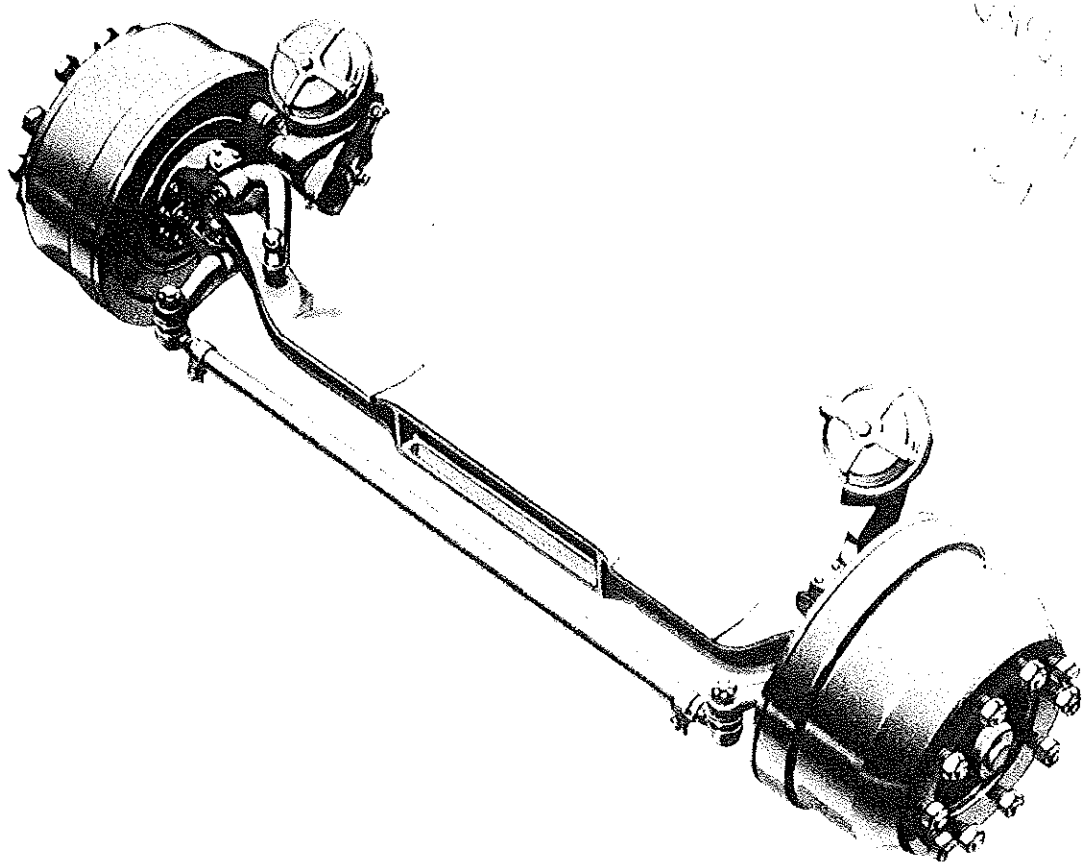
$2.00

MAINTENANCE MANUAL NO. 2
REVISED 6-93

Front Non-Drive Steering Axles

Rockwell



Service Notes

This Maintenance Manual describes the correct service and repair procedures for Rockwell Front Non-Driving Steering Axles.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability.

You must follow your company safety procedures when you service or repair equipment. Be sure you understand all the procedures and instructions before you begin work on the unit.

Rockwell uses the following types of notes to give warning of possible safety problems to give information that will prevent damage to equipment:

⚠ *WARNING*

A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

⚠ *CAUTION*

A caution indicates procedures that must be followed exactly. If the procedure is not followed, damage to equipment or components can occur. Serious personal injury can also occur in addition to damaged or malfunctioning equipment or components.

Ⓣ *TORQUE*

This symbol is used to indicate fasteners that must be tightened to a specific torque value.

NOTE

A note indicates an operation, procedure or instruction that is important for correct service.

Some procedures require the use of special tools for safe and correct service. Failure to use these special tools when required, can cause injury to service personnel or damage to vehicle components.

This manual is written in Rockwell Universal Language System (RULS).

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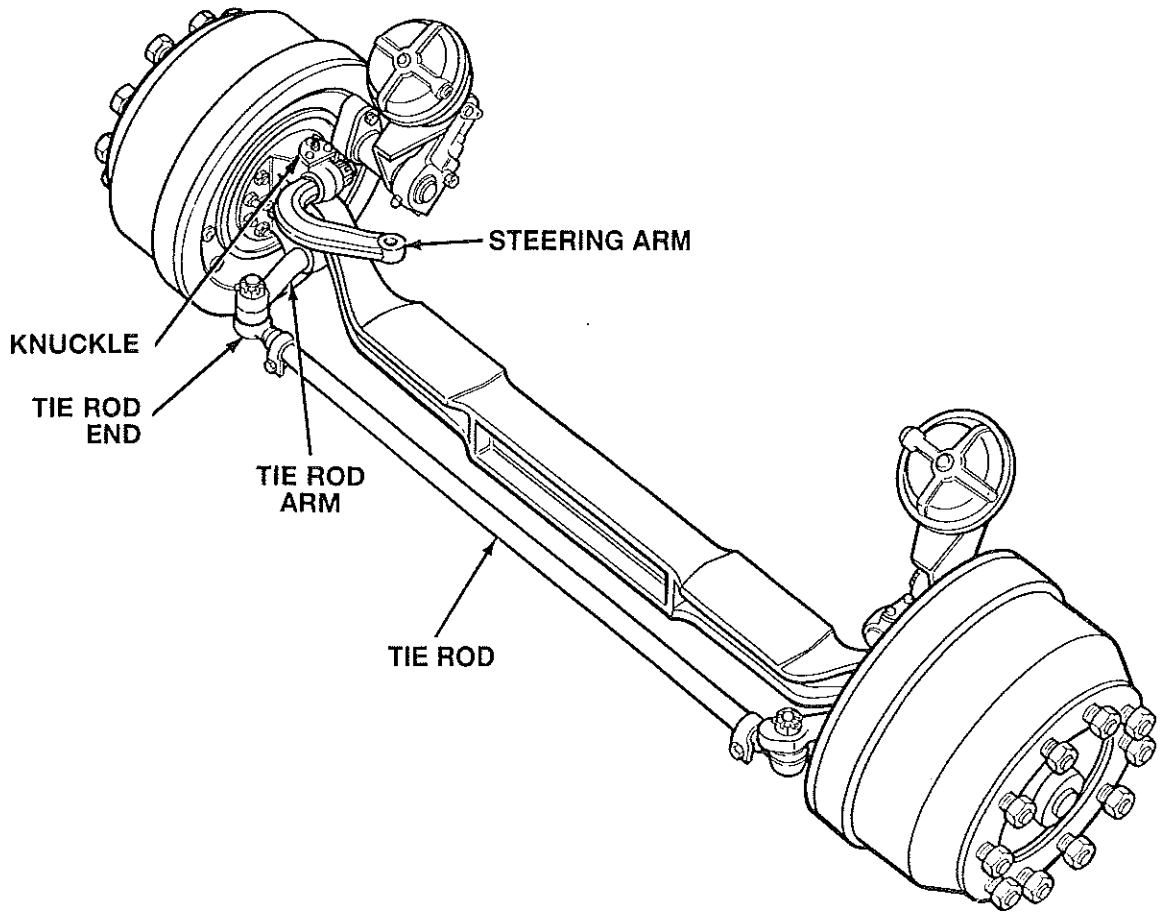
Description

Rockwell non-driving front axles have the following components. **Figure 1.**

- **Tie Rod Arm, Knuckle and King Pin.** The right tie rod is a mirror image of the left and converts the force from the tie rod into a movement to turn the right knuckle, wheel and tire around the king pin. The right knuckle and king pin assembly is similiar 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 knuckle pins. Three types of knuckle bushings are used: nylon, bronze and Easy Steer.™
- **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 a force to the drag link.

Figure 1



Section 1
Introduction

Identification

To identify the model number, see the identification plate on the front of the beam. See the plate to determine the model number of the axle. Use the complete model number to order parts. **Figure 2.**

See **Figure 3** for an explanation of the model number.

For a description of all models, see the chart in **Figure 4.**

Figure 2

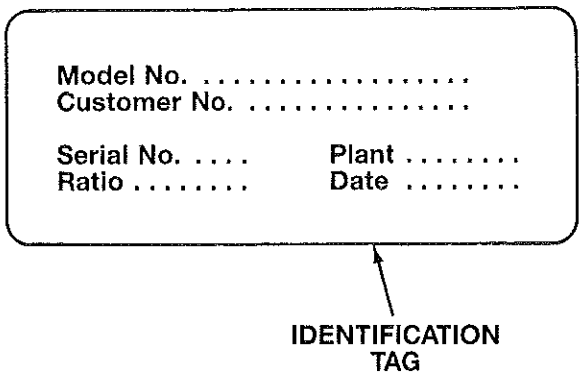


Figure 3

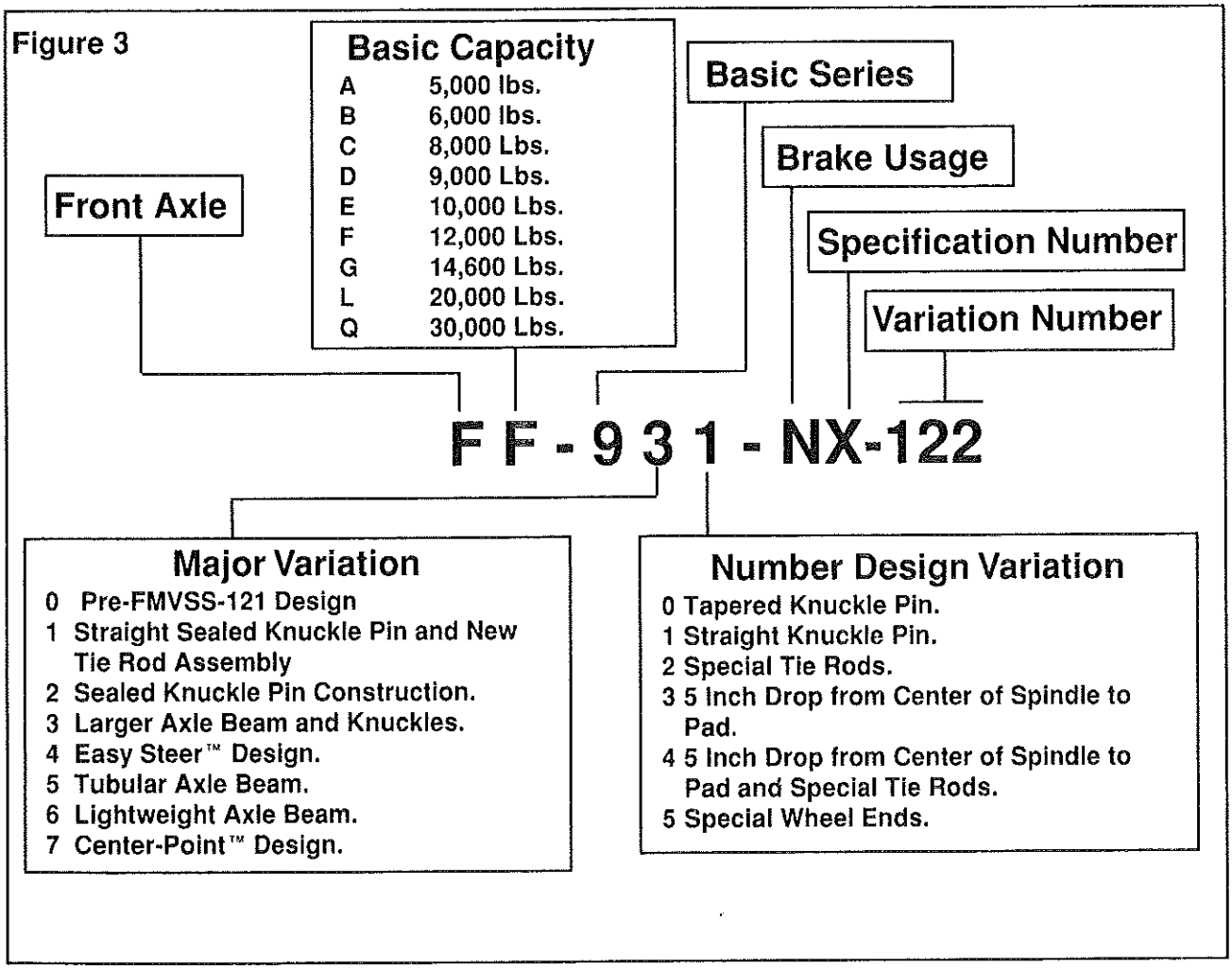


Figure 4 FRONT NON-DRIVING AXLE MODEL NUMBER INFORMATION			
Model Number	**Capacity**	**Major Variation**	**Number Design Variation**
FC-901	7000 lbs.	Pre-FMVSS-121 Design	Straight Knuckle Pin.
FC-903	7000 lbs.	Pre-FMVSS-121 Design	5 Inch Drop from Center of Spindle to Pad.
FC-921	7000 lbs.	Pre-FMVSS Design	Straight Knuckle Pin
FC-941	8000 lbs.	Easy Steer™ Design	Straight Knuckle Pin
FD-901	9000 lbs.	Pre-FMVSS-121 Design	Straight Knuckle Pin
FD-931	9000 lbs.	Larger Axle Beam and Knuckles	Straight Knuckle Pin
FD-933	9000 lbs.	Larger Axle Beam and Knuckles	5 inch Drop from Center of Spindle to Pad.
FD-961	9000 lbs.	Lightweight Axle Beam	Straight Knuckle Pin
FE-970	10,000 lbs.	Center-Point™ Design.	Tapered Knuckle Pin
FF-921	12,000 lbs.	Sealed Knuckle Pin Construction	Straight Knuckle Pin - Off-Highway.
FF-931	12,000 lbs.	Larger Axle Beam and Knuckles	Straight Knuckle Pin.
FF-932	12,000 lbs.	Larger Axle Beam and Knuckles	Special Tie Rods
FF-933	12,000 lbs.	Larger Axle Beam and Knuckles	5 Inch Drop from Center of Spindle to Pad.
FF-934	12,000 lbs.	Larger Axle Beam and Knuckles	5 Inch Drop from Center of Spindle to Pad and Special Tie Rods
FF-941	12,000 lbs.	Easy Steer™ Design.	Straight Knuckle Pin.
FF-942	12,000 lbs.	Easy Steer™ Design.	Special Tie Rods
FF-943	12,000 lbs.	Easy Steer™ Design.	5 inch Drop from Center of Spindle to Pad
FF-944	12,000 lbs.	Easy Steer™ Design.	5 Inch Drop from Center of Spindle to Pad and Special Tie Rods
FF-961	12,000 lbs.	Lightweight Axle Beam	Straight Knuckle Pin.
FF-971	12,000 lbs.	Center-Point™ Design.	Straight Knuckle Pin.
FG-931	14,600 lbs.	Larger Axle Beam and Knuckles	Straight Knuckle Pin.
FG-933	14,600 lbs.	Larger Axle Beam and Knuckles	5 Inch Drop from Center of Spindle to Pad.
FG-941	14,600 lbs.	Easy Steer™ Design.	Straight Knuckle Pin.
FG-943	14,600 lbs.	Easy Steer™ Design.	5 Inch Drop from Center of Spindle to Pad.
FL-931	20,000 lbs.	Larger Beam and Knuckles	Straight Knuckle Pin.
FL-933	20,000 lbs.	Larger Beam and Knuckles	5 Inch Drop from Center of Spindle to Pad.
FL-941	20,000 lbs.	Easy Steer™ Design	Straight Knuckle Pin.
FL-943	20,000 lbs.	Easy Steer™ Design.	5 Inch Drop from Center of Splindle to Pad.
FL-951	20,000 lbs	Tubular Axle Beam	Straight Knuckle Pin.
FU-910	28,000 lbs.	Sealed Knuckle Pin and Tie Rod Assembly – Export	Tapered Knuckle Pin
FU-935	30,000 lbs.	Larger Beam and Knuckles	Special Wheel Ends

Section 2
Troubleshooting

Troubleshooting

See the following charts to troubleshoot the axle.

CONDITION	CAUSE	CORRECTION
Tires wear out quickly or have uneven tire tread wear.	1. Tires have incorrect air pressure. 2. Tires out-of-balance. 3. Incorrect tandem axle alignment. 4. Incorrect toe-in setting. 5. Incorrect steering arm geometry.	1. Put specified air pressure in tires. 2. Balance or replace tires. 3. Align tandem axles. 4. Adjust toe-in specified setting. 5. Service steering system as necessary.
Vehicle is hard to steer.	1. Low pressure in the power steering system. 2. Steering gear not assembled correctly. 3. Steering linkage needs lubrication. 4. King pins binding. 5. Incorrect steering arm geometry. 6. Caster out-of-adjustment. 7. Tie rod ends hard to move. 8. Worn thrust bearing.	1. Repair power steering system. 2. Assemble steering gear correctly. 3. Lubricate steering linkage. 4. Replace king pins. 5. Service steering system as necessary. 6. Adjust caster as necessary. 7. Replace tie rod ends. 8. Replace thrust bearing.
Ends of the cross tube are worn.	1. Ends of the cross tube need lubrication. 2. Severe operating conditions. 3. Damaged boot on end of cross tube. 4. Add-on type of power steering cylinders not installed correctly.	1. Lubricate ends of cross tube. Make sure lubrication schedule is followed. 2. Operate vehicle correctly. 3. Replace boot. 4. Install power steering cylinders correctly.
Bent or broken cross tube, ball stud, steering arm or cross tube arm.	1. Too much pressure in the power steering system. 2. Cut-off pressure of the power steering system out-of-adjustment. 3. Vehicle not operated correctly. 4. Add-on type of power steering system not installed correctly.	1. Adjust power steering system to specified pressure. 2. Adjust power steering system to specified pressure. 3. Make sure vehicle is operated correctly. 4. Correctly install add-on power steering system.

CONDITION	CAUSE	CORRECTION
Worn or broken steering ball stud.	1. Drag link fasteners tightened past specified torque. 2. Lack of lubrication or incorrect lubricant. 3. Power steering stops out-of-adjustment.	1. Tighten drag link fasteners to specified torque. 2. Lubricate linkage with specified lubricant. 3. Adjust stops to specified dimension.
Worn king pins and knuckle bushings.	1. Worn or missing seals and gaskets. 2. Incorrect lubricant. 3. Axle not lubricated at scheduled frequency. 4. Incorrect lubrication procedures. 5. Lubrication schedule does not match operating conditions.	1. Replace seals and gaskets. 2. Lubricate axle with specified lubricant. 3. Lubricate axle at scheduled frequency. 4. Use correct lubrication procedures. 5. Change lubrication schedule to match operating conditions.
Vibration or shimmy of front axle during operation.	1. Caster out-of-adjustment. 2. Wheels and/or tires out-of-balance. 3. Worn shock absorbers.	1. Adjust caster. 2. Balance or replace wheels and/or tires. 3. Replace shock absorbers.

Section 3
Inspection

Inspection

Do 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.

CAUTION

The repair or reconditioning of front axle components is not allowed. Rockwell 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.

- **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 througth the complete turning radius.
- **Tire Wear.** Inspect the tires for wear patterns that indicate suspension damage or misalignment.

Checking the Vertical End Play of the Steering Knuckle

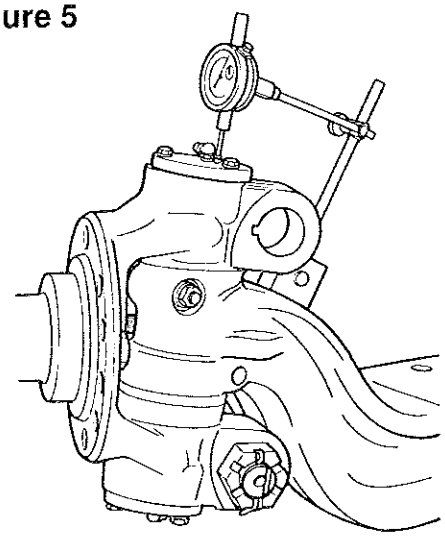
1. Put blocks in front and behind the rear wheels to prevent the vehicle from moving.

WARNING

Do not work under a vehicle only supported by jacks. Jacks can slip or fall over and cause serious personal injury.

2. Use a jack to raise the vehicle until the front wheets 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 5.**
4. Put 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 6.**
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.

Figure 5

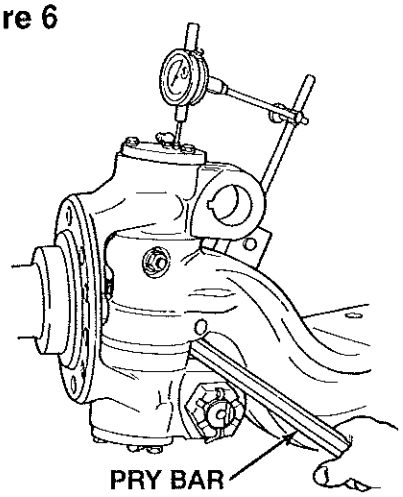


The reading must be 0.001-0.025 inch (0.025-0.635 mm) for new or rebuilt axles and 0.001-0.065 inch (0.025-1.650 mm) for axles in service. **Figure 6.**

If the reading is 'zero' (0), remove the knuckle and remove shims from the shim pack. See Sections 6-8 of this manual.

If the reading is more than the maximum specification, remove the knuckle and add shims to the shim pack. See Sections 6-8 of this manual.

Figure 6



Checking the Knuckle Bushings for Wear

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

WARNING

Do not work under a vehicle only supported by jacks. Jacks can slip or fall over and cause serious personal injury.

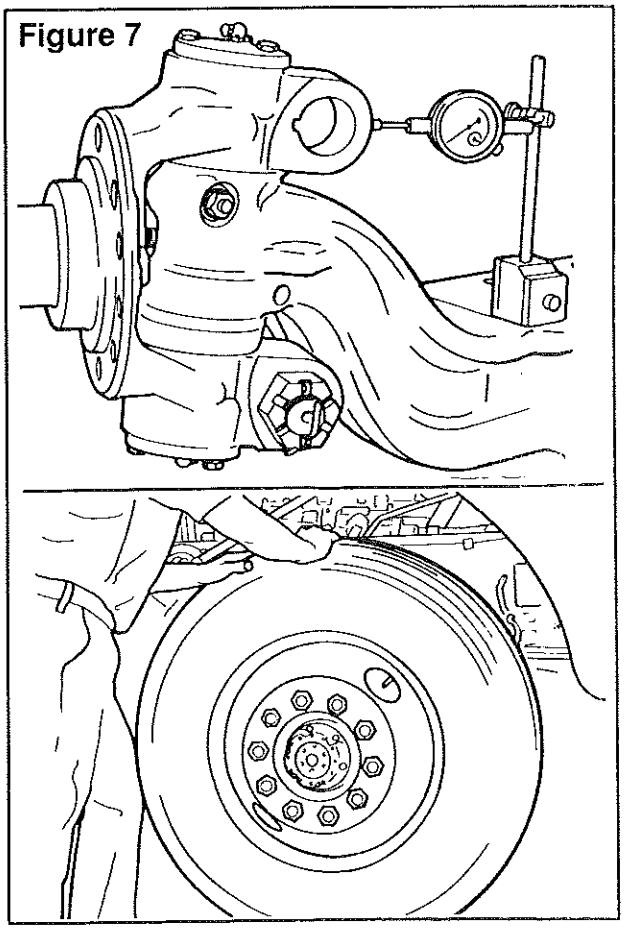
2. Use a jack to raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.
3. Check the upper knuckle bushing for wear. Install a dial indicator so that the base is on the I-beam and that the tip is against the side of the top of the knuckle. **Figure 7.**
4. Set the dial indicator on 'zero' (0).

NOTE

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

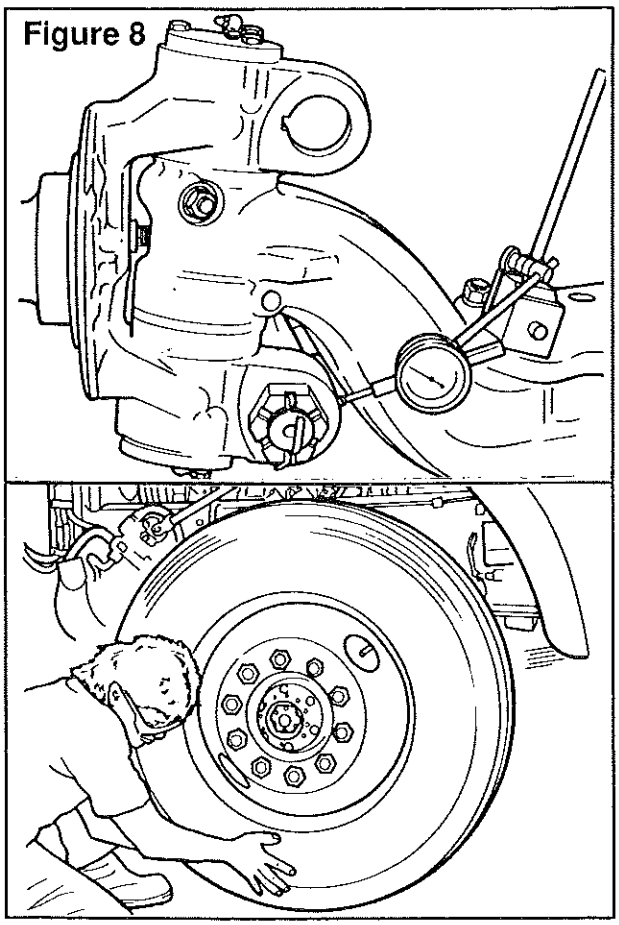
5. Move the top of the tire side-to-side towards and away from the vehicle. If the dial indicator moves a total of 0.010 inch (0.254 mm), the upper bushing is worn or damaged. Replace both bushings. See Sections 6-8 of this manual. **Figure 7.**
6. Check the lower knuckle bushing. Install a dial indicator so that the base is on the I-beam and that the tip is against the side of the bottom of the knuckle. **Figure 8.**

Figure 7



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 (0.254 mm), the lower bushing is worn or damaged. Replace both bushings. See Sections 6-8 of this manual. **Figure 8.**

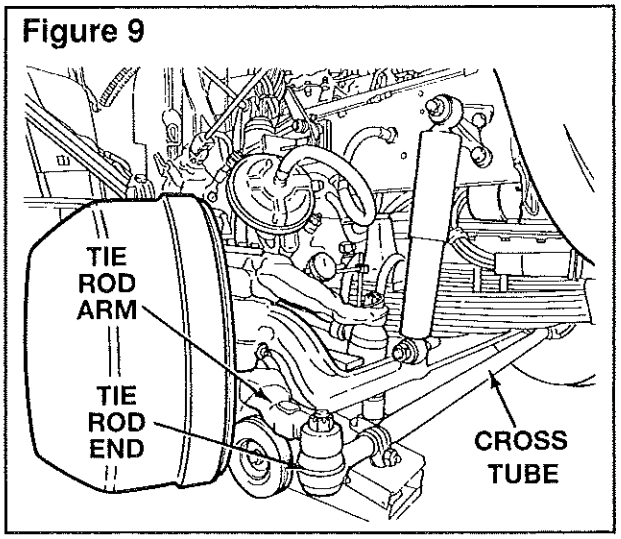
Figure 8



Checking the Tie Rod Ends

Grab and try to move the cross tube in any direction. If any movement or looseness is felt between the tie rod ends and the tie rod arms, remove and replace the tie rod ends. See Sections 6-8 of this manual. **Figure 9.**

Figure 9



Lubricant Specifications

Figure 10: Front Non-Driving Axle Greasing Intervals and Specifications
(APPLIES TO ALL EXCEPT FC-901, FC-903, FC-941, FD-901, FE-970, FU-910 AND FU-935 AXLES)

Component	Greasing Interval	Grease	Rockwell Specification	NLGI Grade	Grease Classification
King Pins and Bushings	50,000 miles (4,800 kilometers) or once a year whichever comes first	Multi-Purpose Grease	O-617-A	1	6% Lithium 12-Hydroxy Stearate
Ball Studs on Steering Arm,Tie Rod Arm Ends and Drag Link ①			O-617-B	2	8% Lithium 12-Hydroxy Stearate

① Applies to ball studs on conventional and Easy Steer axles. For sealed axles, inspect the boot on the ball stud every 96,000 miles (154,000 km) for wear and damage. Service as necessary.

Figure 11: Front Non-Driving Axle Greasing Intervals and Specifications
(APPLIES TO FC-901, FC-903, FC-921, FD-901, FE-970, FU-910 AND FU-935 AXLES)

Component	Greasing Interval	Grease	Rockwell Specification	NLGI Grade	Grease Classification
King Pins and Bushings	3,000 miles (4,800 kilometers)	Multi-Purpose Grease	O-617-A	1	6% Lithium 12-Hydroxy Stearate
Ball Studs on Steering Arm, Tie Rod Arm Ends and Drag Link ①	50,000 miles (80,000 kilometers) or once a year whichever comes first		O-617-B	2	8% Lithium 12-Hydroxy Stearate

① Applies to ball studs on conventional and Easy Steer axles. For sealed axles, inspect the boot on the ball stud every 96,000 miles (154,000 km) for wear and damage. Service as necessary.

Figure 12: Wheel End Oil Change Intervals and Specifications

On-Highway Operation Intervals		Off-Highway Operation Intervals		Rockwell Specification	Military Specification	Oil Description	Outside Temperature			
							F°		C°	
Check Oil Level	Petroleum Oil Change	Check Oil Level	Petroleum Oil Change				Min.	Max.	Min.	Max.
1,000 miles (1,600 kilometers)	Whichever comes first: Seals replaced. Brakes relined. 100,000 miles (160,000 kilometers). Once a year.	1,000 miles (1,600 kilometers)	Whichever comes first: Seals replaced. Brakes relined. Once a year. Whichever comes first: Seals replaced. Brakes relined. Once a year.	0-76A, Gear Oil	MIL-L-2105-D	GL-5, SAE 85W/140	>10	None	12	None
				0-76D, Gear Oil	MIL-L-2105-D	GL-5, SAE 80W/90	-15	None	-26	None
				0-76E, Gear Oil	MIL-L-2105-D	GL-5, SAE75W/90	-40	None	-40	None
				0-76J, Gear Oil	MIL-L-2105-D	GL-5, SAE 75W	-40	36	-40	2
				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

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.

Section 4
Lubrication and Maintenance

General

Lubricate the king pins, the ball studs on the tie rod arm ends, the ball stud on the steering arm and the grease lubricated wheel bearings with the approved lubricant. See **Figures 10** and **11.**

Lubricate the oil lubricated wheel bearings with the oil specified in **Figure 12.**

When to Lubricate the Assemblies and Maintenance

See the Chart in **Figure 19** at the end of this section.

King Pins – Conventional Front Axles

NOTE

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

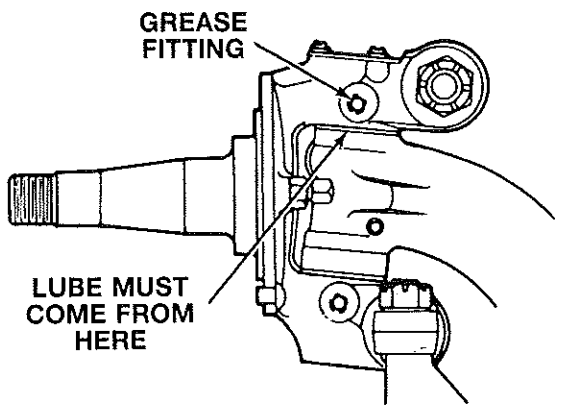
On conventional front axles, the grease fittings are on the side of the knuckle.

WARNING

Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

1. Lift the vehicle so that the tires are off the ground. The tires should be off the ground when the king pins are lubricated. Support the vehicle with safety stands. Put blocks in front and in back of the rear wheels to keep the vehicle from moving.
2. Lubricate the king pins through the top and the bottom grease fittings on the side of the knuckle. **Figure 13.**
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 13



King Pins – Sealed and Easy Steer™ Front Axles

NOTE

This procedure applies to 911, 921, 931, 932, 933, 934, 941, 942, 943, 951, 961, 963, 971 and 975 Series sealed front axles. See the identification tag on the front of the axle beam.

On sealed and Easy Steer™ front axles, the grease fittings are on the top and bottom king pin caps of the knuckle.

1. Make sure the tires touch the ground. DO NOT RAISE THE VEHICLE.
2. Lubricate the king pins through the grease fittings on the top and bottom of the knuckle. **Figure 14.**
3. Apply lubricant until new lubricant comes from the thrust bearing seal and the upper shim pack.

Figure 14

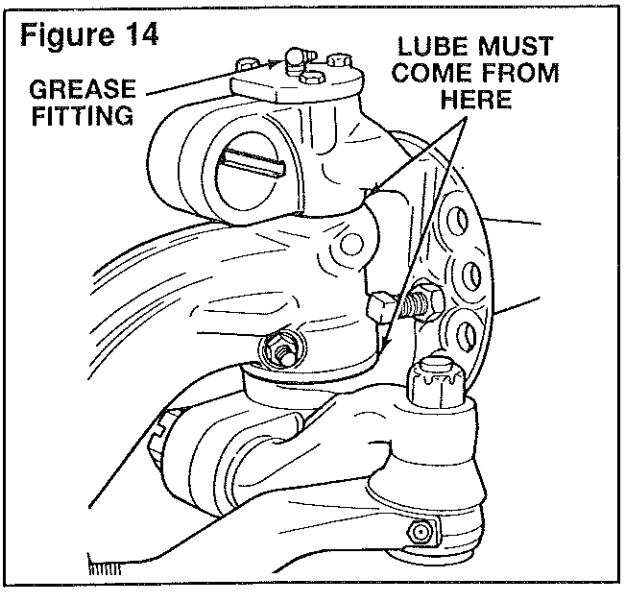
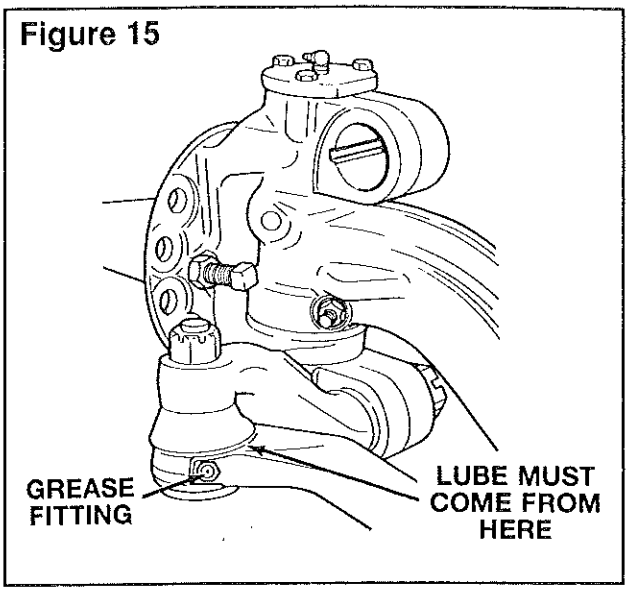


Figure 15



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

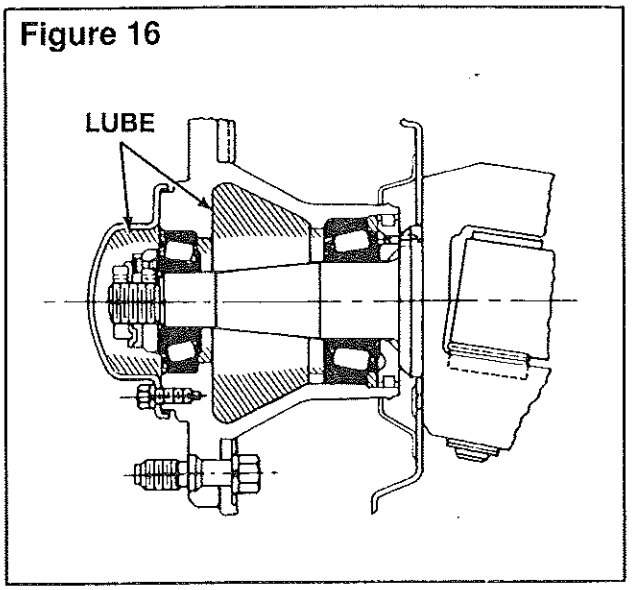
1. Make sure the tires touch the ground.
2. Apply lubricant until new lubricant comes from the boot. **Figure 15.**

Grease-Lubricated Wheel Bearings

See Figure 16.

1. Remove the tire and wheel assembly. Remove and disassemble the hub. See 'Removing the Wheel Ends' in Section 6.
2. Remove the old lubricant from all parts. Discard the seals. Inspect the wheel bearings for wear or damage. Replace worn or damaged bearings. See Section 7, 'Preparing the Parts for Assembly'.
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 smallest diameter of the cups.

Figure 16



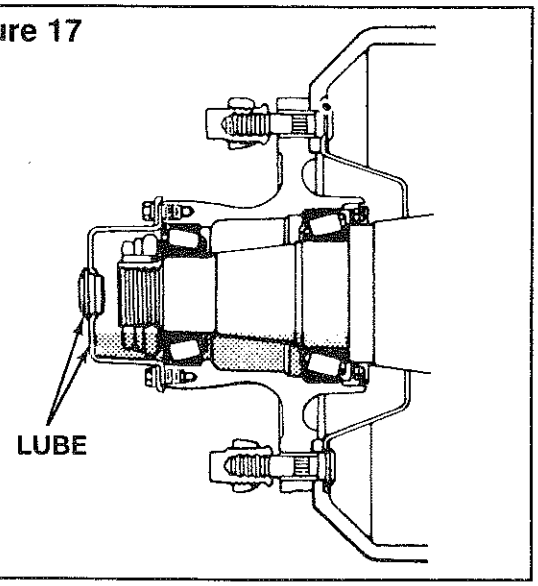
4. Install the inner and outer bearing cones into the cups in the hubs. The bearing cups must be pressed tight against the shoulder in the hubs.
5. Install new wheel seals in the hubs.
6. Install the hub and the wheel and tire assembly. Install the outer wheel bearing cone in the hub. Install the adjusting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

Section 4
Lubrication and Maintenance

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 17.**

Figure 17



Tightening Draw Key Nuts

NOTE

This procedure applies to all except 901, 903 and 970 Series axles. See 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 18.** T

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

Figure 18

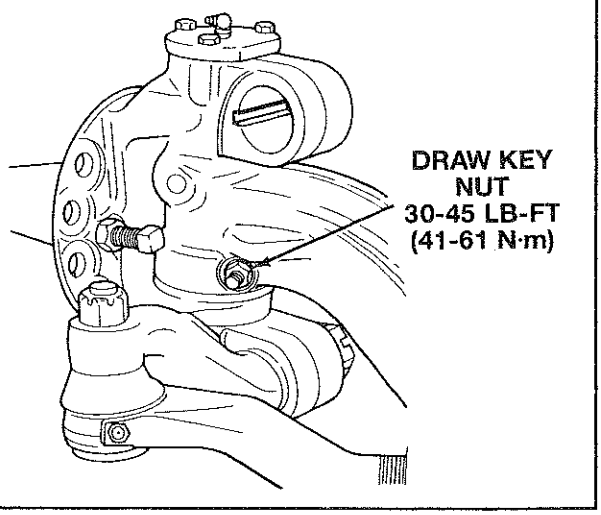


Figure 19

Lubrication Intervals

Model Number	King Pins and Bushings		Ball Stud and Grease Lubricated Wheel Bearing Interval	Oil Lubricated Wheel Bearing Interval
	Lubrication Interval	Wheel Position		
FC-901	3,000 miles (4,800 km)	Off Ground	**Ball Studs on Conventional and Easy Steer Axles: Lubricate every 50,000 miles (80,500 km) or 12 months, whichever comes first.** **Ball Studs on Sealed Axles: Inspect the boot on the ball studs every 96,000 miles (154,000 km) for wear and damage. Service as necessary.** **Grease Lubricated Wheel Bearings: Change the grease when seals are replaced, the brakes are relined or for On-Highway Operation every 30,000 miles (48,000 km) or twice a year and for On/Off Highway and Off Road Operation twice a year.**	**Oil Lubricated Wheel Bearings: Check the oil level every 1,000 miles (1,600 km). Change the oil when seals are replaced, the brakes are relined or for On-Highway Operation every 100,000 miles (161,000 km) or once a year and for On/Off Highway and Off Road Operation once a year.**
FC-903	3,000 miles (4,800 km)	Off Ground		
FC-921	3,000 miles (4,800 km)	Off Ground		
FC-941	50,000 miles (80,500 km) or 12 months	On Ground		
FD-901	3,000 miles (4,800 km)	Off Ground		
FD-931	50,000 miles (80,500 km) or 12 months	On Ground		
FD-933	50,000 miles (80,500 km) or 12 months	On Ground		
FD-961	50,000 miles (80,500 km) or 12 months	On Ground		
FE-970	3,000 miles (4,800 km)	Off Ground		
FF-921	50,000 miles (80,500 km) or 12 months	On Ground		
FF-931	50,000 miles (80,500 km) or 12 months	On Ground		
FF-932	50,000 miles (80,500 km) or 12 months	On Ground		
FF-933	50,000 miles (80,500 km) or 12 months	On Ground		
FF-934	50,000 miles (80,500 km) or 12 months	On Ground		
FF-941	50,000 miles (80,500 km) or 12 months	On Ground		
FF-942	50,000 miles (80,500 km) or 12 months	On Ground		
FF-943	50,000 miles (80,500 km) or 12 months	On Ground		
FF-944	50,000 miles (80,500 km) or 12 months	On Ground		
FF-961	50,000 miles (80,500 km) or 12 months	On Ground		
FF-971	50,000 miles (80,500 km) or 12 months	On Ground		
FG-931	50,000 miles (80,500 km) or 12 months	On Ground		
FG-933	50,000 miles (80,500 km) or 12 months	On Ground		
FG-941	50,000 miles (80,500 km) or 12 months	On Ground		
FG-943	50,000 miles (80,500 km) or 12 months	On Ground		
FL-931	50,000 miles (80,500 km) or 12 months	On Ground		
FL-933	50,000 miles (80,500 km) or 12 months	On Ground		
FL-941	50,000 miles (80,500 km) or 12 months	On Ground		
FL-943	50,000 miles (80,500 km) or 12 months	On Ground		
FL-951	50,000 miles (80,500 km) or 12 months	On Ground		
FU-910	3,000 miles (4,800 km)	Off Ground		
FU-935	3,000 miles (4,800 km)	Off Ground		

Section 5
Adjustments

Inspection Before Alignment

Check the following before doing a front wheel alignment.

Inspection

See 'Inspection' in Section 3, Inspection.

Wheels and Tires

- 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.

Front Suspension

- 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. See the procedure of the manufacturer of the vehicle or the suspension.
- Refer to any additional recommendations and specifications from the manufacturer of the vehicle on rear axles and suspensions.

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.

There are two types of front wheel alignment: a minor alignment and a major alignment.

Minor Front Wheel Alignment

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

Do the minor front wheel alignment in the following sequence:

1. Inspect all the systems that affect the wheel alignment. See 'Inspection Before Alignment' in this section.
2. Check and adjust the wheel bearings.
3. Check and adjust the toe-in.

Major Front Wheel Alignment

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

Do the major front wheel alignment in the following sequence:

1. Inspect all the systems that affect the wheel alignment. See 'Inspection Before Alignment' in this section.
2. Check and adjust the wheel bearings.
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. See the procedure on page 21.
5. Check and adjust the turning radius angle (toe-out on turns or Ackerman angle).
6. Check the king pin (or steering axis) inclination.
7. Check the camber angle.
8. Check and adjust the caster angle.
9. Check and adjust the toe-in.

Section 5
Adjustments

Checking and Adjusting the Wheel Bearings

WARNING

Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

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. **Figure 20.**

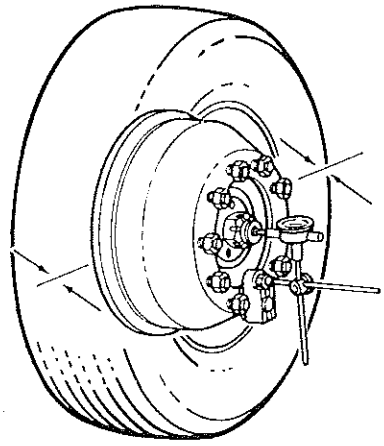
NOTE

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 the 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 0.001-0.005 inch (0.025-0.127 mm), adjust the wheel bearings. **Figure 20.**
6. If necessary, adjust the wheel bearings. See steps 7-13.

Figure 20

WITH INDICATOR MOUNTED AT BOTTOM, PUSH/PULL AT SIDES OF TIRE



7. **On Double Nut and Lock Fasteners,** bend the lockwasher off the jam nut. Remove the jam nut, the lockwasher and the pierced lock ring. **Figure 21.**

   On Single Nut Fasteners, remove the cotter pin from the adjusting nut. **Figure 22.**

NOTE

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

Figure 21

DOUBLE NUT AND LOCK ADJUSTMENT

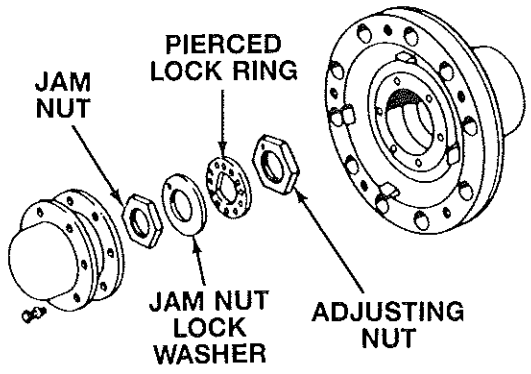
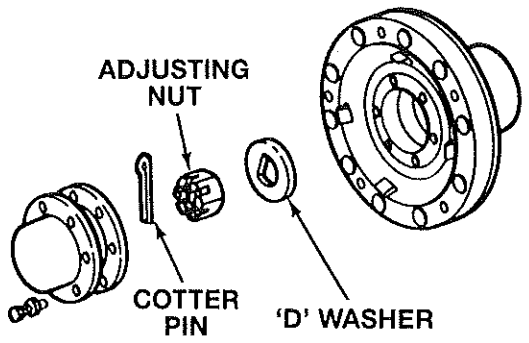


Figure 22

SINGLE NUT ADJUSTMENT

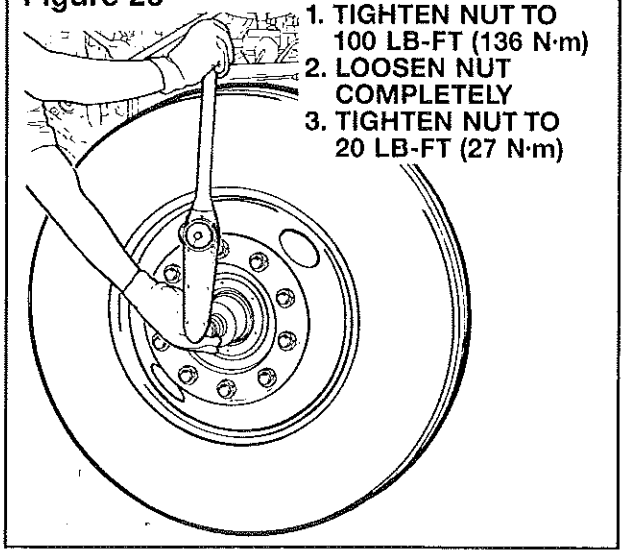


CAUTION

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

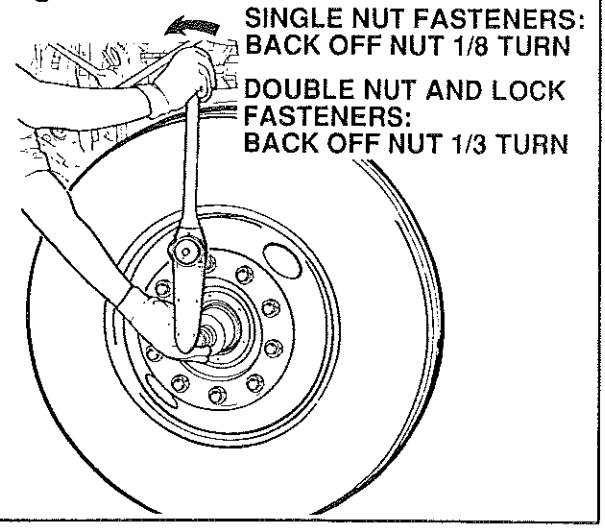
8. Use a torque wrench to tighten the adjusting nut to 100 lb-ft (136 N•m) while rotating the tire in both directions. **Figure 23.**
9. Loosen the nut completely and then tighten the nut to 20 lb-ft (27 N•m) while rotating the tire. **Figure 23.**

Figure 23



10. **On Single Nut Fasteners,** do the following:
    a. Back off the adjusting nut 1/8 turn. **Figure 24.**
    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). See steps 4-5. Readjust if necessary.
11. **On Double Nut and Lock Fasteners,** do the following:
    a. Back off the adjusting nut 1/3 turn. **Figure 24.**
    b. Install the pierced lock ring, the lockwasher and the jam nut.
    c. For jam nuts in sizes from 1-1/8 inch up to 2-5/8 inch, tighten to 200-300 lb-ft (271-407 N•m). For jam nuts 2-5/8 inch and more, tighten to 250-400 lb-ft (339-542 N•m). T
    d. Measure the end play. The end play must be 0.001-0.005 inch (0.025-0.127 mm). See steps 4-5. Readjust if necessary.
12. Install the gasket and the cap on the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N•m). T
13. Lower the vehicle to the ground. Check the correct vehicle operation.

Figure 24



Section 5
Adjustments

Adjusting the Maximum Turn Angle

⚠ CAUTION

Adjust the maximum turn angle only if the manufacturer of the vehicle specifies the adjustment. Do not increase the maximum turn angle. If the angle is increased, 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. See the procedure of the manufacturer of the equipment.

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

For power steering systems, the stop bolt should **NOT** touch the knuckle or beam (depending where installed). The stop bolt should always have a minimum clearance of 1/8 inch (3 mm) as shown in **Figure 25.**

For manual steering systems, Rockwell recommends a stop bolt clearance of 1/8 inch (3 mm). Stop bolt contact is acceptable if no other stops are used in the steering system.

⚠ CAUTION

If the stop bolt is missing, bent or broken, the system requires adjustment. See '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 penetrant inspection procedure to inspect the steering arm. Pay particular attention tothe bend, the taper and the area near the ball stud. See the procedure of the manufacturer of the vehicle for additional procedures.

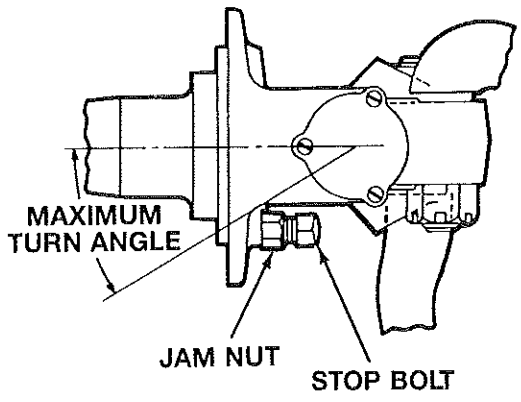
⚠ CAUTION

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.

1. Put a 1/8 inch (3 mm) spacer between the 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. Measure the turn angle.
3. If the maximum turn angle is not to the specifications of the manufacturer of the vehicle, see the following.
   A. Loosen the jam nut on the stop bolt.
   B. Turn the stop bolt until the specified angle is obtained. **Figure 25.**
   C. Tighten the jam nut to 50-65 lb-ft (68-88 N•m). T

Figure 25

KNUCKLE POSITIONS FOR STOP BOLT ADJUSTMENT



Adjusting the Pressure Relief in the Power Steering System

The pressure relief in the power steering system stops or reduces pressure applied to the axle in the full turn positions.

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

Rockwell 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.

Mechanical Stop

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

NOTE

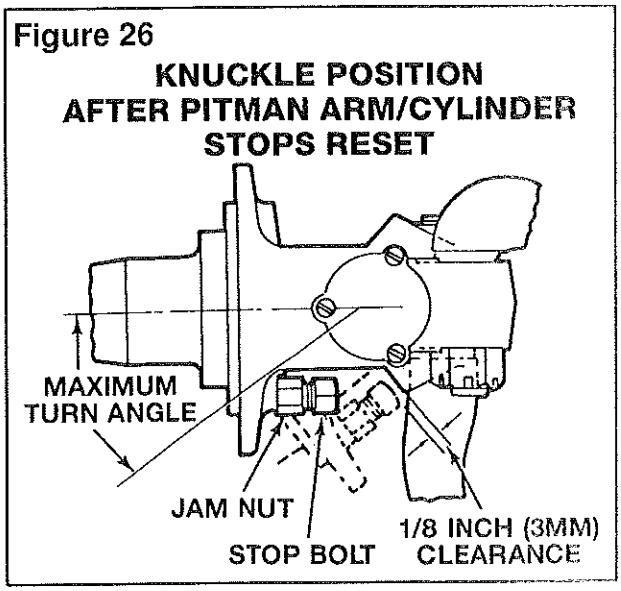
See the specified procedure of the manufacturer of the vehicle.

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.

Systems with mechanical stops are adjusted to stop travel 1/8 inch (3 mm) before the stop bolt touches the boss on the axle beam. The adjustment is done on full right and full left turn positions. **Figure 26.**

Figure 26



Hydraulic Pressure Relief in the Steering Gear

NOTE

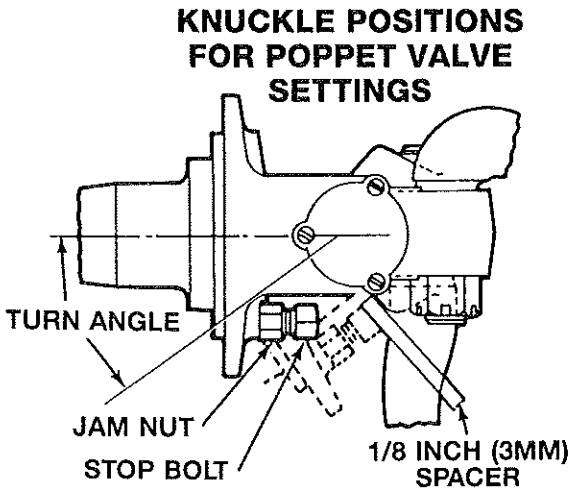
See the specified procedure of the manufacturer of the vehicle.

NOTE

The stop bolt should always have a minimum clearance of 1/8 inch (3 mm).

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 pressure at the distance of the spacer. **Figure 27.**

Figure 27



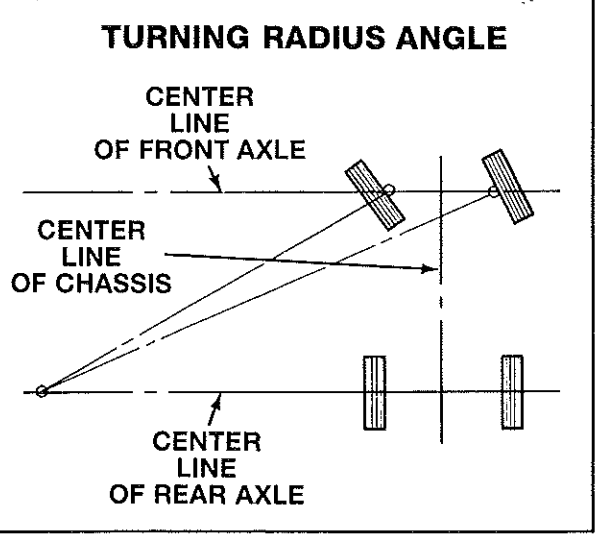
Turning Radius Angle

See Figure 28.

When turning, the inner wheel must turn in a greater angle than the outer wheel. This angle is the turning radius angle (often called the Ackermann angle). 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. See the procedure of the manufacturer of the equipment.

Figure 28



If the angle is not within specifications, 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

See Figure 29.

NOTE

See the specifications of the manufacturer of the vehicle for the king pin inclination specifications.

King pin (or steering axis) inclination is the angle measured between the centerline of the king pin and the vertical position (as viewed from the front of the vehicle). The king pin inclination and the camber angle put the approximate center of the tire tread in contact with the road. This reduces steering effort and improves directional stability.

Use an alignment machine to check the king pin inclination angle. See the procedure of the manufacturer of the equipment.

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 29

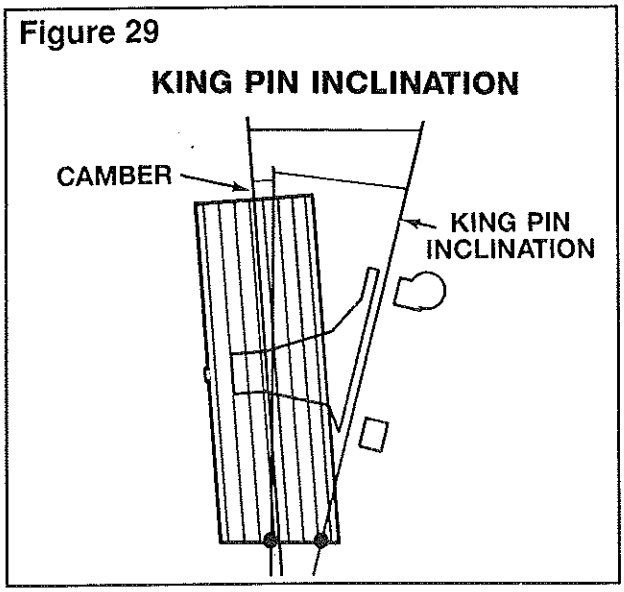
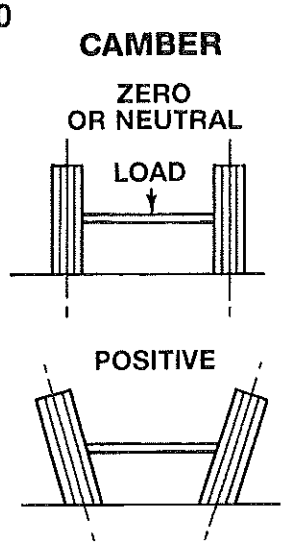


Figure 30



Camber Angle

See Figure 30.

⚠ CAUTION

The camber angle is not adjustable. Rockwell does not recommend changing the camber angle or bending the axle beam. If the axle beam is bent to change the camber angle, the strength of the axle is reduced and the warranty is voided. The axle may be damaged if bent. An axle damaged by bending may 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. 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 1-1/27, tire wear will occur. Bias ply tires will show tire wear because of too much camber more than radial tires.

The camber angle is not adjustable. The camber angle is machined into the axle beam. If the camber angle is not at the specified angle, check the axle beam and the steering knuckle for damage. Service as necessary.

Use an alignment machine to check the camber angle. See the procedure of the manufacturer of the equipment.

See the specifications of the manufacturer of the vehicle for the correct camber setting. The chart in **Figure 31** gives the specification Rockwell builds into the axle but always use the specification of the manufacturer of the vehicle.

Figure 31

CAMBER ANGLE RECOMMENDATIONS

	OLD CAMBER SPECIFICATION AXLES WITH ASSEMBLY DATES: • No date indicated on tag • August 31, 1992 (92244) or earlier • Any date with a "P" suffix		NEW CAMBER SPECIFICATION AXLES WITH ASSEMBLY DATES: • September 1, 1992 (92245) or later with no "P" suffix
CONDITIONS	**LEFT SIDE**	**RIGHT SIDE**	**LEFT AND RIGHT SIDES**
Camber angles machined into axles • Hubs not installed. • Axle 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 • Axle not installed in vehicle. • Load not applied on axle.	+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)

Identifying The Axle Assembly Dates of Front Non-Drive Axles

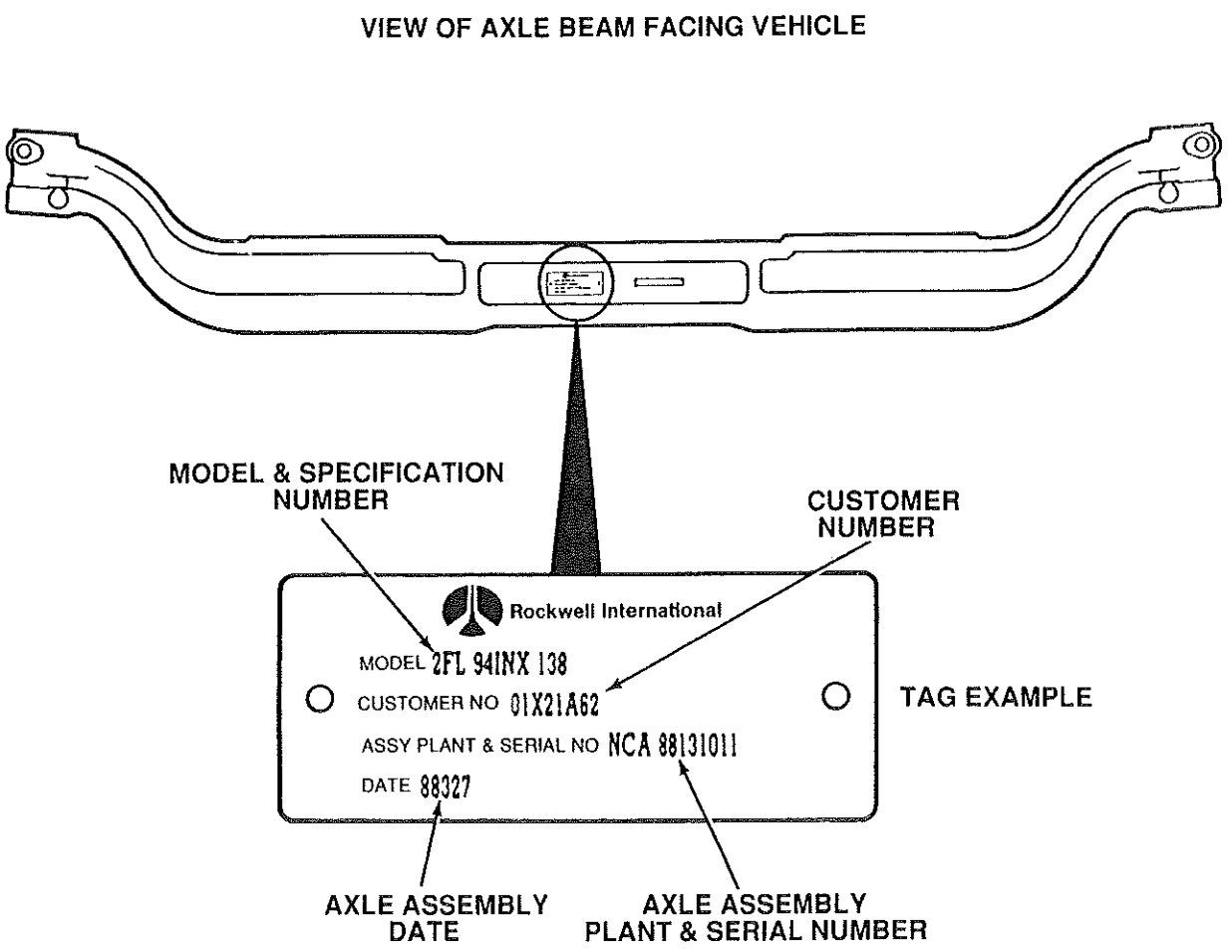
All the necessary axle build information, including assembly date, for any Rockwell front non-drive axle is indicated on the axle identification tag. **Figure 32.**

The identification tag is fastened to the center of the beam at the front surface.

The axle assembly date is located in either the lower right hand or left hand corner of the tag.

If the Julian dating method is used to indicate the axle assembly date as shown in **Figure 32,** the first two digits indicate the year and the last three digits indicate the day of the year. In the example 88327 shown below, 88 is the year or 1988 and the 327th day equates to November 22nd.

Figure 32



Section 5
Adjustments

Caster Angle

See Figure 33.

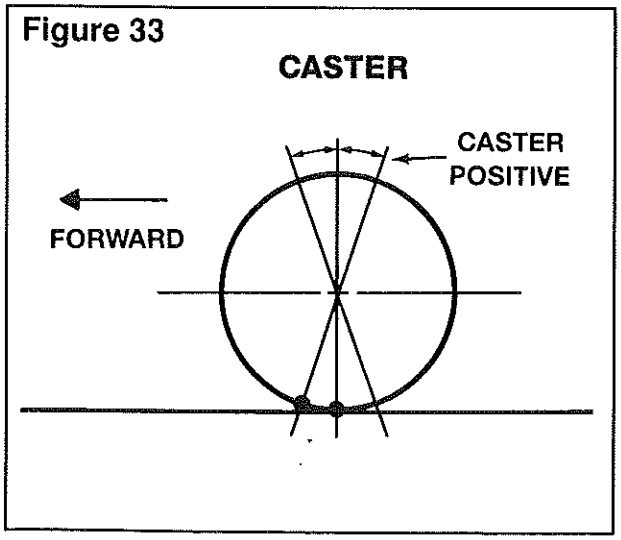
The caster angle is the angle from the vertical position to the centerline of the king pin when seen from the side of the vehicle. If the top of the king pin axis is toward the rear of the vehicle, the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead. If caster is too much, steering effort will increase or may amplify a shimmy condition.

The caster angle is controlled by tapered shims installed under the leaf springs. Adjust caster according to the procedure of the manufacturer of the vehicle.

Use an alignment machine to check the caster angle. See the procedure of the manufacturer of the equipment.

Caster specifications are supplied by the vehicle manufacturer. **See the specifications of the vehicle manufacturer for the caster setting.** If caster specifications are not available from the vehicle manufacturer, Rockwell recommends a caster setting of +1° to +2-1/2° for vehicles with manual steering and +2° to +4-1/2° for vehicles with power steering. FE-970 and FE-971 axles have a recommended caster setting of -1/2° to -2°.

Figure 33



Adjusting the Toe-In

Specification:

- **Unloaded Vehicles:** 1/16 inch (1.587 mm) ± 1/32 inch (0.794 mm).
- **Loaded Vehicles:** 1/32 inch (0.794 mm) ± 1/32 inch (0.794 mm).

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.

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 serious personal injury.

1. Make sure the vehicle is on a level surface. Put blocks behind the rear wheels to prevent the vehicle from moving. Raise the vehicle so that the front tires are off the floor.
2. Use paint or chalk to mark the center area of both front tires around the complete outer surface of the tire.
3. Put 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.

4. Lower the vehicle to the floor. Move the vehicle forward and backward 10 feet (3 meters).
5. Put 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.
6. Put 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 34.**
7. To get the toe measurement, subtract the reading of the front of the tires from the reading at the back of the tires. **Figure 35.**
8. If the toe measurement is not at the specified distance, see 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. Tighten the nut and bolt on each end of the cross tube to the specified torque. See the Torque Chart in Section 9. (T)
9. Repeat steps 1-7 to check the toe-in dimension.

Figure 34

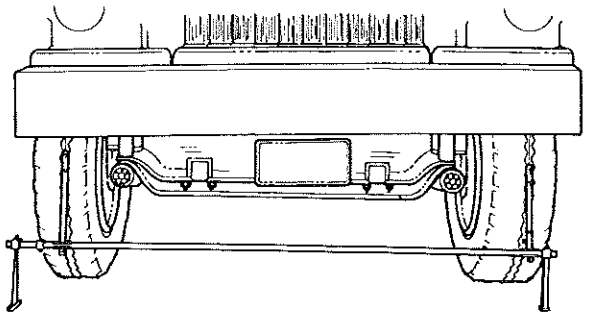
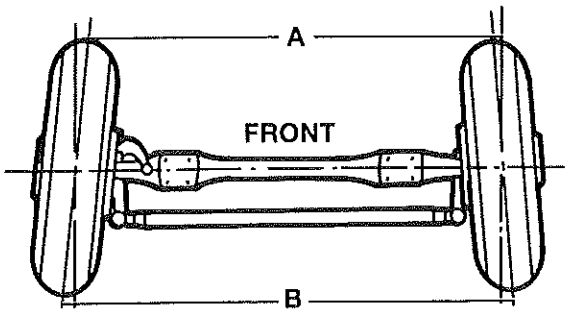


Figure 35



B MINUS A EQUALS TOE-IN

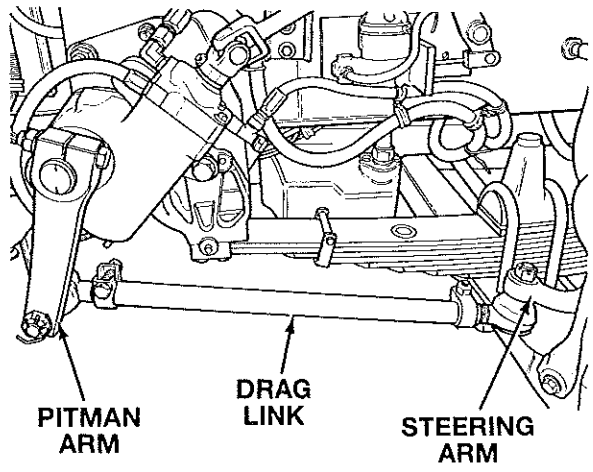
Section 6
Removal

Removing the Drag Link

See Figure 36.

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.
4. Inspect the drag link. See Section 7, 'Preparing the Parts for Assembly.'

Figure 36

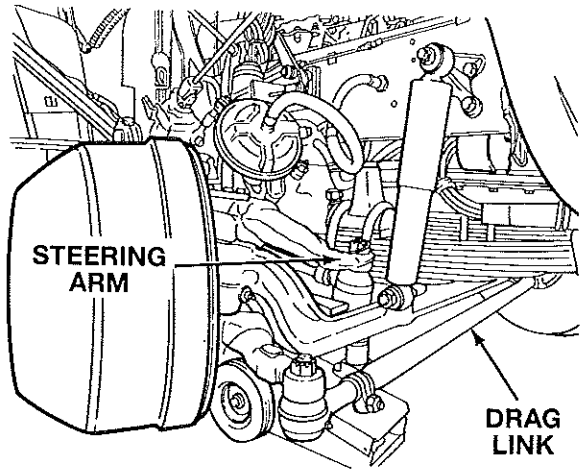


Removing Steering Arm

See Figure 37.

1. Remove the cotter pin and the nut that fasten the steering arm to the drag link. Disconnect the steering arm.
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 arm with a leather or plastic mallet to separate the arm from the knuckle.
4. Remove the key from the steering arm.
5. Inspect the steering arm. See Section 7, 'Preparing the Parts for Assembly.'

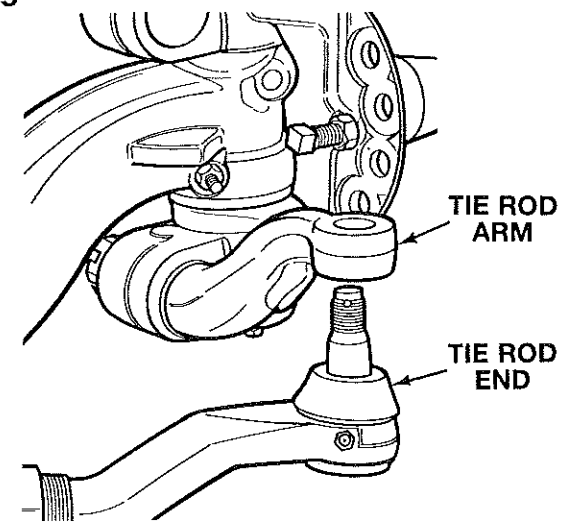
Figure 37



Removing the Tie Rod Arms, the Tie Rod Ends and the Cross Tube

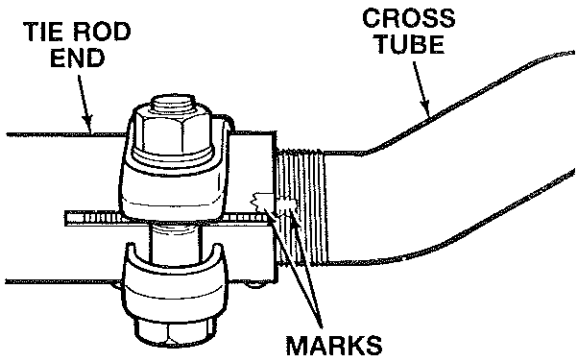
1. Remove the cotter pins and the nuts that fasten each tie rod end to the tie rod arms. **Figure 38.**
2. Disconnect the cross tube assembly from the tie rod arms. If necessary, use a removal tool to separate the tie rod end from the tie rod arm. **Figure 38.**
3. Remove the cotter pin and the nut that fasten the tie rod arms in the knuckle. **Figure 38.**
4. Remove the tie rod arms from the knuckle. If necessary, tap on the end of the rod with a leather or plastic mallet. Remove the key.

Figure 38



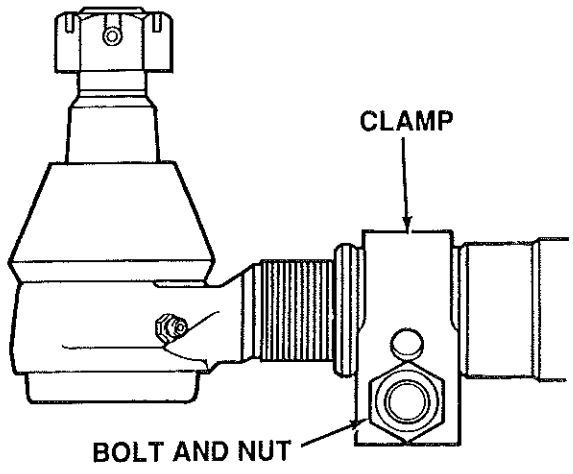
5. If necessary, remove the tie rod ends. See the following procedure. **Figure 39.**

Figure 39



   a. Mark the position each tie rod 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 crosstubes can be rotated for easier accessibility when removing the clamp bolt and nut. **Figure 40.**

Figure 40



7. Inspect the parts. See Section 7, 'Preparing the Parts for Assembly.'

Section 6
Removal

Removing the Wheel Ends

WARNING

Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

1. Raise the vehicle until the 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. See the following procedure.

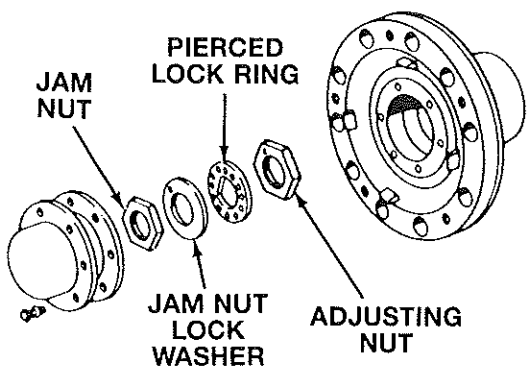
Double Nut and Lock Fasteners

a. Bend the tabs of the lock washer off the jam nut and the adjusting nut. **Figure 41.**

b. Remove the jam nut, the lock washer, the pierced lock ring and the adjusting nut from the knuckle. **Figure 41.**

Figure 41

DOUBLE NUT AND LOCK ADJUSTMENT



Single Nut Fasteners

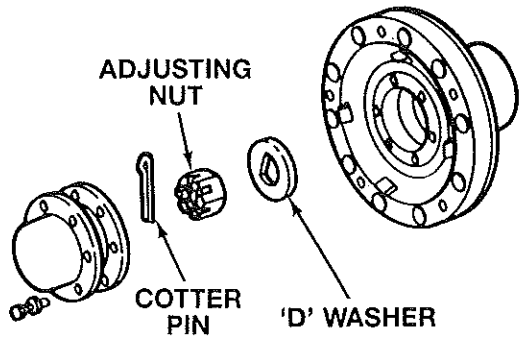
a. Remove the cotter pin from the adjusting nut. **Figure 42.**

b. Remove the adjusting nut and the 'D' washer from the spindle. **Figure 42.**

4. Remove the outer wheel bearing cone from the hub.
5. Remove the wheel and tire, the hub and the drum as assembly.

Figure 42

SINGLE NUT ADJUSTMENT

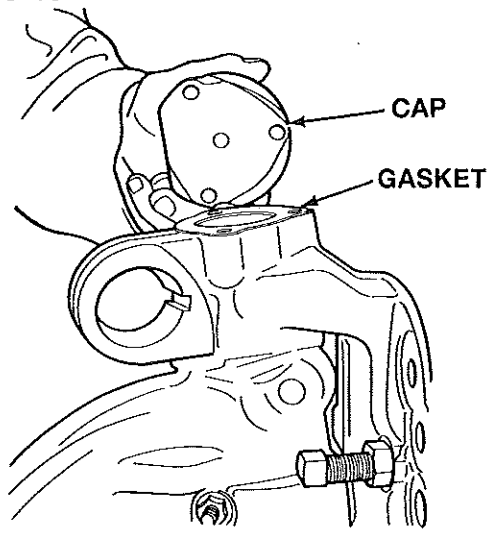


Removing the King Pins and the Steering Knuckle

1. Remove the wheels ends as described in this section.
2. Remove the air from the brake system. Disconnect the air lines from the brakes.
3. Remove the brake assembly from the spindle. See the procedure of the manufacturer of the brake.
4. Remove the tie rod arms and the steering arms from the knuckle. See the procedure in this section.

5. Remove the capscrews that fasten the caps to the top and the bottom of the spindle. Remove the caps and the gaskets. **Figure 43.**

Figure 43



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. See the following procedure.

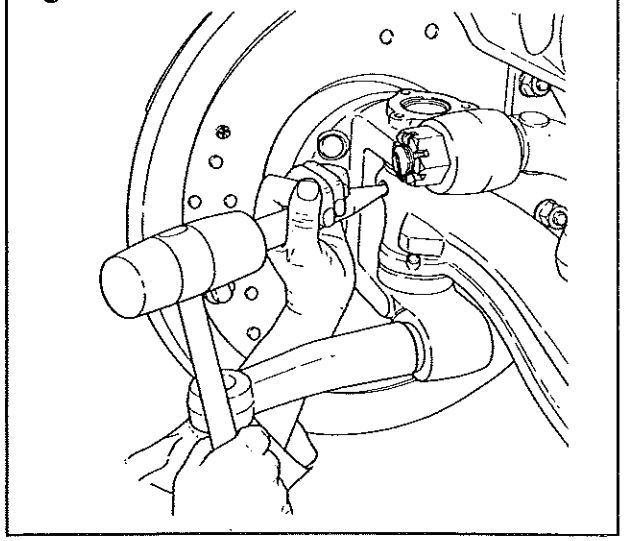
Removing Plain Draw Keys

WARNING

Wear safe eye protection. Do not hit steel parts or tools with a steel hammer. Parts or tools can break and cause serious personal injury.

a. Use a brass hammer and a steel drift to remove the draw key. Put the drift on the small ('D'-shaped) end of the key. **Figure 44.**

Figure 44



Removing Threaded Draw Keys

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

WARNING

Wear safe eye protection. Do not hit steel parts or tools with a steel hammer. Parts or tools can break and cause serious personal injury.

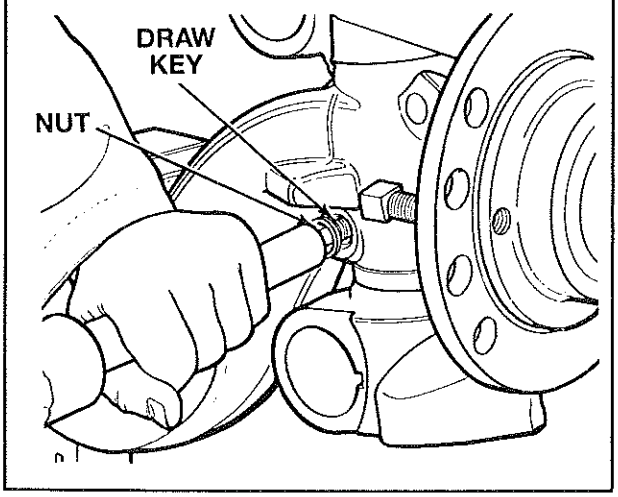
CAUTION

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.

b. Use a brass drift and a hammer to hit the end of the nut to loosen the draw key. **Figure 45.**

c. Remove the nut from the draw key. Remove the draw key from the knuckle.

Figure 45



NOTE

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

1. **Remove any flaring on the drift that may touch the knuckle pin.**
2. **Wrap tape to a thickness of 1/16 inch (1.5 mm) on the end of the drift.**

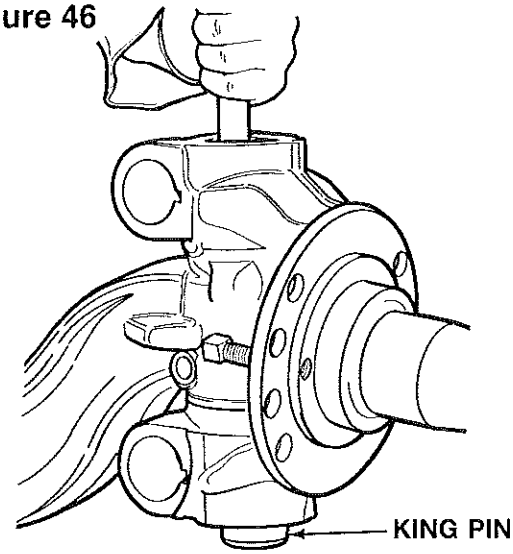
NOTE

For optimal tire wear on crowned road surfaces, the right and the left king pin bores in the beam are machined to slightly different king pin angles. The front of the beam must be installed toward the front of the vehicle. The front of the the beam is marked by the identification tag on the front of the beam and/or a white paint stripe on the left (driver's side) of the beam. If the paint stripe or identefication tag are missing, mark the front of the beam for correct installation.

7. Use a brass drift and a hammer to remove the king pins from the knuckle. **Figure 46.**

If the king pin is hard to remove, use a hydraulic king pin remover. See the Special Tool Chart in Section 10.

Figure 46

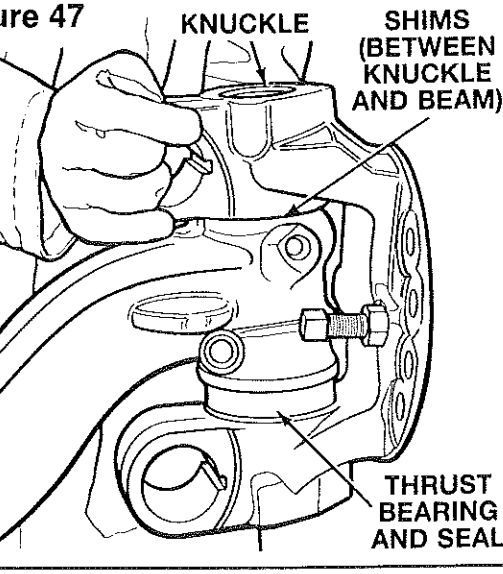


WARNING

Wear gloves when removing shims. The shims have sharp edges.

8. Remove the knuckle from the axle beam. Remove the shims, the thrust bearing and the seal from between the beam and the knuckle. **Figure 47.**
9. Inspect the parts. See Section 7, 'Preparing the Parts for Assembly.'

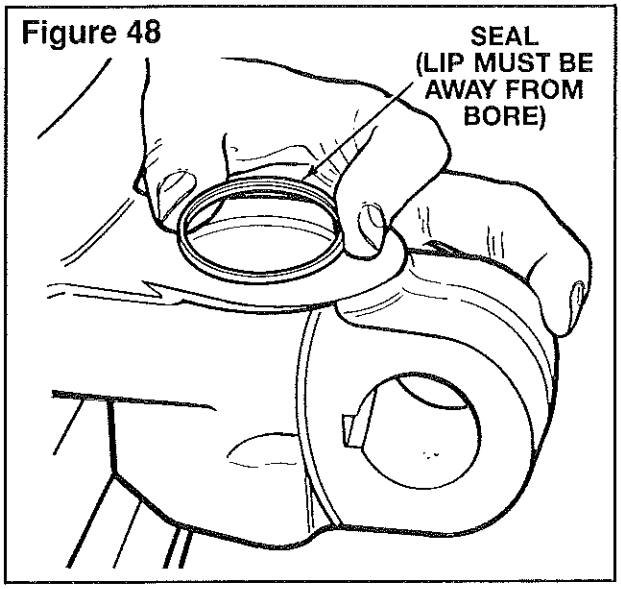
Figure 47



Removing the Bushings from the Knuckle

1. Remove and discard the seal in front of the bushing. **Figure 48.**

Figure 48

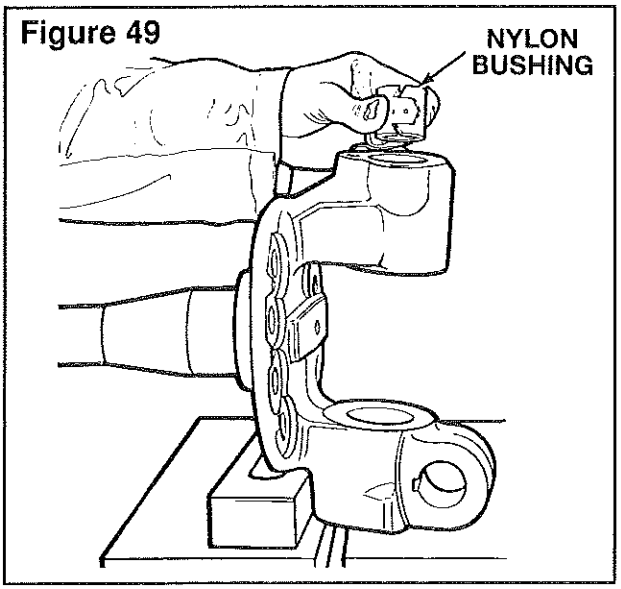


2. Remove the bushing according to the following procedure.

Nylon Bushings

a. Remove the top and the bottom bushing from the knuckle bore. **Figure 49.**

Figure 49



Bronze and Easy Steer™ Bushings

NOTE

On FF-, FG- and FL-Series axles the bushings can be removed with Bushing Service Kit from Kent-Moore Tools. See the 'Special Tools Chart' in Section 10.

a. Make a tool to remove the bushings. See **Figure 51** for the dimensions of the tool.

b. Put the knuckle on a press. Use a press with a 5 ton capacity. Make sure the knuckle does not move when the bushings are removed.

c. Install the tool in the top bushing. Press the top bushing from the knuckle bore. **Figure 50.**

d. Install the tool in the bottom bushing. Press the bottom bushing from the knuckle bore. **Figure 50.**

Figure 50

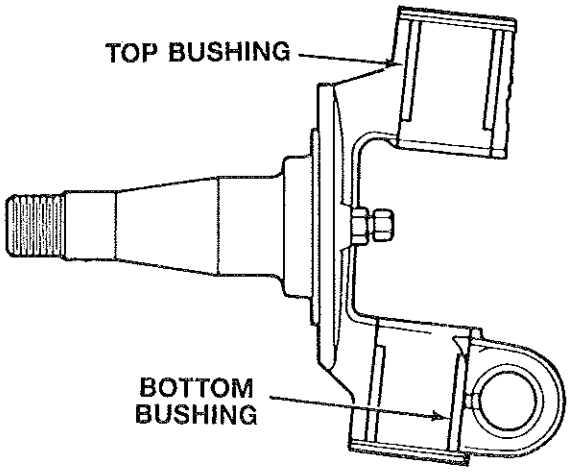
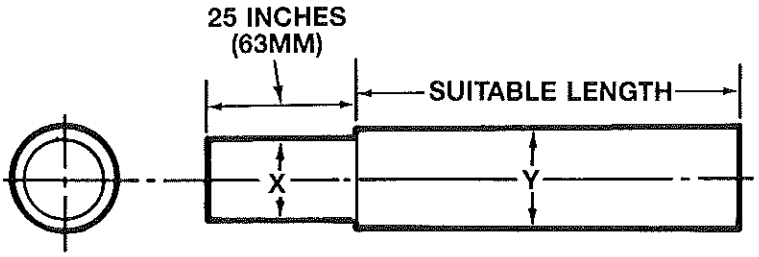


Figure 51

Dimensions for Bushing Removal and Installation Tool



Axle Model Number	Dimension'X'		Dimension'Y'	
	(±0.001 inch)	(±0.025 mm)	(± 0.001 inch)	(±0.025mm)
FC-901	1.228	31.191	1.350	34.290
FC-903	1.228	31.191	1.350	34.290
FC-921	1.228	31.191	1.350	34.290
FC-941	1.493	37.922	1.618	41.097
FD-901	1.427	36.245	1.552	39.420
FD-931	1.600	40.640	1.725	43.815
FD-933	1.600	40.640	1.725	43.815
FD-961	1.786	45.364	1.911	48.539
FE-970	1.600	40.640	1.725	43.815
FF-921	1.787	45.389	1.911	48.539
FF-931	1.787	45.389	1.911	48.539
FF-932	1.787	45.389	1.911	48.539
FF-933	1.787	45.389	1.911	48.539
FF-934	1.787	45.389	1.911	48.539
FF-941	1.786	45.364	1.911	48.539
FF-942	1.786	45.364	1.911	48.539
FF-943	1.786	45.364	1.911	48.539
FF-944	1.786	45.364	1.911	48.539
FF-961	1.786	45.364	1.911	48.539
FF-971	1.600	40.640	1.725	43.815
FG-931	1.787	45.389	1.911	48.539
FG-933	1.787	45.389	1.911	48.539
FG-941	1.786	45.364	1.911	48.539
FG-943	1.786	45.364	1.911	48.539
FL-931	1.992	50.596	2.116	53.746
FL-933	1.992	50.596	2.116	53.746
FL-941	1.990	50.546	2.116	53.746
FL-943	1.990	50.546	2.116	53.746
FL-951	1.992	50.596	2.116	53.746
FU-910	2.054	52.171	2.179	55.346
FU-935	2.054	52.171	2.179	55.346

Section 7
Preparing the Parts for Assembly

Repairing of Parts

The repair or reconditioning of front axle components is not allowed. Rockwell 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.**

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 holes in the knuckle.
5. Spray welding of bearing diameters on the knuckles or in the machined bores.
6. Milling or machining of any component.

⚠ WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent injury, follow the instructions supplied by the manufacturer. Do NOT use gasoline to clean parts. Gasoline can explode.

Cleaning the Ground or Polished Parts

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

Cleaning the 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.

Drying the 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.

Preventing Corrosion and Rust on Cleaned Parts

Apply a light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums.

If parts are to be stored, apply a good rust 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 rust.

Section 7
Preparing the Parts for Assembly

Inspecting the Parts

Carefully inspect all parts before assembly. See the following.

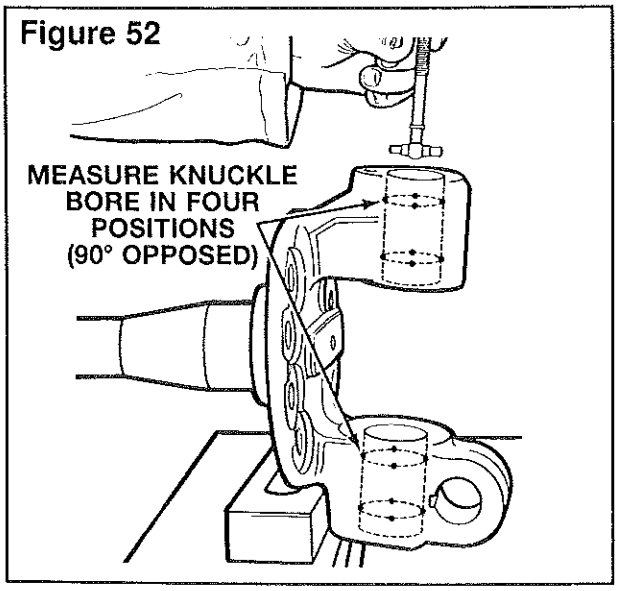
A. Inspect and replace any parts that are worn, cracked or damaged. Check for cracks with a die check or a magnetic or florescent particle inspection.

B. Use a micrometer and a telescoping gauge to measure the bore in the knuckle. Rounding at the top and bottom edges of the bore is acceptable. Make sure the bushing is removed from the knuckle.

   Measure the bore in two positions at the center line of the side of the knuckle. If the average measurement is more than the Knuckle Bore Maximum Diameter specification in **Figure 60**, replace the knuckle. **Figure 52.**

   Repeat the measurement in two more positions at the centerline of the front of the knuckle. If the average measurement is more than the Knuckle Bore Maximum Diameter specification in **Figure 60**, replace the knuckle. **Figure 52.**

Figure 52

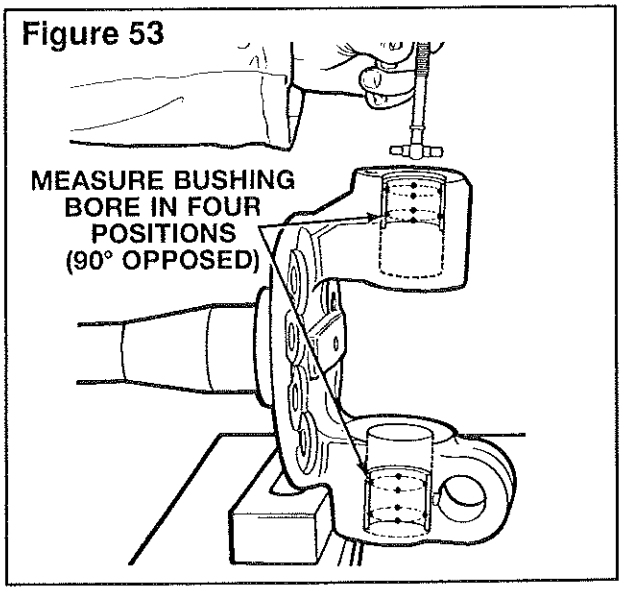


C. Use a micrometer and a telescoping gauge to measure the inner diameter of the bushing in the knuckle.

   Measure the inner diameter of the bushing in two positions at the centerline of the side of the knuckle. If the average measurement is more than the Knuckle Bushing Maximum Inner Diameter specification in **Figure 60**, replace the bushing. **Figure 53.**

   Repeat the measurement in two more positions at the centerline of the front of the knuckle. If the average measurement is more than the Knuckle Bushing Maximum Inner Diameter specification in **Figure 60**, replace the bushing. **Figure 53.**

Figure 53

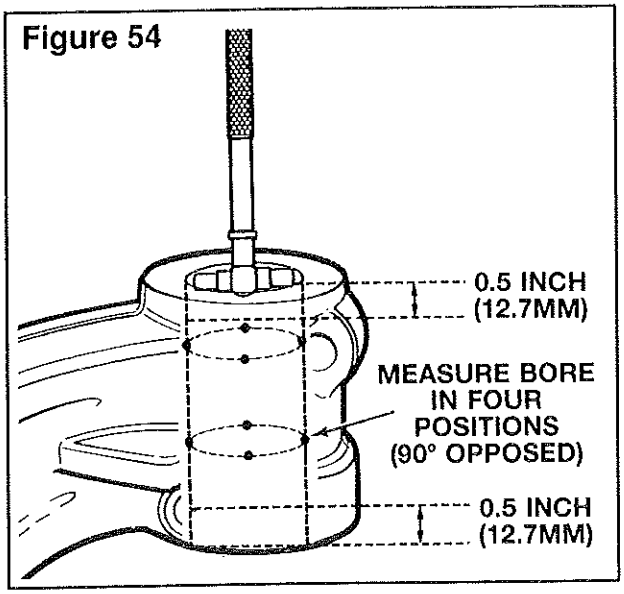


D. Use a micrometer and a telescoping gauge to measure the bore in the beam. Rounding at the top and bottom edges of the bore is acceptable.

   Measure the bore in two positions at the centerline of the side of the beam between 1/2 inch (25mm) from the top of the bore and 1/2 inch (25mm) from the bottom of the bore. If the average measurement is more than the Beam Bore Maximum Diameter specification in **Figure 60**, replace the beam. **Figure 54.**

Repeat the measurement in two more positions at the centerline of the front of the beam between 1/2 inch (25mm) from the top of the bore and 1/2 inch (25mm) from the bottom of the bore. If the average measurement is more than the Beam Bore Maximum Diameter specification in **Figure 60**, replace the beam. **Figure 54.**

Figure 54



Inspecting the Wheel Bearings

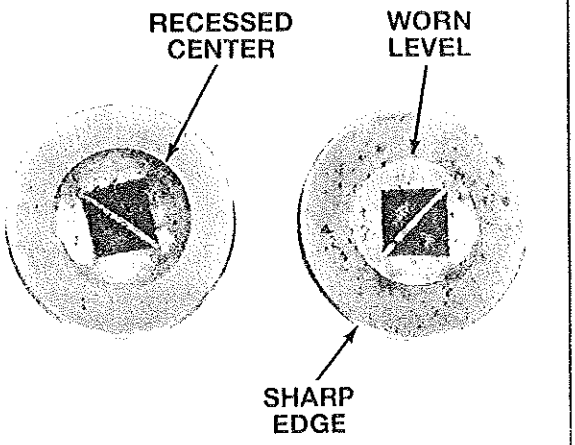
Inspect the wheel bearings when the knuckle is inspected or repaired.

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

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.

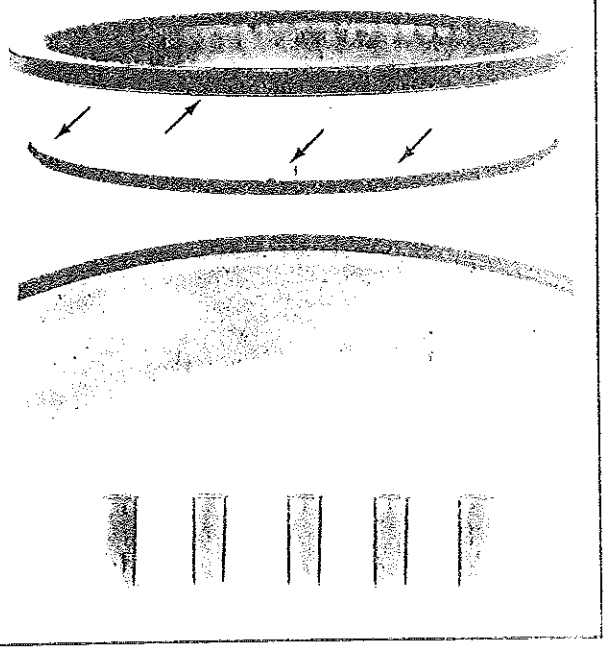
1. The center of the large diameter end of the rollers is worn level or below the outer surface. **Figure 55.**
2. The radius at the large diameter end of the rollers is worn to a sharp edge. **Figure 55.**

Figure 55



3. 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** 56.

Figure 56



Section 7
Preparing the Parts for Assembly

Figure 57

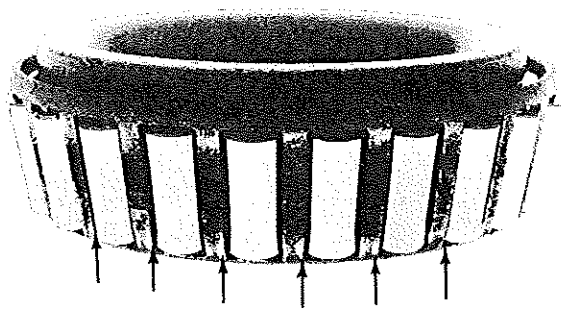
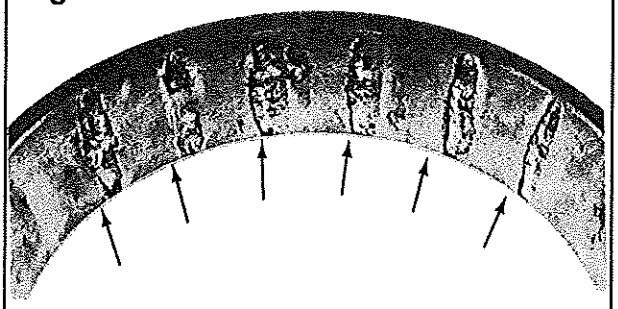
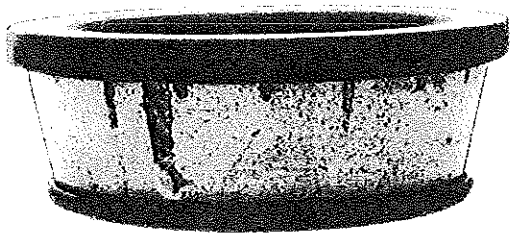


Figure 58

Figure 59





4. Deep cracks or breaks in the cup, the cone inner race or the roller surfaces. **Figure 57.**
5. Bright wear marks on the outer surface of the roller cage. **Figure 58.**
6. Damage on the rollers and on the surfaces of the cup and the cone inner race that touch the rollers. **Figure 58.**
7. Damage on the cup and the cup and the cone inner surfaces that touch the rollers. **Figure 59.**

Figure 60

Axle Wear Limits Specifications

Model Number	Knuckle Bore Maximum Diameter	Beam Bore Maximum Diameter	Knuckle Bushing Maximum Inner Diamater
FC-901 ①	1.361 in.(34.569mm)	1.238 in.(31.445mm)	1.240 in.(31.496mm)
FC-901 ②	1.361 in.(34.569mm)	1.238 in.(34.445mm)	1.238 in.(31.442mm)
FC-903 ①	1.361 in.(34.569mm)	1.238 in.(31.445mm)	1.240 in.(31.496mm)
FC-903 ②	1.361 in.(34.569mm)	1.238 in.(34.445mm)	1.238 in.(31.442mm)
FC-941	1.6295 in (41.389mm)	1.504 in (38.202mm)	1.502 in (38.151mm)
FC-921	1.3615 in (34.582mm)	1.238 in (31.445mm)	1.2365 in (31.407mm)
FD-901	1.563 in.(39.700mm)	1.4375 in.(36.5125mm)	1.438 in.(36.525mm)
FD-931	1.736 in.(44.094mm)	1.6110 in.(40.9194mm)	1.6105 in.(40.9067mm)
FD-933	1.736 in(44.094mm)	1.6110 in.(40.9194mm)	1.6105 in.(40.9067mm)
FD-961	1.922 in(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FE-970	1.736 in.(44.094mm)	1.6110 in.(40.9194mm)	1.6105 in.(40.9067mm)
FF-921	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FF-931	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FF-932	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FF-933	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FF-934	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FF-941	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FF-942	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FF-943	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FF-944	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FF-961	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FF-971	1.736 in.(44.094mm)	1.6105 in.(40.9067mm)	1.6105 in.(40.9067mm)
FG-931	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FG-933	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.7975 in.(45.6565mm)
FG-941	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FG-943	1.922 in.(48.818mm)	1.7980 in.(45.6692mm)	1.796 in.(45.618mm)
FL-931	2.127 in.(54.025mm)	2.0030 in.(50.8762mm)	2.0030 in.(50,8767mm)
FL-933	2.127 in.(54.025mm)	2.0030 in.(50.8762mm)	2.0030 in.(50.8767mm)
FL-941	2.127 in.(54.025mm)	2.0030 in.(50.8762mm)	2.001 in.(50.825mm)
FL-943	2.127 in.(54.025mm)	2.0030 in.(50.8767mm)	2.001 in.(50.825mm)
FL-951	2.127 in.(54.025mm)	2.0030 in.(50.8767mm)	2.0030 in.(50.8767mm)
FU-910	2.190 in.(55.626mm)	2.0655 in.(52.4637mm)	2.0645 in.(52.4383mm)
FU-935	2.190 in.(55.626mm)	2.0655 in.(52.4637mm)	2.0645 in.(52.4383mm)

NOTES:

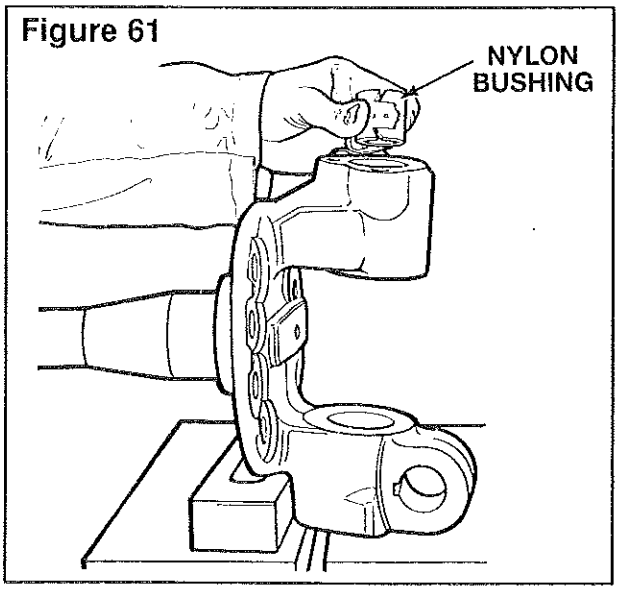
① Knuckles with nylon bushings.

② Knuckles with bronze bushings.

Installing Nylon Bushings in the Knuckle

Put the bushings in the knuckle bores. Make sure the bushing is against the bore in the knuckle. Install the king pin to make sure the bushing is installed correctly. **Figure 61.**

Figure 61



Installing Bronze and Easy Steer™ Bushings in the Knuckle

NOTE

On 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. See the 'Special Tools Chart' in Section 10.

Use the tool shown in **Figure 51** to install the bushings.

Use a press with a minimum capacity of five tons.

Make sure the knuckle does not move when installing the bushings.

Ream the bronze and Easy Steer bushings after installation.

Installing the Bronze Knuckle Bushings

1. Install the top bushing first.
2. Put the knuckle in a press so that the top of the knuckle is toward the top of the press. Make sure the top of the bores are parallell to the top of the press.
3. Put the bushing in the bore. Make sure the hole in the bushing is aligned with the hole in the bore. **Figure 62.**
4. Use the installation tool and press the bushing 1/8 inch (3 mm) into the bore. Release the pressure. Make sure the bushing is straight.
5. Press the bushing until there is 0.135-0.165 inch (3.5-4.0 mm) between the bottom of the bushing and the bottom of the top bore. **Figure 63.**
6. Turn the knuckle over so that the bottom of the knuckle is toward the top of the press. Make sure the bore for the bushing is parallel to the top of the press.
7. Put the bottom bushing in the bore. Make sure the hole in the bushing is aligned with the hole in the bore.
8. Use the installation tool and press the bushing 1/8 inch (3 mm) into the bore. Release the pressure. Make sure the bushing is pressed straight.
9. Press the bushing until there is 0.135-0.165 inch (3.5-4.0 mm) between the bottom of the bushing and the top of the bottom bore. **Figure 64.**
10. Ream the bushings. See the procedure in this section.

Figure 62

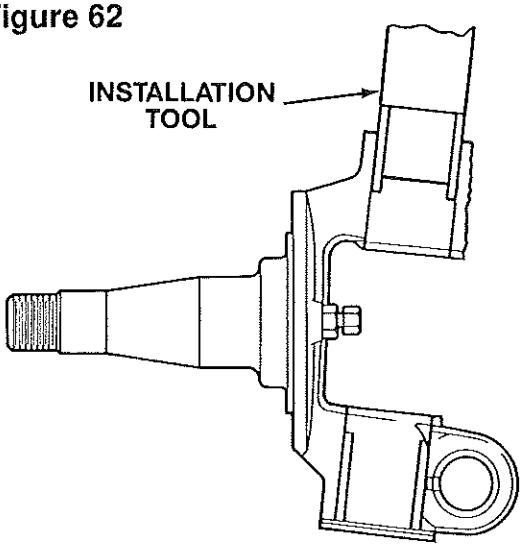


Figure 63

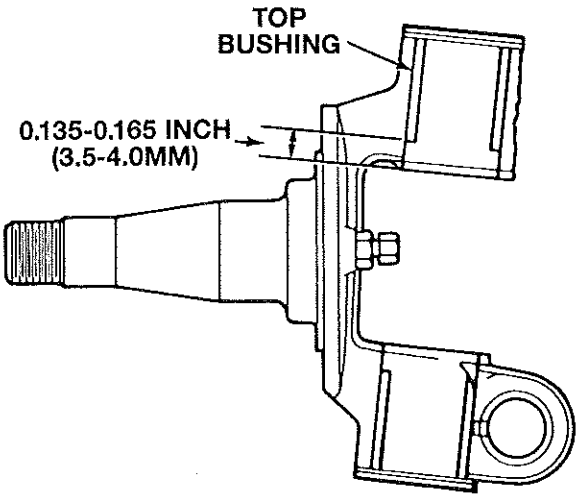
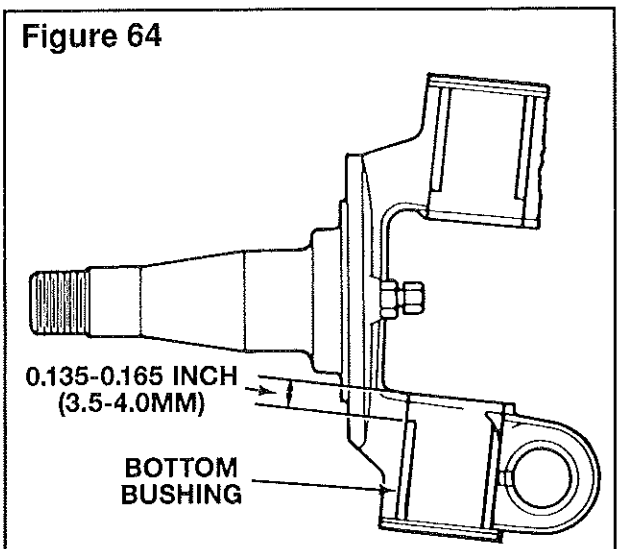


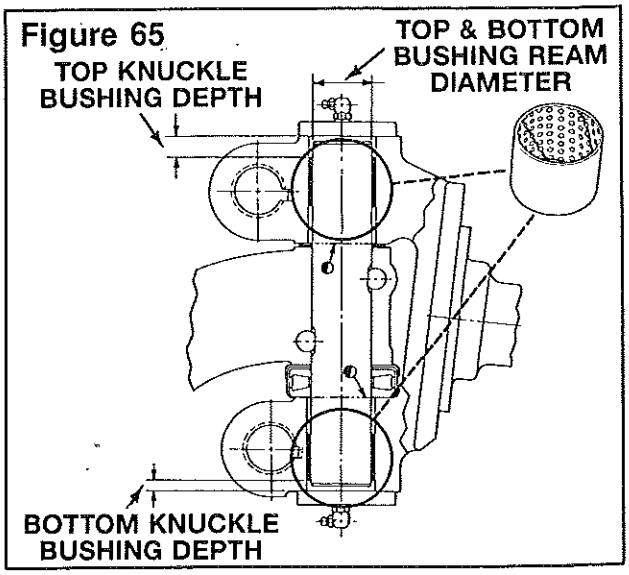
Figure 64



Installing Easy Steer™ Bushings

1. Install the top knuckle bushing first.
2. Put the knuckle in a press 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. Put the bushing in the bore.
4. Use the installation tool and press the bushing 1/8 inch (3 mm) into the bore. Release the pressure. Make sure the bushing is pressed straight.
5. Press the bushing until the top is 0.352-0.382 inch (8.94-9.70 mm) below the top of the knuckle. **Figure 65.**
6. Turn the knuckle over so that the bottom of the knuckle is toward the top of the press. Make sure the bore is parallel to the top of the press.
7. Put the bottom bushing in the bore.
8. Use the installation tool and press the bushing 1/8 inch (3 mm) into the bore. Release the pressure. Make sure the bushing is straight.
9. Press the bushing until the top is 0.352-0.382 inch (8.94-9.70 mm) below with the top of the knuckle. **Figure 65.**
10. Ream the bushings. See the procedure in this section.

Figure 65



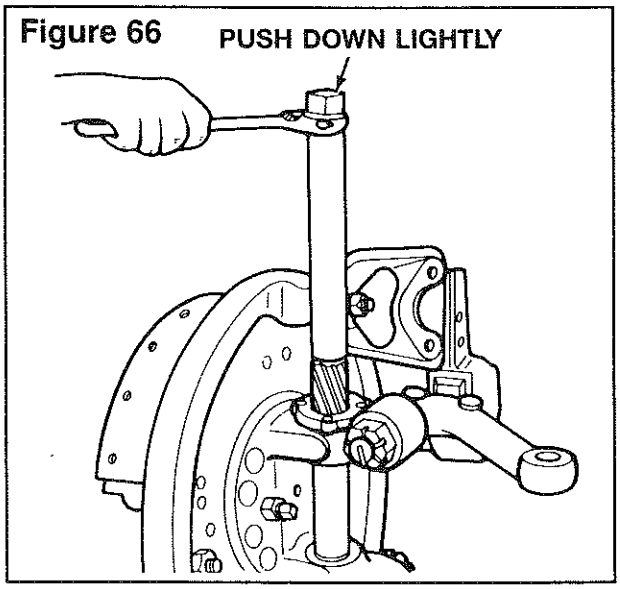
Reaming the Bronze and Easy Steer™ Bushings

CAUTION

Reaming with a fixed reamer is the only recommended procedure. Do not hone or burnish the bushings. The bushings will be damaged by honing or burnishing.

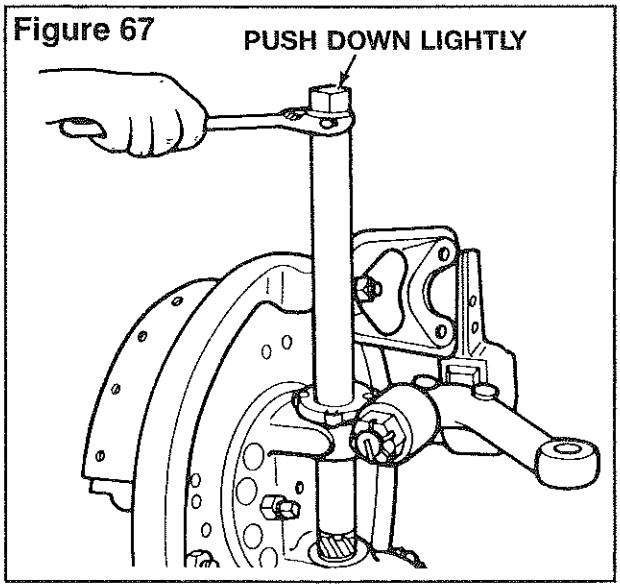
1. Put the knuckle in a vise with brass jaws.
2. See **Figure 68** for the dimensions of the reamer tool.
3. Slide the pilot of the reamer through the top bushing until the reamer blades touch the bushing. **Figure 66.**

Figure 66



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 67.**

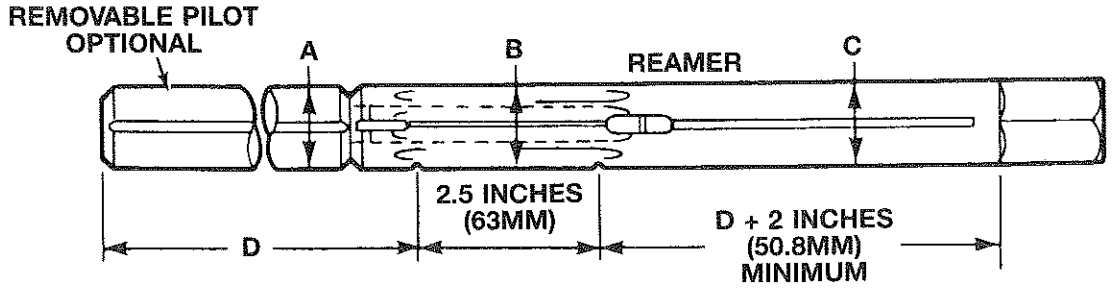
Figure 67



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.

Figure 68

BUSHING REAMER DIMENSIONS (See Chart)



GENERAL REAMER SPECIFICATIONS

MATERIAL: HIGH SPEED STEEL
NUMBER OF BLADES: USE 10-14 BLADES.
CUT OF BLADES: RIGHT HAND CUT, LEFT HAND FLUTE
LENGTH OF BLADES: 2.50 INCHES (63.5 MM)

Figure 68 (Continued)

BUSHING REAMER DIMENSIONS

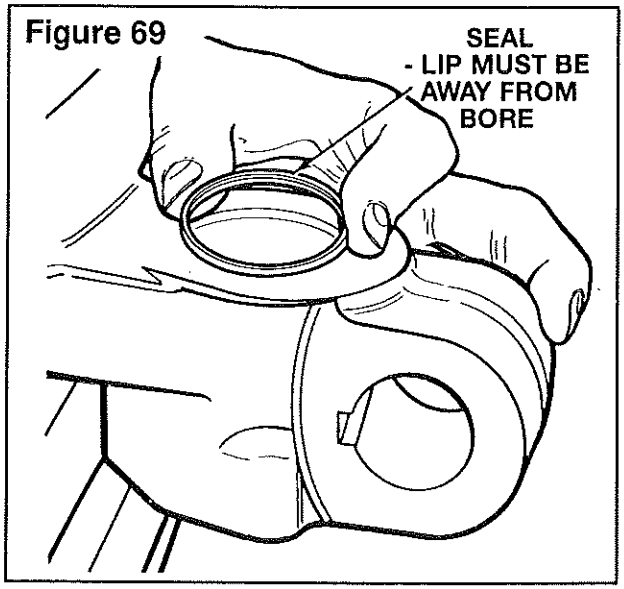
Axle Model	Lower Pilot Diameter Dimension 'A' (±0.001 inch or ±0.0245 mm)		Blade Diameter Dimension 'B' (±0.0005 inch or ±0.0127 mm)		Upper Pilot Diameter Dimension 'C' (±0.001 inch or ±0.0245 mm)		Lower Pilot Length Dimension 'D'		Upper Pilot Length Minimum Dimension 'E'	
	Inch	MM	Inch	MM	Inch	MM	Inch	MM	Inch	MM
FC-901	1.2225	31.0515	1.2375	31.4325	1.2320	31.2928	6.75	171.45	8.75	222.25
FC-901 *	1.2225	31.0515	1.2375	31.4325	1.2320	31.2928	6.75	171.45	8.75	222.25
FC-903	1.2225	31.0515	1.2375	31.4325	1.2320	31.2928	6.75	1.7145	8.75	222.25
FC-921	1.2225	31.0515	1.2360	31.4325	1.2320	31.2928	6.75	171.45	8.75	222.25
FC-941	1.4875	37.7825	1.5015	38.1381	1.4960	37.9984	8.90	226.06	10.90	276.86
FD-901	1.4220	36.1188	1.4370	36.4998	1.4315	36.3601	8.50	215.90	10.50	266.70
FD-901*	1.4220	36.1188	1.4370	36.4498	1.4315	36.3601	8.50	215.90	10.50	266.70
FD-931	1.5950	40.5130	1.6100	40.8940	1.6405	41.6687	8.50	215.90	10.50	266.70
FD-933	1.5950	40.5130	1.6100	40.8940	1.6405	41.6687	8.50	215.90	10.50	266.70
FD-961	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FE-970	1.5950	40.5130	1.6100	40.8940	1.6405	41.6687	8.50	215.90	10.50	266.70
FF-921	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FF-931	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FF-932	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FF-933	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FF-934	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FF-941	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FF-942	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FF-943	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
FF-961	1.7800	45.2120	1.7955	45.6057	1.7900	45.4660	10.25	260.35	12.25	311.15
FF-971	1.5950	40.5130	1.6100	40.8940	1.6405	41.6687	8.50	215.90	10.50	266.70
FG-931	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FG-933	1.7820	45.2628	1.7970	45.6438	1.7915	45.5041	9.30	236.22	11.30	287.02
FG-941	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	45.4787	10.25	260.35	12.25	311.15
FL-931	1.9870	50.4698	2.0025	50.8635	1.9970	50.7238	10.10	256.54	12.10	307.34
FL-933	1.9870	50.4698	2.0025	50.8635	1.9970	50.7238	10.10	256.54	12.10	307.34
FL-941	1.9850	50.4190	2.0005	50.8127	1.9950	50.6730	10.10	256.54	12.10	307.34
FL-943	1.9850	50.4190	2.0005	50.8127	1.9950	50.6730	10.10	256.54	12.10	307.34
FL-951	1.9850	50.4190	2.0005	50.8127	1.9950	50.6730	10.10	256.54	12.10	307.34
FU-910	2.0490	52.0446	2.0640	52.4256	2.0585	52.2859	11.32	287.52	13.32	338.32
FU-935	2.0490	52.0446	2.0640	52.4256	2.0585	52.2859	11.32	287.52	13.32	338.32

*Use these specifications when replacing the existing bushing with an Easy Steer™ bushing.

Installing the Seals for the Knuckle Bushings

1. Put the top of the knuckle in a vise with brass jaws. The bottom of the knuckle must be toward you.
2. Put the seal in the bottom of the top knuckle bore. The lip of the seal must be away from the bore. **Figure 69.**

Figure 69

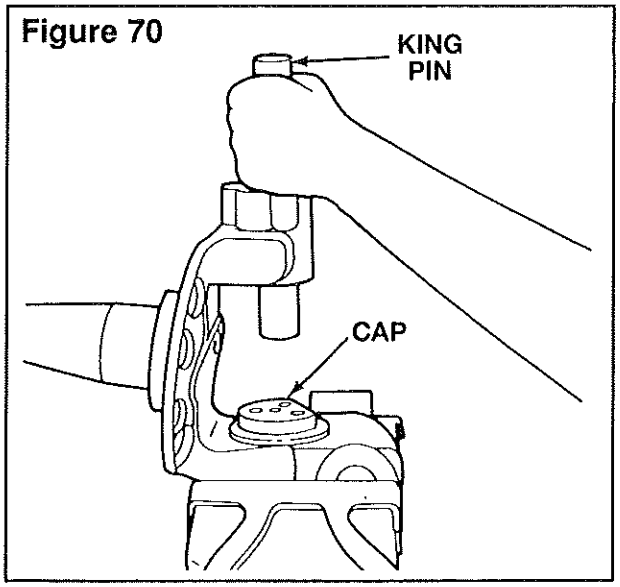


3. Put the end cap for the knuckle on top of the seal. Slide the king pin through the opposite knuckle bore. Use the king pin to install the seal. **Figure 70.**

   For bronze bushings, make sure bottom of the seal touches the bushing.

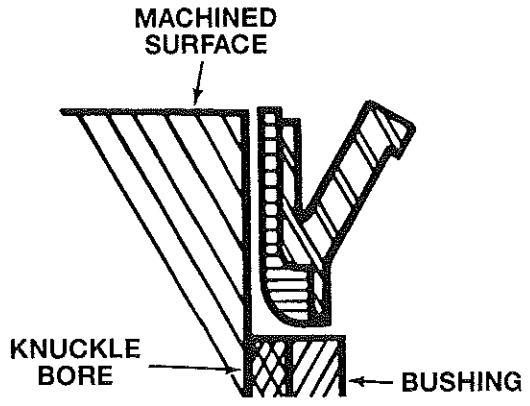
   For Easy-Steer™ and plastic bushings, make sure the top of the seal is even with top of the knuckle. **Figure 71.**

Figure 70



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. Put the seal in the top of the bottom knuckle bore. The lip of the seal must be away from the bore. **Figure 69.**
6. Repeat step 3 of this procedure.

Figure 71



Installing the Knuckle

NOTE

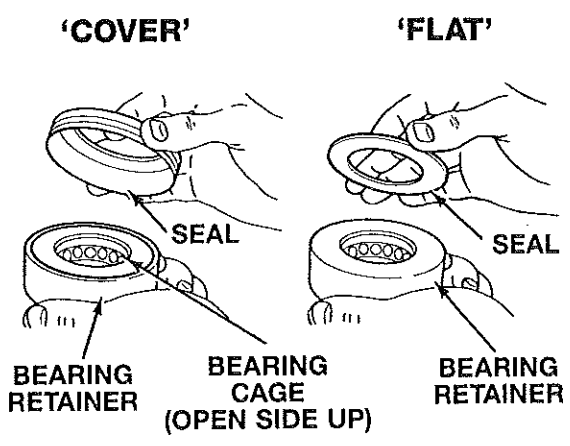
For optimal tire wear on crowned road surfaces, the right and the left king pin bores in the beam are machined to slightly different king pin angles. The front of the beam must be installed toward the front of the vehicle. The front of the the beam is marked by the identification tag on the front of the beam and/or a white paint stripe on the left (driver's side) of the beam. If the paint stripe or identification tag are missing, mark the front of the beam for correct installation.

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

   On 'cover' type seals, install the seal over the open end of the bearing. **Figure 72.**

   On 'flat'-type seals, put the seal over the closed part of the bearing. **Figure 72.**

Figure 72

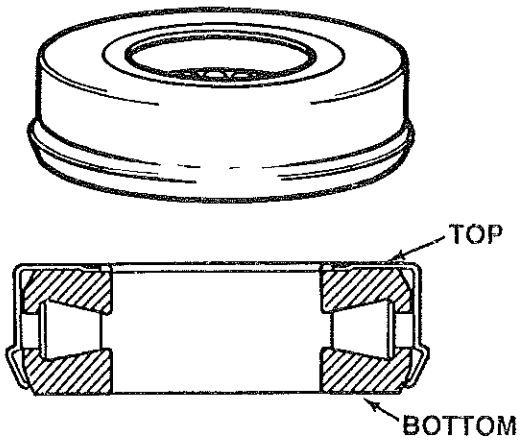


Integral Thrust Bearing and Seal

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:

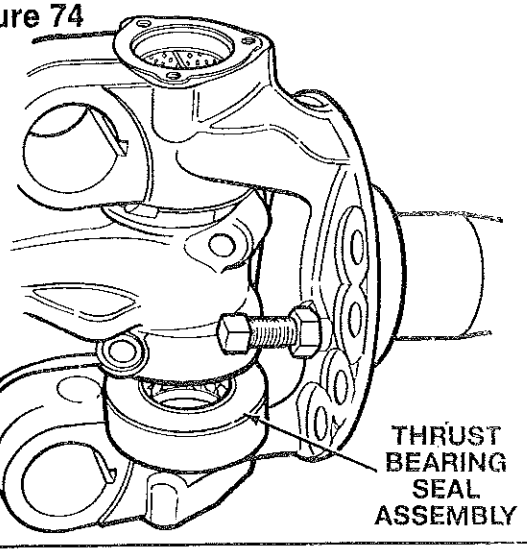
- The surface with the inner diameter seal must be on top.
- The surface with the outer diameter seal must be on the bottom. **Figure 73**

Figure 73



4. Slide the seal and thrust bearing assembly between the bottom of the axle beam and the knuckle. Make sure the seal is toward the beam. **Figure 74.**

Figure 74



WARNING

Wear gloves when installing shims. The shims have sharp edges.

5. Install the shims according to the following procedure.
   A. Inspect the shims. Replace damaged shims.
   B. If a new shim pack must be determined, select the amount of shims that will give the smallest end play.
   C. Put 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 75.**
   D. Make sure all the bores are aligned. If the bores are not aligned, the parts will be damaged when the king pin is installed.
   E. Remove the pry bar.
6. Install the king pin according to the following procedure. **Figure 76.**
   A. Apply the specified lubricant to the bottom half of the king pin.
   B. Install the pin in the top of the knuckle. Make sure the word **'TOP'** is toward you.
   C. Rotate the pin so that the slots are aligned with the holes in the knuckle.

Figure 75

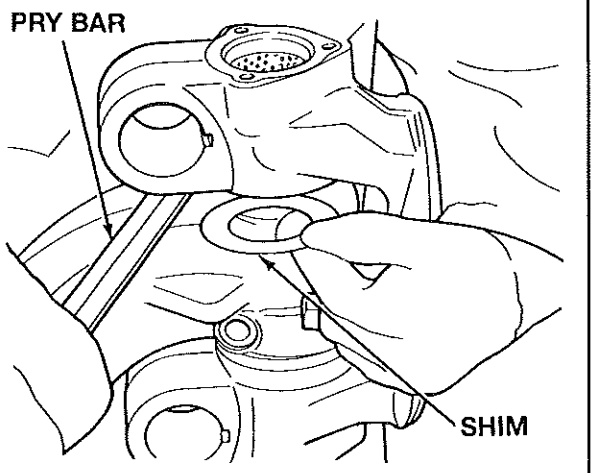
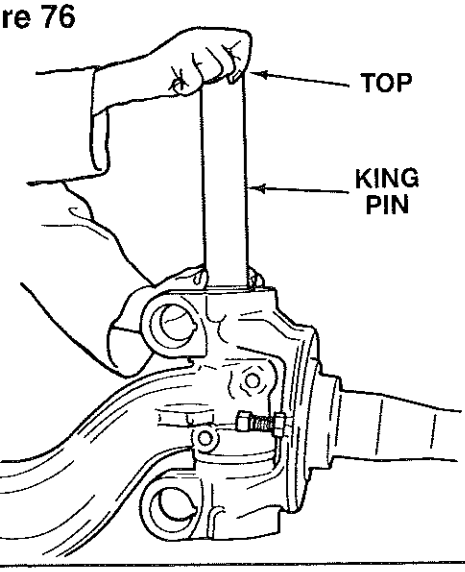


Figure 76



⚠ CAUTION

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

D. Push the pin through the top bushing, the seal and the shim pack. If the pin is difficult to install, make sure the parts are aligned.

⚠ WARNING

Wear eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause serious personal injury.

E. Push the pin into the bottom bushing. If necessary, use a brass hammer to drive the pin into the bushing. Make sure all parts are aligned.

F. Make sure the slots in the pin are aligned with the holes in the axle beam.

NOTE

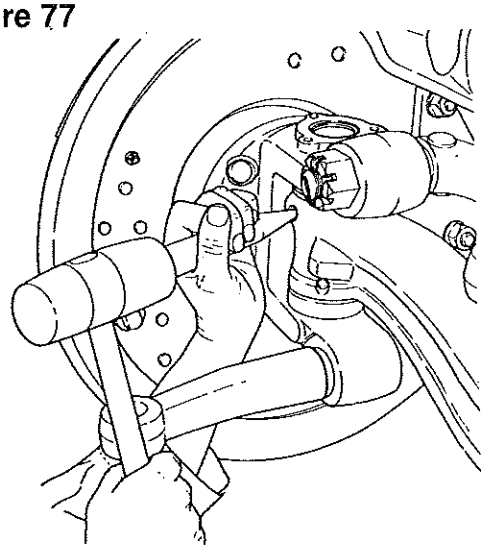
Do not drive or tighten the draw keys into the knuckle until the end play is checked and adjusted.

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.

7. Install the top draw key in the front of the knuckle. Install the bottom draw ey in the back of the knuckle. Make sure the key goes through the slot in the pin. **Figure 77.**

Figure 77



8. Check the end play of the knuckle according to the following procedure.
   A. Hit the boss of the knuckle with a rubber mallet to move the parts in position. **Figure 78.**
   B. Turn the knuckle to the straight (forward) position.
   C. Attach a dial indicator. Put the base on the knuckle. Put the tip on the center of the king pin. Set the dial indicator on 'zero' (0). **Figure 79.**

Figure 78

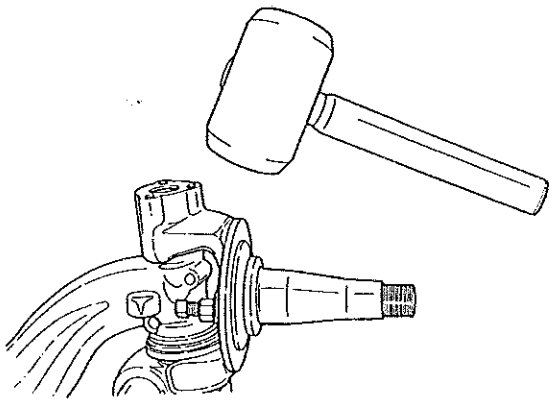
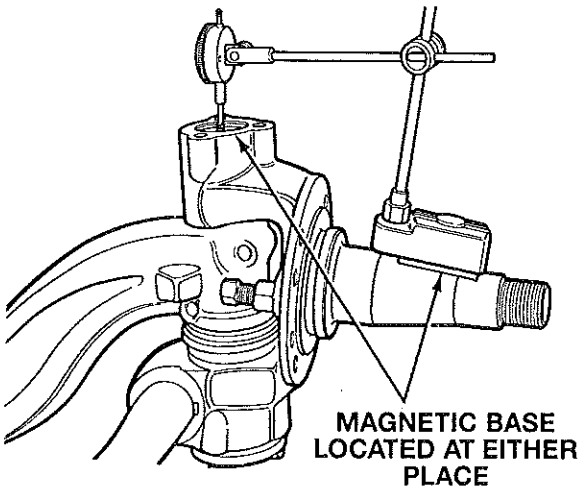
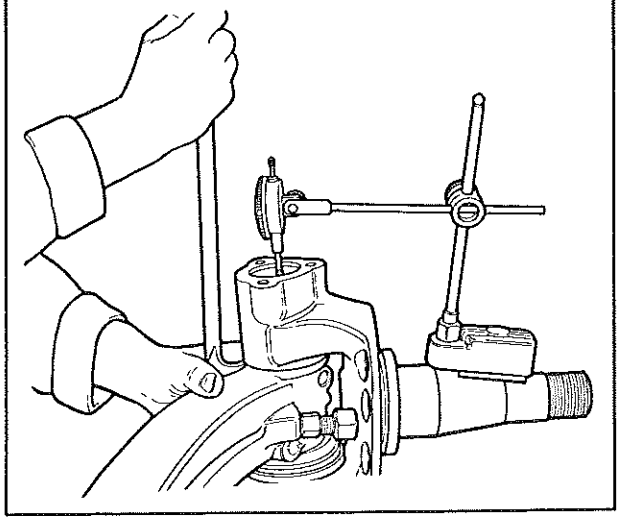


Figure 79



   D. Use one of the following procedures to measure the end play.
   - Put a pry bar between the knuckle and the top of the axle center. Push the knuckle up and measure the end play. **Figure 80.**

Figure 80



⚠ WARNING

If a hydraulic jack is used to measure end play, use two safety stands to support the axle. If safety stands are not used, the axle can fall and cause serious personal injury.

- Put 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 81.**

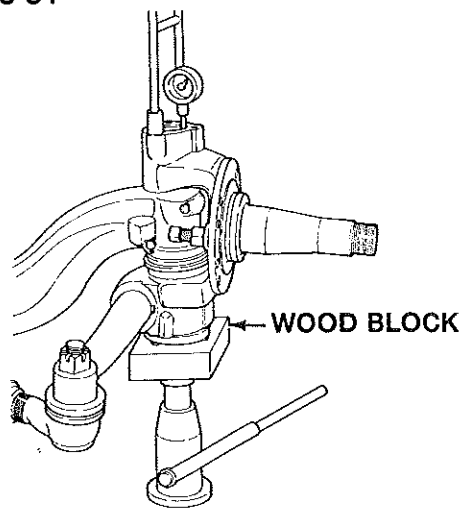
E. Repeat steps C and D with the axle in the full right and full left turn positions.

F. The end play must be 0.001-0.025 inch (0.025-0.635 mm) in all position.

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

   If more than 0.025 inch end play is measured, add shims to the shim pack.

Figure 81



⚠ WARNING

Wear eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause serious personal injury.

⚠ CAUTION

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

NOTE

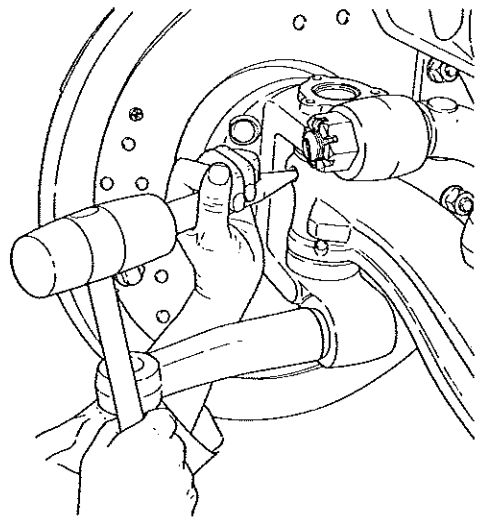
All models except FE-970, FF-971and FL-901 use threaded draw keys. Models FE-970, FF-971 and FL-901 use plain draw keys.

9. Install the draw keys. See 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 1/32-1/8 inch (1-3mm) below the outer surface of the beam. **Figure 82.**

Figure 82



Threaded Draw Keys

On threaded draw keys, install the lock nut and tighten to 30-45 lb-ft (41-54 N•m). **Figure 83.** T

Figure 83

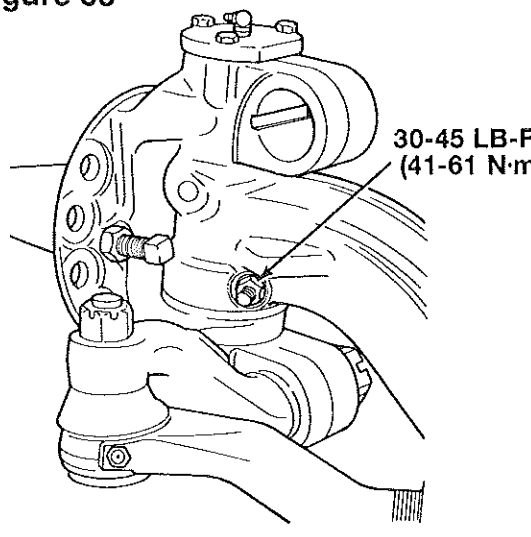
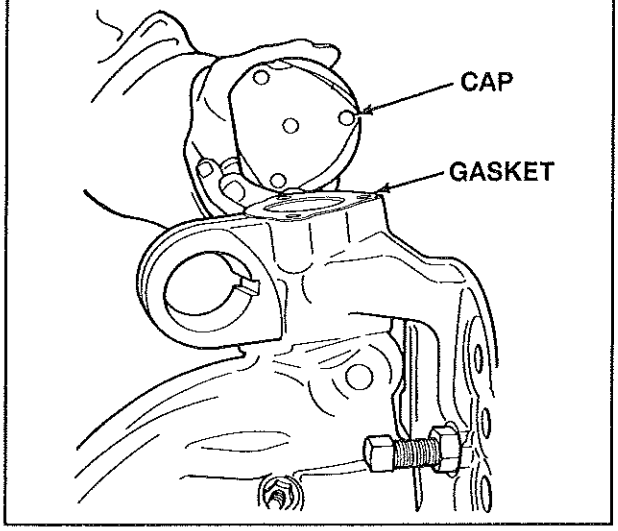


Figure 84



10. 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 84.** T
11. Connect the tie rod arm to the knuckle. See the procedure in this section.
12. Install the brake assembly on the knuckle. See the procedure of the manufacturer of the vehicle.
13. Lubricate the wheel bearings. See Section 4, Lubrication.
14. Install the drum and the wheel and tire assembly.
15. Lubricate the wheel bearings. See Section 4, Lubrication and Maintenance.

16. Install the outer wheel bearing cone in the hub. Install the adjusting nut.
17. Adjust the wheel bearings. See Section 5, Adjustments.
18. Install the cap and the gasket on the hub. Install the capscrews and tighten to 20-30 lb-ft (27-41 N•m). T
19. Lower the vehicle to the ground. Check for correct operation.
20. Check and adjust the toe-in. See Section 5, Adjustments.

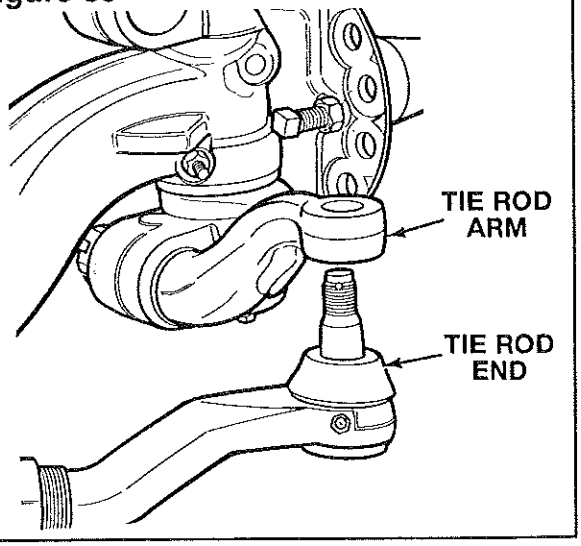
Installing the Tie Rod Arms, the Tie Rod Ends and the Cross Tube

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. See Rockwell Technical Service Aid, TSA-87121 to choose the correct tie rod arm. Contact your Rockwell service representative.

1. Press the key in the slot in the arm. **Figure 85.**
2. Install the tie rod arm in the knuckle. **Figure 85.**

Figure 85



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. See the Torque Chart on page 56. T

4. Install the cotter pins. If the necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.

NOTE

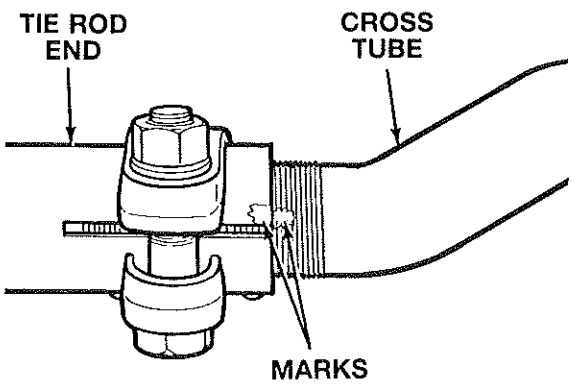
The cross tube has right-hand threads on one end and left hand threads on the other end. Make sure the ends are installed on the tube.

5. If removed, install the tie rod ends on the cross tube to the position marked during removal. **Figure 86.**

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

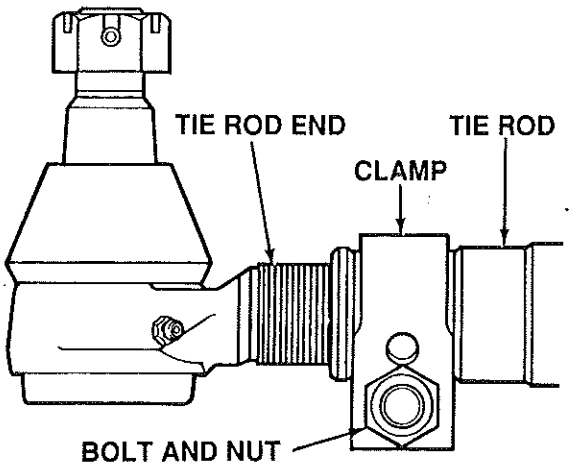
6. Install the nuts and the bolts in the clamps. Tighten to the specified torque. See the Torque Chart on page 56. **Figure 86.** T

Figure 86



7. The rotating style clamp on crosstubes can be rotated for easier accessability 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. **Figure 87.**

Figure 87



8. Connect the tie rod ends into the tie rod arms.
9. Install the nuts on the tie rod ends. Tighten to the specified torque. See the Torque Chart on page 56. T
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. See Section 5, Adjustments.

Installing the Steering Arm

See Figure 88.

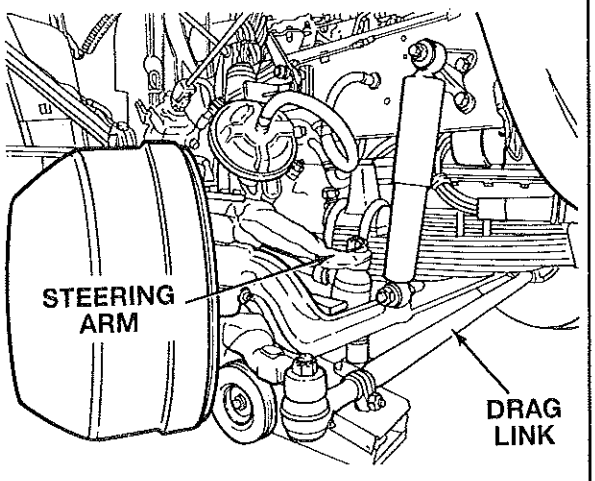
1. Press the key in the slot in the arm.
2. Install the steering arm in the knuckle.
3. Connect the steering arm to the drag link.

CAUTION

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

4. Install the nuts. Tighten to the specified torque. See the Torque Chart on page 56. T
5. Install the cotter pins. If the necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
6. Lubricate the steering arm. See Section 4, Lubrication and Maintenance.
7. Check for correct operation.

Figure 88



Installing the Drag Link

See Figure 89.

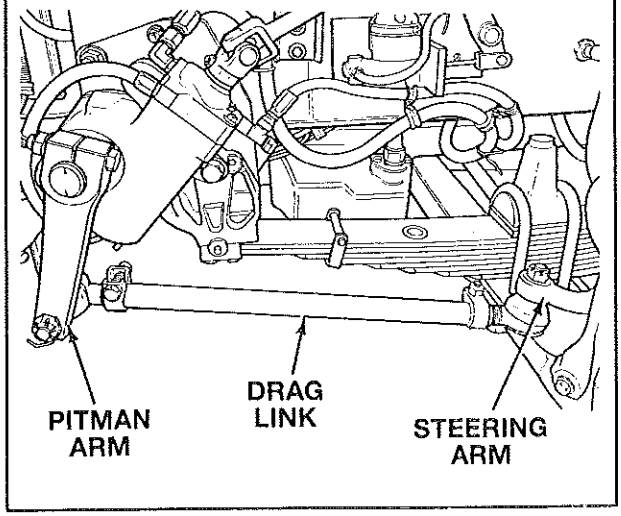
1. Connect the drag link to the steering arm.
2. Connect the drag link to the Pitman arm.

CAUTION

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

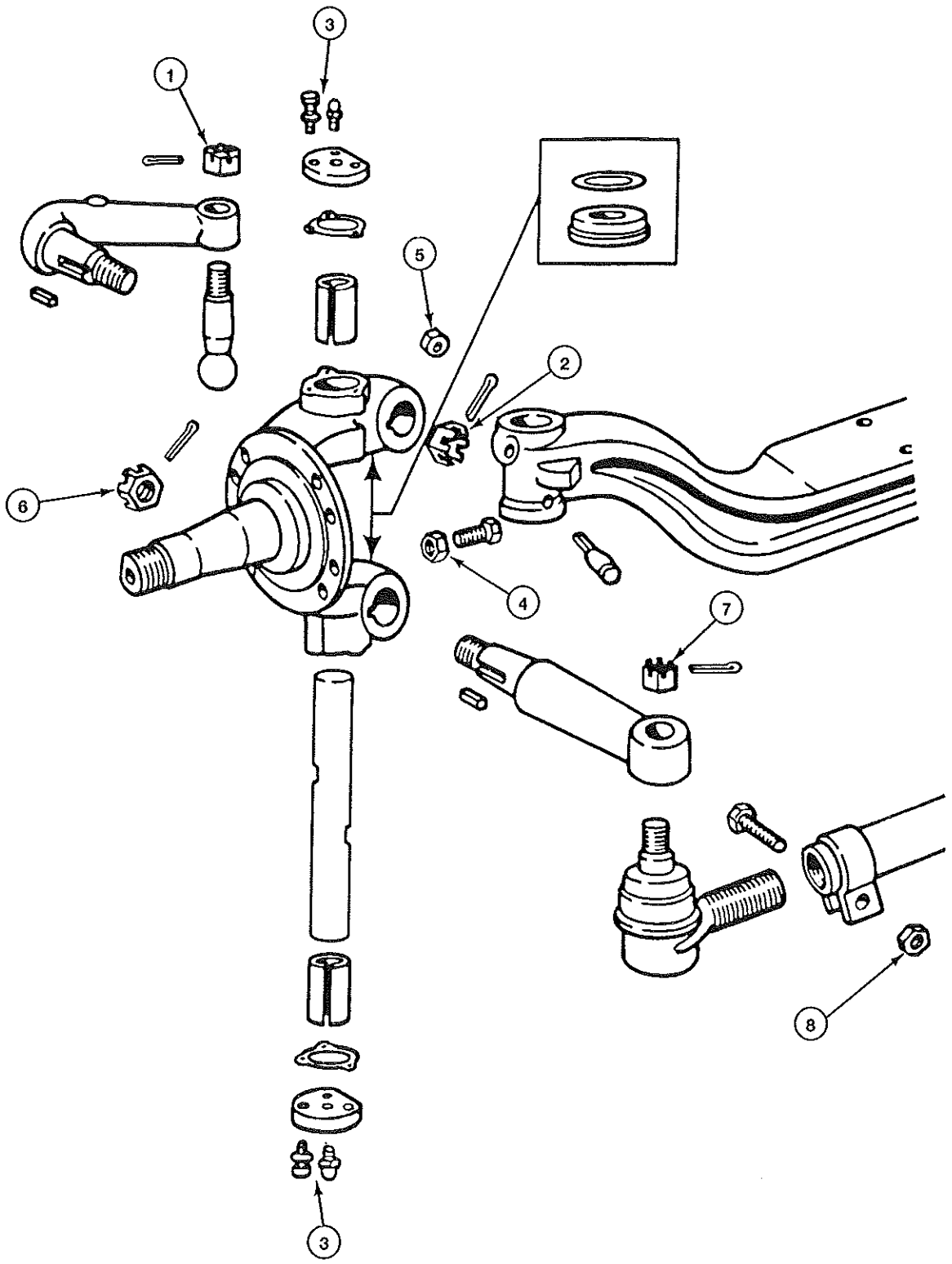
3. Install the nuts. Tighten to the specified torque. See the Torque Chart on page 56. T
4. Install the cotter pins. If the necessary, tighten the nut until the holes are aligned. Do not loosen the nut to install the cotter pin.
5. Lubricate the drag link. See Section 4, Lubrication and Maintenance.
6. Check for correct operation.

Figure 89



Section 9
Torque Specifications

Front Axle Torque Illustration



Front Axle 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	82-155
		3/4"-16	90-170	123-230
		7/8"-14	160-300	217-407
2	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
3	Knuckle Cap Capscrew	5/16"-18	20-30	28-40
4	Stop Screw Locknut	1/2"-13	50-65	68-88
5	Draw Key Nut	7/16"-20	30-45	41-61
6	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
7	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
8	Cross Tube Clamp Nut	5/8"-11	40-60	55-81
		3/4"-10	155-175	211-237

Section 10
Special Tools

Special Tools

Description	Kent-Moore Tool Number ①	Owatonna Tool Number ②	Snap-On® ③ Tool Number
King Pin Remover	J 36136	4240	20 Ton: CG430HYB 35 Ton: CG730HY
King Pin Bushing Service Kit	④		
Basic Service Kit	PT 4375	———	———
FF- and FG-Series Kit	PT 4370-10	———	———
FL-Series Kit	PT 4370-20	———	———

NOTES:

① Order Kent-Moore tools from, Kent-Moore Heavy Duty Division, 29874 Little Mack, Roseville, MI 48066-2298.

② Order Owatonna tools from OTC Toll 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.

Rockwell International

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