SERVICE MANUAL

G-Series

Fixed Frame
Paper Roll Clamps

Manual Number 213744-R3

cascade® corporation

Cascade is a Registered Trademark of Cascade Corporation

CONTENTS

1.1 Introduction

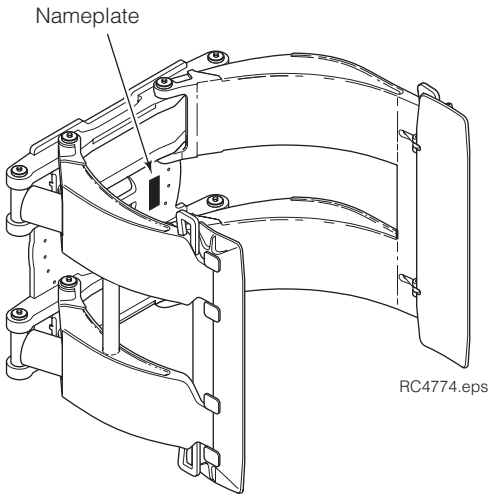
This manual provides the Periodic Maintenance, Troubleshooting, Service and Specifications for Cascade G-Series Paper Roll Clamps

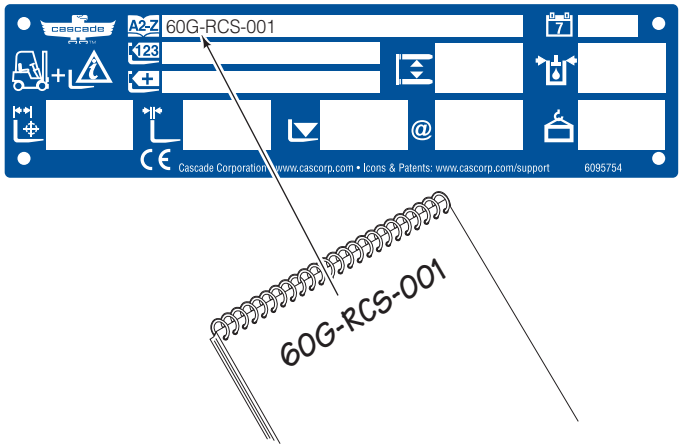
G-Series Roll Clamps are designed for three-shift-a-day continuous-duty operations with minimal maintenance. They provide exceptional visibility for the lift truck driver and offer optimized roll handling.

In any communication about the attachment, refer to the product catalog and serial numbers stamped on the nameplate as shown. If the nameplate is missing, the numbers can be found stamped on the right front web of the baseplate.

IMPORTANT: All hoses, tubes and fittings on these attachments are JIC.

NOTE: Specifications are shown in both US and (Metric) units. All fasteners have a torque value range of ±10% of stated value.





1.2 Special Definitions

The statements shown appear throughout this Manual where special emphasis is required. Read all WARNINGS and CAUTIONS before proceeding with any work. Statements labeled IMPORTANT and NOTE are provided as additional information of special significance or to make your job easier.

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.

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 for loose or missing bolts, work or damaged hoses, and hydraulic leaks.
- Check edges of contact pads for wear or sharp nicks that could damage or tear paper rolls. Grind edges smooth.
- Check contact pad pivot joints for wear and replace parts as necessary.
- Lubricate plungers on 180° stop valve, if equipped.
- Check torque on the 180° stop block capscrews and tighten to 400 ft.-lbs. (540 Nm), if necessary.
- Check that load-holding hydraulic system is functioning properly. Cascade Clamp Force Indicators 830141 and 832442 are available for this test.
- Check decals and nameplate for legibility.

3.2 500-Hour Maintenance

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

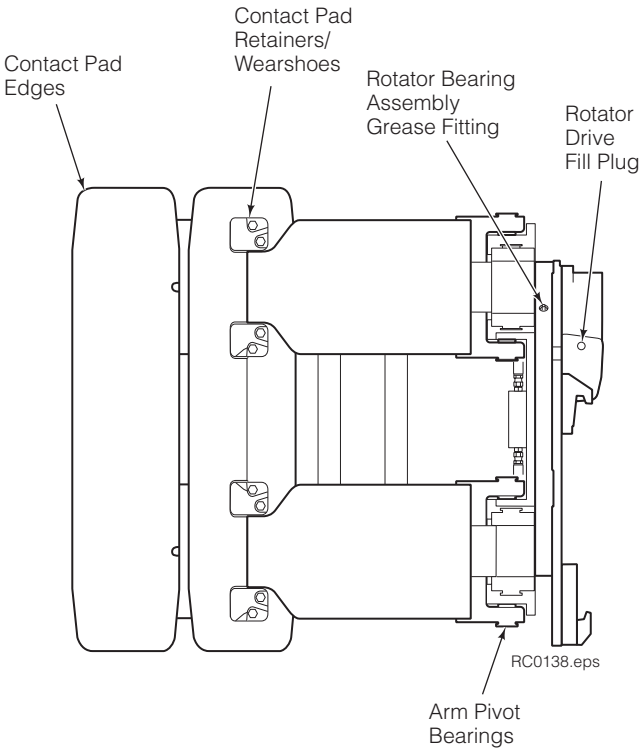
- Check sample of baseplate capscrews for proper torque value. Refer to Sections 4.9-2 and 4.9-3 for checking and replacement procedures.
- Check sample of bearing capscrews for proper torque value. Refer to Sections 4.9-2 and 4.9-3 for checking and replacement procedures.

WARNING: A sampling of baseplate and bearing capscrews must be checked for proper torque at 500 hours (see TB 183). A complete inspection is required every 2000 hours. Failure to keep the capscrews tightened can result in attachment damage and serious injury.

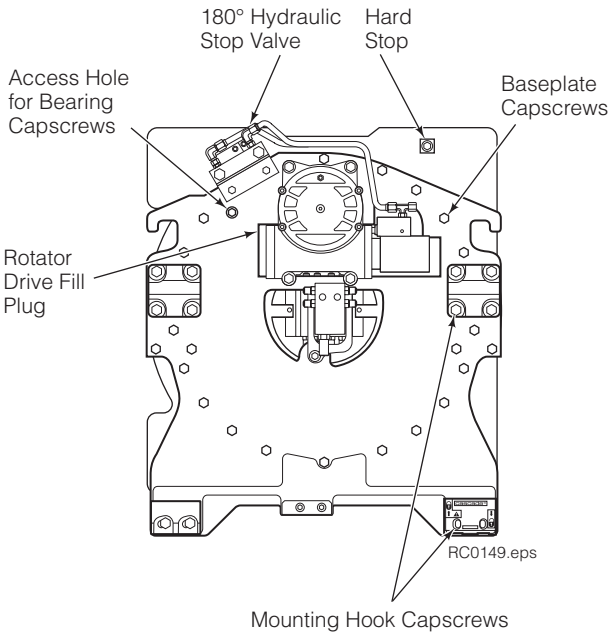
- Tighten upper mounting hook capscrews to:

  Class II/III – 125 ft.-lbs. (165 Nm).
  Class IV – 235 ft.-lbs. (320 Nm).
- Tighten rotator drive capscrews to 75 ft.-lbs. (105 Nm).
- Lubricate rotator bearing assembly with multi-purpose extreme-pressure NLGI 2 grease (Whitmore 'Omnitack' or equivalent). Rotate the attachment one full turn during procedure.
- Check rotator drive gearcase lubricant level. Lubricant should be up to the bottom of the fill plug hole. If necessary, fill with Cascade Rotator Drive Lubricant, Part No. 656300, or SAE 90 wt. gear lube (AGMA 'mild' 6 EP Gear Oil). Replace plug.
- Inspect all arm, frame and cylinder pivot bushings for wear. Replace if necessary. Refer to Section 4.9-1.
- Inspect all load-bearing structural welds on arms, swing frame pivots, arm pivots and cylinder pivot areas for visual cracks. Replace components as required.
- Inspect arm tips, wear shoes and contact pads for wear. Repair and replace as needed. Refer to Section 4.2.

WARNING: After completing any service procedure, always test the attachment through five complete cycles. First test the attachment empty, then test with a load to make sure the attachment operates correctly before returning it to the job.



Short Arm Side



Back (Driver's) View

3.3 2000-Hour Maintenance

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

- Check **all** baseplate and bearing capscrews for proper torque value. Refer to Sections 4.9-2 and 4.9-3 for checking and replacement procedures.
- Inspect all arm and cylinder pivot pins for wear and replace if necessary. Refer to Section 4.7.

3.4 4000-Hour Maintenance

After each 4000 hours of truck operation, in addition to the 100, 500 and 2000-hour maintenance, perform the following procedures:

- Due to normal mechanical wear and component service life, cylinder seals should be replaced to maintain performance and safe operation.

3.1 General Procedures

3.1-1 Truck System Requirements

- Truck hydraulic pressure should be within the range shown in Specifications, Section 5.1. **Pressure to the attachment must not exceed 2600 psi (180 bar).**
- Hydraulic flow should be within the volume range as shown in Specifications, Section 5.1.
- Hydraulic fluid supplied to the attachment must meet the requirements as shown in Specifications, Section 5.1.

WARNING: Before servicing any hydraulic component, relieve pressure in the system. Turn the truck off and move the truck auxiliary control valves several times in both directions.

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

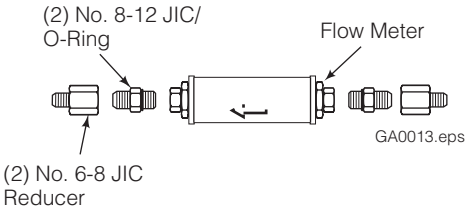
Stay clear of the load while testing. Do not raise the load more than 4 in. (10 cm) off the floor while testing.

3.1-2 Tools Required

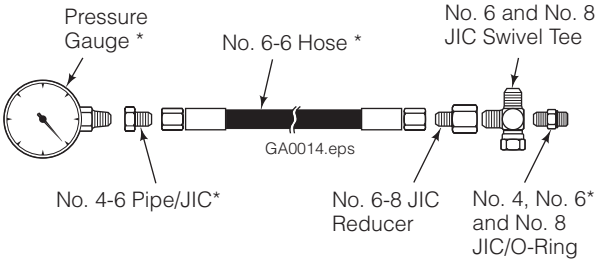
In addition to a normal selection of hand tools, the following will be required:

- Inline Flow Meter Kit –
  10 GPM (37 L/min.) - Cascade Part No. 671476
  OR
  20 GPM (75 L/min.) - Cascade Part No. 671477
- Pressure gauge Kit –
  5000 psi (345 bar) - Cascade Part No. 671212. Two kits are required.
- Assorted fittings and hoses to adapt the gauges and flow meter to the components being tested.

Flow Meter Kit 671477



Pressure Gauge Kit 671212



3.1-3 Troubleshooting Chart

Determine All The Facts – It is important that all the facts regarding the problem are gathered before beginning service procedures. The first step is to talk to the equipment operator. Ask for a complete description of the malfunction. The following guidelines can then be used as a starting point to begin troubleshooting procedures:

Clamp Circuit
- Attachment drops roll after it has been picked up.
- Attachment will not carry rolls to its rated capacity.
- Attachment arms will not function properly.

To correct one of these problems, see Section 3.3.

- Split-arms will not clamp rolls equally.

To correct this problem, see Section 4.6-3 or 4.6-4.

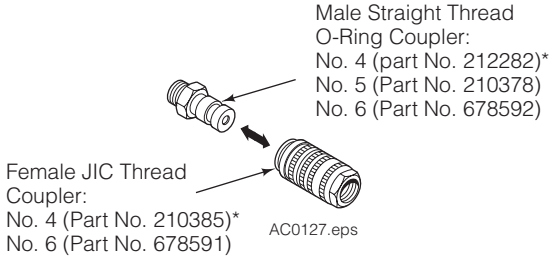
Rotate Circuit
- Attachment will not rotate.
- Attachment will not rotate rolls up to its rated capacity.
- Attachment rotates in one direction only.

To correct one of these problems, see Section 3.4.

- Attachment will not stop properly with 180° stop valve or electronic rotational control.

To correct this problem, see Section 4.10 or 4.11.

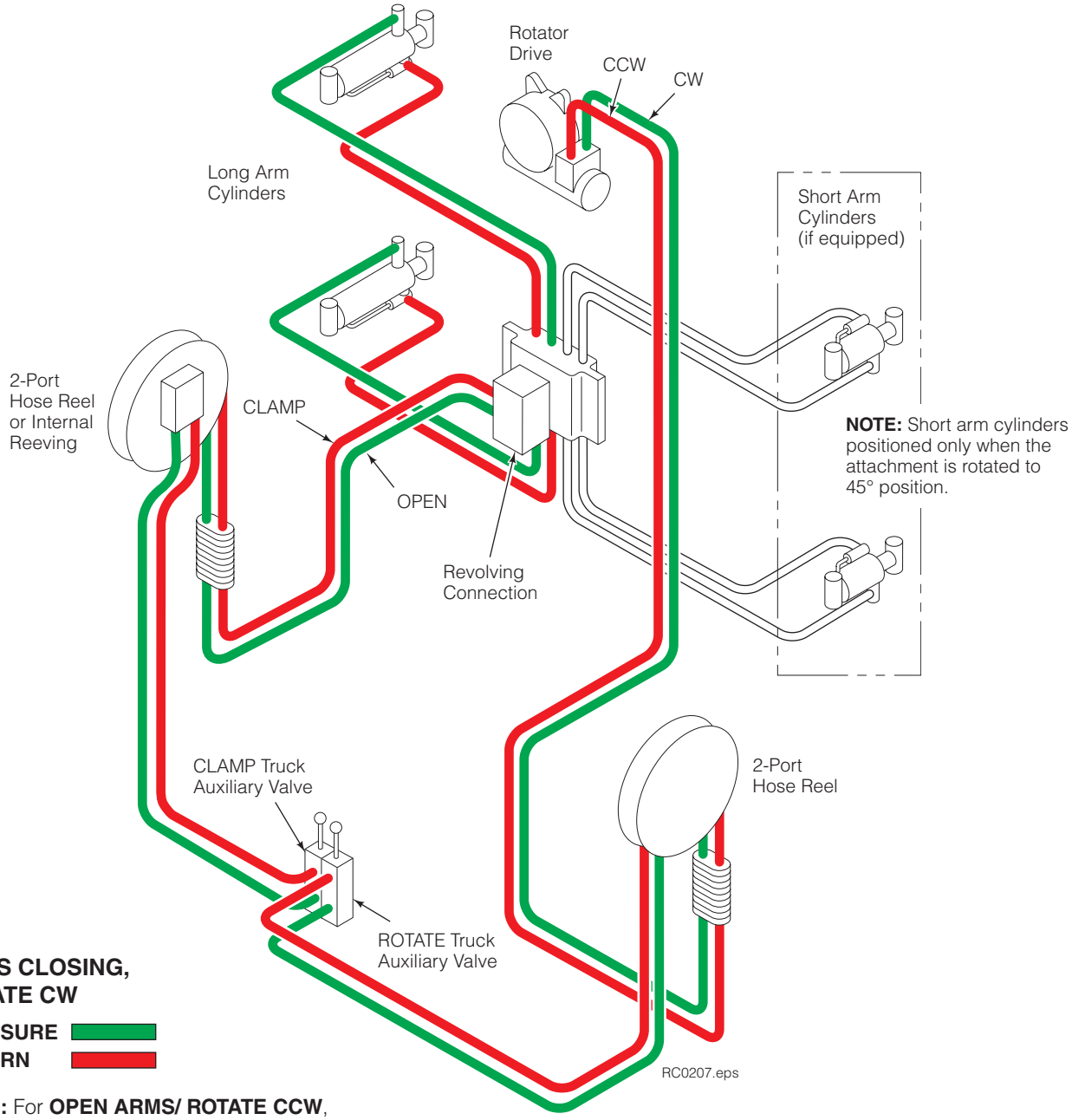
Diagnostic Quick-Disconnects



* Included in Diagnostic Kit 394382

3.2 Plumbing

3.2-1 Fixed Frame Clamp – Hosing Diagram



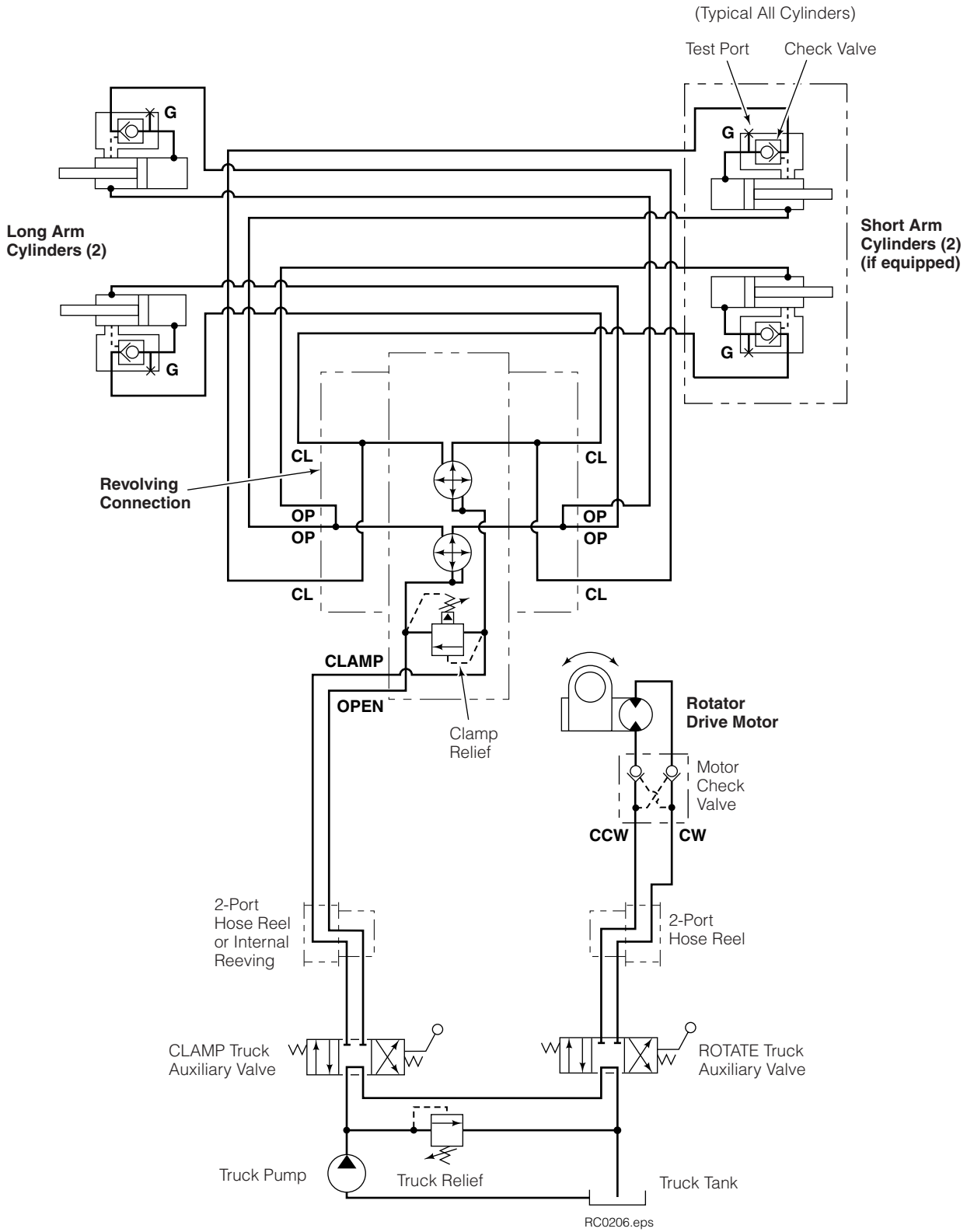
ARMS CLOSING, ROTATE CW

PRESSURE

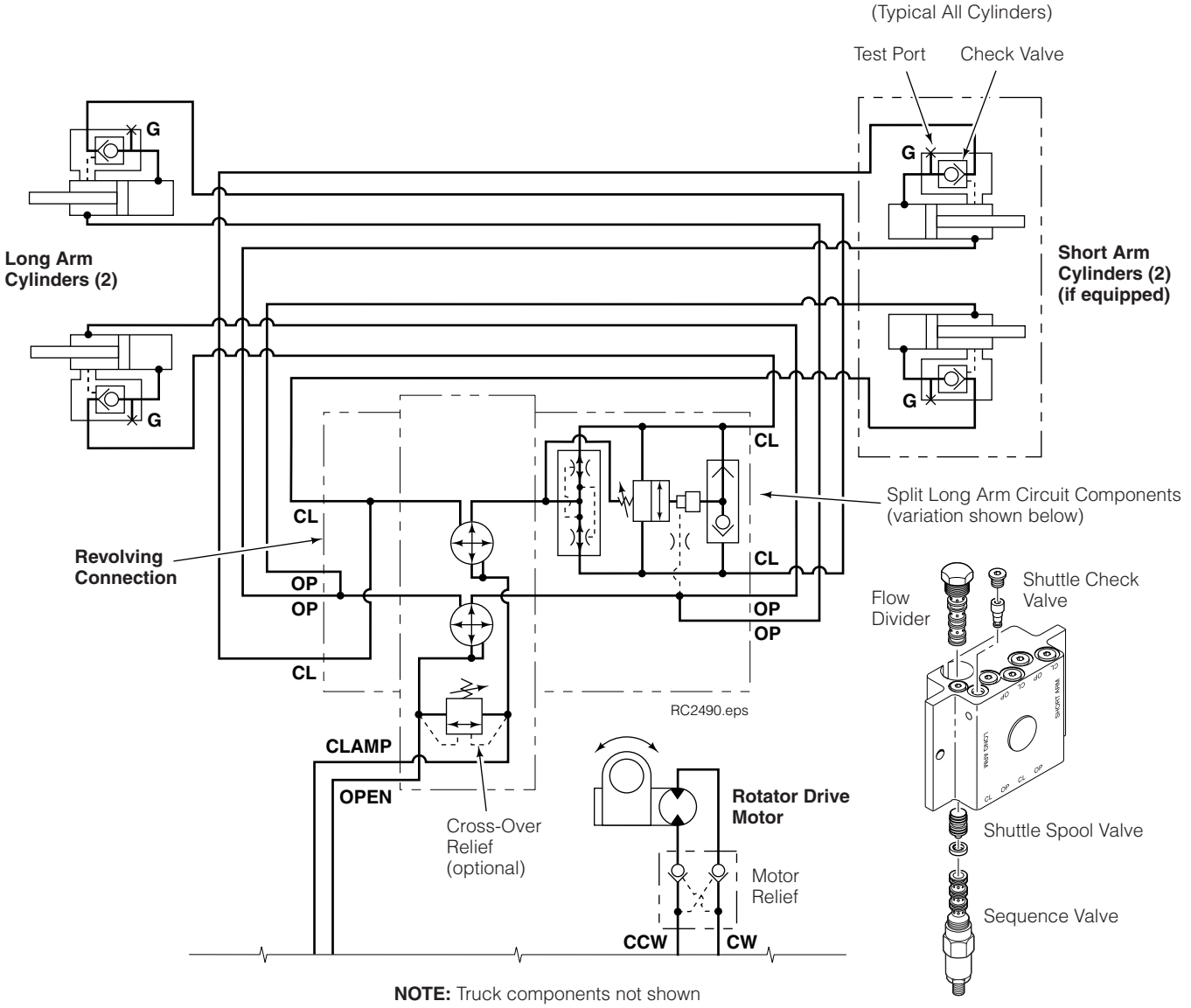
RETURN

NOTE: For **OPEN ARMS/ ROTATE CCW**, reverse the colors shown.

3.2-2 Fixed Frame Clamp – Hydraulic Schematic



3.2-3 Fixed Frame Clamp, Split Long Arm – Hydraulic Schematic



NOTE: Truck components not shown

3.3 Clamp Function

There are five potential problem areas that can affect the clamp function:

- Operator may be handling roll incorrectly. Loads may be too heavy, exceeding capacity of the attachment. Refer to the Operator's Guide for suggested procedures.
- Low hydraulic pressure or flow from lift truck.
- External leaks.
- Defective solenoid coil or valve (solenoid equipped attachments).
- Worn/defective revolving connection shaft seals or cartridge valves, cylinder seals or check valves.

3.3-1 Supply Circuit Test

> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valve several times in both directions.

1. Check the pressure delivered by the truck. Refer to the truck Service Manual. The pressure must be within 100 psi (7 bar) of specified truck pressure. **Pressure to the attachment must not exceed 2600 psi (180 bar),** measured at the carriage hose terminal.
2. Check the flow volume at the carriage hose terminal. See Section 5.1-1 for recommended flow volumes. If the truck pressure and flow are correct, proceed with the clamp circuit pressure test.

3.3-2 Clamp Circuit Test

> **WARNING**: Before removing hydraulic lines, **position both arms at midstroke to relieve cylinder pressure.** Turn the truck off and open the truck auxiliary control valve several times in both directions.

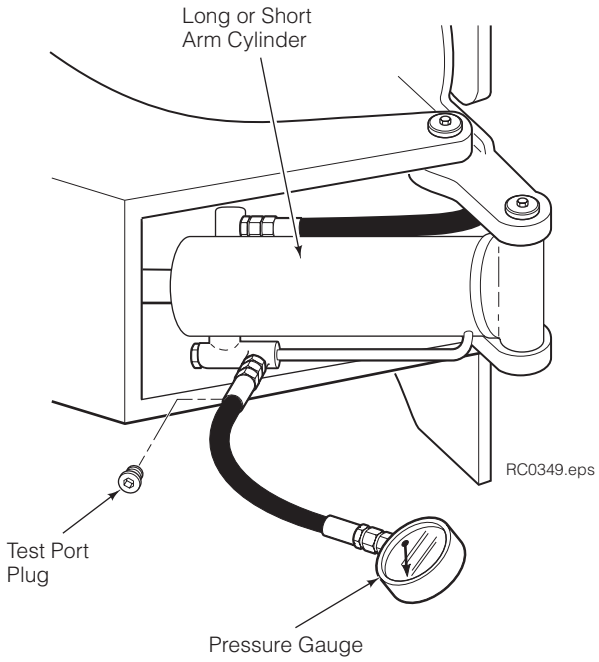
1. Check for external leaks at the cylinders and revolving connection.
2. **Long Arm Cylinders –** Install a pressure gauge to each long arm cylinder's test port. Close the long arm fully and hold the handle in the CLAMP position a few seconds to develop full truck system pressure. Watch the gauge pressure readings.

   Short Arm Cylinders – Install a pressure gauge on each short arm cylinder's gauge port. Rotate the attachment to the 45° position. Close the short arm fully and hold the handle in the CLAMP position a few seconds to develop full truck system pressure. Watch the gauge pressure readings.

   - If the initial gauge pressures are not within 100 psi (7 bar) of system pressure measured at the hose terminal, the revolving connection may be faulty and require service. Refer to Section 4.6.
   - If one of the gauge pressures drops more than 150 psi (10 bar) initially, and an additional drop exceeds 25 psi (2 bar) per minute, the cylinder check valve cartridge or piston seals may be faulty. Continue troubleshooting.
   - If both gauge pressures do not drop more than 150 psi (10 bar) initially, and an additional drop does not exceed 25 psi (2 bar) per minute, the problem is not hydraulic. Refer to Section 4.3.
3. **Position both arms at midstroke to relieve cylinder pressure.** Remove, swap and reinstall the cylinder check valve cartridges.
4. **Long Arm Cylinders –** Close the long arm fully and hold the handle in the CLAMP position a few seconds to develop full truck system pressure. Watch the gauge pressure readings.

   Short Arm Cylinders – Rotate the attachment to the 45° position. Close the short arm fully and hold the handle in the CLAMP position a few seconds to develop full truck system pressure. Watch the gauge pressure readings.

   - If the gauge pressure on the cylinder continues to drop more than 150 psi (10 bar) initially, and an additional drop exceeds 25 psi (2 bar) per minute, the cylinder piston seals are faulty. Refer to Section 4.7 for cylinder service.
   - If the gauge pressure on the cylinder does not drop more than 150 psi (10 bar) initially, and an additional drop does not exceed 25 psi (2 bar) per minute, the check valve (now in the other cylinder) is faulty and requires replacement. Refer to Section 4.7-3.



3.4 Rotation Function

There are four potential problem areas that can affect the rotation function:

- Operator may be handling roll incorrectly. Loads may be too heavy or rotated off-center, exceeding capacity of the attachment. Refer to the Operator's Guide for suggested handling procedures.
- Low hydraulic pressure or flow from lift truck.
- Worn or defective hydraulic rotator motor.
- Worn or defective drive assembly or rotator frame bearing assembly.

3.4-1 Supply Circuit Test

WARNING: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valve several times in both directions.

1 Check the pressure delivered by the truck. Refer to the truck Service Manual. The pressure must be within 100 psi (7 bar) of specified truck pressure. **Pressure to the attachment must not exceed 2600 psi (180 bar),** measured at the carriage hose terminal.

2 Check the flow volume at the carriage hose terminal. See Section 5.1-1 for recommended flow volumes. If the truck pressure and flow are correct, proceed with the Rotation circuit pressure test.

3 Check for external leaks.

3.4-2 Rotation without Load

1 Install pressure gauges on the rotator motor fittings.

2 Rotate the attachment without a load and note pressure readings of both gauges.

- If the attachment rotates in one direction faster than the other or rotates in one direction only, the check assembly may need service. Refer to Section 4.5.
- If the lower gauge reading **exceeds** 500 psi (35 bar), there is excessive back pressure in the supply circuit. Check for restrictions such as numerous fittings, 90° fittings, or hose sizes less than No. 8.

3.4-3 Rotation with Load

1 Rotate a load requiring approximately 3/4 of the attachment's maximum torque capacityL

50G, 60G, 66G – 63,000 in.-lbs. @ 2300 psi (7087 Nm @ 160 bar)

72G – 98,000 in.-lbs. @ 2300 psi (11,025 Nm @ 160 bar)

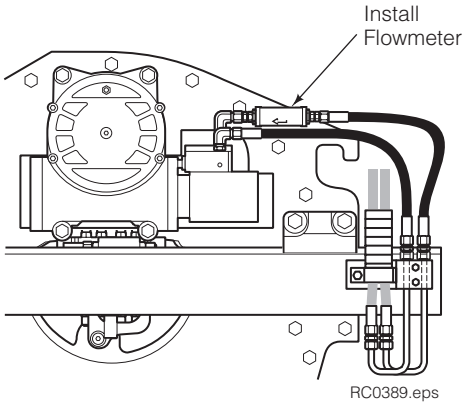
Note gauge readings during rotation.

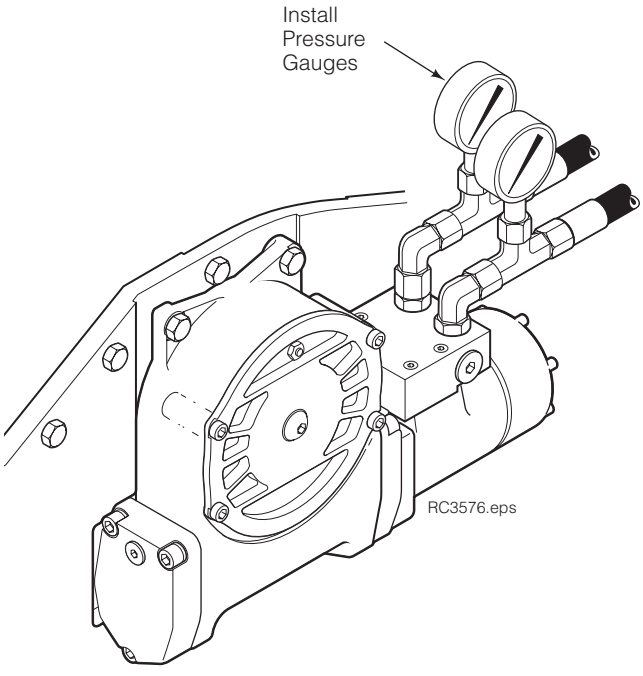
- If the higher gauge reading is substantially **less** than the truck pressure as measured at the carriage hose terminal, the rotator motor geroler set may need repair. Refer to Section 4.4.
- If the higher gauge reading is **close** to truck pressure as measured at the carriage hose terminal and no rotation occurs, the rotator motor output shaft or drive box may need repair. Continue troubleshooting.

2 Remove the motor from the drive box assembly as described in Section 4.4.

3 Reinstall the hoses to the rotator motor fittings. Actuate the rotate circuit.

- If the rotator motor shows rotational output, the drive box may require service. Refer to Section 4.3.
- If the rotator motor shows little or no rotational output, the rotator motor requires service. Refer to Section 4.4.





3.5 Electrical Circuit

(Solenoid-equipped attachments)

Use the schematic shown and follow the steps below.

1 Check the control knob circuit fuse. Replace if necessary.

2 Check for loose electrical connections at the truck ignition switch, control knob button, solenoid coil terminals and diode.

3 Remove the diode from the solenoid coil terminal. Test with an ohmmeter for high resistance in one direction and no resistance in the other direction. If there is no resistance in both directions, replace the diode.

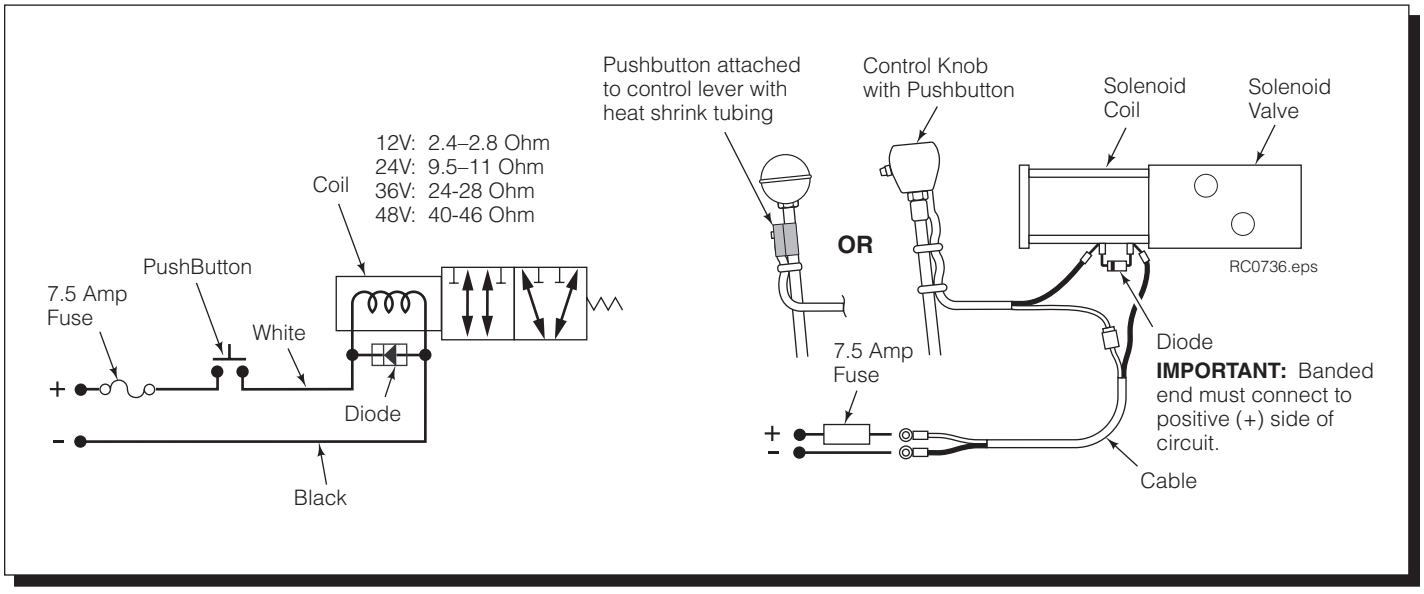
NOTE: When replacing the diode, the banded end must be connected to the coil and wiring as shown.

4 Use a voltmeter to determine if correct voltage is present at the electrical leads when the button is pressed.

- If there is **no voltage** at the solenoid, troubleshoot the electrical circuit for shorts or open circuits.
- If there is **insufficient voltage** to the solenoid, check the circuit for excessive voltage drop.
- If there is **sufficient voltage** to the solenoid, test for coil continuity. Continue to Step 5.

5 Test for coil continuity by placing an ohmmeter test lead on each solenoid coil terminal (ohmmeter on Rx1 scale).

- If there is an ohmmeter reading, the coil is good. Check for proper ohm value for the truck.
- If the coil is good, but the solenoid does not 'click' when the control knob button is depressed, the solenoid cartridge may be jammed. Refer to Section 4.11.
- If there is no ohmmeter reading, the coil is defective. Replace coil. Refer to Section 4.11.



4.1 Attachment Removal

1 Rotate the attachment to the vertical roll handling position. Extend the arms outside the frame width.

> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn truck off and open the truck auxiliary control valves several times in both directions.

2 Disconnect and plug the hydraulic supply hoses to the attachment. Tag hoses for reassembly.

3 Disconnect the lower hooks:

Bolt-On Hooks – Remove the lower mounting hooks. For reassembly, tighten the capscrews to:

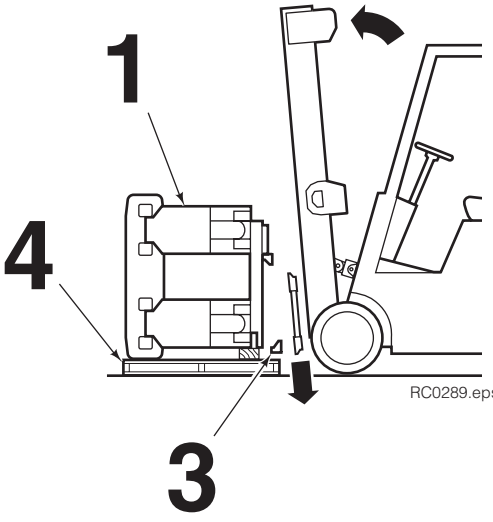
Class II/III Mounting – 125 ft-lbs. (165 Nm)
Class IV Mounting – 250 ft.-lbs. (340 Nm)

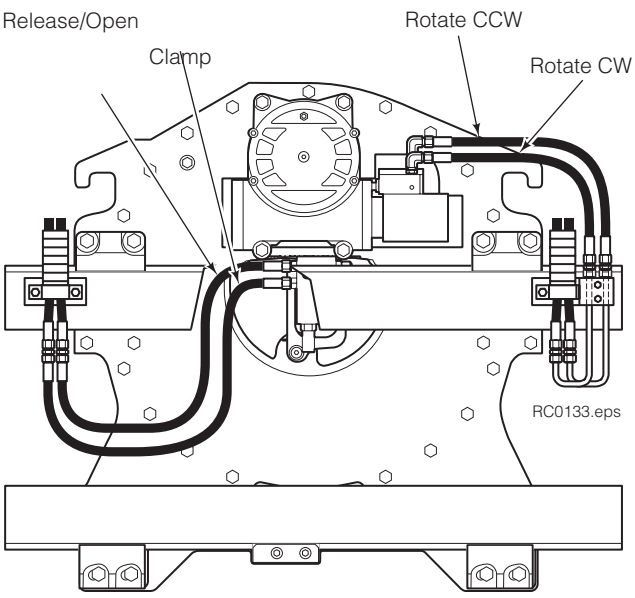
Quick-Change Hooks – Pull out the locking pins and drop the lower hooks to the unlocked position. Reinstall the pins in the lower holes. For reassembly, slide the hooks up to the locked position and install the locking pins on the top holes.

4 Set the attachment on a pallet. Tilt the mast forward and lower the carriage to remove the attachment from the truck.

5 For installation, reverse the above procedures with the following exceptions:

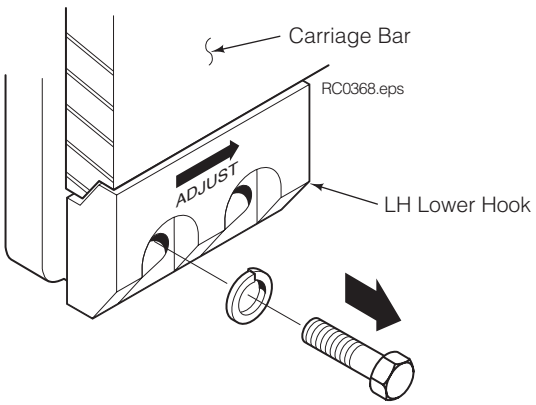
- Refer to Fixed Frame Paper Roll Clamp Installation Instructions 212420, for complete installation procedures.



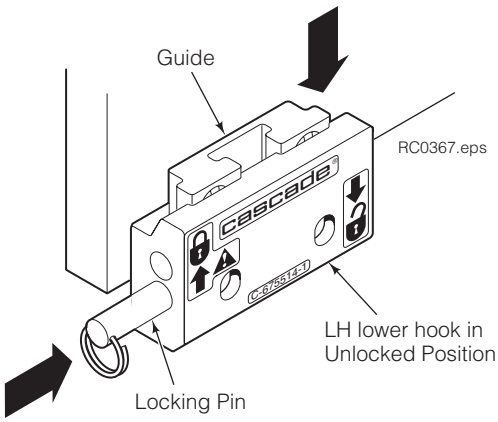


3

BOLT-ON HOOKS



QUICK-CHANGE HOOKS



4.2 Arms

4.2-1 Arm Assembly – Removal and Installation

1 Open the arm to be removed to mid-range position. Rotate the attachment to the vertical roll handling position.

2 Remove the retainer circlips and pivot pins from both cylinder rods. Retract the cylinders.

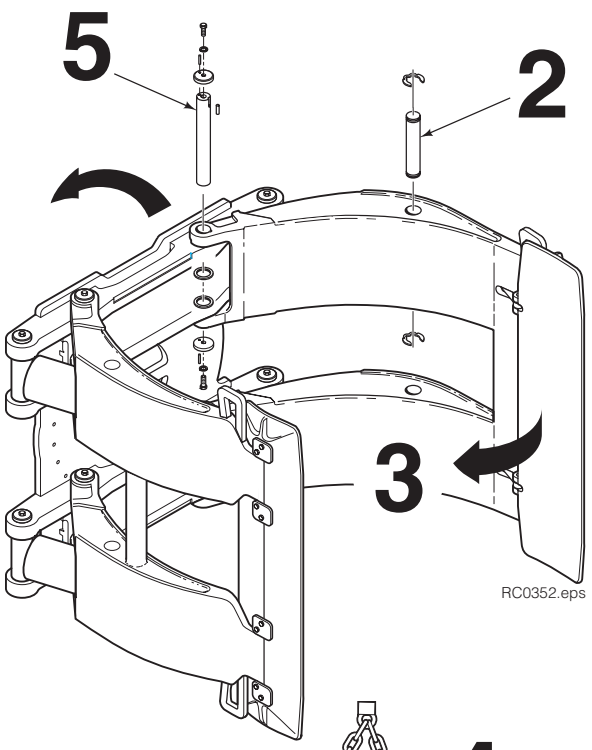
3 Swing the arm being removed inward to contact the other arm. Rotate the attachment 90° to position the arm being removed on top.

> **WARNING**: Verify that the overhead hoist and chains or straps are rated for the weight of the attachment. Refer to nameplate for attachment weight.

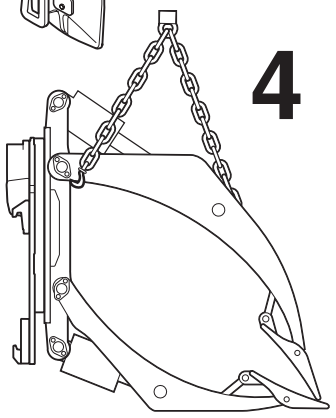
4 Attached an overhead hoist to the arm and take up slack in the chain.

5 Remove the capscrews and arm pivot pins. Note location of shims. Lift away arm assembly. For reassembly, tighten the arm pivot pin capscrews to 35 ft.-lbs. (48 Nm).

6 For reassembly, reverse the above procedures.



RC0352.eps



RC0353.eps

4.2-2 Contact Pad – Removal and Installation

1 Rotate the attachment to the vertical roll handling position. Lower the unit until the contact pads are approximately 1 in. (25 mm) off the ground.

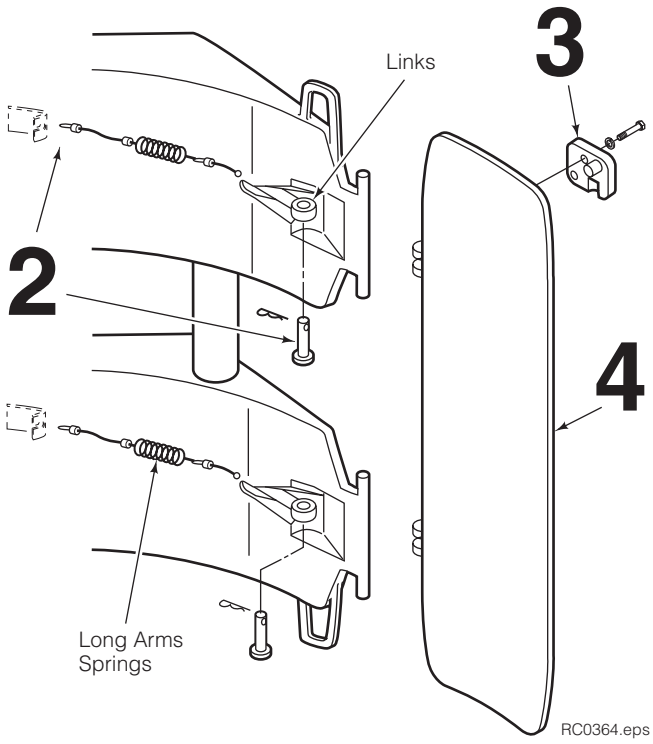
NOTE: If bolt-on pad surfaces are to be replaced, remove and replace them at this point. Tighten capscrews to 16 ft.-lbs. (22 Nm).

2 Remove the clevis pins fastening the links to the contact pads. **NOTE:** On long arms, the springs connected to the links must be disconnected inside the arms near the cylinder rod anchors.

3 Remove the retainers from the contact pad. **NOTE:** Retainers are marked LAL, LAR for the long arm and SAL, SAR for the short arm. For reassembly, tighten the retainer capscrews to 62 ft.-lbs. (85 Nm).

4 Remove the contact pad.

5 For reassembly, reverse the above procedures.



RC0364.eps

4.2-3 Arm Tip Repair

> **WARNING**: The following procedures must be performed by a welder certified per the applicable section of AWS D 1.1 and experienced in this type of repair.

1 Remove the contact pad as described in Section 4.2-2.

2 Scribe a cut line and a grind line on the arm tip castings using the dimensions shown.

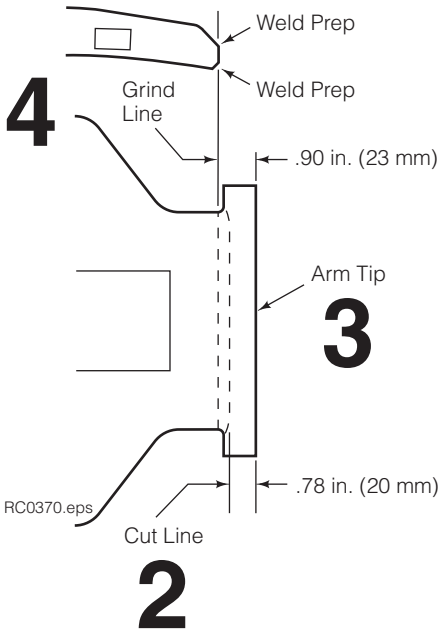
3 Remove the tip portion of the arm casting at the cut line by sawing or flame cutting.

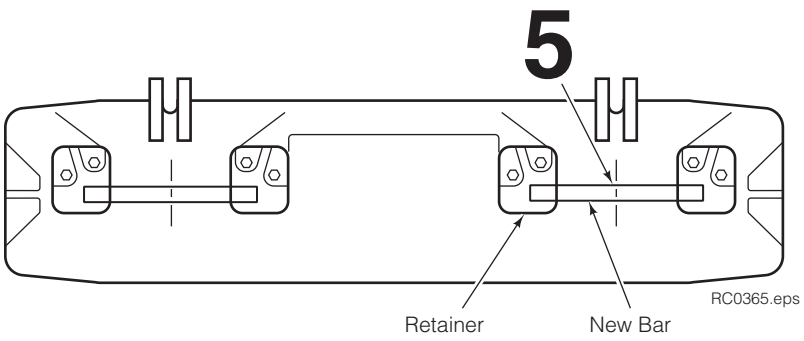
IMPORTANT: Do not remove material behind the scribed grind line.

4 Grind the arm tip casting back to the grind line. Grind a .25 in. (6 mm) chamfer on the tip edges for weld prep.

5 Mark the center of each bar's length for alignment with the arm tip. Assemble the new bars and retainers to the contact pad.

6 Position and clamp the contact pad to the arm. Use the marks on the bars to center them with the arm tips for proper vertical alignment of the pad.

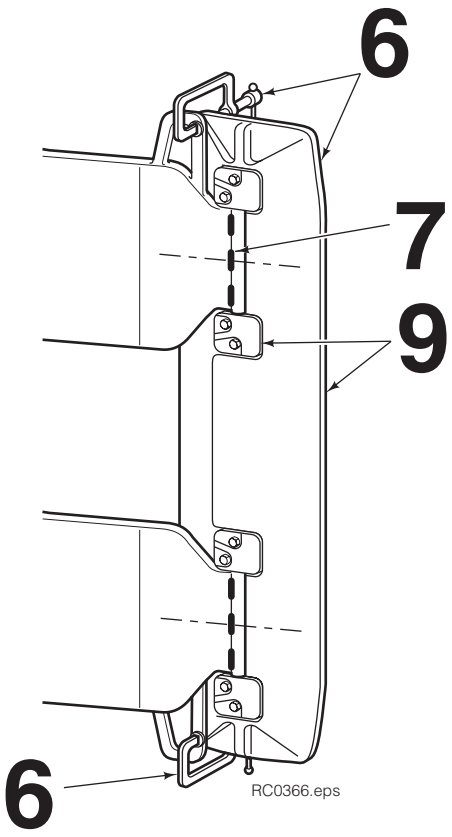




7 Tack weld the bars to the arm tips.

8 Remove the clamps. Check the contact pad for free movement, proper alignment and location. Straighten and retack the bars if necessary.

9 Remove the retainers and contact pad from the arm.



4.2-3 Arm Tip Repair (Continued)

10 Weld the bars to the arm tips using the following weld procedures:

- Preheat the bar to 400° F (200° C). Monitor the bar heat with a 400° F (200° C) tempstick placed at the location shown. Monitor the arm tip casting heat with 150° F (66° C) tempsticks placed at locations shown. **DO NOT OVERHEAT THE ARM TIP CASTING.**
- **WELD METHOD A –** Attach the ground wire tot hat arm. Weld using FCAW (Flux Core Arc Weld) AWS E70T-1 1/16 in. (1.5 mm) diameter wire with 100% CO^2 shielding gas at 35-50 CFH. Use DC+ polarity set at 26-30 volts and 260-325 amps. Apply the weld holding a close arc. Do not oscillate or use a wash bead pattern. Let the welds slow-cool.
- **WELD METHOD B –** Attach the ground wire to the arm. Weld using SMAW (Shielded Metal Arc Welding) E-7018 low hydrogen .125 in. (3 mm) electrodes. Use DC+ polarity or an AC welding machine set at 130-325 amps. **Do not use electrodes exposed to moisture without first redrying them at 200° F (75° C) for 2 hours.** Apply the weld holding a close arc. Do not oscillate or use a wash bead pattern. Let the welds slow-cool.
- Maintain 150° F (66° C) preheat and interpass temperature on the arm tip.
- **Weld Sequence –** Terminate each weld at the center of the bar.
- Do not weld in a drafty area. Cover the weld with an insulating blanket and let slow-cool.

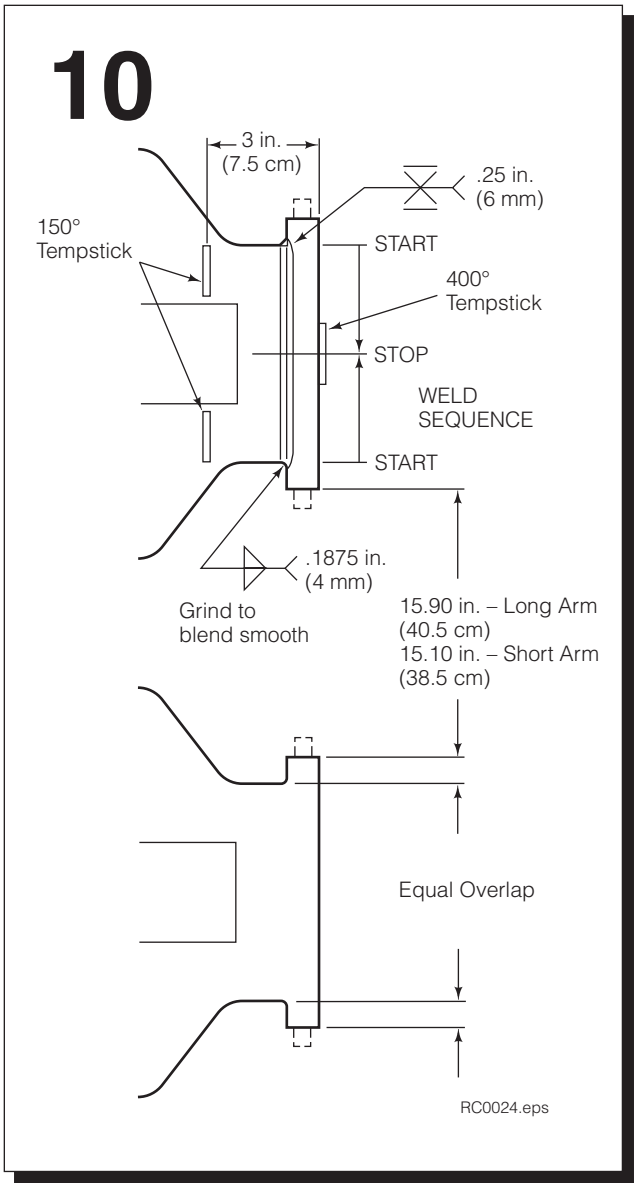
11 Remove slag after each weld and inspect for defects.

NOTES: Arc craters, undercut, overlap and porosity are not permitted. Repair any weld defect as required.

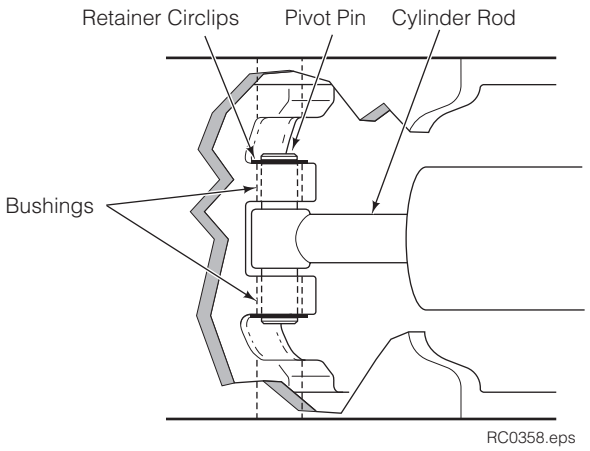
12 Grind all welds to smooth transitions between parts.

13 Install the contact pad to the arm and check for free movement. Tighten the retainer capscrews to 62 ft.-lbs. (85 Nm).

14 Attach the pad links.



4.2-4 Arm Bushing Service (cylinder rod anchor)

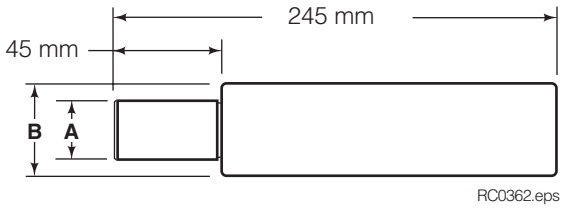


1. Close the arm being serviced. Rotate the attachment to the vertical roll handling position.
2. Remove the retainer circlips and remove both cylinder rod pivot pins from the arm. Retract the cylinder rods.
3. Using a bushing driver, remove the cylinder rod pivot pin bushings from the arm. **NOTE:** See bushing driver dimensions in the table below.
4. For reassembly, reverse the above procedures with the following exceptions:
   - Install a new rod pivot pin bushings (30 mm length).

   CAUTION: Bushings may be damaged if installed without a proper bushing driver.

Bushing Driver Dimensions

	A Bushing ID	B Bushing OD
50G, 60G, 66G, 72G	39.8 mm	44.5 mm



4.3 Drive Group

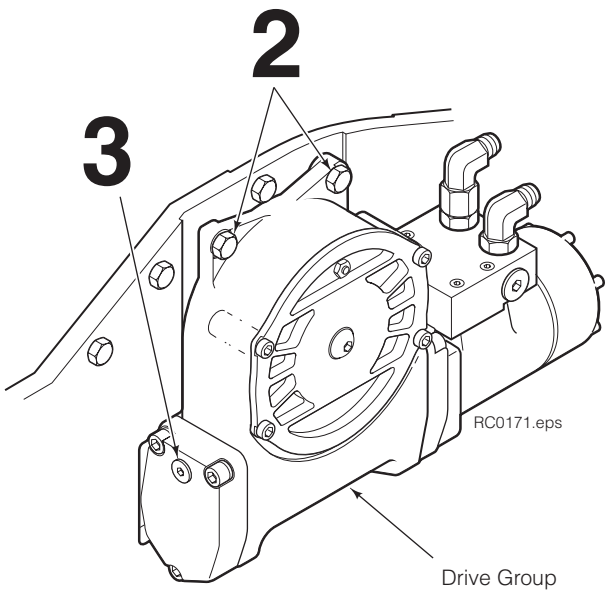
4.3-1 Drive Group Removal and Installation

1 Remove the attachment from the truck as described in Section 4.1.

2 Remove the four capscrews fastening the drive group to the baseplate. For reassembly, tighten the capscrews to 75 ft.-lbs. (105 Nm).

3 For reassembly, reverse the above procedures with the following exceptions:

- After the drive group has been reinstalled, check the gearcase lubricant level. Lubricant must be up to the bottom of the fill plug hole. If necessary, fill with Cascade Gear Lube Part No. 656300, or SAE 90 wt. gear lube (AGMA 'mild' 6 EP Gear Lube).



4.3-2 Drive Group Disassembly and Service

1 Remove the drive group from the baseplate as described in Section 4.3-1.

2 Lay the drive group, pinion down, on two 4 x 4 in. (10 x 10 cm) wood blocks placed on both sides of the pinion.

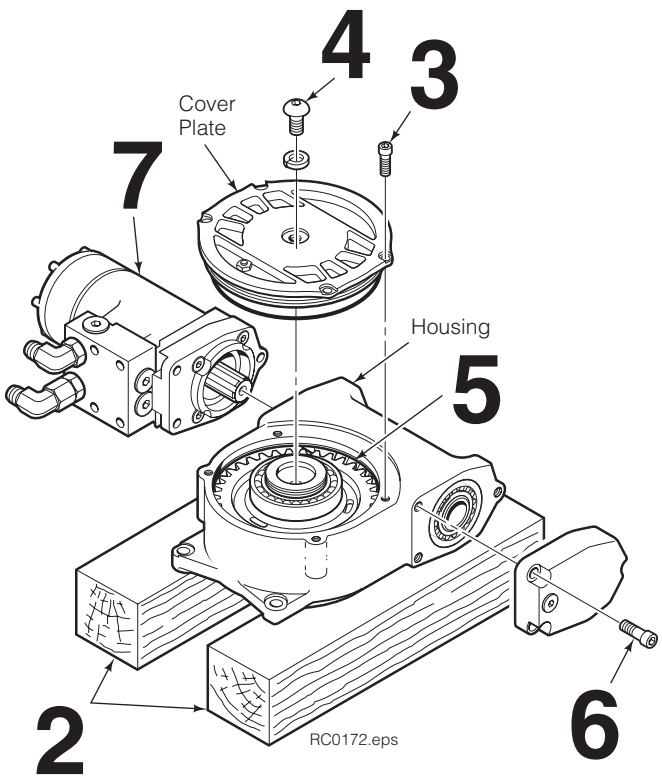
3 Remove the four capscrews fastening the cover plate to the housing.

4 Remove the center capscrew plug from the cover plate and install a (early) .375 in. NC or (later) M10 capscrew with a minimum thread length of 2 in. (50 mm). Remove the cover plate by turning the capscrew clockwise while lightly tapping around the sides of the cover plate.

5 Drain the lubricant from the housing.

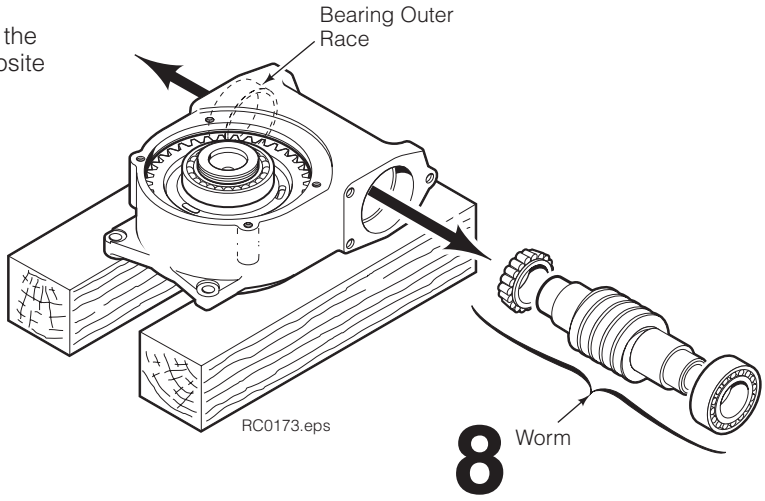
6 Remove the three capscrews fastening the end cover to the housing.

7 Remove the drive motor as described in Section 4.4-1.

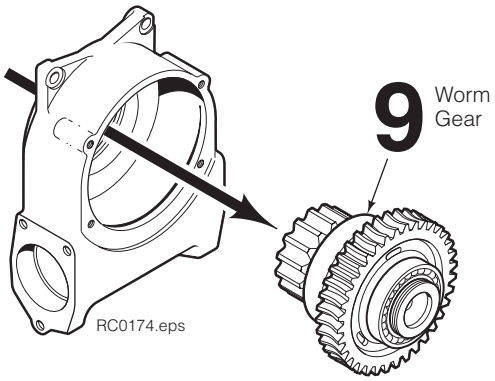


4.3-2 Drive Group Disassembly and Service (Continued)

8 Tap the worm and bearing assembly out through the end-cover side of the housing. Remove the opposite outer bearing race through the motor side of the housing.



9 Press the pinion gear, seal, pinon bearings and worm gear out of the housing as an assembly.

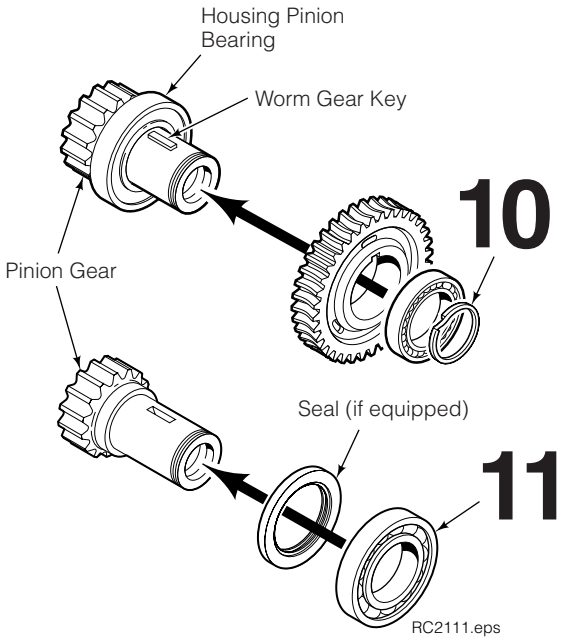


10 Remove the snap ring from the pinion gear shaft. Press the pinion gear bearing from the worm ring gear and cover plate pinion bearing. Remove the pinion shaft key.

IMPORTANT: Heavy Duty Pinion uses two bearings with the first bearing retained by an additional snap ring. Refer to the illustration shown on the next page.

11 Press the pinion gear out of the housing pinion bearing. Remove seal.

12 Clean and inspect all components. Remove all dried sealant or threadlocker residue. Replace all worn items. Remove any burrs or sharp edges with emery cloth.



NOTE: Two types of large pinion bearing used: sealed bearing, and bearing with separate seal (shown)

4.3-3 Drive Group Reassembly

Build up the pinion/worm gear assembly vertically with the pinion gear down.

1 **Standard Pinion –** Position the seal against the pinion gear, spring-side facing housing. Apply Loctite 271 (red) to clean and dry bearing seating area on shaft as shown. Press a non-sealed housing bearing onto the pinion shaft. **IMPORTANT:** Earlier design uses a sealed bearing. Pry out bearing seals when using an external seal. Remove excess Loctite.

Heavy Duty Pinion – No external seal is used. Position the first bearing and snap ring on the pinion shaft. Apply Loctite 271 (red) to the second bearing seating area as shown. Press the second bearing onto the pinion shaft. Remove excess Loctite.

CAUTION: Loctite must not squeeze into the seal or bearings.

2 Preheat worm gear to 200° F (93° C). Install the key, worm gear, cover plate pinion bearing and snap ring on the pinion.

3 Apply Loctite 271 (red) to housing seating area and shoulder for the housing pinion bearing and seal. Install the complete pinion assembly into the housing. Remove excess Loctite.

NOTE: Pinion gear must be clean and dry prior to Loctite 271 application.

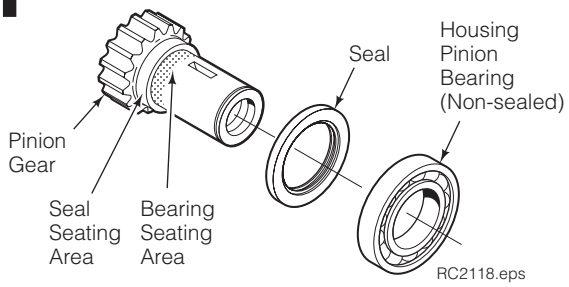
CAUTION: Loctite must not squeeze into the seal or bearings.

4 Install the worm's outer bearing race in the drive motor side of the housing. Make sure the race taper is inward, as shown.

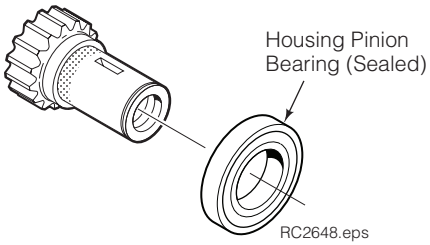
5 Install the drive motor as described in Section 4.4-1.

6 Install the worm and bearings in the housing. Fully engage the worm with the drive motor shaft. Install the remaining outer bearing race. Make sure the race taper is inward as shown.

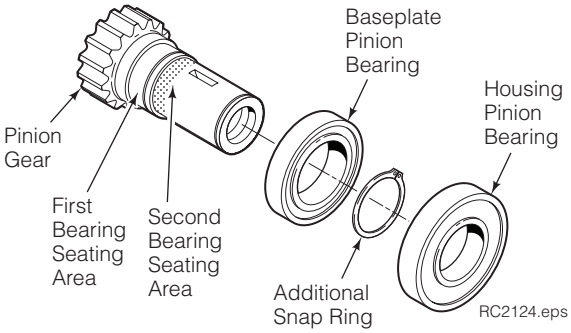
1 **PINION AND BEARING WITH EXTERNAL SEAL**

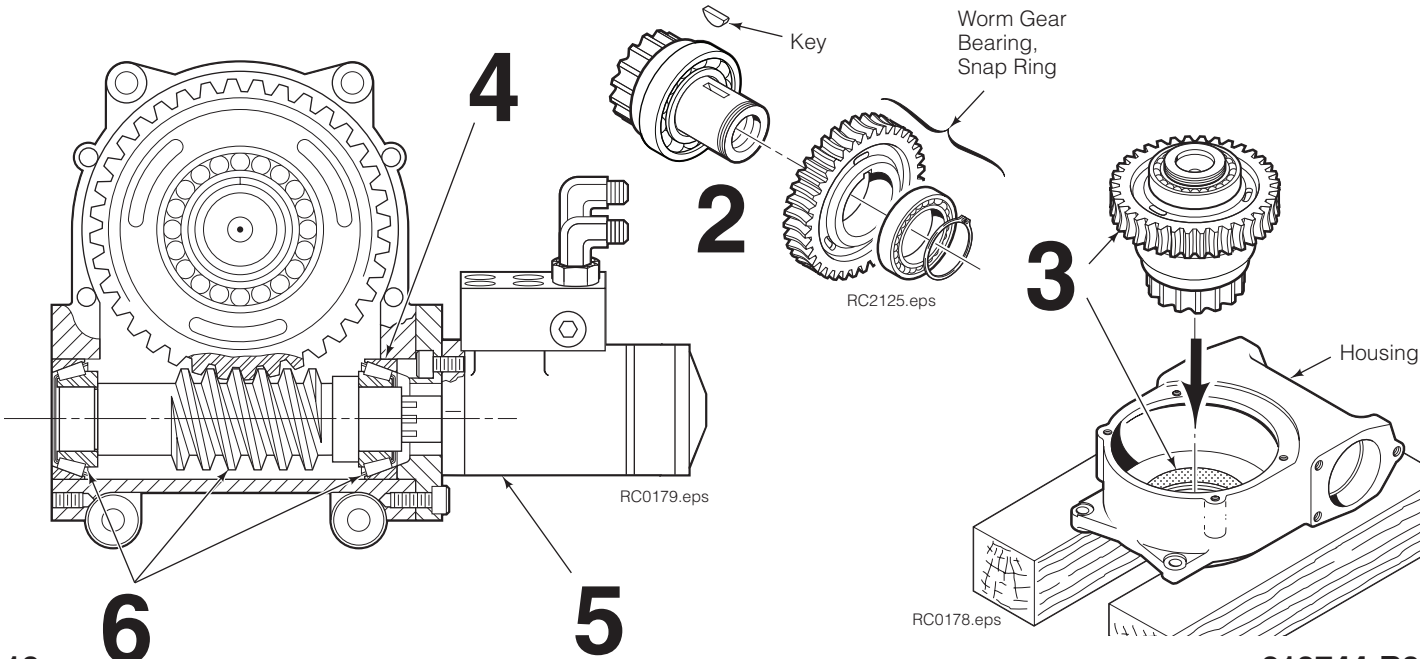


PINION WITH SEAL BEARINGS



HEAVY DUTY PINION WITH SEALED BEARINGS





4.3-3 Drive Group Reassembly (Continued)

7 Temporarily install the end cover without shims. Tighten the capscrews sequentially in 10 ft.-lbs. (15 Nm) increments to 20 ft.-lbs. (30 Nm).

8 Measure the gap between the end cover and housing in three places with a feeler gauge or 'Plastigage' thread and determine the minimum gap.

9 Choose a combination of end cover shims equal to the minimum gap measured plus the next higher .005 in. (0.12 mm) increment. See examples below:

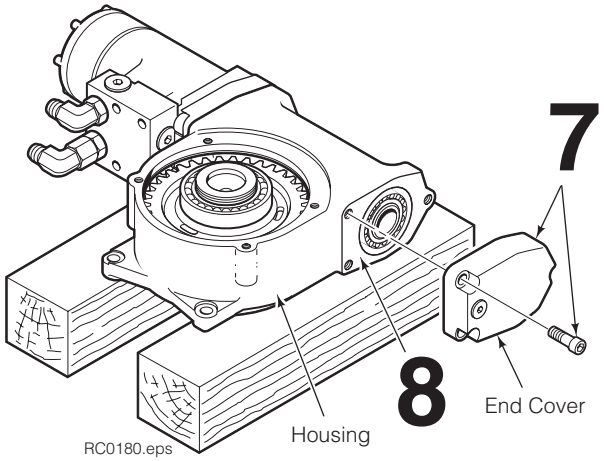
For .025–.029 in. measured gap, use .030 in. total shim thickness.

For .010–.014 in. measured gap, use .015 in. total shim thickness.

For .009 or less, use one .010 in. shim. A minimum of one .010 in. shim is required to seal against leakage.

NOTE: Shim Service Kit 670578 contains the shims listed. A minimum of one .010 in. shim is required to seal against leakage:

Qty	Part No.	Color	Thickness
1	671758	Yellow	.020 in. (.50 mm)
1	671757	Pink	.015 in. (.39 mm)
1	670574	Brown/Clear	.010 in. (.25 mm)
1	674513	Blue	.005 in. (.13 mm)

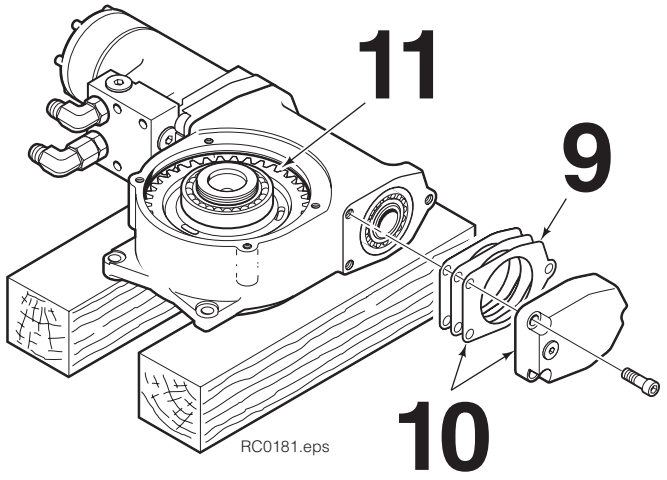


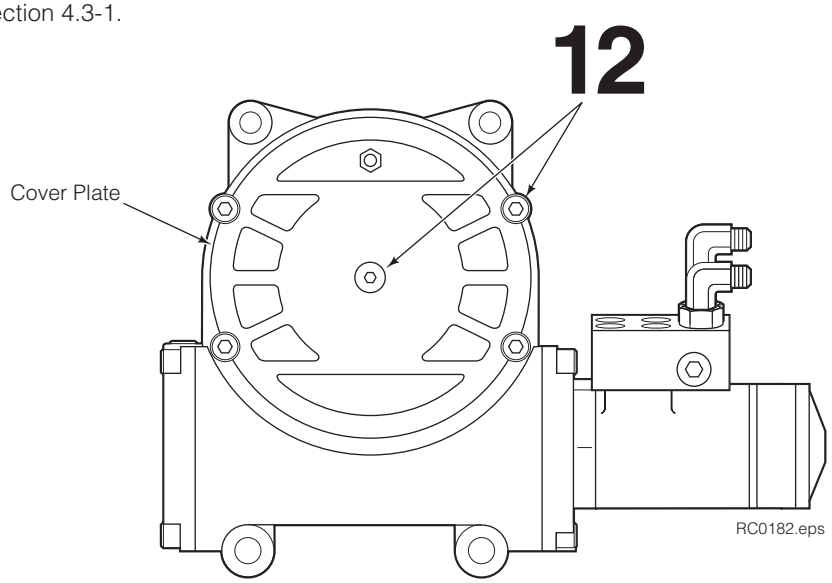
10 Remove the end cover. Apply Loctite 515 sealant (Cascade Part No. 668184) to both surfaces of the shims and the capscrews. Install the shim pack and end cover. Tighten the capscrews to 65 ft.-lbs. (90 Nm). Remove excess sealant.

11 With the gearcase laying flat, fill with 56 fluid ounces (540 ml) of Cascade Gear Lube Part No. 656300 or SAE 90 wt. gear lube (AGMA 'mild' 6EP Gear Lube).

12 Install the cover plate and gasket. Install the four cover plate capscrews and tighten to 15 ft.-lbs. (20 Nm). Install the center hole plug.

13 Reinstall the drive group on the rotator baseplate as described in Section 4.3-1.





4.4 Drive Motor

4.4-1 Drive Motor Removal and Installation

> **WARNING**: Before removing hydraulic line, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

1 Remove the attachment from the lift truck as described in Section 4.1.

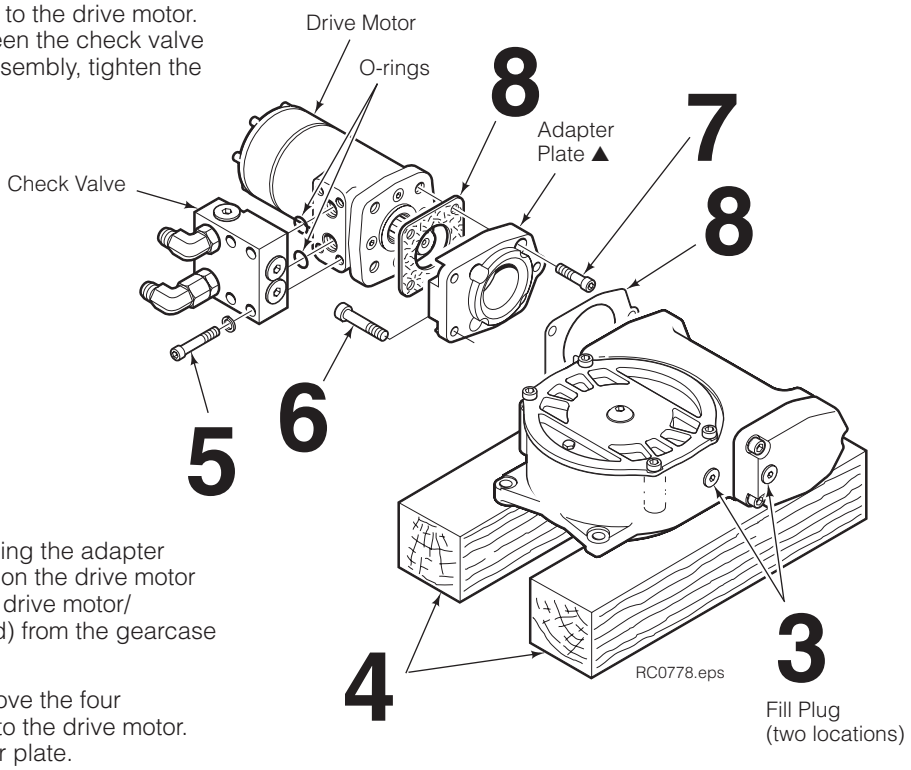
2 Remove the drive group from the attachment as described in Section 4.3-1.

3 Remove the fill plug and drain the lubricant from the drive group.

4 Lay the drive group, pinion down, on two 4 x 4 in. (10 x 10 cm) wood blocks placed on both sides of the pinion gear.

5 Remove the four capscrews and special lockwashers fastening the check valve assembly to the drive motor. Keep track of the two O-rings between the check valve assembly and drive motor. For reassembly, tighten the capscrews to 15 ft.-lbs. (20 Nm).

▲ If equipped. Adapter plate is on motors with Cascade part no. less then 608XXXX.



6 Remove the three capscrews fastening the adapter plate to the gearcase housing. Tap on the drive motor with a rubber mallet to separate the drive motor/adapter plate assembly (if equipped) from the gearcase housing.

7 If equipped with adapter plate, remove the four capscrews fastening adapter plate to the drive motor. Separate the motor from the adapter plate.

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

- Apply Loctite 515 sealant (Cascade Part No. 668184) to both sides of the drive motor/adapter plate gasket (if equipped). Apply sealant to the threads of the four drive motor capscrews. Install the gasket and adapter plate to the drive motor. Tighten capscrews to 40 ft.-lbs. (55 Nm).
- Apply sealant to both sides of the adapter plate/gearcase (or motor/gearcase) gasket. Apply sealant to the threads of the three adapter plate capscrews. Install the drive motor/adapter plate assembly and gasket to the gearcase housing. Tighten the capscrews to 65 ft.-lbs. (90 Nm).
- Fill the drive group with 56 fluid ounces (540 ml) Cascade Gear Lube (Part No. 656300), or SAE 90 wt. gear lube (AGMA 'mild' 6 EP Gear Lube).

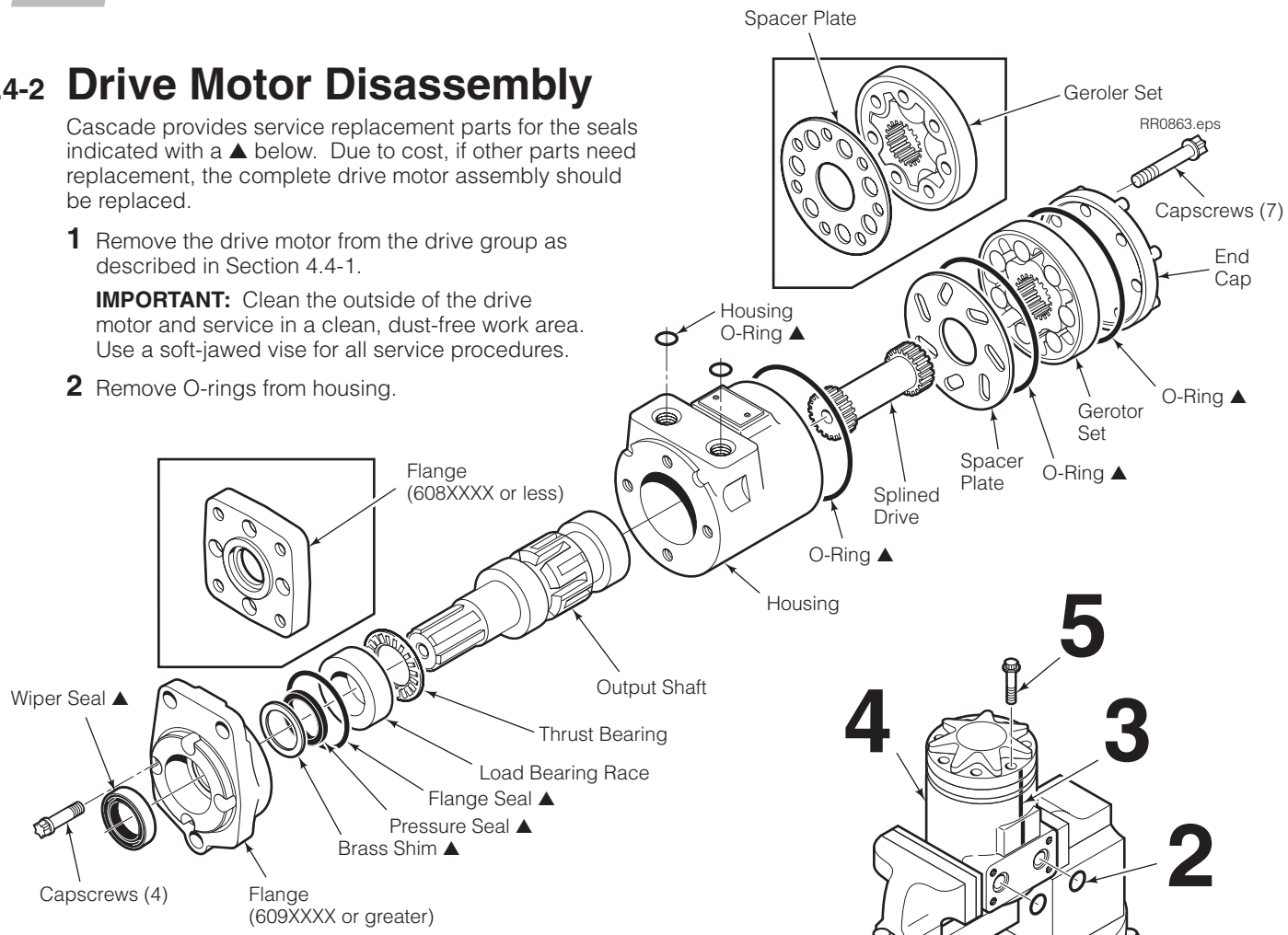
4.4-2 Drive Motor Disassembly

Cascade provides service replacement parts for the seals indicated with a ▲ below. Due to cost, if other parts need replacement, the complete drive motor assembly should be replaced.

1 Remove the drive motor from the drive group as described in Section 4.4-1.

IMPORTANT: Clean the outside of the drive motor and service in a clean, dust-free work area. Use a soft-jawed vise for all service procedures.

2 Remove O-rings from housing.



3 Make a scribe across the drive motor, inline with the capscrew and drive motor's port surface.

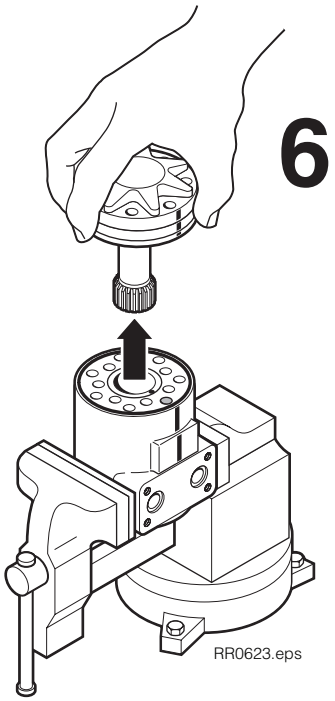
4 Clamp drive motor in a soft-jawed vise across the flange with the output shaft downward.

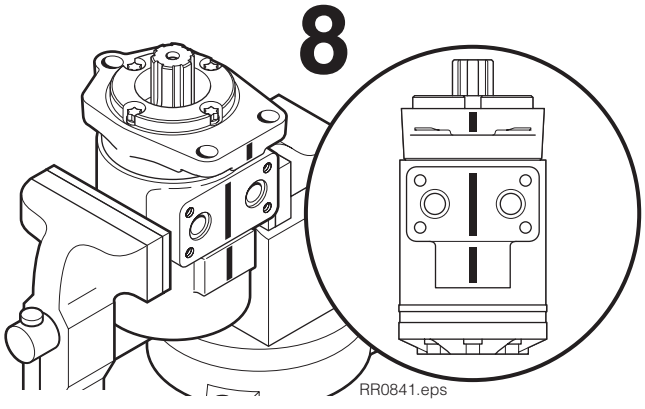
5 Remove all capscrews from the end cap.

6 Remove altogether the end cap, geroler/gerotor set and spacer plate. The splined drive should remain in place with this group.

7 Remove the O-rings from the end cap, geroler/gerotor set and housing.

8 Turn the drive motor over, clamping the housing across the port area with the flange upward.





9 Remove the four Loctited capscrews from the flange with a X10 Torx Socket. Do not use an impact wrench.

CAUTION: Thread sealant used on the capscrews may require a small amount of heat to the housing to remove the capscrews. Use a temperature indicator to prevent overheating the housing.

10 Turn the flange 45° clockwise.

11 Remove the flange and output shaft by pushing the output shaft from under the housing and pulling up on the tapered portion of the output shaft.

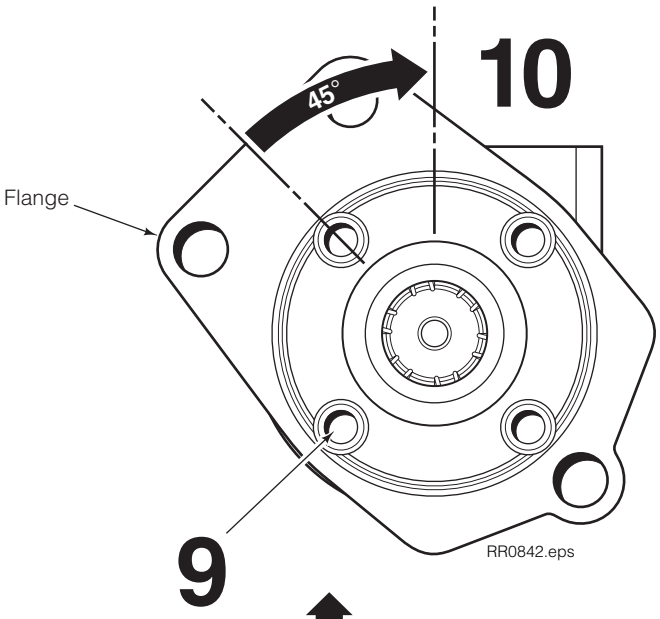
12 Remove the flange and thrust bearing from the output shaft.

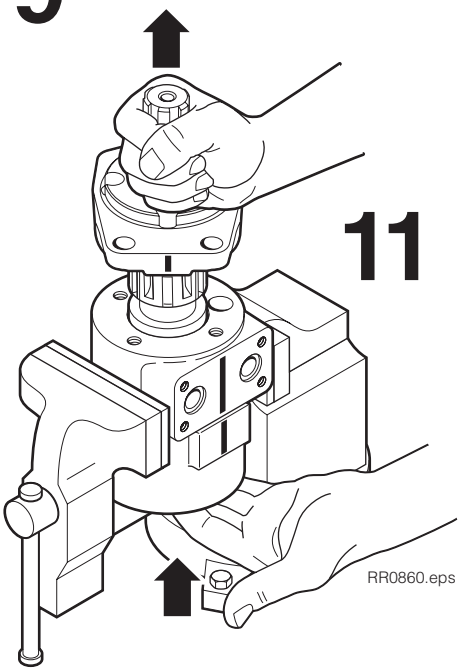
13 Remove the load bearing race and flange seal from the flange.

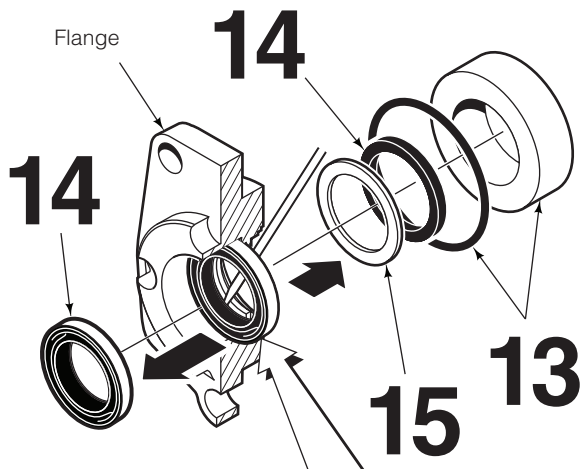
14 Remove the wiper seal and pressure seal from the flange using a seal removal tool or modified screwdriver as shown.

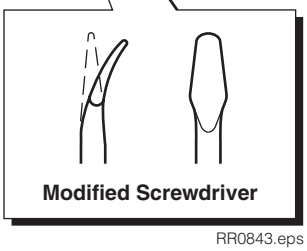
NOTE: Remove the seals by pushing from the back side, as shown.

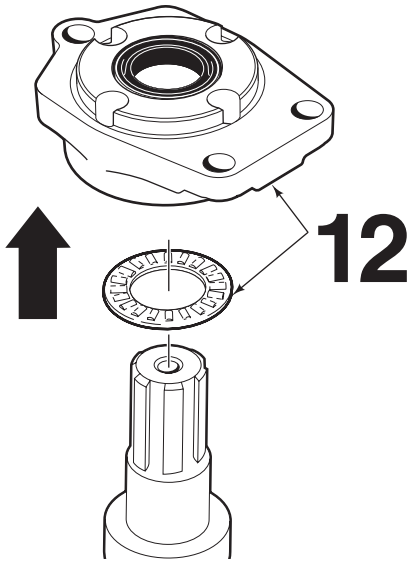
15 Remove the brass shim from the flange.







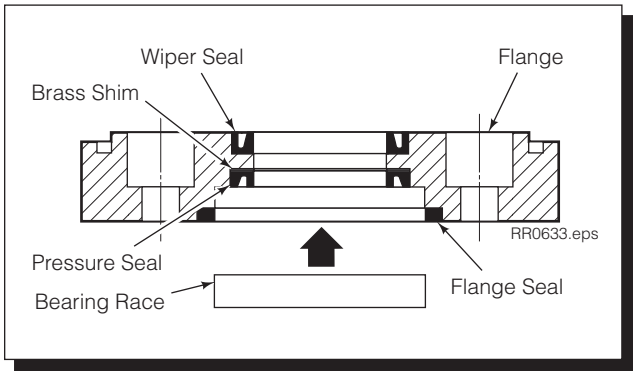




4.4-3 Drive Motor Inspection

- Remove all Loctite residue from the threaded holes.
- Clean all parts with solvent and blow dry. **Do not use paper or cloth towels.**
- Inspect all parts for small nicks, burrs or scratches. Remove imperfections with emery cloth. Replace parts where imperfections could not be removed.
- Inspect the flange seal seats for scratches. Check for cracks in the flange area that could cause leakage.

4.4-4 Drive Motor Reassembly



1 Install the brass shim into the pressure seal side of the flange. Install wiper seal and pressure seal into the flange. The pressure seal must be seated evenly.

2 Place the bearing race in the flange, seated evenly with pressure seal and flange.

3 Lubricate the flange seal with petroleum jelly and seat in lip of flange on the pressure seal side, as shown.

4 Install thrust bearing onto the output shaft.

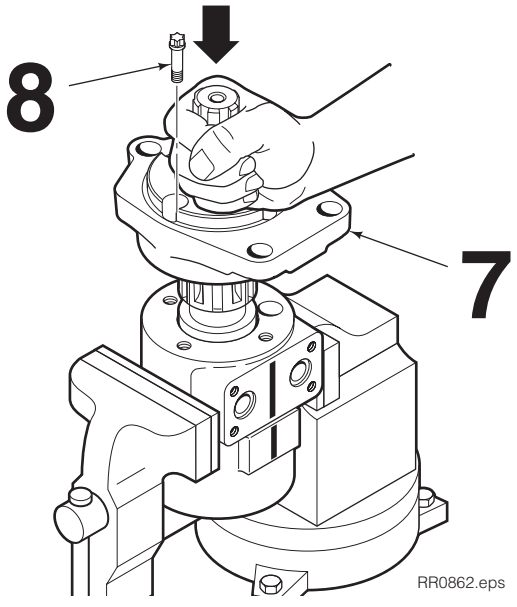
5 Install the flange onto the output shaft with the pressure seal side against the output shaft.

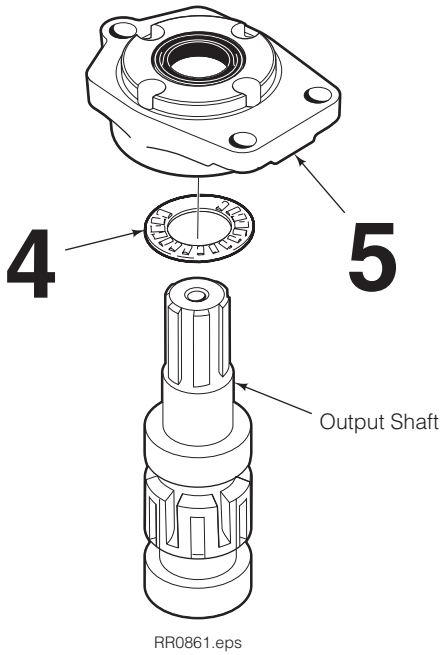
6 Clamp housing into the vise with the flange side facing upward.

7 Install the output shaft/flange assembly into the housing.

8 Apply Loctite sealant 242 (blue) or equivalent to the four holes of the housing and the four capscrews. Wipe away any excess sealant. Install the four capscrews and tighten in a criss-cross pattern to 250 in.-lbs (28 Nm).

IMPORTANT: Capscrews must be clean and dry.





9 Turn the housing over and clamp across the flange with the output shaft taper facing down.

10 Lubricate the O-rings and install into the housing, geroler/gerotor set and endcap grooves.

11 Align the ouput shaft timing dot with the screw hole that is aligned to the port surface. Use the scribe mark to help with the alignment.

12 Use the drive splines to align the gerotor/geroler star point with the capscrew hole, as shown.

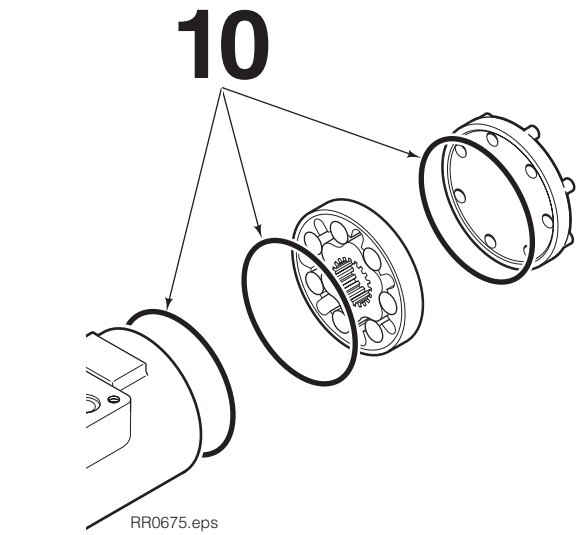
CAUTION: Geroler spacers can fall out.

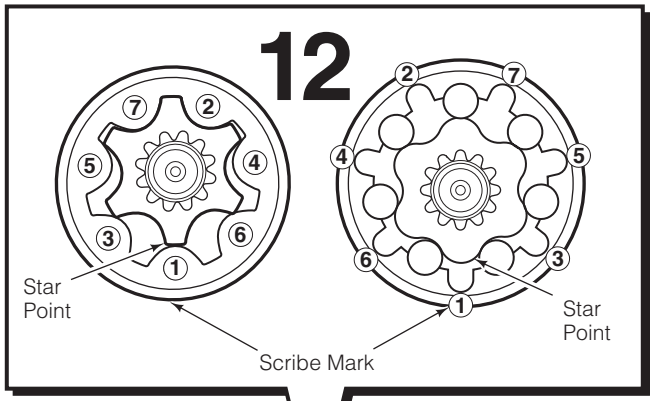
13 Assemble together the endcap with O-ring, gerotor/geroler set with O-ring, drive (short spline end to into gerotor/geroler set and spacer.

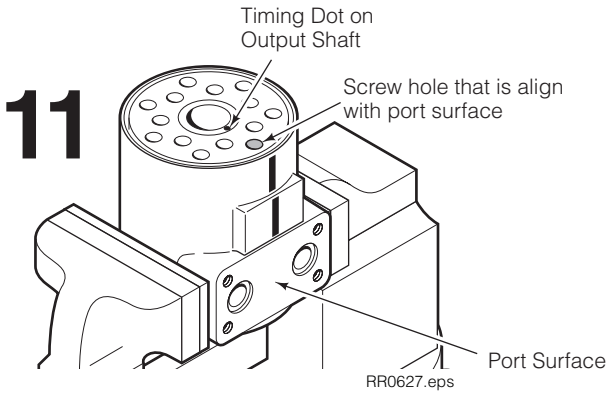
IMPORTANT: Make sure O-rings are properly seated.

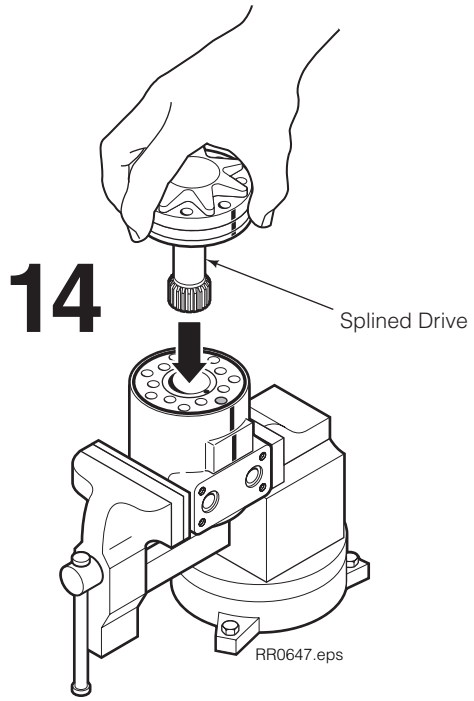
14 Install endcap assembly onto housing while aligning the scribe marks and capscrew holes. Make sure the drive engages with output shaft.

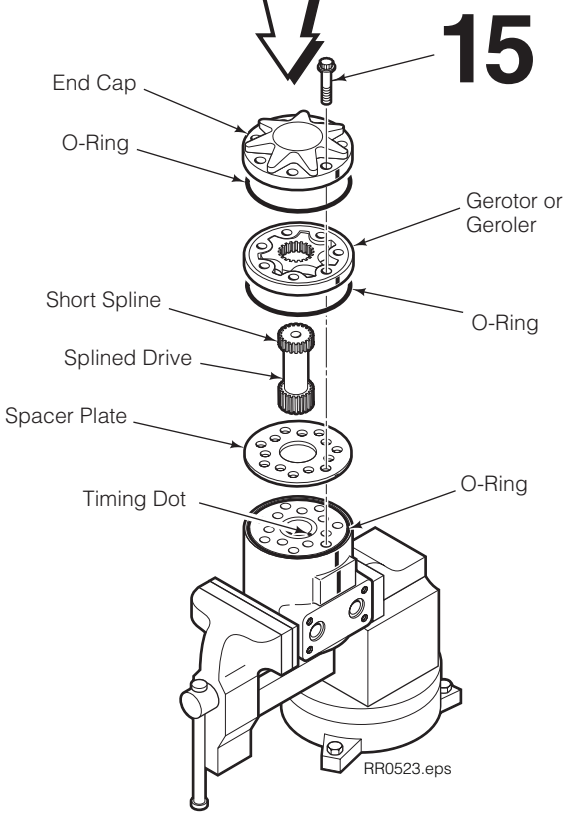
15 Install the capscrews into the end cap. Tighten the capscrews using a criss-cross pattern to 240 in.-lbs. (27 Nm)











4.5 Rotator Drive Check Valve

4.5-1 Check Valve Service

WARNING: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

1 Disconnect the hydraulic hoses to the drive group valve. Tag hoses for reassembly.

2 Remove the four capscrews fastening the check valve to the drive group. Keep track of the two O-rings between the check valve and drive motor. For reassembly, tighten the capscrews to 24 ft.-lbs. (30 Nm).

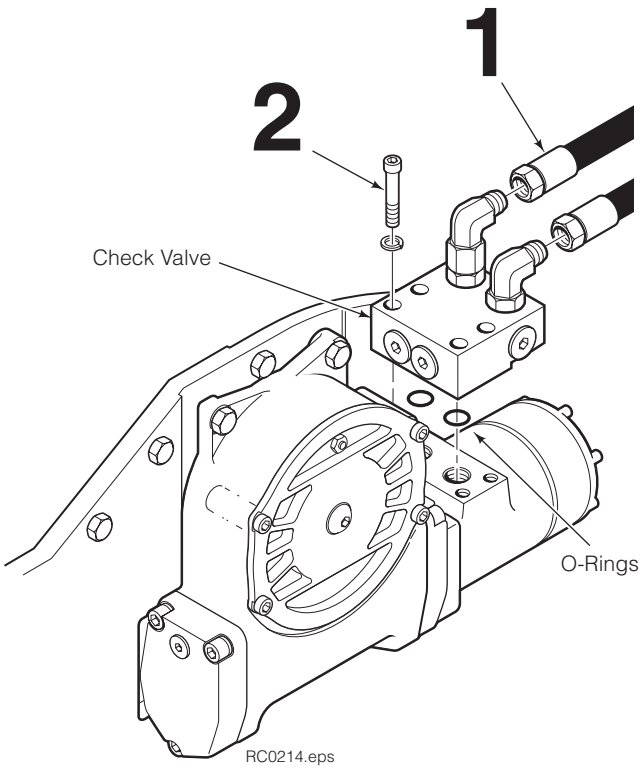
3 Remove the plug fittings, check valve internal parts (early models) or cartridges (later models).

4 Clean all parts with clean solvent. Remove any burrs or sharp edges with emery cloth.

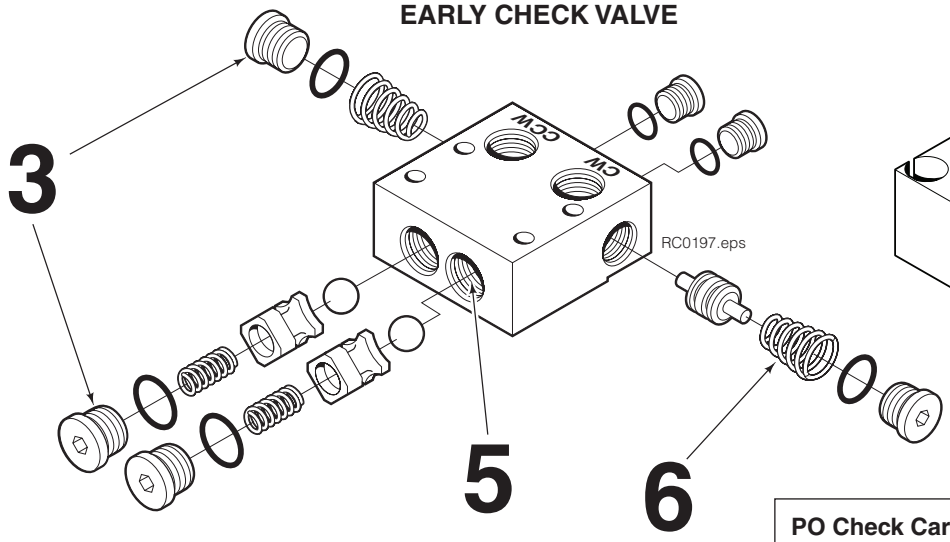
5 Inspect the internal ball seats for imperfections that would keep the balls from seating fully.

6 For reassembly, reverse the above procedures except as follows:

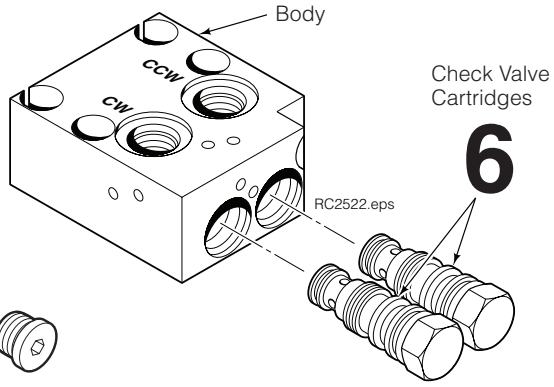
- Note the correct direction of the internal conical springs (early model).
- Install new O-rings and back-up rings on the check valve cartridges, as shown (later model).



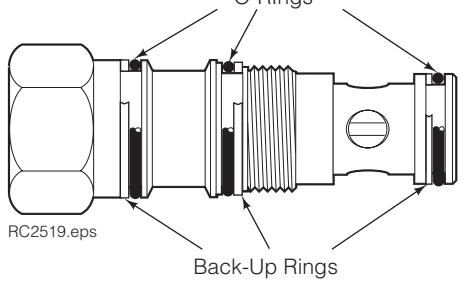
EARLY CHECK VALVE



LATE CHECK VALVE



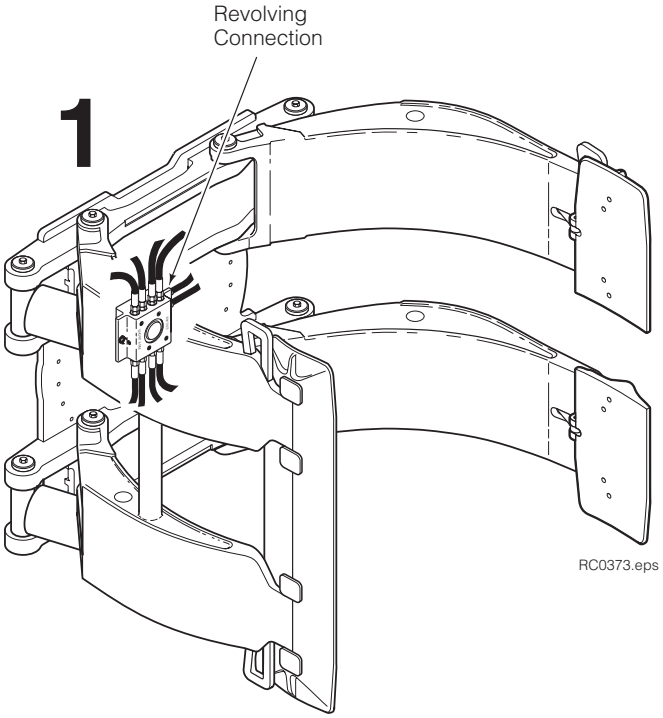
PO Check Cartridge



4.6 Revolving Connection

4.6-1 Revolving Connection Removal and Installation

> **WARNING**: Before removing any hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.



1 Remove the attachment from the lift truck as described in Section 4.1.

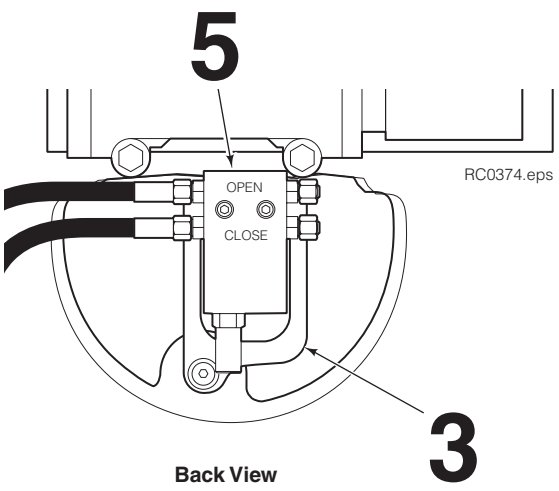
2 Disconnect the hoses from the front and rear of the revolving connection. Tag for reassembly.

3 Remove the yoke supporting the end block on the rear of the revolving connection. For reassembly, tighten the capscrew to 30 ft.-lbs. (40 Nm).

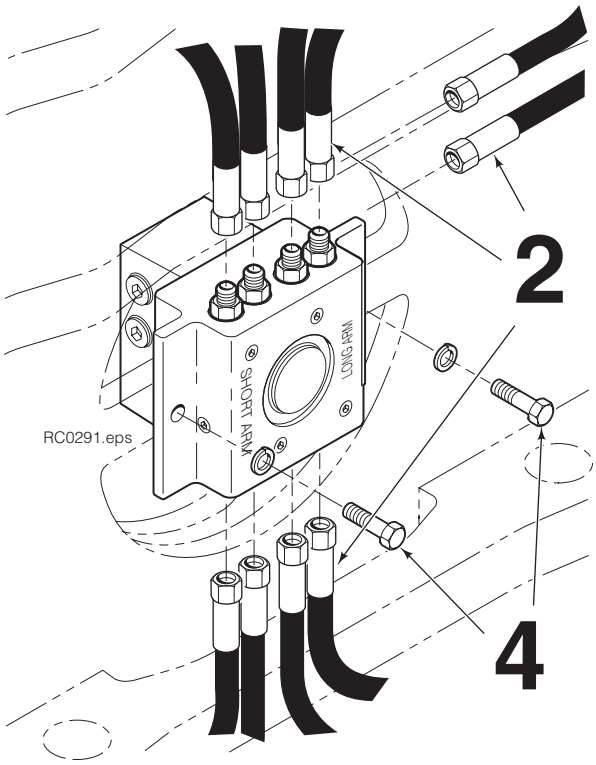
4 Remove the two capscrews and the revolving connection from the front of the attachment. For reassembly, tighten the capscrews to 30 ft.-lbs. (40 Nm).

5 For reassembly, reverse the above procedures except as follows:

- Position the revolving connection on the faceplate so that the stampings 'SHORT ARM' and 'LONG ARM" are facing the appropriate arms.
- Position the end block/shaft assembly so that the stamping 'OPEN' is on top.



Back View



4.6-2 Revolving Connection Service – Fixed Frame

1 Remove the revolving connection from the attachment as described in Section 4.6-1.

2 Remove the spiral snap ring from the front of the shaft.

CAUTION: Remove all burrs and paint from the exposed shaft surface prior to removal from the body. **Burrs or paint chips pulled through the bore may permanently damage the valve body.**

3 Remove the shaft from the body.

4 Remove the end block from the shaft and remove the relief cartridge (if equipped). For reassembly, use O-ring lube or petroleum jelly to hold the O-rings in place between the shaft and end block. Apply Loctite 271 (red) to the capscrews and tighten to 15 ft.-lbs. (20 Nm).

5 Remove the two-piece seal from the revolving connection body using brass hook-type tools (Cascade Part No. 674424).

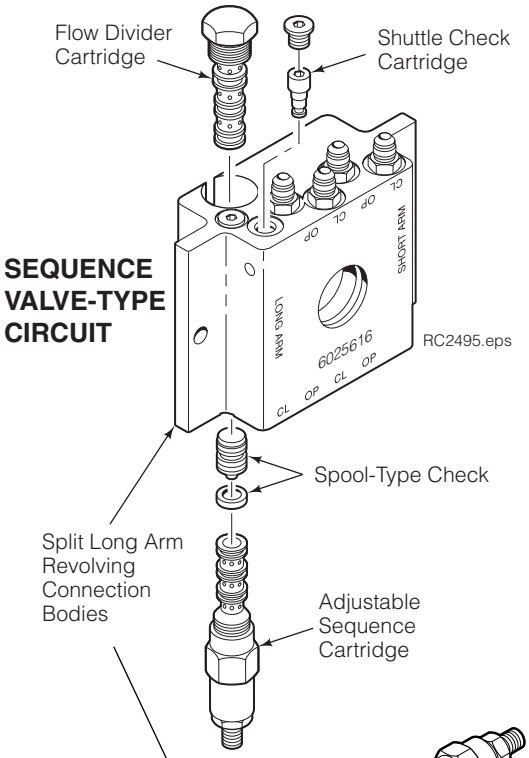
NOTE: Do not scratch or damage the grooved surfaces.

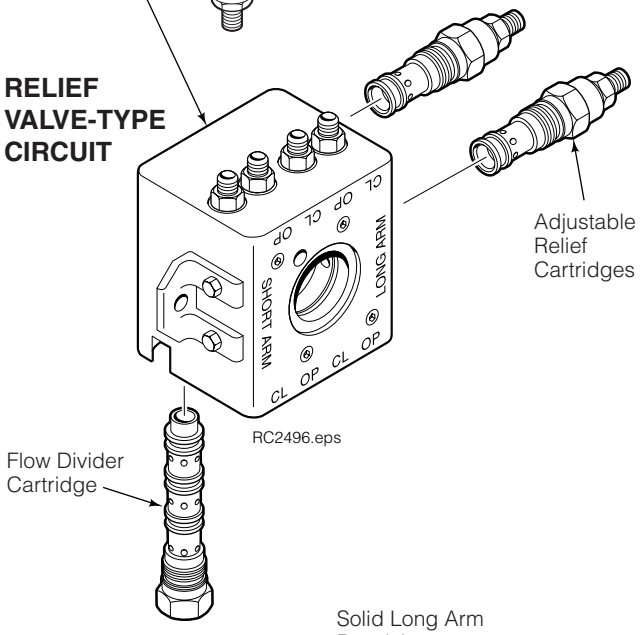
6 **Split Arm Clamps –** Remove the cartridges from the revolving connection body.

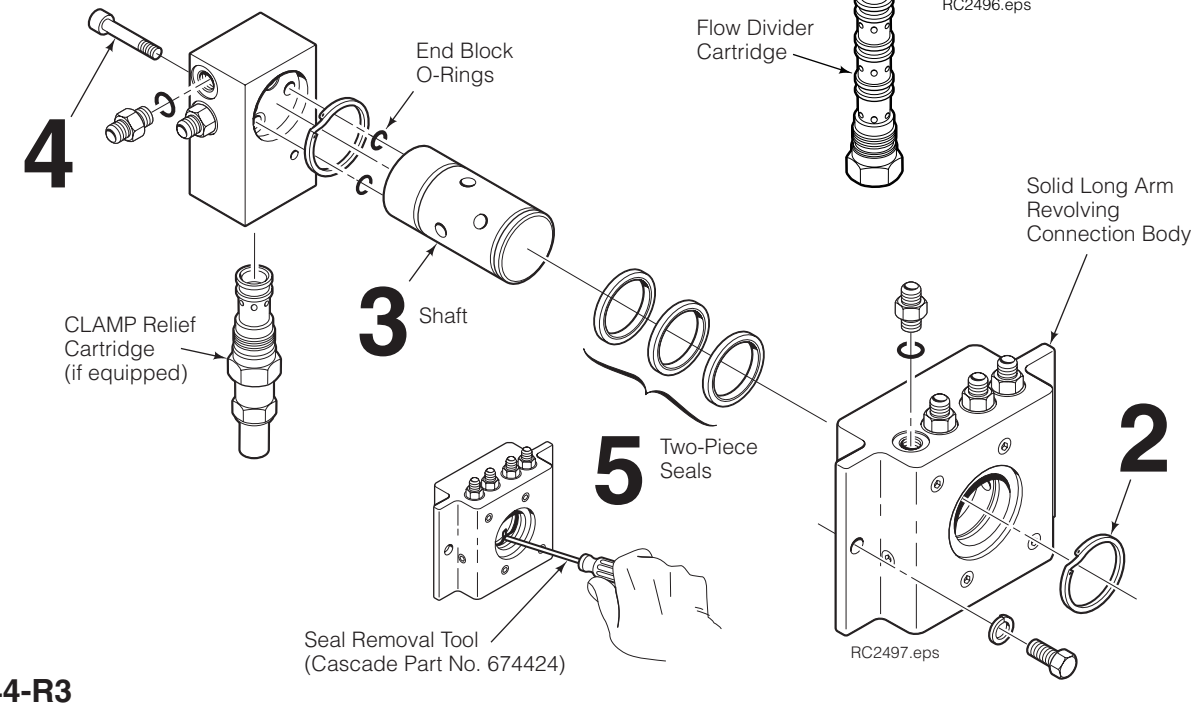
7 Remove the cartridge O-rings and back-up rings.

8 Clean all parts with clean solvent and inspect the following areas:

- Check the sealing surface of the shaft for minor surface imperfections. Remove the 320-grit emery paper. Sand the shaft radially (around), not along the length. Break the edges on the outer end of the shaft and the snap ring grooves with 320-grit emery paper. If severely warn, replace shaft.
- Check the seal grooves in the body for sharp nicks or projections. Remove minor imperfections with 320-grit emery paper. If severely worn, replace the body.







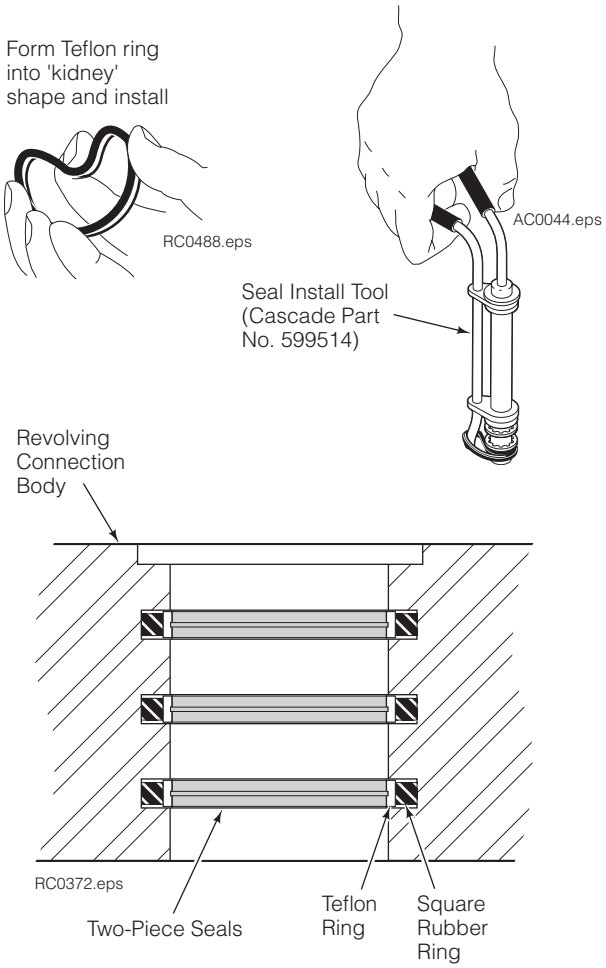
4.6-2 Revolving Connection Service (Continued)

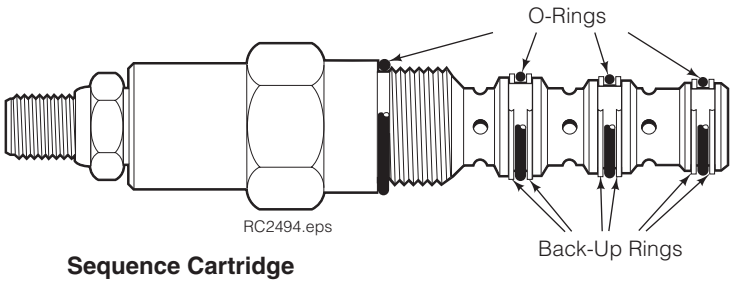
9 For reassembly, reverse the precious procedures with the following exceptions:

- **Clean all traces of oil and moisture from the 2-piece seal grooves inside the revolving connection body by using a non-petroleum based cleaner (example: electronic contact cleaner).**
- **Clean hands thoroughly to remove all traces of oil and moisture prior to 2-piece seal installation.**
- A) Install the square rubber rings into the revolving connection body grooves.

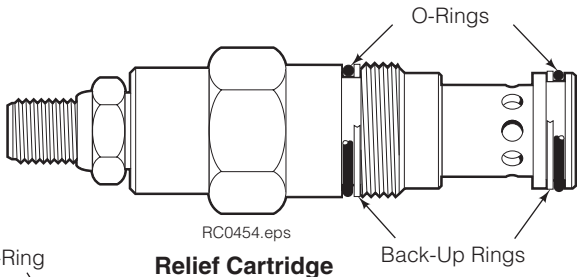
  B) Install the Teflon rings on top of the rubber rings.

  IMPORTANT: Form the seal into a 'kidney' shape as shown to install. Avoid sharp bends. Press the seals into the grooves using finger pressure.
- Lubricate the shaft and body with hydraulic fluid prior to reassembly.
- Rotate the body and apply gentle pressure when installing the shaft to prevent damage to the seals.
- Install new O-rings and back-up rings on the cartridges (if equipped) as shown.



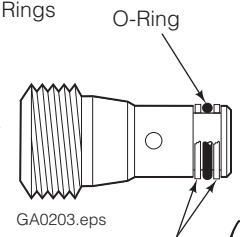


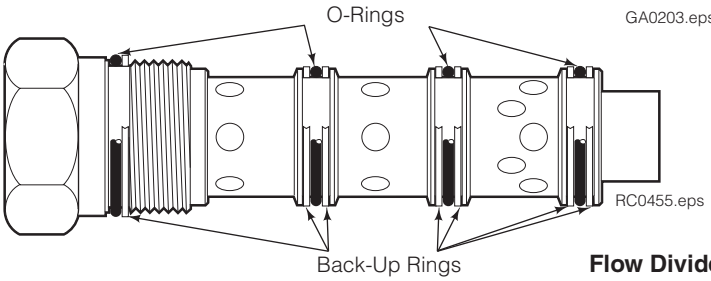
Sequence Cartridge

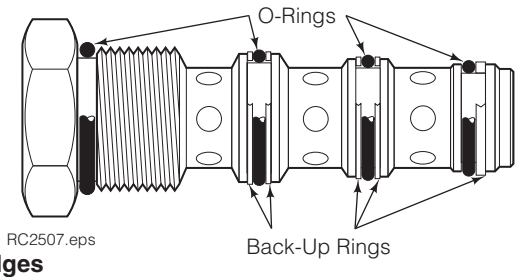


Relief Cartridge

Shuttle Check Cartridge







Flow Divider Cartridges

4.6-3 Split Arm Relief Pressure Adjustment (if required)

IMPORTANT: Revolving connection with relief valve controlled split-arm circuit (shown below) must be adjusted for proper arm movement.

1 Confirm that the truck relief setting is between 2000–2600 psi (140–160 bar).

2 Rotate the attachment to the vertical roll handling position.

> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

3 Remove the test port plugs on both split long arm cylinders and connect 5000 psi (345 bar) pressure gauges to the cylinder (No. 4 O-ring fitting required).

4 Open the long arms. Slowly clamp a split roll (30 in. diameter minimum) or clamp force indicator between the short arm pad and **lower** split long arm pad. Slowly build pressure until the upper arm begins to move freely. Releaser the lever and note the clamped arm pressure.

5 Rotate the attachment 180° and repeat Step 4 for the **opposite** split long arm. Both pressures should be within 50 psi (3.5 bar). If not, adjust the relief cartridge (screw out CCW) on the arm with the higher pressure to equal the arm with the lower pressure.

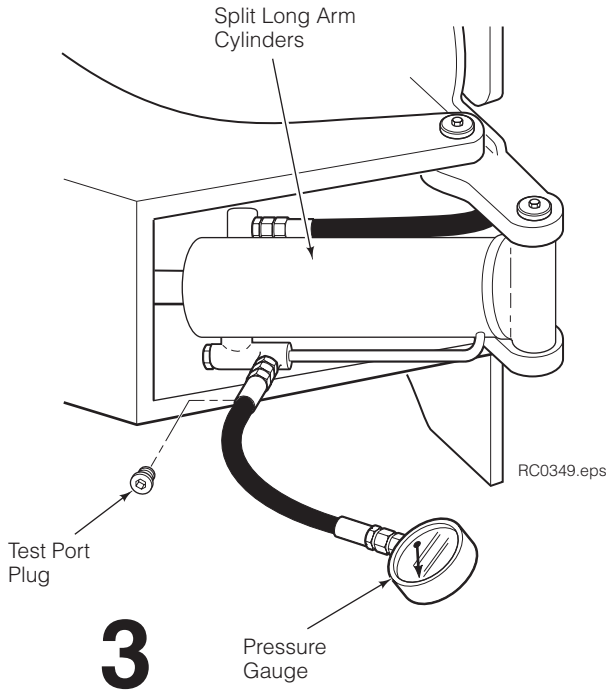
NOTE: 1 turn = approximately 400 psi (28 bar).

6 With the truck at half throttle, compare the clamped arm pressure with truck relief pressure. Adjust both relief cartridges equally using 1/8 steps. Verify unclamped arm moves freely after clamped arm stops and re-syncs freely upon opening.

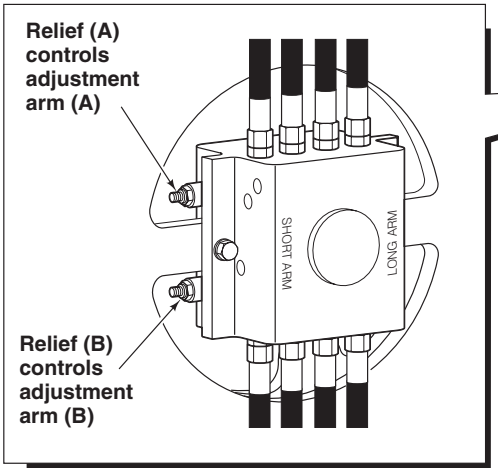
7 Adjust the clamped arm pressure to approximately 200 psi (14 bar) lower than truck relief pressure. If not possible, lower relief settings equally and test until system resets, then start Step 6 procedure again to maximize clamped arm pressure.

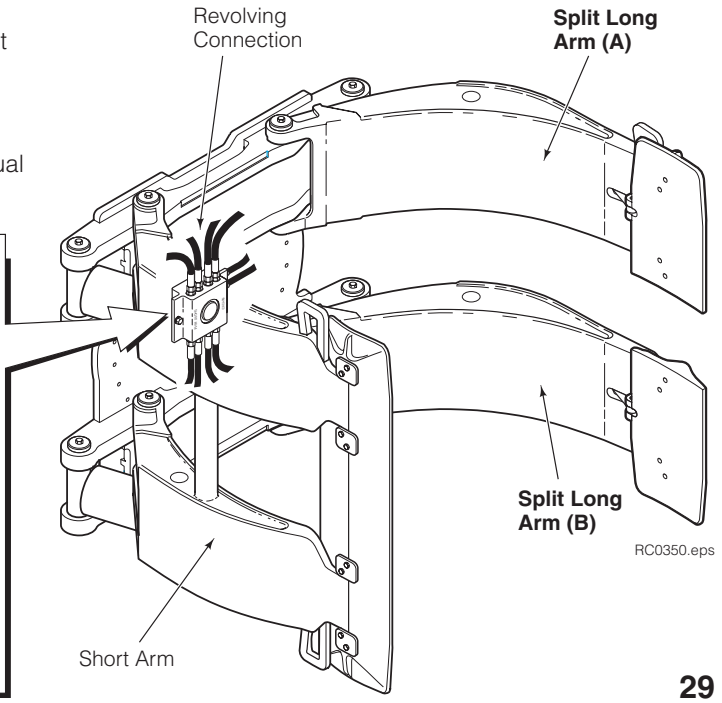
8 Verify that the clamp pressures are approximately equal (Step 5). Tighten jam nut on each relief cartridge.

> **WARNING**: Make sure all personnel are clear of the attachment during testing.



IMPORTANT: If truck is equipped with a 3 or 4-pressure selection valve, adjust split arm relief cartridges while pressure selection valve is at its lower supply setting.





4.6-4 Split Arm Sequence Pressure Adjustment (if required)

IMPORTANT: Revolving connection with sequence valve controlled split arm circuit (shown below) is factory-set and normally needs no adjustment. If required, adjust the sequence valve cartridge as follows:

1 Confirm that the truck relief setting is between 2000–2600 psi (140–160 bar).

WARNING: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

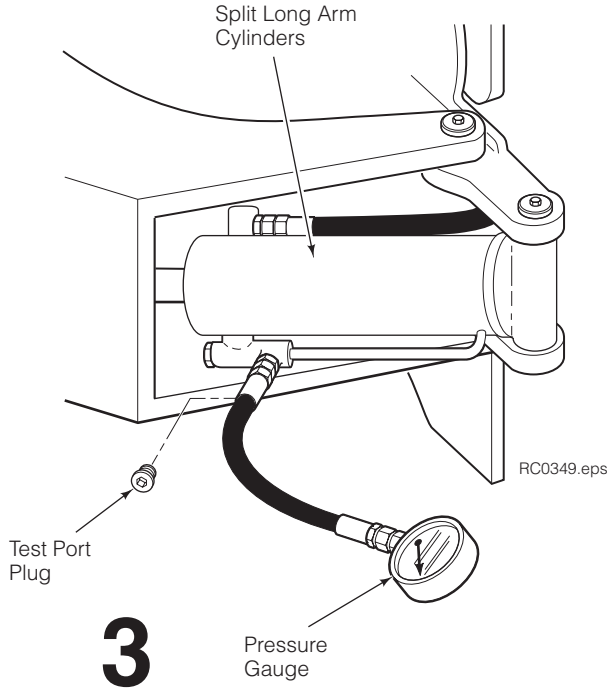
2 Rotate the attachment so the sequence valve cartridge is on top of the revolving connection for access.

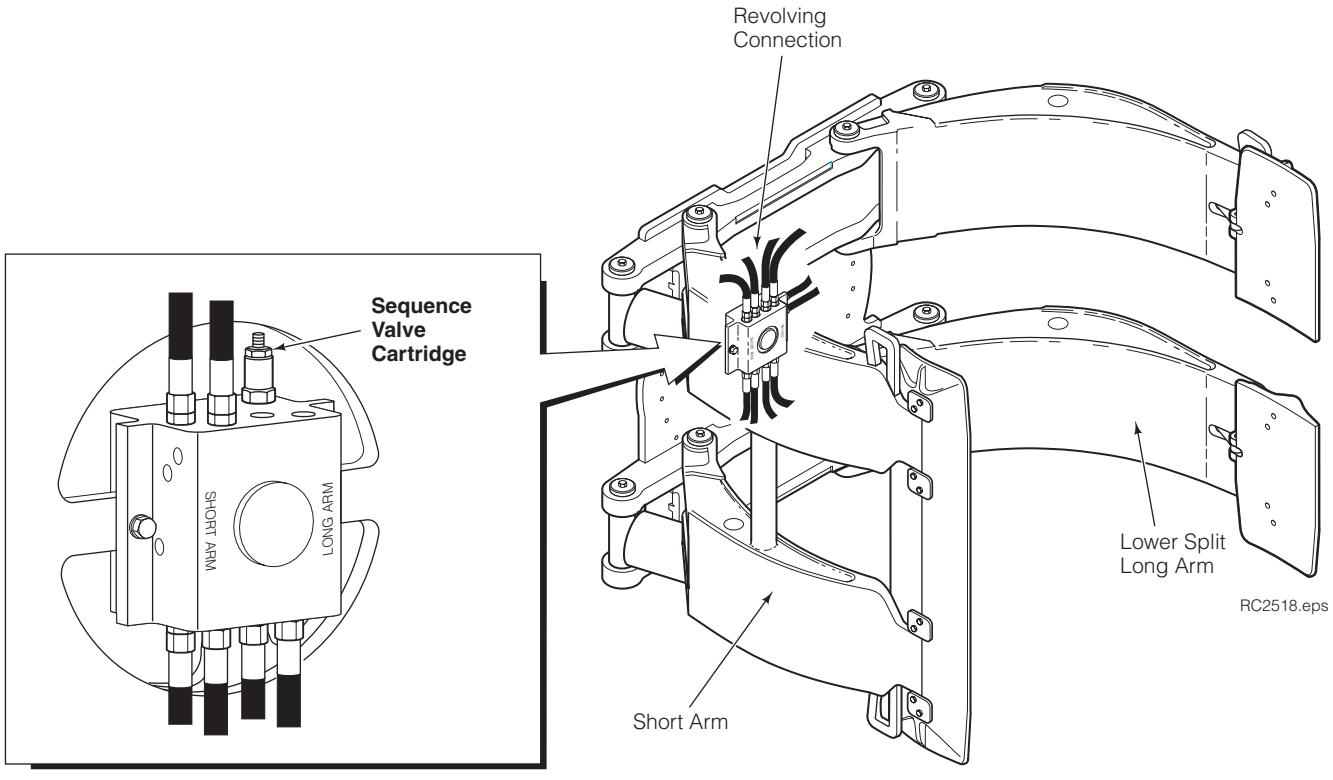
3 Connect a 5000 psi (345 bar) pressure gauge to the test port on the lower split arm (No. 4 O-ring fitting required).

4 Clamp a roll or clamp force indicator with lower arm while stopping the other arm slightly inside the roll diameter. The pressure gauge reading is the sequence valve setting.

5 Set the sequence valve pressure at least 100 psi (7 bar) below the truck relief setting. Turn the adjustment screw clockwise (CW) to increase pressure, counterclockwise (CCW) to decrease pressure. Tighten locknut.

WARNING: Make sure all personnel are clear of the attachment during testing.





4.7 Cylinders

4.7-1 Servicing Cylinders on the Attachment

1 Close the arm attached to the cylinder being serviced. Rotate the attachment to the vertical roll handling position.

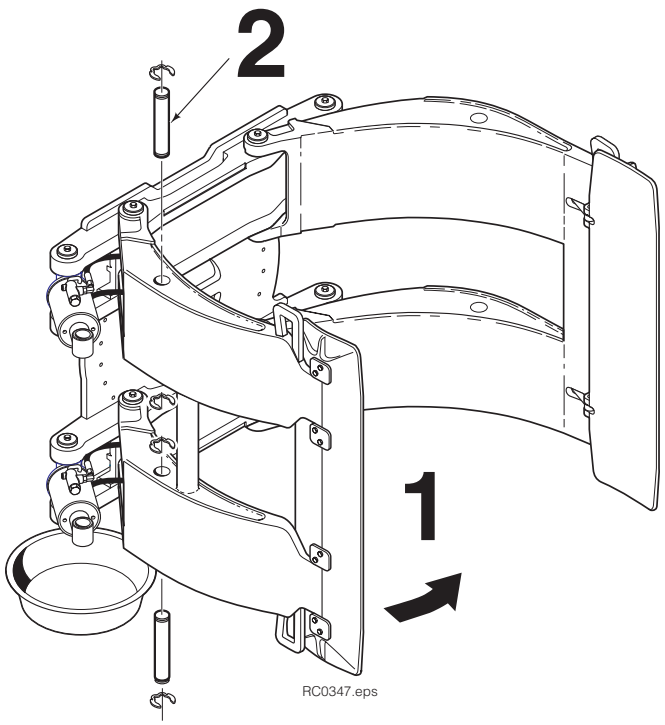
2 Remove the cylinder rod pivot pins from both cylinders.

3 Retract the cylinder rods. Swing the cylinder to be serviced outward to expose the cylinder rod and retainer.

> **WARNING**: Before servicing hydraulic components, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

4 Place a drip pan under the cylinder.

5 Service the cylinder as described in Section 4.8.



4.7-2 Cylinder Removal, Long or Short Arm

1 Position the arm attached to the cylinder being removed to mid-range. Rotate the attachment to the vertical roll handling position.

2 Remove the cylinder rod pivot pin from the cylinder to be removed.

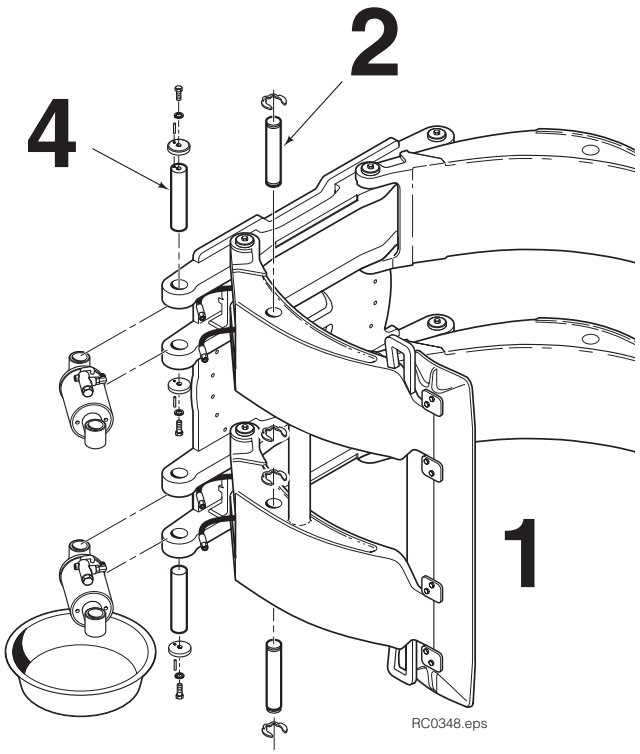
3 Swing the arm inward.

> **WARNING**: Before removing hydraulic hoses, relieve pressure in the hydraulic system. Turn truck off and open the truck auxiliary control valves several times in both directions.

4 Place a drip pan under the cylinder. Disconnect the hoses from the cylinder ports. Plug the hose ends and tag for reassembly.

5 Remove the cylinder base pivot pin. Not location of shims. For reassembly, tighten the pivot pin retainer capscrews to 35 ft.-lbs. (50 Nm).

6 Service the cylinder as described in Section 4.8.



4.7-3 Cylinder Check Valve Service

1 Rotate the attachment to the vertical roll handling position. Close the arm attached to the cylinder being serviced to gain access to the cylinder check valve.

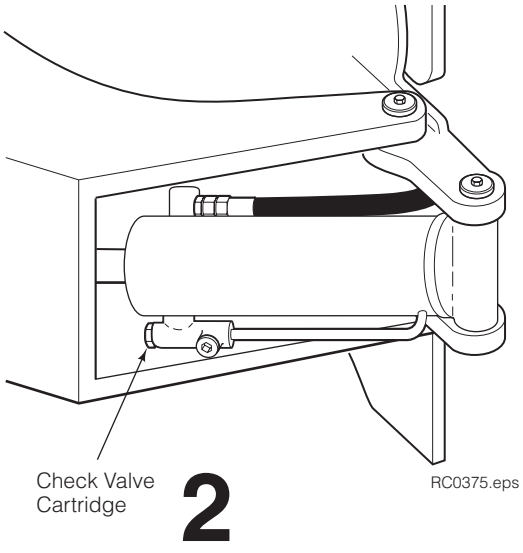
> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn truck off and open the truck auxiliary control valves several times in both directions.

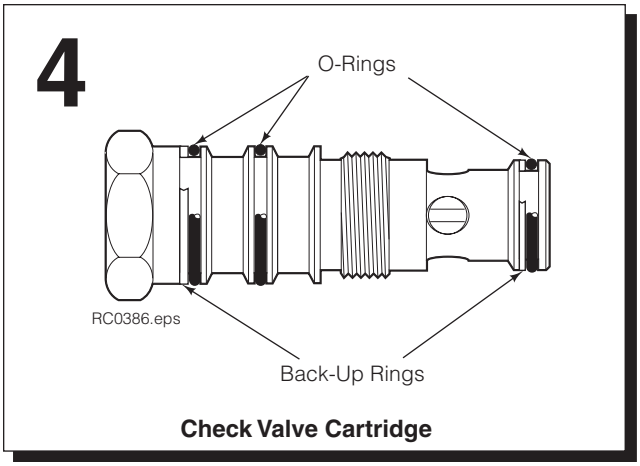
2 Remove the check valve cartridge from the cylinder port.

3 Remove the O-rings and back-up rings. Clean the check valve cartridge with solvent.

4 Install new O-rings and back-up rings as shown.

5 Lubricate the check valve cartridge with petroleum jelly prior to reassembly. Tighten the check valve cartridge to 35 ft.-lbs. (50 Nm).





Check Valve Cartridge

4.8 Cylinder Service

4.8-1 Cylinder Disassembly

1 Clamp the cylinder so that the vise jaws contact only the extreme end of the cylinder base.

NOTE: Use a soft-jawed vise for all cylinder disassembly and assembly procedures.

2 Remove the cylinder retainer by unscrewing it with a pin-type spanner wrench.

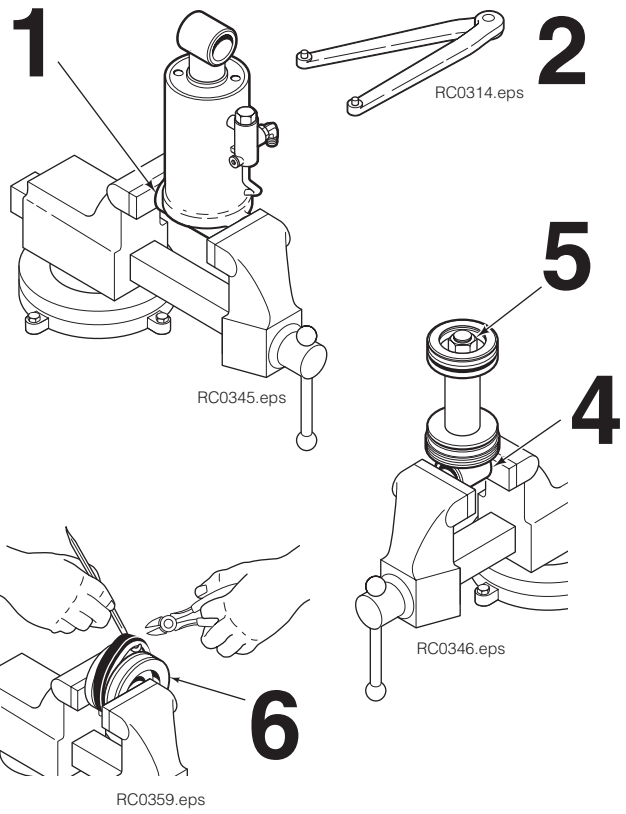
3 Remove the piston/rod/retainer as an assembly from the cylinder shell.

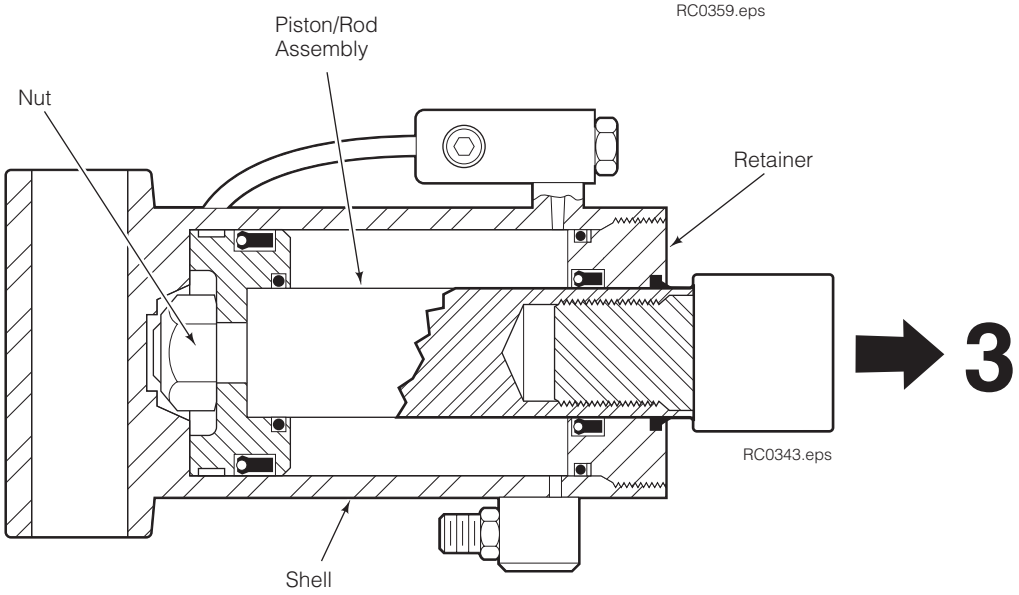
4 Clamp the piston/rod/retainer assembly across the rod end. **Never clamp directly on the rod sealing surface.**

5 Remove the nut from the piston/rod assembly.

6 Clamp the piston on the top and bottom in a soft-jawed vise. Pry seals up with a dental tool, cut and remove.

CAUTION: Do not scratch the seal grooves.





4.8-2 Cylinder Inspection

- Inspect the rod, piston and retainer for nicks and burrs. Minor nicks or burrs may be removed with emery cloth. If they cannot be removed, replace the part.
- Inspect the cylinder shell bore and remove any minor nicks or burrs with a butterfly. If the nicks or burrs cannot be removed, replace the part.
- Inspect the outside of the shell for any deformities or cuts that could impair performance or cause leaks under pressure. If necessary, replace the part.

4.8-3 Cylinder Reassembly

1 Lubricate all new seals and O-rings with petroleum jelly.

2 Note the direction of the U-cup seals. **Pressure seals must always be installed with the lip toward the high pressure side of the cylinder.**

3 Polish the piston and retainer chamfer angle with emery cloth to facilitate seal installation.

4 Install new seals on the piston and retainer. Hook one side of the seal in the groove and carefully work it over the piston or retainer, as shown.

5 Install the retainer and then the piston on the cylinder rod. Tighten the piston retaining nut to the following torque value:

50G, 60G, 66G, 72G – 330 ft-lbs. (440 Nm)

6 Place the piston loader furnished with the seal kit into the cylinder shell. The loader should cover all the cylinder shell threads but not contact the thread relief chamfer. Trim the loader stop fins if more engagement is needed.

CAUTION: The piston will not enter the cylinder shell properly if the loader contacts the thread relief chamfer.

7 Apply a thick film of petroleum jelly on the inside of the cylinder shell, piston loader and piston seals.

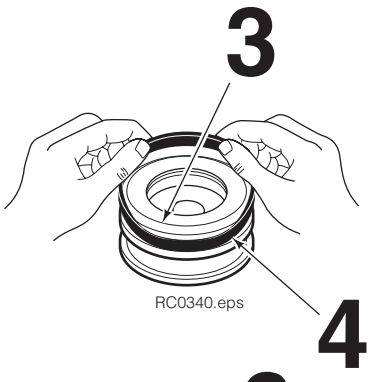
8 Using a rubber mallet, tap the piston/rod assembly through the loader into the cylinder shell.

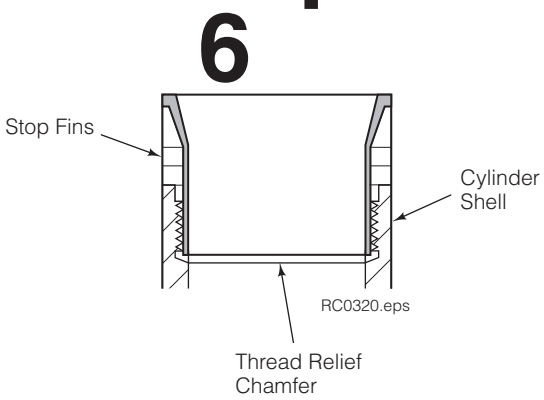
9 Remove the loader by cutting down one side and pulling it out of the cylinder bore.

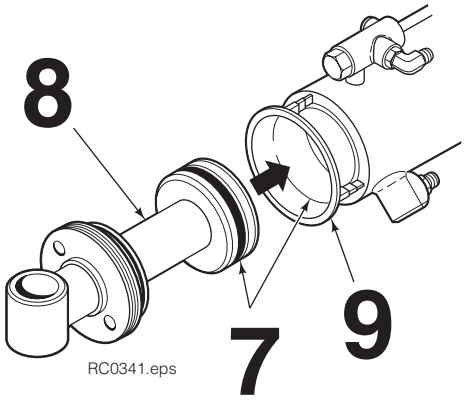
10 Apply a thick film of petroleum jelly to the inside of the cylinder shell, retainer and seal.

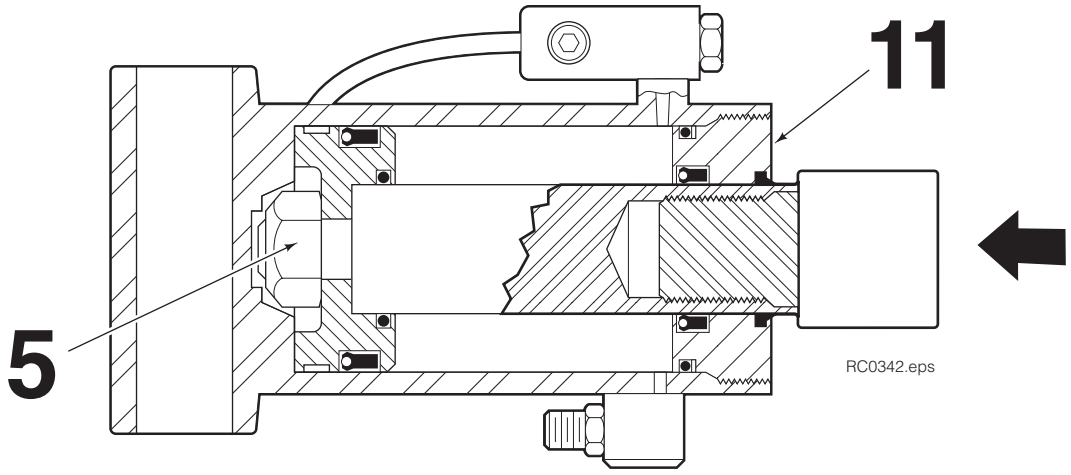
11 Screw the retainer into the cylinder shell. Tighten the retainer to the following torque value:

50G, 60G, 66G 72G – 400 ft.-lbs. (540 Nm)









4.9 Base Unit

4.9-1 Frame Bushing Service

1 Remove the arms from the attachment as described in Section 4.2-1.

2 Remove the cylinder pivot bushings, quantity 8, from the frame using a bushing driver.

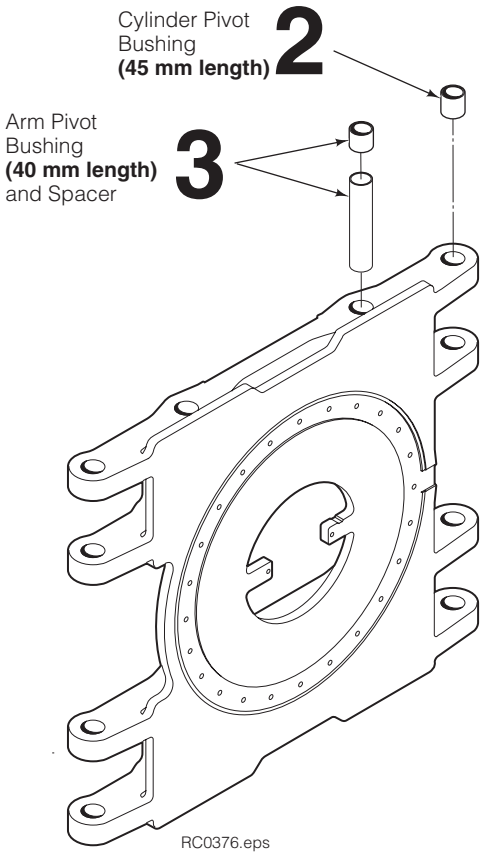
3 Remove the arm pivot bushings, quantity 8, from the frame using a bushing driver.

NOTE: Bushing drivers can be machined using the dimensions shown in the chart below.

4 For reassembly, reverse the above procedures with the following exceptions:

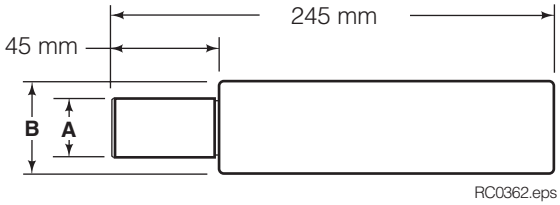
- Install the new cylinder pivot bushings, 45 mm length.
- Install new arm pivot bushings, 40 mm length, and spacer.

CAUTION: Bushings may be damaged if installed without a proper bushing driver.



Bushing Driver Dimensions

	A Bushing ID	B Driver OD
50G, 60G, 66G, 72G	39.8 mm	44.5 mm



4.9-2 Rotation Bearing Assembly – Capscrew Torque Inspection

500-Hour Inspection

Every 500 Hours, perform the following inspection:

1 Check the accessible baseplate capscrews above the upper mounting hooks for an intial torque of:

50G, 60G, 66G, 72G – 75 ft.-lbs. (105 Nm)

Tighten capscrews to 10 ft.-lbs. (14 Nm) above initial torque. Mark each capscrew after checking.

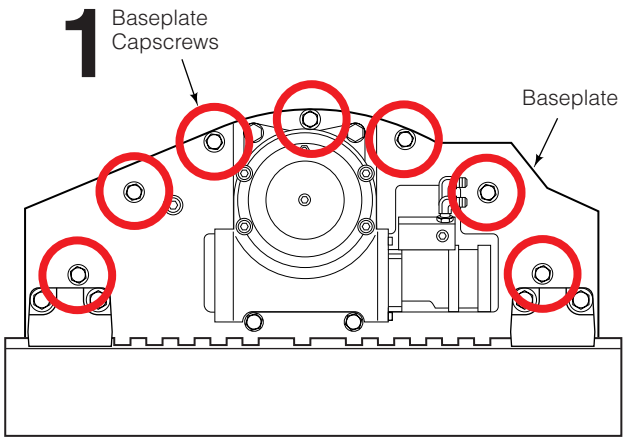
- If any baseplate capscrews are loose, rotate or broken, replace all baseplate capscrews as described in Section 4.9-3.
- If capscrews do not rotate, continue with bearing capscrew inspection in Step 2.

2 Remove the access plug from the back of the baseplate and rotate the attachment to the vertical roll handling position. Check three capscrews closest tot he access hole for an initial torque of:

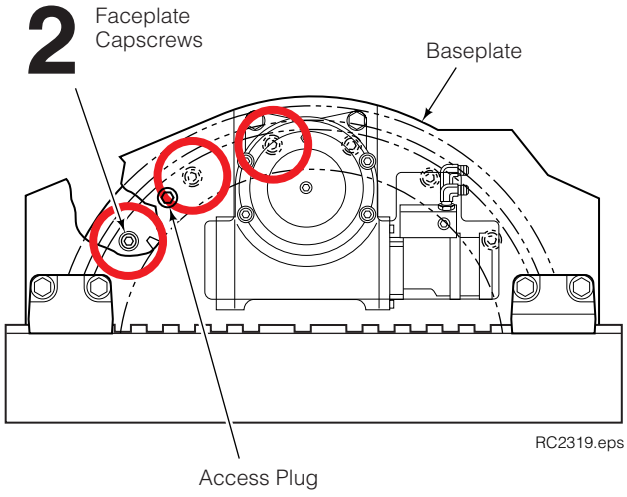
50G – 100 ft.-lbs. (135 Nm)
60G, 66G, 72G – 80 ft.-lbs. (110 Nm)

Tighten capscrews to 10 ft.-lbs. (14 Nm) above initial torque. Mark each capscrew after checking.

- If any bearing capscrews are loose, rotate or broken, replace all bearing capscrews as described in Section 4.9-3.
- If capscrews do not rotate, inspection is complete.



RC2320.eps



RC2319.eps

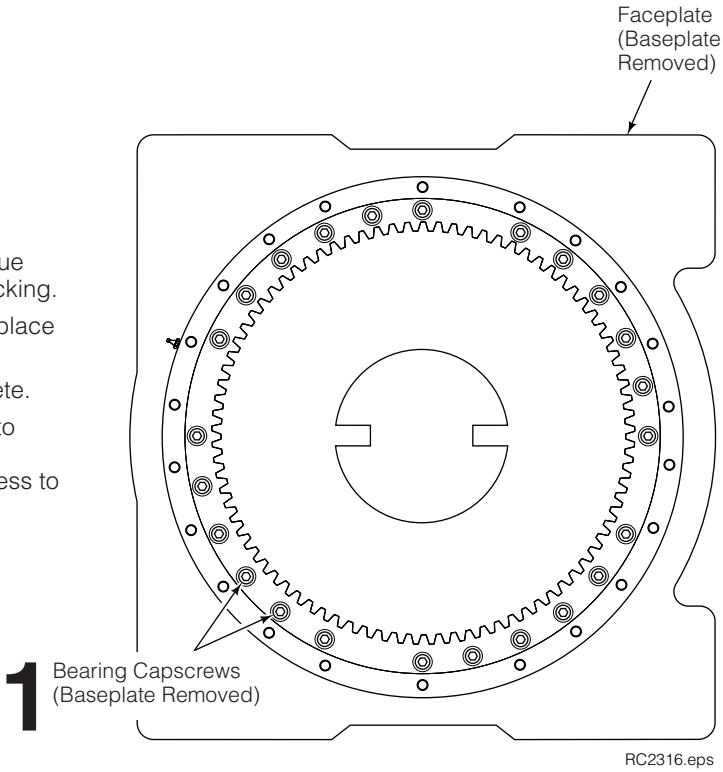
2000-Hour Inspection

Every 2000 Hours, perform the following inspection:

1 Check **all** baseplate and bearing capscrews and tighten until torque is 10 ft-lbs. (14 Nm) above torque value listed above. Mark each capscrew after checking.

- If any capscrews are loose, rotate or broken, replace all capscrews as described in Section 4.9-3.
- If capscrews do not rotate, inspection is complete.

NOTE: The attachment must be removed from truck to provide access to all baseplate capscrews. Remove baseplate (shown) or use access hole to provide access to all bearing capscrews. Refer to Section 4.9-3.



RC2316.eps

4.9-3 Rotating Bearing Assembly – Removal and Installation

1 Remove the attachment from the lift truck as described in Section 4.1.

2 Remove the drive group as described in Section 4.3-1.

3 Remove the upper mounting hooks. For reassembly, tighten the capscrews to 125 ft.-lbs. (165 Nm).

4 Remove the retainer yoke. For reassembly, tighten the capscrew to 30 ft.-lbs. (40 Nm).

5 **Baseplate Capscrews –** Remove the capscrews fastening the baseplate to the bearing assembly. For reassembly, tighten the capscrews using the following technique:

> **WARNING**: Install short capscrews in counterbored holes only. Use lockwashers if supplied in kit.

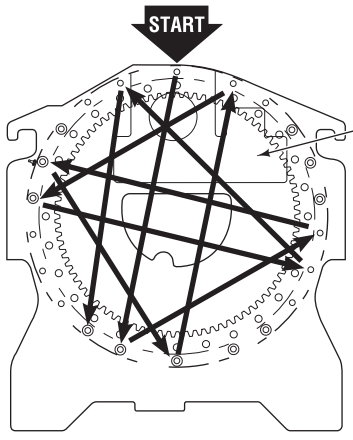
A) Clean and dry capscrews and bearing threaded holes. Apply Loctite 242 (blue) to capscrews.

B) Tighten using the alternating cross-pattern shown to one-half the final torque value shown below.

C) Tighten using the alternating cross-pattern to the final torque value, the double torque by backing of 1/2 turn and immediately retightening to the final torque value shown below:

50G, 60G, 66G, 72G – 75 ft.-lbs. (105 Nm)

CAUTION: Do not reuse old capscrews or washers. Use new hardware kit when installing a new bearing assembly.

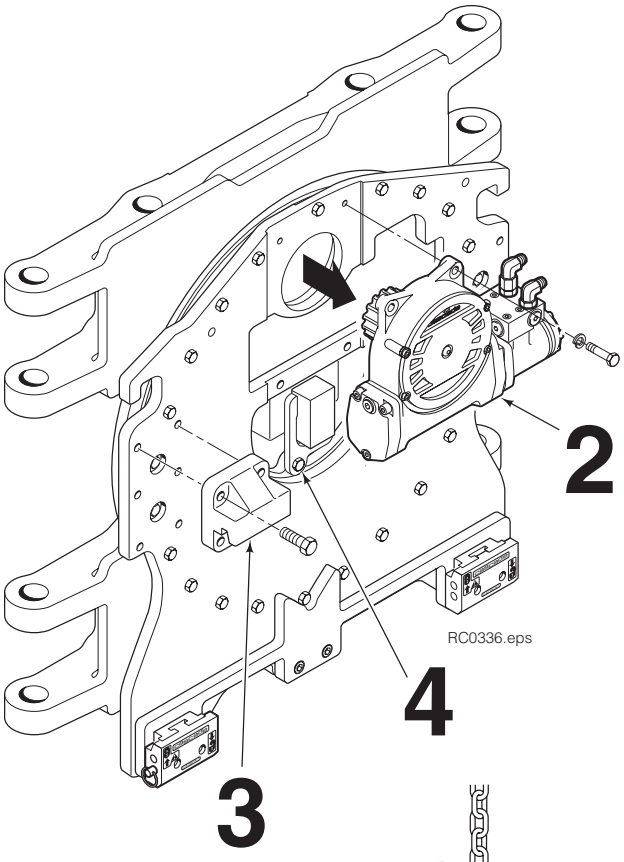


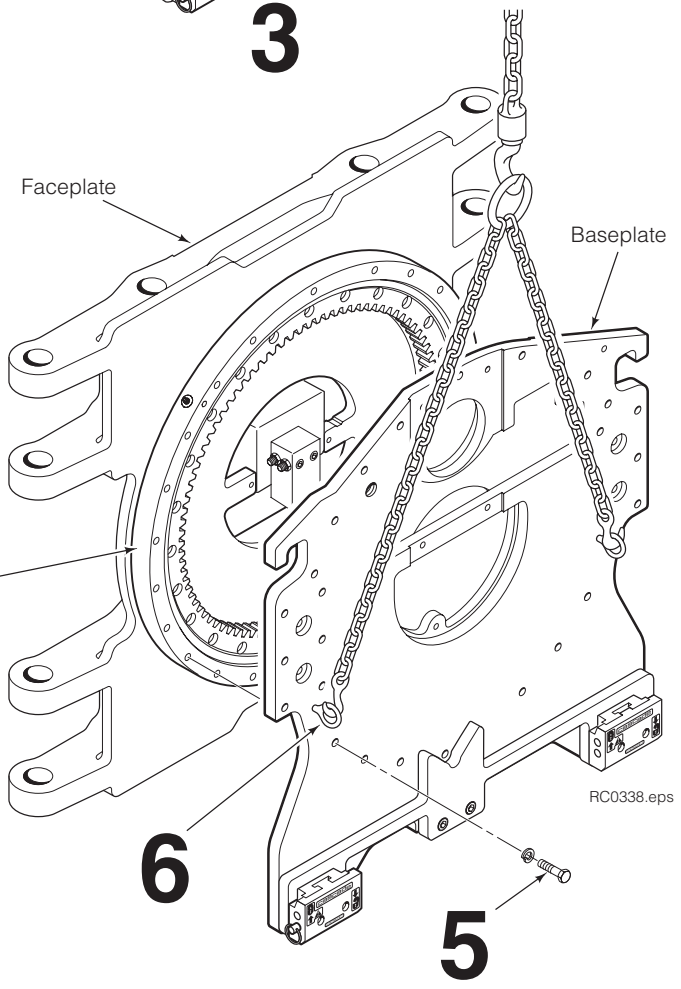
NOTE: If equipped, remove center lower mounting spacer to gain access to rotation bearing capscrews. For reassembly, tighten capscrews to:

50G, 60G, 66G, 72G – 15 ft.-lbs. (20 Nm)

> **WARNING**: Verify that the overhead hoist and chains or straps are rated for the weight of the attachment. Refer to nameplate for attachment weight.

6 Attach two eyebolts to the baseplate. Attach an overhead hoist and lift the baseplate away from the faceplate/bearing assembly.





4.9-3 Rotation Bearing Assembly – Removal and Installation (Continued)

7 **Faceplate Capscrews –** Removed the capscrews fastening the bearing assembly to the faceplate. For reassembly, apply threadlocker and tighten the capscrews using the following technique:

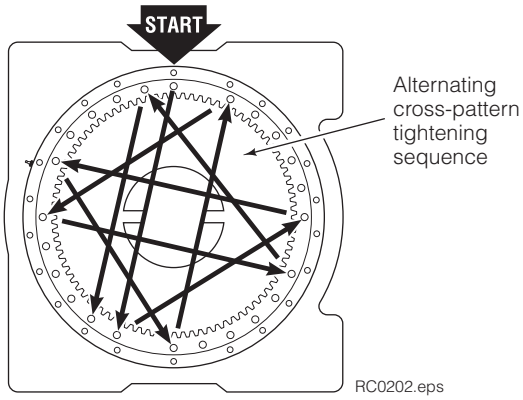
A) Clean and dry capscrews and threaded holes in the faceplate. Apply Loctite 242 (blue) to capscrews.

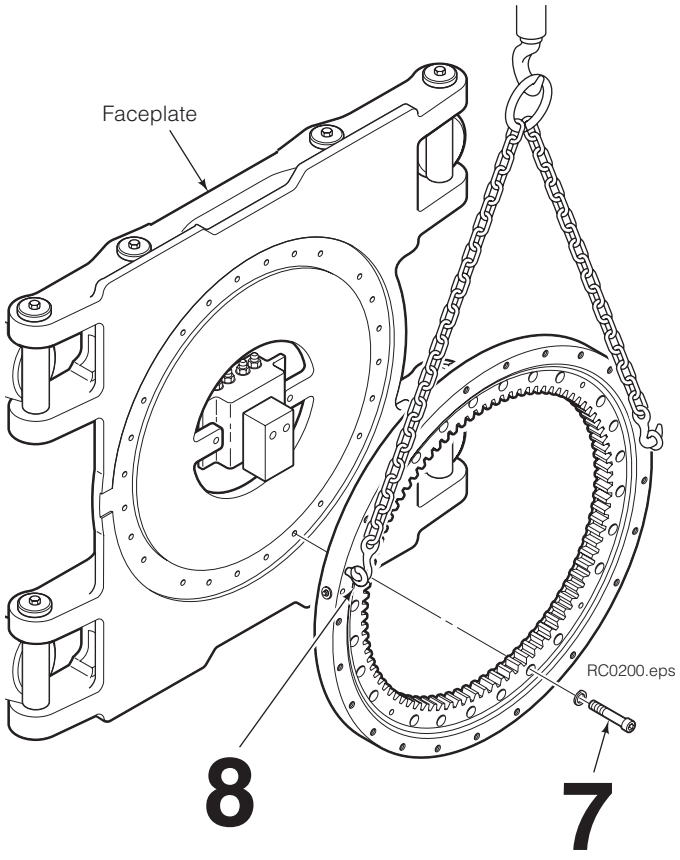
B) Tighten using the alternating cross-pattern shown to one-half the final torque value below.

C) Tighten using the alternating cross-pattern to the final torque value, then double-torque by backing off 1/2 turn and immediately retightening to the final torque value shown below:

50G – 100 ft.-lbs. (135 Nm)
60G, 66G, 72G – 80 ft.-lbs. (110 Nm)

CAUTION: Do not reuse old capscrews or washers. Use new hardware kit when installing a new bearing assembly.





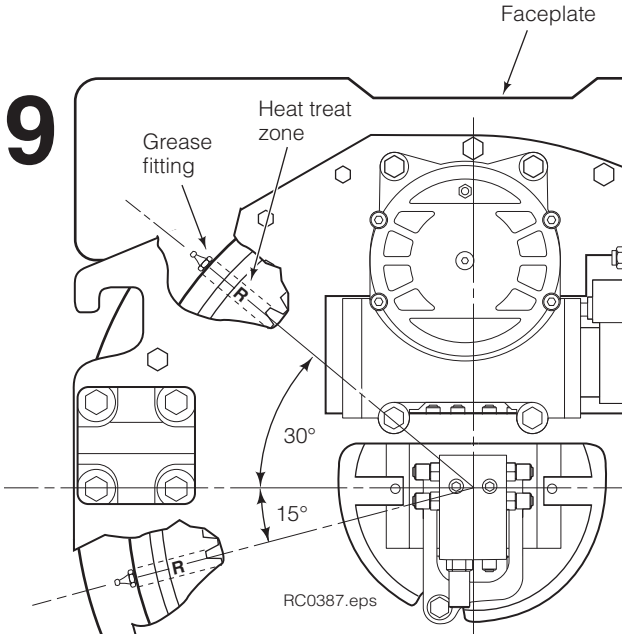
8 Attach two eyebolts to the bearing assembly as shown. Attach an overhead hoist and lift the bearing assembly away from the faceplate.

9 For reassembly, reverse the above procedures with the following exceptions:

- When installing the rotation bearing assembly on the faceplate, align and position the heat treated overlap zone 'R' on the ring gear with the outer race grease fitting as shown.

  50G, 60G – 30° above horizontal
  66G, 72G – 15° below horizontal

- Check the condition of the faceplate center hole seal. Replace if necessary,
- Apply NGLI No. 0 grease to the teeth of the bearing assembly ring gear.
- After remounting the attachment, apply chassis grease to the bearing assembly grease fitting. Rotate the attachment slowly during the procedure.



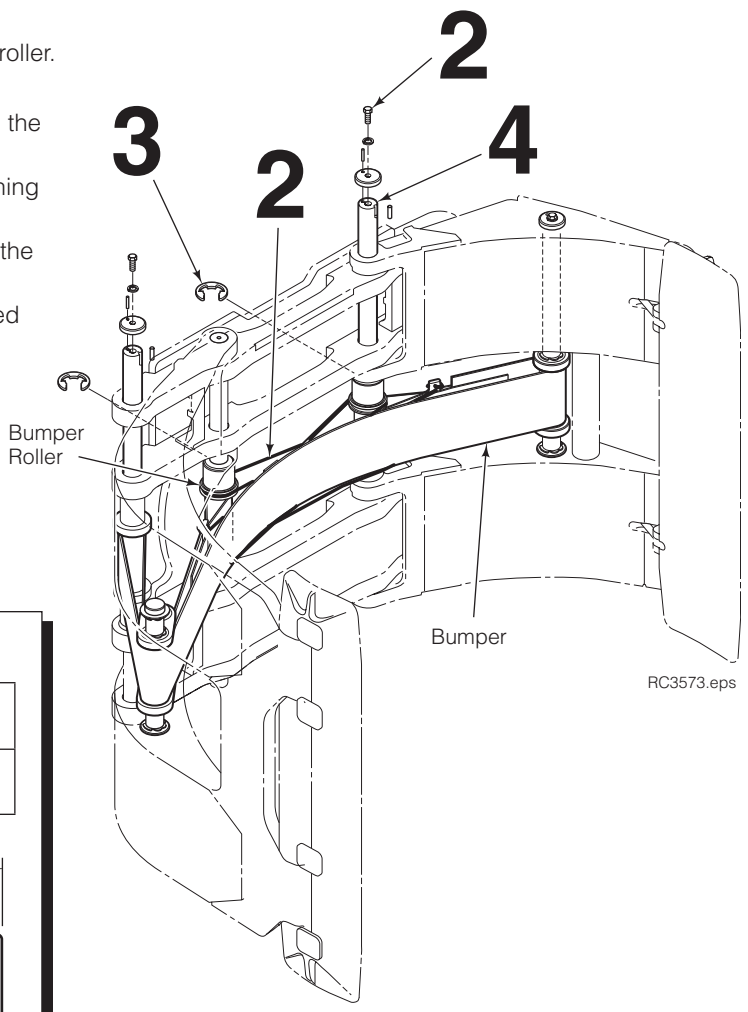
Back (Driver's) View

4.9-4 Adjustable Bumper Service

1. Rotate the attachment to vertical roll handling position. Raise approximately 2 feet (60 cm) off the ground.
2. To release bumper tension, remove bands from their retainers and unwind from rollers.
3. Remove retainer circlips from the cylinder rods.
4. Remove top and bottom capscrews from arm pivot pins. For reassembly, tighten arm pivot pin capscrews to 35 ft.-lbs. (48 Nm).
5. Pull pivot pins out of engagement with the bumper roller. Remove belt loops from rollers.
6. For reassembly, reverse the above procedures with the following exceptions:
   - Install new bushings into the rollers using a bushing driver.

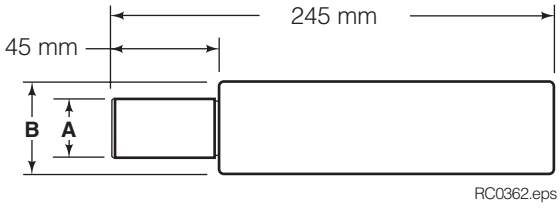
     NOTE: Bushing drivers can be machined using the dimensions shown in the table.

     CAUTION: Bushings may be damaged if installed without a proper bushing driver.
   - Refer to 4.9-5 for elastic band replacement.



Bushing Driver Dimensions

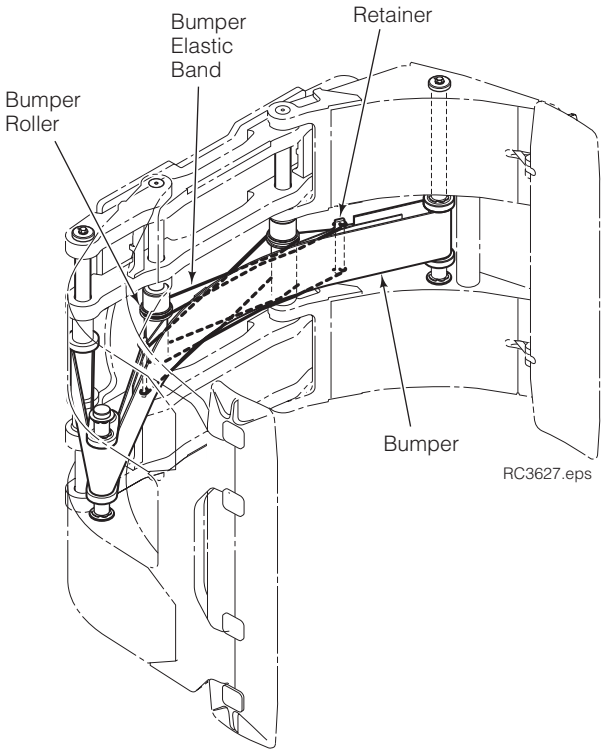
	A Bushing ID	B Driver OD
60G, 66G, 72G	39.8 mm	44.5 mm

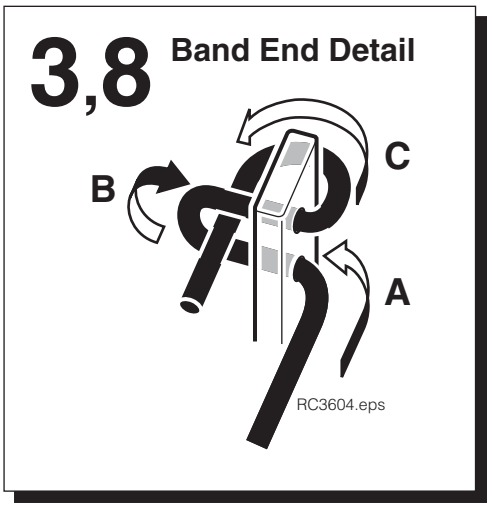


4.9-5 Bumper Elastic Band Service

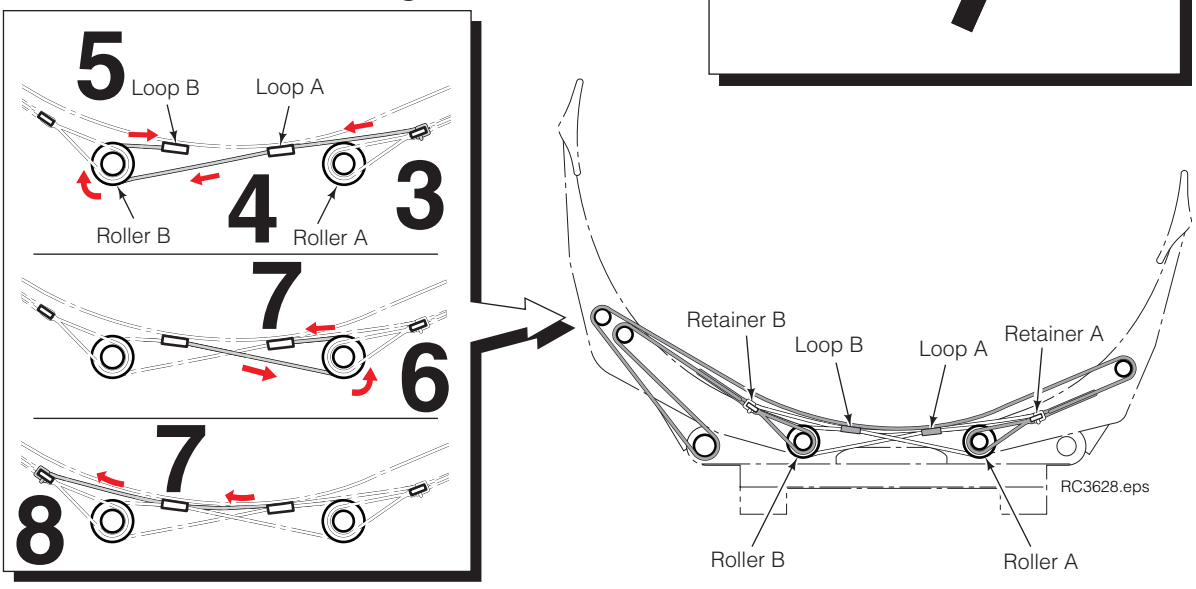
This service replaces old elastic bands with new ones. Refer to service kit 219060.

1. Rotate the attachment to vertical roll handling position. Raise approximately 2 feet (60 cm) off the ground.
2. To release bumper tension, remove bands from their retainers and unwind from rollers.
3. Attach new elastic band to *Retainer A* (short arm). See band end detail.
4. Thread the loose end of elastic band through *Loop A*, to back side of *Roller B* then around to front side.
5. Thread through *Loop B*.
6. Thread elastic band to back side of *Roller A* then around to front side.
7. Thread band through *Loop A* and then through *Loop B*.
8. Terminate band at *Retainer B*. See band end detail.
9. Repeat step 3 through 8 for second elastic band.
10. Tension both bands equally and tighten so that the belt does not sag when arms are in a full open position.
11. Tape band ends 2-3 in. (50-75 mm) to prevent outer fabric from fraying. Trim excess.





Elastic Band Threading

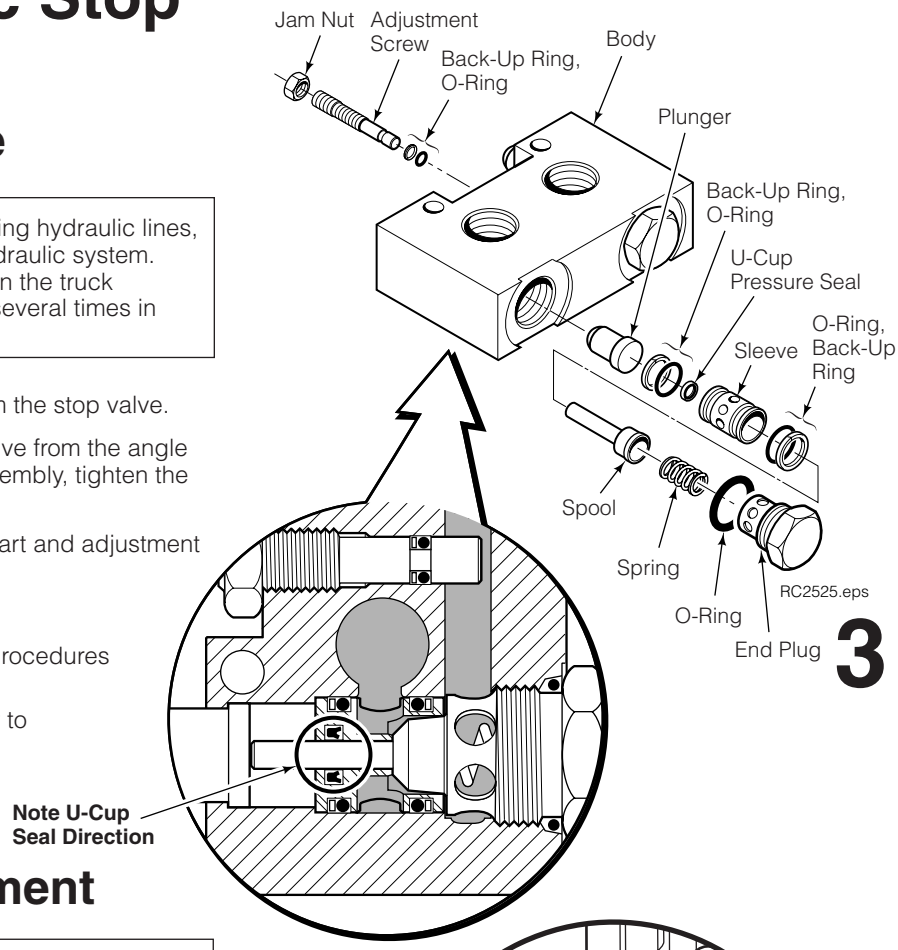


4.10 180° Hydraulic Stop Group

4.10-1 Stop Valve Service

> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valve(s) several times in both directions.

1. Disconnect the hydraulic tubing from the stop valve.
2. Remove the capscrews and stop valve from the angle bracket on the baseplate. For reassembly, tighten the capscrews to 15 ft.-lbs. (20 Nm).
3. Remove the end plugs, all internal part and adjustment screw from the valve body.
4. Clean all parts with clean solvent.
5. For reassembly, reverse the above procedures with the following exceptions:
   - Replace seals and O-rings. Refer to cross-section.
   - If required, adjust stop valve.



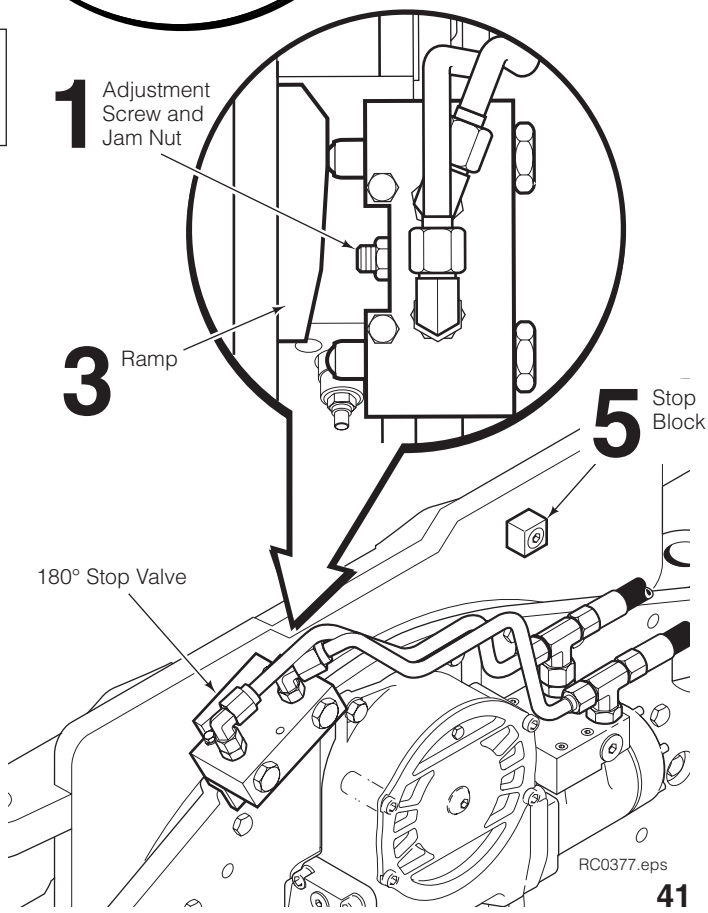
4.10-2 Stop Valve Adjustment

> **WARNING**: Make sure all personnel are clear of the attachment during adjustment.

1. Loosen the jam nut on the stop valve adjustment screw and turn the screw OUT (counterclockwise) until a groove marking the maximum-out position is visible.

   NOTE: Early model valves have two adjustment screws which should be adjusted equally.

   CAUTION: Backing the adjustment screw out past the groove will cause hydraulic leakage.
2. Using a load that: A) is the heaviest to be lifter, or B) requires maximum motor torque, rotate the attachment back and forth to the stops at full speed for 1 to 2 minutes before making adjustments. Note whether the attachment fully completes its rotation slowly into the hard stop.
3. If rotation does not continue into the hard stop, rotate the stop valve off the ramp and turn the adjustment screw IN (clockwise) one-quarter turn. Test for complete rotation slowly into the hard stop.
4. Repeat Step 3 until the attachment fully completes its rotation slowly into the hard stop. Tighten the jam nut on the adjustment screw.
5. Check the torque on the stop block capscrews and tighten to 400 ft.-lbs. (540 Nm) if necessary.



4.11 Electronic Rotational Control (ERC)

4.11-1 Stop Valve Service

> **WARNING**: Before removing hydraulic lines, relieve pressure in the hydraulic system. Turn the truck off and open the truck auxiliary control valves several times in both directions.

1 Disconnect the ROTATE hydraulic hoses from the stop valve fittings and tag for reassembly.

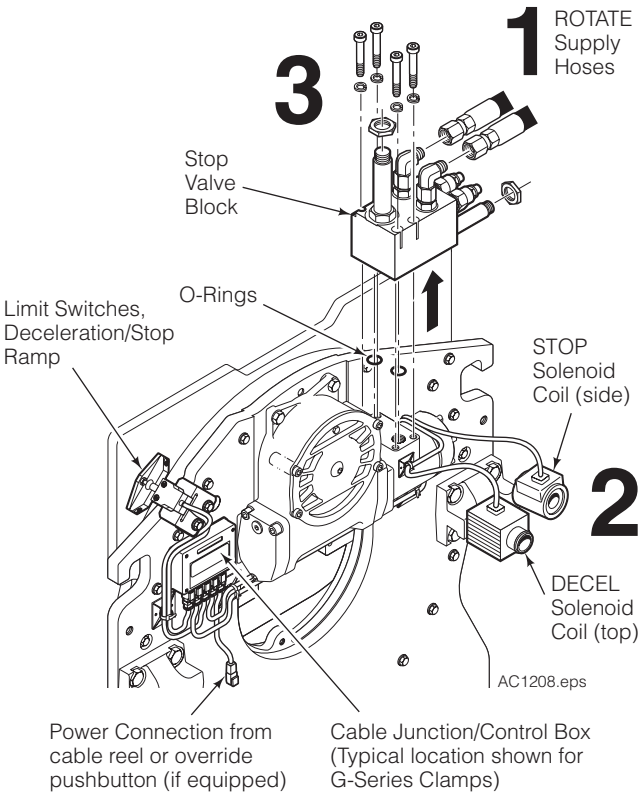
2 Remove the solenoid coils by unscrewing the mounting nut and sliding the coil off the valve cartridge. For reassembly, tighten the nut lightly to 5 ft.-lbs. (7 Nm).

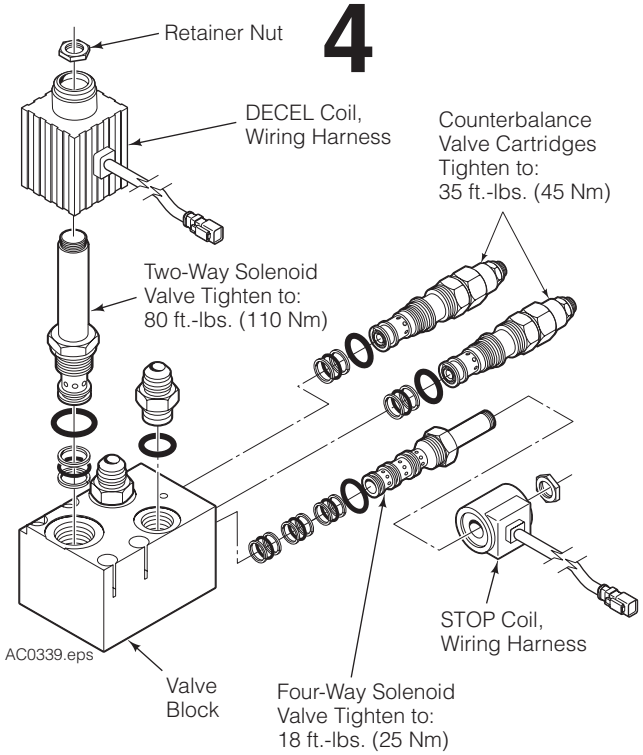
3 Remove the four capscrews and remove the stop valve block from the rotator drive assembly. Keep track of the two O-rings. For reassembly, tighten the capscrews to 35 ft.-lbs. (50 Nm).

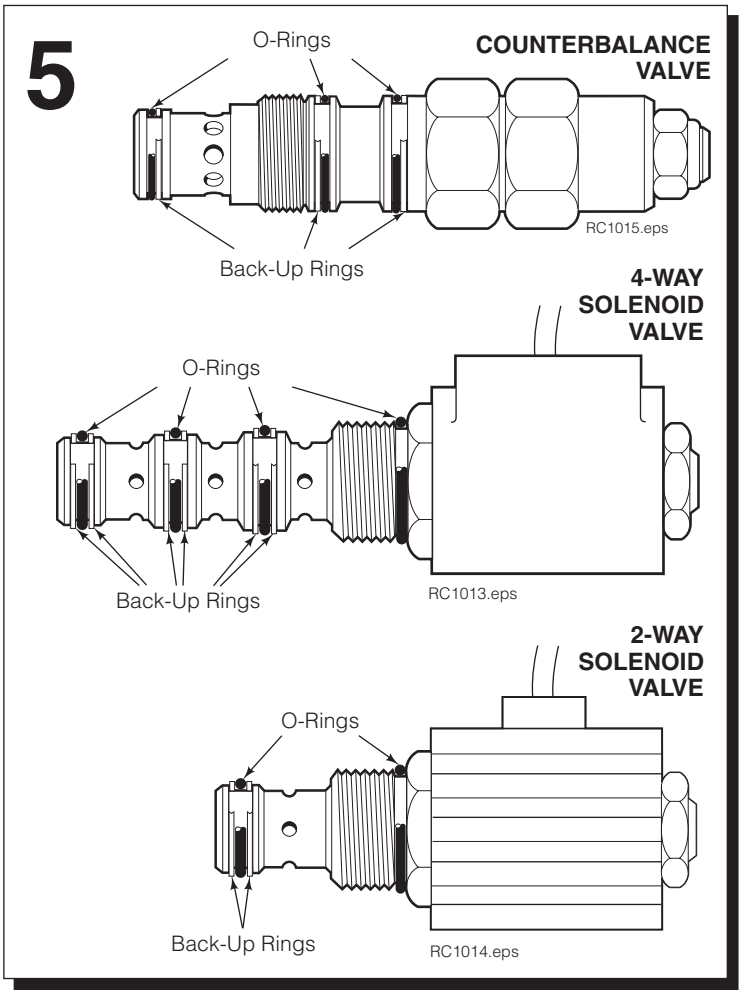
4 Service the valve in a clean work area. Remove the solenoid and cartridge valves. Remove all fittings from the valve block. Clean all parts with solvent.

5 For reassembly, reverse the above procedures with the following exceptions:

- Install new O-rings and back-up rings on cartridge valves and valve block as shown.
- For complete installation procedures refer to Electronic Rotational Control Installation Instructions 6048228.







4.11-2 Stop Position Adjustment

1 Rotate attachment in each direction and verify that the attachment stops in vertical and horizontal (bilge) positions.

- If rotation **does not stop** at vertical and bilge positions, proceed to Troubleshooting, Section 4.11-3.
- If rotation **stops** at vertical and bilge positions, proceed to Step 2.

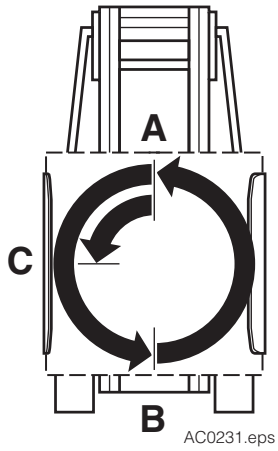
2 Wait 3 seconds and rotate attachment again, verifying rotation stops in the vertical and bilge positions.

3 Press and hold override pushbutton, if equipped. Verify attachment rotates continuously without stopping.

- If continuous rotation does not occur when holding pushbutton, proceed to Troubleshooting, Section 4.11-3.
- If **stop position is not exact**, proceed to Step 4.

4 Inspect limit switch end rollers for full engagement on deceleration ramps with stop capscrews (early) or deceleration/stop ramps (late).

To precisely locate the stop position within ±0.5 in. (13 mm), ramps may be adjusted radially via their slotted mountings, and stop capscrews may be raised or lowered. Refer to illustrations.

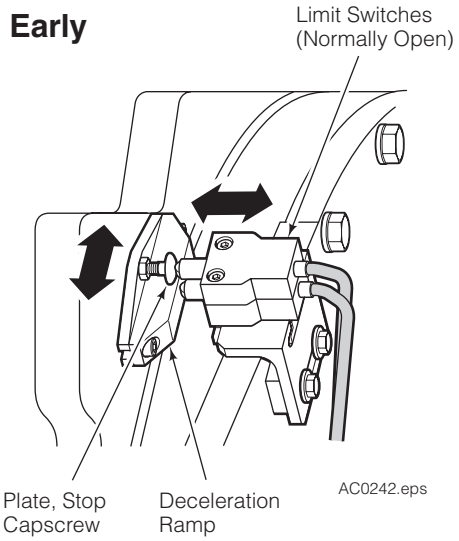


Rotational Control stops attachment at vertical positions **A** top, **B** bottom and **C** bilge position.

To continue rotation after stopping, wait 3 seconds, **OR** press override button (Normally Closed)

For continuous rotation, press and hold button.

Early



4.11-3 Troubleshooting

NOTE: Refer to schematic on following page.

1 Check ERC main power fuse/relay. Verify truck voltage is reaching ERC control box when truck key is turned on.

NOTE: Pushbutton circuit (if equipped) provides power to ERC and is normally closed (NC).

2 Inspect all electrical cables. Look for and correct loose connections, pinched wiring, or wrongly-connected cables.

NOTE: Cable connector and control box are labeled to show proper connections.

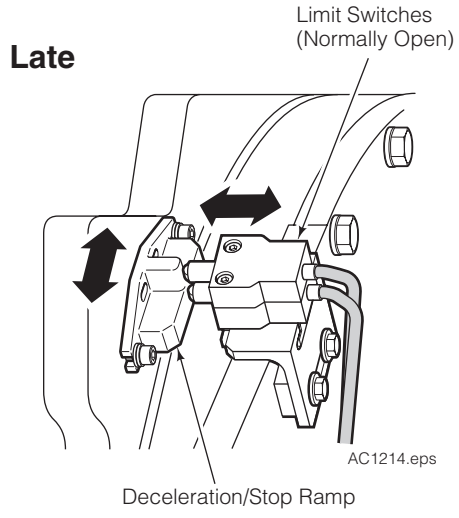
3 Check continuity of solenoid/cable assemblies and limit switch/cable assemblies. Replace if needed.

4 With truck key on, manually operate limit switches. Listen for 'clicks' at solenoids, indicating solenoid coil operation. Or, rotate attachment into ramps and check for voltage at control box solenoid output connectors.

5 Look for 3 second time delay between rotation deceleration and ability to restart rotation. If there is no delay, or attachment will not rotate continuously with pushbutton depressed, replace ERC control box.

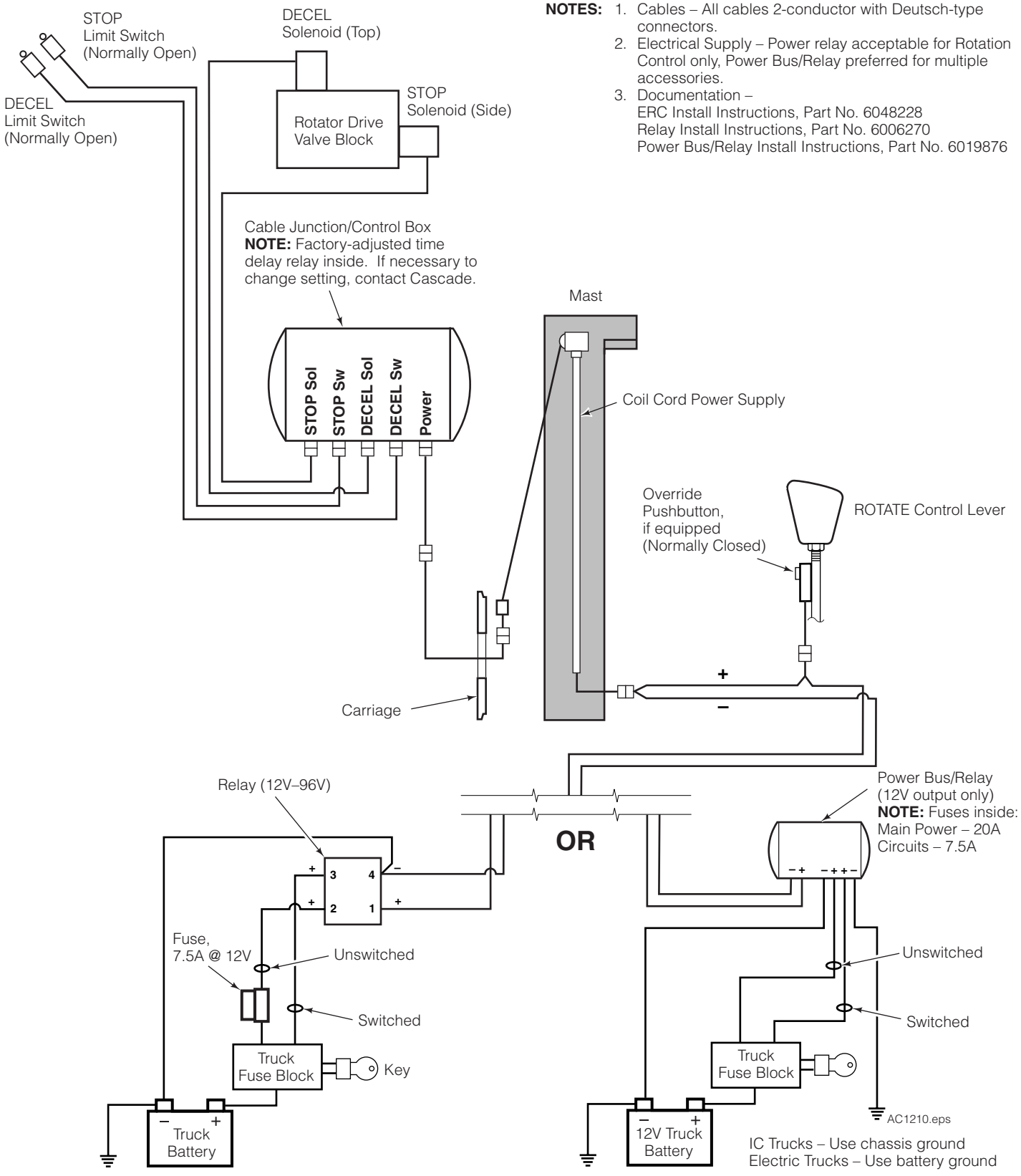
NOTE: The control box contains factory-set time delay. Contact Cascade for adjustment procedure.

Late



4.11-3 Troubleshooting (Continued)

Rotational Control Electrical Hookup



NOTES:
1. Cables – All cables 2-conductor with Deutsch-type connectors.
2. Electrical Supply – Power relay acceptable for Rotation Control only, Power Bus/Relay preferred for multiple accessories.
3. Documentation –
   ERC Install Instructions, Part No. 6048228
   Relay Install Instructions, Part No. 6006270
   Power Bus/Relay Install Instructions, Part No. 6019876

4.12 Solenoid Valve

4.12-1 Coil Service

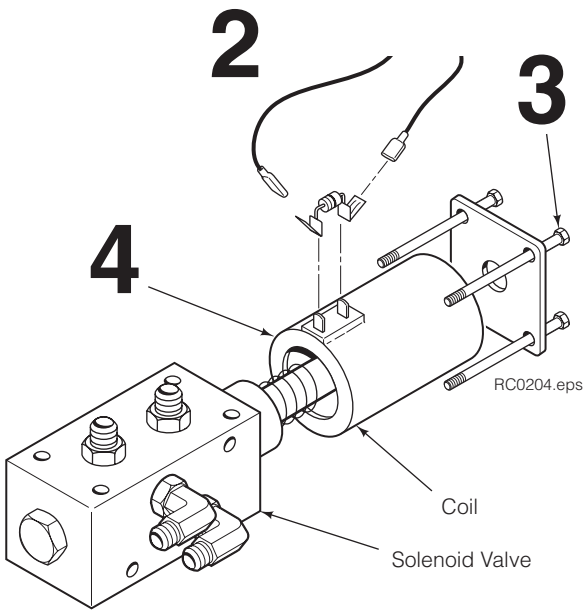
1 Disconnect the wires and diode from the coil terminals.

2 Remove the end cover capscrews and remove the end cover and coil. Note the position of the coil terminals.

3 Install the new coil and end cover. Check that the terminals are positioned correctly.

4 For reassembly, reverse the above procedures except as follows:

- Refer to electrical schematic in Section 3.5 for correct wire and diode installation.



4.12-2 Valve Service

- Check the plunger within the valve body for freedom of movement. Press end button on coil to verify that valve is not jammed or damaged. If problems are found, replace solenoid valve as a complete assembly.

6.1 Specifications

6.1-1 Hydraulics

Truck Relief Setting

2300 psi (160 bar) Recommended
2600 psi (180 bar) Maximum

Truck Flow Volume ①

	Min. ②	Recommended	Max. ③
50G, 60G, 66G, 72G	5 GPM (18 L/min.)	10 GPM (37 L/min.)	15 GPM (56 L/min.)

① Cascade Roll Clamps are compatible with SAE 10W petroleum base hydraulic fluid meeting Mil. Spec. MIL-0-5606 or MIL-0-2104B. Use of synthetic or aqueous base hydraulic fluid is not recommended. If fire resistant hydraulic fluid is required, special seals must be used. Contact Cascade.

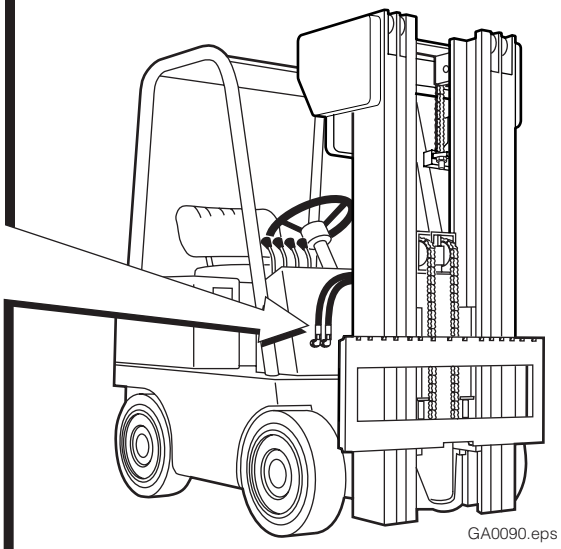
② Flow less than recommended will result in a rotate speed less than 2 RPM.

③ Flow greater than maximum can result in excessive heating, reduced system performance and short hydraulic system life.

Hoses and Fittings

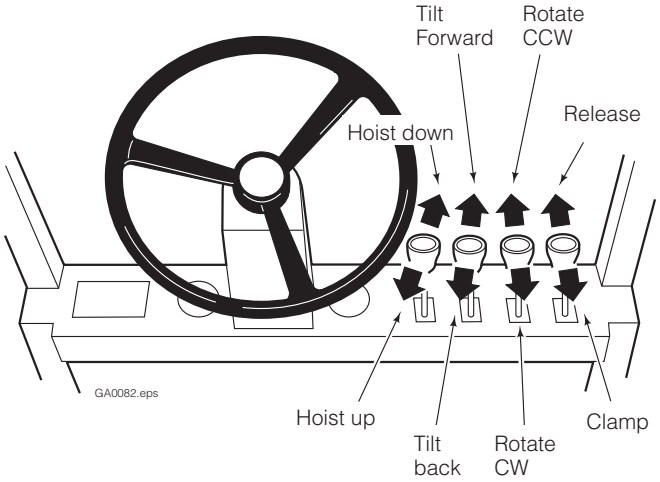
All supply hoses should be No. 8.

All fittings should have a minimum orifice size of 13/32 in. (10 mm).

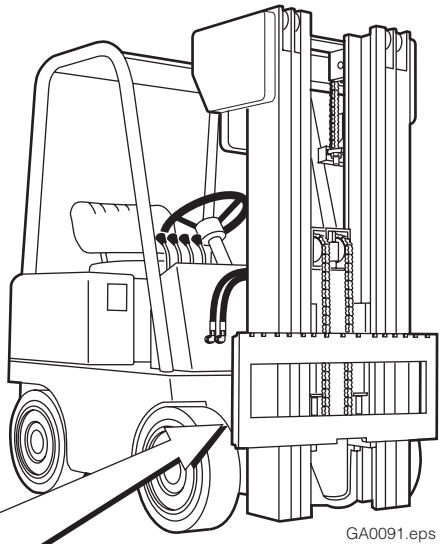

GA0090.eps

6.1-2 Auxiliary Valve Functions

Check for compliance with ANSI (ISO) standards:



GA0082.eps


GA0091.eps

6.1-3 Truck Carriage

GA0028.eps

Carriage Mount Dimension (A) ITA (ISO)

	Minimum	Maximum
Class II	14.94 in. (380.0 mm)	15.00 in. (381.0 mm)
Class III	18.68 in. (474.5 mm)	18.74 in. (476.0 mm)
Class IV	23.44 in. (595.5 mm)	23.50 in. (597.0 mm)

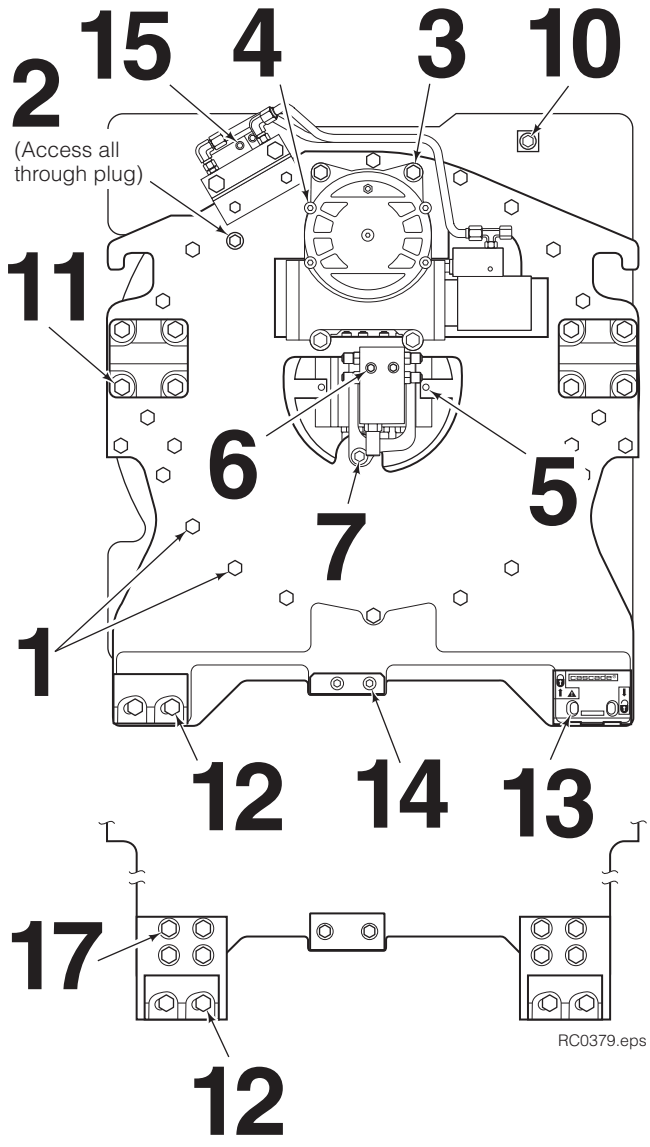
6.1-4 Torque Values

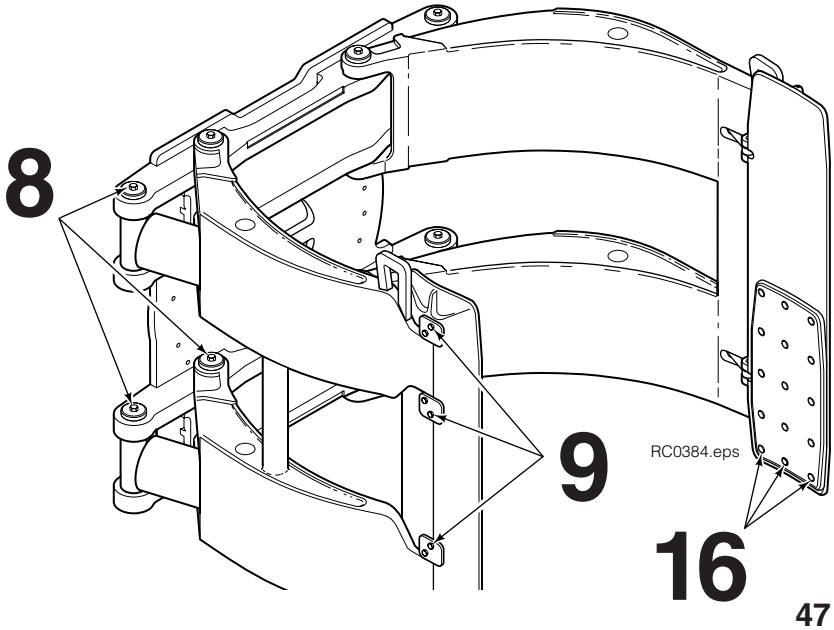
Fastener torque values for the G-Series Roll Clamps are shown in the table below in both US and Metric units. All torque values are also called out in each specific service procedure throughout the manual.

NOTE: All fasteners have a torque value range of ±10% of stated value.

Ref.	Fastener Location		Size	Ft.-lbs.	Nm
1	Baseplate Capscrews ★ ■ ▲		M12	75	105
2	Bearings Capscrews ■ ▲	50G	M12	100	135
		60G-77G	M12	80	110
3	Rotator Drive Assembly Capscrews		M12	75	105
4	Gearbox Cover Plate Capscrews		M8	15	20
5	Revolving Connection Capscrews		M10	30	40
6	End Block Capscrews ✖		M8	15	20
7	Retainer Yoke Capscrew		M10	30	40
8	Pivot Pin Retainer Caps		M10	35	50
9	Contact Pad Retainers/Wearshoes Capscrews		M12	62	85
10	Stop Block Capscrews		M20	40	540
11	Upper Hook Capscrews		M16	125	165
12	Lower hook Capscrews	CL II, CL III	M16	125	165
		CL IV	M20	250	340
13	Quick-Disconnect Lower Hooks Capscrews		M16	125	165
14	Index Block Capscrews		M12	75	105
15	180° Stop Cam Capscrews		M12	75	105
16	Pad Capscrews		M8	15	20
17	Extension Plate Capscrews		M16	125	165

★ Number of fasteners varies depending on model
■ Use Loctite 242 (Blue)
▲ Double-torque (tighten, loosen, 1/2-turn, retighten)
✖ Apply Loctite 271 (Red)





Do you have questions you need answered right now? Call your nearest Cascade Service Department.
Visit us online at www.cascorp.com

AMERICAS

Cascade Corporation
U.S. Headquarters
2201 NE 201st
Fairview, OR 97024-9718
Tel: 800-CASCADE (227-2233)
Fax: 888-329-8207

Cascade Canada Inc.
5570 Timberlea Blvd.
Mississauga, Ontario
Canada L4W-4M6
Tel: 905-629-7777
Fax: 905-629-7785

Cascade do Brasil
Praça Salvador Rosa,
131/141-Jordanópolis,
São Bernardo do Campo - SP
CEP 09891-430
Tel: 55-13-2105-8800
Fax: 55-13-2105-8899

EUROPE-AFRICA

Cascade Italia S.R.L.
European Headquarters
Via Dell'Artigianato 1
37030 Vago di Lavagno (VR)
Italy
Tel: 39-045-8989111
Fax: 39-045-8989160

Cascade (Africa) Pty. Ltd.
PO Box 625, Isando 1600
60A Steel Road
Sparton, Kempton Park
South Africa
Tel: 27-11-975-9240
Fax: 27-11-394-1147

ASIA-PACIFIC

Cascade Japan Ltd.
2-23, 2-Chome,
Kukuchi Nishimachi
Amagasaki, Hyogo
Japan, 661-0978
Tel: 81-6-6420-9771
Fax: 81-6-6420-9777

Cascade Korea
121B 9L Namdong Ind.
Complex, 691-8 Gojan-Dong
Namdong-Ku
Inchon, Korea
Tel: +82-32-821-2051
Fax: +82-32-821-2055

Cascade-Xiamen
No. 668 Yangguang Rd.
Xinyang Industrial Zone
Haicang, Xiamen City
Fujian Province
P.R. China 361026
Tel: 86-592-651-2500
Fax: 86-592-651-2571

Cascade India Material Handling Private Limited
No 34, Global Trade Centre
1/1 Rambaugh Colony
Lal Bahadur Shastri Road,
Navi Peth, Pune 411 030
(Maharashtra) India
Phone: +91 020 2432 5490
Fax: +91 020 2433 0881

Cascade Australia Pty. Ltd.
1445 Ipswich Road
Rocklea, QLD 4107
Australia
Tel: 1-800-227-223
Fax: +61 7 3373-7333

Cascade New Zealand
15 Ra Ora Drive
East Tamaki, Auckland
New Zealand
Tel: +64-9-273-9136
Fax: +64-9-273-9137

Sunstream Industries Pte. Ltd.
18 Tuas South Street 5
Singapore 637796
Tel: +65-6795-7555
Fax: +65-6863-1368

cascade™

© Cascade Corporation 2016

06-2016

Part Number 213744-R3