

# Front Non-Drive Steering Axle



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# Exploded View

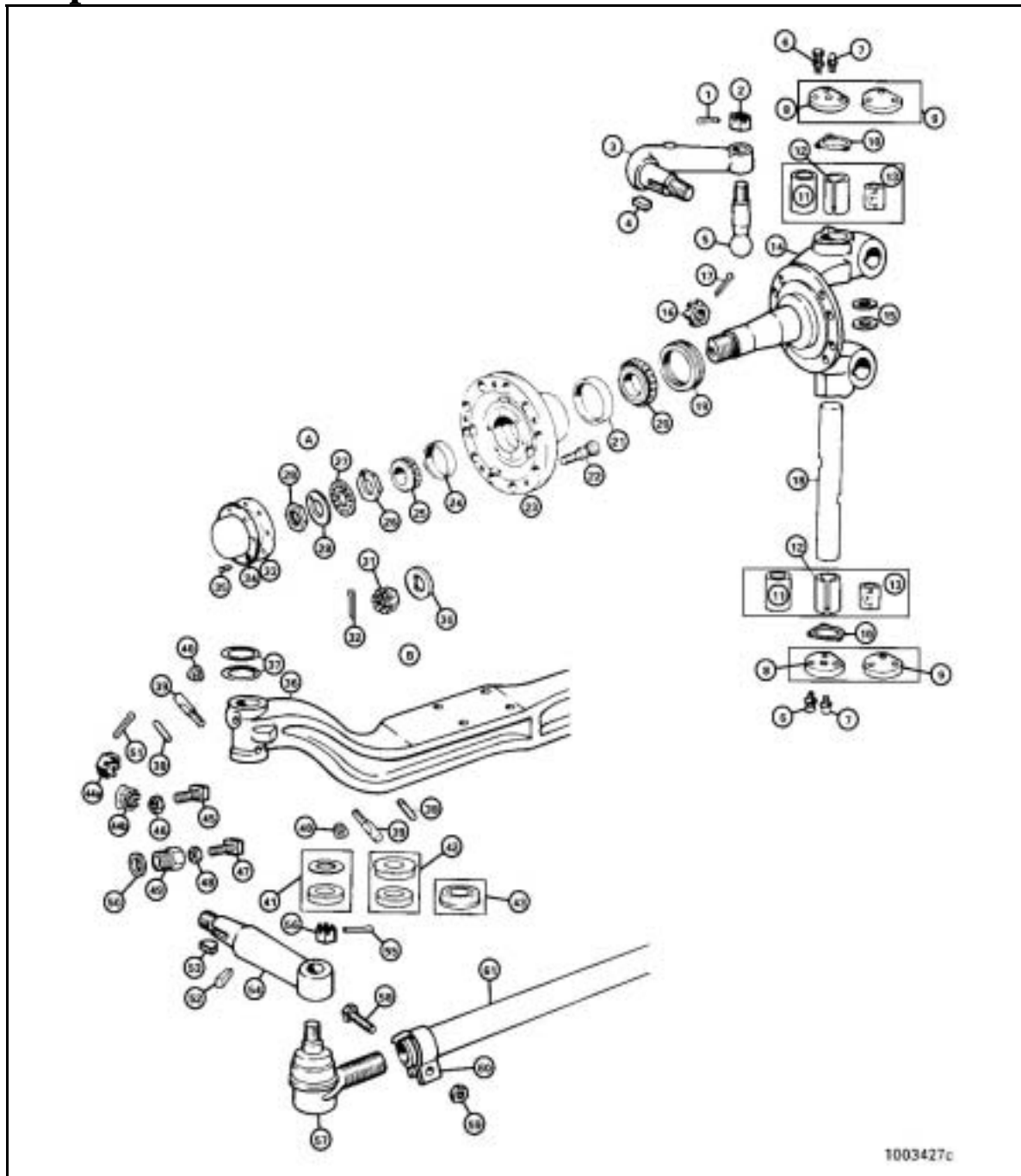


Figure 1

## Axle with Conventional Wheel End

Item	Description
A	Double Nut
B	Single Nut
1	Cotter Pin
2	Castle Nut – Drag Link to Steering Arm
3	Steering Arm
4	Key
5	Ball Stud
6	Capscrew and Washer
7	Grease Fitting
8	Knuckle Cap – Greaseable
9	Knuckle Cap – Sealed
10	Gasket
11	King Pin Bushing – Easy Steer
12	King Pin Bushing – Bronze
13	King Pin Bushing – Nylon
14	Knuckle
15	Seal – King Pin Bushing
16	Castle Nut – Tie Rod Arm to Knuckle
17	Cotter Pin
18	King Pin
19	Hub Grease Seal
20	Inner Wheel Bearing Cup
21	Inner Wheel Bearing Cone
22	Stud
23	Hub
24	Outer Wheel Bearing Cup
25	Outer Wheel Bearing Cone
26	Adjusting Nut
27	Pierced Lock Ring
28	Lock Washer
29	Wheel Bearing Nut
30	“D” Washer
31	Adjusting Nut
32	Cotter Pin
33	Gasket
34	Hubcap
35	Capscrew and Washer
36	Axle Beam

37	Shims
38	Tapered Draw Key
39	Threaded Draw Key
40	Nut, Threaded Draw Key
41	Thrust Bearing and “Flat” - Type Bearing Seal
42	Thrust Bearing and “Cover” - Type Bearing Seal
43	Integral Thrust Bearing and Oil Seal
44a	Castle Nut – Steering Arm to Knuckle
44b	Castle Nut (Flared Base) – Steering Arm to Knuckle
45	3/4 Inch Stop Bolt
46	3/4 Inch Jam Nut
47	1/2 Inch Stop Bolt
48	1/2 Inch Jam Nut
49	3/4 Inch Adapter
50	Washer
51	Cotter Pin
52	Square Key
53	Woodruff Key
54	Knuckle Tie Rod Arm
55	Cotter Pin
56	Castle Nut – Tie Rod Nut to Tie Rod End
57	Tie Rod End
58	Bolt, Clamp
59	Locknut, Clamp
60	Clamp, Cross Tube
61	Cross Tube

# Front Axle

## Safety

The purpose of this safety summary is twofold. First, it is to help ensure the safety and health of individuals performing service on, or operation of, the Blue Bird All American Series bus. Second, it is to help protect equipment. Before performing any service or operating procedure on the All American bus, individuals should read and adhere to the applicable warnings, cautions and notes located throughout this Blue Bird Service Manual.

## Warnings

Warnings apply to a procedure or practice that, if not correctly adhered to, could result in injury or death. Attention should be paid to sections of this manual where warnings appear.

## Cautions

Cautions apply to a procedure or practice that, if not correctly adhered to, could result in damage to, or destruction of, equipment.

## Notes

Notes are used to explain, clarify or otherwise give additional insight for a given subject, product or procedure. Note that on occasion, notes, too, may advise of potential safety issues.

## Introduction

The descriptions and procedures contained in this maintenance manual are applicable to all Meritor front non-drive axles.

## Warning

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

## Descriptions

**Tie Rod Arm Knuckle and King Pin:** The right tie rod arm is a mirror image of the left and both are linked by the cross tube assembly. The right knuckle and king pin assembly is similar to the left, except that it does not have a steering arm attached to it in a manual steering system. A power steering system uses an auxiliary assist cylinder attached to the right knuckle that requires a steering arm in various applications.

**Steering Knuckle:** Steering knuckles are rated according to the capacity of the front axle. All models use straight king pins.

**Steering Arms:** The steering arm (usually a forged component) converts the drag link force into a turning movement through the left king pin through the knuckle.

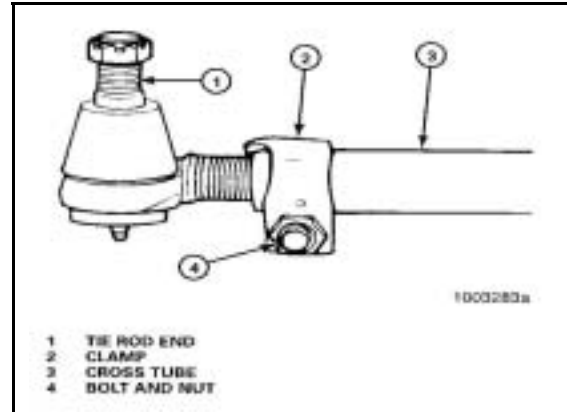
**Pitman Arm:** The Pitman arm converts the output torque from the steering gear into the control force applied to the drag link. This linkage component connects the steering gear to the linkage at the center link end.

**Tie Rod Assembly:** Forged or cast tie rod assemblies are used on Meritor front non-drive steering axles. The tie rod assembly links both steering knuckles for uniform movement and maintains steering control.

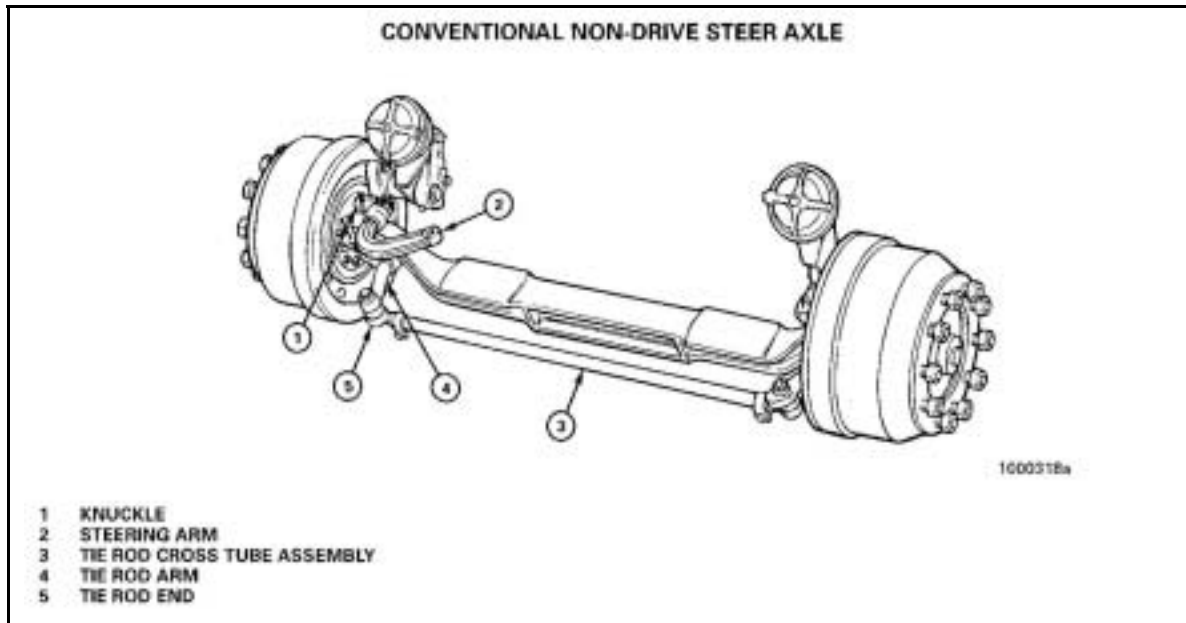
**Cross Tube and Clamp Assembly:** The cross tube and clamp assembly runs approximately parallel to the front axle. The cross tube has right-hand and left-hand threads on the appropriate side of the vehicle. Tie rod clamps secure tie rod ends into the cross tube.

**Tie Rod Ends:** The tie rod ends include a ball joint and boot that thread into the cross tube. Depending on manufacturer design, tie rod ends can be greaseable or non-greaseable. Tie rod ends are either right-hand or left-hand threaded and correspond to the inside threads at each end of the cross tube. **Figure 2.**

Meritor front non-drive steering axles in this manual feature the components found in **Figure 3.**



**Figure 2**



**Figure 3**

## Identification

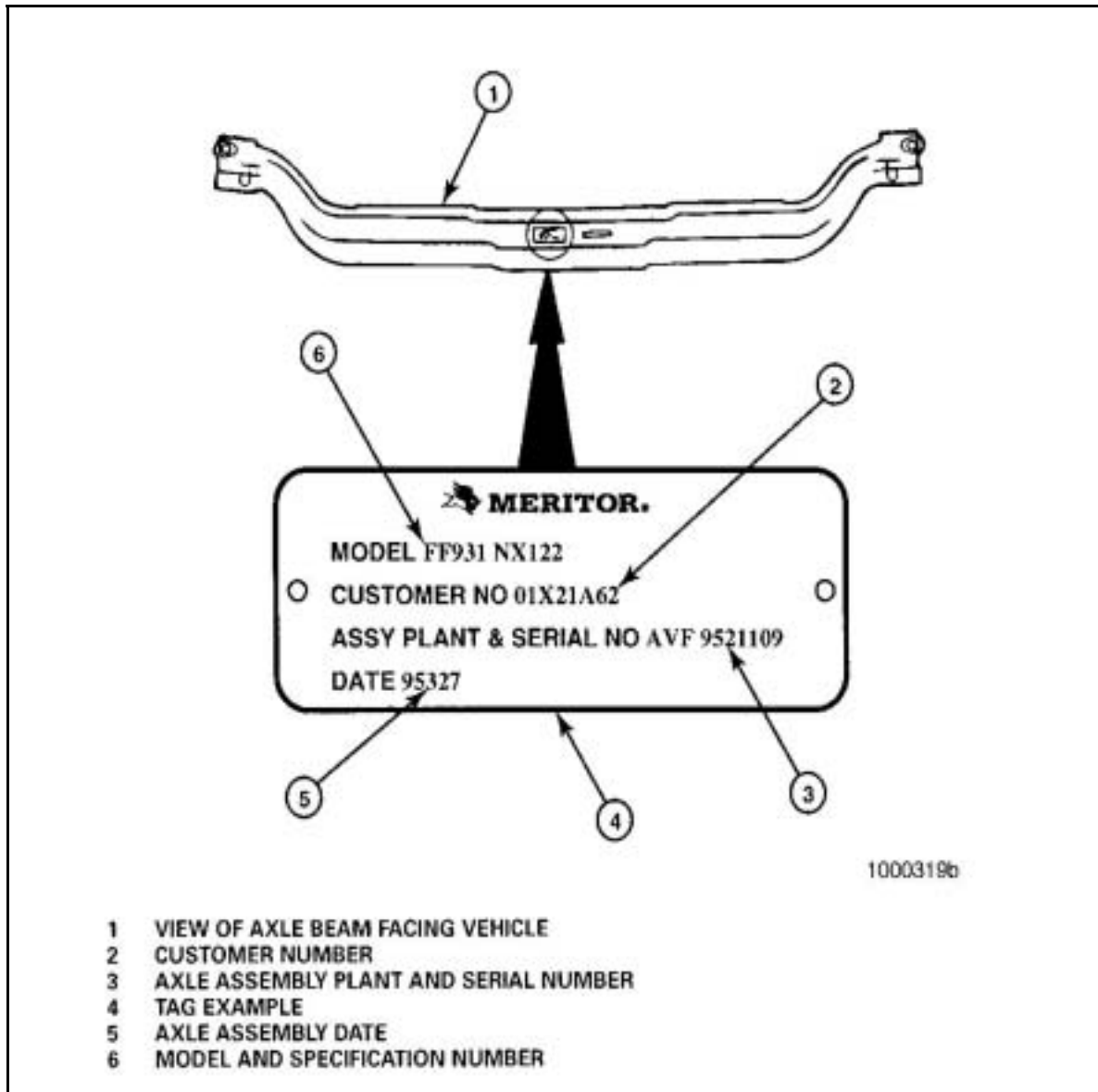
The entire necessary axle build information, including assembly date, for any Meritor front non-drive axle is indicated on the axle identification tag.

The identification tag is fastened to the center of the beam at the front surface. The axle assembly date is either located in the lower right hand or left hand corner of the tag.

The Julian dating method is currently used to indicate the axle assembly date. The first two digits indicate the year, and the last three digits indicate the day of the year.

**Figure 4.**

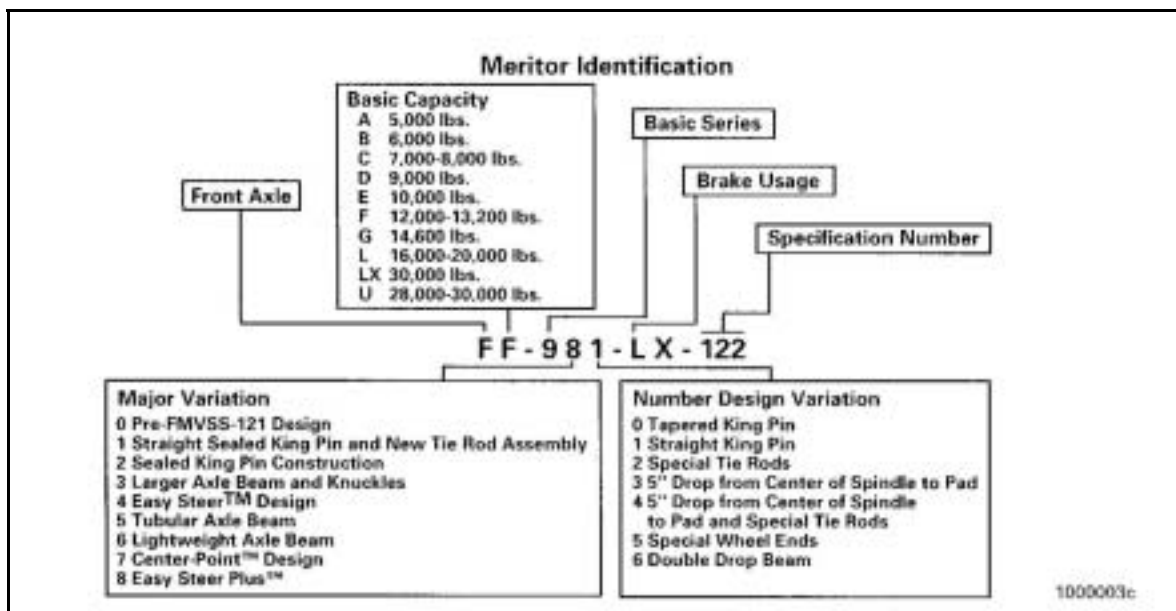
*For example, "95327" would reflect the 327<sup>th</sup> day of 1995 (November 22<sup>nd</sup>)*



**Figure 4**

To identify the model number, refer to the identification plate on the front of the beam. Use the complete model number to order parts. **Figure 5.**

For a description of all models, refer to **Table A.**



**Figure 5**

Model Number	Capacity (lbs)	Wheel End and Knuckle Type	Major Design Variation
FF-966	12,000	Bottle Spindle with Bolted Tie Rod Arm Individual Hub, Bearings, Seals	Straight King Pin
FF-967	13,200	Bottle Spindle with Bolted Tie Rod Arm Individual Hub, Bearings, Seals	Straight King Pin
FF-944	13,200	Bottle Spindle with Bolted Tie Rod Arm Individual Hub, Bearings, Seals	5" Drop from Center of Spindle to Pad and Special Tie Rods/Easy Steer™ Design
FG-943	14,600	Bottle Spindle with Bolted Tie Rod Arm Individual Hub, Bearings, Seals	5" Drop from Center of Spindle to Pad/Easy Steer™ Design

**Table A: Front Non-Driving Axle Model Number Information**

## Disassembly/Removal

### Warning

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

### Wheel Ends

### 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 can result.*

1. Raise the front of the vehicle until the front wheels are off the floor. Support the vehicle with safety stands.
2. Remove the capscrews that fasten the cap to the hub. Remove the cap and the gasket.

### Note

*When the adjusting nuts are tightened or loosened, always use the correct size socket to avoid damaging the nut.*



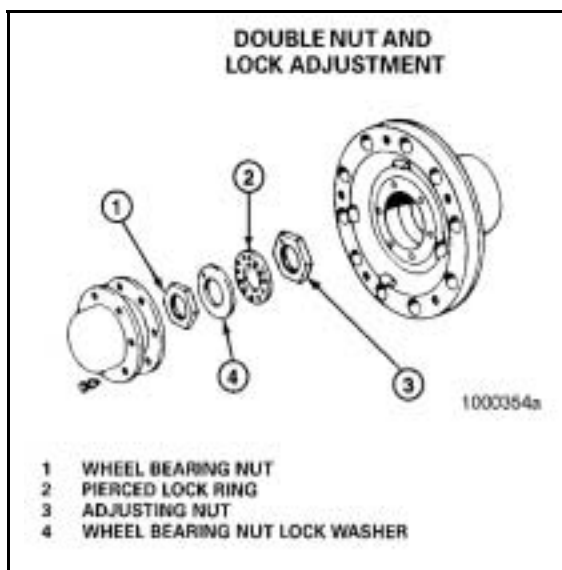
3. Remove the fasteners for the wheel bearings. Refer to the following procedure.

## Double Nut and Lock Fasteners

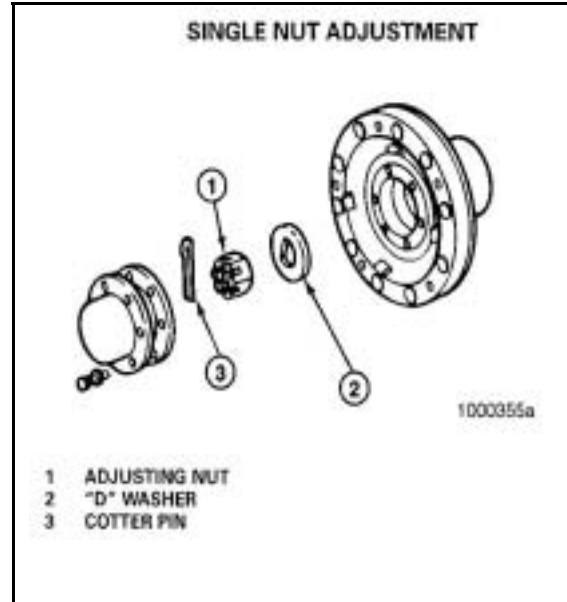
- a. Bend the tabs of the flattened lock washer away from the wheel bearing nut and the adjusting nut. **Figure 6.**
- b. Remove the wheel bearing nut, the lock washer, the pierced lock ring, and the adjusting nut from the knuckle. **Figure 6.**

## Single Nut Fasteners

- a. Remove the cotter pin from the adjusting nut. **Figure 7.**
  - b. Remove the adjusting nut and the "D" washer from the spindle. **Figure 7.**
4. Remove the outer wheel bearing cone from the hub.
  5. Remove the wheel and tire, the hub and the drum as assembly.



**Figure 6**



**Figure 7**

6. Remove the brake components per the manufacturer's procedures.
7. Remove the oil seal from the hub. Remove the inner wheel bearing cone.
8. Inspect the wheel bearings.

## Drag Link

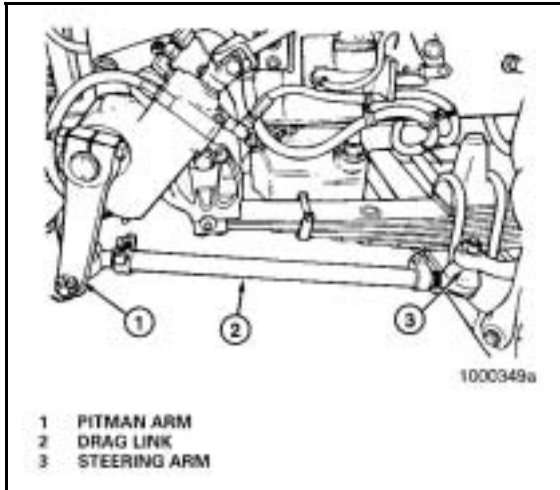
### Caution

*Heating is not an acceptable method for the disassembly of front axle components. Damage to the axle components could result.*

### Note

*This procedure applies to all axles included in this manual.*

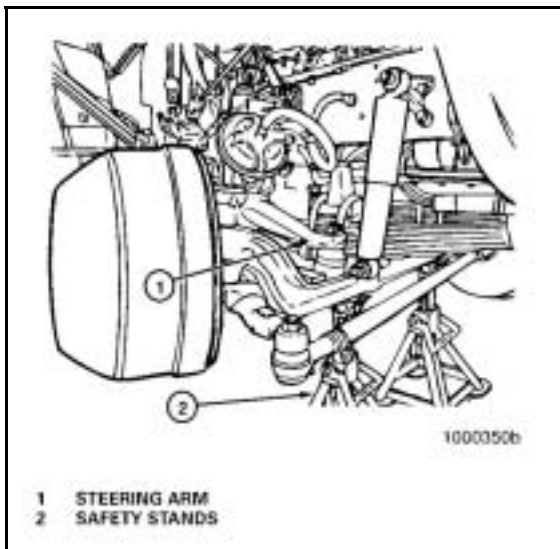
1. Remove the cotter pins from the ball studs.
2. Remove the nuts from the ball studs.
3. Disconnect the drag link from the Pitman arm and the steering arm. **Figure 7.**
4. Inspect the drag link.



**Figure 7**

## Steering Arm

1. Remove the cotter pin and the nut that fastens the steering arm to the drag link. Disconnect the steering arm from drag link. **Figure 8.**

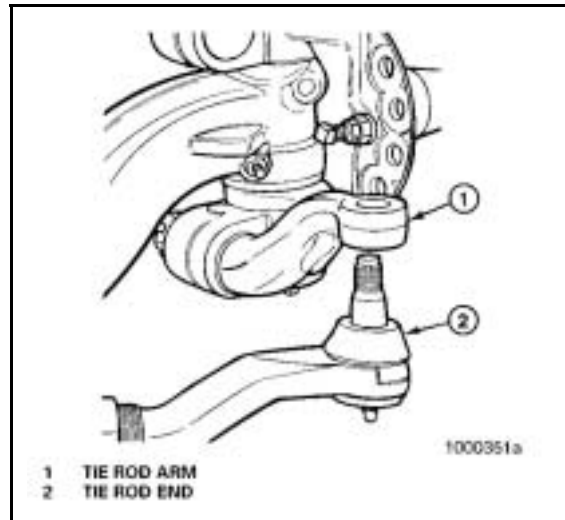


**Figure 8**

2. Remove the cotter pin and the nut that fastens the steering arm to the knuckle.
3. Remove the steering arm from the knuckle. If necessary, tap on the end of the rod with a leather or plastic mallet.
4. Remove the key from the steering arm.
5. Inspect the steering arm.

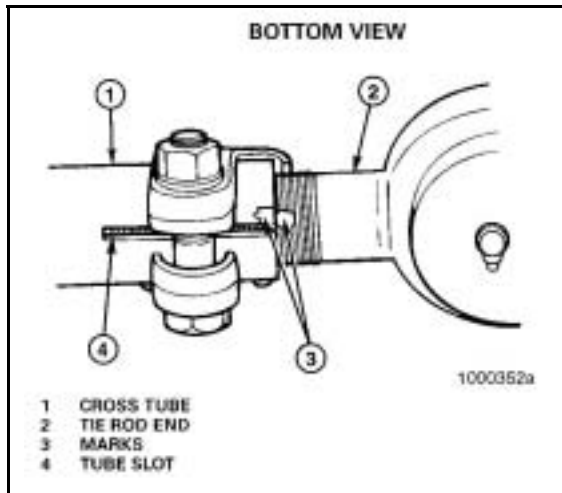
## Tie Rod Arms, Tie Rod Ends and Cross Tube

1. Remove the cotter pins and the nuts that fasten each tie rod end to the tie rod arms. **Figure 9.**
2. Disconnect the cross tube assembly from the tie rod arms. If available, use tie rod end puller to separate the tie rod end from the tie rod arm. **Figure 9.**
3. Remove the cotter pin and the nut that fasten the tie rod arms in the knuckle. **Figure 9.**
4. Remove the tie rod ends from the knuckle. If necessary, tap on the end of the knuckle with a leather or plastic mallet. Remove the key.

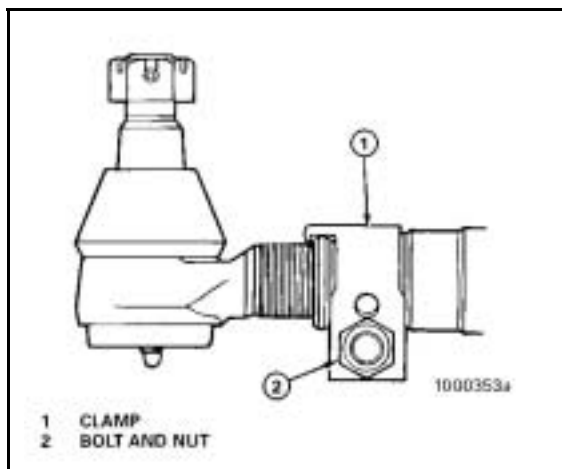


**Figure 9**

5. If necessary, remove the tie rod ends. Refer to the following procedure. **Figure 10.**
  - a. Mark the position each tie rod end is installed in the cross tube.
  - b. Remove the bolts and the nuts from the clamp on the cross tube.
  - c. Remove the tie rod ends from the cross tube.
6. The rotating style clamp on cross tubes can be rotated for easier accessibility when removing the clamp bolt and nut. **Figure 11.**
7. Inspect the parts.



**Figure 10**



**Figure 11**

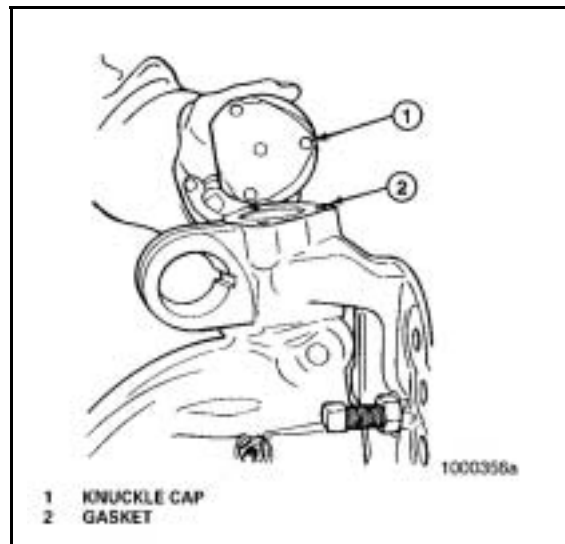
## Draw Keys, King Pins and Steering Knuckle

1. Remove the wheel ends as described in this section.
2. Vent the air from the brake system. Disconnect the air lines from the brakes.
3. Remove the brake components. Refer to procedures from the brake manufacturer.
4. Remove the tie rod arms and the steering arm (left side) from the knuckle. Refer to the procedure in this section.
5. Remove the capscrews that fasten the king pin caps to the top and the bottom of the knuckle. Remove the caps and the gaskets. **Figure 12.**

### Note

*All models except FC-901, FC-921, FE-970, FF-971 and FL-901 use threaded draw keys. Models FC-901, FC-921, FE-970, FF-971 and FL-901 use plain draw keys.*

6. Remove the plain or the threaded draw keys. Refer to the following procedure.



**Figure 12**

## Remove Plain Draw Keys

### Warning

*Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.*

Use a brass hammer and a steel drift to remove the draw key. Place the drift on the small ("D"-shaped) end of the key. **Figure 13.**

## Remove Threaded Draw Keys

- a. Loosen the threaded draw key lock nut until the top of the lock nut is even with the end of the draw key.

- b. Use a brass drift and a hammer to hit the end of the draw key. **Figure 14.**
- c. Remove the nut from the draw key. Remove the draw key from the knuckle.

## Warning

*Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.*

## Caution

*Force must be directly applied to the bottom of the nut and the end of the key. If force is not directly applied, the draw key will be damaged.*

## Note

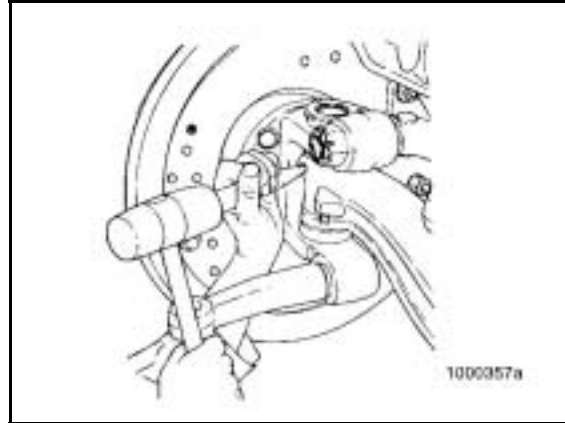
*If the bushings are not being replaced, perform the following to prevent damaging the bushing during king pin removal.*

- Remove any flaring on the drift that may touch the bushings.
  - Wrap tape to a thickness of 1/16 inch (1.5 mm) on the end of the drift.
7. Use a brass drift and a hammer to remove the king pins from the knuckle. **Figure 15.**

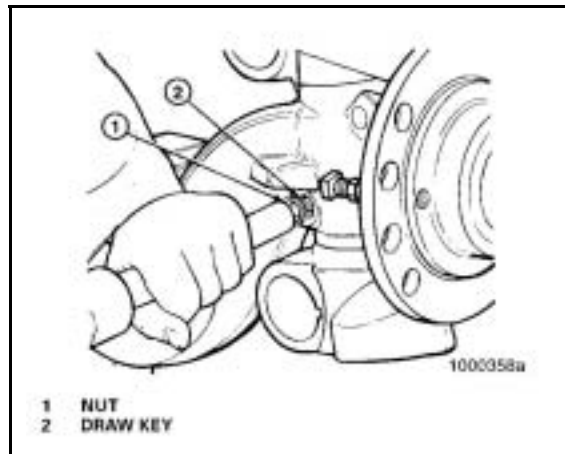
If the king pin is hard to remove, use a hydraulic king pin remover. Refer to **Table J** in Special Tools section.

## Warning

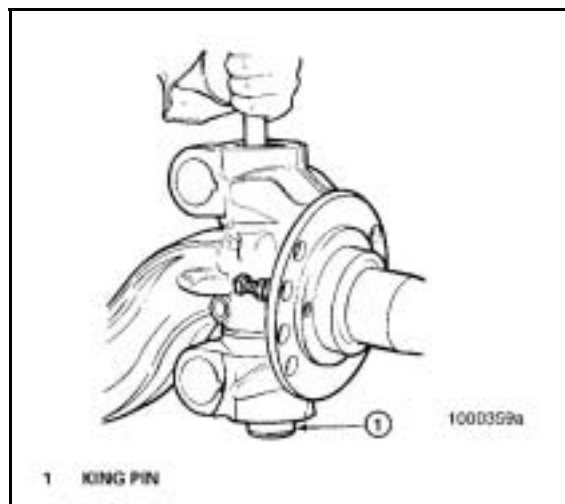
*Wear gloves when you remove or install shims. Shims have sharp edges that can cause injury.*



**Figure 13**

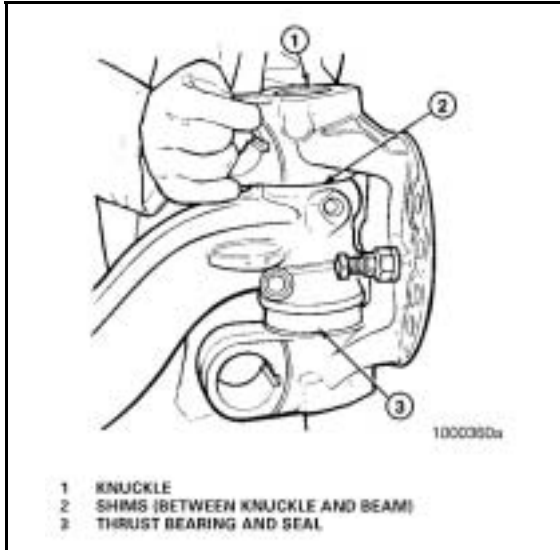


**Figure 14**



**Figure 15**

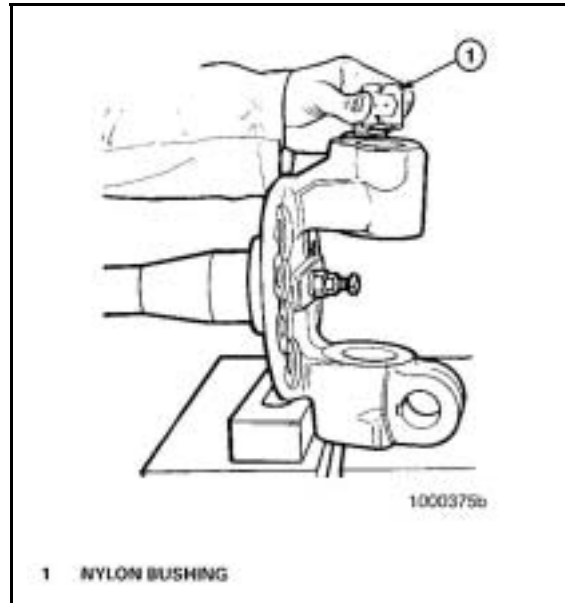
8. Remove the knuckle from the axle beam. Remove the shims, the thrust bearing, and the seal between the beam and the knuckle. **Figure 16.**
9. Inspect the parts.



**Figure 16**

## Nylon Bushings

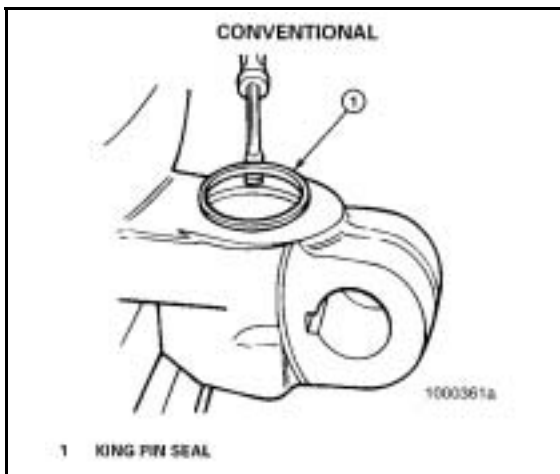
Remove the top and the bottom bushing from the knuckle bore. **Figure 18.**



**Figure 18**

## King Pin Bushings

1. Remove and discard the lower king pin seal. **Figure 17.**
2. Turn knuckle upside down and remove the upper king pin seal.



**Figure 17**

3. Remove the old bushings as follows.

## Easy Steer™ and Bronze Bushings

### Warning

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

### Note

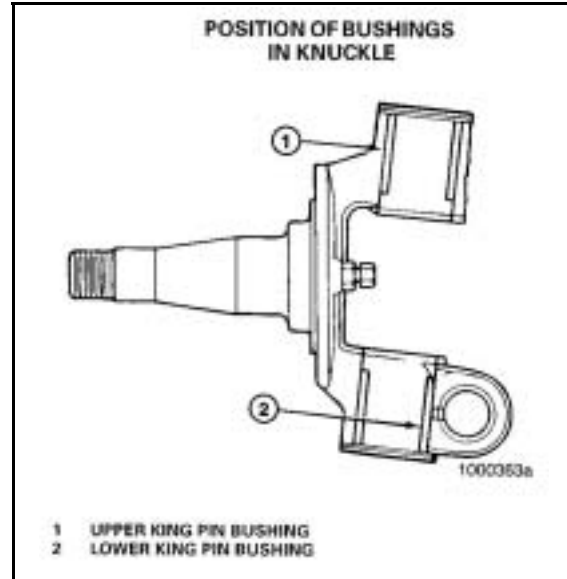
*On FF-, FG-, and FL-Series axles, the bushings can be removed with Bushing Service Kit from Kent-Moore Tools. Refer to Table J in Special Tools section.*

- a. Make a tool to remove the bushings. **Figure 19.**
- b. Place the knuckle in a vise. Use a press with a 5-ton capacity. Make sure the knuckle does not move when the bushings are removed.
- c. Install the tool into the upper king pin bushing. Press the upper king

pin bushing from the knuckle bore.

**Figure 20.**

- d. Turn knuckle upside down and install the tool in the lower king pin bushing. Press the lower bushing from the knuckle bore. **Figure 20.**



**Figure 20**

Axle Model Number	Dimension X		Dimension Y	
	( $\pm 0.001$ in)	( $\pm 0.025$ mm)	( $\pm 0.001$ in)	( $\pm 0.025$ mm)
FF-966	1.786	45.364	1.911	48.539
FF-967	1.786	45.364	1.911	48.539
FF-944	1.786	45.364	1.911	48.539
FF-943	1.786	45.364	1.911	48.539

**Figure 19 - Dimensions for Bushing Removal and Installation Tool**

## Preparing Parts for Assembly

### Warning

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

### Repair Parts

The repair or reconditioning of front axle components is not allowed. Meritor recommends replacing damaged or out-of-specification components. All major components are heat treated and tempered.

### Caution

*Do not bend, weld, or heat any front axle component. If the axle is bent, welded or heated, the strength of the axle is reduced and the warranty is voided. An axle damaged by bending, welding, or heating may cause a vehicle accident and serious personal injury.*

The following operations are prohibited on front axle components.

1. Welding of or to the steering arms, tie rod arms, the knuckles, the king pins, the axle beams, the tie rod assemblies, the hubs, the drums, or the brakes.
2. Hot or cold bending of the knuckles, the steering arms, the tie rod arms, the ball studs, the axle beams or the tie rod assemblies.

3. Drilling out of the holes in the axle beam for the king pins.
4. Drilling out of the draw key holds in the knuckle.
5. Spray welding of bearing diameters on the knuckles or in the machined bores.
6. Disassembly of unitized truck hub unit.
7. Milling or machining of any component.

## Clean Ground or Polished Parts

### Warning

*Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners, and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures.*

- *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. Follow the manufacturer's instructions carefully.*

Use a cleaning solvent to clean ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. Do not use gasoline.

Do not clean ground or polished parts in a hot solution tank or with water, steam, or alkaline solutions. These solutions will cause corrosion of the parts.

### Clean Rough Parts

Rough parts can be cleaned with the ground or polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts must remain in the

hot solution tanks until they are completely cleaned and heated.

## Dry Cleaned Parts

Parts must be dried immediately after cleaning. Dry parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

## Corrosion Prevention on Cleaned Parts

Apply 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.

### Note

*Be sure that all tapered joints are clean and dry with no lubrication or corrosion preventative applied to mating surfaces.*

## Install New Fasteners with Pre-applied Adhesive Patches

1. Clean the oil and dirt from threaded holes. Use wire brush to remove old patch material. There is no special cleaning required.

### Caution

*Do not apply adhesives or sealants on new fasteners with pre-applied adhesive patches or in the threaded holes. If other adhesives or sealants are used, the new adhesive will not function correctly.*

2. Assemble parts using the new pre-applied adhesive fasteners.

### Note

*There is no drying time required for fasteners with pre-applied adhesive.*

3. Tighten the fasteners to the required torque value for that size fastener. Refer to **Table I** in Torque Specification section.

## Install Original or Used Fasteners Using Meritor Liquid Adhesive 2297-C-7049 or Loctite® 680 or Equivalent

1. Clean the oil, dirt, and old adhesive from all threads and threaded holes. Use a wire brush.

### Caution

*Do not apply adhesive to fastener threads that will be installed into a closed bore. As the fastener is installed, air pressure will force adhesive applied to fastener out of the closed bore. Apply adhesive into threaded bore only.*

2. Apply four or five drops of Meritor Liquid Adhesive, Loctite® 680, or equivalent to each threaded hole or bore ONLY. Make sure the adhesive is applied to the threads.
3. Tighten the fasteners to the required torque value for that size fastener.

### Note

*There is no drying time required for Meritor Liquid Adhesive 2297-C-7049, Loctite® 680, or equivalent.*

## Check the Torque Values of Dri-Loc Fasteners Not Requiring Removal

### Note

*If Dri-Loc fasteners do not require removal from components, check the fasteners for correct torque value as follows.*

1. Apply the MINIMUM amount of torque required for that size fastener. The fastener MUST NOT rotate.
2. If the fastener rotates any amount, remove the fastener from the component. Inspect the fastener and the hole for wear and damage. Repair as necessary. If the fastener and the hole are in good condition, apply adhesive to the threaded hole. Follow the procedure for installing old Dri-Loc fasteners.

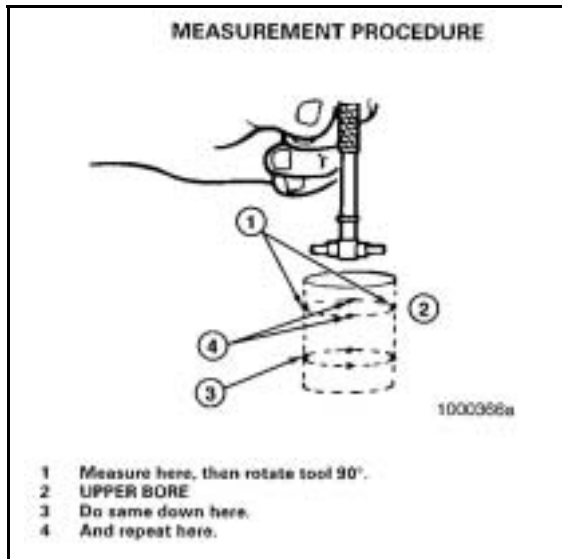
## Inspect the Parts

Carefully inspect all disassembled parts before assembly. Refer to the following guidelines.

1. Inspect and replace any parts that are worn, cracked, or damaged. Check for cracks using dye penetrant, magnetic flux, or fluorescent particle testing methods.
2. Remove the old bushing from the knuckle. Measure the upper knuckle bore inside diameter at two locations. Always use a micrometer and a telescoping gauge when taking knuckle bore measurements. Some rounding of the top and bottom bore edges is acceptable.

Measure the bore in four positions and at two locations. The two locations must be 90 degrees opposed from each other. **Figure 20.** If the average measurement is more than the Knuckle Bore Maximum Diameter specification in **Table B**, replace the knuckle.

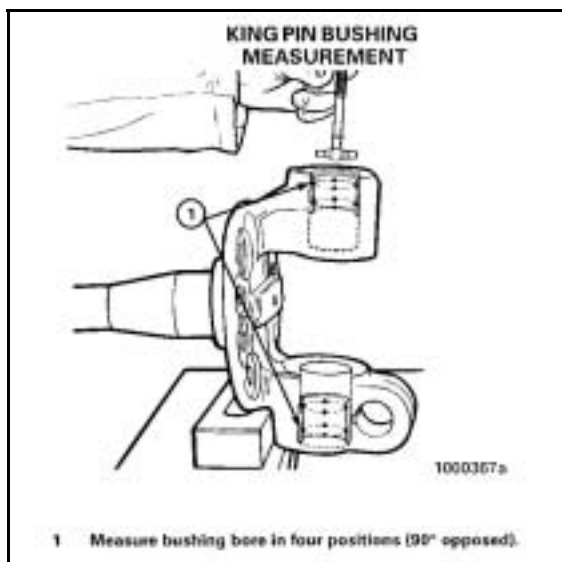




**Figure 20**

Repeat this procedure for measuring the lower knuckle bore. **Figure 21.** Refer to the Knuckle Bore Maximum Diameter indicated in **Table B.** Verify the average inside bore dimension does not exceed the Knuckle Bore Maximum Diameter specifications.

Measurements taken at either the upper or the lower knuckle bores, which exceed the Knuckle Bore Maximum Diameter in **Table B,** indicate the knuckle requires removal and replacement.



**Figure 21**

3. Measure the king pin bushing inside diameter using a micrometer and a telescoping gauge for taking measurements.

If the average inside diameter measurement is greater than the King Pin Bushing Maximum Inner Diameter **Table B,** install a new bushing.

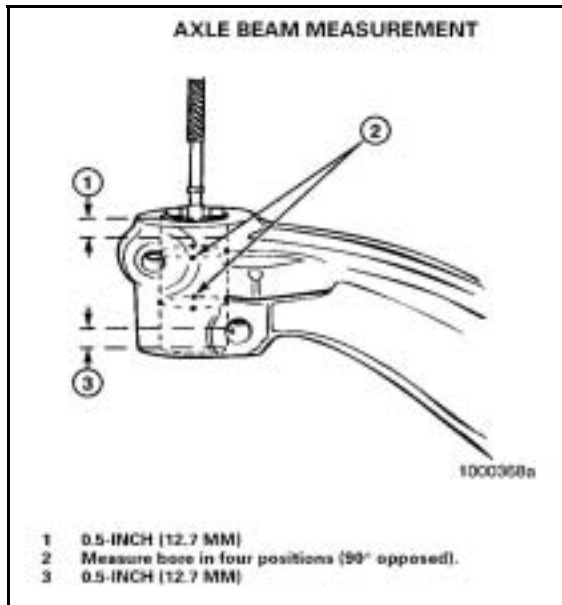
Measure the inner diameter of the new bushing after installation and reaming. Measure the inner diameter of the bushing in four positions and at two locations. The two locations must be 90 degrees opposed from each other.

**Figure 20.** If the average measurement is more than the King Pin Bushing Maximum Inner Diameter specification in **Table B,** replace the bushing.

4. Measure the inner bore diameter of the axle beam. Rounding at the top and bottom of the beam is acceptable.

Measure the axle beam bore at four positions, **Figure 20,** and at two specific locations: 1/2 inch (12.7 mm) below the top of the bore and 1/2 inch (12.7 mm) above the bottom of the bore. **Figure 22.**

If the average measurement is greater than the Axle Beam Bore Maximum Diameter given in **Table B,** the entire axle beam requires replacement.



**Figure 22**

Model Number	Knuckle Bore Max. Diameter	Beam Bore Max. Diameter	King Pin Bushing Max Inner Diameter
FF-966	1.9220 inch (48.818 mm)	1.7980 inch (45.6692 mm)	1.7960 inch (45.6180 mm)
FF-967	1.9220 inch (48.818 mm)	1.7980 inch (45.6692 mm)	1.7960 inch (45.6180 mm)
FF-944	1.9220 inch (48.818 mm)	1.7980 inch (45.67692 mm)	1.7960 inch (45.6180 mm)
FF-943	1.9220 inch (48.818 mm)	1.7980 inch (45.6692 mm)	1.7960 inch (45.6180 mm)

**Table B – Axle Wear Limit Specifications**

## Inspect the Wheel Bearings

Inspect the wheel bearings when the hub is removed from the knuckle spindle.

Remove all lubricant from the bearings, knuckle, hub, and hubcap.

Inspect the cup, the cone and the rollers and cage of all bearings. If any of the following conditions exist, the bearing **MUST** be replaced.

1. The center of the large diameter end of the rollers is worn level or below the outer surface. **Figure 23.**
2. The radius at the large diameter end of the rollers is worn to a sharp edge. **Figure 23.**

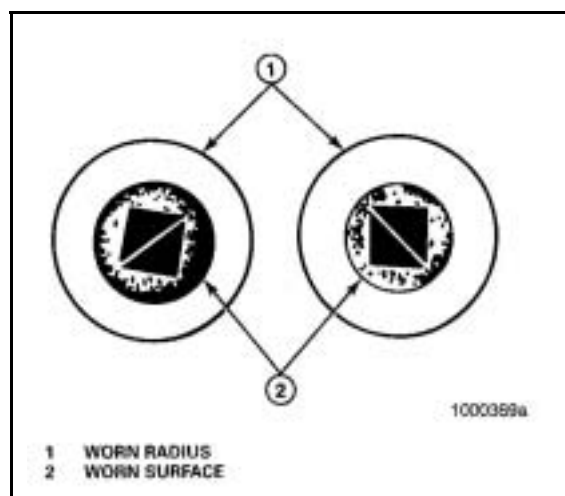
- A visible roller groove in the cup or the cone inner race surfaces. The groove can be seen at the small or large diameter end of both parts. **Figure 24.**

- Deep cracks or breaks in the cup, the cone inner race, or the roller surfaces. **Figure 24.**

- Bright wear marks on the outer surface of the roller cage. **Figure 25.**

- Damage on the rollers and on the surfaces of the cup and the cone inner race that touch the rollers. **Figure 26.**

- Damage on the cup and the cone inner surfaces that touch the rollers. **Figure 27.**



**Figure 23**

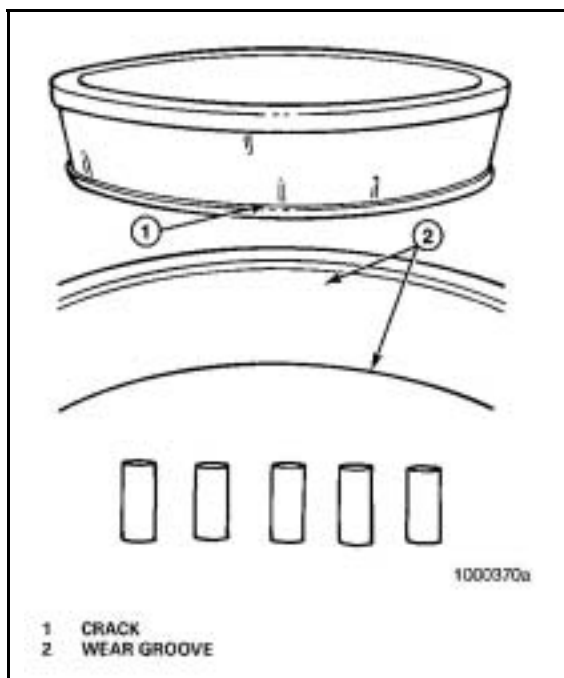


Figure 24

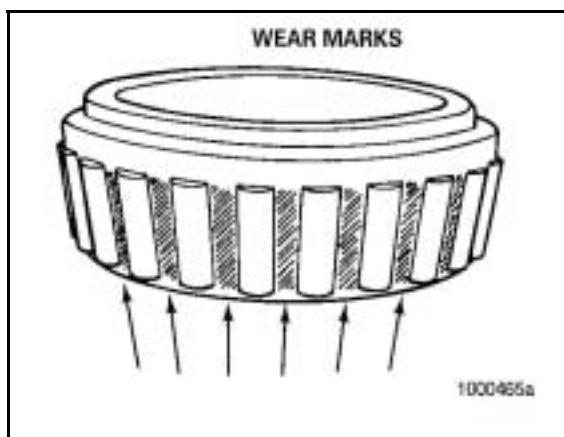


Figure 25

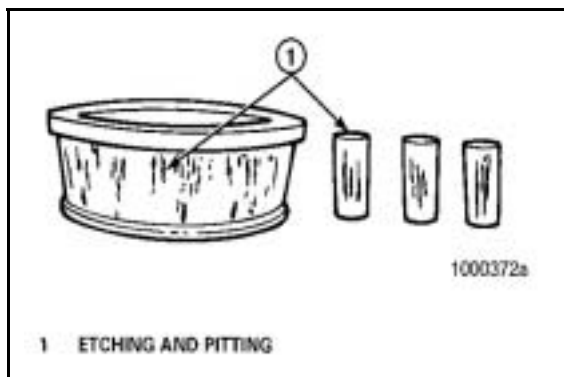


Figure 26

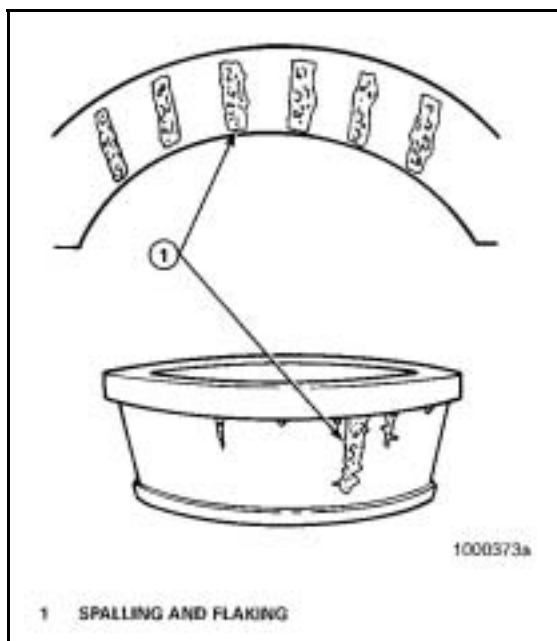


Figure 27

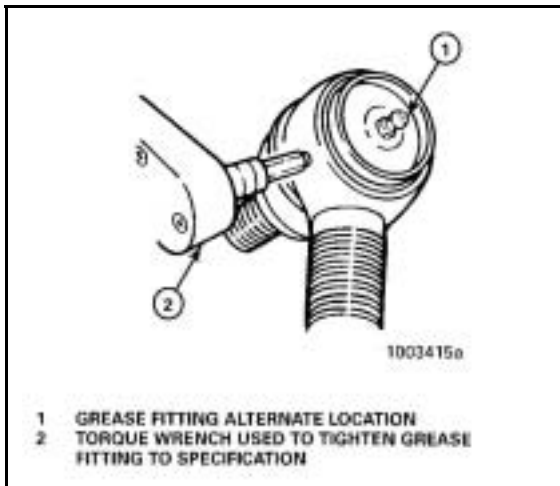
## Tie Rod Grease Fittings

When inspecting the tie rod, observe the following.

1. If a grease fitting is missing, install a new one. Do not attempt to install a fitting if the tie rod end is a non-greaseable design. **Figure 28.**
2. Tighten all grease fittings to the specified torque. **Figure 29.**



Figure 28



**Figure 29**

## Assembly

### Warning

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

## Installation

### King Pin Bushings

#### Nylon Bushings

Insert the nylon bushing in each knuckle bore by hand. Be sure that the entire outer surface of the nylon bushing is in contact with the knuckle bore.

Check the nylon bushing installation before attempting to install the knuckle to the axle beam noting the following.

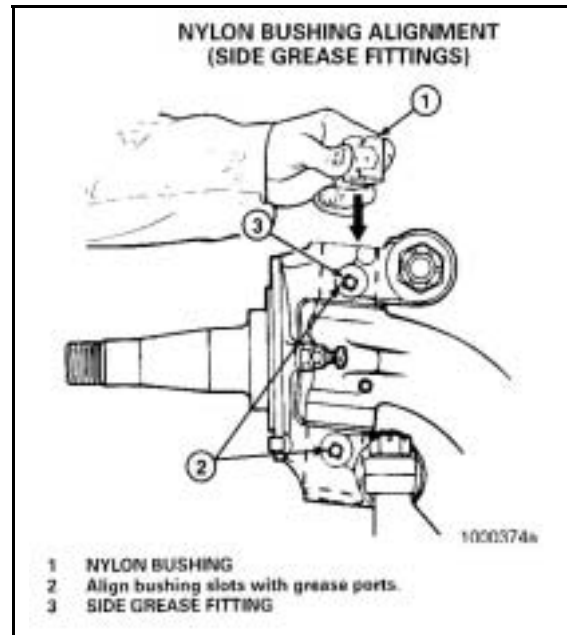
1. Verify that each nylon bushing is fully seated in the knuckle bore by passing the king pin through the upper and lower bores after insertion.

### Note

*The nylon bushing installation is not a press fit in the knuckle bore as in cases where a bronze or Easy Steer™ bushing issued.*

2. Be sure that the bushing lube slots align with the grease ports in the knuckle.

**Figure 30.**



**Figure 30**

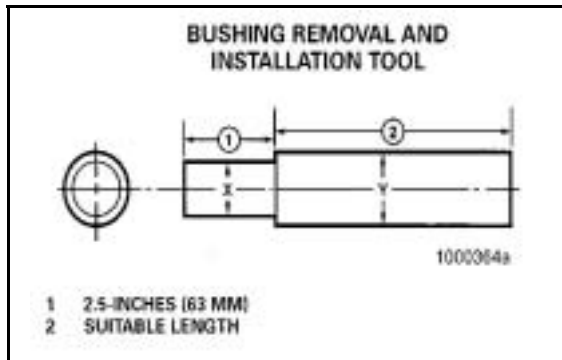
## Bronze and Easy Steer™ King Pin Bushings—Axles with Conventional Wheel Ends

### Without a Press

### Note

*On the FF-, FG- and FL- Series axles, the bushings can be installed without a press. Use the Bushing Service Kit from Kent Moore Tools to install and ream the bushings.*

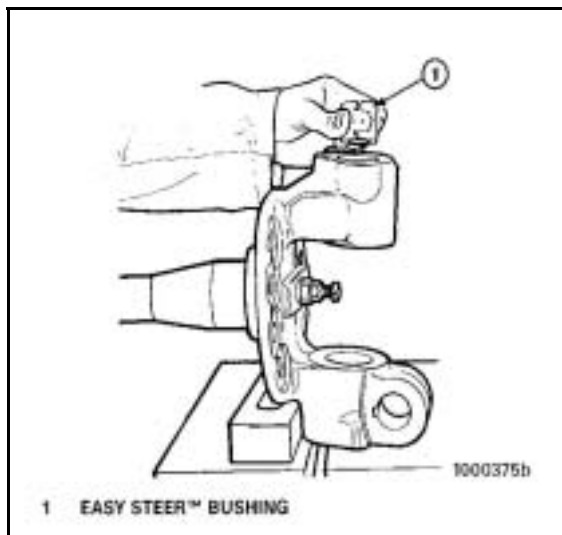
Bronze and Easy Steer™ bushings have an interference fit in the knuckle bores and require a suitable installation tool for bushing installation. **Figure 31.**



**Figure 31**

Position the bushings into outer end(s) of the knuckle bores. Install to proper position using selected installation tool. **Figure 32.**

Ream the Easy Steer™ bushings after installation into the knuckle.



**Figure 32**

### With a Press

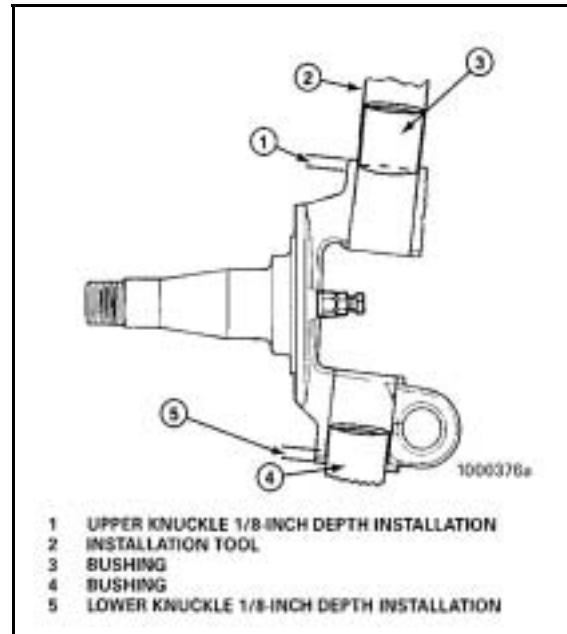
1. Install the top king pin bushing first.

### Warning

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

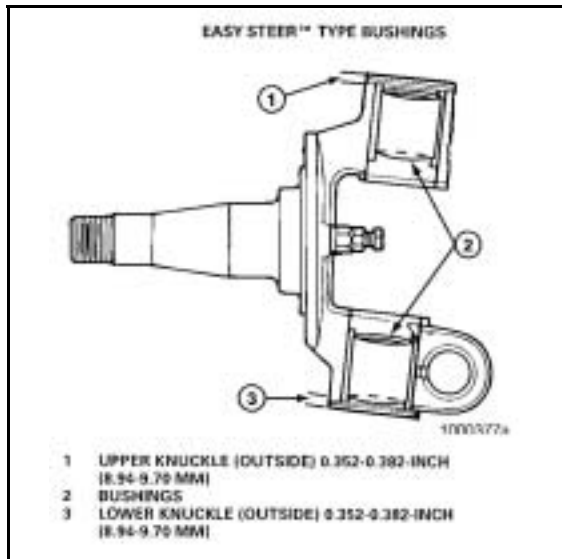
2. Put the knuckle in a press, if used, so that the top of the knuckle is toward the

- top of the press. Make sure tops of the bores are parallel to the top of the press.
3. Place new bushing in the upper knuckle bore.
4. Using installation tool, press start the bushing 1/8 inch (3 mm) into the upper bore. Release the pressure. Make sure the bushing is straight into the upper bore. **Figure 33.**



**Figure 33**

5. On Easy Steer™ bushings and for MFS axles, press the bushing farther to a depth of 0.352- to 0.382-inch (8.94-9.70 mm) below the top of the upper knuckle bore. **Figure 34.**
6. Turn the knuckle over so that the bottom of the knuckle is up. Make sure the bore is parallel to the top of the press.



**Figure 34**

7. Place new bushing in lower knuckle bore.
8. Using installation tool, press start the bushing 1/8 inch (3 mm) into the lower bore. Release the pressure. Make sure the bushing is straight into the lower bore. **Figure 33.**
9. On Easy Steer™ bushings, press the bushing farther to a depth of 0.352- to 0.382-inch (8.94-9.70 mm) below the top of the lower knuckle bore (as viewed with the knuckle upside down). **Figure 34.**
10. Ream the bushings. Refer to the procedures in this section.

## Reaming the King Pin Bushings

### Bronze and Easy Steer™ Bushings

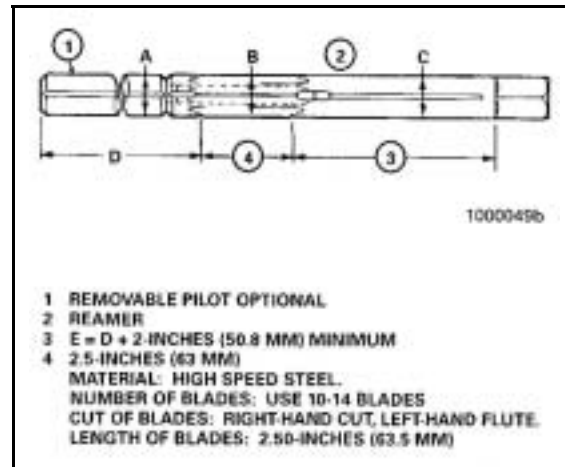
#### Caution

*Do not hone or burnish the bushings. The bushings will be damaged by honing or burnishing.*

#### Note

*Reamer tools are available from SPX-Kent Moore at 1-800-328-6657 and from Wright Tool Company at 1-800-783-9826.*

1. Place the knuckle in a vise with brass jaws.
2. Refer to **Figure 35** for the dimensions of the reamer tool.

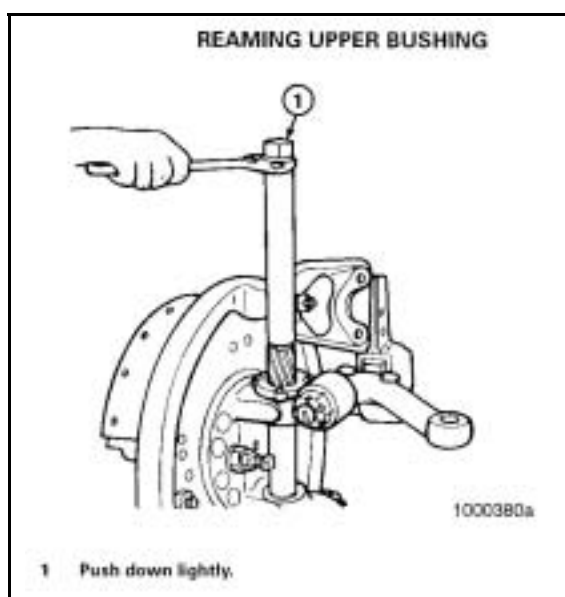


**Figure 35**

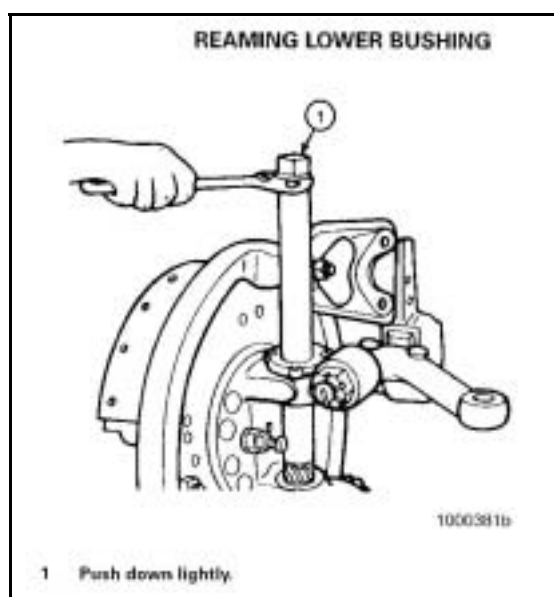
3. Slide the pilot of the reamer through the top bushing until the reamer blades touch the bushing. **Figure 36.**
4. Rotate the reamer with a light downward pressure. Do not apply too much force. Rotate the reamer smoothly.
5. After the reamer cuts most of the top bushing, make sure the tool does not drop to the bottom bushing.
6. After cutting the top bushing, guide the reamer into the bottom bushing. Repeat Steps 3-5. **Figure 37.**
7. Slide the reamer out of the bottom bushing. If the reamer must be removed through the top bushing, rotate the tool in the opposite cutting direction.
8. Clean all material from the bushings.

<b>Bushing Reamer Dimensions</b>										
Axle Model	Lower Pilot Diameter Dimension "A" ( $\pm 0.001$ inch or $\pm 0.0245$ mm)		Blade Diameter Dimension "B" ( $\pm 0.001$ -inch or $\pm 0.0245$ mm)		Upper Pilot Diameter "C" ( $\pm 0.001$ inch or $\pm 0.0245$ mm)		Lower Pilot Length Dimension "D"		Upper Pilot Length Minimum Dimension "E"	
	Inch	Mm	Inch	Mm	Inch	Mm	Inch	Mm	Inch	Mm
FF-966	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FF-967	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FF-944	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FG-943	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15

**Table C: Bushing Reamer Dimensions**



**Figure 36**



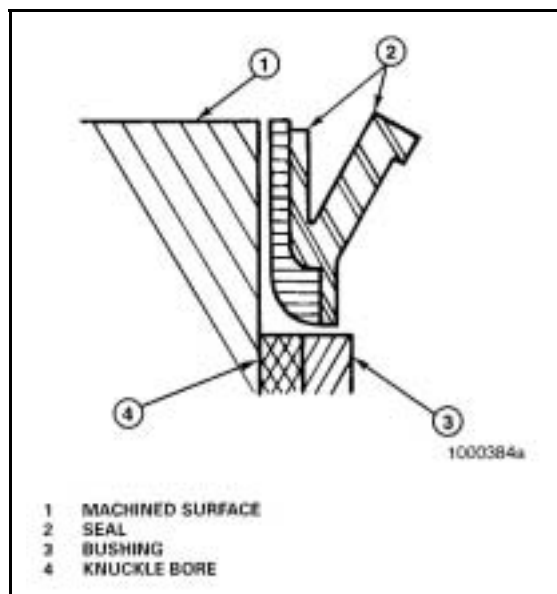
**Figure 37**

## Inner Knuckle Bore King Pin Seals

1. Place the top of the knuckle in a vise with brass jaws. The bottom of the knuckle must be toward you.
2. Place the seal in the bottom of the top knuckle bore. The lip of the seal must be away from the bore. **Figure 38.**



**Figure 38**

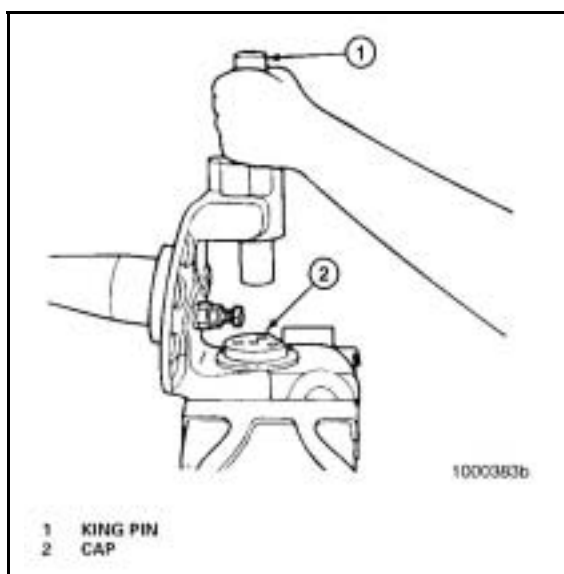


**Figure 40**

3. Place the end cap for the knuckle on top of the seal. Slide the king pin through the opposite knuckle bore. Use the king pin to install the seal. **Figure 39.**

For Easy Steer™ and nylon bushing, make sure the top of the seal is even with top of the knuckle. **Figure 40.**

4. Turn the knuckle over in the vise. The jaws of the vise must hold the bottom of the knuckle, and the top of the knuckle must be toward you.
5. Place the seal in the top of the bottom knuckle bore. The lip of the seal must be away from the bore. **Figure 38.**
6. Repeat step 3 of this procedure.



**Figure 39**

## Install the Knuckle to Axle Beam

1. Clean the bores of the knuckle and the axle beam.
2. Install the seal on the thrust bearing.

On "cover" type seals, install the seal over the open end of the bearing. **Figure 41.**

On "flat" type seals, put the seal over the closed part of the bearing. **Figure 41.**



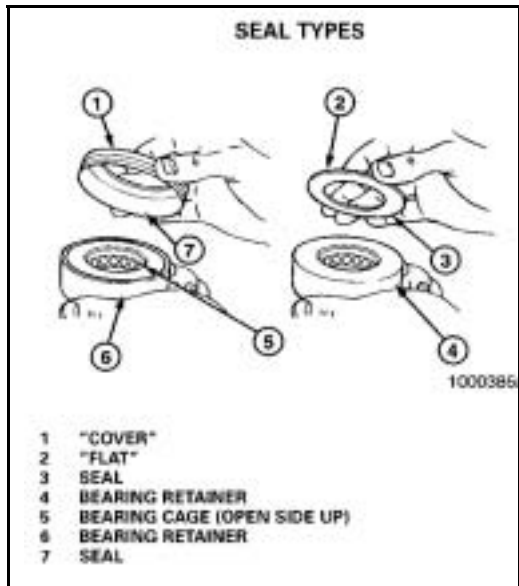


Figure 41

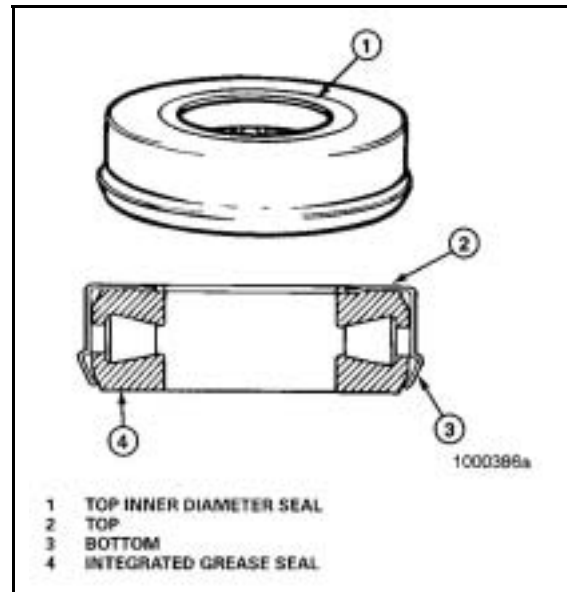


Figure 42

## Integral Thrust Bearing and Seal

The one-piece thrust bearing with an integrated grease seal is completely interchangeable with the two-piece design. It has a specified top and bottom orientation.

- The surface with the inner diameter seal must be on top.
- The surface with the outer diameter seal must be on the bottom. **Figure 42.**

3. Place the seal and thrust bearing assembly on the inner knuckle. Make sure the seal will face upward toward the beam. The top inner diameter will be in contact with the bottom of axle beam. **Figure 43.**

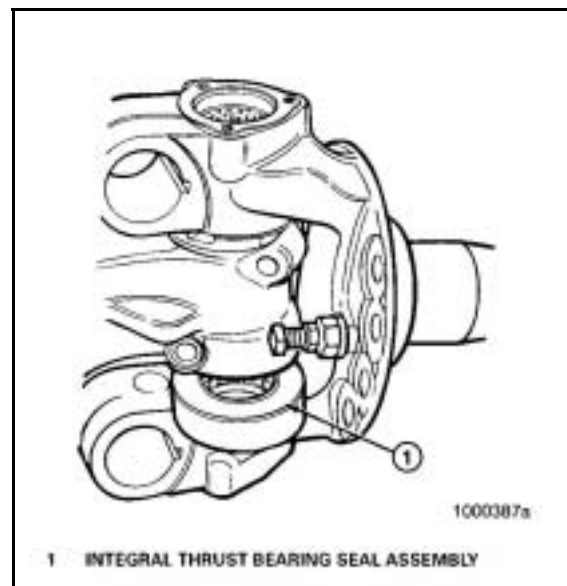
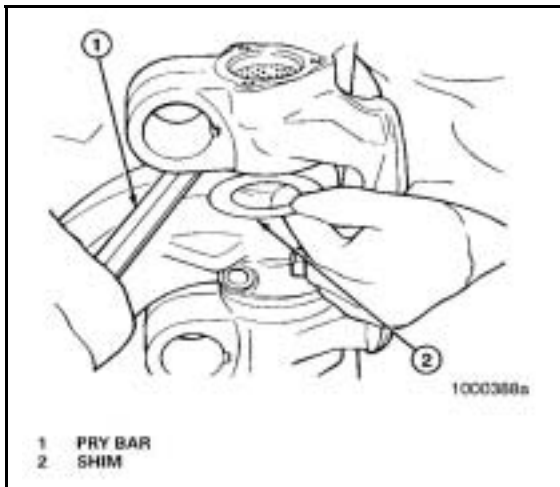


Figure 43

## Warning

*Wear gloves when you install shims. Shims have sharp edges that can cause injury.*

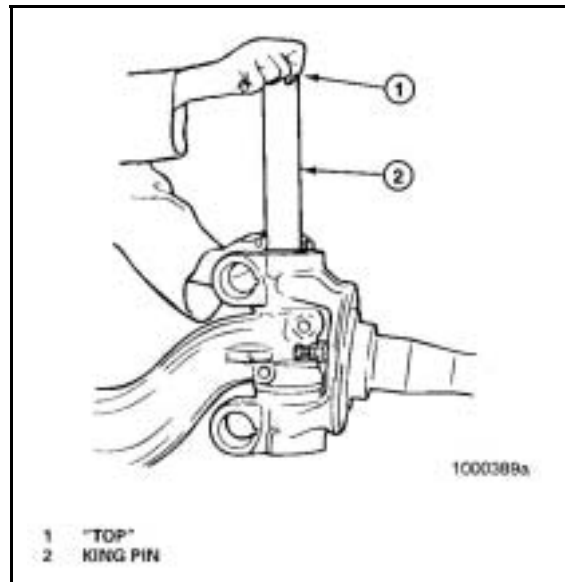
4. Inspect the shims for damage before reinstallation, noting the following.
  - Replace damaged shims with same size shims (or in combination) that allow the least amount of knuckle end play.
  - If a new shim pack must be determined, select the amount of shims that will give the least amount of end play.
5. After inspection, place shims on top of axle beam bore machined surface. Align shims for king pin installation.
6. Place the knuckle on the axle beam.
7. Place a pry bar between the steering arm boss and the axle beam. Lift the knuckle and slide the shim pack between the top of the beam and the knuckle. **Figure 44.**
  - Make sure all the bores are aligned. If the bores are not aligned, the parts will be damaged when the king pin is installed.
  - Remove the pry bar.



**Figure 44**

8. Before installing the king pin into the top of the knuckle, be sure to note the following.
  - Apply the specified lubricant to bottom half of king pin.

- Before placing the king pin into the top of the knuckle, be sure the word "TOP" (which is stamped on the king pin) can be seen. **Figure 45.**
- Rotate king pin so that two draw key slots of pin properly align with draw key slots in the knuckle.



**Figure 45**

### Caution

*Do not force the pin through the top bushing or the shims will be damaged.*

9. Install the king pin into the top of the knuckle and through the area where shims are located.

### Warning

*Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.*

10. If required, use a hammer and a brass drift to apply direct force to king pin for seating it into the lower knuckle bore.

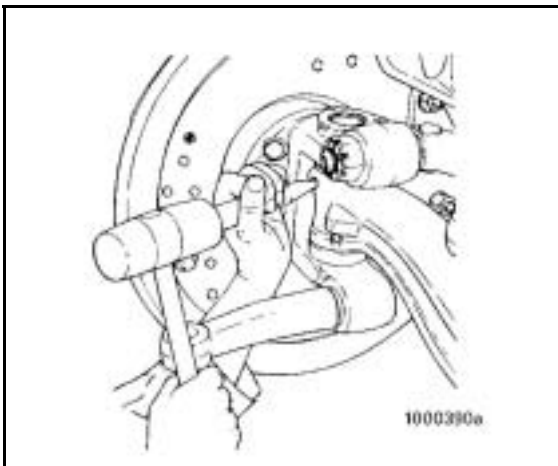
## Note

*Do not drive or tighten the draw keys into the knuckle until the end play is checked and adjusted.*

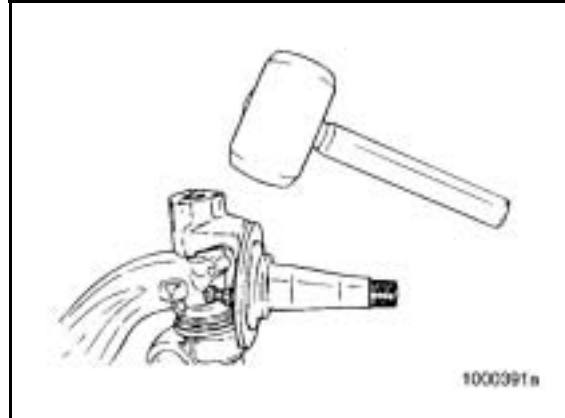
## Note

*All models except FC-901, FC-921, FE-970, FF-971 and FL-901 use threaded draw keys. Models FC-901, FC-921, FE-970, FF-971 and FL-901 use plain draw keys.*

11. Seat top draw key into front of beam.  
Seat bottom draw key in back of beam by striking with hammer and drift.  
Make sure keys align with slots of king pin. Do not install or tighten lock nuts before checking the knuckle end play.  
**Figure 45A.**

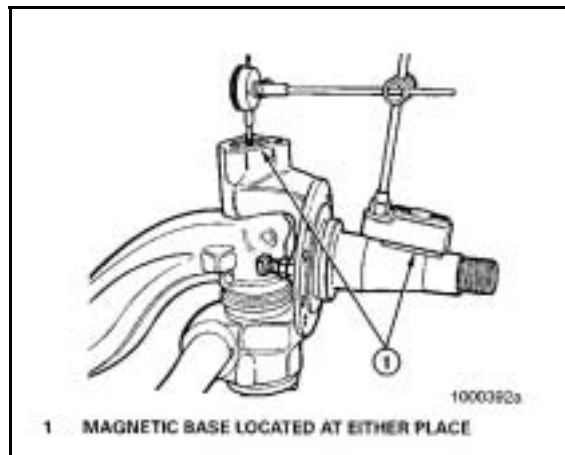


**Figure 45A**



**Figure 46**

3. Attach a dial indicator. Place the base on the knuckle. Place the tip on the center of the king pin. Set the dial indicator on "zero" (0). **Figure 47.**



**Figure 47**

## Check the Steer Knuckle Vertical End Play for Shim Selection

1. Strike the boss of the knuckle with a rubber mallet to move the parts in position. **Figure 46.**
2. Turn the knuckle to the straight (forward) position.

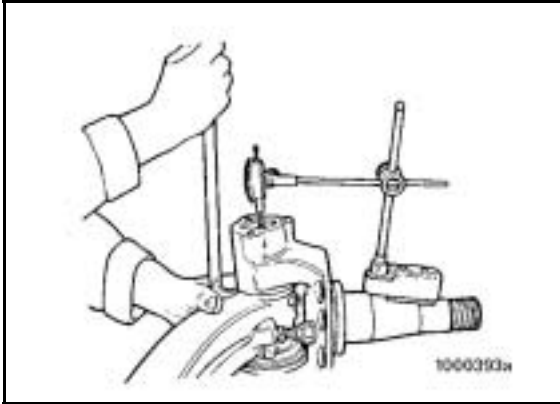
## Warning

*If a hydraulic jack is used to measure end play, use two safety stands to support the axle in the rest position. If safety stands are not used, the axle can fall. Serious personal injury can occur.*

4. Use one of the following procedures to measure the end play.
  - Place a pry bar between the knuckle and the top of the axle center. Push

the knuckle up and measure the end play. **Figure 48.**

- Place a block of wood and a hydraulic jack under the bottom of the knuckle. Raise the knuckle until the pointer on the dial indicator stops. **Figure 49.**

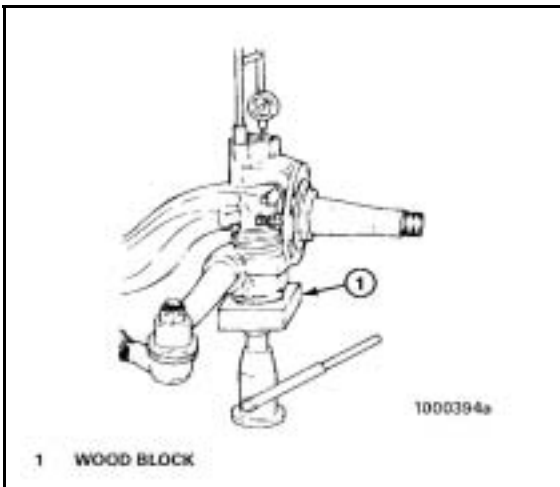


**Figure 48**

5. Repeat Steps 3 and 4 with the axle in the full right and full left turn positions.
6. The end play must be 0.001 to 0.025 inch (0.025-0.635 mm) in all positions.

If the knuckle binds or "0" (zero) end play is measured, remove the shims from the shim pack.

If more than 0.025-inch (0.635 mm) end play is measured, add shims to the shim pack.



**Figure 49**

## Draw Key Lock Nuts

### Warning

*Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.*

### Caution

*Make sure the draw key is installed completely or the lock nut is tightened to the specified torque. If not installed correctly, the king pin and the axle beam will be damaged.*

### Note

*All models except FE-970, FF-971 and FL-901 use threaded draw keys. Models FE-970, FF-971 and FL-901 use plain draw keys.*

1. Install the draw keys. Refer to the following procedure.

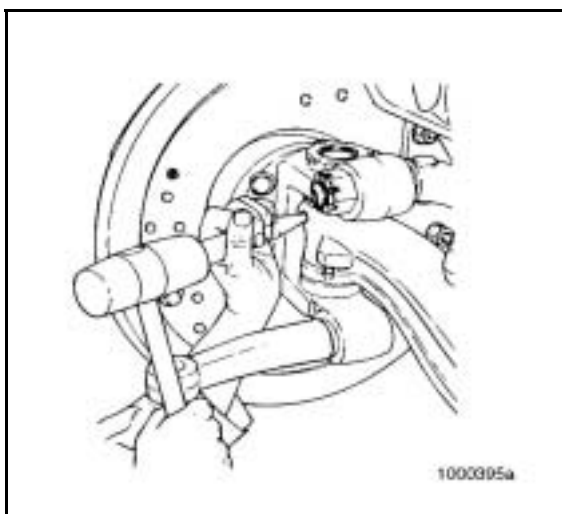
### Plain Draw Keys

Use a hammer and a brass drift to install the draw key in the axle beam and knuckle. Make sure the key is installed 1/32 to 1/8 inch (1-3 mm) below the outer surface of the beam. **Figure 50.**

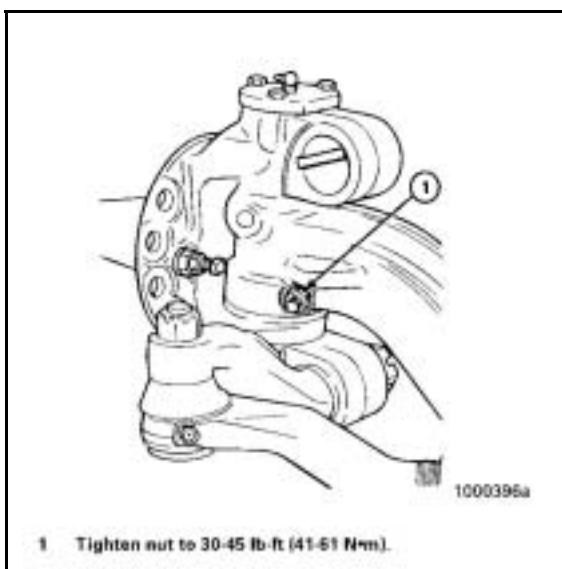
### Threaded Draw Keys

On threaded draw keys, install the lock nut and tighten to 30-45 lb-ft (41-61 N•m). **Figure 51.**

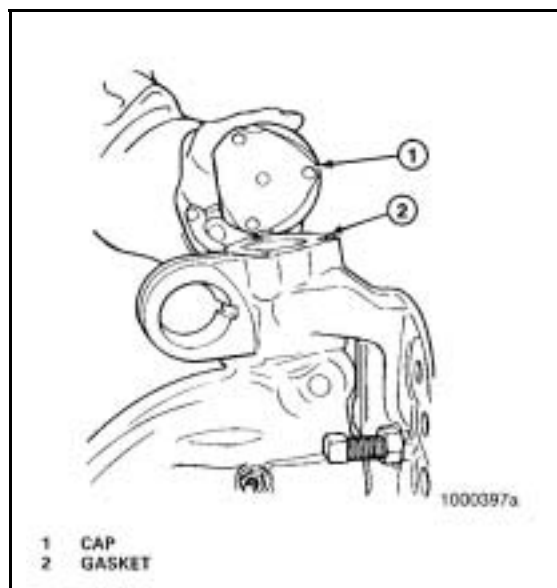
2. Install new gaskets and the caps on the top and the bottom of the knuckle. Install the capscrews and the washers and tighten to 20-30 lb-ft (28-40 N•m). **Figure 52.**
3. Connect the tie rod arm to the knuckle. Refer to the procedure in this section.



**Figure 50**



**Figure 51**



**Figure 52**

## Steering Arm

1. Press the key in the slot in the arm.
2. Install the steering arm in the knuckle.

### Caution

*Tighten the nuts to the specified torque. If the nuts are not tightened to the specified torque, the parts will be damaged.*

3. Install the nuts. Tighten to the specified torque. Refer to **Table I** in Torque Specification section.
4. Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
5. Lubricate the drag link end that connects to steering arm. Refer to Lubrication section
6. Check for correct operation.

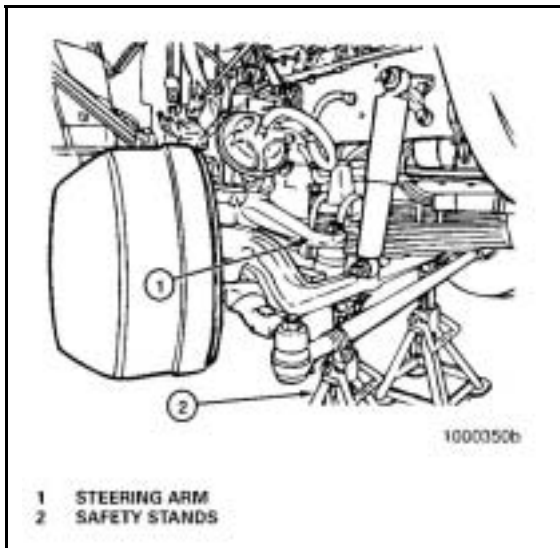


Figure 53

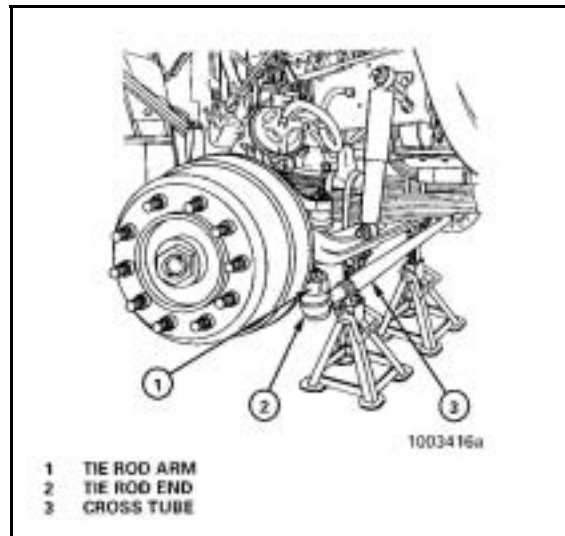


Figure 54

## Tie Rod Ends into the Cross Tube

Refer to Figure 54

### Note

*The cross tube has right-hand threads on the right side of the vehicle and left-hand threads on the left side of the vehicle. Make sure the tie rod end threads are correctly installed into the tube deeper than the end of the cross tube slot. **Figure 55.***

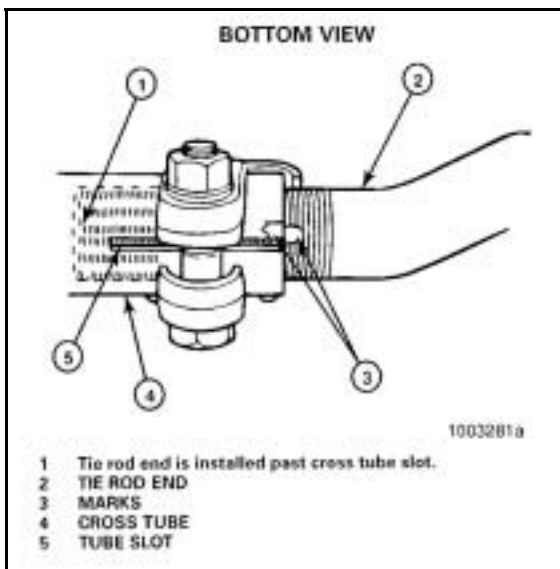


Figure 55

1. **If you are only replacing the cross tube:** When replacing the cross tube, be certain that the replacement cross tubes is properly specified from OE manufacturing standards. The

replacement tube should have the same length and diameter as the original removed tube that couples with the tie rod ends. Use the thread count as a guide and install the tie rod ends into the threaded cross tube ends to the approximate depth marked during the tie rod assembly removal.

Both tie rod ends must be installed into the cross tube deeper than the end of the cross tube slot. **Figure 56.**

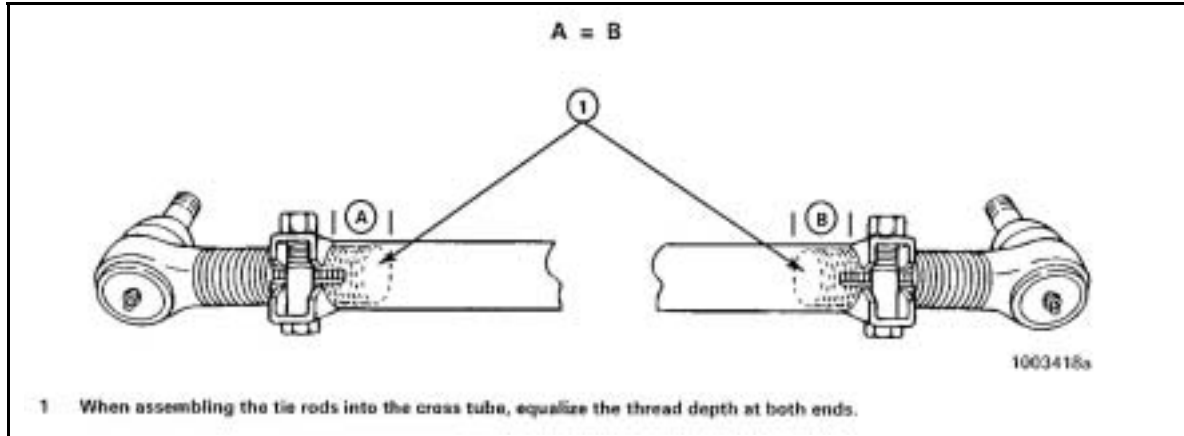
2. **If you are installing new tie rod ends:** Thread the tie rod ends to the approximate original depth inside the cross tube. **Figure 56.**

Both tie rod ends must be installed into the cross tube deeper than the end of the cross tube slot. **Figure 56.**

3. Install the nuts and the bolts in the clamps. Tighten to the specified torque.

**Figure 55.** Refer to Torque Specification section.

4. Check that the tab on the clamps is firmly seated against the end of the cross tube. **Figure 59.**



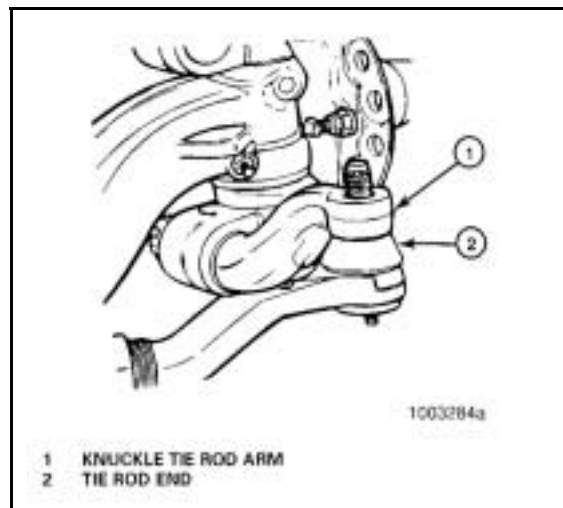
**Figure 56**

## Tie Rod Arms, Tie Rod Ends and Cross Tube Assembly

### Note

*If a different tie rod arm is installed (such as for increasing the maximum turn angle), the steering geometry is changed and may cause tire wear. Contact your Meritor service representative.*

1. Press the key in the slot in the arm. **Figure 57.**
2. Install the tie rod arm in the knuckle. **Figure 57.**



**Figure 57**

### Caution

*Tighten the nuts to the specified torque. If the nuts are not tightened to the specified torque, the parts will be damaged.*

3. Install the nut on the tie rod arm. Tighten to the specified torque. Refer to **Table I** in Torque Specification section.
4. Install the cotter pins. If necessary, tighten the nut slightly, increasing the final torque value until the holes are

aligned. Do not loosen the nut to install the cotter pin.

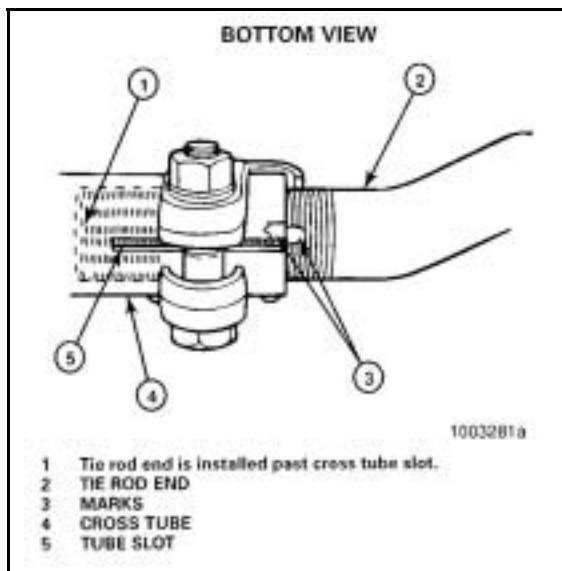
## Note

*The cross tube has right-hand threads on one end and left-hand threads on the other end. Make sure the ends are installed on the tube.*

5. If removed, install the tie rod ends on the cross tube to the position marked during removal.

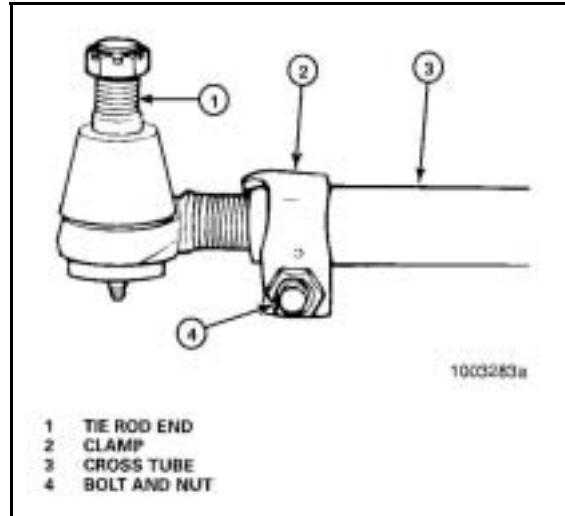
If new tie rod ends are installed, thread the ends equally on the cross tube to the required length. **Figure 58.**

6. Install the nuts and the bolts in the clamps. Tighten to the specified torque. Refer to **Table I** in Torque Specification section. **Figure 58.**



**Figure 58**

7. The rotating style clamp on cross tubes can be rotated for easier accessibility when installing the clamp bolt and nut. Tighten nut sufficiently to engage the locking element of the nut with the bolt. Clamp and tie rod end must be free to rotate. Make certain the clamp tab is firmly seated against the cross tube. **Figure 59.**



**Figure 59**

8. Clean and dry tie rod taper and connect the tie rod ends into the tie rod arms. The threaded portion of the tie rod end must be installed into the cross tube beyond the end of the slot. Make certain the clamp tab is firmly seated against the cross tube.
9. Install the nuts on the tie rod ends. Tighten to the specified torque. Refer to **Table I** in Torque Specification section.
10. Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
11. Check and, if necessary, adjust the toe-in.

## Drag Link

1. Connect the drag link to the steering arm. **Figure 60.**
2. Connect the drag link to the Pitman arm.

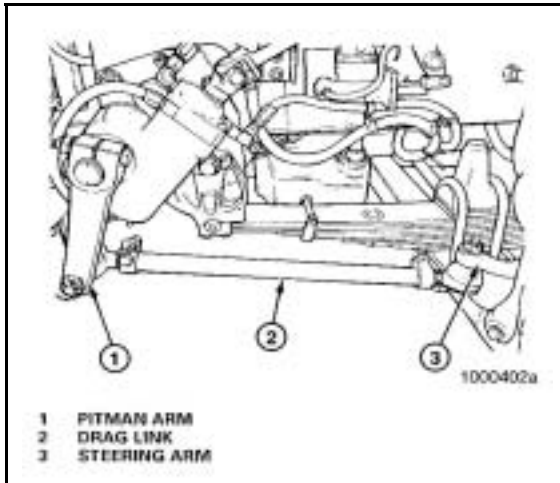
## Caution

*Tighten the nuts to the specified torque. If the nuts are not tightened to the specified torque, the parts will be damaged.*

3. Install the nuts. Tighten to the specified torque. Refer to Torque Specification section.



4. Install the cotter pins. If necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
5. Lubricate the drag link. Refer to Lubrication section.
6. Check for correct operation.



**Figure 60**

## Install the Brake Components and Wheel Ends

1. Install the brake assembly on the knuckle.
2. Lubricate the wheel bearings. Refer to Lubrication section
3. Install the outer wheel bearing cone in the hub. Install the adjusting nut.
4. Adjust the wheel bearings. Refer to section entitled "Check and Adjust the Wheel Bearings". Refer to the wheel end hardware manufacturer's procedures if necessary.
5. Install the cap and the gasket on the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N•m).
6. Install the wheel and tire assembly.
7. Lower the vehicle to the ground. Check for correct operation.
8. Check and adjust the toe-in.

## Adjustments

### Warning

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

## Inspection Before Alignment

Check the following before doing a front wheel alignment.

## Inspection

Refer to section on Lubrication, Inspection and Maintenance.

## Wheels and Tires

Check the following items.

- Make sure the tires are inflated to the specified pressure.
- Make sure the front tires are the same size and type.
- Make sure the lug nuts are tightened to the specified torque.
- Make sure the wheels are balanced.
- Check for bent or damaged wheels.

## Front Suspension

Check for the following items.

- Make sure all fasteners are tightened to the specified torque.
- Inspect the leaf springs for wear and damage.
- Inspect the shock absorbers for wear and damage.

## Rear Axle and Rear Suspension

Front tire wear can be caused by the rear axle. If the outer edge of one front tire is

worn and the inner edge of the other front tire is worn, check the following.

- Make sure all fasteners are tightened to the specified torque.
- Make sure the leaf springs are not worn or damaged.
- Make sure the bushings in the leaf springs are not worn or damaged.
- Make sure the torque rods (if used) are correctly adjusted.
- Make sure the frame is not bent.
- Make sure the rear axle (especially a tandem axle) is correctly aligned.
- Refer to any additional rear axle and suspension recommendations and specifications from Blue Bird Corporation.

## Front Wheel Alignment

Check the front wheel alignment when the following occur.

- Every 200,000 miles (320 000 km) or 24 months (normal maintenance).
- When the vehicle does not steer correctly.
- To correct a tire wear condition.

## Minor Front Wheel Alignment

Perform a minor front wheel alignment for all normal maintenance conditions.

Perform the minor front wheel alignment in the following sequence.

1. Inspect all the systems that affect the wheel alignment. Refer to "Inspection Before Alignment" in this section.
2. Check and adjust the wheel bearings or wheel bearing end ply for the truck hub unit.
3. Check and adjust the toe-in.

## Major Front Wheel Adjustment

Perform a major front wheel alignment to correct steering and tire wear conditions.

To perform the major front wheel alignment, refer to the following sequence.

1. Inspect all the systems that affect the wheel alignment. Refer to section entitled "Inspection Before Alignment".
2. Check and adjust the wheel bearings. For models with unitized hubs, check wheel bearing end play for the truck hub unit. Refer to section entitled "Inspection of Sealed Hub Units" under Lubrication, Inspection and Maintenance.
3. Check and adjust the maximum turn angle.
4. If the vehicle has power steering, check and adjust the pressure relief in the power steering system. Refer to the procedure "Adjust the Pressure Relief in the Power Steering System (Setting the Maximum Turn Angle)" in this section.
5. Check and adjust the turning radius angle (toe-out on turns or Ackerman angle). Refer to "Turning Radius Angle" in this section.
6. Check the king pin (or steering axis inclination). Refer to "King Pin Inclination" in this section.
7. Check the camber angle. Refer to "Camber Angle" in this section.

## Caution

*Axle camber is not adjustable. Do not change the axle camber angle or bend the axle beam. Bending the axle beam to change the camber angle can damage the axle and reduce axle strength, and will void Meritor's warranty. A bent axle beam can also cause a vehicle accident and serious personal injury.*

8. Check and adjust the caster angle. Refer to "Caster Angle" in this section.

9. Check and adjust the toe-in. Refer to "Adjust the Toe-In" in this section.

## Check and Adjust the Wheel Bearings

### Warning

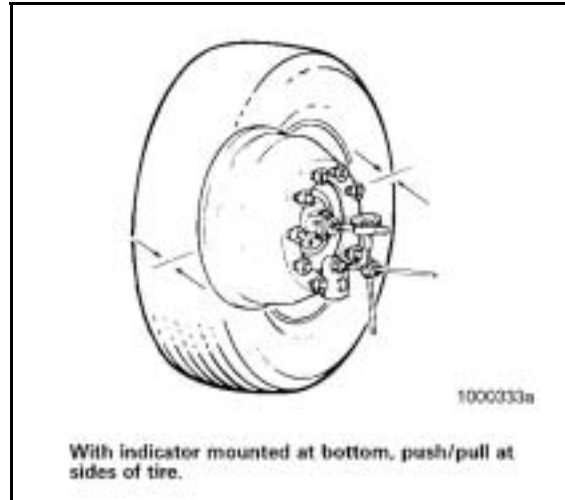
*Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.*

1. Raise the vehicle so that the wheels are off the floor. Support the vehicle with safety stands.
2. Remove the capscrews and remove the gasket and the cap from the hub.
3. Make sure that the brake drum and the hub fasteners are tightened to the manufacturer's specifications.
4. Attach a dial indicator with the magnetic base at the bottom of the hub or the brake drum. Adjust the dial indicator so that the pointer is against the center of the knuckle. Set the dial indicator on "zero" (0). **Figure 61.**

### Note

*Do not push/pull at the top and the bottom of the hub or drum. Pushing or pulling at the top and the bottom will not give a true reading of the end play.*

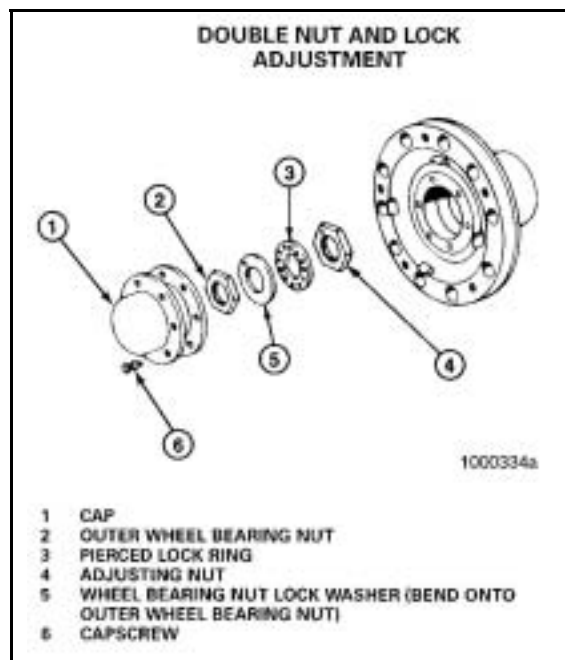
5. Measure the end play by pushing/pulling on each **side** of the hub or drum while looking at the dial indicator. The end play is the total travel observed. If the end play is not within 0.001- to 0.005-inch (0.025-0.127 mm), adjust the wheel bearings. **Figure 61.**



**Figure 61**

6. If necessary, adjust the wheel bearings.
7. **On Double Nut and Lock fasteners,** bend the lock washer off the wheel bearing nut. Remove the wheel bearing nut, the lock washer and the pierced lock ring. **Figure 62.**

**On Single Nut Fasteners,** remove the cotter pin from the adjusting nut. **Figure 63.**



**Figure 62**

## Note

When removing or installing the adjusting nuts, use the correct wrench socket to avoid damaging the adjusting nuts.

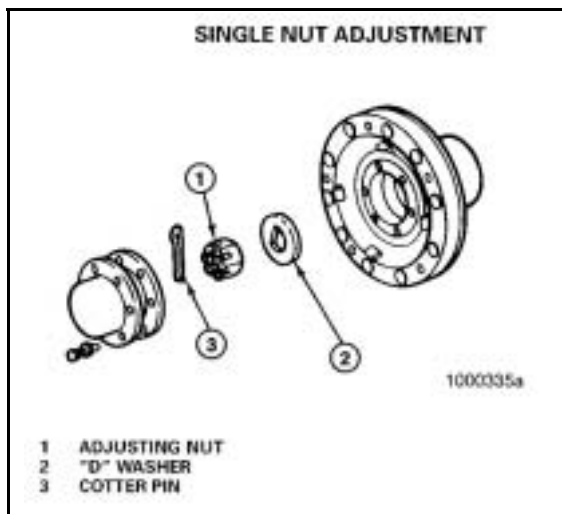
8. Use a torque wrench to tighten the adjusting nut to 100 lb-ft (136 N•m) while rotating the tire in both directions.

**Figure 64.**

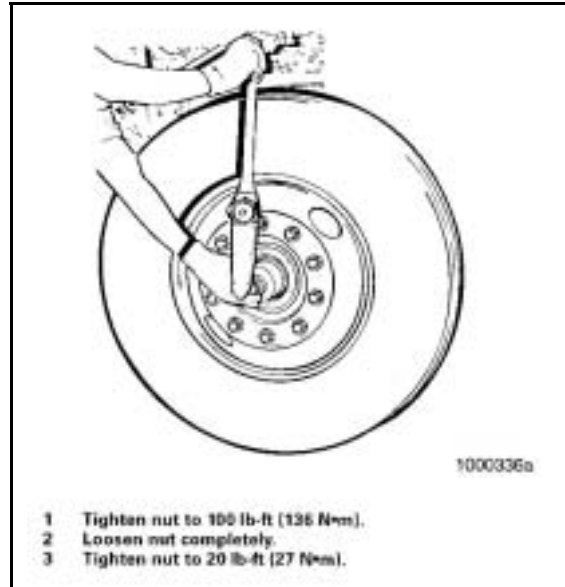
## Caution

Do not strike the adjusting nut with a metal hammer. Do not use a hammer and chisel or drift, or loosen the adjusting nut. This will damage the nut.

9. Loosen the nut completely and then tighten the nut to 20 lb-ft (27 N•m) while rotating the tire. **Figure 64.**



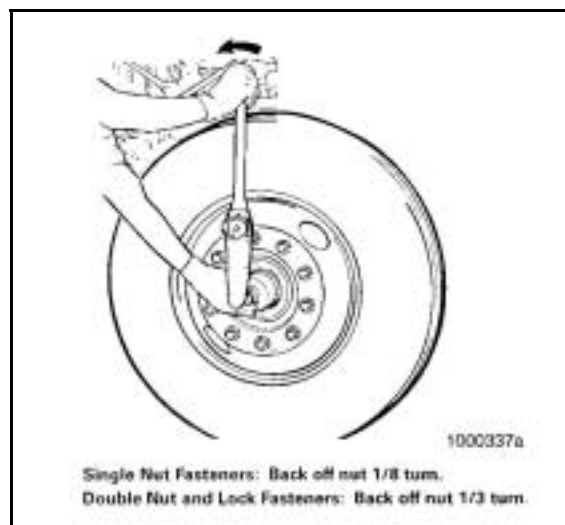
**Figure 63**



**Figure 64**

## 10. Axles with Single Nut Fasteners.

- a. Back off the adjusting nut 1/8 turn. **Figure 65.**
- b. Rotate the nut in either direction to line up a slot with the closest cotter pin hole in the spindle.
- c. Install a new cotter pin in the nut.
- d. Measure the end play. The end play must be 0.001-0.005 inch (0.025-0.127 mm). Refer to Steps 4-5. Readjust if necessary.



**Figure 65**

### 11. Axles with Double Nut and Lock fasteners.

- a. Back off the adjusting nut 1/3 turn. **Figure 65.**
- b. Install the pierced lock ring, the lock washer and the wheel bearing nut.
- c. For wheel bearing nuts in sizes from 1 1/8 inches up to 2 5/8 inches, tighten to 200-300 lb-ft (271-407 N•m). For wheel bearing nuts 2 5/8 inches and more, tighten to 250-400 lb-ft (339-542 N•m).
- d. Measure the end play. The end play must be 0.001-0.005 inch (0.025-0.127 mm). Refer to Steps 4-5. Readjust if necessary.
- e. If end play is to specification, bend washer to at least one flat edge of outer wheel bearing nut. **Figure 62.**

12. Install the gasket and the cap on the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N•m).

13. Lower the vehicle to the ground. Check the correct vehicle operation.

## Adjust the Maximum Turn Angle

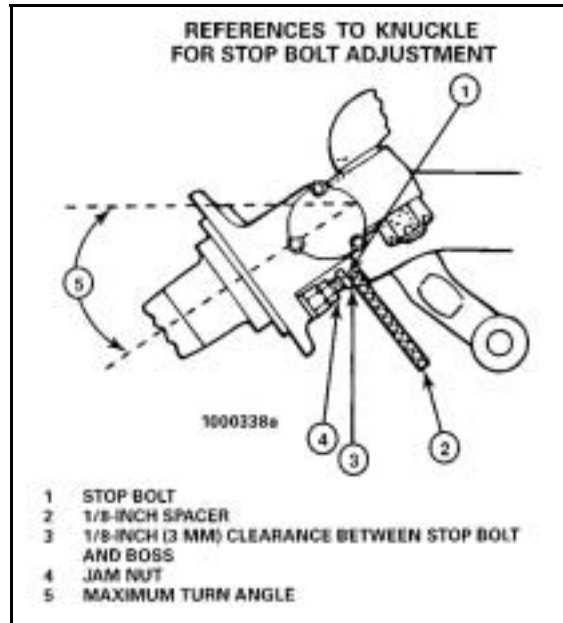
The stop bolt on the back of the knuckle controls the maximum turn angle.

### Caution

*Do not exceed the maximum turn angle specified by the vehicle manufacturer. If the angle is exceeded, the steering arms, the cross tube and the tie rod ends will be damaged.*

Check the angle if the front tires rub against the frame or if the steering gear has been serviced. Use an alignment machine to check the angle. Refer to procedures from the manufacturer of the alignment equipment.

**For power steering systems**, the stop bolt should NOT touch the beam. The stop bolt should always have a minimum clearance of 1/8 inch (3 mm) when the knuckle is in the full-turn position. **Figure 66.**



**Figure 66**

**For manual steering systems**, Meritor recommends a stop bolt clearance of 1/8 inch (3 mm). Stop bolt contact is acceptable if no other stops are used for the maximum turn angle of the steering knuckle.

### Caution

*If the stop bolt is missing, bent or broken, the system requires adjustment. Refer to "Mechanical Stop" in this section.*

### Note

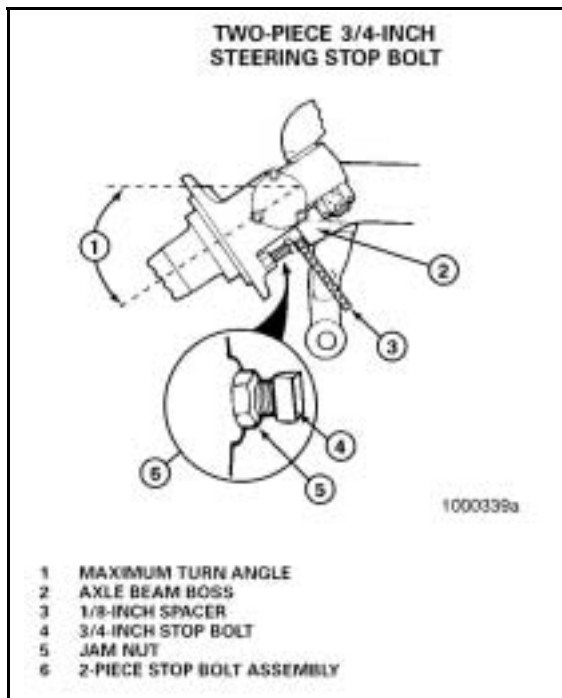
*If the steering system is out-of-adjustment, inspect the steering arm for damage. Use a magnetic particle or liquid dye penetrant inspection procedure to inspect the steering arm. Pay particular attention to the bend, the taper and the area near the ball stud. Refer to the manual from Blue Bird for additional inspection procedures.*

## Caution

*In power steering systems, the hydraulic pressure should relieve or "drop off" at the end of the steering stroke (with 1/8 inch or 3 mm minimum clearance at the stop bolt). If the pressure does not relieve, the components of the front axle will be damaged.*

### Two-Piece Steering 3/4-Inch Stop Bolt

1. Put a 1/8-inch (3 mm) spacer between the stop bolt and the boss on the axle beam.
2. Turn the steering wheel until the boss on the axle beam touches the spacer in front of the stop bolt. **Figure 67.**
3. If the maximum turn angle does not meet vehicle manufacturer's specifications, correct the maximum angle. In a power steering system, adjust the pressure relief. In a manual steering system, follow guidelines and specifications from Blue Bird.

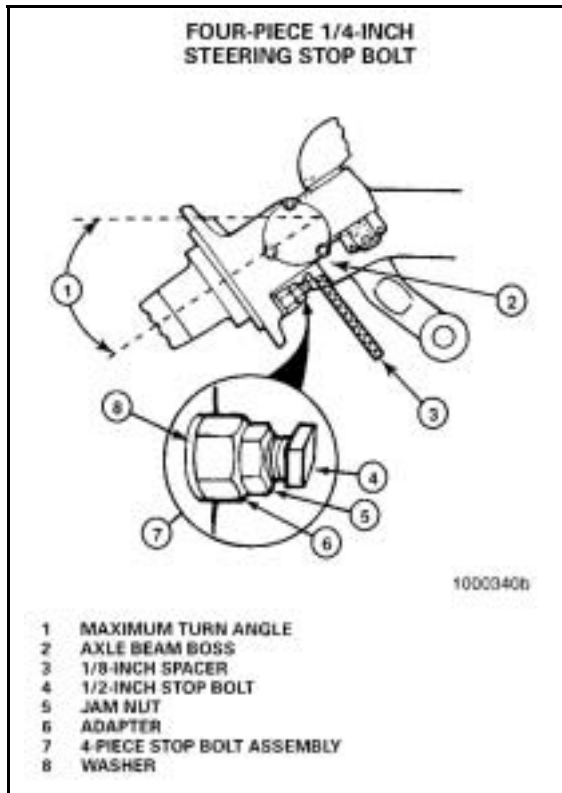


**Figure 67**

4. When the maximum turn angle is correct: **Figure 67.**
  - a. Loosen stop bolt jam nut.
  - b. Insert 1/8 inch spacer and adjust the stop bolt.
  - c. Tighten the jam nut on conventional knuckles from 65-85 lb-ft (68-101 N•m).

### Four-Piece Steering 1/2 Inch Stop Bolt

1. Place washer onto adapter.
2. Apply adhesive patch material into the 3/4-inch knuckle bore stop screw adapter hole.
3. Install adapter with washer into threaded knuckle cavity.
4. Tighten adapter to 85-115 (115-155 N•m).
5. Start jam nut onto 1/2-inch bolt, and install bolt and jam nut assembly into adapter.
6. Place a 1/8-inch (3 mm) spacer between the stop bolt and the boss on the axle beam.
7. Turn the steering wheel until the boss on the axle beam touches the spacer in front of the stop bolt. Measure the turn angle.
8. If the maximum turn angle does not meet vehicle manufacturer's specifications, adjust the maximum turn angle. In a power steering system, adjust the pressure relief. In a manual steering system, follow guidelines and specifications from Blue Bird.
9. When the maximum turn angle is correct:
  - a. Loosen stop bolt jam nut. **Figure 68.**
  - b. Insert 1/8 inch spacer between the stop bolt and the axle beam boss with the steering arm in the full-turn position.
  - c. Tighten the jam nut from 50-75 lb-ft (68-101 N•m).



**Figure 68**

## Adjust the Pressure Relief in the Power Steering System (Setting the Maximum Turn Angle)

The pressure relief in the power steering system stops or reduces forces applied to the axle when the wheel is moved in the full-turn position.

Check the pressure relief if the steering arm is damaged or the power steering gear is serviced.

**Two types of systems are used to adjust the pressure relief:**

- Mechanical Stop on the Pitman Arm or in the Assist Cylinder
- Hydraulic Pressure Relief in the Power Steering Gear

### Caution

*Meritor does not recommend a power steering system that does not have mechanical stops or pressure relief before the maximum turn angle is obtained. The stops or the pressure relief are used to prevent damage to the axle.*

## Axles with Conventional Wheel Ends

### Mechanical Stop

Use the mechanical stop in the steering system to adjust the pressure relief. Do not use the stop bolt on the knuckle alone to adjust the poppet valve pressure relief.

### Note

*Refer to the specified procedures from Blue Bird.*

### Caution

*Use a pressure gauge to make sure that the pressure drops from the maximum system delivery pressure to a maximum of 700-1000 psi (4825-6890 kPa) BEFORE the full turning angle is achieved.*

Steering systems with mechanical stops are adjusted when the wheels are turned to the full right and full left turn positions. The stop travel is set at 1/8 inch (3 mm) before the top bolt contacts the axle beam boss.

**Figure 69.**

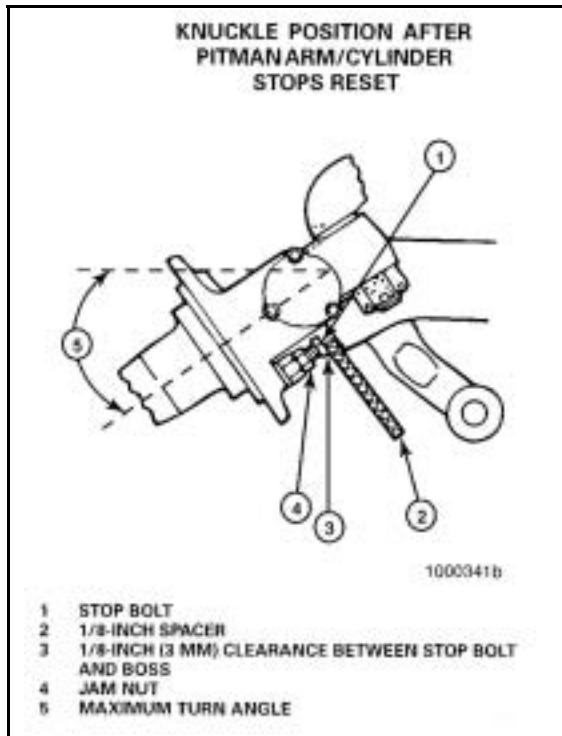


Figure 69

## Hydraulic Pressure Relief in the Steering Gear

### Note

Refer to the specified procedure from Blue Bird. The stop bolt should always have a minimum clearance of 1/8-inch (3 mm) between the stop bolt and the axle beam boss.

Hydraulic steering gears with poppet valves are adjusted with a spacer between the stop bolt in the knuckle and the boss on the axle beam. The poppet valves are adjusted to stop or reduce steering forces from the 1/8-inch (3 mm) specified distance between the beam boss and the spacer. **Figure 70.**

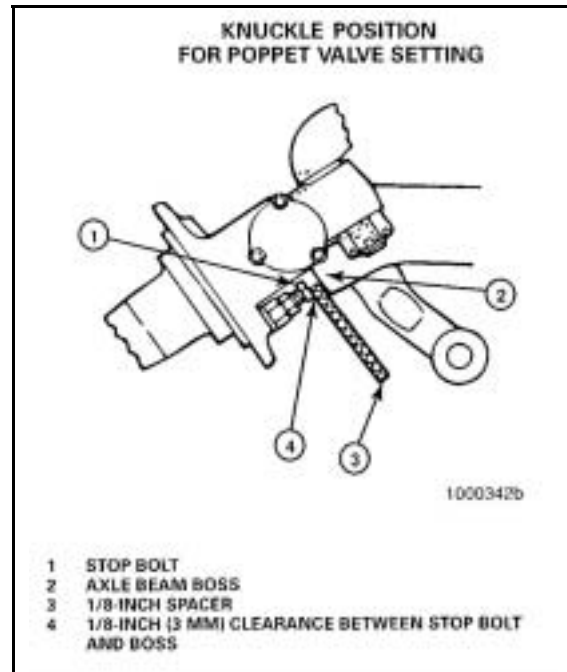


Figure 70

## Turning Radius Angle

When turning, the inner wheel must turn at a greater angle than the outer wheel. This angle is the turning radius angle (often called the Ackerman angle). **Figure 71.**

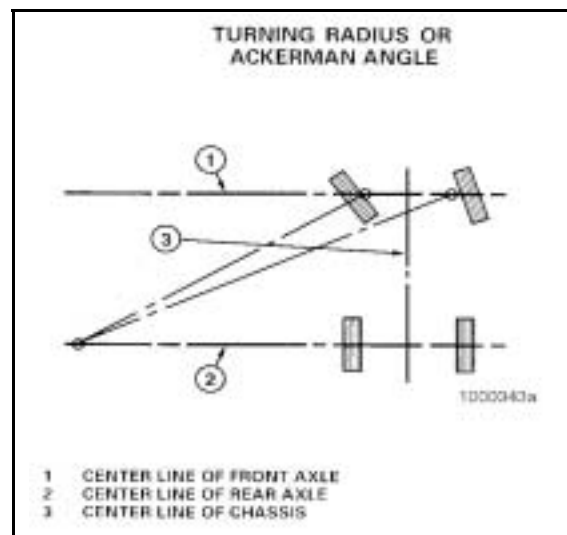


Figure 71

The angle is built into the design of the tie rod arms, the tie rod ends and the cross tube assembly to give the best possible road



contact and to minimize tire wear during turns.

Check the turning radius angle with the radius plates on the alignment equipment.

If the angle is not within specifications, premature tire wear will occur. Inspect the knuckle, tie rod arms, tie rod ends and cross tube for wear or damage. Service as necessary.

## King Pin Inclination

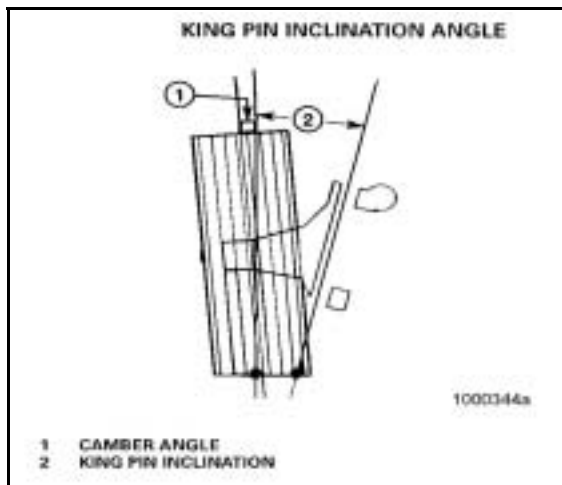
King pin (or steering axis) inclination is the angle measured between the center line of the king pin and the vertical position (as viewed from the front of the vehicle).

**Figure 72.**

The king pin inclination and the camber angle are designed into the axle to place the tire tread center line in contact with the road. This reduces steering effort and improves directional stability.

Use an alignment machine to check the king pin inclination angle.

The king pin inclination is not adjustable. If the inclination is not at the specified angle, check the axle beam and knuckle for damage. Service as necessary.



**Figure 72**

## Camber Angle

### Caution

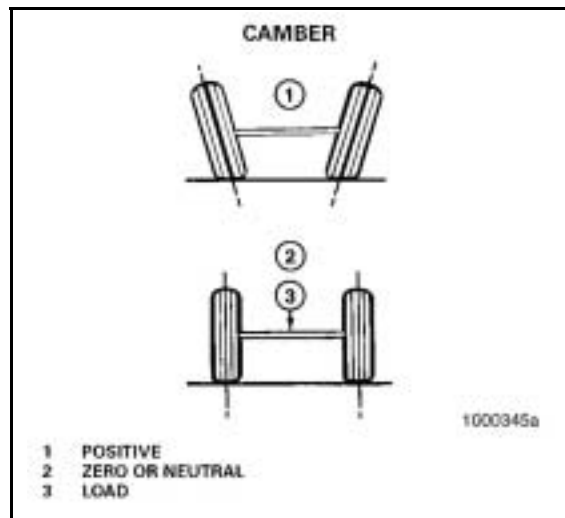
*Axle camber is not adjustable. Do not change the axle camber angle or bent the axle beam. Bending the axle beam to change the camber angle can damage the axle and reduce axle strength, and will void Meritor's warranty. A bent axle beam can also cause a vehicle accident and serious personal injury.*

Camber is the angle of the tire with respect to the ground. Camber is positive when the distance between the top of the wheels is greater than the distance at the ground.

**Figure 73.**

A small amount of positive camber is built into the knuckle because camber changes with load. This results in a zero camber angle when the vehicle is operated at the normal load.

If camber is out of specification by more than 1 1/2 degrees, rapid or uneven tire wear will occur. Bias ply tires will show excess camber easily, while with vehicles equipped with radial tires, excess camber will not be as evident.



**Figure 73**

The camber angle is not adjustable. The camber angle is machined into both the axle

beam and the knuckle. If the camber angle is not at the specified angle, check the axle

beam and the steering knuckle for damage. Service as necessary.

Conditions	Old Camber Specification Ales with Assembly Dates: No Date indicated on tag Prior to Aug 31, 1992 (92244) Any date with a "P" Suffix		New Camber Specification Axles with Assembly Dates On or after Sep 1, 1992 (92245) with no "P" suffix
	Left Side	Right Side	Left and Right Sides
Camber angles machined into axles: Hubs not installed. Axles not installed in vehicle. Load not applied on axle.	+3/4° Nominal	+1/4° Nominal	+1/4° Nominal
Camber angles of axles equipped with hubs	+3/4° (±7/16°) or +1 3/16° to 5/16° (final reading)	+1/4° (±7/16°) or +11/16° to - 3/16° (final reading)	+1/4° (±7/16°) or +11/16° to -3/16° (final reading)
Camber angles under load Axle installed in vehicle	+11/16° to - 3/16° (final reading)	+3/16° to - 11/16° (final reading)	+3/16° to -11/16° (final reading)

**Table D - Camber Angle Recommendations**

Use an alignment machine to check the camber angle. Refer to the procedure of the manufacturer of the alignment equipment. The table above gives the specification Meritor builds into the axle.

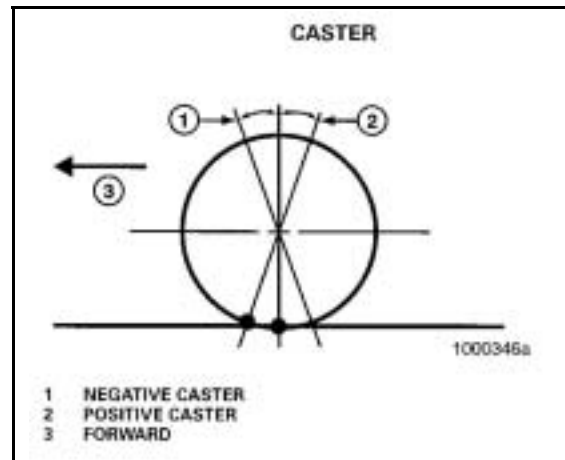
If caster is too much, steering effort will increase or may amplify a shimmy condition.

## Caster Angle

Caster is the forward or rearward tilt of the king pin center line when viewed from the side of the vehicle. The caster angle is the angle from the vertical position to the center line of the king pin. If the top of the king pin axis is toward the rear of the vehicle, the caster is positive. A slight positive caster creates a self-aligning action that helps to stabilize the vehicle after turning and stabilizes it for driving straight ahead.

**Figure 74.**

Always use an alignment machine to check the caster angle. When checking caster, refer to the instructional procedures from the alignment equipment manufacturer.



**Figure 74**

The caster angle is controlled by tapered shims installed under the leaf springs. Adjust caster according to Blue Bird specifications and procedures.

Meritor recommends a caster setting of +1 degree to +2 1/2 degrees for vehicles with manual steering and +2 degrees to +4 1/2 degrees for vehicles with power steering.

## Adjust the Toe-In

Toe is the relationship of the distance between the front of the front tires and the rear of the front tires.

When the front distance is less than the rear distance, the wheels are "toed in". Toe-in is designed into the vehicle to counteract the tendency of the tires to toe-out when the vehicle is driven.

Incorrect toe-in will result in rapid tire wear.

Toe-in specifications:

- **Unloaded vehicles** 1/16 inch (1.587 mm)  $\pm$  1/31 inch (0.794 mm)
- **Loaded vehicles** 1/32 inch (0.794 mm)  $\pm$  1/32 inch (0.794 mm).

## Caution

*Most tire wear is caused by incorrect toe settings. Do not change camber or caster settings to correct tire wear problems. If the axle assembly is bent to change caster or camber, the strength of the axle is reduced and the warranty is voided. An axle damaged by bending may cause a vehicle accident and result in serious personal injury.*

1. Make sure the vehicle is on a level surface. Place blocks behind the rear wheels to prevent the vehicle from moving. Raise the vehicle so that the front tires are off the floor.

## Warning

*Park the vehicle on a level surface. Block the wheels to prevent moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks.*

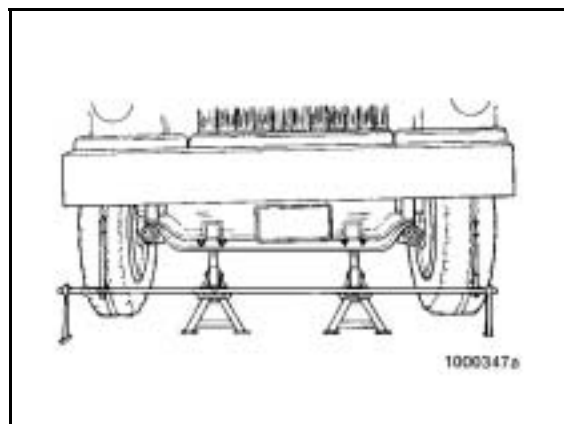
*Jacks can slip and fall over. Serious personal injury can result.*

2. Use jacks to raise vehicle so that front tires are off the ground. Support the front axle with safety stands.
3. Use paint or chalk to mark the center area of both front tires around the complete outer surface of the tire.
4. Place the pointers of a trammel bar on the marks of each tire. Rotate the tires. Make sure a straight line is marked on the outer surface of the tire.

## Note

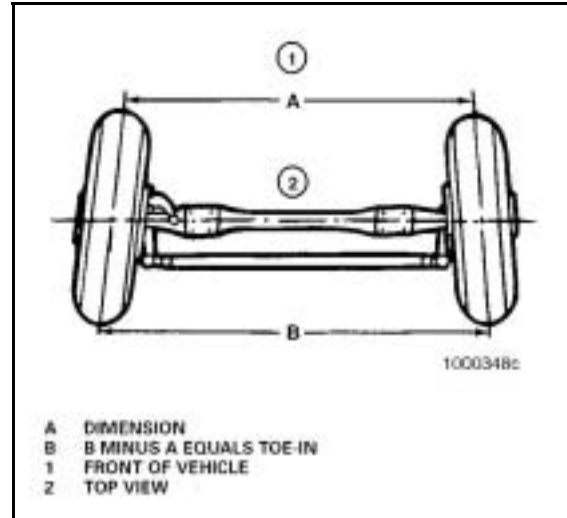
*Do not measure toe-in with the front axle in the raised position. The weight of the vehicle must be on the front axle when toe-in is measured.*

5. Lower the vehicle to the floor. Move the vehicle forward and backward 10 feet (3 meters).
6. Place the trammel bar at the back of the tires. Raise the pointers so that the pointers are level with the spindles. Align the pointers with the marks on the tires. Measure and record the distance between the pointers.
7. Place the trammel bar at the front of the tires. Raise the pointers so that the pointers are level with the spindles. Align the pointers with the marks on the tires. Measure and record the distance between the pointers. **Figure 75.**



**Figure 75**

8. To obtain the toe measurement, subtract the distance reading between the front of the tires from the distance reading between the back of the tires. **Figure 76.**
9. If the toe measurement is not at the specified distance, refer to the following procedure.
  - a. Loosen the tube clamp nut and bolt on each end of the cross tube.
  - b. Turn the cross tube until the specified toe-in distance is obtained.
  - c. The threaded portion of the tie rod end must be installed into the cross tube beyond the point where the tube slot stops.
  - d. Tighten the nut and bolt on each end of the cross tube to the specified torque.
10. Repeat Steps 1-8 to check the toe-in dimension.



**Figure 76**

## Diagnostics

### Warning

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

## Front Non-Drive Steering Axle Diagnostic Chart

The following chart is for troubleshooting front non-drive steering axle conditions.

Condition	Cause	Correction
Tires wear out quickly or have uneven tire tread wear.	<ol style="list-style-type: none"> <li>1. Tires have incorrect air pressure.</li> <li>2. Tires out of balance.</li> <li>3. Incorrect tandem axle alignment.</li> <li>4. Incorrect toe-in setting.</li> <li>5. Incorrect steering arm geometry.</li> <li>6. Excessive wheel end play exists.</li> </ol>	<ol style="list-style-type: none"> <li>1. Place specified air pressure in tires.</li> <li>2. Balance or replace tires.</li> <li>3. Align tandem axles.</li> <li>4. Adjust toe-in specified setting.</li> <li>5. Service steering system as necessary.</li> <li>6. Readjust wheel bearings.</li> </ol>
Vehicle is hard to steer.	<ol style="list-style-type: none"> <li>1. Power steering system pressure low.</li> <li>2. Steering gear linkage not assembled correctly.</li> <li>3. Steering linkage needs lubrication.</li> <li>4. King pins binding.</li> <li>5. Incorrect steering arm geometry.</li> <li>6. Caster out of adjustment.</li> <li>7. Tie rod ends hard to move.</li> <li>8. Worn thrust bearing.</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair power steering system.</li> <li>2. Assemble steering gear correctly.</li> <li>3. Lubricate steering linkage.</li> <li>4. Replace king pins.</li> <li>5. Service steering system as necessary.</li> <li>6. Adjust caster as necessary.</li> <li>7. Replace tie rod ends.</li> <li>8. Replace thrust bearing.</li> </ol>

Tie rod ends are worn and require replacement.	<ol style="list-style-type: none"> <li>1. Tie rod ends require lubrication.</li> <li>2. Severe operating conditions.</li> <li>3. Damaged boot on tie rod end.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lubricate ends of cross tube. Make sure lubrication schedule is followed.</li> <li>2. Increase frequency of inspection and lubrication intervals.</li> <li>3. Replace boot.</li> </ol>
Bent or broken cross tube, tie rod end ball stud, steering arm or tie rod end. (Component requires replacement.)	<ol style="list-style-type: none"> <li>1. Too much pressure in the power steering, pressure exceeds OEM specification.</li> <li>2. Power steering system cut-off pressure, out of adjustment.</li> <li>3. Vehicle operated under severe conditions.</li> <li>4. Add-on type of power steering system not installed correctly.</li> <li>5. Steering gear overtravel poppets improperly set or malfunctioning.</li> <li>6. Axle stops improperly set.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust power steering system to specified pressure.</li> <li>2. Adjust power steering system to specified pressure.</li> <li>3. Make sure vehicle is operated correctly.</li> <li>4. Correctly install add-on power steering system.</li> <li>5. Check for proper operation or adjust overtravel of poppets to OEM specification.</li> <li>6. Set axle stops to OEM specification.</li> </ol>
Worn or broken steering ball stud.	<ol style="list-style-type: none"> <li>1. Drag link fasteners tightened higher than OEM specified.</li> <li>2. Lack of lubrication or incorrect lubricant.</li> <li>3. Power steering stops out-of-adjustment.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten drag link fasteners to specified torque.</li> <li>2. Lubricate linkage with specified lubricant.</li> <li>3. Adjust stops to specified dimension.</li> </ol>
Worn king pins and king pin bushings.	<ol style="list-style-type: none"> <li>1. Worn or missing seals and gaskets.</li> <li>2. Incorrect lubricant.</li> <li>3. Axle not lubricated at scheduled frequency.</li> <li>4. Incorrect lubrication procedures.</li> <li>5. Lubrication schedule does not match operating conditions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace seals and gaskets.</li> <li>2. Lubricate axle with specified lubricant.</li> <li>3. Lubricate axle at scheduled frequency.</li> <li>4. Use correct lubrication procedures.</li> <li>5. Change lubrication schedule to match operating conditions.</li> </ol>
Vibration or shimmy of front axle during operation.	<ol style="list-style-type: none"> <li>1. Caster out-of-adjustment.</li> <li>2. Wheels and/or tires out-of-balance.</li> <li>3. Worn shock absorbers.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust caster.</li> <li>2. Balance or replace wheels and/or tires.</li> <li>3. Replace shock absorbers.</li> </ol>

## Warning

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

Group Number	Typical Vocations	Vehicle Build	Typical Operation Conditions
2	Fire and rescue, city delivery, inner city coach, heavy haul, school bus, motor home, transit coach	After July 1, 1996 Before July 1, 1996, use Group Number 3	Lower mileage operation (less than 50,000 miles/year (80 500 km/year))
3	Logging, oil field, construction, heavy haul, yard tractor (highway licensed), residential refuse	ALL	Low mileage operation (less than 25,000 miles/year (40/250 km/year))

**Table E: Vocational Groups**

## Lubrication, Inspection and Maintenance Schedule

Component	Service Intervals									
	48 hrs	5,000 miles/100 hrs	First 6,000 miles of operation	10,000 miles	20,000 miles	36,000 miles	40,000 miles	50,000 miles	100,000 miles	200,000 miles
		8050 km	10 000 km	16 100 km	32 200 km	58 000 km	64 000 km	80 500 km	160 000 km	320 000 km
<b>Tie Rod Ends</b>										
Group 2					I		L*			
Group 3				I, L*						
<b>Inspect the Tie Rod Assembly for Movement</b>										
Group 2					I					
Group 3				I						
<b>Tie Rod End Shop Inspection</b>										
<b>Ball Stud on Steering Arms</b>									L*	
<b>Easy Steer Plus™ Axle Ball Studs</b>									I	
<b>Sealed Axle Ball Studs</b>									I	
<b>Drag Link</b>									L*	
<b>King Pins and Bushings</b>									L*	
<b>Steering Arm Bolts</b>										I
<b>Thrust Bearings</b>									L*	

<b>Steering Knuckle Vertical End Play Inspection</b>										
Group 2					I					
Group 3				I						
<b>Upper and Lower King Pin Bushings for Wear</b>										
Group 2					I					
Group 3				I						
<b>Draw Key Nuts</b>										
New vehicle			T							
In-service vehicle						T				
<b>Sealed Hub Unit Inspection</b>										I
I=Inspect										
L=Lubricate										
T=Tighten to Specifications.										
*If power washers are used during vehicle cleaning operations, lubrication intervals need to be adjusted. Frequent power washed vehicles will require more frequent lubrication.										

**Table F: Lubrication, Inspection and Maintenance Schedule**

<b>Component</b>	<b>Greasing Interval</b>	<b>Grease</b>	<b>Meritor Specification</b>	<b>NLGI Grade</b>	<b>Grease Type</b>	<b>Outside Temperature</b>
King Pins and Bushings, Thrust Bearings, Ball Studs on Steering Arm, Tie Rod Ends, and Drag Link	100,000 miles (160 000 kilometers) or once a year, whichever comes first	Multi-Purpose Grease	O-617-A Or O-617-B	1 or 2	Lithium 12-Hydroxystearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits
Truck Hub Unit	No Lube to Hub	Unit Sealed for life of component	NONE	Do Not lubricate		

**Table G: Front Non-Driving Axle Greasing Intervals and Specifications**

On-Highway Operation Intervals		Off-Highway Operation Intervals		Meritor Specs	Military Specs	Oil Description	Outside Temperature			
Check Oil Level	Petroleum Oil Change	Check Oil Level	Petro- leum Oil Change				F°		C°	
							Min	Max	Min	Max
1,000 miles (1600 kilo meters)	Whichever comes first:	1,000 miles (1600 kilometers)	Which- ever comes first:  Seals replaced  Brakes relined.  Once a year.	O-76A, Gear Oil	MIL-L- 2105-D	GL-5, SAE 85W/140	10	None	12	None
	Seals replaced			O-76D, Gear Oil	MIL-L- 2105-D	GL-5, SAE 80W/90	-15	None	-26	None
	Brakes relined			O-76E, Gear Oil	MIL-L- 2105-D	GL-5, SAE 75W/90	-40	None	-40	None
	100,000 miles (160 000 kilometers)			O-76J, Gear Oil	MIL-L- 2105-D	GL-5, SAE 75W	-40	36	-40	2
	Once a year			Heavy Duty Engine Oil	MIL-L- 2104-B, C, D or E	API –CD, CE, SF or SG SAE 40 or 50 (1)	10	None	12	None
				Heavy Duty Engine Oil	MIL-L- 2104-B, C, D or E	API –CD, CE, SF or SG SAE 30 (2)	-15	None	-26	None

**Table H: Wheel End Oil Change Intervals and Specifications**

(1) Current designations are acceptable. Multi-weight engine oils are acceptable if the SAE rating ends in a 40 or 50.

(2) Current designations are acceptable. Multi-weight engine oils are acceptable if the SAE rating ends in a 30.

## Lubrication

### Tie Rod End Lubrication

This procedure refers to all tie rod ends on Meritor non-drive steering axles.

1. Turn the vehicle wheels straight ahead.  
**Figure 77.**
2. Wipe the zerk fitting clean with shop towels. **Figure 78.**
3. Wipe the seal/boot clean with shop towels.
4. Attach a grease gun to the zerk fitting. Either a hand or air pressure grease gun is acceptable. If using air pressure, do not exceed 150 psi (1035 kPa). **Figure 79.**
5. Discolored old grease should come out of the purge holes near the boot crimp or bellows area (typically three or more places). **Figure 80.**

6. If the tie rod end is designed for lube service and it does not accept grease:

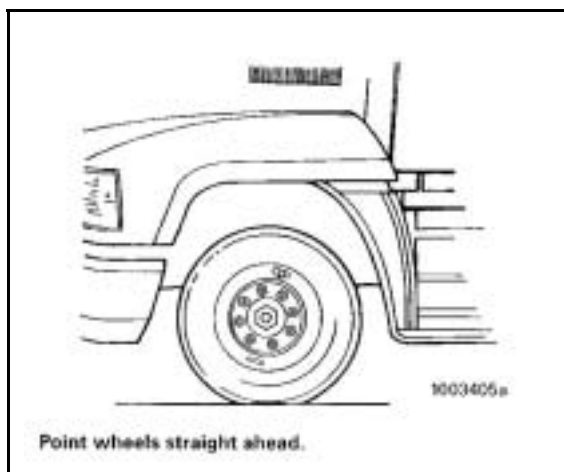
- a. Remove the zerk fitting.
- b. Inspect the threaded zerk fitting hole in the tie rod end and remove any obstructions.
- c. Install a new zerk fitting.
- d. Continue the lubrication procedure.

#### Note

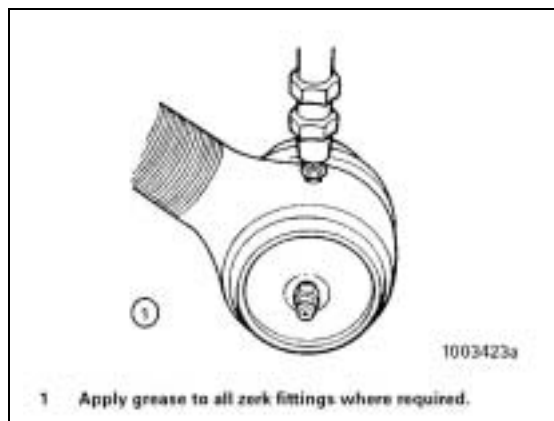
*Synthetic lubes are not yet approved for tie rod end lubrication.*

7. Apply grease **until all old grease is purged from the boot.**

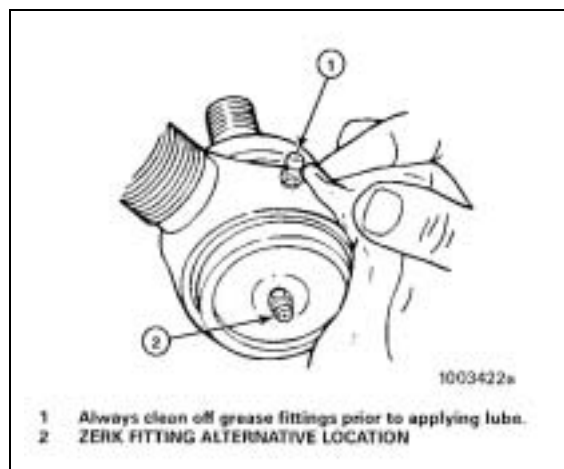




**Figure 77**



**Figure 79**



**Figure 78**

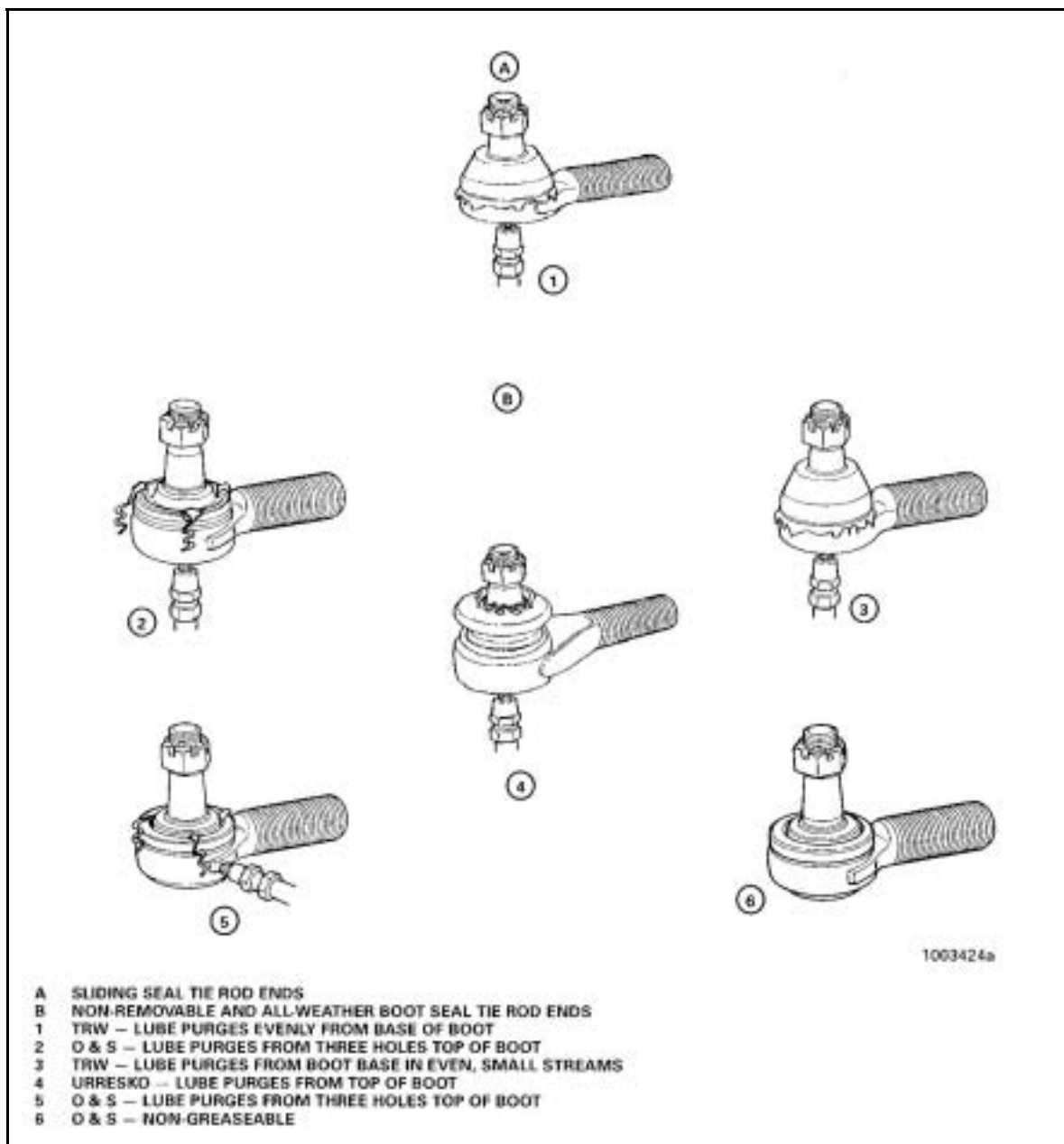


Figure 80

## King Pins

### Straight King Pins

#### Note

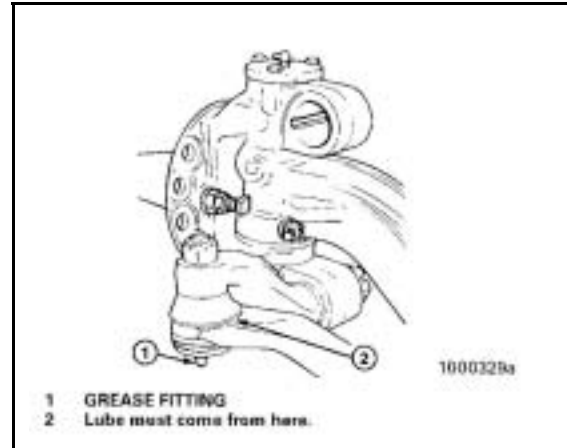
This procedure applies to 901, 903, 910, 935, 952 and 970 front conventional axles. Refer to the identification tag on the front of the axle beam.

On conventional front axles, the grease fittings are on the side of the knuckle.

#### 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 can result.

1. Lift the vehicle so that the tires are off the ground. The front tires should be off the ground when the king pins are lubricated. Support the vehicle with safety stands. Place blocks in front and behind the rear wheels to keep the vehicle from moving. Set the parking brake.
2. Lubricate the king pins through the top and the bottom king pin cap grease fittings. **Figure 81.**
3. Apply lubricant until new lubricant comes from between the upper shim pack and thrust bearing seal.
4. Lower the vehicle so that the wheels touch the ground.
5. Apply lubricant to the bottom fitting until new lubricant purges and fills the thrust bearing.

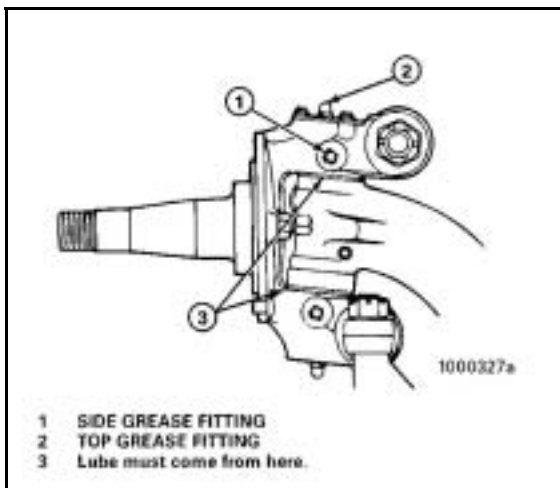


**Figure 81**

## Grease-Lubricated Wheel Bearings

### Note

*This procedure applies to hubs with grease-lubricated wheel bearings.*

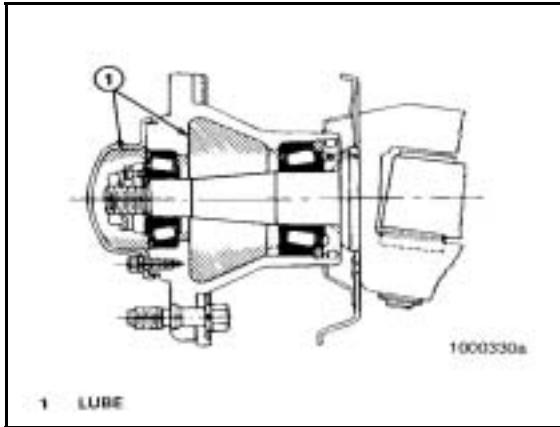


**Figure 81**

## Ball Studs on Steering Arm, the Tie Rod Arm Ends and the Drag Link

1. Make sure the tires touch the ground. **DO NOT RAISE THE VEHICLE.**
2. Clean off all grease fittings prior to lubrication.
3. Apply lubricant until new lubricant comes from the boot. **Figure 81.**

1. Remove the tire and wheel assembly. Remove and disassemble the hub. Refer to the section on "Wheel Ends".
2. Remove the old lubricant from all parts. Discard the seals. Inspect the wheel bearings for wear or damage. Replace worn or damaged bearings. Refer to "Preparing Parts for Assembly" section.
3. Force the specified lubricant from the large end of the cones into the cavities between the rollers and cage. Pack the hub between the bearing cups with lubricant to the level of the small diameter of the cups. **Figure 82.**



**Figure 82**

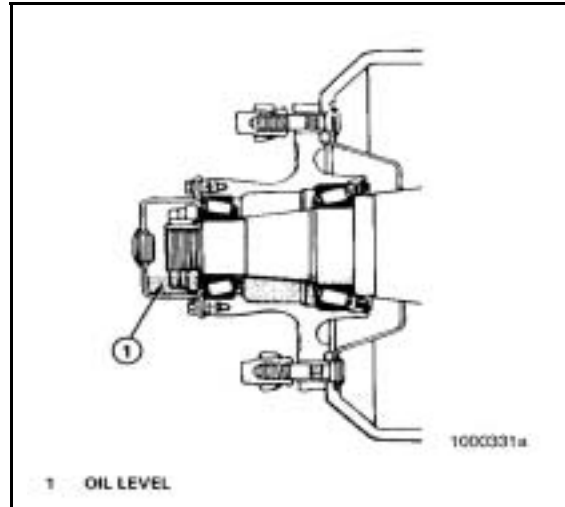
4. Install the inner and outer bearing cones into the cups in the hubs. The bearing cups must be pressed tight against the shoulder in the hubs.
5. Install new wheel seals in the hubs.
6. Install the hub and the wheel and tire assembly. Install the outer wheel bearing cone in the hub. Install the adjusting nut.
7. Adjust the wheel bearings. Refer to Section entitled "Check and Adjust the Wheel Bearings".

## Oil-Lubricated Wheel Bearings

### Note

*This procedure applies to hubs with oil-lubricated wheel bearings.*

Check the level on the cap. If the oil level is not at the specified level on the cap, remove the fill plug. Add the specified oil until the oil is at the specified level. **Figure 83.**



**Figure 83**

## Inspection and Maintenance

### Inspection Tools

Before performing an inspection of axle components, make sure the proper tools are available. Using the proper tools will ensure safety and provide the most accurate results. Check for the following tools:

- Dial Indicator
- Tire Blocks
- Jack
- Safety Stands
- Pry Bar
- Torque Wrench

### Inspection

#### Caution

*The repair or reconditioning of front axle components is not allowed. Meritor recommends replacing damaged or out-of-specification components. All major components are heat treated and tempered. The components cannot be bent, welded, heated or repaired in any way without reducing the strength or life of the component and voiding the warranty and*

*may cause a vehicle accident which can result in serious personal injury.*

Check the following during an inspection.

**Fasteners.** Make sure all fasteners are tightened to the specified torque. Use a torque wrench to check the torque in a tightening direction. As soon as the fastener starts to move, record the torque. Correct if necessary. Replace any worn or damaged fasteners.

**Wear and Damage.** Inspect the parts of the axle for wear and damage. Look for bent or cracked parts. Replace all worn or damaged parts.

**Pivot Points.** Make sure looseness does not exist at the pivot points. Make sure the pivot points are lubricated.

**Operation.** Make sure all the parts move freely through the complete turning radius.

**Tire Wear.** Inspect the tires for wear patterns that indicate suspension damage or misalignment.

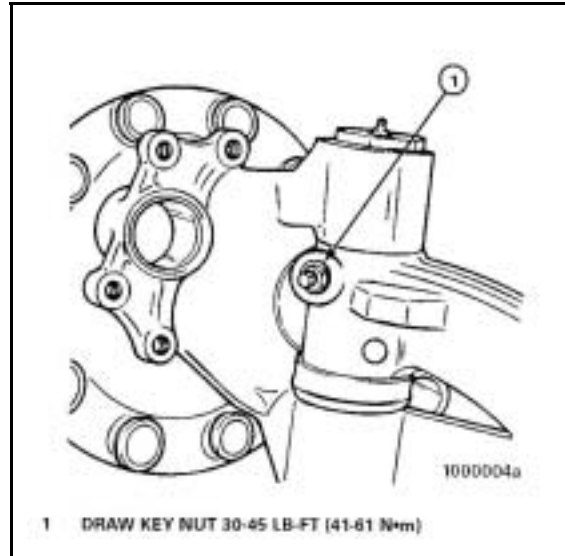
**Steering Arm Bolts.** Check torque on Easy Steer Plus™ MFS 10-2015 and MFS 12-2015 axles every 200,000 miles (320 000 km). Refer to the "Checking Steering Arm Bolts" in this section.

## Checking Draw Key Nuts

Tighten the draw key nuts from 30 to 45 lb-ft (41-61 N•m) at the following intervals.

**Figure 84.**

- After the first 6,000 miles (10 000 km) of new vehicle operation.
- Every 36,000 miles (58 000 km) of operation.



**Figure 84**

## Checking Steering Knuckle Vertical End Play

1. Place blocks in front and behind the rear wheels to prevent the vehicle from moving.

### 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 can result.*

2. Use a jack to raise the vehicle until the front wheels are off the ground. Support the front axle with safety stands.
3. Install a dial indicator so that the base is on the I-beam and that the tip is on the top knuckle cap. **Figure 85.**
4. Place a pry bar between the boss for the tie rod arm and the I-beam. Push the knuckle to the bottom of vertical travel. **Figure 86.**

## Note

*If one bushing requires replacement, then replace both bushings in the knuckle.*

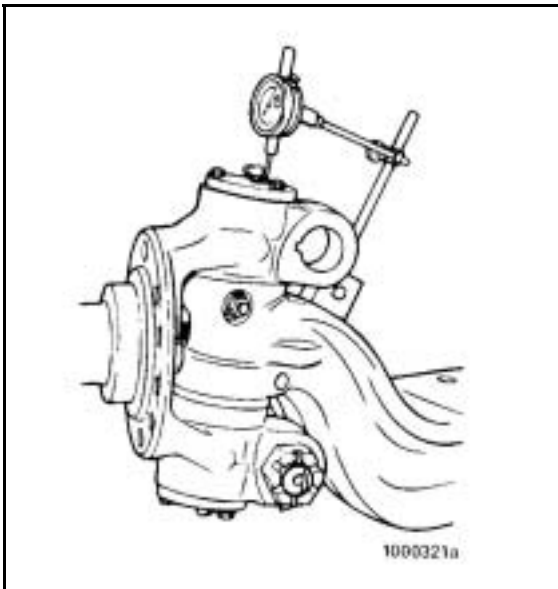
5. Set the dial indicator on "zero" (0).
6. Use the pry bar to push the knuckle upward. Record the reading on the dial indicator.

The reading must be 0.001- to 0.025-inch (0.025-0.635 mm) for new or rebuilt axles and 0.001- to 0.065-inch (0.025-1.650 mm) for axles in service.

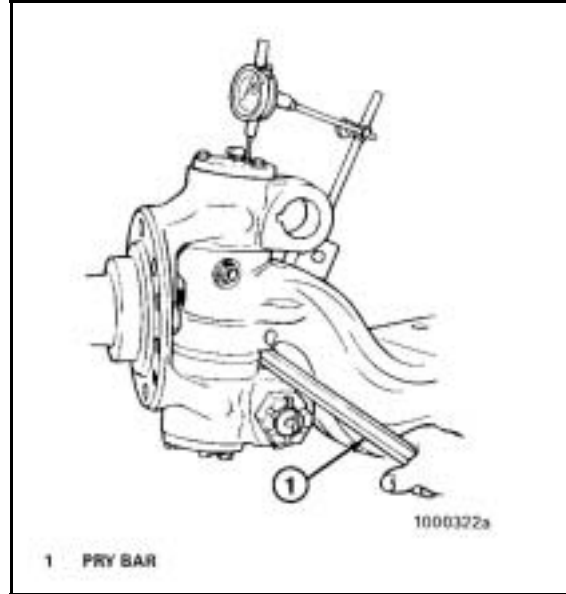
### Figure 86.

If the reading is "zero" (0), remove the knuckle and remove shims from the shim pack.

If the reading is more than the maximum specification, remove the knuckle and add shims to the shim pack.



**Figure 85**



**Figure 86**

## Checking the Upper and Lower King Pin Bushings for Wear

1. Place blocks in front and behind the rear wheels to prevent the vehicle from moving.

### Warning

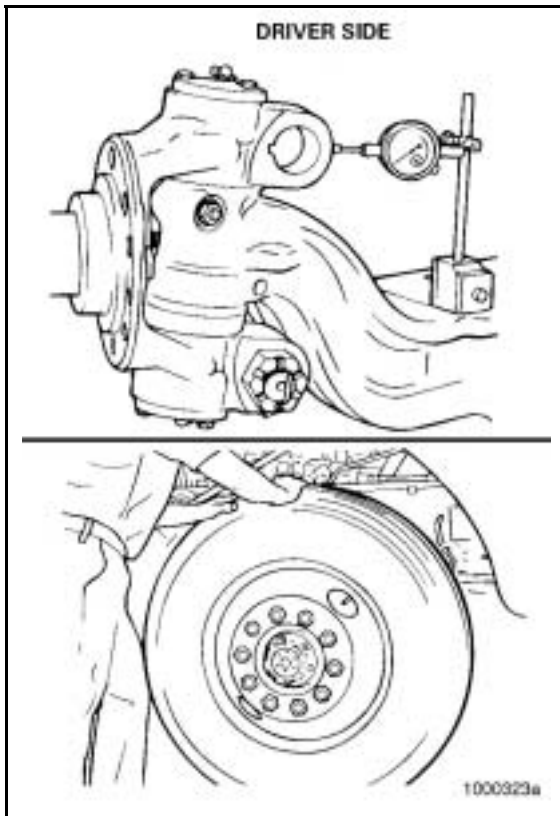
*Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.*

2. Use a jack to raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.
3. Check the upper king pin bushing for wear. Install a dial indicator so that the base is on the I-beam and that the tip is against the side of the top of the knuckle. **Figure 87.**
4. Set the dial indicator to "zero" (0).

## Note

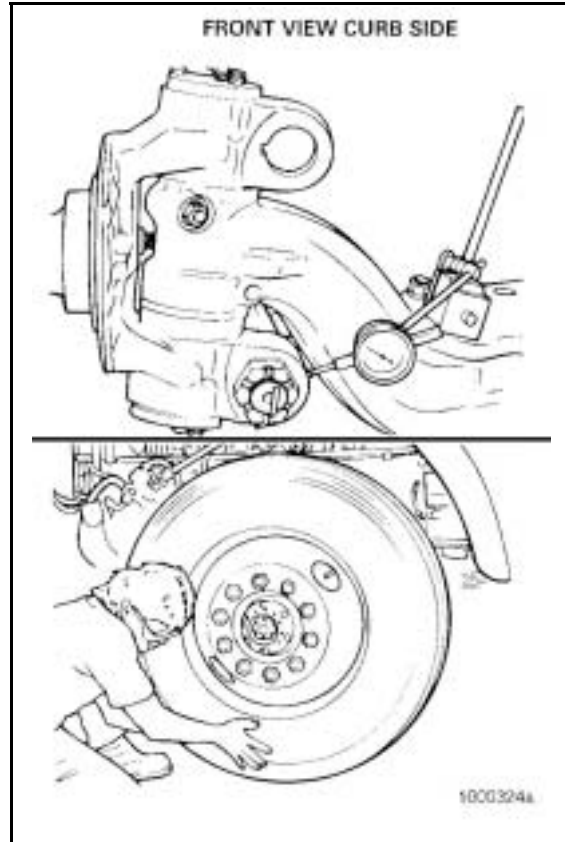
*If one bushing must be replaced, replace both bushings in the knuckle.*

5. Move the top of the tire side-to-side towards and away from the vehicle. If the dial indicator moves a total of 0.010-inch (0.254 mm), the upper bushing is worn or damaged. Replace both bushings. **Figure 87.**



**Figure 87**

6. Check the lower king pin bushing. Install a dial indicator so that the base is on the I-beam and that the tip is against the side of the bottom of the knuckle. **Figure 88.**
7. Set the dial indicator on "zero" (0).
8. Move the bottom of the tire side-to-side towards and away from the vehicle. If the dial indicator moves a total of 0.010-inch (0.2254 mm), the lower bushing is worn or damaged. Replace both bushings. **Figure 88.**

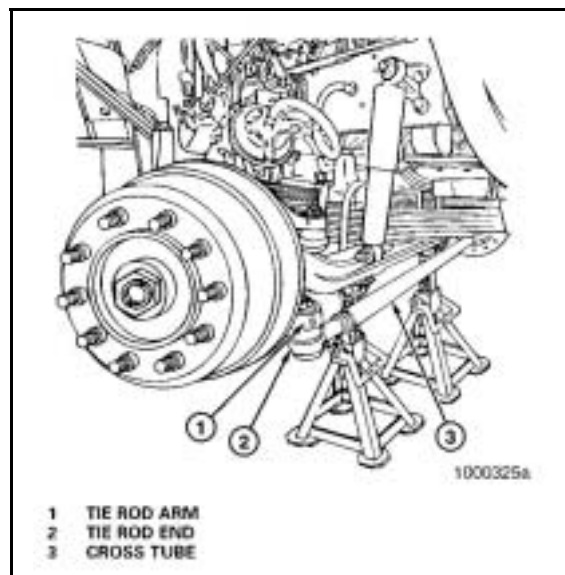


**Figure 88**

## Inspect the Tie Rod Ends

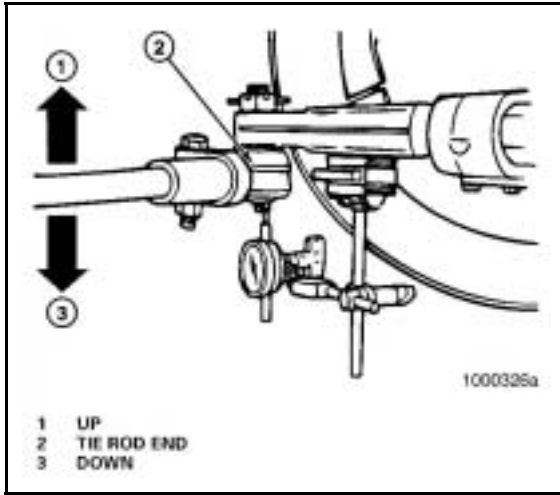
1. Park the vehicle with the steering wheels in the straight-ahead position.

**Figure 89.**



**Figure 89**

2. Place blocks in front and behind the rear wheels to prevent the vehicle from moving. Set the parking brake.
  3. Remove dirt and grease from the tie rod end seals.
  4. Place indicator base on the bottom of the tie rod arm.
  5. Place the indicator tip near the ball stud center (grease fitting) of the tie rod end.
- Figure 90.**



**Figure 90**

6. Set the dial indicator on "zero" (0).

### Caution

*Check the tie rod end play by hand. Do not use a pry bar. If a pry bar is used, readings from the dial indicator will not be accurate.*

7. Move the tie rod and cross tube assembly up and down by hand.
8. Record the dial indicator reading. If the dial indicates a reading of more than 0.060-inch (1.52 mm), tie rod end replacement is required.
9. Place the dial indicator on the tie rod end assembly at the opposite side of vehicle and repeat Steps 1 through 8.

## Inspect the Tie Rod Assembly for Movement

This procedure applies to all tie rod assemblies.

To perform this inspection, the entire system must be "unloaded" (i.e., the front end of the vehicle must be raised and supported with stands).

### Caution

*Do not grease the tie rod assembly before performing the inspection. Doing so may provide inaccurate results.*

*Replace the entire tie rod end if the boot is torn or missing. Do not replace the boot only.*

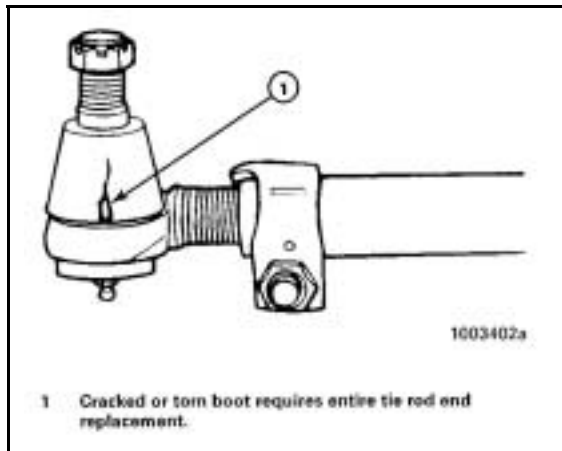
1. Place blocks in front of and behind the vehicle's rear wheels. Using the bottom of the I-beam or frame rails, raise the front end off the ground, and support with stands.
2. With the engine off, turn wheels from full left to full right, and then return to the straight-ahead position. (This step will require more force for vehicles with power steering turned off.)
3. Check that the boot is in place and completely installed over the tie rod end.

### Note

*The boot may be missing completely or may not completely cover the ball joint.*

4. Check for cracking or tears in the boot. Also, check the boot seals for damage. Replace the entire rod end if the boot is damaged. **Figure 91.**





**Figure 91**

### Warning

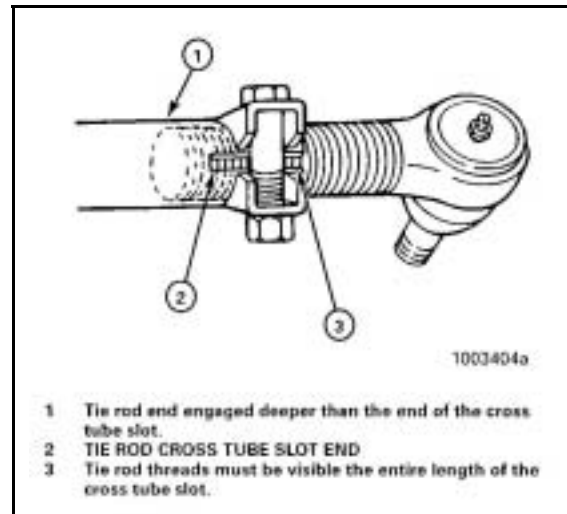
*A cotter pin must be installed through the tie rod end with the tie rod end nut tightened to torque specification to securely attach the tie rod. Loss of the cotter pin will allow the tie rod end nut to become loose and affect vehicle steering and possibly result in loss of steering control.*

5. Check that the tie rod nut is installed and secured with a cotter pin. If the cotter pin is missing, check the nut torque specification and then install a new cotter pin. Always tighten tie rod nut to specified torque when setting the cotter pin.

### Caution

*The tie rod ends must be at the end of the cross tube slot to ensure adequate thread engagement.*

6. Check that the tie rod end is threaded correctly into the cross tube and engaged 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 92.**



**Figure 92**

7. Check that zerk fittings are installed. Replace a damaged zerk fitting with a new one. Some tie rod ends are non-greaseable and will not have zerk fittings. Do not install fitting if tie rod end is non-greaseable type.

### Caution

*Do not use the following items or methods to check for movement of the tie rod assembly. Damage to components can result if:*

- A crow bar, pickle fork or 2 x 4 is used.
  - A tool instead of your hands is used to grasp the cross tube assembly that results in cross tube damage.
  - Pressure or force is applied to the ends or the joints of the assembly.
  - The tires are rocked either with the vehicle on the ground or with the wheels raised.
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. 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, grab the assembly end as close to the socket as

possible (no more than 6 inches or 152.4 mm). Apply hand pressure (approximately 100 pounds) vertically (up and down) in a push-and-pull motion several times. Check for any movement or looseness at both tie rod end locations.

10. If there is any movement in the tie rod assembly, replace both tie rod ends.

## Tie Rod End Shop Inspection

### Caution

*Replace the entire tie rod end if the boot is torn or missing. Do not replace the boot only.*

1. Check the tie rod boot for cracks, tears or other damage. All tie rod ends with a damaged boot require that the entire tie rod end be replaced. **Figure 91.**
2. Grab by hand (or using a pipe wrench with jaw protectors to avoid gouging the cross tube) and slightly rotate the cross tube toward the front of the vehicle and then slightly toward the rear. After this movement, check in both directions, centering the cross tube between the stop positions. If the cross tube will not rotate in either direction, replace both tie rod ends.
3. Position yourself directly below the ball stud socket. Using both hands, grab the end as close to the socket as possible (no more than 6 inches or 152.4 mm from the end). Firmly apply hand pressure (approximately 100 pounds) in a vertical push and pull motion several times. When moving the assembly, check for any movement at both tie rod ends.

### Warning

*If any movement is detected by hand, replace the worn components with new components before releasing the vehicle back into service.*

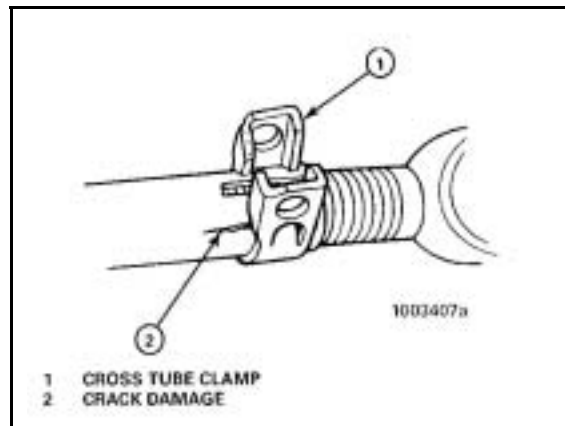
4. **If any movement is detected** at one tie rod end, replace it and the other tie rod end. Always replace tie rod ends in pairs, even if only one tie rod is found damaged.

### Warning

*Do not attempt to straighten a bent cross tube. Damage to the axle can result. Be certain to replace any cross tube with an original equipment cross tube (with the same length, diameter and threads).*

5. Inspect the cross tube and clamps for damage. **Figure 93.**

- Replace the cross tube if it is cracked or bent.
- Replace the clamps if they are damaged.
- Replace the entire cross tube assembly if either clamp is welded onto it.

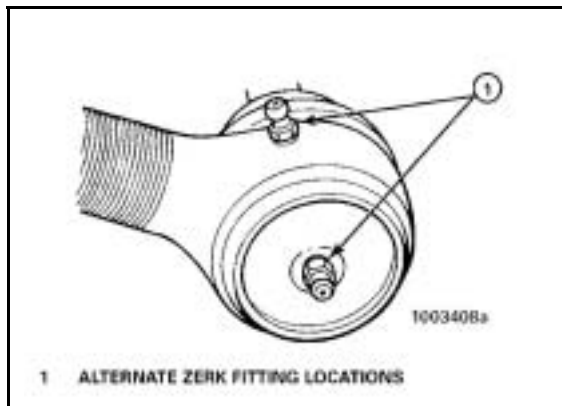


**Figure 93**

6. Check for proper installation of the tie rod end clamp to the cross tube. Be certain that tie rod ends are threaded in the cross tube past the clamps and the slots at the cross tube ends.
7. Check that zerk fittings are installed. Replace damaged zerk fittings. Replace damaged zerk fittings. **Figure 94.** Refer to **Table E.**

Some tie rod ends have no zerk fittings because they are not greaseable. Do not install a zerk fitting on a non-greaseable design tie rod end.

8. Check that the cotter pin is in place. Replace if missing. Tighten the tie rod end nut to the specified torque and then insert the cotter pin through the castellated nut and the hole in the tie rod end.



**Figure 94**

## Tie Rod Service Tips

If available, a service pit is recommended for tie rod inspection and maintenance. If a service pit is not available, use the following method.

1. Use jacks to raise the vehicle using the following.
  - a. The vehicle must be on a level surface.
  - b. Put blocks under the wheels not being raised to keep the vehicle from moving.
  - c. Raise the vehicle so that the area to be serviced is off the ground. Support the vehicle with safety stands.
  - d. Inspect and lubricate the tie rod ends as specified in **Table E**.

2. Drive-on ramps may also be used. Observe all of the manufacturer's safety recommendations.

## Tie Rods

### Effect of Tie Rod End Wear on Steering Linkage

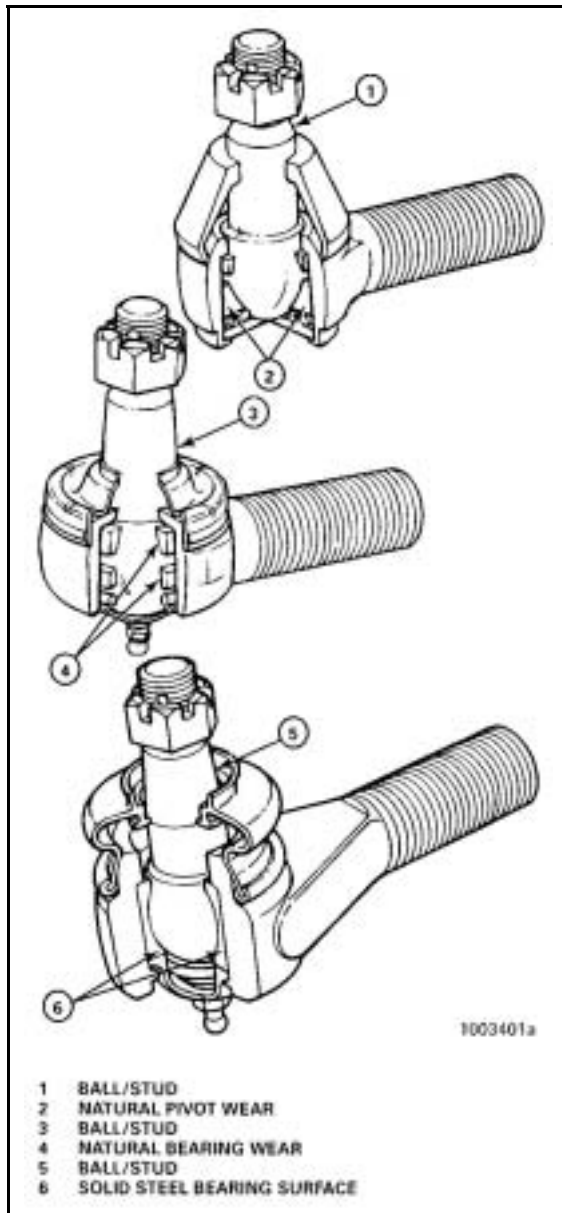
Unless tie rod end wear becomes excessive, a safe steering linkage is maintained. However, tie rod end wear can affect uniform steering control and, ultimately, wear to the front tires.

### Detecting 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. Refer to **Table E** for inspection intervals

### Tie Rod End Wear

It is imperative that inspection and maintenance is performed at the recommended intervals to minimize the impact of tie rod end wear. Tie rod end wear occurs over time, under normal operating conditions. As wear occurs, the preload bearings inside each tie rod end provide less resistance. Excessive tie rod end wear will affect steering and contribute to premature wear of the tires and other axle components. **Figure 95.**



**Figure 95**

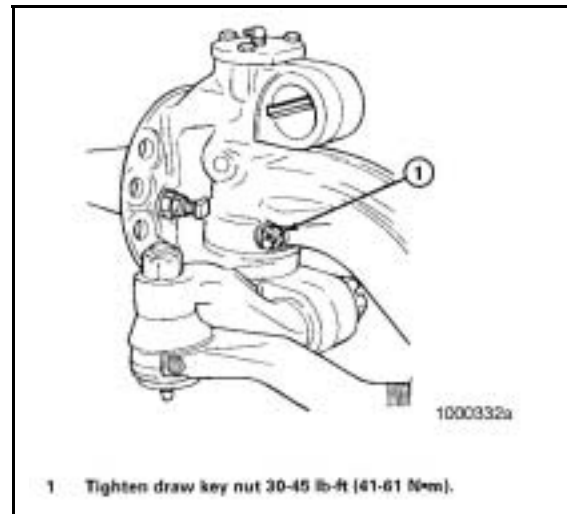
## Tightening Draw Key Nuts

### Note

*This procedure applies to all except 901, 903 and 970 Series axles. These axles do not utilize a draw key. Refer to the identification tag on the front of the axle beam.*

Tighten the nuts that hold the draw keys on the side of the knuckle to 30-45 lb-ft (41-61 N•m) at the following times. **Figure 96.**

- After the first 6,000 miles (10 000 km) of new vehicle operation.
- Every 36,000 miles (58 000 km) of operation.



**Figure 96**

## Checking Steering Arm Bolts

### Warning

*Take care when you use Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.*

### Note

*This procedure applies to ALL axles included in this manual.*

Check steering arm bolts for minimum 300 lb-ft (406 N•m) torque. If steering arm bolt torque has fallen below 300 lb-ft (406 N•m), remove bolts, clean all threads, and install new Loctite®. Tighten bolts from 300 to 450 lb-ft (406-610 N•m) torque. Check steering arm bolt torque every 200,000 miles (320 000 km) or 24 months.

## Note

Old Loctite® must be removed from bolt threads and internal threads of knuckle itself. Reapply new Loctite® 680 (Meritor #2297-K-5523).

## Torque Specifications

### Warning

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

## Front Non-Drive Axles with Conventional Wheel Ends

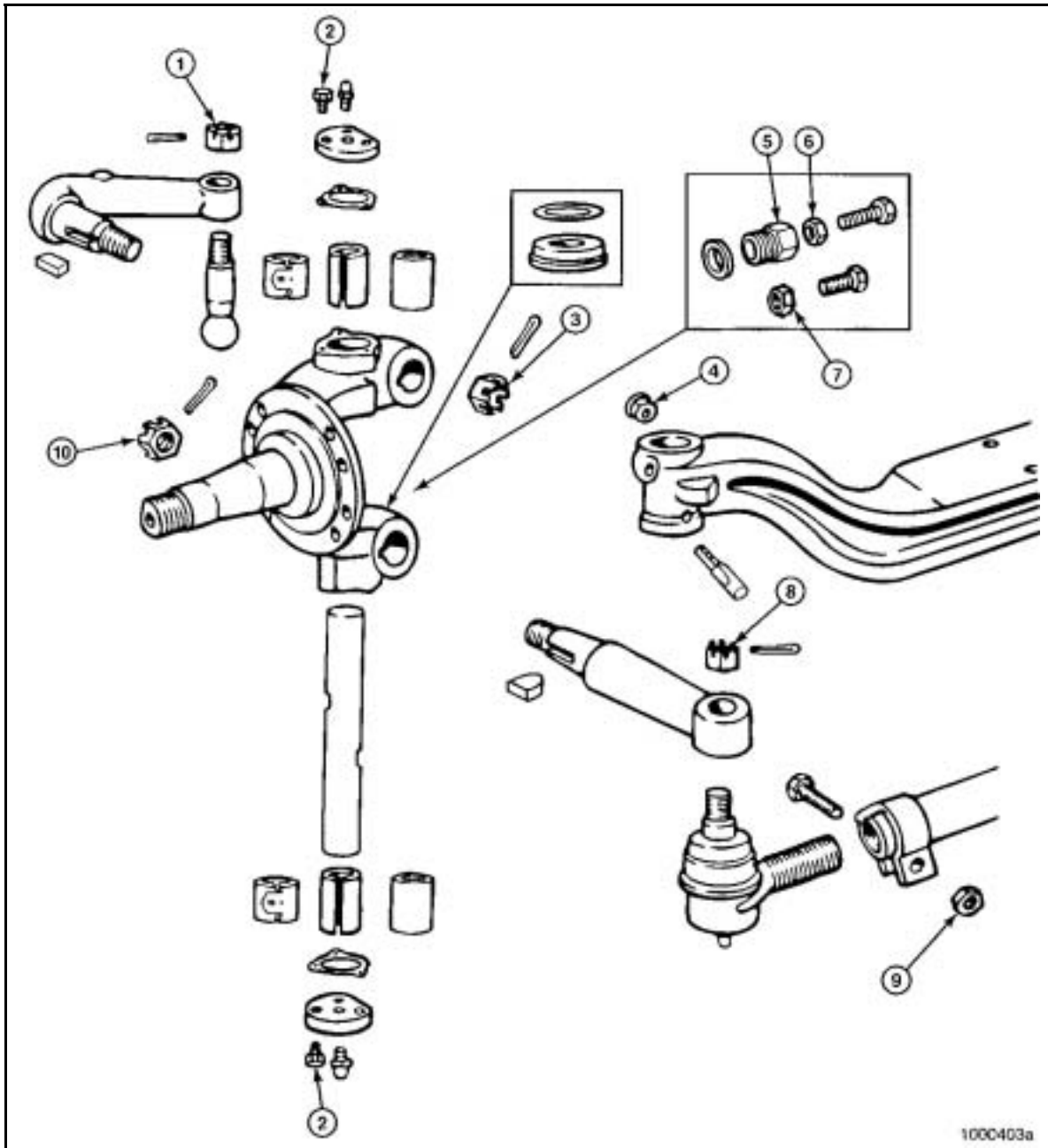


Figure 97

## Front Axle with Conventional Wheel Ends Torque Specifications

Item	Description	Size	Torque Range	
			lb—ft	N•m
1	Steering Arm to Drag Link Nut	5/8"—16	60—115	82—155
		5/8"—18	60—115	92—155
		3/4"—16	90—170	123—230
		7/8"—14	160—300	217—407
2	Knuckle Cap Screw	5/16"—18	20—30	28—40
3	Steering Arm to Knuckle Nut	7/8"—14	250—450	339—610
		1"—14	390—725	529—982
		1-1/8"—12	550—1025	746—1389
		1-1/4"—12	775—1450	1051—1965
		1-1/2"—12	1350—2525	1831—3423
4	Draw Key Nut	7/16"—20	30—45	41—61
5	3/4" Stop Screw Adapter		65—115	88—155
6	1/2" Stop Screw Lock/Jam Nut		50—75	68—101
7	3/4" Stop Screw Lock/Jam Nut		65—85	88—115
8	Tie Rod Arm to Tie Rod End Nut	7/8"—14	160—300	217—406
		1"—14	250—450	339—610
		1-1/8"—12	350—650	475—881
		1-1/4"—12	500—675	678—915
9	Cross Tube Clamp Nut	5/8"—11	40—60	55—81
		3/4"—10	155—175	211—237
10	Tie Rod Arm to Knuckle Nut	7/8"—14	250—450	339—610
		1"—14	390—725	529—982
		1-1/8"—12	550—1025	746—1389
		1-1/4"—12	775—1450	1051—1965
		1-1/2"—12	1350—2525	1831—3423

**Table I—Front Axle with Conventional Wheel Ends**

## Special Tools

Description	Kent-Moore Tool Number (1)	Owatonna Tool Number (2)	Snap-On® Tool Number (3)	References
King Pin Remover	4240	4240	20 Ton: CG430HYB	"Disassembly" Section
King Pin Bushing Service Kit Basic Service Kit FF- and FG- Series Kits FL-Series Kit	(4)  PT 4375-A PT 4370-10  PT 4370-20			"Disassembly" Section

**Table J—Special Tools**

- (1) Order Kent-Moore tools from: *Kent-Moore, 28635 Mound Road, Warren, MI 48092*
- (2) Order Owatonna tools from: *OTC Tool and Equipment Division, 655 Eisenhower Drive, Owatonna, MN 55060*
- (3) See your local Snap-On® dealer.
- (4) Use Basic Service Kit along with the correct axle series kit.

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