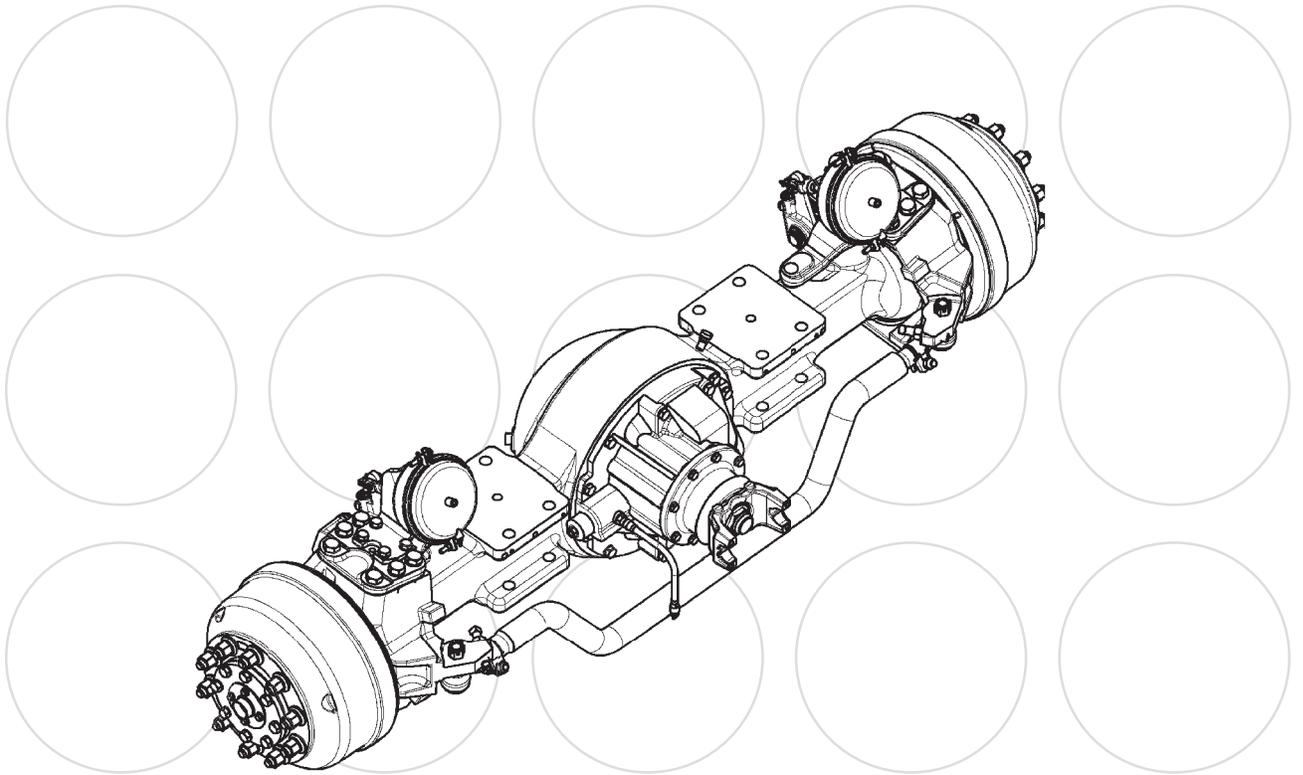


Maintenance Manual MM-0361

# Heavy-Duty Front Drive Steer Axles MX-140 and MX-160 Series

Revised 04-10



# Service Notes

## About This Manual

This manual provides maintenance and service information for the Meritor heavy-duty front drive steer axles equipped with Q Series or Q Plus™ cam brakes

## Before You Begin

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

## Hazard Alert Messages and Torque Symbols

### WARNING

A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

### CAUTION

A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

 This symbol alerts you to tighten fasteners to a specified torque value.

## How to Obtain Additional Maintenance and Service Information

### On the Web

Visit Literature on Demand at [arvinmeritor.com](http://arvinmeritor.com) to access and order product, service, aftermarket, and warranty literature for ArvinMeritor's truck, trailer and specialty vehicle components.

### Literature on Demand DVD (LODonDVD)

The LODonDVD contains product, service and warranty information for ArvinMeritor components. To order the DVD, visit Literature on Demand at [arvinmeritor.com](http://arvinmeritor.com) and specify TP-0742.

## How to Obtain Tools and Supplies Specified in This Manual

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

## How to Obtain Labels

Call ArvinMeritor's Customer Service Center at 800-535-5560 to obtain Meritor's labels.

## How to Obtain Kits

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355.

Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change without notice or liability. Meritor Heavy Vehicle Systems, LLC, reserves the right to revise the information presented or to discontinue the production of parts described at any time.

pg. i	<b>Asbestos and Non-Asbestos Fibers</b>	pg. 21	<b>Section 6: Cam Brake Assembly and Installation</b>
1	<b>Section 1: Exploded Views</b>		Assembly
	MX-160 Series with Q Series Cam Brakes		Axle Shaft Universal Joint
2	Q Series Brake	22	Steering Knuckle and Axle Shaft
3	<b>Section 2: Introduction</b>	24	Spindle and Brake to the Steering Knuckle
	Description	27	Installation
	Identification		Wheel Bearings Into the Hubs
	Current Axle Models		Adjustment
5	<b>Section 3: Inspection</b>		Brakes
	Inspection		Wheel Bearings
	Tie Rod End Wear	28	ABS Sensor
6	Tie Rod Assembly for Movement	29	Assembly
8	Federal Out of Service Roadside Inspection Criteria (Department of Transportation)		Drum and Drive Flange
10	<b>Section 4: Cam Brake Removal and Disassembly</b>		Cross Tube to the Knuckle
	Disassembly		Adjustment
	Front Drive Steer Axle Wheel Ends Equipped with Cam Brakes		Steering Stop Setting
	Removal		Maximum Turn Angle Setting
	Wheels, Drums and Hubs from the Axle	30	Manual Steering
11	Disassembly		Power Steering
	Bearing Cups and Oil Seal from the Hub		Wheel Toe-In
	Removal	<b>33</b>	<b>Section 7: Lubrication</b>
	Steering Knuckle from the Housing		Overview
13	Disassembly		Magnets and Magnetic Drain Plugs
	Steering Universal Joint		Breather
15	Cam Brake and Spindle from the Steering Knuckle		Seals
17	<b>Section 5: Prepare Parts for Assembly</b>		Temperature Indicators
	Clean, Dry and Inspect Parts		Check and Adjust the Oil Level
	Ground and Polished Parts	34	Drain and Replace the Oil
	Rough Parts		Lubrication
	Axle Assemblies		Knuckle King Pins
	Dry Cleaned Parts		Camshaft Retainer Bushing and Cam Bushing
	Prevent Corrosion on Cleaned Parts		Drive Axle Shaft Universal Joint
	Tapered Roller Bearings		Axle Shaft Spline and Thrust Washer
19	Axle Housing		Cross Tube End Assembly
	Axle Shafts	35	Knuckle Bushing
	Tie Rod Ends		Greasing Wheel Bearings
	Repair or Replace Parts	36	Specifications
20	Applying Adhesive and Silicone Gasket Material		Front Drive Axle Oil Change Intervals and Specifications
		37	Front Drive Axle Greasing Intervals and Specifications
			Wheel-End Axle Greasing Intervals and Specifications
		<b>38</b>	<b>Section 8: Specifications</b>
			Torque Specifications
			Cam Brake Fastener Torque Specifications

## ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

### Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

### Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS  
CANCER AND LUNG DISEASE HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS AND PROTECTIVE CLOTHING  
ARE REQUIRED IN THIS AREA.

2. Respiratory Protection. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. Procedures for Servicing Brakes.
  - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
  - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
  - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
  - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a ne mist of water and dispose of the used filter with care.
5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

### Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

## NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

### Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

### Recommended Work Practices

1. Separate Work Areas. Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. Respiratory Protection. OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m<sup>3</sup> as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. Procedures for Servicing Brakes.

- a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
  - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
  - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
  - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. Cleaning Work Areas. Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

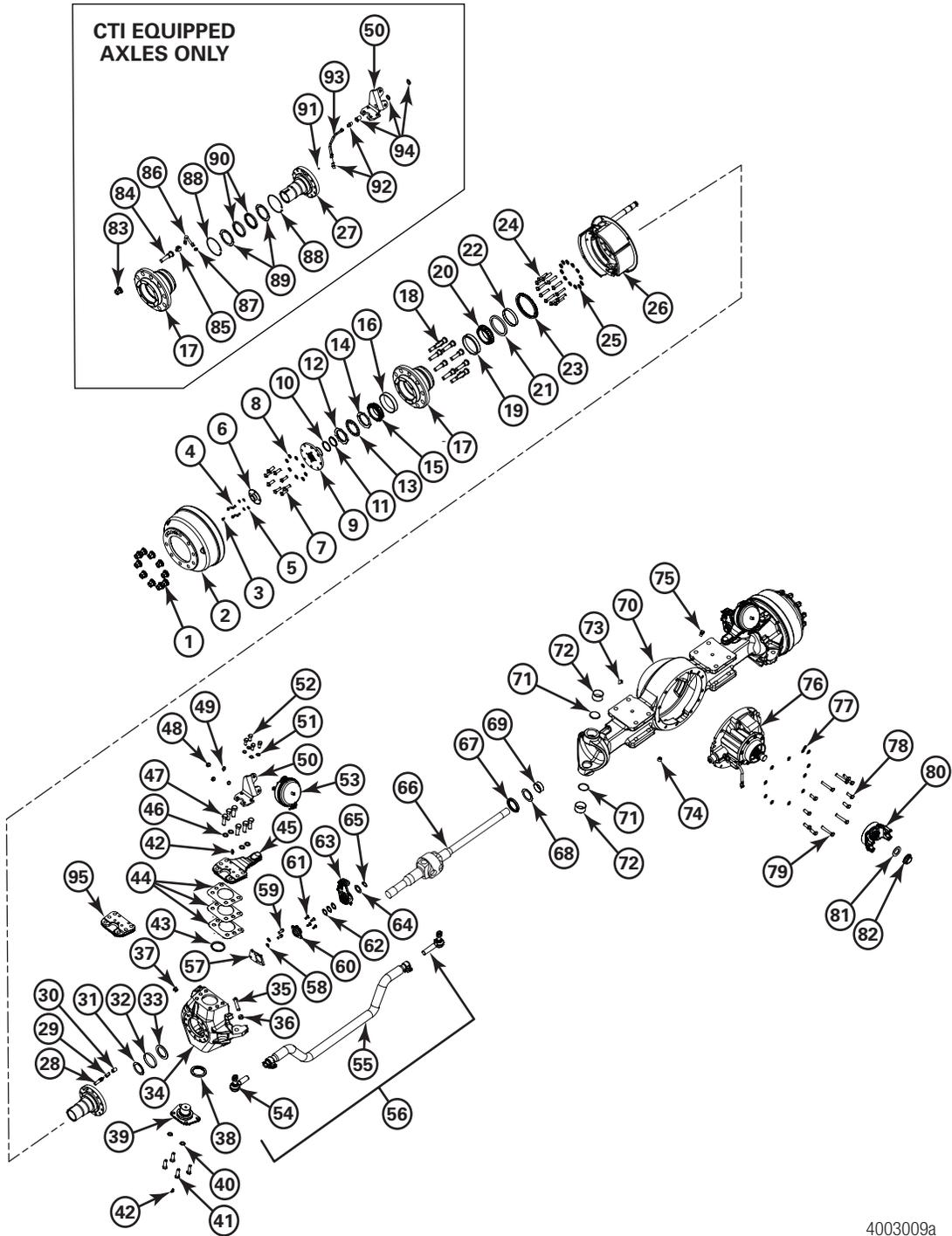
6. Waste Disposal. Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

### Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

# 1 Exploded Views

## MX-140/MX-160 Series with Q Series Cam Brakes

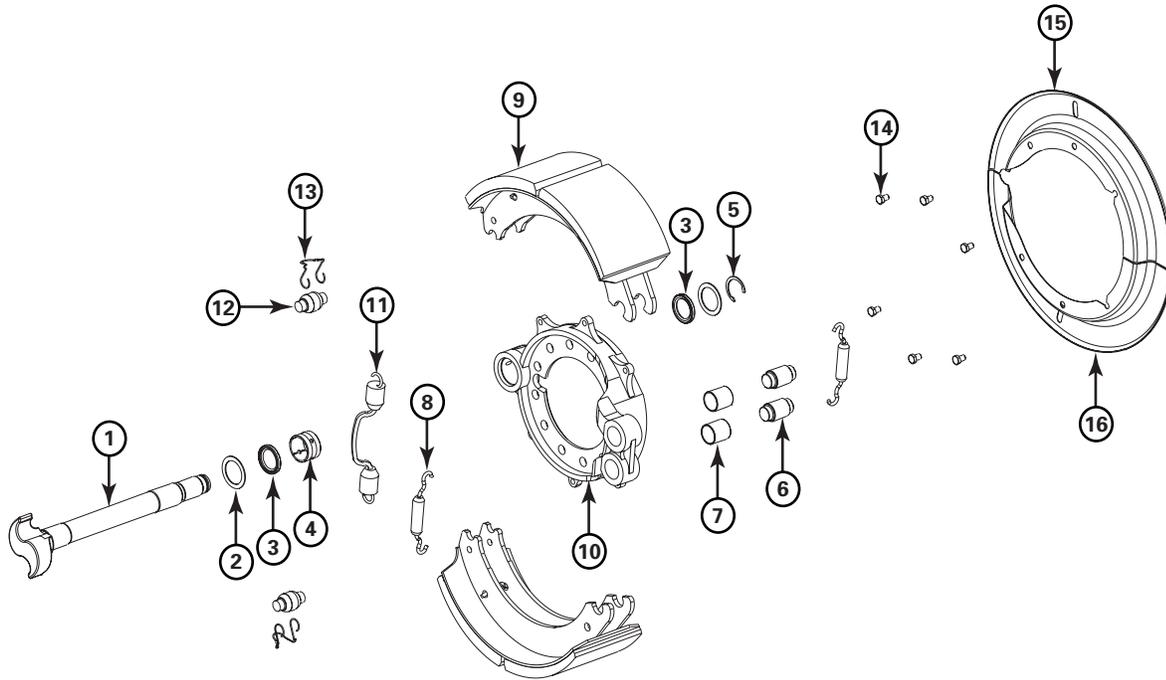


# 1 Exploded Views

Item	Description	Item	Description	Item	Description
1	Wheel Nut	36	Steering Stop Adjusting Nut	71	Socket Plug
2	Brake Drum	37	Rubber ABS Bushing	72	King Pin Bushing
3	Grease Fitting	38	Thrust Bearing	73	Lube Fill Plug
4	Cover Plate Capscrews	39	Lower Knuckle Cap	74	Lube Drain Plug
5	Cover Plate Washers	40	Lower Knuckle Cap Washers	75	Breather Assembly
6	Cover Plate	41	Lower Knuckle Cap Capscrews	76	Carrier Assembly
7	Drive Flange Capscrews	42	Grease Fitting	77	Carrier Housing Washers
8	Drive Flange Washers	43	Upper Cap/Steering Arm Grease Seal	78	Short Carrier Housing Capscrews
9	Drive Flange	44	Shim	79	Long Carrier Housing Capscrews
10	Drive Flange Felt	45	Steering Arm	80	Yoke
11	Drive Flange Retainer	46	Steering Arm Washers	81	Yoke Washer
12	Outer Adjusting Nut	47	Steering Arm Capscrews	82	Yoke Nut
13	Lock Washer	48	Air Brake Chamber Nut	83	CTI Wheel Nut
14	Inner Adjusting Nut	49	Air Brake Chamber Washers	84	CTI Wheel Stud
15	Outer Bearing Cone	50	Chamber Bracket	85	Elbow
16	Outer Bearing Cup	51	Chamber Bracket Washers	86	Tube Assembly
17	Hub Assembly	52	Chamber Bracket Capscrews	87	Tube Seat
18	Wheel Studs	53	Air Brake Chamber	88	CTI Snap Ring
19	Inner Bearing Cup	54	Tie Rod End	89	Guide
20	Inner Bearing Cone	55	Cross Tube with Clamps	90	CTI Air Seal
21	Grease Seal	56	Tie Rod Assembly	91	Ball Plug
22	Outer Oil Seal Sleeve	57	Camshaft Bracket	92	Connector Fitting
23	ABS Tooth Ring	58	Camshaft Bracket Washers	93	Tube Assembly
24	Brake Assembly Capscrews	59	Camshaft Bracket Capscrews	94	Bulkhead Fitting
25	Brake Assembly Washers	60	Retainer Assembly	95	Upper Knuckle Cap
26	Brake Assembly	61	Self-Tapping Capscrews		
27	Spindle Assembly	62	Outer Spacing Washer		
28	ABS Sensor Assembly	63	Automatic Slack Adjuster		
29	ABS Clip	64	Retainer		
30	ABS Bushing	65	Camshaft Snap Ring		
31	Thrust Washer	66	Axle Shaft Assembly		
32	Inner Oil Seal Sleeve	67	Axle Shaft Oil Seal		
33	Axle Shaft Grease Seal	68	Axle Thrust Washer		
34	Steering Knuckle	69	Inner Axle Shaft Bushing		
35	Steering Stop Adjusting Screw	70	Housing Assembly		

# 1 Exploded Views

## Q Series Brake



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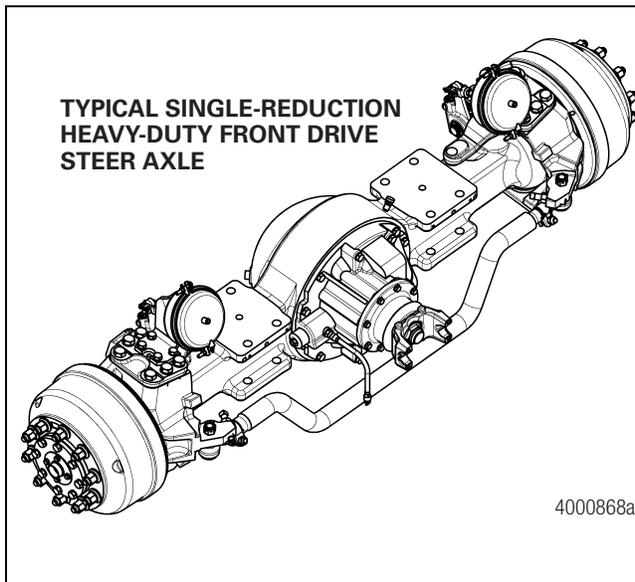
Item	Description
1	Camshaft
2	Washer
3	Camshaft Seal
4	Camshaft Bushing
5	Snap Ring
6	Brake Shoe Anchor Pin
7	Anchor Pin Bushing
8	Brake Shoe Retaining Spring
9	Brake Shoe and Lining Assembly
10	Brake Spider Assembly
11	Brake Shoe Return Spring
12	Brake Shoe Roller
13	Brake Shoe Roller Retainer
14	Dust Shield Capscrew
15	Dust Shield
16	Dust Shield

## Description

Meritor produces a complete line of heavy-duty front drive steer axles with single axle capacities of 21,000-23,000 lbs (9525-10 432 kg). Figure 2.1.

Some axle models are available with the following features.

- Right-hand or left-hand gearing
- Standard or wide tracks
- Driver-controlled main differential lock for increased traction



**Figure 2.1**

## Identification

### Current Axle Models

Front drive steer axle models are identified by a letter and number system. The letters and numbers give important information about the specific axle model.

The first seven positions of the designations identify a basic axle model. The second group of letters and numbers identify particular specifications.

As an example, a 21,000 lb (9525 kg) front drive steer axle with a single-reduction 145 model carrier is identified by the following in Figure 2.2.

### Basic Axle Models Covered in This Manual

#### Current Models

MX-17-140	MX-21-160R
MX-19-140	MX-23-160
MX-21-140	MX-23-160R
MX-21-160	

## 2 Introduction

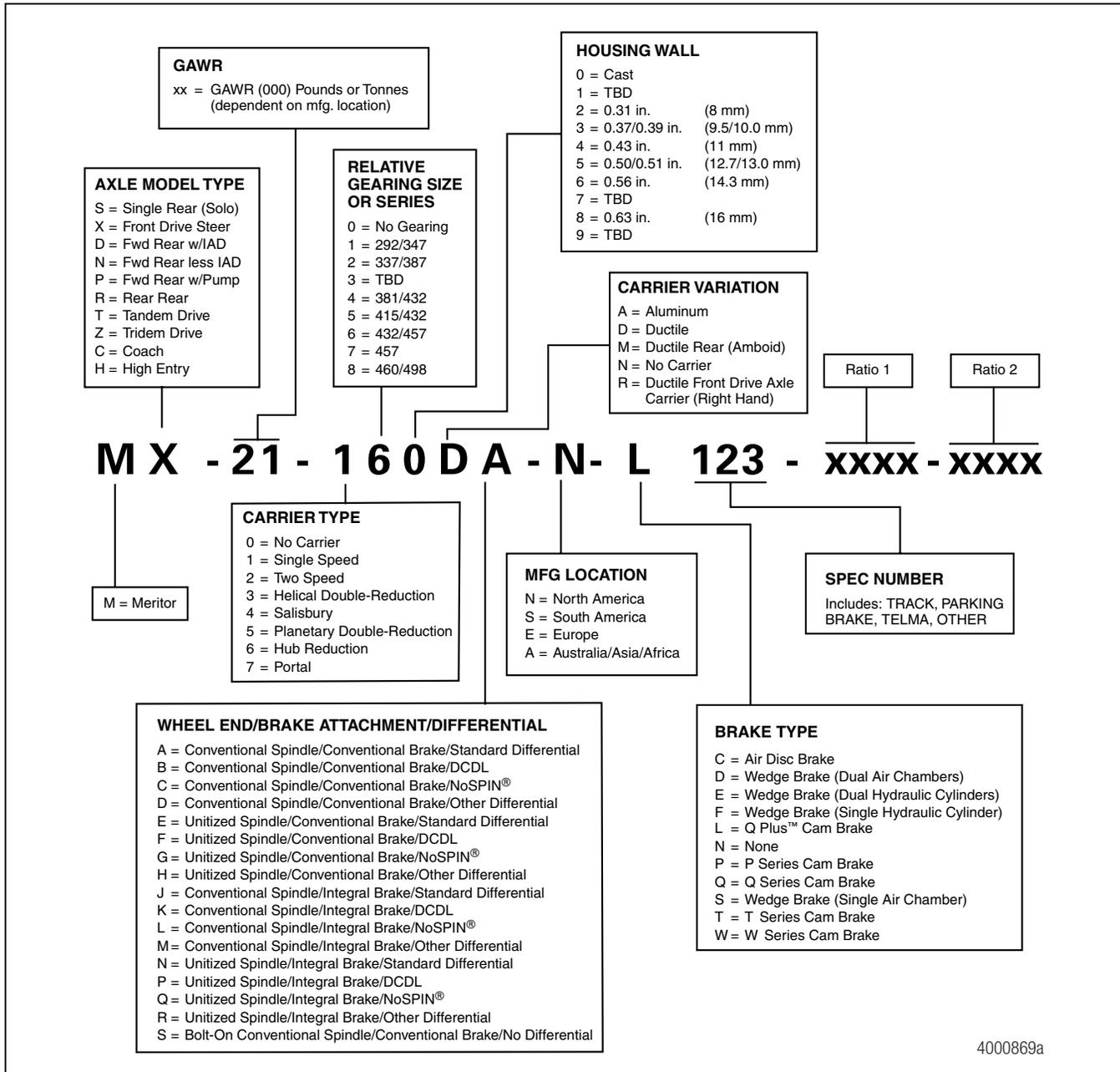


Figure 2.2

## Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

### **⚠️ WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

## Inspection

### Tie Rod End Wear

You may not be able to detect loose or worn tie rod ends during operation. Under normal operating conditions, wear occurs over time. The preload bearings inside each tie rod end provide less resistance, which can affect steering control, front tire wear and other axle components.

Regularly-scheduled inspection and maintenance helps to minimize the effects of tie rod end wear on the vehicle. Refer to Section 7 for greasing intervals. Figure 3.1.

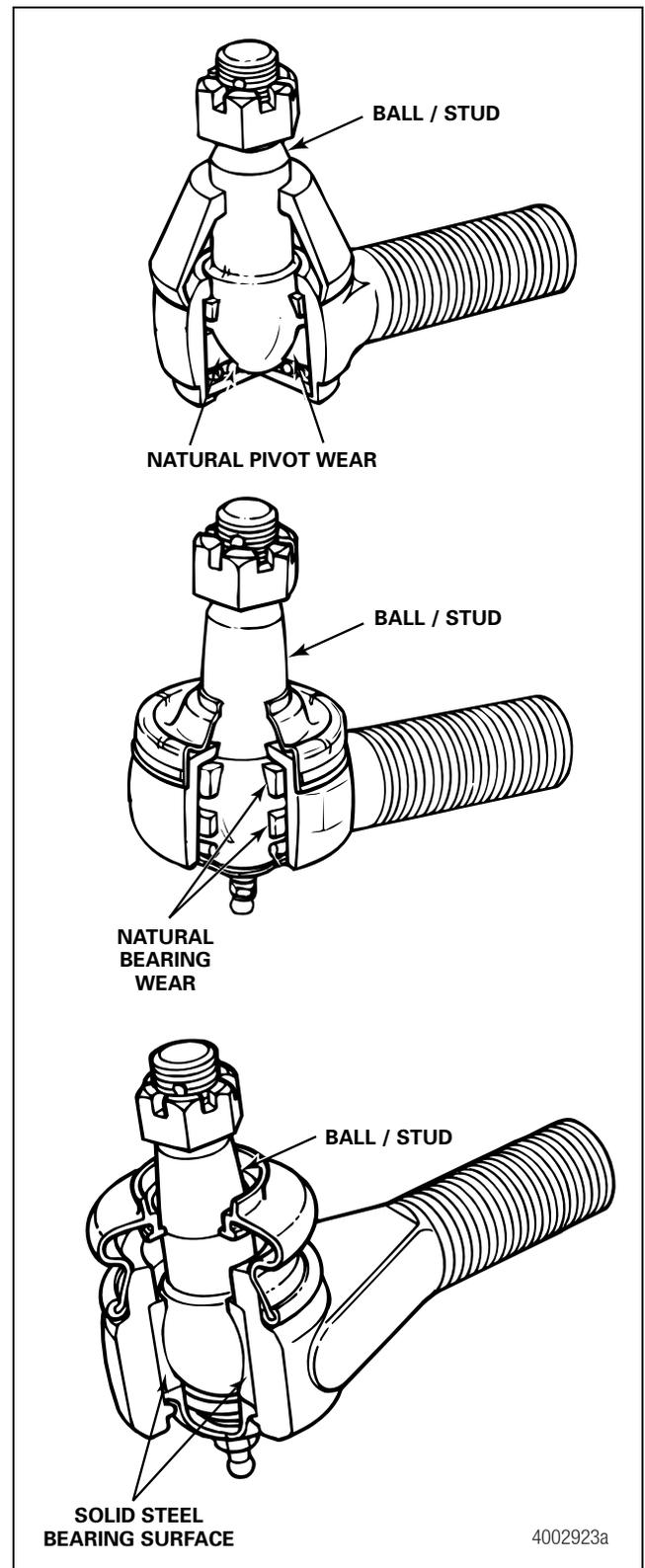


Figure 3.1

## 3 Inspection

### Does Tie Rod End Wear Affect the Steering Linkage?

Unless tie rod end wear becomes excessive, a safe steering linkage is maintained. However, tie rod end wear can affect uniform steering control and, ultimately, wear to the front tires.

### Can the Driver Detect Tie Rod End Wear During Vehicle Operation?

A driver may not always detect a loose tie rod end condition during vehicle travel conditions. This is why it is important to inspect tie rod ends for wear and allowable movement at regular intervals.

### Tie Rod Assembly for Movement

For roadside inspection, refer to the procedure in this section.

### Vehicle Raised and Supported with Safety Stands

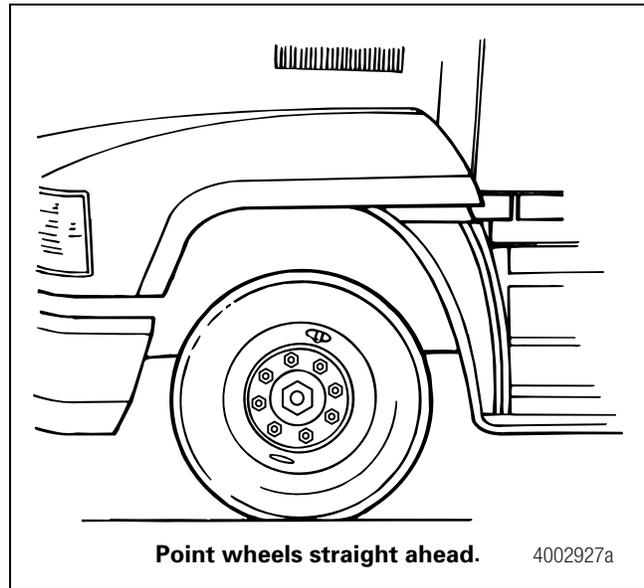
To perform this inspection, the entire system must be unloaded. The front end of the vehicle must be raised and supported with stands.

**NOTE:** Do not grease the tie rod assembly before you perform the inspection.

#### **WARNING**

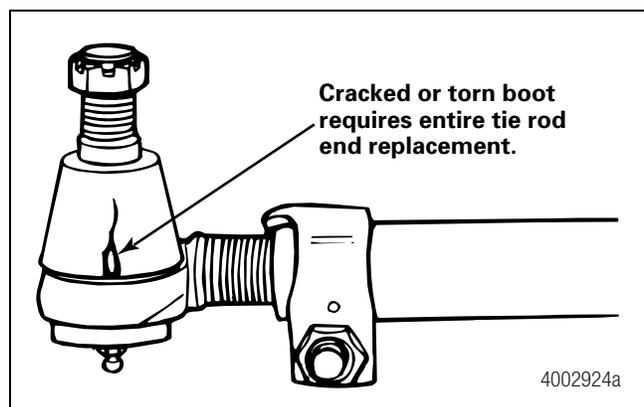
**Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.**

1. Park the vehicle on a level surface with the wheels STRAIGHT. Block the wheels to prevent the vehicle from moving. Set the parking brake. Figure 3.2.



**Figure 3.2**

2. Raise the vehicle so that the front wheels are off the ground. Support the vehicle with safety stands. Do not use a jack to support the vehicle.
3. With the engine off, turn the wheels from full left to full right. Return to the straight-ahead position. This step will require more force for vehicles with the power steering off.
4. Check the tie rod boot for cracks, tears or other damage. Also check the boot seals for damage. Replace the entire tie rod end if the boot is damaged or missing. Figure 3.3.



**Figure 3.3**

**⚠ WARNING**

Verify that a cotter pin is installed through the tie rod end, and the tie rod end nut is tightened to the correct torque specification. Replace a missing cotter pin and tighten a loose tie rod end nut. A missing cotter pin or loose tie rod end nut can cause loss of steering control. Serious personal injury and damage to components can result.

5. Check that the tie rod end nut is installed and secured with a cotter pin.
  - **If the cotter pin is missing:** Tighten the tie rod end nut to the correct specification. Install a new cotter pin. Always tighten the tie rod end nut to the specified torque when setting the cotter pin. Refer to Section 8. Do not back-off the nut to insert the cotter pin. Figure 3.4.

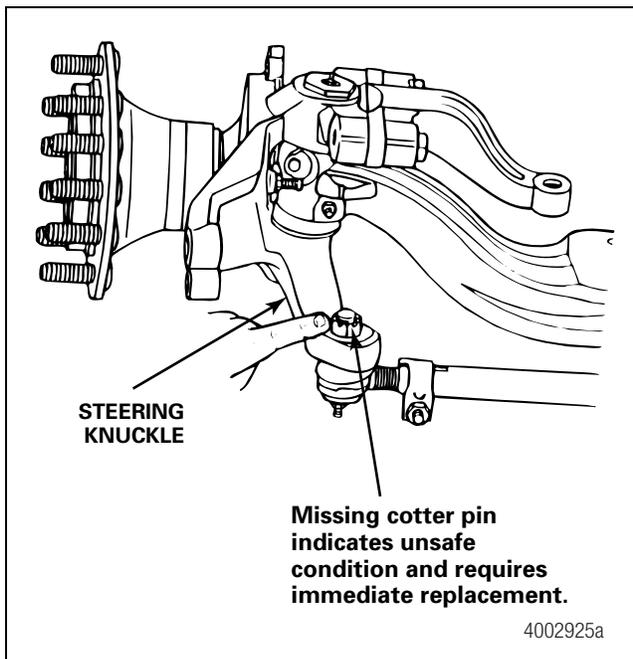


Figure 3.4

6. Check that the tie rod end is threaded correctly into the cross tube and installed deeper than the end of the cross tube slot. The tie rod end must be visible the entire length of the cross tube slot. Figure 3.5.

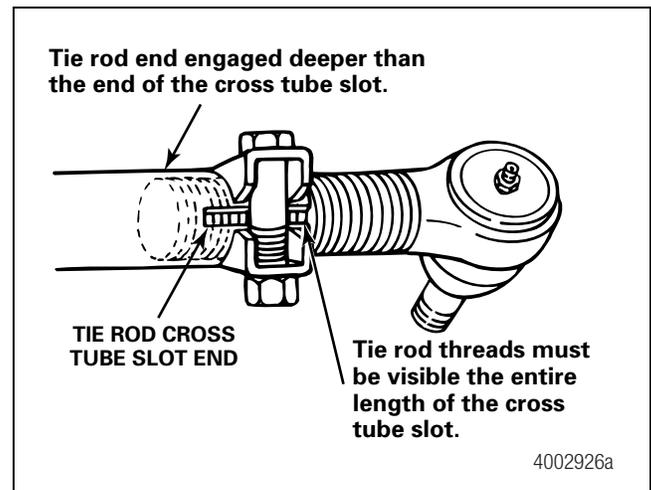


Figure 3.5

7. Check that the grease fittings are installed. Replace a damaged grease fitting.
  - **If the tie rod ends are non-greaseable:** Do not install a grease fitting. Figure 3.6.

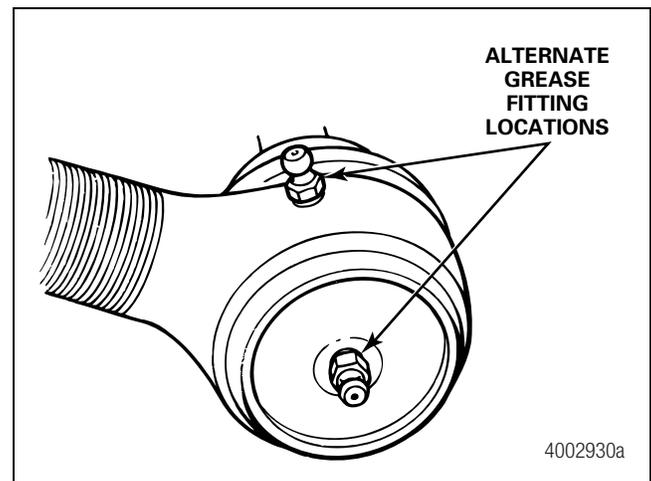


Figure 3.6

8. By hand or using a pipe wrench with jaw protectors to avoid gouging the cross tube, rotate the cross tube toward the FRONT of the vehicle and then toward the REAR. After rotating, center the cross tube between the stop positions.
  - **If the cross tube will not rotate in either direction:** Replace both tie rod ends.
9. Position yourself directly below the ball stud socket. Using both hands, grasp the assembly end as close to the socket as possible, no more than six-inches (152.4 mm) from the end.

## 3 Inspection

### ⚠ CAUTION

Only use your hands to check for movement or looseness of the tie rod assembly. Do not use a crow bar, pickle fork or two-by-four. Do not apply pressure or force to the tie rod assembly ends or joints. Do not rock the tires with the vehicle on the ground or with the wheels raised. Damage to components can result.

10. Apply hand pressure of approximately 100 pounds (45 kg) in a vertical PUSH-and-PULL motion several times. Check for any movement or looseness at both tie rod ends. Figure 3.7.

- **If there is any movement in the tie rod assembly:**  
Replace both tie rod ends.

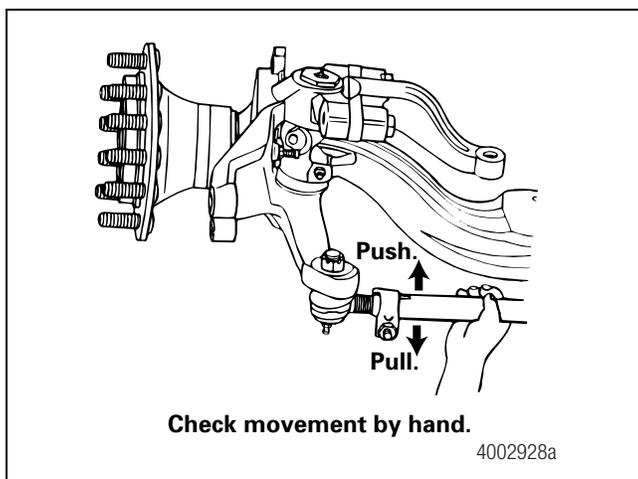


Figure 3.7

### ⚠ CAUTION

Replace bent or damaged cross tubes with original equipment parts of the same length, diameter and threads. Do not attempt to straighten a bent cross tube. Damage to components can result.

11. Inspect the cross tube and clamps for damage. Figure 3.8.

- **If the cross tube is bent or cracked:** Replace it. Use original equipment parts of the same length, diameter and threads.
- **If the clamps are damaged:** Replace them.
- **If either clamp has become welded to the cross tube:** Replace the entire cross tube assembly. Use original equipment parts of the same length, diameter and threads.

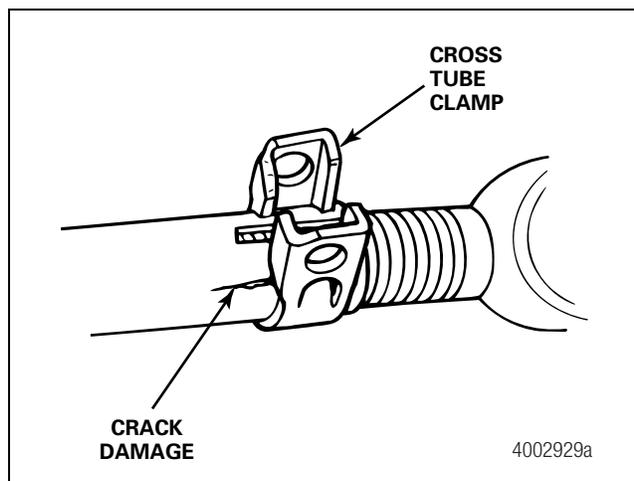


Figure 3.8

## Federal Out of Service Roadside Inspection Criteria (Department of Transportation)

The following cross tube and tie rod end components may be checked during roadside inspections. Deficiencies may result in the vehicle being placed out-of-service by authorized personnel.

1. Loose clamps or clamp bolts on the tie rods.
2. Any looseness in the threaded tie rod end and cross tube joint.
3. Loose or missing nuts on the tie rods or cross tube.
4. Any movement under the steering load of a tie rod arm ball stud nut.
5. Any motion, other than rotational, between any linkage member and its attachment point of more than 0.125-inch (3 mm), when measured with hand pressure.
6. Any obvious welded repairs.

### Replacement Criteria

Any detectable movement of 0.125-inch (3 mm) or more requires that the vehicle is immediately taken out of service for replacement of the tie rod ends.

When the roadside check indicates tie rod end movement of less than 0.125-inch (3 mm), the vehicle does not need to be immediately removed from a service run. It is advisable to schedule a major out-of-service inspection and maintenance as soon as possible.

### Commercial Vehicle Safety Alliance (CVSA) Criteria

The following are reprinted with permission from the CVSA operations manual.

When any of these values are met or exceeded, vehicle shall be placed out-of-service.

g. Ball and Socket Joints:

(1) Any movement under steering load of a stud nut. [396.3(a)(1)]

(2) Any motion, other than rotational, between any linkage member and its attachment point of more than 1/8 inch (3mm) measured with hand pressure only. [396.3(a)(1)]

(3) Any obvious welded repair(s). [396.3(a)(1)]

h. Tie Rods and Drag Links:

(1) Loose clamp(s) or clamp bolt(s) on tie rods or drag links. [396.3(a)(1)]

(2) Any looseness in any threaded joint. [396.3(a)(1)]

i. Nuts:

Loose or missing on tie rods, pitman arm, drag link, steering arm, or tie rod arm. [393.209(d)]

## 4 Cam Brake Removal and Disassembly

### Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

#### **⚠ WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Use a brass or synthetic mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off. Serious personal injury and damage to components can result.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

### Disassembly

#### Front Drive Steer Axle Wheel Ends Equipped with Cam Brakes

**NOTE:** When servicing drive shafts only, you may remove the steering knuckle as an assembly. To remove the steering knuckle as an assembly:

- Refer to the steering knuckle removal procedure in this section.
- After you remove the steering knuckle, proceed to the procedure in this section to service the drive shafts.

### Removal

#### Wheels, Drums and Hubs from the Axle

#### **⚠ WARNING**

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

1. Park the vehicle on a level surface. Block the wheels to keep the vehicle from moving.
2. Use a jack to raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.

3. Retract the brake linings so that the drums will clear the linings.
4. Remove the automatic slack adjuster. Refer to Maintenance Manual 4B, Automatic Slack Adjusters. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.
5. If the steering universal joint is to be removed from the housing, remove the oil drain plug and drain the lubricant from the axle.

**NOTE:** It is not necessary to remove the rim and tire at this time.

6. Remove the capscrews and washers that connect the drive flange to the wheel hub. The hubcap does not need to be removed from the drive flange unless it is damaged. Figure 4.1.

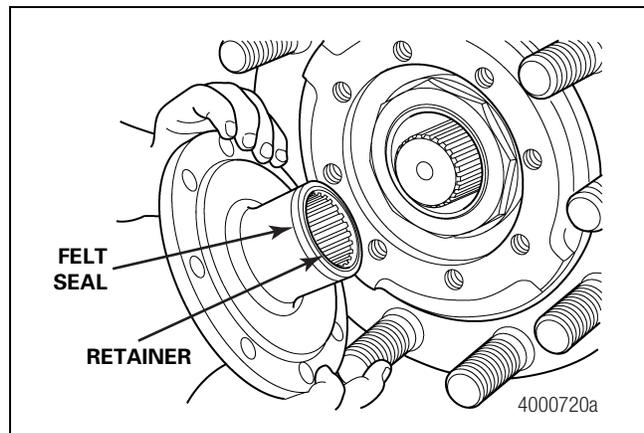


Figure 4.1

7. If necessary, remove the hubcap. Use a puller to remove the drive flange. Figure 4.2.

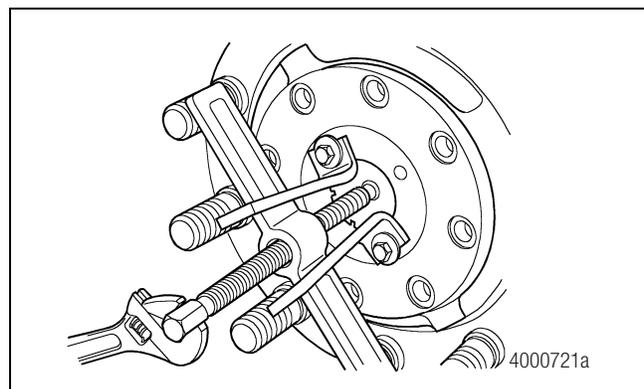


Figure 4.2

## 4 Cam Brake Removal and Disassembly

8. If necessary, remove the felt seal and retainer from the drive flange.
9. Remove the outer adjusting nut, lockwasher and inner adjusting nut from the spindle. Use the correct size wrench socket to remove the adjusting nut. Figure 4.3.

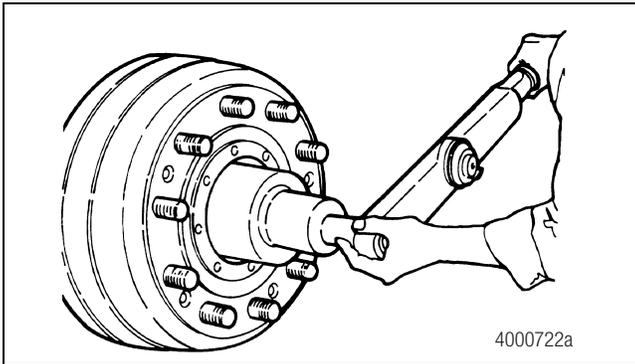


Figure 4.3

10. Remove the hub, drum and wheel assembly, if still mounted, straight off the spindle. If necessary, hit the inside of the wheel with a mallet to loosen it. Prevent the outer bearing cone from falling when you remove the hub.

### Disassembly

#### Bearing Cups and Oil Seal from the Hub

1. Remove the wheel, rim and tire, from the hub if not previously removed.
2. If it is necessary to remove the wheel studs from the hub, place the hub in a press. Support the hub flange and press the studs through the hub.
  - **If a press is not available:** Use a brass hammer or drift.
3. If necessary, use a long screwdriver to remove the oil seal from the hub. Discard the oil seal. Figure 4.4.

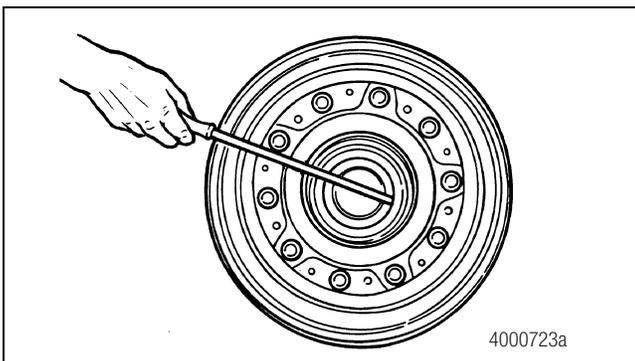


Figure 4.4

4. If necessary, on units equipped for ABS, use a suitable puller to remove the ABS tooth wheel from the hub.
5. Remove the inner bearing cone from the hub.
6. Use a press and sleeve or a bearing puller to remove the inner and outer bearing cups from the hub.
7. Tap and stretch the oil sleeve to remove it from the spindle. Do not reuse the sleeve.

### Removal

#### Steering Knuckle from the Housing

The steering knuckle must be disassembled before the steering universal joint can be removed.

The steering arm and cross tube assemblies can be serviced without removing the steering knuckle from the housing.

1. Remove the steering arm ball cotter pin and nut to disconnect the steering linkage from the steering arm.
2. Remove the cross tube, tie rod, cotter pin and nut to disassemble the cross tube from the knuckle arm. Figure 4.5.

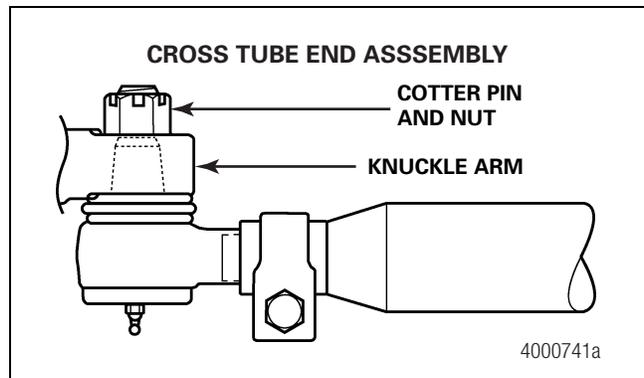


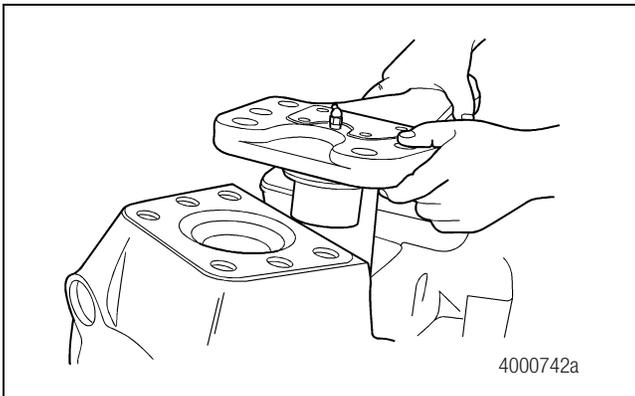
Figure 4.5

3. Push the stud for the cross tube end through the knuckle arm. If necessary, use a soft mallet to drive the stud through the knuckle arm.
4. On units equipped for ABS, remove the grommet for the ABS cable and the ABS sensor from the knuckle.

## 4 Cam Brake Removal and Disassembly

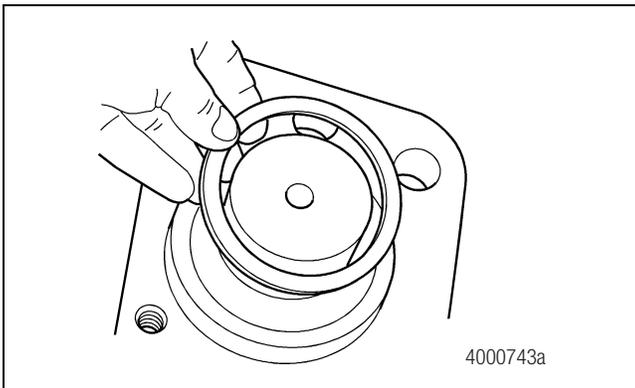
**NOTE:** It is not necessary to disassemble both cross tube ends unless both knuckle assemblies are being serviced at the same time.

5. Remove the six capscrews from the upper knuckle cap or steering arm.
6. Lift the upper knuckle cap or steering arm from the bore. Keep the shims together for use at reassembly. Figure 4.6.



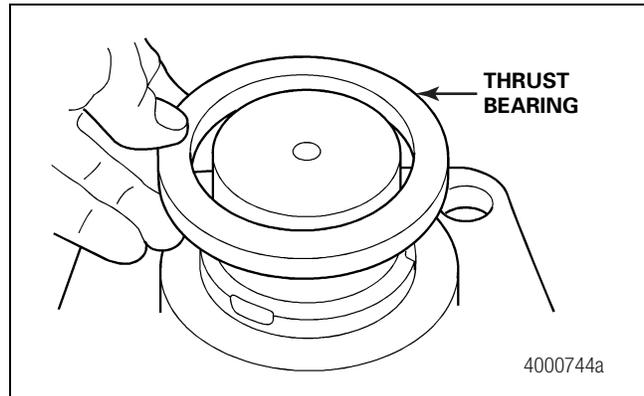
**Figure 4.6**

7. Inspect the steering arm oil seal on the upper knuckle cap for wear and damage. Replace a worn or damaged oil seal at reassembly. Figure 4.7.



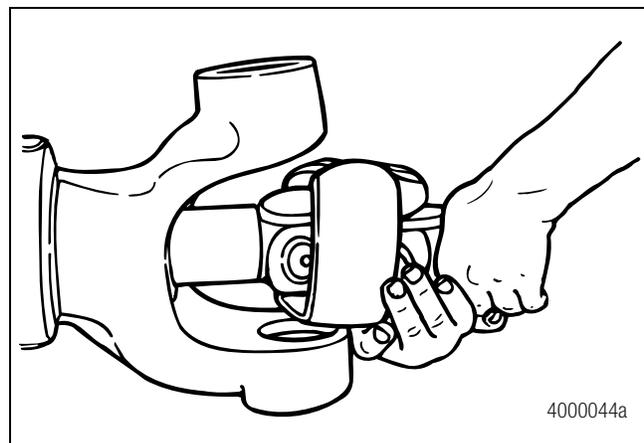
**Figure 4.7**

8. Disassemble the lower knuckle cap. Inspect the thrust bearing for wear and damage. Replace a worn or damaged thrust bearing at reassembly. Figure 4.8.



**Figure 4.8**

9. After both the upper and lower knuckle cap and steering arm assemblies are removed, pull the steering knuckle from the housing.
10. The bushings will remain in the sockets of the housing. Inspect the upper and lower bushings while they are still in the sockets for wear and damage.
11. Pull the universal joint and drive shaft assembly straight from the carrier housing. Figure 4.9.



**Figure 4.9**

12. Remove the oil seal from the outer drive shaft. Discard the seal.
13. If required, remove the inner drive shaft oil seal, thrust washer and bushing from the axle housing.
14. If necessary, remove the bushings and the socket plugs from the upper and lower sockets in the housing.

## 4 Cam Brake Removal and Disassembly

15. Grind off the four tack welds, if used, that hold the socket plugs to the housing. Grind the tack welds carefully so that the bore is not damaged. Some housings use a pressed-in socket plug.
16. Use a sleeve that is slightly smaller than the socket bore to drive the socket plug and bushing toward the outside of the socket using. Figure 4.10.

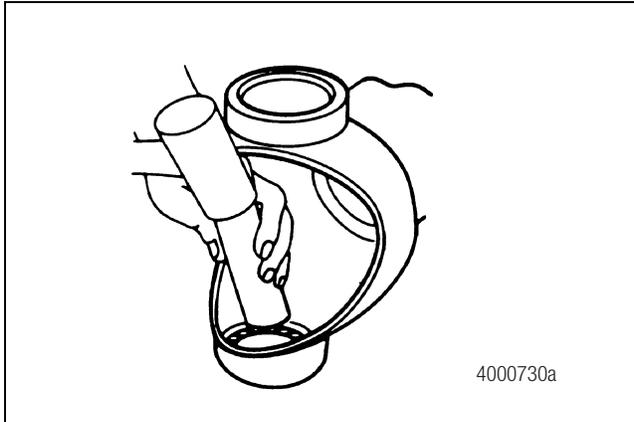


Figure 4.10

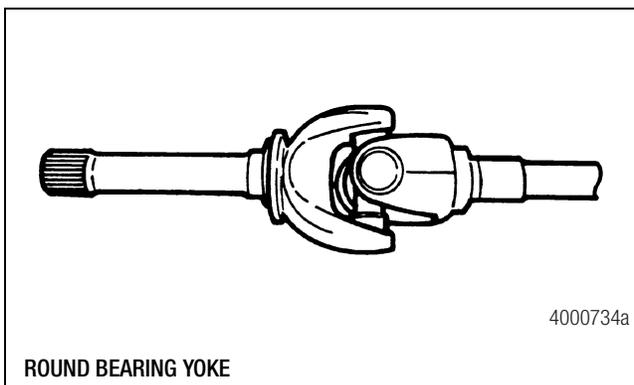
17. Clean all grease and dirt from the bores before reassembly.

### Disassembly

#### Steering Universal Joint

**NOTE:** Do not disassemble Permalube™ joints. Disassembly will void the Meritor warranty. The cross assemblies are Permalube™ design and are non-greaseable.

**NOTE:** Meritor front drive steer axles with cam brakes have a round bearing yoke joint design. Figure 4.11.



ROUND BEARING YOKE

Figure 4.11

1. Use snap ring pliers to remove the snap rings. Figure 4.12.

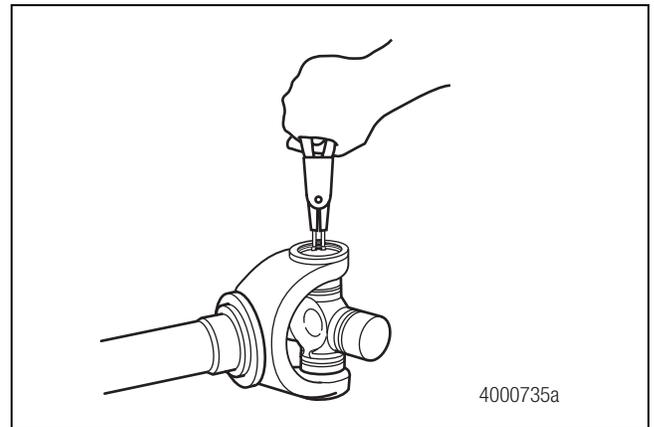


Figure 4.12

2. If necessary, use a brass drift and lightly tap the center of the bushing to assist in snap ring removal. Figure 4.13.

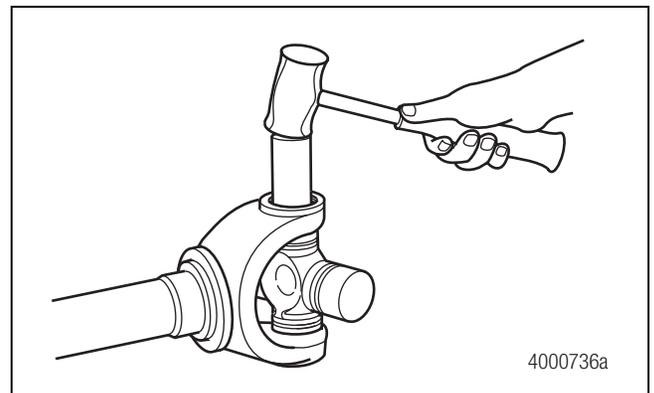


Figure 4.13

3. Repeat the previous step on the other sides of the yoke.
4. Use a press, bridge and bearing cup bushing receiver as shown in Figure 4.14. The bridge and bearing cup bushing receiver are detailed in Figure 4.15.

## 4 Cam Brake Removal and Disassembly

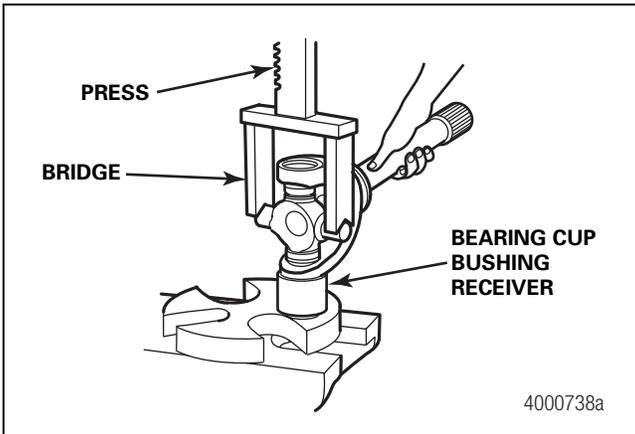


Figure 4.14

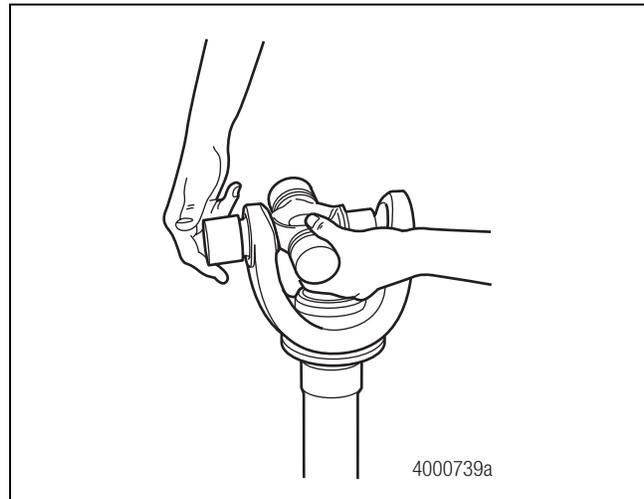


Figure 4.16

7. Turn over the universal joint. Repeat the procedure for the opposite side of the universal joint. Figure 4.17.

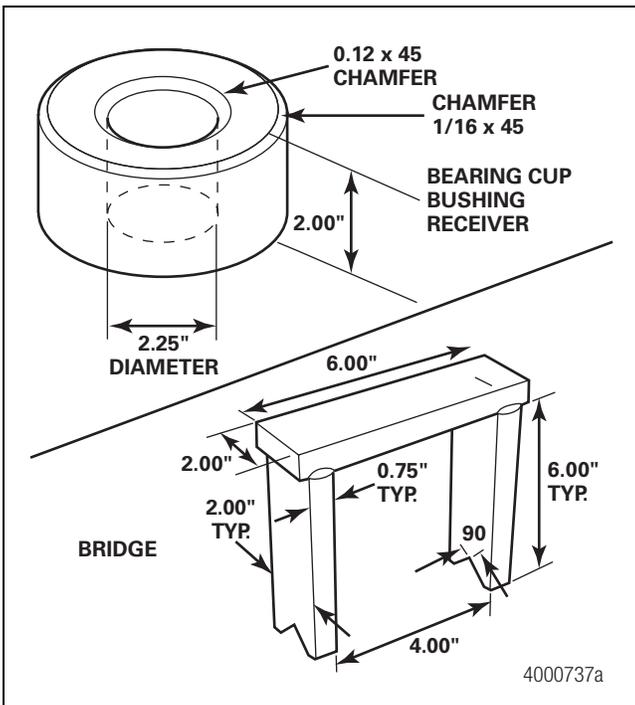


Figure 4.15

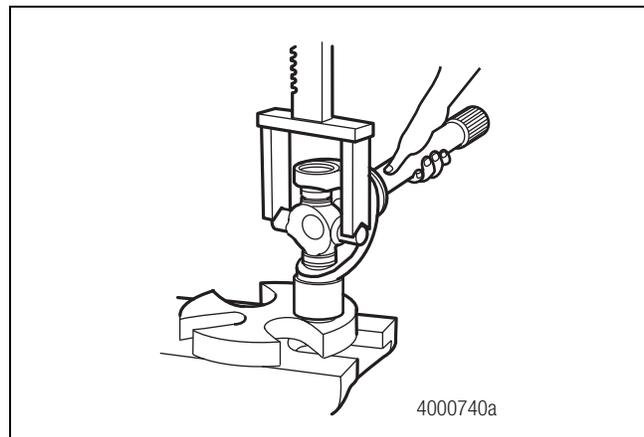


Figure 4.17

5. Press down until the first round bushing is loose. Figure 4.14.
6. Remove the round bushing. Figure 4.16.

## 4 Cam Brake Removal and Disassembly

### Cam Brake and Spindle from the Steering Knuckle

#### **⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING**

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

**NOTE:** It is possible to remove the brake as an assembly after removing the slack adjuster and the brake spider-to-knuckle attachment screws.

1. Remove the cam brake return springs and brake shoes from the brake spiders. Figure 4.18.

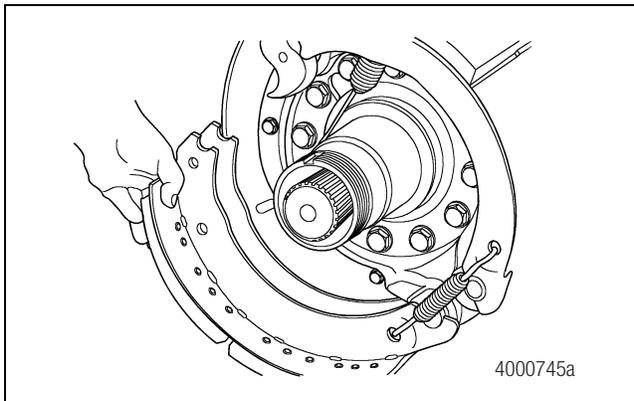


Figure 4.18

2. Remove the dust shield from the brake spider. Figure 4.19.

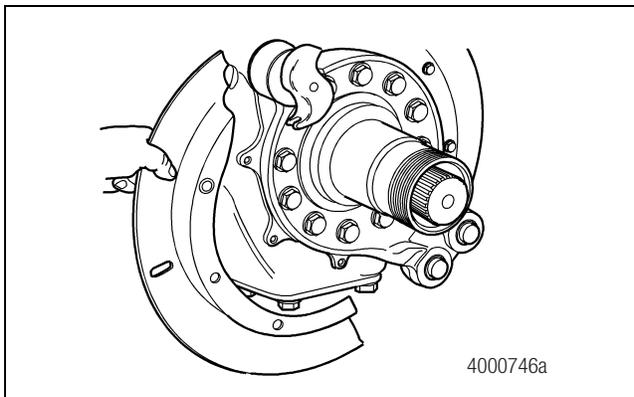


Figure 4.19

3. Remove the slack adjuster retaining ring at the adjuster end of the camshaft. Figure 4.20.

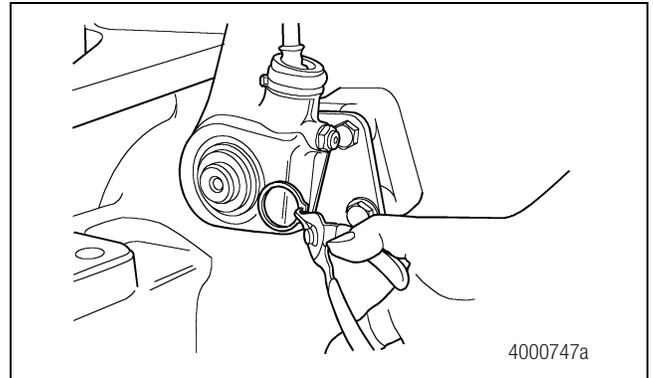


Figure 4.20

4. Remove the slack adjuster shims at the adjuster end of the camshaft. Figure 4.21.

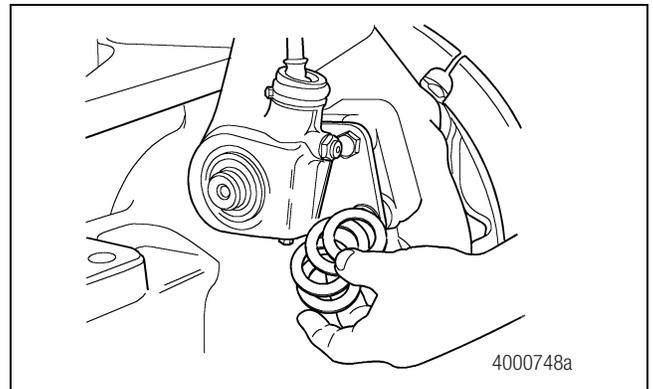


Figure 4.21

5. Remove the pins that engage the push rod yoke and the slack adjuster. Remove the slack adjuster from the camshaft. Figure 4.22.

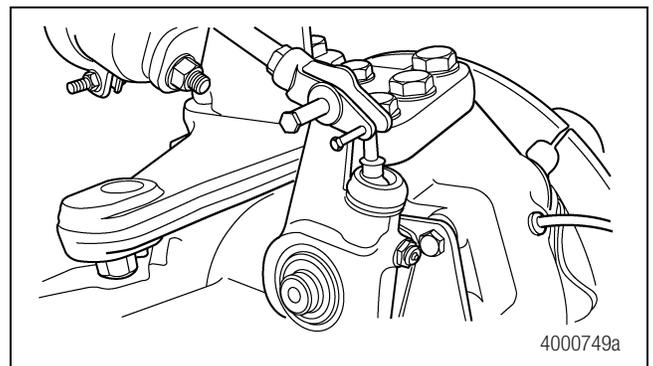


Figure 4.22

## 4 Cam Brake Removal and Disassembly

6. Remove the retaining ring from the camshaft at the back of the spider assembly. Figure 4.23.

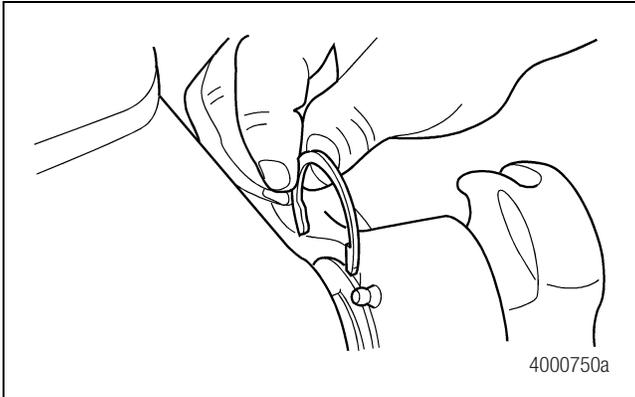


Figure 4.23

7. Remove the camshaft.

### **⚠ WARNING**

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

8. Drain the air tank.
9. Disconnect the air lines at the brake chamber.
10. Remove the air brake chambers and brackets.
11. To disassemble the brake spider and spindle assembly from the steering knuckle, remove the attaching capscrews.
12. On units equipped for ABS, push the ABS sensor into the knuckle cavity.
13. Pull the spindle straight from the knuckle and drive shaft. Figure 4.24.

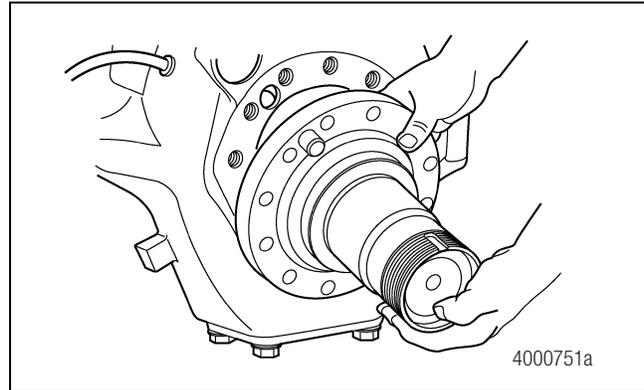


Figure 4.24

14. The seal wiper sleeve and thrust washer will remain inside the spindle. If necessary, use a screwdriver to disassemble these parts.
15. On units equipped for ABS, the steel sleeve and sensor clip for positioning the ABS sensor will remain on the spindle. If necessary, push out the sensor clip. Use a suitable driver to remove the sleeve.
16. Remove the screws and the bearing support bushing plate from the back side of steering knuckle. Figure 4.25.

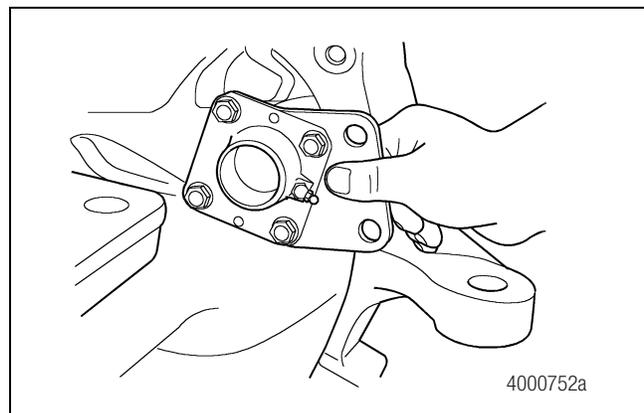


Figure 4.25

### Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

#### **WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- Wear safe eye protection.
- Wear clothing that protects your skin.
- Work in a well-ventilated area.
- Do not use gasoline or solvents that contain gasoline. Gasoline can explode.
- You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.

### Clean, Dry and Inspect Parts

#### Ground and Polished Parts

Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used for this purpose. DO NOT USE GASOLINE.

- Do NOT clean ground or polished parts in a hot solution tank, water, steam or alkaline solutions.
- Use a knife, if required, to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.

#### Rough Parts

- Rough parts can be cleaned with cleaning solvent or in a hot solution tank with a weak alkaline solution.
- Parts must remain in hot solution tanks until completely cleaned and heated.
- When removed from the hot solution, wash the parts with water until the alkaline solution is removed.

#### Axle Assemblies

- A completely assembled axle assembly can be steam cleaned on the outside to remove heavy amounts of dirt.
- Before the axle is steam cleaned, close or put a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

#### Dry Cleaned Parts

#### **CAUTION**

Do not dry bearings by spinning with compressed air. Damage to components can result.

- Parts must be dried immediately after cleaning and washing.
- Dry the parts using soft clean paper or cloth rags.
- Except for bearings, parts can be dried with compressed air. Do not dry bearings by spinning with compressed air.

#### Prevent Corrosion on Cleaned Parts

- Apply a light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do not apply oil to the brake linings or the brake drums.
- If parts are to be stored, apply a good corrosion preventative to all surfaces. Do not apply the material to the brake linings or the brake drums. Store the parts inside special paper or other material that prevents corrosion.

#### Tapered Roller Bearings

Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If you find any of the following conditions, replace the bearing. Figure 5.1.

- The center of the large-diameter end of the rollers is worn level or below the outer surface.
- The radius at the large-diameter end of the rollers is worn to a sharp edge.
- You find a roller groove at the small- or large-diameter end of the cup or cone inner race surfaces.
- You can see deep cracks or breaks in the cup, cone, and inner race or roller surfaces. Figure 5.2.
- You can see bright wear marks on the outer surface of the roller cage. Figure 5.3.
- The rollers are damaged. Figure 5.4.
- The cup and cone inner race surfaces that touch the rollers are damaged. Figure 5.5.

# 5 Prepare Parts for Assembly

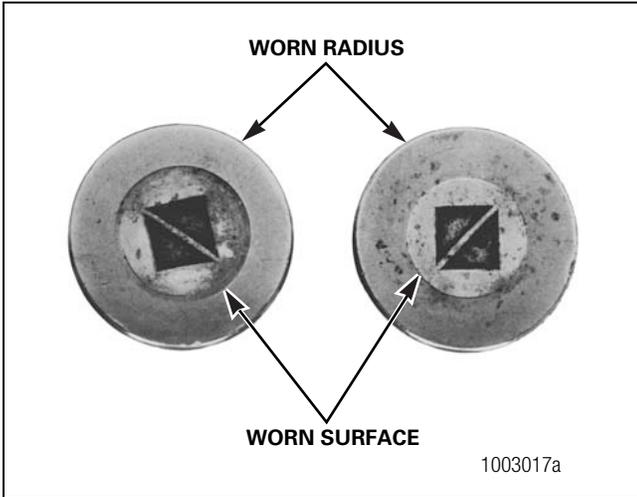


Figure 5.1

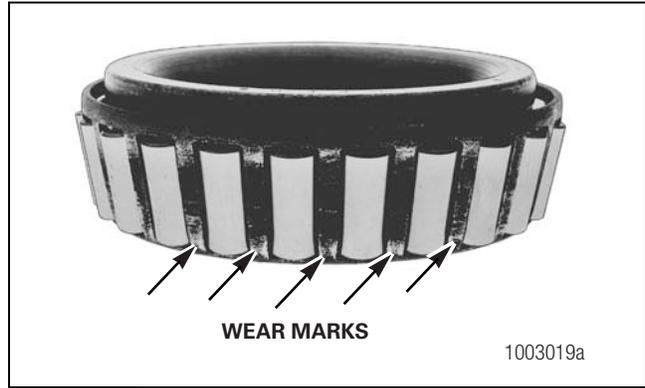


Figure 5.3



Figure 5.2

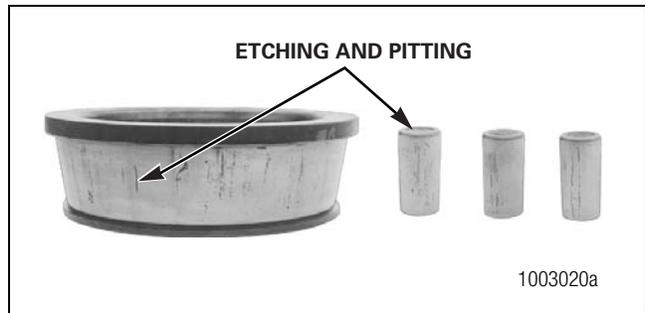


Figure 5.4

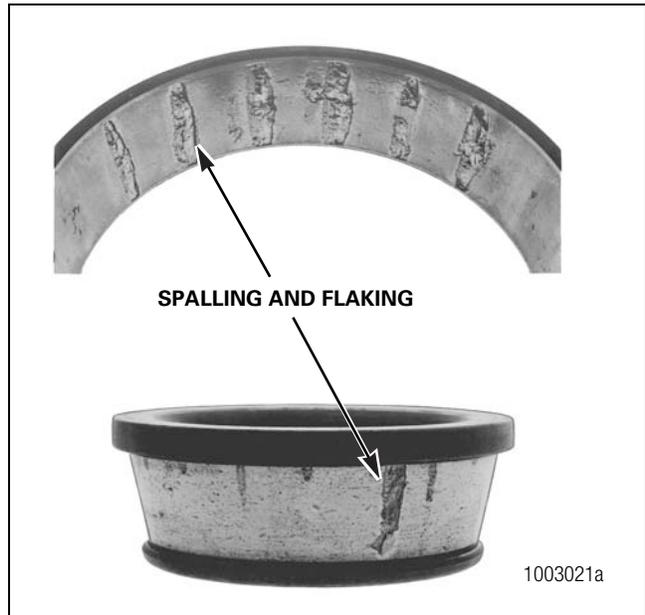


Figure 5.5

### Axle Housing

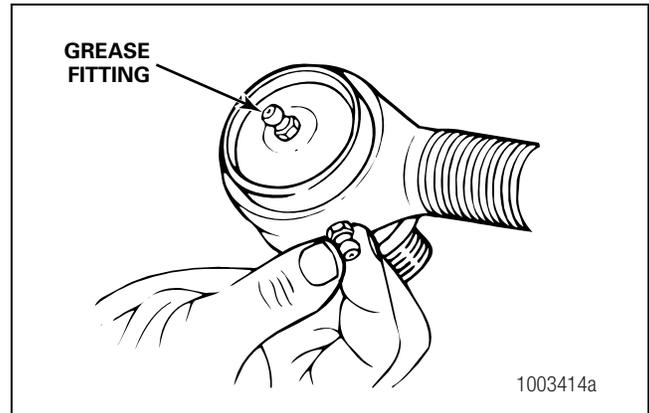
1. Remove dirt from the housing sleeves. Check for cracks, loose studs and damage to machined surfaces. Repair or replace damaged parts.
2. Check the king pin bushing for wear or damage. Replace worn or damaged parts.
3. Inspect the needle roller thrust bearing for wear or damage. Replace worn or damaged parts.
4. Inspect the knuckle or steering stops for wear or damage. Replace worn or damaged parts.
5. Inspect the axle housing knuckle socket bushings for wear. Replace worn components.

### Axle Shafts

1. Inspect the axle shafts for wear, stress and cracks at the splines, shaft and yoke ears. Replace damaged components.
2. Inspect the inner and outer axle shaft bushings in the housing and spindle for wear or damage. Replace worn or damaged bushings.
3. Inspect the axle shaft oil seals in the housing and spindle for damage. Replace damaged seals.

### Tie Rod Ends

1. Inspect tie rod ends for wear and damage. Replace worn or damaged tie rod ends. Do not repair them.
2. Check seals for damage. Replace damaged seals. Verify that seals are fastened correctly on the socket.
3. If tie rod ends have grease fittings, check fittings for wear and damage. Replace worn or damaged fittings. If a grease fitting is missing, install a new one. Don't try to install a grease fitting onto a tie rod end that's a non-greaseable design. Figure 5.6.



**Figure 5.6**

4. Tighten all grease fittings to the correct torque. Do not overtighten, which can damage the threads. Refer to Section 8 for torque specifications.

### Repair or Replace Parts

#### **⚠ WARNING**

**Replace damaged or out-of-specification axle components. Do not bend, repair or recondition axle components by welding or heat-treating. A bent axle beam reduces axle strength, affects vehicle operation and voids Meritor's warranty. Serious personal injury and damage to components can result.**

#### **⚠ CAUTION**

**Repair of axle housing by welding is not permissible. Damage to components can result.**

Replace worn or damaged parts of an axle assembly. The following are some conditions to check.

1. Replace the fasteners if the corners of the head are worn.
2. Replace the damaged washers.
3. Replace the gaskets, oil seals, grease seals or felt seals at the time of axle or carrier repair.
4. Clean the parts. Apply new silicone gasket material, where required, when the axle or carrier is assembled.
5. Use a fine file, emery cloth or crocus cloth to remove rough edges from parts that have machined or ground surfaces.
6. Clean and repair fastener threads and holes. Use a die or tap of the correct size or a fine file.

## 5 Prepare Parts for Assembly

7. Verify that threads are clean and not damaged, so that correct torque specifications for fasteners can be obtained.
8. Tighten all fasteners to the correct torque specifications. Refer to Section 8.

### Applying Adhesive and Silicone Gasket Material

#### **⚠ WARNING**

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin. If Loctite® adhesive material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

The silicone gasket products listed in Table A or their equivalent can be used on Meritor components.

Table A

Product Name	Description
Loctite® 5699 Ultra Grey	Adhesive/Sealant
Permatex® 82194 Ultra Grey	Silicone Sealant
Three Bond 1216	Silicone Sealant
Three Bond 1216E	Silicone Sealant

1. Remove all old gasket material from both surfaces.
2. Clean the surfaces where you'll apply the silicone gasket material. Remove all oil, grease, dirt and moisture. Dry both surfaces.

#### **⚠ CAUTION**

The amount of silicone gasket material applied must not exceed a 0.125-inch (3.18 mm) diameter bead. Too much gasket material can block lubrication passages. Damage to components can result.

3. Apply a 0.125-inch (3.18 mm) diameter continuous bead of silicone gasket material around one surface. Also apply the gasket material around the edge of all the fastener holes on that surface. Figure 5.7.

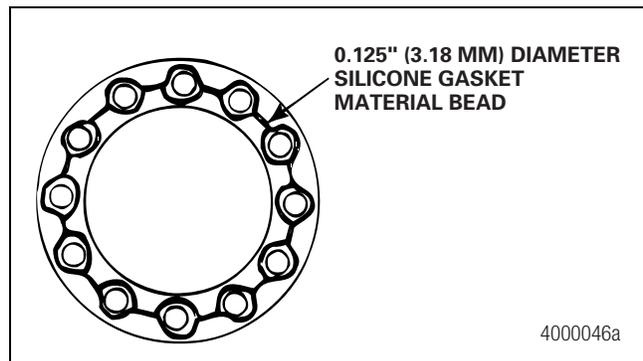


Figure 5.7

4. Assemble the components immediately to permit the gasket material to compress evenly between the parts.
5. Tighten the fasteners to the required torque specification for that size fastener. Refer to Section 8.
6. Wait 20 minutes before filling the assembly with lubricant.

### Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

#### **⚠ WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Use a brass or synthetic mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off. Serious personal injury and damage to components can result.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

### Assembly

#### Axle Shaft Universal Joint

1. Slide the first bushing onto the trunnion. Figure 6.1.

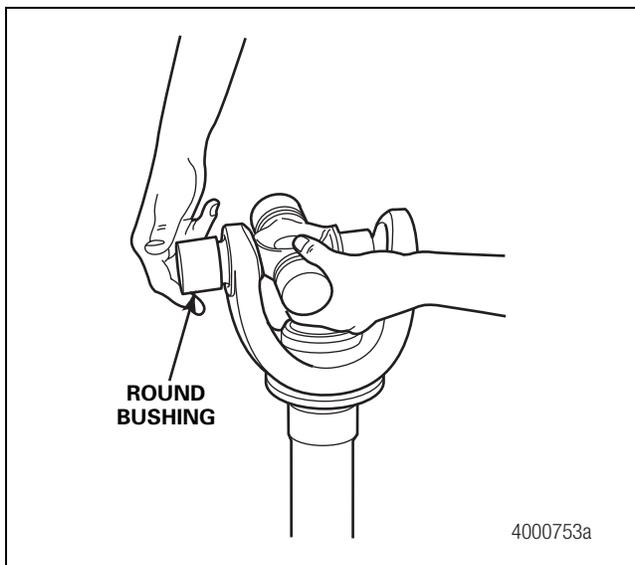


Figure 6.1

2. Press the first round bushing into the yoke slightly past the snap ring groove. Check that the bushing is aligned with the universal joint trunnion. Figure 6.2.

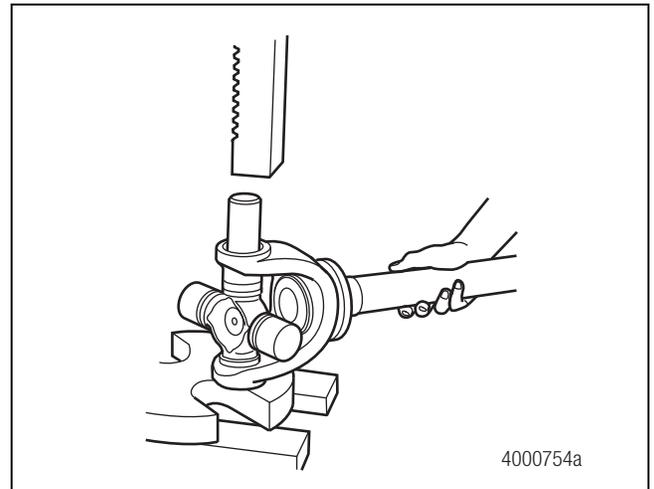


Figure 6.2

3. Use snap ring pliers to install the snap ring into the snap ring groove. You must fully seat the snap ring into the snap ring groove to avoid damage to the drive shaft. Figure 6.3.

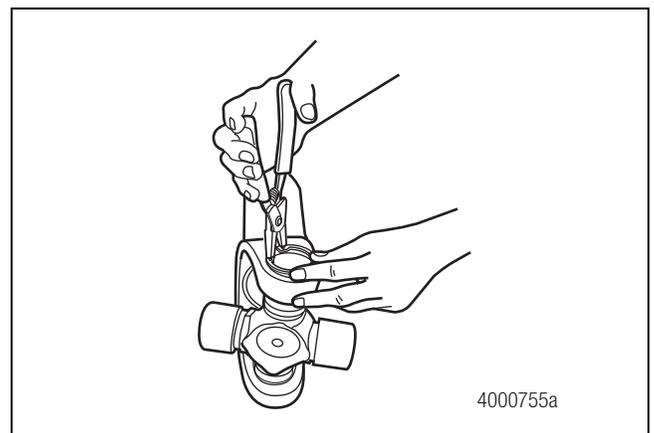


Figure 6.3

4. Use a snap ring installation gauge to check that the snap ring is fully seated in the snap ring groove. Figure 6.4.

## 6 Cam Brake Assembly and Installation

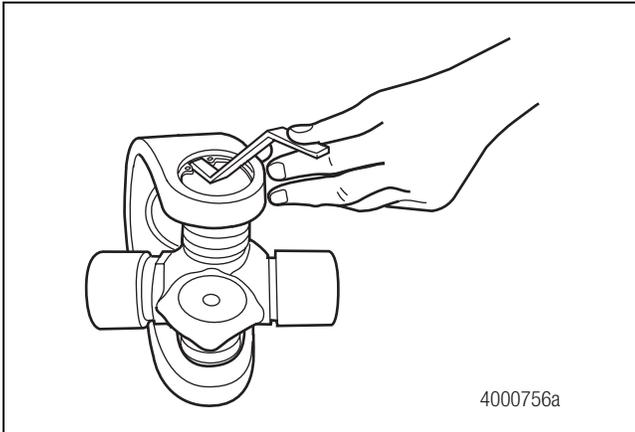


Figure 6.4

5. Repeat the previous four steps to install the remaining bushings into the yoke.
6. Lubricate the universal joint when the joint includes a grease fitting.
  - **If the universal joint does not move freely:** Strike the yoke ear with a brass or copper hammer. Figure 6.5.

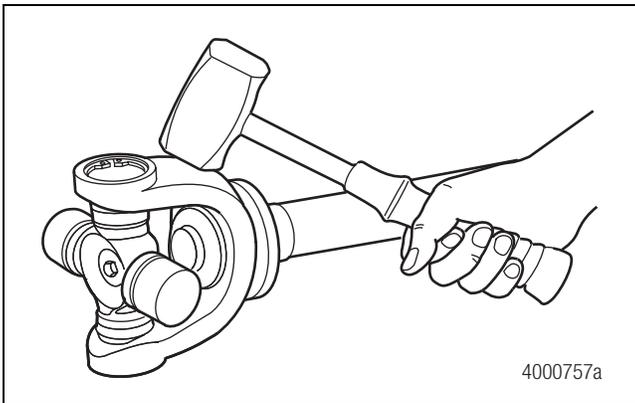
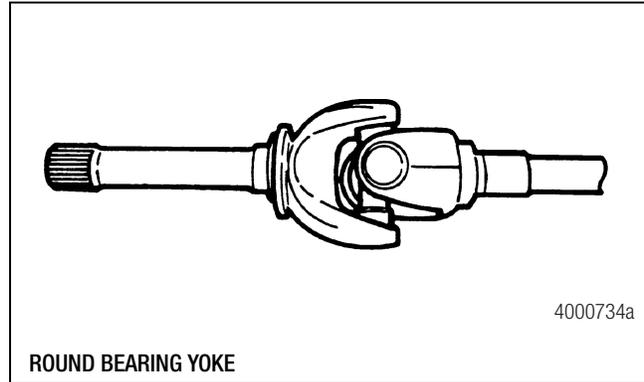


Figure 6.5

### Steering Knuckle and Axle Shaft

1. Install a new seal onto the outer drive shaft. Figure 6.6.



ROUND BEARING YOKE

Figure 6.6

2. Inspect the bushing for wear and damage. The bushing diameter must be 2.630-2.634-inches (66.8-66.9 mm).
  - **If the bushing diameter is not within the specification:** Use a correct size sleeve or driver to install a new inner drive shaft bushing, thrust washer and oil seal into the housing or housing socket adapter. Apply a layer of non-hardening sealing compound to the seal retainers before the seals are installed.

#### ⚠ CAUTION

Do not force or hit the seal after it is correctly installed into its seat. You can damage the seal retainer.

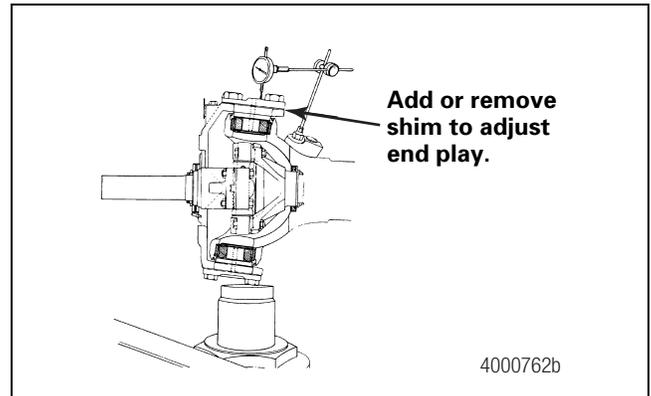
3. If the socket plugs were removed from the housing, position the socket plugs in the housings up against the counter bore. If tack welds were used previously, carefully tack weld each plug in position with four welds.
4. Use the correct size sleeve or driver to drive new bushings into the socket bores so that the bushings are level with the outside of the socket.
  - **If a press is available:** Press-in the domed socket plugs or tack weld them into position. To avoid distortion to the bushing and bushing bore diameter, do not apply too much heat to the socket during tack welding of socket plugs.
5. Inspect the axle shaft journals for wear and damage. The seal journal diameter on the axle shaft should be 3.248-3.250-inches (82.50-82.55 mm).
  - **If the seal journal diameter is not within the specification:** Replace the seal.

## 6 Cam Brake Assembly and Installation

6. Inspect the housing seal and thrust washer to verify that these pieces are correctly installed. Install the universal joint into the housing. Align the inner shaft splines with the splines of the differential side gear.
7. Pack the thrust washer rollers with grease before assembly.
8. Install the thrust bearing against the journal on the lower cap.
9. Place the knuckle into its correct position over the end of the housing. Align the knuckle bores with the housing socket bores.
10. Install the lower cap assembly through the bottom bores of the knuckle and housing until the cap is against the knuckle.
11. Install the capscrews and tighten to the correct torque. Refer to Section 8.
12. Install the shims and oil seal against the base of the upper cap. Use the same thickness shim pack that was removed during disassembly. The shim pack must contain a minimum of three shims.
13. Install the cap assembly through the upper bores of the knuckle and housing until the cap is against the knuckle.
14. Install the capscrews and tighten to the correct torque. Refer to Section 8.
15. Check the steering knuckle end play.
  - A. Support the vehicle with safety stands under the axle housing.
  - B. Place a magnetic base dial indicator into position on the housing. Figure 6.7.

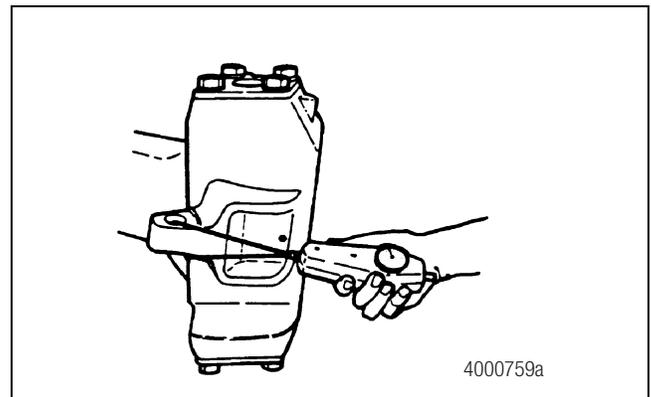
**NOTE:** If necessary, remove the grease fitting from the lower knuckle cap to prevent damage.

- C. Use a jack to place pressure onto the lower knuckle cap. Set the dial indicator to ZERO.
- D. Fully release the jack pressure and read the end play on the dial indicator. Correct end play is 0.005-0.015-inch (0.127-0.381 mm). Remove or add shims from between the upper knuckle cap and steering knuckle to obtain the correct end play.



**Figure 6.7**

16. Check the knuckle bearing preload.
  - A. Fasten a soft wire or cord to the tie rod arm. Attach a pound scale to the opposite end of the wire or cord. Hold the outer shaft of the universal joint away from the knuckle opening and pull on the pound scale to rotate the knuckle. Read the pounds on the scale. Read the pull necessary to rotate the knuckle, not the pull necessary to start the movement. Figure 6.8.
  - B. The pounds shown on the scale must be 10-30 lbs (4.5-13.5 kg). The correct rotating torque is 8-25 lb-ft (20.8-33.9 N•m). 



**Figure 6.8**

## 6 Cam Brake Assembly and Installation

### Spindle and Brake to the Steering Knuckle

1. On units equipped for ABS, if the steel sleeve for holding the ABS sensor clip and ABS sensor has been disassembled, install the sleeve with a suitable driver. Install the sleeve into the spindle until it is 0.9375-inch (23.8 mm) below the inner bearing shoulder. Install the ABS sensor clip into the sleeve. Figure 6.9.

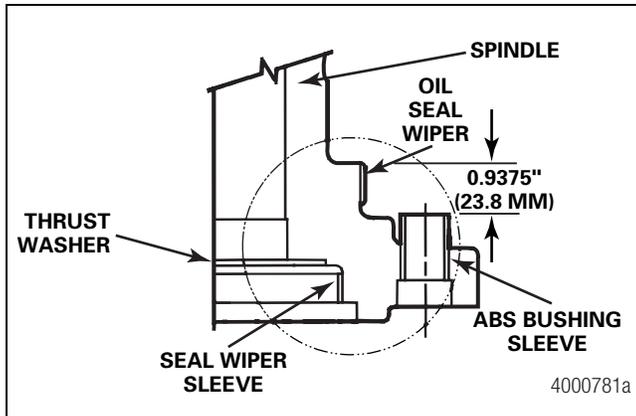


Figure 6.9

2. If disassembled, install the thrust washer and seal wiper sleeve into the spindle. Figure 6.10.

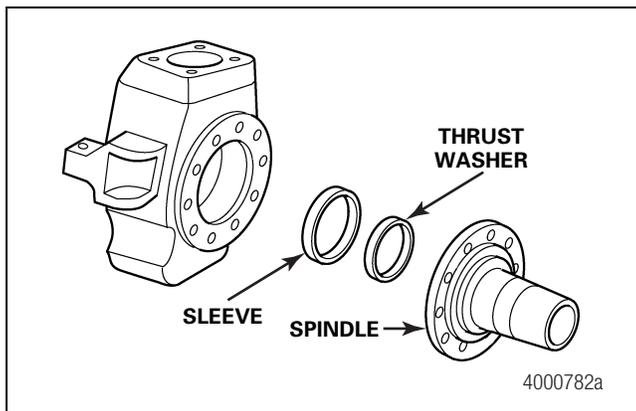


Figure 6.10

**NOTE:** On larger model axles, spindle installation will be easier if you install two temporary pilot studs into opposite sides of the knuckle. Tighten the studs finger-tight. Figure 6.11.

3. If the brake was removed as an assembly, install it at this time.

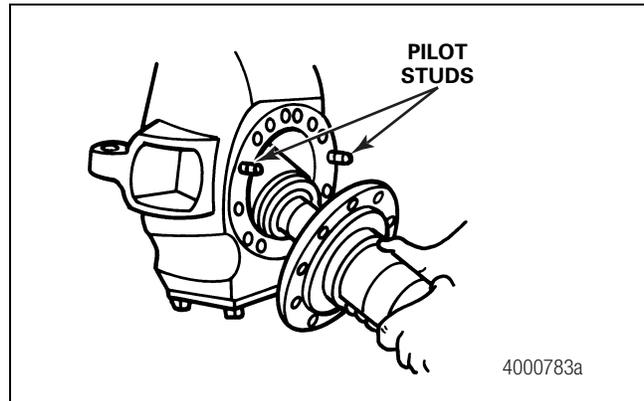


Figure 6.11

4. Install the spider assembly against the knuckle with the keyway slot for the wheel bearing adjusting nut system toward the top for ABS spindles.
5. Install the brake spider onto the spindle. Fasten all parts to the knuckle with 12 capscrews and washers. Tighten to the correct torque. Refer to Section 8. Figure 6.12.

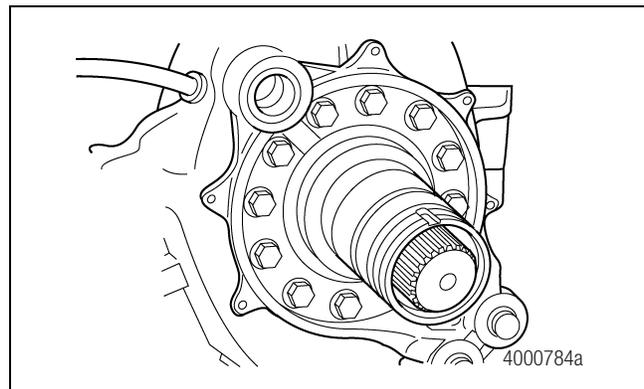


Figure 6.12

6. Check the axle shaft end play.
  - A. Place a magnetic base dial indicator into position on the housing with the pointer on the shaft. Set the dial indicator to ZERO.

## 6 Cam Brake Assembly and Installation

B. Push DOWN on the axle shaft and read the end play on the dial indicator.

- **If the end play is greater than 0.118-inch (3 mm):** Remove the wheel end and inspect for wear. The thrust washer thickness must be at least 0.120-inch (3.05 mm). Replace the thrust washer if necessary. Inspect the thrust surfaces on the spindle, housing and axle shaft for wear. Replace parts as necessary.

7. On units equipped for ABS, install the ABS cable and grommet into the knuckle. Install the ABS sensor into the ABS bushing in the spindle. Figure 6.12.
8. Install the camshaft bushing retainer plate and two bolts to the back side of the steering knuckle. Tighten the capscrews to the correct torque. Refer to Section 8. Figure 6.13.

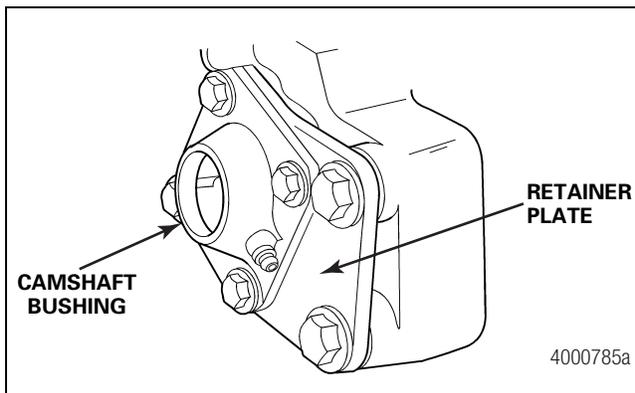


Figure 6.13

9. If the camshaft bushing was disassembled, attach it to the retainer plate with four self-tapping screws. Tighten the screws to the correct torque. Refer to Section 8.
10. Install the air brake chambers and brackets. Tighten the bracket mounting capscrews to the correct torque. Refer to Section 8. Figure 6.14.

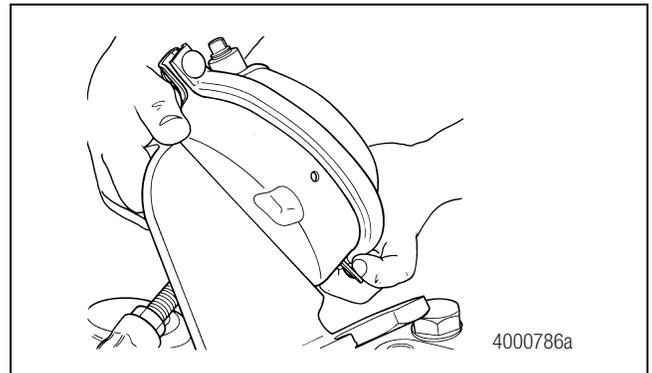


Figure 6.14

11. Install the camshaft. Figure 6.15.

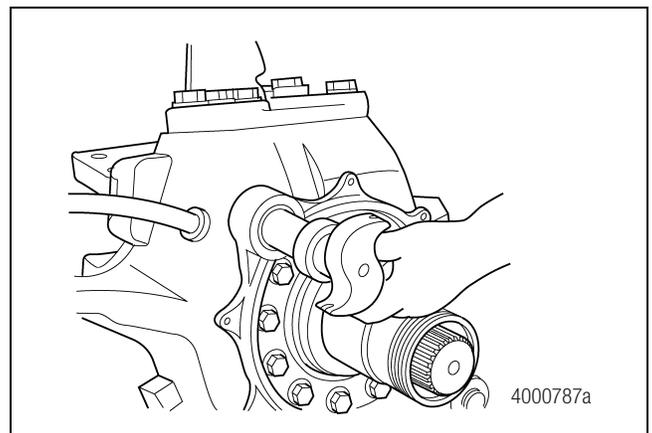


Figure 6.15

12. Install the retaining ring onto the camshaft at the back of the spider assembly. Figure 6.16.

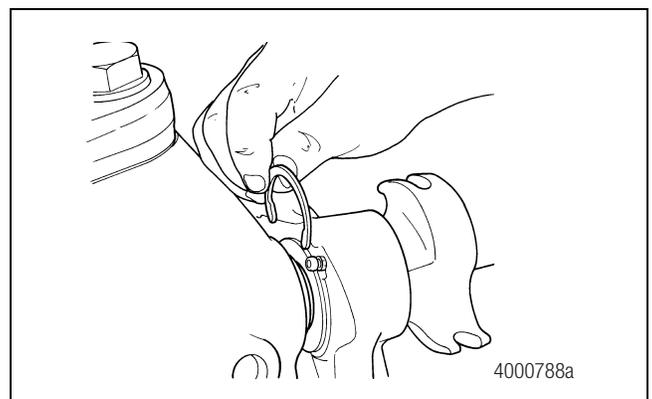


Figure 6.16

13. Install the slack adjuster onto the camshaft. Figure 6.17.

## 6 Cam Brake Assembly and Installation

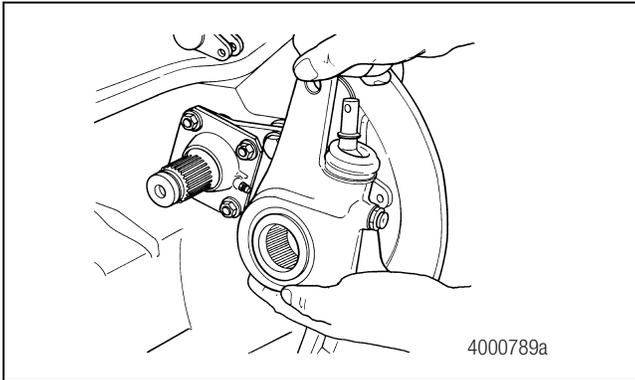


Figure 6.17

14. Install slack adjuster shims at the adjuster end of the camshaft. Figure 6.18.

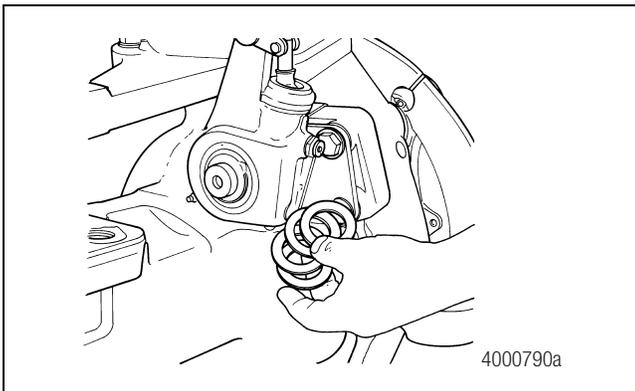


Figure 6.18

15. Install the slack adjuster retaining ring at the adjuster end of the camshaft. Figure 6.19.

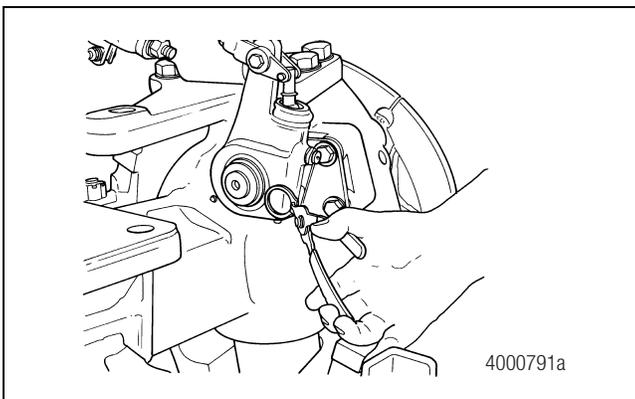


Figure 6.19

16. If disassembled, install the nut and push rod yoke onto the air chamber push rod.
17. Install the pin and retainer that engages the push rod yoke and the slack adjuster plunger rod. Figure 6.20.

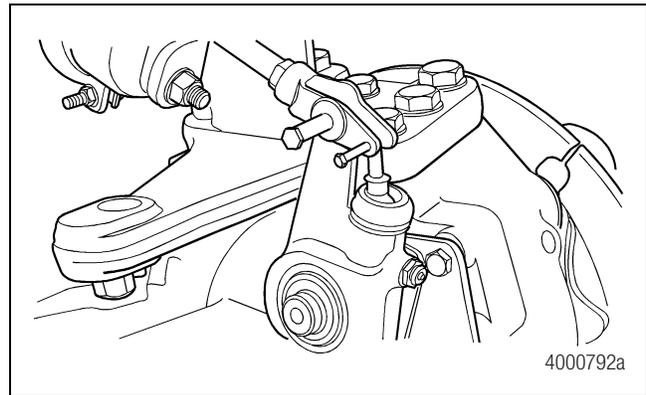


Figure 6.20

18. The distance from the back of the brake air chamber to the center of the clevis pin is the brake slack adjuster position (BSAP). Adjust the slack adjuster position to obtain the correct specification in Table B.

Table B

Slack Adjuster Length	BSAP
5.5" (139.7 mm)	6.3" (160.02 mm)
6.0" (152.4 mm)	6.43" (163.32 mm)

19. Tighten the nut on the push rod to the clevis pin to the correct torque. Refer to Section 8.
20. Install the dust shields to the brake spider. Tighten the mounting screws to the correct torque. Refer to Section 8. Figure 6.21.

## 6 Cam Brake Assembly and Installation

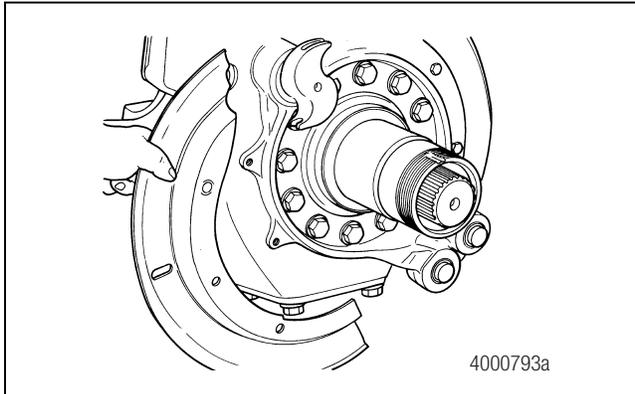


Figure 6.21

21. Connect the air lines to the brake chambers.

### Installation

#### Wheel Bearings Into the Hubs

1. If the wheel studs were removed from the hub, place the hub into a press with the drum side at the bottom. Align the grooves on the studs with the grooves in the stud holes in the hub. Press the studs into position. If a press is not available, use a brass hammer.
2. Install the inner and outer bearing cups into the hub. Use a press and sleeve.
3. Fill the bearing cones and hub cavity with the correct grease until it is level with the inside diameter of the bearing cones. Refer to Section 7.
4. Install the inner bearing cone into its cup inside the hub.
5. Install a new inner oil seal. Apply a layer of non-hardening sealing compound to the outside of the seal. Install the seal into its correct position against the bore. Do not force or hit the seal after it has touched the bottom of the bore. The seal can be damaged.
6. On units equipped for ABS, use a suitable driver to install the ABS tooth wheel onto the hub. Damage to the teeth on the ABS tooth ring can create an error signal during testing and operation of the ABS system.
7. Install the oil sleeve onto the spindle with a driver.
8. Install the hub assembly onto the spindle. Be careful the oil seal is not damaged during installation. Press the hub until the inner bearing is flat against the face of the spindle.

9. Install the outer bearing cone onto the spindle and push it into its cup inside the hub.
10. Check the axle lubricant level and fill if required. Refer to Section 7 for lubricant specifications.

### Adjustment

#### Brakes

##### **⚠ WARNING**

You must manually adjust the brake after you perform maintenance or service. Do not depend on the automatic adjusters to remove the excessive clearance created when you back off the brake during service. The automatic adjusters are designed to compensate for normal lining wear. Damage to components and serious personal injury can occur.

Refer to Maintenance Manual 4, Cam Brakes, for complete brake adjustment procedures. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

#### Wheel Bearings

##### **⚠ WARNING**

When you adjust a wheel bearing, always use the correct socket wrench to loosen the adjusting nut. Use a torque wrench to tighten it to the correct specification. Do not attempt to tighten or loosen an adjusting nut by striking it with a hammer. Do not place a chisel or drift next to the adjusting nut and strike the chisel with a hammer.

Damage to the adjusting nut can result, which can prevent you from obtaining the correct wheel bearing adjustment. An incorrect adjustment can cause a wheel to separate from the vehicle during operation. Serious personal injury and damage to components can result.

1. Use a torque wrench to tighten the adjusting nut to 100 lb-ft (136 N•m). Figure 6.22. **ⓘ**

## 6 Cam Brake Assembly and Installation

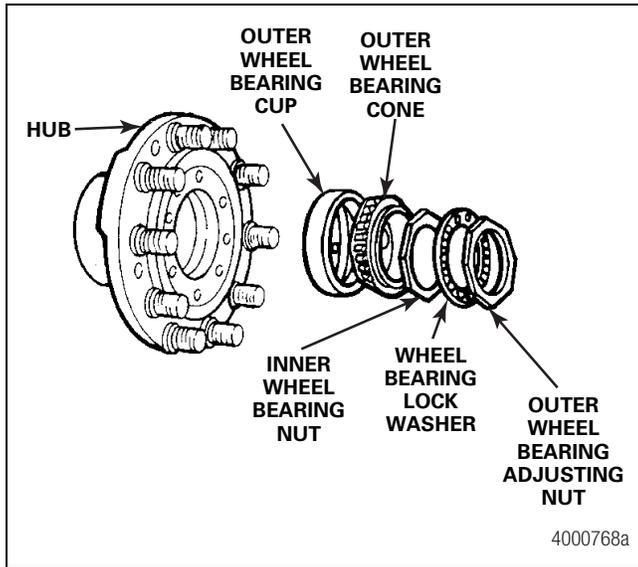


Figure 6.22

2. Rotate the hub three full turns to ensure all the bearings and seal surfaces are in contact.
3. Back off the adjusting nut 1/4 turn, 2-1/2 studs of the drum bolt circle. Do not rotate the hub assembly after backing off the adjusting nut.
4. Assemble the lock ring and jam nut. Tighten the jam nut to 250-400 lb-ft (339-542 N•m). If the lock ring does not line up with the adjusting nut, rotate the adjusting nut clockwise, tightening, to the closest lock ring hole. To make the smallest turn possible, flip the lock ring over if necessary. 
5. Check the resulting end play with a dial indicator and perform the following actions.

End Play (inch)	Action
0.000-0.002	No action required.
>0.002-0.005	Remove the jam nut and lock ring. Tighten the adjusting nut 1/32 turn by flipping the lock ring over and turning the adjusting nut to align with the next hole.
>0.005-0.008	Remove the jam nut and lock ring. Tighten the adjusting nut 1/16 turn by turning the adjusting nut to align with the next hole. Do not flip the lock ring.
>0.008-0.011	Remove the jam nut and lock ring. Tighten the adjusting nut 3/32 turn by flipping the lock ring over and turning the adjusting nut to align with the second hole from the current position.
>0.011	Return to Step 1 and repeat the procedure.

### ABS Sensor

1. On units equipped for ABS, push the ABS sensor completely into the sensor bearing until it contacts the tooth wheel on the hub. Figure 6.23.

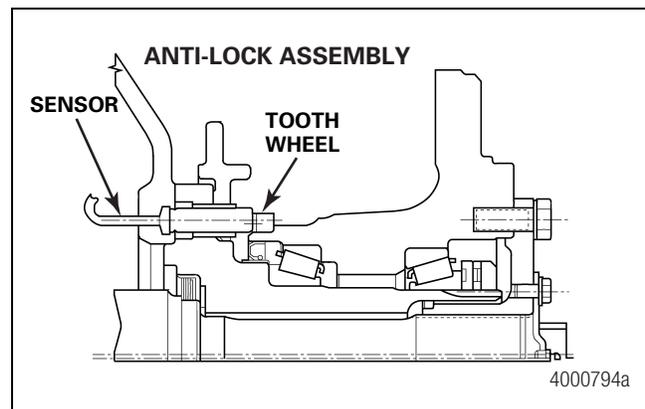


Figure 6.23

2. With the sensor in place, feed any excess cable back through the grommet on the knuckle. Do not affect the position of the sensor or allow excess cable to contact the drive shaft.

## 6 Cam Brake Assembly and Installation

3. For service instructions for ABS braking systems, refer to Maintenance Manual 28, Anti-Lock Braking Systems (ABS) for Trucks, Tractors and Buses, For C Version ECUs; and Maintenance Manual 30, Anti-Lock Braking Systems (ABS) for Trucks, Tractors and Buses, For D Version ECUs. To obtain these publications, refer to the Service Notes page on the front inside cover of this manual.

### Assembly

#### Drum and Drive Flange

##### WARNING

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

1. Install the drum over the hub pilot. If a flat-head capscrew is used for retention, fasten the drum to the hub with the flat-head capscrews. Tighten the capscrews to the correct torque. Refer to Section 8.
2. Install a felt seal and retainer onto the drive flange.
3. Apply a layer of silicone gasket material to the hub mounting surface of the drive flange only. Refer to Section 5.
4. Apply Meritor specification number O-617-A or O-617-B wheel bearing grease to the inside splines of the drive flange and the splines of the drive shaft.
5. Install the drive flange on the hub and fasten with washers and capscrews. Tighten the capscrews to the correct torque. Refer to Section 8.
6. If previously removed, install the hubcap, if used, to the drive flange. Apply a 0.125-inch (3.18 mm) continuous bead of silicone gasket material around either the mounting surface of the hubcap or the drive flange. Refer to Section 5. Tighten the capscrews to the correct torque. Refer to Section 8.

#### Cross Tube to the Knuckle

1. Assemble the cross tube end assembly and clamp if these parts were disassembled. Tighten the locknuts to the correct torque. Refer to Section 8.

2. Push the stud of the tie rod end through the bottom of the bore in the knuckle arm tapered hole. Tighten the cross tube nut to the correct torque. Refer to Section 8.
3. Install the slotted nut and cotter pin assembly.
  - A. Tighten the nut to the initial torque specified.
  - B. Advance the nut, do not back it off, to align the cotter pin.
  - C. Final installed torque must not exceed the maximum specified.
    - **If the final torque exceeds the maximum:** Remove the nut and reinstall it to the correct specification.
    - **If the minimum torque is not met:** Check if the stud taper is showing. If necessary, shim with a 0.125-inch (3.18 mm) washer.
4. Install the cotter pin.
5. Assemble the wheel, tire and rim, to the drum. Tighten the wheel nuts to the manufacturer's specifications.

### Adjustment

#### Steering Stop Setting

All Meritor front drive steer axles are shipped with the steering stop screws preset at the factory according to the manufacturer's specifications. Additional adjustments can be made by the vehicle manufacturer or end user to accommodate a specific chassis design or tire size as long as the maximum angle does not exceed the U-joint capability.

**NOTE:** Check the adjustments of both axle steering stops and power steering units every time part of the steering system is disassembled.

#### Maximum Turn Angle Setting

**NOTE:** Do not adjust the turn angle beyond the specifications set by the vehicle manufacturer.

The maximum turn angle of the U-joint is 35 degrees.

## 6 Cam Brake Assembly and Installation

### Manual Steering

Adjust both the right- and left-hand knuckle steering stops to touch the housing when the maximum turning angle specified by the vehicle manufacturer is reached. Lock the steering stop in position with the jam nut tightened to the correct torque. Refer to Section 8. Figure 6.24.

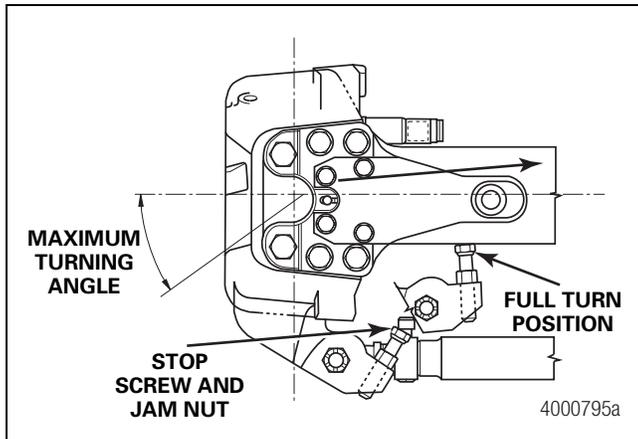


Figure 6.24

### Power Steering

#### ⚠ CAUTION

Meritor does not permit any power steering system that does not have a pressure relief or positive mechanical stop to be set before the maximum turn angle is reached. The power units must be stopped before the axle stop touches the housing to prevent stress to the axle components. Damage to components can result.

#### Mechanical Relief

Vehicles with mechanical Pitman arm stops or cylinder stops must be adjusted to end the travel of the Pitman arm or cylinder 0.125-inch (3.18 mm) before the steering stop screw touches the housing. Maximum turn angle is then controlled by the arm or cylinder stop, not the axle stop. Make the adjustments for both full-right and full-left turns. Figure 6.25.

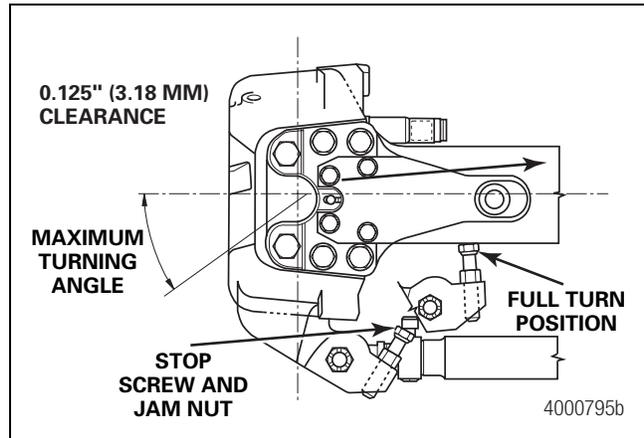


Figure 6.25

#### Hydraulic Relief

Hydraulic steering gears or cylinders with poppet valves must be adjusted while a 0.250-0.1875-inch (6.35-4.76 mm) spacer is held between the housing and stop screw. The poppet valves must be adjusted to permit pressure bypass at this position with the spacer in place for full-right and full-left turns. During this setting the steering gear pressure must be at a maximum 600 psi (41.4 bar). Figure 6.26.

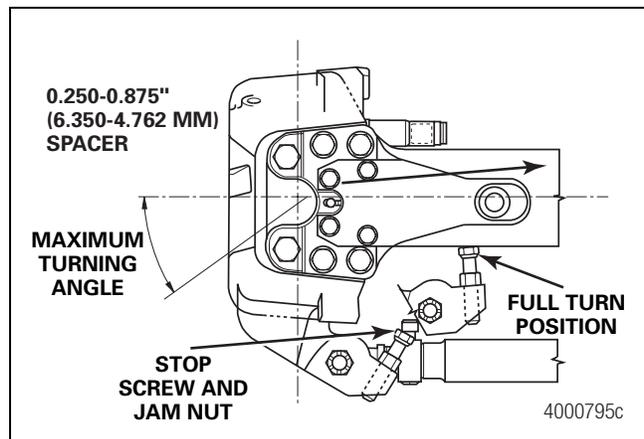


Figure 6.26

#### Wheel Toe-In

Toe-in must be checked and adjusted on all front drive axles after the axle is installed in the vehicle. Figure 6.27.

## 6 Cam Brake Assembly and Installation

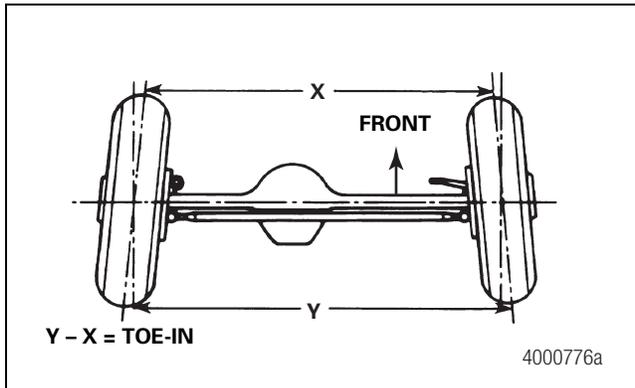


Figure 6.27

**NOTE:** Toe-in must be measured with the weight of the vehicle on the axle and the axle on a level floor. Use the following procedure.

1. Use a jack to raise the front axle.
2. Use a piece of chalk to mark the center area of both front tires around the complete circumference.
3. Place a scribe or pointed instrument against the center of the whitened part of each tire and rotate the tires. The scribe must be held in place so that a single straight line is marked all around the tire.
4. Place a full-floating turning radius gauge plate under each wheel. Lower the vehicle and remove the lock pins from the gauge plates.
  - **If full-floating gauge plates are not available:** Lower the vehicle to the floor and move the vehicle backward approximately six feet (1.8 m) and then forward for the same distance.
5. Set the slide scale end of a trammel bar to ZERO and lock the scale in place.
6. Place the trammel bar at the rear of the tires. Adjust the pointer to line up with the scribe lines on the tires. Lock the pointers in place. The sliding scale still must be set on ZERO. Figure 6.28.

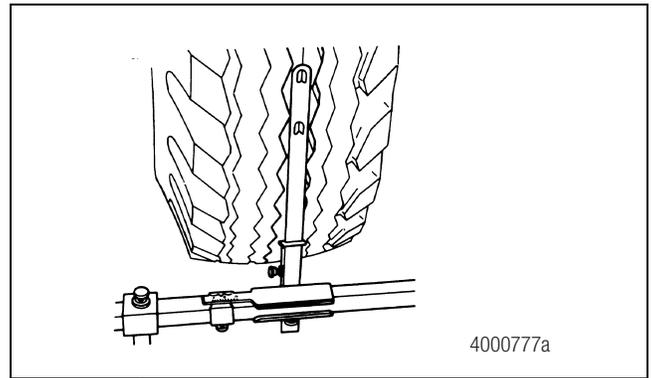


Figure 6.28

7. Place the trammel bar at the front of the tires. Adjust the pointer to line up with the scribe lines. Figure 6.29.

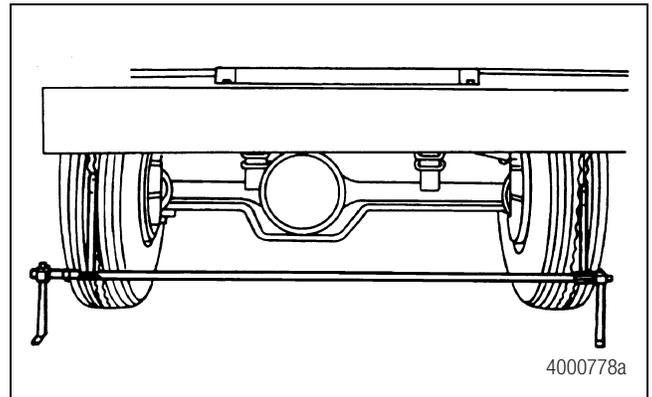
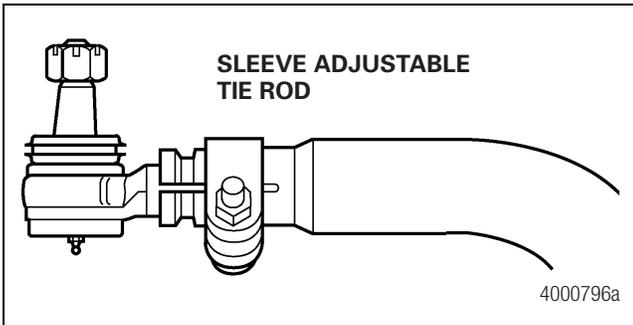


Figure 6.29

8. Read the toe-in or toe-out from the scale. Toe-in must be one of the following specifications.
  - Unloaded:  $0.06 \pm 0.31$ -inch ( $1.59 \pm 0.79$  mm)
  - Loaded:  $0.31 \pm 0.31$ -inch ( $0.79 \pm 0.79$  mm)
9. If toe-in adjustment is necessary, use the following procedure. Figure 6.30.

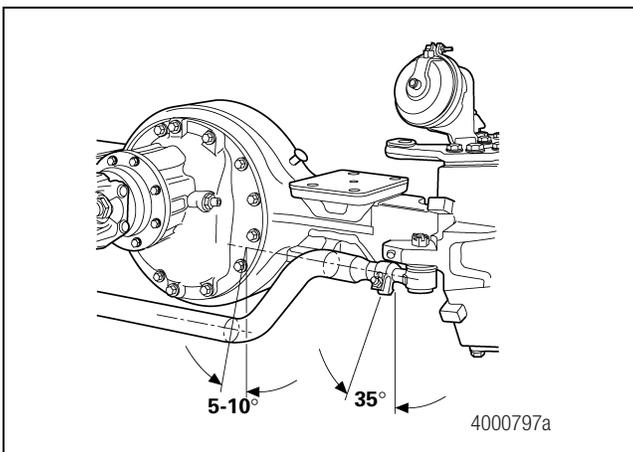
## 6 Cam Brake Assembly and Installation



**Figure 6.30**

### Axles with Sleeve Adjustable Cross Tubes

1. Loosen the tie rod clamp located on the sleeve side of the tie rod.
2. Rotate the sleeve to set toe-in or toe-out.
3. Tighten the clamp to the correct torque. Refer to Section 8. Figure 6.31.



**Figure 6.31**

4. Verify that the cross tube drop center does not interfere with the carrier or other vehicle components. Larger axles should have the drop center inclined at 5-10 degrees to vertical for optimum clearance at maximum turn conditions. Figure 6.31.
5. Check the toe-in measurement again to verify that it is within the correct limits.

## Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

### WARNING

**To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.**

**Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.**

## Overview

Drive axles generate small metal wear particles at a fairly steady rate, especially during the break-in period. If these fine, but hard particles are allowed to circulate in the lubricant, along with external moisture and dirt, internal components will wear at a much faster rate than normal.

## Magnets and Magnetic Drain Plugs

Front drive axles are equipped with magnetic drain plugs that have a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

The magnetic drain plug can be reused if, after cleaning, the plug has a minimum pick-up capacity of 1.5 pounds (0.7 kilograms) of low carbon steel.

Inspect the magnetic drain plug each time the oil is changed. Use the correct part. Pipe plugs will leak if used as a drain plug.

## Breather

### CAUTION

**Cover the breather when steam cleaning the housing to prevent water from entering the housing and contaminating the oil. Damage to components will result.**

Baffle-type breathers help keep axles free from external moisture and dirt which can cause premature oil and component failure.

## Seals

### CAUTION

**Always use the correct tools and procedures when replacing seals to ensure correct installation and help prevent seals from leaking.**

Seals keep lubricant in and dirt out of a component. When they are worn or damaged, seals leak and produce low lubricant levels which may damage components.

Durable triple-lip seals, standard in Meritor axles, protect the quality and levels of the lubricant and provide superior performance.

## Temperature Indicators

### CAUTION

**Meritor axles can operate above 190°F (88°C) without damage. However, if the oil temperature reaches 250°F (121°C), stop the vehicle immediately and check for the cause of overheating. Damage to components can result.**

Many Meritor axles have a tapped hole in the housing for the installation of a lubricant temperature indicator that will help reduce the failure of axle parts from overheated oil.

## Check and Adjust the Oil Level

1. Park the vehicle on a level surface.
2. Remove the fill plug from the axle.
3. The oil level must be even with the bottom of the fill plug hole.
  - **If oil flows from the hole when the plug is loosened:**  
The oil level is high. Let the oil drain to the correct level.
  - **If the oil level is below the bottom of the fill plug hole:**  
Add the specified oil.
4. Install and tighten the fill plug to 35-50 lb-ft (48-67 N•m). 

## 7 Lubrication

### Drain and Replace the Oil

1. Park the vehicle on a level surface. Place a large container under the axle.
2. Remove the drain plug from the bottom of the axle. Drain and discard the oil correctly.
3. Clean, install and tighten the drain plug to 35-50 lb-ft (48-67 N•m). 
4. Remove the fill plug from the axle.
5. Fill the axle to the bottom of the fill plug hole with the specified oil. Allow enough time for oil to circulate through the axle assembly.
6. Install and tighten the fill plug to 35-50 lb-ft (48-67 N•m). 

### Lubrication

#### Knuckle King Pins

With the vehicle weight on the wheel end, pump grease through the grease fittings located on the upper cap or steering arm and lower cap assemblies. Grease should purge through the seals and thrust bearing.

#### Camshaft Retainer Bushing and Cam Bushing

Pump grease until it purges through the seals.

#### Drive Axle Shaft Universal Joint

1. Permanently-lubricated Permalube™ drive shaft joints do not have a grease fitting provided. Periodic greasing is not required for these parts. For serviceable universal joints with grease fittings, follow Step 2 through Step 3.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the universal joint. Apply grease until new grease purges from all the seals.
  - **If new grease does not purge at every seal:** Move the drive shaft while applying grease at the fittings until new grease purges at every seal.
  - **If new grease still does not purge:** Disassemble the universal joint. Inspect the grease and the components. Service as necessary.

#### Axle Shaft Spline and Thrust Washer

On axles with greaseable drive flanges, pump grease through the grease fitting until it purges at the axle shaft seal. Figure 7.1.

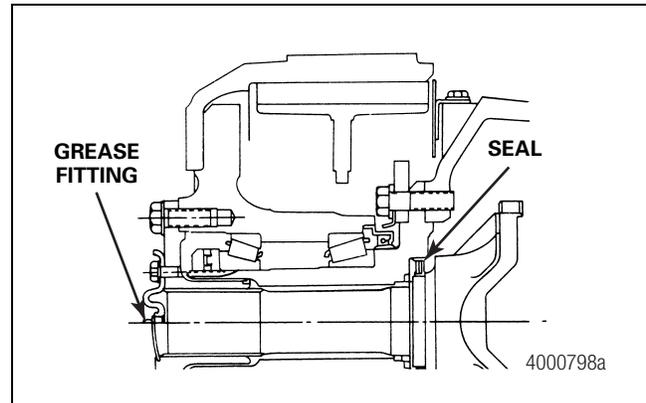


Figure 7.1

#### Cross Tube End Assembly

1. Check the cross tube for looseness of more than 0.060-inch (1.52 mm). Figure 7.2. If loose, service as necessary.

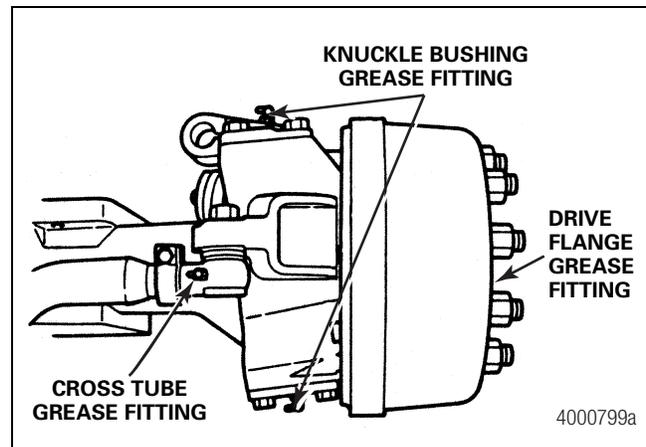


Figure 7.2

2. Apply the specified grease at the grease fitting on the cross tube. Apply grease until new grease purges from all the seals.
  - **If new grease does not purge at the seals:** Move the cross tube while applying grease at the fittings until new grease purges from all the seals.
  - **If new grease still does not purge:** Disassemble the cross tube. Inspect the grease and the components. Service as necessary.

## Knuckle Bushing

1. Check the knuckle for looseness. The correct end play is 0.005-0.015-inch (0.127-0.381 mm). Figure 7.2. If loose, service as necessary.
2. Clean all grease fittings prior to lubrication.
3. Apply the specified grease at the grease fitting on the knuckle until new grease purges from all the seals. Grease the lower pin cap with the vehicle weight on the wheel end to ensure that the thrust bearing is completely greased.
  - **If new grease does not purge at the seals:** Move the knuckle while applying grease at the fittings until new grease purges at the seals.
  - **If new grease still does not purge:** Disassemble the knuckle. Inspect the grease and the components. Service as necessary.

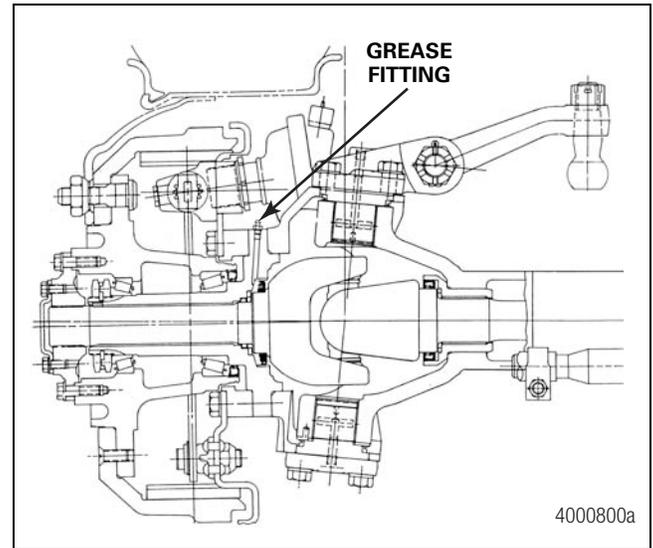


Figure 7.3

## Greasing Wheel Bearings

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.
2. Use a jack to raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
3. Remove the tire and wheel assembly. Remove and disassemble the hub.
4. Use the correct cleaning solvent to remove the old grease from all parts. Discard the seals. Inspect the wheel bearings for wear and damage. Replace worn or damaged bearings.
5. Before installing the wheel bearings, lubricate the bearing journals on the spindle with the grease that is used for the bearings. Figure 7.3 and Figure 7.4.

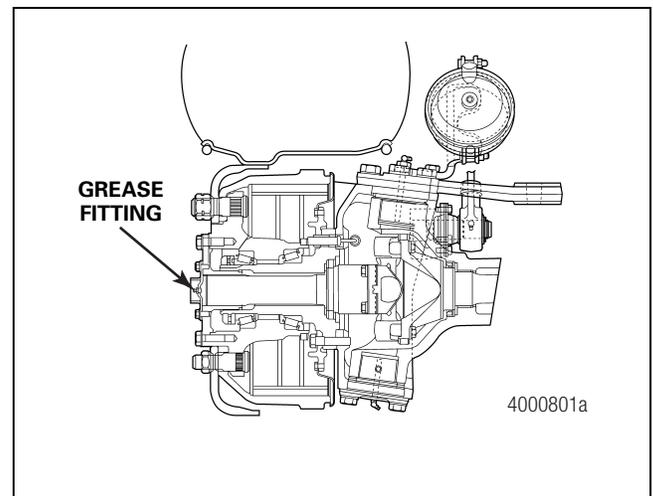


Figure 7.4

6. Use a pressure packer to force the specified grease from the large end of the cones into the cavities between the rollers and cage. Pack the hub between the bearing cups with grease to the level of the smallest diameter of the cups.
  - **If a pressure packer is not available:** Grease the bearings by hand.
7. Install the inner and outer bearing cones into the cups in the hubs. The bearing cups must be pressed tight against the shoulder in the hubs.
8. Install new wheel seals into the hubs.

## 7 Lubrication

9. Install the hub and the wheel and tire assembly. Install the outer wheel bearing cone into the hub. Install the adjusting nut.
10. Adjust the wheel bearings.

### Specifications

#### Front Drive Axle Oil Change Intervals and Specifications\*

<b>Initial Oil Change</b>	No longer required as of January 1, 1993
<b>Check Oil Level</b>	Every 5,000 miles (8000 km), once a month, or the fleet maintenance interval, whichever comes first
<b>Petroleum Oil Change</b>	Every 25,000 miles (40 000 km) or annually, whichever comes first*
<b>Synthetic Oil Change</b>	Every 50,000 miles (80 000 km) or annually, whichever comes first

\*For continuous heavy-duty operation, check the oil level every 1,000 miles (1600 km). Add the correct type and amount of oil as required.

Meritor Specifications	Military Specification Approval	Oil Description	Outside Temperature			
			°F		°C	
			Min.	Max.	Min.	Max.
O-76-A, Gear Oil	MIL-PRF-2105-E and SAE J2360	GL-5, SAE 85W/140	10	None	-12	None
O-76-D, Gear Oil		GL-5, SAE 80W/90	-15	None	-26	None
O-76-E, Gear Oil		GL-5, SAE 75W/90	-40	None	-40	None
O-76-J, Gear Oil		GL-5, SAE 75W	-40	35	-40	2
O-76-L, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None
O-76-M, Full-Synthetic Oil		GL-5, SAE 75W/140	-40	None	-40	None
O-76-N, Full-Synthetic Oil		GL-5, SAE 75W/90	-40	None	-40	None

\*If the front drive axle is the only axle on the vehicle, change the oil every 15,000 miles (24 000 km) or 1,000 hours of operation, whichever comes first.

## Front Drive Axle Greasing Intervals and Specifications

Component	Greasing Intervals	Grease/Oil	Meritor Specification	NLGI Grade	Grease Classification	Outside Temperature
Knuckle King Pins Brake Camshaft Bushings and Seals Cross Tube End Assembly	Every 3,000 miles (4800 km) or 200 hours of operation, whichever comes first.	Multi-Purpose Grease	0-617-A (preferred) or 0-617-B (acceptable)	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
Wheel Bearings	On-Highway: 30,000 miles (48 000 km) or once a year, whichever comes first.  On/Off Highway and Off-Highway: 15,000 miles (24 140 km) or twice a year, whichever comes first.					
Spindle Axle Shaft Bushing	Every 100,000 miles (160 000 km) or 2 years, whichever comes first.					

## Wheel-End Axle Greasing Intervals and Specifications

Greasing Intervals	Grease	Meritor Specification	NLGI Grade	Grease Classification	Outside Temperature
Whichever comes first: <ul style="list-style-type: none"> <li>• Replacing Seals</li> <li>• Relining Brakes</li> <li>• On-Highway: 30,000 miles (48 000 km)/Once a year</li> <li>• On/Off Highway and Off-Highway: 15,000 miles (24 140 km)/Twice a year</li> </ul>	Multi-Purpose Grease	0-617-A (preferred) or 0-617-B (acceptable)	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.

# 8 Specifications

## Torque Specifications

### Cam Brake Fastener Torque Specifications

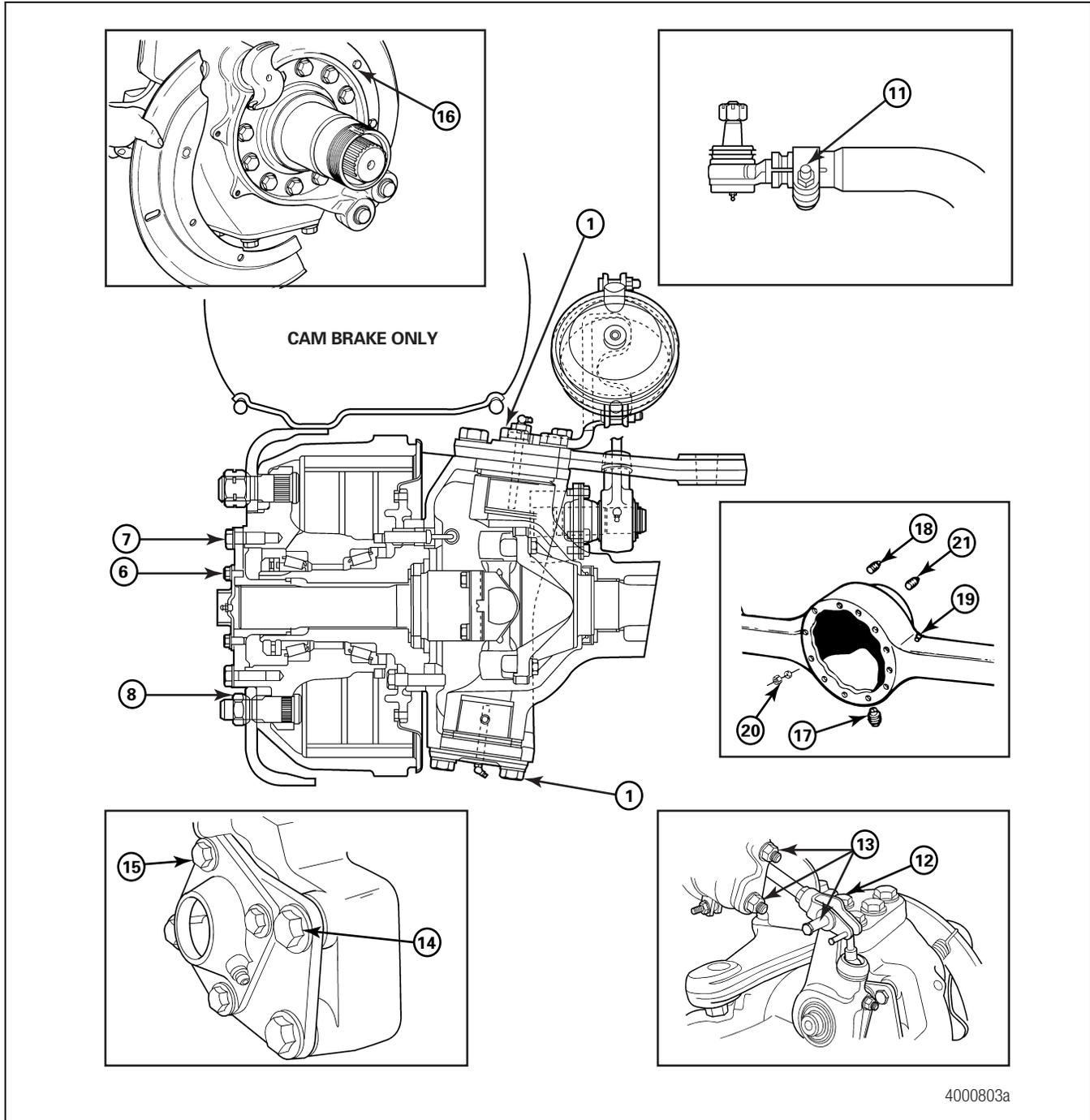


Figure 8.1

Table C: Cam Brake Fastener Torque Chart

Item	Fastener	Thread Size (Inches)	Wrench Torque	
			Lb-Ft	N•m
1	Upper Knuckle Cap	3/4-10	310-400	420-542
	Lower Knuckle Cap	1-8	775-1000	1052-1355
2	Steering Arm Nut	1-1/4-12	775-1050 (initial)	1050-1424
			1450 (after assembly)	1965
3	Steering Arm Ball Nut	7/8-14	160-215 (initial)	217-292
			300 (after assembly)	407
4	Drum Mounting Flathead Screw	1/2-13	15-30	20-41
5	Spindle and Brake Attachment Capscrew	5/8-11	180-230	244-312
6	Hubcap	3/8-16	35-50	47-68
7	Drive Flange	5/8-11	180-230	244-312
8	Wheel Nut	1-1/8-16	Refer to manufacturer's specifications.	
		1-3/16-12		
9	Stop Screw Jam Nut	3/4-10	180-230	244-312
10	Tie Rod End Nut	7/8-14	160-215 (initial)	217-292
			300 (after assembly)	407
11	Tie Rod Clamp Sleeve Adjuster Locknut	5/8-11	80-90	108-122
12	Brake Chamber Bracket Capscrew	5/8-11	180-230	244-312
13	Brake Chamber Attachment Nut	5/8-11	100-115	136-156
14	Camshaft Retainer Bracket Capscrew	1/2-13	90-120	122-163
15	Camshaft Retainer Self-Tapping Screw	3/8-16	35-50	47-68
16	Dust Shield Attachment Capscrew	3/8-16	35-50	47-68
17	Housing Drain Plug	3/4-14	25 minimum	34
18	Heat Indicator	3/4-14	25 minimum	34
19	Breather Assembly	3/8-18	20 minimum	27
20	Carrier Bolts	5/8-11	185-235	251-319
		5/8-18	210-270	285-366
21	Housing Oil Fill Plug	3/4-14	35 minimum	47.5

**NOTE:** The correct torque must be reached on steering arms. Torques below minimum will not seat the tapers correctly and will reduce service life.

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