

Single Reduction Differential Carriers

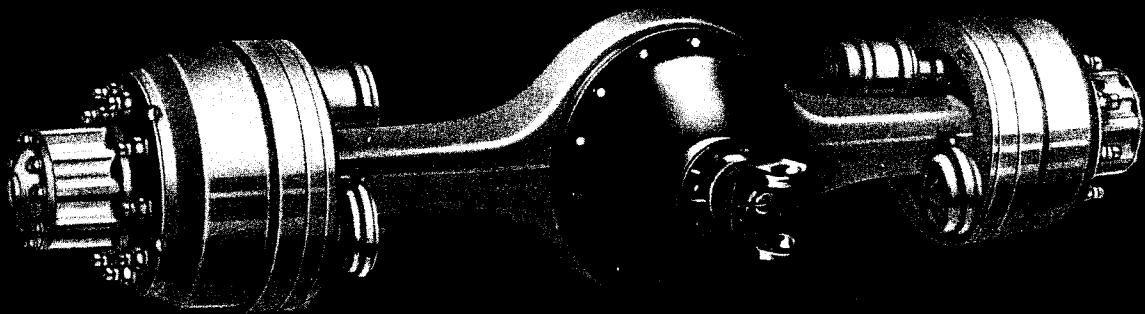
**Maintenance Manual No. 5
Revised 2-97**

Standard Carriers Including:

- **Single Axles**
- **Rear of Tandem Axles**
- **Front Drive Steering Axles**

Excluding RS and RT Series (Rear Only) Single Reduction Axles and RF Series Front Drive Axles

(See inside front cover for specific axle models)



Axle Models Covered in This Manual

Single Drive Axles:						For All RS & RT Single Reduction Axle Model Series, Refer to Maintenance Manual No. 5A.
A-150	E-100	F-140	H-172	Q-100	R-163	
B-100	E-105	G-161	L-100	Q-145	R-170	
B-140	E-150	H-100	L-140	RL-170	S-170	
B-150	F-100	H-140	L-155	R-100	U-140	
C-100	F-106	H-150	L-172	R-140	W-170	
D-100	F-120	H-162	M-172	R-155		
D-140	F-121	H-170	QT-140	R-160		
Rear Axle of Tandem Axles:						
SDHD	SLHD	SRHD	SU-170			
SFHD	SQ-100	SSHD	SUHD			
SHHD	SQHD	ST-170	SW-170			
SL-100	SR-170	STHD				
Front Drive Steering Axles:						
FDS-75	FDS-90	FDS-1807	FDS-2101	FDS-2111		
FDS-78	FDS-93	FDS-1808	FDS-2107	FDS-2117		
FDS-85	FDS-1600	FDS-2100	FDS-2110			

Service Notes

Important Information

This manual contains maintenance procedures for Rockwell's early production Non-World Series axles. The information contained in this manual was current at time of publication and is subject to change without notice or liability.

You must follow your company procedures and understand all maintenance procedures and instructions before beginning service or repair of an axle carrier. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as result in damaged equipment and components.

Rockwell uses the following notations to warn the user of possible safety issues and to provide information that will prevent damage to equipment and components.



WARNING

A WARNING indicates that you must follow a procedure exactly. Otherwise, serious personal injury can occur.



CAUTION

A CAUTION indicates that you must follow a procedure exactly. Otherwise, damage to equipment or components can occur. Serious personal injury can also result, in addition to damaged or malfunctioning equipment or components.

NOTE:

A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that can help to make service quicker and easier.



This symbol indicates that you must tighten fasteners to a specific torque value.

Also Available from Rockwell On-Highway Axles

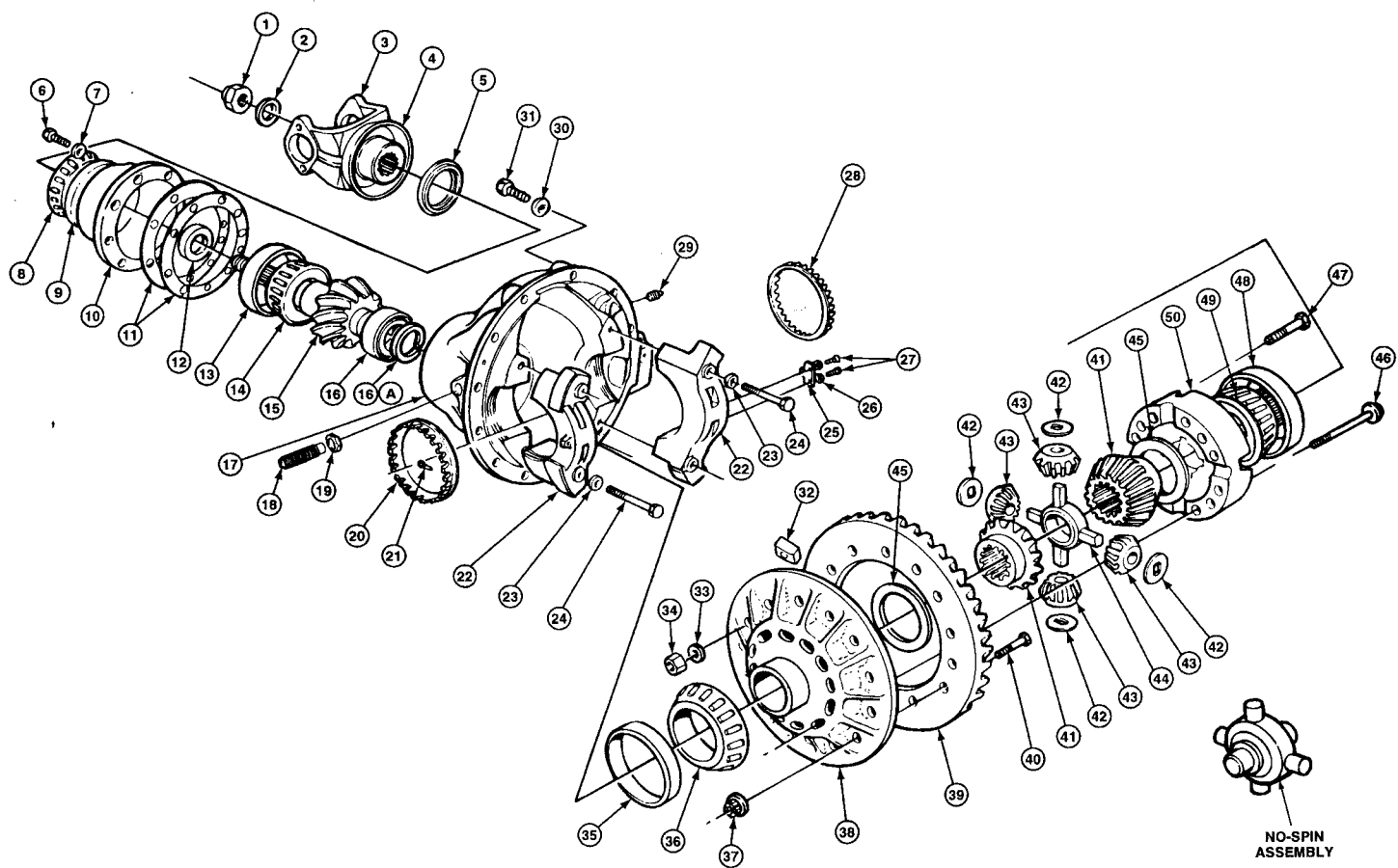
Video Package

The package, entitled *Traction Controls*, contains two videos — the all-new *Splitting the Difference*, and *Driver-Controlled Full Locking Main Differential*.

How to Order

A copy of the video package may be obtained for \$50.00 by requesting item number T-95125V from Rockwell Automotive, Literature Distribution, 35000 Industrial Road, Livonia, Mich. 48150, or call Rockwell at 800-535-5560. Each video is available individually as well, *Splitting the Difference* (T-87127V) and *Driver-Controlled Full Locking Main Differential* (T-9007V).

Single Reduction Differential Carrier



Item	Description
1	Nut — Drive Pinion
2	Washer — Drive Pinion*
3	Input Yoke* or Flange*
4	Deflector
5	Oil Seal
6	Capscrew — Bearing Cage
7	Washer
8	Bearing Cone — Pinion Outer
9	Bearing Cup — Pinion Outer
10	Bearing Cage — Drive Pinion
11	Shims
12	Spacer — Pinion Bearing
13	Bearing Cup — Pinion Inner
14	Bearing Cone — Pinion Inner
15	Drive Pinion
16	Spigot Bearing
16A	Snap Ring
17	Carrier
18	Thrust Screw*
19	Jam Nut* — Thrust Screw*
20	Adjusting Ring — L.H.
21	Cotter* or Pin*
22	Caps — Differential Bearing
23	Washers
24	Capscrews — Differential Bearing Cap
25	Lock Plate* — Adjusting Ring
26	Washers* — Lock Plate
27	Capscrews* — Lock Plate*
28	Adjusting Ring — R.H.
29	Plug* — Oil Fill Hole (carrier)
30	Washer* — Capscrew/Plug*
31	Capscrew/Plug — Sensor Hole
32	Thrust Block*
33	Washers* — Differential Case
34	Nuts* — Differential Case
35	Bearing Cup — Differential L.H.
36	Bearing Cone — Differential L.H.
37	Nuts* — Ring Gear and Case Half
38	Case Half — Flange
39	Ring Gear
40	Bolts* or Rivets* — Ring Gear and Case Half
41	Side Gears — Differential
42	Thrust Washers — Differential Pinion
43	Pinions — Differential
44	Spider — Differential
45	Thrust Washers — Differential Side Gear
46	Capscrews — Differential Case
47	Bolts* — Differential Case
48	Bearing Cup — Differential R.H.
49	Bearing Cone — Differential R.H.
50	Case Half — Plain

*Some Rockwell carriers do not have these described parts.

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Section 1

Introduction

Standard Single Reduction Carriers Without Differential Lock

Rockwell single reduction standard carriers, **Figure 1**, are used in most Rockwell single axles, rear of tandem axles and front drive steering axles.

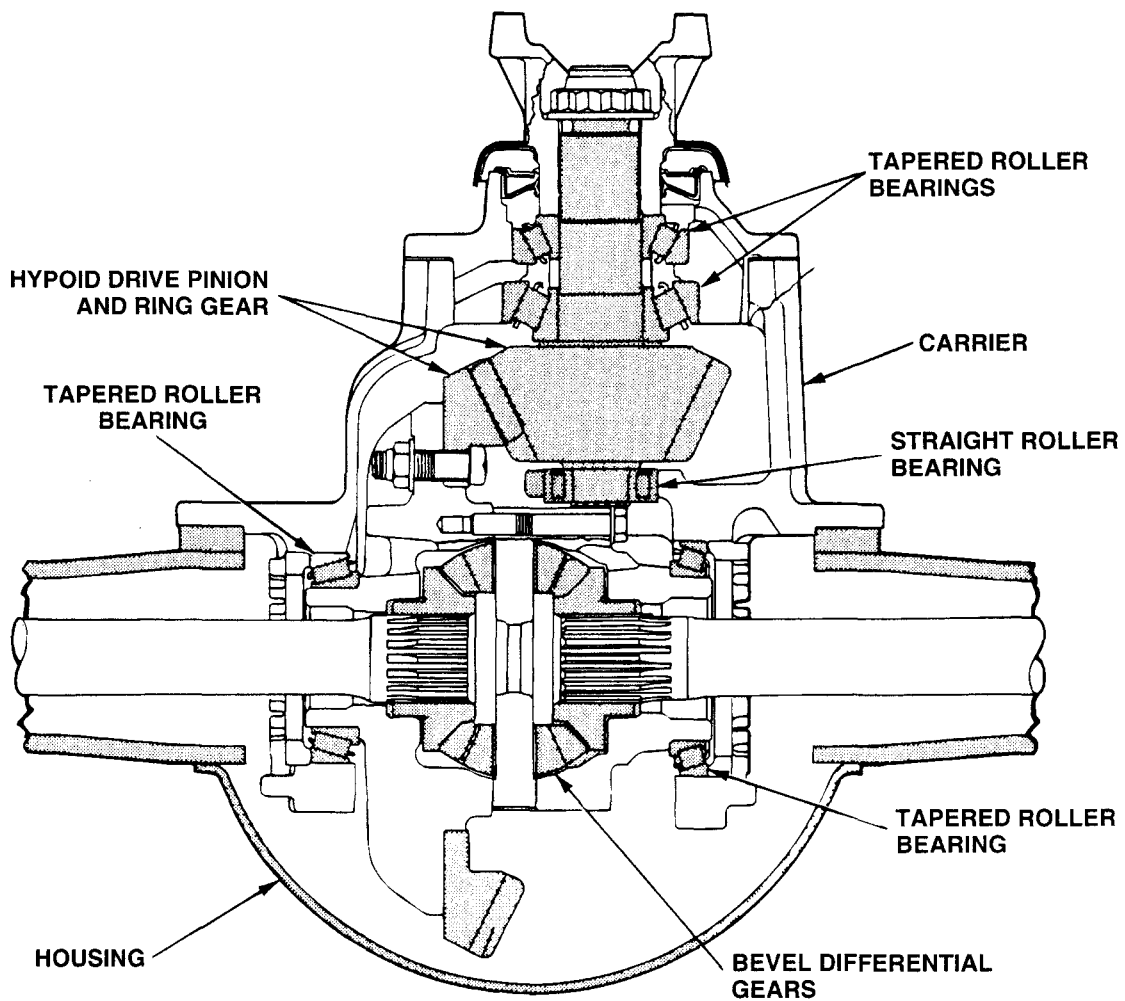
The single reduction carrier models are front mounted into the axle housing. These carriers have a hypoid

drive pinion and ring gear set and bevel gears in the differential assembly.

A straight roller bearing (spigot) is mounted on the head of the drive pinion. All other bearings in the carrier are tapered roller bearings.

When the carrier operates, there is normal differential action between the wheels all the time.

Figure 1



Section 2

Disassembly

Remove Differential Carrier from Axle Housing



WARNING

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

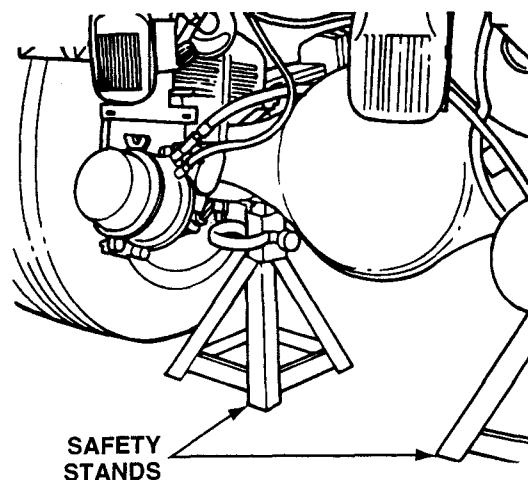
1. Raise the end of vehicle where the axle is mounted. Use a jack or other lifting tool, and place safety stands under each side of the axle.
Figure 2.



WARNING

Do not work under a vehicle supported only by a jack. Jacks can slip or fall over resulting in serious personal injury. Always use safety stands.

Figure 2



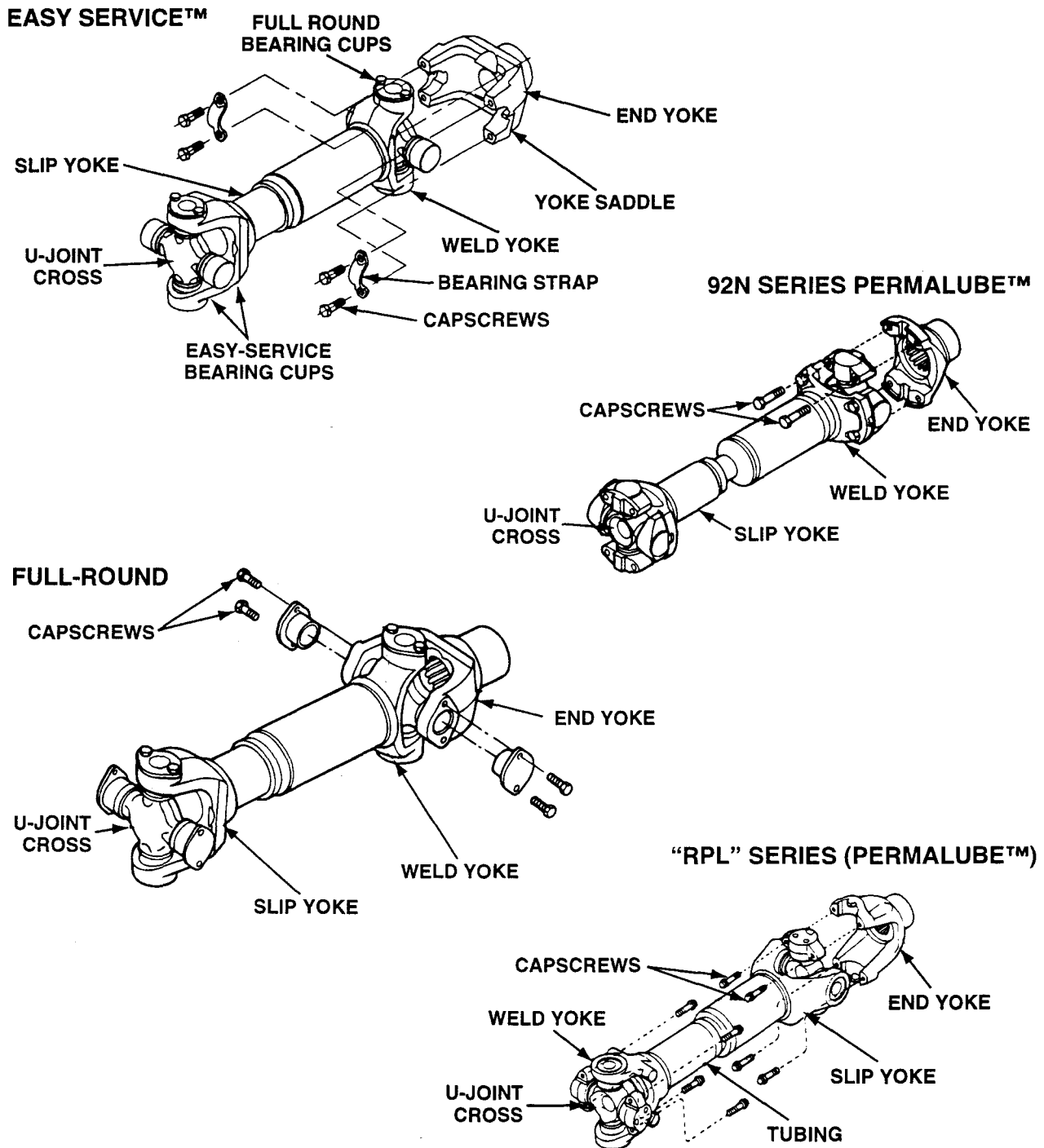
2. Place jack stands under each spring seat of the axle to hold vehicle in the raised position.
Figure 2.
3. Remove the plug from bottom of axle housing and drain lubricant from the assembly.

Section 2 Disassembly

4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier.
Figure 3.

5. Remove the capscrews* and washers or stud nuts* and washers from the flanges of both axle shafts.

Figure 3



*Some Rockwell carriers do not have these described parts.

Section 2

Disassembly

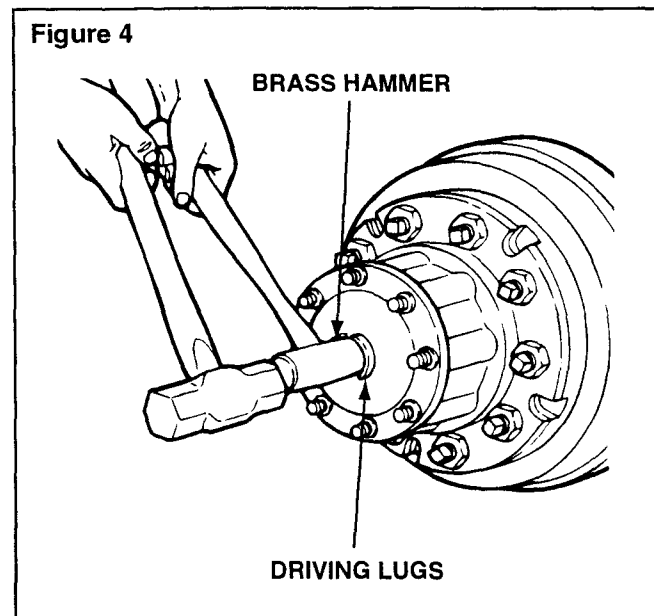
- Loosen the tapered dowels* if applicable, in the axle flanges of both axle shafts using either the **Brass Drift** or the **Air Hammer Vibration** method.

Brass Drift Method

WARNING

Wear safe eye protection. Do not directly strike or hit the round driving lugs on the flange of the axle shaft. Striking the lugs can cause them to break off from the axle shaft hub resulting in serious personal injury.

- Hold a 1-1/2 inch diameter brass drift against the center of the axle shaft, inside the round driving lugs. **Figure 4.**



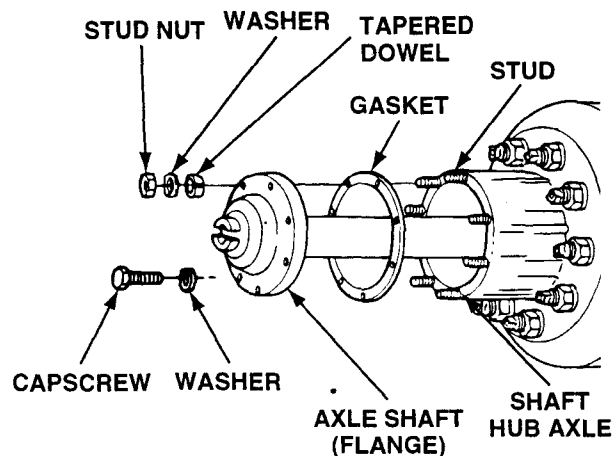
NOTE:

A 1-1/2 inch diameter brass hammer can be used as a drift.

- Strike the end of the drift with a large hammer (five to six pounds) and the axle shaft and tapered dowels will loosen.
- Mark to identify each axle shaft before it is removed from the axle assembly.

- Remove the tapered dowels and separate the axle shafts from the main axle hub assembly. **Figure 5.**

Figure 5



- Install a cover over the open end of each axle assembly hub where an axle shaft was removed.

Air Hammer Vibration Method

WARNING

Wear safe eye protection when using an air hammer. When using power tools, axle components can loosen and break off causing serious personal injury.

CAUTION

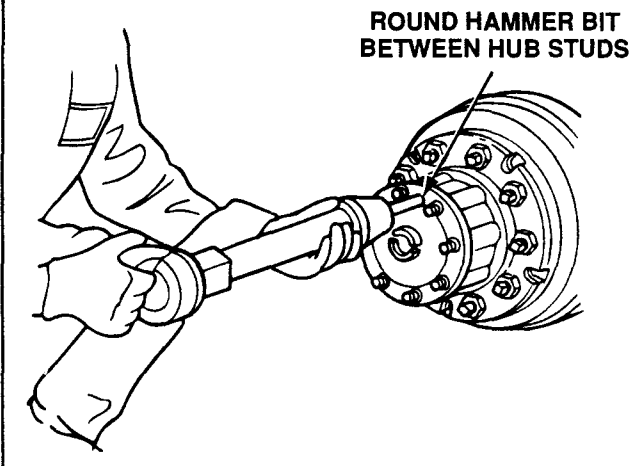
Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

- Use a round hammer bit and an air hammer such as Chicago Pneumatic CP-4181-Puller, or equivalent, to loosen tapered dowels and axle shaft.

Section 2 Disassembly

2. Place the round hammer bit against the axle shaft (flange) between the hub studs. Operate the air hammer at alternate locations between the studs to loosen the tapered dowels and axle shaft from the hub. **Figure 6.**

Figure 6



3. Mark to identify each axle shaft before it is removed from the axle assembly.
4. Remove the tapered dowels and separate the axle shaft from the main axle hub assembly. **Figure 5.**
5. Install a cover over the open end of each axle assembly hub where an axle shaft was removed.

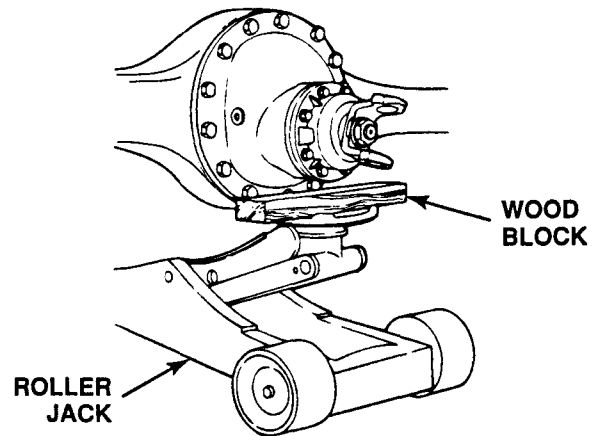
! CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

Carrier Removal from Axle

1. Place a hydraulic roller jack under the differential carrier to support the assembly. **Figure 7.**
2. Remove all but the top two carrier to housing capscrews or stud nuts and washers.
3. Loosen the top two carrier-to-housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.
4. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of carrier at several points.
5. After the carrier is loosened, remove the top two fasteners.

Figure 7

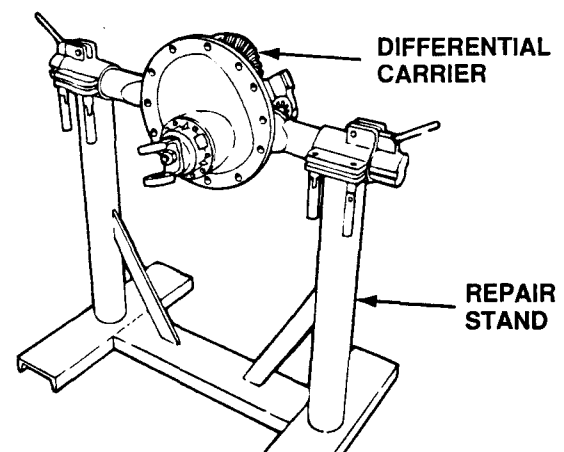


! CAUTION

When using a pry bar be careful not to damage the carrier or housing flange. Damage to these surfaces will cause oil leaks.

6. Carefully remove the carrier from the axle housing using the hydraulic roller jack. Use a pry bar that has a round end to help remove the carrier from the housing.
7. Lift the differential carrier by the input yoke or flange and place the assembly in a repair stand. **Figure 8.** Use a lifting tool for this procedure. Do not lift by hand. A carrier stand can be built by referring to the drawing on page 8.

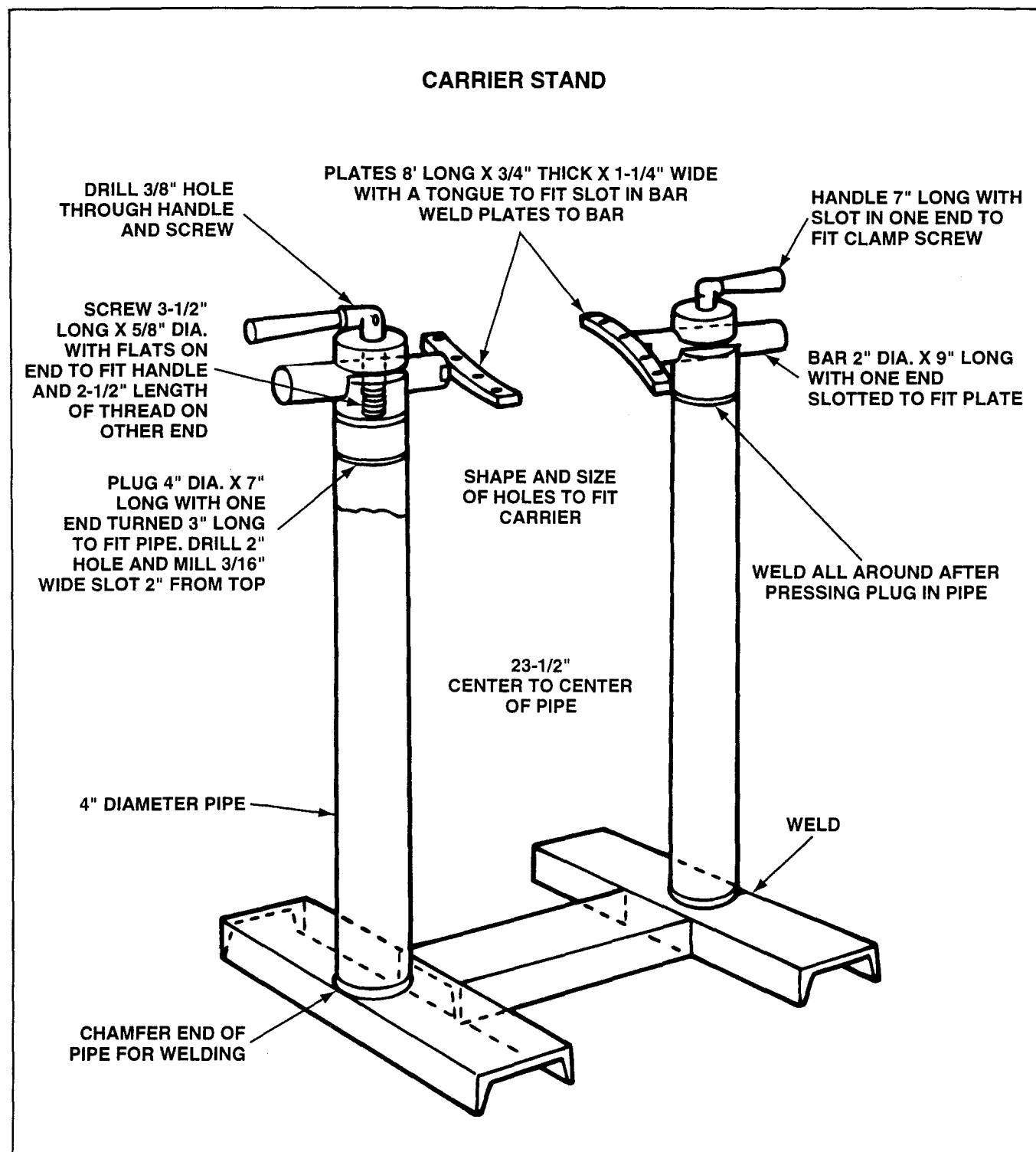
Figure 8



Section 2

Disassembly

A carrier stand, part number J 3409-D is available from Kent-Moore, Heavy-Duty Division, 29784 Little Mack, Roseville, Michigan 48066-2298.



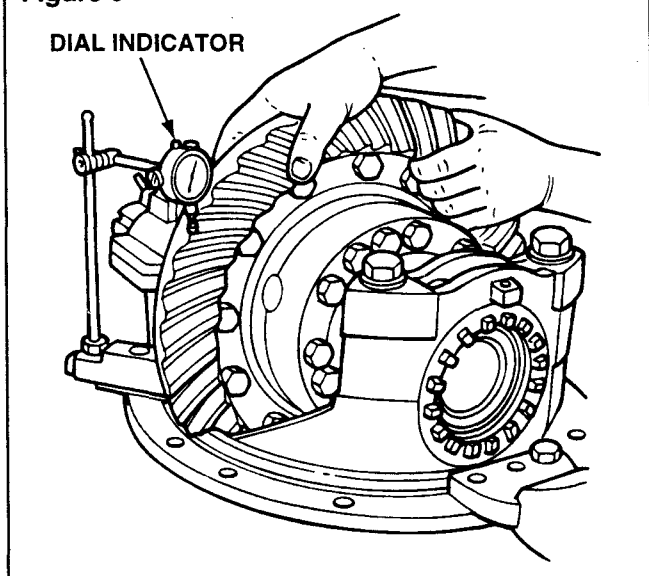
Section 2 Disassembly

Remove the Differential and Ring Gear from the Carrier

NOTE:

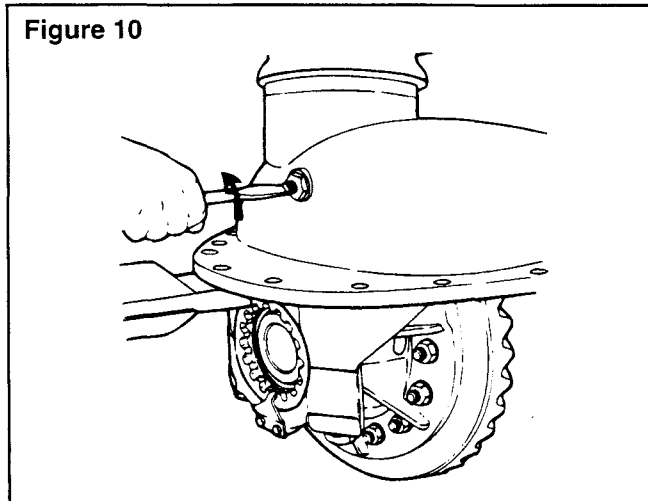
Before working on the differential carrier, inspect the hypoid gear set for damage. If inspection shows no damage, the same gear set can be used again. Measure the backlash of the gear set and make a record of the dimension. Figure 9. (Refer to procedure on page 48, steps 1-5.) During differential reassembly, adjust the backlash to the original recorded dimension when the gear set is installed into the carrier.

Figure 9



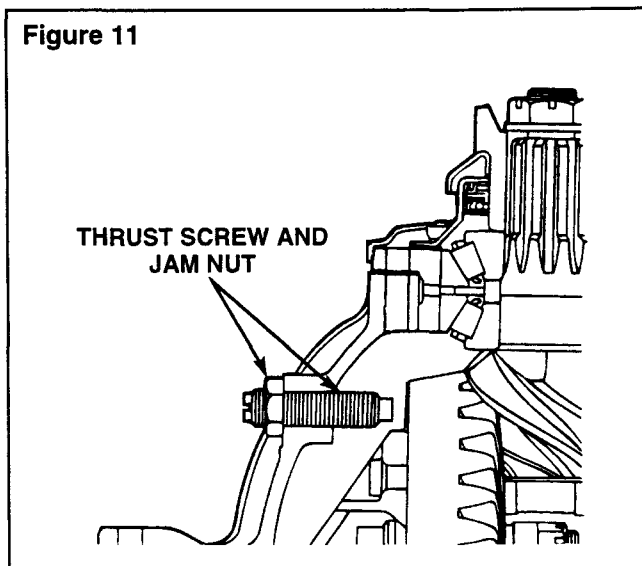
1. Loosen the jam nut* on the thrust screw*. Figure 10.

Figure 10



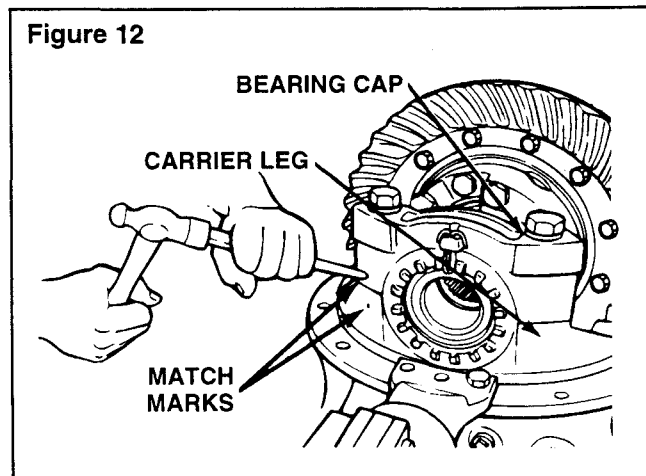
2. Remove the thrust screw* and jam nut* from the differential carrier. Figure 11.

Figure 11



3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.
4. Mark one carrier leg and bearing cap to correctly match the parts during carrier assembly. Mark the parts using a center punch and hammer. Figure 12.

Figure 12



Section 2

Disassembly

5. Remove the cotter keys*, pins* or lock plates* that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews. **Figure 13.**
6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers. **Figure 14.**
7. Remove the bearing caps and bearing adjusting rings from the carrier: **Figure 15.**
8. Safely lift the main differential and ring gear assembly from the carrier. Place the assembly on a work bench. **Figure 16.**

Figure 13

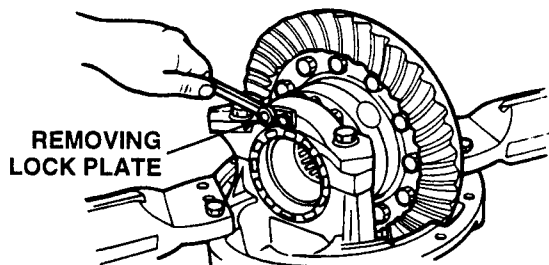
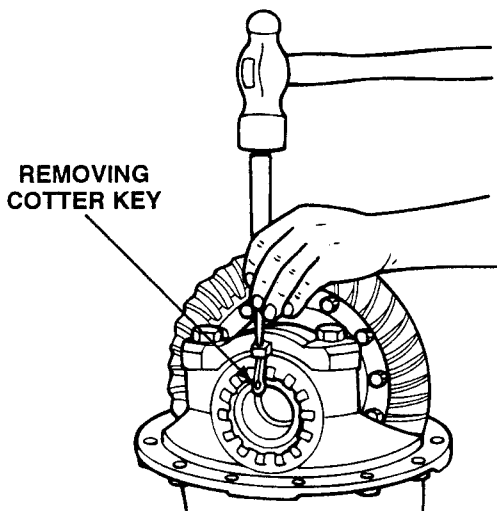


Figure 14

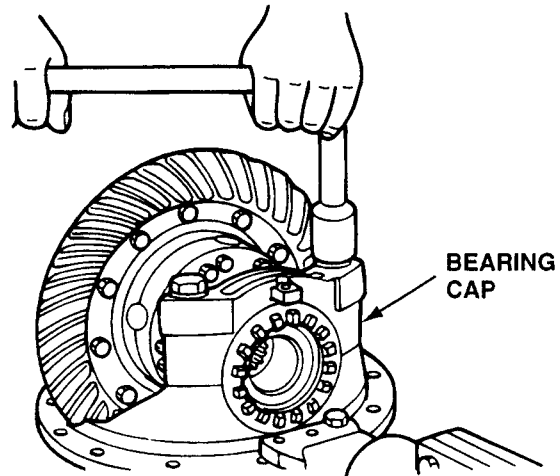


Figure 15

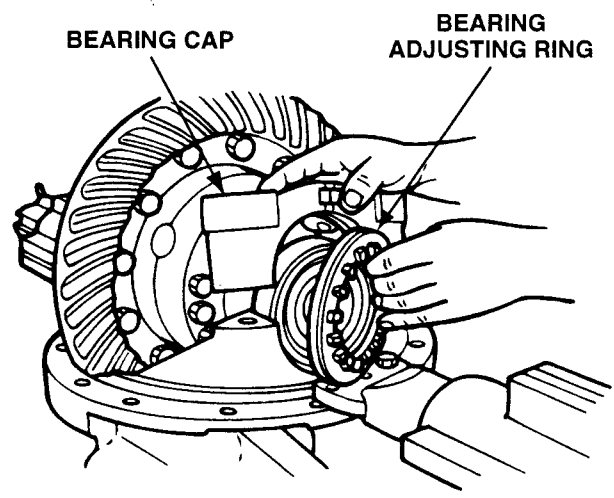
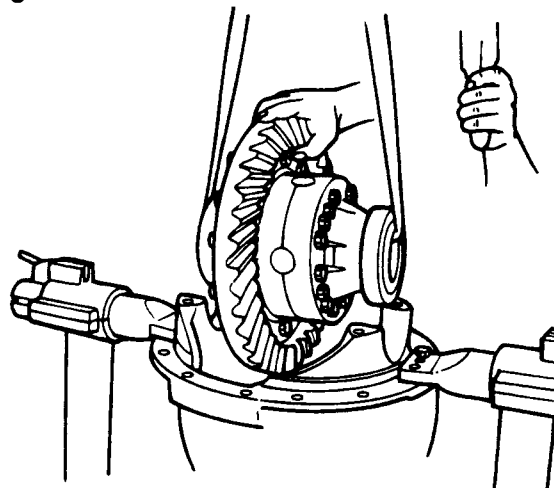


Figure 16

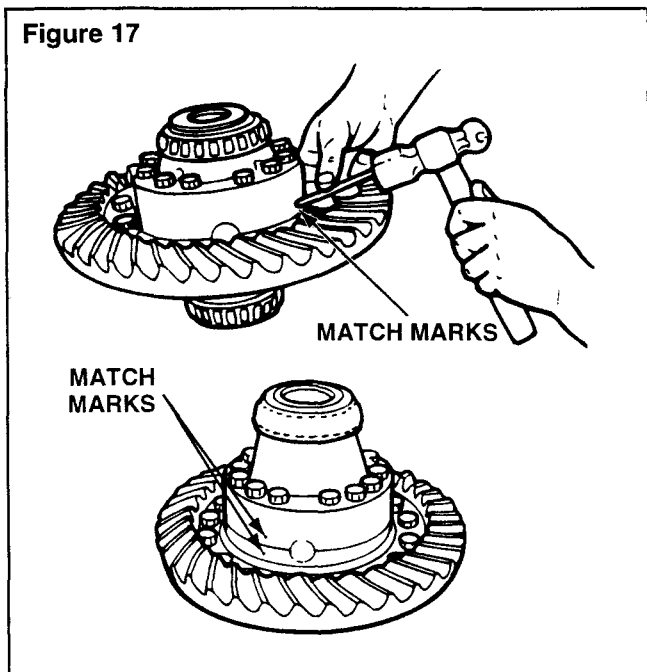


Section 2 Disassembly

Disassemble the Differential and Ring Gear Assembly

1. If the matching marks on the case halves of the differential assembly are not visible, mark each case half with a center punch and hammer. The purpose of the marks is to match the plain half and flange half correctly when you assemble the carrier. **Figure 17.**

Figure 17



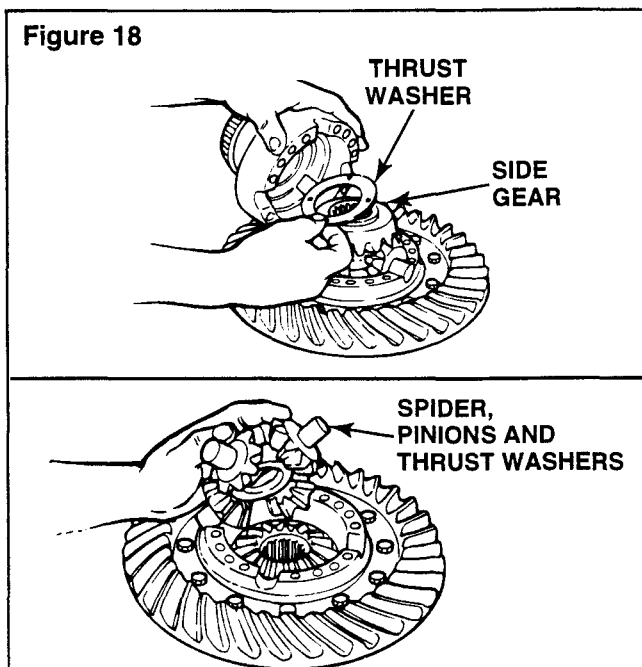
2. Remove the capscrews* and washers* or bolts*, nuts* and washers that hold the case halves together.

WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

3. Separate the case halves. If necessary, use a brass, plastic or leather mallet to loosen the parts.
4. Remove the differential spider (cross), four pinion gears, two side gears and six thrust washers from inside the case halves. **Figure 18.**
5. If the ring gear needs to be replaced, remove the bolts*, nuts*, and washers* that hold the gear to the flange case half.

Figure 18



CAUTION

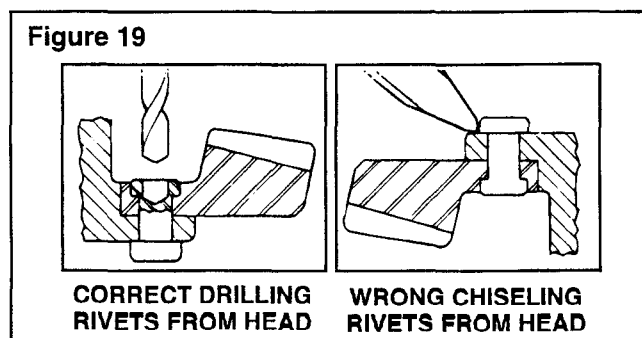
Do not remove the rivets or rivet heads with a chisel and hammer. Using a flat edge tool can cause damage to the flange case. Refer to Figure 19.

WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

6. If rivets* hold the ring gear to the flange case half, remove the rivets as follows:
7. Carefully center punch each rivet head in the center, on the ring gear side of the assembly.
8. Drill each rivet head on the ring gear side of the assembly to a depth equal to the thickness of one rivet head. Use a drill bit that is 1/32 of an inch smaller than the body diameter of the rivets.

Figure 19.



*Some Rockwell carriers do not have these described parts.

Section 2

Disassembly

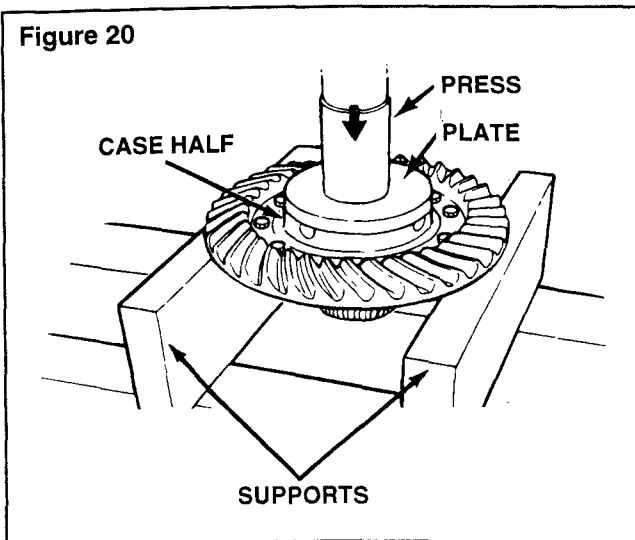
9. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.

WARNING

Observe all **WARNINGS** and **CAUTIONS** provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

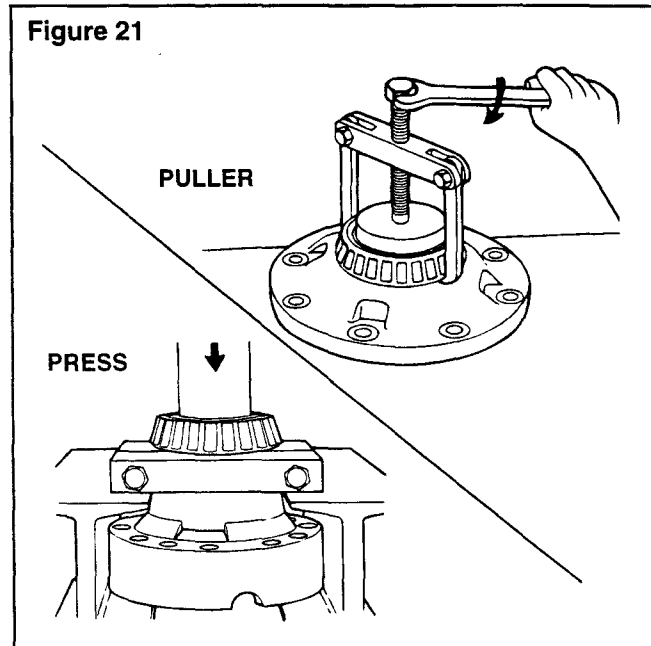
10. Separate the case half and ring gear using a press. Support the assembly under the ring gear with metal or wood blocks and press the case half through the gear. **Figure 20.**

Figure 20



11. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press. **Figure 21.**

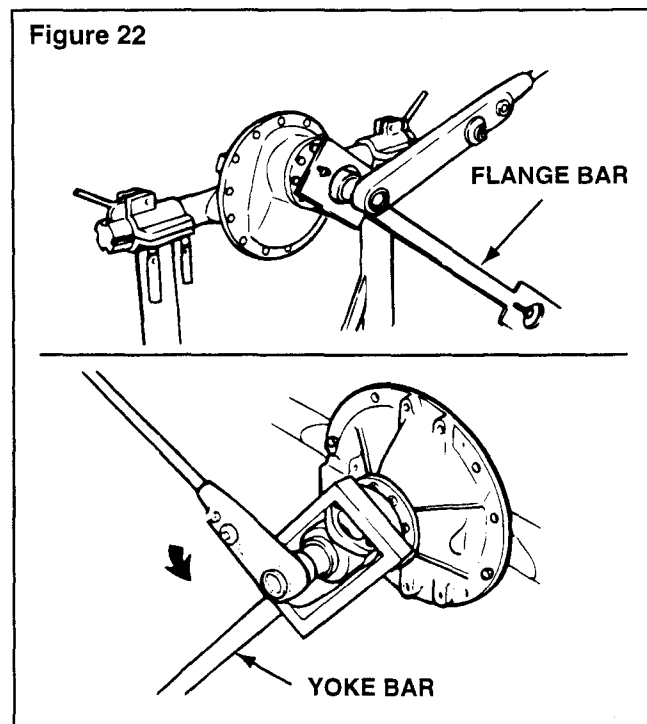
Figure 21



Remove the Drive Pinion and Bearing Cage from Carrier

1. Fasten a flange bar to the input yoke or flange. When the nut is removed, the bar will hold the drive pinion in position. **Figure 22.**

Figure 22



Section 2

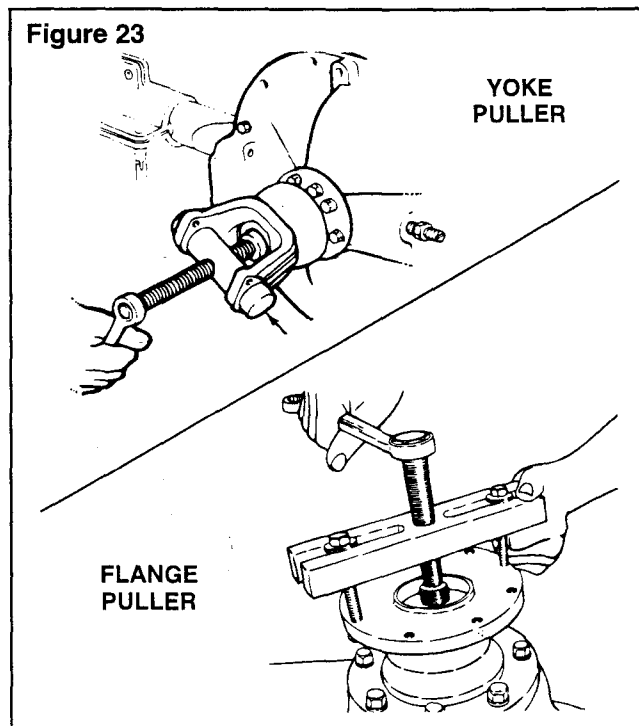
Disassembly

2. Remove the nut and washer* from the drive pinion. **Figure 22.**
3. Remove the yoke or flange bar.

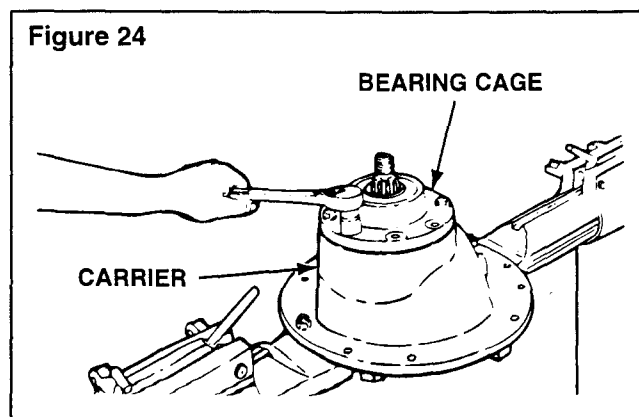
CAUTION

Do not use a hammer or mallet to loosen and remove the yoke or flange. A hammer or mallet can damage the parts and cause driveline runout, or driveline imbalance problems after carrier to driveline assembly.

4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. **Figure 23.**



5. Remove the capscrews and washers that hold the bearing cage in the carrier. **Figure 24.**



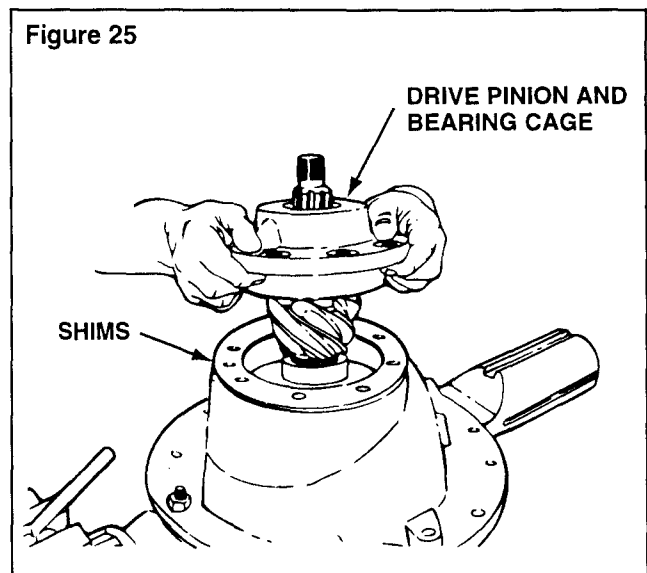
WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

CAUTION

Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing cage, shims and carrier.

6. Remove the drive pinion, bearing cage and shims from the carrier. If the bearing cage is tight in the carrier, hit the bearing cage at several points around the flange area with a leather, plastic or rubber mallet. **Figure 25.**



7. If the shims are in good condition, keep the shims together for use later when the carrier is assembled.
8. If shims are to be discarded because of damage, first measure the total thickness of the pack. Make a note of the dimension. The dimension will be needed to calculate the depth of the drive pinion in the carrier when the gear set is installed.

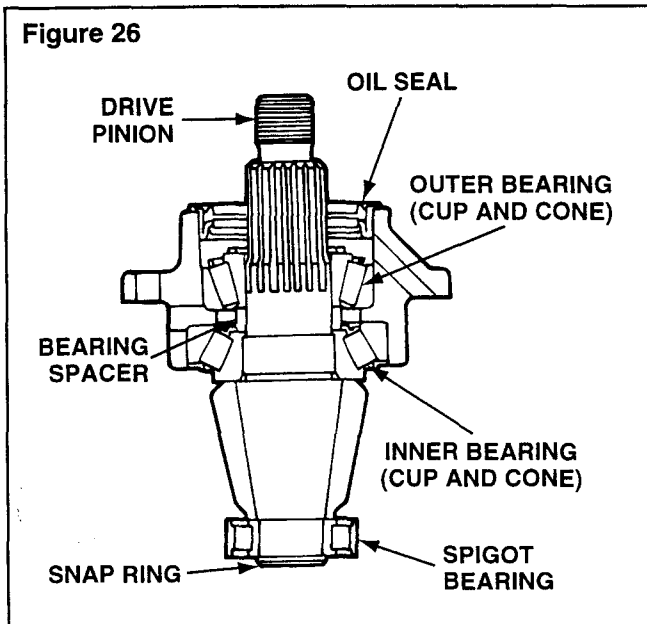
*Some Rockwell carriers do not have these described parts.

Section 2

Disassembly

Disassemble the Drive Pinion and Bearing Cage

Figure 26

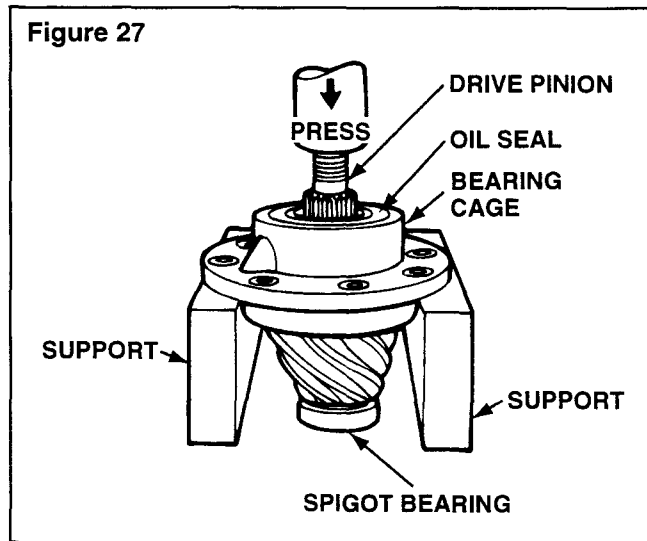


WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

1. Place the drive pinion and bearing cage in a press. The pinion shaft must be toward the top of the assembly. **Figure 27.**

Figure 27



2. Support the bearing cage under the flange area with metal or wood blocks. **Figure 27.**
3. Press the drive pinion through the bearing cage. **Figure 27.**

NOTE:

The inner bearing cone and bearing spacer will remain on the pinion shaft.

WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

4. If a press is not available, use a leather, plastic or rubber mallet to drive the pinion through the bearing cage.

CAUTION

Be careful when removing the seal. Do not damage the wall of bore. Damage to the bore wall can result in oil leaks.

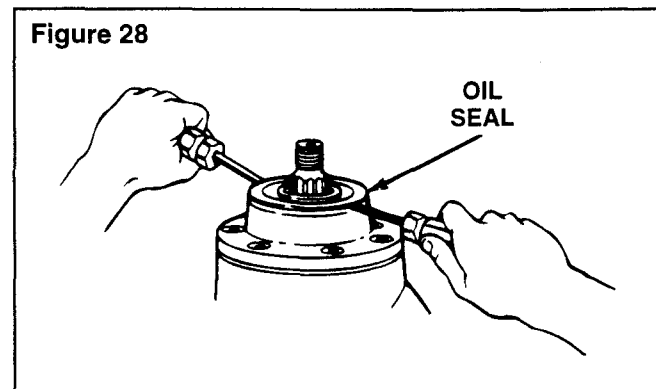
NOTE:

When the oil seal has been removed, always replace it with a new triple-lip (main) seal during component reassembly.

5. If the pinion oil seal is mounted directly in the outer bore of the bearing cage, remove the seal at this time.

Be careful that you do not damage the mounting surfaces of the bearing cage. **Figure 28.**

Figure 28



Section 2 Disassembly

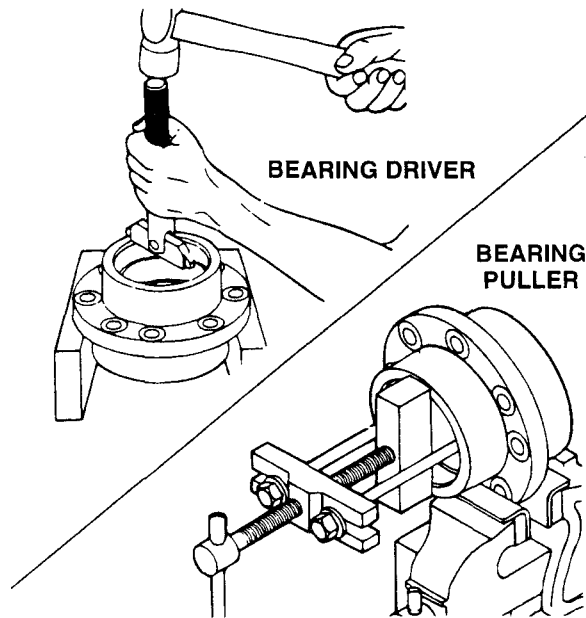
WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

6. If the pinion bearings need to be replaced, remove the inner and outer bearing cups from the inside of cage. Use a press and sleeve, bearing puller or a small drift hammer. The type of tool used depends on the design of the bearing cage. **Figure 29.**

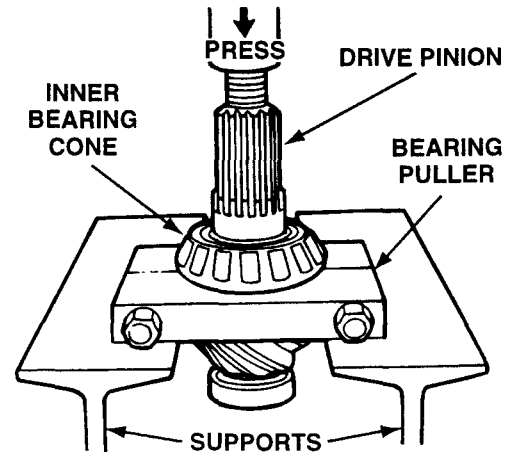
When a press is used, support the bearing cage under the flange area with metal or wood blocks.

Figure 29



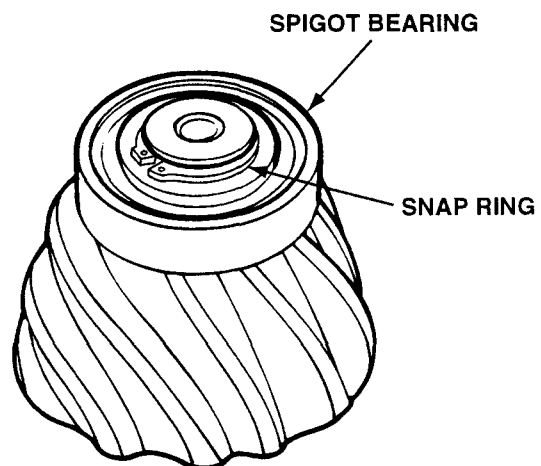
7. If the pinion bearings need to be replaced, remove the inner bearing cone from the drive pinion with a press or bearing puller. The puller **must** fit under the inner race of the cone to remove the cone correctly without damage. **Figure 30.**

Figure 30



8. If the spigot bearing needs to be replaced, place the drive pinion in a vise. Install a soft metal cover over each vise jaw to protect the drive pinion.
9. Remove the snap ring* from the end of drive pinion with snap ring pliers that expand. **Figure 31.**

Figure 31



*Some Rockwell carriers do not have these described parts.

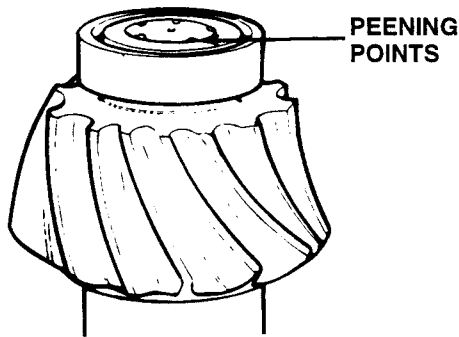
Section 2

Disassembly

NOTE:

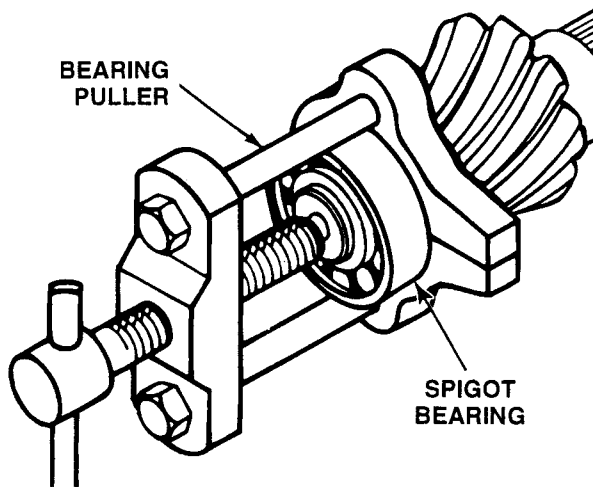
Some spigot bearings are fastened to the drive pinion with a special peening tool. Figure 32.

Figure 32



10. Remove the spigot bearing from the drive pinion with a bearing puller. Figure 33.

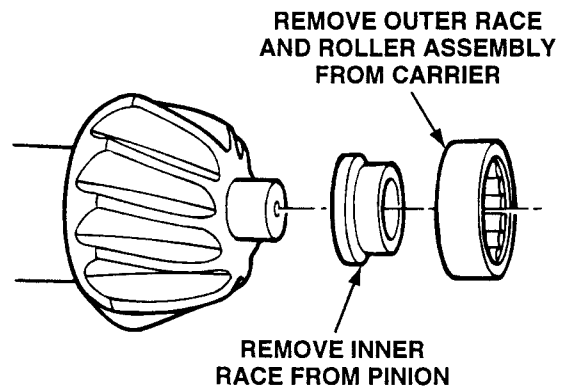
Figure 33



NOTE:

Some spigot bearings are a two-piece assembly. Remove the inner race from the pinion with a bearing puller. Remove the outer race/roller assembly from carrier with a drift or a press. Figure 34.

Figure 34



Section 3

Preparing the Parts for Assembly

Cleaning Ground and Polished Parts



WARNING

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

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



WARNING

Be careful when using cleaning solvents. Follow the solvent manufacturer's instructions for safe use and to prevent personal injury.

2. Use a tool with a flat blade, if required, to remove sealant material from parts. Be careful not to damage the polished or smooth surfaces.



CAUTION

Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose. If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.

3. **Do not** clean ground or polished parts with water or steam. Do not immerse ground or polished parts in a hot solution tank or use strong alkaline solutions for cleaning, or the smooth sealing surface may be damaged.

Cleaning Rough Parts

1. Clean rough parts with the same method as cleaning ground and polished parts.
2. Rough parts can be cleaned in hot solution tanks with a weak or diluted alkaline solution.
3. Parts must remain in hot solution tanks until heated and completely cleaned.



WARNING

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

4. Parts must be washed with water until all traces of the alkaline solution are removed.

Cleaning Axle Assemblies

1. A complete axle assembly can be steam cleaned on the outside to remove dirt.
2. Before the axle is steam cleaned, close or place a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

Drying Parts After Cleaning

1. Parts must be dried immediately after cleaning and washing.
2. Dry the parts using soft, clean paper or cloth rags.
3. Except for bearings, parts can be dried with compressed air.



CAUTION

Damage to bearings can result when they are rotated and dried with compressed air.

Preventing Corrosion on Cleaned Parts

1. Apply axle lubricant to cleaned and dried parts that are not damaged and are to be assembled.
2. To store parts, apply a special material that prevents corrosion to all surfaces. Wrap cleaned parts in a special paper that will protect the parts from moisture and prevent corrosion during storage.

Section 3

Preparing the Parts for Assembly

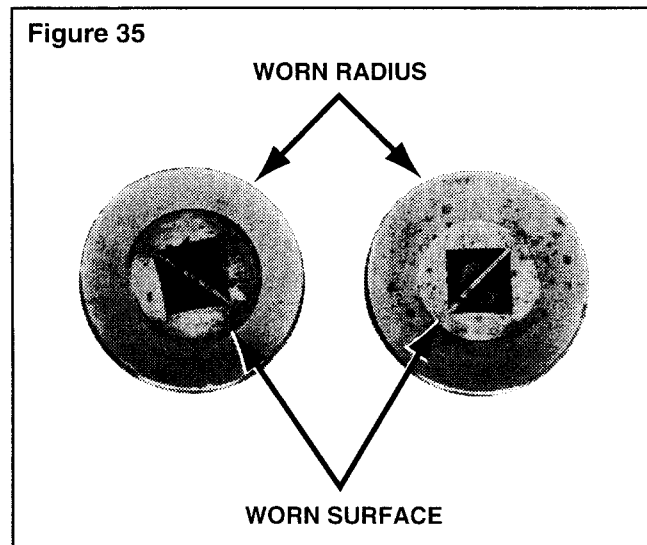
Inspecting Parts

It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Inspect all parts for wear and replace damaged parts. Replacement of damaged or worn parts now, will prevent failure of the assembly later.

1. Inspecting Tapered Roller Bearings:

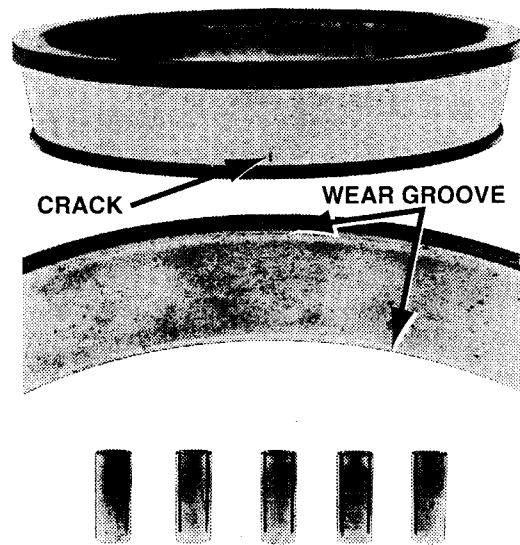
Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, the bearing **must** be replaced.

- a. The center of large-diameter end of rollers worn level with or below the outer surface. **Figure 35.**



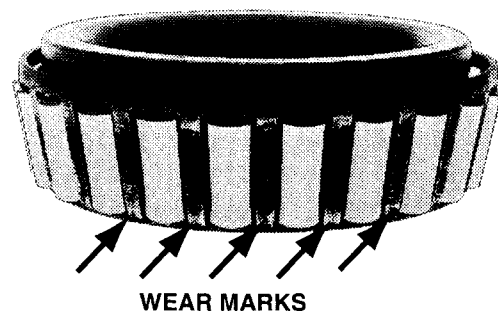
- b. The radius at large-diameter end of rollers worn to a sharp edge. **Figure 35.**
- c. A visible roller groove in the cup or cone inner race surfaces. The groove can be seen at the small- or large-diameter end of both parts. **Figure 36.**

Figure 36



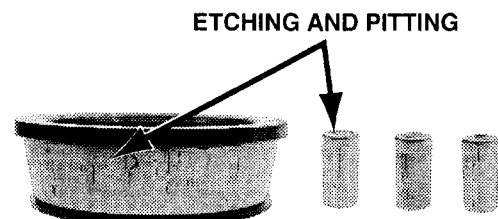
- d. Deep cracks or breaks in the cup, cone inner race or roller surfaces. **Figure 36.**
- e. Bright wear marks on the outer surface of the roller cage. **Figure 37.**

Figure 37



- f. Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers. **Figure 38.**

Figure 38

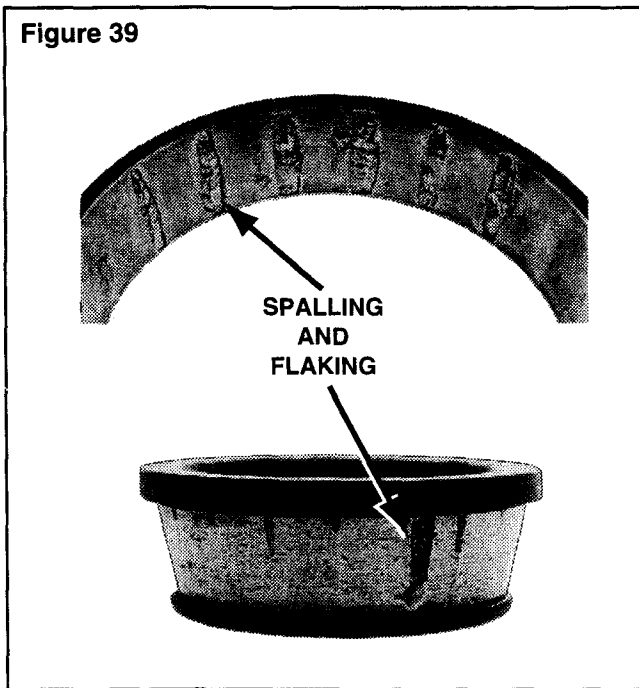


Section 3

Preparing the Parts for Assembly

- g. Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 39.**

Figure 39



CAUTION

Hypoid drive pinions and ring gears are machined in matched sets. When a drive pinion or ring gear of a hypoid set needs to be replaced, both drive gear and pinion must be replaced at the same time.

2. Inspect hypoid pinions and gears for wear or damage. Gears that are worn or damaged **must** be replaced.

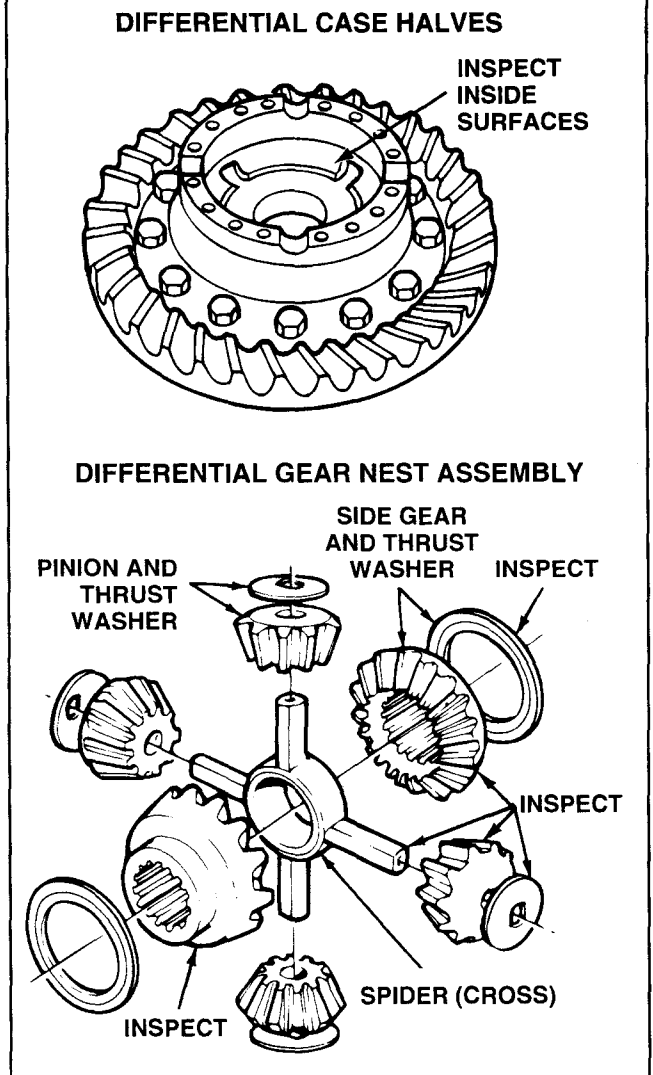
CAUTION

Always replace thrust washers, differential side gears and pinion gears in full matched sets. A higher stress on original parts and early failure of the entire assembly will result if a new part is used in combination with parts that are older or worn.

3. Inspect the Main Differential Assembly:

Inspect the following parts for wear or stress. Parts that are damaged **must** be replaced. **Figure 40.**

Figure 40



- a. Inside surfaces of both case halves.
 - b. Both surfaces of all thrust washers.
 - c. The four trunnion ends of the spider (cross).
 - d. Teeth and splines of both differential side gears.
 - e. Teeth and bore of all differential pinions.
4. Inspect Axle Shafts:
 - a. Inspect axle shafts for wear and cracks at the flange, shaft and splines.
 - b. Replace axle shafts, if required.

Section 3

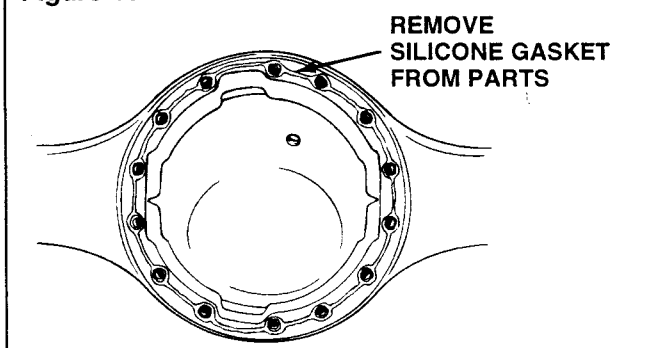
Preparing the Parts for Assembly

Repair or Replacement of Parts, General

Replace worn or damaged parts of an axle assembly. The following are some examples in inspecting for part replacement or repair.

1. Replace any fastener if corners of the head are worn.
2. Replace washers if damaged.
3. Replace gaskets, oil seals or grease seals at the time of axle or carrier repair.
4. Clean parts and apply new silicone gasket material where required when axle or carrier is assembled. **Figure 41.**

Figure 41



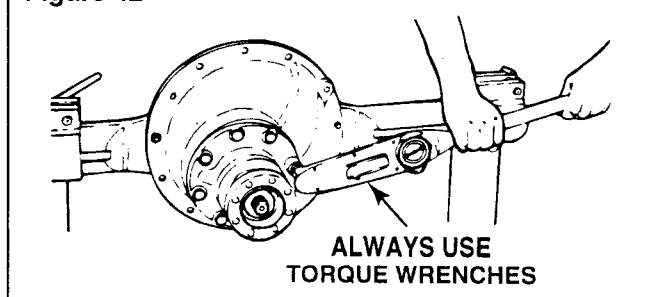
5. Remove nicks, mars and burrs from parts with machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth for this purpose.

CAUTION

Threads must be without damage and clean so that accurate adjustments and correct torque values can be applied to fasteners and parts.

6. Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.
7. Tighten all fasteners to the correct torque values. Refer to the chart on page 61 for torque values of fasteners. **Figure 42.** 

Figure 42



8. *Do not* repair rear axle housings by bending or straightening.

WARNING

Repair of axle housings by bending or straightening will cause poor or unsafe vehicle operation and early failure of the axle.

Repair Axle by Welding

1. Rockwell International will permit repairing drive axle housing assemblies by welding **only** in the following areas:
 - a. Snorkel welds.
 - b. Housing seam welds between the suspension attaching brackets.
 - c. Bracket welding to drive axle housing. Refer to TP-9421.
 - d. Refer to Rockwell Maintenance Manual No. 8 for approved axle welding procedures.
 - e. Contact your Rockwell representative for further or specific recommendations.

CAUTION

Welding can be used when the crack or damaged area is within the old weld material. Replace the axle housing if the crack extends into the metal next to the old weld. A repaired housing must be used only in correct specified vehicle load applications.

WARNING

Using wrong welding procedures or welding at locations other than the three areas permitted by Rockwell will make the heat-treated component weak. A weak component will cause poor or unsafe operation of the vehicle and early axle failure. The following procedure must be used.

2. Welding Procedure
 - a. Drain the lubricant from the axle assembly.
 - b. Remove hub, drum, wheel bearing and brake air chambers.
 - c. Remove the axle shafts and differential carrier from the axle housing.

Section 3

Preparing the Parts for Assembly



WARNING

Be careful when using a cleaning solvent. Follow the solvent manufacturer's instructions for safe use to prevent serious personal injury.

- d. Clean the damaged area inside and outside the housing. Cleaning solvent can be used.
- e. Grind the damaged weld to the base metal.
- f. Warm the complete axle housing to a temperature of 70°F–80°F (21°C–27°C) or higher.
- g. Before you start welding, heat the damaged area to be repaired to approximately 300°F (149°C).
- h. Use a 70,000 psi tensile weld material and the correct voltage and amperage for the diameter weld rod used. Examples of weld rods that can be used are E-7018 or ER-70S-3.



CAUTION

If the E-7018 weld rod is used, the rod must be kept dry. Electrodes that are not stored in the correct sealed containers must be heated at 700°F (371°C) for one hour before welding. Wet electrodes must be dried at 180°F (82°C) for one to two hours and then heated at 700°F (371°C) for one hour before welding.

- i. Fill in the weld gap as follows:



CAUTION

Do not connect the ground cable at any point on the axle assembly that will place a bearing between the ground cable and weld area. If a bearing is between the ground cable and weld, the bearing will be damaged because of electrical arcing in the bearing and bearing track areas.

A good location to connect the ground cable is the spring mounting pad of the housing.

1. The opening in cover welds **must** be filled level with the old weld.
2. The opening in seam welds **must** be ground out to 70% of the wall thickness. The wall thickness can be measured at the carrier opening of housing.
3. Clean the new weld area. Carefully remove all the rough weld material.

4. Install the differential carrier and axle shafts.
5. Fill the axle assembly with the correct amount of lubricant. Refer to Rockwell Field Maintenance Manual No. 1 for information on lubricants.

NOTE:

Before welding brackets or other components to the axle housing, contact Rockwell for proper welding procedures.

Bending or Straightening Drive Axle Housings

Rockwell International is emphatically opposed to any attempt to correct or modify drive axle housings by bending or straightening. All damaged drive axle housings should be replaced.



WARNING

Do not bend or straighten damaged drive axle housings. Any bending or straightening process may result in misalignment or weakening of the axle housing and cause component damage and result in serious personal injury.

Removing Dri-Loc® Fasteners

If it is difficult to remove fasteners from components, the strength of Dri-Loc®, Rockwell adhesive or Loctite® 277 can be decreased by heating. Use the following procedure:

1. Heat the fastener for three to five seconds **only** and try to loosen the fastener with a wrench. **Do not** use an impact wrench to loosen the fastener or hit the fastener with a hammer.



CAUTION

Do not exceed 350°F (177°C) maximum. Heating must be done slowly to prevent thermal stresses in the other components.

2. Repeat step 1 until the fastener can be removed.

Section 4

General Information

Installing Fasteners with Pre-Applied Adhesive, Rockwell Liquid Adhesive 2297-C-7049, Loctite® 680 Liquid Adhesive or Equivalent

Installing New Fasteners with Pre-applied Adhesive Patches



WARNING

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

1. Clean the oil and dirt from threaded holes. Use a wire brush. There is no other special cleaning required.



CAUTION

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

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

NOTE:

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

3. Tighten the fasteners to the required torque value for that size fastener.

Installing Original or Used Fasteners Using Rockwell Liquid Adhesive 2297-C-7049 or Loctite® 680 or Equivalent

1. Clean the oil, dirt and old adhesive from all threads and threaded holes. Use a wire brush.
2. Apply four or five drops of Rockwell Liquid Adhesive, Loctite® 680 or equivalent inside each threaded hole or bore ONLY. Make sure the adhesive is applied inside to the bore threads. Figure 43.



CAUTION

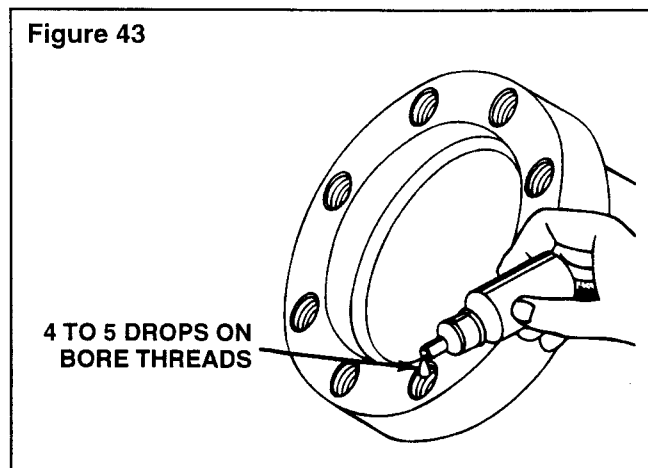
Do not apply adhesive directly to the fastener threads. Air pressure in a closed hole will push the adhesive out and away from mating surfaces as the fastener is installed.

3. Tighten the fasteners to the required torque value for that size fastener.

NOTE:

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

Figure 43



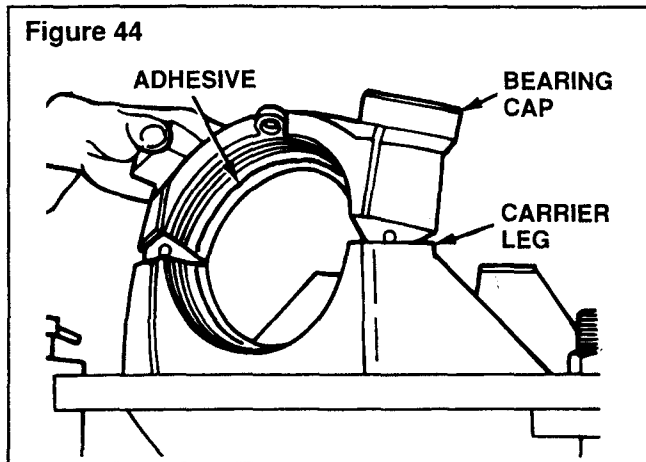
Section 4

General Information

Application of Rockwell Adhesive 2297-T-4180 in Bearing Bores for the Differential

- Use adhesive 2297-T-4180 for all axles.
1. Clean the oil and dirt from outer diameters of bearing cups and bearing bores in the carrier and bearing caps. There is no special cleaning required.
 2. Apply axle lubricant to the bearing cones and the inner diameters of the bearing cups of the main differential. **Do not** get oil on the outer diameter of the bearing cup and **Do not** permit oil to drip on the bearing bores.
 3. Apply a single continuous bead of the adhesive to the bearing bores in the carrier and bearing caps. Apply the adhesive 360° around the smooth, ground surfaces only. **Do not** place adhesive on threaded areas. Figure 44.

Figure 44



NOTE:

Rockwell adhesive 2297-T-4180 will become hard (dry) in approximately two hours. The following two steps of the procedure must be done in two hours from the time the adhesive was applied. If two hours have passed since application, clean the adhesive from the parts again and apply new adhesive.

4. Install the main differential assembly, bearing cups and bearing caps into the carrier. Use the normal procedure, refer to page 44.
5. Adjust preload of the differential bearings, backlash and tooth contact patterns of the gear set as required using the normal procedures. Refer to pages 45-54.

Application of Three Bond 1216 or Equivalent Silicone Gasket Material

⚠ WARNING

Small amounts of acid vapor are present when applying silicone gasket material. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

NOTE:

The following silicone gasket products or equivalent are available in 3 oz (85 gram) tubes and can be used for Rockwell components:

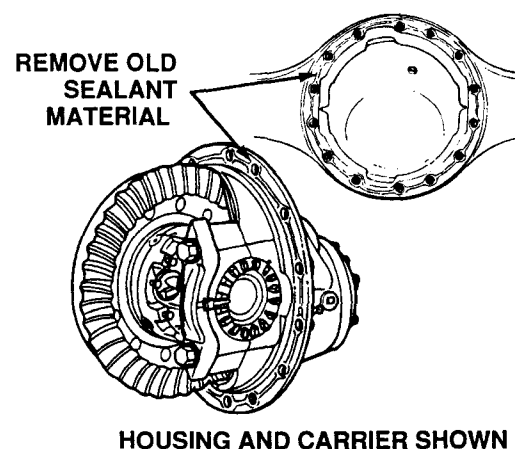
- Three Bond RTV No. TB 1216 (Grey) — Rockwell Part Number 2297-Z-7098
- Loctite® Ultra Grey RTV No. 5699 — Rockwell Part Number 2297-A-7021

Also available in 120 oz (3.4 kg) cartridges:

- Three Bond RTV1216 (Grey) — Rockwell Part Number 2297-A-7051

1. Remove all old gasket material from both surfaces. Figure 45.
2. Clean the surfaces where silicone gasket material will be applied. Remove all oil, grease, dirt and moisture without damaging the mating surfaces. Figure 45.

Figure 45



Section 4

General Information

3. Dry both surfaces.

CAUTION

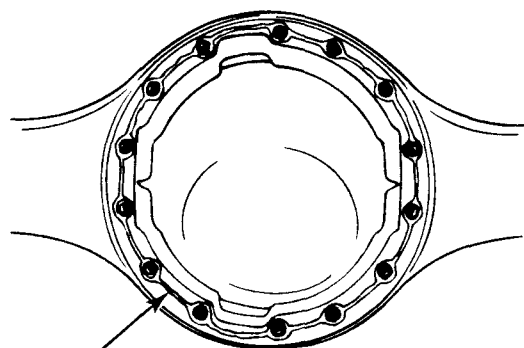
The amount of silicone gasket material applied must not exceed 0.125 inch (3 mm) diameter bead. Too much gasket material can block lubrication passages and result in damage to the components.

4. Apply 0.125 inch (3 mm) diameter continuous bead of the silicone gasket material around one surface. Also apply the gasket material around the edge of all fastener holes on that surface. **Figure 46.**
5. Assemble the components immediately to permit the silicone gasket material to compress evenly between the parts. Tighten fasteners to the required torque value for that size fastener. There is not special procedure or additional torque value required. Refer to the Torque Chart on page 61.



6. Wait 20 minutes before filling the assembly with lubricant.

Figure 46



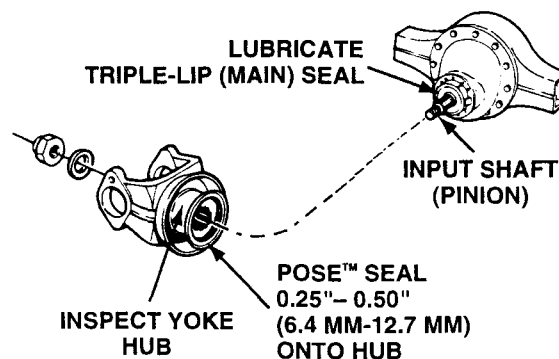
0.125" (3 MM) DIAMETER
SILICONE GASKET BEAD

NOTE:

Rockwell adhesive products are available from Rockwell Heavy Vehicle Systems, Inc.

Installing Tight Fit Yokes and POSE™ Seal

Figure 47

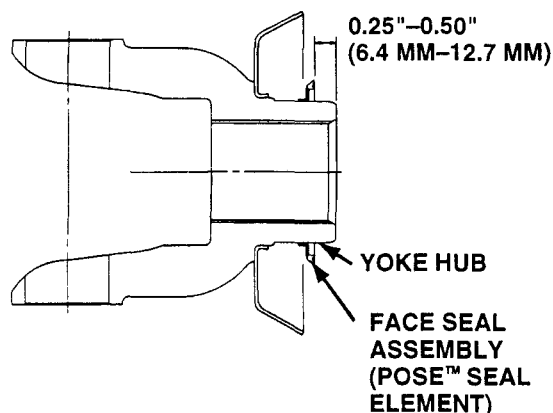


1. Apply the same lubricant used in the axle housing to the hub of the yoke or flange.
2. Inspect and make sure the lips of the POSE™ seal and the outer retainer of the triple-lip (main) seal are clean and free from dirt and particles that may cause lubricant leakage between the seals.
3. Install the POSE™ seal on the hub of the yoke or flange by hand. The lips of the seal must face toward the end of the hub (opposite shoulder). Slide the POSE™ seal on the hub until the lips are from 0.25 inch to 0.50 inch (6.4 mm-12.7 mm) from the end of the hub. **Do not install the POSE™ seal against the shoulder.** **Figure 48.**

NOTE:

The POSE™ seal will position itself correctly as the yoke or flange is pressed on the shaft.

Figure 48



Section 4

General Information

4. Before you install the yoke or flange on the shaft, again apply the same lubricant used in the axle housing to the hub.
5. Install the yoke or flange using the correct procedure.

NOTE:

The yoke must be completely seated before tightening pinion nut to the input shaft.

General Yoke and U-Joint Reassembly

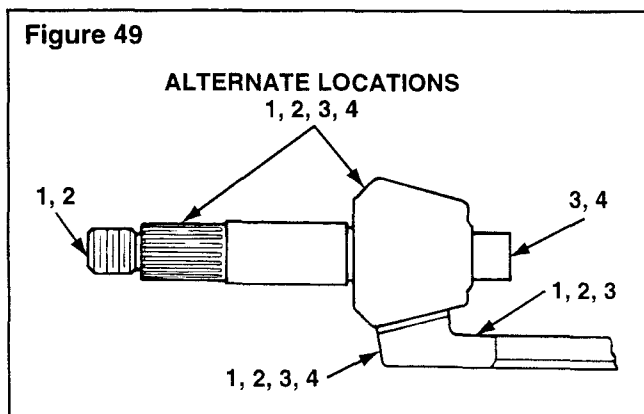
Install the end yoke hub capscrews by hand after seating the U-joint. Tighten the capscrews according to manufacturer's torque specifications.

Gear Set Information (Drive Pinion and Ring Gear Marks)

NOTE:

Read the following information before installing a new gear set in the carrier. Always inspect the gear set for correct marks to make sure the gears are a matched set.

The location of the marks are shown in Figure 49.



1. Part Number

a. Examples of gear set part numbers:

- Conventional ring gear, 36786.
- Conventional drive pinion, 36787.
- Generoid ring gear, 36786 K or 36786 K2.
- Generoid drive pinion, 36787 K or 36787 K2.

NOTE:

The last digit in part numbers for Generoid gears is a letter or letter and number.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

2. Tooth Combination Number

a. Example of a tooth combination number:
5-37.

NOTE:

A 5-37 gear set has a 5-tooth drive pinion and a 37-tooth ring gear.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

3. Gear Set Match Number

Rockwell drive pinions and ring gears are available only as matched sets. Both gears of a set have a match number.

a. Example of a gear set match number:
M29.

NOTE:

A gear set match number has any combination of a number or letter and number.

b. Location on Drive Pinion: End of gear head.

c. Location on Ring Gear: Front face or outer diameter.

Section 4

General Information

4. Pinion Cone Variation Number

NOTE:

The pinion cone variation number is not used when inspecting for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier. Refer to the procedure for adjusting the shim pack thickness under the pinion cage on pages 36-38.

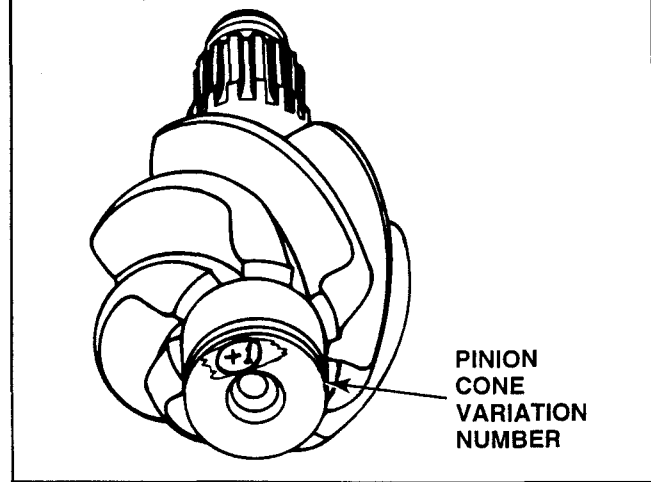
- a. Examples — refer to **Figure 50**.

Pinion cone variation numbers:

- PC+3 • +2 • +0.01 mm
- PC-5 • -1 • -0.02 mm

- b. **Location on Gear Set:** End of pinion gear head or outer diameter of ring gear.

Figure 50



Assemble the Drive Pinion, Bearings and Bearing Cage



WARNING

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

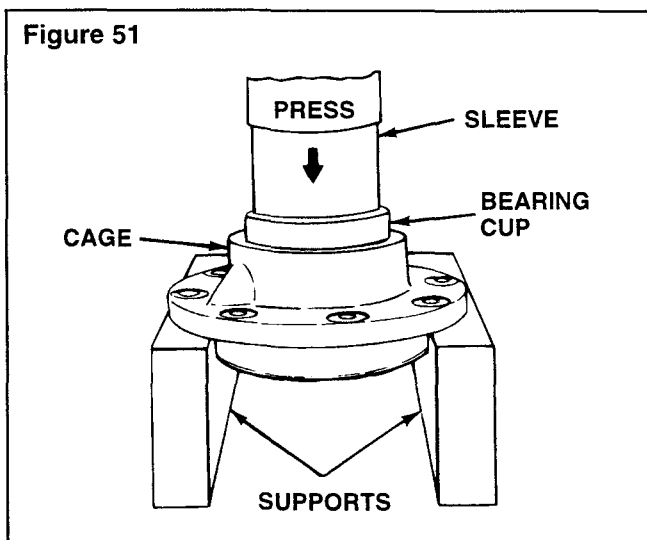


WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

1. Place the bearing cage in a press. **Figure 51.**

Figure 51



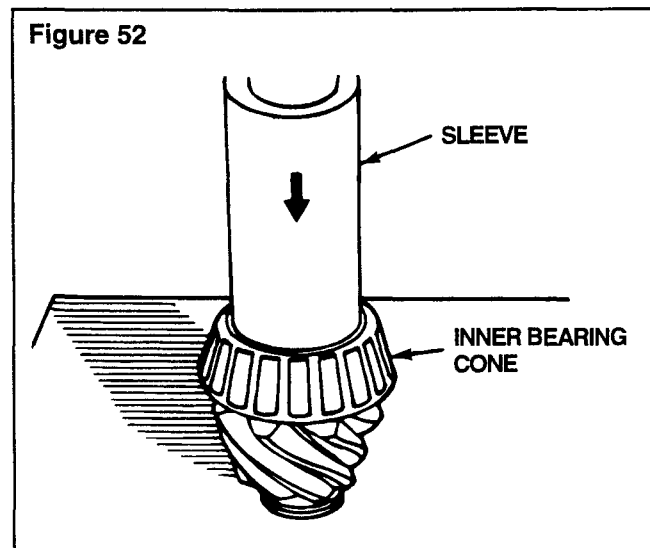
2. Support the bearing cage with metal or wood blocks.
3. Press the bearing cup into the bore of bearing cage until cup is flat against bottom of bore. Use a sleeve of the correct size to install bearing cup. **Figure 51.**

NOTE:

Use the same procedure for both bearing cups.

4. Place the drive pinion in a press, gear head (teeth) toward the bottom. **Figure 52.**

Figure 52



5. Press the inner bearing cone on the shaft of the drive pinion until the cone is flat against the gear head. Use a sleeve of the correct size against the bearing inner race.

NOTE:

Spigot bearings are usually fastened to the drive pinion with a snap ring. Some are fastened with a peening tool, and some are a two-piece bearing assembly with the inner race pressed on the nose of the pinion and the outer race pressed into its bore in the carrier. Use the following procedure to install the spigot bearing, then continue with steps 6-9 on page 31.

Section 5

Assembly

Installing the One-Piece Spigot Bearing on the Drive Pinion with Snap Ring

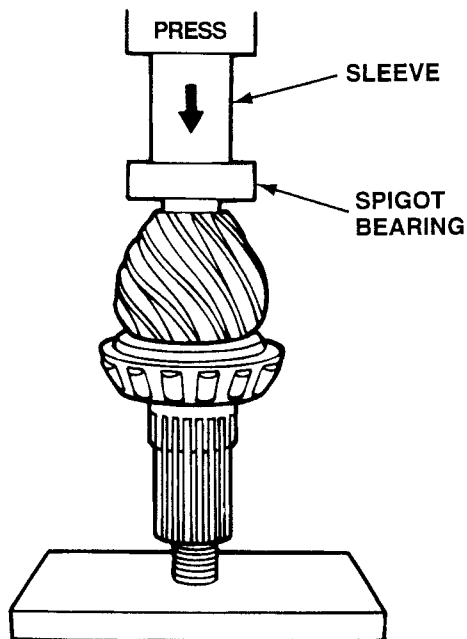
NOTE:

This procedure applies to all axles except:

- *Some 160 Series single axles may use snap rings.*
- *Some 160 and 180 Series rear rear tandem axles may use snap rings.*

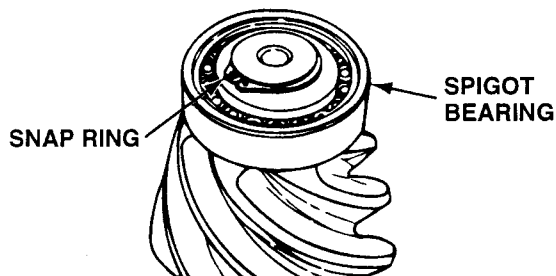
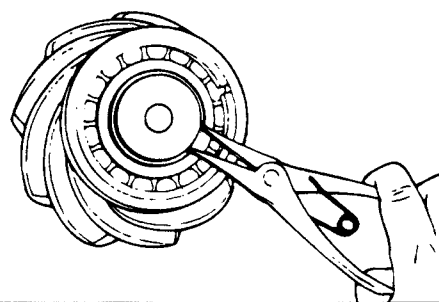
- a. Place the drive pinion in a press, gear head (teeth) toward the top. **Figure 53.**
- b. Press the spigot bearing on the end of drive pinion until the bearing is flat against the gear head. Use a sleeve of the correct size against the bearing inner race. **Figure 53.**

Figure 53



- c. Install the snap ring* into groove in end of drive pinion with snap ring pliers. **Figure 54.**

Figure 54



Staking the One-Piece Spigot Bearing on the Drive Pinion (Without Snap Ring)

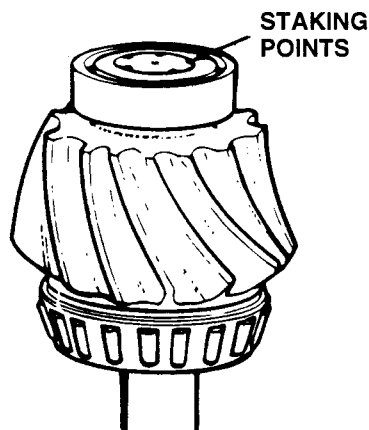
NOTE:

This procedure applies to some 180 Series rear rear tandem axles with existing snap ring components.

Specification

- Apply 6,614 lb. (3,000 kg) force on a 0.375-inch (10 mm) ball.
- Stake the end of drive pinion at a minimum of five points. **Figure 55.**

Figure 55



When using a staking tool and press (Figure 56), calculate the force required on the tool as follows.

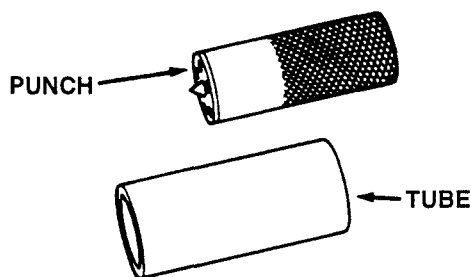
6,614 lb. (3,000 kg) x amount of balls in tool = pounds or kilograms

Example

6,614 lb. x 3 balls = 19,842 pounds

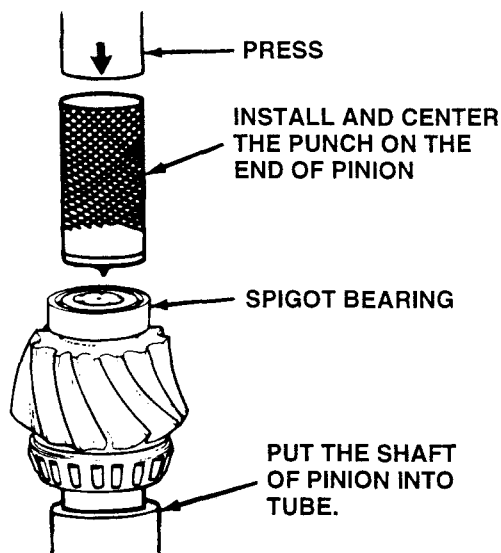
For information about the staking tool, contact your local Rockwell representative. Figure 56.

Figure 56



- Place the drive pinion and the tube of the staking tool in a press, spigot bearing toward the top. Figure 57.
- Calculate the amount of force that will be required on the staking tool. Refer to specification and example calculation.

Figure 57



- Place the punch of the staking tool over the end of the pinion and spigot bearing. Apply the required amount of force on the punch. Figure 57.

CAUTION

Do not align new points with grooves in end of drive pinion or in old points. If the new staked points are placed in the wrong areas, the spigot bearing will not be held correctly on the pinion shaft.

- Rotate the punch as many times as required for a minimum of five points. Repeat step c for each point.

NOTE:

If a three-ball stake tool is used, rotate the tool 180° (degrees).

Installing and Staking the Two-Piece Spigot Bearing on the Drive Pinion

NOTE:

This procedure applies to some 160 Series single rear axles and rear rear tandem axles. These axles may also use a one-piece spigot bearing with a snap ring retainer.

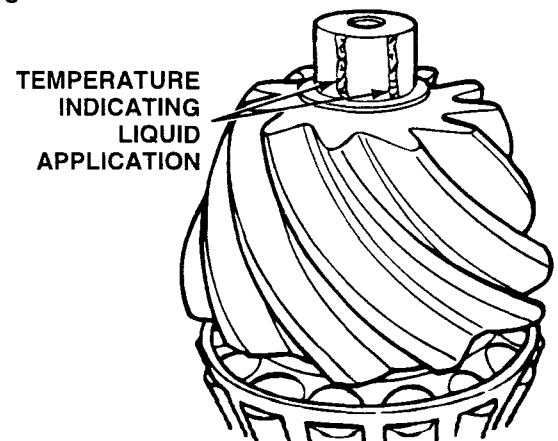
The inner race of two-piece spigot bearings may need to be staked in place on some R-160 series rear axles. Before you stake the pinion, you must heat the pinion stem to soften it.

NOTE:

Kent-Moore Kit J-39039 includes the staking tool, temperature indicating liquid, heating shield and plastigage needed for this job.

- Apply two stripes of temperature indicating liquid on the pinion stem from the top to the bottom. Figure 58. Apply a green stripe to indicate 400°F (205°C) and a blue stripe to indicate 500°F (260°C).

Figure 58

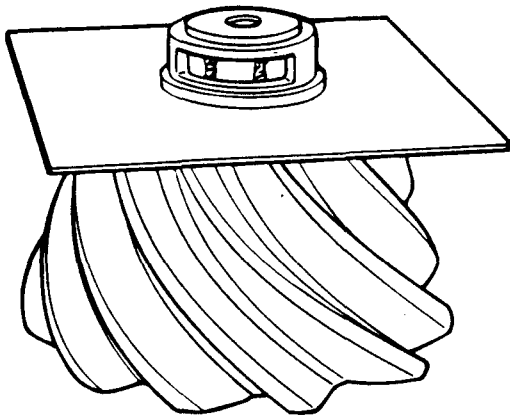


Section 5

Assembly

- b. Place the heating shield over the pinion stem so that you can see the temperature indicating liquid through the hole in the shield. **Figure 59.**

Figure 59



WARNING

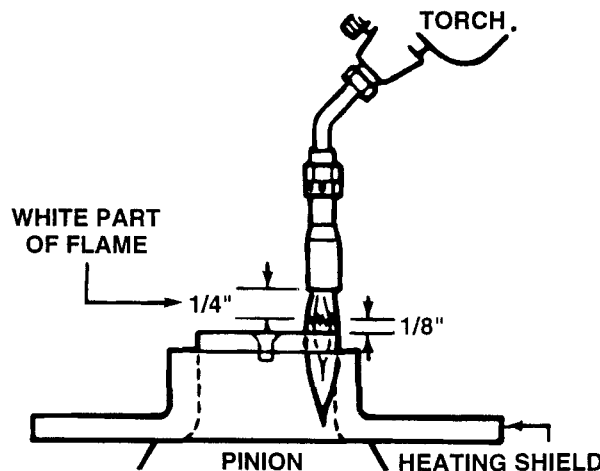
Always wear safe clothing, gloves and eye protection when working with a torch for heating parts to prevent serious personal injury during assembly.

CAUTION

Do not heat the pinion stem without the heat shield in place. Also, do not overheat the pinion stem or you will weaken the metal which can cause early failure. Correct heating will take approximately 25-35 seconds, depending on how hot the torch is.

- c. Light and adjust the torch until the white part of the flame is approximately 1/4 inch long. Keep the white part of the flame approximately 1/8 inch from the top of the stem. **Figure 60.** Move the flame around the outer diameter of the top of the pinion stem. The green temperature indicating liquid will turn black before the blue liquid does. Heat the stem until the blue liquid turns black at a point in the middle of the window.

Figure 60



- d. Remove the flame and the heat shield from the pinion. Let the pinion air cool for 10 minutes. Use a razor blade to remove the temperature indicating liquid.

CAUTION

Do not press or directly strike the new inner race in step e or damage to the bearing will result.

WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

- e. Use a press, if available, or a brass hammer to install the new inner race. Use the old inner race as a sleeve. The face is completely seated when you cannot fit a 0.002-inch feeler gauge between the race and the pinion shoulder.

Section 5 Assembly

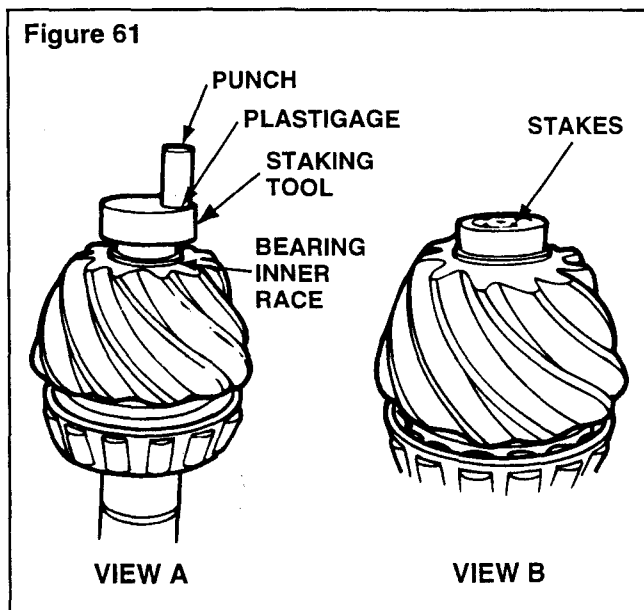
NOTE:

To hold the races in place, use a staking tool, instead of the old race, to start the new race on the stem. The old race can be used to completely seat the new race.

NOTE:

In step f, you do not need to use the plastigage for every stake. Use the plastigage until you are sure you are hitting the punch with the correct amount of force.

- f. Place the staking tool over the bearing race. Cut a one inch piece from the green plastigage strip and place in between the punch and the staking tool. **Figure 61 — View A.**

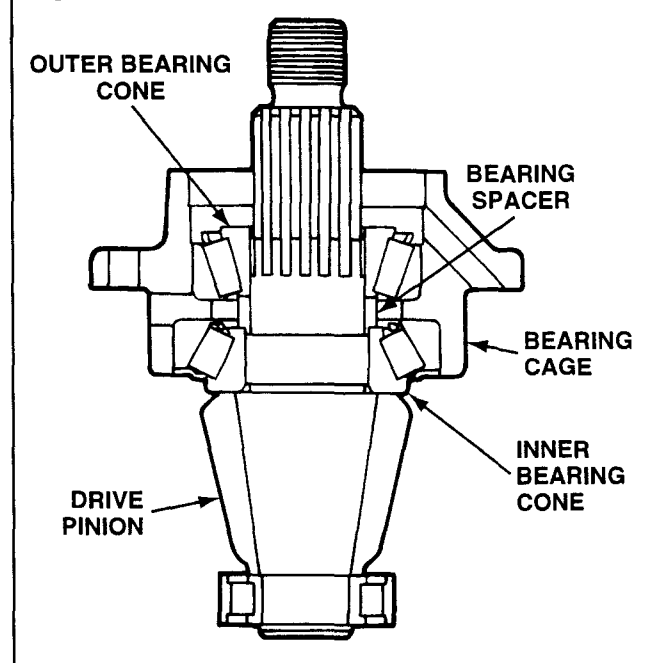


- g. Strike the punch with a two-three pound brass hammer to upset the end of the pinion stem. Then, remove the strip and measure its thickness against the gauge on the wrapper that the strip came in. The strip must not be less than 0.003 inch thick. This thickness indicates that you are using enough force when you hit the punch. If the strip is too thin, then you must hit the punch harder so the stake will hold the race in place. Rotate the tool and repeat this procedure until there are six evenly spaced stake marks around the stem. **Figure 61 — View B.**

- h. With a press or a soft mallet and sleeve, install the outer race and roller assembly into its bore in the carrier. Use a sleeve that is the same size as the outer race and press the bearing until it is squarely against the shoulder in the bottom of its bore.

6. Apply axle lubricant to the bearing cups and to the bearing cones in the cage.
7. Install the drive pinion into the bearing cage.
8. Install the bearing spacer or spacers on pinion shaft against the inner bearing cone. **Figure 62.**

Figure 62



NOTE:

The spacer or spacers control the preload adjustment of the drive pinion bearings.

9. Install the outer bearing cone on pinion shaft against the spacer. **Figure 62.**

NOTE:

DO NOT install pinion seal in bearing cage. Continue with adjusting preload of pinion bearings.

Section 5 Assembly

Adjusting Preload of Pinion Bearings

Specifications

- New pinion bearings — torque
— 5 to 45 lb-in (0.56-5.08 N•m) **T**
- Used pinion bearing in good condition — torque
— 10 to 30 lb-in (1.13-3.39 N•m) **T**

Press Method

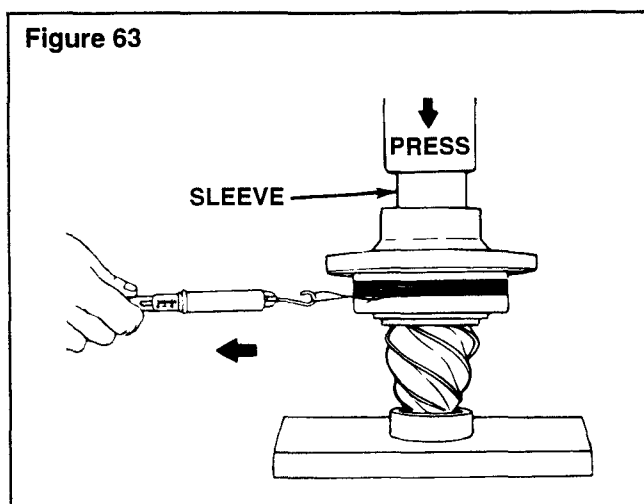
NOTE:

If a press is not available, or the press does not have a pressure gauge, use the yoke or flange method to adjust pinion bearing preload. Refer to page 33.

- Place the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom.
- Install a sleeve of the correct size against the inner race of the outer bearing. **Figure 63.**
- Apply and hold the correct amount pressure to the pinion bearings. Refer to **Chart 1**. As pressure is applied rotate the bearing cage several times so that bearings make normal contact.

- While pressure is held against the assembly, wind a cord around the bearing cage several times.

Figure 63



- Attach a spring scale to the end of the cord.
- Pull the cord with scale on a horizontal line. As the bearing cage rotates, read the value indicated on scale. Write down and record the reading. **Figure 63.**

NOTE:

Do not read starting torque. Read only the torque value after the cage starts to rotate. Starting torque will give a false reading.

Chart 1

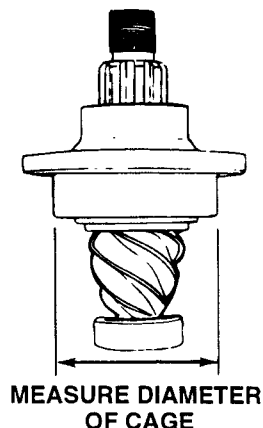
Thread Size of Pinion Shaft	Press Pressure Needed on Bearings for Correct Preload.		T Torque Value Needed on Pinion Nut for Correct Bearing Preload.	
	pounds/tons	(kg/metric tons)	lb-ft	(N•m)
7/8"-20	22,000/1	(9979/10)	200-275	(271-373)
1"-20	30,000/15	(13608/13.6)	300-400	(407-542)
1 1/4"-12	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/4"-18	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/2"-12	54,000/27	(24494/24.5)	800-1100	(1085-1491)
1 1/2"-18	54,000/27	(24494/24.5)	800-1100	(1085-1491)
1 3/4"-12	50,000/25	(22680/22.7)	900-1200	(1220-1627)
2"-12	50,000/25	(22680/22.7)	1200-1500	(1627-2034)

Section 5 Assembly

g. Measure the diameter of bearing cage where the cord was wound. Measure in inches or centimeters. **Figure 64.**

h. Divide the dimension in half to get the radius. Write down and record the radius dimension.

Figure 64



i. Use the following procedure to calculate the bearing preload (torque).

- Pounds Pulled x Radius (inches) = lb-in Preload

— Preload x 0.113 = N•m Preload

- Kilograms Pulled x Radius (cm) = kg-cm Preload

— Preload x 0.098 = N•m Preload

or

Examples

- Reading from spring scale = 7.5 pounds (3.4 kg)

- Diameter of bearing cage = 6.62 inches (16.80 cm)

- Radius of bearing cage = 3.31 inches (8.40 cm)

7.50 lb. x 3.31 in. = 24.80 in-lb Preload

Preload x 0.113 = 2.800 N•m Preload

or

3.4 kg x 8.4 cm = 28.6 kg-cm Preload

Preload x 0.098 = 2.800 N•m Preload

j. If the preload (torque) of pinion bearings is not within specifications, do the following procedure then repeat steps a through i.

To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

k. Inspect the bearing preload with the drive pinion and cage assembly installed in the carrier. Follow the procedures to adjust preload of pinion bearings, yoke or flange method.

Yoke or Flange Method

WARNING

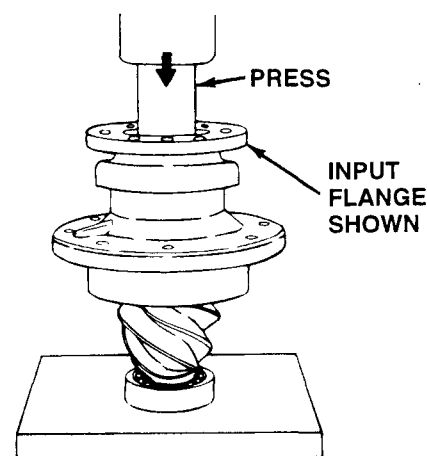
Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

a. Install the input yoke or flange, nut and washer* on the drive pinion. The yoke or flange **must** be seated against the outer bearing

NOTE:

Use a press to install the yoke or flange. Figure 65.

Figure 65



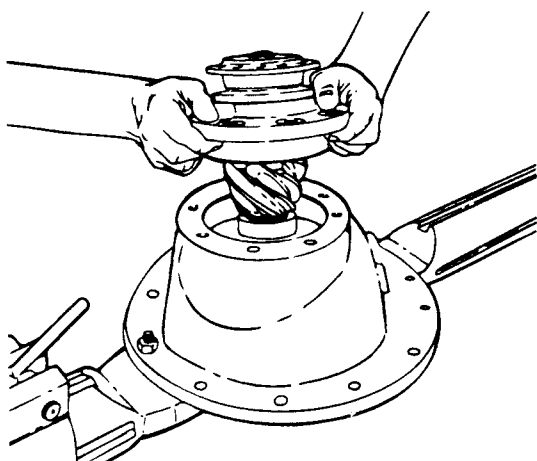
Section 5 Assembly

CAUTION

Do not install tight fit yokes or flanges on shafts using a hammer or mallet. A hammer or mallet will damage the yoke or flange.

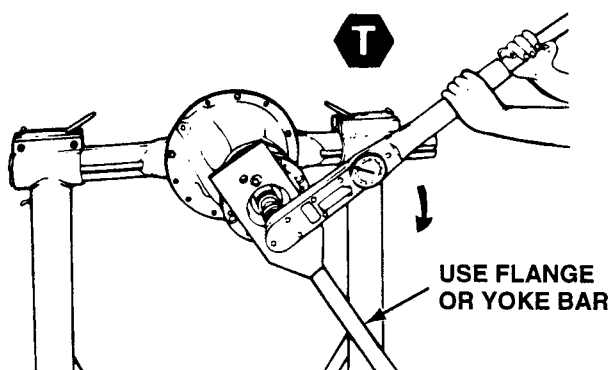
- b. Temporarily install the drive pinion and cage assembly in the carrier. Do not install shims under the bearing cage. **Figure 66.**

Figure 66



- c. Install the bearing cage to carrier capscrews. Washers are not required at this time. Tighten the capscrews by hand until snug.
- d. Fasten a yoke or flange bar to the input yoke or flange. The bar will hold the drive pinion in position when the nut is tightened. **Figure 67.**

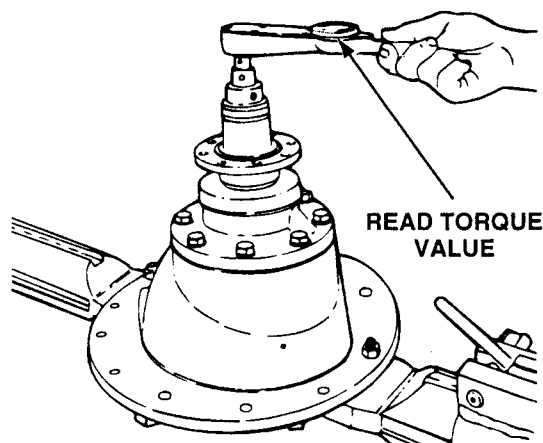
Figure 67



- e. Tighten the nut on drive pinion to the correct torque value. **Figure 67.** Refer to **Chart 1** on page 32. 

- f. Remove the yoke or flange bar.
- g. Attach a torque wrench on the drive pinion nut. Rotate the drive pinion and read the value indicated on torque wrench. **Figure 68.**

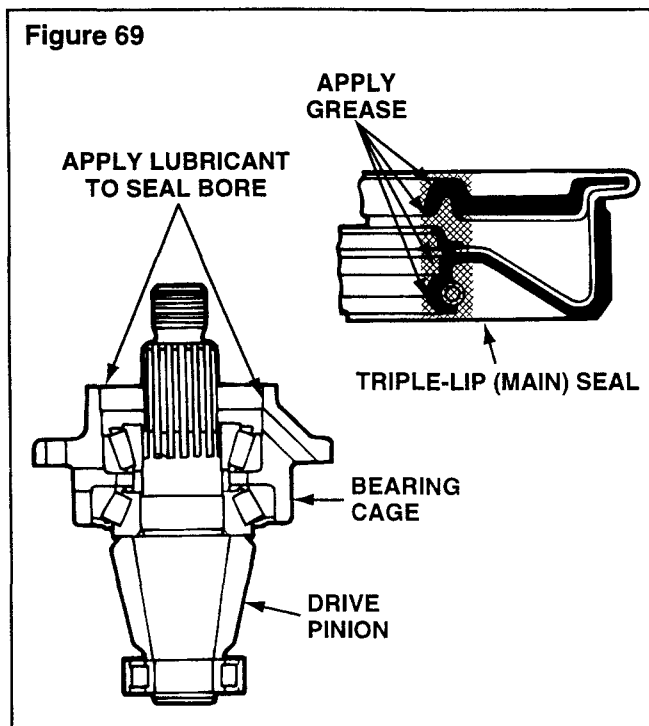
Figure 68



- h. If the preload (torque) of pinion bearings is not within specifications, remove the pinion and cage assembly from carrier. Do the following procedure then repeat steps **a** through **g**.
- To **increase** preload, install a thinner bearing spacer.
 - To **decrease** preload, install a thicker bearing spacer.
10. After adjusting preload of pinion bearings, remove the drive pinion and bearing cage from carrier. Follow steps 1-5 on pages 12-13.

11. Install a new triple-lip seal as follows.

- a. Apply the same lubricant used in the axle housing to the outer surface of the seal and the seal bore in the bearing cage. **Figure 69.**

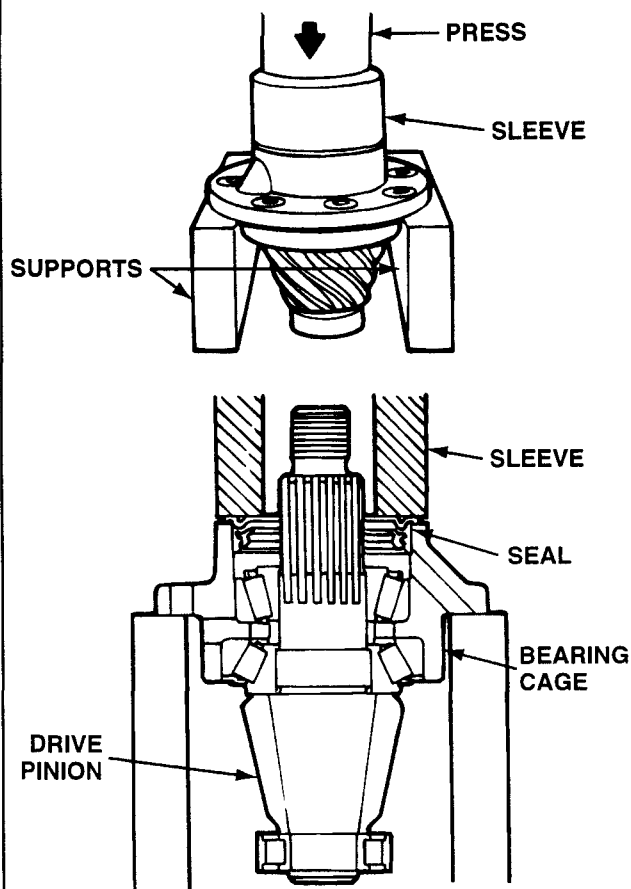


CAUTION

Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.

- b. Place the drive pinion and cage assembly in a press, seal bore toward the top.
- c. Press the seal into bearing cage until flange of seal is flat against the top of bearing cage. Use a sleeve or seal driver of the correct size that fits against the metal flange of seal. The diameter of the sleeve or driver **must** be larger than the diameter of the flange. **Figure 70.**

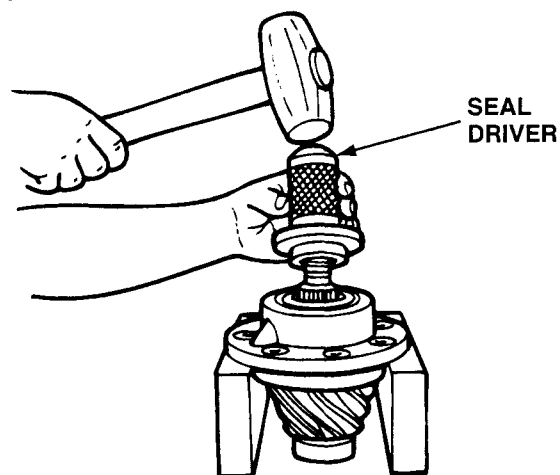
Figure 70



NOTE:

*If a press is not available, use a mallet and the sleeve or driver to install the seal. **Figure 71.***

Figure 71



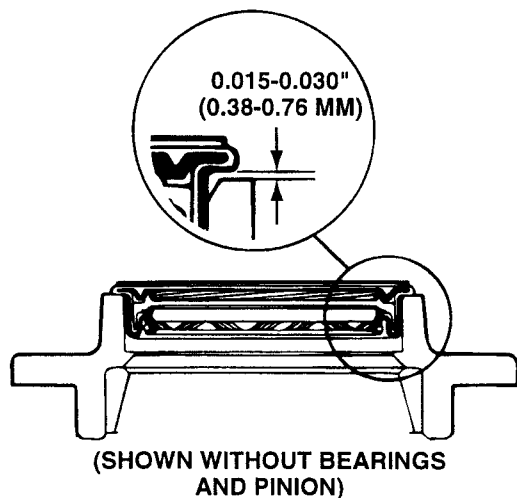
Section 5 Assembly

WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

- d. After the triple-lip seal is installed, a gap of approximately 0.015 to 0.030 inch (0.38-0.76 mm) between the flange and bearing cage is normal. **Figure 72.**

Figure 72



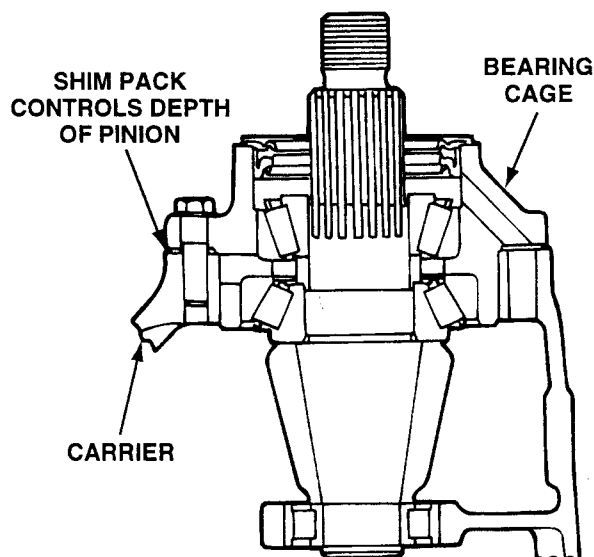
Inspect the gap with a feeler gauge at several points around the seal. The gap must be within 0.015 to 0.030 inch (0.38-0.76 mm). The difference between the largest and smallest gap measurement **must not** exceed 0.010 inch (0.254 mm).

Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)

NOTE:

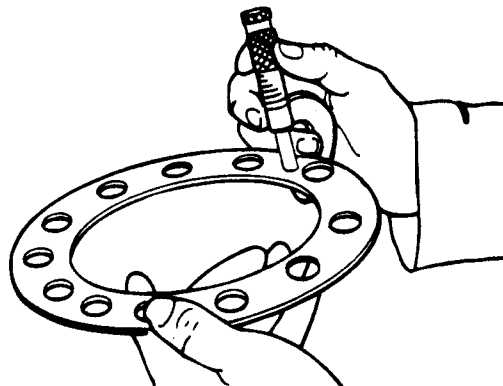
Use this procedure if a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted. Figure 73.

Figure 73



1. Measure the thickness of the old shim pack that was removed from under the pinion cage with a micrometer. Record the measurement for use later. **Figure 74.**

Figure 74

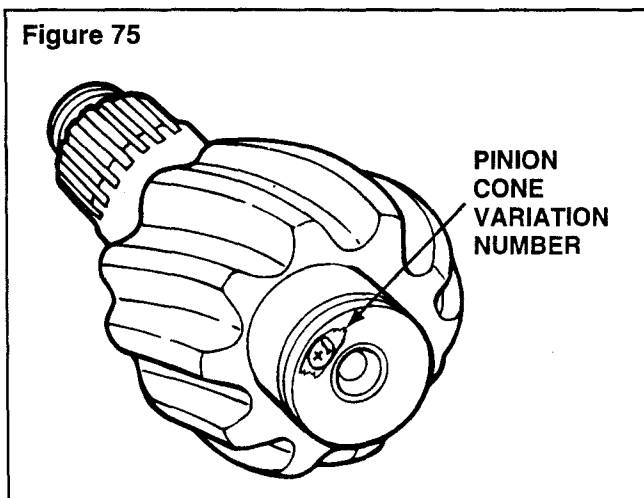


Section 5

Assembly

2. Look at the pinion cone ("PC") variation number on the old drive pinion that is being replaced. Refer to Gear Set Information, step 4 on page 26 for examples and location of the number. Record the number for later use. If ("PC") variation number cannot be located, assemble gear set with shim pack thickness found in step 1 on page 36.
Figure 75.

Figure 75



NOTE:

The pinion cone number can be either 100ths of a millimeter or 1,000ths of an inch. Refer to the following examples.

PC +3, PC - 3, +3 or -3 = 0.003 inch

PC +.03, PC -0.03 mm, +0.03 mm or -0.03 = 0.03 mm

To change millimeters to inches — millimeters x 0.039

To change inches to millimeters — inches x 25.40

3. If the old pinion cone number is a plus (+) number, subtract the number from the old shim pack thickness that was measured in step 2.
4. If the old pinion cone number is a minus (-) number, add the number to the old shim pack thickness that was measured in step 2.

NOTE:

The value calculated in step 3 or 4 is the thickness of the standard shim pack, without a variation.

5. Look at the pinion cone ("PC") variation number on the new drive pinion that will be installed. Record the number for later use.
6. If the new pinion cone number is a plus (+) number, add the number to the standard shim pack thickness that was calculated in step 3 or 4.
7. If the new pinion cone number is a minus (-) number, subtract the number from the standard shim pack thickness that was calculated in step 3 or 4.

Section 5

Assembly

NOTE:

The value calculated in step 6 or 7 is the thickness of the new shim pack that will be installed. Refer to the following examples, Chart 2.

8. Install the drive pinion, bearing cage and new shim pack into the carrier.

Chart 2

Examples:		Inches	mm
1.	Old Shim Pack Thickness	.030	.760
	Old PC Number, PC +2 inches (+0.050 mm)	<u>-.002</u>	<u>-.050</u>
	Standard Shim Pack Thickness	.028	.710
	New PC Number, PC +5 inches (+0.130 mm)	<u>+.005</u> (Add)	<u>+.130</u> (Add)
New Shim Pack Thickness		0.033	0.804
2.	Old Shim Pack Thickness	.030	.760
	Old PC Number, PC -2 inches (-0.050 mm)	<u>+.002</u>	<u>+.050</u>
	Standard Shim Pack Thickness	.032	.810
	New PC Number, PC +5 inches (+0.130 mm)	<u>+.005</u> (Add)	<u>+.130</u> (Add)
New Shim Pack Thickness		0.037	0.940
3.	Old Shim Pack Thickness	.030	.760
	Old PC Number, PC +2 inches (+0.050 mm)	<u>-.002</u>	<u>-.050</u>
	Standard Shim Pack Thickness	.028	.710
	New PC Number, PC -5 inches (-0.130 mm)	<u>-.005</u> (Subtract)	<u>-.130</u> (Subtract)
New Shim Pack Thickness		0.023	0.580
4.	Old Shim Pack Thickness	.030	.760
	Old PC Number, PC -2 inches (-0.050 mm)	<u>+.002</u>	<u>+.050</u>
	Standard Shim Pack Thickness	.032	.810
	New PC Number, PC -5 inches (-0.130 mm)	<u>-.005</u> (Subtract)	<u>-.130</u> (Subtract)
New Shim Pack Thickness		0.027	0.608

NOTE:

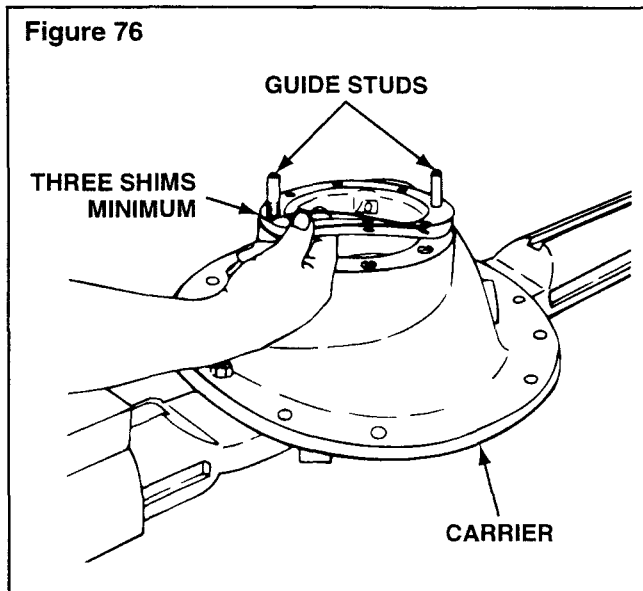
Drive pinions and ring gears MUST be replaced as fully matched sets.

Installing the Drive Pinion, Bearing Cage and Shim Pack into the Carrier

NOTE:

If a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted, calculate the thickness of the shim pack. Refer to the procedure "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)" on page 36.

1. Select the correct shim pack between the bearing cage and carrier. **Figure 76.**
2. Apply Loctite® 518 Gasket Eliminator to face of carrier.
3. Align the oil slots in the shims with oil slots in the bearing cage and carrier. The use of guide studs will help align the shims. **Figure 76.**



NOTE:

If the pack is made from different thickness shims, install the thinnest shims on both sides of the pack for maximum sealing.

4. Apply Loctite® 518 Gasket Eliminator to top of shim pack.

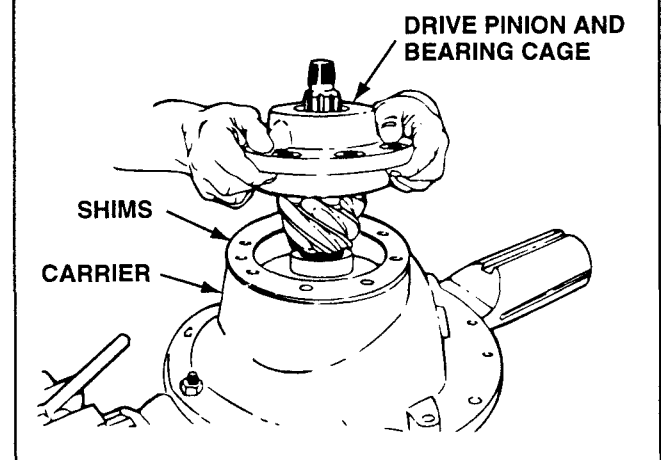


WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

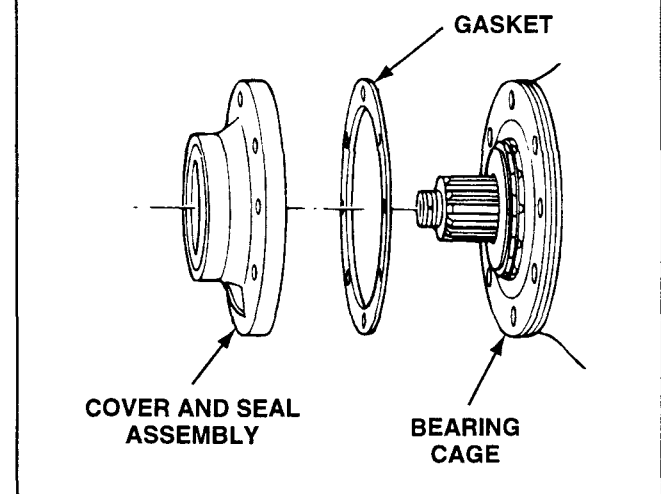
5. Install the drive pinion and bearing cage into the carrier. If necessary, use a rubber, plastic or leather mallet to hit the assembly into position. **Figure 77.**

Figure 77



6. If used, install the cover* and seal assembly and gasket* over the bearing cage. **Figure 78.**

Figure 78



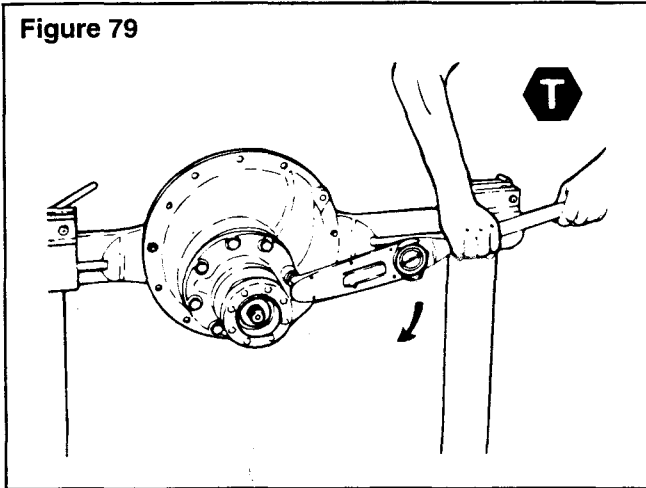
7. Align the oil slots in the cover* and gasket* with oil slot in the bearing cage.

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8. Install the bearing cage to carrier capscrews and washers. Tighten capscrews to correct torque value. Refer to the Torque Chart on page 61.

Figure 79. 

Figure 79



Installing Tight Fit Yokes and POSE™ Seal

CAUTION

Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.

CAUTION

Do not install tight fit yokes on shafts using a hammer or mallet. Using a hammer or mallet can damage the yoke.

1. Apply axle lubricant on the yoke seal.
2. Inspect all surfaces of the yoke hub for damage.

If carrier uses a POSE™ seal element, install a new POSE™ seal as follows:

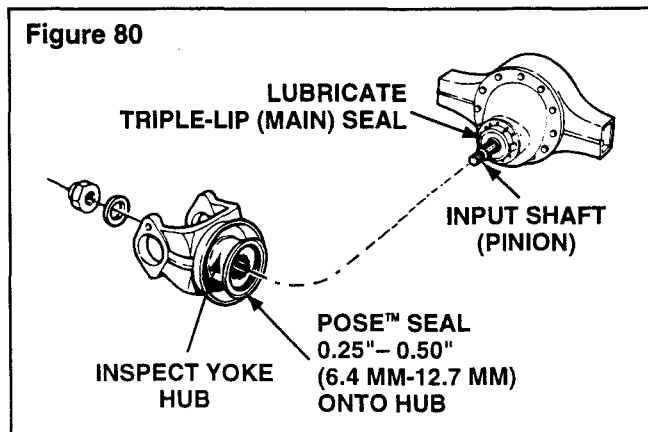
- a. Lightly lubricate yoke journal with same lubricant used in the axle housing.

CAUTION

Make sure that the seal lips are clean and free from dirt and particles that can cause a leak between the yoke and the POSE™ seal.

- b. Partially install the POSE™ seal onto the yoke to 1/4 inch-1/2 inch as shown in **Figure 80**.

Figure 80



NOTE:

DO NOT install POSE™ seal all the way against the yoke shoulder. This seal is designed to position itself as yoke is installed.

- c. Before installing the yoke onto the drive pinion, lubricate the yoke again with the same lubricant used in the axle housing.
3. Slide the yoke over the input shaft pinion. Align the yoke splines with the shaft splines.

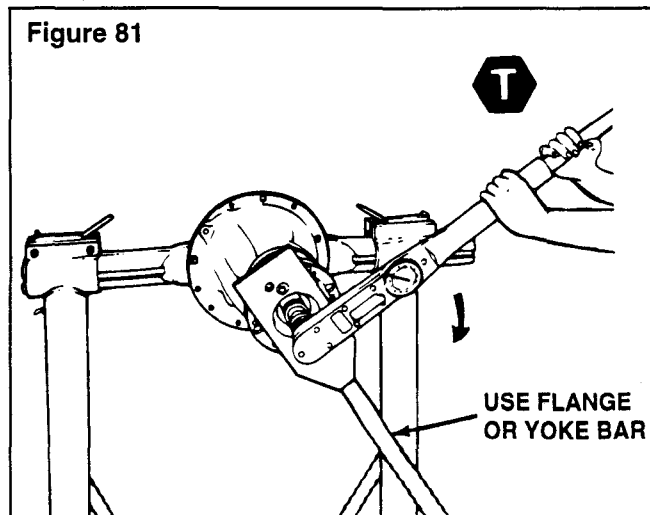
CAUTION

Do not use a hammer or mallet to install the yoke to the input pinion shaft. Using a hammer or mallet can damage the yoke or flange.

4. Install the input yoke flange onto the drive pinion shaft. The yoke or flange must be fully seated against the outer differential bearing **before** the nut is torqued to specifications.
5. Install the drive pinion nut on the input pinion shaft and against the yoke collar. Tighten the nut against yoke collar to torque specifications.

Figure 81. Refer to page 61. 

Figure 81



Assemble the Main Differential and Ring Gear Assembly

CAUTION

Do not press a cold ring gear on the flange case half. A cold ring gear will damage the case half because of the tight fit. Metal particles between the parts will cause gear runout that exceeds the Rockwell specification of 0.008 inch (0.200 mm).

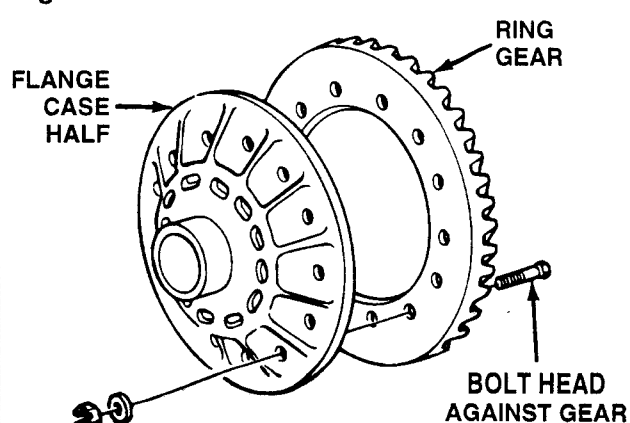
1. Expand the ring gear by heating the gear in a tank of water to a temperature of 160°F to 180°F (71°C-82°C) for 10 to 15 minutes.

WARNING

Wear safe clothing and gloves for protection from injury when working with the hot ring gear.

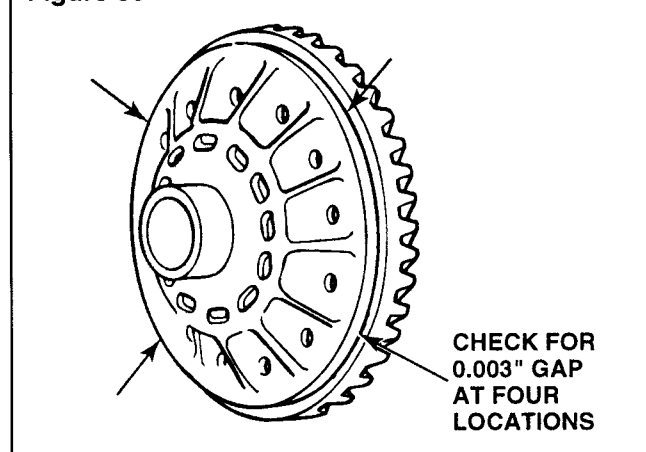
2. Safely lift the ring gear from the tank of water using a lifting tool.
3. Install the ring gear on the flange case half immediately after the gear is heated. If the ring gear does not fit easily on the case half, heat the gear again. Repeat step 1.
4. Align fastener holes of the ring gear and flange case half. Rotate the ring gear as needed.
5. If rivets* were used to hold the ring gear to the flange case half, replace them with bolts, nuts and washers.
6. Install the bolts*, nuts* and washers* that hold the ring gear to the flange case half. Install the bolts from the gear side of the assembly. The bolt heads **must** be against the ring gear. **Figure 82.**

Figure 82



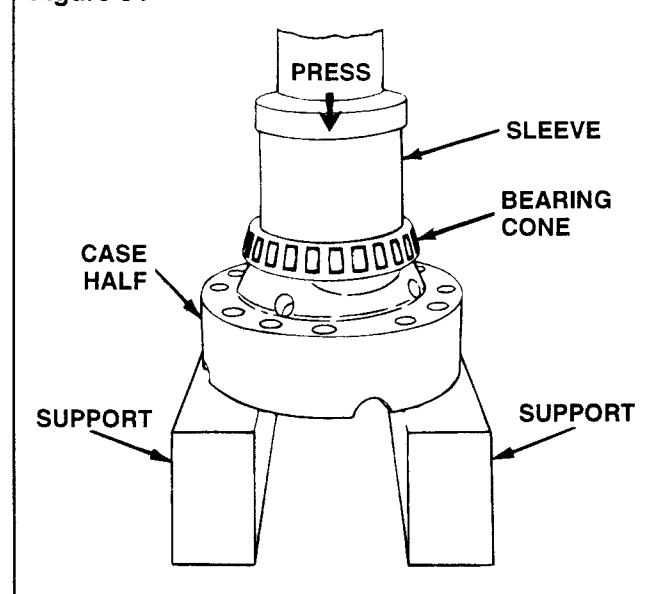
7. Tighten the bolts* and nuts* to the correct torque value. Refer to the Torque Chart on page 61. **T**
8. Inspect for gaps between the back surface of the ring gear and the case flange after the bolts are installed. Use an 0.003 inch (0.080 mm) feeler gauge and inspect at four points around the assembly. **Figure 83.**

Figure 83



9. Inspect the flange case half and ring gear for the problem that causes the gap. Repair or replace parts that do not meet specifications.
10. Assemble the repaired or replaced ring gear on the flange case half. Repeat the Main Differential and Ring Gear Assembly procedure on this page.
11. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size. **Figure 84.**

Figure 84



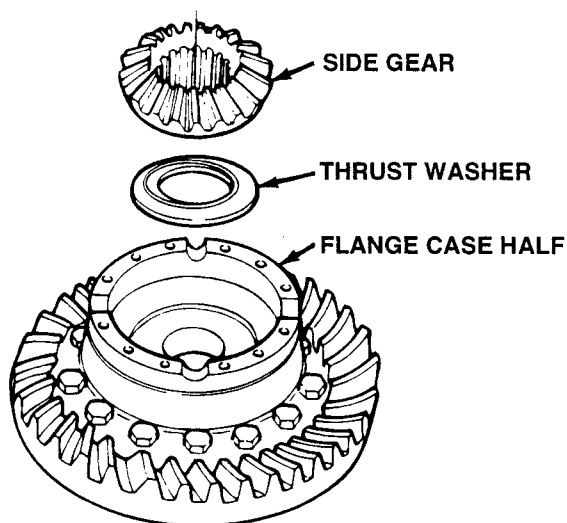
*Some Rockwell carriers do not have these described parts.

Section 5

Assembly

12. Apply axle lubricant on the inside surfaces of both case halves, spider (cross), thrust washers, side gears and differential pinions.
13. Place the flange case half on a bench, ring gear teeth toward top.
14. Install one thrust washer and side gear into the flange case half. **Figure 85.**

Figure 85

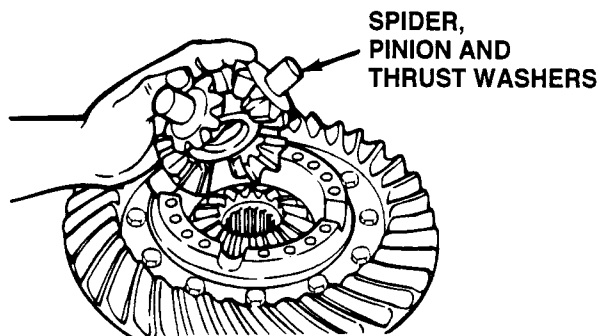


CAUTION

The side gears in some carrier models have hubs of different lengths. Install the correct length side gear into the flange case half.

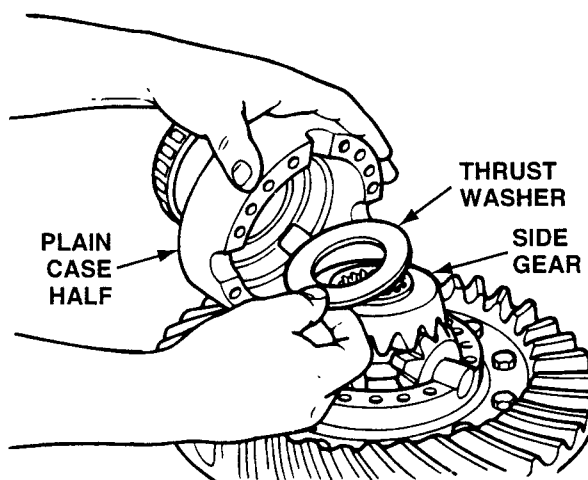
15. Install the spider (cross), differential pinions and thrust washers into the flange case half. **Figure 86.**

Figure 86



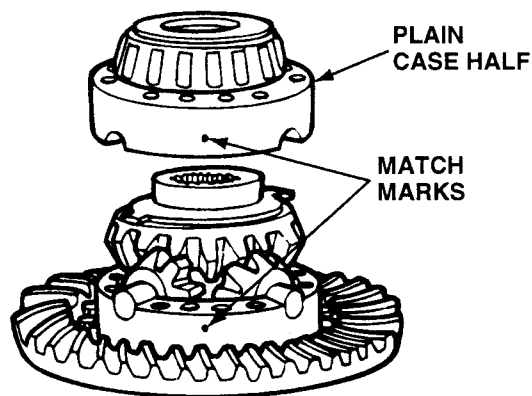
16. Install the second side gear and thrust washer over spider and differential pinions. **Figure 87.**

Figure 87



17. Place the plain half of the differential case over the flange half and gears. Rotate the plain half as needed to align the match marks. **Figures 87 and 88.**

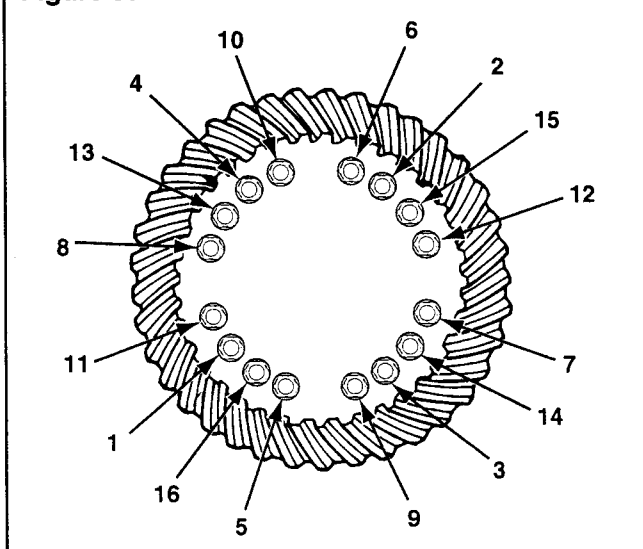
Figure 88



Section 5 Assembly

18. Install Dri-Loc fasteners into the case halves. Refer to the procedures on page 23 and the following steps **a** and **b**.
- Install four capscrews* and washers* or bolts*, nuts* and washers* into the case halves. The distance between the fasteners **must** be equal. Tighten the fasteners to the correct torque value in a progressive criss-cross pattern opposite each other. Refer to **Figure 89** and the Torque Chart on page 61. **T**

Figure 89



- Install the other fasteners into the case halves. Tighten the fasteners to the correct torque value. Refer to the Torque Chart on page 61. **T**

19. Inspect the rotating resistance of the differential gears. Use the following procedure.

Inspecting the Rotating Resistance of the Differential Gears

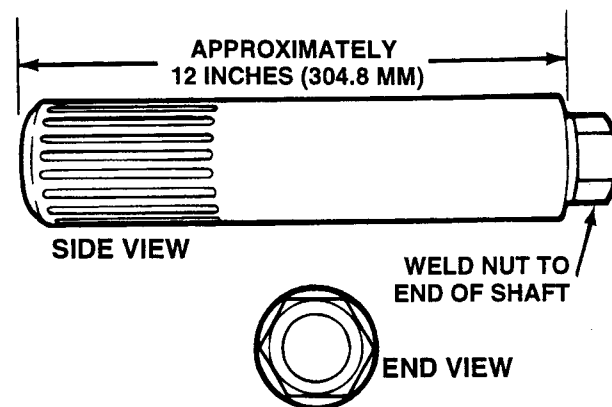
Specification

- 50 lb-ft (67.8 N•m) maximum torque applied to one side gear. **T**

NOTE:

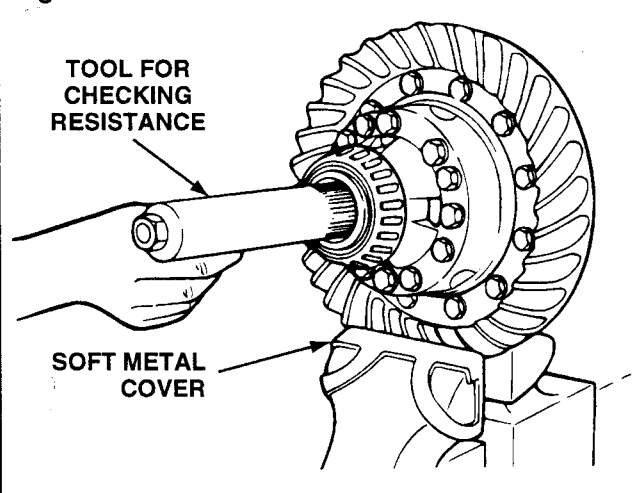
Make a tool for inspecting the rotating resistance of the differential gears. The tool can be made from an axle shaft that matches the spline size of the differential side gear. Refer to Figures 90 and 91.

Figure 90



- Install soft metal covers over vise jaws to protect the ring gear. **Figure 91**.

Figure 91



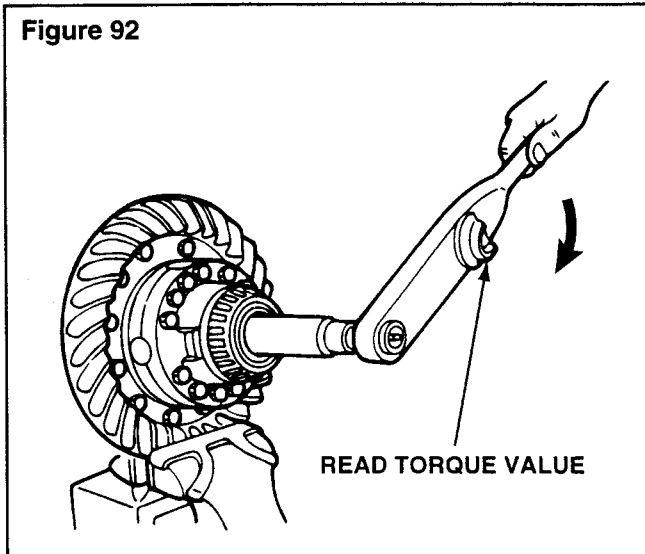
- Place the differential and ring gear assembly in the vise and close the vise jaws.
- Install the tool into the differential until the splines of the tool and one side gear are engaged. **Figure 91**.

Section 5

Assembly

- Engage a torque wrench to the nut of the tool and rotate the differential gears. As the differential gears rotate, read the value indicated on the torque wrench. **Figure 92.**

Figure 92

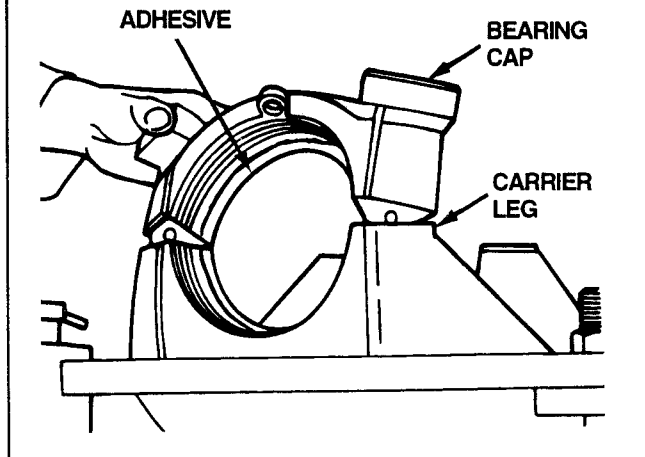


- If the torque value exceeds the specification, disassemble the differential gears from the case halves.
- Inspect the case halves, spider, gears and thrust washers for the problem that causes the torque value to exceed the specification. Repair or replace parts.
- After all the differential assembly parts are repaired or replaced, assemble the parts and repeat steps 1 through 7.

Install the Differential and Ring Gear Assembly

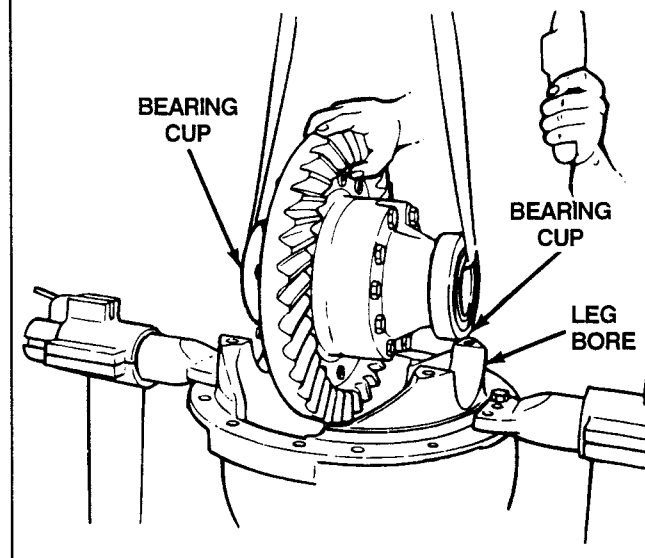
- Clean and dry the bearing cups and bores of the carrier legs and bearing caps.
- Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are assembled on the case halves.
- Apply Rockwell Adhesive into the bearing bores of the carrier legs and bearing caps. Make certain not to allow adhesive to contact adjusting ring threads. Refer to the procedure on page 23. **Figure 93.**

Figure 93



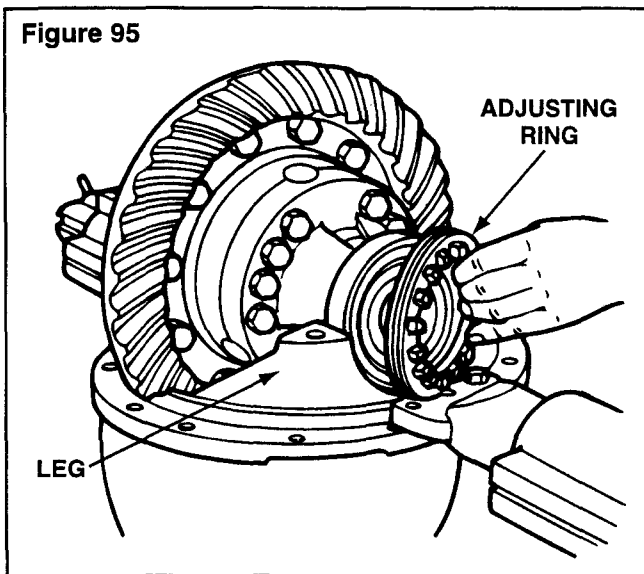
- Install the bearing cups over the bearing cones that are assembled on the case halves. **Figure 94.**
- Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups **must** be flat against the bores between the carrier legs. **Figure 94.**

Figure 94



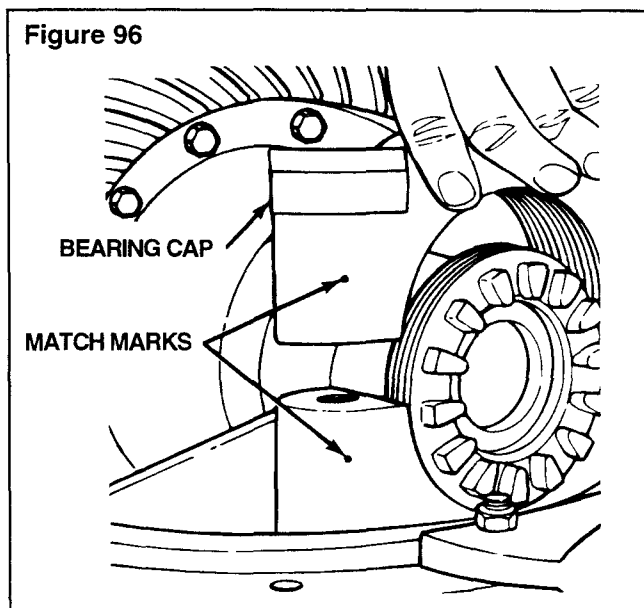
- Install both of the bearing adjusting rings into position between the carrier legs. Turn each adjusting ring hand-tight against the bearing cup. **Figure 95.**

Figure 95



7. Install the bearing caps over the bearings and adjusting rings in the correct location as marked before removal. **Figure 96.**

Figure 96



WARNING

Do not hit steel parts with a steel hammer during removal and disassembly procedures. Striking parts with a hammer can cause the parts to break and result in serious personal injury.

8. Seat each bearing cap with a light leather, plastic or rubber mallet. The caps **must** fit easily against the bearings, adjusting rings and carrier. **Do not force the bearing caps into position.**

CAUTION

If bearing caps are not installed in the correct original locations, the bores and threads in caps will not match the carrier. Assembling mismatched caps into the carrier can result in carrier damage after reassembly to axle and during vehicle operation. Do not force the bearing caps into unmatched bore locations in the carrier.

9. If bearing caps do not correctly fit into position, inspect the alignment of match marks between caps and carrier. Remove the caps and repeat steps 6-8.
10. Install the capscrews and washers that hold bearing caps to the carrier. Tighten the capscrews by hand four to six turns, then tighten the capscrews to the correct torque value. Refer to the Torque Chart on page 61. 

NOTE:

Do not install the cotter keys*, pins* or lock plates* that hold the bearing adjusting rings in position. Continue by adjusting the preload of differential bearings, adjust backlash of the hypoid gear and inspect tooth contact patterns.

Adjust Preload of Differential Bearings

Specifications

- Preload of differential bearings (all carrier models)
 - 15 to 35 lb-in (1.7-3.9 N•m) torque. 
- Expansion between bearing caps (leg spread)
 - R-140, R-155 and R-160 carrier models: 0.002 to 0.009 inch (0.050-0.229 mm)
 - R, S, U and W 120 series and most (check latest specifications) other carrier models: 0.006 to 0.013 inch (0.150-0.330 mm)

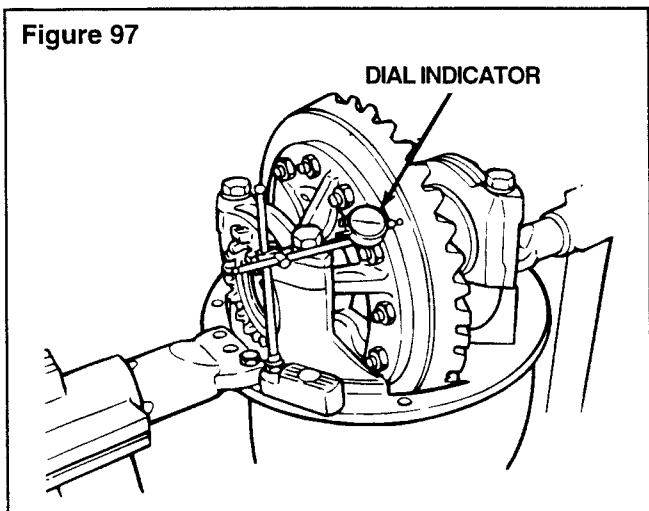
*Some Rockwell carriers do not have these described parts.

Section 5 Assembly

Method 1

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear. **Figure 97.**

Figure 97

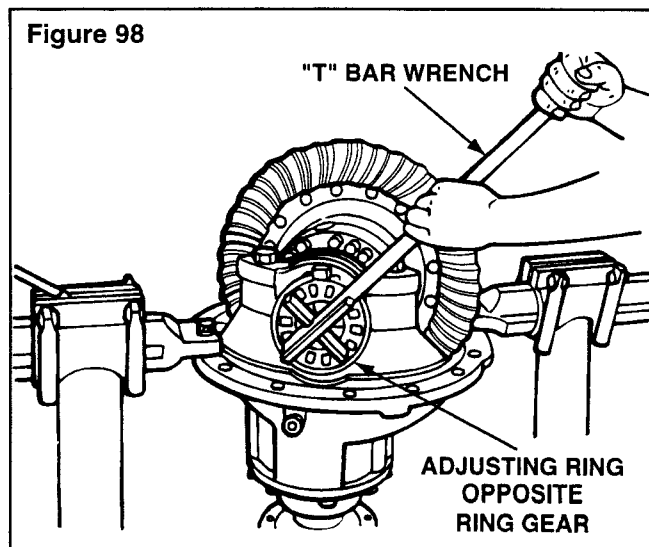


CAUTION

*When you turn the adjusting rings, always use a tool that engages two or more opposite notches in the ring. A "T" bar wrench can be used for this purpose. If the tool does not correctly fit into the notches, damage to the lugs will occur. **Figure 98.***

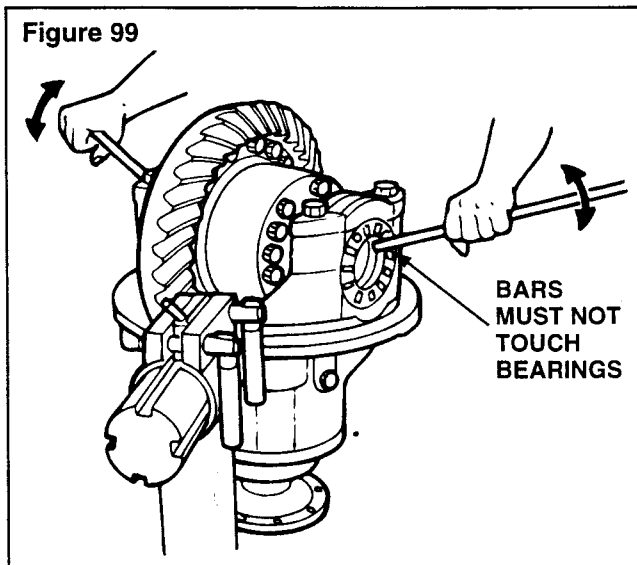
3. Loosen the bearing adjusting ring that is opposite the ring gear so that a small amount of end play shows on the dial indicator. **Figure 98.** Move the differential and ring gear to the left and right with pry bars while you read the dial indicator. Use the following step **a** or **b**.

Figure 98



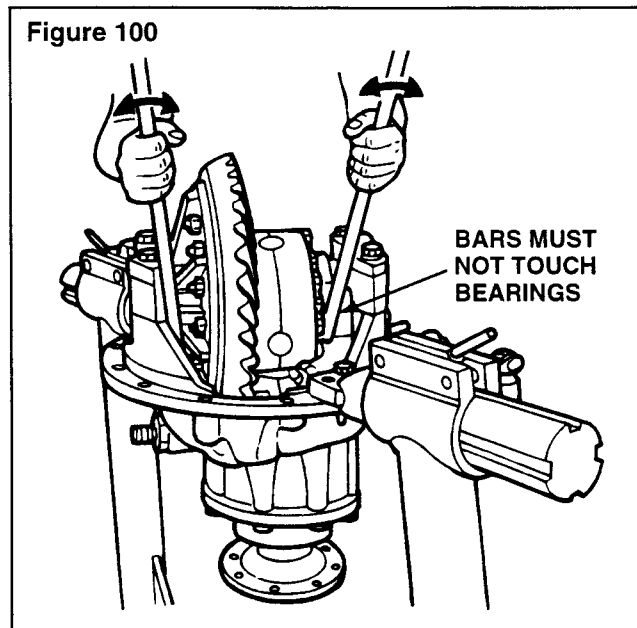
- a. Use two pry bars that fit between the bearing adjusting rings and ends of the differential case. The pry bars **must not** touch the differential bearings. **Figure 99.**

Figure 99



- b. Use two pry bars between the differential case or ring gear and the carrier at locations other than described in step **a**. The pry bars **must not** touch the differential bearings. **Figure 100.**

Figure 100



4. Tighten the same bearing adjusting ring so that no end play shows on the dial indicator. Move the differential and ring gear to the left and right as needed. Repeat step **a** or **b**.

Section 5 Assembly

5. Tighten each bearing adjusting ring one notch from the zero end play measured in step 4.
6. Continue by checking runout of the ring gear.

Method 2

A second method of inspecting preload is to measure the expansion between the bearing caps (leg spread) after the adjusting rings are tightened. Use the following procedure.

1. Turn both adjusting rings hand tight against the differential bearings.
2. Measure the distance X or Y between opposite surfaces of the bearing caps. Use a large micrometer of the correct size. **Figures 101 and 102.** Record the measurement.

Figure 101

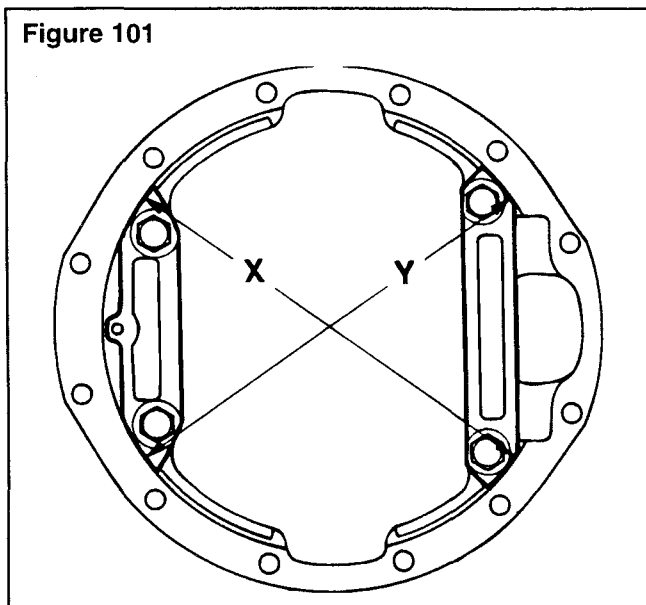
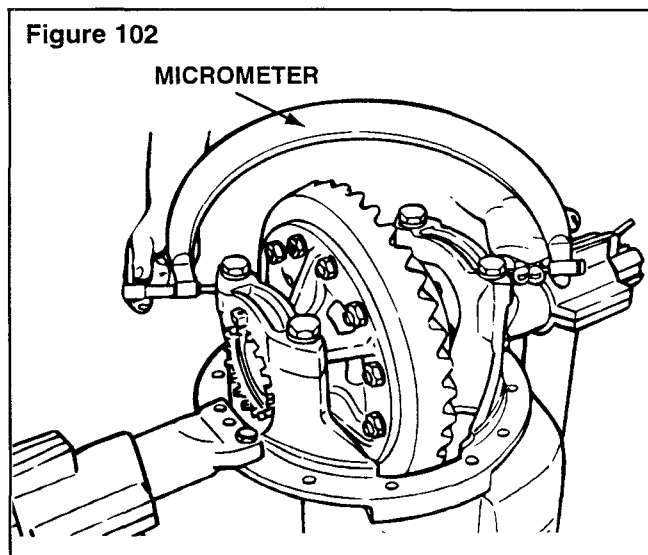


Figure 102



3. Tighten each bearing adjusting ring one notch.
4. Measure the distance X or Y again. Compare the dimension with the distance X or Y measured in step 2. The difference between the two dimensions is the amount the bearing caps have expanded.

Example

- Measurements of R-155 carrier
- Distance X or Y
 - before tightening adjusting rings = 13.927 inch (353.740 mm).
- Distance X or Y
 - after tightening adjusting rings = 13.936 inch (353.970 mm)
- $13.936 \text{ inch} - 13.927 \text{ inch} = 0.009 \text{ inch} (0.230 \text{ mm})$ difference.

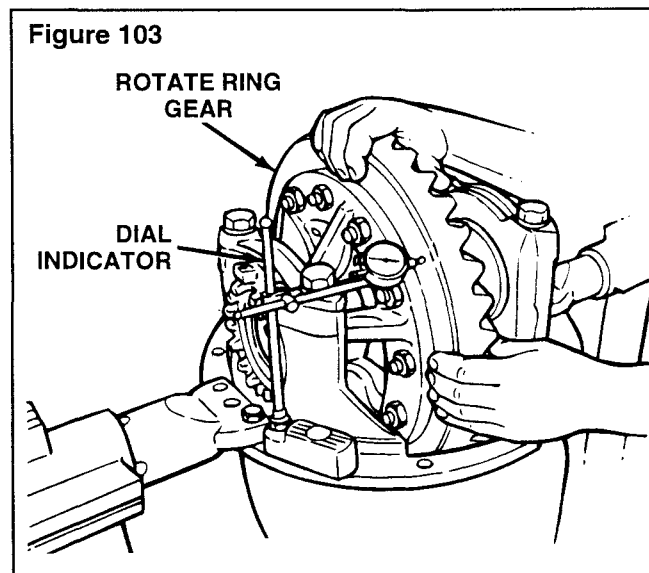
If the dimension is within specifications, continue by checking runout of the ring gear. If the dimension is less than specifications, repeat steps 3 and 4 as needed.

Inspect Runout of Ring Gear

Runout Specification

- 0.008 inch (0.200 mm)
1. Attach a dial indicator on the mounting flange of the carrier. **Figure 103.**

Figure 103



Section 5

Assembly

2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Set the dial indicator to zero (0).
4. Rotate the differential and ring gear and read the dial indicator. The runout of the ring gear **must not exceed** 0.008 inch (0.200 mm). **Figure 103.**

If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. Refer to the procedure on page 9 and the following steps 5 and 6.

5. Inspect the differential parts including the carrier for the problem that causes the runout of gear to exceed specifications. Repair or replace parts.
6. After the parts are repaired or replaced, install the differential and ring gear into the carrier. Refer to the procedure on page 44.
7. Repeat preload adjustment of differential bearings.

Ring Gear Backlash Adjustment

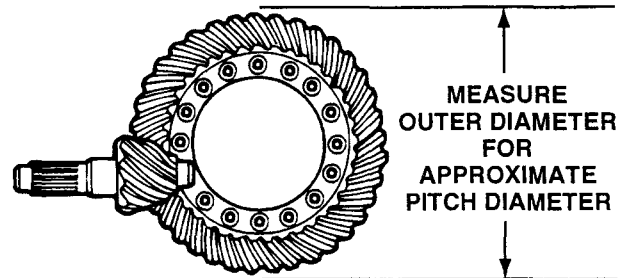
Specifications

- Ring gears that have a pitch diameter of less than 17 inches (431.8 mm)
 - Range of backlash setting: 0.008 to 0.018 inch (0.200-0.460 mm).
 - Backlash setting for new gear sets: 0.012 inch (0.300 mm)
- Ring gears that have a pitch diameter greater than 17 inches (431.8 mm)
 - Range of backlash setting: 0.010 to 0.020 inch (0.250-0.510 mm)
 - Backlash setting for new gear sets: 0.015 inch (0.380 mm)

NOTE:

Measure the outer diameter of ring gear for approximate pitch diameter. Figure 104.

Figure 104



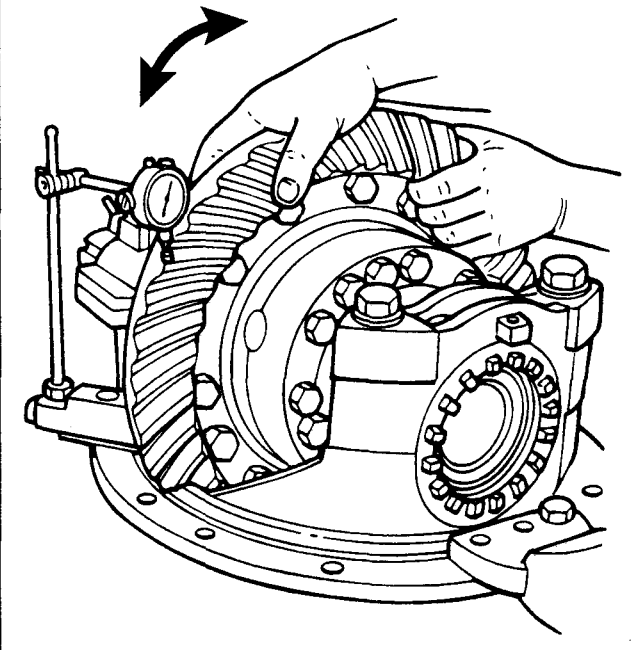
If the old gear set is installed, adjust the backlash to the setting that was measured before the carrier was disassembled.

If a new gear set is installed, adjust the backlash to the correct specification for new gear sets.

After inspection of the tooth contact patterns, the backlash can be adjusted within specification limits, if needed. To change the location of the pattern use the following procedures.

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 105.**

Figure 105



Section 5 Assembly

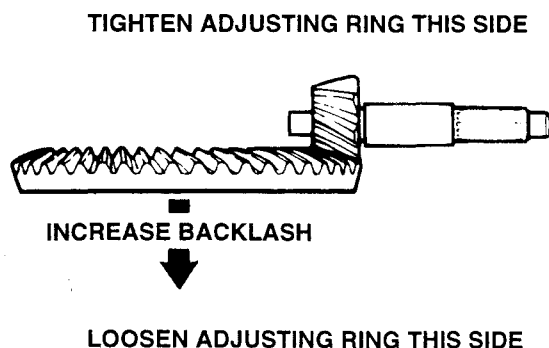
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. **Figure 105.**
3. Adjust the indicator dial to zero (0).
4. Hold the drive pinion in position.
5. After reading the dial indicator, rotate the differential and ring gear a small amount in both directions, against the drive pinion teeth. If the backlash reading is within specification, continue inspecting tooth contact patterns. If the backlash reading is not within specifications, adjust backlash as needed. Continue following steps 6 and 7.

NOTE:

Backlash is increased by moving the ring gear away from the drive pinion. Figure 106.

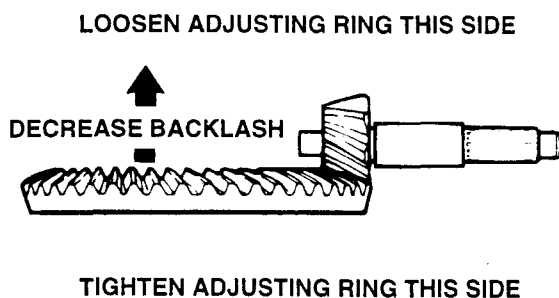
Backlash is decreased by moving the ring gear toward the drive pinion. Figure 107.

Figure 106



6. Loosen one bearing adjusting ring one notch then tighten the opposite ring the same amount. Refer to **Figures 106 and 107.**

Figure 107



NOTE:

When you adjust backlash, move the ring gear ONLY. DO NOT move the drive pinion.

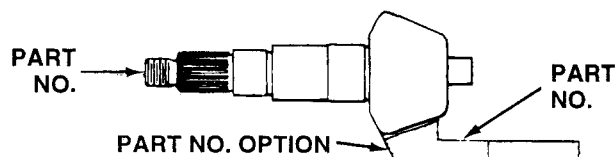
7. Repeat steps 2-6 until the backlash is within specifications.

Inspect Tooth Contact Patterns of the Gear Set

General Information

Rockwell carriers can have a conventional **HYPoid** gear set or a **GENERoid** hypoid gear set. The tooth contact patterns for each type of gear set are different. Look at the part numbers to see what type of gear set is in the carrier. Refer to **Figure 108** for the location of part numbers.

Figure 108



Examples of part numbers for conventional **HYPoid** gear sets.

- 36786 for the ring gear.
- 36787 for the drive pinion.

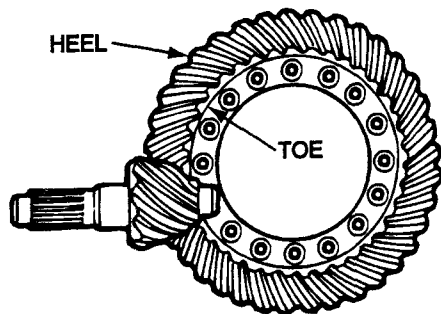
Examples of part numbers for **GENERoid** gear sets.

- 36786-K or 36786-K2 for the ring gear.
- 36787-K or 36787-K2 for the drive pinion.

Section 5 Assembly

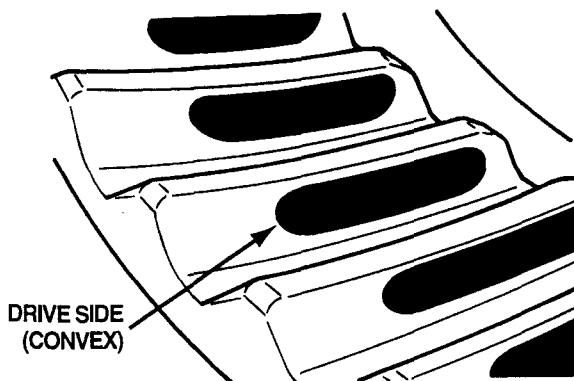
In the following procedures, movement of the contact pattern in the length of the tooth is indicated as, toward the "heel" or "toe" of the ring gear. **Figure 109.**

Figure 109



Always inspect tooth contact patterns on the drive side of the gear teeth. **Figure 110.**

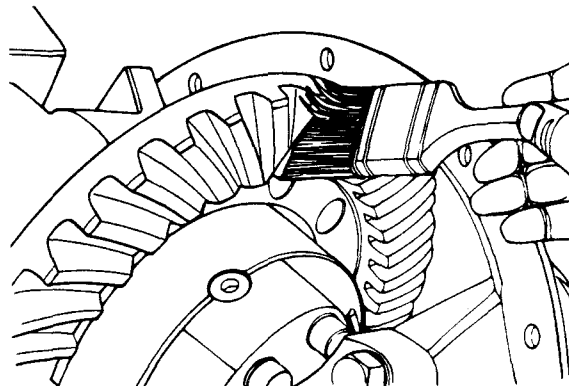
Figure 110



Tooth Contact Patterns of Conventional Hypoid and Generoid Hypoid Gear Sets

1. Adjust the backlash of a new gear set to either .012 inch (.300 mm) or .015 inch (.380 mm) depending on the size of the ring gear. Adjust the backlash of an old gear set to the setting that was measured before the carrier was disassembled. Refer to the procedure on page 48.
2. Apply a marking compound to approximately 12 gear teeth of the ring gear. Rotate the ring gear so that the 12 gear teeth are next to the drive pinion. **Figure 111.**

Figure 111



3. Rotate ring gear forward and backward so that the 12 gear teeth go past the drive pinion six times to get the contact patterns. Repeat if needed to get a more clear pattern.
4. Look at the contact patterns on the ring gear teeth. Compare the patterns to **Figures 112A or B, 113A or B, and 114A or B.**

The Location of Good Hand-Rolled Contact Patterns.

New Conventional and Generoid Gear Sets — toward the toe of the gear tooth and in the center between the top and bottom of the tooth. Refer to **Figures 112A and 112B.**

When the carrier is being operated, a good pattern will extend approximately the full length of the gear tooth. The top of the pattern will be near the top of the gear tooth. Refer to **Figure 115A or B.**

The location of a good hand-rolled contact pattern for an old gear set **must** match the wear pattern in the ring gear. The contact pattern will be smaller in area than the wear pattern.

If the contact patterns require adjustment, continue by following step 5 to move the contact patterns between the top and bottom of the gear teeth. If the contact patterns are in the center of the gear teeth, continue by following step 6.

5. Change the thickness of the shim pack under bearing cage to move the contact patterns between the top and bottom of the gear teeth. Use the following procedure.

Section 5 Assembly

Conventional Gears

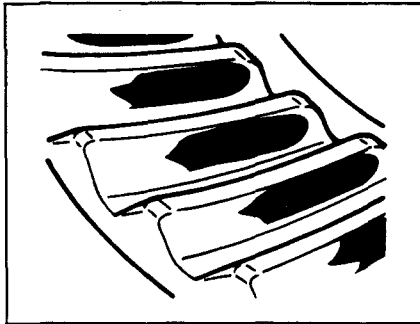


Figure 112A
Good Hand-Rolled Pattern

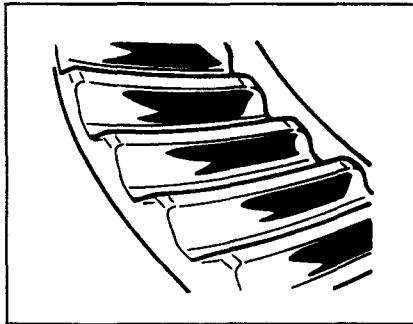


Figure 113A
High Pattern

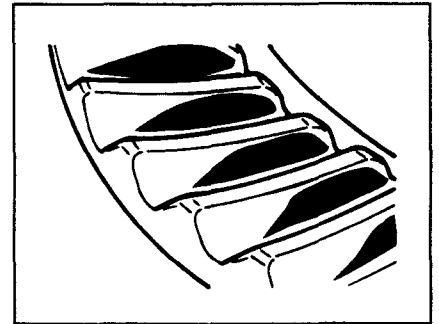


Figure 114A
Low Pattern

Generoid Gears

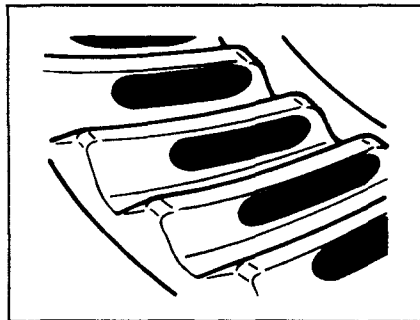


Figure 112B
Good Hand-Rolled Pattern

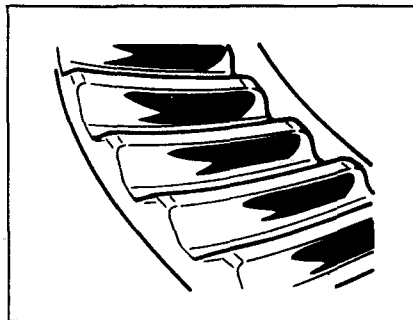


Figure 113B
High Pattern

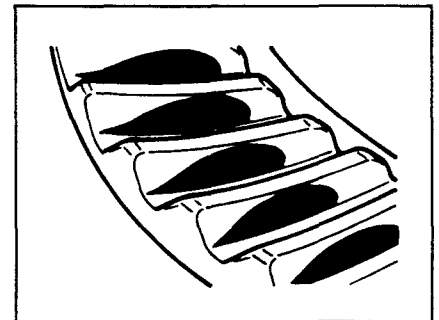


Figure 114B
Low Pattern

Figure 115A
Good Pattern in Operation
Conventional Gears

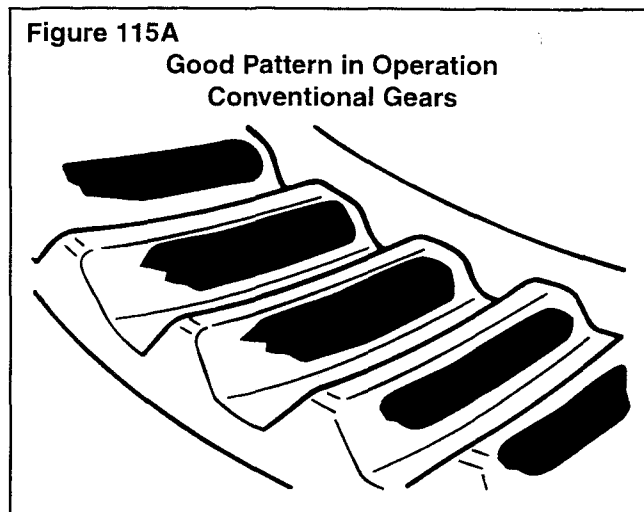
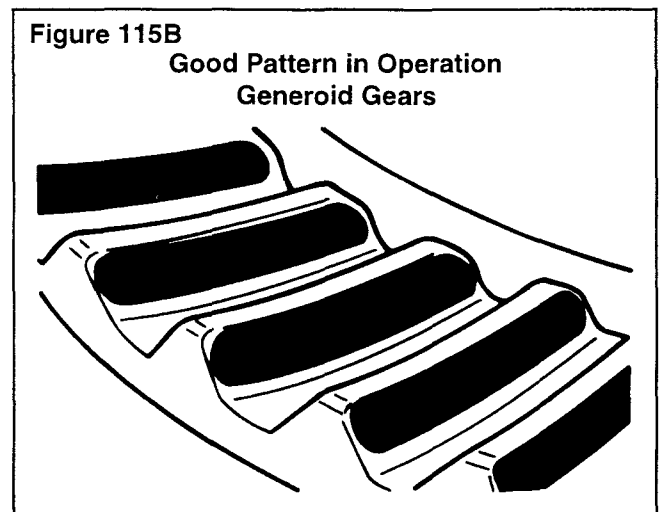


Figure 115B
Good Pattern in Operation
Generoid Gears



Section 5 Assembly

NOTE:

A high contact pattern indicates that the drive pinion was not installed deep enough into the carrier. A low contact pattern indicates that the drive pinion was installed too deep in the carrier.

- a. Remove the drive pinion and bearing cage from the carrier. Refer to the procedure on page 12.
- b. To correct a high contact pattern, **Figure 113A** decrease the thickness of the shim pack under the bearing cage. When decreasing the thickness of the shim pack, the drive pinion will move toward the ring gear. **Figure 116.**

To correct a low contact pattern, **Figure 117** increase the thickness of shim pack under the bearing cage. When increasing the thickness of the shim pack, the drive pinion will move away from the ring gear. **Figure 117.**

Figure 116

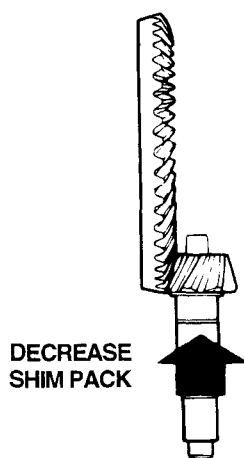
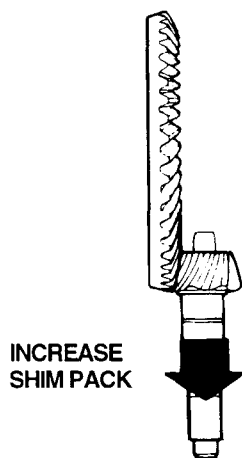
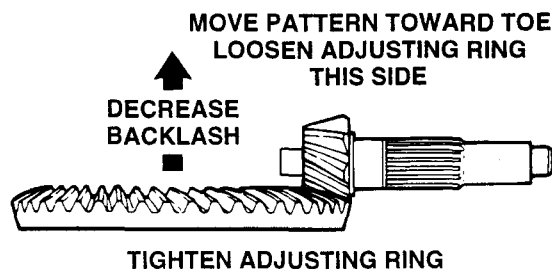


Figure 117



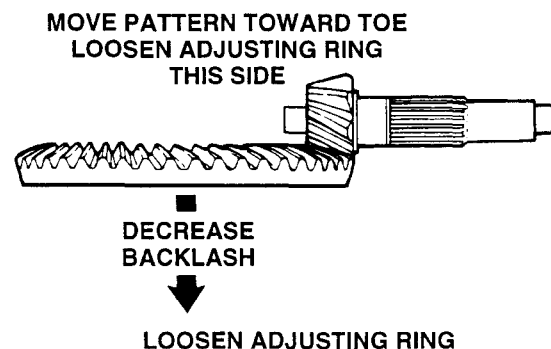
- c. Install the drive pinion, bearing cage and shims into the carrier. Refer to the procedure on page 36.
- d. Repeat steps 2-5 until the contact patterns are in the center between the top and bottom of the gear teeth.
6. Adjust backlash of the ring gear within specification range to move the contact patterns to the correct location in the length of the gear teeth. Refer to the procedure on page 48.
 - a. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth. **Figure 118.**

Figure 118



- b. Increase backlash to move the contact patterns toward the heel of the ring gear teeth. **Figure 119.**

Figure 119



- c. Repeat steps 2-4 and 6 until the contact patterns are at the correct location in the length of the gear teeth.
7. Install cotter keys*, pins*, or lock plates* that hold the two bearing adjusting rings in position. Use the following procedures.

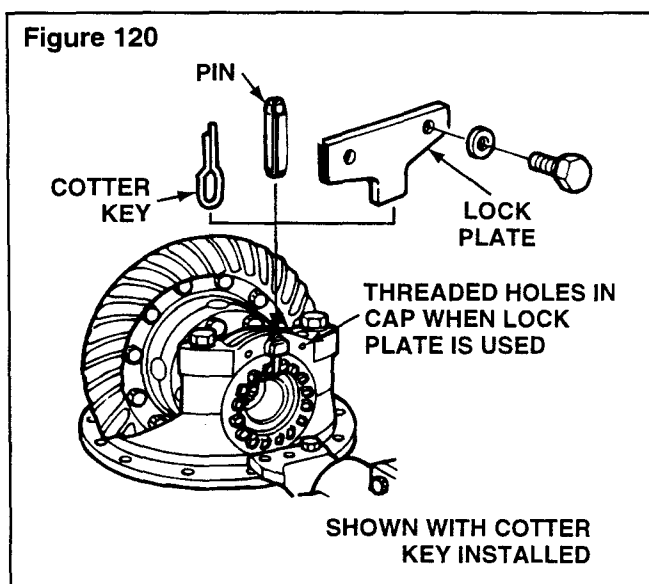


CAUTION

If the carrier has cotter keys, lock the adjusting rings only with cotter keys. If your carrier has roll pins, reuse the roll pins or lock the adjusting rings with cotter keys. Do not force a roll pin into a cotter key hole.

Section 5 Assembly

- a. **Cotter Keys*** — Install cotter keys between lugs of the adjusting ring and through the boss of the bearing cap. Bend the two ends of the cotter key around the boss. **Figure 120.**
- b. **Pins*** — Install pin through boss of the bearing cap until the pin is between lugs of the adjusting ring. Use a drift and hammer to install the pin. **Figure 120.**
- c. **Lock Plates*** — Install lock plate on bearing cap so that the tab is between lugs of the adjusting ring. Install the two capscrews that hold the lock plate to the bearing cap. Tighten the capscrews to correct torque value. Refer to the Torque Chart on page 61. **Figure 120.** **T**



Install and Adjust the Thrust Screw*

Specification

- Clearance between thrust screw and ring gear — 0.025 to 0.045 inch (0.650-1.140 mm).
- Loosen the thrust screw 1/2 turn or 180°.

If the carrier does not have a thrust block*, start at step 4.

1. Rotate the carrier in the repair stand until the back surface of ring gear is toward the top. **Figure 121.**
2. Place the thrust block* on the back surface of the ring gear. The thrust block* **must** be in the center between the outer diameter of gear and differential case.

3. Rotate the ring gear until the thrust block* and hole for thrust screw, in carrier, are aligned. **Figure 121.**
4. Install the jam nut* on the thrust screw*, one half the distance between both ends.
5. Install the thrust screw* into the carrier until the screw stops against the ring gear or thrust block*. **Figure 122.**

Figure 121

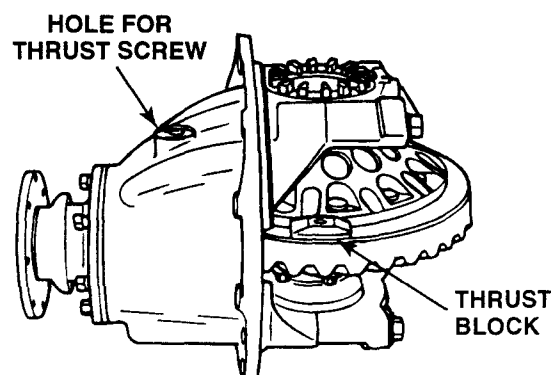
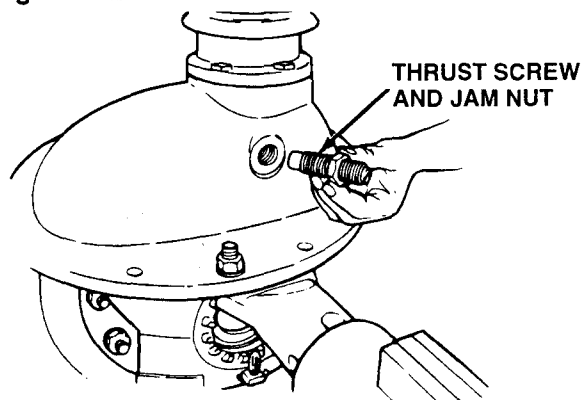
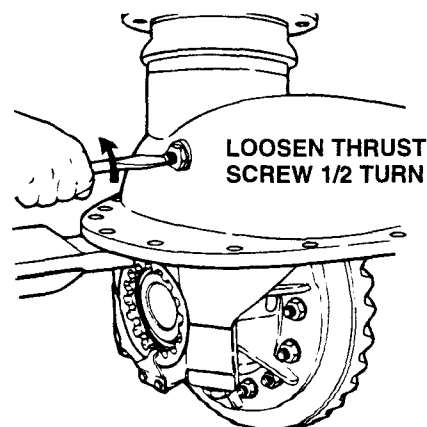


Figure 122



6. Loosen the thrust screw* 1/2 turn, 180°. **Figure 123.**

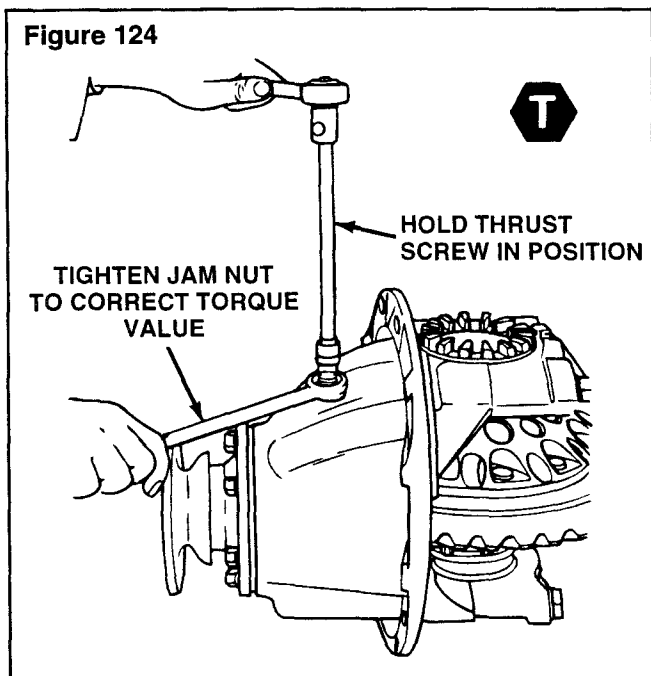
Figure 123



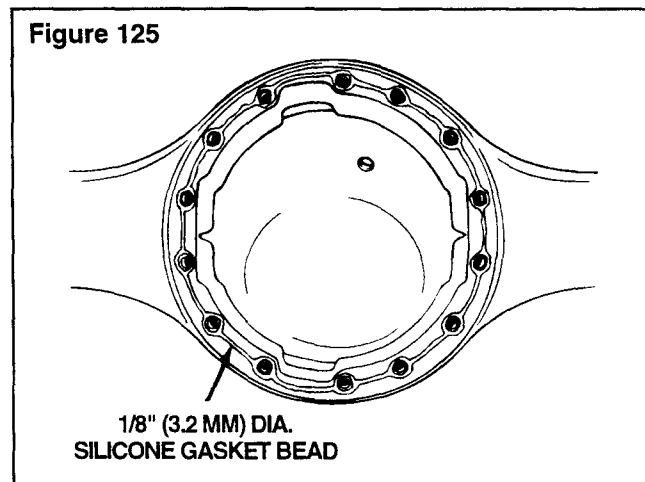
Section 5

Assembly

7. Tighten the jam nut* to the correct torque value against the carrier. Refer to the Torque Chart on page 61. **Figure 124.** 



5. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. Refer to the procedure on page 23. **Figure 125.**



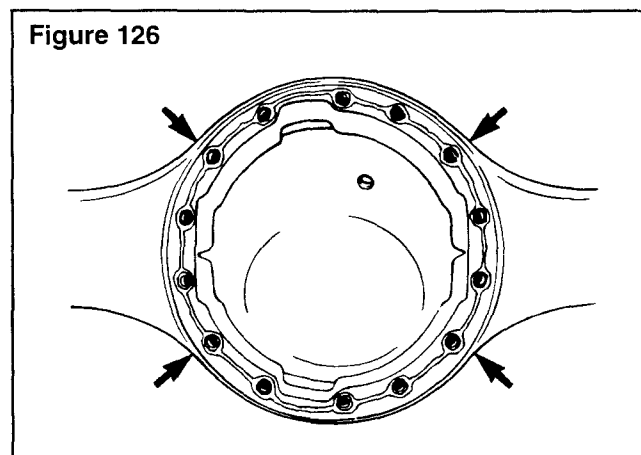
6. Install the carrier into the axle housing. Use a hydraulic roller jack or a lifting tool.



CAUTION

Do not install the carriers using a hammer or mallet. A hammer or mallet will damage the mounting flange of carrier and cause oil leaks.

7. Install nuts* and washers or capscrews and washers in the four corner locations around the carrier and axle housing. Tighten the fasteners hand tight at this time. **Figure 126.**



Install Differential Carrier into Axle Housing



WARNING

Be careful when using cleaning solvents. Follow the solvent manufacturer's instructions for safe use to prevent injury.

1. Clean the inside of axle housing and the mounting surface where the carrier fastens. Use a cleaning solvent and rags to remove dirt. Blow dry the cleaned areas with air. Also refer to the procedure on page 17.
2. Inspect the axle housing for damage. Repair or replace the axle housing. Refer to the procedure on pages 20-21.
3. Inspect for loose studs* in the mounting surface of the housing where the carrier fastens. Remove and clean the studs* that are loose.
4. Apply liquid adhesive to the threaded holes and install the studs* into axle housing. Refer to the procedure on page 23. Tighten studs* to correct torque value. Refer to the Torque Chart on page 61. 

8. Carefully push the carrier into position. Tighten the four fasteners two or three turns each in a pattern opposite each other. Refer to **Figure 126**.
9. Repeat step 8 until the four fasteners are tightened to the correct torque value. Refer to the Torque Chart on page 61. **T**
10. Install the other fasteners and washers that hold the carrier in the axle housing. Tighten fasteners to the correct torque value. Refer to the Torque Chart on page 61. **T**
11. Connect the driveline universal joint to the pinion input yoke or flange on the carrier.
12. Install the gaskets and axle shafts into the axle housing and carrier. The gasket and flange of the axle shafts **must** fit flat against the wheel hub. **Figure 127**.

Straight Holes, Nuts and Hardened Washers

1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to **Figure 127**.
4. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in **Chart 3**.

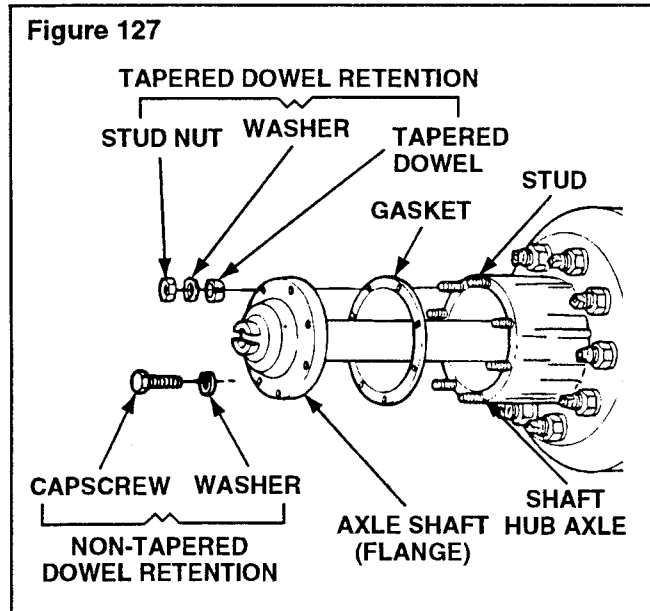


Chart 3

Shaft-to-Hub Torque Fastener Chart—Non-tapered Dowel Applications

Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) T	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	.62-18 .75-16	150-230 (203-312) 310-400 (420-542)	130-190 (176-258) 270-350 (366-475)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Section 5 Assembly

Tapered Dowel, Hardened Washer and Hardened Nut

1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to **Figure 127**.
4. Install solid tapered dowels over each stud and into the flange of the axle shaft. Use a punch or a drift and hammer, if necessary.
5. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in **Chart 4**.

Chart 4

Shaft-to-Hub Torque Fastener Chart — Tapered Dowel Applications

Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) 	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	.44-20	50-75 (81-102)	40-65 (67-88)
	.50-20	75-115 (115-156)	65-100 (102-136)
	.56-18	110-165 (176-224)	100-145 (149-197)
	.62-18	150-230 (203-312)	130-190 (176-258)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Section 6 Lubrication

NOTE:

For complete information on lubricating drive axles and carriers, refer to *Rockwell Maintenance Manual No. 1*.

Refer to the following **Charts 5, 6 and 7** for standard information on lubricants, schedules and capacities.

Chart 5

Lubricant Cross Reference (Viscosity) and Temperature Chart

Rockwell Lubricant Specification	Description	Cross Reference	Minimum Outside Temperature	Maximum Outside Temperature
O-76-A	Hypoid Gear Oil	GL-5, S.A.E. 85W/140	+10°F (-12.2°C)	... **
O-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	-15°F (-26.1°C)	... **
O-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	-15°F (-26.1°C)	... **
O-76-E	Hypoid Gear Oil	GL-5, S.A.E. 75W/90	-40°F (-40°C)	... **
O-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	-40°F (-40°C)	+35°F (+1.6°C)
O-76-L	Hypoid Gear Oil	GL-5, S.A.E. 75W/140	-40°F (-40°C)	... **
** There is no upper limit on these outside temperatures, but the axle sump temperature <i>must never exceed</i> 250°F (+121°C).				

Chart 6

Rear Drive Axle Oil Change Intervals and Specifications^①

APPLIES TO ALL REAR AXLES EXCEPT THE "ADVANCED LUBE" REAR AXLES.

On-Highway Operation Intervals				Off-Highway Operation Intervals ②				Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Initial Oil Change	Inspect Oil Level	Petroleum Oil Change	Synthetic Oil Change	Initial Oil Change	Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change			F°		C°	
										Min.	Max.	Min.	Max.
3,000 miles (4,800 km)	3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	If annual mileage is less than 100,000 miles (160,000 km) change oil once a year.	250,000 miles (400,000 km)	1,000 miles (1,600 km)	1,000 miles (4,800 km)	If annual mileage is less than 60,000 miles (96,000 km) change oil twice a year.	50,000 miles (80,000 km)	O-76A, Gear Oil (MIL-L-2105D or MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None
								O-76D, Gear Oil (MIL-L-2105D or MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None
								O-76E, Gear Oil (MIL-L-2105D or MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None
								O-76J, Gear Oil (MIL-L-2105D or MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2
								O-76L, Gear Oil (MIL-L-2105D or MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
		O-76M, Full Synthetic Gear Oil (MIL-L-2105D or MIL-PRF-2105E)				GL-5, SAE 75W/140		-40	None	-40	None		
		O-76N, Full Synthetic Gear Oil (MIL-L-2105D or MIL-PRF-2105E)				GL-5, SAE 75W/90		-40	None	-40	None		
		If annual mileage is more than 100,000 miles (160,000 km), change oil every 100,000 miles (160,000 km).				If annual mileage is more than 60,000 miles (96,000 km), change oil every 30,000 miles (48,000 km).							

NOTES:

- ① If oil pump and filter is used, change filter every 100,000 miles (160,000 km). Inspect oil level. Add correct oil as required.
- ② Includes heavy-duty on-highway and on/off-highway applications.
- ③ For continuous heavy-duty operation, inspect oil level every 1,000 miles (1,600 kilometers).

Section 6

Lubrication

"Advanced Lube" Rear Drive Axle without Oil Pump and Filter Oil Change Intervals and Specifications^①

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH
"MEMBRANE" TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On-/Off-Highway Operation Intervals ②			Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change ④	Inspect Oil Level ⑤	Petroleum Oil Change ③	Synthetic Oil Change ④			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	250,000 miles (400,000 km)	3,000 miles (4,800 km) or 200 hours of operation	40,000 miles (64,000 km)	80,000 miles (128,000 km)	O-76A, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES:

- ① If a No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 64,000 km (40,000 miles) or a maximum interval of 50,000 miles (80,000 km).
- ② Also applies to heavy-duty on-highway applications. Does not apply to off-highway applications.
- ③ For petroleum oil with extended drain additives, use the "Synthetic Oil Change" interval.
- ④ Applies to semi-synthetic oils and full-synthetic oils. For a list of approved synthetic oils, refer to Rockwell Maintenance Manual No. 1.
- ⑤ For continuous heavy-duty operation, inspect the oil level every 1,000 miles (1,600 km). Add the correct oil as required.

Tandem "Advanced Lube" Rear Drive Axle with Oil Pump and Filter Oil Change Intervals and Specifications^{①②}

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH
"MEMBRANE" TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On-/Off-Highway Operation Intervals ③			Rockwell Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ④	Synthetic Oil Change ⑤	Inspect Oil Level ⑥	Petroleum Oil Change ④	Synthetic Oil Change ⑤			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles 4,800 km) once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	500,000 miles (800,000 km)	3,000 miles (4,800 km) or 200 hours of operation	50,000 miles (80,000 km)	100,000 miles (160,000 km)	O-76A, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES:

- ① Replace oil filter every 100,000 miles (160,000 km). Inspect oil level. Add specified oil as required.
- ② If No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 40,000 miles (64,000 km) or a maximum interval of 50,000 miles (80,000 km).
- ③ Applies to heavy-duty on-highway applications and to on/off highway applications. Does not apply to off-highway applications.
- ④ For petroleum oil with extended drain additives, use the "Synthetic Oil Change" interval.
- ⑤ Applies to semi-synthetic oils. For list of approved synthetic oils, refer to Rockwell Maintenance Manual No. 1.
- ⑥ For continuous heavy-duty operation, inspect oil level every 1,000 miles (1,600 km). Add correct oil as required.

Section 6 Lubrication

Chart 7

Lubricant Capacities

Use the following lubricant capacities as a guide only. The capacities are measured with the drive pinion in the horizontal position. When the angle of the drive pinion changes, the lubricant capacity of the axle will change.

Axle Model	Capacity	
	U.S. Pints	Liters
Single Drive Axles		
A-150	5.5	2.6
B-100	10	4.7
B-140	12	5.7
B-150	3.5	1.7
C-100	12.5	5.9
D-100	12.5	5.9
D-140	12.5	5.9
E-100	15	7.1
E-105	12.5	5.9
E-150	9	4.3
F-100	13	6.2
F-106	13	6.2
F-120	15	7.1
F-121	15	7.1
F-140	14	6.6
FDS-75	14	6.6
FDS-78	14	6.6
FDS-85	15	7.1
FDS-90	14	6.6
FDS-93	14	6.6
FDS-750	7	3.3
FDS-1600	23	10.9
FDS-1800	35	16.6
FDS-1805	35	16.6
FDS-1807	27	13.2
FDS-1808	27.9	13.2
FDS-2100	27.9	13.2
FDS-2101	27.9	13.2
FDS-2107	43	20.3
FDS-2110	43	20.3
FDS-2111	43	20.3
FDS-2117	43	20.3
G-161	21	9.9
H-100	20	9.5
H-140	21	9.9
H-150	11	5.2
H-162	20	9.5
H-170	27*	12.8
H-172	27	12.8
L-100	23	10.9
L-140	24	11.4

Axle Model	Capacity	
	U.S. Pints	Liters
Single Drive Axles (Continued)		
L-155	24	11.4
L-172	27	12.8
M-172	27	12.8
QT-140	24	11.4
Q-100	31	14.7
Q-145	24	11.4
RL-170	48	22.7
R-100	30	14.2
R-140	28	13.2
R-155	28	13.2
R-160	28	13.2
R-163	34	16.1
R-170	43	20.3
S-170	43	20.3
U-140	24	11.4
U-170	43	20.3
W-170	43	20.3

* Includes 1 pint (0.97 liter) for each wheel end and with drive pinion angle at 3°.

Axle Model	Capacity	
	U.S. Pints	Liters
Rear Axle of Tandems		
SDHD (DHR rear)	16	7.6
SFHD (FHR rear)	16.5	7.8
SHHD (HHR rear)	26	12.3
SL-100 (LR-100 rear)	37	17.5
SLHD (LHR rear)	32	15.1
SQ-100 (QR-100 rear)	33	15.7
SQHD (QHR rear)	31	14.7
SQHP (QAR rear)	36	17
SR-170 (RR-170 rear)	43	20.3
SRHD (RHR rear)	36	17
SSHD (SHR rear)	28	13.2
ST-170 (TR-170 rear)	43	20.3
STHD (THR rear)	28	13.2
SU-170 (UR-170 rear)	43	20.3
SUHD (UHR rear)	28	13.2
SW-170 (WR-170 rear)	43	20.3

Section 7

Fastener Torque Information

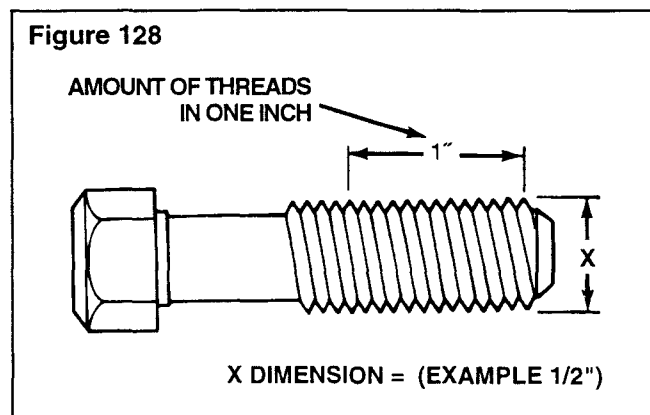
Torque Values for Fasteners

General Information

1. The torque values in **Chart 8** are for fasteners that have a light application of oil on the threads.
2. If the fasteners are dry, increase the torque values by ten percent (10%).
3. If the fasteners have a heavy application of oil on the threads, decrease the torque values by ten percent (10%).
4. If you do not know the size of the fastener that is being installed, measure the fastener. Use the following procedure.

American Standard Fasteners

- a. Measure the diameter of the threads in inches, dimension X. **Figure 128.**



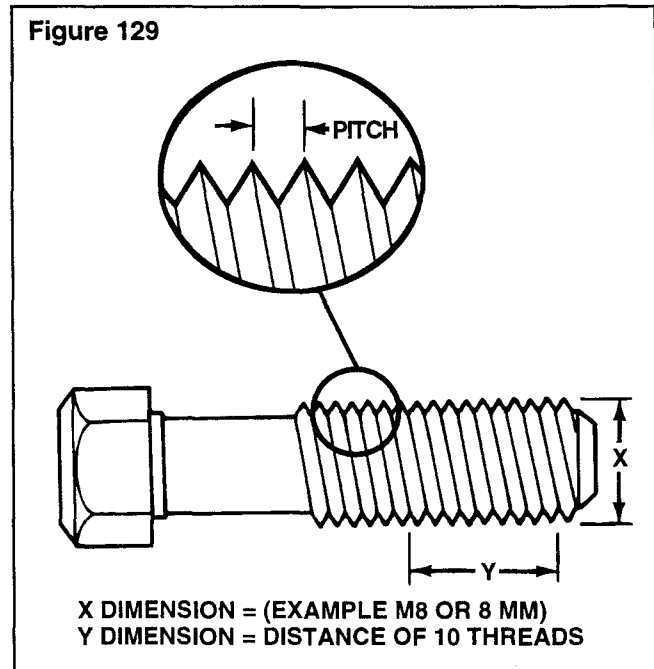
- b. Count the amount of threads there are in one inch (1.0 inch). **Figure 128.**

Example

- American Standard size fastener is .50-13.
 - 0.50 is the diameter of the fastener in inches or dimension X.
 - 13 is the amount of threads in one inch (1.0 inch).

Metric Fasteners

- a. Measure the diameter of the threads in millimeters (mm), dimension X. **Figure 129.**



- b. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 129.**
- c. Divide dimension Y by ten (10). The result will be the distance between two threads or pitch.

Example

- Metric size fastener is M8 x 1.25.
 - M8 is the diameter of the fastener in millimeters (mm) or dimension X.
 - 1.25 is the distance between two threads or pitch.
- 5. Compare the size of fastener measured in step 4 to the list of fasteners in **Chart 8** to find the correct torque value.

Section 7

Fastener Torque Information

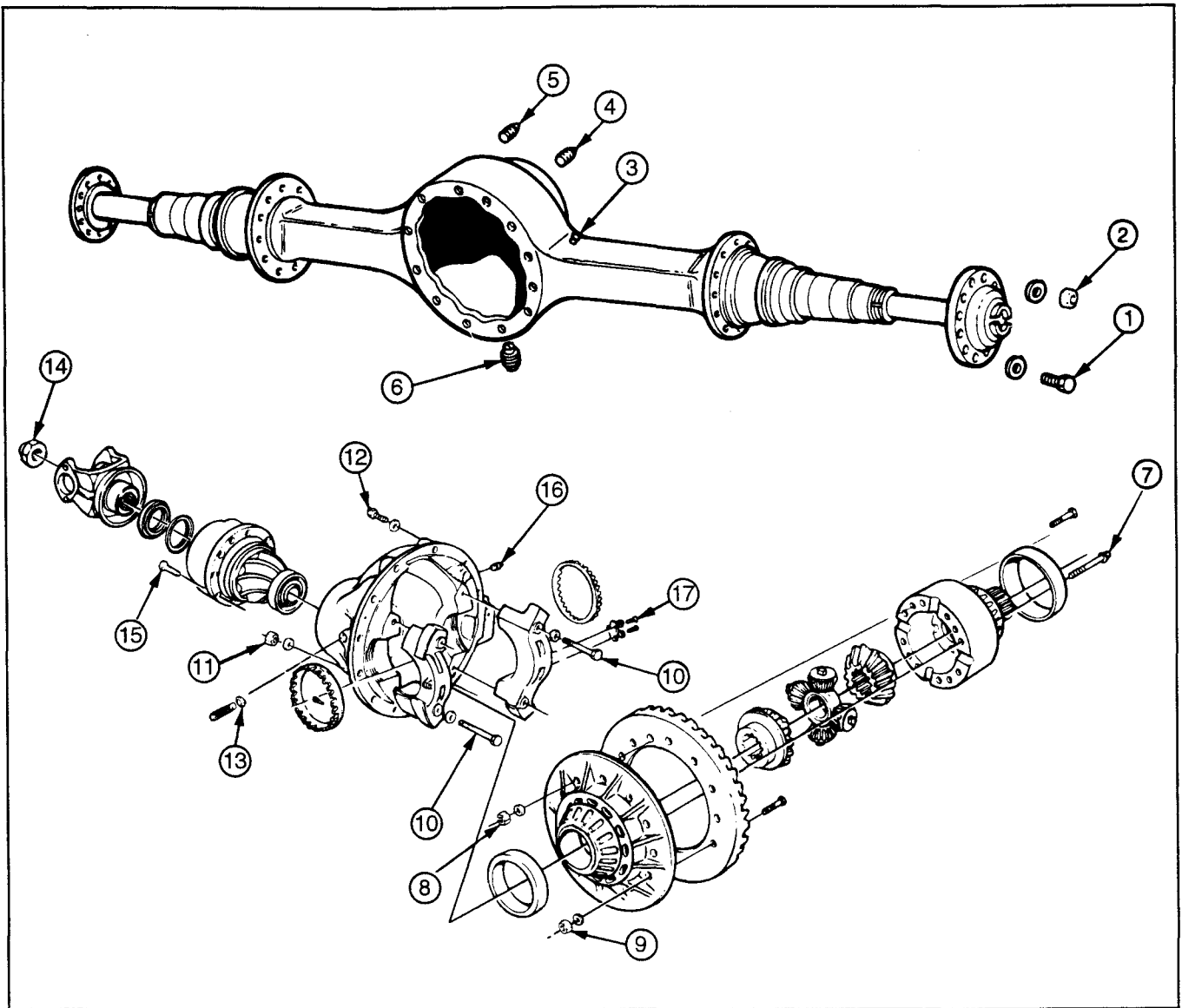


Chart 8
Torque Chart

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
1.	*Capscrew, Axle Shaft	.31-24	18-24	(24-33)
		.50-13	85-115	(115-156)
2.	*Nut, Axle Shaft Stud	Plain Nut		
		.44-20	50-75	(68-102)
		.50-20	75-115	(102-156)
		.56-18	110-165	(149-224)
		.62-18	150-230	(203-312)
		Lock Nut		
		.44-20	40-65	(54-88)
		.50-20	65-100	(88-136)
		.56-18	100-145	(136-197)
		.62-18	130-190	(176-258)

*Some Rockwell carriers do not have these described parts.

Section 7

Fastener Torque Information

Chart 8 (Continued)

Fastener		Thread Size	Torque Value lb-ft (N•m) T	
3.	Breather	.38-18	20 minimum (27 minimum)	
4.	*Plug, Oil Fill (Housing)	.75-14	35 minimum (47.5 minimum)	
5.	*Plug, Heat Indicator	.50-14	25 minimum (34 minimum)	
6.	Plug, Oil Drain	.50-14	25 minimum (34 minimum)	
7.	Capscrew, Differential Case	.38-16	35-50	(48-68)
		.44-14	60-75	(81-102)
		.50-13	85-115	(115-156)
		.56-12	130-165	(176-224)
		.62-11	180-230	(244-312)
		Grade 10.9 Flange Head M12 x 1.75	85-103	(115-140)
		Grade 10.9 Standard Hex Head M12 x 1.75	74-96	(100-130)
8.	*Nut, Differential Case Bolt	Grade 12.9 Standard Hex Head M12 x 1.75	105-125	(143-169)
		Grade 12.9 Flange Head M16 x 2	203-251	(275-340)
		Grade 12.9 Standard Head M16 x 2	220-310	(300-420)
		.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
		.62-11	150-190	(203-258)
		.62-18	180-230	(244-312)
9.	*Nut, Ring Gear Bolt	M12 x 1.75	74-96	(100-130)
		M16 x 2	220-310	(300-420)
		.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
		.62-11	150-190	(203-258)
		.62-18	180-230	(244-312)
		M12 x 1.25	66-81	(90-110)
10.	Capscrew, Bearing Cap	M12 x 1.75	77-85	(104-115)
		Flange Head M16 x 1.5	192-214	(260-190)
		Standard Hex Head M16 x 1.5	196-262	(265-355)
		.56-12	110-145	(149-197)
		.62-11	150-190	(203-258)
		.75-10	270-350	(366-475)
		.88-14	360-470	(488-637)
11.	Nut, Housing to Carrier Stud	.88-9	425-550	(576-746)
		M16 x 2	181-221	(245-300)
		M20 x 2.5	347-431	(470-585)
		M22 x 2.5	479-597	(650-810)
		.44-20	50-75	(68-102)
		.50-20	75-115	(102-156)
		.56-18	110-165	(149-224)
12.	Capscrew, Carrier to Housing	.62-18	150-230	(203-312)
		.44-14	50-75	(68-102)
		.50-13	75-115	(102-156)
		.56-12	110-165	(149-224)
		.62-11	150-230	(203-312)
		.75-10	270-400	(366-542)
		M12 x 1.75	74-89	(100-120)
		M16 x 2	181-221	(245-300)

Section 7

Fastener Torque Information

Chart 8 (Continued)

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
13.	*Jam Nut, Thrust Screw	.75-16	150-190	(203-258)
		.88-14	150-300	(203-407)
		1.12-16	150-190	(203-258)
		M22 x 1.5	148-210	(200-285)
		M30 x 1.5	236-295	(320-400)
14.	Nut, Drive Pinion	.88-20	200-275	(271-373)
		1.0-20	300-400	(407-542)
		1.25-12	700-900	(949-1220)
		1.25-18	700-900	(949-1220)
		1.50-12	800-1100	(1085-1491)
		1.50-18	800-1100	(1085-1491)
		1.75-12	900-1200	(1220-1627)
		M32 x 1.5	738-918	(1000-1245)
		M39 x 1.5	922-1132	(1250-1535)
		M45 x 1.5	996-1232	(1350-1670)
15.	Capscrew, Bearing Cage	.38-16	30-50	(41-68)
		.44-14	50-75	(68-102)
		.50-13	75-115	(102-156)
		.56-12	110-165	(149-224)
		.62-11	150-230	(203-312)
		M12 x 1.75	70-110	(90-150)
16.	*Plug, Oil Fill (Carrier)	.75-14	25 minimum (34 minimum)	
		1.5-11.5	120 minimum (163 minimum)	
		M24 x 1.5	35 minimum (47 minimum)	
17.	*Capscrew, Lock Plate	.31-18	20-30	(27-41)
		M8 x 1.25	21-26	(28-35)

Section 8

Adjustments and Specifications

Drive Pinion Bearings — Preload

Page

Specification	New bearings — 5 to 45 lb-in (0.56-5.08 N•m) torque  Used bearings — 10 to 30 lb-in (1.13-3.39 N•m) torque 	32
Adjustment	Preload is controlled by the thickness of the spacer between bearings. — To increase preload install a thinner spacer — To decrease preload install a thicker spacer	

Drive Pinion — Depth in Carrier

Specification	Install the correct amount of shims between the bearing cage and carrier. To calculate, use old shim pack thickness and new and old pinion cone numbers.	36-38
Adjustment	Change the thickness of the shim pack to get a good gear tooth contact pattern.	

Hypoid Gear Set — Tooth Contact Patterns (Hand Rolled)

Specification	Conventional gear set — Toward the toe of the gear tooth and in the center between the top and bottom of the tooth Generoid gear set — Between the center and toe of the tooth and in the center between the top and bottom of the tooth	49
Adjustment	Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash — To move the contact pattern lower, decrease the thickness of the shim pack under the pinion bearing cage — To move the contact pattern higher, increase the thickness of the shim pack under the pinion bearing cage — To move the contact pattern toward the toe of the tooth, decrease backlash of the ring gear — To move the contact pattern toward the heel of the tooth, increase backlash of the ring gear	

Main Differential Bearings — Preload

Specification	15 to 35 lb-in (1.7-3.9 N•m) torque  <i>or</i> Expansion between bearing caps — R-140, R-155 and R-160 carrier models — 0.002 to 0.009 inch (0.050-0.229 mm) — All other carrier models — 0.006 to 0.013 inch (0.150-0.330 mm)	45
Adjustment	Preload is controlled by tightening both adjusting rings after zero end play is reached	

Section 8

Adjustments and Specifications

Main Differential Gears — Rotating Resistance

Page

Specification	50 lb-ft (68 N•m) torque applied to one side gear 	43
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Ring Gear — Backlash

Specification	Ring gears that have a pitch diameter of less than 17 inches (431.8 mm) — Range: 0.008 to 0.018 inch (0.200-0.460 mm) 0.012 inch (0.300 mm) for a new gear set Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater — Range: 0.010 to 0.020 inch (0.250-0.510 mm) 0.015 inch (0.380 mm) for a new gear set	48
Adjustment	Backlash is controlled by the position of the ring gear. Change backlash within specifications to get a good tooth contact pattern. — To increase backlash, move the ring gear away from the drive pinion — To decrease backlash, move the ring gear toward the drive pinion	

Ring Gear — Runout

Specification	0.008 inch (0.200 mm) maximum	47
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Spigot Bearing — Peening on the Drive Pinion

Specification	Apply 6,614 lb (3,000 kg) load on a 0.375 inch or 10 mm ball. Peen the end of the drive pinion at a minimum of five points. Softening of the pinion stem end by heating may be required.	28-29 29
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Section 9

Vehicle Towing Instructions (Non DCDL)

SINGLE AXLE without Driver Controlled Main Differential Lock (DCDL)

TANDEM AXLE without Driver Controlled Main Differential Lock (DCDL), with Inter-Axle Differential (IAD)

These instructions are for vehicles equipped with Rockwell single or tandem rear drive axles.

The instructions supersede all other instructions for the purpose of transporting vehicles for service or new vehicle drive-away dated before April 1995, including those contained in Rockwell Maintenance Manuals.

When transporting a vehicle with the wheels of one or both drive axles on the road, it is possible to damage the axles if the wrong procedure is used before transporting begins. Rockwell recommends that you use the following procedure.

Before Towing or Drive-Away



WARNING

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



WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. Apply the vehicle parking brakes using the switch inside the cab of the vehicle.

NOTE:

Single Axle continue with step 5. Tandem Axle continue with step 2.

2. Shift the transmission into neutral and start the vehicle's engine.
3. Shift the IAD to the unlocked (disengaged) position using the switch inside the cab of the vehicle. The indicator light in the cab will go off.
4. Stop the engine.

NOTE:

Remove both axle shafts from the axle(s) that will remain on the road when the vehicle is transported. Continue with step 5 for both axle shafts.

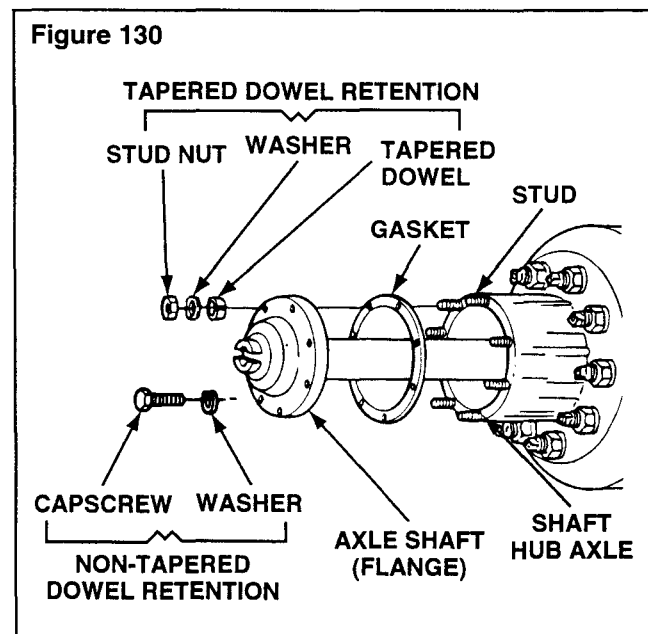
5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. **Figure 130.**
6. Loosen the tapered dowels, if used, in the flange of the axle shaft using one of the two following methods. **Figure 130.**



CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

Figure 130



Section 9

Vehicle Towing Instructions (Non DCDL)

Brass Drift Method:

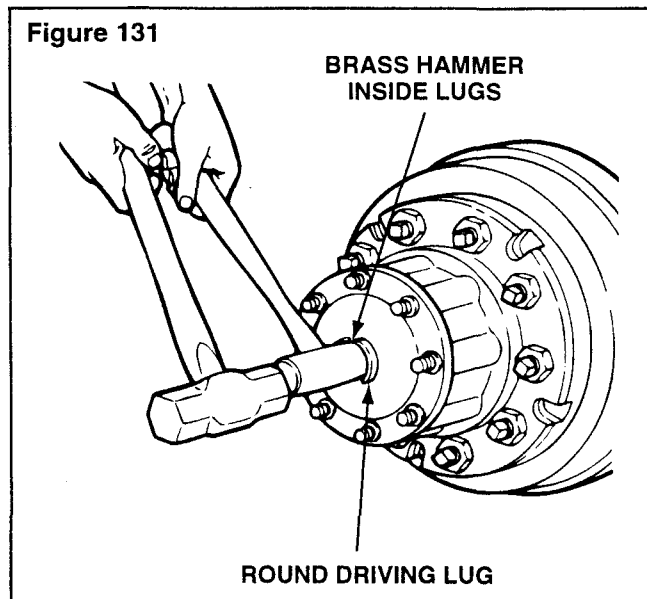
WARNING

Wear safe eye protection. Do not directly strike or hit the round driving lugs on the flange of the axle shaft. Striking the lugs can cause them to break off from the axle shaft hub resulting in serious personal injury.

NOTE:

A 1.5 inch (38.1 mm) diameter brass hammer can be used as a drift.

- a. Hold a 1.5 inch (38.1 mm) diameter brass drift against the center of the axle shaft flange, inside the round driving lugs. **Figure 131.**



- b. Hit the end of the drift with a large hammer (5 to 6 lbs, 2 to 3 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 131.**

Air Hammer Vibration Method:

WARNING

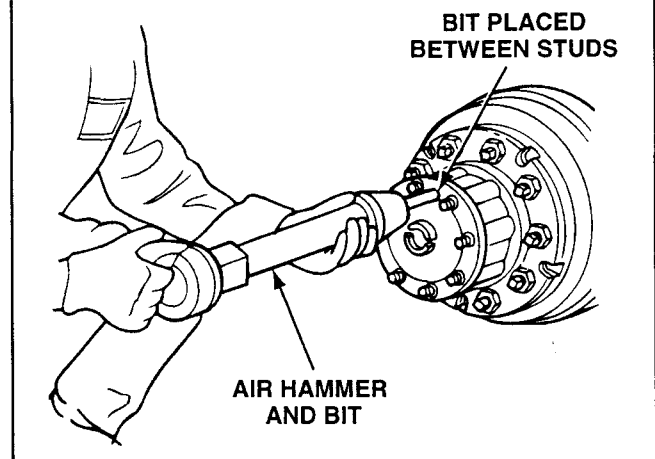
Wear safe eye protection when using an air hammer. Power tools and components can loosen and break and cause serious personal injury.

- a. Use an air hammer, such as Chicago Pneumatic CP-4181-PULER, or equivalent, with a round hammer bit to loosen the axle shaft and dowels.

- b. Place the round hammer bit against the axle shaft flange between the studs, at different points around the flange. Operate the air hammer at each location and loosen the axle shaft and tapered dowels from the hub.

Figure 132.

Figure 132



7. Identify each axle shaft that is removed from the axle assembly so they can be installed in the same location after transporting or repair is completed. (Example: Match mark a mating axle shaft and hub.)
8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 130**, page 66.
9. Install a cover over the open end of each hub where an axle shaft was removed. This will prevent dirt from entering the bearing cavity and loss of lubricant.

NOTE:

If an air supply will be used for the brake system of the transported vehicle, continue with steps 10 and 11, otherwise continue with step 12.

10. Connect an auxiliary air supply to the brake system of the vehicle that is being transported. Before moving the vehicle, charge the brake system with the correct amount of air pressure to operate the brakes. Refer to the instructions supplied by the manufacturer of the vehicle for procedures and specifications. If an auxiliary air supply is not used, continue with step 12.
11. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 12 is not required.

Section 9

Vehicle Towing Instructions (Non DCDL)

WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually compress the spring. Sudden release of a compressed spring can cause serious personal injury.

12. If there are spring (parking) brakes on the axle(s) that will remain on the road when the vehicle is transported, and they cannot be released by air pressure, manually compress and lock each spring so that the brakes are released. Refer to the manufacturer's instructions.

After Towing or Drive-Away

WARNING

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

WARNING

Do not work under a vehicle unless the parking brake is engaged. The vehicle can move and cause serious personal injury if the parking brake is not applied before maintenance tasks are begun.

1. If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with step 2.

WARNING

When you work on a spring (parking) brake, carefully follow the service instructions of the chamber manufacturer to manually release the spring. Sudden release of a compressed spring can cause serious personal injury.

2. Apply the vehicle spring (parking) brakes by manually releasing each spring that was compressed before transporting started. Refer to manufacturer's instructions.
3. Disconnect the auxiliary air supply, if used, from the brake system of the vehicle that was transported. Connect the vehicle's air supply to the brake system.

4. Remove the covers from the hubs.

NOTE:

Continue with steps 5 through 7 to install all axle shafts.

5. Install the gasket, if used, and axle shaft into the axle housing and carrier in the same location it was removed from. The gasket and flange of the axle shaft must be flat against the hub. Rotate the axle shaft and/or the driveline as necessary to align the splines and the holes in the flange with the studs in the hub. **Figure 130**, page 66.
6. Install the dowels, if used, over each stud and into the tapered holes of the flange.
7. Install the washers and capscrews or stud nuts. Determine the size of the fasteners and tighten the capscrews or nuts to the corresponding torque value shown in **Chart 9** below.

Chart 9

	Thread Size	Torque Value lb-ft (N•m) 
Capscrews:	0.31"-24	18-24 (24-33)
	0.50"-13	85-115 (115-156)
Stud Nuts: (plain nuts)	0.44"-20	50-75 (68-102)
	0.50"-20	75-115 (102-156)
	0.56"-18	110-165 (149-224)
	0.62"-18	150-230 (203-312)
	0.75"-16	310-400 (420-542)
(lock nut)	0.44"-20	40-65 (54-88)
	0.50"-20	65-100 (88-136)
	0.56"-18	100-145 (136-197)
	0.62"-18	130-190 (176-258)
	0.75"-16	270-350 (366-475)

8. Inspect the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. For information about lubrication, refer to the Rockwell Maintenance Manual, MM No. 1, Lubrication, or refer to the Lubrication Section of the Rockwell Maintenance Manual for the axle model you are working with.



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Printed in the U.S.A.

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Revised 2/97

16579/24240