Service Manual

30D/35D/40D/50D/55D/60D

Full Free Lift 3-Stage Mast - MT

Manual Part Number 687250 R3

LIFT-TEK ELECAR MASTS
Lift Technologies

Contents

Section 1 Introduction

1.1 Introduction

This manual provides the installation instruction, periodic maintenance, troubleshooting and service procedures for the Lift Tek Series masts.

In any communication about the mast, refer to the mast serial number stamped in the nameplate. If the nameplate is missing, these numbers are also stamped on the left-hand upper cheekplate. See Figure 1.

WARNING: Do not install a Lift Tek Mast on a truck with a capacity greater than the truck rated capacities shown below

TRUCK CAPACITY AT 24IN. (610 mm) LOAD CENTER					
30D	**35D**	**40D**	**50D**	**55D**	**60D**
3000 lbs.	3500 lbs.	4000 lbs.	5000 lbs.	5500 lbs.	6000 lbs.
(1361 kg)	(1585 kg)	(1812 kg)	(2268 kg)	(2491kg)	(2718 kg)

Modifications and additions which affect capacity or safe operation shall not be performed without prior written approval from Lift Technologies per ANSI B56. 1.

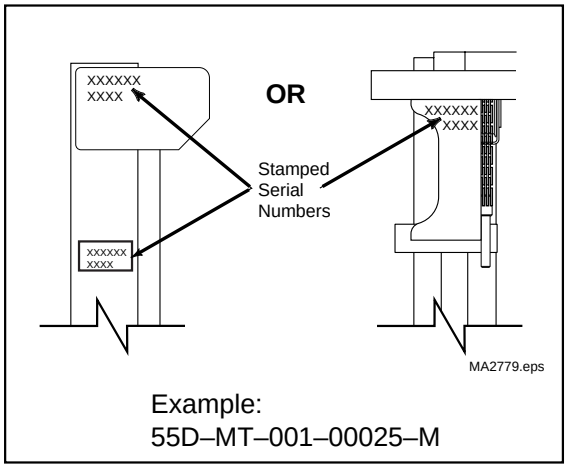


Figure 1. Serial Mast Number Location

1.2 Special Definitions

WARNING

A statement preceded by **WARNING** is information that should be acted upon to prevent **bodily injury**. A **WARNING** is always inside a ruled box.

CAUTION

A statement preceded by **CAUTION** is information that should be acted upon to prevent **machine damage**.

IMPORTANT

A statement preceded by **IMPORTANT** that possesses special significance.

NOTE

A statement preceded by **NOTE** is information that is handy to know and may make your job easier.

Section 2 Installation Instructions

2.1 Truck System Requirements

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

Lift Tek Mast	Relief Pressure	Hose Size	Fitting* Size
30D/35D/40D	2000 psi	No. 8 min.	No. 8 min.
30D/35D/40D	2600 psi	No. 6 min.	No. 6 min.
50D/55D/60D	2600 psi	No. 8 min.	13/32 in. Orifice

* Valve inlet port is 3/4 in. SAE O-ring. See Figure 2.

WARNING: For proper truck stability or to prevent interference, tilt restriction may be required. Contact the truck manufacturer.

IMPORTANT: Lift Tek Masts are compatible with SAE 10W petroleum base oil per Mil. Spec. MIL-0-5606 or MIL-0-2104 B only. Use of synthetic or aqueous base hydraulic oil is not recommended. If fire resistant hydraulic oil must be used, contact Lift Tek.

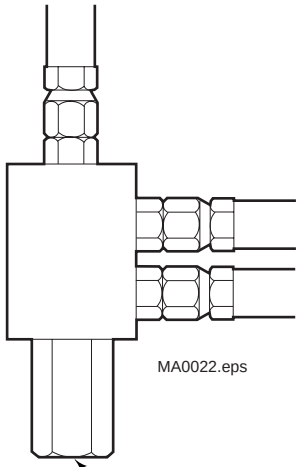


Figure 2. Valve inlet Port.

2.2 Mounting Bracket Installation

If it is necessary to install mounting brackets and cross-members to fit your lift truck, consult with the nearest Lift Tek Service Department listed on the back cover. You must supply dimensions **A** through **F** shown in Figure 3. Failure to install the correct brackets and cross-members 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.

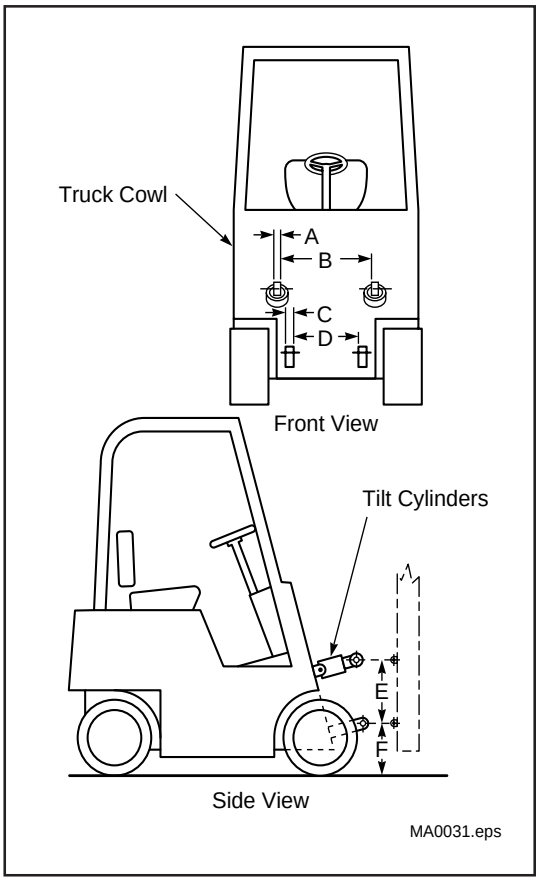


Figure 3. Determining Mounting Bracket Location.

Section 2 Installation Instructions

2.3 Mast Installation

1. **Raise** and block the front end of the truck 1ft. (30 cm) per ANSI B56.1 or drive the truck over a service pit.

2. Install the bearings to lower the axle mounts.

3. Lubricate the bearing surfaces of the lower axle and tilt cylinder mounting brackets with chassis grease.

4. Lift the mast using an overhead hoist with chain hooks attached to the cheekplate lifting holes. Position the mast by lowering the axle mounts on the truck axle. Install the mount caps and capscrews. Tighten the capscrews to the truck manufacturer's torque specifications.

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

5. Connect the lift truck hose to the mast valve.
6. Connect the tilt cylinders to the mast anchor brackets. Tighten the pin capscrews to the truck manufacturer's torque specifications.

NOTE: Use as few fittings as possible and always use 45° fittings instead of 90° fittings. Keep the hose lengths to a minimum. Avoid sharp bends or pinch points when routing the hose.

Contact Lift Tek if additional fittings are required. See back cover.

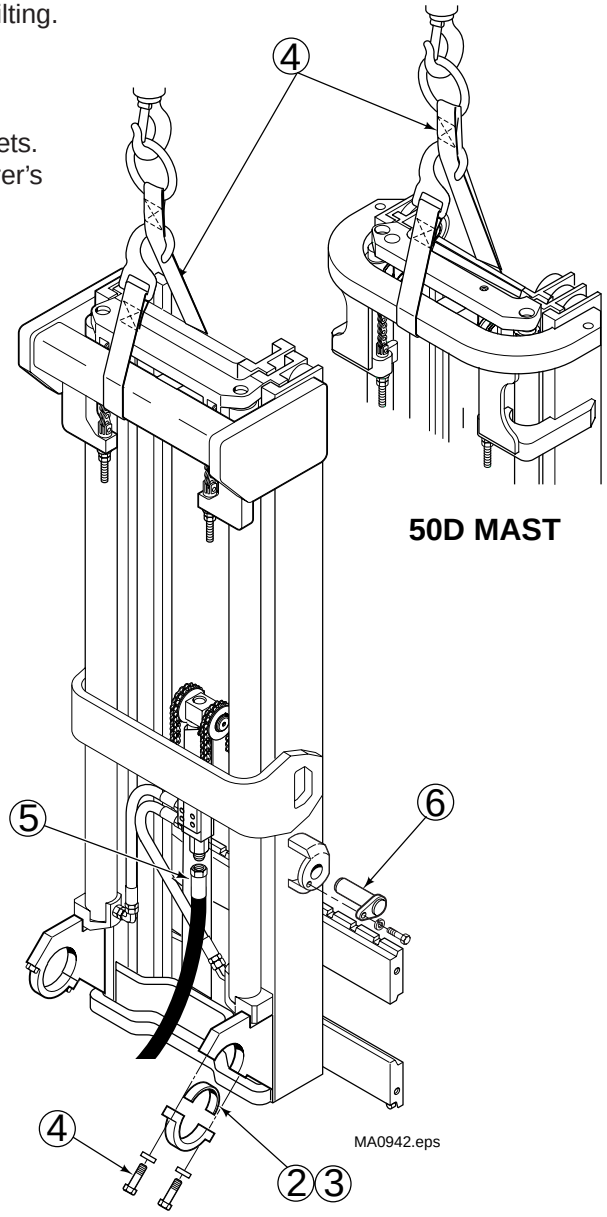


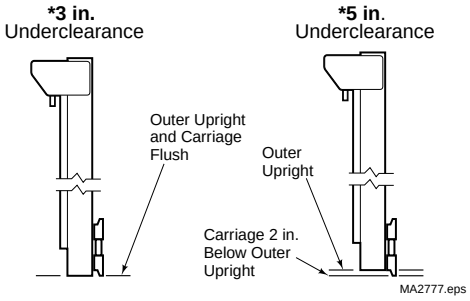
Figure 4. Mast Installation.

2.4 Inspection and Adjustments

2.4-1 Chain Inspection and Tension

The 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 for internal mast installation.**

The chains must be adjusted with equal tension to ensure proper load distribution and mast operation. To determine equal tension, extend the unload 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”. If they do not have equal tension, preform the hoist chain adjustments described in Section 5.6-3 and 5.6-4.



NOTE: Underclearance is based on mast production series, actual mast underclearance may vary by truck model.

Figure 5. Upright and Carriage Position.

2.4-2 Main Lift Chain Adjustment

SEE SECTION 5.6-4.

2.4-3 Free Lift Chain adjustment

SEE SECTION 5.6-6.

2.4-4 Free lift Cylinder Supply Hose Tracking Adjustment

Make sure the cylinder supply hose is not twisted and travels evenly in the hose guide. Check the hose to be sure it is not scuffing. Adjust the hose by loosening the hose end connection at the valve and twist the hose. Tighten the hose end while holding the hose in place. See Figure 10. Tension on the hose can be adjusted by using a different set of bracket holes. Use the holes that place a small amount of tension on the hose.

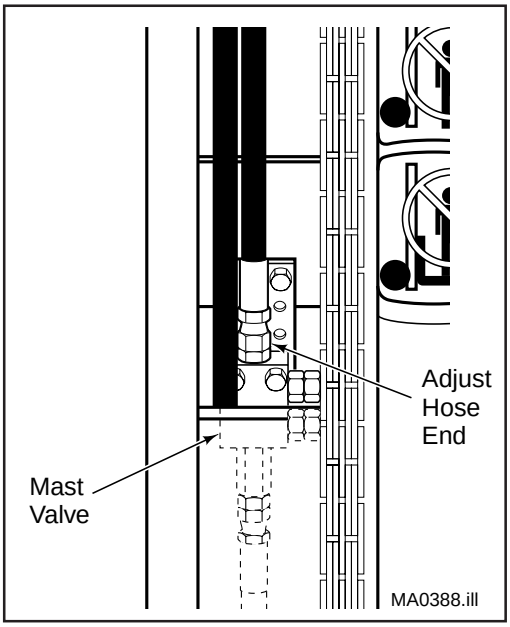


Figure 6. Free Lift Cylinder Supply Hose Adjustment.

2.4-5 Upright Rail Lubrication

Lubricate the full length of each upright rail with chassis lube or Kendall SR-12X as shown in Figure 6.

2.4-6 Cylinder Bleeding

SEE SECTION 5.2-11.

2.4-7 Mast Skewing

Check for mast skewing as described in Section 5.5-6.

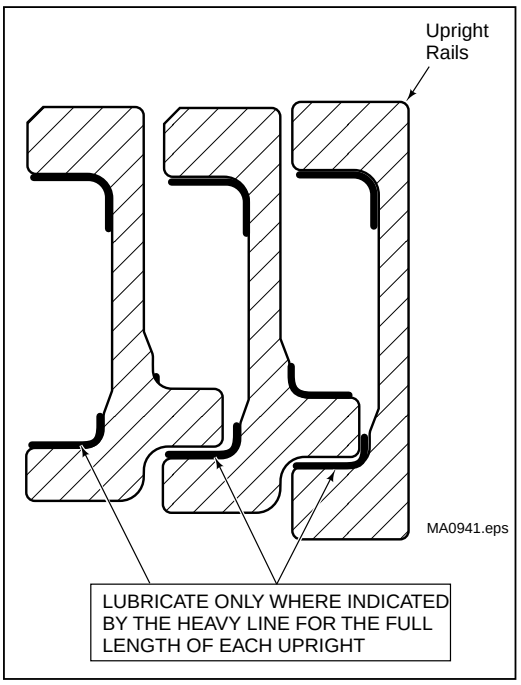


Figure 7. Channel lubrication.

Internal Reeving - Hi-Vis Installation 30D/35D/40D and 50D

2.5

1. Install the shafts, sheaves and hose guards to the crosshead center plate. Leave the capscrew and nut finger tight to allow hose installation.

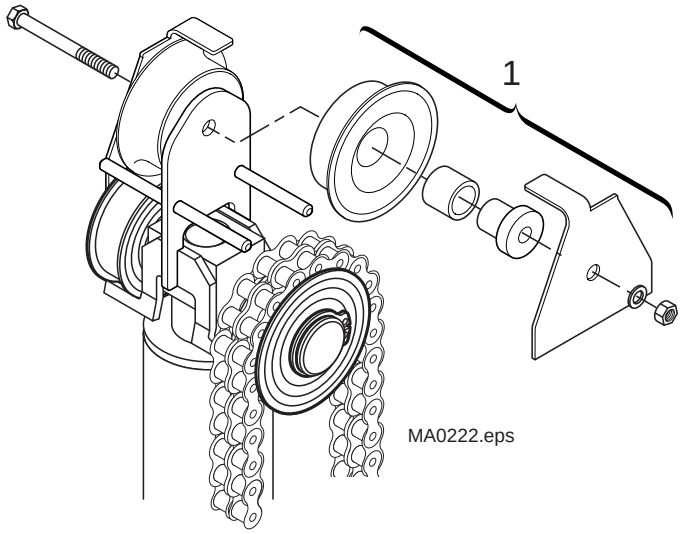


Figure 8 . Crosshead Assembly.

2. Install the carriage bracket to the tabs between the carriage sideplates. Leave the capscrews finger tight.

3. Install fittings to bracket.

* Single Function - Install the fittings to the left or right side location. Tighten the fittings finger tight.
* Double Function - Install the fittings to the left and right side location. Tighten the fittings finger tight.

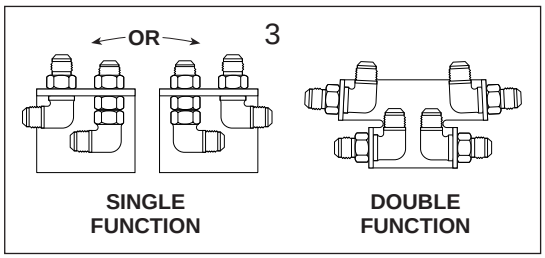


Figure 8. Carriage Bracket Assembly.

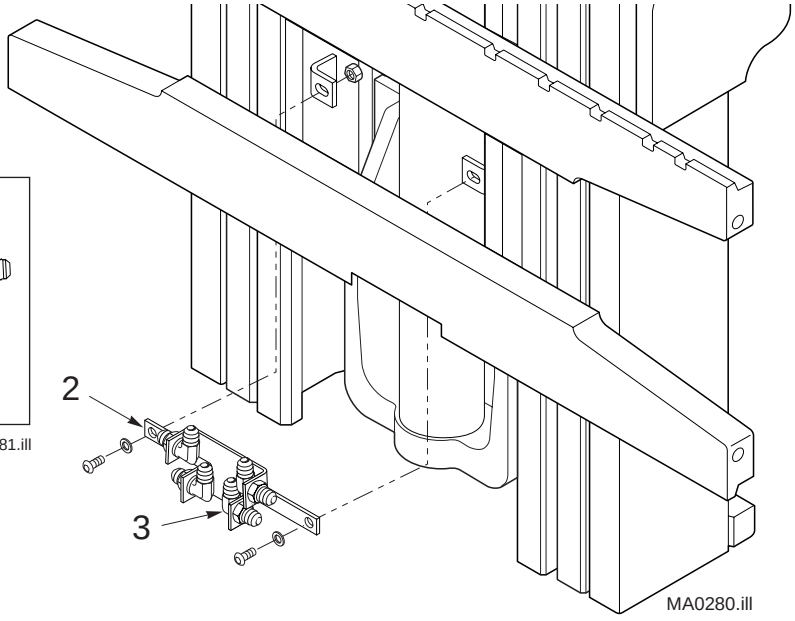


Figure 9. Carriage bracket Installation.

Internal Reeving - Hi-Vis Installation 30D/35D/40D and 50D

4. Install the brackets, hose clamps and sheaves to the uprights. Tighten the bracket capscrews to a torque of 38 ft.- lbs. (51 Nm).

5. Completely lower the carriage. Route the hoses down behind the top carriage bar to the carriage bracket fittings. Connect the hoses fittings to the carriage fittings and tighten.

6. Loosen the crosshead coverplate capscrew. Route the hoses up over the crosshead sheaves. Orient the hoses with the natural curve over the sheaves.

7. Route the hoses down between the free lift cylinder and middle inner crossmember to the bracket behind the free lift cylinder. The hoses route through the wire loop then underneath the lower inner crossmember. Assemble the clamp and hoses, then pull down on the hoses with 80 lbs. force to remove slack. Tighten the clamp capscrews to a torque of 8 ft.-lbs (11Nm).

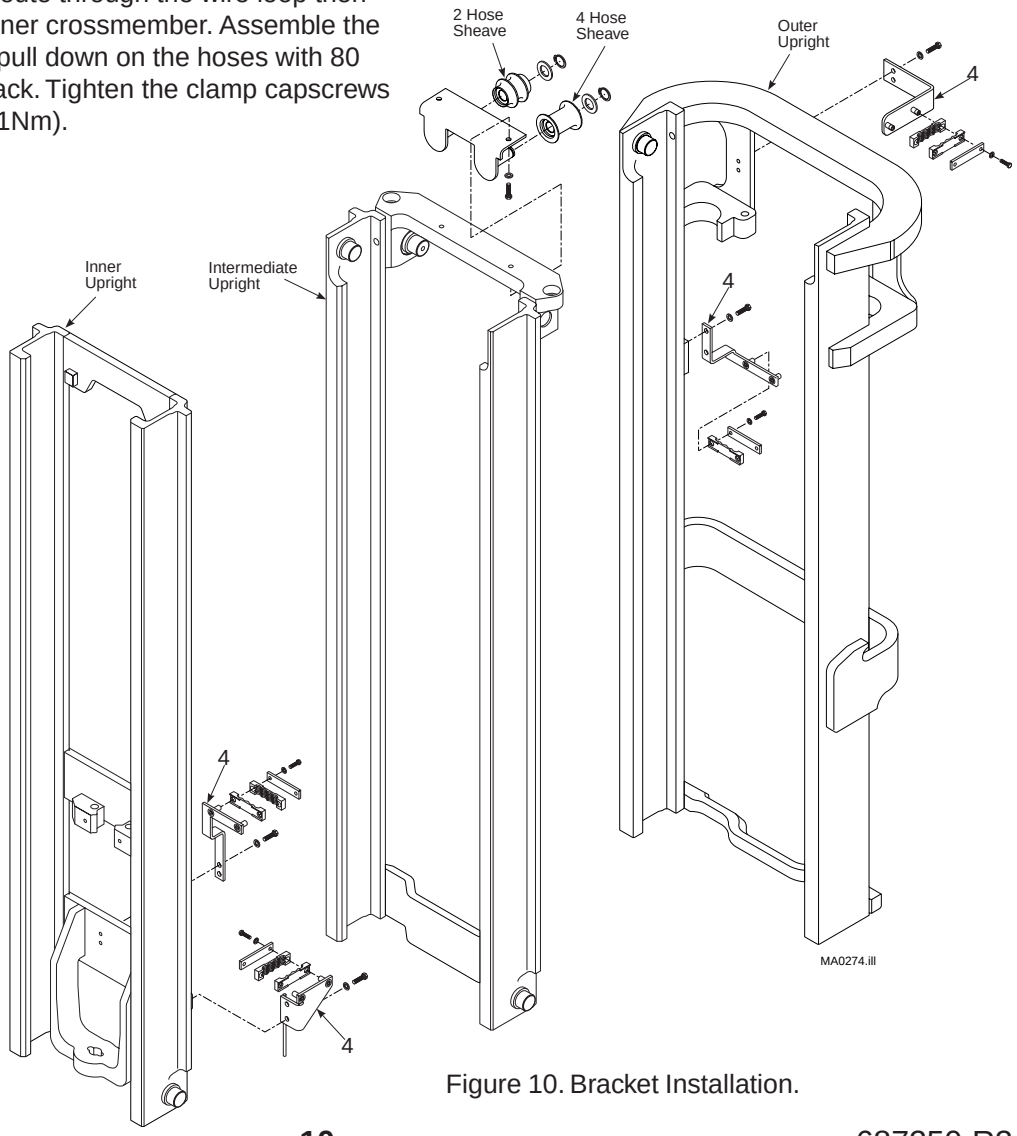


Figure 10. Bracket Installation.

Section 2 Installation Instructions

Internal Reeving - Hi-Vis Installation 30D/35D/40D and 50D

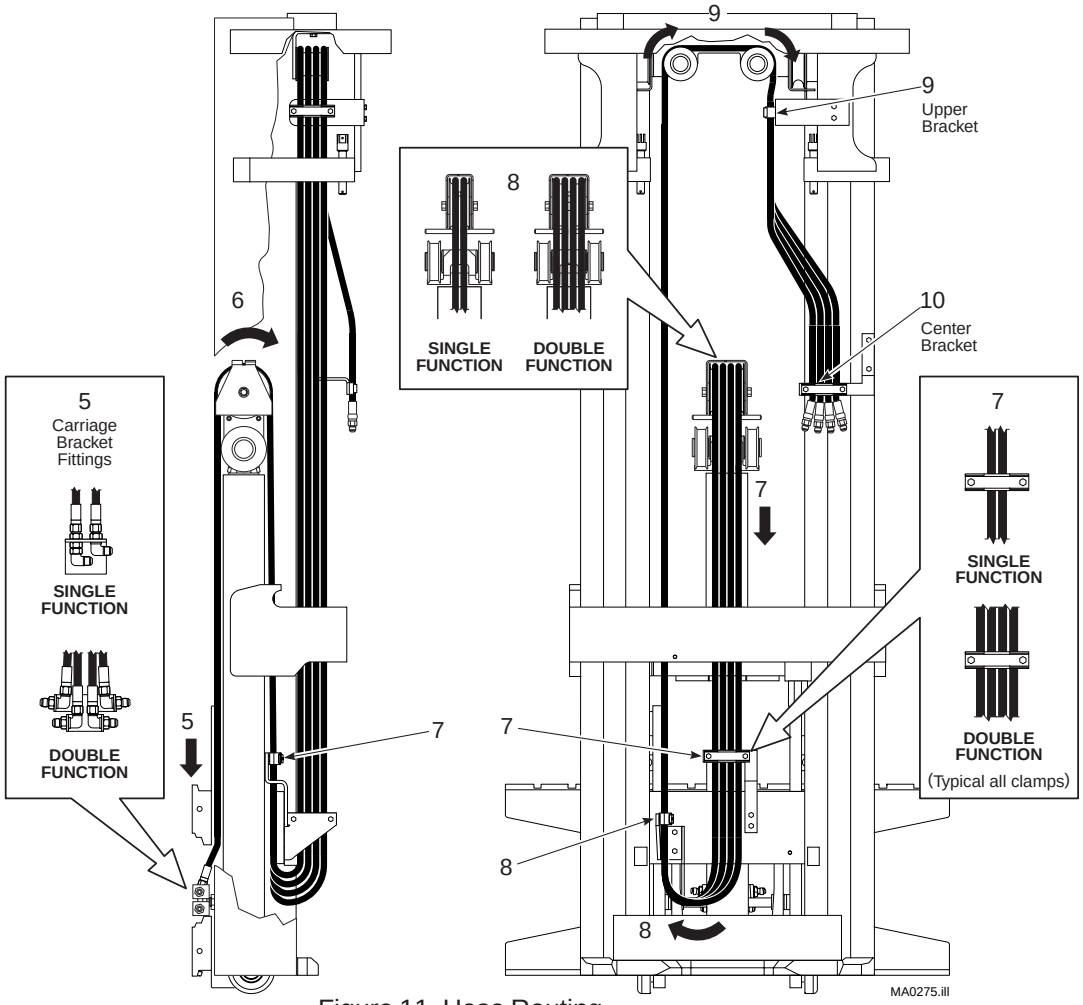


Figure 11. Hose Routing.

8. Route the hoses under the lower inner crossmember to loop up to the lower hose bracket. Install the hose clamps leaving the capscrews finger tight. Align the hoses under the crossmember and into the clamp. Tighten the clamp capscrews to a torque of 8 ft.-lbs. (11Nm).

9. Route the hoses up to and over the upper hose sheaves and then down to the upper hose bracket. Assemble the clamp and hoses to the upper bracket leaving the capscrews finger tight. Starting with the outer hose, pull down on the hoses with 80 lbs. of force to remove slack, then tighten the clamp capscrews to a torque of 8 ft.-lbs. (11Nm).

10. Attach the hose ends to the center hose bracket aligning the hoses with their natural curve. Tighten the clamp capscrews to a torque of 8 ft.-lbs. (11Nm.)

11. Attach the left hand cylinder supply hose and clamp to the outer upright center crossmember. Tighten the clamp capscrew to a torque of 8 ft.-lbs. (11Nm.)

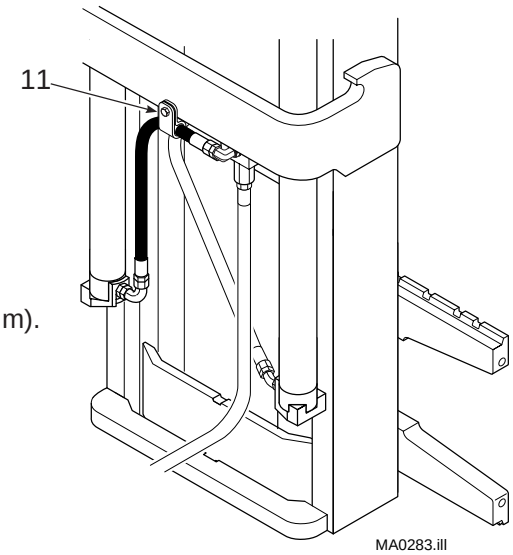


Figure 12. Main Lift Hose.

Internal Reeving - Hi-Vis Installation 30D/35D/40D and 50D

12. Tighten the crosshead coverplate capscrew to a torque of 51 ft.-lbs. (70Nm.).

13. Tighten the carriage bracket capscrews to a torque of 46 ft.-lbs. (63 Nm.)

14. Raise and lower the mast slowly through several cycles checking for proper hose alignment, clearances and hose tracking.

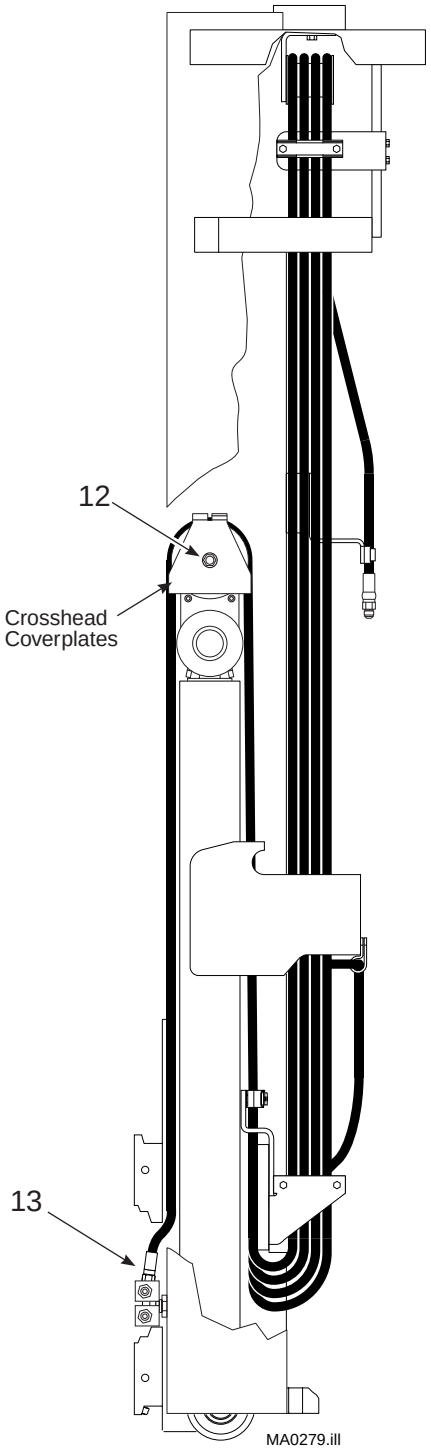


Figure 13. Crosshead Assembly.

Internal Reeving - Std-Vis Installation 55D/60D

1. Install the reeving brackets to the crosshead. Tighten the capscrews to a torques of 12 ft.-lbs. (17Nm.).

2. Install the rollers and hose guards to the crosshead reeving bracket. Leave the nut finger tight to allow hose installation.

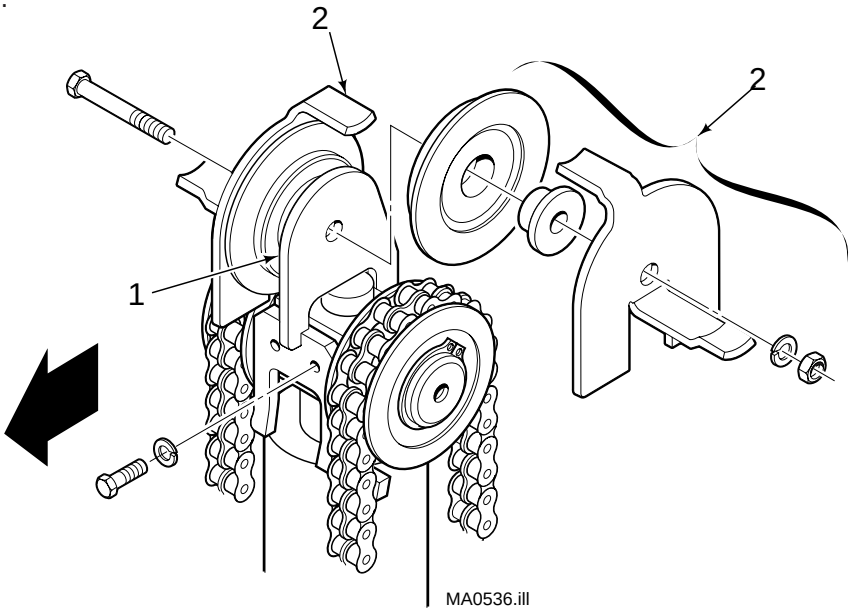


Figure 14. Center Crosshead Sheaves.

3. Double Function Internal Reeving - Install the sheaves to the crosshead chain shafts. Leave the capscrews finger tight to allow for hose installation.

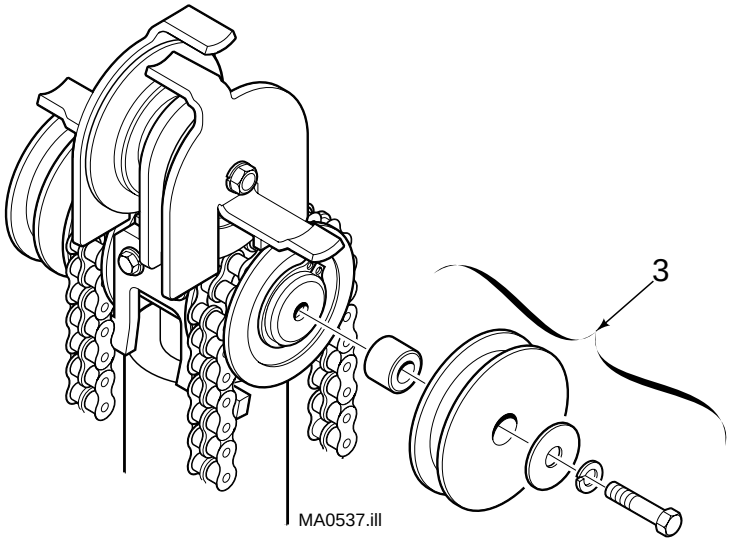


Figure 15. Outer Crosshead Sheaves.

Section 2 Installation Instructions

Internal Reeving - Std-Vis
Installation 55D/60D Single Function

1. Install the carriage bracket to the tabs on the carriage side plates. Tighten the nuts to a torque of 38 ft.-lbs. (51Nm.)

2. Install the bulkhead and 90^0 fitting to the middle two holes in the carriage bracket.

3. Install the hoses to the carriage bracket fittings. Leave the fittings loose.

4. Route the hoses up and over the rollers on the center of the crosshead. Tighten the hose guard capscrew to a torque of 38 ft.-lbs. (51Nm.).

WARNING: Chain and block the uprights and carriage to secure for step 5.

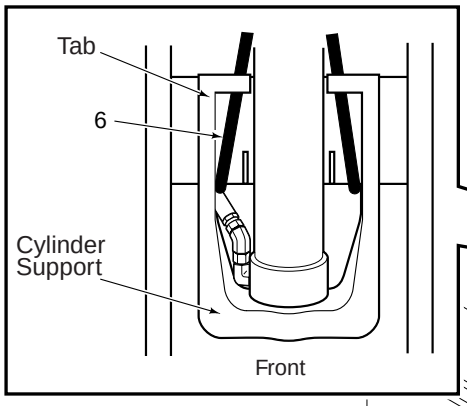
5. Install spacers to the inner crossmember backside tabs.

6. Raise the carriage approximately 8 ft. (240cm). route the hoses downward on the front side of all the cross-members**,** then under the tab on the front side of the cylinder support. Feed the hoses backward under the cross-member, around the casting guide upward under the back side.

7. Pull the hose ends to remove hose slack.

8. Remove the existing capscrews from the main lift chain shafts. Install the hose, sheaves, shafts and spacers to the main lift chain shafts. Tighten the capscrews to a torque of 58 ft.-lbs. (79Nm.). Make sure the sheaves rotate freely.

9. Attach the hoses to the brackets and fittings. Leave the fittings loose on the bracket.



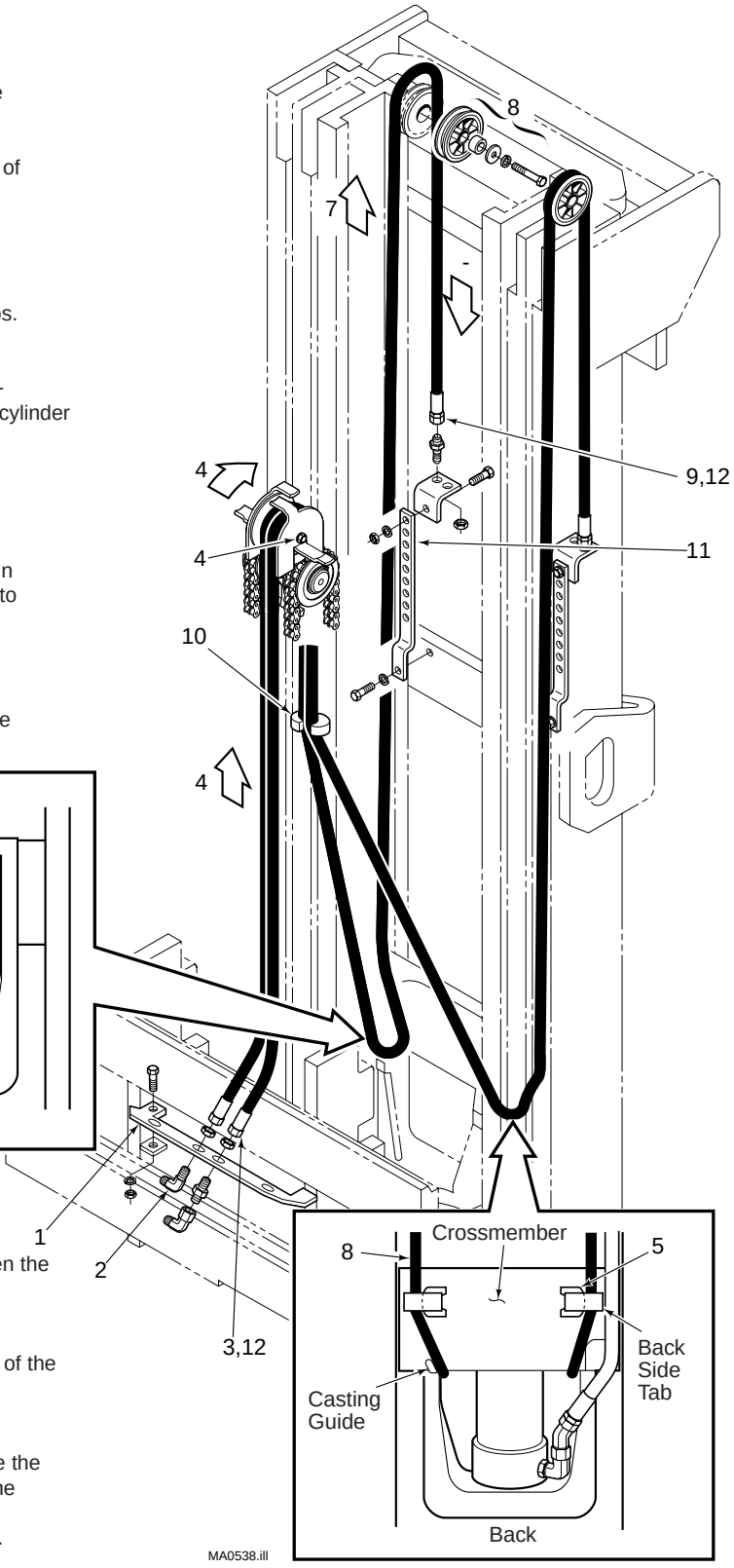


Figure 16. Hose Routing.

10. Install the hose clamps to the hoses half way between the crosshead and lower crossmember.

11. Pull down on the hoses to remove slack and stretch hoses one inch. Install the brackets on the front side of the crossmember using the next hole down. Tighten the capscrew to a torque of 38 ft.-lbs. (51 Nm.).

12. Raise and lower the mast several times to make sure the hoses are tracking correctly. Use the white line on the hose to detect twisting. Adjust the hose ends if re-quired. Tighten fittings making sure they do not twist.

Internal Reeving - Std-Vis
Installation 55D/60D Double Function

1. Install the carriage bracket to the tabs on the carriage side plates. Tighten the nuts to a torque of 38 ft.-lbs. (51Nm.).

2. Install the bulkhead and 90^0 fitting to the holes in the carriage bracket.

3. Install the hoses to the carriage bracket fittings. Leave the fittings loose.

4. Route the hoses up and over the rollers on the crosshead. Tighten the sheave capscrews to a torque of 38 ft.-lbs. (51Nm.).

WARNING: Chain and block the uprights and carriage to secure for step 5.

5. Raise the carriage approximately 8 ft. (240 cm). Route the hoses downward on the front side of all crossmembers, then under the tab on the front side of the cylinder support. Feed the hoses backward under the crossmember, around the casting guide upward under the back side tabs.

6. Pull the hose ends to remove slack.

7. Remove the existing capscrew from the main lift chain shafts. Install the hoses, sheaves, shaft and spacers to the main lift chain shafts. Tighten the capscrew to a torque of 58 ft.-lbs. (79Nm.). Make sure the sheaves rotate freely.

8. Attach the hoses to the brackets and fittings. Leave the fittings loose on the bracket

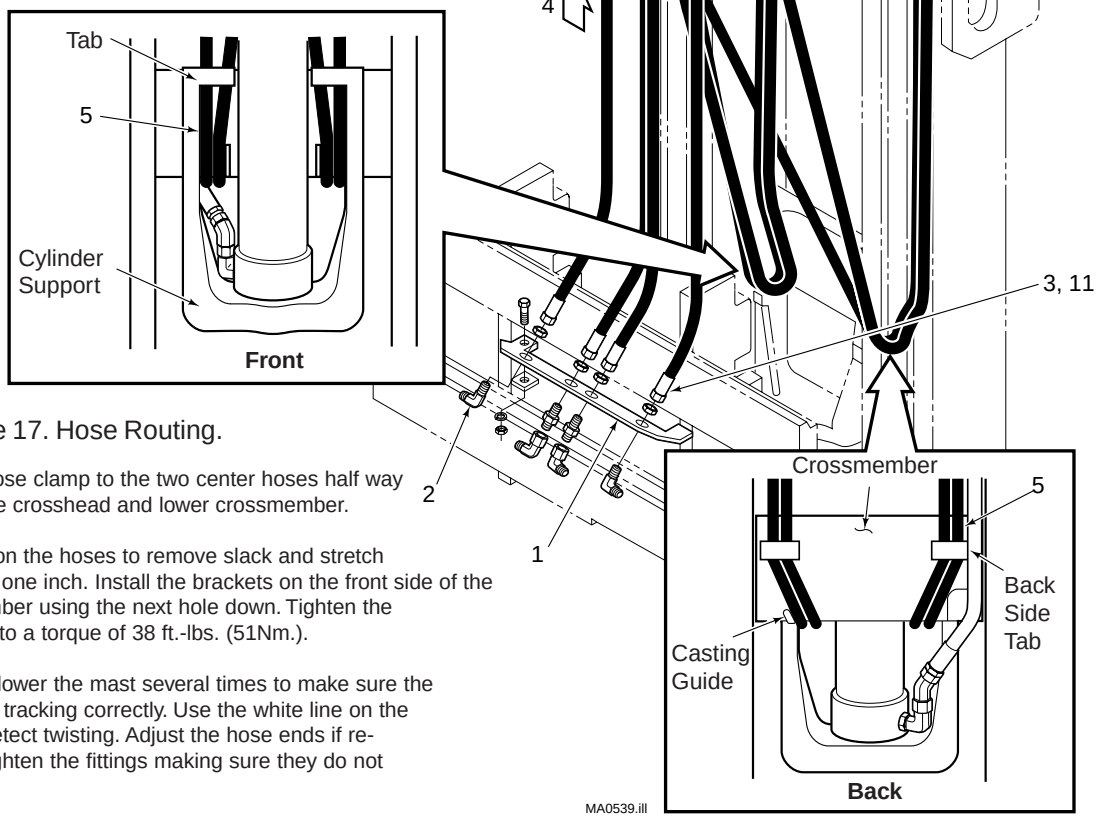


Figure 17. Hose Routing.

9. Install the hose clamp to the two center hoses half way between the crosshead and lower crossmember.

10. Pull down on the hoses to remove slack and stretch the hoses one inch. Install the brackets on the front side of the crossmember using the next hole down. Tighten the capscrew to a torque of 38 ft.-lbs. (51Nm.).

11. Raise and lower the mast several times to make sure the hoses are tracking correctly. Use the white line on the hose to detect twisting. Adjust the hose ends if required. Tighten the fittings making sure they do not twist.

Section 3 Periodic Maintenance

3.1 Periodic Maintenance

For proper operation and an extended service life, your Lift Tek Mast should be inspected and serviced regularly as part of your normal lift truck maintenance schedule according to the following outlines and ANSI B56.1 procedures.

The recommended intervals are for masts operating under normal conditions. If the mast is operating in severe conditions or corrosive atmospheres, the inspections should be performed more frequently.

WARNING: Never work on the mast with a load on the forks or attachment, in the raised position without supports or while anyone is near the lift truck control handles per ANSI B56.1

3.1-1 Daily Inspection

Perform the following at the beginning of each work shift:

1. Extend the carriage a few inches off the ground and make sure the chains are under equal tension. Refer to Section 5.6-3 and 5.6-6 for chain adjustment.

2. Extend the mast to its fullest height to make sure the mast rails and carriage extend freely without binding.

3. While the mast is extended, inspect the upright rails for proper lubrication. Refer to Section 2.4-5 Step for rail lubrication.

4. Make sure the internal reeving hoses (if equipped) travel evenly in the hose guides. Adjust the hose ends if required. Tighten the fittings making sure they do not twist.

100 Hour Inspection

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

1. Inspect and lubricate the full length of the chains with SAE 40 wt. oil or Bowman Heavy Load Red Grease.

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

500 Hour Inspection

After each 500 hours of lift truck operation, and in addition to the Daily and 100 Hour Inspection:

1. Each pair of load rollers on the uprights and carriage should be shimmed so that a total side to side clearance no greater than 1/16 in. (1.5 mm) occurs at the tightest point throughout the travel of the member. Pry between the upright and load roller so that the opposite load roller is tight against the upright. Measure the clearance for the pair of rollers at XXX shown. See Figure 18.

2. Check the chains for wear and stretch. Refer to Section 5.6-1 for complete chain inspection.

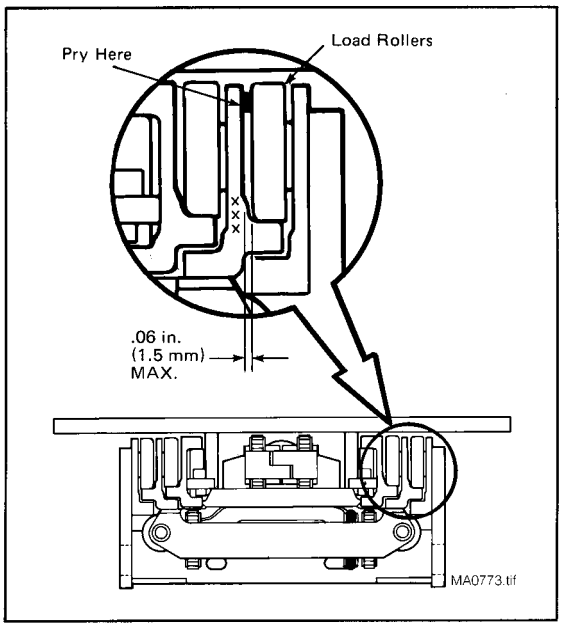


Figure 18. Load Roller Clearances.

Section 4 Troubleshooting

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

PROBLEM	PROBABLE CAUSE	SOLUTION
Cylinders don't lift load or won't move		
Empty	**a)** Plugged inlet hose	**a)** Unplug hose or replace.
	b) Insufficient oil.	**b)** Check the truck hydraulic system for correct oil level in tank, defective pump or pump drive, leaks in the lines or disconnect control valve linkage. Repair or replace as necessary.
	c) Bent or jammed plunger.	**c)** Repair or replace as necessary.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
Loaded	**a)** Plugged piston check valve.	**a)** Unplug check valve or replace.
	b) Truck relief valve setting low.	**b)** Raise truck relief setting to specified level.
	c) Over capacity.	**c)** Reduce load to specified capacity.
	d) Mechanical bind due to bent plunger or bad rollers.	**d)** Remove mechanical bind by replacing/freeing plunger and rollers.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
Cylinders drift-	**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 retainer.	**c)** Replace all cylinder seals.
	d) Piston check valve leaking.	**d)** Replace check valve.
Spongy or jerky action-	**a)** Sticky or defective truck relief valve.	**a)** remove and check the truck relief valve. If contaminated oil caused the malfunction, drain and flush the system, change the filter and refill with fresh oil.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
	b) Bent or damaged cylinder plunger.	**b)** Disassemble, check and repair cylinder assembly.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
	c) Load rollers not properly adjusted or defective.	**c)** Adjust or repair as necessary.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
	d) Mast channels improperly lubricated.	**d)** Lubricate mast.
	⚠ **WARNING:** Extreme care should be used when working on a unit when the carriage (with or without a load) is in the raised position.	
	e) Low Battery charge.	**e)** Charge battery.
	f) Low pump volume.	**f)** Install accumulator.
	g) Low oil level.	**g)** Fill oil reservoir.
	h) Insufficient hydraulic tank capacity or baffles.	**h)** Install larger tank baffles
	Other.	**Contact Lift Technologies**

5.1 Mast Removal

1. Raise and block the front end of the truck 1ft. (30cm) or drive the truck over a service pit.

2. Disconnect the lift truck supply hose from the mast valve. Plug the hose end and cap the valve fitting.

> **WARNING:** Do not stand on or near the mast while suspended by the hoist.

3. Attach overhead hoist with lifting strap routed under all upper crossmembers. Take up slack in the strap.

4. Disconnect the tilt cylinders from the mast anchor brackets. For reassembly, tighten the pin capscrews to the truck manufacturer's torque specifications.

5. Disconnect the mast lower mounts. For reassembly, tighten the capscrews to the truck manufacturer's torque specifications.

6. Lift away the mast.

7. For mast installation, refer to Section 2.1.

> **WARNING:** Do not stand the mast upright unless it is chained to a support.

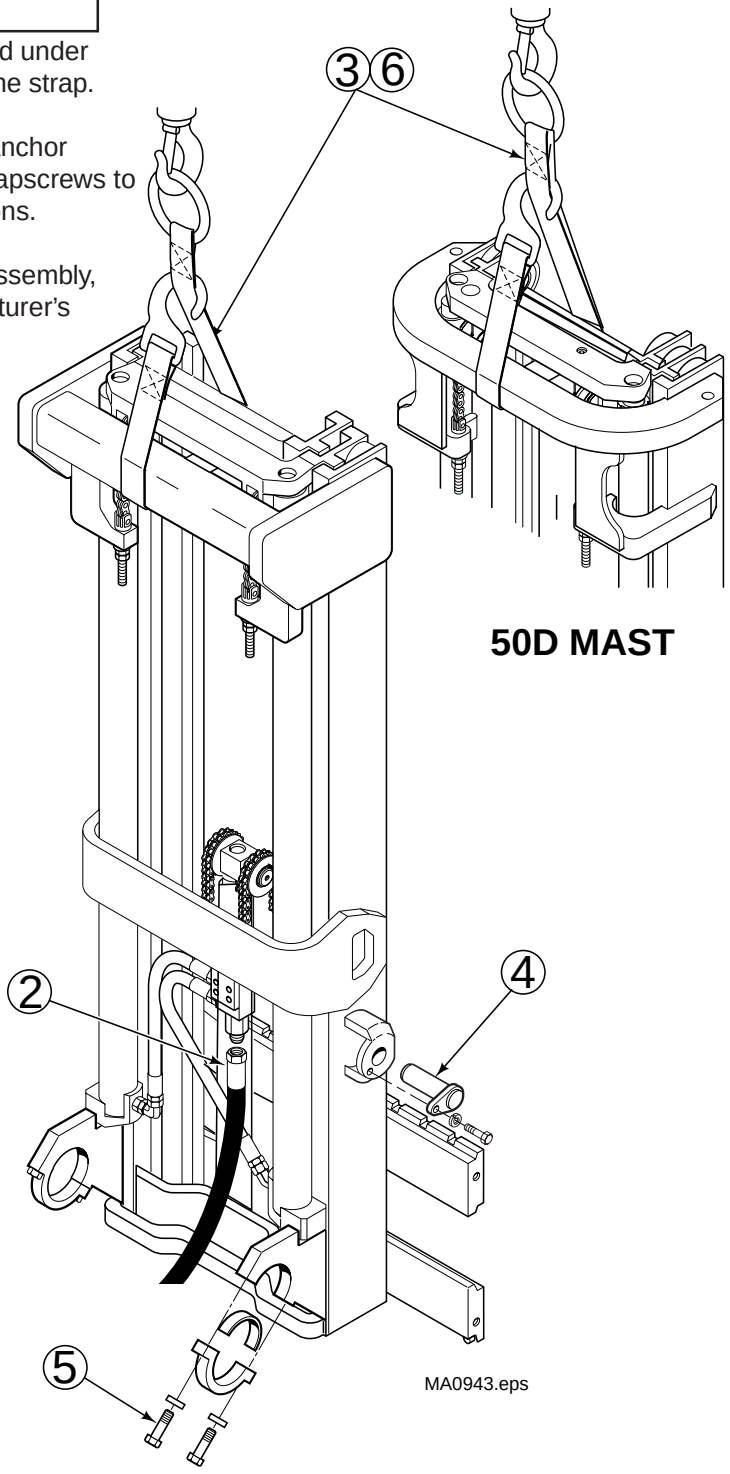


Figure 19. Mast Removal

5.2 Cylinders

5.2-1 2000 PSI Main Lift Cylinder Description

The main lift cylinders are single stage piston type cylinders. They consist of a shell and a telescoping plunger/piston assembly. During extension oil pressure is acting against the full piston area. The truck hoist control valve holds the cylinder in place once extension has stopped.

The shell is internally threaded at the top end to hold the retainer. The retainer seals provide a high-pressure hydraulic seal against the plunger. The retainer also limits the upward stroke of the plunger.

A piston is attached to the bottom end of the plunger. The piston seal provides a high-pressure hydraulic seal against the shell. A check valve is located in the bottom of the piston. The check valve allows residual oil between the shell and plunger to escape when the cylinder is extending.

A hydraulic fuse/cushion valve is located in the cylinder port. In case of a hose failure between the lowering control valve and cylinders, the fuse limits the lowering speed of the cylinder. The valve also cushions the piston when the cylinder nears the fully lowered position.

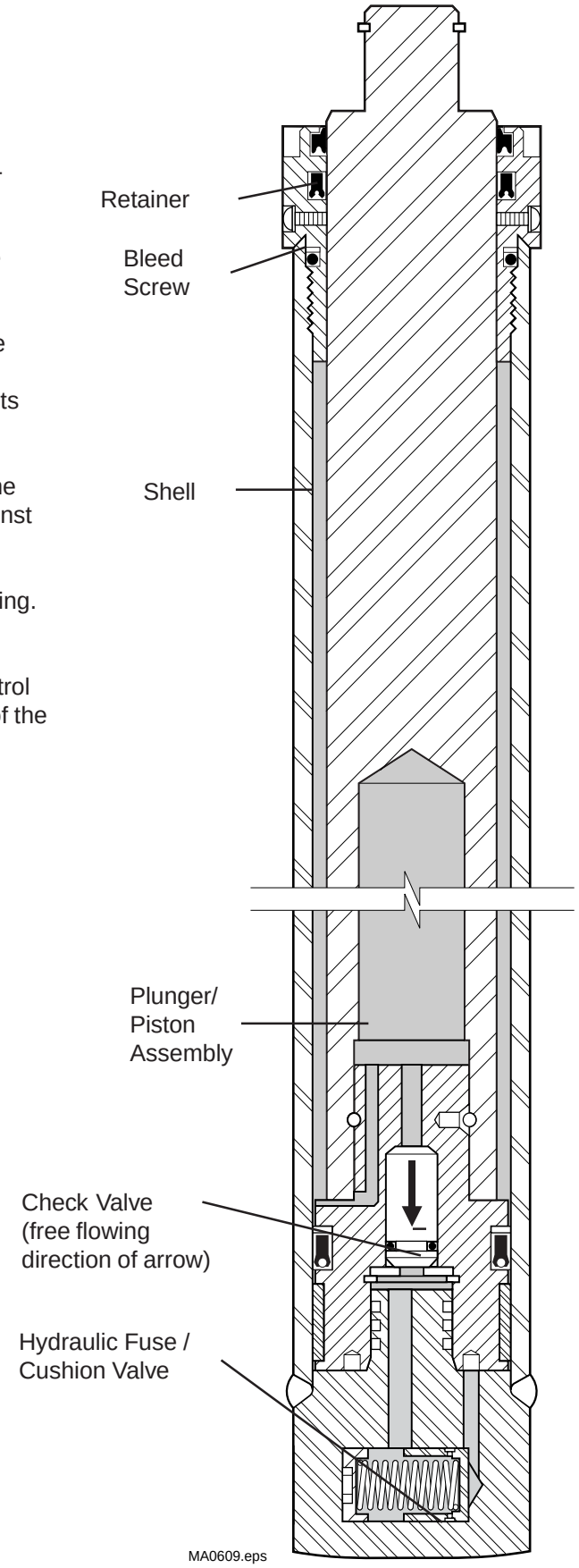


Figure 20. 2000 PSI Cylinder

5.2-2 2600 PSI Main Lift Cylinder Description

The main lift cylinders are a single stage displacement type cylinders. They consist of a shell and a telescoping plunger/piston assembly. During extension the oil pressure is acting against the plunger outer diameter due to the internal porting through the piston. The piston seals do not affect cylinder extension. The truck hoist control valve holds the cylinders in place once extension has stopped.

The shell is internally threaded at the top end to hold the retainer. The retainer seals provide a high-pressure hydraulic seal against the plunger. The retainer also limits the upward stroke of the plunger.

A piston is attached to the bottom end of the plunger. The piston seal provides a high-pressure hydraulic seal against the shell that engages the cushion valve when the cylinder is fully lowered.

A hydraulic fuse/cushion is located in the cylinder port. In case of a hose failure between the lowering control valve and cylinders, the fuse limits the lowering speed of the cylinder. The valve also cushions the piston when the cylinder nears the fully lowered position.

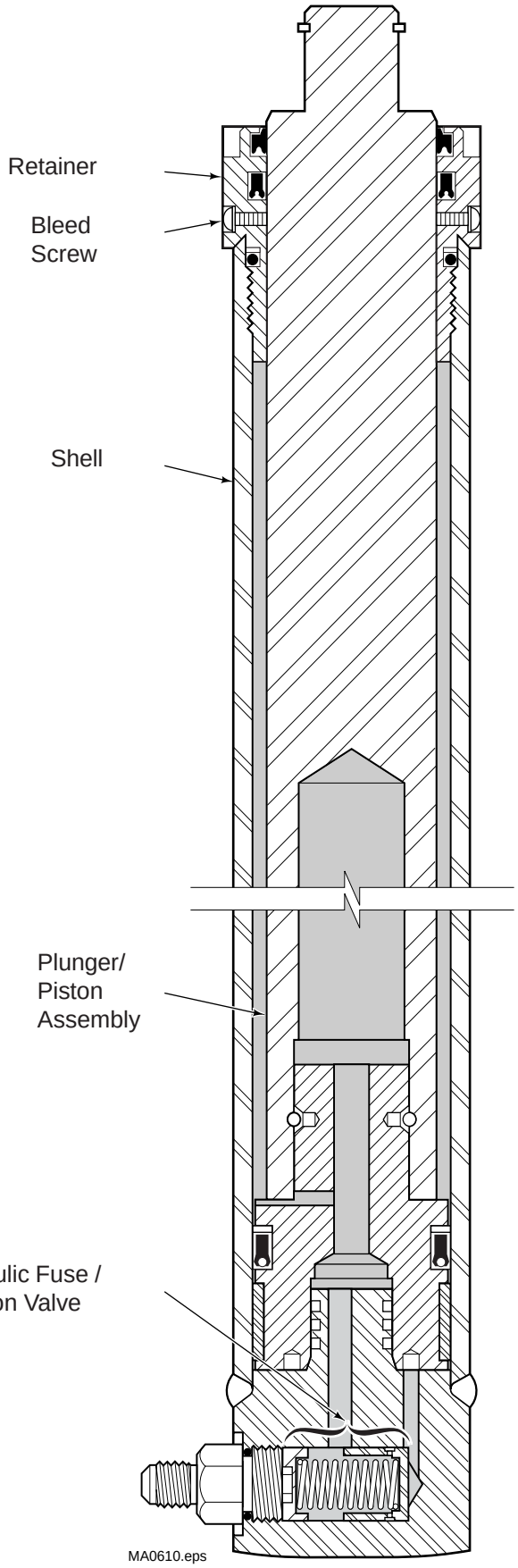


Figure 21. 2600 PSI Cylinder

5.2-3 Free Lift Cylinder Description

The 2000 and 2600 psi free lift cylinders are single stage piston type cylinders. They consist of a shell and a plunger/piston assembly. During extension the oil pressure is acting against the full piston area. The truck hoist control valve holds the cylinder in place once extension has stopped.

The shell is internally threaded at the top end to hold the retainer. The retainer seal provide a high-pressure hydraulic seal against the plunger. The retainer also limits the upward stroke of the plunger.

A piston is attached to the bottom end of the plunger. The piston seal provides a high-pressure hydraulic seal against the shell. A check valve is located in the bottom on the piston. The check valve allows residual oil between the shell and plunger to escape when the cylinder is extending.

A hydraulic fuse/cushion valve is located in the cylinder port. In case of a hose failure between the lowering control valve and cylinder, the fuse limits the lowering speed of the cylinder.

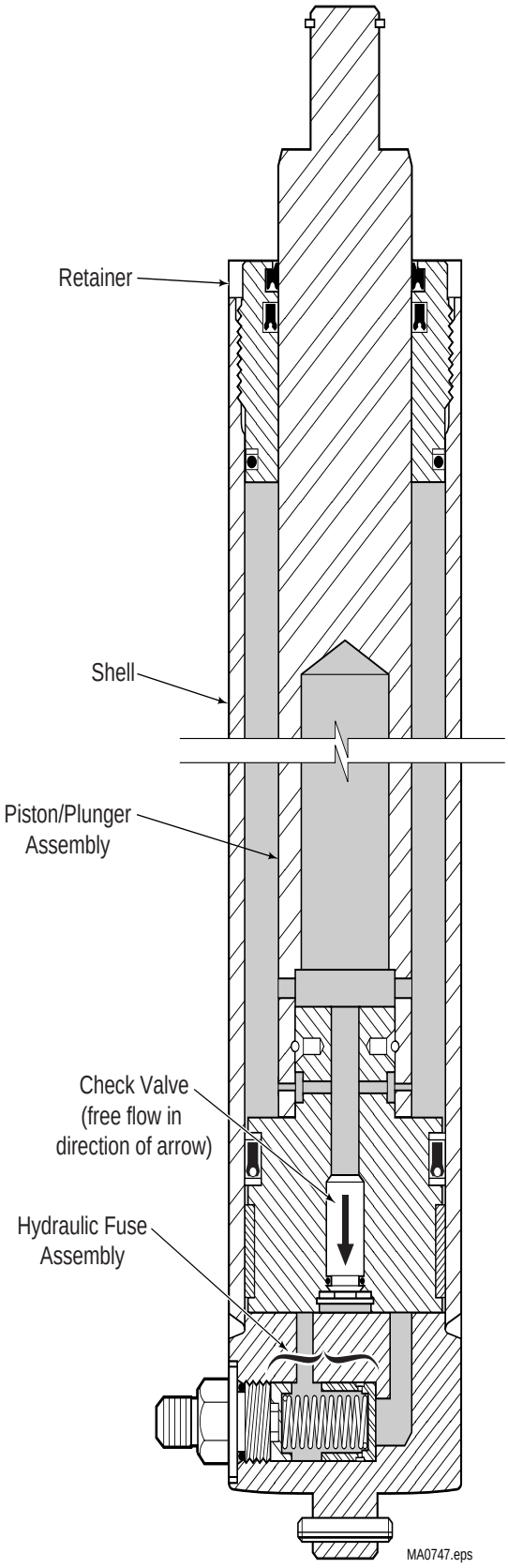


Figure 22. Free Lift Cylinder

5.2-4 Cylinder Operation

Cylinders Raising

1. When the truck hoist control valve is actuated, oil enters the lowering control valve through the inlet port and flows unrestricted through the lowering control cartridge.

2. Oil flows to the cylinder inlet ports. Due to the larger bore diameter of the free lift cylinder compared to both main lift cylinders, the free lift cylinder will raise completely before the main lift cylinders raise.

3. Oil flows through the free lift cylinder hydraulic fuse/cushion valve to the bottom of the piston. Lifting force is created against the bottom of the piston causing the plunger to raise. Oil in the area between the plunger and shell is allowed to escape through the check valve in the piston as the plunger raises to the end of its stroke.

4. **2000 PSI Piston Type Main Lift-Cylinders-** Oil flows through the hydraulic fuse/cushion valve to the bottom of the piston. Lifting force is created against the bottom of the piston causing the plunger to raise. Oil in the area between the plunger and shell is allowed to escape through the check valve in the piston as the plunger raises.

2600 PSI Displacement Type Main Lift Cylinders- Oil flows through the hydraulic fuse/cushion valve to the piston. The piston is internally ported to allow oil flow to the area between the plunger and shell. Lifting force is created that acts on the diameter of the plunger causing the plunger to raise.

5. When oil flow from the truck hoist control valve is discontinued, the cylinders are held in position by the closed center spool of the truck valve.

Cylinders Lowering

1. When the truck hoist control valve is actuated, the main lift then free lift cylinder plungers lower, forcing oil out through the hydraulic fuse/cushion valves.

NOTE: The restriction setting of each hydraulic fuse is lower (allows more oil flow) than the setting of the lowering control valve. The hydraulic fuses restrict flow only in the instance of a lowering control valve or hose failure.

2. Oil flows to the lowering control valve where it is restricted at a controlled speed determined by the load being handled.

3. As the main lift cylinder pistons lower over the spear in the bottom of the shell, a high pressure area is developed between the piston and shell which engages the cushion valve to restrict flow. This slows the piston/plunger just prior to bottoming providing a smooth transition to the free lift cylinder lowering.

Triple Mast (MT) Hydraulic Schematic

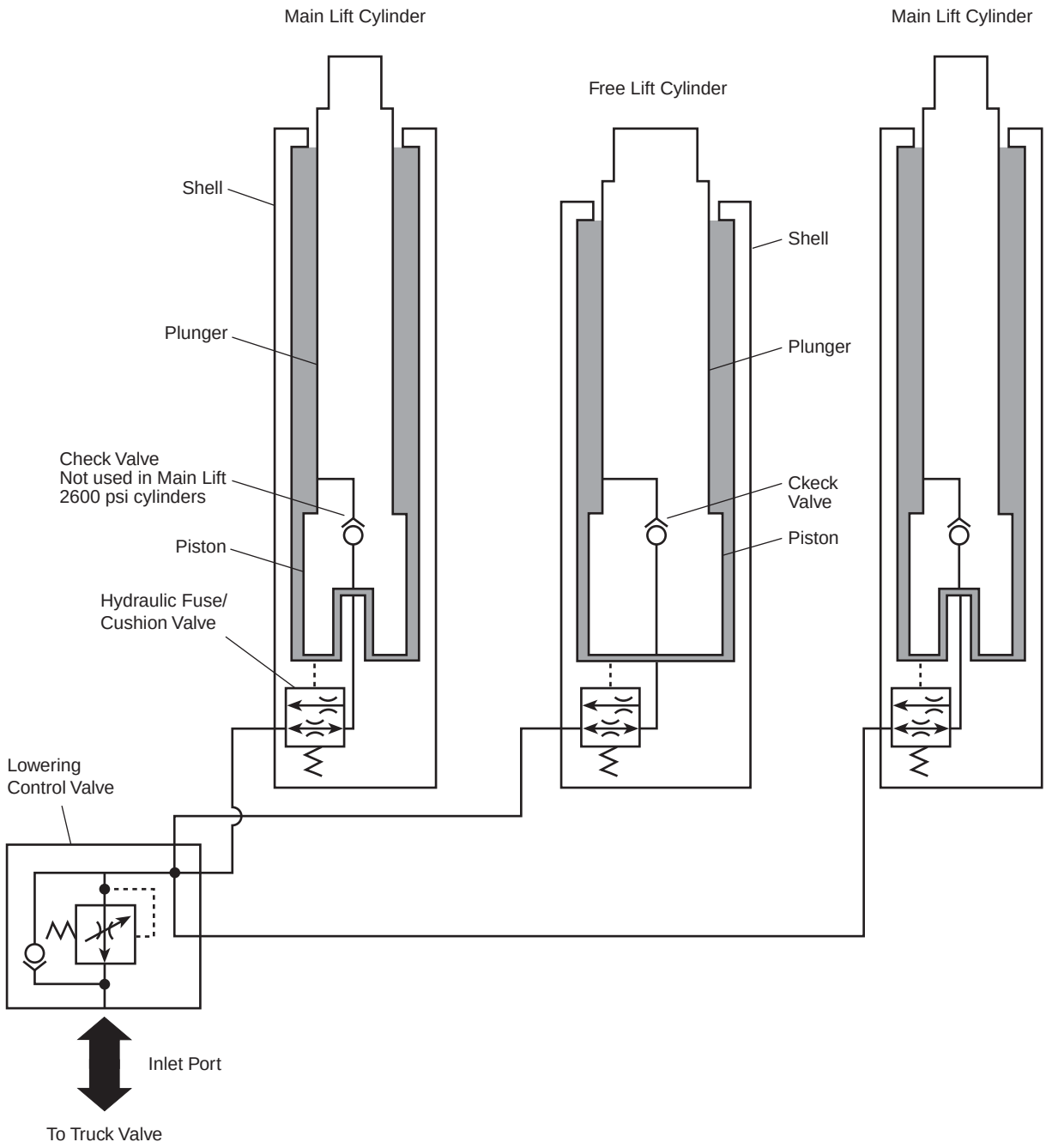


Figure 23. Cylinder Operation

5.2-5 Main Lift Cylinder Removal- Mast on Floor

1. Remove the mast from the truck as described in Section 5.1

2. Lay the mast down on wooden blocks as shown. Block under the outer upright so the inner upright will be free to move. The carriage must be positioned between the blocks and free to move.

3. Disconnect the cylinder supply hoses from the cylinder inlet ports. Remove the special long fittings from the cylinder ports and install plug fittings. **NOTE**: Each fitting holds a compressed spring in place.

4. Remove the snap rings fastening the cylinder rods to the intermediate upright.

5. Pull the inner and intermediate upright outward 2 ft. (60 cm).

6. Lift the cylinder from the base mount and angle inward to remove through the gap at the top of the uprights.

7. Note the number of shims (if equipped) on each cylinder rod.

8. For reassembly, reverse the above procedures except as follows:

WARNING: Main lift cylinders must be bled to remove trapped air prior to returning the mast to operation. Refer to Section 5.2-11.

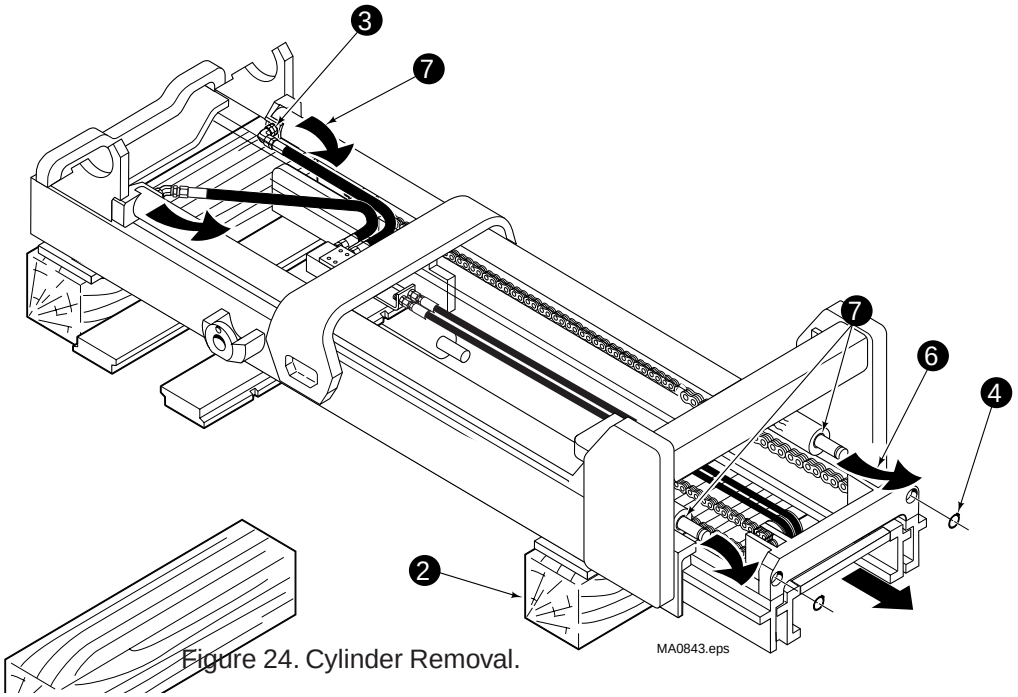


Figure 24. Cylinder Removal.

5.2-6 Free Lift Cylinder Removal- Mast on Floor

1. Remove the mast from the truck as described in Section 5.1.

2. Lay the mast down as shown.

3. Roll the carriage toward the center of the cylinder to slacken the chains and internal reeving hoses (if equipped).

4. Disconnect the hose from the cylinder 45° fitting. Cap the fitting and plug the hose.

5. Remove the chain guards from the crosshead. For reassembly, tighten the capscrews to a torque of 48-52 ft.-lbs. (65-70 Nm).

6. Remove the snap ring fastening the crosshead to the cylinder rod.

7. Pull the crosshead with chains and hoses (if equipped) off the cylinder rod.

8. Remove the cylinder strap.

9. Remove the cylinder from the mast.

10. For reassembly, reverse the above procedures.

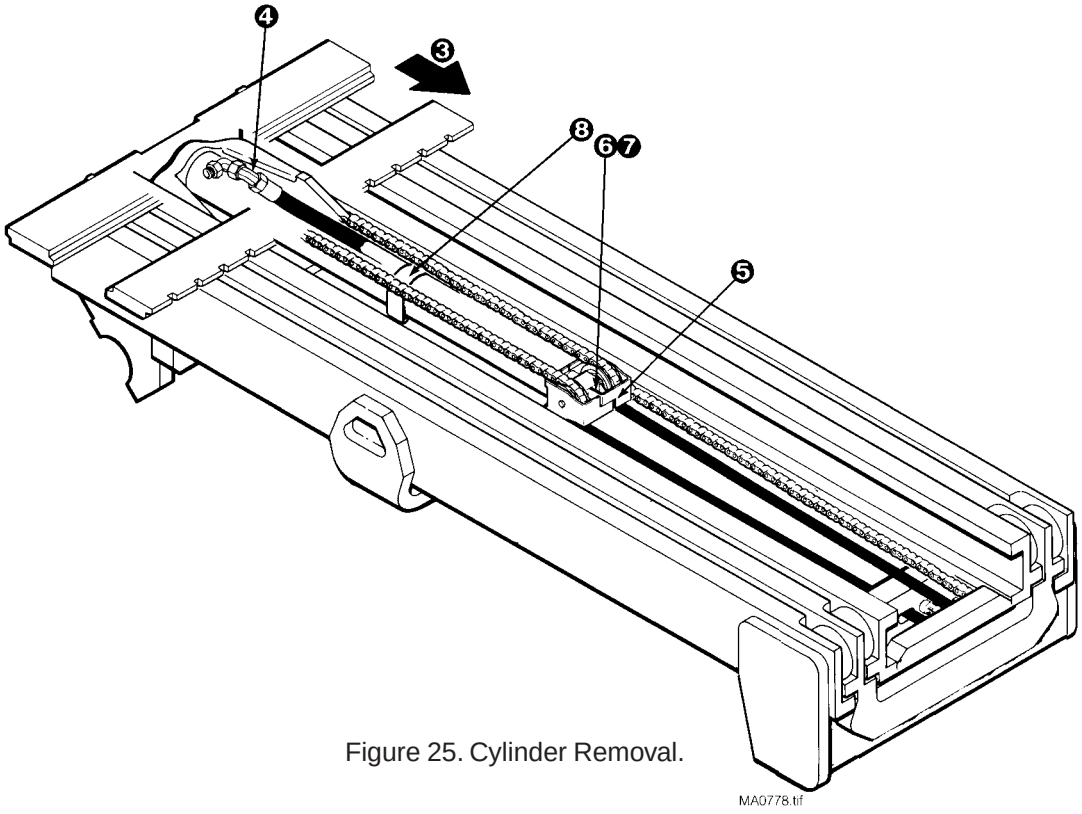


Figure 25. Cylinder Removal.

5.2-7 Free Lift Cylinder Removal- Mast on Truck

1. Completely lower the carriage. Remove forks or attachment if equipped. Make sure the free lift cylinder is completely retracted. Attach an overhead hoist to the top carriage bar.

> **WARNING:** The carriage must be supported by a block while removing the cylinder to avoid possible injury.

2. Raise the carriage to the center of the cylinder to slacken the chains and internal reeving hoses (if equipped). Block the carriage in place using a 4 X 4 X 24 in. (10 X 10 X 60 cm) wood block between the lower carriage bar and the floor.

3. Remove the cylinder strap.

4. Remove the chain guards from the crosshead. For reassembly, tighten the capscrews to a torque of 48-52 ft.-lbs. (65-70 Nm).

5. Remove the snap ring fastening the crosshead to the cylinder rod.

6. Pull the crosshead with chains and hoses (if equipped) off the cylinder rod and lay over upper carriage bar.

7. Pry the cylinder up out of the support casting to gain access to the cylinder hose fitting. Remove the hose from the 45° fitting. Cap the fitting and plug the hose.

8. Remove the cylinder from the mast from the top.

9. For reassembly, reverse the above procedures.

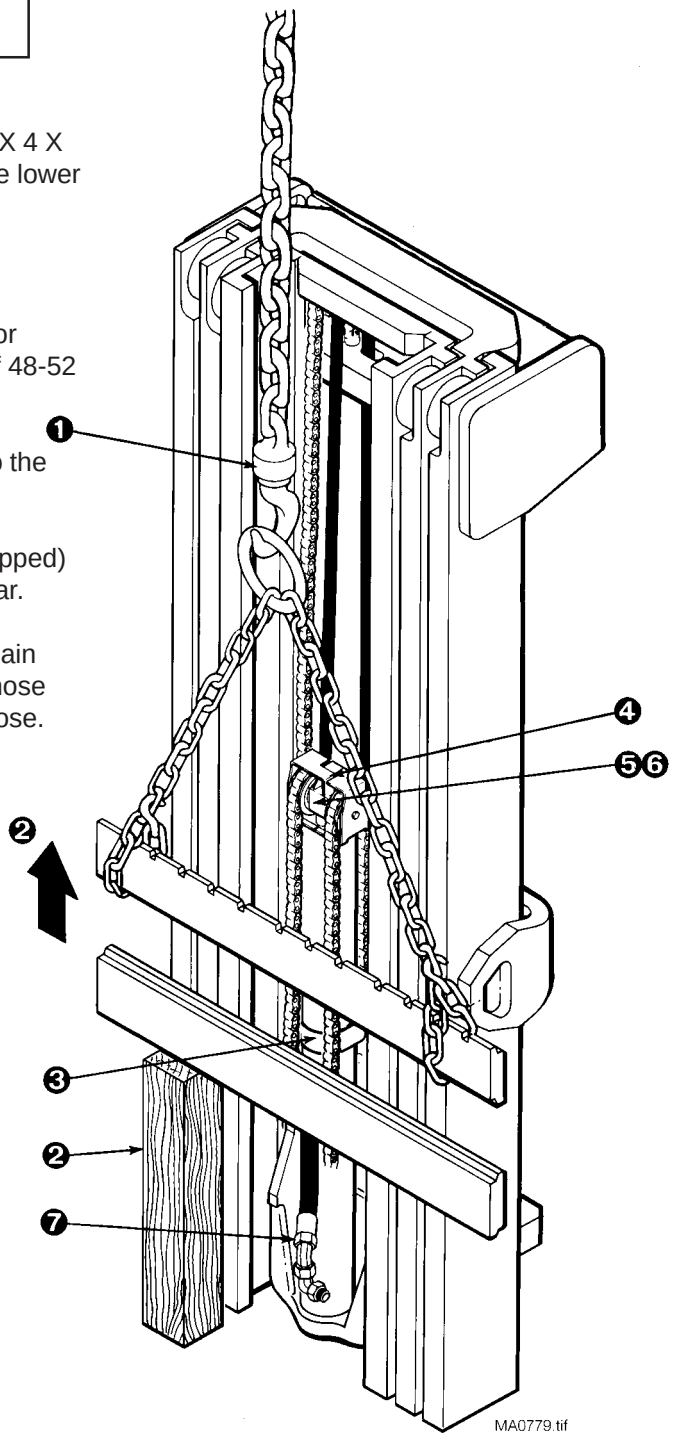


Figure 26. Cylinder Removal.

5.2-8 Main Lift Cylinder Service

1. Remove the cylinder from the mast as described in Section 5.2-5.

2. Use a claw type spanner wrench to remove the retainer. See Figure 27.

3. Remove the plunger/piston assembly from the shell.

4. Remove the Hydraulic Fuse/Lowering Cushion components.

5. Inspect all components for nicks or burrs. Minor nicks or burrs can be removed with 400 grit emery cloth. **NOTE:** Minor nicks are those that will not bypass oil when under pressure. If they cannot be removed with emery cloth, replace the part. If the piston requires replacing, refer to Section 5.2-10.

6. Replace the retainer and piston seals, back-up rings O-rings and bearing. Lubricate the new seals with petroleum jelly prior to installation. **Note the correct seal directions**. The cylinder will not operate correctly if the seals are installed backwards.

7. 2000 PSI CYLINDERS- When replacing the piston check valve O-ring, make sure the check valve is reinstalled with the arrow pointed in the correct direction.

8. Install the plunger retainer on the plunger. Install the plunger/piston assembly into the cylinder shell. Tighten the retainer to the torque value listed below using the claw spanner wrench and a strap wrench.

30D/35D/40D- 95-125 ft.-lbs. (129-169 Nm)
50D/55D/60D- 225-250 ft.-lbs. (305-340 Nm)

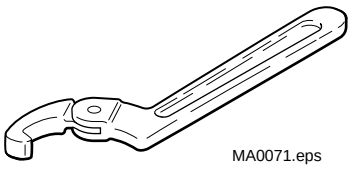


Figure 27. Claw Type Spanner Wrench..

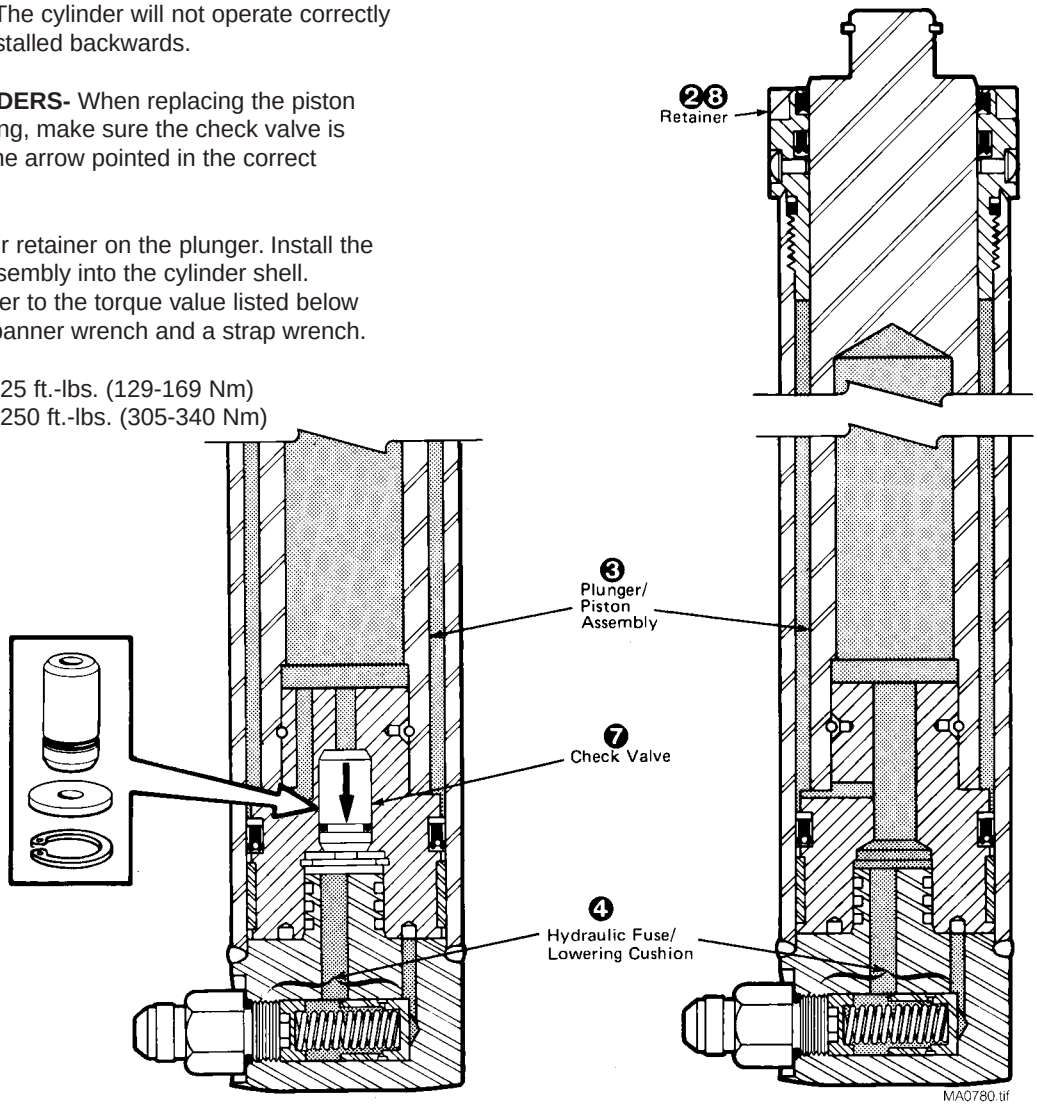


Figure 28. Cylinder Service.

5.2-9 Free Lift Cylinder Service

1. Remove the cylinder from the mast as described in Section 5.2-6 or 5.2-7.

2. Use a claw type spanner wrench to remove the retainer. See Figure 29.

3. Remove the plunger/piston assembly from the shell.

4. Remove the Hydraulic Fuse/Lowering Cushion components.

5. Inspect all components for nicks or burrs. Minor nicks or burrs can be removed with 400 grit emery cloth. **NOTE:** Minor nicks are those that will not bypass oil when under pressure. If they cannot be removed with emery cloth, replace the part. If the piston requires replacing, refer to Section 5.2-10.

6. Replace the retainer and piston seals, back-up rings, O-rings and bearing. Lubricate the new seals with petroleum jelly prior to installation. **Note the correct seal directions.** The cylinder will not operate correctly if the seals are installed backwards.

7. When replacing the piston check valve O-ring, make sure the check valve is reinstalled with the arrow pointed in the correct direction.

8. Install the plunger retainer on the plunger. Install the plunger/piston assembly into the cylinder shell. Pour 1/2 cup (120 ml) hydraulic oil into the cylinder cavity between the shell and rod. Tighten the retainer to a torque of 275-300 ft.-lbs. (375-405 Nm) using the claw spanner wrench and a strap wrench.

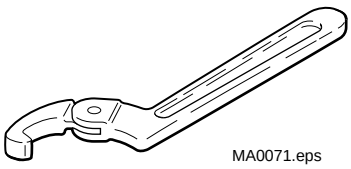


Figure 29. Claw Type Spanner Wrench..

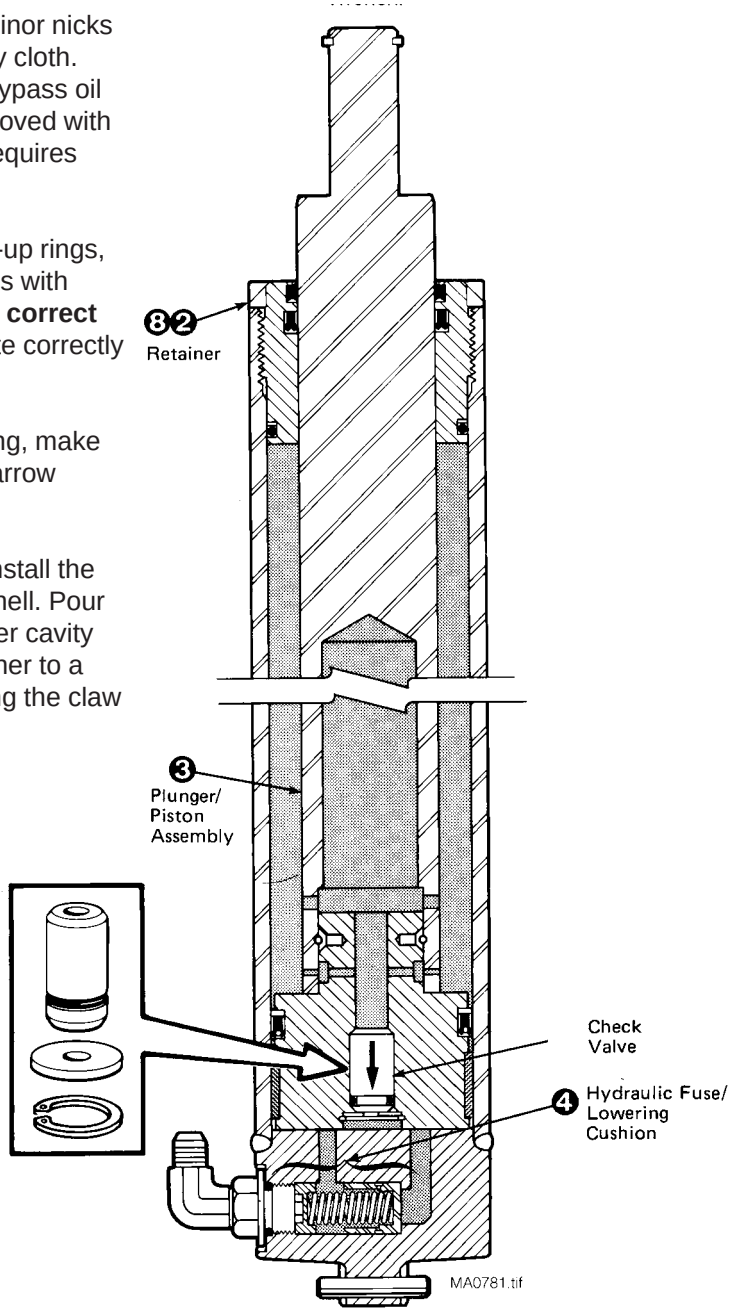


Figure 30. Cylinder Service.

5.2-10 Piston Removal

1. Remove the plunger/piston assembly from the cylinder shell as described in Section 5.2-8 or 5.2-9.
2. **Use** a strap wrench and 400 grit emery cloth to secure the plunger while turning the piston with a pin type spanner wrench
3. Turn the piston until the snap wire end is visible through the hole. Use a screwdriver to start the wire end out the hole. Turn the piston to feed the wire out.
4. Pull the piston from the plunger.
5. For reassembly, reverse the above procedures except as follows:
   *Install a new snap wire when installing the piston.

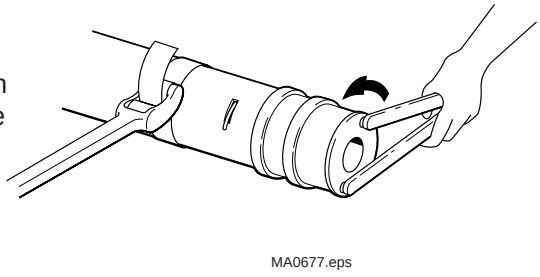


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Figure 31. Piston Removal.

5.2-11 Cylinder Bleeding

WARNING: The cylinders must be bled to remove air. Air in the cylinders will compress on the first extension which could rupture the cylinders causing serious bodily injury and property damage.

After repair, the cylinders may have air trapped in them that must removed. To bleed air do the following:

1. **Without a load** extend the free lift cylinder and continue to extend the main lift cylinders to 90% of full stroke. Retract all cylinders completely. Repeat **three** times.

2. Extend the cylinders **without a load** at 50% full engine speed then build to full system pressure at the end of the main lift cylinder stroke. Electric trucks - limit the control valve movement to achieve 50% speed. Retract all cylinders. Repeat **four** times.

3. Cycle the mast with a half load (50% mast rated capacity) through full cylinder extension several times. The cylinders should extend smoothly. Repeat the steps if cylinder extension is not smooth.

5.3 Valve

5.3-1 Valve Cartridge Service

1. Completely lower the mast.
2. Remove the truck supply hose from the valve cartridge. See Figure 32. Plug the hose.
3. Remove the valve cartridge from the valve. Note the stamped part no. on the Cartridge for ordering a replacement.

WARNING: Replacing the valve cartridge with a different part no. cartridge may cause the mast to malfunction.

4. For reassembly, reverse the above procedures.

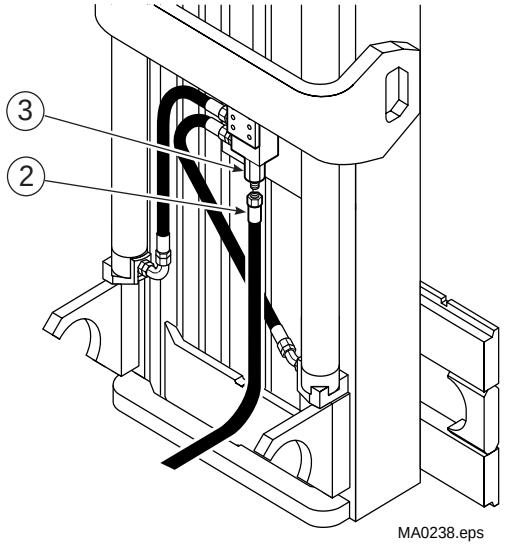

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Figure 32. Valve Cartridge Service.

5.4 Carriage

5.4-1 Description

The carriage shown below is the structure that hook-type forks or attachments are attached. The carriage travels within the rails of the mast inner upright on four (or six optional) shim adjustable rollers. The rollers are held in the uprights*. All load rollers are interchangeable. There are four side thrust rollers to transfer carriage side loading to the inner rails. These rollers are eccentrically adjustable. A pair of chain anchors are used to connect the carriage chains to the carriage.

***Except on 6 roller carriages where the top roller extends past the top of the mast inner upright at full extention and are held in place by a retainer plate.*

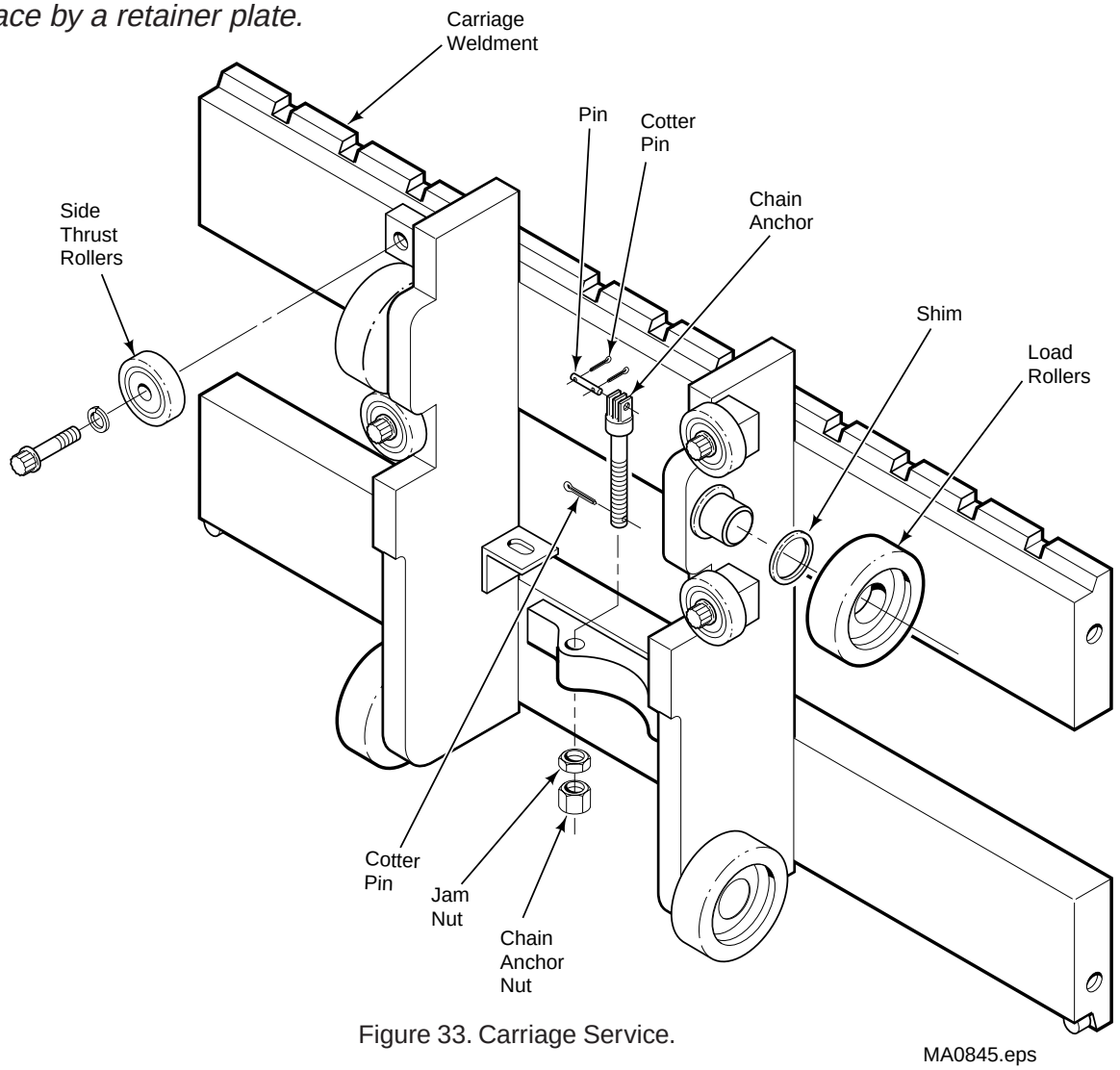

Figure 33. Carriage Service.

IMPORTANT: The chain anchor nuts must be installed as shown for correct operation.

5.4-2 Carriage Removal-Mast on Truck

1. Raise the mast high enough to place a 20 in. (50 cm) long, 4X4 in. (10 X 10cm) wood block between the intermediate lower crossmember and the ground. Lower the carriage to be even with the bottom of the inner upright

2. Attach an overhead hoist to the carriage. Raise the carriage to slacken the carriage chains.

3. Remove the chain anchor nuts. Note the location of the double nuts for reassembly.

4. Disconnect the internal reeving hoses from the carriage fittings (if equipped). Plug the hose ends.

5. Using the overhead hoist, lower the carriage to the bottom of the mast to remove.

6. Note the number of shims behind each load roller for reassembly.

7. For reassembly, reverse the above procedures except as follows:

*inspect the carriage as described in Section 5.4-4.

*Lubricate the inner upright rails with chassis lube or Kendall SR-12X.
See Figure 34.

*Assemble shims and load rollers on the stub shafts. The shims should be installed to provide a total side to side clearance no looser than 1/16 in. (1.5 cm) at the tightest point throughout the travel of the carraige. Use an equal amount of shims side to side.

*Adjust the carriage side thrust rollers for unrestricted clearance along the travel of the carriage. The rollers have eccentric mount bases. Turn the base of the roller toward the upright rail to decrease clearance. See Figure 28. Tighten the capscrews to a torque of 70-80 ft.-lbs. (95-110 Nm).

*Check and adjust the free lift chains as described in Section 5.6-4 and 5.6-6.

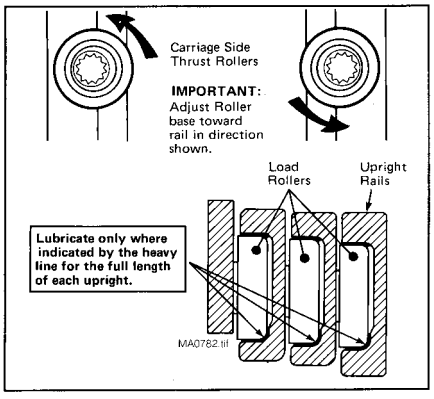

Figure 34. Rail Lubrication and Carriage Side Thrust Rollers.

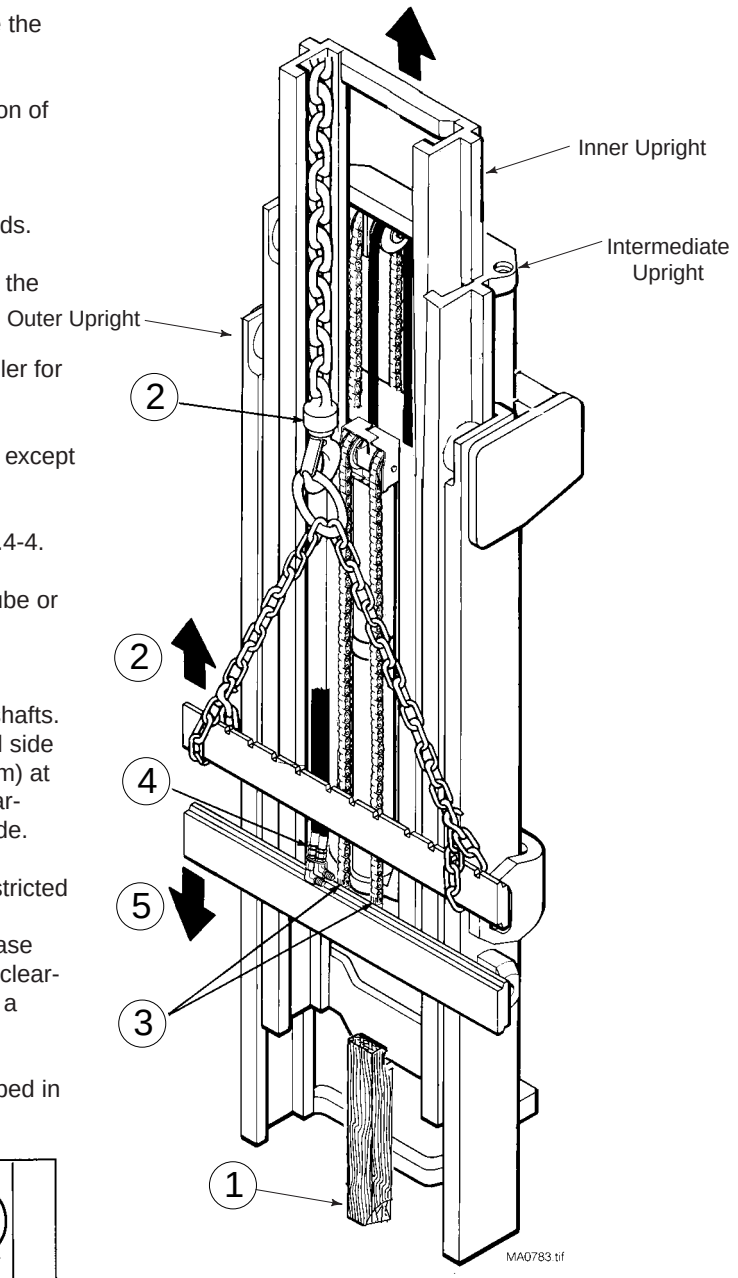

Figure 35. Carriage Removal.

5.4-3 Carriage Removal- Mast on Floor

1. Remove mast from truck as described in Section 5.1.

2. Remove chain anchor nuts. Note location of double nuts for reassembly. Remove the chain anchors.

3. Disconnect the internal reeving hoses for the carriage fittings (if equipped). Plug the hose ends.

4. Roll the carriage tot he bottom of the mast.

5. Attach an overhead hoist to the carriage for bars. Remove the carriage through the bottom of the mast.

6. Note the number of shims located behind each load roller for reassembly.

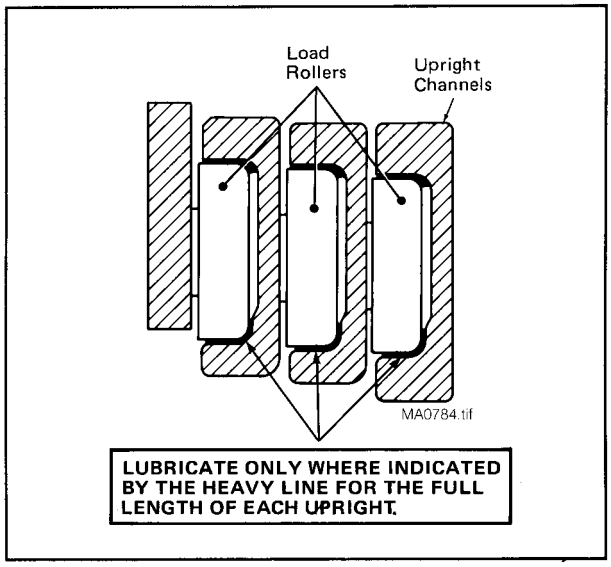

Figure 36. Rail Lubrication.

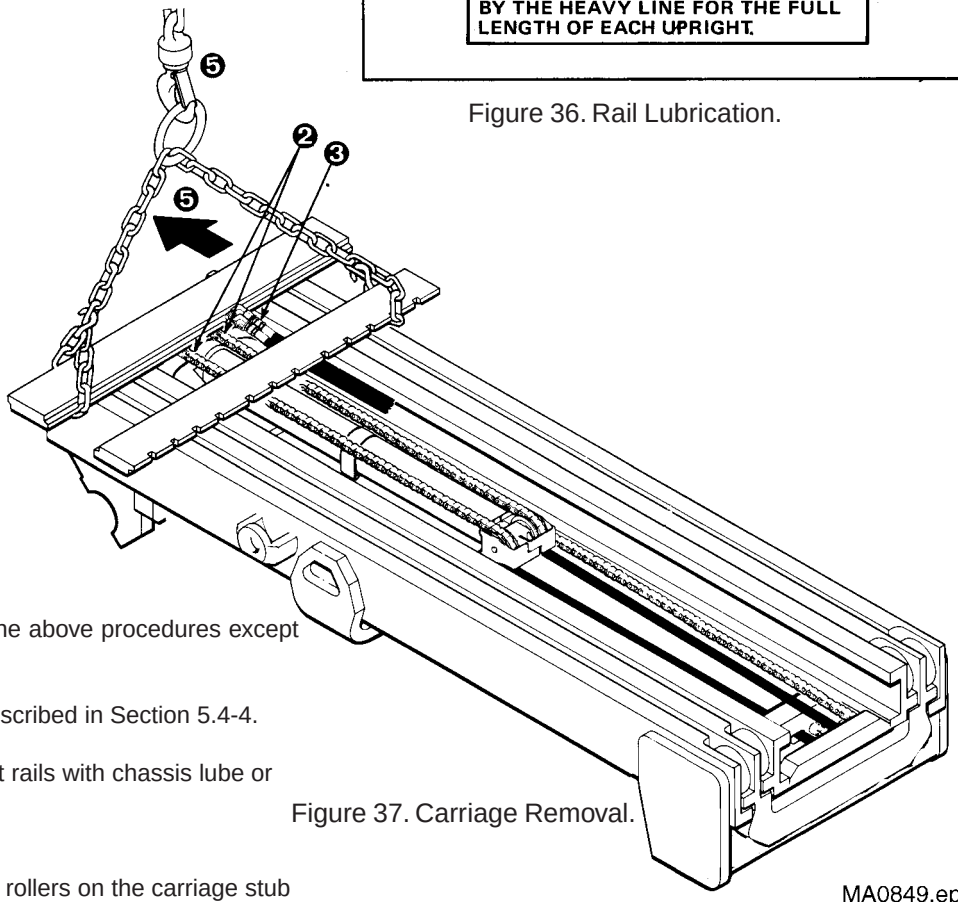

Figure 37. Carriage Removal.

7. For Reassembly, reverse the above procedures except as follows:

*inspect the carriage as described in Section 5.4-4.

*Lubricate the inner upright rails with chassis lube or Kendall SR-12X . See Figure 38.

*Assemble shims and load rollers on the carriage stub shafts. The shims should be installed to provide a total side to side clearance no looser than 1/16 in. (1.5 mm) at the tightest point throughout the travel of the carriage. Use an equal amount of shims side to side.

*Adjust the carriage side thrust rollers for unrestricted clearance along the travel of the carriage. The rollers have eccentric mount bases. Turn base of rollers toward the upright rail to decrease clearance. Tighten to a torque of 70-80 ft.-lbs. (96-110 Nm).

*Check and adjust the free lift chains as described in Section 5.6-4 and 5.6-6.

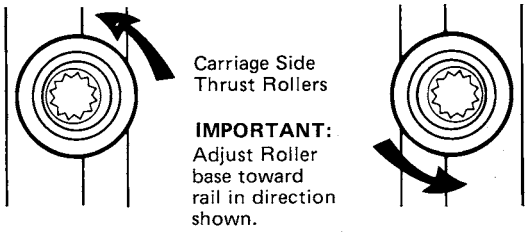

Figure 38. Carriage Side Thrust Rollers.

5.4-4 Carriage Inspection

1. Inspect the rollers for excessive wear or damage. Rollers with visible flat spots or cracks should be replaced.

2. Inspect the roller bearings by turning the rollers on their shafts. Rollers with roughness or noticeable restrictions to turning should be replaced.

3. Inspect all welds between the carriage side plates and the carriage fork bars. If any welds are cracked, replace the carriage.

4. Inspect the roller 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. Contact Lift Tek for repair procedures.

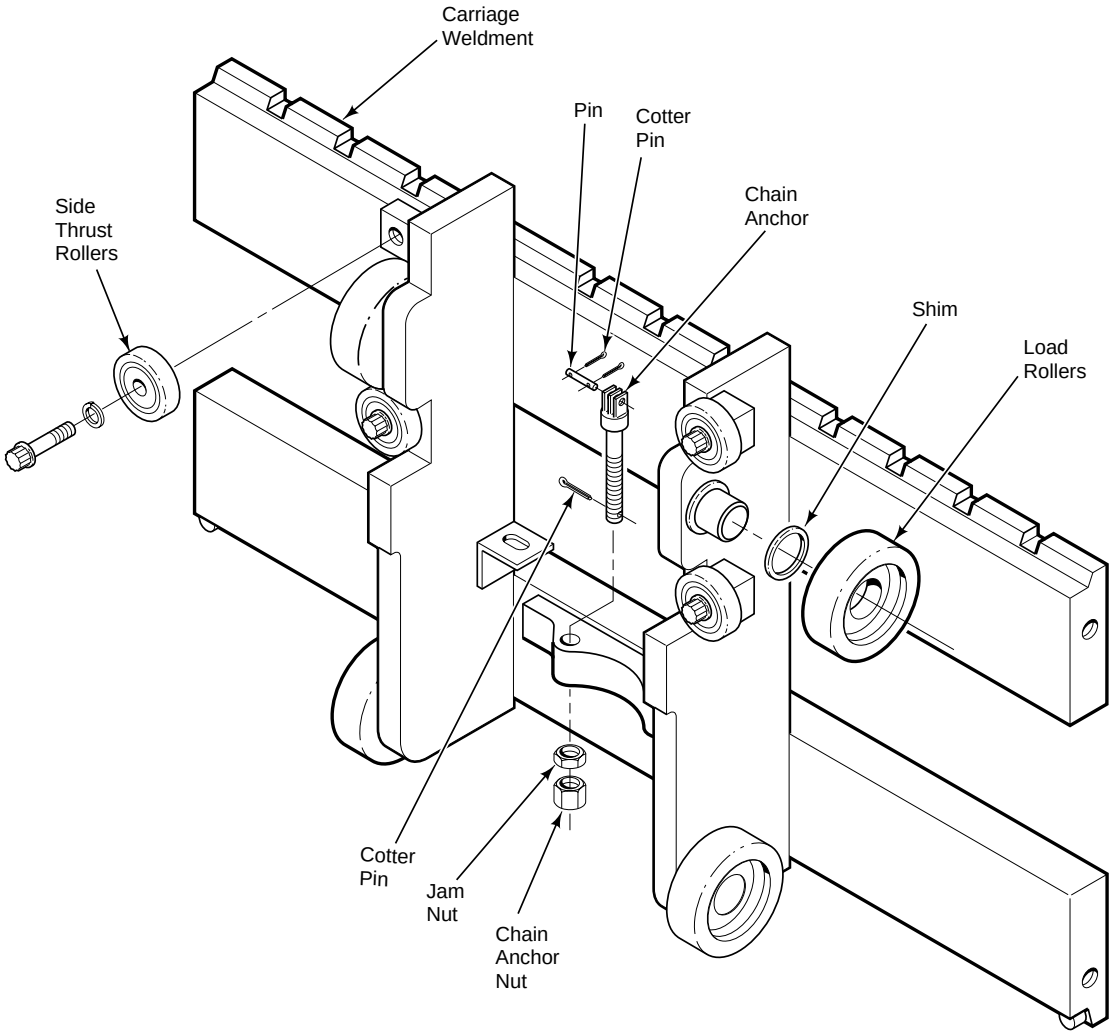

Figure 39. Carriage . MA0845.eps

IMPORTANT: The chain anchor nuts must be installed as shown for correct operation.

5.5 Mast Uprights

5.5-1 Upright Description

Outer Upright Assembly
The outer upright assembly is mounted to the truck. A pair of shim adjustable load rollers are attached to stub shafts located near the top of the upright. A pair of adjustable hoist chain anchors are located on the top crossmember.

Intermediate Upright Assembly
The intermediate upright assembly telescopes within the outer upright assembly. A pair of shim adjustable load rollers are attached to stub shafts located at the top and bottom of the upright. A pair of chain sheaves are located near the top of the upright to provide a rolling surface for the main lift chains.

Inner Upright Assembly
The inner upright assembly telescopes within the intermediate upright assembly. A pair of shim adjustable load rollers are attached to stub shafts located at the bottom of the upright. The free lift chain anchors are attached to the center crossmember. The free lift cylinder rests on a cradle which is integral with the lower crossmember.

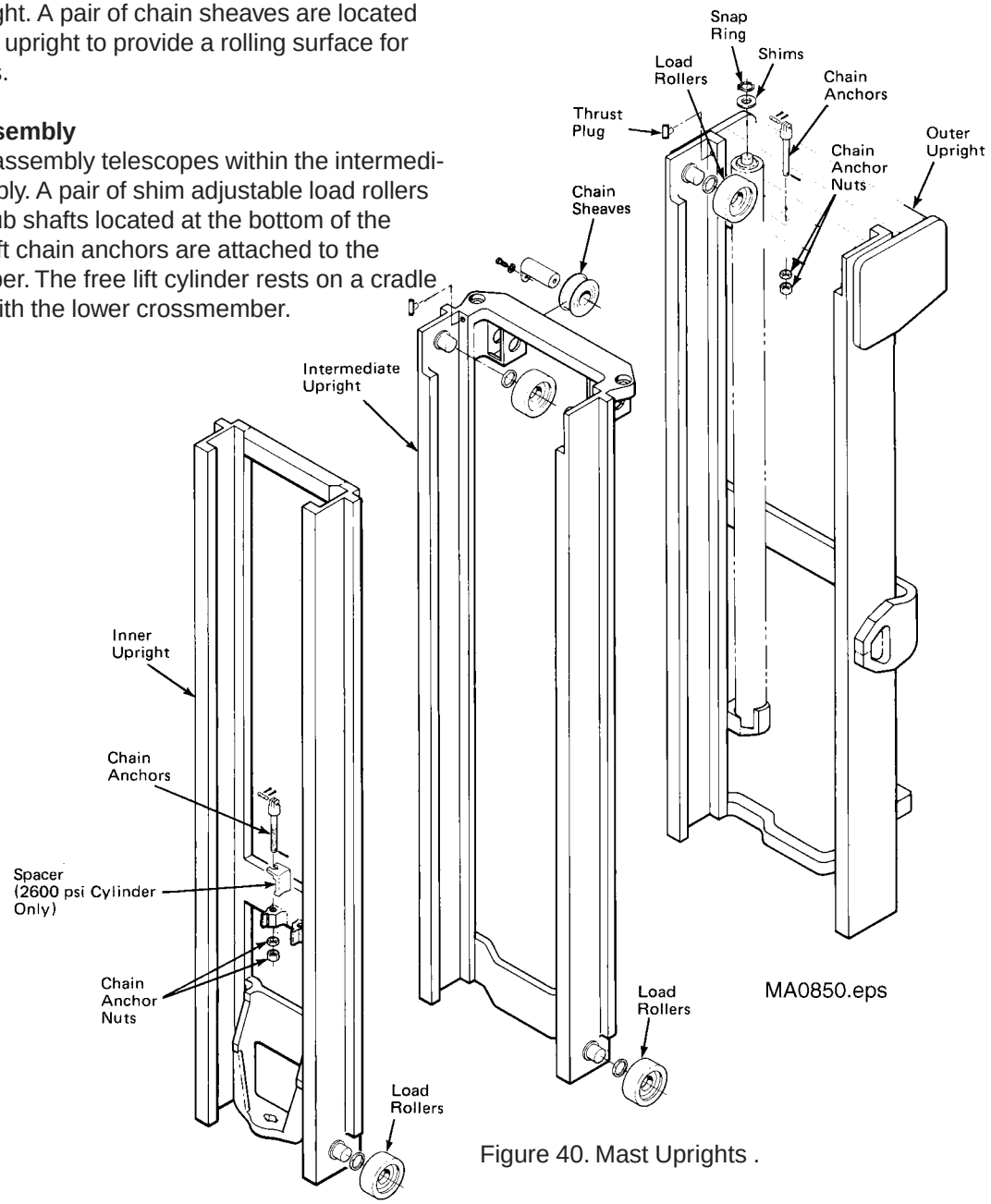

Figure 40. Mast Uprights .

5.5-2 Upright Operation

Fully Lowered

The main Lift chains are anchored to the outer upright top crossmember then travel over the intermediate upright chain sheaves and attach to the inner upright anchors.

The free lift chains are anchored to the inner upright center crossmember then travel over the free lift cylinder chain sheaves and attach to the carriage chain anchors.

Free Lift

Actuating the truck hoist valve causes the free lift cylinder to raise which draws the carriage to the top of the inner upright.

Full Extension

When the free Lift cylinder reaches the end of its stroke the main lift cylinders begin to rise. The extension of the cylinders causes the intermediate and inner uprights to raise.

Lowering

The main lift cylinders lower at the same time. Once the main lift cylinder have nottomed out, the free lift cylinder begins to lower resulting in a smooth lowering of the carriage.

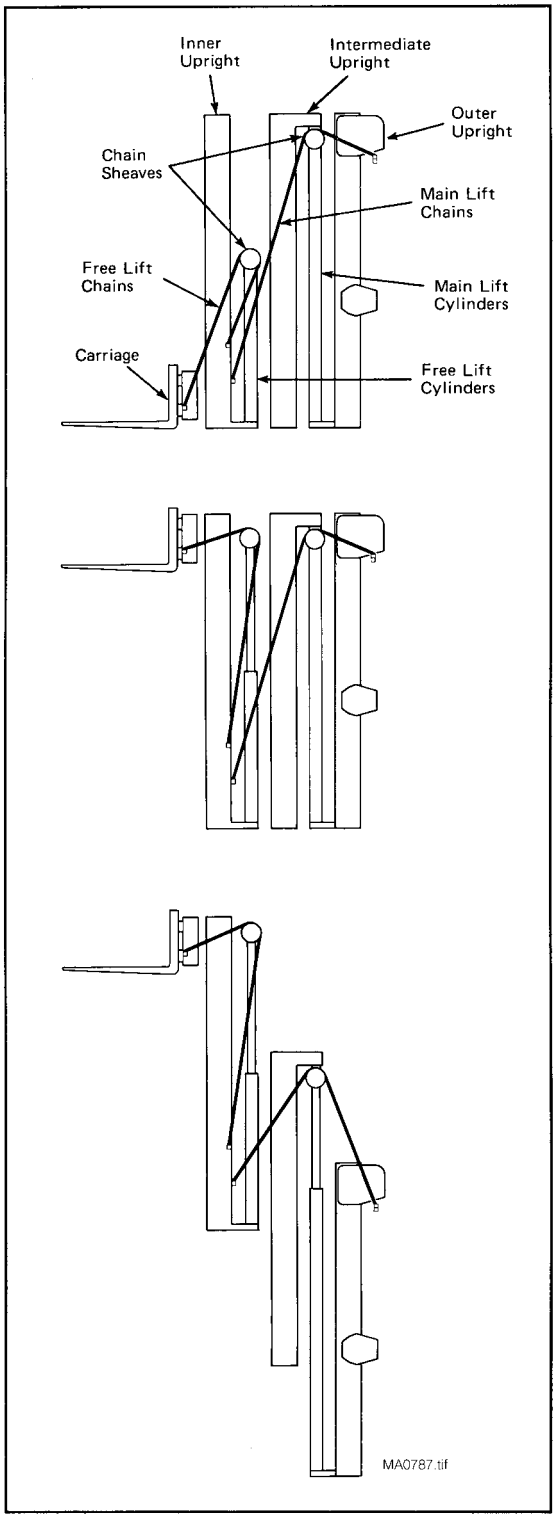

Figure 41. Upright Operation .

5.5-3 Upright Disassembly

1. Remove the mast assembly from the truck as described in Section 5.1.

2. Remove the main lift cylinders from the mast as described in Section 5.2-5.

3. Turn the mast over.

4. Remove the free lift cylinder from the mast as described in Section 5.2-6.

5. Remove the carriage from the mast as described in Section 5.4-3.

6. Remove the internal hose reeving sheave and hoses (if equipped).

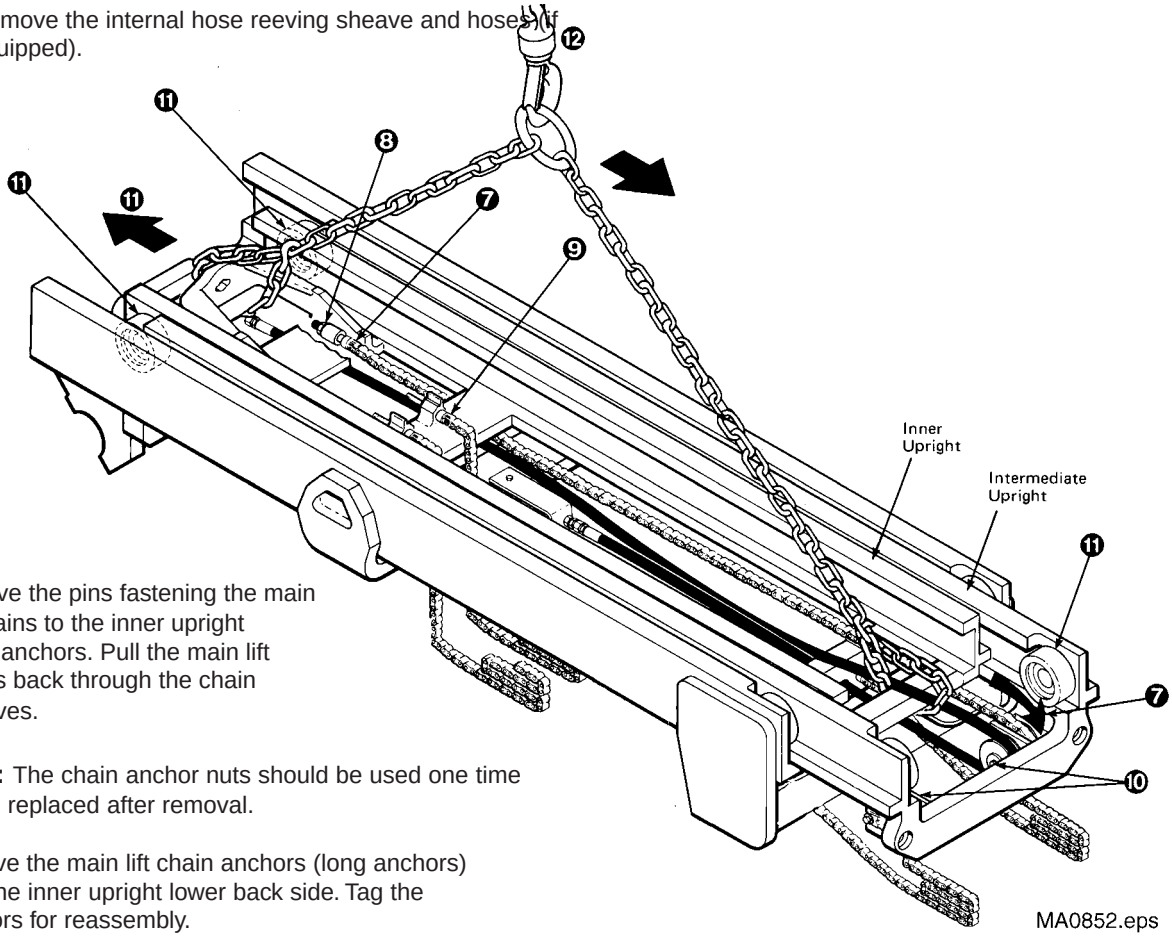

Figure 42. Upright Disassembly .

7. Remove the pins fastening the main lift chains to the inner upright chain anchors. Pull the main lift chains back through the chain sheaves.

CAUTION: The chain anchor nuts should be used one time only and be replaced after removal.

8. Remove the main lift chain anchors (long anchors) from the inner upright lower back side. Tag the anchors for reassembly.

9. Remove the pins fastening the free lift chains to the inner upright chain anchors.

10. Remove the free lift cylinder supply hose and sheave. Remove the main lift chain sheaves.

11. Roll the inner upright downward to expose the inner and intermediate upright load rollers. Remove the load rollers. Note the number of shims behind each load roller.

12. Attach an overhead hoist to the inner upright. Remove the inner upright through the top of the intermediate upright.

5.5-3 Upright Disassembly

(Continued)

CAUTION: The chain anchor nuts should be used one time only and be replaced after removal.

13. Remove the main lift chain anchors (long anchors) and chains from the outer upright crossmember. Tag the anchors for reassembly.

14. Roll the inner upright downward to expose the intermediate and outer upright load rollers. Remove the load rollers. Note the number of shims behind each load roller.

15. Attach an overhead hoist to the intermediate upright. Remove the intermediate upright through the top of the outer upright.

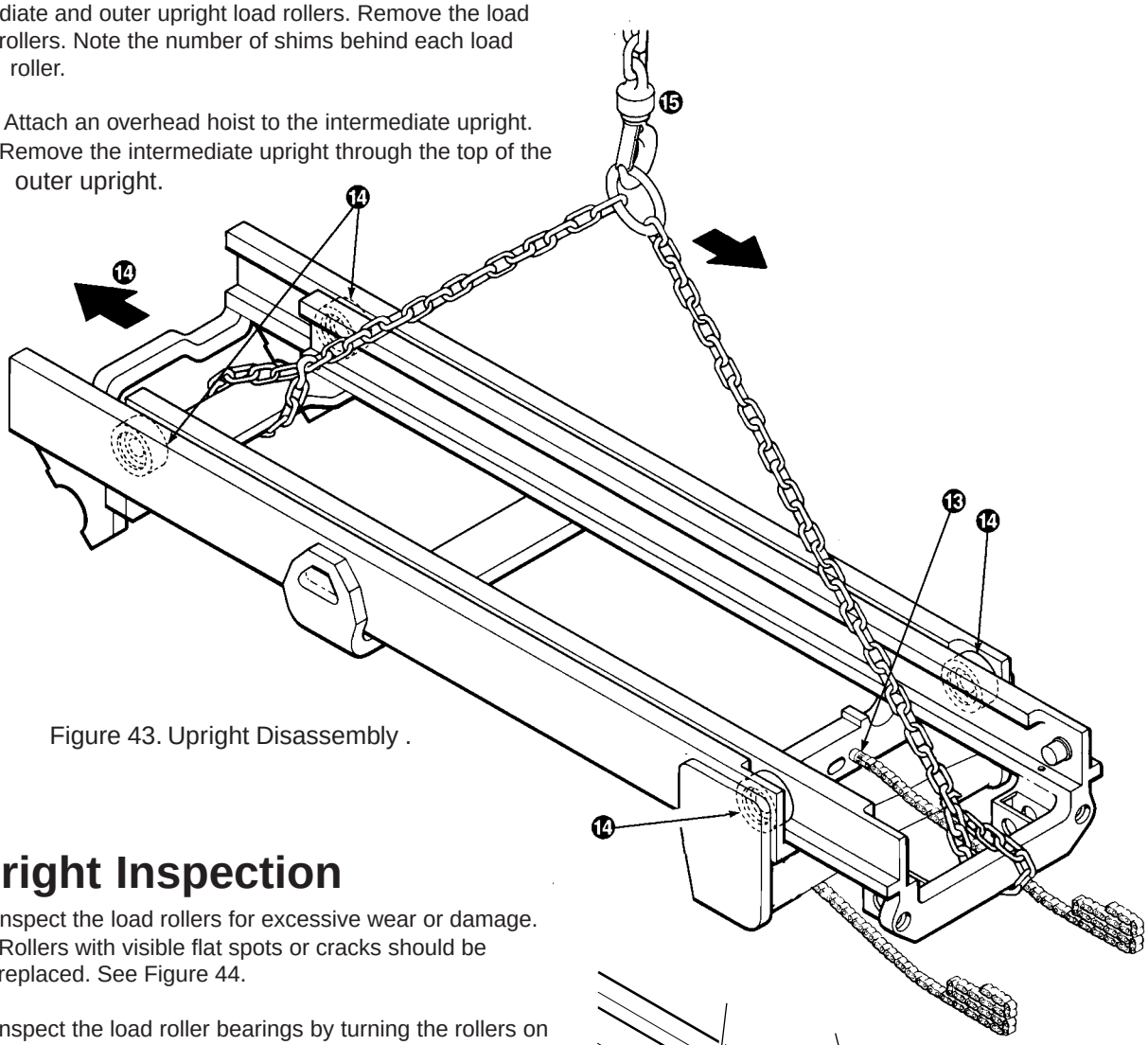

Figure 43. Upright Disassembly .

5.5-4 Upright Inspection

1. Inspect the load rollers for excessive wear or damage. Rollers with visible flat spots or cracks should be replaced. See Figure 44.

2. Inspect the load roller bearings by turning the rollers on their shafts. Rollers with roughness or noticeable restrictions to turning should be replaced.

3. Inspect the load roller stub shafts. If they are damaged or have cracks at the base, the upright mast must be replaced or repaired.

4. Inspect the outer and intermediate upright thrust plugs. If the wear surface is worn to less than 1/16 in. (1.5 mm), they should be replaced.

5. Inspect the hoist chains as described in Section 5.6-1.

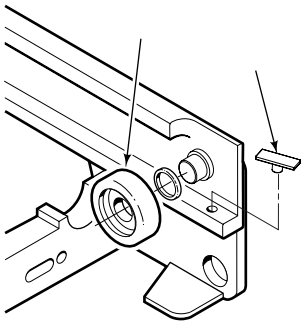

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Figure 44. Upright Inspection .

5.5-5 Upright Reassembly

1. Lubricate the outer upright rails with chassis lube or Kendall SR-12X. See Figure 45.

2. Attach an overhead hoist to the intermediate upright. Install the intermediate uptight through the top of the outer upright.

3. Install the thrust plugs to the uprights.

4. Assemble shims and load rollers to the outer upright and lower intermediate upright stub shafts. The shims should be installed to provide a total side to side clearance no looser than 1/16 in. (1.5 mm) at the tightest point throughout the travel in the upright. Use an equal amount of shims side to side. **NOTE:** Roll the upright past the thrust plugs before checking roller clearances.

5. Lubricate the intermediate upright rails with chassis lube or Kendall SR-12X. See Figure 40.

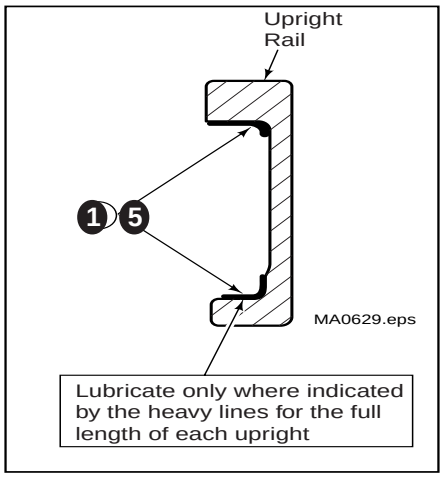


Figure 45. Rail Lubrication

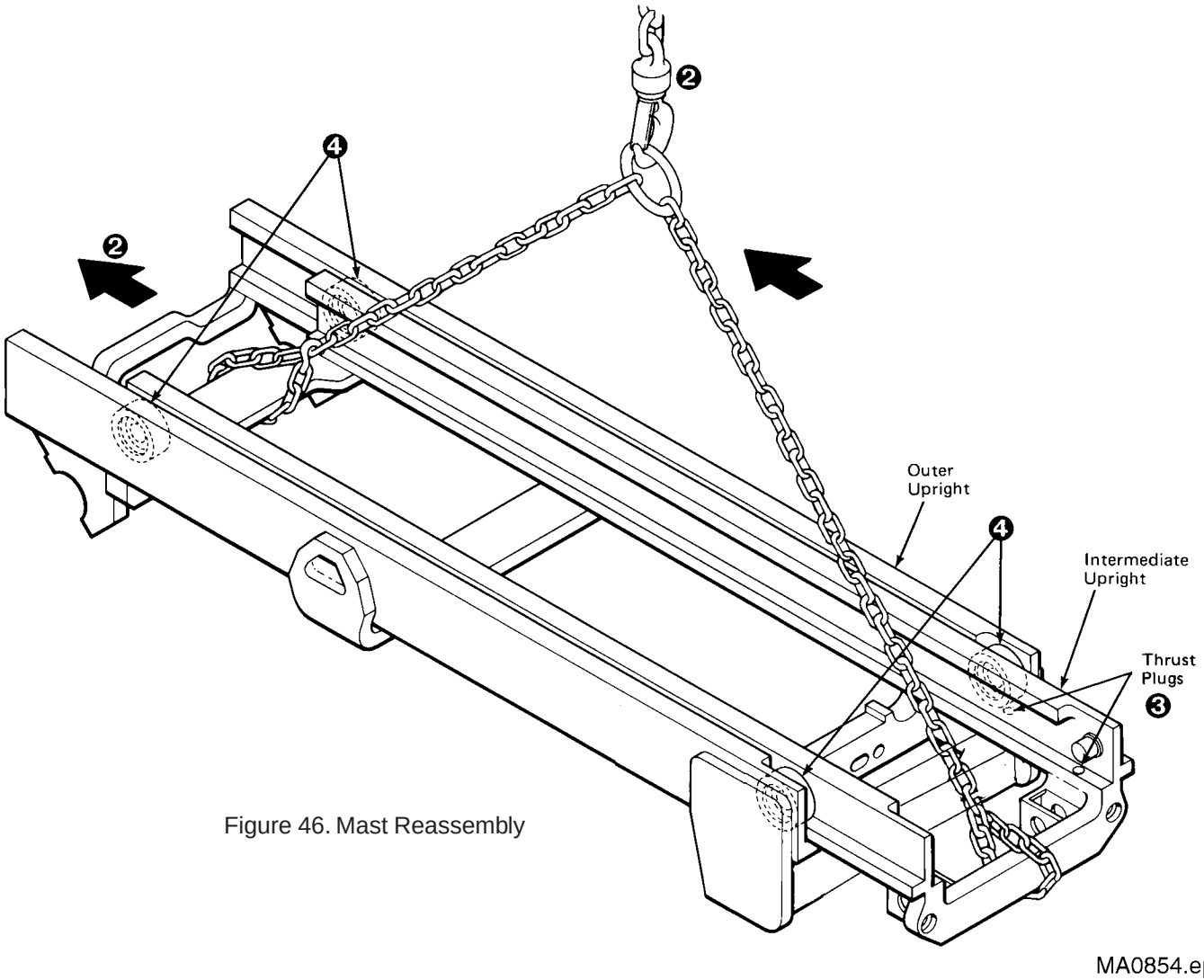


Figure 46. Mast Reassembly

5.5-5 Upright Reassembly (Continued)

5. Attach an overhead hoist to the inner upright. Install the inner upright through the top of the intermediate upright.

6. Assemble shims and load rollers to the intermediate upright top and inner upright lower stub shafts. The shims should be installed to provide a total side clearance no loosest than 1/16 in. (1.5 mm) at the tightest point throughout the travel in the upright. Use an equal amount of shims side to side. **NOTE:** Roll the upright past the thrust plugs before checking roller clearances.

7. Install the chain sheave and free lift hose sheave to the intermediate upright. Tighten the capscrew to a torque of 26-30 ft.-lbs. (35-40 Nm).

8. Install the main lift chain anchors (long anchors) and chains to the outer upright crossmember.

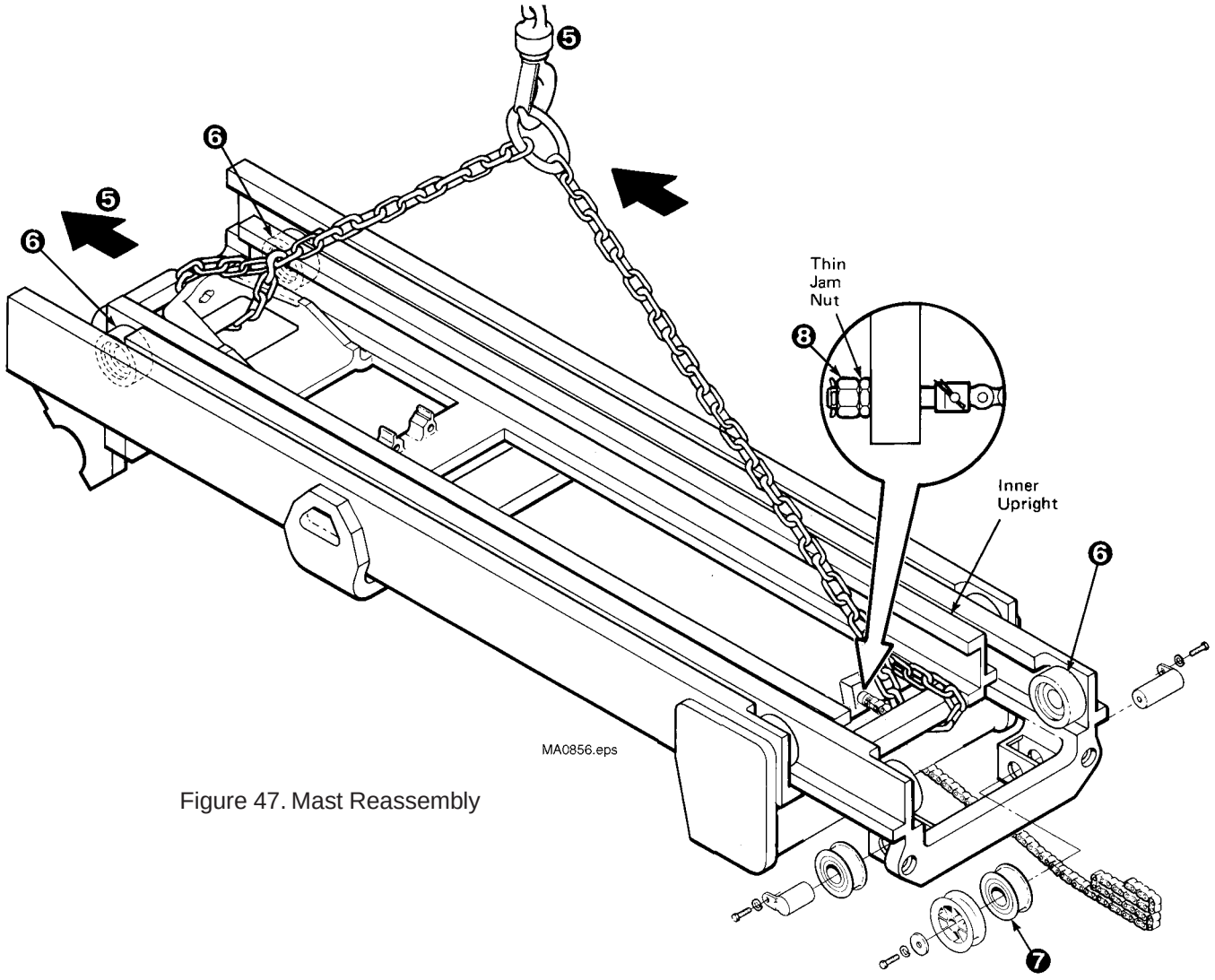


Figure 47. Mast Reassembly

5.5-5 Upright Reassembly

(Continued)

9. Install the chain anchors (long anchors) to the back side of the inner upright lower crossmember.

10. Pull the main lift chains over the chain sheaves and attach to the lower inner upright chain anchors.

11. Install the free lift chain anchors (short anchors) and chains to the inner upright center crossmember.

12. Install the free lift cylinder supply hose through the hole in the outer upright top crossmember and over the sheave on the intermediate top upright.

13. Install the carriage as described in Section 4.5-3.

14. Install the free lift cylinder as described in Section 5.2-6.

15. Install the internal reeving sheave and hoses (if equipped) as described in Section 2.4.

16. Turn the mast over.

17. Install the main lift cylinders as described in Section 5.2-5.

18. Install the mast to the truck as described in Section 5.1.

19. Adjust the main lift and free lift chains as described in Sections 5.6-3 and 5.6-4. Check for mast skewing as described in Section 5.5-6.

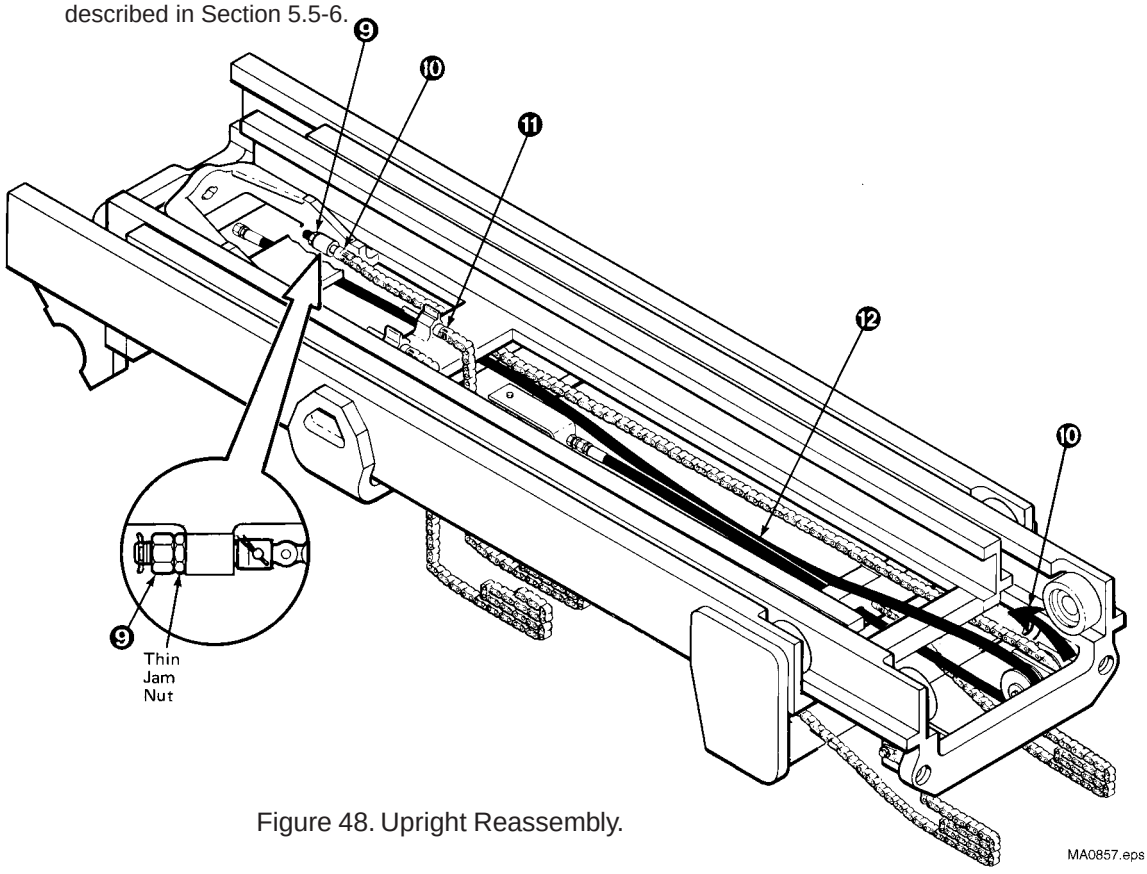


Figure 48. Upright Reassembly.

5.5-6 Mast Skewing

WARNING: The intermediate upright must be supported by angle iron to avoid possible injury.

1. Extend the mast to the full lift height.

*If the mast kicks to the right at full extension, a shim (part no. 200524) needs to be installed to the right hand main lift cylinder rod.

*If the mast kicks to the left at full extension, a shim (part no. 200524) needs to be installed to the left hand main lift cylinder rod.

2. Place a 6 in. (15 cm) long, 2 X 2 in. (5 X 5 cm) angle iron between the top of the main lift cylinder and the crossmember. See Figure 45. Lower the crossmember onto the angle iron.

3. Remove the snap ring from the cylinder to be adjusted. Open the truck valve to allow the center (free lift) cylinder to fully retract. Tap the main lift cylinder rod down past the crossmember to install the shim.

4. Slowly hydraulically power the main lift cylinder back into the crossmember and reinstall the snap ring.

5. Repeat steps through until skewing is removed.

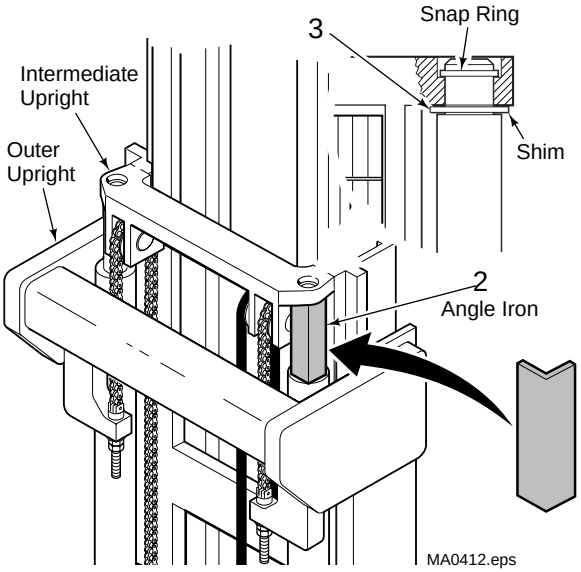


Figure 49.Shim Installation.

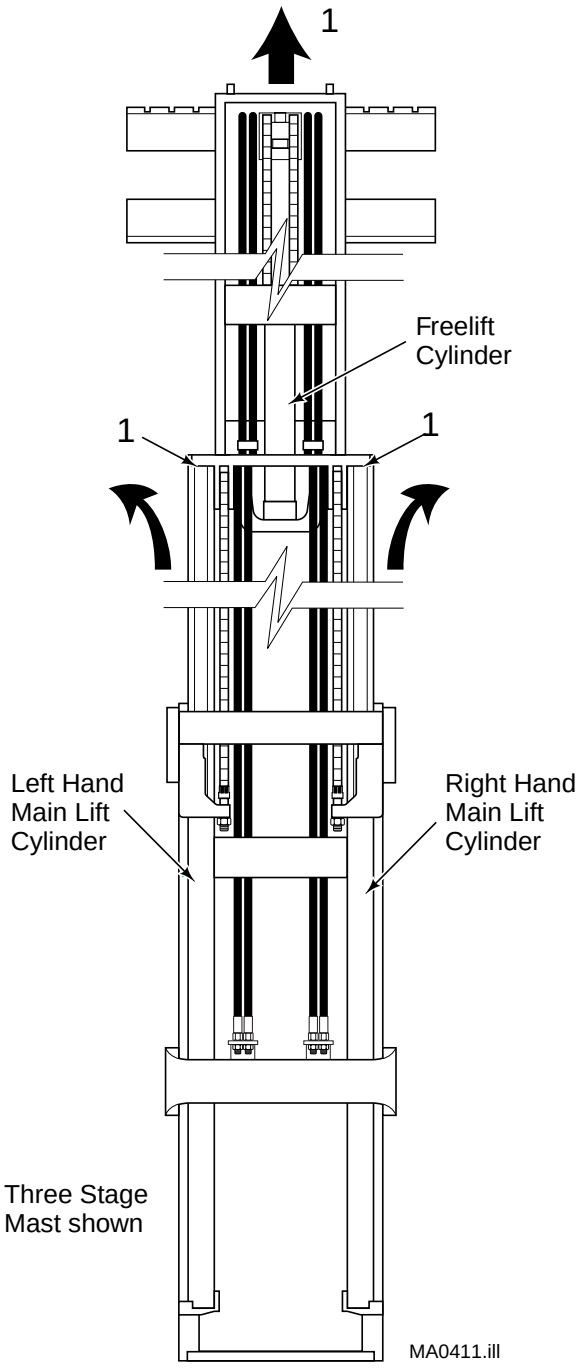


Figure 50.Extended Upright.

5.6 Chains

5.6-1 Inspection and Tension

Each pair of chains has 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.**

The 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". If tension is not equal, adjust the chains as described in **Chain Adjustment.**

Inspect the 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 chain.

*Check for tight joints. If tight joints are caused by rust or corrosion, loosen them with SAE 40 wt. oil or penetrating oil. If they cannot be loosened, or if the tight joints are caused by bent pins or plates or by peened plate edge, replace **both** strands of the chain.

*Check for protruding or turned pins. Replace **both** strands of the chain.

*Check for chain side wear. If pins and outside plates show signs of wear, check for misalignment os sheaves, anchors or other components. Correct the misalignment. If wear is excessive, replace **both** strands of chain.

*Check for worn, broken or misaligned chain anchors. Replace or adjust as required.

*Lubricate the full length of the chains with SAE 40 wt. oil or Bowman Heavy Load Red Grease.

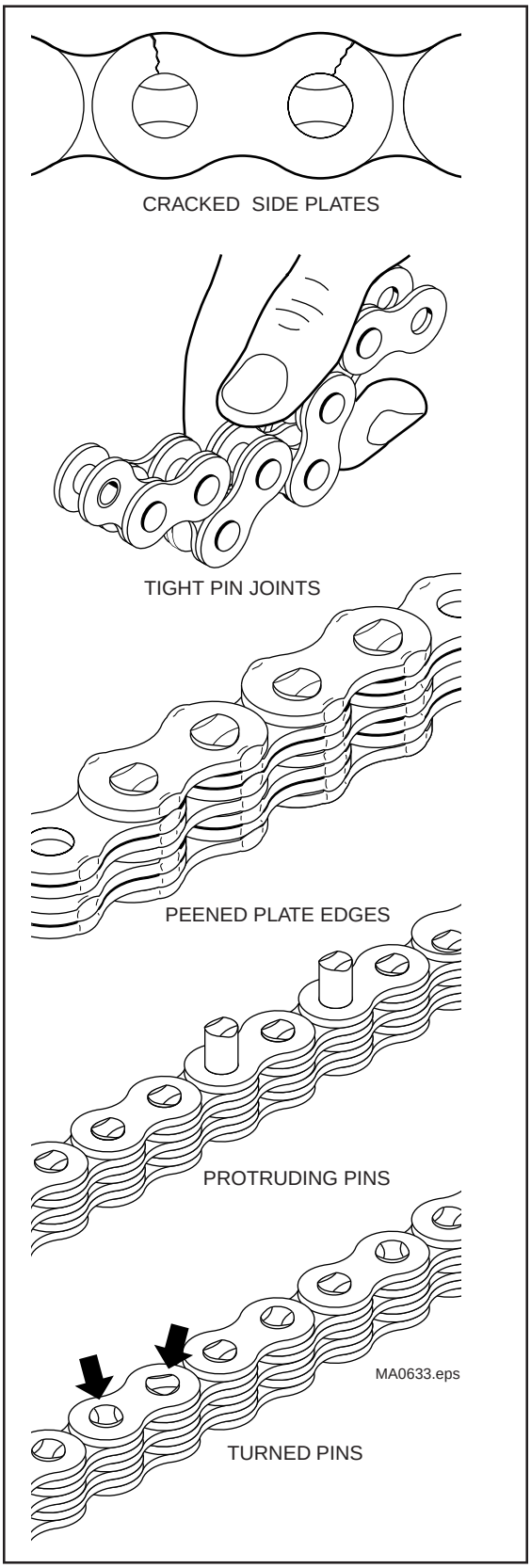


Figure 51.Chain Inspection.

5.6-2 Measuring Chain Stretch

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

If the chains stretch beyond the recommended amount, they should be replaced in pairs. Chain stretch can be measured with chain wear scale. Measure the chains according to the instructions printed on the chain wear scale, without a load on the carriage.

*to check the free lift chains, raise the carriage 1 ft. (30 cm) off the ground to put tension on the chains.

*To check the main lift chains, raise the mast until the inner upright starts to extend ensuring tension on the chains.

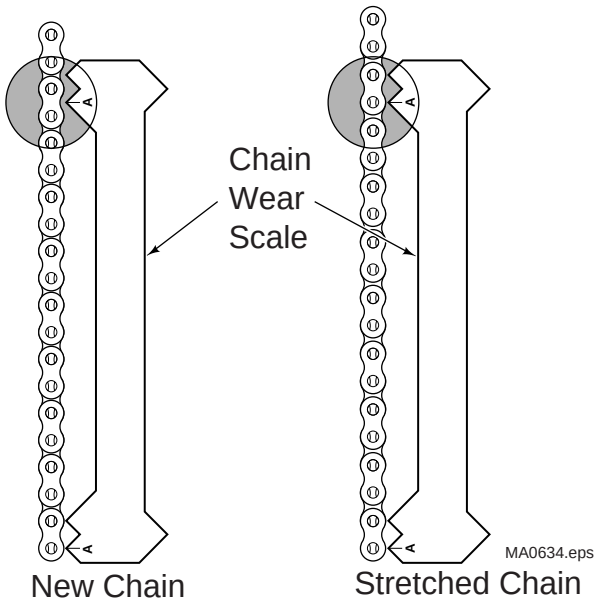


Figure 52.Measuring Chain Stretch.

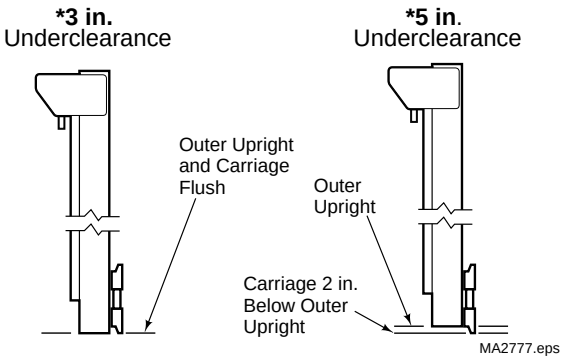
Main Lift Chain Adjustment

5.6-3 The main lift chains should be adjusted so that when the unloaded mast is fully lowered, the uprights are positioned as shown in figure 53.

1. Adjust one chain to achieve the correct upright position when fully lowered. See Figure 55.

2. Adjust the other chain to achieve equal chain tension. Tighten the nuts together to a torque of 50-70 ft.-lbs. (98-96 Nm).

3. Raise and lower the mast several times to confirm the adjustments.



NOTE: Underclearance is based on mast production series, actual mast underclearance may vary by truck model.

Figure 53.Upright and Carriage Position.

Free Lift Chain Adjustment

5.6-4 The free lift chains should be adjusted so that when the unloaded mast is fully lowered, the upright channels and carriage are positioned as shown in Figure 53.

1. Locate the threaded chain anchors on the front side of the inner upright crossmember on each side of the cylinder. Adjust one chain to achieve the correct upright position when fully lowered. See Figure 54.

2. Adjust the other chain to achieve equal chain tension. Tighten the nuts together to a torque of 50-70 ft.-lbs. (68095 Nm).

3. Raise and lower the mast several times to confirm the adjustments.

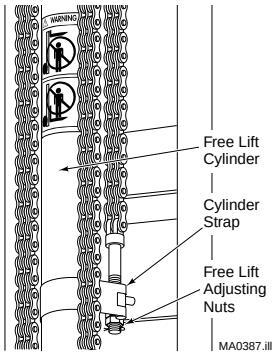


Figure 54.Free Lift Chains.

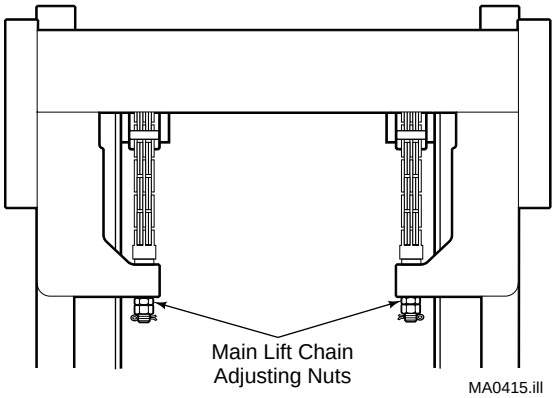


Figure 55.Main Lift Chains.

5.6-5 Main Lift Chain Service

WARNING: The intermediate upright must be supported by a block to avoid possible injury.

1. Raise the inner upright 3 ft. (90 cm). Place a 3 ft. (90 cm) block under the free lift cylinder support casting, then lower the cylinder support onto the block. The main lift chains should be slack. See Figure 51.

2. Remove the cotter pins and pins from the chain anchors. Remove the chains.

3. Inspect the chain anchors for cracks. Replace as required.

4. For reassembly, reverse the above procedures. Adjust the chains as described in Section 5.6-3.

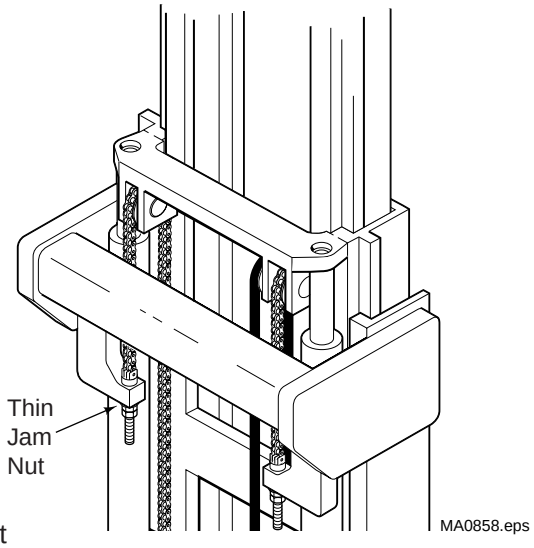


Figure 56.Main Chains.

5.6-6 Free Lift Chain Service

WARNING: The carriage must be supported by a block to avoid possible injury.

1. Raise the carriage 12 in. (30 cm). Place a 12 in. (30 cm) block under the carriage, then lower the carriage onto the block. The free lift chains should be slack. See Figure 52.

2. Remove the cotter pins and pins from the chain anchors. Remove the chains.

3. Inspect the chain anchors for cracks. Replace as required.

4. For reassembly, reverse the above procedures. Adjust the chains as described in Section 5.6-4.

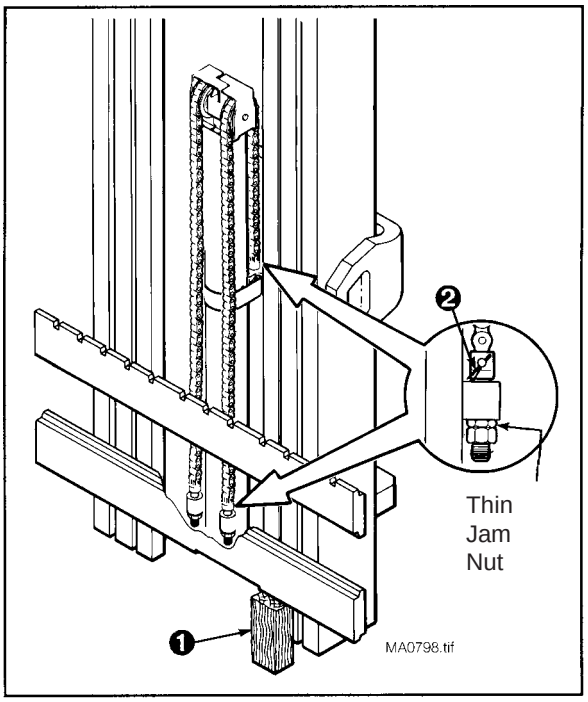


Figure 57.Free Lift Chains.

Manual Change Summary

R3 - 07/20/05

Remove description “cushion” and “pneumatic” from figures 5 and 53.
Add note to page 30.
Add nameplate to figure 1.

Do you have any questions that need to be answered right now?

Lift Technologies, Inc.
7040 South Highway 11
Westminster, SC 29693
USA
Tel: +1(864) 647-1119
Fax: +1(864) 647-5406

Customer Service
(North America Toll Free)
1-888-946-3330

Other Lift Technologies Locations

Lift Technologies Inc.
Corporate Head Office
251 Woodlawn Road W., Unit 217
Guelph, ON N1H 8J1 Canada
Tel: +1-519-823-4545

Lift -Tek Elecar Srl
29015 Castel. San. Giovanni (PC)
Via G. Galilei
Italy

LIFT-TEK ELECAR MASTS
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