

SERVICE REPAIR

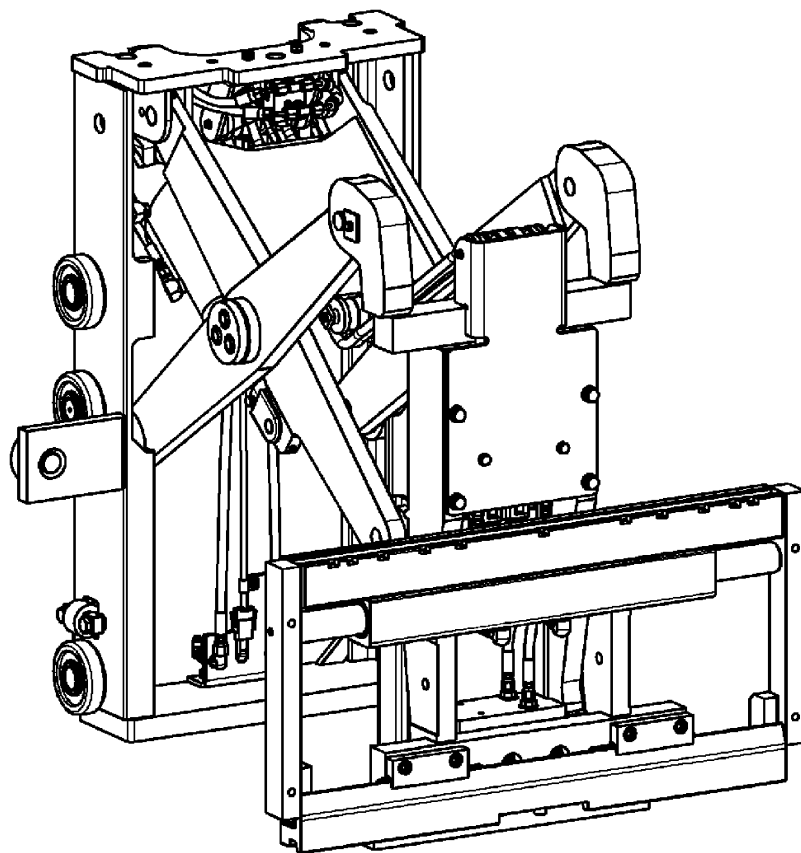
MANUAL

Hyster B453 (W30ZA W40ZA) Forklift

HYSTER

REACH CARRIAGES

N30XMDR3, N45XMR3 [G138]; N30XMXDR3,
N45XMXR3 [B264]; W20/30ZR [B455]; N25XMDR3,
N30-40XMR3 [C470]; N50XMA3 [C471]



HYSTER

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!

On the lift truck, the WARNING symbol and word are on orange background. The CAUTION symbol and word are on yellow background.

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This section is for the following models:

N30XMDR3, N45XMR3 [G138];
 N30XMDR3, N45XMR3 [B264];
 W20/30ZR [B455];
 N25XMDR3, N30-40XMR3 [C470];
 N50XMA3 [C471]

General

This manual has a description and the repair procedures for the single-reach and double-reach carriages on two-stage or three-stage masts.

Safety Procedures When Working Near Mast



WARNING

All chains, ropes, and lifting equipment **MUST** be fully examined by qualified personnel at least once a year or more at frequent intervals according to the local conditions of use.



WARNING

Mast parts are heavy and can shift. Distances between parts are small. Serious injury 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 the power is off and the key is removed. Attach a **DO NOT OPERATE** tag to the control handle.
- **DO NOT** make repairs or adjustments unless specifically authorized to do so. Repairs and adjustments must be performed by trained service technicians.
- **DO NOT** climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.
- Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.
- Move the truck to a safe location with room to raise the mast if necessary. Block the wheels of the truck to prevent movement.

The forks may be difficult to see when the mast is raised. Be careful not to hit your head when working around raised forks. Also, be careful not to trip over forks on or near the floor. If possible, remove forks from carriage before safety chaining mast.

WHEN WORKING NEAR THE MAST, ALWAYS:

- Lower the mast and carriage completely. Make sure there is no movement in the mast. Make sure all parts of the mast, that can move, are fully lowered.

OR

- If the mast must be in a raised position for repairs, install a safety chain around the top or middle crossmember of the outer weldment and the crossmember of the inner weldment to secure the mast.



WARNING

Perform the following step from the side of the mast using a ladder. Never stand under the carriage until safety chains are installed.

1. Remove forks from carriage if possible.
2. Raise mast to align bottom crossmember(s) of weldment(s) that move within the outer weldment with a crossmember on outer weldment. On the two-stage mast, the moving part is the inner weldment. On the three-stage mast, it is the intermediate weldment.
3. Wrap a safety chain, 9.5 mm (3/8 in.) minimum size, around crossmembers of inner and outer weldment. Secure it in place. See Figure 1.
4. Lower mast until safety chain stops mast. Make sure there is no movement of mast.
5. Turn key switch to **OFF**, disconnect battery, and place a **DO NOT OPERATE** tag on control handle head.
6. Wrap a second safety chain, 9.5 mm (3/8 in.) minimum size, around crossmembers of inner and outer weldment. Secure it in place as an additional precaution.

NOTE: The mast operator guard **MUST** be removed to install safety chain. Remove safety chain and install guard **AFTER** repairs are complete.

Legend for Figure 1

- A. TWO-STAGE MAST
- B. THREE-STAGE MAST

- 1. OUTER WELDMENT
- 2. INNER WELDMENT
- 3. INTERMEDIATE WELDMENT
- 4. SAFETY CHAIN
- 5. FREE-LIFT CYLINDER
- 6. CARRIAGE

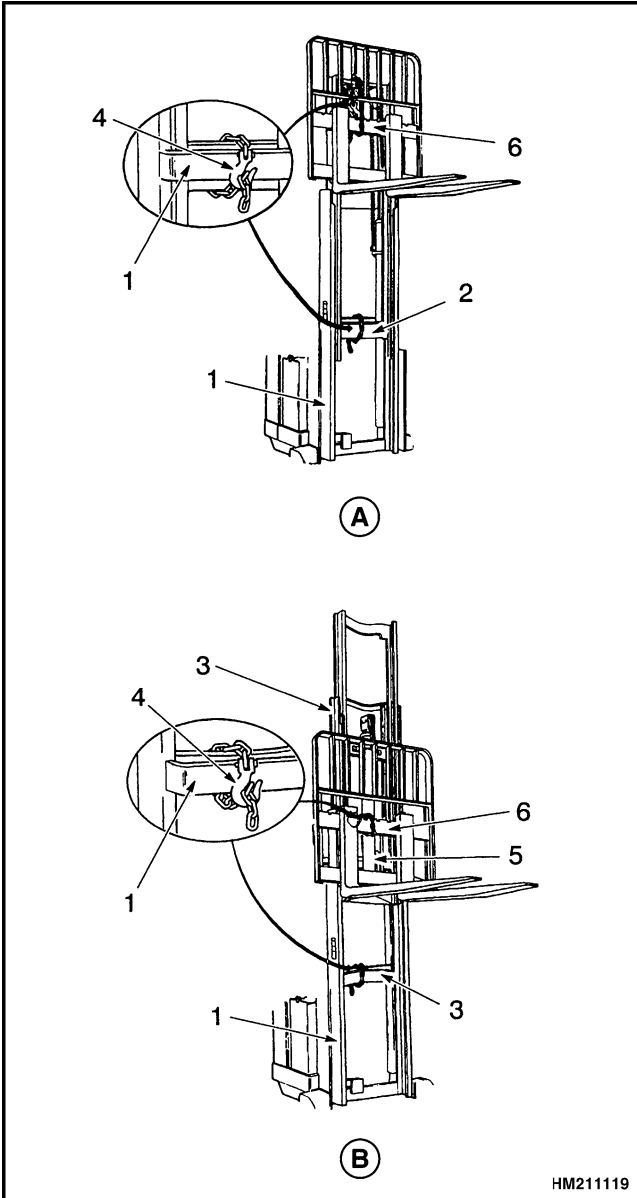


Figure 1. Safety Chain the Mast

Description

The reach carriages are used to extend the reach of the carriage. There are two types of reach carriages. There is a single-reach carriage with one set of scissor arms. The other carriage has two sets of scissor arms for double reach. Both carriages have a tilt cylinder to tilt the forks. Each carriage is also available with the optional sideshift function. The parts of the reach carriages are shown in Figure 8 and Figure 9. The inner and outer frame assemblies are connected by a scissor linkage. The top of the scissor arm weldment at the inner frame is fastened to the top of the inner frame by pins. The top of each scissor arm at the outer frame is fastened to the top of the frame by pins. On double reach units, the ends of each set of scissor arms and scissor arm weldments are fastened together by studs with bearings. The bearings on each pin or stud permit the arms to pivot. Large bearings at the center pivot of each scissor arm and scissor arm weldment also permit the linkage to pivot.

NOTE: The reach assembly can be removed from the mast assembly with the load backrest and forks attached. Both the two-stage and three-stage mast assemblies can also be removed with the reach assembly installed. Do only those procedures necessary for repair.

REACH ASSEMBLIES

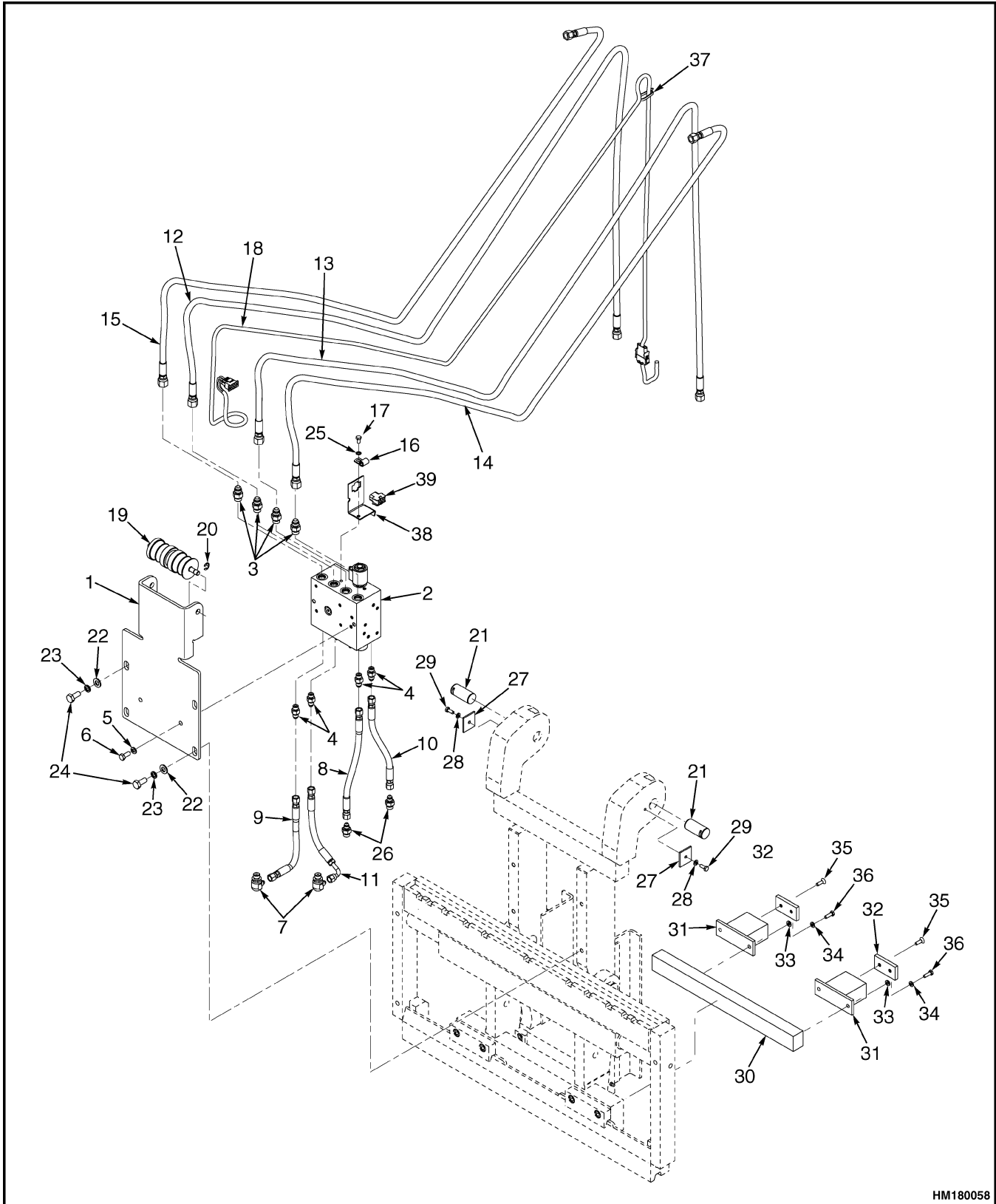
The reach assembly is used to extend the reach of the forks. There are two types of reach assemblies. There is a single-reach assembly with one set of scissor arms. The other reach assembly has two sets of scissor arms for double reach. Both reach assemblies have a tilt cylinder to tilt the forks. Each reach assembly may also be equipped with an optional sideshift function. The parts of the reach assemblies are shown in Figure 2, Figure 10, and Figure 11. The rear- and front-frame assemblies are connected

by a scissor linkage. The top of the scissor arm weldment at the inner frame is fastened to the top of the inner frame by pins. The top of each scissor arm at the outer frame is fastened to the top of the frame by pins. On double-reach units, the ends of each set of scissor arms and scissor arm weldments are fastened together by studs with bearings. The bearings on each pin or stud permit the arms to pivot. Large bearings at the center pivot of each scissor arm and scissor arm weldment also permit the linkage to pivot.

Two hydraulic cylinders control the reach movement of the scissor arms. The tilt cylinder controls the tilt action of the pivot assemblies at the heel of the forks. The forks pivot on a large pin that connects the forks to the frame. The sideshift cylinder controls the movement of the mobile frame assembly and forks.

The bottom arms at the outer frame and the inner frame have load bearings that fit into channels in the frame assemblies. The load bearings permit the ends of the arms to move vertically in the frame channels. The sideshift carriages have another frame that can move sideways on the apron. Two bearing blocks at the top of the apron and two at the bottom reduce the friction for side to side movement of the sideshift frame.

The flow of oil to and from the cylinders is controlled by the electro-hydraulic control valve. The electro-hydraulic control valve controls the rate and direction of oil flow. The switches located in the control handle, when actuated, direct the valve to open and close to control the rate and direction of oil flow. A selector valve (2, Figure 2) directs the oil flow from the reach cylinders to the tilt cylinder, and from the tilt cylinder to the sideshift cylinder for sideshift operation.



HM180058

Figure 2. Hydraulic Parts for Double-Reach Assembly (Single-Reach is Similar)

Legend for Figure 2

- | | |
|----------------------------|-------------------------|
| 1. COVER PLATE | 20. EXTERNAL SNAP RING |
| 2. VALVE ASSEMBLY | 21. FRONT PIVOT PINS |
| 3. 6×4 FITTING WITH O-RING | 22. WASHER |
| 4. 4×4 FITTING WITH O-RING | 23. LOCKWASHER |
| 5. LOCKWASHER | 24. CAPSCREW |
| 6. BOLT | 25. LOCKWASHER |
| 7. 6×4 FITTING WITH O-RING | 26. FITTING WITH O-RING |
| 8. HOSE ASSEMBLY | 27. RETAINING PLATE |
| 9. HOSE ASSEMBLY | 28. LOCKWASHER |
| 10. HOSE ASSEMBLY | 29. CAPSCREW |
| 11. HOSE ASSEMBLY | 30. WELDMENT |
| 12. HOSE ASSEMBLY | 31. STOP ASSEMBLY |
| 13. HOSE ASSEMBLY | 32. STOP PAD |
| 14. HOSE ASSEMBLY | 33. WASHER |
| 15. HOSE ASSEMBLY | 34. LOCKWASHER |
| 16. WIRE CLAMP | 35. CAPSCREW |
| 17. CAPSCREW | 36. CAPSCREW |
| 18. WIRE ASSEMBLY | 37. WIRE TIE |
| 19. SHEAVE | |

Repair - General

NOTE: Most repairs of the reach carriage can be done without removing the carriage from the mast. These repair procedures require that the carriage is installed in the mast and the scissor arms are fully extended.

 **WARNING**

The reach carriage can fall or tip easily and cause an injury when not installed in the mast. If the reach carriage cannot be installed in a mast during repair, make sure the rear frame is fastened to a support that cannot move. The rear frame must be in the same position as it is in the mast. The rear frame must also be fastened so that it cannot move on the support. The support must be strong enough to allow full extension of the reach carriage without tipping.

 **WARNING**

Hydraulic oil is hot after system operation and can cause burns. **DO NOT** disconnect any hydraulic lines of the system until the oil for the system is cool.

 **CAUTION**

Make sure the lift truck is in a location that is level and has access to a crane or other lifting device before doing any repairs on the reach carriage.

NOTE: It is usually not necessary to completely disassemble the reach carriage. Do only the steps of the procedures necessary to make the required repairs.

Read and follow the Safety Procedures When Working Near Mast in the section **Mast, Repair** 4000 SRM 482, as well as all **WARNINGS** and **CAUTIONS**.

Load Backrest Removal and Installation **WARNING**

The load backrest is heavy and can cause an injury. Do not try to remove it without using a lifting device.

1. Use a hoist to secure the load backrest in position.
2. Loosen the four capscrews that fasten the load backrest to the carriage assembly.
3. Lift the load backrest off the mobile frame.
4. Reverse the procedure to install the load backrest. Tighten the capscrews to 102 N•m (75 lbf ft).

Fork Replacement

HOOK FORKS



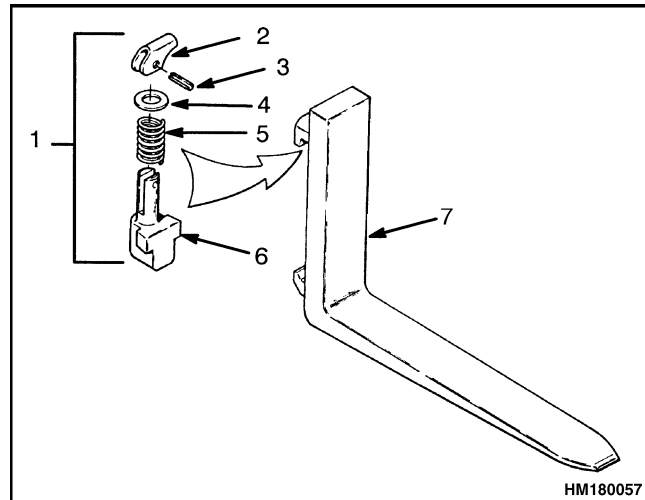
WARNING

Forks are heavy and can cause an injury. **DO NOT** try to remove forks without using a lifting device.

These forks are connected to the carriage by hooks. Latch pins fit through the top fork hooks and into slots on the top crossmember of the carriage to keep the forks in position.

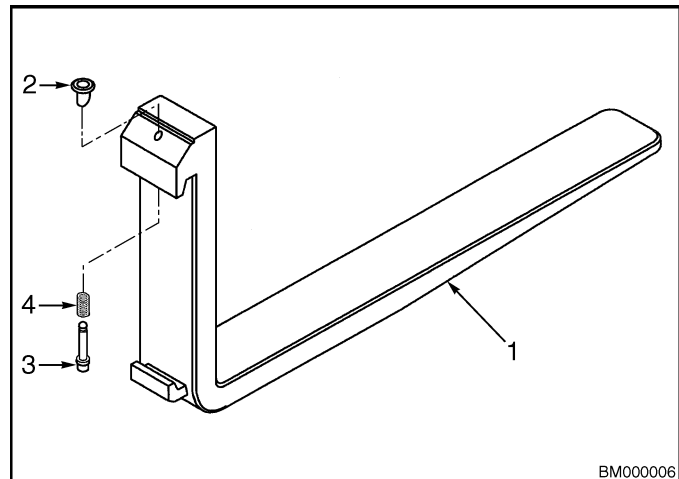
To remove the forks, lift the latch lever and slide the fork to the fork removal notch on the carriage. See Figure 3 or Figure 4. The removal notch is in the bottom crossmember of the carriage. Lower the carriage with blocks under the fork or raise the fork tip. The bottom hook of the fork will move through the fork removal notch. Lower the carriage further or raise the fork so the top hook of the fork is disengaged from the top crossmember. Move the carriage away from the fork, or use the lifting device to move the fork away from the carriage. Follow the same procedure to remove the other fork.

To install the forks, move the fork or carriage so the top hook on the fork engages the top crossmember of the carriage. Raise the carriage or lower the fork to move the lower hook through the removal notch. Slide the fork on the carriage so both upper and lower hooks are engaged and the latch pin engages a notch.



- | | |
|-------------------|--------------|
| 1. LATCH ASSEMBLY | 5. SPRING |
| 2. LEVER | 6. LATCH PIN |
| 3. ROLL PIN | 7. FORK |
| 4. WASHER | |

Figure 3. Forks (Early Latch Kit)



- | | |
|-------------------|--------------|
| 1. FORK | 3. LATCH PIN |
| 2. LATCH ASSEMBLY | 4. SPRING |

Figure 4. Forks (Current Latch Kit)

Reach Assembly Removal and Installation

1. Operate the LIFT/LOWER controls to raise the reach assembly until the rollers of the rear frame (reach) are above the top of the outer weldment.
2. Operate the REACH/RETRACT controls to fully retract the forks. Install safety chains so the forks cannot extend. Install the safety chains around the center plates of the scissor arm weldment and the reach frame. Make sure a safety chain does not touch the mount for the hose sheave, lift chains, chain or hose sheaves, hoses, tubes, or fittings.
3. Move the key to the **OFF** position and disconnect the battery. Remove the mast guard from the mast assembly.
4. Use safety chains to fasten the movable member of the mast to the outer weldment so it cannot move.
7. Hold the lift chains to keep them from falling. Remove the pins in the chain anchors at the back of the outer weldment of two-stage masts. Remove the pins in the chain anchors at the back of the free-lift cylinder of three-stage masts. Disconnect the lift chains. Carefully move the lift chains through the sheaves and lay the lift chains over the reach assembly.



WARNING

Be careful when removing or installing snap rings. These snap rings are large and can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

5. Remove the snap rings, washers, thrust rollers, and spacers.
6. Disconnect the hydraulic lines (sideshift or reach only) at the inner frame. Put tags on the fittings for correct connection during installation. Make sure to put caps on the open fittings to keep dirt out of the system. Disconnect the electrical connections (reach only) at the base of the inner frame.

NOTE: Removing the pins at the chain anchors will disconnect the lift chains without changing the chain adjustment. Always adjust the chains if new lift chains or other components are installed.



WARNING

The inner frame assembly is heavy and can cause an injury if it tips or falls. Make sure the carriage assembly has stability during and after removal. If the forks are removed, put the carriage assembly on the floor so the load rollers are up.



CAUTION

DO NOT damage lift chains, hoses, or electrical cables as the carriage assembly is lifted out of the mast weldment.

8. Carefully lift the reach assembly out of the channels of the rear weldment. Carefully lower the reach assembly to the floor.

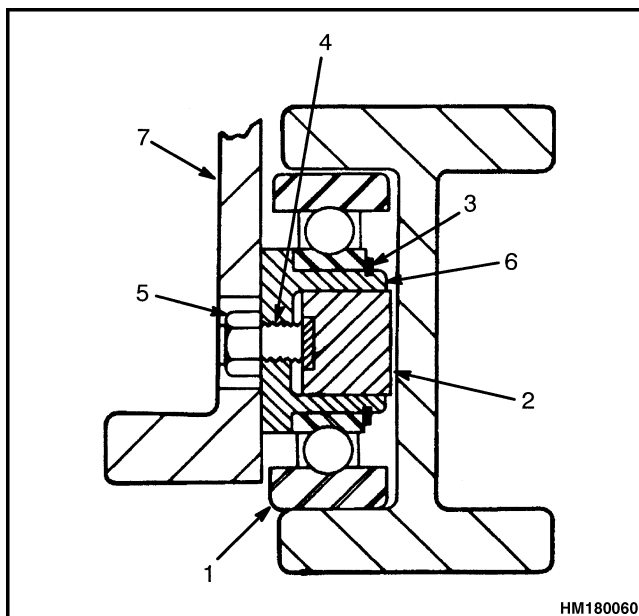
NOTE: The reach assembly side rollers must be adjusted while the reach assembly is out of the mast. Adjust the side rollers as described in Carriage or Reach Assembly Adjustments, Adjust Side Rollers before installing the reach assembly.

9. To install the reach assembly, reverse the removal procedures. Always use new chain anchors when installing the lift chains. Apply Loctite™ to the studs of the thrust rollers during installation.
10. Adjust the reach assembly. See Adjust Reach Cylinders, Carriage or Reach Assembly Adjustments. Test the reach assembly for correct operation.

Carriage Load Rollers Removal and Installation

For the following procedures, refer to Figure 5 and Figure 6.

1. Remove the reach assembly from the mast assembly to remove and install the carriage load rollers. See Reach Assembly Removal and Installation.
2. Remove the jam nuts and setscrews for the load rollers.
3. If necessary, replace the wear plugs by pushing at the back of the wear plug.



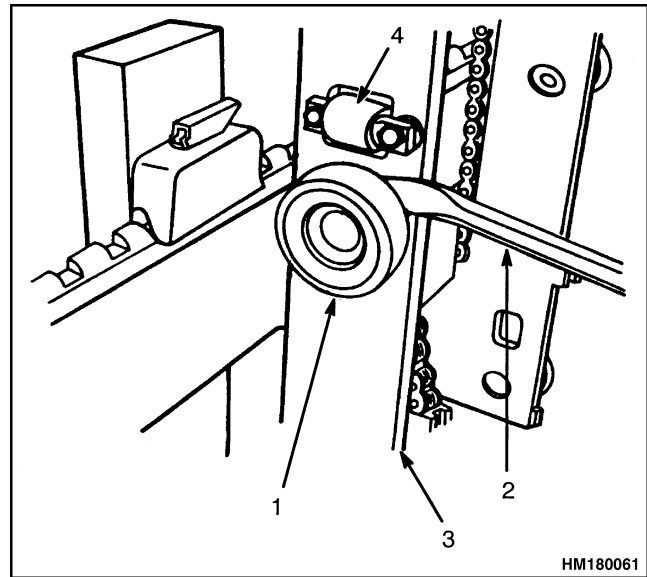
- | | |
|----------------|-------------------------------------|
| 1. LOAD ROLLER | 6. STUB SHAFT |
| 2. WEAR PLUG | 7. MAST, REACH, OR CARRIAGE CHANNEL |
| 3. SNAP RING | |
| 4. SETSCREW | |
| 5. JAM NUT | |

Figure 5. Load Roller and Wear Plug Assembly

WARNING

Lift chains, hoses, and cables can roll over the sheaves to fall and cause an injury if the ends are not fastened. Keep control of the ends of the lift chains, hoses, and cables as they are removed. Use wire to temporarily connect the ends of the lift chains, hoses, or cable to the masts.

4. On three-stage masts, remove the safety chains installed in Step 4. Lower the reach assembly for access to the chain anchors at the back of the free-lift cylinder. Use safety chains to fasten the movable member of the mast to the outer weldment so it cannot move. Move the key to the **OFF** position and disconnect the battery.



1. LOAD ROLLER WITH SNAP RING REMOVED
2. PRY BAR
3. MAST, REACH, OR CARRIAGE
4. SIDE ROLLER

Figure 6. Removing Load Roller

5. Install lifting eyes in the reach assembly for chains or slings. Fasten chains or slings to the reach assembly so the reach assembly cannot tip as it is removed from the mast weldment. Fasten the chains to the lifting eyes. Use the crane to raise the reach assembly so the lift chains become loose.

WARNING

Be careful when removing or installing snap rings. These snap rings are large and can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

6. Remove the snap rings from the stub shaft for the load roller.
7. Use a pry bar to remove the load roller from the stub shaft for the load roller. See Figure 6.
8. Use a cloth to clean each load roller. Inspect the load rollers for cracks, flat spots, or bearings that do not turn freely. Replace any roller that shows wear or is damaged.
9. Install the reach assembly. See Reach Assembly Removal and Installation.
10. Adjust the reach assembly. See Adjust Reach Cylinders in Carriage or Reach Assembly Adjustments.

Side Rollers Disassembly and Assembly

1. Remove the reach assembly from the mast to replace the side rollers.
2. Remove the capscrews that fasten the side roller bracket.
3. Inspect and replace all damaged or worn parts.
4. Reverse the procedure to install the side rollers. See Figure 6. Adjust the carriage side rollers during assembly. See Carriage or Reach Assembly Adjustments.

NOTE: Observe the position of the shims.

NOTE: Correct placement of shims is critical for the operation of the reach mechanism. Unless the shims are installed correctly, the reach mechanism will not operate.

NOTE: To remove and replace load rollers, wear plugs, weldments, or lift cylinders, it is necessary to remove the two-stage mast assembly from the truck.

Reach Assembly Repair

NOTE: Most repairs of the reach assembly can be done without removing the reach assembly from the mast. These repair procedures require that the reach assembly is installed in the mast and the scissor arms are fully extended.

WARNING

The reach assembly can fall or tip easily and cause an injury when not installed in the mast. If the reach assembly cannot be installed in a mast during repair, make sure the rear frame is fastened to a support that cannot move. The rear frame must be in the same position as it is in the mast. The rear frame must also be fastened so it cannot move on the support. The support must be strong enough to allow full extension of the reach assembly without tipping.

WARNING

Hydraulic oil is hot after system operation and can cause burns. **DO NOT** disconnect any hydraulic lines of the system until the oil for the system is cool.

CAUTION

Make sure the lift truck is in a location that is level and has access to a crane or other lifting device before doing any repairs on the reach carriage.

It is usually not necessary to completely disassemble the reach assembly. Do only the steps of the procedures necessary to make the required repairs.

Reach Assembly Outer Frame

For the following procedures refer to Figure 7, Figure 8, and Figure 9.

REMOVE

WARNING

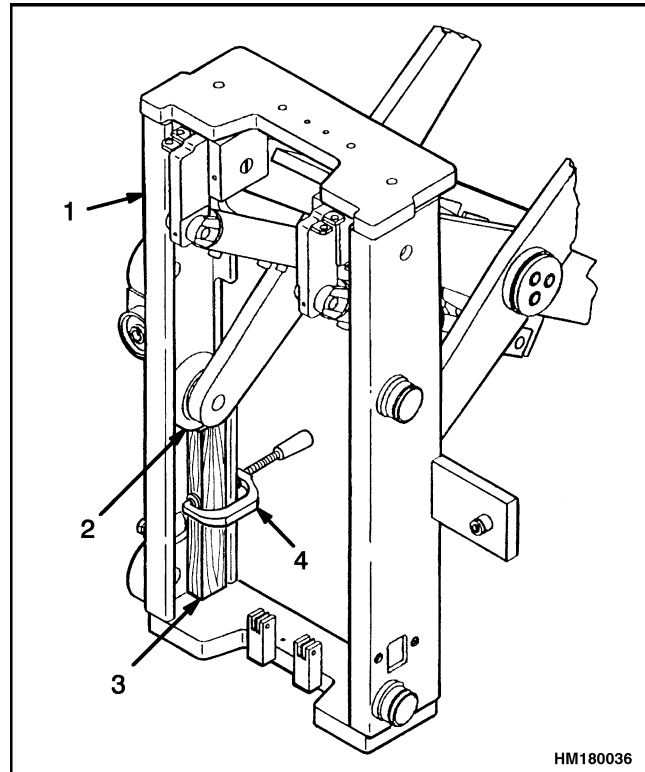
There are pinch points on the reach carriage that can cause an injury. Use clamps and blocks to prevent the scissor arms from moving. Install the clamps and blocks at the channels of the rear frame to make sure the load bearings cannot move in the channel. See Figure 7.

NOTE: Use safety chains on the rear frame and mast weldments to keep the reach assembly and mast weldments from moving. Install the safety chains as described in Safety Procedures When Working Near Mast in this section.

NOTE: Make sure that the reach assembly is in the fully extended position. The outer frame should be removed with the forks removed.

1. Remove the forks as described in Fork Replacement.
2. Remove the sideshift cylinder as described in Sideshift Cylinder, Remove.
3. Extend the reach fully and install blocks and clamps inside the channels of the rear frame to make sure the load bearings cannot move in the channel. See Figure 7.
4. Tag and disconnect the hydraulic lines at the bottom of the rear frame. Cap or plug the hydraulic lines and valve ports to prevent dirt from entering the system. Make note of the location of all cable ties for replacement during installation.
5. Tag and disconnect the wire at the bottom of the rear frame. Remove the hose and wire guide.
6. Connect an overhead lifting device (crane) to the top of the outer frame.
7. Remove the brackets that retain the pivot pins in the outer frame to the inner scissor arms. Remove the pivot pins.
8. Use the crane to lift the outer frame high enough to allow the inner scissor arm rollers to come out of the bottom of the outer frame channels.

Move the outer frame away from the lift truck and place it face down on the floor.



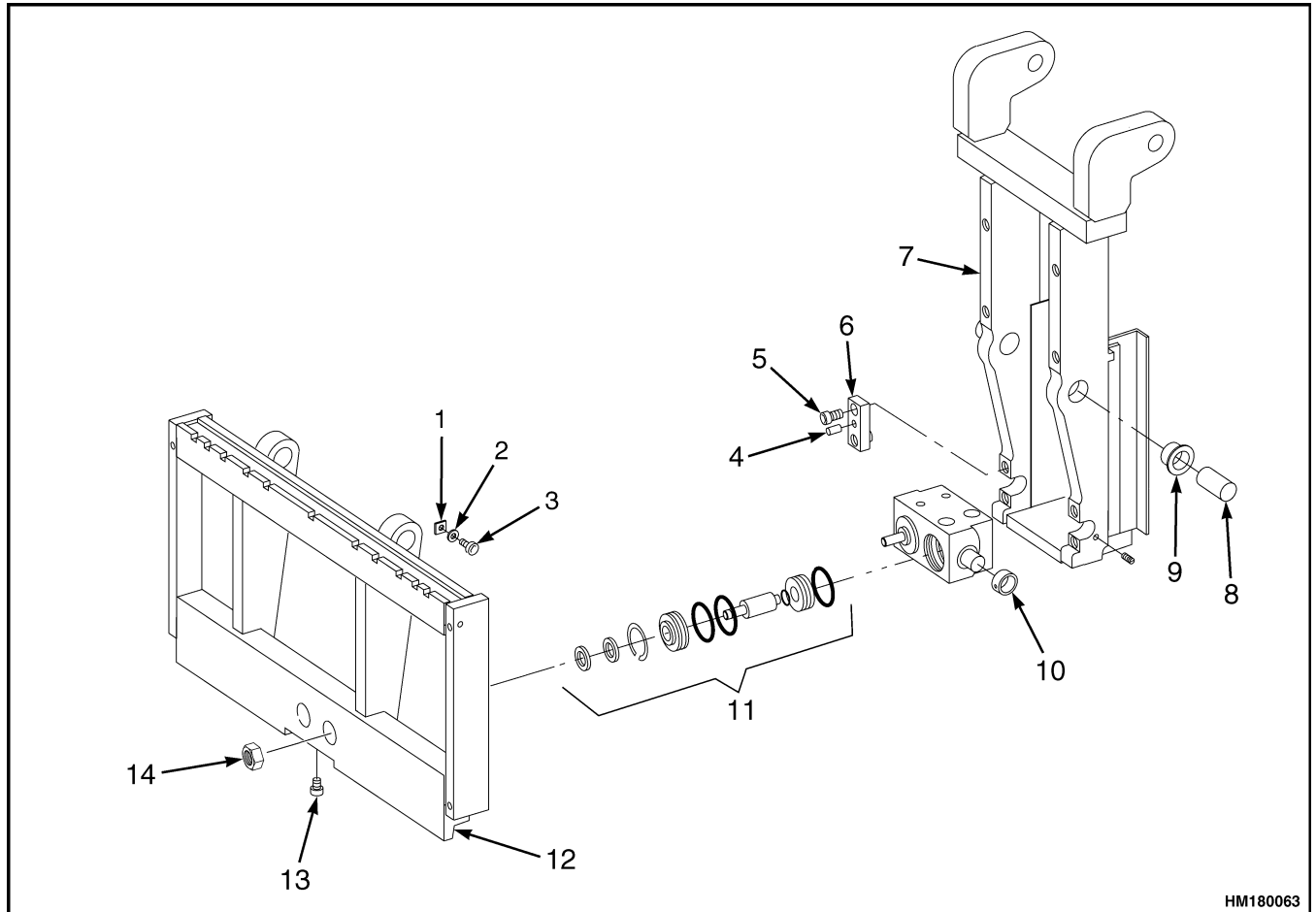
1. REAR FRAME OF REACH ASSEMBLY
2. LOAD BEARING
3. WOOD BLOCK
4. CLAMP

Figure 7. Typical Blocks and Clamps Installation

DISASSEMBLE

The numbers in the parenthesis in the following procedures refer to item numbers in Figure 9.

1. Orient outer frame assembly with roller guides down and secure the unit.
2. Remove forks as outlined in Fork Replacement.
3. Remove load backrest as shown in Load Backrest Removal and Installation section.
4. Remove tilt cylinder nuts (20). (Used on sideshift only.)
5. Remove brackets and hardware (24) from mobile frame. (Used on sideshift only.)

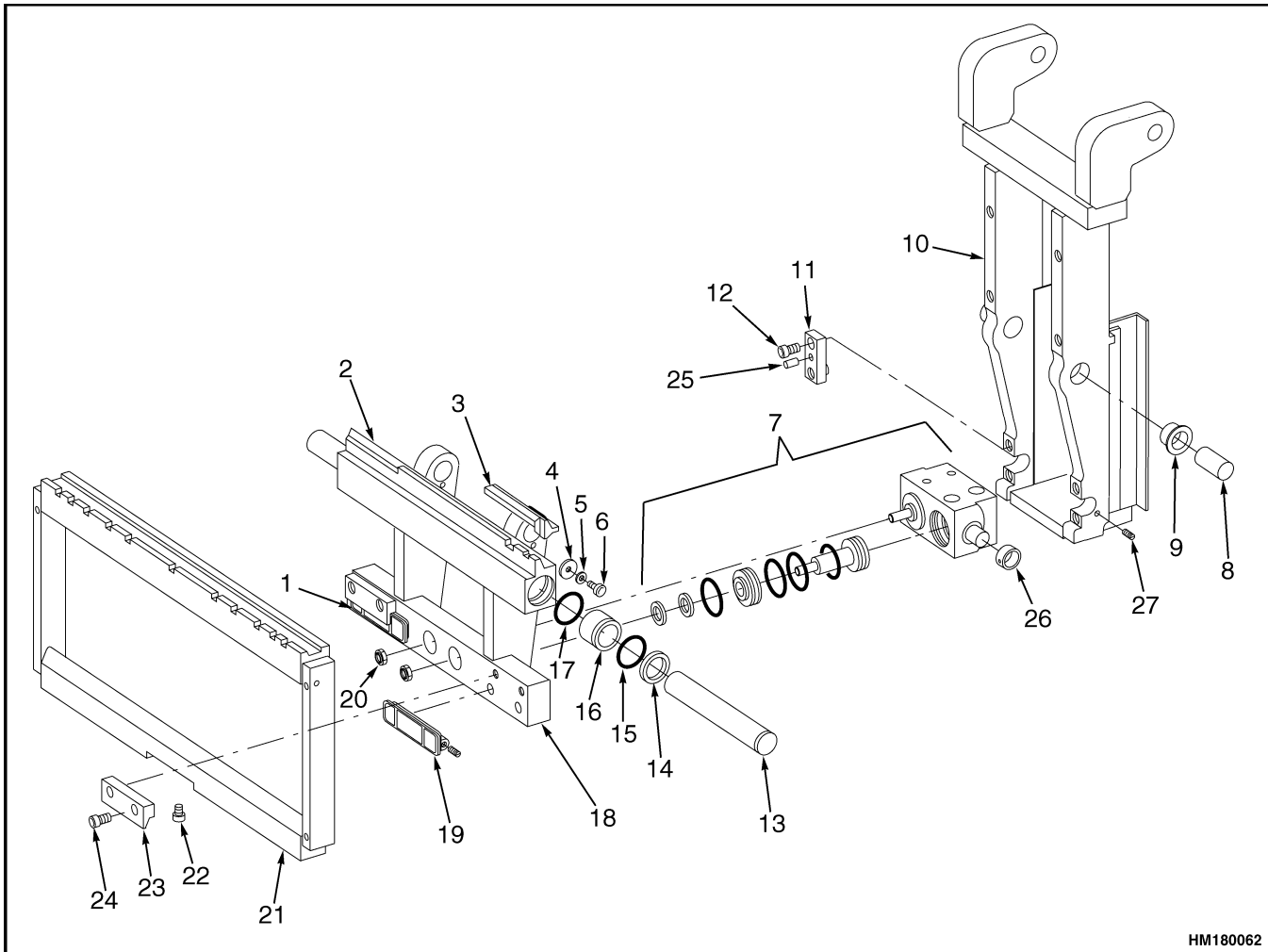


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- | | |
|-----------------|-------------------|
| 1. RETAINER | 8. PIVOT PIN |
| 2. LOCKWASHER | 9. BUSHING |
| 3. CAPSCREW | 10. BUSHING |
| 4. PIN | 11. TILT CYLINDER |
| 5. CAPSCREW | 12. TILTING FRAME |
| 6. TRUNNION CAP | 13. CAPSCREW |
| 7. FIXED FRAME | 14. CAPSCREW |

Figure 8. Outer Frame Without Sideshifter

- | | |
|---|---|
| 6. Remove mobile frame (21). (Used on sideshift only.) | 12. Remove tilt cylinder trunnion cap and hardware (11, 12, 25). |
| 7. Remove polymer wear strips (1, 2, 3, and 19). | 13. Remove tilt cylinder bushing (26). |
| 8. Remove pin-retaining hardware (4, 5, and 6). | 14. Remove tilt cylinder (7). |
| 9. Use a punch to remove pins (8). | 15. Remove bushing from fixed frame (21). |
| 10. Remove tilting frame (18). | |
| 11. Remove (13 through 17) only if needed for service. | |



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- | | | |
|------------------|-------------------|------------------|
| 1. WEAR STRIP | 10. FIXED FRAME | 19. WEAR STRIP |
| 2. WEAR STRIP | 11. TRUNNION CAP | 20. NUT |
| 3. WEAR STRIP | 12. CAPSCREW | 21. MOBILE FRAME |
| 4. WASHER | 13. ROD | 22. CAPSCREW |
| 5. LOCKWASHER | 14. WIPER | 23. BRACKET |
| 6. CAPSCREW | 15. SEAL | 24. CAPSCREW |
| 7. TILT CYLINDER | 16. SLEEVE | 25. PIN |
| 8. PIVOT PIN | 17. SEAL | 26. BUSHING |
| 9. BUSHING | 18. TILTING FRAME | 27. LUBE FITTING |

Figure 9. Outer Frame With Sideshifter

CLEAN AND INSPECT

WARNING

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

CAUTION

Do NOT use steam to clean the load bearings. Do not use compressed air on the bearings. The bearings are sealed and permanently lubricated. The air can force the lubricant out of the bearings.

Clean all of the parts of the outer frame with solvent. Dry the parts with compressed air. Inspect the parts of the outer frame for damage and wear. Replace all bushings.

ASSEMBLE

1. To assemble, reverse the removal procedure.
2. If removed, install the hydraulic hoses for the tilt and sideshift cylinder. Always use new O-rings on the O-ring fittings.

INSTALL



WARNING

The points between the scissor arms and the outer frame is a pinch point and can cause an injury. Do NOT put any part of your body between these assemblies. Use a screwdriver or other tool to move the bearing blocks or assemblies into the correct positions.

1. Use multipurpose grease to lubricate the bushings on the inner and outer scissor arms. Use multipurpose grease to lube the bottom bearings in the channel at the bottom of the outer frame.
2. Use a crane to lift the outer frame. Align the outer frame with the outer scissor arms. Install the pivot pins that retain the inner scissor arms to the outer frame.
3. Install the brackets and hardware to retain the pivot pins.

NOTE: The reach assembly must be installed on the mast before starting Step 4.

4. After all hydraulic lines are connected, operate the functions to check for leaks and correct operation. Remove the air from the system and adjust the stroke of the tilt cylinder as described in Carriage or Reach Assembly Adjustments.
5. If necessary, install the forks and load backrest as described in Fork Replacement and Load Backrest Removal and Installation.

REMOVE WITHOUT SIDESHIFTER



WARNING

There are pinch points on the reach carriage that can cause an injury. Use clamps and blocks to prevent the scissor arms from moving. Install the clamps and blocks at the channels of the rear frame to make sure that the load bearings cannot move in the channel. See Figure 7.



CAUTION

Do NOT use steam to clean the load bearings. Do not use compressed air on the bearings. The bearings are sealed and permanently lubricated. The air can force the lubricant out of the bearings.

NOTE: Use safety chains on the rear frame and mast weldments to keep the reach assembly and mast weldments from moving. Install the safety chains as described in Safety Procedures When Working Near Mast in this section.

1. If necessary, remove the load backrest as described in Load Backrest Removal and Installation.
2. If necessary, remove the forks as described in Fork Replacement.
3. Install labels for correct connection during installation and remove the hoses at the top of the outer frame. For units without sideshift, see Figure 8. For units with sideshift, see Figure 9. Make a note of the location of all cable ties for correct installation of new cable ties during installation. Install caps on the hydraulic lines of the selector valve to prevent dirt from entering the system.



WARNING

The points between the scissor arms and the outer frame are pinch points and can cause an injury. Do NOT put your finger in the hole when you remove the pins. Use the brass drift to remove the pins.



WARNING

The outer frame is heavy and can tip forward and cause an injury when removed from the scissor arms. Tipping is even more possible if the forks or outer frame are installed. Make sure to install the chains or slings between the crane and outer frame to prevent tipping.

4. Use a crane as a support for the outer frame. Use a brass drift to remove the pivot pin that fastens the outer frame to the top ends of the scissor arms.

 **CAUTION**

Do not let the load bearings or shims fall off the scissor arms.

- Carefully move the top of the outer frame away from the scissor arms. Slowly lower the outer frame until the load bearings at the bottom of the scissor arms are out of the frame channels. Move the outer frame away from the scissor arms. Put the outer frame on the ground so that the scissor side is down.

NOTE: Install labels for each set of shims and the load bearing for correct installation during installation of the outer frame. When new load bearings are installed, the shim arrangement will normally be the same or similar.

NOTE: Correct placement of shims is critical for the operation of the reach mechanism. Unless the shims are installed correctly the reach mechanism will not operate.

DISASSEMBLE WITHOUT SIDESHIFTER

NOTE: The bearings for the outer frame are normally removed and installed with the outer frame. The selector valve for the tilt/sideshift functions is also installed on the outer frame. Plugs are installed at the ports for the sideshift cylinder and the solenoids. The tilt pivot assembly is also installed on the outer frame.

- Remove the tilt cylinder and tilt pivot assemblies as described in Tilt Cylinder.
- Remove the solenoid valve body and hose guide. Disassemble the selector valve as described in Tilt/Sideshift Selector Valve Repair, Disassemble.

CLEAN AND INSPECT

 **WARNING**

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

 **CAUTION**

Do NOT use steam to clean the load bearings. Do not use compressed air on the bearings.

The bearings are sealed and permanently lubricated. The air can force the lubricant out of the bearings.

NOTE: Inspect the load bearings of the scissor arms for wear or damage. If necessary, replace the load bearings before installing the outer frame.

Clean all parts of the outer frame with solvent. Dry the parts with compressed air. Inspect the parts of the outer frame for damage and wear.

ASSEMBLE WITHOUT SIDESHIFTER

For the following procedures, see Figure 9.

NOTE: The bearings for the outer frame are normally removed and installed with the outer frame. The selector valve is installed on the outer frame.

- If removed, install the solenoid valve on the outer frame.
- To assemble, reverse the removal procedure.

INSTALL WITHOUT SIDESHIFTER

For the following procedures, see Figure 9.

NOTE: Make all repairs for the scissor arm assembly before installing the outer frame. See Single-Reach Scissor Arms and Double-Reach Scissor Arms to repair the scissor arm assembly. If necessary, install new load bearings using the same shims as marked during removal of the outer frame. When new load bearings are installed, the shim arrangement will normally be the same or similar.

NOTE: The outer frame can be installed with the forks installed.

 **WARNING**

The outer frame is heavy and can cause an injury during installation. NEVER put any part of your body between the outer frame and the scissor arm assembly. Tipping is even more possible if the forks are installed. Make sure to install the chains or slings between the crane and outer frame to prevent tipping.

- Use a crane as a support for the outer frame. Move the outer frame into the approximate position for installation on the scissor arm assembly.

**CAUTION**

Do not let the load bearings or shims fall off the scissor arms.

2. Make sure the shims and load bearings are installed in the correct positions on the scissor arms. If necessary, use tape to keep the load bearings on the scissor arms. Do not let the load bearings fall during installation of the outer frame.

NOTE: Correct placement of shims is critical for the operation of the reach mechanism. Unless the shims are installed correctly, the reach mechanism will not operate.

**WARNING**

There are pinch points on the reach carriage that can cause an injury. Use clamps and blocks to prevent the scissor arms from moving. Install the clamps and blocks at the channels of the rear frame to make sure that the load bearings cannot move in the channel. See Figure 7.

**CAUTION**

Do NOT operate any functions if the outer frame has been removed. Hydraulic oil can come out of the hoses.

NOTE: Another installation method for the outer frame is to raise the scissor arms and rear frame as a unit. Operate the lift system of the lift truck to raise the scissor arms and rear frame above the outer frame. Use the crane and a bar to align the channels of the outer frame under the load bearings of the scissor arms. Tilt the outer frame forward for clearance. Have another person slowly lower the scissor assembly so the load bearings are in the channels. Tilt the outer frame to align the scissor arms for installation of the pins and retaining brackets.

NOTE: Use safety chains on the rear frame and mast weldments to keep the rear frame and mast weldments from moving. Install the safety chains as described in Safety Procedures When Working Near Mast in this section.

3. Use the crane to move the outer frame for alignment with the scissor arms. Tip the outer frame forward and align the channels with the load bearings of the scissor arms. Slowly lift the outer frame to install the load bearings in the channels.

NOTE: Another removal method for the outer frame is to raise the scissor arms and rear frame as a unit. All auxiliary hoses must be plugged to do this. Remove the safety chains and operate the lift system of the lift truck to raise the scissor arms and rear frame off the outer frame.

4. The load bearings must move in the channels and have minimum clearance with free movement. Keep the outer frame in vertical alignment and move it up and down on the load bearings. If necessary, add or remove shims for free movement and minimum clearance.
5. Install new bushings in the top end of each scissor arm. Lubricate the bushings with multipurpose grease. Tip the outer frame back and align the holes for the pivot pins with the bushings in the top scissor arms.
6. Keep the pivot pins (8) (Figure 8 and Figure 9) in alignment to install the retaining brackets and hardware. Install the pins and brackets.
7. Install the hoses and wire at the base of the rear frame as marked during removal. For units without sideshift, see Figure 8. For units with sideshift, see Figure 9.
8. After all hydraulic lines and wire are connected, operate the functions to check for leaks and correct operation. Remove the air from the system as described in Carriage or Reach Assembly Adjustments. Install new cable ties at the original locations for clearance of hoses and electrical cables during operation.

Single-Reach Scissor Arms

REMOVE AND DISASSEMBLE

NOTE: The reach assembly must be in the fully-extended position.

For the following procedures, see Figure 10.

WARNING

There are pinch points on the reach carriage that can cause an injury. Use clamps and blocks to prevent the scissor arms from moving. Install the clamps and blocks at the channels of the rear frame to make sure that the load bearings cannot move in the channel. See Figure 7.

WARNING

Be careful when removing or installing snap rings. These snap rings are large and can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

NOTE: Use safety chains on the rear frame and mast weldments to keep the rear frame and mast weldments from moving. Install the safety chains as described in Safety Procedures When Working Near Mast in this section.

1. Remove the front frame as described in Reach Assembly Outer Frame. Remove the snap rings and hose sheaves at the scissor arm weldment. Fasten the cable and hoses at the rear frame so that they are not damaged.
2. Use a crane and chains or slings as a support for the scissor arm weldment. Do not damage the hose sheave mount.

WARNING

The points between the scissor arms and the front frame are pinch points and can cause an injury. **DO NOT** put your finger in the hole when you remove the pins. Use the brass drift to remove the pins.

3. Remove the shoulder bolt and nut. Use a drift to remove the pins that fasten the rod ends of the reach cylinders to the scissor arm weldment. Use wire to hold each reach cylinder and their hoses in a position for clearance as the load bearings move. Remove the bushings from the mounts.

WARNING

The load bearings and scissor arms can move and cause an injury when the clamps and blocks at the load bearings are removed. Make sure the crane is in a position to prevent movement of the scissor arms as the clamps and blocks are removed.

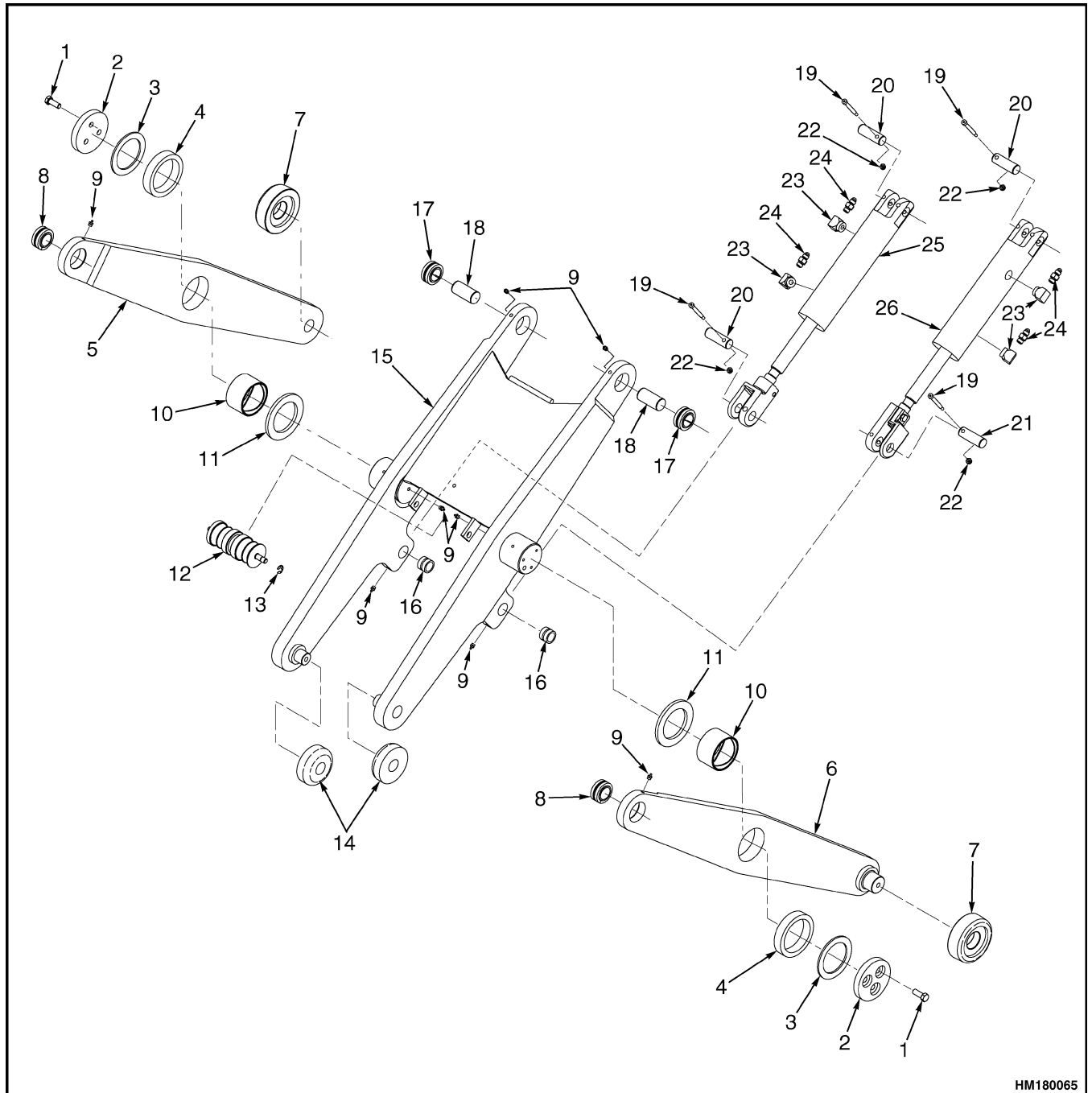
4. Carefully remove the clamps and blocks at the load bearings on the channels of the rear frame. Slowly move the scissor arms to align the load bearings with the removal notch in the rear frame. Raise the scissor arm weldment and the scissor arms to move the load bearings out of the rear frame.

NOTE: Install labels for each set of shims and the load bearing on the scissor arms for correct assembly during installation of the scissor arms. When new load bearings are installed, the shim arrangement will normally be the same or similar. Remove the load bearings and shims.

WARNING

The scissor arms are heavy and can cause an injury if allowed to fall. Have another person help you support the scissor arm during removal and installation.

5. Install labels for correct installation of the right-hand or left-hand scissor arms. Carefully remove the three capscrews, the lockwashers, the end cap, and the two thrust washers at the center pivot for the scissor arm and scissor arm weldment. Hold the scissor arm and carefully slide it off the bushing and stub shaft of the scissor arm weldment. Remove the bushing and the other two thrust washers. Remove the other scissor arm following this same procedure.



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|---------------------------------------|-------------------------------------|--------------------------|
| 1. CAPSCREW, LOCKWASHER, AND LOCTITE® | 10. MAIN BUSHING | 19. SCREW |
| 2. END CAP | 11. THRUST WASHER | 20. PIN |
| 3. THRUST WASHER | 12. SHEAVE | 21. PIN ROD END |
| 4. THRUST WASHER | 13. RETAINING RING | 22. LOCK NUT |
| 5. RH OUTER ARM ASSEMBLY | 14. FRONT ARM LOAD BEARING AND SHIM | 23. FITTING WITH O-RING |
| 6. LH OUTER ARM ASSEMBLY | 15. INNER ARM WELDMENT | 24. FITTING WITH O-RING |
| 7. BEARING AND SHIM | 16. BUSHING | 25. RH CYLINDER ASSEMBLY |
| 8. BEARING | 17. BUSHING | 26. LH CYLINDER ASSEMBLY |
| 9. LUBE FITTING | 18. PIN | |

Figure 10. Single-Reach Scissor Arms

 **WARNING**

The points between the scissor arms and the rear frame are pinch points and can cause an injury. **DO NOT** put your finger in the hole when you remove the pins. Use a hammer and brass punch to remove the pins.

- Remove the pivot pins that fasten the scissor arm weldment to the rear frame. Move the scissor arm weldment and put it on the floor without damaging the hose sheave mount. Remove the bushings.
- If necessary, install the forks and load backrest as described in Fork Replacement and Load Backrest Removal and Installation.

CLEAN AND INSPECT **WARNING**

Cleaning solvents can be flammable and toxic and can cause skin irritation. Always wear the proper protective equipment including eye protection and petroleum resistant gloves when handling. Always follow the recommendations of the manufacturer.

 **CAUTION**

DO NOT use steam to clean sealed bearings. **DO NOT** use compressed air or immerse in solvent to clean sealed bearings. Sealed bearings are self-contained and permanently lubricated. Wipe bearings off with a clean cloth and turn to check for proper operation. Replace if movement is restricted or if bearing does not turn smoothly.

Clean all of the parts of the scissor arm assembly with solvent. Inspect the parts of the scissor arm assembly for damage and wear. Replace all bushings and load rollers.

ASSEMBLE AND INSTALL

NOTE: Safety chain the rear frame and mast weldments to keep the rear frame and mast weldments from moving. Install the safety chains as described in Safety Procedures When Working Near Mast in this section.

NOTE: Always use new bushings and load rollers. Install a thin coat of multipurpose grease on all

new bushings, all thrust washers, all shims, all stub shafts, and all pins of the scissor arm assembly.

 **WARNING**

The points between the scissor arms and the rear frame are pinch points and can cause an injury. **DO NOT** put your hands near pinch points when removing the pivot pins. Use a hammer and brass drift to remove the pivot pins.

- Use a crane and chains or slings as a support for the scissor arm weldment. Do not damage the hose sheave mount. Move the weldment into a position of alignment to install the pins that fasten the weldment to the rear frame. Install the bushings, pins, and shoulder bolt. See Figure 15.

 **WARNING**

The scissor arms are heavy and can cause an injury if allowed to fall. Have another person help you support the scissor arm during removal and installation.

- Install two thrust washers and the bushing on each stub shaft of the scissor arm weldment. Install the right-hand and left-hand scissor arms as shown in Figure 10. Use the other two thrust washers, the end cap, lockwashers, and capscrews on each stub shaft and bushing. Tighten the three capscrews at each end cap to 41 N•m (30 lbf ft).

 **WARNING**

The scissor assembly is heavy and can cause an injury during installation. **NEVER** put any part of your body between the rear frame and the scissor arm assembly. **NEVER** put any part of your body between the parts of the scissor arm assembly.

 **CAUTION**

DO NOT let the load rollers or shims fall off the scissor arms.

NOTE: Correct placement of shims is critical for the operation of the reach carriage assembly. Unless the shims are installed correctly, the reach carriage assembly will not operate.

- Slowly raise the weldment so you can install the shim sets and load rollers on each scissor arm as marked during removal and disassembly. If