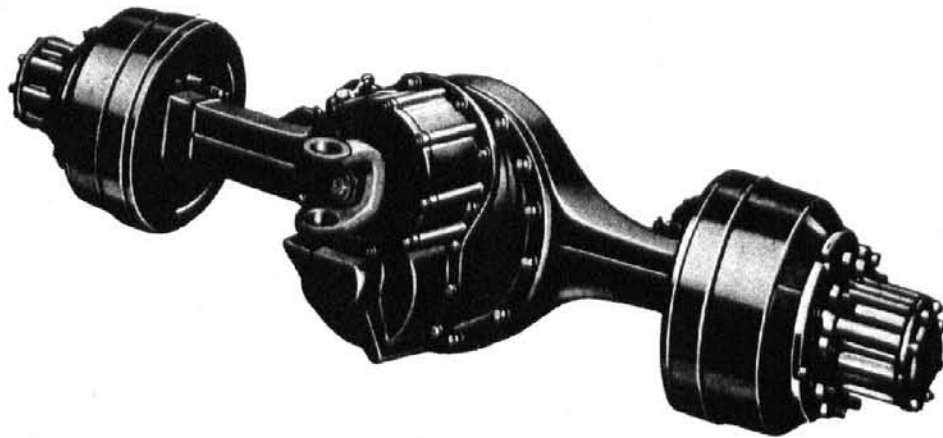


Field Maintenance Manual No. 6C

# **270 Series Double-Reduction**

**SINGLE REAR DRIVE UNITS (R, U & W) and  
REAR/REAR DRIVE UNITS  
ON SR-270, SU-270 and SW-270 TANDEM AXLES**



**Use Only Genuine Rockwell Parts**



**Rockwell International**

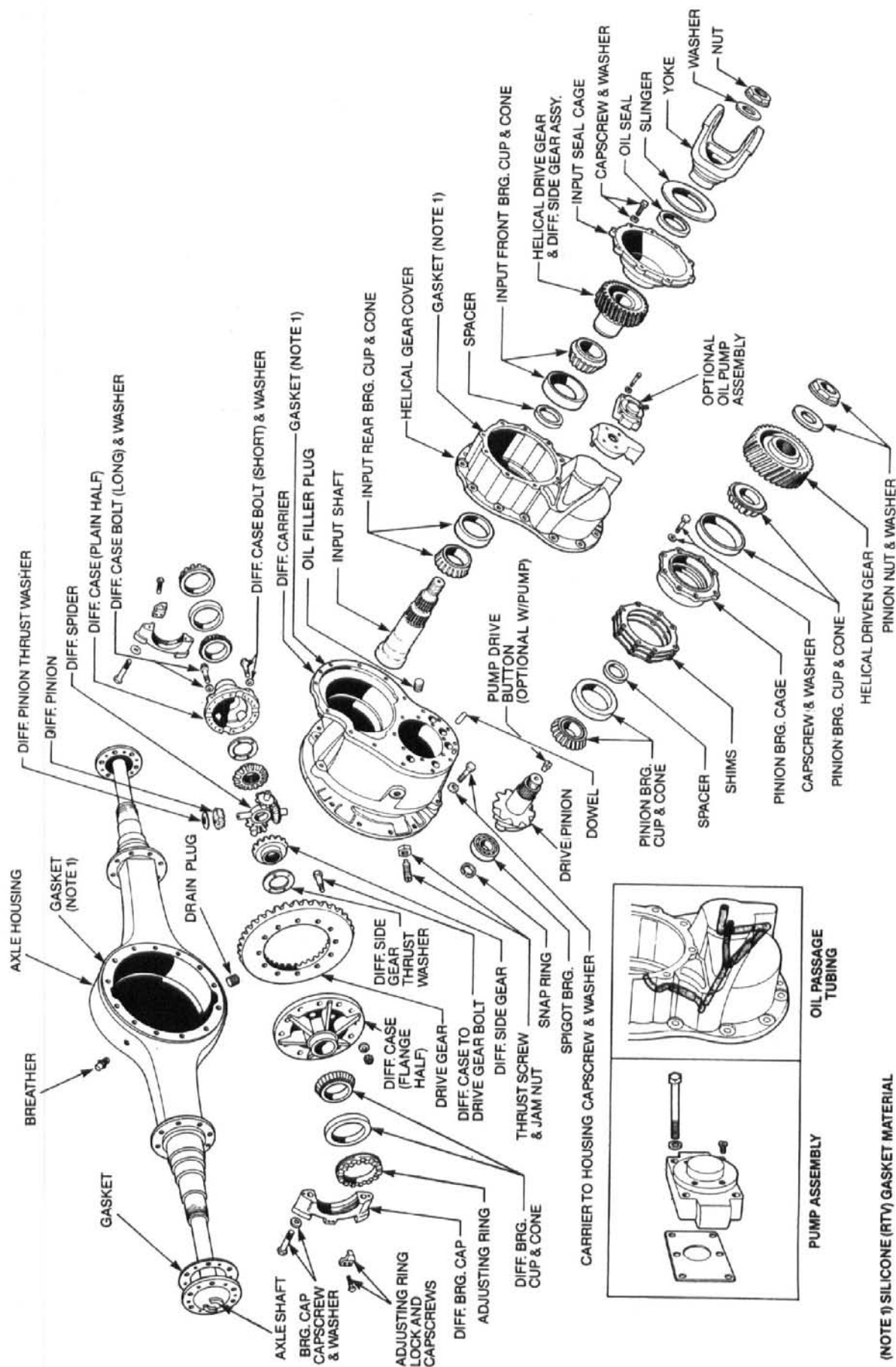
...where science gets down to business

**SERVICE NOTE:** *For safety purposes and to maintain the mechanical integrity of components being serviced, it is of utmost importance to follow completely all the procedures including all "caution" and "important" items throughout this manual.*

# TABLE OF CONTENTS

	Page No.
<b>Component Description and Introduction</b> .....	5
<b>Remove Drive Unit from Housing</b> .....	5
<b>Disassemble Drive Unit</b> .....	6
Remove Helical Gear Cover Assembly .....	6
Remove Main Differential and Gear Assembly .....	7
Disassemble Differential Case and Gear Assembly .....	8
Dri-Loc Bolts and Liquid Adhesive Fastener .....	9,16
Remove Helical Driven Gear .....	9
Remove Pinion and Cage Assembly .....	9
Disassemble Pinion and Cage Assembly .....	11
<b>Prepare for Reassembly</b> .....	11
Bearing Inspection .....	12
Silicone Gasket Application .....	13
<b>Reassemble Drive Unit</b> .....	14
Reassemble Pinion and Cage Assembly .....	14
Adjust Pinion Cage Shim Pack Thickness .....	15
Assemble Main Differential and Gear .....	16
Rolling Resistance Check of Differential Nest .....	17
Install Differential and Gear Assembly .....	18
Adjust Differential Bearing Preload .....	18
Check Hypoid Gear Backlash .....	19
Check Tooth Contact .....	19
Adjust Drive Gear Thrust Screw .....	20
Install Pump Screen .....	20
Reassemble Input Shaft and Helical Gear in Cover .....	20
Install Helical Gear Cover Assembly on Carrier .....	21
Install Seal Retainer Cover on Helical Gear Cover .....	22
Install Input Yoke .....	22
Install Oil Pump .....	22
<b>Clean and Inspect Housing, Assemble Drive Unit</b> .....	23
<b>Lubrication</b> .....	24
Tandem and Tridem Axle Tire Matching .....	25
<b>Fastener Torque Values</b> .....	26

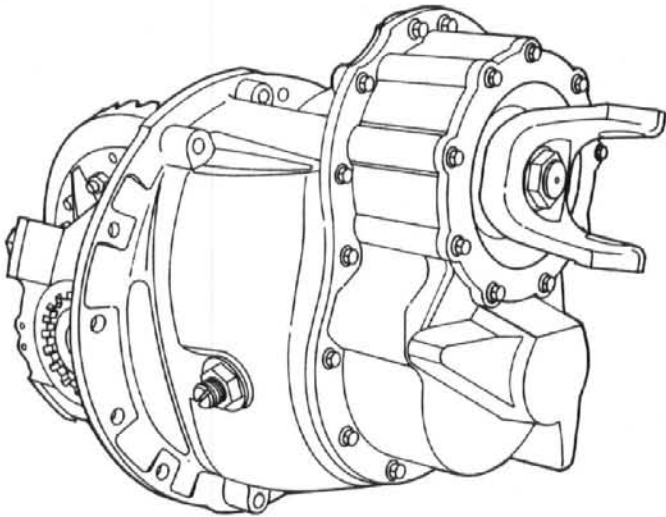
# 270 SERIES DOUBLE-REDUCTION REAR AXLE



(NOTE 1) SILICONE (RTV) GASKET MATERIAL

## 270 SERIES DOUBLE-REDUCTION AXLES

### COMPONENT DESCRIPTION AND INTRODUCTION



The 270 Series models are front-mounted double-reduction carriers with the first reduction taking place in

the two gear transfer train. The second reduction takes place in the 18.875" hypoid gearing.

Basic lubrication of these units is accomplished with a gravity feed (splash) system. An optional forced feed (pump) system is available for special applications involving slow vehicle speeds and/or off-road usage where the standard gravity feed system may not provide adequate lubrication to the forward helical gear train and input shaft bearings.

**It is important to adhere to the instructions whenever "caution" precedes them. Failure to do so could result in personal injury or severe damage to the unit.**

**NOTE:** The hypoid gear set in this carrier must be serviced as a matched set only. We can assume no responsibility for gears of this design serviced in any other manner. Also, the bevel type gears employed in differential assembly should be serviced in sets: that is, all four pinions, thrust washers should be replaced as individual sets even if only one piece is in need of replacement.

## REMOVE DRIVE UNIT FROM HOUSING

- A. Remove plug from bottom of axle housing and drain lubricant.
- B. Remove the axle shaft stud nuts, washers and tapered dowels.

**IMPORTANT:** To loosen the dowels, hold a 1½ inch diameter brass drift against the center of the axle shaft head **INSIDE THE CIRCULAR DRIVING LUGS**. Strike a sharp blow with a 5 to 6 pound hammer or sledge. A 1½ inch diameter brass hammer is an excellent and safe drift.

**CAUTION:** Do not hit the circular driving lugs on the shaft head. This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels. This will damage the hub, shaft and oil seal.

- C. Remove the axle shafts from the drive unit and housing.
- D. Disconnect the propeller shaft.
- E. To remove carrier from housing, first loosen the two top nuts or capscrews and leave attached to the housing. This will prevent carrier from falling.  
Remove all other nuts and/or capscrews and washers.
- F. Break carrier loose from housing with a rawhide mallet.
- G. To remove carrier from housing, place roller jack under carrier. Remove top capscrews and washers and work carrier free. A small pinch bar may be used to straighten carrier in housing bore. However, the end must be rounded to prevent indenting the carrier flange. Discard carrier to housing gasket if used.

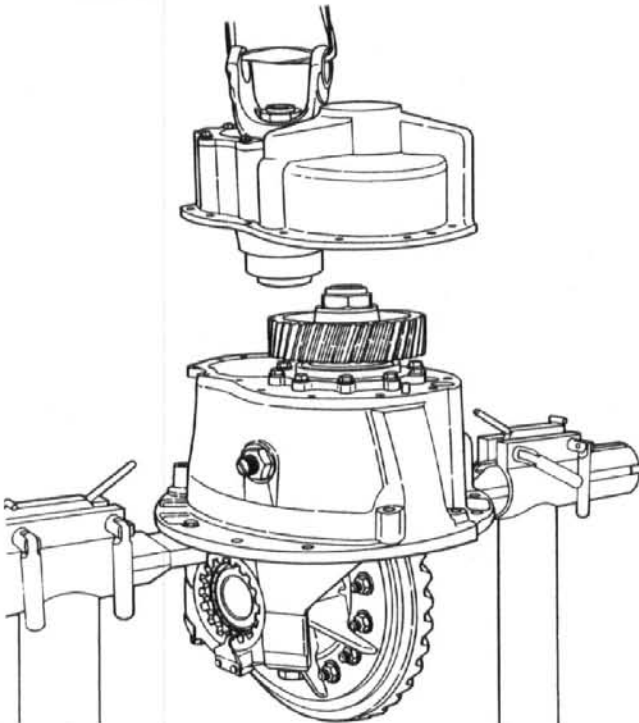
## DISASSEMBLE DRIVE UNIT

### REMOVE HELICAL GEAR COVER ASSEMBLY

- A. Place the complete drive unit in a suitable repair stand.
- B. Check and record the hypoid backlash. This information will be needed in reassembling unless a new gear set is used.

**CAUTION:** Lift the unit by the input yoke. Use a chainfall and suitable lifting strap to avoid damaging the machined surfaces of the yoke.

- C. Place the drive unit (attached to repair stand) in an upright position (input yoke pointing upward).
- D. Loosen the input yoke nut, using a suitable wrench or socket. However, leave the nut and yoke on the input shaft at this time to facilitate gear cover removal.
- E. Remove helical gear cover to carrier capscrews and washers.



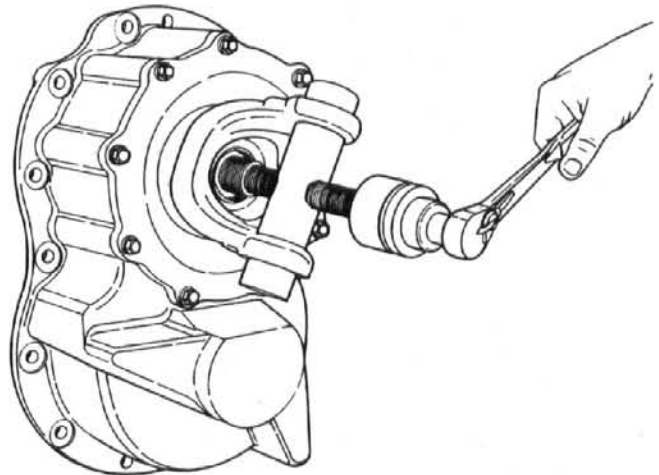
- F. Separate the gear cover from the carrier by attaching a chain fall to the input yoke as shown. It may be necessary to use a rawhide mallet to break the cover from the carrier. Avoid cocking cover during removal by lifting cover straight up from carrier.

**CAUTION:** Do not use pry bars, chisels or wedges to loosen the cover. This will damage the cover and carrier flange mating surfaces.

- G. After separating the parts, remove the cover to carrier gasket or gasket material and discard. (Refer to page 13.)

### DISASSEMBLE HELICAL GEAR COVER ASSEMBLY

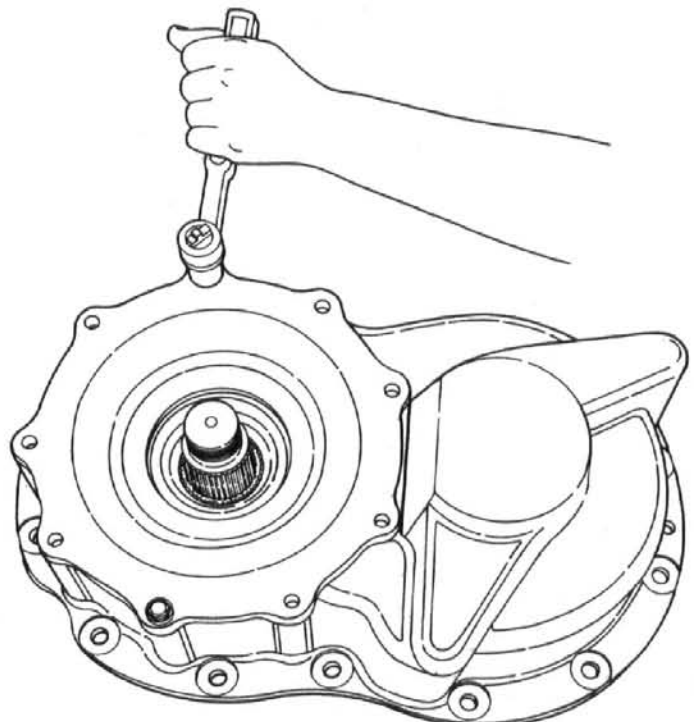
- A. Remove the input yoke nut from the input shaft.



- B. Remove the input yoke from the shaft using a yoke puller as shown.

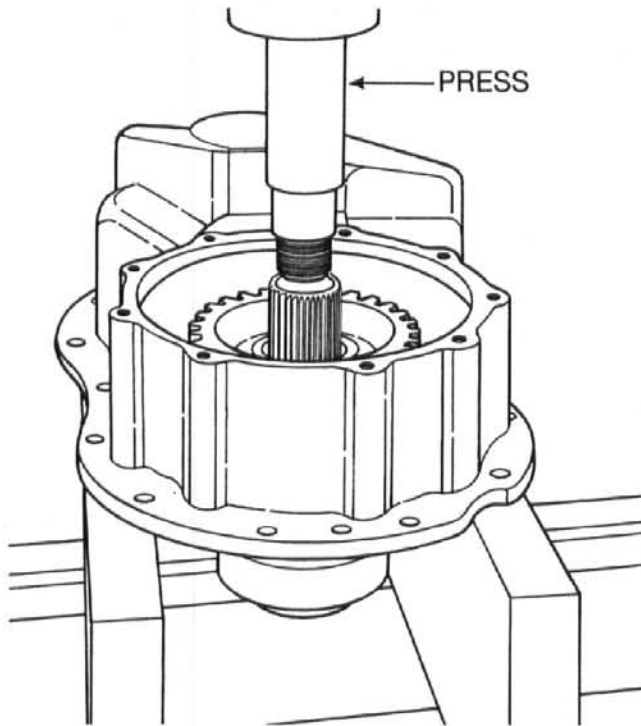
**IMPORTANT:** If the input oil seal is not to be serviced, care must be taken when pulling the yoke so as not to damage the seal in the seal retainer cover.

**CAUTION:** Do not use a hammer to loosen yoke. This will damage the yoke and splines and cause excessive yoke runout and misalignment.



- C. Separate the input seal retainer cover from helical gear cover by removing retainer to cover capscrews and washers.

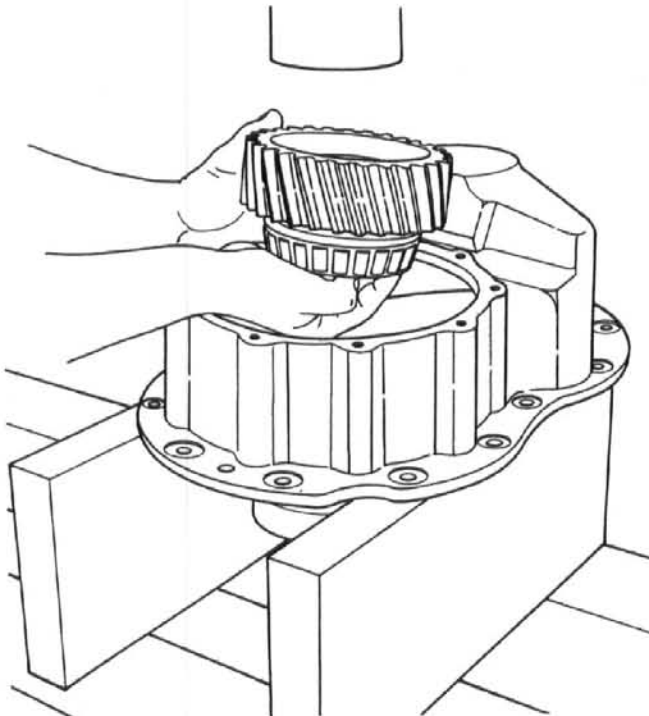




D. Remove the oil seal from the retainer cover using a press and suitable sleeve. If press is not available, use a drift and hammer and tap out seal and discard seal.

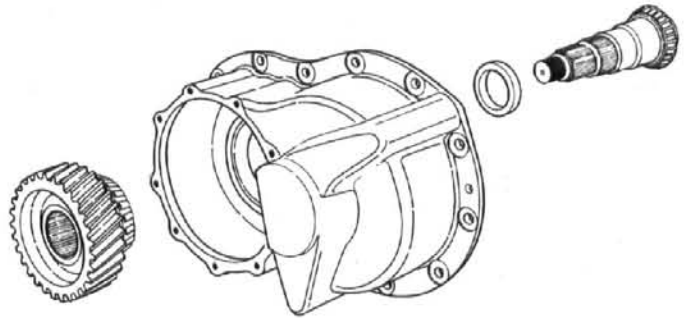
E. Remove input shaft from helical gear cover and helical drive gear. Press shaft out of cover from the front (input) end.

**CAUTION:** Do not strike these hardened steel pieces directly with a steel hammer.



F. With shaft removed, helical drive gear and bearing can be lifted out of cover.

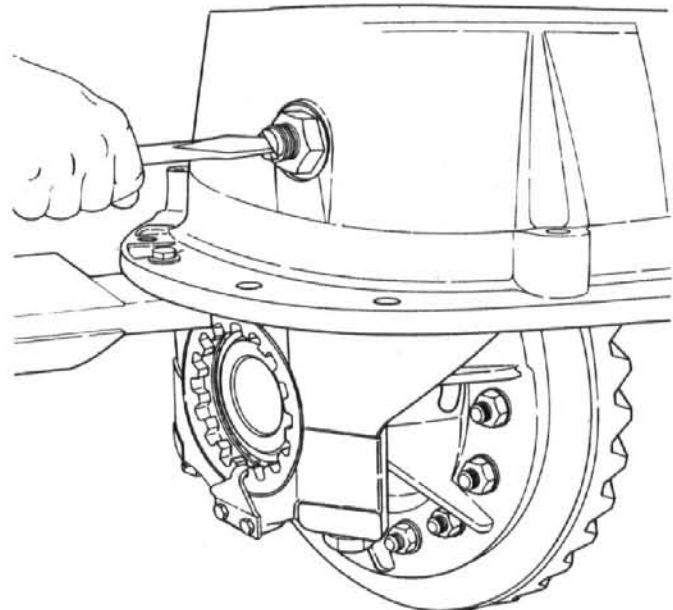
G. Remove bearing from helical gear using suitable puller.



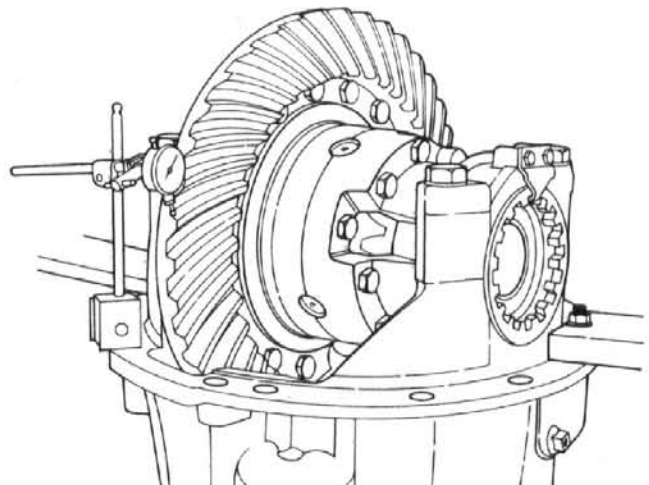
H. Remove bearing spacer and bearing from input shaft with suitable puller.

I. If necessary, remove inner and outer bearing cups from cover using press or suitable puller.

## REMOVE MAIN DIFFERENTIAL AND GEAR ASSEMBLY

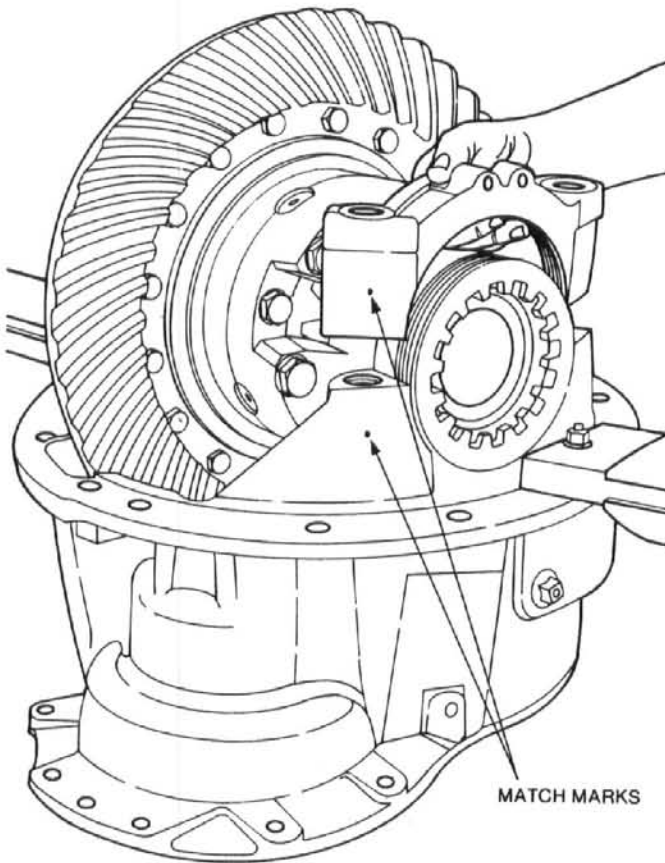


A. With the carrier still in an upright position, loosen jam nut and back off drive gear thrust screw.

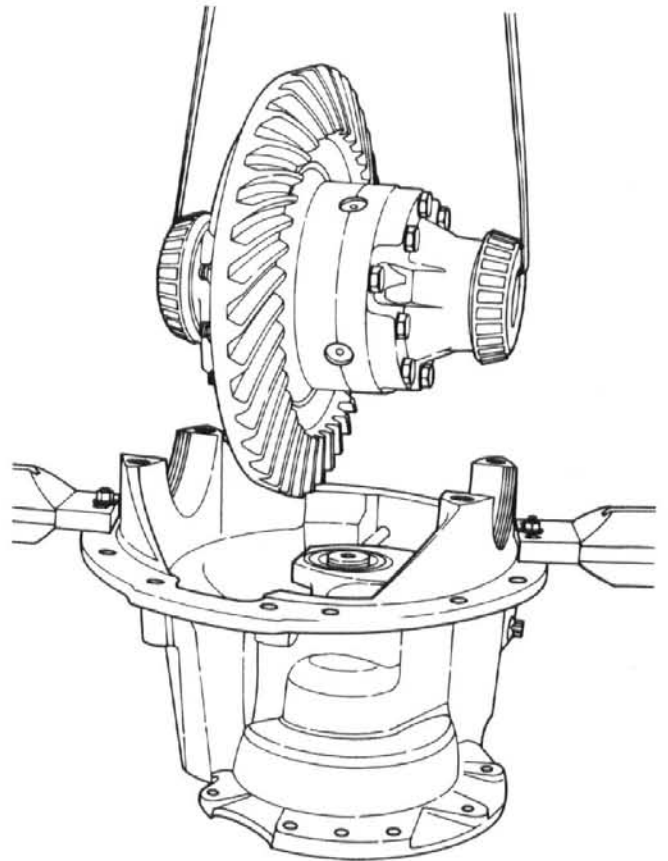


## CARE AND MAINTENANCE

- B. Rotate the carrier 180° and bring the driven hypoid gear to an upright position.
- C. If not already performed, check and record the backlash. This information will be needed in reassembling unless a new gear set is used.
- D. If not already marked, center punch leg and bearing cap to identify at reassembly.
- E. Remove bearing adjusting ring lock capscrews and lock.
- F. Loosen bearing adjusting ring.
- G. Remove the carrier cap capscrews and washers from both sides of the carrier.



- H. Remove the bearing adjusting rings, the carrier caps and bearing cups.

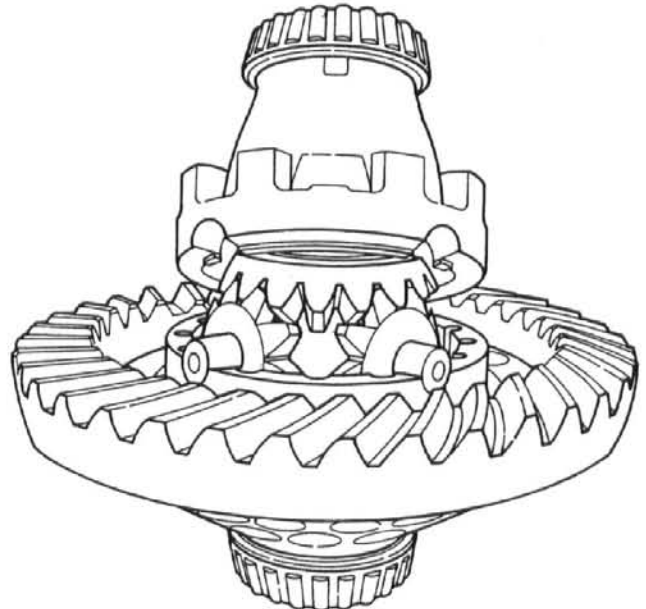


- I. Lift out the differential and gear assembly.

**CAUTION:** Use appropriate heavy-duty lifting devices to prevent personal injury and/or damage to carrier.

## DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

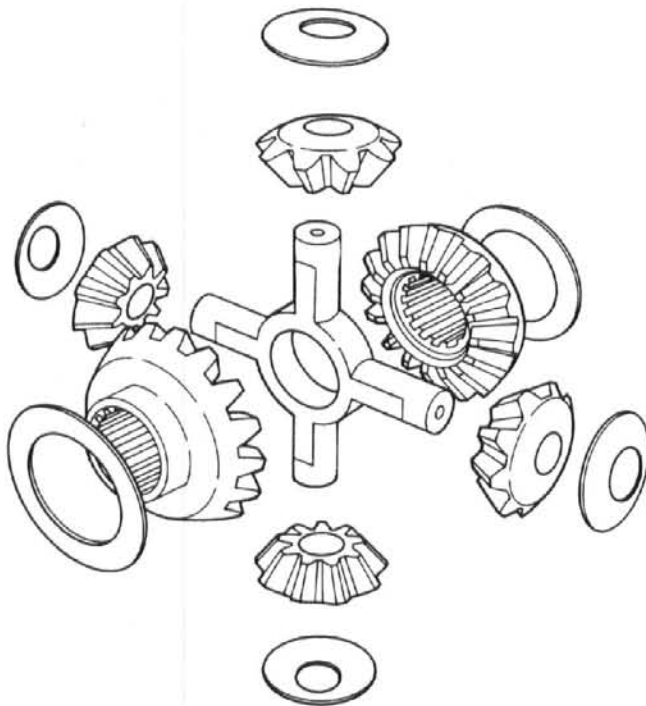
- A. If original identification (matching) marks are not clear, mark the differential case halves with a punch for correct alignment at reassembly.





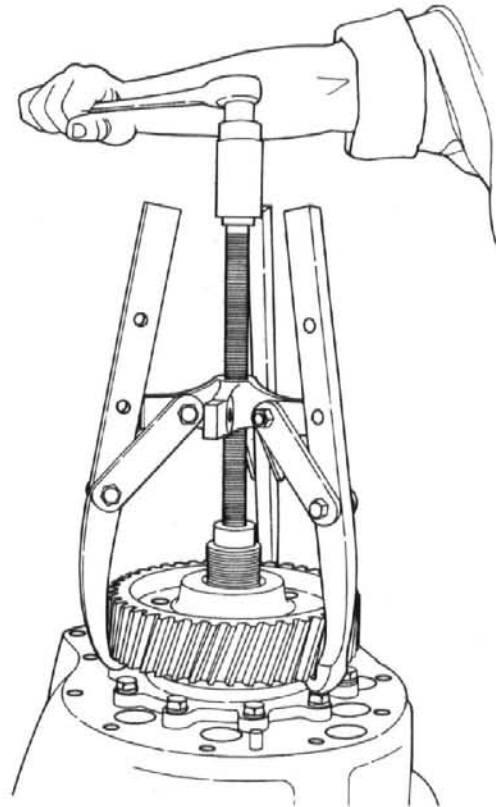
- B. Remove the capscrews and washers and separate the case halves. Rockwell assembles all threaded hole differential cases with Dri-Loc bolts. If bolt removal becomes difficult due to worn bolt heads or unusually high breakaway torques, the locking strength of the Dri-Loc bolts can be reduced by heating. Heat the bolt for only a few seconds at a time while trying to loosen it. **DO NOT EXCEED 350° F MAXIMUM.** Heating should be done slowly to avoid thermal stresses in the differential case and gears. Application of heat reduces the strength of Dri-Loc bolts below the recommended installation torque.

Rockwell does not recommend removing bolts with an impact wrench or by striking with a hammer. Refer to page 16 for additional information on the use of Dri-Loc bolts or Loctite 277 Liquid Adhesive.

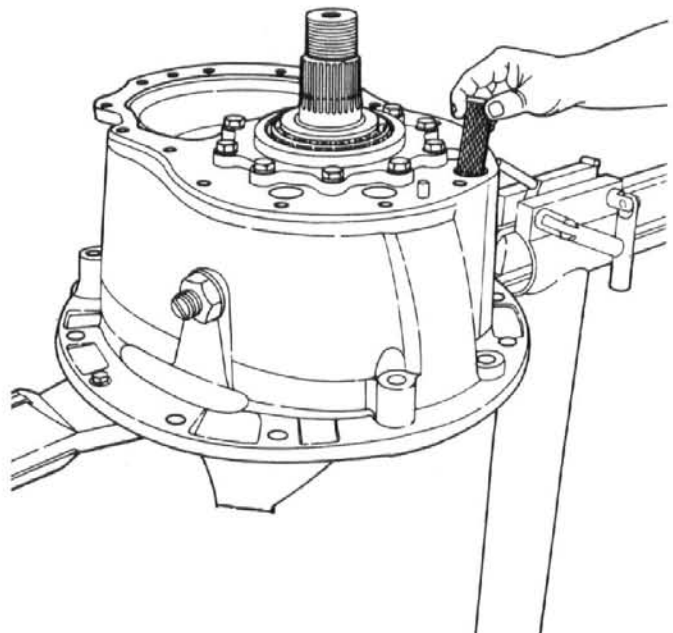


- C. Remove spider, pinions, side gear and thrust washers.
- D. If hypoid gear is to be replaced for any reason, remove the gear to case bolts, nuts and washers, and press the case half from the gear.
- E. If necessary to replace differential bearings, remove with a suitable puller.

## REMOVE HELICAL DRIVEN GEAR



- A. Attach a suitable fixture to the helical driven gear to hold it stationary. The helical gear **must** be held stationary in order to remove fasteners. With the carrier in an upright position, the pinion shaft nut and washer can now be removed.
- B. Using suitable puller, remove driven helical gear from shaft.

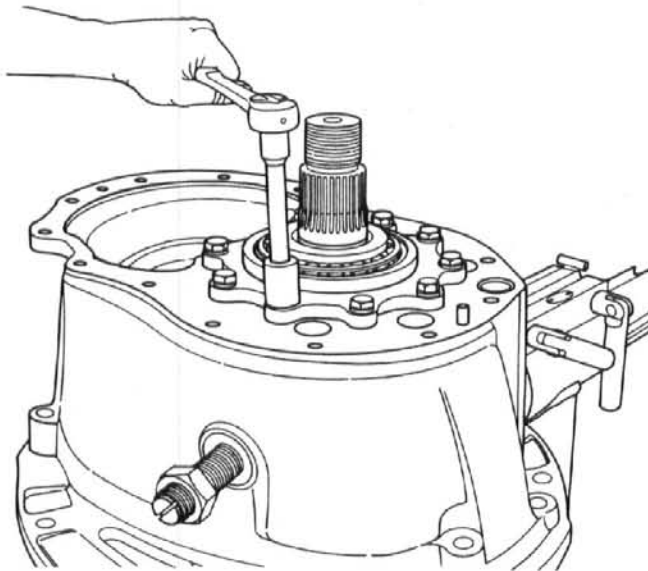


## CARE AND MAINTENANCE

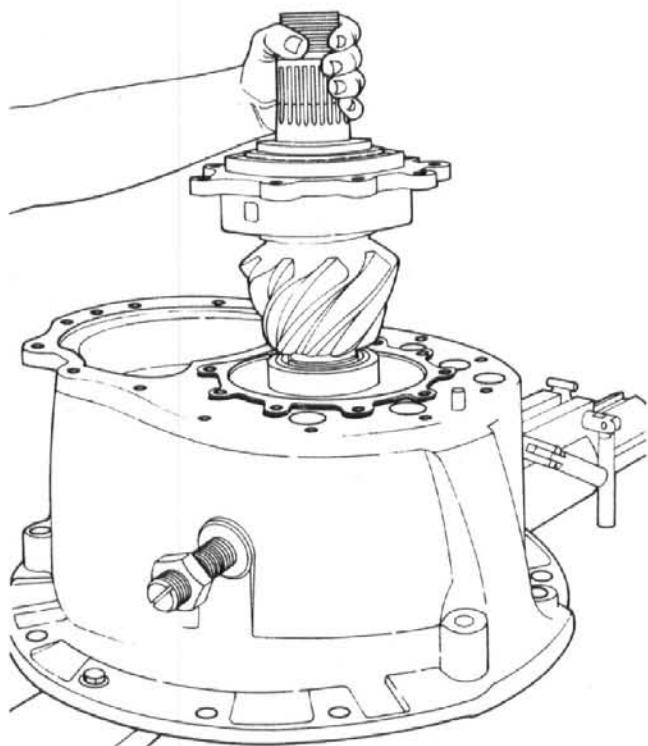
Before continuing with the major disassembling of the drive unit, remove the internal oil filter screen (from carrier units with optional pump assembly) from the carrier housing. The screen is located in the lower left of the housing adjacent to the pinion driven (helical) gear as shown on page 9.

Remove the screen from its seat and make a visual check. If the screen is damaged in any way, discard and replace at reassembly. Otherwise, set it aside for cleaning.

### REMOVE PINION AND CAGE ASSEMBLY

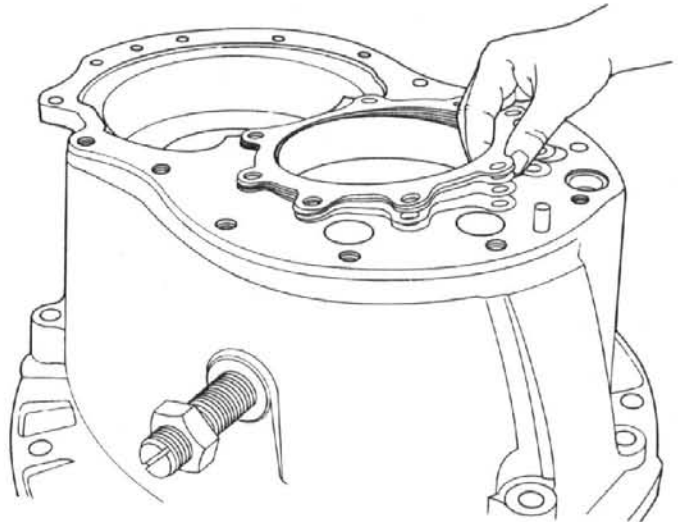


A. Remove capscrews and washers securing pinion cage to carrier.



B. Lift pinion and cage assembly out of carrier.

**NOTE:** It may be necessary to tap out the pinion and cage assembly by using a brass bar and hammer on the pinion end. Care should be exercised not to damage the spigot bearing or retaining ring shoulder. In either case the spigot bearing will remain on the pinion.



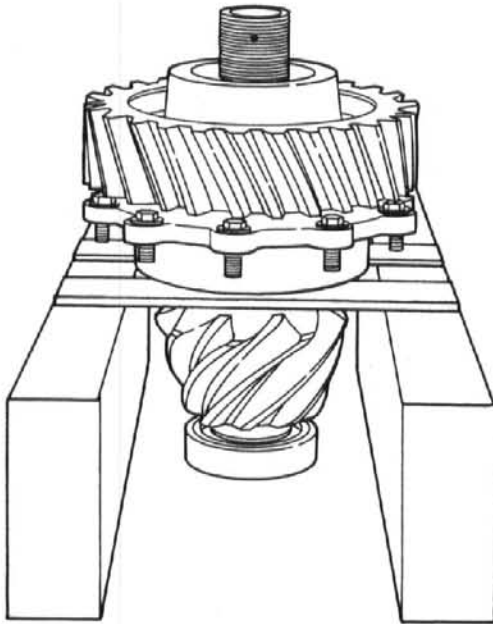
C. Remove shims from under cage; keep shim pack intact, for reassembly.

**NOTE:** Pinion and cage assembly may be removed from carrier with helical gear still installed on pinion shaft. Use following procedure:

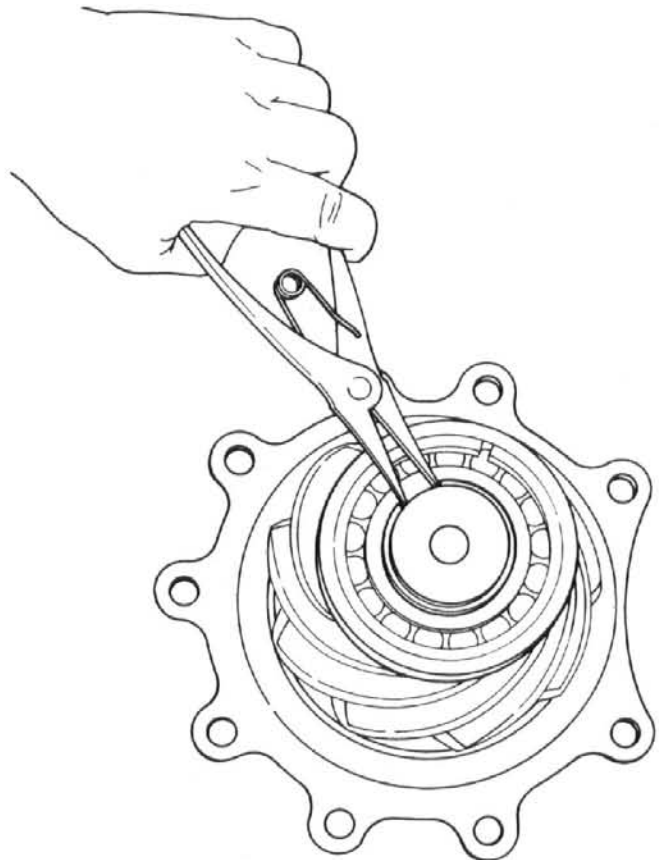
1. Loosen pinion cage capscrews until heads contact the back (under) face of the helical driven gear. Continue loosening capscrews approximately three turns each alternating to the other capscrews. This will avoid cocking the cage in the carrier while the capscrews act as puller screws. Continue loosening capscrews until the cage and capscrews are free.
2. Lift helical gear and pinion and cage assembly out of carrier.

## DISASSEMBLE PINION AND CAGE ASSEMBLY

- A. Remove pinion nut and washer (if not previously removed).



- B. Press pinion shaft through cage and bearings (and helical driven gear if still installed).
- C. Remove outer bearing cone from cage and bearing spacer from pinion shaft.
- D. If required, remove the pinion inner bearing cone from the pinion shaft with a suitable puller.



- E. If required, remove the spigot bearing snap ring and use a suitable puller to remove the bearing from the pinion nose.
- F. If necessary to replace pinion bearing cups, remove with a suitable puller (if cups are in good condition, and are to be reused, do not disturb).

## PREPARE FOR REASSEMBLY

### CLEAN

Parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in a suitable solvent.

**CAUTION:** Exercise care to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

### GASOLINE SHOULD BE AVOIDED.

Do NOT clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates or phosphates.

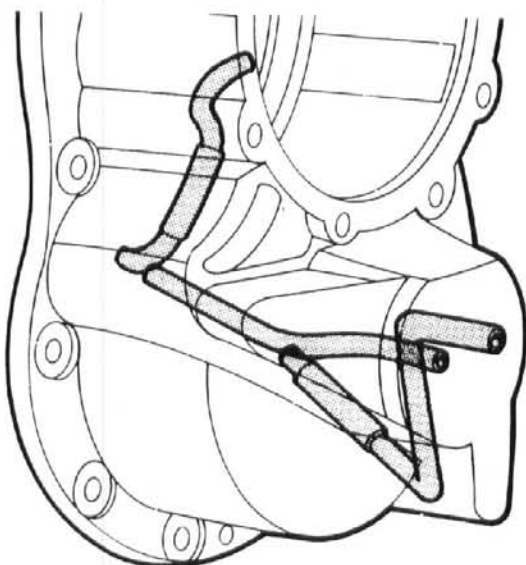
We do NOT recommend steam cleaning assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts.

This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

Clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful not to damage mating surfaces.

**NOTE:** All gasketed surfaces should be carefully inspected to insure there are no nicks, etc.

On units equipped with optional oil pumps, examine all internal oil passage tubing. Tubes should be free of dents, holes, etc. and be tight in all terminal passages. Also, all hose couplings must be secure on tubing.



If any tube is loose, remove tube, degrease and clean both tube and hole. Reinstall tube using Loctite Grade 635—Rockwell Part No. 2297-D-3994 to secure tube. If any hose couplings are loose, replace and secure with Loctite 635.

## ROUGH PARTS

Rough parts, such as differential carrier castings, cast brackets and some brake parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali.

**CAUTION:** Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

## COMPLETE ASSEMBLIES

Completely assembled axles, torque dividers and transfer cases may be steam cleaned on the outside only, to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

## DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

## CORROSION PREVENTION

Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good **rust preventive** and wrapped in special paper or other material designed to prevent corrosion.

## INSPECT

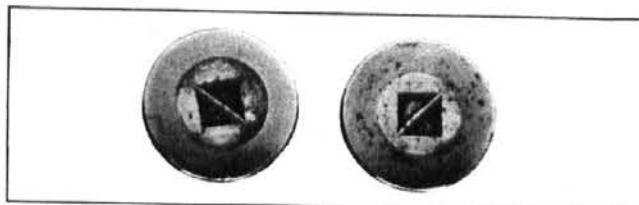
It is impossible to overstress the importance of careful and thorough inspection of drive unit parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable drive unit failure.

### A. TAPERED ROLLER BEARINGS

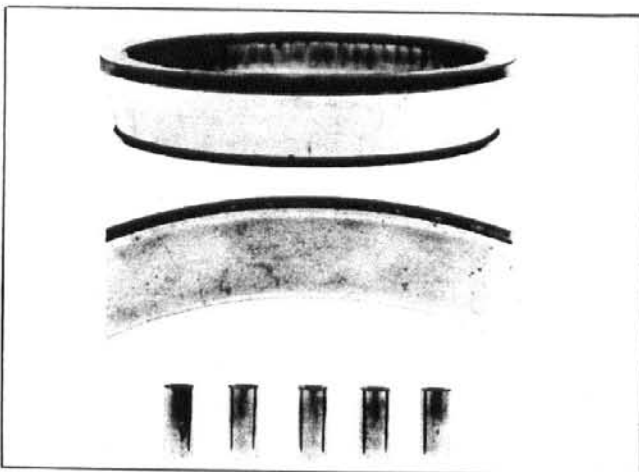
The carrier employs tapered roller bearings in three (3) areas: at the input shaft, the drive pinion, and main differential.

Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

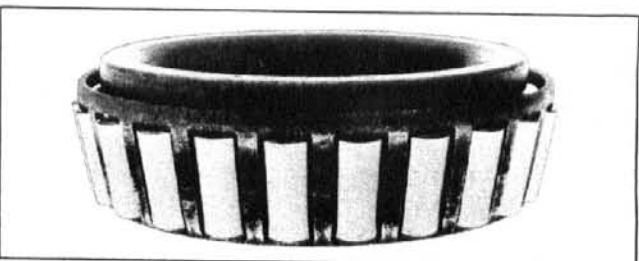
If any of the following bearing conditions exist, **bearings must be replaced:**



1. Large ends of rollers worn flush to recess or radii at large ends of rollers worn sharp.
2. (a) Visible step wear, particularly at the small end of the roller track.

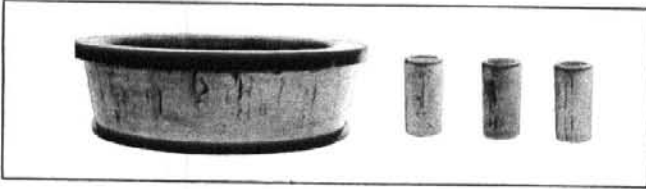


- (b) Deep indentations, cracks or breaks in bearing cup and/or cone surfaces.





3. Bright rubbing marks on the dark phosphate surfaces of the bearing cage.



4. Etching or pitting on functioning surfaces.



5. Spalling or flaking on bearing cup and/or cone surfaces.

#### B. DRIVE PINION AND RING GEARS

Inspect hypoid gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. When necessary to replace either the pinion or gear of a hypoid set, the entire gear set must be replaced.

#### C. DIFFERENTIAL NEST GEARS

Inspect the differential assembly for the following:

1. Pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.
2. Wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

#### D. HELICAL GEARS

Inspect helical gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. Helical gears should be replaced in sets.

#### E. AXLE SHAFTS

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

### REPAIR

- A. Replace all worn or damaged parts. Hex nuts with rounded corners, all lock washers, oil seals and gaskets or silicone gasket material should be replaced at the time of overhaul.

Use only genuine Rockwell replacement parts for satisfactory service. For example, using gaskets of foreign material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression, oil, etc.

- B. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.
- C. When assembling component parts, use a press where possible.
- D. Tighten all the nuts to the specified torque. (Refer to torque chart at end of manual.)

### SILICONE (RTV) GASKET APPLICATION

**NOTE:** Where silicone RTV gasket material is used, Dow Silastic No. RTV-732 Black and General Electric No. RTV-1473 Black meet our requirements. However, silicone RTV is also available in bulk under Rockwell part number 1199-Q-2981; in 10 oz. tubes, part number 1250-X-388, or in 3 oz. tubes, part number 1199-T-3842.

### SERVICE

Removal of all gaskets including silicone RTV is accomplished by peeling or scraping the used gasket off the carrier to housing surfaces.

Application of silicone RTV gasket material is as follows:

1. Remove dirt, grease or moisture from the surface of the carrier and housing.
2. Dry the surface.
3. Apply thin bead, maximum 1/8" diameter, completely around one mating surface and all fastener holes to assure complete sealing and prevent leakage.

**CAUTION:** Minor concentrations of acetic acid vapor may be produced during application. Adequate ventilation should be provided when silicone RTV is applied in confined areas.

**Further, eye contact with these silicone (RTV) materials may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.**

4. Assemble the components **immediately** to permit silicone RTV gasket material to spread evenly.

When rebuilding any assembly, always use torque values on fasteners as specified by either Rockwell or the vehicle manufacturer.

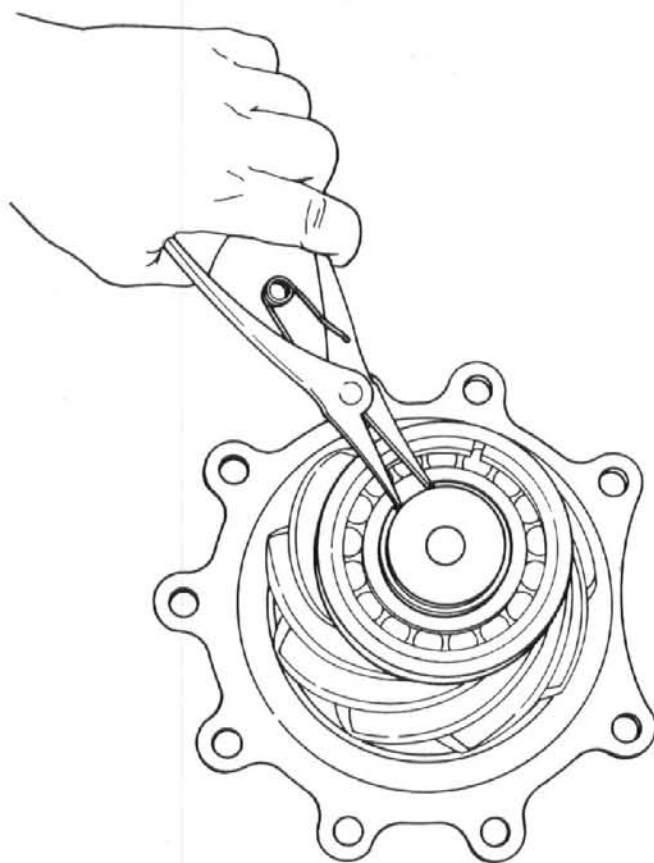
**CAUTION:** Failure to use appropriate gasket material will cause axle to leak. Do not apply excessive gasket material.

# REASSEMBLE DRIVE UNIT

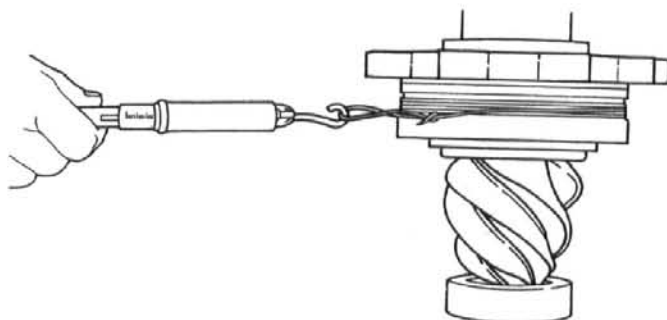
## REASSEMBLE PINION AND CAGE ASSEMBLY

**IMPORTANT:** Before assembling, coat all parts of bearings with recommended axle lubricant.

- A. Press rear bearing firmly against the pinion shoulder with a suitable sleeve against the bearing inner race.
- B. Press the spigot bearing into position on pinion end, with larger radius against pinion, using a sleeve against the inner race only.



- C. To retain the spigot bearing on the pinion end, assemble the snap ring on the nose of the pinion.
- D. If new cups are to be installed, press cups into cage using suitable sleeve. Make sure cups are firmly against the cage shoulders.
- E. Insert pinion and bearing assembly in pinion cage and position spacer over the pinion shaft.
- F. Press forward bearing firmly against the spacer.
- G. Rotate cage several revolutions to assure normal bearing contact.



- H. While in the press under pressure, check the bearing preload torque. Wrap a soft wire around the cage pilot and pull on a horizontal line with a pound scale. (If the press is not equipped with a pressure gauge, the pinion nut may be tightened to the correct torque and the preload checked in a vise.)

$\frac{1}{2}$  cage dia. (ins.) x lbs. pull = in. lbs. preload.

**EXAMPLE:** Cage diameter is 6.75 inches, the radius is 3.375; with 6 pound pull, preload torque is 20 pounds inches. Use rotating torque, not starting torque.

The correct pressure and nut torque for checking pinion bearing preload are as follows:

PINION SHAFT THREAD SIZE	REQUIRED NUT TORQUE TO OBTAIN CORRECT PRE-LOAD	REQUIRED PRESSURE TO OBTAIN CORRECT PRE-LOAD
2" x 12	1200-1500 lb. ft.	25 tons

For new pinion bearings, the rotating torque must be within 10—30 lb. ins.

For reused pinion bearings, the rotating torque must be within 10—20 lb. ins.

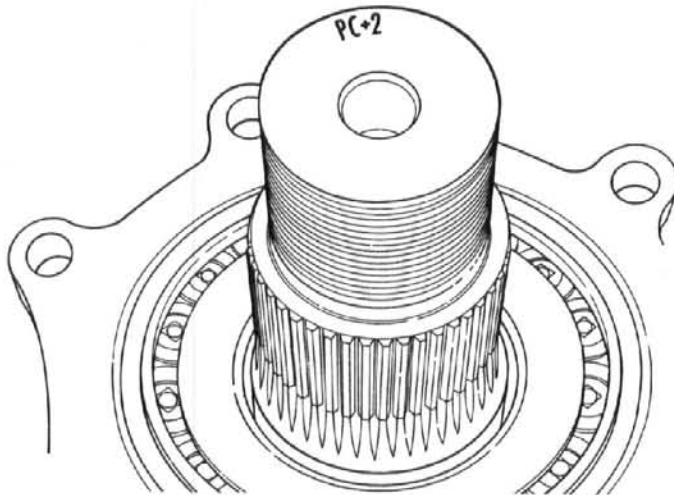
If the rotating torque is not within these values, use a thinner spacer to increase, or a thicker spacer to decrease the preload torque.

- I. Insert pinion cage to carrier capscrews and washers in their respective holes in the pinion cage.
- J. Press the drive pinion helical gear against the forward bearing and install washer and pinion shaft nut.
- K. Using a suitable holder on gear, tighten the pinion shaft nut to the required torque.
- L. Recheck pinion bearing preload torque. If rotating torque is not within specified values, repeat the foregoing procedure. After establishing correct preload, continue with adjusting pinion cage shim pack thickness.



## ADJUST PINION CAGE SHIM PACK THICKNESS

- A. Measure the thickness of the original shim pack used with the gear set being replaced; use a micrometer or vernier gauge. Make a note of this measurement.



- B. Note the "PC" or variation number on the original pinion being replaced. If this number is a plus (+) value, subtract it from the original shim pack measurement taken in Item "A." If the variation number is a minus (—) value, add it to the measurement from Item "A." Make a note of this value.

**NOTE:** The value calculated in Item "B" will establish a "standard shim pack thickness" without a variation. This value will be used in calculating the shim pack thickness used with a new pinion and gear set.

- C. Note the "PC" or variation number on the new pinion. Add or subtract this number as indicated by the variation sign (+ add or — subtract) from the calculated "standard shim pack thickness" determined in Item "B."

The resulting answer indicates the thickness (in thousandths) of the new shim pack to be used. (Refer to examples on this page.)

**IMPORTANT:** Use a minimum of three (3) shims per pack.

### EXAMPLES OF CALCULATION:

#### EXAMPLE NO. 1

Original Pack Thickness	.030"
Original Variation (PC + 2)	— .002
Standard Pack Thickness	.028"
New Variation (PC + 5)	+ .005
New Pack Thickness	.033"

#### EXAMPLE NO. 2

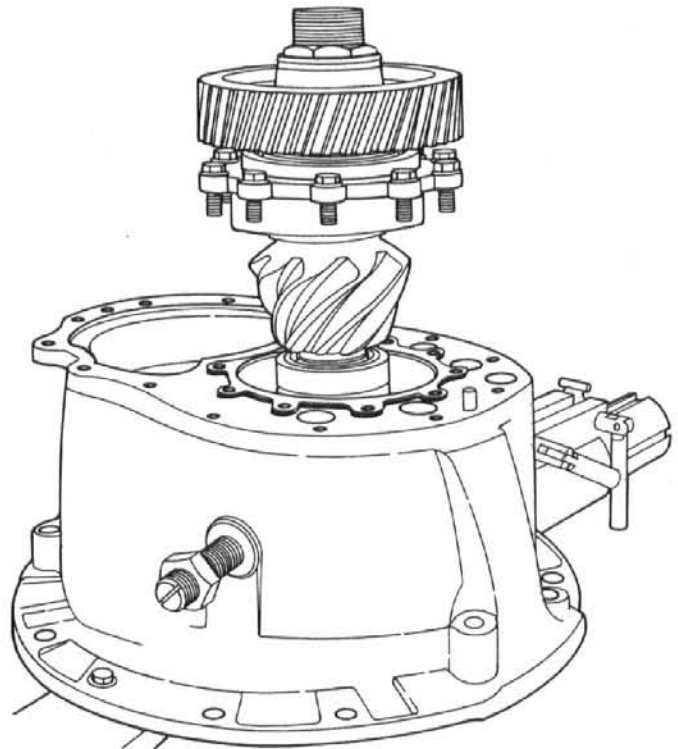
Original Pack Thickness	.030"
Original Variation (PC — 2)	+ .002
Standard Pack Thickness	.032"
New Variation (PC + 5)	+ .005
New Pack Thickness	.037"

#### EXAMPLE NO. 3

Original Pack Thickness	.030"
Original Variation (PC + 2)	— .002
Standard Pack Thickness	.028"
New Variation (PC — 5)	— .005
New Pack Thickness	.023"

#### EXAMPLE NO. 4

Original Pack Thickness	.030"
Original Variation (PC — 2)	+ .002
Standard Pack Thickness	.032"
New Variation (PC — 5)	— .005
New Pack Thickness	.027"



- D. Assemble the new pinion and cage assembly with the correct shim pack into the carrier.
- E. Position the pinion and cage assembly in the carrier pinion cage bore and tap into place with a soft mallet. Make certain that capscrews are aligned with respective holes in carrier, and that cage is not cocked in its bore.
- F. Start turning in pinion cage capscrews approximately three turns each and alternating to other capscrews. This will avoid cocking the cage in the carrier while the capscrews push the cage into posi-

## CARE AND MAINTENANCE

tion. When the cage is seated in the carrier back off capscrews (loosen) and retighten to correct torque. (Refer to Torque Chart at the end of this manual.)

**NOTE:** After assembling the pinion and cage assembly with new shim pack and differential and gear assembly into carrier, make a gear tooth contact check. (Refer to page 19.)

## ASSEMBLE MAIN DIFFERENTIAL AND GEAR

- A. Proper service replacement of the differential ring gear onto the differential case half is necessary for correct gear adjustment and longer drive unit service life. For correct installation, Rockwell recommends heating the ring gear in water to approximately 160°–180°F for about ten minutes before assembly. This will allow an easier fit of the gear over the differential case pilot, without the use of a press, and without damaging the case and ring gear mating surfaces.

The gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and case, thus resulting in gear runout. Proper installation should, therefore, incorporate preheating the gear as described above to assure correct interference fit and to eliminate metal pickup.

- B. After the gear is correctly positioned onto the case half, secure it with the nuts, bolts and washers. Assemble the bolts from the gear side and position the washers under the nuts. Tighten to the correct torque value. (Refer to the Torque Chart at the end of the manual.)
- C. Prelubricate differential case inner walls and all component parts with the recommended axle lubricant.
- D. Position thrust washer and side gear in gear case half.
- E. Place spider with pinions and thrust washers in position.
- F. Install second side gear and thrust washer.
- G. Position other case half over assembly aligning match marks of both halves.

Rockwell assembles all threaded hole differential cases with Dri-Loc bolts. Rebuild these assemblies with new Dri-Loc bolts or reuse the old bolts by applying liquid adhesive to the threaded holes in the cases.

When new Dri-Loc bolts are used, identified by a visible patch of adhesive on threads, the locking feature is usable only once. When the same bolt is reused, liquid adhesive must be applied to the threaded hole in the case to achieve the locking feature. Use the following procedures:

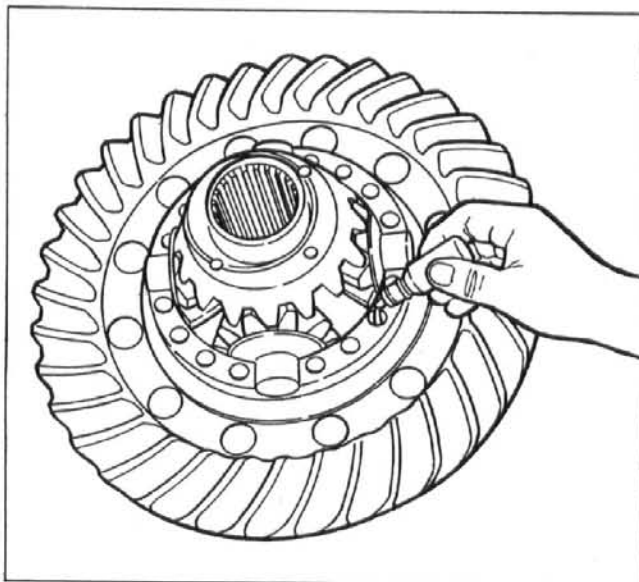
### NEW DRI-LOC BOLTS

1. Wipe excess oil and any residue from the threaded holes in the case. The holes should be relatively oil free, however, no special cleaning is required.
2. Assemble the differential case components using the new Dri-Loc bolts. **DO NOT APPLY LIQUID ADHESIVE OR ANY OTHER TYPE OF FASTENER RETAINER MATERIAL, SEALANT OR ADHESIVE ON NEW DRI-LOC BOLTS OR IN THE THREADED HOLES.**
3. Tighten the Dri-Loc case bolts to the specified torque value recommended for the same regular bolt. Dri-Loc will not alter the torque requirement. (Refer to the Torque Chart at the end of this manual.)

**NOTE:** No cure time is required for Dri-Loc bolts prior to rebuilding the axle and returning it to service.

### REUSE OF DRI-LOC BOLTS OR USE OF REGULAR BOLTS AND LIQUID ADHESIVE

1. Wipe excess oil residue from the bolts and threaded holes in the case. The bolts and holes should be relatively oil free; however, no special cleaning is required. When reusing Dri-Loc bolts, it is not necessary to remove the Dri-Loc residue from threads.



2. Apply liquid adhesive to the threaded holes only, by letting four or five drops run down the side of each hole. Before threading in the bolts, visually check to make sure that the liquid adhesive has contacted the threads.

**IMPORTANT:** Do not apply liquid adhesive to the bolt, since trapped air in hole will create back pressure and "blow out" the liquid adhesive as the bolt advances.

3. Tighten the bolts to the specific torque value recommended for that size bolt. Liquid adhesive will not alter the torque requirement. (Refer to the Torque Chart at the end of this manual.)

**NOTE:** No cure time is required for liquid adhesive prior to rebuilding the axle and returning it to service.

Rockwell 2297-C-3747 liquid adhesive is available in ten (10) bottle cartons (10 cc per bottle) from Rockwell International, Florence Distribution Center, Florence, Kentucky 41042. Liquid adhesive is presently available at your local dealer.

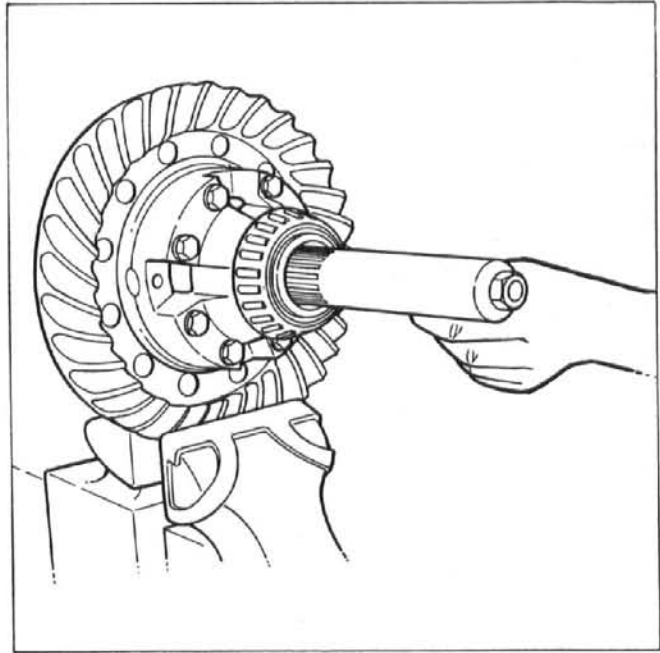
**IMPORTANT:** When servicing drive units assembled with Dri-Loc bolts or liquid adhesive in threaded case holes where the bolts do not require removal, check each bolt for tightness by applying the minimum amount of torque specified for that size fastener. If the bolt does not rotate, it is satisfactory. If the bolt rotates to any degree, it must be removed from the case halves and liquid adhesive must be applied to the threaded hole. Use the above procedure.

- H. Draw the assembly together with three (3) equally spaced capscrews.
- I. Install remaining capscrews and tighten to correct torque. (Refer to Torque Chart at the end of this manual.)
- J. If new bearings are to be used, press squarely and firmly on differential case halves with suitable sleeve.

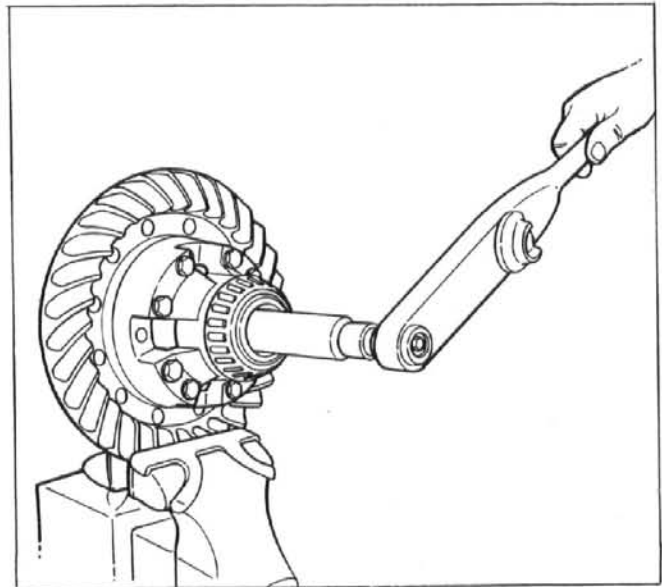
## ROLLING RESISTANCE CHECK OF DIFFERENTIAL NEST

- A. Place differential and ring gear assembly in a vise.

**IMPORTANT:** Use soft metal covers over vise jaw to protect ring gear.

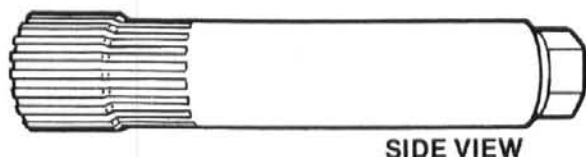


- B. Insert checking tool (made from splined axle shaft end) into differential nest. Allow splines of tool to engage with spline of one side gear only.



- C. Using a suitable socket and torque wrench, rotate differential nest while observing scale on torque wrench.

Correct rolling resistance of differential assembly is 50 lb. ft. torque maximum applied to one side gear. This applies to all differential assemblies, except inter-axle differential assemblies and high traction equalizers.



SIDE VIEW

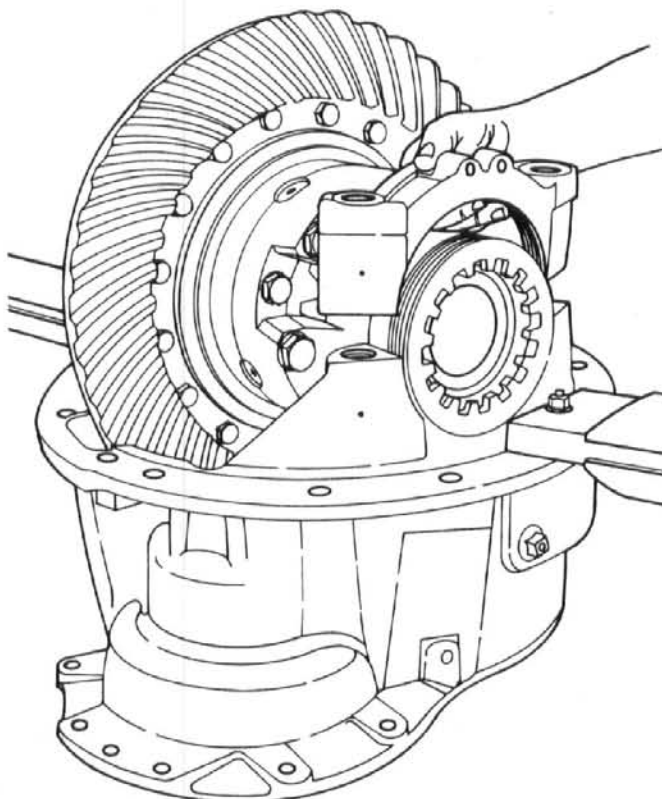


END VIEW

- D. A suitable checking tool can be made by cutting an axle shaft to an appropriate length and welding a nut on the end to accept a wrench socket.

### INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

- Pre-lubricate differential bearings and cups with the recommended axle lubricant.
- Place cups over bearings and position assembly in carrier housing.
- Insert bearing adjusting rings and turn hand-tight against bearing cups.



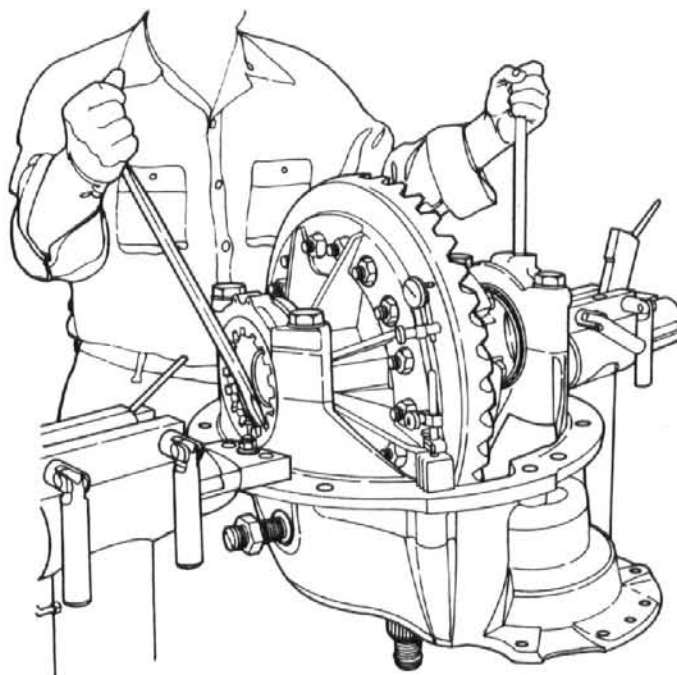
- D. Install bearing caps in the correct location as marked and tap lightly into position.

**CAUTION:** If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting rings. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

- E. Apply liquid adhesive to carrier leg capscrews. Refer to page 16, for liquid adhesive part number and application instructions. Install carrier leg capscrews and washers and tighten to required torque. (Refer to Torque Chart at end of manual.)

### ADJUST DIFFERENTIAL BEARING PRELOAD

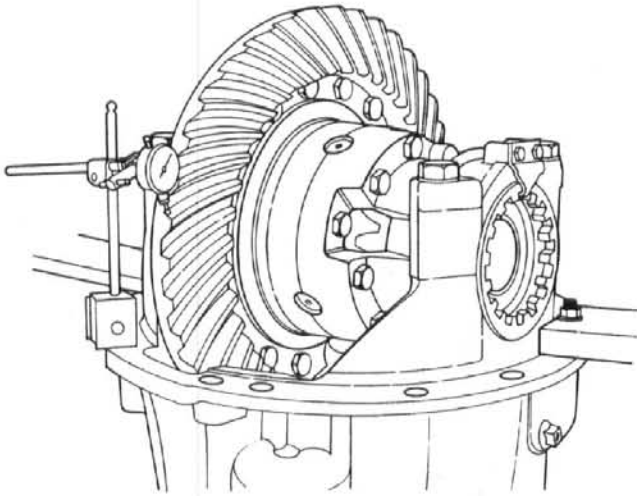
- A. Using dial indicator at backface of gear, loosen the bearing adjusting ring on **the side opposite gear only** sufficient to notice end play on the indicator.



- Tighten the same adjusting ring only sufficient to obtain .000 end play.
- Check gear for runout. If runout exceeds .008", remove differential and check for cause.
- Tighten adjusting rings **one notch each** from .000 end play to pre-load differential bearings, or spread legs from .006" to .010".
- Install bearing adjusting ring locks. Tighten capscrews to required torque.

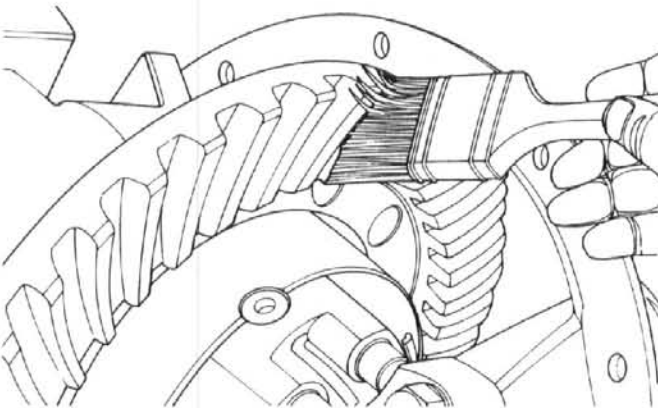


## CHECK HYPOID GEAR BACKLASH

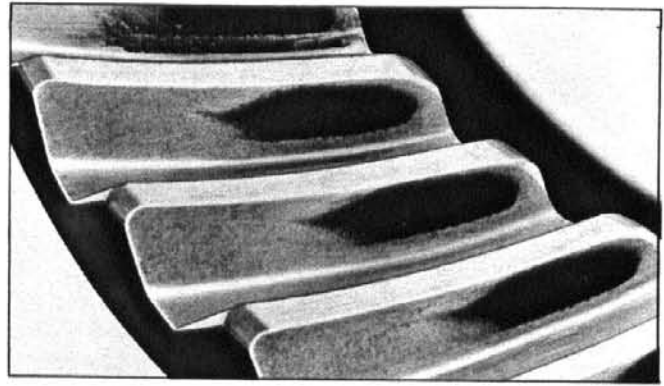


If the drive gear is not going to be replaced, we suggest the established backlash recorded before disassembly be used. For new gears the new backlash should be initially set at .014". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

## CHECK TOOTH CONTACT



- A. Apply gear marking compound lightly to the gear teeth. When the pinion is rotated, the marking compound is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.
- B. Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve (12) teeth is sufficient for checking purposes.

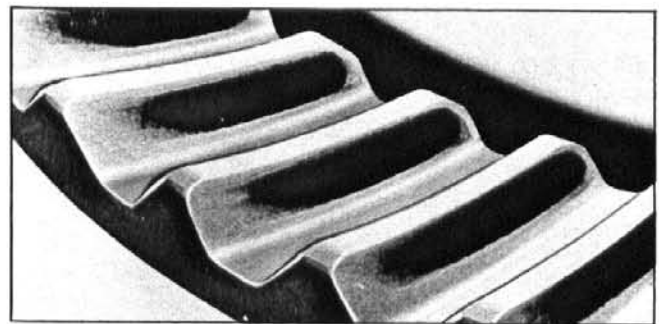


**SATISFACTORY TOOTH CONTACT  
(HYPOID GEARS UNLOADED)**

After obtaining a satisfactory tooth contact, the backlash can be altered within the limits of .008" — .020" to obtain a better contact position relative to the length of the tooth.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

After correct tooth contact has been established, install adjusting ring locks and capscrews. Tighten capscrews to correct torque. Set adjusting ring locks into notch to assure lock.

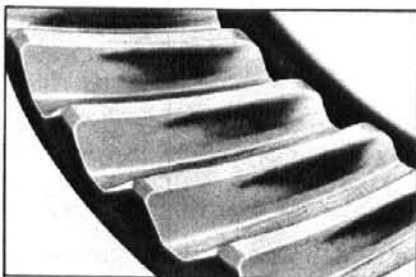


**SATISFACTORY TOOTH CONTACT  
(HYPOID GEARS LOADED)**

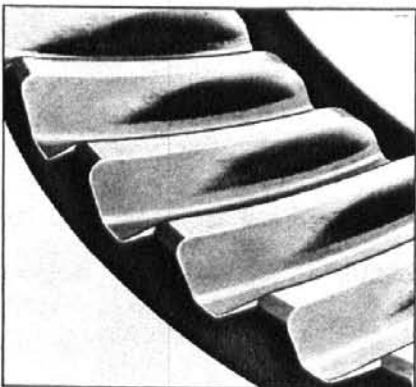
With adjustments properly made (pinion at correct depth and backlash set at .014") contacts will be produced as shown. The area of contact favors the toe and is centered between the top and bottom of the tooth.

The hand-rolled pattern shown (gears unloaded), will result in a pattern centered in the length of the tooth when the gears are under load, as shown (gears loaded). The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

## INCORRECT HYPOID TOOTH CONTACT



A high contact indicates pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. Slight outward movement of hypoid gear may be necessary to maintain correct backlash.

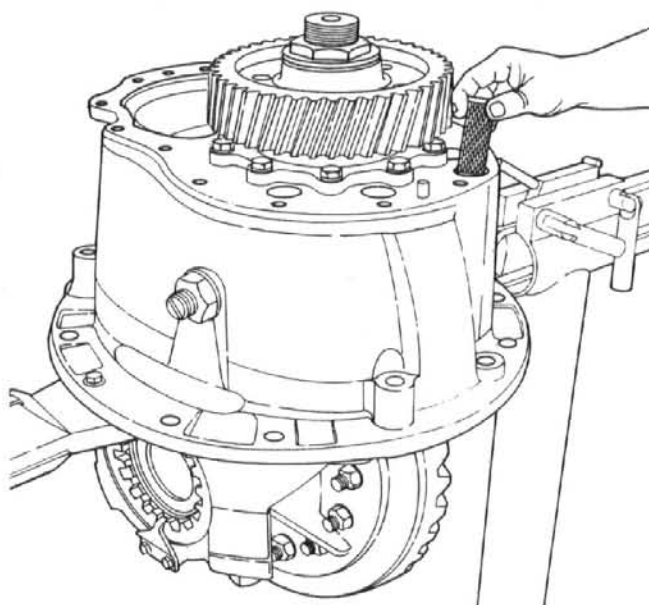


A low contact indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the hypoid gear may be necessary to maintain correct backlash.



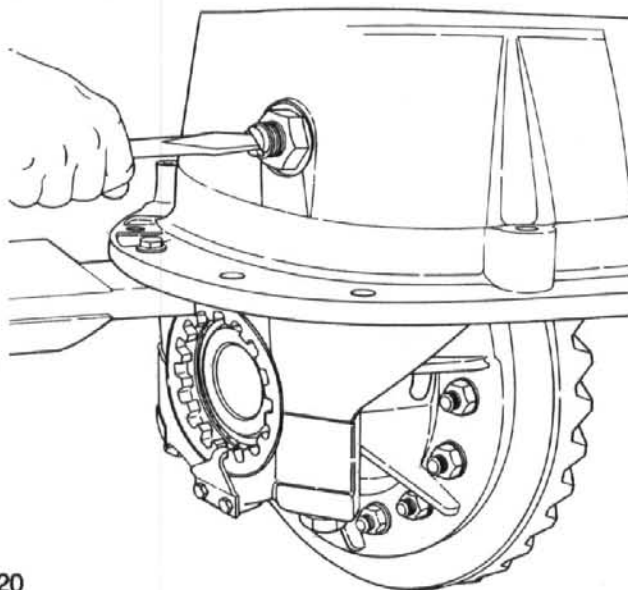
- Back out thrust screw and jam nut.
- Coat thrust end of screw with grease and reinstall screw and jam nut into carrier.
- Tighten screw until it is firm against back face of hypoid drive gear.
- To secure the correct adjustment of .010" — .015" clearance, loosen thrust screw ¼ turn and lock securely with nut. (Refer to Torque Chart at end of manual.)
- Recheck clearance between end of thrust screw and back face of gear for .010" — .015" clearance.

## INSTALL PUMP SCREEN (IF EMPLOYED)



- Clean and install the oil screen in its seat in the carrier.
- Set the differential carrier assembly aside at this time and continue with reassembling the helical gear cover.

## ADJUST DRIVE GEAR THRUST SCREW

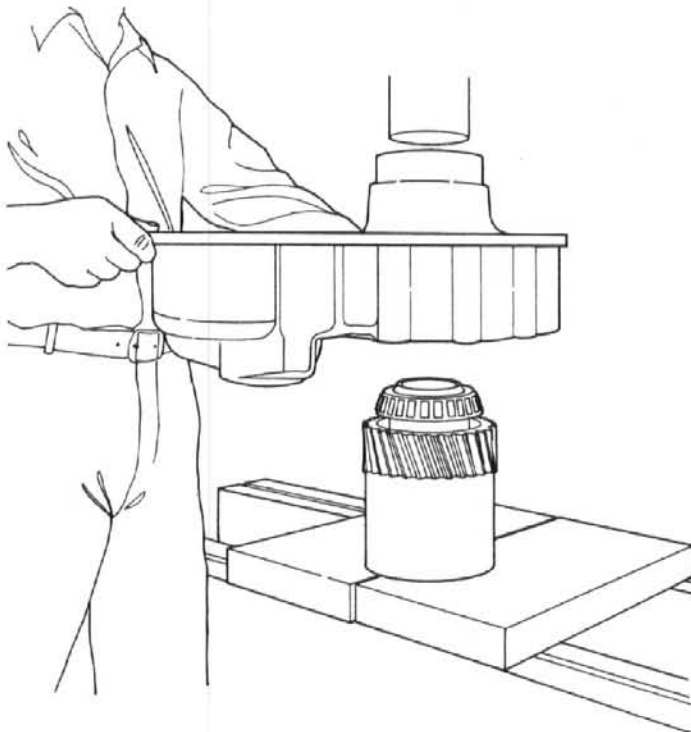


## REASSEMBLE INPUT SHAFT AND HELICAL GEAR IN COVER

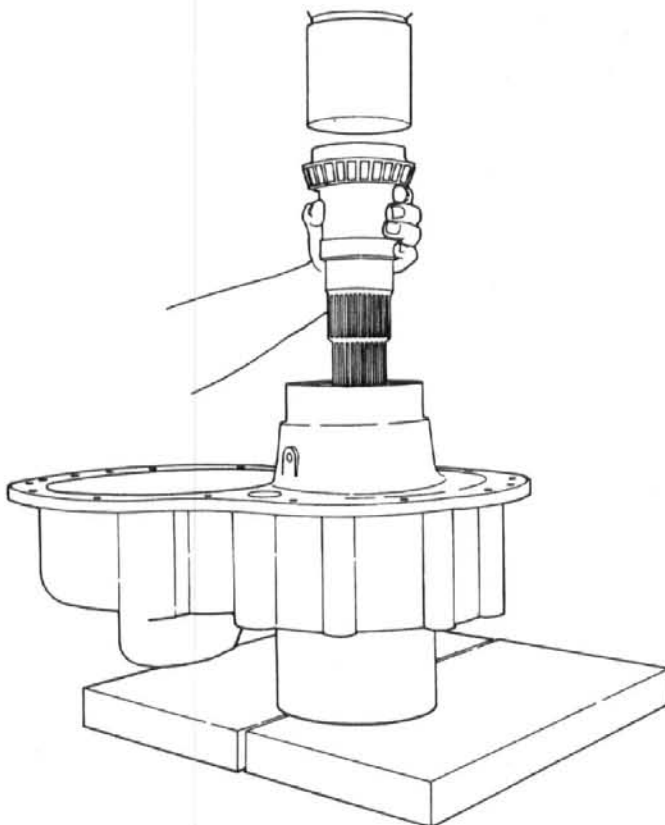
- Install new inner and outer bearing cups in cover, if required, using suitable press.
- If required, press new bearing on input shaft.



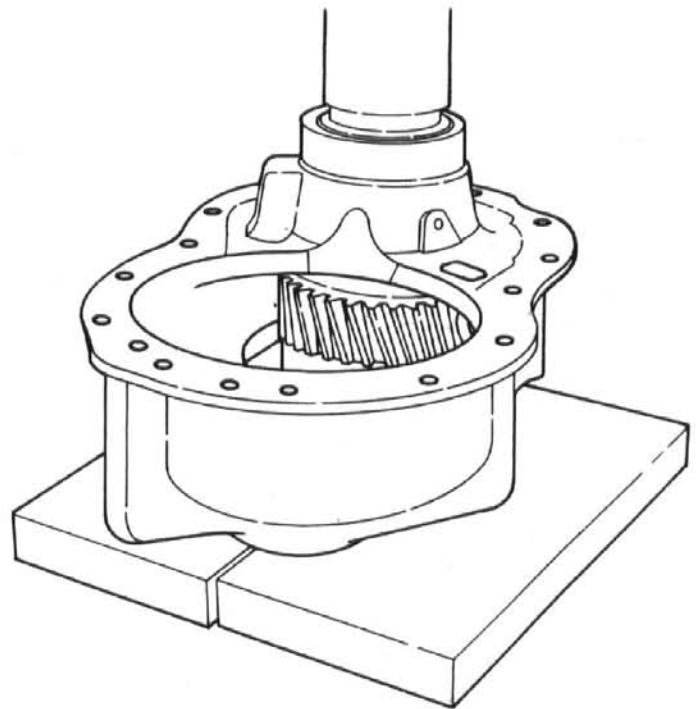
- C. If required, install new bearing on helical drive gear, using suitable press.
- D. Install bearing spacer on input shaft.



- E. Position helical drive gear and bearing assembly in press, as shown.



- F. Position helical gear cover over drive gear and bearing.

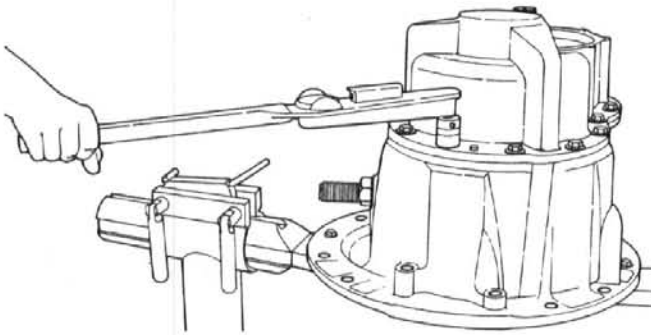


- G. Press input shaft through drive gear from the back side of cover.
- H. Check input shaft bearing preload. Load press to 25 tons.
- I. Install input yoke, flat washer and nut, tighten the input yoke nut to the required torque.
- J. Check input shaft bearing preload torque using a suitable socket and torque wrench, rotate input shaft while observing scale on torque wrench.
- For new input shaft bearings, the rotating torque must be within 10—50 in. lbs.
- For re-used input shaft bearings, the rotating torque must be within 10—35 in. lbs.
- If the rotating torque is not within these values, use a thinner spacer to increase, or a thicker spacer to decrease the pre-load torque.
- K. Remove nut, washer and yoke.

**NOTE:** input shaft bearing preload is controlled by the thickness of the bearing spacer.

## INSTALL HELICAL GEAR COVER ASSEMBLY ON CARRIER

- A. Apply silicone RTV gasket material to mating surface and position gear cover assembly on carrier.(Refer to page 13.)
- B. As the cover is lowered into position, allow teeth of input shaft gear to mesh with teeth of pinion drive gear. Tap cover into position with soft-faced mallet.

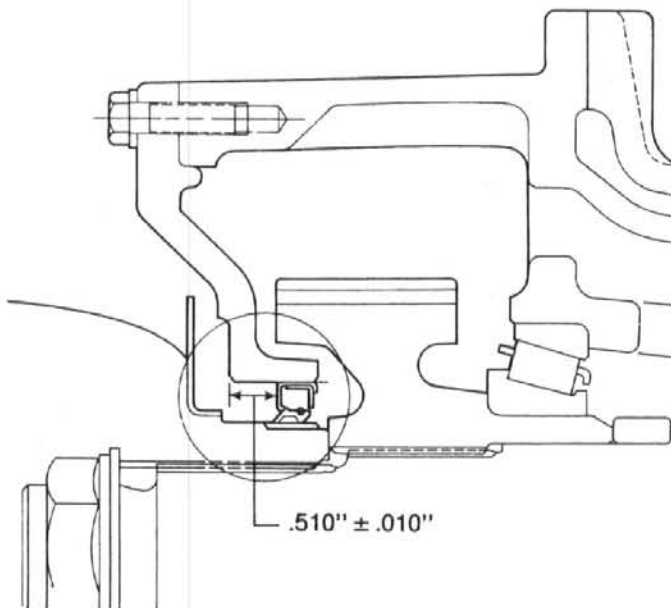


- C. Install gear cover to carrier capscrews and washers. Tighten capscrews to correct torque. (Refer to Torque Chart at end of manual.)

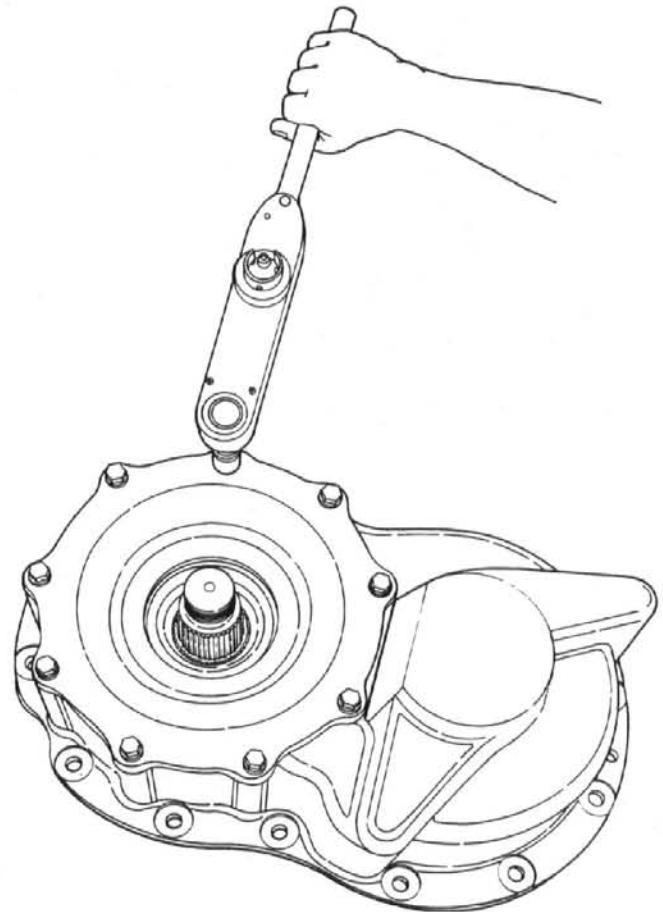
## INSTALL SEAL RETAINER COVER ON HELICAL GEAR COVER

- A. If required, install new seal cover using suitable seal driver. Press to  $.510'' \pm .010''$ .

**NOTE:** Seal must be driven from front face with a driver which will bottom on cover face.



- B. Lubricate seal with Lubriplate or other suitable lubricant.
- C. Apply RTV gasket material to mating flange. (Refer to page 13.)
- D. Position seal retainer cover on gear cover.



- E. Install cover capscrews and washers and tighten to correct torque.

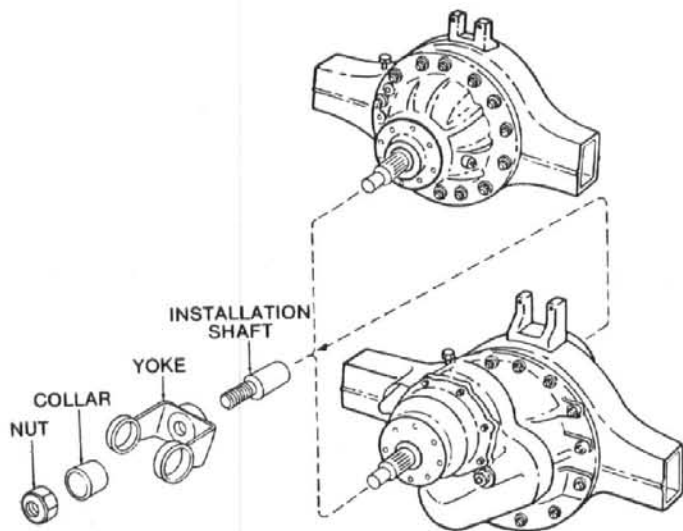
## INSTALL INPUT YOKE

Input shaft has a helical spline so that yoke will start with a slip-fit but end up an interference side tooth fit. Carriers with interference fit yokes, require the use of a press or the three-piece installation tool and the following procedures:

**IMPORTANT:** Do not drive yokes onto pinion, input, output or through shafts by pounding or tapping. This will damage the yoke, splines, and shafts and bearings.

- A. Coat yoke seal elements with recommended axle lubricant. Also ensure that there are no burrs or nicks on the yoke wiper surface or on any surfaces that will pass through the seal during installation.
- B. Thread the yoke installation shaft onto pinion input, output or through shaft until installation shaft bottoms.

**NOTE:** The installation tool can be purchased from Kent-Moore, Tool Division, 1501 South Jackson St., Jackson, Michigan 49203 or can be made from drawings available from the Communications Dept., Rockwell Int'l, 2135 W. Maple, Troy, MI. 48064.



- C. Slide the yoke over the installation shaft, aligning yoke and shaft spines of drive unit.
- D. Place installation collar over the installation shaft, against yoke.
- E. Thread nut onto installation shaft, against the collar. Continue threading the nut against collar until yoke seats against bearing. A torque value of 200 lb. ft. on nut may be required to properly install and seat the yoke.

**CAUTION:** Do not use a prevailing torque nut to install the yoke, as damage to the threads will result. Use only the nut furnished with tool.

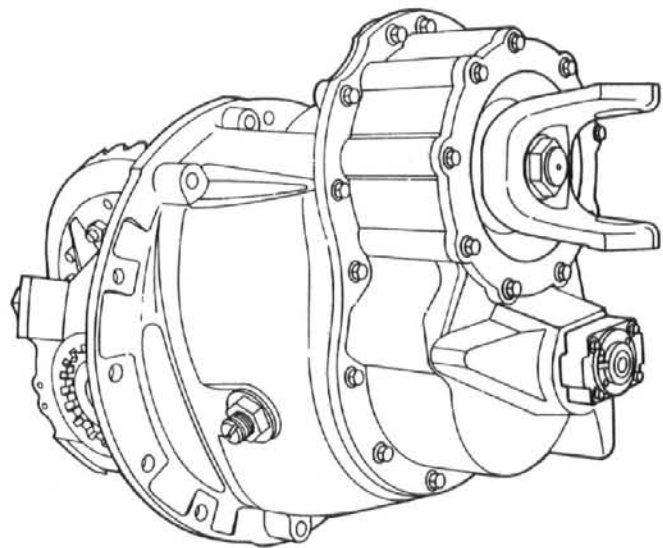
- F. Remove all parts of the installation tool from the drive unit.
- G. Use free running nut (not a prevailing torque nut) to seat yoke and preload bearings.

- H. Install pinion, input, output or through-shaft washers (if employed) and nut. Tighten nut to the required torque value.

## INSTALL OIL PUMP (IF UNIT IS SO EQUIPPED)

- A. Position oil pump and gasket on cover flange allowing pump drive to mesh with slot on pinion shaft.

**NOTE:** One bolt is larger in diameter to correctly position pump.



- B. Install capscrews and washers and tighten to correct torque.

## CLEAN AND INSPECT HOUSING, ASSEMBLE DRIVE UNIT

- A. Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.
- B. Inspect housing for cracks, nicks and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs of parts replacements before installing drive unit in housing. Be sure housing is thoroughly cleaned after repairing.
- C. Apply drive unit to housing silicone RTV gasket material over drive unit opening in housing. (Refer to page 13.)
- D. Roll carrier into position on roller jack. Start carrier into housing with four flat washers and capscrews equally spaced and tighten alternately to draw the carrier squarely into axle housing. **Driving carrier into housing with a steel hammer will damage carrier flange and cause severe oil leakage.**
- E. After drive unit has been drawn up tightly to the housing, install balance of washers and capscrews and nuts. Tighten capscrews and nuts to correct torque. (Refer to Torque Chart at end of manual.)

## LUBRICATION

"Standard" S.A.E. 140 viscosity lubricants, Rockwell specifications 0—76, 0—76—A and 0—76—B, are to be used in drive units that operate under average conditions, except where atmospheric temperatures require the use of the lower viscosity S.A.E. 90, Rockwell specifications 0—76—C, 0—76—D, 0—76—F and 0—76—J.

"Optional" S.A.E. 90 viscosity lubricants should be used when starting or storage temperatures fall below the channel point of the particular S.A.E. 140 viscosity lubricant being used.

Generally speaking, the "Standard" lubricants will render satisfactory service in most areas of the continental United States.

Unusual temperature or operating conditions may require other or more specific lubricant recommendations. Rockwell International will review these circumstances, upon request, and make optional gear oil or grease recommendations. It is essential that all details of vehicle operation, loads, area temperatures, etc., are clearly and completely stated when applying to our Engineering Department for an optional lubricant recommendation.

The design of hypoid gear teeth, which mesh with a sliding action, enables them to withstand higher unit pressures. Therefore, the lubricant should have extreme pressure properties. Lubricants meeting the requirements of S.A.E. designation API-GL-5 best meet most requirements. For detailed oil specifications, refer to Rockwell Field Maintenance Manual No. 1 on Lubrication.

Further, since Rockwell lubricant specifications are periodically revised, always refer to Manual No. 1 for current complete lubricant specifications and applications.

### MAGNETIC DRAIN PLUGS

Magnetic drain plugs perform the vital function of trapping small iron particles that circulate in the lubricant, through the gears and bearings, causing rapid wear and premature failure. The magnet must be strong enough to firmly hold the particles under service conditions. We

recommend plugs with elements having a minimum pickup capacity of 2 pounds of low carbon steel in plate or flat bar form. (See Plug section in Field Maintenance Manual No. 1.)

Spare clean plugs should be kept on hand for replacement at regular intervals. The change schedule can easily be established by periodic plug examination.

### NEW AND RECONDITIONED AXLE SERVICE

With new axles, the original drive axle lubricant should be drained at 1,000 miles, but not later than 3,000 miles. Drain the lubricant initially used in the assembly while the assembly is still warm. Axles must not be flushed with any solvent, such as kerosene.

All new axles should be checked for correct oil level before being placed into service.

For reconditioned axles, follow the same procedures as above after overhaul.

Fill rear axle with 55 pints (26 litres) of specified lubricant through fill hole in left side of carrier housing.

NOTE: This lubricant capacity is with pinion at horizontal centerline.

### REGULAR AXLE SERVICE

Refer to Field Maintenance Manual No. 1, "Lubrication," for recommended service interval.

Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain. Fill the axle with the recommended type and amount of fresh lubricant.

After filling the new or rebuilt carrier and housing assembly with lubricant, as specified, drive the vehicle, unloaded, for one to two miles at speeds not to exceed 25 miles per hour to thoroughly circulate the lubricant throughout the assembly.

### PREPARATION FOR STORAGE

In the event the carrier is a spare and may not be immediately installed, all gears and bearings should be thoroughly oiled and the carrier placed in a dustproof container.

## TANDEM AND TRIDEM AXLE TIRE MATCHING

Unmatched tires on Tandem Drive Units or Tridem Drive Units will cause the tire wear and scuffing and possible damage to the drive units. Consequently Rockwell recommends the tires to be matched to within  $\frac{1}{8}$ " of the same rolling radius,  $\frac{3}{4}$ " of the same rolling circumference.

### TANDEM UNITS:

**IMPORTANT:** The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an inter-axle "fight, and unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

In addition to matching individual tire rolling radii or rolling circumference, Rockwell recommends matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

### TRIDEM UNITS:

When three driving axles are "hooked" together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs.

Rockwell recommends matching, as nearly as possible, the total tire circumference of each of the three driving axles. Use the following procedures:

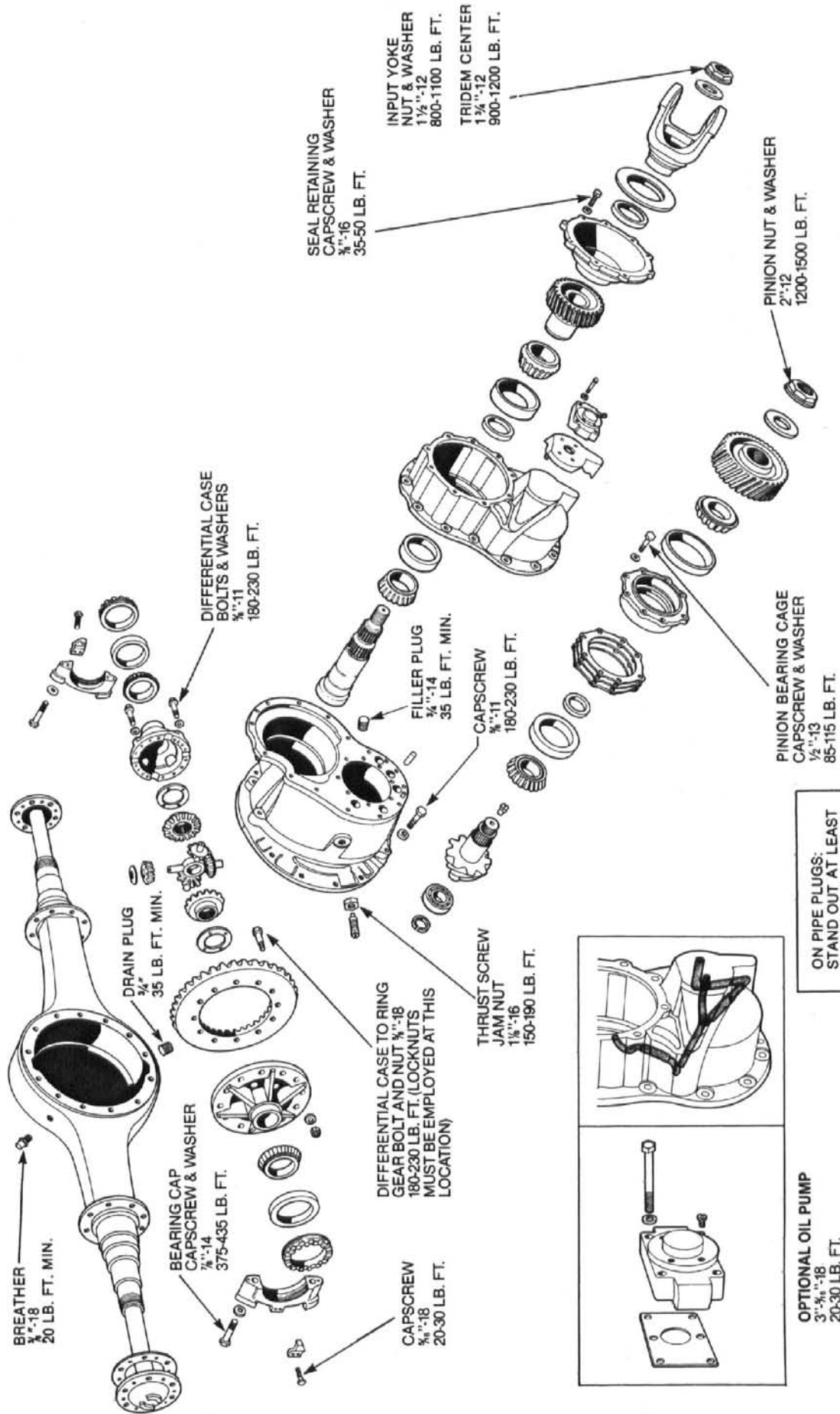
The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size (measure new tires to be sure they will be correctly matched).

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire air pressure, within the tire manufacturer's recommended range, so the lubricant temperature of both axles is within 30°F of each other and not in excess of 200°F. This will usually result in uniform tire loading and good tire life.

Follow the same procedure (Items #1 through #7) for matching tires on a Tridem Unit. Arrange the tires in order of size. The two largest and two smallest go on one axle, the next two largest and smallest on the second axle, and the remaining four on the third axle.



# FASTENER TORQUE VALUES







## **Rockwell International**

**Automotive Operations**  
Communications  
2135 West Maple Road  
Troy, Michigan 48084 U.S.A.