

SERVICE MANUAL

D-Series ***360° Rotators***

Manual Number 672946-R4

cascade[®]
corporation

Cascade is a Registered Trademark of Cascade Corporation

	Page
INTRODUCTION, Section 1	
Introduction	1
Special Definitions	1
PERIODIC MAINTENANCE, Section 2	
100-Hour Maintenance	2
500-Hour Maintenance	2
2000-Hour Maintenance	3
TROUBLESHOOTING, Section 3	
General Procedures	4
Truck System Requirements	4
Tools Required	4
Troubleshooting Chart	4
Plumbing	5
Hosing Diagram	5
Hydraulic Schematics	5
Rotate Function	6
Supply Circuit Test	6
Rotation without Load	6
Rotation with Load	7
SERVICE, Section 4	
Attachment Removal	8
Drive Group	9
Drive Group Removal and Installation	9
Drive Group Disassembly and Service	9
Drive Group Reassembly	11
Drive Motor	13
Drive Motor Removal and Installation	13
Ross Drive Motor Disassembly and Service	14
Char-Lynn Drive Motor Disassembly	16
Char-Lynn Drive Motor Inspection	18
Char-Lynn Drive Motor Reassembly	18
Check Valve Assembly	20
Check Valve Assembly Service Models – 40D, 55D, 65D, 100D, 120D	20
Check Valve Assembly Service Models – 150D, 200D	21
Base Unit	22
Bearing Assembly – Capscrews Torque Inspection	22
Bearing Assembly Removal and Installation	23
Fork Service	24
180° Stop Group	25
Stop Valve Service	25
Stop Group Adjustment	25
SPECIFICATIONS, Section 5	
Specifications	26
Hydraulics	26
Auxiliary Valve Functions	26
Truck Carriage	26
Torque Values	27
Determining Load Torque Requirements	28

1.1 Introduction

This manual provides Periodic Maintenance, Troubleshooting, Service and Specifications for Cascade D-Series Rotators.

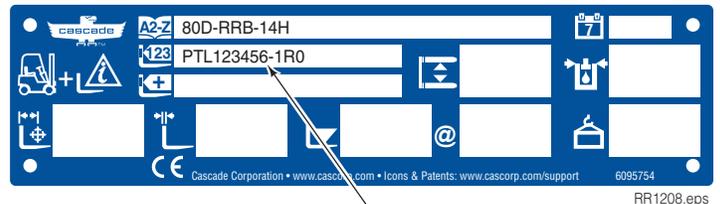
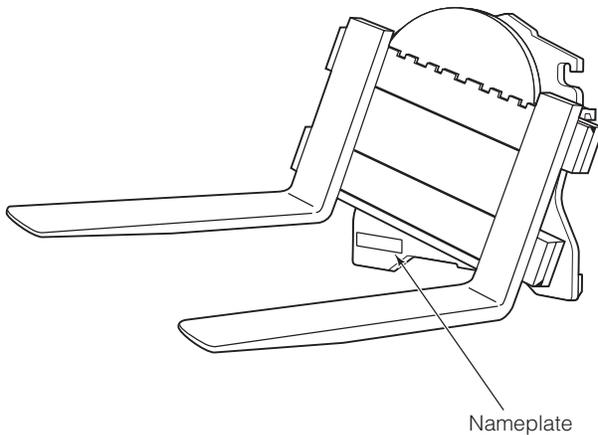
In any communication about the attachment, refer to the product catalog and serial numbers stamped on the nameplate. If the nameplate is missing, the numbers can be found stamped on the right front web of the baseplate.

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

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



WARNING: Fork size affects attachment capacity. Refer to Installation Instructions 672327, "Fork Middle Hook Installation" section. Verify capacity for truck nameplate.



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.



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

2.1 100-Hour Maintenance

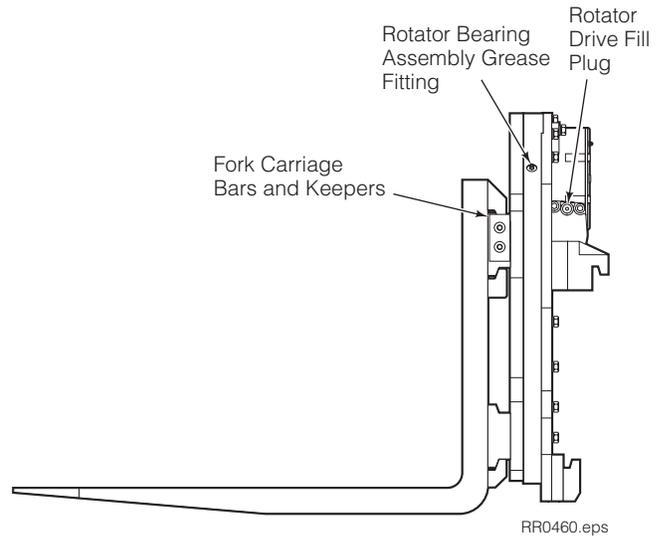
Every time the lift truck is serviced or every 100 hours of truck operation, whichever comes first, complete the following maintenance procedures:

- Check for loose or missing bolts, worn or damaged hoses, and hydraulic leaks.
- Check that fork locking pins and end bar keepers are installed and functional.
- If equipped, lubricate plungers on hydraulic or electric 180° stop valves.
- Check decals and nameplate for legibility.

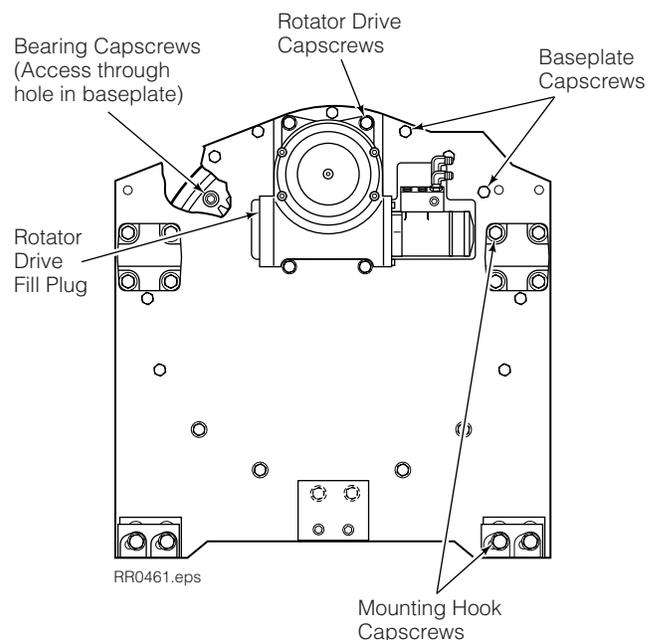
2.2 500-Hour Maintenance

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

- Check a sample of baseplate/bearing assembly capscrews for proper torque value. See Technical Bulletin TB183 or Service Section 4.5-1 for inspection and replacement procedures.
- Check a sample of faceplate/bearing assembly capscrews for proper torque value. See Technical Bulletin TB183 or Service Section 4.5-1 for inspection and replacement procedures.
- Tighten lower mounting hook capscrews to a torque of:
 - Class II/III** – 125 ft.-lbs. (165 Nm)
 - 80D, 100D** – 165 ft.-lbs. (225 Nm)
 - 120D, 150D, 200D** – 195 ft.-lbs. (265 Nm)
- Tighten rotator drive capscrews to 75 ft.-lbs. (105 Nm).
- Lubricate rotation bearing assembly with EP-2 grease (Whitmore 'Omni-task' or equivalent). Rotate in 90° increments and apply grease.
- Check rotator drive gearcase lubricant level. Lubricant should be up to bottom of 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.

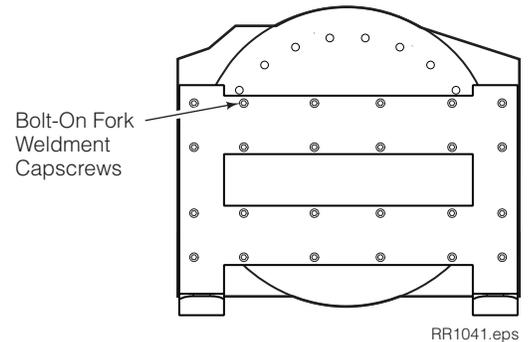
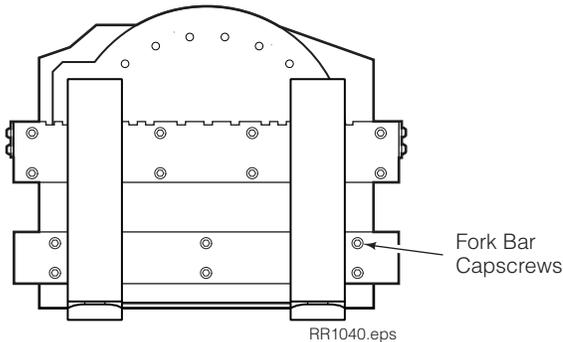


WARNING: A sampling of faceplate and baseplate bearing assembly capscrews must be checked for proper torque at 500 hours (see TB183). A complete inspection is required every 2000 hours. Failure to keep the capscrews tightened can result in attachment damage and serious injury.



2.2 500-Hour Maintenance (continued)

- Inspect forks, carriage bars and frame for cracks and wear. Replace components as required.
- **Bolt-On Fork Weldment** – If equipped, tighten capscrews to:
 - 100D, 150D, 200D** – 285 ft.-lbs. (385 Nm)
 - 220D, 300D, 400D** – 395 ft.-lbs. (535 Nm)
- **Fork Bar** – If equipped, tighten capscrews to:
 - CL II** – 150 ft.-lbs. (145 Nm)
 - CL III** – 135 ft.-lbs. (185 Nm)
 - CL IV** – 190 ft.-lbs. (255 Nm)
 - CL V** – 390 ft.-lbs. (530 Nm)



2.3 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 rotation bearing capscrews for proper torque value. See Technical Bulletin TB183 or Service Section 4.5-1 for inspection and replacement procedures.
- **Fork Inspection** – After 2000 hours of truck operation, forks in use shall be inspected at intervals of not more than 12 months (for single shift operations) or whenever any defect or permanent deformation is detected. Severe applications will require more frequent inspection.

Fork inspection shall be carried out by trained personnel to detect any damage that might impair safe use. Any fork that is defective shall be removed from service. Reference ANSI B56.1-2005.

Inspect for the following defects:

- Surface cracks
- Straightness of blade and shank
- Fork angle
- Difference in height of fork tips
- Positioning lock
- Wear on fork blade and shank
- Wear on fork hooks
- Legibility of marking

NOTE: Fork Safety Kit 3014162 contains wear calipers, inspection sheets and safety poster. Also available is fork hook & carriage wear gauge 209560 (Class II), 209561 (Class III) and 6105257 (Class IV).

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 2300 psi (160 bar).**
- Hydraulic flow should be within the volume range as shown in Specification, 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.

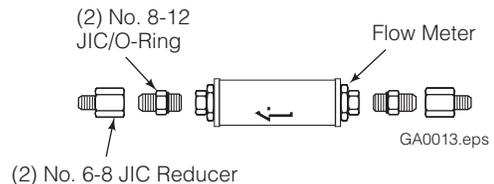
Stay clear of the load while testing. Do not raise the load more than 4 in. (10 cm) off the floor while testing.

3.1-2 Tools Required

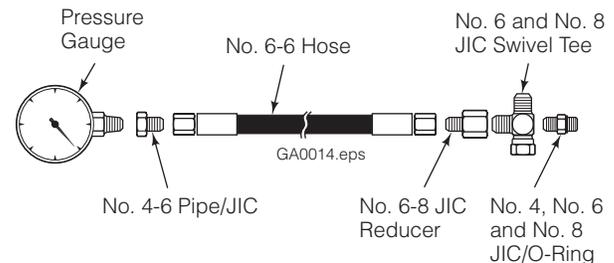
In addition to a normal selection of hand tools, you will need:

- Inline Flow Meter Kit:
20 GPM (75 L/min.) – Cascade Part No. 671477
- Pressure Gauge Kit:
5000 psi (345 bar) – Cascade Part No. 671212, two kits required.
- Assorted fittings and hoses to adapt gauges and flow meter to the components being tested.

Flow Meter Kit 671477



Pressure Gauge Kit 671212



3.1-3 Troubleshooting Chart

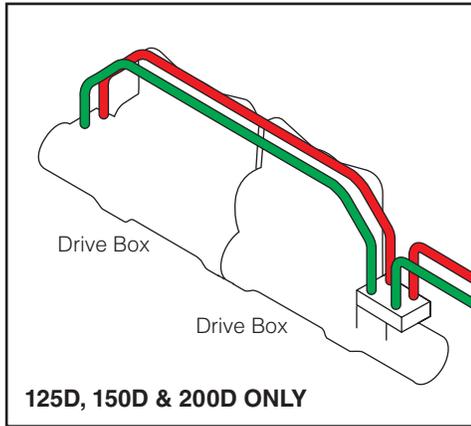
Determine All The Facts – It is important that all the facts regarding the problem are gathered before beginning service procedures. The first step is to talk to the equipment operator. Ask for a complete description of the malfunction. The following guidelines can then be used as a starting point to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

Rotate Circuit

- Attachment will not rotate.
 - Attachment will not rotate with load at rated capacity.
 - Attachment rotates in one direction only.
- To correct one of these problems, see Section 3.3.

3.2 Plumbing

3.2-1 Hosing Diagram



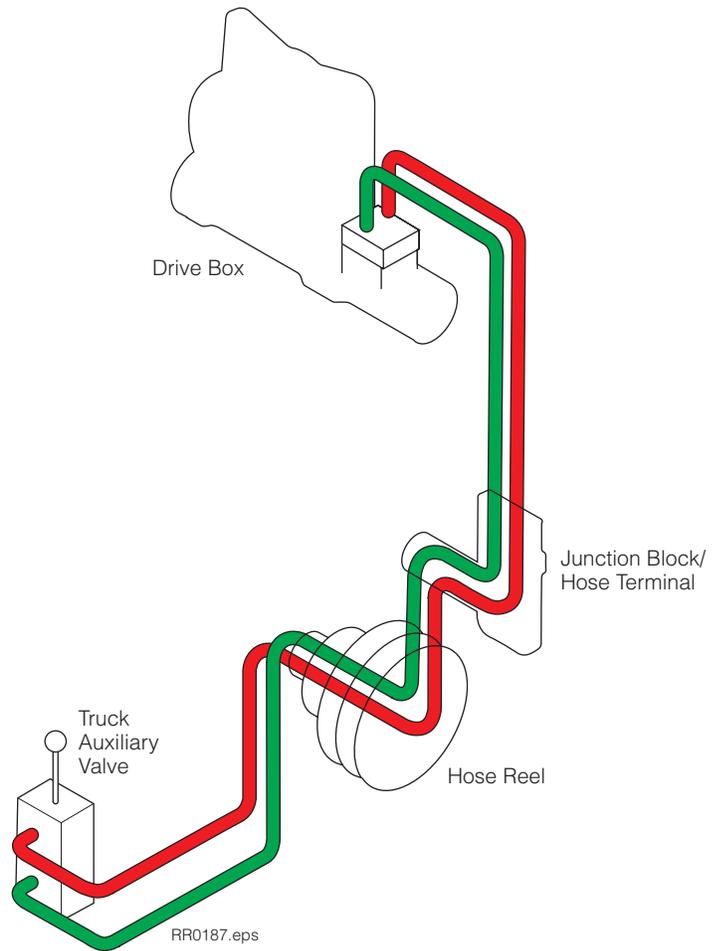
**ROSS MOTOR
ROTATE (CLOCKWISE SHOWN)**

PRESSURE █
RETURN █

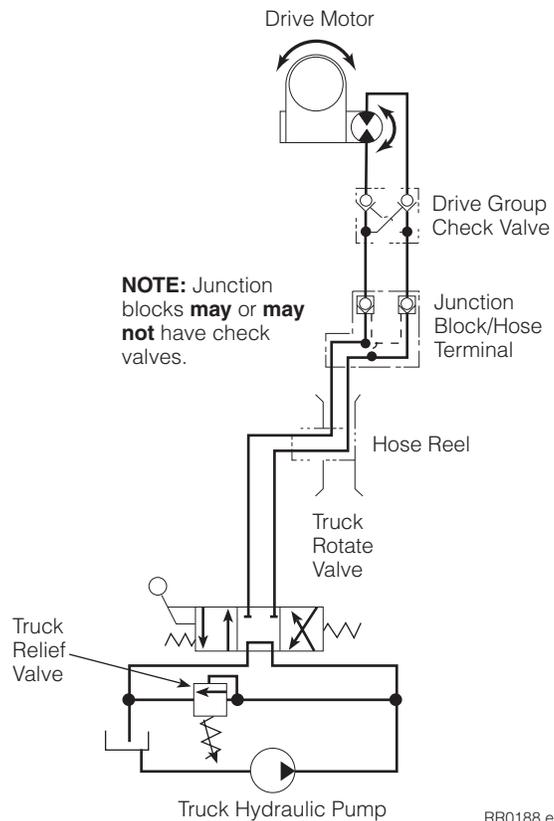
IMPORTANT: See motor end cover for identification.

**CHAR-LYNN MOTOR
ROTATE (COUNTERCLOCKWISE SHOWN)**

IMPORTANT: See motor end cover for identification.



3.2-2 Hydraulic Schematic



3.3 Rotate Function

There are four potential problem areas that could affect the rotation function.

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

3.3-1 Supply Circuit Test

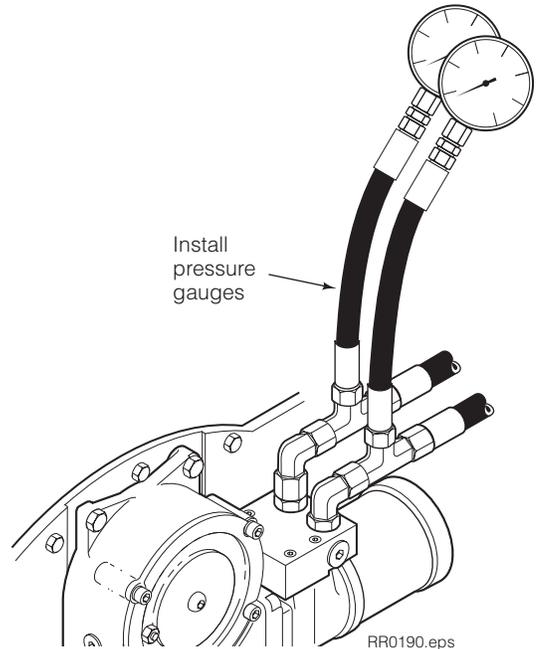


WARNING: Before removing any hoses, relieve pressure in the hydraulic system. With the truck off, open the truck auxiliary control valve(s) several times in both directions.

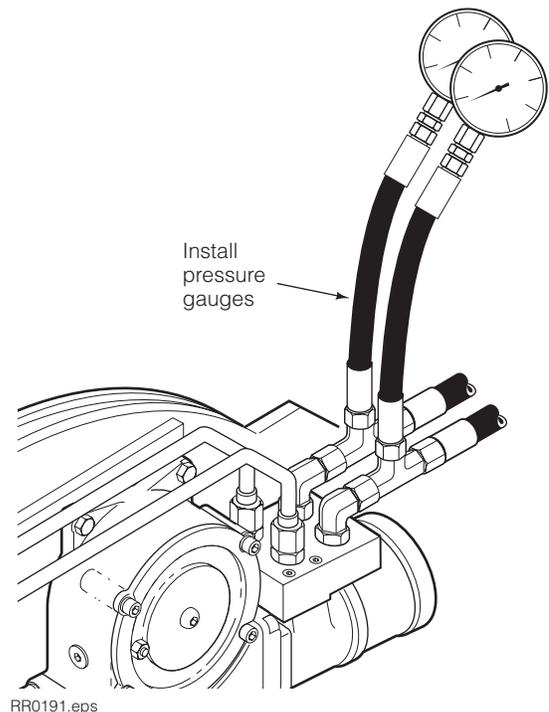
- 1 Check the pressure delivered by the truck. Refer to the truck service manual. **PRESSURE TO THE ATTACHMENT MUST NOT EXCEED 2300 psi (160 bar)**, measured at the carriage hose terminal.
- 2 Check the flow volume at the carriage hose terminal. Refer to Specifications section for recommended flow volumes.
- 3 Check for external leaks.

3.3-2 Rotation without Load

- 1 Install pressure gauges to the motor fittings.
- 2 Start the truck and rotate the attachment without a load. While rotating, 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 valve assembly may need repair. Refer to Section 4.4.
 - 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 and hose sizes less than No. 8, etc.



40D, 55D, 65D, 100D, 120D Drive Group



125D, 150D, 200D Drive Group

3.3-2 Rotation with Load

1 Rotate a load requiring approximately 3/4 of attachment maximum torque capacity shown in the chart. Refer to Section 5.1-4 to determine load required. Note gauge readings during rotation.

- If the higher gauge reading is substantially less than truck pressure measured at the junction block/hose terminal, the motor gerotor set may need repair. Refer to Section 4.3-2 or 4.3-3.
- If the higher gauge is close to truck pressure measured at the junction block/hose terminal, and no rotation occurs. The motor output shaft or drive box may need repair. Continue troubleshooting with Step 2 below.

125D, 150D, 200D Models – Remove the left drive group from the attachment as described in Section 4.2-1. Cap the connector fittings on the right hand drive group. Rotate a load requiring approximately 1/3 of attachment maximum torque.

- If the higher gauge reading is substantially less than truck pressure measured at the junction block/hose terminal, the R.H. motor gerotor set may need repair. Refer to Section 4.3-2 or 4.3-3.
- If the higher gauge is close to truck pressure measured at the junction block/hose terminal, and no rotation occurs. The R.H. motor output shaft or drive may need repair. Continue troubleshooting.
- If the higher gauge is close to truck pressure measured at the junction block/hose terminal, and rotation occurs. The L.H. motor output shaft or drive box may need repair. Continue troubleshooting.

2 Remove the motor from the malfunctioning drive assembly as described in Section 4.2-2.

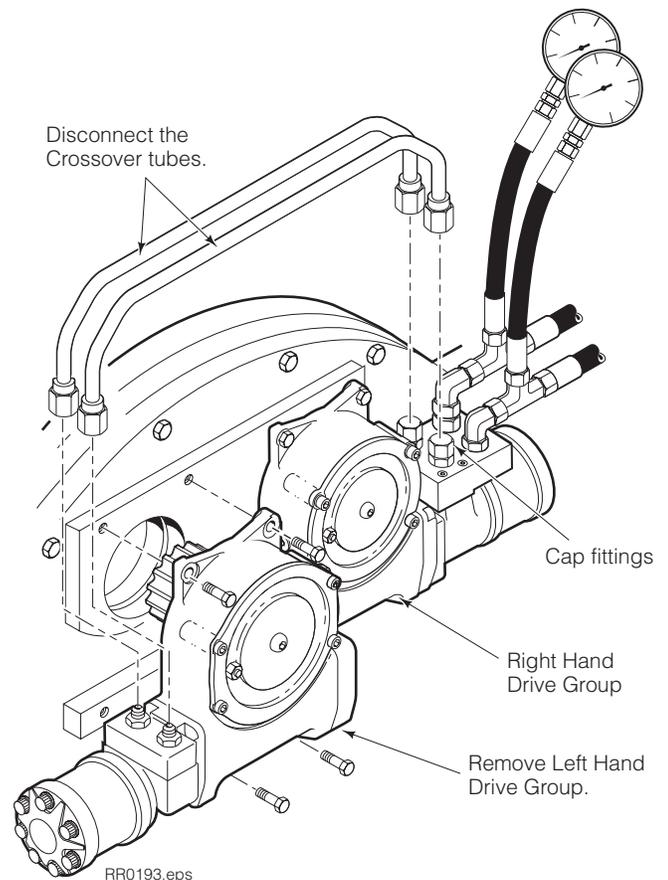
3 Reinstall the hoses to the motor fittings. Actuate the rotate circuit.

- If the motor shows rotational output, the drive box may require service. Refer to Section 4.2-2.
- If the motor shows little or no rotational output, service the motor as described in Section 4.3-2 or 4.3-3.

Model	Maximum Torque Capacity
40D, 55D, 65D *	75,000 in.-lbs. @ 2000 psi (8,475 N·m @ 140 bar)
100D *	90,000 in.-lbs. @ 2000 psi (10,170 N·m @ 140 bar)
120D *	115,000 in.-lbs. @ 2000 psi (12,995 N·m @ 140 bar)
100D ■	129,000 in.-lbs. @ 2000 psi (14,580 N·m @ 140 bar)
150D ■	126,000 in.-lbs. @ 2000 psi (14,238 N·m @ 140 bar)
200D ■	190,000 in.-lbs. @ 2000 psi (21,470 N·m @ 140 bar)

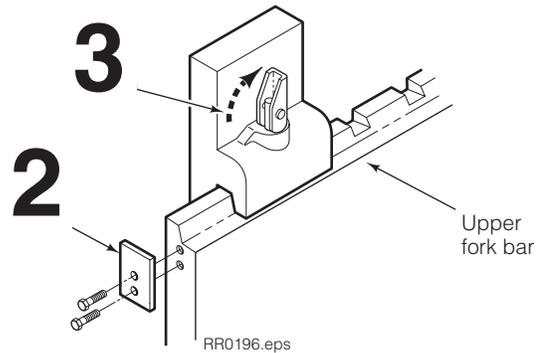
★ Rated at 15 GPM (56L/min.) flow.

■ Rated at 20 GPM (75L/min.) flow.



4.1 Attachment Removal

- 1 Rotate the attachment to position the forks parallel to the ground.
- 2 Remove the fork keepers at each end of the top carriage bar. For reassembly, tighten the capscrew to a torque of 60 ft.-lbs. (80 Nm).
- 3 Release the spring lock on the top of each fork. Remove the forks from the rotator.



- 4 Disconnect the lower hooks.

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

Class II/III – 110 ft.-lbs. (150 Nm)

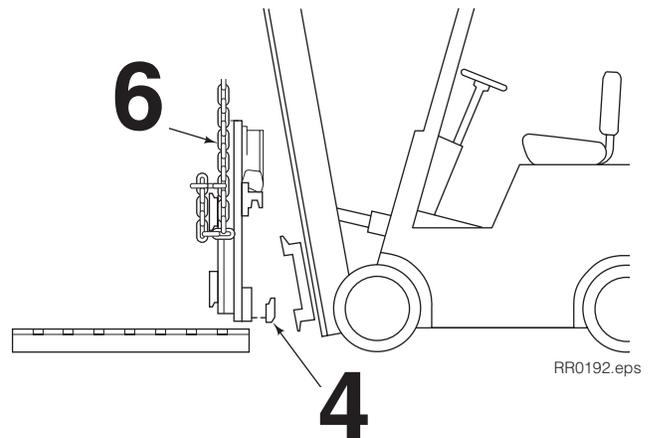
Class IV 80D, 100D – 195 ft.-lbs. (265 Nm)

Class IV 120D & larger – 260 ft.-lbs. (360 Nm)

Quick Change Hooks – Pull out the locking pins, slide the hooks down and reinstall the pins in the lower holes. For reassembly, slide the hooks up and install the pins in the top holes.



WARNING: Before removing any hoses, relieve pressure in the hydraulic system. Turn the truck off, then open the truck auxiliary control valve(s) several times in both directions.

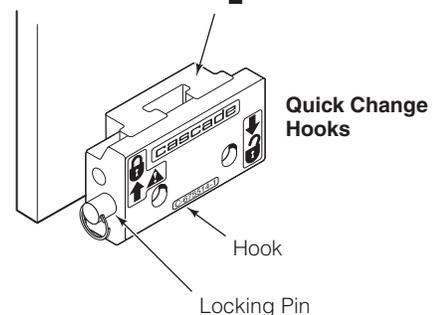


- 5 Disconnect the hydraulic hoses to the drive motor. Tag the hoses for reassembly.



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

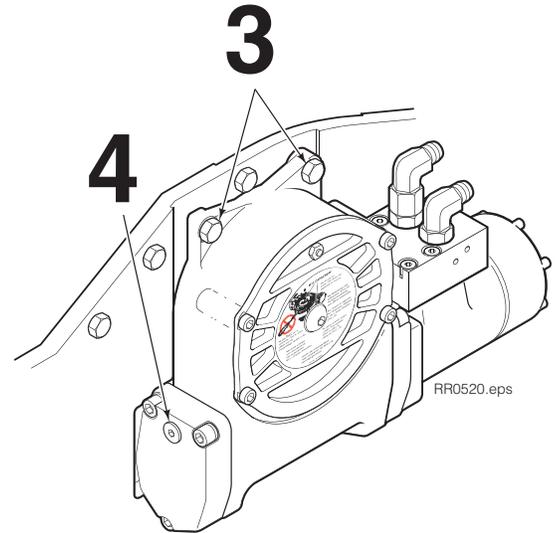
- 6 Attach a suitable overhead hoist to the upper fork bar. Remove the rotator from the truck. Lay the rotator face down on a pallet with the drive group upward.
- 7 For installation, reverse the above procedures.



4.2 Drive Group

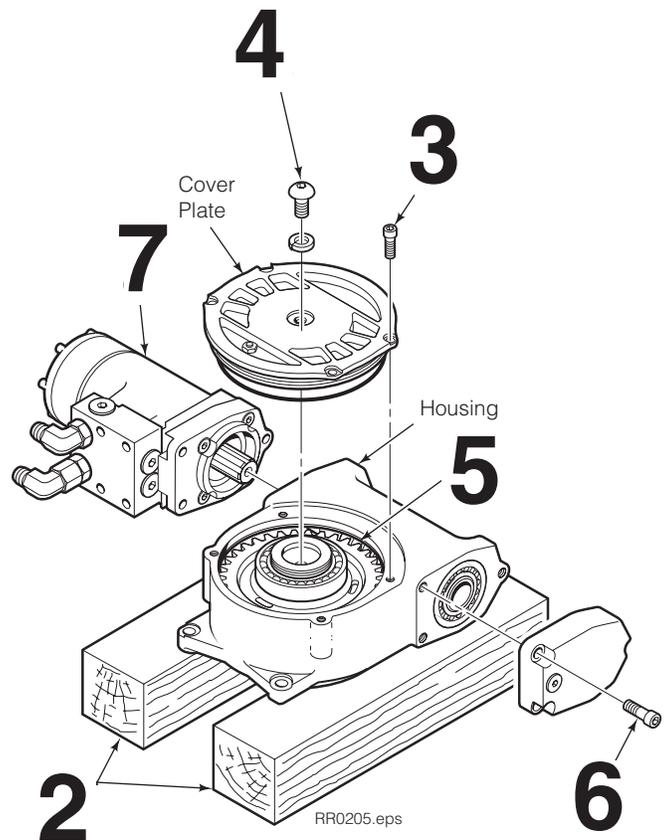
4.2-1 Drive Group Removal and Installation

- 1 Remove the attachment from the truck as described in Section 4.1.
- 2 **125D, 150D, 200D Rotators** – Disconnect the crossover tubes from the check valve assembly.
- 3 Remove the four capscrews fastening the drive group to the baseplate. For reassembly, tighten the capscrews to 75 ft.-lbs. (100 Nm).
- 4 For reassembly, reverse the above procedures except as follows:
 - After the drive group has been reinstalled, check the oil level. The oil level must be visible in the fill hole. Fill if necessary with Cascade Gear Lube 656300 or equivalent SAE 90 wt. lube (AGMA "mild" 6EP Gear Oil).



4.2-2 Drive Group Disassembly and Service

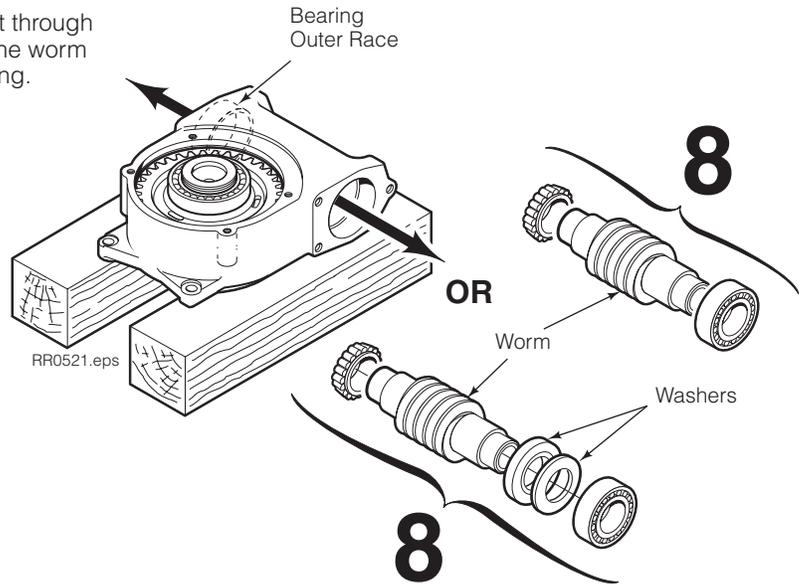
- 1 Remove the drive group from the attachment as described in Section 4.2-1.
- 2 Lay the drive group pinion down on wooden blocks approximately 4 x 4 in. (10 x 10 mm) placed on both sides of the pinion.
- 3 Remove the four capscrews fastening the cover plate to the housing.
- 4 Remove the cover plate center capscrew. Install a 3/8 NC capscrew with a minimum of 2 in. (50 mm) thread length in the cover plate center hole. Remove the cover by turning the capscrew clockwise and tapping on the side of the cover plate.
- 5 Drain oil from housing.
- 6 Remove the three capscrews fastening the end cover to the housing.
- 7 Remove the drive motor as described in Section 4.3-1.



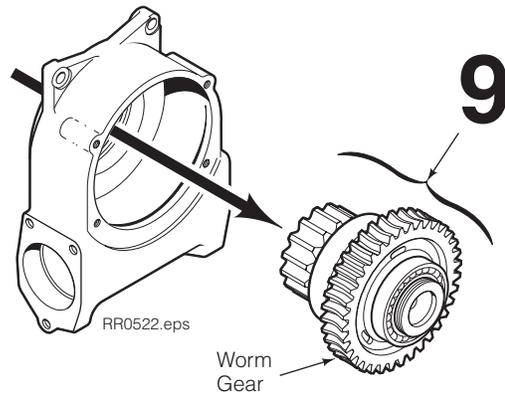
- 8** Tap the worm, worm bearing and washers out through the end cover side of the housing. Remove the worm bearing race from the motor side of the housing.

NOTE: The drive group being serviced may or may not be assembled with the washers shown on the worm.

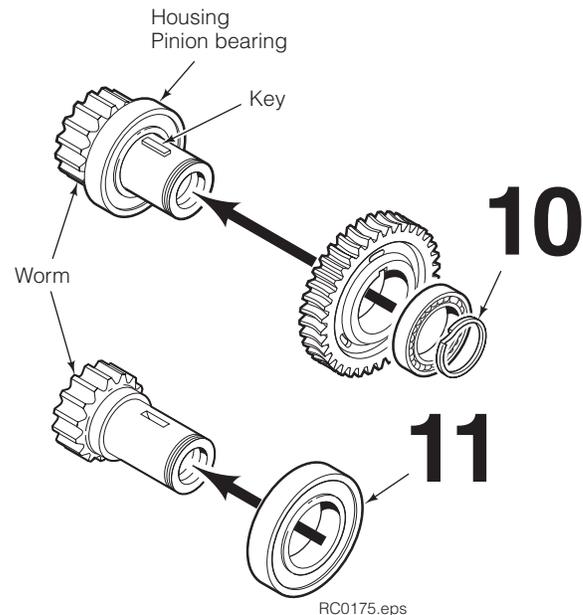
CAUTION: When replacing a worm or worm gear, the serial number of the attachment and whether washers are or are not installed on the worm must be supplied to identify the correct replacement parts.



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



- 10** Remove the snap ring from the pinion. Press the pinion and housing/pinion bearing from the worm gear and cover plate/pinion bearing. Remove the pinion key.



- 11** Press the pinion out of the housing/pinion bearing. Cascade 125D, 150D and 200D Drive Groups have an additional baseplate/pinion bearing and snap ring to remove.

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

4.2-3 Drive Group Reassembly

NOTE: The 125D, 150D and 200D Drive Groups have an additional bearing and snap ring on the pinion. All other procedures are similar for all drive groups.

- 1** Cascade 125D, 150D and 200D Drive groups –Install the baseplate/pinion bearing and snap ring on the pinion.

 - 2** Apply sealant (668184) to the pinion shaft seating area and shoulder for the housing/pinion bearing. Install the housing/pinion bearing. Remove excess sealant.

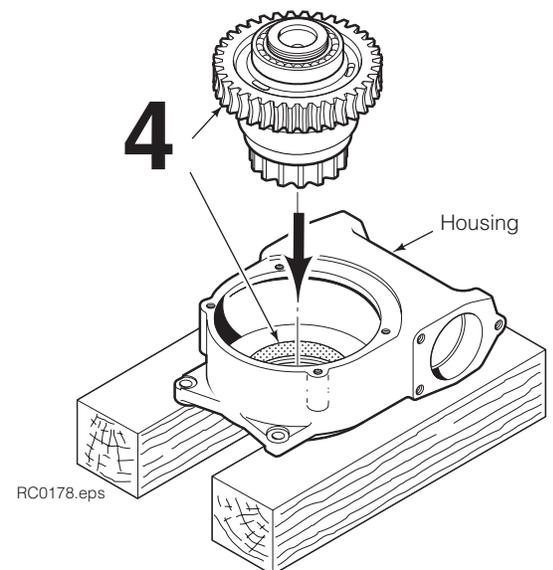
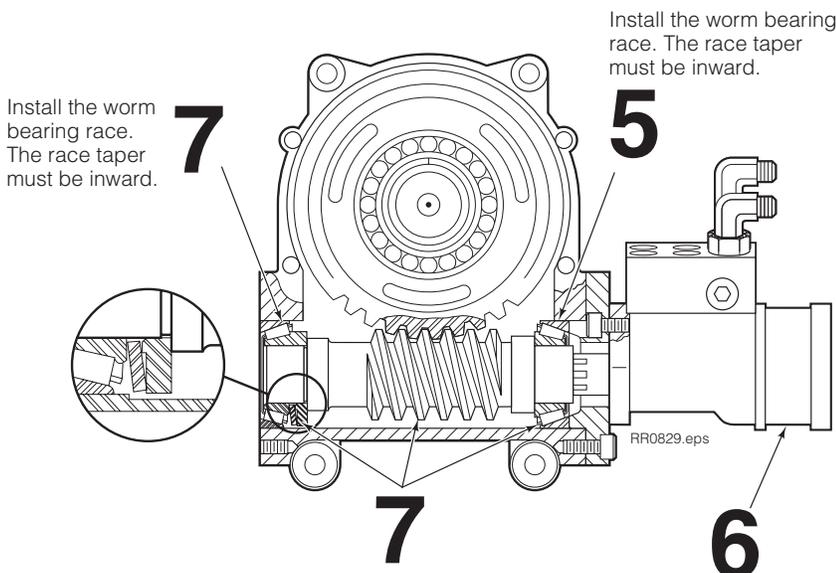
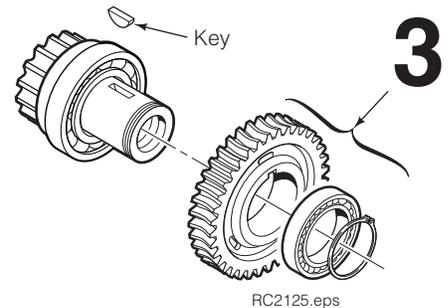
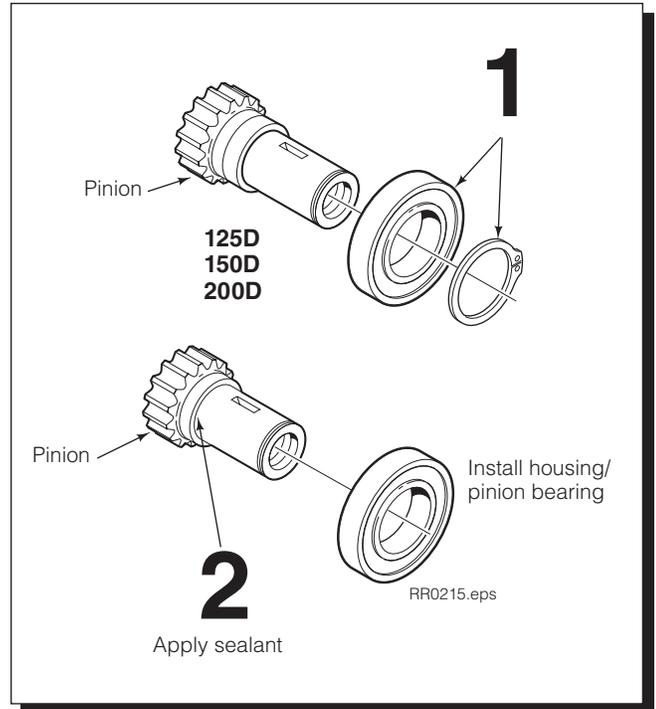
 - 3** Preheat worm gear to 200° F (93° C). Install the key, worm gear, cover plate/pinion bearing and snap ring on the pinion.

 - 4** Apply sealant (668184) to the housing seating area and shoulder for the housing/pinion bearing. Install the pinion assembly in the housing. Remove excess sealant.

 - 5** Install worm bearing race in the drive motor side of the housing. Make sure the bearing race is facing in the correct direction.

 - 6** Install drive motor as described in Section 4.3-1.

 - 7** Install the worm, worm bearings and washers (if equipped) in the housing. Fully engage the worm with the drive motor shaft. Install the remaining worm bearing race.
- NOTE:** Some production drive groups are not equipped with the washers shown on the worm.



8 Install the end cover. There must not be any shims between the end cover and housing at this time. Tighten the capscrews in 10 ft.-lbs. (13 Nm) increments to a torque of 25 ft.-lbs. (34 Nm).

9 Measure the gap between the end cover and housing in three places with a feeler gauge or plasti-gage and determine the minimum gap.

10 Drive Group with Worm Washers –

The washers and bearings require 0.020-0.025 in. (0.050-0.064 mm) preload. Subtract the preload numbers from the feeler gauge measurement to determine the shims required between the end cover and housing. Example:

$$\begin{array}{r} 0.063 \text{ in.} \\ - 0.025 \text{ in.} \\ \hline 0.038 \text{ in.} \end{array} \quad \begin{array}{r} 0.063 \text{ in.} \text{ (Feeler gauge measurement)} \\ - 0.020 \text{ in.} \text{ (Preload)} \\ \hline 0.043 \text{ in.} \text{ (Shim thickness range)} \end{array}$$

In this case two 0.020 in. (0.50 mm) yellow shims would be installed to equal 0.040 in. (1.0 mm). Refer to shims listed below.

Drive Group without Worm Washers –

Choose a combination of the end cover shims equal to the next higher 0.005 in. (0.12 mm) feeler gauge measurement increment. See examples below:

- For 0.020–0.024 in. (0.508–0.610 mm) measured gap, use 0.025 in. (0.635 mm) total shim thickness.
- For 0.025–0.029 in. (0.635–0.736 mm) measured gap, use 0.030 in. (0.762 mm) total shim thickness.

The shim pack must contain only one blue (.005 in.) shim. See shims listed below.

Shim Service kit 670578 contains the following shims:

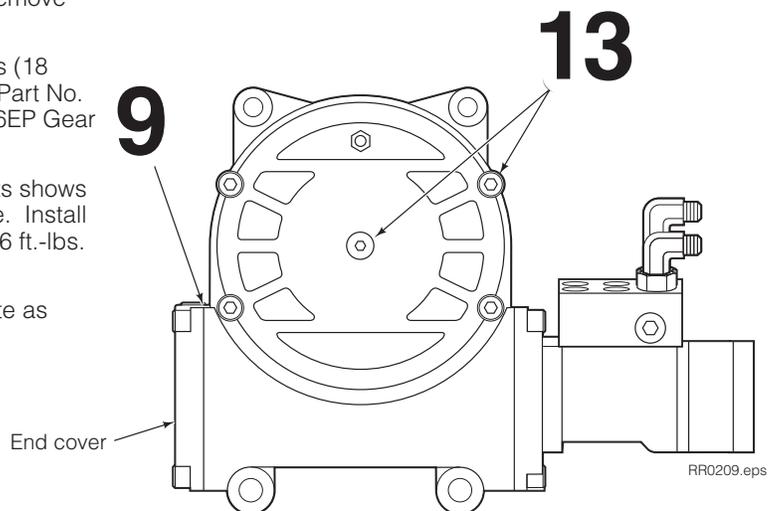
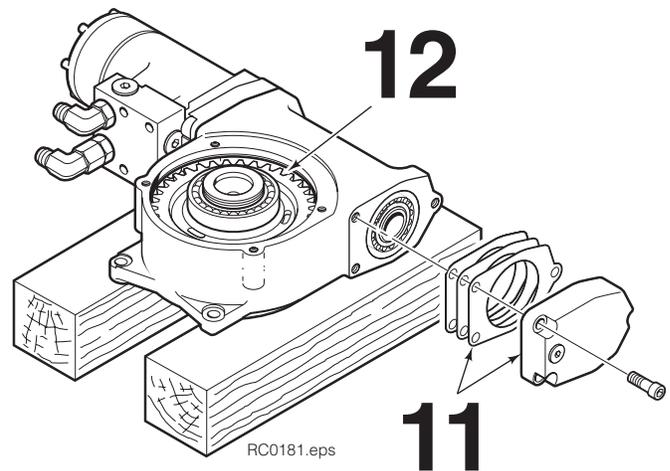
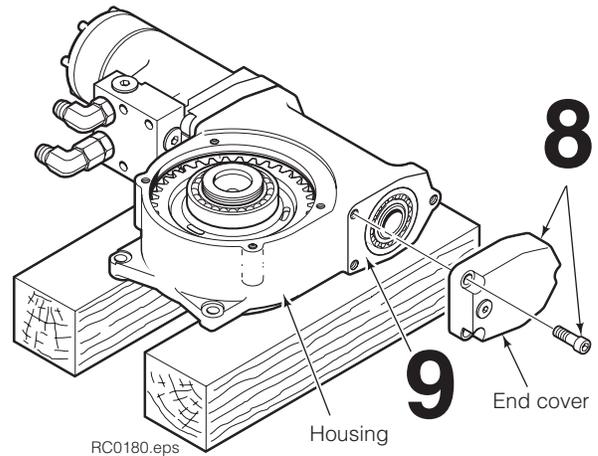
Qty	Part No.	Color	Thickness
1	674513	Blue	0.005 in. (0.125 mm)
1	670574	Brown	0.010 in. (0.254 mm)
1	671757	Pink	0.015 in. (0.381 mm)
1	671758	Yellow	0.020 in. (0.508 mm)

11 Remove the end cover. Apply Loctite 515 sealant (Cascade Part No. 668184) to both surfaces of the shims. Install the shim pack and end cover. Tighten the capscrews to a torque of 65 ft.-lbs. (88 Nm). Remove excess sealant.

12 With the gearcase laying flat, fill with 2-1/4 Cups (18 fluid ounces or 540 ml) of Cascade Gear Lube Part No. 656300, or SAE 90 wt. gear lube (AGMA 'mild' 6EP Gear Lube).

13 Install the cover plate and gasket. If the gaskets shows porosity, apply Loctite 515 sealant to cover face. Install the four cover plate capscrews and tighten to 16 ft.-lbs. (22 Nm). Install the center hole plug.

14 Reinstall the drive group on the rotator baseplate as described in Section 4.2-1.



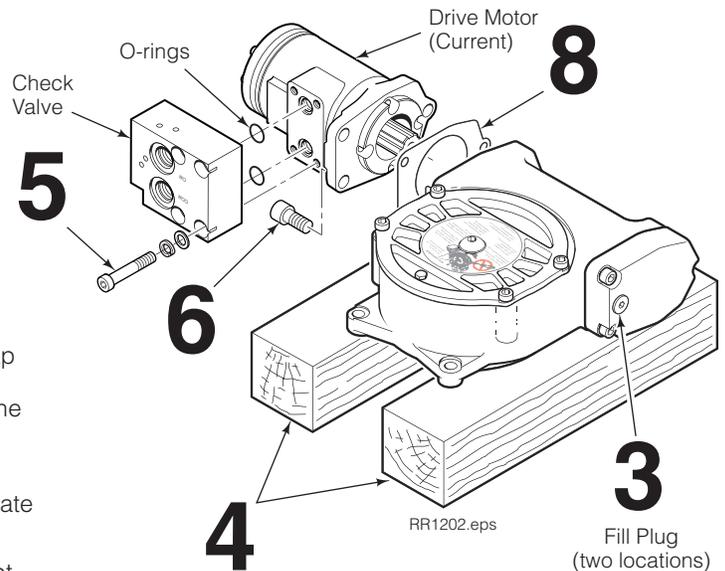
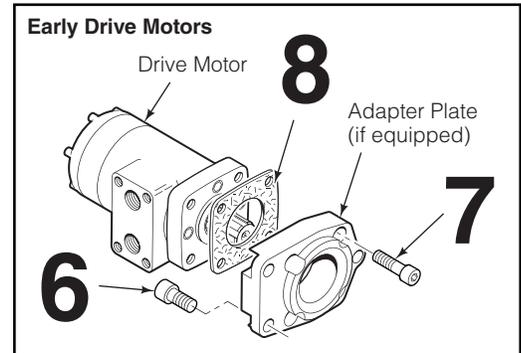
4.3 Drive Motor

4.3-1 Drive Motor Removal and Installation

- 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 4.2-1.
- 3 Remove the oil fill plug and drain oil 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 fastening the check valve assembly to drive motor. Keep track of the two O-rings between the check valve assembly and drive motor. For reassembly, tighten the capscrews to a torque of 15 ft.-lbs. (20 Nm).



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



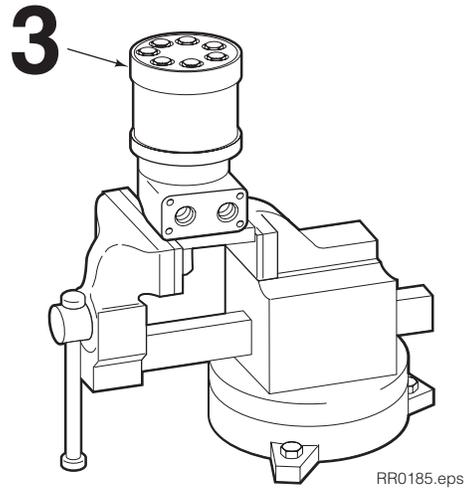
- 6 Remove the three capscrews fastening the motor flange (or adapter plate) to the gear box housing. Tap the drive motor with a rubber mallet to separate the drive motor (or drive motor with adapter plate) from the gearcase housing.
- 7 **Early Drive Motors** – Remove the four capscrews fastening the adapter plate to the drive motor. Separate the motor from the adapter plate.
- 8 For reassembly, reverse the above procedures except as follows:
 - **Early Drive Motors** – Apply Loctite 515 sealant (Cascade Part No. 668184) to both sides of the drive motor/adapter plate gasket. 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. (54 Nm).
 - Apply sealant to both sides of the motor/gearcase (or adapter plate/gearcase) gasket. Apply sealant to the threads of the three motor flange (or adapter plate) capscrews. Install the motor (or motor with adapter plate) and gasket to the gearcase housing. Tighten the capscrews to 65 ft.-lbs. (88 Nm).
 - Fill the drive group with fill with 18 fluid ounces (540 ml) of Cascade Gear Lube Part No. 656300, or SAE 90 wt. gear lube (AGMA 'mild' 6EP Gear Lube).

4.3-2 Ross Drive Motor Disassembly and Service

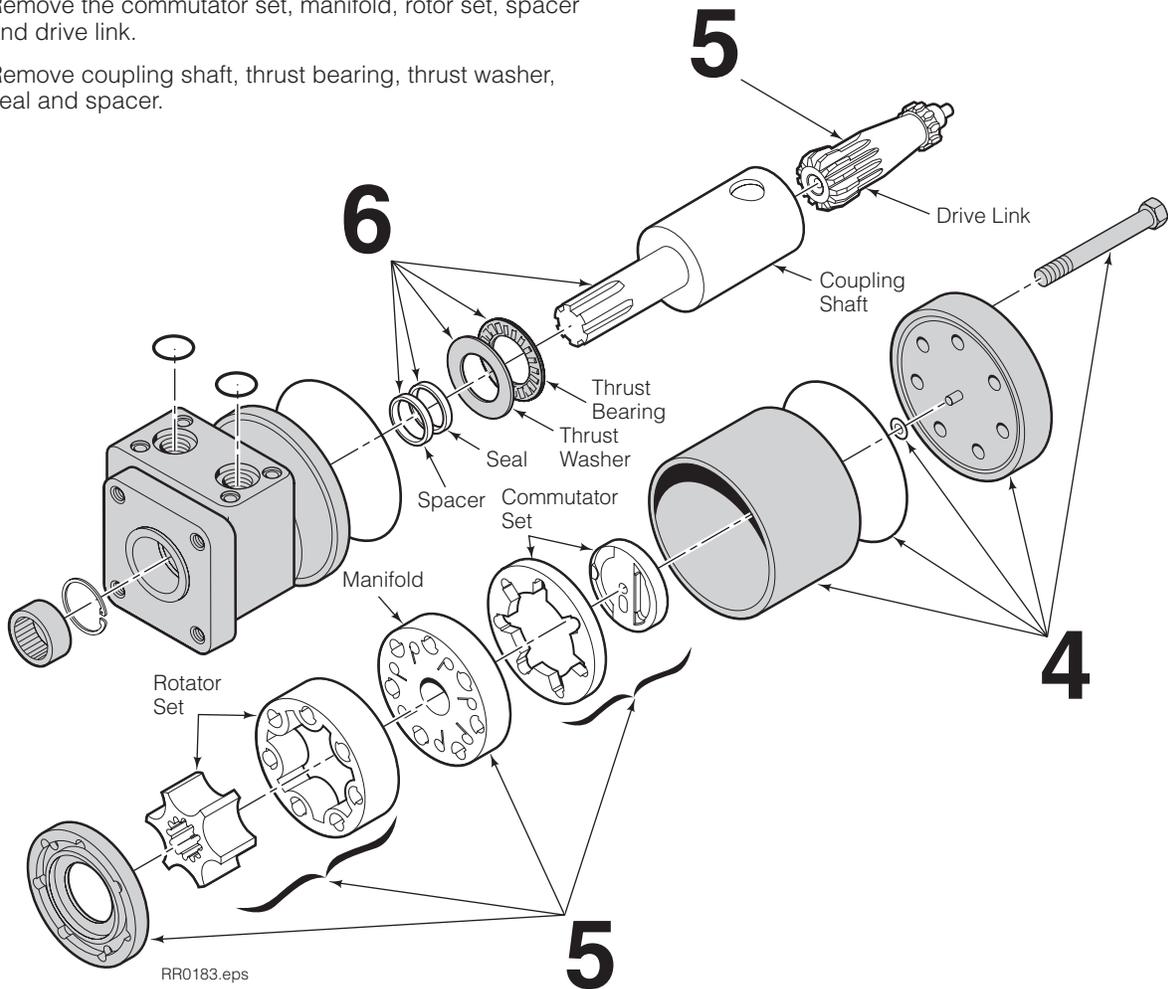
IMPORTANT: See motor end cover for identification.

Cascade provides service replacement parts for only the unshaded parts below. Due to cost, if other parts need replacement, the complete drive motor should be replaced.

- 1 Remove the drive motor from the drive group as described in Section 4.3-1.
- IMPORTANT:** Service the drive motor in a clean work area.
- 2 Drain oil from the drive motor by rotating the coupling shaft. Wash the outside of the drive motor with solvent and blow dry.
- 3 Clamp the drive motor in a vise with the coupling shaft downward.
- 4 Remove the end cover bolts, end cover, washer, seal and sleeve. For reassembly, tighten the cover bolts to a torque of 25 ft.-lbs. (35 Nm).
- 5 Remove the commutator set, manifold, rotor set, spacer and drive link.
- 6 Remove coupling shaft, thrust bearing, thrust washer, seal and spacer.



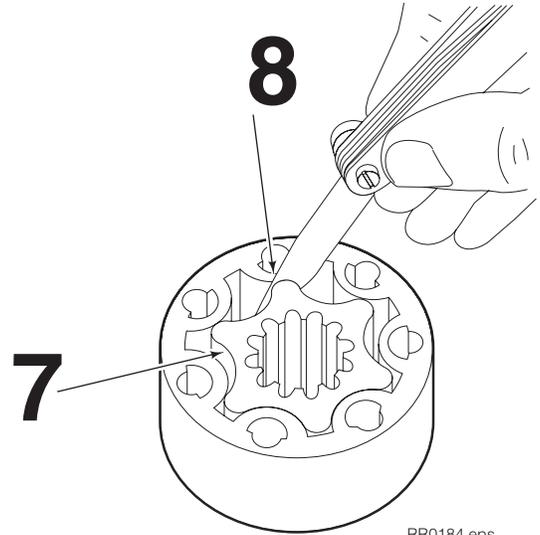
RR0185.eps



RR0183.eps

4.3-2 Ross Drive Motor Disassembly and Service (Continued)

- 7** Inspect the rotor set for pits and wear marks. If either part is pitted or worn the set should be replaced.
- 8** Measure the tip clearance between the rotor sets rotor and stator. Replace the rotor set if the clearance exceeds 0.006 in. (0.15mm).
- 9** For reassembly, reverse the above procedures except as follows:
 - Lubricate the bearings with wheel bearing grease prior to reassembly.
 - Before installing the end cover, apply wheel bearing grease to the small washer and place the washer over the pin in the end cover.



RR0184.eps

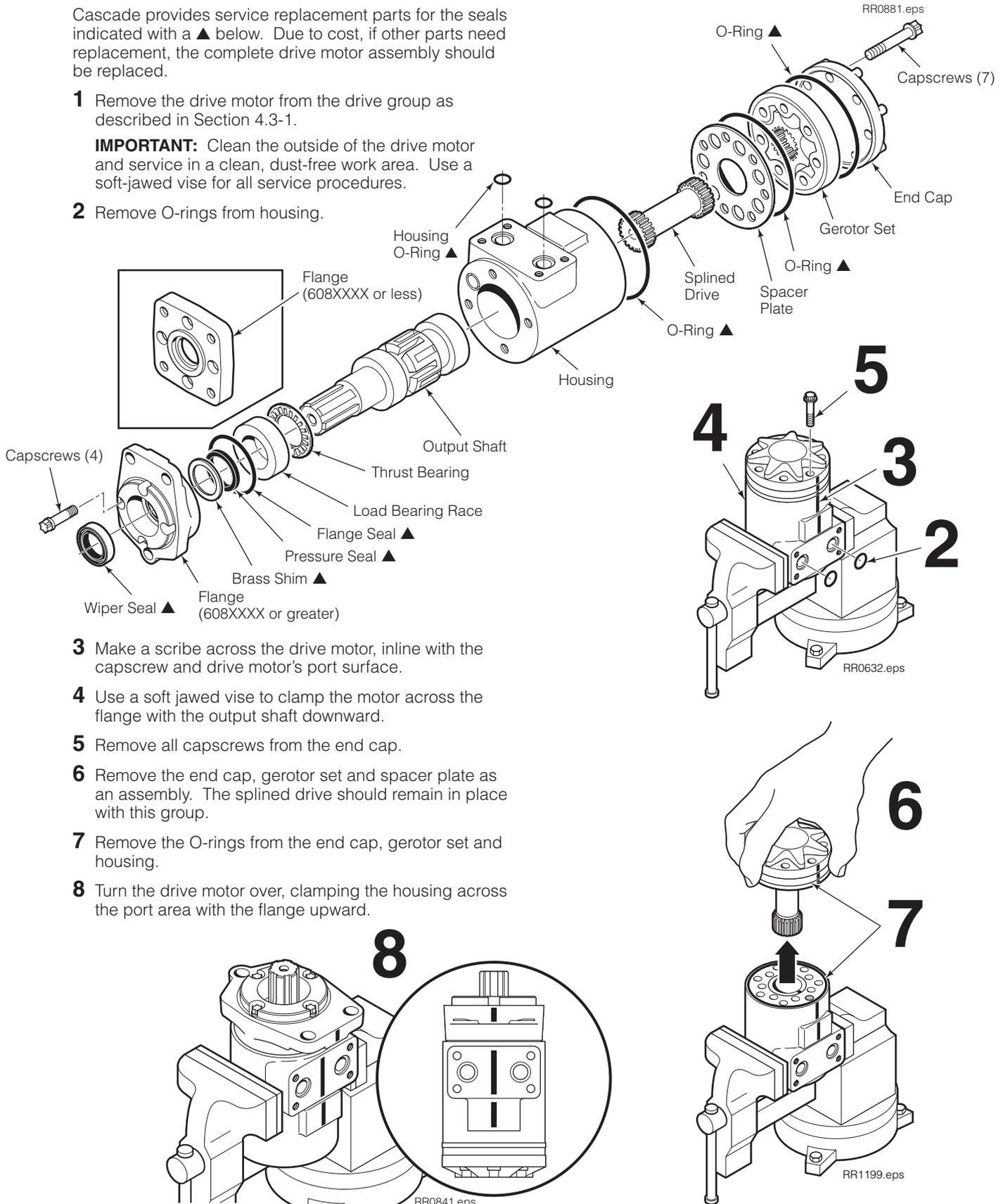
4.3-3 Char-Lynn® Drive Motor Disassembly

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 4.3-1.

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 Use a soft jawed vise to clamp the motor across the flange with the output shaft downward.
- 5 Remove all capscrews from the end cap.
- 6 Remove the end cap, gerotor set and spacer plate as an assembly. The splined drive should remain in place with this group.
- 7 Remove the O-rings from the end cap, 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 degrees 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.

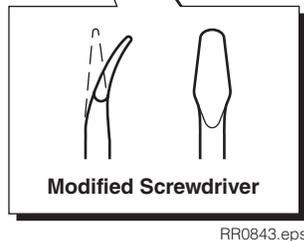
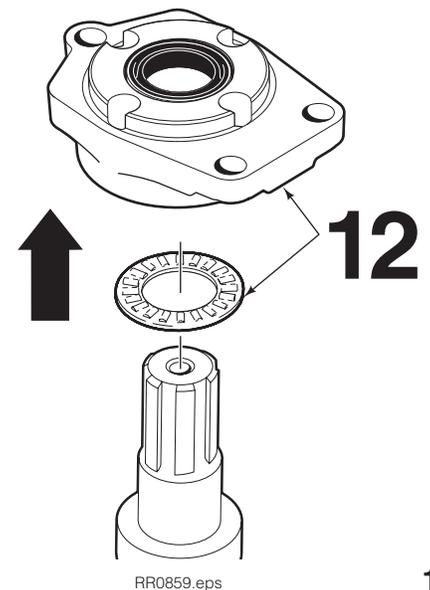
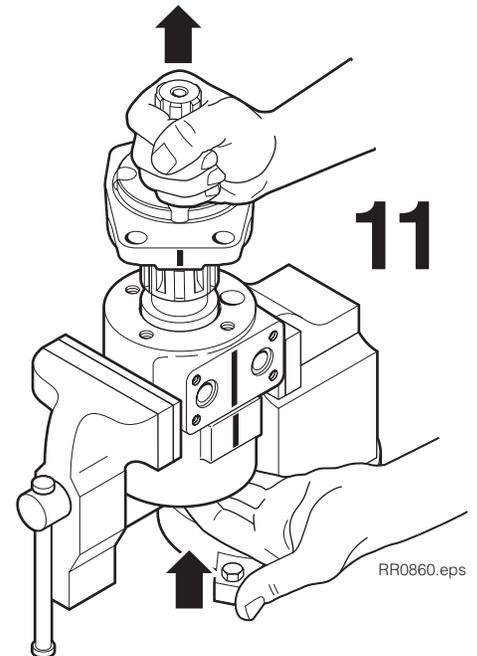
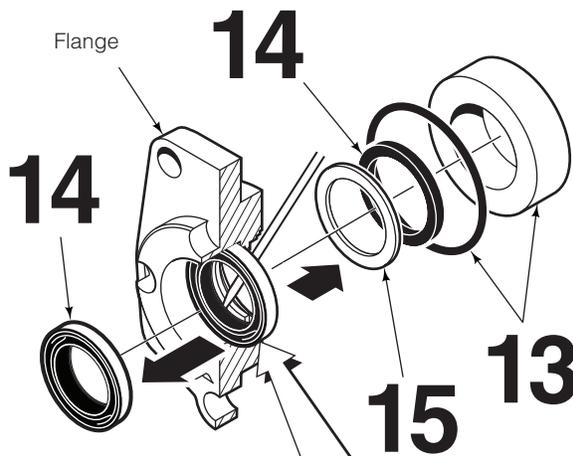
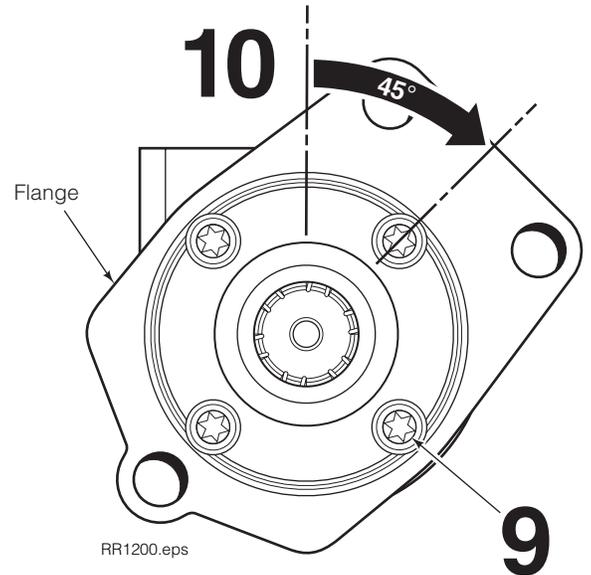
12 Remove the flange and thrust bearing from the output shaft.

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.



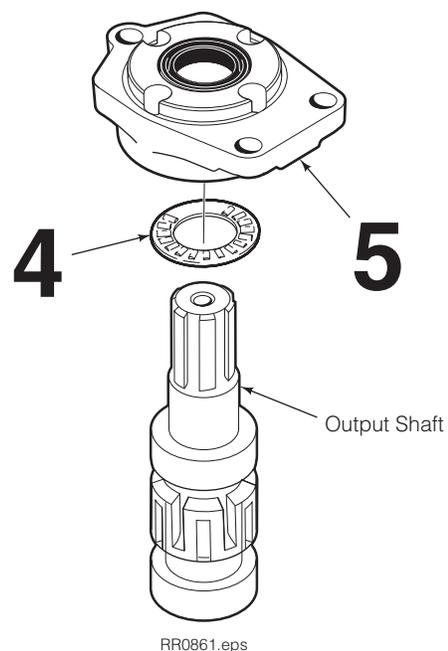
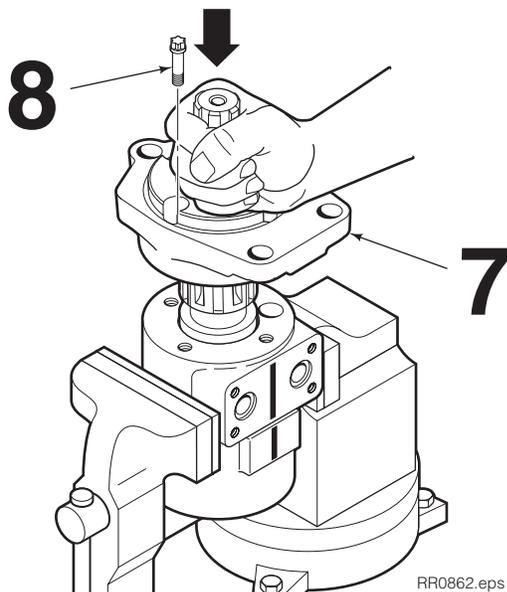
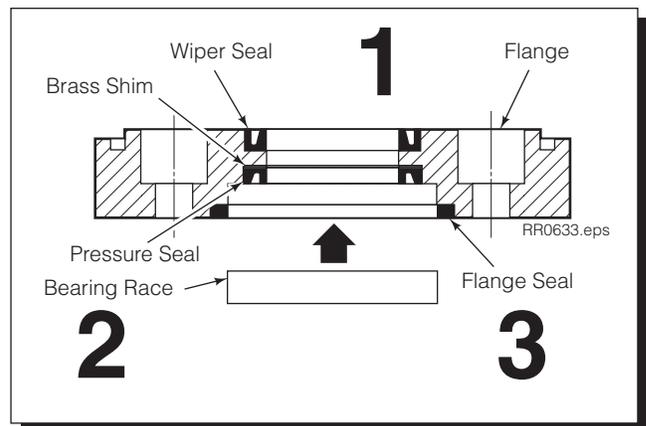
4.3-4 Char-Lynn® Drive Motor Inspection

- 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.

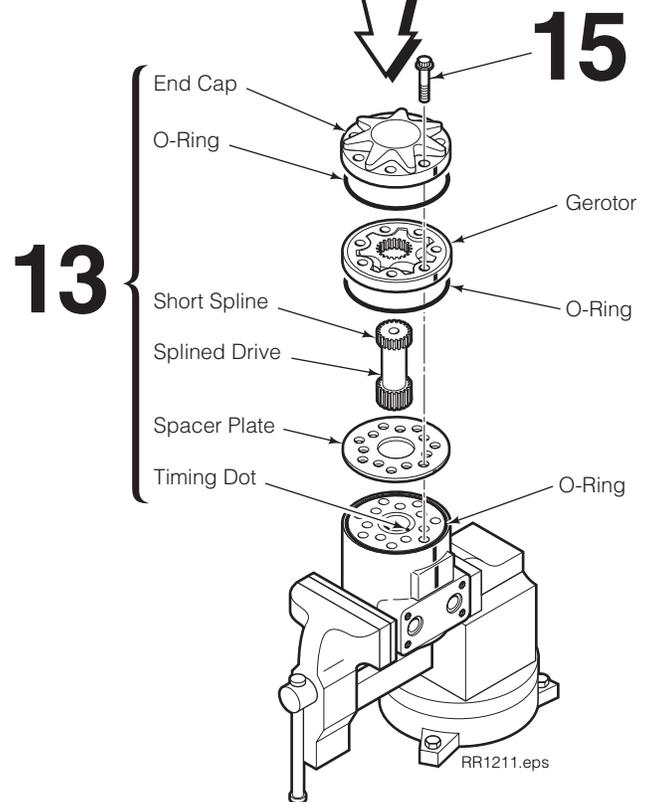
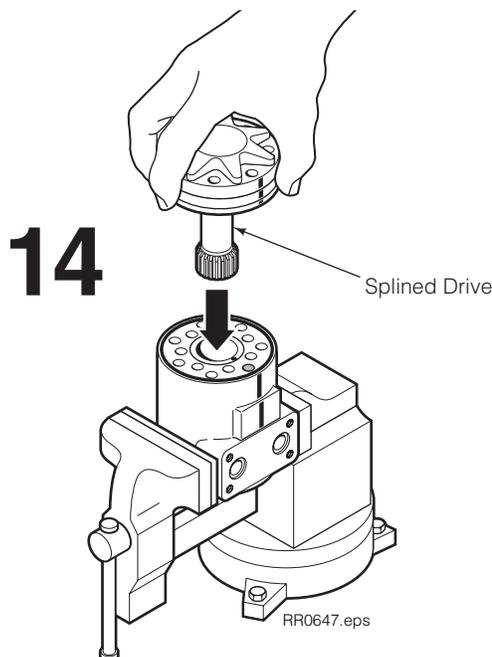
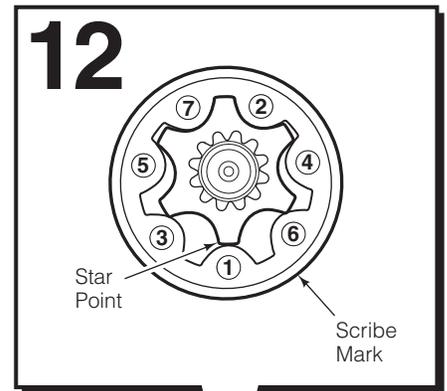
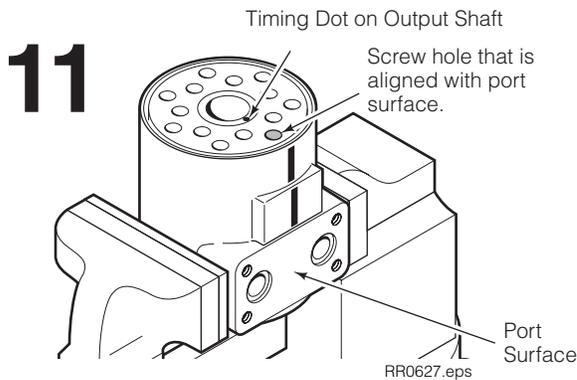
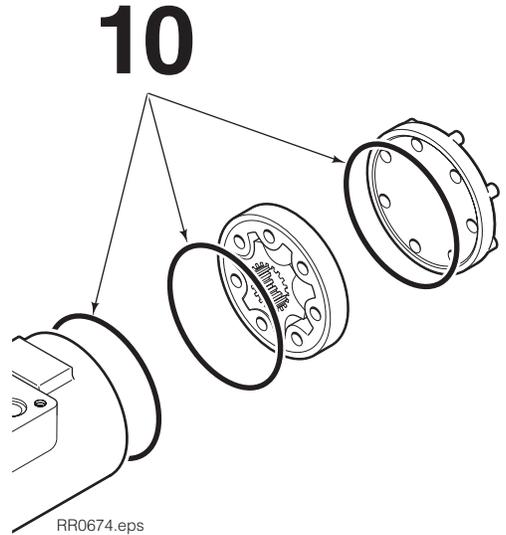
4.3-5 Char-Lynn® Drive Motor Reassembly

- 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 alternating 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, gerotor set and endcap grooves.
- 11 Align the output 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 star point with the capscrew hole, as shown.
- 13 Assemble together the endcap with O-ring, gerotor set with O-ring, drive (short spline end into gerotor 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 an alternating cross pattern to 240 in.-lbs. (27 Nm).



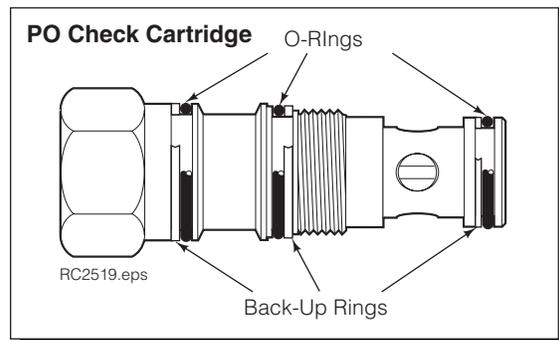
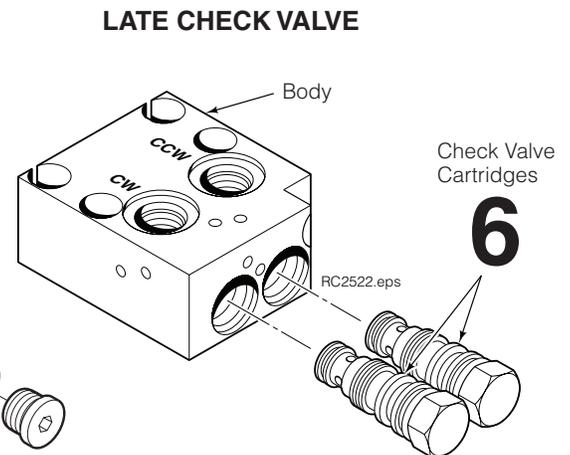
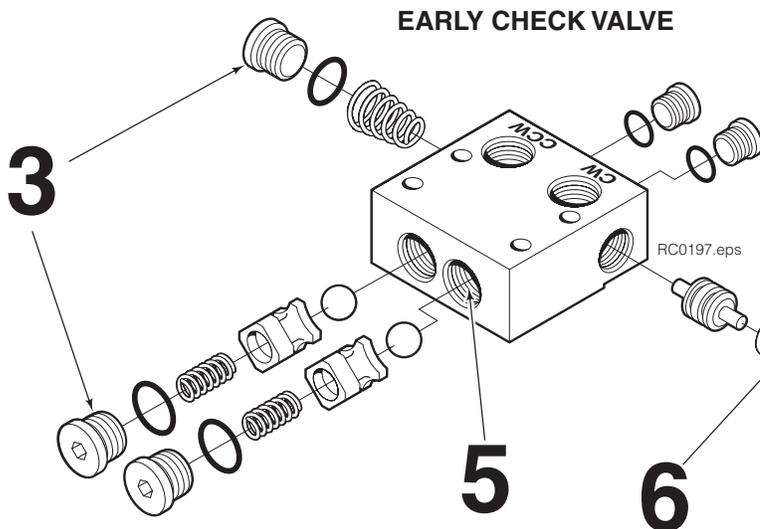
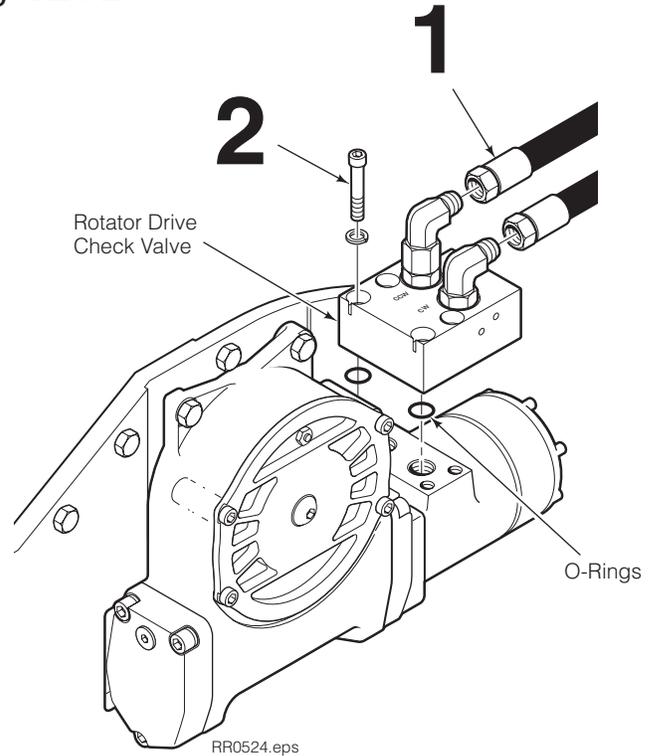
4.4 Check Valve Assembly

4.4-1 Check Valve Assembly Service Models – 40D, 55D, 65D, 100D, 120D



WARNING: Before removing supply hoses, relieve pressure in hydraulic lines. Turn truck off, then 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).

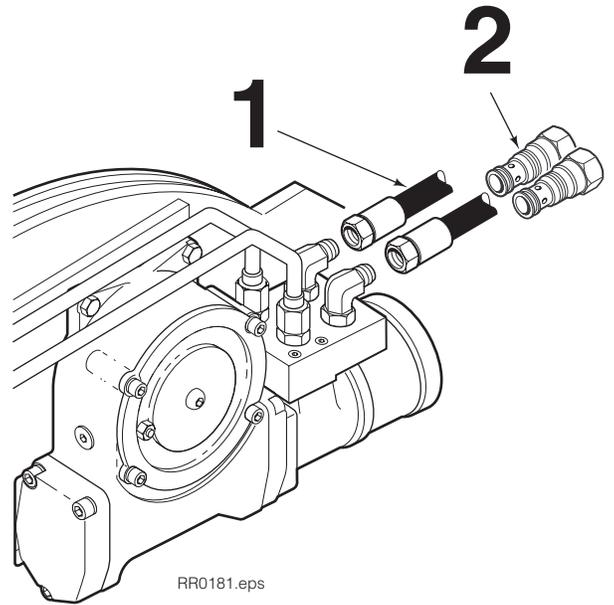


4.4-2 Check Valve Assembly Service Models – 150D, 200D



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

- 1 Disconnect the hydraulic hoses to the drive group. Tag the hoses for reassembly.
- 2 Remove the check valve cartridges.
- 3 Remove the O-rings and backup rings from the check valve cartridges.
- 4 Clean the parts with solvent.
- 5 For reassembly, reverse the above procedures except as follows:
 - Lubricate all O-rings and seals prior to reassembly with petroleum jelly.
 - The check valve cartridge backup rings and O-rings must be installed. Refer to previous page.



4.5 Base Unit

4.5-1 Bearing Assembly – Capscrew Torque Inspection

500-Hour Inspection

Every 500 hours perform the following inspection:

- 1 Check the accessible baseplate capscrews above upper mounting hooks for an initial torque:

40D-120D – 80 ft.-lbs. (110 Nm)

150D, 200D – 280 ft.-lbs. (380 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 fasteners as described in Section 4.5-2.
- If capscrews do not rotate, continue with faceplate capscrew inspection in Step 2.

- 2 Remove the access plug from the back of the baseplate and rotate the attachment forks are positioned parallel to the ground. Check three capscrews closest to the access hole for an initial torque:

40D-120D – 80 ft.-lbs. (110 Nm)

150D – 280 ft.-lbs. (380 Nm)

200D – 394 ft.-lbs. (534 Nm)

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

- If any faceplate capscrew are loose, rotate or broken, replace all faceplate fasteners as described in Section 4.5-2.
- If capscrews do not rotate, inspection is complete.

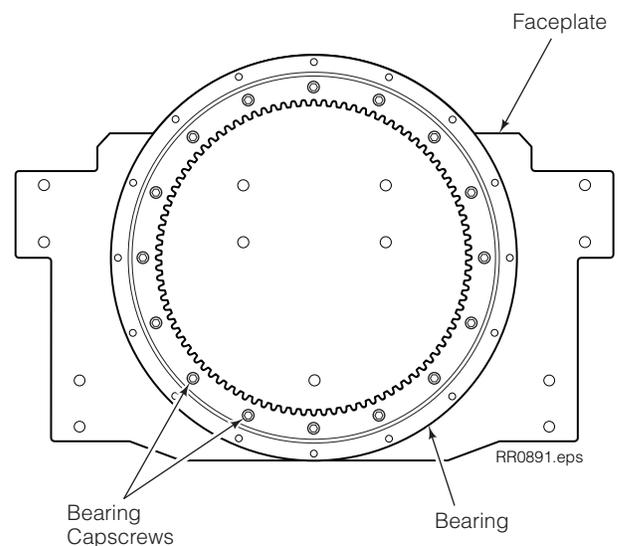
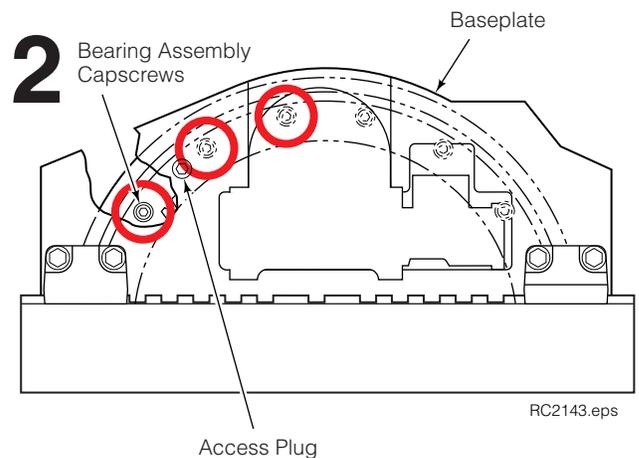
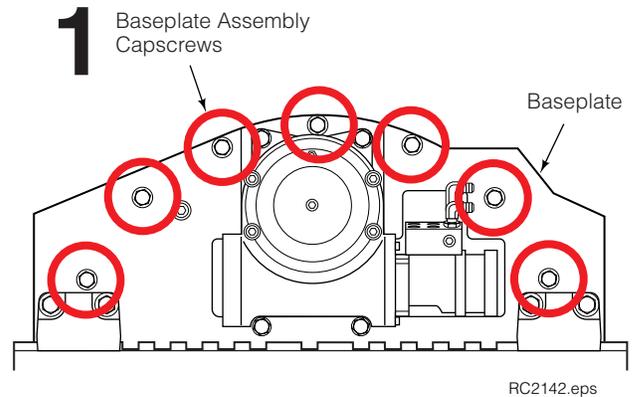
2000-Hour Inspection

Every 2000 hours perform the following inspection:

NOTE: The attachment must be removed from truck to provide access to all bearing assembly capscrews. For faceplate capscrews, remove the baseplate (shown) or use access hole to provide access to all faceplate capscrews. Refer to section 4.5-3.

- 1 Check **all** baseplate and faceplate capscrews fastened to the bearing assembly. Tighten until torque is 10 ft.-lbs. (14 Nm) above torque values listed above. Mark each capscrew after checking.

- If any capscrews are loose, rotate or broken, replace all capscrews as described in Section 4.5-3.
- If capscrews do not rotate, inspection is complete.

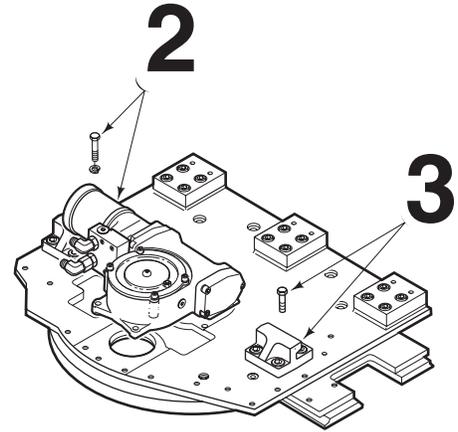


(Baseplate Removed)

4.5-2 Bearing Assembly Removal and Installation

- 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 4.2-1.
- 3 Remove upper mounting hooks. For reassembly, tighten the capscrews to the torque values below:

40D, 55D, 65D, 100D – 115 ft.-lbs. (155 Nm)
120D, 150D – 200 ft.-lbs. (270 Nm)



RR0180.eps

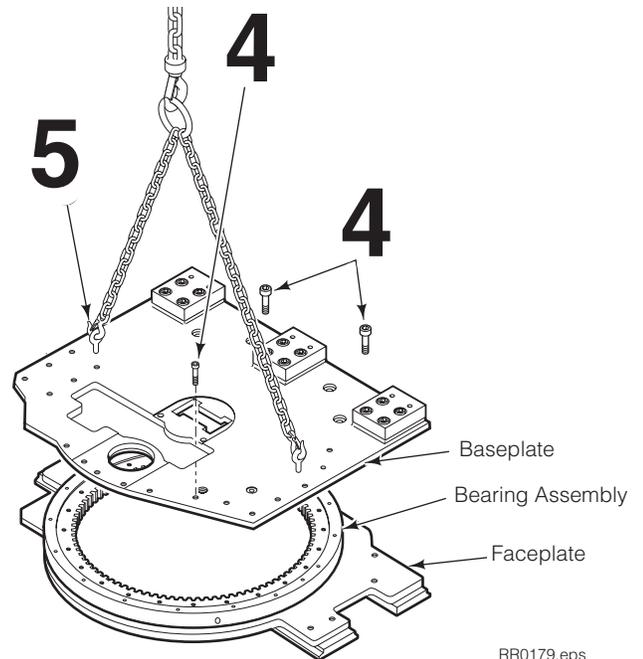
- 4 Remove the capscrews fastening the baseplate to the bearing assembly. For reassembly, tighten the capscrews to the torque values shown. If necessary, remove the lower mounting spacers to gain access to all of the capscrews. For reassembly, tighten the capscrews to a double torque values below:

40D – 120D – 80 ft.-lbs. (108 Nm)
150D, 200D – 280 ft.-lbs. (380 Nm)



WARNING: Check the attachment weight (located on the nameplate) to make sure the overhead hoist and chains or straps are at least the rated capacity of the attachment.

- 5 Attach two eyebolts to the baseplate. Attach an overhead hoist and lift away the baseplate.

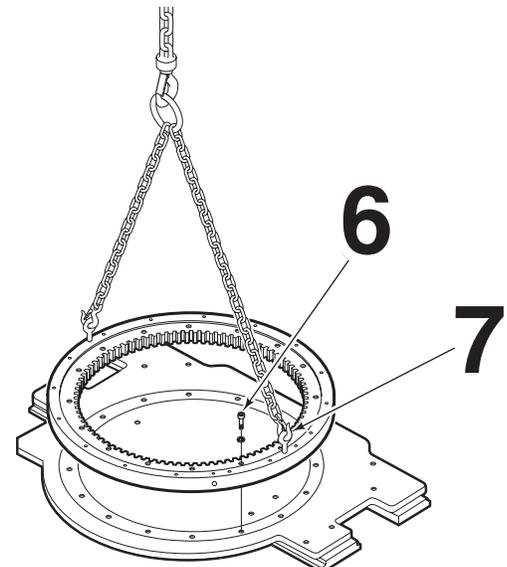


RR0179.eps

- 6 Remove the capscrews fastening the baseplate to the faceplate. New capscrews are supplied with each new bearing assembly, tighten the new capscrews to a double torque values below:

40D, 55D, 65D, 100D, 120D – 80 ft.-lbs. (108 Nm)
150D – 280 ft.-lbs. (380 Nm)
200D – 394 ft.-lbs. (534 Nm)

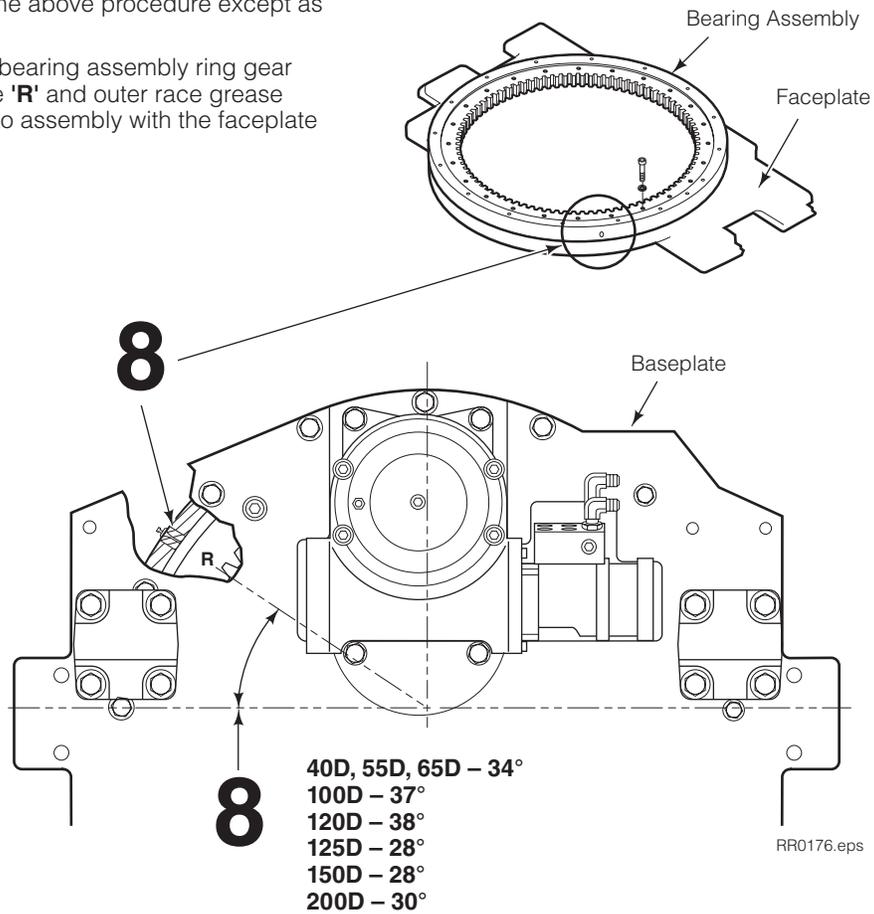
- 7 Attach two eyebolts to the baseplate. Attach an overhead hoist and lift away the baseplate.



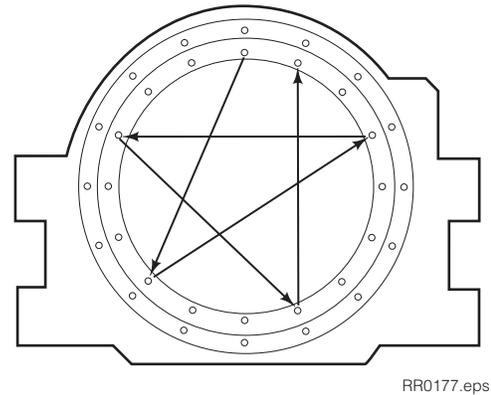
RR0182.eps

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

- Align and position the bearing assembly ring gear heat treat overlap zone 'R' and outer race grease fitting as shown, prior to assembly with the faceplate and baseplate.



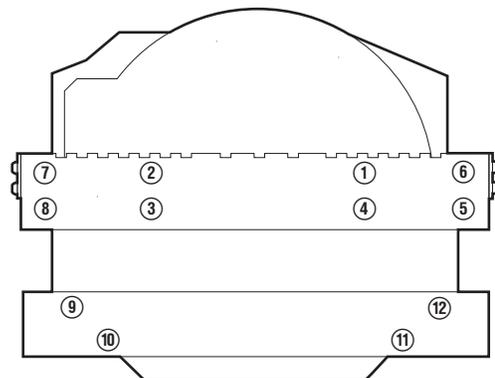
- Tighten the bearing assembly capscrews to half torque value using the star pattern shown. Then tighten to full torque value.
- Apply NLGI No. 0 grease to the teeth of the bearing assembly ring gear.
- After mounting the attachment on the lift truck, apply chassis grease to the bearing assembly grease fitting. Rotate the attachment slowly while applying grease.



4.5-3 Fork Service

1 Tighten the fork bar capscrews using the tightening sequence shown.

- 40D – 110 ft.-lbs. (150 Nm)
- 55D, 65D, 100D – 140 ft.-lbs. (190 Nm)
- 120D, 125D, 150D – 200 ft.-lbs. (270 Nm)



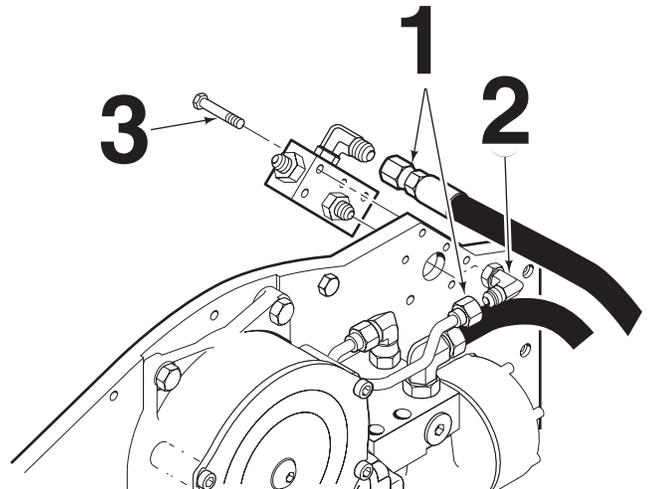
4.6 180° Stop Group

4.6-1 Stop Valve Service

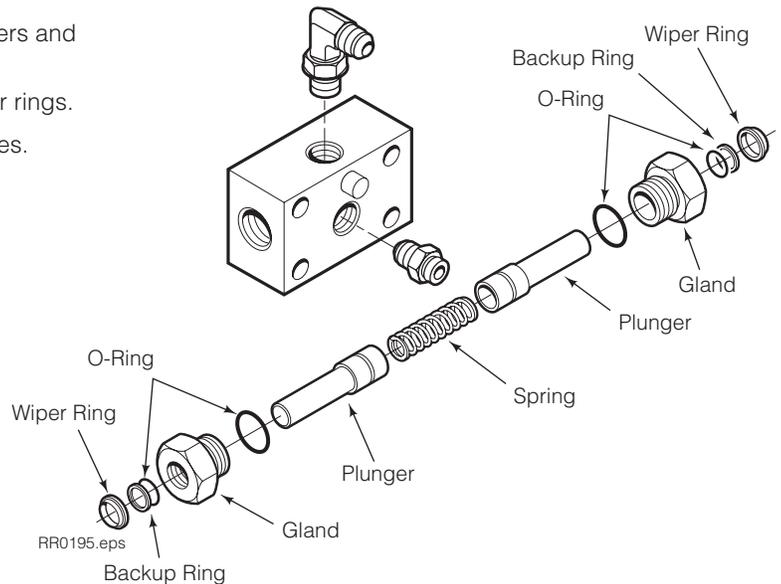


WARNING: Before removing any hoses, relieve system pressure in the hydraulic system. Turn the truck off, then open the auxiliary control valves several times in both directions.

- 1 Disconnect the hydraulic hoses and tube from the stop valve fitting.
- 2 Remove the elbow fitting that comes out through the baseplate.
- 3 Remove the capscrews fastening the stop valve to the baseplate. For reassembly, tighten the capscrews to a torque of 40 ft.-lbs. (55 Nm).
- 4 Remove the end glands. Remove the plungers and spring. Remove the exterior.
- 5 Replace the O-rings, backup rings and wiper rings.
- 6 For reassembly, reverse the above procedures.



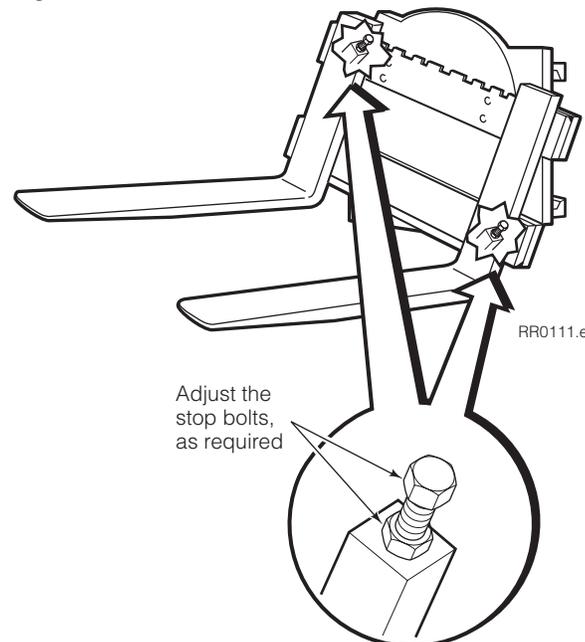
RR0175.eps



RR0195.eps

4.6-2 Stop Group Adjustment

Rotate the attachment in each direction to the stop positions. If the stop positions need to be changed, loosen the stop bolt locknuts and adjust the stop bolts as required. Retighten the lock nuts after adjusting.



RR0111.eps

5.1 Specifications

5.1-1 Hydraulics

Truck Relief Setting

2000 psi (140 bar) Recommended
2300 psi (160 bar) Maximum

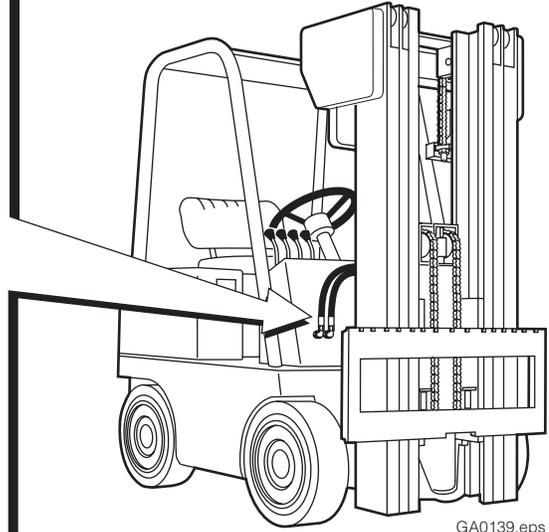
Truck Flow Volume ^①

	Min. ^②	Recommended	Max. ^③
40D-100D	5 GPM (19 L/min)	10 GPM (38 L/min)	15 GPM (57 L/min)
120D	7 GPM (26 L/min)	12 GPM (45 L/min)	15 GPM (57 L/min)
150D	10 GPM (37 L/min)	20 GPM (76 L/min)	24 GPM (95 L/min)
200D	12 GPM (57 L/min)	20 GPM (76 L/min)	24 GPM (95 L/min)

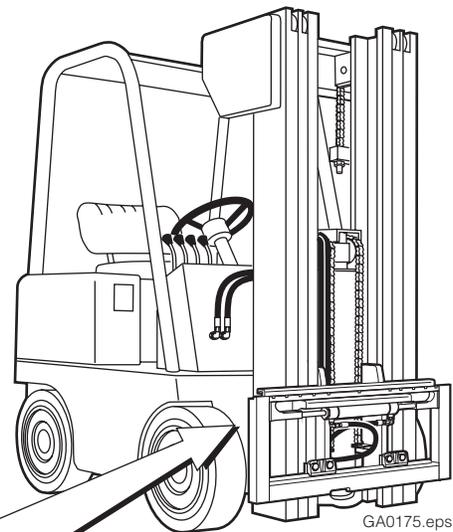
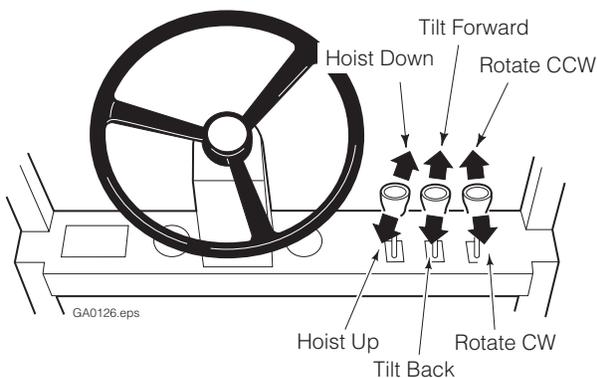
① Cascade D-Series Rotators are compatible with SAE 10W petroleum base hydraulic fluid meeting Mil. Spec. MIL-O-5606 or MIL-O-2104B. Use of synthetic or aqueous base hydraulic fluid is not recommended. If fire resistant hydraulic fluid is required, special seals must be used. Contact Cascade.

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.



5.1-2 Auxiliary Valve Functions



5.1-3 Truck Carriage

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)

GA0028.eps

5.1-4 Torque Values

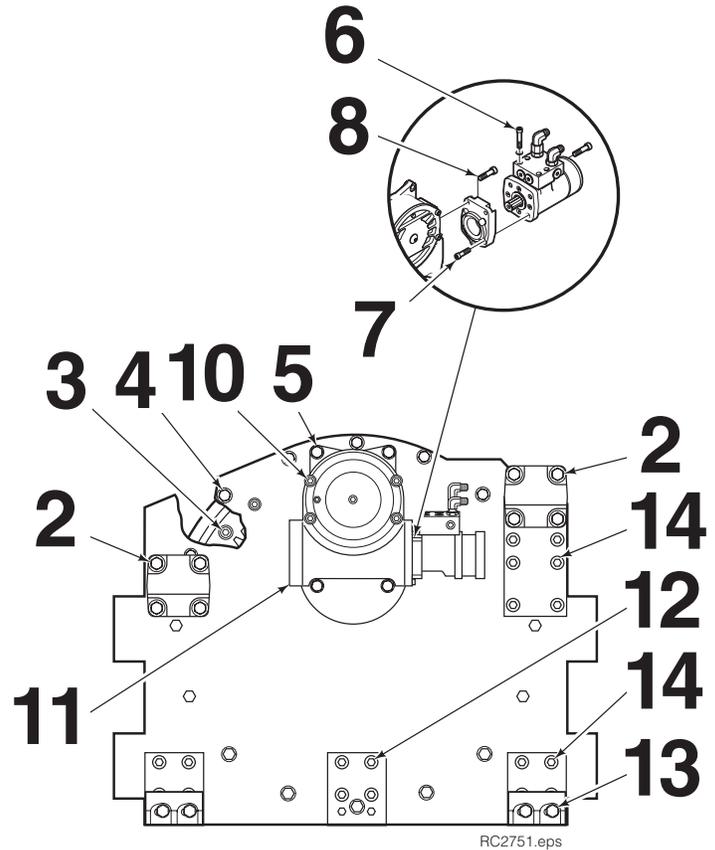
Fastener torque values for the D-Series Rotators are shown in the table below in both US and Metric units. All torque values are also called out in each specific service procedure throughout this manual.

NOTE: All fasteners have a torque value range of $\pm 10\%$ of stated value.

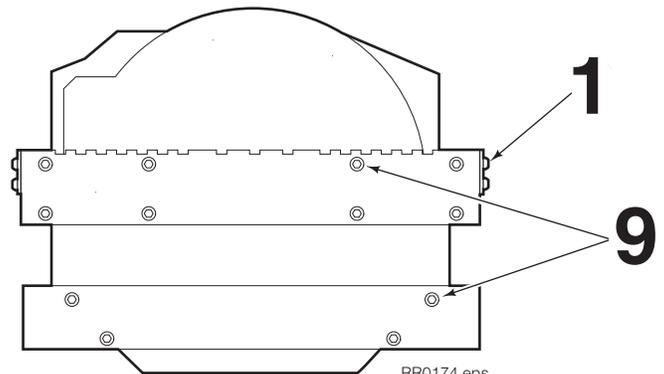
Ref.	Fastener Location	Size	Ft.-lbs.	Nm	
1	Fork Keeper Capscrews	1/2 (M12)	60	80	
2	Upper Hook Capscrews	40D-65D, 100D III	5/8 (M16)	115	155
		100D IV	3/4 (M20)	130	176
		120D	M20	265	360
		125D-150D	3/4 (M20)	200	270
3	Bearing Capscrews	40D-120D	1/2 (M12)	80	108 ▲
		125D-150D	3/4 (M20)	280	380 ▲
		200D	M20	394	534 ▲
4	Baseplate Capscrews	40D-120D	1/2 (M12)	80	108 ▲
		125D-200D	3/4 (M20)	280	380 ▲
5	Drive Group Housing Capscrews	1/2 (M12)	75	100	
6	Check Valve Capscrews	5/16 (M8)	24	32	
7	Adapter Plate/Motor Capscrews	3/8 (M10)	40	54	
8	Adapter Plate/Housing Capscrews	7/16 (M12)	65	88	
9	Fork Bar Capscrew	40D	M16	110	150
		55D-100D	3/4 (M20)	140	190
		120D-150D	3/4 (M20)	200	270
10	Housing Cover Plate Capscrews	5/16 (M8)	16	22	
11	Housing End Cover Capscrews	7/16 (M12)	65	88	
12	Center Spacer Capscrews	40D, 55D	5/8 (M16)	75	100
		65D	5/8 (M16)	115	155
		100D, 125D	1/2 (M12)	45	60
		120D, 150D	1/2 (M10)	45	60
13	Lower Hook Capscrew	40D	5/8 (M16)	110	150
		55D, 65D, 100D III	5/8 (M20)	110	150
		100D IV	3/4 (M20)	195	265
		120D	M20	260	360
		125D, 150D	3/4 (M20)	200	270
14	Hook Spacer Capscrew	100D	5/8 (M16)	115	155
		120D	3/4 (M20)	200	270

■ Use Loctite 242 (Blue)

▲ Double-Torque (tighten, loosen 1/2 turn, retighten)



RC2751.eps



RR0174.eps

5.1-5 Determining Load Torque Requirements

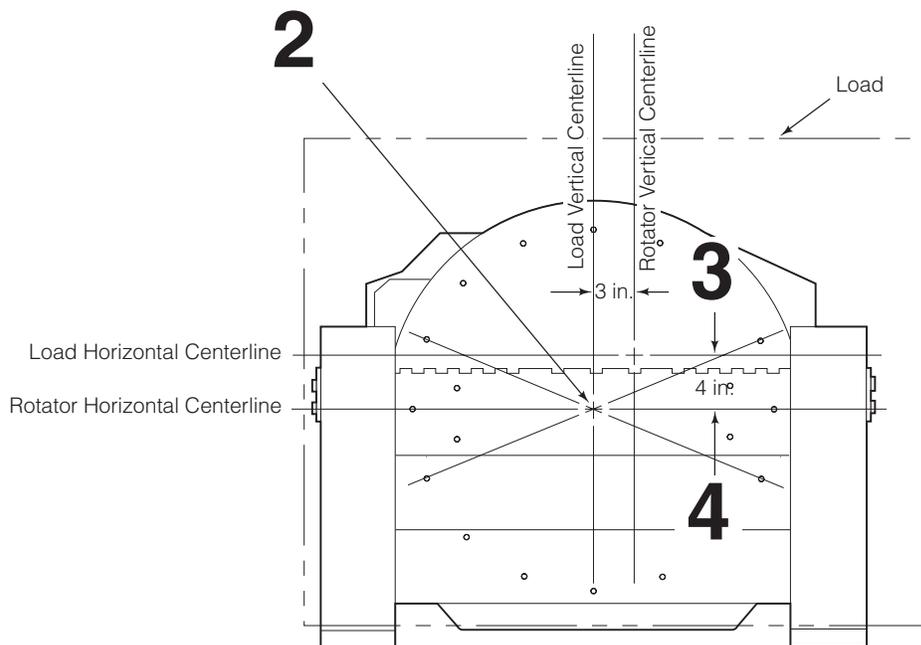
IMPORTANT: Positioning the load as close to center as possible will reduce the torque requirements and increase truck stability.

To make sure your Rotator will handle a specific load, calculate the torque requirements as follows:

- 1 Weigh the load to be handled. Example: 1500 lbs.
- 2 Determine the center of the rotator faceplate. Draw a line between a set of faceplate holes that are 180° apart. Repeat for a second set of holes. Where they cross is the center point of the rotator.
- 3 Determine the vertical off-center distance of the load. Measure from the load vertical centerline to the rotator vertical centerline.
- 4 Determine the horizontal off-center distance of the load. Measure from the load horizontal centerline to the rotator horizontal centerline.
- 5 Off-center distance calculation.
 - Square the vertical measurement.
Example: $(3 \text{ in.})^2 = 9 \text{ in.}$
 - Square the horizontal measurement.
Example: $(4 \text{ in.})^2 = 16 \text{ in.}$
 - Add these two figures together.
Example: $9 \text{ in.} + 16 \text{ in.} = 25 \text{ in.}$
 - Determine the square root and you have the total off-center distance.
Example: $\sqrt{25 \text{ in.}} = 5 \text{ in.}$ off-center distance
 - Multiply the total off-center distance by the load weight and you have the torque required to handle the load. Compare this figure to the rotator specifications in the chart.
Example: $5 \text{ in.} \times 1500 = 7500 \text{ in.-lbs.}$

Model	Maximum Torque Capacity
40D, 55D, 65D*	75,000 in.-lbs. @ 2000 psi (8,475 N·m @ 140 bar)
100D*	90,000 in.-lbs. @ 2000 psi (10,170 N·m @ 140 bar)
120D*	115,000 in.-lbs. @ 2000 psi (12,995 N·m @ 140 bar)
100D [†]	129,000 in.-lbs. @ 2000 psi (14,580 N·m @ 140 bar)
150D [†]	126,000 in.-lbs. @ 2000 psi (14,238 N·m @ 140 bar)
200D [†]	190,000 in.-lbs. @ 2000 psi (21,470 N·m @ 140 bar)

* Rated at 15 GPM (56L/min.) flow.
[†] Rated at 20 GPM (75L/min.) flow.



RR0173.eps

BLANK

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

