SERVICE REPAIR

MANUAL

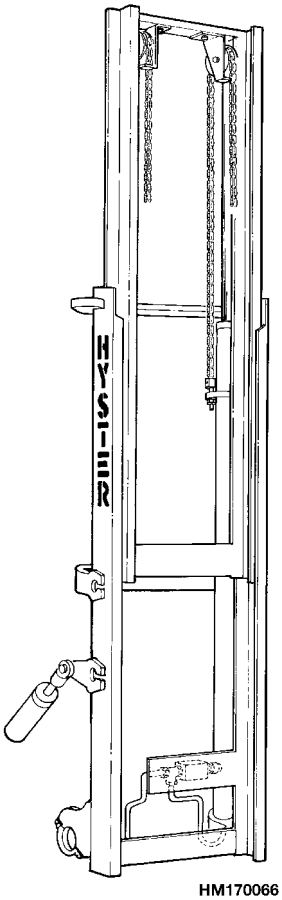
Hyster G005 (H70XL, H80XL, H90XL, H100XL, H110XL, H90XLS) Forklift

HYSTER

VISTA® MASTS

DESCRIPTION AND REPAIRS FOR LIFT TRUCKS WITH 3,500 TO 6,000 KG (7,000 TO 12,000 LB) CAPACITIES

H3.50-5.00XL (H70-110XL) [G005];
S3.50-5.50XL (S70-120XL) [D004];
E3.50-5.50XL (E70-120XL) [C098]



HM170066

HYSTER

PART NO. 897122

4000 SRM 340

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!

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This section is for the following models:

H3.50-5.00XL (H70-110XL) [G005];
S3.50-5.50XL (S70-120XL) [D004];
E3.50-5.50XL (E70-120XL) [C098]

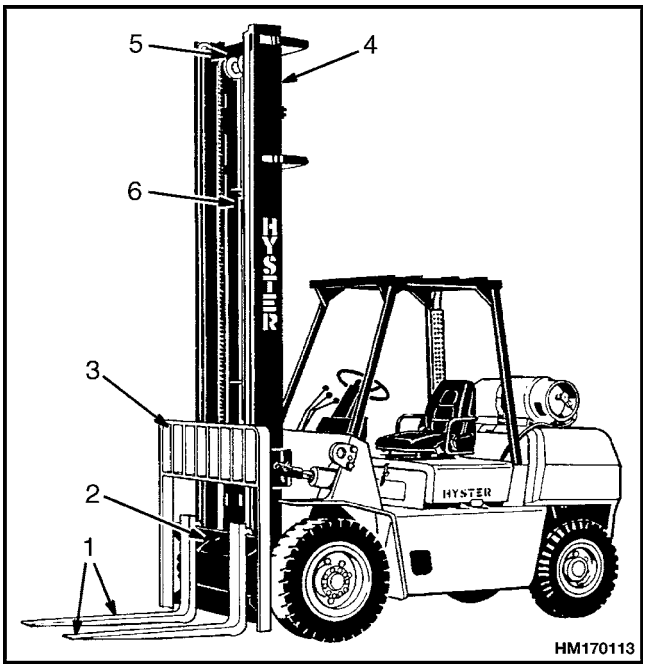
General

This section has the description, operation, and repair procedures for the Vista® masts for the 3,500 to 6,000 kg (7,000 to 12,000 lb) capacity lift trucks. Information on the different types of sideshift carriages is also included. The lift cylinders and the lowering control valves are described in the section **Lift Cylinders** 4000 SRM 1354000 YRM 135. The tilt cylinders are described in the section **Tilt Cylinders** 2100 SRM 103 .

Description and Operation

The vertical frames of a mast are called weldments. See Figure 1. Channels, load rollers and crossmembers are parts of the weldments. The channels on each side of the weldment are the support members of the mast and the tracks for the load rollers. During lifting and lowering a load, large forces are put on the mast assembly. The load rollers reduce the friction between the channels when the weldments move vertically.

Each mast can tilt forward and backward. Tilt cylinders are installed between the frame of the lift truck and the outer weldment of the mast. The pivot mounts at the bottom of the outer weldment connect the mast to the lift truck. During the tilt operation, the mast rotates on the pivot pins in the frame.



1. FORKS
2. CARRIAGE
3. LOAD BACKREST EXTENSION
4. OUTER WELDMENT
5. INNER WELDMENT
6. LIFT CYLINDER

Figure 1. Mast Components

CARRIAGES

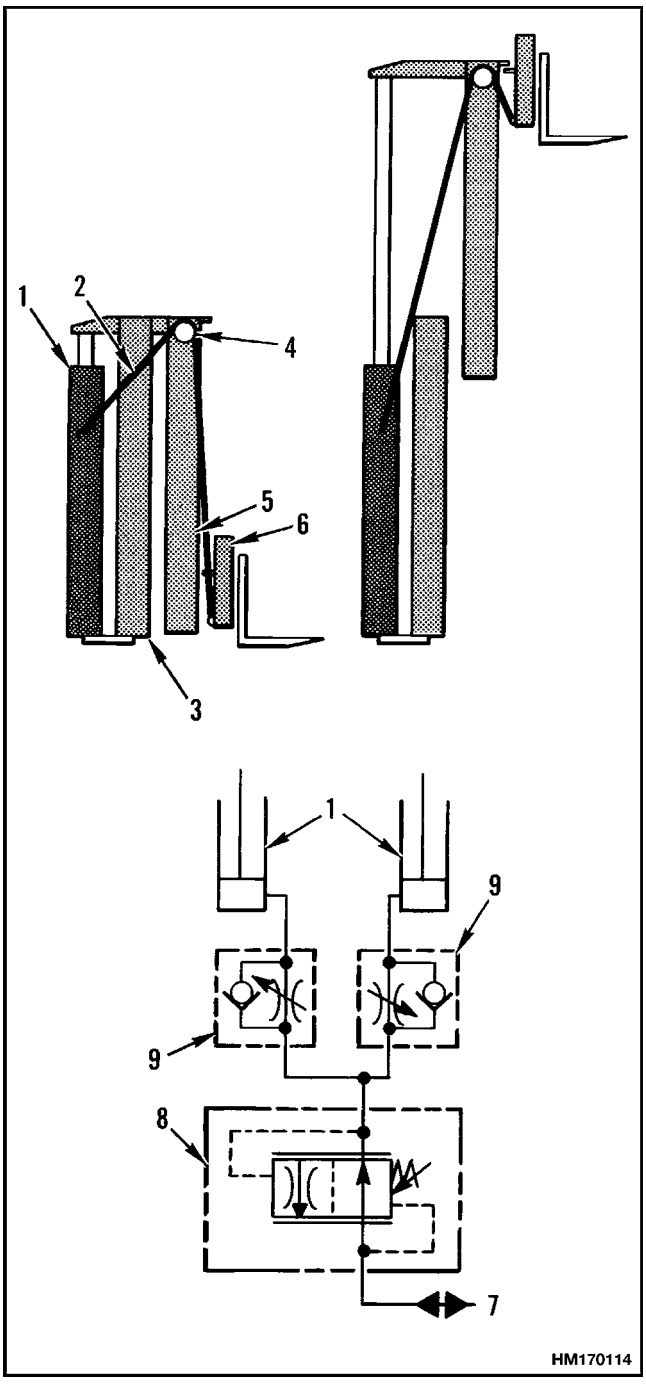
The carriage is a separate section that moves on load rollers within the vertical channels of the inner weldment. Forks or other types of load handling equipment are attached to the carriage. A load backrest extension is installed on the carriage.

A sideshift carriage permits the operator to hydraulically change the lateral position of the load handling device on the carriage.

TWO-STAGE MAST WITH LIMITED FREE-LIFT

The Vista Two-Stage mast has two weldments, an outer weldment and an inner weldment. See Figure 2. The outer weldment is connected to the lift truck by the pivot mounts and the tilt cylinders. The top of the outer weldment has one load roller on each side. The base of the inner weldment has one load roller on each side. These load rollers travel along the channels of the weldments. The angle of the load rollers permits them to control the forces from the front, back and sides of the mast. The shims on the load rollers control the lateral clearance between the weldments and the load rollers. Strip bearings are installed at the top of each side of the outer weldment. The strip bearings keep the correct clearance (forward and backward) between the outer weldment and the inner weldment.

The two-stage mast has two single stage lift cylinders. The lift cylinders are installed at the back of the outer weldment. The base of each lift cylinder sits in a mount at the bottom of the outer weldment. The hydraulic fitting for each lift cylinder goes through a hole in the mount. The top of each lift cylinder (cylinder rod) fits into a guide at the top of the inner weldment. A bracket on the cylinder shell holds the lift cylinder in position on the outer weldment. Operation of the lift cylinders extends and retracts the inner weldment.



1. LIFT CYLINDER (2)
2. LIFT CHAIN
3. OUTER WELDMENT
4. CHAIN SHEAVE
5. INNER WELDMENT
6. CARRIAGE
7. FROM MAIN CONTROL VALVE
8. EXTERNAL LOWERING CONTROL VALVE
9. INTERNAL LOWERING CONTROL VALVE

Figure 2. Two-Stage Mast With Limited Free-Lift

Two lift chains control the movement of the carriage. The chains are fastened to mounts near the top of the lift cylinder shells. The chains go up and over the chain sheaves on the inner weldment and then connect to the carriage. When the lift cylinders extend, the lift chains transfer the force from the lift cylinders to the carriage.

When the lift cylinders retract, the weight of the load, carriage and inner weldment push the oil from the lift cylinders. The oil flows from the lift cylinders, through the lowering control valves, main control valve and then to the hydraulic tank.

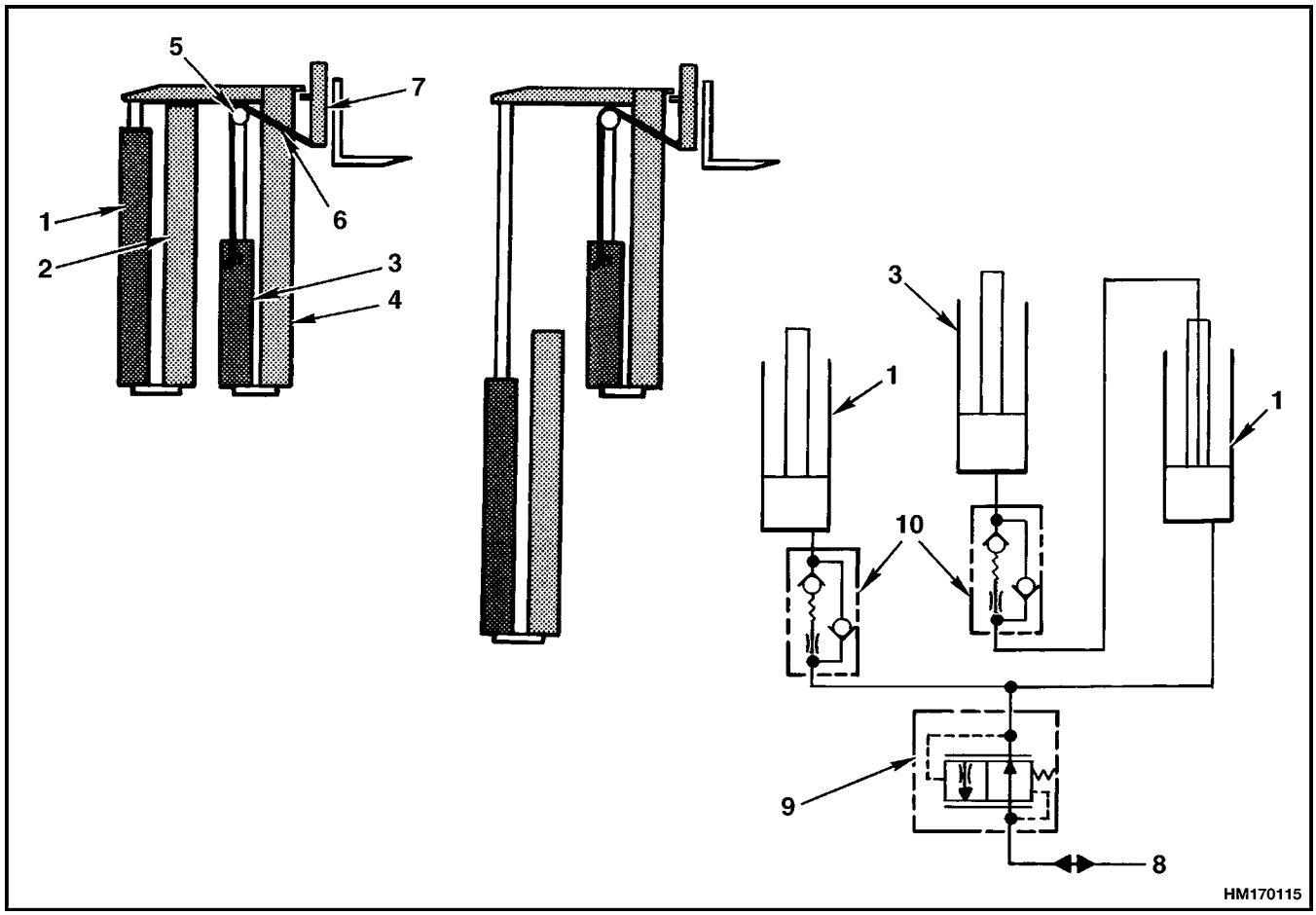
TWO-STAGE MAST WITH FULL FREE-LIFT MAST

The Vista Free-Lift mast has an inner weldment, an outer weldment and three single stage lift cylinders. See Figure 3. It is called a free-lift mast because the carriage can travel to the top of the inner weldment without increasing mast height. The free-lift mast has load roller and strip bearing arrangements similar to the two-stage mast.

The two main lift cylinders are installed at the back of the outer weldment. The base of each lift cylinder sits in a mount at the bottom of the outer weldment. The hydraulic fitting for each lift cylinder goes through a hole in the mount. The top of each lift cylinder (cylinder rod) fits into guides at the top of the inner weldment.

The free-lift cylinder is installed in the inner weldment. The main lift cylinder on the right side of the mast and the free-lift cylinder each have an internal lowering control valve. A single external lowering control valve is connected by tubing to all of the lift cylinders. Two chain sheaves are installed on the cylinder rod of the free-lift cylinder. The lift chains are connected to a mount behind the free-lift cylinder. The chains then go over the sheaves and are connected to the carriage.

The three lift cylinders are connected by hoses and tubing. To extend the mast, oil from the main control valve flows to all of the lift cylinders at the same time. The free-lift cylinder raises first because it lifts the least amount of weight. The free-lift cylinder raises the carriage to the top of the inner weldment. After the free-lift cylinder reaches the end of its stroke, the main lift cylinders begin to extend and raise the inner weldment.



1. MAIN LIFT CYLINDER (2)
2. OUTER WELDMENT
3. FREE-LIFT CYLINDER
4. INNER WELDMENT
5. CHAIN SHEAVE
6. LIFT CHAIN
7. CARRIAGE
8. FROM MAIN CONTROL VALVE
9. EXTERNAL LOWERING CONTROL VALVE
10. INTERNAL LOWERING CONTROL VALVE

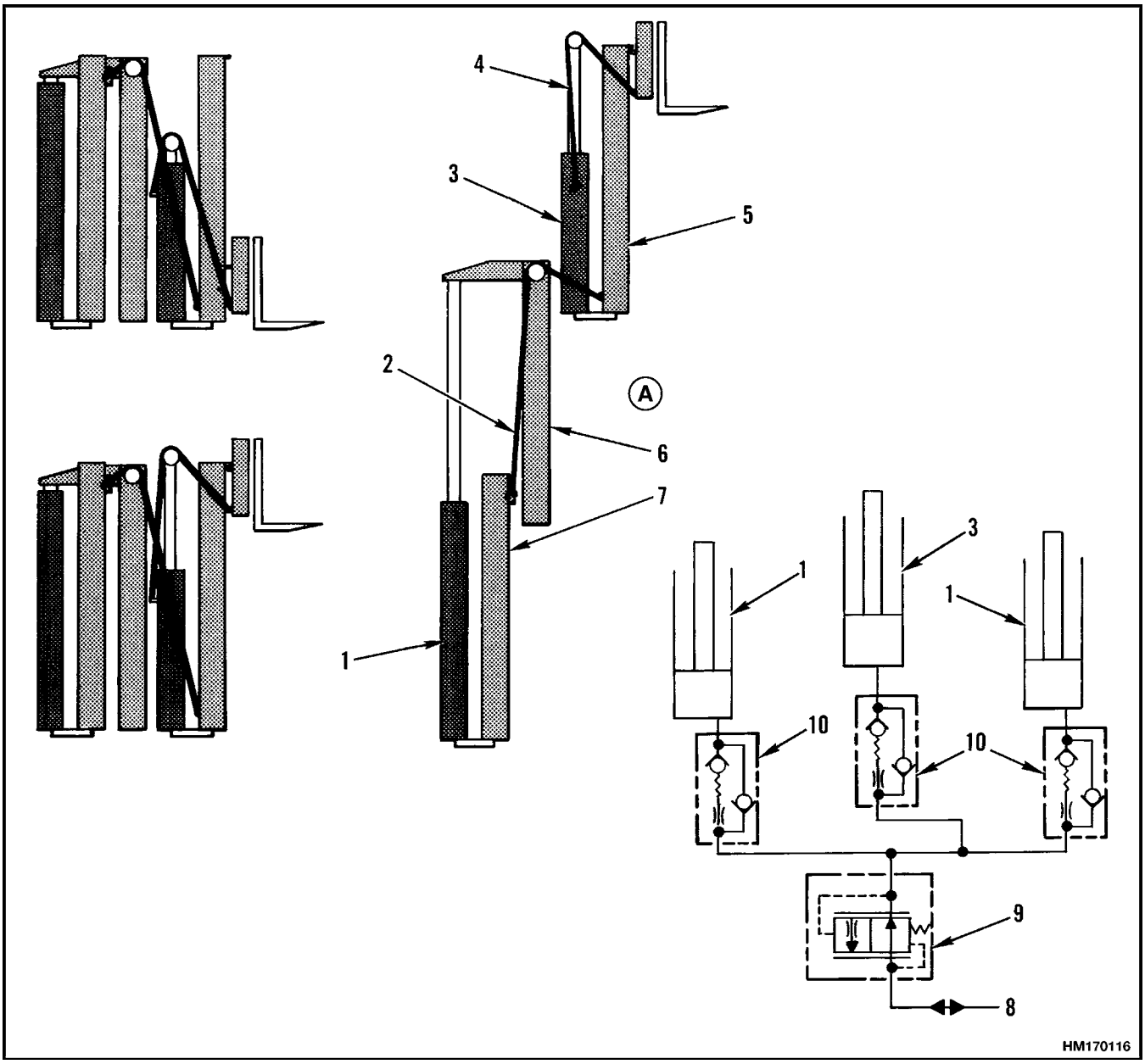
Figure 3. Two-Stage Mast With Full Free-Lift

During lowering, the main lift cylinders lower first because they have a greater load. After the main lift cylinders have retracted, the free-lift cylinder lowers. All of the oil from the lift cylinders flows through the lowering control valves to the hydraulic tank.

THREE-STAGE MAST WITH FULL FREE-LIFT

The Vista Three-Stage mast has an outer, an intermediate and an inner weldment. See Figure 4. Three single stage lift cylinders are used on the mast to raise the carriage and extend the weldments. The weldments are telescopic and have load roller and strip bearing arrangements similar to the two-stage mast. The two main lift cylinders are installed at the back of the outer weldment. The base of each lift cylinder is held on a mount at the bottom of the outer weldment. The hydraulic fittings for the lift cylinders go through holes in the mounts. The top of each main lift cylinder (cylinder rod) fits into a guide at the top of the intermediate weldment. The free-lift cylinder is installed in the inner weldment.

The two main lift chains fasten at one end near the top of the outer weldment. The lift chains then go over sheaves at the top of the intermediate weldment and fasten at the bottom of the inner weldment. The free-lift chains are connected to a mount behind the free-lift cylinder. The chains then go over the sheaves and connect to the carriage.



A. PHASE 2

1. MAIN LIFT CYLINDER (2)
2. OUTER LIFT CHAIN
3. FREE-LIFT CYLINDER
4. INNER LIFT CHAIN
5. INNER WELDMENT
6. INTERMEDIATE WELDMENT
7. OUTER WELDMENT
8. FROM MAIN CONTROL VALVE
9. EXTERNAL LOWERING CONTROL VALVE
10. INTERNAL LOWERING CONTROL VALVE

Figure 4. Three-Stage Mast With Full Free-Lift

The three lift cylinders are connected by hoses and tubing. To extend the mast, oil from the main control valve flows to all cylinders at the same time. The free-lift cylinder raises first because it lifts the least amount of weight. The free-lift cylinder raises the carriage to the top of the inner weldment. After the free-lift cylinder reaches the end of its stroke, the main lift cylinders begin to extend. As the main lift cylinders extend the intermediate weldment, the inner weldment is extended by the lift chains.

During lowering, the main lift cylinders lower first because they have a greater load. After the main lift cylinders have retracted, the free-lift cylinder lowers. All oil from the lift cylinders flows through the lowering control valves to the hydraulic tank.

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 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:

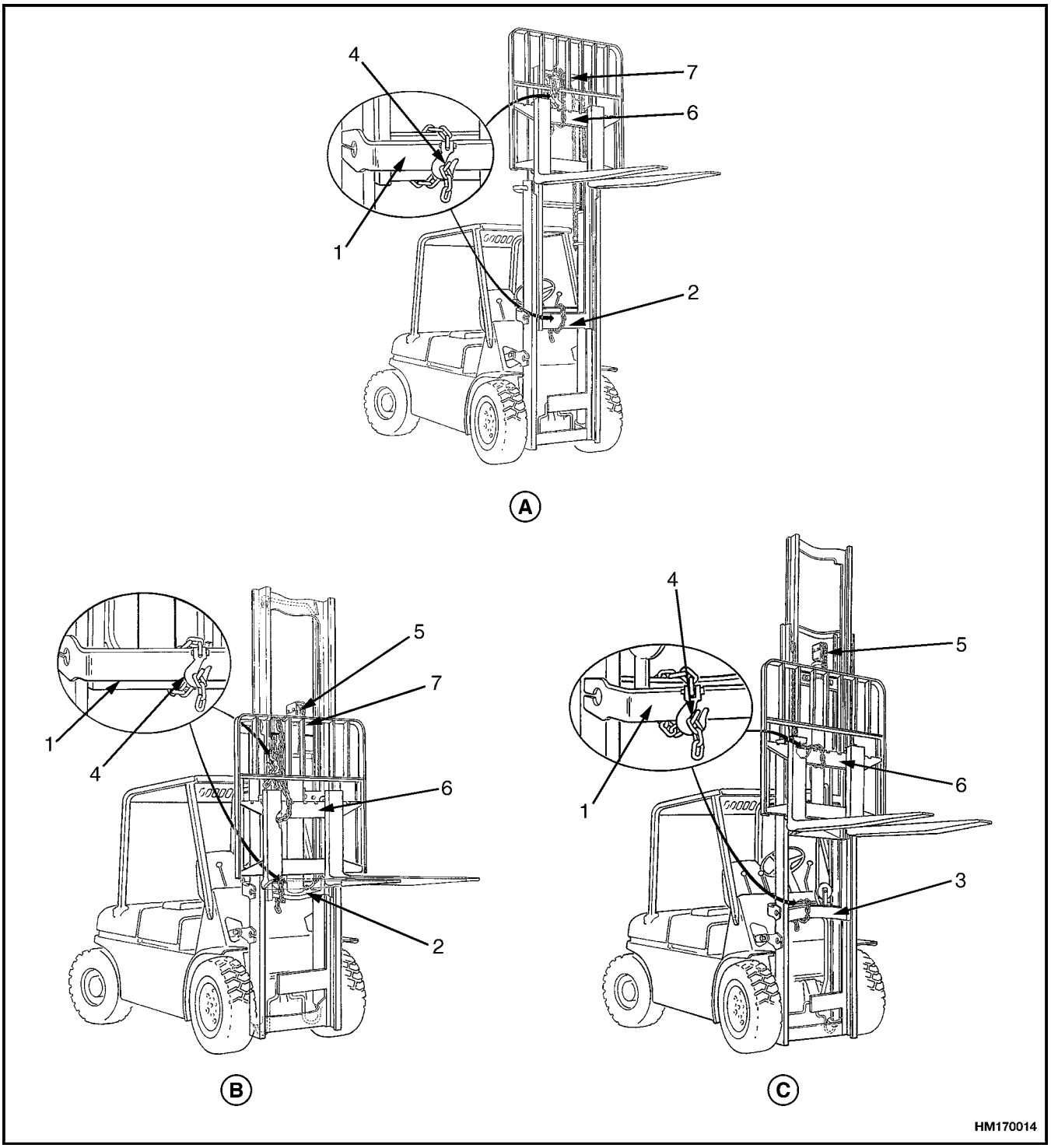
- **Lower the mast and carriage completely. Push the lift/lower control lever toward and make sure there is no movement in the mast. Make sure that all parts of the mast that move are fully lowered.**

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:**

1. Put mast in vertical position.
2. Raise mast to align bottom crossmember of weldment that moves in the outer weldment with a crossmember on the outer weldment. On the two-stage and free-lift mast, the moving part is the inner weldment. On the three-stage mast, it is the intermediate weldment. See Figure 5.
3. Use a 3/8 inch minimum safety chain with a hook to fasten the crossmembers together so the movable member cannot 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.
4. Lower mast until there is tension in the safety chain and the free-lift cylinder (free-lift, three-stage, and four-stage masts only) is completely retracted. If running, stop the engine. Apply parking brake. Install a **DO NOT REMOVE** tag on the safety chain(s).
5. Install another safety chain (3/8 inch minimum) between the top or bottom crossmember of the carriage and a crossmember on the outer weldment.

NOTE: Apply parking brake. After lowering or restraining the mast, shut off power and remove key. Put a **DO NOT OPERATE** tag in the operator's compartment. Disconnect battery on electric lift trucks and put a tag or lock on battery connector.



A. TWO-STAGE LFL MAST

1. OUTER WELDMENT
2. INNER WELDMENT
3. INTERMEDIATE WELDMENT

B. TWO-STAGE FFL MAST

4. HOOK
5. FREE-LIFT CYLINDER
6. CROSSMEMBER

C. THREE-STAGE FFL MAST

7. CROSSMEMBER

Figure 5. Two-Stage LFL, Two-Stage FFL, and Three-Stage FFL Masts

Forks Replacement

The identification of a fork describes how the fork is connected to the carriage. The series of lift trucks that use this mast normally have hook forks. See Figure 6. Pin forks are available on the larger capacity lift trucks in this series as an option. Pin forks are fastened to the carriage with large fork pins. See Figure 8.

Hook forks are connected to the carriage by hooks and lock pins. These lock pins are installed through the top fork hooks and fit into slots in the top carriage bar. Separate the forks as much as possible for maximum support of the load. Hook forks will slide along the carriage bars to adjust for the load to be lifted. 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 the width adjustment is made.

REMOVE AND INSTALL

WARNING

Do not try to move a fork without a lifting device. Each fork for these lift trucks can weigh [66 to 183 kg (145 to 402 lb) for a hook fork] and [128 to 226 kg (281 to 498 lb) for a pin fork].

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

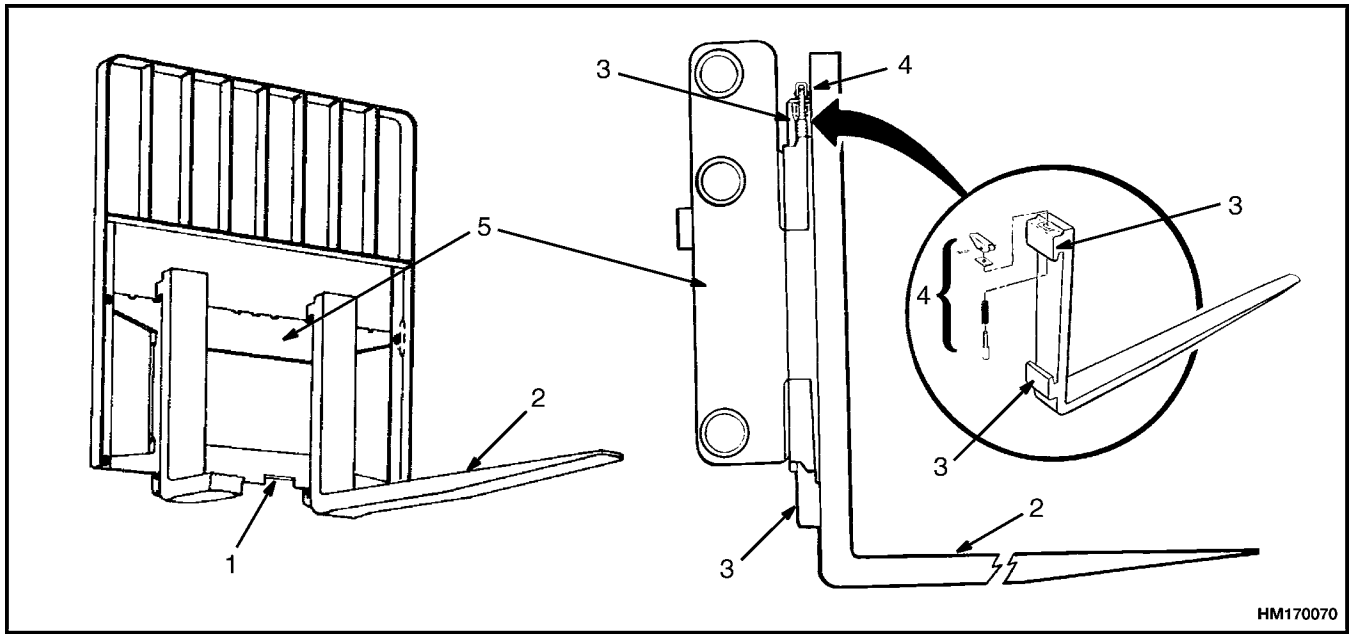
Hook Fork

Remove

Slide a hook fork to the fork removal notch on the carriage. See Figure 6. Lower fork on to blocks so bottom hook of fork moves through fork removal notch. See Figure 7. Lower carriage further so top hook of fork is disengaged from top carriage bar. Move carriage away from fork, or use lifting device to move fork away from carriage.

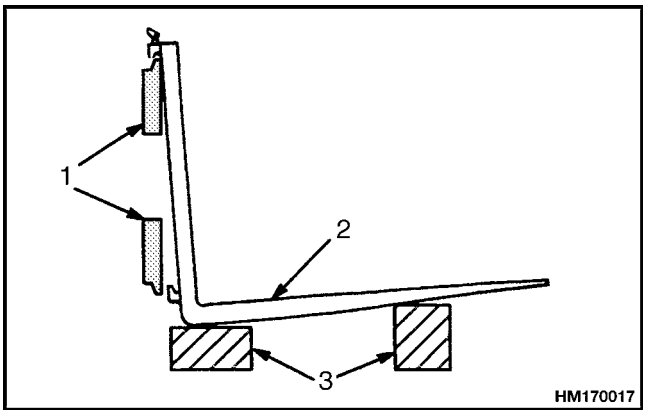
Install

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



1. FORK REMOVAL NOTCH
2. FORK
3. HOOK
4. LOCKING PIN ASSEMBLY
5. CARRIAGE

Figure 6. Hook Fork



1. CARRIAGE BARS
2. HOOK FORK
3. BLOCKS

Figure 7. Hook Fork Removal

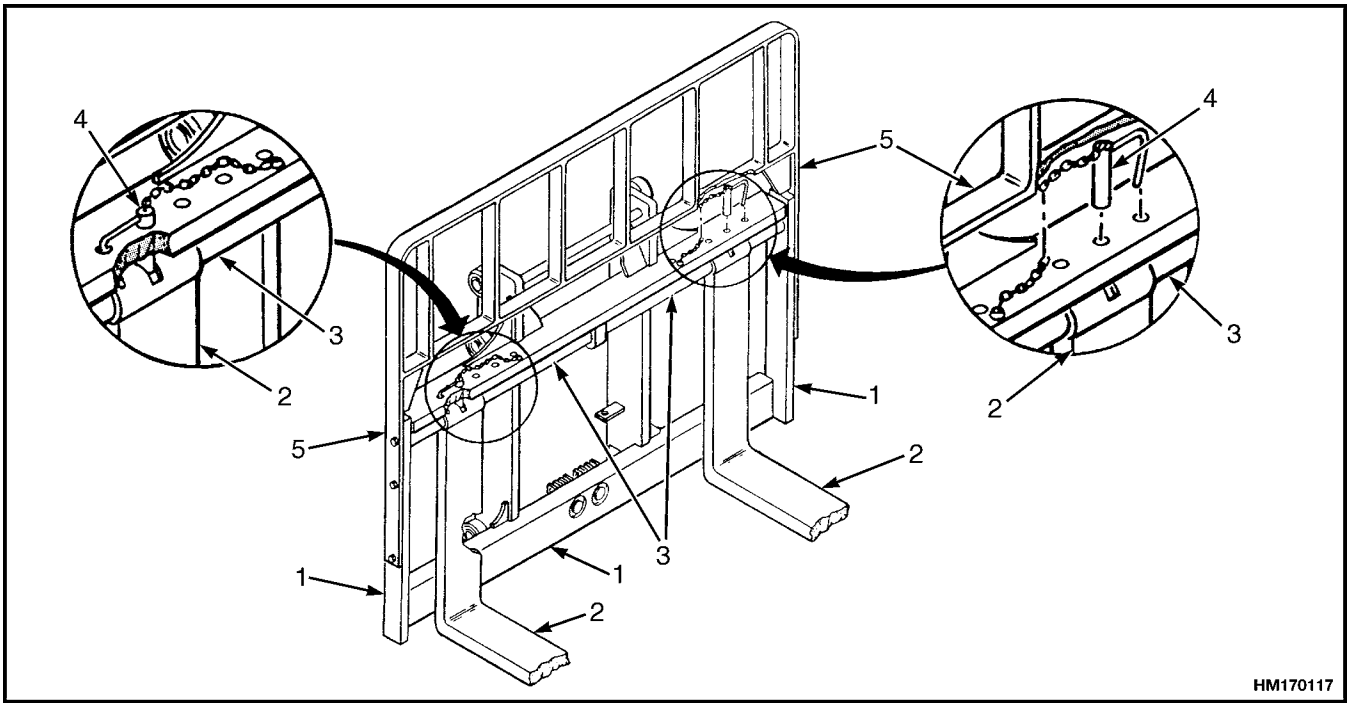
Pin Fork

Remove

Put blocks under forks and lower carriage. When weight of forks have been removed from fork pin, remove load backrest extension. The load backrest extension holds the fork pin in the carriage. Slide fork pin from its mount in the carriage and through the eye of the fork. See Figure 8. Use lifting device to lift fork away from carriage.

Install

Install fork pin in carriage. Align eyes of forks so forks will be installed on fork pin. When fork pin is installed in carriage so it holds forks, install load backrest extension. Engage fork with lock pin.



1. CARRIAGE
2. FORK
3. FORK PIN
4. LOCK PIN
5. LOAD BACKREST EXTENSION

Figure 8. Pin Forks

Carriage Repair

REMOVE

WARNING

Do not work under a raised carriage. Lower the carriage or use a chain or blocks to prevent the carriage and inner weldment from lowering.

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

1. Lower carriage and forks on blocks so lift chains become loose. See Figure 9 and Figure 12.

WARNING

When disconnecting the lift chains, keep control of the ends. Use wire to temporarily connect the ends of the lift chains to the mast. This procedure will prevent the lift chains from falling and causing an injury or damage.

2. Remove pin from each chain anchor at the carriage. Disconnect lift chains from carriage.

3. Put weight on forks so carriage has stability and will not fall when it is disconnected from mast.

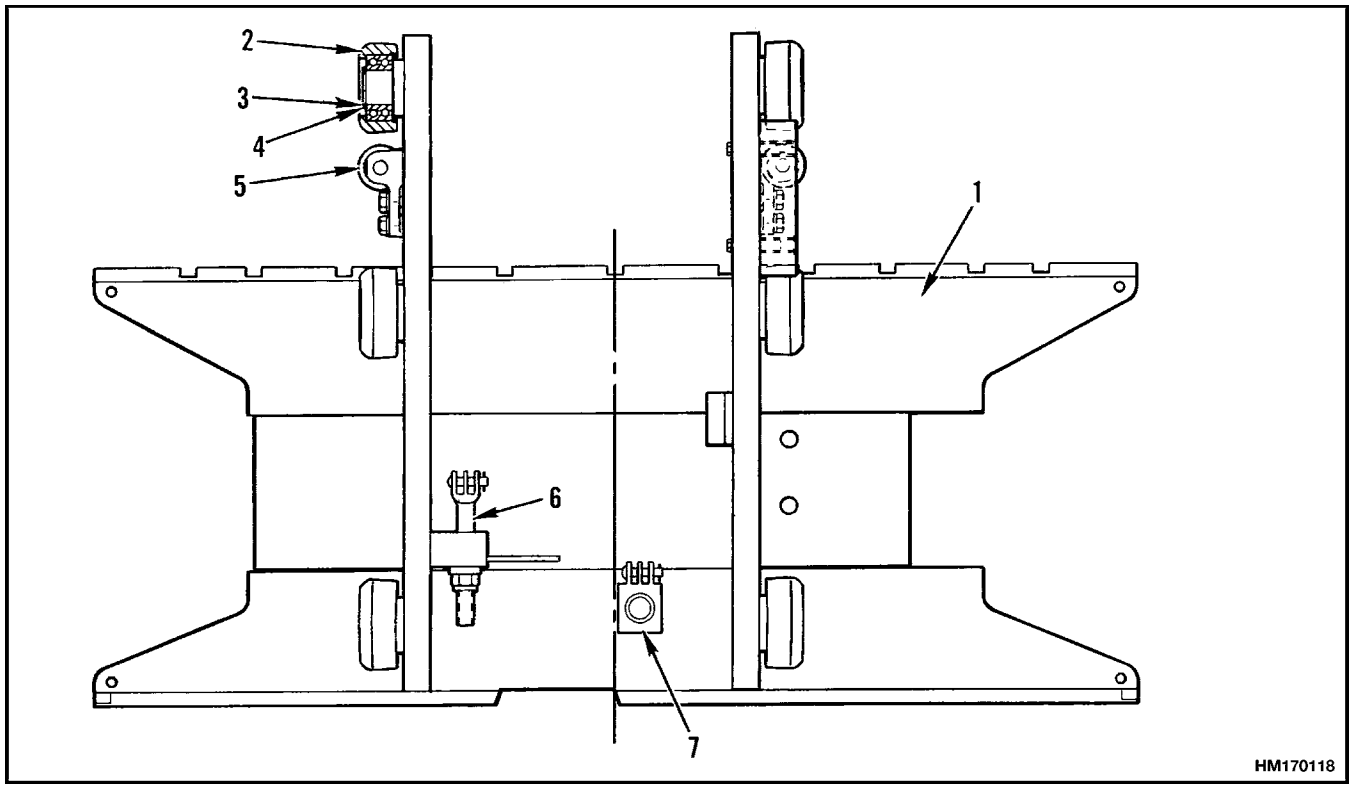
WARNING

Make sure that the carriage has stability and will not fall over when the inner weldment is raised above the load rollers of the carriage.

4. Use lift cylinders to raise inner weldment until it is above load rollers of carriage. If the hydraulic system cannot be used, connect lifting device to top of inner weldment. Carefully raise inner weldment until it is above load rollers of carriage.

5. Move lift truck from carriage. Connect lifting device to carriage. Make sure carriage has stability. Remove load backrest, fork pins, and forks. Put carriage on floor so load rollers are up.

6. If any of the load rollers must be replaced, make a note of the arrangement of the shims.



1. CARRIAGE
2. LOAD ROLLER
3. SHIMS
4. SNAP RING
5. SIDE ROLLER
6. CHAIN ANCHOR (TWO-STAGE MAST)
7. CHAIN ANCHOR (FREE-LIFT AND THREE-STAGE MAST)

Figure 9. Carriage

Sideshift Carriage Repair

SIDESHIFT CARRIAGE (EARLIER DESIGNS)

The earlier Hyster Company designs of sideshift carriages for this mast are shown in Figure 12 and Figure 13. These designs are used on lift trucks manufactured through 1993. During the second half of 1993, a second design shown in Figure 14 was installed on lift trucks. The operation of the designs are similar, but the components are different.

NOTE: See the section, **Main Control Valve** 2000 SRM 77 for information about the control valve linkage for the sideshift carriage.

Disassemble

WARNING

Make sure any lifting devices have the correct capacity for the parts being moved. See Weight of Mast Parts.

1. Disconnect hydraulic lines at sideshift cylinder. Disconnect sideshift cylinder at carriage and at apron. Remove sideshift cylinder. See Figure 10, Figure 11, Figure 12, and Figure 13.
2. Remove keeper plates or carriage hooks at bottom of carriage. Use lifting device and lift apron from carriage. Remove rollers and bearing segments as necessary.
3. Disassemble sideshift cylinder (see Figure 10) and Figure 11 as follows:
   a. Remove retaining ring, then remove retainer from cylinder shell. Pull rod and piston from shell.
   b. Remove nut from rod, and remove piston and retainer.
   c. Remove seals and O-rings.

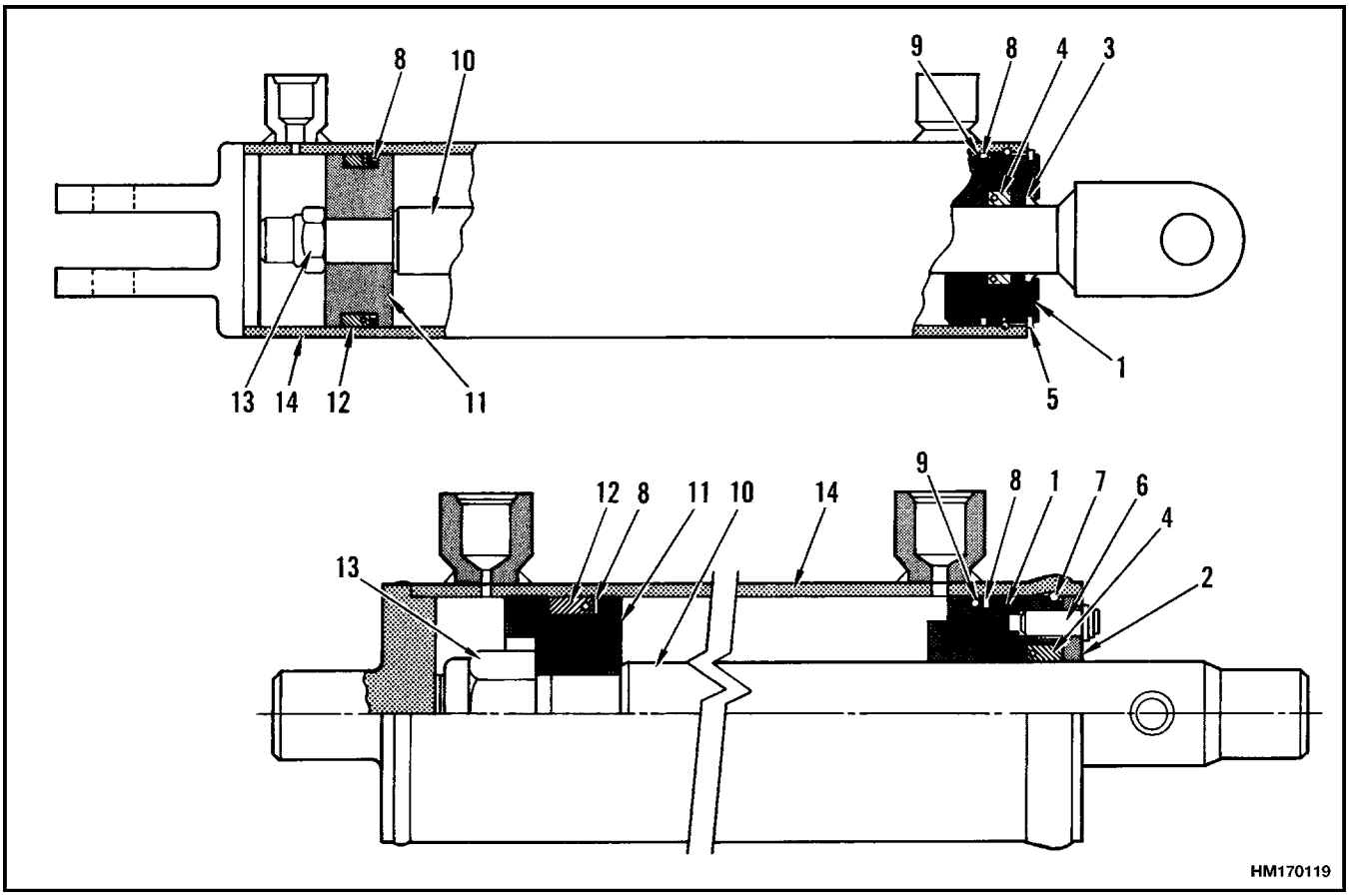
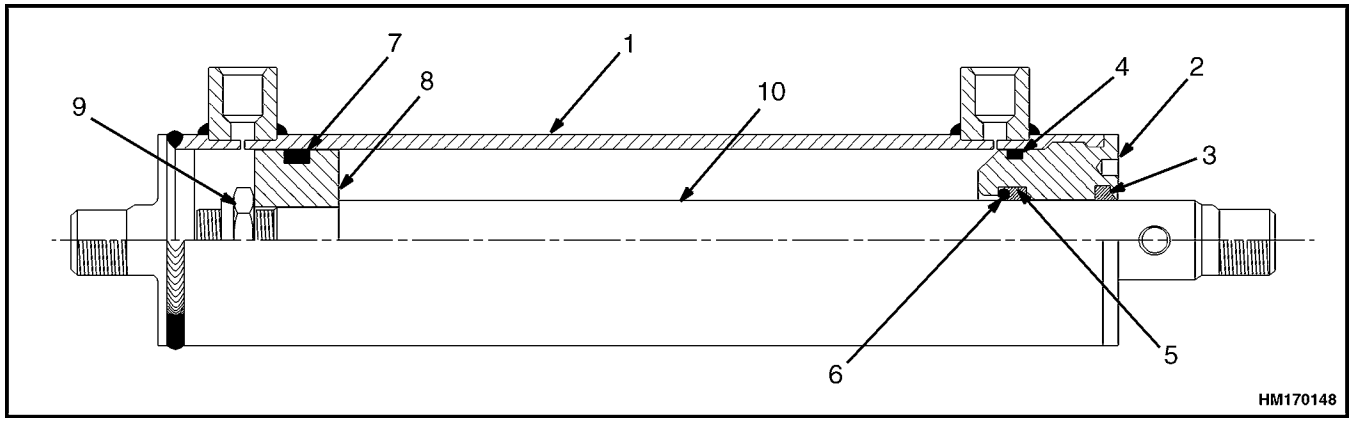


Figure 10. Sideshift Cylinders for Earlier Design Carriages (Old Style)

Legend for Figure 10

1. RETAINER
2. COVER
3. WIPER
4. ROD SEAL
5. SNAP RING
6. CAPSCREW
7. RETAINING RING
8. BACKUP RING
9. O-RING
10. ROD
11. PISTON
12. PISTON SEAL
13. NUT
14. SHELL



1. CYLINDER SHELL
2. GLAND
3. WIPER
4. O-RING
5. BACKUP RING
6. ROD SEAL
7. "T" SEAL (INCLUDES BACKUP RING)
8. PISTON
9. NUT
10. ROD

Figure 11. Sideshift Cylinders for Earlier Design Carriages (New Style)

Assemble

NOTE: Several different types of carriages are used on these lift trucks. Not all procedures are necessary for some carriages. See Figure 12 and Figure 13 when assembling the carriage.

1. Assemble sideshift cylinder (see Figure 10) and Figure 11 as follows:

a. Lubricate seals and O-rings with clean hydraulic oil. Install rod seal and wiper in retainer. Install retainer on rod. Install O-ring and backup ring in groove of retainer.

b. Install piston on rod. Tighten nut for rod to 122 to 149 N•m (90 to 110 lbf ft).

c. Install piston seal and backup ring on piston. Install rod and piston in shell. Install gland into cylinder tube. Tighten gland to 140 to 160 N•m (103 to 118 lbf ft).

2. Install guide rollers on brackets at carriage. When used, install bearing segments as shown in Figure 12 and Figure 13. Make sure to lubricate bearing segments and sliding surfaces with multipurpose grease.

3. Install load rollers on apron. Install thrust rollers on carriage.

4. Use a lifting device and install apron on carriage. Install keeper plate or carriage hooks on carriage. Tighten capscrews for keeper plates to 90 N•m (66 lbf ft). Tighten capscrews for carriage hooks to 165 N•m (120 lbf ft). For carriages that have hook-type forks and carriage hooks, adjust carriage hooks during Install, Step 5.

5. When used, install mount bracket for sideshift cylinder. Tighten capscrews that hold bracket to carriage to 320 N•m (235 lbf ft).

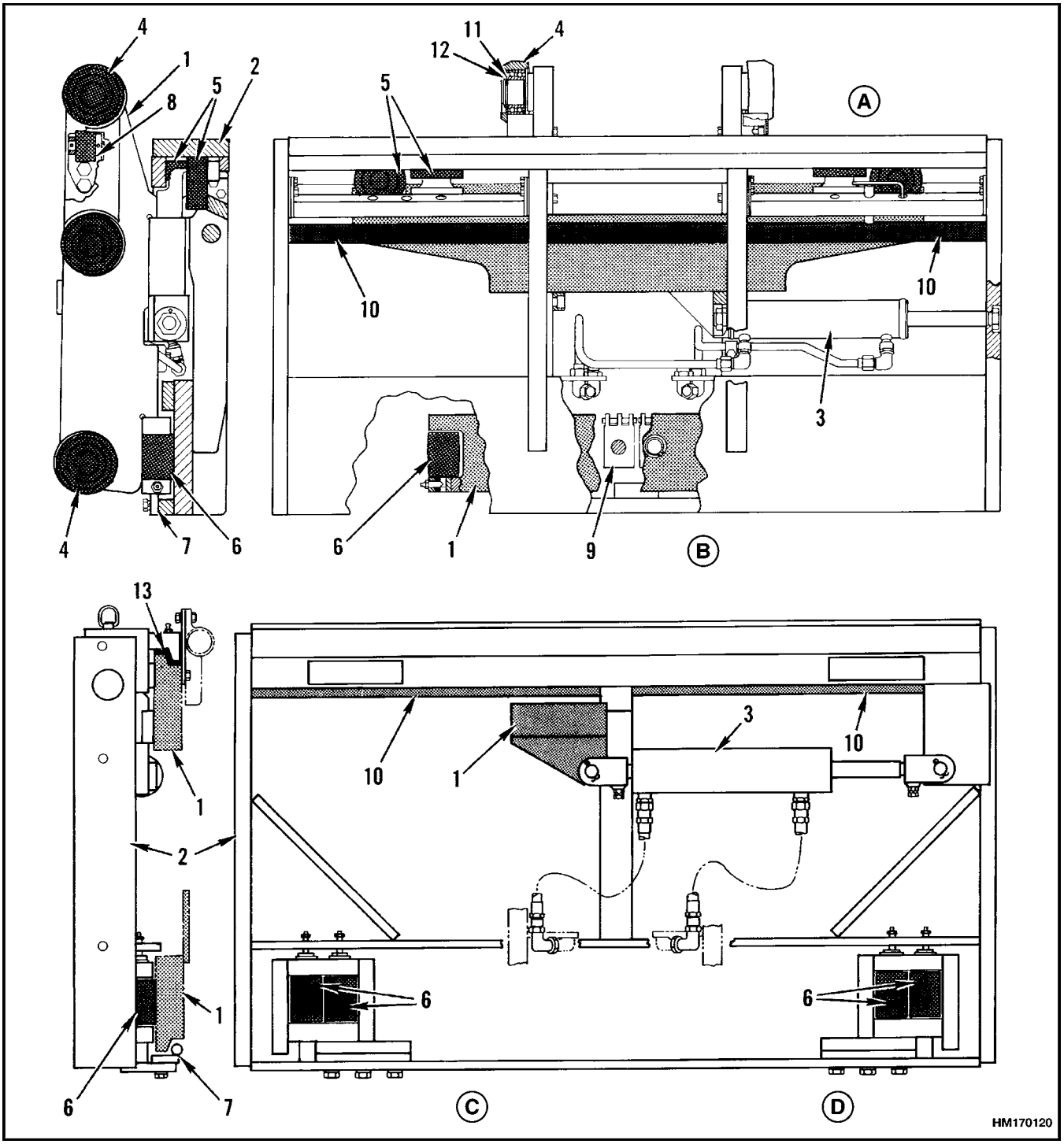
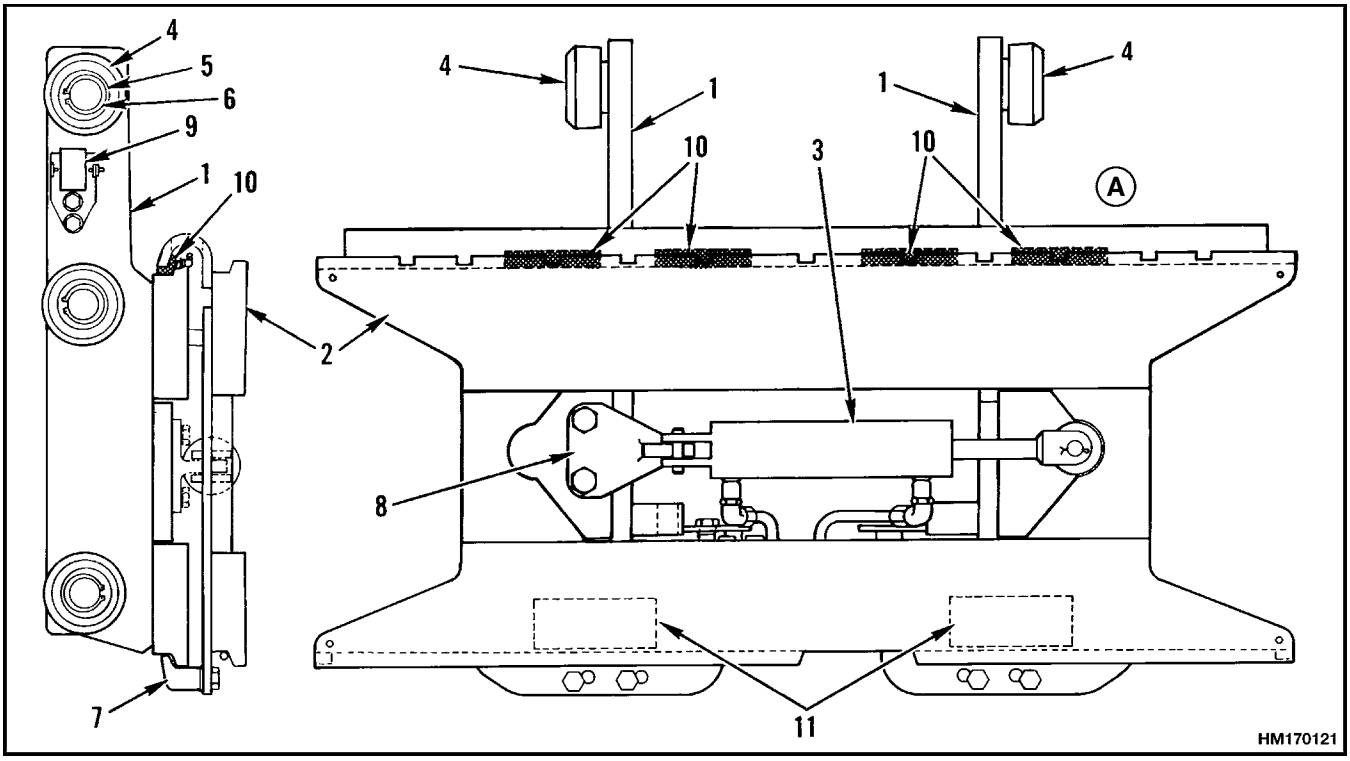


Figure 12. Sideshift Carriages

Legend for Figure 12

A. H3.50-4.00XL-5 (H70-80XL)
B. FACE OF CARRIAGE
C. BACK OF CARRIAGE
D. H4.00XL-6, H4.50-5.00XL (H90-100XL)

1. CARRIAGE
2. APRON
3. SIDESHIFT CYLINDER
4. LOAD ROLLER
5. GUIDE ROLLER
6. THRUST ROLLER
7. KEEPER PLATE
8. SIDE ROLLER
9. CHAIN ANCHOR (FREE-LIFT AND THREE-STAGE MAST)
10. FORK PIN
11. SHIMS
12. SNAP RING
13. BEARING SEGMENT



A. S/H3.50-4.50XL (S/H70-110XL)

1. CARRIAGE
2. APRON
3. SIDESHIFT CYLINDER
4. LOAD ROLLER
5. SHIMS
6. SNAP RING
7. CARRIAGE HOOK
8. CYLINDER MOUNT
9. SIDE ROLLER
10. BEARING SEGMENT
11. BEARING BLOCK

Figure 13. Sideshift Carriages

6. Install sideshift cylinder in carriage. Install anchor pins or nuts at both ends of the cylinder. After the nut at the apron is just tight, loosen nut 1/4 turn. Connect hydraulic lines to cylinders.

7. Install side rollers and load rollers on carriage. Tighten capscrews for side rollers to 65 N•m (50 lbf ft).

Install

1. Use hydraulic system of lift truck or a lifting device to raise inner weldment. Raise inner weldment until it is above the load rollers of the carriage. Carefully lower inner weldment until it engages all load rollers.

2. Check clearance of load rollers and side rollers. See Mast Adjustments and Carriage Adjustment in this section. When installing the side rollers, make sure grease fittings are toward front of lift truck. Tighten capscrews for side rollers to 65 N•m (50 lbf ft).

3. Connect lift chains. Install pins using new cotter pins.

4. Install forks and fork pins. Install load backrest.

5. Adjust carriage hooks (see Figure 12 and Figure 13) as follows:

   a. Check clearance between carriage hook and bottom carriage bar. The maximum clearance is 4 mm (0.16 in.).

   b. There are two sets of mount holes for the carriage hooks. Install carriage hooks in mount holes so clearance measured in Step a is 4 mm (0.16 in.) or less. Tighten capscrews for carriage hooks to 165 N•m (120 lbf ft).

6. Connect any hydraulic lines as necessary. Check lift chains as described in Lift Chain Adjustments.

SIDESHIFT CARRIAGE (1993 AND LATER DESIGN)

Remove

1. Lower carriage completely and remove forks. See Figure 14.

2. Connect lifting device to lifting eye on sideshift carriage.

3. Remove two upper capscrews from bottom carriage bar. Slowly loosen two bottom capscrews, but do not remove them. The holes have slots that will permit the bottom carriage bar to move down so the sideshift carriage can be removed. Carefully lift sideshift carriage from standard carriage. The sideshift cylinder mounting bracket and cylinder will stay on the standard carriage. Remove bushings.

4. Disconnect hydraulic lines at sideshift cylinder. Put caps on open lines. Remove cylinder mount bracket from carriage. If necessary, remove threaded rods and shims to remove sideshift cylinder.

Repairs

1. Do the following procedure to repair the sideshift cylinder (see Figure 15 and Figure 16):

   a. Remove retainers from shell. Pull rod from shell.

   b. Replace seals, O-rings, or backup rings as necessary.

   c. Lubricate all internal parts with clean hydraulic oil.

   d. Install piston and rod in shell. Apply Loctite® 242 to threads of retainers. Install retainers and tighten them to 25 to 30 N•m (223 to 267 lbf in).

2. Use new bushings if the old bushings are worn or damaged.

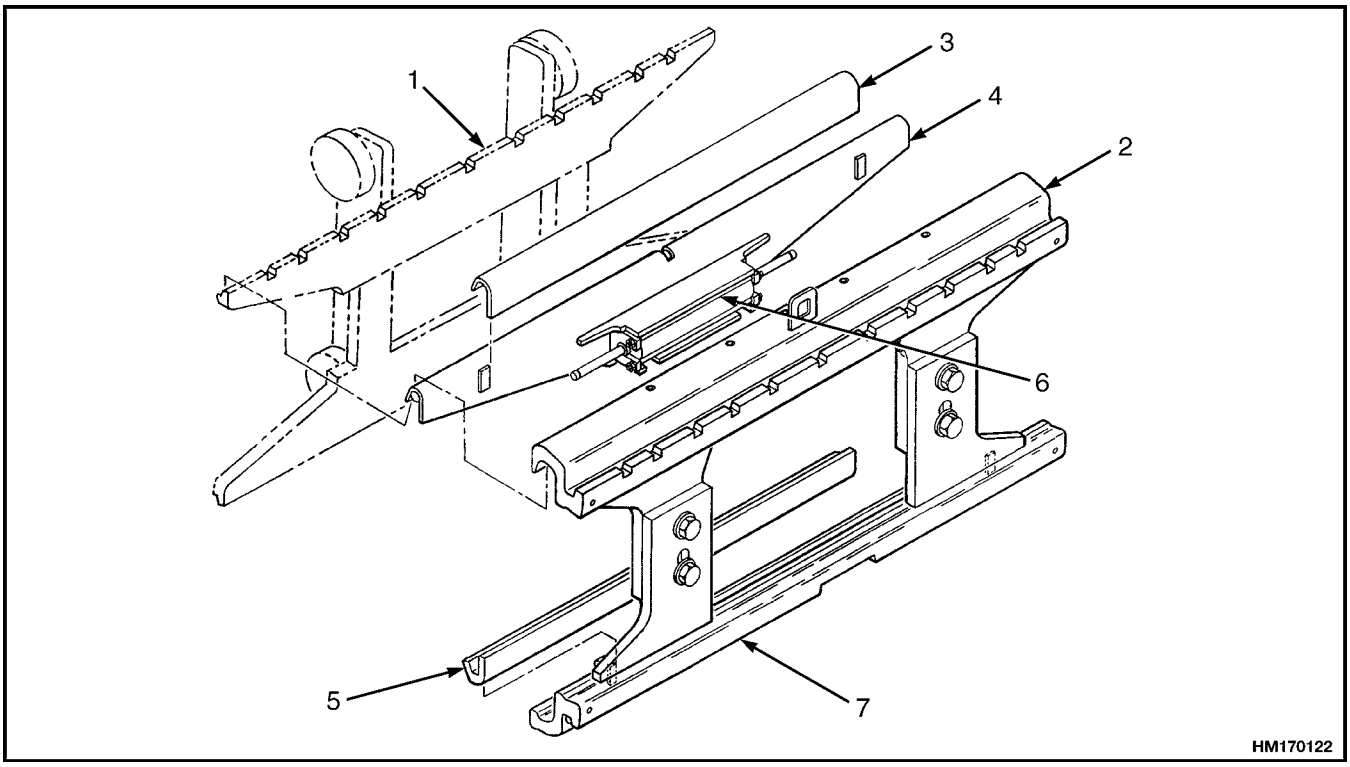
Install

1. Install sideshift cylinder in bracket. Use an equal number of shims on both sides of the cylinder to limit side-to-side movement within the bracket. Maximum movement is 0.6 mm (0.024 in.). Install threaded rods to hold cylinder in position.

2. Install cylinder mount bracket on standard carriage, and make sure it is engaged in the notch in the top carriage bar. Connect hydraulic lines to sideshift cylinder. Put grease on ends of cylinder rod.

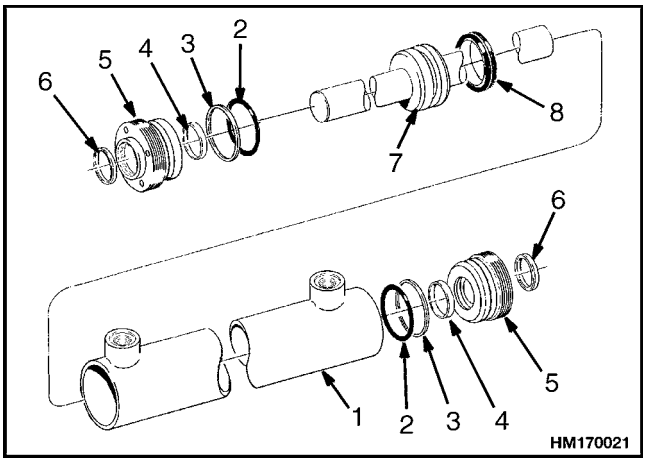
3. Install top bushing on mounting bracket. Lubricate outer surface of bushing with multipurpose grease.

4. Connect top and bottom carriage bars by installing two bottom capscrews. Do not tighten capscrews. Lubricate outer surface of bottom bushing with multipurpose grease. Install bottom bushing in bottom bar of sideshift carriage.



1. STANDARD CARRIAGE
2. TOP BAR, SIDESHIFT CARRIAGE
3. TOP BUSHING
4. CYLINDER MOUNT BRACKET
5. BOTTOM BUSHING
6. SIDESHIFT CYLINDER
7. BOTTOM BARS, SIDESHIFT CARRIAGE

Figure 14. Sideshift Carriage (1993 and Later Design)



1. SHELL
2. O-RING
3. BACKUP RING
4. ROD SEAL
5. RETAINER
6. WIPER
7. PISTON AND ROD
8. PISTON SEAL

Figure 15. Sideshift Cylinder

5. Make sure standard carriage is completely lowered. Connect lifting device to lifting eye. Install sideshift carriage on standard carriage. Put blocks under bottom bar of sideshift carriage so bottom bushing is moved tight against standard carriage.

6. Install two top capscrews. On 2.00 to 2.75 ton (4,000 to 5,000 lb) lift trucks, tighten all capscrews to 435 N•m (320 lbf ft). On 3.00 to 3.20 ton (6,000 to 6,500 lb) lift trucks, tighten all capscrews to 755 N•m (557 lbf ft). Remove lifting device. Lubricate top bushing at grease fittings.

7. Install forks.