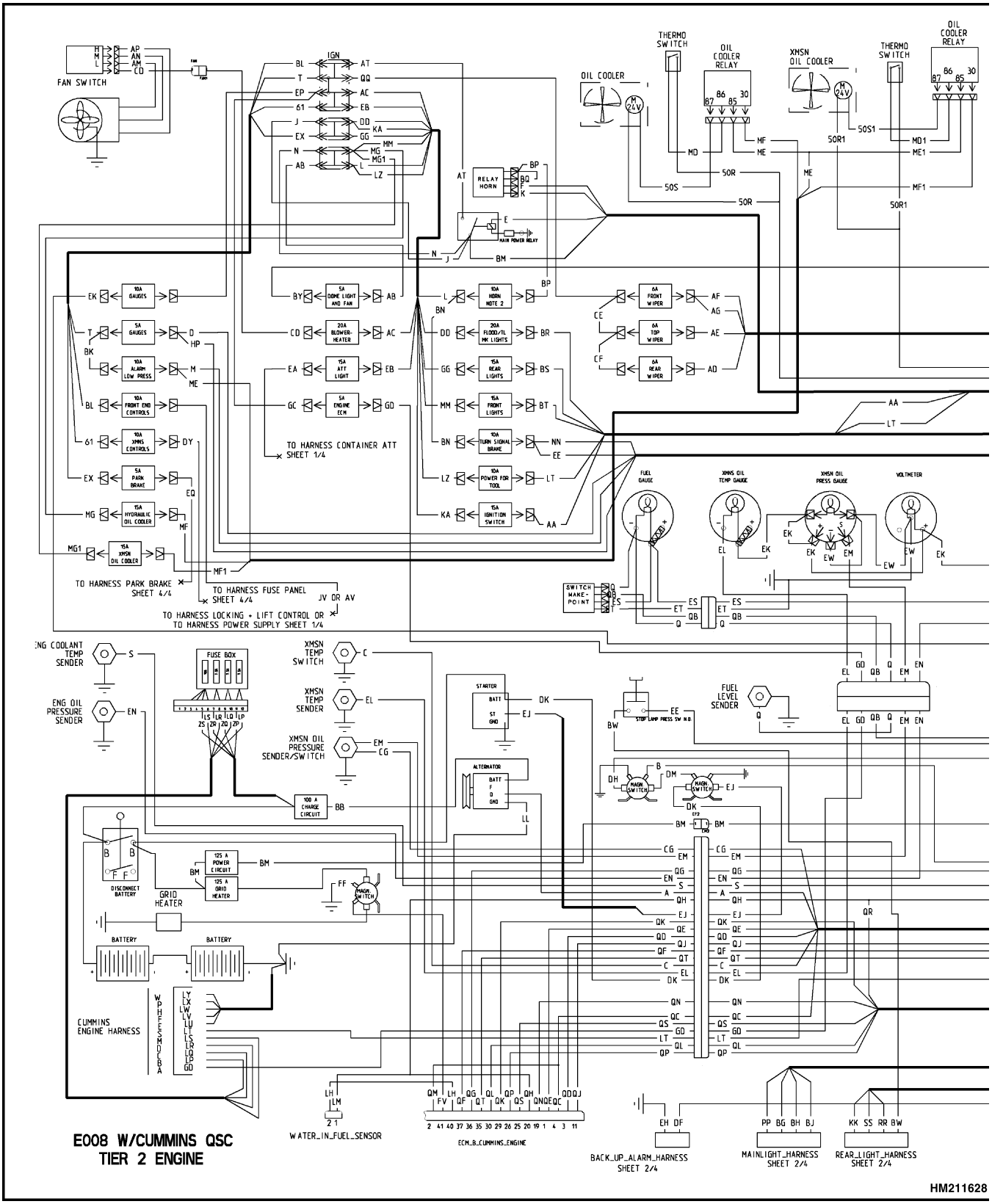


1. ROCKER ARM
2. LOCK NUT
3. CROSSHEAD

Figure 45. Rocker Arm Clearance

Table 12. Nominal Valve Clearance

Intake	0.305 mm (0.012 in.)
Exhaust	0.559 mm (0.022 in.)


FAN SWITCH
IGN
OIL COOLER
THERMO SWITCH
OIL COOLER RELAY
XMSN OIL COOLER
RELAY HORN
MAIN POWER RELAY
TO HARNESS CONTAINER ATT SHEET 1/4
TO HARNESS PARK BRAKE SHEET 4/4
TO HARNESS FUSE PANEL SHEET 4/4
JV OR AV
TO HARNESS LOCKING + LIFT CONTROL OR TO HARNESS POWER SUPPLY SHEET 1/4
FUEL GAUGE
XMSN OIL TEMP GAUGE
XMSN OIL PRESS GAUGE
VOLTMETER
ENG COOLANT TEMP SENDER
ENG OIL PRESSURE SENDER
FUSE BOX
XMSN TEMP SWITCH
XMSN TEMP SENDER
XMSN OIL PRESSURE SENDER/SWITCH
STARTER
ALTERNATOR
FUEL LEVEL SENDER
DISCONNECT BATTERY
GRID HEATER
BATTERY
CUMMINS ENGINE HARNESS
E008 W/CUMMINS QSC TIER 2 ENGINE
WATER_IN_FUEL_SENSOR
ECM_B_CUMMINS_ENGINE
BACK_UP_ALARM_HARNESS SHEET 2/4
MAINLIGHT_HARNESS SHEET 2/4
REAR_LIGHT_HARNESS SHEET 2/4
HM211628

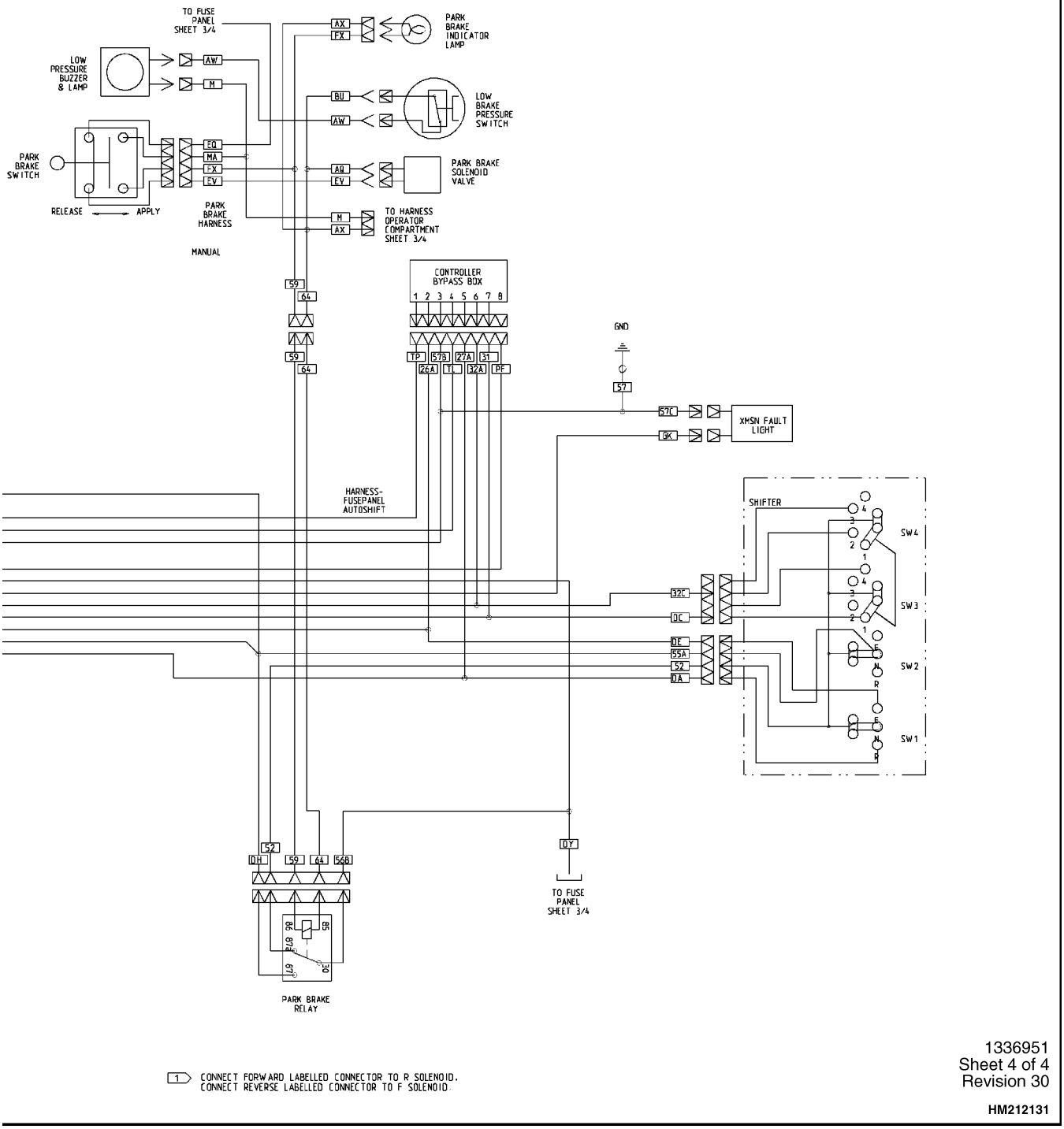


Figure 2. Wiring Diagram Tier 2 (With Operator Presence System Starting With S/N 02065 and Up) (Sheet 4 of 4)

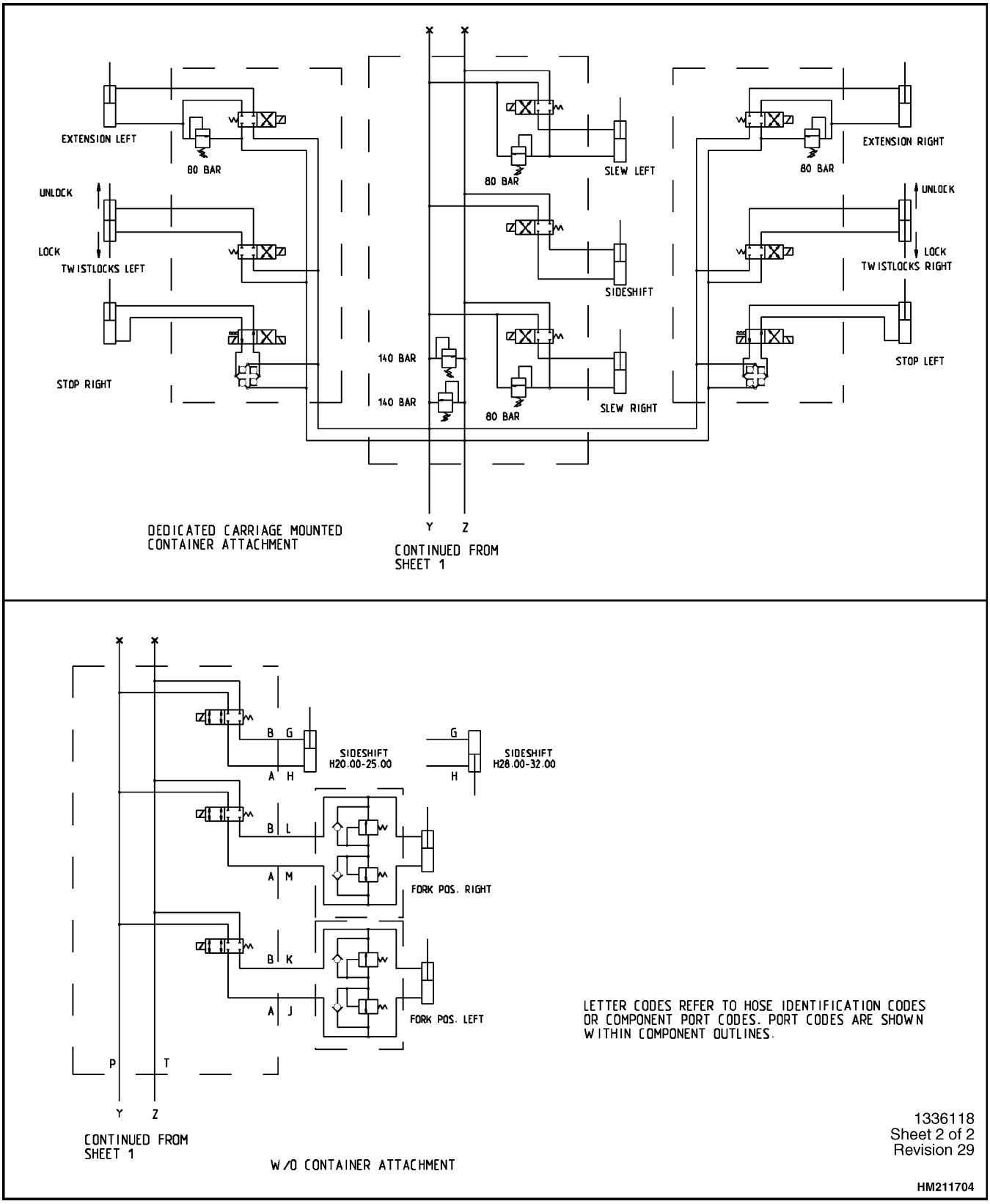


Figure 4. Hydraulic Schematic (Sheet 2 of 2)

Fenders Repair

REMOVE

WARNING

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

1. Place truck on level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply parking brake.
5. Remove the hood from the frame. See Figure 2.
6. Fasten a chain or cable around the middle of the fender. Put the chain or cable through the slot in the fender.
7. Operate the lifting device just enough to give support to the fender.
8. Remove the nuts, washers, and bolts that hold the fender to the frame.
9. Carefully lift the fender away from the frame and lower to the floor.

INSTALL

1. Fasten a chain or cable around the middle of the fender. Verify the chain or cable is in the slot on the side of the fender. See Figure 2.
2. Raise the fender to the lift truck.
3. Align the tapered dowels of the fender with the holes in the frame. Do not disconnect the chain sling.
4. Install the bolts, washers, and nuts. Tighten the nuts to 814 N•m (600 lbf ft) to eliminate all looseness between the fenders and frame.

Hood Repair

REMOVE

1. Place truck on level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply parking brake.
5. Disconnect the exhaust system at the flexible tube connection.
6. Disconnect the air filter at the rubber elbow connection.
7. Disconnect the hose from the air restriction indicator.
8. Remove the three nuts and capscrews at the front of the hood assembly. See Figure 3 and Figure 4.
9. Remove the three nuts and capscrews at the rear of the hood assembly.
10. Lift the hood from the frame.

INSTALL

NOTE: Verify the clamps for the air intake tubes are tight. Air leaks can cause engine damage.

1. Align hood to frame.
2. Replace the three nuts and capscrews at the rear of the hood assembly.
3. Replace the three nuts and capscrews at the front of the hood assembly.
4. Connect the hose from the air restriction indicator.
5. Connect the air filter at the rubber elbow connection.
6. Connect the exhaust system at the flexible tube connection.

Engine Repair

REMOVE

CAUTION

Battery disconnect should only be performed at least 60 seconds after switching OFF ignition.

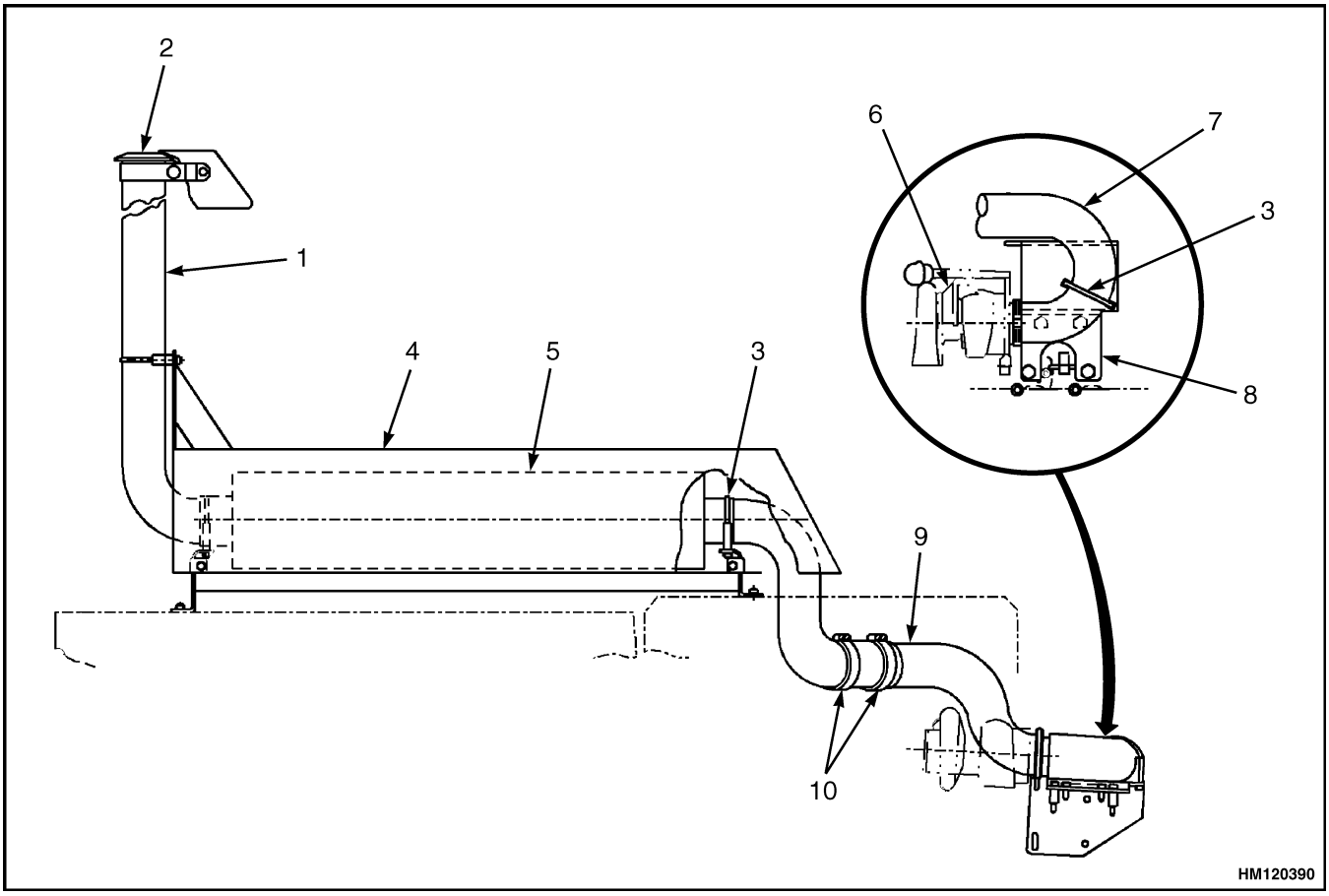
NOTE: The engine can be removed with or without the transmission.

The following procedures are for the removal of the engine only:

1. Place truck on level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply the parking brake.

NOTE: When removing the battery cables, remove the ground cable first.

5. Disconnect the cables at the battery.
6. Disconnect the air filter intake elbow and air restriction indicator hose from under the center hood panel.
7. Disconnect the exhaust system at the flexible tube connection. See Figure 12 and Figure 13.
8. Remove the hood assembly.



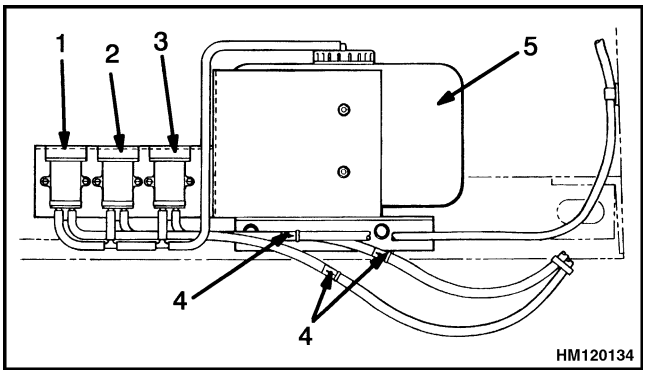
1. EXHAUST STACK
2. RAIN CAP
3. CLAMP
4. EXHAUST COVER
5. MUFFLER
6. TURBOCHARGER
7. EXHAUST TUBE
8. BRACKET
9. FLEXIBLE TUBE
10. CLAMP

Figure 12. Exhaust System (Tier 2)

Window Washer Motor/Pumps

NOTE: To obtain access to the window washer motor/pumps, tilt the cab.

Three window washer motor/pump assemblies and a water reservoir are installed just below and at the right rear part of the operator compartment. See Figure 20. When cleaning or replacing any of the hoses, make sure the check valves are installed so that the arrows are toward the nozzles.



1. FRONT WASHER MOTOR/PUMP
2. TOP WASHER MOTOR/PUMP
3. REAR WASHER MOTOR/PUMP
4. CHECK VALVE
5. RESERVOIR

Figure 20. Window Washers

Heater Assembly

Heater Control Panel Assembly, Remove

1. Remove the right-hand access panel, and disconnect the control cables from the damper rod and the heater valve. See Figure 21.
2. Remove the four screws from the face plate. Disconnect the blower electrical harness from the blower control switch, and remove the heater control panel and cable assemblies.

Blower and Core Assemblies, Remove

1. Remove the right-hand access panel, and disconnect the control cables from the damper rod and the heater valve.
2. Remove the sheet metal screws and the cover panel from the cowl. Disconnect the blower electrical harness from the blower control switch as the cover panel is removed.
3. Disconnect the blower harness from the electrical harness and disconnect the ground wire. Remove the two screws that fasten the blower retainer over the base of the blower assembly (at the top). Pivot the blower assembly downward and then position the assembly so that it can be lifted out of the cowl area.
4. The heater core can be removed by disconnecting the heater hoses (through the right-hand access panel). Remove the capscrews and clamp that fasten the core to the support panel. Remove the heater core.

Install

Install the heater assembly in the reverse order of removal. See Figure 21.

Label Replacement

WARNING

If labels that have warnings or cautions are damaged, they must be replaced. See Figure 31.

If a mast of a different size or an accessory carriage is installed, the capacity rating can change. Changes in the size of drive tires can change the capacity rating. See a dealer for Hyster lift trucks for a replacement nameplate. The nameplate information is a safety item and must be correct.

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 using 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 all air is removed from under the label, and the corners and edges are tight.

   If the labels or information plates are missing or damaged, they must be replaced.

Legend for Figure 31

A. LEFT SIDE OF LIFT TRUCK

1. PARKING BRAKE AND HYDRAULIC PRESSURE
2. PARKING BRAKE WARNING
3. WARNING FOR SAFETY
4. NAMEPLATE TAG
5. FUSE PANEL
6. PATENT PLATE
7. MAST CONTROL
8. ATTACHMENT CONTROL
9. CASE FOR OPERATING MANUAL
10. REPLACE OPERATING MANUAL
11. TRANSMISSION CONTROL AND TWIST LOCK OPERATION
12. FAN WARNING
13. DOOR RELEASE
14. MODEL LABEL
15. MODEL SIZE
16. DIESEL STARTING AID
17. NO RIDERS
18. MAST LABEL
19. MAST SAFETY
20. BATTERY DISCONNECT SWITCH H20.00-32.00F (H440-700F)
21. BATTERY DISCONNECT SWITCH H440-700FS
22. TILT CAB OPERATION LABEL H20.00-32.00F (H440-700F)
23. TILT CAB OPERATION LABEL H440-700FS
24. HYDRAULIC TEST PORT LABEL
25. OPERATOR PRESENCE SYSTEM LABEL

3. Install blocks at the wheels to prevent the lift truck from moving.

4. Operate the lift/lower lever and the brake pedals until the hydraulic accumulator pressure is released.

5. Verify nitrogen supply is **OFF**.

NOTE: Verify correct thread type of gauging assembly to avoid thread damage and incorrect readings.

6. Attach hose from gauging assembly to nitrogen source.

7. Remove gas valve guard and gas valve cap.

NOTE: Back T-handle on gauging assembly all the way out before attaching charging assembly to accumulator gas valve.

8. Close bleed valve on gauging assembly.

9. Attach swivel nut on gauging assembly to gas valve and tighten to 1.13 to 1.69 N•m (10 to 15 lbf in). Make sure not to loop or twist the hose.

10. Turn T-handle on gauging assembly all the way down to depress core in gas valve.

CAUTION

Only fill if both nitrogen gas and accumulator are at approximately 20°C (68°F).

11. Crack open nitrogen bottle valve and slowly fill accumulator to the required precharge pressure as shown in Table 1 and then close the nitrogen bottle valve.

CAUTION

Do not reduce precharge by depressing valve core with a foreign object. High pressure may rupture rubber valve seat.

12. Turn T-handle all the way out.

13. Let the precharge set for 10 to 15 minutes. This will allow the gas temperature to stabilize. If the desired precharge is exceeded, slowly open bleed valve on gauge assembly. Close the bleed valve when the correct value is obtained.

14. Remove gauging assembly by holding the gas valve and loosening the swivel nut on the gauging assembly.

15. Replace gas valve cap and valve guard. Tighten to 1.13 to 1.69 N•m (10 to 15 lbf in).

REMOVE

WARNING

Before disconnecting the hydraulic line, 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 line.

2. Slowly disconnect the hydraulic line from the accumulator to release any pressure slowly.

3. Put cap on the line.

4. Loosen screws and remove accumulator from the frame brackets.

DISASSEMBLE

NOTE: Back T-handle on gauging assembly all the way out before attaching gauging assembly to accumulator gas valve. See Figure 2.

1. Remove gas valve guard and gas valve cap.

2. Close bleed valve on gauging assembly.

3. Attach swivel nut on gauging assembly to gas valve and tighten to 1.13 to 1.69 N•m (10 to 15 lbf in). Make sure not to loop or twist the hose.

4. Turn T-handle on gauging assembly all the way down to depress core in accumulator.

5. Open bleed valve until all gas precharge is relieved from the accumulator.

6. Remove gauging assembly and gas valve.

7. Lay accumulator horizontal and hold down with a strap wrench or in a vise.

8. Install three pins into holes in gas valve cap.

9. Using a long bar, working against the pins, unscrew the gas valve cap from the body.

Auxiliary Brake Caliper Repair

BRAKE LININGS

Remove

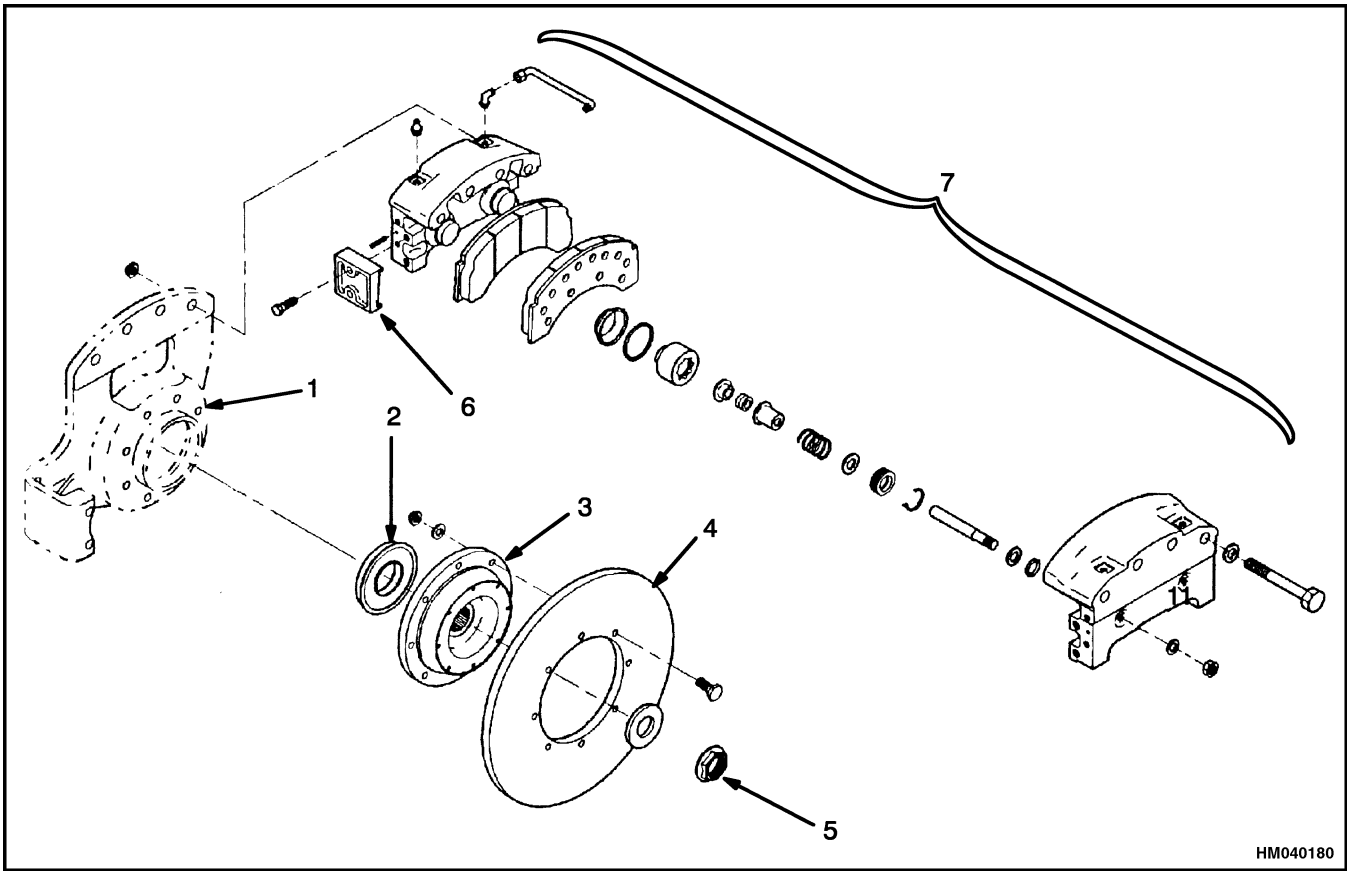
1. Verify that the vehicle is on a level surface.
2. Put blocks under the wheels to keep the vehicle from moving.
3. At one side of the caliper only, remove the bolts that fasten the end plates. Remember to replace the end plates if worn or damaged. See Figure 2.
4. Slip out and discard the worn linings.

Clean and Inspect

CAUTION

Always replace both linings. If only one lining is replaced, possible rotor damage can occur.

1. Replace linings when the thickness of the lining is less than 7.9 mm (0.31 in.) from the back plate.
2. Replace the lining if the thickness of the two linings is different.
3. Replace the linings if contaminated with oil or grease.



1. CALIPER MOUNT
2. OIL SEAL
3. ROTOR FLANGE
4. ROTOR
5. NUT AND WASHER
6. END PLATE
7. CALIPER ASSEMBLY

Figure 2. Auxiliary Brake Assembly

8. Slowly lower the arbor to compress the return spring to minimum height and hold.

9. Use an adjustable wrench to screw the threaded ring against the spring retainer. Verify the threaded ring is bottomed.

NOTE: The following step provides the required built-in clearance (BIC).

10. Keeping the spring compressed, back the threaded ring off one full turn, plus additional amount to install the lock ring in the second available lock ring position.

11. Raise the arbor and install lock ring.

Caliper

WARNING

Use only specified components when assembling the caliper. Do not use components from other calipers. If the wrong components are installed, the caliper will not operate correctly and can cause damage to the equipment. Use of parts not approved by Hyster can cause damage and loss of braking which could result in serious personal injury.

1. Position the housings on a work surface with the cylinder bores up.

2. Lubricate all cylinder bores, threads, seals, backup rings, piston seal surfaces, and seal grooves with Dow® Corning DC4 or with the type of hydraulic fluid used in the system.

3. Install a new O-ring into the groove of each housing cylinder bore. Push the O-rings to the bottom of the grooves.

4. Install a new piston backup ring above each piston O-ring so that the curved side of the piston backup ring is against each piston O-ring.

5. Install a washer and a new O-ring on the exposed part of each adjuster pin.

6. Gently push and twist each piston subassembly past the O-ring and backup ring until the O-ring and washer are seated in the bottoms of the cavities.

WARNING

When installing dust boots, avoid pushing boots against the sharp edge of the boot groove. This can cut the underside of the boots and cause failure of boots in service. This can cause loss of braking and serious personal injury.

7. Carefully install new dust boots keeping them free of lubricant.

8. Position the housing subassemblies with adjuster pins up and install the lockwashers and nuts.

CAUTION

Avoid turning the adjuster pin when tightening the nuts. This can cause damage to the O-ring and cause the seal to leak.

9. Hold the adjuster pin using a screwdriver or Allen wrench and torque nuts to 13.6 to 17.0 N•m (120 to 150 lbf in).

WARNING

Follow all warnings and cautions regarding press operation to avoid serious personal injury and possible damage to components.

10. Place each housing subassembly on the arbor press and press the piston subassemblies into their cavities to the maximum retracted position.

11. Install fittings and bleeder screws in the housing subassemblies according to 12 o'clock and 6 o'clock installation requirements.

Install

1. Slide the caliper housing subassembly between the disc and axle mounting. Support the housing subassembly in place while installing the two special studs in the two inner bolt holes.

2. Slide the remaining housing assembly over the two special studs and install the two inner bolts.

3. Remove special studs and install remaining bolts.

4. Torque the inner and outer bolts to 746 to 881 N•m (550 to 650 lbf ft).

5. Install the crossover tube and reconnect the hydraulic fluid inlet line.

6. Install new linings. See Brake Linings.

Parking Brake Caliper Repair

RELEASE BRAKE MANUALLY

Hydraulic Pressure Available

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.

WARNING

Never try to turn or remove the spring cap while hydraulic pressure is applied to the brake. Turning the cap while pressure is applied can damage the O-ring seals and the spring cap threads. Removing the cap can cause serious personal injury by the sudden release of hydraulic pressure. Verify that the nut is at the end of the stud before you place the vehicle in service. If the nut is tightened against the spring cap, the brake cannot be applied and serious personal injury can result.

1. Verify that the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
3. Apply hydraulic pressure to release the brake.

NOTE: The manual release stud and nut have left-hand threads.

4. To lock the brake in the released position, remove the cotter pin from the stud nut until it touches the spring cap.
5. Release the hydraulic pressure.

Hydraulic Pressure not Available

1. Verify that the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
3. Remove the cotter pin from the stud nut. Tighten the nut against the spring cap and continue tightening to manually retract the piston and lining from the disc. Stop tightening when the spring cap starts to turn.

REMOVE

1. Verify that the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.

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.

WARNING

Brake linings can contain dangerous fibers. Breathing the dust from these linings can be a cancer or lung disease hazard. Do not make dust! Do not clean brake parts with compressed air or by brushing. Use vacuum equipment approved for brake dust or follow the cleaning procedure in this section. When calipers are removed, do not make dust.

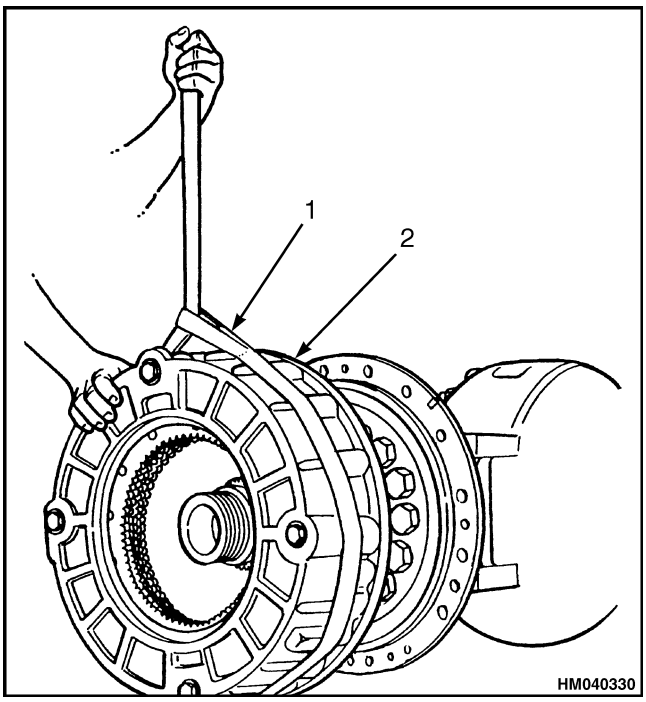
Do not sand, grind, chisel, hammer, or change linings in any way that will make dust. Any changes to linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

3. Manually release the brakes using the procedures described in Release Brake Manually.
4. Disconnect the brake line from the caliper inlet. Put plugs in the brake line and in the inlet to prevent contamination of the system. See Figure 2.
5. Remove the centering device if one is assembled on the end of the caliper.
6. Remove the caliper slide pin fasteners. Remove slide pins.

CAUTION

Do not damage spindle when removing the brake assembly.

23. Carefully slide the brake assembly away from the spindle using the lifting device. See Figure 9.



1. LIFTING DEVICE 2. BRAKE HOUSING

Figure 9. Brake Housing

24. Remove all gasket material from surfaces.

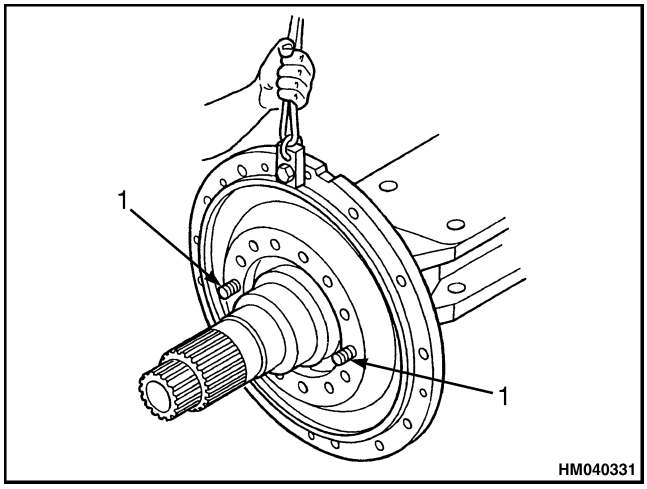
Spindle and Brake Cover

NOTE: On some axle assemblies, the brake cover is mounted between the spindle and axle housing flanges. To remove the spindle and brake cover, use the following procedure.

Remove the spindle first followed by the brake cover.

1. Support the cover of the brake housing with a lifting device.

2. Remove two of the capscrews that fasten the brake cover and spindle to the axle housing. Replace them with two studs. See Figure 10.



1. STUD

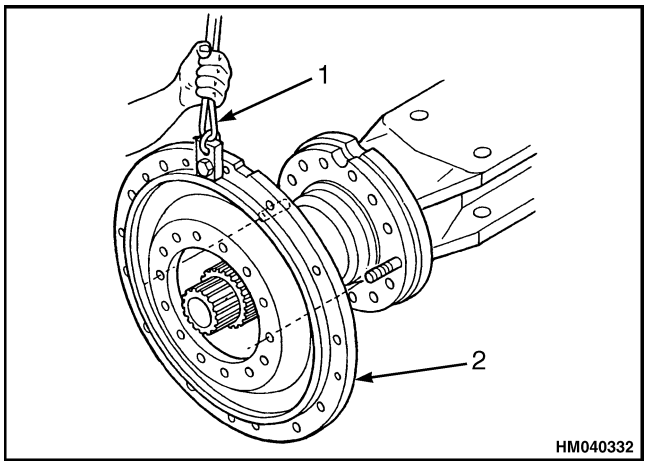
Figure 10. Brake Housing Studs

3. Remove the remaining capscrews.

4. Hold the spindle against the axle housing.

NOTE: If necessary, tap the brake cover with a rubber or plastic hammer to separate it from the spindle.

5. Use a lifting device to remove the brake cover. See Figure 11.

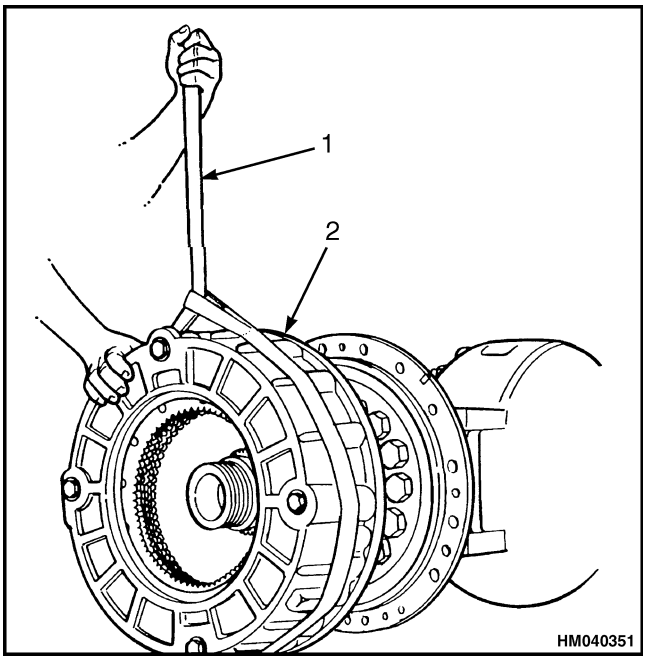


1. LIFTING DEVICE 2. BRAKE COVER

Figure 11. Brake Cover

NOTE: If necessary, tap the spindle with a rubber or plastic hammer to separate it from the axle housing.

6. Use a lifting device to remove the spindle. See Figure 12.



1. LIFTING DEVICE
2. BRAKE HOUSING

Figure 35. Brake Housing

9. Install and tighten the following components on the back (inboard) side of the cover of the brake housing. See Figure 7.

a. Bleeder screw: Tighten to 20 to 27 N•m (15 to 20 lbf ft).

CAUTION

Use the correct fitting. You cannot replace a tapered seat fitting with an O-ring fitting. You cannot replace an O-ring fitting with a tapered seat fitting. If the wrong fitting is used, the housing and the fitting will be damaged.

b. Inlet fitting for the hydraulic line: A tapered seat fitting or an O-ring fitting.

(1) Tapered seat fitting: Verify all of the threads are clean. Install the fitting in the brake housing. Tighten the fitting to 34 to 47 N•m (25 to 35 lbf ft) BUT DO NOT TIGHTEN THE TAPERED SEAT FITTING MORE THAN 47 N•m (35 lbf ft).

(2) O-ring fitting: Verify all of the threads are clean. Inspect the O-ring. Replace the O-ring if it is damaged. Install the fitting in the brake housing. Tighten the fitting to 34 to 47 N•m (25 to 35 lbf ft).

c. Plug: The plug is opposite from the inlet fitting for the hydraulic line. Tighten the plug to 34 to 47 N•m (25 to 35 lbf ft).

10. Check the brake housing for leaks with the following procedure:

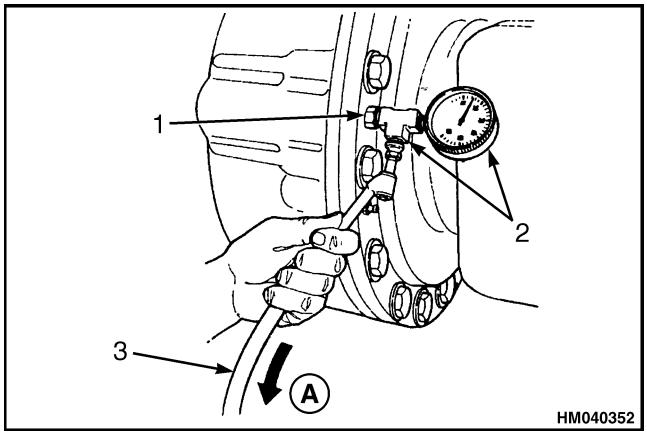
a. Put a plug in the coolant inlet and outlet ports on the inboard side of the cover of the brake housing cover. See Figure 6.

b. Remove plug at top of brake housing cover. Install a 0.375-in. pipe thread adapter or a 0.875-in O-ring fitting adapter and male fitting for an air hose.

c. Connect an air pressure gauge and regulator assembly to the male fitting on the adapter. The gauge must measure pressure accurately to 7 bar (102 psi). See Figure 36.

d. Connect an auxiliary air supply system to the gauge and regulator assembly. See Figure 36.

e. Apply 7 bar (102 psi) of pressure to the brake housing. Turn the regulator to the **CLOSED** position. Look at the gauge for 3-5 minutes. The pressure in the brake housing must remain at 7 bar (102 psi).



A. TO REGULATOR AND AIR SUPPLY

1. ADAPTER
2. GAUGE AND MALE HOSE FITTING
3. AIR LINE

Figure 36. Leak Test

Specifications

NOTE: Tighten all fasteners to the correct torque value. See Figure 46, Figure 47, Table 3, and Table 4.

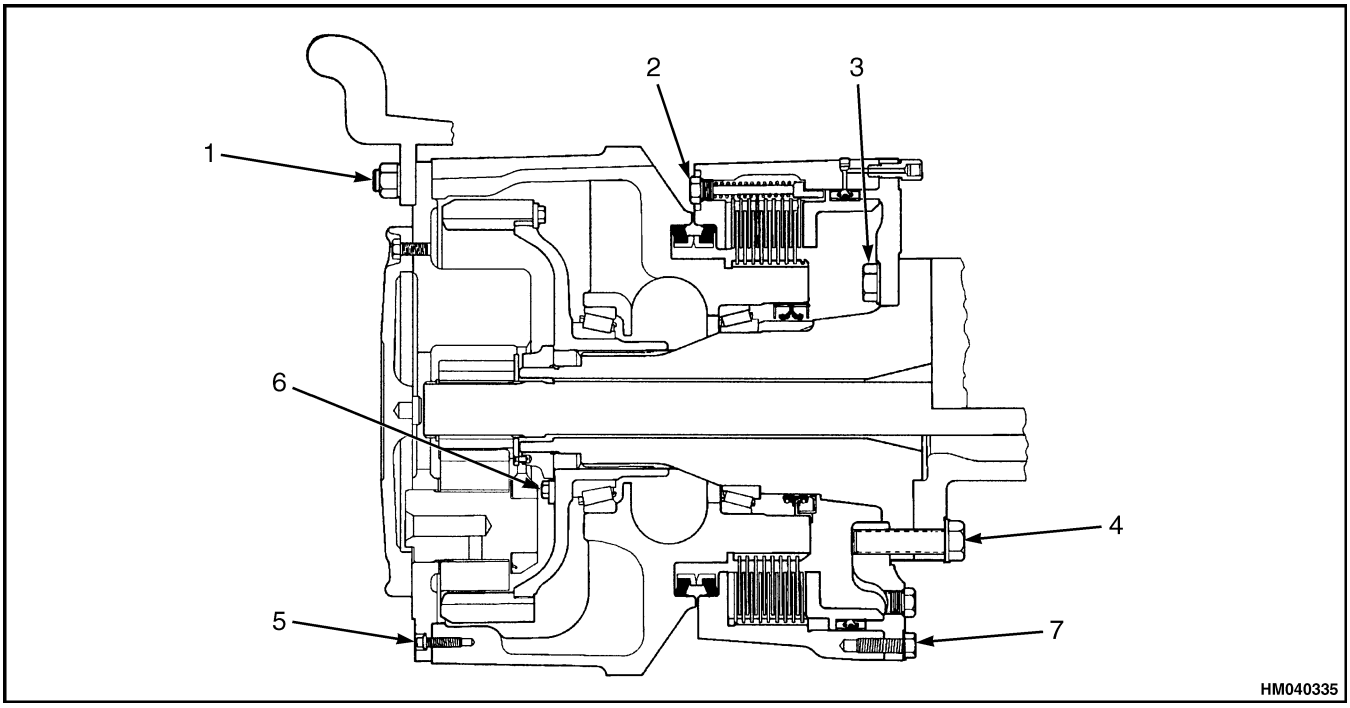


Figure 46. Wheel Hub and Brake Housing

TABLE OF CONTENTS

This section is for the following models:

H20.00-32.00F/FS (H440-700F/FS) [E008]

