

**SERVICE REPAIR**

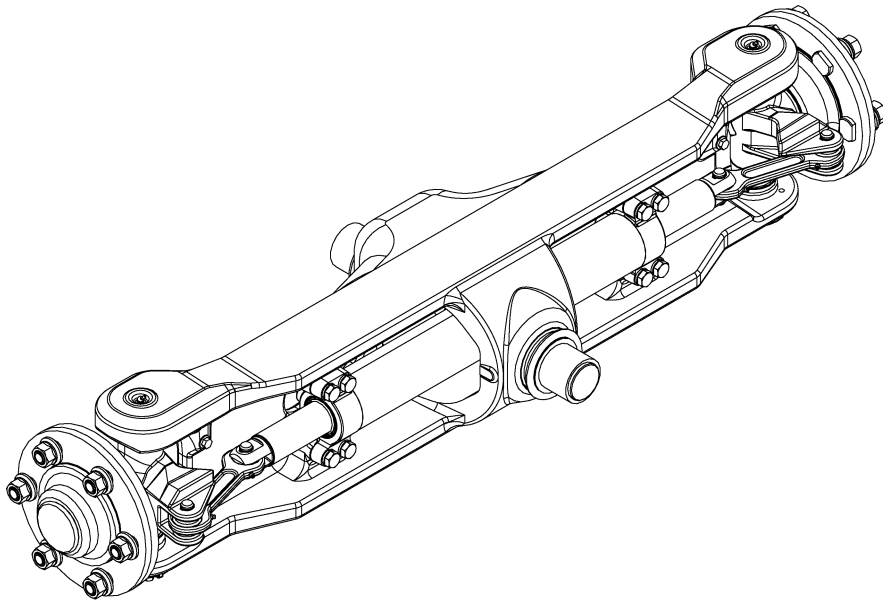
**MANUAL**

Hyster C299 (H170FT, F175FT36, F190FT) Internal  
Combustion Engine Trucks Service Repair Manual

***HYSTER***

# **STEERING AXLE**

**H6.0-7.0FT (H135-155FT) [L006];  
H8.0FT, H8.0FT9, H9.0FT  
(H170FT, H175FT36, H190FT) [C299]**



# ***HYSTER***

# SAFETY PRECAUTIONS

## MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Hyster® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

**NOTE:** The following symbols and words indicate safety information in this manual:



### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the **WARNING** symbol and word are on orange background. The **CAUTION** symbol and word are on yellow background.

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This section is for the following models:

H6.0-7.0FT (H135-155FT) [L006];  
H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) [C299]

**"THE  
QUALITY  
KEEPERS"**

**HYSTER  
APPROVED  
PARTS**

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Want to get more information,  
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## General

This section has the description and repair procedures for the steering axle.

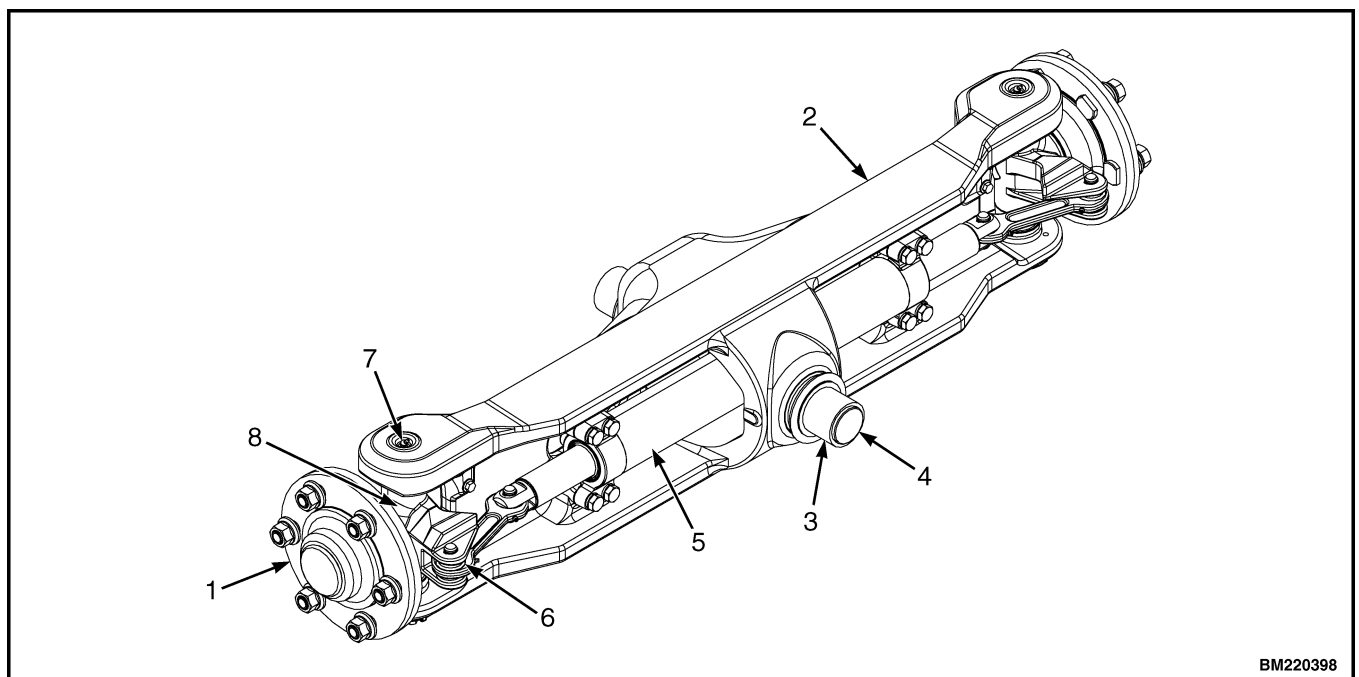
The steering axle assembly includes an axle frame, steering cylinder, and two spindle and hub assemblies. See Figure 1. The steering axle is articulated and is connected to the frame with two mounting plates and four capscrews and washers. See Figure 2.

The end caps of the steering cylinder are also the mounts for the cylinder and are held to the shell by the mount capscrews. There are O-rings, seals, and wipers in the end caps to seal the caps to the shell and rod. The ends of the piston rod extend from both ends of the cylinder. A single piston and the

seal are at the center of the rod. Oil pressure on one side of the piston moves the piston in the bore. The piston pushes an equal amount of oil from the opposite side of the cylinder.

When the piston reaches the end of the stroke, a relief valve in the steering circuit controls the oil pressure. The tie rods that connect the spindle arms to the cylinder are not adjustable. See Figure 1.

Each spindle turns on two tapered roller bearings in mounts in the axle frame. The preload on the bearings is controlled by shims at the lower bearing cap.



1. HUB ASSEMBLY
2. AXLE FRAME
3. BUSHING
4. STUB SHAFT

5. STEERING CYLINDER
6. TIE ROD
7. LUBE FITTING
8. SPINDLE

**Figure 1. Steering Axle Arrangement**

The wheels rotate on two tapered roller bearings and are held on the spindles by a castle nut. The bearing preload of the wheels is adjusted by the castle nut. The grease seals protect the bearings from dirt and water. Wear sleeves protect the hub from wear by the seals.

For information on performing regular maintenance and service on the steering axle, see service manual

**Periodic Maintenance** 8000SRM1957 for lift truck models

- H6.0-7.0FT (H135-155FT) (L006)

**Periodic Maintenance** 8000SRM1959 for lift truck models

- H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (C299)

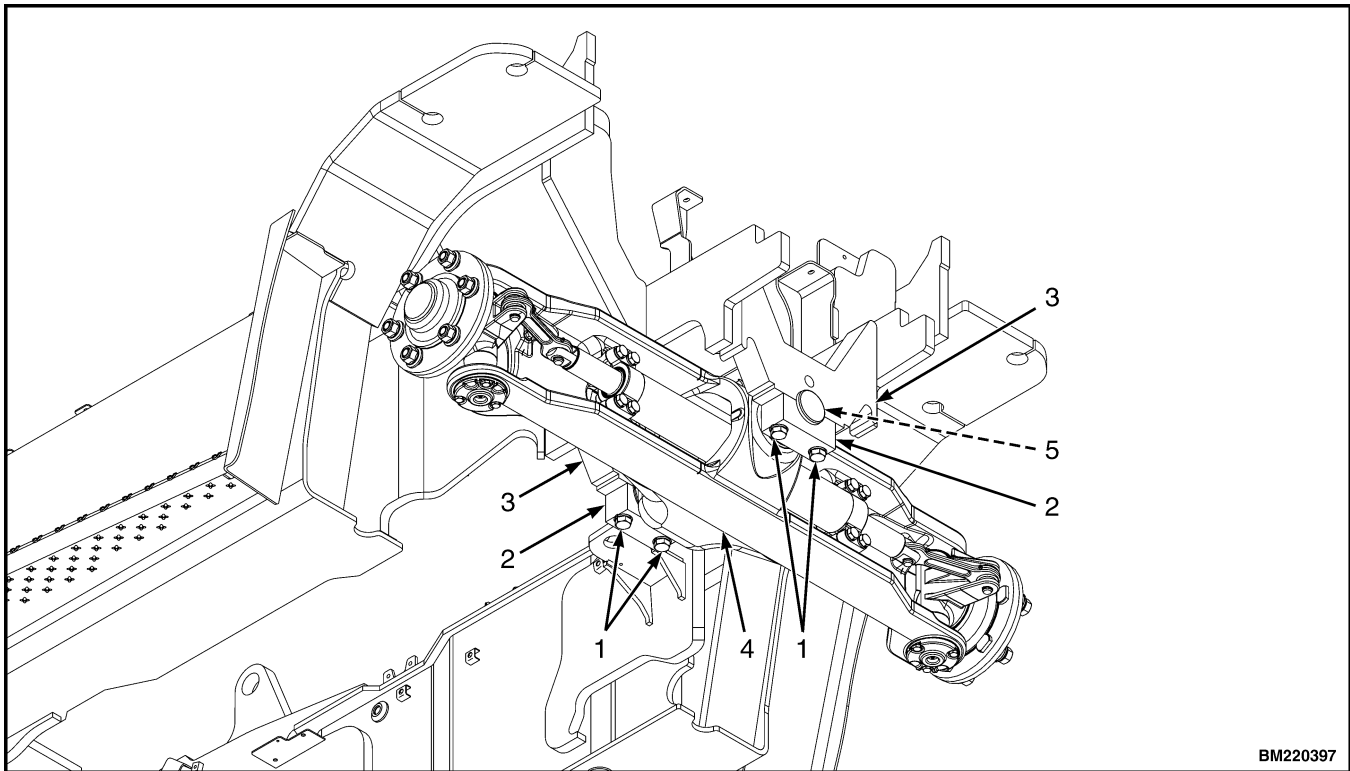
For information related to lift truck capacities and specifications, see service manual

**Capacities and Specifications** 8000SRM1958 for lift truck models

- H6.0-7.0FT (H135-155FT) (L006)

**Capacities and Specifications** 8000SRM1960 for lift truck models

- H8.0FT, H8.0FT9, H9.0FT (H170FT, H175FT36, H190FT) (C299)



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- |                        |                           |
|------------------------|---------------------------|
| 1. CAPSCREW AND WASHER | 4. STEERING AXLE          |
| 2. MOUNTING PLATE      | 5. STUB SHAFT AND BUSHING |
| 3. FRAME               |                           |

**Figure 2. Steering Axle Mounting Arrangement**



## Steering Axle Assembly Repair

### REMOVE



#### WARNING

#### PUTTING THE LIFT TRUCK ON BLOCKS

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the mast, drive axle, battery, or counterweight assemblies will cause large changes in the center of gravity. When the lift truck is put on blocks, put additional blocks in the following positions:

- If the mast and drive axle are removed, put blocks under the counterweight so the lift truck cannot fall backward.
- If the counterweight is removed, put blocks under the mast so that the lift truck cannot fall forward.

Put the lift truck on blocks on a solid, even, and level surface. Verify the blocks or stands have enough capacity to hold the lift truck. Use additional blocks next to the tires as necessary to prevent movement of the lift truck. Verify the lifting devices used during repairs can lift the weight of the parts and assemblies.

See the Operating Manual or Periodic Maintenance manual listed in the General section of this manual for the procedures to put the lift truck on blocks.

**NOTE:** The steering axle can be removed without removing the counterweight.

1. Verify wheels are set for straight travel. Put lift truck on blocks so the steering axle will have enough clearance to be removed. The top of the axle frame must have clearance under the bottom of the frame at the rear of the lift truck.
2. Disconnect hydraulic lines at steering cylinder. Install plug fittings in cylinder and put caps on hydraulic lines. Plug fittings will prevent spindles from turning as axle is removed from under the lift truck. See Figure 3.
3. Slide floor jack or forks of another lift truck under steering axle. Raise lifting device until it holds the weight of the axle assembly.
4. Remove four capscrews and washers from two mounting plates on bottom of steering axle and lift truck frame. See Figure 3.
5. Remove mounting plates and slowly lower steering axle assembly onto wheels. Carefully roll steering axle assembly away from lift truck.

### DISASSEMBLE

**NOTE:** If the spindle, bearings or tie rods need to be repaired, go to Spindles, Bearings, and Tie Rods Repair section for repair procedures.

1. Remove ring seal, shims, flange, stub shaft and bushing from steering axle assembly. See Figure 4.
2. Put axle on blocks so the wheels just touch the floor. Remove hub cap. Remove cotter pin, washer, and castle nut. Remove bearing cone and discard cotter pin.

**NOTE:** Identify and tag the outer and inner bearing cones so they can be reassembled in their original locations.

3. Slide wheel from spindle. Remove inner bearing cone, wear ring, and oil seal from spindle. See Figure 3.

**NOTE:** If the bearing is replaced, then the associated bearing cup must be replaced also.

4. If the bearings must be replaced, use a brass drift pin to remove the bearing cups and wear ring.
5. Repeat Step 1 through Step 4 for other wheel.

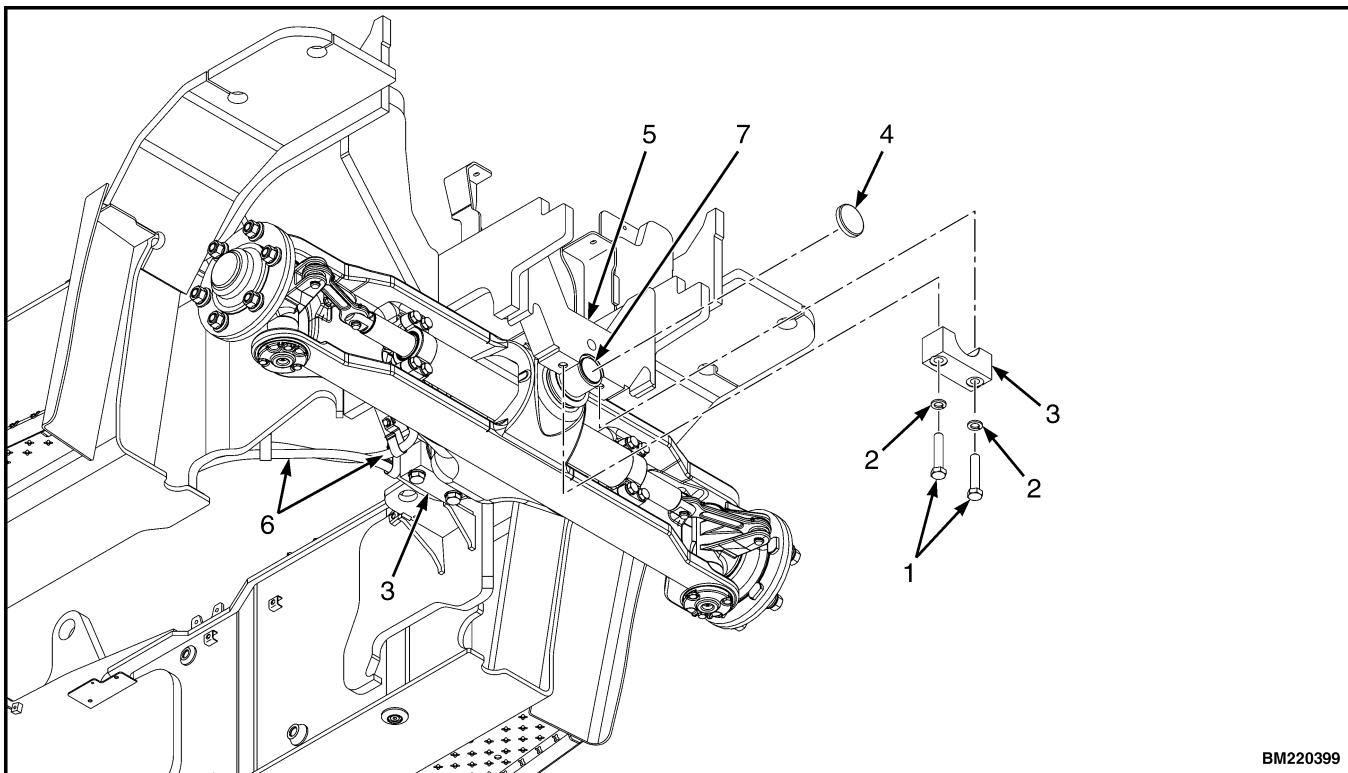
**CLEAN****WARNING**

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

**WARNING**

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

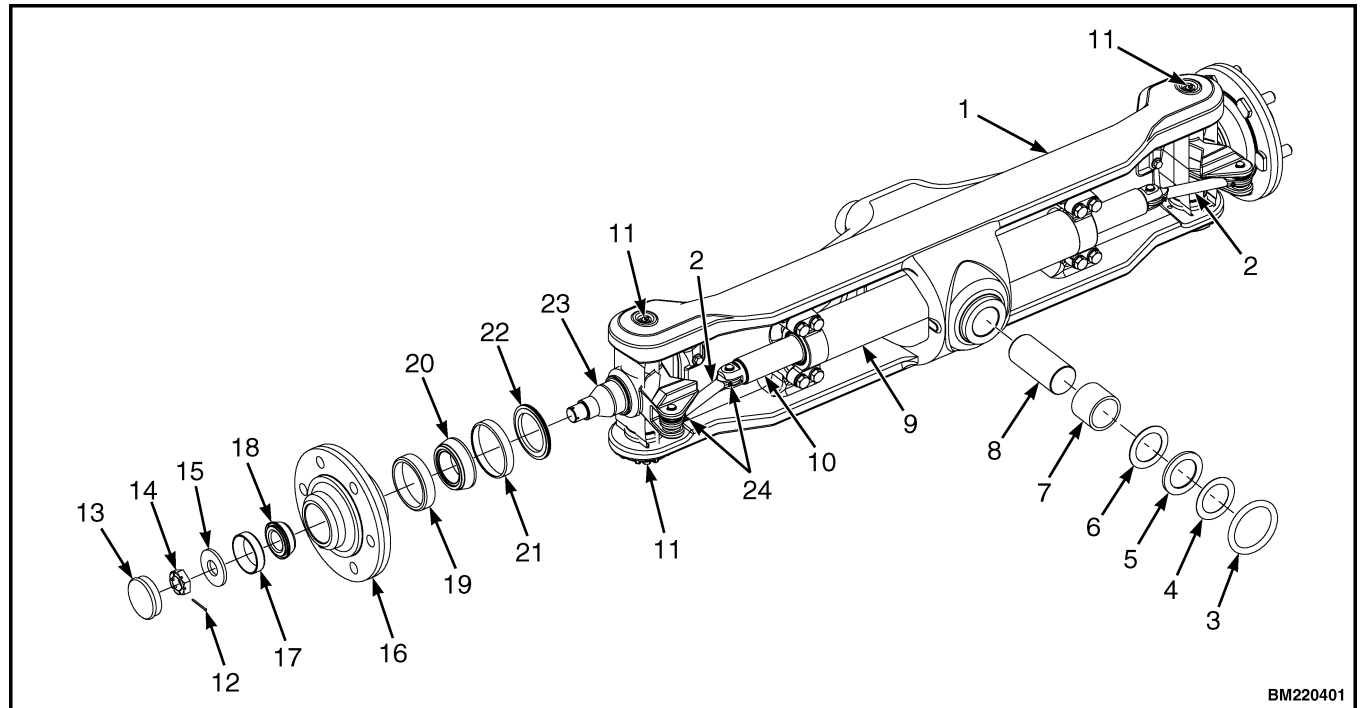
1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.
2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.
3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.



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- |                   |                                  |
|-------------------|----------------------------------|
| 1. CAPSCREW       | 5. FRAME MOUNT                   |
| 2. WASHER         | 6. STEERING AXLE HYDRAULIC LINES |
| 3. MOUNTING PLATE | 7. STUB SHAFT                    |
| 4. PLUG           |                                  |

**Figure 3. Steering Axle, Remove**



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- 1. STEER AXLE ASSEMBLY
- 2. TIE ROD
- 3. RING SEAL
- 4. SHIM
- 5. FLANGE
- 6. SHIM
- 7. BUSHING
- 8. STUB SHAFT
- 9. STEERING CYLINDER
- 10. STEERING CYLINDER ROD
- 11. GREASE FITTING
- 12. COTTER PIN

- 13. HUB CAP
- 14. CASTLE NUT
- 15. WASHER
- 16. WHEEL HUB
- 17. BEARING CUP (OUTER)
- 18. BEARING CONE (OUTER)
- 19. BEARING CUP (INNER)
- 20. BEARING CONE (INNER)
- 21. WEAR RING
- 22. OIL SEAL
- 23. SPINDLE
- 24. LUBE FITTING

**Figure 4. Steering Axle, Disassemble**

**INSPECT**

1. Inspect for loose, burned, missing, cracked or damaged hardware.
2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion or marred finish.

**ASSEMBLE**

**NOTE:** For specified lubricant to use, see the **Periodic Maintenance** manual listed in the General section of this manual.

1. If necessary, use a press to install new bearing cups in wheel or hub. See Figure 5.
2. Lubricate bearing cones with multipurpose grease. Verify bearings are filled with grease. Install oil seal, wear ring (if removed) and inner bearing cone on spindle.

**CAUTION**

**DO NOT** damage the seals during installation.

3. Carefully slide wheel onto spindle. Install outer bearing cone and install washer. See Figure 5.

**NOTE:** Ensure that the washer is seated properly against the bearing cone and not against the shaft shoulder before tightening the castle nut.

4. Install the castle nut and tighten castle nut as described below:
  - Tighten castle nut to 203 N•m (150 lbf ft) while rotating the wheel in both directions to properly seat the bearings. Loosen the castle nut until wheel turns freely with no end play. Tighten castle nut to 34 N•m (25 lbf ft).

5. Install new cotter pin in castle nut. If cotter pin cannot be installed, tighten castle nut to the first alignment position where the cotter pin can be installed.

6. Install hub cap. See Figure 5.

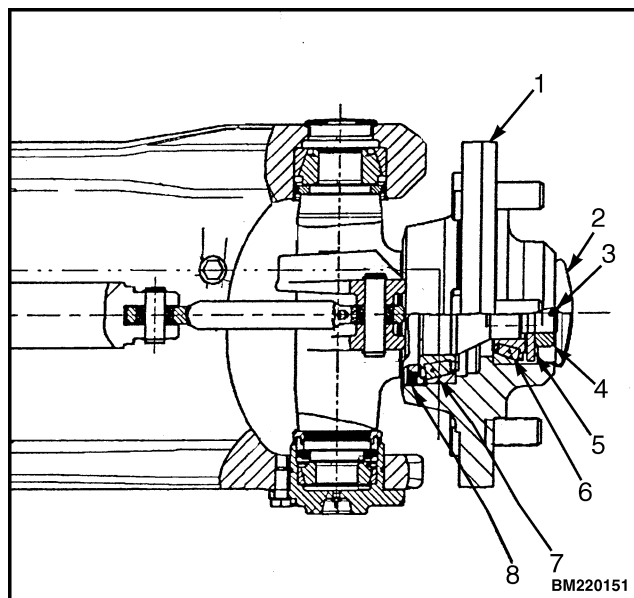
7. Repeat Step 1 through Step 6 for other wheel.

**NOTE:** Apply multipurpose grease to stub shaft prior to installing. See the **Periodic Maintenance** manual listed in the General section of this manual for grease specifications.

8. Install stub shaft, bushing, shims, flange, and rig seal to steering axle assembly. See Figure 4.

**INSTALL**

1. Use floor jack or another lift truck to put steering axle into position in frame.
2. Attach steering axle to lift truck frame with two mounting plates, four washers, and four capscrews. Tighten capscrews to 270 N•m (199 lbf ft). See Figure 3.
3. Remove plugs and caps and connect hydraulic lines to steering cylinder. See Figure 3.
4. Operate steering system to remove air from system. Turn steering wheel several times from one stop to the other. Check for hydraulic leaks.



**NOTE:** RIGHT SIDE SHOWN.

1. HUB ASSEMBLY
2. HUB CAP
3. COTTER PIN
4. CASTLE NUT
5. WASHER
6. OUTER BEARING CUP AND CONE
7. INNER BEARING CUP AND CONE
8. SEAL

**Figure 5. Bearing Arrangement**

## Spindles, Bearings, and Tie Rods Repair

### SPINDLES AND BEARINGS

#### Remove



#### WARNING

#### PUTTING THE LIFT TRUCK ON BLOCKS

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the mast, drive axle, battery, or counterweight assemblies will cause large changes in the center of gravity. When the lift truck is put on blocks, put additional blocks in the following positions:

- If the mast and drive axle are removed, put blocks under the counterweight so the lift truck cannot fall backward.
- If the counterweight is removed, put blocks under the mast so that the lift truck cannot fall forward.

Put the lift truck on blocks on a solid, even, and level surface. Verify the blocks or stands have enough capacity to hold the lift truck. Use additional blocks next to the tires as necessary to prevent movement of the lift truck. Verify the lifting devices used during repairs can lift the weight of the parts and assemblies.

See the Operating Manual or Periodic Maintenance manual listed in the General of this manual, for the procedures to put the lift truck on blocks.

1. Put the lift truck on blocks.
2. Remove the wheel and bearings. See Steering Axle Assembly Repair for procedures.
3. Remove two snap rings and washers from the pin holding the tie rod to steering cylinder rod and remove pin. See Figure 6.



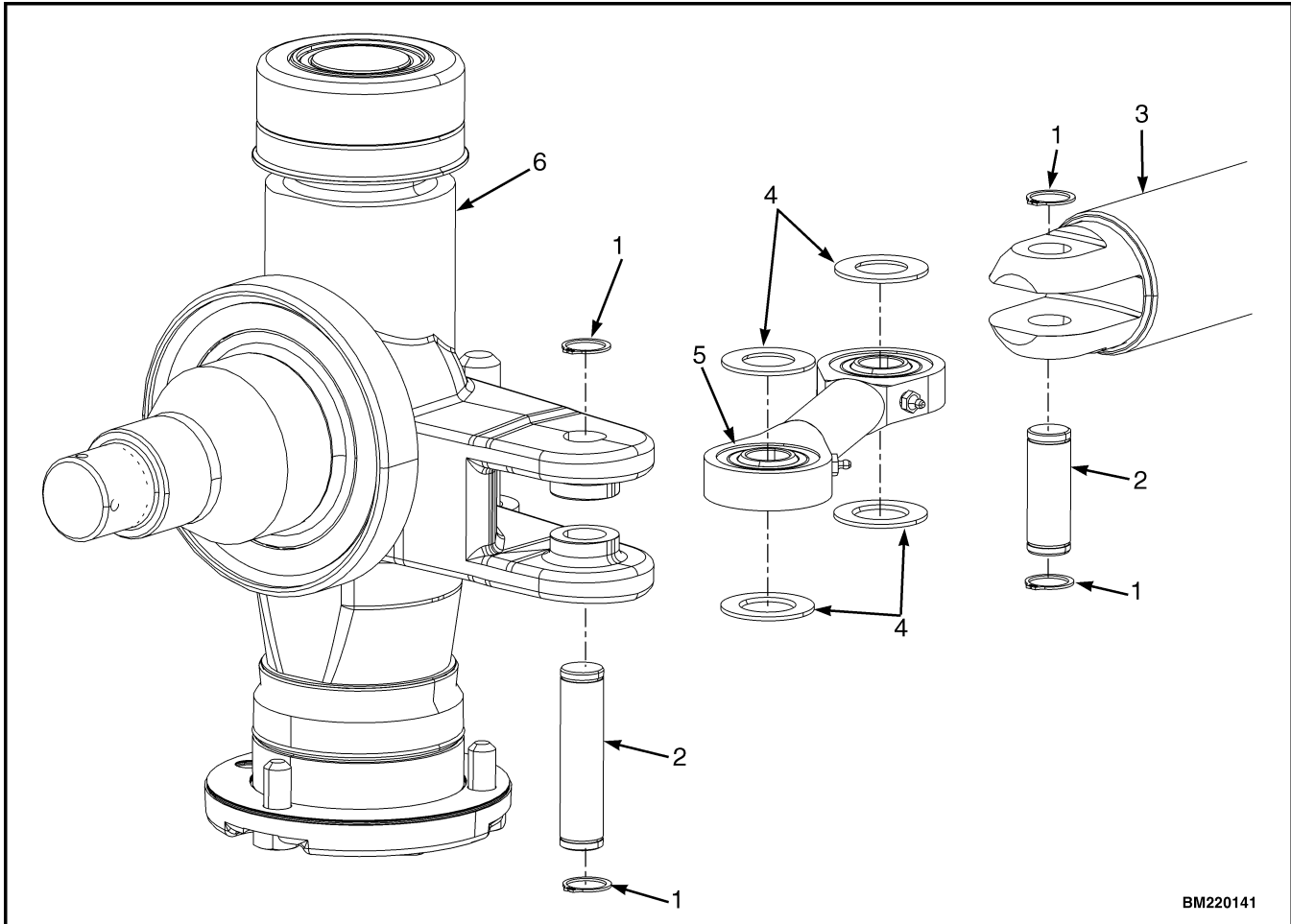
#### CAUTION

**DO NOT hit the threads of the tie rod.**

4. Remove snap rings, washers and pin. Remove tie rod end from spindle arm. See Figure 6.
5. If necessary, repeat above steps for other spindle and tie rod.

#### Disassemble

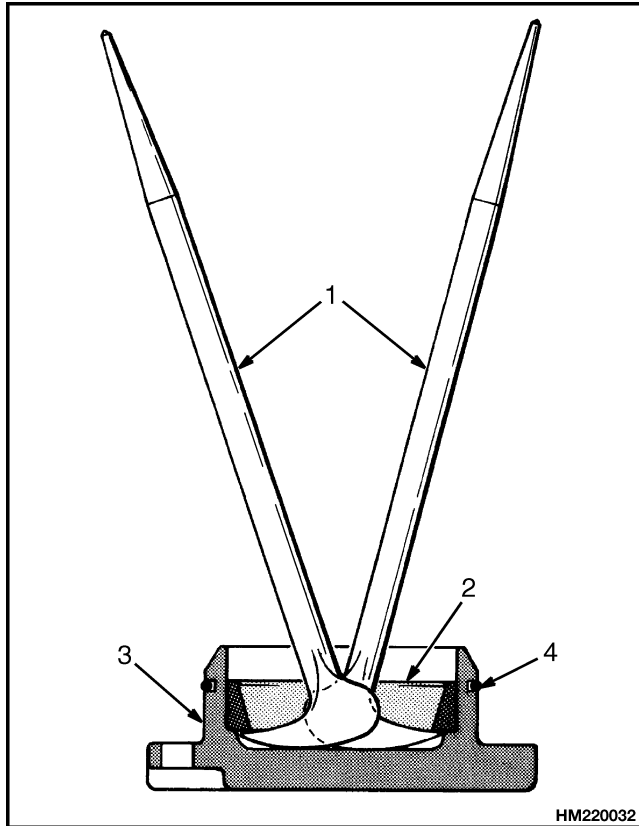
1. Remove plug from the top of spindle. Remove the capscrews from the bearing cap. Remove the bearing cap and shims. If necessary, remove the bearing cup from the bearing cap. See Figure 7.
2. Tilt the spindle and lift the spindle from the axle. If necessary, remove the bearing and seals from the spindle. If necessary, remove the wear sleeve and bearing cup from the axle frame.
3. If necessary, repeat above steps for other spindle and tie rod.



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- 1. SNAP RING
- 2. PIN
- 3. STEERING CYLINDER
- 4. SEAL
- 5. TIE ROD ASSEMBLY
- 6. SPINDLE (LEFT SIDE SHOWN)

**Figure 6. Tie Rod Assembly**



1. PRY BAR
2. BEARING CUP
3. BEARING CAP
4. O-RING

**Figure 7. Bearing Cup Removal**

### Clean

#### **WARNING**

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

#### **WARNING**

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.

2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.
3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

### Inspect

1. Inspect for loose, missing, cracked, burned or damaged hardware.
2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion, or marred finish.

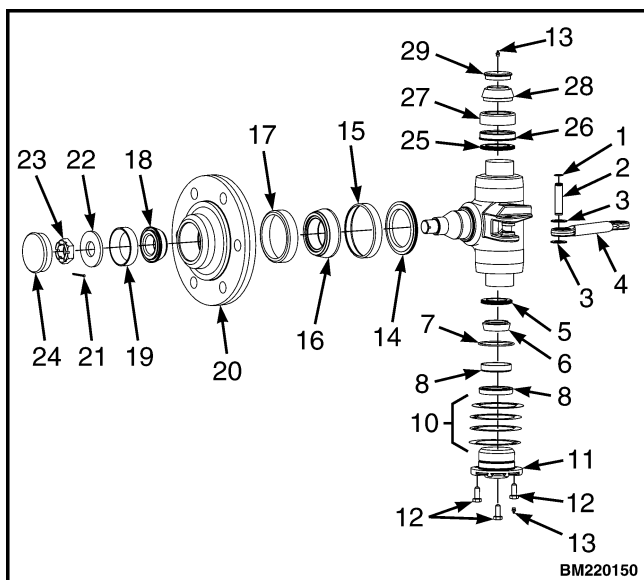
### Assemble

1. Install new seals on the spindle. Lubricate the seals with grease. If necessary, press new bearing cones on the spindle.
2. Lubricate the bearings with wheel bearing grease. Verify the bearings are filled with grease. If necessary, press the new bearing cups into the steering axle frame and bearing cap. Install the wear sleeve in the steering axle frame.
3. Install the spindle in the steering axle. Install the bearing cap without the O-rings. See Figure 8.

Measure the clearance between the bearing cap and the axle. Remove the bearing cap and install enough shims to provide a preload of 0.00 to 0.13 mm (0.000 to 0.005 in.).

**NOTE:** The spindle bearings must have no clearance. Install shims 0.00 to 0.13 mm (0.000 to 0.005 in.) less than the measured gap.

4. Install the O-ring on the bearing cap. Apply Loctite ® 242 to threads of capscrews. Install the bearing cap and capscrews. Tighten capscrews to 47 N•m (35 lbf ft).
5. If necessary, repeat the steps above for the other spindle and tie rod.



**NOTE:** THE LUBRICATION FITTING NEEDS TO BE ORIENTED 45° TO CENTERLINE AND REAR OF LIFT TRUCK.

1. SNAP RING
2. PIN
3. SEAL
4. TIE ROD
5. SEAL
6. BEARING CONE (LOWER)
7. O-RING
8. BEARING CUP (LOWER)
9. SEAL
10. SHIM
11. BEARING CAP
12. CAPSCREW
13. LUBE FITTING
14. OIL SEAL
15. WEAR SLEEVE
16. BEARING CONE (INNER)
17. BEARING CUP (INNER)
18. BEARING CONE (OUTER)
19. BEARING CUP (OUTER)
20. HUB
21. COTTER PIN
22. WASHER
23. CASTLE NUT
24. HUB CAP
25. SEAL
26. WEAR SLEEVE
27. BEARING CUP (UPPER)
28. BEARING CONE (UPPER)
29. PLUG

**Figure 8. Spindle Assembly**

## Install

1. Install tie rod end to spindle arm and steering cylinder with pins, seals and snap rings. See Figure 6.
2. Install plug on the top of the spindle.
3. Install the bearings and wheel. See Steering Axle Assembly Repair for procedures.
4. If necessary, repeat the procedure for the other spindle and tie rod.
5. Remove lift truck from blocks.

## TIE RODS

### Remove



## WARNING

### PUTTING THE LIFT TRUCK ON BLOCKS

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the mast, drive axle, battery, or counterweight assemblies will cause large changes in the center of gravity. When the lift truck is put on blocks, put additional blocks in the following positions:

- If the mast and drive axle are removed, put blocks under the counterweight so the lift truck cannot fall backward.
- If the counterweight is removed, put blocks under the mast so that the lift truck cannot fall forward.

Put the lift truck on blocks on a solid, even, and level surface. Verify the blocks or stands have enough capacity to hold the lift truck. Use additional blocks next to the tires as necessary to prevent movement of the lift truck. Verify the lifting devices used during repairs can lift the weight of the parts and assemblies.

See the Operating Manual or Periodic Maintenance manual listed in the General of this manual, for the procedures to put the lift truck on blocks.

1. Put the lift truck on blocks.



2. Remove the wheel and if necessary, the bearings. See Steering Axle Assembly Repair section for procedures.
  3. Remove the snap rings from the pin retaining the tie rod to the spindle. Remove the pin. To loosen and remove the pin, use a brass punch and hammer. See Figure 6.
  4. Remove the snap rings from the pin retaining the tie rod to the steering cylinder rod. Remove the pin.
  5. Slide the tie rod and washers from the spindle housing and steering cylinder rod. See Figure 6.
2. Align holes and place lubricated pin into the spindle and tie rod. Install the two snap rings on top and bottom of pin.
  3. Align holes and place lubricated pin into the steering cylinder rod and tie rod. Install the two snap rings on top and bottom of pin. See Figure 6.
  4. If removed, install the bearings and install the wheel. See Steering Axle Assembly Repair for procedures.
  5. Repeat the procedure for the other tie rod.
  6. Remove the lift truck from blocks.

### Install

1. Place the tie rod and washers in position in the spindle and steering cylinder rod. See Figure 6.

## Steering Cylinder Repair

### REMOVE AND DISASSEMBLE



#### CAUTION

**Disposal of lubricants and fluids must meet local environmental regulations.**

**NOTE:** The end caps of the steering cylinder are held in the shell by the installation of cylinder mount capscrews into the axle frame. To prevent oil leaks at the caps, hold the caps on the cylinder shell during removal.

1. Disconnect and tag hydraulic lines at steering cylinder. See Figure 9. Install caps in fittings on cylinder and put fittings on hydraulic lines.
2. Remove the tie rods. See Spindles, Bearings, and Tie Rods Repair section for procedures.
3. Remove capscrews that fasten cylinder to axle frame. Hold end caps on cylinder shell and remove steering cylinder.
4. Hold end of steering cylinder over a container. Remove plug for hydraulic fitting from each end cap. Push rod toward end of shell that is over container. Oil will drain from cylinder. Repeat procedure for other end.

5. Carefully remove one end cap from shell and slide off of rod. Carefully pull rod out of shell, keeping rod centered in shell during removal. Remove other end cap from shell. Remove all seals, wipers, and O-rings. See Figure 9.
6. Remove piston seal and two guide rings.

### CLEAN AND INSPECT



#### WARNING

**Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.**

1. Clean all metal parts in solvent.
2. Inspect piston rod for grooves or damage. Remove small scratches with fine emery cloth.
3. Inspect cylinder bore for damage
4. Inspect mounts for cracks.

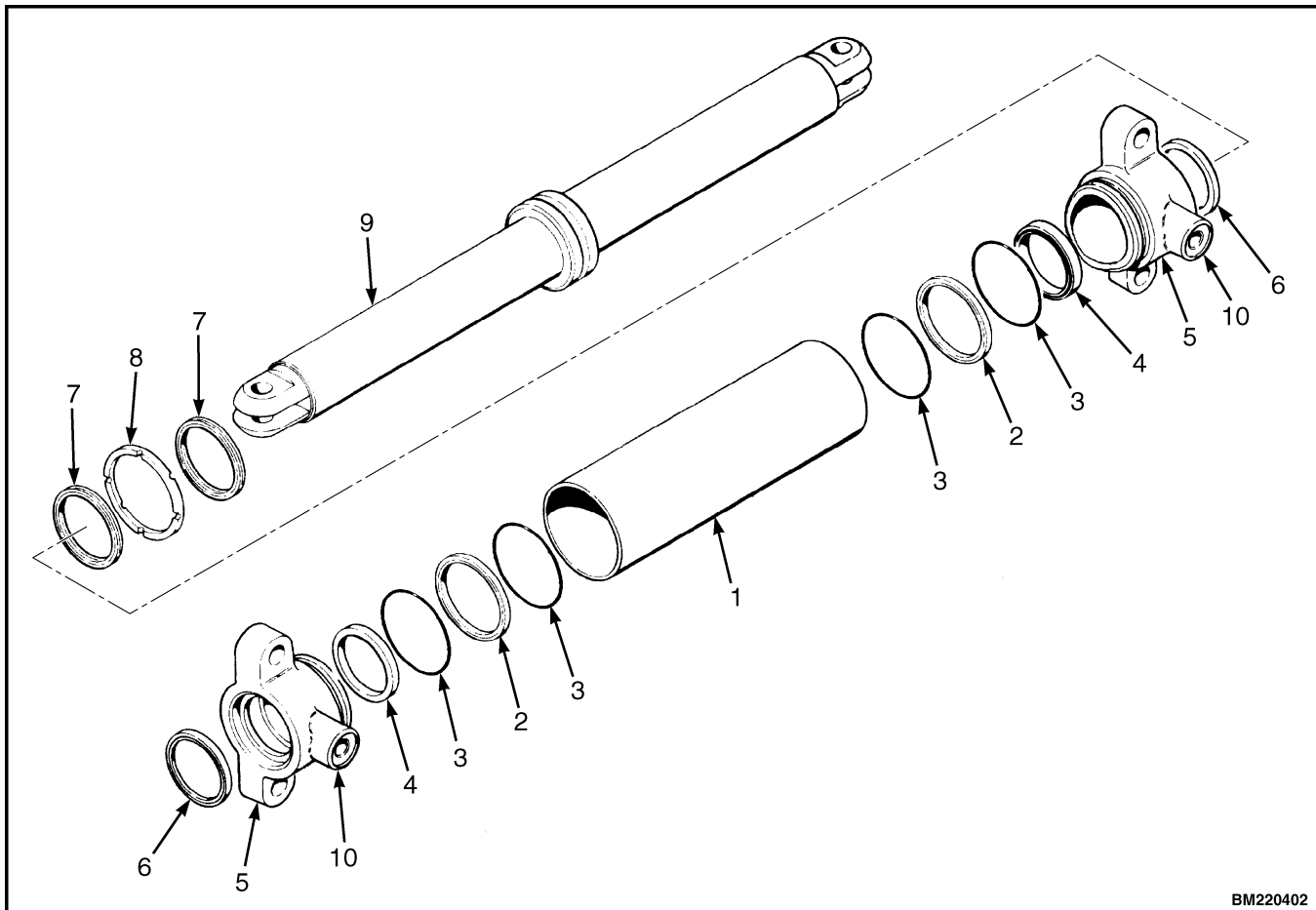
**ASSEMBLE AND INSTALL****CAUTION**

Do not damage the O-rings, seals, or wipers during installation.

1. Put O-rings, seals, guide rings, and wipers in warm hydraulic oil.
2. Install O-rings, seals, guide rings, and wipers as shown in Figure 9.
3. Lubricate O-rings, seals, and wipers with O-ring lubricant and carefully install one end cap on cylinder rod.
4. Carefully slide cylinder rod into cylinder shell and end onto shell. Keep cylinder rod aligned in center of cylinder shell during installation so

the parts are not damaged. Install other end cap into shell. Put caps on hydraulic fittings of end caps.

5. Hold end caps and install cylinder on axle frame using capscrews. Tighten capscrews to 225 N·m (166 lbf ft).
6. Install tie rods. See Spindles, Bearings, and Tie Rods Repair for procedures.
7. Remove plugs and caps and connect hydraulic lines as tagged during removal, to steering cylinder. Operate steering system to remove air from cylinders and system. Turn steering wheel several times from one stop to the other. Check that the steer cylinder operates lock to lock.



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**Figure 9. Steering Cylinder**

**Legend for Figure 9**

- |                   |                         |
|-------------------|-------------------------|
| 1. CYLINDER SHELL | 6. ROD WIPER            |
| 2. BACKUP RING    | 7. GUIDE RING           |
| 3. O-RING         | 8. PISTON SEAL          |
| 4. ROD SEAL       | 9. CYLINDER ROD         |
| 5. END CAP        | 10. HYDRAULIC LINE PORT |

**Torque Specifications****Axle Mounting Bolts and Nuts**

270 N•m (199 lbf ft)

**Spindle Bearing Cap Capscrews**

47 N•m (35 lbf ft)

**Hub Nut (Initial)**

203 N•m (150 lbf ft)

**Steer Cylinder Mounting Bolts**

225 N•m (166 lbf ft)

**Hub Nut (Final)**

34 N•m (25 lbf ft)



