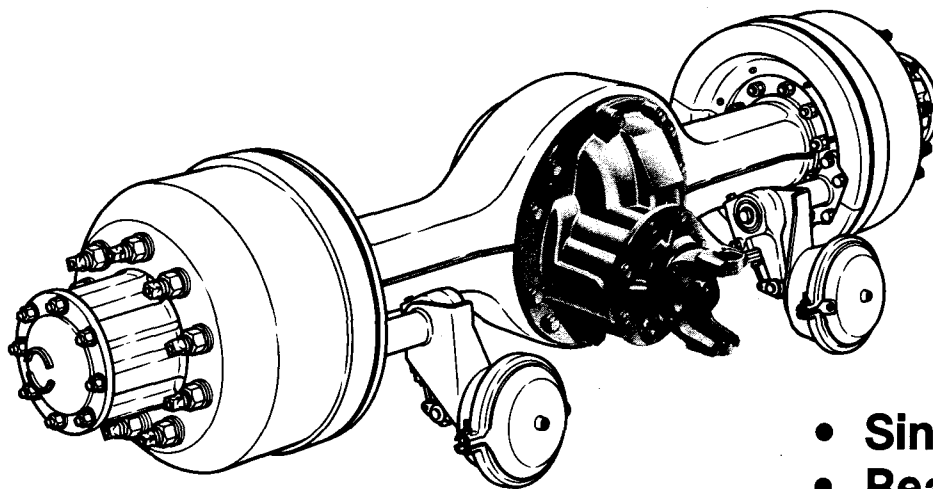


Single Reduction Differential Carriers



Standard and Diff. Lock Carriers For:



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

**(See inside front cover for
specific axle models)**

Use only genuine Rockwell Parts

Axle Models Covered in This Manual

Single drive axles:

A-150	E-100	F-140	H-172	Q-100	R-163	RS-16-140	RS-23-180
B-100	E-105	G-161	L-100	Q-145	R-170	RS-17-140	RS-26-180
B-140	E-150	H-100	L-140	RL-170	S-170	RS-16-141	RS-36-180
B-150	F-100	H-140	L-155	R-100	U-140	RS-17-141	
C-100	F-106	H-150	L-172	R-140	W-170	RS-19-145	
D-100	F-120	H-162	M-172	R-155	RS-13-120	RS-21-145	
D-140	F-121	H-170	QT-140	R-160	RS-15-120	RS-23-160	

Rear axle of tandem axles:

SDHD	SL-100	SQHD	SSHD	SU-170	RT-34-140	RT-40-145	RT-48-180
SFHD	SLHD	SR-170	ST-170	SUHD	RT-40-140	RT-44-145	RT-52-180
SHHD	SQ-100	SRHD	STHD	SW-170	RT-34-145	RT-46-160	RT-58-180

Front drive steering axles:

FDS-75	FDS-85	FDS-93	FDS-1807	FDS-2100	FDS-2107	FDS-2111	FDS-2117
FDS-78	FDS-90	FDS-1600	FDS-1808	FDS-2101	FDS-2110		

Service Notes

This Field Maintenance Manual describes the correct service and repair procedures for Rockwell Single Reduction Carriers. The information contained in this manual was current at the time of printing and is subject to change without notice or liability.

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

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



WARNING:

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



CAUTION:

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



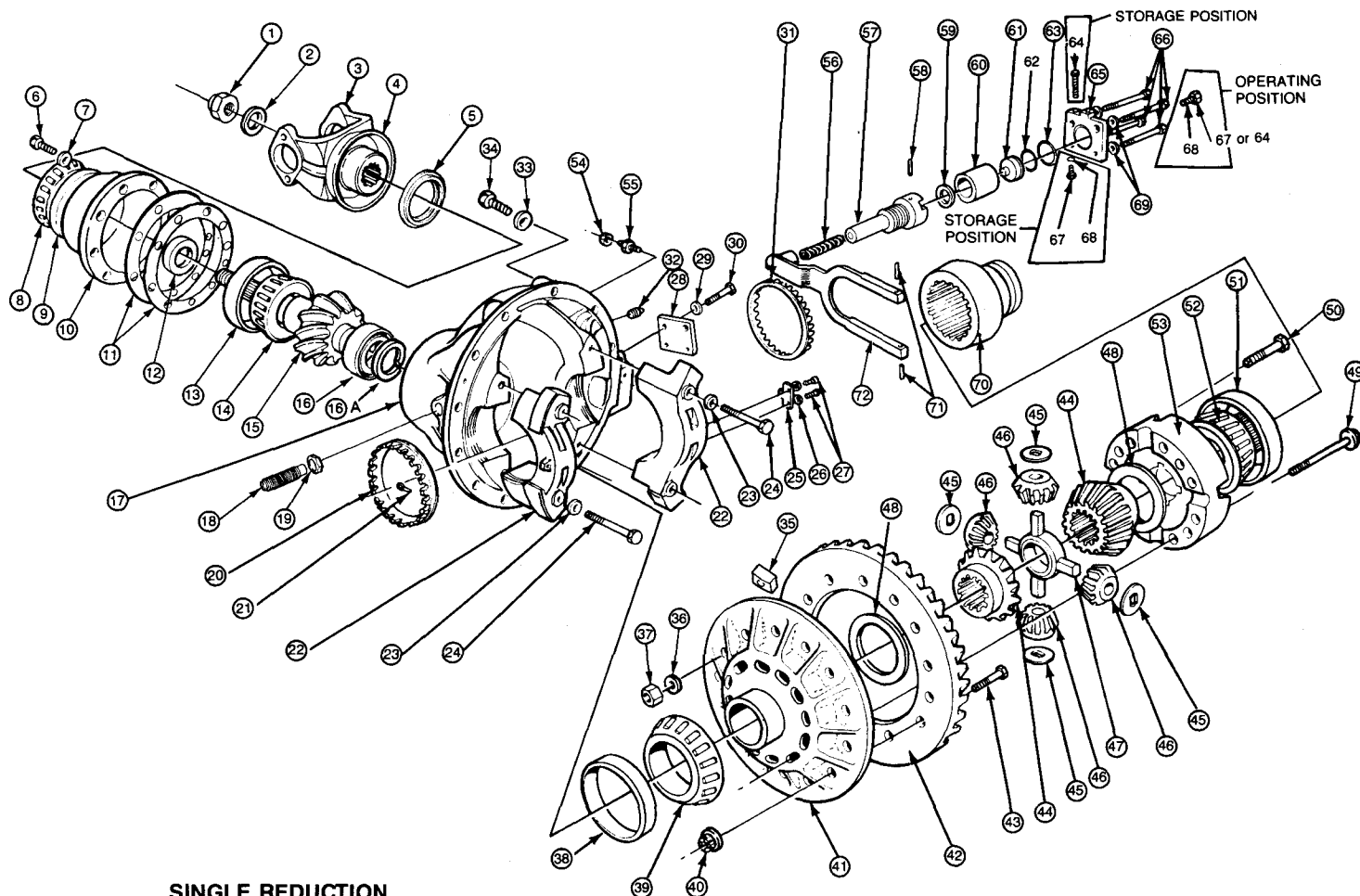
TORQUE:

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

NOTE:

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

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



SINGLE REDUCTION DIFFERENTIAL CARRIER

NOTE DIFFERENTIAL CARRIERS WITHOUT DIFF. LOCK DO NOT HAVE PARTS 54 THROUGH 72. SOME OF THESE CARRIERS HAVE A COVER AND PLUG INSTALLED OVER THE AIR CYLINDER OPENING AND SENSOR SWITCH HOLE IN THE CARRIER.

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Nut - Drive Pinion	11	Shims
2	Washer - Drive Pinion*	12	Spacer - Pinion Bearing
3	Input Yoke* or Flange*	13	Bearing Cup - Pinion Inner
4	Deflector	14	Bearing Cone - Pinion Inner
5	Oil Seal	15	Drive Pinion
6	Capscrew - Bearing Cage	16	Spigot Bearing
7	Washer	16A	Snap Ring
8	Bearing Cone - Pinion Outer	17	Carrier
9	Bearing Cup - Pinion Outer	18	Thrust Screw*
10	Bearing Cage - Drive Pinion	19	Jam Nut* - Thrust Screw*

*Some Rockwell Carriers do not have the parts described.

ITEM	DESCRIPTION
20	Adjusting Ring - L.H.
21	Cotter* or Pin*
22	Caps - Differential Bearing
23	Washers
24	Capscrews - Diff. Bearing Cap
25	Lock Plate* - Adjusting Ring
26	Washers* - Lock Plate*
27	Capscrews* - Lock Plate*
28	Cover* - Air Cylinder Opening
29	Washers* - Cover*
30	Capscrews* - Cover*
31	Adjusting Ring - R.H.
32	Plug* - Oil Fill Hole (carrier)
33	Washer* - Capscrew/Plug*
34	Capscrew/Plug* - Sensor Hole
35	Thrust Block*
36	Washers* - Differential Case
37	Nuts* - Differential Case
38	Bearing Cup - Differential L.H.
39	Bearing Cone - Differential L.H.
40	Nuts* - Ring Gear and Case Half
41	Case Half - Flange
42	Ring Gear
43	Bolts* or Rivets* - Ring Gear and Case Half
44	Side Gears - Differential
45	Thrust Washers - Differential Pinion
46	Pinions - Differential
47	Spider - Differential
48	Thrust Washers - Differential Side Gear
49	Capscrews - Differential Case
50	Bolts* - Differential Case
51	Bearing Cup - Differential R.H.
52	Bearing Cone - Differential R.H.
53	Case Half - Plain

THE FOLLOWING PARTS ARE FOR DIFF. LOCK CARRIERS ONLY

54	Lock Nut - Sensor Switch
55	Sensor Switch
56	Spring - Shift Shaft
57	Shift Shaft
58	Pin - Spring Retaining
59	Washer* or Silastic* - Air Cylinder
60	Tube - Air Cylinder
61	Piston
62	O-Ring - Piston
63	Copper Gasket - Cylinder Cover
64	Capscrew - Manual Actuation
65	Cylinder Cover
66	Capscrews - Cylinder Cover
67	Plug - Cylinder Cover
68	Gasket - Cover Plug
69	Washers - Cylinder Cover
70	Shift Collar
71	Pins - Shift Fork
72	Shift Fork

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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

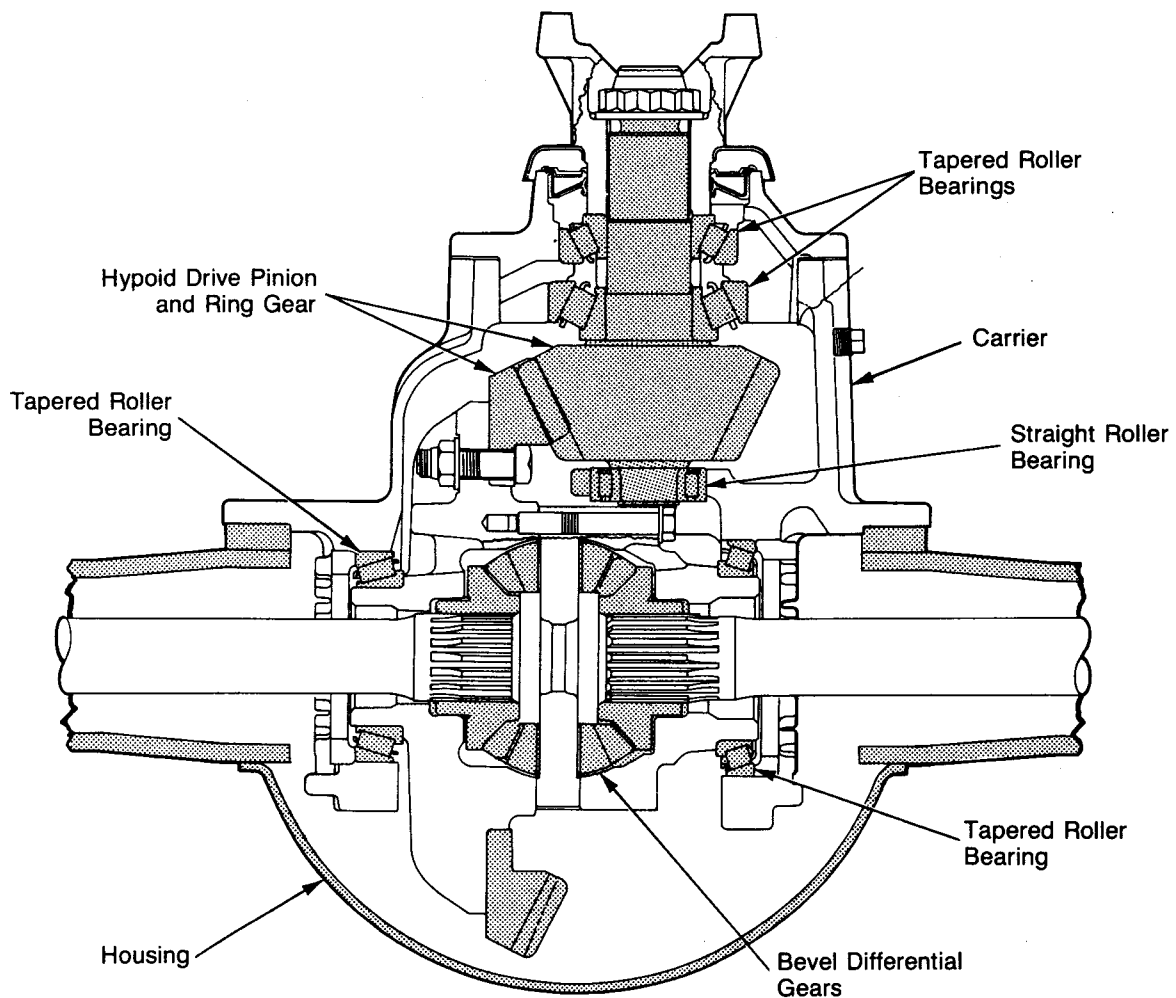
drive pinion and ring gear set and bevel gears in the differential assembly.

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

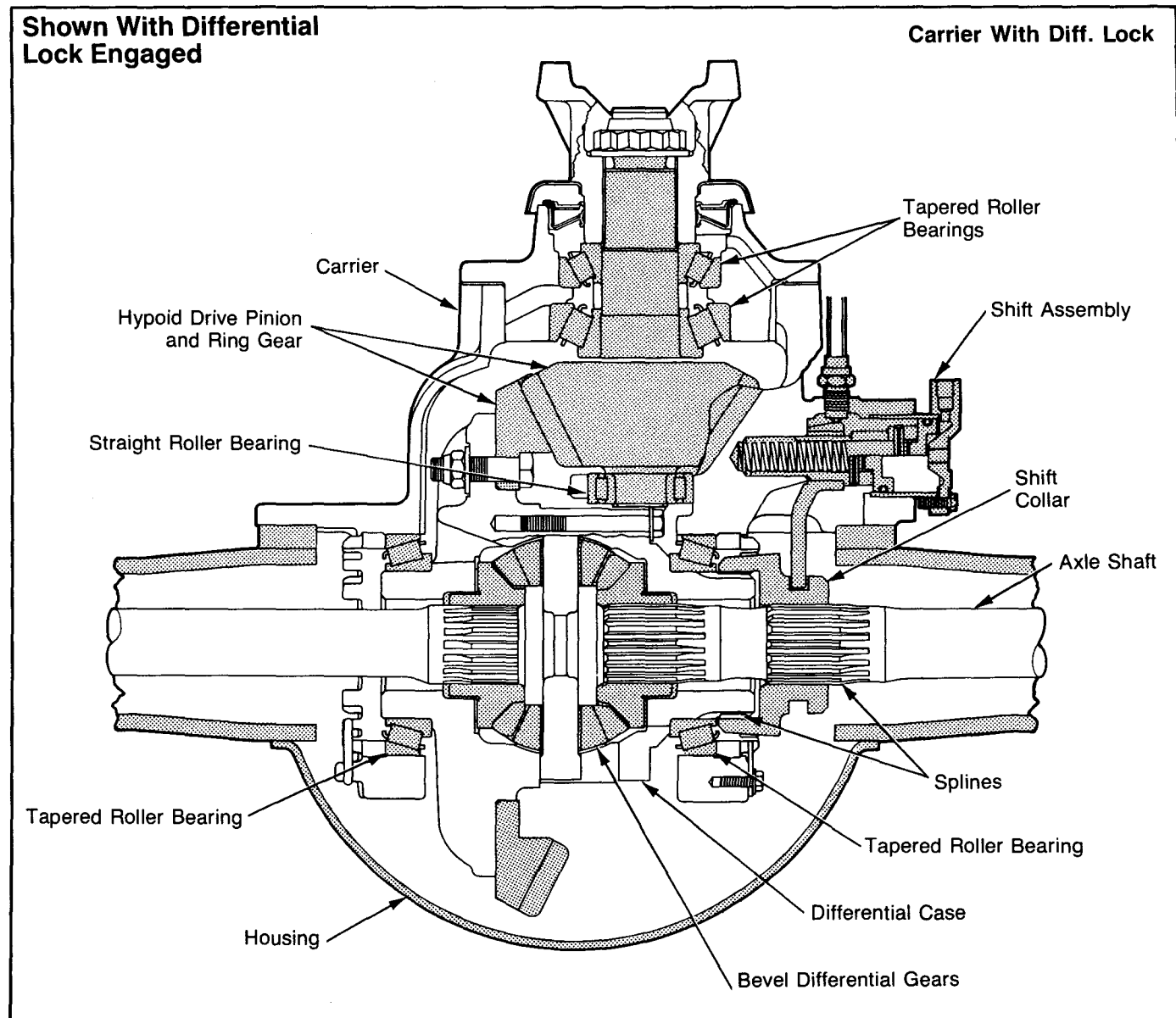


Single Reduction Carriers with Driver Controlled Main Differential Lock (Diff. Lock)

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.



section 2 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.

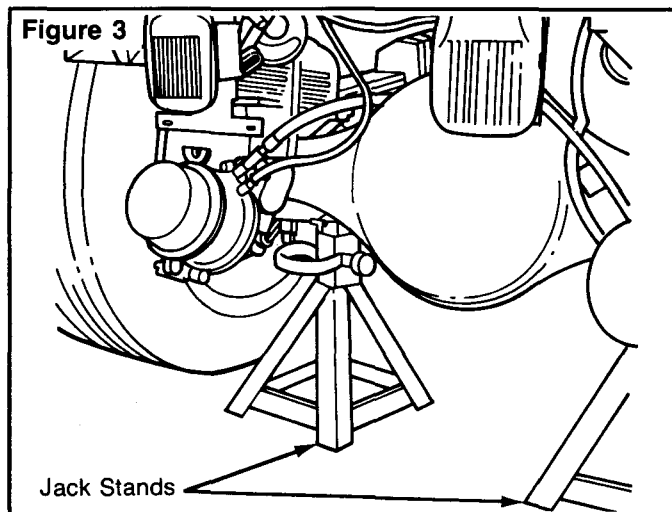
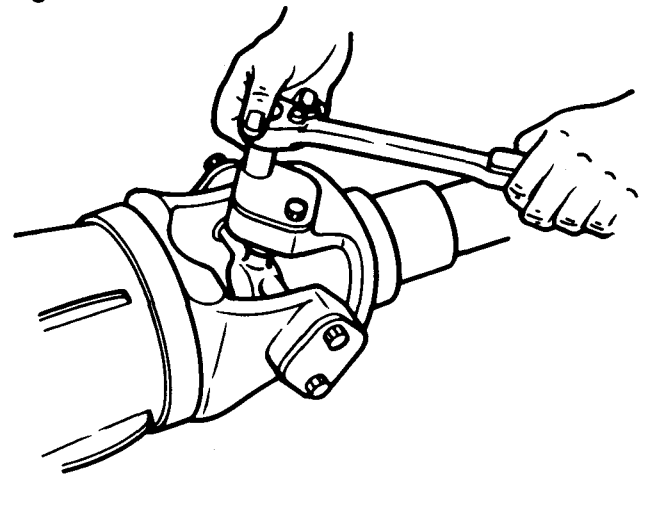


Figure 4

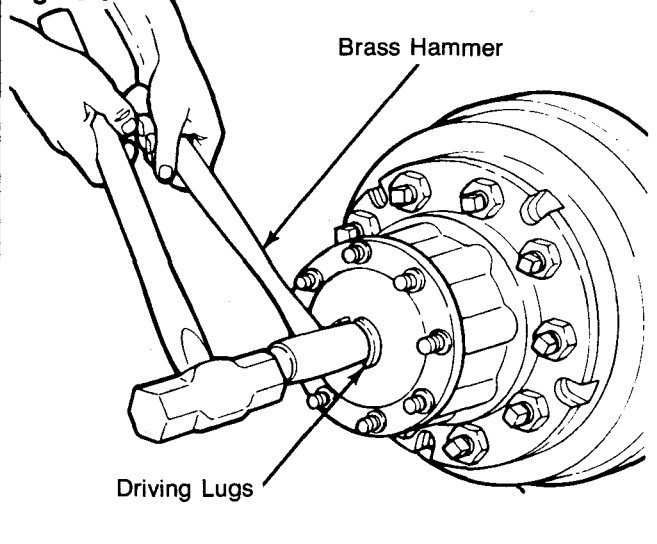


WARNING:

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.

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.

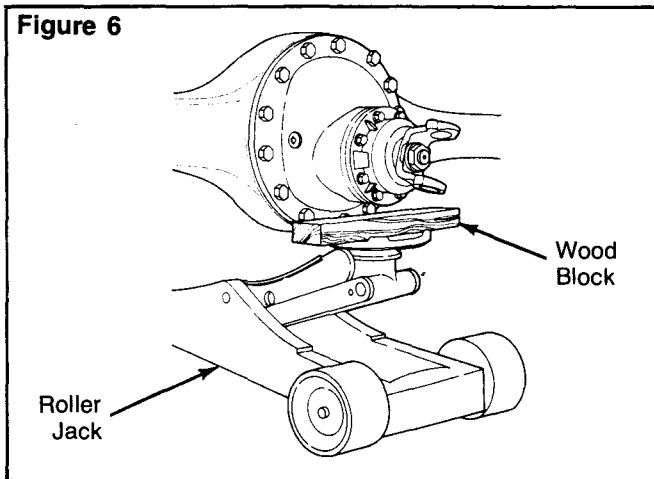


CAUTION:

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.**

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.



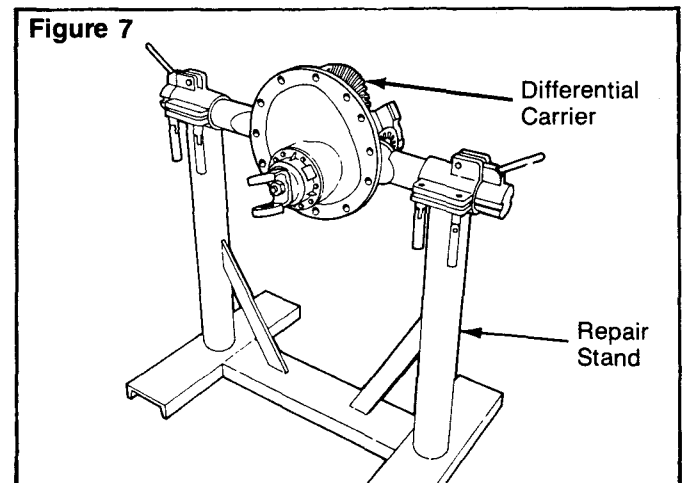
CAUTION:

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.

Figure 7



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.

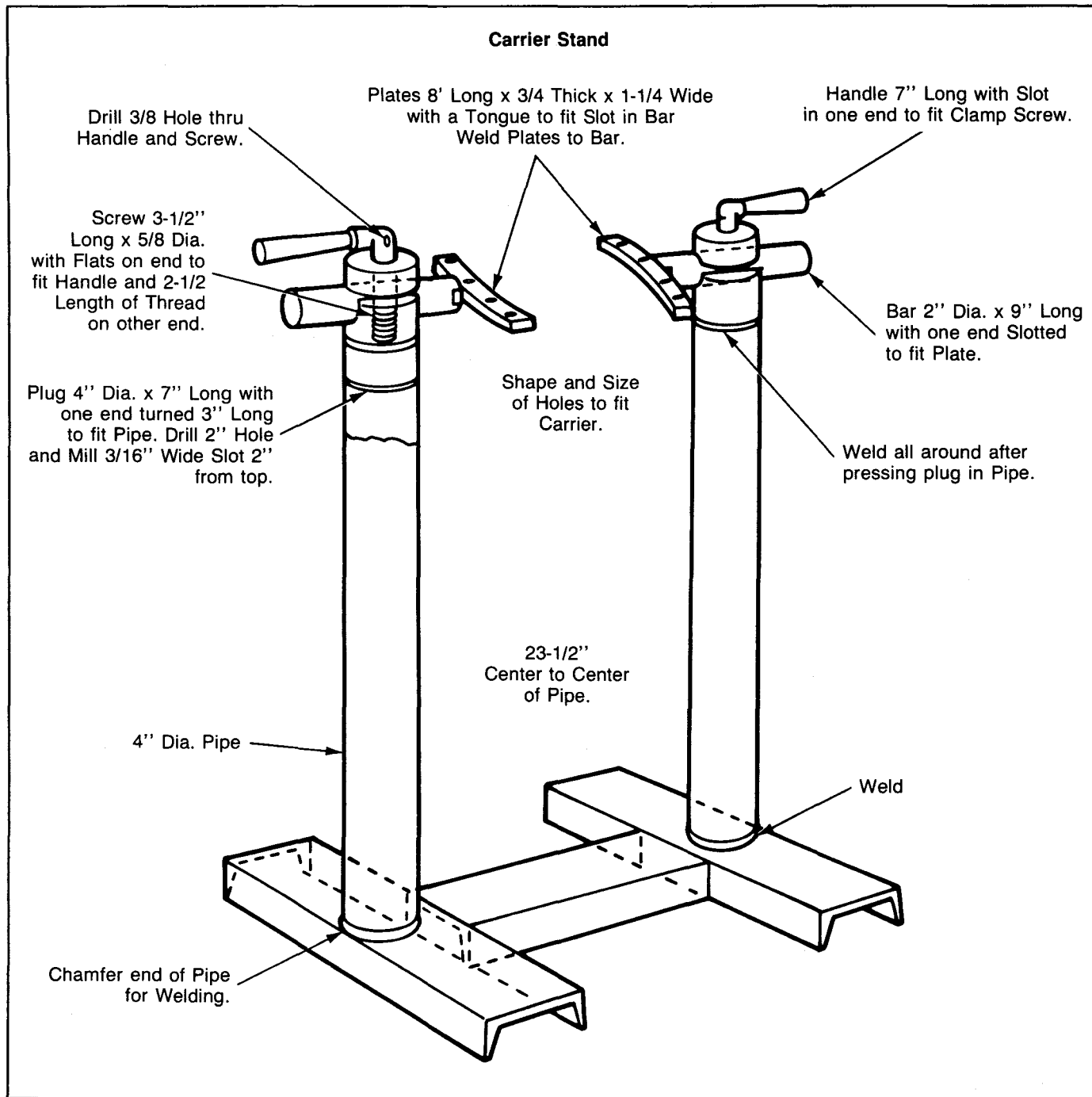
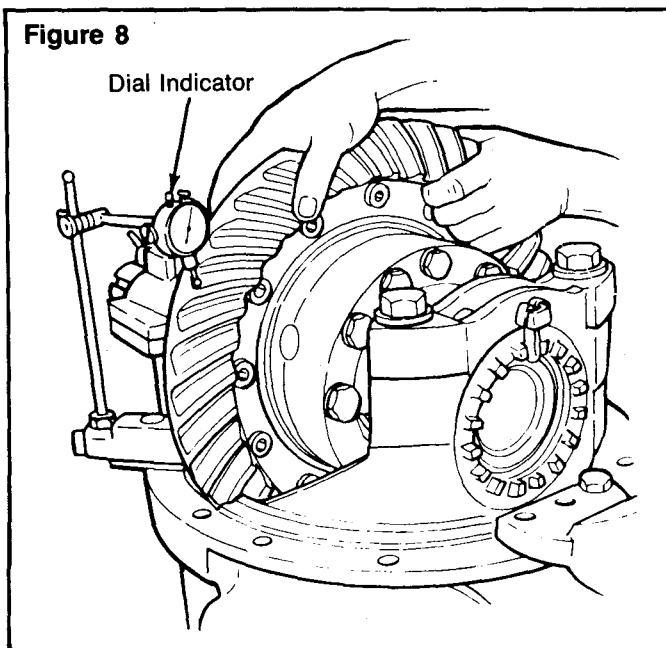
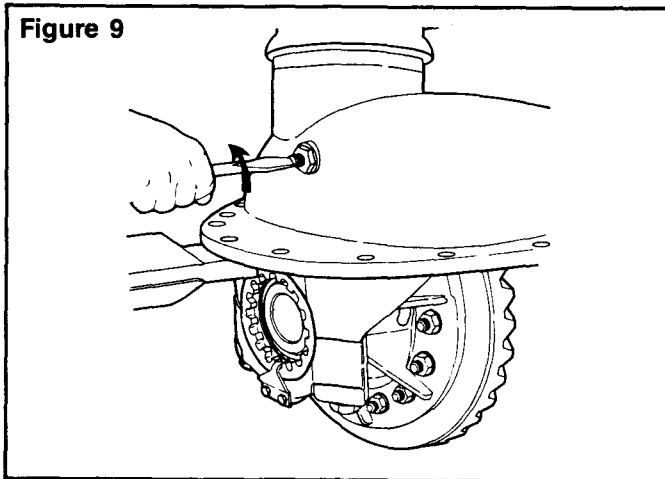


Figure 8



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

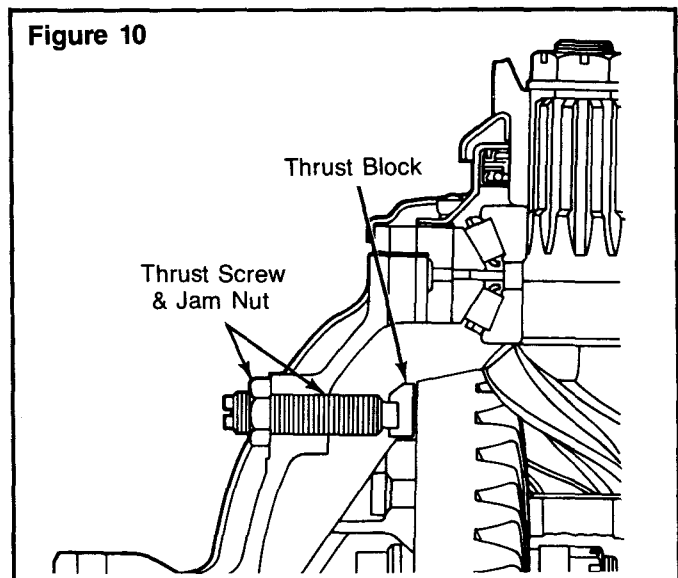
Figure 9



NOTE:

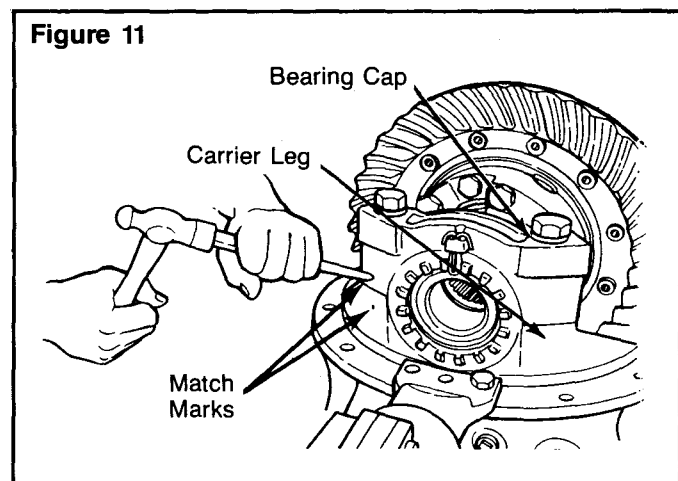
Some Rockwell carrier models have a thrust block*. The thrust block will fall away from the ring gear inside the carrier when you remove the thrust screw. **Figure 10.**

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.**

Figure 11

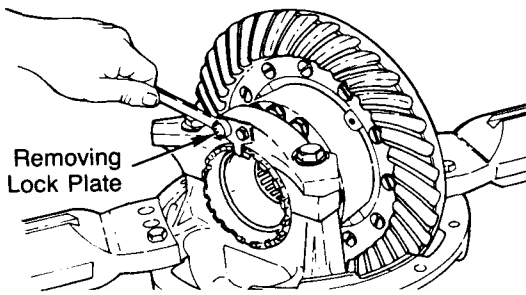
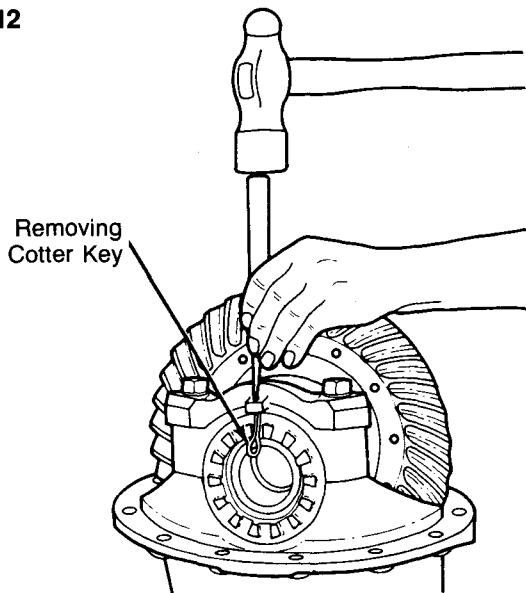


5. Remove the cotter keys*, pins* or lock plates* that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews. **Figure 12.**

*Some Rockwell carriers do not have the parts described.

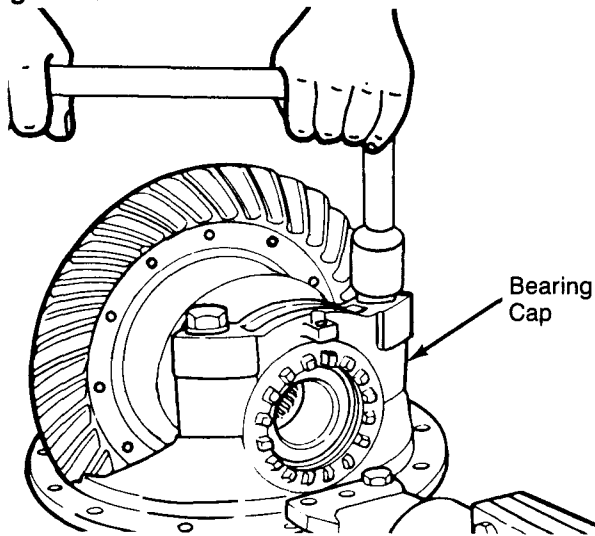
section 2 Disassembly

Figure 12



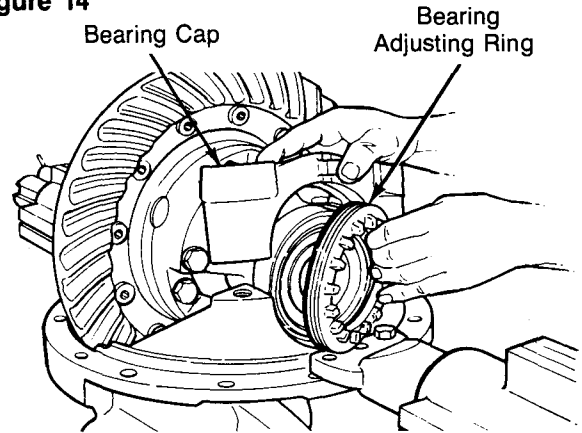
6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers. **Figure 13.**

Figure 13



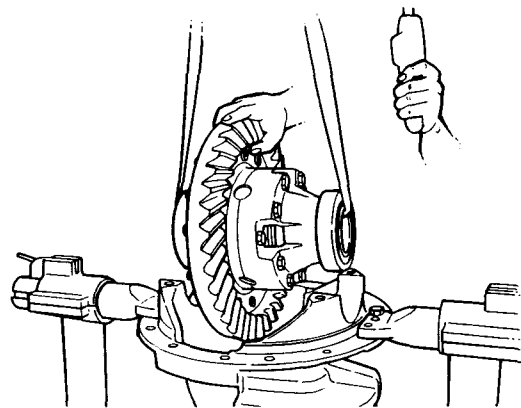
7. Remove the bearing caps and bearing adjusting rings from the carrier. **Figure 14.**

Figure 14



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

Figure 15



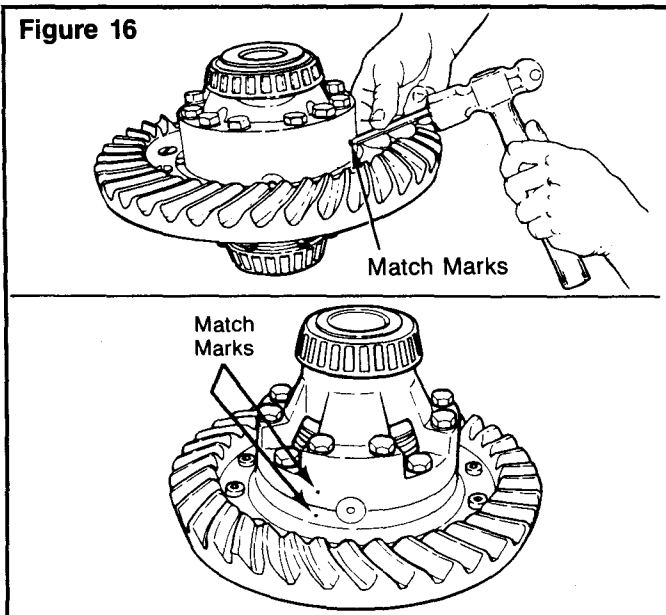
9. Remove the thrust block* from inside the carrier.

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 16



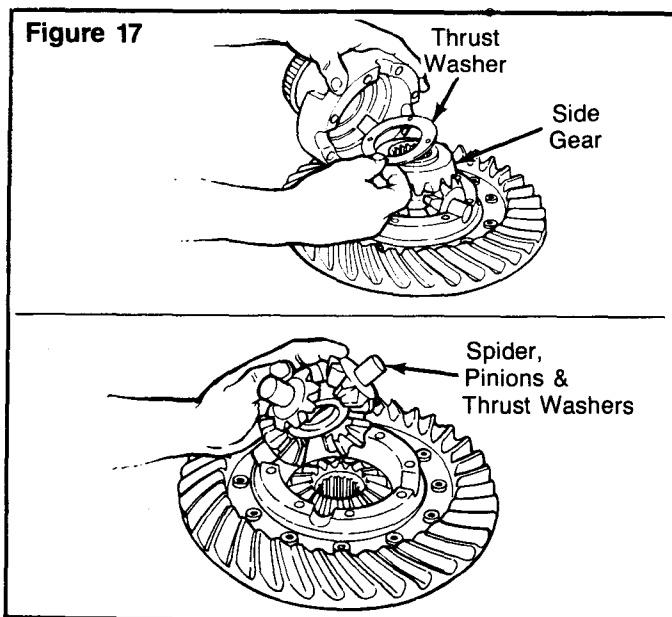
2. Remove the lock wire* capscrews* and washers* or bolts*, nuts* and washers that hold the case halves together.

WARNING:

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

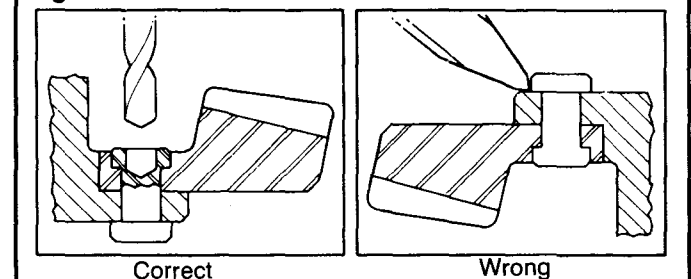
3. Separate the case halves. If necessary, use a brass, plastic or leather mallet to loosen the parts.
4. Remove the differential spider (cross), four pinion gears, two side gears and six thrust washers from inside the case halves. **Figure 17.**

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



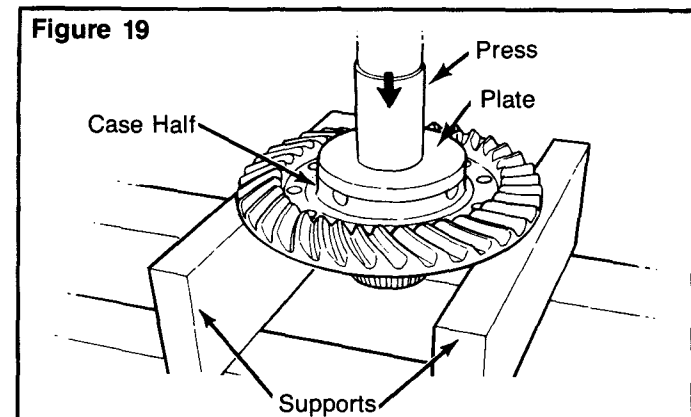
- C. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.

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.**

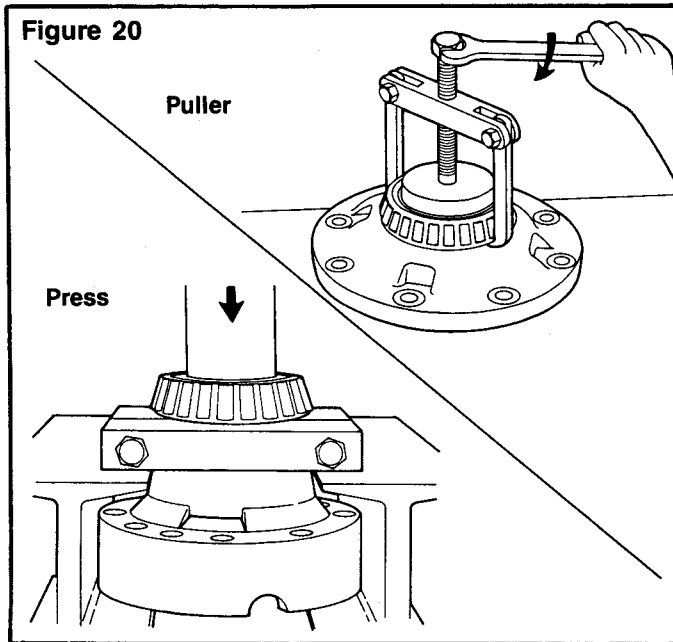
Figure 19



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

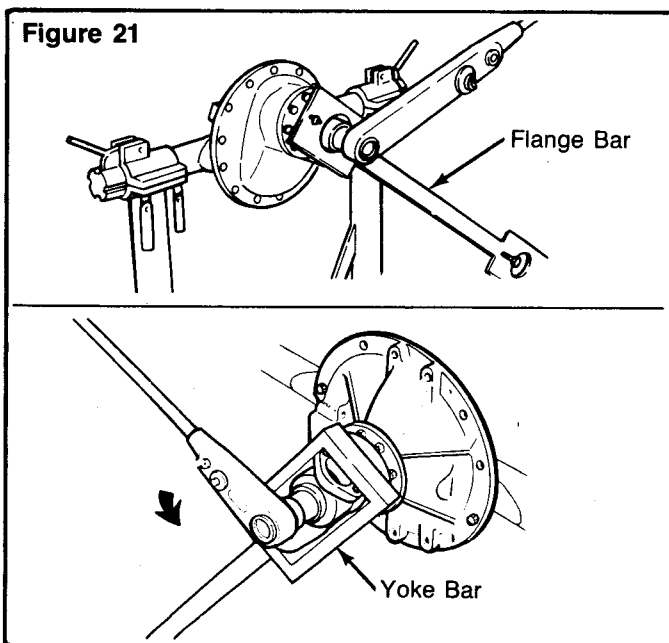
section 2 Disassembly

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.**

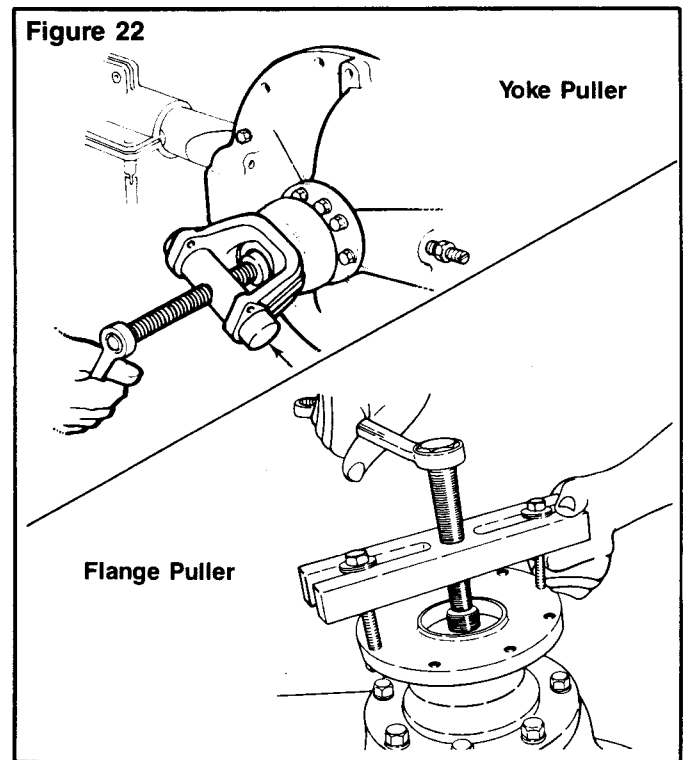


Remove the Drive Pinion and Bearing Cage From Carrier

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.**



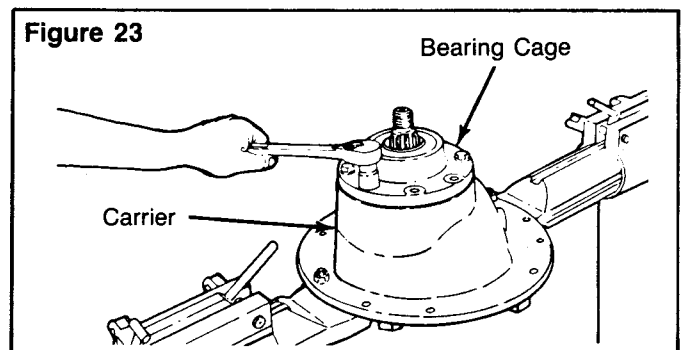
2. Remove the nut and washer* from the drive pinion. **Figure 21.**
3. Remove the yoke or flange bar.
4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. **Figure 22.**



! 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.**



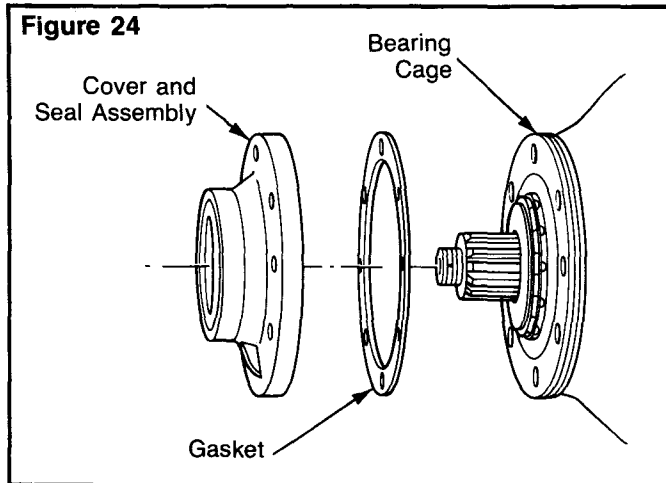
**Some Rockwell carriers do not have the parts described.*



WARNING:

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

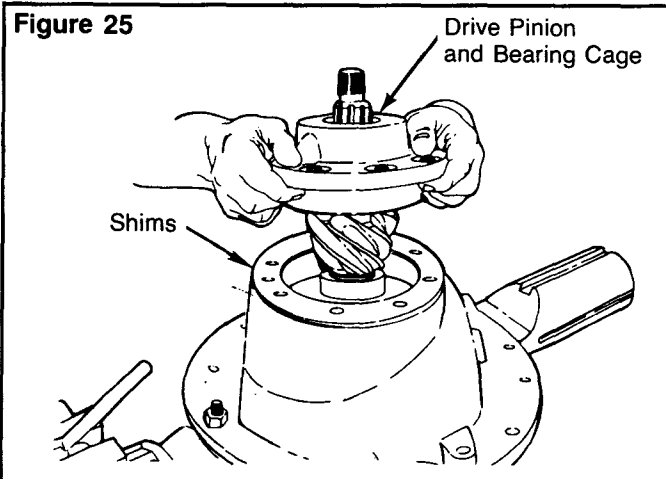
6. Remove the cover* and seal assembly and gasket* from the bearing cage. If the cover* is tight on the bearing cage, use a brass drift and hammer for removal. **Figure 24.**



7. 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.



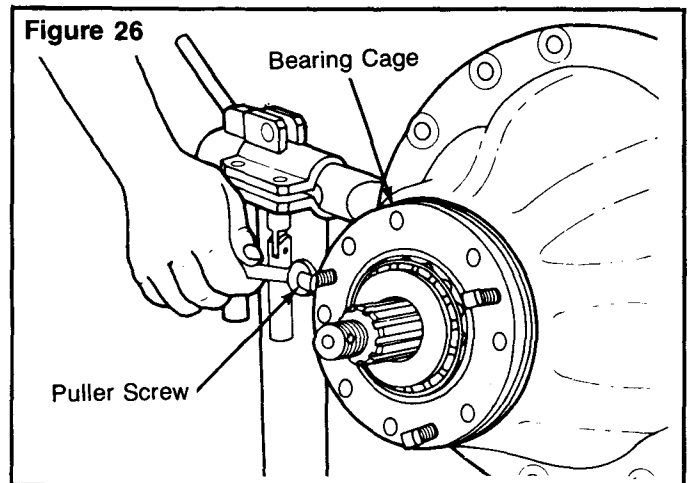
8. Remove the drive pinion, bearing cage and shims from the carrier. If the bearing cage is tight in the carrier, use the following procedures to loosen the cage. **Figure 25.**



WARNING:

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

- A. Hit the bearing cage at several points around the flange area with a leather, plastic or rubber mallet.
- B. 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:

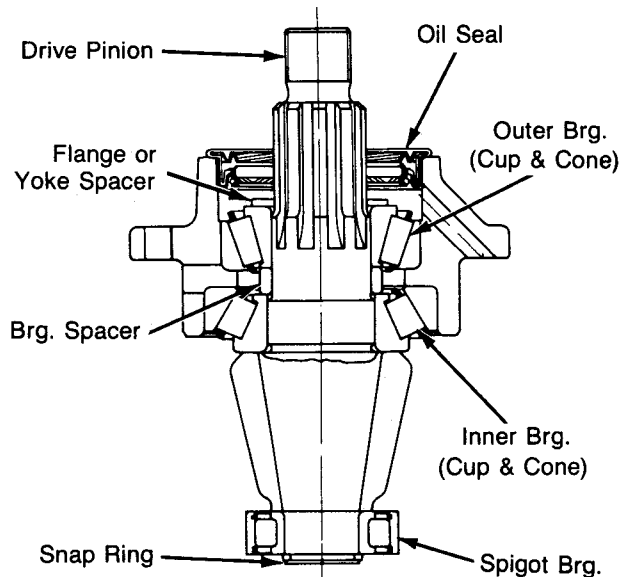
Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing cage, shims and carrier.

9. If the shims are in good condition, keep the shims together for use later when the carrier is assembled.
10. 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.

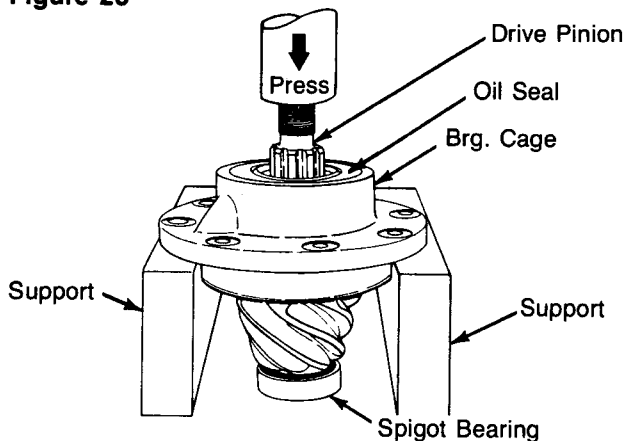
Disassemble The Drive Pinion And Bearing Cage

Figure 27 — (Pinion & Bearing Cage Assembly)



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

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:

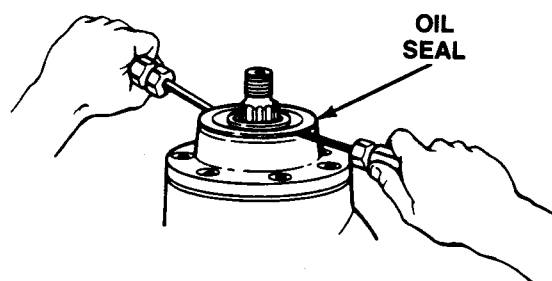
Wear safe eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause injury.

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 bore of the bearing cage, remove the seal at this time. Be careful that you do not damage the mounting surfaces of the bearing cage. **Figure 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.

Figure 29

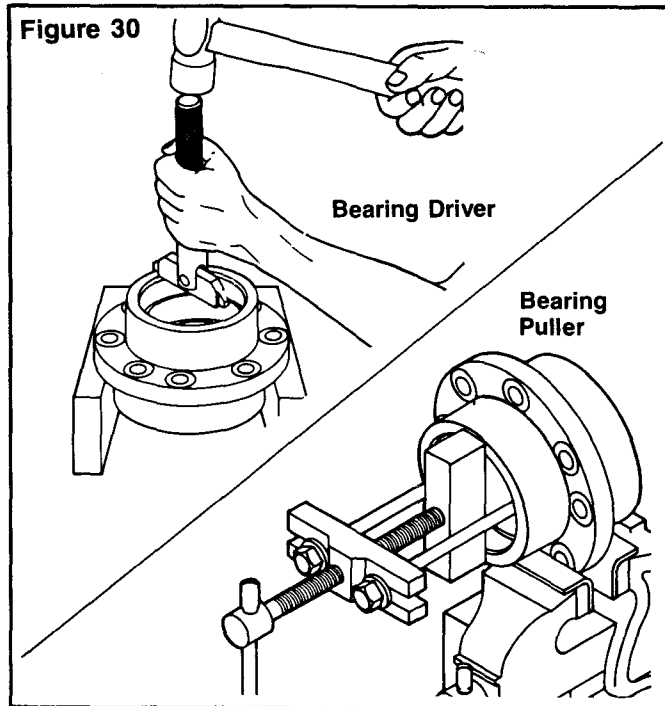


CAUTION:

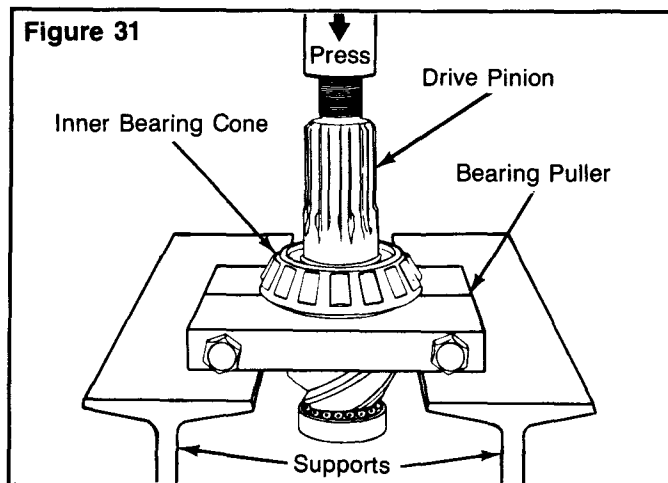
Be careful when using a screwdriver or pry bar to remove the seal. Do not damage the wall of bore. Damage to the bore can cause oil leaks.

6. If the pinion bearings need to be replaced, remove the inner and outer bearing cups from 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.

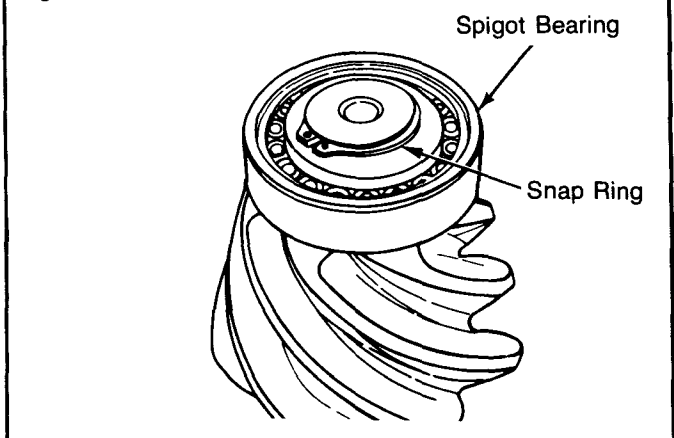


7. If the pinion bearings need to be replaced, remove the inner bearing cone from the drive pinion with a press or bearing puller. The puller **MUST** fit under the inner race of the cone to remove the cone correctly without damage. **Figure 31.**



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.**

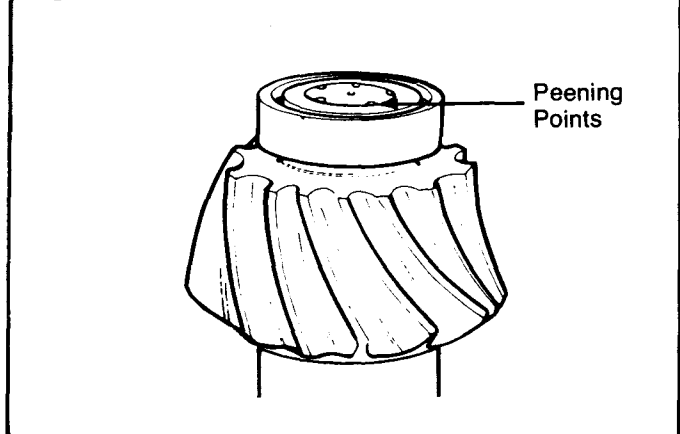
Figure 32



NOTE:

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

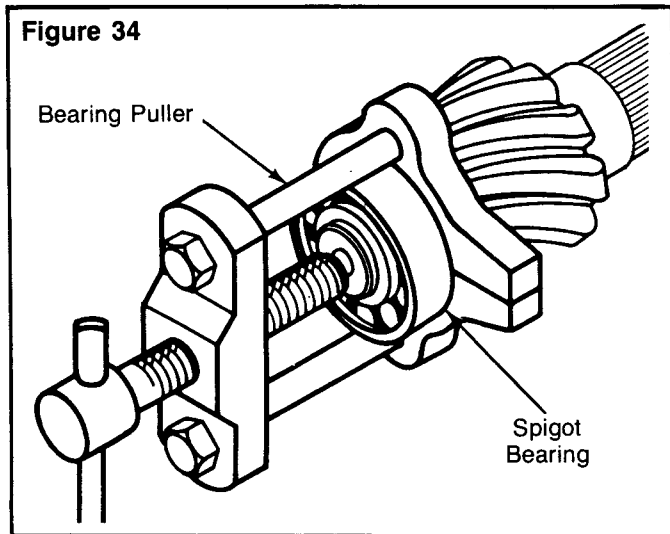
Figure 33



*Some Rockwell carriers do not have the parts described.

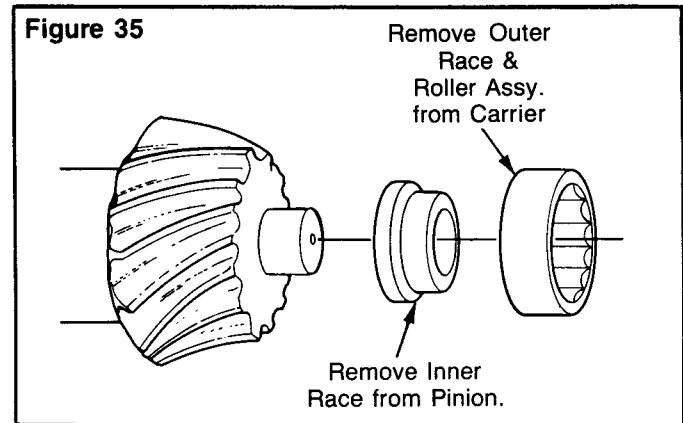
section 2 Disassembly

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:

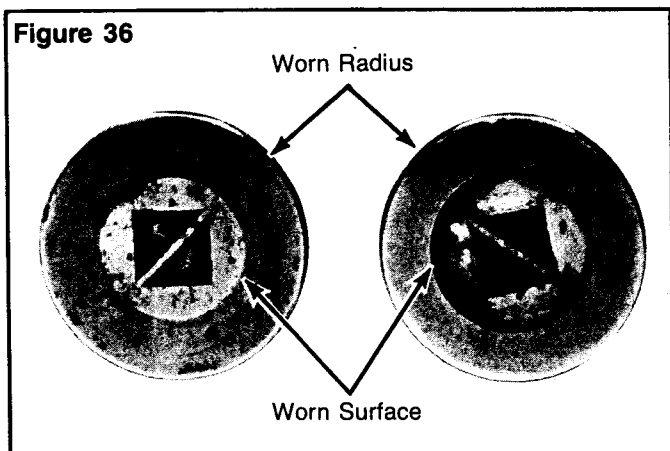
It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged or worn parts now, will prevent failure of the assembly later.

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.

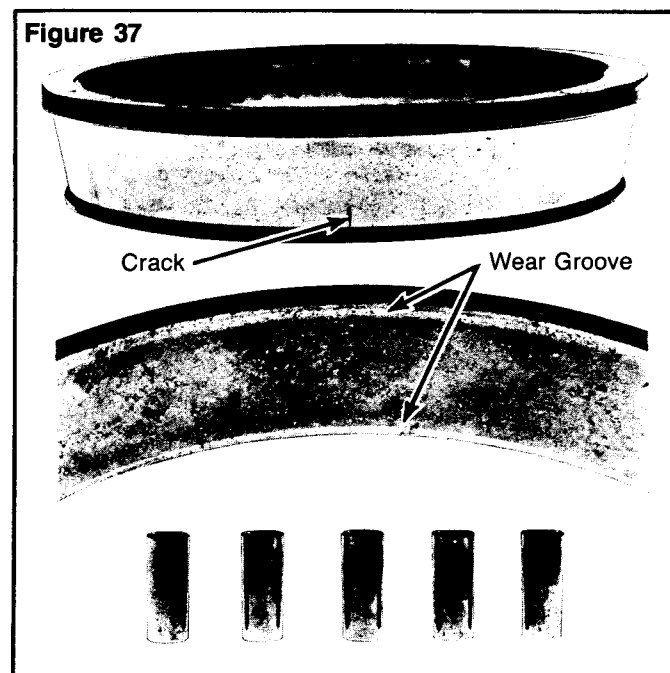
section 3 Prepare Parts for Assembly

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



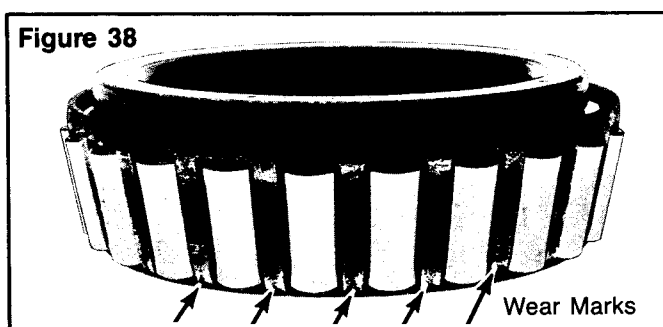
B. The radius at large diameter end of rollers worn to a sharp edge. **Figure 36.**

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.**

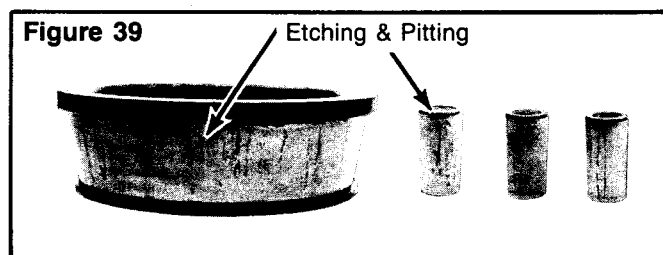


D. Deep cracks or breaks in the cup, cone inner race or roller surfaces. **Figure 37.**

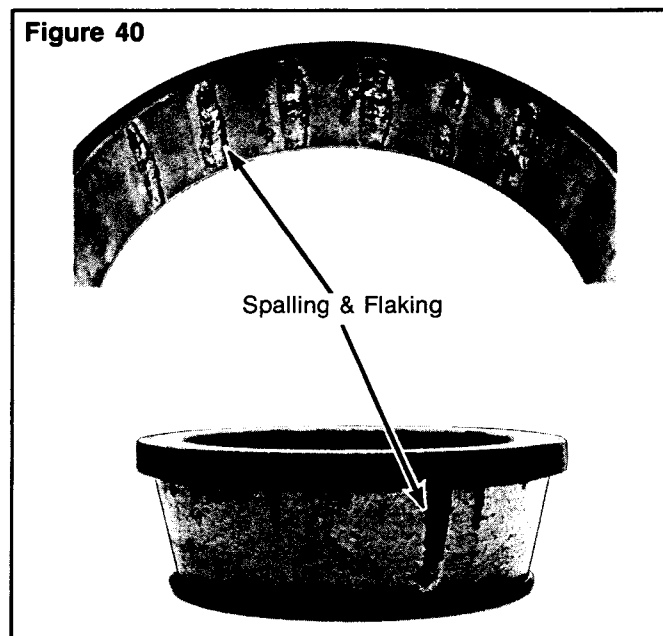
E. Bright wear marks on the outer surface of the roller cage. **Figure 38.**



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:

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



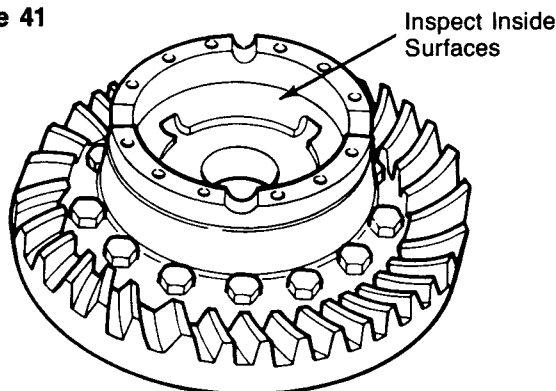
CAUTION:

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.

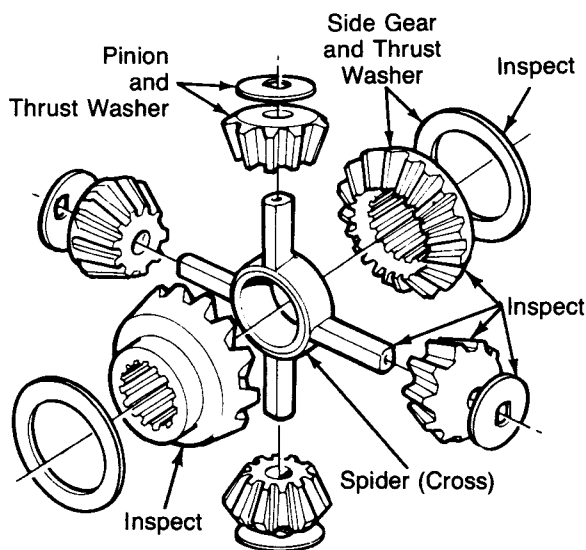
3. Inspect the Main Differential Assembly:

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

Figure 41



DIFFERENTIAL CASE HALVES



DIFFERENTIAL GEAR NEST ASSEMBLY

- Inside surfaces of both case halves.

- Both surfaces of all thrust washers.

- The four trunnion ends of the spider (cross).

- Teeth and splines of both differential side gears.

- 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:

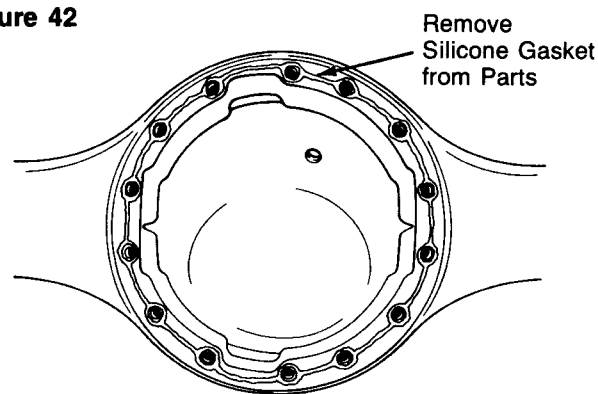
- Inspect axle shafts for wear and cracks at the flange, shaft and splines. Replace axle shaft if required.

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.

- Replace any fastener if corners of the head are worn.
- Replace washers if damaged.
- Replace gaskets, oil seals or grease seals at the time of axle or carrier repair.
- Clean parts and apply new silicone gasket material where required when axle or carrier is assembled. **Figure 42.**

Figure 42



section 3 Prepare Parts for Assembly

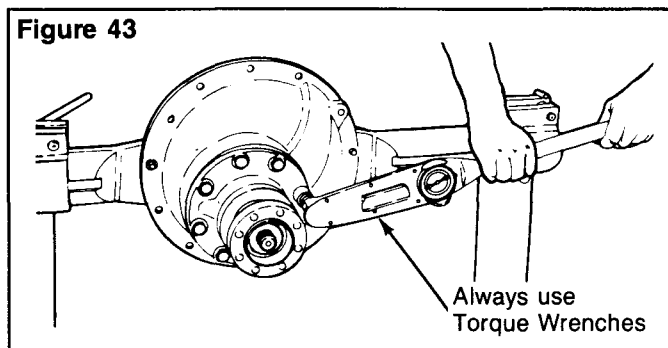
5. Remove nicks, mars and burrs from parts having machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth for this purpose.
6. Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.

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 old 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 (149° 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 only* 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.

section 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.

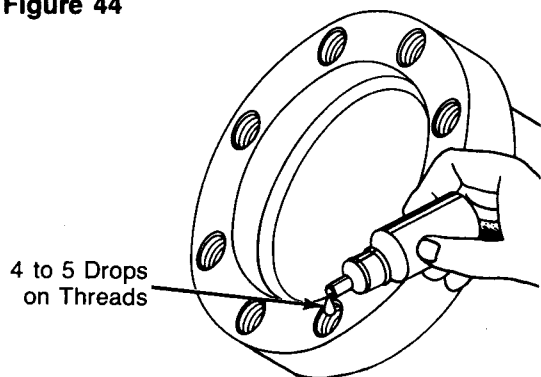


NOTE:

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.**



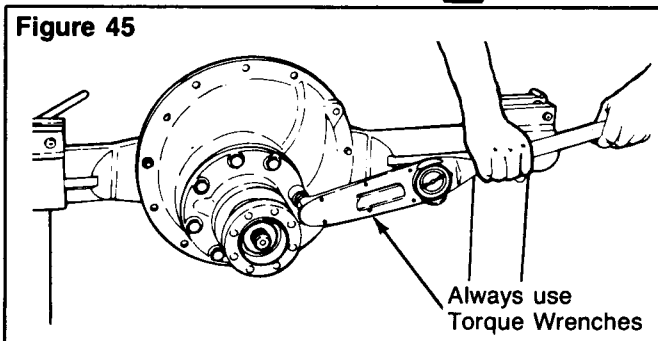
CAUTION:

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.

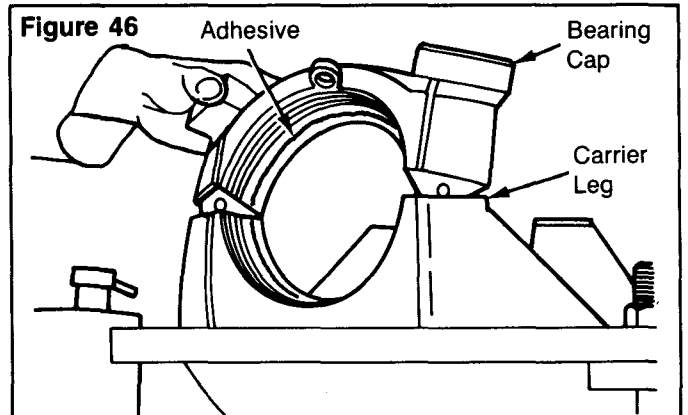


CAUTION:

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.

c. From Rockwell International:

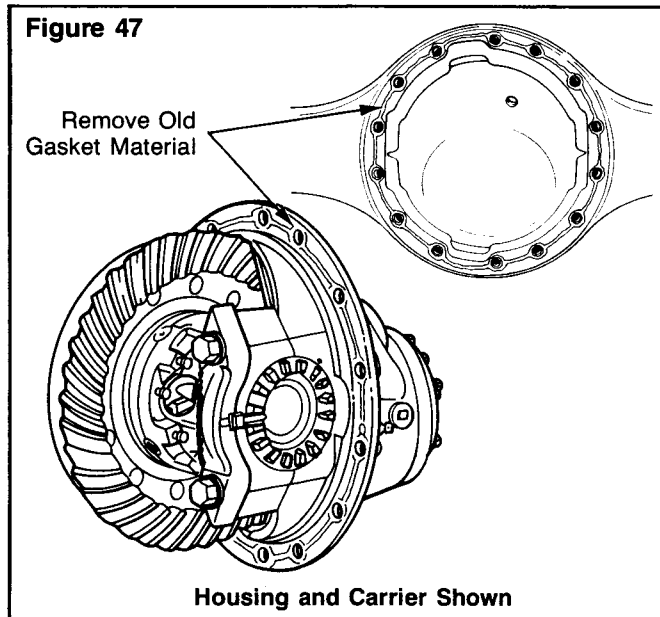
- 40 pound containers, Part No. 1199-Q-2981
- Ten ounce tubes, Part No. 1250-X-388
- Three ounce tubes, Part No. 1199-T-3842



WARNING:

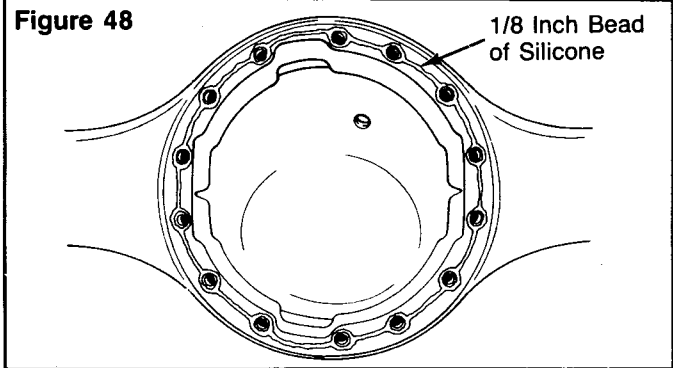
Small amounts of acid vapor are present when applying silicone gasket material. For this reason, be sure there is good ventilation in the work area. If the silicone gasket material gets in the eyes, flush the eyes with water for 15 minutes. Have the eyes checked by a doctor.

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.**

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	SSHD	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		Rear Input	D80T-4859-B
	Forward Output	D89T-4859-B	SU-170	Forward Input	D80T-4859-B
	Rear Input	D89T-4859-B		Forward Output	D80T-4859-A
RT-44-145*	Forward Input	D89T-4859-B		Rear Input	D80T-4859-B
	Forward Output	D89T-4859-B	SR-270/280	Forward Input	D80T-4859-B
	Rear Input	D89T-4859-B		Forward Output	D80T-4859-A
RT-46-160*	Forward Input	D89T-4859-A		Rear Input	D80T-4859-A
	Forward Output	D89T-4859-B	ST-270/280	Forward Input	D80T-4859-B
	Rear Input	D89T-4859-A		Forward Output	D80T-4859-A
RT-48-180**	Forward Input	D80T-4859-B		Rear Input	D80T-4859-A
	Forward Output	D80T-4859-A	SU-270/280	Forward Input	D80T-4859-B
	Rear Input	D89T-4859-A		Forward Output	D80T-4859-A
				Rear Input	D80T-4859-A
			SW-280	Forward Input	D80T-4859-B
				Forward Output	D80T-4859-A
				Rear Input	D80T-4859-A
			SFDD-4640	Forward Input	D80T-4859-B
				Forward Output	D80T-4859-A
				Rear Input	D80T-4859-A

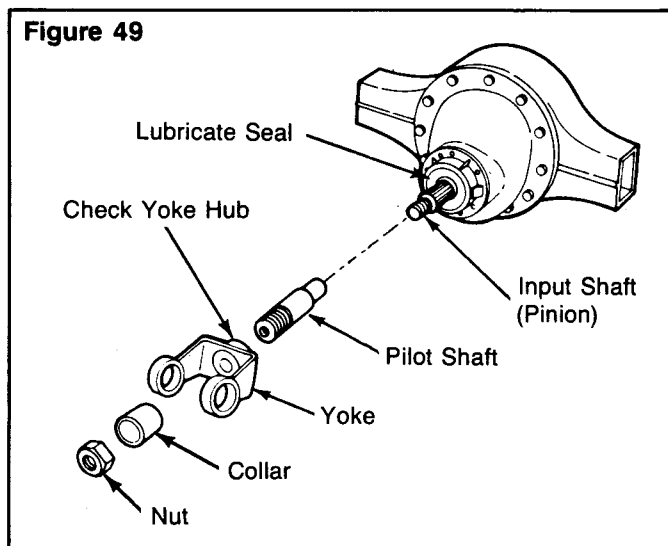
*Axle models have metric size threads on drive pinions, input shafts and output shafts.
 **Metric threads only on drive pinions of rear/rear axles.

section 4 General Procedures

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.

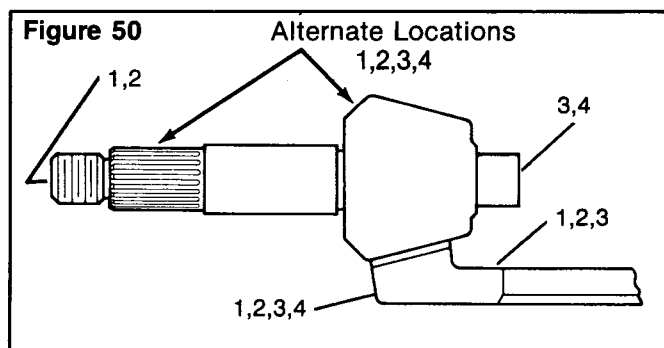


Gear Set Information (Drive Pinion and Ring Gear Marks)

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.

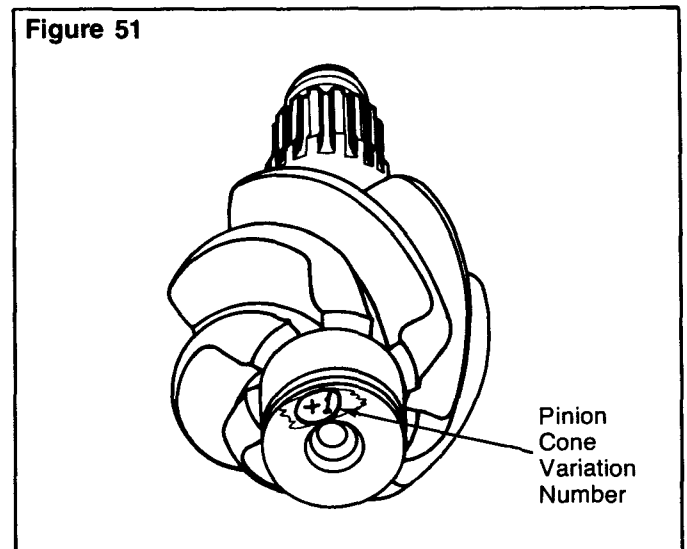
4. Pinion Cone Variation Number

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, +.01mm or -.02mm.
Figure 51.

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.

section 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.

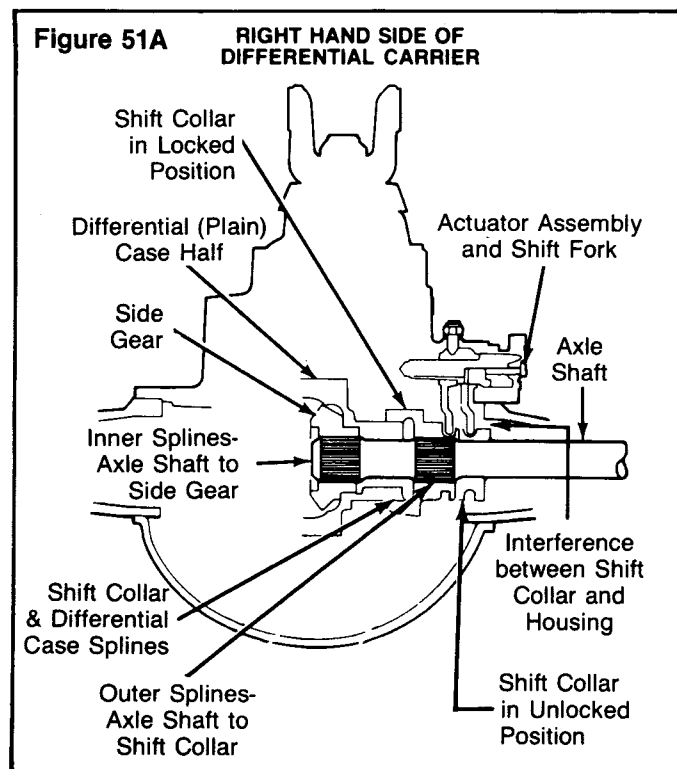
NOTE:

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.

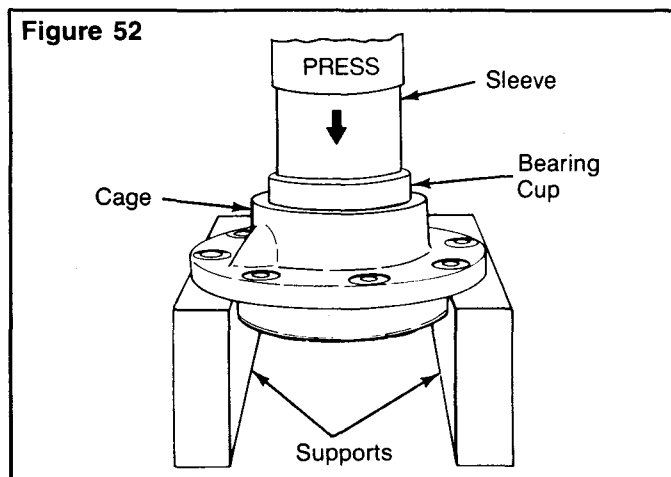
Assembly

section

5

Assemble the Drive Pinion, Bearings and Bearing Cage

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

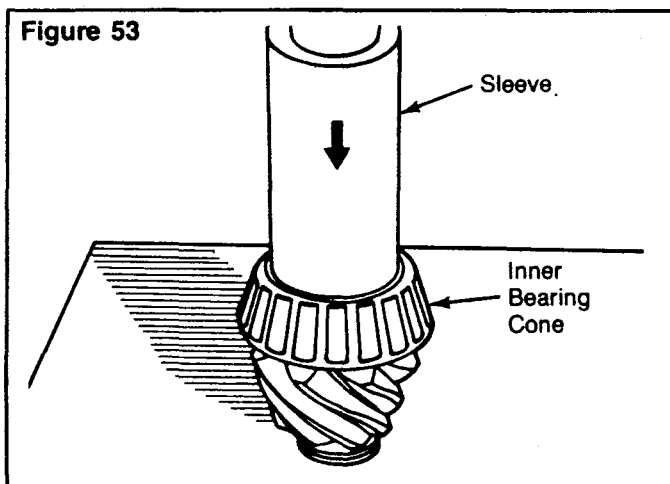


2. Support the bearing cage with metal or wood blocks.
3. Press the bearing cup into the bore of bearing cage until cup is flat against bottom of bore. Use a sleeve of the correct size to install bearing cup. **Figure 52.**

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:

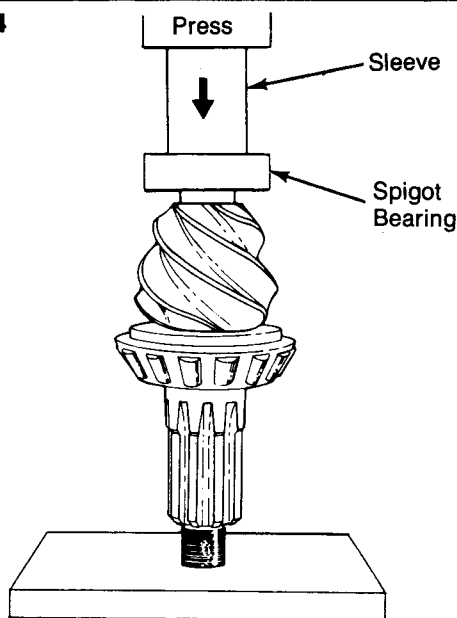
This procedure applies to all axles except:

- 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.**

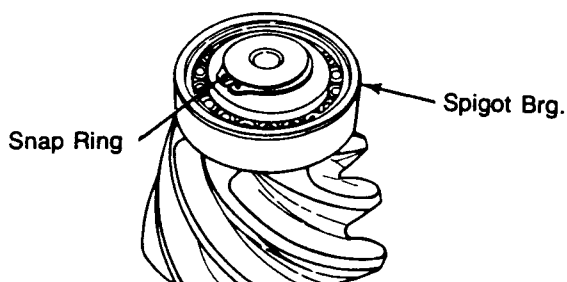
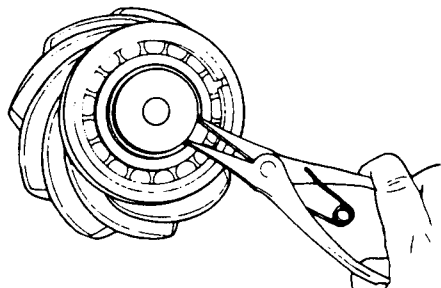
- B. Press the spigot bearing on the end of drive pinion until the bearing is flat against the gear head. Use a sleeve of the correct size against the bearing inner race. **Figure 54.**

Figure 54



- C. On R-155 and R-163 single rear axles, and SRHD, SSHD, STHD and SUHD 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.**

Figure 55



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

NOTE:

This procedure applies to the following axles:

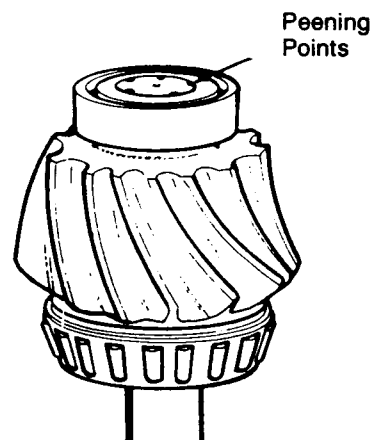
- All H-170 single rear axles.
- Some 120 and 125 Series single axles. These axles may use snap rings.
- Some SL-100, SQ-100 and 180 Series rear rear tandem axles. These axles may use snap rings.

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.**

Figure 56



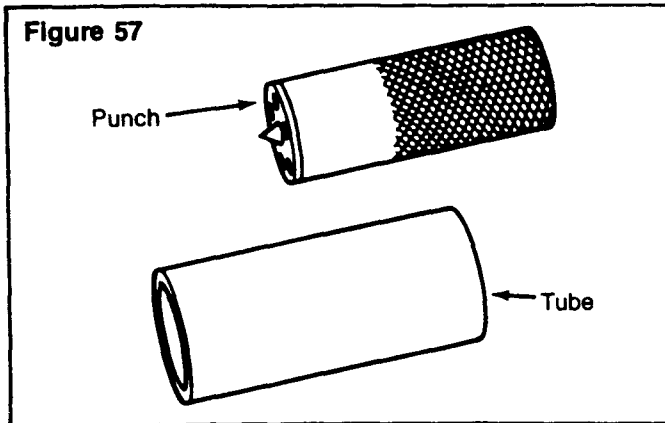
When a peen tool and press (**Figure 57**) are used, calculate the force required on the tool as follows.

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

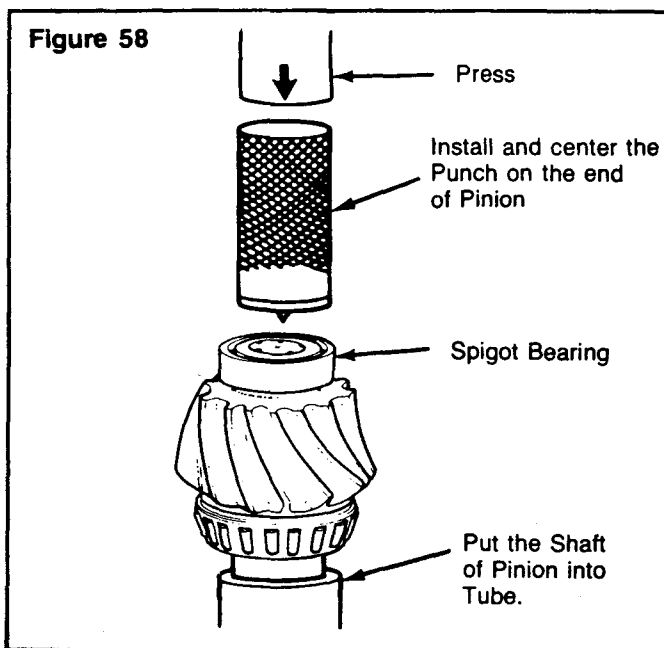
Example: 6,614 lb. x 3 balls = 19,842 pounds

**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:

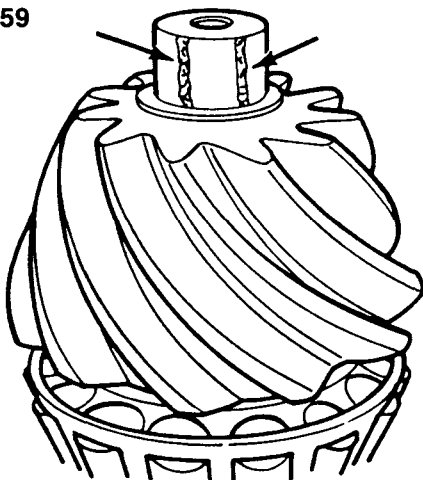
Kent-More Kit J-39039 includes the staking tool, temperature indicating liquid, heating shield and plastigage needed for this job.

section 5 Assembly

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

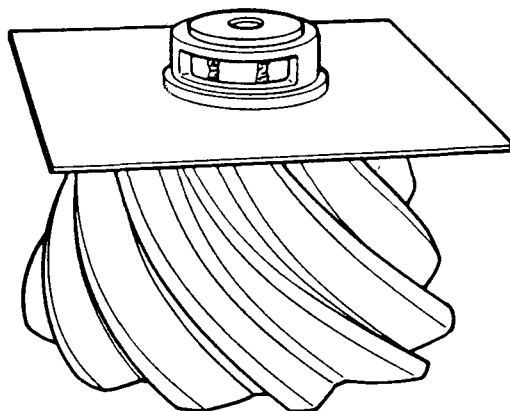
Figure 59. Apply a green stripe to indicate 400°F and a blue stripe to indicate 500°F.

Figure 59



- 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.**

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.

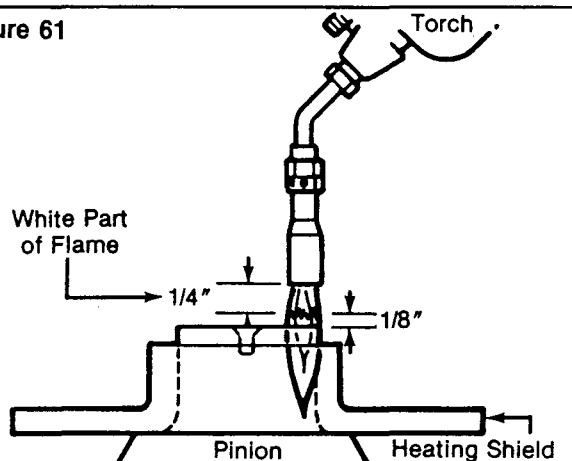


CAUTION:

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.

Figure 61



- 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:

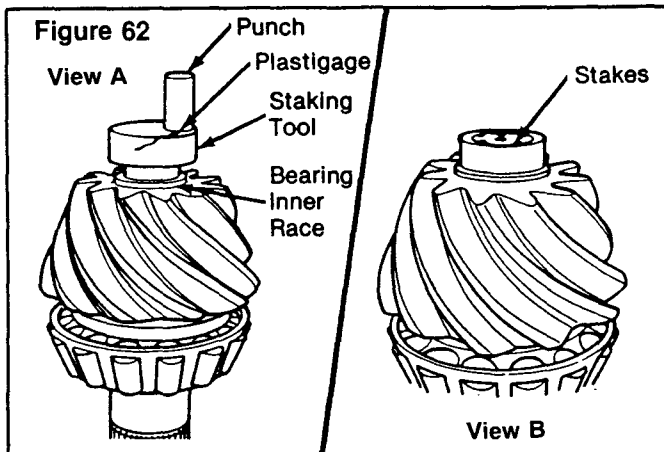
If you cannot hold the races in place, try using the staking tool instead of the old race to start the new race on the stem. But, use the old race to completely seat the new race.

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.

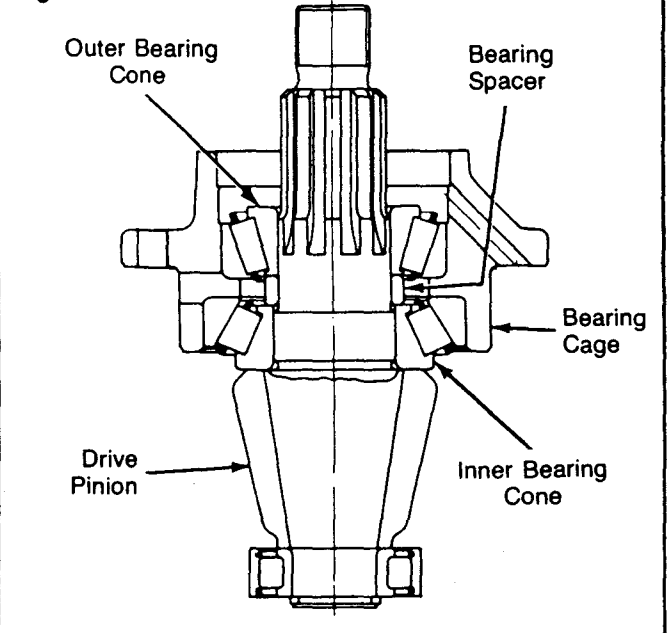
- F. Put the staking tool over the bearing race. Cut a one inch piece from the green plastigage strip and put in between the punch and the staking tool. **Figure 62 — View A.** Hit the punch with a two-three pound brass hammer to upset the end of the pinion stem. Then, remove the strip and measure its 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.**

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.

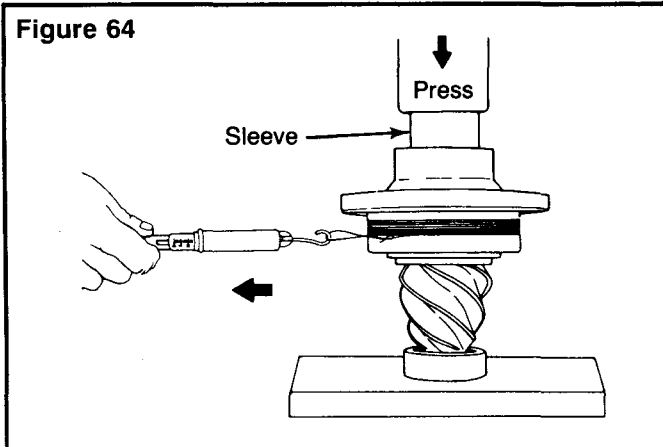
Press Method

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.

Figure 64



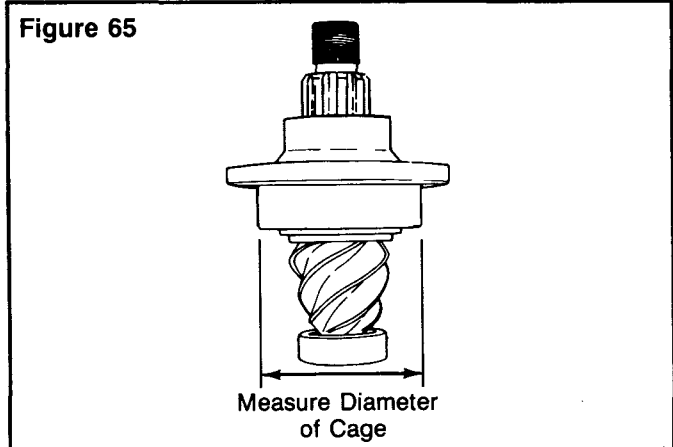
- B. Install a sleeve of the correct size against the inner race of the outer bearing. **Figure 64.**
- C. Apply and hold the correct amount pressure to the pinion bearings. See chart 1. As pressure is applied rotate the bearing cage several times so that bearings make normal contact.
- D. While pressure 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.

Figure 65



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

Pounds pulled x Radius (inches) =
 lb.-in. preload x .113 = N.m preload OR
 Kilograms pulled x Radius (centimeters) =
 kg-cm preload x .098 = N.m preload

Examples:

Reading from spring scale = 7.5 pounds (3.4 kg)
 Diameter of bearing cage = 6.62 inches (16.8 cm)
 Radius of bearing cage = 3.31 inches (8.4 cm)

7.5 lb. x 3.31 in. = 24.8 in.-lb. preload x .113
 = 2.8 N.m preload OR
 3.4 kg x 8.4 cm = 28.6 kg-cm preload x .098
 = 2.8 N.m preload

- 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)

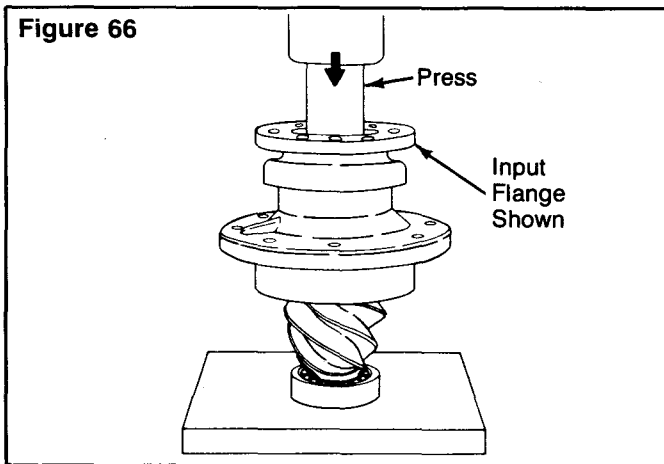
Yoke or Flange Method

- 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.

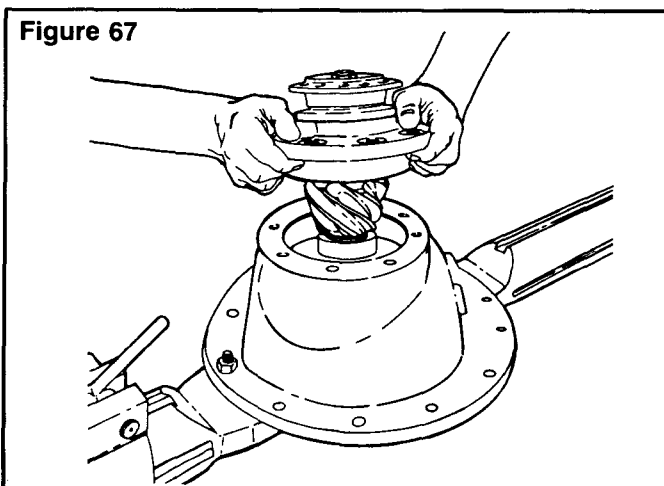
If a press is not available, use the three piece pilot tool for installation. See the procedure on page 22.



CAUTION:

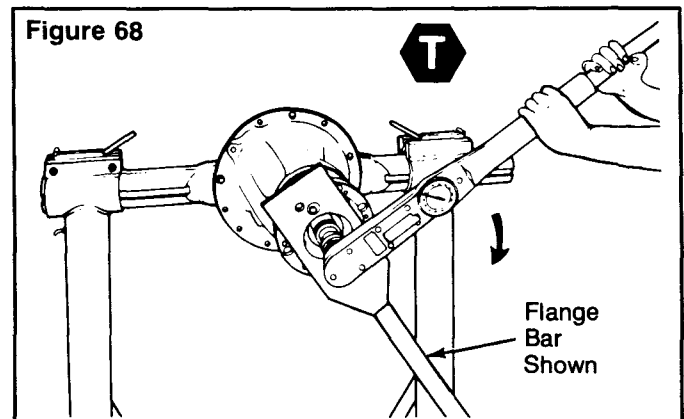
Do not install tight fit yokes or flanges on shafts using a hammer or mallet. A hammer or mallet will damage the yoke or flange.

- 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.

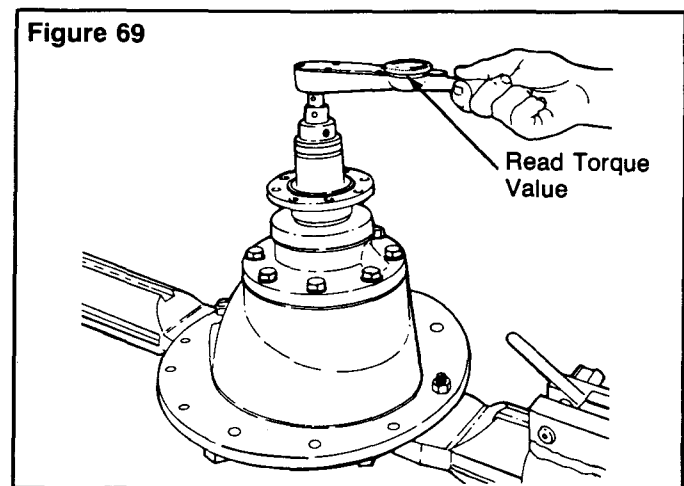
- D. Fasten a yoke or flange bar to the input yoke or flange. The bar will hold the drive pinion in position when the nut is tightened. **Figure 68.**



- 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.*

H. If the preload (torque) of pinion bearings is not within specifications, remove the pinion and cage assembly from carrier. Do the following procedure then repeat steps A 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.

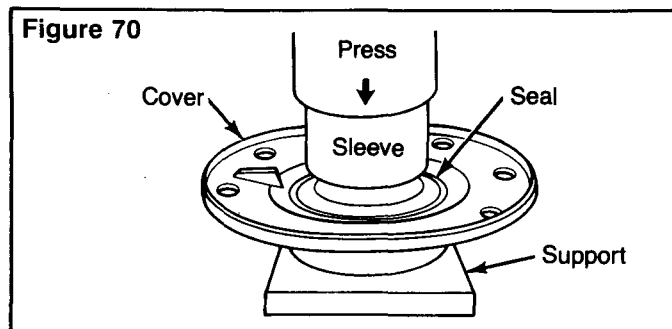
11. If the carrier has a cover and seal assembly over the bearing cage, install a new seal into cover as follows.

A. Apply Lubriplate or grease used for wheel bearings to the seal lips and cavities between lips. The Rockwell specification for grease is O-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:

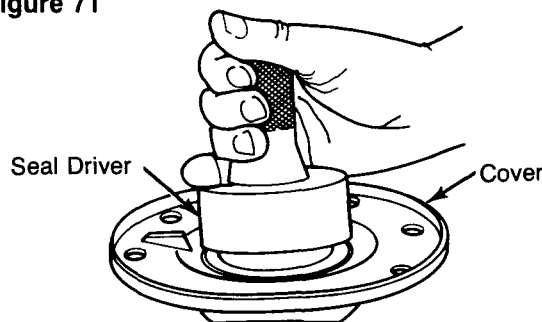
If a press is not available, use a mallet and the sleeve or driver to install the seal. Figure 71.



WARNING:

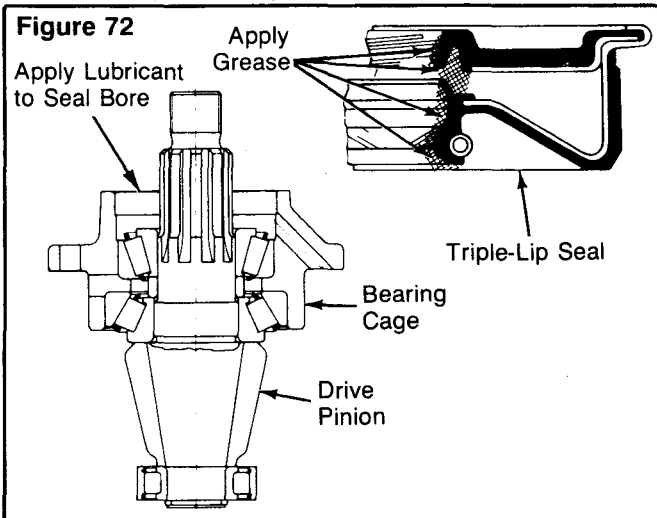
Wear safe eye protection. Do not hit steel parts or tools with a steel hammer. Parts or tools can break and cause injury.

Figure 71



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.**



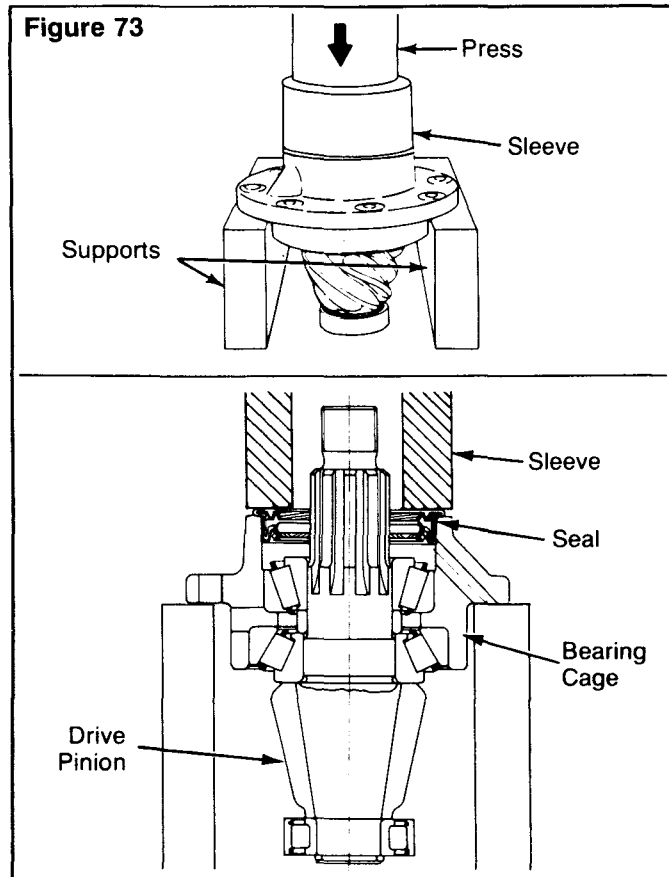
CAUTION:

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.

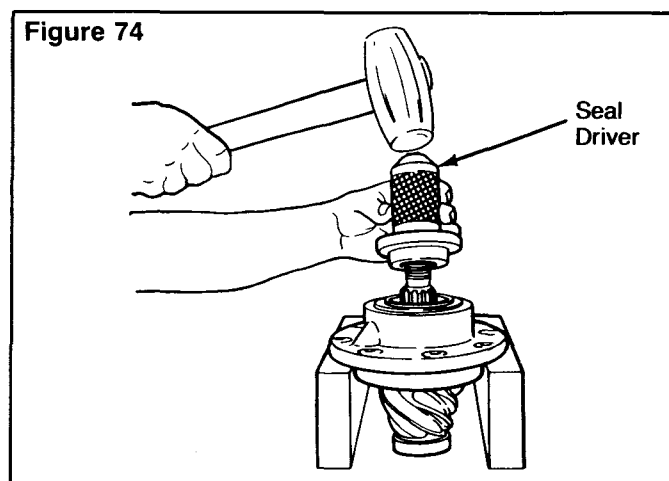
C. On reused seals, apply Lubriplate or wheel bearing grease to the seal lips.

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.**

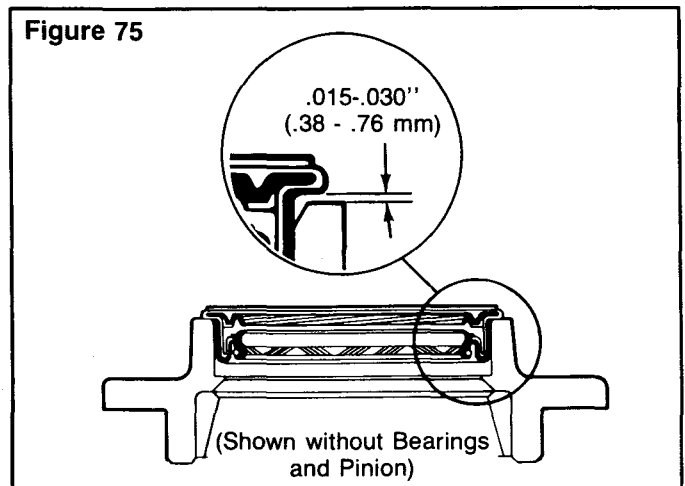


NOTE:
If a press is not available, use a mallet and the sleeve or driver to install the seal. Figure 74.



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

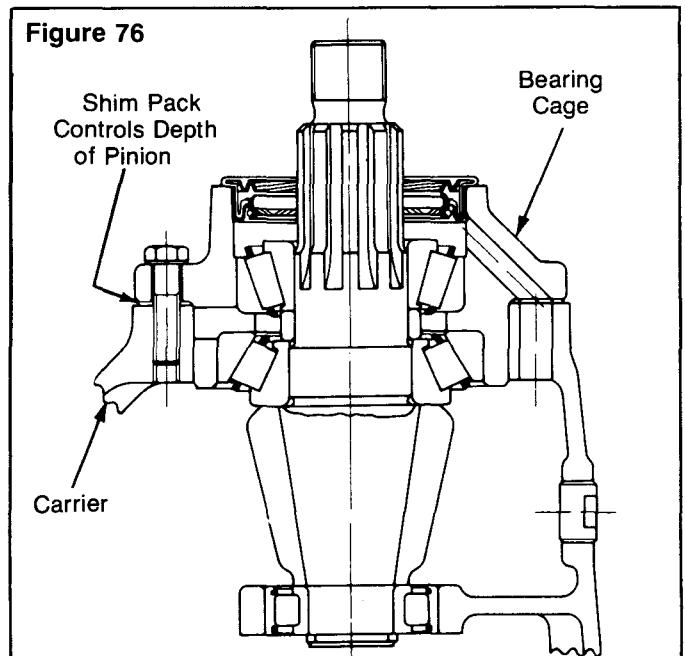
F. After the triple-lip seal is installed, a gap of approximately .015 to .030 inch (.38 to .76 mm) between the flange and bearing cage is normal. Figure 75.



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.

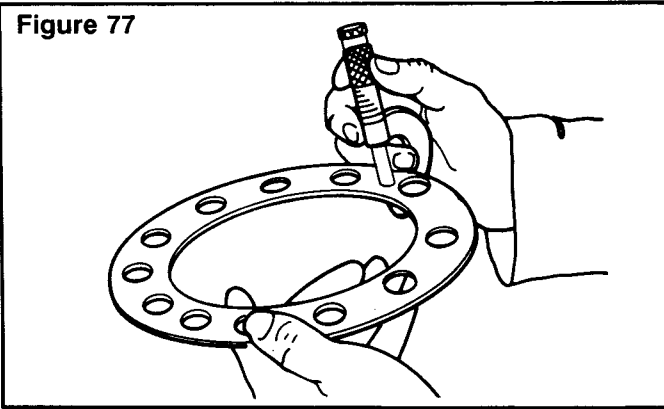
Adjust Thickness of Shim Pack for the Pinion Cage (Depth of Pinion)

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.



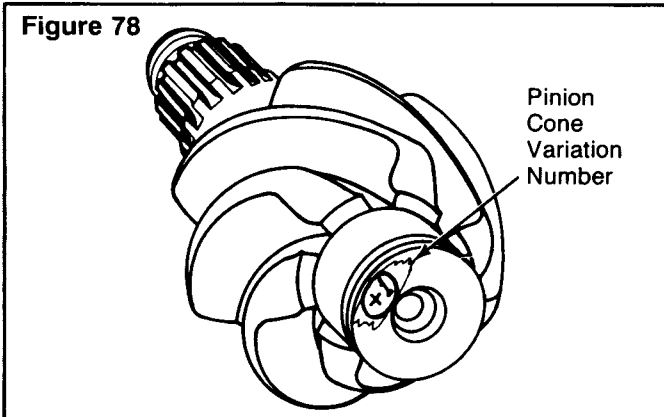
1. Measure the thickness of the old shim pack that was removed from under the pinion cage with a micrometer. Record the measurement for later use. **Figure 77.**

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.**

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 mm

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.

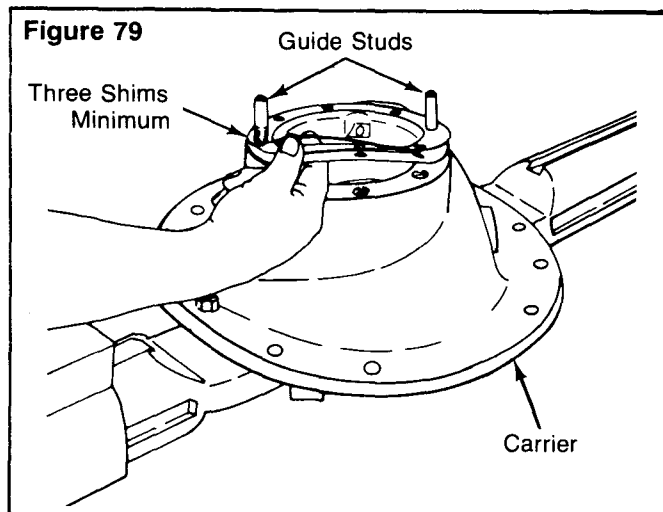
8. Install the drive pinion, bearing cage and new shim pack into the carrier.

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.

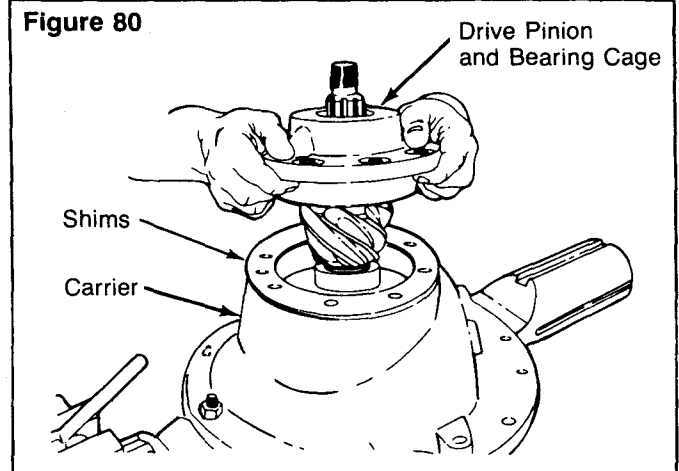
1. Install the correct shim pack between the bearing cage and carrier. **Figure 79.**
2. Align the oil slots in the shims with oil slots in the bearing cage and carrier. The use of guide studs will help align the shims. **Figure 79.**



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.

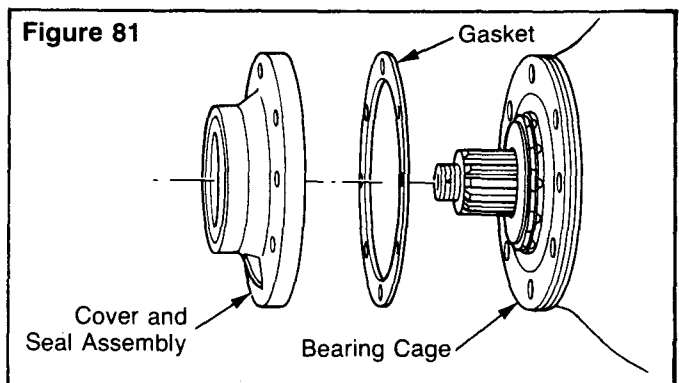
3. Install the drive pinion and bearing cage into the carrier. If necessary, use a rubber, plastic or leather mallet to hit the assembly into position. **Figure 80.**



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.**



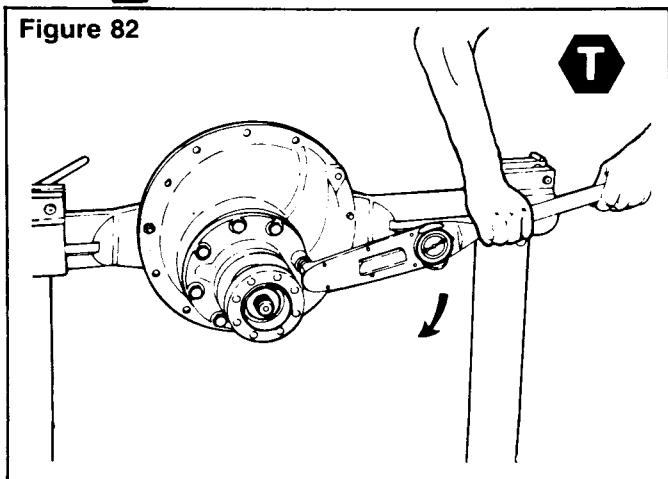
5. Align the oil slots in the cover* and gasket* with oil slot in the bearing cage.

*Some Rockwell carriers do not have the parts described.

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.**



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.



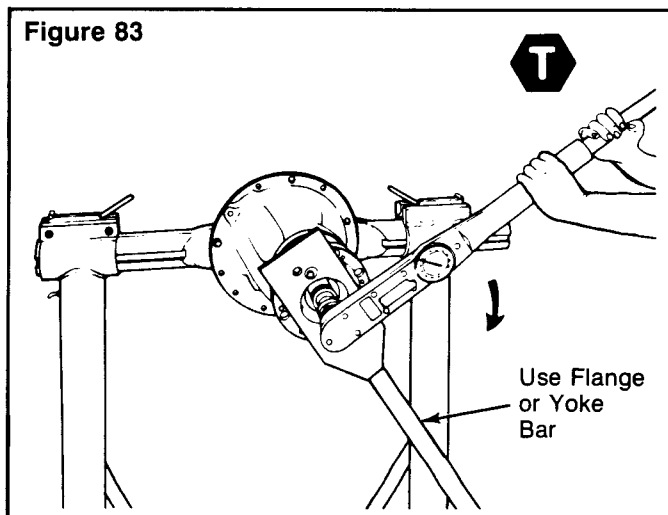
CAUTION:

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.**



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 parts 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.

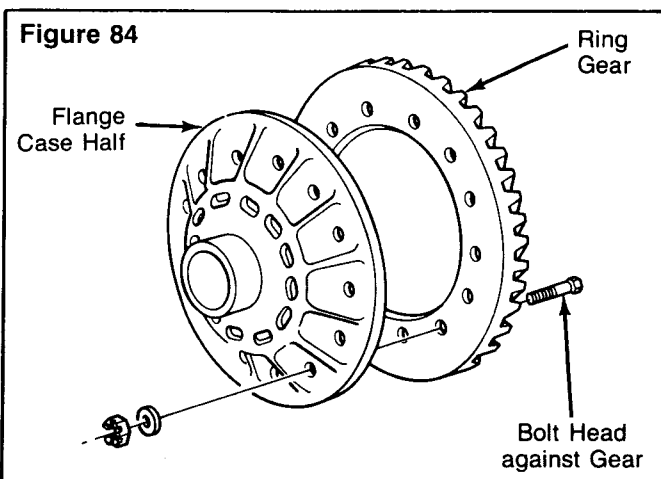


WARNING:

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.**

Figure 84



6. Tighten the bolts* and nuts* to the correct torque value. See the torque chart on page 65. **Figure 85.**
7. If rivets* are used to hold the ring gear to the flange case half, install the rivets* as follows:



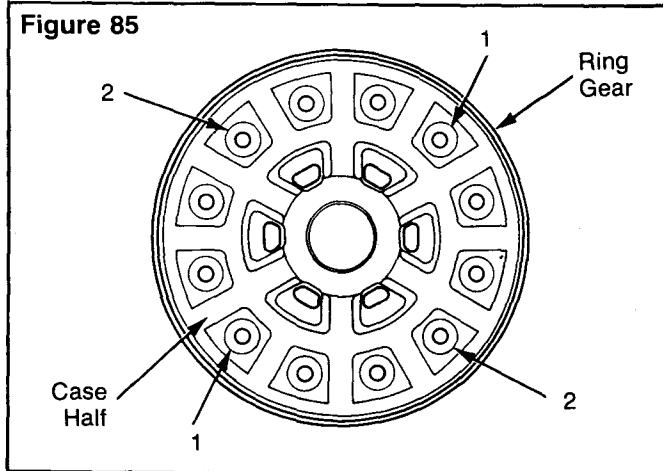
**Some Rockwell carriers do not have the parts described.*



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	
	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



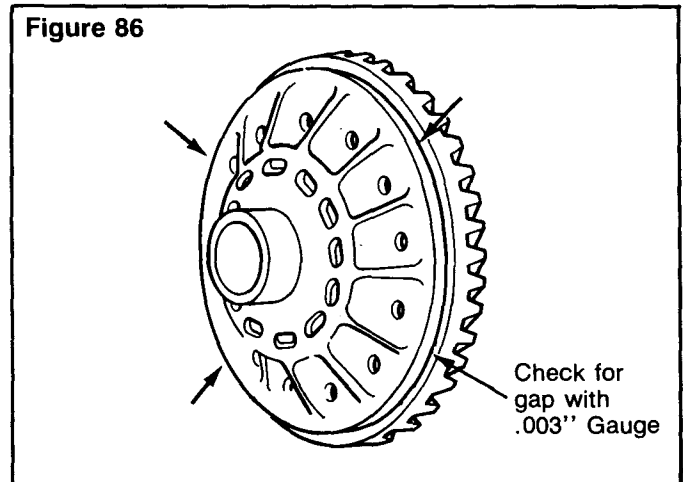
CAUTION:

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.**

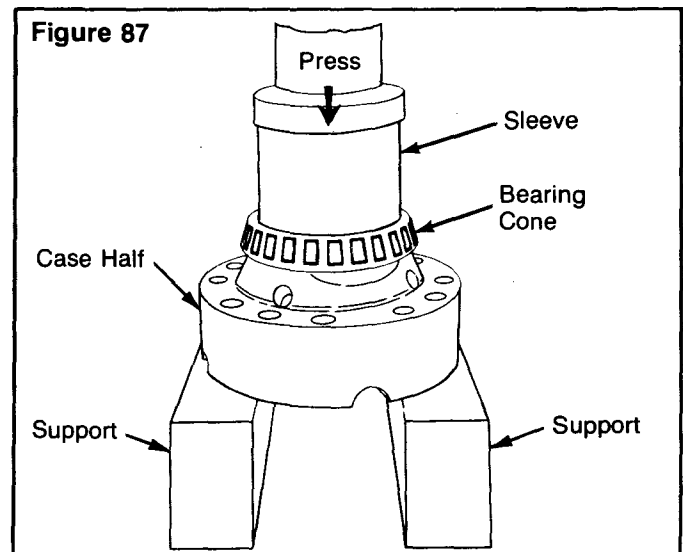
If the gauge fits more than one half the distance between the outer diameter of the flange and the pilot diameter of the gear, remove the ring gear. See the procedure on page 9 and the following steps D and E. If the gap is less than .003 inch (.08 mm), continue by following step 8.

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

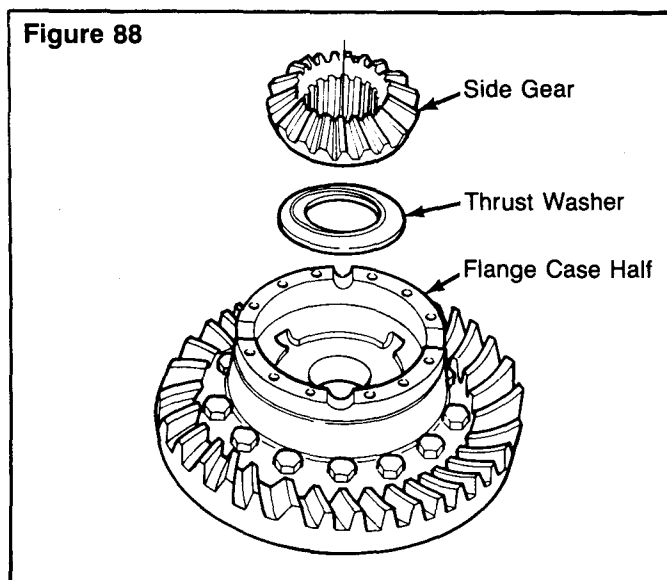


9. Apply axle lubricant on the inside surfaces of both case halves, spider (cross), thrust washers, side gears and differential pinions.

10. Put the flange case half on a bench, ring gear teeth toward top.

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

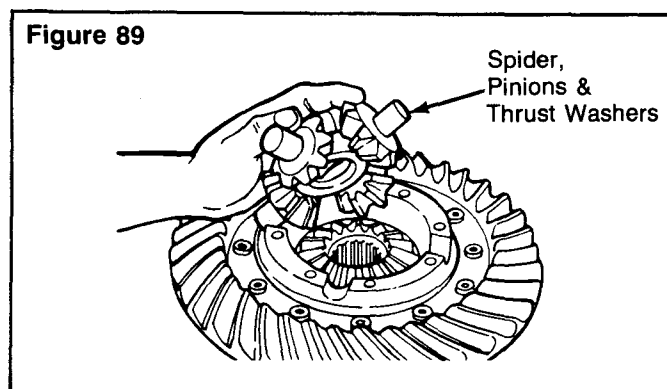
11. Install one thrust washer and side gear into the flange case half. **Figure 88.**



CAUTION:

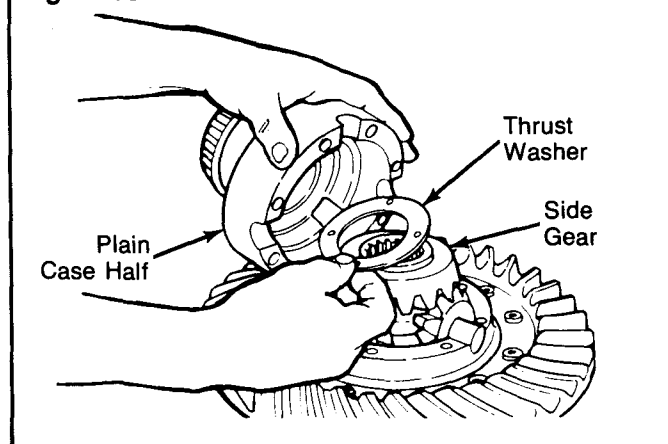
The side gears in some carrier models have hubs of different lengths. Install the correct length side gear into the flange case half.

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



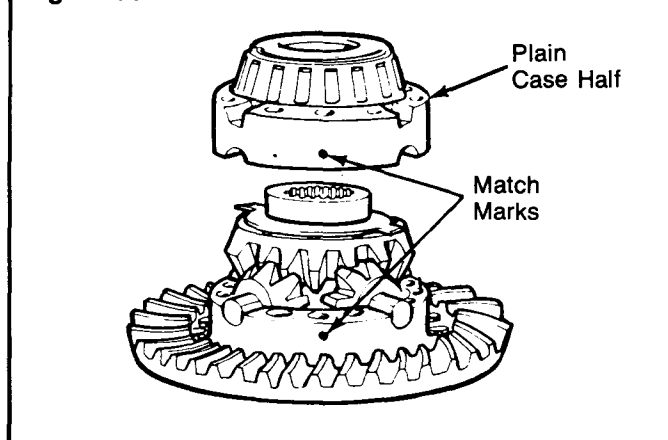
13. Install the second side gear and thrust washer over spider and differential pinions. **Figure 90.**

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.**

Figure 91



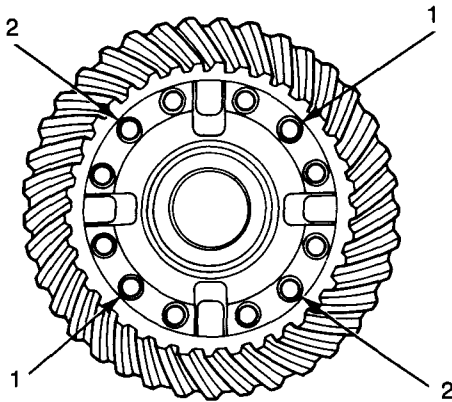
15. Install Dri-Loc fasteners into the case halves. See the procedures on page 20 and the following steps A and B.

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.

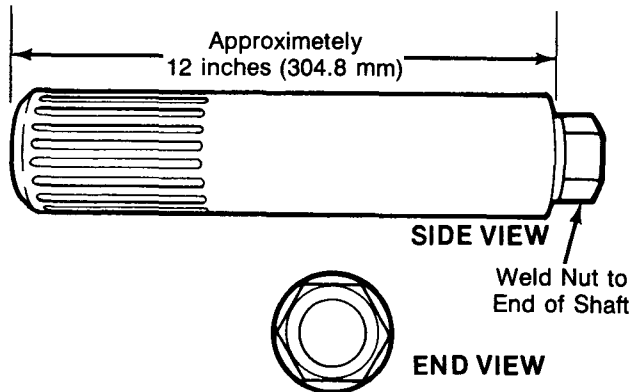
Rotating Resistance Check of Differential Gears

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.

Figure 93

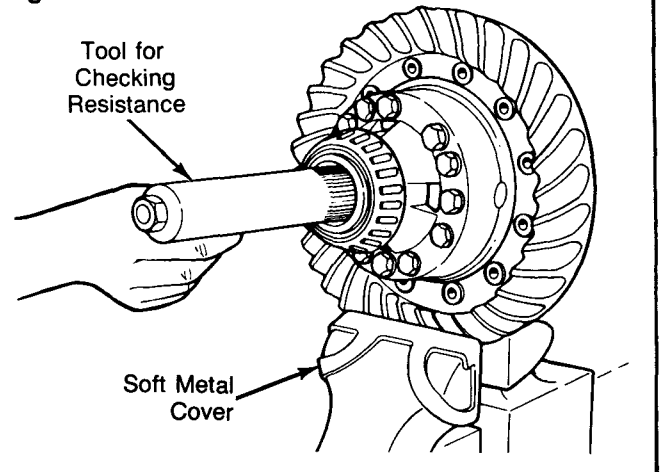


A. Install soft metal covers over vise jaws to protect the ring gear. **Figure 94.**

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

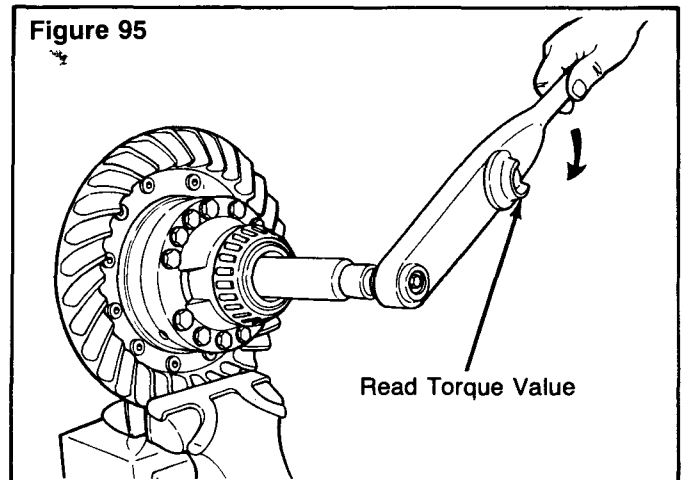
C. Install the tool into the differential until the splines of the tool and one side gear are engaged. **Figure 94.**

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.

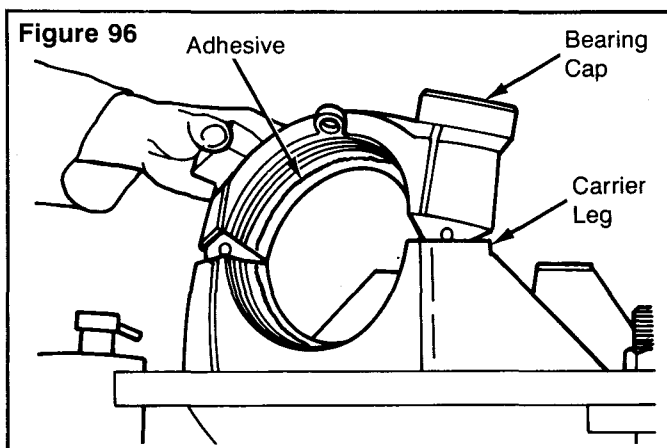
17. After the parts are repaired or replaced, assemble the parts and repeat steps A to F.

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

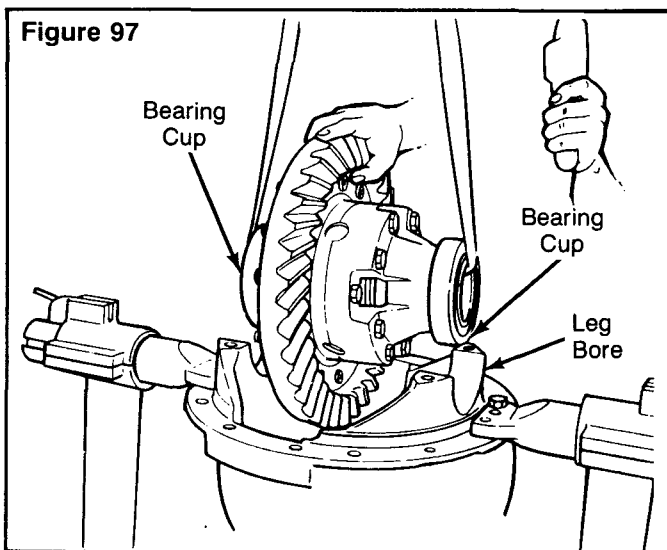
section 5 Assembly

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.**

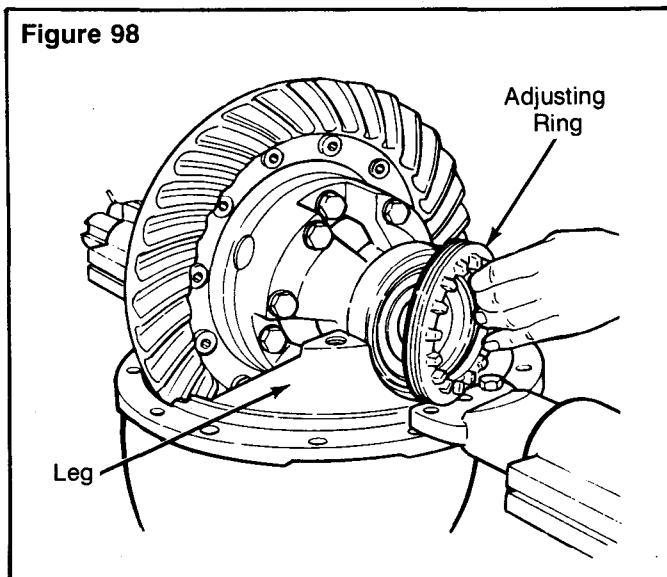


4. Install the bearing cups over the bearing cones that are assembled on the case halves. **Figure 97.**

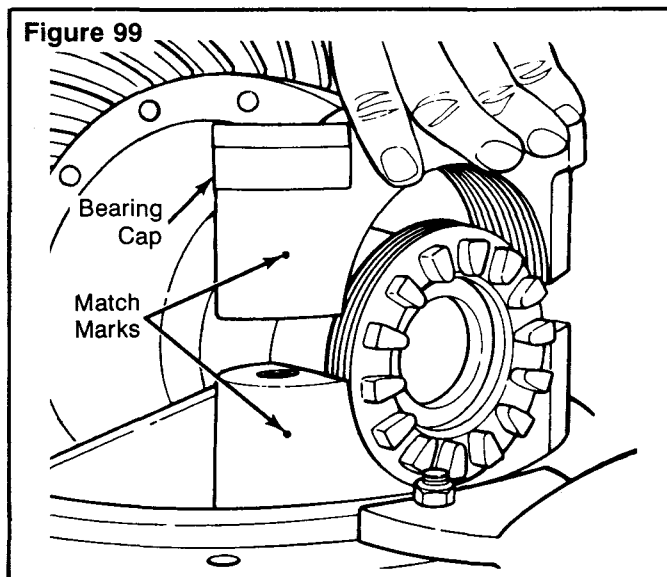


5. Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups **MUST** be flat against the bores between the carrier legs. **Figure 97.**

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 -

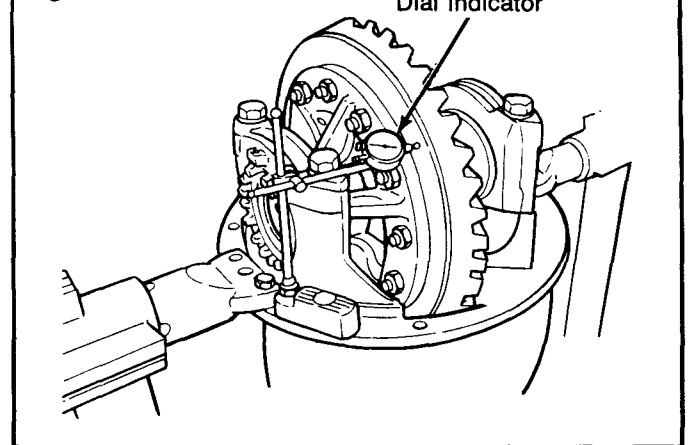
RS-140 and RS-145 carrier models - .003 to .009 inch (.08 to .22 mm)

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

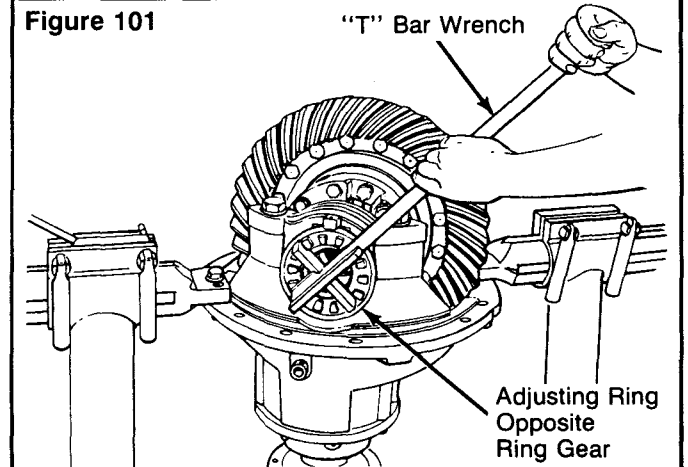


CAUTION:

*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.

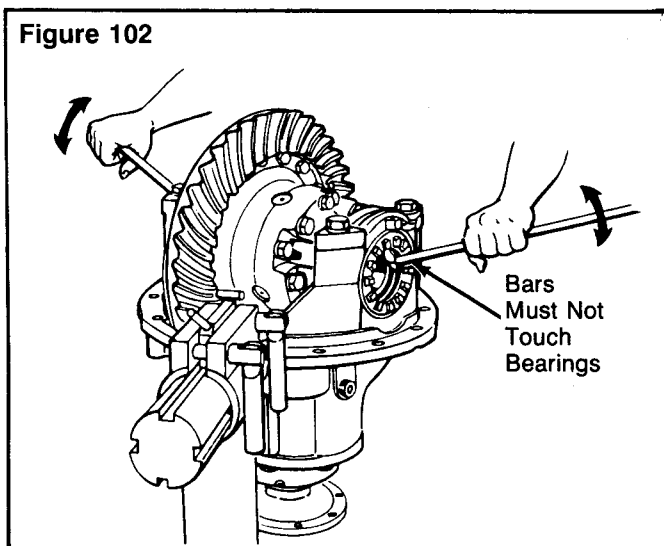
Figure 101



*Some Rockwell carriers do not have the parts described.

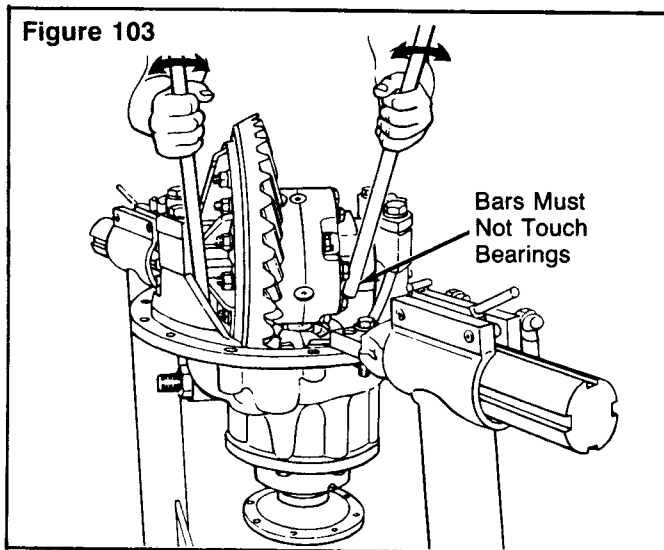
- A. Use two pry bars that fit between the bearing adjusting rings and ends of the differential case. The pry bars **MUST NOT** touch the differential bearings. **Figure 102.**

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.**

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.

Figure 104

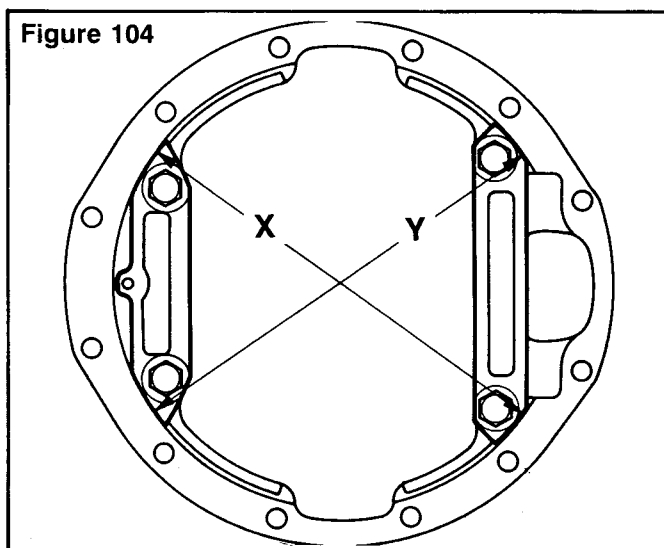
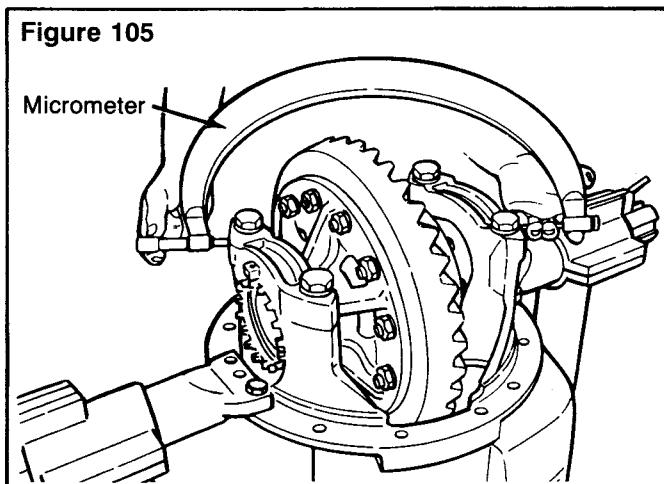


Figure 105



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)

$15.324 \text{ inch} - 15.315 \text{ inch} = .009 \text{ inch} (.23 \text{ mm})$ difference.

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

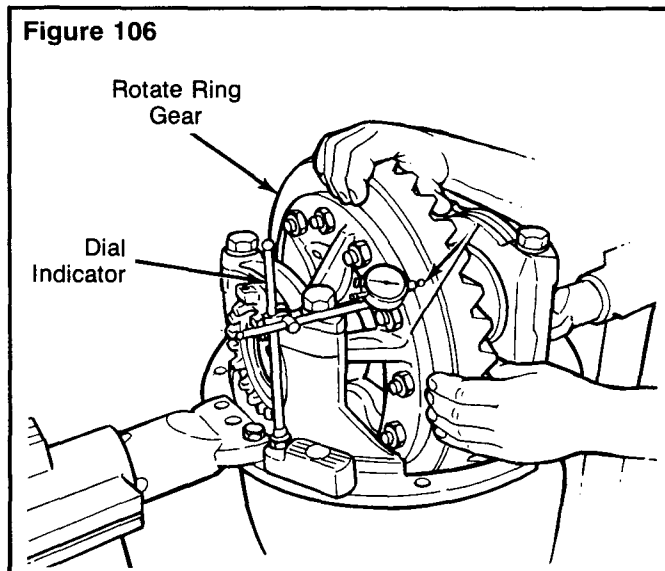
If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. See the procedure on page 5 and the following steps 5 and 6.

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).

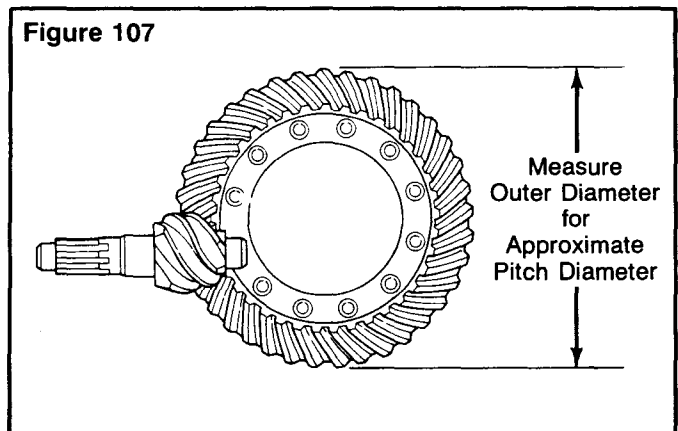
Range of backlash setting - .008 to .018 inch (.20 to .46 mm).

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.**

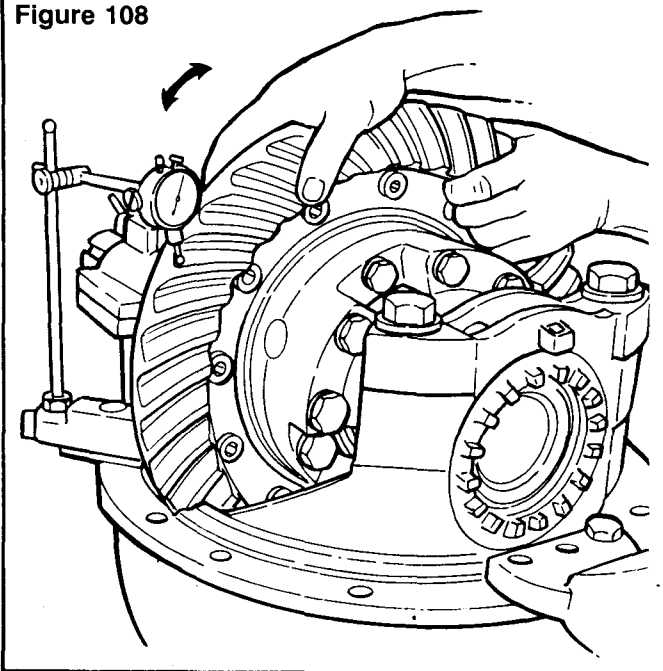
If the old gear set is installed, adjust the backlash to the setting that was measured before the carrier was disassembled.

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.**

Figure 108



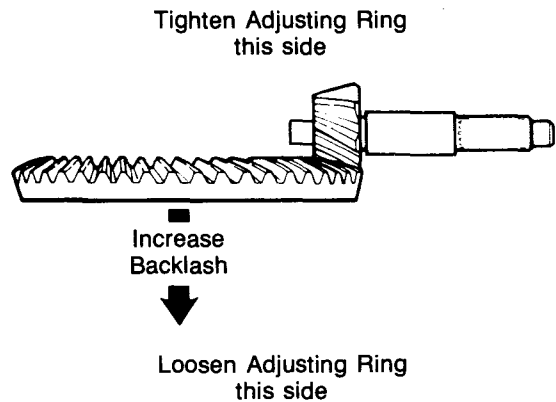
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. **Figure 108.**
3. Adjust the dial of the indicator to zero (0).
4. Hold the drive pinion in position.
5. While you read the dial indicator, rotate the differential and ring gear a small amount in both directions, 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.

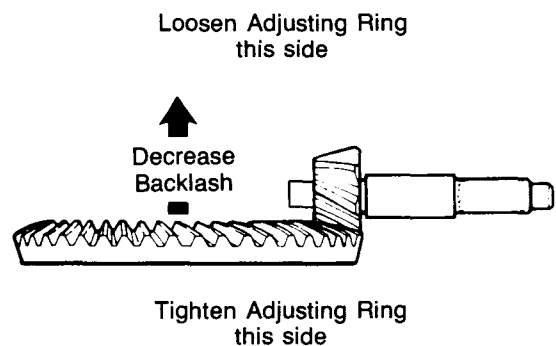
Backlash is decreased by moving the ring gear toward the drive pinion. Figure 110.

Figure 109



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

Figure 110



NOTE:

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

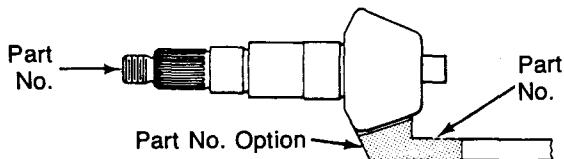
7. Repeat steps 2 to 6 until the backlash is within specifications.

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.

Figure 111

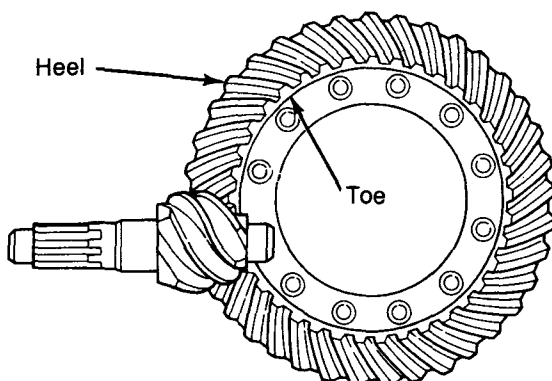


Examples of part numbers for conventional gear sets.
36786 for the ring gear.
36787 for the drive pinion.

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.

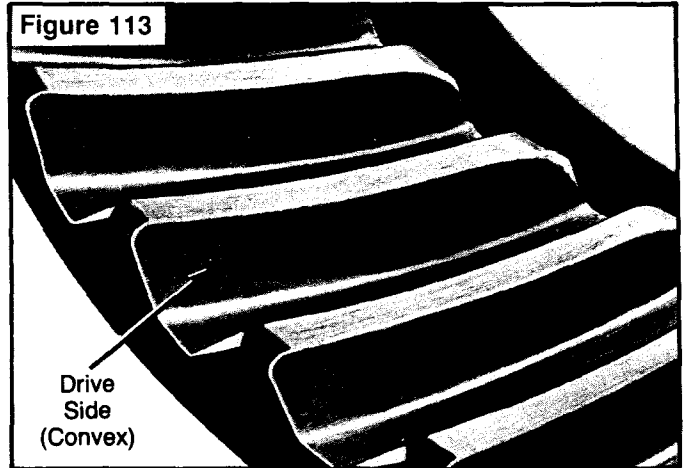
In the following procedures, movement of the contact pattern in the length of the tooth is indicated as, toward the "heel" or "toe" of the ring gear. **Figure 112.**

Figure 112



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

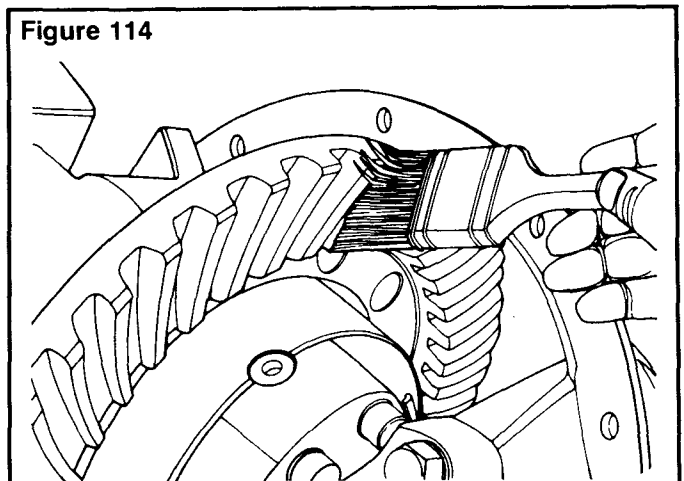
Figure 113



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.**

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

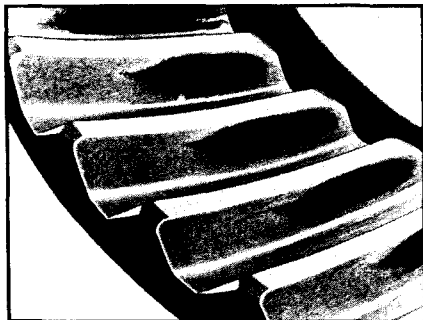


Figure 115A
Good Hand Rolled Pattern

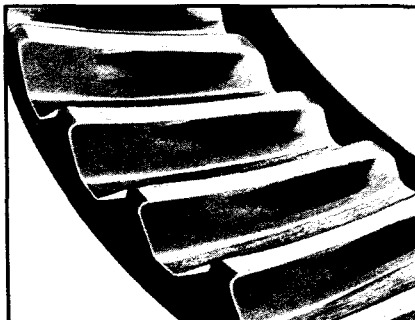


Figure 116A
High Pattern

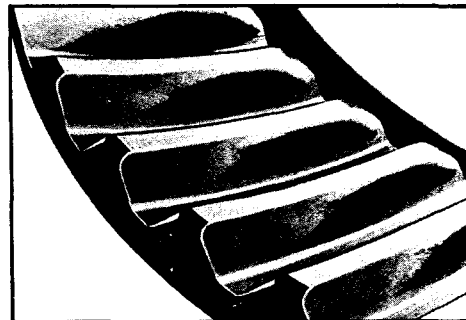


Figure 117A
Low Pattern

Generoid Gears

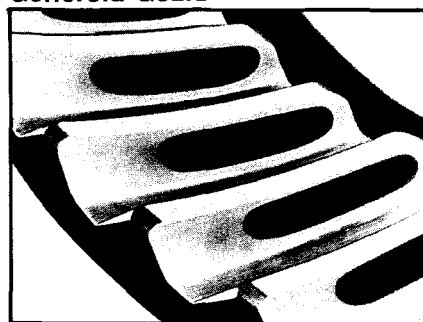


Figure 115B
Good Hand Rolled Pattern



Figure 116B
High Pattern

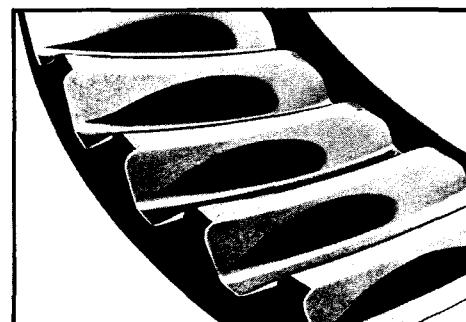


Figure 117B
Low Pattern

4. 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.

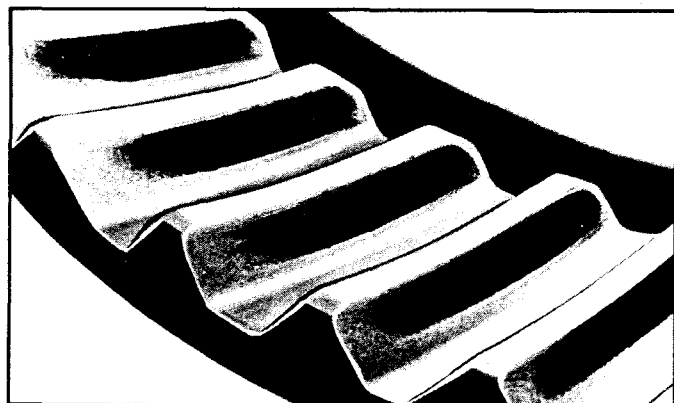


Figure 118A
Good Pattern in Operation
Conventional Gears

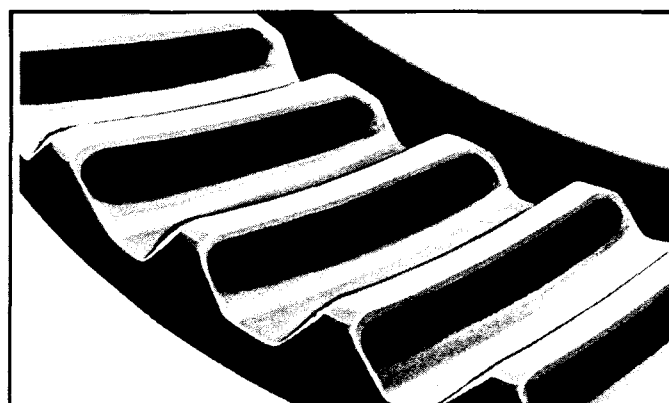


Figure 118B
Good Pattern in Operation
Generoid Gears

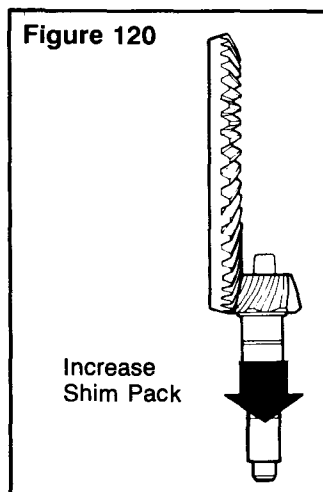
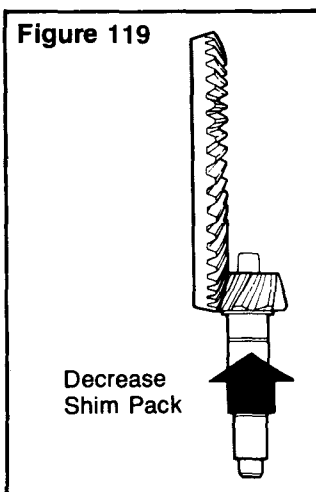
5. Change the thickness of the shim pack under bearing cage to move the contact patterns between the top and bottom of the gear teeth. Use the following procedure.

NOTE:

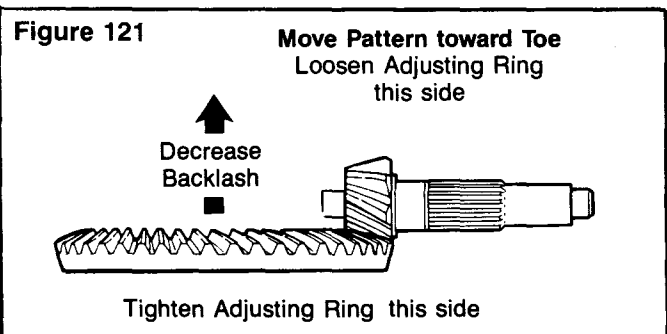
A high contact pattern indicates that the drive pinion was not installed deep enough into the carrier.
A low contact pattern indicates that the drive pinion was installed too deep in the carrier.

- 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.**

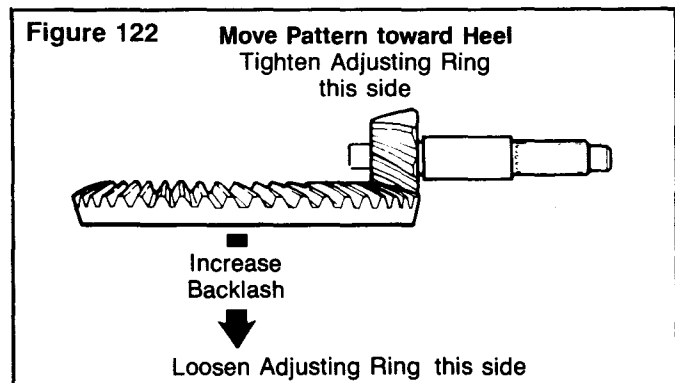
To correct a low contact pattern, **Figure 117A or B** increase the thickness of shim pack under the bearing cage. When you increase the thickness of the shim pack, the drive pinion will move away from the ring gear. **Figure 120.**



- 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.



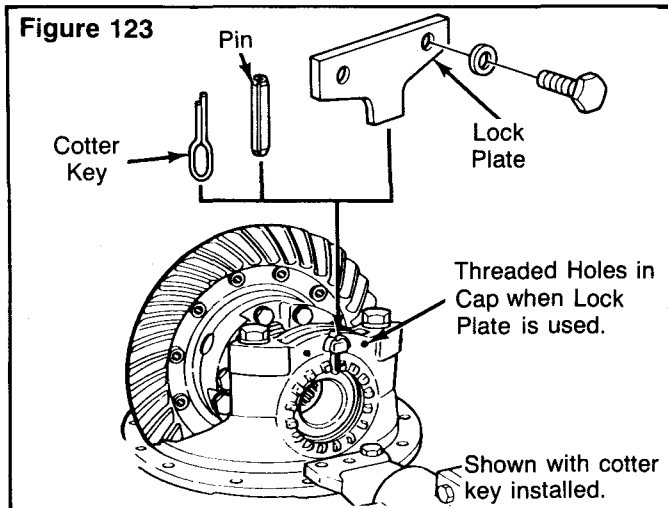
CAUTION:

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.

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



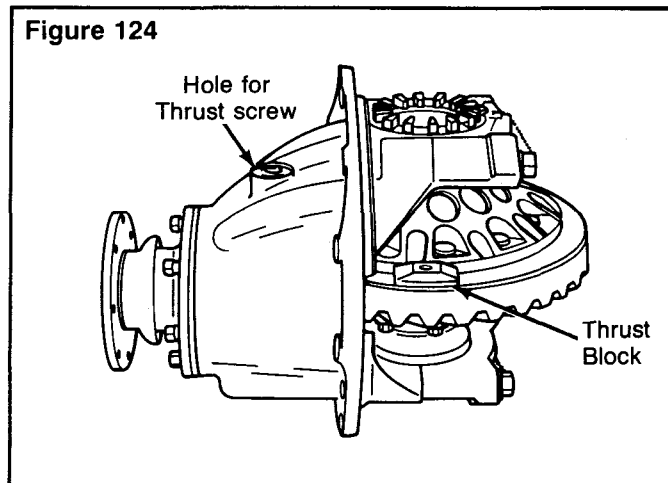
Install and Adjust the Thrust Screw*

Specification:

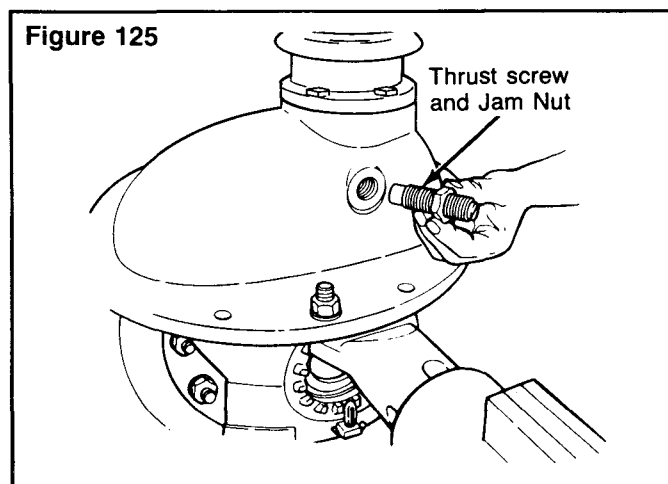
Clearance between thrust screw or block and ring gear - .025 to .045 inch (.65 to 1.14 mm). Loosen the thrust screw 1/2 turn, 180°.

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

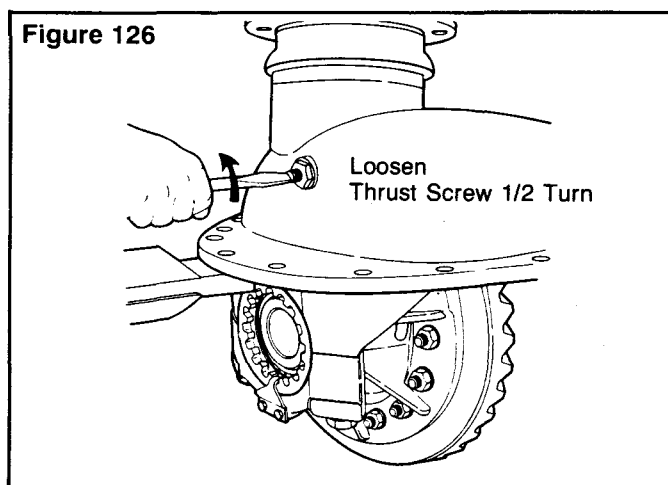
1. Rotate the carrier in the repair stand until the back surface of ring gear is toward the top.



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.**

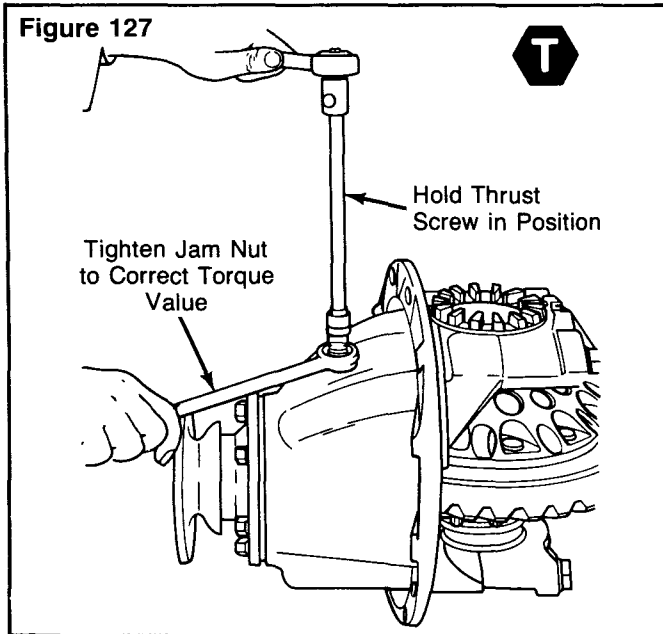


5. Install the thrust screw* into the carrier until the screw stops against the ring gear or thrust block*. **Figure 125.**
6. Loosen the thrust screw* 1/2 turn, 180°. **Figure 126.**



*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:

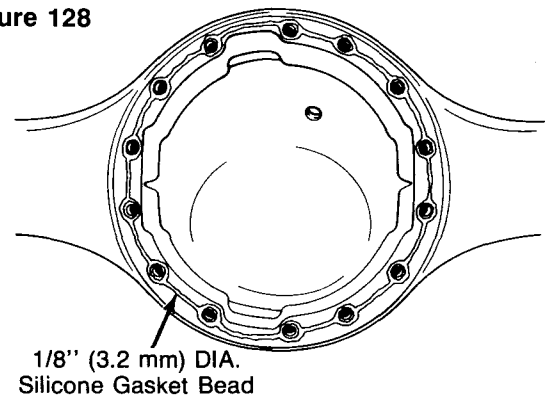
Be careful when using cleaning solvents. Follow the solvent manufacturer's instructions for safe use to prevent injury.

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.**



Figure 128



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

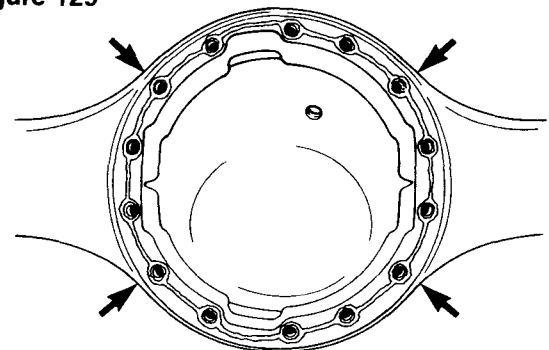


CAUTION:

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.**

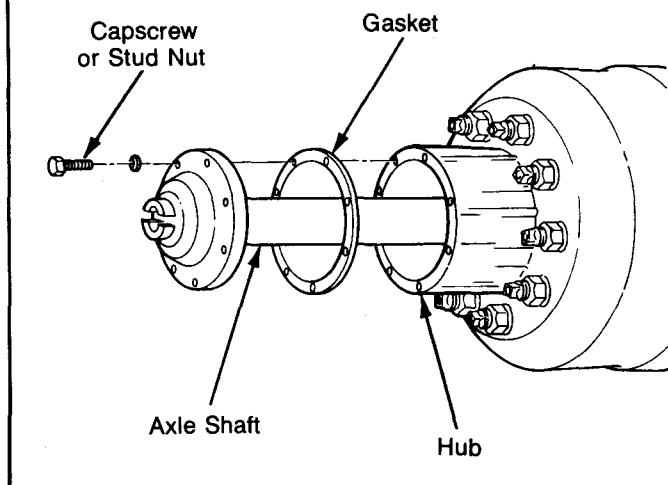
Figure 129



*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



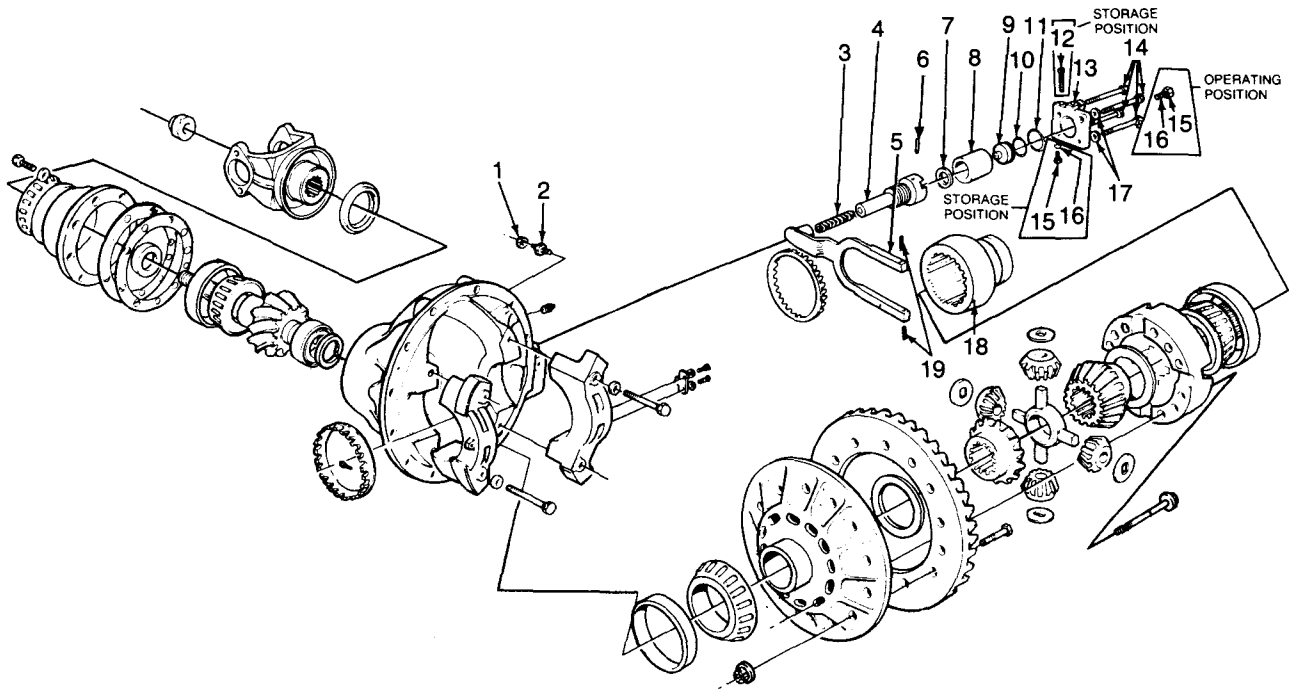
15. Install the nuts* and washers on the studs*. Tighten nuts* to the correct torque value. See the torque chart on page 65. **T**

**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.

section 6 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).

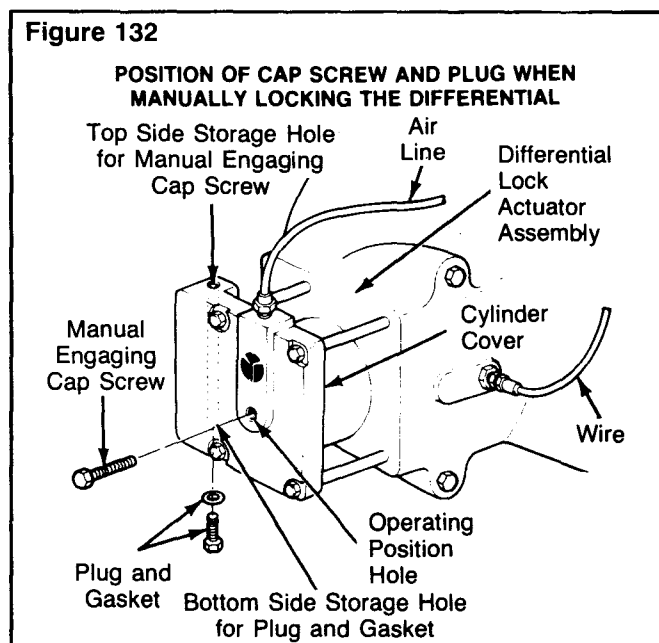
Continue to hold the main differential in the locked position with air pressure until the carrier assembly is completely removed from the axle housing.

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.*

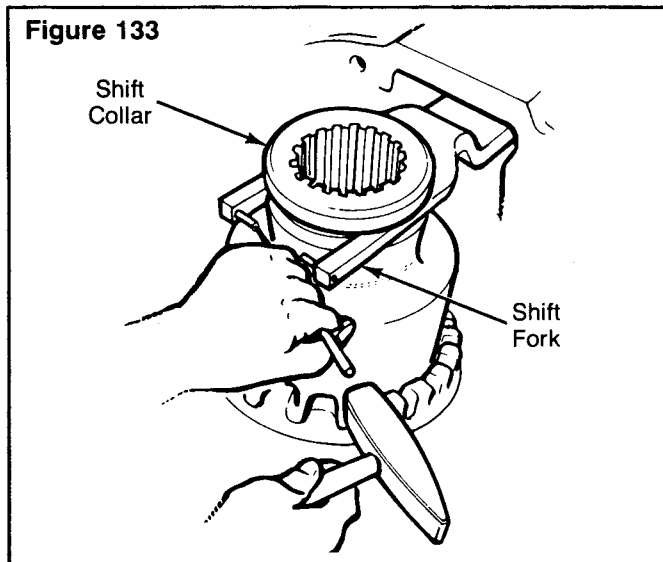
A high resistance on the capscrew indicates that the splines of the shift collar and the differential case half are not aligned or engaged. To align the splines use the following procedure:

- 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.

section 6 Driver Controlled Main Differential Lock

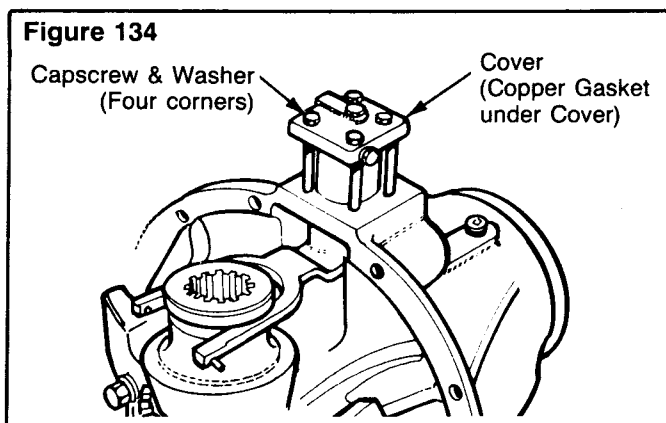
Remove Differential And Gear Assembly

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:

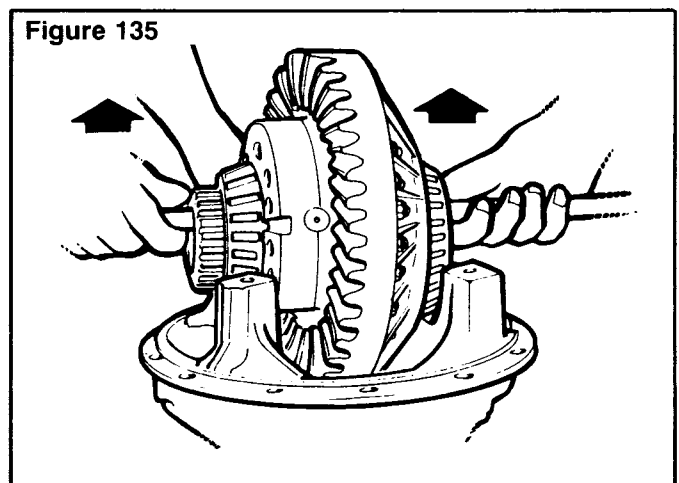
Some models use silastic seal instead of the flat washer in Step E.

- 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.**



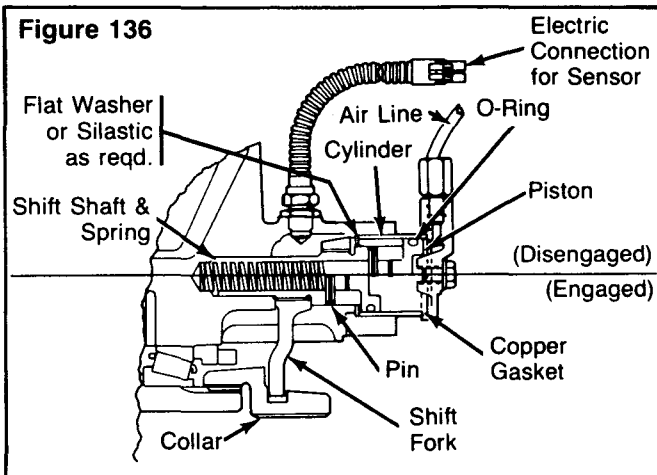
**Some Rockwell carriers do not have the parts described.*

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.

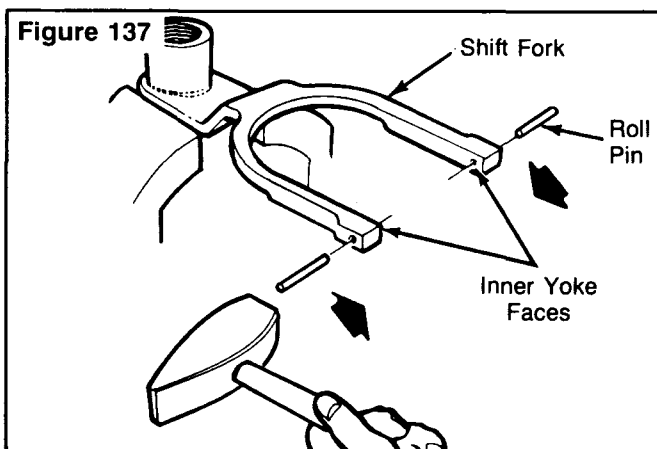
PREPARE PARTS FOR ASSEMBLY, ADJUSTMENTS, AND CARRIER ASSEMBLY (UP TO THE POINT OF "INSTALL DIFFERENTIAL CARRIER INTO AXLE HOUSING" ON PAGE 51) ARE ALSO THE SAME FOR BOTH AXLES.

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**.

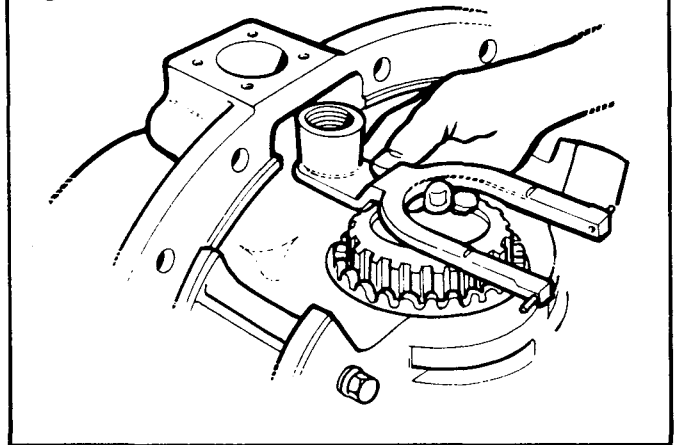


1. Install the two roll pins into the ends of the shift fork. Tap the pins into position until they are level with the inner yoke face. **Figure 137**. Do not install completely at this time.



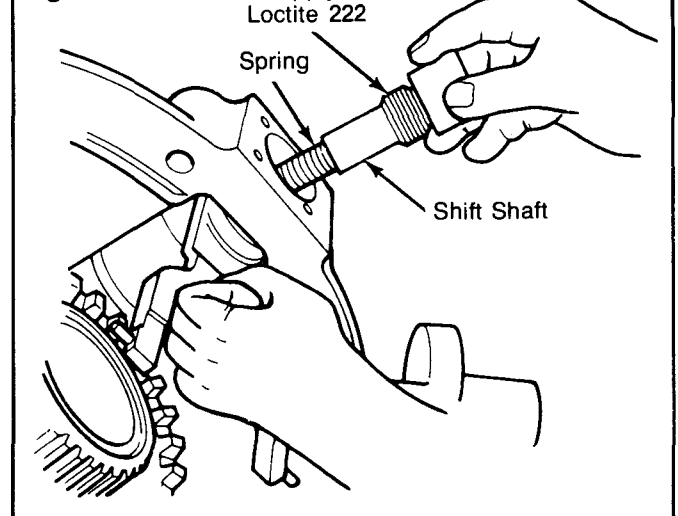
2. If the spring stop roll pin was removed from the head of the shift shaft, install the pin at this time.
3. Apply Loctite 222 (Rockwell Part No. 2297-B-6112) to the threads of the shift shaft.
4. Install the shift fork into its correct position in the carrier case. **Figure 138**.

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**.

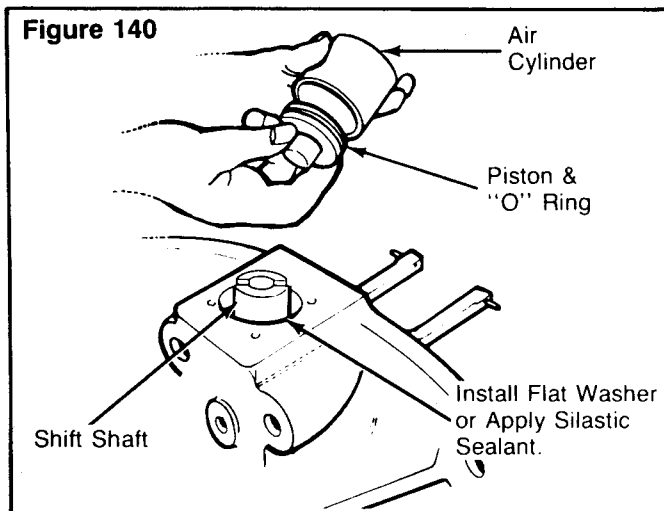
Figure 139



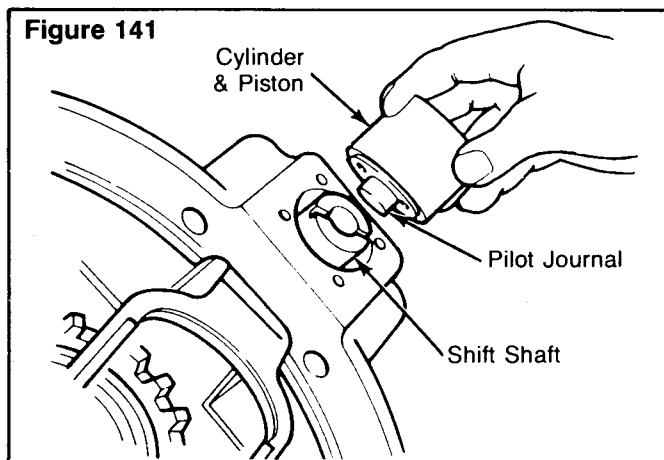
6. Slide the shift shaft over the spring and install the shaft into the shift fork. Tighten to 20-25 lb. ft. (27-34 N.m) torque. **T**
7. Install the flat washer (when used) or apply silastic sealant (Rockwell Part No. 1199-Q-2981) to the bottom of the cylinder bore. **Figure 140**.

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.**

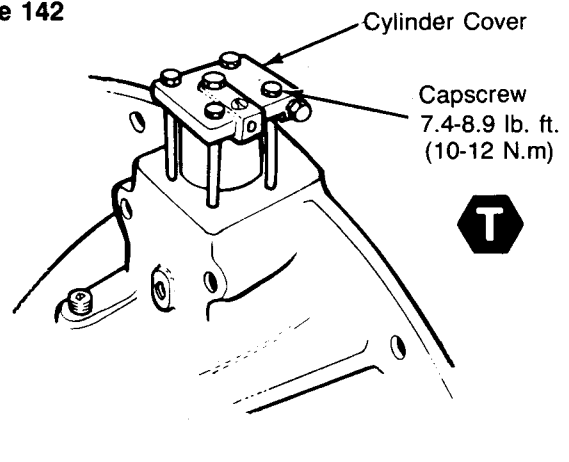


10. Install the copper gasket into its bore on the inside of the cylinder cover. Put the cover in position over the cylinder so that the air intake port will point up when the carrier is installed into the housing. Install the cover with the four attaching capscrews and washers. Tighten to 7.4-8.9 lb.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



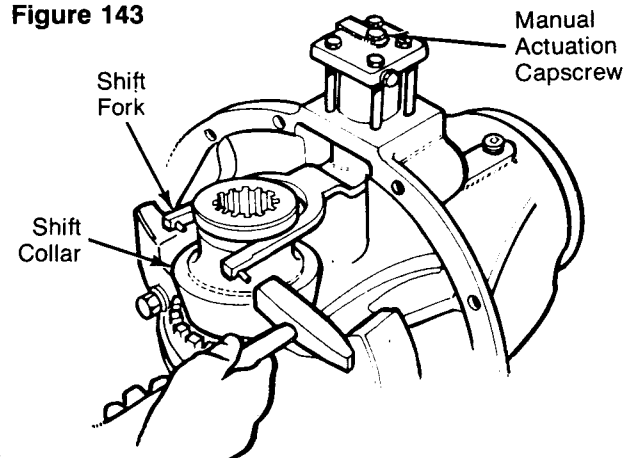
11. Slide the shift collar into the fork and engage the shift collar splines with the splines of the differential case. Use the manual actuation capscrew to move the shift collar splines into the differential case splines. See "Manual Engaging Method" on page 60.

Figure 142



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.**

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.



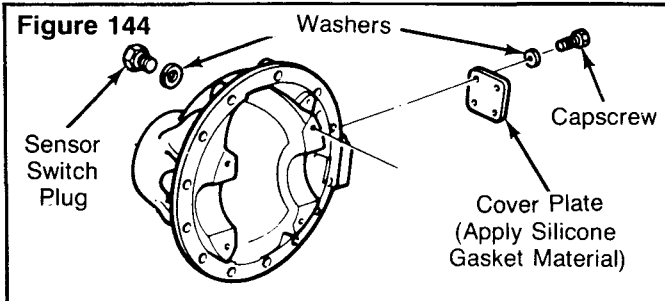
NOTE:

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.

6 Driver Controlled Main Differential Lock

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 cap screw into the threaded hole in the center of the cylinder cover.
- C. Turn the manual adjusting cap screw to the right until the head of the cap screw is approximately 1/4 inch from the cylinder cover. DO NOT turn the cap screw beyond its normal stop. The cap screw 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 cap screw. If a high resistance is felt before reaching the locked (engaged) position, STOP TURNING THE CAPSCREW, or the cover, fork and cap screw threads will be damaged.

A high resistance on the cap screw 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 cap screw. When the normal amount of spring resistance is again felt on the cap screw, the splines are engaged. Continue to turn in the manual engaging cap screw.

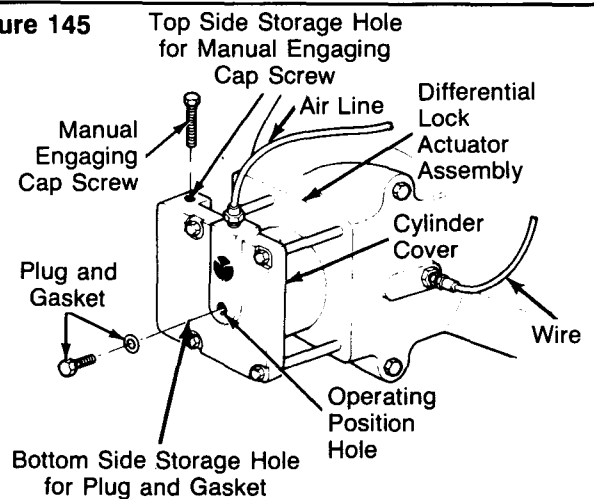
- D. Install and fasten the carrier into the axle housing. Follow Steps G and H of the "Air Pressure Method" on page 60.
- E. Remove the plug and gasket from their position. Remove the manual engaging cap screw from its service position.

NOTE:

When the manual engaging cap screw 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 cap screw into its storage position. See Figure 145.

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-86101) 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
0-76-A	Hypoid Gear Oil	GL-5, S.A.E. 85W/140	- 12.2°C (+ 10°F)	- - -**
0-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	- 26.1°C (- 15°F)	- - -**
0-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	- 26.1°C (- 15°F)	- - -**
0-76-E	Hypoid Gear Oil	GL-5, S.A.E. 75W/90	- 40°C (- 40°F)	- - -**
0-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	- 40°C (- 40°F)	+ 1.6°C (+ 35°F)
0-76-L	Hypoid Gear Oil	GL-5, S.A.E. 75W/140	- 40°C (- 40°F)	- - -**

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

- Heavy-Duty On-Highway - On and Off Highway - Off-Highway		Common Carrier On-Highway	
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-150	3.5	1.7
C-100	12.5	5.9
D-100	12.5	5.9
D-140	12.5	5.9
E-100	15	7.1
E-105	12.5	5.9
E-150	9	4.3
F-100	13	6.2
F-106	13	6.2
F-120	15	7.1
F-121	15	7.1
F-140	14	6.6
FDS-75	14	6.6
FDS-85	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-170	27*	12.8*
H-172	27	12.8
L-100	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-100	31	14.7
Q-145	24	11.4
RL-170	48	22.7
R-100	30	14.2
R-140	28	13.2
R-155	28	13.2
R-160	28	13.2
R-163	34	16.1
R-170	43	20.3
S-170	43	20.3
U-140	24	11.4
U-170	43	20.3
W-170	43	20.3
RS-13-120	15	7.2
RS-15-120	15	7.2
RS-16-141	31	14.7
RS-17-140	32	15.4
RS-17-141	31	14.7
RS-19-145	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-100		
(QR-100 rear)	33	15.7
SQHD		
(QHR rear)	31	14.7
SQHP		
(QAR rear)	36	17
SR-170		
(RR-170 rear)	43	20.3
SRHD		
(RHR rear)	36	17
SSHD		
(SHR rear)	28	13.2
ST-170		
(TR-170 rear)	43	20.3
STHD		
(THR rear)	28	13.2
SU-170		
(UR-170 rear)	43	20.3
SUHD		
(UHR rear)	28	13.2
SW-170		
(WR-170 rear)	43	20.3
RT-34-140		
(RR-17-140)	35	16.9
RT-34-145		
(RR-17-145 rear)	36	17.1
RT-40-140		
(RR-20-140)	35	16.9
RT-40-145		
(RR-20-145 rear)	36	17.3
RT-44-145		
(RR-22-145 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-48-180		
(RR-24-180 rear)	39	18.6
RT-52-180		
(RR-26-180 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°.

8 Fastener Torque Info.

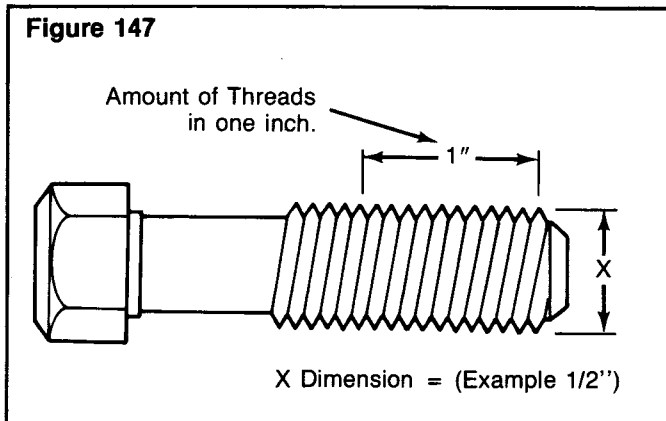
Torque Values for Fasteners

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.**

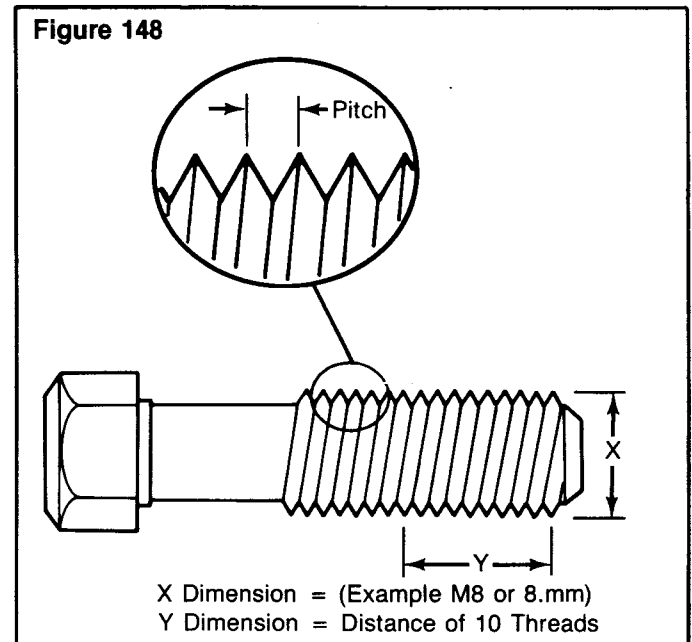
Example of an American Standard size fastener is .50 - 13.

The .50 is the diameter of the fastener in inches or dimension X.

The 13 is the amount of threads in one inch (1.0 inch).

Metric Fasteners

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

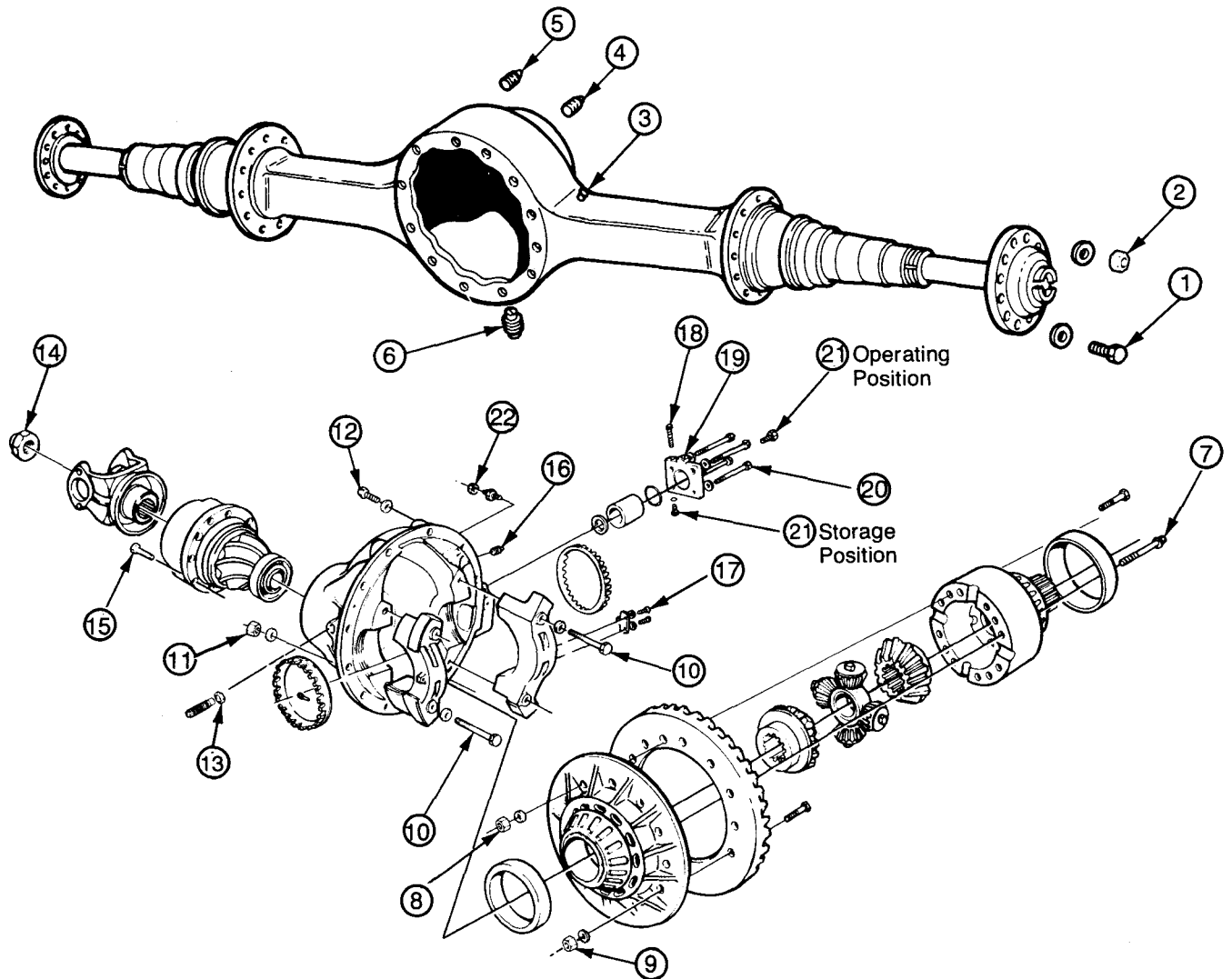


CHART 7
FASTENER TORQUE CHART

	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) (102-156) (149-224) (203-312) (54-88) (88-136) (136-197) (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.

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.	Adapter, Air Cylinder	M12 x 1.5	22-30	(30-40)
20.	Capscrew, Air Cylinder Cover	M6 x 1	7.4-8.9	(10-12)
21.	Capscrew/Plug, Air Cylinder Cover (Operating Position) (Storage Position)	M10 x 1.5	15-25 15-25	(20-35) (20-35)
22.	Lock Nut, Sensor Switch	M16 x 1	26-33	(35-45)

* Some Rockwell carriers do not have the parts described.

section 9 Adjustments and Specifications

DRIVE PINION BEARINGS - PRELOAD

PAGE

Specification: 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 Adjustment: Preload is controlled by the thickness of the spacer between bearings. To increase preload install a thinner spacer To decrease preload install a thicker spacer	31
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DRIVE PINION - DEPTH IN CARRIER

Specification: Install the correct amount of shims between the bearing cage and carrier. To calculate, use old shim pack thickness and new and old pinion cone numbers. Adjustment: Change the thickness of the shim pack to get a good gear tooth contact pattern	35-37
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HYPOID GEAR SET - TOOTH CONTACT PATTERNS (HAND ROLLED)

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

Specification: 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) Adjustment: Preload is controlled by tightening both adjusting rings after zero end play is reached	43
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MAIN DIFFERENTIAL GEARS - ROTATING RESISTANCE

PAGE

Specification: 50 lb-ft (68 N.m) torque applied to one side gear	41
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RING GEAR - BACKLASH

Specification: Ring gears that have a pitch diameter of less than 17 inches (431.8 mm) Range - .008 to .018 inch (.20 to .46 mm) .012 inch (.30 mm) for a new gear set Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater Range - .010 to .020 inch (.25 to .51 mm) .015 inch (.38 mm) for a new gear set Adjustment: Backlash is controlled by the position of the ring gear. Change backlash within specifications to get a good tooth contact pattern. To increase backlash, move the ring gear away from the drive pinion To decrease backlash, move the ring gear toward the drive pinion	45
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RING GEAR - RUNOUT

Specification: .008 inch (.20 mm) maximum	45
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SENSOR SWITCH - INSTALLATION (CARRIERS WITH DIFF. LOCK ONLY)

Specification: Shift the differential to the locked position. Tighten the sensor switch into the carrier until the test light comes on. Tighten the sensor switch one additional turn and tighten lock nut to correct torque value.	58 Steps 13&14
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SPIGOT BEARING - PEENING ON THE DRIVE PINION

Specification: Apply 3,000 kg (6,614 lb) load on a 10 mm or .375 inch ball. Peen the end of the drive pinion at a minimum of five points. Softening of the pinion stem end by heating may be required.	28-31 30
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THRUST SCREW OR THRUST BLOCK - CLEARANCE

Specification: .025 to .045 inch (.65 to 1.14 mm) OR Loosen the thrust screw 1/2 turn after tightening the thrust screw, hand tight, against the ring gear	50
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