



Service Manual

M4Q Quad Lift Mast

Manual Number 667415

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Quad Lift Mast Service Manual

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ATTENTION

Do not install the Quad Mast on a truck having a rated capacity greater than 6,000 lbs. at 24'.

Section 1 INSTALLATION

1-1. INTRODUCTION

1-2. The following instructions outline the recommended installation procedures for installing the Cascade Quad Lift Mast.

1-3. Masts supplied complete with mounting, brackets (base, tilt cylinder and crossbar) are ready for installation.

1-4. Masts purchased without mounting brackets must have a crossbar bracket installed (see subsection 1-8) in addition to the mounting and anchor brackets.

1-5. BASE MOUNTING & ANCHOR BRACKET INSTALLATION

1-6. Weld the base mountings and tilt cylinder anchor brackets to the mast with E-70XX low hydrogen welding rod. Preheat to 300° F, wrap with asbestos and allow to slow cool.

NOTE: Cover all exposed components near the weld (chain, cylinder, etc.) to protect from weld splatter.

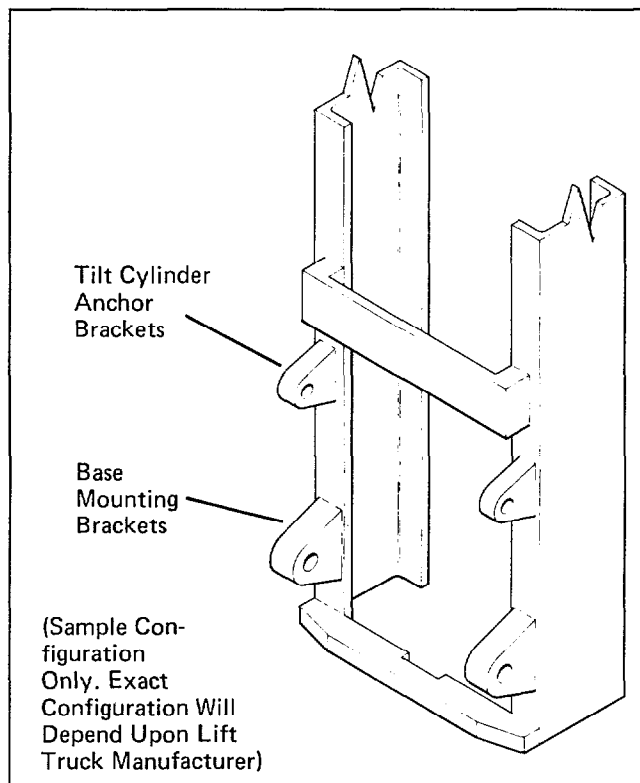


Figure 1-1 Mounting Brackets

1-7. Replace any melted grease on the mast channels with graphite base grease (30% graphite base recommended.).

1-8. CROSSBAR BRACKET INSTALLATION

1-9. All Quad Lift Masts must have a crossbar bracket installed near the tilt cylinder anchor brackets. Some tilt cylinder anchor brackets incorporate the crossbar bracket as an integral part of the bracket assembly.

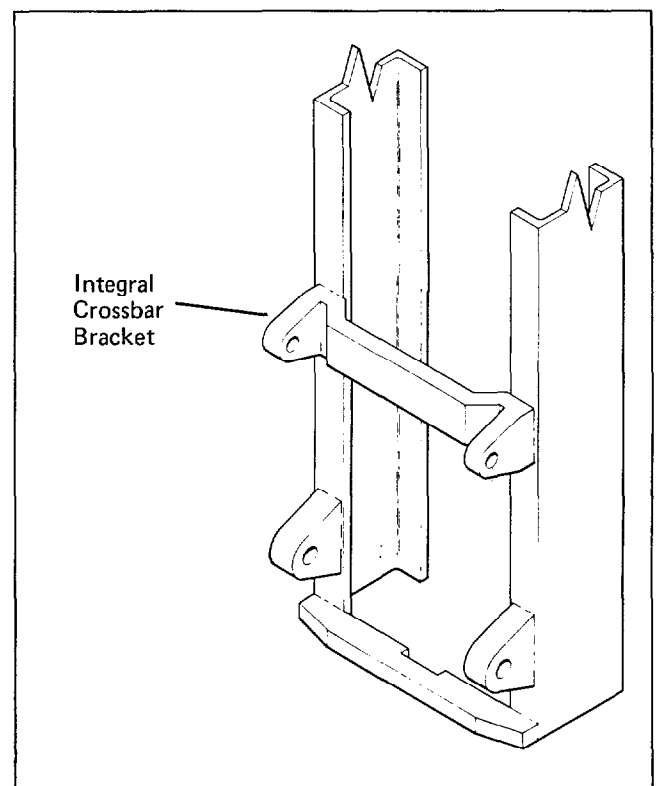


Figure 1-2 Integral Crossbar Bracket

1-10. If the crossbar bracket is not an integral part of the tilt cylinder anchor bracket, a bracket may be fabricated and installed as follows.

1. Fabricate a 1" x 5" x 22" bar from A-7 steel.
2. Cut two 3" x 3" x 5" blocks from A-7 steel.
3. Weld a block to each outer upright channel not more than 6" above the cylinder anchor brackets. See Figure 1-3. Use E-70XX low hydrogen welding rod and weld on vertical seams only. Preheat to 300° F, wrap with asbestos and allow to slow cool.

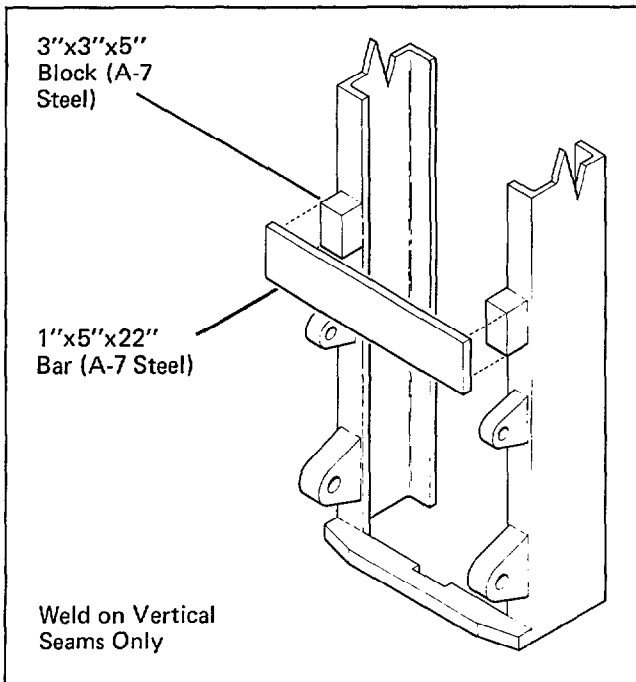


Figure 1-3 Fabricated Crossbar Bracket

NOTE: Cover all exposed components near the weld (chain, cylinder, etc.) to protect from weld splatter.

4. Weld the bar to the blocks to form the crossbar bracket. Use the welding procedures described in step 3 and weld on vertical seams only.

NOTE: If the mast is to be repainted, the cylinder rods and chain must be completely covered.

5. Replace any melted grease on the mast channels with graphite base grease (30% graphite base recommended).

1-11. MAST HOISING INSTALLATION

See Figure 1-5.

NOTE: The right hand hose guide has a bulkhead bracket welded to the bottom. See figure 1-5.

1. Bolt the right hand hose guide to the two mounting plates on the outer channel.
2. Bolt the left hand hose guide to the two mounting plates on the outer intermediate channel.
3. Carefully remove the protective plug from the port at the base of the hoist cylinder.

NOTE: This plug retains a spacer, spring and washer. Make sure these parts are correctly located in the port before proceeding. See figure 1-4.

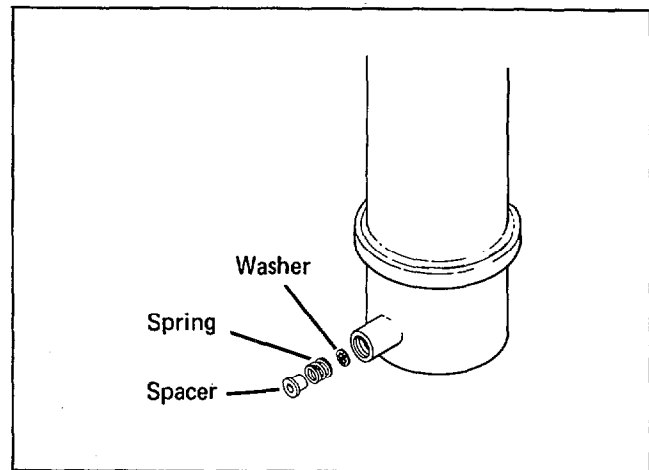


Figure 1-4 Hoist Cylinder Port

4. Thread a male connector into the cylinder port.
5. Attach a 90° fitting to the male connector as shown in figure 1-5.

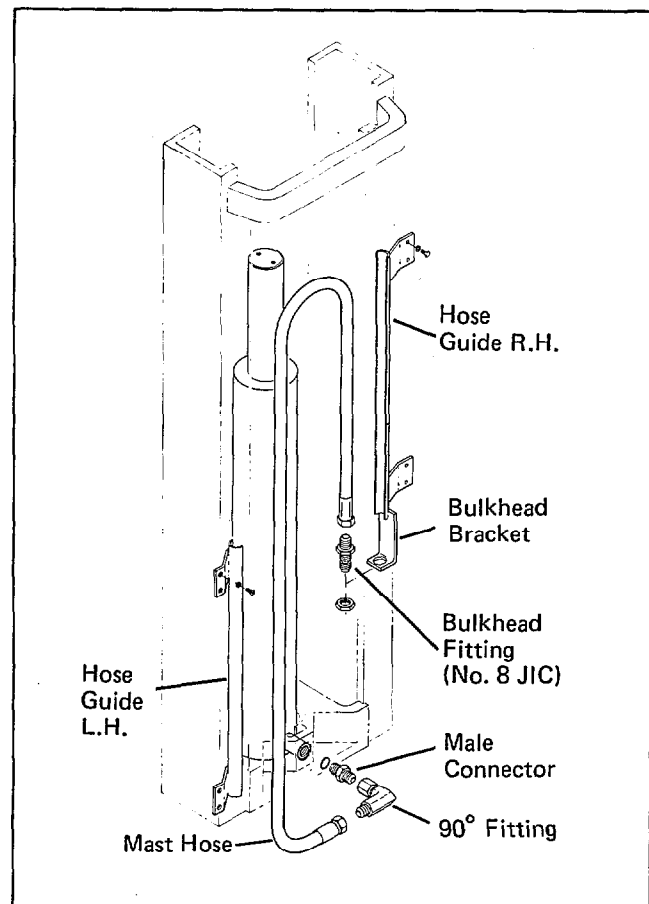


Figure 1-5 Mast Hoising

6. Connect the hose to the 90° fitting.
7. Connect the short side of the bulkhead fitting to the other end of the hose.
8. Loop the hose in the hose guides as shown in figure 1-5.
9. Secure the bulkhead fitting to the bulkhead bracket with a jam nut.

NOTE: The hose must not be twisted when connected to the bulkhead bracket. Twists in the hose will result in hose chafing and cause the hose to dislodge from the guides during operation.

1-12. MAST INSTALLATION

1. Thread a 3/4" UNC x 2-1/2" capscrew (grade 5 or better) with a large flatwasher into the hole on each side of the mast as shown in figure 1-6.

CAUTION: The capscrews must be threaded into the holes until they "bottom out" before the mast is lifted.

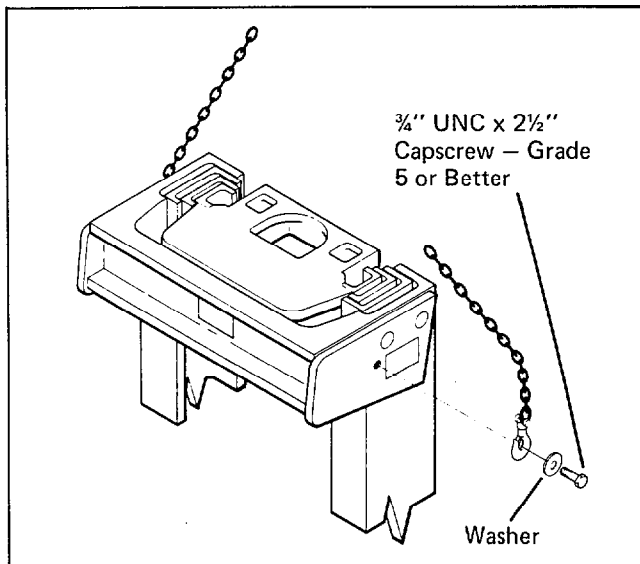


Figure 1-6 Lifting Procedure

2. Using suitable chains, lift the mast into installation position.
3. Connect the supply hose to the bulkhead fitting on the right hand hose bracket.
4. Lubricate the interior diameters of the base mounting brackets with wheel bearing grease and mount on the truck.

5. Lubricate the interior diameters of the tilt cylinder anchor brackets with wheel bearing grease and attach the tilt cylinders.

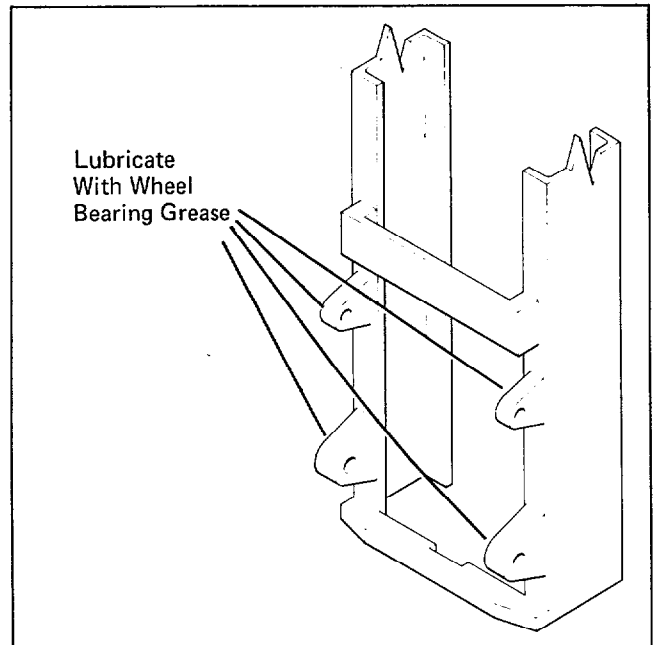


Figure 1-7 Lubrication Points

6. Loosen the bleeder screw located near the top of the mast hoist cylinder. See figure 1-8.

CAUTION: Do not unthread the bleeder screw more than 1 turn when bleeding the hoist cylinder. Keep hands clear of the mast while operating the truck valve.

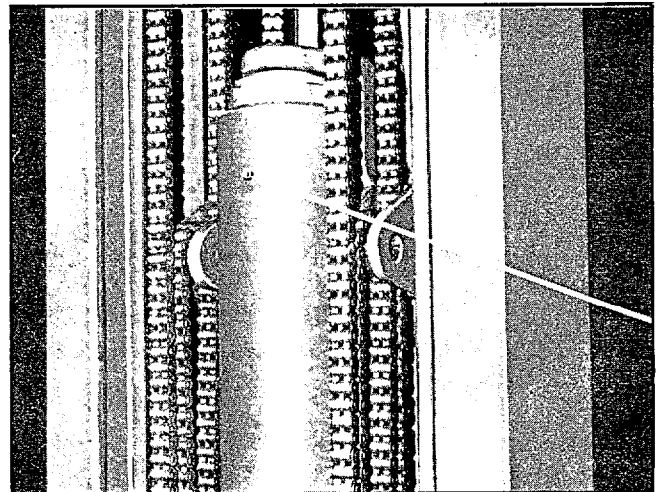


Figure 1-8 Hoist Cylinder Bleeder Screw

7. Run the lift truck at normal operating volume and pressure and slowly open the truck control valve in the "raise" position. Keep the valve open until a clear flow of oil is obtained around the bleeder screw.

CAUTION: The cylinder must be free of air for safe operation.

8. Tighten the bleeder screw during cylinder extension and check for leakage.
9. Carefully sequence and tilt the mast to its full extent to check for obstructions and proper operation. If the cylinder or mast does not sequence or operate properly, refer to the trouble-shooting chart sub-section 2-10.

CAUTION: Check for overhead obstructions before raising mast.

10. During the first extension of the mast, make sure the hose and hose brackets clear the crossmember.

1-13. The mast should now be ready for operation. In addition to the previously mentioned procedures, Cascade recommends that the supply hose be secured to the truck cowl to prevent the hose from being damaged while the mast is in operation.

1-14. SAFETY INSPECTION

1-15. Every Quad Lift Mast has "No Hand Hold" decals (part no. C-655248) located on the side of the outer channel and on the back of the three upper cross members. See figure 1-9.

1-16. If any of these decals are missing, contact the Cascade parts depot for replacements.

1-17. In addition to the normal mast and lift truck inspection procedures, the Quad Lift Mast should be rechecked to insure that:

1. The mast hose is properly fitted in the hose guides and remains in the guides during operation.
2. The crossbar bracket is securely mounted to the outer channel.

3. All hose brackets, hoses, etc. clear the crossbar bracket during operation.

4. The hoist cylinder is bled and free of air.

5. The hoist cylinder bleeder screw is tight and no leakage is occurring.

6. All "No Hand Hold" decals are legible, in their proper location and have the paint masks removed.

7. The chain is completely free of paint and weld splatter.

8. Mast channels are properly relubed with graphite base grease (30% graphite base recommended).

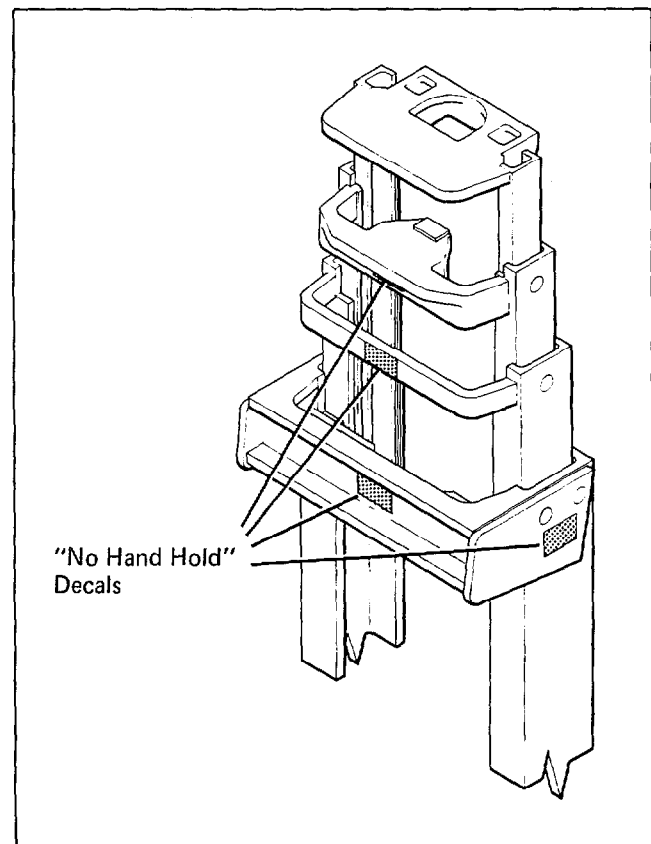


Figure 1-9 "No Hand Holds" Decal Location

TROUBLE-SHOOTING & MAINTENANCE

2-1. INTRODUCTION

2-2. For efficient operation, and in the interest of safety, it is essential that the Quad Lift Mast be inspected and serviced on a routine basis in conjunction with the lift truck's preventative maintenance schedule.

2-3. In this section the minimum required maintenance and inspection procedures are outlined for daily inspection, 100 hour maintenance and 500 hour maintenance. These recommended maintenance periods are for masts operating under normal conditions. Masts operating under severe conditions or in corrosive or extremely dusty atmospheres should be inspected and serviced at more frequent intervals.

2-4. DAILY INSPECTION

2-5. At the beginning of each shift of operation the mast should carefully be inspected following

the points outlined in this sub-section. Unless otherwise indicated, all inspection procedures should be carried out while the mast is completely collapsed, the carriage is in its lowest position and the lift truck is turned off.

CAUTION: Never work on the mast while the lift truck is running or while anyone is near the lift truck control handles.

1. Inspect the carriage chains to make sure they are under equal tension. If adjustment is necessary, follow the procedures outlined in sub-section 2-6, step 8.
2. Inspect the latch mechanisms on the inner channel and on the inner intermediate channel for damage. If damaged they must be replaced (reference sub-section 4-7, steps 2 and 19 for latch installation; reference sub-section 4-10, steps 3 and 4 for adjustment).

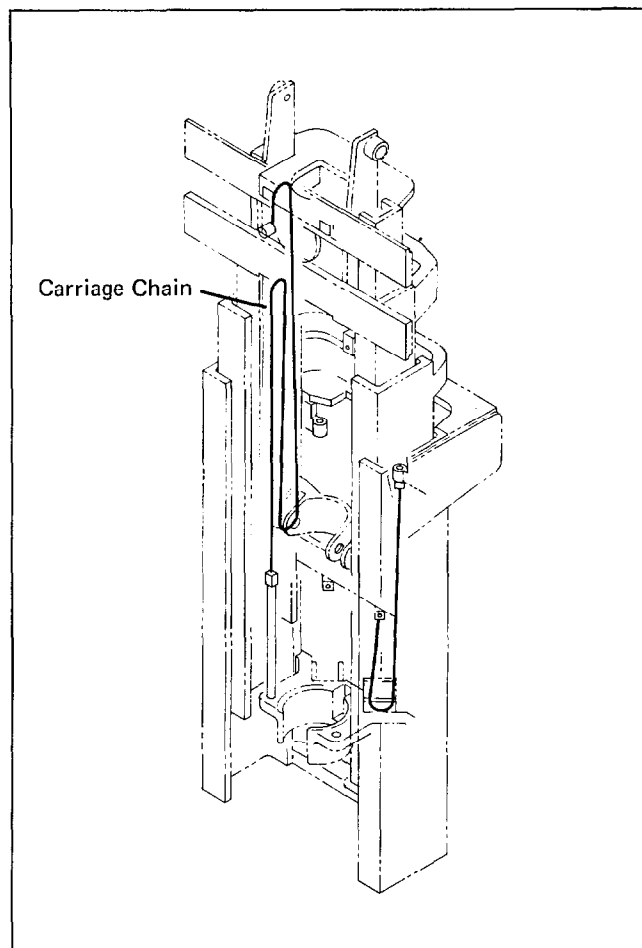


Figure 2-1 Carriage Chains

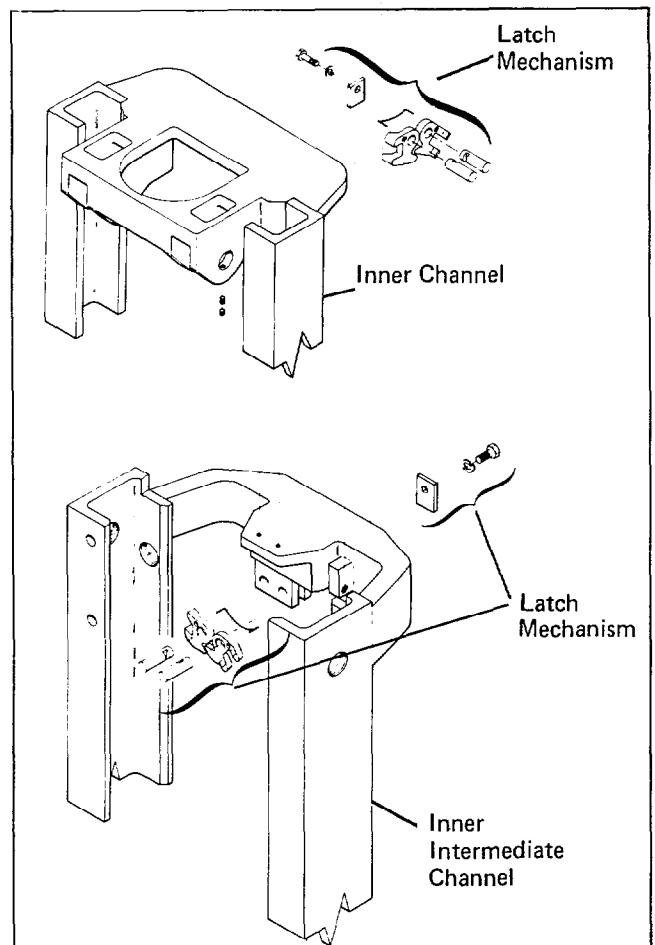


Figure 2-2 Latch Mechanisms

3. Inspect the capscrew latch pins on the outer intermediate channel crossmember and the back of the crosshead. If damaged or missing they must be replaced with a grade 5 or better 5/8" UNC x 1" socket head, not knurled, capscrew. Inspect the capscrew latch pin on the inner intermediate channel crossmember. If damaged or missing it must be replaced with a grade 5 or better 1/2" UNC x 3/4" socket head, not knurled, capscrew.

4. Check the latch pin on the back of the carriage and replace if damaged or missing.

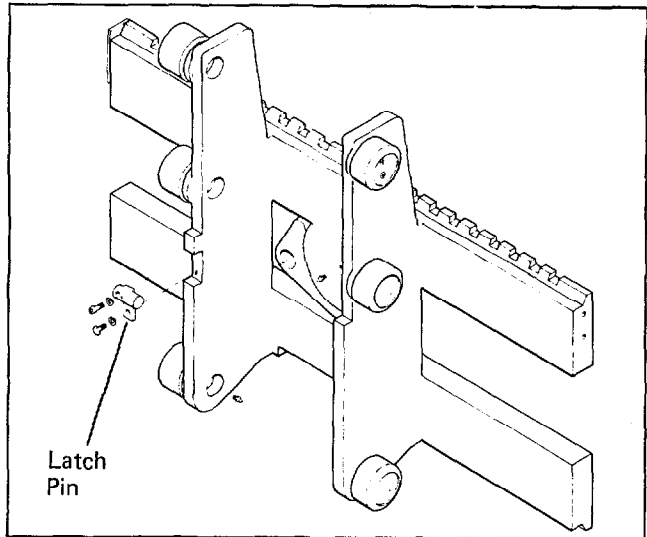
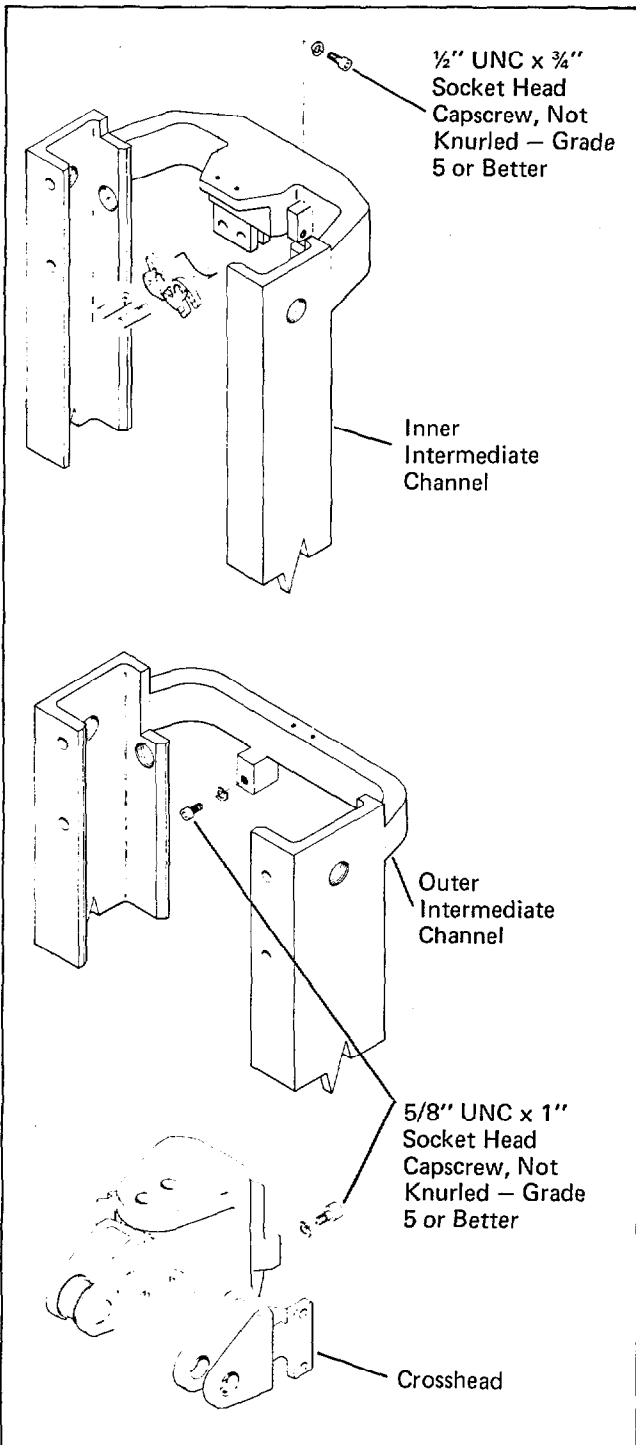


Figure 2-4 Carriage Latch Pin

5. Check the bootstrap chains to make sure they are under equal tension, and if necessary, adjust as outlined in sub-section 2-6, step 10.

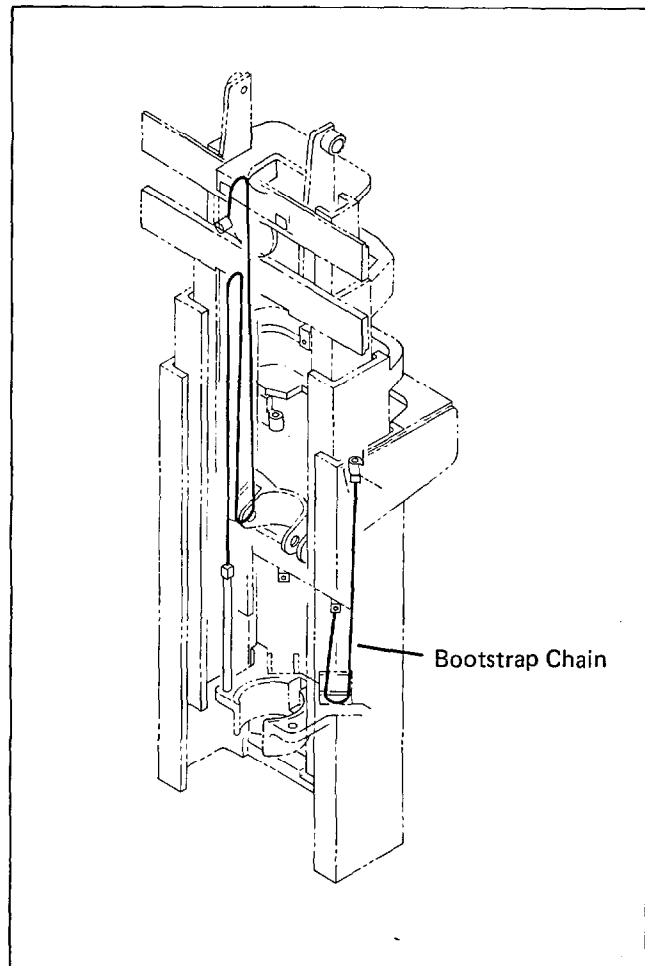


Figure 2-5 Bootstrap Chain

Figure 2-3 Latch Pin Location

6. Start the lift truck and raise the mast to its full height. Inspect all channels for lubrication. If any part of a sliding surface is not completely coated with grease, apply graphite base grease (30% graphite base recommended).

CAUTION: Before greasing the channel, turn the lift truck off and make sure no one is near the lift truck control handles.

7. Lower the mast. If the mast does not sequence or operate properly, refer to the trouble-shooting guide in sub-section 2-10.
8. Make sure the mast hose is not twisted and is traveling correctly in the hose guides. If the hose does not lay correctly in the hose guides it must be reinstalled to prevent chafing and damage (reference sub-section 1-11).

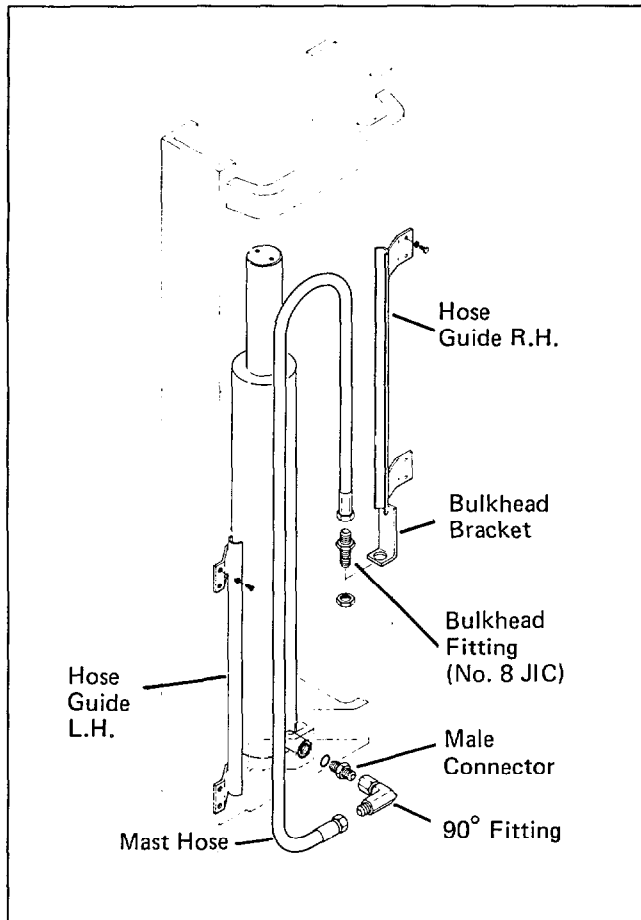


Figure 2-6 Mast Hosing

2-6. 100 HOUR MAINTENANCE & INSPECTION

- 2-7. Every 100 truck operating hours or every four weeks the Quad Lift Mast should be serviced and inspected following the steps listed in this sub-section.

Unless otherwise indicated, these procedures should be performed while the mast is in its completely lowered position, the carriage completely lowered and the lift truck turned off.

CAUTION: Never work on the mast while the lift truck is running or while anyone is near the lift truck control handles.

1. Fully extend the mast and coat all sliding surfaces with graphite base grease (30% graphite base recommended).
2. Inspect the sliding surfaces for scoring. If there are score marks on any of the channels, the wear shoes or brass wear plugs in the mating channel may be excessively worn. If the wear shoes require replacement, the mast must be overhauled as outlined in section 4. If the brass wear plugs require replacement, proceed as follows:

(a) Extend the mast to approximately 1/2 of its overall lift height.

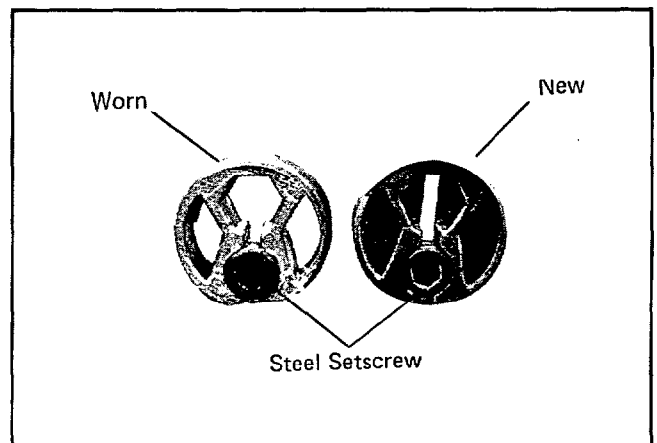


Figure 2-7 Brass Wear Plug

NOTE: A tool for adjusting the brass wear plugs may be fabricated from a six-point, 7/8" socket. See figure 2-8.

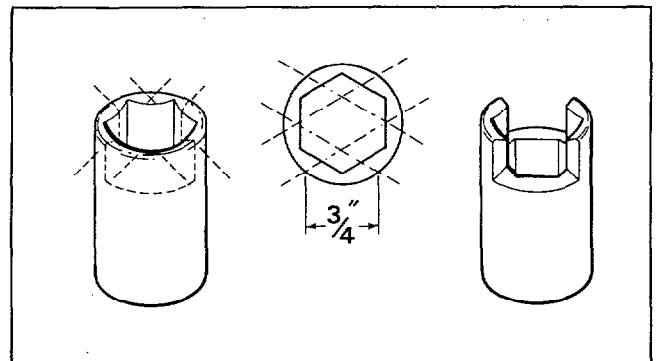


Figure 2-8 Wear Plug Tool

(b) Loosen the steel setscrew and remove the wear plug.

(c) Install the new wear plug and thread it in until it "bottoms out." Unthread it 1/4 turn and tighten the steel setscrew.

3. Brush the carriage chains and the bootstrap chains with SAE 30 engine oil.

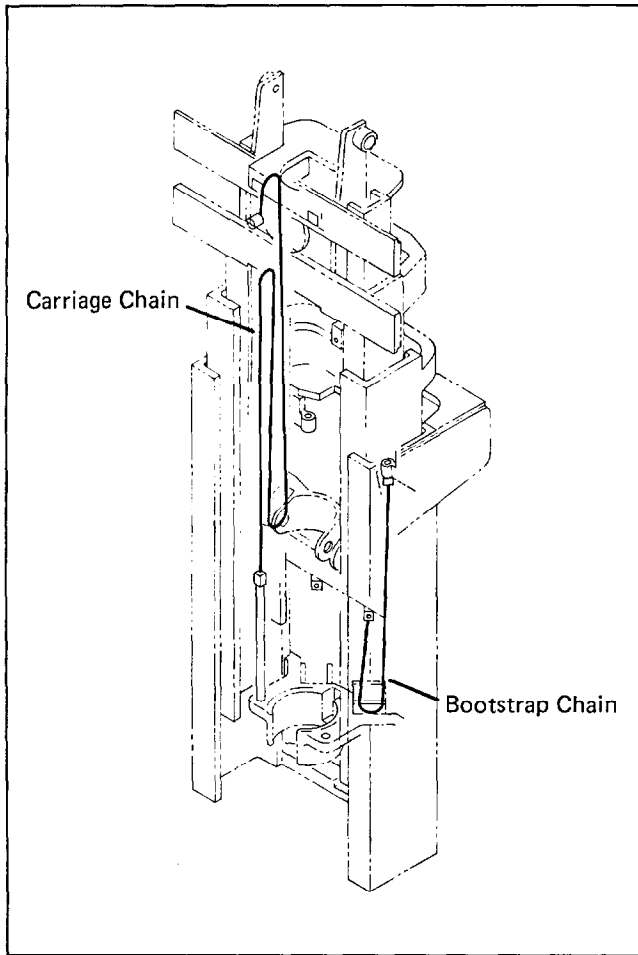


Figure 2-9 Bootstrap & Carriage Chains

4. Grease all chain sheaves with wheel bearing grease through the grease fitting on the end of the sheave shafts. Use one of the following adaptors for easy access to the grease fittings:

(a) Alemite no. 321990-90° adaptor on a flexible hose.

(b) Alemite no. 322120-90° adaptor (permanent attachment to the grease gun).

(c) Universal no. 31-90° adaptor.

(d) Lincoln no. 5855 adaptor extension (push type adaptor, does not lock onto gun).

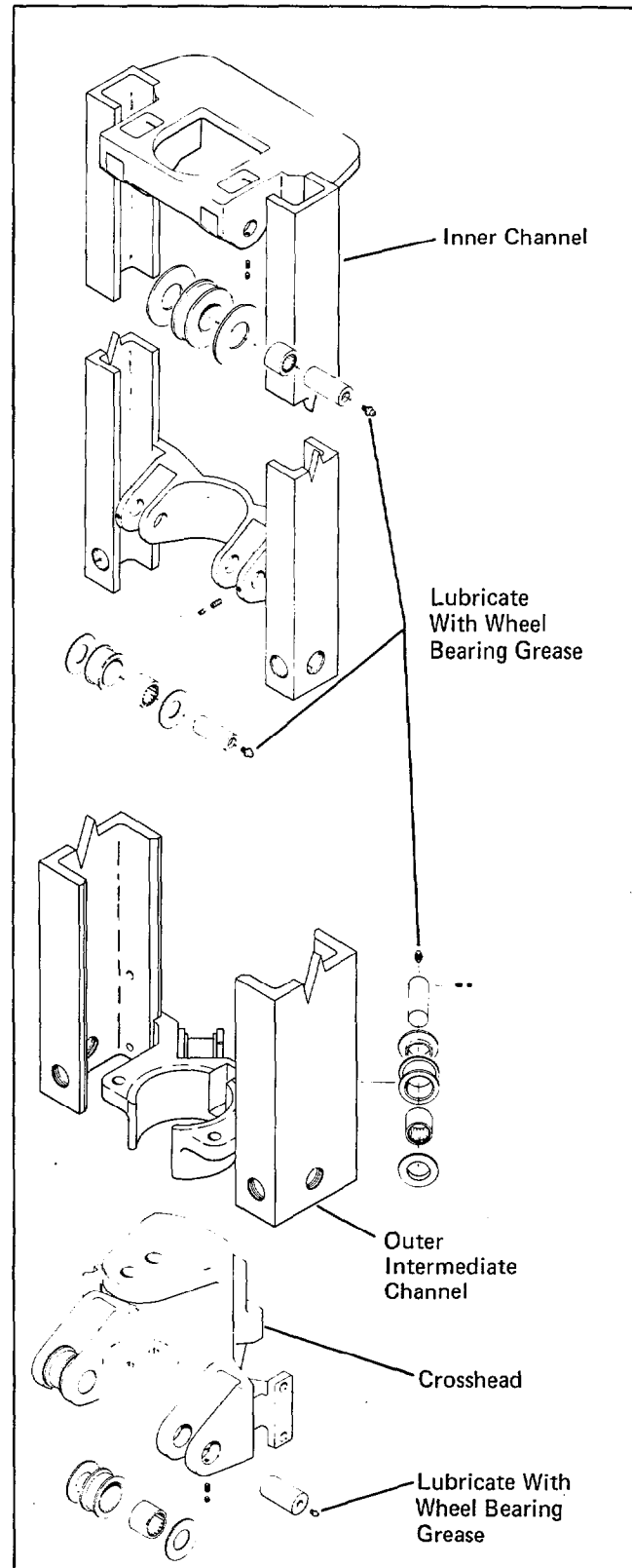


Figure 2-10 Chain Sheaves

5. Grease the carriage rollers with wheel bearing grease through the grease fittings in the back of the stub shafts. Use one of the adaptors listed in step 4 for easy access.

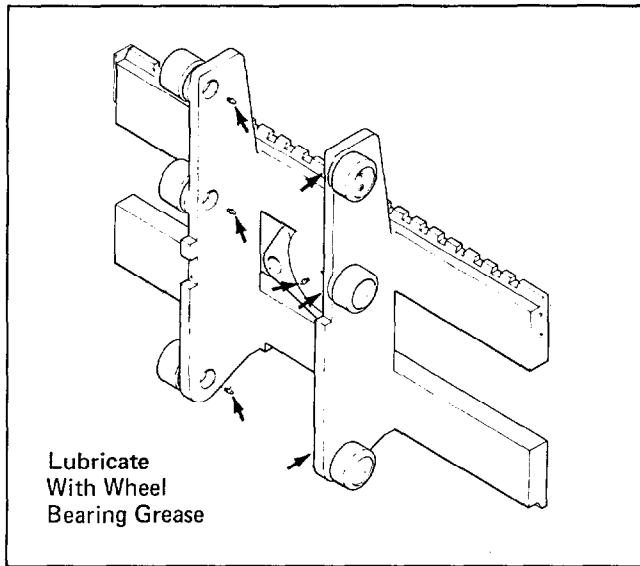


Figure 2-11 Carriage Lubrication Points

6. Inspect all latches and latch pins for damage and for correct positioning as listed below:

(a) The latch mechanism on the inner channel should be engaged with the capscrew latch pin on the inner intermediate channel.

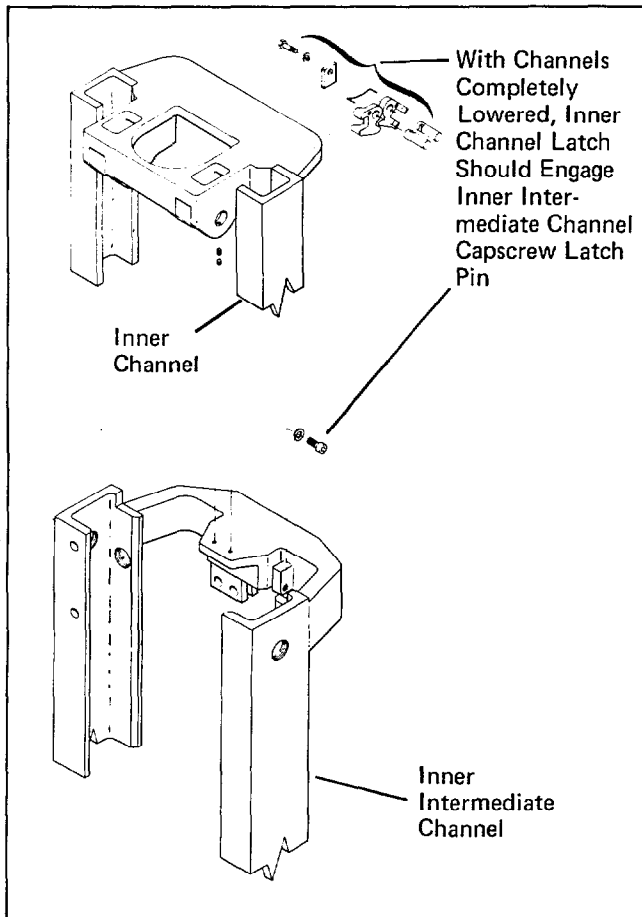


Figure 2-12 Inner Channel Latch

(b) The latch mechanism on the inner intermediate channel should be engaged with the capscrew latch pin on the outer intermediate channel.

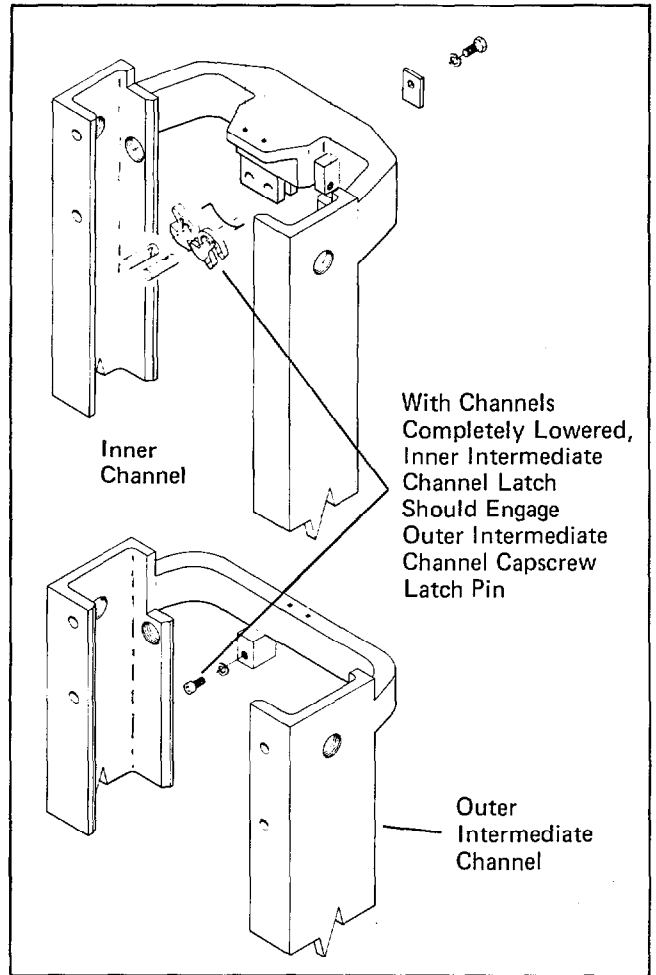


Figure 2-13 Inner Intermediate Channel Latch

(c) Both latches on the mechanisms should be interlocked and connected with the spring.

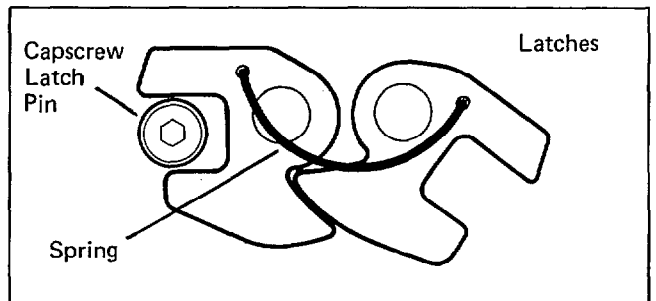


Figure 2-14 Latch Mechanism

(d) If the latches are damaged or not properly positioned they must be replaced and/or adjusted (reference sub-section 4-7, steps 2 and 19 for installation; reference sub-section 4-10, steps 3 and 4 for adjustment).

7. Lubricate all mating surfaces on the latch mechanisms with SAE 30 engine oil.
8. Adjust the carriage position according to the following specifications by adjusting the carriage chain anchors located in the cylinder base:

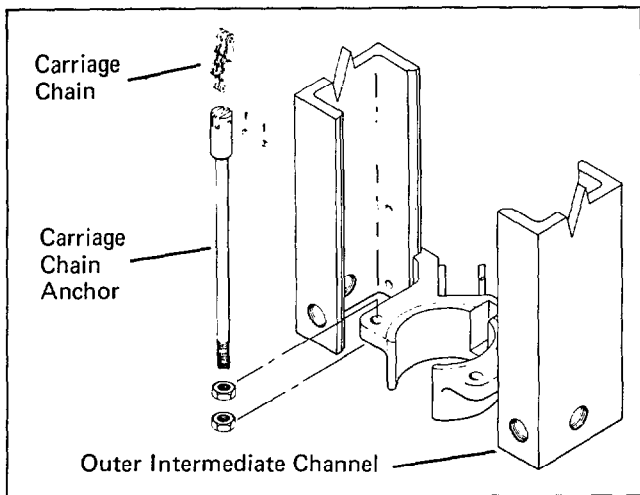


Figure 2-15 Carriage Chain Anchors

(a) The yoke must be evenly centered in the carriage as shown in figure 2-16.

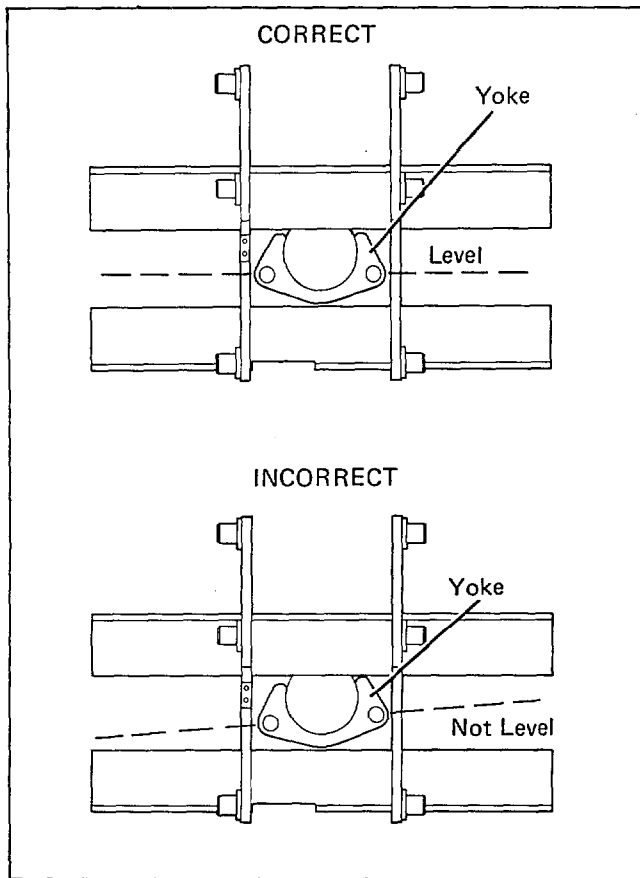


Figure 2-16 Carriage Yoke Position

(b) For masts with 3" underclearance, adjust the carriage so the bottom of the lower fork bar is even with the bottom of the outer channel. See figure 2-17.

(c) For masts with 5" underclearance, adjust the carriage so the bottom of the lower fork bar is 2" below the bottom of the outer channel. See figure 2-17.

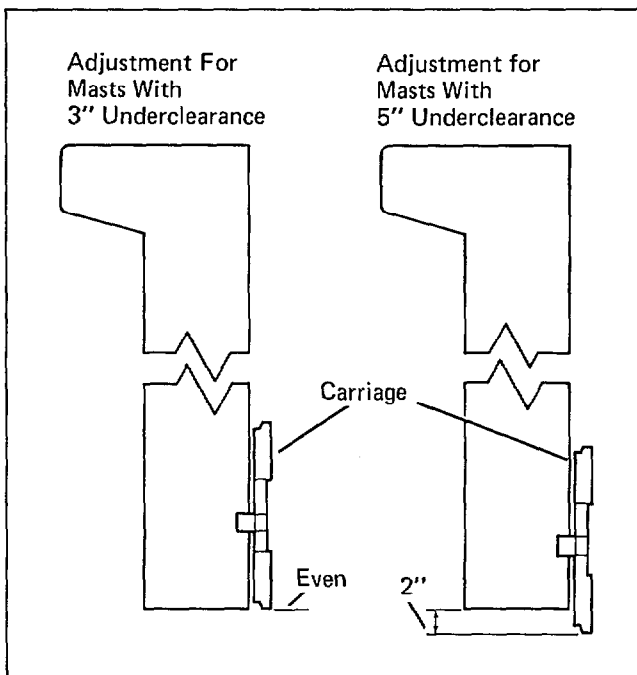


Figure 2-17 Carriage Positioning

9. Push the crosshead from side to side. If it moves more than 1/16" or it is more than 1/16" off center in relation to the inner intermediate channel, adjust as follows:

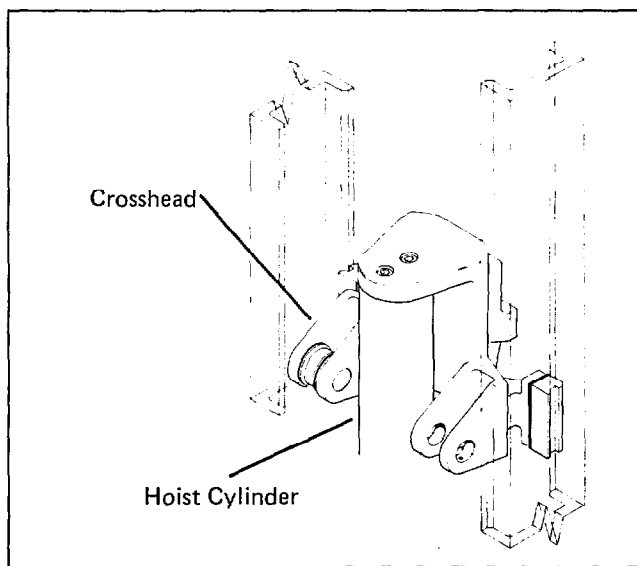


Figure 2-18 Crosshead

- (a) Block the carriage up.
- (b) Disconnect the carriage chains by removing the two small chain anchors from the yoke.

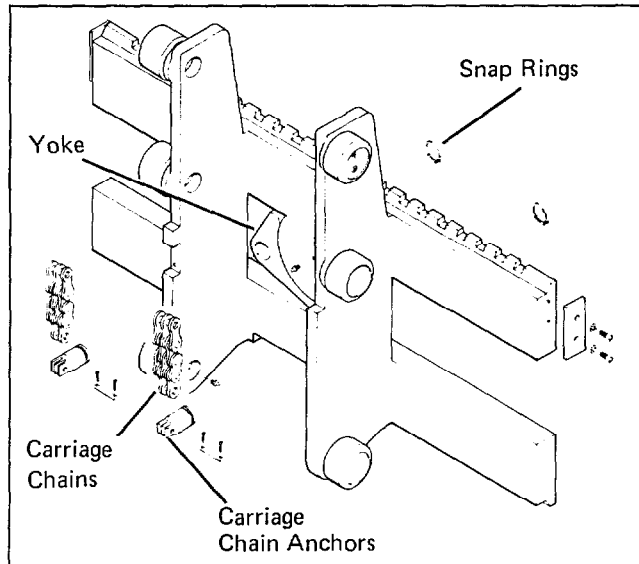


Figure 2-19 Carriage Chain Anchors

- (c) Remove the two capscrews that retain the crosshead to the cylinder plunger.

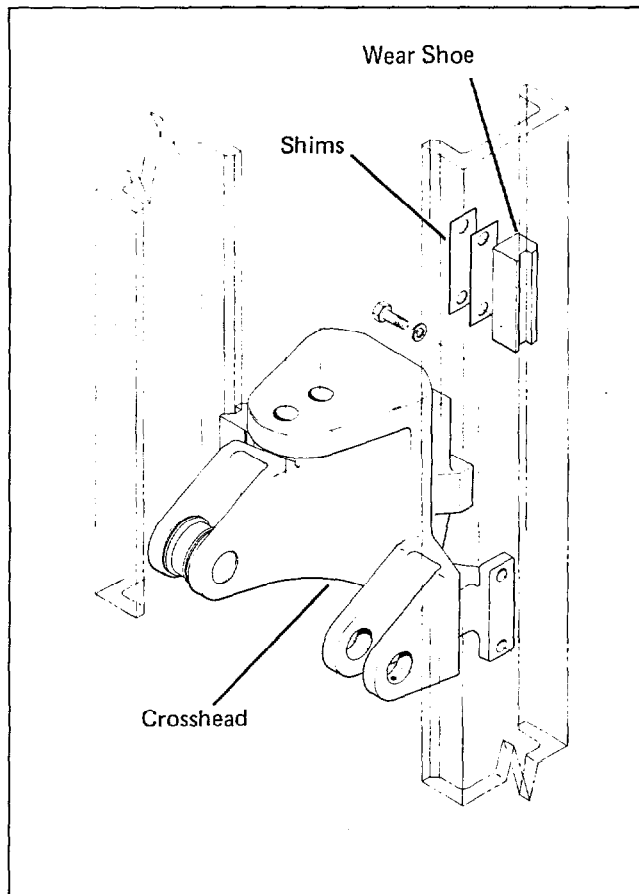


Figure 2-20 Crosshead Adjustment

- (d) Slide the crosshead part way up the mast and secure it in this position with a chain.

- (e) Remove the capscrews that retain one wear shoe and slide the wear shoe free of the crosshead.

- (f) Add the necessary number of shims behind the wear shoe, slide it back into position on the crosshead and reinstall the capscrews.

NOTE: If the crosshead requires more than four shims behind each wear shoe to meet specifications, the wear shoe must be replaced.

- (g) Repeat this procedure with the other wear shoe and recheck the tolerances. The crosshead must not move more than $1/16''$ from side to side and must be centered to within $1/16''$ between the inner intermediate channel.

- (h) Reconnect the crosshead to the plunger. If the original capscrews are not used, the replacements must be grade 5 or better $1/2''$ UNF x 1'' socket head capscrews.

- (i) Reconnect the carriage chain anchors to the yoke.

- (j) Slowly raise the carriage until the crosshead is between the carriage side plates. Turn the lift truck off. The side plates must clear the crosshead by $1/4'' \pm 1/16''$. If the side plate clearances do not meet these specifications, adjust the side wear plugs in the inner channel (reference sub-section 4-8, step 8).

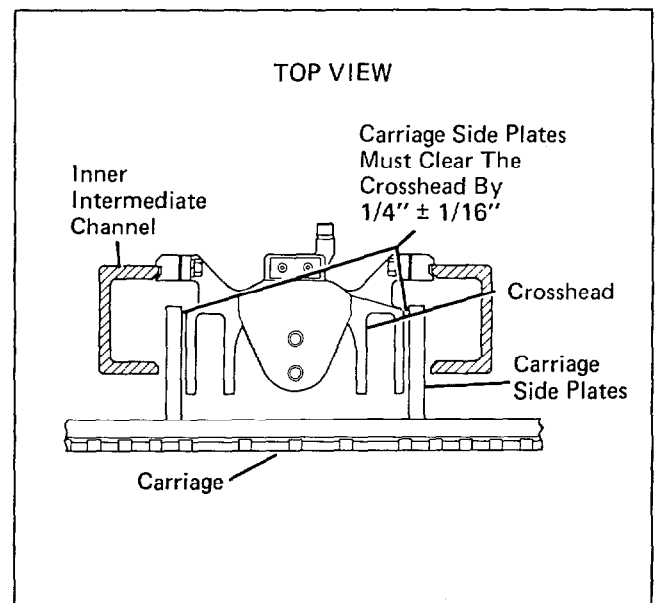


Figure 2-21 Crosshead Clearances

10. Adjust the bootstrap chains according to the following guidelines by adjusting the chain anchors on the outer channel crossmember.

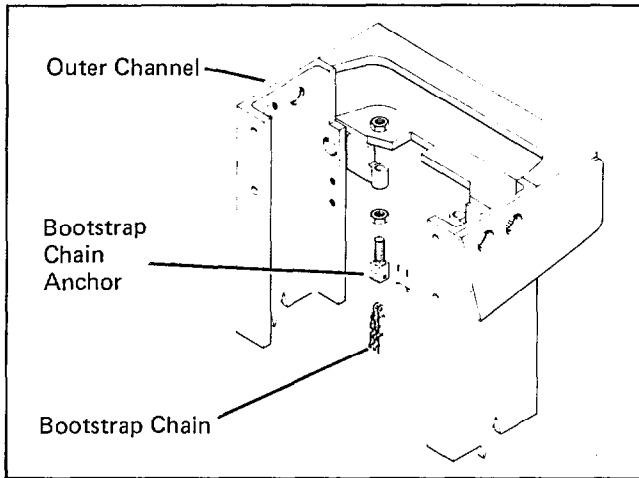


Figure 2-22 Bootstrap Chain Anchor

- (a) Both chains must be under equal tension.
- (b) The contact pad on the bottom of the outer intermediate channel crossmember must just touch the outer channels crossmember when the mast is fully collapsed. See figure 2-23.

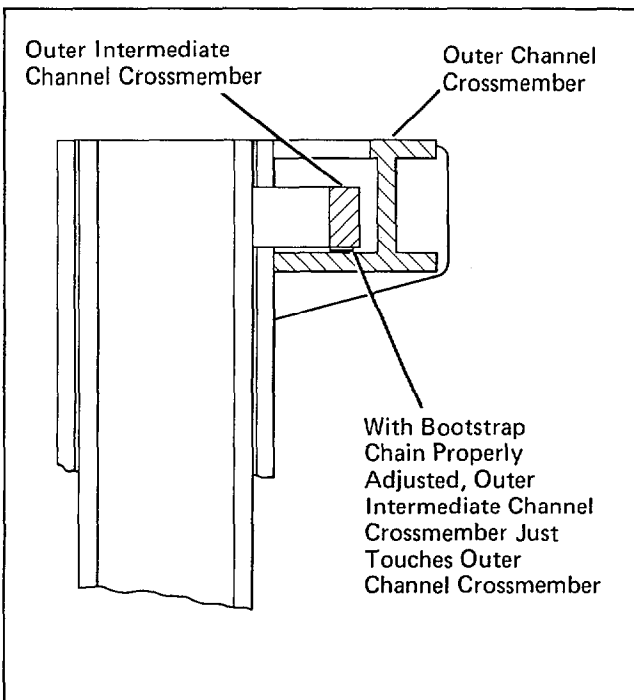


Figure 2-23 Bootstrap Chain Adjustment

11. Inspect the mast hose, fittings and hose guides for wear or damage. If there is visible wear or damage, they must be replaced. Reference sub-section 1-11.

2-8. 500 HOUR MAINTENANCE & INSPECTION

2-9. Every 500 truck operating hours or every ten weeks the Quad Lift Mast should be serviced and inspected following the steps listed in this sub-section. Unless otherwise indicated, these procedures should be performed while the mast is in its completely lowered position, the carriage completely lowered and the lift truck turned off.

CAUTION: Never work on the mast while the lift truck is running or while anyone is near the lift truck control handles.

1. Complete all 100 hour maintenance and inspection procedures with the exception of steps 3, 8 and 10.
2. Remove the bootstrap chains (see figure 2-5) from the mast. Inspect and service as follows:

(a) Inspect the side plates on the chain links for cracks caused by corrosion. If a cracked side plate is found, both chains must be replaced. See figure 2-24.

(b) Manually flex the chain joints to check for tight spots caused by bent pins, plates or peened plate edges. If cleaning does not free a joint, both chains must be replaced.

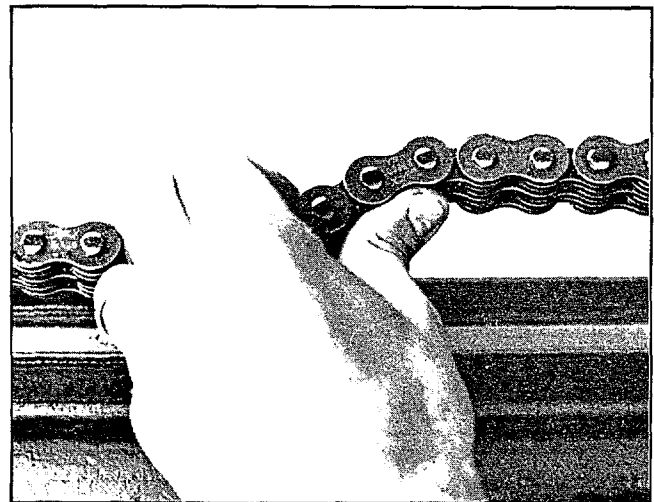


Figure 2-24 Chain Link Inspection

(c) Wash the chains in kerosene, wipe dry and soak in SAE 30 engine oil for 30 minutes.

3. Install the chains on the mast and adjust according to the following guidelines by adjusting the chain anchors on the outer channel crossmember.

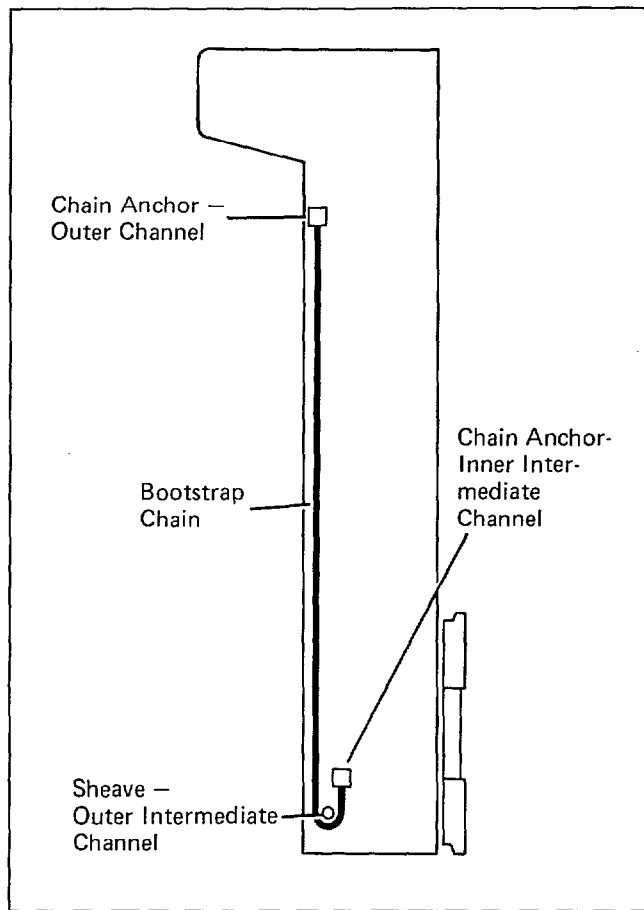


Figure 2-25 Bootstrap Chain Installation

(a) Both chains must be under equal tension.

(b) The contact pad on the bottom of the outer channel crossmember must just touch the outer intermediate channel crossmember when the mast is fully lowered.

4. Block the carriage up and remove the carriage chains. Inspect and service the chains as follows:

(a) Inspect the side plates on the chain links for cracks caused by corrosion. If a cracked side plate is found, both chains must be replaced. See figure 2-24.

(b) Manually flex the chain joints to check for tight spots caused by bent pins, plates or peened plate edges. If cleaning does not free a joint, both chains must be replaced.

(c) Wash the chains in kerosene, wipe dry and soak in SAE 30 engine oil for 30 minutes.

5. Install the chains on the mast. Adjust the carriage position according to the following

guidelines by adjusting the chain anchors located in the cylinder base.

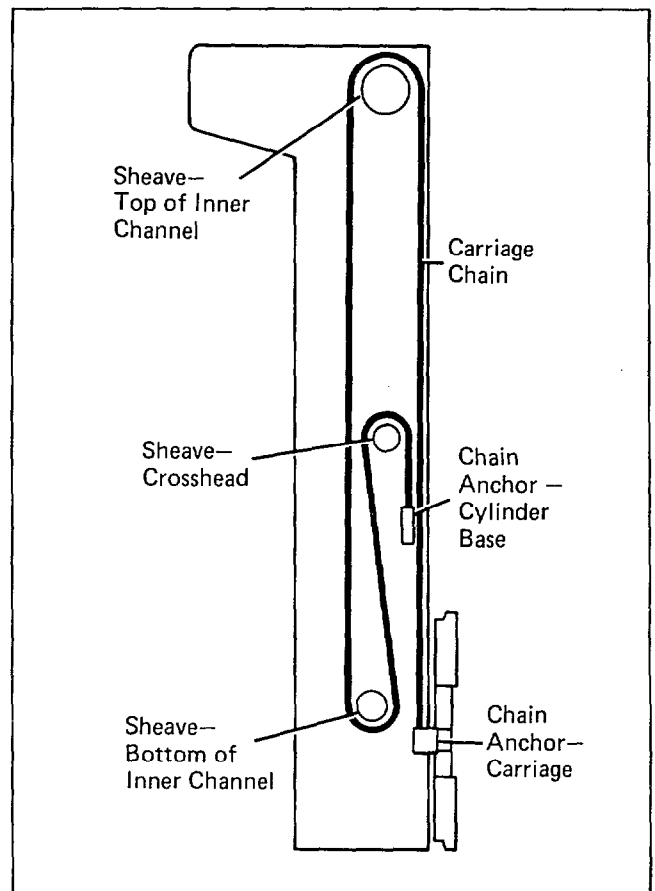


Figure 2-26 Carriage Chain Installation

(a) The yoke must be evenly centered in the carriage as shown in figure 2-16.

(b) For masts with 3" underclearance, adjust the carriage so the bottom of the lower fork bar is even with the bottom of the outer channel. See figure 2-17.

(c) For masts with 5" underclearance, adjust the carriage so the bottom of the lower fork bar is 2" below the bottom of the outer channel.

6. Adjust the mast channels as follows:

(a) Extend the mast approximately 1/2 of the overall lift height and turn the truck off.

CAUTION: Never work on the mast while the lift truck is running or while anyone is near the lift truck control handles.

(b) Loosen the steel setscrews in the brass wear plugs on both sides of the channel members.

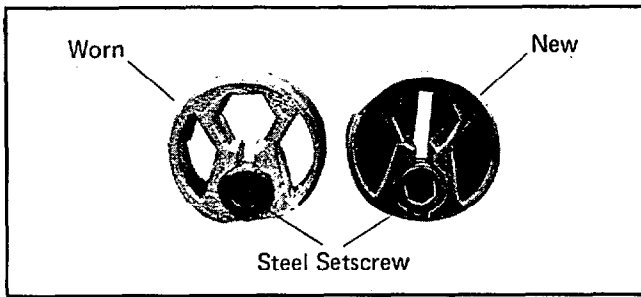


Figure 2-27 Brass Wear Plug

(c) Beginning with the outer intermediate channel, center each channel from side to side in its mating channel by tightening and adjusting the side brass wear plugs. See figure 2-8 for wear plug tool.

NOTE: If the brass has worn through on the inside of the wear plug it must be replaced. If more than one wear plug is to be replaced, they should be replaced one at a time.

(d) When all the channels are centered, unthread each wear plug 1/4 turn and tighten the steel setscrews.

NOTE: If the steel setscrew touches the channel's sliding surface before it tightens the wear plug, the wear plug must be replaced. If more than one wear plug is to be replaced, they should be removed and installed one at a time.

(e) Loosen the steel setscrews in all brass wear plugs on the front and back of the channel members.

(f) Beginning with the outer intermediate channel, center each channel from front to back in its mating channel by tightening and adjusting the wear plugs.

NOTE: If the brass has worn through on the inside of the wear plug it must be replaced. If more than one wear plug is to be replaced, they should be removed and installed one at a time.

(g) With the wear plugs tightened, measure the location of each channel member in relation to its mating channel. If a channel is more than 3/32" off center from front to back the bearing strips are excessively worn and the mast should be completely disassembled, inspected and overhauled as outlined in section 4. See figure 2-28.

(h) When each channel member is centered

from front to back, unthread each wear plug 1/4 turn and tighten the steel setscrews.

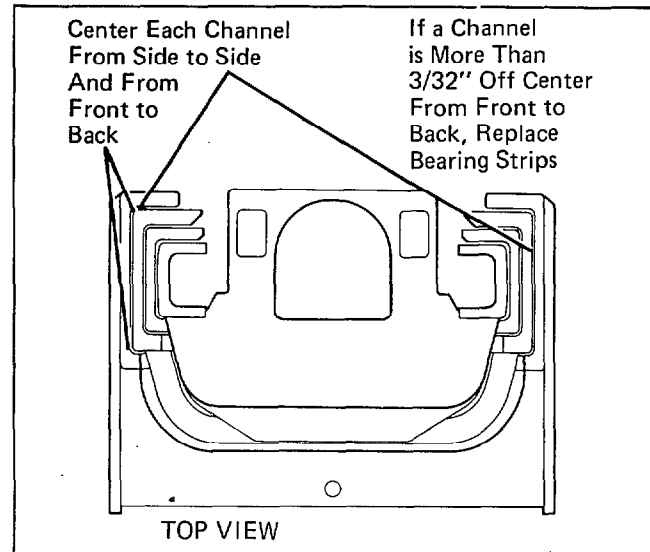


Figure 2-28 Channel Adjustment

NOTE: If the steel setscrew touches the channel's sliding surface before it tightens the wear plug, the wear plug must be replaced.

(i) Slowly lower the mast until the crosshead is between the carriage side plates. Turn the truck off. The side plates must clear the crosshead by 1/4" ± 1/16". If the side plate clearances do not meet these specifications, readjust the side wear plugs in the inner channel (reference sub-section 4-8, step 8).

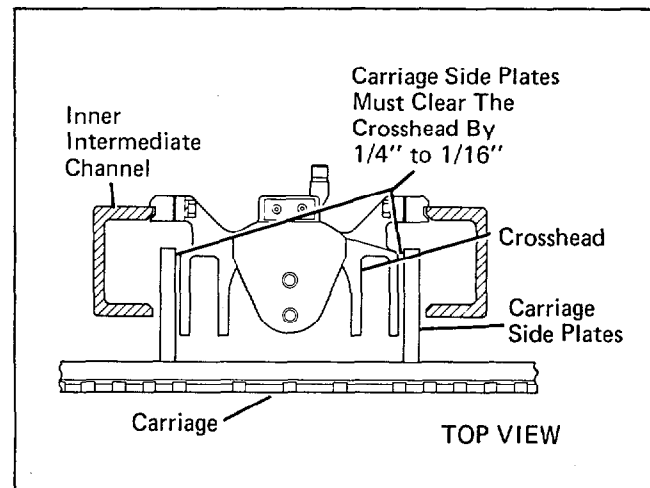


Figure 2-29 Crosshead Adjustment

(j) Carefully cycle the mast. If the mast appears to be binding or will not completely lower with just the weight of the forks on the carriage, recheck the brass wear plugs to make sure they have been unthreaded 1/4 turn.

2-10. TROUBLE-SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Carriage roller failure.	Shock loading from ramming operation.	Caution operator on results of ramming. For repair refer to section 3.
	Insufficient lubrication.	Lubricate every 100 hours or four weeks as outlined in sub-section 2-6. For repair refer to section 3.
Carriage side plates hitting or scraping channel cross-members.	Carriage rollers improperly shimmed or excessively worn.	Remove carriage from mast and adjust shims behind rollers as outlined in section 3.
Flat spot in carriage rollers	Roller bearing faulty.	Replace roller following service procedures outlined in section 3.
Carriage scraping against front of hoist cylinder.	Crosshead too loose.	Inspect and adjust crosshead as outlined in sub-section 2-6, step 9.
Carriage side plates scraping against crosshead.	Crosshead too loose or not properly shimmed.	Inspect and adjust crosshead as outlined in sub-section 2-6, step 9.
Carriage hangs up or appears to bind during operation.	Stub shaft broken.	Remove, inspect, repair and/or adjust carriage as outlined in section 3.
	Roller bearing or roller assembly damaged.	
	Carriage adjusted too tight in inner channel.	
Mast hose comes out of hose guides during operation.	Hose guides bent or improperly installed.	Remove hose, inspect guides and reinstall as outlined in sub-section 1-11.
	Hose twisted when tightened at bulkhead fitting.	
Mast hose chafing or showing visible wear spots.	Hose not lying properly in hose guides.	Remove hose and reinstall as outlined in sub-section 1-11.
Latch mechanism damaged. (continued on page 18)	Mast out of adjustment.	Replace latch as outlined in sub-section 4-7, steps 2 and 19. Adjust mast as outlined in sub-section 4-10, steps 3, 4 and 10.
	Latch spring broken or missing.	

PROBLEM	POSSIBLE CAUSE	SOLUTION
Latch mechanism damaged. (continued)	Latch pin damaged or missing.	Inspect capscrew latch pins on inner intermediate channel crossmember, outer intermediate channel crossmember and back of crosshead. If damaged or missing replace using only capscrews meeting specifications outlined in sub-section 2-4, step 3.
		Inspect latch pin on back of carriage and replace if damaged or missing.
		Replace damaged latches as outlined in sub-section 4-7, steps 2 and 19. Adjust mast as outlined in sub-section 4-10, steps 3, 4 and 10.
	Crosshead out of adjustment.	Adjust crosshead as outlined in sub-section 2-6, step 9.
Capscrew latch pin damaged.	Latch mechanism damaged or improperly positioned.	Replace capscrew latch pins using only capscrews that meet specifications outlined in sub-section 2-4, step 3.
		Replace latch mechanism as outlined in sub-section 4-7, steps 2 and 19. Adjust mast as outlined in sub-section 4-10, steps 3, 4 and 10.
	Bootstrap chain out of adjustment.	Adjust as outlined in sub-section 2-6, step 10.
	Carriage chain out of adjustment.	Adjust as outlined in sub-section 2-6, step 8.
Carriage latch pin damaged. (continued on page 19)	Latch pin hitting crosshead.	Adjust shims behind crosshead wear shoes as outlined in sub-section 2-6, step 9.
		Adjust carriage position relative to crosshead by readjusting inner channel. Reference sub-section 4-8, step 8.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Mast locked in partially extended position.	Latches jammed.	Inspect and adjust latch mechanisms following procedures described in sub-section 4-10, steps 3, 4 and 10. If latches are damaged, replace following procedures described in sub-section 4-7, steps 2 and 19.
		Inspect all latch pins and replace if damaged or missing. Use only capscrews that meet specifications listed in sub-section 2-4, step 3.
Mast won't extend to full lift height.	Latch jammed.	Inspect and adjust latch mechanisms following procedures outlined in sub-section 4-10, steps 3, 4 and 10. If a latch is damaged, replace following procedures outlined in sub-section 4-7, steps 2 and 19.
		Inspect capscrew latch pins and replace if damaged or missing using only capscrews that meet specifications listed in sub-section 2-4, step 3.
	Truck reservoir low on oil.	Add oil meeting truck manufacturer's specifications.
	Valve porting in hoist cylinder inner plunger plugged or valve cartridge faulty.	Overhaul hoist cylinder as outlined in section 5.
Mast action spongy or jerky.	Air in hydraulic system.	Bleed air from hoist cylinder as outlined in sub-section 1-12, step 6.
	Mast channels improperly lubricated.	Coat all sliding surfaces with graphite base grease (30% graphite base recommended).
	Brass wear plugs improperly adjusted.	Adjust mast as outlined in sub-section 2-8, step 6.
Fitting in hoist cylinder port bent or broken.	Bootstrap chains too loose or improperly adjusted.	Adjust bootstrap chains as outlined in sub-section 2-8, step 3.

Section 3

CARRIAGE SERVICE

3-1. INTRODUCTION

3-2. This section outlines disassembly techniques, inspection procedures and assembly techniques for servicing the Quad Lift Mast carriage. Before attempting to remove the carriage from the mast channels, the mast must be removed from the lift truck and placed on a work surface with the carriage facing up.

3-3. MAST REMOVAL

1. Secure the mast to an overhead crane using the lifting technique outlined in sub-section 1-12, steps 1 and 2. See figure 3-1.

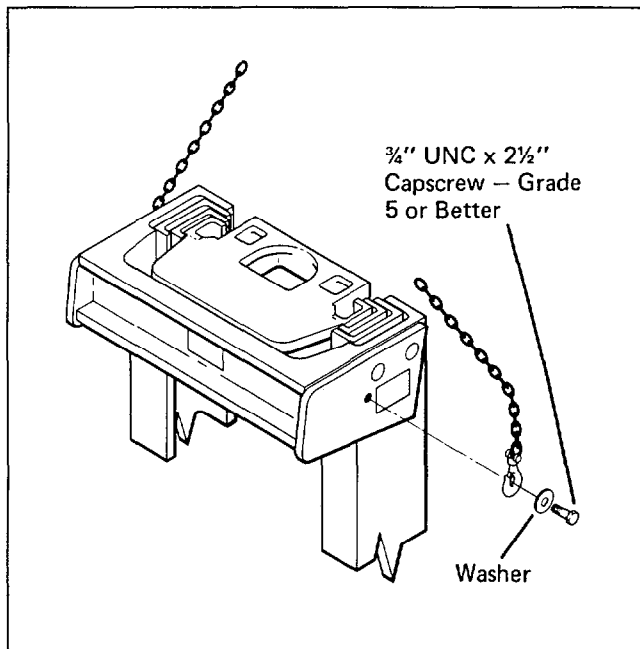


Figure 3-1 Lifting Procedure

CAUTION: It is important that the mast be properly secured in a stable upright position before proceeding.

2. Disconnect the forks or attachment from the carriage.
3. Disconnect and cap the supply hose from the lift truck and the cylinder supply hose. See figure 3-2.

CAUTION: Recheck the chains and overhead crane being used to hold the mast in an upright position.

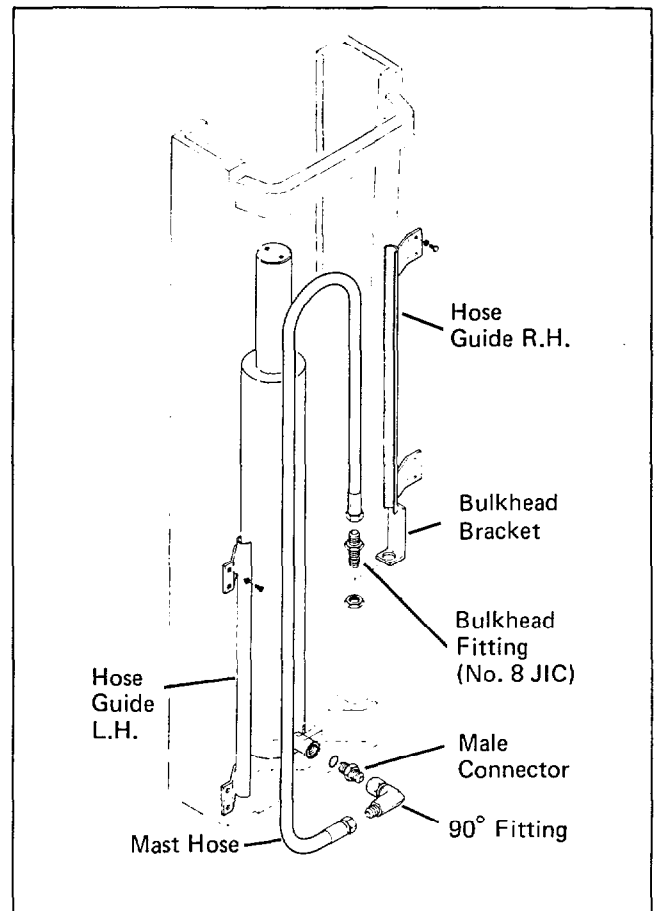


Figure 3-2 Mast Hosing

4. Disconnect the tilt cylinders.
5. Disconnect the base mounting brackets.
6. Remove the latch pin from the back of the carriage.

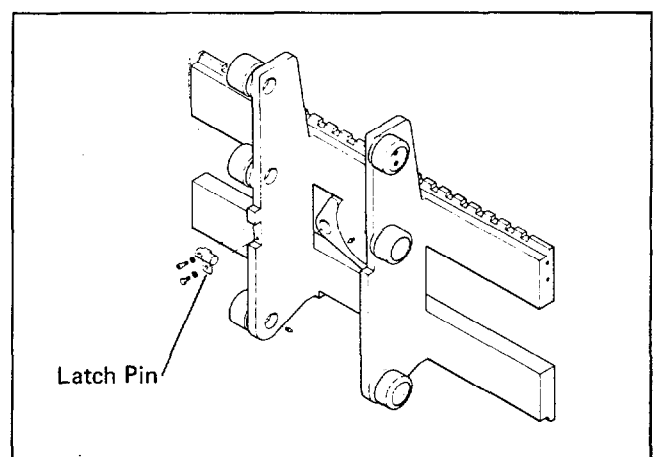


Figure 3-3 Carriage Latch Pin

7. Lay the mast on a work surface with the carriage facing up.

NOTE: Take precautions to prevent bending the hose brackets while positioning the mast on the work surface.

3-4. CARRIAGE REMOVAL & DISASSEMBLY

See Figure 3-4.

1. Remove the snap rings from the chain anchors and pull the chain anchors out of the carriage.
2. Secure the carriage with an overhead crane. Remove the carriage by pulling it out the bottom of the mast channels.
3. Remove the two middle and two lower roller assemblies.
4. Remove the two upper roller assemblies by removing the capscrews that connect the retaining plates to the stub shafts. Pull the roller assemblies off the stub shafts.

3-5. CARRIAGE INSPECTION

See Figure 3-4.

1. Inspect the roller bearings by placing the roller assembly on a stub shaft and manually turning the roller. If there is a noticeable restriction or "catch" the roller assembly must be replaced.

2. Inspect each roller for excessive wear. If there is a visible flat area or a crack in the roller, the roller assembly must be replaced.

3. Inspect the latch pin. If it is bent or damaged it must be replaced.

4. Inspect all welds between the carriage side plates and the carriage bars. If any weld seams are cracked the weld must be stripped out and the seam rewelded. Use E-70XX low hydrogen welding rod. Pre-heat to 300°, wrap with asbestos and allow to slow cool.

5. Inspect the stub shafts. If they are damaged or there are any cracks at the base of the stub shaft, the carriage must be replaced.

3-6. CARRIAGE ASSEMBLY & INSTALLATION

1. Secure the carriage with an overhead crane.
2. Coat the stub shafts with wheel bearing grease.
3. Reinstall the middle and lower roller assemblies by sliding the thrust washer, shims, roller and plug, in that order, on the shaft.
4. Slide the thrust washer, inner shims, roller and outer shim, in that order, on each upper stub shaft. Reinstall the retaining plate and cap-

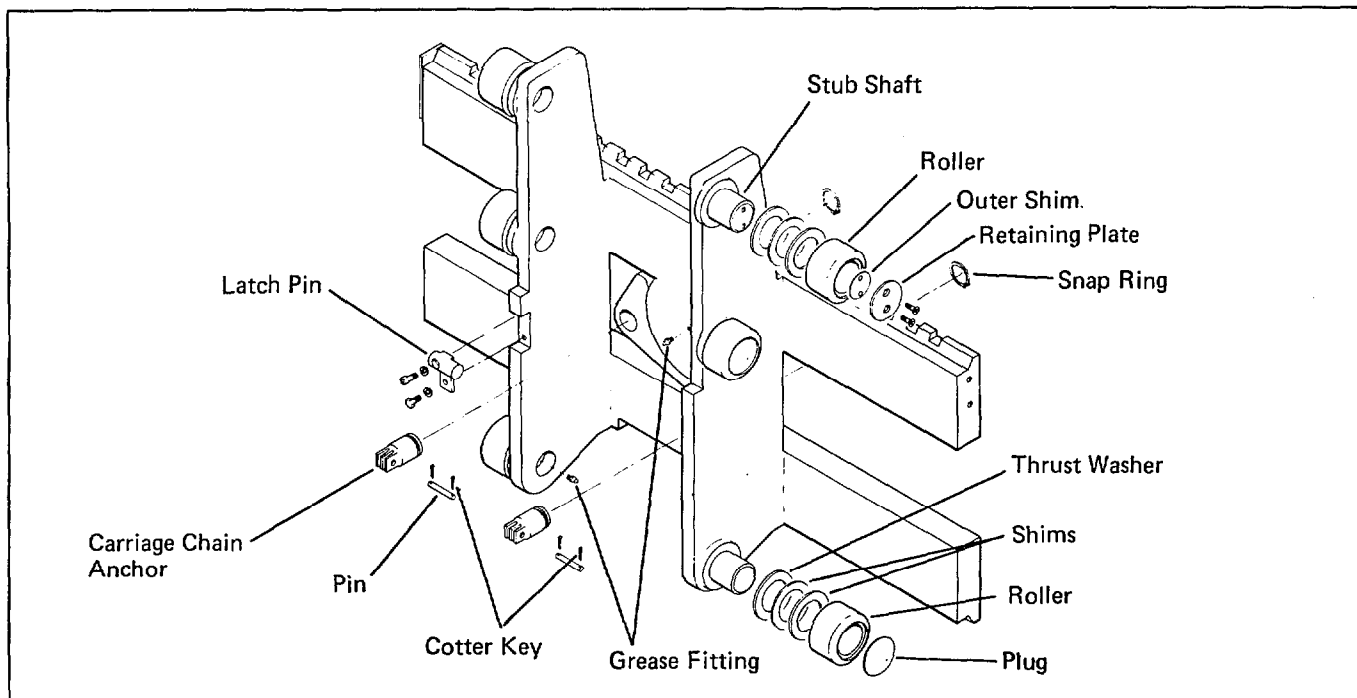


Figure 3-4 Carriage

screws on each stub shaft. Before proceeding, make sure both upper rollers turn without restriction.

5. Slide the carriage back into the bottom of the inner channel.
6. If the carriage enters the channel freely, remove and add shims behind the rollers until the carriage will just enter the channel without mechanical assistance.

NOTE: All rollers on the same side of the carriage must be shimmed equally. All six rollers on the carriage must be shimmed within one shim of being equal.

7. Slide the carriage to both ends of the mast to check clearances between the carriage side plates and the upper and lower channel crossmembers. The carriage side plates must clear both crossmembers by $1/4'' \pm 1/16''$ on both sides. If necessary, remove the carriage and adjust the shims behind the rollers accordingly, following the procedures outlined in steps 4, 5 and 6.

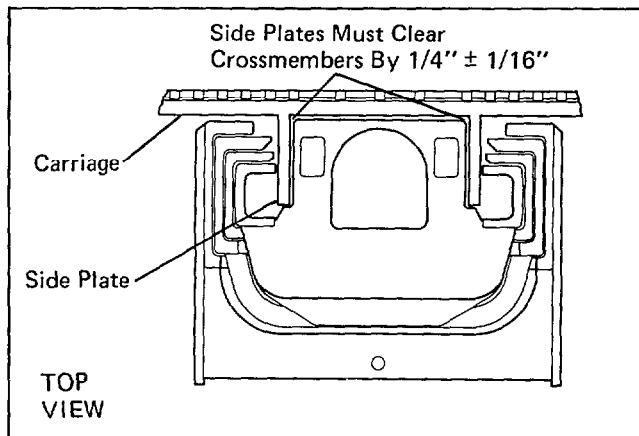


Figure 3-5 Side Plate Clearances

8. Slide the carriage up until the crosshead is between the carriage side plates. The side plates must clear the crosshead by $1/4'' \pm 1/16''$. If the side plate clearances do not meet this specification, move the crosshead from side to side in the channel, measure this movement and proceed as follows:

(a) If the crosshead moves more than $1/16''$ or has more than $1/16''$ of "play" from side to side, it must be adjusted as outlined in sub-section 4-7, steps 13 and 14. After this adjustment is made, recheck the clearance between the crosshead and the side plates.

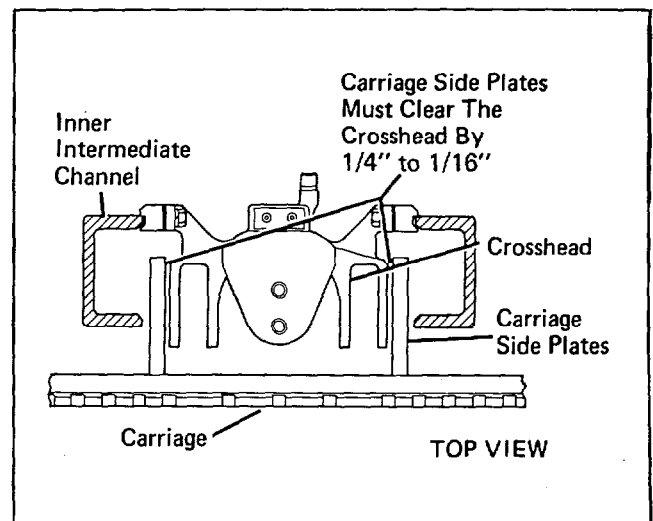


Figure 3-6 Side Plate Clearances

(b) If the crosshead does not move more than the allowable $1/16''$ from side to side, readjust the inner channel as outlined in sub-section 4-7, step 8.

NOTE: If the steel setscrew touches the channels sliding surface before tightening the wear plug, or if the brass has worn through in the inside of the wear plug, it must be replaced.

9. Once the carriage is properly shimmed and located in the channel, move it the full length of the channel to check for restrictions and proper roller action. If the carriage does not roll freely the full length of the channel, check the inner channel for obstructions, recheck the carriage adjustment and, if necessary, recheck the carriage roller assemblies.
10. Reinstall the latch pin on the back of the carriage.
11. Reinstall both chain anchors in the yoke, making sure the snap rings are securely in their grooves. Inspect the chains to make sure they are not twisted and are lying properly in the sheaves.

3-7. MAST INSTALLATION

1. Thread a $3/4''$ UNC x $2-1/2''$ capscrew (grade 5 or better) with a large flatwasher into the hole on each side of the mast as shown in figure 3-1.

CAUTION: The capscrews must be threaded into the holes until they "bottom out" before the mast is lifted.

- Using suitable chains, lift the mast into installation position.
- Connect the supply hose to the bulkhead fitting on the right hand hose bracket.
- Lubricate the interior diameters of the base mounting brackets with wheel bearing grease and mount on the truck.
- Lubricate the interior diameters of the tilt cylinder anchor brackets with wheel bearing grease and attach the tilt cylinders.

3-8. CARRIAGE ADJUSTMENT

- With the mast in the fully lowered position, adjust the carriage to the following specifications by adjusting the chain anchors in the cylinder base:

(a) The yoke must be evenly centered in the carriage. See figure 3-7.

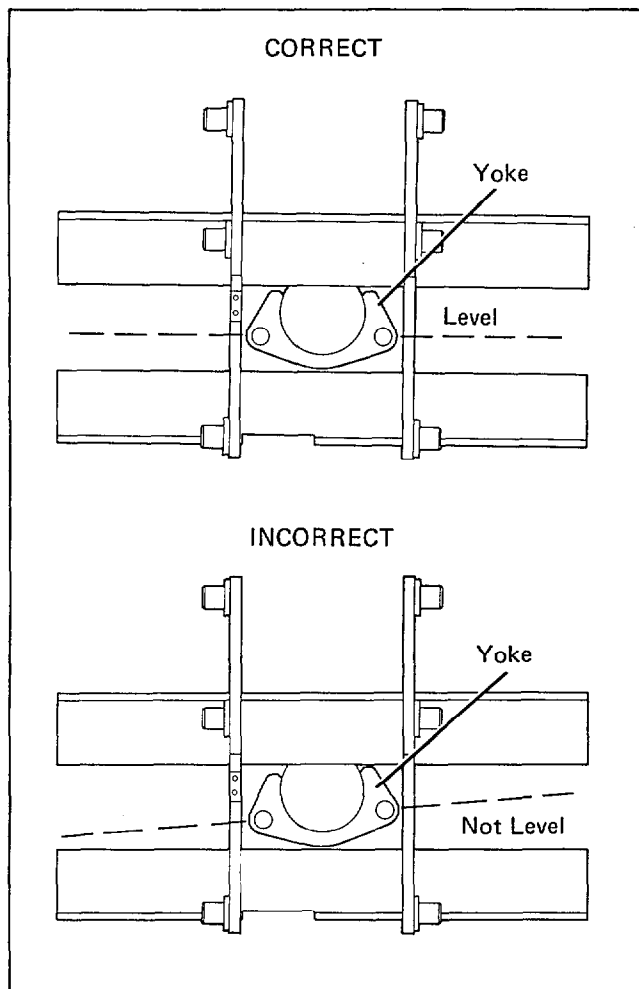


Figure 3-7 Carriage Yoke Position

(b) For masts with 3" underclearance, adjust the carriage so the bottom of the lower fork bar is even with the bottom of the outer channel.

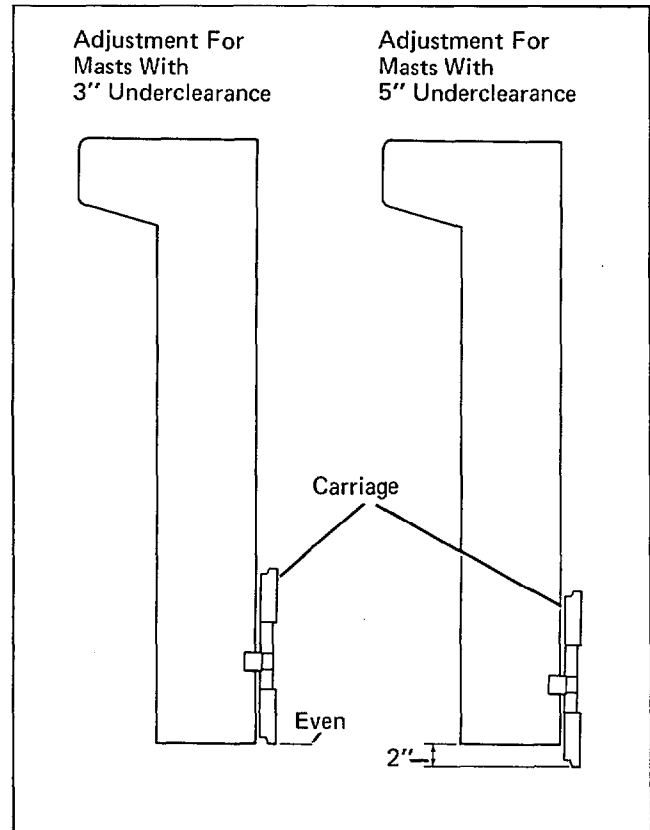


Figure 3-8 Carriage Adjustment

(c) For masts with 5" underclearance, adjust the carriage so the bottom of the lower fork bar is 2" below the bottom of the outer channel.

NOTE: To prevent damage to the carriage latch pin, the carriage must not be allowed to go lower than these specifications.

CAUTION: Before proceeding, make certain both nuts on each chain anchor are tight.

3-9. FINAL INSPECTION

- Carefully sequence and tilt the mast to its full extent to check for obstructions and proper mast sequencing. If the mast is not operating properly, refer to the trouble-shooting chart in sub-section 2-10.
- Before placing the mast back into service, complete the safety inspection procedures outlined in sub-section 1-14 of this manual.

Section 4

CHANNEL SERVICE

4-1. INTRODUCTION

4-2. This section outlines all necessary procedures for disassembling, repairing and assembling the channel sections of the Quad Lift Mast.

4-3. Before disassembling the mast, the following items should be on hand or readily available; (a) wear shoes, (b) shims, (c) wear plugs, (d) crosshead wear shoes, (e) crosshead shims. Refer to the Quad Lift Mast parts manual, Cascade form 5038, for specific part numbers.

4-4. MAST REMOVAL

1. Secure the mast to an overhead crane using the lifting technique outlined in sub-section 1-12, steps 1 and 2. See figure 4-1.

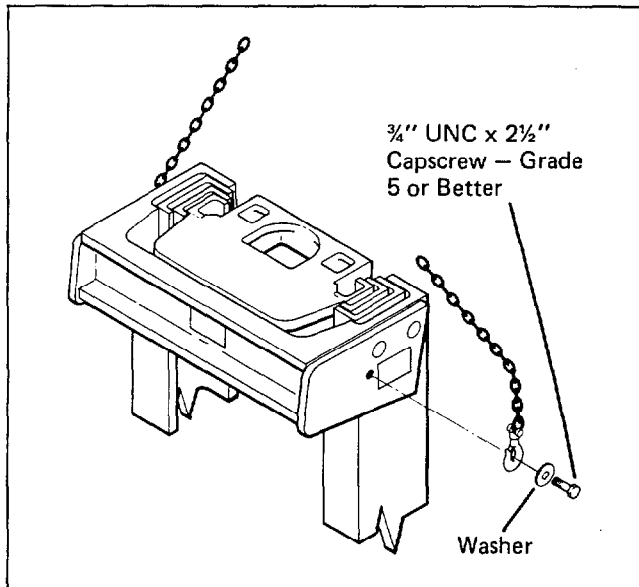


Figure 4-1 Lifting Procedure

CAUTION: It is important that the mast be properly secured in a stable upright position before proceeding.

2. Disconnect the forks or attachment from the carriage.
3. Disconnect and cap the supply hose from the lift truck.

CAUTION: Recheck the chains and overhead crane being used to hold the mast in an upright position.

4. Disconnect the tilt cylinders.

5. Disconnect the base mounting brackets.

6. Lay the mast on a work surface with the carriage facing down.

4-5. UPRIGHT DISASSEMBLY

See Figure 4-3

1. Disconnect the mast hose and remove the fittings from the bulkhead and cylinder port. Cap the cylinder port.

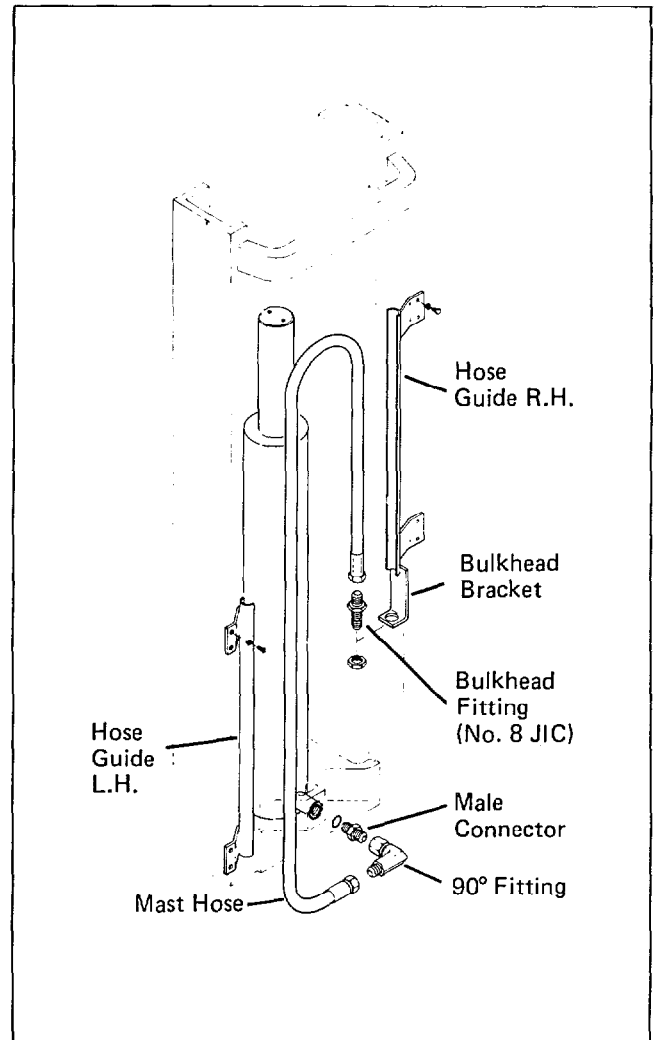


Figure 4-2 Mast Hosing

NOTE: The cylinder port contains a washer, spring and spacer. Care should be taken to avoid losing these parts during disassembly. See figure 4-4.

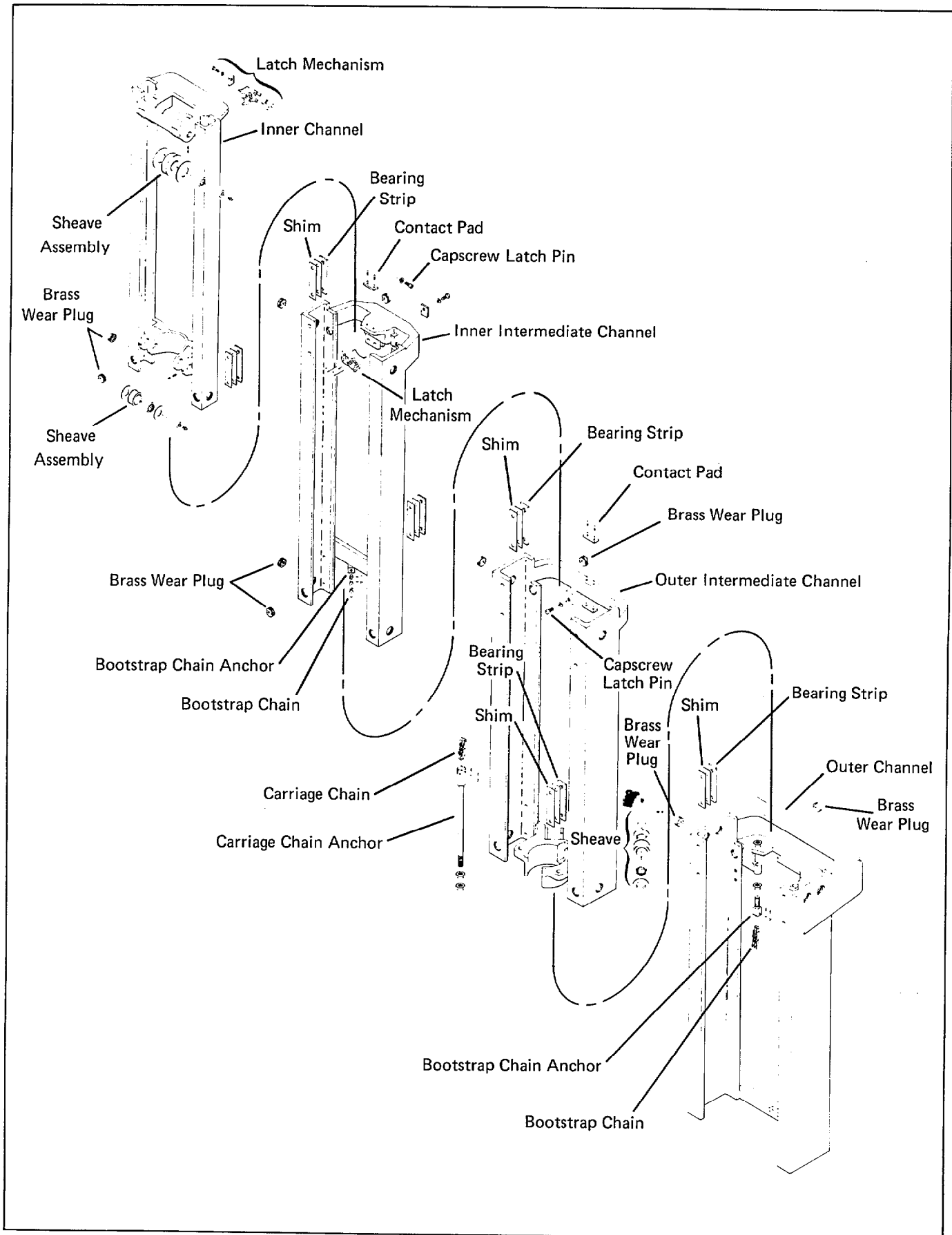


Figure 4-3 Quad Lift Mast

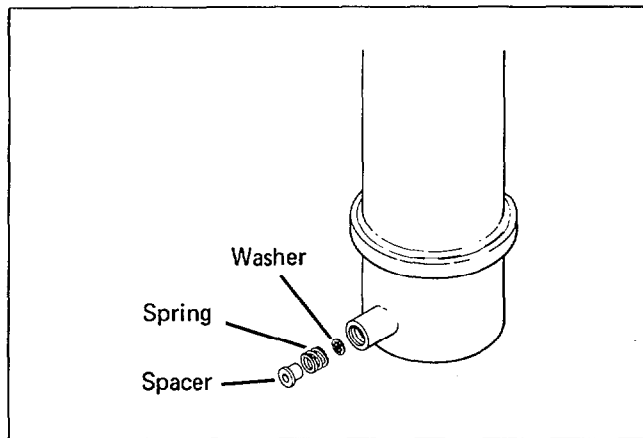


Figure 4-4 Hoist Cylinder Port

2. Remove both hose guides.
3. Disconnect and remove the bootstrap chains. Clean the chains in kerosene and soak in SAE 30 engine oil while servicing the mast.

NOTE: The chain may be loosened for removal by prying the two intermediate channels out a few inches with a pry bar.

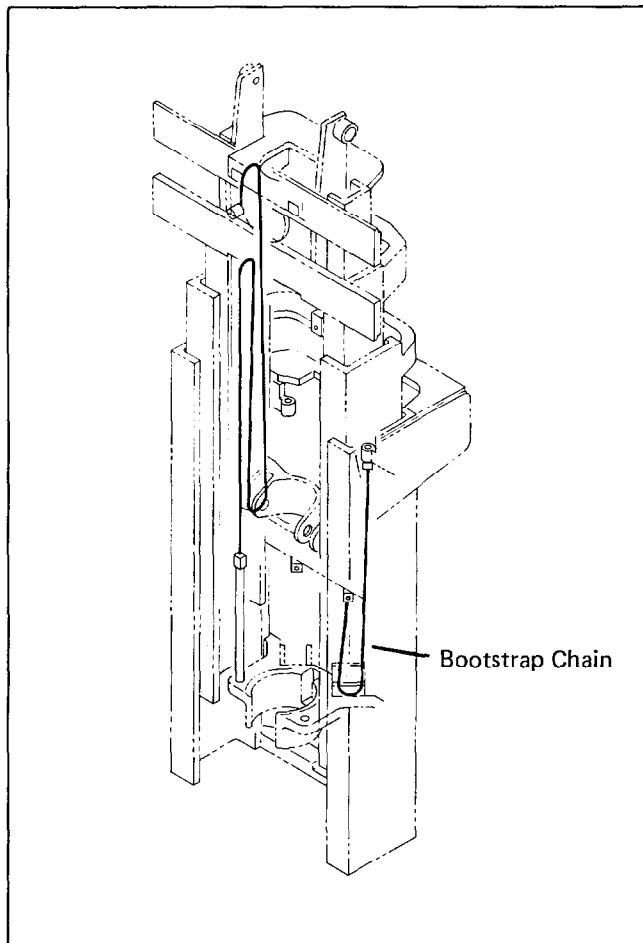


Figure 4-5 Bootstrap Chain

4. Remove the setscrew and the jamscrew from both sheave brackets in the base of the outer intermediate channel. Tap both sheave shafts out and remove the sheave components from the brackets.

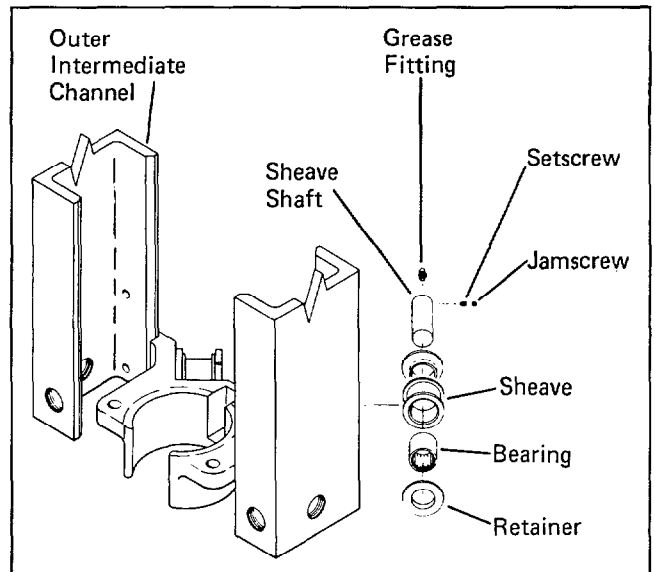


Figure 4-6 Outer Intermediate Sheave

5. Reposition the mast on the work surface with the carriage facing up.

CAUTION: Always use an overhead crane to lift the mast.

6. Remove the carriage, following the procedures outlined in sub-section 3-4.
7. Disconnect the carriage chains from both sets of chain anchors and pull the chains free of the sheaves. Clean the chains in kerosene and soak in SAE 30 engine oil while servicing the mast.
8. Remove the carriage chain anchors from the cylinder base in the outer intermediate channel.

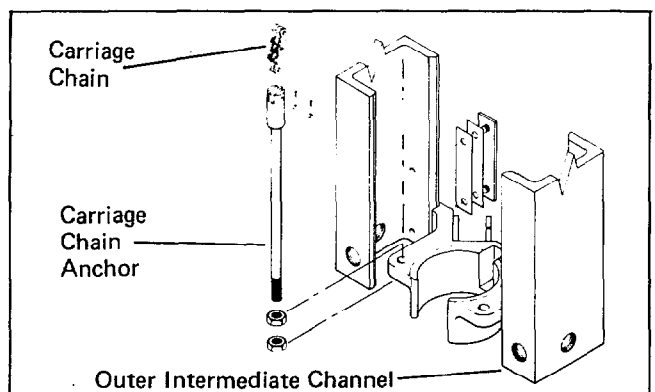


Figure 4-7 Carriage Chain Anchors

9. Remove the two capscrews that retain the crosshead to the cylinder's inner plunger. Slide the crosshead to the top of the mast.
10. Secure the crosshead with a strap and an overhead crane. Unthread the capscrews retaining the wear shoes and remove the crosshead from the mast.

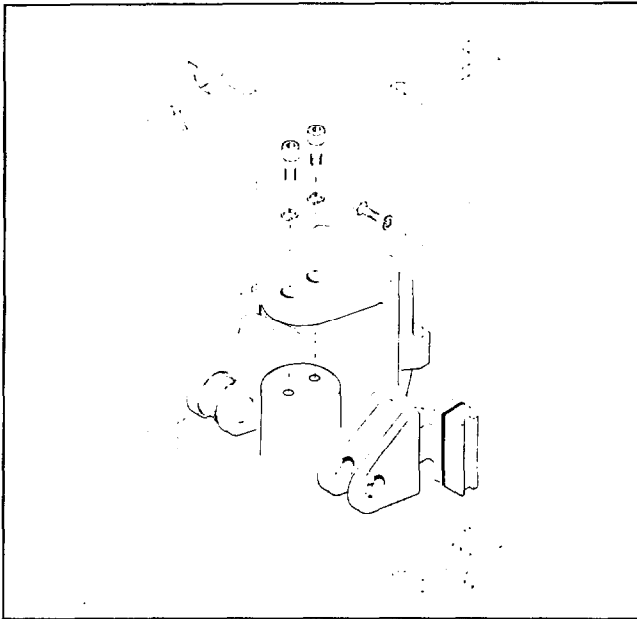


Figure 4-8 Crosshead Removal

11. Remove the setscrew and the jamscrew from both sheave brackets in the crosshead. Tap both sheave shafts out and remove the sheave components.

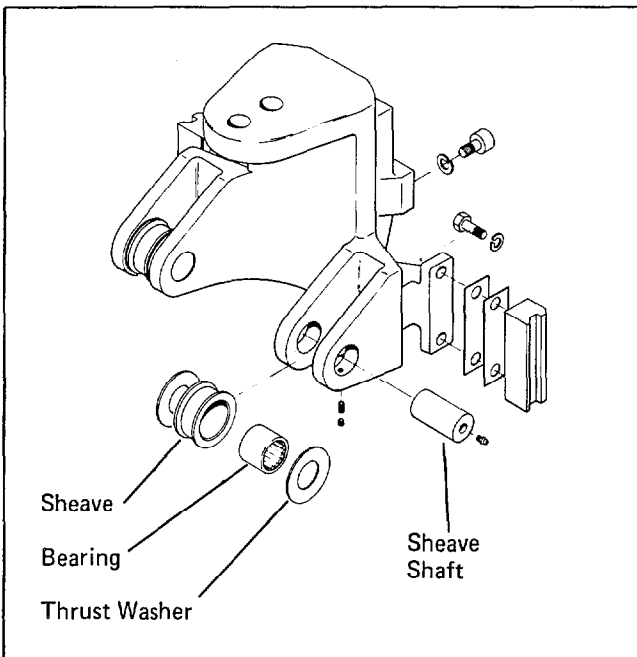


Figure 4-9 Crosshead

12. Secure the cylinder with straps and an overhead crane. Slide the cylinder out of the cylinder base and lift it out of the mast.

NOTE: If the cylinder is to be disassembled, loosen the retainer on the cylinder shell with the proper spanner wrench before sliding the cylinder out of the base.

13. Remove the capscrew latch pin from the upper crossmember of the outer intermediate channel.

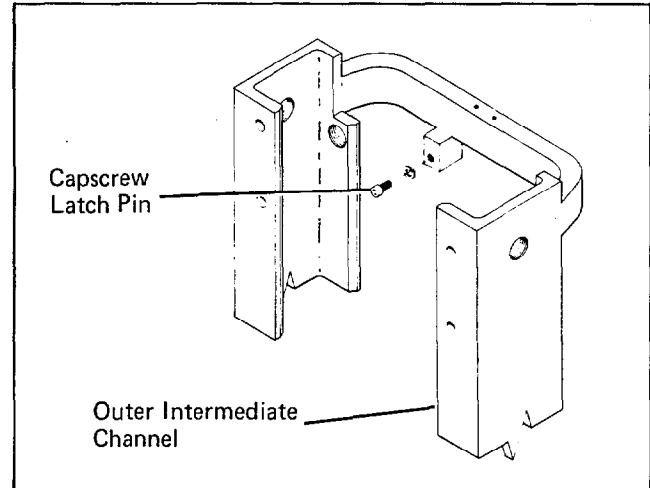


Figure 4-10 Capscrew Latch Pin

14. Remove the capscrew and retaining plate from the latch bracket on the inner channel cross member. Pull the pivot pins out of engagement and at the same time, remove the latch mechanism.

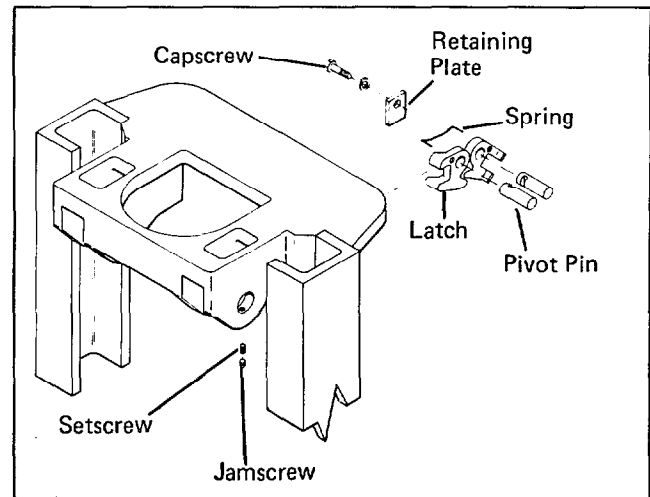


Figure 4-11 Latch Mechanism

15. Remove the setscrew and jamscrew from both upper and both lower sheave brackets on the inner channel. Tap the sheave shafts out and remove the sheave components.

16. Remove the latch mechanism on the inner intermediate channel crossmember by removing the capscrew and retaining plate on the back side of the latch bracket.

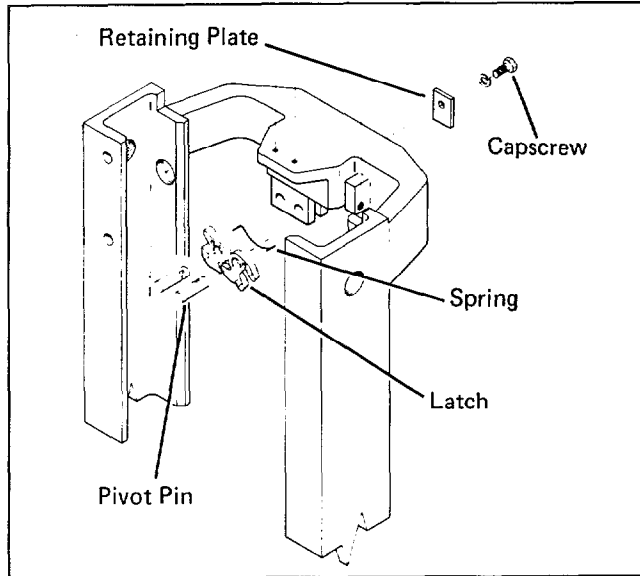


Figure 4-12 Latch Mechanism

17. Secure the outer channel to the work surface. Use a pry bar between the channel crossmembers to begin separating the channels.

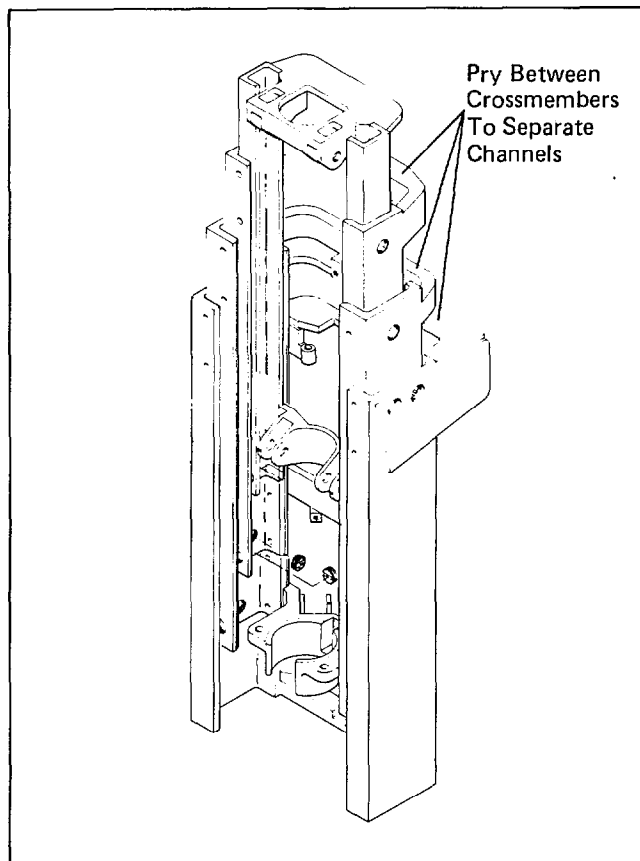


Figure 4-13 Channel Separation

18. Individually pull each channel out the top of the upright assembly, beginning with the inner channel.

NOTE: In most cases it will be necessary to use a pry bar against the channel crossmember to separate the channel from the upright assembly.

CAUTION: Before completely removing a channel, secure it with an overhead crane.

4-6. INSPECTION

1. Inspect the brass wear plugs in each channel. If the brass has worn through on the inside of the wear plug, it must be replaced. If the brass has not worn through, inspect the plug's wear surface. If the wear surface has worn down to the thread on the O.D. of the plug, it must be replaced.

NOTE: During reassembly, notice how far the steel setscrew will thread into the plug. If the setscrew touches the channel before tightening the plug, the plug must be replaced.

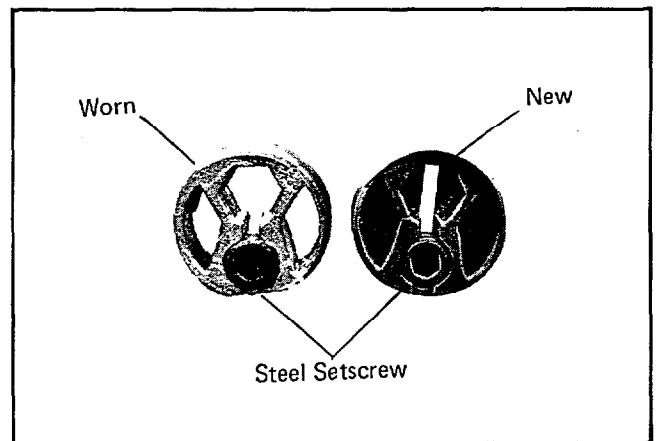


Figure 4-14 Brass Wear Plug

NOTE: If any of the wear plugs require replacement, it is a good preventive maintenance procedure to replace the entire set of plugs in each channel.

2. Inspect the bearing strips from each channel. If the "tread" on the bearing strip is not plainly visible, it must be replaced.

NOTE: If any of the bearing strips require replacement, it is a good preventive maintenance procedure to replace the entire set of bearing strips used on the mast.

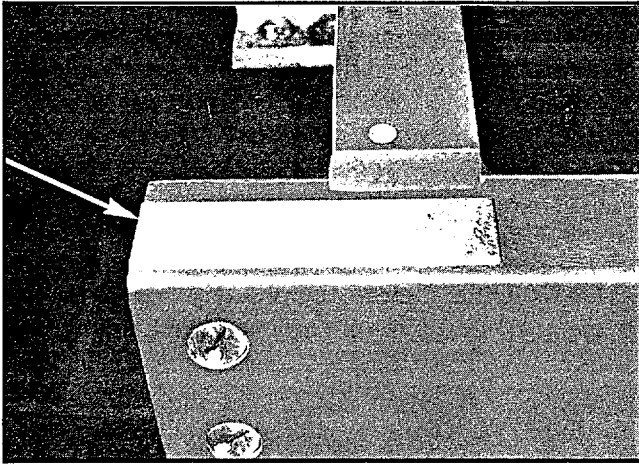


Figure 4-15 Bearing Strip

3. Inspect the exterior and interior faces of the two intermediate channels. Inspect the exterior face of the inner channel and the interior face of the outer channel. If there are any wear grooves or vertical scoring marks on the channel surfaces, the brass wear plugs are probably worn and the steel setscrew is contacting the channel surface. Replace the wear plugs and buff the channel surface to eliminate burrs.

4. Inspect and tighten the capscrew latch pin on the inner intermediate channel. If it is bent it must be replaced with a grade 5 or better 1/2" UNC x 3/4" socket head, not knurled, capscrew.

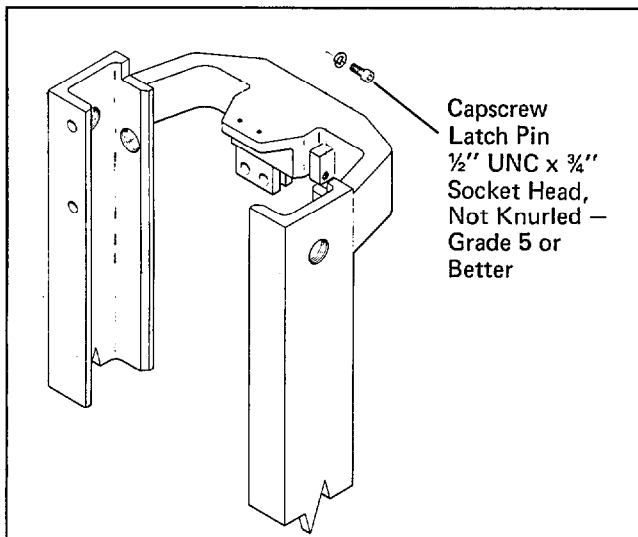


Figure 4-16 Capscrew Latch Pin

5. Inspect the capscrew latch pin that was removed from the outer intermediate channel. If it is bent it must be replaced with a grade 5 or better 5/8" UNC x 1" socket head, not knurled, capscrew.

6. Rotate each sheave on its respective shaft. The sheave should turn freely with no restrictions. If there is a restriction or "catch" in the rotation, replace the sheave bearing. Replace the sheave roller if it is visibly worn or damaged. Replace the shaft if it is visibly worn or damaged.

7. Inspect the contact pads in the following locations:

(a) The top of the inner intermediate channel crossmember.

(b) The top and bottom of the outer intermediate channel crossmember.

(c) The back of the crosshead.

If any of these pads are missing or damaged they must be replaced.

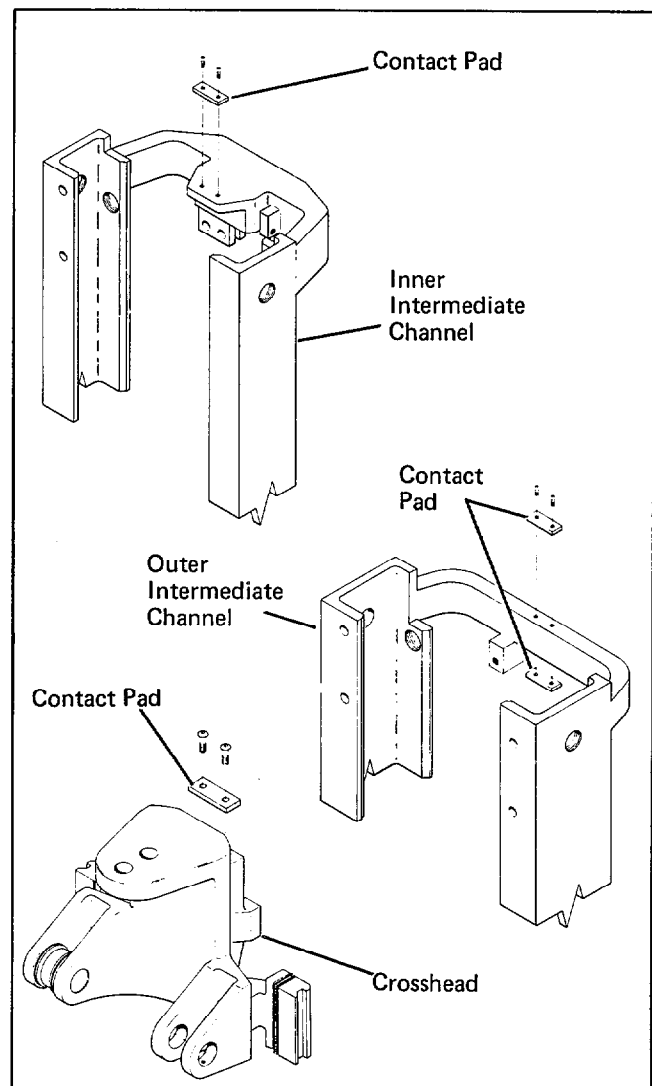


Figure 4-17 Contact Pads

8. Inspect the crosshead wear shoes for excessive wear. If, during reassembly, the crosshead requires more than four shims behind each wear shoe to tighten it to specifications, the wear shoes must be replaced. See figure 4-9.
9. Inspect the latch mechanisms. Replace any component that is visibly damaged. See figures 4-11 and 4-12.

4-7. UPRIGHT ASSEMBLY.

1. Reinstall both sheaves in the crosshead as follows:
 - (a) Reinstall the bearing in the sheave.
 - (b) Coat the shaft with wheel bearing grease.
 - (c) Place one thrust washer on each side of the sheave and reinstall the sheave in its bracket.
 - (d) Reinstall the shaft so the grease fitting is toward the outside.
 - (e) Reinstall and tighten the setscrew. After the setscrew is tightened, reinstall and tighten the jamscrew.
 - (f) Rotate each sheave to make sure it is turning without restriction.

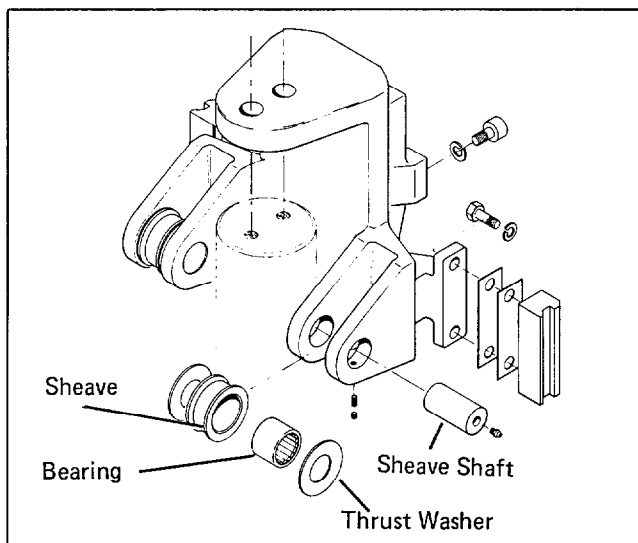


Figure 4-18 Crosshead

2. Reinstall the latch mechanism on the inner intermediate channel as follows:
 - (a) Engage the two latches and latch spring as shown in figure 4-19.

(b) Coat the pivot pins with wheel bearing grease.

(c) Slide the latches into the latch bracket so the spring is toward the back side (cross member side) of the channels.

(d) Reinstall the two pivot pins with the notched ends toward the back side of the channel.

(e) Engage the keeper plate in the pin notches and reinstall the capscrew and lockwasher in the keeper plate.

(f) Manually trip the latch several times to be sure it is working properly and the spring is securely engaged with both latches.

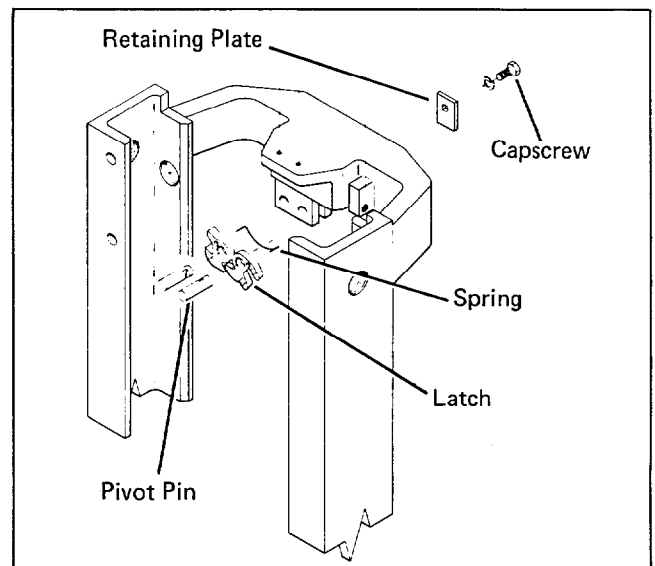


Figure 4-19 Latch Mechanism

3. Unthread the wear plugs in each channel until they are flush with the channel surface.

NOTE: Before attempting to unthread the wear plugs, loosen the steel setscrews.

4. Reinstall both the upper set and the lower set of sheaves in the inner channel as follows:

(a) Reinstall the bearing in the sheave.

(b) Coat the shaft with wheel bearing grease.

(c) Place one thrust washer on each side of the sheave and reinstall the sheave in its bracket.

(d) Reinstall the shaft so the grease fitting is toward the outside of the mast.

(e) Reinstall and tighten the setscrew. After the setscrew is tightened, reinstall and tighten the jamscrew.

(f) Rotate each sheave to make sure it is turning without restrictions.

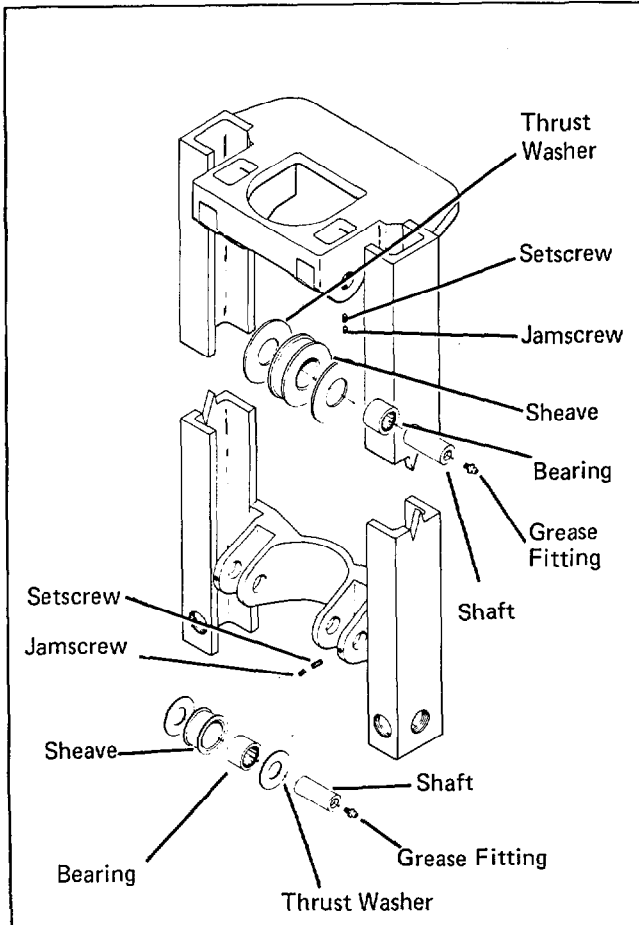


Figure 4-20 Inner Channel Sheaves

5. Lay the outer channel on a work surface with the crossmember facing up.

CAUTION: Use an overhead crane to position the channel on the workbench.

6. Secure the channel to the work surface in a position that will allow the remaining channels to be installed from the top of the outer channel.

7. Install the outer intermediate channel in the outer channel as follows (see figure 4-21):

CAUTION: Make sure the outer intermediate channel is securely fastened to an overhead crane before attempting to install it.

(a) Place two shims each behind two bearing

strips and replace the bearing strips on the interior face of the outer channel.

(b) Place two shims each behind two bearing strips and replace the bearing strips on the exterior face of the outer intermediate channel.

(c) Coat the exterior surface of the outer intermediate channel with graphite base grease (30% graphite base recommended).

(d) Slide the outer intermediate channel into the outer channel.

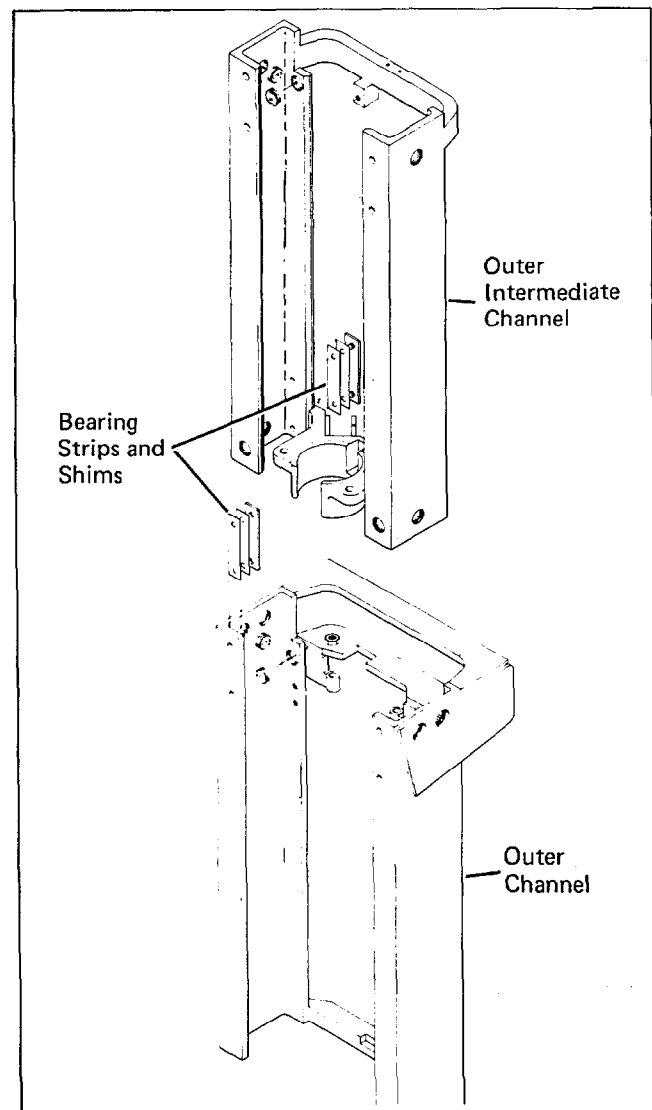


Figure 4-21 Channel Assembly

8. Adjust the outer intermediate channel in the outer channel as follows:

(a) Fully tighten the wear plugs on the front and back sides of both channels. Do not tighten the steel setscrews.

NOTE: Only tighten and adjust the wear plugs at the bottom of the outer intermediate channel and the top of the outer channel.

(b) If the outer intermediate channel is more than $1/16''$ off center, front to back, loosen the wear plugs and remove the channel. Add or subtract shims behind the four bearing strips as required to center the channel. Reinstall the outer intermediate channel in the outer channel.

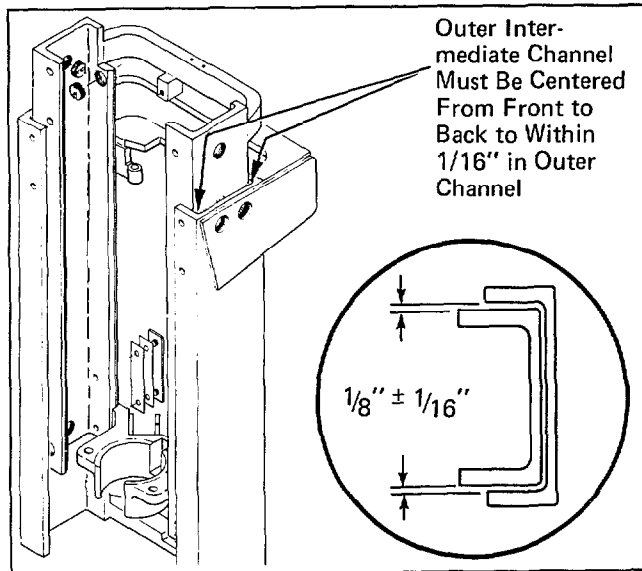


Figure 4-22 Channel Clearances

NOTE: The outer intermediate channel must be centered from front to back at both the top and bottom end of the outer channel.

(c) When the outer intermediate channel is centered front to back, tighten all wear plugs in the sides of both channels. Do not tighten the steel setscrews.

NOTE: Only tighten and adjust the wear plugs at the bottom of the outer intermediate channel and the top of the outer channel.

(d) If the outer intermediate channel is off center more than $1/16''$ from side to side, adjust the side wear plugs accordingly.

NOTE: The outer intermediate channel must be centered from side to side at both the top and bottom end of the outer channel.

(e) When the outer intermediate channel is completely centered in the outer channel, back each wear plug off $1/4$ turn and tighten the steel setscrews.

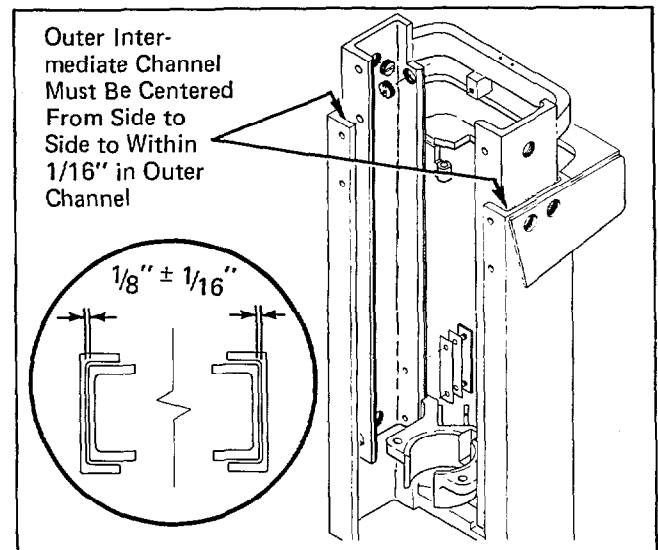


Figure 4-23 Channel Clearances

NOTE: If the steel setscrew touches the opposing channel surface before it tightens the wear plug, the wear plug must be replaced.

9. Install the inner intermediate channel in the outer intermediate channel as follows (see figure 4-24):

CAUTION: Make sure the inner intermediate channel is securely fastened to an overhead crane before attempting to install it.

(a) Pull the outer intermediate channel approximately $1/3$ of the way out of the outer channel.

(b) Place two shims each behind two bearing strips and replace the bearing strips on the interior face of the inner intermediate channel.

(c) Place two shims each behind two bearing strips and replace the bearing strips on the exterior face of the inner intermediate channel.

(d) Coat the exterior surface of the inner intermediate channel with graphite base grease (30% graphite base recommended).

(e) Slide the inner intermediate channel into the outer intermediate channel.

10. Adjust the inner intermediate channel in the outer intermediate channel as follows:

(a) Fully tighten the wear plugs on the front and back sides of both channels. Do not tighten the steel setscrews.

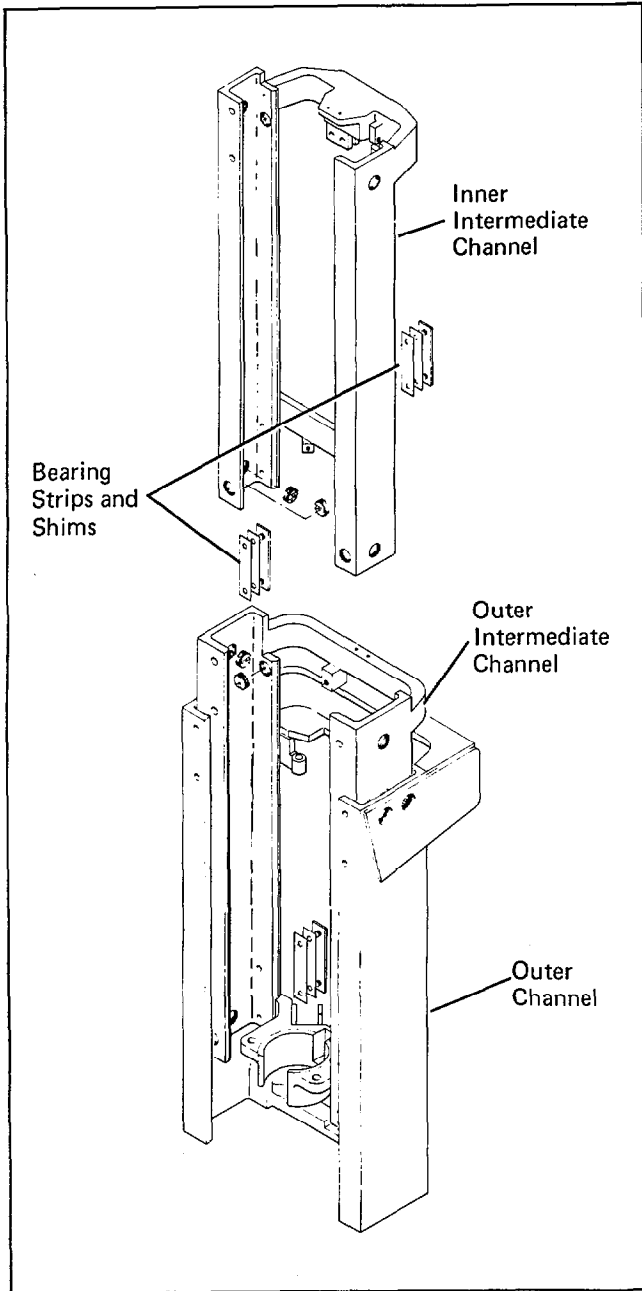


Figure 4-24 Channel Assembly

NOTE: Only tighten and adjust the wear plugs at the bottom of the inner intermediate channel and the top of the outer intermediate channel.

(b) If the inner intermediate channel is more than 1/16" off center, front to back, loosen the wear plugs and remove the channel. Add or subtract shims behind the four bearing strips as required to center the channel. Reinstall the channel in the outer intermediate channel.

NOTE: The inner intermediate channel must be centered from front to back at both the top

and bottom end of the outer intermediate channel.

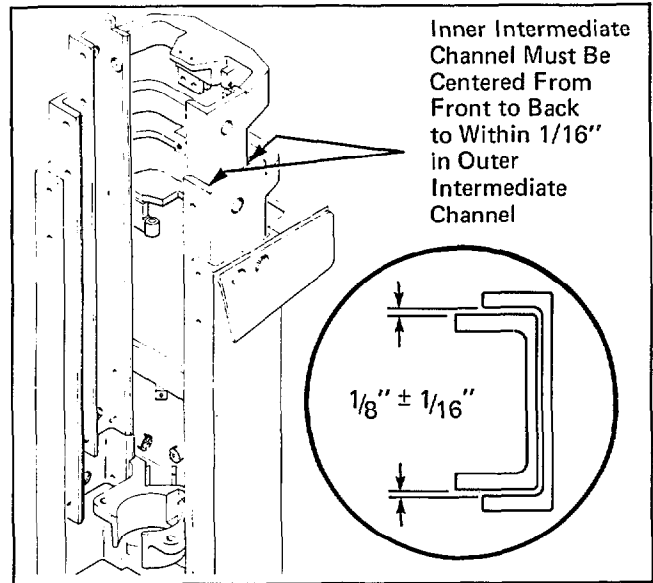


Figure 4-25 Channel Clearances

(c) When the inner intermediate channel is centered front to back, tighten all wear plugs in the sides of both channels. Do not tighten the steel setscrews.

NOTE: Only tighten and adjust the wear plugs at the bottom of the inner intermediate channel and the top of the outer intermediate channel.

(d) If the inner intermediate channel is off center more than 1/16" from side to side, adjust the side wear plugs accordingly.

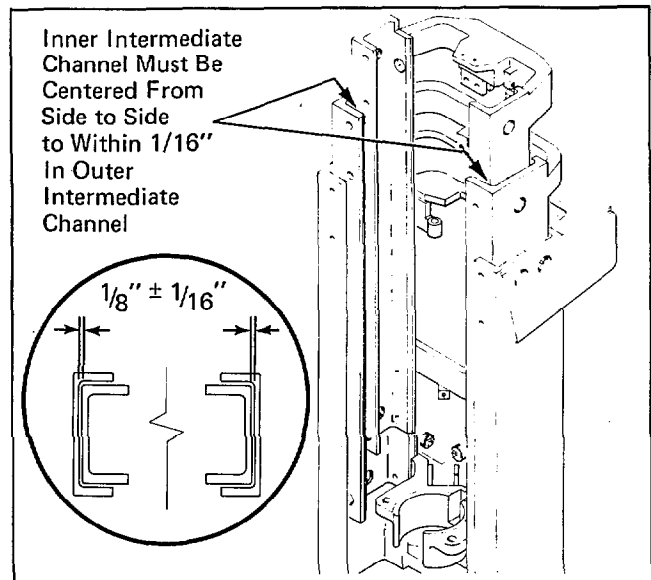


Figure 4-26 Channel Clearances

NOTE: The inner intermediate channel must be centered from side to side at both the top and bottom end of the outer intermediate channel.

(e) When the inner intermediate channel is completely centered in the outer intermediate channel, back each wear plug off 1/4 turn and tighten the steel setscrews.

NOTE: If the steel setscrew touches the opposing channel surface before it tightens the wear plug, the wear plug must be replaced.

11. Install the inner channel in the inner intermediate channel as follows (see figure 4-27):

CAUTION: Make sure the inner channel is securely fastened to an overhead crane before attempting to install it.

NOTE: To allow easier installation of the inner channel, place small blocks under the assembled upright so it is approximately two inches off the work surface. Before proceeding, make sure the assembled upright is again securely fastened to the work surface.

(a) Pull the inner intermediate channel approximately 1/3 of the way out of the outer intermediate channel.

(b) Place two shims each behind two bearing strips and replace the bearing strips on the interior face of the inner intermediate channel.

(c) Place two shims each behind two bearing strips and replace the bearing strips on the exterior face of the inner channel.

(d) Coat the exterior surface of the inner channel with graphite base grease (30% graphite base recommended).

(e) Slide the inner channel into the inner intermediate channel.

12. Adjust the inner channel in the inner intermediate channel as follows:

(a) Fully tighten the wear plugs on the front and back sides of both channels. Do not tighten the steel setscrews.

NOTE: Only tighten and adjust the wear plugs at the bottom of the inner channel and the top of the inner intermediate channel.

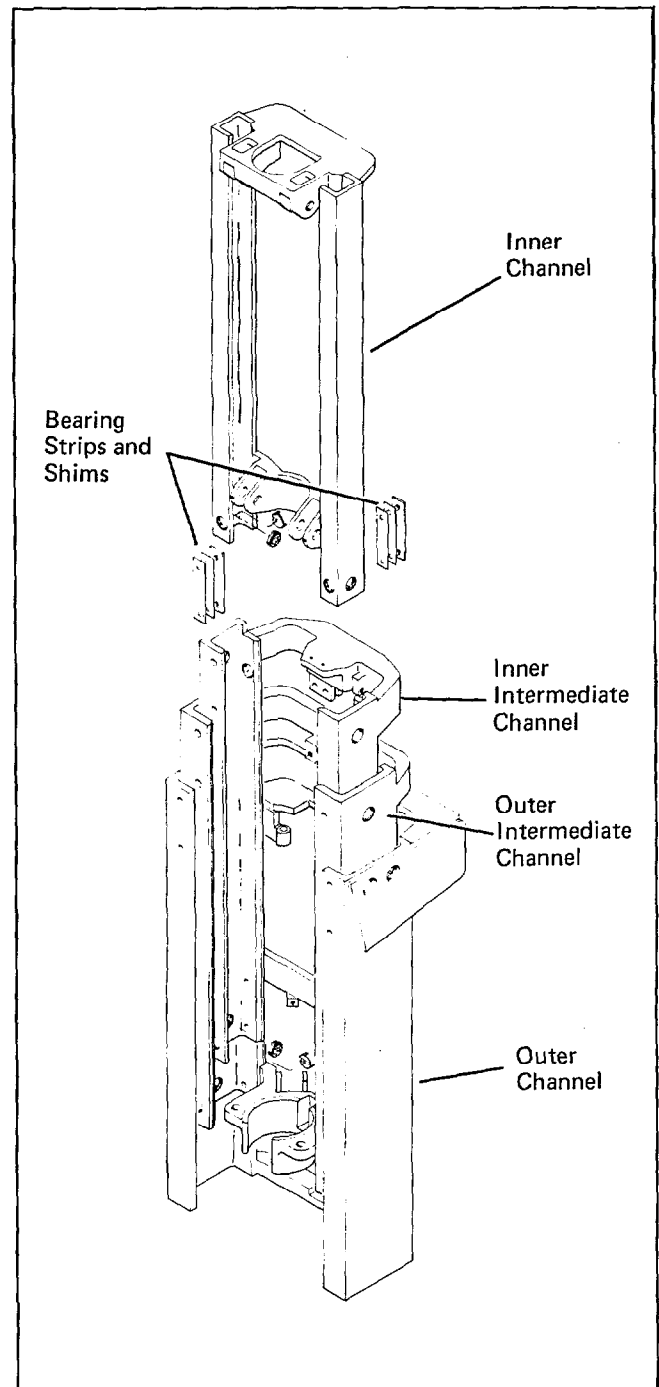


Figure 4-27 Channel Assembly

(b) If the inner channel is more than 1/16" off center, front to back, loosen the wear plugs and remove the channel. Add or subtract shims behind the four bearing strips as required to center the channel. Reinstall the inner channel in the inner intermediate channel. See figure 4-28.

(c) When the inner channel is centered front to back, tighten all wear plugs in the sides of both channels. Do not tighten the steel setscrews.

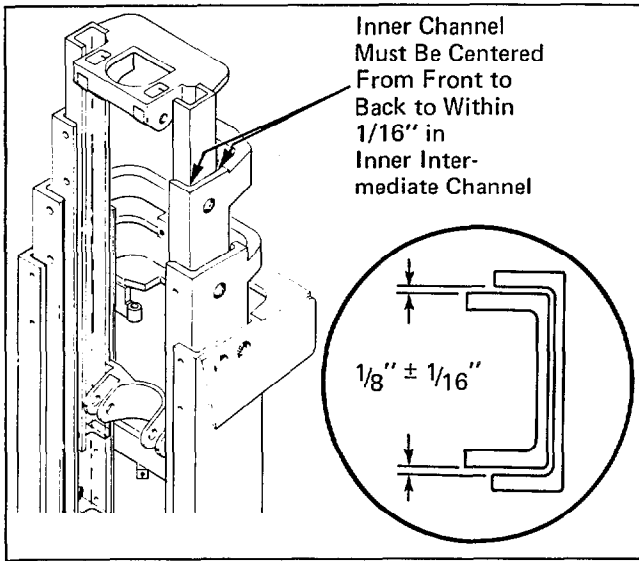


Figure 4-28 Channel Clearances

NOTE: Only tighten and adjust the wear plugs at the bottom of the inner channel and the top of the inner intermediate channel.

(d) If the inner channel is off center more than $1/16''$ from side to side, adjust the side wear plugs accordingly.

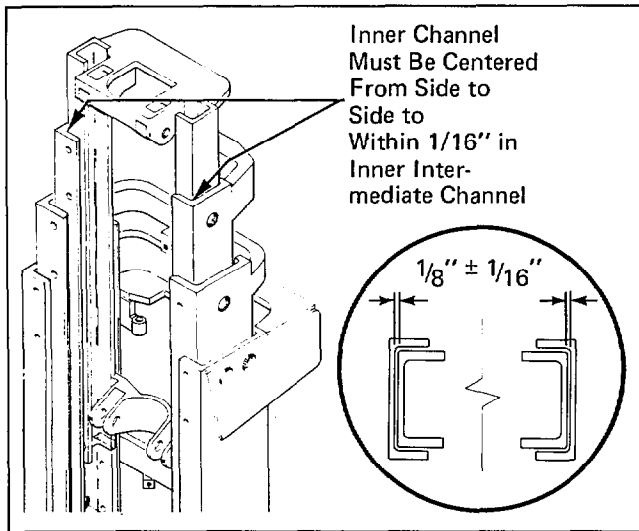


Figure 4-29 Channel Clearances

NOTE: The inner channel must be centered from side to side at both the top and bottom end of the inner intermediate channel.

(e) When the inner channel is completely centered in the inner intermediate channel, back each wear plug off $1/4$ turn and tighten the steel setscrews.

NOTE: If the steel setscrew touches the op-

posing channel surface before it tightens the wear plug, the wear plug must be replaced.

13. Install the crosshead as follows:

(a) Reinstall one wear shoe on the crosshead, using two shims between the wear shoe and crosshead.

(b) Place the crosshead in the mast assembly and engage the wear shoe with the inner intermediate channel.

(c) Engage the other wear shoe with the opposite channel member of the inner intermediate channel, just above the crosshead.

(d) Hold two shims behind the wear shoe and slide it down into the correct position on the crosshead.

(e) Fasten the wear shoe to the crosshead with two capscrews and two lockwashers.

(f) Tighten the capscrew latch pin on the back of the crosshead.

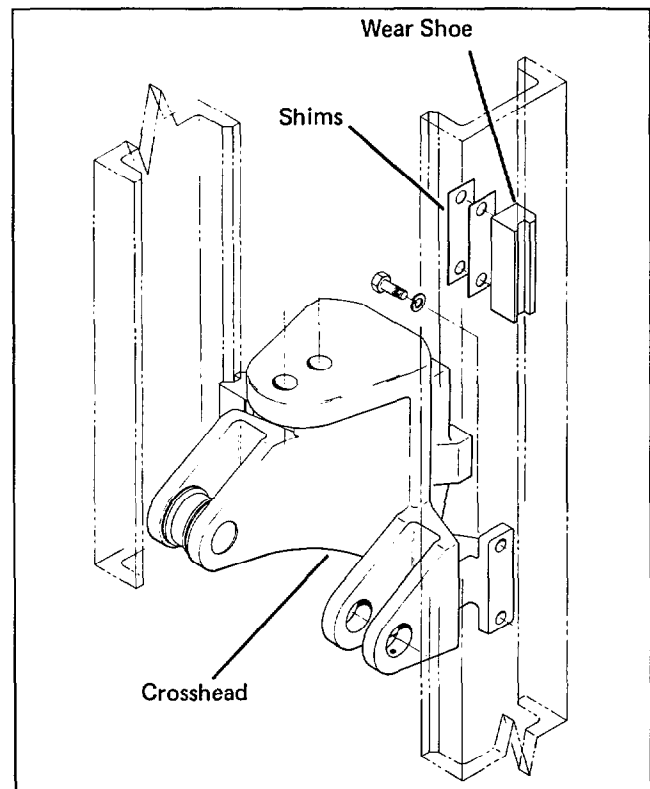


Figure 4-30 Crosshead Installation

14. Adjust the crosshead to the following specifications by adding or removing shims behind the wear shoes:

(a) The crosshead must be centered within 1/16" between the inner intermediate channel members.

(b) When moved from side to side, the crosshead must not have more than 1/16" looseness or "play."

NOTE: If the crosshead requires more than four shims on either side to meet these specifications, the wear shoes must be replaced.

15. Reinstall both sheaves in the lower crossmember of the outer intermediate channel as follows:

- (a) Reinstall the bearing in the sheave.
- (b) Coat the shaft with wheel bearing grease.
- (c) Place one retainer on each side of the sheave and replace the sheave in its bracket.
- (d) Replace the shaft so the grease fitting is toward the outside.
- (e) Replace and tighten the setscrew. After the setscrew is tightened, replace and tighten the jamscrew.
- (f) Rotate both sheaves to make sure they are turning without restrictions.

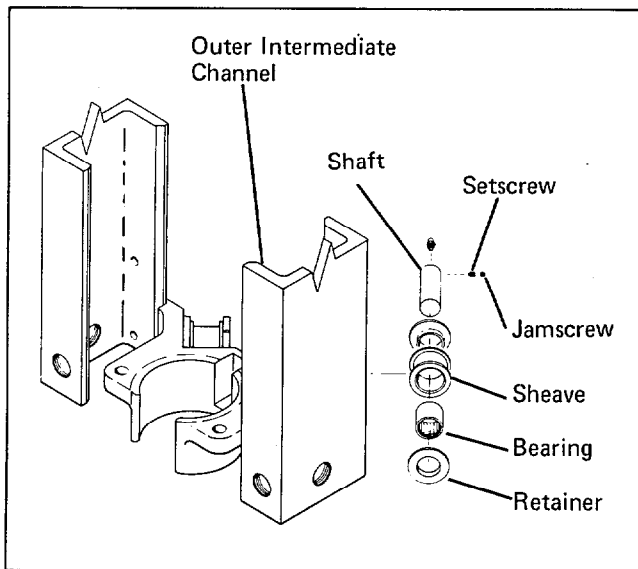


Figure 4-31 Outer Intermediate Sheave

16. Reinstall the bootstrap chain as follows:

- (a) Thread the chains through the sheaves in

the lower part of the outer intermediate channel.

(b) Connect the chains to the chain brackets on the lower crossmember of the inner intermediate channel.

(c) Connect the chains to the chain anchors on the outer channel.

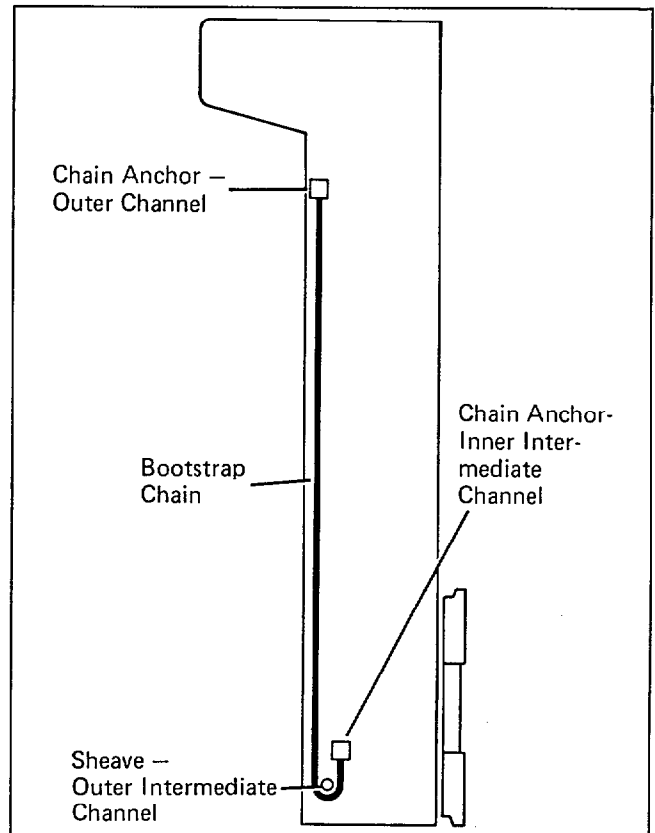


Figure 4-32 Bootstrap Chain Location

NOTE: If the chain will not reach the chain anchor, pry the outer intermediate channel and the inner intermediate channel out a few inches.

(d) Inspect the chains to make sure they are not twisted and are lying properly in the sheaves.

17. Push all channel members into the completely collapsed position and turn the mast over on the work surface so the channel crossmembers are underneath the mast.

CAUTION: Do not attempt to reposition the mast without an overhead crane.

18. Hand trip the latch on the inner intermediate channel so the capscrew latch pin may be

replaced in the outer intermediate channel crossmember. Reinstall the capscrew latch pin and lockwasher.

(e) Engage the keeper plate in the pivot pin notches and reinstall the capscrew and lockwasher in the keeper plate.

20. Reinstall the cylinder in its bracket.

CAUTION: Use an overhead crane to lift and position the cylinder.

21. Fasten the crosshead to the cylinder's inner plunger by replacing the two capscrews and lockwashers. If the original capscrews are not used, the replacements must be grade 5 or better 1/2" UNC x 1" socket head capscrews.

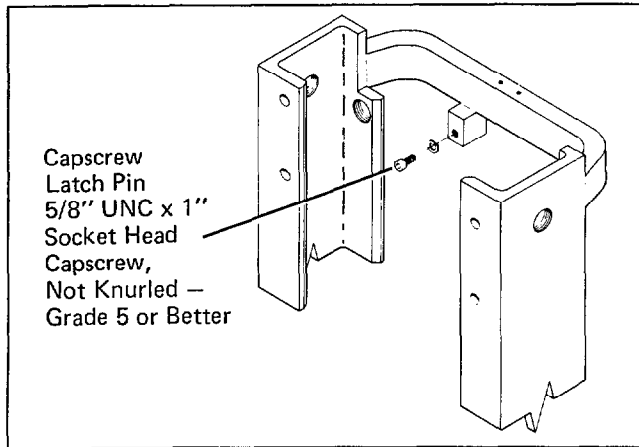


Figure 4-33 Capscrew Latch Pin

19. Reinstall the latch mechanisms on the inner channel as follows:

(a) Engage the two latches and the latch spring as shown in figure 4-34.

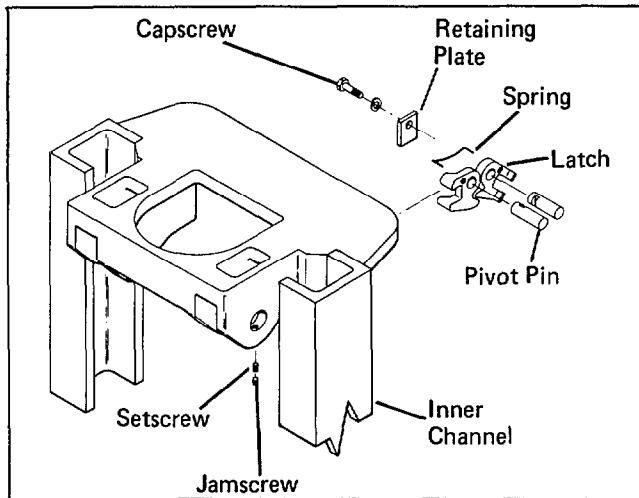


Figure 4-34 Latch Mechanism

(b) Coat the pivot pins with wheel bearing grease.

(c) Slide the latch mechanism into the bracket on the inner channel. When the latches are located in the bracket one latch must be engaged with the capscrew latch pin on the inner intermediate channel and the spring must be on the front side (away from the channels) of the latches.

(d) Reinstall the two pivot pins with the notched ends facing the outside of the bracket.

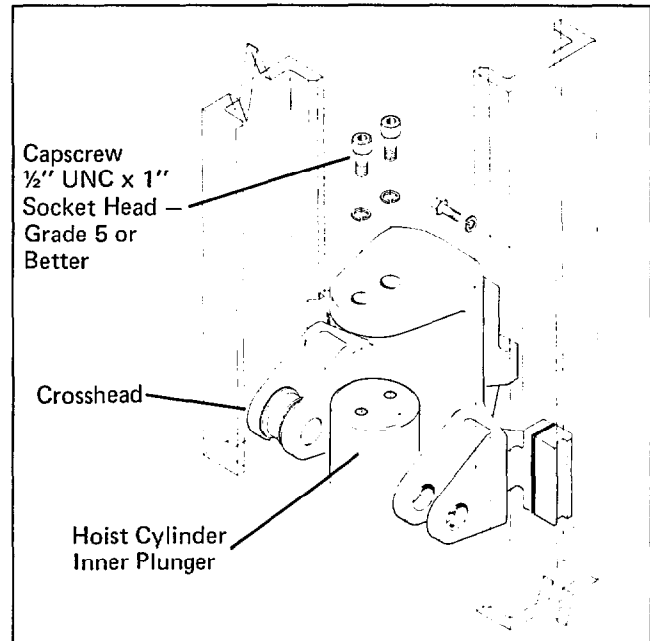


Figure 4-35 Crosshead

22. Install the carriage chain as follows:

(a) Reinstall the chain anchor in the base of the cylinder brackets.

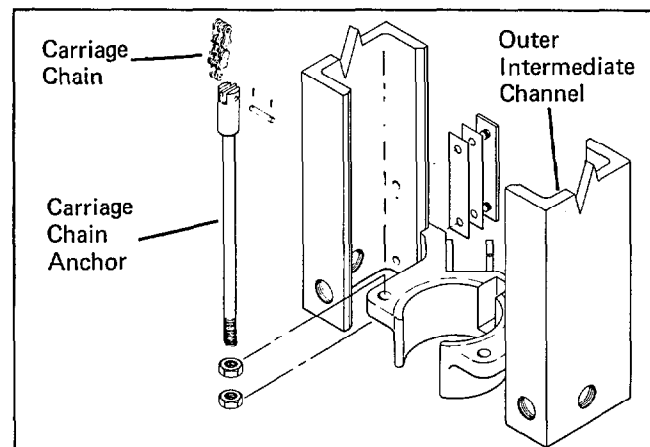


Figure 4-36 Carriage Chain Anchor

(b) Connect the chains to these chain anchors.

(c) Thread the chains through the sheaves as shown in figure 4-37.

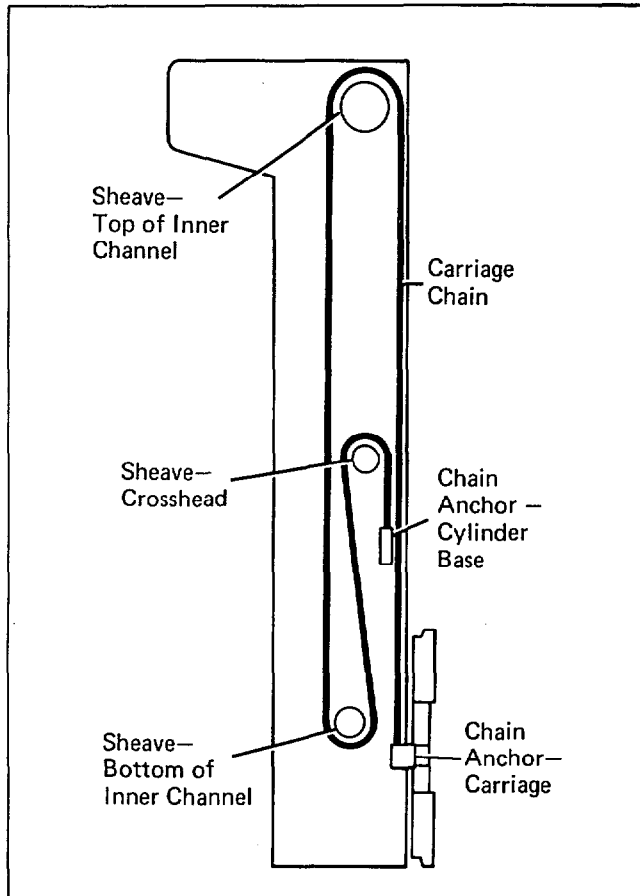


Figure 4-37 Carriage Chain Location

(d) Connect the small chain anchors to the chains to prevent them from slipping back through the sheaves.

(e) Inspect the chains to make sure they are not twisted and are lying properly in their sheaves.

4-8. CARRIAGE INSTALLATION

1. Secure the carriage with an overhead crane.
2. Coat the stub shafts with wheel bearing grease.
3. Reinstall the middle and lower roller assemblies by sliding the thrust washer, shims, roller and plug, in that order on the shaft.
4. Slide the thrust washer, inner shims, roller and outer shim, in that order, on each upper stub shaft. Reinstall the retaining plate and cap-

screws on each stub shaft. Before proceeding, make sure both upper rollers turn without restriction.

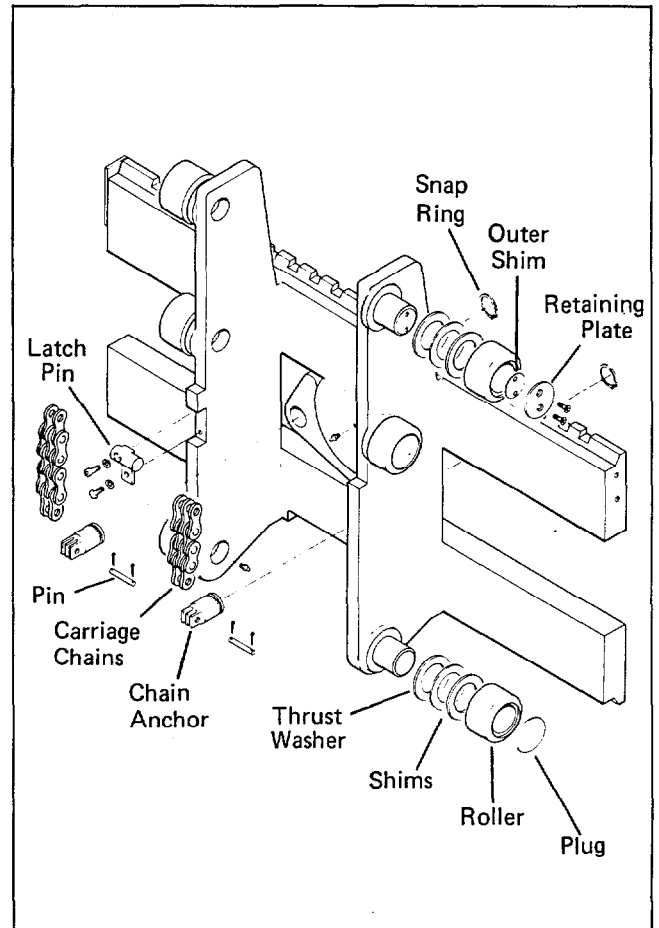


Figure 4-38 Carriage

5. Slide the carriage back into the bottom of the inner channel.
6. If the carriage enters the channel freely, remove and add shims behind the rollers until the carriage will just enter the channel without mechanical assistance.

NOTE: All rollers on the same side of the carriage must be shimmed equally. All six rollers on the carriage must be shimmed within one shim of being equal.

7. Slide the carriage to both ends of the mast to check clearances between the carriage side plates and the upper and lower channel cross-members. The carriage plates must clear both cross members by $1/4'' \pm 1/16''$ on both sides. If necessary, remove the carriage and adjust the shims behind the rollers accordingly following the procedures outlined in steps 4,5,and 6.

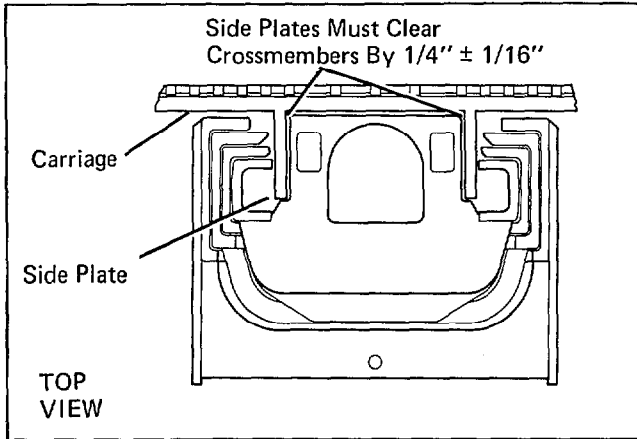


Figure 4-39 Carriage Clearances

8. Slide the carriage up until the crosshead is between the carriage side plates. The side plates must clear the crosshead by $1/4'' \pm 1/16''$. If the side plate clearances do not meet this specification, readjust the side wear plugs in the inner channel to center the carriage around the crosshead as follows:

(a) Loosen the steel setscrews in the side wear plugs of the inner channel.

(b) Adjust the wear plugs until the carriage side plates are centered around the crosshead.

(c) Back each wear plug off $1/4$ turn and tighten the steel setscrews.

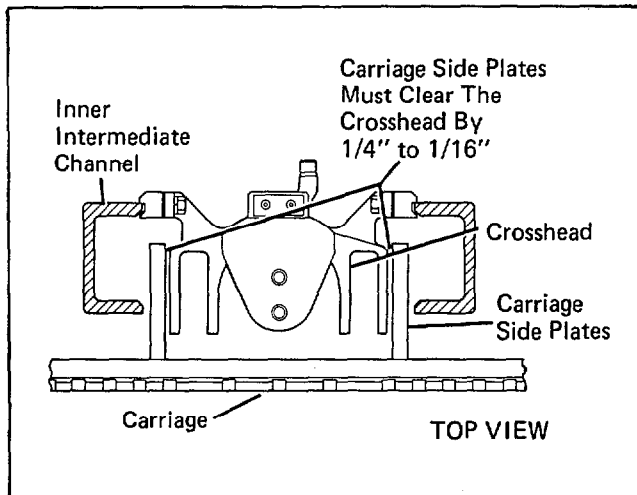


Figure 4-40 Carriage Clearances

NOTE: If the carriage is centered in respect to the inner channel crossmembers and requires more than $1/16''$ adjustment of the inner channel to center it around the crosshead, recheck the crosshead wear shoes and adjust-

ment as outlined in sub-section 4-7, steps 13 and 14.

9. Once the carriage is properly shimmed and located in the channel, move it the full length of the channel to check for restrictions and proper roller action. If the carriage does not roll freely, check the inner channel for obstructions, recheck the carriage adjustment and if necessary, recheck the carriage roller assemblies.

10. Check to make sure the carriage latch pin does not hit or touch the crosshead. If the latch pin does come into contact with the crosshead, recheck the crosshead adjustment as outlined in sub-section 4-7, step 14.

11. Replace both chain anchors in the yoke, making sure the snap rings are securely in their grooves. See figure 4-38.

4-9. MAST INSTALLATION

1. Reposition the mast on the work surface so the carriage is facing down.

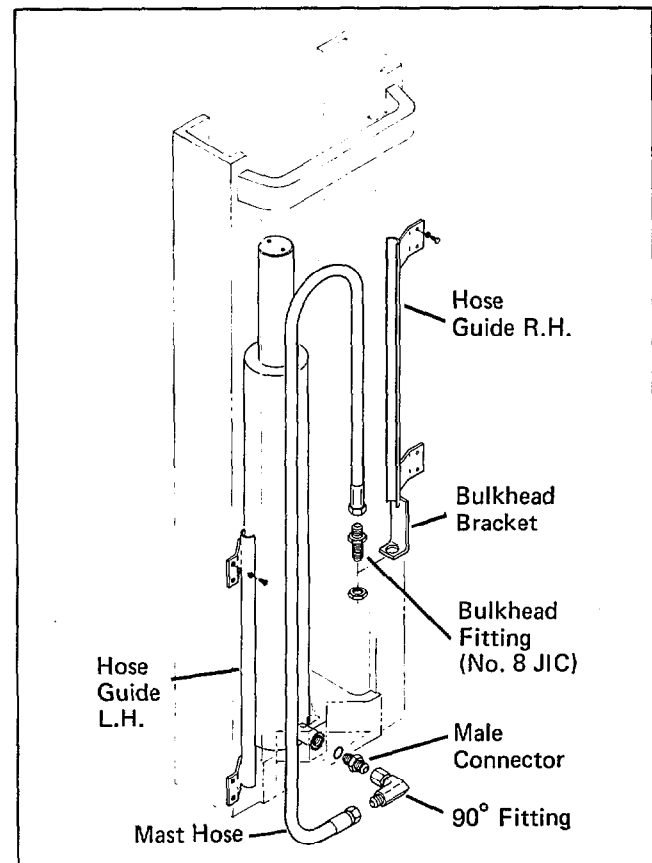


Figure 4-41 Mast Hosing

CAUTION: Always use an overhead crane when positioning the mast.

NOTE: The right hand hose guide has a bulkhead bracket welded to the bottom.

2. Bolt the right hand hose guide to the two mounting plates on the outer channel.
3. Bolt the left hand hose guide to the two mounting plates on the outer intermediate channel.
4. Reinstall the spacer, spring and washer in the cylinder port, making sure the parts are clean and that no dirt or contamination is contained in the port. See figure 4-42.

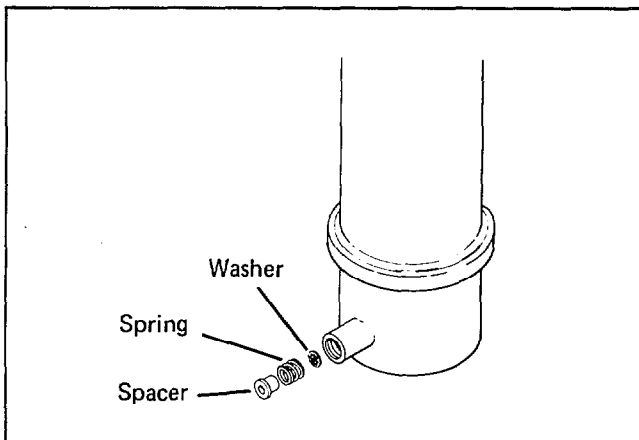


Figure 4-42 Hoist Cylinder Port

CAUTION: The spacer, spring and washer must be properly installed in that order in the cylinder port for proper operation.

5. Thread a male connector into the cylinder port.
6. Attach a 90° fitting to the male connector.
7. Connect the mast hose to the 90° fitting.
8. Connect the short side of the bulkhead fitting to the other end of the hose.
9. Loop the hose in the hose guides as shown in figure 4-41.
10. Secure the bulkhead fitting to the bulkhead bracket with a jam nut.

NOTE: The hose must not be twisted when connected to the bulkhead bracket. Twists in the hose will result in hose chafing and cause

the hose to dislodge from the guides during operation.

11. Thread a 3/4" UNC x 2-1/2" capscrew (grade 5 or better) with a large flatwasher into the hole on each side of the mast as shown in figure 4-43.

CAUTION: The capscrews must be threaded into the holes until they "bottom out" before the mast is lifted.

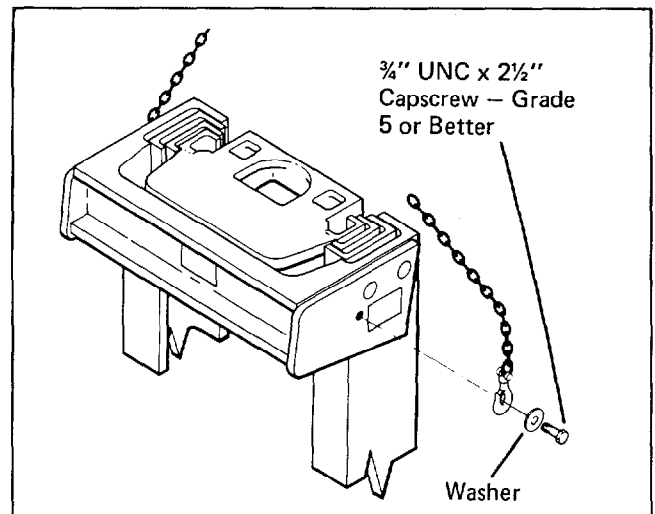


Figure 4-43 Lifting Procedure

12. Using suitable chains, lift the mast into installation position.
13. Connect the supply hose to the bulkhead fitting on the right hand hose bracket.
14. Lubricate the interior diameters of the base mounting brackets with wheel bearing grease and mount on the truck.
15. Lubricate the interior diameters of the tilt cylinder anchor brackets with wheel bearing grease and attach the tilt cylinders.

4-10. MAST ADJUSTMENT

1. Adjust the bootstrap chains to the following specifications by adjusting the chain anchors on the outer channel crossmember:
 - (a) Both chains must be under equal tension.
 - (b) The contact pad on the bottom of the outer intermediate channel crossmember must just touch the outer channel crossmember when the mast is fully lowered.

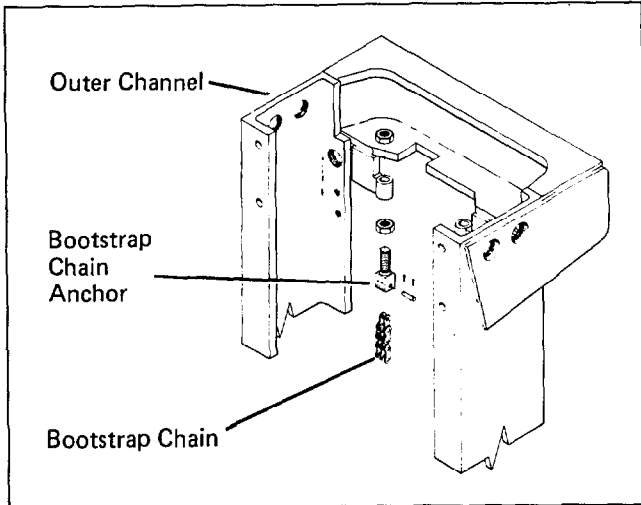


Figure 4-44 Bootstrap Chain Anchor

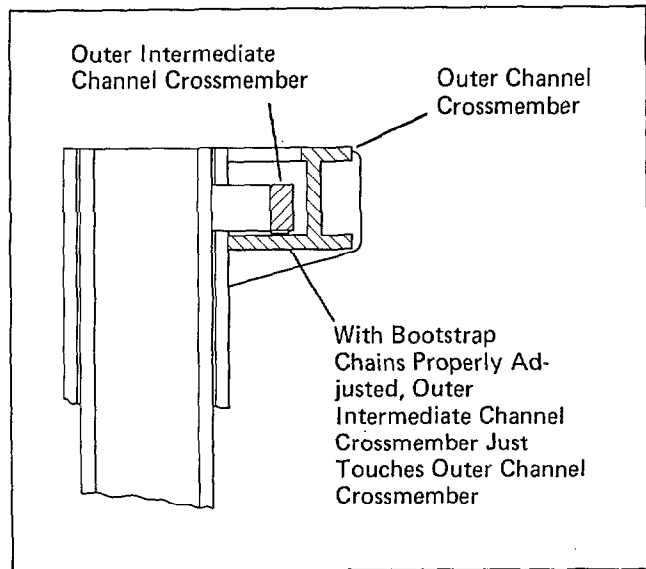


Figure 4-45 Bootstrap Chain Adjustment

2. Adjust the carriage to the following specifications by adjusting the carriage chain anchors in the cylinder bracket:

- (a) The yoke must be evenly centered in the carriage.
- (b) For masts with 3" underclearance adjust the carriage so the bottom of the lower fork bar is even with the bottom of the outer channel when the mast is fully collapsed.
- (c) For masts with 5" underclearance, adjust the carriage so the bottom of the lower fork bar is 2" below the bottom of the outer channel when the mast is completely collapsed.

NOTE: To prevent damage to the carriage latch

pin, the carriage must not be allowed to go lower than these specifications.

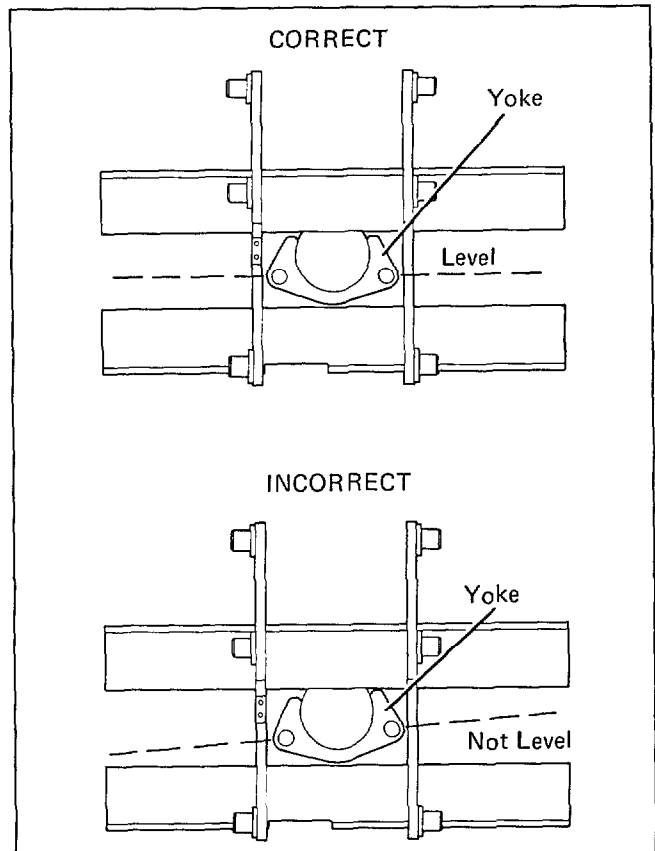


Figure 4-46 Carriage Yoke Position

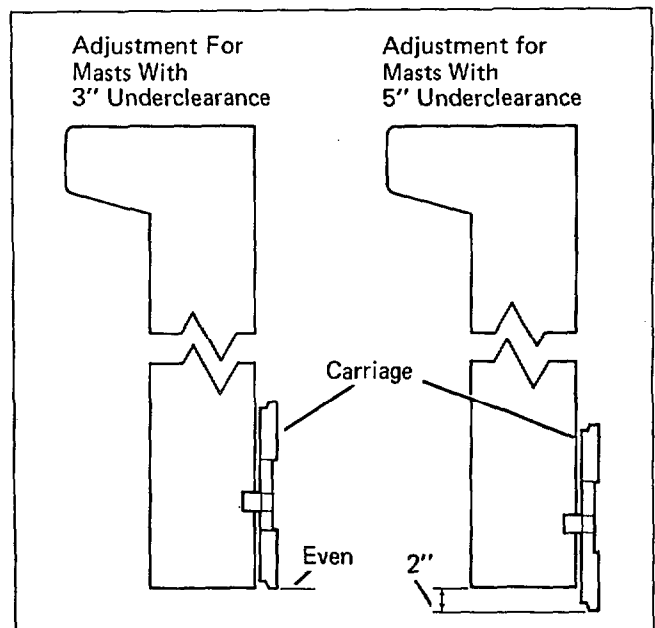


Figure 4-47 Carriage Positioning

CAUTION: Before proceeding, make certain both nuts on each carriage chain anchor and on each bootstrap chain anchor are tight.

3. Inspect the latch mechanism on the inner intermediate channel. The latch throat that engages the pin must be horizontal as shown in figure 4-48. If the capscrew latch pin holds the latch in a non-horizontal position, add or subtract shims under the contact pad on the top of the outer intermediate channel crossmember until the latch is properly adjusted.

CAUTION: If the latches are not properly adjusted, they could over travel, causing latch failure and incorrect mast sequencing.

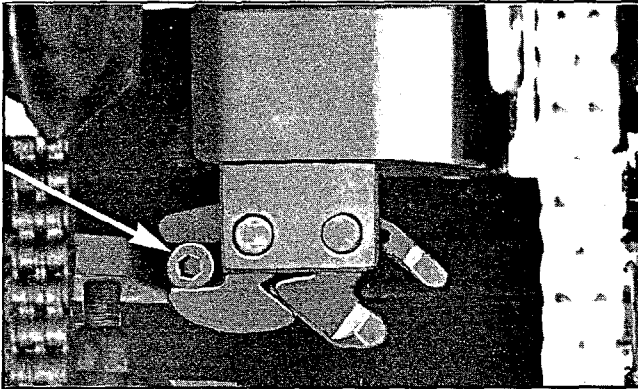


Figure 4-48 Latch Positioning

- (b) The two latches must be properly interlocked as shown in figure 4-48 and the spring must be securely engaged with both latches.
 - (c) Before proceeding, lubricate the latch spring and all mating surfaces with SAE 30 engine oil.
4. Inspect the latch mechanism on the inner channel with the mast completely collapsed.

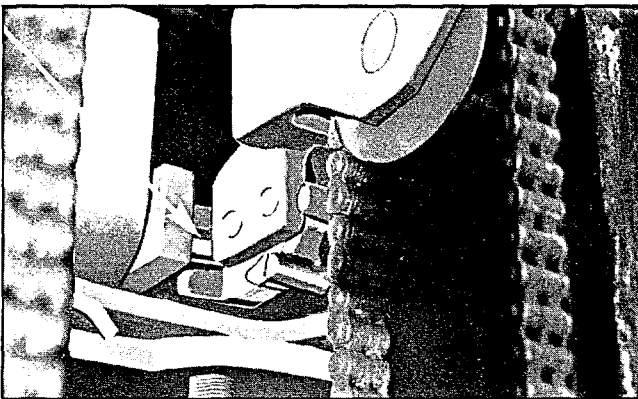


Figure 4-49 Latch Positioning

- (a) The latch must be engaged with the capscrew latch pin on the inner intermediate channel. The latch throat that engages the pin must be completely horizontal. If the capscrew

latch pin holds the latch in a non-horizontal position, add or subtract shims under the contact pad of the inner intermediate channel crossmember until the latch is properly adjusted.

CAUTION: If the latches are not properly adjusted, they could over travel, causing latch failure and incorrect mast sequencing.

- (b) The two latches must be properly interlocked as shown in figure 4-49 and the spring must be securely engaged with both latches.
 - (c) Before proceeding, lubricate the latch spring and all mating surfaces with SAE 30 engine oil.
5. Grease the sheaves on the mast and on the crosshead through the grease fittings in the sheave shafts with wheel bearing grease. Use one of the following adapters for easy access to the grease fittings:
 - (a) Alemite no. 321990-90° adaptor on a flexible hose.
 - (b) Alemite no. 322120-90° adaptor (permanent attachment to grease gun).
 - (c) Universal no. 31-90° adaptor.
 - (d) Lincoln no. 5855 adaptor extension (push type adaptor, does not lock onto gun).
 6. Reconnect the forks or attachment to the carriage. Carefully raise the carriage to the top of its free-lift position (height of collapsed mast) and then lower the carriage to its lowest position. Check the following points:

CAUTION: Make sure all persons are clear of the mast during testing.

- (a) The carriage must completely lower with the weight of the forks only. If the carriage does not lower, refer to the trouble-shooting guide in section 2.
- (b) The carriage side plates must maintain a $1/4'' \pm 1/16''$ clearance between the inner channel crossmembers. If the side plates do not maintain the required clearance between the crossmembers, readjust as outlined in subsection 4-8, step 7.
- (c) The carriage side plates must maintain a

1/4" ± 1/16" clearance on both sides of the crosshead. If the side plates do not maintain this clearance, readjust as outlined in sub-section 4-8, step 8.

(d) The carriage must not touch the cylinder shell. If the carriage is scraping against the cylinder shell, the crosshead is too loose and must be adjusted as outlined in sub-section 4-7, steps 13 and 14.

(e) When the mast is fully collapsed, the bottom of the carriage bar must not go below the bottom of the outer channel for 3" underclearance masts or lower than 2" below the outer channel for 5" underclearance masts.

(f) All chain anchors must be securely anchored.

(g) The capscrews retaining the wear shoes to the crosshead must be tight.

7. Cycle the mast, raising it to its full height. The mast must sequence as follows:

CAUTION: Check for overhead obstructions before raising mast.

(a) The carriage travels the full height of the collapsed mast by chain action. The chain is pulled by the crosshead and the crosshead is raised directly by the cylinder.

(b) As the carriage reaches the top of the inner channel, the latch pin engages with the latch mechanism on the inner channel, tripping the latch and releasing the inner channel from the inner intermediate channel. At the same time the carriage side plates contact the inner channel crossmember, raising the inner channel and the carriage by chain action. When the latch mechanism is tripped, it also locks the carriage to the inner channel.

(c) The inner channel will rise partially out of the mast before the remaining channels begin sequencing. As the crosshead reaches the top of the inner intermediate channel, the capscrew latch pin on the back of the crosshead trips the latch mechanism on the inner intermediate channel, releasing it from the outer intermediate channel. At the same time the crosshead begins carrying the inner intermediate channel up with it. When the latch was tripped to release the two channels it also locked the inner intermediate channel to the crosshead.

(d) As the crosshead carries the inner intermediate channel up, the bootstrap chain connected between the inner intermediate channel and the outer channel pulls the outer intermediate channel up.

(e) The mast will now continue rising until the cylinder reaches the top of its stroke.

(f) As the mast is lowered, all three channels will descend until the outer intermediate channel and the inner intermediate channel simultaneously reach their collapsed position. As they reach this collapsed position, the capscrew latch pin in the outer intermediate channel crossmember trips the latch mechanism on the inner intermediate channel, releasing the crosshead and locking the two intermediate channels together.

(g) At the point the two intermediate channels are collapsed, the inner channel is still partially extended, and the carriage is still at the top of the inner channel. When the inner channel reaches its collapsed position, the latch mechanism on the inner channel is tripped by the capscrew latch pin on the inner intermediate channel, releasing the carriage from the inner channel and locking the two inner channels together.

(h) The carriage will now continue to lower until it is at the bottom of the mast.

(i) During the first extension, check to make sure the hose and hose brackets clear the crossmembers.

8. Beginning with the mast in its completely lowered position, bleed the cylinder as follows:

CAUTION: Make sure all persons are clear of the mast during testing.

(a) Loosen the bleeder screw located near the top of the mast hoist cylinder as shown in figure 4-50.

CAUTION: Do not unthread the bleeder screw more than 1 turn when bleeding the hoist cylinder. Keep hands clear of the mast while operating the truck valve.

(b) Run the lift truck at normal operating volume and pressure and slowly open the truck control valve in the "raise" position. Keep the

valve open until a clear flow of oil is obtained around the bleeder screw.

CAUTION: The cylinder must be free of air for safe operation.

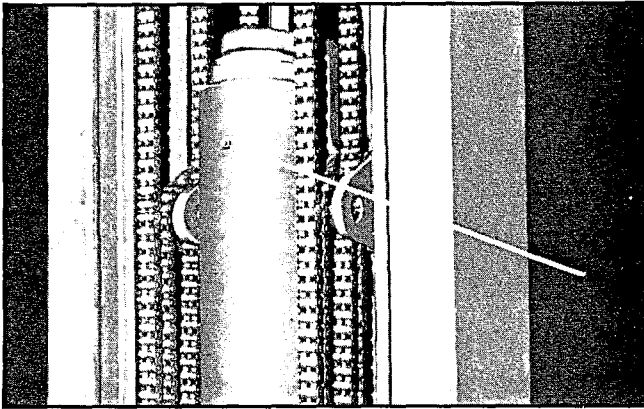


Figure 4-50 Bleeder Screw

(c) Tighten the bleeder screw, while the cylinder is extending and check for leakage.

9. When the mast is fully lowered, recheck the latch mechanisms. They should be in the positions described in steps 3 and 4. If they are not in this position, adjust as outlined in the same steps.

10. Raise the mast until the crosshead has begun raising the inner intermediate channel. Turn the lift truck off and inspect the latch mechanism on the inner intermediate channel.

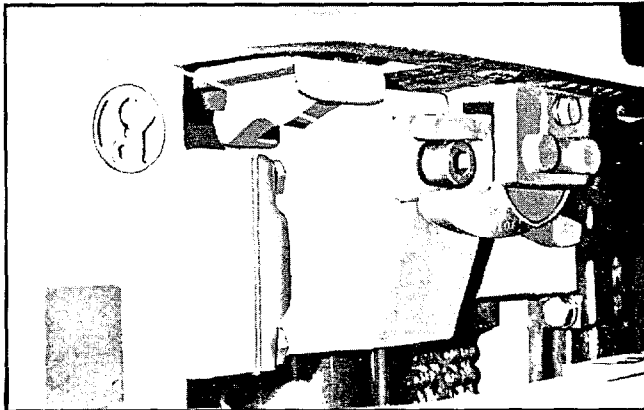


Figure 4-51 Latch Mechanism

CAUTION: Make sure the lift truck is off and no one is near the lift truck control handles before inspecting the latch mechanism.

(a) The latch mechanism must be engaged with the latch pin on the back of the carriage and the two latches must be interlocked.

(b) The latch throat that engages the pin must be completely horizontal. If the latch pin holds the latch in a non-horizontal position, add or subtract shims under the contact pad on the back of the crosshead until the latch is in the proper position when engaged with the crosshead latch pin.

CAUTION: If the latches are not properly adjusted, they could over travel, causing latch failure and incorrect mast sequencing.

11. With the mast in the same position as in step 10, check the latch mechanism on the inner channel. The latch mechanism should be engaged with the carriage latch pin and the two latches should be interlocked.

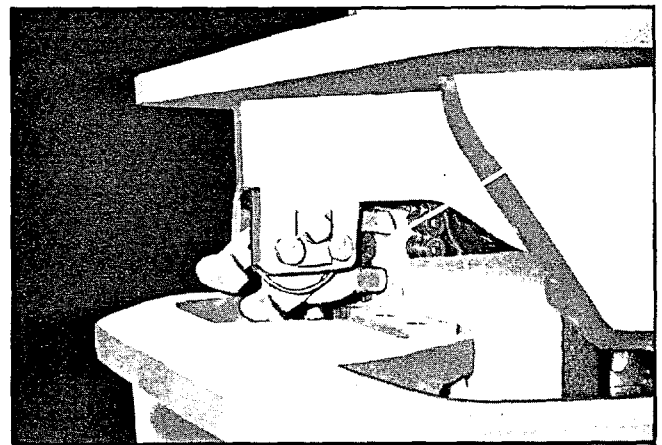


Figure 4-52 Latch Mechanism

12. If the mast does not sequence properly, recheck the following points:

(a) Adjustment and installation of the carriage chains (reference sub-section 4-7, step 22 and sub-section 4-10, step 2).

(b) Bootstrap chain adjustment and installation (reference sub-section 4-7, step 16 and subsection 4-10, step 1).

(c) Cylinder sequencing. The intermediate plunger should fully extend before the inner plunger begins extending. If the cylinder is not sequencing correctly, disassemble as outlined in section 5. Inspect the valve porting in the base of the inner plunger and replace the valve cartridge.

(d) Latch mechanisms and installation (reference sub-section 4-7, steps 2 and 19). Latch mechanism adjustment (reference sub-section 4-10, steps 3, 4 and 10).

4-11. SAFETY INSPECTION

4-12. Every Quad Lift Mast has "No Hand Hold" decals (part no. C-655248) located on the side of the outer channel and on the back of the three upper crossmembers. See figure 4-53. If any of these decals are missing, contact the Cascade parts depot for replacements.

4-13. In addition to the mast inspection procedures described in sub-section 4-10, the mast should be rechecked to insure that:

1. The mast hose is properly fitted in the hose guides and remains in the guides during operation (reference sub-section 4-9, steps 1 through 10).
2. The crossbar bracket is securely mounted to the outer channel (reference sub-section 1-8).
3. All hose guides, hoses, etc., clear the crossbar bracket during operation.
4. The hoist cylinder is bled and free of air (reference sub-section 4-10, step 7).
5. The hoist cylinder bleeder screw is tight and no leakage is occurring (reference sub-section 4-10, step 7).
6. All "No Hand Hold" decals are legible and in their proper location and the paint masks have been removed.

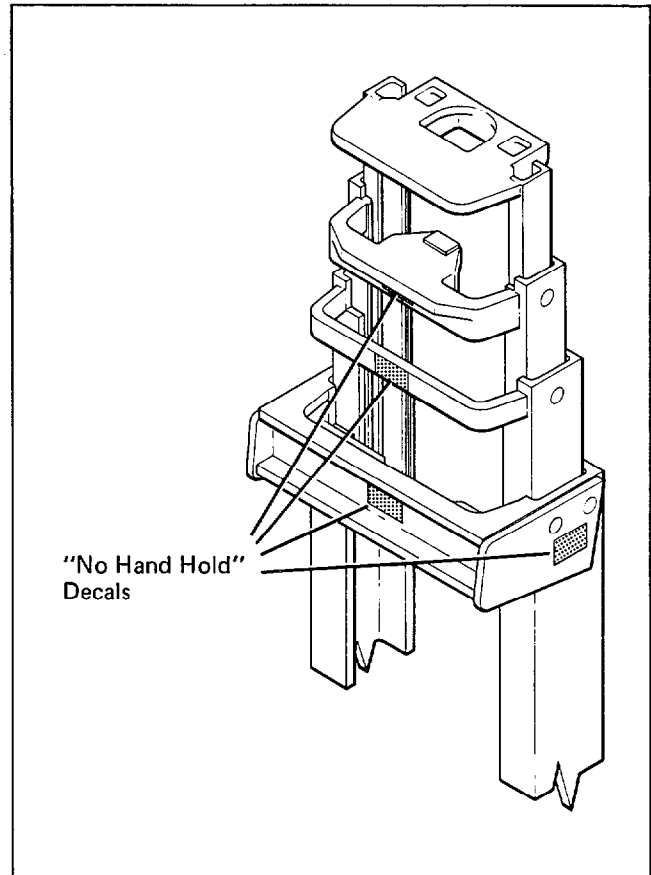


Figure 4-53 "No Hand Hold" Decals

7. The chain is free of paint and weld splatter.
8. All mast channels are lubricated with graphite base grease (30% graphite base recommended).

Section 5

CYLINDER SERVICE

5-1. INTRODUCTION

5-2. This section outlines procedures for overhauling the Quad Lift Mast hoist cylinder.

5-3. Before the cylinder is disassembled, a complete set of soft parts (O-rings, seals, back-up rings, etc.) should be in stock or readily available. A new valve cartridge for the base of the inner plunger should also be available. Refer to the Quad Lift Mast parts manual, Cascade form 5038, for specific part numbers.

5-4. To service the hoist cylinder, the mast should be removed from the lift truck and the cylinder should be removed from the mast.

5-5. MAST REMOVAL

1. Thread a 3/4" UNC x 2-1/2" capscrew (grade 5 or better) with a large flatwasher into the hole on each side of the mast as shown in figure 5-1.

CAUTION: The capscrews must be threaded into the holes until they "bottom out" before the mast is lifted.

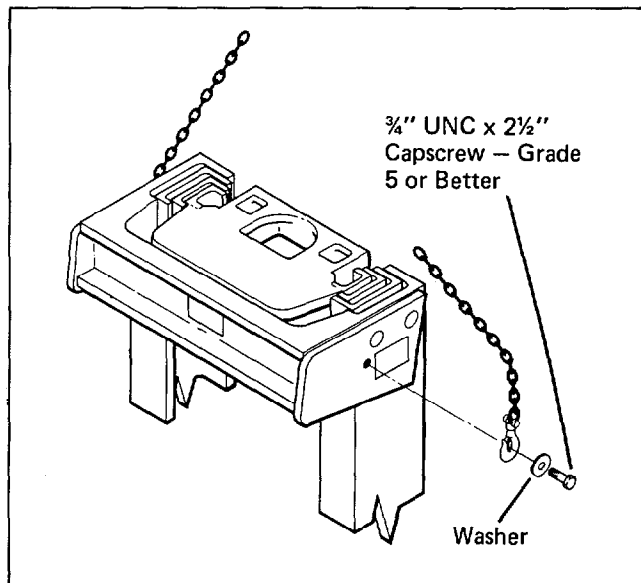


Figure 5-1 Lifting Procedure

2. Using suitable chains, secure the mast to an overhead crane.
3. Disconnect the forks or attachment from the carriage.

4. Disconnect and cap the supply hose from the lift truck.

CAUTION: Recheck the chains and overhead crane being used to hold the mast in an upright position.

5. Disconnect the tilt cylinders.
6. Disconnect the base mounting brackets and remove the mast from the lift truck.
7. Disconnect and cap the mast hose from the bulkhead fitting and from the cylinder port.

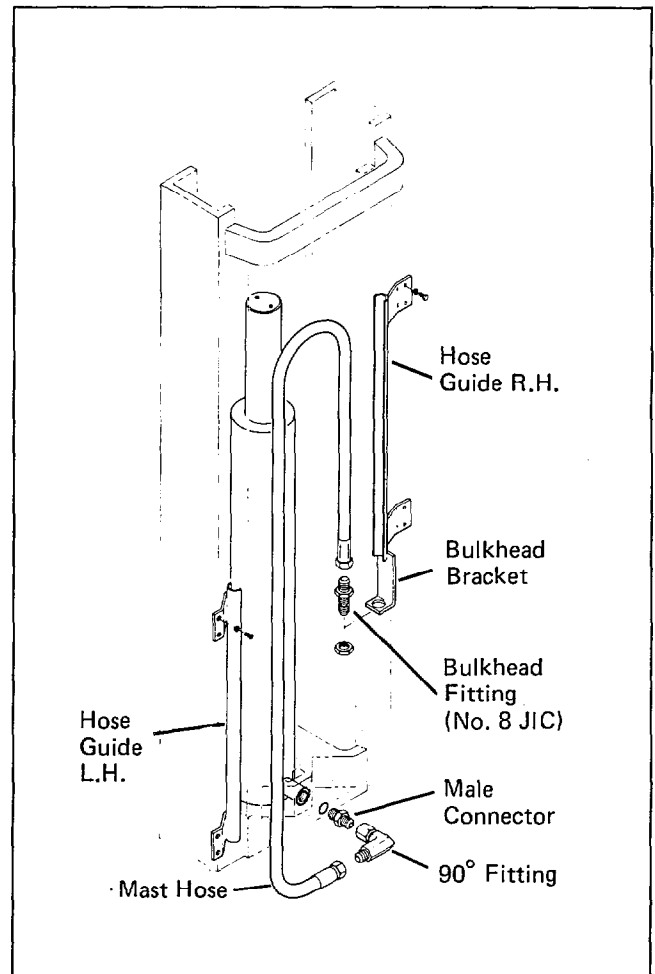


Figure 5-2 Mast Hosing

8. Remove the male connector from the cylinder port and cap the port.

NOTE: The cylinder port contains a washer, spring and spacer. Care should be taken to avoid losing these parts during disassembly.

9. Lay the mast on a work surface with the carriage facing up.

CAUTION: Always use an overhead crane to lift the mast.

5-6. CYLINDER REMOVAL

1. Slide the carriage to the top of the mast.
2. Remove the two capscrews that retain the crosshead to the cylinder's inner plunger. Slide the crosshead to the top of the mast.

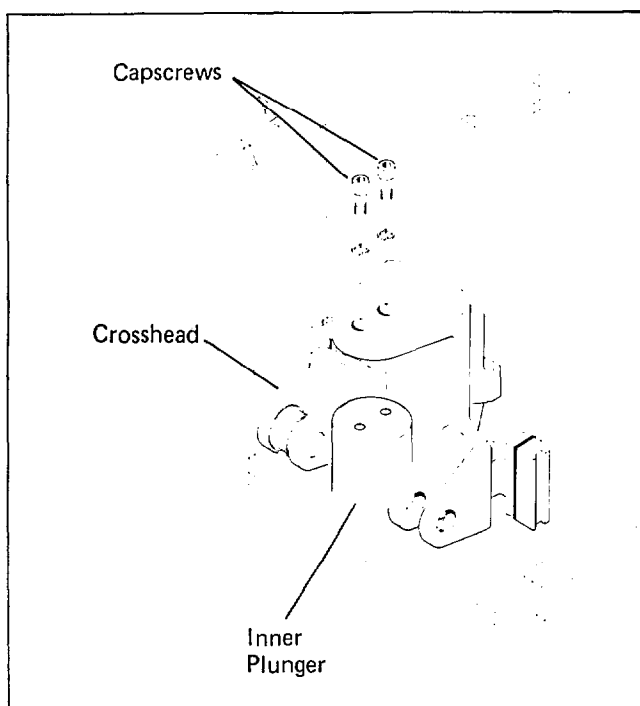


Figure 5-3 Crosshead

3. Loosen the intermediate plunger retainer with the proper spanner wrench before sliding the cylinder out of the base.
4. Secure the cylinder with straps to an overhead crane. Slide the cylinder out of the cylinder base and lift out of the mast.

5-7. CYLINDER DISASSEMBLY

5-8. Care must be taken during cylinder disassembly and assembly to prevent damage to the chrome surfaces of the plungers and the I.D. of the shell. Minor nicks and scratches may be repaired by using fine emery paper. Nicks or scratches that cannot be easily removed with emery paper will require the replacement of the entire component.

5-9. While disassembling the cylinder, place all parts in clean containers. Dirt and contaminants may cause damage to the cylinder components and result in mis-sequencing of the cylinder.

5-10. To disassemble the cylinder, proceed as follows:

1. Lay the cylinder in three or more "V" blocks and secure it to the workbench with straps.

NOTE: The cylinder must not be clamped in a vice. Clamping may distort the cylinder shell, requiring the replacement of the shell assembly.

2. Pull the intermediate plunger partially out of the cylinder.

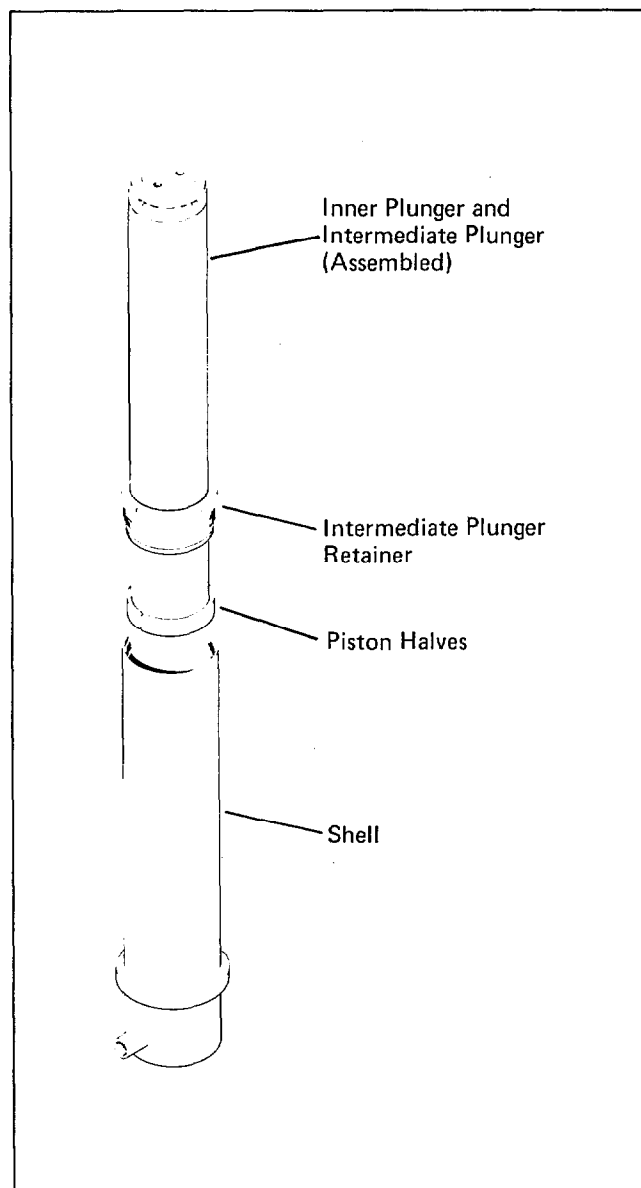


Figure 5-4 Cylinder Disassembly

3. Using the proper spanner wrench, unthread the intermediate plunger retainer from the shell. Support the intermediate plunger so it doesn't drop when the retainer is unthreaded. Leave the retainer on the intermediate plunger.
4. Remove the two plungers, as an assembly, from the shell.

NOTE: The piston halves on the intermediate plunger will disengage as the plunger is removed. The end of the shell should be located directly over a workbench or table to avoid damage to the piston halves as they fall.

5. Remove the piston halves retaining ring from the bottom of the intermediate plunger.

NOTE: Take special precautions to prevent scratching or gouging the plunger while removing the retaining ring.

6. Lay the two plungers in a set of "V" blocks and secure to the workbench with straps.

CAUTION: Always use an overhead crane to position the assembled plungers.

NOTE: The plunger must not be clamped in a

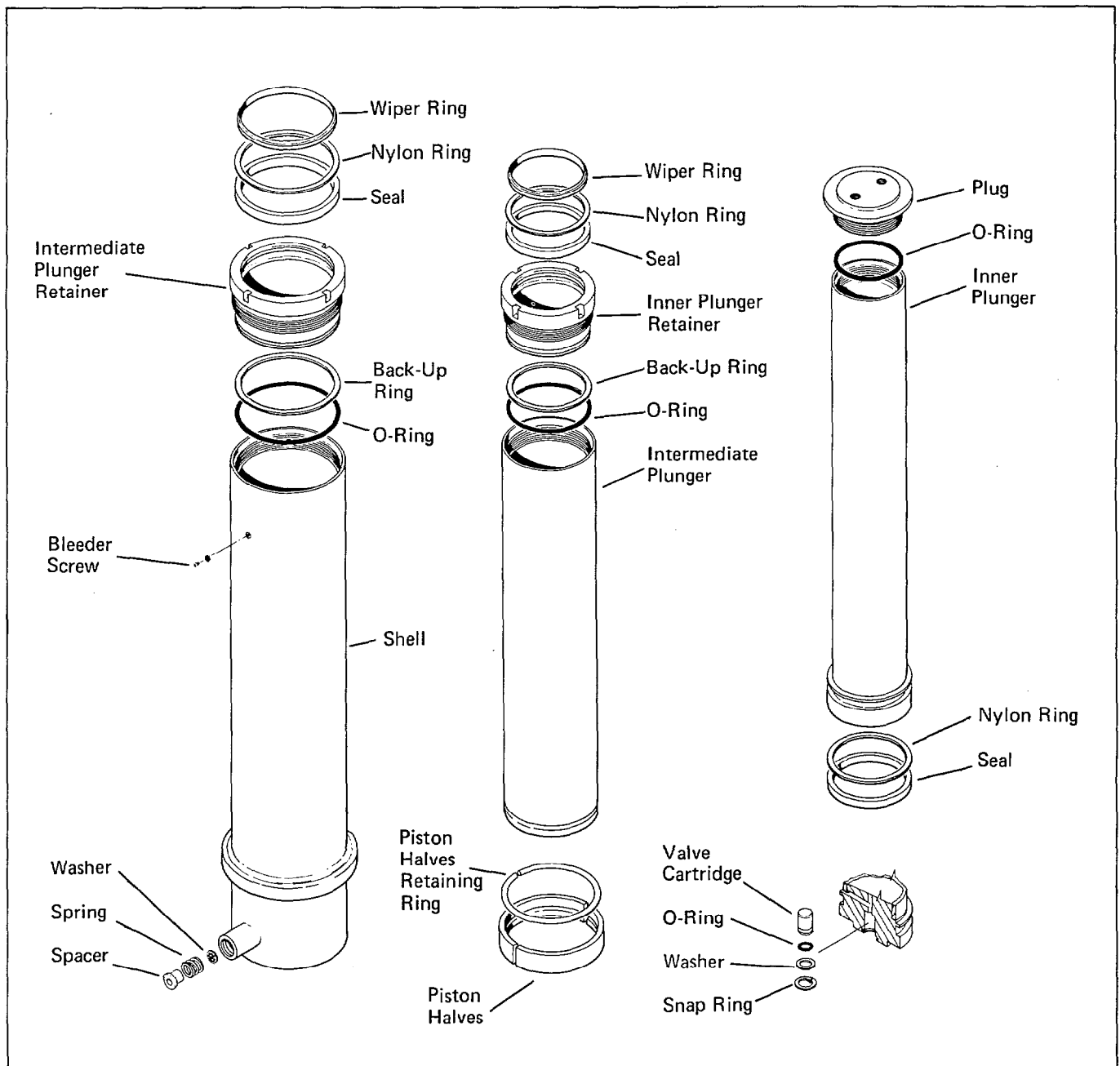


Figure 5-5 Hoist Cylinder

vice. Clamping may damage the chrome surface or cause distortion, requiring the replacement of the plunger assembly.

7. Remove the plug from the inner plunger as follows:

(a) Thread two socket head capscrews (1/2" UNF x 1") into the holes on the top of the plug.

(b) Secure the inner plunger with a strap wrench to prevent it from turning.

(c) Use a bar between the two capscrews to unthread the plug.

(d) Remove and discard the O-ring.

8. Using a spanner wrench and strap wrench, remove the inner plunger retainer.

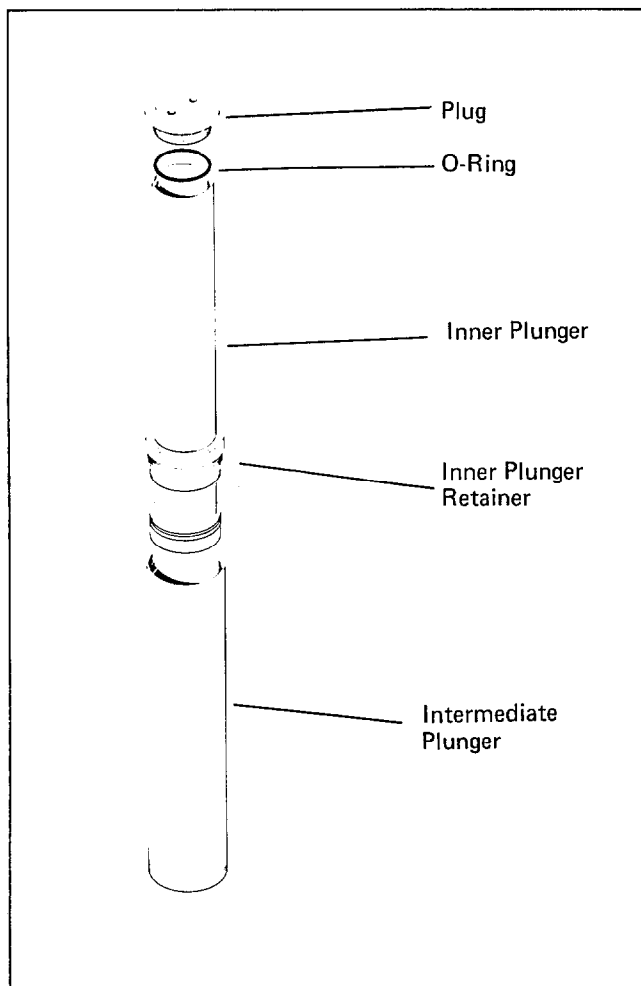


Figure 5-6 Cylinder Disassembly

9. Remove the back-up ring and O-ring from the O.D. of the retainer by carefully prying up

with a screwdriver and cutting them with a knife. Discard these parts.

NOTE: Take special precautions to avoid scratching the seal groove. Scratches in the seal groove will allow oil leakage and will require the replacement of the retainer.

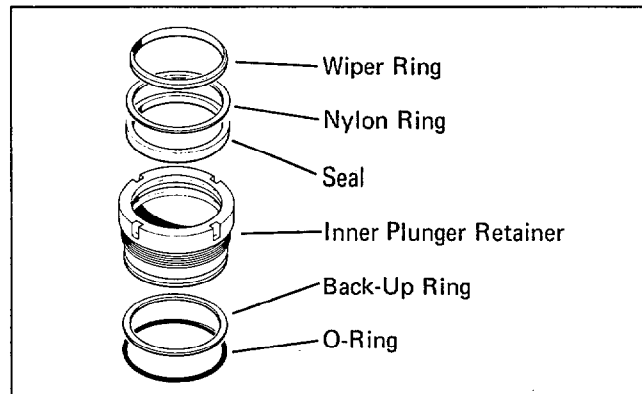


Figure 5-7 Inner Plunger Retainer

10. Remove the wiper ring, nylon ring and seal from the I.D. of the retainer by carefully prying them out with a screwdriver. Discard these parts.

NOTE: Take special precautions to avoid scratching or gouging the seal grooves. Scratches or gouges will allow oil by-pass, and will require the replacement of the retainer.

11. Pull the inner plunger out through the top of the intermediate plunger.
12. Remove the nylon ring and seal from the base of the inner plunger by carefully prying them up with a screwdriver and cutting them with a knife.

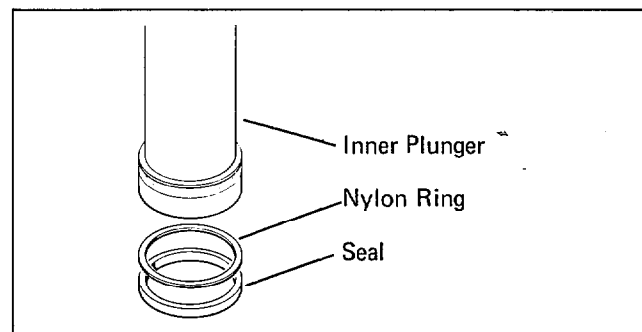


Figure 5-8 Inner Plunger Seal

NOTE: Take special precautions to avoid scratching the seal groove. Scratches in the seal groove will result in cylinder mis-sequencing and require the replacement of the plunger.

13. Remove the small snap ring in the base of the inner plunger. Remove the washer, O-ring and valve cartridge. Discard the O-ring and valve cartridge.

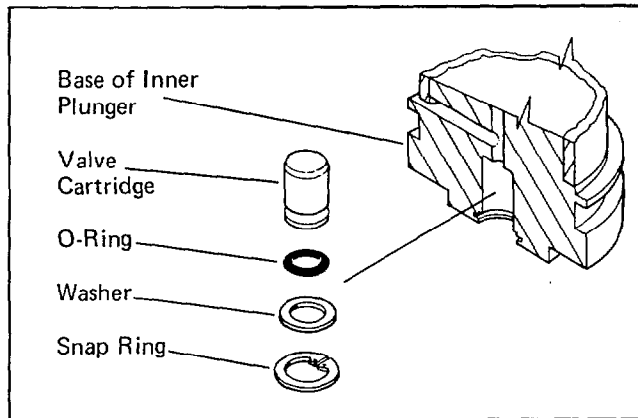


Figure 5-9 Inner Plunger Valve & Port

14. Slide the intermediate plunger retainer off the intermediate plunger. See figure 5-4.
15. Remove the back-up ring and O-ring from the O.D. of the retainer by carefully prying up with a screwdriver and cutting them with a knife. Discard these parts.

NOTE: Take special precautions to avoid scratching the seal groove. Scratches in the seal groove will allow oil leakage and will require the replacement of the retainer.

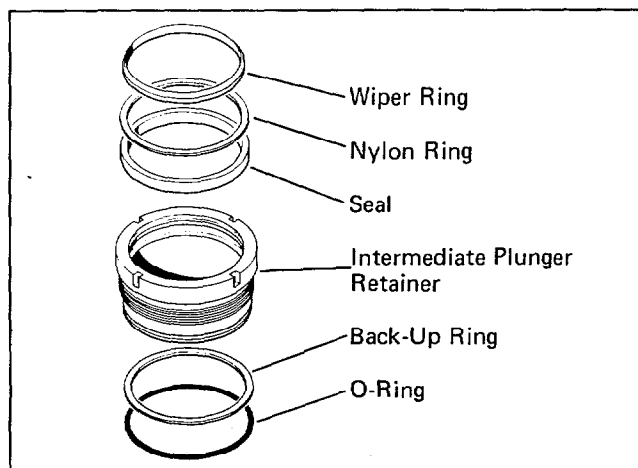


Figure 5-10 Intermediate Plunger Retainer

16. Remove the wiper ring, nylon ring and seal from the I.D. of the retainer by carefully prying them out with a screwdriver. Discard these parts.

NOTE: Take special precautions to avoid scratching or gouging the seal grooves.

Scratches or gouges will allow oil by-pass, and will require the replacement of the retainer.

5-11. INSPECTION & SERVICE

1. Inspect and clean the valve ports in the base of the inner plunger. See figure 5-9.
2. Inspect the I.D. of the shell. Minor scratches or abrasion spots may be removed by rubbing lightly with fine emery paper. If there are scratches or abrasion spots that cannot be easily removed by fine emery paper, the shell must be replaced.
3. Inspect the O.D. and I.D. of the intermediate plunger. Minor scratches or abrasion spots may be removed by rubbing lightly with fine emery paper. If there are scratches or abrasion spots that cannot be easily removed by fine emery paper, the plunger must be replaced. If the chrome surface has visibly deteriorated on any part of the O.D., the plunger must be replaced.
4. Inspect the O.D. of the inner plunger. Minor scratches or abrasion spots may be removed by rubbing lightly with fine emery paper. If there are scratches or abrasion spots that cannot be easily removed by fine emery paper, the plunger must be replaced. If the chrome surface has visibly deteriorated on any part of the O.D., the plunger must be replaced.
5. Inspect the two intermediate plunger piston halves. If they are visibly worn or have any scratches or gouges in their surface, they must be replaced.

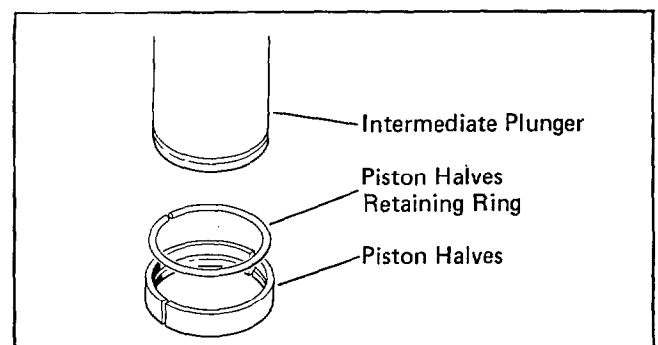


Figure 5-11 Piston Halves

6. Thoroughly clean all parts before reassembling.

5-12. CYLINDER ASSEMBLY

1. Lay the intermediate plunger in a set of "V"

blocks and secure to the workbench with straps.

NOTE: The plunger must not be clamped in a vice. Clamping may damage the chrome surface or cause distortion, requiring the replacement of the plunger assembly.

2. Install a new valve cartridge in the base of the inner plunger. Place a new O-ring and reinstall the washer and snap ring in the port. See figure 5-9.
3. Place a new seal and nylon ring on the base of the inner plunger as follows.

NOTE: The seal used on the base of the inner plunger and the seal used in the inner plunger retainer are nearly identical in appearance and size, but are not interchangeable. To assure proper cylinder operation, it is extremely important that these seals be used in their correct locations. The correct seal for use on the base of the inner plunger has the sealing lip on the O.D. of the seal as shown in figure 5-12.

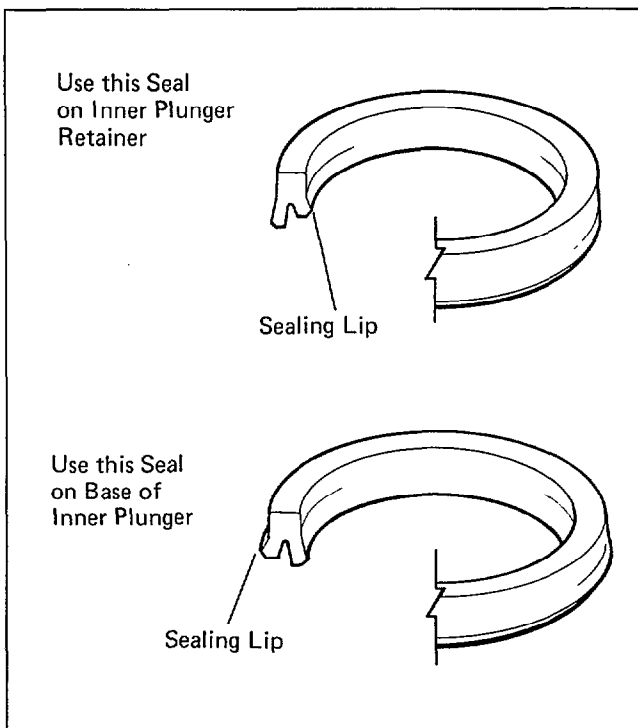


Figure 5-12 Seals

(a) Lubricate the base of the inner plunger with petroleum jelly cut with hydraulic oil.

(b) Hook one edge of the nylon ring in the seal groove. Manually press the ring into the groove, using a circular pattern in applying pressure.

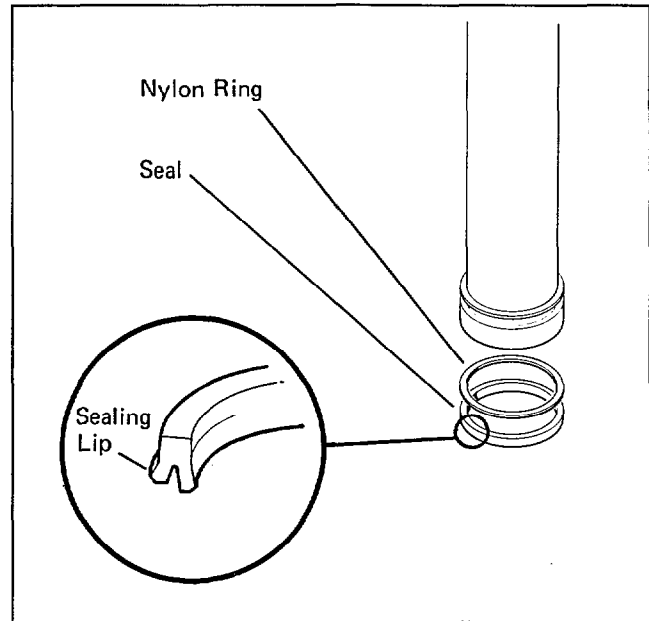


Figure 5-13 Inner Plunger Base

(c) Hook one edge of the seal in the seal groove with the open end of the seal facing the bottom of the plunger. Manually press the seal into the groove, using a circular pattern in applying pressure.

4. Place a new back-up ring and O-ring, in that order, on the O.D. of the intermediate plunger retainer.
5. Place a new seal, nylon ring and wiper ring, in that order, in the intermediate plunger retainer's I.D. seal groove. The open end of the seal should face the threaded end of the retainer.

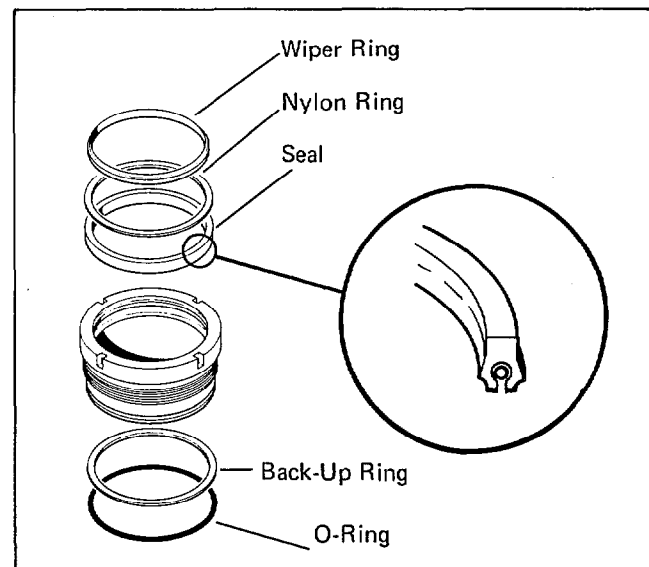


Figure 5-14 Intermediate Plunger Retainer

6. Slide the retainer on to the intermediate plunger. Use petroleum jelly cut with hydraulic oil for assembly lubrication.
7. Place a new back-up ring and O-ring, in that order, on the O.D. of the inner plunger retainer.
8. Place a new seal, nylon ring and wiper ring, in that order, in the inner plunger retainer's I.D. seal groove. The open end of the seal should face the threaded end of the retainer. See figure 5-15.

NOTE: The seal used on the inner plunger retainer and the seal used on the base of the inner plunger are nearly identical in appearance and size, but are not interchangeable. To assure proper cylinder operation, it is extremely important that these seals be used in their correct locations. The correct seal for use in the inner plunger retainer has the sealing lip on the I.D. of the seal as shown in figure 5-12.

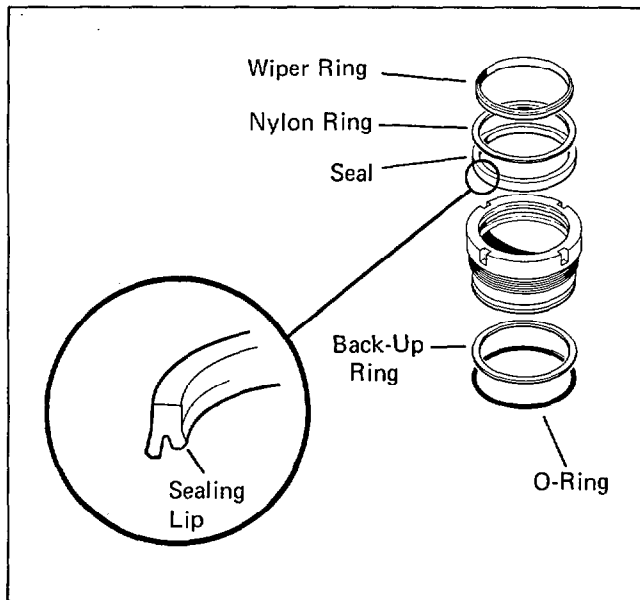


Figure 5-15 Inner Plunger Retainer

9. Slide the retainer on to the inner plunger. Use petroleum jelly cut with hydraulic oil for assembly lubrication.
10. Place the base end of the inner plunger in the top end of the intermediate plunger and slide the two plungers together. Use petroleum jelly cut with hydraulic oil for assembly lubrication.
11. Thread the inner plunger retainer into the intermediate plunger and tighten with a spanner wrench.

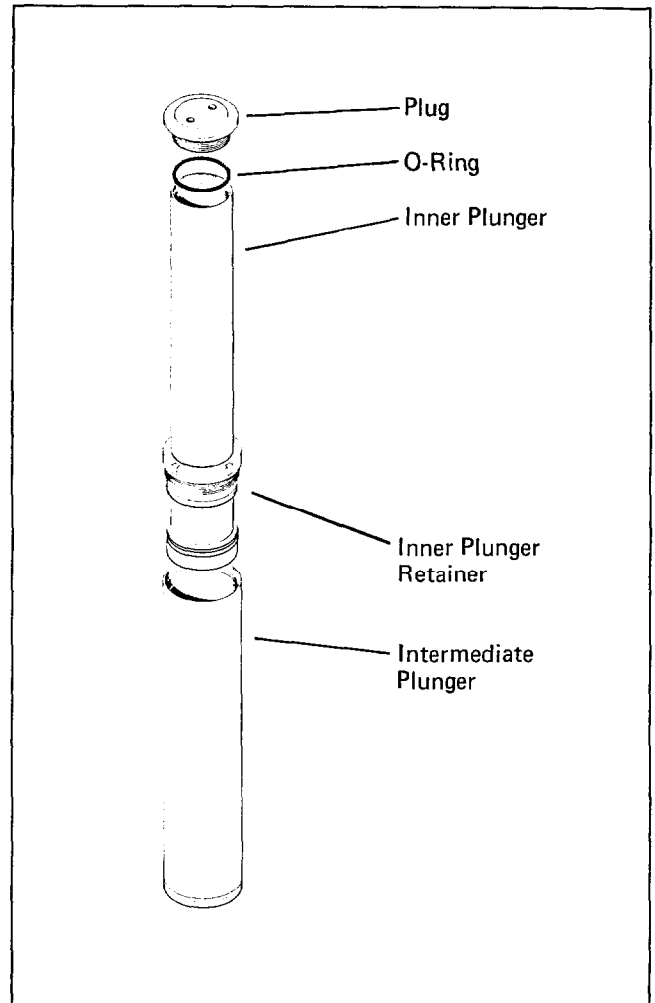


Figure 5-16 Cylinder Assembly

12. Replace the plug in the inner plunger as follows:
 - (a) Place a new O-ring on the plug.
 - (b) Thread two socket head capscrews into the holes on the top of the plug.
 - (c) Secure the inner plunger with a strap wrench to prevent it from turning.
 - (d) Thread the plug into the plunger. Tighten the plug by using a bar between the two capscrews.
13. Lay the shell in three or more "V" blocks and secure it to the workbench with straps.

NOTE: The cylinder must not be clamped in a vice. Clamping may distort the shell, requiring the replacement of the shell assembly.
14. Reinstall the piston half retaining ring and the

two piston halves on the base end of the intermediate plunger.

- Slide the assembled plungers into the shell. Use petroleum jelly cut with hydraulic oil for assembly lubrication.

CAUTION: Always use an overhead crane to lift the assembled plungers.

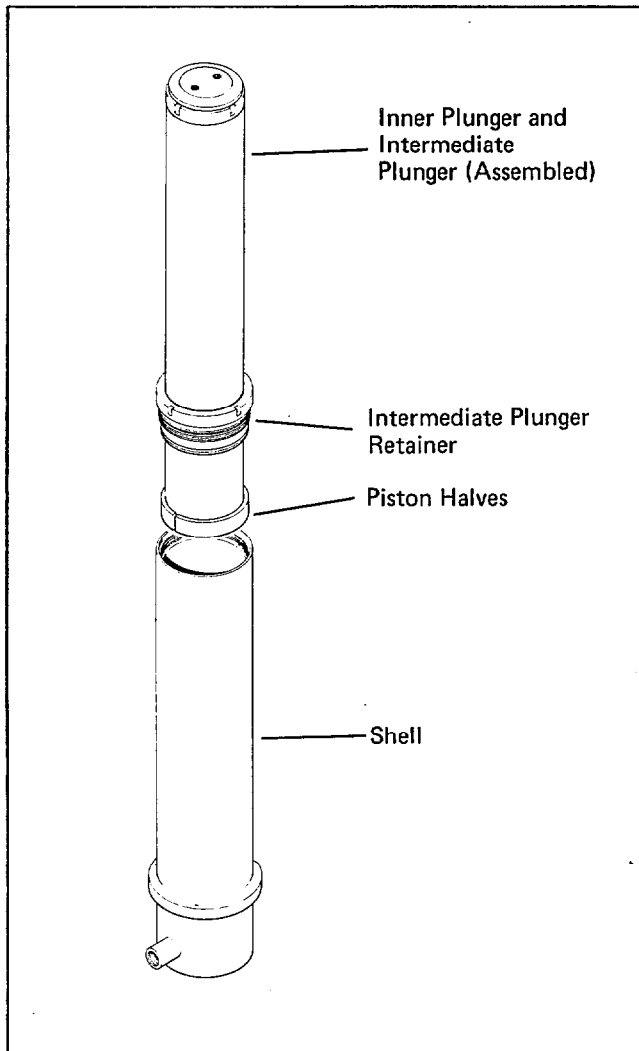


Figure 5-17 Cylinder Assembly

- Thread the intermediate plunger retainer into the shell and tighten with a spanner wrench.

5-13. CYLINDER INSTALLATION

5-14. To install the cylinder, as outlined below, the mast should be still lying on a work surface with the carriage facing up.

- Slide the carriage and crosshead to the top of the mast.

- Reinstall the cylinder in its bracket.

CAUTION: Use an overhead crane to lift and position the cylinder.

- Fasten the crosshead to the inner plunger by reinstalling the two capscrews and lockwashers. If the original capscrews are not used, the replacements must be a grade 5 or better 1/2" UNF x 1" socket head cap screw.

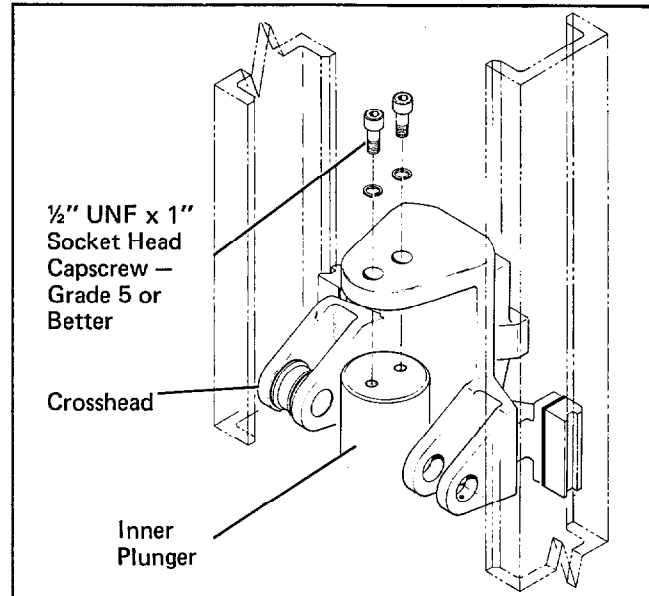


Figure 5-18 Cylinder Installation

- Slide carriage to the bottom of the mast.

5-15. MAST INSTALLATION

- Reposition the mast on the work surface with the carriage facing down.

CAUTION: Always use an overhead crane when lifting or repositioning the mast.

NOTE: The right hand hose guide has a bulkhead bracket welded to the bottom.

- Bolt the right hand hose guide to the two mounting plates on the outer channel.
- Bolt the left hand hose guide to the two mounting plates on the outer intermediate channel.
- Replace the spacer, spring and washer in the cylinder port, making sure the parts are clean and that no dirt or contamination is contained in the port. See figure 5-17.

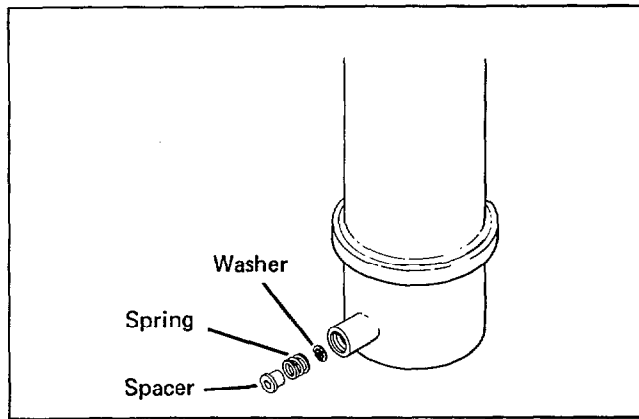


Figure 5-19 Cylinder Port

CAUTION: The spacer, spring and washer must be properly installed in that order in the cylinder port for proper operation.

5. Thread a male connector into the cylinder port.

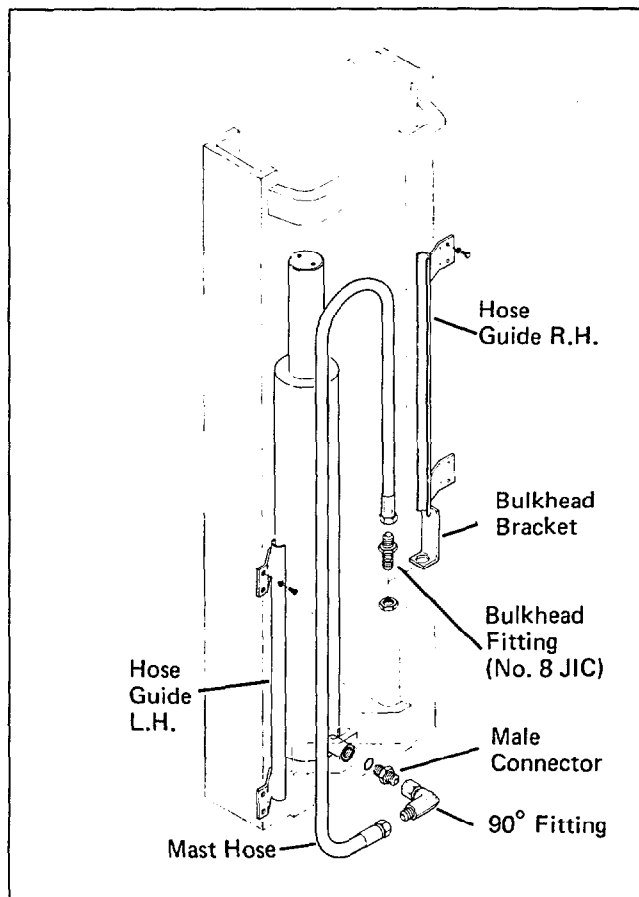


Figure 5-20 Mast Hosing

6. Attach a 90° fitting to the male connector on the cylinder.
7. Connect the mast hose to the 90° fitting.

8. Connect the short side of the bulkhead fitting to the other end of the mast hose.
9. Loop the hose in the hose guides as shown in figure 5-20.
10. Secure the bulkhead fitting to the bulkhead with a jam nut.

NOTE: The hose must not be twisted when connected to the bulkhead bracket. Twists in the hose will result in hose chafing and cause the hose to dislodge from the guides during operation.

11. Thread a 3/4" UNC x 2-1/2" capscrew (grade 5 or better) with a large flatwasher into the hole on each side of the mast as shown in figure 5-21.

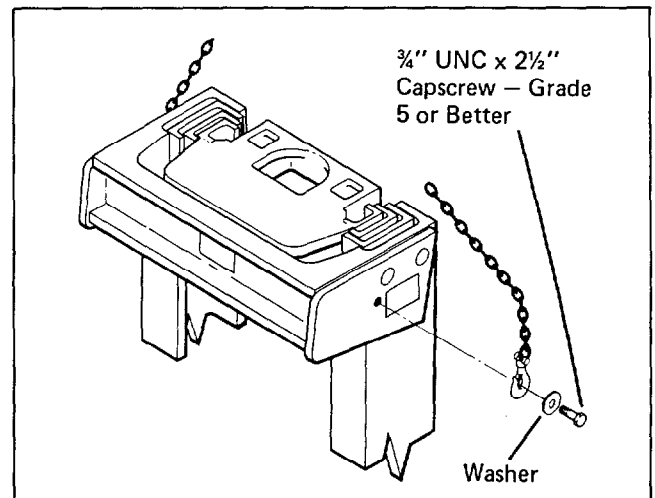


Figure 5-21 Lifting Procedure

CAUTION: The capscrews must be threaded into the holes until they "bottom out" before the mast is lifted.

12. Using suitable chains, lift the mast into installation position.
 13. Connect the supply hose to the bulkhead fitting on the right hand hose bracket.
 14. Lubricate the interior diameters of the base mounting brackets with wheel bearing grease and mount on the truck.
 15. Lubricate the interior diameters of the tilt cylinder anchor brackets with wheel bearing grease and attach the tilt cylinders.
- 5-16. The cylinder is now ready for testing. Never

place the mast back into operation without following the testing and inspection procedures described in sub-section 5-17.

5-17. SAFETY INSPECTION

1. Make sure the carriage chains are lying properly in their sheaves.

CAUTION: Make sure all persons are clear of the mast during testing.

2. Beginning with the mast in its completely lowered position, bleed the cylinder as follows:

(a) Loosen the bleeder screw located near the top of the cylinder as shown in figure 5-22.

CAUTION: Do not unthread the bleeder screw more than 1 turn when bleeding the cylinder. Keep hands clear of the mast while operating the truck valve.

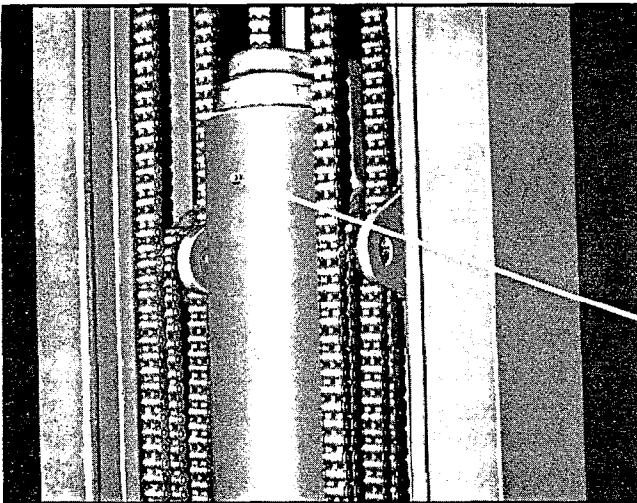


Figure 5-22 Hoist Cylinder Bleeder Screw

(b) Run the lift truck at normal operating volume and pressure and slowly open the truck control valve in the “raise” position. Keep the valve open until a clear flow of oil is obtained around the bleeder screw.

CAUTION: The cylinder must be free of air for safe operation.

(c) Tighten the bleeder screw during cylinder extension and check for leakage.

3. Slowly raise the mast to its full height and then lower to the fully collapsed position. The intermediate plunger of the cylinder should fully extend before the inner plunger begins extending. If the cylinder is not sequencing correctly, remove it from the mast (reference sub-section 5-6) and disassemble (reference sub-section 5-7). Inspect the valve porting in the base of the inner plunger. If there are no obstructions in the valve porting, replace the valve cartridge.

CAUTION: Make sure all persons are clear of the mast during testing and cylinder bleeding operation.

4. During the masts first extension, check to make sure the hose and hose brackets clear the crossmembers.

5-18. FINAL INSPECTION

5-19. In addition to the cylinder testing procedures outlined in sub-section 5-17, every Quad Lift Mast should be rechecked to insure that:

1. The mast hose is properly fitted in the hose guides and remains in the guides during operation (reference sub-section 5-15, steps 1 through 10).
2. The crossbar bracket is securely mounted to the outer channel (reference sub-section 1-8).
3. All hose brackets, hoses, etc. clear the crossbar bracket during operation.
4. The hoist cylinder is bled and free of air, the bleeder screw is tight and there is no leakage occurring (reference sub-section 5-17, step 3).
5. All “No Hand Hold” decals are legible in their proper location and the paint masks have been removed (reference paragraphs 4-12 and 4-13).
6. The chains are free of paint and weld splatter.
7. All mast channels are lubricated with graphite base grease (30% graphite base recommended).

Do you have questions you need answered right now? Call your nearest Cascade Service Department.

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