

# INTRODUCTION

## GENERAL

This section has the description and repair procedures for the steering axle. See the following sections for additional information on the parts of the steering system: **THE STEERING CONTROL UNIT** and **HYDRAULIC SYSTEM**.

## DESCRIPTION (See FIGURE 1.)

The steering axle assembly includes an axle frame, steering cylinder and two spindle and hub assemblies. The steering axle is connected to the frame with center pivot mounts. The center pivot mounts on the axle frame are fastened to the lift truck frame with rubber mounts. The steering axle can make an articulated motion and give the lift truck a smoother travel over rough surfaces.

The end caps of the steering cylinder are also the mounts for the cylinder and are held to the shell by the mount capscrews. O-rings, seals, and wipers in the end caps are used to keep the oil inside of the steering cylinder.

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. When the piston moves in the bore, it pushes an equal amount of oil from the opposite end of the cylinder. This oil returns to the steering control unit.

When the piston reaches the end of the stroke, a relief valve controls the oil pressure so that the components are not damaged. Tie rods connect the spindle arms to the cylinder.

Each spindle turns on two tapered roller bearings. The spindle and bearings are held in the axle frame by a king-pin. The preload on the bearings is controlled by a threaded nut on the bottom of the king pin.

The wheel or hub rotates on two tapered roller bearings and is held on the spindle by a castle nut. The preload on the bearings in the hub is adjusted by the castle nut. A grease seal in the inner hub and a hub cap protect the bearings from dirt and water. A wear sleeve in the inner hub protects the hub from wear by the seal.

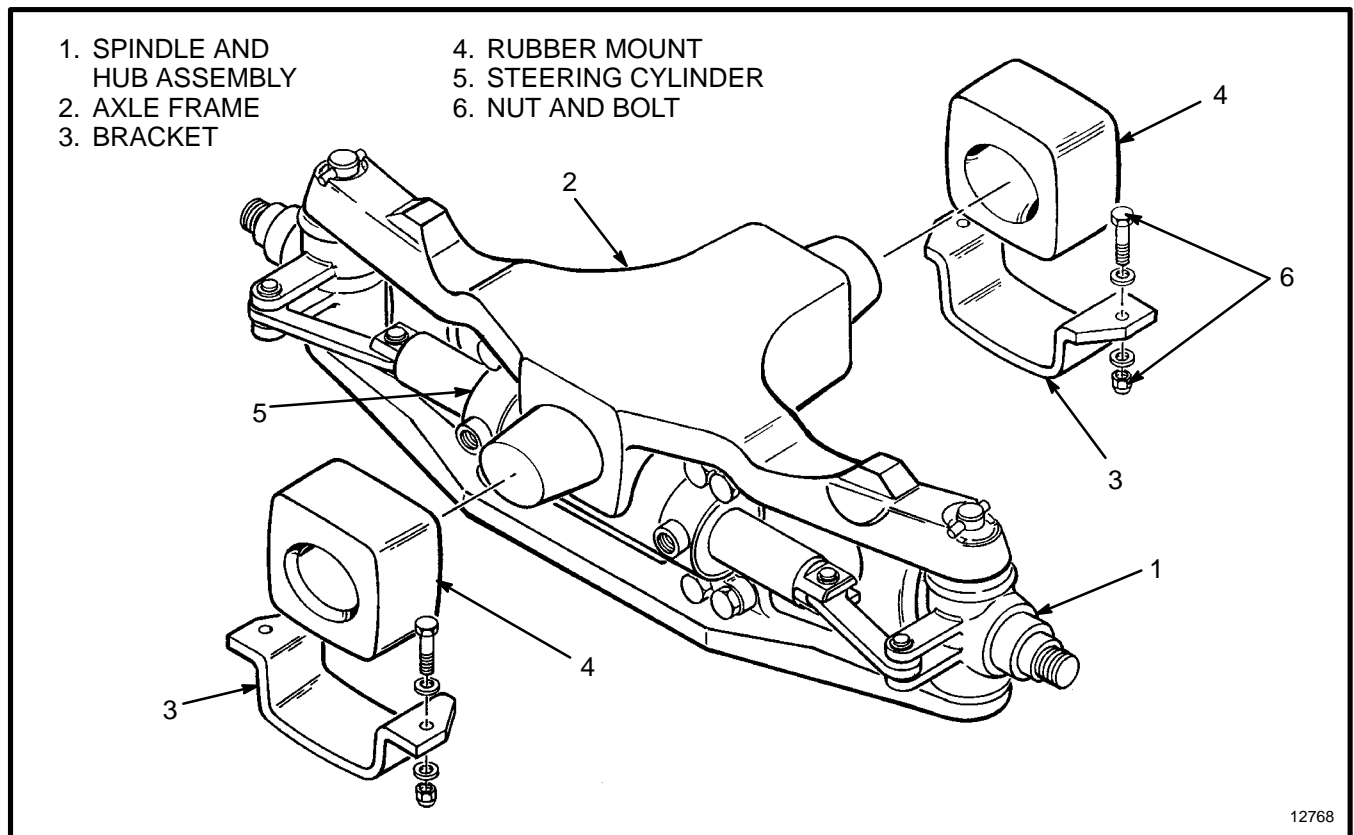


FIGURE 1. STEERING AXLE

## REPAIRS

### **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 following assemblies will cause large changes in the center of gravity: drive axle, battery or counterweight. When the lift truck is put on blocks, put additional blocks in the following positions:

1. If the mast and drive axle are removed, put blocks under the counterweight so that the lift truck can not fall backward.

2. If the battery (electric lift trucks) or counterweight is removed, put blocks under the mast so that the lift truck can not fall forward.

Put the lift truck on blocks on a solid, even and level surface. Make sure the blocks of 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. Make sure the lifting devices used during repairs can lift the weight of the parts and assemblies.

#### **STEERING AXLE ASSEMBLY**

**NOTE:** The steering axle assembly without the wheels weighs approximately 115 kg (250 lb)

#### **Removal (See FIGURE 1.)**

The steering axle can be removed without removing the counterweight. If necessary, remove the counterweight as described in the **FRAME**.

1. Make sure the wheels are set for straight travel. Put the lift truck on blocks so that the steering axle can be removed. The top of the axle frame must have clearance under the counterweight so that the steering axle can be removed.

2. Disconnect the hydraulic lines at the steering cylinder. Install caps on the cylinder and put plugs in the hydraulic lines. The caps will prevent the spindles from turning when the axle is removed from under the lift truck.

3. Slide a floor jack or the forks of another lift truck under the steering axle. Raise the lifting device until it

holds the weight of the axle assembly. Remove the four capscrews and nuts that fasten the two brackets under the rubber mounts. Remove the brackets and slowly lower the axle assembly onto the wheels. Carefully roll the axle assembly from under the lift truck.

#### **Installation (See FIGURE 1.)**

1. Install the rubber mounts on the axle as follows:

a. E1.25–1.75XL (E25–35XL), J2.00–3.00XL (J40–60XL), H/J2.00–3.20XM (H/J40–65XM): Make sure the PART NO. on the mounts is right side up and facing away from the axle frame.

b. J1.25–1.75XL (Europe only): Make sure the PART NO. on the mounts is upside down and facing away from the axle frame.

2. Apply a lubricant that is approved for use with rubber to the rubber mount. The lubricant is used where the rubber mount fits into the frame brackets.

3. Use a floor jack or another lift truck to put the steering axle into the position in the frame. Make sure the rubber mounts fit inside the frame brackets for the mounts.

4. Install the bottom brackets. Tighten the four bracket capscrews and nuts to 88 N.m (65 lb<sub>f</sub> ft).

5. Remove the plugs and caps and connect the hydraulic lines to the steering cylinder.

6. Operate the steering system to remove the air from the system. Turn the steering wheel several times from one stop to the other stop. Check for hydraulic leaks.

#### **WHEELS AND HUBS**

#### **Removal and Disassembly (See FIGURE 2.)**

### **WARNING**

**Completely deflate the tires before removing them from the lift truck. Air pressure in the tires can cause the tire and rim parts to explode causing serious injury or death.**

**Never loosen the nuts that hold the inner and outer wheel halves together when there is air pressure in the tire.**

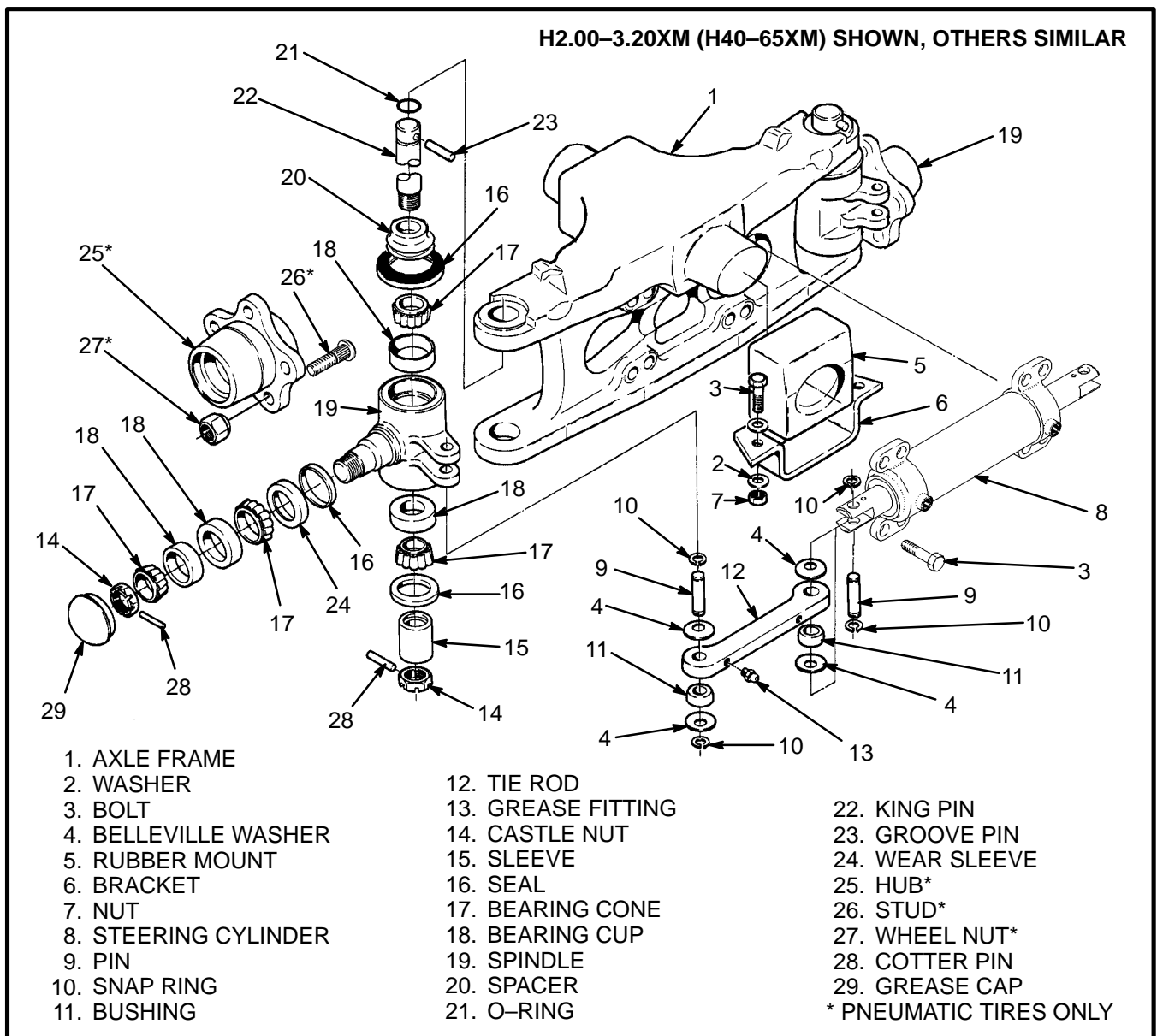


FIGURE 2. STEERING AXLE

1. Put the axle on blocks so that the tires are raised from the floor. Remove the grease cap. Remove the cotter pin and the castle nut. Remove the outer bearing cone. Slide the wheel from the spindle. Remove the inner bearing cone and the seal from the spindle.

2. If the wheel bearings must be replaced, use a brass drift to remove the bearing cups and the wear sleeve.

3. Repeat the procedure for the other wheel.

### Cleaning

#### **WARNING**

**Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning sol-**

**vents, always follow the solvent manufacturer's recommended safety procedures.**

Clean all parts with solvent. Make sure the bearings are clean.

### Assembly And Installation (See FIGURE 2.)

1. If the wheel bearings must be replaced, use a press to install the new bearing cups in the wheel or hub. Install a new wear sleeve in the wheel or hub. Install the grease seal on the spindle. Lubricate the bearing cones with grease. Make sure the bearings are filled with grease. Install the bearing cone on the spindle.

## CAUTION

Do not damage the seals during installation.

- Carefully slide the wheel or hub onto the spindle. Install the outer bearing cone.
- Install the castle nut. Tighten the castle nut to 200 N.m (150 lb<sub>f</sub> ft) while the wheel is rotated. Loosen the nut to less than 27 N.m (20 lb<sub>f</sub> ft). Tighten the nut to 34 N.m (25 lb<sub>f</sub> ft). If the cotter pin can not be installed with the nut tightened to 34 N.m (25 lb<sub>f</sub> ft), tighten the castle nut until the cotter pin can be installed. Install the cotter pin.
- Repeat the procedure for the other wheel.

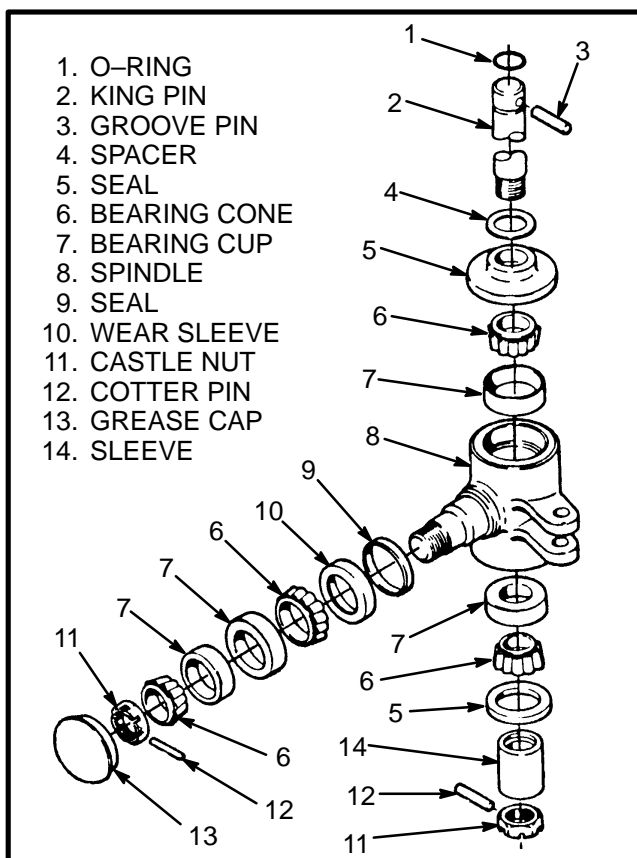


FIGURE 3. SPINDLE ASSEMBLY

## SPINDLES, BEARINGS AND TIE RODS

### Removal (See FIGURE 3.)

Remove the wheel or hub from the steering axle spindle. Remove the pin to disconnect the tie rod from the spindle. Remove the cotter pin and the castle nut from the bottom of the king pin. Use a driver to remove the king pin. Remove the sleeve and then the spindle from

the axle. Use a driver to remove the bearings and seals from the spindle.

**NOTE:** Dirt and corrosion can make the spacer difficult to remove from the steering axle frame. A machined space is made in the top of the spacer so that the spacer can be removed with a bearing puller.

### Installation (See FIGURE 2., FIGURE 3.)

1. Use new bearings and seals. Apply grease to the bearings and king pin as they are installed in the axle. Install the bearings in the spindle. Install the seals in the correct position. Align the spindle in the axle and install the king pin. Make sure a new O-ring is installed at the top of the king pin. Install the sleeve on the bottom of the king pin. Install the castle nut and tighten it to 90 N.m (66 lb<sub>f</sub> ft). Loosen the castle nut to less than 34 N.m (25 lb<sub>f</sub> ft). Tighten the nut to 34 N.m (25 lb<sub>f</sub> ft). If the cotter pin can not be installed with the nut tightened to 34 N.m (25 lb<sub>f</sub> ft), tighten the castle nut until the cotter pin can be installed. Install the cotter pin.

2. Connect the tie rods. Make sure the belleville washers are installed on both sides of the bushings.

3. Install the wheels or hubs. See the section WHEELS AND HUBS for the proper installation procedure. On the H/J2.00-3.20XM (H/J40-65XM), tighten the wheel nuts to 237 to 305 N.m (175 to 225 lb<sub>f</sub> ft). On the J1.25-1.75XL (J25-35XL) and the J2.00-3.00XL (J40-60XL), tighten the wheel nuts to 155 N.m (115 lb<sub>f</sub> ft).

## STEERING CYLINDER

### Removal And Disassembly (See FIGURE 4.)

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

1. Disconnect the hydraulic lines at the steering cylinder. Install caps in the fittings on the cylinders and put caps on the hydraulic lines.

2. Remove the snap rings from the pins in the tie rods. Remove the pins.

3. Remove the capscrews or nuts and bolts that fasten the cylinder to the axle frame. Hold the end caps on the shell and remove the steering cylinder.

4. Hold the end of the steering cylinder over a drain pan. Remove the cap for the hydraulic fitting from each end cap. Push the rod toward the end of the shell that is over the drain pan. Oil will drain from the cylinder. Repeat the procedure for the other end.

5. Carefully slide one end cap from the shell. Carefully pull the cylinder rod and piston from the shell. Keep the cylinder rod aligned in the center of the shell during removal so that the parts are not damaged. Remove the end cap from the rod. Remove the other end cap from the shell. Remove all seals, wipers, and O-rings.

### Cleaning and Inspection

#### **⚠ 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.

Clean all parts in solvent.

Inspect the piston rod for grooves or damage. Remove small scratches with fine emery cloth. Inspect the cylinder bore for damage. Inspect the mounts for cracks.

### Assembly and Installation (See FIGURE 4.)

1. Put the seals and wipers in warm hydraulic oil. Install the quadrant ring and piston seal as shown in FIGURE 4.

#### **⚠ CAUTION**

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

2. Lubricate the O-rings, seals, and wipers with O-ring lubricant and install them in the end caps. Install one end cap on the cylinder rod.

3. Carefully slide the cylinder rod and piston into the shell. Keep the cylinder rod aligned in the center of the shell during installation so that the parts are not damaged. Carefully slide the end cap into the shell. Carefully install the other end cap on the rod and shell. Put caps on the hydraulic fittings of the end caps.

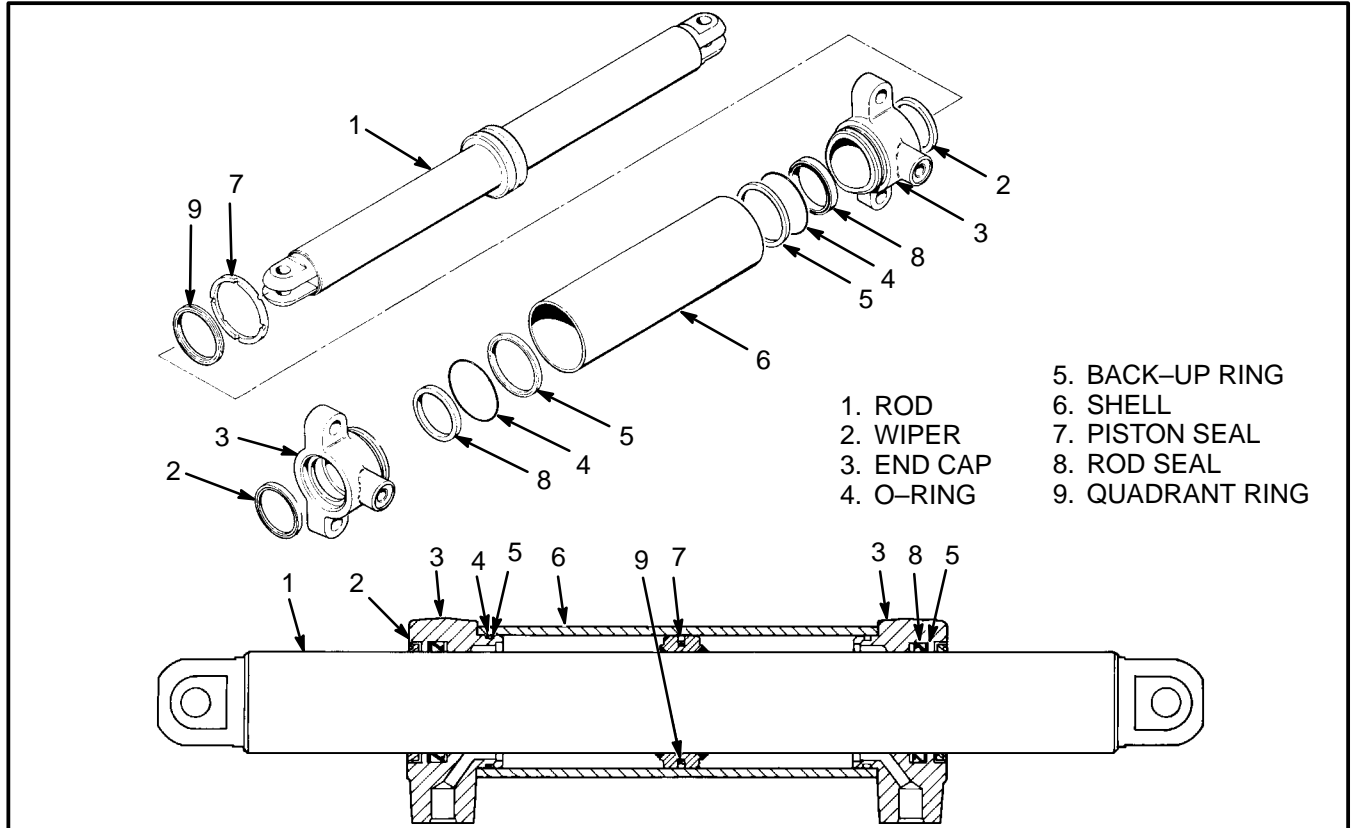


FIGURE 4. STEERING CYLINDER

4. Hold the end caps and install the cylinder on the axle frame using the capscrews or nuts and capscrews. On the H/J2.00–3.20XM (H/J40–65XM), tighten the capscrews to 225 N.m (165 lb<sub>f</sub> ft). On the E/J1.25–1.75XL (E25–35XL) and the J2.00–3.00XL (J40–60XL), tighten the capscrews and nuts to 165 N.m (122 lb<sub>f</sub> ft).

**NOTE:** On J2.00–3.00XL (J40–60XL) units the nuts are against the end caps.

5. Install the tie rods between the cylinder and the spindles. Make sure the belleville washers are on each side of the bushings in the tie rods. Install the pins and snap rings.

6. Remove the caps and connect the hydraulic lines to the steering cylinder. Operate the steering system to remove the air from the cylinder and the hydraulic system. Turn the steering wheel several times from one stop to the other.

## TORQUE SPECIFICATIONS

|                                   |  |
|-----------------------------------|--|
| Steer Axle Mount Bracket Hardware | 88 N.m (65 lb <sub>f</sub> ft)                 |
| Wheel/Hub Nut                     |  |
| Initial Torque                    | 200 N.m (150 lb <sub>f</sub> ft)               |
| Final Torque                      | 34 N.m (25 lb <sub>f</sub> ft)                 |
| King Pin Nut                      |  |
| Initial Torque                    | 90 N.m (66 lb <sub>f</sub> ft)                 |
| Final Torque                      | 34 N.m (25 lb <sub>f</sub> ft)                 |
| Wheel Nuts                        |  |
| H/J2.00–3.20XM (H/J40–65XM)       | 237 to 305 N.m (175 to 225 lb <sub>f</sub> ft) |
| J1.25–1.75XL (J25–35XL)           | 155 N.m (115 lb <sub>f</sub> ft)               |
| J2.00–3.00XL (J40–60XL)           | 155 N.m (115 lb <sub>f</sub> ft)               |
| Steer Cylinder Mount Hardware     |  |
| H/J2.00–3.20XM (H/J40–65XM)       | 225 N.m (165 lb <sub>f</sub> ft)               |
| E/J1.25–1.75XL (E/J25–35XL)       | 165 N.m (122 lb <sub>f</sub> ft)               |
| J2.00–3.00XL (J40–60XL)           | 165 N.m (122 lb <sub>f</sub> ft)               |

## TROUBLESHOOTING

| PROBLEM   | POSSIBLE CAUSE  | PROCEDURE OR ACTION   |
|---|---|---|
| There is no action when the steering wheel is turned.             | <p>There is no oil or not enough oil in the hydraulic tank.</p> <p>The lines are loose at the control unit or manifold block.</p> <p>The sleeve and spool in the control unit will not move.</p> <p>Steering cylinder leaks.</p> <p>Spacer for center pin is not installed.</p>   | <p>Fill the tank to the correct level.</p> <p>Tighten fittings.</p> <p>Repair steering control unit.</p> <p>Repair steering cylinder.</p> <p>Assemble steering control unit correctly.</p>  |
| The lift truck steers slowly. The steering wheel is hard to turn. | <p>The oil level is low. There is no oil in the tank.</p> <p>The lines to the control unit are damaged.</p> <p>The sleeve and spool in the control unit are worn.</p> <p>The parts of the metering section are worn.</p> <p>The check valve in the control unit does not open.</p> <p>The check valve or relief valve in the manifold block is damaged or is not adjusted correctly.</p> <p>Priority valve is not operating correctly.</p> <p>Steering relief pressure is too low.</p> <p>Engine idle speed is too low.</p> | <p>Fill the tank to the correct level.</p> <p>Repair oil lines.</p> <p>Repair steering control unit.</p> <p>Repair steering control unit.</p> <p>Clean or repair steering control unit.</p> <p>Clean or replace manifold block.</p> <p>Clean or repair priority valve.</p> <p>Adjust relief pressure.</p> <p>Adjust idle speed to specifications.</p> |
| The steering wheel turns the tires in the wrong direction.        | The lines at the control unit are not correctly connected.  | Connect lines correctly.  |
| The tires continue to turn after the steering wheel stops.        | <p>The neutral position springs are broken.</p> <p>The sleeve or spool has damage.</p>  | <p>Repair steering control unit.</p> <p>Repair steering control unit.</p>   |
| Steering wheel kicks back in both directions.                     | Center shaft is not correctly aligned with metering section.  | Correctly assemble steering control unit.   |

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