

# SECTION 11: REAR AXLES

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## CONTENTS

1. DRIVE AXLE .....	11-2
1.1 Description .....	11-2
1.2 Drive Axle Lubrication .....	11-2
1.3 Maintenance.....	11-2
1.3.1 Checking and Adjusting the Oil Level .....	11-3
1.3.2 Draining and Replacing the Oil .....	11-3
1.3.3 Speed Sensors (Anti-Lock Brake System, ABS) .....	11-3
1.4 Removal and Replacement .....	11-3
1.4.1 Removal.....	11-3
1.4.2 Replacement.....	11-4
1.5 Disassembly and reassembly.....	11-4
1.6 Gear Set Identification.....	11-4
1.7 Adjustments.....	11-4
1.8 Fastener Torque Chart .....	11-4
1.9 Tire Matching.....	11-4
1.10 Drive Axle Alignment.....	11-5
1.10.1 Description.....	11-5
1.10.2 Procedure .....	11-5
1.11 Axle Shaft Sealing Method.....	11-6
2. TAG AXLE .....	11-7
2.1 Description .....	11-7
2.2 Oil Lubricated Wheel Bearings.....	11-8
2.3 Removal and Replacement .....	11-8
2.3.1 Removal.....	11-8
2.3.2 Replacement.....	11-9
2.4 Tag Axle Alignment .....	11-9
2.4.1 Description.....	11-9
3. SPECIFICATIONS.....	11-10

## LIST OF ILLUSTRATIONS

FIG. 1: DIFFERENTIAL AXLE HOUSING BOWL .....	11-2
FIG. 2: DRIVE AXLE ALIGNMENT .....	11-6
FIG. 3: AXLE SHAFT INSTALLATION .....	11-7
FIG. 4: OIL FILL CAP .....	11-8

## 1. DRIVE AXLE

### 1.1 Description

The Rockwell drive axle is equipped with a single reduction standard carrier mounted in front of the axle housing. The carrier has a hypoid drive pinion, a ring gear set and 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 a normal differential action between the wheels all the time.

Several speed ratios are available for the drive axle. These ratios depend upon the motor and transmission. Also, special applications may suggest slightly different gear ratios.

### 1.2 Drive Axle Lubrication

Additional lubrication information is covered in "Field Maintenance Manual No. 5" annexed to the end of this section. During initial stage of normal operation, tiny metal particles originating from moving parts can be found on mating surfaces. These particles are carried by the lubricant through the assembly and act as lapping compound which accelerates wear of all parts. To ensure maximum life of the differential and prevent premature failure, the original "factory fill" lubricant should be drained. Change break-in oil after 3,000 miles (4 800 km) of initial operation (drain the unit while it is still warm from operation), in accordance with the lubrication and servicing schedule.

Change differential oil and clean the breathers, the magnetic fill and drain plug, every 100,000 miles (160 000 km) or once every two years, whichever comes first. Use Multigrade gear oil MIL-L-2105-D. Use the 75W90 gear oil for northern climates and the 80W140 for southern climates. In extreme conditions, or for better performance, fill with synthetic gear oil.

Check oil level and if necessary add oil every 6,250 miles (10 000 km) or twice a year, whichever comes first (Fig. 1).

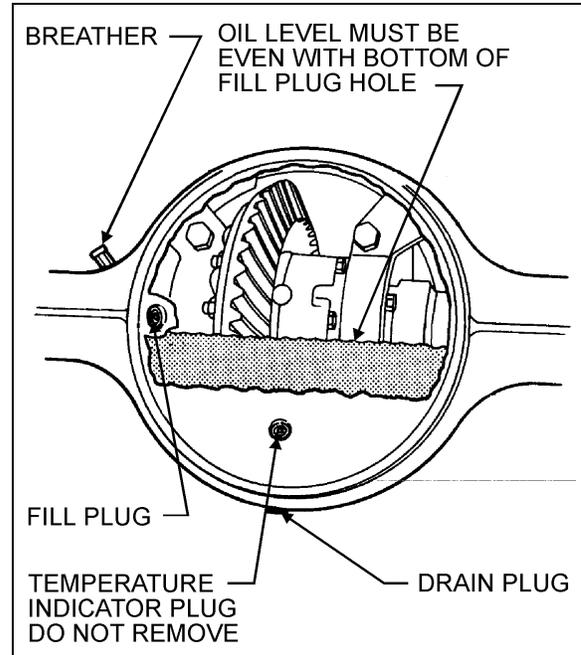


FIGURE 1: DIFFERENTIAL AXLE HOUSING BOWL 11007

### 1.3 Maintenance

Proper vehicle operation begins with preventive maintenance, such as good differential use. The most common types of drive axle carrier failures are spinout, shock, fatigue, overheating and lubrication. Avoid neglecting these points as it would be the first step to improper maintenance, expensive repairs, and excessive downtime.

Inspect the pinion oil seal, axle shaft flange and carrier housing gaskets for evidence of lubricant leakage. Tighten the bolts and nuts, or replace the gaskets and seals to correct leaks. Maintenance of the axle mountings consists primarily in a regular and systematic inspection of the air suspension units and radius rods, as directed in Section 16, "Suspension".

## Section 11: REAR AXLES

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### 1.3.1 Checking and Adjusting the Oil Level

1. Make sure the vehicle is parked on a level surface.

**Caution:** Check the oil level when the axle is at room temperature. When hot, the oil temperature may be 190 F (88 C) or more and can cause burns. Also, a correct reading is not obtained when the axle is warm or hot.

2. Make sure the axle is "cold" or at room temperature.
3. Clean the area around the fill plug. Remove the fill plug from the differential axle housing bowl.
4. The oil level must be even with the bottom of the hole of the fill plug.
  - a. If oil flows from the hole when the plug is loosened, the oil level is high. Drain the oil to the correct level.
  - b. If the oil level is below the bottom of the hole of the fill plug, add the specified oil.
5. Install and tighten the fill plug to 35-50 lbf•ft (48-67 N•m).

### 1.3.2 Draining and Replacing the Oil

1. Make sure the vehicle is parked on a level surface. Put a large container under the axle.

**Note:** Drain the oil when the axle is warm.

2. Remove the drain plug from the bottom of the axle. Drain and discard the oil.
3. Install and tighten the drain plug to 35-50 lbf•ft (48-67 N•m).

4. Clean the area around the fill plug. Remove the fill plug from the differential housing bowl.
5. Add the specified oil until the oil level is even with the bottom of the hole of the fill plug. Allow the oil to flow through the axle and check the oil level again (lube capacity 41 pints [13,3 liters]).
6. Install and tighten the fill plug to 35-50 lbf•ft (48-67 N•m).

### 1.3.3 Speed Sensors (Anti-Lock Brake System, ABS)

For removing and installing the rockwell in-axle speed sensors (for anti-lock brake systems, ABS), refer to Rockwell technical bulletin annexed at the end of this section.

## 1.4 Removal and Replacement

The following procedure deals with the removal of the drive axle assembly and its attachments as a unit. The method used to support the axle during removal and disassembly depends upon local conditions and available equipment.

### 1.4.1 Removal

1. Raise vehicle by its jacking points on the body (see Section 18, "Body" under heading "16. VEHICLE JACKING POINTS"). Place jack stands under frame. Remove drive axle wheels (if required, refer to Section 13, "Wheels, Hubs and Tires").

2. Exhaust compressed air from the air supply system by opening the drain cock of each air reservoir.
  3. Disconnect the propeller shaft as directed in Section 9, "Propeller Shaft", of this manual.
  4. On both sides of the vehicle, unscrew fasteners retaining front wheelhouse plastic guards, and remove them from vehicle.
  5. Disconnect both height control valve links from air spring mounting plate brackets.
  6. Remove cable ties securing the ABS cables (if vehicle is so equipped) to service brake chamber hoses. Disconnect the ABS cable plugs from connectors on the differential carrier.
- Note:** When you remove cable ties to ease operation, remember to replace them afterwards.
7. Disconnect the brake chamber hoses. Position the hoses so they will not be damaged when removing the axle.
  8. Install jacks under the axle jacking points to support the axle weight.
  9. Remove the four shock absorbers as outlined in Section 16, "Suspension" under heading "3.2 SHOCK ABSORBER REMOVAL".
  10. Remove the sway bar.
  11. Remove the lower and upper longitudinal radius rod supports from vehicle subframe as outlined in Section 16, "Suspension", under heading "4.2 RADIUS ROD REMOVAL".
  12. Remove the transversal radius rod support from the vehicle subframe.
  13. Remove the two retaining nuts from each of the four air bellows lower mounting supports.
  14. Use the jacks to lower axle. Carefully pull away the jacks axle assembly from under the vehicle.

### **1.4.2 Replacement**

Reverse removal procedure to reinstall drive axle.

**Note:** Refer to Section 16, "Suspension" for suspension components proper torques tightening.

### **1.5 Disassembly and Reassembly**

Disassembly and reassembly procedures are explained under applicable headings in "Rockwell Field Maintenance Manual, No. 5", annexed to this section.

### **1.6 Gear Set Identification**

Gear set identification is explained under applicable heading in "Rockwell Field Maintenance Manual No. 5", annexed to this section.

### **1.7 Adjustments**

Adjustments are explained under applicable headings in Rockwell Field Maintenance No. 5, annexed to this section.

### **1.8 Fastener Torque Chart**

A differential fastener torque chart is provided in Rockwell Field Maintenance No. 5, annexed to this section.

### **1.9 Tire Matching**

Drive axle tire matching is explained under the applicable heading in Section 13, "Wheels, Hubs and Tires" of this manual.

**Note:** The upper mounting bolt of each lower radius rod support is accessible from the last baggage compartment.

## Section 11: REAR AXLES

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### 1.10 Drive Axle Alignment

#### 1.10.1 Description

**For drive axle alignment specifications, refer to paragraph "3. SPECIFICATIONS" in this section.**

The drive axle alignment consists in aligning the axle according to the frame. The axle must be perpendicular to the frame. The alignment is achieved with the use of shims inserted between the lower longitudinal radius rod supports and the frame.

Drive axle alignment is factory set and is not subject to any change, except if the vehicle has been damaged by an accident or if there are requirements for replacement.

**Caution:** *If this setting is altered significantly, the vehicle will produce offset tracking (dog tracking).*

If the axle has been removed for repair or servicing and if all the parts are reinstalled exactly in the same place, the axle alignment is not necessary. However, if the suspension supports have been replaced or altered, proceed with the following instructions to verify or adjust the drive axle alignment.

#### 1.10.2 Procedure

1. Park vehicle on level floor, then chock front vehicle wheels.
2. Using two jacking points (which are at least 30 inches [76 cm] apart) on drive axle, raise the vehicle sufficiently so that wheels can turn freely at about ½ inch from ground. Secure in this position with safety stands, and release parking brake.
3. Using an optical toe and tracking system installed on each side of the drive axle, fix and position the projector in the center of the wheel. Measure the distance on each side of projector

mounting rods. Distance should be equal on both sides. If not, adjust the projector.

4. Install a target board on each side of the vehicle, at the level of the last baggage compartment front wall (see installation in Fig. 2).
5. Connect the projectors and set to zero. Rotate the wheel and set projectors to zero at four opposite positions. It is important to have a zero marking when rotating the wheel in order to eliminate wheel run-out.
6. Aim projector on the target board. Measure distance between target center line (provided by the projector) and the frame post located immediately beside the target board.  
  
Record measurement, then repeat procedure on the other side (Fig. 2). Dimensions obtained are identified RR on rear right-hand side and RL on rear left-hand side.
7. Move the target boards to the front of vehicle, i.e. at 13 feet towards the first target location (Fig. 2) for installation.

## Section 11: REAR AXLES

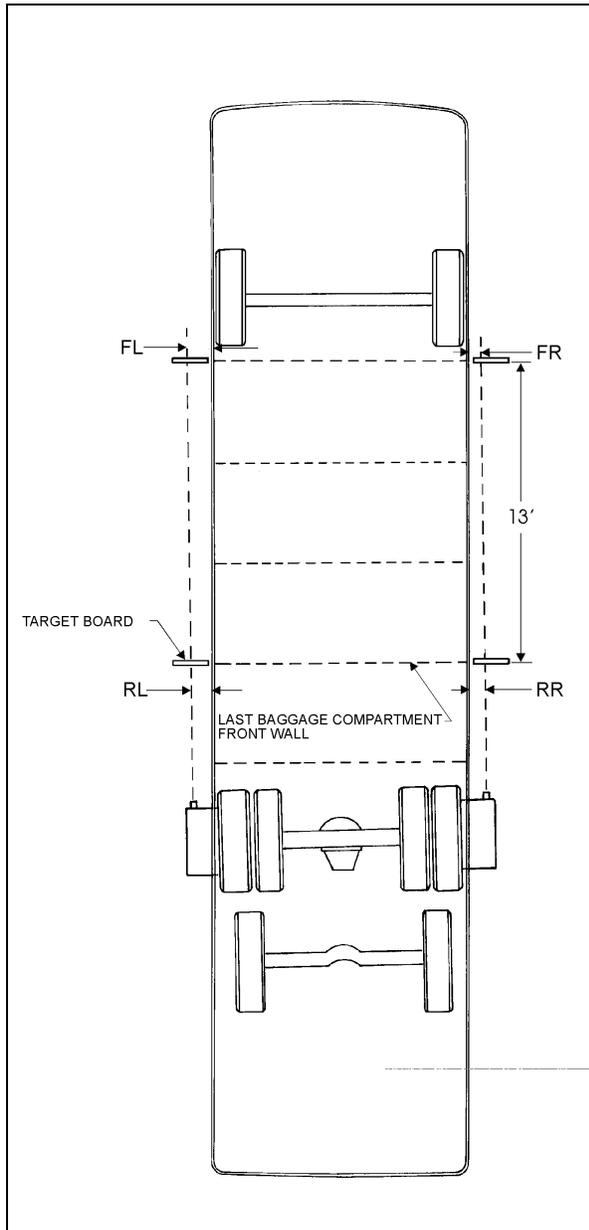


FIGURE 2: DRIVE AXLE ALIGNMENT

11008

8. Aim the projector on the target board, then measure the distance between target centerline (provided by the projector) and the frame post located immediately beside the target board. Record measurement, then repeat on the other side. Dimensions obtained are identified FR on front right-hand side and FL on front left-hand side.

9. Subtract measurement taken at rear of the vehicle from measurement taken at front of the vehicle on the same side. Record results. Repeat previous operation on other side of vehicle. Record results.

**FR - RR = RESULT "A"**

**FL - RL = RESULT "B"**

10. The results on either side must be less than or equal to 5/8 inch (16 mm) for H3-41 and 9/16 inch (14 mm) for H3-45 vehicles. These results are obtained with a distance of 13 feet between the two target board locations. If one or both results exceed the value specified for the vehicle, corrective action should be taken with respect to axle position.
11. Correct axle position by inserting a shim between the lower longitudinal radius rod support and the frame, on right or left side of vehicle, according to the previous results.

**Note:** Refer to Section 16, "Suspension", for proper torque tightening of the longitudinal radius rod support nuts.

12. Repeat steps 6 to 10 to ensure that axle is truly perpendicular to the frame.

### 1.11 Axle Shaft Sealing Method

The following method is to be used to ensure that axle shaft installation is fluid-tight:

## Section 11: REAR AXLES

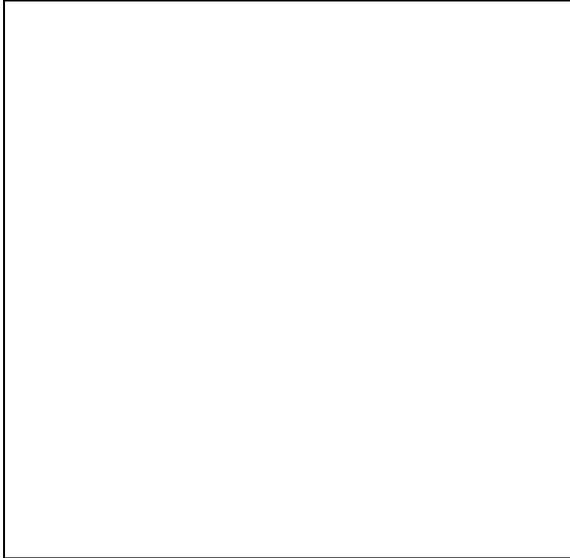


FIGURE 3: AXLE SHAFT INSTALLATION 11003

- 1.....Silicone sealant\*
- 2.....Axle shaft
- 3..... Gasket
- 4..... Wheel hub

1. Clean the mounting surfaces of both the axle shaft flange and wheel hub where silicone sealant will be applied. Remove all old silicone sealant, oil, grease, dirt and moisture. Dry both surfaces.
2. Apply a continuous thin bead of silicone sealant\* (Prévost P/N 680053) on the mounting surfaces and around the edge of all fastener holes of both the axle shaft flange and wheel hub.

**Warning:** Carefully read cautions and instructions on the tube of silicone sealant and its packing.

\* GENERAL ELECTRIC Silicone Rubber Adhesive Sealant RTV 103 Black.

3. Assemble components immediately to permit the silicone sealant to compress evenly between parts.

- a. Place a new gasket, then install the axle shaft into the wheel hub and differential carrier. The gasket and flange of the axle shaft must fit flat against the wheel hub.
- b. Install the tapered dowels at each stud and into the flange of the axle shaft. Use a punch or drift and hammer if needed.
- c. Install the lock washers and nuts on the studs. Tighten nuts to the correct torque value.

**Note:** Torque values are for fasteners that have a light application of oil on the threads (refer to Rockwell Maintenance Manual).

9/16-18plain nut:110 - 165 bf•ft(149 - 224 N•m)

5/8-18 plain nut: 150 - 230 lbf•ft(203 - 312 N•m)

## 2. TAG AXLE

### 2.1 Description

The tag axle is located behind the drive axle. It carries a single wheel and tire on each side. The standard system allows unloading of the tag axle air springs without raising the axle, while the optional system enables unloading and raising of the tag axle (refer to Operator's Manual for details about control location). Both these systems have been designed for the following purposes:

1. Shortening of wheelbase, thus allowing tighter turning in tight maneuvering areas such in a parking lot or when making a sharp turn.
2. Transferring extra weight and additional traction to the drive wheels on slippery surfaces.

**Caution:** Never exceed 30 mph (50 km/h) with tag axle up or unloaded for normal driving.

The tag axle service brakes operate only when the axle is in normal driving (loaded) position.

## 2.2 Oil Lubricated Wheel Bearings

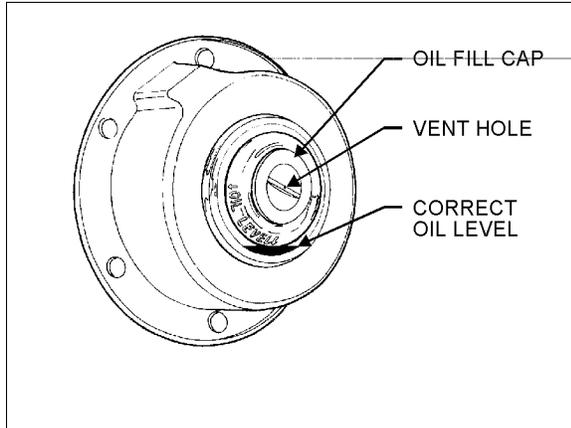


FIGURE 4: Oil Fill Cap

13003

The oil level on the tag axle wheel bearings must be maintained to the level mark in the cap. The level is determined by a line, indicated by arrows, that is incorporated to the plastic lens and passes underneath the words "OIL LEVEL" (Fig. 4). To check oil level after vehicle has been driven, wait at least 15 minutes to ensure that oil has settled.

## 2.3 Removal and Replacement

The following procedure deals with the removal of the tag axle assembly along with the suspension components. The method used to support the axle and suspension components during removal and disassembly depends upon local conditions and available equipment.

### 2.3.1 Removal

1. Raise vehicle by its jacking points on the body (see Section 18, "Body" under heading "16. VEHICLE JACKING POINTS"). Place jack under frame. Remove drive axle wheels (if required, refer to Section 13, "Wheels, Hubs and Tires").
2. Exhaust compressed air from the air supply system by opening the drain cock of each air reservoir.
3. Install jacks under tag axle jacking points to support the axle weight.
4. Only for vehicle equipped with the retractable tag axle. Disconnect tag axle lifting chain collars from lower longitudinal radius rods
5. Remove the propeller shaft as directed in Section 9, "Propeller Shaft", of this manual.
6. Disconnect the tag axle brake chamber hoses. Position the hoses so they will not be damaged when removing axle.
7. Disconnect hose from the air spring upper mounting plate.
8. Remove the two shock absorbers as outlined in Section 16, "Suspension", under "3.2 SHOCK ABSORBER REMOVAL".
9. Disconnect the lower longitudinal radius rods as outlined in Section 16, "Suspension", under "4.2 RADIUS ROD REMOVAL".
10. Disconnect the transversal radius rod.
11. Disconnect the upper longitudinal radius rod.
12. Remove the retaining nuts of the air bellows from each of the two upper mounting plates.
13. Use the jacks to move the axle forward to clear the axle of the transmission. Lower the axle.

## Section 11: REAR AXLES

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**Caution:** On vehicles equipped with an automatic transmission (with or without the output retarder), move tag assembly very carefully. Pay special attention to the U-shaped section, as the transmission end components may be easily damaged through a false maneuver.

### 2.3.2 Replacement

Reverse removal procedure to reinstall tag axle.

**Note:** Refer to Section 16, "Suspension", for proper torque tightening of suspension components.

## 2.4 Tag Axle Alignment

### 2.4.1 Description

**For tag axle alignment specifications, refer to paragraph "3. SPECIFICATIONS" in this section.**

The tag axle alignment consists in aligning the tag axle parallel to the drive axle position. Before aligning the tag axle, proceed with the drive axle alignment (see paragraph "1.10 DRIVE AXLE ALIGNMENT"). Tag axle alignment is achieved with the use of shims inserted between the lower longitudinal radius rod supports and axle. Tag axle alignment is factory set and is not subject to any change, except if vehicle has been damaged by an accident or if there are requirements for part replacement.

**Caution:** If this setting is altered significantly, it will cause excessive wear.

If axle has been removed for repair or servicing and if all parts are reinstalled exactly in the same place, axle alignment is not necessary. However, if the suspension supports have been replaced or have changed position, proceed with the following instructions to verify or adjust the tag axle alignment.

**Section 11: REAR AXLES**

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**3. SPECIFICATIONS**

**Drive Axle**

Make .....Rockwell International  
 Drive track..... 76.7 inches (1 949 mm)  
 Gear type .....Hypoid  
 Axle type ..... Full floating  
 Lube capacity ..... 41 pints (19,3 liters)

**Drive axle ratio**

w/11.1L - PS130-6B and w/12.7L - PS145-7A

3.21:1 Standard

3.07:1 Optional

World Transmission

4.88:1 Standard

4.56:1 Optional

Drive Axle Alignment Specifications		
Off Tracking	Specifications	Inst.
H3-41 (Both sides)	5/8 inch max. on 13 feet	Projector
H3-45 (Both sides)	9/16 inch max. on 13 feet	Projector

**Note:** The drive axle alignment consists in aligning the axle according to the frame. The axle must be perpendicular to the frame.

**Tag Axle**

Make .....Prévost  
 Type..... GKN TS5 hub unit  
 Rear track .....83.6" (2 124 mm)

Tag Axle Alignment Specifications			
Toe	Minimal	Nominal	Maximal
H3-41 and H3-45 (Both sides)	-3/64	0	+3/64

**Note:** The tag axle alignment consists in aligning the tag axle parallel to the drive axle position.

## Remove the Speed Sensor

### **WARNING**

*The Rockwell Speed Sensor is part of an electrical system. When you work on the speed sensor, take the same precautions as you must take with any electrical system to avoid serious personal injury. As with any electrical system, there is a danger of electrical shock or sparks which can ignite flammable substances. Always disconnect the battery ground cable before working on the speed sensor or electrical system.*

*Wear safe eye protection to help prevent serious personal injury when servicing the vehicle.*

*Do not work under a vehicle that is supported only by jacks. Jacks can slip or fall over and cause serious personal injury. Support the vehicle with jack stands.*

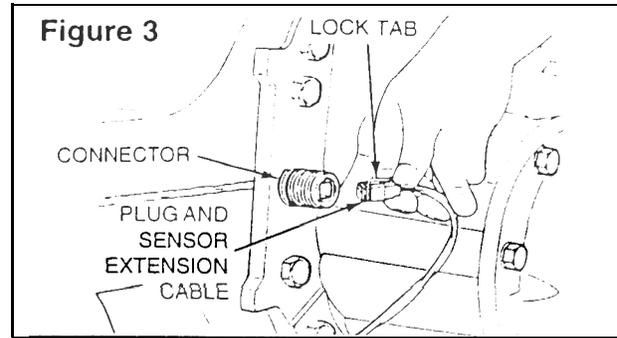
1. Follow steps 1 and 2 of Remove Differential Carrier From Axle Housing in Section 2, Disassembly, on page 4 of Maintenance Manual No. 5.
2. Shut off the vehicle ignition.
3. Disconnect the ground cable from the battery.

### **CAUTION**

*Do not disconnect the sensor plug from the connector by pulling the sensor extension cable. Damage to the plug will occur and cause an open circuit. Always disconnect the sensor by pulling the plug housing.*

4. Disconnect the left-hand and right-hand sensor plugs from the connectors. See Figures 1 and 3 for the location of the parts.

In one action, hold the plug, press the lock tab on the top of the plug housing and pull the plug from the connector. **Figure 3.**

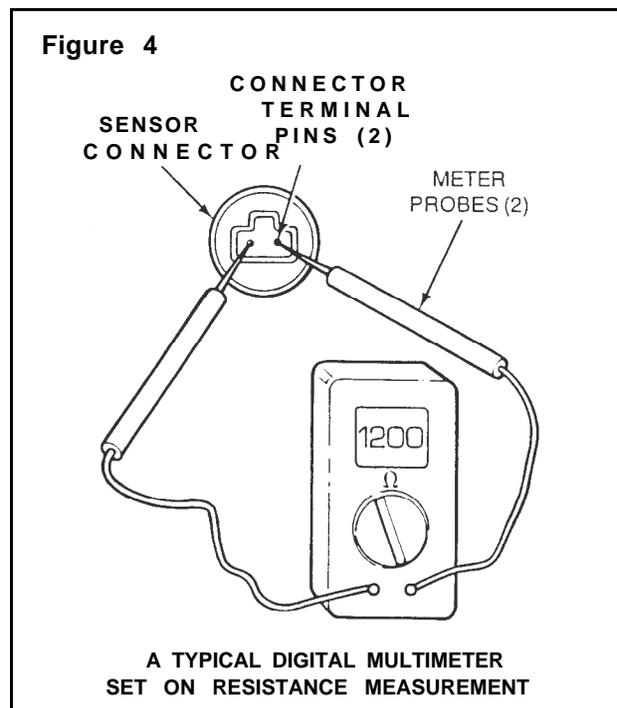


### **NOTE:**

*Before continuing on, perform the following Sensor Continuity Test.*

## Sensor Continuity and Short Tests

- A. **Sensor Continuity Test** — Sensor resistance should be 1080 to 1320 ohm ( $\hat{U}$ ) at 70°F; however, it may vary between 900 to 1500 ohm ( $\hat{U}$ ) depending upon large temperature extremes. **Figure 4.**



## Remove the Speed Sensor

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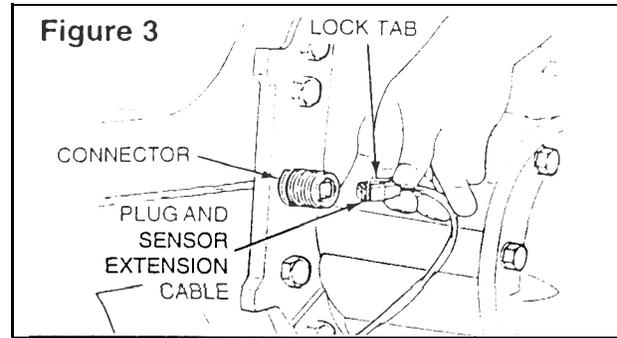
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### **CAUTION**

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In one action, hold the plug, press the lock tab on the top of the plug housing and pull the plug from the connector. **Figure 3.**

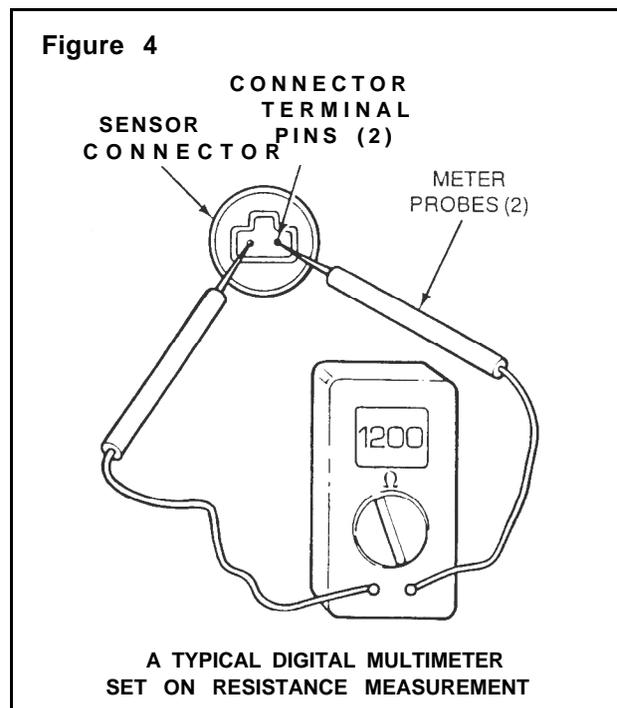


### **NOTE:**

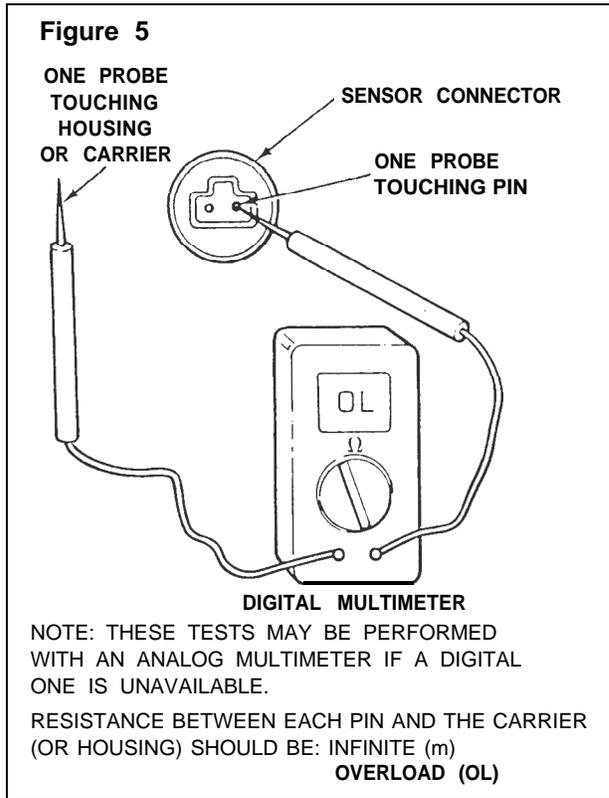
**Before continuing on, perform the following Sensor Continuity Test.**

### **Sensor Continuity and Short Tests**

- A. **Sensor Continuity Test** — Sensor resistance should be 1080 to 1320 ohm ( $\hat{U}$ ) at 70°F; however, it may vary between 900 to 1500 ohm ( $\hat{U}$ ) depending upon large temperature extremes. **Figure 4.**



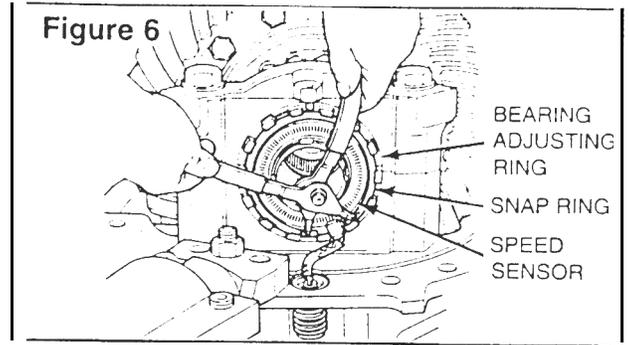
**Sensor Short Test** — Test for short between sensor connector and carrier/axle housing before removing and after installing the carrier into housing. **Figure 5.**



5. If you are using Maintenance Manual No. 5, follow steps 3-15 of Remove Differential Carrier From Axle Housing in Section 2, Disassembly, starting on page 4.

If you are using Maintenance Manual No. 5L, follow steps 1-6, 8-21 and 23 of Removing the Differential Carrier From the Axle Housing in Section 3, Disassembly, starting on page 7.

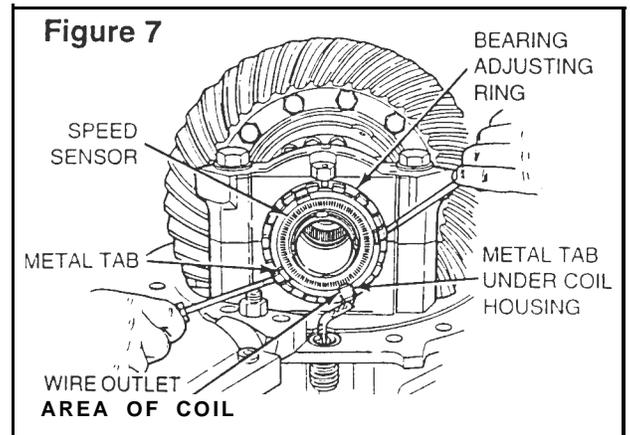
6. Remove the snap ring that holds the speed sensor in the adjusting ring of the differential bearing. Use snap ring pliers. **Figure 6.**

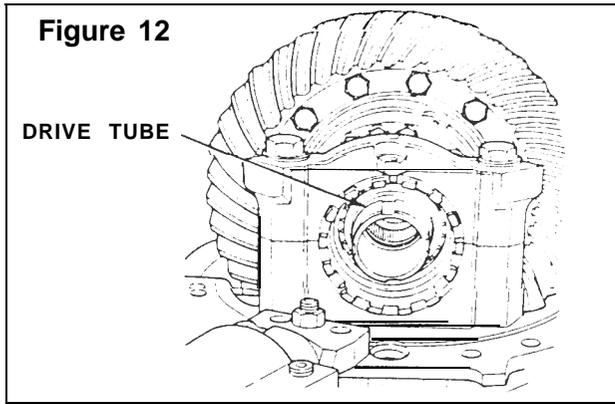


**CAUTION**

*When you pry out the speed sensor from the bearing adjusting ring always position the screwdrivers under the metal tabs. Do not pry out the sensor from the plastic wire outlet area of the coil. Damage to the coil will occur.*

7. Pry the speed sensor loose but do not completely remove it from the bearing adjusting ring. Use two screwdrivers to pry the sensor at the two opposite tabs. **Figure 7.**





12. If you are using Maintenance Manual No: 5, continue with the following steps in Section 2, Disassembly:

- Page 5, all steps of Remove The Differential and Ring Gear From The Carrier.
- Page 8, steps 1-4 of Disassemble The Differential And Ring Gear Assembly.

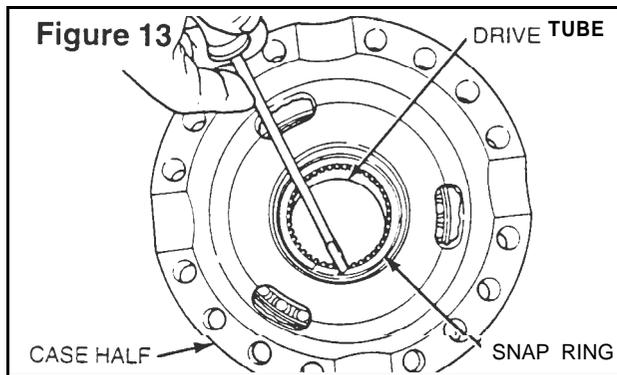
If you are using Maintenance Manual No: 5L, continue with the following steps in Section 3, Disassembly:

- Page 21, steps 1-7 of Removing The Main Differential Case And Ring-Gear Assembly.

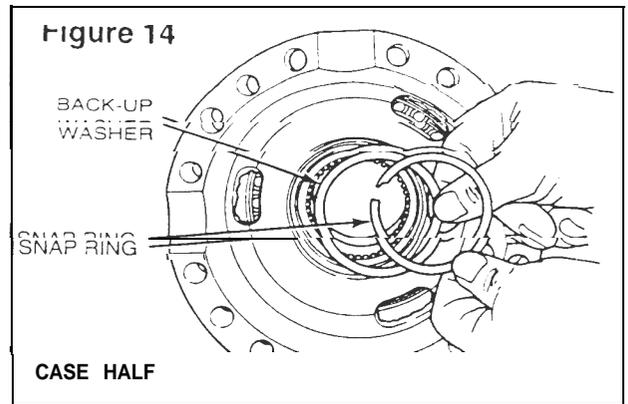
Page 22, steps 1-3 of Disassembling The Main Differential Case And Ring Gear.

13.

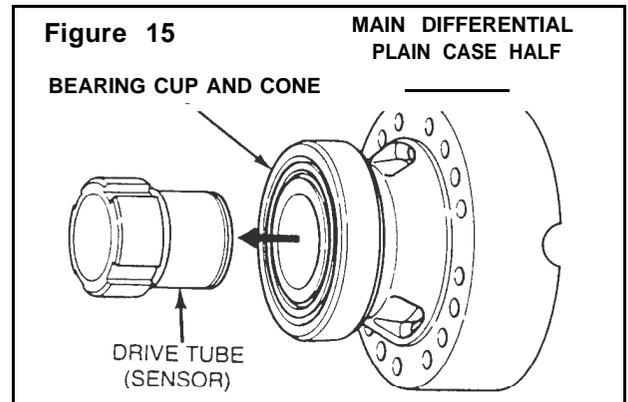
the differential case half. Figure 13.



14. Lift out the back-up washer that is behind the snap ring, inside the differential case half. Figure 14.



15. Pull the drive tube out from the bearing side of the differential case half. Figure 15.



## Prepare Parts For Assembling

### CAUTION

*Do not clean the speed sensor assembly by using cleaning solvents. Damage to components can occur. Clean the speed sensor assembly only with a clean dry rag or paper towel.*

1. If you are using Maintenance Manual No. 5, continue with the following:
  - Section 3, Prepare Parts for Assembly, starting on page 15, all necessary steps.
  - Section 4, General Procedures, starting on page 20, all necessary steps.

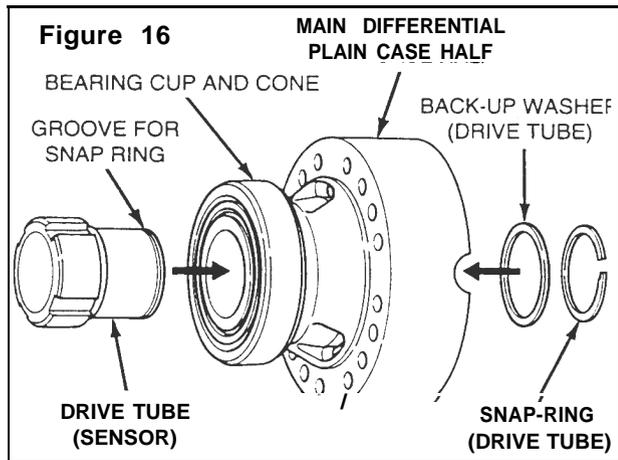
If you are using Maintenance Manual No. 5L, continue with the following:

- Section 4, Prepare the Parts for Assembly, starting on page 25, all necessary steps.
- Section 5, General Information, starting on page 31, all necessary steps.

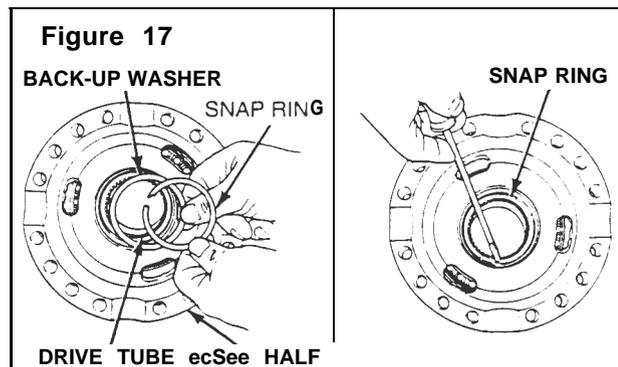
## Install the Speed Sensors

If the drive tube was not removed, start with the **Note** before **Figure 18** and step 4 on page 7.

1. Install the drive tube into the differential case half from the bearing side. **Figure 16**.



2. While holding the drive tube in position, place the back-up washer over the drive tube and against the inside of the differential case half. Install the snap ring into the groove in the drive tube using a screwdriver if necessary. **Figures 16 and 17**.



3. If you are using Maintenance Manual No. 5, continue with the following steps in Section 5, Assembly:

- Page 39, steps 9-16 of Assemble the Main Differential and Ring Gear Assembly.

Continue with all steps of the following procedures in Section 5, Assembly:

- Page 41, Rotating Resistance Check of Differential Gears.
- Page 42, Install the Differential and Ring Gear Assembly.
- Page 43, Adjust Preload of Differential Bearings.
- Page 45, Check Runout of Ring Gear.
- Page 45, Adjust Backlash of the Ring Gear.
- Page 47, Check Tooth Contact Patterns of the Gear Set.
- Page 50, Install and Adjust the Thrust SCREW.

If you are using Maintenance Manual No. 5L, continue with the following steps in Section 6, Assembly:

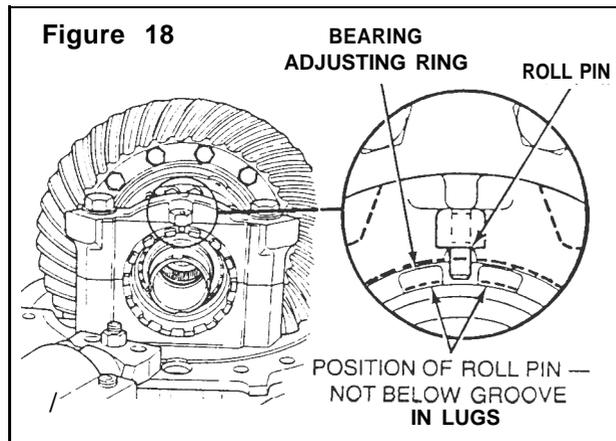
- Page 45, steps 5-13 of Assembling the Main Differential Case and the Ring Gear.

Continue with all steps of the following procedures in Section 6, Assembly:

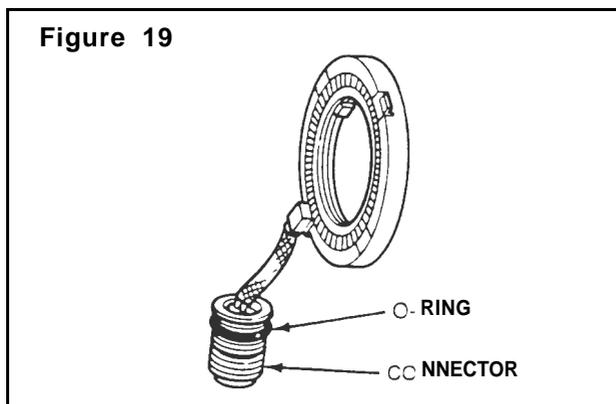
- Page 46, Checking the Rotating Resistance of the Side Gears in the Main Differential Case.
- Page 47, Installing the Main Differential Case and Ring Gear Assembly into the Carrier.
- Page 49, Adjusting the Preload on the Differential Bearings.
- Page 51, Checking the Runout of the Ring Gear.
- Page 52, Adjusting the Backlash of the Ring Gear.
- Page 53, Checking the Tooth Contact Patterns of the Gear Set.

**NOTE:**

*Before you start installing the speed sensor assembly and components into the bearing adjusting ring, check the position of the roll pin that locks the adjusting ring in place. Correct installation of the speed sensor cannot be done if the roll pin extends beyond the snap ring groove in the lugs of the adjusting ring. Adjust the position of the roll pin, if necessary, by using a drift and hammer. Figure 18.*



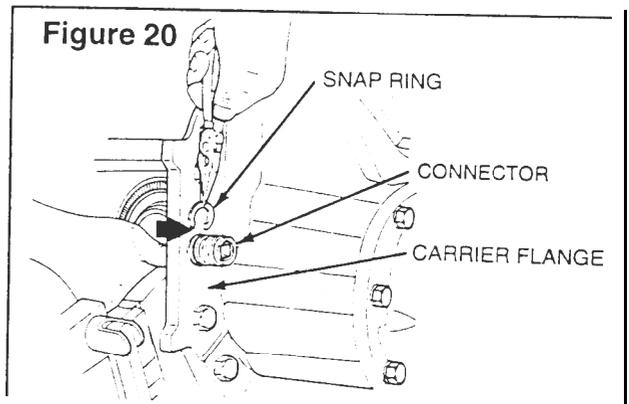
4. Check the outside of the speed sensor connector, there must be an O-ring positioned in the first groove. Install an O-ring if necessary. **Figure 19.**



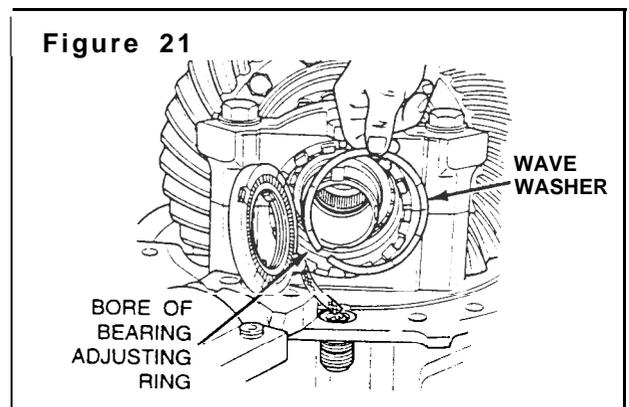
**~ CAUTION**

*If an old sensor assembly is being installed, a visual inspection of the cables should be performed. If there is evidence of broken wire insulation the sensor assembly may not function correctly. The old sensor assembly should be replaced.*

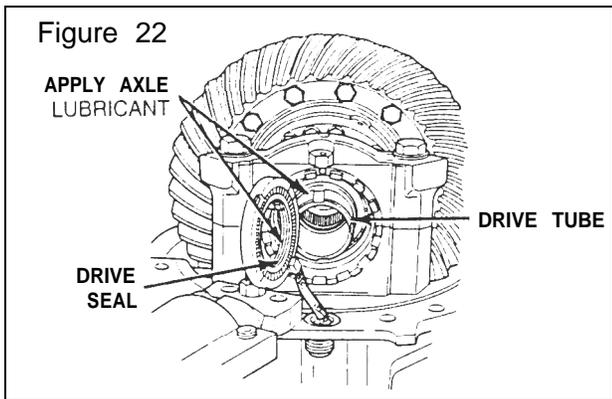
5. Using your thumbs, push the connector of the speed sensor through the large hole in the carrier flange. Push from the inside surface of the flange toward the outside surface.
6. Using your thumb, apply and hold pressure against the back of the connector. While you hold the pressure, install the snap ring into the first full groove that appears past the outside surface of the carrier flange. Needle nose pliers are shown to install the snap ring. **Figure 20.** Lay the sensor on the inside face of the carrier flange and continue with step 7.



7. Install the wave washer inside the bore of the bearing adjusting ring. **Figure 21.**

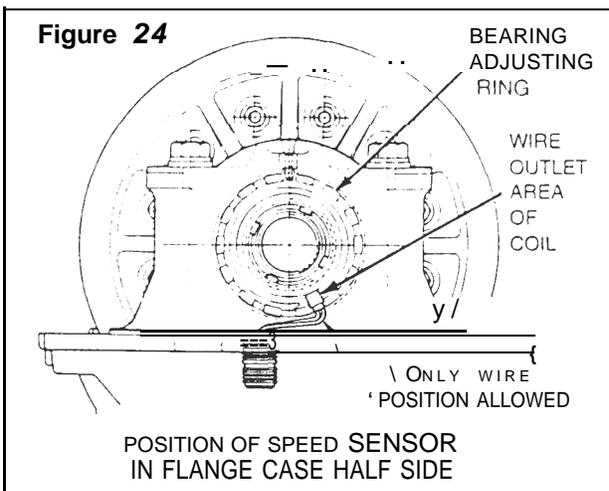
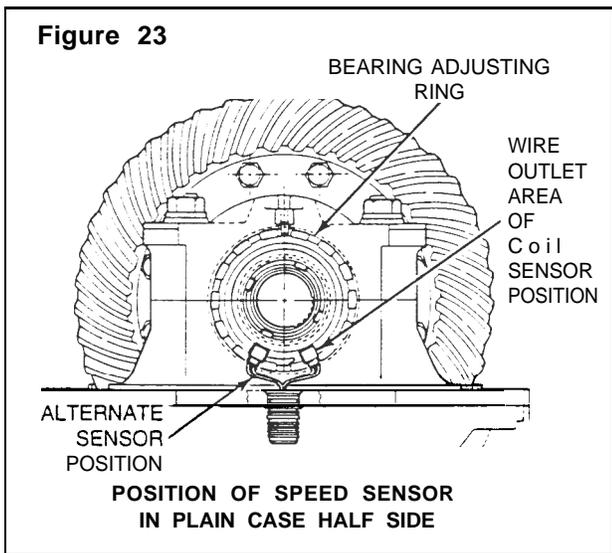


8. Apply the same lubricant that is used in the axle to the outer surface of the drive tube and on the drive seal of the speed sensor.  
**Figure 22.**



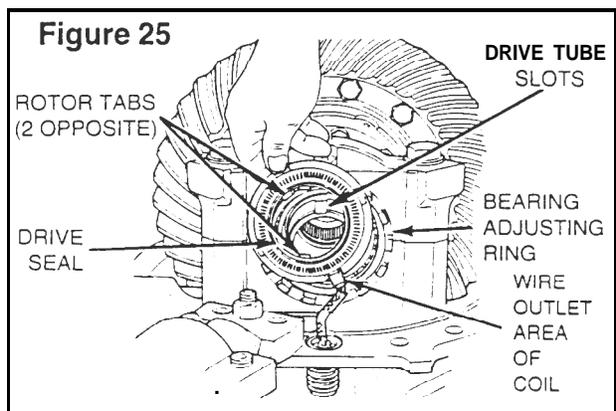
**NOTE:**

*Correct position of the speed sensors installed in the bearing adjusting rings are shown in Figures 23 and 24. The wire outlet area of the coil of each sensor must face out and be aligned with the correct slot in the adjusting ring.*



9. Place the speed sensor assembly over the bearing adjusting ring with the wires in the position shown in **Figure 23** or **24**. Turn the rotor in the sensor until the tabs align with the slots in the drive tube. **Figure 25.**

Position the sensor so the wire outlet area of the coil is centered in the slot. It must not hit the adjusting ring lug as the sensor assembly is pushed into the bore. The wire outlet area of the coil will not center itself and can be damaged during the installation.



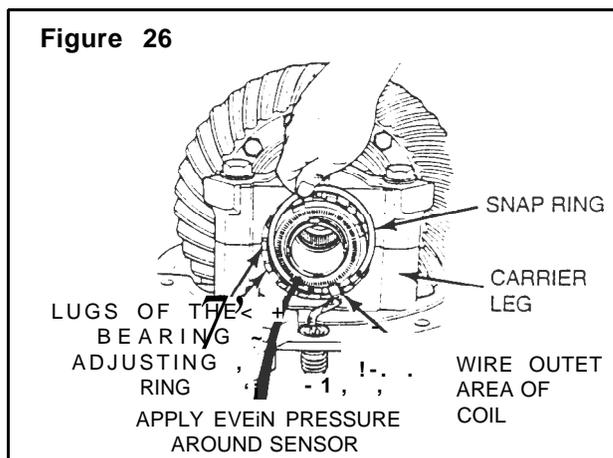
## CAUTION

**The speed sensor must be installed carefully and evenly into the bore of the bearing adjusting ring or damage to the sensor can occur.**

10. Press the speed sensor evenly into the bore of the bearing adjusting ring by hand while carefully sliding the drive seal over the drive tube. Watch the wire outlet area of the coil to see that it freely enters the slot and is not being distorted. Use even pressure around the sensor, near the outer diameter until the sensor is against the wave washer.

If the drive seal slips off the rotor of the sensor, remove the speed sensor from the adjusting ring. Place the drive seal in position on the rotor and repeat steps 9 and 10. **Figure 2.**

11. Press the speed sensor down into the bearing adjusting ring so that the top of the sensor is past the snap ring grooves in the lugs. Hold the sensor in this position for snap ring installation.
12. Place the snap ring over the speed sensor with the opening aligned with the wire outlet area of the coil. Start by placing one end of the snap ring in the groove close to the wire outlet area of the coil. While you apply and hold even pressure around the sensor, install the snap ring into the grooves in the lugs of the adjusting ring. Use snap ring pliers or a screwdriver, if necessary, to help install the snap ring. **Figure 26.**



13. The sensor should position itself firmly and evenly against the snap ring. If it does not, apply hand pressure to the sensor, depressing it against the wave washer until sensor realignment occurs.
14. After the sensor is installed, make sure the outlet wires of the sensor are as close to the carrier leg as possible to be sure they will not get pinched when the carrier is installed in the axle housing.
15. If you are using Maintenance Manual No. 5, continue with the following steps:
  - Section 5, Assembly, page 51, all steps of Install Differential Carrier into Axle Housing.
  - Fill the axle with the specified type and amount of lubricant. See Section 7, Lubrication, page 62.

Ž For additional information about lubrication, see Rockwell Maintenance Manual No. 1, Lubrication.

If you are using Maintenance Manual No. 5L, continue with the following steps:

  - Section 6, Assembly, page 71, all steps of Install the Differential Carrier in the Axle Housing.
16. Perform "Sensor Continuity and Short Tests" as outlined in steps A. and B. on pages 2 and 3.

## WARNING

**The Rockwell Speed Sensor is part of an electrical system. When you work on the speed sensor, take the same precautions as you must take with any electrical system to avoid serious personal injury. As with any electrical system, there is a danger of electrical shock or sparks which can ignite flammable substances.**

17. Connect the ground cable to the battery.

### NOTE:

**You must perform a complete ABS check-out per the manufacturer's recommendations prior to returning the vehicle to service.**



## RockWELL Automotive

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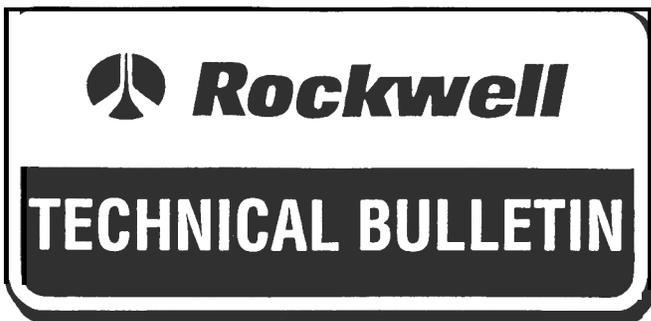
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## Removing and Installing The Rockwell In-Axle Speed Sensors (For Anti-Lock Brake Systems, ABS)

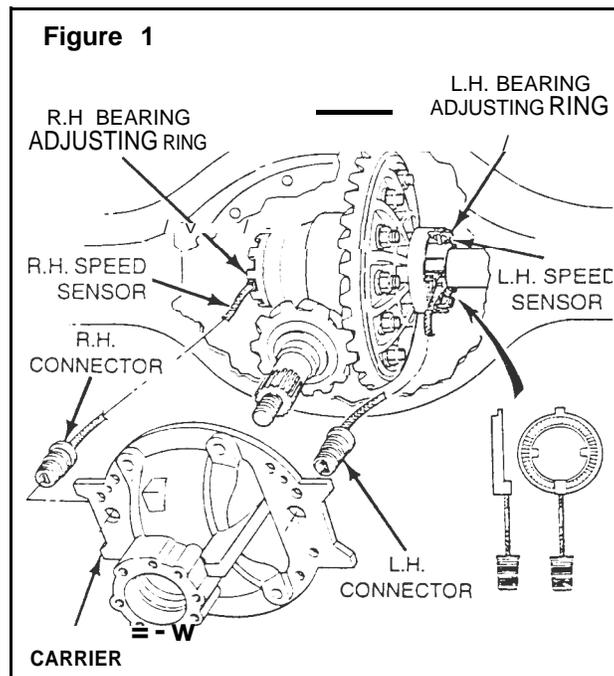
When a vehicle is equipped with an anti-lock brake system that has Rockwell in-axle mounted speed sensors, there are two sensor assemblies in the differential carrier. The speed sensors mount into each adjusting ring of the differential bearings. **Figure 1.**

Service both speed sensors by using the following instructions and the procedures from Rockwell Maintenance Manuals No. 5 or 5L that are indicated in the steps.

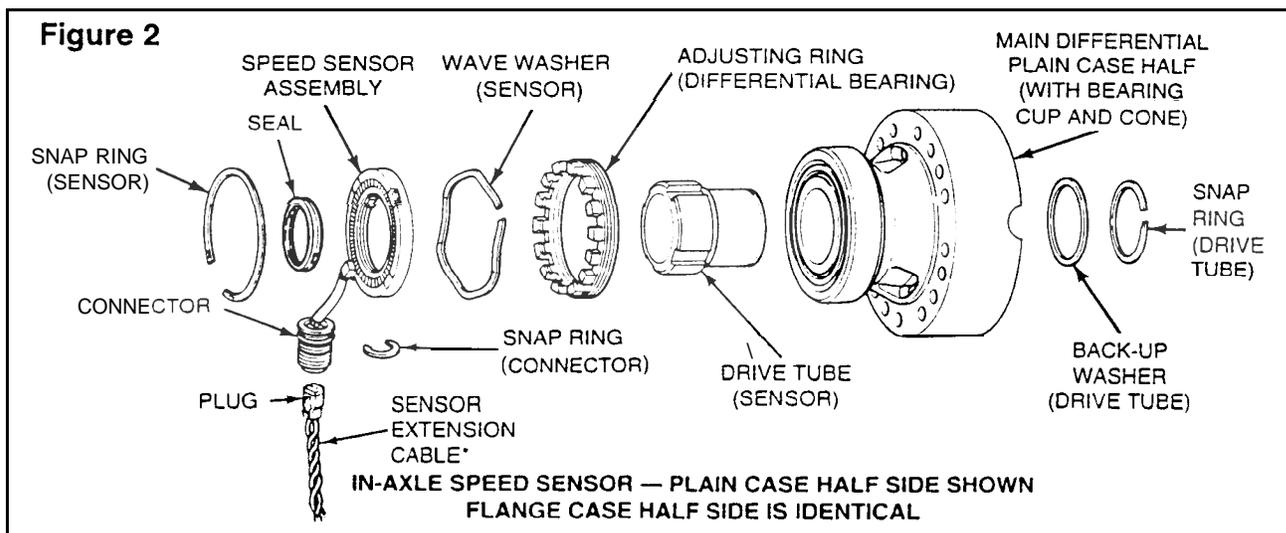
Use Maintenance Manual No. 5 if the speed sensors are mounted in a single drive axle or the rear axle of a tandem. Use Maintenance Manual No. 5L if the speed sensors are mounted in the forward axle of a tandem.

**NOTE:**

*Illustrations used in this publication are of an RS-145 Series single drive axle. The parts and location of the connectors of 160 and 180 Series single and tandem axles may vary from those shown.*



One speed sensor assembly and all related parts are shown in **Figure 2.** Use Figures 1 and 2 as a reference when using these instructions.



*NOTE: Sensor Extension Cable — it is recommended that the two wires be twisted together at greater than 20 turns per meter.*

# section 1 Introduction

## Standard Single Reduction Carriers Without Diff. 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

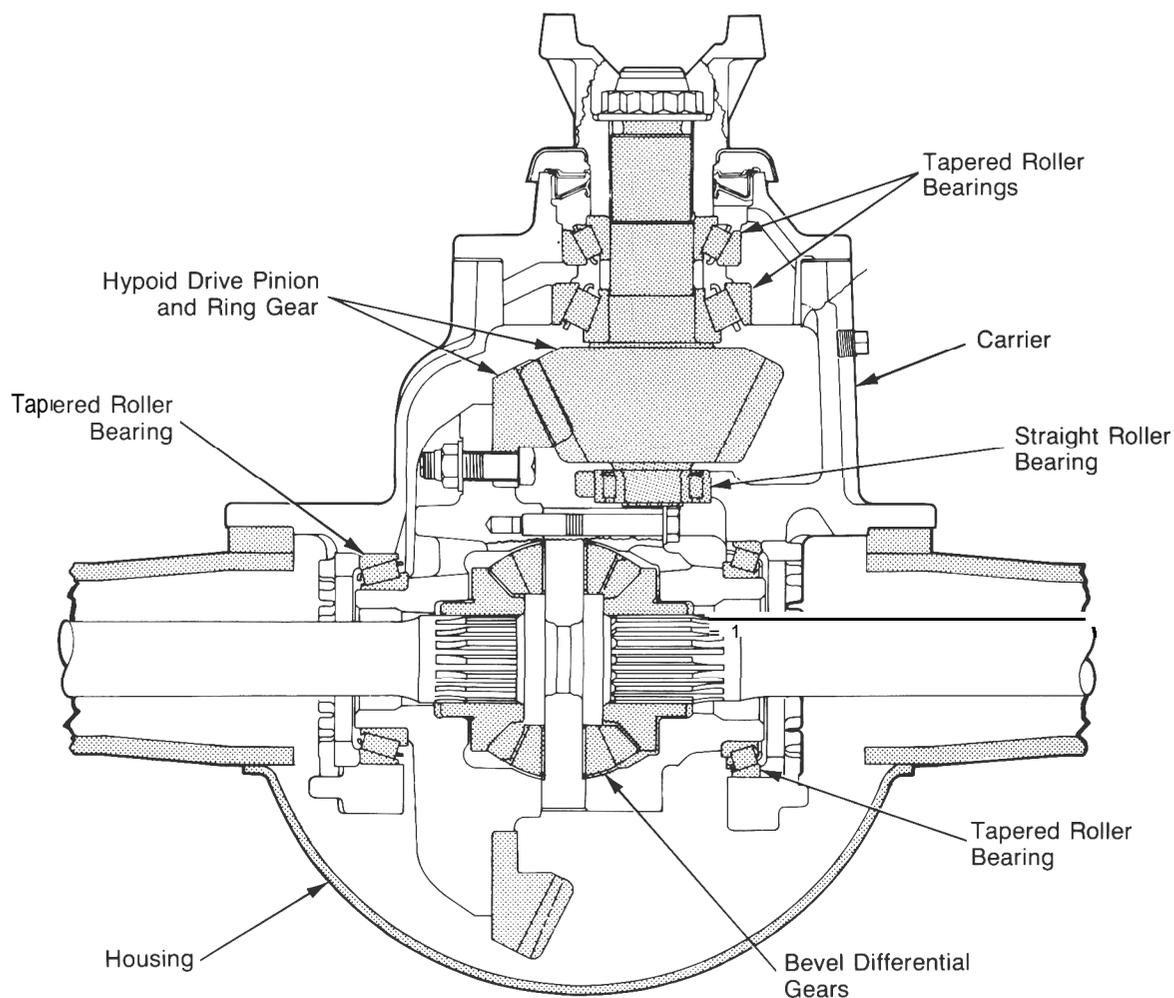
drive pinion and ring gear set and bevel gears in the differential assembly.

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

Standard Carrier

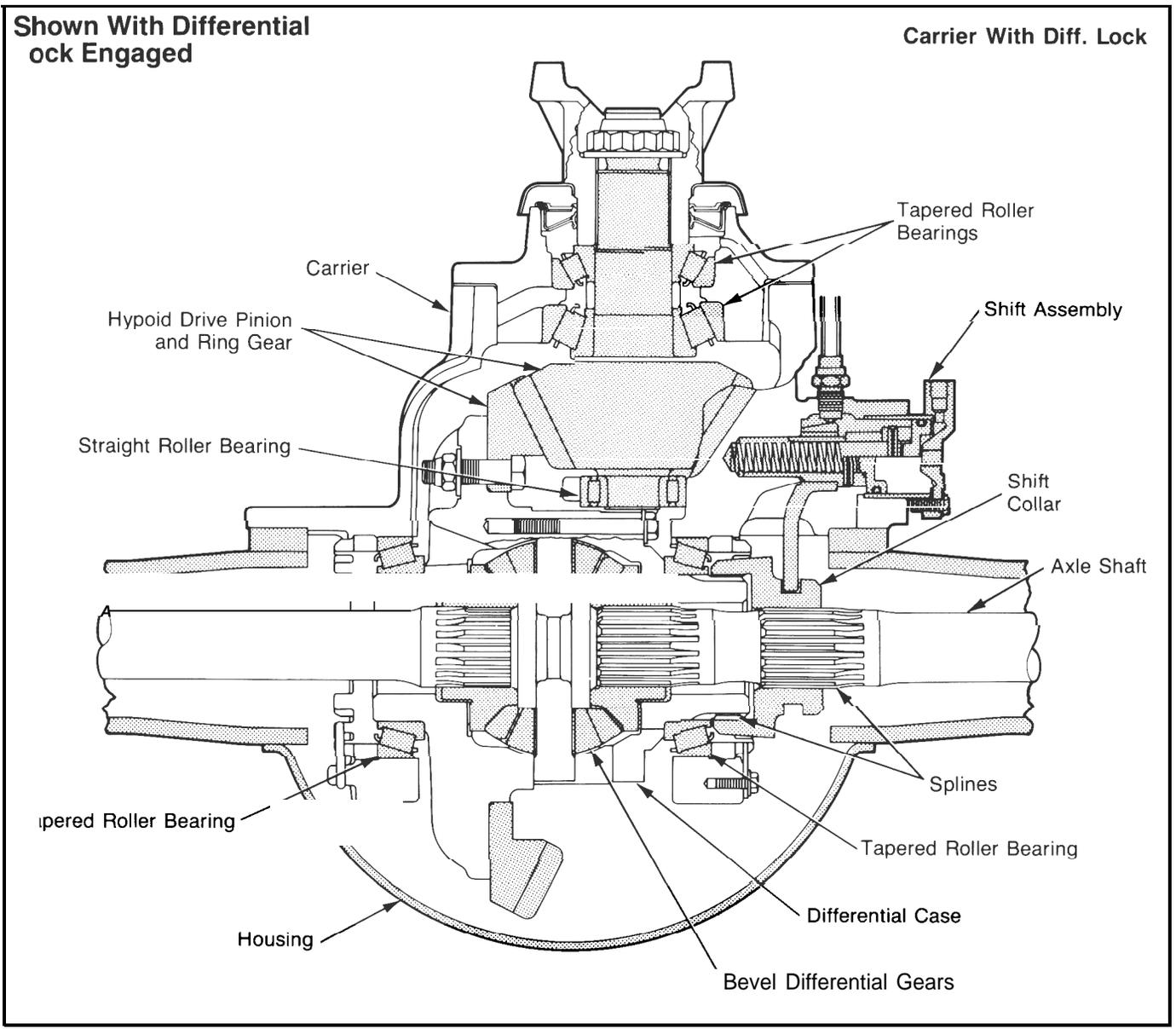


## Single Reduction Carriers with Driver Controlled Main Differential Lock (Diff. Lock)

Rockwell single reduction carriers with Differential Lock, Figure 2, have the same type of gears and bearings as the standard type carriers.

The differential lock is operated by an air actuated shift assembly that is mounted on the carrier. When the differential lock is activated, the shift collar is

moved along the splines of the axle shaft toward the differential case. When the splines on the collar are engaged with splines on the differential case the axle shafts and differential assembly are locked together. When the carrier operates in the locked position, there is no differential action between the wheels. When the carrier is operated in the unlocked position, there is normal differential action between the wheels all the time.



# Disassembly

## Remove Differential Carrier From Axle Housing

**IMPORTANT.** If the vehicle is equipped with a driver controlled main differential lock, see complete instructions beginning on page 53. To tow a vehicle see instructions on pages 25 and 26.

1. Raise the end of vehicle where the axle is mounted. Use a jack or other lifting tool.

Figure 3.

**! WARNING:**

*Do not work under the vehicle if supported by jacks or lifting tools only. Jacks and lifting tools can slip and cause injury.*

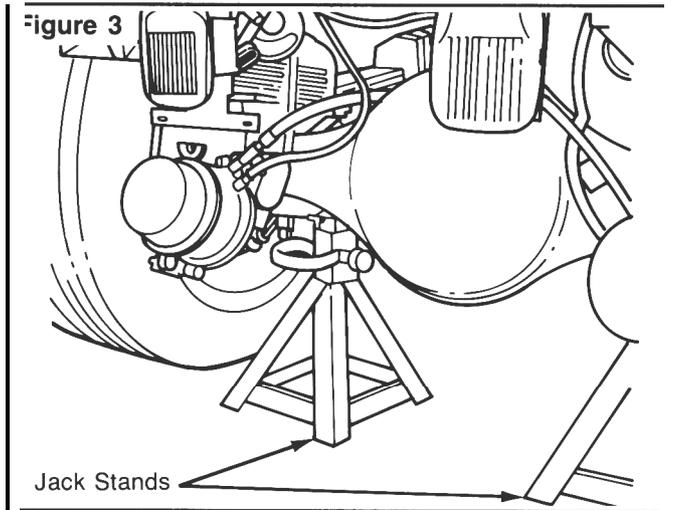
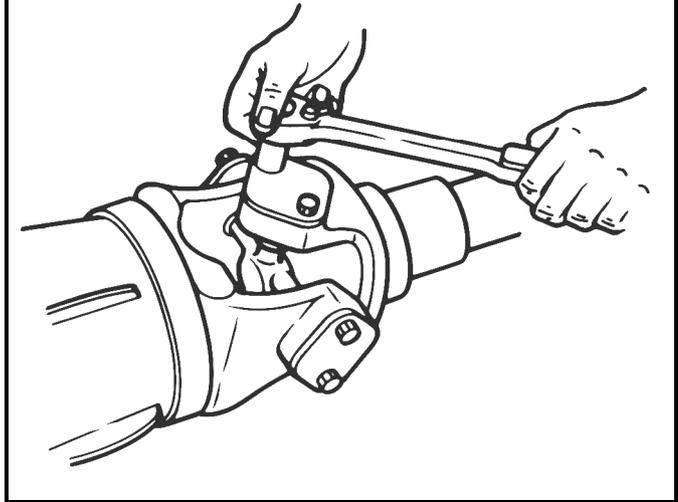


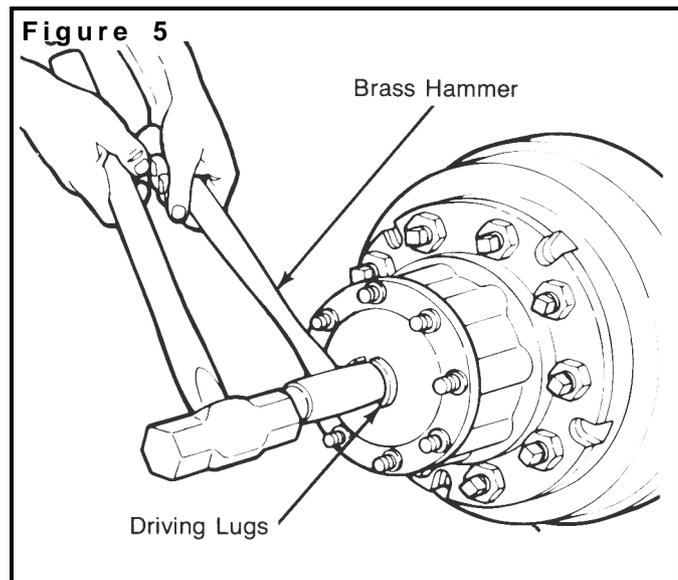
Figure 4



**! WARNING:**

*Wear safe eye protection. Do not hit the round driving lugs on the head of axle shafts. Lugs can break and cause injury.*

- A. Hold a 1-1/2 inch diameter brass drift against the center of the axle shaft, inside the round driving lugs. **Figure 5.**



2. Put jack stands under each spring seat of the axle to hold vehicle in the raised position. **Figure 3.**
3. Remove the plug from bottom of axle housing and drain lubricant from the assembly.
4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier. **Figure 4.**
5. Remove the capscrews\* and washers or stud nuts\* and washers from the flanges of both axle shafts.
6. Loosen the tapered dowels\* in the flanges of both axle shafts as\* follows.

*\*Some Rockwell carriers do not have the parts described.*

## NOTE:

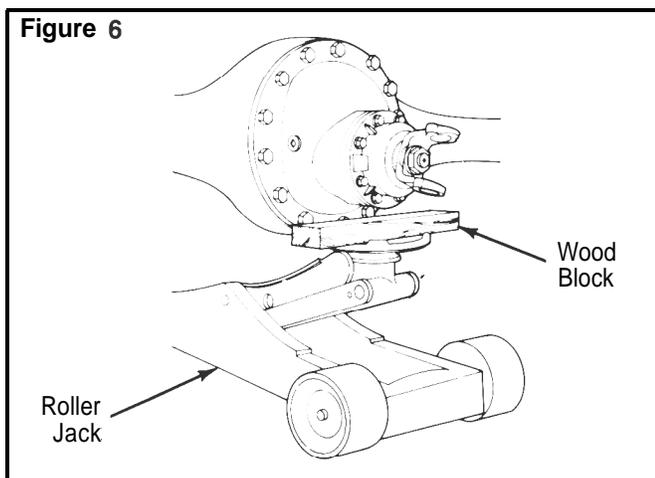
A 1-1/2 inch diameter brass hammer *can be used as a drift.*

B Hit the end of the drift with a large hammer (five to six pounds) and the axle shaft and tapered dowels will loosen.

## CAUTION:

**Do not use a chisel or wedge to loosen the axle shafts and dowels. The chisel or wedge can damage the hub, axle shafts and, if used, oil seals.**

7. Remove the tapered dowels and both axle shafts from the axle assembly.
8. Place a hydraulic roller jack under the differential carrier to support the assembly. **Figure 6.**



9. Remove all but the top two carrier to housing capscrews or stud nuts and washers.
10. Loosen the top two carrier to housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.
11. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of carrier at several points.

## NOTE:

**Some carrier models have threaded puller screw holes in the mounting flange. Puller screws can be used to loosen and pull the carrier from the axle housing. If puller screws are used, clean the threaded holes before the puller screws are installed.**

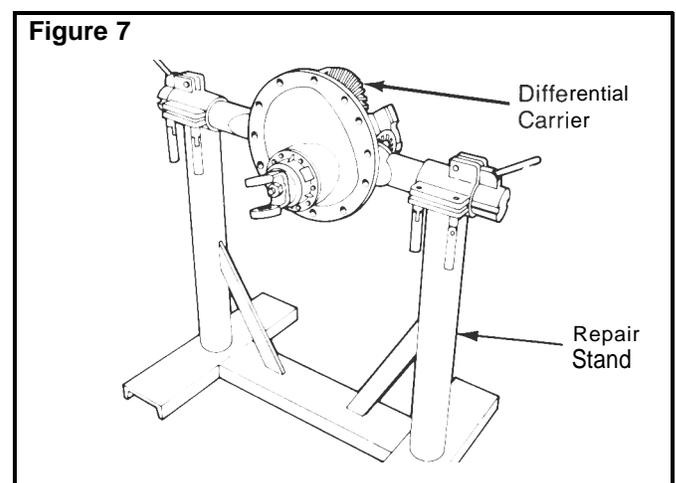
12. After the carrier is loosened, remove the top two fasteners.

13. 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.

## CAUTION:

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

14. Remove and discard the carrier to housing gasket.
15. Lift the differential carrier by the input yoke or flange and put the assembly in a repair stand. **Figure 7.** Use a lifting tool for this procedure. Do not lift by hand. A carrier stand can be made by using the drawing on page 6.



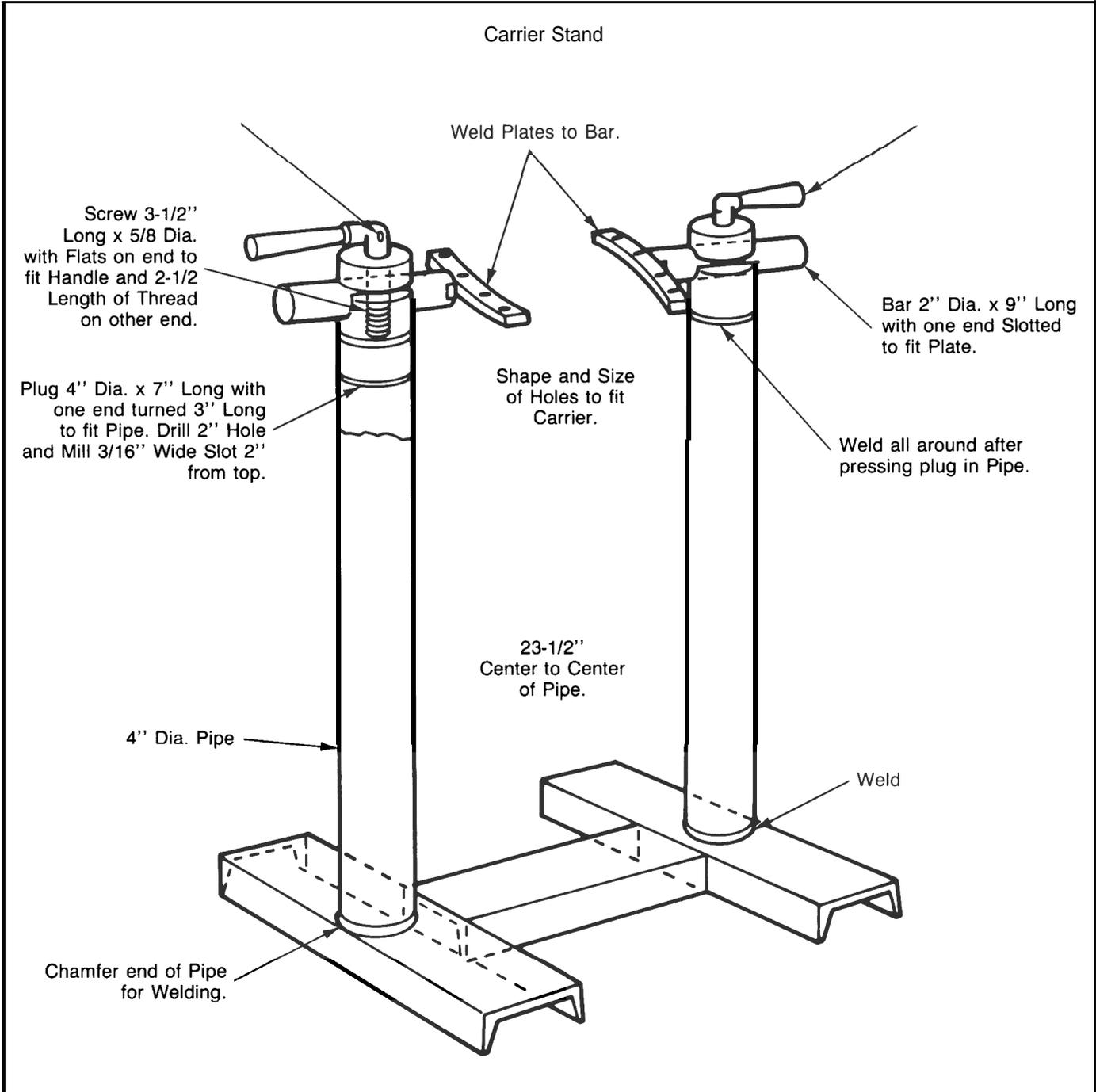
## Remove The Differential And Ring Gear From The Carrier

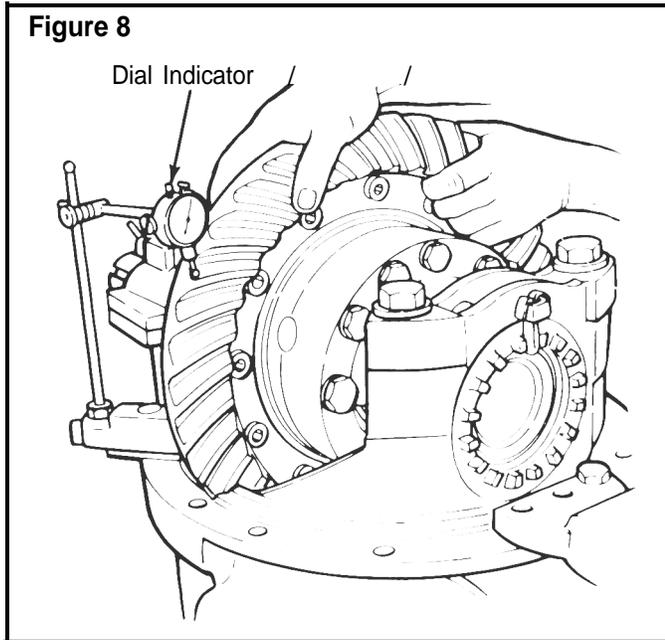
## NOTE:

**Before you start work on the differential carrier inspect the hypoid gear set for damage. If the inspection shows no damage, the same gear set can be used again. Measure the backlash of the gear set and make a note of the dimension. Figure 8. (See procedure on page 46, Steps 1 to 5.) Adjust the backlash to the same dimension after the gear set is installed into the carrier.**

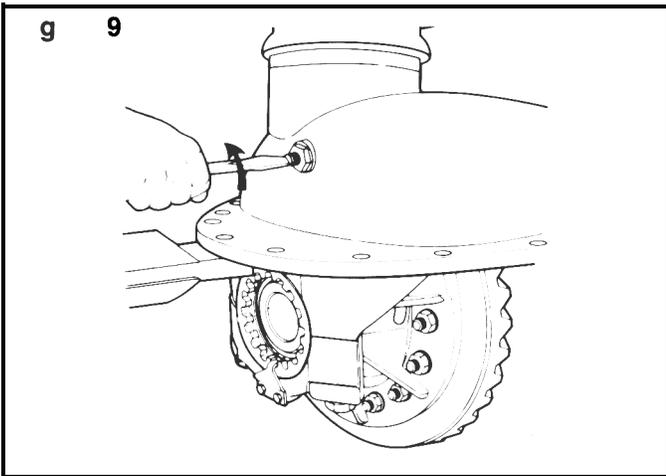
section **2** **Disassembly**

A carrier stand, part number J 3409-01 is available from Kent-Moore, Heavy-Duty Division, 29784 Little Mack, Roseville, Michigan 48066-2298.

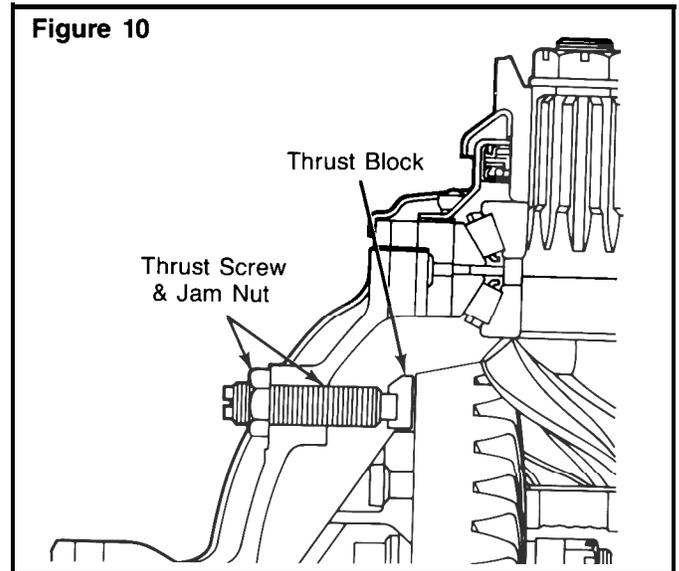




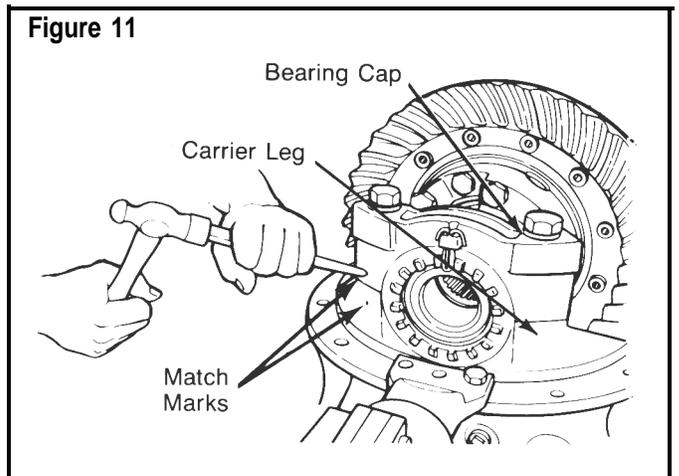
1. Loosen the jam nut\* on the thrust screw\*.
2. Remove the thrust screw\* and jam nut\* from the differential carrier. **Figure 9.**



**NOTE:**  
*Some Rockwell carrier models have a thrust block: The thrust block will fall away from the ring gear inside the carrier when you remove the thrust screw. Figure 10.*



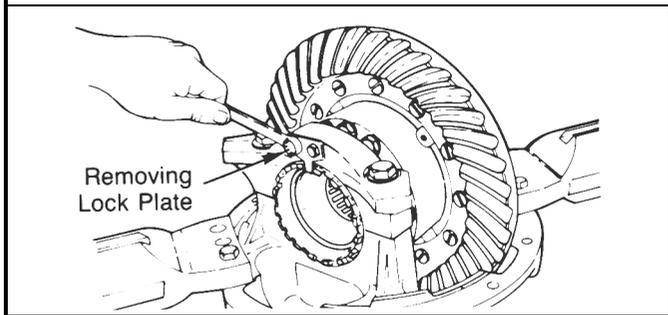
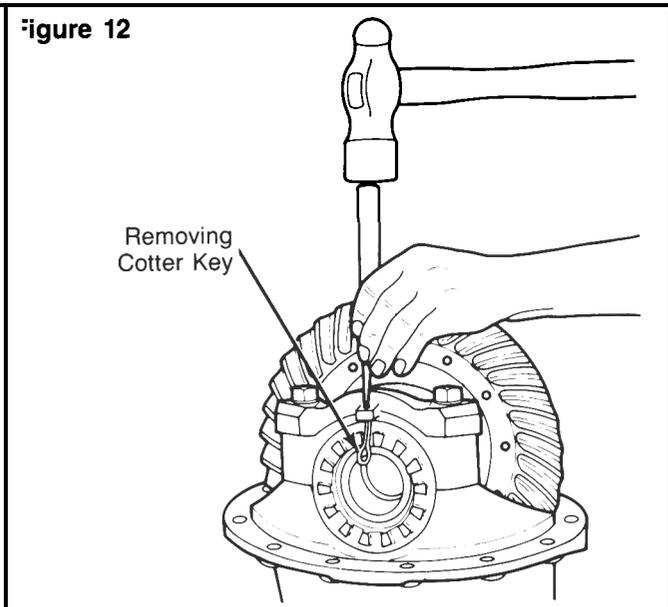
3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.
4. Mark one carrier leg and bearing cap for the purpose of correctly matching the parts when you assemble the carrier. A center punch and hammer can be used to mark the parts. **Figure 11.**



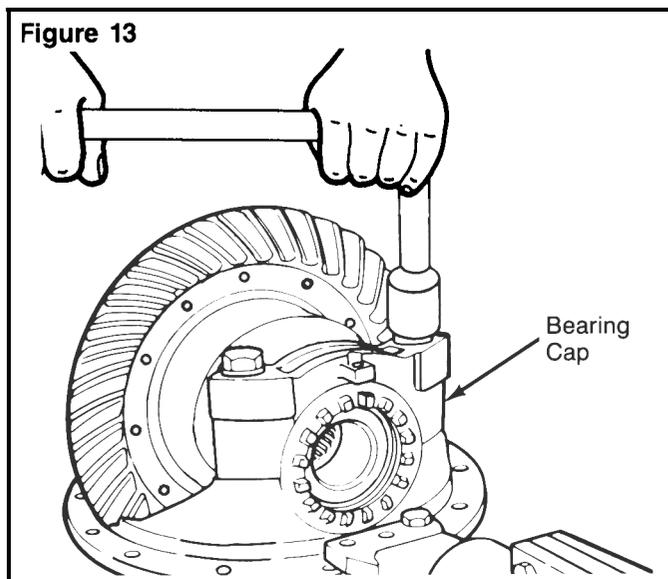
5. Remove the cotter keys\*, pins\* or lock plates\* that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews. **Figure 12.**

*\*Some Rockwell carriers do not have the parts described.*

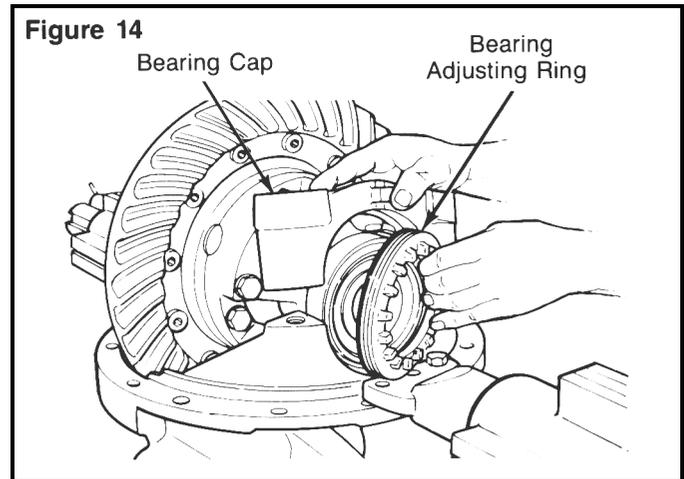
section **2** **Disassembly**



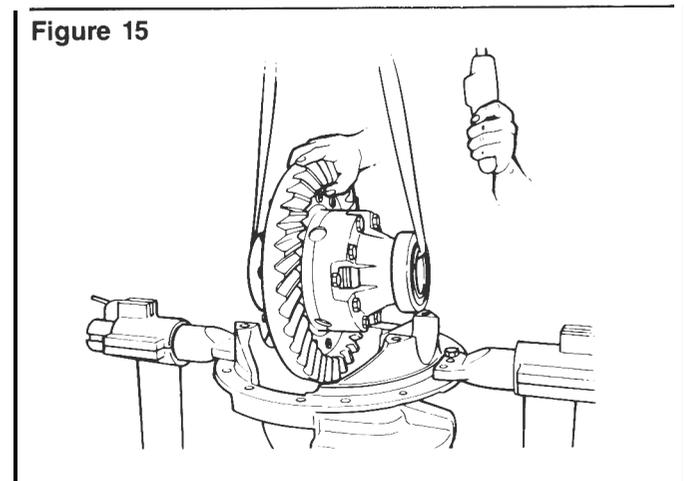
6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers. **Figure 13.**



7. Remove the bearing caps and bearing adjusting rings from the carrier. **Figure 14.**



8. Safely lift the main differential and ring gear assembly from the carrier. Put the assembly on a work bench. **Figure 15.**



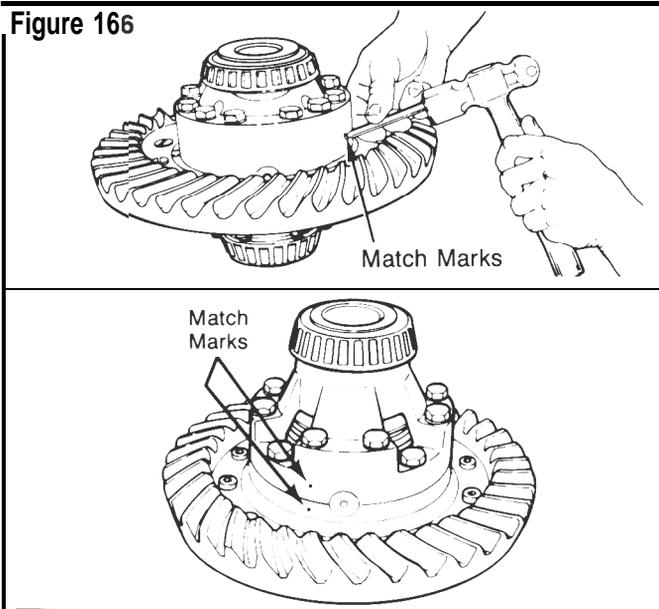
9. Remove the thrust block\* from inside the carrier.

## 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 16.**

*\*Some Rockwell carriers do not have the parts described.*

Figure 166



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

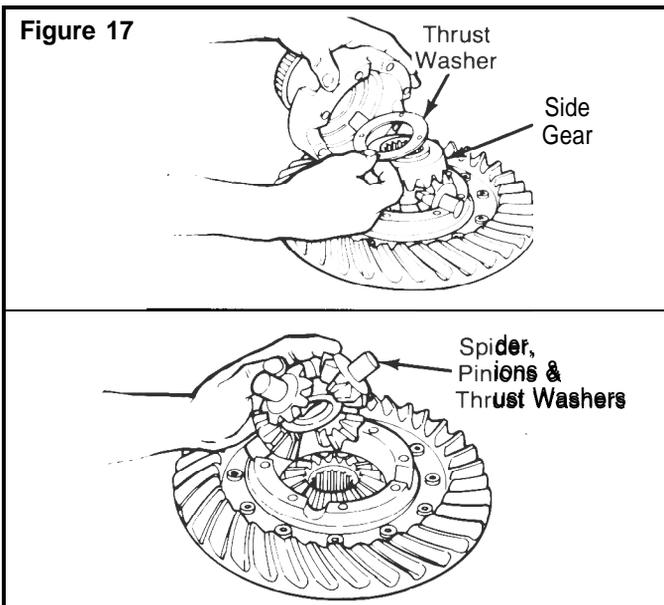
**WARNING:**

*Wear safe eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause 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 17.**

Figure 17

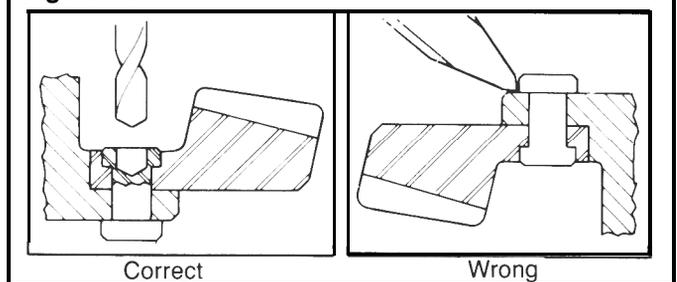


5. If the ring gear needs to be replaced, remove the bolts\*, nuts\*, and washers\* that hold the gear to the flange case half.

6. If rivets\* hold the ring gear to the flange case half, remove the rivets as follows:

- A. Carefully center punch each rivet head in the center, on the ring gear side of the assembly,
- B. 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 18.**

Figure 18



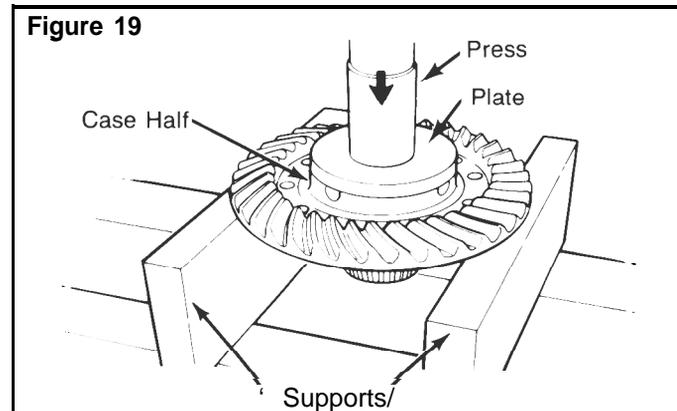
C. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.

**CAUTION:**

*Do not remove the rivets or rivet heads with a chisel and hammer. The chisel can damage the flange case half. Figure 18.*

7. 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 19.**

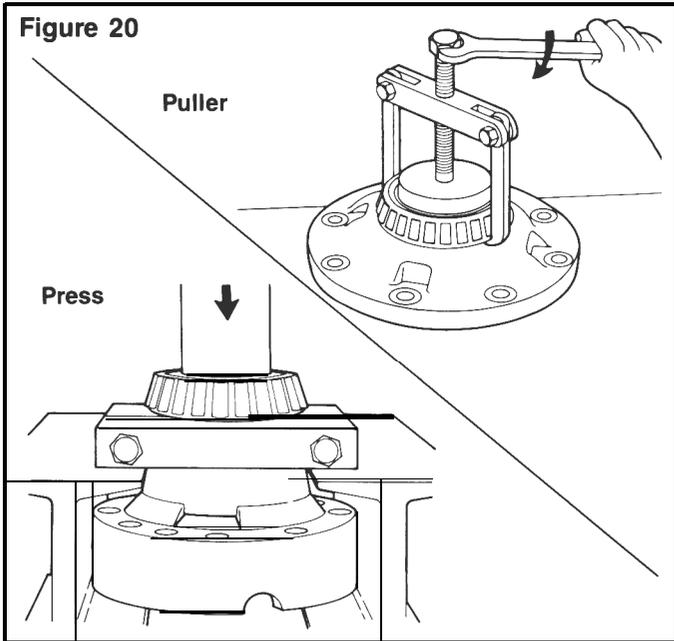
Figure 19



\*Some Rockwell carriers do not have the parts described.

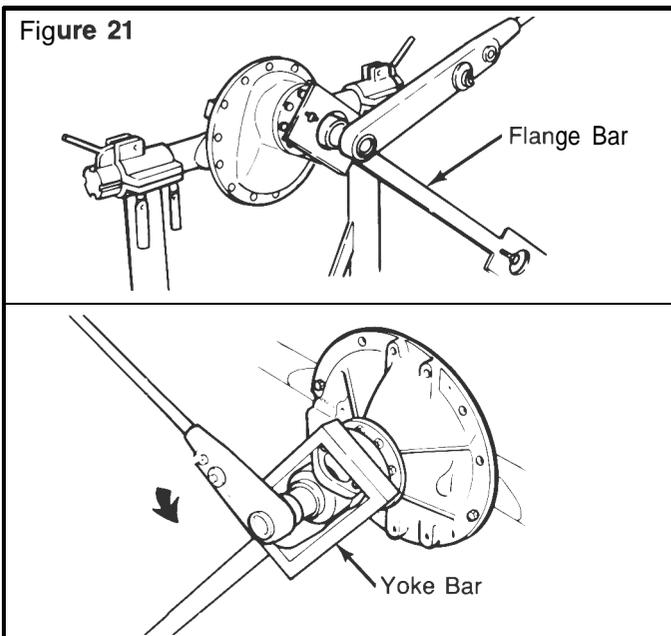
# section 2 Disassembly

8. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press. **Figure 20.**

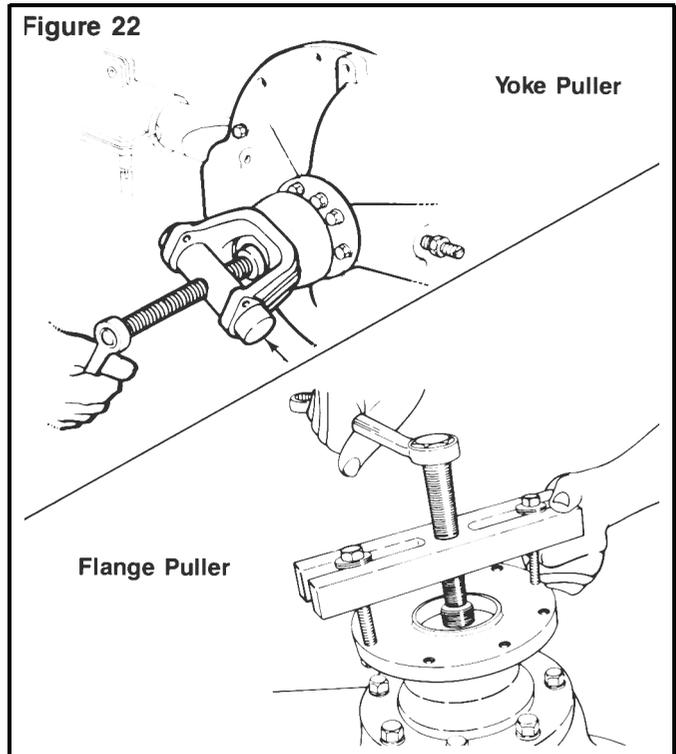


## Remove the Drive Pinion and Bearing Cage From Carrier

1. 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 removed. **Figure 21.**



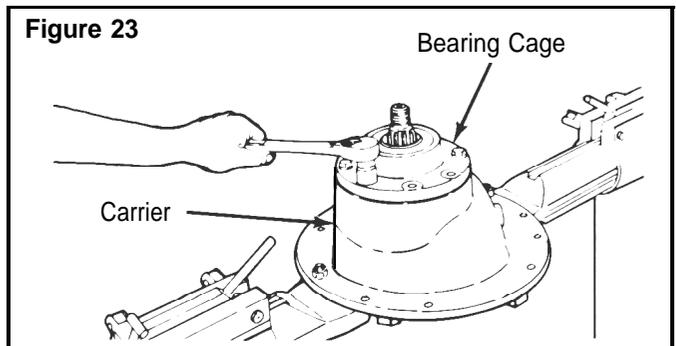
2. Remove the nut and washer\* from the drive pinion. **Figure 21.**
3. Remove the yoke or flange bar.
4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. **Figure 22.**



### **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 runout or alignment problems.*

5. Remove the capscrews and washers that hold the bearing cage in the carrier. **Figure 23.**

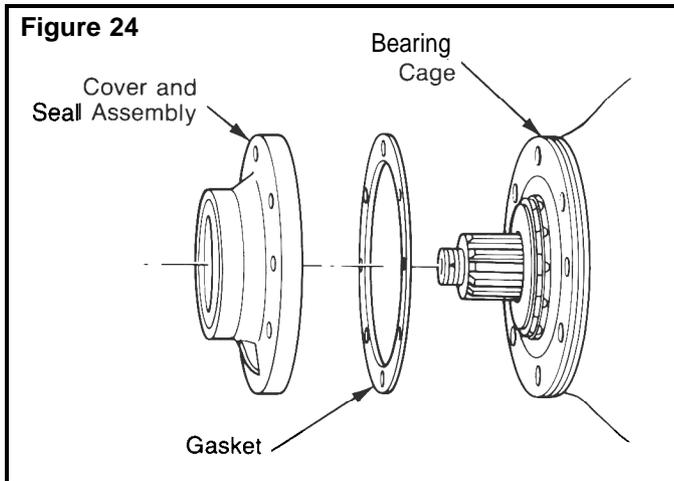


*\*Some Rockwell carriers do not have the parts described.*

**! WARNING:**

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

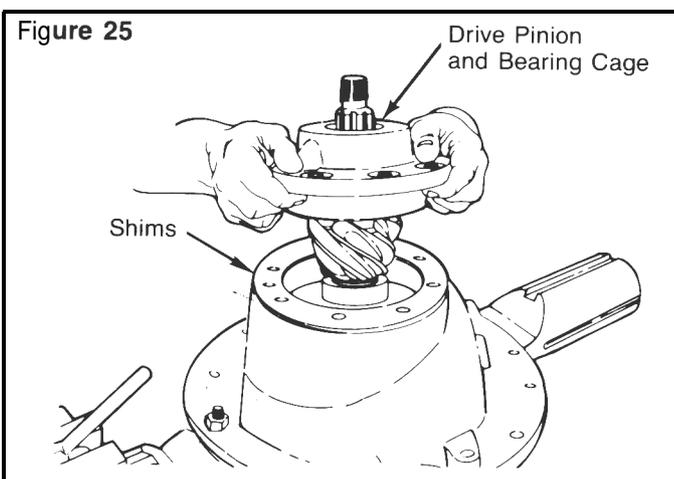
- Remove the cover\* and seal assembly and gasket\* from the bearing cage. If the cover\* is tight on the bearing cage, use a brass drift and hammer for removal. **Figure 24.**



- If the pinion seal is damaged, remove the seal from the cover\*. Use a press and sleeve or seal driver. If a press is not available, use a screwdriver or small pry bar for removal. Discard the pinion seal.

**NOTE:**

*If the carrier does not have a cover and seal assembly the pinion seal will be mounted in the outer bore of the bearing cage. Remove the seal after the drive pinion is removed from the bearing cage.*

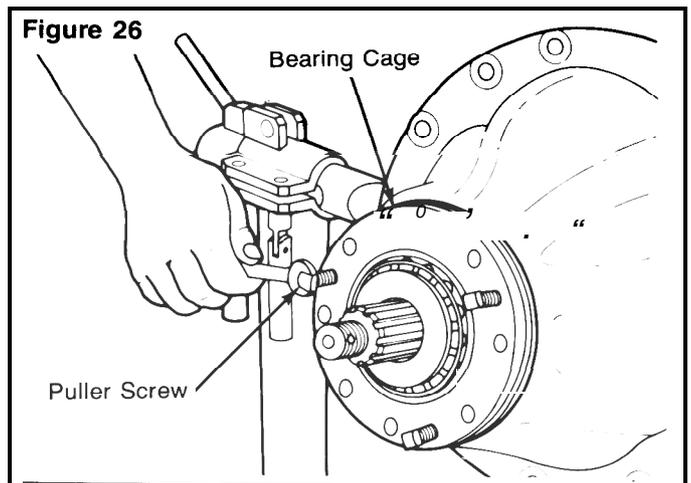


- Remove the drive pinion, bearing cage and shims from the carrier. If the bearing cage is tight in the carrier, use the following procedures to loosen the cage. **Figure 25.**

**! WARNING:**

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

- Hit the bearing cage at several points around the flange area with a leather, plastic or rubber mallet.
- Some bearing cages have threaded puller screw holes\* in the mounting flange. Puller screws can be used to loosen and pull a tightly fitted cage from the carrier. If puller screws are used, clean the threaded holes before the puller screws are installed, **Figure 26.**



**! CAUTION:**

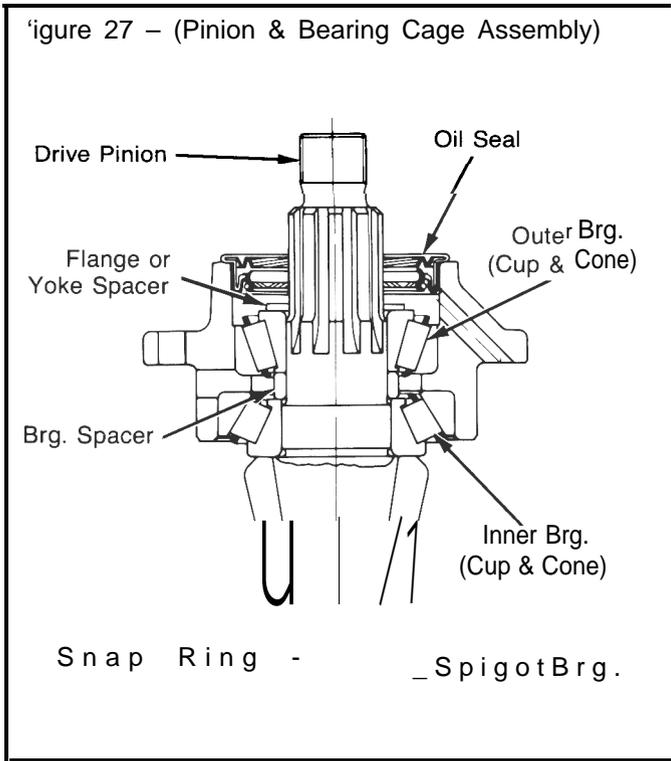
*Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing cage, shims and carrier.*

- If the shims are in good condition, keep the shims together for use later when the carrier is assembled.
- 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.

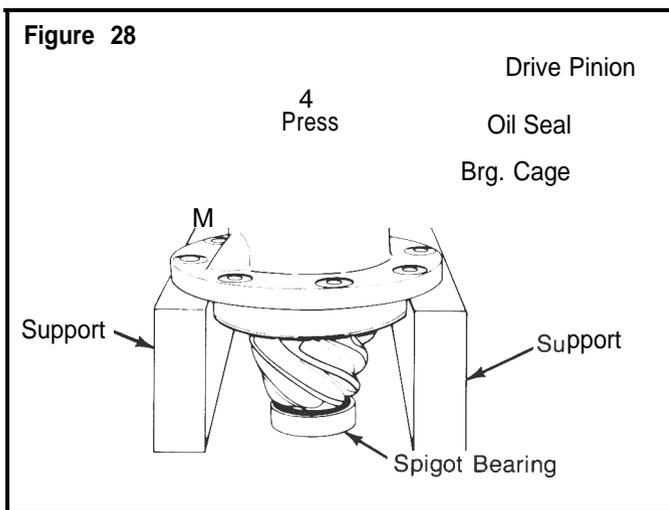
*\*Some Rockwell carriers do not have the parts described.*

# section 2 Disassembly

## Disassemble The Drive Pinion And Bearing Cage



1. Put the drive pinion and bearing cage in a press. The pinion shaft must be toward the top of the assembly. **Figure 28.**



2. Support the bearing cage under the flange area with metal or wood blocks. **Figure 28.**
3. Press the drive pinion through the bearing cage. **Figure 28.**

### NOTE:

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



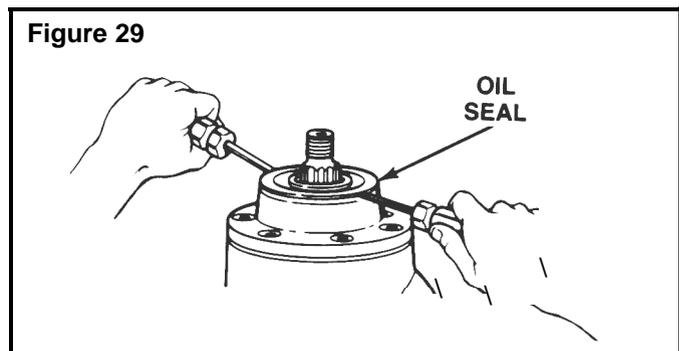
### WARNING:

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

4. If a press is not available, use a leather, plastic or rubber mallet to drive the pinion through the bearing cage.
5. If the pinion oil seal is mounted directly in the outer kre 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 29.**

If the seal is a one piece design (without mounting flange), discard the seal.

If the oil seal is a triple-lip design (with flange), inspect the seal for damage. If the surfaces of the seal and the yoke or flange are smooth and not worn or damaged, you can use the seal again when you assemble the carrier.

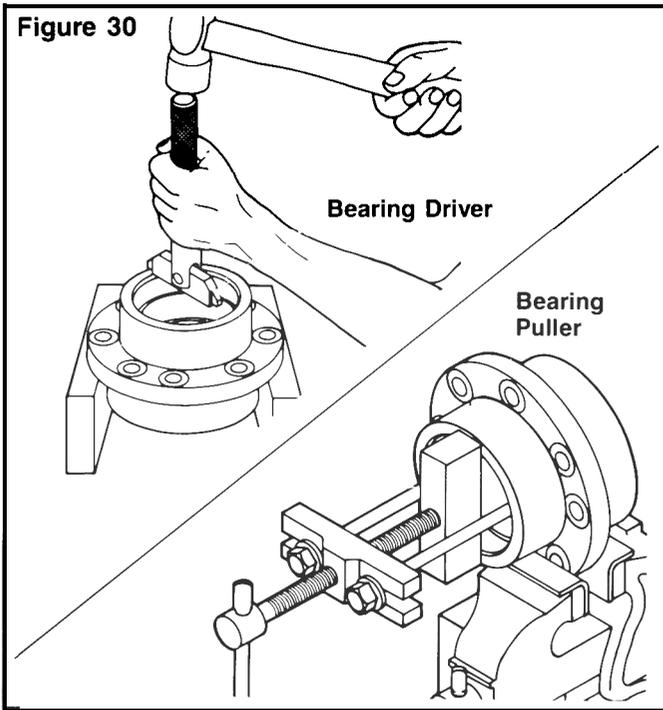


### CAUTION:

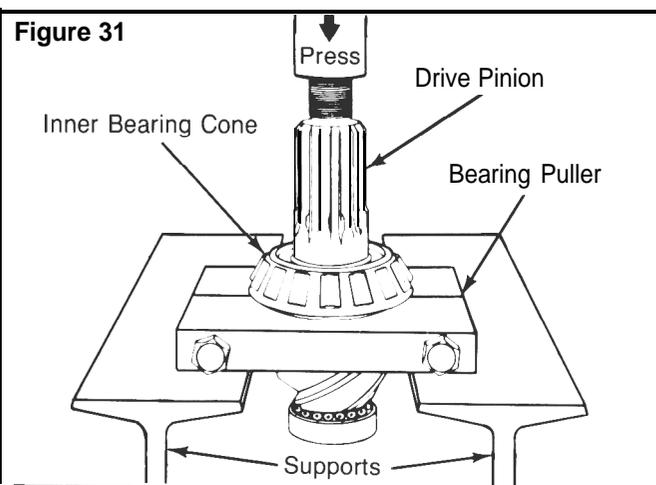
*Be careful when using a screwdriver or pry bar to remove the seal. Do not damage the wall of bore. Damage to the bore can cause oil leaks.*

6. If the pinion bearings need to be replaced, remove the inner and outer bearing cup the inside of cage. Use a press and sleeve, bearing puller or a small drift and hammer. The type of tool used depends on the design of the bearing cage.  
**Figure 30.**

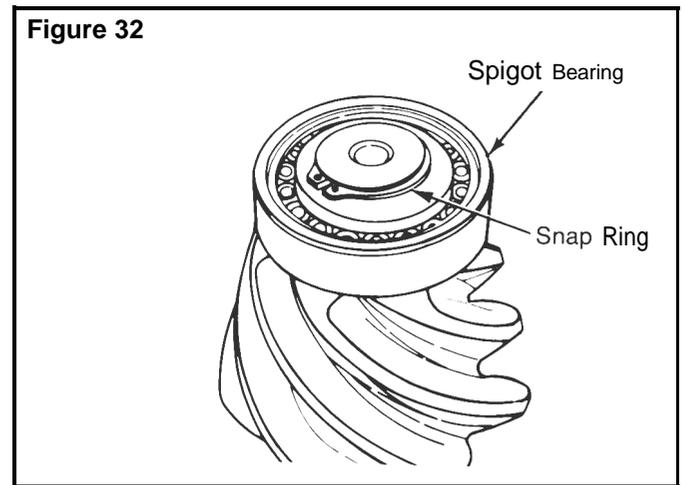
When a press is used, support the bearing cage under the flange area with metal or wood blocks.



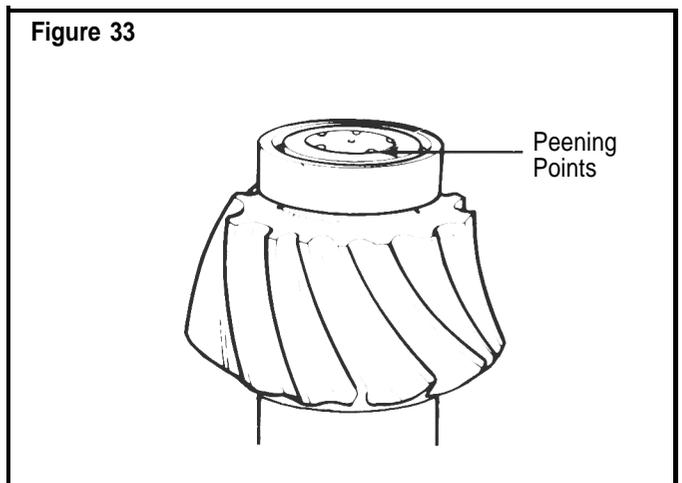
7. If the pinion bearings need to be replaced, remove the inner bearing cone from the drive pinion with a press or bearing puller. The puller **MUST** fit under the inner race of the cone to remove the cone correctly without damage. **Figure 31.**



8. If the spigot bearing needs to be replaced, put 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 32.**



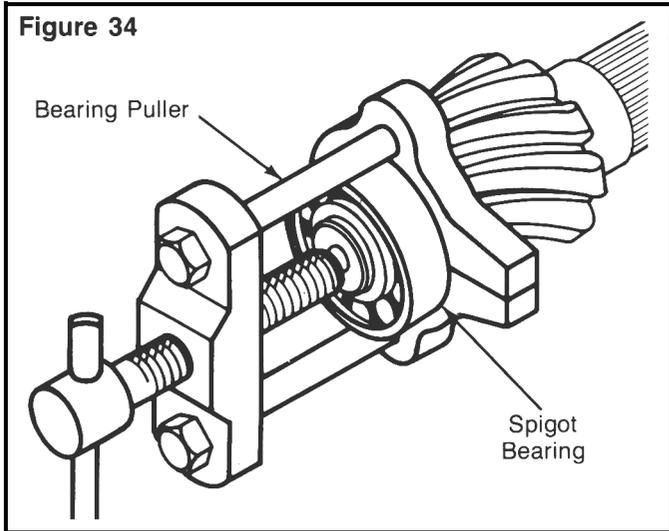
**NOTE:**  
*Some spigot bearings are fastened to the drive pinion with a special peening tool. Figure 33.*



\*Some Rockwell carriers do not have the parts described.

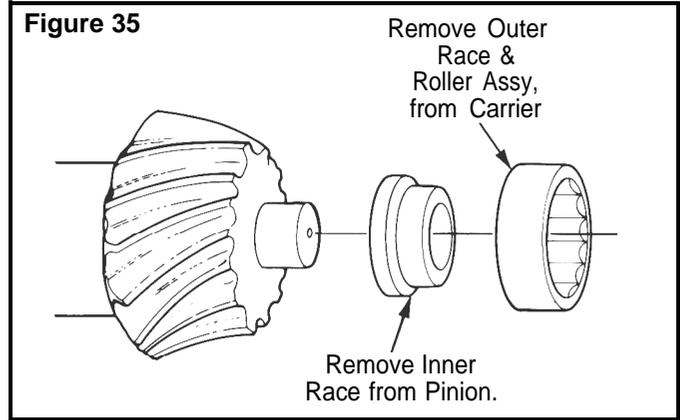
section **2** **Disassembly**

10. Remove the spigot bearing from the drive pinion with a bearing puller. **Figure 34.**



**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 35.*



# Prepare Parts for Assembly

section

# 3

## Clean Ground and Polished Parts:

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 to prevent injury.*

2. Use a tool with a flat blade if required to remove gasket material from parts. Be careful not to damage the ground surfaces.
3. ~~DO NOT clean ground or polished parts in a hot solution tank, water, steam or alkaline solutions.~~

## Clean Rough Parts:

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



### **WARNING:**

*Be careful when using hot solution tanks and alkaline solutions. Follow the alkaline manufacturer's instructions for safe use to prevent injury.*

4. Parts must be washed with water until the alkaline solution is removed.

## Clean 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 put a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

## Dry Parts That Have Been Cleaned:

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 be caused if dried by rotating with compressed air.*

## Prevent Corrosion and Rust 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 and rust to all surfaces. Wrap them in a special paper that prevents corrosion and rust.

## Inspect Parts:

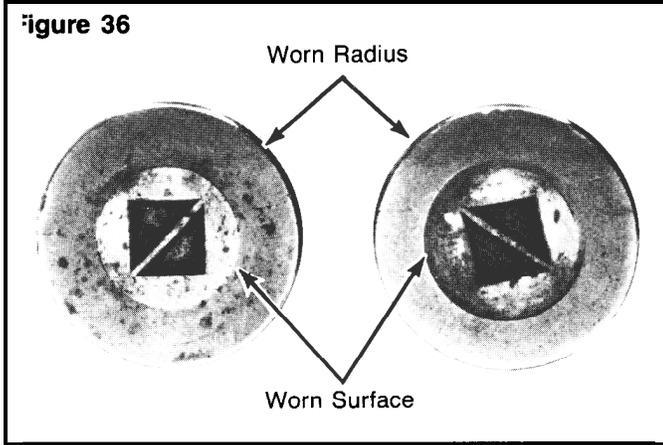
It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged or worn parts now, will prevent failure of the assembly later.

1. Inspect 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.

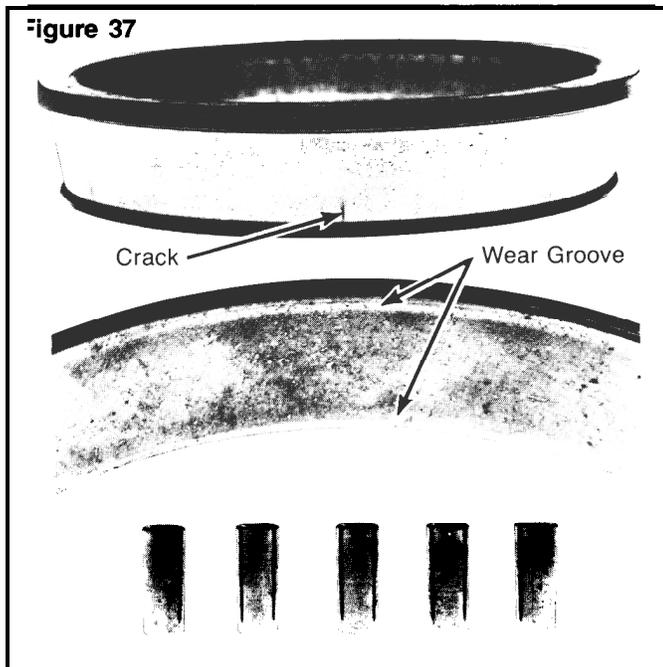
# section 3 Prepare Parts for Assembly

A. The center of large diameter end of rollers worn level with or below the outer surface. **Figure 36.**



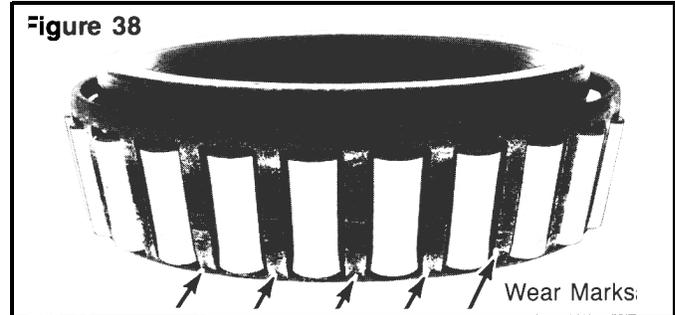
B. The radius at large diameter end of rollers worn to a sharp edge. **Figure 36.**

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 37.**

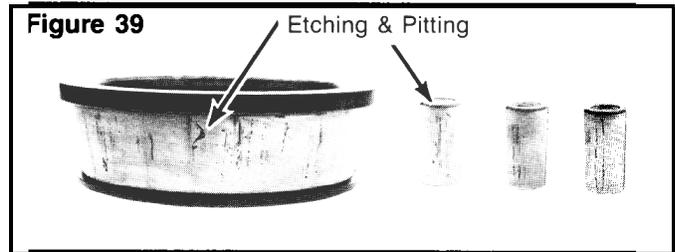


D. Deep cracks or breaks in the cup, cone inner race or roller surfaces. **Figure 37.**

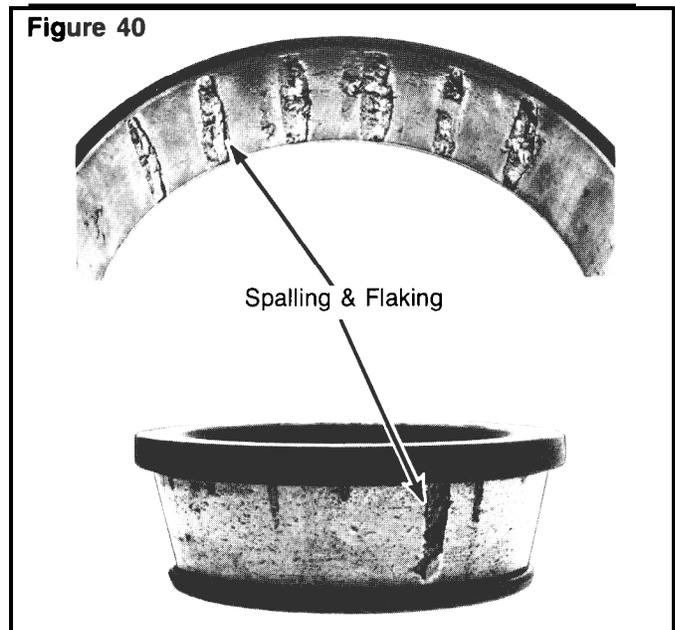
E. Bright wear marks on the outer surface of the roller cage. **Figure 38.**



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



G. Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 40.**



## 2. Inspect Hypoid Drive Pinion and Ring Gear Sets:

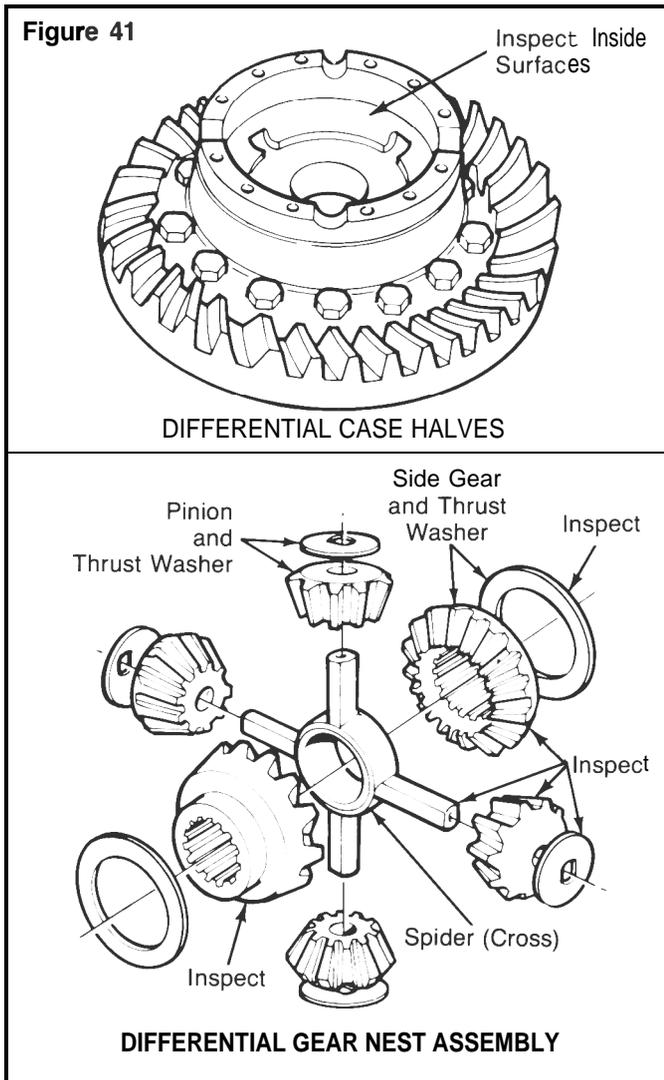
- A. Inspect hypoid pinions and gears for wear or damage. Gears that are worn or damaged MUST be replaced.

### **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.*

## 3. Inspect the Main Differential Assembly:

Inspect the following parts for wear or stress. Parts that are damaged MUST be replaced, **Figure 41**.



- 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.

### **CAUTION:**

*Always replace thrust washers, differential side gears and pinion gears in sets. A higher stress on parts and early failure of the assembly will occur if a new part is used with parts that are old or worn.*

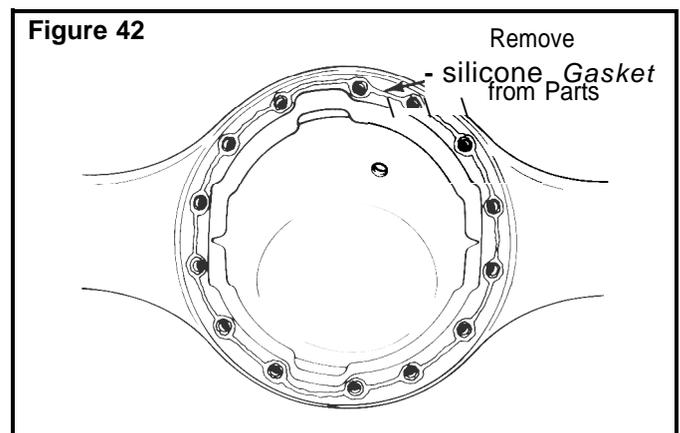
## 4. Inspect Axle Shafts:

- A. Inspect axle shafts for wear and cracks at the flange, shaft and splines. Replace axle shaft if required.

## Repair or Replace Parts General:

Replace worn or damaged parts of an axle assembly. The following are some examples to check for, repair or replace.

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 42**.



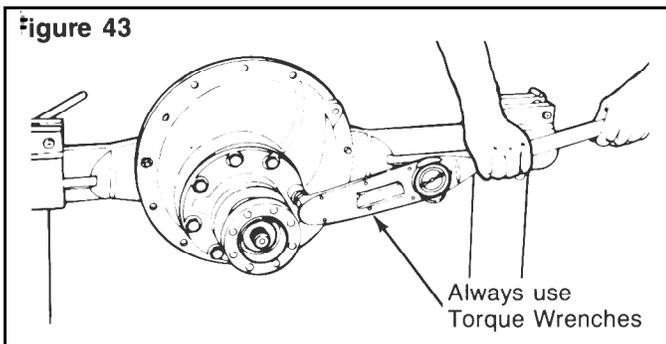
# section 3 Prepare Parts for Assembly

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

## ! CAUTION:

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

7. Tighten all fasteners to the correct torque values. See the chart on page 65 for torque values of fasteners. **Figure 43.**



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 operation of the axle and early failure.*

## Repair Axle By Welding:

1. Rockwell International will permit repairing drive axle housing assemblies by welding ONLY in the following areas:
  - A. Cover welds.
  - B. Snorkel welds.
  - C. Housing seam welds between the suspension attaching brackets.

## ! CAUTION:

*Welding can be used when the crack or damaged area is within the o/d weld material. Replace the axle housing if the crack extends into the metal next to the old weld. A housing that has damage in the seam weld or cover weld because of overload conditions can be repaired. A repaired housing must be used in correct 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 axle and early failure. The following procedure must be used.*

### 2. Welding Procedure

- A. Drain the lubricant from the axle assembly.
- B. Remove the axle shafts and differential carrier from the axle housing.

## ! WARNING:

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

- C. Clean the damaged area inside and outside the housing. Cleaning solvent can be used.
- D. Grind the damaged weld to the base metal.
- E. Warm the complete axle housing to a temperature of 70° F -80° F (21° C -27° C) or higher.
- F. Before you start welding, heat the damaged area to be repaired to approximately 300° F (1490°c).
- G. 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.*

H. Fill in the Weld Gap as Follows:



## **CAUTION:**

***Do not connect the ground cable at any point on the axle assembly that will put 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 electricity arcing. A good location to connect the ground cable is the spring mounting pad of the housing.***

1. The snorkle weld MUST be a .375 inch (9.5 mm) fillet.
2. The opening in cover welds MUST be filled level with the old weld.
3. 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.
4. Clean the new weld area. Carefully remove all the rough weld material.
5. Install the differential carrier and axle shafts.
6. Fill the axle assembly with the correct amount of lubricant. See page 62 or Rockwell Field Maintenance Manual No. 1 for information on lubricants.

## **NOTE:**

***To weld brackets or other components to the axle housing, use the procedure in Rockwell Technical Service Aid, TSA-2-95.***

## **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.

Also, Rockwell will allow *repair welding on/y* in the following areas: cover welds, snorkel welds, and housing seam welds between the suspension attaching brackets. Repair welding should be performed only if the crack/porosity is located within the weld material.

Replace any housing assemblies where cracks have worked into the parent metal. Also, any housings that have seam weld or cover weld cracks, due to known overloading of the axle, should not be repair welded.



## **CAUTION:**

***Bending, straightening, improper repair welding procedures or repair welding at locations other than those indicated above, may result in premature housing failure and affect the safe operation of the axle assembly.***

For further information regarding Repair Welding, refer to page 18.

# 4 General Procedures

## Use of Dri-Loc Fasteners and Rockwell Liquid Adhesive 2297-C-3747 or Loctite 277

### Install New Dri-Loc Fasteners.

1. Clean the oil and dirt from threaded holes. There is no special cleaning required.
2. Assemble parts using the new Dri-Loc fasteners.



### CAUTION:

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

3. Tighten the Dri-Loc fasteners to the required torque value for that size fastener. There is no special procedure or torque value required. See the torque chart on page 65.

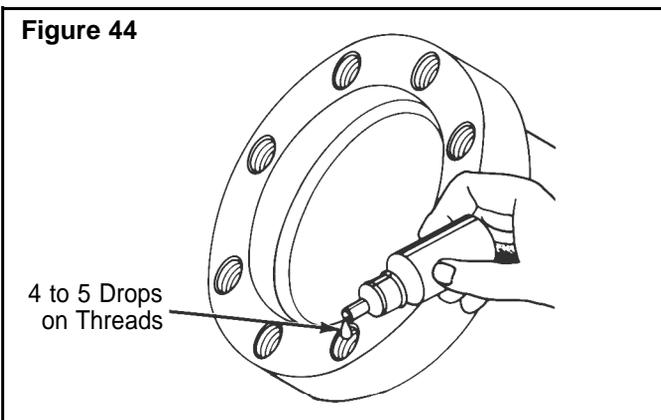


### NOTE:

*There is no drying time required for Dri-Loc fasteners.*

### Install Old Dri-Loc Fasteners using Rockwell Liquid Adhesive 2297-C-3747 or Loctite 277.

Figure 44



1. Clean the oil and dirt from threaded holes. There is no special cleaning required and it is not necessary to remove the old Dri-Loc adhesive from threads.
2. Apply four or five drops of Rockwell Liquid Adhesive or Loctite 277 to threaded holes ONLY. Make sure the adhesive is on the threads. **Figure 44.**



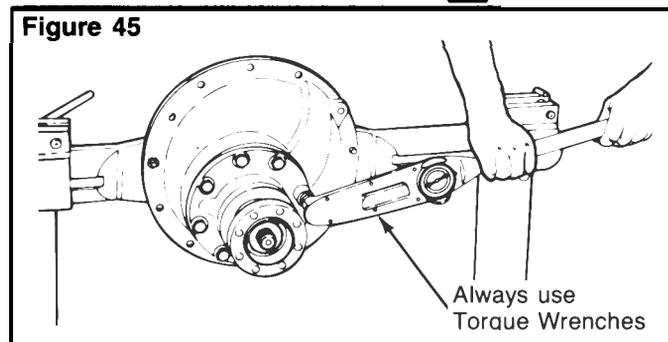
### CAUTION:

*Do not apply adhesive to the fastener threads. Air pressure in the hole will push the adhesive out as the fastener is installed.*

3. Tighten the fasteners to the required torque value for that size fastener. There is no special procedure or torque value required. See the torque chart on page 65. **Figure 45.**



Figure 45



### NOTE:

*There is no drying time required for Rockwell Liquid Adhesive 2297-C-3747 or Loctite 277.*

**Check Torque Values of Dri-Loc Fasteners not requiring removal.**



### CAUTION:

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

1. Apply the MINIMUM amount of torque required for that size fastener. See the torque chart on page 65. The fastener MUST NOT rotate. **Figure 45.**
2. If the fastener rotates any amount, remove the fastener from the component and apply adhesive to the threaded hole. Follow the procedure for installing old Dri-Loc fasteners.

## Remove Dri-Loc Fasteners.

If it is difficult to remove Dri-Loc 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.
2. Repeat step 1 until the fastener can be removed.

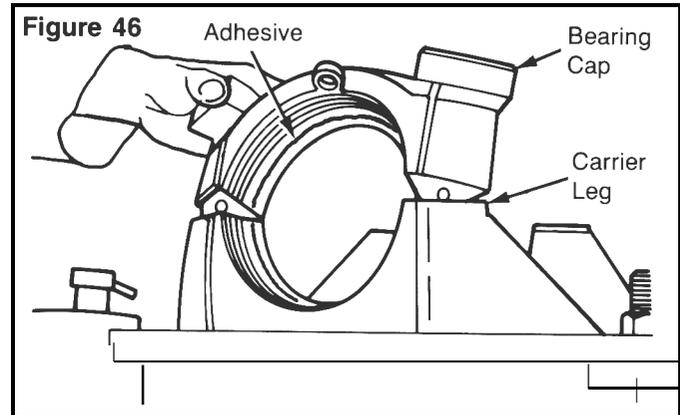


### **CAUTION:**

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

## Application of Rockwell Adhesive 2297-T-4180 or 1199-Z-3250 in Bearing Bores for the Differential

- Use adhesive 1199-Z-3250 for SQ series axles.
  - Use adhesive 2297-T-4180 for all other 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 put adhesive on threaded areas. **Figure 46.**



### **NOTE:**

**The Rockwell adhesives 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 parts again and apply new adhesive.**

4. Install the main differential assembly, bearing cups and bearing caps into the carrier. Use the normal procedure, see page 42.
5. Adjust preload of the differential bearings, backlash and tooth contact patterns of the gear set as required using the normal procedures, See pages 43-51.

## Application of Silicone Gasket Material

### **NOTE:**

**The following silicone gasket products can be used on Rockwell-components**

- a. Dow Corning Silicone Rubber Sealant, No, 732 Black.
- b. General Electric No, RTV-1473 Black.

# 4 General Procedures

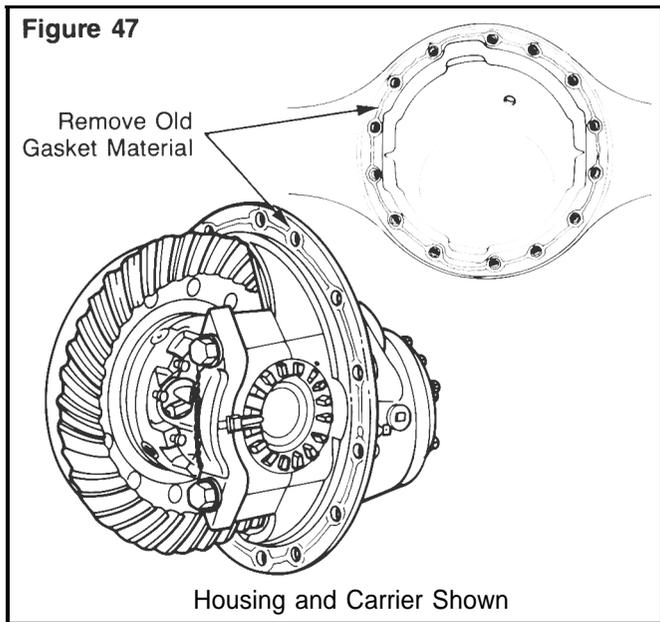
c. From Rockwell International:

- 40 pound containers, Part No. 1199-Q-2981
- Ten ounce tubes, Part No. 1250-X-388
- Three ounce tubes, Part No. 1199-T-3842

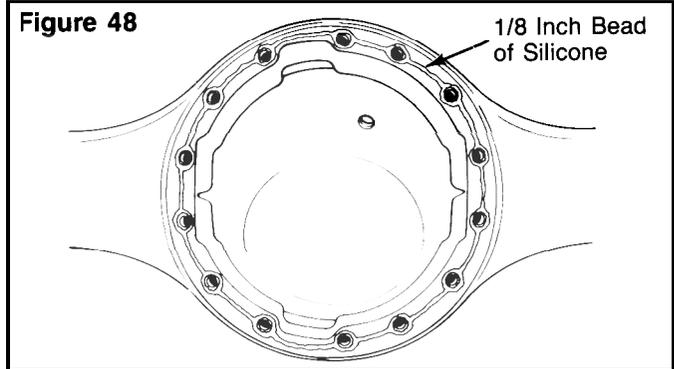
**! WARNING:**

Small amounts of acid vapor are present when applying silicone gasket material. For this reason, be sure there is good ventilation in the work area. If the silicone gasket material gets in the eyes, flush the eyes with water for 15 minutes. Have the eyes checked by a doctor.

1. Remove all old gasket material from both surfaces. **Figure 47.**



2. Clean the surfaces where silicone gasket material will be applied. Remove all oil, grease, dirt and moisture.
3. Dry both surfaces.
4. Apply a 1/8 inch diameter continuous bead of the silicone gasket material around one surface. Also apply the gasket material around the edge of all fastener holes in that surface. **Figure 48.**



**! CAUTION:**

The amount of silicone gasket material applied must not exceed a 1/8 inch diameter bead. Too much gasket material can block lubrication passages.

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 no special procedure or torque value required. See Torque Chart on page 65. **T**
6. Wait 20 minutes before the assembly is filled with lubricant.

**NOTE:**

The Rockwell adhesive and gasket products are available from:

Rockwell International Corp.  
 Florence Distribution Center  
 7975 Dixie Highway  
 Florence, Kentucky 41042

## Installing Tight Fit Yokes using the Three Piece Pilot Tool

**NOTE:**

A three piece installation tool is required to correctly install yokes with interference fit splines. The yoke installation tools are not available from Rockwell International but can be purchased from OTC Tool and Equipment Division, 655 Eisenhower Drive, Owatonna, MN 55060. Specify the Rockwell axle model when ordering. See the following list.

Axle Series	Position	OTC Tool Number	Axle Series	Position	OTC Tool Number
H-172		D80T-4859-A	RT-52-160•	Forward Input	D89T-4859-A
L-172		D80T-4859-A		Forward Output	D89T-4859-B
P-174		D80T-4859-A		Rear Input	D89T-4859-A
R-155		D80T-4859-A	RT-52-180*	Forward Input	D80T-4859-B
R-255		D80T-4859-A		Forward Output	D80T-4859-A
R-170		D80T-4859-B		Rear Input	D89T-4859-A
R-270		D80T-4859-A	RT-58-180•	Forward Input	D80T-4859-B
s-170		D80T-4859-B		Forward Output	D80T-4859-A
U-170		D80T-4859-B		Rear Input	D89T-4859-A
U-240		D80T-4859-A	SL-100	Forward Input	D80T-4859-A
U-270		D80T-4859-A		Forward Output	D80T-4859-B
U-280		D80T-4859-A		Rear Input	D80T-4859-B
W-280		D80T-4859-A	SQ-100	Forward Input	D80T-4859-A
RS-13-120*		D89T-4859-B		Forward Output	D80T-4859-A
RS-15-120*		D89T-4859-B		Rear Input	D80T-4859-A
RS-15-210*		D89T-4859-B	SQR-100	Forward Input	D80T-4859-A
RS-17-140*		D89T-4859-B		Forward Output	D80T-4859-A
RS-17-220*		D89T-4859-B		Rear Input	D80T-4859-A
RS-19-145*		D89T-4859-B	SSH D	Forward Input	D80T-4859-B
RS-20-230*		D89T-4859-B		Forward Output	D80T-4859-A
RS-21-145*		D89T-4859-B		Rear Input	D80T-4859-A
RS-23-160•		D89T-4859-A	STHD	Forward Input	D80T-4859-B
RS-23-180*		D89T-4859-A		Forward Output	D80T-4859-A
RS-23-240*		D89T-4859-B		Rear Input	D80T-4859-A
RS-26-180•		D89T-4859-A	SR-170	Forward Input	D80T-4859-B
RS-30-180*		D89T-4859-A		Forward Output	D80T-4859-A
RT-34-145*	Forward Input	D89T-4859-B		Rear Input	D80T-4859-B
	Forward Output	D89T-4859-B	ST-170	Forward Input	D80T-4859-B
	Rear Input	D89T-4859-B		Forward Output	D80T-4859-A
RT-40-145*	Forward Input	D89T-4859-B		Forward Output	D80T-4859-A
	Forward Output	D89T-4859-B	Su-170	Rear Input	D80T-4859-B
	Rear Input	D89T-4859-B		Forward Input	D80T-4859-B
RT-44-145*	Forward Input	D89T-4859-B		Forward Output	D80T-4859-A
	Forward Output	D89T-4859-B	SR-270/280	Rear Input	D80T-4859-A
	Rear Input	D89T-4859-B		Forward Input	D80T-4859-B
RT-46-160•	Forward Input	D89T-4859-A		Forward Output	D80T-4859-A
	Forward Output	D89T-4859-B	ST-270/280	Rear Input	D80T-4859-A
	Rear Input	D89T-4859-A		Forward Input	D80T-4859-B
RT-48-180**	Forward Input	D80T-4859-B		Forward Output	D80T-4859-A
	Forward Output	D80T-4859-A	SU-270/280	Rear Input	D80T-4859-A
	Rear Input	D89T-4859-A		Forward Input	D80T-4859-B
				Forward Output	D80T-4859-A
			SW-280	Rear Input	D80T-4859-A
				Forward Input	D80T-4859-B
				Forward Output	D80T-4859-A
			SFDD-4640	Rear Input	D80T-4859-A
				Forward Input	D80T-4859-B
				Forward Output	D80T-4859-A
				Rear Input	D80T-4859-A

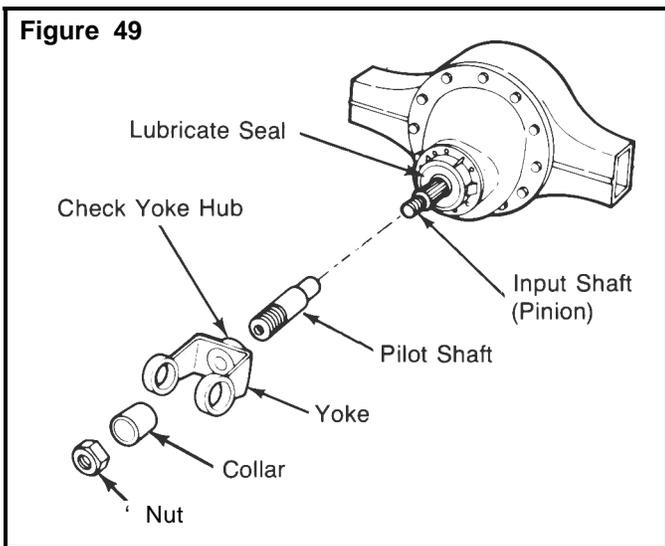
\*Axle models have metric size threads on drive pinions, input shafts and output shafts.

\* \*Metric threads only on drive pinions of rear/rear axles.

**CAUTION:**

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

1. Apply axle lubricant on the yoke seal.
2. Check all surfaces of the yoke hub for damage. If necessary, polish the yoke hub with an india stone, emery cloth or crocus cloth.
3. Install the pilot shaft on the input shaft of the assembly. **Figure 49.**



4. Slide the yoke over the pilot shaft. Align the yoke splines with the shaft splines.
5. Put the collar on the pilot shaft and slide it against the yoke.
6. Install the nut on the pilot shaft and against the collar. Tighten the nut against collar until the yoke is completely in position on the shaft. Sometimes a torque value of 200 lb.—ft. on the nut is required to install the yoke correctly.

**CAUTION:**

Do not use the assembly yoke nut for installation purposes. Use the nut that is supplied with the three piece pilot tool.

7. Remove all parts of the pilot tool from the shaft. (Pilot shaft, collar and nut).
8. Install the washer (if required) and yoke nut on the shaft, Tighten the nut to the required torque value. See the torque chart on page 65.

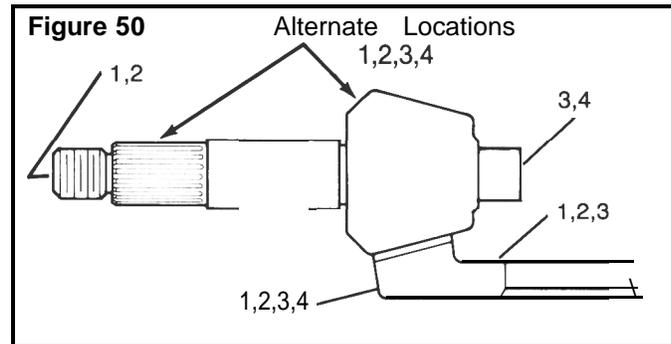


## Gear Set Information (Drive Pinion and Ring Gear Marks)

**NOTE:**

Before a new gear set is installed in the carrier read the following information. Always check the gear set for correct marks to make sure the gears are a matched set.

The location of the marks are shown in Figure 50.



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.*

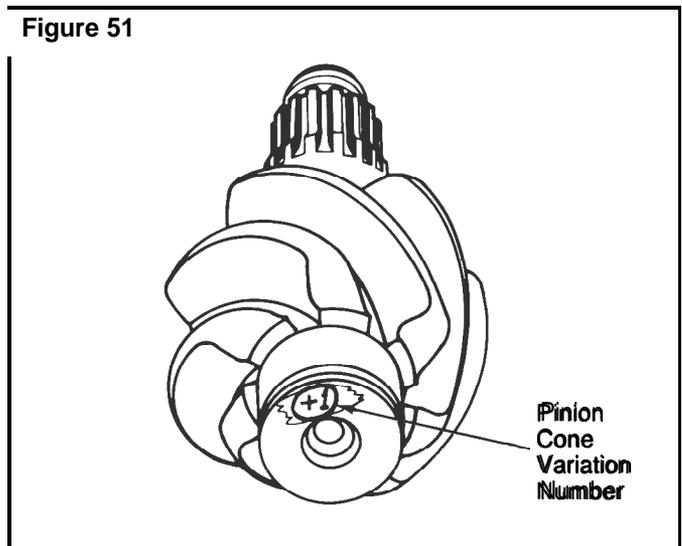
- B. Location on Drive Pinion: End of gear head.
  
- C. Location on Ring Gear: Front face or outer diameter.

**4. Pinion Cone Variation Number**

**NOTE:**

*The pinion cone variation number is not used when checking for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier. See the procedure for adjusting the shim pack thickness under the pinion cage on Pages 35.37.*

- A. Examples of pinion cone variation numbers: PC+ 3, PC-5, +2, -1, + .01 mm or -.02mm. Figure 51.



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

## Vehicle Towing Instructions:

When towing or “piggybacking” a vehicle with the wheels of one or both drive axles on the ground, it is possible to damage the axles or cause additional damage if the wrong procedure is used before towing begins. Rockwell recommends that you use the following procedure.

# 4 General Procedures

**Before Towing:**

1. If the drive axle(s) are equipped with a main differential lock, shift the differential to the unlocked (disengaged) position. The differential lock light in the cab of the vehicle will go out.

**NOTE:**

If the *air supply to the differential lock is damaged, the differential will unlock (disengage)* when air pressure is lost.

2. Identify each axle shaft so that they can be installed in the same location after repair is completed.
3. Remove both axle shafts of drive axles that will remain on the ground while the vehicle is being towed. Follow the procedures described in the Disassembly section of this manual.

**NOTE:**

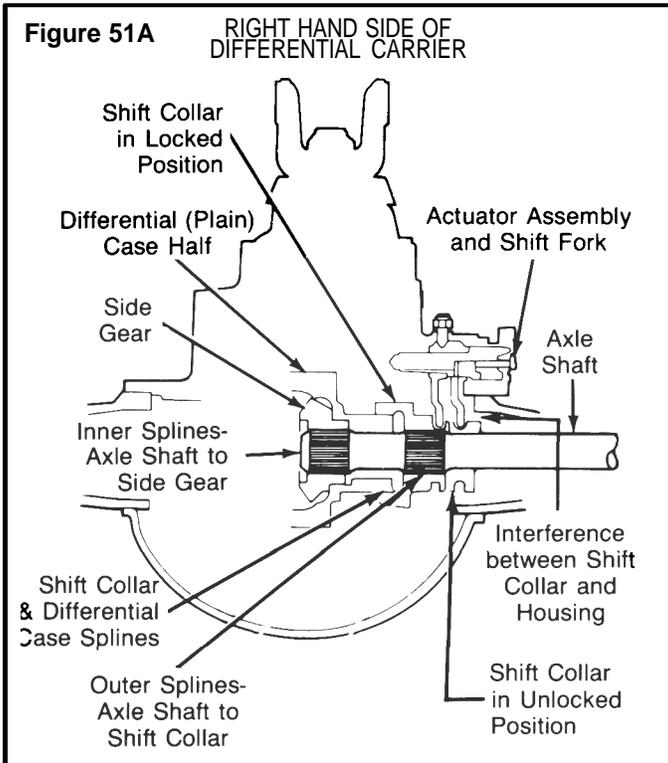
If the axle(s) are equipped with main differential lock, the left-hand *front axle shaft and right-hand rear axle shaft of tandem axles and the right-hand axle shaft of single axles have two sets of splines. One set of splines is engaged with the side gear and one set is engaged with the shift collar. It may be necessary to rotate the shaft when pulling it through the shift collar. Figure 51A (single or rear of tandem axle shown).*

4. Install a cover over the openings of both hubs to retain the lubricant and keep dirt from entering the hub.

**Before Operating the Vehicle:**

1. Remove the covers from the hubs.
2. If the drive axle(s) are equipped with a main differential lock, shift the differential to the unlocked (disengaged) position. Install the axle shafts with two sets of splines and new gaskets in the correct locations as follows:
  - A. Push the axle shaft and gasket into the hub and housing until the shaft stops against the shift collar.
  - B. Push down and in on the axle shaft flange and rotate the shaft until the splines of the shaft and collar are engaged.
  - C. Push the axle shaft further into the housing until the shaft stops against the differential side gear.
  - D. Push down on the axle shaft flange and rotate the shaft until the splines of the shaft and side gear are engaged.
  - E. Push the axle shaft completely into the housing until the flange and gasket are flush against the hub.

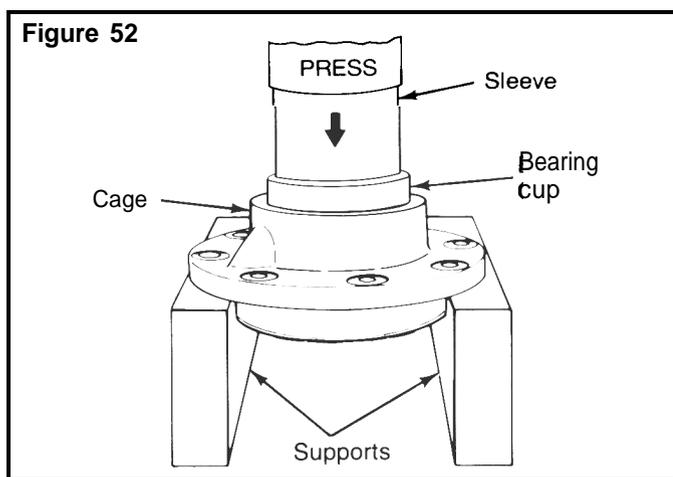
3. Install the other axle shafts at the locations from where they were removed. Follow the procedures described in the Assembly section of this manual.
4. Check the lubricant level in the axles and hubs where the axle shafts were removed. Add lubricant if necessary. See the Lubrication section of this manual for information.



# Assembly section 5

## Assemble the Drive Pinion, Bearings and Bearing Cage

1. Put the bearing cage in a press. **Figure 52.**

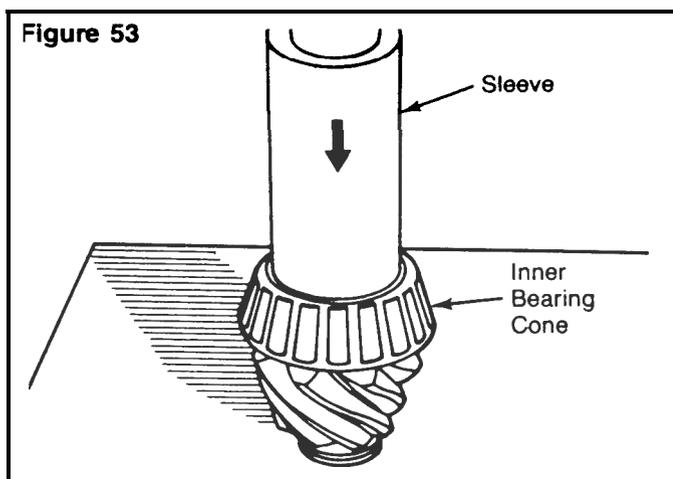


2. Support the bearing cage with metal or wood blocks.
3. Press the bearing cup into the bore of bearing cage until cup is flat against bottom of bore. Use a sleeve of the correct size to install bearing cup. **Figure 52.**

### NOTE:

Use the same procedure for both bearing cups.

4. Put the drive pinion in a press, gear head (teeth) toward the bottom. **Figure 53.**



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:

Some spigot bearings are 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. B-140 single rear axles and SQHP rear rear axles do not use spigot bearings. Use the following procedure to install the spigot bearing, then continue with steps 6 through 9 on page 31.

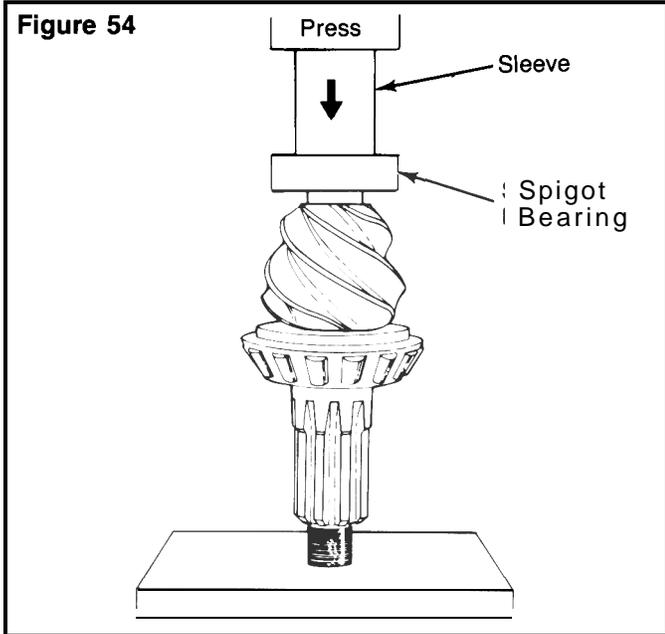
## Installing the One-Piece Spigot Bearing on the Drive Pinion with Snap Ring

### NOTE:

This procedure applies to all axles except:

- All H-170 and B-140 single rear axles.
- Some 120, 125 and 160 Series single axles. These axles may use snap rings.
- All SQHP rear tandem axles.
- Some SL-100, SQ-100 and 160 and 180 Series rear rear tandem axles. These axles may use snap rings.

- A. Put the drive pinion in a press, gear head (teeth) toward the top. **Figure 54.**
- 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 54.**



### Peening the One-Piece Spigot Bearing on the Drive Pinion (without Snap Ring)

**NOTE:**

*This procedure applies to the following axles:*

- All H-170 single rear axles.
- Some 120 and 125 Series single axles. These axles may use snap rings.
- Some SL-100, SQ-100 and 180 Series rear rear tandem axles. These axles may use snap rings.

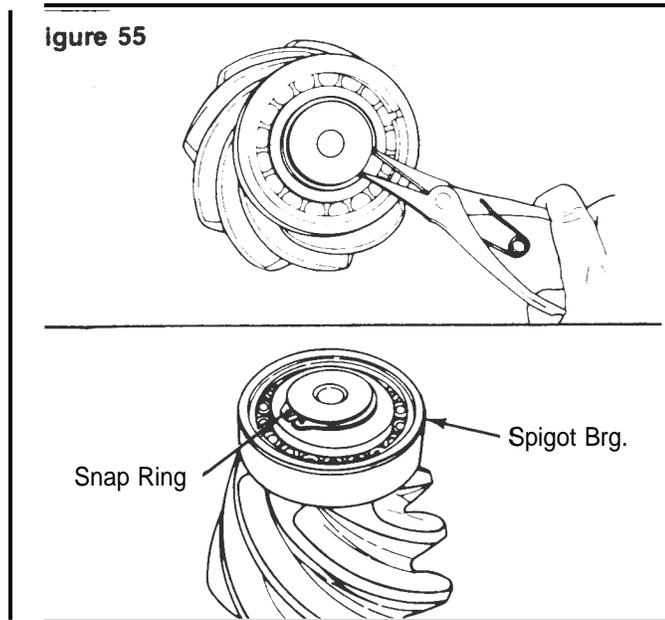
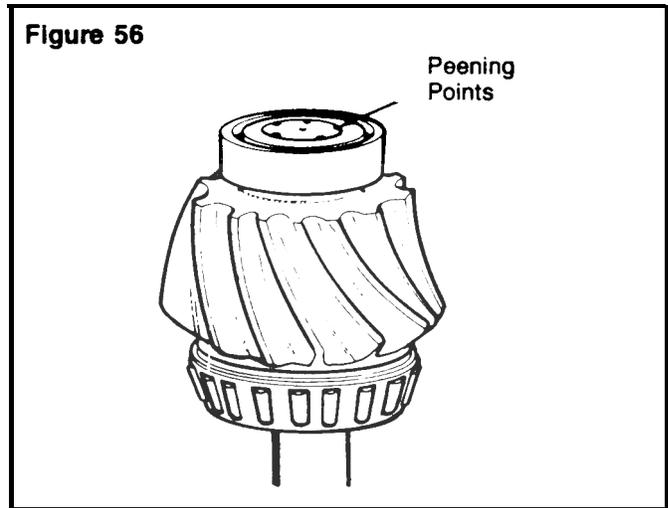
**Specification:**

Apply 3,000 kg (6,614 lb.) force on a 10 mm or .375 inch ball.

Peen the end of drive pinion at a minimum of five points. **Figure 56.**

C. On R-155 and R-163 single rear axles, and SRHD, SSHD, STHD and SUHb rear rear axles, install the dished washer on the end of the drive pinion.

D. Install the snap ring into groove in end of drive pinion with snap ring pliers. **Figure 55.**



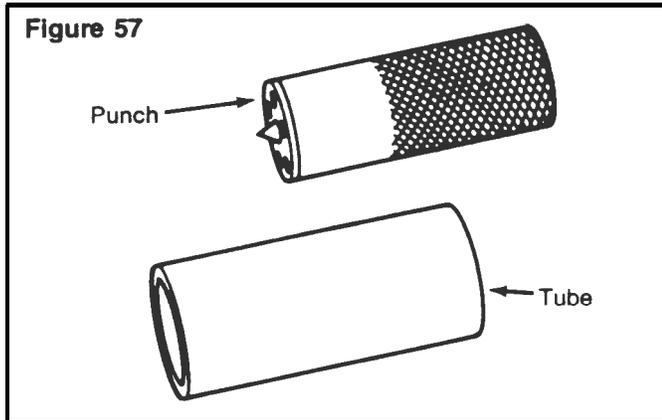
When a peen tool and press (**Figure 57**) are used, calculate the force required on the tool as follows.

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

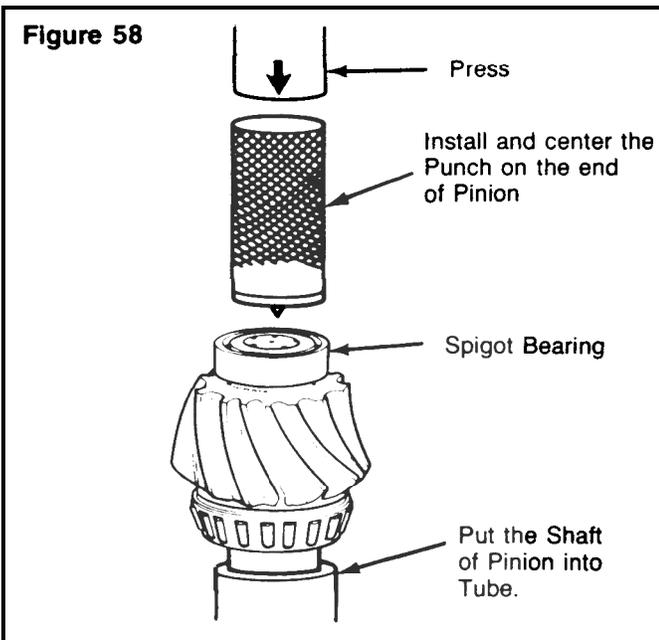
Example: 6,614 lb. x 3 balls = 19,842 pounds

*\*Some Rockwell carriers do not have the parts described.*

For information about the peen tool write to Rockwell International, Communications Department, 2135 West Maple Road, Troy, Michigan 48084. **Figure 57.**



- A. Put the drive pinion and the tube of the peen tool in a press, spigot bearing toward the top. **Figure 58.**
- B. Calculate the amount of force that will be required on the peen tool. See specification and example calculation.



- C. Put the punch of the peen tool over the end of the pinion and spigot bearing. Apply the required amount of force on the punch. **Figure 58.**

### **CAUTION:**

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

- D. 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 peen 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 must be staked in place on RS and RR-160 series rear axles. Before you stake the pinion, you must heat the pinion stem to soften it.*

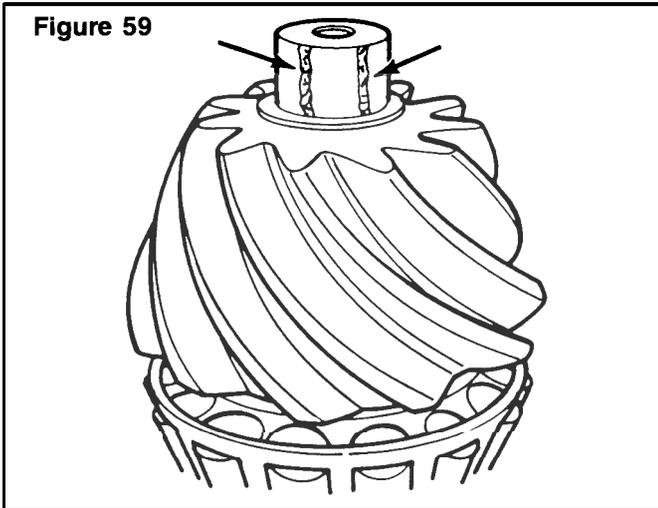
### **NOTE:**

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

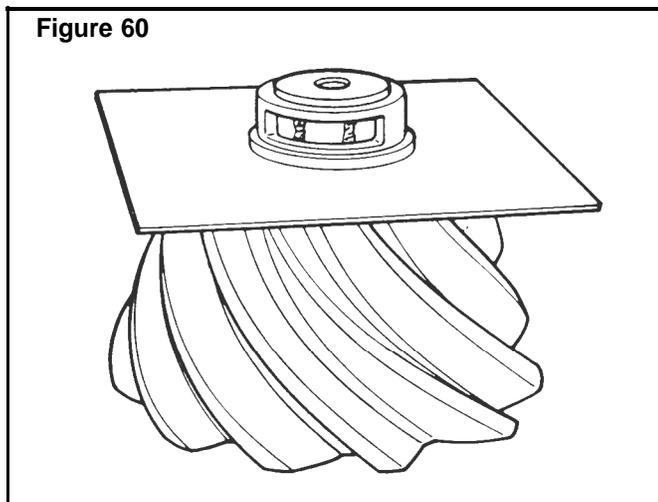
# section 5 Assembly

- A. Apply two stripes of temperature indicating liquid on the pinion stem from the top to the bottom.

**Figure 59.** Apply a green stripe to indicate 400°F and a blue stripe to indicate 500°F.



- B. Put the heating shield over the pinion stem so that you can see the temperature indicating liquid through the hole in the shield. **Figure 60.**



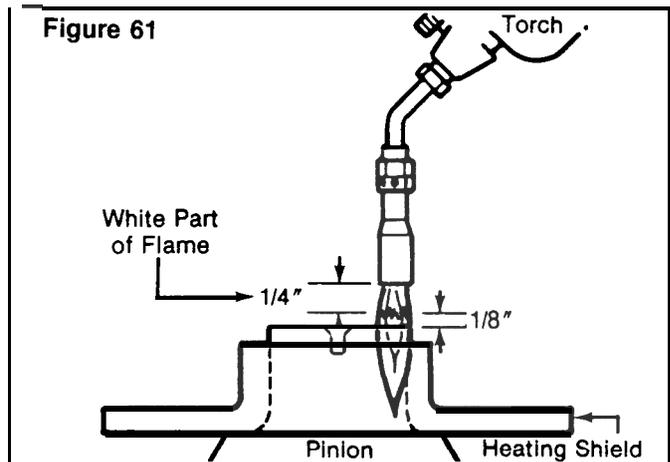
## **WARNING:**

To protect yourself from injury, wear safety glasses when you do steps C-F. Wear heat resistant gloves while you do steps C and D.

## **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 61.** 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.



- 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 hit directly on the new inner race in step E or you will damage the bearing.

- 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 race is completely seated when you cannot fit a 0.002 inch feeler gauge between the race and the pinion shoulder.

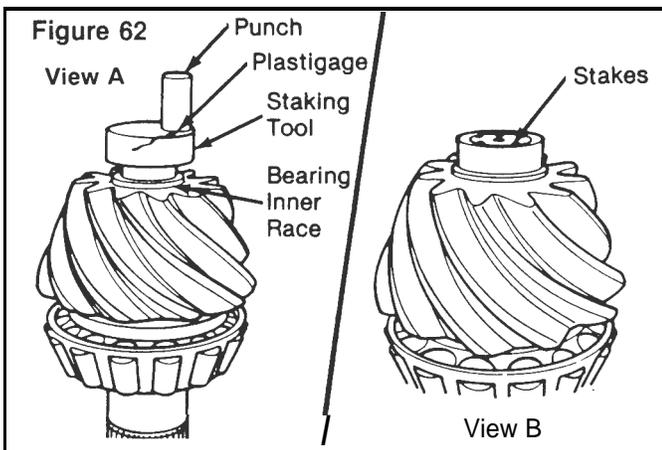
**NOTE:**

If you cannot hold the races in place, try using the staking tool instead of the old race to start the new race on the stem. But, use the old race to completely seat the new race.

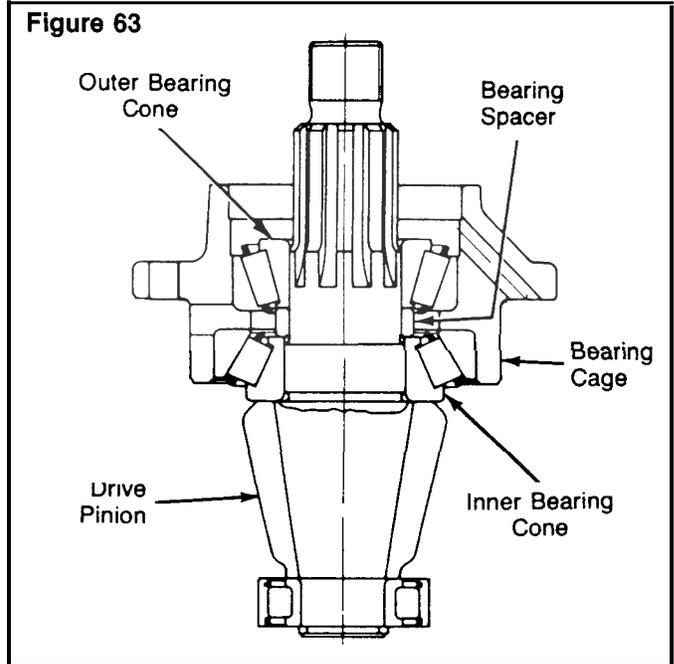
**NOTE:**

In Step F, you do not need to use the plastigage for every stake. Just use it until you are sure you are hitting the punch with the correct force.

- F. Put the staking tool over the bearing race. Cut a one inch piece from the green plastigage strip and put in between the punch and the staking tool. **Figure 62 — View A.** Hit 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 62 — View B.**



- G. 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 on bearing cups in the cage and bearing cones,
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 63.**



**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 63.**

**NOTE:**

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

## Adjust Preload of Pinion Bearings

Specifications:

New pinion bearings -5 to 45 lb.-in. (.56 to 5.08 N.m) torque.

Used pinion bearings in good condition -10 to 30 lb.-in. (1.13 to 3.39 N.m) torque.

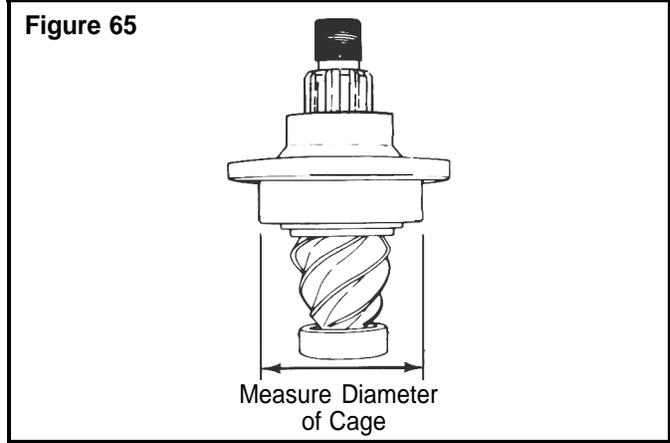
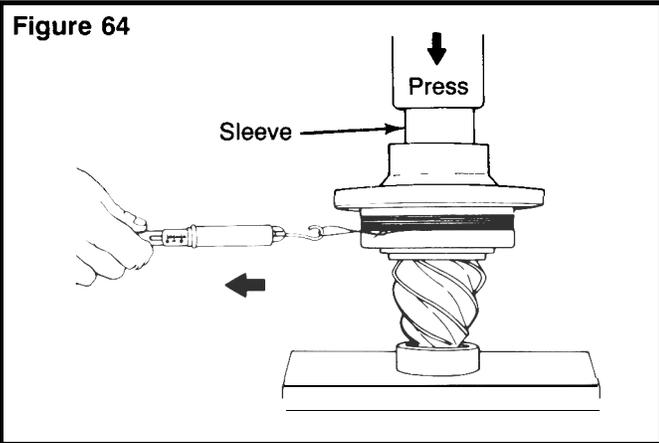
### Press Method

**NOTE:**

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

- A. Put the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom.

# section 5 Assembly



- B. Install a sleeve of the correct size against the inner race of the outer bearing. **Figure 64.**
- C. Apply and hold the correct amount pressure to the pinion bearings. See chart 1. As pressure is applied rotate the bearing cage several times so that bearings make normal contact.
- D. While pressure is held against the assembly, wind a cord around the bearing cage several times.
- E. Attach a spring scale to the end of the cord.
- F. Pull the cord with scale on a horizontal line. As the bearing cage rotates, read the value indicated on scale. Make a note of reading. **Figure 64.**

## NOTE:

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

- G. Measure the diameter of bearing cage where the cord was wound. Measure in inches or centimeters. **Figure 65.**
- H. Divide the dimension in half to get the radius. Make a note of radius dimension.

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

$$\begin{aligned} \text{Pounds pulled} \times \text{Radius (inches)} &= \\ \text{lb.-in. preload} \times .113 &= \text{N.m preload OR} \\ \text{Kilograms pulled} \times \text{Radius (centimeters)} &= \\ \text{kg-cm preload} \times .098 &= \text{N.m preload} \end{aligned}$$

Examples:

$$\begin{aligned} \text{Reading from spring scale} &= 7.5 \text{ pounds (3.4 kg)} \\ \text{Diameter of bearing cage} &= 6.62 \text{ inches (16.8 cm)} \\ \text{Radius of bearing cage} &= 3.31 \text{ inches (8.4 cm)} \\ 7.5 \text{ lb.} \times 3.31 \text{ in.} &= 24.8 \text{ in.-lb. preload} \times .113 \\ &= 2.8 \text{ N.m preload OR} \\ 3.4 \text{ kg} \times 8.4 \text{ cm} &= 28.6 \text{ kg-cm preload} \times .098 \\ &= 2.8 \text{ N.m preload} \end{aligned}$$

- J. If the preload (torque) of pinion bearings is not within specifications, do the following procedure then repeat steps A to I.

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

- K. Check 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.

## CHART 1

Thread Size of Pinion Shaft	Press Pressure Needed on Bearings for Correct Preload. pounds/tons (kg/metric tons)	 Torque Value Needed on Pinion Nut for Correct Bearing Preload. lb.-ft. (N.m)
7/8"-20	22,000 / 11 (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)

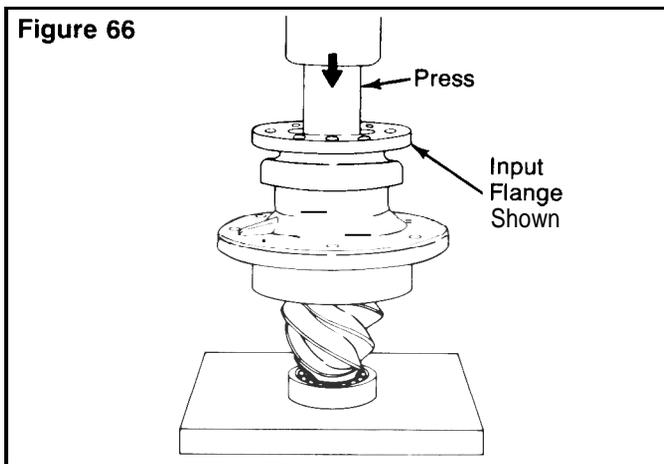
## Yoke or Flange Method

- A. Install the input yoke or flange, nut and washer\* on the drive pinion. The yoke or flange **MUST** be against the outer bearing.

### NOTE:

*If the fit between the yoke or flange splines and drive pinion splines are tight, use a press to install the yoke or flange. Figure 66.*

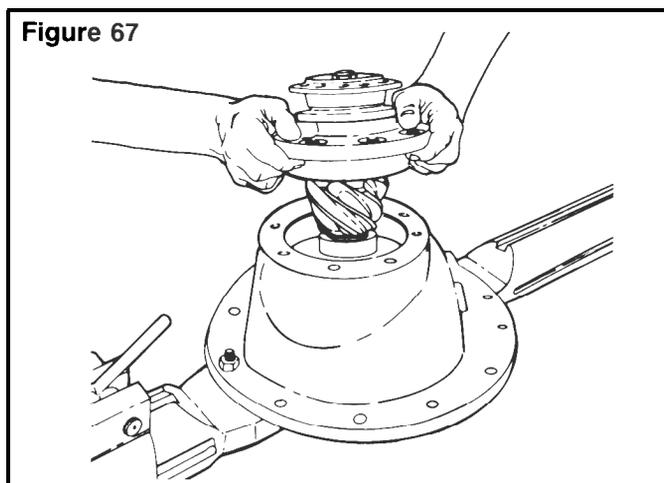
*If a press is not available, use the three piece pilot tool for installation. See the procedure on page 22.*



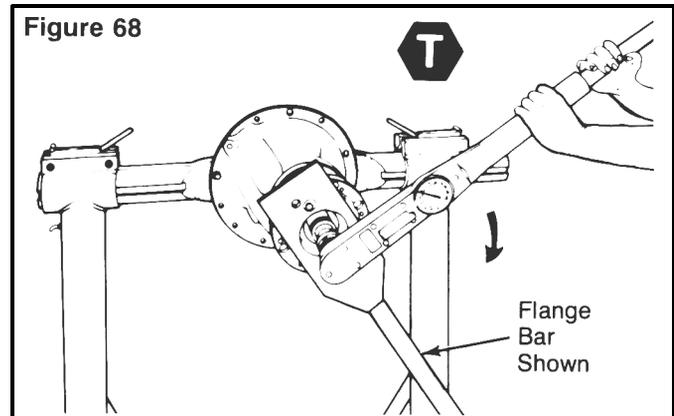
### CAUTION:

*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 67.**



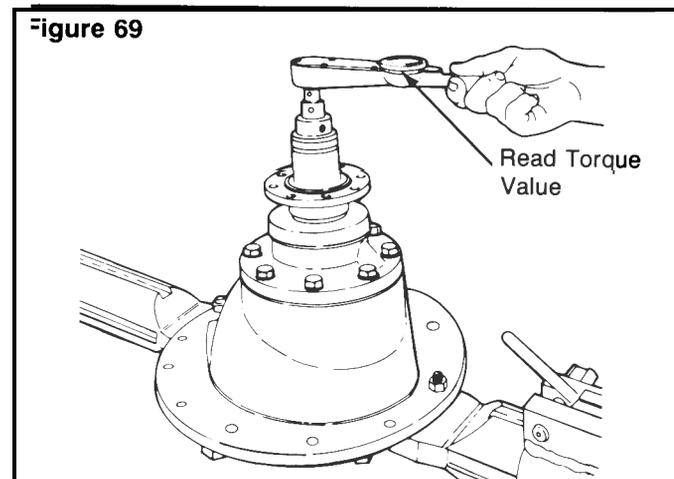
- C. Install the bearing cage to carrier capscrews. Washers are not required at this time. Tighten the capscrews hand tight.
- D. Fasten a yoke or flange bar to the input yoke or flange. The bar will hold the drive pinion in position when the nut is tightened. **Figure 68.**



- E. Tighten the nut on drive pinion to the correct torque value. **Figure 68.** See 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 69.**



*\*Some Rockwell carriers do not have the parts described.*

# section 5 Assembly

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 to 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 to 5 on page 10.

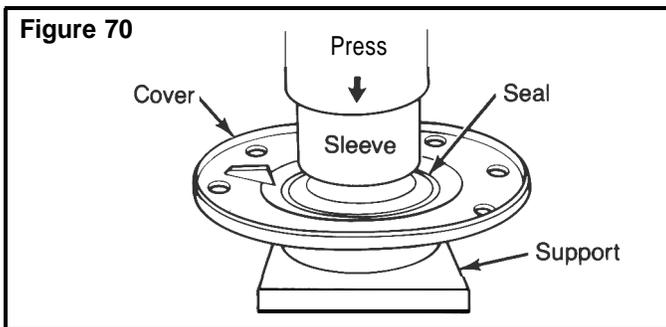
11. If the carrier has a cover and seal assembly over the bearing cage, install a new seal into cover as follows.

A. Apply Lubriplate or grease used for wheel bearings to the seal lips and cavities between lips. The Rockwell specification for grease is 0-617-A, O-617-B or equivalent.

B. Apply a sealing compound on the outer diameter of seal.

C. Put the cover in a press, large diameter toward the top.

D. Support the cover under the small diameter opening with metal or wood blocks. **Figure 70.**



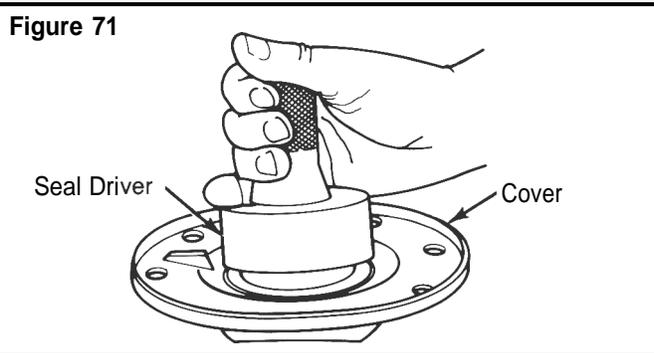
E. Press the seal into cover until seal is flat against the bottom of bore. Use a sleeve or seal driver of the correct size that fits against the metal retainer of seal. **Figure 70.**

## NOTE:

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

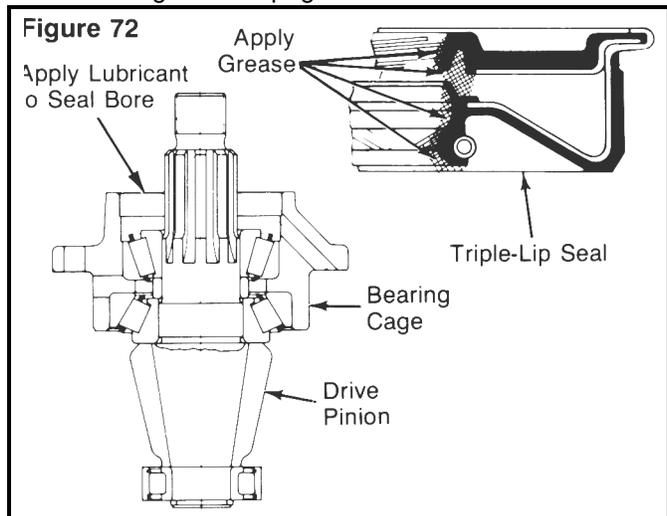
## WARNING:

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



12. If the pinion seal mounts directly into the bearing cage, install a new triple-lip seal as follows.

A. The old triple-lip seal can be installed into the bearing cage if the seal is not worn or damaged. See page 12.



B. 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 72.**



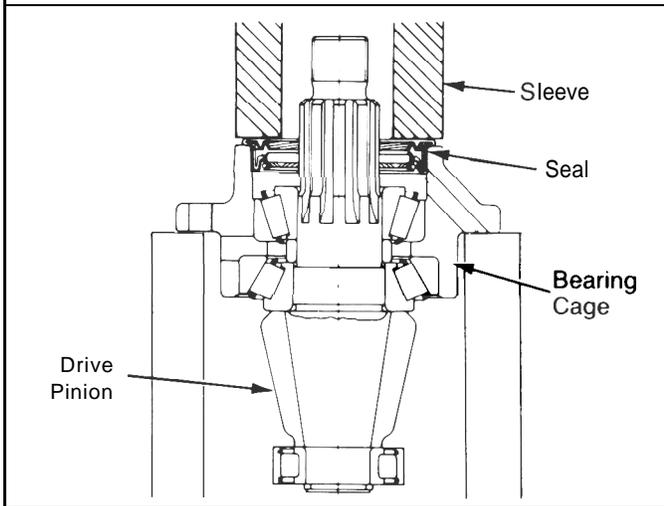
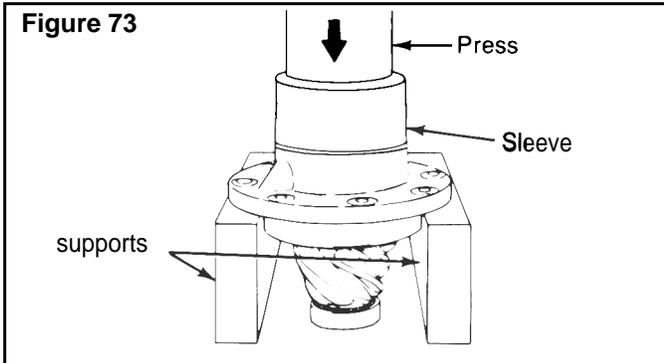
## CAUTION:

**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.**

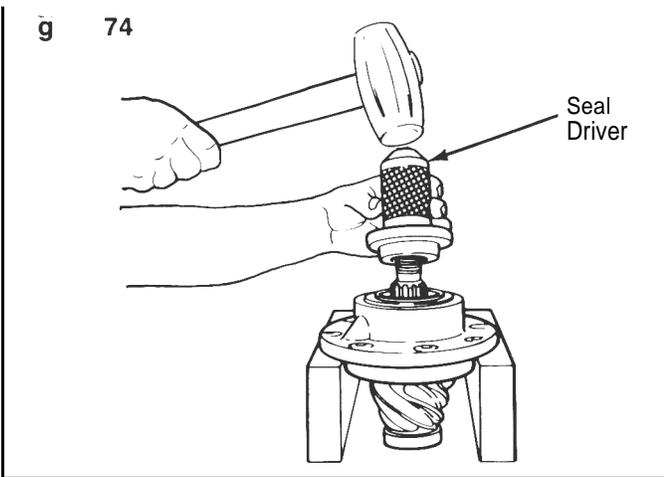
C. On reused seals, apply Lubriplate or wheel bearing grease to the seal lips.

D. Put the drive pinion and cage assembly in a press, seal bore toward the top.

E. 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 73.**

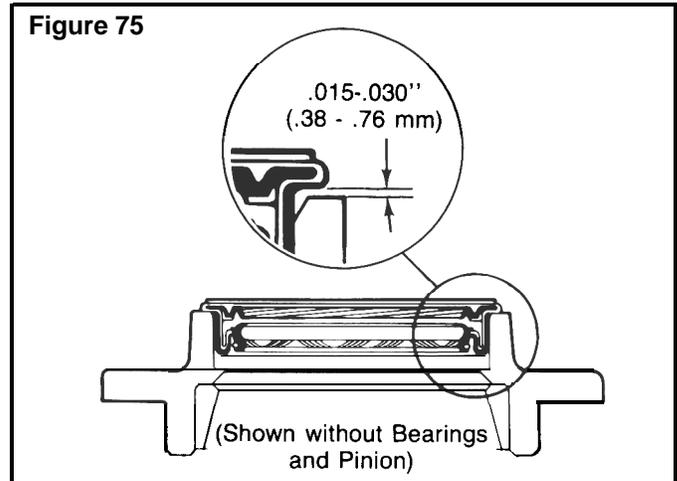


**NOTE:**  
If a press is not available, use a mallet and the sleeve or driver to install the seal. Figure 74.



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

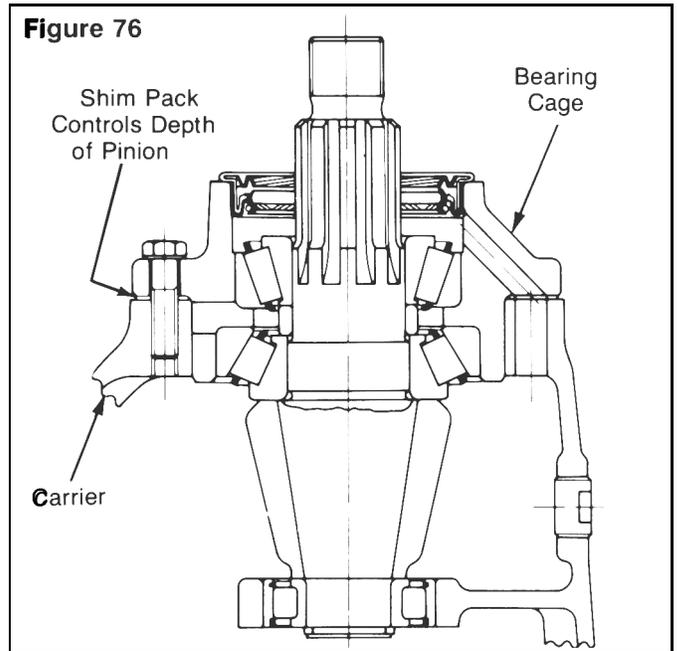
F. After the triple-lip seal is installed, a gap of approximately .015 to .030 inch (.38 to .76 mm) between the flange and bearing cage is normal. Figure 75.



Check the gap with a feeler gauge at several points around the seal. The gap must be within .015 to .030 inch (.38 to .76 mm). The difference between the largest and smallest gap measurement MUST NOT exceed .010 inch.

**Adjust Thickness of Shim Pack for the Pinion Cage (Depth of Pinion)**

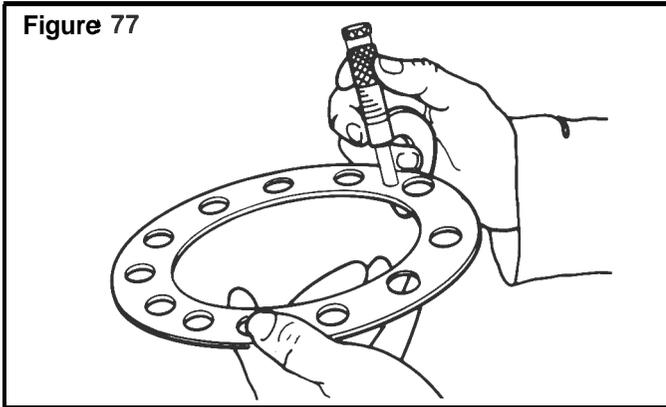
**NOTE:**  
Use this procedure if a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted. Figure 76.



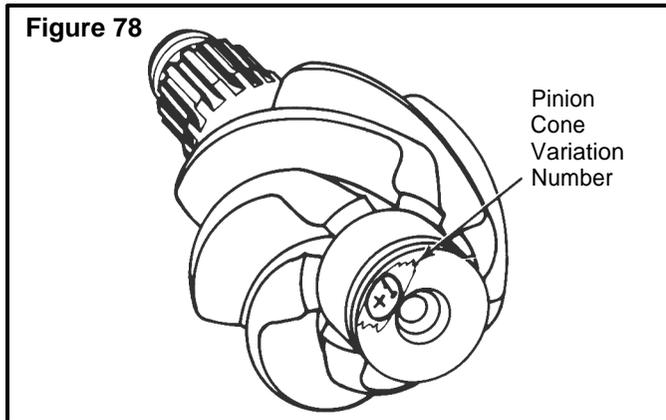
# section 5 Assembly

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

Figure 77.



2. Look at the pinion cone ("PC") variation number on the old drive pinion that is "being replaced. See Gear Set Information, step 4 on page 25 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. **Figure 78.**



**NOTE:**

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

PC+ 3, PC-3, + 3 or -3 equal .003 inch.  
 PC+ .03, PC-.03 mm, + .03 mm or -.03 equal .03 m m

To change inches to millimeters, multiply inches by 25.40  
 To change millimeters to inches, multiply millimeters by 0.039

3. If the old pinion cone number is a plus (+), 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 (-), 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 (+), 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 (-), subtract the number from the standard shim pack thickness that was calculated in step 3 or 4.

**NOTE:**

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

Chart 2

Examples:	Inches	mm
1. Old Shim Pack Thickness	.030	.76
Old PC Number, PC+2(+.05 mm)-	.002	.05
Standard Shim Pack Thickness	.028	.71
New PC Number, PC+5(+.13 mm)+	.005	.13
New Shim Pack Thickness	.033	.84
2. Old Shim Pack Thickness	.030	.76
Old PC Number, PC-2 (-.05 mm)	+ .002	+ .05
Standard Shim Pack Thickness	.032	.81
New PC Number, PC+5(+.13 mm)+	.005	+ .13
New Shim Pack Thickness	.037	.94
3. Old Shim Pack Thickness	.030	.76
Old PC Number, PC+ 2( +.05 mm)-	.002	-.05
Standard Shim Pack Thickness	.028	.71
New PC Number, PC-5 (-.13 mm) -	.005	-.13
New Shim Pack Thickness	.023	.58
4. Old Shim Pack Thickness	.030	.76
Old PC Number, PC-2 (-.05 mm)	+ .002	+ .05
Standard Shim Pack Thickness	.032	.81
New PC Number, PC-5(-.13 mm) -	.005	-.13
New Shim Pack Thickness	.027	.68

**IMPORTANT** Remember, that Rockwell drive pinions and ring gears MUST be replaced as matched sets.

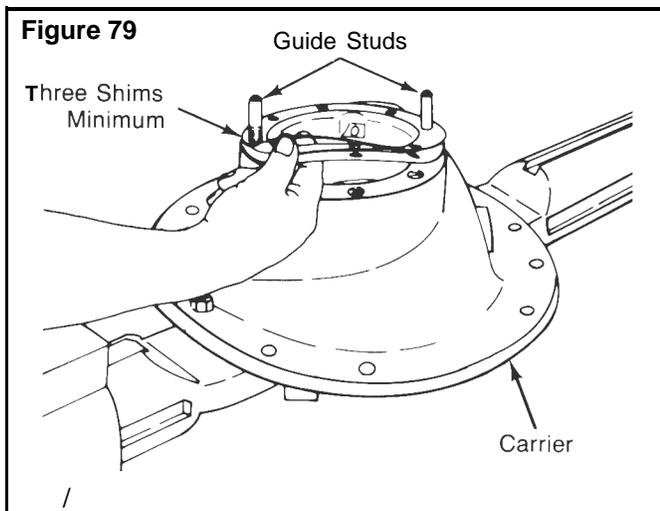
8. Install the drive pinion, bearing cage and new shim pack into the carrier.

## Install 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. See the procedure to Adjust Thickness Of Shim Pack For The Pinion Cage on page 35.*

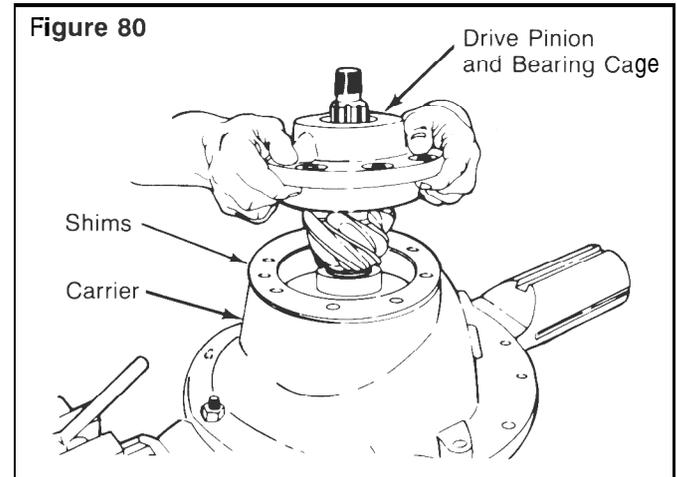
1. Install the correct shim pack between the bearing cage and carrier. **Figure 79.**
2. Align the oil slots in the shims with oil slots in the bearing cage and carrier. The use of guide studs will help align the shims. **Figure 79.**



### NOTE:

*Use a minimum of three shims in a pack. If the pack is made from different thickness shims, install the thinnest shims on both sides of the pack for maximum sealing.*

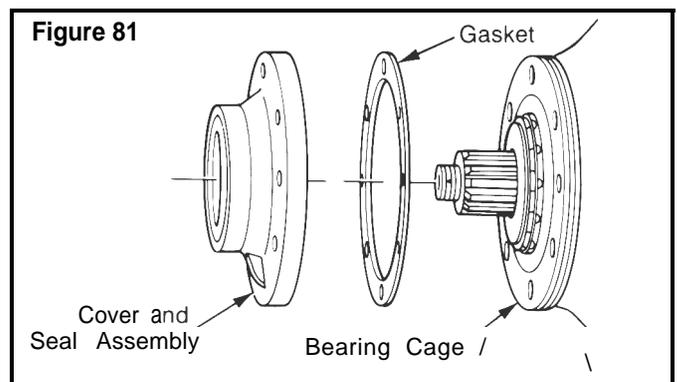
3. Install the drive pinion and bearing cage into the carrier. If necessary, use a rubber, plastic or leather mallet to hit the assembly into position. **Figure 80.**



### **WARNING:**

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

4. If used, install the cover\* and seal assembly and gasket\* over the bearing cage. **Figure 81.**

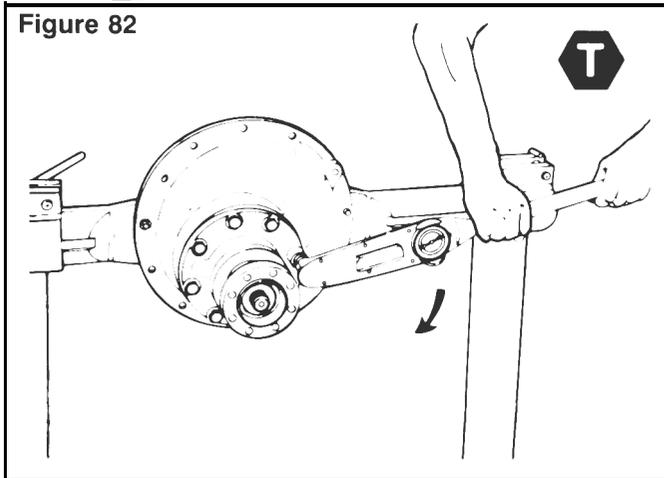


5. Align the oil slots in the cover\* and gasket\* with oil slot in the bearing cage.

● Some Rockwell carriers do not have the parts described.

# section 5 Assembly

6. Install the bearing cage to carrier capscrews and washers. Tighten capscrews to correct torque value. See the torque chart on page 65. **Figure 82.**



7. Install the input yoke or flange, nut and washer\* on the drive pinion. The yoke or flange **MUST** be against the outer bearing.

### NOTE:

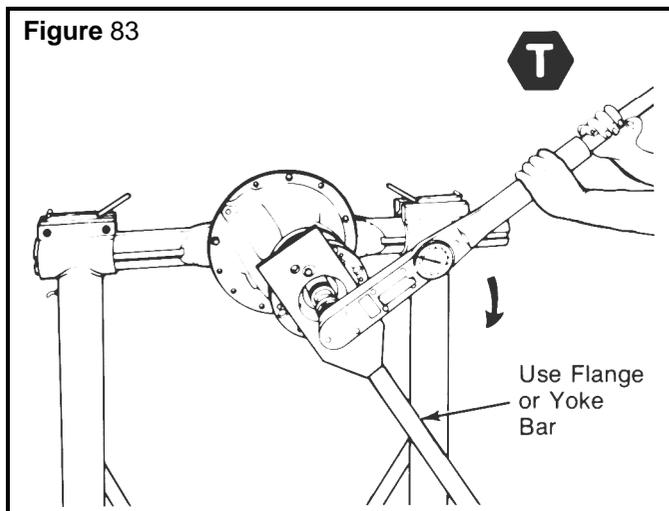
*If the fit between the yoke or flange splines and drive pinion splines is tight, use the three-piece pilot tool for installation. See the procedure on page 22.*



### 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.*

8. Tighten the pinion nut to the correct torque value. See the torque chart on page 65. **Figure 83.**



## 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 pads will cause gear runout that exceeds the Rockwell specification of .008 inch (0.2 mm)*

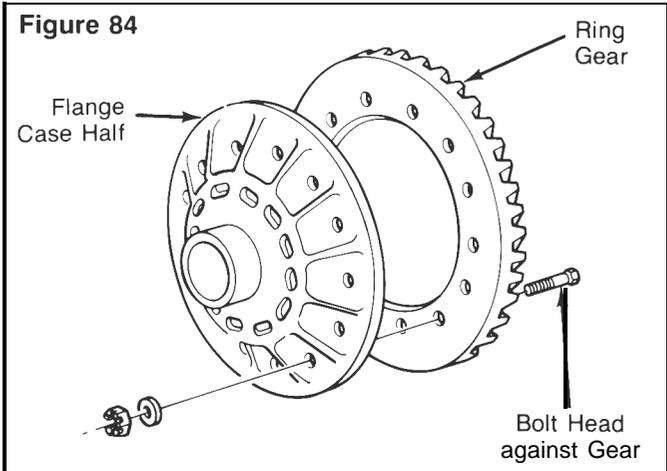
1. Expand the ring gear by heating the gear in a tank of water to a temperature of 160°F to 180° F (71°C to 82°C) for 10 to 15 minutes.



### WARNING:

*Wear safe clothing and gloves that will protect you from injury when you touch 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. 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 84.**



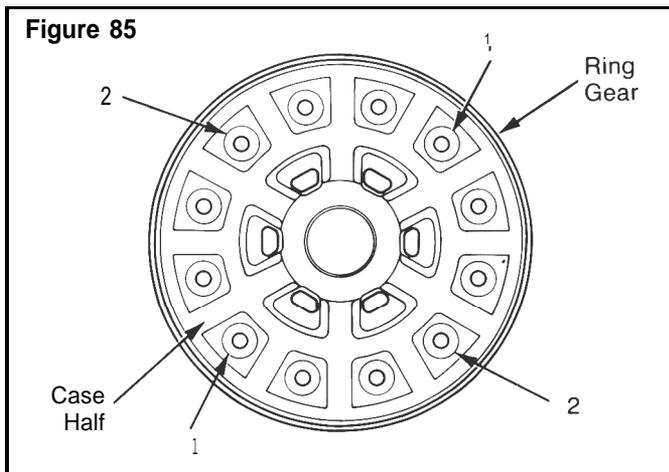
6. Tighten the bolts\* and nuts\* to the correct torque value. See the torque chart on page 65. **Figure 84.**
7. If rivets\* are used to hold the ring gear to the flange case half, install the rivets\* as follows:

*\*Some Rockwell carriers do not have the parts described.*

**! CAUTION:**

**Do not heat rivets before installation. Use only cold rivets to fasten the ring gear correctly on the flange case half.**

- A. Install the correct size rivets\* in pairs opposite each other from the case half side of the assembly. The rivet\* heads **MUST** be against the flange case half. **Figure 85.**



- B. Press the rivets\* into position from the ring gear side of the assembly. Use a riveter machine and apply the correct amount of pressure. See Chart 3 for rivet pressures.

**Chart 3**

Diameter of Rivet Body		Press Pressure Needed to Install Rivets	
inch (mm)	pounds / tons	kilograms / metric tons	
.438 (11.13)	44,000 / 22	19958 / 20	
.500 (12.70)	60,000 / 30	27216 / 27.2	
.563 (14.30)	72,000 / 36	32659 / 32.7	
.625 (15.88)	90,000 / 45	40824 / 40.8	

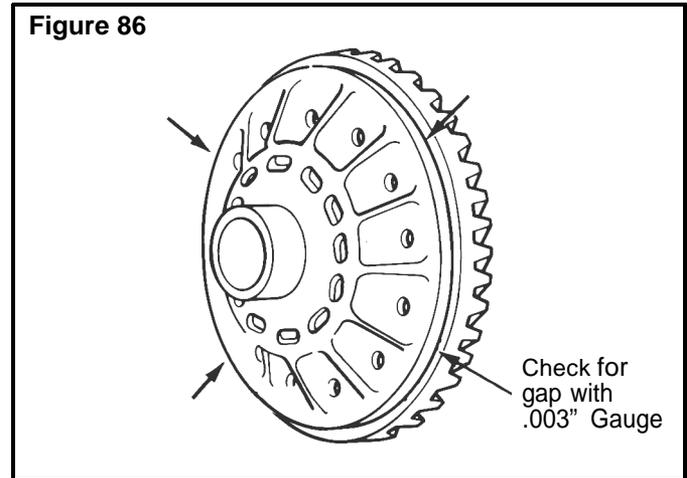
**! CAUTION:**

**The pressure on rivets must be held for approximately one minute so that the rivet body will fill the hole.**

- C. After the rivets are installed, check for gaps between the back surface of the ring gear and the case flange. Use a .003 inch (.08 mm) feeler gauge and check at four points around the assembly. **Figure 86.**

If the gauge fits more than one half the distance between the outer diameter of the flange and the pilot diameter of the gear, remove the ring gear. See the procedure on page 9 and the following steps D and E. If the gap is less than .003 inch (.08 mm), continue by following step 8.

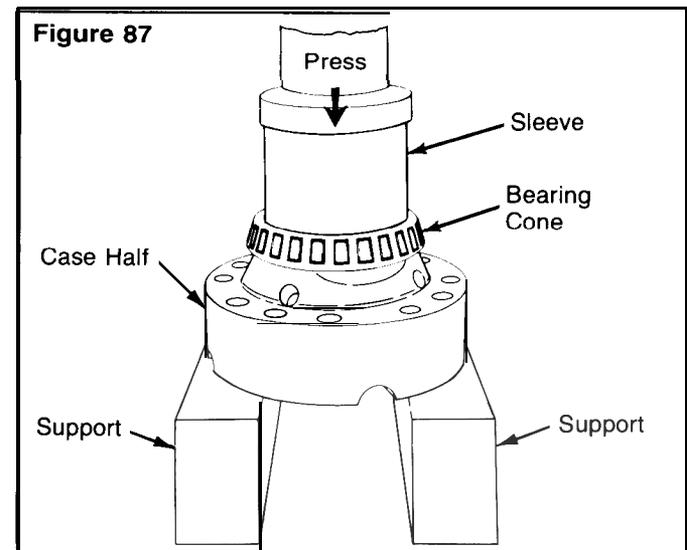
**Figure 86**



- D. Check the flange case half and ring gear for the problem that causes the gap. Repair or replace parts.
- E. After the parts are repaired or replaced, assemble the ring gear on the flange case half. Repeat the procedure on page 38, and steps A to C on this page.

8. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size. **Figure 87.**

**Figure 87**

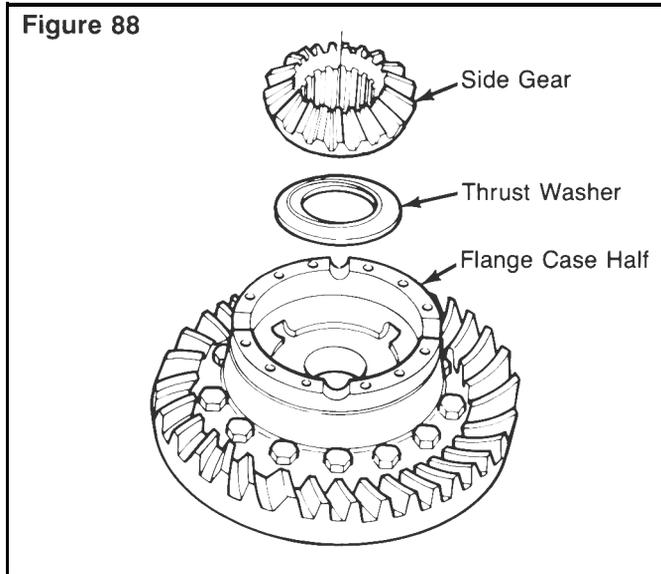


9. Apply axle lubricant on the inside surfaces of both case halves, spider (cross), thrust washers, side gears and differential pinions.
10. Put the flange case half on a bench, ring gear teeth toward top.

● Some Rockwell carriers do not have the parts described.

# section 5 Assembly

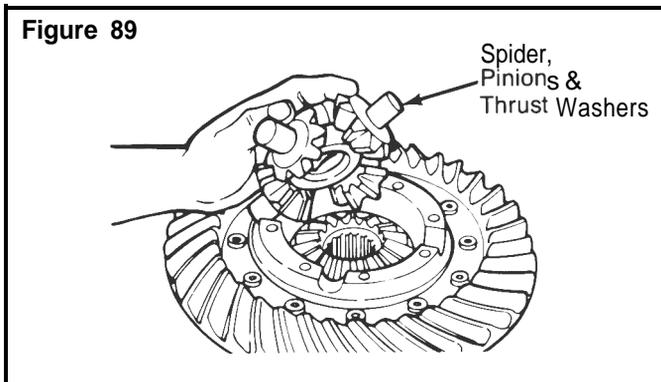
11. Install one thrust washer and side gear into the flange case half. **Figure 88.**



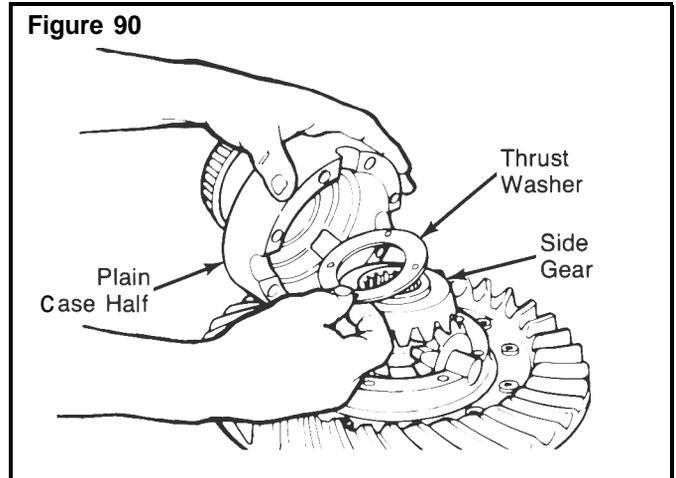
## CAUTION:

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

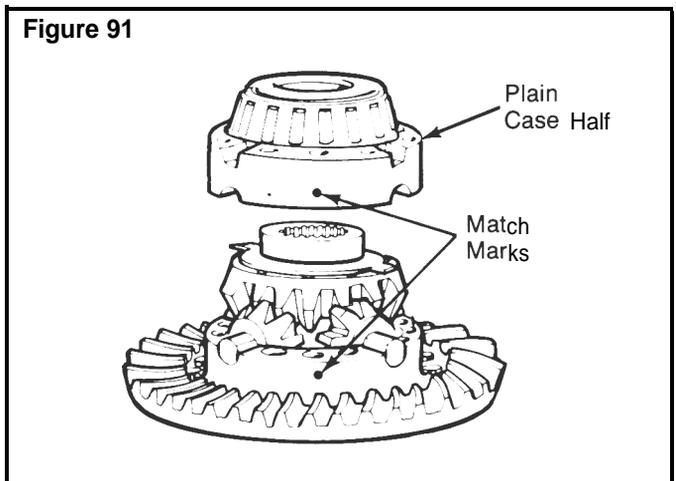
12. Install the spider (cross), differential pinions and thrust washers into the flange case half. **Figure 89.**



13. Install the second side gear and thrust washer over spider and differential pinions. **Figure 90.**



14. Put the plain half of the differential case over the flange half and gears. Rotate the plain half as needed to align the match marks. **Figure 90 and 91.**

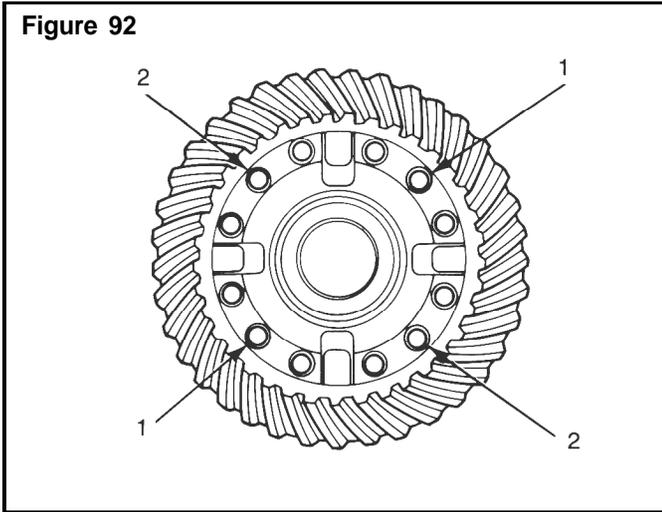


15. Install Dri-Loc fasteners into the case halves. See the procedures on page 20 and the following steps A and B.

- A. 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 pattern opposite each other. **Figure 92** and see torque chart on page 65.



\*Some Rockwell carriers do not have the parts described.



**Figure 92**

B. Install the other fasteners into the case halves. Tighten the fasteners to the correct torque value. See the torque chart on page 65. **T**

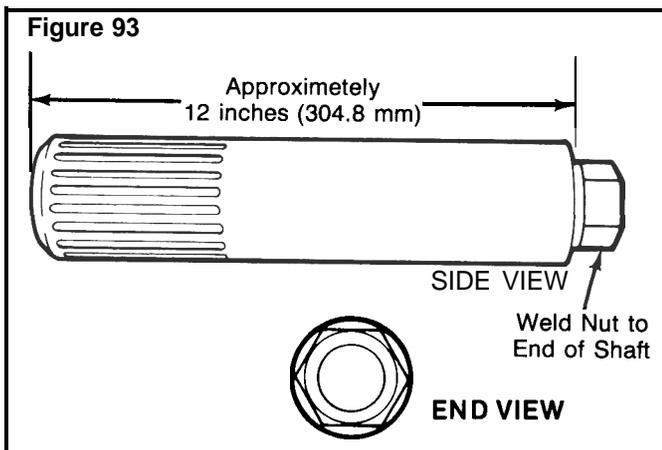
16. Check the rotating resistance of the differential gears. Use the following procedure.

### Rotating Resistance Check of Differential Gears

Specification:  
50 lb.-ft. (67.8 N.m) torque maximum applied to one side gear.

#### NOTE:

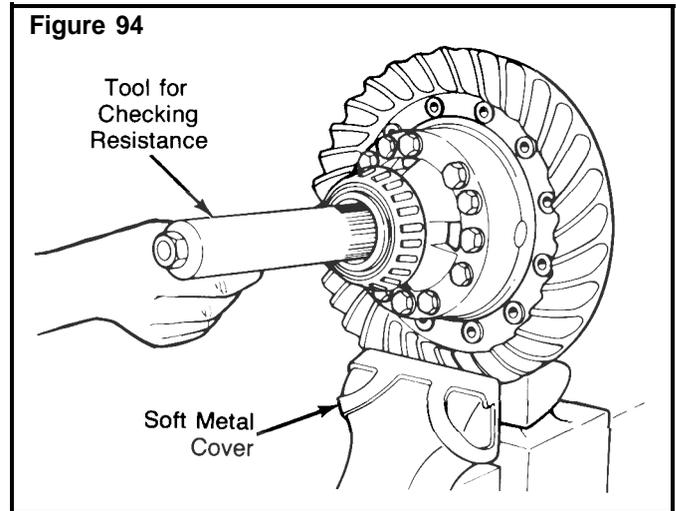
*Make a tool for checking the rotating resistance of the differential gears. The tool can be made from an axle shaft that matches the spline size of the differential side gear. See Figure 93.*



A. Install soft metal covers over vise jaws to protect the ring gear. **Figure 94.**

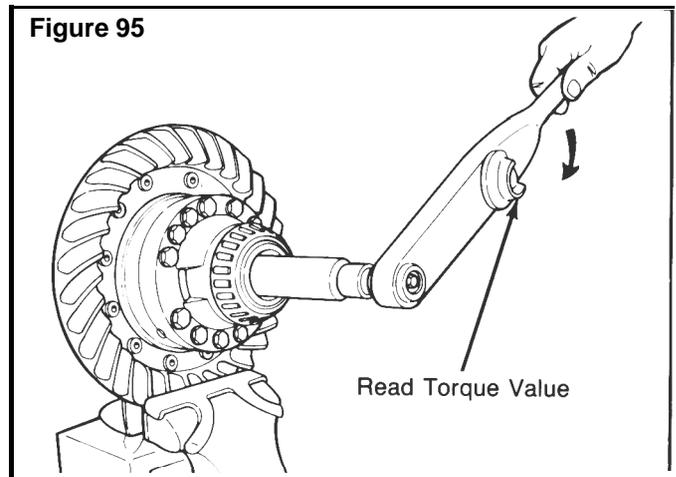
B. Put the differential and ring gear assembly in the vise.

C. Install the tool into the differential until the splines of the tool and one side gear are engaged. **Figure 94.**



**Figure 94**

D. Attach 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 95.**



**Figure 95**

E. If the torque value exceeds the specification, disassemble the differential gears from the case halves.

F. Check the case halves, spider, gears and thrust washers for the problem that causes the torque value to exceed the specification. Repair or replace parts.

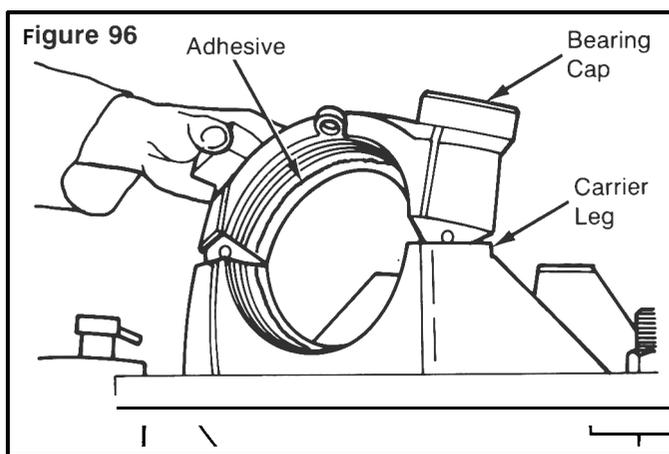
17. After the parts are repaired or replaced, assemble the parts and repeat steps A to F.

*Some Rockwell carriers do not have the parts described.*

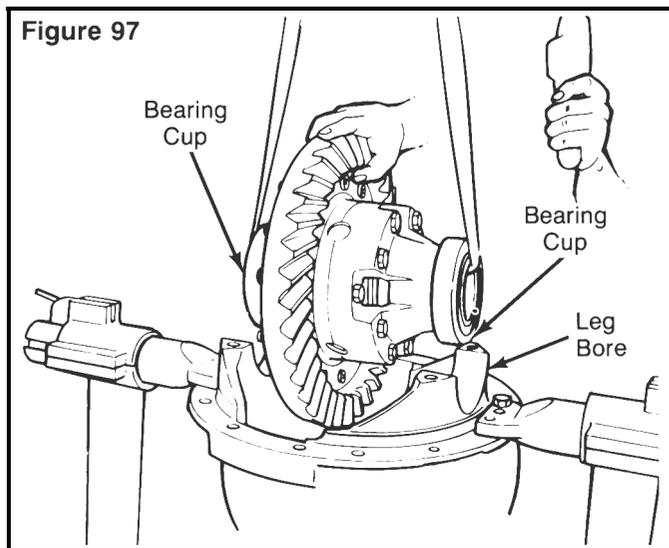
# section 5 Assembly

## Install the Differential and Ring Gear Assembly

1. Clean and dry the bearing cups and bores of the carrier legs and bearing caps.
2. Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are assembled on the case halves.
3. Apply Rockwell Adhesive in the bearing bores of the carrier legs and bearing caps. See the procedure on page 21. **Figure 96.**

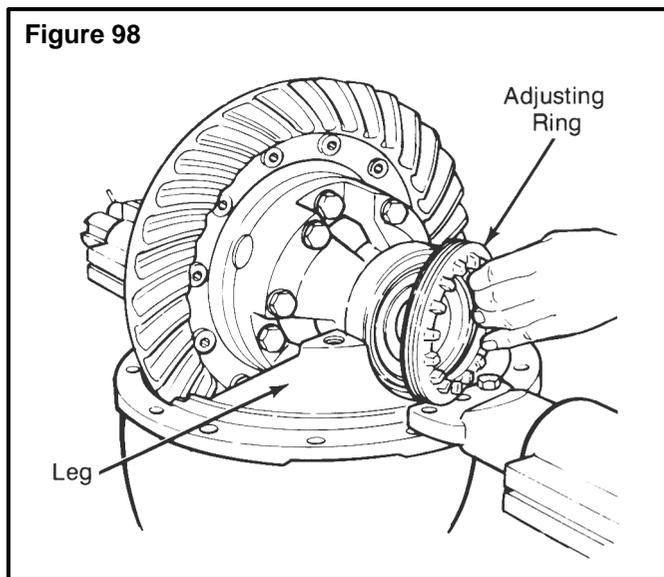


4. Install the bearing cups over the bearing cones that are assembled on the case halves. **Figure 97.**

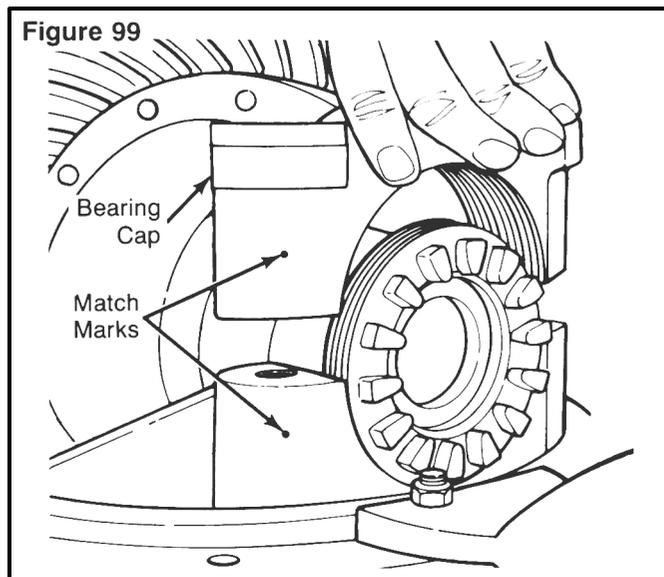


5. Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups **MUST** be flat against the bores between the carrier legs. **Figure 97.**

6. Install both of the bearing adjusting rings into position between the carrier legs. Turn each adjusting ring hand tight against the bearing cup. **Figure 98.**



7. Install the bearing caps over the bearings and adjusting rings in the correct location as marked before removal. **Figure 99.**



**! WARNING:**  
*Wear safe eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause injury.*

8. Hit each bearing cap into position 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 correct locations, the bores and threads in caps will not match the carrier. You will have problems assembling the caps on the carrier and damage to parts can occur. Do not force the bearing caps into position.*

9. If bearing caps do not correctly fit into position, check the alignment of match marks between caps and carrier. Remove the caps and repeat steps 6 to 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. See the torque chart on page 65.



## **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 check tooth contact patterns.*

## **Adjust Preload of Differential Bearings**

Specifications:

Preload of differential bearings - all carrier models - 15 to 35 lb.-in. (1.7 to 3.9 N.m) torque.

or

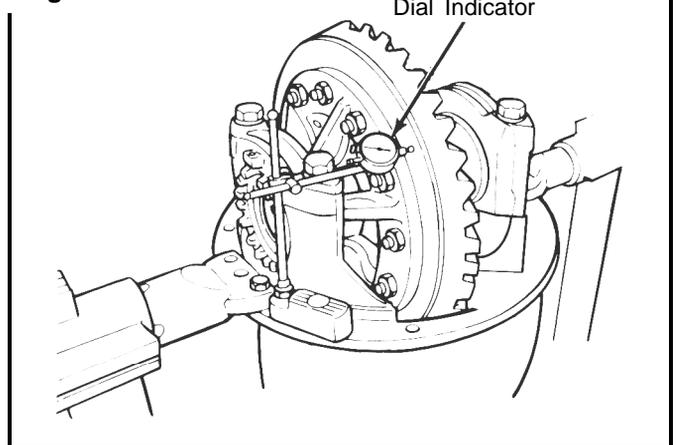
Expansion between bearing caps - RS-140 and RS-145 carrier models -.003 to .009 inch (.08 to .22 mm)

All other carrier models -.006 to .013 inch (.15 to .33 mm)

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 100.**

**Figure 100**

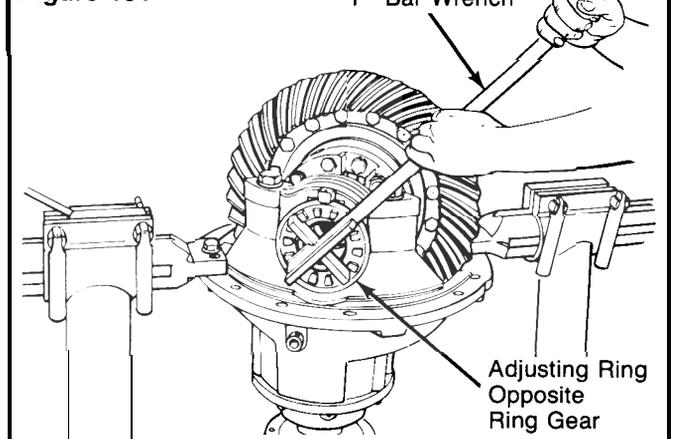


## **CAUTION:**

*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 101.***

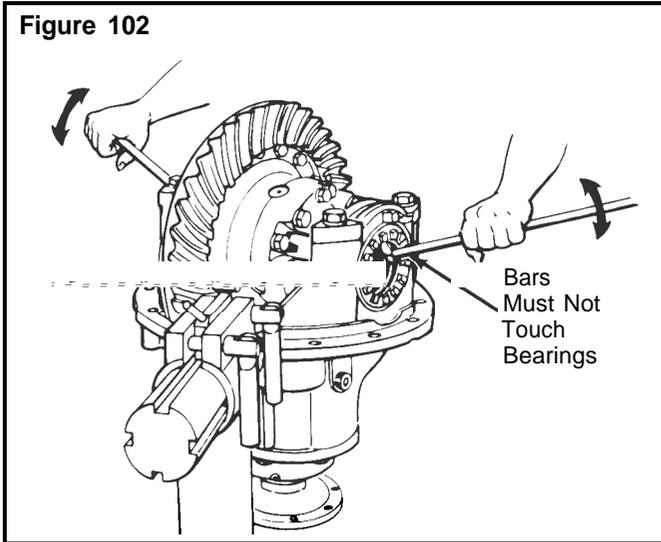
3. Loosen the bearing adjusting ring that is opposite the ring gear so that a small amount of end play shows on the dial indicator. **Figure 101.** Move the differential and ring gear to the left and right with pry bars while you read the dial indicator. Use the following step A or B.

**Figure 101**

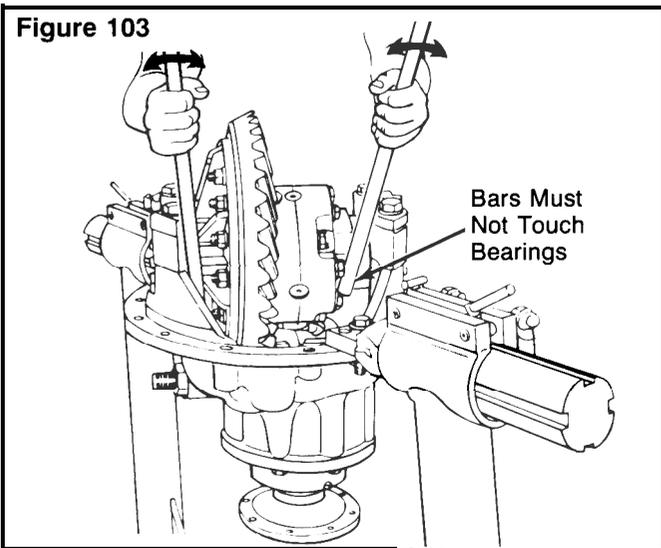


\*Some Rockwell carriers do not have the parts described,

- A. Use two pry bars that fit between the bearing adjusting rings and ends of the differential case. The pry-bar **MUST NOT** touch the differential bearings. **Figure 102.**



- 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 103.**

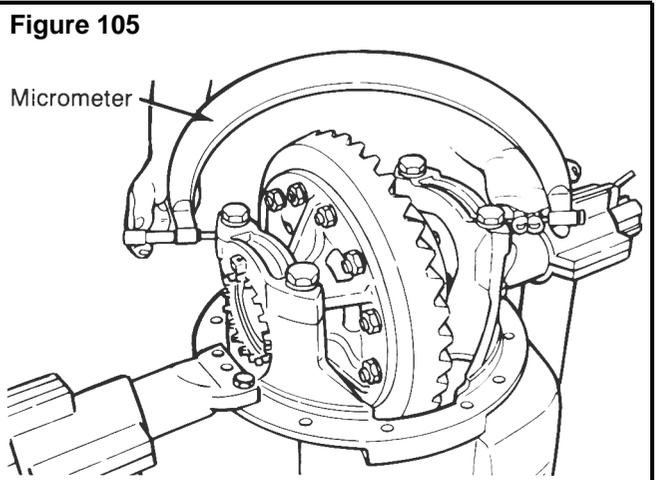
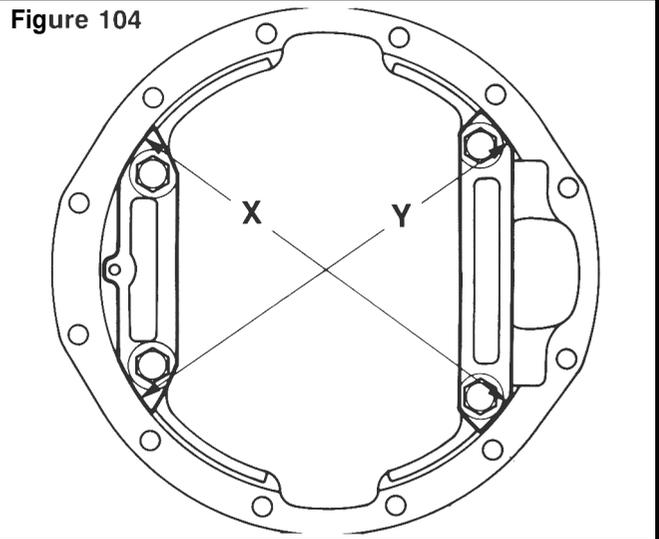


4. Tighten the same bearing adjusting ring so that no end play shows on the dial indicator. Move the differential and ring gear to the left and right as needed. Repeat step A or B.
5. Tighten each bearing adjusting ring one notch from the zero end play measured in step 4.
6. Continue by checking runout of the ring gear.

Method 2.

A second method of checking preload is to measure the expansion between the bearing caps after you tighten the adjusting rings. 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 104 and 105.** Make a note of the measurement.



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 a Q-100 carrier,

Distance X or Y before tightening adjusting rings = 15.315 inch (389.00 mm).  
 Distance X or Y after tightening adjusting rings = 15.324 inch (389.23 mm)

15.324 inch - 15.315 inch = .009 inch (.23 mm) difference.

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

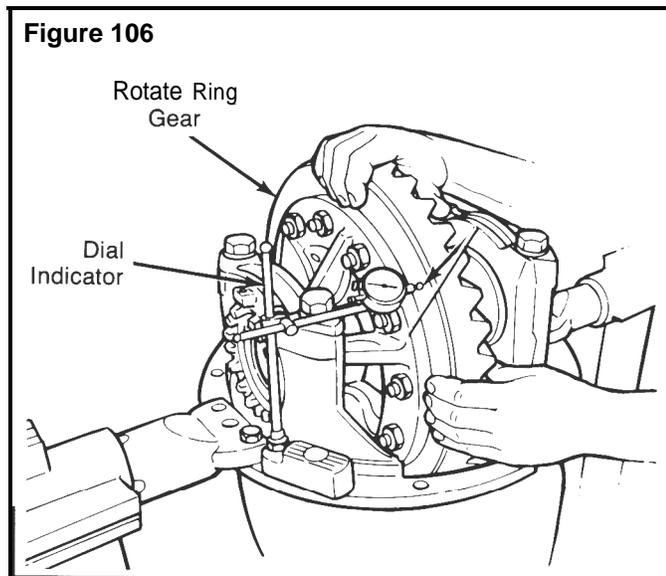
If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. See the procedure on page 5 and the following steps 5 and 6.

5. Check 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. See the procedure on page 42.
7. Repeat preload adjustment of differential bearings.

## Check Runout of Ring Gear

Specification:  
 .008 inch (.20 mm)

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 106.**

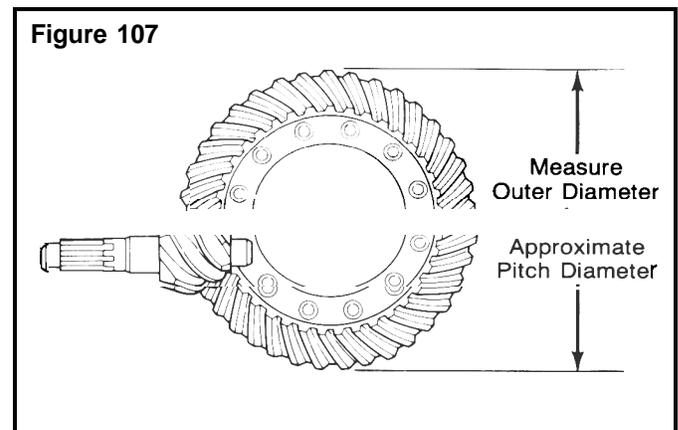


2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Adjust the dial of the indicator to zero (0).
4. Rotate the differential and ring gear while you read the dial indicator. The runout of the ring gear **MUST NOT EXCEED .008 inch (.20 mm).** **Figure 106.**

## Adjust Backlash of the Ring Gear

Specifications:  
 Ring gears that have a pitch diameter of less than 17 inches (431.8 mm).  
 Range of backlash setting -.008 to .018 inch (.20 to .46 mm).  
 Backlash setting for new gear sets -.012 inch (.30 mm).

Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater than 17 inches.  
 Range of backlash setting -.010 to .020 inch (.25 to .51 mm).  
 Backlash setting for new gear sets -.015 inch (.38 mm)



**NOTE:**  
 Measure the outer diameter of ring gear for approximate pitch diameter. **Figure 107.**

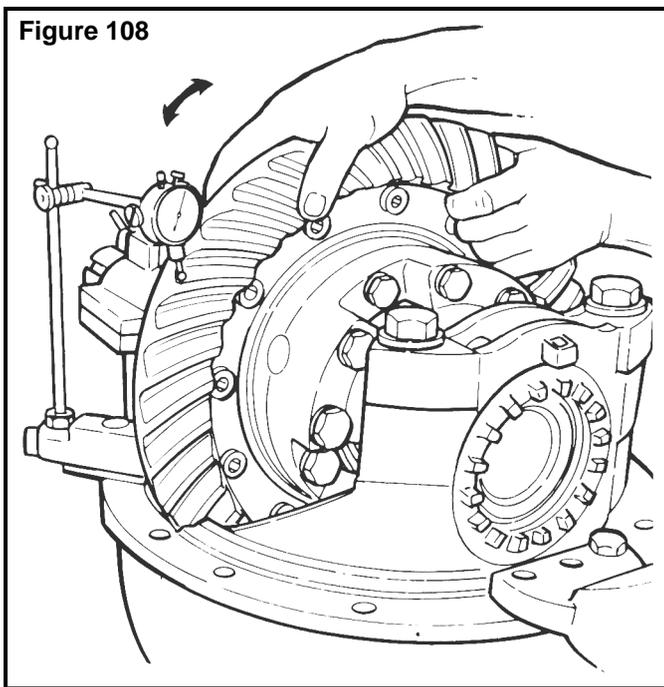
# section 5 Assembly

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.

During the check of tooth contact patterns, the backlash can be adjusted within specification limits, if needed, to change the location of the pattern.

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 108.**

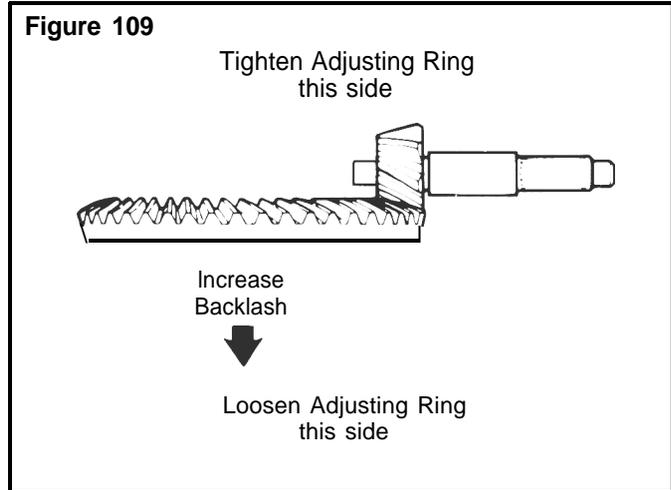


2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. **Figure 108.**
3. Adjust the dial of the indicator to zero (0).
4. Hold the drive pinion in position.
5. While you read the dial indicator, rotate the differential and ring gear a small amount in both directions, against teeth of the drive pinion. If the backlash reading is within specification, continue by checking tooth contact patterns. If the backlash reading is not within specifications, adjust backlash as needed. Continue by following steps 6 and 7.

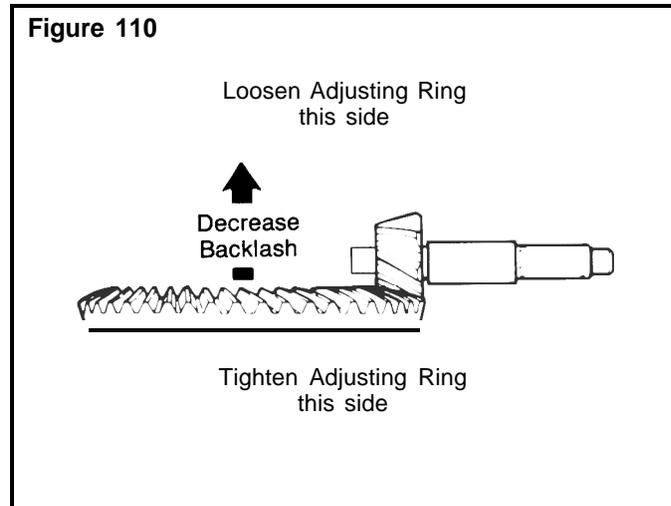
## NOTE:

**Backlash is increased by moving the ring gear away from the drive pinion. Figure 109.**

**Backlash is decreased by moving the ring gear toward the drive pinion. Figure 110.**



6. Loosen one bearing adjusting ring one notch then tighten the opposite ring the same amount. **See Figures 109 and 110.**



## NOTE:

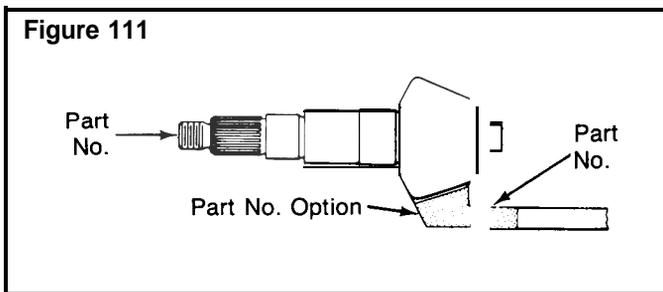
**When you adjust backlash, move the ring gear ONLY DO NOT move the drive pinion.**

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

## Check Tooth Contact Patterns of the Gear Set

### General Information

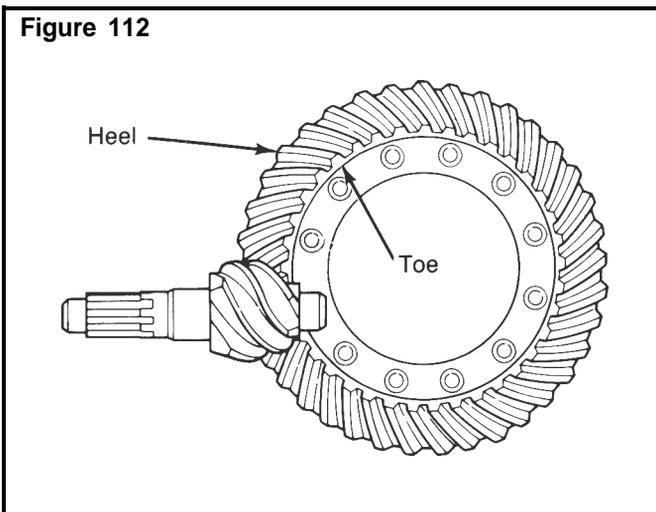
Rockwell carriers can have a conventional hypoid gear set or a GENEROID hypoid gear set. The tooth contact patterns for each type of gear set are different. Look at the part numbers to see what type of gear set is in the carrier. See **Figure 111** for the location of part numbers.



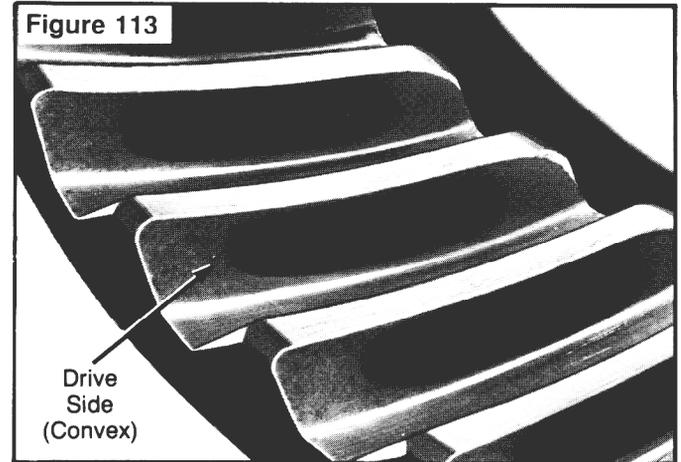
Examples of part numbers for conventional gear sets,  
36786 for the ring gear.  
36787 for the drive pinion.

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.

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 112**.

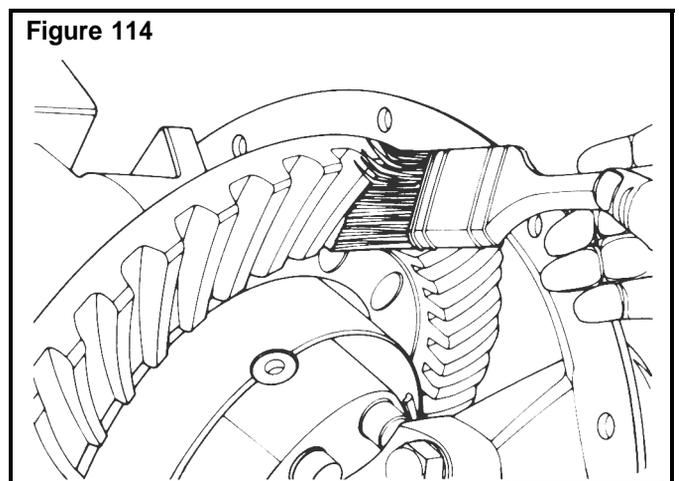


Always check tooth contact patterns on the drive side of the gear teeth. **Figure 113**.



### Tooth Contact Patterns of Conventional Hypoid and Generoid Hypoid Gear Sets

1. Adjust the backlash of a new gear set to either .012 inch (.30 mm) or .015 inch (.38 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. See the procedure on page 45.
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 114**.



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.

### Conventional Gears

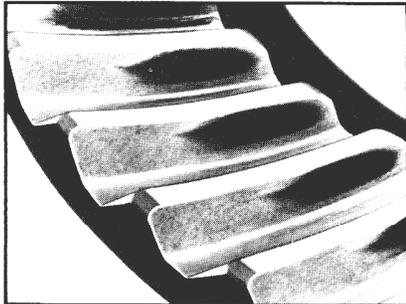


Figure 115A  
Good Hand Rolled Pattern

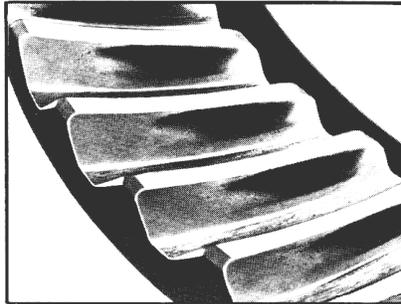


Figure 116A  
High Pattern

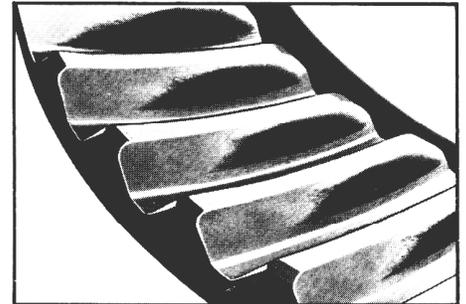


Figure 117A  
Low Pattern

### Generoid Gears

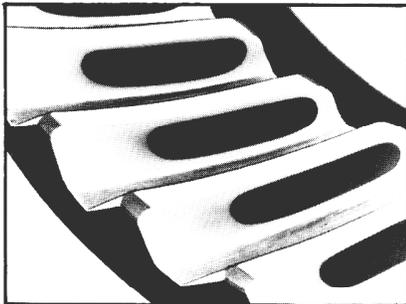


Figure 115B  
Good Hand Roller Pattern

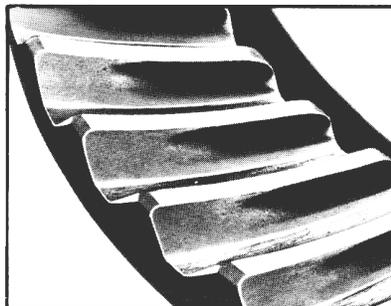


Figure 116B  
High Pattern

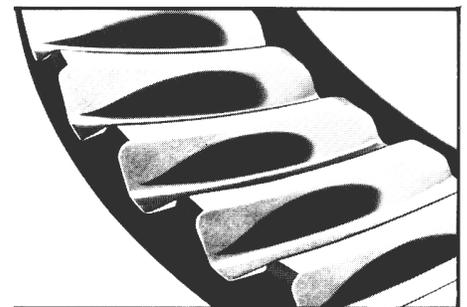


Figure 117B  
Low Pattern

- Look at the contact patterns on the ring gear teeth. Compare the patterns to Figures 115A or B, 116A or B and 117A 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. See **Figures 115A and 115B.**

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. **See Figure 118A 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

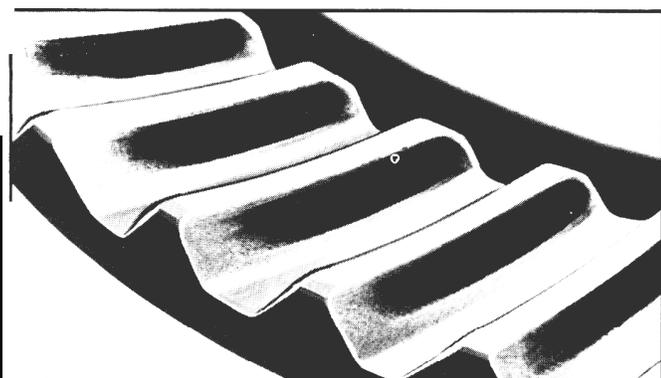


Figure 118A  
Good Pattern in Operation  
**Conventional Gears**

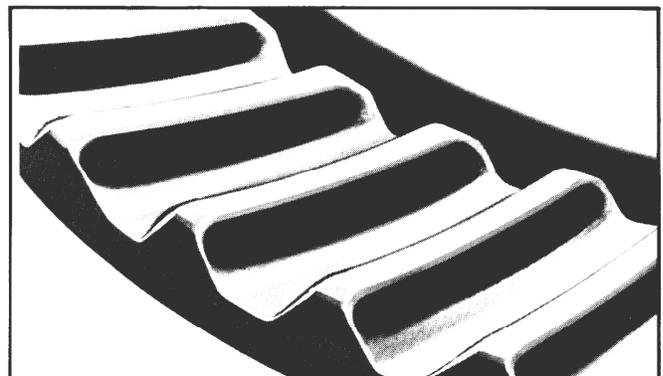


Figure 118B  
Good Pattern in Operation  
**Generoid Gears**

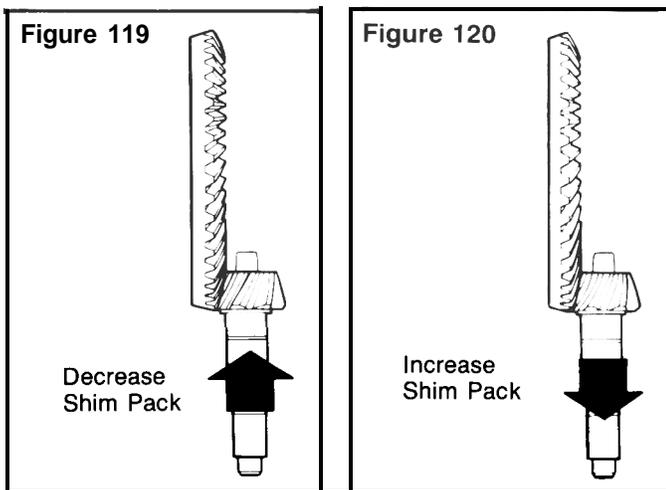
5. Change the thickness of the shim pack under bearing cage to move the contact patterns between the top and bottom of the gear teeth. Use the following procedure.

**NOTE:**

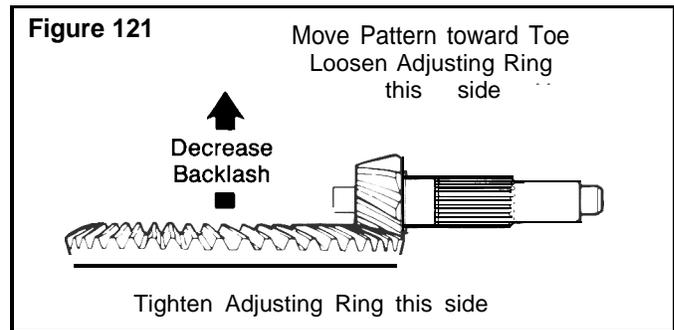
*A high contact pattern indicates that the drive pinion was not installed deep enough into the carrier.*  
*A low contact pattern indicates that the drive pinion was installed too deep in the carrier.*

- A. Remove the drive pinion and bearing cage from the carrier. See the procedure on page 10.
- B. To correct a high contact pattern, **Figure 116A or B** decrease the thickness of the shim pack under the bearing cage. When you decrease the thickness of the shim pack, the drive pinion will move toward the ring gear. **Figure 119.**

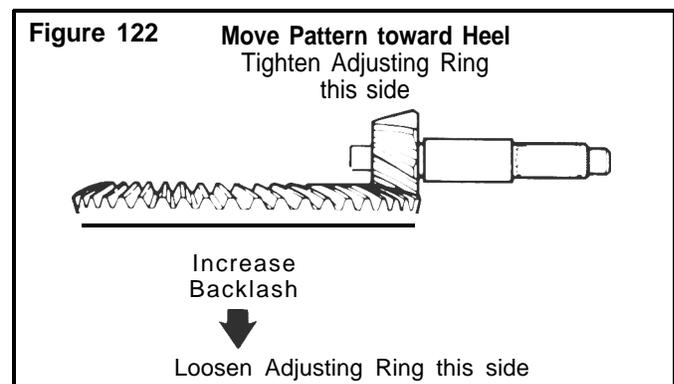
To correct a low contact pattern, **Figure 117A or B** increase the thickness of shim pack under the bearing cage. When you increase the thickness of the shim pack, the drive pinion will move away from the ring gear. **Figure 120.**



- C. Install the drive pinion, bearing cage and shims into the carrier. See the procedure on page 35.
- D. Repeat steps 2 to 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. See the procedure on page 45.
  - A. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth. **Figure 121.**



- B. Increase backlash to move the contact patterns toward the heel of the ring gear teeth. **Figure 122.**



- C. Repeat steps 2 to 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:**

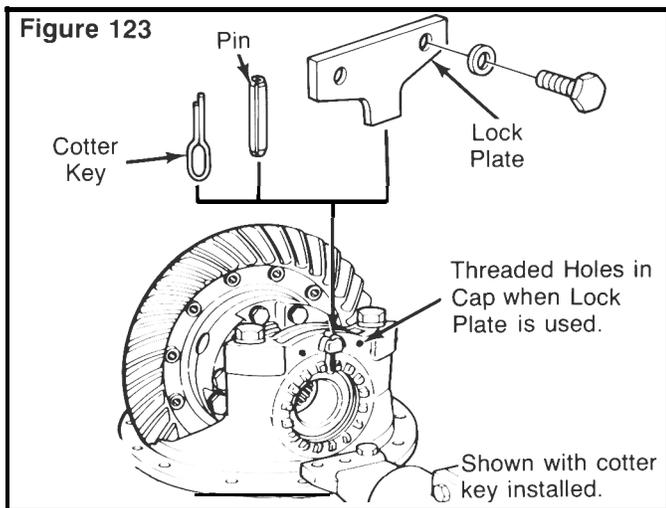
*If your carrier was built using cotter keys, lock the adjusting rings only with cotter keys. If your carrier was built using roll pins, reuse the roll pins or lock the adjusting rings with cotter keys. Do not force a roll pin into a cotter key hole.*

- 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 123.**
- 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 123.**

*\*Some Rockwell carriers do not have the parts described.*

# section 5 Assembly

C. Lock Plates\* - Install lock plate on bearing cap so that the tab is between lugs of the adjusting ring. Install the two cap screws that hold the lock plate to the bearing cap. Tighten the cap screws to correct torque value. See the torque chart on page 65. **Figure 123.**



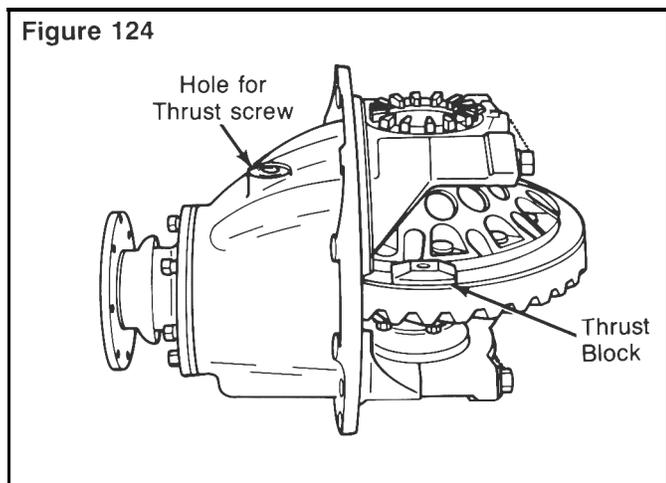
## Install and Adjust the Thrust Screw\*

### Specification:

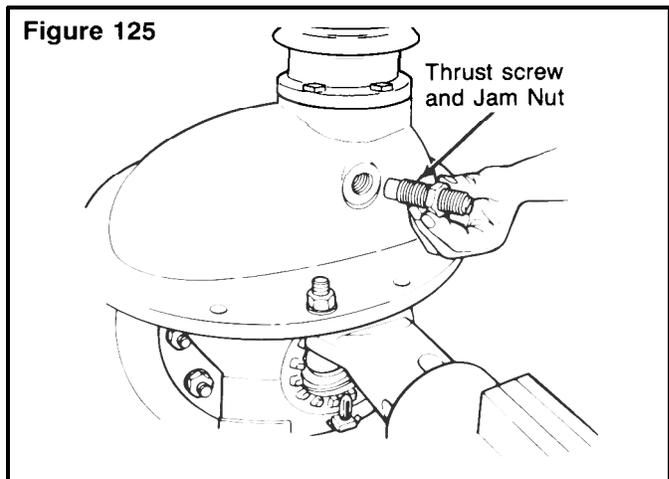
Clearance between thrust screw or block and ring gear -.025 to .045 inch (.65 to 1.14 mm). Loosen the thrust screw 1/2 turn, 180°.

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

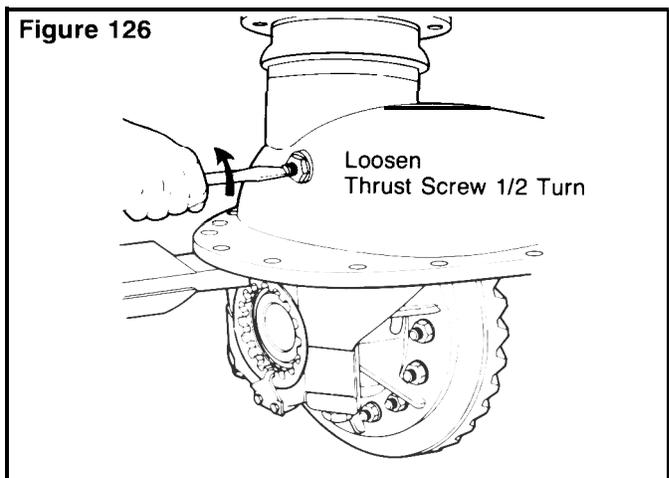
1. Rotate the carrier in the repair stand until the back surface of ring gear is toward the top.



2. Put 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 124.**
4. Install the jam nut\* on the thrust screw\*, one half the distance between both ends. **Figure 125.**

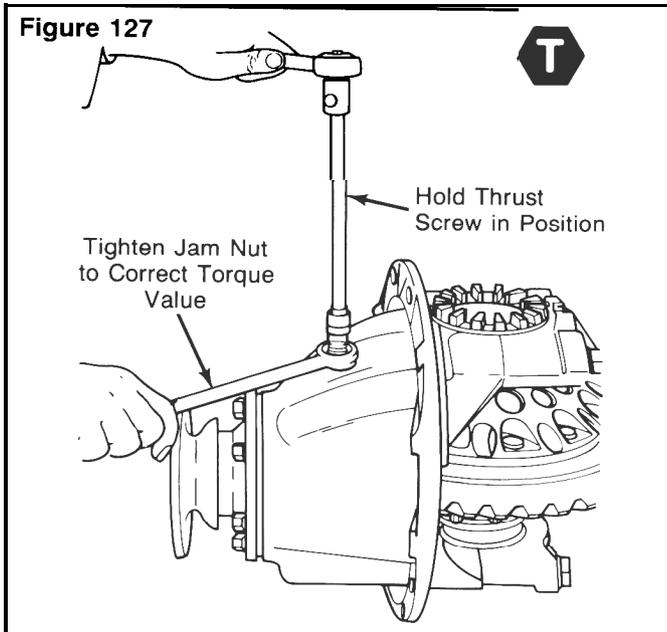


5. Install the thrust screw\* into the carrier until the screw stops against the ring gear or thrust block\*. **Figure 125.**
6. Loosen the thrust screw\* 1/2 turn, 180°. **Figure 126.**



● Some Rockwell carriers do not have the parts described.

7. Tighten the jam nut\* to the correct torque value against the carrier. See the torque chart on page 65. **Figure 127.**



**IMPORTANT:** To complete the assembly of axles equipped with driver controlled main differential locks, see pages 57 through 61. Start with "Install Differential Shift Assembly" page 57.

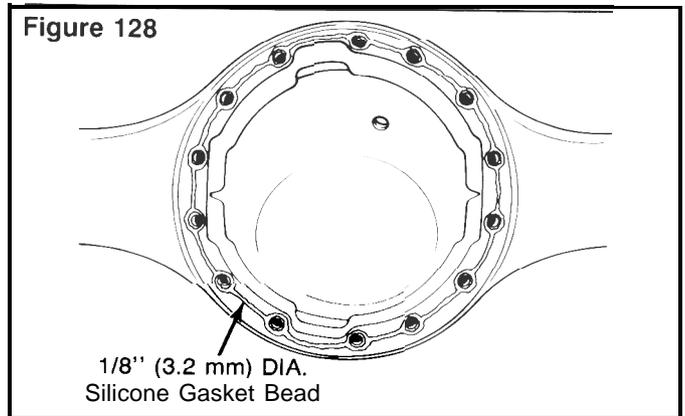
## Install Differential Carrier into Axle Housing

### **! 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 see the procedure on page 15.
2. Inspect the axle housing for damage. Repair or replace the axle housing. See the procedure on pages 17 to 19.

3. Check 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. See the procedure on page 20. Tighten studs\* to correct torque value. See the torque chart on page 65.
5. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. See the procedure on page 21. **Figure 128.**



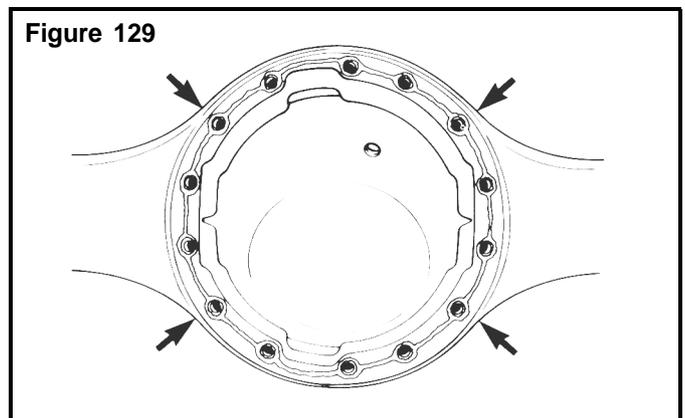
6. Install the carrier into the axle housing. Use a hydraulic roller jack or a lifting tool.



### **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.*

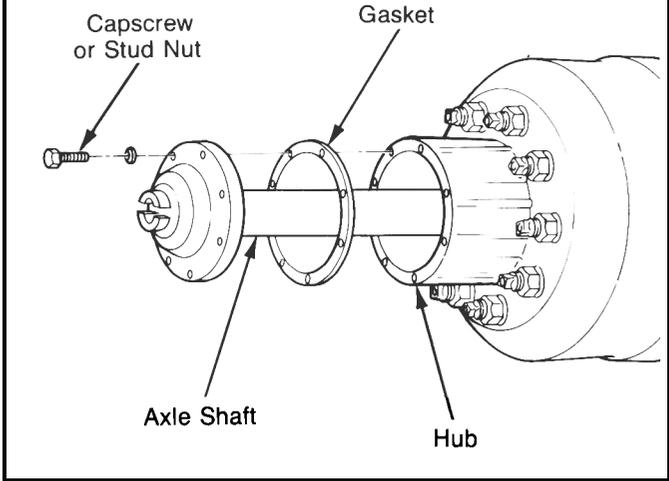
7. Install nuts\* and washers or capscrews and washers in the four corner locations around the carrier and axle housing. Tighten the fasteners hand tight at this time. **Figure 129.**



*\*Some Rockwell carriers do not have the parts described.*

8. Carefully push the carrier into position, Tighten the four fasteners two or three turns each in a pattern opposite each other. See **Figure 129**.
9. Repeat step 8 until the four fasteners are tightened to the correct torque value. See the torque chart on page 65. **T**
10. Install the other fasteners and washers that hold the carrier in the axle housing. Tighten fasteners to the correct torque value. See the torque chart on page 65. **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 130**.
13. Install the capscrews and washers that hold the axle shaft to the wheel hub. Tighten capscrews to the correct torque value. See the torque chart on page 65. **T**
14. If the wheel hubs have studs\*, install the tapered dowels\* at each stud and into the flange of the axle shaft. Use a punch or drift and hammer if needed.

**Figure 130**



15. Install the nuts\* and washers on the studs\*. Tighten nuts\* to the correct torque value. See the torque chart on page 65. **T**

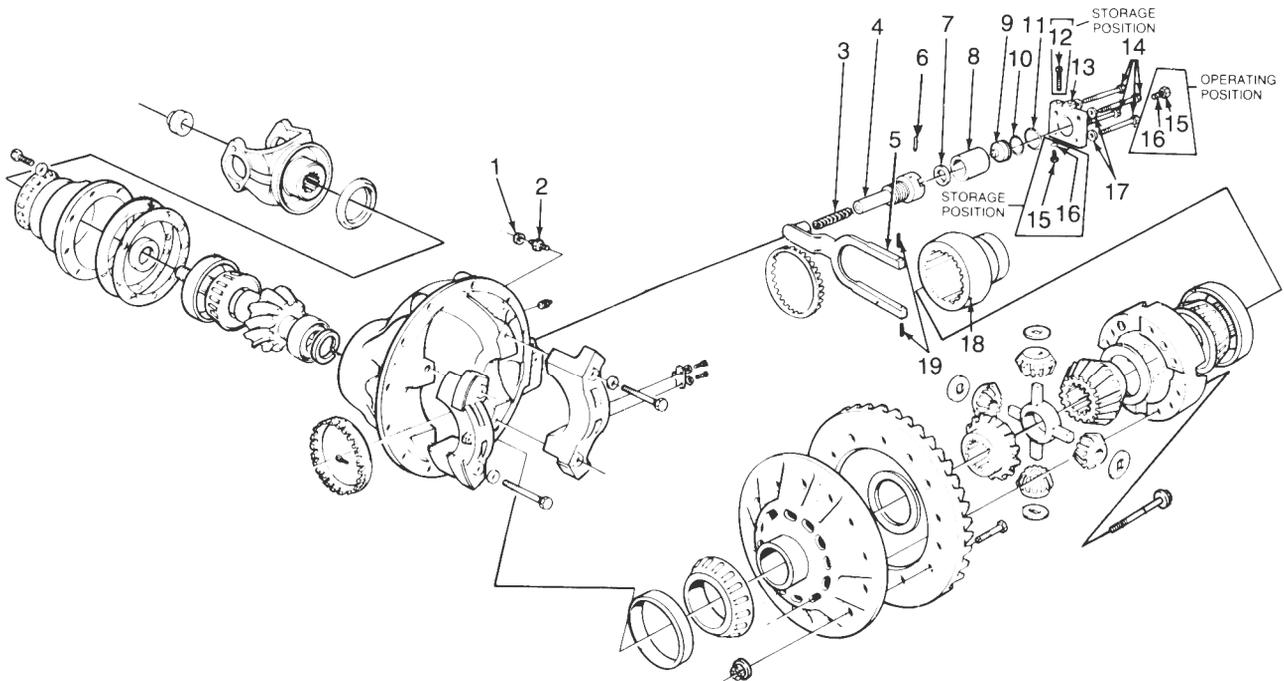
*\*Some Rockwell carriers do not have the parts described.*

# Driver Controlled Main Diff. Lock

# section 6

## Driver Controlled Main Differential Lock

Figure 131



1. Lock Nut - Sensor Switch
2. Sensor Switch
3. Shift Shaft Spring
4. Shift Shaft
5. Shift Fork
6. Spring Retaining Pin
7. Flat Washer (or silastic as reqd.)

8. Air Cylinder Tube
9. Piston
10. Piston "O" Ring
11. Cover Copper Gasket
12. Capscrew - Manual Actuation
13. Cylinder Cover
14. Cover Capscrews

15. Cover Plug
16. Plug Gasket
17. Washers
18. Shift Collar
19. Shift Fork Roll Pins

Some Rockwell drive axle models have a driver controlled main differential lock. This differential lock is operated by a carrier mounted, air actuated shift unit. When activated, the shift unit moves a sliding collar which is installed on the splines of the axle shaft. When engaged, the collar locks the axle shaft to a second set of splines on the differential case. **Figure 131.**

### **NOTE:**

*The Rockwell carrier models with driver controlled differential lock equipment are manufactured in metric dimensions and sizes. When these carriers are serviced, it is important to use the correct metric size tools on the fasteners. See the metric torque chart at the back of this manual.*

# Driver Controlled Main Differential Lock

1. Remove the axle shafts before the vehicle is towed. See the procedures on pages 25 and 26.



## CAUTION:

*If the vehicle must be towed to a service facility with the drive axle wheels on the ground, it is necessary to remove the axle shafts before the vehicle is towed.*

2. Install the axle shafts after the vehicle is towed. See the procedure on page 26.
3. If the differential carrier must be removed from the axle housing, use the following procedures.

## Remove Differential Carrier From Axle Housing

Before the differential carrier can be removed or installed, the differential lock MUST be shifted into and held in the locked (engaged) position. The locked position gives enough clearance between the shift collar and the axle housing to permit the removal or installation of the carrier.

## NOTE:

*If the axle shafts were removed for towing with the differential in the unlocked (disengaged) position, install the right-hand axle shaft into the housing before continuing. Follow steps 1 and 2 of "install Axle Shafts After the Vehicle is Towed" on page 26.*

To shift into the locked position, use either of the following "Air Pressure" or the "Manual Engaging" methods.

### Air Pressure Method:

1. Remove the drain plug from the bottom of the housing and drain the lubricant.
2. Raise the right hand wheel of the drive axle off the floor with a hoist or jack.



## WARNING:

*Do not start the vehicle engine and engage the transmission with one wheel raised from the floor. When the differential is in locked (engaged) position, power will go to the wheel on the floor and cause the vehicle to move.*

3. Put a jack stand under the right-hand spring seat to hold the vehicle in the raised position.



## WARNING:

*Do not work under a vehicle supported only by jacks. Jacks can slip or tip over and cause injury,*

4. Disconnect the driveline from the pinion input yoke.
5. Disconnect the vehicle air line from the differential lock actuator assembly.
6. Connect an auxiliary air supply to the differential lock actuator assembly.

## NOTE:

*If an auxiliary air supply is not available, continue to "Manual Engaging Method" of locking the differential.*

7. Apply and hold air pressure to the actuator assembly. The air pressure will move the shift collar to engage with the splines on the differential case half and lock the assembly.
8. Make sure that the shift collar has moved the full distance on the splines of the differential case half. Rotate the drive pinion or the right-hand wheel until the right-hand wheel makes one complete rotation (forward or backward).

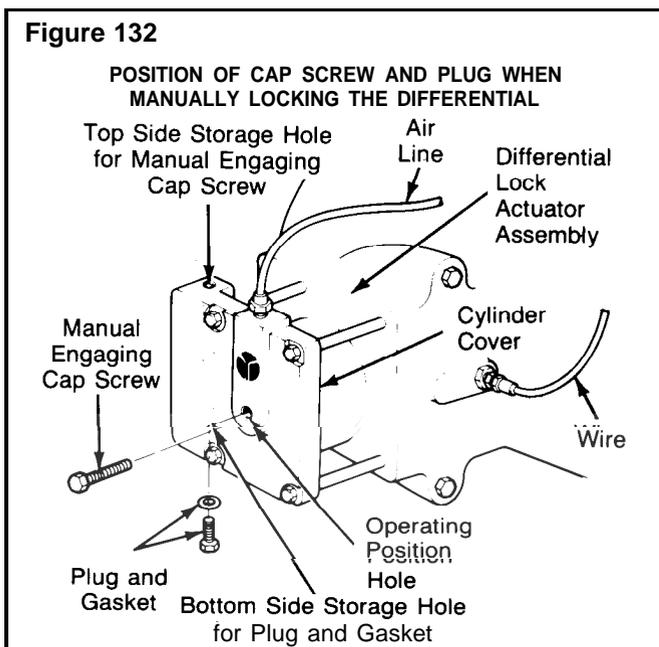
Continue to hold the main differential in the locked position with air pressure until the carrier assembly is completely removed from the axle housing.

9. Remove the axle shafts from the housing. Follow Steps 1-3 of "Remove Axle Shafts Before The Vehicle is Towed" on page 26.
10. Remove the carrier from the housing as described in Steps 8 through 15 on page 5.
11. After the carrier is removed from the axle housing, release the air pressure from the actuator assembly.

### Manual Engaging Method:

If an auxiliary air supply is not available or if the differential carrier is to be stored for later use, use this manual engaging method, **Figure 132**.

1. Follow Steps 1 through 5 of the "Air Pressure Method".



2. Remove the plug and gasket from the hole in the center of the cylinder cover.
3. Remove the manual engaging cap screw from the top storage hole in the cylinder cover.

4. Install the plug and gasket into the bottom storage hole in the cylinder cover.

### NOTE:

*The storage hole for the plug and gasket is the opposite end of the storage hole for the manual engaging cap screw.*

5. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover.
6. Turn the manual adjusting capscrew to the right until the head is approximately 1/4 inch from the cylinder cover. DO NOT turn the capscrew beyond its normal stop. The capscrew is now in the service position and the main differential lock is completely engaged.



### CAUTION:

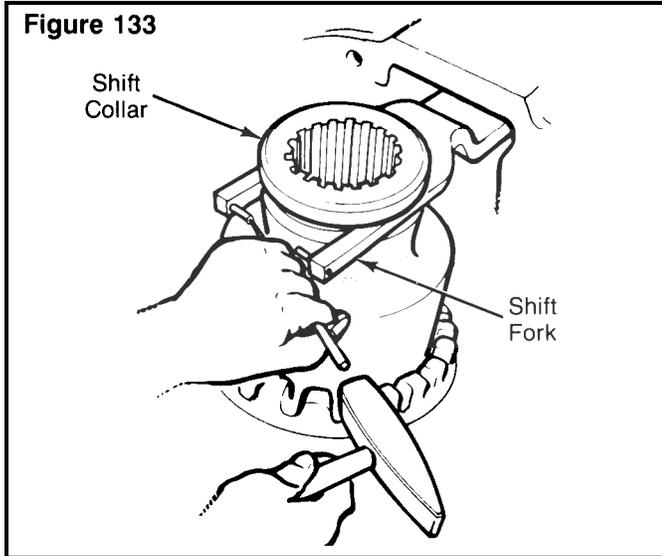
*There will be a small amount of spring resistance felt when you turn in the manual engaging capscrew. If a high resistance is felt before reaching the locked (engaged) position, STOP TURNING THE CAPSCREW, or the cover and capscrew threads will be damaged.*

*A high resistance on the capscrew indicates that the splines of the shift collar and the differential case half are not aligned or engaged. To align the splines use the following procedure:*

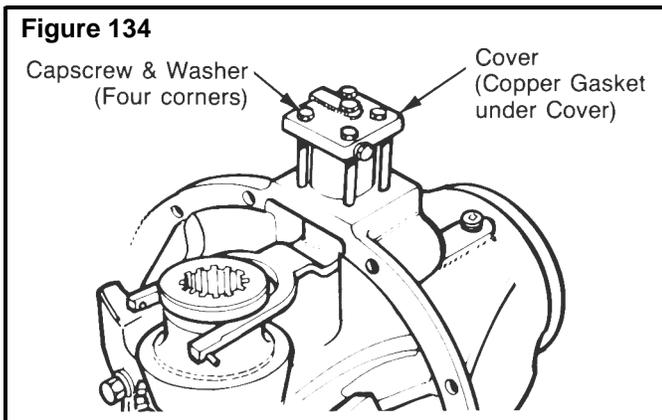
- A. Rotate the drive pinion or right-hand wheel to align the splines of the shift collar and case half while you turn in the manual engaging capscrew.
  - B. When the normal amount of spring resistance is again felt on the capscrew, the splines are engaged. Continue to turn in the manual engaging capscrew until the head is approximately 1/4 inch from the cylinder cover.
7. Remove the carrier from the axle housing as described in steps 8 through 15 on page 5.

## Remove Differential And Gear Assembly

1. To remove the differential lock sliding shift collar, tap out the two retainer roll pins until they are level with the inner face of the shift fork. Release the differential lock if it is manually engaged. **Figure 133.**



2. If required, remove the differential lock shift unit.
  - A. Remove the sensor switch and lock nut.
  - B. Remove the four capscrews and washers that hold the cylinder cover. Remove the cover and copper gasket. **Figure 134.**



- C. Remove the shift unit-cylinder and piston. Remove the O-ring from the piston.

- D. Remove the shift shaft from the shift fork. The shaft may be loctited to the fork, use the heating procedure to breakdown loctite. The recommended procedure is similar to "Remove Dri-Lock Fasteners" on page 21.

- E. Remove the shift shaft spring and flat washer.

**NOTE:**

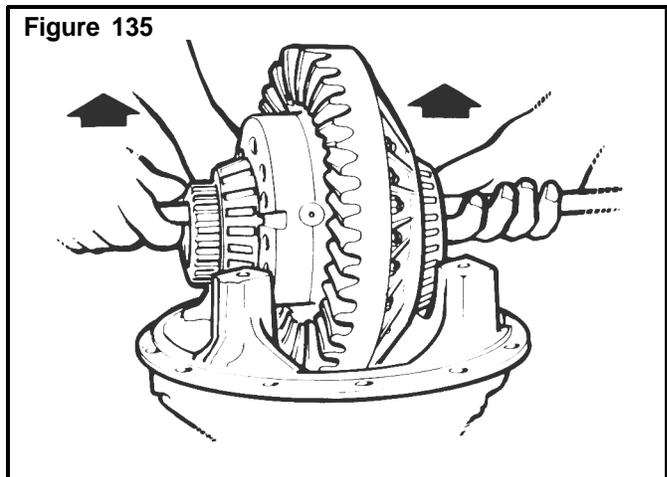
*Some models use silastic seal instead of the flat washer in Step E.*

- F. Remove the shift fork,

**NOTE:**

*A roll pin is installed in the shift shaft and is used as a stop for the shift shaft spring. It is not necessary to remove this roll pin during a normal disassembly.*

3. 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.
4. Match mark one bearing cap and one carrier leg so that these parts will be assembled in the correct positions. Remove the bearing cap capscrews and washers, the bearing caps and the adjusting rings.
5. Lift the differential and gear assembly from the carrier. Tilt the assembly as required to permit the ring gear to clear the support for the pinion spigot bearing. **Figure 135.**



● Some Rockwell carriers do not have the parts described.

FURTHER DISASSEMBLY OF THESE CARRIERS IS THE SAME AS AXLES WITHOUT THE DRIVER CONTROLLED MAIN DIFFERENTIAL LOCK. TO CONTINUE DISASSEMBLY FOLLOW THE PROCEDURES STARTING ON PAGE 8.

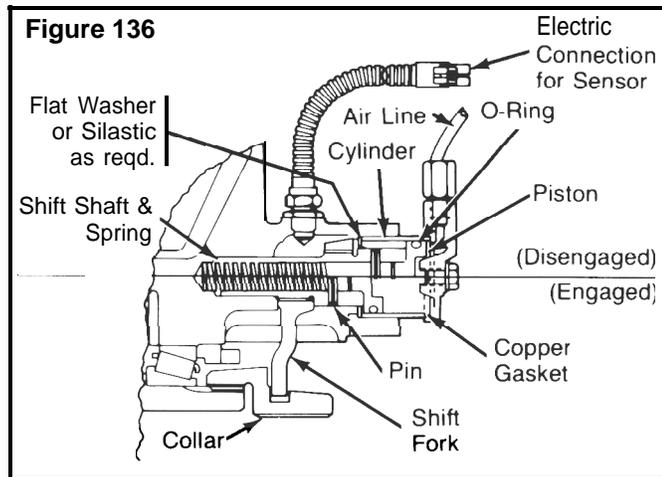
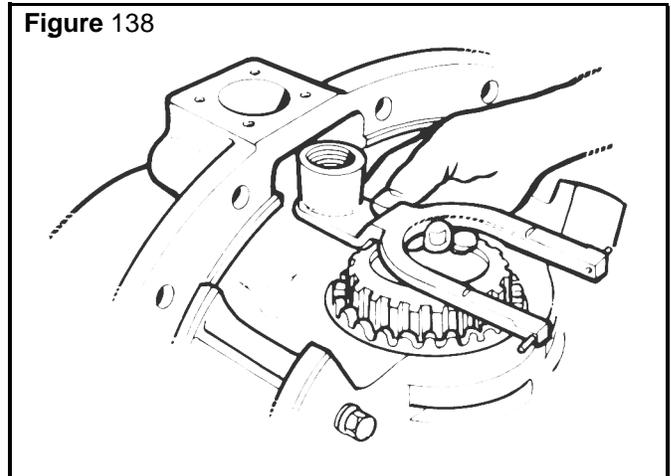
PREPARE PARTS FOR ASSEMBLY, ADJUSTMENTS, AND CARRIER ASSEMBLY (UP TO THE POINT OF "INSTALL DIFFERENTIAL CARRIER INTO AXLE HOUSING" ON PAGE 51) ARE ALSO THE SAME FOR BOTH AXLES.

2. If the spring stop roll pin was removed from the head of the shift shaft, install the pin at this time,
3. Apply Loctite 222 (Rockwell Part No. 2297-B-61 12) to the threads of the shift shaft.
4. Install the shift fork into its correct position in the carrier case. **Figure 138.**

## Install Differential Shift Assembly

Install the differential shift assembly after the differential carrier is assembled and the gear and bearing adjustments are made. Parts of the shift assembly are shown in **Figure 136.**

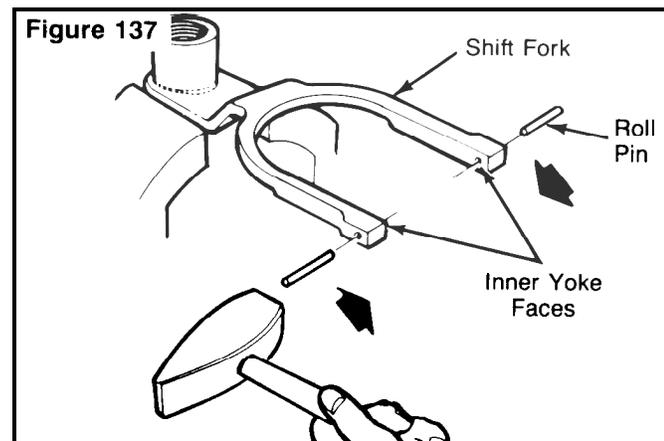
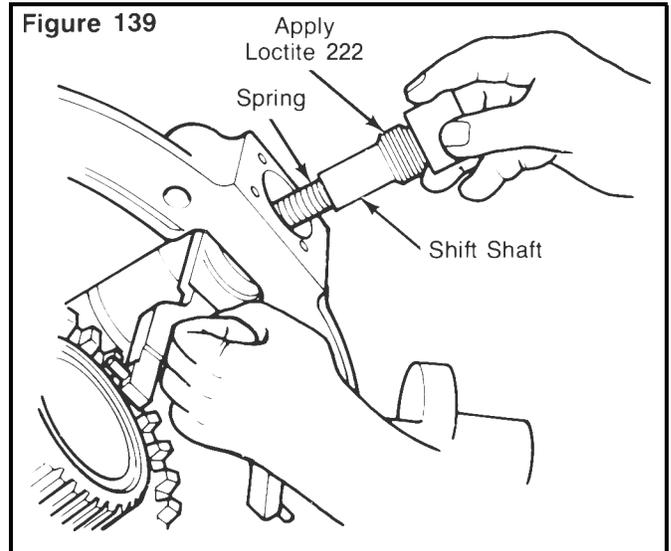
**Figure 138**



5. Hold the shift fork in position and install the shift shaft spring into the shift shaft opening in the carrier, through the shift fork bore and into the bore for the shift shaft spring. **Figure 139.**

1. Install the two roll pins into the ends of the shift fork. Tap the pins into position until they are level with the inner yoke face. **Figure 137.** Do not install completely at this time.

**Figure 139**

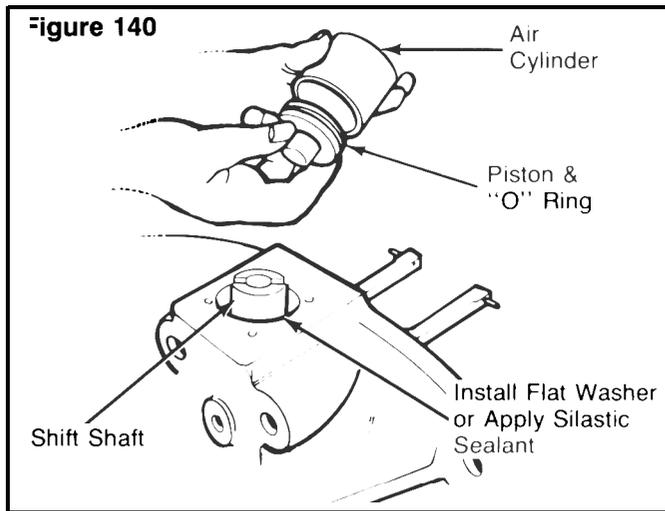


6. Slide the shift shaft over the spring and install the shaft into the shift fork. Tighten to 20-25 lb. ft. (27-34 N.m) torque. **T**

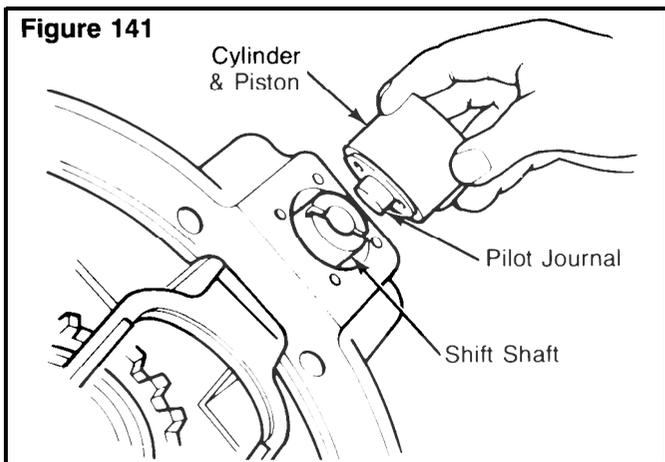
7. Install the flat washer (when used) or apply silastic sealant (Rockwell Part No. 1199-Q-2981 ) to the bottom of the cylinder bore. **Figure 140.**

# section 6 Driver Controlled Main Differential Lock

8. Install the O-ring into its groove on the piston. Lubricate the O-ring with axle lubricant. Install the piston into the air cylinder. **Figure 140.**

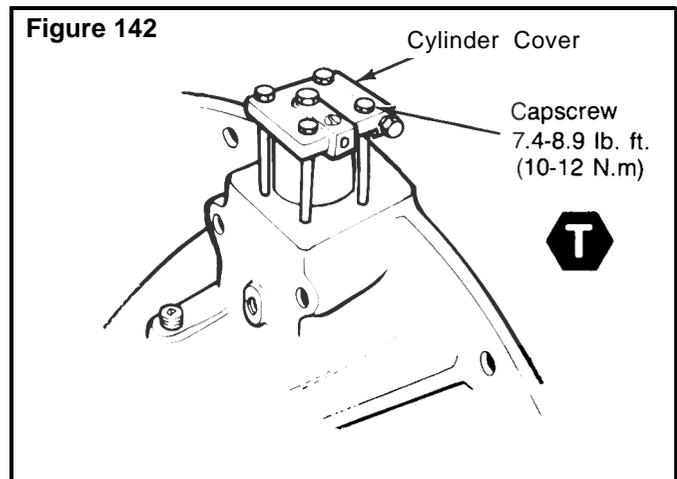


9. Install the cylinder into the housing bore. Make sure that the pilot journal on the piston is against its bore on the shift shaft. **Figure 141.**

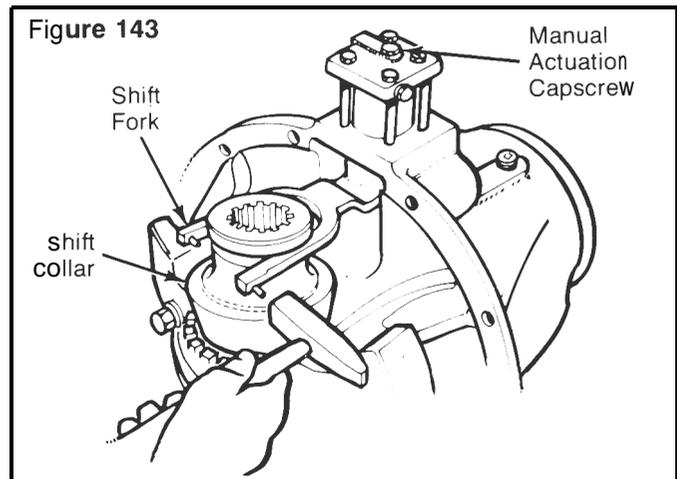


10. Install the copper gasket into its bore on the inside of the cylinder cover. Put the cover in position over the cylinder so that the air intake port will point up when the carrier is installed into the housing. Install the cover with the four attaching capscrews and washers. Tighten to 7.4-8.9 lb. fi. (10-12 N.m) torque. **Figures 136 and 142.**

11. Slide the shift collar into the fork and engage the shift collar splines with the splines of the differential case. Use the manual actuation capscrew to move the shift collar splines into the differential case splines. See "Manual Engaging Method" on page 60.



12. Hold the shift collar in the locked (engaged) position and tap in the two roll pins in the shift fork ends until they are level with the outer yoke faces, **Figure 143.**

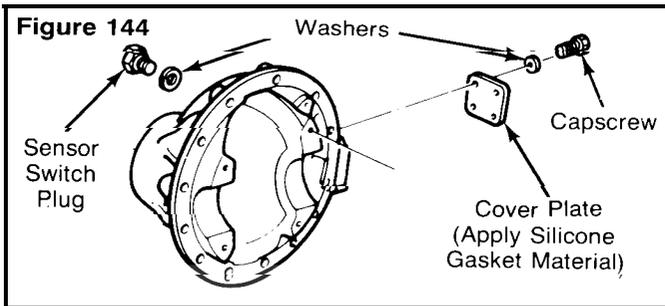


13. While the shift collar is still in the locked position, put the sensor switch (with the lock nut loosely attached) into its hole.
14. Connect a battery/bulb tester to the sensor switch and rotate the switch into its hole until contact with the shift fork causes the light to go on. Turn the switch one additional revolution and tighten the lock nut to 26-33 lb. ft. (35-45 N.m) torque.

**NOTE:**  
For carriers without the differential lock (Less Air Shift), assemble the sensor switch plug and cover plate as follows:

1. Install the washer and plug into the hole for the sensor switch. Tighten the plug to 45-55 lb. ft. (60-74 N.m). **Figure 145.**

2. Apply silicone gasket material to the cover plate mounting surface on the carrier. (See procedures on page 21).
3. Install the four washers and capscrews. Tighten the capscrews to 7.4-8.9 lb. ft. (10-12 N.m). **Figure 144.**



## NOTE:

When the carrier is to be installed into the axle housing, the shift collar must be held in the engaged position. This can be done by keeping the air pressure applied to the shift cylinder (see "Air Pressure Method" on page 60), or by using the manual engaging bolt (see "Manual Engaging Method" on page 60). Failure to keep the differential in the locked (engaged) position will make it impossible to install the carrier assembly into the axle housing.

After the carrier is installed into the axle housing, shift the differential into the unlocked (disengaged) position to permit the installation of the right hand axle shaft.

## Install Carrier Into Axle Housing

1. Clean the inside of the axle housing and the mounting surface where the carrier fastens. Use a cleaning solvent and rags to remove the dirt. Blow dry the cleaned areas with compressed air. (See procedures on page 15).



## WARNING:

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

2. Inspect the axle housing for damage. If necessary, repair or replace the housing. (See procedures on pages 17 to 19).
3. Check for loose studs in the mounting surface of the housing where the carrier fastens. Remove and replace the studs where required.
4. Install the differential carrier into the housing. Use one of the following procedures.

### Air Pressure Method:

- A. Before the carrier is installed into the housing, install the right-hand axle shaft through the shift collar and into the side gear. (The axle shaft is being used as a spline alignment tool).

## NOTE:

A similar tool can be made from a damaged right-hand axle shaft by cutting off approximately 24 inches from the spline end.

- B. Align the splines of the shift collar and differential case half by rotating the axle shaft tool or drive pinion.



## WARNING:

Do not use your hands to hold the collar in position. Injury can result when air pressure is applied to the actuator.

- C. Connect an auxiliary air supply to the actuator assembly.
- D. Apply and hold pressure to the actuator assembly. The air pressure will move the shift collar to engage the differential case half and lock the assembly.
- E. If the shift collar has not moved the full distance on the splines of the differential case half, rotate the axle shaft tool or the drive pinion one complete rotation to the right or left.
- F. Remove the axle shaft tool from the carrier.

**NOTE:**

Continue to hold the main differential in the locked (engaged) position with air pressure until the carrier is completely installed in the axle housing. If no air supply is available, use the "Manual Engaging Method" on this page to lock (engage) the differential.

- G. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. (See procedures on page 21).
- H. Install the carrier into the axle housing. Follow steps 6-10 on page 51.
- I. Release the air pressure from the differential lock actuator and disconnect the auxiliary air supply.
- J. Proceed to Step 5 on page 61.

**Manual Engaging Method:**

- A. Align the splines of the shift collar and the differential case half. This can be done by hand or by installing the right-hand axle shaft through the shift collar and into the side gear. See Steps A and B of the "Air Pressure Method" on this page.
- B. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover.
- C. Turn the manual adjusting capscrew to the right until the head of the capscrew is approximately 1/4 inch from the cylinder cover. DO NOT turn the capscrew beyond its normal stop. The capscrew is now in the service position and the main differential lock is completely engaged.



**CAUTION:**

There will be a small amount of spring resistance felt when you turn in the manual engaging capscrew. If a high resistance is felt before reaching the locked (engaged) position, STOP TURNING THE CAPSCREW, or the cover, fork and capscrew threads will be damaged.

A high resistance on the capscrew indicates that the splines of the shift collar and the differential case half are not aligned or engaged.

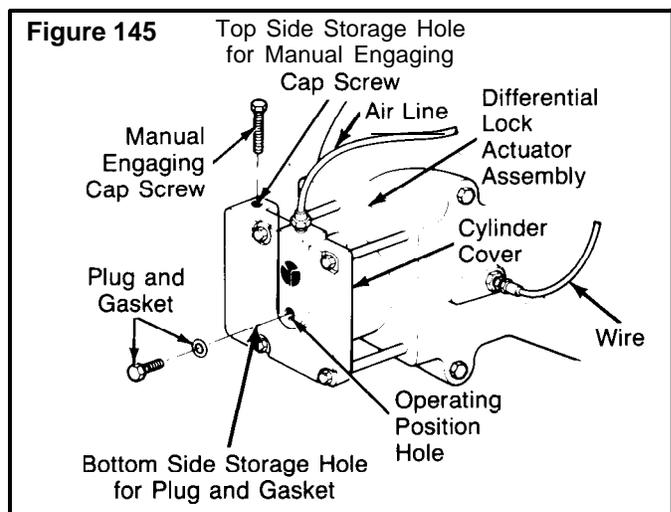
Lift the shift collar as required and rotate to align the splines of collar and case half while you turn in the manual engaging capscrew. When the normal amount of spring resistance is again felt on the capscrew, the splines are engaged. Continue to turn in the manual engaging capscrew.

- D. Install and fasten the carrier into the axle housing. Follow Steps G and H of the "Air Pressure Method" on page 60.
- E. Remove the plug and gasket from their position.

**NOTE:**

When the manual engaging capscrew is removed from the service position in the actuator, the main differential lock becomes disengaged.

- F. Clean the plug, gasket, cylinder cover, and threaded hole in the center of the cylinder cover.
- G. Install the plug and gasket into their operating position in the cylinder cover. Install the manual engaging capscrew into its storage position. See Figure 145.



H. Tighten the plug to 44-55 lb. ft. (60-75 N.m) torque. Tighten the manual engaging capscrew to 22-28 lb. ft. (30-38 N.m).



5. Connect the vehicle air line to the differential lock actuator assembly.
6. Install the electrical connection on the sensor switch located in the carrier, below the actuator assembly.
7. Install the right and left-hand axle shafts. Follow the procedures in Steps 2 through 4 of "Before Towing" on page 26.
8. Remove the jack stand from under the drive axle and lower the vehicle to the floor.

## Check the Differential Lock

1. Shift the vehicle transmission to neutral and start the engine to get the system air pressure to the normal level.



### **WARNING:**

**Do not start the vehicle engine and engage the transmission with one wheel raised from the floor. When the differential is in locked (engaged) position, power will go to the wheel on the floor and cause the vehicle to move.**

2. Put the differential lock switch (in the cab of the vehicle) in the unlocked (disengaged) position.
3. Drive the vehicle at 5-10 MPH (8-16 kmph) and check the differential lock indicator light. The light must be off when the switch is in the unlocked position.

4. Continue to drive the vehicle and put the differential lock switch in the locked (engaged) position. Let up on the accelerator to remove the driveline torque and permit the shift. The light must be on when the switch is in the locked position.

### **NOTE:**

**If the indicator light remains "on" with the switch in the unlocked position, the differential is still in the locked position. Check to make sure that the manual engaging capscrew was removed from the cylinder cover of the actuator assembly. See Steps E through H of "Manual Engaging Method" on this page.**

## Driver Caution Label

Figure 146



Check to see that the "Driver Caution" label is installed in the vehicle cab. The caution label must be put in a location that is easily visible to the driver. A recommended location is on the instrument panel, next to the differential lock switch and lock indicator light. Driver Caution labels (Tp-861 01) are available from Rockwell International, Troy, Michigan. **Figure 146.**

# section 7

# Lubrication

## NOTE:

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

See the following charts 4, 5 and 6 for standard information on lubricants, schedules and capacities.

Chart 4

### 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. 85W140	- 12.2°C (+ 10°F)	... **
O-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	- 26.1 °C (- 15°F)	... **
O-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	- 26.1 °C (- 15°F)	... **
O-76-E	Hypoid Gear Oil	GL-5, S.A. E. 75W/90	- 40°C (- 40°F)	... **
O-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	- 40°C (- 40°F)	+ 1.6°C (+ 35°F)
O-76-L	Hypoid Gear Oil	GL-5, S.A. E. 75WH140	- 40°C (- 40rF)	... **

● \*There is no upper limit on these outside temperatures, but the axle sump temperature MUST NEVER EXCEED + 121°C (250°F)

Chart 5

### LUBRICATION SCHEDULE

<ul style="list-style-type: none"> <li>● Heavy-Duty On-Highway</li> <li>● On and off Highway</li> <li>● Off-Highway</li> </ul>		<ul style="list-style-type: none"> <li>● Common Carrier On-Highway</li> </ul>	
Less than 60,000 miles (96,000 Km) a year	More than 60,000 miles (96,000 Km) a year	Less than 100,000 miles (160,000 Km) a year	More than 100,000 miles (160,000 Km) a year
Two Times A Year	25,000 to 30,000 miles (40,000 to 48,000 Km)	One Time A Year	100,000 miles (160,000 Km)

**NOTE: If operation is continuous heavy-duty, check lubricant each 1,000 miles (1,600 Km).**

## CHART 6

### 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-1 50	3.5	1.7
C-1 00	12.5	5.9
D-100	12.5	5.9
D-140	12.5	5.9
E-1 00	15	7.1
E-105	12.5	5.9
E-1 50	9	4.3
F-1 00	13	6.2
F-1 06	13	6.2
F-120	15	7.1
F-1 21	15	7.1
F-1 40	14	6.6
FDS-75	14	6.6
FDS-65	15	7.1
FDS-90	14	6.6
FDS-750	7	3.3
FDS-1600	23	10.9
FDS-1800	35	16.6
FDS-1805	35	16.6
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-1 70	27*	12.8*
H-1 72	27	12.8
L-1 00	23	10.9
L-140	24	11.4
L-155	24	11.4
L-172	27	12.8
M-172	27	12.8
QT-140	24	11.4
Q-1 00	31	14.7
Q-1 45	24	11.4
RL-170	48	22.7
R-100	30	14.2
R-140	28	13.2
R-1 55	28	13.2
R-1 60	28	13.2
R-163	34	16.1
R-1 70	43	20.3
s-1 70	43	20.3
U-140	24	11.4
u-1 70	43	20.3
w-1 70	43	20.3
RS-13-120	15	7.2
RS-1 5-120	15	7.2
RS-1 6-141	31	14.7
RS-1 7-140	32	15.4
RS-1 7-141	31	14.7
RS-1 9-145	36	17.3
RS-21-145	35	16.9
RS-23-160	43/41	20.7/19.5

AXLE MODEL	CAPACITY	
	U.S. Pints	Liters
RS-23-180	39	18.6
RS-26-160	51	24.2
RS-26-180	38	18.3
RS-30-180	38	18.3
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-I 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-1 70 (TR-170 rear)	43	20.3
STHD (THR rear)	28	13.2
Su-170 (U R-170 rear)	43	20.3
SUHD (UHR rear)	28	13.2
SW-170 (WR-170 rear)	43	20.3
RT-34-140 (RR-17-140)	35	16.9
RT-34-145 (RR-17-145 rear)	36	17.1
RT-40-140 (RR-20-1 40)	35	16.9
RT-40-145 (RR-20-145 rear)	36	17.3
RT-44-145 (RR-22-1 45 rear)	35	16.9
RT-46-160 (RR-23-160 rear)	43/41	20.7/19.5
RT-52-160 (RR-26-160 rear)	51	24.2
RT-48-1 80 (RR-24-180 rear)	39	18.6
RT-52-180 (RR-26-1 80 rear)	39	18.3
RT-58-180 (RR-29-180 rear)	39	18.3

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

# section 8 Fastener Torque Info.

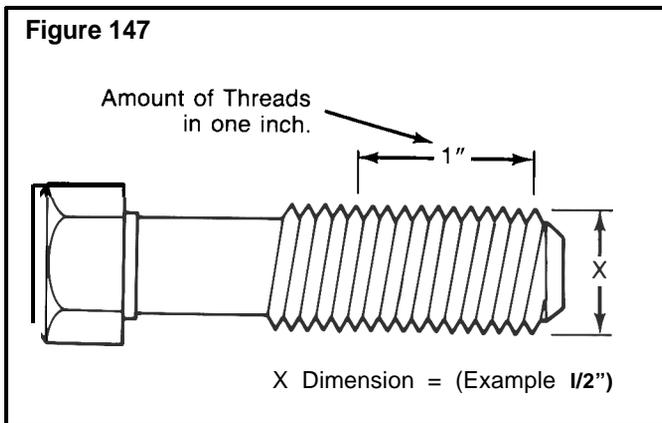
## Torque Values for Fasteners

### General Information.

1. The torque values in chart 7 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 147.**

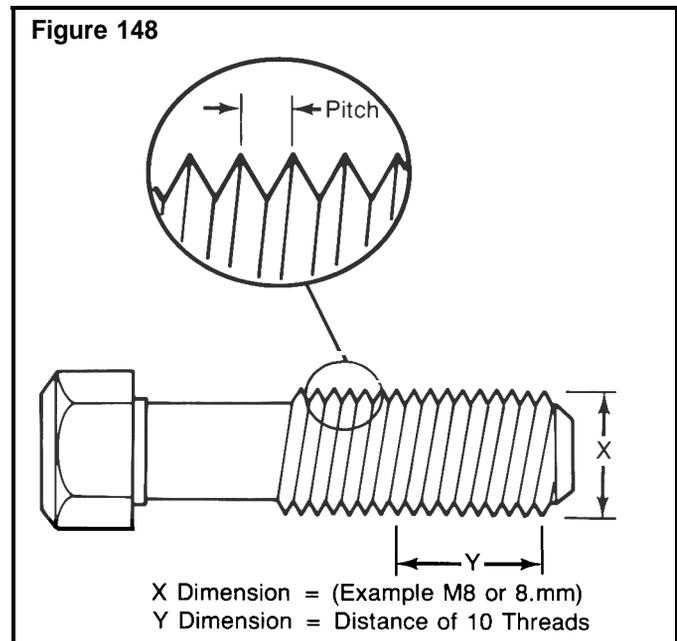


- B. Count the amount of threads there are in one inch (1.0 inch). **Figure 147.**

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

### Metric Fasteners

- A. Measure the diameter of the threads in millimeters (mm), dimension X. **Figure 148.**



- B. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 148.**

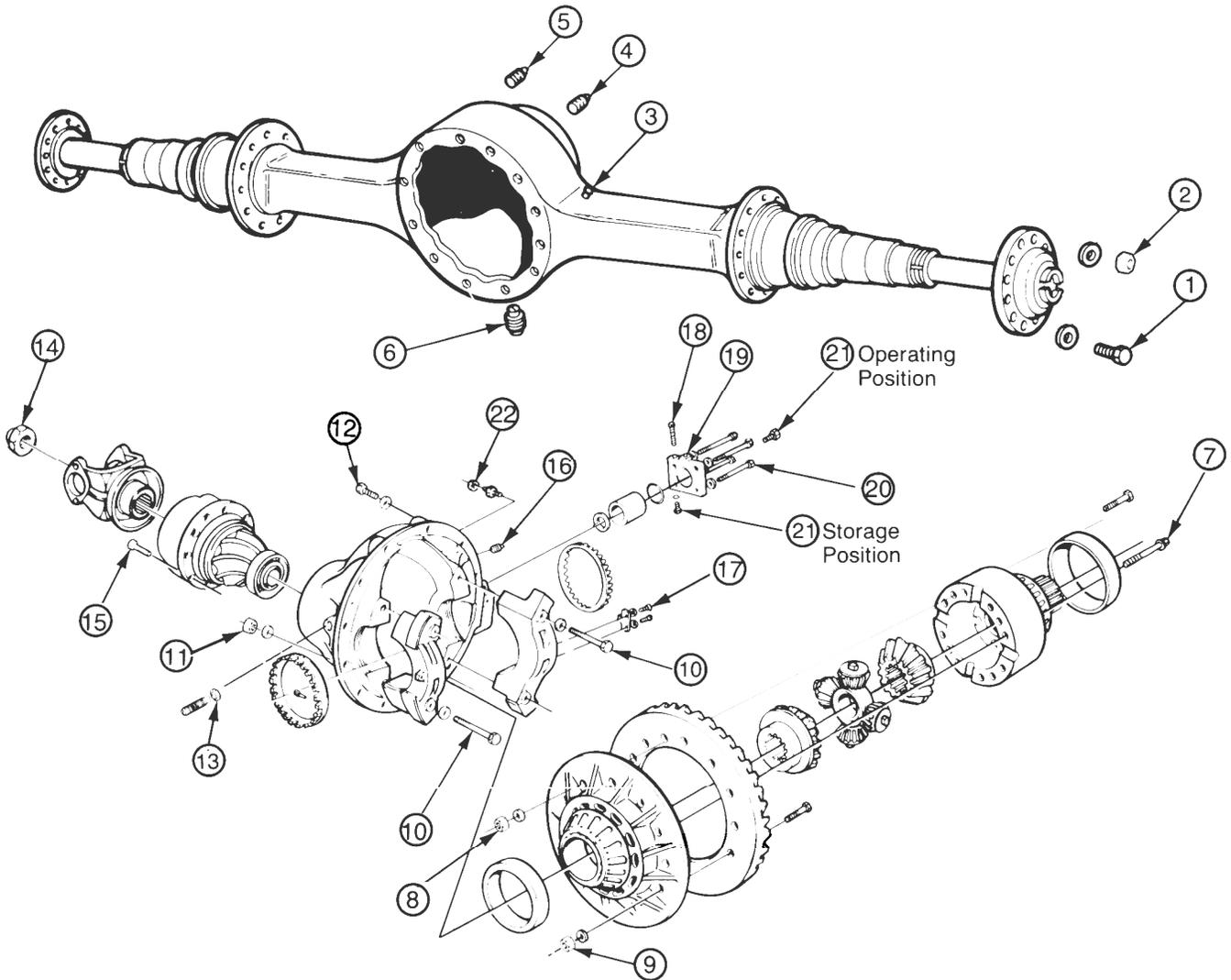
- C. Divide dimension Y by ten (10). The result will be the distance between two threads or pitch.

Example of a Metric size fastener is M 8 x 1.25.

The M 8 is the diameter of the fastener in millimeters (mm) or dimension X.

The 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 7 to find the correct torque value.



**CHART 7  
FASTENER TORQUE CHART**

	FASTENER	THREAD SIZE	TORQUE VALUE lb-ft (N.m)	
1.	* Capscrew, Axle Shaft	.31-24 .50-13	18-24 85-115	(24-33) (115-156)
2.	* Nut, Axle Shaft Stud	Plain Nut .44-20 .50-20 .56-18 .62-18 Lock Nut .44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230 40-65 65-100 100-145 130-190	(68-102) (1 02-1 56) (149-224) (203-31 2) (54-88) (88-136) (1 36-1 97) (176-258)

*\* Some Rockwell carriers do not have the parts described.*

# section 8 Fastener Torque Information

CHART 7 (Continued)

	FASTENER	THREAD SIZE	TORQUE VALUE lb-ft (N.m)	
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 .44-14 .50-13 .56-12 .62-11 Grade 10.9 Flange Head M12 x 1.75 Grade 10.9 Standard Hex Head M12 x 1.75 Grade 12.9 Standard Hex Head M12 x 1.75 M16 x 2	35-50 60-75 85-115 130-165 180-230 85-103 75-95 105-125 203-251	(48-68) (81-102) (115-156) (176-224) (244-312) (115-140) (100-130) (143-169) (275-340)
8.	*Nut, Differential Case Bolt	.50-13 .50-20 .62-11 .62-18 M12 x 1.75	75-100 85-115 150-190 180-230 74-96	(102-136) (115-156) (203-258) (244-312) (100-130)
9.	*Nut, Ring Gear Bolt	.50-13 .50-20 .62-11 .62-18 M12 x 1.25 M12 x 1.75 Flange Head M16 x 1.5 Standard Hex Head M16 x 1.5	75-100 85-115 150-190 180-230 66-81 77-85 192-214 190-225	(102-136) (115-156) (203-258) (244-312) (90-110) (104-115) (260-290) (260-305)
10.	Capscrew, Bearing Cap	.56-12 .62-11 .75-10 .88-14 .88-9 M16 x 2 M20 x 2.5 M22 x 2.5	110-145 150-190 270-350 360-470 425-550 181-221 347-431 479-597	(149-197) (203-258) (366-475) (488-637) (576-746) (245-300) (470-585) (650-810)
11.	Nut, Housing to Carrier Stud	.44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230	(68-102) (102-156) (149-224) (203-312)
12.	Capscrew, Carrier to Housing	.44-14 .50-13 .56-12 .62-11 .75-10 M12 x 1.75 M16 x 2	50-75 75-115 110-165 150-230 270-400 74-89 181-221	(68-102) (102-156) (149-224) (203-312) (366-542) (100-120) (245-300)

• Some Rockwell carriers do not have the parts described.

# Fastener Torque Information



CHART 7 (Continued)

	FASTENER	THREAD SIZE	TORQUE VALUE lb-ft (N.m)	
13.	*Jam Nut, Thrust Screw	.75-16 .88-14 1.12-16 M22 x 1.5 M30 x 1.5	150-190 150-300 150-190 148-210 236-295	(203-258) (203-407) (203-258) (200-285) (320-400)
14.	Nut, Drive Pinion	.88-20 1.0-20 1.25-12 1.25-18 1.50-12 1.50-18 1.75-12 M32 x 1.5 M39 x 1.5 M45 x 1.5	200-275 300-400 700-900 700-900 800-1100 800-1100 900-1200 738-918 922-1132 996-1232	(271-373) (407-542) (949-1220) (949-1220) (1085-1491) (1085-1491) (1220-1627) (1000-1245) (1250-1535) (1350-1670)
15.	Capscrew, Bearing Cage	.38-16 .44-14 .50-13 .56-12 .62-11 M12 x 1.75	30-50 50-75 75-115 110-165 150-230 74-96	(41-68) (68-102) (102-156) (149-224) (203-312) (100-130)
16.	*Plug, Oil Fill (Carrier)	.75-14 1.5-11.5 M24 x 1.5	25 minimum 120 minimum 35 minimum	(34 minimum) (163 minimum) (47 minimum)
17.	*Capscrew, Lock Plate	.31-18 M8 x 1.25	20-30 21-26	(27-41) (28-35)

**THE FOLLOWING FASTENERS AND TORQUE VALUES ARE FOR DIFF. LOCK CARRIERS ONLY**

18.	Capscrew, Manual Actuation (Storage Position)	M10 X 1.5	15-25	(20-35)
19.	I Adapter, Air Cylinder	I M12 X 1.5	I 22-30	(30-40)
20.	I Capscrew, Air Cylinder Cover	I M 6 x 1	I 7.4-8.9	(10-12)
21.	Capscrew/Plug, Air Cylinder Cover (Operating Position) (Storage Position)	M10 X1.5	15-25 15-25	(20-35) (20-35)
22.	Lock Nut, Sensor Switch	M16X1	26-33	(35-45)

\* Some Rockwell carriers do not have the parts described.

# section 9

# Adjustments and Specifications

## DRIVE PINION BEARINGS - PRELOAD

PAGE

<p><b>Specification:</b> New bearings -5 to 45 lb-in (.56 to 5.08 N.m) torque Used bearings in good condition - 10-30 lb-in (1 .13 to 3.39 N.m) torque</p> <p><b>Adjustment:</b> 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</p>	31
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## DRIVE PINION - DEPTH IN CARRIER

<p><b>Specification:</b> 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.</p> <p><b>Adjustment:</b> Change the thickness of the shim pack to get a good gear tooth contact pattern</p>	35-37
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## HYPOID GEAR SET - TOOTH CONTACT PATTERNS (HAND ROLLED)

<p><b>Specification:</b> Conventional gear set - Toward the toe of the gear tooth and in the center between the top and bottom of the tooth</p> <p>Generoid gear set - Between the center and toe of the tooth and in the center between the top and bottom of the tooth</p> <p><b>Adjustment:</b> Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash</p> <p>To move the contact pattern lower, decrease the thickness of the shim pack under the pinion bearing cage</p> <p>To move the contact pattern higher, increase the thickness of the shim pack under the pinion bearing cage</p> <p>To move the contact pattern toward the toe of the tooth decrease backlash of the ring gear</p> <p>To move the contact pattern toward the heel of the tooth increase backlash of the ring gear</p>	47-49
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## MAIN DIFFERENTIAL BEARINGS - PRELOAD

<p><b>Specification:</b> 15 to 35 lb-in (1.7 to 3.9 N.m) torque OR Expansion between bearing caps - RS-140 and RS-145 carrier models -.003 to .009 inch (.08 to .22 mm) All other carrier models -.006 to .013 inch (.15 to .33 mm)</p> <p><b>Adjustment:</b> Preload is controlled by tightening both adjusting rings after zero end play is reached</p>	43
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