

SERVICE REPAIR

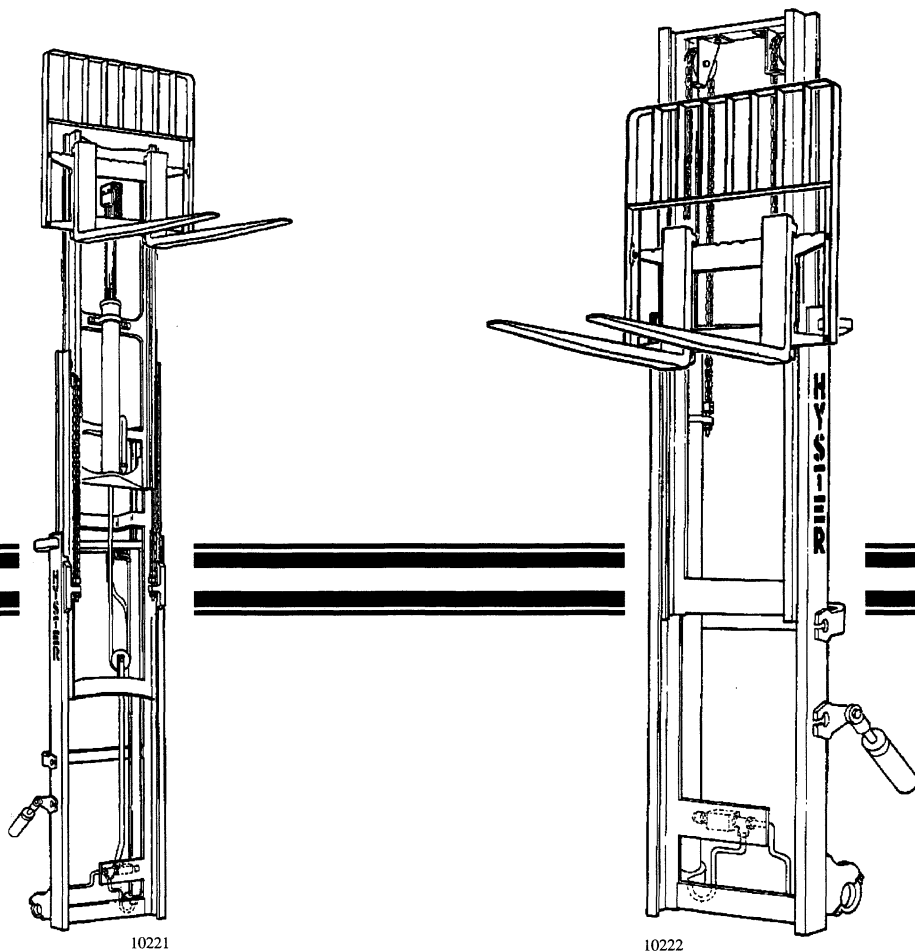
MANUAL

Hyster B098 (E60B E70B E80B E100B E120B) Forklift

HYSTER

VISTA® MASTS

REPAIRS



HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure that all slings, chains or cables are correctly fastened and that the load being lifted is balanced. Make sure that 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 and working area clean and in order.
- 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 that all nuts, bolts, snap rings and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE sign to the controls of the unit when making repairs or if the unit needs repairs.
- Make sure you follow the **DANGER, WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), and Diesel are flammable fuels. Make sure that you 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 has ventilation.

CONTENTS

INTRODUCTION	1
GENERAL	1
SAFETY PROCEDURES WHEN WORKING NEAR THE MAST	1
REPAIRS	2
FORKS	2
Removal	2
CARRIAGE	2
Removal (Two-Stage and Later Production Three-Stage Carriages)	2
Removal (Carriages with Removable Stop Block)	3
Installation (Two-Stage and Later Production Three-Stage Carriages)	4
Installation (Carriages With Removable Stop Block)	4
TWO-STAGE MASTS	6
REMOVAL	6
DISASSEMBLY	7
CLEANING AND INSPECTION	8
ASSEMBLY	9
INSTALLATION	10
THREE-STAGE MASTS	10
REMOVAL	10
DISASSEMBLY	10
CLEANING AND INSPECTION	12
ASSEMBLY	12
INSTALLATION	13
LIFT AND TILT CYLINDERS	14
SIDE SHIFT CARRIAGE	14
Removal	14
Repairs	14
Installation	14
SEQUENCE VALVE	15
Removal and Disassembly	18
Cleaning	18
Assembly and Installation	18
CHECKS AND ADJUSTMENTS	19
CHECKING FOR LEAKS IN THE LIFT SYSTEM	19
ADJUSTING THE TILT CYLINDER STROKE AND THE BACKWARD TILT ANGLE	19
LIFTING CHAIN ADJUSTMENTS	20
MAST ADJUSTMENTS	21
CARRIAGE ADJUSTMENT	22
HEADER HOSE ROLLER ADJUSTMENT, 2-STAGE	23
TROUBLESHOOTING	24
TORQUE SPECIFICATIONS	25
VISTA MASTS	26

This section is for the following models:

E30-60BC, E30-60BS, E60-120B, J40-60AS,
H40-60J, H40-60XL, H60-110E, S30-60ES, S60-120E

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**"THE
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INTRODUCTION

GENERAL

This section has the repair procedures for the Vista two-stage and three-stage masts. A section for trouble-

shooting and a section for checks and adjustments are given at the end of the section. The description and operation of the masts are given in **THE VISTA MASTS, 4000 SRM 197**.

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

The following procedures must be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast.

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

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

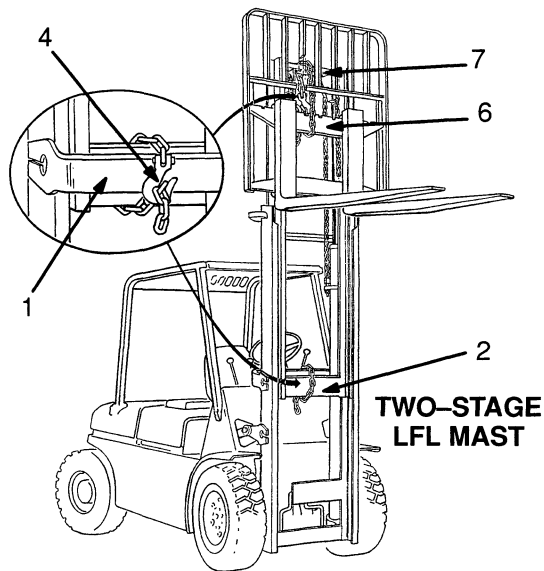
WHEN WORKING NEAR THE MAST ALWAYS:

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

OR

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

- a. Put the mast in a vertical position.
- b. Raise the mast to align the bottom crossmember of the weldment that moves in the outer weldment with a crossmember on the outer weldment (1). On the two-stage and free-lift mast, the moving part is the inner weldment (2). On the three-stage mast it is the intermediate weldment (3).



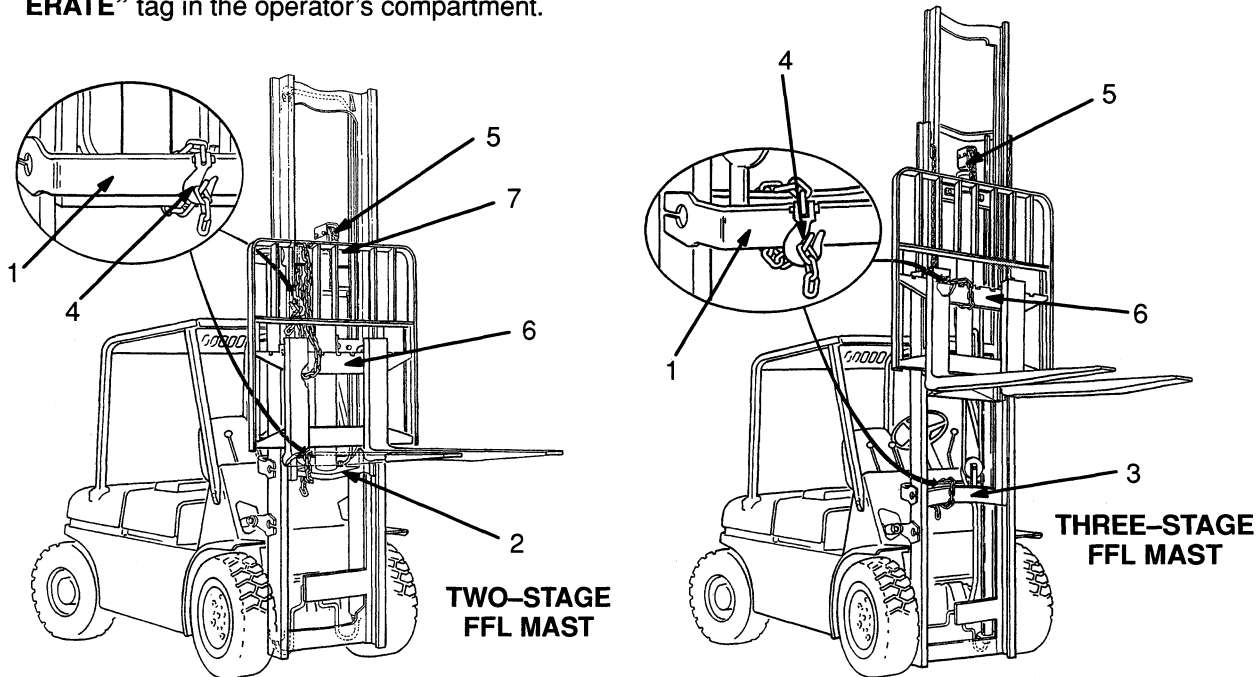
SAFETY PROCEDURES WHEN WORKING NEAR THE MAST (2 OF 2)

c. Use a $\frac{3}{8}$ inch minimum safety chain with a hook (4) to fasten the crossmembers together so that the movable member can not lower. Put the hook on the back side of the mast. Make sure the hook is completely engaged with a link in the chain. Make sure the safety chain does not touch lift chains or chain sheaves, tubes, hoses, fittings or other parts on the mast.

d. Lower the mast until there is tension in the safety chain and the free-lift cylinder (5) (two-stage full free-lift and three-stage masts only) is completely retracted. If running, stop the engine. Apply the parking brake. Install a “DO NOT REMOVE” tag on the safety chain(s).

e. Install another safety chain (3/8 inch minimum) between the top or bottom crossmember of the carriage (6) and a crossmember on the outer weldment (7).

- After lowering or restraining the mast, shut off the power and remove the key. Put a “DO NOT OPERATE” tag in the operator’s compartment.



REPAIRS

FORKS

Removal

The forks are connected to the carriage by hooks and locking pins. The pins fit through the top fork hooks and into slots on the top crossmember of the carriage. The forks can be removed from the carriage by aligning them with the removal notch. The notch is in the bottom crossmember of the carriage.

WARNING

Do not try to move forks without using a lifting device.

CARRIAGE

Removal (Two-Stage and Later Production Three-Stage Carriages)

1. Lower the carriage and forks on blocks so that the lifting chains become loose.

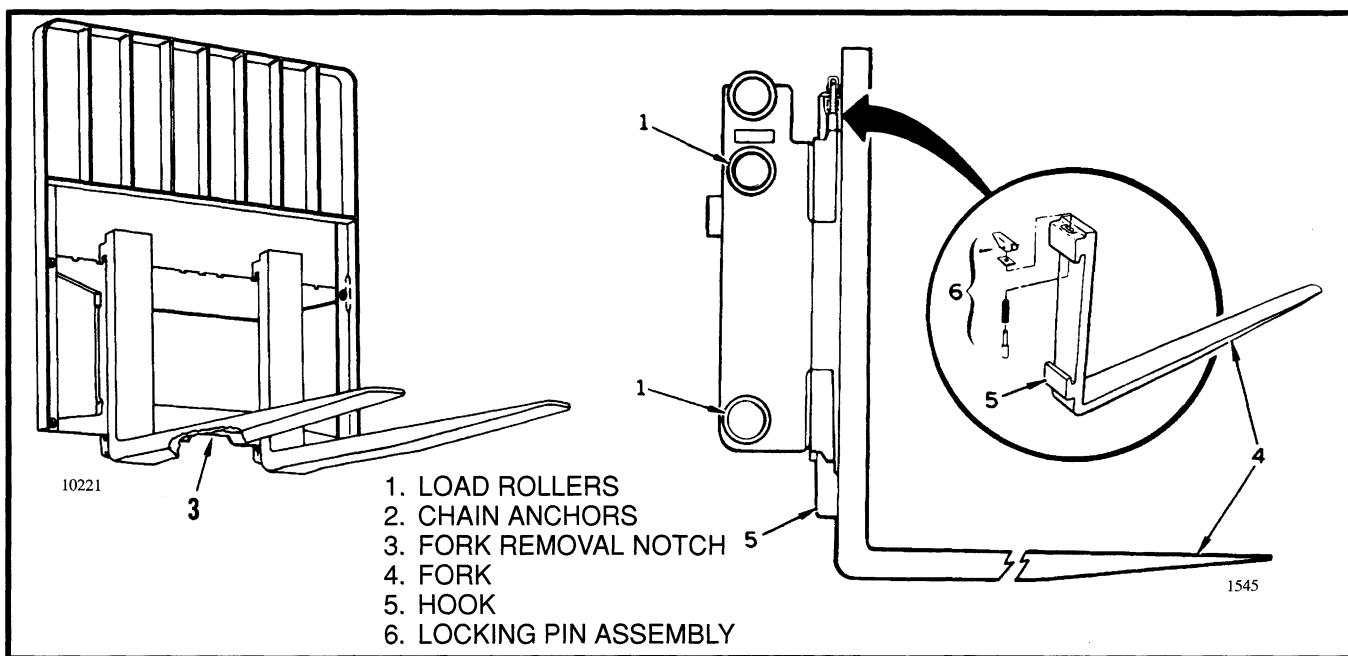


FIGURE 1. FORKS AND CARRIAGE

⚠ WARNING

When disconnecting the lifting chains, keep control of the ends. Use wire to temporarily connect the ends of the lift chain(s) to the masts. This procedure will prevent the chains from accelerating through the sheaves to cause possible injury or damage when they fall.

2. Disconnect the lifting chains from the carriage.
3. Put a one-quarter capacity load on the fork tips. The load must give the carriage stability so that the carriage cannot fall over when it is disconnected from the mast.
4. Use the hydraulic system and lift cylinders to raise the inner weldment. Carefully raise the inner weldment until it is above the load rollers of the carriage. If the hydraulic system cannot be used, do step 5, instead of step 4.

⚠ WARNING

When the inner weldment is above the load rollers of the carriage, make sure the carriage assembly has stability.

5. When the hydraulic system cannot be used, connect a crane to the top of the inner weldment. Make sure the chains or slings do not damage the sheaves or other parts of the weldment. Carefully lift the inner weldment until it is above the load rollers of the carriage.

6. Separate the lift truck from the carriage.

⚠ WARNING

Make sure that weights are put on the fork tips so that the carriage has stability and cannot fall over. If the forks are removed, put the carriage on the ground so that the load rollers are up.

7. If any of the carriage 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.

Removal (Carriages with Removable Stop Block)

This procedure is for carriages in masts that have a carriage stop block that can be removed. The stop block is at the top of the inner weldment.

1. Remove the forks.
2. Lower the carriage and forks on blocks so that the lifting chain(s) becomes loose.
3. Remove the pin from the chain anchor to disconnect the lift chain.
4. Rotate the crosshead assembly on the free-lift cylinder 90° in either direction.
5. Remove the stop block from the top crossmember of the inner weldment.

6. Connect a crane to the carriage and lift the carriage out through the top of weldments.

7. If any of the carriage load rollers must be replaced, make a note of the shim arrangement. When the load rollers are installed, the shim arrangement normally will be similar.

Installation (Two-Stage and Later Production Three-Stage Carriages)

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

2. Check the load roller clearance. See the Carriage Adjustment procedure at the end of this section.

3. Install the lift chains. Make sure new cotter pins are installed. See the Lift Chain Adjustment at the end of this section.

Installation (Carriages With Removable Stop Block)

1. Connect a crane to the carriage. Raise the carriage and install it through the top of the inner weldment.

2. Rotate the crosshead assembly on the free-lift cylinder so that the lifting chain can be installed.

3. Use the pin to install the lift chain to the chain anchor. Use a new cotter pin during installation.

4. Check the load roller clearance. See the Carriage Adjustment procedure at the end of this section.

5. Install the stop block on the top crossmember of the inner weldment.

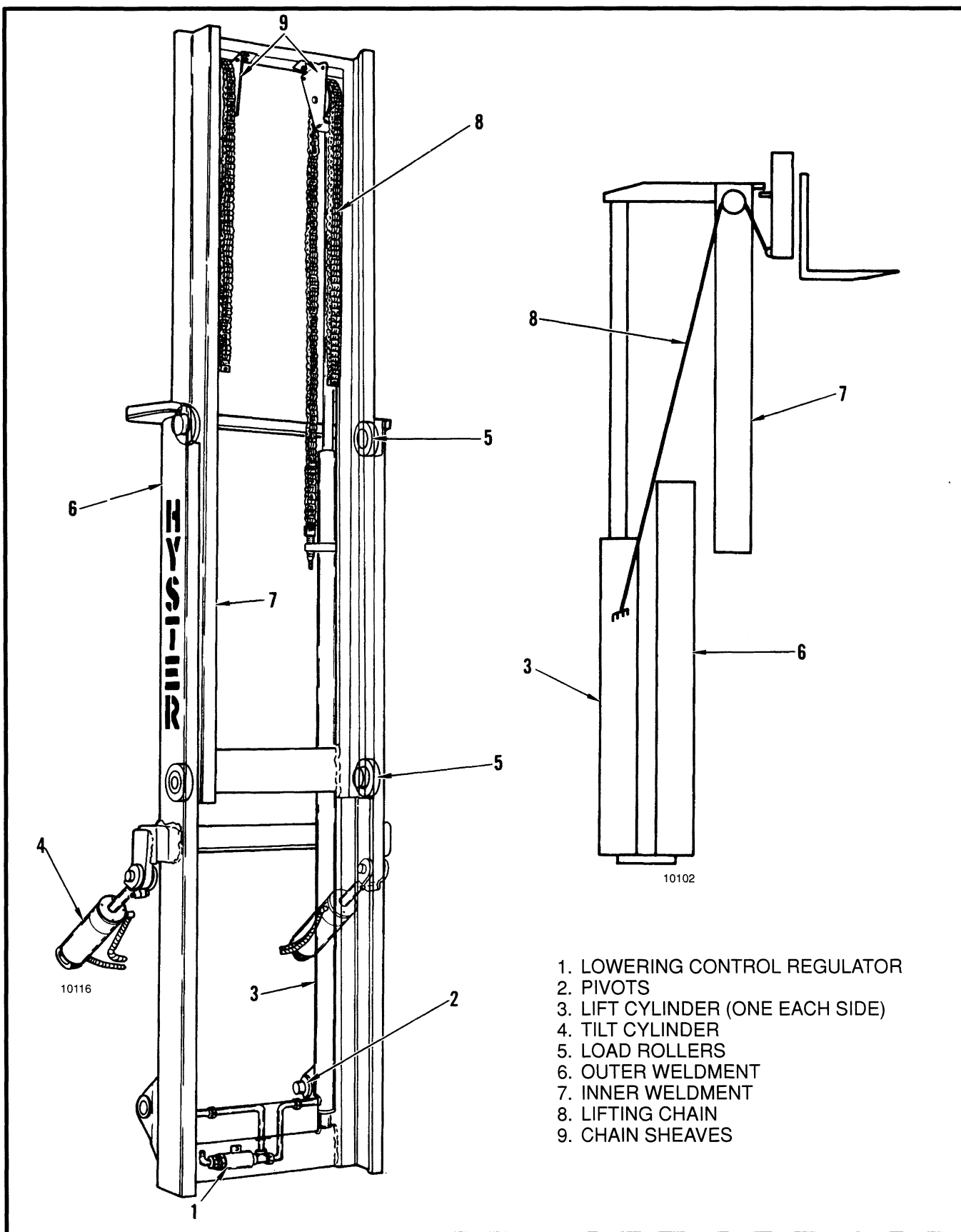


FIGURE 2. TYPICAL VISTA TWO-STAGE MAST

TWO-STAGE MASTS

REMOVAL

1. Fully lower all the mast weldments.

NOTE: If the mast assembly will be disassembled, remove the carriage before the mast assembly is removed. See Removal of Carriage in this section for the correct procedure.

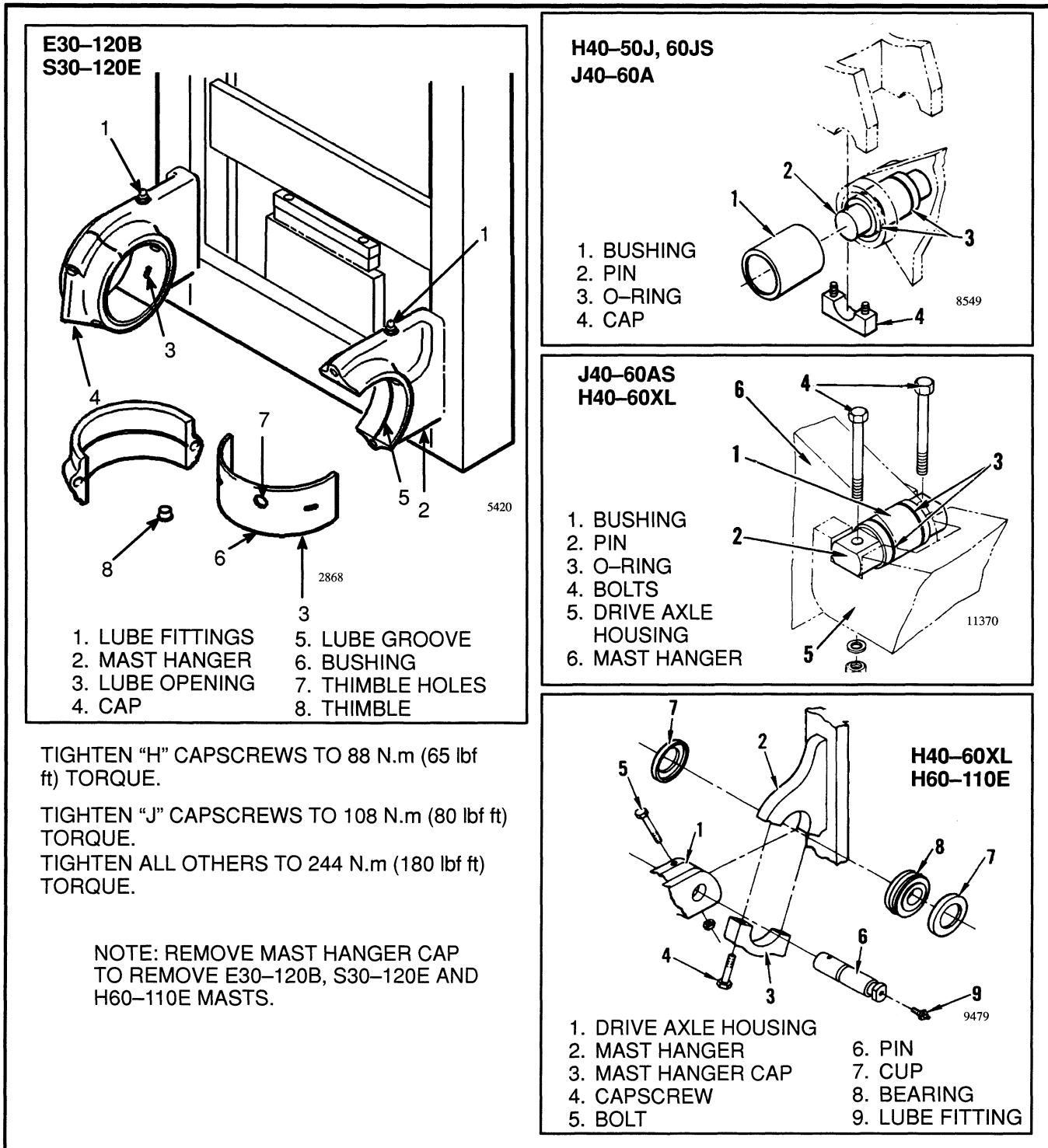


FIGURE 3. MAST PIVOTS

2. Clean the area at the fittings for the lowering control valve. Put a drain pan under the area where the lines are disconnected. Disconnect the hydraulic line between the main control valve and the fitting at the lowering control valve.

3. Connect a crane to top of the masts using chains. Make sure the crane has the correct capacity. Make sure all the weldments are fastened together with a chain. Make sure the chains will not damage the sheaves or other parts of the mast assembly. Operate the crane until it gives support to the weight of the masts. Put the crane in position so that the mast assembly will be lifted vertically.

4. Make marks on the caps so that they will be replaced in the same position. Make sure the mast assembly will not move suddenly when the caps are removed. Remove the caps. See FIGURE 3. for the types of pivots and caps.

⚠ WARNING

DO NOT use your fingers to push the connecting pins from the clevis of the tilting rods. Use a driver.

5. Disconnect the tilt cylinders at the mast. Do not damage the rods of the tilt cylinders. Put a cloth between the tilt rods and the frame if the tilt rods will touch the frame when they are lowered.

6. Operate the crane and carefully lift the mast assembly away from the lift truck.

7. Put the mast assembly on blocks so that the front of the mast is towards the floor.

NOTE: If the carriage has been removed, put the mast assembly on the floor so that the front of the masts is toward the floor.

DISASSEMBLY

1. Remove the lift chains.

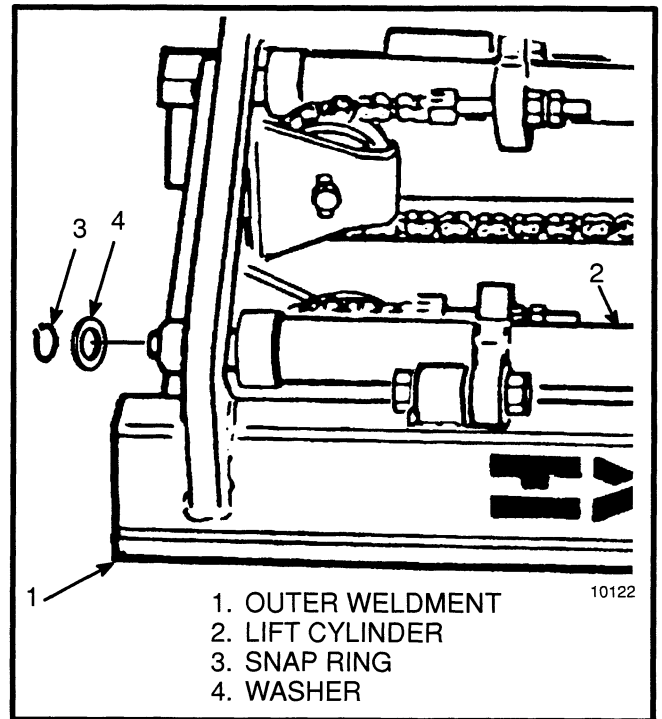


FIGURE 4. DISCONNECTING THE LIFT CYLINDERS FROM THE INNER CHANNEL

2. Clean the area at the hydraulic fittings for the lift cylinders. Disconnect the fittings. Put caps on the open fittings.

3. Remove the snap rings and washers from the top of each lift cylinder. See FIGURE 4.

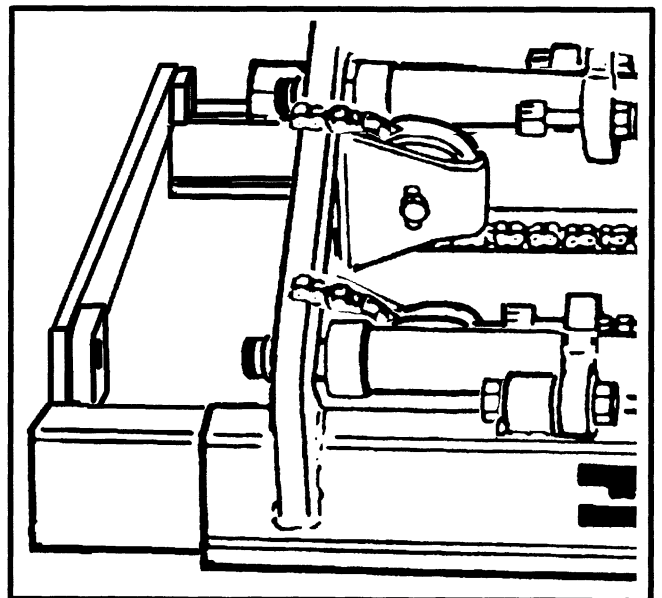


FIGURE 5. REMOVAL OF THE LIFT CYLINDERS

4. Remove the chain pins to disconnect the chain from the the chain anchor. Replace the rod end pin and cotter pin on the chain. See FIGURE 5.

5. Pull the inner weldment out approximately 1 foot (30 cm) to disengage the lift cylinders from the inner channel.

6. Remove the nut and capscrew that hold each lift cylinder to the outer channel. Pull the bottom of the lift cylinder out of the guide. Then move the bottom of the lift cylinder to the opposite side of the inner weldment. Remove the lift cylinder.

7. Push the inner weldment out of the bottom of the outer weldment to get access to the load rollers and the strip bearings. Remove the snap rings from the lower and upper load rollers. Make a note of the shim arrangement for each load roller when the load roller is removed. The shim arrangement will be approximately the same when the weldments are assembled.

8. Remove the strip bearings from the outer weldment. See FIGURE 6. Make a note of the shim arrangement during removal of the strip bearings.

9. Slide the inner weldment half way out the top of the outer weldment. Connect a crane to the center of the inner weldment. See FIGURE 7. Slide the inner weldment away from the outer weldment until its lower stub shafts are in the notches of the outer weldment. Remove the inner weldment.

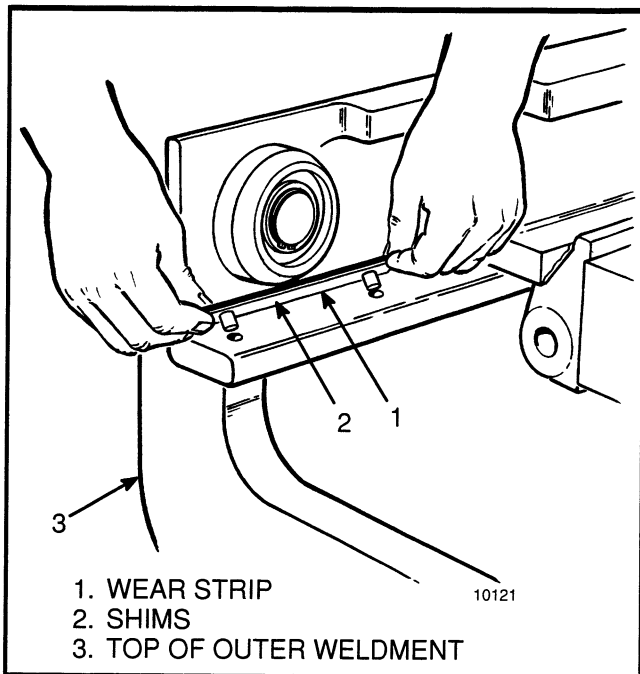


FIGURE 6. STRIP BEARINGS

10. Disassemble the sheaves and rollers as necessary for repair and cleaning.

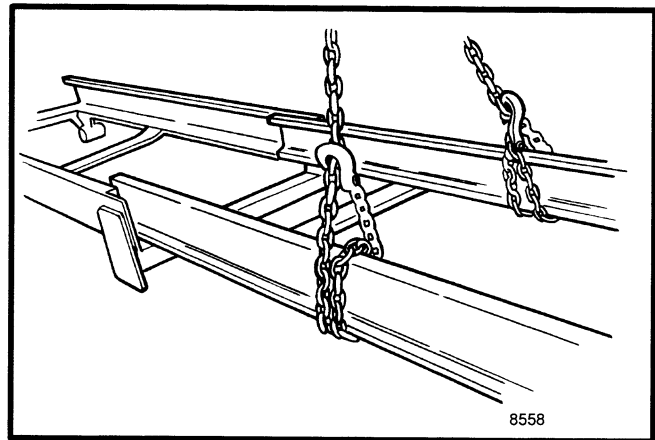


FIGURE 7. REMOVAL OF INNER WELDMENT

CLEANING AND INSPECTION

NOTE: This section for the cleaning and inspection procedures applies to both the two-stage and three-stage masts.

1. 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 wash the lubricant from the bearings.

2. Wash the lift chains with solvent. Use compressed air to dry the chains. Inspect the chains for wear and damage.

3. 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% longer than a new chain, the chain must be replaced. If a chain scale is available, check the lift chains as shown in FIGURE 8. If a chain scale is not available, measure 20 links of chain. Compare the measurements with the lengths given in TABLE 1. Replace the chains if the increase in length is 3% or greater.

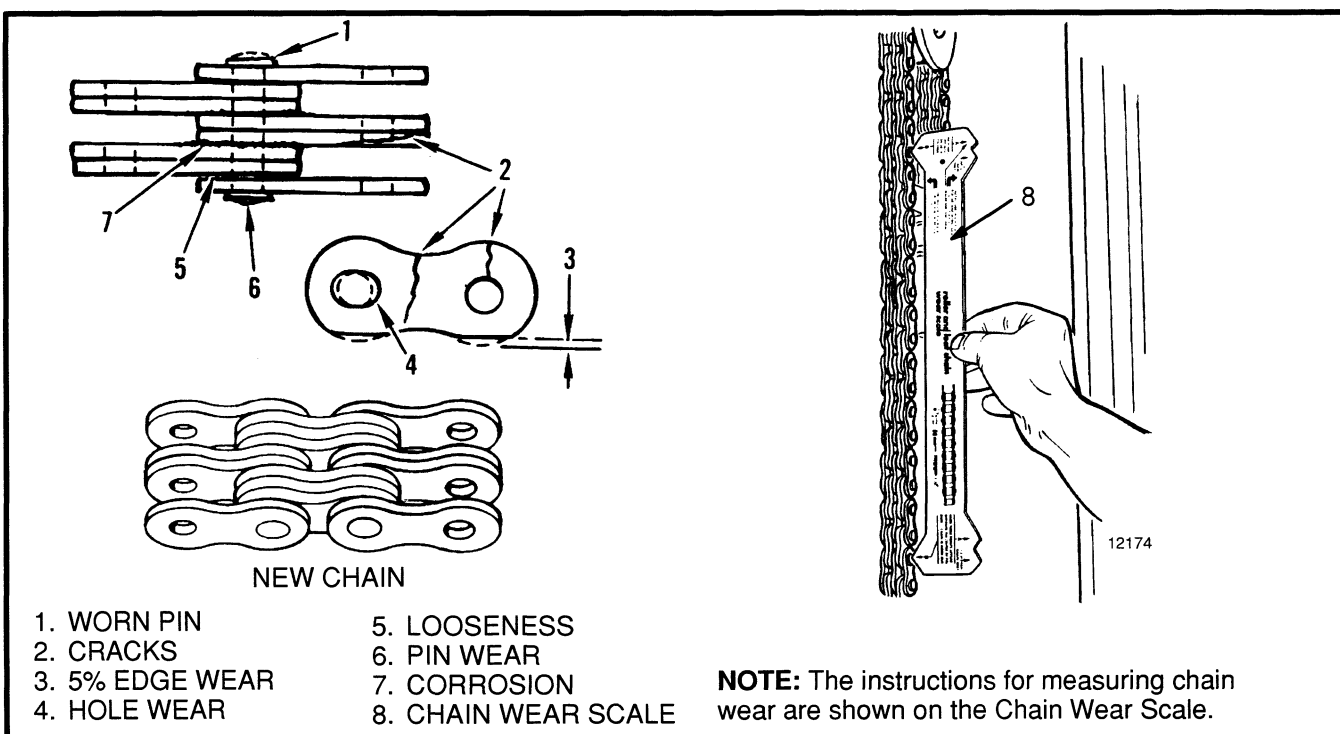


FIGURE 8. CHAIN PARTS AND WEAR

TABLE 1. MEASURING THE CHAIN WEAR

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

⚠ 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.

4. For chains that can be used again, soak for 12 hours in SAE 30 oil.

5. Inspect the chain anchors and pins. Replace chain anchors that have broken fingers, or holes worn out of round. Replace chain anchor pins that are worn or have cracks.

6. Clean the mast weldments with steam or solvent.

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

⚠ WARNING

DO NOT weld on masts. Get information from your Hyster dealer before welding on masts.

ASSEMBLY

NOTE: The shims for the load rollers keep the channels of the 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 because of repairs. The strip bearings at the top of the outer weldments are also adjusted using shims. See the Checks And Adjustments in this section for the instructions to make the necessary adjustments.

1. Connect a crane to the center of the inner weldment. Fit the shafts through the notches in the outer weldment. Slide the inner weldment into the outer weldment so that the stub shafts are seen at the top and bottom of the weldments.

2. Install the strip bearings and the shims on the outer weldment. Apply grease to the bearing and the bearing surface of the channels. See FIGURE 6.

3. Install the load rollers and the shims on both weldments.

4. Check the clearance of the load rollers and the strip bearings. Make the necessary adjustments as described in Checks And Adjustments.

5. Install the lift cylinders. Push the inner weldment to engage the rods of the lift cylinders. Install the snap rings and the washers.

6. Install the lifting chains. Adjust the length of the lift chains as described in Checks And Adjustments.

7. Install the hydraulic lines and the lowering control valve.

INSTALLATION

1. Connect a crane to the top of the mast assembly. Make sure the chains will not damage the sheaves or other parts of the mast assembly.

2. Raise the mast assembly to a vertical position. Move the mast assembly into position on the lift truck.

3. Lubricate the pivots and bushings with multi-purpose grease. See FIGURE 3. for the different designs of pivots and caps.

4. Tighten the cap capscrews to the correct torque. See FIGURE 3.

5. Move the mast so that the tilt cylinders can be connected. Install the pins and the retainers.

6. Connect the hydraulic lines.

7. If the carriage was not installed with the masts, install the carriage as described in Carriage Installation in this section. Apply grease to the web of the inner weldment for the carriage load rollers.

8. Check the clearance of the load rollers as described in Checks And Adjustments.

THREE-STAGE MASTS

REMOVAL

The removal procedure of the three-stage mast is similar to the removal procedure for the two-stage mast. See Removal of the Two-Stage Masts for the correct procedure.

DISASSEMBLY

1. Put the mast assembly on blocks so that the pivots are toward the floor.

2. If installed, remove the hoses and hose reel from the outer weldment.

3. Disconnect and remove the lift chains from the free lift cylinder and the carriage. If there is a stop block at the top crossmember of the inner weldment that can be removed, remove the stop block. Use a crane to remove the carriage through the top of the inner weldment. Remove all other carriages through the bottom of the inner weldment.

4. Disconnect the hydraulic lines from the free lift cylinder. Remove the chain sheave and the cross head assembly from the free lift cylinder.

5. Connect a crane to the free lift cylinder. Disconnect the lift cylinder from the inner weldment then remove the lift cylinder. Remove the hose sheaves at the bottom of the intermediate weldment.

6. Disconnect the main lift chains from the anchors at the top of the outer weldment. Push the inner channel toward the bottom of the mast assembly until the load rollers are seen at the top and bottom of the channel.

7. Remove the load rollers. Make a note of the arrangement of the shims for each load roller. The arrangement of the shims will be approximately the same when the channels are assembled.

8. Disconnect the lift chains from the chain anchors at the bottom of the inner channel. See FIGURE 10. Remove the lift chains.

9. Push the inner weldment out the bottom of the assembly until it is approximately half way out and connect a crane to its center. When the inner weldment has support from the crane, remove it from the intermediate weldment.

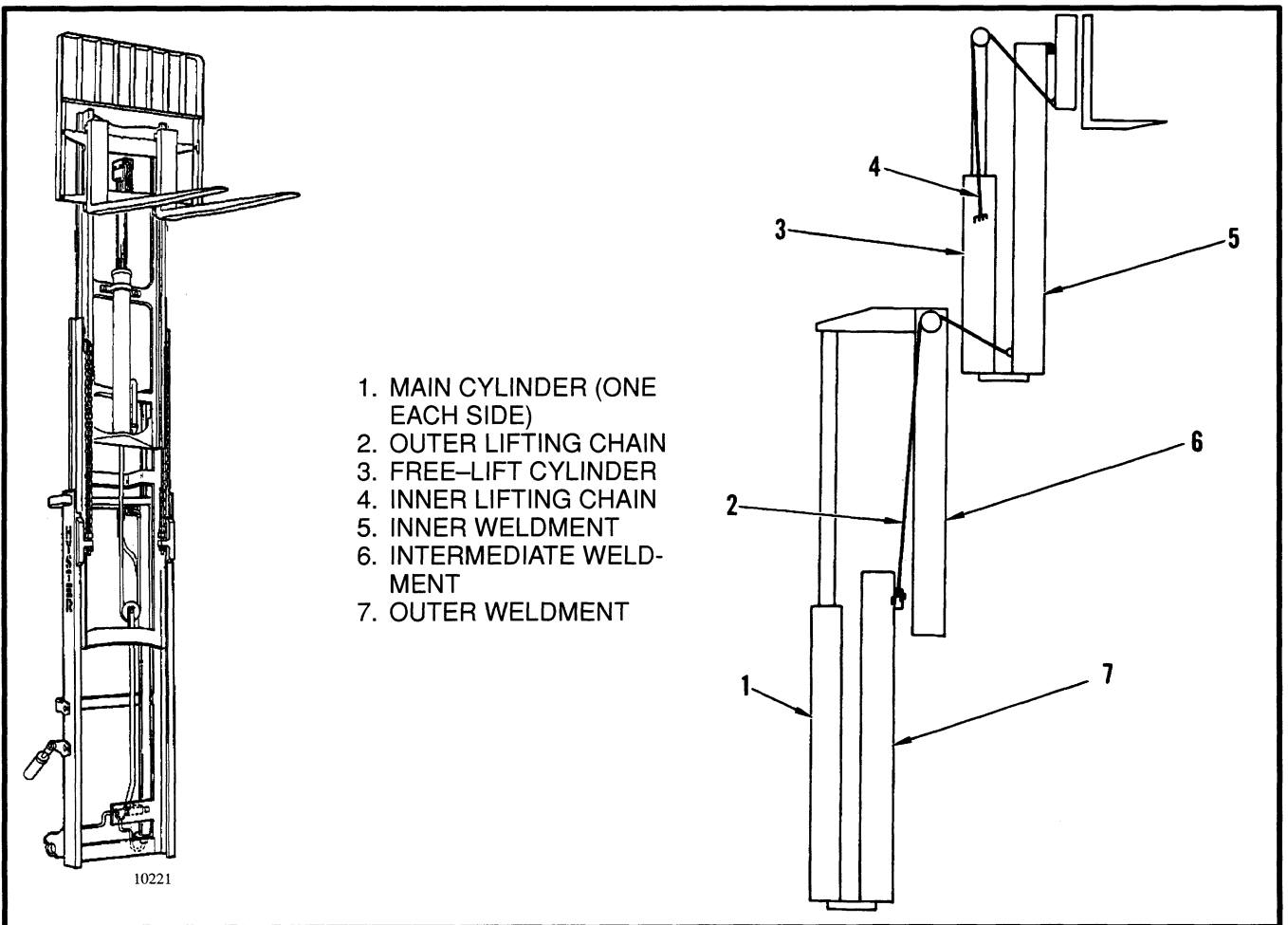


FIGURE 9. TYPICAL VISTA THREE-STAGE MAST

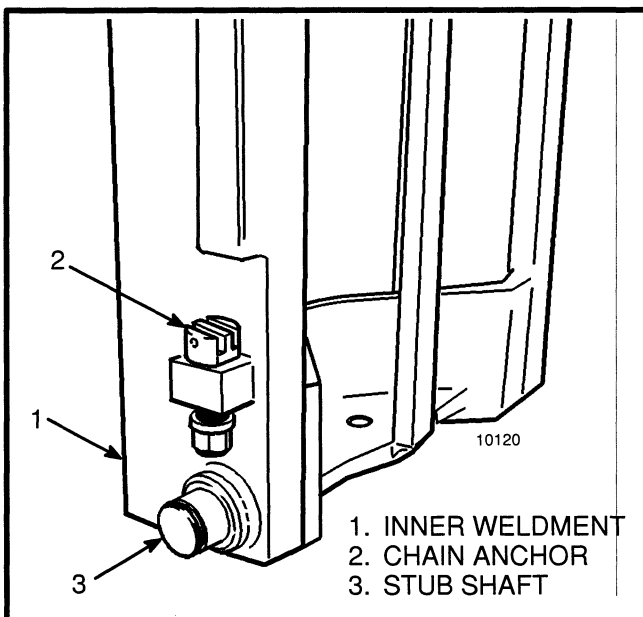


FIGURE 10. CHAIN ANCHORS

10. Remove the snap rings for the main lift cylinders from the top of the intermediate weldment. Push the intermediate weldment to disengage the lift cylinders. Remove the washers from the rods of the lift cylinders. Remove the hydraulic lines from the lift cylinders, then remove the lift cylinders. Put caps on the open fittings.

11. Push the intermediate weldment toward the bottom of the mast assembly to get access to the load rollers and the strip bearings. Remove the load rollers and the strip bearings. Make a note of the arrangement of the shims for each load roller and each strip bearing. The arrangement of the shims will be approximately the same when the weldments are assembled.

12. Push the intermediate weldment toward the top of the outer weldment and connect a crane to its center. When the weldment has support from the crane, remove it from the outer weldment. See FIGURE 8.

13. If installed, remove the sequence valve from the outer weldment. Make sure to put caps on the open fittings.

CLEANING AND INSPECTION

The cleaning and inspection procedures for the three-stage masts are the same as the procedures for the two-stage masts. See Cleaning and Inspection for the Two-Stage Masts for the correct procedures.

NOTE: The service procedures for the sequence valve are found in Repair for the Sequence Valve in this section.

ASSEMBLY

NOTE: The shims for the load rollers keep the channels 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 because of repairs. The strip bearings at the top of the outer weldments are also adjusted using shims. See Checks And Adjustments in this section for the instructions to make the necessary adjustments.

1. Put the outer weldment on the floor so that the pivots are toward the floor. Connect a crane to the center of the intermediate weldment. Fit the lower stub shafts of the intermediate weldment into the notches in the top of the outer weldment. Slide the intermediate weldment into the outer weldment so that the stub shafts are seen at the top and bottom of the weldments.

2. Install the strip bearings and the shims on the outer weldment. See FIGURE 6. Apply grease to the bearings.

3. Install the load rollers and the shims on the outer and intermediate weldments. Before you do the next step, adjust the clearance for the intermediate weldment as described in Checks And Adjustments.

4. Install the lift cylinders. Install the shims at the top of the lift cylinder rods. Push the inner weldment to engage the rods of the lift cylinders. Install the washers

and the snap rings. The maximum clearance between the top of the washer and the bottom of a snap ring is 1.9 mm (0.074 in). Use shim under the washer to change the dimension.

5. Connect a crane to the center of the inner weldment. Slide the inner weldment into the intermediate weldment so that the stub shafts are seen at the top and bottom of the weldments. Install the load rollers and shims. Before you do the next step, adjust the clearance for the inner weldment as described in Checks And Adjustments.

6. Install the outer lift chains as follows:

- a. Slide the inner weldment toward the bottom of the mast assembly just far enough to get access to the chain anchors.
- b. Connect a piece of wire approximately 1 metre (3 feet) 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 weldments. Connect the ends of the chains to the chain anchors at the bottom of the inner 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 weldment. Look between the weldments of the inner and intermediate weldments to see the positions of the lift chains. If necessary, use a thin screwdriver to put each lift chain onto the inside edge of the weldment of the inner weldment. Remove the wires.
- d. Connect each end of a wire approximately 1800 mm (6 feet) long to the end of each lift chain as shown in FIGURE 11. Make sure that each chain will be pulled vertically.
- e. Pull the wire to pull the inner weldment into the intermediate weldment. Remove the wires from the chains. Connect each chain to the anchors on the outer weldment. Use new cotter pins during installation of the chains. Adjust the length of the lift chains as described in Checks And Adjustments.

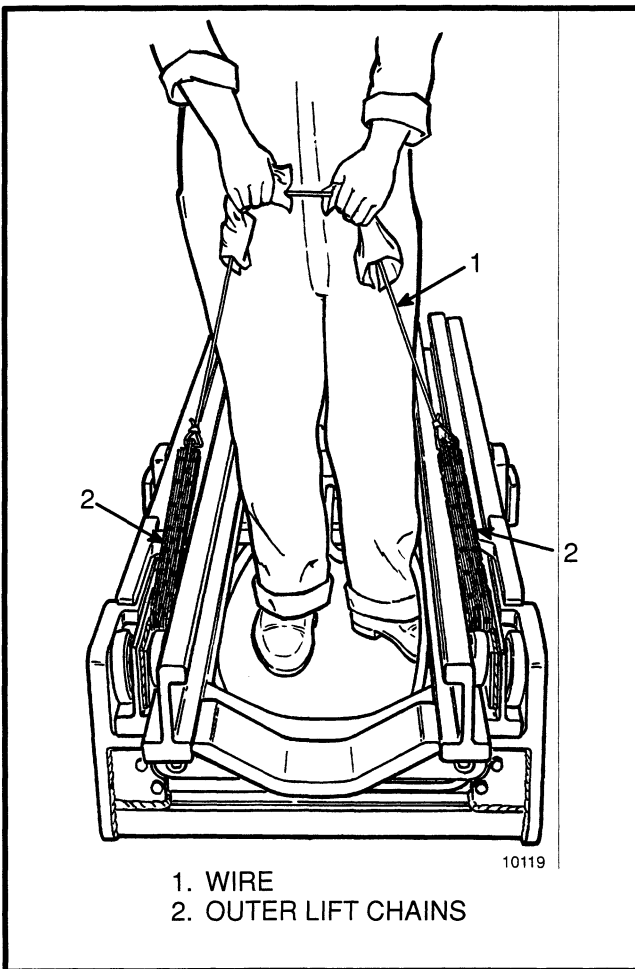


FIGURE 11. INSTALLING THE OUTER LIFT CHAINS

7. Install the free lift cylinder. Install the crosshead assembly to the free lift cylinder. Adjust the cylinder so that the cylinder shell is parallel to the sides of the inner weldment within 3.0 mm (0.12 in). Install the hydraulic lines to the free-lift cylinder. See FIGURE 12.

8. Install the hoses, sheaves and hose reels.

9. Install the sequence valve (if equipped). See the section for the Sequence Valve for more information.

10. Connect all the hydraulic lines.

INSTALLATION

1. Connect a crane to the top of the mast assembly. Make sure the chains will not damage the sheaves or other parts of the assembly.

2. Raise the mast assembly to a vertical position. Move the mast assembly into position on the lift truck.

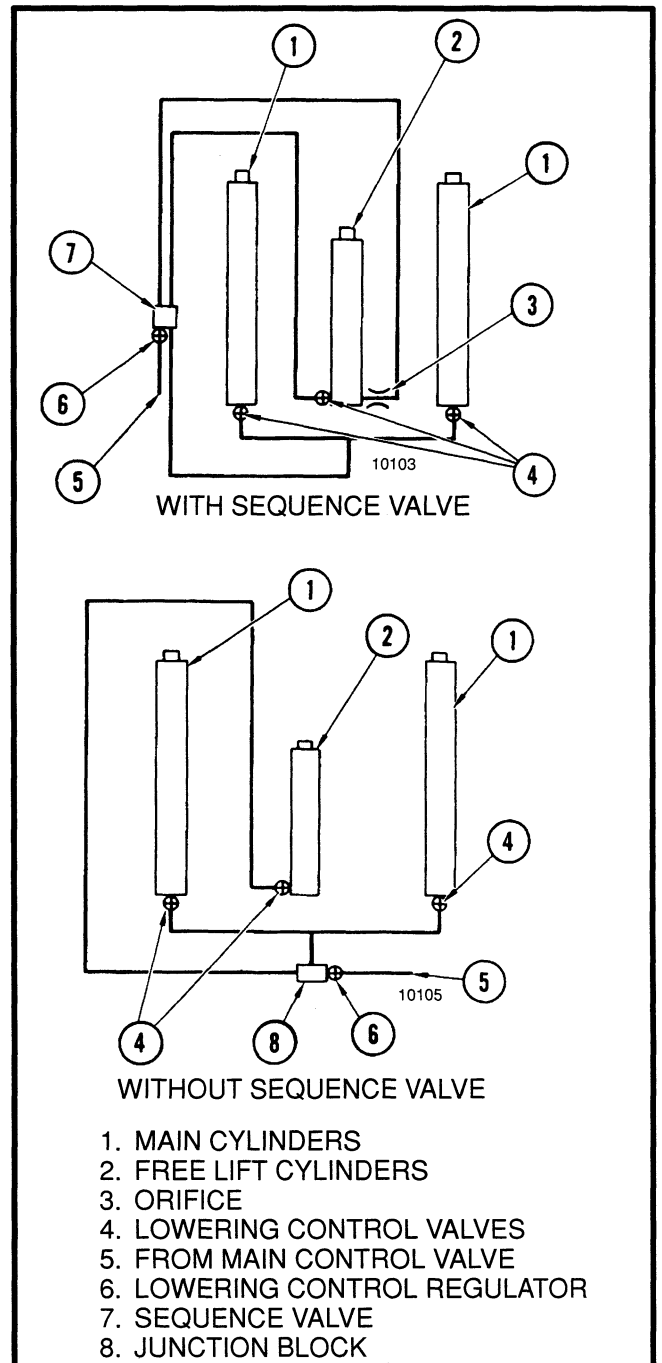


FIGURE 12. HYDRAULIC DIAGRAM - VISTA THREE-STAGE MAST

3. Lubricate the pivots and bushings with multi-purpose grease. See FIGURE 3. for the different designs of pivots and fastening caps. Tighten the fastening capscrews to the correct torque. See FIGURE 3.

4. Move the mast assembly so that the tilt cylinders can be connected. Install the pins and the retainers.

5. Connect the hydraulic lines. Apply grease on the webs of the inner weldment for the carriage load rollers.

6. Install the carriage as described in Carriage Installation in this section. Adjust the carriage as described in Checks And Adjustments.

LIFT AND TILT CYLINDERS

NOTE: See the section for the **LIFT CYLINDERS, 4000 SRM 135**, and the **TILT CYLINDERS, 2100 SRM 103**, for the correct service procedures.

SIDE SHIFT CARRIAGE (See FIGURE 13.)

NOTE: See the **MAIN CONTROL VALVE, 2000 SRM 90** section for information on the control valve linkage for the side shift carriage.

Removal

1. Remove the forks.
2. Connect a crane to the top bar of the apron.
3. Disconnect the hydraulic lines at the side shift cylinder. Put caps on the open lines. Remove and anchor pins and cotter pins from the side shift cylinder. Remove the side shift cylinder.

4. Remove the two carriage hooks at the bottom of the apron.

5. Lift the apron from the carriage. Remove the bearings at the top of the carriage.

Repairs

The only item in the side shift carriage that normally needs repairs is the side shift cylinder. See FIGURE 14.

1. Remove the capscrews from the cover. Remove the retaining ring.

2. Pull the rod and piston assembly from the shell. Replace any seals, O-rings or back up rings as necessary.

3. Lubricate all parts with clean hydraulic oil. Tighten the nut for the piston to 122 to 135 N.m (90 to 100 lbf ft). Install the retainer, piston and rod assembly in the shell.

4. Install the retaining ring, cover and capscrews. Tighten the capscrews to 8 to 16 N.m (6 to 12 lbf ft).

Installation

1. Install the bearings on the carriage. Lubricate the bearings with grease.

2. Use a crane and install the apron on the carriage.

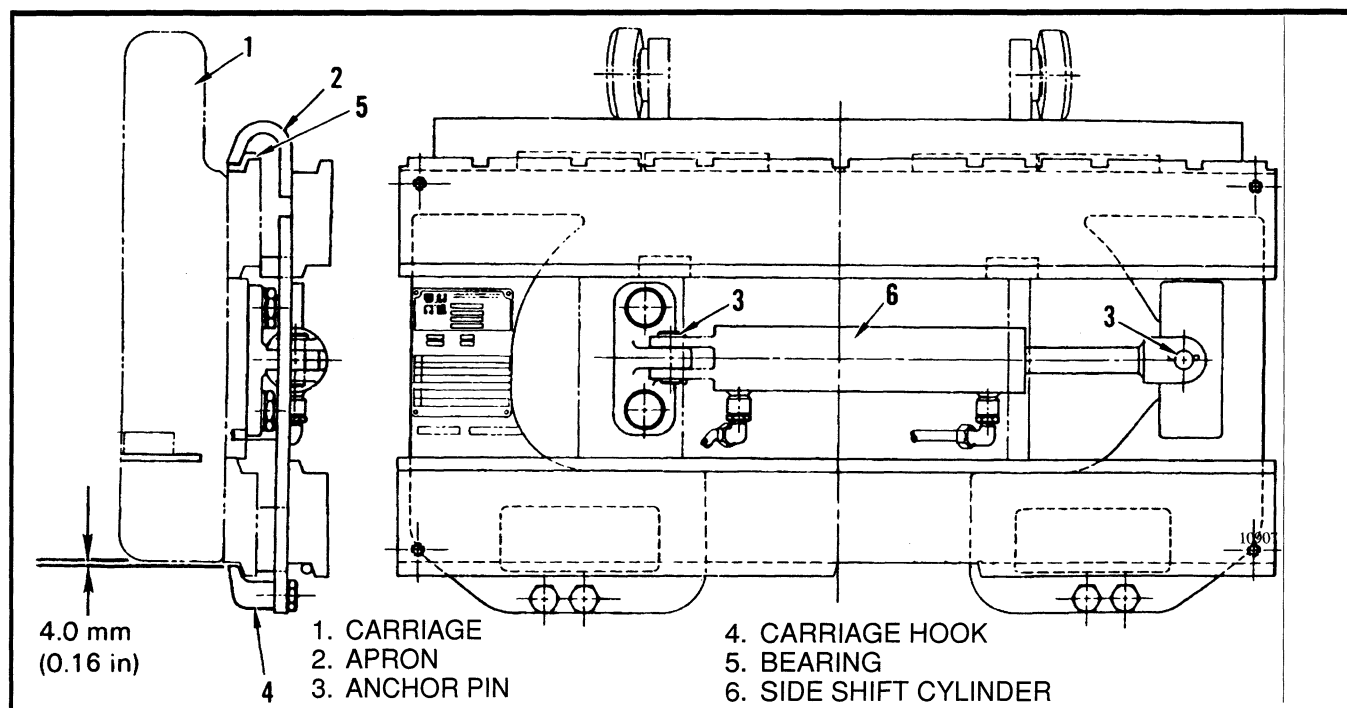


FIGURE 13. SIDE SHIFT CARRIAGE

3. Install the two carriage hooks at the bottom of the apron. Check the clearance between carriage hook and the carriage. See FIGURE 13. If the clearance is more than 4.0 mm (0.16 in), move the hooks to the upper mounting position in the apron. Tighten the capscrews to 165 N.m (122 lbf ft).

4. Install the side shift cylinder in position. Install the anchor pins and cotter pins. Connect the hydraulic lines to the cylinder.

5. Install the forks.

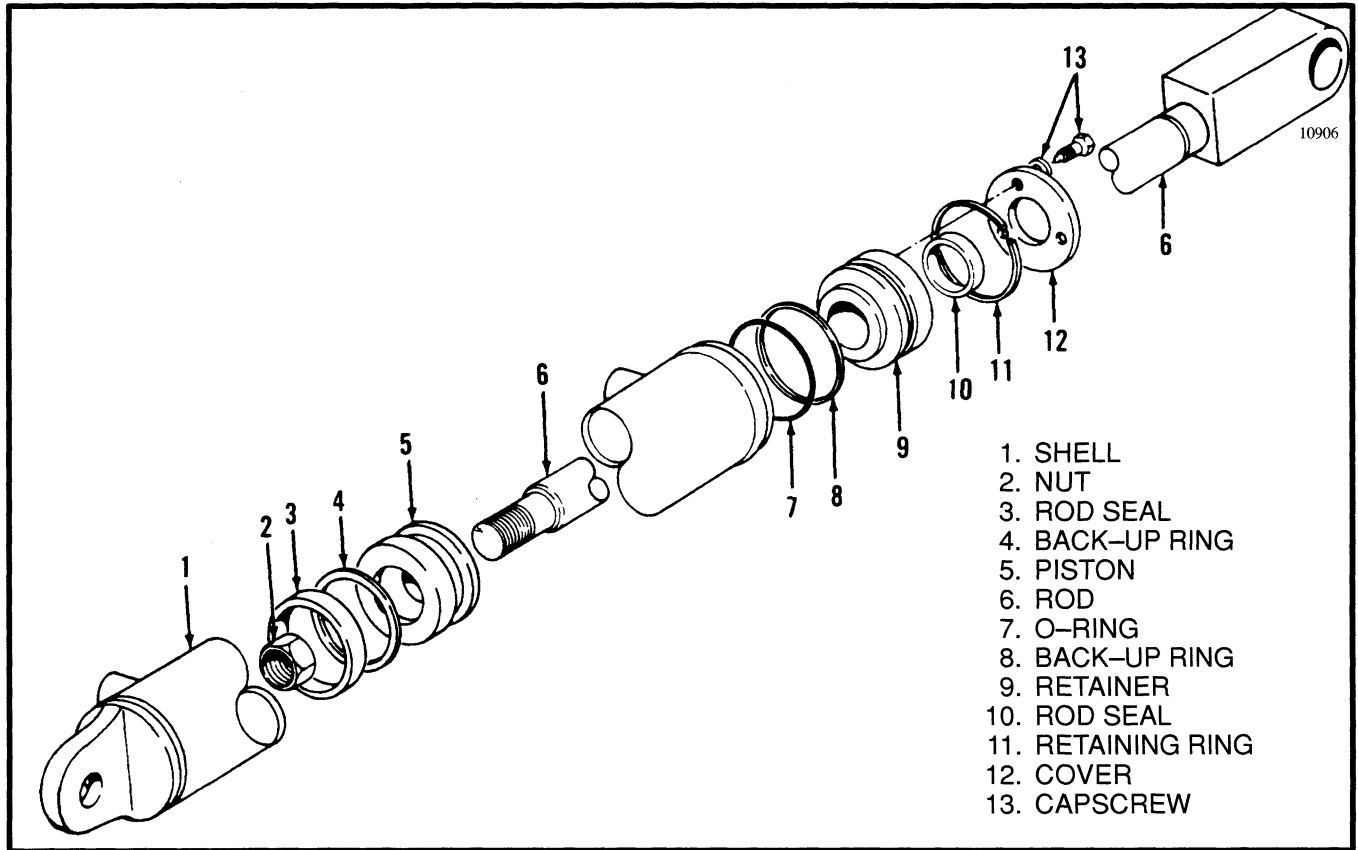


FIGURE 14. SIDE SHIFT CYLINDER

SEQUENCE VALVE (See FIGURE 15.)

NOTE: The H60–110E models use a high pressure hydraulic system and do not need a sequence valve. The high pressure system uses less flow that causes a smaller difference in pressure between the lift cylinders during maximum lift.

A sequence valve is installed on three-stage masts that use a low pressure hydraulic system. It controls the hydraulic functions for the lift cylinders. At the start of the lift sequence, the free-lift cylinder raises the carriage to the top of the inner weldment. When the free-lift cylinder reaches the end of its stroke, the outer lift cylinders begin to extend. The sequence valve makes sure that the lift cylinders extend in the correct se-

quence. The sequence valve is installed on the right hand side of the outer weldment.

The parts of the sequence valve are shown in FIGURE 16. The lift spool in the main control valve is moved to the Lift position. Oil with pressure moves to the supply port of the sequence valve. The oil continues through the lowering control regulator and enters the sequence valve. See the section on **LIFT CYLINDERS, 4000 SRM 135**, for more information on the lowering control regulator. Now the oil can go to either the free-lift cylinder or the main lift cylinders. Since the lift cylinders are connected hydraulically in parallel, the oil will flow to the cylinder that will raise with the smallest force.