



● Service Manual

30C, 55C, 80C Viewmast® II Triple Free-lift Roller Masts

Serial Numbers 658437 through 692673

●
●
Manual Number 667433 Rev. 1

cascade®

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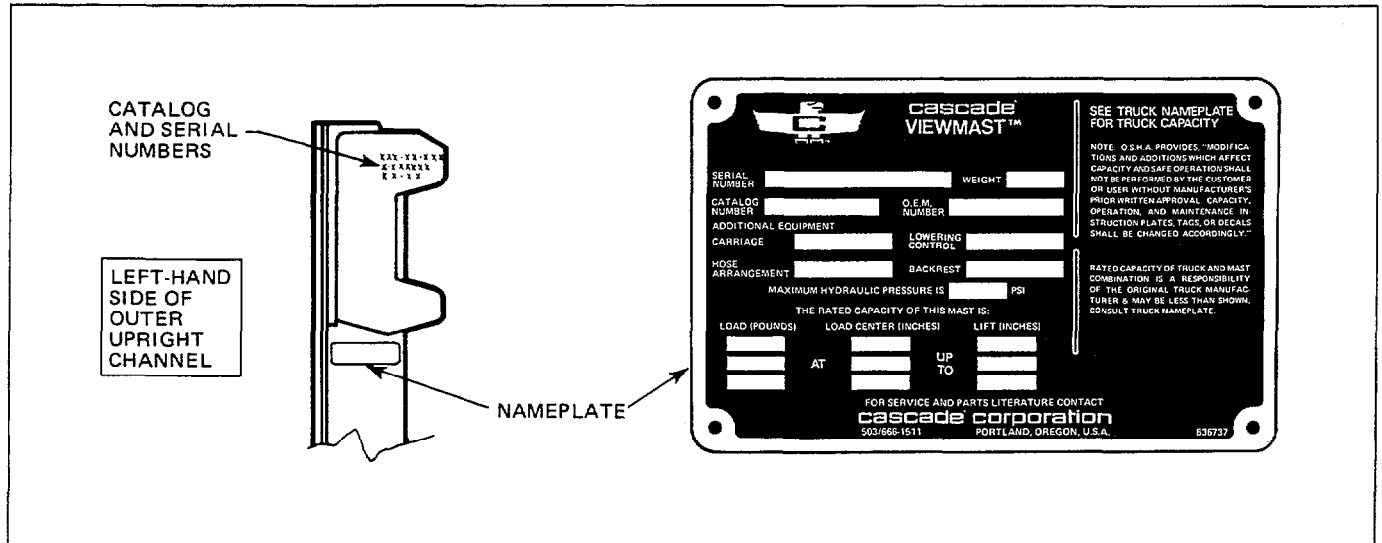
Section 1 Introduction

This manual provides the installation instructions and maintenance, troubleshooting, and service procedures for the Cascade Viewmast® II a three-stage, full free-lift roller mast.

Viewmast® II provides **exceptional visibility** for the lift truck driver. The mast carriage and upright channels are **all-roller** mounted, which results in smooth operation and long service life. A unique, three-stage hoist cylinder provides fast operation

and **uniform lifting and lowering speeds of the carriage.**

In any communication about your Cascade Viewmast® II, always refer to the mast catalog and serial numbers stamped on the mast nameplate. If the nameplate is missing, these numbers are also stamped on the left-hand side plate of the upper crossbar.



! WARNING

Do not install a Viewmast® II on a truck with a rated capacity **greater** than the capacities shown by the accompanying chart.

CASCADE VIEWMAST II	TRUCK CAPACITY AT 24-INCH LOAD CENTER
30C	3000 Pounds
55C	5500 Pounds
80C	8000 Pounds

Rated capacity of the truck/mast combination is a responsibility of the original truck manufacturer and may be less than shown on the mast nameplate. Consult the truck nameplate.

2.1 Truck System Requirements

To achieve the maximum lifting capacity of the mast, the truck relief valve should be set to relieve at the pressures indicated on the chart below. This chart also indicates the hose and fitting size to use between the truck control valve and the mast bootstrap hose.

Cascade Viewmast II	Minimum Relief Pressure	Maximum Relief Pressure	Hose Sizes	Fitting Thread Sizes
30C Triple	1650 PSI	2000 PSI	# 8	3/4-16
55C Triple	1900 PSI	2100 PSI	# 8	3/4-16
80C Triple	1800 PSI	2200 PSI	# 10	7/8-14



WARNING: For proper truck stability or to prevent interference, tilt restriction may be required. Contact the truck manufacturer or one of the Cascade Service Departments listed on the back cover for the specific tilt modification required. Note: To achieve the proper tilt restriction, contact the lift truck manufacturer, or your truck service manual.

IMPORTANT: Standard Viewmast® II masts are compatible with SAE 10W petroleum base oil per Mil. Spec. MIL-0-5606 or MIL-02104 B only. Use of synthetic or aqueous base hydraulic oil is not recommended. If fire resistant hydraulic oil must be used, contact one of the Cascade Service Departments listed on the back cover.

2.2 Mounting Bracket Installation

If it is necessary to install mounting brackets and crossmembers to fit your truck, consult with the nearest Cascade Service Department listed on the back cover. You must supply dimensions **A** through **F** shown below in Figure 1. Failure to install the correct brackets and crossmembers can result in mast structural failure, bodily injury and loss of warranty.



WARNING: Failure to install the correct brackets and crossmembers can result in mast structural failure, bodily injury and loss of warranty.

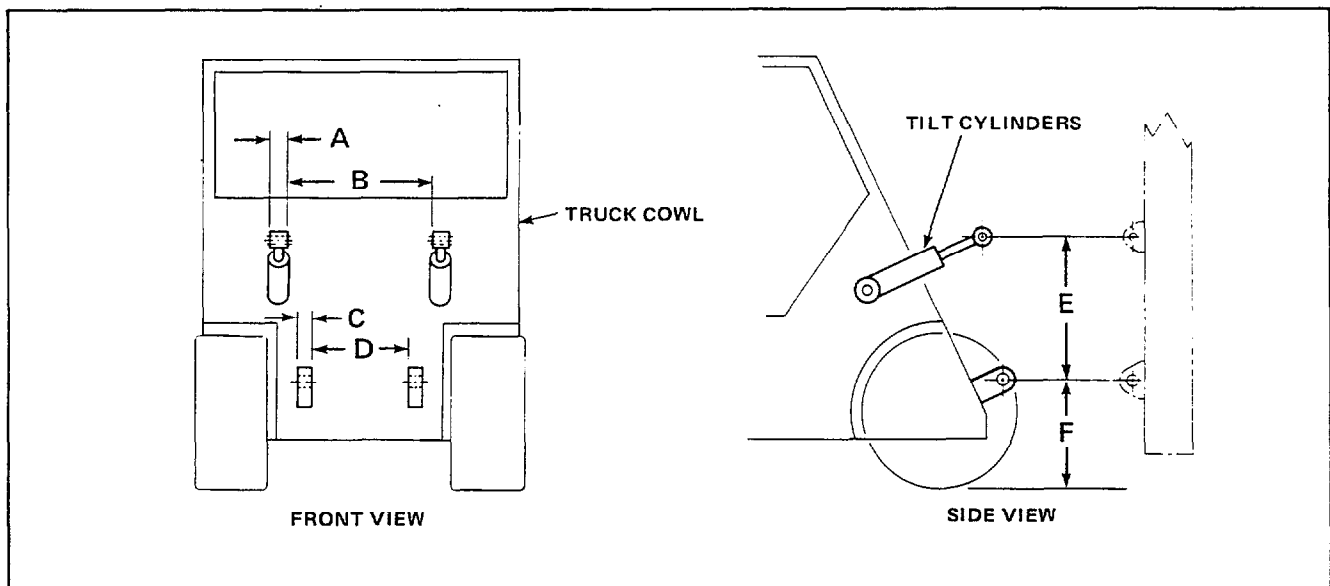


Figure 1. Determining Mounting Bracket and Crossmember Location.

Section 2 Installation Instructions

2.2 Mounting Bracket Installation(Cont.)

1. Mounting bracket and crossmember welding must be performed by a qualified welder only, using the following procedures:
 - a. Disassemble the outer channel from the mast prior to welding. See Section 5.3-6 for disassembly procedures.
 - b. Clean all surfaces to be welded. Remove paint, oil, grease and other contaminants.
 - c. Locate the mounting brackets and crossmembers on the mast channels.
Clamp in place with a "C" clamp. Protect the mast channel inner surfaces from weld splatter.
 - d. Use only 7018 low hydrogen electrodes AWS E7018, 5/32" diameter. Electrodes must be in good condition. Bake as required to remove all moisture per electrode manufacturers procedures.
 - e. Use DC reverse polarity, or an AC welding machine. Set the amperage at 175 amps.
 - f. Preheat the upright and mounting brackets to 100 F. Monitor with a Tempstick (crayon). Do not weld in a drafty area.

WARNING: Weld areas that will be vertical seams when the mast is standing upright only. DO NOT WELD ANY HORIZONTAL SEAMS.

- g. Weld areas that will be vertical seams when the mast is standing upright only. DO NOT WELD ANY HORIZONTAL SEAMS. See Figure 2.
- h. Weld the mounting brackets and crossmember with a .25 in. minimum fillet, holding a close arc. Weld in the flat position only. Do not oscillate or use a wash bead pattern. Make the weld in three passes. Let the weld slow cool.
- i. Remove slag and inspect the weld. The following defects are not allowed: undercut, overlap, stress cracks and porosity. Clean the weld area and repaint with Cascade paint part number 668209.

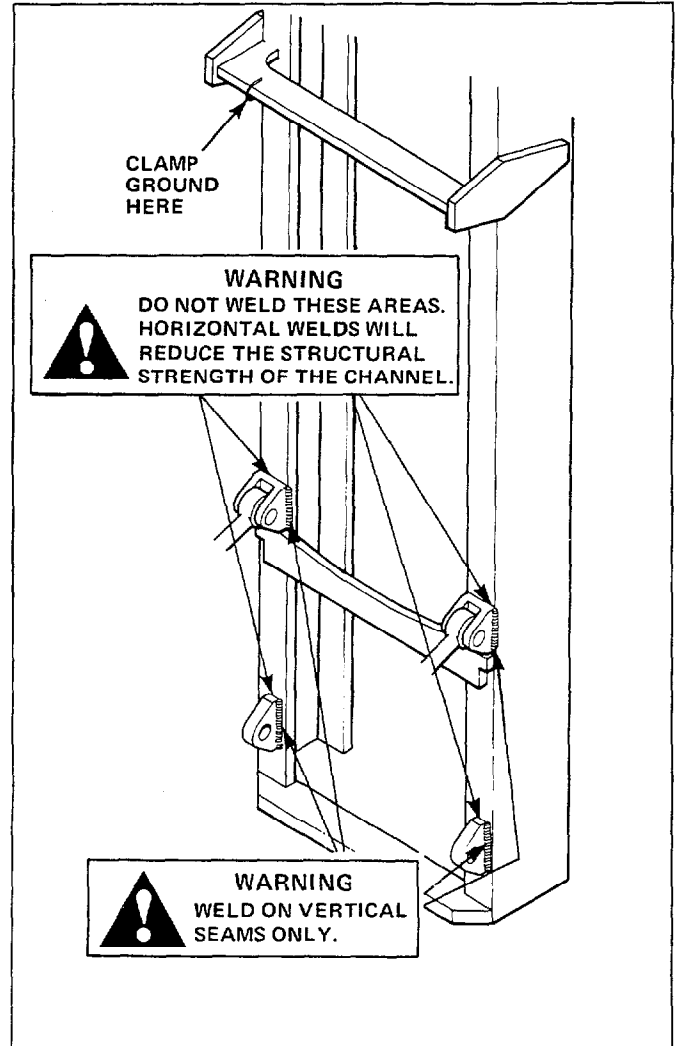


Figure 2. Clamp Ground and Weld.

2. The measurement shown in Figure 3 should be taken after welding and cooling the mast. This dimension must be maintained for the uprights to slide together.
3. Reassemble the mast as described in Section 5.3-8.

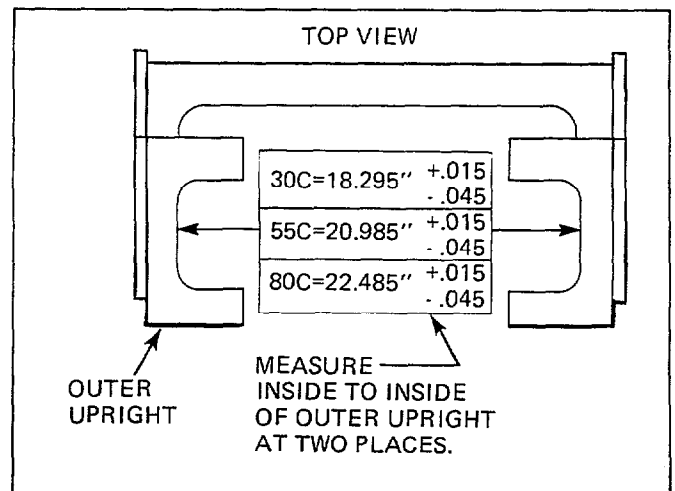


Figure 3. Dimensional Inspection

Section 2 Installation Instructions

2.3 Mast Installation

1. Lubricate the bearing surfaces of the base and tilt cylinder mounting brackets with chassis grease.
2. Lift the mast by a link chain wrapped twice around the upper channel crossmembers. Position the mast into place on the lift truck and secure the base mountings.

IMPORTANT

Prior to connecting the tilt cylinders to the mast, make sure the cylinders "bottom" evenly. Adjust the tilt cylinders as required to prevent the mast from "racking" during tilting. Refer to your truck service manual for procedures.

3. Connect the tilt cylinders to the cylinder anchor brackets.
4. Before connecting the truck hose to the mast bootstrap, connect the truck hose to the truck return fitting and actuate the control valve to flush the system with hydraulic oil.
5. Connect the lift truck hose to the mast bootstrap hose. See Figure 4. The lift truck hose can be SAE 100 R2 or R9. NOTE: Use as few fittings as possible and always use 45° elbows instead of 90° elbows. Keep the hose lengths to a minimum. Avoid sharp bends or pinch points when routing the hose.

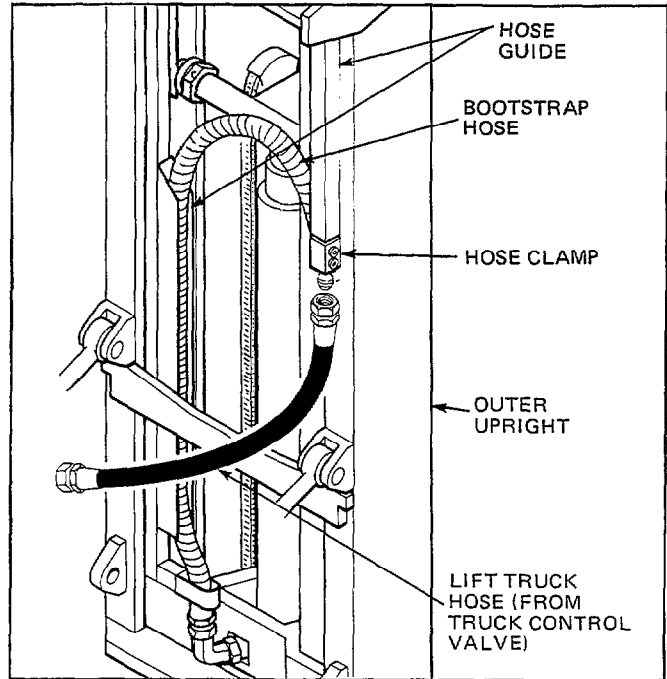


Figure 4. Cylinder and Truck Hose Connection

2.4 Operational Inspection and Adjustments

CAUTION

The factory set adjustments may not be correct for your truck. Check each of the following before using the mast for the first time.

- Bleed air from the mast cylinder as described in Section 5.1-7. Do not use bleed screw on side of cylinder shell.
- The hoist cylinder must sequence as described in Section 5.1-8.
- Inspect the chains and check chain tension as described in Section 5.4-1.
- Check crosshead rollers for proper adjustment as described in Section 5.1-9.
- Inspect the cylinder hose for correct tension and tracking over the rollers. Refer to Section 5.3-13.
- Inspect the bootstrap hose for correct tracking in the hose guides. Adjustments to the hose are made by loosening the hose clamp shown in Figure 4. It may be necessary to loosen the connector fitting between the lift truck hose and bootstrap hose to straighten out the hoses.

For proper operation and an extended service life, your Viewmast® II should be inspected and serviced regularly as part of your normal lift truck maintenance schedule according to the following outlines.

The recommended inspection intervals are for masts operating under normal conditions. If the mast is operating in severe

conditions or very corrosive atmospheres, these operations should be performed more frequently.



WARNING: Never work on the mast with a load on the forks or attachment or while anyone is near the lift truck control handles.

3.1 Daily Inspection

Perform the following at the beginning of each work shift:

- Extend the carriage a few inches off the ground and make sure the carriage chains are under equal tension. Refer to Section 5.4-1.
- Extend the mast to its full height to make sure the hoist cylinder sequences properly. The primary plunger should extend fully, then the master and slave plungers should extend together. Make sure the mast channels and carriage extend freely without binding. Refer to Section 5.1-8.
- While the mast is extended, inspect the upright channels for proper lubrication. Refer to Section 5.3-8 step 1.
- With the mast extended, make sure the hoist chains are under equal tension. Refer to Section 5.4-1.

- Lower the mast and make sure the cylinder sequences properly. The master and slave plungers should lower first, then the primary plunger should lower. Make sure the mast channels and carriage lower freely without binding. Refer to Section 5.1-3.
- Make sure the cylinder hose is not twisted and is traveling smoothly in the hose guides. Check the hose to be sure it is not scuffing. Minor adjustments to the hose can be made by loosening the hose clamp and twisting the hose slightly to fit in the guides.
- Be sure the urethane cushions at the base of the outer and intermediate channels are not flattened or distorted.
- Check crosshead roller clearance to assure proper operation without binding. Refer to Section 5.1-9.

3.2 100 Hour Inspection

After each 100 hours of lift truck operation, in addition to the daily inspection:

- Inspect and lubricate the full length of each pair of hoist chains with SAE 40 oil.

CAUTION: The chains must be coated with a film of lubricant at all times.

- Check each pair of hoist chains for wear and stretch. Refer to Section 5.4.

3.3 500 Hour Inspection

After each 500 hours of lift truck operation, in addition to the daily and 100 hour inspection:

- Check the clearances for load rollers. Refer to Section 5.3-12.

Section 4 Troubleshooting

The following table lists problems that may be encountered on your Quad Viewmast® II, the probable causes, and the recommended corrective action that should be taken to restore the mast to normal operating condition.

NOTE: Any time oil is added to the truck reservoir, check the hoist cylinder for possible entrapment of air. Refer to Section 5.1-7.

PROBLEM	PROBLEM CAUSE	SOLUTION		
Hoist cylinder doesn't lift load or won't move— ● Empty	a) Plugged inlet hose	a) Unplug hose or replace		
	b) Insufficient oil	b) Check truck hydraulic system for correct oil level in tank, defective pump or pump drive, leaks in the lines or disconnected control valve linkage. Repair or replace as necessary.		
	c) Bent or jammed plungers. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	c) Replace defective plungers.		
	● Loaded	a) Plugged piston check valve—master may move.	a) Unplug check valve or replace.	
		b) Reversed piston check valve—master may move.	b) reverse direction of check valve – arrow-up.	
		c) Truck relief setting low.	c) Raise truck relief setting to specified level. Do not exceed: 30C – 2000 psi 55C – 2100 psi 80C – 2200 psi	
		d) Over capacity.	d) Reduce load to specified capacity.	
		e) Mechanical bind due to bent plunger(s), bad rollers and/or bad cross head rollers. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	e) Remove mechanical bind by replacing/freeing plungers and rollers.	
		Mis-sequencing— ● Empty or light load	a) Sequence rod adjusted too long	a) Adjust sequence rod. (Turn clockwise.)
			b) Bent plungers. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	b) Repair or replace as necessary.
c) Master piston ball check not seating properly. (Master will move during primary stage.)	c) Clean and/or replace piston ball check assembly.			
d) Master piston I.D. O-ring seal leaking. (Master will move during primary stage.)	d) Replace O-ring and back-up ring.			
e) Relief valve defective. (Master will move during primary stage.)	e) Replace relief valve—do not adjust or repair.			
f) Master seal worn out. (Master will move during primary stage.)	f) Replace all cylinder seals.			
g) Master piston check valve open.	g) Replace check valve.			
h) Sequence rod out of adjustment. (Too long.)	h) Adjust sequence rod. (Clockwise.)			
● Loaded	a) Piston sequence valve defective. (Master will move during primary stage.)		a) Repair or replace valve.	
	b) Master piston ball check not seating properly. (Master will move during primary stage.)		b) Clean and/or replace piston ball check assembly.	
	c) Master piston I.D. O-ring seal leaking. (Master will move during primary stage.)	c) Replace O-ring and back-up ring.		
Primary up - 1st Slave up - 2nd Master up - 3rd, if at all.				
Primary up-1st Master/Slave-2nd Slave stops short of full lift.				

Section 4 Troubleshooting

PROBLEM	PROBLEM CAUSE	SOLUTION
● Loaded (Continued)	d) Master seal worn out. (Master will move during primary stage.)	d) Replace all cylinder seals.
	e) Sequence rod stroke adjusted too short.	e) Adjust sequence rod. (Turn counter-clockwise.)
	f) Bent plungers. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	f) Repair or replace as necessary.
	g) Check valve defective. (Open.)	g) Clean or replace as necessary.
	h) Relief valve defective. (Master moves at all times.)	h) Replace relief valve. Do not adjust or repair.
● Empty or loaded Master up-1st-slow Primary up-2nd (or during master) Slave up-3rd	a) Relief valve open.	a) Replace relief valve - do not adjust or repair.
Hoist cylinder drifts-		
● All plungers down	a) External leak in pressure line.	a) Tighten or replace as necessary.
	b) Truck valve defective-cycle to full lift height to verify.	b) Repair or replace truck valve.
	c) External leaks at retainers.	c) Replace all cylinder seals.
● Slave plunger down-Master plunger up.	a) Relief valve defective.	a) Replace relief valve-do not adjust or repair.
	b) Master piston check valve leaking.	b) Replace check valve.
Master plunger drifts up when load is lifted, then stops. (Approximately 1-2")	a) Air in cylinder.	a) Bleed air from cylinder.
Spongy or jerky action.	a) Air in cylinder.	a) Bleed air from cylinder.
	b) Sticky or defective truck relief valve. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	b) Remove and check truck relief valve. If contaminated oil caused the malfunction drain and flush the system, change the filter, and refill with fresh oil.
	c) Bent or damaged cylinder plunger(s). ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	c) Disassemble, check and repair cylinder assembly.
	d) Load rollers improperly adjusted or defective. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	d) Adjust or repair as necessary.
	e) Mast channels improperly lubricated. ▲ WARNING: Extreme care should be used when working on a unit when the carriage (with or without load) is in a raised position.	e) Lubricate mast.
	f) Low battery charge.	f) Charge battery.
	g) Low pump volume.	g) Install accumulator.
	h) Low oil level.	h) Fill oil reservoir and bleed cylinder.
	i) Insufficient hydraulic tank capacity or baffles.	i) Install larger tanks or baffles.
	j) Improperly sequencing mast cylinder.	j) Adjust sequence rod.
	k) Other.	k) Contact Cascade Corporation.

5.1 Hoist Cylinder

5.1-1 Description

The hoist cylinder, shown in Figure 6, is a three-stage, displacement cylinder. It consists of a shell with three hollow, telescoping plunger assemblies. The slave plunger (smallest diameter) telescopes into the primary plunger, and the primary plunger telescopes into the master plunger (largest diameter).

The shell, master plunger, and primary plunger are threaded at one end to receive retainers. A retainer is threaded into the shell to limit the stroke of the master plunger. A retainer is threaded onto the master plunger which secures an aluminum bearing to limit the stroke of the primary plunger. A retainer is threaded onto the primary plunger which secures an aluminum bearing to limit the stroke of the slave plunger.

Each retainer has a Bi-Element seal assembly to provide a high-pressure hydraulic seal between the retainer and its adjacent plunger. In addition, each retainer has a static (non-moving) O-ring assembly and a plunger wiper.

A piston assembly is threaded onto the base of the master plunger. The piston has a Bi-Element seal assembly to provide a high-pressure hydraulic seal between the piston and the cylinder shell.

IMPORTANT: During cylinder operation, the pressure produced in the cavity between the cylinder shell and the master plunger is greater than that produced at the cylinder base (truck pressure). Thus, the seal assembly on the master plunger piston (item 35, Figure 6) **must** be installed with the lip toward the plunger end of the cylinder.

The master plunger piston also has a static O-ring seal to seal between the piston and the master plunger.

A synthetic bearing is installed on the master plunger piston and cast iron half-rings are installed at the base of the primary and slave plungers.

The master plunger piston also serves as a housing for a poppet-operated check valve, a relief valve, and a sequence valve assembly. The sequence valve assembly ensures the proper sequencing of the cylinder plungers during extension and retraction. It is comprised of a spring-loaded ball and seat assembly actuated by a spring-cushioned plunger. The sequence valve plunger is actuated by a rod. The valve plunger is attached to the rod at the rod's lower end. The rod extends through a square hole in the base of the primary plunger and into the central cavity of the slave plunger and terminates near the top of the slave plunger.

A spacer and circular plate are installed at the top of the sequence valve actuating rod. They are held in place by a

spring that bears between the circular plate and the shoulder of a special adjusting nut, threaded onto the upper end of the rod. Access to the adjusting nut can be gained by removing the bleed fitting threaded into a port at the top of the slave plunger. To turn the nut, insert a 3/16-inch, long-handle, Allen wrench. Refer to Section 5.1-8.

A lowering control valve is located at the supply port at the base of the cylinder shell. It consists of a spacer, spring, and special washer held in place by an elbow fitting threaded into the port. The lowering control valve is a one-way flow limiter. When the cylinder is extended, oil is free to flow unrestricted around and through the special washer. However, when the cylinder is lowered, the oil flow produced by the retracting plungers forces the special washer toward the spacer. This forces oil to flow through the orifice in the center of the washer (as long as the washer is forced completely against the spacer). This restriction allows the mast to lower at a controlled speed, depending upon the weight of the load.

5.1-2 Bi-Element Seal Assembly (Fig. 13)

The hoist cylinder assembly contains four Bi-Element seal assemblies. See Figure 5. Each seal assembly is comprised of a seal element and an anti-extrusion element. The seals are used in combination with nylon back-up rings. The seals must be installed in the cylinder assembly with the seal element facing the highest pressure.

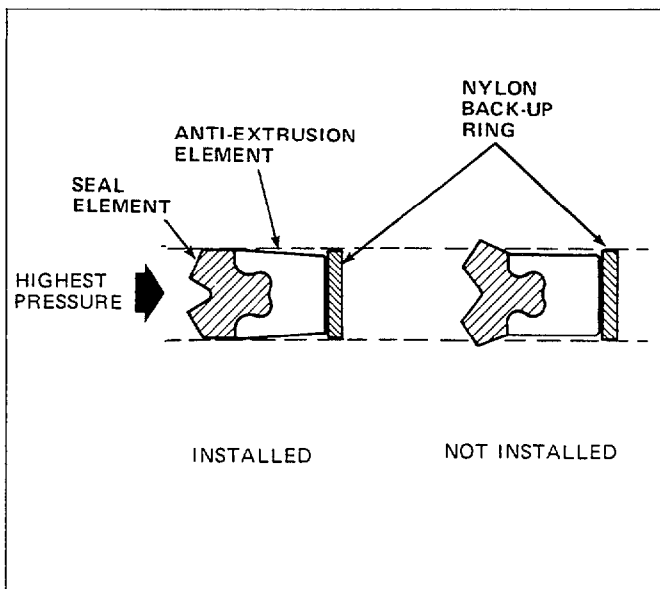


Figure 5. Bi-Element Seal Assemblies

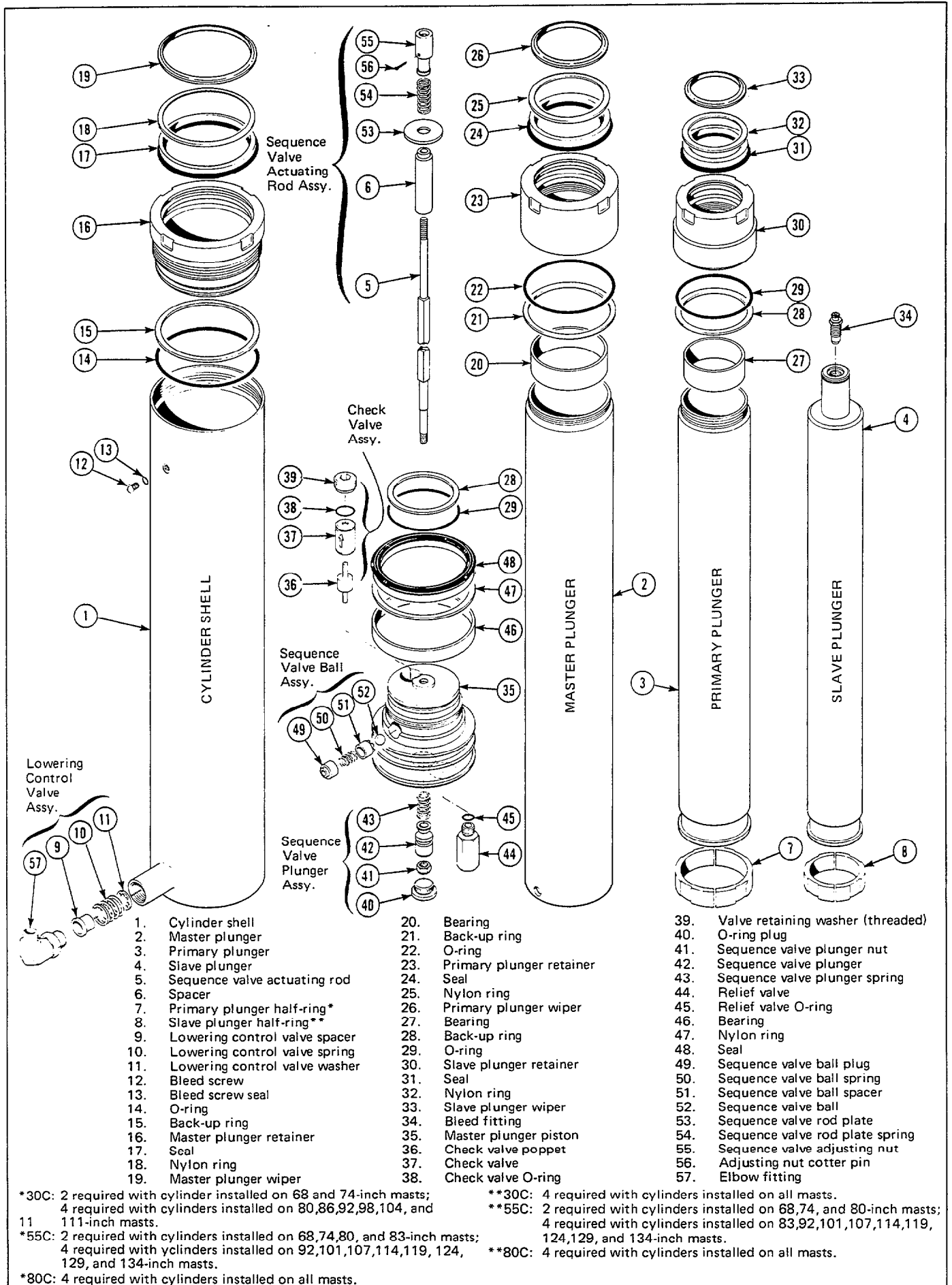


Figure 6. Exploded View of Hoist Cylinder Assembly

5.1-3 Cylinder Operation (Figure 7)

View A

The entire cylinder assembly is filled with oil at the beginning of its lifting sequence. Since the cylinder is fully lowered, the check valve is unseated by its actuating poppet in contact with the base of the cylinder shell. Since the sequence valve ball is seated, oil in the cavity between the cylinder shell and the master plunger (referred to as "sequencing oil") is trapped. The master plunger is thus prevented from moving. As a result, when oil from the truck enters the cylinder through the inlet port, it flows through the angled port in the master plunger piston and through the unseated check valve to the primary and slave plunger cavity.

View B

Since the area of the primary plunger piston is greater than that of the slave plunger, the primary plunger begins to extend. As the primary plunger reaches the end of its stroke, its base contacts the spacer at the top of the sequence valve actuating rod. The actuating rod thus shifts upward, pulling the sequence valve plunger upward with it. The sequence valve plunger unseats the sequence valve ball. The point at which this event occurs may be adjusted by turning the special adjusting nut at the top of the sequence valve actuating rod.

View C

The trapped sequence oil is at a pressure greater than that from the truck. (This pressure intensification results because the area of the piston that forms the cavity between the cylinder shell and the master plunger is less than the area of the base of the master plunger piston. Remember that pressure equals force divided by area. Since the area of the piston in the sequence oil cavity is less, the pressure in the cavity is greater.) Thus, as soon as the sequence valve ball is unseated, the previously trapped high-pressure sequencing oil flows past the unseated sequence valve ball to the primary plunger cavity and seats the unseated check valve. Oil from the truck can thus no longer flow to the plunger cavities and truck pressure begins to extend the master plunger.

View D

As the master plunger extends, the sequencing oil flows past the unseated sequence valve ball and extends the slave plunger from within the extended primary plunger. This occurs until the cylinder is fully extended.

Since the volume of the sequencing oil cavity is nearly identical to the volume of the slave plunger cavity, master and slave plungers extend at the same speed. The volume of oil required to lift the master plunger is approximately **twice** that required to extend the primary plunger (the first plunger to extend). Thus, the master plunger extends at **half** the speed that the primary plunger extended. However, since the master and slave plungers extend simultaneously at the same speed, the **combined speed** of the master and slave plungers equals the speed of the primary plunger. As a result, the cylinder assembly extends (and lowers) at a constant speed throughout its complete sequence of operation.

A relief valve (shown in View C) is included in the master plunger piston. If the pressure of the sequencing oil should exceed a value preset by the relief valve, the valve will unseat to allow pressure to be relieved to the base of the cylinder. This could occur each time the cylinder is extended or when excessive pressure build-up of the sequencing oil, such as would occur when the cylinder is at rest, is heated by ambient air. A check valve is located in the base of the slave plunger piston. The check valve allows release of trapped oil which could occur if oil leaks past the seal and gets caught between the piston and retainer.

The lowering of the cylinder assembly is a reversal of extension.

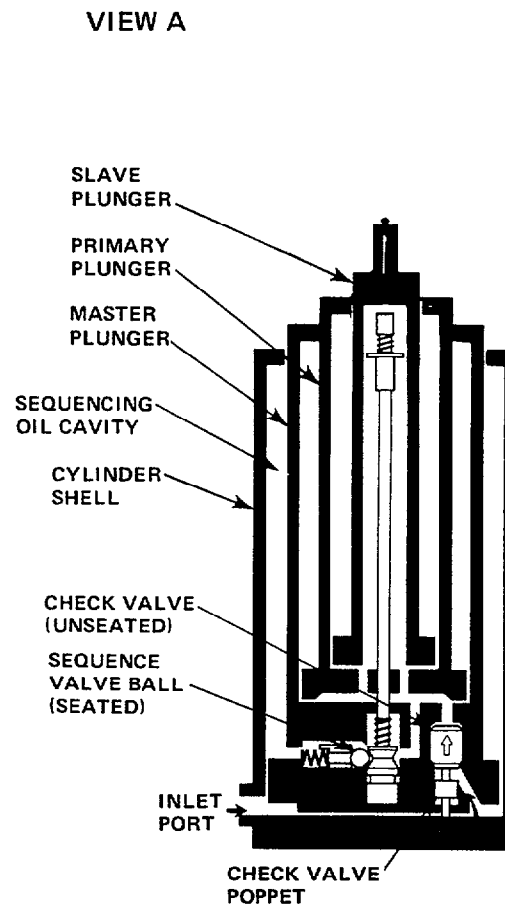
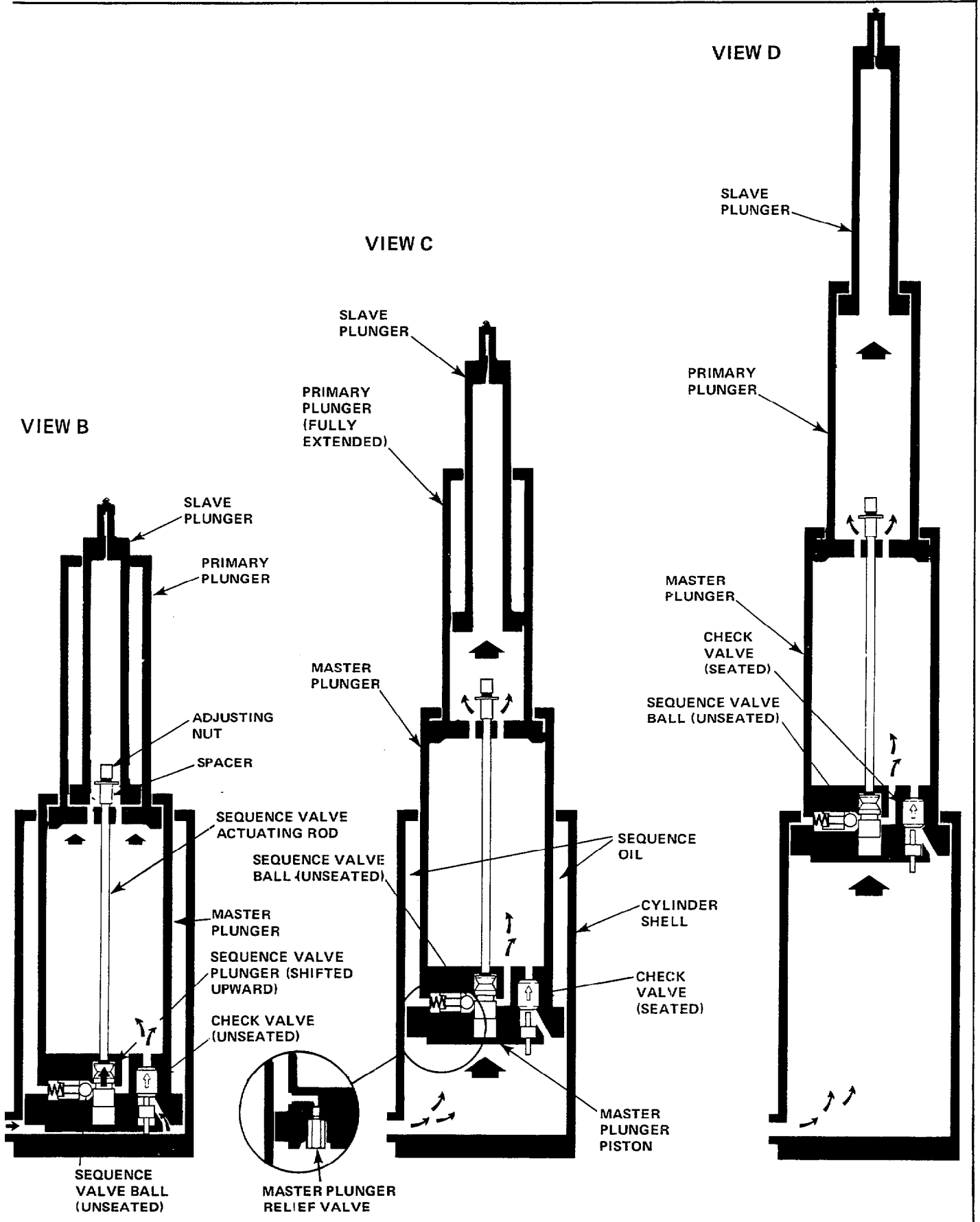


Figure 7. Hoist Cylinder Sequence of Operation

Section 5 Service



Section 5 Service

5.1-4 Cylinder Removal

1. Make sure the hoist cylinder is fully lowered.

CAUTION: Always lubricate new seals, O-rings, and wipers with petroleum jelly or hydraulic oil prior to installation.

WARNING: Never work on the mast with a load on the forks or attachment nor while anyone is near the lift truck control handles.

2. Loosen the bleed screw no more than required to bleed off any hydraulic pressure that may remain in the cylinder. The bleed screw is located on the side of the cylinder shell just below the large piston retainer. Tighten the screw securely.
3. Remove the carriage according to the removal procedures specified in Carriage Section 5.2.
4. Remove the pad at the top of the cylinder crosshead.
5. Remove the snap ring that retains the crosshead assembly to the hoist cylinder rod.
6. Remove the crosshead.
7. Wash the cylinder assembly with solvent to remove any foreign material on the shell. Especially clean around the plunger retainers. Blow dry with compressed air. **If you are going to replace the seals, O-rings, and/or wipers in the plunger retainers only, you can do so with the cylinder in place on the mast according to the following procedures (refer to Figure 8).**
 - a. Unthread and remove all three retainers. **Do not remove any of the cylinder plungers.**
 - b. Replace the seals, O-rings, and/or wipers in the retainers as required. Carefully note their positions (see Figure 8). Avoid excessive stretching of the O-ring on the large diameter retainer.
 - c. Install the retainers as described in section 5.1-5 steps 12 through 15. Tighten all retainers to the torque values shown in Figure 8.

If you are going to replace components in addition to those described above, the cylinder must be removed from the mast. Continue as follows.

8. Remove the bootstrap hose from the base of the cylinder. Be prepared to collect oil. **Do not remove the elbow fitting from the cylinder base.** To gain access to the hose fitting, you may have to lift the intermediate channel upright high enough to expose the base of the cylinder. Use another lift truck, hoist, crane, or some other suitable lifting device.

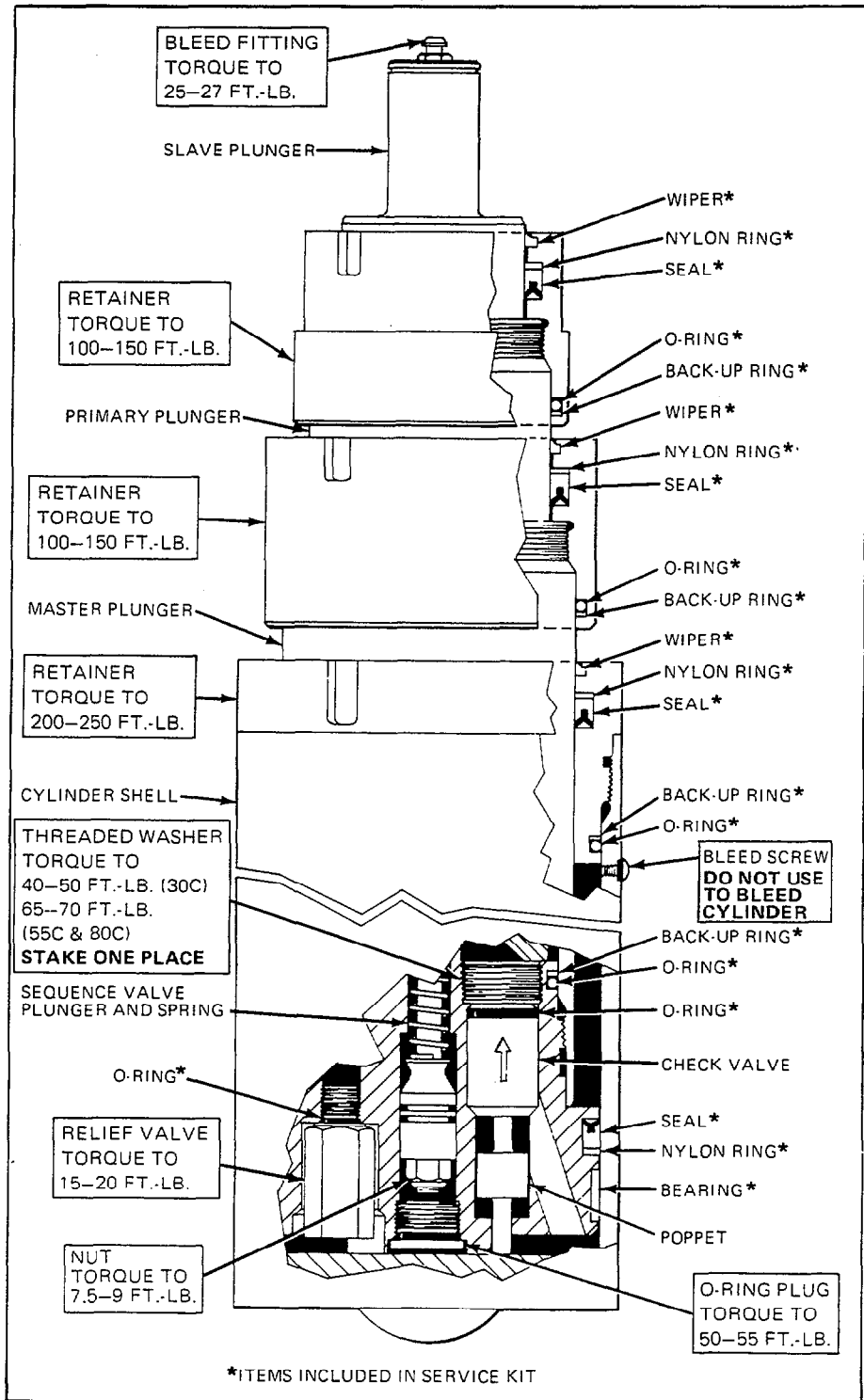


Figure 8. Hoist Cylinder Components

9. Cap the fitting at the base of the cylinder with a high-pressure steel cap (a plastic cap will not afford sufficient protection to the threads if the fitting is "banged" during cylinder removal). Plug the bootstrap hose.
10. Using a lifting strap and hoist, remove the cylinder from the mast.
11. Lay the completely collapsed cylinder on 4 X 4's.
NOTE: Cut 2 (two) 2" deep U-Cuts in each 4 X 4.

Section 5 Service

5.1-5 Cylinder Disassembly, Service and Reassembly

1. Use a claw type spanner wrench to unthread the master plunger retainer. (Item 16, Figure 6.)
2. Slide the master, primary, and slave plungers out of the cylinder shell as an assembly.
3. Remove the seal and nylon ring from the piston at the base of the master plunger using the following procedures. **Be careful not to scratch the seal groove diameter.**
 - a. Pry the seal up from its groove with a dull screwdriver.
 - b. Cut the seal off the piston groove with wirecutters or a knife. Make sure the knife does not scratch the groove or the plunger.
 - c. Remove the nylon ring.

IMPORTANT

When cylinder components are disassembled and seals, O-rings, and wipers are removed, thoroughly wash all metallic parts in solvent. Blow dry with compressed air. Carefully inspect the plungers, cylinder bore, piston, and disassembled valve components. Replace if seriously scored, grooved, pitted, or worn. Minor damage to the cylinder bore and plungers can be removed with 400 grit polishing cloth (wash after polishing). Place components in a clean container until reassembly.

4. Install the new seal and back-up ring on the piston, carefully noting their position (see Figure 8). Avoid excessive stretching of the seal. Using a lubricant such as STP or hydraulic oil will ease seal installation.
5. Replace the bearing on the piston at the base of the master plunger.
6. Remove the relief valve located on the bottom of the master plunger piston. See Figure 9. It is recommended that the relief valve be replaced. Tighten to a torque of 15–20 ft.-lbs.
7. If you are going to replace the check valve and/or the O-ring and back-up ring between the master piston and its plunger, do so now according to the following procedures. If any of these components are **not** to be replaced, proceed to Step 8.
 - a. Remove the O-ring plug from the base of the master piston. See Figure 9.

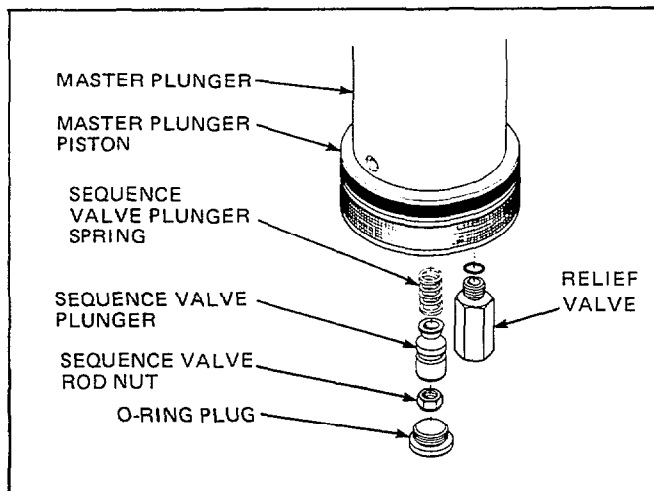


Figure 9. Sequence Valve Plunger Assembly and Relief Valve

- b. Remove the nut retaining the sequence valve plunger and spring. Remove the sequence valve plunger and spring. See Figure 9.
- c. Depress the sequence valve plug protruding through a hole near the base of the master plunger with a screwdriver or a punch. Then, using a spanner wrench in the holes provided in the piston, unthread and remove the piston from the plunger. See Figure 10. You may need a helper to hold the plunger with a strap wrench. When you have turned the piston the first 180°, use your screwdriver or punch to prevent the sequence valve plug

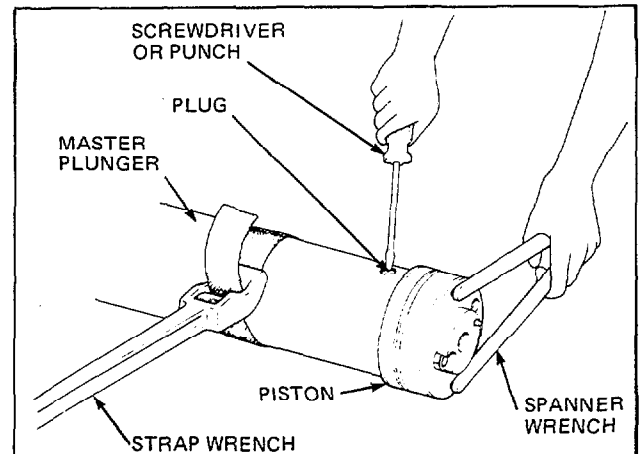


Figure 10. Removing the Piston from the Master Plunger

from snapping into the hole on the other side of the plunger. **Be prepared to catch the sequence valve plug, spring, spacer, and ball when the plug clears the plunger.**

- d. Replace the O-ring and back-up ring on the piston, carefully noting their position. See Figure 8. Avoid excessive stretching of the O-ring during installation.
- e. If you are **not** going to replace the check valve, proceed to Step g.

If you **are** going to replace the check valve, remove the threaded washer retaining the valve. The washer is staked in one place. Remove the valve. (If the poppet behind the valve falls out, it is symmetrical and can be reinstalled either way.) Replace the check valve using a new O-ring. See Figure 11.

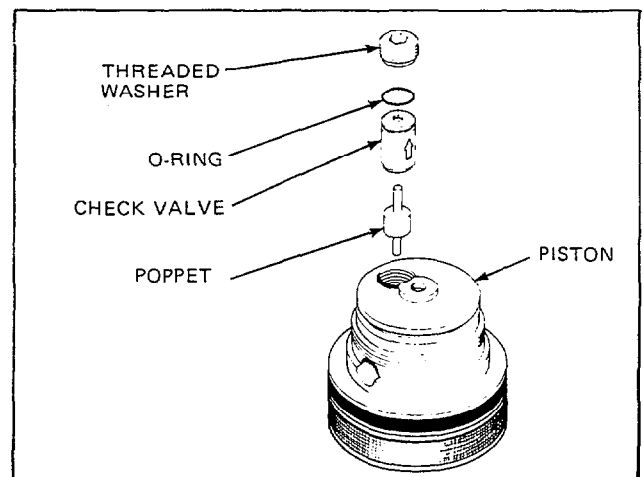


Figure 11. Check Valve Assembly

5.1-5 Cylinder Disassembly, Service and Reassembly (Cont.)

IMPORTANT

Make sure you install the check valve with the arrow (stamped on the valve body) pointing toward the rod end of the cylinder (See Figure 11).

- f. Install and torque the threaded washer to 40–50 ft.-lb. (30C), 65–70 ft.-lb. (55C and 80C). See Figure 8. Stake the washer in place to secure it.
- g. Assemble the sequence valve ball, ball spacer, spring, and plug in place onto the master plunger as shown in Figure 12. Then thread the piston onto the master plunger. As the piston is threaded on, the sequence valve plug will snap into one of the two holes in the plunger. With a

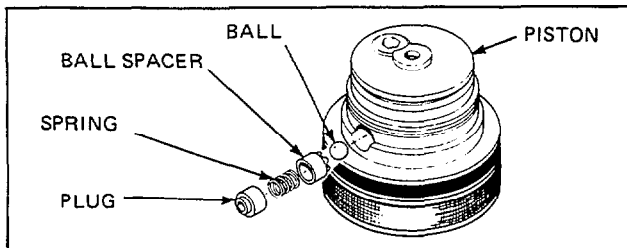


Figure 12. Sequence Valve Ball Assembly

screwdriver or punch, push the plug in and keep turning the piston until it seats. Then back off no more than 1/2 turn until the plug snaps into one of the holes. Use the tools and procedures shown in Figure 10.

- h. Install the sequence valve plunger spring and plunger in the hole in the base of the master piston. See Figure 13. Install and torque the retaining nut to 7.5–9 ft.-lb.
- i. Install the O-ring plug and torque to 50–55 ft.-lb. See Figure 13. Figure 13 illustrates the correct orientation of the sequence valve components when the piston is assembled onto the master plunger.

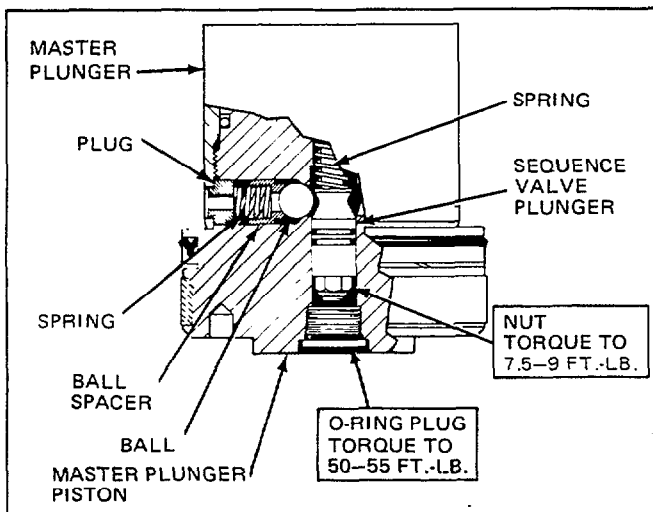


Figure 13. Sequence Valve Assembly, Located at the Base of the Master Plunger

8. Place the largest diameter piston loader in the cylinder shell. See Figure 14. The loader must cover all of the threads but not contact the thread relief chamfer. The length of the stop fins can be trimmed with a sharp knife if more engagement is needed. The piston will not enter the shell if the loader contacts the thread relief chamfer. Apply petroleum jelly to the master plunger seals and loader I.D.

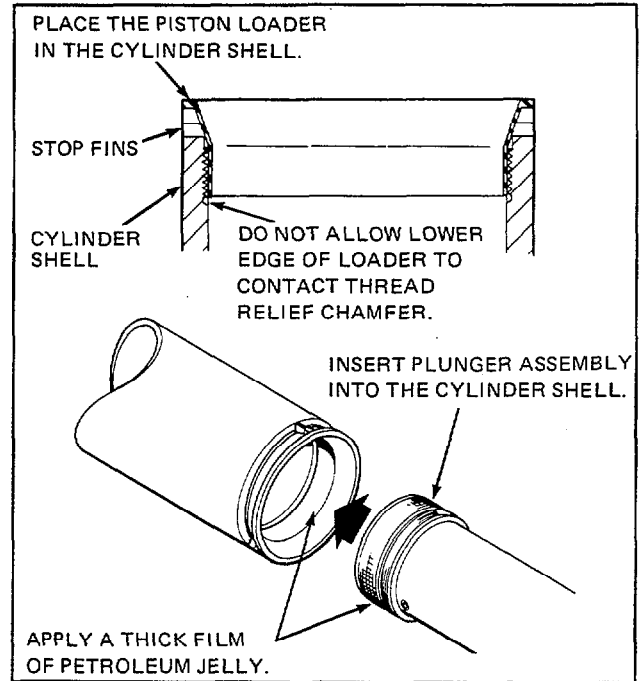


Figure 14. Master Plunger Loader

9. Slide the master/primary/slave plunger assembly all the way into the cylinder shell but don't tighten the large-diameter retainer. See Figure 14.
10. Unthread and remove the upper two retainers, then remove the large-diameter retainer. **Do not remove any of the cylinder plungers.**
11. Replace the seals, o-rings and wipers in the retainers. Lubricate the new seals with petroleum jelly prior to installation. Note the correct seal locations. See Figure 8. Avoid excessive stretching of the o-ring on the large-diameter retainer.
12. Place the second largest retainer loader over the end of the master plunger. Apply petroleum jelly to the loader and inner surface of the master plunger retainer. Load the retainer onto the master plunger then remove the loader. Tighten the retainer to a torque of 200–250 ft.-lbs. See Figure 15.

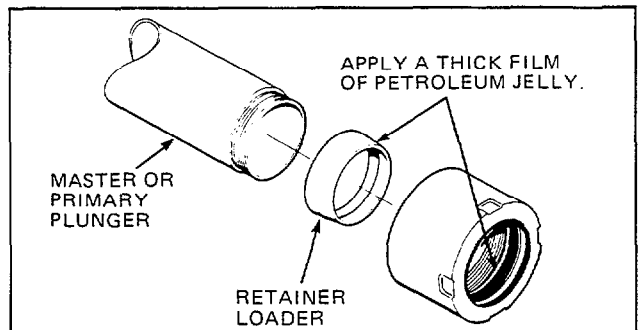


Figure 15. Retainer Loader

13. Place the third largest retainer loader over the end of the primary plunger. Apply petroleum jelly to the loader and inner surface of the primary plunger retainer. Load the retainer onto the primary plunger. Tighten the retainer to a torque of 100–150 ft.-lbs. See Figure 15.

Section 5 Service

5.1-5 Cylinder Disassembly, Service and Reassembly (Cont.)

- Place the smallest retainer loader over the end of the slave plunger. Apply petroleum jelly to the loader and inner surface of the slave plunger retainer. Load the retainer onto the slave plunger. Tighten the retainer to a torque of 100–150 ft.-lbs. See Figure 16.

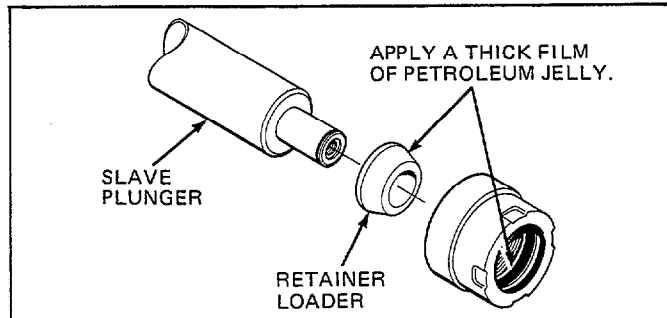
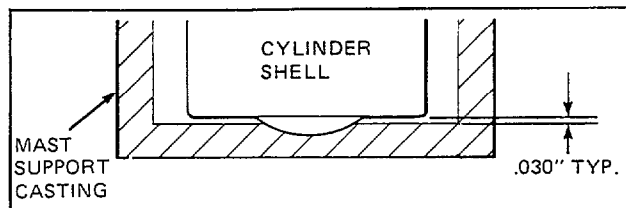


Figure 16. Retainer Loader

- Reinstall the cylinder to the mast by reversing the removal instructions in Section 5.1-4.

CAUTION: Be sure the cylinder is properly seated in the mast support casting, with the pin in the hole.



5.1-6 Lowering Control Valve Service

- Remove the hoist cylinder from the mast as specified in Section 5.1-4.
- Remove the elbow fitting from the base of the hoist cylinder. Be prepared to catch the valve spacer and spring. Remove the lowering control valve special washer. See Figure 17.
- Clean and inspect the valve components and the cylinder inlet port. Replace any defective parts.
- Replace the lowering control valve components as shown in Figure 17.
- Reinstall the cylinder to the mast by reversing the removal instructions in Section 5.1-4.

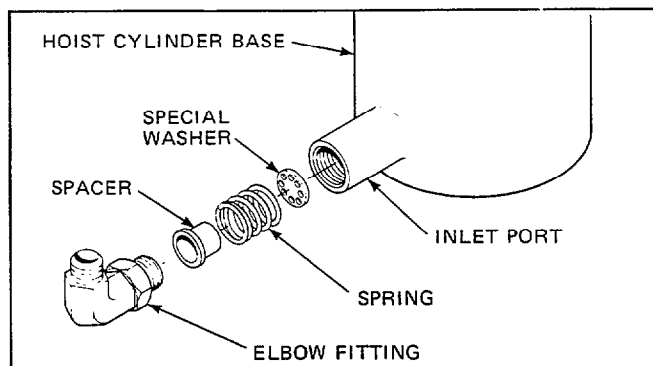


Figure 17. Lowering Control Valve Assembly

5.1-7 Bleeding the Cylinder

Before the mast is put in service, air must be bled from the hoist cylinder according to the following procedures.

- Assemble the forks (or attachment) onto the mast carriage.
- Without a load on the forks, extend and retract the mast through one complete cycle.
- With the mast fully lowered, check the truck hydraulic tank and top off if necessary.
- Extend and retract the mast completely at least four more times. This action will force air in the system to the cylinder center cavity under the bleed fitting.
- Extend the carriage to about 10 inches off the ground.
- The Customer User Kit (661506) includes a metal hex tube wrench (661507) and a length of clear plastic hose (661922). Slide the plastic hose through the hex tube wrench and onto the bleed fitting located at the top of the cylinder cross-head. Put the other end of the tube in a container to collect oil. See Figure 18.

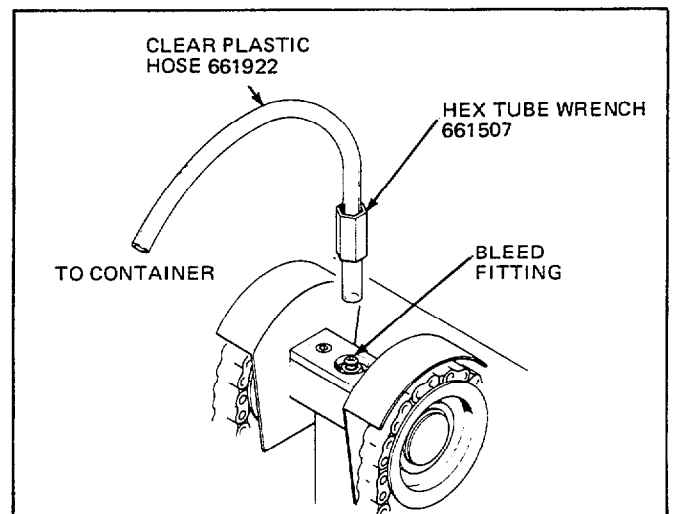
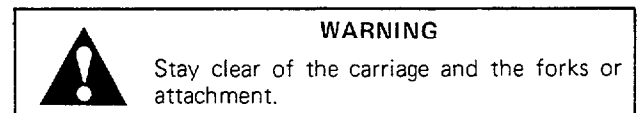


Figure 18. Hoist Cylinder Bleed Kit




- Open the bleed fitting no more than 1/4 turn with the hex tube wrench. The weight of the carriage will force air and hydraulic oil out of the cylinder through the bleed fitting.
- If the carriage reaches the bottom of its travel before all the air is bled, close the bleed fitting and repeat Steps 5 through 7.
- When the oil stream no longer contains air bubbles, close the bleed fitting and torque to 25–27 ft.-lb.
- Top off the truck hydraulic tank with clean, fresh oil.
- Extend and retract the mast completely. If the mast doesn't operate smoothly or if it appears to be "spongy", repeat Steps 2 through 10.

5.1-8 Cylinder Sequencing

When the mast is actuated from the fully lowered position, the primary plunger should extend from within the master plunger to the end of its stroke. Then the master and slave plungers should extend simultaneously to the end of their strokes. See Figure 19. The lowering of the plungers is a reversal of extension.

However, if adjustment is required, do so according to the following procedures.

WARNING

 Never work on the hoist cylinder with a load on the forks or attachment, or while anyone is near the lift truck control handles.

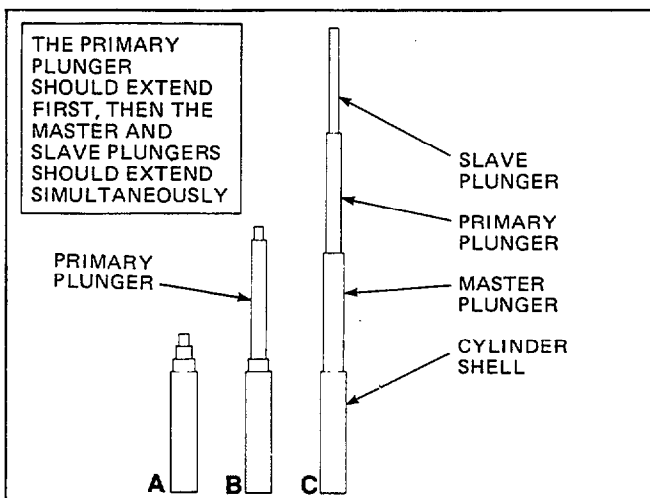


Figure 19. Sequence of Hoist Cylinder Plunger Extension

The sequencing of the hoist cylinder is controlled by an internal sequence valve. **The sequence valve is preset at the factory and should not require adjustment.** However, if the cylinder is disassembled, the sequence valve can be adjusted according to the following procedures.

1. Remove the bleed fitting at the top of the slave plunger.
2. Insert a 3/16-inch, long-handle, hex socket wrench 662611 into the bleed hole and engage the adjusting nut.
3. Turn the adjusting nut counterclockwise until it bottoms. The nut is crimped slightly to prevent free-turning so it may be a little stiff. **Don't force the nut after it bottoms.** See Figure 20.

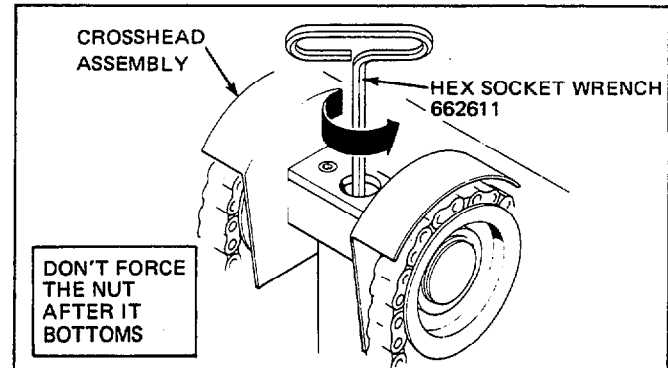


Figure 20. Turning the Adjusting Nut Counterclockwise

4. Turn the adjusting nut clockwise two full turns to provide an initial adjustment. Remove the wrench and install the bleed fitting.
5. Operate the cylinder with about a half-capacity load to check for proper sequencing. If the slave plunger extends too fast and the master plunger does not extend at all, the sequence valve is not opening. Turn the adjusting nut clockwise **one turn only**. Reinstall the bleed fitting and retest. Continue this process until the cylinder sequences properly. See Figure 19. The adjusting nut should be turned 10 turns maximum.
6. As soon as the cylinder sequences properly, turn the adjusting nut clockwise **one more turn only** to assure a positive adjustment.
7. Extend and retract the cylinder completely. If it does not operate smoothly or if it appears to be "spongy", bleed air from the cylinder as specified in Section 5.1-7.

5.1-9 Crosshead Adjustment

The sum total clearance between the tire shoulders and the Mast I-Beam must be .060" as shown in Figure 21. If one tire is touching the I-Beam (which is acceptable) the other tire should have .060" clearance.

Adjust the Crosshead to attain the clearance as follows.

1. Loosen the setscrew. See Figure 21.
2. Use an open end wrench to turn the hex nut to attain the clearance shown in Figure 21.
3. Tighten the setscrew.

CAUTION

Insufficient tightening can result in the tire loosening and the crosshead jamming between the I-Beams.

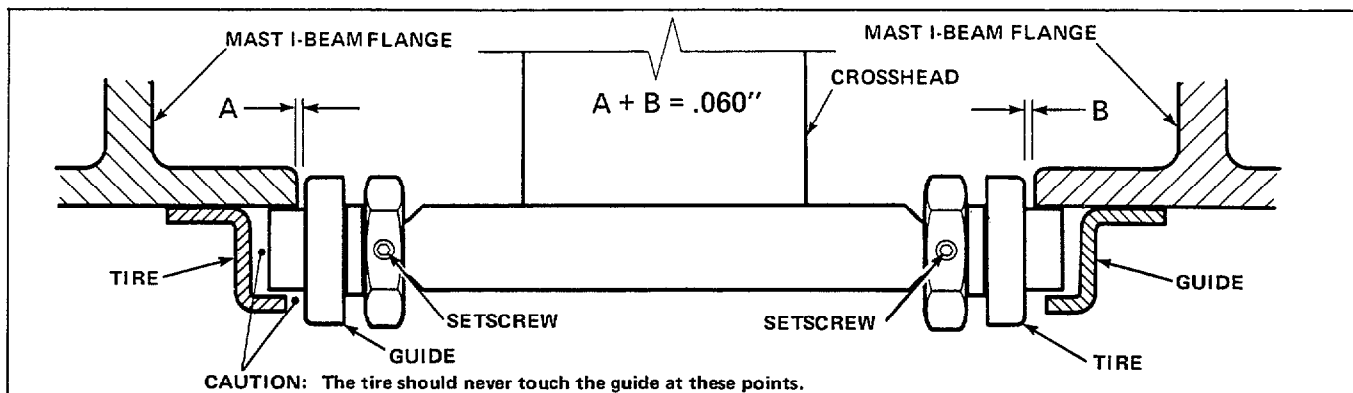


Figure 21. Triple Lift Crosshead Adjustment

Section 5 Service

5.2 Carriage

5.1-1 Description

The carriage, shown in Figure 22, is the structure to which hook-type forks or the attachment is attached. The carriage travels within the channels of the mast inner upright on six, shim-adjustable load rollers. The two upper load rollers are secured to their stub shafts by keepers; the four lower load rollers are held in place by the inner channel when the carriage is assembled onto the mast. All six load rollers are interchangeable. A pair of non-adjustable chain anchors are used to connect the carriage chains to the carriage.

5.2-2 Carriage Removal

The carriage may be removed with the mast installed on the truck according to the following procedures.

1. Block the carriage off the ground and lower the mast to slacken the carriage chains. Connect a sling to the carriage and secure it with some suitable lifting device.
2. Remove the snap rings that retain the chain anchors to the carriage lower fork bar. Remove the chain anchors.

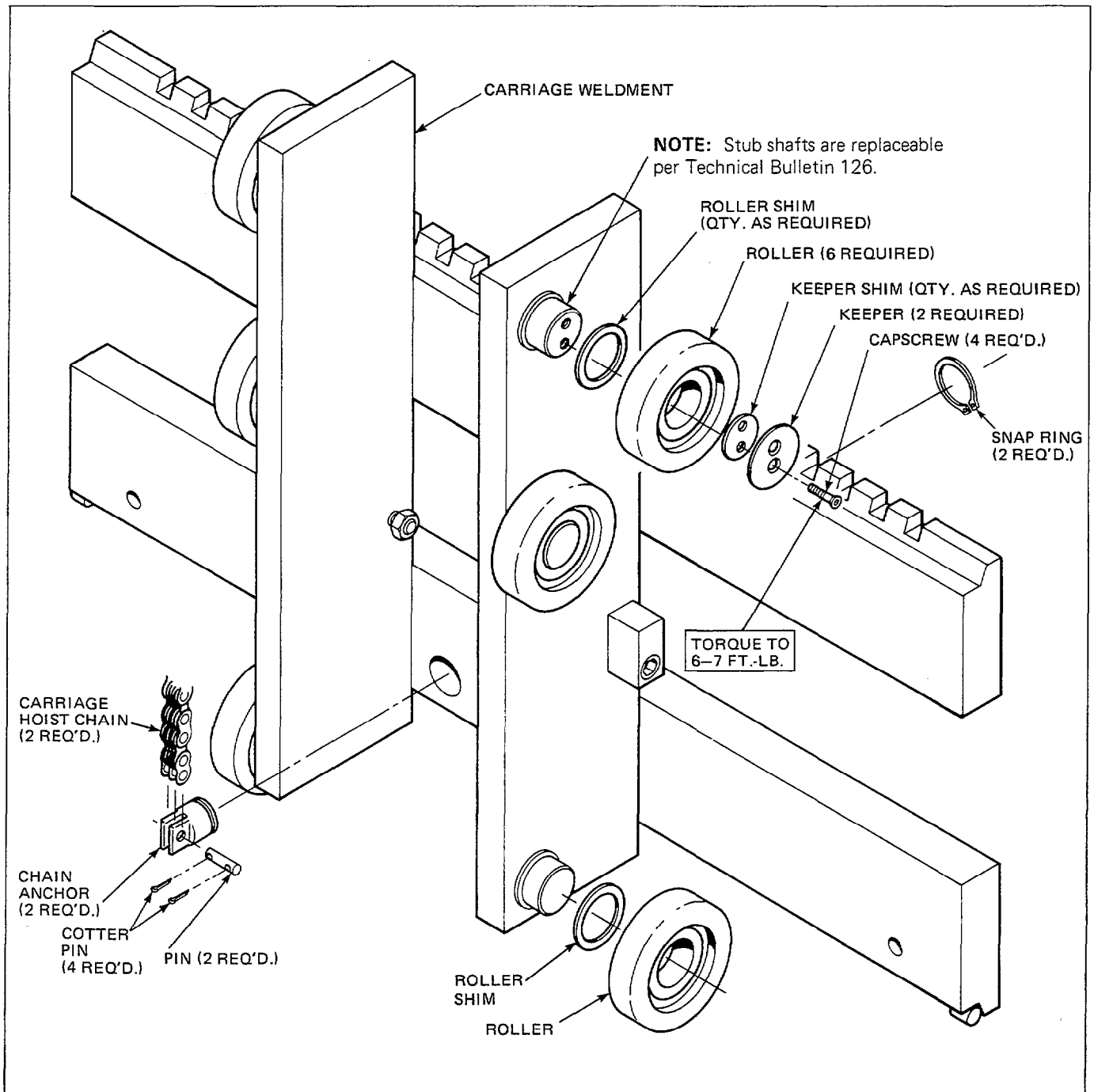


Figure 22. The Carriage Assembly

5.2-2 Carriage Removal (Cont.)

- Back out the two carriage stop screw assemblies. A stop screw assembly is comprised of a nut welded to a socket-head capscrew. See Figure 23. By backing out the nut that extends through the carriage side plate, the socket head of the screw will clear the stop block on the inner channel upright. You may have to extend the carriage to gain access to the stop screw assemblies.
- Power the hoist cylinder to extend until the inner upright channel clears the carriage load rollers. Back the truck away from the carriage. (If the hoist cylinder is inoperative, raise the inner upright channel with a hoist, crane, or some other suitable lifting device.)

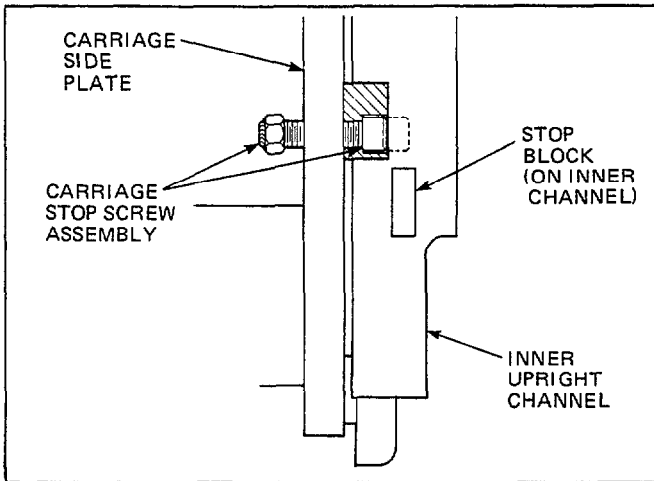


Figure 23. Carriage Stop Screw Assembly

5.2-3 Cleaning and Inspection

- Remove the load rollers and thoroughly clean the carriage assembly with cleaning solvent. **Note the number of shims on the rollers so that an appropriate number of shims can be installed during reassembly.**
- Inspect the rollers for excessive wear or damage. Roller assemblies with visible flat spots or cracks should be replaced.
- Inspect the roller bearings by turning the rollers on their shafts. Roller assemblies with roughness or noticeable restrictions to turning should be replaced.
- Inspect all welds between the carriage side plates and the carriage fork bars. If any weld seams are cracked, replace the carriage.
- Inspect the stub shafts. If they are damaged or if there are cracks at the base of the stub shafts, the carriage must be replaced or repaired. Refer to Technical Bulletin 126 for stub shaft replacement.
- Inspect the carriage hoist chains. If inspection reveals that one strand of a pair of chains requires replacement, **both** strands of the pair should be replaced.
 - Check for rust and corrosion.
 - Check for cracked side plates. If you find cracked side plates, replace **both** strands of chains.
 - Check for tight joints. If tight joints are caused by rust or corrosion, loosen them with SAE 30 oil or penetrating oil. If they cannot be loosened or if tight joints are caused by bent pins or plates or by peened plate edges, replace **both** strands of chains.

- Check for protruding or turned pins. Replace **both** strands of chains.
- Check for chain side wear. If pins and outside plates show signs of wear, check for misalignment of sheaves, anchors, or other components. Correct the misalignment. If wear is excessive, replace **both** strands of chains.
- Check for worn, broken, or misaligned chain anchors. Replace or adjust as required.

5.2-4 Carriage Installation (with the mast installed on the truck)

- Make sure the inner upright channel members are lubricated with chassis lube or Kendall SR-12X (Cascade part number 599474). See Figure 24.

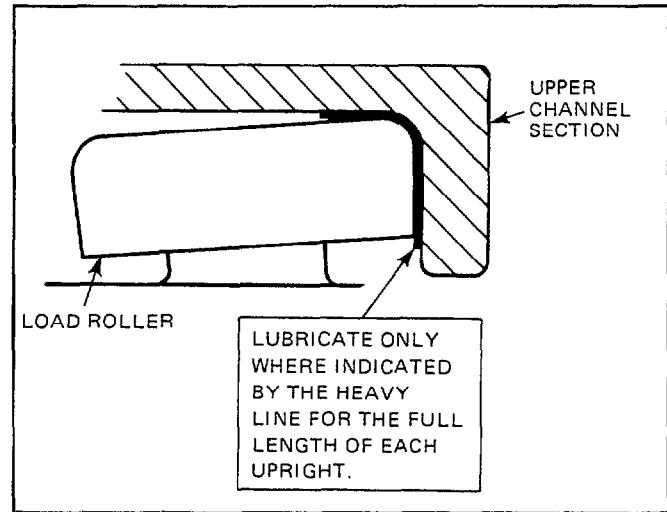


Figure 24. Mast Lubrication (typical)

- Assemble the load rollers onto their stub shafts using an appropriate number of shims. See Figure 22. The shims should be installed to provide a total clearance no looser than 0.030 inch at the tightest point throughout the travel of the carriage. Refer to Section 5.3-12 for load roller shimming.
- With a sling, position the carriage assembly in place on blocks in front of the mast.
- Raise the inner upright sufficiently for the carriage load rollers to be fitted within the inner upright channels. Lower the inner upright over the carriage.
- Lift the carriage the full length of the inner upright channel and check side play and freedom of movement. Adjust load roller clearance as specified in step 2.
- Thread in the carriage stop screw assemblies. See Figure 41. Tighten to a torque of 100–110 ft.-lbs.

CAUTION: Failure to thread in the stop screw assemblies can cause the mast uprights to sequence incorrectly.
- Install the carriage hoist chains.
- Lower the carriage and check and adjust the load chains as shown in paragraph 5.2–5.
- Check the total freedom of the carriage movement as described in Section 5.3-10, step 7.

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5.2-5 Carriage Chain Adjustment

The carriage hoist chains should be adjusted so that when the unloaded mast is fully lowered, the carriage is positioned as shown in Figure 25.

To adjust the carriage chains:

1. Locate the carriage chain anchors on the inner upright. See Figure 26.
2. Adjust one carriage chain anchor nut to achieve the correct carriage position when fully lowered as shown in Figure 25.
3. Adjust the other carriage chain anchor nut to achieve equal chain tension.

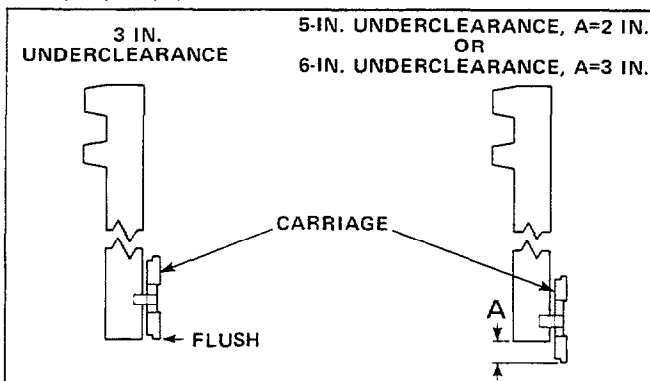


Figure 25. Correct Carriage Positions when Mast is Fully Lowered

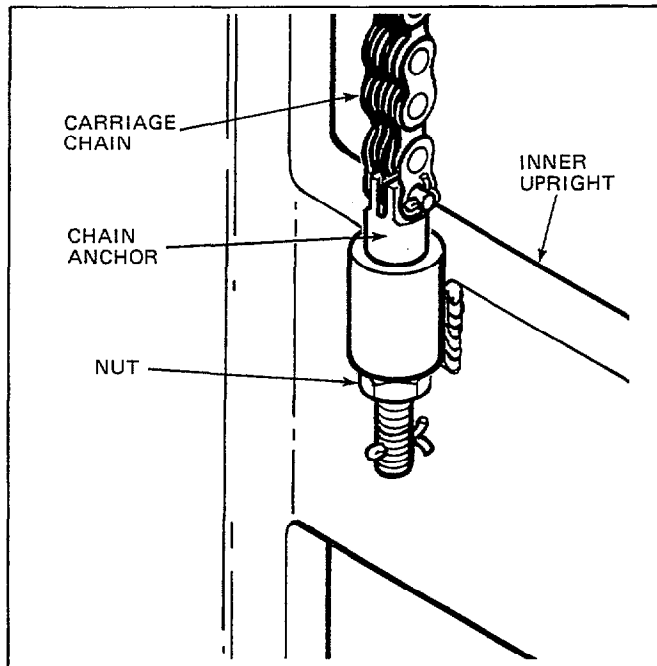


Figure 26. Carriage Chain Adjusting Nut

5.3 Mast Upright Assembly

5.3-1 Upright Description

The Cascade Viewmast® II is comprised of three upright assemblies: outer, intermediate, and inner. See Figure 27.

1. Outer Upright Assembly

The outer upright assembly is mounted to the truck. A pair of shim-adjustable load rollers is attached to canted stub shafts located near the top of the upright. A pair of urethane cushions is attached to the lower crossmember to cushion the intermediate upright when the mast is fully lowered. A pair of non-adjustable chain anchors is located near the top of the upright to which the bootstrap hoist chains are attached.

2. Intermediate Upright Assembly

The intermediate upright assembly telescopes within the outer upright assembly. A pair of shim-adjustable load rollers is attached to canted stub shafts near the top of the upright and a pair is attached near the bottom of the upright. In addition, a pair of chain sheaves is located near the bottom of the intermediate upright to provide a rolling surface for the bootstrap hoist chain.

A pair of bushing blocks are bolted to steel blocks welded on both sides of the upright near the bottom. The bushing blocks stabilize the intermediate upright assembly when the mast is extended and tilted back. A cushion is attached to the intermediate upright lower crossmember to cushion the inner upright when the mast is fully lowered. The hoist cylinder rests on a cradle which is integral with the lower crossmember of the intermediate upright assembly.

3. Inner Upright Assembly

The inner upright assembly telescopes within the intermediate upright assembly. A pair of shim-adjustable load rollers is attached to canted stub shafts near the bottom of the assembly. A pair of adjustable chain anchors is located near the bottom of the inner upright assembly to which the bootstrap hoist chains are attached. In addition, a pair of adjustable chain anchors is located on the lower crossmember of the inner upright to which the carriage hoist chains are attached.

4. Mast Operation

Figure 28 illustrates the operation of the Cascade Viewmast® II.

Section 5 Service

NOTE: Upright stub shafts are replaceable per Technical Bulletin 126.

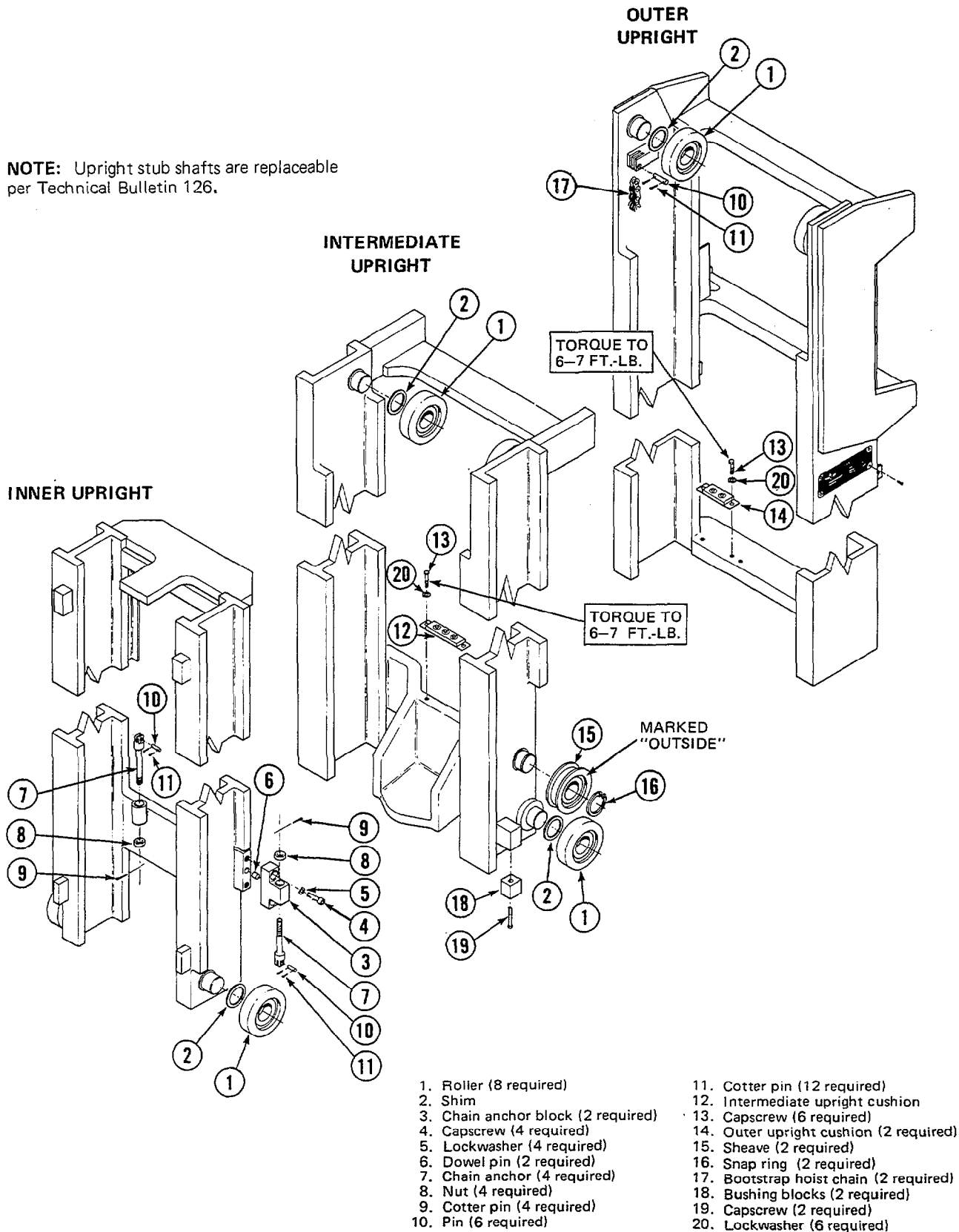


Figure 27. Exploded View of Mast Upright Assembly

Section 5 Service

5.3-1 Upright Description(Cont.)

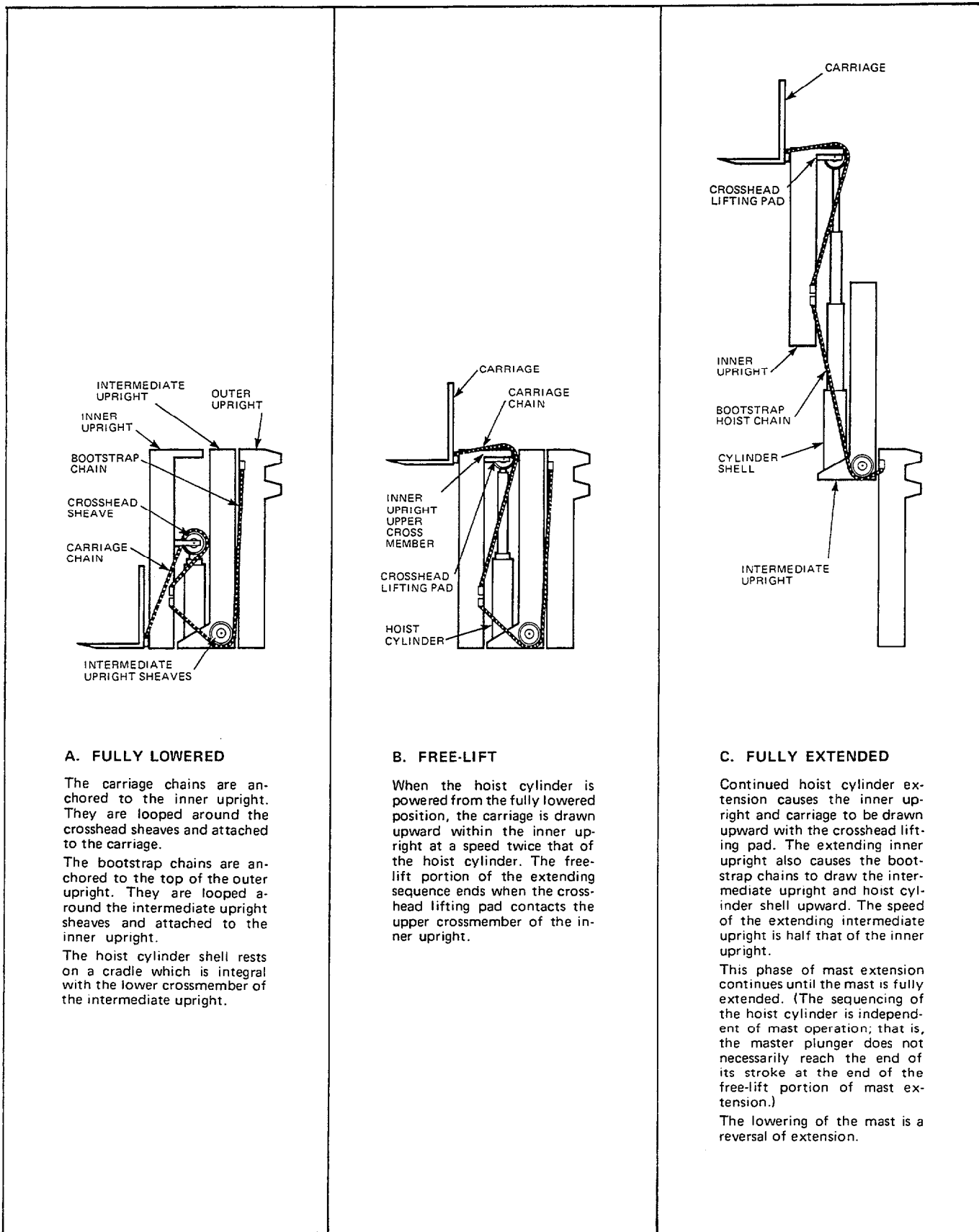


Figure 28. Mast Operation

5.3-2 Crosshead Description

The crosshead, shown in Figure 29, is attached to the top of the hoist cylinder. Rollers attached to the crosshead move within guides on the inner upright assembly to guide the hoist cylinder as it extends and retracts. A pair of chain sheaves attached to the crosshead provide a rolling surface for the carriage hoist chains.

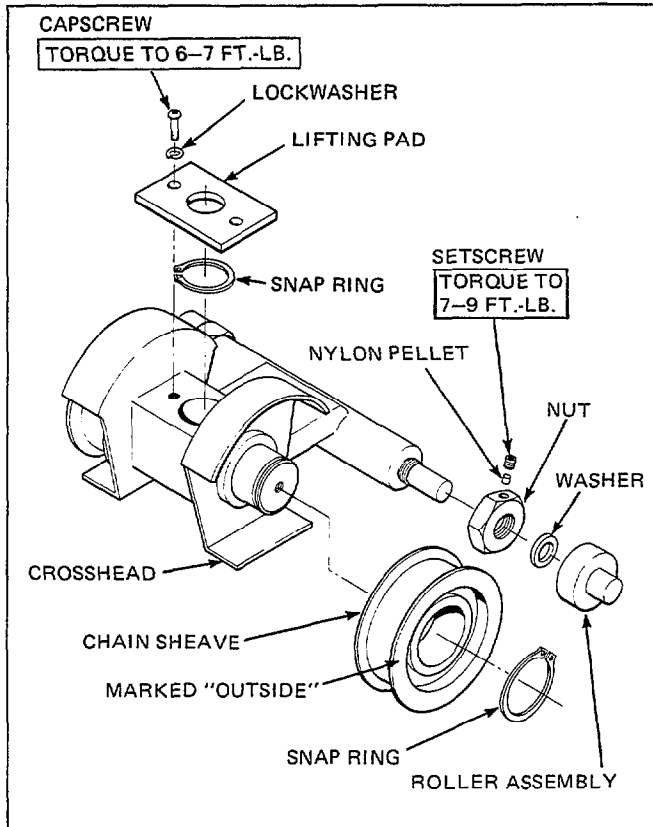


Figure 29. Crosshead Assembly

5.3-3 Mast Removal

WARNING
Never work on the mast with a load on the forks or attachment or while anyone is near the lift truck control handles.

1. Make sure the mast is fully lowered. Make sure the mast is straight up (not tilted forward or backward).
2. Remove the forks or attachment from the mast carriage. Remove any auxiliary equipment that would interfere with mast removal.
3. Remove the truck auxiliary hose from the hoist cylinder bootstrap hose. See Figure 30. Be prepared to collect oil. Plug the bootstrap hose and cap the truck auxiliary hose.
4. Loosen the hoist cylinder bleed screw no more than required to bleed off any hydraulic pressure that may remain in the cylinder. The bleed screw is located on the cylinder shell just below the largest piston retainer. Tighten the screw.
5. Wrap a link chain twice (minimum) around the three upper mast channel crossmembers and secure with a hoist, crane, or some other suitable lifting device.

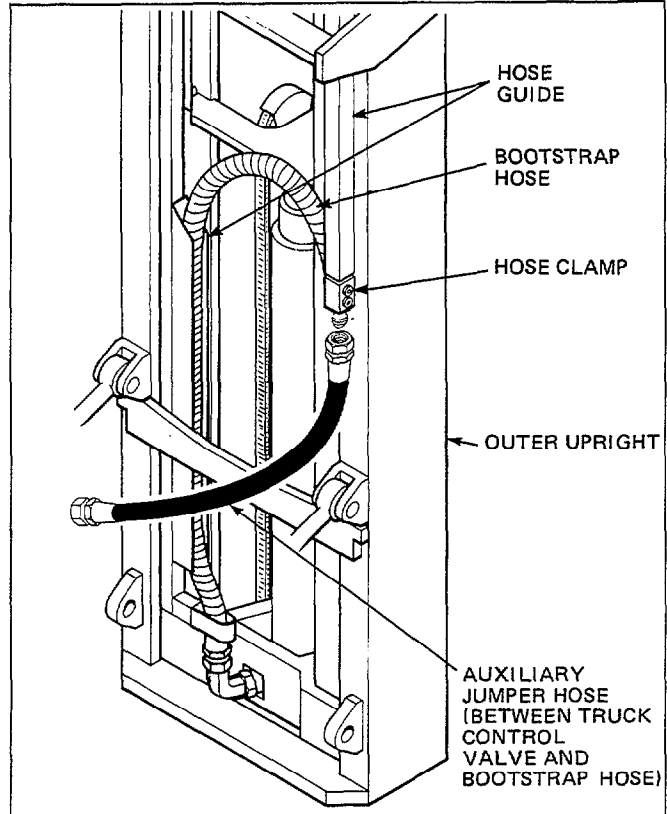


Figure 30. Rear View of Mast Assembly

6. Disconnect the tilt cylinders from the tilt cylinder anchor brackets.
7. Disconnect the mast base mounting brackets.
8. Lift off the mast and set it on a work surface with the carriage up. If the mast is equipped with a hose reel, block under the mast sufficiently to clear the reel, or remove the reel. Make sure the mast assembly does not rest on the bootstrap hose guides. Remove the hose guides if necessary.

5.3-4 Carriage Removal (with mast removed from the truck)

1. Connect a sling to the carriage and secure it with some suitable lifting device.
2. Remove the pins that secure the carriage hoist chains to the chain anchors located on the lower fork bar. See Figure 31.

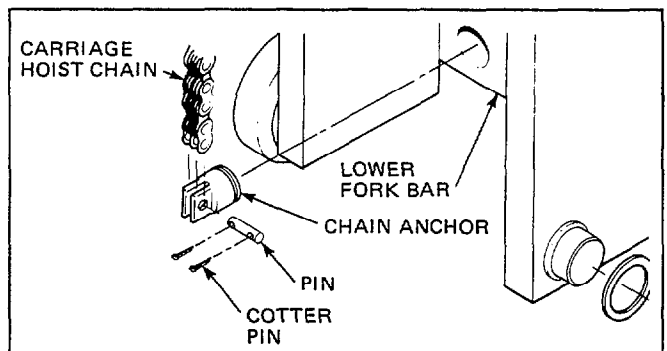


Figure 31. Carriage Hoist Chain Anchor

5.3-4 Carriage Removal (Cont.) (with mast removed from the truck)

- Unthread the two carriage stop screw assemblies. A stop screw assembly is comprised of a nut welded to a socket-head capscrew. See Figure 32. By backing out the nut that extends through the carriage side plate, the socket head of the screw will clear the stop block on the inner channel upright.

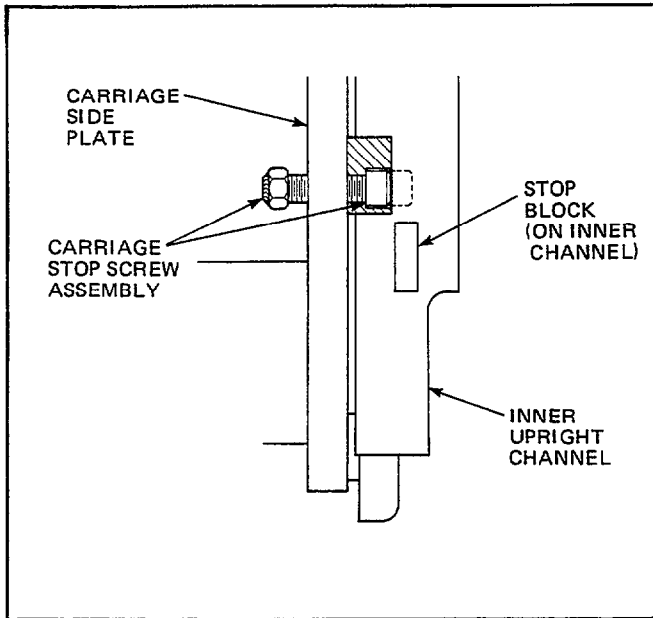


Figure 32. Carriage Stop Screw Assembly

- With the lifting device secured to the carriage, remove the carriage out the bottom of the mast assembly.
- Remove the carriage hoist chains from the inner upright lower crossmember.
- For carriage cleaning and inspection, refer to Section 5.2-3.

5.3-5 Crosshead and Cylinder Removal (with mast removed from the truck)

- Remove the bootstrap hose from the base of the hoist cylinder. Be prepared to collect oil. **Do not remove the elbow fitting from the cylinder base.** Cap the fitting with a high-pressure steel cap (a plastic cap will not afford sufficient protection to the threads if the fitting is "banged" during cylinder removal).
- Connect a sling around the hoist cylinder and secure it with some suitable lifting device.
- Remove the pad at the top of the cylinder crosshead.
- Pull the carriage hoist chains through the crosshead sheaves.
- Remove the snap ring that retains the crosshead assembly to the hoist cylinder rod and remove the crosshead.
- With the lifting device secured to the sling, lift the cylinder from the mast.
- For cylinder service, refer to Section 5.1.

5.3-6 Upright Disassembly (with mast removed from the truck)

Refer to Figure 34.



WARNING: Disassembly of the mast uprights with the mast mounted on the truck is NOT recommended.

- Remove the carriage and hoist cylinder. Refer to Sections 5.3-4 and 5.3-5.
- Manually extend the mast until the bootstrap hoist chain anchor blocks on the inner upright are exposed.
- Remove the pins that secure the bootstrap hoist chains to the chain anchors on the inner upright.
- Remove the bootstrap chain anchors from the inner upright.
- Roll the inner upright toward the top of the mast until the inner upright load rollers are exposed by the cutouts at the top of the intermediate upright.
- Using a sling and hoist or some other appropriate lifting device, lift the inner upright out of the intermediate upright and set it on a work surface.
- Roll the intermediate upright toward the top of the mast until the intermediate load rollers are exposed by the cutouts at the top of the outer upright. Pull on the bootstrap hoist chains to keep them straight.

CAUTION: Pull on the bootstrap hoist chains to keep them straight.

- Using a sling and hoist or some other suitable lifting device, lift the intermediate upright out of the outer upright. As soon as the chain sheaves at the bottom of the intermediate upright are clear of the outer upright cutouts, pull the bootstrap hoist chains off the sheaves. See figure 33. Set the intermediate upright on a work surface.
- Remove the bootstrap hoist chains from the outer upright chain anchors.

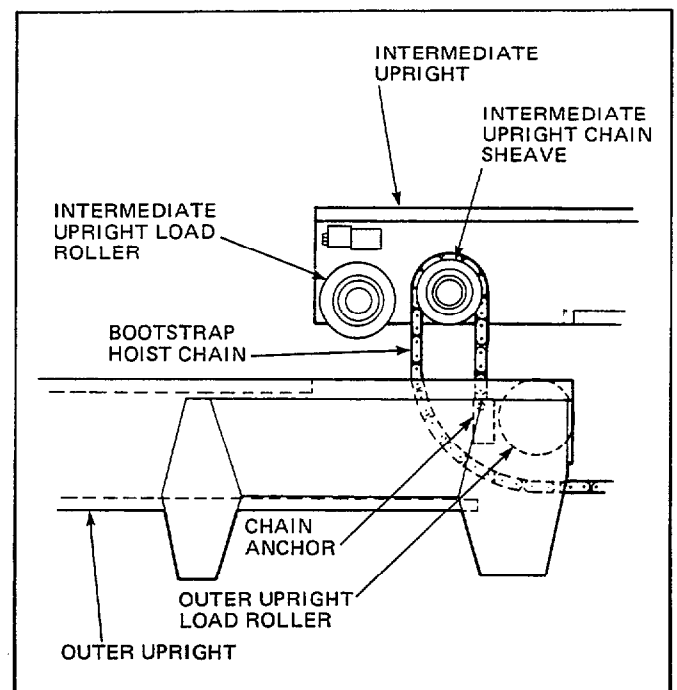


Figure 33. Bootstrap Hoist Chain Routing

5.3-7 Cleaning and Inspection

1. Remove the load rollers and chain sheaves from the uprights, carriage, and crosshead. Note the number of shims on the rollers so that an appropriate number of shims can be installed during reassembly.
2. Thoroughly clean the upright, carriage, and crosshead assemblies with cleaning solvent.
3. Inspect the rolling surfaces of the upright channels. Excessive wear, grooves, or scoring could be the result of faulty load rollers and/or improper mast lubrication.
4. Inspect the load rollers and chain sheaves. Roller and sheave assemblies with visible flat spots, excessive wear, or cracks should be replaced.
5. Inspect the load roller and chain sheave bearings by turning them on a shaft. Roller and sheave assemblies with roughness or noticeable restrictions to turning should be replaced.
6. Inspect the rollers on the crosshead. If they do not turn freely or are damaged or excessively worn, replace the roller assemblies. Torque the roller nut to 30–35 ft.-lbs.

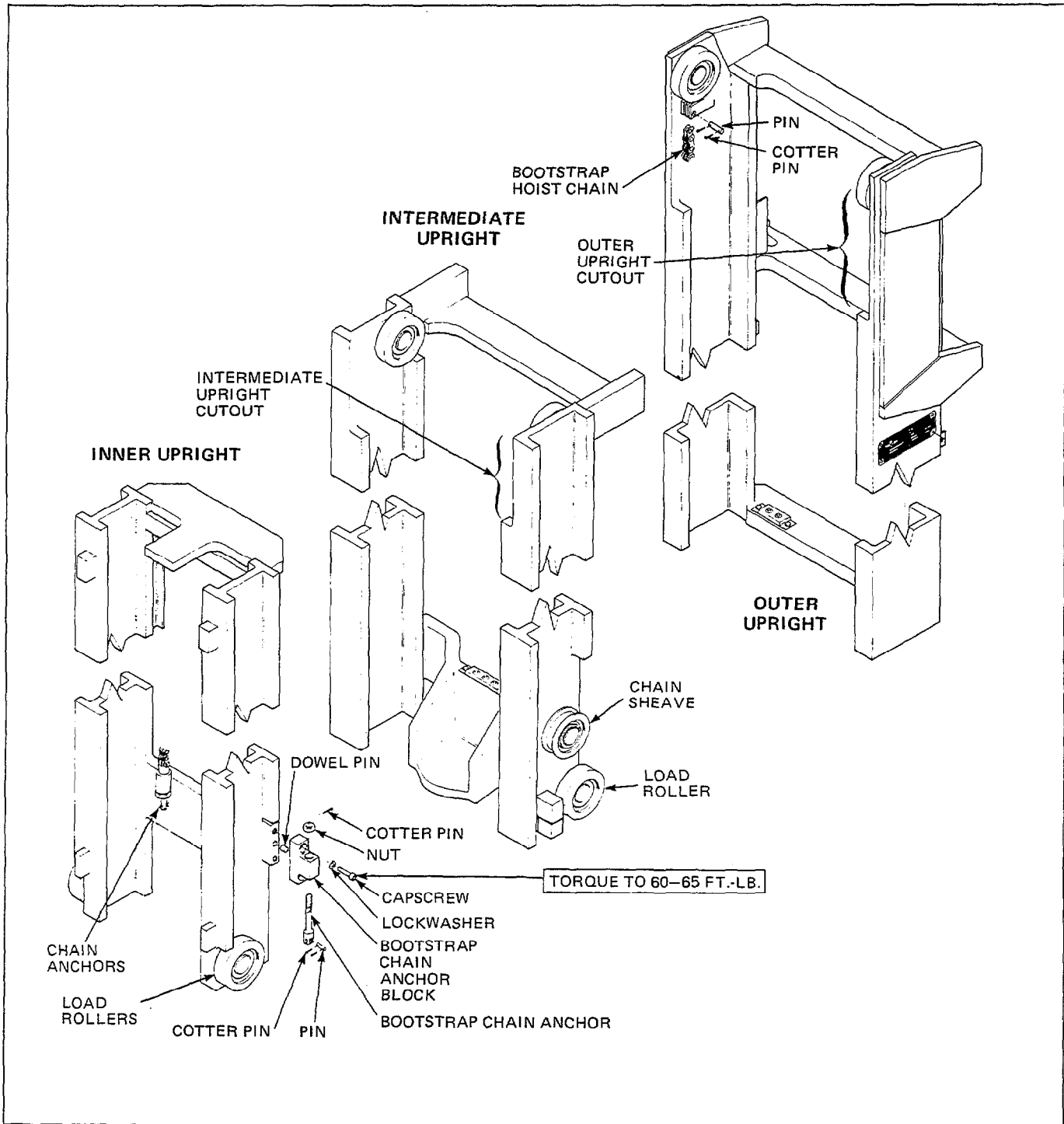


Figure 34. Exploded View of Mast Upright Assembly

Section 5 Service

5.3-7 Cleaning and inspection (Cont.)

7. Inspect the stub shafts. An assembly with a damaged stub shaft or a cracked stub shaft base should be repaired or replaced. Refer to Technical Bulletin 126 for stub shaft replacement.
8. Inspect the cushions on the lower crossmember of the upright channels. If the cushions are damaged, crushed, or missing, replace them.
9. Inspect the crosshead lifting pad. If it is damaged or crushed, replace it.
10. Inspect the bootstrap hoist chains. Refer to Section 5.4-1.

5.3-8 Upright Reassembly (with uprights lying horizontal)

1. Lubricate the full length of each upright channel with chassis lube or Kendall SR-12X (Cascade part no. 599474) as shown in Figure 35.
2. Assemble the upright load rollers onto their stub shafts using an appropriate number of shims. See Figure 34. These shims should be installed to provide a clearance no looser than 0.030 inch at the tightest point throughout the travel of the member. Refer to Section 5.3-12 for load roller shimming.
3. Assemble the mast chain sheaves on their stub shafts at the base of the intermediate upright. See Figure 34.

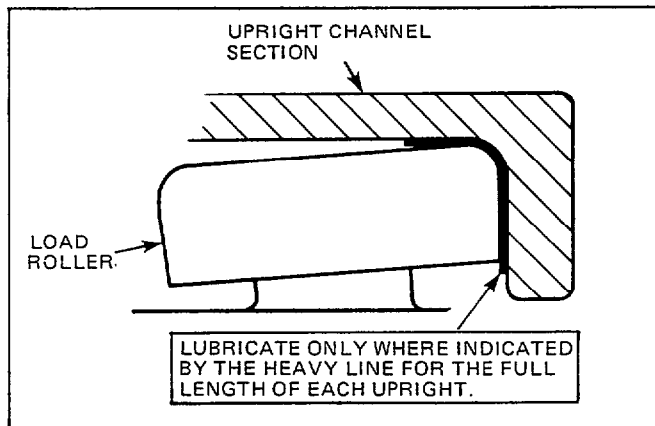


Figure 35. Mast Lubrication (typical)

4. Connect the bootstrap hoist chains to the outer upright anchors using new cotter pins.
5. Using a sling and hoist or some other appropriate lifting device, position the intermediate upright over the outer upright as shown in Figure 36.
6. Position the bootstrap hoist chains over the intermediate upright sheaves as shown in Figure 36.
7. Lower the intermediate upright onto the outer upright. Hold the hoist chains out the top of the outer upright to keep them straight. Roll the intermediate upright part way down the outer upright. Adjust load roller clearance as specified in Adjustment Section 5.3-12.
8. Using a sling and hoist or some other suitable lifting device, position the inner upright so that the inner upright load rollers fit into the cutouts at the top of the intermediate upright. Lower the inner upright onto the intermediate upright. See Figure 37.

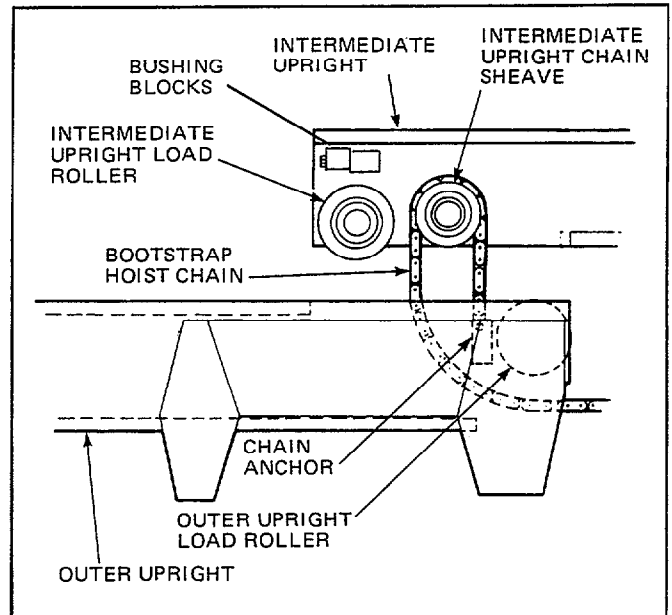


Figure 36. Intermediate Upright Installation

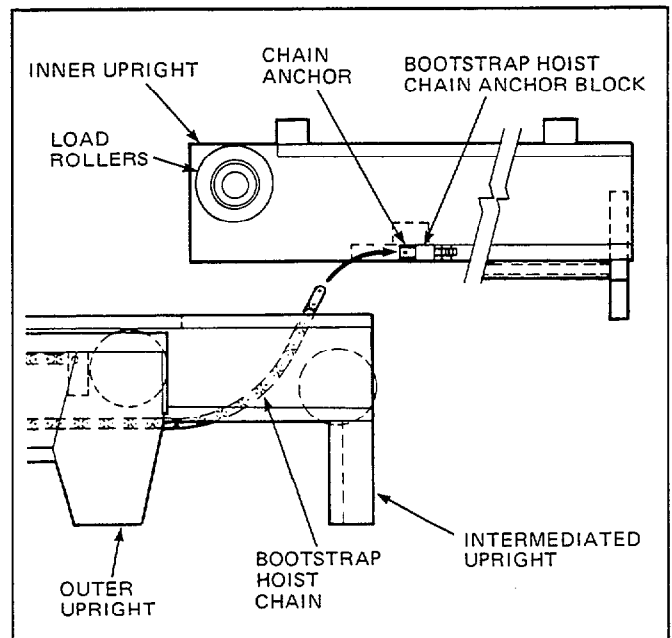


Figure 37. Inner Upright Installation

9. Attach the bootstrap hoist chain anchor blocks to the inner upright. Torque to 60–65 ft.-lbs. See Figure 37.
10. Attach the bootstrap hoist chains to their anchors on the inner upright using new cotter pins.
11. Manually retract the upright assembly. Check for side play and freedom of movement. Adjust load roller clearance as specified in the Adjustment Section 5.3-12.
12. The intermediate upright bushing blocks can be adjusted to four positions. See Figure 36. Adjust the bushing blocks to the tightest position that allows free travel of the uprights. Tighten the capscrews to a torque of 35–40 ft.-lbs.

Section 5 Service

5.3-9 Crosshead and Cylinder Installation (with uprights lying horizontal)

1. Assemble the crosshead chain sheaves in place on the crosshead assembly. See Figure 38.

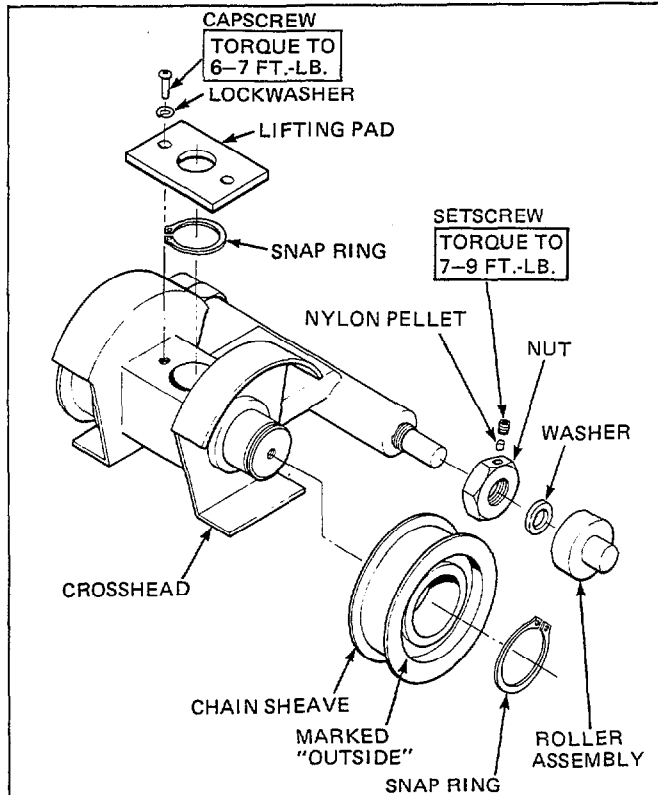


Figure 38. Crosshead Assembly

2. Connect the carriage hoist chains to the brackets on the inner upright assembly. See Figure 39.
3. Connect a sling around the hoist cylinder and secure it with a suitable lifting device.
4. Position the hoist cylinder in place in the bracket at the base of the intermediate upright. Make sure the elbow fitting at the base of the cylinder fits into the cutout in the cylinder mounting bracket without binding.
5. Position the crosshead assembly in place at the top of the hoist cylinder. Make sure the crosshead rollers fit into their guides on the inner upright channels.
6. Secure the crosshead to the cylinder rod using the retaining snap ring. Refer to Figure 38.
7. Install the crosshead lifting pad. Refer to Figure 38.

5.3-10 Carriage Installation (with uprights lying horizontal)

1. Assemble the carriage load rollers onto their stub shafts using an appropriate number of shims. See Figure 40. The shims should be installed to provide a clearance no greater than .030 inch at the tightest spot throughout its travel. Refer to Section 5.3-12 for load roller shimming.
2. Make sure the carriage stop screw assemblies are retracted to clear the inner upright stop blocks. See Figure 32.
3. Connect a sling to the carriage. With a suitable lifting

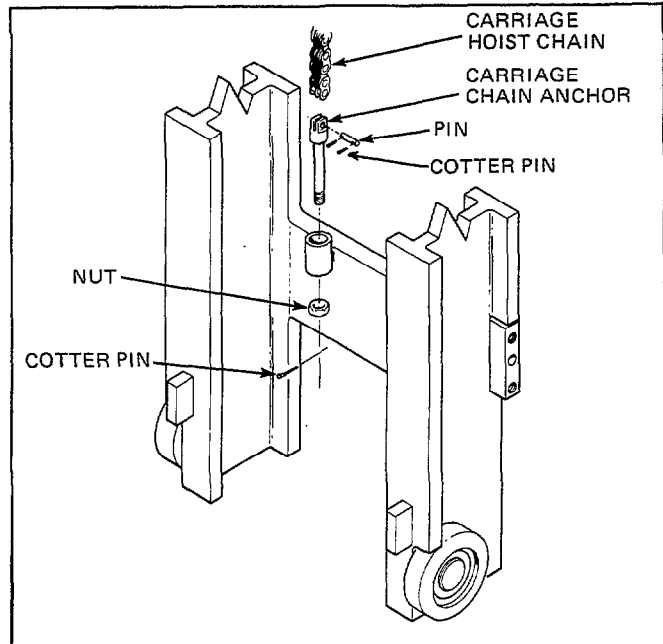


Figure 39. Carriage Hoist Chain Installation Assembly (Inner Upright)

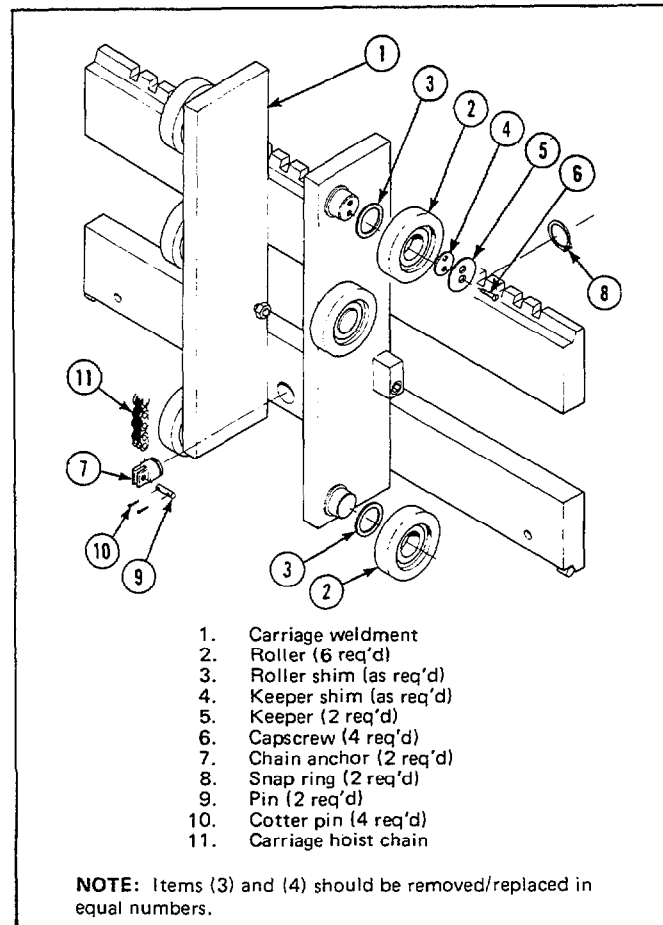


Figure 40. The Carriage Assembly

device, position the carriage in place through the bottom of the inner upright.

4. Roll the carriage the full length of the inner upright channel and check side play and freedom of movement. Adjust the load roller clearances as specified in Section 5.3-12.

Section 5 Service

5.3-10 Carriage Installation (Cont.)

- Thread in the carriage stop screw assemblies. See Figure 41. Torque to 100–110 ft.-lb.

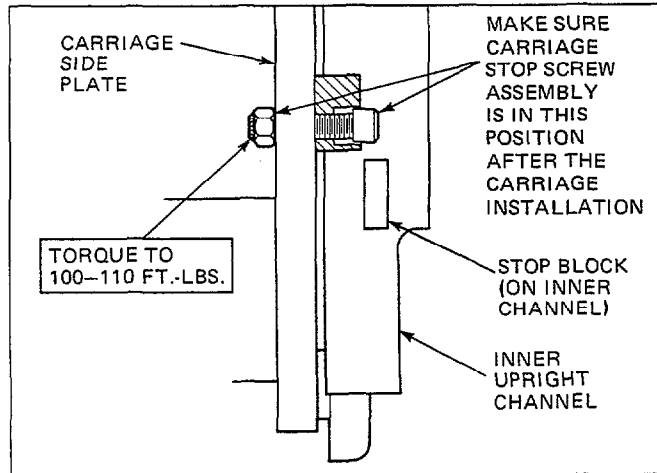


Figure 41. Carriage Stop Screw Assembly

- Roll the carriage hoist chains over the crosshead sheaves and connect the chains to the carriage lower fork bar. See Figure 42.

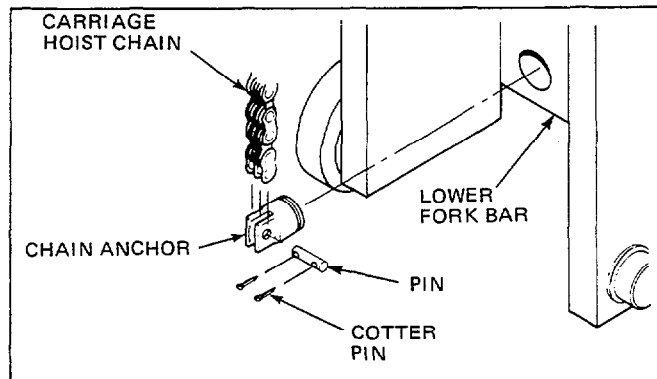


Figure 42. Carriage Hoist Chain Anchor

5.3-11 Mast Installation

- Clean and lubricate the bearing surfaces of the base and tilt cylinder mounting brackets with wheel bearing grease.
- Lift the mast by a link chain wrapped twice around the three upper channel crossmembers.
- Position the mast into place on the lift truck and secure the base mountings.
- Connect the bootstrap hose to the base of the hoist cylinder. If the hose guides were removed during disassembly, install them now.

IMPORTANT

Prior to connecting the tilt cylinders to the mast, make sure the cylinders bottom evenly. Adjust the tilt cylinders as required to prevent the mast from "racking."

- Connect the tilt cylinders to the tilt cylinder anchor brackets.
- Connect the truck auxiliary hose to the bootstrap hose.
- Perform the mast operational inspection and adjustments as described in Section 2.4.

- Lower the carriage. Stand on left end of lower carriage bar. Measure distance between left bottom of carriage bar and ground. Stand on right end of lower carriage bar and measure distance at same point as before. The difference between the two measurements should not exceed $\frac{1}{4}'' \pm .06$. See Figure 43.

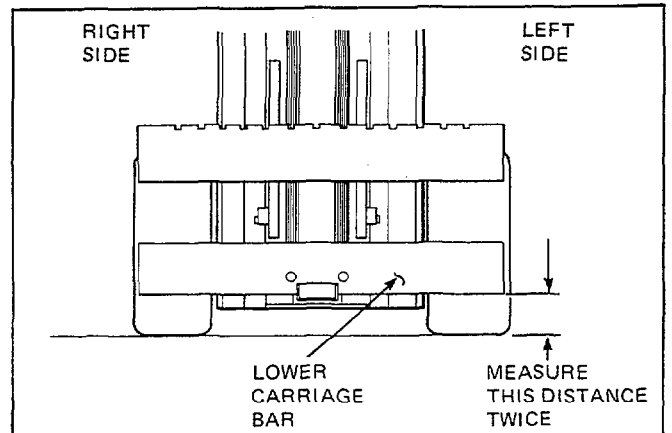


Figure 43. Measuring Carriage Looseness

5.3-12 Load Roller Shimming

Each pair of load rollers on the uprights and carriage should be shimmed so that a total clearance no greater than 0.030 inch occurs at the tightest point throughout the travel of the member. See Figure 44.

Install a pair of load rollers and use an equal number of shims on each side of the assembly (within one shim). A standard shim (631881) is 0.030 inch thick.

To check the clearance, pry between the upright and load roller as shown below so the opposite load roller is tight against the upright. Measure the clearance for the pair of load rollers at the XXX shown. Repeat for each pair of rollers.

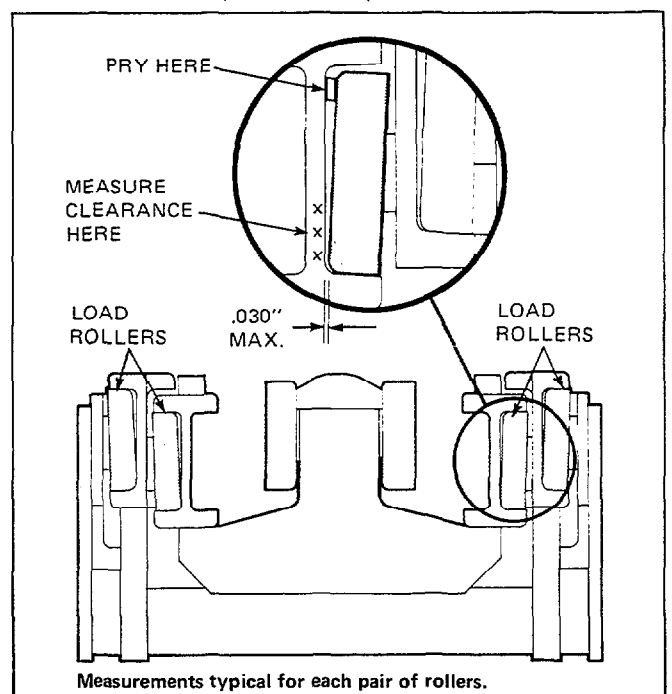


Figure 44. Roller Clearance

5.4 Hoist Chains

5.4-1 Inspection and Tension

Each pair of hoist chains have been factory-lubricated using heat and pressure to force the lubricant thoroughly into the chain links. Avoid removal or contamination of this factory applied lubricant. **Do not wash, sand blast, etch, steam clean, or paint the chains on initial mast installation.**

Hoist chains must be adjusted with equal tension to ensure proper load distribution and mast operation. To determine equal tension, extend the unloaded mast to put the chains under tension. Press the center of a strand of chain with your thumb. Then press at the same place on the other chain of the pair. Each chain in a pair should have equal "give". Do this with all hoist chains. If they do not have equal tension perform the Mast or Carriage chain adjustment in paragraphs 5.4-3 and 5.4-4.

Inspect the hoist chains. If inspection reveals that one strand of a pair of chains requires replacement, **both** strands of the pair should be replaced.

- Check for rust and corrosion.
- Check for cracked side plates. If you find cracked side plates, replace **both** strands of chains.
- Check for tight joints. If tight joints are caused by rust or corrosion, loosen them with SAE 40 oil or penetrating oil. If they cannot be loosened or if tight joints are caused by bent pins or plates or by peened plate edges, replace **both** of chains.
- Check for protruding or turned pins. Replace **both** strands of chains.
- Check for chain side wear. If pins and outside plates show signs of wear, check for misalignment of sheaves, anchors, or other components. Correct the misalignment. If wear is excessive, replace **both** strands of chains.
- Check for worn, broken, or misaligned chain anchors. Replace or adjust as required.

5.4-2 Measuring Chain Stretch

Regular inspection and lubrication of the hoist chains will increase their service life and reduce downtime.

If the hoist chains stretch beyond the recommended amount, they should be replaced in pairs. Chain stretch can be measured with the chain wear scale 661923 included with the Customer User Kit. Measure the chains as shown in Figure 45 according to the instructions printed on the chain wear scale, without a load on the carriage.

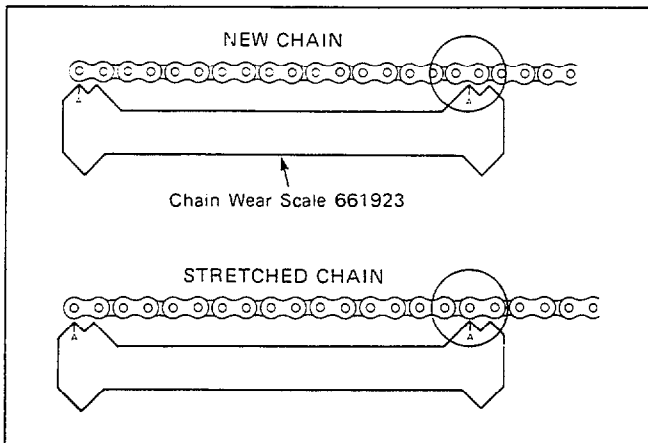


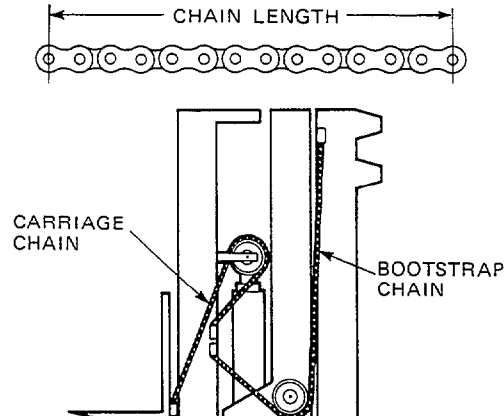
Figure 45. Checking Chain Stretch

1. To check the carriage hoist chains, raise the carriage a few inches off the ground to put tension on the chains.
2. To check the mast hoist chains, the mast must be extended sufficiently to expose the chains.

If the chains are removed from the mast, you can check chain stretch without using the chain wear scale. If the overall length of a hoist chain exceeds 103% of its original length, the chains should be replaced in pairs. The following table provides the length of the hoist chains when new and their limits of stretch.

HOIST CHAIN TABLE				
Overall retracted channel length (inches)	Length* of bootstrap chain when new (inches)	103% limit (inches)	Length* of carriage chain when new (inches)	103% limit (inches)
30C VIEWMAST® II				
68	64.4	66.3	65.6	67.6
74	70.6	72.7	71.9	74.0
80	76.9	79.2	76.9	79.2
86	83.1	85.6	83.1	85.6
92	88.1	90.8	89.4	92.1
98	94.4	97.2	94.4	97.2
104	100.6	103.6	100.6	103.6
111	108.1	111.4	108.1	111.4
55C VIEWMAST® II				
68	63.8	65.7	66.8	68.8
74	69.8	71.8	72.8	74.9
80	75.8	78.0	78.8	81.1
83	78.8	81.1	80.3	82.7
92	87.8	90.4	90.8	93.5
101	96.8	99.7	98.3	101.2
107	102.8	105.8	104.3	107.4
114	110.3	113.6	111.8	115.1
119	114.8	118.2	116.3	119.7
124	119.3	122.8	120.8	124.4
129	125.3	129.0	126.8	130.6
134	129.8	133.6	131.3	135.2
80C VIEWMAST® II				
68	65.0	66.9	69.0	71.1
74	71.0	73.1	75.0	77.3
80	77.0	79.3	81.0	83.4
87	83.0	85.5	89.0	91.7
95	91.0	93.7	97.0	99.9
102	99.0	101.9	103.0	106.1
112	109.0	112.3	113.0	116.4
122	119.0	122.6	125.0	128.8
132	129.0	132.9	135.0	139.1
142	139.0	143.2	145.0	149.4
149	147.0	151.4	151.0	155.5

*Chain length is measured from hole center to hole center of end links.



Section 5 Service

5.4-3 Mast Chain Adjustment

The mast chain should be adjusted so that when the unloaded mast is fully lowered, all upright channels are even with each other at the bottom within 1/8 inch. See Figure 46.

1. To adjust, raise the mast until the mast chain adjusting nut is just above the outer upright. See Figures 46 and 47. Tighten or loosen the adjusting nut to adjust one chain to achieve the equal dimension. Adjust the other mast chain until equal tension is achieved.
2. Lower the mast and check your adjustment. All channels should be even with each other at the bottom within 1/8 inch.

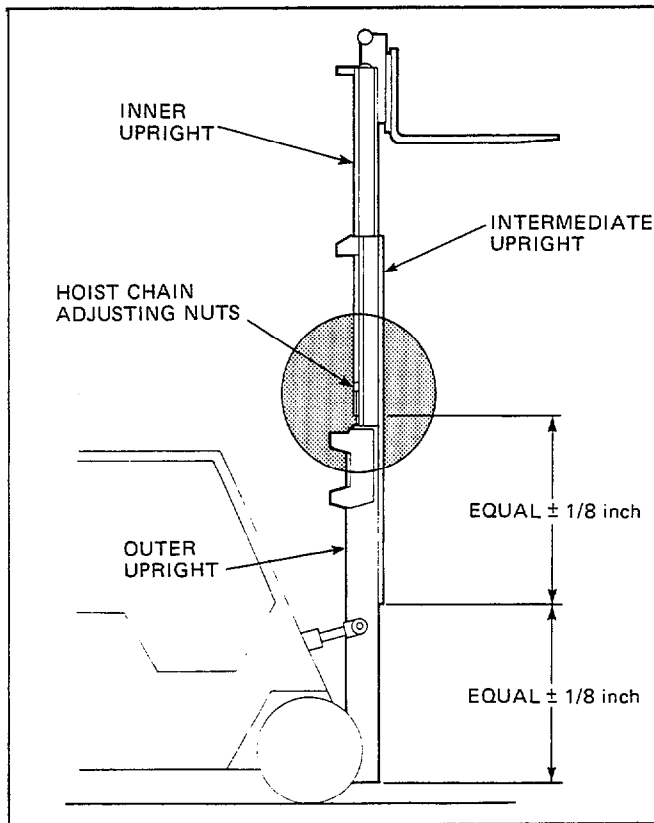


Figure 46. Triple Lift Adjusting Nuts

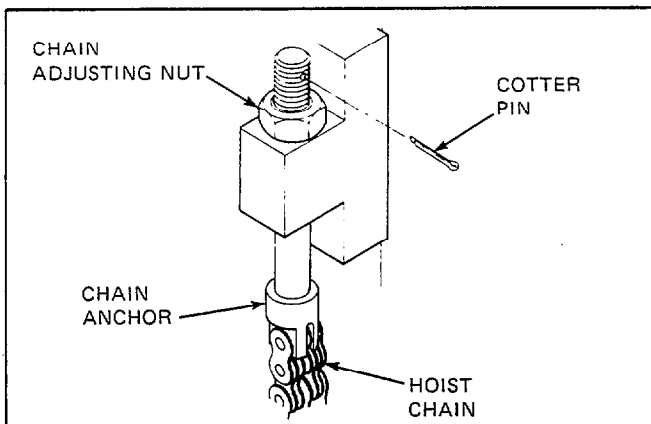


Figure 47. Mast Chain Anchor

5.4-4 Carriage Chain Adjustment

The carriage chains should be adjusted so that when the unloaded mast is fully lowered, the carriage is positioned as shown in Figure 48.

To adjust the carriage chains:

1. Locate the carriage chain anchors on the inner upright. See Figure 49.
2. Adjust one carriage chain anchor nut to achieve the correct carriage position when fully lowered as shown in Figure 48.
3. Adjust the other carriage chain anchor nut to achieve equal chain tension.

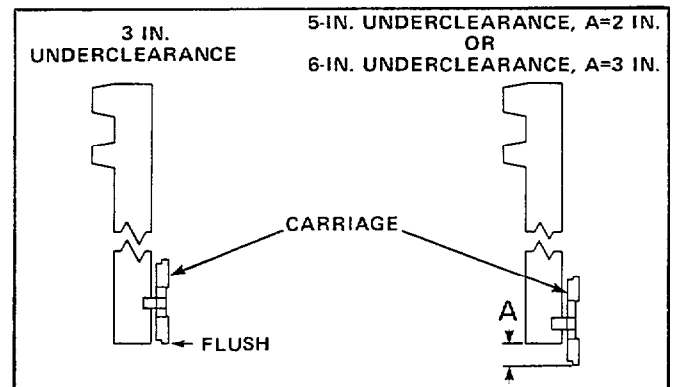


Figure 48. Correct Carriage Positions when Mast is Fully Lowered

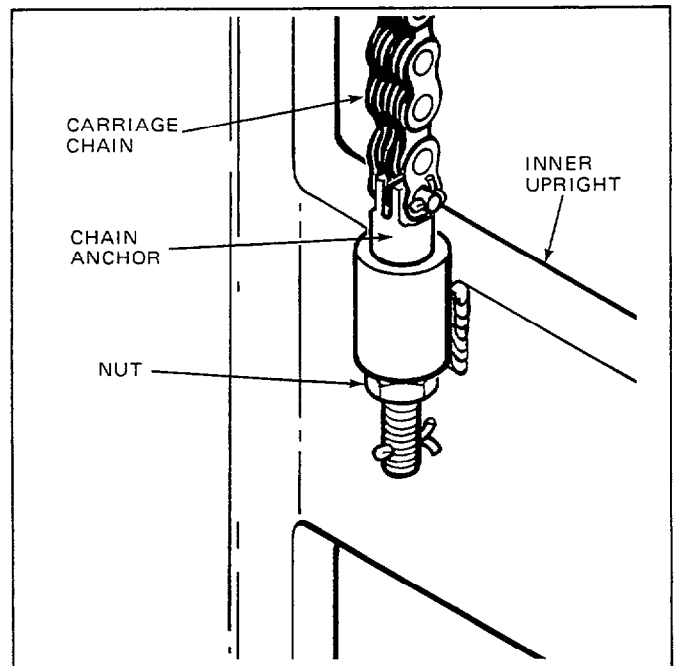


Figure 49. Carriage Chain Adjusting Nut

Section 6 Standard Labor Times

6.1 Determining Labor Times

Standard Labor Time is the average time required to perform each operation described in Section 5 Service. Each Standard Labor Time is identified by the Service Section paragraph number and title that corresponds to that operation.

The Standard Labor Times are based on the assumption a qualified serviceman is working on a reasonably clean mast with adequate tools. We realize the actual time required to perform an operation may occasionally be greater than that listed, especially if a "first time" serviceman lacks the needed tools, or if a bolt is frozen. But considering all factors that can affect the job, Cascade can only honor warranty labor claims based on these carefully evaluated averages.

We strongly urge servicemen to read the applicable Service Sections of the manual before repairs are initiated. If problem diagnosis is difficult, call one of the Cascade Service Departments listed on the back cover.

To arrive at the total Standard Labor Time for a job, list each operation and add the times. As an example, to replace bushings, your list should look something like this:

5.2-2	Carriage Removal	1.0
5.2-4	Carriage Installation	1.0
Total Standard Labor Time (hours)		2.0

6.2 Standard Labor Times

Paragraph Number	Times (hours)
5.1-4	Cylinder Removal (mast mounted on truck) 1.0
5.1-4	Cylinder Retainer Seal Replacement Steps 1-7. 1.0
5.1-5	Cylinder Disassembly, Service and Reassembly. . . 3.0
5.1-6	Lowering Control Valve Service 0.5
5.1-7	Bleeding the Cylinder 0.3
5.1-8	Cylinder Sequencing 0.3
5.1-9	Crosshead Adjustment 0.5
5.2-2	Carriage Removal (mast mounted on truck) 1.0
5.2-4	Carriage Installation (mast mounted on truck) 1.0
5.2-5	Carriage Chain Adjustment 0.5
5.3-3	Mast Removal 1.0
5.3-4	Carriage Removal 0.3
5.3-5	Crosshead and Cylinder Removal 0.5
5.3-6	Upright Disassembly 1.5
5.3-8	Upright Reassembly 3.0
5.3-9	Crosshead and Cylinder Installation 0.5
5.3-10	Carriage Installation 0.3

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

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