

MC-9 MAINTENANCE MANUAL

SECTION 2

REAR AXLES

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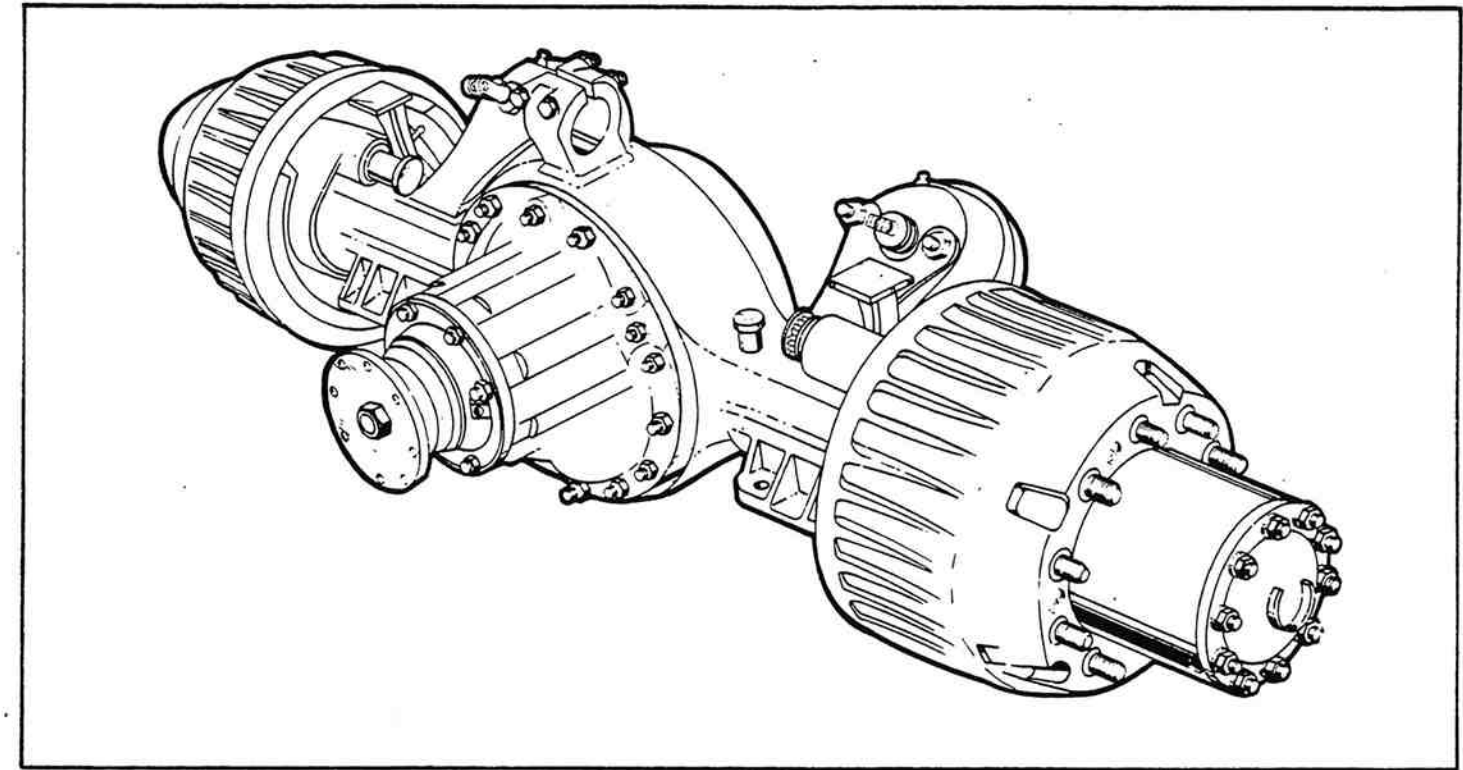


Figure 2-1. Drive Axle

REAR AXLES

DRIVE AXLE

The drive axle (figure 2-1) is a Rockwell Standard full floating type with pressed steel housing, fitted with replaceable pressed in steel sleeves. A magnetic drain plug is installed in the bottom of the housing.

The single reduction final drive employs a heavy duty hypoid drive pinion and ring gear. The differential and gear assembly is mounted on tapered roller bearings and lubricated by the differential oil.

The straddle-mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust, and a third bearing behind the pinion teeth to carry the radial load.

The standard drive axle ratio on all of the coach models is 3.73:1. Optional ratios which may be present are 3.33:1 and 4.10:1.

LUBRICATION

Lubrication recommendations will be found in Section 10 of

this manual.

During initial stages of normal operation, tiny metal particles are freed from mating surfaces of moving parts. These metal particles are carried by the lubricant through the assembly and act as lapping compound which accelerates wear of all parts.

To ensure maximum life of the differential and prevent premature failure, the original "factory fill" lubricant should be drained. This also prevents lubricant contamination caused by differences in the "factory fill" and lubricant used by the operator when topping up.

CAUTION: Change break-in oil after 1,000 miles (1,600 km) but no later than 3,000 miles (4,800 km). Drain the unit while still warm from operation.

See figure 2-2 for fill and drain plugs. Magnetic drain plugs perform the vital function of trapping small metallic particles that circulate in the lubricant, through the gears and bearings. They prevent 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 pick-up capacity of 2 pounds of low carbon steel in plate or flat bar form.

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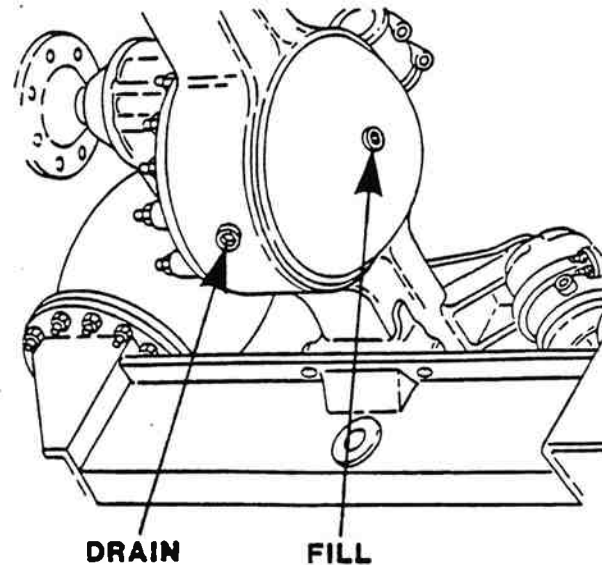


Figure 2-2. Drive Axle Housing.

Clean all magnetic drain plugs prior to reinstallation.

1. Fill axle housing to the correct level with specified lubricant with the vehicles on level ground. Use general purpose gear lubricant SAE 90 above 0°F. (-18°C.) or SAE 140 below 0°F. (-18°C.).

2. Lubricate universal joint.

3. 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.

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

OIL CHANGE INTERVALS

Gear oil should be changed every 25,000-30,000 miles (40,000-48,000 km) on units run over 60,000 miles (96,000 km) annually.

For units run less than 60,000 miles, the oil should be changed twice yearly (spring and fall) regardless of mileage.

The Rockwell axle drive unit employs the gravity feed (splash) system of distributing lubricant throughout the assembly. As the vehicle is initially driven in service, a short period of time is required for the lubricant to reach all areas of the drive units.

MAINTENANCE

Careful adherence to maintenance and lubrication procedures will go a long way toward successful operation.

The most common causes of drive axle carrier failures are spinout, shock, fatigue and poor lubrication.

Spinout is defined as excessive differential action. On a single rear axle, main differential spinout occurs when one wheel remains stationary while the other wheel is spinning. The

relatively high speed differences between the mating parts generate heat, and the rate of heat generation increases with the speed differences. When the heat becomes excessive it can cause galling of the journals of the cross and the mating differential pinion bores. In extreme cases of spinout, enough heat may be generated to weld the differential pinion to the cross and cause a catastrophic failure.

Shock is another common cause of carrier failure. It results from a rapidly applied load or force that is severe enough to exceed the strength of the carrier component and cause it to crack or fail instantly.

There are a number of operating conditions which can result in a shock failure:

- Hitting dry pavement with a spinning wheel.
- Missing a shift.
- "Popping" the clutch.
- Reverse interlock failure.

If the failed part separates into two or more pieces, the operator will usually realize the fact immediately. But if the part is only cracked, the operator may not be aware of the damage until sometime later. Depending on the severity of the crack in the part, the final failure may not occur until many miles later. The crack will be a point of origin for a fatigue failure, and can progress until the part fails. Thus the failure could happen while the vehicle is being operated under normal conditions.

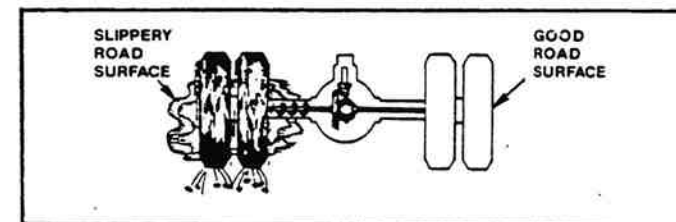


Figure 2-3. Drive Axle Spinout.

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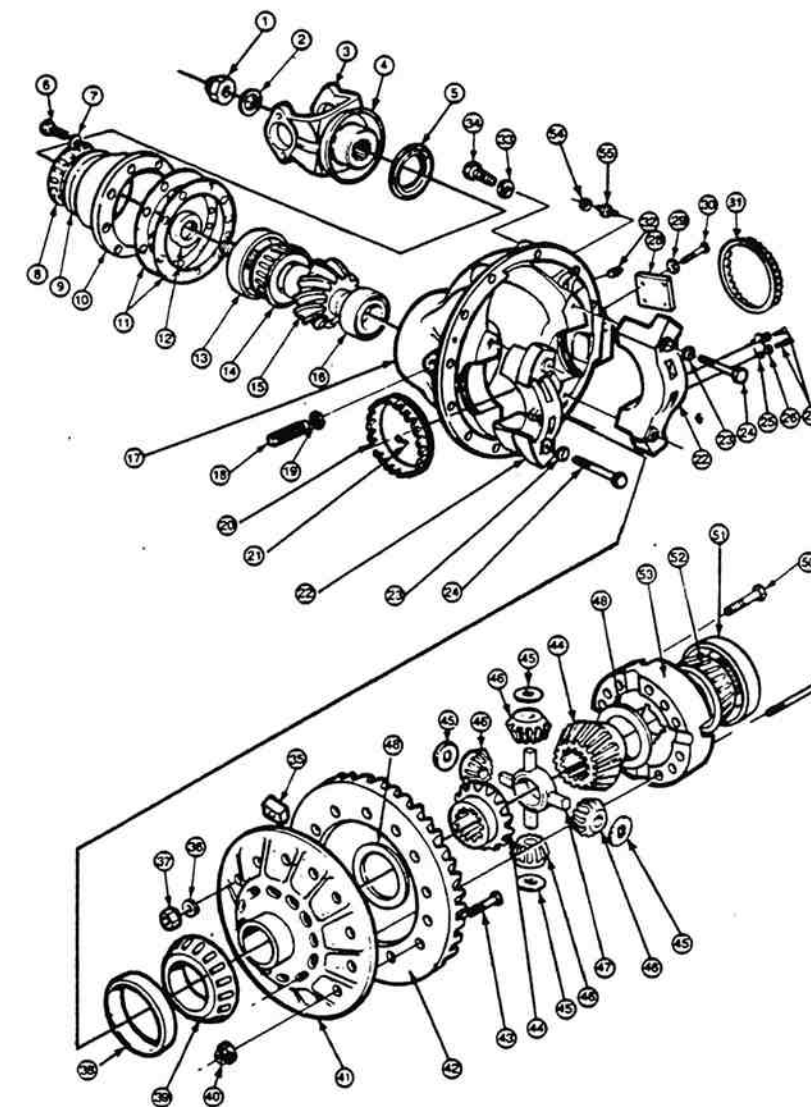


Figure 2-4. Single Reduction Differential Carrier.

- Nut - Drive Pinion
- Washer - Drive Pinion
- Input Yokr or Flange
- Deflector
- Oil Seal
- Capscrew - Bearing Cage
- Washer
- Bearing Cone - Pinion Outer
- Bearing Cup - Pinion Outer
- Bearing Cage - Drive Pinion
- Shims
- Spacer - Pinion Bearing
- Bearing Cup - Pinion Inner
- Bearing Cone - Pinion Inner
- Drive Pinion
- Spigot Bearing
- Carrier
- Thrust Screw
- Jam Nut - Thrust Screw
- Adjusting Ring - LH
- Cotter or Pin
- Caps - Differential Bearing
- Washers
- Capscrews - Differential Bearing Cap
- Lock Plate - Adjusting Ring
- Washers - Lock Plate
- Capscrews - Lock Plate
- Cover - Air Cylinder Opening
- Washers - Cover
- Capscrews - Cover
- Adjusting Ring - RH
- Plug - Oil Fill Hole (Carrier)
- Washer - Capscrew Plug
- Capscrew Plug - Sensor Hole
- Thrust Block
- Washers - Differential Case
- Nuts - Differential Case
- Bearing Cup - Differential LH
- Bearing Cone - Differential LH
- Nuts - Ring Gear & Case Half
- Case Half - Flange
- Ring Gear
- Bolts or Rivets - Ring Gear & Case Half
- Side Gears - Differential
- Thrust Washers - Differential Pinion
- Pinions - Differential
- Spider - Differential
- Thrust Washers - Differential Side Gear
- Capscrews - Differential Case
- Bolts - Differential Case
- Bearing Cup - Differential RH
- Bearing Cone - Differential RH
- Case Half - Plain

Fatigue is another type of failure in axle carriers, one that results from repeated loadings of a component. A single application of these loads or forces is not great enough to damage the part but repeated applications gradually weaken it to the point of failure. Fatigue failures that occur in drive axle carriers have two sources:

- Exceeding the GVW/GCW rating of the carrier
- Shock loads

When the vehicle is operated at a weight in excess of what the carrier was designed for, the life of the components is reduced. The rated GVW/GCW of a carrier changes with the road grade and surface. As the grade increases, so does the effort (torque) required to move a vehicle loaded to a given GVW/GCW. Again, as the road surface changes from hard to soft, rolling resistance increases and more torque is needed. Thus, a vehicle loaded to a given GVW/GCW will have a reduced carrier life when operated in hilly or mountainous

terrain as opposed to being operated on the level. The same is true for operation on soft or unimproved surfaces as compared to hard surface roads.

The fourth common cause of axle carrier failures originates with the lubricant, or with lubricant change practices. The lubricant which protects the axle components has three key functions:

- To reduce friction between parts.
- To carry heat away from parts.
- To carry dirt and wear particles away from parts.

When lubricant failure occurs, it is generally the result of improper maintenance and has its roots in one of three basic problem areas:

- Low lubricant level.
- Improper type of lubricant or lubricant with depleted additives.
- Contaminated lubricant.

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DRIVE AXLE REMOVAL

Removal of the entire axle is recommended to facilitate repair work on the carrier. Axle removal and replacement instructions follow.

Block front wheels of the coach to prevent rolling. Raise the rear end of the vehicle with jacks until the bottom of the body is approximately 18" (457.2 mm) from the floor. Block the body in this position as outlined in Section 3 under Coach Jacking Points.

CAUTION: Do not allow the rear axle assembly to hang on the air springs. Damage to the air springs may result.

1. Exhaust air pressure from the suspension system air tank by opening the drain cock on the bottom of air filter.
2. Disconnect the sway bar links.
3. Disconnect the brake chamber hoses.
4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier (figure 2-5).

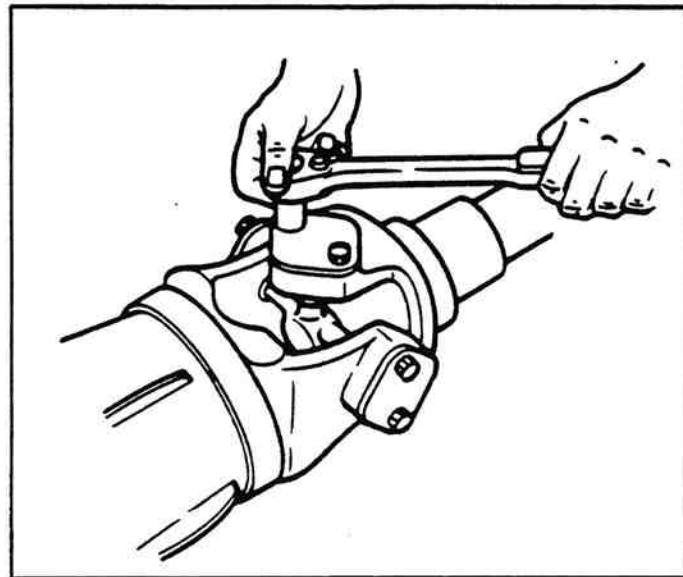


Figure 2-5. Disconnecting Universal Joint.

5. Disconnect both height control valve links from brackets, and pull down on each height control valve arm to exhaust air from the air springs.

6. Disconnect both ends of all four radius rods as outlined in this section under Radius Rods.

7. Remove shock absorbers.
8. Disconnect air springs from the suspension supports.
9. Lower the axle and carefully remove from under the coach body.

Replacement is the reverse of removal.

SINGLE REDUCTION DIFFERENTIAL CARRIER

DESCRIPTION

The single reduction differential carrier (Figure 2-6) is front mounted into the axle housing. This carrier has a hypoid drive pinion and ring gear set and bevel gears in the differential assembly.

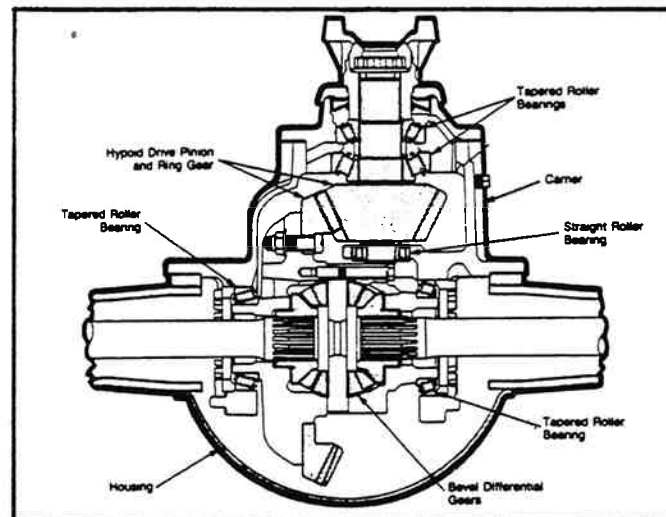


Figure 2-6. Single Reduction Differential Carrier.

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.

REMOVAL OF CARRIER ASSEMBLY FROM AXLE HOUSING

1. After the axle has been removed from the coach, support it securely under the axle shaft housings. Support the axle at a height sufficient to allow a roller jack to pass under the center (banjo) of the axle.

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2. Remove the plug from bottom of axle housing and drain lubricant from the assembly.
3. Remove the stud nuts and washers from the flanges of both axle shafts.
4. Loosen the tapered dowels in the flanges of both axle shafts as follows.

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 1½-inch-diameter brass drift against the center of the axle shaft, inside the round driving lugs (Figure 2-7).

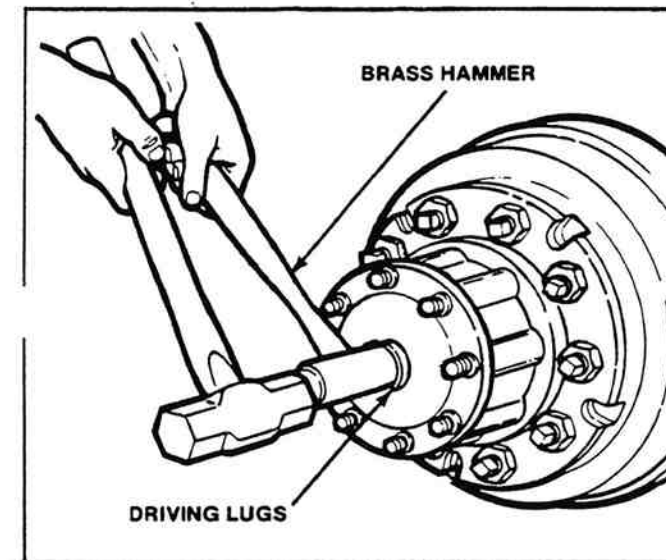


Figure 2-7. Loosening Shaft And Dowels.

NOTE: A 1½-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 oil seals.

5. Remove the tapered dowels and both axle shafts from the axle assembly.
6. Place a hydraulic roller jack under the differential carrier to support the assembly (Figure 2-8).

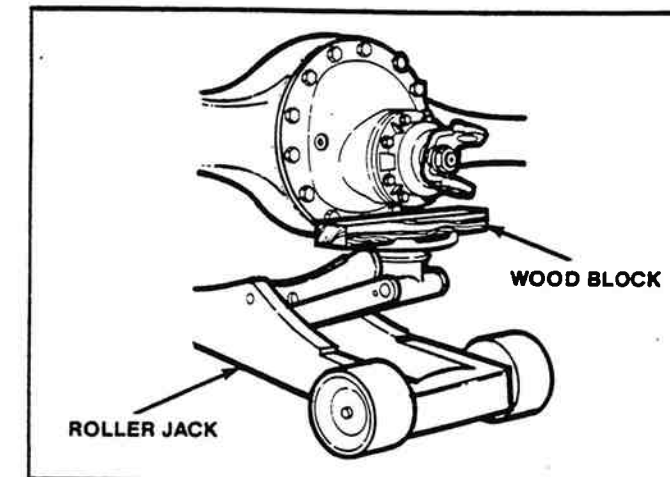


Figure 2-8. Supporting Carrier Assembly.

7. Remove all but the top two carrier-to-housing capscrews or stud nuts and washers.

8. Loosen the top two carrier-to-housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.

9. 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.

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

11. Remove and discard the carrier-to-housing gasket.
12. Lift the differential carrier by the input yoke or flange and put the assembly in a repair stand. Figure 2-9 shows the carrier in a stand. Such a stand may be purchased; see tools at end of this section. Do not lift the carrier assembly by hand; use a lifting tool.

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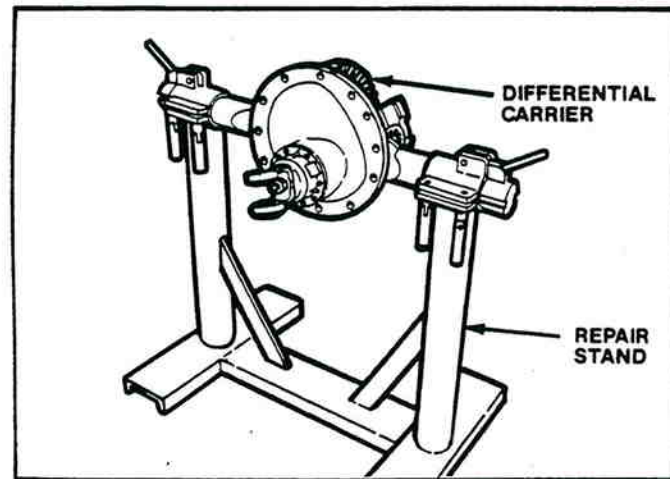


Figure 2-9. Carrier Mounted In Repair Stand.

REMOVAL OF DIFFERENTIAL AND RING GEAR

NOTE: Before starting 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. Using a dial indicator as shown in Figure 2-10, measure the backlash of the gear set and make a note of it. This measurement will be needed when the set is reinstalled.

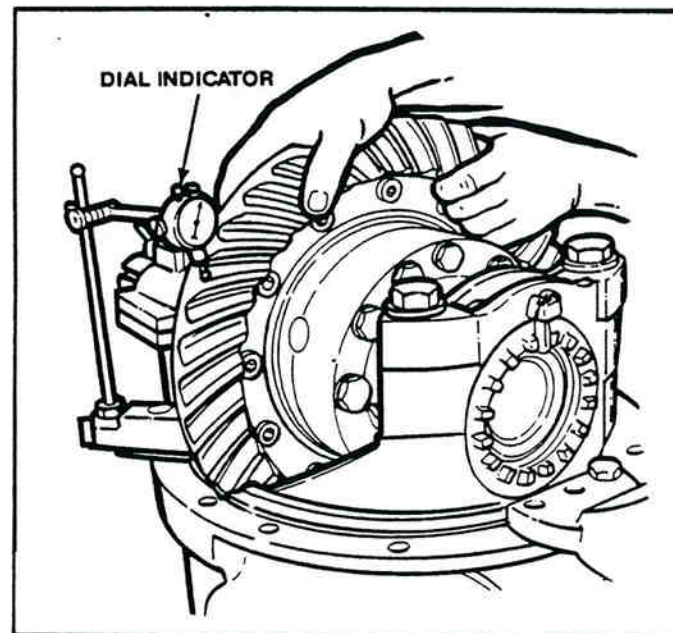


Figure 2-10. Measuring Backlash.

1. Loosen the jam nut on the thrust screw.

2. Remove the thrust screw and jam nut from the differential carrier (Figure 2-11).

3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.

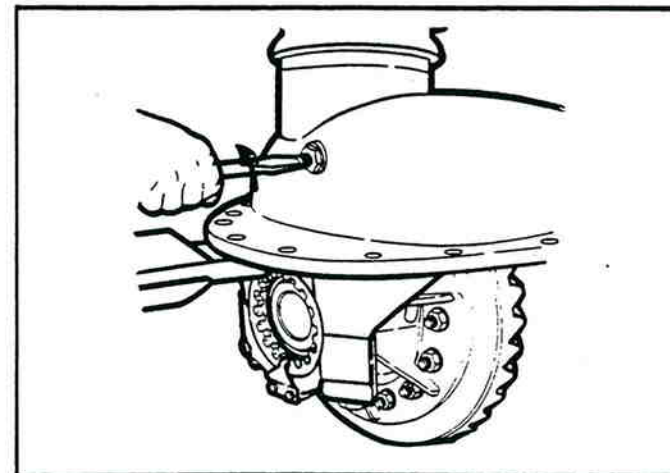


Figure 2-11. Removing Thrust Screw And Jam Nut.

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 2-12).

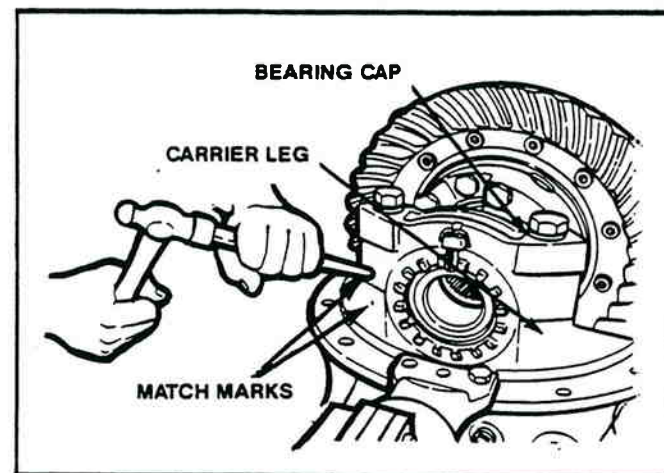


Figure 2-12. Making Match Marks.

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 2-13).

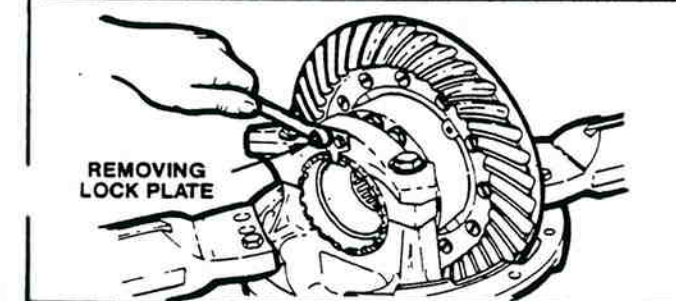
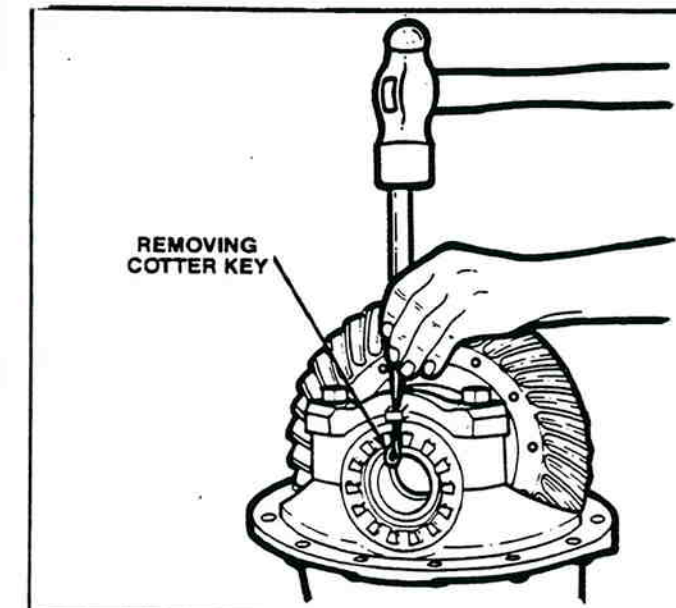


Figure 2-13. Cotter Key/Lock Plate Removal.

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 2-14).

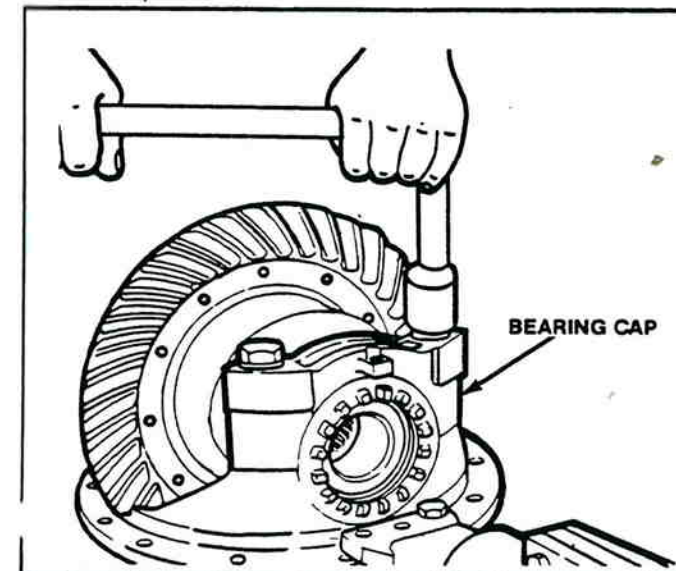


Figure 2-14. Removal of Bearing Cap Capscrews.

7. Remove the bearing caps and bearing adjusting rings from the carrier (Figure 2-15).

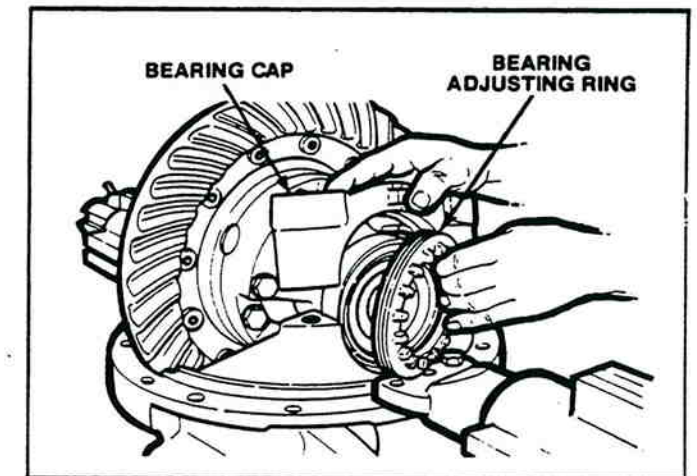


Figure 2-15. Removing Bearing Cap And Adjusting Ring.

8. Safely lift the main differential and ring gear assembly from the carrier. Put the assembly on a work bench (Figure 2-16).

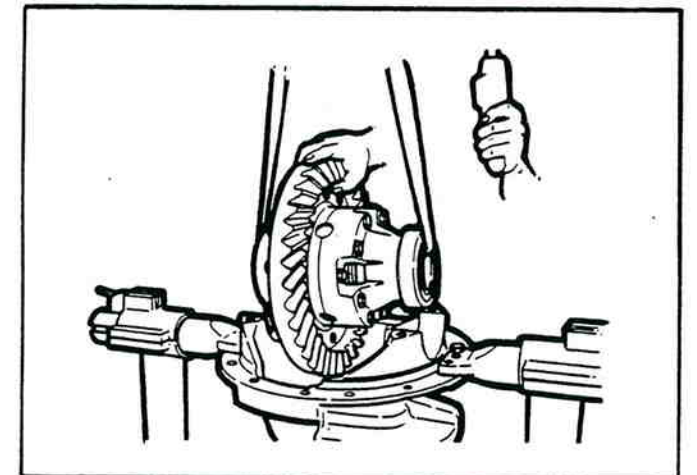


Figure 2-16. Lifting Differential And Ring Gear From Carrier.

DISASSEMBLING 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 2-17).

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

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

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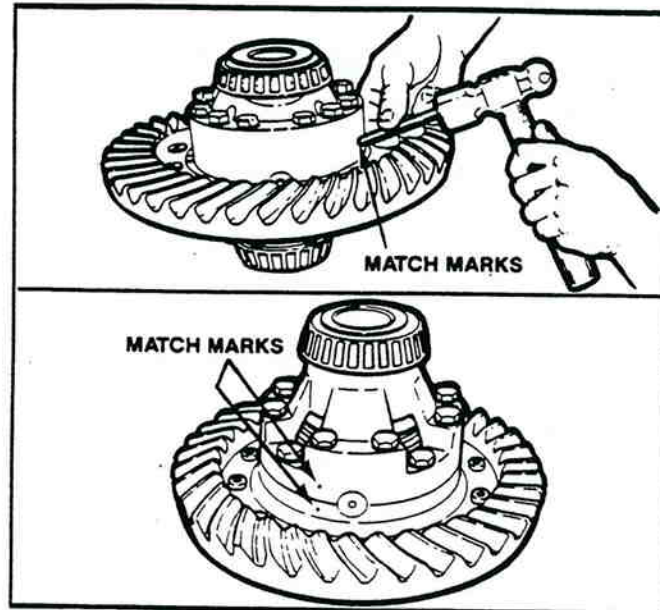


Figure 2-17. Putting Match Marks On Case Halves.

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 2-18).

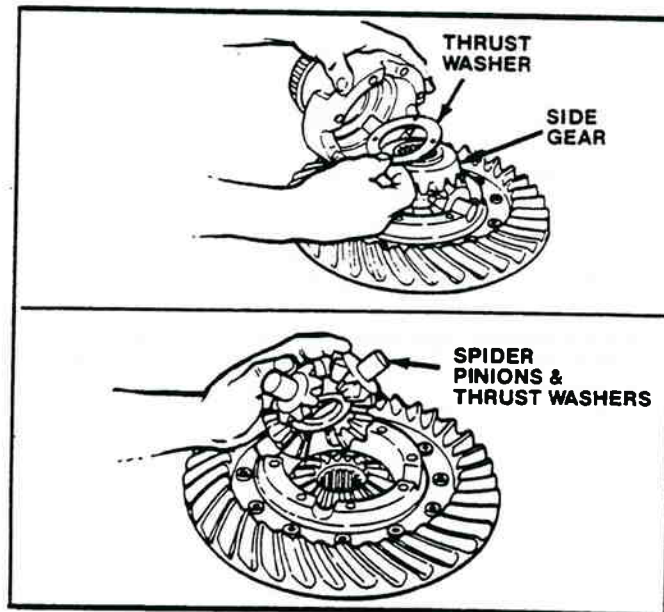


Figure 2-18. Disassembling Differential.

5. If the ring gear needs to be replaced, remove the bolts, nuts and washers that hold the gear to the flange case half; 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 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 to an inch smaller than the body diameter of the rivets.

- 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.

6. 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 2-19).

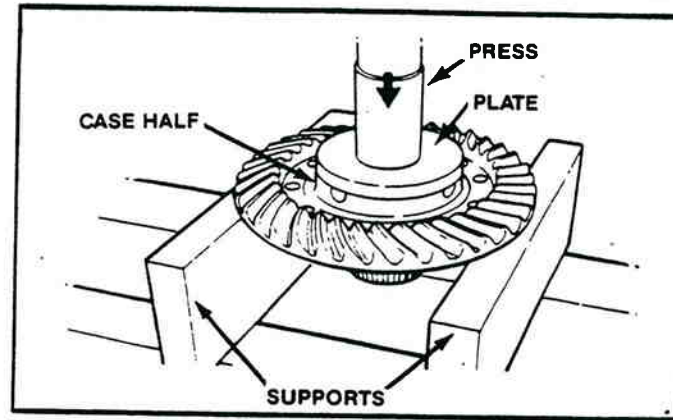


Figure 2-19. Pressing Case Half From Gear.

7. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press (Figure 2-20).

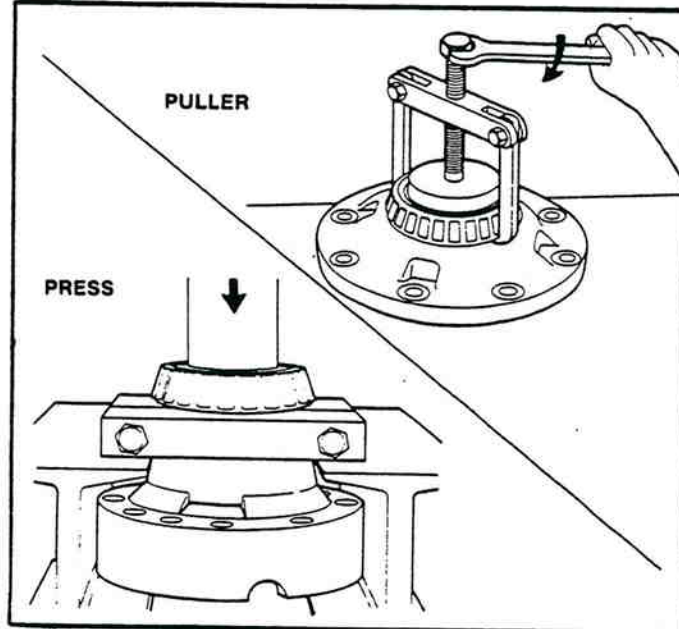


Figure 2-20. Removing Bearing From Case Half.

REMOVING 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. Remove the nut and washer from the drive pinion (Figure 2-21).

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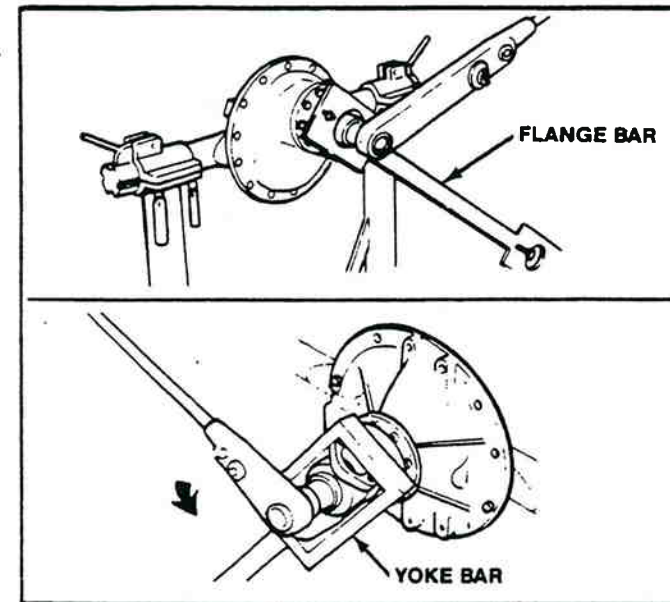


Figure 2-21. Removing Drive Pinion Nut.

2. Remove the yoke or flange bar.
3. 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 2-22).

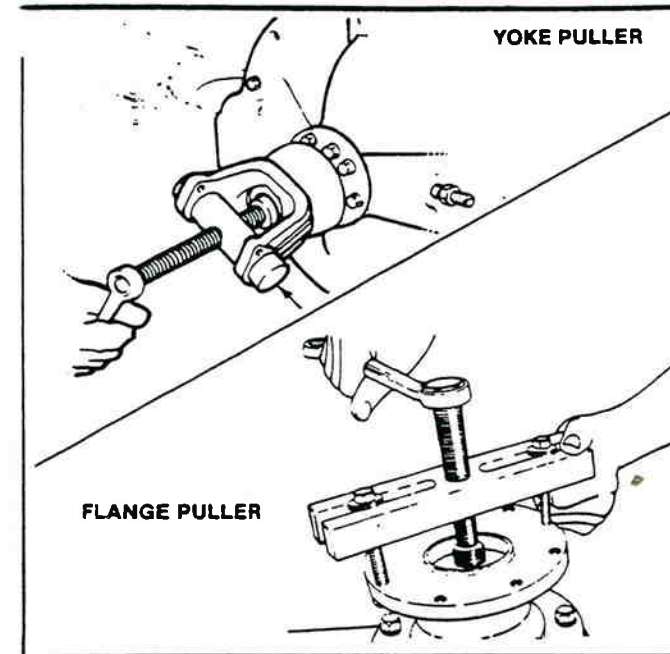


Figure 2-22. Removing Yoke or Flange.

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.

4. Remove the capscrews and washers that hold the bearing cage in the carrier (Figure 2-23).

5. 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.

6. The pinion seal is mounted in the outer bore of the bearing cage. Remove the seal after the drive pinion is removed from the bearing cage.

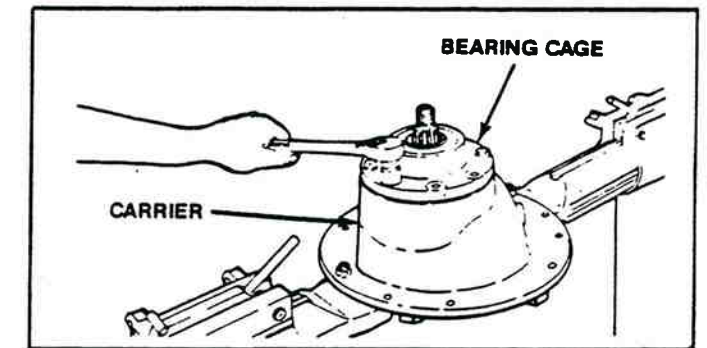


Figure 2-23. Removing Bearing Cage Capscrews.

7. 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 2-24).

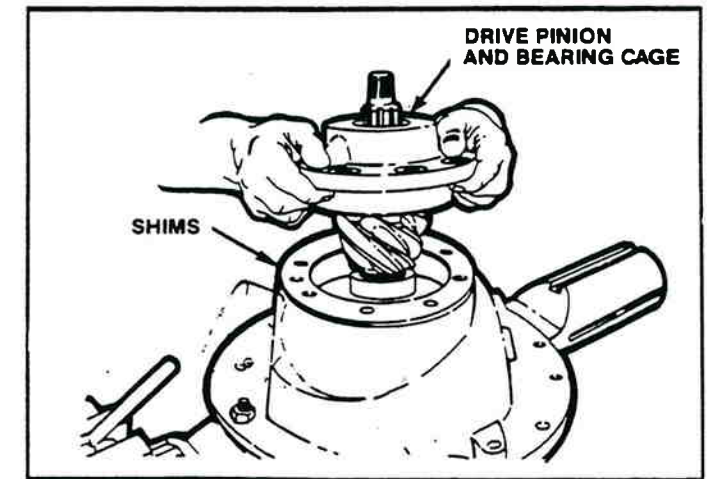


Figure 2-24. Removing Drive Pinion And Bearing Cage.

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 areas 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 2-25).

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.

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

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9. 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.

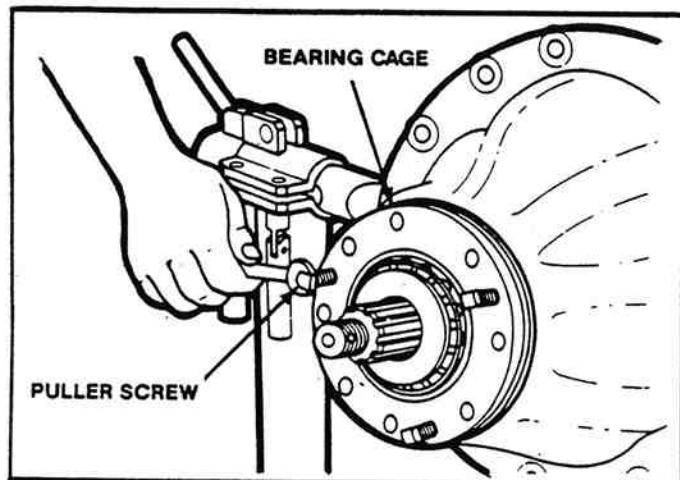


Figure 2-25. Removing Bearing Cage Using Puller Screws.

DISASSEMBLING THE DRIVE PINION AND BEARING CAGE

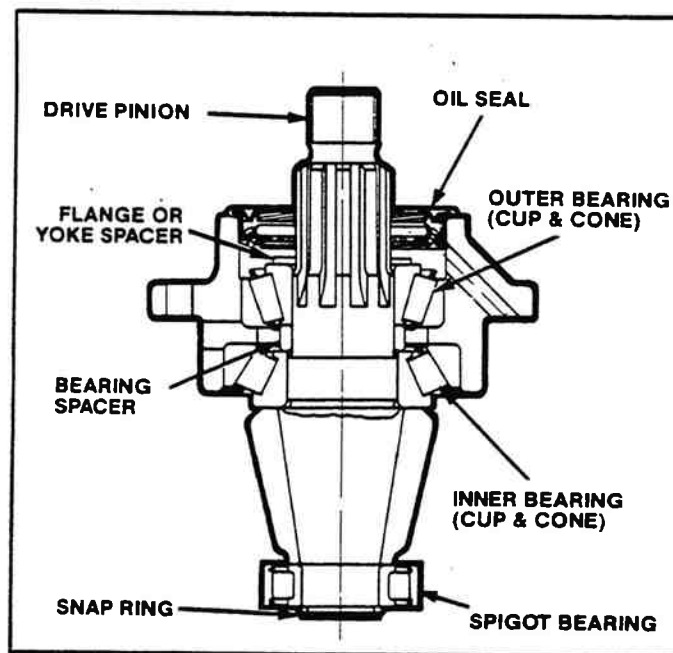


Figure 2-26. Pinion And Bearing Cage Assembly.

1. Put the drive pinion and bearing cage (figure 2-26) in a press. The pinion shaft must be toward the top of the assembly. Support the bearing cage under the flange area with metal or wood blocks. Press the drive pinion through the bearing cage (Figure 2-27).

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

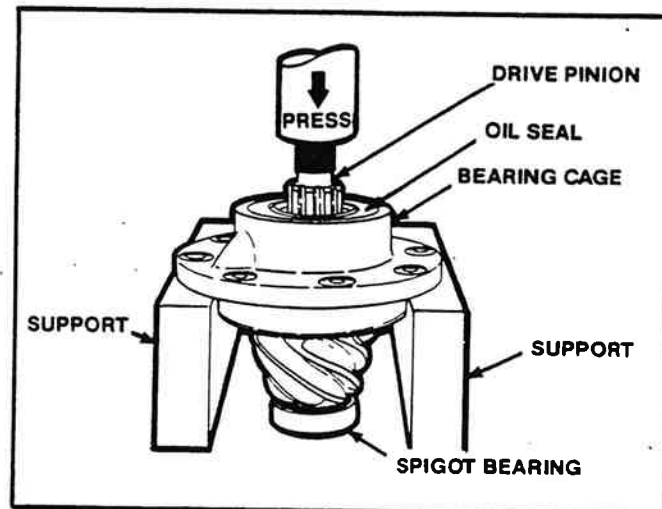


Figure 2-27. Removing Drive Pinion From Bearing Cage.

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

3. If the pinion seal is mounted directly in the outer bore of the bearing cage, remove the seal at this time. Use a screwdriver or small pry bar for removal. After the seal is removed, lift the outer bearing cone from the cage (Figure 2-28).

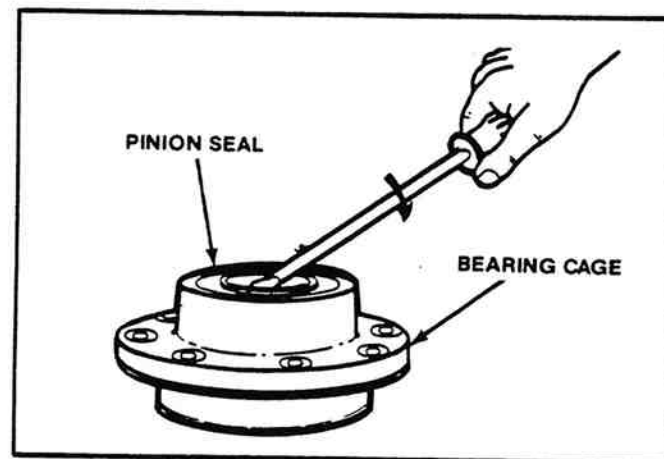


Figure 2-28. Removing Pinion Seal.

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.

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

When a press is used, support the bearing cage under the flange area with metal or wood blocks (Figure 2-29).

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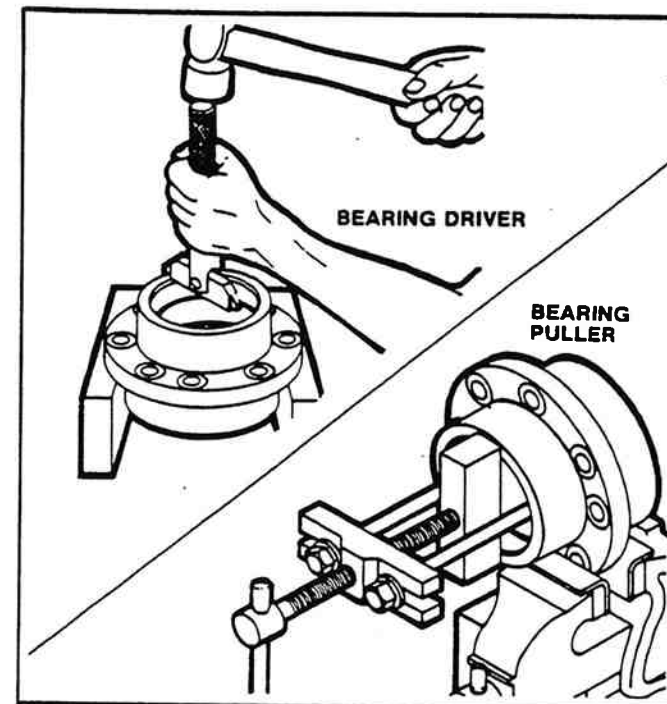


Figure 2-29. Removing Bearing Cups.

5. 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 2-30).

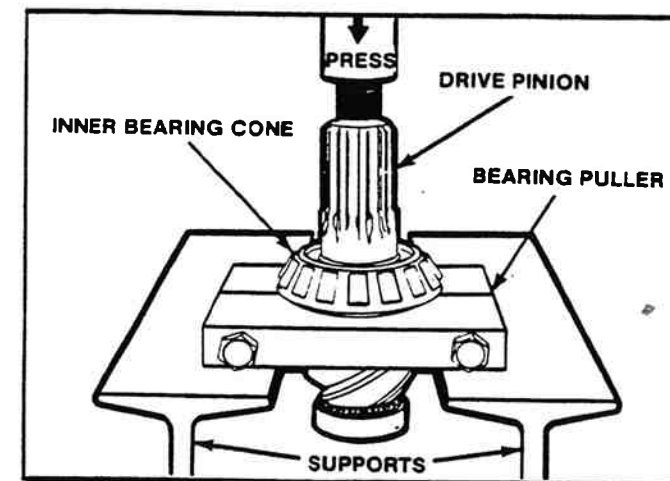


Figure 2-30. Removing Inner Bearing Cone.

6. 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.

Remove the snap ring from the end of drive pinion with snap ring pliers that expand (Figure 2-31).

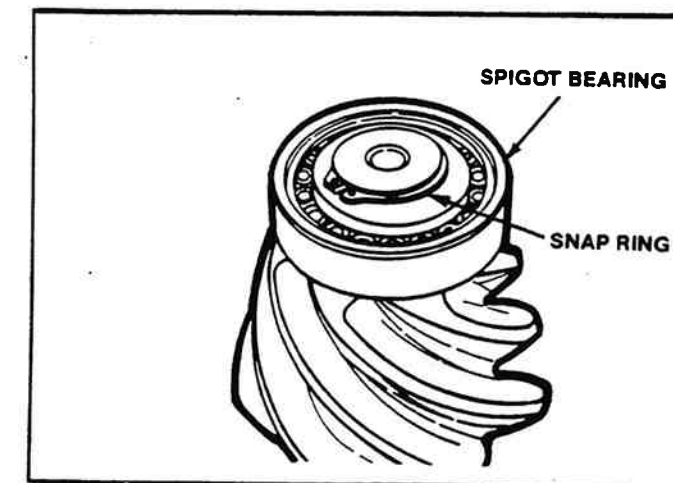


Figure 2-31. Snap Ring On Drive Pinion.

8. Remove the spigot bearing from the drive pinion with a bearing puller (Figure 3-32).

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.

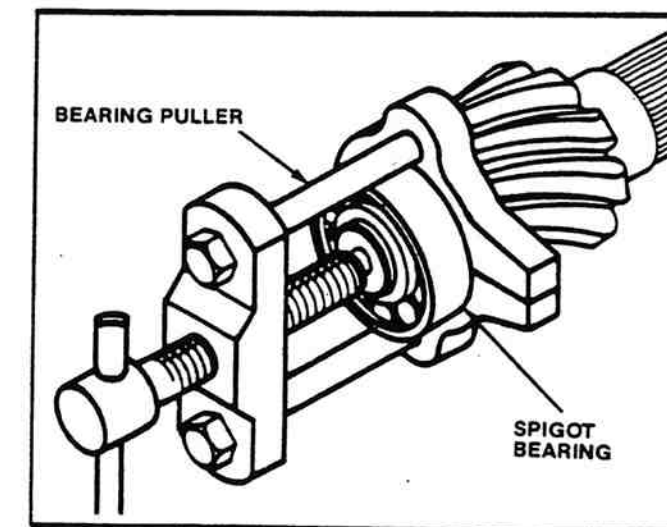


Figure 2-32. Removing Spigot Bearing From Drive Pinion.

GENERAL PROCEDURES BEFORE REASSEMBLY

CLEANING OF PARTS

It is important that all parts being reassembled are clean. Foreign material in the assembly will cause abrasion of parts and shorten their life.

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To 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. 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, stream or alkaline solutions.

To 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. Follow the alkaline product manufacturer's instructions for safe use to prevent injury.
4. Parts must be washed with water until the alkaline solution is removed.

To 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.

To 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.

To 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.

INSPECTING OF 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.
 - a. The center of large diameter end of rollers worn level with or below the outer surface.
 - b. The radius at large diameter end of rollers worn to a sharp edge.
 - 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.

- d. Deep cracks or breaks in the cup, cone inner race or roller surfaces.
- e. Bright wear marks on the outer surface of the roller cage.
- f. Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers.
- g. Damage on the cup and cone inner race surfaces that touch the rollers.

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 2-33).

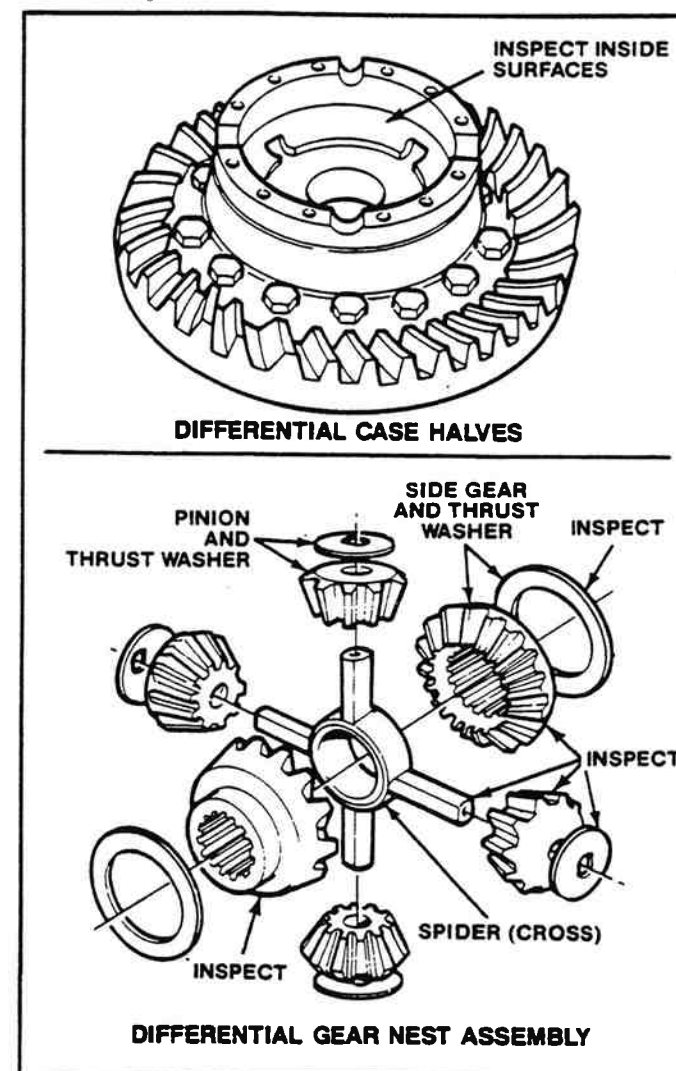


Figure 2-33. Inspection Points.

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- a. Inside surfaces of both case halves.
- b. Both surfaces of all thrust washers.
- c. The four trunnion ends of the spider (cross).
- d. Teeth and splines of both differential side gears.
- e. Teeth and bore of all differential pinions.

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

4. Inspect Axle Shafts: Inspect axle shafts for wear and cracks at the flange, shaft and splines. Replace axle shaft if required.

REPAIRING AND REPLACING FASTENERS

All threads of the fasteners and holes in the assembly must be without damage and clean so that accurate adjustments and correct torque values can be applied to the fasteners and parts.

Use the following procedures to ensure that all fasteners and threaded holes are in good condition.

1. Replace any fastener if the corners of the head are worn or distorted.
2. Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.
3. Replace any damaged washer.
4. When installing new fasteners of the "Dri-Loc" type, do not apply adhesives or sealants to the new fastener or to the hole. The "Dri-Loc" adhesive will not function correctly if this is done.
5. When the old fasteners are being reused:
 - a. 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.
 - b. Apply four or five drops of Rockwell Liquid Adhesive or Loctite 277 to threaded holes only. Make sure the adhesive is on the threads. CAUTION: Do not apply adhesive to the fastener threads. Air pressure in the hole will push the adhesive out as the fastener is installed.

INSTALLING FASTENERS

When installing the fasteners, torque to the required value for that size fastener. See Torque Value Chart later in this section. Always use a torque wrench (Figure 2-34).

CHECKING TORQUE OF UNREMOVED FASTENERS

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 later in this section. The fastener must not rotate (Figure 2-34).
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.

MOVAL OF "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:

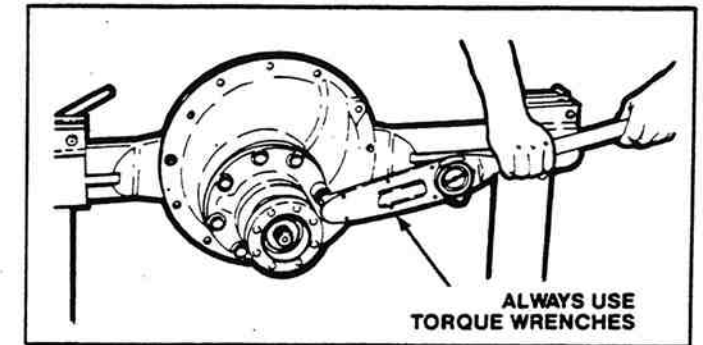


Figure 2-34. Reinstalling Fasteners.

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.

REPAIRING PARTS

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.

REPAIRING AXLE HOUSING

Certain repairs may be made to the axle housing, by welding — see below. However, attempted repairs of the housing by bending or straightening will cause poor or unsafe operation of the axle and early failure can result.

NOTE: Refer to the welding caution in the introductory pages of this manual before starting any welding operation.

Following is the vendor-allowed welding procedure which can be done on the drive axle housing. The vendor, Rockwell International, will permit repairing drive axle housing assemblies by welding ONLY in the following areas:

1. Cover welds.
2. Snorkel welds.
3. 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.

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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.

WELDING PROCEDURE

1. Drain the lubricant from the axle assembly.
2. Remove the axle shafts and differential carrier from the axle housing.
3. Clear the damaged area inside and outside the housing. Cleaning solvent can be used.

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

4. Grind the damaged weld to the base metal.
5. Warm the complete axle housing to a temperature of 70°F-80°F (21°C-27°C) or higher.
6. Before you start welding, heat the damaged area to be repaired to approximately 300°F (149°C).
7. 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.

8. 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.

- a. The snorkel weld must be a .375 inch (9.5 mm) fillet.
- b. The opening in cover welds must be filled level with the old weld.
- c. 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.
- d. Clean the new weld area. Carefully remove all the rough weld material.
- e. Install the differential carrier and axle shafts.

- f. Fill the axle assembly with the correct amount of lubricant. See Section 10 (Lubrication) of this manual.

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

REPLACING GASKET AND SEALS

At the time of axle or carrier repair, all gaskets, oil seals or grease seals should be replaced.

Silicone gasket material is used at mating surfaces of the carrier housing and the axle housing. When carrier assembly is being re-installed in the axle:

1. Remove all old gasket material from both surfaces (Figure 2-35).
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 2-35).

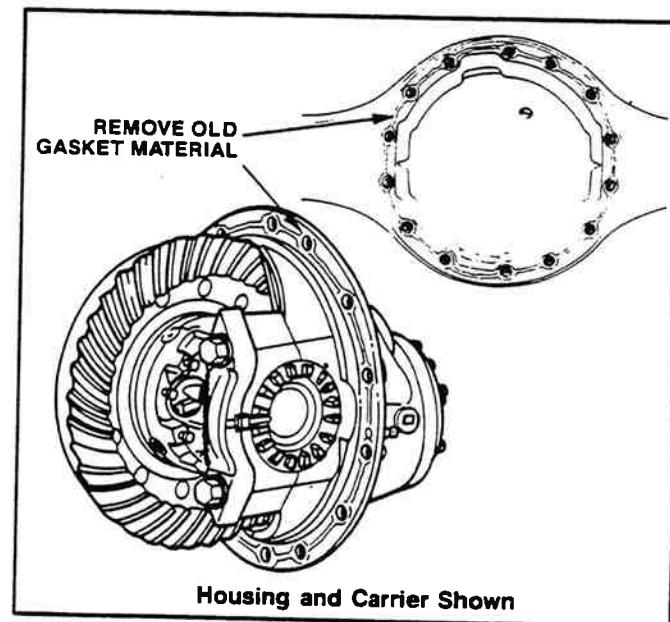


Figure 2-35. Replacing Silicone Gasket.

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. See Torque Chart later in this section.
6. Wait 20 minutes before the assembly is filled with lubricant.

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NOTE: The following silicone gasket products can be used.

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

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.

APPLICATION OF ADHESIVE IN BEARING BORES FOR THE DIFFERENTIAL

A special adhesive (Rockwell part number 2297-T-4108) is used in the bearing bores for the differential. Apply as follows:

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 2-36).

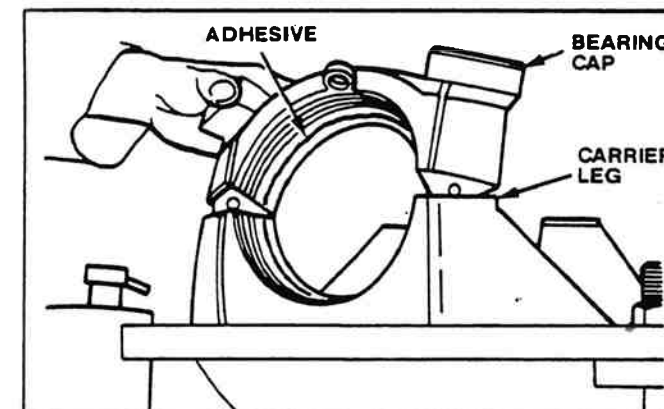


Figure 2-36. Applying Adhesive To Bearing Bore.

NOTE: The Rockwell adhesive 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 given later in this section.

5. Adjust preload of the differential bearings, backlash and tooth contact patterns of the gear set as required using the normal procedures given later in this section.

CHECKING FOR MATCHED RING GEAR AND DRIVE PINION SET

Before a new gear set is installed in the carrier, 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 2-37. The numbers in the figure correspond to the following item numbers.

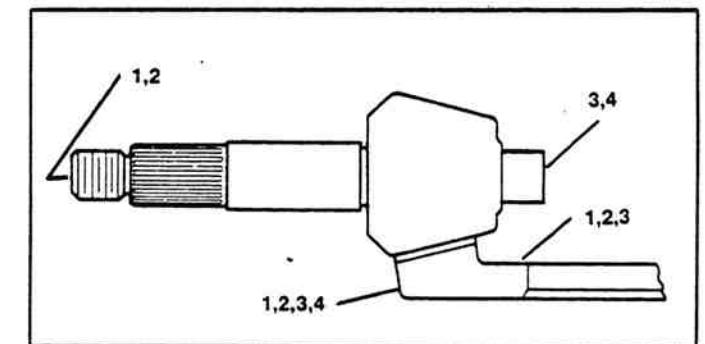


Figure 2-37. Location Of Gear Set Marks.

1. *Part Number*
 - a. Examples of gear set part numbers: Ring gear, 36786; drive pinion, 36787.
 - 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 adjusting the depth of the pinion in the carrier. See the procedure for adjusting the shim pack thickness under the pinion cage in reassembly procedure later in this section.

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- a. Examples of pinion cone variation numbers: PC+3, PC-5, +2, -1, +.01 mm or -.02 mm (Figure 2-38).
 b. Location on Gear Set End of pinion gear head or outer diameter of ring gear.

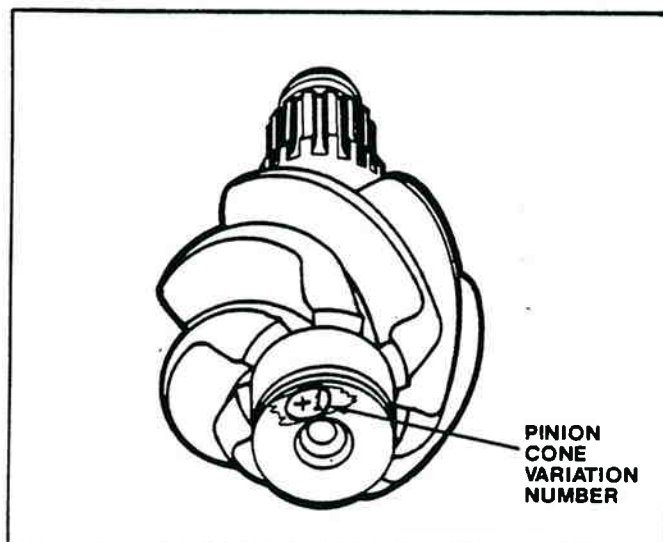


Figure 2-38. Location Of Pinion Cone Variation Number.

YOKE OR FLANGE INSTALLATION ON INTERFERENCE FIT SPLINES

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.

1. Apply axle lubricant on the yoke or flange seal.
2. Check all surfaces of the yoke or flange hub for damage. If necessary, polish the hub with an india stone, emery cloth or crocus cloth.
3. Install the pilot shaft on the input shaft of the assembly (Figure 2-39).

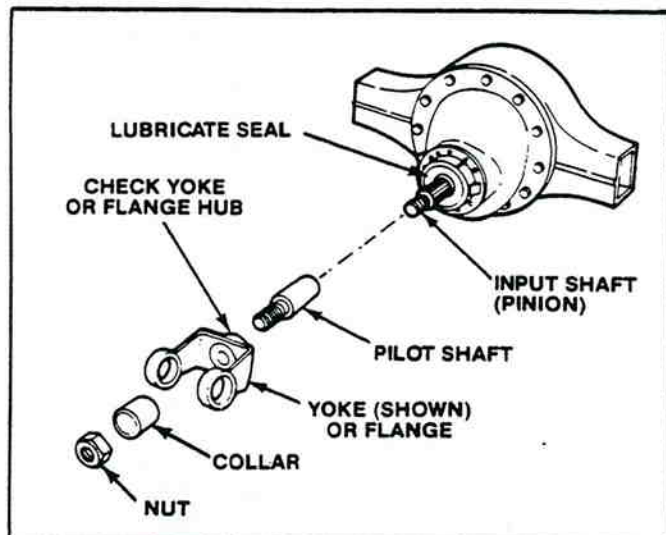


Figure 2-39. Installing Yoke Or Flange Using Pilot Tool.

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

CAUTION: Do not use the assembly yoke or flange 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 or flange nut on the shaft. Tighten the nut to minimum 800 ft. lbs. (1,085 Nm), maximum 1,100 ft. lbs. (1,492 Nm).

ASSEMBLING THE DRIVE PINION, BEARINGS AND BEARING CAGE

1. Put the bearing cage in a press (Figure 2-40).
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 2-40).

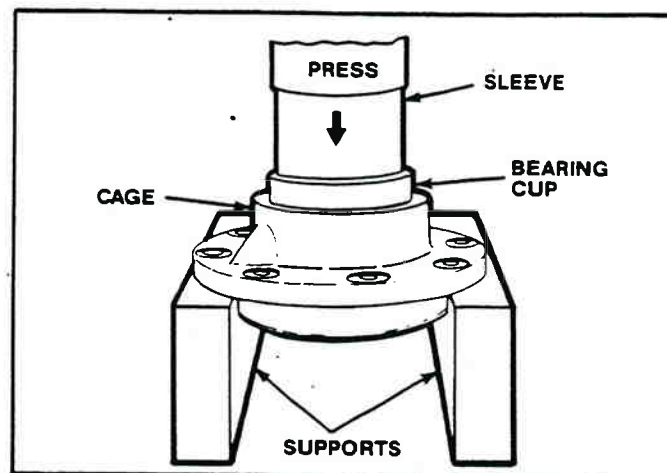


Figure 2-40. Pressing In Bearing Cup.

NOTE: Use the same procedure for both bearing cups.

4. Put the drive pinion in a press, gear head (teeth) toward the bottom (Figure 2-41).
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.

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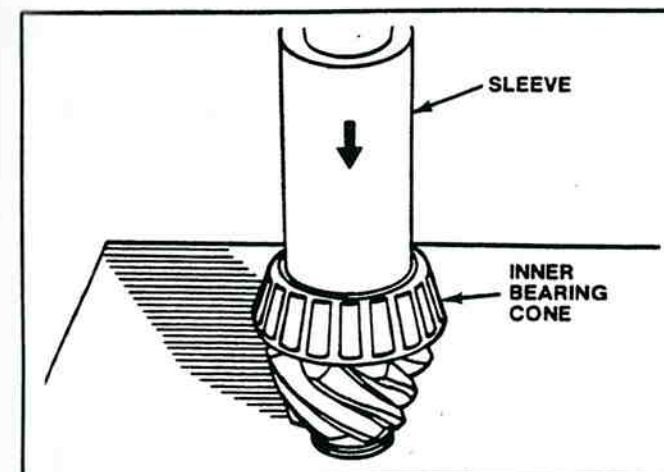


Figure 2-41. Pressing On Inner Bearing Cone.

INSTALLING SPIGOT BEARING ASSEMBLY

1. Put the drive pinion in a press, gear head (teeth) toward the top (Figure 2-42).
2. 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 2-42).

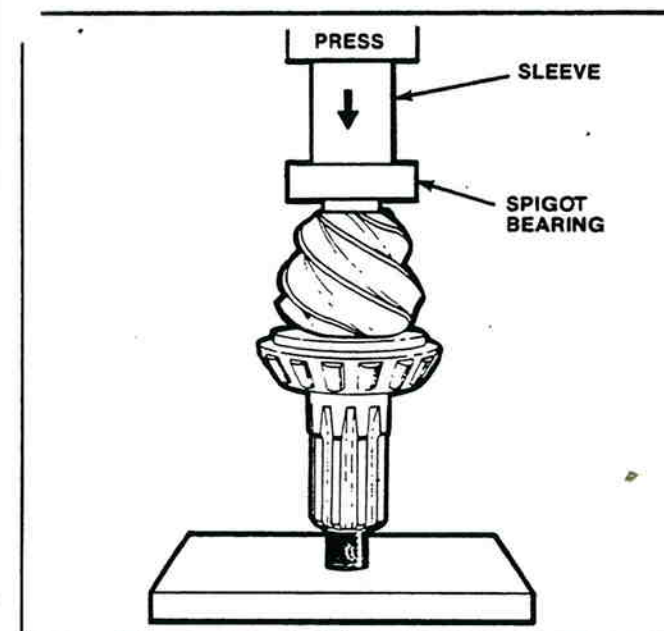


Figure 2-42. Pressing On Spigot Bearing.

3. Install the snap ring into groove in end of drive pinion with snap ring pliers (Figure 2-43).

ADJUSTING PRELOAD OF PINION BEARINGS

Specifications:

- New** pinion bearings - 5 to 45 lb.-in. (.56 to 5.08 Nm) torque.
Used pinion bearings in good condition - 10 to 30 lb.-in. (1.13 to 3.39 Nm) torque.

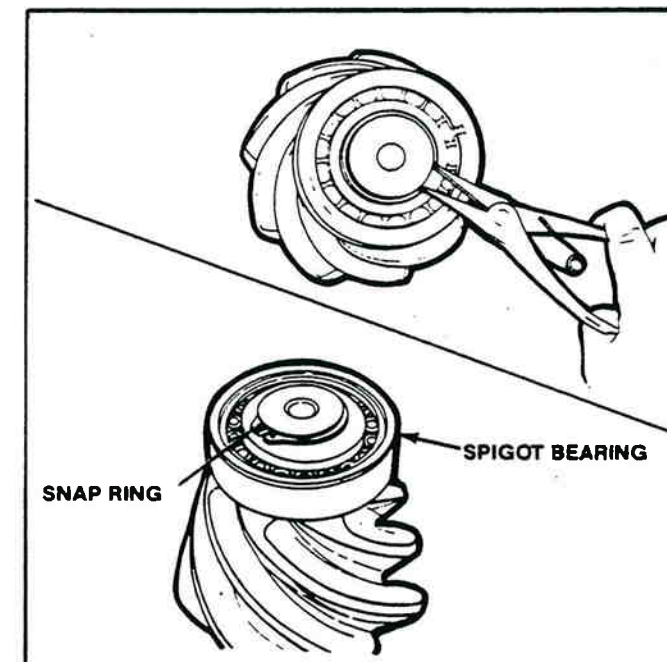


Figure 2-43. Installing Snap Ring.

Press Method

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

1. Put the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom.
2. Install a sleeve of the correct size against the inner race of the outer bearing (Figure 2-44).

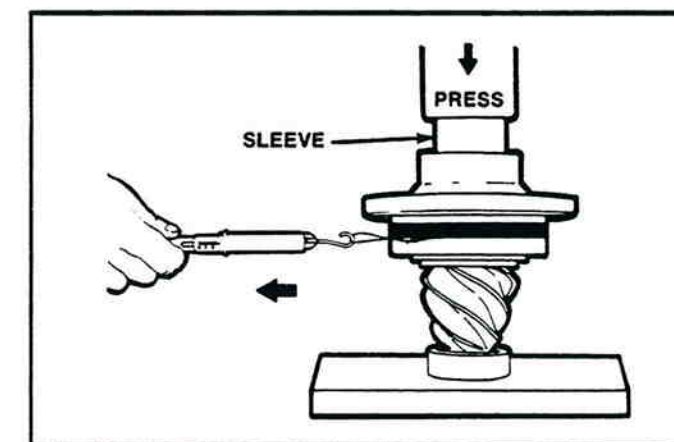


Figure 2-44. Checking Pinion Bearing Preload.

3. Apply and hold 54,000 lbs. (24,494 kg) pressure to the pinion bearings. As pressure is applied, rotate the bearing cage several times so that bearings make normal contact.
4. While pressure is held against the assembly, wind a cord around the bearing cage several times.

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- Attach a spring scale to the end of the cord.
- Pull the cord with scale on a horizontal line. As the bearing cage rotates, read the value indicated on scale. Make a note of reading (Figure 2-44).

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

- Measure the diameter of bearing cage where the cord was wound. Measure in inches or centimeters (Figure 2-45).

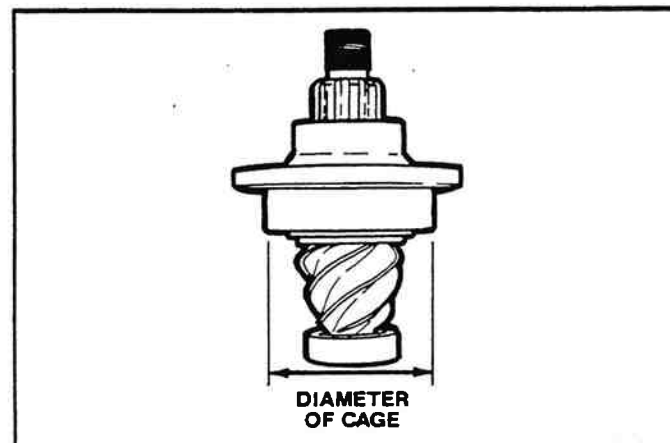


Figure 2-45. Measuring Diameter Of Cage.

- Divide the dimension in half to get the radius. Make a note of radius dimension.

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

Pounds pulled x Radius (inches) +
lb.-in. preload x .113 + Nm preload

OR

Kilograms pulled x Radius (centimeters) +
kg-cm preload x .098 + Nm preload

Examples:

Reading from spring scale + 7.5 pounds (3.4 kg)
Diameter of bearing + 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 Nm preload

OR

3.4 kg x 8.4 cm + 28.6 kg-cm preload x .098
+ 2.8 Nm preload

- If the preload (torque) of pinion bearings is not within specifications, do the following procedure, then repeat steps 1 to 9. To increase preload; install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

- 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.

Yoke or Flange Method

- 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 2-46). If a press is not available, use the three-piece pilot tool for installation. See the procedure in earlier pages of this section.

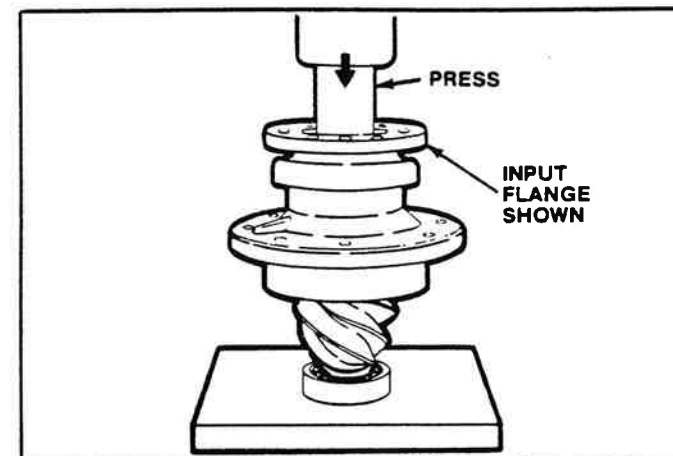


Figure 2-46. Pressing On Flange Or Yoke.

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.

- Temporarily install the drive pinion and cage assembly in the carrier. Do not install shims under the bearing cage (Figure 2-47).

- Install the bearing cage to carrier capscrews. Washers are not required at this time. Tighten the capscrews hand tight.

- 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 2-47).

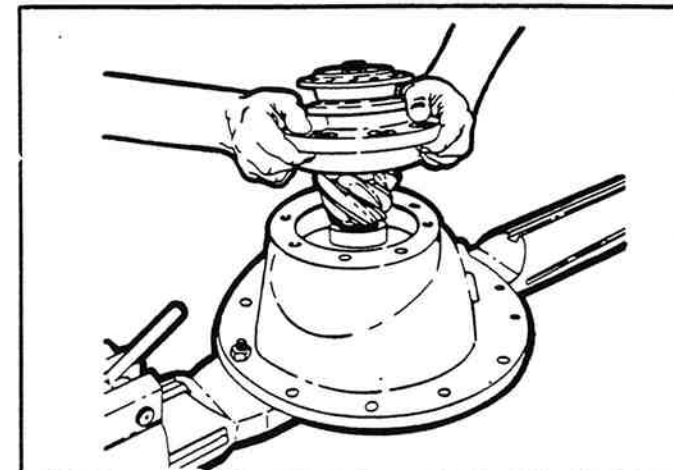


Figure 2-47. Placing Pinion And Cage Assembly In Carrier.

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- Tighten the nut on drive pinion to minimum 800 ft. lbs. (1,085 Nm), maximum 1,100 ft. lbs. (1,492 Nm) (Figure 2-48).
- Remove the yoke or flange bar.

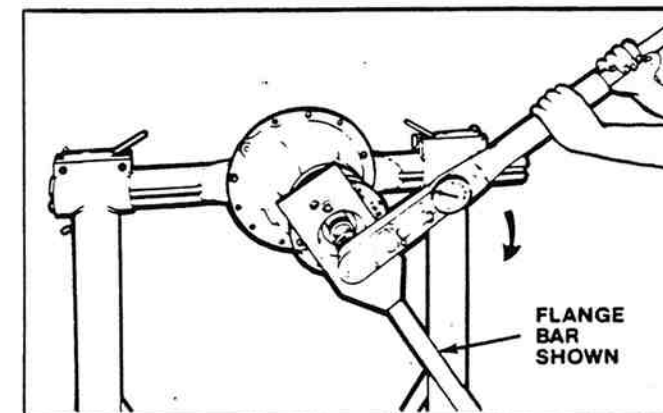


Figure 2-48. Torquing Drive Pinion Nut.

- Attach a torque wrench on the drive pinion nut. Rotate the drive pinion and read the value indicated on torque wrench (Figure 2-49).

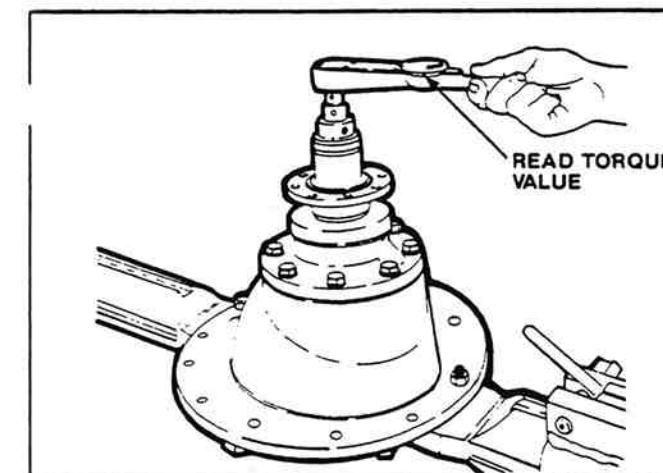


Figure 2-49. Reading Drive Pinion Torque.

NOTE: The preload (torque) of pinion bearings can be increased or decreased by tightening or loosening the pinion nut within specifications.

- 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 1 to 7. To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

After adjusting preload of pinion bearings, remove the drive pinion and bearing cage from carrier. Follow steps 1 to 4 of procedure for removing pinion and cage from carrier.

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

- Apply Lubriplate or grease used for wheel bearings to the seal lips and cavities between lips.

- Apply a sealing compound on the outer diameter of seal.
- Put the cover in a press, large diameter toward the top.
- Support the cover under the small diameter opening with metal or wood blocks (Figure 2-50).

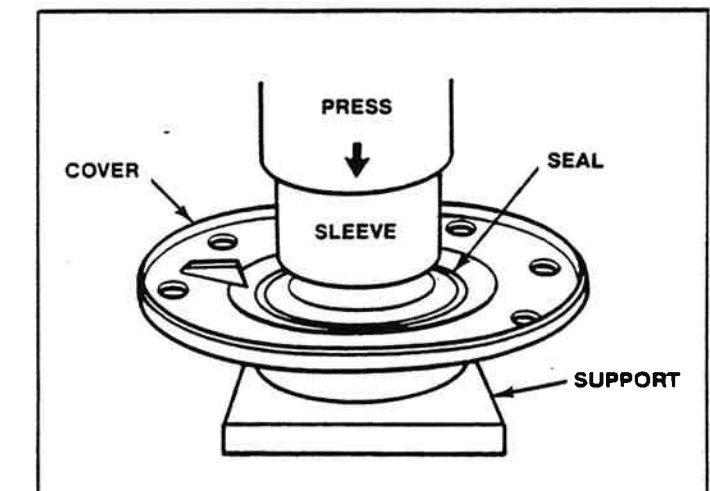


Figure 2-50. Pressing Seal Into Cover.

- 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 2-51).

NOTE: If a press is not available, use a mallet and the sleeve or driver to install the seal (Figure 2-51).

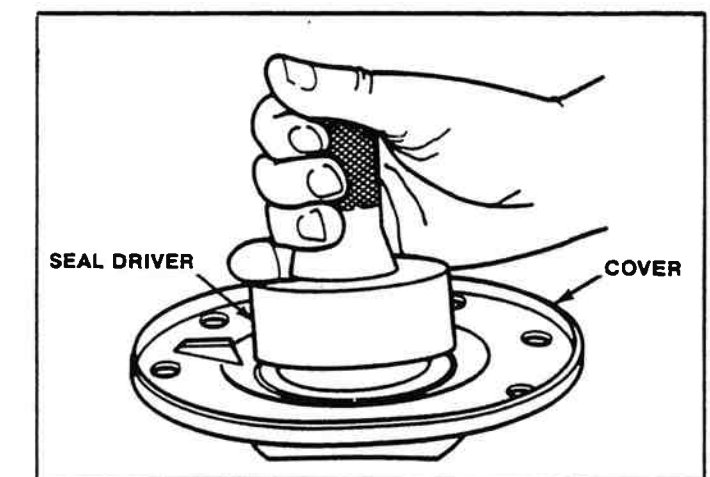


Figure 2-51. Installing Seal With Driver.

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

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

- Apply Lubriplate or grease used for wheel bearings to the seal lips and cavities between lips (Figure 2-51).
- Apply axle lubricant to seal bore in bearing cage (Figure 2-52).

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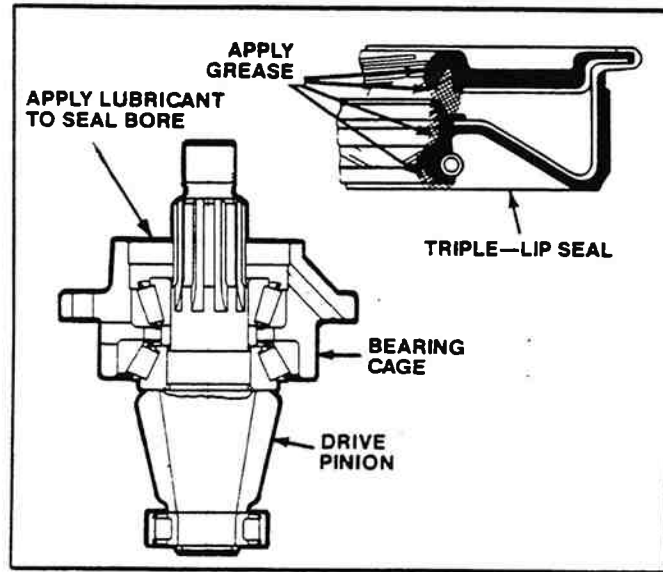


Figure 2-52. Installing Seal Into Bore.

- Put the drive pinion and cage assembly in a press, seal bore toward the top.
- 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 2-53).

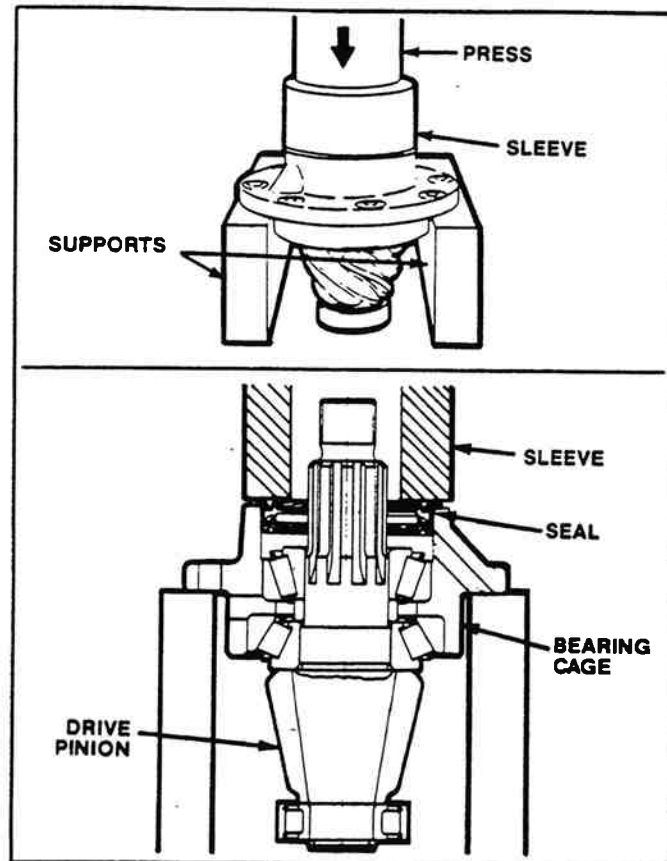


Figure 2-53. Pressing In Seal.

NOTE: If a press is not available, use a mallet and the sleeve or driver to install the seal (Figure 2-54).

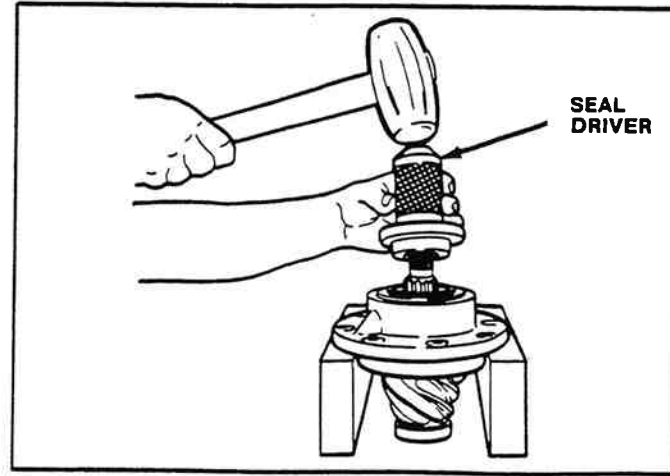


Figure 2-54. Putting In Seal With Driver.

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

- 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 2-55).

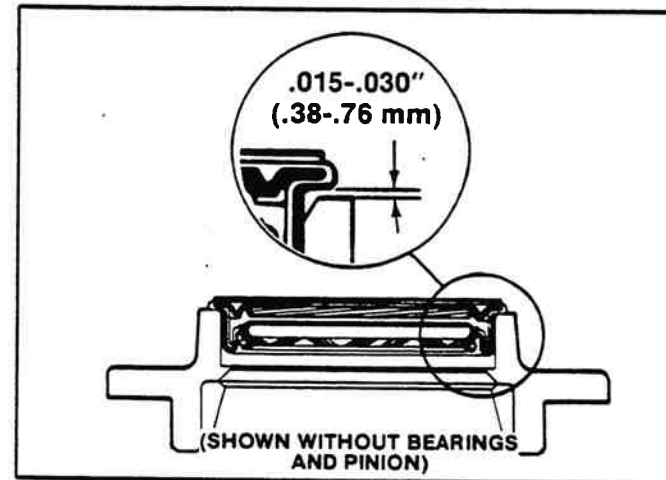


Figure 2-55. Checking Seal Gap.

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.

INSTALLING THE DRIVE PINION, BEARING CAGE AND SHIM PACK INTO THE CARRIER

NOTE: If a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted, calculate the thickness of the shim pack. See the procedure to Adjust Thickness Of Shim Pack For The Pinion Cage in later pages of this section.

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- Install the correct shim pack between the bearing cage and carrier (Figure 2-56).

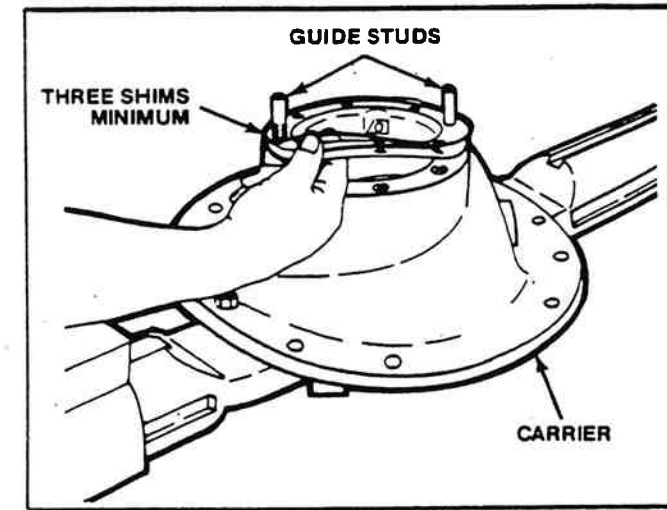


Figure 2-56. Installing Shims.

- 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 2-56).

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.

- 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 2-57).

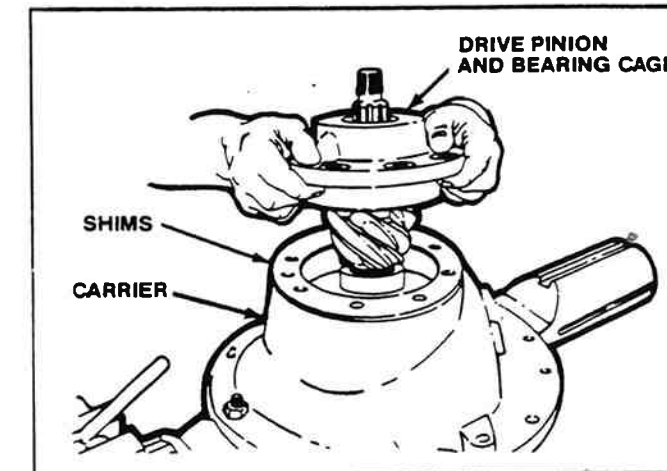


Figure 2-57. Installing Drive Pinion And Cage.

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

- Align the oil slots in the cover and gasket with oil slot in the bearing cage.
- Install the bearing cage to carrier capscrews and washers. Tighten capscrews to correct torque value. See the torque chart later in this section (Figure 2-58).

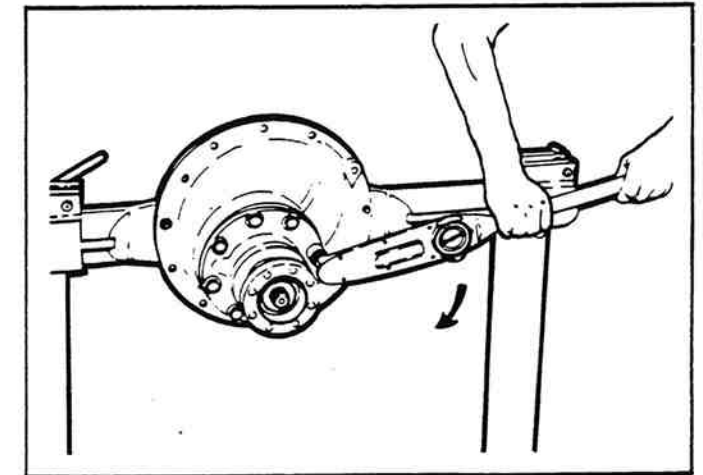


Figure 2-58. Torquing Cage Mounting Capscrews.

- 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 in earlier pages of this section.

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.

- Tighten the pinion nut to minimum 800 ft. lbs (1,085 Nm), maximum 1,100 ft. lbs. (1,492 Nm) (Figure 2-59).

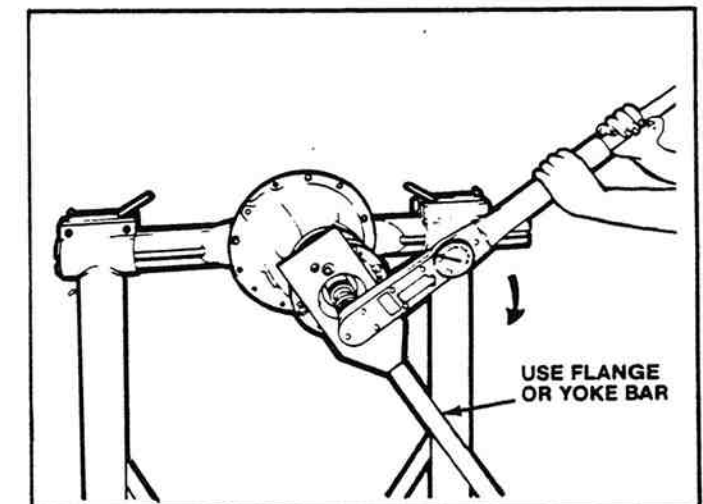


Figure 2-59. Torquing Yoke Or Flange Nut.

ADJUSTING 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 2-60).

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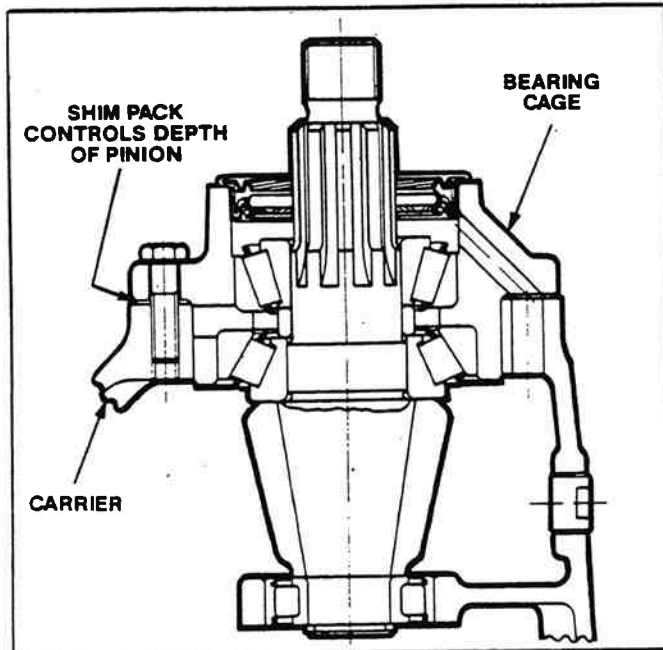


Figure 2-60. Shim Pack Adjustment.

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 2-61).

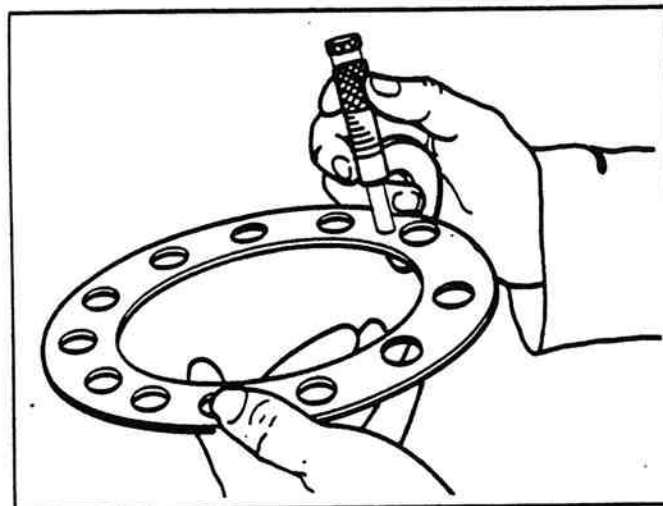


Figure 2-61. Measuring Thickness Of Old Shim Pack.

2. Look at the pinion cone ("PC") variation number on the old drive pinion that is being replaced. See Gear Set Information, step 4 in earlier pages of this section for examples and locations of the number. Record the number for later use.

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, +.03 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 example in the following chart.

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

IMPORTANT: Remember that the drive pinions and ring gears must be replaced as matched sets.

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8. Install the drive pinion, bearing cage and new shim pack into the carrier. See the procedure earlier in this section.

ASSEMBLING 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 2-62).

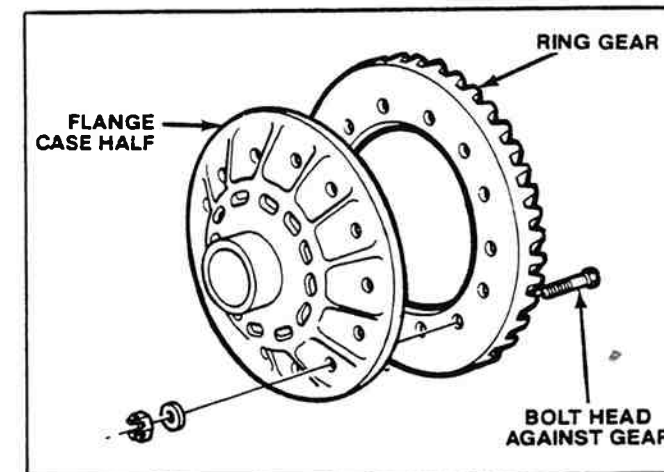


Figure 2-62. Installing Ring Gear Mounting Bolts.

6. Tighten the bolts and nuts to the correct torque value. See the torque chart later in this section.

7. When rivets are used to hold the ring gear to the flange case half, install the rivets as follows:

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 2-63).

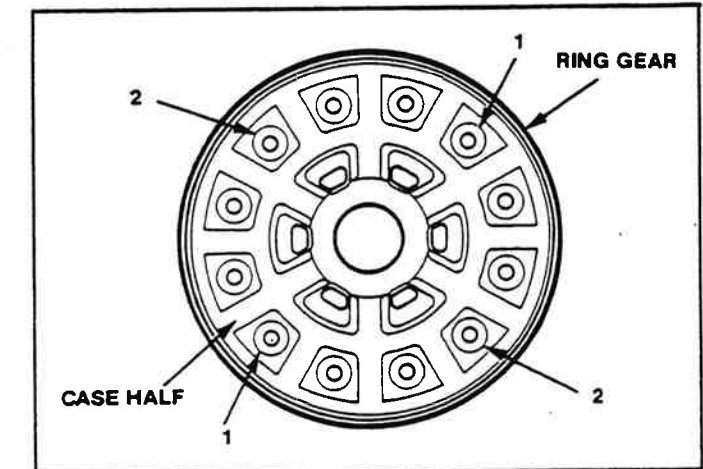


Figure 2-63. Installing Rivets.

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 following chart for rivet pressures.

Diameter of Rivet Body	Press Pressure Needed to Install Rivets	
	pounds / tons	kilograms / metric tons
inch (mm)		
438 (11.13)	44,000 / 22	19,958 / 20.0
500 (12.70)	60,000 / 30	27,216 / 27.2
563 (14.30)	72,000 / 36	32,659 / 32.7
625 (15.88)	90,000 / 45	40,824 / 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 2-64).

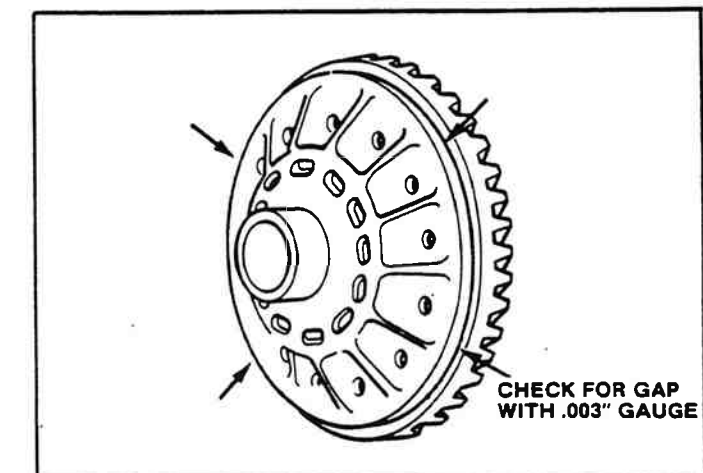


Figure 2-64. Checking Gap.

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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 for rivet removal in earlier pages of this section and the following steps *d* and *e*. If the gap is less than .003 inch (.08 mm), continue by following step 8.

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 steps 7 through 6 and steps 7a through 7c of the main differential and ring gear assembly procedure.

8. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size (Figure 2-65).

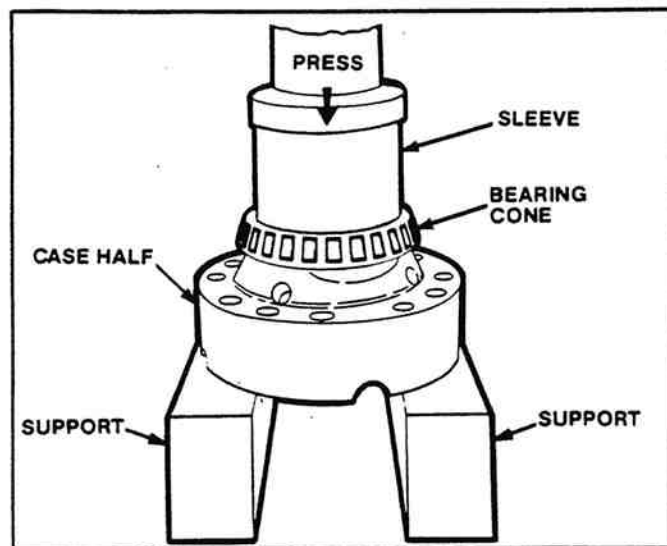


Figure 2-65. Installing Bearing Cones.

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.

11. Install one thrust washer and side gear into the flange case half (Figure 2-66).

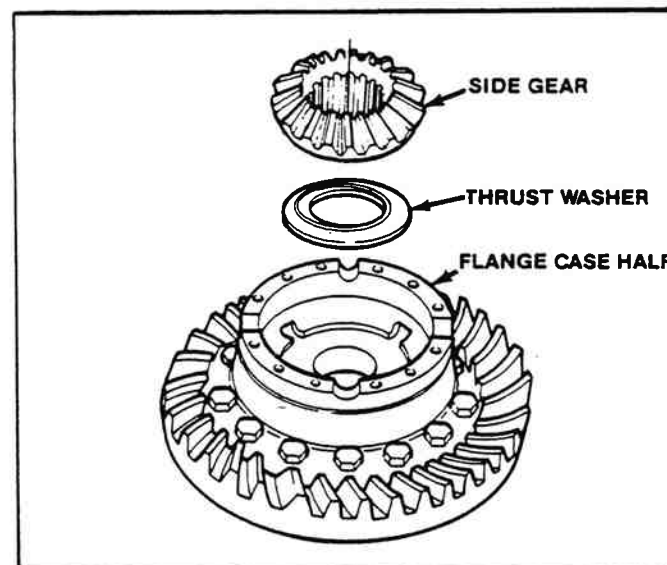


Figure 2-66. Installing Thrust Washer And Side Gear.

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 2-67).

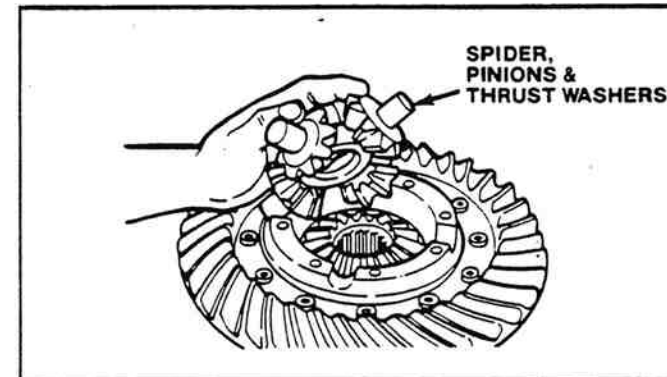


Figure 2-67. Installing Spider, Pinions And Thrust Washers.

13. Install the second side gear and thrust washer over spider and differential pinions (Figure 2-68).

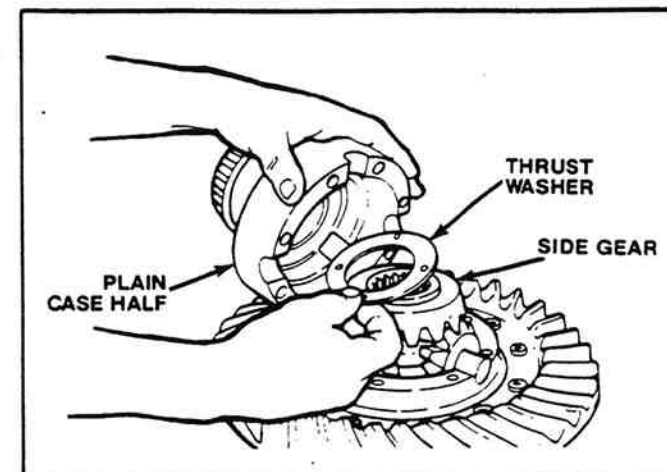


Figure 2-68. Installing Second Side Gear And Thrust Washer.

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 (Figures 2-68 and 2-69).

15. Install Dri-Loc fasteners into the case halves. See the procedures in earlier part of this section 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 2-70). See torque chart in later pages of this section.

b. Install the other fasteners into the case halves. Tighten the fasteners to the correct torque value. See the torque chart later in this section.

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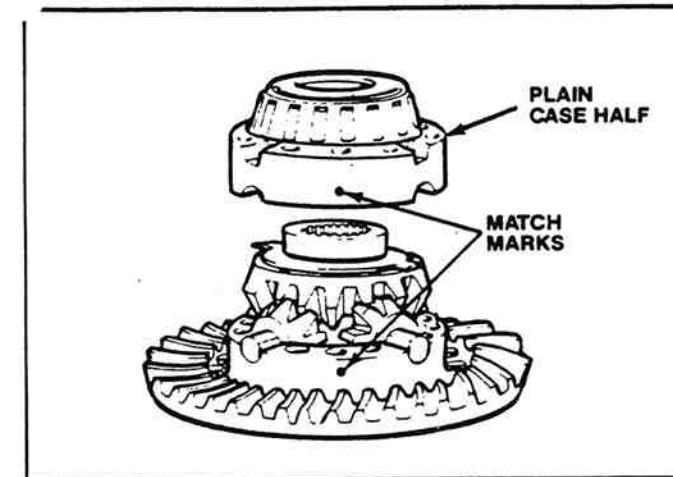


Figure 2-69. Aligning Match Marks.

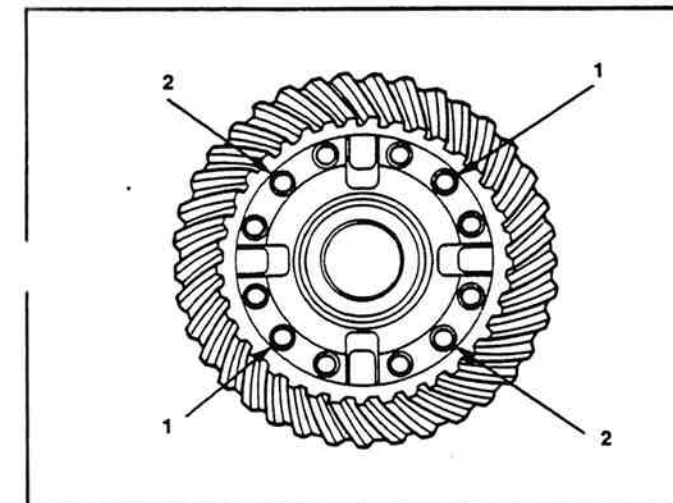


Figure 2-70. Installing Capscrews In Equally Spaced Pattern.

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 Nm) 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 2-71.

a. Install soft metal covers over vise jaws to protect the side gear (Figure 2-72).

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

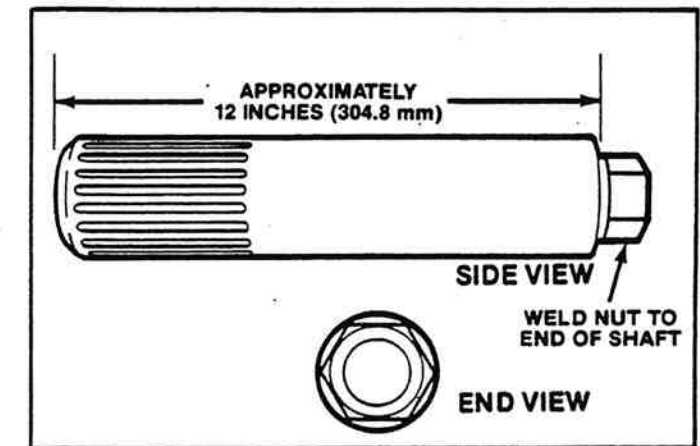


Figure 2-71. Rolling Resistance Check Tool.

c. Install the tool into the differential until the splines of the tool and one side gear are engaged (Figure 2-72).

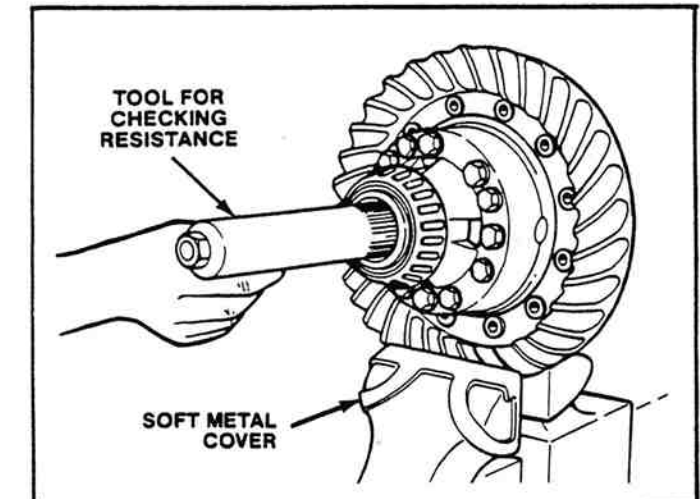


Figure 2-72. Installing Rolling Resistance Checking Tool.

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 2-73).

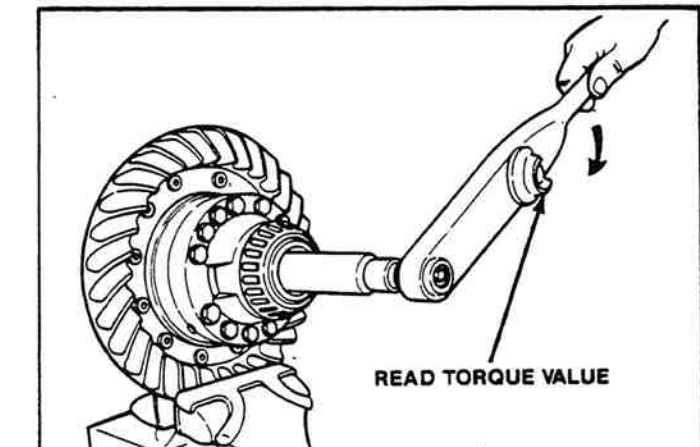


Figure 2-73. Reading Rolling Resistance Torque.

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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*.

Installing 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 in earlier pages of this section.

4. Install the bearing cups over the bearing cones that are assembled on the case halves (Figure 2-74).

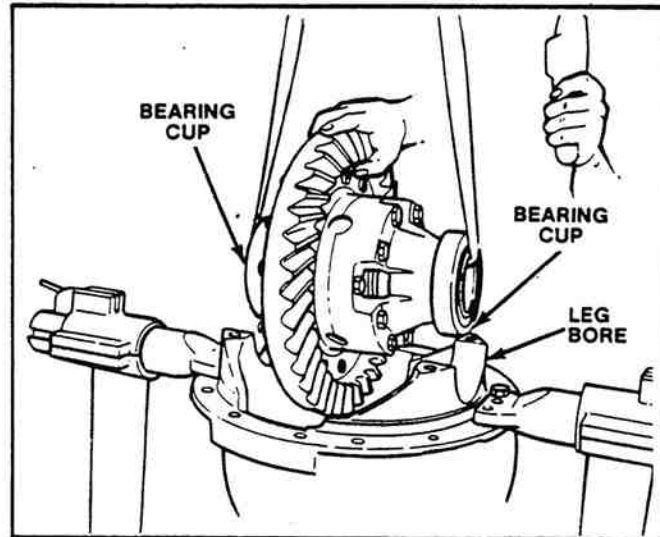


Figure 2-74. Installing Bearing Cups.

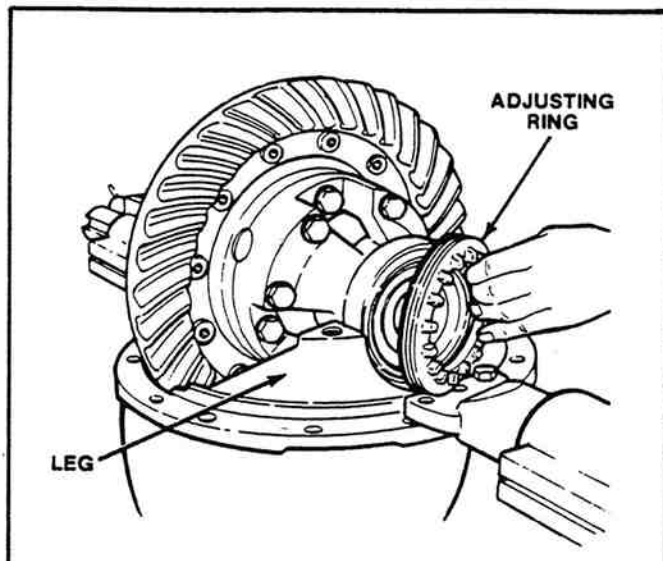


Figure 2-75. Installing Bearing Adjusting Rings.

5. Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups must be flat against the bore between the carrier legs (Figure 2-74).

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 2-75).

7. Install the bearing caps over the bearings and adjusting rings in the correct location as marked before removal (Figure 2-76).

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

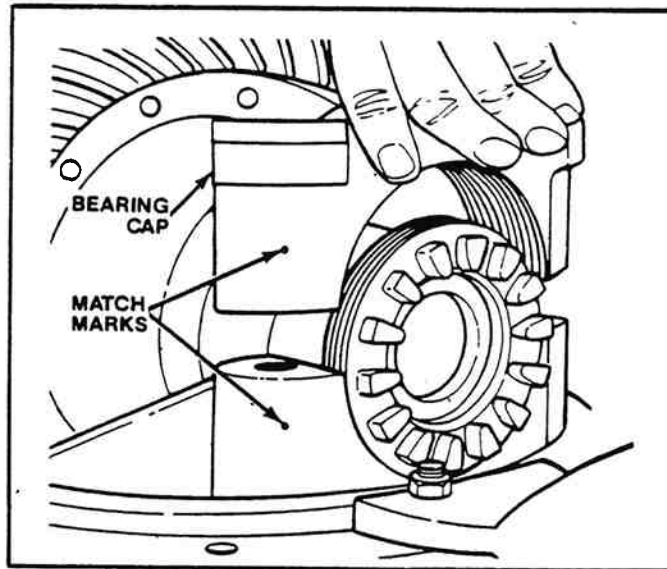


Figure 2-76. Installing Bearing Caps.

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. 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 later page of this section.

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.

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ADJUSTING PRELOAD OF DIFFERENTIAL BEARINGS

Specifications:

Preload of differential bearings - 15 to 35 lb.-in. (1.7 to 3.9 Nm) torque.

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 2-77).

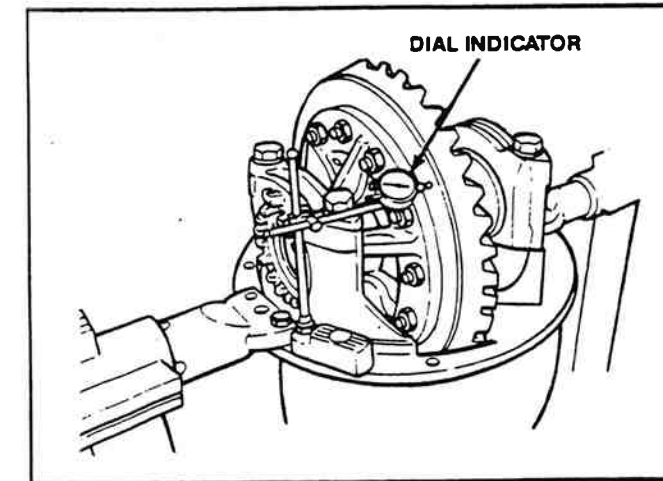


Figure 2-77. Positioning Of Dial Indicator.

CAUTION: When turning 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 2-78).

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 2-78). Move the differential and ring gear to the left and right with pry bars while reading the dial indicator. Use the following step *a* or *b*.

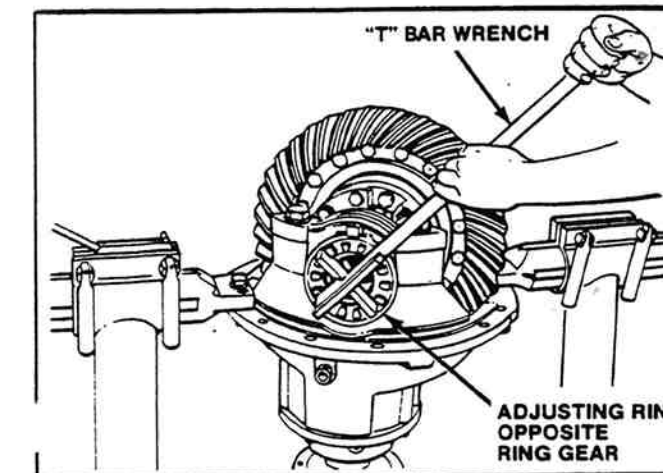


Figure 2-78. Loosening Bearing Adjusting Ring.

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 2-79).

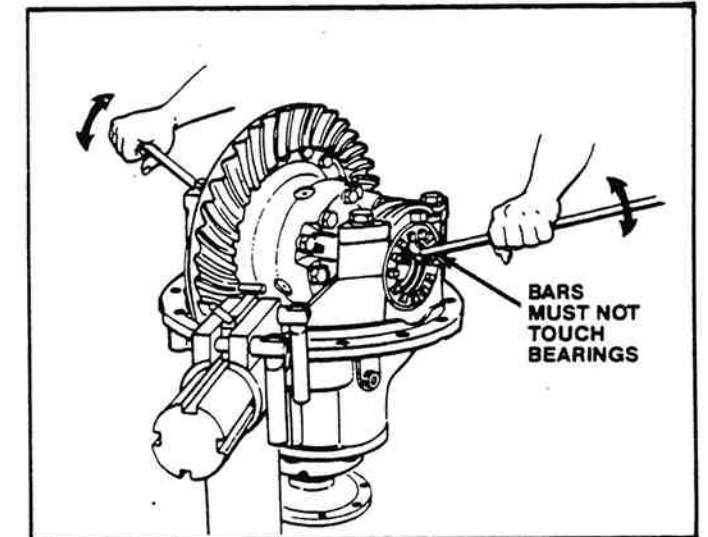


Figure 2-79. Placing Pry Bars At Bearing Adjusting Rings.

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 2-80).

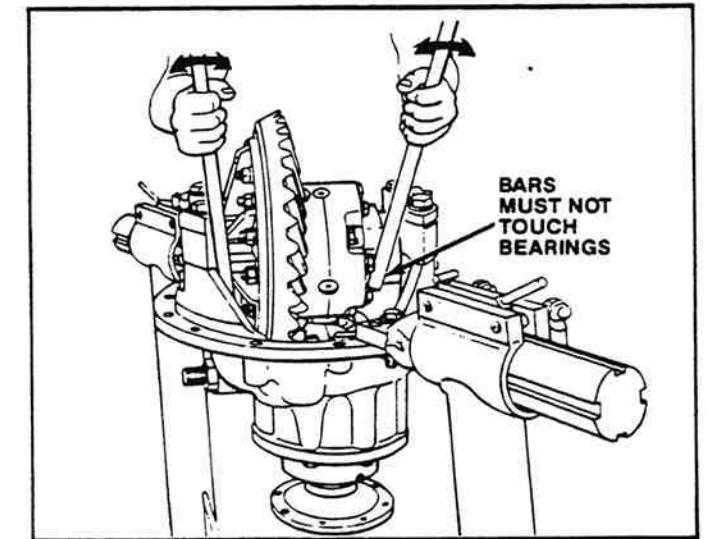


Figure 2-80. Placing Pry Bars (Alternate Locations).

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.

CHECKING RUNOUT OF RING GEAR

1. Attach a dial indicator on the mounting flange of the carrier (Figure 2-81).

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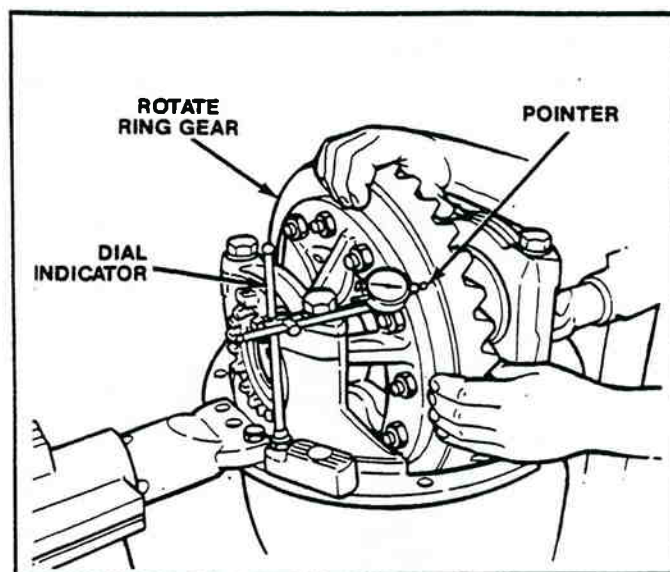


Figure 2-81. Checking Ring Gear Runout.

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 2-81). If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. See the disassembly procedure in earlier pages of this section 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 in preceding pages of this section.
7. Repeat preload adjustment of differential bearings.

ADJUSTING BACKLASH OF THE RING GEAR

Measure the outer diameter of ring gear for approximate pitch diameter (Figure 2-82).

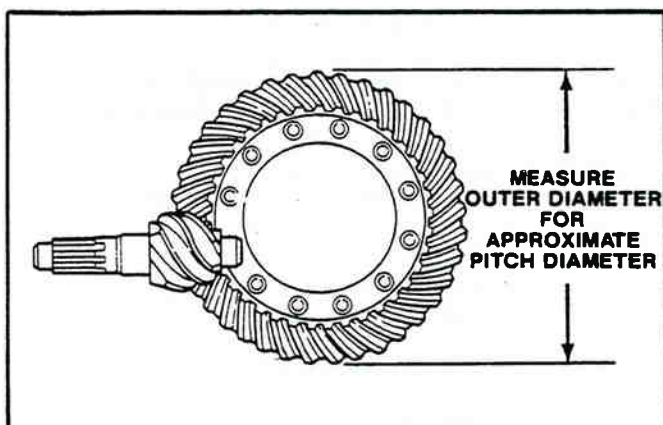


Figure 2-82. Determining Approximate Pitch Diameter.

Specifications:

Range of backlash setting — .008 to .018 inch (.20 to .46 mm).
Backlash setting for new gear sets — .012 inch (.30 mm).

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 2-83).
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface (Figure 2-83).
3. Adjust the dial of the indicator to zero (0).
4. Hold the drive pinion in position.

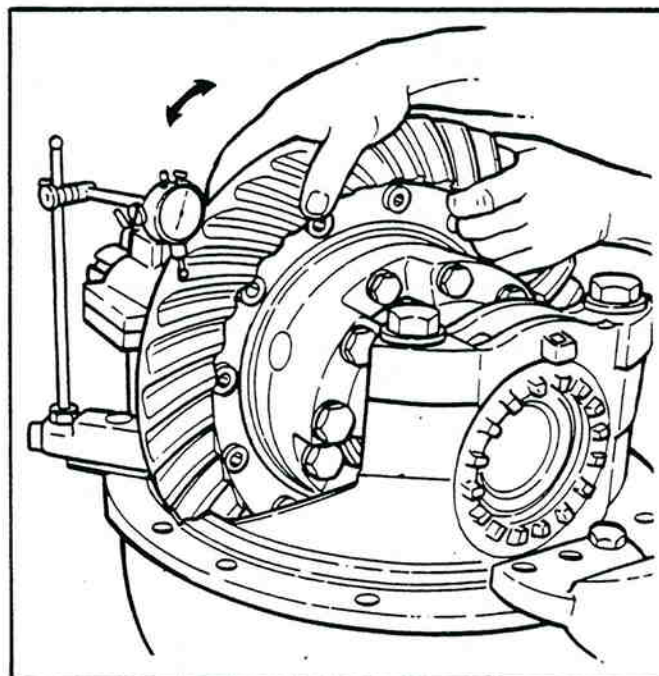


Figure 2-83. Attaching Dial Indicator.

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 2-84). Backlash is decreased by moving the ring gear toward the drive pinion (Figure 2-85).

6. Loosen one bearing adjusting ring one notch, then tighten the opposite ring the same amount (see Figures 2-84 and 2-85).

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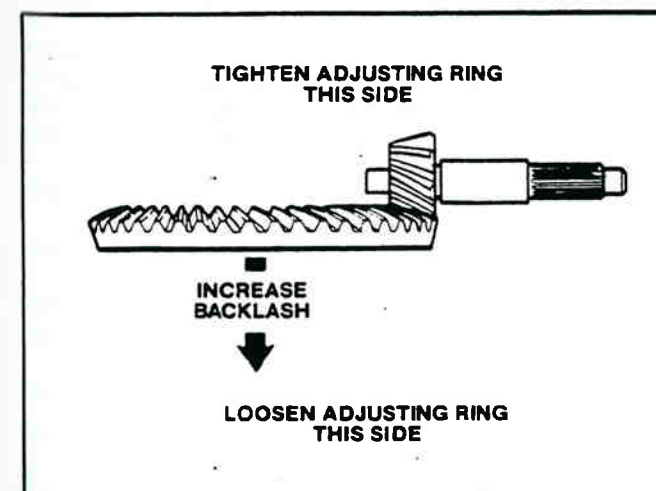


Figure 2-84. Adjusting For Increased Backlash.

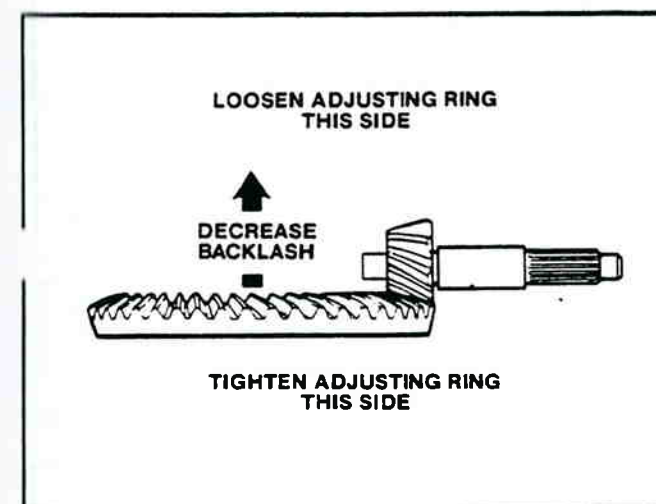


Figure 2-85. Adjusting For Decreased Backlash.

NOTE: When adjusting backlash, move the ring gear only. Do not move the drive pinion.

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

CHECKING TOOTH CONTACT PATTERNS OF THE GEAR SET

GENERAL INFORMATION

The carrier has a conventional hypoid gear set.

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 2-86).

Always check tooth contact patterns on the drive side of the gear teeth (Figure 2-87).

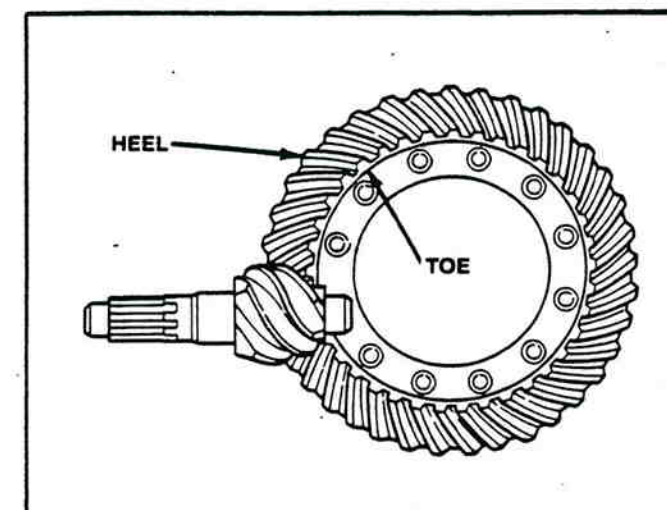


Figure 2-86. Hypoid Gear Heel And Toe Locations.

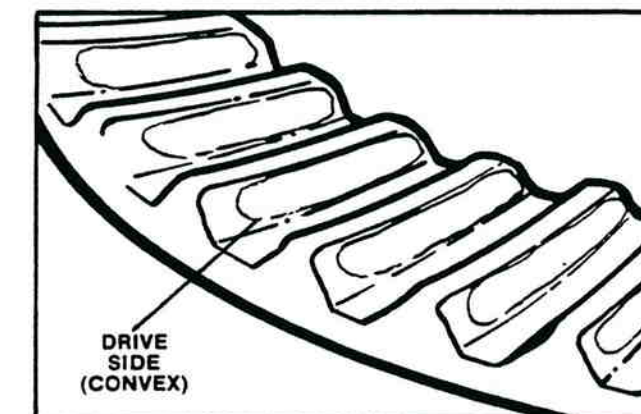


Figure 2-87. Checking Tooth Contact Pattern.

TOOTH CONTACT PATTERNS OF CONVENTIONAL HYPOID GEAR SETS

1. Adjust the backlash of a new gear set to .012 inch (.30 mm). Adjust the backlash of an old gear set to the setting that was measured before the carrier was disassembled. See the procedure on previous pages.

2. Apply a marking compound, such as oiled red lead, 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 2-88).

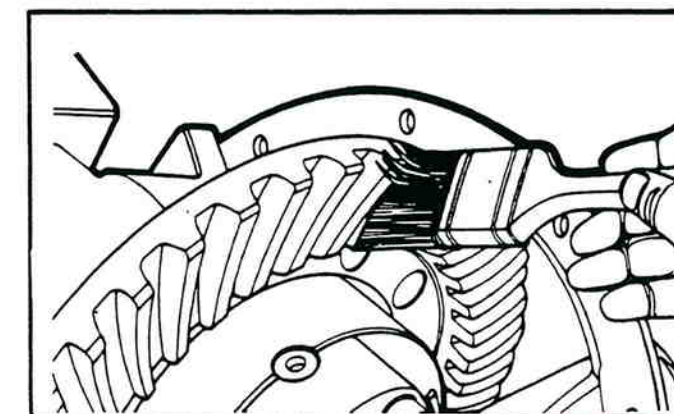


Figure 2-88. Applying Marking Compound.

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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 clearer pattern.

4. Look at the contact patterns on the ring gear teeth. Compare the patterns to Figures 2-89, 2-90 and 2-91.

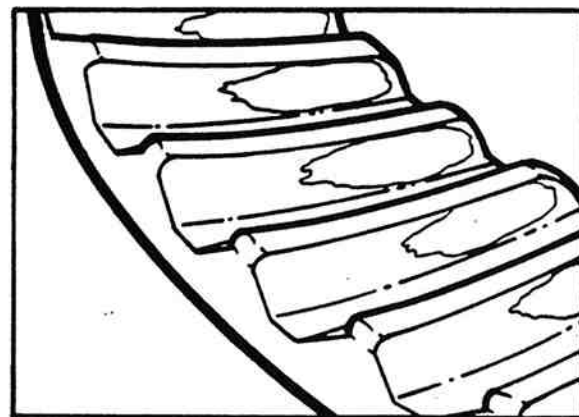


Figure 2-89. Good Hand Rolled Pattern.

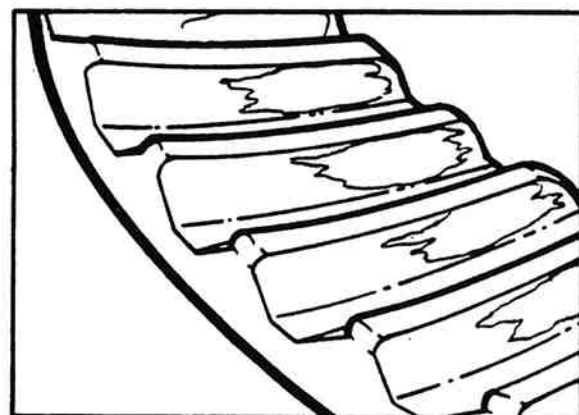


Figure 2-90. High Pattern.

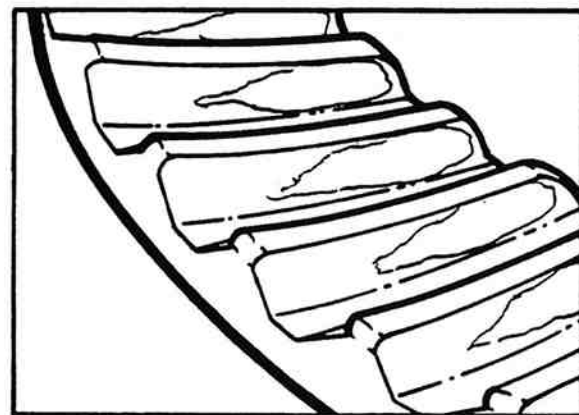


Figure 2-91. Low Pattern.

The Location of Good Hand-Rolled Contact Patterns

For new gear sets, the location of good hand-rolled tooth contact patterns will be toward the toe of the gear tooth and in the center between the top and bottom of the tooth (see Figure 2-89).

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 2-92).

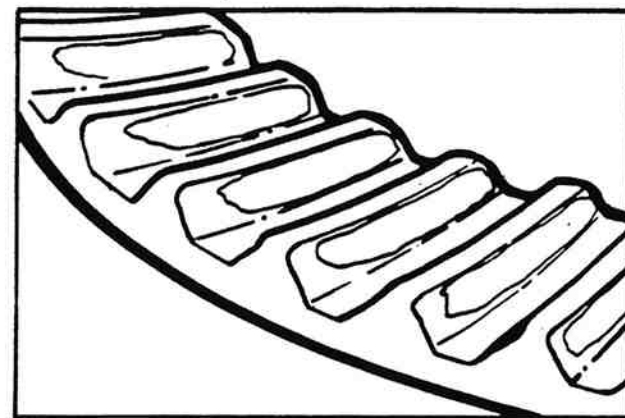


Figure 2-92. Good Pattern In Operation.

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

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

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

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 previous pages.

b. To correct a high contact pattern (Figure 2-90), decrease the thickness of the shim pack under the bearing cage. When the thickness of the shim pack is decreased, the drive

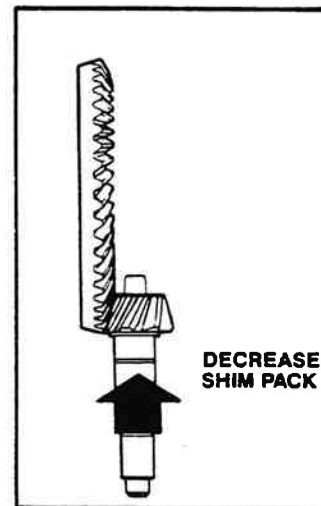


Figure 2-93.

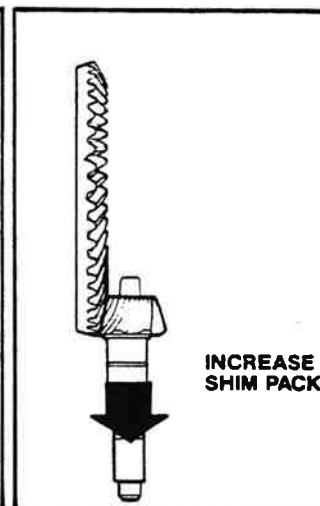


Figure 2-94.

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pinion will move toward the ring gear (Figure 2-93). To correct a low contact pattern (Figure 2-91), increase the thickness of the shim pack under the bearing cage. When the thickness of the shim pack is increased, the drive pinion will move away from the ring gear (Figure 2-94).

c. Install the drive pinion; bearing cage and shims into the carrier. See the procedure on previous pages.

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 previous pages.

a. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth (Figure 2-95).

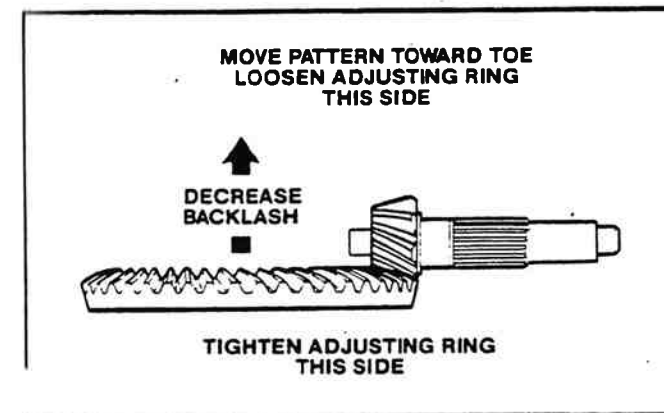


Figure 2-95. Moving Contact Pattern Toward Top Of Ring Gear Teeth.

b. Increase backlash to move the contact patterns toward the heel of the ring gear teeth (Figure 2-96).

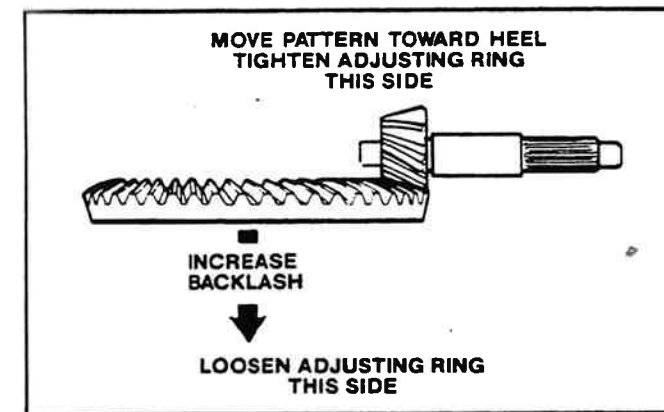


Figure 2-96. Moving Contact Pattern Toward Heel Of Ring Gear Teeth.

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.

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 2-97).

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 2-97).

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 later in this section (Figure 2-97).

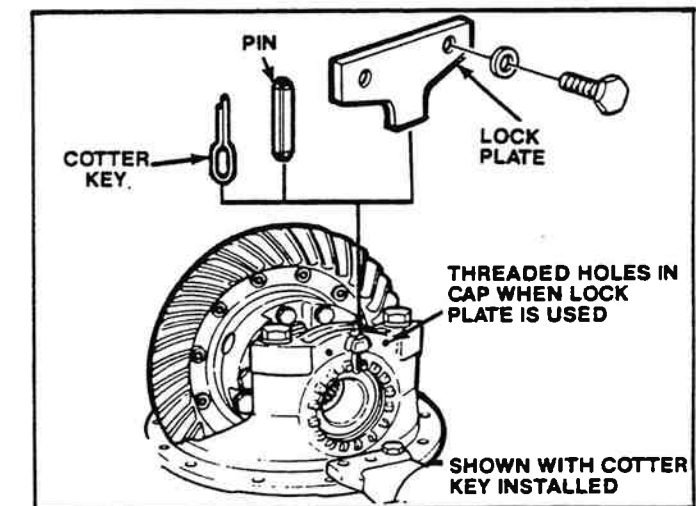


Figure 2-97. Fastening Bearing Adjusting Rings.

INSTALLING AND ADJUSTING THE THRUST SCREW

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

1. Install the jam nut on the thrust screw, one half the distance between both ends (Figure 2-98).
2. Install the thrust screw into the carrier until the screw stops against the ring gear (Figure 2-98).

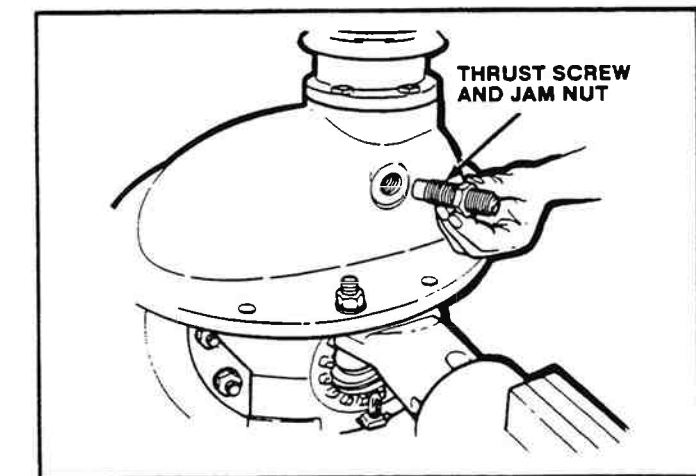


Figure 2-98. Installing Thrust Screw.

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3. Loosen the thrust screw $\frac{1}{2}$ turn, 180° (Figure 2-99).

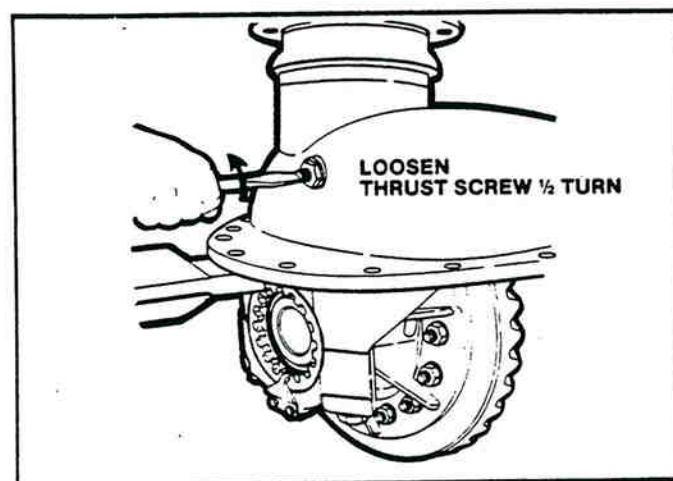


Figure 2-99. Adjusting Thrust Screw.

4. Tighten the jam nut to the correct torque value against the carrier (Figure 2-100). See the torque chart later in this section.

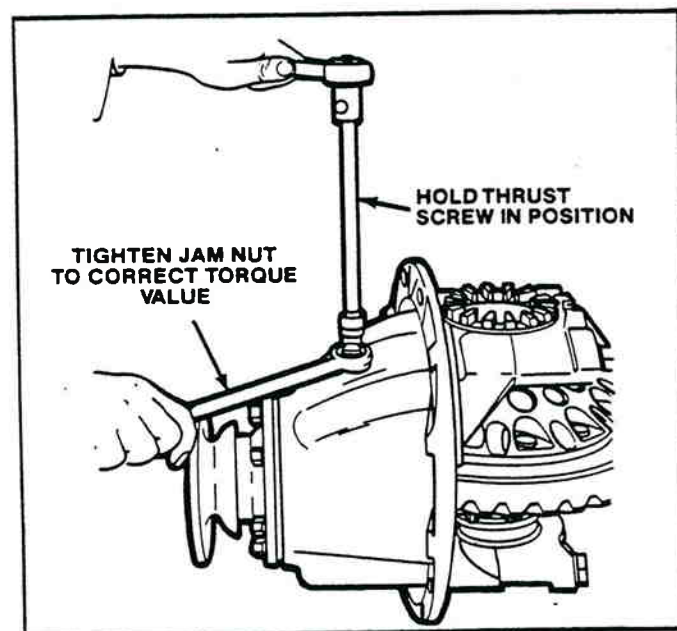


Figure 2-100. Torquing Jam Nut On Thrust Screw.

INSTALLING 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 cleaning axle assembly earlier in this section.
2. Inspect the axle housing for damage. Repair or replace the axle housing. See the procedure earlier in this section.

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 outlined earlier. Tighten studs to current torque value. See the torque chart later in this section.

5. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. See the procedure earlier in this section.

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 2-101).

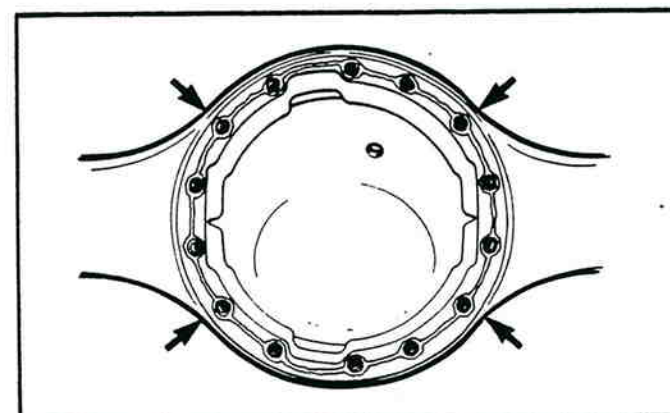


Figure 2-101. Installing Carrier Mounting Capscrews.

8. Carefully push the carrier into position. Tighten the four fasteners two or three turns each in a pattern opposite each other (see Figure 2-101).

9. Repeat step 8 until the four fasteners are tightened to the correct torque value. See the torque chart later in this section.

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 later in this section.

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 2-102).

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 later in this section.

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.

15. Install the nuts and washers on the studs. Tighten nuts to the correct torque value. See the torque chart later in this section.

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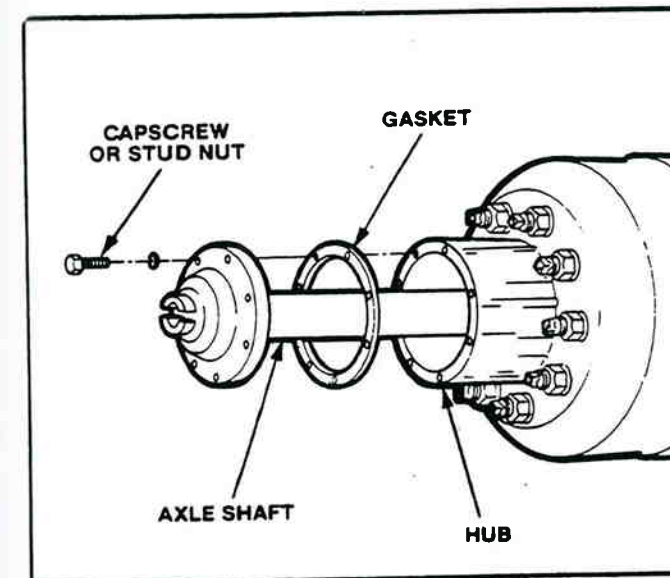


Figure 2-102. Installing Axle Shafts And Gaskets.

TORQUE VALUES FOR FASTENERS

GENERAL INFORMATION

1. The torque values in the following chart 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 2-103).

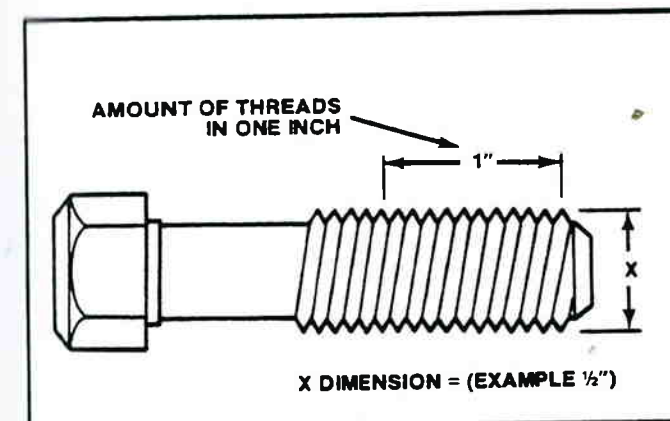


Figure 2-103. Determining Size Of American Standard Fastener.

- b. Count the amount of threads there are in one inch (1.0 inch) (Figure 2-103). Example of an American Standard size fastener is .50 - 13. The .50 is the diameter of the fastener in inches (dimension X). The 13 is the number of threads in one inch (1.0 inch).

Metric Fasteners

- a. Measure the diameter of the threads in millimeters (dimension X) (Figure 2-104).

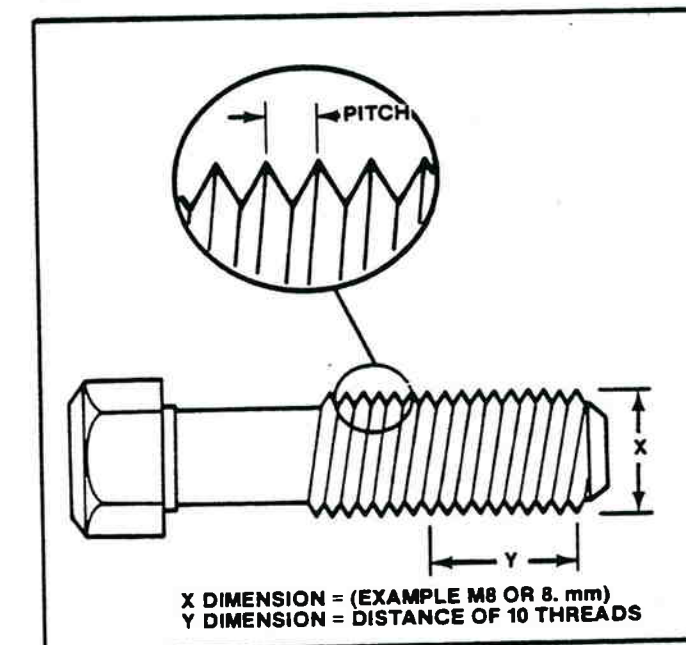


Figure 2-104. Determining Size Of Metric Fastener.

- b. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y (Figure 2-104).

- 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 M8 x 1.25. The M8 is the diameter of the fastener in millimeters (mm) (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 the following chart to find the correct torque value.

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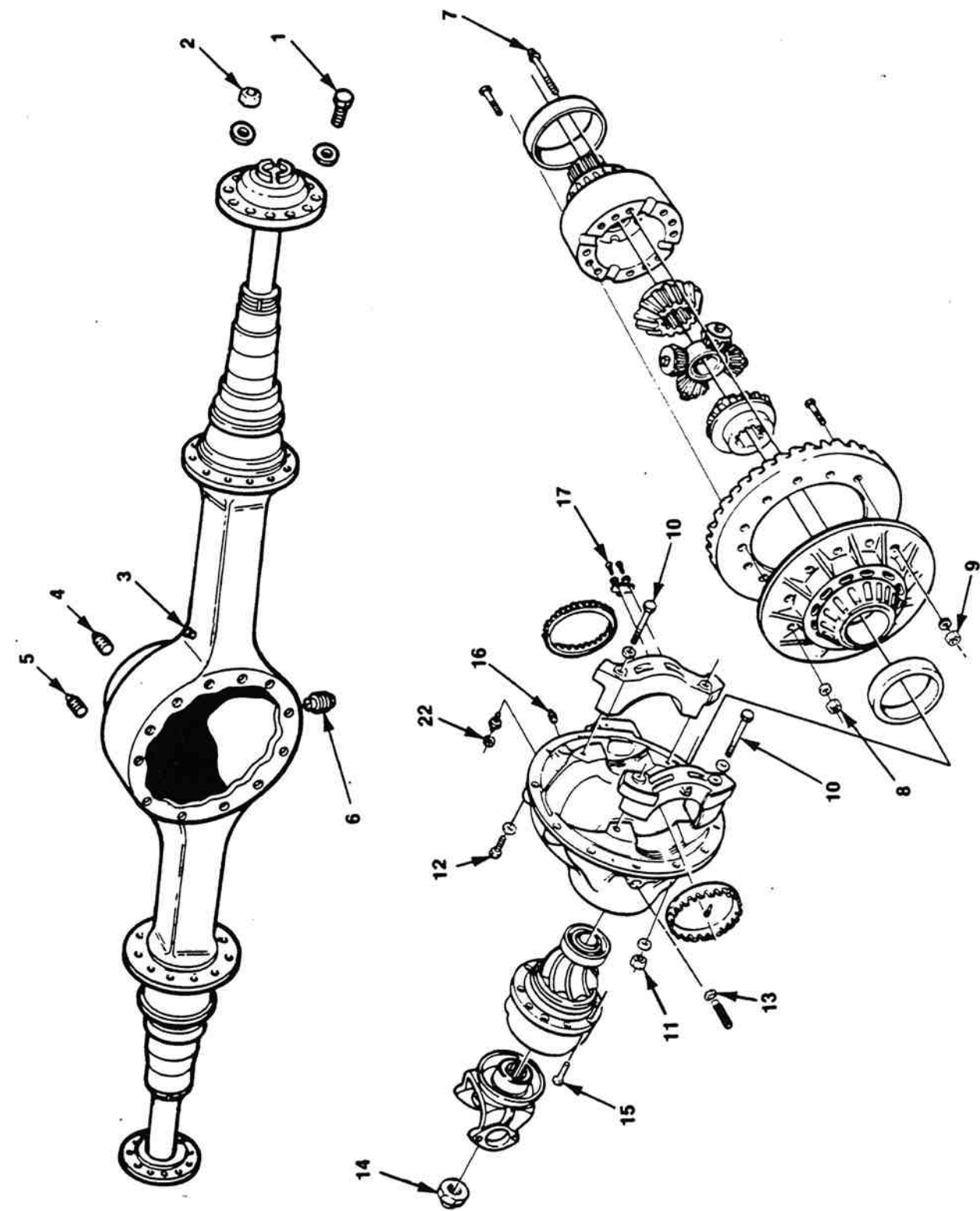


Figure 2-105. Axle Fastener Locations.

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FASTENER TORQUE CHART — Refer to Figure 2-105

FASTENER	THREAD SIZE	TORQUE VALUE		
		lb-ft	(Nm)	
1. Capscrew, Axle Shaft	.31-24	18-24	(24-33)	
	.50-13	85-115	(115-156)	
2. Nut, Axle Shaft Stud	Plain Nut			
	.44-20	50-75	(68-102)	
	.50-20	75-115	(102-156)	
	.56-18	110-165	(149-224)	
	.62-18	150-230	(203-312)	
	Lock Nut			
	.44-20	40-65	(54-88)	
	.50-20	65-100	(88-136)	
	.56-18	100-145	(136-197)	
	.62-18	130-190	(176-258)	
3. Breather	.38-18	20 minimum	(27 minimum)	
	.75-14	35 minimum	(47.5 minimum)	
4. Plug, Oil Filter (Housing)	.50-14	25 minimum	(34 minimum)	
5. Plug, Heat Indicator	.50-14	25 minimum	(34 minimum)	
6. Plug, Oil Drain	.38-16	35-50	(48-68)	
	.44-14	60-75	(81-102)	
	.50-13	85-115	(115-156)	
	.56-12	130-165	(176-224)	
	.62-11	180-230	(244-312)	
	M12 x 1.75	85-103	(115-140)	
	M12 x 1.75	75-95	(100-130)	
	M16 x 2	203-251	(275-340)	
	8. Nut, Differential Case Bolt	.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
.62-11		150-190	(203-258)	
.62-18		180-230	(244-312)	
M12 x 1.75		74-96	(100-130)	
9. Nut, Ring Gear Bolt		.50-13	75-100	(102-136)
		.50-20	85-115	(115-156)
		.62-11	150-190	(203-258)
		.62-18	180-230	(244-312)
		M12 x 1.25	66-81	(90-110)
	M12 x 1.75	77-85	(104-115)	
	M16 x 1.5	192-214	(260-290)	
	M16 x 1.5	190-225	(260-305)	
	10. Capscrew, Bearing Cap	.56-12	110-145	(149-197)
		.62-11	150-190	(203-258)
.75-10		270-350	(366-475)	
.88-14		360-470	(488-637)	
.88-9		425-550	(576-746)	
M16 x 2		181-221	(245-300)	
M20 x 2.5		347-431	(470-585)	
M22 x 2.5		479-597	(650-810)	
11. Nut, Housing to Carrier Stud		.44-20	50-75	(68-102)
		.50-20	75-115	(102-156)
	.56-18	110-165	(149-224)	
	.62-18	150-230	(203-312)	
	12. Capscrew, Carrier to Housing	.44-14	50-75	(68-102)
.50-13		75-115	(102-156)	
.56-12		110-165	(149-224)	
.62-11		150-230	(203-312)	
.75-10		270-400	(366-542)	
M12 x 1.75		74-89	(100-120)	
M16 x 2		181-221	(245-300)	
13. Jam Nut, Thrust Screw	.75-16	150-190	(203-258)	
	.88-14	150-300	(203-407)	
	1.12-16	150-190	(203-258)	
	M22 x 1.5	148-210	(200-285)	
	M30 x 1.5	236-295	(320-400)	

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

DRIVE AXLE LOAD TUBE REPLACEMENT

REMOVAL

After removing the drive axle differential assembly, the axle load tubes may be removed and new tubes installed.

An axle tube pulling and installing set, a pulling adaptor, a tube adaptor and a carrier pilot plate are required to perform this operation. Refer to the tool listing at the end of this section for the part numbers of these items. To remove the axle tube follow these steps (refer to Figure 2-106):

1. Place the pulling adaptor in position at the end of the axle tube inside the axle housing.
2. Place the tube adaptor in position at the hub end.
3. Insert the puller screw in the axle tube and secure the pulling adaptor with the hex nut.
4. Place the puller tube against the tube adaptor.
5. Place the hydraulic ram in position. Apply the speed nut against the ram head as shown.
6. Connect the ram to the hydraulic pump and apply pressure. The load tube will be withdrawn from the axle housing with continued applications of pressure.

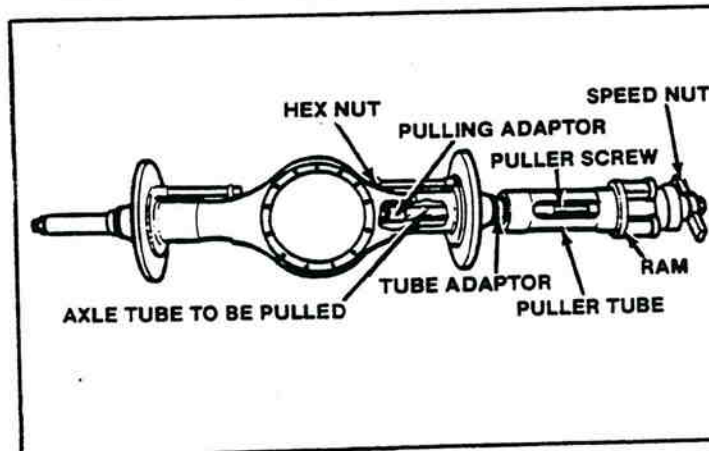


Figure 2-106. Removing Axle Tube.

INSTALLATION

To install the new load tube follow these steps (refer to Figure 2-107):

1. Insert the two puller screws in the axle housing and connect them with the connecting nut as shown.
2. Place the axle tube in position at the end of the axle housing.
3. Place the pulling adaptor in position at the outside end of the new tube. Also place one in the opposite end as a guide and secure the puller screw with the hex nut as shown.
4. Place the tube adaptor in position at the opposite end of the axle housing.
5. Place the puller tube in position against the tube adaptor as shown.
6. Install the carrier pilot plate assembly.
7. Position the hydraulic ram and screw the speed nut tightly against the ram head.
8. Connect the ram to the hydraulic pump and apply pressure until the load tube flange is flush with the end of the axle housing.

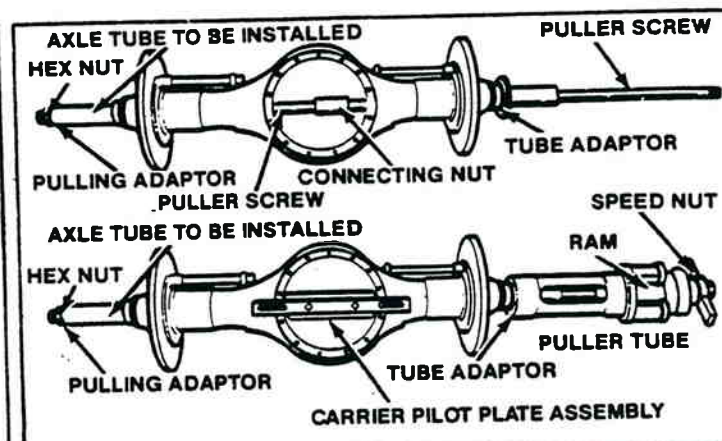


Figure 2-107. Installing Axle Tube.

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RAILING AXLE

Two independent rear trailing axles are mounted behind the rear drive axle. Each axle carries a single wheel and tire, with outside face 3-9/16" (90.4 mm) in from the outside face of the outside dual tire of the drive axle. Each axle pivots independently on a trunnion, allowing sufficient independent movement. Refer to Section 10 for lubrication.

Both of the swingarm type stub axles have hubs, bearings, seals and attaching parts which are identical to those on the front axle. See figure 2-108.

REMOVAL

Rear trailing wheels are carried on independent oscillating axle units, one for each wheel, attached to an axle tube located behind the rear driving axle.

To remove the right or left trailing axle assembly:

1. Exhaust air from suspension bellows by turning the air release valve to the OFF position (lever in horizontal position) until air is released from air springs.
2. Disconnect hose from the brake chamber.
3. Remove the wheel.
4. Remove the clamp which retains the axle assembly to the axle tube.
5. Remove screws holding the air springs to the bellows support plate.
6. Slide trailing axle assembly off cross tube bearing.

CAUTION: Do not apply air brakes until

reassembled, as loss of air from brake system will result.

INSTALLATION

1. Install cross tube to bogie leg mounting plates, using 3/4"-16 UNF capscrews. Torque to 315 ft. lbs. (427 Nm). Tighten outer bolts fully first and inner next.

2. Install cross tube brass bushing. With vent plugs removed, install new trailing arm assembly. Install retaining clamps at arm and cross tube assembly.

3. Reinstall bellows to spring seat. Reinstall the balance of assemblies and parts in the reverse order of removal.

Refer to Section 10 of this manual for lubrication of brake camshafts and cross tube. When installing wheel oil seals, refer to Section 15 of this manual. Add SAE 30 oil to wheel hubs if required.

ALIGNMENT

Trailing wheel alignment must be checked when replacing axles. Toe in of 0" to a maximum of 1/8" (3.17 mm) is acceptable. Rear wheel track is 76.5" (1.943 m). On some coaches with toe-out conditions, minor corrections beyond the above limit can be made by installing 20 Ga shims between flanges at inner mounting bolts.

NOTE: The inner and outer flange faces of cross-tube mounting must contact the bogie leg flanges after the bolts are tightened.

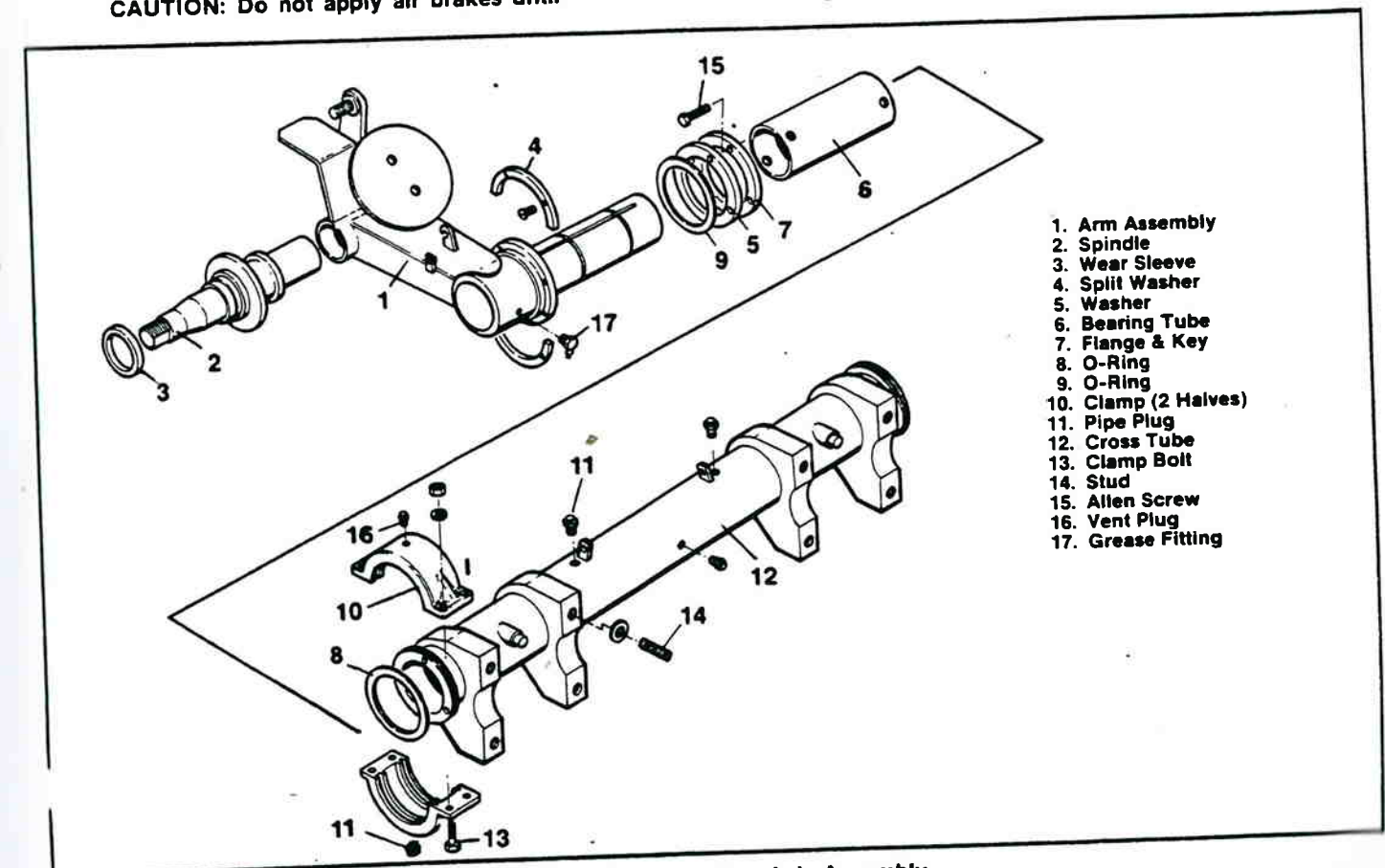


Figure 2-108. Trailing Axle Assembly.

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SPECIFICATIONS DRIVE AXLE

DRIVE AXLE

Manufacturer	Rockwell Standard
Wheel Track (from center of duals)	70.6" (1,793 mm)
Gears, Type	Hypoid
Axle, Type	Full Floating, Pressed Steel Housing
Rear Axle Ratio (Std)	3.73:1
Rear Axle Lube Capacity	20 Qts. (18.9 liters)

CLEARANCE

Differential Bearing End Play	0.000" (.000 mm)
Differential Gear Run-Out Max.	0.008" (.203 mm)
Hypoid Gear Backlash (New)	0.010" (.254 mm)
Hypoid Gear Backlash Limits	0.005"-0.015" (.127 mm-.381 mm)

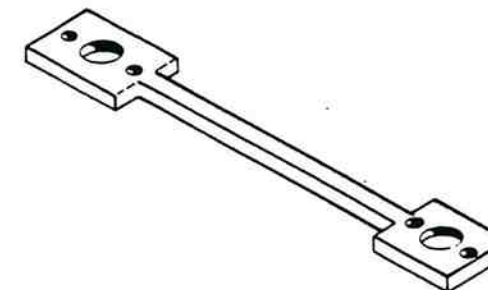
TRAILING AXLE

Wheel Track	81.5" (2,070 mm)
Trailing Wheel Toe In	1/4" ± 1/4" (6.3 ± 6.3 mm)

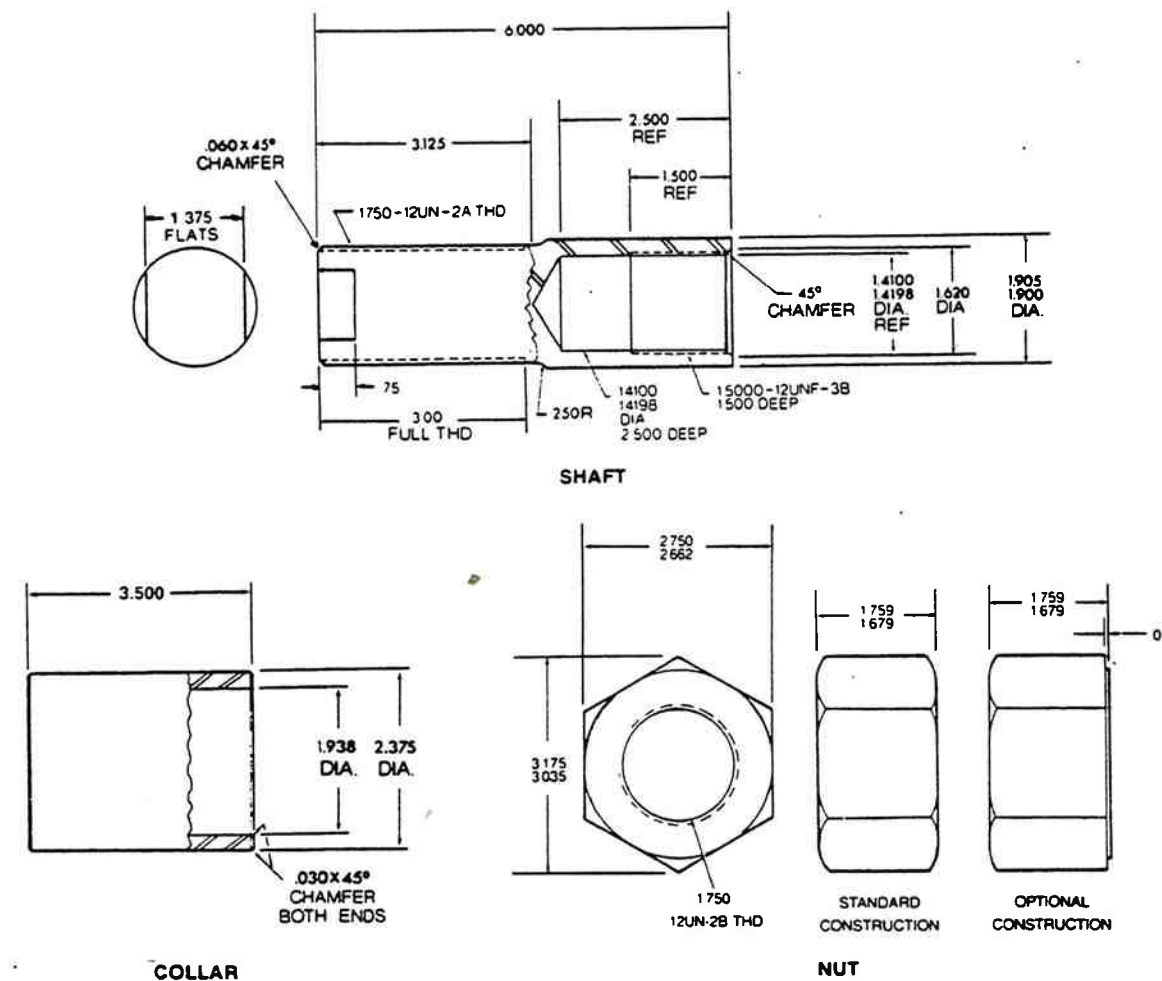
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SERVICE TOOLS

SOME OF THE TOOLS USED FOR THE MAINTENANCE PROCEDURES OUTLINED IN THIS SECTION ARE NONSTANDARD. THEY ARE, HOWEVER, AVAILABLE FOR PURCHASE FROM MOTOR COACH INDUSTRIES, TRANSPORTATION MANUFACTURING CORPORATION AND UNIVERSAL COACH PARTS. WHERE PRACTICAL, THEY MAY BE FABRICATED BY THE SERVICE FACILITY.



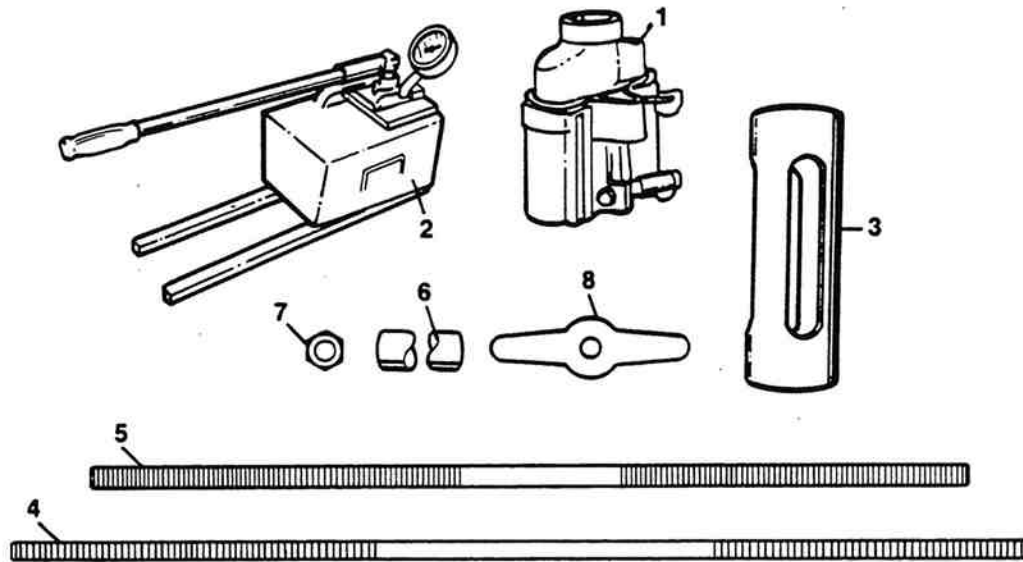
20-41 Trans. & Differential Flange, Holding Fixture For Torquing Nut



20-142 Tool Kit — Yoke or Companion Flange Installation
20-143 Shaft 20-144 Collar 20-145 Nut

MC-9 MAINTENANCE MANUAL

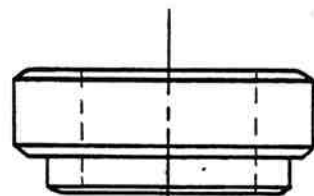
DRIVE AXLE TUBE PULLING TOOLS



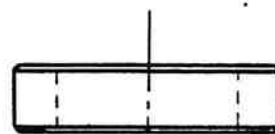
CONTENTS OF 20-313 SET

- 1 — 100 TON HYDRAULIC RAM
- 2 — TWO SPEED HYDRAULIC PUMP
- 3 — PULLER TUBE
- 4 — PULLER SCREW 71"
- 5 — PULLER SCREW 59"
- 6 — CONNECTING NUT
- 7 — HEX NUT
- 8 — ADJUSTING SPEED NUT

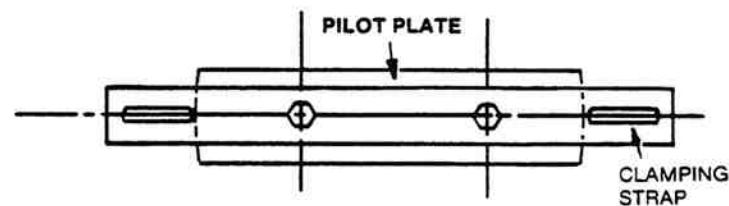
20-313 Axle Tube Pulling/Installing Set



* 20-314 PULLING ADAPTOR



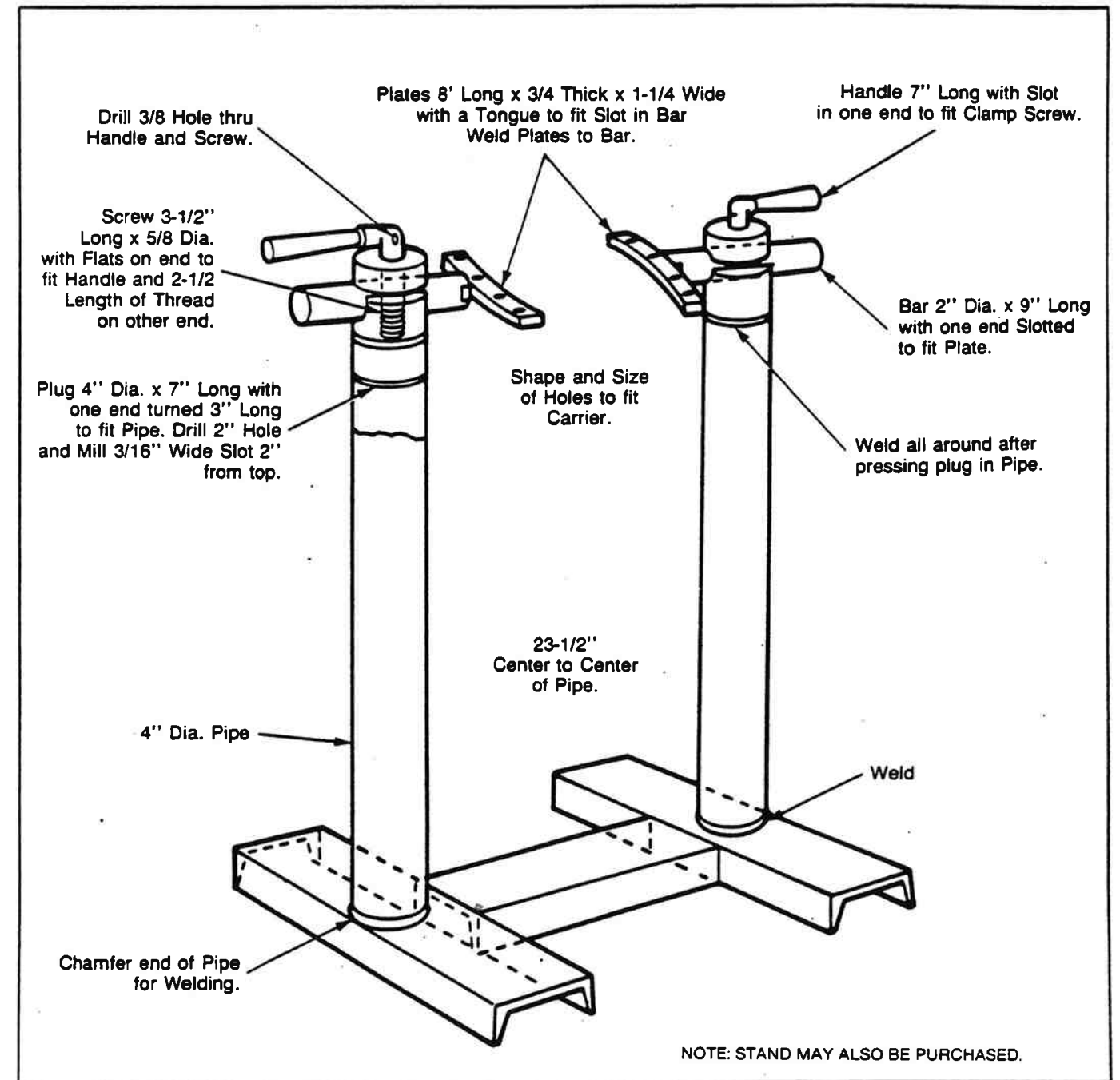
* 20-315 TUBE ADAPTOR



- * 20-316 CARRIER PILOT PLATE
- * 20-317 CLAMPING STRAP

* NOT INCLUDED IN 20-313 SET, BUT REQUIRED ALONG WITH SET - ORDER SEPARATELY.

MC-9 MAINTENANCE MANUAL



20-318 Differential Carrier Stand.

NOTE: STAND MAY ALSO BE PURCHASED.

