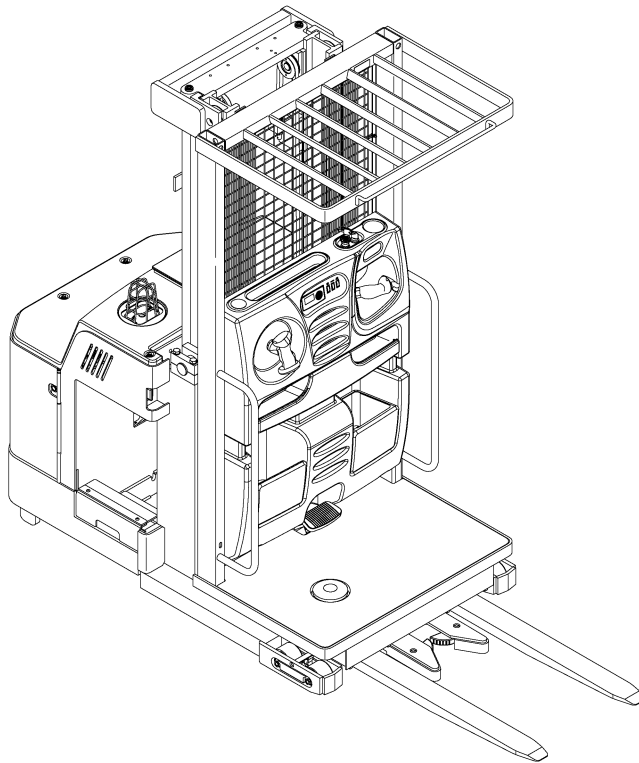


MAST REPAIR

R30XMF3 [A169]; R30XMA3 [A185]; N40-50EA,
N40-45ER [C138]; R30E/EA, R30EA-FS [D118];
R30XMS2 [D174]; R30XMS3 [E174]; R30XM/XMA/XMF [F118];
R30XM2, R30XMA2, R30XMF2 [G118]; R30XM3 [H118]



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 hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and 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:

R30XMF3 [A169];
R30XMA3 [A185];
N40-50EA, N40-45ER [C138];
R30E/EA, R30EA-FS [D118];
R30XMS2 [D174];
R30XMS3 [E174];
R30XM/XMA/XMF [F118];
R30XM2, R30XMA2, R30XMF2 [G118];
R30XM3 [H118]

**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

General

This manual has the repair procedures for the two-stage and three-stage masts. A section for troubleshooting and a section for checks and adjustments is given at the end of the section. The description

and operation of the masts are given in the section **MAST, Description** 4000 SRM 763. Repair procedures for the operator platform are also in this section.

Forks

REPLACE



WARNING

Lower the lift mechanism completely. Never allow anyone under a raised operator platform or forks. Do not put any part of your body in or through the mechanism unless all parts of the mast are completely lowered and the key switch is OFF.

Before making any repairs, use blocks and chains on the mast weldments and operator platform so they cannot move. Make sure the moving parts are attached to a nonmoving part.



WARNING

Forks are heavy and can cause an injury. Do not try to remove forks without using a lifting device.

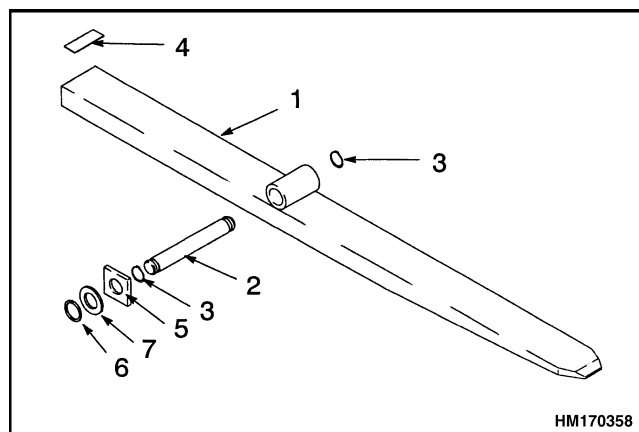
Each of these forks is connected to the operator platform by a pin near the edge of the platform. See Figure 1 and Figure 2. The pin fits through a tube welded to the top of the fork. The forks can be removed by raising the operator platform for access.



WARNING

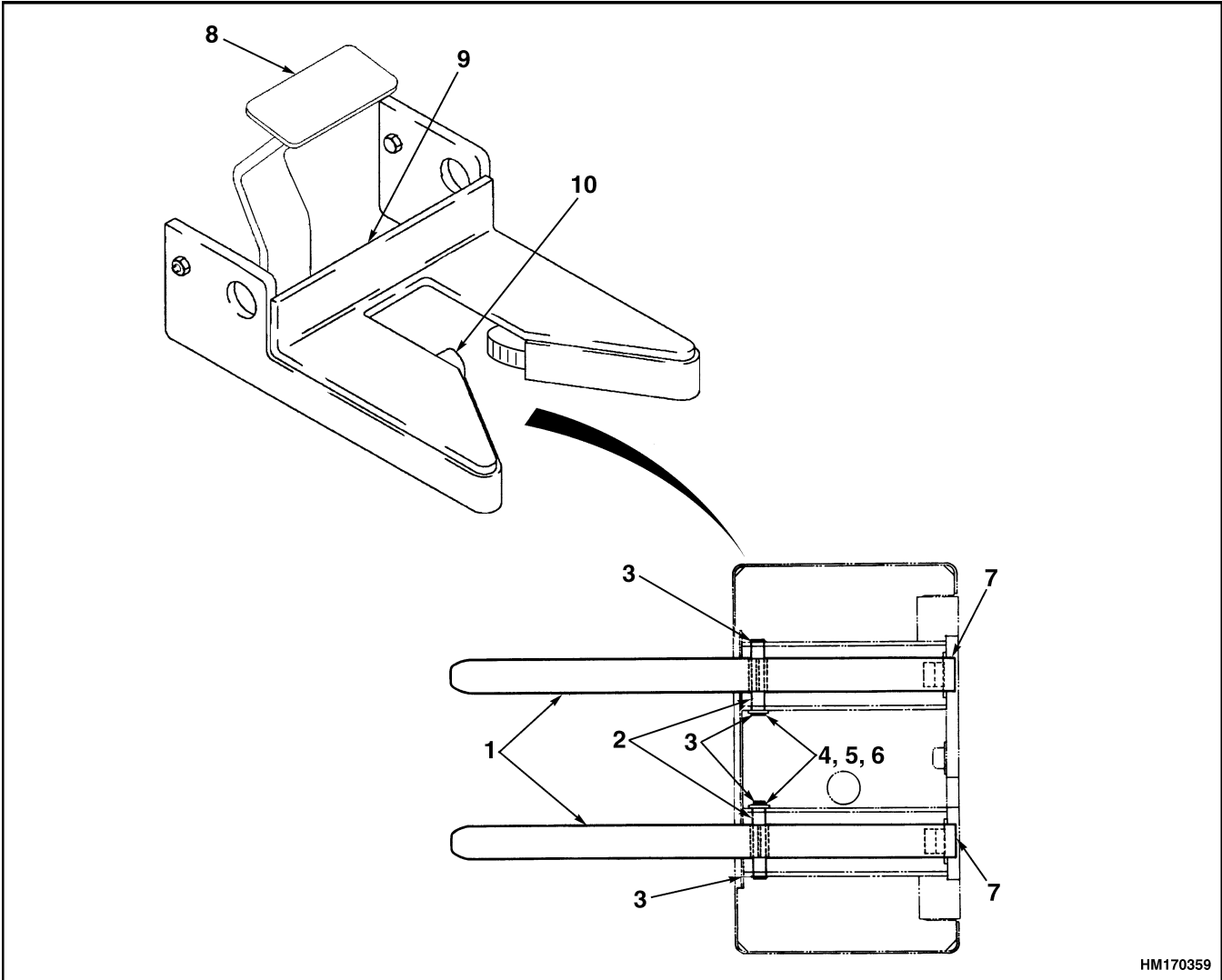
Before replacing forks, use blocks and chains on the mast weldments and operator platform so they cannot move. Make sure the moving parts are attached to a nonmoving part.

Use blocks and chains to prevent movement of the mast or operator platform. Support the fork, remove the snap ring on the end of the pin, and remove the pin. Install the forks using the reverse procedure. Make sure the hook at the end of the fork engages the plate of the platform. Do not install any shims at this time. Make sure the operator platform is fully lowered. Adjust the lift chains of the operator platform so the tip of the highest fork is within the specification. See Lift Chain Adjustment at the end of this section. After the chains are adjusted, use shims on the top of the fork (lowest fork tip) at the hook so the fork tips are aligned within 3.2 mm (1/8 in.).



- | | |
|--------------|-----------|
| 1. FORK | 5. SPACER |
| 2. PIN | 6. WASHER |
| 3. SNAP RING | 7. WASHER |
| 4. SHIM | |

Figure 1. Fork Assembly



HM170359

- | | |
|-----------|----------------|
| 1. FORK | 6. SPACER |
| 2. PIN | 7. SHIM |
| 3. WASHER | 8. PEDAL |
| 4. WASHER | 9. PALLET GRIP |
| 5. WASHER | 10. PAWL |

Figure 2. Forks, Pallet Grip, and Operator Platform

Operator Platform

REMOVE

1. Remove the forks as described in the section Forks, Replace in this manual.
2. If the hydraulic system cannot be used, perform Step 3 instead of this step. Tie a rope to the free-lift crosshead (three-stage only). Use the hydraulic system to raise the operator platform for access to the chain anchors above the top of the main lift truck frame.
3. When the hydraulic system cannot be used, connect a crane to the top of the operator platform. Make sure that the chains or slings do not damage the parts of the operator platform. Tie a rope to the free-lift crosshead (three-stage only). Carefully lift the operator platform for access to the chain anchor(s) above the top of the main lift truck frame. Make sure the lift chain(s) passes over the sheave(s) correctly.



WARNING

Before making any repairs, use blocks and chains on the mast weldments and operator platform so they cannot move. Make sure the moving parts are attached to a nonmoving part.

Lift chains and cables can roll over the sheaves to fall and possibly cause an injury if the ends are not fastened. Keep control of the ends of the lift chains and cables as they are disconnected.

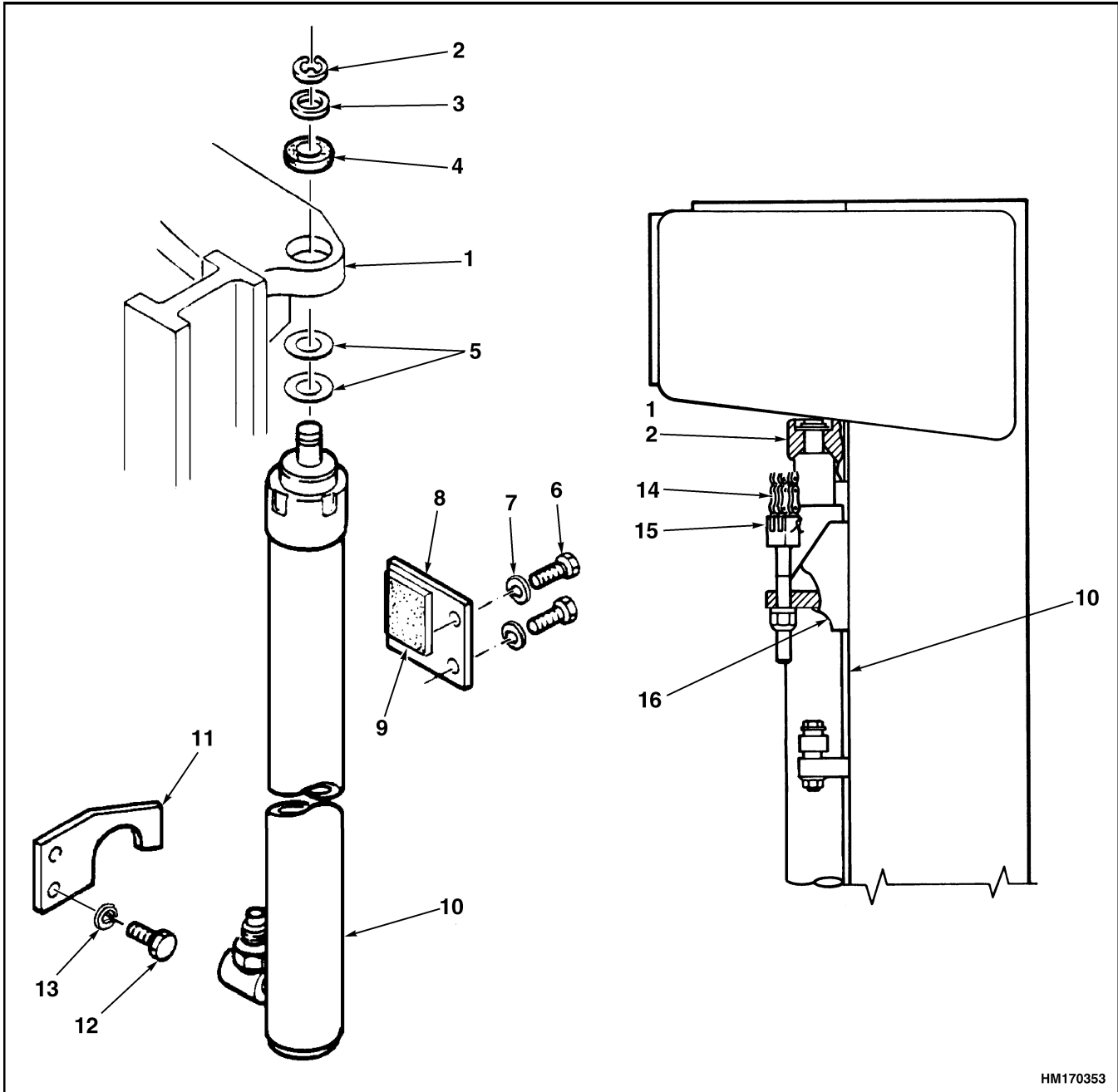
4. Use blocks and chains to prevent movement of the mast or operator platform. Use the battery disconnect lever to disconnect the battery. Remove the battery as described in the **Operating Manual** or the section **Periodic Maintenance** 8000 SRM 924 or **Periodic Maintenance** 8000 SRM 1472.
5. Remove the pin(s) in the chain anchor of the operator platform to disconnect the lift chain(s). Removing the pin(s) will disconnect the lift chain(s) without changing the chain adjustment. Carefully move the lift chain(s) through the sheave(s) and lay the chain(s) over the top of the lift truck.
6. Use a ladder for access to the operator platform. Make a note of all the connections and disconnect the electrical cables. Carefully move each cable through the sheave and lay it over the top of the lift truck.
7. Use a crane and chains or slings to support the operator platform. Remove the blocks and chains. Use the crane to slowly lower the operator platform to the floor. Make sure the operator platform is resting on the floor and not on chains or slings.



WARNING

The operator platform assembly is heavy and can cause an injury if it tips or falls. Make sure the operator platform assembly has stability during and after removal.

8. Fasten the operator platform so it cannot fall. Use chains or slings to fasten a crane to the inner mast weldment. On two-stage masts, remove the snap ring and washer at the rod of each lift cylinder. See Figure 3. The inner mast weldment must be able to move without extending the cylinder rods.
9. Use the crane to raise the inner mast weldment slowly so the carriage rollers come out from the bottom of the channels. Make sure the chains or slings do not damage the sheaves or other mast parts. Make sure there is clearance for the chains or slings as the inner mast weldment moves. Carefully move the carriage away from the lift truck. Carefully lower the inner mast weldment.
10. On three-stage masts, open the Manual Lowering valve. Pull on the rope to retract the free-lift cylinder rod.
11. If any of the operator platform load rollers must be replaced, make a note of the shim arrangement. When the new load rollers are installed, the shim arrangement normally will be similar.



HM170353

- | | |
|------------------------|---------------------------------|
| 1. LIFT CYLINDER MOUNT | 9. CUSHION |
| 2. RETAINING RING | 10. MAIN LIFT CYLINDER |
| 3. WASHER - BACK | 11. LOCK PLATE |
| 4. RUBBER BUSHING | 12. SCREW |
| 5. SHIMS | 13. LOCKWASHER |
| 6. SCREW | 14. LIFT CHAIN |
| 7. LOCKWASHER | 15. CHAIN ANCHOR |
| 8. CYLINDER RETAINER | 16. OUTER MAST WELDMENT SUPPORT |

Figure 3. Disconnecting Lift Cylinders

INSTALL

NOTE: Replace any load rollers that need replacing **BEFORE** starting this installation procedure. Use the same shim arrangement noted during removal.

1. Make sure the two-stage cylinder rods are not fastened to the inner mast weldment. Use a crane and chains or slings to raise the inner mast weldment as described in the Remove procedure. Raise the inner mast weldment until it is above the load rollers of the operator platform. Carefully align the operator platform load rollers and the mast channel. Slowly lower the inner mast weldment until it engages all the load rollers. On two-stage masts, install the washers and snap rings that fasten the cylinder rods to the inner mast weldment.
2. Check the load roller clearance. See the Operator Platform Adjustment procedure at the end of this section.
3. Use a crane and chains or slings to raise the operator platform for access to the chain anchor(s) above the top of the main lift truck frame.



WARNING

Before installing lift chains or cables, use blocks and chains on the mast weldments and

operator platform so they cannot move. Make sure the moving parts are attached to a non-moving part.

Lift chains and cables can roll over the sheaves to fall and possibly cause an injury if the ends are not fastened. Keep control of the ends of the lift chains and cables as they are connected.

4. Use blocks and chains to prevent movement of the operator platform. Install the lift chain(s) using the pin(s) in the chain anchor(s). Make sure new cotter pin(s) is installed. See the Lift Chain Adjustment procedure at the end of this section to check and if necessary, adjust, the lift chains. Do **NOT** remove the blocks and chains for the operator platform.
5. Use a ladder for access to the operator platform. Carefully move each electrical cable through the sheave and install the cable at the operator platform. Connect the wires according to the notes made during removal. Also see the section **Diagrams** 8000 SRM 923, **Diagrams** 8000 SRM 958, **Diagrams** 8000 SRM 1473 for the correct connections. Remove the blocks and chains and carefully lower the operator platform.

Two-Stage Mast

REMOVE



WARNING

Fully lower all the mast weldments. Weldments, operator platform, and forks can move suddenly and cause an injury as hydraulic lines are disconnected.

NOTE: If the mast assembly will be disassembled, remove the operator platform before the mast assembly is removed. See Operator Platform, Remove in this section.

1. Disconnect and remove the battery. Refer to the correct procedure in the **Operating Manual** or the section **Periodic Maintenance** 8000 SRM 924 or **Periodic Maintenance** 8000 SRM 1472.
2. Install blocks under the main frame near the mast to support the main frame without changing the height. Make sure the mast, base arms, and load wheels do not support any weight so the mast capscrews can be removed. Use chains to fasten the mast channels together at the top of the mast.
3. Open the door and remove the access cover over the electrical compartment. Remove the hydraulic tube at the cylinder port of the solenoid valve. Put caps on the port, the mast hose, and both ends of the tube to prevent dirt from entering the system. Use wire to fasten the hose in a position to prevent damage during removal of the mast.
4. Disconnect the electrical cable for the operator platform. Push the cable and connectors through the holes in the lift truck frame to prevent damage to the cable during removal of the mast. Use wire to fasten the hoses and cable in a position to prevent damage.
5. Use chains to connect a crane to the top of the mast. Make sure the chains will not damage the sheaves or other parts of the mast assembly. Make sure the chains and crane have the capacity to lift approximately 2000 kg (4500 lb). Use other chains to fasten all the mast weldments together so they cannot move. Operate the crane until it gives support to the weight of the mast. Move the crane to a position so the mast assembly will be lifted vertically.
6. Remove the four large capscrews and washers that fasten the bottom of the mast to the lift truck frame. Hold the spacers and remove the four large capscrews and washers that fasten the top of the mast. Remove all the spacers.



WARNING

Lift chains and cables can roll over the sheaves to fall and possibly cause an injury if the ends are not fastened. Keep control of the ends of the lift chains and cables as they are disconnected.

7. Use a ladder to disconnect the lift chains at the top of the outer mast weldment. Remove the pins in the chain anchors to remove the chains without changing the adjustment. Carefully lower the lift chains. Disconnect the electrical wires from the limit switches and remove the cables.
8. Remove the cross tube (horizontal) at the battery side of the bottom of the mast.
9. Operate the crane and carefully move the mast assembly away from the lift truck. Do not damage any hydraulic lines or the electrical cable.
10. Put the mast assembly on the floor so the back (battery side) of the mast is toward the floor.

DISASSEMBLE

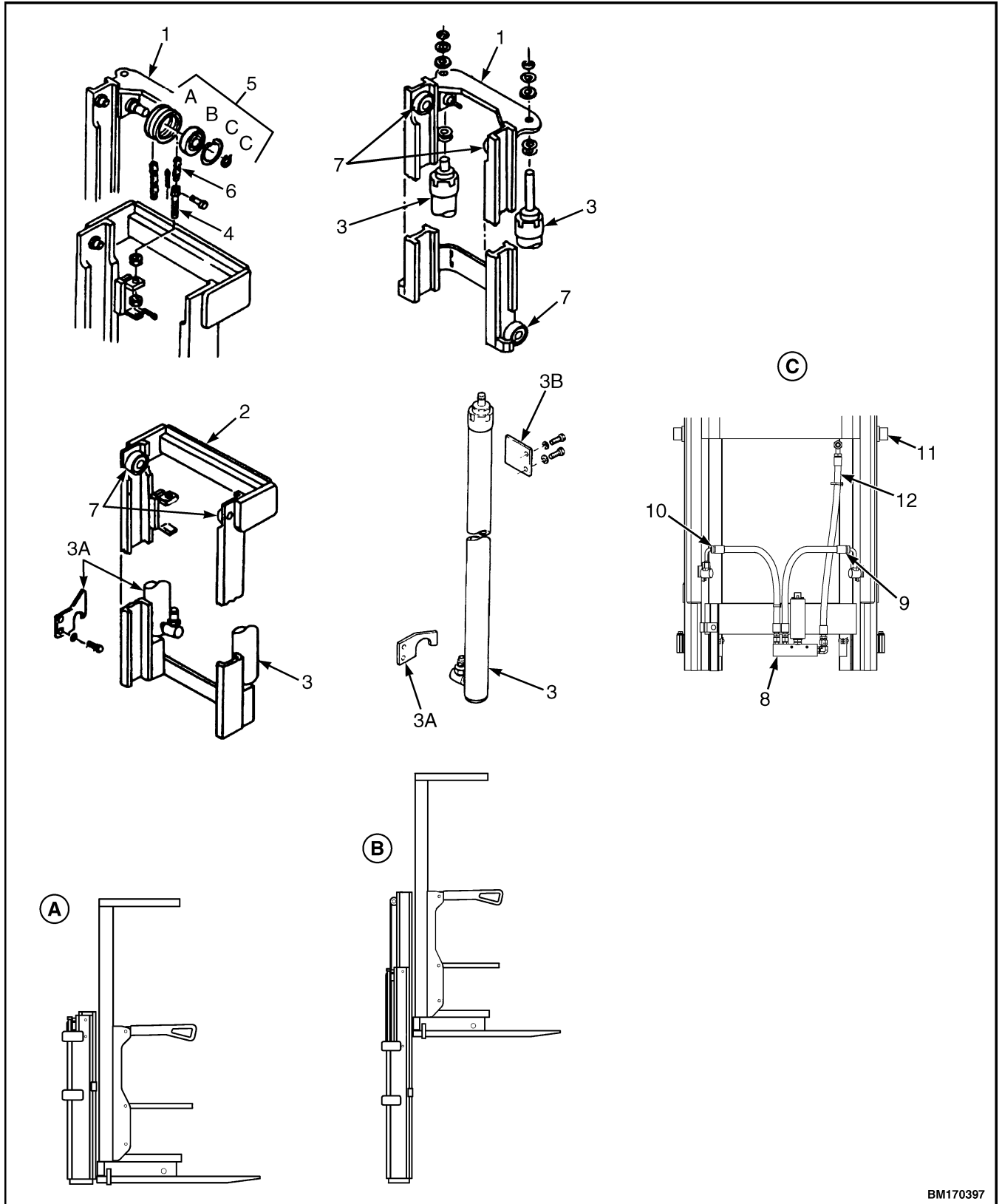
NOTE: This procedure does NOT include the removal of the operator platform. Remove the operator platform before starting this procedure. See Operator Platform, Remove in this section to remove the operator platform. See Figure 3 and Figure 4.



WARNING

Make sure the battery side of the mast is toward the floor so the front of the mast is up for easier disassembly. Make sure the mast weldments are fastened together so the weldments will only slide when being moved during disassembly.

1. If necessary, remove the lift chains by removing the pin in the chain anchor. Removing the pin will allow chain removal without changing the adjustment.



BM170397

Figure 4. Two-Stage Mast Assembly

*Legend for Figure 4***A. POSITION 1**

1. ELEVATING MAST WELDMENT
2. STATIONARY MAST WELDMENT
3. MAIN LIFT CYLINDER
 - A. LOCK PLATE
 - B. RETAINER
4. CHAIN ANCHOR

B. POSITION 2

5. CHAIN SHEAVE ASSEMBLY (RH)
 - A. CHAIN SHEAVE
 - B. BALL BEARING
 - C. SNAP RING
6. MAIN LIFT CHAIN
7. LOAD ROLLER

C. REAR VIEW HOSE ROUTING - LIFT

8. FLOW REGULATOR HOUSING
9. HYDRAULIC TUBE (MAIN LIFT)
10. HYDRAULIC HOSE (MAIN LIFT)
11. TRUNNION STUB SHAFT
12. TO TRUCK CONTROL VALVE

2. Remove the snap rings and washers from the top of each lift cylinder. Use a pry bar to move the inner mast weldment approximately 152 to 305 mm (6 to 12 in.) out from the top of the outer mast weldment. Remove the chain and hose sheaves.
3. Install a sling near the center of each channel of the inner mast weldment so it will be balanced. The slings must pass through the loop at the end of the sling so the sling tightens and does not slip on the channel as the weldment is lifted. Fasten a crane to the slings.
4. Use the crane to move the inner mast weldment out of the outer mast weldment. Move the mast weldment until the bottom rollers of the inner mast weldment touch the top rollers of the outer mast weldment. Use the crane to raise the top of the inner mast weldment so it is at an angle of approximately 30°. Lift the weldment straight up to remove the inner from the outer mast weldment. Put the weldment flat on the floor so it cannot fall.
5. Clean the area at the hydraulic fittings for the lift cylinders. Disconnect the fittings. Put caps on the open fittings and cylinder port to prevent dirt from entering the system. Remove the snap rings at the bottom of each cylinder.
6. Install a sling near the center of the lift cylinder in the same manner used for the mast weldment removal. Remove the capscrew, washer, and spacer that fastens the cylinder to the outer mast channel. See Figure 3. Use the crane to move the cylinder from the base hole and remove the cylinder from the mast. Repeat the procedure to remove the other cylinder.

7. Remove the snap rings from the lower and upper load rollers. Make a note of the shim arrangement as each load roller is removed. The shim arrangement will be approximately the same when the mast is assembled.
8. Remove the strip bearings from the outer mast weldment. Make a note of the shim arrangement during removal of the strip bearings for correct installation during assembly.
9. Disassemble the sheaves and rollers as necessary for repair and cleaning.

CLEAN AND INSPECT

NOTE: These cleaning and inspection procedures apply to both the two-stage and three-stage masts.

**CAUTION**

Do NOT use steam to clean the lift chains, sheaves, or load rollers. The sheaves and roller bearings are sealed and permanently lubricated. Do not use compressed air on the bearings. The air can force the lubricant out of the bearings. Follow the manufacturer's instructions when using solvent.

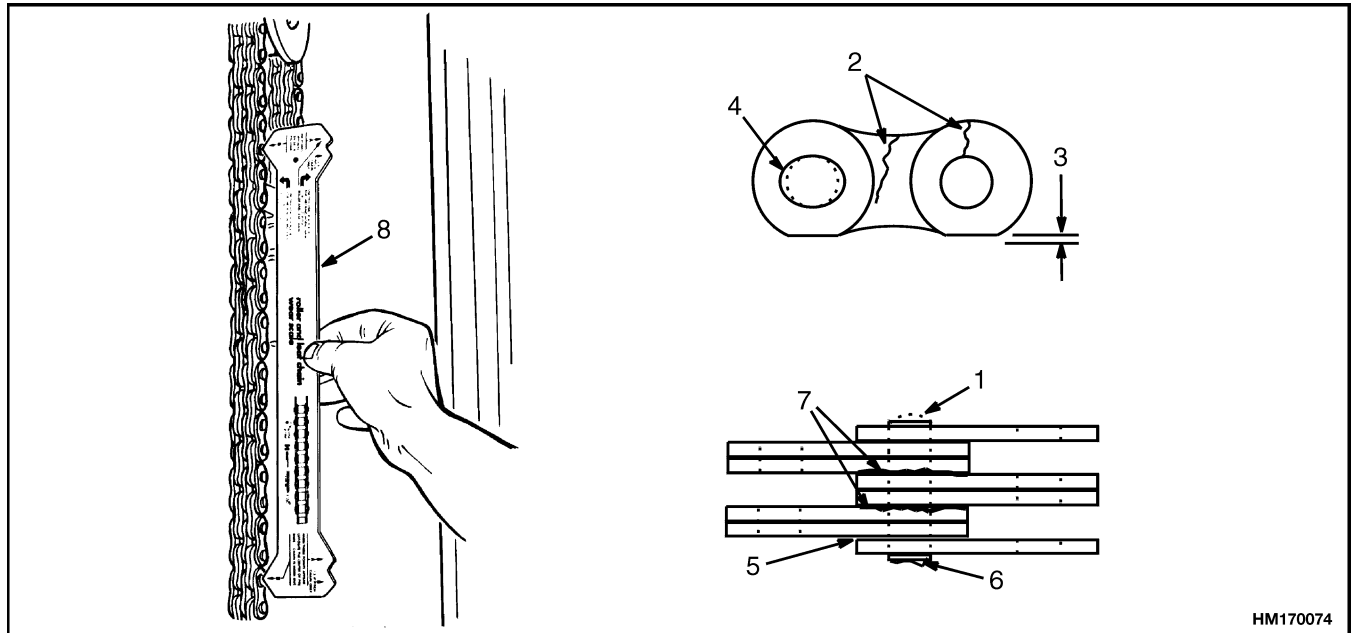
1. Wash the lift chains with solvent. Use compressed air to dry the chains. Inspect the chains for wear and damage.
2. Inspect the lift chains for cracks or broken links and pins. Check for corrosion or worn holes in the links. When the pins or the holes wear, the chain becomes longer. The chain links that run over the chain sheaves have the most wear. If a chain is 3 percent longer than a new chain, the chain must be replaced. If a chain scale is available, check the lift chains as shown in Figure 5. If a chain scale is not available, measure 20 links of chain. Replace the chains if the increase in length is 3 percent or greater.

⚠ WARNING

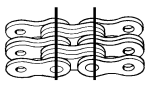
Never replace just the worn section of a chain. Replace the complete chain. Never replace just one chain of a chain pair. Replace both chains.

3. For chains that can be used again, put the chains in SAE 30 oil for 12 hours.

4. Inspect the chain anchors and pins. Replace chain anchors that have broken fingers or holes worn so that they are not round. Replace chain anchor pins that are worn or have cracks.



NOTE: THE INSTRUCTIONS FOR MEASURING CHAIN WEAR ARE SHOWN ON THE CHAIN WEAR SCALE.

Pitch 	Total Lengths of 20 Links (Pitch) of New Chain	Wear Limit The Maximum Length of 20 Links
12.7 mm (0.50 in.)	254.0 mm (10.0 in.)	261.6 mm (10.3 in.)
15.9 mm (0.625 in.)	317.5 mm (12.5 in.)	327.0 mm (12.87 in.)
19.1 mm (0.75 in.)	381.0 mm (15.0 in.)	392.4 mm (15.45 in.)
25.4 mm (1.00 in.)	508.0 mm (20.0 in.)	523.25 mm (20.6 in.)
31.8 mm (1.25 in.)	635.0 mm (25.0 in.)	654.1 mm (25.75 in.)
44.5 mm (1.75 in.)	889.0 mm (35.0 in.)	915.7 mm (36.05 in.)
50.8 mm (2.00 in.)	1016.0 mm (40.0 in.)	1046.5 mm (41.2 in.)

- 1. WORN PIN
- 2. CRACKS
- 3. EDGE WEAR
- 4. HOLE WEAR
- 5. LOOSE LEAVES
- 6. DAMAGED PIN
- 7. CORROSION
- 8. CHAIN WEAR SCALE

Figure 5. Chain Parts and Wear

 **WARNING**

Commercial cleaning solvents can be flammable and toxic and can cause severe skin irritation. When using commercial cleaning solvents, always comply with the solvent manufacturer's recommended safety precautions.

5. Clean the mast weldments with steam or solvent.

 **WARNING**

Do NOT weld on masts. Get information from your Hyster lift truck dealer before welding on masts.

6. Inspect the sliding and rolling surfaces. Inspect the welds around the stub shafts.

LIFT CYLINDERS

NOTE: The lift cylinders are removed during disassembly of the mast. To repair the cylinders, see the section **Lift Cylinders** 4000 SRM 135 for the correct service procedures.

ASSEMBLE

NOTE: The shims for the load rollers keep the channels of the mast weldments parallel and give correct clearance. During assembly, the arrangement of the shims will be the same or approximately the same as they were before disassembly. Check the clearance and adjust for wear or changes from the repairs. The strip bearings at the top of the outer mast weldment and the bottom of the inner mast weldment are also adjusted using shims. See the Checks and Adjustments in this section for the instructions to make the necessary adjustments.

1. Assemble the load rollers, sheaves, and strip bearings on the mast weldments and operator platform as necessary. Make sure to keep the same shim arrangement noted during disassembly. Apply a thin layer of multipurpose grease to the strip bearings and the bearing and roller surfaces of the channels.
2. Make sure the cylinders are assembled and install a sling near the center of the cylinder as

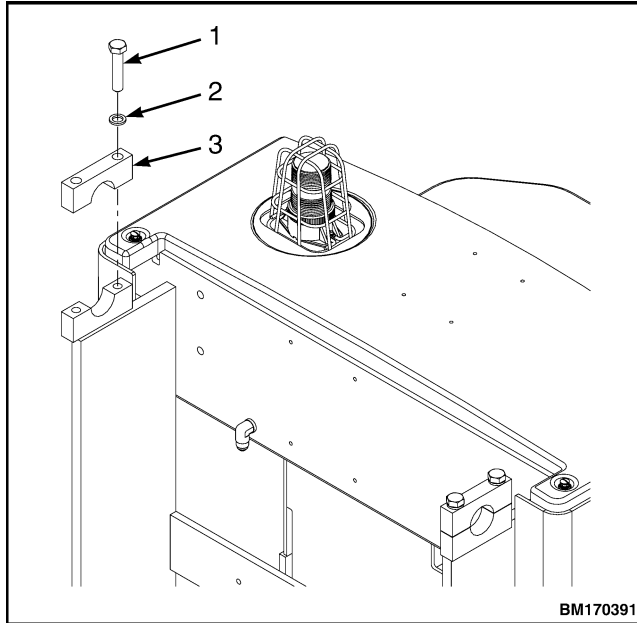
during removal. Use a crane to move the cylinder into position in the outer mast weldment. Install the snap ring on the bottom of the cylinder. Install the capscrew, washer, and spacer to fasten the cylinder shell to the channel. Repeat the procedure to install the other cylinder.

3. Use the crane to move the inner mast weldment into position over the outer mast weldment. Fasten the slings to the centers of the channels to balance the weldment as during removal. Make sure the inner mast weldment is at approximately a 30-degree angle with the bottom load rollers in the notch near the top load rollers of the outer mast channels. Slowly lower the inner mast weldment and insert it into the outer mast weldment.
4. Check the clearance of the load rollers and the strip bearings. Make the necessary adjustments as described in Mast Adjustments.
5. With the inner mast weldment approximately 152 to 305 mm (6 to 12 in.) out of the outer mast weldment, install the chain and hose sheaves. Move the inner mast weldment into the outer mast weldment so the tops of the cylinder rods are through the holes in the inner mast channels. Install the washers and snap rings to fasten the cylinder rods to the channels.

INSTALL

NOTE: If two hoists are available, connect one to the mast and the other to the base of the platform for stability. This will allow for easier mounting of the mast. Make sure the hoist and chains or straps have the capacity to lift the mast assembly.

1. Attach a chain or strap to the top of the mast and elevate the mast with the hoist. Ensure the mast cable on the mast is secure during installation of the mast.
2. On the chassis frame, the mast trunnion caps and capscrews allow the mast to attach securely to the frame. Remove the two bolts and caps on both sides of the chassis frame if they were reinstalled after the initial removal of the mast. See Figure 6.



1. CAPCREW
2. WASHER
3. TRUNNION CAP

Figure 6. Mast Trunnion



WARNING

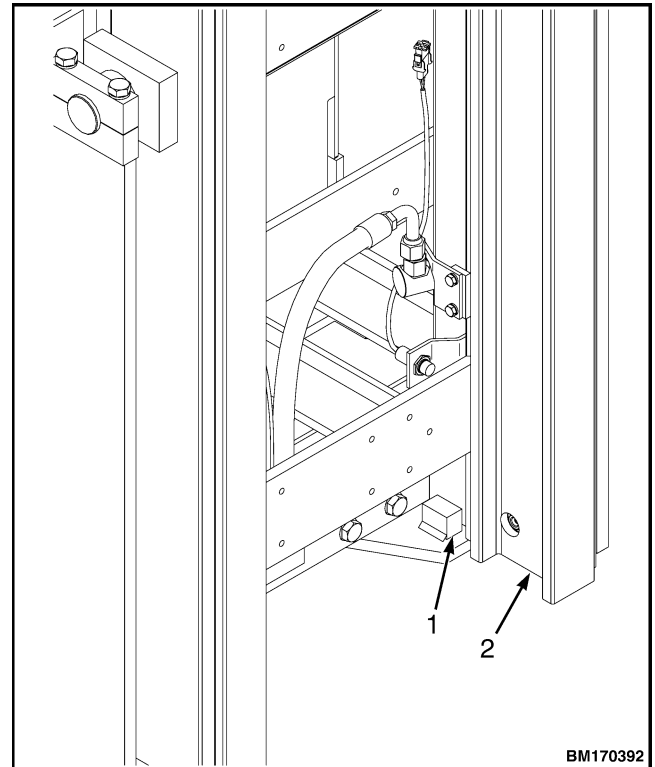
Mast assemblies are heavy and can cause an injury when moving. NEVER put any part of your body between the mast and a solid object when the mast is being moved.

3. Using the hoist, raise the mast to a height that will allow the base of the mast to clear the base of the frame.

NOTE: The alignment block mounted to the frame keeps the mast from tipping during installation.

4. Align the mast directly over the open trunnions and lower the mast until it rests on the trunnion blocks as shown in Figure 6. Make sure the alignment block is resting in the angled bracket shown

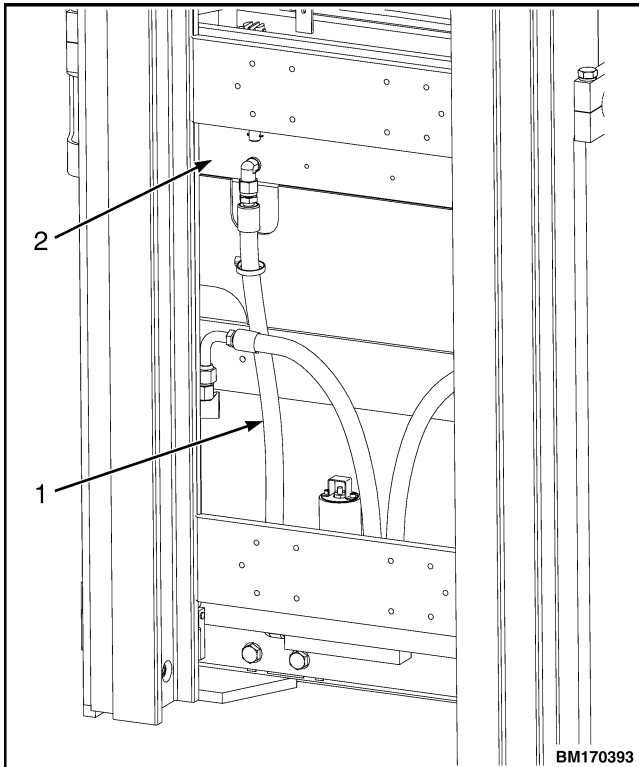
in Figure 7. Install the trunnion caps, bolts, and washers and torque to 203 N•m (150 lbf ft).



1. ALIGNMENT BLOCK
2. MAST ASSEMBLY

Figure 7. Alignment Block

5. After securing the mast in the trunnions, the mast cable must be connected to the chassis wire harness. The mast cable will travel down and enter the grommet and opening in the chassis. Connect the mast cable connector to the wire harness connector.
6. Attach the hydraulic hose connecting the manifold to the chassis frame. See Figure 8.



1. HYDRAULIC HOSE
2. FRAME

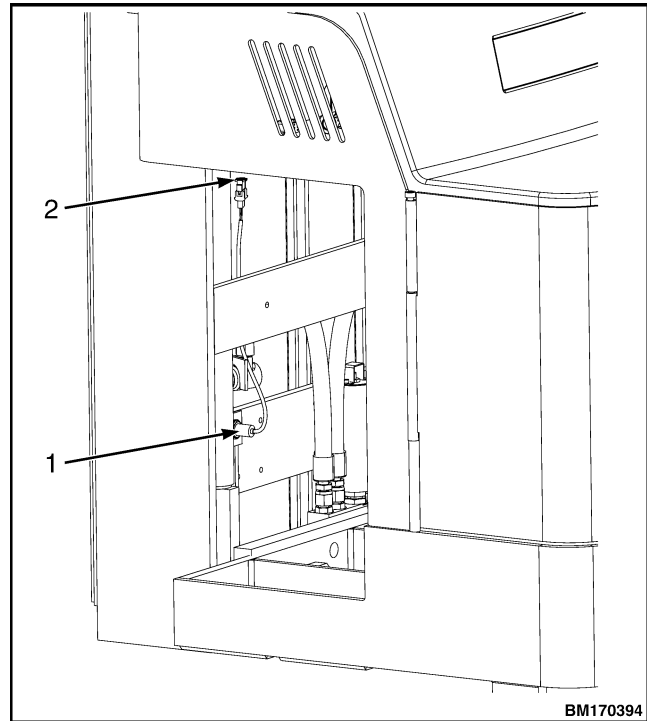
Figure 8. Hydraulic Hose

7. Connect the proximity switch wire harness to the proximity switch connector located on the mast cylinder. Use clamp straps to secure the wire harness traveling up the cylinder. The harness needs to travel through the grommet and down the mast cylinder See Figure 9.

8. With the hoist still attached to the platform, raise the platform to a height that will allow for easy access under the platform.

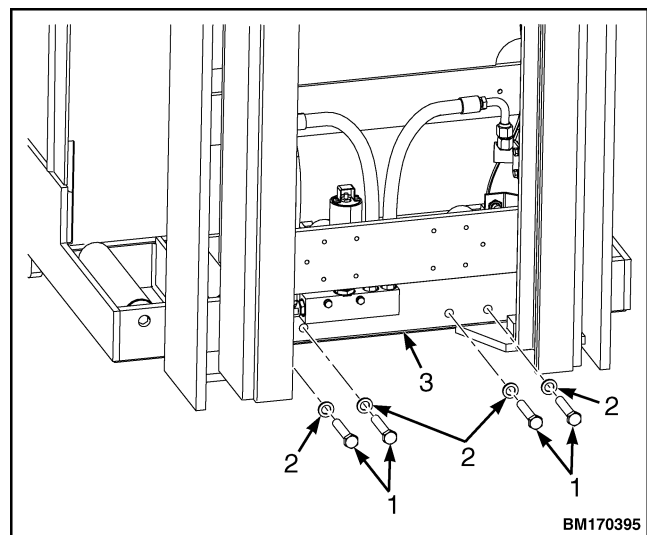
NOTE: If your truck is equipped with wire guidance refer to the Installation section of **Wire Guidance** 2200 SRM 1471 before continuing with installation.

9. Under the platform, insert the four mast mounting bolts and washers as shown in Figure 10. After inserting the bolts lower the platform.



1. PROXIMITY SWITCH
2. HARNESS

Figure 9. Proximity Wire Routing and Connection

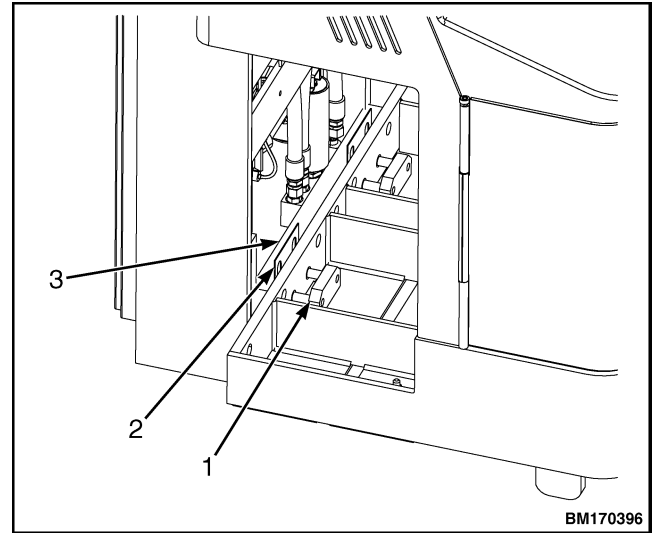


1. CAPSCREW
2. WASHER
3. MAST ASSEMBLY

Figure 10. Mast Connection

NOTE: If the battery is in the battery compartment, remove it at this time.

10. With the four capscrews inserted, place the plate nuts on the back side through the battery compartment and start the bolts. Do not tighten at this time.
11. Once the mast mounting capscrews have been started into the plate nuts, insert the shims between the mast and the chassis frame. See Figure 11. If the shims are unable to be inserted between the frame and mast use a second hoist to connect to the platform and pull away from the truck. This will allow the shims to have enough space to go between the mast and frame.
12. After inserting the shims, tighten the mast mounting bolts to 225 N•m (166 lbf ft).



1. PLATE NUT
2. SHIM
3. MAST ASSEMBLY

Figure 11. Plate Nut Mast Mounting

Three-Stage Mast

REMOVE

NOTE: If the mast assembly will be disassembled, remove the operator platform before the mast assembly is removed. See Operator Platform, Remove in this section.

WARNING

Fully lower all the mast weldments. Weldments, carriages, or operator platform and forks can move suddenly and cause an injury as hydraulic lines are disconnected.

The removal procedure of the three-stage mast is similar to the removal procedure for the two-stage mast. See Two-Stage Mast, Remove in this section for the correct procedure.

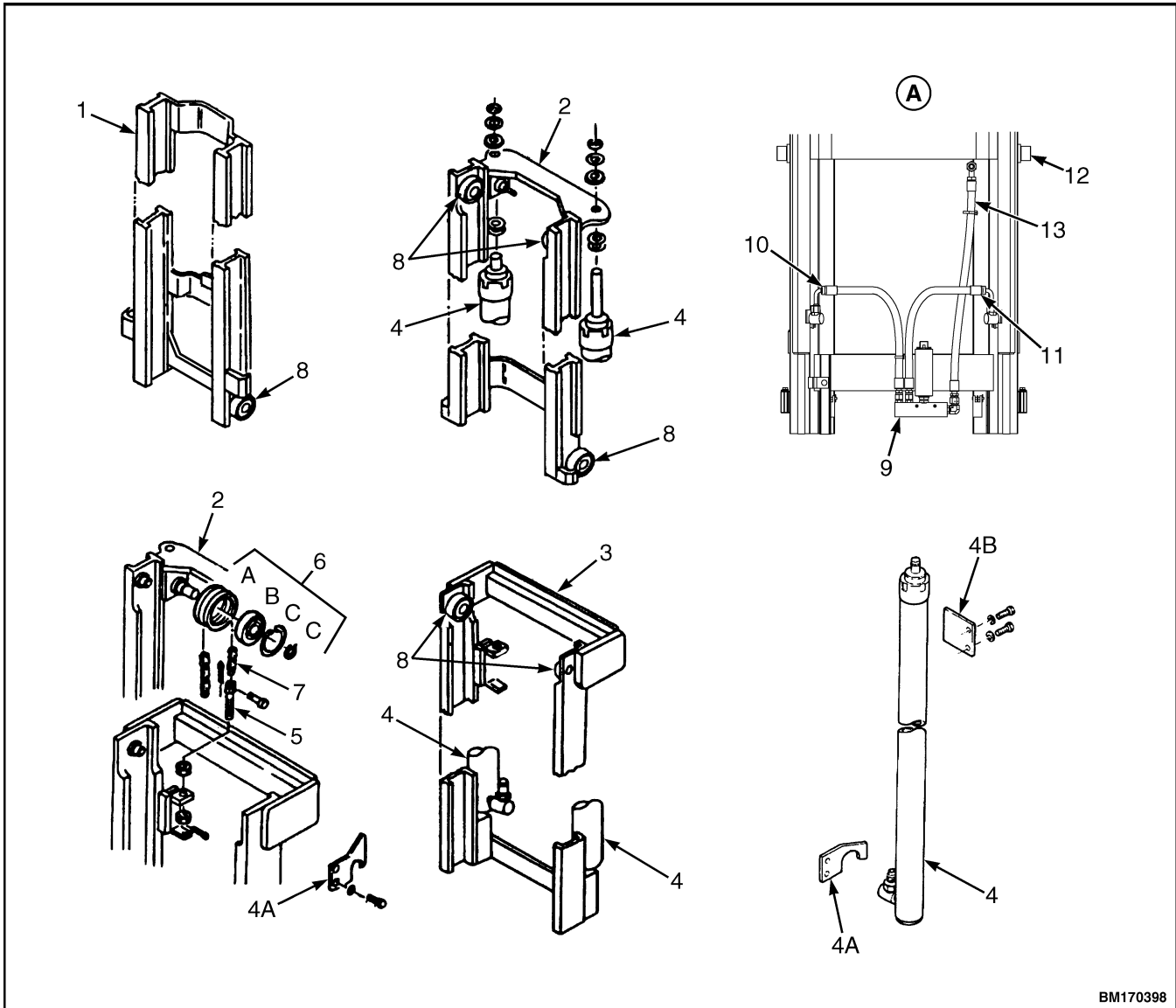
DISASSEMBLE

NOTE: This procedure does NOT include the removal of the operator platform. Remove the operator platform before starting this procedure. See the Operator Platform, Remove in this section to remove the operator platform. See Figure 4 and Figure 12.

WARNING

Make sure the battery side of the mast is toward the floor so the front of the mast is up for easier disassembly. Make sure the mast weldments are fastened together so the weldments will only slide when being moved during disassembly.

1. If necessary, remove the lift chains by removing the pin in the chain anchor. Removing the pin will allow chain removal without changing the adjustment.
2. Install a sling near the center of the free-lift cylinder. The sling must pass through the loop at the end of the sling so the sling tightens and does not slip on the cylinder as it is lifted.
3. Remove the capscrews, spacers, washers, and nuts that fasten the shell of the free-lift cylinder to the inner mast weldment. Remove the hydraulic fitting at the bottom of the cylinder. Install plugs to keep dirt out of the cylinder and hydraulic lines. Remove the snap ring that fastens the bottom of the cylinder to the mast weldment. Use a crane to remove the cylinder.



BM170398

A. REAR VIEW HOSE ROUTING - LIFT

- | | | |
|--------------------------|-------------------------------|--------------------------------|
| 1. INNER WELDMENT | 6. CHAIN SHEAVE ASSEMBLY (RH) | 9. FLOW REGULATOR HOUSING |
| 2. INTERMEDIATE WELDMENT | A. CHAIN SHEAVE | 10. HYDRAULIC TUBE (MAIN LIFT) |
| 3. OUTER WELDMENT | B. BALL BEARING | 11. HYDRAULIC HOSE (MAIN LIFT) |
| 4. MAIN LIFT CYLINDER | C. SNAP RING | 12. TRUNNION STUB SHAFT |
| A. LOCK PLATE | 7. MAIN LIFT CHAIN | 13. TO TRUCK CONTROL VALVE |
| B. RETAINER | 8. LOAD ROLLER | |
| 5. CHAIN ANCHOR | | |

Figure 12. Three-Stage Mast Assembly

4. Use a pry bar to move the inner mast weldment approximately 1/2 to 3/4 out of the intermediate mast weldment. Remove the snap rings and washers from the top of each main-lift cylinder. Move the intermediate mast weldment approximately 152 to 305 mm (6 to 12 in.) out from the top of the outer mast weldment. Remove the chain and remove the hose sheaves at the top of the intermediate mast weldment.
5. Install a sling near the center of each channel of the inner mast weldment so it will be balanced. The slings must pass through the loop at the end of the sling so the sling tightens and does not slip on the channel as the weldment is lifted. Fasten a crane to the slings.
6. Use the crane to move the inner mast weldment out of the outer mast weldment. Move the mast weldment until the bottom rollers of the inner mast weldment touch the top rollers of the outer mast weldment. Use the crane to raise the top of the inner mast weldment so it is at an angle of approximately 30°. Lift the weldment straight up to remove the inner from the outer mast weldment. Put the weldment flat on the floor so it cannot fall.
7. Use the procedure of Step 5 and Step 6 to remove the intermediate mast weldment from the outer mast weldment.
8. Clean the area at the hydraulic fittings for the main-lift cylinders. Disconnect the fittings. Put caps on the open fittings and cylinder port to prevent dirt from entering the system. Remove the snap rings at the bottom of each cylinder.
9. Install a sling near the center of one main-lift cylinder in the same manner used for the mast weldment removal. Remove the capscrew, washer, and spacer that fasten the cylinder to the outer mast channel. See Figure 3. Use the crane to move the cylinder out of the base hole and remove the cylinder from the mast. Repeat the procedure to remove the other main-lift cylinder.
10. Remove the snap rings from all load rollers. Make a note of the shim arrangement as each load roller is removed. Remove the snap rings from all the sheaves. Make a note of the shim arrangement as each sheave is removed. All shim arrangements will be approximately the same when the mast is assembled.

11. Remove the strip bearings from the outer mast weldment. Make a note of the shim arrangement during removal of the strip bearings for correct installation during assembly.
12. Disassemble the sheaves and rollers as necessary for repair and cleaning.

CLEAN AND INSPECT

The procedures for cleaning and inspecting the three-stage masts are the same as the procedures for the two-stage masts. See Clean and Inspect for the Two-Stage Mast for the correct procedures.

LIFT CYLINDERS

NOTE: The lift cylinders are removed during disassembly of the mast. To repair the cylinders, see the section **Lift Cylinders** 4000 SRM 135 for the correct service procedures.

ASSEMBLE

NOTE: The shims for the load rollers keep the channels of the mast weldments parallel and give correct clearance. During assembly, the arrangement of the shims will be the same or approximately the same as they were before disassembly. Check the clearance and adjust for wear or changes from the repairs. The strip bearings at the top of the outer mast weldment and the bottom of the inner mast weldment are also adjusted using shims. See the Checks and Adjustments in this section for the instructions to make the necessary adjustments. See Figure 4 and Figure 12.

1. Assemble the load rollers, sheaves, and strip bearings on the mast weldments and operator platform as necessary. Assemble the sheaves on the free-lift cylinder. Make sure to keep the same shim arrangement noted during disassembly. Apply a thin layer of multipurpose grease to the strip bearings and the bearing and roller surfaces of the channels.
2. Make sure the cylinders are assembled and install a sling near the center of one main-lift cylinder as during removal. Use a crane to move the cylinder into position in the outer mast weldment. Install the snap ring on the bottom of the cylinder. Install the capscrew, washer, and spacer to fasten the cylinder shell to the channel. Repeat the procedure to install the other main-lift cylinder.

3. Use the crane to move the intermediate mast weldment into position over the outer mast weldment. Fasten the slings to the centers of the channels to balance the weldment as during removal. Make sure the intermediate mast weldment is at approximately a 30-degree angle with the bottom load rollers in the notch near the top load rollers of the outer mast channels. Slowly lower the intermediate mast weldment and insert it into the outer mast weldment.
4. Check the clearance of the load rollers and the strip bearings. Make the necessary adjustments as described in Mast Adjustments.
5. With the intermediate mast weldment approximately 152 to 305 mm (6 to 12 in.) out of the outer mast weldment, install the chain and hose sheaves. Move the intermediate mast weldment into the outer mast weldment so the tops of the main-lift cylinder rods are through the holes in the intermediate mast channels. Install the washers and snap rings to fasten the cylinder rods to the channels.
6. Use the procedure of Step 3 to install the inner mast weldment. Check the clearance of the load rollers and the strip bearings. Make the necessary adjustments as described in Mast Adjustments.
7. Use the following procedure to install the outer lift chains between the top of the outer mast weldment and the inner mast weldment:
 - a. Slide the inner mast weldment for access to the chain anchors.
 - b. Connect a piece of wire approximately 1 m (3 ft) long to the end of each lift chain. Use the wire to pull each lift chain into position between the channels of the inner and intermediate mast weldments. Connect the ends of the chains to the chain anchors at the bottom of the inner mast weldment. Use new cotter pins during installation of the chains.
 - c. Use the wires to pull the chains up between the chain sheaves and the top load rollers on the intermediate mast weldment. Look between the inner and intermediate mast weldments to see the positions of the lift chains. If necessary, use a thin screwdriver to move each lift chain to the inside edge of the inner mast weldment. Remove the wires.
 - d. Install the chain, hose, and cable sheaves as removed during disassembly. Lubricate the bearings with multipurpose grease during installation.
 - e. Connect each end of a wire approximately 2 m (6 ft) long to the end of each lift chain.
 - f. Pull on the wires to pull the inner mast weldment into the intermediate mast weldment. Remove the wires from the chains. Connect each chain to the anchors on the outer mast weldment. Use new cotter pins during installation of the chains. If necessary, adjust the length of the lift chains as described in Lift Chain Adjustment.
8. Install a sling near the center of the free-lift cylinder as during removal. Use a crane to move the cylinder into position in the inner mast weldment. Install the capscrews, spacers, washers, and nuts that fasten the shell of the free-lift cylinder to the inner mast weldment. Install the snap ring that fastens the bottom of the cylinder to the mast weldment. If necessary, install the crosshead assembly to the free-lift cylinder. Adjust the cylinder so the cylinder shell is parallel to the sides of the inner mast weldment ± 3.0 mm (± 0.12 in.). Install the hydraulic lines to the free-lift cylinder. See Figure 12 or the Diagrams manual for your truck..

INSTALL

The procedure for installing the three stage masts is the same as the procedure for the two-stage masts. See Install for the Two-Stage Mast for the correct procedure.

Load Wheels Replacement

NOTE: This procedure applies to both the two-stage and three-stage masts.

For easier installation, remove and install one load wheel before removing the next load wheel. The load wheel brackets are held in the load arms by the load wheels. Make sure the base arms and load wheels do not support any weight. If necessary, install blocks under the base arms. Remove the axle nut, axle with washer, and load wheel. Remove the axle sleeve from the load wheel. Completely fill new bearings with the grease shown in the Maintenance Schedule in the

section **Periodic Maintenance** 8000 SRM 924 or **Periodic Maintenance** 8000 SRM 1472. Install the bearings in the replacement load wheel. Make sure the seal of each bearing is toward the outside of the load wheel. Fill the area between the bearings with the same grease and install the axle sleeve. Install the washer on the axle. Install the load wheel, axle, and axle nut.

NOTE: On units that have the freezer and corrosion option, add additional grease through each grease fitting.

Lift System Leak Check



WARNING

During the test procedures for the hydraulic system, use chains to fasten the load to the forks to prevent the load from falling. Keep all people away from the lift truck during the tests.

1. Leaks outside the hydraulic lift system:
 - a. Operate the hydraulic system. Put a capacity load on the forks. Make sure there is enough overhead clearance. Raise and lower the load several times. Check for leaks.
2. Leaks inside the hydraulic lift system:
 - a. Put a capacity load on the forks. Make sure there is enough clearance to raise the operator platform. Raise the operator platform until all the mast weldments are extended. If the operator platform slowly lowers with the **LOWER** controls released, there are leaks inside the hydraulic system. Maximum lowering of the operator platform from inside leaks in the lift system is 50 mm (2 in.) in

10 minutes. This maximum rate for leaks is for hydraulic oil at 32°C (90°F). If the oil temperature is 71°C (160°F), the maximum lowering rate is 150 mm (6 in.) in 10 minutes.

- b. Check the lift cylinders for internal leaks. Install a gate valve at the cylinder port of the **LIFT/LOWER** solenoid valve. Connect the hydraulic line to the gate valve. Put an 80 to 90 percent capacity load on the forks. Fasten the load to the forks. Raise the operator platform until all the mast weldments are extended. Close the gate valve. If the operator platform and mast weldments slowly lower, the seals in the lift cylinders have leaks.
- c. If the operator platform does not move, open the gate valve and check the movement again. If the carriage or operator platform lowers when the gate valve is open, check for leaks in the hydraulic lines and fittings. If no leaks are found, the solenoid valve can have a defect. Remove the load from the forks.

Lift Chain Adjustment

The following specifications must be correct for correctly adjusted lift chains (see Figure 13):

- The chain tension must be the same for each chain of the chain set. Chains that have the same tension will move the same amount using the same pressure.
- The chain lengths must be equal for each chain set and the length must be correct for the mast height.
- The chains must travel freely through the complete raising and lowering cycle.

1. Put an 80 to 90 percent capacity load on the forks. Lower the forks as much as possible.
2. Check the amount of the bottom operator platform roller extending below the inner mast weldment of the mast. No more than one-third of the roller can extend below the mast. If the rollers are too low, adjust the chain anchors. Make sure 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 all of the adjustment is not removed from the chain anchors so they cannot move in their sockets.



CAUTION

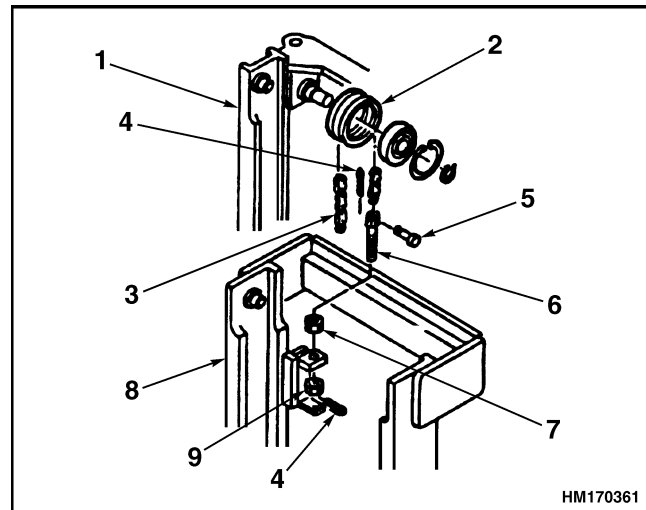
The minimum thread extending above the nut of the chain anchor is two times the chain pitch. Periodic checks must be made to correct chain adjustments for wear.

3. Remove the load from the forks. Check the clearance of the operator platform when the mast is fully extended. The operator platform stops must not touch the stop at the top of the inner mast weldment. The chains are too short if the operator platform touches the stop. Lower the operator platform completely. Check that the tops of the forks are the correct height above the floor as listed below in Step a and Step b. If the forks are not within the specified height above the floor, the chains need to be adjusted. If the chains are too long or too short, adjust the chain anchors. Make sure each anchor is adjusted the same amount.

- a. For the standard lift truck, the top of the forks should be 76.2 ± 6.35 mm (3.0 ± 0.25 in.) above the floor in the fully lowered position.
- b. For the furniture lift truck, the top of the forks should be 165.1 ± 9.525 mm (6.5 ± 0.375 in.) above the floor in the fully lowered position.

NOTE: If the chain anchors are too loose, the Lowering Interrupt Switches will prevent lowering of the platform and mast.

4. Three-stage mast chain adjustment: Adjust the main lifting chains until the top of the inner mast weldment is at the same height as the top of the outer mast weldment. Adjust the free-lift chain as described in Step 3.



- | | |
|-----------------------|-------------------|
| 1. SECONDARY WELDMENT | 6. CHAIN ANCHOR |
| 2. CHAIN SHEAVE | 7. LOCK NUT |
| 3. LIFT CHAIN | 8. OUTER WELDMENT |
| 4. COTTER PIN | 9. ADJUSTMENT NUT |
| 5. ANCHOR PIN | |

Figure 13. Lift Chain Adjustments (Main Lift)

Mast Adjustments

NOTE: Each load roller is kept in the correct position on the stub shaft using shims. The shims are installed on both sides of the load roller. Do not add or remove shims from the stub shafts. To change the position of the roller on the stub shaft, move the shims from one side of the roller to the other.

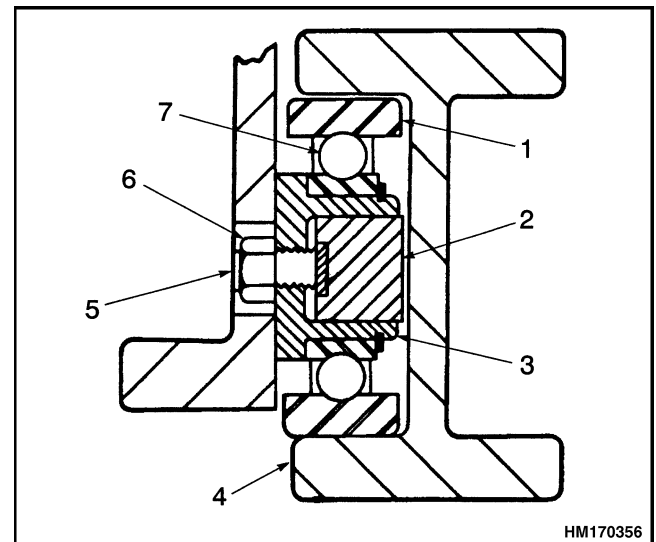
During assembly, the shim arrangement will be approximately the same as before disassembly. Make notes of each shim arrangement during disassembly. Check the clearance and adjust for wear or change from the repairs. See Figure 14.

1. The load rollers control the alignment of the masts. The alignment conditions are given in the steps following this paragraph with the most important condition first.
 - The vertical mast weldments must be parallel to each other to decrease wear.
 - The maximum clearance between the load roller and the mast weldment at the POINT OF TIGHTEST FIT is 0.8 mm (0.031 in.).
 - The number of shims between the roller and mast weldment on a stub shaft must be approximately the same as the stub shaft in the opposite channel. The mast weldments will be approximately in the center.
2. Use the following procedure to adjust the load rollers for the mast:
 - a. Use a crowbar to move the mast weldments from side to side to measure the amount of movement. Repeat in a minimum of three different positions of the mast weldments.
 - b. Separate the masts and change the shim arrangements as needed. Assemble the mast weldments. Slide the mast weldment all the way to the top and bottom to find the tightest fit.
 - c. Repeat Step a and Step b until the clearance is not more than 0.8 mm (0.031 in.) at the point of tightest fit.

- d. Measure the distance on the top and bottom between the mast weldments. Move shims from one side of the roller to the other to keep the distance equal between the top and bottom so the masts are parallel.

3. Adjust the strip bearings. Insert shims between the strip bearing and the mast weldment. Adjust the clearance until there is less than 0.8 mm (0.031 in.) at the point of tightest fit.
4. Slowly raise and lower the mast several times without a load. The mast components must raise and lower smoothly in the correct sequence. The inner mast weldments and the carriage or operator platform must lower completely.

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



- | | |
|-------------------|--------------------|
| 1. LOAD ROLLER | 5. SETSCREW |
| 2. WEAR PLUG | 6. NUT |
| 3. STUB SHAFT | 7. SEALED BEARINGS |
| 4. ELEVATING MAST | |

Figure 14. Load Roller and Wear Plug Assembly

Operator Platform Adjustment

1. Install the load rollers on the operator platform. Install the shims for the rollers in the same sequence on the stub shaft as they were before disassembly. There must be no shims between the roller and the weldment on the two top rollers only.
2. Use a crane to raise the operator platform within the inner mast weldment. Find the point of tightest fit between the load rollers and the inner mast weldments.
3. Remove the operator platform from the mast. Adjust the shim arrangement for each roller for clearance between the roller and the inner mast weldment. The clearance must be 0.1 to 0.8 mm (0.004 to 0.031 in.) at the POINT OF TIGHTEST FIT. Repeat Step 2 and Step 3 if necessary.
4. Keep the shim arrangement on each side of the carriage or operator platform approximately

equal. The operator platform must run parallel with the inner mast weldment.

5. After adjustment, lubricate the mast roller channels with a thin layer of grease.



CAUTION

Too much grease can cause the rollers to slide and wear flat areas on the rollers.

6. Slowly raise and lower the mast several times without a load. The mast components must raise and lower smoothly in the correct sequence. The inner mast weldments and the operator platform must lower completely.

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

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
No movement of lifting cylinders.	Lift control linkage disconnected.	Connect lift control linkage.
	No oil or not enough oil to supply cylinders.	See the section Periodic Maintenance for the correct oil level. Fill hydraulic oil to correct level.
	Hydraulic leaks, bad pump or pump drive, relief valve set too low, bad check valve.	Repair leaks. Replace pump or pump drive. Adjust relief valve or replace check valve.
Slow action of lifting cylinders.	Not enough oil supply to cylinders.	See the section Periodic Maintenance for the correct oil level. Fill hydraulic oil to correct level.
	Bad cylinder seals.	Replace cylinder seals.
	Relief valve pressure is adjusted incorrectly.	Adjust relief valve pressure.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Rough movement of the mast assembly.	Air in the hydraulic system.	Purge air from system.
	Bent rods, cylinders with distortion or damage.	Repair or replace cylinders.
	Mast assembly damaged or not in alignment.	Inspect, repair, or align mast assembly.

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