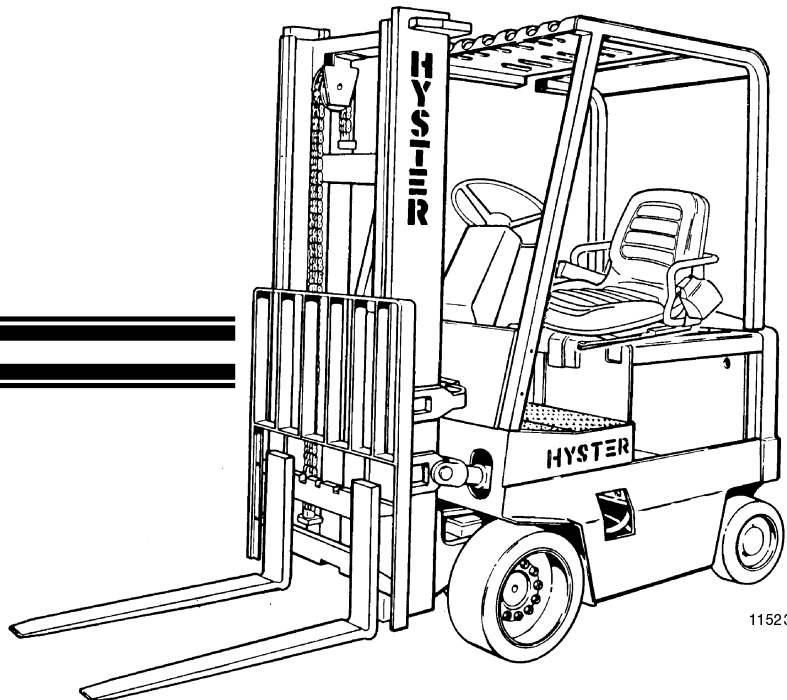


PERIODIC MAINTENANCE

E3.50-5.50XL (E70-120XL₃)



HYSTER

PERIODIC MAINTENANCE

GENERAL

This section contains a MAINTENANCE SCHEDULE and the instructions for maintenance and inspection.

The MAINTENANCE SCHEDULE has time intervals for inspection, lubrication and maintenance for your lift truck. The service intervals are given in both operating hours recorded on the lift truck hour meter, and in calendar time. Use the interval that occurs first.

The recommendation for the time intervals are for eight hours of operation per day. The time intervals must be decreased from the recommendations in the MAINTENANCE SCHEDULE for the following conditions:

- a. If the lift truck is used more than eight hours per day.
- b. If the lift truck must work in dirty operating conditions.

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

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

WARNING

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

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

Do not work under a raised carriage. Lower the carriage or use a chain to prevent the carriage and the inner or intermediate weldments from lowering when doing maintenance. Make sure that the moving parts are attached to parts that cannot move.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

SERIAL NUMBER DATA

The serial number code for the lift truck is on the capacity plate. The code is also stamped on the right side of the rear bulkhead (battery compartment) on the top edge or on the front face near the top.

HOW TO MOVE A DISABLED LIFT TRUCK

WARNING

Use extra caution when towing a lift truck if any of the following conditions exist:

- a. Brakes do not operate correctly.
- b. Steering does not operate correctly.
- c. Tires are damaged.
- d. Traction conditions are bad.
- e. The lift truck must be towed on a slope.

If the steering pump motor does not operate, steering control of the lift truck can be slow. This can make the control of the lift truck difficult. If there is no electrical power, there is no power steering. DO NOT tow the lift truck if there is no power. Poor traction can cause the disabled lift truck or towing vehicle to slide. Steep grades will require additional brake force to stop the lift truck.

Never carry a disabled lift truck unless the lift truck MUST be moved and cannot be towed. The lift truck used to carry the disabled lift truck MUST have a rated capacity equal to or greater than the weight of the disabled lift truck. The capacity must be for a load center equal to half the width of the disabled lift truck. See the capacity plate of the disabled lift truck for the approximate total weight. The forks must extend the full width of the disabled lift truck. Center the weight of the disabled lift truck on the forks and be careful not to damage the under side of the lift truck.

How to Tow a Lift Truck

1. The towed lift truck must have an operator.

2. Raise the carriage and forks approximately 30 cm (12 inches) from the surface. Install a chain to prevent the carriage and mast channels from moving.

3. If another lift truck is used to tow the disabled lift truck, that lift truck must have an equal or larger capacity than the disabled lift truck. Install an approximate half-capacity load on the forks of the lift truck that is being used to tow the disabled lift truck. This half-capacity load will increase the traction of the lift truck. Keep the load as low as possible.

4. Use a solid towing link made of steel that attaches to the tow pins in the counterweights of both lift trucks.

5. Release the parking brake.

6. Tow the lift truck slowly.

HOW TO PUT A LIFT TRUCK ON BLOCKS

WARNING

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the following assemblies will cause large changes in the center of gravity: mast, drive axle, battery or counterweight. When the lift truck is put on blocks, put additional blocks in the following positions to maintain stability:

- a. Before removing the mast and drive axle, put blocks under the counterweight so that the lift truck can not fall backward.
- b. Before removing the counterweight, put blocks under the mast assembly so that the lift truck can not fall forward.

The surface must be solid, even, and level when the lift truck is put on blocks. Make sure that any blocks used to support the lift truck are solid, one piece units.

NOTE: Some lift trucks have lifting eyes. These lift points can be used to raise the lift truck so that blocks can be installed.

How To Raise the Drive Tires (See FIGURE 1.)

1. Put blocks on each side (front and back) of the steering tires to prevent movement of the lift truck.

2. Put the mast in a vertical position. Put a block under each outer mast channel.

3. Tilt the mast fully forward until the drive tires are raised from the surface.

4. Put additional blocks under the frame behind the drive tires.

5. If the hydraulic system will not operate, use a hydraulic jack under the side of the frame near the front. Make sure that the jack has a capacity equal to at least half the weight of the lift truck. See the capacity plate.

How To Raise the Steering Tires (See FIGURE 1.)

1. Apply the parking brake. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.

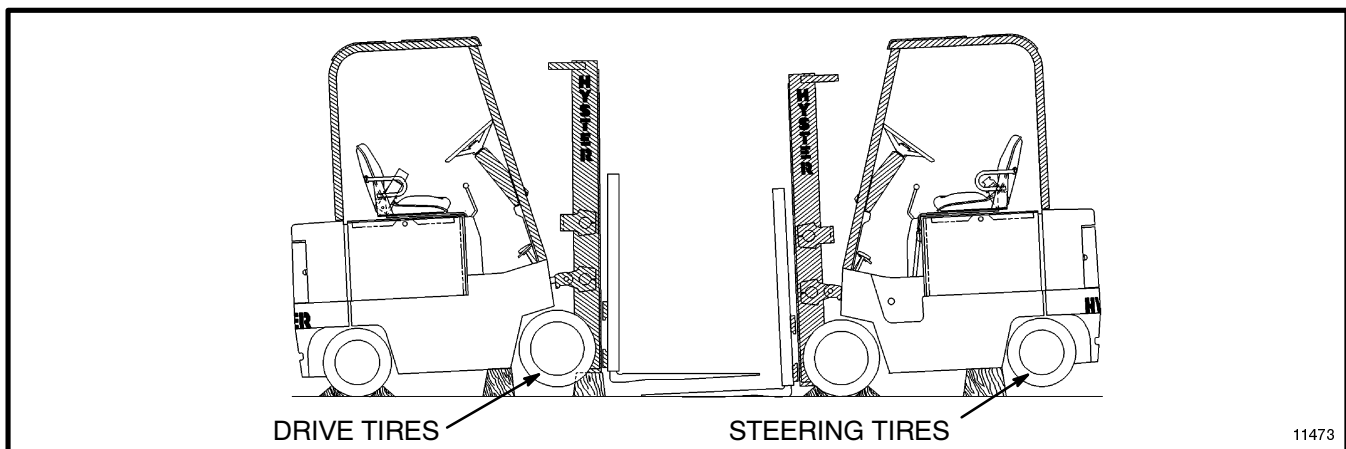


FIGURE 1. PUT THE LIFT TRUCK ON BLOCKS

11473

2. Use a hydraulic jack to raise the steering tires. Make sure that the jack has a capacity of at least 2/3 of the total weight of the lift truck as shown on the capacity plate.

3. Put the jack under the steering axle or frame to raise the lift truck. Put blocks under the frame to support the lift truck.

MAINTENANCE SCHEDULE (Item No. Reference FIGURE 2.)

ITEM NO.	ITEM	8 Hrs or 1 Day	350 Hrs or 1 Month	2000 Hrs or 1 Year	PROCEDURE OR QUANTITY	SPECIFICATION
1	HYDRAULIC OIL, Total System E3.50-4.50XL (E70-100XL ₃ S) E4.50-5.50XL (E100-120XL ₃)	X		C	41.3 litre (10.9 gal) 49.2 litre (13.0 gal)	-18°C to 38°C (0°F to 100°F) SAE 10W API SC/CC
2	BATTERY RESTRAINT LATCH	X ¹ X			Check Condition Check Operation	
3	TIRES	X			Check Condition	Parts Manual
4	FORKS	X			Check Condition	
5	LIFT CHAINS	X	L ² X		Check Condition and Lubrication Check Adjustment and Length	Engine oil

X=Check C=Change L=Lubrication
NOTE: Never use steam to clean electrical parts.
 Refer to **SERVICE MANUAL** for procedures.

1. Equalization Charge is required approximately each month.
 2. Lubricate at 250 hours.

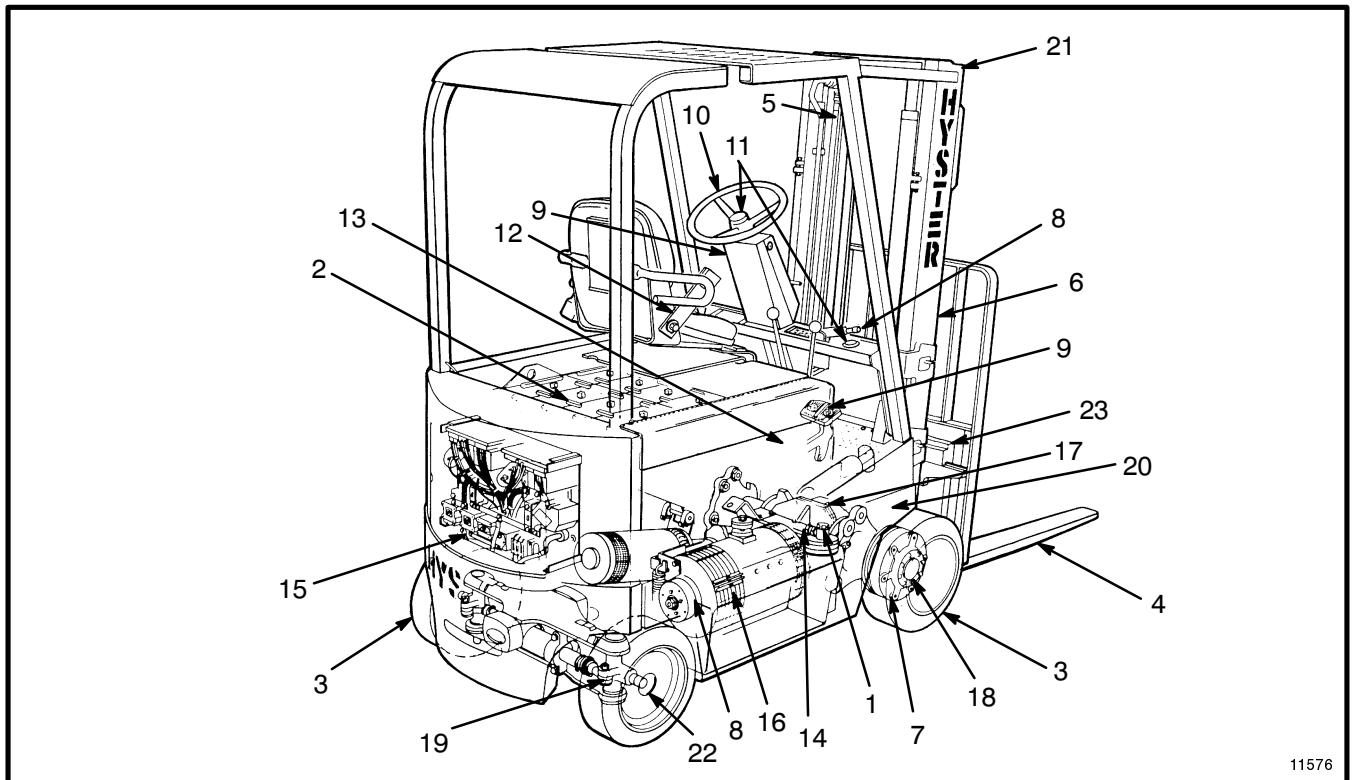


FIGURE 2. MAINTENANCE POINTS

MAINTENANCE SCHEDULE (Item No. Reference FIGURE 2.)

ITEM NO.	ITEM	8 Hrs or 1 Day	350 Hrs or 1 Month	2000 Hrs or 1 Year	PROCEDURE OR QUANTITY	SPECIFICATION
6	MAST	X			Check Operation	
7	SERVICE BRAKES	X		X	Check Operation Check Condition	
	SAFETY LABELS	X			Replace if necessary	Parts Manual
8	PARKING BRAKE	X			Check Operation	
9	DIRECTION/ SPEED CONTROLS	X			Check Operation	
10	STEERING	X			Check Operation	
11	GAUGES, HORN, LIGHTS, ALARM, FUSES	X			Check Operation	
12	SEAT BELT AND SEAT RAILS	X			Check Condition	
23	FORK GUIDES AND LOCKS	X	L		As Necessary	Engine Oil, CC/SE
13	BRAKE FLUID		X		0.25 litre (0.5 pt)	SAE J-1703
14	HYDRAULIC TANK BREATHER		X		Clean or Replace	
	SEAT (PARKING) BRAKE ADJUSTMENT		X		Adjust as Required	
15	CONTACTORS		X	C ⁴	Check Condition	
16	MOTOR BRUSHES		X ³		Check Condition	
17	DIFFERENTIAL/SPEED REDUCER		X	C	5.2 litre (5.5 qt)	Ultra Gear Lube Gear Oil SAE 80W (Chevron Oil) or SAE 90W EP
18	WHEEL NUTS (Drive Wheels)		X		Check Torque	680 Nm (500 lbf ft)
19	STEERING SPINDLE AND ROD ENDS		L		2 Fittings As Required	Multi-Purpose Grease ⁵
6 20 21	MAST PIVOTS SLIDING SURFACES		L L		2 Fittings As Required	Multi-Purpose Grease ⁵ Multi-Purpose Grease ⁵
	HINGES, LEVERS, PEDALS, SEAT RAILS		L	L	As Required As Required	Use Hyster Part No 328388 Use Hyster Part No 328388
1	HYDRAULIC FILTER			C	1	See Parts Manual
22	WHEEL BEARINGS			L	As Necessary	Multi-Purpose Grease ⁵

X=Check C=Change L=Lubrication

NOTE: Never use steam to clean electrical parts. Refer to service manual for detailed instruction.

3. After first 350 hr check, if brush wear allows, extend check interval to 1000 hrs

4. Replace hydraulic pump contactor tips every 1000 hours of operation. Replace other contact tips when the tip thickness is 30% of thickness when new.

5. Multi-purpose grease with 2 - 4% molybdenum disulfide.

MAINTENANCE PROCEDURES EVERY 8 HOURS OR DAILY

⚠ WARNING

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

HOW TO MAKE CHECKS WITH THE KEY SWITCH OFF

Inspect the lift truck every eight hours or daily before use. Put the lift truck on a level surface. Lower the carriage and forks and turn the key to the **OFF** position. Apply the parking brake. Remove the floor plates and inspect for leaks and conditions that are not normal. Clean any oil spills. Make sure that lint, dust, paper and other materials are removed from the compartments. Make the additional checks as described in the following paragraphs of HOW TO MAKE CHECKS WITH THE KEY SWITCH “OFF” and HOW TO MAKE CHECKS WITH THE KEY SWITCH “ON”.

Tires and Wheels (See FIGURE 3.)

Inspect the tires for wire, rocks, glass, pieces of metal, holes, cuts and other damage. Remove any object that will cause damage. Check for loose or missing hardware. Remove any wire strapping or other material wrapped around the axle.

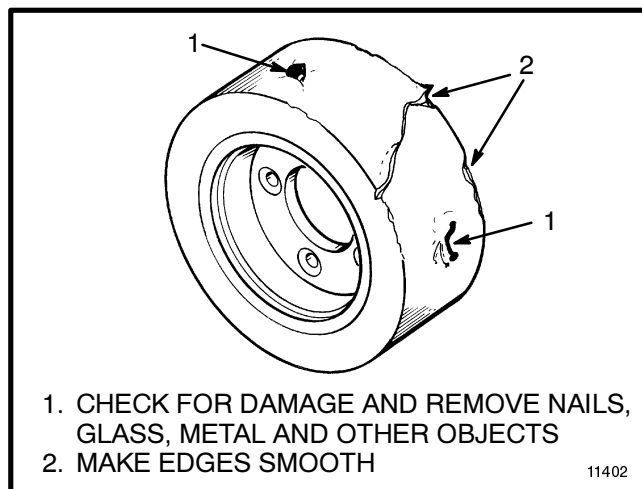


FIGURE 3. CHECK THE TIRES

Make sure that the wheel nuts are tight. Tighten the wheel nuts in a cross pattern to the correct torque value shown in the MAINTENANCE SCHEDULE.

⚠ CAUTION

Check all wheel nuts after 2 to 5 hours of operation: when new lift trucks begin operation and on all lift trucks when the drive wheels have been removed and installed. Tighten the nuts in a cross pattern to the correct torque value shown in the MAINTENANCE SCHEDULE. When the nuts stay tight for eight hours, the interval for checking the torque can be extended to 350 hours.

Forks (See FIGURE 4.)

The identification of a fork is determined by how it is connected to the carriage. These lift trucks have hook forks.

ADJUSTMENT

Hook forks are connected to the carriage by hooks and lock pins. See FIGURE 4. These lock pins are installed through the top fork hooks and fit into slots in the top carriage bar. Adjust the forks as far apart as possible for maximum support of the load. Raise the lock pin in each fork to slide the fork on the carriage bar. Make sure the lock pin is engaged in the carriage bar to lock the fork in position after making adjustments.

REMOVAL

⚠ WARNING

Do not try to move a fork without a lifting device. Each hook fork for these lift trucks can weigh 35 kg to 180 kg (80 to 395 lb).

Slide a hook fork to the fork removal notch on the carriage. See FIGURE 4. Lower the fork onto blocks so that the bottom hook of the fork moves through the fork removal notch. Lower the carriage further so that the top hook of the fork is disengaged from the top carriage bar. Move the carriage away from the fork, or use a lifting device to move the fork away from the carriage. Lay the fork on its side so that it cannot fall and cause injury.

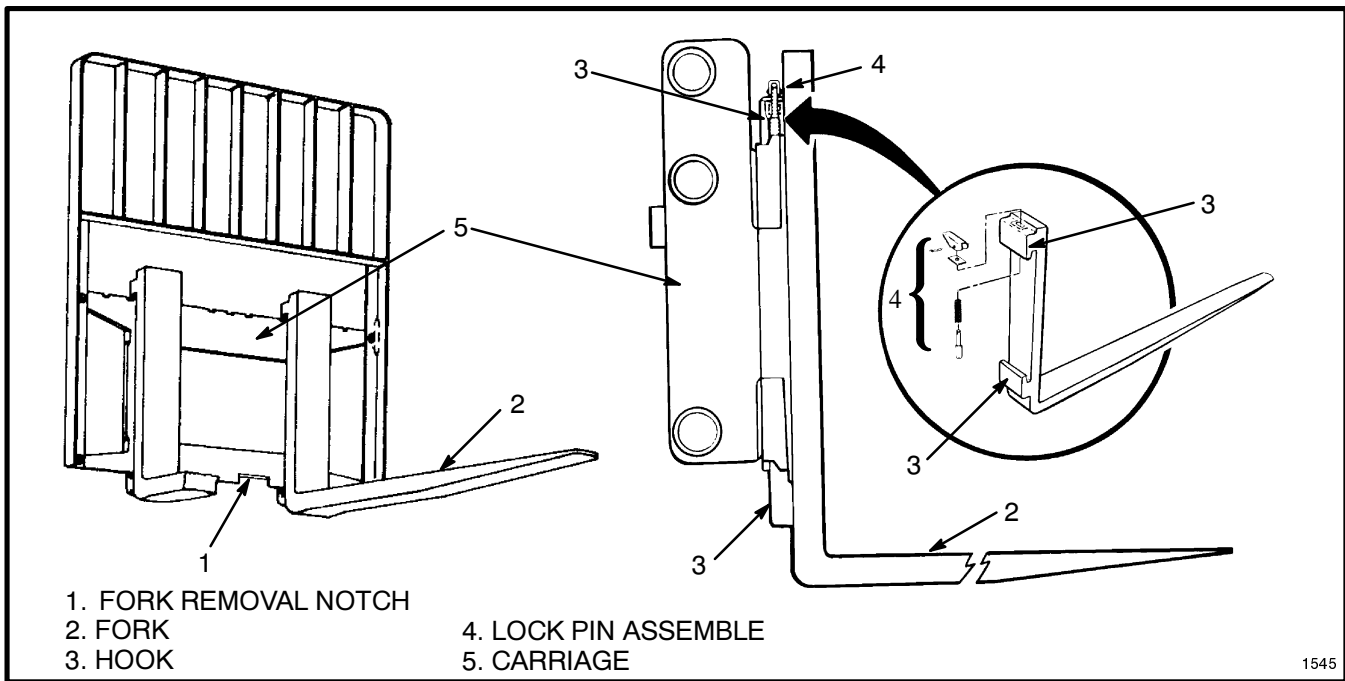


FIGURE 4. HOOK FORK

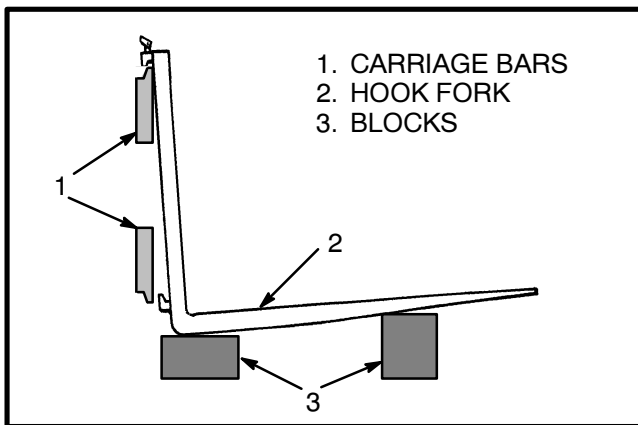


FIGURE 5. REMOVE A HOOK FORK

INSTALLATION

Move the fork and carriage so that the top hook on the fork can engage the top carriage bar. Raise the carriage to move the lower hook through the fork removal notch. Slide the fork on the carriage so that both upper and lower hooks engage the carriage. Engage the lock pin with a notch in the upper carriage bar.

Inspection Of The Mast, Forks And Lift Chains (See FIGURE 6. and FIGURE 7.)

⚠ WARNING

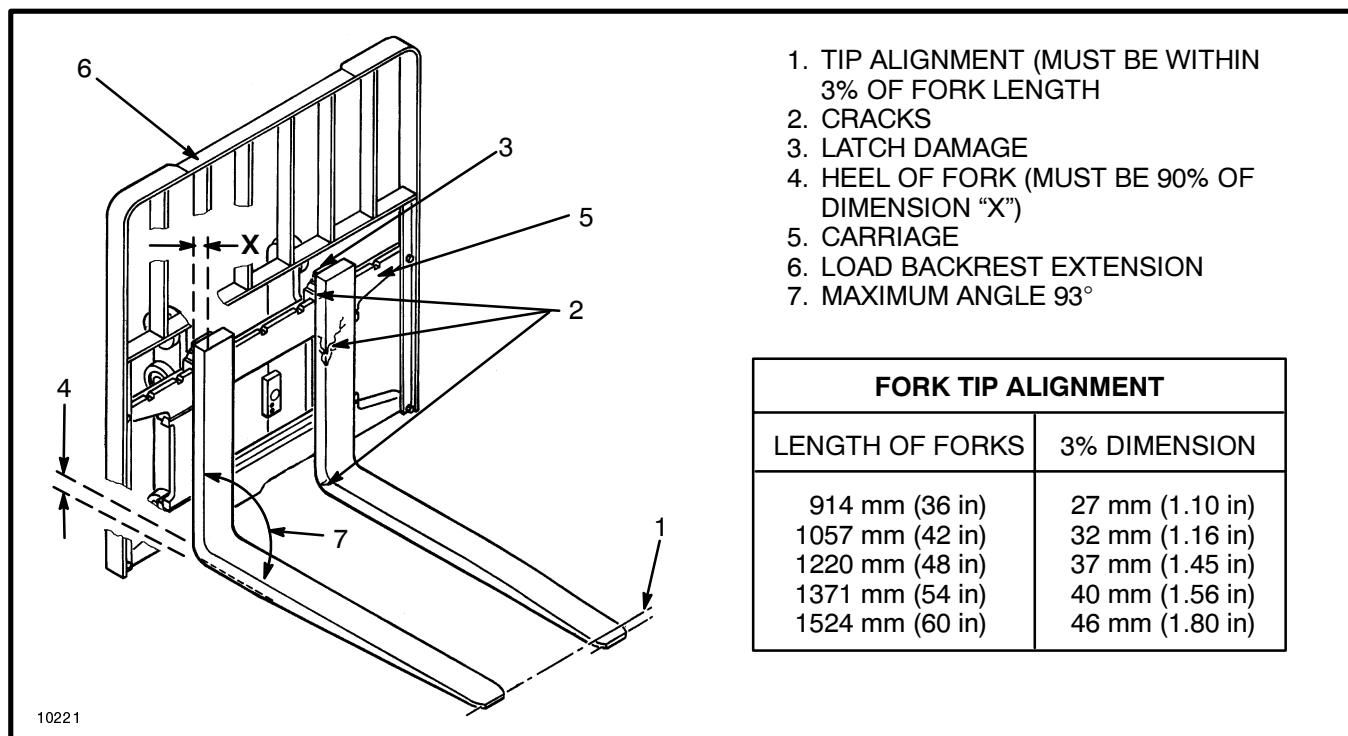
NEVER work under a raised carriage or forks. Lower the carriage or use chains on the mast weldments

and carriage so that they can not move. Make sure the moving parts are attached to a part that does not move. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered, the key switch is in the OFF position and the key is removed.

Do not try to correct the alignment of the fork tips by bending the forks or adding shims. Replace damaged forks.

Never repair damaged forks by heating or welding. Forks are made of special steel using special procedures. Replace damaged forks.

1. Inspect the welds on the mast and carriage for cracks. Make sure that the capscrews and nuts are tight.
2. Inspect the channels for wear in the areas where the rollers travel. Inspect the rollers for wear or damage.
3. Inspect the load backrest extension for cracks and damage.
4. Inspect the forks for cracks and wear. Check that the fork tips are aligned within 13 mm (0.5 in) of each other. See FIGURE 6. Check that the bottom of the fork is not worn (Item 4).
5. Replace any damaged or broken parts that are used to keep the forks locked in position.



1. TIP ALIGNMENT (MUST BE WITHIN 3% OF FORK LENGTH)
2. CRACKS
3. LATCH DAMAGE
4. HEEL OF FORK (MUST BE 90% OF DIMENSION "X")
5. CARRIAGE
6. LOAD BACKREST EXTENSION
7. MAXIMUM ANGLE 93°

FORK TIP ALIGNMENT	
LENGTH OF FORKS	3% DIMENSION
914 mm (36 in)	27 mm (1.10 in)
1057 mm (42 in)	32 mm (1.16 in)
1220 mm (48 in)	37 mm (1.45 in)
1371 mm (54 in)	40 mm (1.56 in)
1524 mm (60 in)	46 mm (1.80 in)

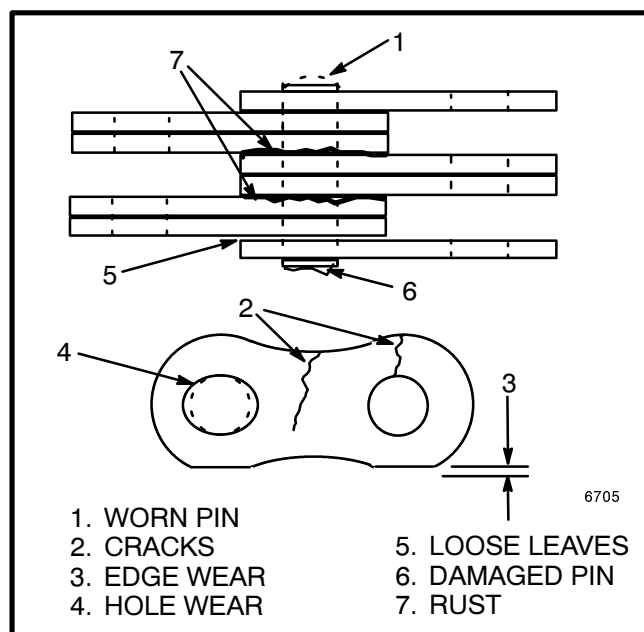
FIGURE 6. CHECK THE FORKS

6. Inspect the lift chains for the correct lubrication. Use 30W engine oil or Hyster Chain and Cable Lubricant.

7. Inspect the lift chains for cracks and broken links and pins. See FIGURE 7.

8. Inspect the chain anchors and pins for cracks and damage.

9. Make sure the lift chains are adjusted so that they have equal tension. Adjustment or replacement of the lift chains must be done by authorized personnel. See LIFT CHAIN ADJUSTMENTS in GENERAL PROCEDURES in this section.



1. WORN PIN
2. CRACKS
3. EDGE WEAR
4. HOLE WEAR
5. LOOSE LEAVES
6. DAMAGED PIN
7. RUST

FIGURE 7. CHECK THE LIFT CHAINS

Safety Labels

⚠ WARNING

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

Check that all safety labels are installed in the correct location on the lift truck. See the **PARTS MANUAL** or the **FRAME** section of the **SERVICE MANUAL** for the correct location of the safety labels. See the **FRAME** section for the installation procedure.

Steering Column Latch

Make sure the latch for the steering column operates correctly. The latch must NOT allow the column to move unless the latch is released.

Operator Restraint System (See FIGURE 8.)

There is an indicator light on the display panel for the seat belt. The red light is ON as described in the **OPERATING MANUAL**. The light can help the operator remember to fasten the seat belt.

The seat belt, hip restraint brackets, seat and seat rails, battery restraint (seat plate) and latch are all part of the operator restraint system. Each item must be checked to make sure it is attached securely, functions correctly and is in good condition.

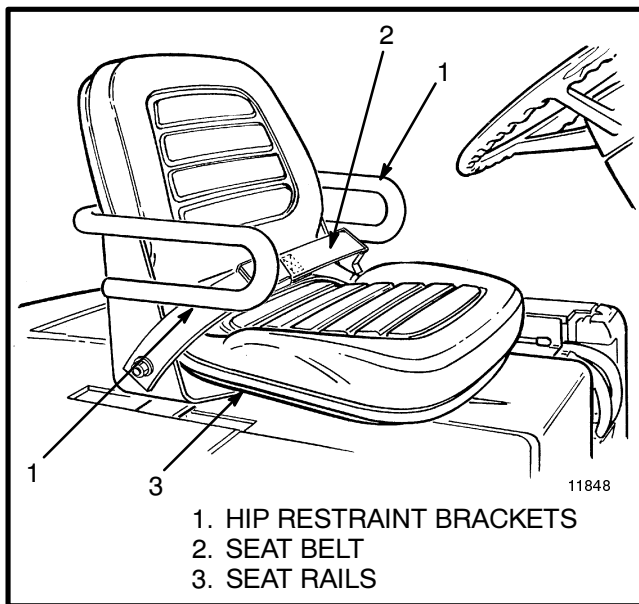


FIGURE 8. OPERATOR RESTRAINT SYSTEM

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 can not be pulled from the retractor assembly, it must be replaced.

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.

Battery Restraint System (See FIGURE 9.)

The battery restraint system is a heavy steel seat plate that has a hinge at the front of the battery compartment.

Spacers are used inside the battery compartment to prevent horizontal movement of the battery. An additional battery retention bar is used on all models where batteries can be longer. This bar has a hinge fastened to the counterweight and is part of the hood mechanism on lift truck with hoods. The bar is also installed on lift trucks without hoods.

To operate correctly, the battery restraint plate must be locked in the down position. The battery retention bar (and hood) must be lowered first, then the battery restraint plate is locked in the down position over the bar. The battery must have spacers to prevent movement in any one horizontal direction of 13 mm (0.5 in) maximum. Use the knob near the hinge to release the battery restraint plate (see FIGURE 9.). Use the handle on the restraint plate to raise the plate and seat. A spring brace will hold the assembly in the up position. If installed, raise the hood. Make sure that the battery can not move more than a total of 13 mm (0.5 in) in any one horizontal direction. Make sure the correct spacers are installed to prevent the movement. See your dealer for Hyster lift trucks to replace damaged or missing spacers. If a smaller battery of the correct weight (see capacity plate) is installed and the spacers cannot prevent movement, your dealer for Hyster lift trucks has larger spacers. Push the seat and the battery restraint down until the latch locks. Make sure the battery restraint is locked securely. Lift on the battery restraint to make sure it is latched and will not move.

⚠ WARNING

The battery restraint and its latch mechanisms must operate correctly before a lift truck is operated. A loose battery can cause serious injury and property damage if the lift truck overturns. The battery retention bar must be down and under the seat and battery restraint plate. Make sure the battery has a cover if the lift truck does not have a hood.

If necessary, adjust the battery spacer system as described in HOW TO CHANGE THE BATTERY under GENERAL PROCEDURES. See your dealer for Hyster lift trucks to replace damaged or missing spacers.

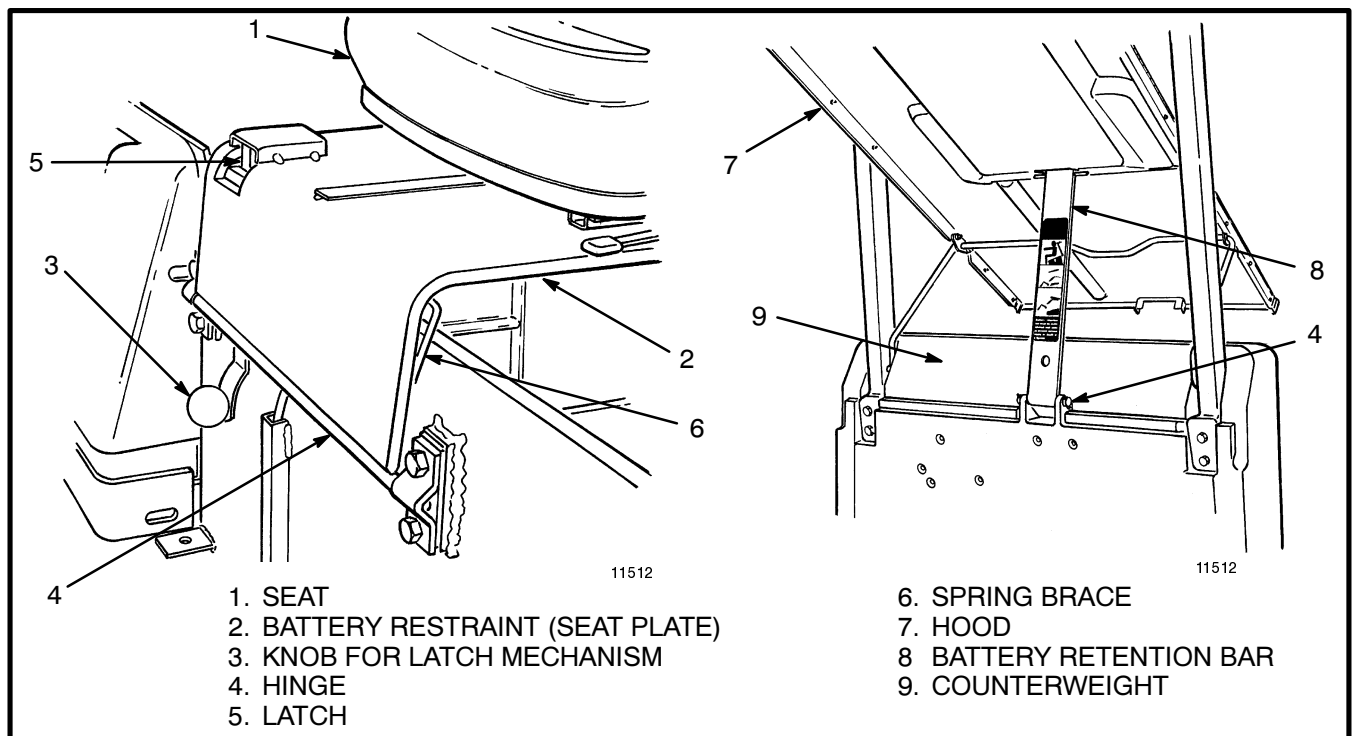


FIGURE 9. BATTERY RESTRAINT

Battery

NOTE: There can be one of two types of batteries. One type has removable cell caps. The other type has sealed cells. The sealed batteries require a different charger, the electrolyte level or specific gravity cannot be checked and water cannot be added to the electrolyte.

⚠ WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

The acid in the electrolyte can cause injury. If the electrolyte is spilled, use water to flush the area. Make the acid neutral with a solution of sodium bicarbonate (soda). Acid in the eyes must be flushed with water immediately.

Batteries generate explosive fumes. Keep the vents in the caps clean. Keep sparks or open flames away from the battery area. Do not make a spark from the battery connections.

Disconnect the battery when doing maintenance.

Make sure that the voltage and the weight of the battery are correct as shown on the nameplate. See **BATTERY SPECIFICATIONS** at the rear of this manual to check for correct battery dimensions.

Keep the battery case, top cover and the area for the battery clean and painted. Leakage from the battery and corrosion can cause a malfunction in the electric controls of the lift truck. Use a water and sodium bicarbonate (soda) solution to clean the battery and the battery area. Keep the top of the battery clean, dry and free of corrosion.

Make sure the battery is charged and has the correct voltage and ampere hour rating for the lift truck. See the nameplate.

Inspect the battery case, connector and cables for damage, cracks or breaks. See the battery dealer in the area to repair any damage.

On batteries with cell caps, check the level of the electrolyte daily on a minimum of one cell. Add only distilled water, as necessary, to all cells that do not have the correct electrolyte level. The correct level is half-way

between the top of the plates and the bottom of the fill hole.

Hydraulic System (See FIGURE 10.)

⚠ WARNING

At operating temperature the hydraulic oil is **HOT**. Do not permit the hot oil to contact the skin and cause a burn.

⚠ CAUTION

Do not permit dirt to enter the hydraulic system when the oil level is checked or the filter is changed.

Never operate the pump without oil in the hydraulic system. The operation of the hydraulic pump without oil will damage the pump.

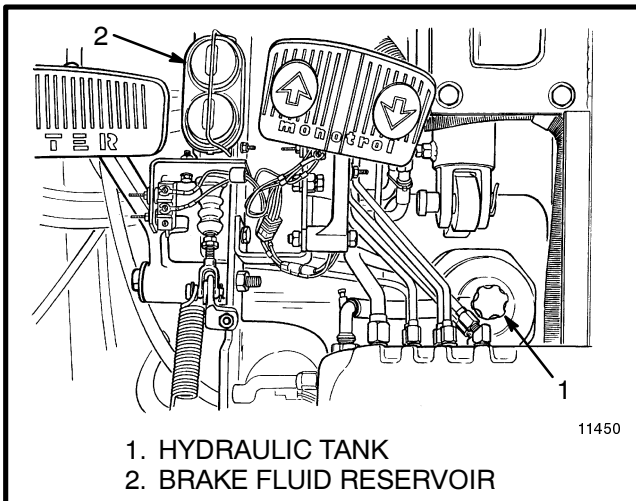


FIGURE 10. HYDRAULIC AND BRAKE CHECKS

Check the hydraulic oil level when the oil is at operating temperature, the carriage is lowered and the key switch is in the **OFF** position. Add hydraulic oil only as needed. If more hydraulic oil is added than the “FULL” level, hydraulic oil will leak from the breather during operation.

Inspect the hydraulic system for leaks and damaged or loose components.

HOW TO MAKE CHECKS WITH THE KEY SWITCH ON

⚠ 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 the area around the lift truck is clear before moving the lift truck. Always look in the direction that you intend to move the lift truck. Be careful when making the checks.

Gauges, Horn and Fuses

1. Check the operation of the gauges and horn. The horn will operate when the key is in any position. On both the standard and enhanced panels, the hourmeters record the hours during operation. The hours are displayed on the digital display as described in the **OPERATING MANUAL**.

2. The battery indicator will operate as described in the **OPERATING MANUAL**.

3. Most fuses are located in the electrical compartment.

Steering System

⚠ WARNING

Because the lift truck has hydraulic power steering, the lift truck can be difficult to steer when the power steering pump is not operating.

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

Service Brakes

There is an indicator light on the display panel for the brake fluid level. The red light is **ON** as described in the **OPERATING MANUAL**. If the light is **ON** during operation, the fluid in the reservoir for the brake master cylinder is too low. Add brake fluid and check for leaks. The reservoir is under the brake pedal and floor plate. Clean the area around the fill cap so that no dirt enters the reservoir.

Check the operation of the service brakes. Push on the brake pedal. The brake pedal must stop firmly and must not move slowly down after the brakes are applied. The service brakes must apply equally to both drive wheels.

The service brakes must not pull the lift truck to either side of the direction of travel when they are applied. The service brakes are automatically adjusted when the brakes are applied and the lift truck changes direction.

NOTE: Some lift trucks are used in operations where the automatic adjusters can be slow to adjust the brake shoes. If the brakes need adjustment, operate the lift truck in forward and reverse 10 times. Apply the brake pedal firmly, but do not cause the wheels to slide. If the automatic adjusters do not adjust the brake shoes, a qualified service person must check the operation and condition of the brakes.

WARNING

Loss of fluid from the brake fluid reservoir indicates a leak. Repair the brake system before using the lift truck. Replace the brake fluid in the system if there is dirt, water, or oil in the system.

Parking Brake

There is an indicator light on the display panel for the parking brake. The red light is ON as described in the **OPERATING MANUAL**. If the light is ON after approximately one second, the operator is not on the seat or the key is in the **OFF** position. An alarm will also make a noise. **ALWAYS** apply the parking brake when leaving the seat.

Make sure the service brakes operate correctly before checking the operation of the parking brake. The parking brake, when correctly adjusted, will hold the lift truck with a capacity load on a 15% grade [1.5 metre rise in 10 metres (1.5 ft rise in 10 ft)]. Turn the knob on the end of the hand lever to adjust the parking brake. Do not tighten the adjustment so that the brakes are applied when the hand lever is released.

Some lift trucks are equipped with an additional brake that is actuated automatically when the operator leaves the seat. When correctly adjusted, this brake will hold the lift truck with a capacity load on a 15% grade. Make sure the service brakes operate correctly before checking the operation of the seat brake. If the brake does not hold the lift truck on the grade, the seat brake must be

adjusted by authorized service personnel according to the procedure in the **SERVICE MANUAL**.

Control Levers And Pedals

Check that the levers for the mast and attachment operate as described in the **OPERATING MANUAL**.

Lift System Operation

WARNING

NEVER work under a raised carriage or forks. Lower the carriage or use chains on the mast weldments and carriage so that they can not move. Make sure the moving parts are attached to a part that does not move.

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

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. The mast components must raise and lower smoothly in the correct sequence. The carriage raises first, then the inner mast and intermediate mast (three-stage mast only).

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

3. The inner mast and the carriage must lower completely.

4. Raise the mast one metre (three feet), with a capacity load. The inner mast and carriage must raise smoothly. Lower the mast. All moving components must lower smoothly.

5. With the load lowered, tilt the mast backward and forward. The mast must tilt smoothly and both tilt cylinders must stop evenly.

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

(More Content includes: Brake system, Capacities, and specifications, Frame, Hydraulic, System, Industrial battery, Main control, Valve, Mast repair, Fasteners, Schematics diagrams, Steering axle, Steering system, Wire harness repair And more)

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**Thank you very
much.**

EVERY 350 HOURS OR TWO MONTHS

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

HYDRAULIC TANK BREATHER

Check and clean the hydraulic tank breather. Clean the breather when it is dirty and will not permit the easy passage of air. The breather is on a pipe near the hydraulic filter.

DIFFERENTIAL AND SPEED REDUCER (See FIGURE 11.)

⚠ WARNING

Do not work under a raised carriage. Lower the carriage or use a chain to prevent the carriage and the inner or intermediate weldments from lowering when doing maintenance. Make sure that the moving parts are attached to parts that can not move.

Check the oil level at the fill plug in the differential housing. The oil level must be even with the bottom of the hole. Add oil if the oil level is low. Install and tighten the plug.

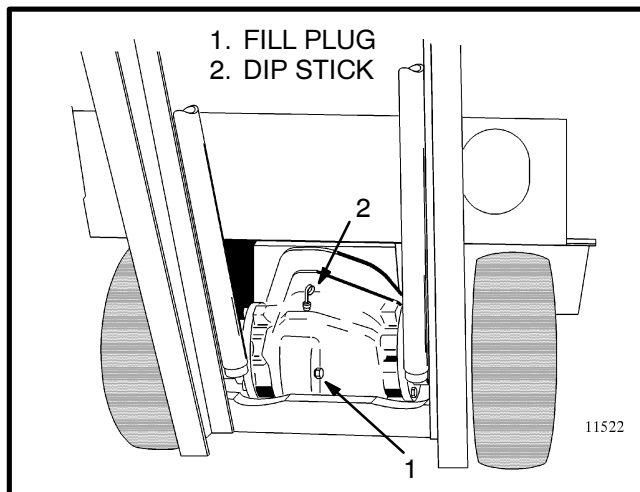


FIGURE 11. DIFFERENTIAL

WHEEL NUTS

Tighten wheel nuts as required. See Install The Wheels and SPECIFICATIONS.

STEERING AXLE SPINDLES

Use multi-purpose grease to lubricate the king pins in the steering axle. A grease fitting is at the end of each king pin on the bottom of the steering axle.

MAST (See FIGURE 12.)

⚠ CAUTION

DO NOT use steam or high-pressure water to clean the load rollers or the lift chains. Steam and high-pressure water can remove the lubrication from the bearings in the load rollers. Water in the bearings of the sheaves and the link pins of chains can also shorten the service life of these parts.

⚠ WARNING

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

Parts of the lift mechanism can move and cause serious injury. Do not allow anyone under a raised carriage or forks. Do not put any part of your body in or through the lift mechanism if any part of the lift mechanism can move.

Before you reach into the lift mechanism:

- Make sure that all parts of the lift mechanism are completely lowered.
- If the lift mechanism cannot be lowered completely, use blocks or chains on the mast weldments and carriage so that they cannot move. Use a chain to attach each moving part of the lift mechanism to a part that does not move. If blocks are used, make sure that blocks are placed between each part that moves and the ground. Operate the lift/lower control to check that all parts will not move, but do not allow the lift chains to become loose.
- Turn the key switch to OFF. Remove the key.

1. Clean the mast assembly. Inspect the mast channels in the areas where the rollers travel. If there are loose or displaced metal particles, remove the metal particles.

⚠ WARNING

Metal particles can fall into the eyes during the operation of the mast. Failure to remove this loose material can cause eye injury. Remove displaced metal particles with a grinder if necessary.

2. Lubricate the sliding surfaces and the load roller surfaces along the *full length* of the channels as shown in FIGURE 12. Only apply lubricant to surfaces that are clean and dry. Only apply lubricant to the darker areas like those indicated by 1 and 2.

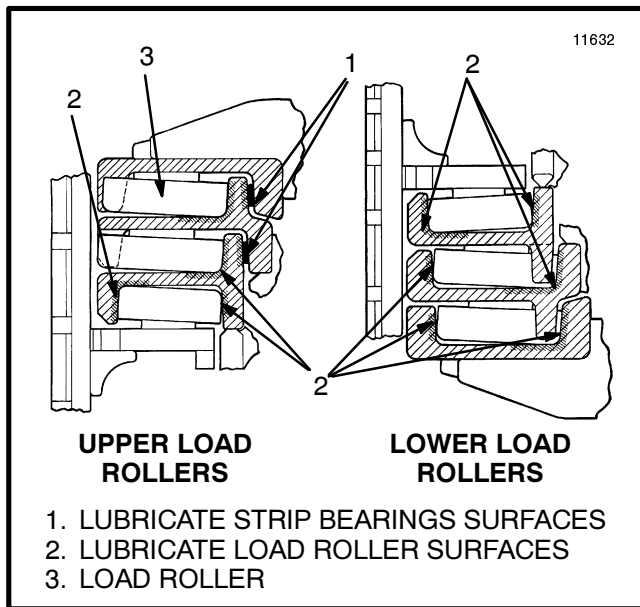


FIGURE 12. LUBRICATE THE MAST

NOTE: Some applications will require more frequent cleaning and lubrication of the mast assembly. **DO NOT** use a lubricant-spray on the surfaces of the mast channels where the load rollers make contact. The use of the correct lubricant is important! Use multi-purpose grease (Hyster Part No. 3020381) or an equivalent grease with 2% to 4% molybdenum disulfide. The load rollers and sheaves have sealed bearings that do not need additional lubrication.

3. Lubricate the pivots for the mast at the grease fittings on the pivots or the pivot pins. Use multi-purpose grease.

4. If a side-shift carriage is installed, lubricate the fittings for the rollers or the sliding surfaces with multi-purpose grease.

LIFT CHAINS (See FIGURE 13.)

Check for Wear

⚠ WARNING

Do not repair a worn or damaged lift chain. Replace a worn or damaged lift chain with a new chain. If a pair of lift chains is used in the mast, both lift chains must be replaced.

pitch		Total length of 20 links (pitch) of new chain		WEAR LIMIT The maximum length of 20 links	
mm	(inch)	mm	(inch)	mm	(inch)
12.7	(0.50)	254.0	(10.0)	261.6	(10.3)
15.9	(0.63)	317.5	(12.5)	327.0	(12.9)
19.1	(0.75)	381.0	(15.0)	392.4	(15.6)
25.4	(1.00)	508.0	(20.0)	523.3	(20.6)

1. CHAIN WEAR SCALE

12174

NOTE: The instructions for measuring chain wear are shown on the Chain Wear Scale.

FIGURE 13. CHECK THE LIFT CHAINS

If a section of chain is 3% longer than a similar section of new chain, the chain is worn and must be replaced. If a chain scale is available, check the lift chains as shown in FIGURE 13. If a chain scale is not available, measure 20 links of chain. Measure from the center of a pin to the

center of another pin 20 links away. Compare the length with the chart in FIGURE 13. Replace the chain if the length of 20 links of the worn section is more than the WEAR LIMIT.

Inspect the lift chains for edge wear where they pass over the chain sheaves. Make sure the chain links are a minimum of 95% (5% wear) of a chain link that is not worn. See FIGURE 7.

Lubrication

Lubricate the lift chains with clean 30W engine oil or Hyster Chain and Cable Lubricant (Hyster Part No. 171350).

NOTE: Lubrication or cleaning (see EVERY 2000 HOURS OR YEARLY) can be needed more frequently in very dirty applications. Correct lubrication helps provide normal service life from these parts.

FORKS (See FIGURE 6.)

⚠ WARNING

Never repair damaged forks. Do not heat, weld, or bend the forks. Forks are made of special steel using special methods. Replace damaged forks.

1. Check the heel and attachment points of the forks with a penetrant or magnetic particle inspection.
2. Measure the thickness of the forks at a vertical section where there is no wear. This is dimension X. Now measure the thickness at the heel (4) of the fork. If the thickness is not more than 90% of dimension X, replace the fork.
3. Use clean engine oil as necessary to lubricate the guides and locks for the forks.

BRAKE FLUID

⚠ WARNING

Loss of fluid from the master cylinder indicates a leak. This condition can cause brake failure. The result can be material damage or personal injury. Repair the brake system before the lift truck is used. Replace the brake fluid in the system if there is dirt, water, or oil in the system.

Check the brake fluid in the reservoir for the master cylinder. Add brake fluid as necessary. Use the brake fluid shown in the MAINTENANCE SCHEDULE.

OTHER LUBRICATION

Lubricate hinges, pins, linkages, cables, pedals, and levers as necessary. Use SAE 30 oil, multi-purpose grease, or silicone lubricant-spray (Hyster Part No. 328388) as needed. See the MAINTENANCE SCHEDULE.

SEAT BRAKE

Adjust the seat brake for parking as described in section for **THE FRAME**. Lubricate the linkage for the brake as shown in FIGURE 14. See the MAINTENANCE SCHEDULE for lubricants.

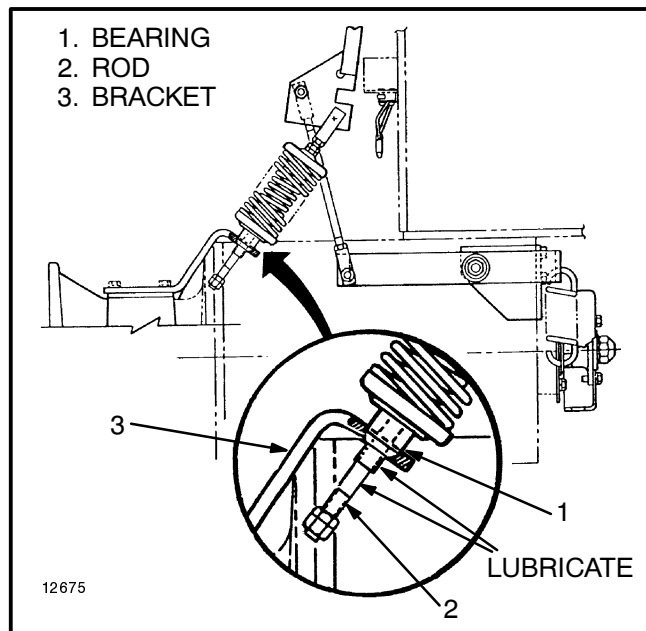


FIGURE 14. LUBRICATE THE LINKAGE FOR THE SEAT BRAKE

ELECTRICAL INSPECTION

⚠ WARNING

Disconnect the battery connector to prevent injury from electric shock before you make any inspections or repairs.

⚠ CAUTION

Never clean the components of the electrical system with steam or high pressure water.

Contactors (See FIGURE 15.)

The contactor contacts are made of special silver alloy. The contacts will look black and rough from normal operation. This condition does not cause problems with the operation of the lift truck. Cleaning is not necessary. **DO NOT USE A FILE ON THE CONTACTS. DO NOT LUBRICATE THE CONTACTS.** Always replace the contacts in sets. Check for equal spring tension if the contacts do not wear evenly. See the **ELECTRICAL** sections for replacement and adjustment procedures.

Motor Brushes

NOTE: The traction motor and the hydraulic pump motor are below the battery compartment. Remove the battery and the access panel to check the motors. The steering pump motor is on a vertical mount below the floor plate. Remove the floor plates for access to the steering pump.

1. Visually inspect the commutator and brushes every 350 hours. Make sure the surface of the commutator is good and the operation of the motor is correct. Worn motor brushes must be replaced before they damage the surface of the commutator.

Move the brush spring and remove a brush from the brush holder. When the brush wears within approxi-

mately 1.5 mm (0.060 in) of where the brush wire joins the brush, the brush must be replaced.

2. Some lift trucks are equipped with brush wear indicators on the traction and hydraulic motors. The brush wear indicators give a signal on the LED display panel on the instrument panel. The sensor wires for the brush wear indicators are an insert in the brush material when it is made. When the brush wears within 1.5 mm (0.060 in) of the brush wire, the insulation between the sensor wire and the brush material is destroyed. The connection between the brush and the sensor causes the LED indicator to illuminate. The brush wear indicators will not indicate a damaged commutator nor indicate a motor malfunction. Visually inspect the commutator and brushes on lift trucks with brush wear indicators also.

3. Inspect the brush holders for burns or damage. Make sure the brush holder is fastened tightly to the mounts at the end of the motor. Make sure the brushes will move freely and smoothly in the brush holders.

4. Check the brush springs for damage from heat and corrosion. Replace a damaged brush spring.

See the section **DC MOTOR MAINTENANCE, 620 SRM 294**, for additional information to inspect the commutator and brushes.

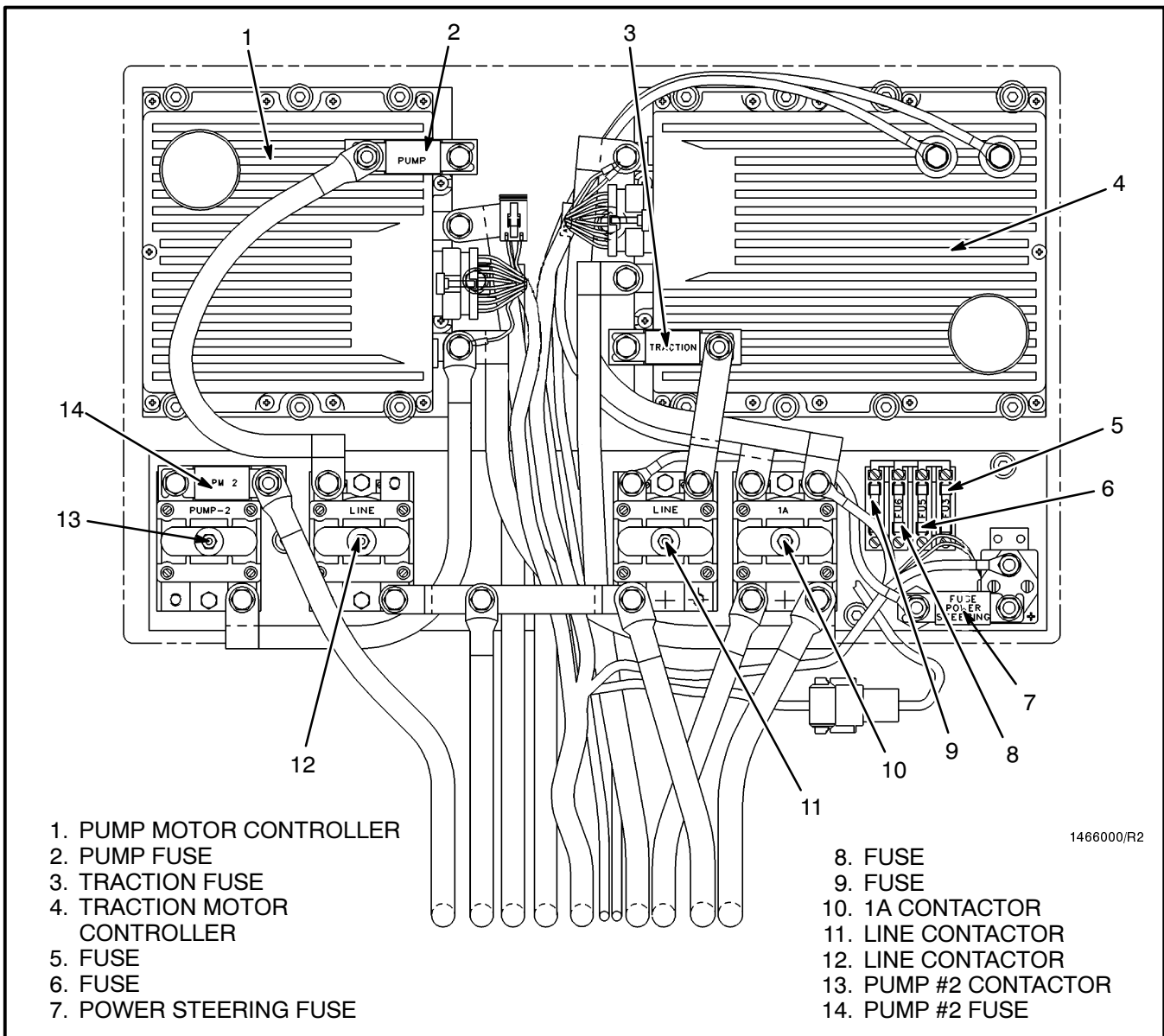


FIGURE 15. TRACTION AND PUMP MOTOR CONTROLLERS

EVERY 2000 HOURS OR YEARLY

HYDRAULIC SYSTEM

⚠ WARNING

The hydraulic oil is **HOT** at operating temperature. Do not permit the hot oil to contact the skin and cause a burn.

⚠ CAUTION

Do not permit dirt to enter the hydraulic system when the oil level is checked or the filter is changed.

Dirt can cause damage to components of the hydraulic system.

Change the Filter for the Hydraulic Oil (See FIGURE 16.)

NOTE: Change the oil filter for the hydraulic system after the first 100 hours on new lift trucks.

1. Remove the floor plates. Clean the top of the hydraulic tank in the area of the filter.

2. Remove the nut, retainer and wire clamp that hold the filter head on the tank. Remove the filter head. Remove the filter from the tank.

NOTE: The hydraulic oil filter has a by-pass relief valve that is part of the filter. Make sure the correct replacement filter with a by-pass relief valve is installed.

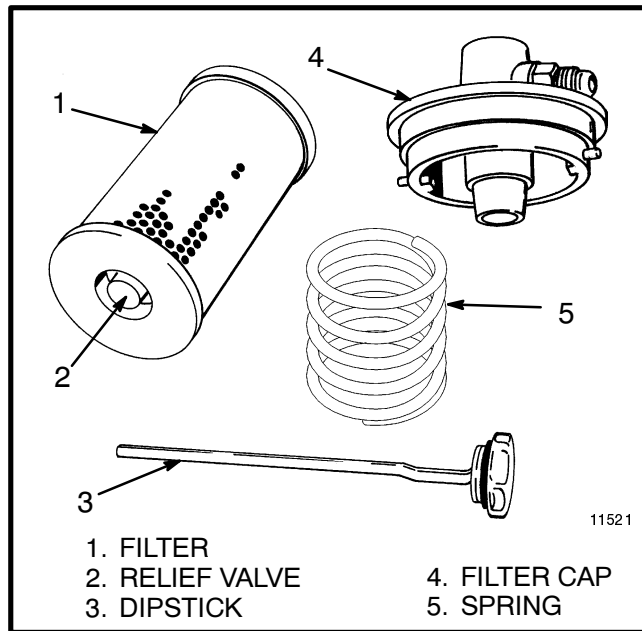


FIGURE 16. HYDRAULIC FILTER

Change the Hydraulic Oil

Put the lift truck on a level surface. Lower the mast. Put a drain pan with a 25 litre (26 qt) capacity under the hydraulic tank. Disconnect the hydraulic hose from the hydraulic tank to the steering pump and drain the oil into the drain pan. (The quantity of oil is according to the size of the mast and the optional hydraulic equipment.)

When the oil has drained, connect the hydraulic hose. Fill the hydraulic tank with the correct oil *after* the filter is installed. See the MAINTENANCE SCHEDULE.

DIFFERENTIAL AND SPEED REDUCER

Remove the plug from the bottom of the differential housing to drain the oil. See the MAINTENANCE SCHEDULE for the correct lubricant. Fill the differential and speed reducer so that the oil level is even with the fill plug or the “FULL” mark on the dipstick.

SERVICE BRAKES

⚠ WARNING

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

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

Cleaning Procedures:

- a. Do not release brake lining dust from the brake linings into the air when the brake drum is removed.
- b. Use a solvent approved for cleaning of brake parts to wet the lining dust. Follow the instructions and cautions of the manufacturer for the use of the solvent. If a solvent spray is used, do not create brake lining dust with the spray.
- c. 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 an “DANGEROUS FIBERS” warning label on the plastic bag or airtight container.
- d. Any cleaning cloths that will be washed must be cleaned so that fibers are not released into the air.

⚠ CAUTION

Do not use an oil solvent to clean the wheel cylinder. Use a solvent approved for cleaning of brake parts. Do not permit oil or grease in the brake fluid or on the brake linings.

Check the brake lining and parts of the brake assembly for wear or damage. See the BRAKE SYSTEM section for the removal and installation procedures of the drive wheels and hubs. If the brake linings or brake shoes are worn or damaged, they must be replaced. Brake shoes must be replaced in complete sets. Inspect the brake drums for cracks or damage. Replace any damaged parts.

CONTACTORS

Always replace the contacts of a contactor as a complete set. See the **ELECTRICAL** sections for replacement and adjustment procedures.

WHEEL BEARINGS

Steer Wheels, Lubrication

Lubricate the wheel bearings in the hubs for the steer wheels with multi-purpose grease. Do the following procedure to install the hubs:

- a. Install the hub and bearings on the spindle.
- b. Install the castle nut. Tighten the castle nut to 200 Nm (150 lbf ft) while rotating the wheel and hub. Loosen the nut until the wheel rotates freely and the bearings are not loose. Tighten the nut to 35 Nm (25 lbf ft) and install the cotter pin at the closest slot in the nut. Install the cap for the bearings.

Drive Wheels, Lubrication

Lubricate the inner wheel bearings in the hubs for the drive wheels with multi-purpose grease. See the section for the **DRIVE AXLE** or the **BRAKE SYSTEM** for the

procedures to remove and install the drive wheels and hubs.

LIFT CHAINS

WARNING

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

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

Remove the lift chains. Clean the lift chains by soaking them in a solvent that has a petroleum base for at least 30 minutes. Use compressed air to completely dry the chains when they are clean.

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

GENERAL PROCEDURES

HOW TO CHARGE THE BATTERY

WARNING

If the lift truck was operated with a low battery, inspect all contactors for welded contacts **BEFORE** you connect a charged battery. The lift truck can not be controlled if contacts are welded. This condition can cause personal injury when the battery is connected.

CAUTION

Never connect the battery charger plug to the plug of the lift truck. You can damage the electronic controller. Make sure the battery charger voltage is the correct voltage for the battery.

WARNING

The acid in the electrolyte can cause injury. Use water to flush the area and make the acid neutral with a water and soda solution. Acid in the eyes must

be flushed with water. Batteries generate explosive fumes when they are being charged. Keep fire, sparks and burning material away from the battery charger area. Avoid sparks from the battery connections. Charge batteries only in the special area for charging batteries. When the battery is being charged, keep the vent caps clear. The battery charger area must have ventilation so that explosive fumes are removed. Open the battery cover on a covered battery. Disconnect the battery when doing cleaning and maintenance.

Correct use of the hydrometer (See FIGURE 17.) and proper operation of the battery charger is important. Follow the instructions of the charger manufacturer. Never let the battery discharge below the minimum value given by the battery manufacturer. A fully charged battery will have a specific gravity of 1.265 to 1.310 at 25°C (77°F). Never charge a battery at a rate that will

raise the electrolyte temperature above 49°C (120°F). Never let a battery stay discharged for long periods.

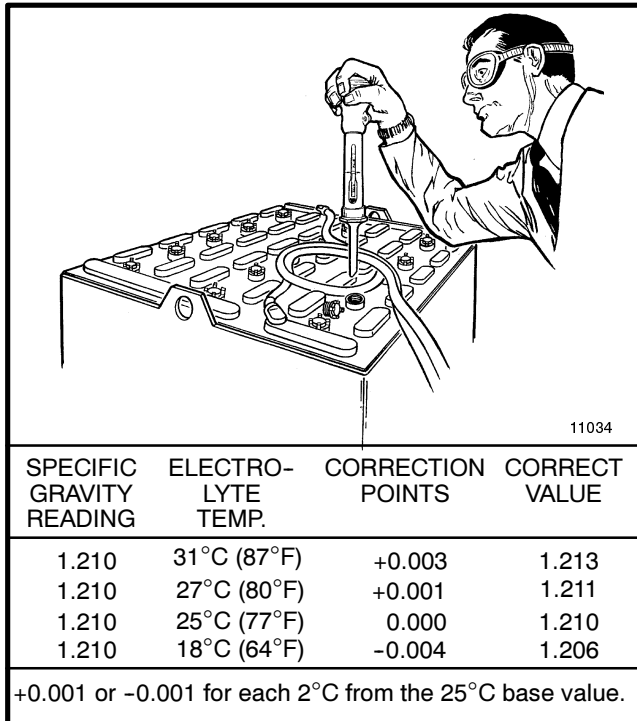


FIGURE 17. CHECK SPECIFIC GRAVITY

1. **NORMAL CHARGE:** This charge is the charge that is normally given to a battery that is discharged from normal service. Many users give this charge at a regular interval based on usage. This practice will keep the battery fully charged if the battery is not discharged below the limit. Always use a hydrometer (See FIGURE 17.) to check the battery if the interval charge cycle is used. Frequent charging of a battery that has 2/3 of a full charge or more can decrease battery life.

2. **EQUALIZING CHARGE:** This charge is at a low rate and balances the charge in all of the cells. The equalizing charge is normally given approximately once a month. It is a charge at a slow rate for three to six hours in addition to the regular charging cycle.

DO NOT give an equalizing charge more than once a week. The most accurate specific gravity measurements for a charged battery will be after an equalizing charge. If the specific gravity difference is more than 0.020 between cells of the battery after an equalizing charge, there can be a damaged cell. Consult your battery dealer.

NOTE: Many users have battery chargers that can follow a program to automatically charge a battery accord-

ing to recommendations of the battery manufacturer. Use the recommendations of the battery manufacturer for charging the battery.

Also see the section **THE INDUSTRIAL BATTERY, 2240 SRM 1**, for additional information on the charging and maintenance of a battery.

HOW TO CHANGE THE BATTERY

⚠ WARNING

Batteries are heavy and can cause an injury. Use care to avoid injury. Do NOT put hands, arms, feet and or legs between the battery and a solid object.

Make sure the capacity of the crane and spreader bar is greater than the weight of the battery. The weight of the battery is normally shown on the battery case. The maximum battery weight is shown on the lift truck capacity plate. The spreader bar must NOT be made of metal or it must have insulated straps.

The replacement battery must fit the battery area correctly. Use spacers to prevent the battery from moving horizontally in the battery compartment.

Make sure that the battery voltage and weight of the replacement battery is correct as shown on the capacity plate.

Make sure the battery restraint is locked in the down position and the battery retention bar is lowered and locked under the seat before the lift truck is operated..

Before connecting the battery, make sure the key switch is in the OFF position and the parking brake is set.

1. Disconnect the battery. Move the connector and cables so that they will not be damaged when the battery is moved. Tilt the steering column forward and make sure the detent engages to hold the steering column. Slide the seat to the rear adjustment position. Release the lock on the battery restraint and tilt the battery restraint and seat to the up position. Make sure the battery restraint and the seat are locked in the up position.

2. If the lift truck has a hood, open the hood from over the battery. See FIGURE 19. If the battery is not a covered battery, put an insulating cover over the battery. If

the lift truck has a battery retention bar, secure the bar in the UP position.

3. Use a spreader bar and crane to lift the battery from the lift truck. See FIGURE 20. When a replacement battery is installed, make sure the battery fits the battery compartment. Use spacers to prevent the battery from moving more than a total of 13 mm (0.5 in) in any one horizontal direction. See FIGURE 18.

⚠ WARNING

Correct operation of the battery restraint system requires that the battery does not move more than 13 mm (0.5 in). Make sure the battery spacers are correctly adjusted. Use only spacers supplied with the truck.

4. The lift trucks are equipped with adjustable spacers in the battery compartment. See FIGURE 18. Add or remove shims from under the front spacer bar to control

the movement of the battery in the forward and backward directions. Install an equal number of shims at each capscrew. Install the unused shims under the nuts of the capscrews (outside battery compartment). The spacers on each side of the battery can be adjusted to control the movement of the battery from side to side. Access to the nuts for the spacers for the sides of the battery is under the frame near the steer tires. Tighten all capscrews. It can be necessary to install the side spacers facing the opposite direction for some batteries. If the spacers can not be adjusted for a battery that is specified for this lift truck, see your dealer for Hyster lift trucks for the correct spacers.

⚠ WARNING

Make sure the capacity of the crane and spreader bar is greater than the weight of the battery. The weight of the battery is normally shown on the battery case. The spreader bar must NOT be made of metal or it must have insulated straps.

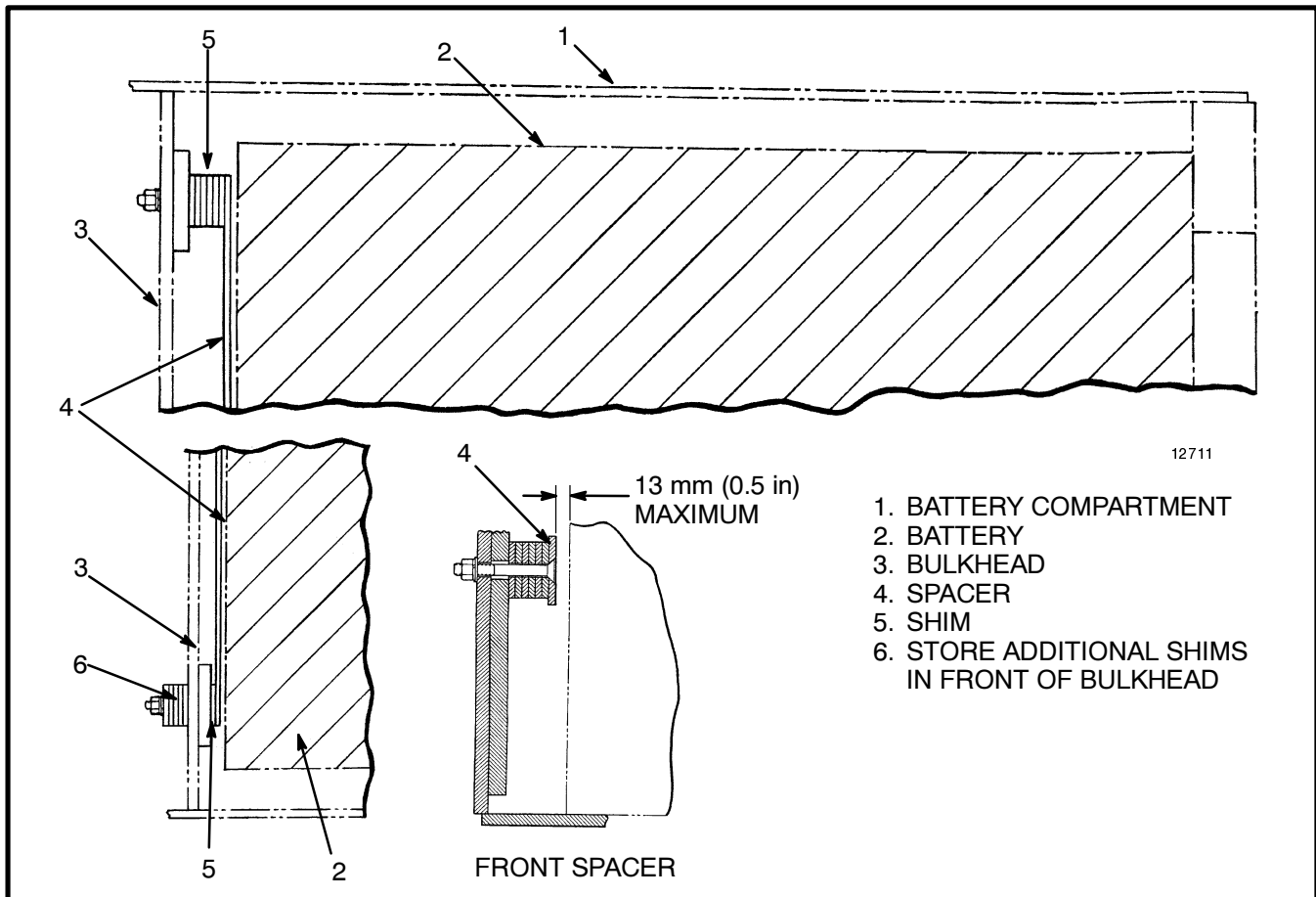


FIGURE 18. BATTERY COMPARTMENT SPACERS

⚠ WARNING

Batteries are heavy. Use care to avoid injury.

The replacement battery must fit the battery compartment so that the battery restraint system operates correctly.

Make sure the weight of the replacement battery is within the maximum and minimum weights shown on the capacity plate.

Make sure that the voltage of the battery is the correct voltage for the lift truck.

Make sure that the key switch is in the OFF position and the park brake is applied before you connect the battery.

Make sure the battery restraint plate is locked in the down position and the battery retention bar is lowered and locked under the seat before the lift truck is operated.

1. Disconnect the battery. Move the connector and cables so that they will not be damaged when the battery is moved. Tilt the steering column forward and make sure it locks in position. Slide the seat to the rear adjustment

position. Release the lock on the battery restraint and tilt the battery restraint and seat to the up position. Make sure they are locked in the up position.

2. If the lift truck has a hood, open the hood from over the battery (see FIGURE 19.). If the battery is not a covered battery, put an insulating cover over the battery. Lift trucks without hoods must have a battery cover. If installed, raise the battery retention bar and put it in the up position.

3. Use a spreader bar and crane to lift the battery from the lift truck. (See FIGURE 20.) When a replacement battery is installed, make sure the battery fits the battery compartment. Use the spacers designed by Hyster Company to prevent the battery from moving more than 13 mm (0.5 in) in any horizontal direction. See the **OPERATING MANUAL** for installation of spacers.

⚠ WARNING

Correct operation of the battery restraint system requires that the battery does not move more than 13 mm (0.5 in). Make sure that the battery spacers are correctly adjusted.

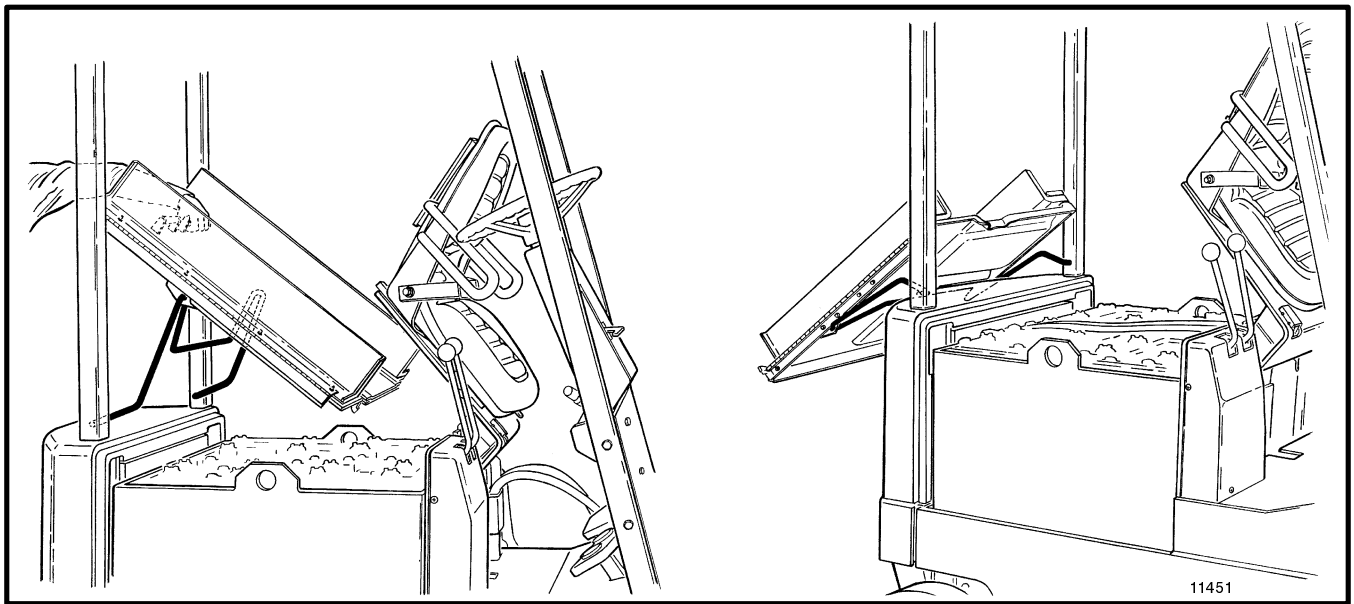


FIGURE 19. OPEN THE HOOD

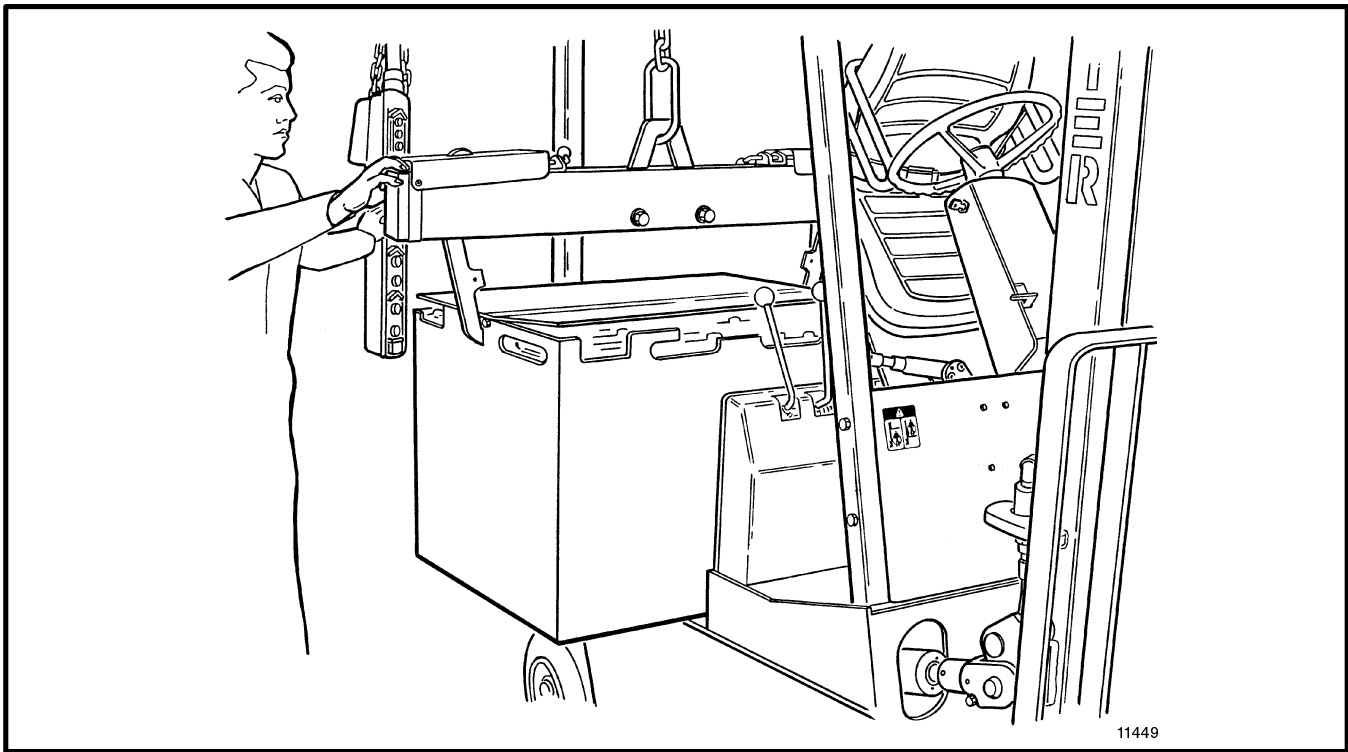


FIGURE 20. CHANGE THE BATTERY

4. The lift trucks are equipped with adjustable spacers in the battery compartment. Add or remove shims from under the front spacer bar to control the movement of the battery in the forward and backward directions. Install an equal number of shims at each capscrew. Install the unused shims under the nuts of the capscrews (outside battery compartment). The spacers on each side of the battery can be adjusted to control the movement of the

battery from side to side. Access to the nuts for the spacers for the sides of the battery is under the frame near the steer tires. Tighten all capscrews. It can be necessary to install the side spacers facing the opposite direction for some batteries. If the spacers can not be adjusted for a battery that is specified for this lift truck, see your dealer for Hyster lift trucks for the correct spacers.

SAFETY PROCEDURES WHEN WORKING NEAR THE MAST (1 of 2)

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 the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that the power is off and the key is removed. Put a “DO NOT OPERATE” tag in the 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 the mast or lift truck at any time. Use a ladder or personnel lift to work on the 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 for the mast.

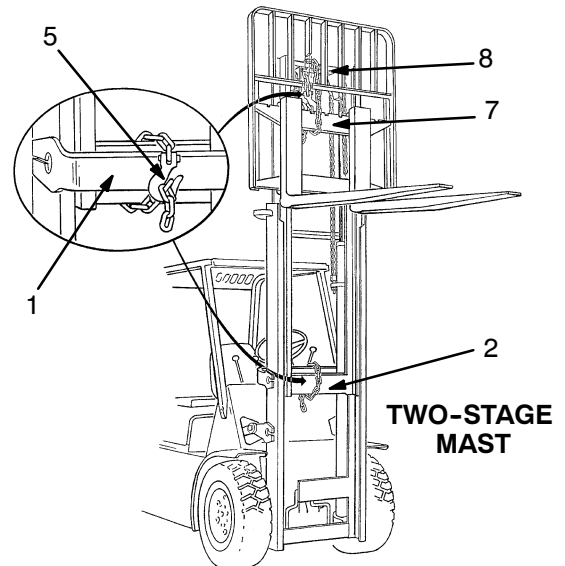
WHEN WORKING NEAR THE MAST ALWAYS:

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

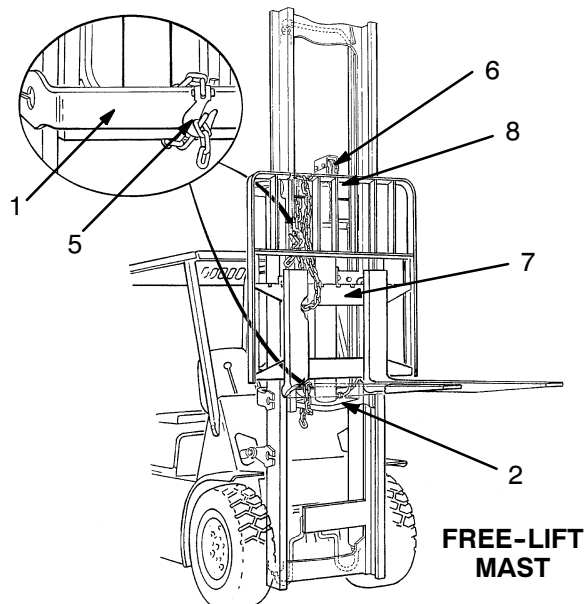
OR

- If parts of the mast must be in a raised position, install a safety chain to restrain the moving parts of the mast. Connect moving parts to a part that does not move. Follow these procedures:

- Put the mast in a vertical position.
 - Raise the mast to align the bottom crossmember of the weldment that moves in the outer weldment with a crossmember on the outer weldment (1). On the two-stage and free-lift mast, the moving part is the inner weldment (2). On the three-stage mast it is the intermediate weldment (3).
 - Use a 3/8 inch minimum safety chain with a hook (5) to fasten the crossmembers together so that the movable member can not lower. Put the hook on the back side of the mast. Make sure the hook is completely engaged with a link in the chain. Make sure the safety chain does not touch lift chains or chain sheaves, tubes, hoses, fittings or other parts on the mast.
 - Lower the mast until there is tension in the safety chain and the free-lift cylinder (6) (free-lift and three-stage masts only) is completely retracted. If running, stop the engine. Apply the parking brake. Install a “DO NOT REMOVE” tag on the safety chain(s).
 - Install another safety chain (3/8 inch minimum) between the top or bottom crossmember of the carriage (7) and a crossmember on the outer weldment (8).
- Apply the parking brake. After lowering or restraining the mast, shut off the power and remove the key. Put a “DO NOT OPERATE” tag in the operator’s compartment. Disconnect the battery on electric lift trucks and put a tag or lock on the battery connector.

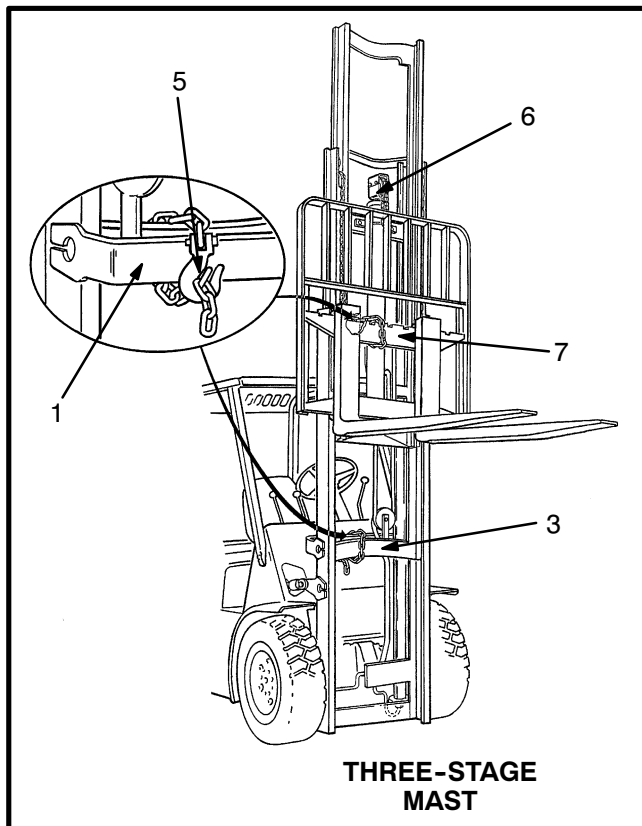


TWO-STAGE MAST



FREE-LIFT MAST

SAFETY PROCEDURES WHEN WORKING NEAR THE MAST (2 of 2)



CHECK FOR LEAKS IN THE LIFT AND TILT SYSTEM

⚠ WARNING

Never allow any person under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered, the key switch is in the OFF position and the key is removed.

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

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 pressure.

During test procedures for the hydraulic system, fasten the load to the carriage with chains to prevent it from falling. Keep all personnel away from the lift truck during the tests.

Check the Lift Cylinders for Leaks

1. Operate the hydraulic system. Put a capacity load on the forks and raise and lower the load several times. Lower the load and tilt the mast forward and backward several times. Check for leaks.

2. Raise the carriage and load so that the rods of the main lift cylinders extend at least 60 cm (2 ft). If the carriage lowers slowly with the control valve in the NEUTRAL position, there are leaks inside the hydraulic system. The maximum speed that the carriage is allowed to lower is 100 mm (4 in) per 10 minutes when the hydraulic oil is 50°C (122°F).

3. Check the lift cylinders for internal leaks. Remove the load from the forks. Install a gate valve in the supply line between the main control valve and the mast. Put a capacity load on the forks again. Raise the carriage and load so that the rods of the main lift cylinders extend at least 60 cm (2 ft). Close the gate valve. If the carriage or mast weldments lower slowly, the seals in the lift cylinders have leaks.

4. If the carriage and mast weldments do not move, open the gate valve and check for movement again. If the carriage lowers when the valve is open, check for leaks in the hydraulic lines or fittings. If no leaks are found, the main control valve can have damage. Remove the load from the forks.

Check the Tilt Cylinders for Leaks

1. Put a capacity load on the forks. Slowly tilt the mast forward. If the mast continues to slowly tilt forward when the control valve is in the NEUTRAL position, there are leaks inside the hydraulic system. The maximum speed that the mast is allowed to tilt forward when there are internal leaks in the lift system is 34 mm (1.3 in) per 10 minutes (measured at the tilt cylinder). The maximum speed is measured when the hydraulic oil is 50°C (122°F).

2. If the leak rate is greater than specifications, remove the load from the mast. Install a valve between the port at the front of the tilt cylinder and the hydraulic line. Put the load on the forks again. Close the valve. If the mast tilts slowly forward, the cylinder seals are leaking. Be sure to check both tilt cylinders.

3. If the mast does not move, open the gate valve and check for movement again. If the mast moves forward

when the gate valve is open, check for leaks in the hydraulic lines or fittings. If no leaks are found, the main control valve can have damage. Remove the load from the forks.

LIFT CHAIN ADJUSTMENTS (See FIGURE 21.)

When the lift chains are correctly adjusted:

- The tension will be the same on each chain of the chain set. Check tension by pushing on both chains at the same time.
- The chain length will be correct.
- The chains must travel freely through the complete cycle.

1. When adjusting the two-stage or the free-lift mast, start with step 2. Do the following step first when adjusting the three-stage mast.

- a. Adjust the chain anchors on the outer weldment so that the top of the inner (or third) weldment is level with the top of the outer weldment. The tolerance is ± 1.5 mm (0.06 in).

2. Put a load equal to 80 to 90% of the capacity load on the forks. Lower the forks as much as possible. Tilt the mast fully backward.

3. See FIGURE 21. Check the amount that the bottom carriage roller extends below the inner channel of the mast. The carriage roller must not extend more than 1/3 of the roller diameter below the inner channel. If the adjustment is not correct, remove the load and adjust the chain anchors. Make sure that each chain anchor is adjusted the same amount.

4. Remove the load from the forks. On the two-stage mast, check the clearance of the carriage when the mast is fully extended. On a mast with a free-lift cylinder, make this check after extending the weldments a short distance. The carriage stops must not touch the stop on the top crossmember of the inner weldment. The chains are too tight if the carriage touches the crossmember. Put the mast in a vertical position and lower the carriage completely. If the forks do not just touch the surface, the chains are too tight. If the chains are too tight, adjust the chain anchors. Make sure that each anchor is adjusted the same amount.

NOTE: When the chain adjustments are complete, make sure that the threads on the nuts of the chain anchors are completely engaged. Make sure that all of the adjustment is not removed from the chain anchors. The chain anchors must be able to move in their sockets.

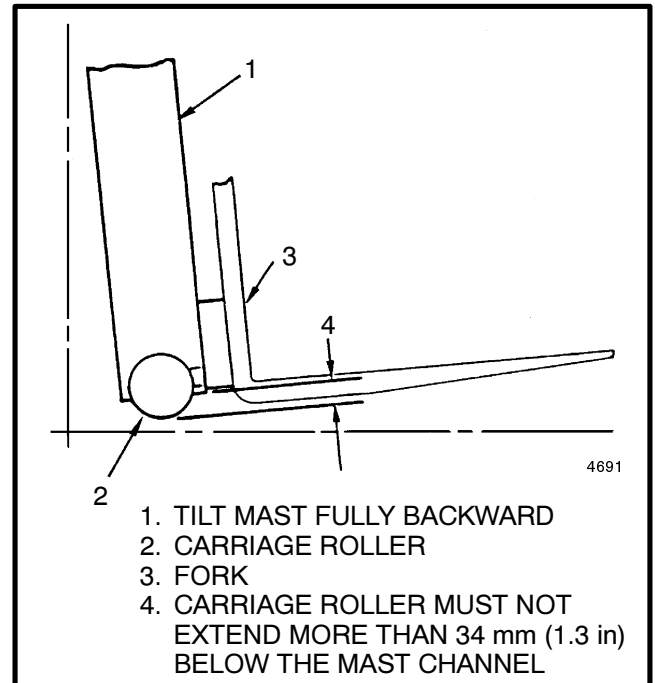


FIGURE 21. LIFT CHAIN ADJUSTMENTS

HOW TO CHECK THE PMT CIRCUIT

WARNING

Some malfunctions can make the traction motor run at high speed with no control by the speed controller. The PMT circuit prevents this operation if these malfunctions occur. Do not operate the lift truck if the PMT circuit does not operate correctly.

The Pulse Monitor Trip (PMT) circuit only functions if a fault occurs. To check the circuit, we must cause a temporary malfunction. Check the PMT circuit for correct operation as follows:

1. Raise the drive wheels and put the lift truck on blocks. See “How To Raise The Drive Tires” in this section. Release the parking brake.

WARNING

Disconnect the battery connector before making any inspections or repairs. Personal injury or equipment and tool damage can occur if the battery is not disconnected.

Do not touch the terminals of capacitor C1 of the traction or lift control circuits. The charge on the capacitors can cause electrical shock and personal injury. Use an insulated screwdriver or jumper wire to make a short-circuit across the capacitor terminals to discharge each capacitor. This will discharge the capacitors to prevent electrical shocks.

2. Disconnect the battery, open the electrical compartment and discharge capacitor(s) C1 on the SCR control panels.

3. Disconnect the gate lead from the SCR 5 for the traction circuit (white/violet wire). The gate lead has a push-on connector. Make sure that the end of the lead does not touch any other surface. See the **DIAGRAMS** section that came with the lift truck for the location of the gate lead.

4. Connect the battery.

5. Sit on the seat to close the seat switch and turn the key to the “**ON**” position. Actuate the Monotrol control pedal or the direction control lever and accelerator for slow movement in the FORWARD or REVERSE direction.

6. Listen for the direction contactor to open. The traction system will not operate. The traction motor controller will allow two power pulses before opening the contactor.

7. As soon as the PMT circuit disables the traction control, turn the key to the “**OFF**” position. If the PMT circuit does not disable the traction control, replace the control card. Correct procedures are in the **SERVICE MANUAL**:

8. Disconnect the battery, open the electrical compartment and discharge capacitors C1 (and C2 if installed) on the SCR control panels as described in the earlier **WARNING**.

9. Connect the SCR 5 gate lead. Connect the battery. Raise the drive wheels and remove the blocks. Check for normal operation of the traction motor.

WELDING REPAIRS

Some repairs require welding. If an acetylene or arc welder is used, make sure the procedures in the following **WARNING** and **CAUTION** are done.

WARNING

Welding can cause a fire or an explosion. Always follow the instructions in the **FRAME** section of the **SERVICE MANUAL** if a fuel or hydraulic tank must be welded. Make sure there is no fuel, oil, or grease near the weld area. Make sure there is good ventilation in the area where the welding must be done.

Do not heat, weld, or bend forks. Forks are made of special steel using special methods. Get information from your dealer for Hyster lift trucks before welding on an mast.

CAUTION

When an arc welder is used, always disconnect the battery connector on the lift truck. This action will prevent damage to the SCR control.

Connect the ground clamp for the arc welder as close as possible to the weld area. This action will prevent damage to a bearing from the large current from the welder.

CHANGES TO THE OVERHEAD GUARD

WARNING

Do not weld mounts for lights or accessories to the legs of the overhead guard. The strength of the overhead guard can be reduced by welding or heating.

Do not operate the lift truck without the overhead guard correctly fastened to the lift truck.

TIRES AND WHEELS

(See FIGURE 22. and FIGURE 23.)

WARNING

The type of tires shown on the lift truck capacity plate. Make sure the capacity plate is correct for the type of tires that are installed on the lift truck.

General

These lift trucks use solid rubber tires. Solid rubber tires made from softer or harder material can be installed as optional equipment. The tread on the solid rubber tires can be either smooth or it can have lugs. Electric compound tires are recommended. Do not mix types of tires or tread on the lift truck. Make sure the type of tires that

are installed on the lift truck are the same as shown on the lift truck capacity plate.

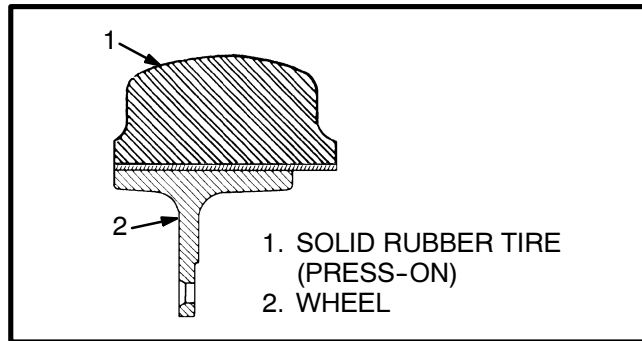


FIGURE 22. WHEEL AND TIRE

Remove The Wheels From The Lift Truck

⚠ WARNING

Wheels must be changed and tires repaired by trained personnel only.

Always wear safety glasses.

1. Raise the lift truck as described in **How To Put A Lift Truck On Blocks** in this manual.

2. Remove the wheel nuts and remove the wheel from the lift truck. Lift truck wheels are heavy.

Remove The Tire From The Wheel And Install Tire On The Wheel (See FIGURE 23.)

1. The correct tools, equipment and a press ring must be used for each size of wheel. Use a press to push the wheel from the rim and tire. The capacity of the press must be approximately 36 000 kg to 181,600 kg (80,000 to 400,000 lb).

NOTE: Make sure the tires are installed on the wheels according to the dimensions shown in FIGURE 23. The tires must be installed the same for both wheels (drive or steer). Also check the capacity plate of the lift truck for the correct tread width.

2. When the drive wheels are installed on the lift truck, tighten the wheel nuts to the torque shown in the Specifications column in the MAINTENANCE SCHEDULE.

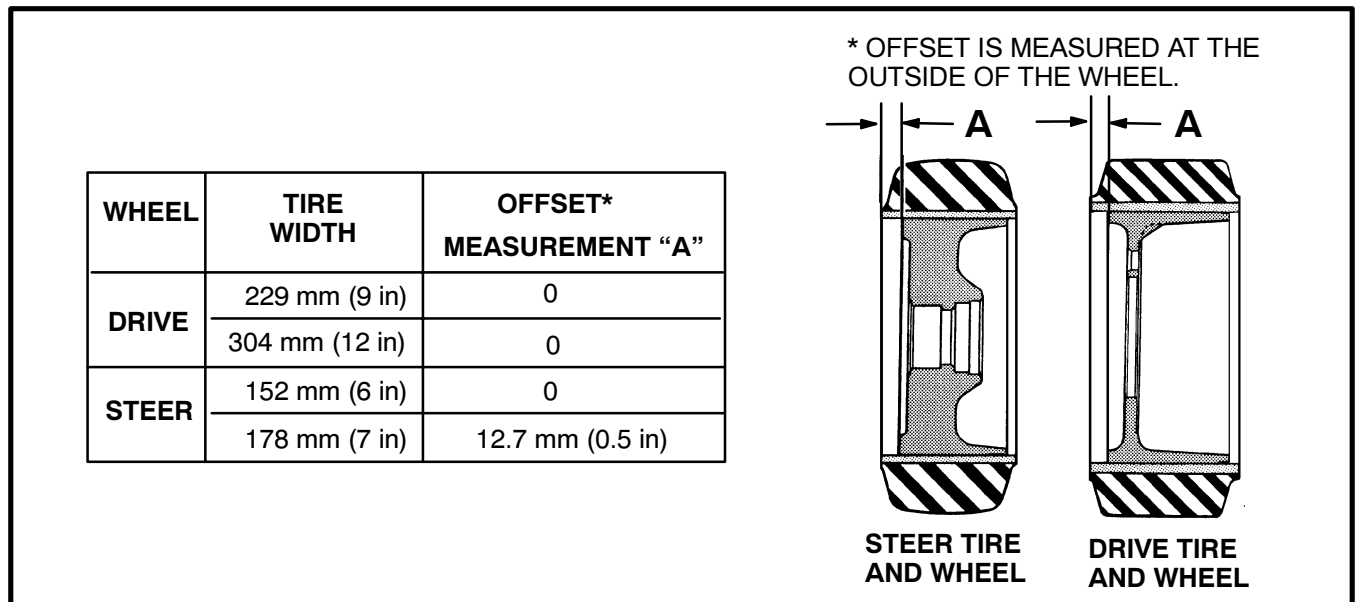


FIGURE 23. WHEEL AND TIRE MOUNTS

Install The Wheels

1. Install the wheel on the hub. Tighten the nuts as shown in the Specifications.

CAUTION

Check all wheel nuts after 2 to 5 hours of operation: when new lift trucks begin operation and on all lift trucks when the drive wheels have been removed and installed. Tighten the nuts in a cross pattern to the correct torque value shown in the MAINTENANCE SCHEDULE. When the nuts stay tight for

eight hours, the interval for checking the torque can be extended to 350 hours.

2. The steering wheels are fastened to the spindle of the steering axle with a large castle nut. Make sure the inner and outer bearings are correctly lubricated with grease. Install the wheel and inner bearing assembly on the spindle. Install the outer bearing cone and castle nut. Tighten the castle nut to 200 Nm (150 lbf ft) while the wheel is rotated. Loosen the castle nut to less than 27 Nm (20 lbf ft). Tighten the castle nut to 34 Nm (25 lbf ft). Tighten the castle nut to the first position where the cotter pin can be installed. Install the cotter pin.

BATTERY SPECIFICATIONS

MODEL	VOLTS	MINIMUM COMPARTMENT SIZE Length x Width	BATTERY LENGTH Min./Max.	WEIGHT	
				Minimum	Maximum
E3.50-4.00XL (E70-80XL ₃)	36	841 x 987 mm (33.1 x 38.9 in)	950 / 990 mm (37.4 / 39.0 in)	1542 kg (3400 lb)	2400 kg (5292 lb)
E5.00XL (E100XL ₃ S)	36	841 x 987 mm (33.1 x 38.9 in)	950 / 990 mm (37.4 / 39.0 in)	1633 kg (3600 lb)	2400 kg (5292 lb)
E5.00XL (E100XL ₃)	36	694 x 1037 mm (27.3 x 40.8 in)	1115 / 1150 mm (43.9 / 45.3 in)	1814 kg (4000 lb)	2700 kg (5954 lb)
E5.50XL (E120XL ₃)	36	993 x 1146 mm (39.3 x 45.1 in)	1115 / 1150 mm (43.9 / 45.3 in)	1919 kg (4231 lb)	2700 kg (5954 lb)
E3.50-4.00XL (E70-80XL ₃)	48	841 x 987 mm (33.1 x 38.9 in)	950 / 990 mm (37.4 / 39.0 in)	1542 kg (3400 lb)	2400 kg (5292 lb)
E5.00XL (E100XL ₃ S)	48	841 x 987 mm (33.1 x 38.9 in)	950 / 990 mm (37.4 / 39.0 in)	1633 kg (3600 lb)	2400 kg (5292 lb)
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*BATTERY WIDTH

Batteries Without Cover: 950 to 1117 mm (37.4 to 44.0 in)

Batteries With Cover: 950 to 1143 mm (37.4 to 45.0 in)

NOTE: Maximum tolerances are +0 and -13 mm (+0 and -0.5 in) for the size of the battery compartment. The battery specification chart shows the maximum size tolerances that will permit the battery to still fit into a battery compartment.