Service Manual

Pivot Arm Paper Roll Clamps

Manual Number 667445

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cascade® corporation

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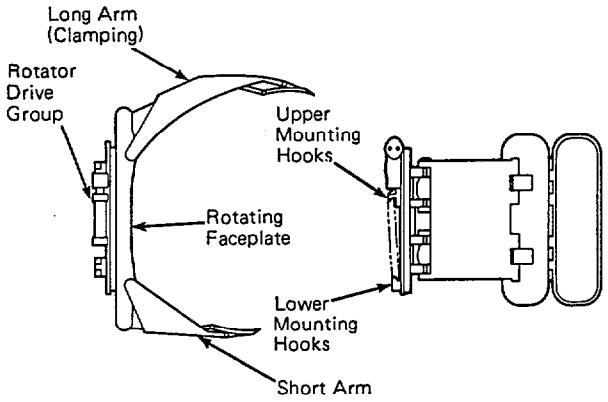
Contents

Section 1 Introduction

This manual provides the installation instructions, periodic maintenance requirements, troubleshooting procedures, and service guides for Cascade Pivot Arm Paper Roll Clamp models 40C (C4P), 40D, 55C, 70C (C7P), 70D, and 100C. Each is a hydraulically-actuated, two-function lift truck attachment designed for paper roll handling.



1.1 Truck System Requirements

Pressure: Your lift truck should supply sufficient hydraulic pressure to handle the heaviest load. PRESSURE MUST NOT EXCEED 2000 PSI.

Volume: **40C, 40D, 55C**—15 gpm
70C, 70D, 100C—20 gpm

1.2 Special Instructions 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** is information that possesses special significance.

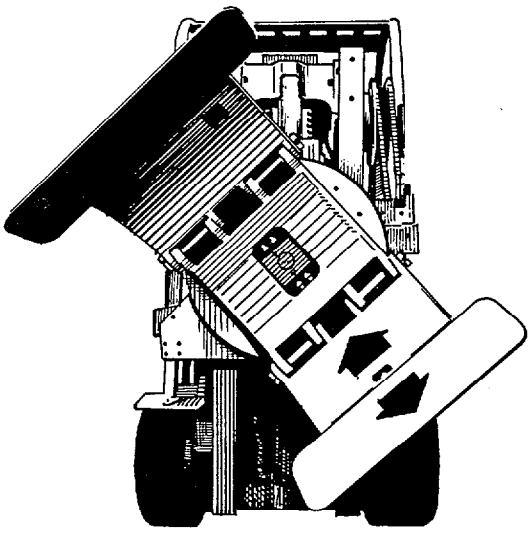
NOTE

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

1.3 Special Operating Procedures

The hydraulically positioned short arm on Pivot Arm Paper Roll Clamps will move only when the clamp is in the 45° position.

The short arm can be repositioned to accommodate different size rolls by simply rotating the clamp to a 45° position.



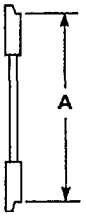
Short Arm Moves When Clamp is in 45° Position

Section 2 Installation Instructions

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

2.1 Truck System Requirements

- Truck relief valve setting: 2000 psi, maximum.
- Volume: **40C, 40D, 55C**—15 gpm
  70C, 70D, 100C—20 gpm.
- Recommended hose and fitting size: No. 8 (1/2 inch ID) with minimum fitting orifices of 13/32 inch.
- Truck carriage must conform to the Industrial Truck Association (ITA) dimensional standards as shown in the following chart.



Mounting	Dimension A (in.)	
	Min.	Max.
Class II (40C, 40D, 55C)	14.94	15.00
Class III (40C, 40D, 55C, 70C, 70D)	18.68	18.74
Class IV (70C, 70D, 100C)	23.44	23.50

- Make sure the truck carriage is clean and the notches are undamaged.

2.2 Prior to Installation

1. Install the hydraulic hoses to the **truck junction blocks** using the correct Cascade Attachment Installation Kit (C-663598 for 100C, C-663585 for all other clamps)

   OR,

   use hoses and fittings shown in Figure 1 or 2. Be careful not to pinch, twist, or otherwise damage the hoses.

IMPORTANT

In order to conform to industry standard practice, the hoses should be connected to the truck auxiliary valves as indicated by the following chart.

Function, in order of location from operator	Attachment Movement	Motion of the operator's hand
Rotate	Clockwise	Rearward or Up
	Counter-clockwise	Forward or Down
Clamp	Clamp	Rearward or Up
	Release	Forward or Down

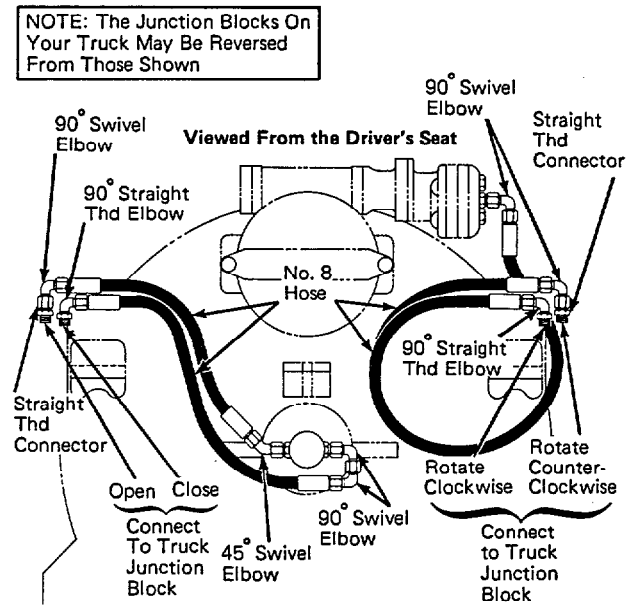


Figure 1. Plumbing Diagram, Models 40C/40D (C4P), 55C 70C (C7P), 70D

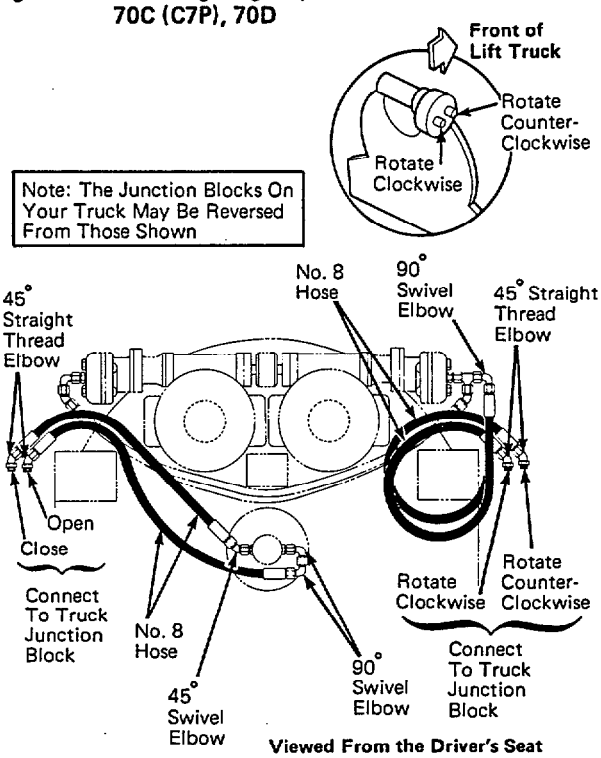


Figure 2. Plumbing Diagram, Model 100C

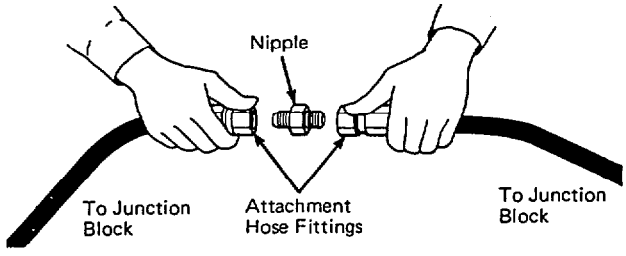
CAUTION:

2. Flush the hoses as follows to prevent damage to the rotator motor and the revolving connection.

   a. Connect the hoses that go to the rotator motor together.

   b. Connect the hoses that go to the revolving connection together.

   c. Start the truck and actuate the rotate and clamp levers in both directions for about 30 seconds to carry any debris left in the hoses to the truck hydraulic tank and filter.



2.3 Installation

❶ Using a suitable hoist and chain, position the clamp as shown and remove the lower mounting hooks.

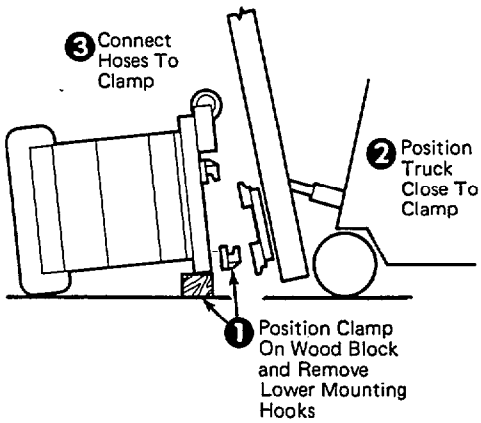
❷ Position the truck close enough so the hoses on the junction blocks can be connected to the rotator motor and revolving connection on the clamp.

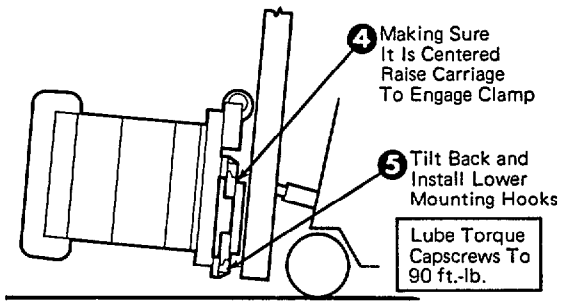
❸ Connect the hoses to the rotator motor and the revolving connection. See Figure 1 or 2.

❹ Raise the truck carriage and engage the attachment upper mounting hooks. Make sure the centering block on the attachment aligns with the center notch on the carriage.

IMPORTANT: Some models have a positioning block welded to the upper left-hand mounting hook. Center the attachment on the carriage, making sure the positioning block is engaged in a notch on the carriage.

❺ Tilt the mast back and install the lower mounting hooks. Lube-torque the capscrews to 90 ft.-lb. (180-200 ft.-lb. on 100C).

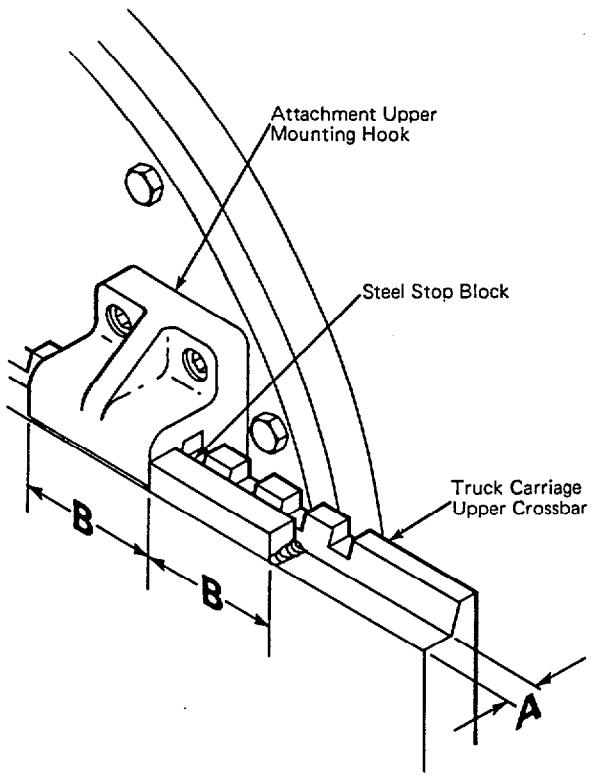




2.4 Attachment Stop Blocks

Cascade recommends that a steel stop block be permanently welded on each side of the truck carriage upper crossbar adjacent to each attachment upper mounting hook. To perform the installation:

1. Select square steel stock with a width about equal to the flat of the carriage upper crossbar (dimension A).
2. Cut two blocks from the stock, each about as long as the width of the attachment upper mounting hook (dimension B).
3. Position the blocks adjacent to the upper mounting hooks. The blocks should not extend behind the flat of the carriage upper crossbar (dimension A).
4. Weld the blocks in place. Make sure you protect adjacent hoses and hydraulic components from weld splatter.



2.5 Prior to Operation

1. Before picking up a load, operate the attachment through several full cycles to force any air from the system to the truck hydraulic tank. Check for leaks.
2. Pick up a maximum load and operate the clamp. If the clamp does not function correctly, recheck the plumbing. If the clamp drops the load, contact Cascade's Service Department, telephone 800-547-5266 (toll-free), or, in Oregon, call 666-1511.

WARNING: Make sure there are no people in the vicinity of the attachment when picking up a load.

Section 3 Periodic Maintenance

3.1 100 Hour Maintenance

Every time the lift truck is serviced or every 100 hours of truck operation, whichever comes first, complete the following maintenance procedures.

☐ Check the edge of the contact plates for wear or sharp nicks that could damage or tear paper rolls. Replace the contact plates if necessary.

☐ Check the pivot pins securing the contact plates and contact plate links. If a concentration of wear is visible, replace the pins.

IMPORTANT:
After completing any service procedure, always test each function through 5 complete cycles. First test the clamp empty to bleed excess air trapped in the system. Then test each function with a load to make sure the clamp operates correctly before returning it to the job.

3.2 500 Hour Maintenance

After each 500 hours of lift truck operation, in addition to the 100-hour maintenance procedures, perform the following procedures.

☐ Lubricate the ring gear/bearing assembly with wheel bearing grease. Rotate the clamp one full turn during lubrication.

☐ Retorque the mounting hook capscrews. Use the torque specifications shown in Section 2.

☐ Remove the plug on the back of the baseplate and retorque all the ring gear/bearing assembly capscrews to 65-70 ft.-lb., (120-125 ft.-lb. on 100C). Replace the plug.

☐ Remove the plug on the side of the rotator drive gearcase and fill to capacity with Cascade Rotator Drive Lubricant (Cascade part number C-656300) or Keystone WG-1. Replace the plug.

3.3 1000 Hour Maintenance

After each 1000 hours of lift truck operation, in addition to the 100-hour and 500-hour maintenance procedures, perform the following procedures.

☐ Check the pivot point bushings on the cylinders, arms, and rotator frame. If the inside surfaces are worn, marred, or deeply scratched, replace the bushings.

☐ Check the cylinder anchor pins and the arm anchor pins. If the chrome plating is pitted or worn through, replace the pins.

3.4 2000 Hour Maintenance

After each 2000 hours of lift truck operation, in addition to the 100-hour, 500-hour, and 1000-hour maintenance procedures, perform the following procedure.

☐ Replace all pivot point bushings.

Section 4 Troubleshooting

4.1 General Procedures

WARNING: Before servicing any hydraulic component, relieve pressure in the system. Open the arms 1 or 2 inches, turn the truck off, and open the truck auxiliary valves several times in both directions.

After completing any service procedure, always test the function through several cycles. First test the attachment empty to bleed air trapped in the system to the truck system. Then test the attachment with a load to be sure it operates correctly before returning it to the job.

Stay clear of the load while testing. Do not raise the load more than 3 inches off the floor while testing.

4.1-1 Truck System Requirements

Pressure: Your lift truck should supply sufficient hydraulic pressure to handle the heaviest load. PRESSURE MUST NOT EXCEED 2000 PSI.

Volume: **40C, 40D, 55C**—15 gpm
70D, 100C—20 gpm

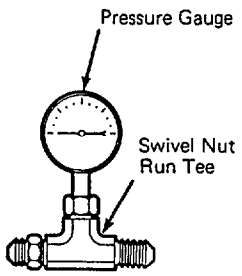
4.1-2 Tools Required

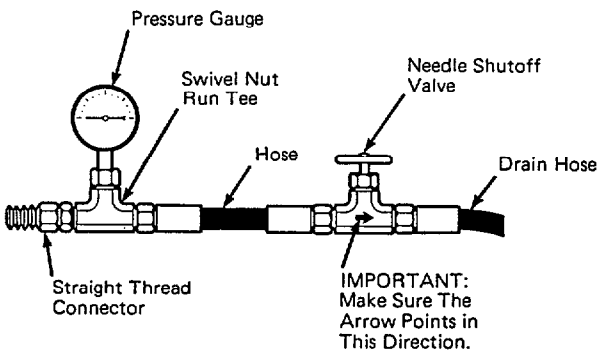
In addition to a normal selection of hand tools, you will need:

- Two pressure gauges capable of measuring pressure to 2500 psi.
- Two No. 6 swivel nut run tees (37° JIC) suitable for mounting gauges.
- Two No. 8 swivel nut run tees (37° JIC) suitable for mounting gauges.
- Two needle shutoff valves, rated for 2500 psi service, minimum. (Recommended supplier for needle shutoff valves: Marsh Instrument Co., Skokie, Ill.)

Install the gauges in the tees. Use No. 6 tees for troubleshooting clamping circuits on models 40C, 40D, 55C, 70C and 70D. Use No. 8 tees for troubleshooting model 100C clamping circuits and the rotator circuits on **all** models.

For some tests, you will install the needle valve and a drain line in conjunction with the gauge arrangement.





4.1-3 Get All The Facts Before You Begin Working On The Clamp

It is important that you gather all the facts regarding the problem before you begin service procedures. The best way is to talk with the operator. Ask for a complete description of the malfunction. The following guidelines will help you decide where to begin your troubleshooting procedures.

A. Clamp Circuit

- Clamp drops the roll after it has been picked up.
- Clamp will not carry rolls up to its rated capacity.
- Clamp arms will not function properly.
- Long arm drifts when in the horizontal position.

If you encounter one of these problems, refer to Paragraph 4.3.

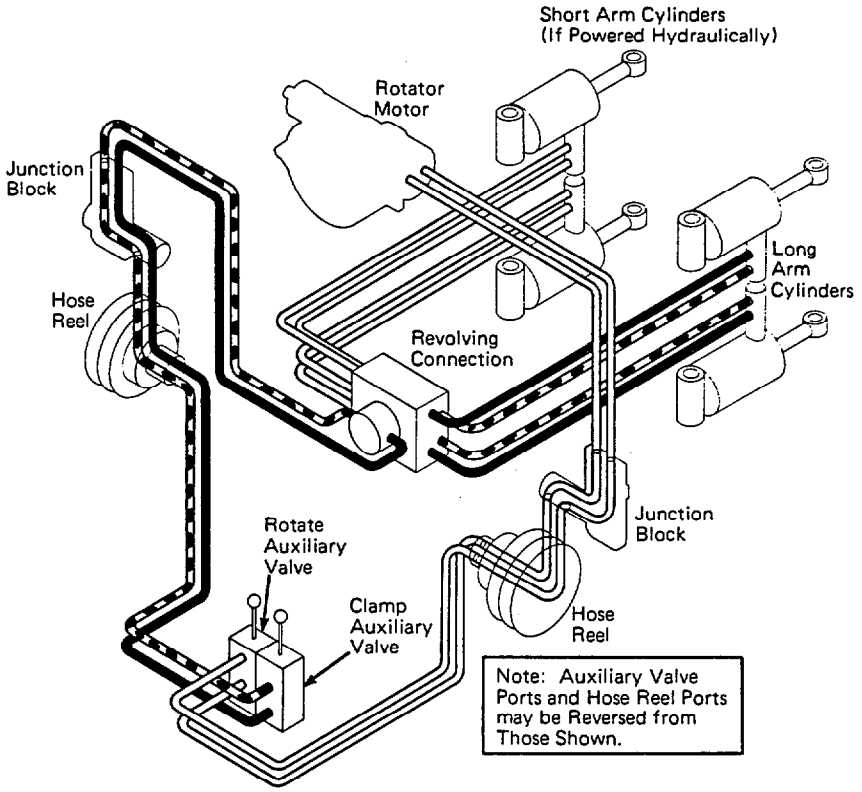
B. Rotate Circuit

- Clamp will not rotate.
- Clamp will not rotate rolls up to its rated capacity.
- Clamp rotates in one direction only.

If you encounter one of these problems, refer to Paragraph 4.4.

4.2 Plumbing

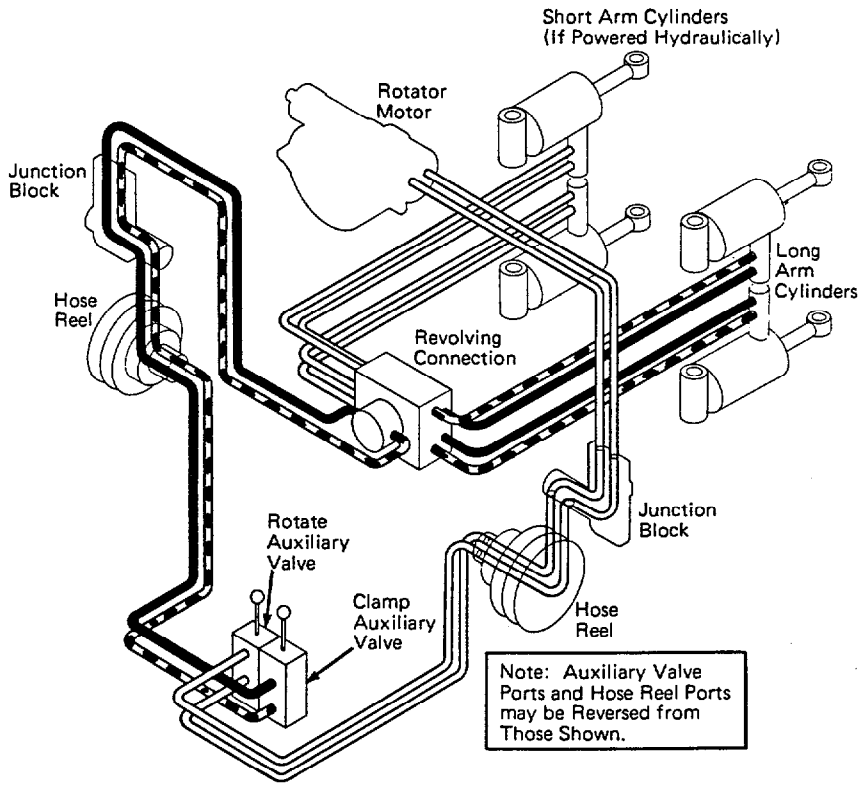
4.2-1 Hosing Diagram



ARMS CLOSING

PRESSURE

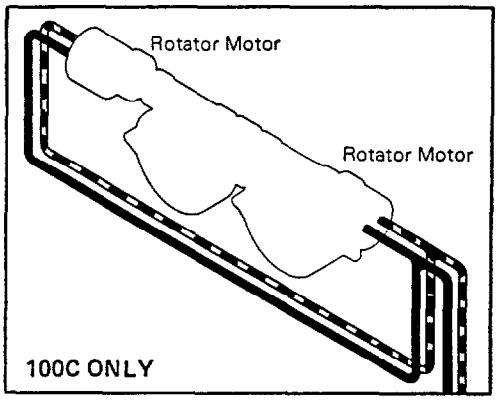
RETURN

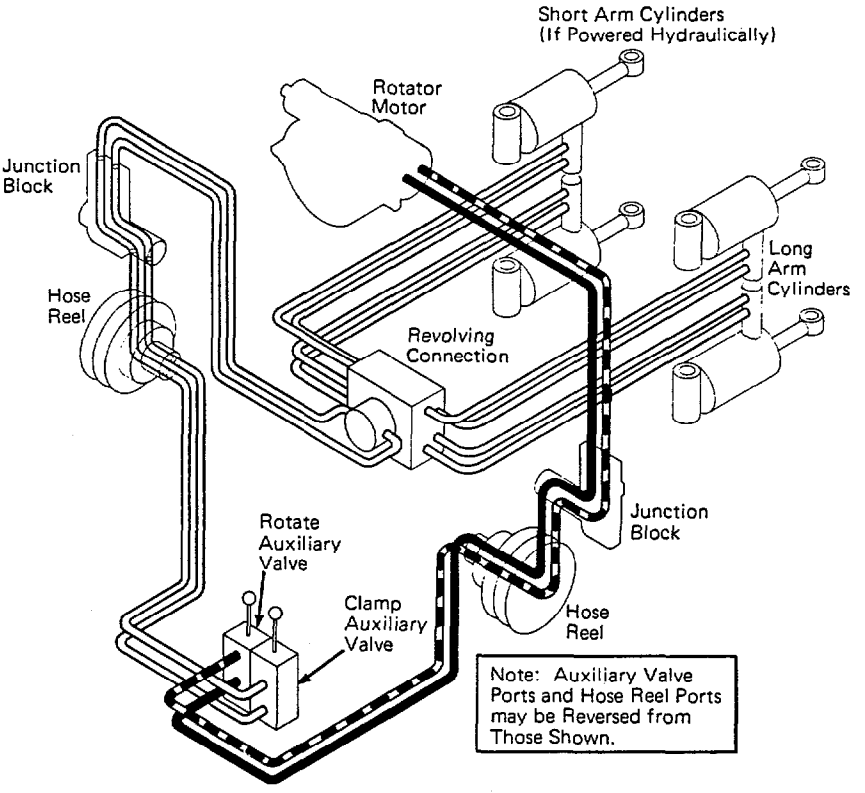


ARMS OPENING

PRESSURE

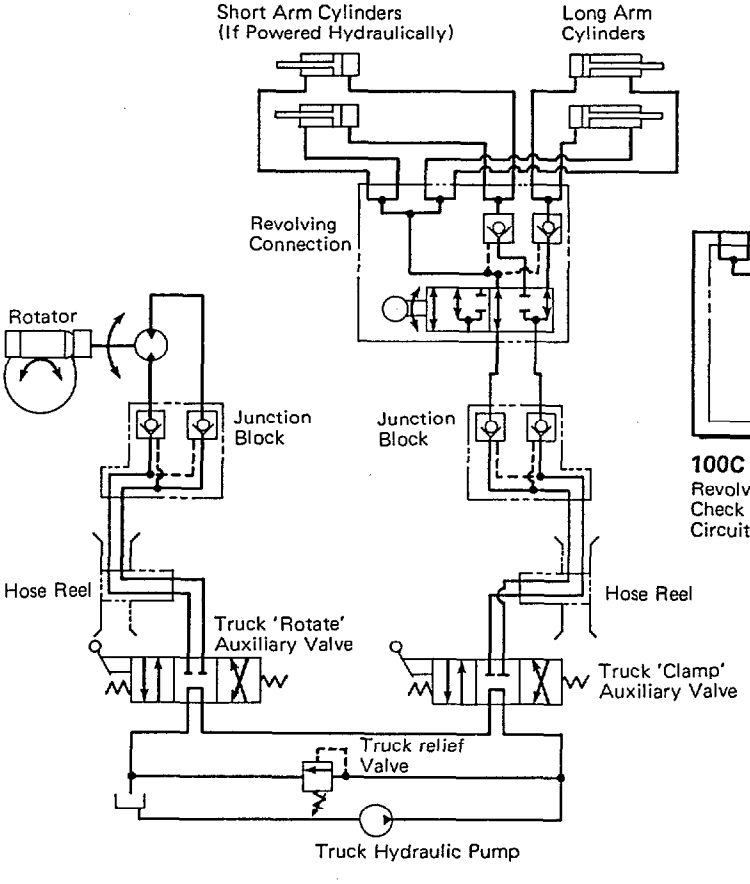
RETURN

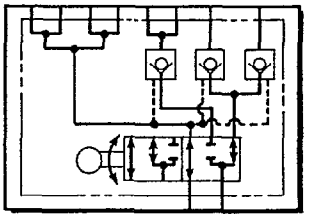




ROTATE (CLOCKWISE SHOWN)
PRESSURE
RETURN

4.2-2 Circuit Schematic





100C ONLY
Revolving Connection Has Two Check Valves in Long Arm Clamp Circuit.

4.3 Clamp Circuit Troubleshooting

There are four potential problem areas that could affect clamping force.

- Insufficient hydraulic pressure.
- External leaks.
- Malfunctioning check valves.
- Worn or defective cylinder seals.

To isolate the problem area, complete the following check list in the **exact** sequence indicated.

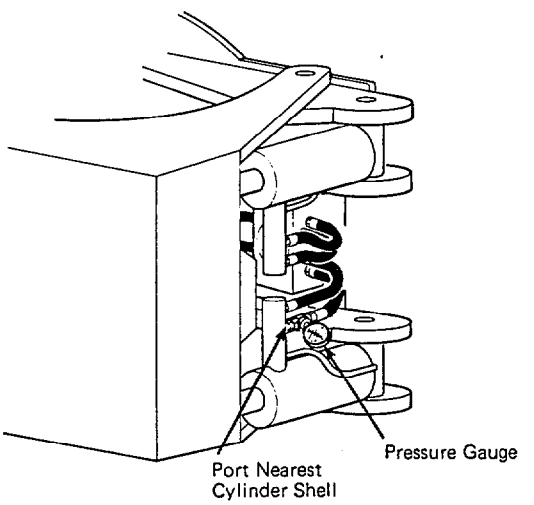
4.3-1 Clamp Circuit Pressure Test

☐ Close the long arm to within 1 or 2 inches of the end of its stroke.

☐ Install a pressure gauge (without the needle valve) in the long arm cylinder extension port (port nearest the cylinder shell). Reconnect the hose from the revolving connection to the other end of the gauge tee.

☐ Start the truck and move the truck control handle to the "clamp" position. After the arm has fully closed, continue holding the handle for a moment to allow clamping circuit pressure to reach the full truck relief setting. Note the pressure.

If the gauge does not register the specified truck system pressure, check the pressure delivered by the truck pump. Refer to the truck service manual. Adjust and repair as necessary. Recheck cylinder pressure.



☐ Return the handle to neutral and note any change of the gauge reading. If the pressure remains within 100 psi of the relief setting after one minute, your problem is **not** in the long arm clamping circuit, but may be in the short arm clamping circuit (if your clamp is equipped with a hydraulically-powered short arm).

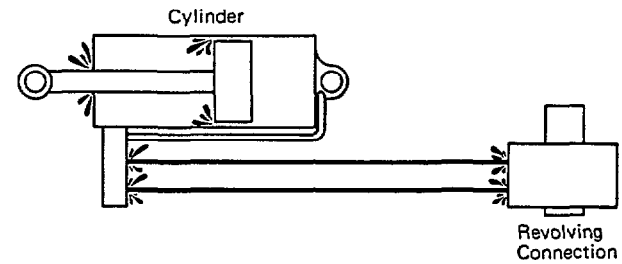
NOTE: 100C CLAMPS ONLY. Since each long arm cylinder of a 100C has separate check systems, both long arm cylinders must be tested individually.

☐ Repeat the above procedures on the short arm cylinders to test short arm clamping force.

NOTE: To test the short arm cylinders, the clamp must be rotated to any 45° position and must remain in that position during the test.

If the gauge reading dropped more than 100 psi below the relief setting after one minute during either long or short arm cylinder tests, proceed with the trouble-shooting check list to isolate the faulty component.

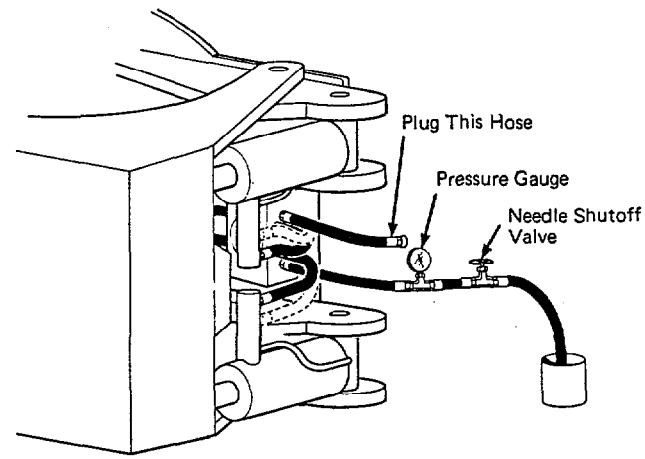
4.3-2 External Leaks



☐ Refer to the accompanying diagram and check all areas that could have external leaks. Repair as necessary and carefully operate the clamp to determine if the problem has been solved.

4.3-3 Check Valve Test

IMPORTANT: If you determine by the pressure test that the long arm system is faulty, the attachment must be positioned so the arms are side-by-side to test the check valves. To test the short arm system, the attachment must be rotated to any 45° position.



☐ Remove both clamp hoses from the cylinders (either long arm or short arm—not both arms). The clamp hoses are connected to the ports nearest the cylinder shell. Plug one hose with a No. 8 metal plug.

☐ Install a pressure gauge with a needle shutoff valve and drain line into the other cylinder clamp hose (refer to Paragraph 4.1-2 for an illustration of the gauge arrangement). Put the drain hose into an empty container.

☐ Open the needle valve no more than 1/2 to 1 full turn. Start the truck and let it idle.

☐ Operate the truck "clamp" lever for 4 or 5 seconds, then close the needle valve tightly. Release the truck "clamp" lever after 2 to 3 seconds, allowing the gauge to reach full lift truck pressure.

☐ If the gauge drops more than 100 psi in one minute, one or more of the following is responsible.

- Check valve is defective.
- Check valve seals are damaged.
- Revolving connection valve body is damaged internally.

☐ Repeat the test on the capped hose to test the other check valve.

☐ If necessary, service the check valve as described in Section 5, Paragraph 5.5.

☐ If the gauge does **not** drop more than 100 psi in one minute but **did** fail the general pressure test, the cylinder seals require service. See Section 5, Paragraph 5.3.

Call Cascade's Service Department

If you have carefully and accurately completed this check list and you still have not solved the problem, call us. Our Service Department is open from 10:00 AM to 8:00 PM **Eastern time.**

Call 800-547-5266 (toll free)
In Oregon, 666-1511

4.4 Rotate Circuit Troubleshooting

To isolate the problem area in the rotation system, complete the following check list.

4.4-1 Problem

Clamp will not rotate or will not rotate rolls up to its rated capacity.

Probable causes:

- Insufficient truck hydraulic pressure.
- Incorrect roll handling.
- Excessive back pressure in the truck hydraulic system.

Tests:

☐ Check the pressure delivered by the truck hydraulic system. A pressure drop of no more than 100 psi below truck relief valve setting at the auxiliary valve port is OK. If the pressure is not as specified, refer to the truck service manual for adjustment or service. **Pressure must not exceed 2000 psi.**

☐ Make sure the operator is gripping the roll as shown in the illustration. Gripping a roll, especially a long one, near its end, then attempting to rotate it requires a tremendous amount of torque—often times beyond the capacity of the clamp.

☐ Install a pressure gauge into each port of the hydraulic motor (do not use the needle valve).

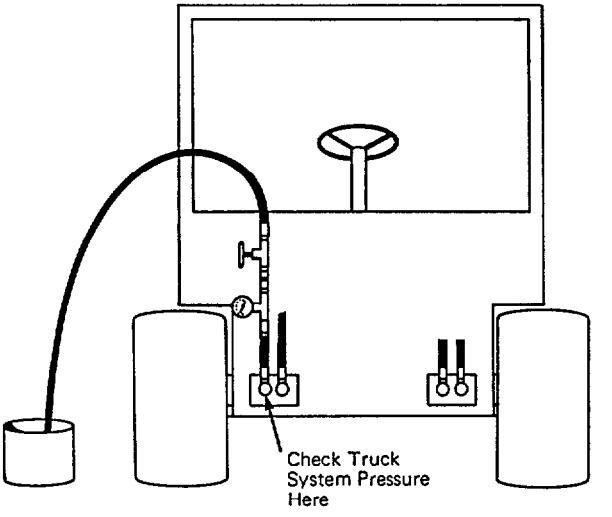
☐ Securely grip a roll that weighs close to the capacity of the clamp.

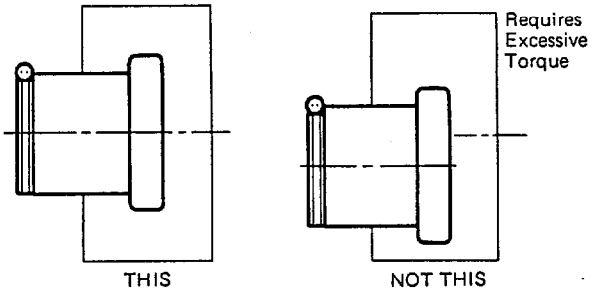
☐ Rotate the roll and note the pressure readings on the gauges during rotation.

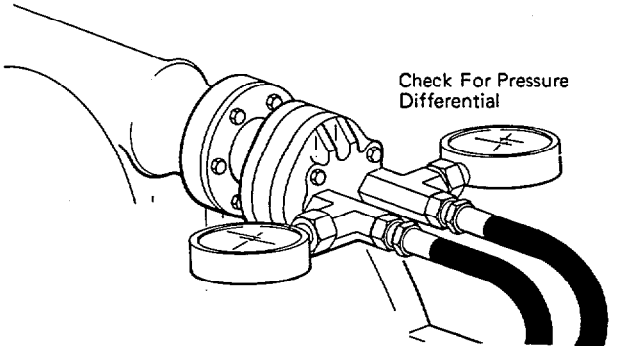
IMPORTANT: On 100C models, you must perform this test on each motor individually.

If the lower pressure reading EXCEEDS 200 psi, you have excessive back pressure in your supply circuit. Check for restrictions such as numerous fittings and elbows, hose sizes less than No. 8, clogged oil filter, etc.

If the lower pressure does NOT EXCEED 200 psi, and the truck pressure is within specifications, the hydraulic motor needs repair. Refer to Section 4, Paragraph 4.7.







4.4-2 Problem:

Clamp rotates in one direction only.

Probable cause:
The pilot spool in the junction block that supplies the rotator motor is jammed.

Solution:
Replace the junction block.

Call Cascade's Service Department

If you have carefully and accurately completed this check list and you still have not solved the problem, call us. Our Service Department is open from 10:00 AM to 8:00 PM **Eastern time.**

Call 800-547-5266 (toll free)
In Oregon, 666-1511

5.1 Clamp Removal and Installation

1. Make sure the attachment is rotated so the arms are positioned side-by-side (for vertical roll handling). Open the arms completely.

2. Remove the lower mounting hooks. For reassembly, lube-torque the lower mounting hook capscrews to 90 ft.-lb., (180-200 ft.-lb. on 100C).

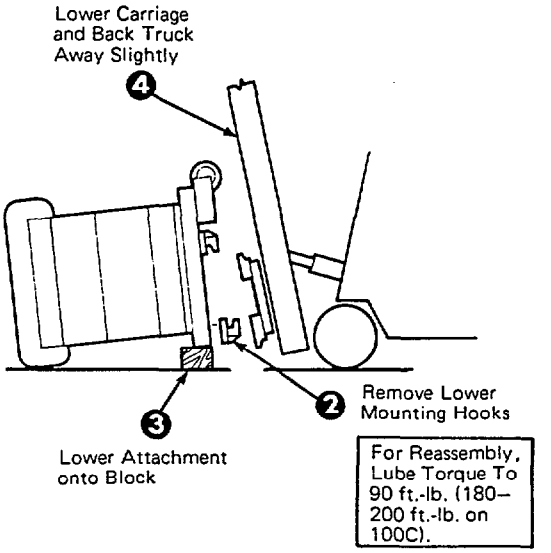
3. Position a wood block under the attachment frame. Lower the mast carriage until the arm contact plates are on the floor and the frame is resting on the block.

4. After making sure the attachment is securely positioned, continue lowering the mast carriage enough to clear the upper mounting hooks. Back the truck away a few inches to gain access to the hoses to the revolving connection.

> **WARNING:** Before removing any hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.

5. Disconnect and cap the hoses to the revolving connection and to the rotator drive hydraulic motor. Tag the hoses for ease in reconnecting.

6. For reinstallation, reverse the above procedures, or consult Installation Instructions, Section 2.



5.2 Arms

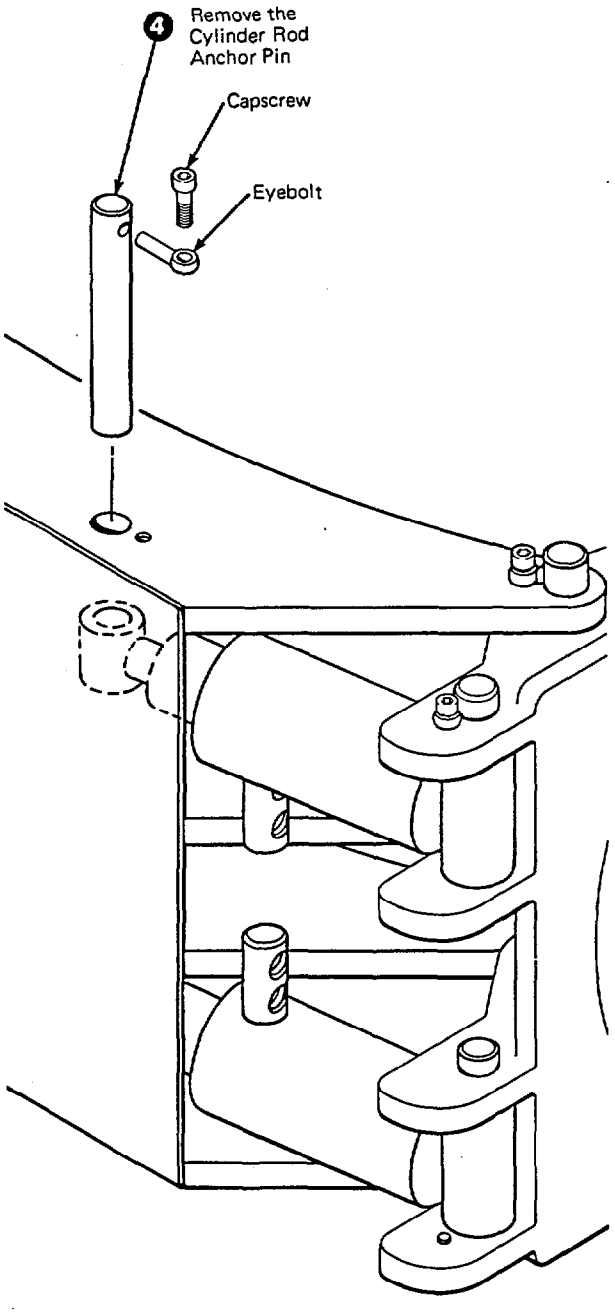
5.2-1 Arm Removal and Installation

Arm removal is easiest to perform with the attachment mounted on the truck. Either arm can be removed according to the following procedures.

1. Fully close the clamp arms to be removed.
2. Rotate the attachment so the arms are positioned side-by-side (for vertical roll handling).
3. Secure the arm with a suitable overhead hoist and chain.

> **WARNING:** Make sure your overhead hoist has a rated lifting capacity of at least 1000 pounds.

4. Remove the capscrews and eyebolts securing the cylinder rod anchor pins to the attachment arm. Remove the cylinder rod anchor pins. In the case of a fixed short arm, remove the rod assembly anchor pins.
5. Slowly retract the clamp cylinders hydraulically so the cylinder rods disengage from the arm. In the case of a fixed short arm, manually pull the arm out of engagement with the rod assembly.
6. Remove the capscrews and eyebolts securing the arm pivot pins to the frame. **Making sure the overhead hoist and chain are secure,** remove the pins. Note the quantity and location of shims when removing the pins. Make sure you replace the same number of shims when you reinstall the pins.
7. For reassembly, reverse the above procedures.



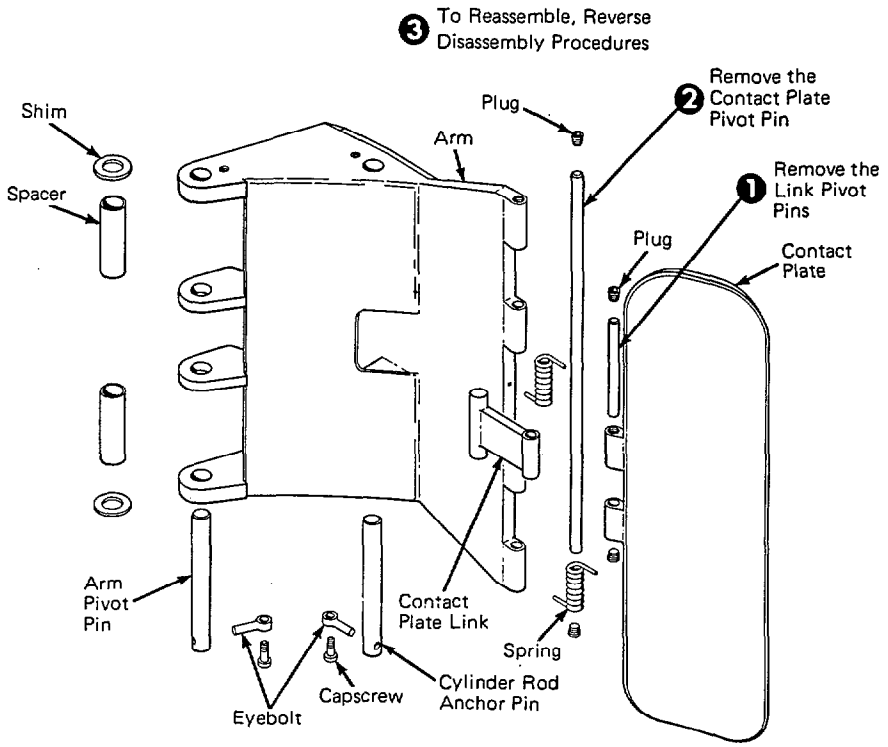
5.2-2 Arm Disassembly and Reassembly

The following procedures can be performed with the attachment on the truck and with the arms on the attachment.

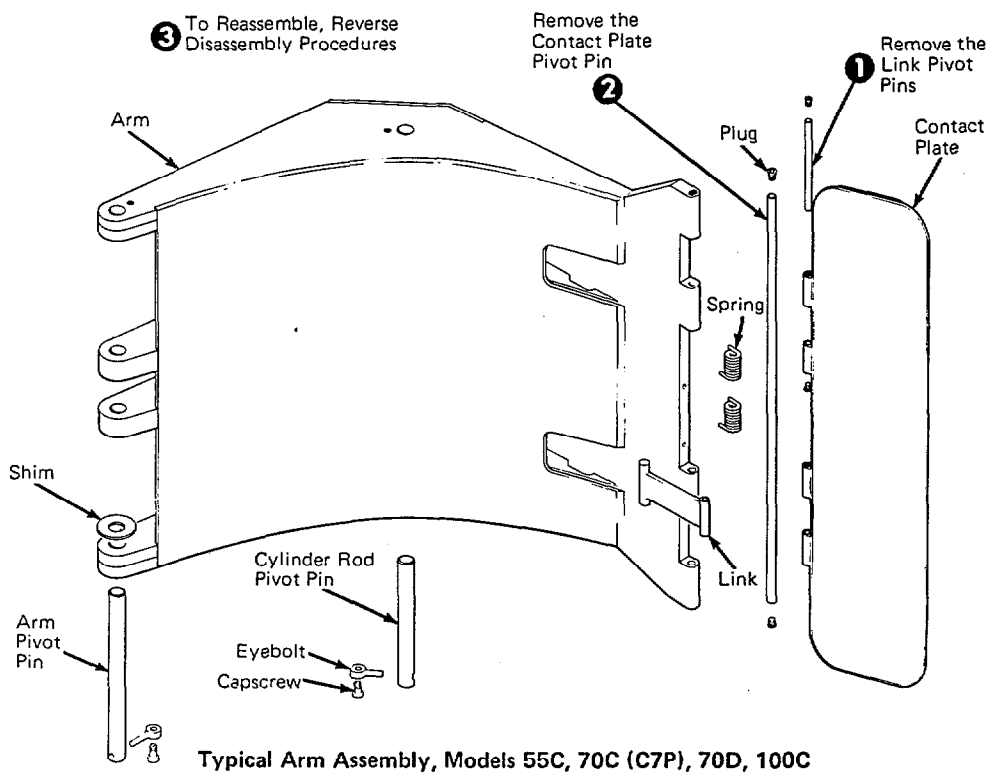
❶ Remove the contact plate link(s) by removing the link pivot pin(s). The links are pivoted to the inside edge of the contact plates to limit the travel of contact plate articulation.

❷ Remove the contact plate by removing the pivot pin from the back of the contact plate. The pin is secured by two pipe plugs.

❸ For reassembly, reverse the above procedures.



Typical Arm Assembly, Model 40C (C4P)

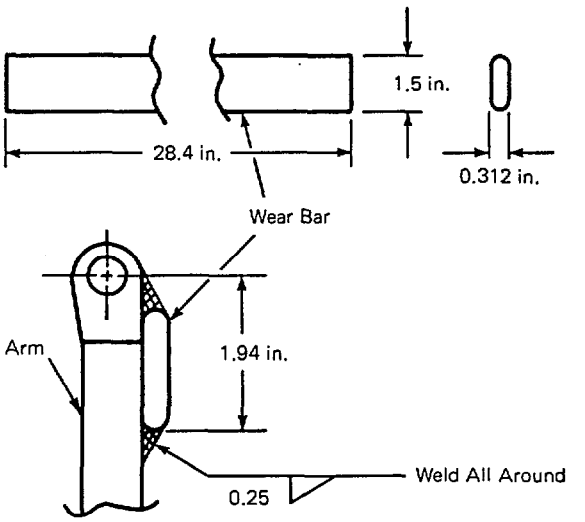


Typical Arm Assembly, Models 55C, 70C (C7P), 70D, 100C

5.2-3 Wear Bar Installation

Inspect the short arm tip for wear. It frequently wears excessively when the arm is dragged across the floor. To reduce arm tip damage, install a wear bar as follows.

1. Order a wear bar (Cascade part number C-636736) or make a wear bar from AISI 5160 HR (hot-rolled steel). Cut the bar to match the width of the arm.
2. Weld the wear bar to the arm tip as shown. Use E7018 welding rod; pre-heat to 350 °F, post-heat to 900 °F.
3. Make sure the welds are smooth to avoid paper roll damage during handling in close stacks.
4. Since the wear bar installation makes the arm slightly thicker, make sure the operator knows so he can compensate.

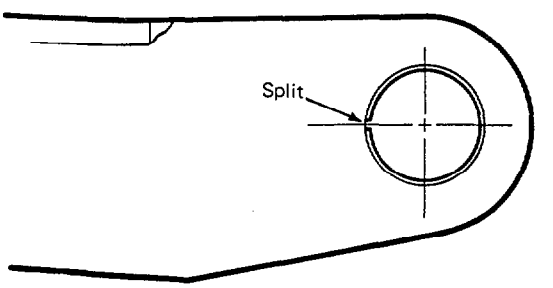


5.2-4 Arm Bushing Replacement

CAUTION: When installing a new bushing or inserting a pivot pin, be careful not to scratch or mar the special grey coating on the inside surface of the bushing.

1. Drive out the old bushings with a bushing driver of the same diameter. Do not gouge the bore surfaces of the arm.
2. Making sure the split in the new bushings are positioned as shown, install the new bushings with a bushing driver. Drive the bushings in until they are flush.
3. When installing the pivot pins, lightly lubricate the bushings to ease installation.

Install Bushing with Split Located as Shown.



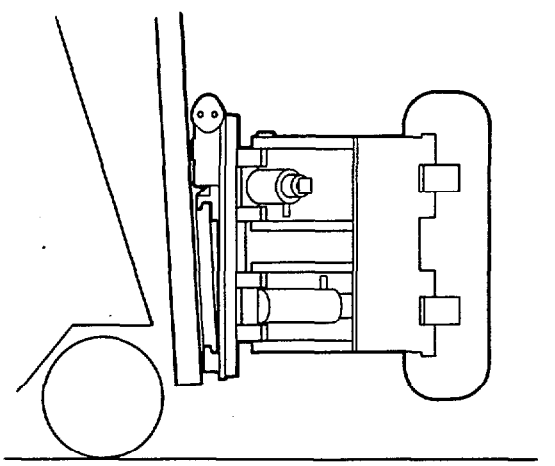
5.3 Cylinders, General Procedures

5.3-1 To Service a Cylinder on the Clamp

1. Fully close the arm powered by the cylinder(s) to be serviced.
2. Rotate the attachment so the arms are positioned side-by-side (for vertical roll handling).
3. Remove the cylinder rod anchor pins.
4. Slowly retract the cylinders hydraulically so the cylinder rods disengage from the arm.

> **WARNING:** Before removing any hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.

5. Remove and cap all hoses at the cylinder(s). Tag the hoses for ease in reconnecting.



5.3-1 To Service a Cylinder on the Clamp (Cont.)

6. Install a cylinder in the reverse order that it was removed.

7. Operate the attachment through several full cycles to force air in the system to the truck hydraulic tank. Check for leaks.

5.3-2 To Remove a Cylinder from the Clamp

1. Perform the procedures described in Paragraph 5.3-1.

2. Remove the capscrews and eyebolts securing the cylinder base anchor pins to the frame. Secure each cylinder with a suitable hoist, then remove the cylinder base anchor pins. Note the quantity and location of shims when removing the pins. Make sure you replace the same number of shims when you reinstall the pins.

3. Install a cylinder in the reverse order that it was removed.

4. Operate the attachment through several full cycles to force air in the system to the truck hydraulic tank. Check for leaks.

5.3-3 Cylinder Disassembly

- Use a spanner wrench to remove cylinder retainers. You'll need a pin spanner and a claw spanner.

- When servicing a cylinder, clamp it in a soft-jawed vise as shown. Never clamp the cylinder shell or the cylinder rod shaft in a vise.

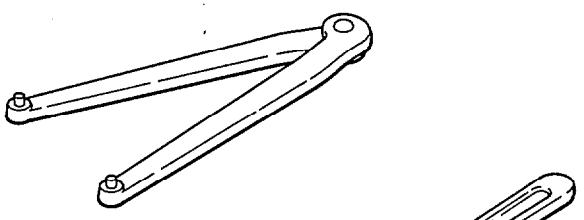
- To remove the seal from a piston or a retainer, put the piston or retainer in a soft-jawed vise. Pry the seal up with a blunt tool such as a screwdriver, then cut the seal to remove it. Be careful not to scratch the seal groove.

5.3-4 Cylinder Inspection

- Inspect the rod, piston, and retainer for nicks or burrs. If deeply gouged, replace the part. Minor nicks and burrs can be removed with an emery cloth.

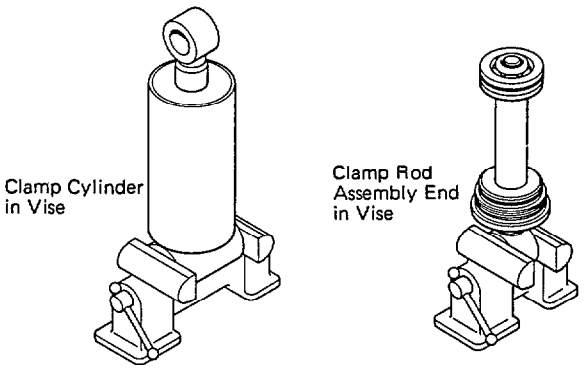
  NOTE: A minor nick is one that will not cause a bypass of oil when the cylinder is operating.

- Inspect the inside of the cylinder shell and remove any minor nicks and burrs (see Note, above) with a butterfly hone. Replace the cylinder shell if it is deeply gouged.



Pin Type Spanner Wrench

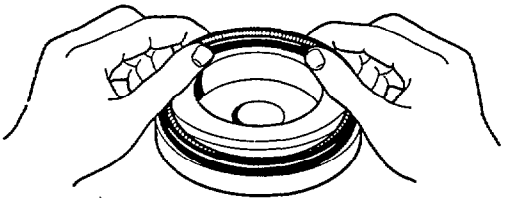
Claw Type Spanner Wrench



5.3-5 Cylinder Assembly

- Lubricate all new seals with STP before installing.
- To install a new seal on a piston or retainer, hook one side of the seal in the groove and push it over the piston or retainer.

  NOTE: Polishing the chamfer angle will allow the seal to slide into the groove much easier.
- Carefully note the direction of U-cup seals. If they are installed backwards, the seals will not seal properly. Refer to the illustration of the cylinder you are servicing.
- Always reassemble the rod assembly by sliding the retainer on first, then the piston assembly. Install and torque the piston retaining nut before sliding the rod assembly back into the shell.
- When reassembling a cylinder, always observe all torque values as shown on the appropriate illustration.

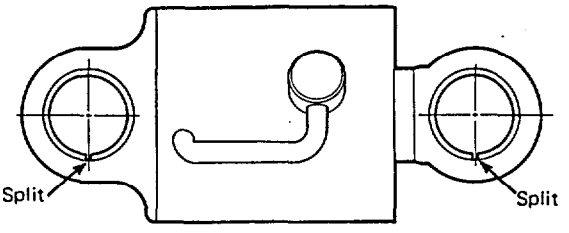


Install New Seal as Shown.

5.3-6 Cylinder Bushing Replacement

CAUTION: When installing a new bushing or inserting a pivot pin, be careful not to scratch or mar the special grey coating on the inside surface of the bushing. Do not gouge the bore surface of the cylinder end.

1. Drive out the old bushings with a bushing driver of the same diameter. On cylinder ends that have two bushings, drive out each old bushing from the opposite side.
2. Making sure the new bushing is positioned as shown, drive the new bushing in flush. On cylinder ends that have two bushings, drive in one bushing, turn the cylinder over, install the spacer if there is one, then drive in the other bushing.



Install Bushings with Split Located as Shown.

5.4 Cylinder Service

Short Arm Cylinders with Articulation

Select the illustration that represents the cylinder you are servicing and perform the following procedures. Read the General Procedures, Paragraph 5.3, before proceeding.

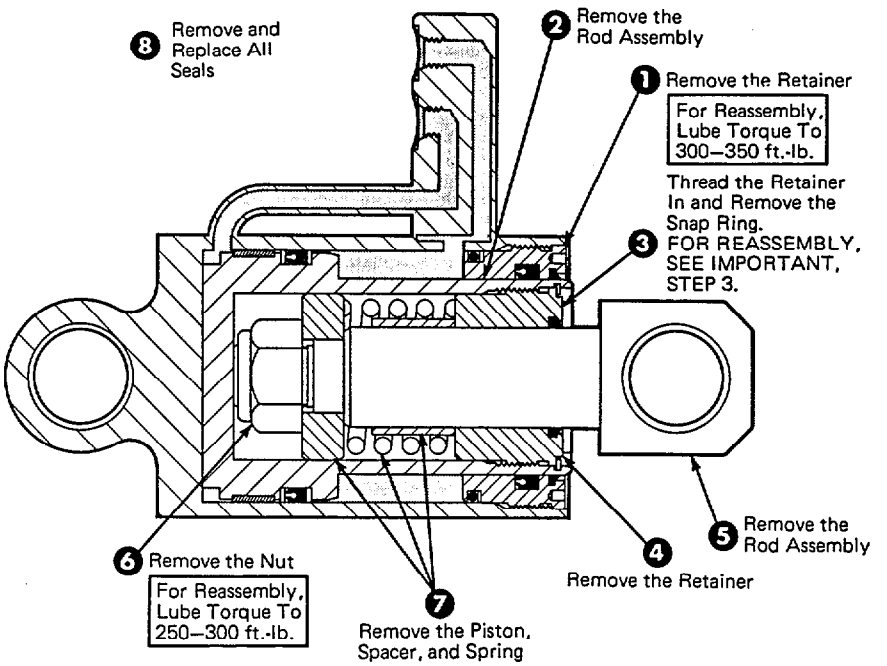
1. Remove the large retainer.
2. Pull the rod assembly out of the shell.

To disassemble the articulation cylinder:

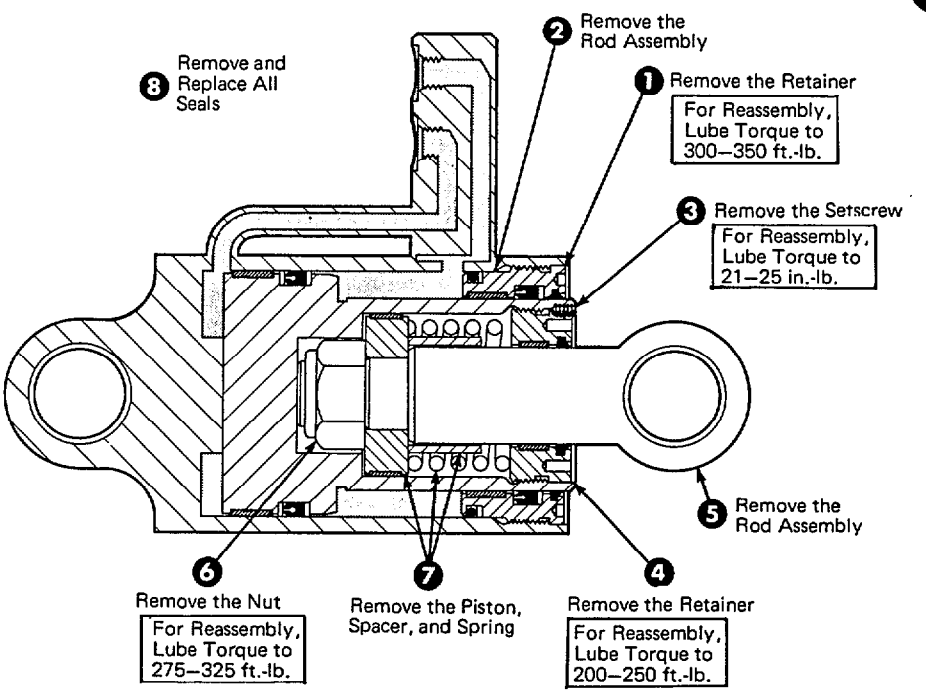
3. **On articulation rod retainers secured with a setscrew,** remove the setscrew. (Old-style articulation rod retainers are secured with a roll pin. Refer to IMPORTANT below).

   On articulation rod retainers secured with a snap ring, thread the articulation retainer **in** until it bottoms. Remove the articulation rod retainer snap ring.

   IMPORTANT: When reinstalling the articulation rod retainer and securing it with the snap ring, thread the retainer all the way **in.** Install the snap ring, then back out the retainer until it bottoms against the snap ring.
4. Untread the articulation retainer.
5. Remove the articulation rod assembly.
6. Remove the nut securing the articulation piston to the articulation rod.
7. Remove the articulation piston, spacer (if equipped), spring, and retainers from the articulation rod.
8. Remove and replace all seals as shown.
9. Reassembly is a reverse of disassembly.



70C and 100C Short Arm Cylinder with Articulation



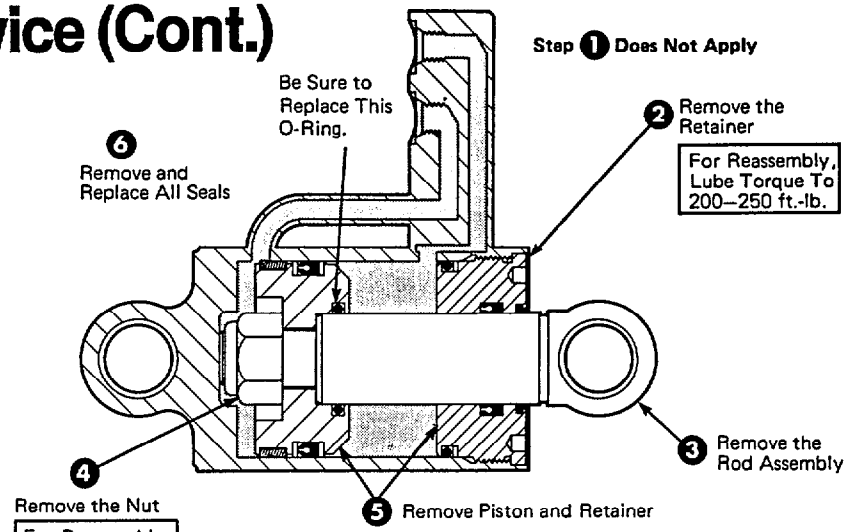
70C Short Arm Cylinder with Articulation

5.4 Cylinder Service (Cont.)

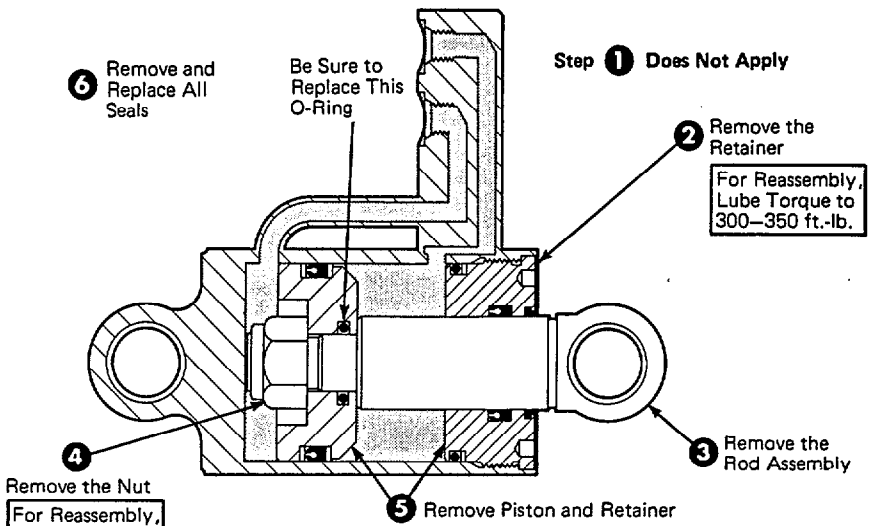
Short Arm Cylinders without Articulation

Select the illustration that represents the cylinder you are servicing and perform the following procedures. Read the General Procedures, Paragraph 5.3, before proceeding.

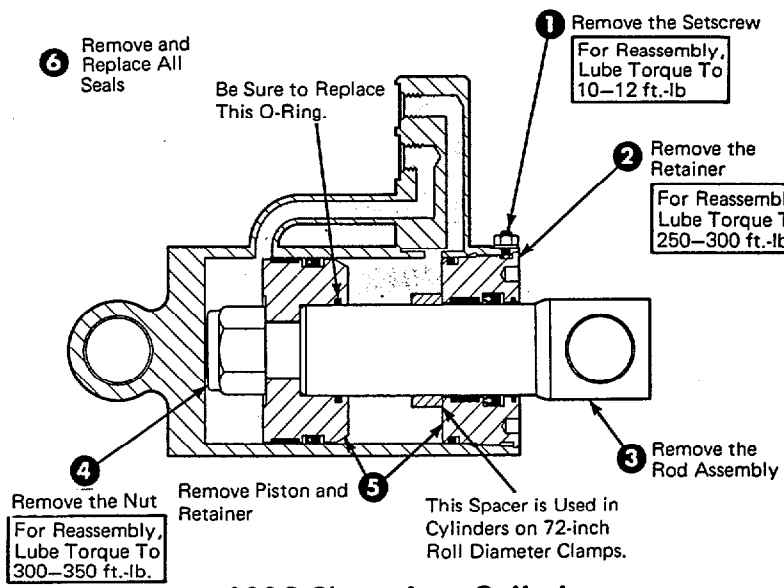
1. Remove the retainer setscrew if equipped.
2. Remove the retainer.
3. Pull the rod assembly out of the shell.
4. Remove the nut securing the piston to the rod.
5. Remove the piston, spacer (if equipped), and retainer from the rod.
6. Remove and replace all seals as shown.
7. Reassembly is a reverse of disassembly.



40C, 40D, and 55C Short Arm Cylinder



70D Short Arm Cylinder



100C Short Arm Cylinder

5.4 Cylinder Service (Cont.)

Long Arm Cylinders with Articulation

Select the illustration that represents the cylinder you are servicing and perform the following procedures. Read the General Procedures, Paragraph 5.3, before proceeding.

❶ Remove the large retainer.

❷ Pull the rod assembly out of the shell.

❸ On cylinders with two articulation springs, remove the nut securing the piston to the rod. Remove the piston and the large retainer.

To disassemble the articulation cylinder:

❹ **On articulation rod retainers secured with a setscrew,** remove the setscrew. (Old-style articulation rod retainers are secured with a roll pin. Refer to IMPORTANT below).

On articulation rod retainers secured with a snap ring, thread the articulation retainer **in** until it bottoms. Remove the articulation rod retainer snap ring.

IMPORTANT: When reinstalling the articulation rod retainers and securing it with the snap ring, thread the retainer all the way **in**. Install the snap ring, then back out the retainer until it bottoms against the snap ring.

❺ Untread the articulation retainer.

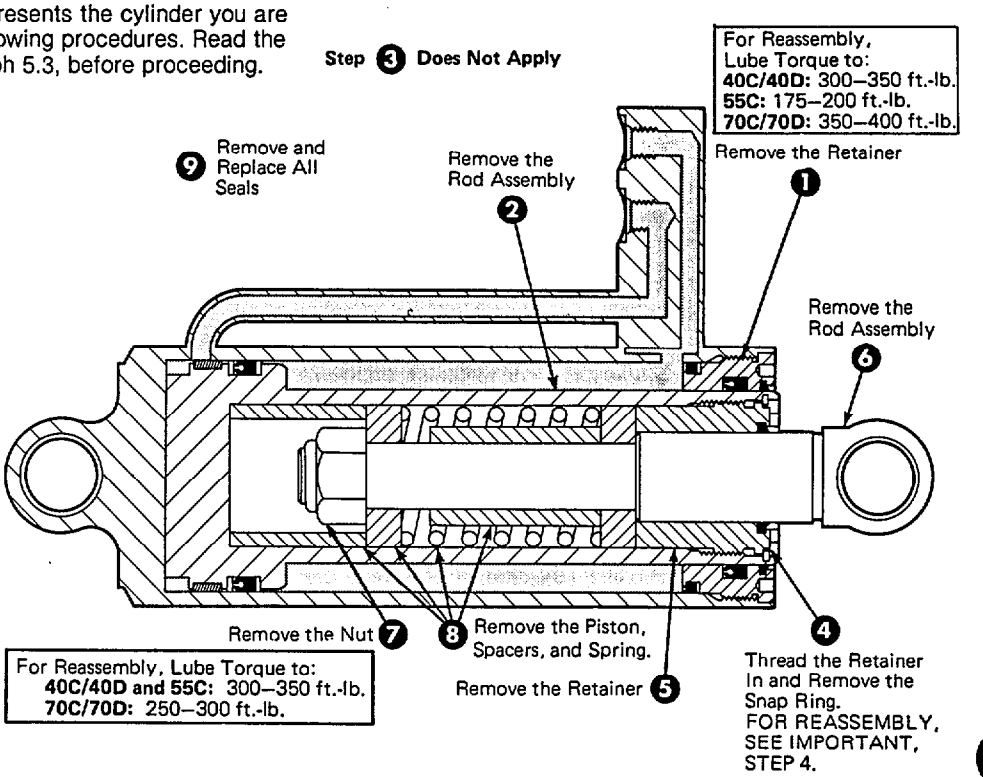
❻ Remove the articulation rod assembly.

❼ Remove the nut securing the articulation piston to the articulation rod.

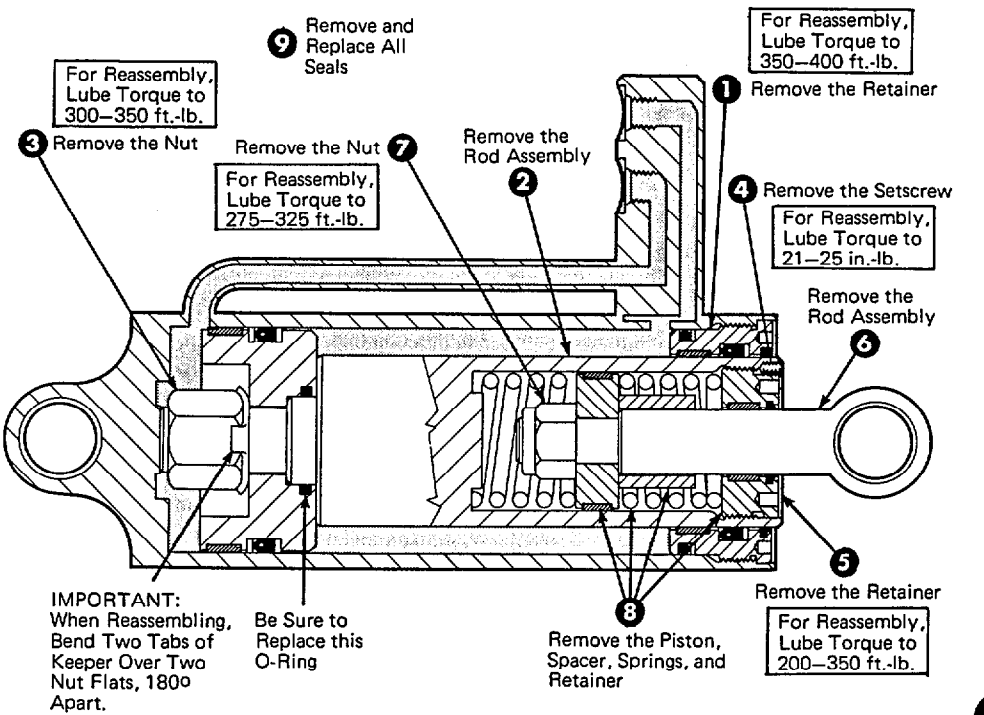
❽ Remove the articulation piston, spacer (if equipped), spring, and retainer(s) from the articulation rod.

❾ Remove and replace all seals as shown.

❿ Reassembly is a reverse of disassembly.



40C, 40D, 55C, and 70D Long Arm Cylinder with Articulation (single spring)



70C Long Arm Cylinder with Articulation (double spring)

5.4 Cylinder Service (Cont.)

Step ❶ Does Not Apply

Long Arm Cylinders without Articulation

Select the illustration that represents the cylinder you are servicing and perform the following procedures. Read the General Procedures, Paragraph 5.3, before proceeding.

❶ Remove the retainer setscrew if equipped.

❷ Remove the retainer.

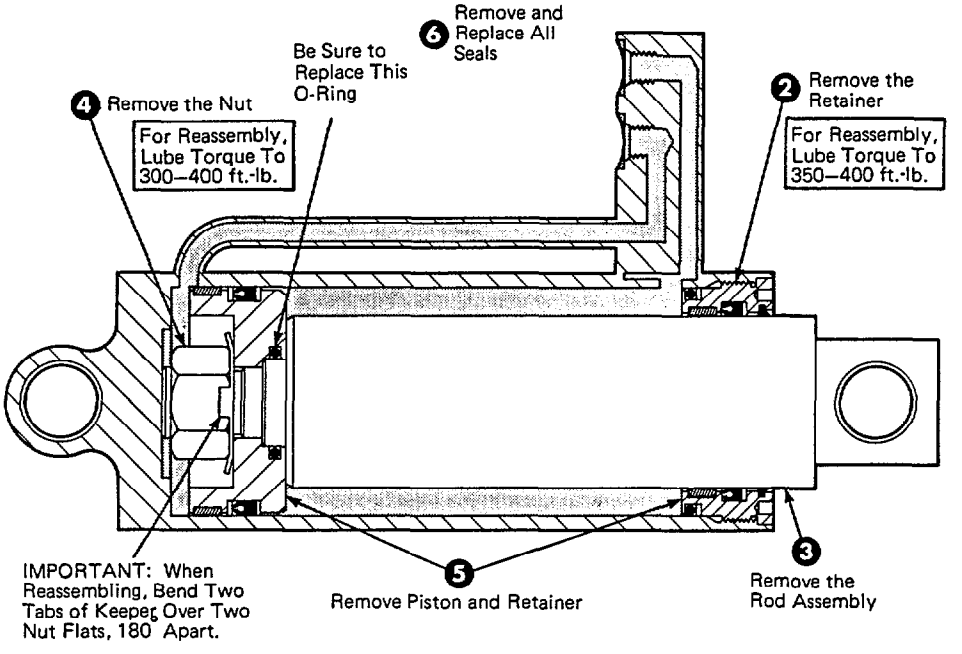
❸ Pull the rod assembly out of the shell.

❹ Remove the nut securing the piston to the rod.

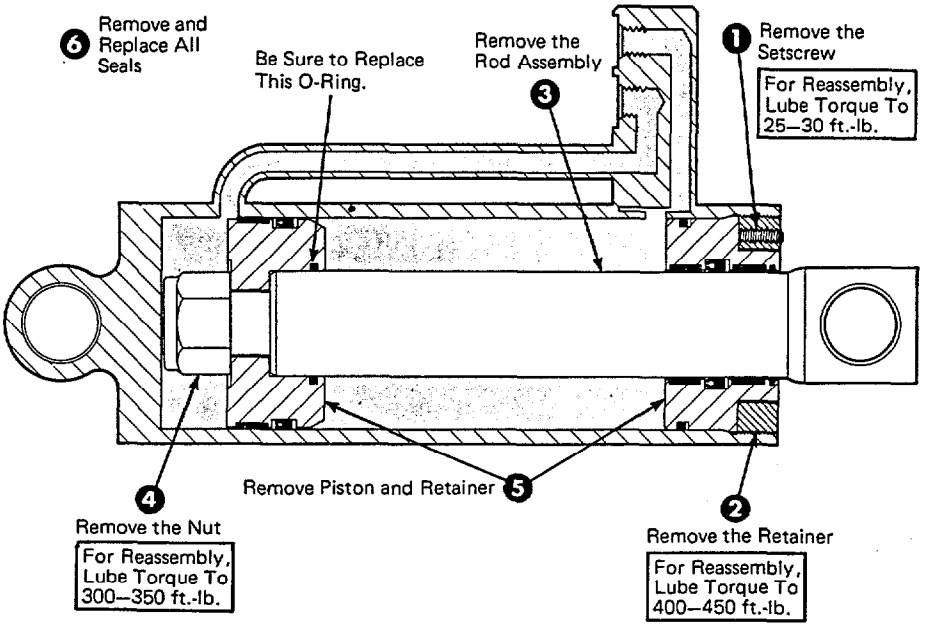
❺ Remove the piston and retainer from the rod.

❻ Remove and replace all seals as shown.

❼ Reassembly is a reverse of disassembly.



70C and 100C Long Arm Cylinder (60-inch max. roll diameter)

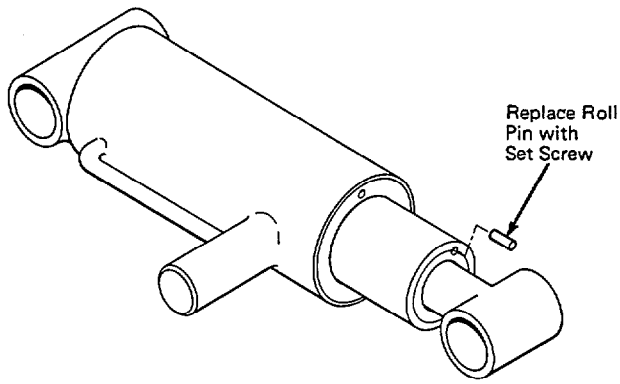


100C Long Arm Cylinder

5.4 Cylinder Service (Cont.)

IMPORTANT: OLD-STYLE C7P CLAMPS WITH ARTICULATING ARM CYLINDERS ONLY. The articulating cylinders of old-style Model C7P Clamps use a roll pin to secure the articulating rod retainer. Some users report that the roll pin tends to loosen. If your cylinder has not been modified according to Cascade Service Bulletin 81A (Jan. 1, 1975) and you are experiencing this problem and wish to correct it, replace the roll pin with a set screw according to the following procedures.

1. Remove the roll pin.
2. Using a 13/64-inch bit, redrill the roll pin hole to a depth of .375 inch (3/8 in.). **DO NOT OVERDRILL.**
3. Thread the hole with a .250-20 UNC-2B tap. Use a screwdriver extender on the tap.
4. Install a 1/4 in. UNC x 1/4 in. setscrew, Cascade part number C-4951. Coat the setscrew with Loctite and tighten until it is just snug (21-25 in.-lbs.). **DO NOT OVERTIGHTEN.**



5.5 Revolving Connection

5.5-1 Revolving Connection, Ball-and-Plunger Check Valve Service

The following procedures can be performed with the attachment on the truck.

> **WARNING:** Before removing check valves, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.

❶ Remove the two allen-head O-ring plugs on the front of the revolving connection. Remove the balls, springs, and ball guides. Thoroughly clean the parts.

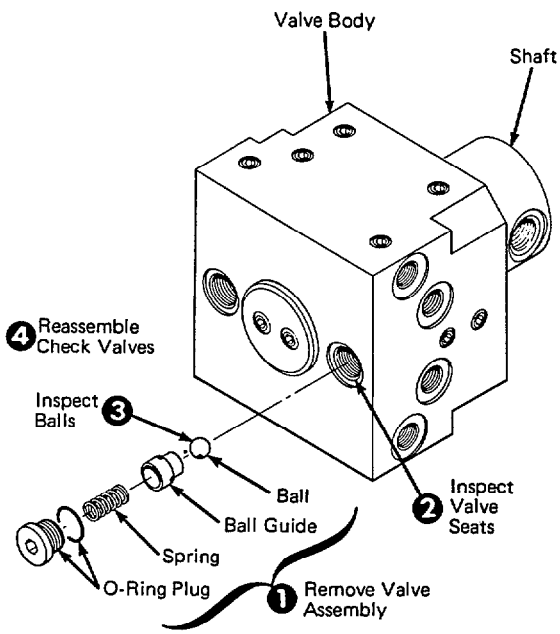
❷ Inspect the valve seats for scoring or elongation. The valve seats can be reseated by tapping a ball into its seat with a brass punch. If the seat cannot be reseated, the revolving connection assembly must be replaced.

❸ Inspect the balls for nicks and scratches.

IMPORTANT: If leakage is visible between the shaft and valve body, the shaft seals must be replaced. To replace the shaft seals, the revolving connection must be removed from the attachment. Refer to the procedures in Paragraphs 5.5-3 and 5.5-4.

❹ Reassembly of the check valves is a reverse of disassembly.

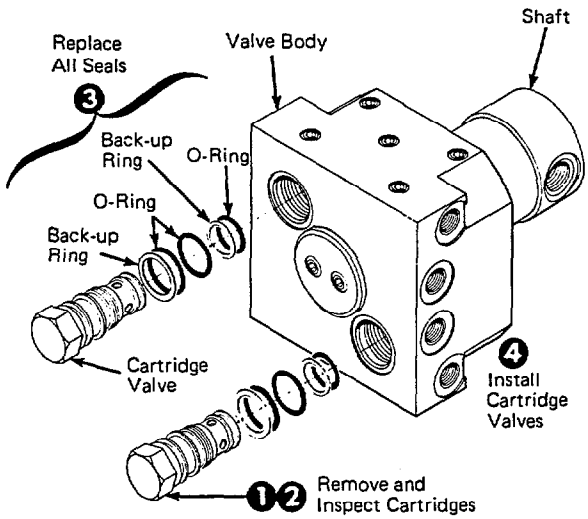
NOTE: You may modify your attachment by installing a new-style cartridge-type revolving connection that is interchangeable with your old-style ball-and-plunger-type. They are available as complete assemblies only. Consult the appropriate Cascade Parts Manual or the Cascade Service Department.



5.5-2 Revolving Connection, Cartridge-type Check Valve Service

The following procedures can be performed with the attachment on the truck.

> **WARNING:** Before removing check valves, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.



1. Remove the two hex-head cartridge valves on the front of the revolving connection (three cartridge valves on a 100C). Thoroughly clean the parts.

2. Inspect the cartridge valve assemblies for cut or defective external O-rings.

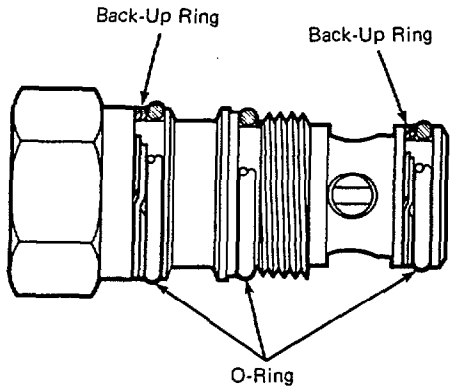
   NOTE: Internal cartridge valve components are not serviceable.

3. Replace all O-rings and backup rings.

   CAUTION: Backup rings must be wound as shown to avoid seal damage during cartridge installation. O-rings must be installed on the pressure side of the groove.

   IMPORTANT: If leakage is visible between the shaft and valve body, the shaft seals must be replaced. To replace shaft seals, the revolving connection must be removed from the attachment. Refer to the procedures in Paragraphs 5.5-3 and 5.5-4.

4. Installation of the cartridge valves is a reversal of removal. Before installing each cartridge, lubricate the O-rings with STP, or equivalent.

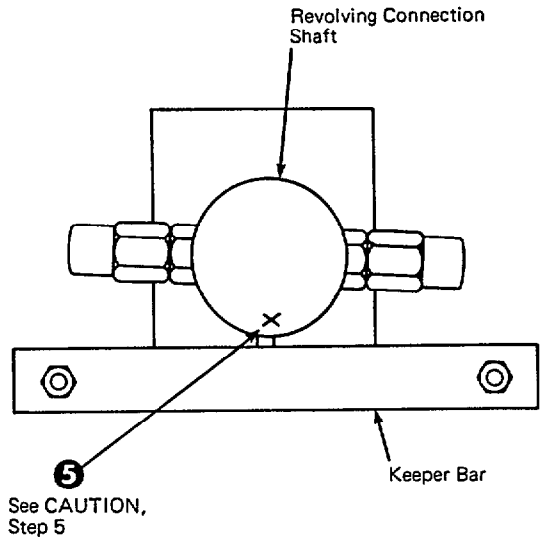


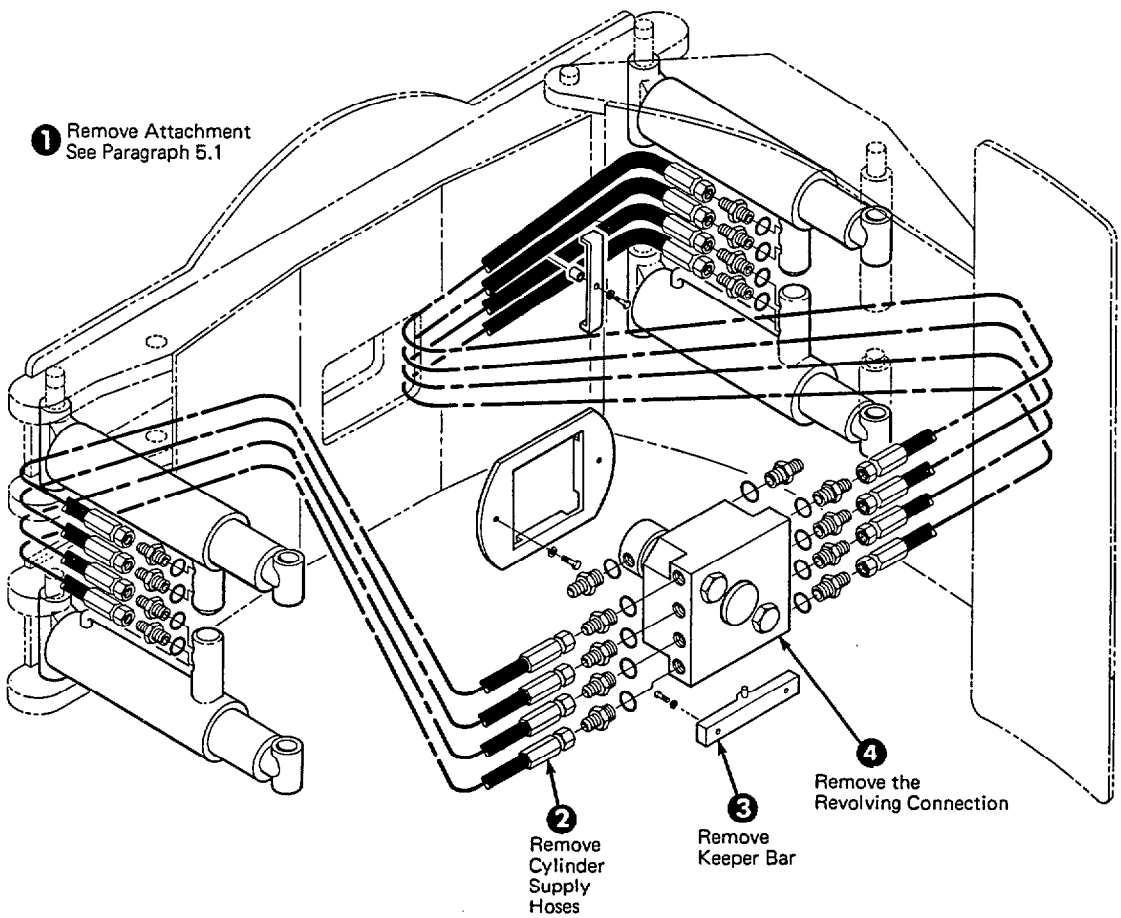
5.5-3 Revolving Connection Removal and Installation

1. Remove the attachment from the truck as described in Paragraph 5.1.
2. Remove, cap, and tag the cylinder supply hoses at the revolving connection valve body.
3. Remove the shaft keeper bar.
4. Pull the valve assembly out of the attachment.
5. Installation of the revolving connection to the attachment is a reversal of removal.

   CAUTION: The shaft locating hole marked with an "X" must be engaged by the horizontal keeper bar.

6. Install the attachment onto the truck as described in Section 2.





5.5-4 Revolving Connection Service

IMPORTANT: Service the revolving connection in a clean work area.

1. Remove the snap ring from the revolving connection shaft.

   CAUTION: Remove any paint or burrs from the shaft end and snap ring groove before pulling the shaft out of the valve body to prevent damage to the valve.

2. Remove the shaft from the body.
3. Clean the parts and inspect the shaft bore for scoring. If the bore is scored, the valve body must be replaced.
4. Note the position of the O-rings and backup rings, then remove them from the valve shaft. Be careful not to scratch the grooves.
5. Check the shaft grooves for rough edges or scratches. Remove minor imperfections with fine emery cloth. If the scratches cannot be removed, replace the shaft.

   NOTE: A minor imperfection is one that will not cause a bypass of oil when the revolving connection is operating.

6. Service the check valves as described in Paragraph 5.5-1 or 5.5-2.
7. **Ball-and-plunger-type revolving connections only.**

   a. Remove the O-ring plugs and plungers from the pilot bores opposite the check valve bores. Clean the parts.

   b. Inspect the pilot bores. They should be smooth and free of scoring. If you cannot smooth minor irregularities with an emery cloth, replace the revolving connection assembly.

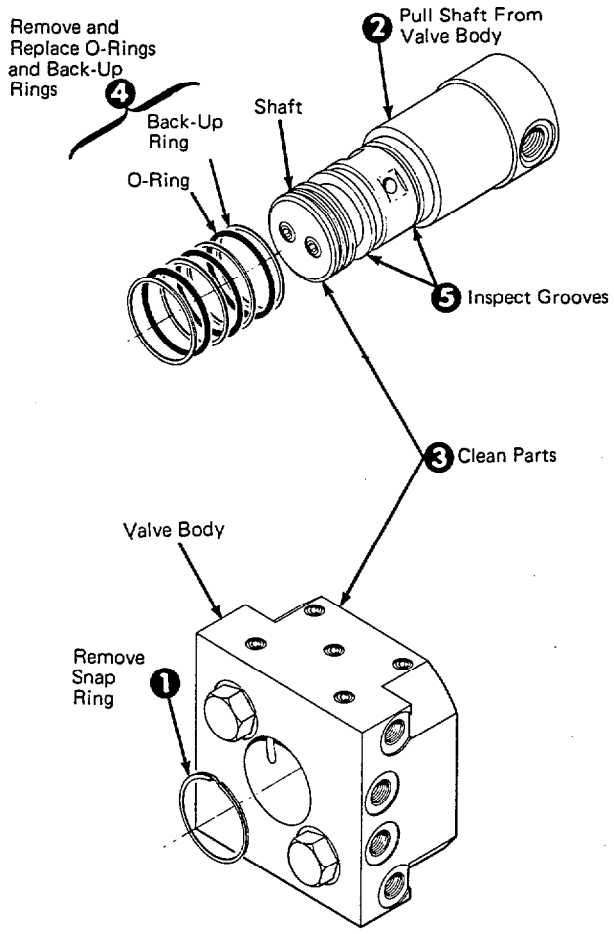
   c. With the ball and seat **only** in place, attach a hose from the truck junction block to each ball port to test for leakage.

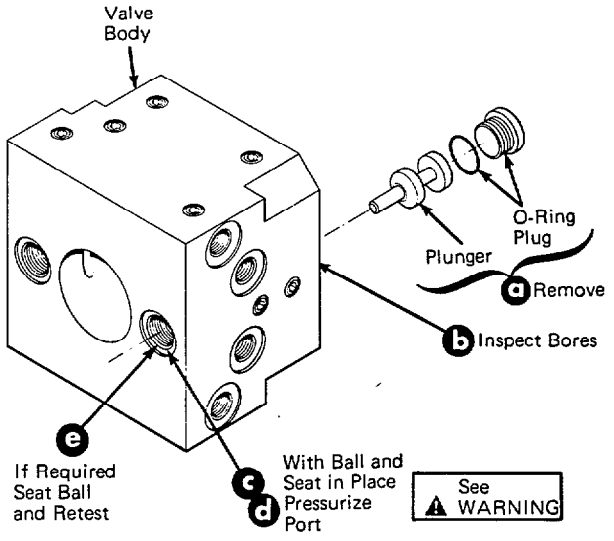
   > **WARNING:** Examine the pilot bores with a mirror to avoid the possibility of getting oil in the face.

   d. Pressurize the line and examine each pilot bore for leakage. If there is no leakage, continue reassembling the valve.

   e. If leakage is present, remove the hose and reseat the balls by tapping them into their seats with a brass punch. Retest. If the balls cannot be reseated, the revolving connection assembly must be replaced.

8. Install new O-rings and backup rings on the revolving connection shaft. Be careful not to distort the seals.
9. Reassembly of the revolving connection is a reversal of disassembly. Apply STP to the shaft O-rings to ease reassembly. Rotate the shaft into the body to prevent "rolling" the O-ring seals. Be careful not to damage the valve bore.





5.6 Rotator Drive Group

Your attachment may be equipped with either a cushioned rotator drive group or an uncushioned unit. Cushioning is achieved by the installation of cone-shaped spring washers on both sides of the worm, powered by the rotator motor. The worm gear is in mesh with the rotator ring gear. Therefore, shock loads applied to the attachment arms are transferred to the worm through the worm gear and are absorbed by the spring washers.

All Pivot Arm Paper Roll Clamps have a single rotator drive group except the 100C, which has a dual drive unit. Special procedures for 100C models are noted in the following.

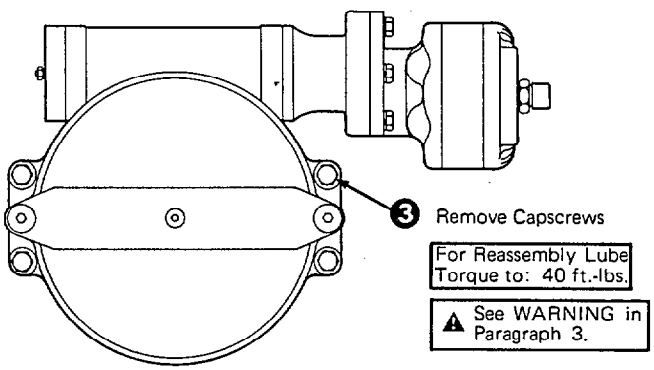
5.6-1 Rotator Drive Group Removal and Installation

1. Remove the attachment from the truck as described in Paragraph 5.1.

2. **100C Models only.** Remove the four capscrews securing the two halves of the cover over the dual drive coupling and remove both cover halves. Then remove the chain around the coupling sprockets.

3. Remove the rotator gear drive case retaining capscrews and remove the gearcase(s) from the attachment baseplate.

> **WARNING:** With the gearcase(s) removed, the baseplate is free to rotate. Keep clear of the baseplate to avoid being pinched.



4. **100C Models only.** Remove the coupling sprockets from the worm shaft of each drive group.

5. Service the rotator drive group as described in Paragraphs 5.6-2 and 5.6-3.

6. Reinstallation of the rotator drive group is a reverse of removal, except the 100C. Perform the following Steps 7 through 16 to synchronize the 100C dual drive group.

7. Install the circular seal (located in the coupling cover) over one sprocket hub. The lip of the seal should face the sprocket teeth. Leave the felt dust seal in place in the coupling cover.

8. Install the coupling sprockets on the worm shaft of each drive group. Make sure the keys are in place. Don't tighten the setscrews in the sprocket hubs yet.

9. Install both drive groups onto the baseplate.

5.6-1 Rotator Drive Group Removal and Installation (Cont.)

⑩ To synchronize the worm shafts, rotate each sprocket counterclockwise by hand until you feel resistance. Using the uppermost allen-head capscrew on the shaft end cap as a reference, mark one tooth of the sprocket. Then turn the sprocket clockwise, counting the teeth as they pass the allen-head capscrew. Stop turning when you feel resistance. Now rotate the sprocket back counterclockwise **half** the number of teeth counted. The sprockets are now positioned halfway between where you felt resistance.

⑪ Install the chain around the sprockets. If one sprocket does not align with the chain, rotate it no more than 1/2-tooth-width until it does.

⑫ Center the sprockets within 1/8 inch between the drive unit end housings. Tighten the setscrews on both sprocket hubs.

⑬ Coat the chain with Richfield No. 2MP grease or equivalent.

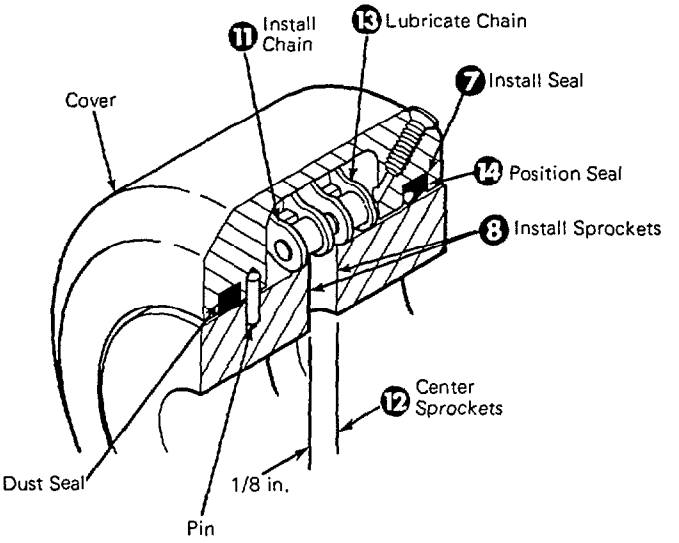
⑭ Position the seal on the sprocket so that it aligns with the grooves in the cover.

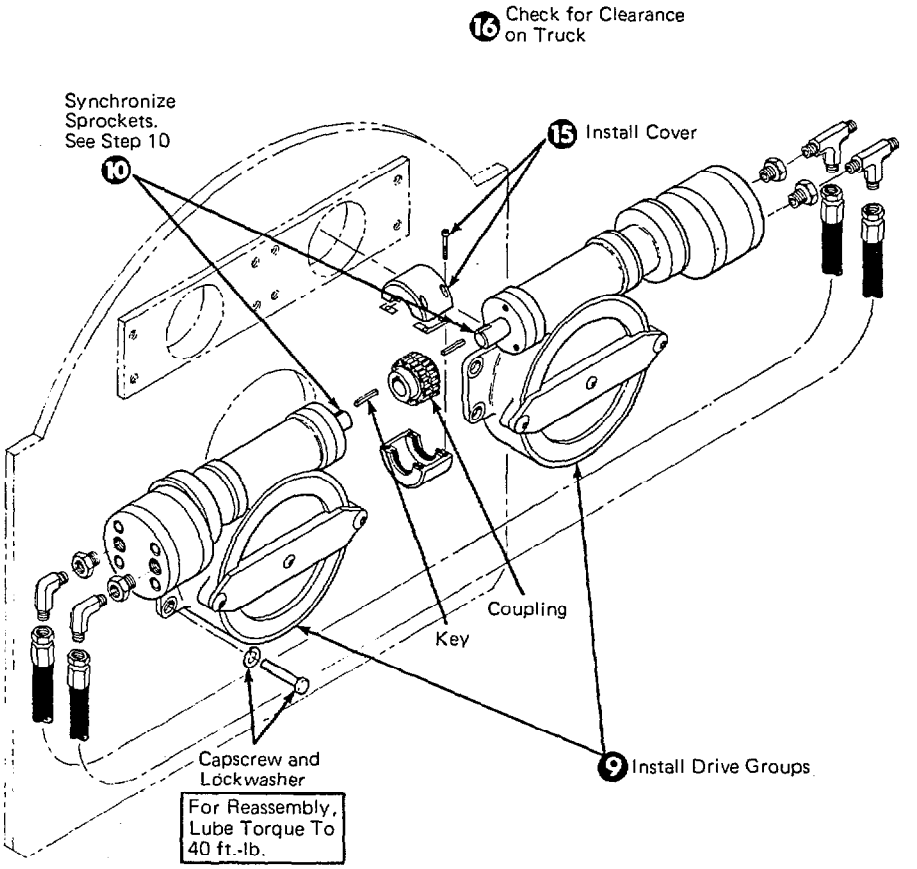
⑮ Install the cover over the sprockets, making sure the seals are in place.

CAUTION: The steel pin on one cover half must align with the hole in the other half before you tighten the screws.

⑯ After the attachment is installed on the truck, power the rotator to check for clearance between the coupling and the baseplate.

⑰ Install the attachment onto the truck as described in Section 2.



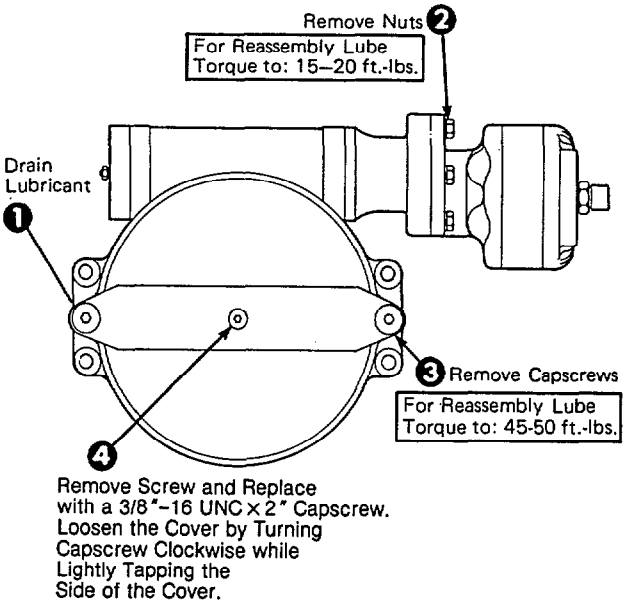


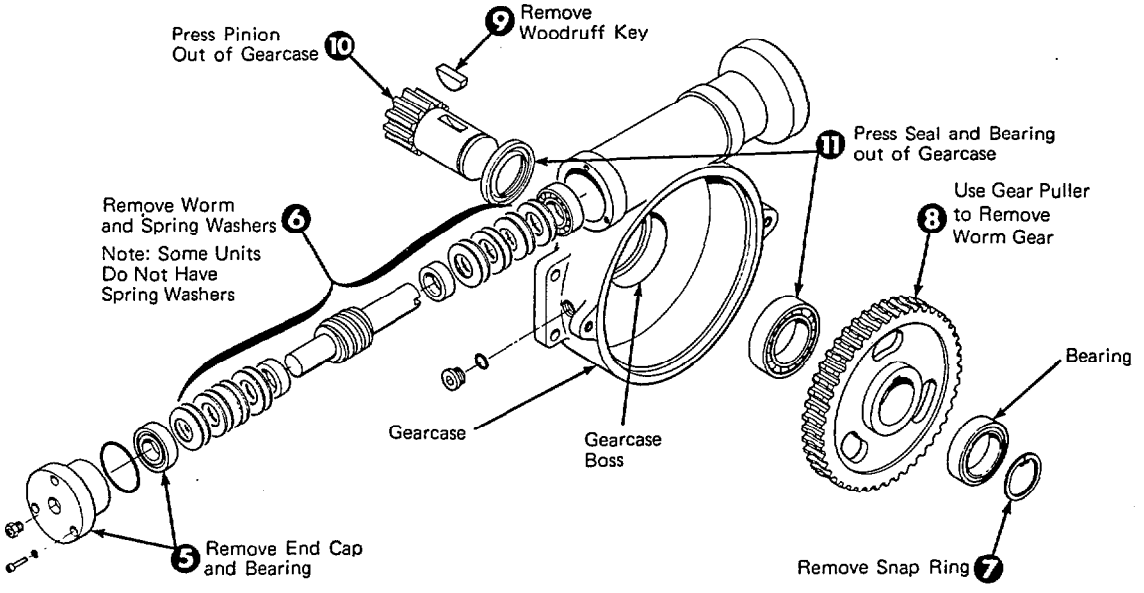
5.6-2 Rotator Drive Group Disassembly and Service

The following describes the service procedures for a cushion drive rotator. The general disassembly procedures for a rotator without cushion drive are identical except for references to the spring washers.

1. Drain the lubricant from the gearcase. Lay the gearcase (pinion down) on 4 x 4's placed on either side of the pinion.
2. Remove the rotator motor as described in Paragraph 5.7-1. Motor service procedures are described in Paragraph 5.7-2.
3. Remove the two capscrews retaining the gearcase cover.
4. Remove the capscrew from the center of the cover and replace it with a 3/8-inch-16 UNC capscrew 2 inches long. Turn the capscrew clockwise while lightly tapping the side of the cover with a plastic-head hammer to loosen it.

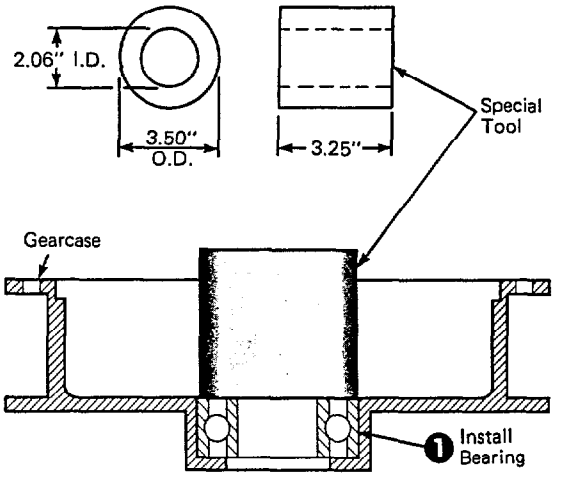
   CAUTION: Do not pry the cover off. It's made of aluminum and is easily damaged.
5. Remove the end cap and bearing.
6. Remove the worm and spring washers.
7. Remove the snap ring from the pinion shaft.
8. Using a gear puller, remove the worm gear from the pinion shaft.
9. Remove the Woodruff key from the pinion shaft.
10. Press the pinion out of the gearcase.
11. Press the pinion seal and bearing out of the gearcase.
12. Clean and inspect the components. Replace any item that is worn or galled. Remove any burrs with an emery cloth or small hand grinder.

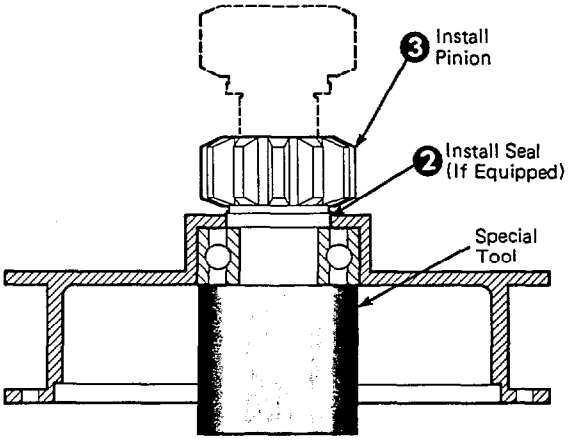


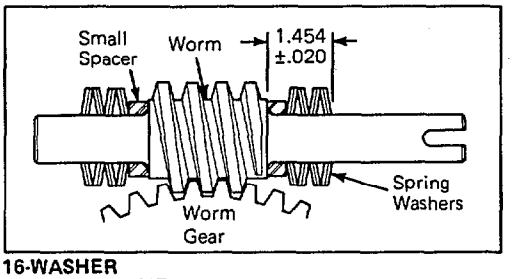


5.6-3 Rotator Drive Group Reassembly

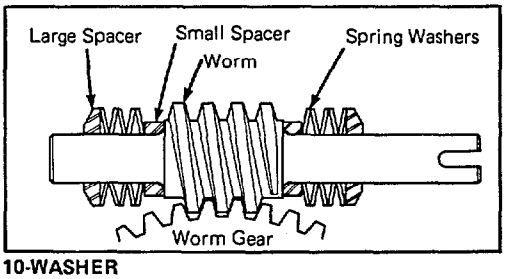
1. Press the bearing into the housing from the inside using the special tool, Cascade part number C-664620. Make sure the bearing is fully seated and flush with the inside of the gearcase.
2. Install the seal into the boss of the housing (from the outside of the housing). The lip must be facing inward. The seal must be flush with the boss.
3. Support the bearing from the inside with the special tool and press the pinion into the bearing from the outside.
4. Install the Woodruff key into the pinion shaft.
5. Press the worm gear onto the pinion shaft, making sure you align it with the Woodruff key.
6. Press the bearing onto the pinion shaft.
7. Install the snap ring.
8. On cushion drive rotators, assemble the spring washers and spacers on the worm and install in the housing.



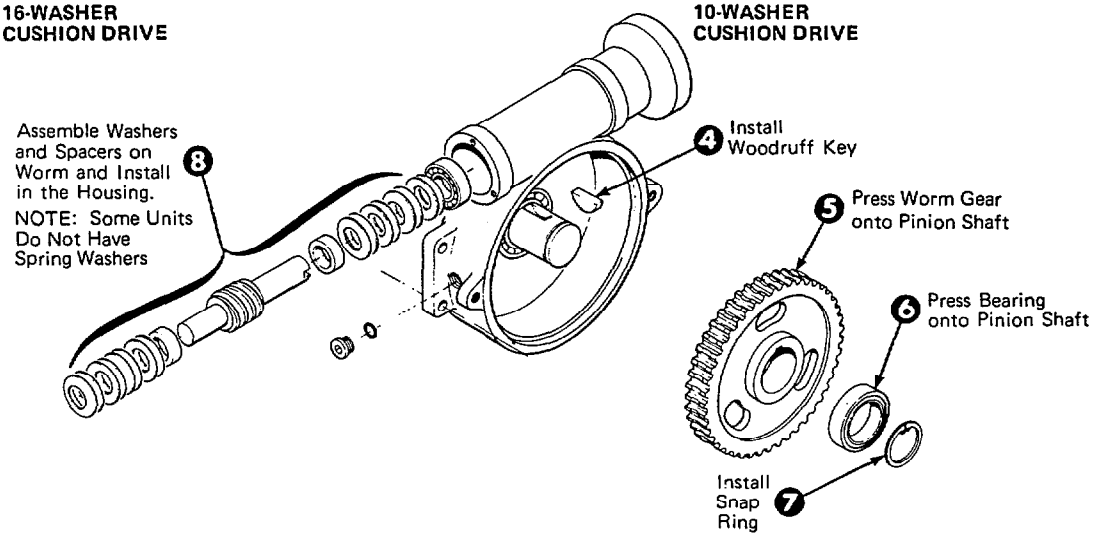




16-WASHER CUSHION DRIVE



10-WASHER CUSHION DRIVE



5.6-3 Rotator Drive Group Reassembly (Cont.)

⑨ Install the end cap. If the gap is greater than that shown, the spring washers are incorrectly stacked. Remove the worm and restack the spring washers.

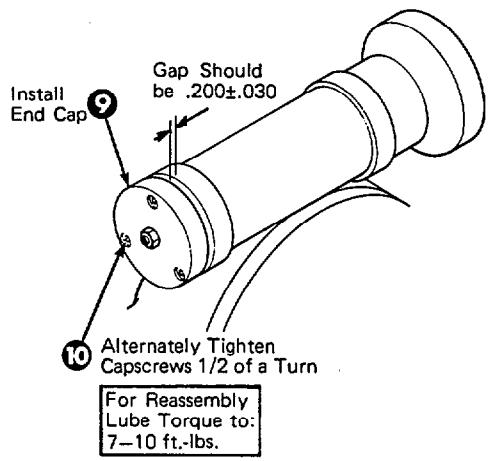
⑩ Alternately tighten the endcap capscrews 1/2 of a turn. Lube torque the capscrews to 7-10 ft.-lbs.

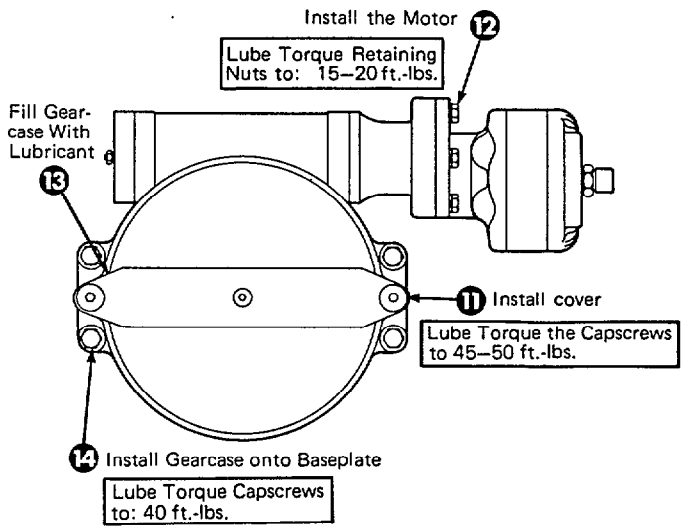
⑪ Install the cover.

⑫ Install the motor.

⑬ Fill the gearcase with one quart of Cascade Rotator Fluid (Cascade part number C-656300).

⑭ Install the gearcase onto the attachment baseplate.





5.7 Motor

5.7-1 Motor Removal and Installation

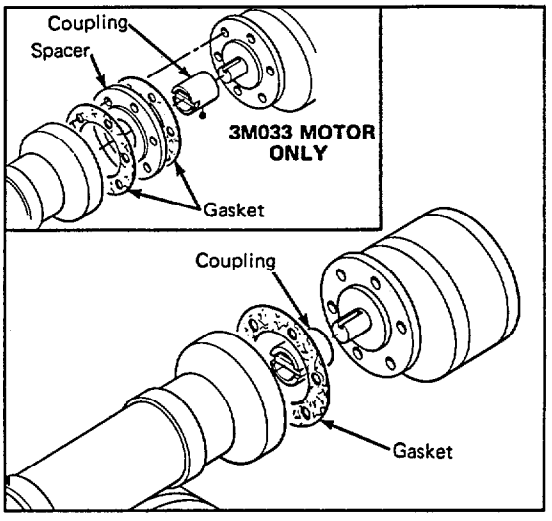
The rotator motor can be removed for service with the attachment on the truck.

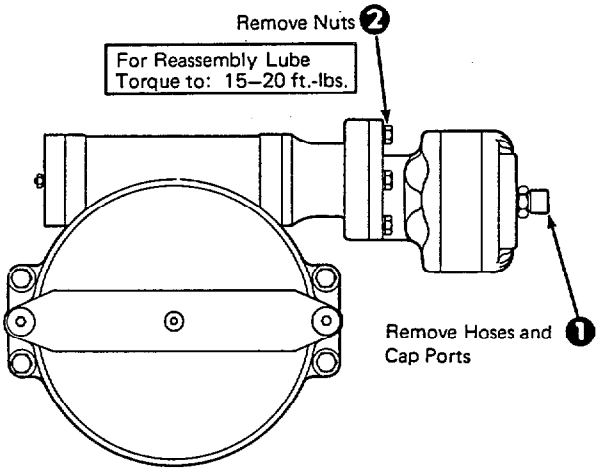
> **WARNING:** Before removing supply hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.

❶ Remove, cap, and tag the supply hoses to the motor.

❷ Remove the motor from the rotator drive assembly by removing the six retaining nuts. Slide the motor out of engagement and remove the coupling and key from the motor shaft.

❸ Installation of the motor is a reverse of removal.

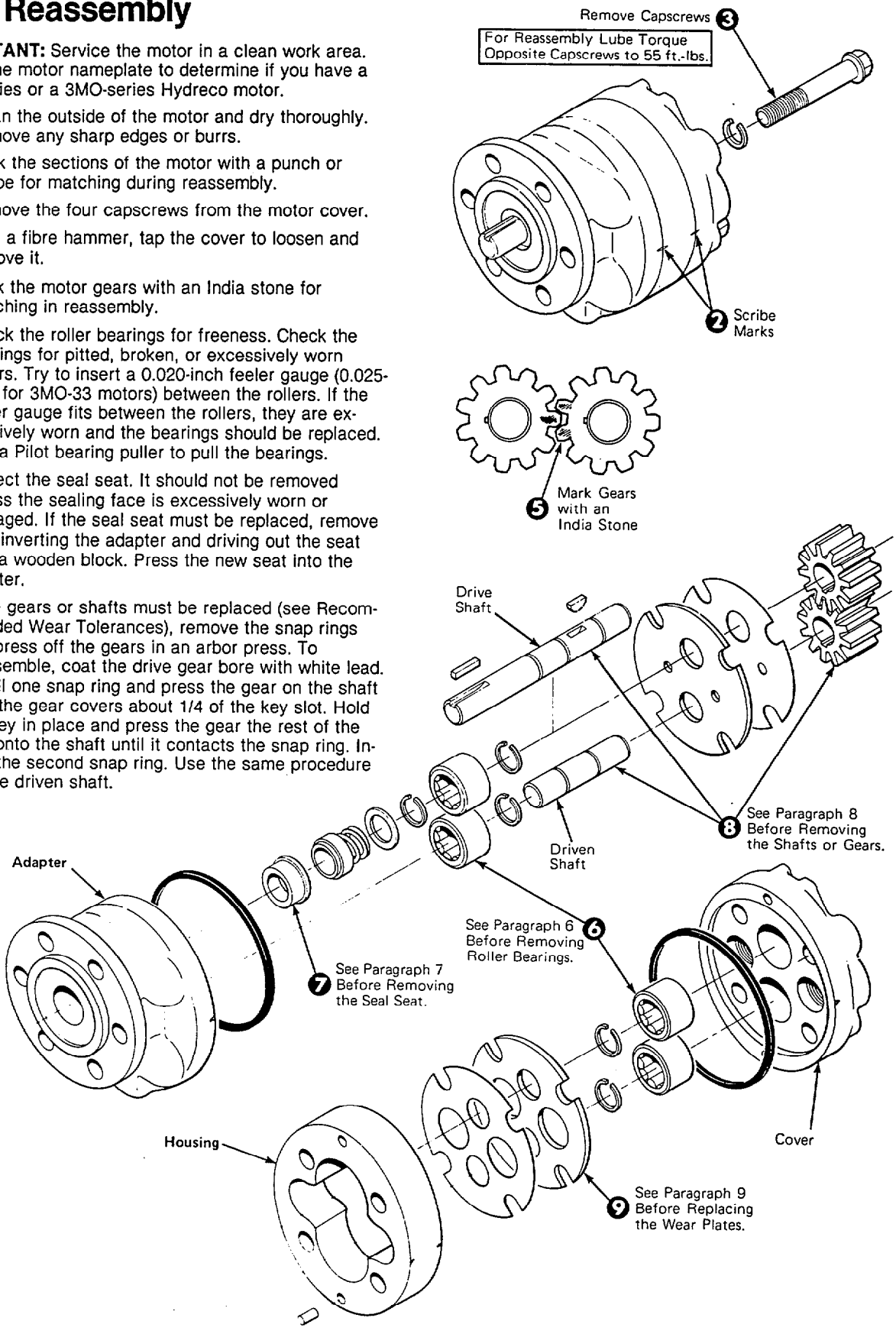




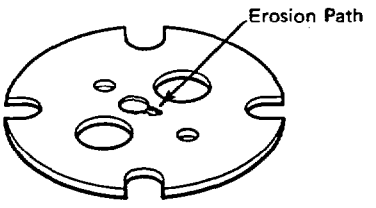
5.7-2 Motor Disassembly, Service, and Reassembly

IMPORTANT: Service the motor in a clean work area. Check the motor nameplate to determine if you have a 2MO-series or a 3MO-series Hydreco motor.

1. Clean the outside of the motor and dry thoroughly. Remove any sharp edges or burrs.
2. Mark the sections of the motor with a punch or scribe for matching during reassembly.
3. Remove the four capscrews from the motor cover.
4. With a fibre hammer, tap the cover to loosen and remove it.
5. Mark the motor gears with an India stone for matching in reassembly.
6. Check the roller bearings for freeness. Check the bearings for pitted, broken, or excessively worn rollers. Try to insert a 0.020-inch feeler gauge (0.025-inch for 3MO-33 motors) between the rollers. If the feeler gauge fits between the rollers, they are excessively worn and the bearings should be replaced. Use a Pilot bearing puller to pull the bearings.
7. Inspect the seal seat. It should not be removed unless the sealing face is excessively worn or damaged. If the seal seat must be replaced, remove it by inverting the adapter and driving out the seat with a wooden block. Press the new seat into the adapter.
8. If the gears or shafts must be replaced (see Recommended Wear Tolerances), remove the snap rings and press off the gears in an arbor press. To reassemble, coat the drive gear bore with white lead. Install one snap ring and press the gear on the shaft until the gear covers about 1/4 of the key slot. Hold the key in place and press the gear the rest of the way onto the shaft until it contacts the snap ring. Install the second snap ring. Use the same procedure for the driven shaft.



5.7-2 Motor Disassembly, Service, and Reassembly (Cont.)

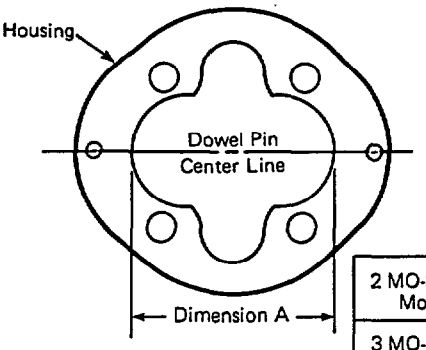


⑨ Replace the wear plates if they are scored or excessively worn.

CAUTION: DO NOT turn the wear plate over. The counterbored relief pocket is on the gear side only. If the wear plate is steel-backed, the bronze side should be next to the gears. Even if you see only slight wear on the gear pattern, check for a path of erosion in the vicinity of the relief pocket. Replace the wear plate if you find an erosion path.

Also check for proper seating of the wear plate in the adapter or cover. If the plate can be rocked, there may be a burr on the face of the adapter or cover. Remove the burr.

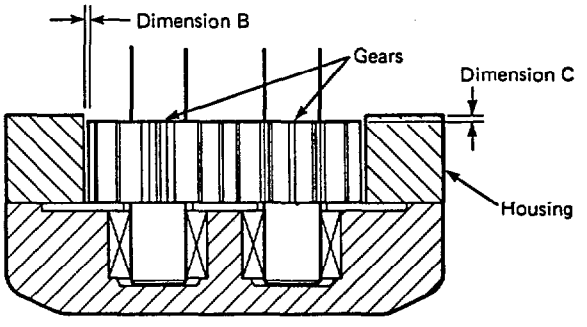
⑩ Assembly of the motor is a reverse of disassembly.



Dimension A	
2 MO-Series Motors	3.259 in.
3 MO-Series Motors	4.343 in.

Recommended Wear Tolerances

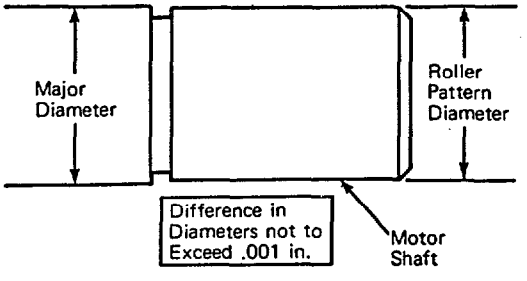
- Discard any housing whose gear bores, when measured through the dowel pin hole centerline, is greater than dimension A.
- Replace both gears if the difference between the housing width and the gears (without gaskets) is in excess of dimension B. Assembled, the total end clearance between the gear faces and the housing width should be within the tolerances of dimension C.
- Replace the shafts if wear at the roller patterns exceeds 0.001 inch from that of the major diameter. If the shafts are to be replaced due to excessive wear, also replace the bearings.
- Measure the thickness of the adapter and the gears. If the difference is greater than 0.005 inch, replace both gears. If the difference is 0.005 inch or less, add shims to the adapter and cover side of the assembly as shown by the following chart.



Motor series	If the gear thickness is this much less than the housing:	add these shims to:	
		the adapter side.	the cover side.
2MO*	0.001	0.0025	0.0025
	0.002	0.002	0.002
	0.003	0.001	0.002
	0.004	0.001	0.001
3MO**	0.001	0.002	0.003
	0.002	0.002	0.002
	0.003	0.001	0.002
	0.004	0.001	0.001
	0.005	none	0.001

*2MO Series motors use color-coded plastic shims. Color code: 0.001-Amber, 0.002-Red, 0.0015-Purple.
**3MO Series motors use brass shim gaskets, 0.001 and 0.002 thickness

Motor Series	Dimension B (inch)	Dimension C (inch)	
		Minimum	Maximum
2MO	0.0035 Maximum	0.0025	0.0035
3MO	0.0065 Maximum	0.0030	0.0045



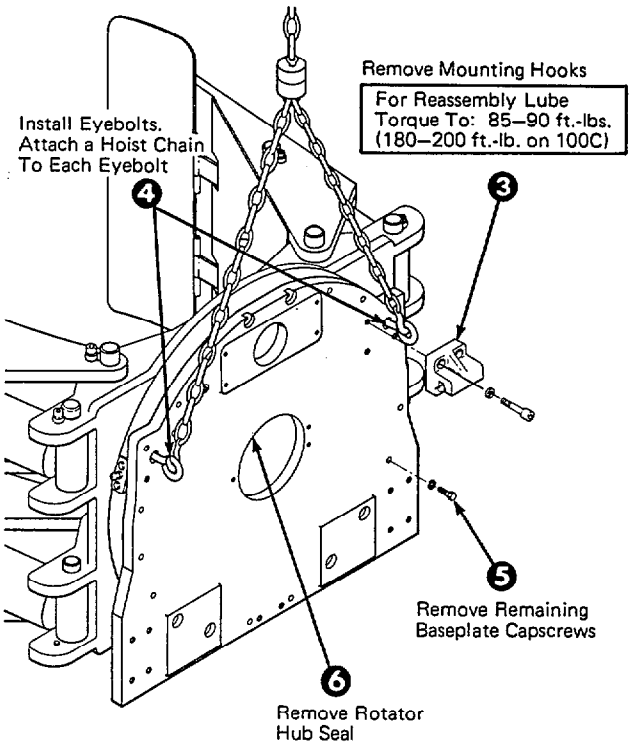
5.8 Frame Assembly

5.8-1 Baseplate Removal

1. Remove the attachment as described in Paragraph 5.1.
2. Remove the revolving connection, Paragraph 5.5-3. Remove the rotator drive group, Paragraph 5.6-1.
3. Remove the upper mounting hooks.
4. Remove the two baseplate retaining capscrews closest to each upper mounting hook bolt pattern. Replace the two capscrews with eyebolts. Attach a hoist chain to each eyebolt. Lift the hoist chains to take out the slack.

> **WARNING:** Be sure to attach a hoist chain to each eyebolt before removing the remaining baseplate capscrews. Make sure your overhead crane has a rated capacity of at least 1000 pounds.

5. Remove the remaining baseplate retaining capscrews. Lift off the baseplate.
6. Remove the hub seal from the rotator hub.

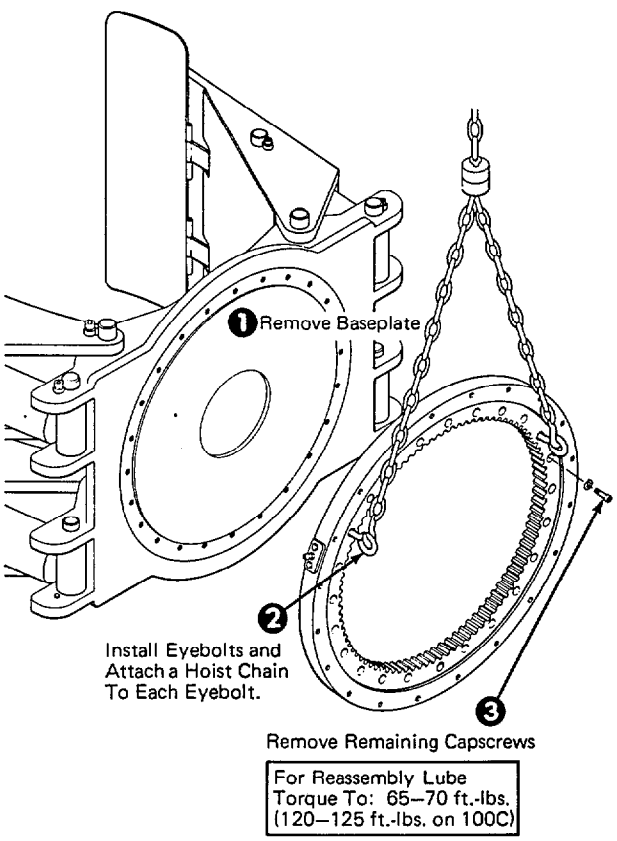


5.8-2 Ring Gear/Bearing Assembly Removal

1. Remove the baseplate assembly as described in Paragraph 4.8-1.
2. Replace two ring gear retaining capscrews with eyebolts. Attach a hoist chain to each eyebolt. Lift the hoist chains to take out the slack.

> **WARNING:** Be sure to attach a hoist chain to each eyebolt before removing the remaining ring gear capscrews. The ring gear is very heavy and oily, so take care to prevent pinching or dropping on fingers or feet. Make sure your overhead crane has a rated capacity of at least 1000 pounds.

3. Remove the remaining capscrews and lift the ring gear/bearing assembly from the attachment.



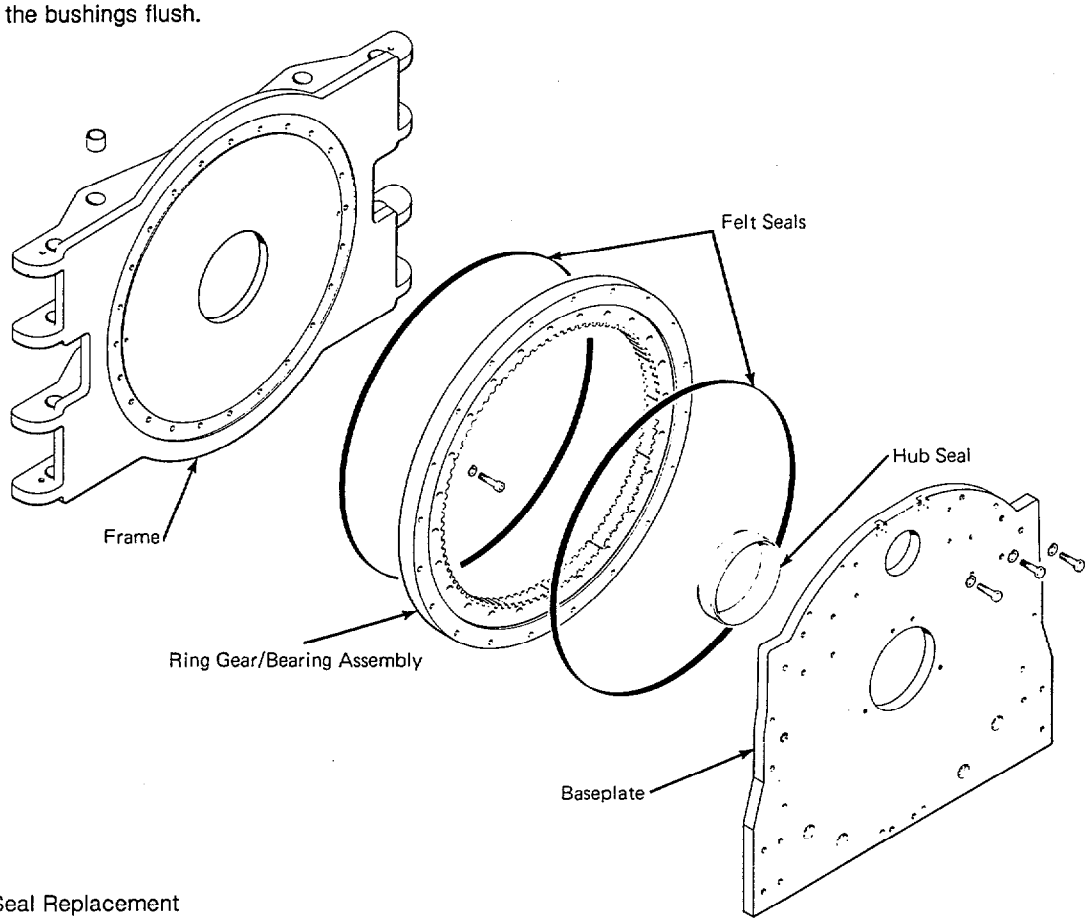
5.8-3 Frame Assembly Service

❶ Bushing Replacement

CAUTION: When installing a new bushing or inserting a pivot pin, be careful not to scratch or mar the special grey coating on the inside surface of the bushing.

a. Drive out the old bushings with a bushing driver of the same diameter. Do not gouge the bore surface of the frame.

b. Install the new bushings with a bushing driver. Drive the bushings flush.



❷ Felt Seal Replacement

Whenever the frame assembly is serviced, the felt seals must be replaced with new ones.

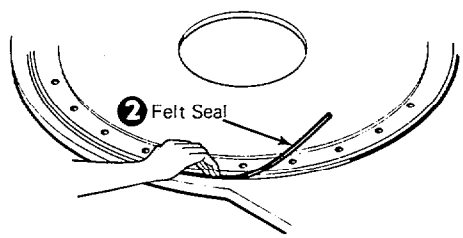
a. Remove the old felt seals and clean the grooves.

b. To install a new seal, start one end of the seal strip in the groove.

c. Push the seal to the bottom of the groove all the way around the groove. If the seal is too short, stretch it evenly around the groove to lengthen it.

d. Cut the two ends of the seal so the two ends meet squarely.

e. Bond the ends of the seal with 3M-brand weatherstrip adhesive No. 8001 or equivalent. After the adhesive dries, lubricate the seal with SAE30 motor oil to swell the seal into the groove.



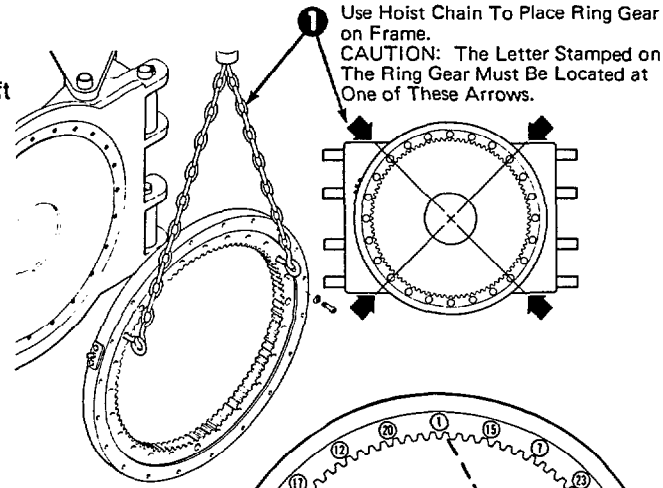
❸ Ring Gear/Bearing Assembly Service

The ring gear and bearing are matched components and must be replaced as an assembly.

5.8-4 Frame Reassembly

❶ Attach the hoist chain to the ring gear eyebolts and lift the ring gear/bearing assembly into position.

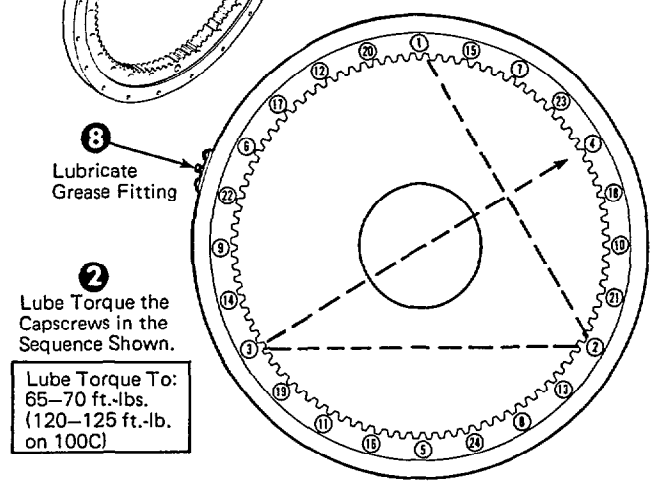
CAUTION: All ring gear/bearing assemblies have a "heat treat overlap" zone. This zone is designated by a stamped letter on the outer ring of the assembly. When installing the ring gear/bearing assembly, the "heat treat overlap" zone must be located in one of the four locations shown.



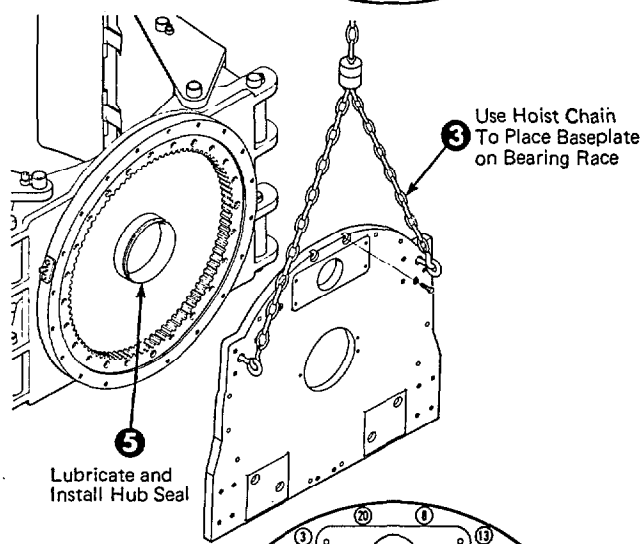
❷ Lube-torque the capscrews to 65-70 ft.-lb. in the order shown.

NOTE: The 100C has 16 capscrews. Using a similar pattern, lube-torque the capscrews to 120-125 ft.-lb.

IMPORTANT: Apply a liberal quantity of NLGI consistency No. 0 grease to the teeth of the ring gear before continued assembly.



❸ Using the hoist chain, lift the baseplate into position on the bearing race.



❹ Lube-torque the capscrews to 75-80 ft.-lb. in the order shown.

NOTE: The 100C has 16 capscrews. Using a similar pattern, lube-torque the capscrews to 200-205 ft.-lb.

WARNING: The capscrews that secure the baseplate to the bearing race must be grade 5 minimum.

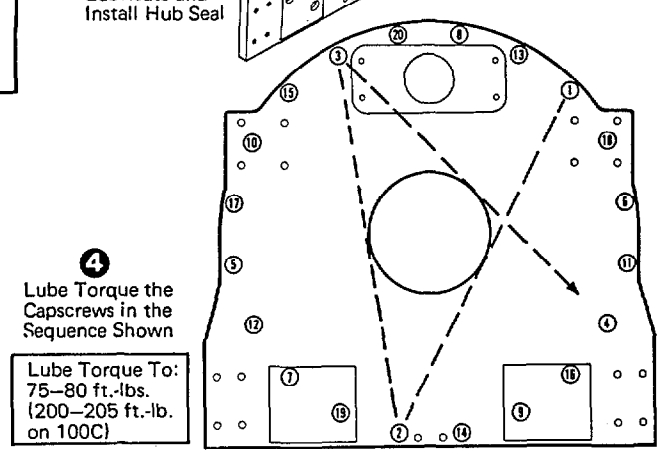
❺ Lubricate and install the hub seal.

❻ Reinstall the revolving connection. See Paragraph 5.5-3.

❼ Reinstall the rotator drive group. See Paragraph 5.6-1.

❽ Lubricate the bearing race through the grease fitting on the ring gear/bearing assembly.

❾ Install the attachment on the truck as described in Section 2.



Section 6 Standard Labor Times

6.1 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 attachment 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 the Cascade Service Department at 1-800-547-5266 (toll free), or, in Oregon, call 666-1511.

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:

5.1	Clamp Removal and Installation	1.0
5.2-1	Arm Removal and Installation	1.4
5.2-4	Arm Bushing Replacement	0.5
	Total Standard Labor Time	2.9

6.2 Standard Labor Times

Paragraph Number and Title		Hours
5.1	Clamp Removal and Installation	1.0
5.2-1	Arm Removal and Installation	1.4
5.2-2	Arm Disassembly and Reassembly	1.0
5.2-4	Arm Bushing Replacement	0.5
5.3-1	To Service a Cylinder on the Clamp	1.0
5.3-2	Remove and Replace Cylinder	0.5
5.4	Cylinder Service	1.0
5.5-1	Revolving Connection, Ball-and-Plunger Check Valve Service	0.7
5.5-2	Revolving Connection, Cartridge-type Check Valve Service	0.7
5.5-3	Revolving Connection Removal and Installation	1.0
5.5-4	Revolving Connection Service	0.9
5.6-1	Rotator Drive Group Removal and Installation	0.5
5.6-2	Rotator Disassembly and Service	1.5
5.6-3	Rotator Reassembly	1.5
5.7-1	Motor Removal and Installation	0.8
5.7-2	Motor Disassembly, Service, and Reassembly	1.0
5.8-1	Baseplate Removal	1.0
5.8-2	Ring Gear/Bearing Assembly Removal	1.0
5.8-3	Frame Assembly Service	1.0
5.8-4	Frame Reassembly	2.0

NATIONAL
ASSOCIATION
OF SERVICE
MANAGERS

Do you have questions you need answered right now?

Dial Directline
800-547-5266
(toll free)

Part No. 667445