SECTION 4A

PROPELLER SHAFT

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: ***Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will also call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.***

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GENERAL DESCRIPTION

PROPELLER SHAFT

Torque is transmitted from the transmission to the rear axle through one or more propeller shafts. The number of propeller shafts vary with the vehicle wheel base and combination of transmission, transfer case, (front drive), and rear axle equipment (Figure 1). Propeller shafts have universal joints at each end to accommodate angle variations between the transmission and rear axle, and rear axle position caused by suspension motion. All propeller shafts are the balanced tubular type. The driveline is connected to the transmission with a splined slip joint (normal for a one-piece propeller shaft) (Figure 2) or a fixed yoke, normal for a two-piece and three-piece propeller shafts (Figure 3). If two or more propeller shafts are used on a vehicle, a center bearing is used. The center bearing is usually located near the rear of the front propeller shaft, and the slip joint is usually at the forward end of the rear propeller shaft.

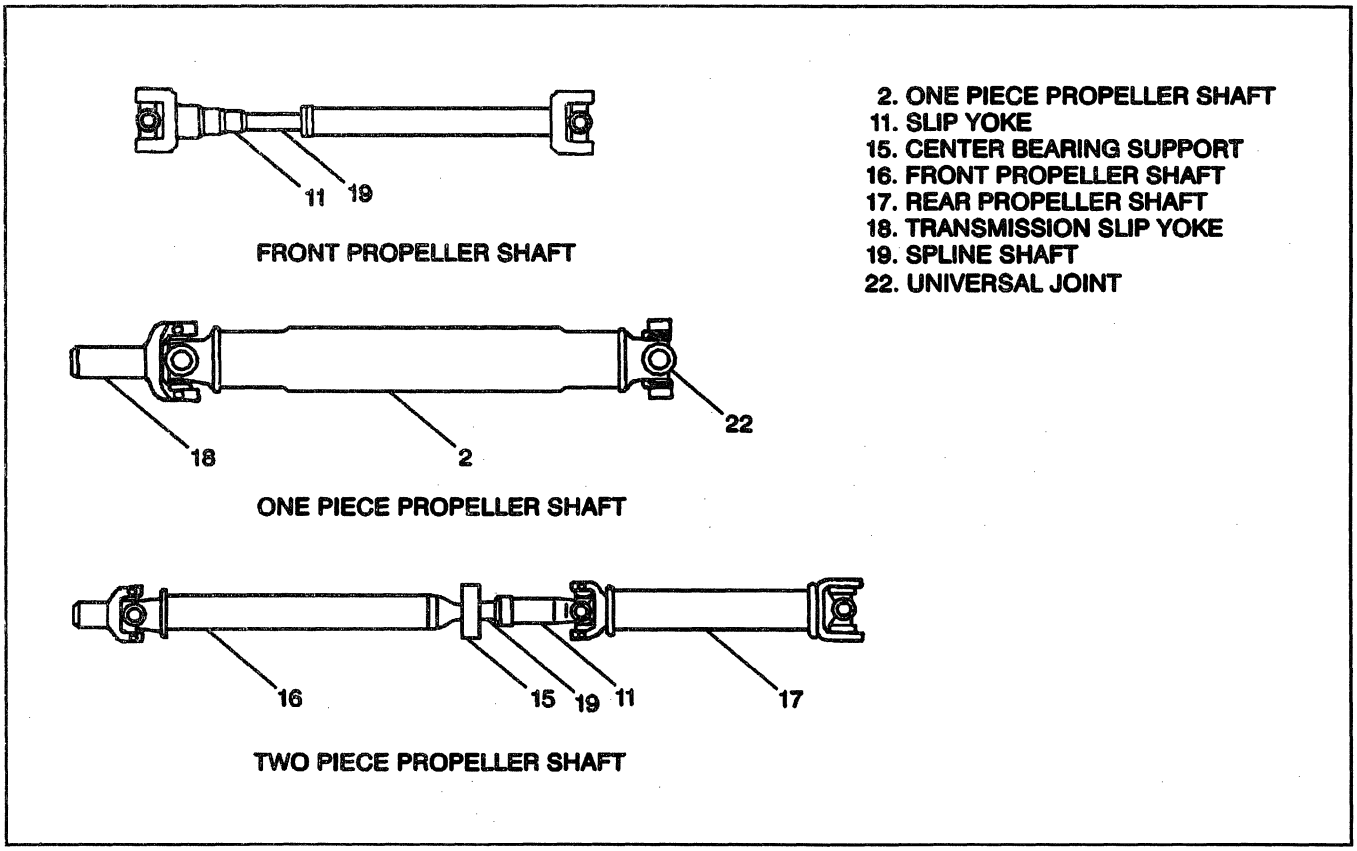


Figure 1—Propeller Shafts

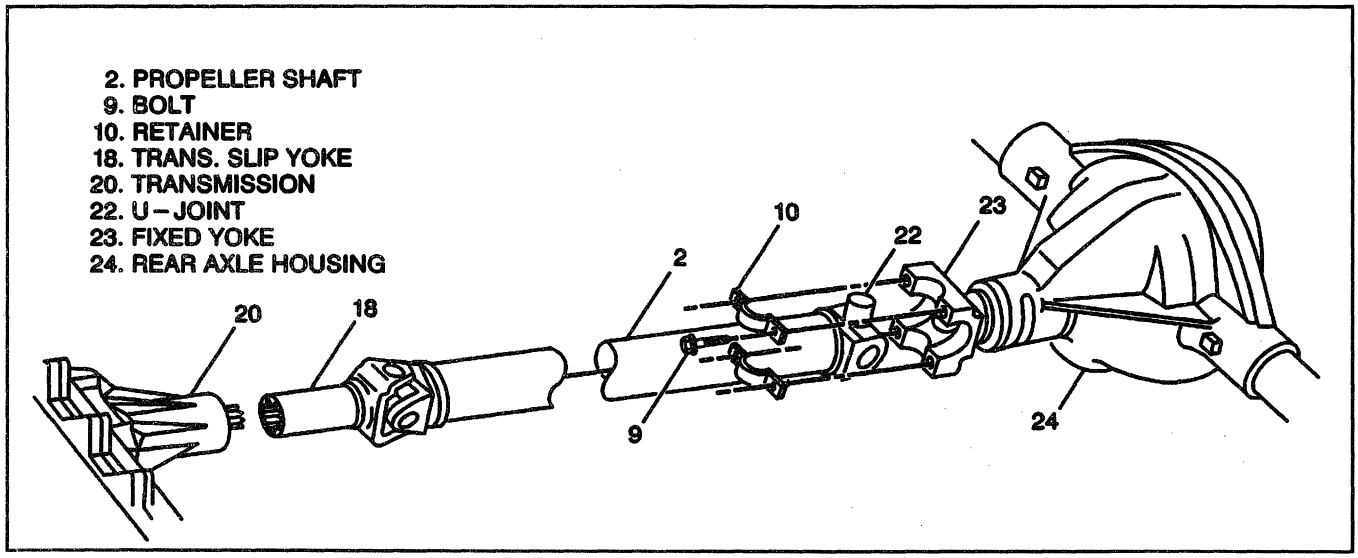
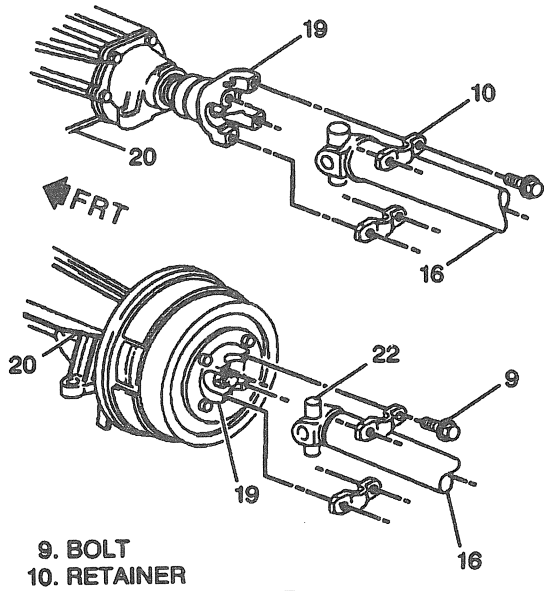


Figure 2—Transmission Slip Yoke

Phasing

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other. This design produces the smoothest running shaft possible, and is known as "in phase"(Figures 1 and 4).

An out of phase propeller shaft can cause vibration. The propeller shaft will generate vibration from speeding up and slowing down each time the universal joint goes around. This vibration would be the same as a person snapping a rope and watching the "wave" reaction flow to the end. An in phase propeller shaft would be similar to two persons snapping a rope at the same time, and watching the "waves" meet and cancel each other out. A total cancellation of vibration produces a smooth flow of power in the driveline. Since phasing of a propeller shaft is between the center universal joints, it is very important to reference mark the front and rear propeller shafts before removal to ensure proper phasing upon reinstallation. Some splined shaft slip yokes are keyed to ensure proper phasing.



9. BOLT
10. RETAINER
16. PROPELLER SHAFT
19. FIXED YOKE
20. TRANSMISSION
22. U-JOINT

Figure 3—Fixed Yoke Companion Flange

CENTER BEARING

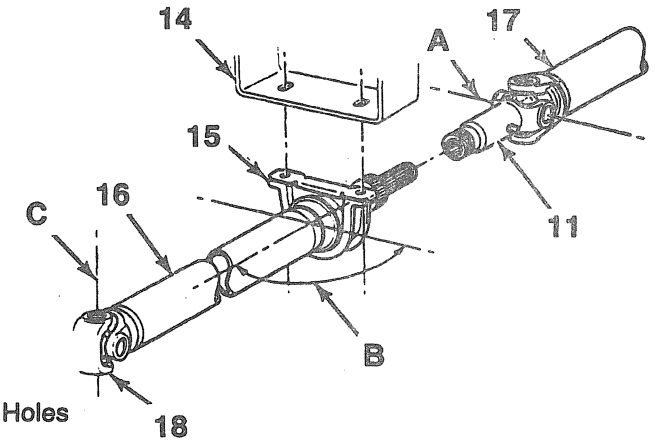
Center bearings support the driveline when two or more propeller shafts are used (Figure 4). The center bearing is a ball bearing mounted in a rubber cushion that is attached to a frame crossmember. The bearing is prelubricated and sealed by the manufacturer. The cushion allows vertical motion at the driveline and helps isolate the vehicle from vibration.

UNIVERSAL JOINT

Universal joints (Figure 5) are designed to handle the effects of various loadings and rear axle windup during acceleration and braking. Within the designed angle variations, the universal joint will operate efficiently and safely. When the design angle is changed or exceeded, the operational life of the joint may decrease.

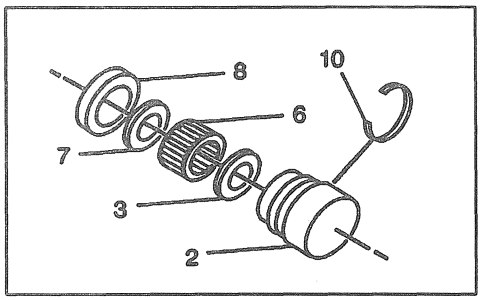
The trunnion bearings used in universal joints are the needle roller type. The needle rollers are held in place on the trunnions by round bearing cups. The bearing cups are held in the yokes by either snap rings or injected plastic.

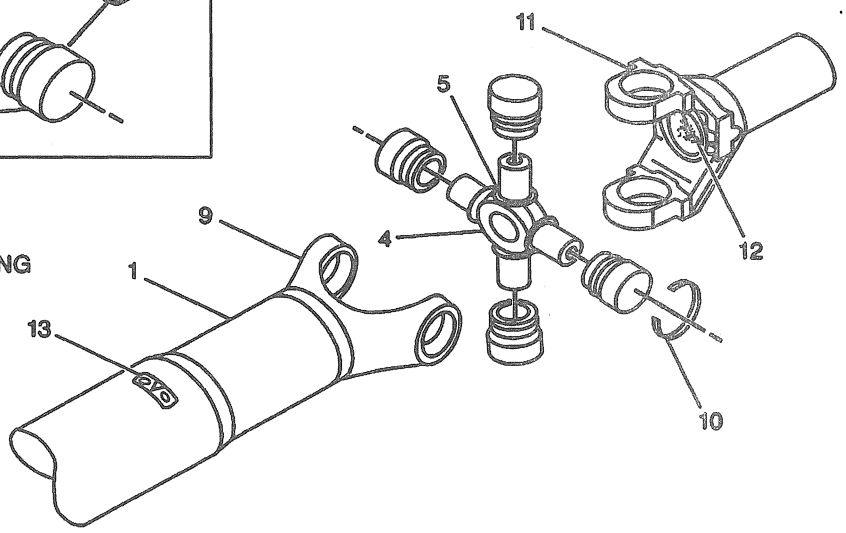
The OEM universal joints are lubricated for life and cannot be lubricated on the vehicle. A service kit which consists of a spider with bearing assemblies and snap rings may be installed if a universal joint becomes worn or noisy. If it becomes necessary to repair a universal joint, the propeller shaft must be removed from the vehicle. Take care to avoid jamming, bending, or over-angulating any parts of the propeller shaft assembly. Care should be taken to avoid damage to the propeller weld yokes and slip yoke ears upon installation or removal of U-joints.



11. Slip Yoke
14. Crossmember/Frame
15. Center Bearing Support
16. Front Propeller Shaft
17. Rear Propeller Shaft
18. Transmission Slip Yoke
A. Horizontal Center Line At The Yoke
B. 90 ± 1 Degree Angle for Slotted Hanger Holes
C. Vertical Center Line At The Yoke

Figure 4—Propeller Shaft Assembly in Phase





1. SHAFT, PROPELLER
2. CAP, UNIVERSAL JOINT BEARING
3. (NEEDLE BEARING), ROLLER
4. SPIDER, UNIVERSAL JOINT
5. RETAINER, SEAL
6. WASHER, BEARING
7. WASHER, SEAL
8. SEAL, UNIVERSAL JOINT
9. YOKE, WELD
10. RING, RETAINER
11. YOKE, SLIP
12. PLUG, DUST
13. WEIGHT, BALANCE

Figure 5—Universal Joint Components

DIAGNOSIS OF PROPELLER SHAFT AND UNIVERSAL JOINT

PROBLEM	POSSIBLE CAUSE	CORRECTION
Leak at the Front Slip Yoke. (An Occasional Drop of Lubricant Leaking from the Splined Yoke is Normal and Requires No Attention)	1. Slip yoke barrel burred, nicked, corroded, or worn. 2. Defective transmission rear oil seal.	1. Replace the seal. Minor burrs can be smoothed by careful use of crocus cloth or fine stone honing. Replace the yoke if badly burred. 2. Replace the transmission rear oil seal and replenish the transmission oil.
Ping, Snap, or Click in Drive Line (Usually Heard on Initial Load after the Transmission is in Gear; Forward or Reverse)	1. Loose bushing bolts on the rear springs or upper and lower control arms. 2. Loose fixed yoke or companion flange. 3. Worn or damaged universal joints.	1. Tighten the bolts to specified torque. 2. Tighten the bolts and pinion nut to specified torque. 3. Replace universal joints.
Knocking or Clunking Noise in the Driveline when Operating the Vehicle in High Gear or coasting in Neutral at 16 km/h (10 mph).	1. Worn or damaged universal joint. 2. Side gear hub counterbore in the differential is worn oversize.	1. Replace the worn or damaged universal joint. 2. Replace the differential case and/or the side gears.

DIAGNOSIS OF PROPELLER SHAFT AND UNIVERSAL JOINT (cont'd)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Roughness or Vibration	1. Bent or dented propeller shaft. 2. Undercoating on propeller shaft. 3. Tire unbalance, 48-80 km/h (30-50 mph). 4. Tight universal joints. 5. Worn universal joints. 6. Bent companion flange or flange with excessive runout. 7. Burrs or gouges on companion flange. Check snap ring locating surfaces on flange yoke. 8. Propeller shaft, parking brake drum, or companion flange is unbalanced. 9. Incorrect rear joint angle. The angle is usually too large when it is a factor. 10. Excessive looseness at the slip spline. 11. Distorted or damaged yokes or flanges. 12. Yokes out of phase on two-piece propshaft system. 13. Driveline vibration at 80 km/h (50 mph). 14. Propeller and axle flange paint marks misaligned by more than 90°.	1. Replace propeller shaft. 2. Clean propeller shaft. 3. Balance or replace as required. 4. On snap ring retainer U-joints, tap the yokes with a hammer to free up. If unable to free up or if joint feels rough, replace joint. 5. Replace. 6. Refer to SECTION 0C. 7. Deburr or replace the companion flange. 8. Check for a missing balance weight on all three components. Rotate the propeller shaft in the companion flange 180 degrees. 9. Check and correct trim height at curb weight. Check and correct joint angle. Refer to SECTION 0C. 10. Replace necessary parts. 11. Install new yokes or flanges. 12. Re-index propeller shaft. 13. Check propeller shaft runout and for missing balance weights. Refer to "Propeller Shaft Runout Check" in this section. 14. Align paint marks as close as possible.
Scraping Noise	Pinion flange, or center bearing rubbing.	Correct the interference.
Roughness Above 56 km/h (35 MPH) Felt and/or Heard	1.Tires unbalanced or worn.	1.Balance or replace as required.
Squeak	1. Lack of lubricant.	1. Replace universal joints as required.
Shudder on Acceleration (Low Speed)	1. Loose or missing bolts at the flanges. 2. Incorrectly set or excessive joint angle. 3. Worn universal joint.	1. Replace or tighten bolts to specified torque. 2. Shim under the transmission support mount to change the joint angle using standard shim P/N 1254001, or shim axle pinion down. 3. Replace.

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ON-VEHICLE SERVICE

PROPELLER SHAFT BALANCE CHECK

Important

- Never vent or fill the propeller shaft with an aerosol foam product. This will cause an excessive imbalance condition.
- Raise the vehicle on a hoist so the wheels can spin.
- In order to get an accurate check it is necessary to lift the vehicle by the axle or suspension to duplicate actual conditions. By doing this the pinion angle will be as close as possible to normal.

Remove or Disconnect (Figure 1)

1. Tire and wheel assemblies and the brake drums.

Inspect

- Propeller shaft, universal joints, and attachments for mud, undercoating, or loose fasteners.

Clean

- Propeller shaft, universal joints, and attachments.

Tighten

- Any loose attachments or fasteners.

CAUTION: Never run the vehicle higher than 89 km/h (55 mph). All persons should stay clear of universal joints and balance weight areas to avoid possible injury. Do not run the vehicle on the hoist for extended periods due to the danger of overheating the transmission or engine.

Measure

- Run the vehicle in gear at the speed where the disturbance peaks; observe the intensity of the disturbance. Refer to SECTION 0C.

CAUTION: Do not apply the brakes with the drums removed. System damage or personal injury may result.

2. Bolts from rear of pinion flange.
3. Retainers.
4. Propeller shaft.
   - Rotate the propeller shaft 180 degrees from the original position.

Install or Connect (Figure 1)

1. Propeller shaft.
2. Retainers.
3. Bolts into rear pinion flange.

Tighten

- Bolts to 20 N·m (15 lb. ft.).
- Bolts to 37 N·m (27 lb. ft.) (C 310 and C 314 over/under 15,000 GVW).

4. Rear drums and wheel and tire.
   - Determine the position which gives the best driveline response by road testing the vehicle for a final check of the propeller shaft balance.
   - If unacceptable balance/vibration, continue with "Propeller Shaft Runout Check" in this section.

PROPELLER SHAFT RUNOUT CHECK

Noise or vibration at high speed could be caused by a bent propeller shaft. The propeller shaft could have been damaged by rough handling or a collision. Check for propeller shaft straightness.

1. Raise the vehicle on a hoist so the wheels can spin.
2. Attach a dial indicator having a magnetic base to a smooth place on the vehicle underbody.
3. Take dial indicator readings at the propeller shaft check points (Figures 6 and 7).

PROPELLER SHAFT	FRONT CHECK	CENTER CHECK	REAR CHECK
One Piece	0.025"	0.050"	0.025"
Two Piece Driveshaft:			
Front Piece	0.025"	0.005"*	
Rear Piece		0.030"†	0.030"
*NOTE: This measurement must be taken on the ground surface near the spline, with the rear propeller shaft removed.			
†NOTE: This measurement must be taken with the rear propeller shaft mounted on the front shaft which is within specifications. T2568			

Figure 6—Propeller Shaft Runout Specifications

Important

- Do not attach the dial indicator base at a weld.
- The indicator base must not rock.

4. With the transmission in neutral, hand rotate one wheel or the axle pinion flange or the transmission yoke and take the necessary dial indicator readings on the propeller shaft. Record the readings. On models having a two-piece driveline, measure the rear propeller shaft runout (Figure 7).
5. Reference mark the position of the rear propeller shaft yoke to the pinion flange, then remove the rear propeller shaft and measure the front propeller shaft runout on the tube and at the specified location on the splined shaft end (Figure 7).

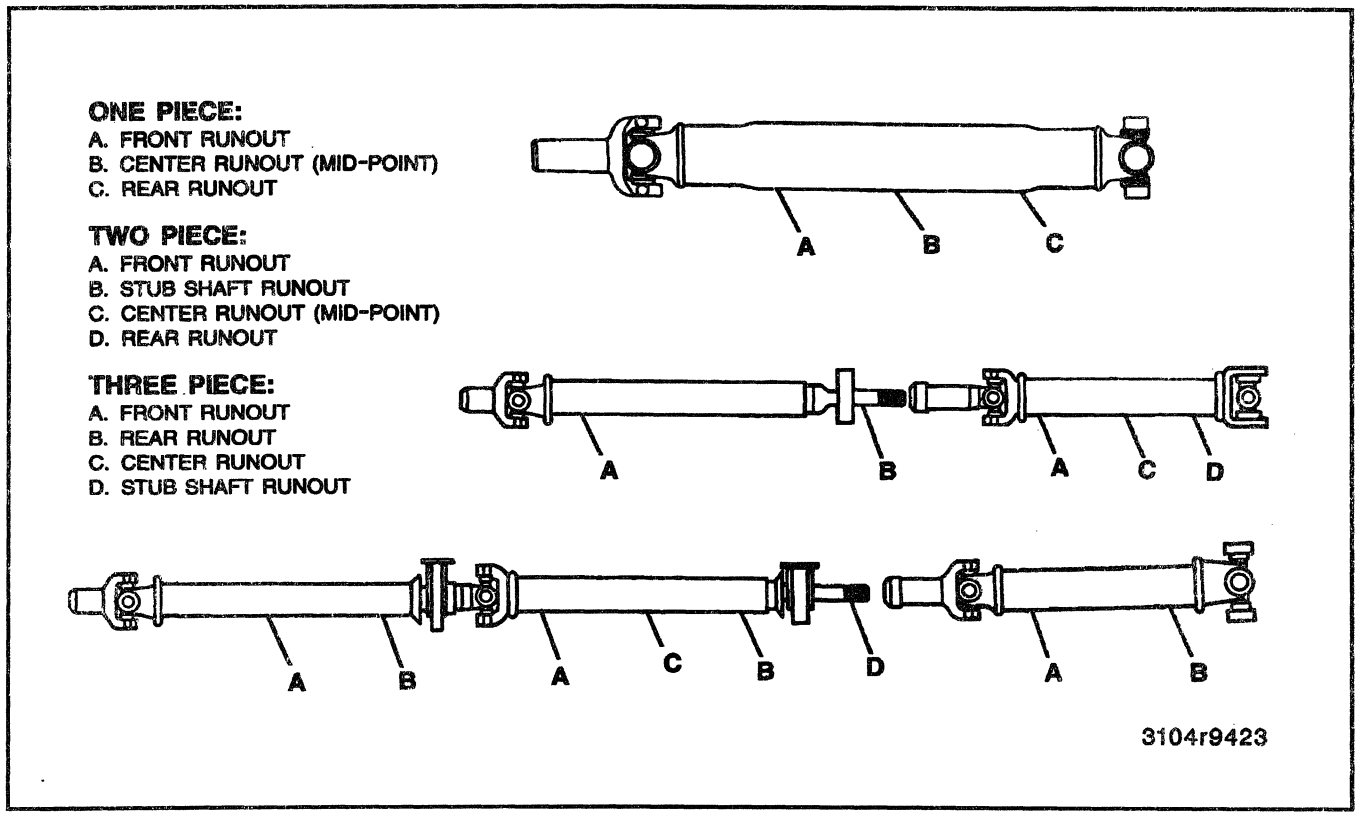

Figure 7—Propeller Shaft Runout Check Points

6. If the runout exceeds specification, rotate the propeller shaft 180 degrees at the companion flange and install. Check the runout.
7. If the propeller shaft runout is over specification, check for a damaged companion flange. Refer to SECTION 0C.
8. If the runout is still over specification (Figure 6) at one or more check points, replace the propeller shaft after checking for vibration or noise.
   - Check the runout on the replacement propeller shaft.

Important

- The splined end of the front propeller shaft is critical to the smooth operation of a two-piece driveline. Be sure the dial indicator readings are accurate.

REAR PROPELLER SHAFT REPLACEMENT (REAR DRIVE)

Important

- It is essential that the positions of all driveline components relative to the propeller shaft and axles be observed and accurately reference marked prior to disassembly. These components include the propeller shafts, drive axles, pinion flanges, output shafts, etc. All components must be reassembled in the exact relationship to each other as they were when removed. In addition, published specifications and torque values, as well as any measurements made prior to disassembly, must be followed.
  - Reference mark the propeller shaft to pinion flange connection.
  - Reference mark slip yoke to transmission for proper reassembly
  - For two-piece American Axle and Manufacturing propeller shaft, unscrew threaded cap on center slip yoke.
  - For two-piece Dana propeller shaft, pull the stub shaft out of the slip yoke (Figure 10).
  - When servicing driveshafts with the pop on seal, do not remove the seal from the sleeve. Removal of the seal causes damage to the seal lip where it contacts the sleeve yoke. If removal of the seal is necessary, it should be replaced with a new unit.

Remove or Disconnect (Figures 8 and 9)

- Raise vehicle on a hoist.

1. Front differential carrier shield, if used. Refer to "Front Differential Carrier Shield" in SECTION 4C.
2. Bolts.
3. Retainers.

Important

- Do not pound on the propeller shaft yoke ears. The injection joints may fracture. Never pry or place any tool between a yoke and a universal joint.

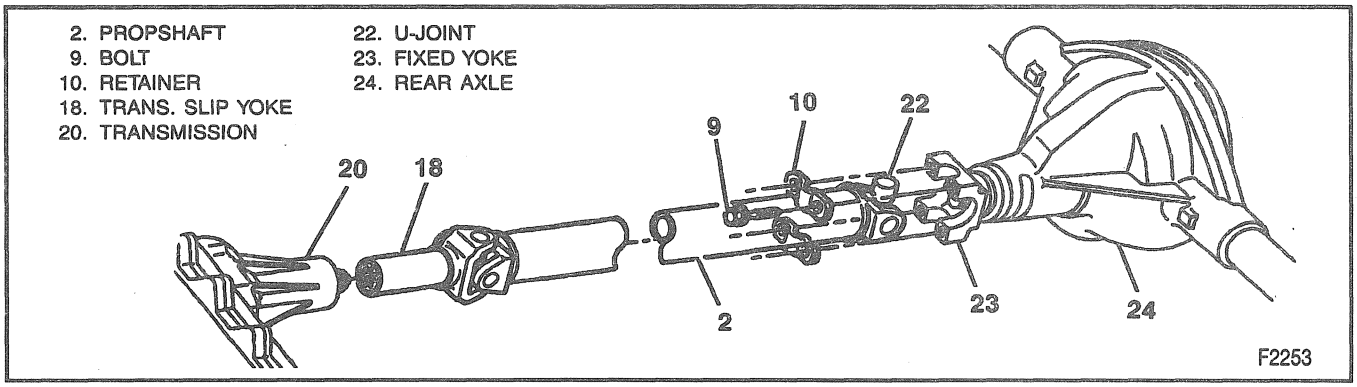

Figure 8—One-Piece Propeller Shaft

4. Yoke and cross assembly.
   - Tape bearing cups to prevent the loss of bearing rollers.
5. Propeller shaft.
   - Slide the propeller shaft forward.
   - Lower the propeller shaft and remove.
   - Do not allow the universal joint to incline greatly; the joint may fracture.
6. Center bearing support.
7. Front propeller shaft.
   - Always support the propeller shaft.
   - Do not allow the universal joint to bend deeply as the universal joint could fracture.
   - Remove the propeller shaft with a rearward movement.

Clean

- All parts with an approved solvent.

Inspect

1. Outer diameter of transmission yoke for burrs. Any burring will damage the transmission seal.
2. For proper installation and uniform seating of bearing cups.
3. Slip yoke splines for wear.
4. For twisted slip yoke splines or possibly the wrong universal joint.
5. Universal joint bearings for wear. Replace as necessary.

Install or Connect (Figures 8 and 9)

One-Piece Propeller Shaft (Figure 8)

1. Propeller shaft into the transmission.
   - Lubricate slip joint spline with chassis grease.
2. Align the reference marks on the pinion flange and the propeller shaft rear yoke.
3. Yoke and cross assembly onto the fixed yoke.
4. Retainers.
5. Bolts.

Tighten

- Bolt to 20 N·m (15 lb. ft.).

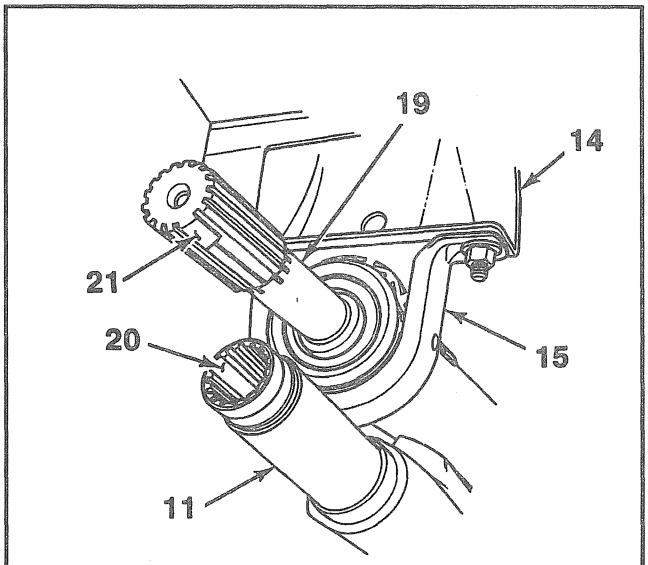

Figure 9—Splined Shaft Indexing

Two-Piece Propeller Shaft (Figure 1)

1. Propeller shaft into the transmission.
   - Be sure the slip joint splines are lubricated.
   - Bottom the propeller shaft yoke in the transmission.
2. Center bearing support.
   - Align the center bearing support 90 degrees to the propeller shaft center lines (Figure 4).
3. Center bearing support bolts.

Tighten

- Center bearing support bolts to 35 N·m (26 lb. ft.).

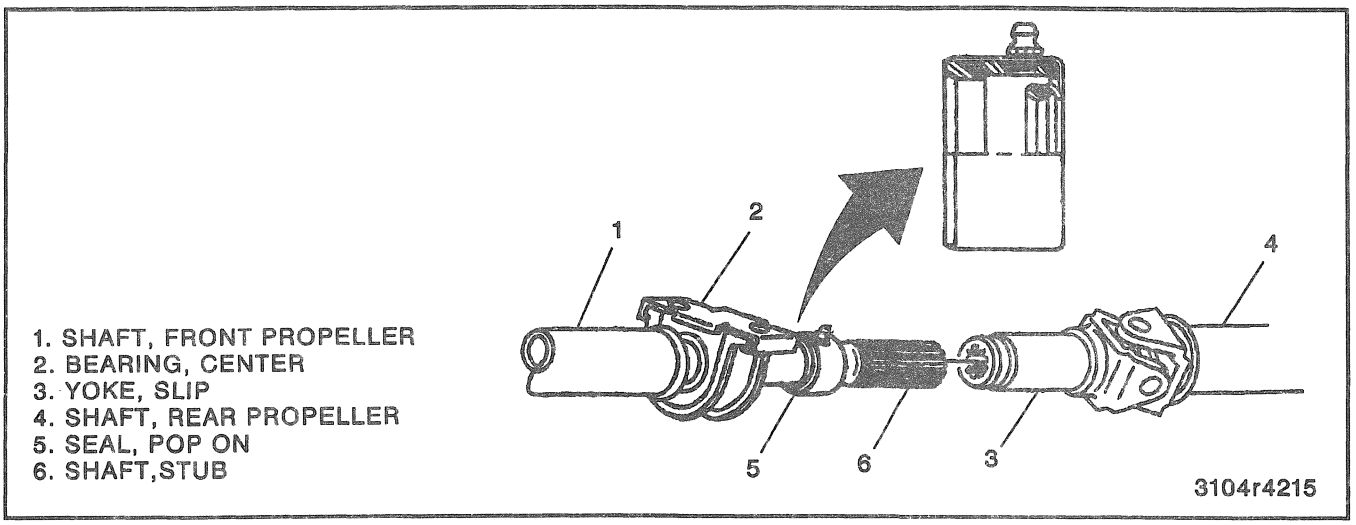

Figure 10—Two-Piece Propeller Shaft (Dana)

Important

- Set the transmission yoke ears in a vertical position for proper phasing.
- Locate the bridged tooth (21) on the splined shaft (Figure 9).

4. Slip yoke onto the splined shaft.
   - Mate the missing tooth in the yoke with the bridged tooth on the splined shaft (Figure 9).
   - Support the propeller shaft.
   - Be sure the slip yoke ears are horizontal.
5. Propeller shaft.
   - Align reference marks.
6. Retainers.
7. Bolts.

Tighten

- Bolts to 20 N·m (15 lb. ft.).
- Bolts to 37 N·m (27 lb. ft.) (C 310 and C314 over 15,000 GVW).

8. Front differential carrier shield, if used.
   - Check for proper joint fit.
9. Lubricate the slip yoke.
10. Lubricate the center slip joint on two-piece shaft.

Three-Piece Propeller Shaft

Remove or Disconnect (Figures 4 and 11).

- Raise the vehicle on a hoist.

Important

- It is essential that the positions of all driveline components relative to the propeller shaft and axles be observed and accurately reference marked prior to disassembly. These components include the propeller shafts, drive axles, pinion flanges, output shafts, etc. All components must be reassembled in the exact relationship to each other as they were when removed. In addition, published specifications and torque values, as well as any measurements made prior to disassembly, must be followed.

1. Reference mark the rear propeller shaft to pinion flange connection.
2. Support the rear propeller shaft.
3. Bolts from pinion flange.
4. Retainers.
5. Yoke and universal joint assembly from pinion flange.

Important

- Do not pound on the original propeller shaft yoke ears. The plastic injection joints may fracture. Never pry or place any tool between a yoke and a universal joint.
- Tape bearing cups onto yoke to prevent the loss of bearing rollers.

6. Rear propeller shaft.
   A. Slide the rear propeller shaft forward.
   B. Lower the rear propeller shaft and withdraw under the rear axle.
   C. Do not allow the universal joint assembly to incline greatly. The joint may fracture.
   D. Reference mark the intermediate propeller shaft to front propeller shaft yoke.
   E. Support the intermediate propeller shaft.
7. Bolts from front propeller shaft yoke at front center bearing support.
8. Retainers.
9. Nuts from intermediate shaft center bearing support.
10. Bolts and washers.
11. Intermediate propeller shaft center bearing support from hanger.
12. Yoke and universal joint assembly from front propeller shaft rear yoke.

Important

- Do not pound on the original propeller shaft yoke ears. The plastic injection joints may fracture. Never pry or place any tool between a yoke and a universal joint.
- Tape bearing cups onto yoke to prevent the loss of bearing rollers.

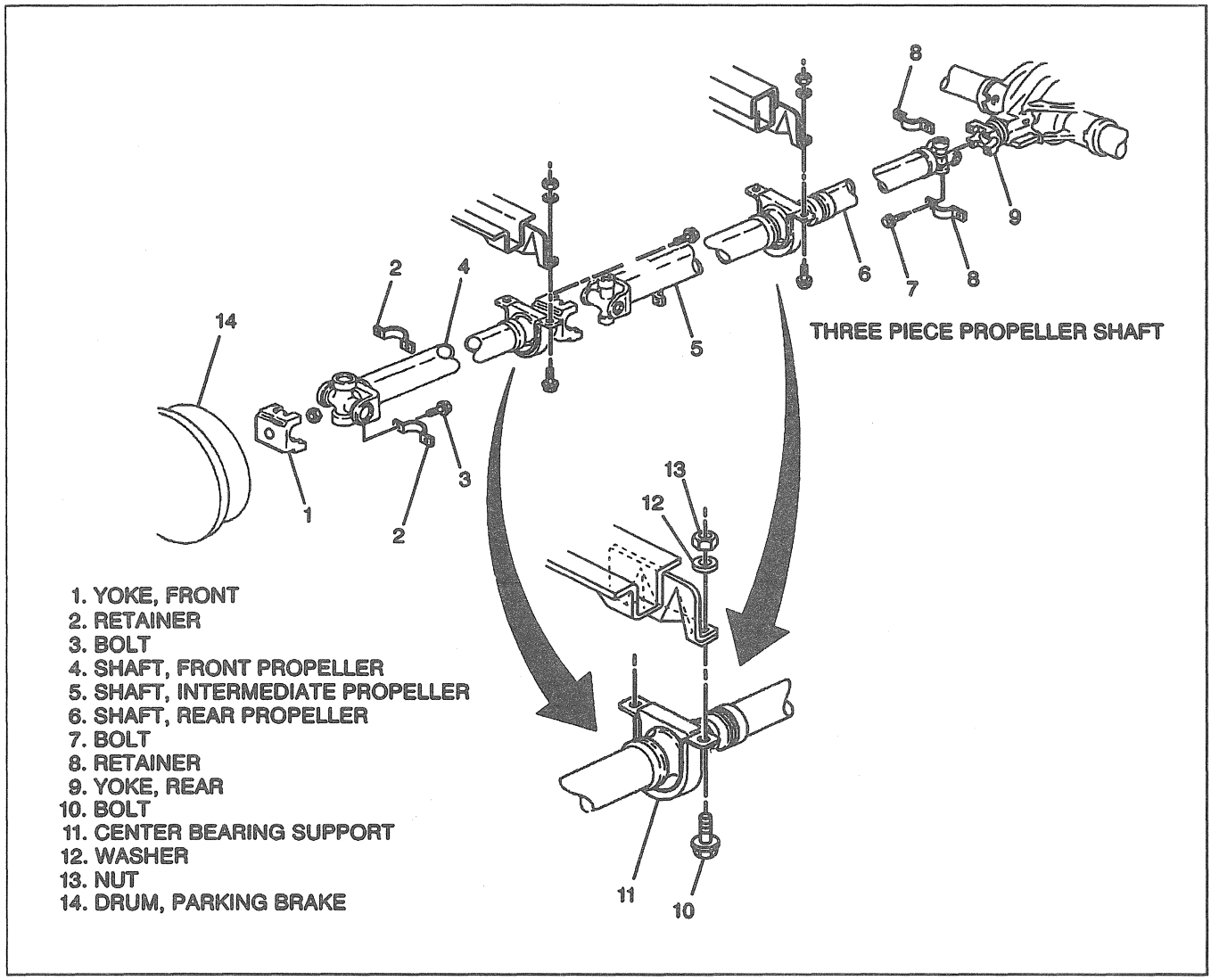

Figure 11—Three-Piece Propeller Shaft

13. Intermediate propeller shaft.
    - Reference mark the front propeller shaft to the yoke or parking brake drum.
    - Support the front propeller shaft.
14. Bolts and retainers from yoke.
15. Nuts from front propeller shaft center bearing support.
16. Bolts and washers.
17. Front propeller shaft center bearing support from hanger.
18. Universal joint assembly from transmission yoke.

Important

- Do not pound on the original propeller shaft yoke ears. The plastic injection joints may fracture. Never pry or place any tool between a yoke and a universal joint.
- Tape bearing cups onto yoke to prevent the loss of bearing rollers.

19. Front propeller shaft.

Clean

- All parts with an approved solvent.

Inspect

- For proper installation and uniform seating of all universal joint bearing cups.
- Intermediate propeller shaft to rear propeller shaft slip yoke splines for twisting or wear.
- Inside of rear propeller shaft slip yoke for spline twisting or wear.
- Front and rear center bearing support rubber insulators for deterioration or separation from the support framework.
- Propeller shaft assemblies for damage.

Install or Connect (Figures 4 and 11)

1. Front propeller shaft to yoke.
   - Make sure the reference marks are aligned.
   - Support front propeller shaft.
2. Bolts and retainers to yoke.

Tighten

- Bolts to 20 N·m (15 lb. ft.).

3. Front center bearing support to hanger.
   - Align the center bearing support 90 degrees to the propeller shaft center line. Refer to Figure 4.
4. Bolt and washers.
5. Nuts.

Tighten

- Nuts to 35 N·m (26 lb. ft.). Maintain alignment (Figure 11).

6. Intermediate propeller shaft to front propeller shaft yoke.
   - Make sure reference marks are aligned.
   - Support intermediate propeller shaft.
7. Bolts and retainers.

Tighten

- Bolts to 35 N·m (26 lb. ft.).
- Nuts to 35 N·m (26 lb. ft.).

8. Rear center bearing support to hanger.
   - Align the center bearing support 90 degrees to both the front and intermediate propeller shaft centerlines (Figure 11).
9. Bolts and washers.
10. Nuts.

Tighten

- Nuts to 35 N·m (26 lb. ft.). Maintain alignment (Figure 11).
- Support the rear propeller shaft.

11. Rear propeller shaft to rear axle pinion flange.
    - Make sure reference marks are aligned.
12. Bolts and retainers.

Tighten

- Bolts to 37 N·m (27 lb. ft.).

CENTER BEARING REPLACEMENT

Remove or Disconnect (Figure 11)

- Raise vehicle and support with safety stands.

1. Rear propeller shaft. Refer to "Propeller Shaft Replacement (Rear Drive)" in this section.
2. Front or intermediate propeller shaft.
3. Center bearing.
   - Stand propeller shaft on end in press with center bearing supported by press bars.
   - Press propeller shaft down and off center bearing.

Install or Connect (Figure 4)

1. Center bearing onto propeller shaft.
   - Press center bearing onto shaft using a press.
2. Front or intermediate propeller shaft.

Important

- Center bearing must be aligned to prevent damage to propeller shaft assembly.
- When bolting center bearing in place, be sure to keep it perpendicular (90° +/- 1°) to the propeller shaft, (Figure 4).

3. Rear propeller shaft. Refer to "Propeller Shaft Replacement (Rear Drive)" in this section.

Tighten

- Nuts to 35 N·m (26 lb. ft.).

4. Remove safety stands and lower vehicle.

SYSTEM BALANCED PROPELLER SHAFT ASSEMBLY REPLACEMENT

Important

- If one propeller shaft of a system balanced assembly is replaced, the mating shaft must be rebalanced with the replaced shaft. System balanced propeller shafts have a notice affixed to them similar to Figure 12.

Remove or Disconnect (Figure 4)

- Raise the vehicle on a hoist.
- Reference mark all propeller shaft related components for reassembly including flanges and yokes.

Important

- Center slip yokes to spline shafts, end yokes, companion flanges, etc. must not be rotated from their original position during reassembly.

1. Bolts and retainers.
2. Propeller shaft.

Clean

- Propeller shaft, universal joints, and attachments with an approved solvent.

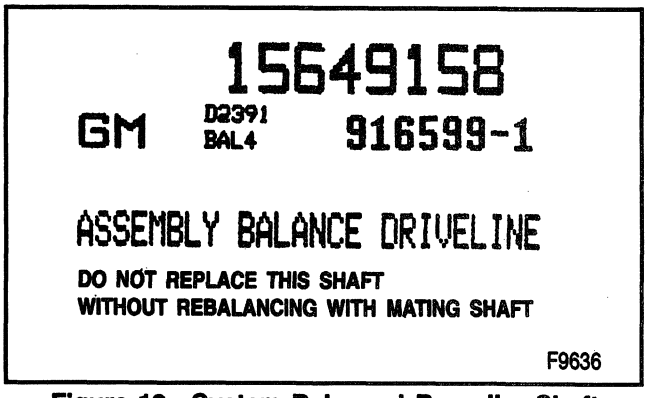

Figure 12—System Balanced Propeller Shaft Assembly Notice

Install or Connect

1. Propeller shaft.
2. Bolts and retainers.

Tighten

- Bolts to 20 N·m (15 lb. ft.).
- Bolts to 37 N·m (27 lb. ft.).

PROPELLER SHAFT REPLACEMENT (FRONT DRIVE)

Remove or Disconnect (Figure 13)

- Raise the vehicle on a hoist.
- Remove front differential carrier shield, if used. Refer to "Front Differential Carrier Shield" in SECTION 4C.

Important

- It is essential that the positions of all driveline components relative to the propeller shaft and axles be observed and accurately reference marked prior to disassembly. These components include the propeller shafts, drive axles, pinion flanges, output shafts, etc. All components must be reassembled in the exact relationship to each other as they were when removed. In addition, published specifications and torque values, as well as any measurements made prior to disassembly, must be followed.

1. Reference mark the relationship of the propeller shaft to the front axle and the transfer case flange.
2. Bolts and retainers from front axle.
3. Bolts and retainers from transfer case.

Important

- Do not pound on the propeller shaft to disconnect.

4. Propeller shaft.

- Compress the propeller shaft forward, enough to disengage, then move the propeller shaft rearward.
- Avoid dropping bearing cap assemblies from the yoke ends.

Clean

- All parts with an approved solvent.

Inspect

- Splines for damage, wear, burrs, and twisting.
- Universal joint bearings for wear.
- Propeller shaft for any evidence of damage.

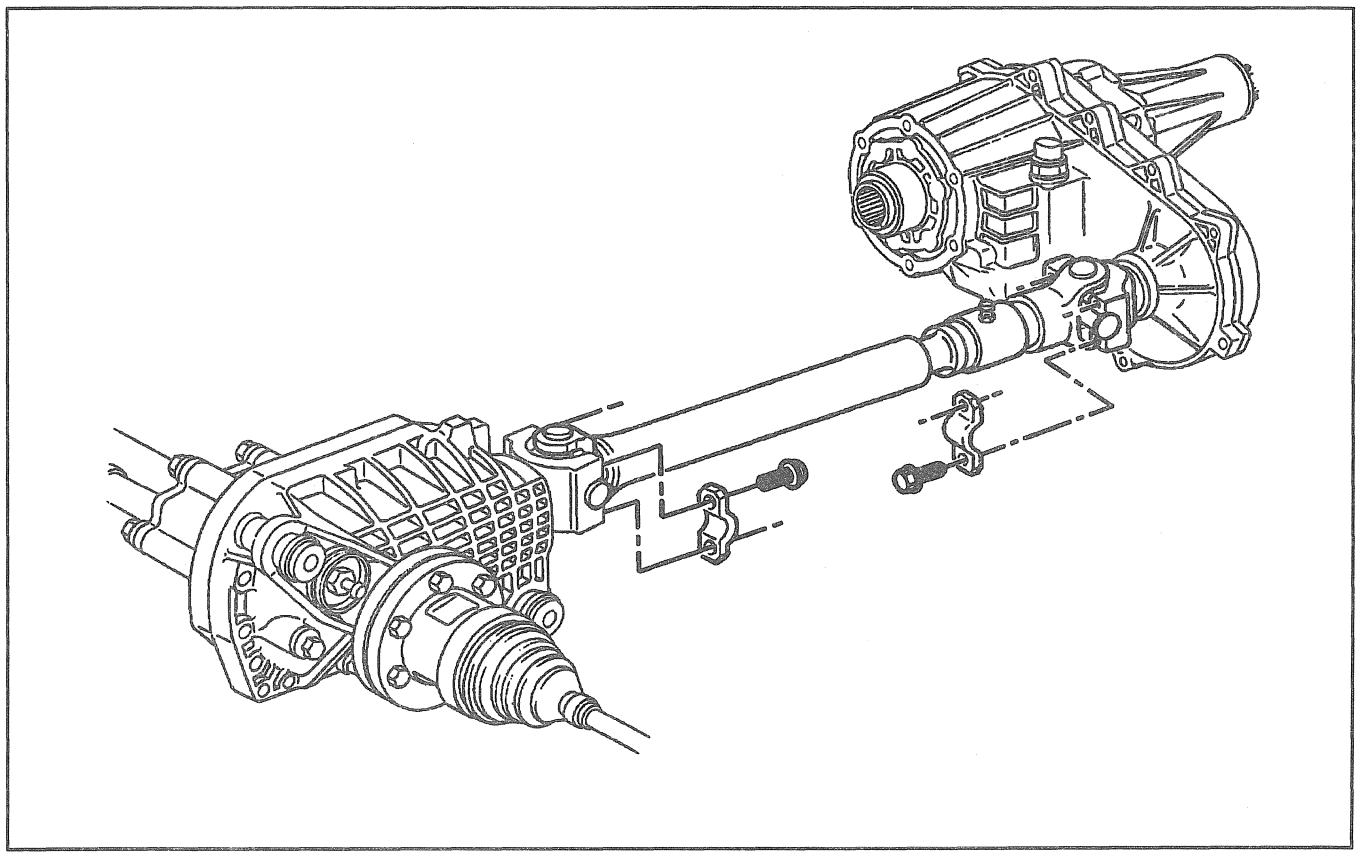

Figure 13—Front Drive Propeller Shaft

Install or Connect (Figure 13)

- Extend the propeller shaft to its full length, then compress it about half its stroke.

1. Propeller shaft to front axle.
   - Line up the reference marks made previously.
2. Retainers and bolts.

Tighten

- Retainer bolts to 20 N·m (15 lb. ft.).

3. Propeller shaft to transfer case.
   - Line up the reference marks made previously.
   - Adjust the propeller shaft length.
   - Support the propeller shaft.
4. Retainers and the bolts.

Tighten

- Retainer bolts to 20 N·m (15 lb. ft.).

5. Front differential carrier shield, (if equipped). Refer to "Front Differential Carrier Shield" in SECTION 4C.

Slip Yoke Splines

Apply chassis lubricant at the slip spline grease fitting until the grease begins to leave through the vent hole.

If the slip spline is dry or corroded, it may be necessary to disconnect the propeller shaft from the vehicle, remove the slip yoke, and wire brush the affected area. Wipe clean before installation.

UNIVERSAL JOINTS

Nylon Injected Ring Type

NOTICE: ***Never clamp propeller shaft tubing in a vise. Clamping could dent or deform the tube causing an imbalance or unsafe condition. Always clamp on one of the yokes and support the shaft horizontally. Avoid damaging the slip yoke sealing surface. Nicks may damage the bushing or cut the lip seal.***

Tools Required:
J 9522-3 Universal Joint Bearing Separator
J 9522-5 Universal Joint Bearing Spacer Remover

- Support the propeller shaft in a line horizontal with the table of a press.
- Mark the propeller shaft as to which end is the transmission end and which end goes to the rear axle.
- Place the universal joint so that the lower ear of the yoke is supported on a 30mm (1 1/8 inch) socket (Figure 14).
- In order to shear the plastic retaining ring on the bearing cup, place J 9522-3 on the open horizontal bearing cups and press the lower bearing cup out of the yoke ear. If the bearing cup is not completely removed, lift the cross and insert tool J 9522-5 between the seal and bearing cup being removed and continue to press it out of the yoke (Figure 15).
- Rotate the propeller shaft and press the opposite bearing cup out of the yoke.

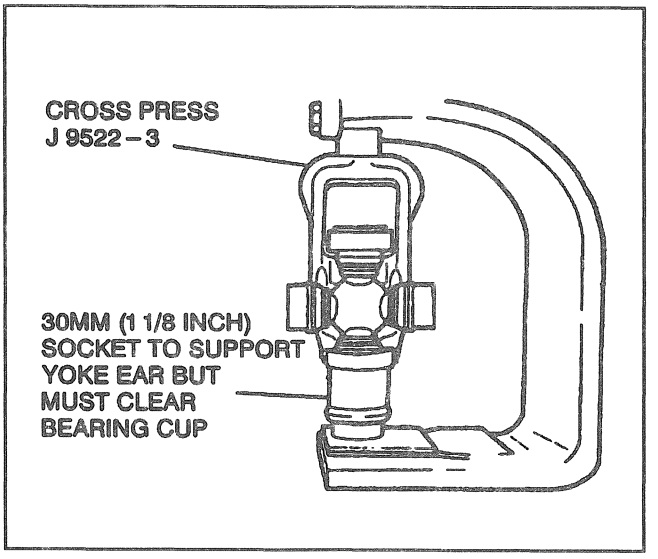

Figure 14—Pressing Out Universal Joint

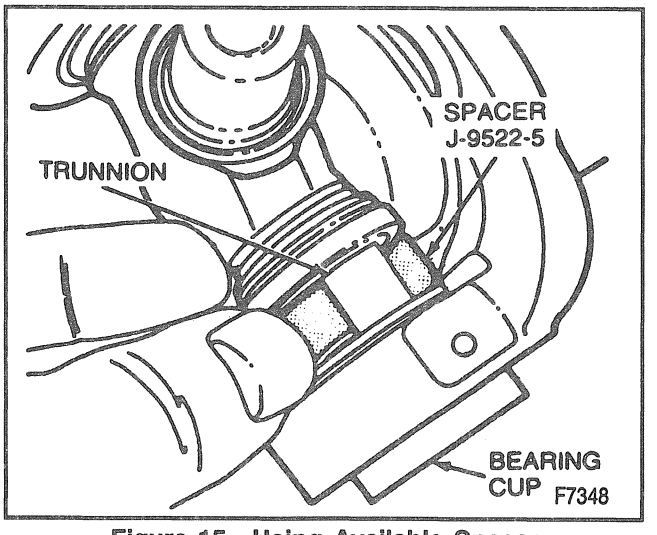

Figure 15—Using Available Spacer

Disassemble

- Mark orientation of slip yoke to tube for proper reassembly.

1. The cross from the yoke.
2. Remaining universal joint parts from the yoke.
   - If the front universal joint is being replaced, remove the bearing cups in the slip yoke in the same manner.

Inspect

A. The retaining ring grooves for plastic.
B. The bearing cup bores in the yoke ears for burrs or imperfections.

Clean

- The remains of the sheared plastic bearing retainers from the grooves in the yoke.

- The sheared plastic may prevent the bearing cups from being pressed into place and thus prevent the bearing retainers from being properly seated.

Assemble

- Remove the bearing cups from the universal joint and use your finger to coat the needle bearings in the bearing cup with a thin layer of chassis grease.

1. One bearing cup part way into one side of the yoke (Figure 16).
   - Turn the yoke ear toward the bottom.
2. Cross into the yoke so the trunnion seats freely into the bearing cup.
   - With the trunnion seated in the bearing cup press the bearing cup into the yoke until it is flush with the yoke ear.
3. The opposite bearing cup part way into the yoke ear.
   - Make sure that the trunnions are started straight and true into both bearing cups (Figure 17).
   - Press the opposite bearing cup into the yoke ear while working the cross all the time to check for free unbinding movement of the trunnions in the bearing cups.
   - Press the bearing cup into the yoke until the bearing retainer groove clears the inside of the yoke.

Important

- If there seems to be a hangup or binding, stop pressing, and check the needle bearings for misalignment in the bearing cup.

4. Bearing retainer in the retainer groove (Figure 18).
   - Continue to press until both retainers can be snapped into place.
   - If the retainer is difficult to seat, the yoke can be sprung slightly with a firm blow from a dead blow hammer (Figure 19).
   - It may be necessary to lubricate the snap ring with a slight amount of chassis grease so it seats in the bearing cup groove.

External Snap Ring Type

NOTICE: ***Never clamp propeller shaft tubing in a vise. Clamping could dent or deform the tube causing an imbalance or unsafe condition. Always clamp on one of the yokes and support the shaft horizontally. Avoid damaging the slip yoke sealing surface. Nicks may damage the bushing or cut the lip seal.***

Tools Required:
J 9522-3 Universal Joint Bearing Separator
J 9522-5 Universal Joint Bearing Remover Spacer

- Support the propeller shaft in a line horizontal with the table of a press.
- Mark the propeller shaft to show which end connects to the transmission and which end goes to the rear axle.

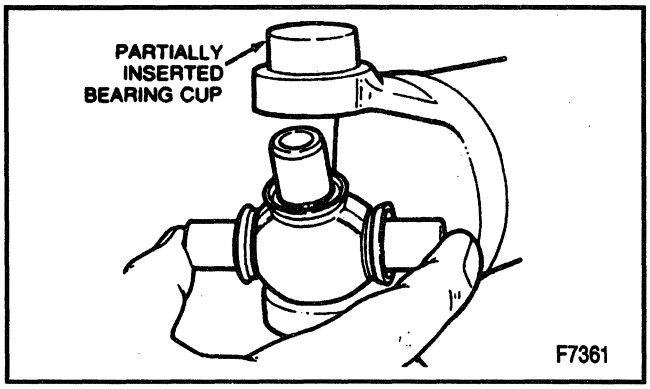

Figure 16—Partially Inserted Bearing Cup

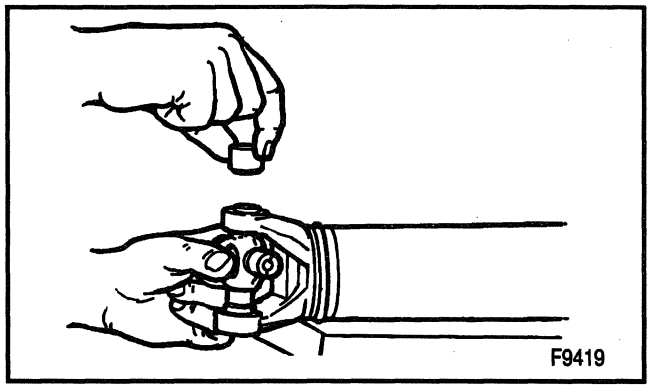

Figure 17—Aligning the Trunnion Between the Bearing Cups

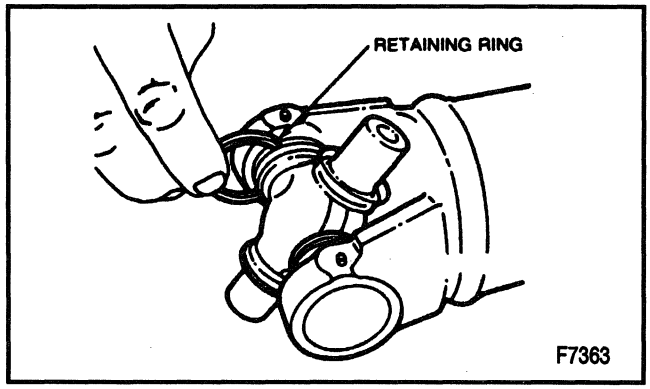

Figure 18—Installing Retaining Ring

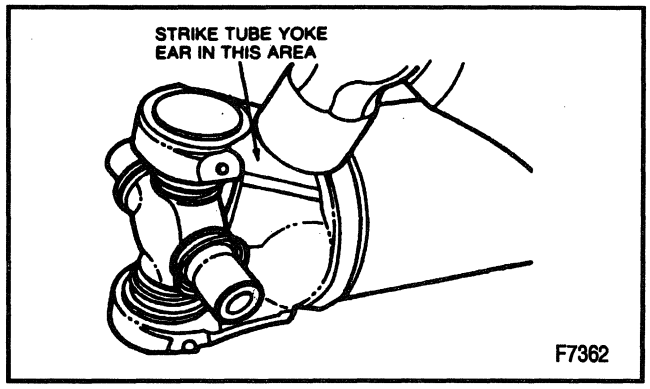

Figure 19—Seating the Universal Joint Snap Ring

Disassemble

1. Snap rings by pinching the ends together with a pair of pliers.
   - If the ring does not readily snap out of the groove in the yoke, tap the end of the bearing cup lightly to relieve the pressure from the ring.
   - Place the universal joint so the lower ear of the yoke is supported on a 30mm (1 1/8 inch) socket (Figure 14).
   - Place J 9522-3 on the open horizontal bearing cups and press the lower bearing cup out of the yoke ear. If the bearing cup is not completely removed, lift the cross and insert tool J 9522-5 between the seal and bearing cup being removed and continue to press it out of the yoke (Figure 15).
   - Rotate the propeller shaft and press the opposite bearing cup out of the yoke.

Disassemble

- Mark orientation of slip yoke to tube for proper reassembly.

1. The cross from the yoke.
2. Remaining universal joint parts from the yoke.
   - If the front universal joint is being replaced, remove the bearing cups in the slip yoke in the same manner.

Inspect

- The retaining ring grooves for dirt, corrosion, or pieces of the old ring.
- The bearing cup bores for burrs or imperfections.

Clean

- The retaining ring grooves.
- Corrosion, dirt, rust, or pieces of the old retaining ring may prevent the bearing cups from being pressed into place or prevent the bearing retainers from being properly seated.

Assemble

- Remove the bearing cups from the universal joint and use your finger to coat the needle bearings in the bearing cup with a thin layer of chassis grease.

1. One bearing cup part way into one side of the yoke (Figure 16).
   - Turn the yoke ear toward the bottom.
2. Cross into the yoke so that the trunnion seats freely into the bearing cup.
   - With the trunnion seated in the bearing cup press the bearing cup into the yoke until it is flush with the yoke ear (Figure 17).
3. The opposite bearing cup part way into the yoke ear.
   - Make sure that the trunnions are started straight and true into both bearing cups.
   - Press the opposite bearing cup into the yoke ear while working the cross all the time to check for free unbinding movement of the trunnions in the bearing cups.
   - Press the bearing cup into the yoke until the bearing cup retainer groove is visible over the top of the bearing cup.

Important

- If there seems to be a hangup or binding, stop pressing, and check the needle bearings for misalignment in the bearing cup.

4. Bearing retainer in the retainer groove (Figure 18).
   - Continue to press until both retainers can be snapped into place.
   - If the retainer is difficult to seat, the yoke can be sprung slightly with a firm blow from a dead blow hammer (Figure 19).
   - It may be necessary to lubricate the snap ring with a slight amount of chassis grease so it seats in the bearing cup groove.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Rear Axle Yoke Retainer Bolt		
C/K 1, 2, 3	20	15
C 310 w/C5B	37	27
C 314 w/C5B	37	27
C/K 310 w/o C5B	37	27
C/K 314 w/o C5B	37	27
Two-Piece and Three-Piece Propeller Shaft		
Yoke to MT1 Transmission	120	90
Transmission Yoke Retainer Bolt	20	15
Transfer Case Yoke Retainer Bolt	20	15
Transmission Parking Brake Flange Bolt		
C 310 w/C5B	37	27
C 314 w/C5B	37	27
Center Bearing Support		
Crossmember Mounting Nut	35	26
Front Drive Propeller Shaft		
Front Axle Retainer Bolt	20	15
Transfer Case Retainer Bolt	20	15

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SPECIAL TOOLS

1.  J 9522-3

2.  J 9522-5

1. "U" Joint Bearing Separator
2. "U" Joint Bearing Spacer Remover
   (Use with J 9522-3)

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SECTION 4B1

REAR AXLE

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: ***Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will also call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.***

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GENERAL DESCRIPTION

These trucks use various rear axles. The axles can be identified by ring gear size in inches, by manufacturer (corporate or Dana) and by the type of axle shaft used (semi-floating or full-floating). Corporate axles include the 8 1/2, 8 5/8, 9 1/2, and 10 1/2 inch ring gear axles. Dana supplies a 11 inch ring-gear axle. The locking differential is supplied by Eaton.

REAR AXLE OPERATION

A basic differential has a set of four gears. Two are side gears and two are pinion gears. Some differentials have more than two pinion gears. Each side gear is splined to an axle shaft; so each axle shaft turns when its side gear rotates.

The pinion gears are mounted on a differential pinion shaft, and the gears are free to rotate on this shaft. The pinion shaft is fitted into a bore in the differential case and is at right angles to the axle shafts.

Power is transmitted through the differential as follows: the drive pinion rotates the ring gear. The ring gear, being bolted to the differential case, rotates the case. The differential pinion, as it rotates with the case, forces the pinion gears against the side gears. When both wheels have equal traction, the pinion gears do not rotate on the pinion shaft because the input force on the pinion gear is equally divided between the two side gears. Therefore, the pinion gears revolve with the pinion shaft, but do not rotate around the shaft itself. The side gears, being splined to the axle shafts and in mesh with the pinion gears, rotate the axle shafts.

If a vehicle were always driven in a straight line, the ring and pinion gears would be sufficient. The axle shaft could then be solidly attached to the ring gear and both driving wheels would turn at equal speed.

However, if it became necessary to turn a corner, the tires would scuff and slide because the outside wheel would travel further than the inside wheel. To prevent tire scuffing and sliding, the differential allows the axle shafts to rotate at different speeds.

When the vehicle turns a corner, the inner wheel turns slower than the outer wheel and slows its rear axle side gear (as the axle shaft is splined to the side gear). The rear axle pinion gears will roll around the slowed rear axle side gear, driving the other rear axle side gear and wheel faster.

Locking Rear Axle

The locking rear differential allows for normal differential function as indicated in the standard rear axle description. Additionally, the locking rear differential uses multi-disc clutch packs and a speed sensitive engagement mechanism that locks both wheels together if one wheel should spin excessively during slow vehicle operation.

Under light loads, the clutch plates alone tend to lock axle shafts to the differential case, and therefore, locking each other. This is due primarily to the gear separating load developed on the right clutch pack. This induced clutch torque capacity resists motion between the side gear and the rear axle differential case. The differential allows the wheels to turn at different speeds while the axle shafts continue to transmit the driving force. Also, heavier throttle application will cause an axle speed differential, but this starts the full-lock feature of the unit.

Full locking is accomplished through the use of a heavyweight governor mechanism, cam system, and multi-disc clutch packs. The flyweights on the governor mechanism move outward to engage a latching bracket whenever the wheel-to-wheel speed varies by approximately 100 rpm or more. This action retards a cam which, in turn, compresses the multi-disc clutch packs locking both side gears to the case. The 100 rpm wheel-to-wheel speed allows for cornering without differential lockup.

At vehicle speeds above approximately 32 km/h (20 mph), the latching bracket overcomes a spring preload and swings away from the flyweights. At this vehicle speed or greater, the differential is designed to not lock, since added traction is generally not needed.

All axle parts of vehicles equipped with the locking rear axle are interchangeable with those equipped with the conventional rear axle, except for the case assembly.

DIAGNOISIS OF REAR AXLE NOISE

DETERMINING REAR AXLE NOISE

Proper diagnosis is an important part of rear axle repair. In axle work, one of the most difficult conditions to diagnose is noise. Locating a broken axle shaft or broken differential gear presents little or no problem, but locating and isolating axle noise can be an entirely different matter.

Any gear-driven unit, especially an automotive drive axle where engine torque multiplication occurs at a 90 degree turn in the drive line, produces a certain amount of noise. Therefore, an interpretation must be made for each vehicle to determine whether the noise is normal or if a problem actually exists. A certain amount of noise must be expected and cannot be eliminated by conventional repairs or adjustment.

Normal axle noise can be described as a slight noise heard only at a certain speed or under unusual or remote conditions. For example, the noise tends to reach a peak at speeds from 60 to 100 km/h (40 to 60 mph) depending on road and load conditions, or on gear ratio and tire size. This slight noise is in no way indicative of trouble in the axle assembly.

Driveline noises may confuse even the best technician. Vehicle noises coming from tires, transmission, propeller shaft, universal joints, and front or rear wheel bearings are often mistaken for axle noise. Such practices as raising tire pressure to eliminate tire noise (although this will not silence tread noise of mud and snow tires), or listening for the noise at varying speeds and road surfaces, (drive, float, and coast conditions) will aid in locating the source of alleged axle noises. Every effort should be made to isolate the noise to a specific driveline component instead of making a random guess that could be a costly waste of time.

External Noise—Noise which seems to be coming from the rear axle may actually be produced somewhere else. Determine whether the noise might originate in the tires, road surface, front wheel bearings, engine, or transmission.

Road Noise—Driving on certain road surfaces, such as brick or rough-surfaced concrete, cause noise which may be mistaken for tire or rear axle noise. Driving on a different type of road, such as smooth asphalt or dirt, will quickly show whether the road surface is the cause of noise. Road noise usually is the same in drive or coast.

Tire Noise—Tire noise may easily be mistaken for rear axle noise, even though the noisy tires may be located on the front wheels. Tires worn unevenly, or having surfaces on non-skid divisions worn in saw-tooth fashion, are usually noisy and may produce vibrations which seem to originate elsewhere in the vehicle. This is particularly true with low tire pressure.

Tire Noise Test—Tire noise changes with different road surfaces, but rear axle noise does not. Temporarily inflating all tires to 345 kPa (50 psi) pressure, **for test purposes only**, will materially alter noise caused by tires but will not affect noise caused by the rear axle. Rear axle noise usually stops when coasting at speeds under 30 mph; however, tire noise continues but with lower tone as the vehicle speed is reduced. Rear axle noise usually changes when the tire "pulls" in a forward direction or when the vehicle "coasts" down the road and tire noise remains about the same.

Engine and Transmission Noises—Sometimes a noise which seems to originate in the rear axle is actually caused by the engine or transmission. To determine which unit is actually causing the noise, observe approximate vehicle speeds and conditions under which the noise is most pronounced; then stop the vehicle in a quiet place to avoid interfering noises. With the transmission in neutral, run the engine slowly up and down through the engine speeds corresponding to the vehicle speed at which the noise was most pronounced. If a similar noise is produced with the vehicle standing, it is caused by the engine or transmission and not the rear axle.

Front Wheel Bearing Noise—Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast" conditions. Light application of the brake, while holding the vehicle speed steady, will often cause the wheel bearing noise to diminish, since this takes some weight off of the bearing. Front wheel bearings may be easily checked for noise by jacking up the wheels and spinning them, and also by shaking the wheels to determine if the bearings are excessively loose.

Body Boom Noise or Vibration—Objectional "body boom" noise or vibration at 55-65 mph (90-100 km/h) can be caused by an unbalanced propeller shaft. Excessive looseness at the spline can contribute to this unbalance.

Other items that may also contribute to the noise problem are as follows:

- Undercoating or mud on the shaft, causing unbalance.
- Shaft or companion flange balance weights missing.
- Shaft damage, such as bends, dents, or nicks.
- Rough tires. Switch tires from a known good vehicle to determine a tire fault.

If, after making a comprehensive check of the vehicle, all indications point to the rear axle, further diagnostic steps are necessary to determine the axle components at fault. True rear axle noise generally falls into two categories: gear noise and bearing noise.

Rear Axle Noises—If a careful test of the vehicle shows that the noise is not caused by external items, it is then reasonable to assume that noise is caused by the rear axle assembly. Test the rear axle on a smooth level road to avoid road noise. It is not advisable to test the rear axle for noise by running with the rear wheels jacked up.

Noise in the rear axle assembly may be caused by a faulty propeller shaft, faulty rear wheel bearings, faulty differential or pinion shaft bearings, misalignment between two U-joints, or worn differential side gears and pinions. Noise may also be caused by a mismatched, improperly adjusted, or scored ring and pinion gear set.

Rear Wheel Bearing Noise—A rough rear wheel bearing produces a vibration or growl which continues with the vehicle coasting and the transmission in neutral. A brinelled rear wheel bearing causes a knock or click approximately every two revolutions of the rear wheel, since the bearing rollers do not travel at the same speed as the rear axle and wheel. With the rear wheels jacked up, spin the rear wheels by hand while listening at the hubs for evidence of a rough or brinelled wheel bearing.

Differential Side Gear and Pinion Noise—Differential side gears and pinions seldom cause noise since their movement is relatively slight on straight ahead driving. Noise produced by these gears will be most pronounced on turns.

Pinion bearing failures can be determined by how the bearings rotate at higher speeds as opposed to differential side bearings and axle shaft bearings. Rough or brinelled pinion bearings produce a continuous low-pitched whirring or scraping noise starting at a low speed.

Side bearings produce a constant rough noise pitched lower than pinion bearing noise. Side bearing noise may also fluctuate in the previous rear wheel bearing test.

Gear Noise—There are two basic types of gear noise. The first type is produced by broken, bent, or forcibly damaged gear teeth and is usually quite audible over the entire speed range and presents no particular problem in diagnosis. For example, hypoid gear tooth scoring generally results from the following: insufficient

lubricant, improper break-in, incorrect lubricant, insufficient gear backlash, improper ring and pinion gear alignment, or loss of drive pinion nut torque. The scoring will progressively lead to complete erosion of the gear tooth, or gear tooth pitting and then eventual fracture if the initial scoring condition is not corrected (Figure 1).

Other causes of hypoid tooth fracture are extended overloading of the gear set which will produce fatigue fracture, or shock loading which will result in sudden malfunction.

Differential pinion and side gears rarely give trouble. Common causes of differential malfunction are shock loading, extended overloading, and seizure of the differential pinions to the cross shaft resulting from excessive wheel spin and consequent lubrication breakdown. The second type of gear noise pertains to the mesh pattern of the gear teeth. This form of abnormal gear noise can be recognized because it produces a cycling pitch (whine) and will be very pronounced in the speed range at which it occurs, appearing under either "drive," "float," or "coast" conditions. "Drive" is acceleration or heavy pull. "Coast" is allowing the vehicle roll down the road without accelerating and "float" is lightly stepping on the accelerator pedal to keep the vehicle from driving the engine; the vehicle slows down gradually but the engine still pulls slightly. Gear noise tends to peak in a narrow speed range or ranges and will tend to remain constant in pitch. Bearing noise will vary in pitch with vehicle speeds.

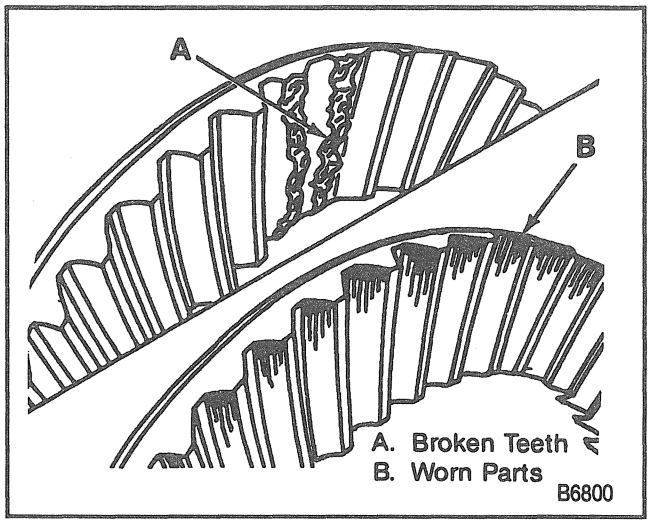
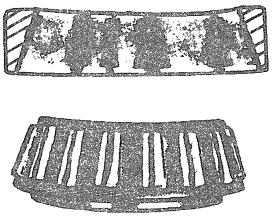


Figure 1—Causes of Gear Noise

Refer to Figures 2 and 3 for bearing diagnosis.

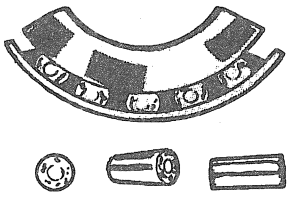
TAPERED ROLLER BEARING DIAGNOSIS

Consider the following factors when diagnosing bearing condition:
1. General condition of all parts during disassembly and inspection.
2. Classify the failure with the aid of the illustrations.
3. Determine the cause.
4. Make all repairs following recommended procedures.



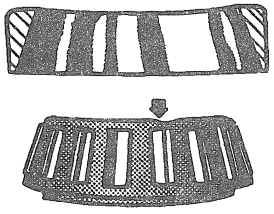
ABRASIVE ROLLER WEAR

Pattern on races and rollers caused by fine abrasives.
Clean all parts and housings, check seals and bearings and replace if leaking, rough or noisy.



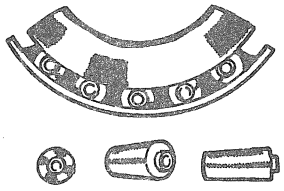
GALLING

Metal smears on roller ends due to overheat, lubricant failure or overload.
Replace bearing, check seals and check for proper lubrication.



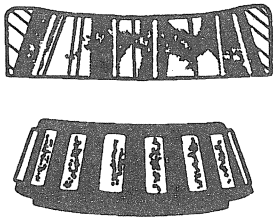
BENT CAGE

Cage damaged due to improper handling or tool usage.
Replace bearing.



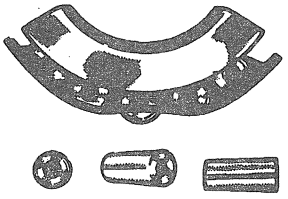
ABRASIVE STEP WEAR

Pattern on roller ends caused by fine abrasives.
Clean all parts and housings, check seals and bearings and replace if leaking, rough or noisy.



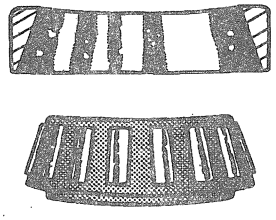
ETCHING

Bearing surfaces appear gray or grayish black in color with related etching away of material usually at roller spacing.
Replace bearings, check seals, and check for proper lubrication.



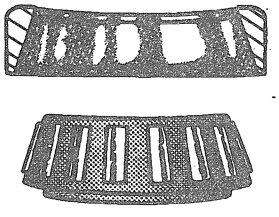
BENT CAGE

Cage damaged due to improper handling or tool usage.
Replace bearing.



INDENTATIONS

Surface depressions on race and rollers caused by hard particles of foriegn material.
Clean all parts and housings. Check seals and replace bearings if rough or noisy.



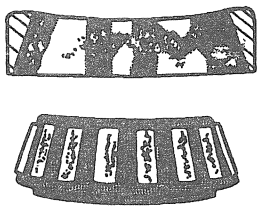
MISALIGNMENT

Outer race misalignment due to foreign object.
Clean related parts and replace bearing. Make sure races are properly sealed.

F9315

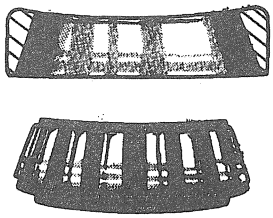
Figure 2—Diagnosis of Tapered Roller Bearings

Diagnosis of Tapered Roller Bearings (con't)



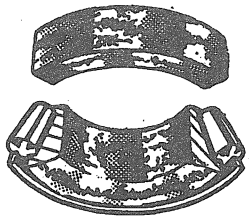
FATIGUE SPALLING

Flaking of surface metal resulting fron fatigue.
Replace bearing, clean all related parts.



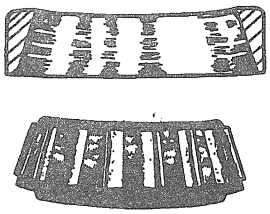
STAIN DISCOLORATION

Discoloration can range fron light brown to black caused by incorrect lubricant or moisture.
Re-use bearings if stains can be removed by light polishing or if no evidence of overheating is observed.
Check seals and related parts for damage.



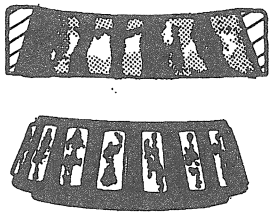
FRETTAGE

Corrosion set up by small relative movement of parts with no lubrication.
Replace bearing. Clean related parts.
Check seals and check for proper lubrication.



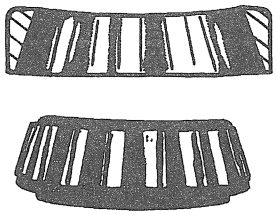
CAGE WEAR

Wear around outside diameter of cage and roller pockets caused by abrasive material and inefficient lubrication.
Clean related parts and housings.
Check seals and replace bearings.



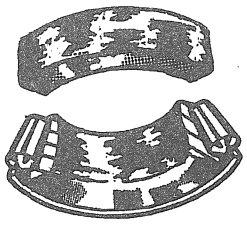
HEAT DISCOLORATION

Heat discoloration can range from faint yellow or dark blue resulting from overload or incorrect lubricant. Excessive heat can cause softening of races or rollers. To check for loss of temper on races or rollers a simple file test may be made. A file drawn over a tempered part will grab and cut metal, whereas, a file drawn over a hard part will glide readily with no metal cutting.
Replace bearings if overheating damage is indicated.
Check seals and other parts.



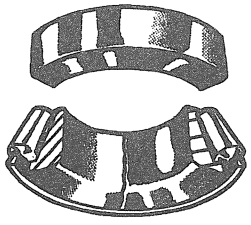
BRINELLING

Surface indentations in raceway caused by rollers either under impact loading or vibration while the bearing is not rotating.
Replace bearing if rough or noisy.



SMEARS

Smearing of metal due to slippage. Slippage can be caused by poor fits, lubrication, overheating, overloads or handling damage.
Replace bearings, clean related parts and check for proper fit and lubrication.



CRACKED INNER RACE

Race cracked due to improper fit, cocking, or poor bearing seats.
Replace bearing and correct bearing seats.

F9314

Figure 3—Diagnosis of Tapered Roller Bearings

ON-VEHICLE SERVICE

SEMI-FLOATING AXLE (8 1/2, 8 5/8 AND 9 1/2 INCH RING GEAR)

VENT HOSE REPLACEMENT

The axle vent hose is located on the axle carrier on 8 1/2, 8 5/8, and 9 1/2 inch ring gear axles.

Remove or Disconnect (Figure 4)

1. Vent clamp bolt from the brake bracket.
2. Clamp from the brake bracket.
3. Vent assembly from the hose.
4. Clamp from the hose.
5. Hose clamp bolt from the hose clamp and the brake junction block.
6. Hose clamp and hose from the axle nipple.
7. Hose clamp from the hose.

Install or Connect (Figure 4)

1. Hose clamp to the hose.
2. Hose clamp and hose to the axle nipple.
3. Hose clamp bolt to the hose clamp and the brake junction block.
4. Clamp to the hose.
5. Vent assembly to the hose.
6. Clamp to the brake bracket.
7. Vent clamp bolt to the brake bracket.

REAR AXLE ASSEMBLY REPLACEMENT

- Raise the vehicle on a hoist and support the axle assembly with a suitable lifting device.
- Drain the lubricant from the axle housing.

Remove or Disconnect (Figure 4)

1. Propeller shaft. Refer to SECTION 4A.
   - Tie the propeller shaft to a side rail or cross-member.
   - Tape the bearing cups to prevent loss of the needle bearings.
2. Wheel and brake drum or hub and drum assembly. Refer to SECTION 5C1 or 5C2.
3. Parking brake cable from the lever and at the brake backing plate.
4. Hydraulic brake pipes from the connectors.
5. Shock absorbers from the axle brackets.
6. Vent hose from the axle vent fitting.
   - Support the axle assembly with a hydraulic floor jack.
7. Nuts and washers from the U-bolts.

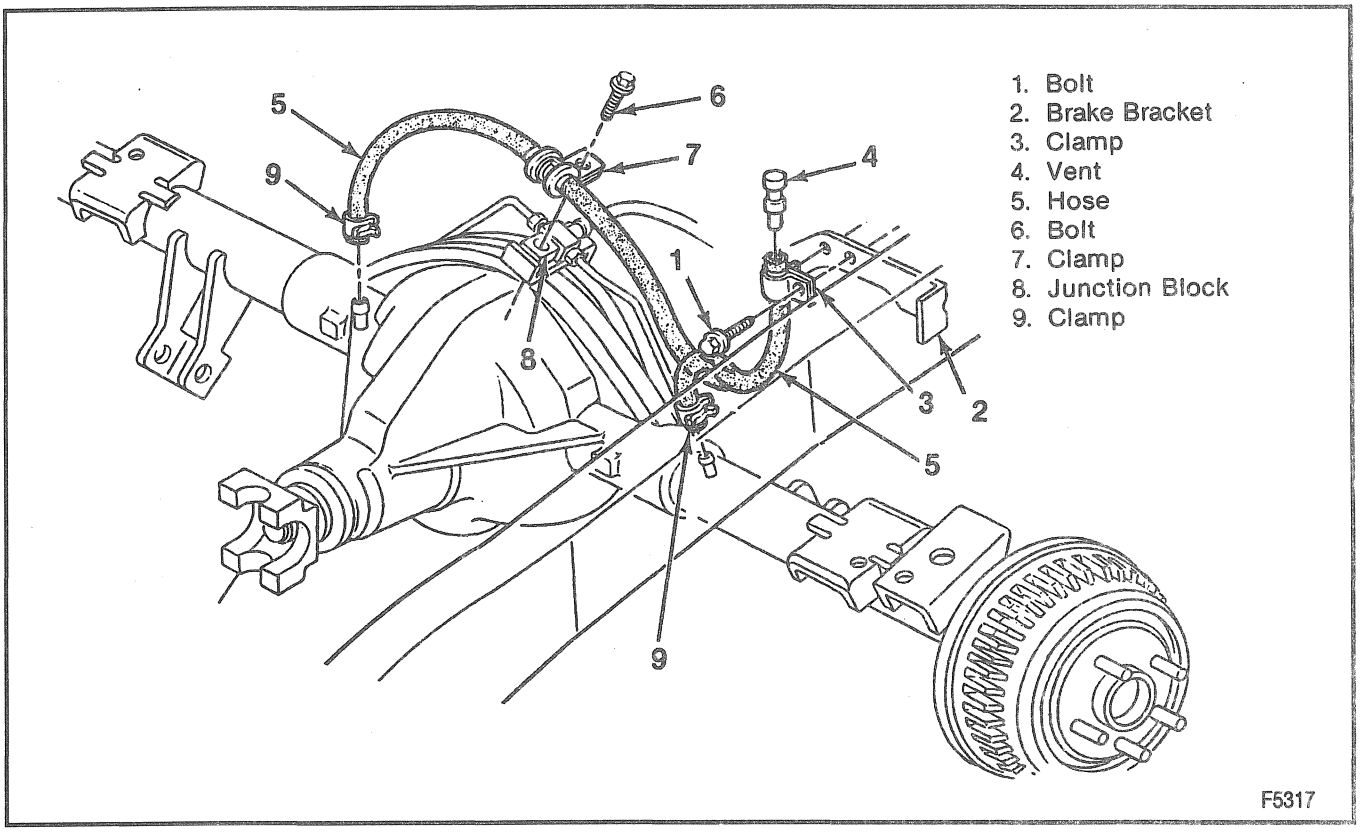


Figure 4—Axle Vent Hose

10. Drum
11. Bolt
12. Shaft
13. Lock
14. Seal
15. Bearing
16. Housing
17. Clip
18. Bolt
19. Carrier Cover

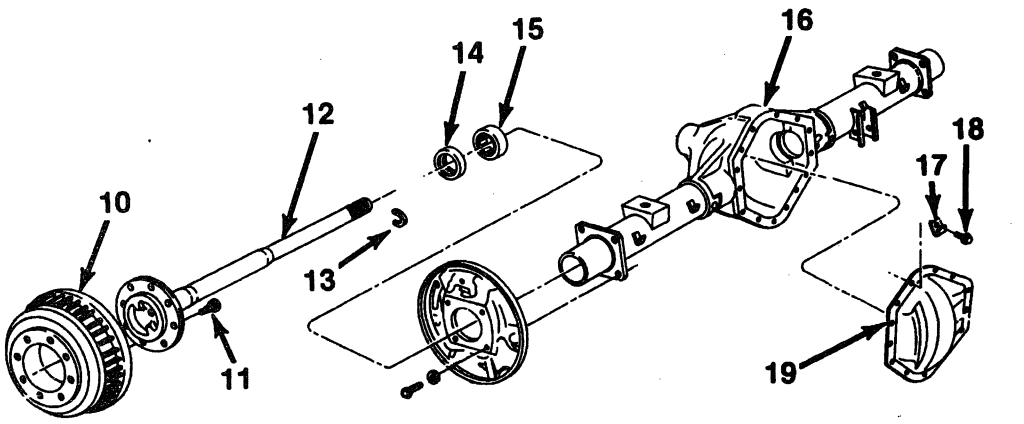


Figure 5—Axle Shaft and Housing Components

8. U-bolts, spring plates, and spacers from the axle assembly.
   - Lower the jack and the axle assembly.

Install or Connect (Figure 4)

1. Axle assembly under the vehicle.
   - Align the axle assembly with the springs.
2. Spacers, spring plates, and U-bolts to the axle assembly.
   - Raise the axle assembly.
3. Washers and nuts to the U-bolts.
   - Thread the nuts on firmly.
   - Adjust alignment of semi-float axles.
4. Vent hose to the axle vent fitting (if used).
5. Shock absorbers to the axle brackets.
6. Hydraulic brake pipes to the connectors.
7. Parking brake cable to the lever and the backing plate.
8. Wheel and brake drum or hub and drum assembly.
9. Propeller shaft.

Tighten

- All fasteners to "Specifications" at the end of this section.

Important

A. Check axle lubricant level at the filler plug hole. Lubricate as needed. Refer to SECTION 0B.
B. Bleed the brake system, check operation, and adjust if necessary. Refer to SECTION 5A.
C. Check axle and brake operation.
D. Check for fluid leaks and road test the vehicle.

AXLE SHAFT, OIL SEAL, AND BEARING REPLACEMENT

Tools Required:
- J 2619-01 Slide Hammer with Adapter
- J 23689 Axle Shaft Bearing Remover (large shaft)
- J 29712 Axle Shaft Bearing Remover (9 1/2 inch ring gear)
- J 8092 Driver Handle
- J 21128 Axle Shaft and Pinion Oil Seal Installer
- J 23690 Axle Shaft Bearing Installer
- J 29709 Axle Shaft Bearing Installer (9 1/2 inch ring gear)
- J 29713 Axle Shaft Seal Installer (9 1/2 inch ring gear)

Remove or Disconnect (Figures 5 through 11)

- Raise the vehicle on a hoist.

1. Wheel and tire assembly.
2. Brake drum.
   - Clean the dirt from around the carrier cover.

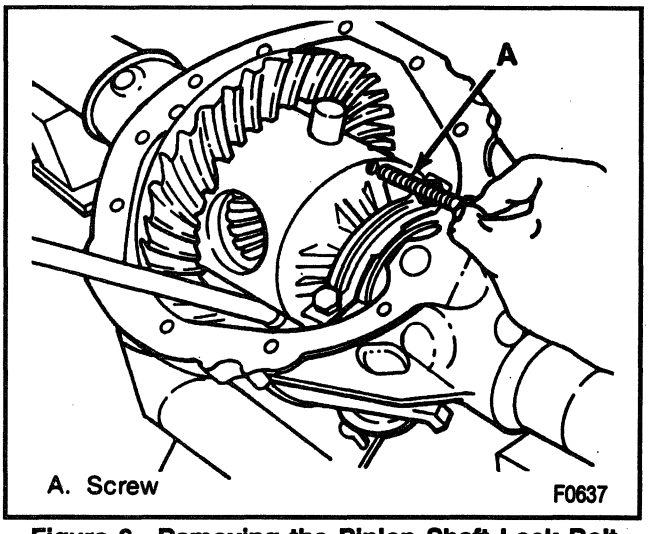


Figure 6—Removing the Pinion Shaft Lock Bolt

3. Carrier cover.
   - Catch the oil in a drain pan.
   - Remove gasket material if used.
4. Screw (A).
5. Pinion shaft (B).
   - Remove the shaft from the case on vehicles without a locking differential.
   - With a locking differential, remove the shaft (B) part way, and rotate the case until the pinion shaft touches the housing.
   - Use a screwdriver or similar tool to enter the case and rotate the lock until it aligns with the thrust block.
6. Lock (Figure 9).
   - Push the flange of the axle shaft towards the differential. Do not force or hammer the shaft to move the axle shaft (Figure 10).
   - Remove the lock from the button end of the axle shaft.
7. Axle shaft.
   - Slide the axle shaft out, being careful not to damage the seal.
8. Seal using J 23689.

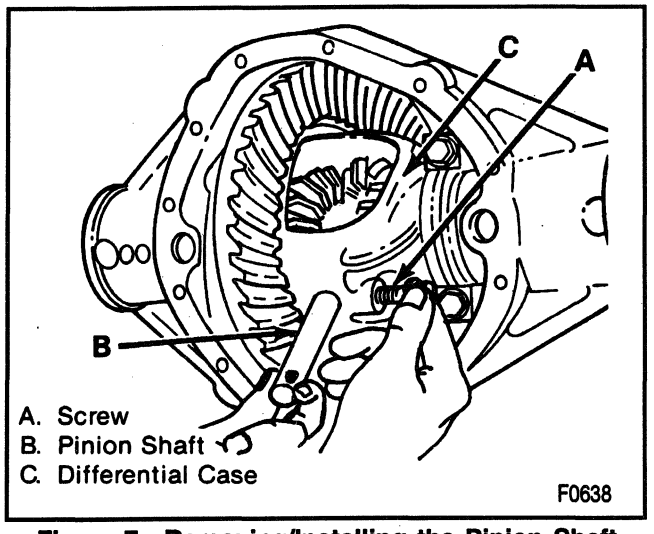


Figure 7—Removing/Installing the Pinion Shaft

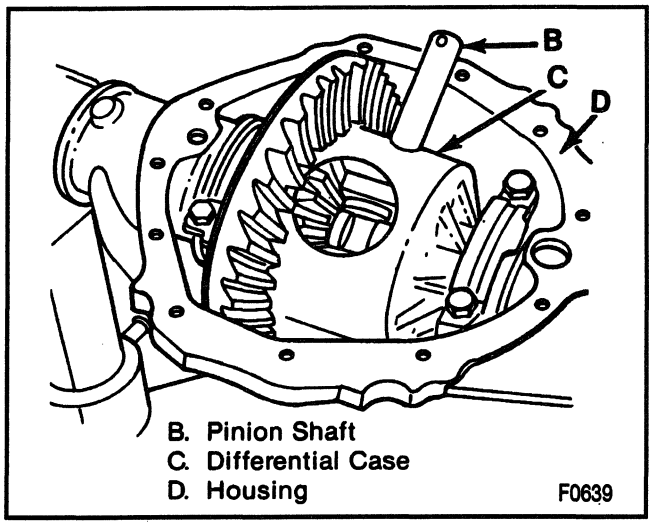


Figure 8—Positioning the Case for Best Clearance

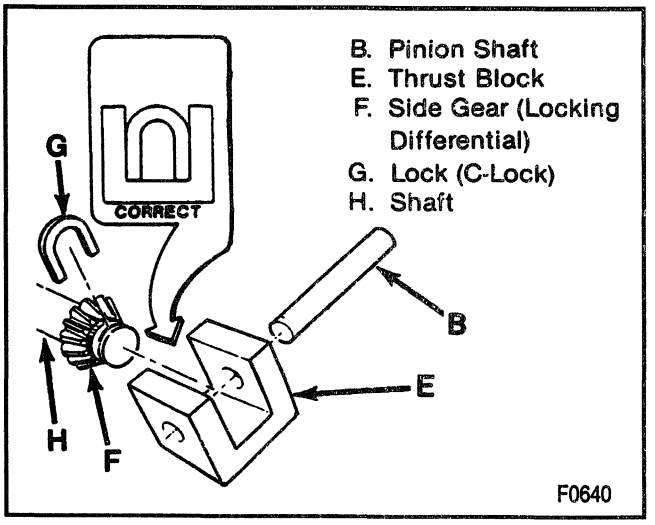


Figure 9—Aligning the Lock

9. Bearing.
   A. Use J 23689 for 8 1/2 and 8 5/8 inch ring gear axles or J 29712 for 9 1/2 inch ring gear to pull the bearing from the axle.
   B. Insert the tool into the axle bore so that it grasps behind the bearing (Figure 11). Tighten the nut and washer against the face of the bearing. Pull the bearing out using J 2619-01.

Inspect

- All parts. Replace as necessary.

Install or Connect (Figures 5, 9, 12, and 13)

- Lubricate the axle cavity between the seal lips and the bearing with wheel bearing lubricant. Refer to SECTION 0B.

1. Bearing.
   - Use J 23690 for the 8 1/2 and 8 5/8 inch gear axle and J 29709 for the 9 1/2 inch ring gear axle.
   - Bearing into the axle housing until the tool bottoms against the tube. Refer to Figure 12.

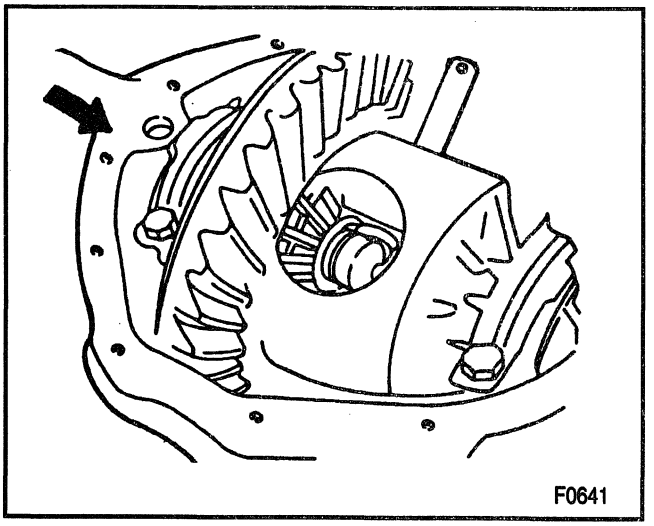


Figure 10—Pushing the Axle Shaft Inward

2. Seal.
   - Use J 21128 for 8 1/2 and 8 5/8 inch ring gear axle and J 29713 for the 9 1/2 inch ring gear axle.
   - Drive the tool into the bore until the seal bottoms flush with the end of the tube (Figure 13).
3. Axle shaft.
   - Be careful not to damage the seal when inserting the axle shaft.
   - Slide the axle shaft into place allowing the splines to engage the differential side gear (F) (Figure 9).
4. Lock.
   - Without locking differential:
     — Place the lock on the button end of the axle shaft, then pull the shaft flange outward to seat the lock in the differential side gear.
   - With locking differential:
     A. Keep the pinion shaft partially withdrawn (Figure 7).
     B. Place the lock in the position shown in Figure 9. Pull the shaft flange outward to seat the lock in the differential side gear.

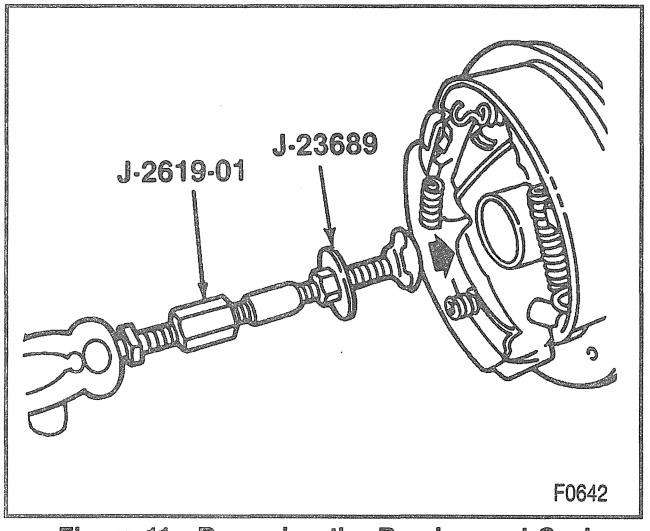


Figure 11—Removing the Bearing and Seal

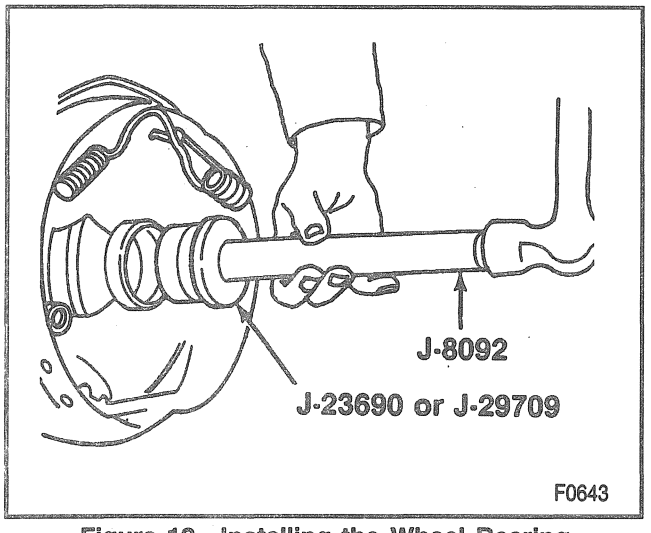


Figure 12—Installing the Wheel Bearing

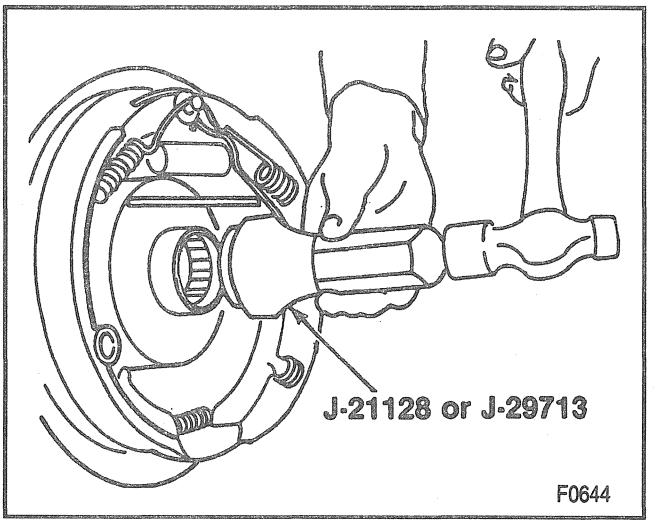


Figure 13—Installing the Seal

5. Pinion shaft (Figure 6).
   - Align the hole in the pinion shaft with the screw hole in the differential case.

Important

- Anytime a differential pinion shaft locking screw is removed, it is important to coat the screw threads with Loctite 242 before reinstalling. These screws are coated with an adhesive which helps to prevent the screw from loosening in the case. When this screw is removed, the adhesive is also removed.

6. Screw (A).

Tighten

- Screw to 36 N.m (27 lb. ft.).

7. Carrier cover gasket or RTV (if used).
8. Carrier cover.
9. Bolts and clip.

Tighten

- Bolts in a crosswise pattern to 41 N.m (30 lb. ft.).

10. Brake drum.
11. Wheel and tire assembly.
    - Lower the vehicle.
12. Axle lubricant. Fill to the filler plug hole level. Refer to SECTION 0B.

BRAKE BACKING PLATE REPLACEMENT

- Raise the vehicle on a hoist.

Remove or Disconnect (Figure 5)

1. Wheel, tire, and brake drum.
2. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
3. Brake pipe from the wheel cylinder.

4. Brake components from the backing plate. Refer to SECTION 5C1.
5. Bolts and washers from the axle.
6. Backing plate.

Install or Connect (Figure 5)

1. Backing plate to the axle.
2. Bolts and washers to the plate.
3. Brake components to the backing plate. Refer to SECTION 5C1.
4. Brake pipe to the wheel cylinder.
   - Refer to SECTION 5A for bleeding and adjustment procedure.
5. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
6. Wheel, tire, and brake drum.

WHEEL STUD REPLACEMENT

Tool Required:
J 6627-A Wheel Stud Remover

- Raise the vehicle on a hoist and allow the axle to hang free.

Remove or Disconnect

1. Wheel, tire, and brake drum.
2. Stud from the axle flange using J 6627-A (Figure 14).

Install or Connect

1. Stud in the axle flange hole.
   A. Start the new stud into the axle flange hole by pressing firmly with your hand.
   B. Thread on a lug nut with the flat side to the vehicle.
   C. Tighten the lug nut and draw the stud into the rear of the flange.
   D. Thread the lug nut off.
2. Wheel, tire and brake drum.
   - Lower the vehicle.

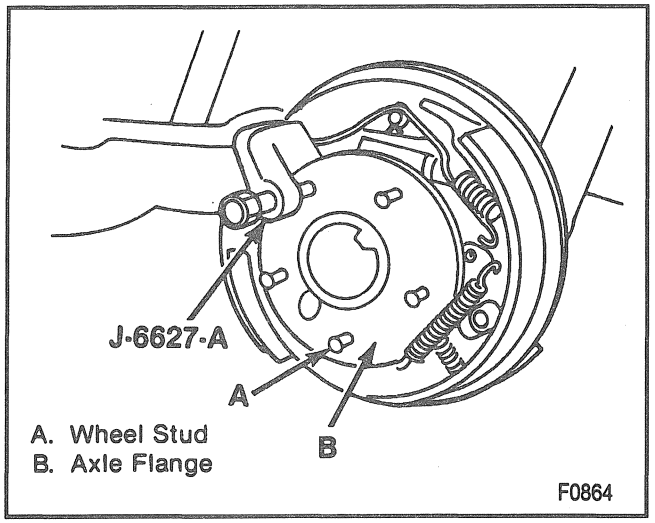


Figure 14—Pressing Out a Wheel Stud

PINION FLANGE AND DUST DEFLECTOR/OIL SEAL REPLACEMENT

Tools Required:
J 8614-01 Companion Flange Holder and Remover
J 22388 Pinion Oil Seal Installer (9 1/2 inch ring gear)
J 22804-1 Pinion Oil Seal Spacer
J 22836 Pinion Seal Installer (8 1/2, 8 5/8 inch ring gear)

Remove or Disconnect (Figures 15 through 18)

- Raise the vehicle on a hoist.

1. Propeller shaft from the axle. Refer to SECTION 4A.
   - Tie the propeller shaft to a frame rail or cross-member.

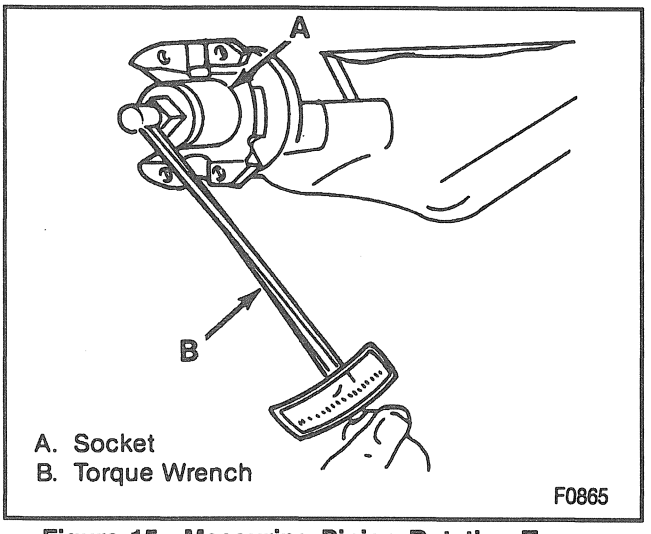


Figure 15—Measuring Pinion Rotating Torque

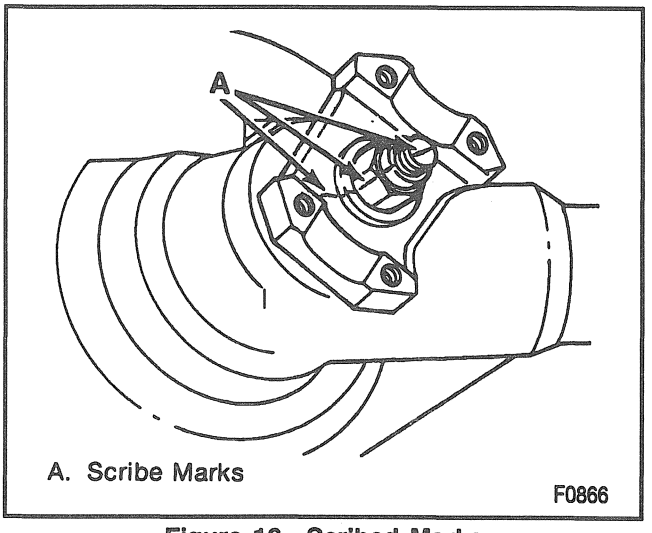


Figure 16—Scribed Marks

Measure

- The torque required to rotate the pinion (Figure 15). Record the torque value for later reference.

Important

- Scribe a line on the pinion stem, pinion nut and the companion flange and record the number of exposed threads on the pinion stem. Use the scribed reference and the exposed threads as a reinstallation guide (Figure 16).

2. Nut using J 8614-01.
   - Position J 8614-01 on the flange so that the four notches on the tool face the flange (Figure 17).
3. Flange using J 8614-01
   - Use the special nut and forcing screw to remove the flange (Figure 18).
4. Oil seal using a seal removal tool.

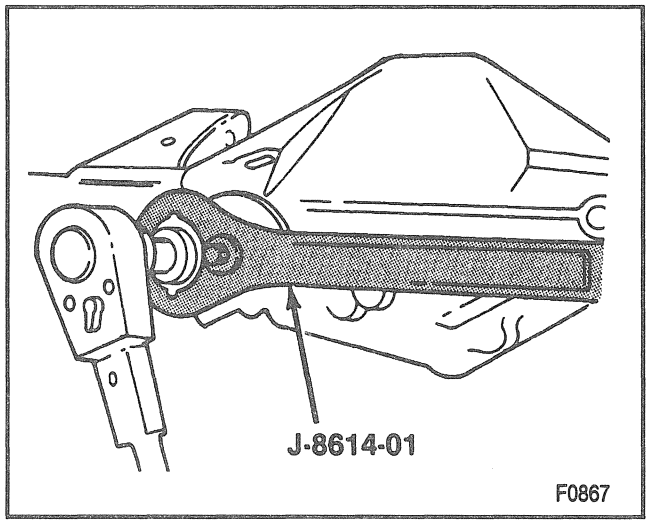


Figure 17—Removing the Drive Pinion Nut

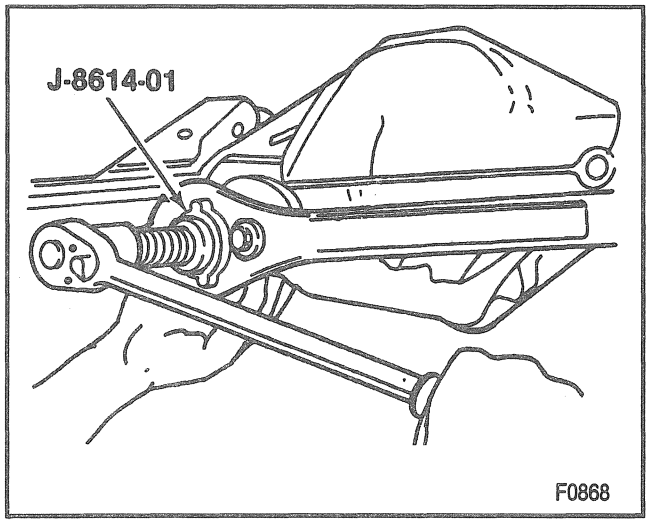


Figure 18—Removing the Drive Pinion Flange

Inspect

- The pinion flange for a smooth oil seal surface, for worn drive splines, damaged ears, and for smoothness of the bearing contact surface. Replace if necessary.

5. Dust deflector.
   - Tap the deflector from the flange if replacement is necessary.
   - Clean up the stake points on the flange.
   - Clean all foreign material from the contact area.

Install or Connect (Figures 19 and 20)

1. Dust deflector on the flange.
   - Stake new deflector at three new equally spaced positions. Staking must be such that the seal operating surface is not damaged.
2. Oil seal.
   A. Pack the cavity between the lips of the oil seal with extreme pressure lithium-base lubricant.
   B. Position the oil seal in the bore. Then place J 22804-1 over the oil seal and flat against the sealflange (Figure 19).
   C. Use J 22836 for the 8 1/2 and 8 5/8 inch ring gear or J 22388 for the 9 1/2 inch ring gear to press the oil seal into the bore.

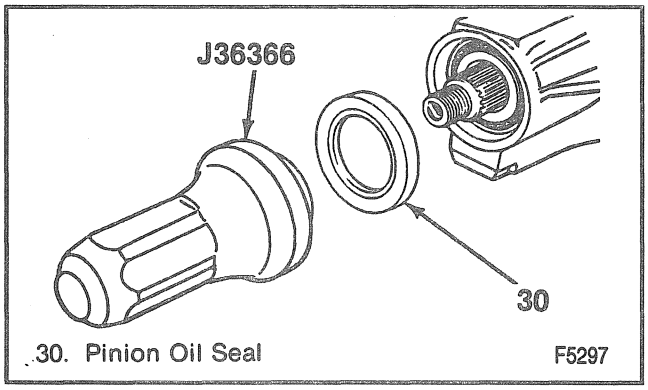


Figure 19—Installing the Pinion Seal

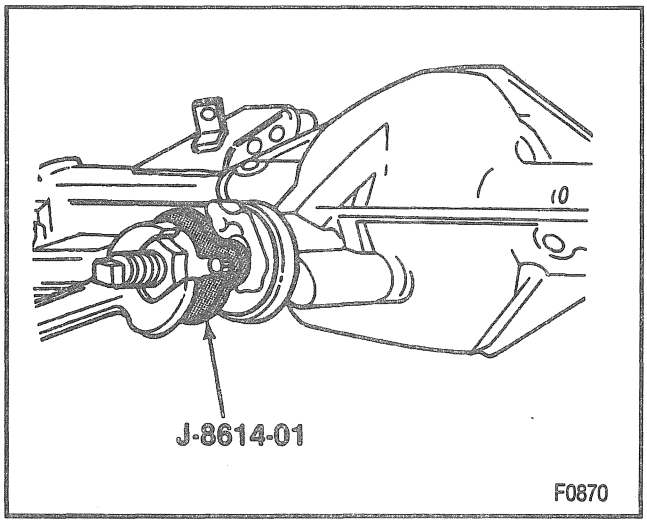


Figure 20—Installing the Pinion Flange

D. Turn J 22804-1 from installed position 180 degrees to ensure proper installation against the pinion flange.

3. Flange onto the pinion using J 8614-01 (Figure 20).
   - Place washer and nut on the pinion threads and tighten the nut to the original scribed position using the scribe marks and exposed threads as a reference (Figure 16).

NOTICE: *Do not hammer the pinion flange onto the pinion shaft or the pinion flange may be damaged.*

Measure

- The rotating torque of the pinion and compare with the torque recorded earlier (Figure 15).

Tighten

- The pinion nut in additional small increments until the torque necessary to rotate the pinion exceeds the original recorded value by 0.35 N·m (3 lb. in.).

4. Propeller shaft.
   - Lower the vehicle and road test.

FULL-FLOATING AXLE (10 1/2 INCH RING GEAR)

AXLE SHAFT REPLACEMENT

Remove or Disconnect (Figure 21)

1. Bolts.
   - Rap the axle shaft flange lightly with a soft-faced hammer to loosen the shaft.
   - Grip the rib on the axle shaft flange with a locking plier and twist, to start shaft removal.
2. Axle shaft from the tube.

Clean

- Axle shaft flange. Remove old RTV or gasket.
- Outside face of the hub assembly.

Inspect

- All parts and replace as necessary.

Install or Connect

1. Axle shaft with a gasket or RTV applied.
   - Be sure the shaft splines mesh into the differential side gear.
   - Align the axle shaft holes with the hub holes.
2. Bolts.

Tighten

- Bolts to 156 N·m (115 lb. ft.).

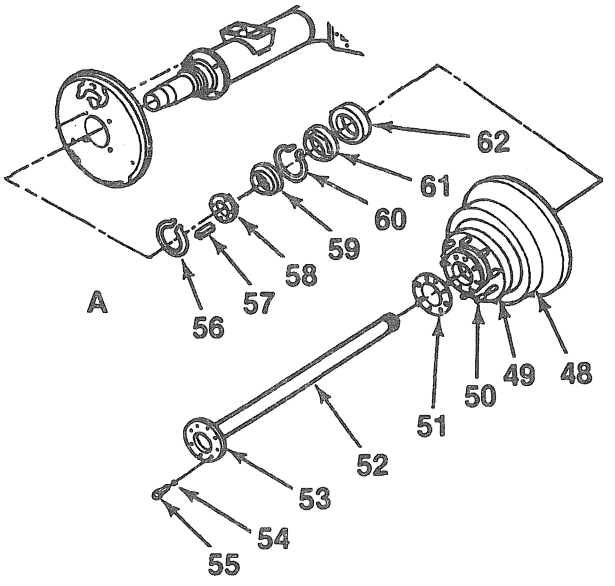
HUB AND DRUM ASSEMBLY REPLACEMENT

Tool Required:
J 2222-C Wheel Bearing Nut Wrench

Remove or Disconnect (Figure 21)

- Raise the vehicle until the wheel is free to rotate.

1. Wheel and tire.
2. Axle shaft as outlined earlier in this section.
3. Retaining ring.
4. Key.
5. Adjusting nut.
6. Washer.
7. Hub and drum.



A. Dana
48. Drum
49. Hub
50. Stud
51. Gasket
52. Shaft
53. Axle Shaft Flange
54. Washer
55. Bolt
56. Retaining Ring
57. Key
58. Adjusting Nut
59. Outer Bearing
60. Retaining Ring
61. Inner Bearing
62. Oil Seal

F3530

Figure 21—Full Floating Axle, Hub, and Drum Assembly Components

Inspect

- All parts and replace as necessary.

Install or Connect (Figures 21 and 22)

1. Hub and drum to the tube.
   - Be sure the bearings and the oil seal are positioned properly.
   - Apply a light coat of high melting point EP bearing lubricant to the contact surfaces and the outside of the axle tube.
2. Washer.
   - Place the tang into the keyway.
3. Adjusting nut.

Adjust

- Bearing preload. Refer to "Bearing Adjustment" in this section.

4. Key.
5. Retaining ring.
6. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
7. Wheel and tire.
   - Lower the vehicle.

WHEEL BEARING/CUP REPLACEMENT

Tools Required:
- J 8092 Driver Handle
- J 8608 Pinion Bearing Cup Installer
- J 24426 Outer Wheel Bearing Cup Installer
- J 24427 Inner Wheel Bearing Cup Installer
- J 24428 Axle Shaft Seal Installer

- Raise the vehicle until the wheels are free to rotate.

Remove or Disconnect (Figure 21 and 23)

1. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
2. Hub and drum. Refer to "Hub and Drum Assembly Replacement" in this section.
3. Oil seal.
4. Inner bearing. Use a drift to remove the bearing and cup.
5. Retaining ring.
   - Use snap ring pliers to remove the ring.
6. Outer bearing using J 8092 with J 24426 (Figure 23).
   - Drive the bearing and cup from the hub.

Clean

- Old sealing compound from the oil seal bore in the hub.
- Bearing assemblies in a solvent using a stiff brush to remove the old lubricant. Dry the bearings with compressed air. Do not spin them.
- Lubricant from the axle housing and inside the hub.
- Gasket material from the hub and axle shaft.

Inspect

- Bearings for wear, chipped edges or other damage. Check for flat or rough spots on the rollers.
- Cups for pits and cracks.
- Replace parts as necessary.

Install or Connect (Figure 23)

1. Outer bearing cup into the hub.
   - Drive the cup into the hub using J 8092 and J 8608. Be sure J 8608 is installed upside down on J 8092 so that the chamfer does not contact the bearing cup. Drive the cup beyond the retaining ring groove.
2. Retaining ring into the groove.
   - Drive the cup back onto the retaining ring using J 24426.
3. Inner bearing cup using J 8092 and J 24427.
   - Drive the cup into place until it is seated against the hub shoulder.

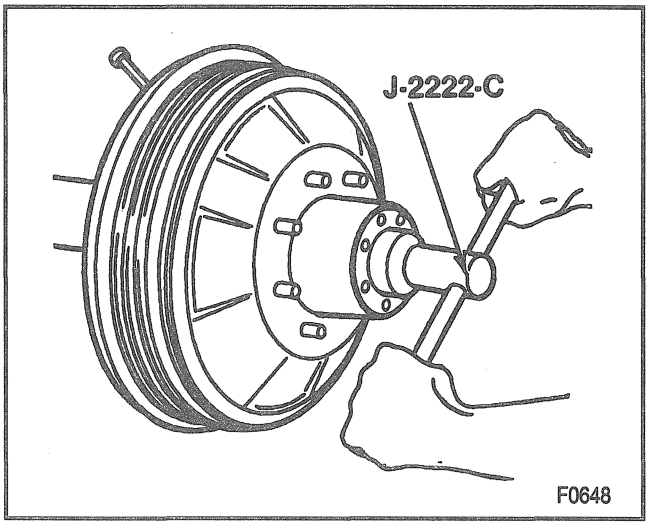


Figure 22—Removing or Installing Bearing Adjusting Nut

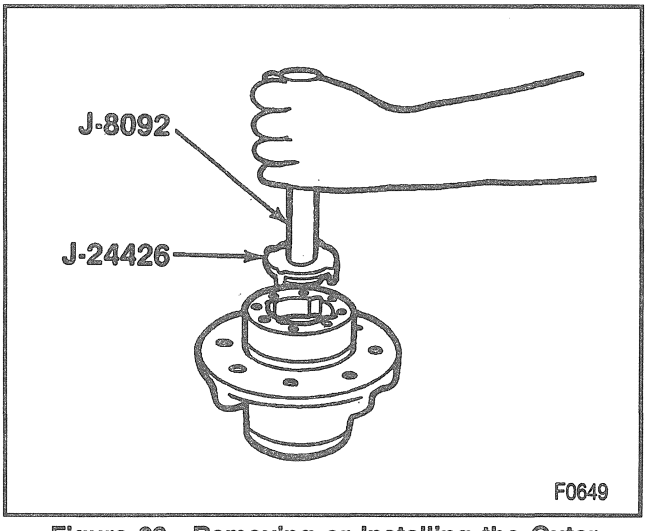


Figure 23—Removing or Installing the Outer Bearing Cup

4. Inner bearing.
5. New oil seal using J 24428.
6. Hub and drum assembly.
7. Outer bearing.

Adjust

- Bearing preload. Refer to "Bearing Adjustment" in this section.

8. Axle shaft.

NON-DEMOUNTABLE TYPE DRUM REPLACEMENT

Construction of this drum and hub assembly does not allow replacement with the hub assembly installed on the vehicle.

Remove or Disconnect

- Raise the vehicle on a hoist and support with suitable safety stands.

1. Hub and drum assembly. Refer to "Hub and Drum Assembly Replacement" in this section.
2. Retaining bolts, stud nuts, or wheel studs.
   A. Separate the drum, hub, and oil deflector.
   B. Press the wheel studs out of the drum. Replace parts as necessary.

Install or Connect

1. Drum to the hub.
   - Make certain that the drain holes are in alignment.
2. Oil deflector to the drum.
   - Apply a light coating of sealing compound to the oil deflector contact surface.
3. Retaining bolts, stud nuts, or wheel studs.
   - Press the wheel studs into the drum.

WHEEL BOLT REPLACEMENT

Wheel bolts are serrated and may also be swaged in place; however, replacement procedure remains the same for both types of installation. Press the wheel bolts out of the hub flange, then press new wheel bolts into place, making sure of a tight fit. When replacing all of the wheel bolts, make sure that the hub oil deflector is in position under the wheel bolt heads.

BEARING ADJUSTMENT

Tool Required:
J 2222-C Wheel Bearing Nut Wrench

Make sure the brakes are fully released and do not drag. Check the wheel bearing play by grasping the tire at the top and pulling and pushing back and forth, or by using a pry bar under the tire. If the wheel bearings are properly adjusted, movement of the brake drum in relation to the brake backing plate will be barely noticeable and the wheel will turn freely. If the movement is excessive, adjust the bearings.

Remove or Disconnect (Figures 21 and 24)

- Raise the vehicle until the wheel is free to spin.

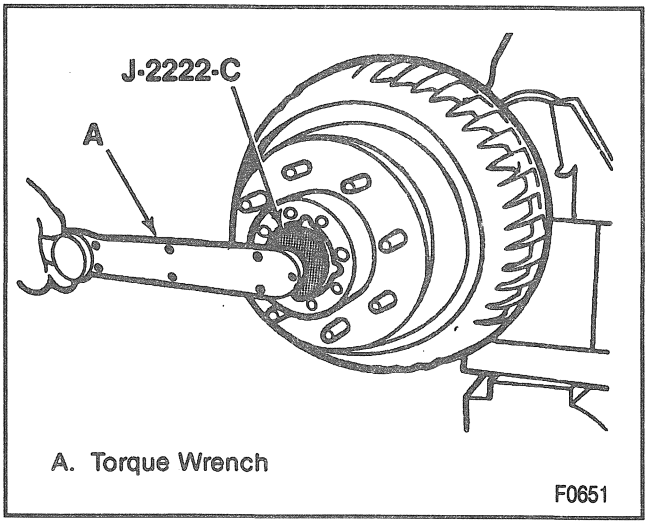


Figure 24—Tightening the Adjusting Nut

1. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
   - Be sure the keyway, threads, and adjusting nut are clean and free of chips, burrs, and shavings.
2. Retaining ring.
3. Key.

Tighten

- Adjusting nut to 68 N·m (50 lb. ft.) while rotating hub and drum assembly (Figures 24 and 25).
- Inner bearing roller assembly must be seated against spindle shoulder.

Adjust

- Nut. If adjusting nut slot is not aligned with keyway, back the nut off until just loose, but not more than one slot of the lock or the axle spindle using J 2222-C. Align the adjusting nut slot with the keyway in the axle spindle.

Install or Connect (Figure 23)

1. Key.
   - Key into the keyway and adjusting nut slot.
2. Retaining ring.
   - Be sure the retaining ring is seated.
3. Axle shaft. Refer to "Axle Shaft Replacement" in this section.

PINION OIL SEAL/COMPANION FLANGE REPLACEMENT

Tools Required:
J 8614-01 Companion Flange Holder
J 8614-02 Companion Flange Remover
J 24384 Pinion Oil Seal Installer
(Dana 10 1/2 inch ring gear axle).

The pinion oil seal and the companion flange may be replaced with the carrier assembly installed in the vehicle.

Remove or Disconnect

- Raise the vehicle on a hoist and support with safety stands.

1. Propeller shaft. Refer to SECTION 4A.
   - Tie the propeller shaft to a frame rail or crossmember.

Important

- Scribe a line on the pinion shaft, pinion nut, and companion flange to be used as a guide for reinstallation (Figure 16).

2. Nut using J 8614-01 (Figure 17).
   - Have a drain pan ready to catch the oil.
3. Flange using J 8614-02 (Figure 18).
4. Oil seal.
   - Pry the oil seal from the bore. Do not damage the machined surfaces. Thoroughly clean foreign material from the contact area.
   - Replace parts as necessary.

Install or Connect

1. Oil seal into the bore using J 24384.
   - Lubricate the cavity between the new seal lips with a high melting point bearing lubricant.

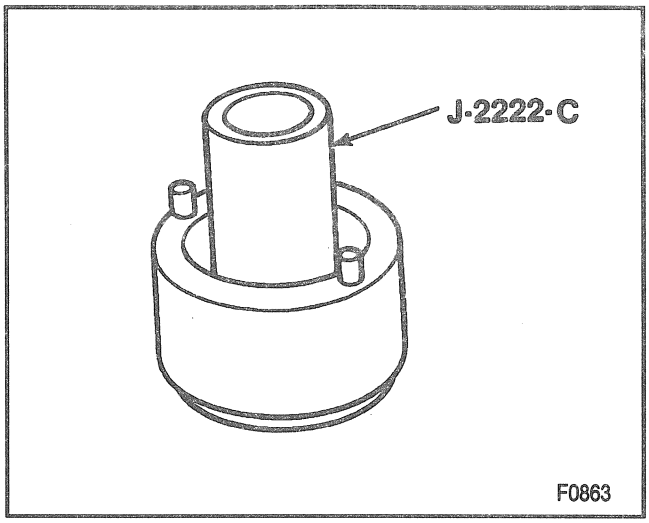


Figure 25—Wheel Bearing Nut Wrench

2. Flange using J 8614-01.
   - Use scribed marks for reinstallation.
3. Nut, using J 8614-01 (Figure 17).
   - Use scribe mark as an installation reference.
4. Propeller shaft. Refer to SECTION 4A.

FULL FLOATING AXLE (11 INCH RING GEAR)

The following rear axle procedures apply to vehicles equipped with disc brakes. For the appropriate disc brake related repair procedures, refer to SECTION 5B2.

AXLE SHAFT REPLACEMENT

Remove or Disconnect (Figures 26 and 27)

1. Bolts. If the vehicle is equipped with rear disc brakes the axle cap must also be removed (Figure 27).
   A. Tap the axle shaft lightly with a soft-faced hammer to loosen the gasket.
   B. Grip the rib on the axle shaft with a locking plier and twist to start shaft removal.
2. Axle shaft from the tube.

Clean

- Axle shaft. Remove old RTV or gasket.
- Outside face of the hub assembly.

Inspect

- Shaft to see if it is bent.
- Shaft splines for chips, burrs, cracking, or if they are worn.

Replace if any of the above conditions exist.

Install or Connect (Figures 26 and 27)

1. Axle shaft and gasket.
   A. Be sure the shaft splines mesh into the differential side gear.
   B. Align the axle shaft holes with the hub holes.
2. Bolts (Figures 26 and 27).

Tighten

- Cap bolts to 20 N·m (15 lb. ft.).

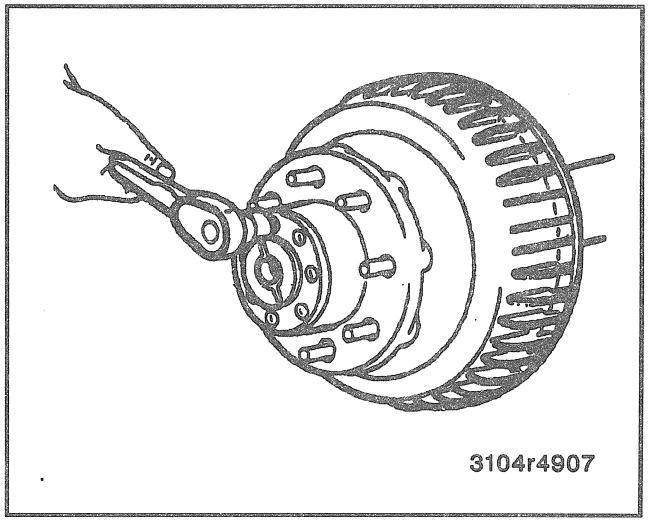


Figure 26—Removing or Installing Flange-to-Hub Bolts

HUB AND ROTOR ASSEMBLY REPLACEMENT

Tool Required:
J 2222-C Wheel Bearing Nut Wrench

Remove or Disconnect (Figures 27 and 28)

- Raise the vehicle until the wheel is free to rotate.

1. Tire and wheel assembly.
2. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
3. Nut using J 2222-C, or retaining ring. Refer to Figure 28.
4. Lock or key.
5. Adjusting nut. Refer to Figure 28.
6. Washer.
7. Hub and rotor.

Inspect

- For any worn or damaged parts. Replace any part which appears defective.

Install or Connect (Figures 27 and 28)

1. Hub and rotor to the tube.
   - Be sure the bearings and the oil seal are positioned properly.
   - Apply a light coat of high melting point EP bearing lubricant to the contact surfaces and the outside of the axle tube. Refer to SECTION 0B.
2. Washer.
   - Engage tang in keyway.
3. Adjusting nut. Refer to Figure 28.

Tighten

- Adjusting nut to 68 N.m (50 lb. ft.) while turning the hub.
- Back-off locknut and retighten to 41 to 54 N.m (30 to 40 lb. ft.) while hub is rotated.
- Back-off nut 135 degrees to 150 degrees.
- Final bearing adjustment is 0.025 to 0.25 mm (0.001 to 0.010 inch)

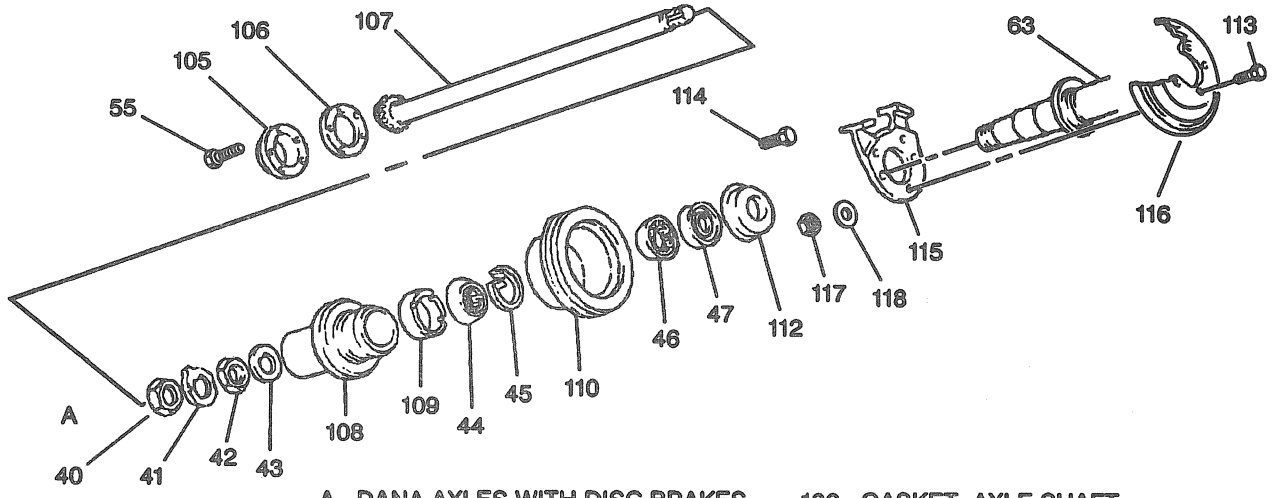
4. Lockwasher and outer locknut.
   - Bend one ear of the lockwasher over inner nut 30 degrees minimum.
   - Bend one ear of the lockwasher over outer nut 60 degrees minimum.

Tighten

- Nut to 88 N.m (65 lb. ft.).

5. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
6. Tire and wheel assembly.

- Lower the vehicle.



A. DANA AXLES WITH DISC BRAKES
40. LOCKNUT, OUTER
41. WASHER, LOCK
42. NUT, ADJUSTER
43. WASHER, WHEEL BEARING
44. BEARING, OUTER
45. RING, RETAINING
46. BEARING, INNER
47. SEAL, OIL
55. BOLT, REAR AXLE SHAFT
63. TUBE, AXLE
105. CAP, AXLE SHAFT
106. GASKET, AXLE SHAFT
107. SHAFT, AXLE
108. HUB, REAR WHEEL
109. SPACER, WHEEL BEARING
110. ROTOR, REAR BRAKE
112. DEFLECTOR, WHEEL BEARING OIL
113. BOLT, CALIPER MOUNTING PLATE
114. BOLT, WHEEL HUB
115. BRACKET, CALIPER MOUNT
116. SHIELD, DUST
117. NUT
118. WASHER

Figure 27—Full-Floating Axle, Wheel End Components

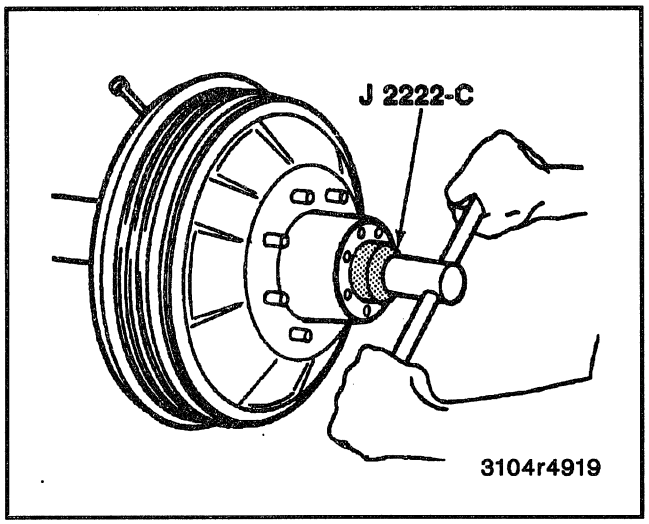


Figure 28—Removing or Installing Bearing Adjusting Nut

WHEEL BEARING/CUP REPLACEMENT

Tools Required:
- J 8092 Drive Handle
- J 8608 Outer Pinion Bearing Cup Installer
- J 24426 Outer Wheel Bearing Cup Installer
- J 24427 Inner Wheel Bearing Cup Installer
- J 39114-A Axle Shaft Seal Installer

Remove or Disconnect (Figures 27 and 29)

- Raise the vehicle until the wheels are free to rotate.

1. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
2. Hub and drum assembly. Refer to "Hub and Rotor Assembly Replacement" in this section.
3. Inner bearing and oil seal.
   A. Lay the drum on a flat surface with a shop towel to catch the bearing and seal.
   B. Use a drift to remove the bearing cup and seal.
4. Retaining ring.
   - Use snap ring pliers to remove the ring.
5. Outer bearing using J 8092 with J 24426 (Figure 29).
   - Drive the bearing and cup from the hub.

Clean

- Old sealing compound from the oil seal bore in the hub.
- Bearing assemblies in a solvent using a stiff brush to remove the old lubricant. Dry the bearings with compressed air. Do not spin them.
- Lubricant from the axle tube and inside the hub.
- Gasket material (if used) from the hub and axle shaft.

Inspect

- Bearings for wear, chipped edges or other damage. Check for flat or rough spots on the rollers. Refer to wheel bearing diagnosis illustrations in this section (Figures 2 and 3).
- Cups for pits and cracks.
- Discard the oil seal and replace with a new one.
- Pack inner and outer bearings with wheel bearing lubricant GM P/N 1051344. Refer to SECTION 0B.

Install or Connect (Figures 27, 30 through 32)

1. Outer bearing cup into the hub.
   - Drive the cup into the hub using J 8092 and J 8608 (Figure 30). Drive the cup beyond the retaining ring groove.

Important

- Be sure J 8608 is installed upside down on J 8092 so that the chamfer does not contact the bearing cup.

2. Retaining ring into the groove.
   - Drive the cup back onto the retaining ring using J 24426 (Figure 31).
3. Inner bearing cup using J 8092 and J 24427 (Figure 32).
   - Drive the cup into place until it is seated against the hub shoulder.
4. Inner bearing.
5. New oil seal using J 39114-A (Figure 33).
6. Hub and drum.
7. Outer bearing.

Adjust

- Bearing preload. Refer to "Bearing Adjustment" in this section.

8. Axle shaft.

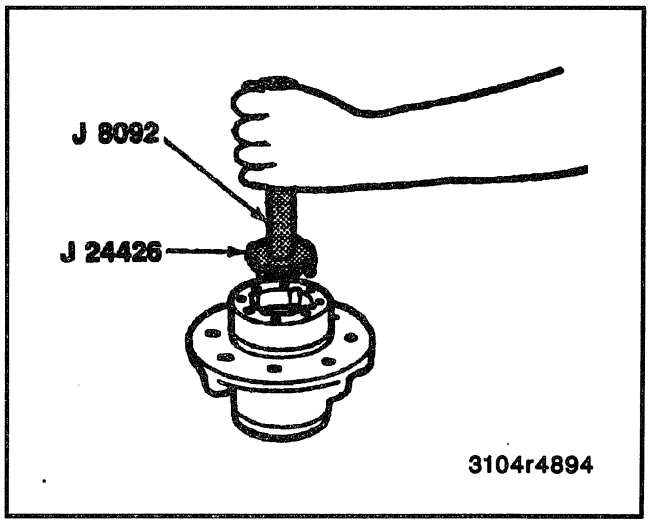


Figure 29—Removing the Outer Bearing and Cup

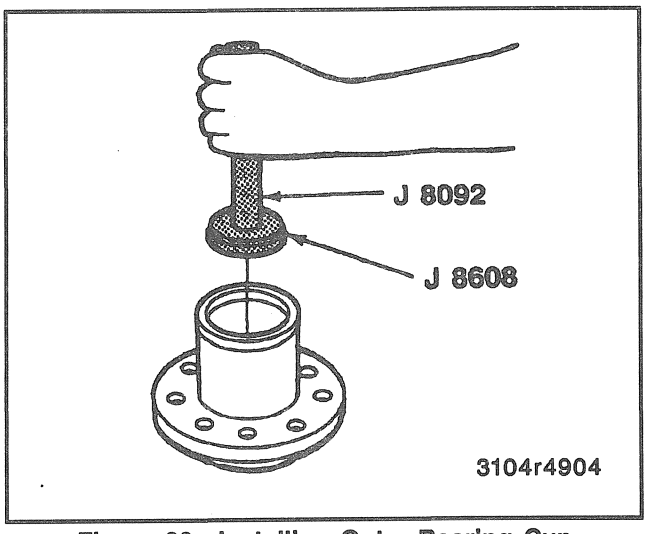


Figure 30—Installing Outer Bearing Cup

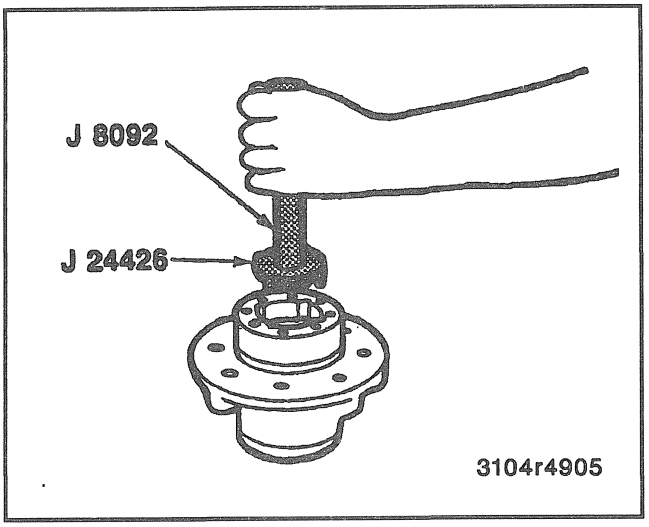


Figure 31—Seating Outer Bearing Cup onto Retaining Ring

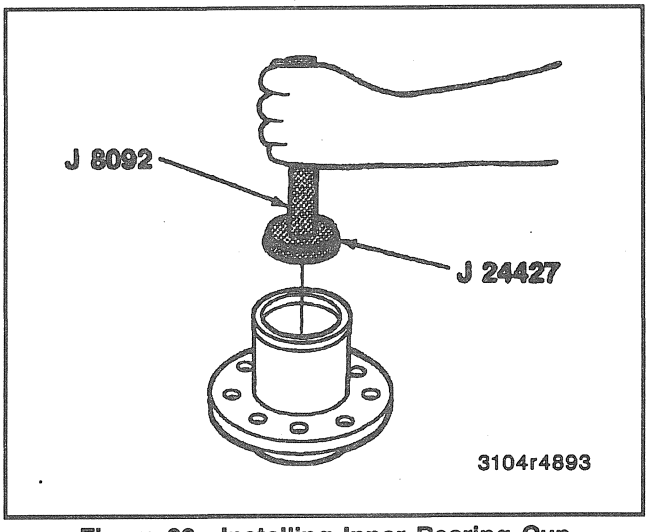


Figure 32—Installing Inner Bearing Cup

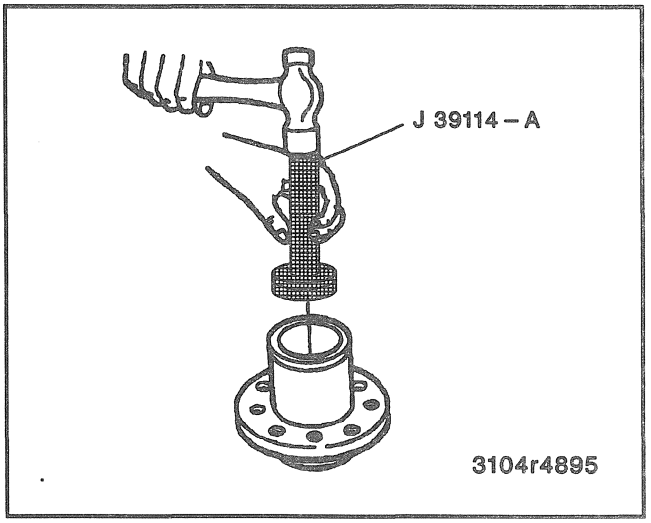


Figure 33—Installing Oil Seal Into Hub

WHEEL STUD REPLACEMENT

Wheel studs are serrated and may also be swaged in place; however, replacement procedure remains the same for both types of installation. Press the wheel studs out of the hub flange, then press new wheel studs into place, making sure of a tight fit. When replacing all of the wheel studs be sure that the hub oil deflector (if equipped) is in position under the wheel stud heads. Refer to Figure 34.

WHEEL BEARING ADJUSTMENT

- Make sure the brakes are fully released and do not drag.
- Check the wheel bearing play by grasping the tire at the top and pulling and pushing back and forth, or by using a pry bar under the tire. If the tapered roller bearings are properly adjusted, movement of the brake drum in relation to the brake flange plate will be barely noticeable and the wheel will turn freely. If the movement is excessive, adjust the bearings.

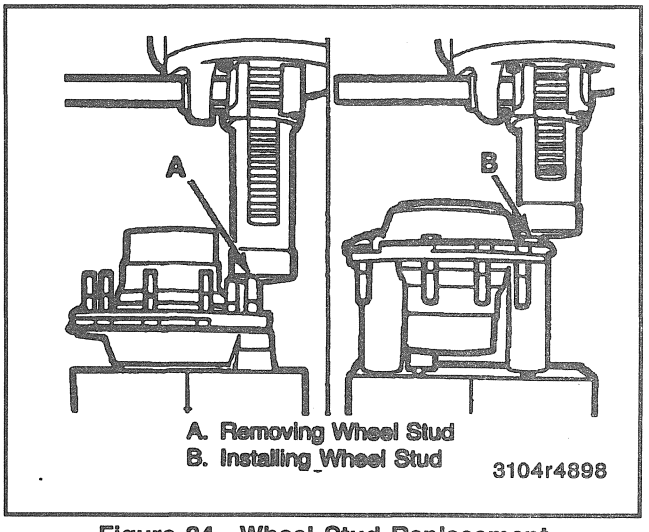


Figure 34—Wheel Stud Replacement

Rear Axles With Disc Brakes

Tool Required:
J 2222-C Wheel Bearing Nut Wrench

Remove or Disconnect (Figure 35)

- Raise the vehicle until the wheel is free to spin.

1. Axle shaft. Refer to "Axle Shaft Replacement" in this section.
   - Be sure the keyway, threads and adjusting nut are clean and free of chips, burrs and shavings.
2. Retaining ring.
3. Rear wheel bearing axle adjusting nut key.
4. Adjusting nut.

Tighten

- Adjusting nut to 68 N·m (50 lb. ft.). Tighten with J 2222-C while rotating the hub assembly, making certain the bearing cones are seated and in contact with the spindle shoulder.

Adjust

- Back off the adjusting nut and retighten to 47 N·m (35 lb. ft.) while hub is rotated.
- Back off the adjusting nut 135 to 150 degrees.

Install or Connect

1. Lock washer.
   - Bend one tang of the retaining washer over a flat of the adjusting nut, 30 degrees minimum.
2. Outer retaining nut.

Tighten

- Outer retaining nut to 88 N·m (65 lb. ft.) minimum.

Adjust

- Final bearing adjustment is 0.025 to 0.25 mm (0.001 to 0.010 inch).
- Bend one tang of the retaining washer over a flat of the outer nut, 60 degrees minimum.

3. Wheel bearing grease into bearings.
4. Axle shaft. Refer to "Axle Shaft Replacement" in this section.

PINION OIL SEAL/PINION FLANGE REPLACEMENT

Tool Required:
J 8614-01 Pinion Flange Holder and Remover
J 24384 Pinion Oil Seal Installer (Dana 11 inch ring gear axle).

The pinion oil seal and the pinion flange may be replaced with the carrier assembly installed in the vehicle.

Remove or Disconnect (Figures 16 through 18)

- Raise the vehicle.

1. Propeller shaft. Refer to SECTION 4A.

Important

- Scribe a line on the pinion stem, pinion nut and pinion flange to be used as an installation guide (Figure 16).

2. Nut using J 8614-01 (Figure 17).
3. Flange using J 8614-01 (Figure 18).
   - Use the special nut and forcing screw to remove the flange.
4. Oil seal.
   - Pry the oil seal from the bore. Do not damage the machined surfaces.
   - Thoroughly clean foreign material from the contact area.

Inspect

- Oil seal mating surfaces for any burrs which may cause seal failure.
- Flange deflector for any abnormality such as cracking or distortion.

Replace any part which shows any of the above conditions.

Install or Connect (Figure 35)

1. Oil seal into the bore using J 24384 (Figure 36).
   - Lubricate the inside diameter of the new oil seal with extreme pressure lubricant such as GM P/N 9985038.
   - Pack the cavity between the pinion stem, pinion flange and pinion nut washer with a non-hardening sealer such as Permatex® Type A or equivalent. Do not coat the bearing.
2. Flange using J 8614 (Figure 20).
   - Use marks scribed previously for installation.

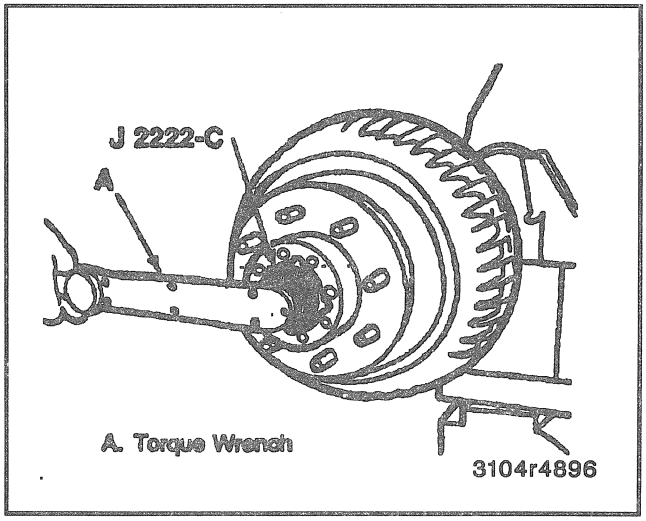


Figure 35—Tightening the Adjusting Nut

3. A new pinion nut, using J 8614-01 (Figure 20).
   - Use marks scribed previously for installation.

Tighten

   - Pinion nut to 596 to 678 N.m (440 to 500 lb. ft.)
4. Propeller shaft. Refer to SECTION 4A.

REAR AXLE ASSEMBLY REPLACEMENT

Remove or Disconnect

- Raise the vehicle and place jack stands under the frame side rails for support.
- Drain the lubricant from the axle housing.

1. Propeller shaft. Refer to SECTION 4A.
2. Tire and wheel assembly.
3. Brake drum or hub and drum.
4. Parking brake cable from the lever and at the brake flange plate. Refer to SECTION 5F.
5. Hydraulic brake pipes from the connectors. Refer to SECTION 5A.
6. Shock absorbers from the axle brackets.
7. Vent hose from the axle vent fitting.
   - Support the assembly with a hydraulic floor jack.
8. Nuts and washers from the U-bolts.
9. U-bolts, spring plates, and spacers from the axle assembly.
   - Lower the jack and the axle assembly.

Install or Connect

1. Axle assembly under the vehicle.
   - Align the axle assembly with the springs.
2. Spacers, spring plates, and U-bolts to the axle assembly.
   - Raise the axle assembly.
3. Washers and nuts to the U-bolts.
   - Thread the nuts on firmly.
   - Adjust alignment of axle.
4. Vent hose to the axle vent fitting.

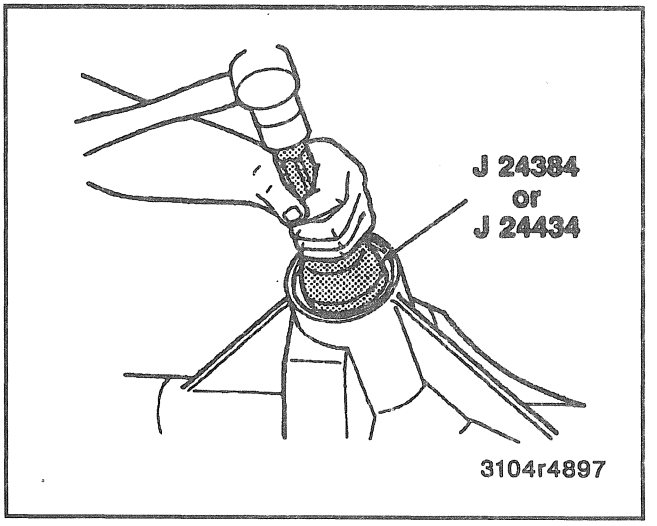


Figure 36—Installing Pinion Oil Seal Into Bore

5. Shock absorbers to the axle brackets.
6. Hydraulic brake lines to the connectors. Refer to SECTION 5A.
7. Parking brake cable to the lever and the flange plate. Refer to SECTION 5F.
8. Tire and wheel assembly.
9. Brake drum or hub and drum.
10. Propeller shaft. Refer to SECTION 4A.

Tighten

   - All fasteners. Refer to "Specifications" at the end of this section.
11. Axle lubricant. Fill to the filler plug hole level. Refer to SECTION 0B.

Important

- Bleed the brake system, check operation and adjust if necessary. Refer to SECTION 5A.
- Remove jack stands and lower vehicle.
- Check axle and brake operation.
- Check for fluid leaks and road test the vehicle.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	8 1/2"and 8 5/8" Ring Gear—Semi Floating Axle		9 1/2" Ring Gear—Semi Floating Axle		DANA 11" Ring Gear Axle—Full Floating	
	N·m	Lb. Ft.	N·m	Lb. Ft.	N·m	Lb. Ft.
Hub Cap Bolts	—	—	—	—	21	15
Brake Backing Plate	47	35	142	105	105	78
Carrier Cover	27	20	27	20	47	35
Filler Plug	34	25	24	18	34	25
Lock Screw	34	25	34	25	—	—
Pinion Flange Nut	—	—	—	—	596	440

LUBRICATION+

Item	8 1/2"and 8 5/8" Ring Gear—Semi Floating Axle		9 1/2" Ring Gear—Semi Floating Axle		DANA 11" Ring Gear Axle—Full Floating	
	Liters	Pints	Liters	Pints	Liters	Pints
Capacity	2.0	4.2	2.6	5.5	4.0	8.2

WHEEL BEARING ADJUSTMENT VALUES*

Axle Make	Rear Brake Type	Ring Gear Size	Bearing Adjusting Nut Torque (While Rotating Wheel)		Adjusting Nut Back-Off	Outer Locknut Torque	
			N·m	Lb. Ft.		N·m	Lb. Ft.
Saginaw	Drum	10 1/2"	68	50	**	—	—
Dana	Disc	11"	68	50	***	88	65

* Resulting end play should be 0.0254 to 0.254 mm (0.001 to 0.010 inch).

** Back off until loose. Rotate nut up against bearing cone shoulder (zero torque).

*** Back off the nut and while rotating the hub tighten to 54 N·m (40 lb. ft.). Then back off nut 135 to 150 degrees. Final end play 0.025 to 0.25 (0.001 to 0.010 inch).

\+ C3500 HD models with applications requiring extreme overload/trailer tow conditions and highspeed conditions (above 45 MPH) for extended periods of time: Change lubrication every 3,000 miles or 3 months, whichever comes first, or use 75W-140 synthetic lubrication GM P/N 12346140. If synthetic lubricant is used, the fluid change interval may be increased to 30,000 miles.

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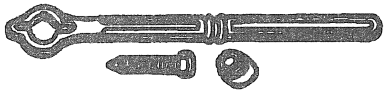
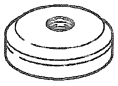
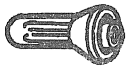
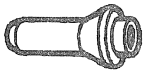
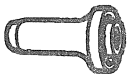
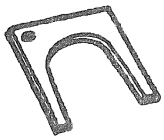
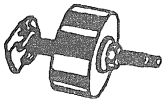
SPECIAL TOOLS

1.  J 6627-A
2.  J 8092
3.  J 5853-B
4.  J 8614-01
5.  J 2222-C
6.  J 24426
7.  J 24427
8.  J 8608
9.  J 24384
10.  J 39114 – A
11.  J 22349
12.  J 23689
13.  J 21128
14.  J 23690
15.  J 29709
16.  J 29713
17.  J 22388
18.  J 22804-1
19.  J 22836
20.  J 29712

1. WHEEL STUD REMOVER
2. DRIVER HANDLE
3. TORQUE WRENCH
4. COMPANION FLANGE HOLDER
5. WHEEL BEARING NUT WRENCH
6. OUTER WHEEL BEARING CUP INSTALLER
7. INNER WHEEL BEARING CUP INSTALLER
8. PINION BEARING CUP INSTALLER
9. DANA PINION SEAL INSTALLER
10. AXLE SHAFT SEAL INSTALLER
11. PINION BEARING CUP INSTALLER
12. AXLE SHAFT BEARING REMOVER (LARGE SHAFT)
13. AXLE SHAFT AND PINION SEAL INSTALLER
14. AXLE SHAFT BEARING INSTALLER
15. AXLE SHAFT BEARING INSTALLER
16. AXLE SHAFT BEARING INSTALLER (9 1/2-INCH)
17. PINION OIL SEAL INSTALLER (9 1/2-INCH)
18. PINION OIL SEAL SPACER
19. PINION SEAL INSTALLER (8 1/2-INCH)
20. AXLE SHAFT BEARING REMOVER (9 1/2-INCH)

3104r3531

BLANK

SECTION 4B2

8 5/8-INCH RING GEAR

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: ***Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.***

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GENERAL DESCRIPTION

The 8 5/8 inch ring gear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers the driving force at a 90 degree angle from the propeller shaft to the axle shafts.

This axle is semi-floating. The axle shafts are supported at the wheel end of the shaft by a roller bearing pressed into the housing. The shafts are retained in the housing by retaining clips within the differential. The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.

The ring gear is bolted onto the differential case with left-hand thread bolts.

The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gears are located in relationship to the pinion by using selective shims between the bearing and axle housing. To move the ring gear, shims are removed from one side and an equal amount added to the other side. These shims are also used to preload the bearings pressed into the differential case. Two bearing caps are used to hold the differential in the axle housing.

The differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing during turns and premature wear on internal axle parts.

The axle is sealed at each axle shaft end, at the differential pinion, and at the differential case cover.

All corporate axles are identified by the alphabetic broadcast code on the right axle tube near the carrier. The carrier cover does not have a drain plug.

CHECKING THE AXLE BEFORE DISASSEMBLY

Inspect

- Remove the axle cover from the axle and drain the axle lubricant.

1. The ring gear backlash. Refer to "Backlash Adjustment" in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential case.
2. The case for metal chips and shavings. Determine where these chips and shavings came from, such as a broken gear or bearing cage.
   - Determine the cause of the axle problem before disassembly if possible.

DISASSEMBLY OF THE REAR AXLE

Tools Required:
- J 2619-01 Slide Hammer
- J 22813-01 Axle Bearing Remover
- J 8107-4 Differential Side Bearing Remover Plug
- J 22888-20 Side Bearing Remover
- J 8614-01 Pinion Flange Remover
- J 8612-B Rear Pinion Bearing Cone Remover

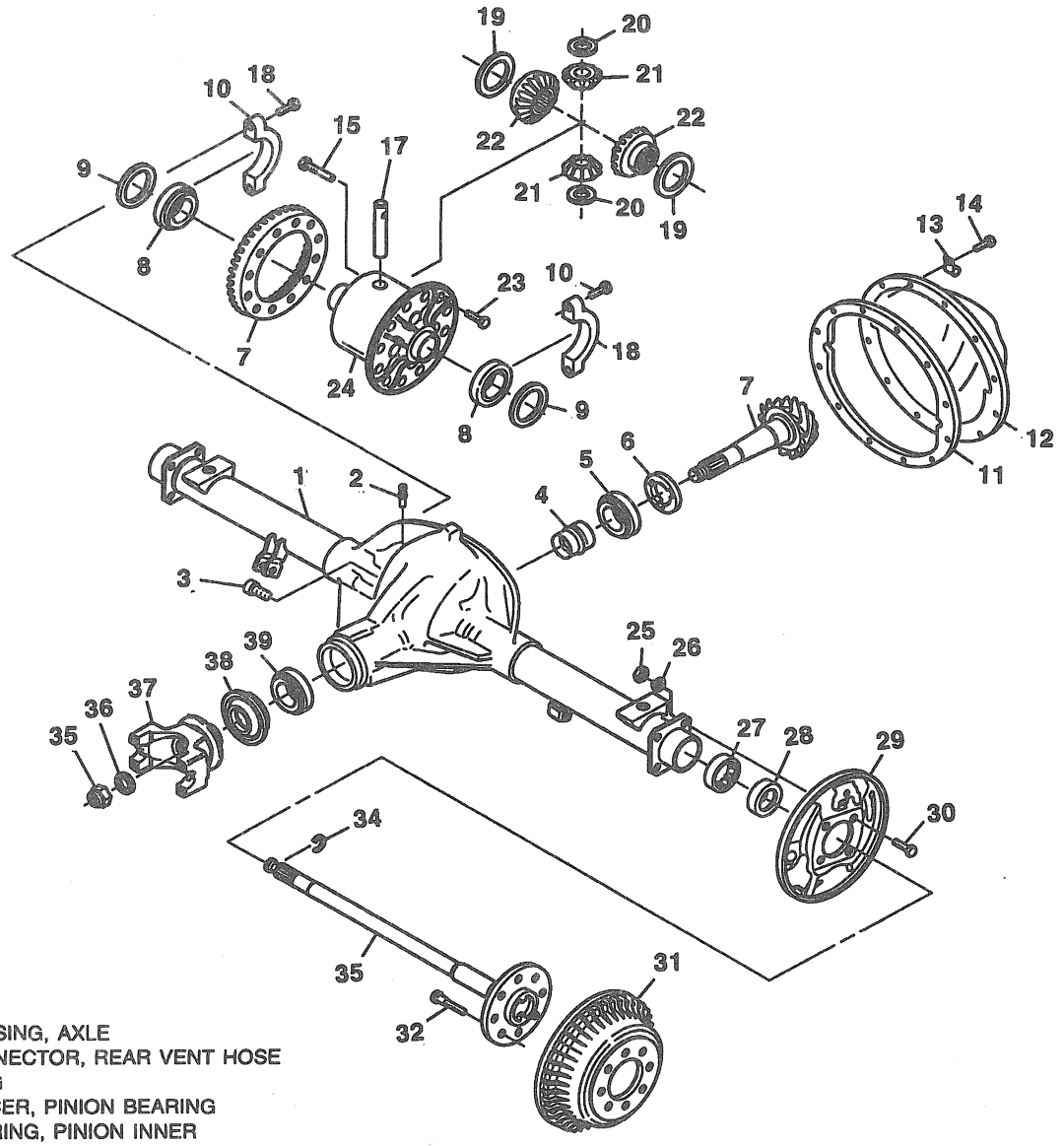
Remove or Disconnect (Figures 1 through 9)

- Place the axle in an approved support.

1. Differential cover bolts (14) and cover (12).
   - Drain the gear lubricant.
   - Refer to "Checking the Axle Before Disassembly" in this section.
2. Pinion shaft lock bolt (15) (Figure 2).
3. Pinion shaft (17).
4. "C" clip (34) from the button end of the axle shaft (33).
   - Push the axle shaft (33) in towards the center of the differential case (24).
5. Axle shaft (33) from the axle housing (1).
6. Seal (28) using an oil seal removing tool.
   - Be careful not to damage the housing.
7. Bearing (27) using J 2619-01 and J 22813-01.
   - The tangs of the tool should engage the bearing outer race.
8. Pinion gear(21) and side gears (22).
   - Roll the pinion gears out of the case with the pinion thrust washers (20).
   - Remove the side gears and side gear thrust washers (19). Mark the gears and the differential case as left and right.
9. Bearing cap bolts (18).
10. Bearing caps (10).
    - Mark the caps and housing as left and right.

NOTICE: ***Be careful when prying the differential case out of the axle housing so as not to damage the cover gasket surface. The differential case must be supported when it is being removed to prevent the case from falling and damaging the case.***

11. Differential case (24).
    - Pry the case from the axle housing at the differential "window" (Figure 3).
12. Bearing outer races and shims.
    - Mark the races and shims as left and right, and place them with the bearing caps.
13. Differential side bearings (8) using J 8107-4 and J 22888-20 (Figure 4).
    - The jaws of J 22888-20 must pull from beneath the bearing cone and not the cage. Use the slots provided for the puller.



1. HOUSING, AXLE
2. CONNECTOR, REAR VENT HOSE
3. PLUG
4. SPACER, PINION BEARING
5. BEARING, PINION INNER
6. SHIM, PINION INNER
7. GEAR SET, RING AND PINON
8. BEARING, DIFF
9. SHIM, DIFF BEARING ADJ
10. CAP, DIFF BEARING
11. GASKET, CARRIER COVER
12. COVER, DIFF CARRIER
13. CLIP, BRAKE CROSSOVER PIPE
14. BOLT, HEX SERRATED COVER
15. BOLT, DIFF P/GR SHF LK
17. SHAFT, DIFF PINION
18. BOLT, HEX
19. WASHER, DIFF SIDE GEAR
20. WASHER, DIFF PINION
21. GEAR, DIFF PINION
22. GEAR, DIFF SIDE
23. BOLT, HYPOOID DRIVE GEAR
24. CASE, DIFFERENTIAL
25. NUT, HEX
26. WASHER, LOCK
27. BEARING, REAR WHEEL
28. SEAL, REAR AXLE SHF (OIL)
29. PLATE, BRAKE BACKING
30. BOLT, HEX
31. DRUM, REAR BRAKE
32. BOLT, REAR
33. SHAFT, AXLE
34. LOCK, REAR AXLE SHF (OIL)
35. NUT, PINION FLANGE
36. WASHER, PINION FLANGE
37. FLANGE ASM, PINION
38. SEAL ASM, PINION
39. BEARING, OUTER PINION

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Figure 1—Rear Axle Components

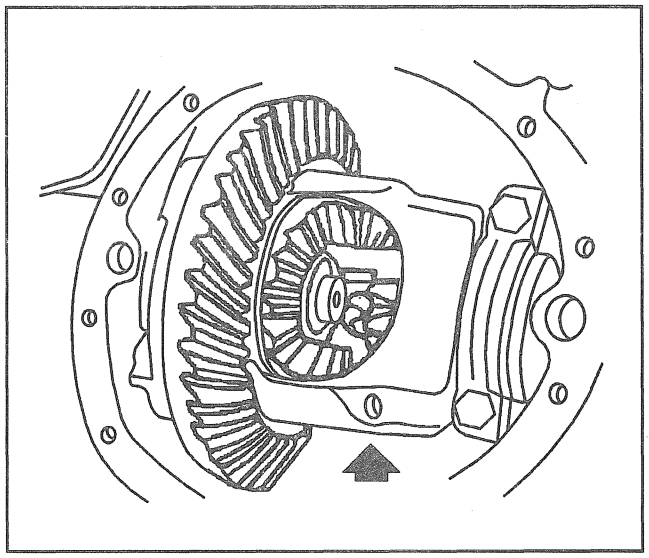


Figure 2—Pinion Shaft Lock Bolt

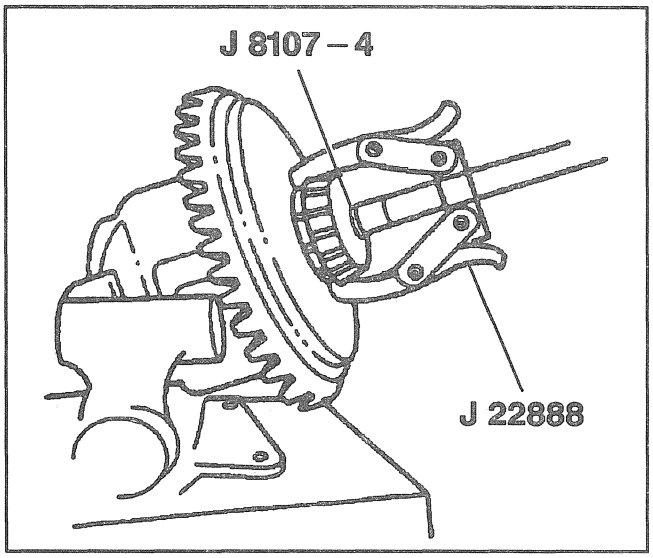


Figure 4—Removing Differential Side Bearing

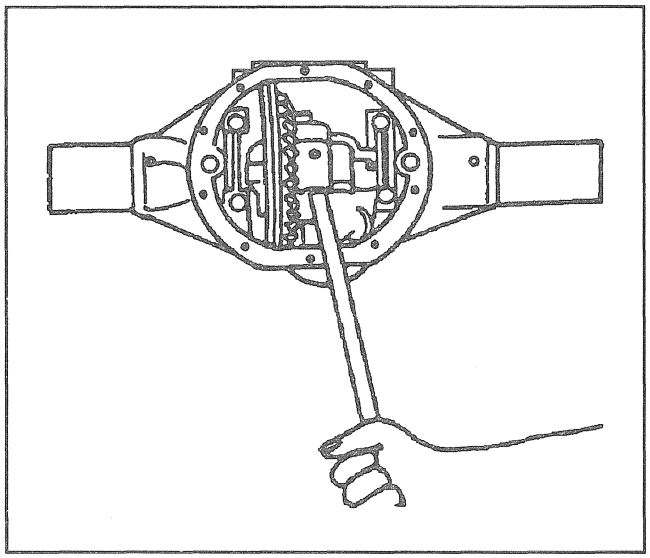


Figure 3—Prying the Differential Case

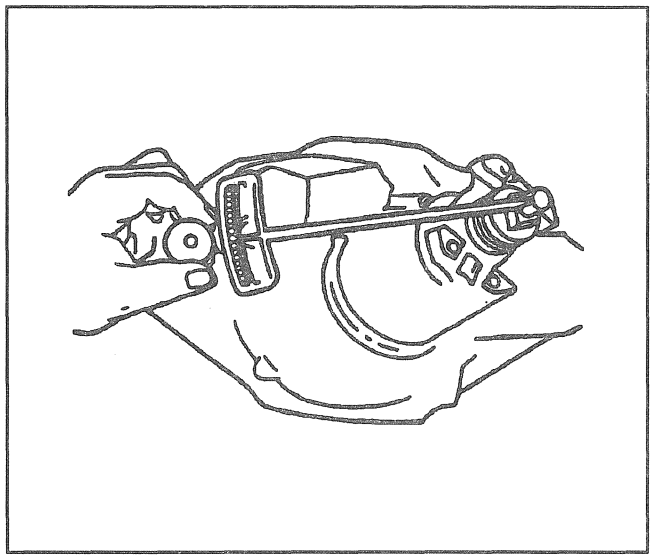


Figure 5—Checking Pinion Preload

14. Ring gear bolts (23).
    - Ring gear bolts use left-handed threads.

NOTICE: ***Do not pry the ring gear from the case. This will damage the ring gear and differential case.***

15. Ring gear (7) from the differential case.
    - Drive the ring gear off with a brass drift if necessary.

Inspect

- Drive pinion bearing preload and record for reference upon reassembly (Figure 5).
- Looseness of pinion assembly by moving it back and forth. (This indicates excessive bearing wear).

16. Pinion flange nut (35) and washer (36) using J 8614-01 to hold the pinion flange (Figure 6).
17. Pinion flange using J 8614-01 (Figure 7).
18. Pinion (7) from the axle housing.
    A. Thread the pinion nut halfway onto the pinion.
    B. Replace the differential cover (12) with two bolts (14) to keep the pinion from falling to the floor.
    C. Drive the pinion out of the housing with a hammer and a soft drift (Figure 8).
19. Collapsible spacer (4) from the pinion.
20. Outer pinion seal (38) and bearing (39).
21. Inner bearing (5) and shim (6) from the pinion.
    A. Press the bearing off the pinion using J 8612-B (Figure 9).
    B. Remove the shim.
22. Bearing cups (5 and 39) from the axle housing using a hammer and punch.
    - Work the cups out of the housing evenly, moving the punch back and forth between one side of the cup and the other. Use the slots provided for this purpose.

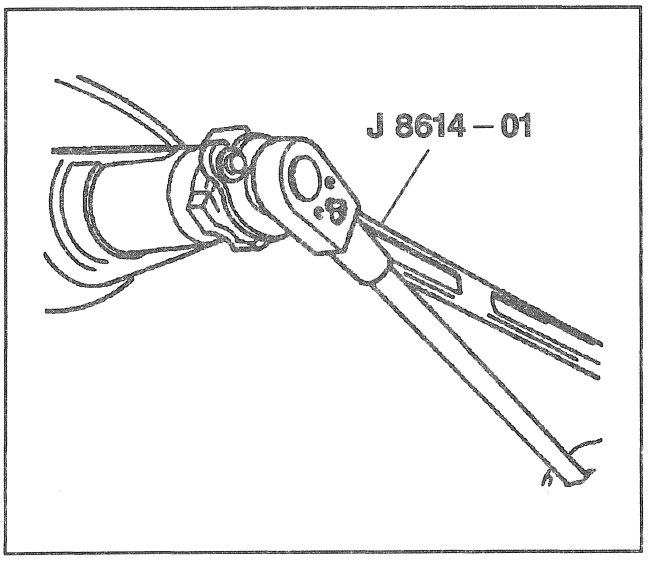


Figure 6—Removing the Drive Pinion Nut

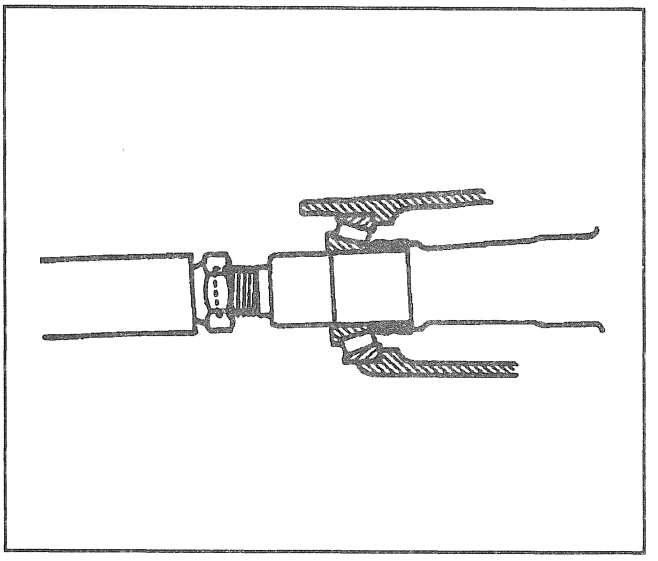


Figure 8—Removing the Drive Pinion

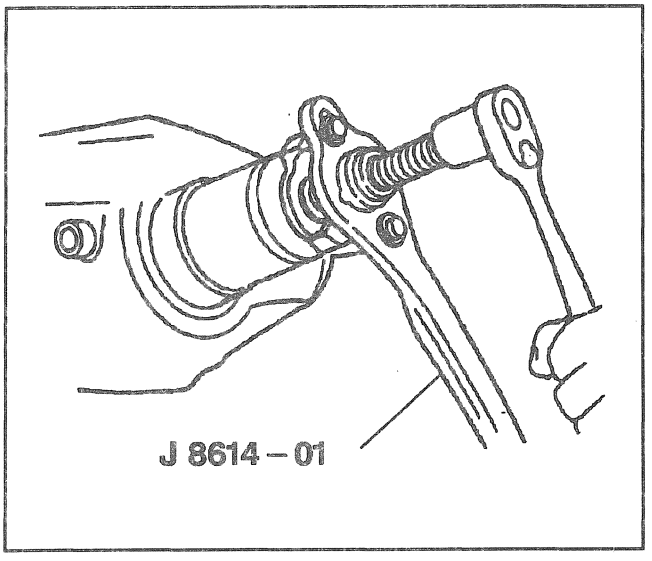


Figure 7—Removing the Pinion Flange

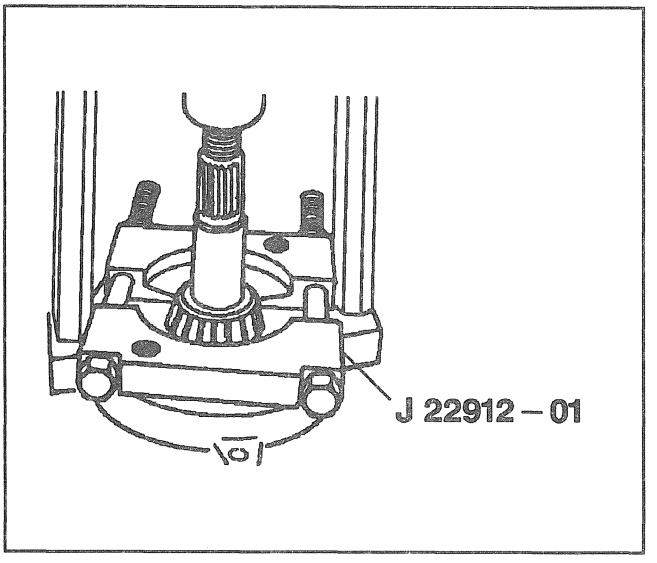


Figure 9—Removing the Pinion Rear Bearing

CLEANING

Do not steam clean drive parts having ground and polished surfaces such as gears, bearings, and shafts. All parts should be disassembled before cleaning. These parts should be cleaned in a suitable solvent.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow the bearings to spin while drying them with compressed air.

INSPECTION

It is critical to carefully and thoroughly inspect all drive unit parts before reassembly.

Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

Axle Housing

Inspect

- The carrier bore for nicks or burrs that would prevent the outer diameter of the pinion seal from sealing. Remove any burrs that are found.
- The bearing cup bores for nicks or burrs. Remove any burrs that are found.
- The housing for cracks. Replace the housing if any cracks are found.
- The housing for foreign material such as metal chips, dirt, or rust. Refer to "Cleaning" in this section.

Differential

Inspect

- Pinion gear shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- Replace all worn parts.

Ring and Pinion Gears

Inspect

- Ring and pinion gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion gear splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion gear on the pinion flange.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks that would cause damage to the seal's inside diameter and result in an oil leak.
- Replace all worn or broken parts.

Important

- Ring and pinion gears are matched sets and both must be replaced any time a replacement of either is necessary.
  - — A new pinion flange must be replaced when ring gear and pinion gear are replaced to maintain proper system balance.

Bearings

Inspect

- Bearings visually and by feel.
- The bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.
- The large end of the bearing rollers for wear. This is where tapered roller bearing wear is most evident.
- Bearing cups for wear, cracks, brinelling, and scoring.
- Bearings and cups are replaced only as sets.
  - — If the axle was operated for an extended period of time with very loose bearings, the ring gear and drive pinion will also require replacement.
  - — Low mileage bearings may have very small scratches and pits on the rollers and bearing cups from the initial preload. Do not replace a bearing for this reason.
  - — Bearing caps for cracks or chips.

Shims

Inspect

- Shims for cracks and chips. Damaged shims should be replaced with an equal size service shim.

ASSEMBLY OF THE REAR AXLE

Tools Required:
J 8608 Rear Pinion Bearing Cup Installer
J 8611-01 Front Pinion Bearing Cup Installer
J 8092 Driver Handle
J Inner Bearing Cup Installer

Install or Connect (Figures 1, 10 through 14)

1. Front pinion bearing cup (39) using J 8611-01 and J 8092 (Figure 10).
2. Rear pinion bearing cup (5) using J 8608 and J 8092 (Figure 11).

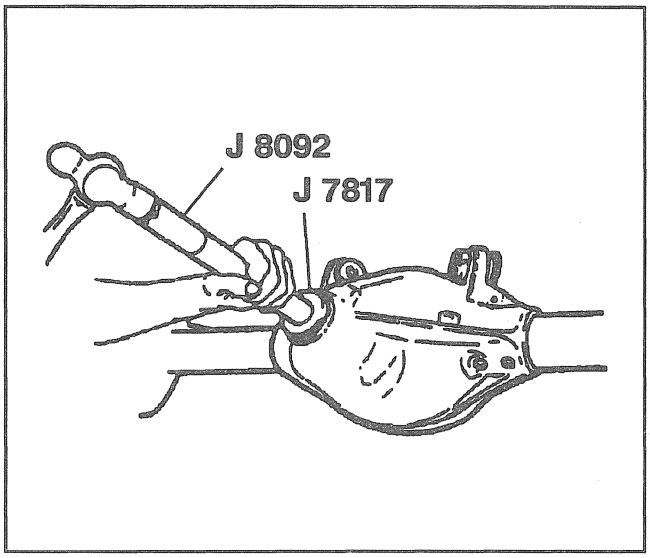


Figure 10—Installing the Front Pinion Bearing Cup

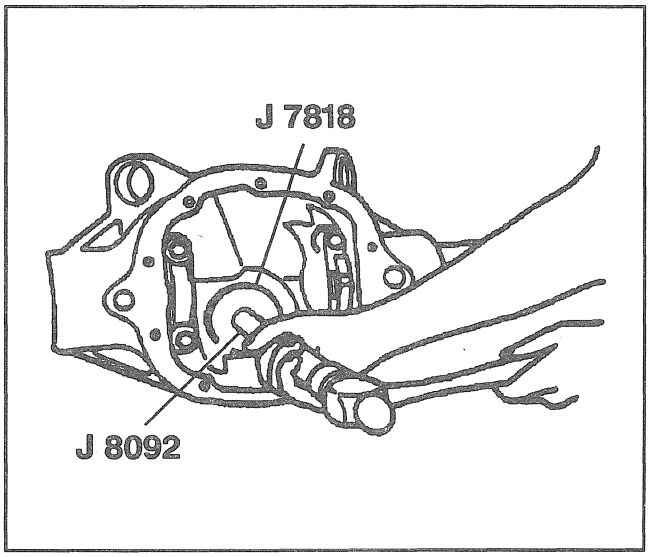


Figure 11—Installing the Rear Pinion Bearing Cup

Pinion Depth Adjustment

Tools Required:
- J 8001 Dial Indicator Gage Set
- J 21777-1 Arbor
- J 21777-29 Gage Plate
- J 21777-35 Rear Pilot Washer
- J 21777-42 Front Pilot Washer
- J 21777-43 Stud Assembly—Bolt
- J 21777-45 Side Bearing Disc

1. Clean all the gage parts.
2. Lubricate the front and rear pinion bearings with axle lubricant.
3. Place the bearings into the pinion bearing cups.
4. Install J 21777-35, J 21777-42, J 21777-29, and J 21777-43 to the pinion bore (Figure 12).
5. Hold the stud stationary at the flats of the stud.

Tighten

- Stud nut to 2.2 N·m (20 lb. in.).

6. Rotate the gage plate and bearings several complete revolutions to seat the bearings.

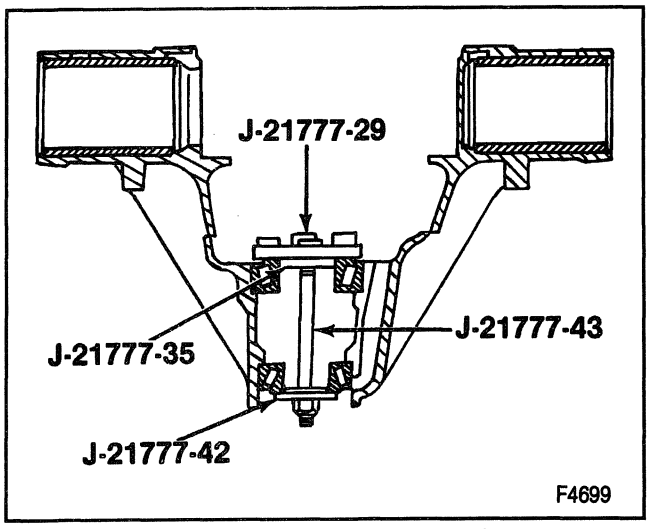


Figure 12—Gage Plate Tools

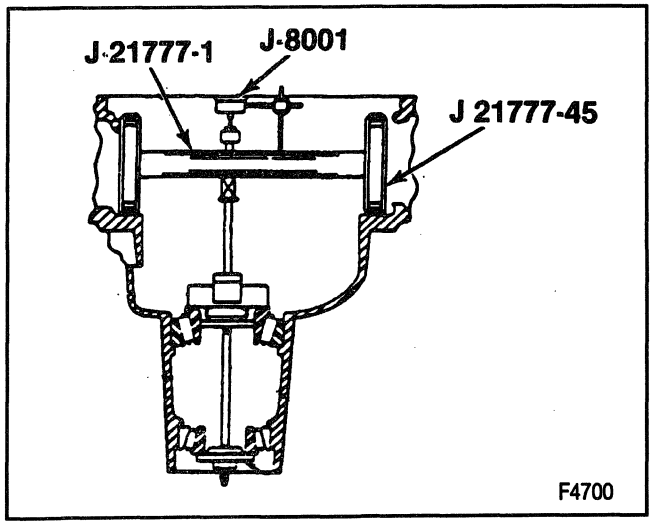


Figure 13—Pinion Depth Tools

7. Tighten the stud nut until a torque of 1.6 to 2.2 N·m (15 to 25 lb. in.) is obtained to keep the gage plate in rotation.
8. Assemble J 21777-45, J 21777-1, and J 8001 to the differential bearing bore as shown in (Figure 13).
   - The bearing bores must be clean and burr free.
9. Install the side bearing caps.

Tighten

- Bolts to 74 N·m (55 lb. ft.)

10. Rotate the gage plate until the proper gaging area is parallel with the discs.
11. Position the gage shaft assembly in the carrier so the dial indicator rod is centered on the gage area of the gauge block.
12. Set the dial indicator at zero. Push the indicator down on the indicator shaft until the needle rotates approximately 3/4 of a turn to the right. Tighten the dial indicator in this position.
13. Rotate the gage shaft slowly back and forth until the dial indicator reads the greatest deflection. This is when the indicator needle is centered between movement to the left and to the right.
14. At the point of greatest deflection, set the dial indicator to zero. Repeat the rocking action of the gage shaft to verify the zero setting.
15. Rotate the gage shaft until the dial indicator rod does not touch the gage block. 16 Record the actual number on the dial indicator and not the number which represents how far the needle travels. This is the nominal pinion setting. EXAMPLE: The indicator needle moved counter clockwise 1.70 mm (0.067 inch) to a dial reading of 0.84 mm (0.033 inch) (Figure 14). Record the dial reading of 0.84 mm (0.033 inch), NOT 1.70 mm (0.067 inch).
16. Check the pinion face for a pinion adjustment mark. This mark indicates the best running position for the pinion from the nominal setting.
    - If the pinion has no plus or minus marked on it, use the nominal pinion setting to select a shim.

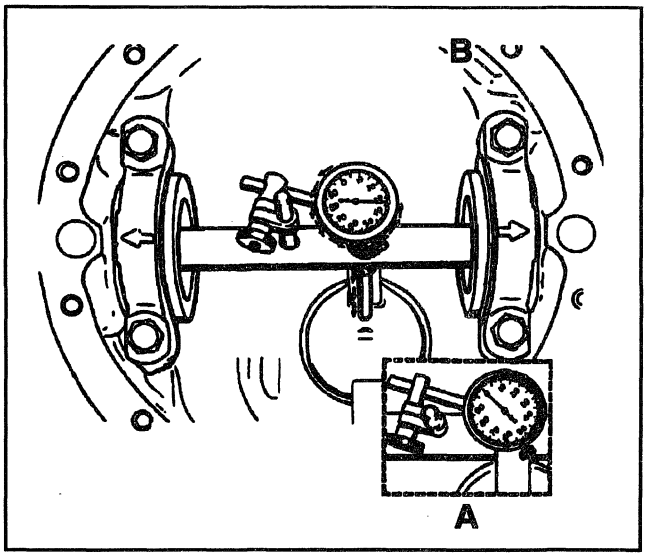


Figure 14—Checking Pinion Depth

17. Remove bearing caps (10) and depth gaging tools.
18. Install the correct pinion shim (6) to the pinion according to this procedure.

NOTICE: ***Proper pinion depth setting is a two-step procedure.***

1. ***Setup dimension arrived at with the indicator to be considered a starting point.***
2. ***Gear tooth pattern check is necessary to "fine tune" the pinion depth and may indicate additional shim changes to the pinion stem. Both procedures must be performed to ensure proper axle performance and prevent system damage.***

PINION INSTALLATION

Tools Required:
- J 8609-01 Rear Pinion Bearing Cone Installer
- J 22388 Pinion Oil Seal Installer
- J 8614-01 Pinion Flange Remover
- J 5590 Rear Pinion Bearing Cone Installer

Install or Connect (Figures 1, 15, and 16)

- The bearing cups should have been installed in "Pinion Depth Adjustment."

1. The pinion inner bearing (5) using J 8609-01.
   - Press the bearing onto the pinion until the bearing cone seats on the pinion shims.
2. A new collapsible spacer (4).
   - Lubricate the pinion bearings with axle lubricant.
3. Pinion (7) to the axle housing.
4. Outer pinion bearing (39) onto the pinion using J 5590.
   - Hold the pinion forward from inside the case while driving the bearing onto the pinion.
5. Pinion oil seal (38) using J 22388 (Figure 15).
6. Pinion flange (37) to the pinion by tapping it with a soft faced hammer until a few threads show through the pinion flange.
7. Pinion washer (36) and a new nut (35) while holding the pinion flange with J 8614-01 (Figure 16).

Adjust

A. The nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is no end play in the pinion, the preload torque should be rechecked.
B. Remove J 8614-01. Check the pinion preload by rotating the pinion. Preload should be at or below 2.3 to 2.8 N·m (20 to 25 lb. in.) on new bearings, or 1.1 to 1.7 N·m (10 to 15 lb. in.) for used bearings (Figure 17).

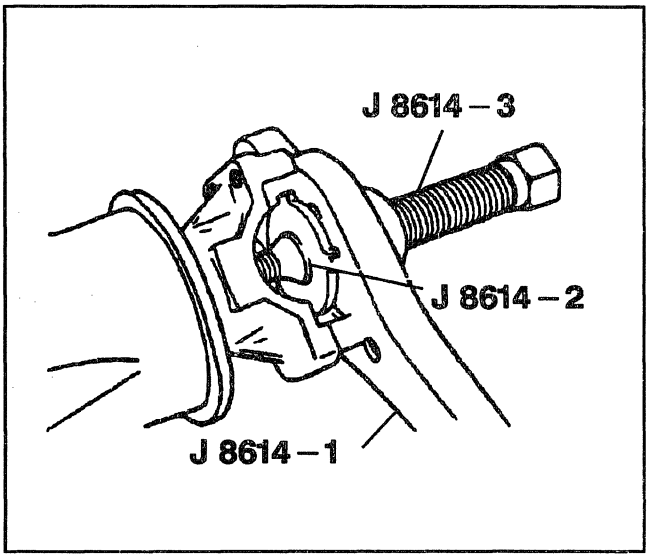


Figure 16—Installing the Pinion Flange

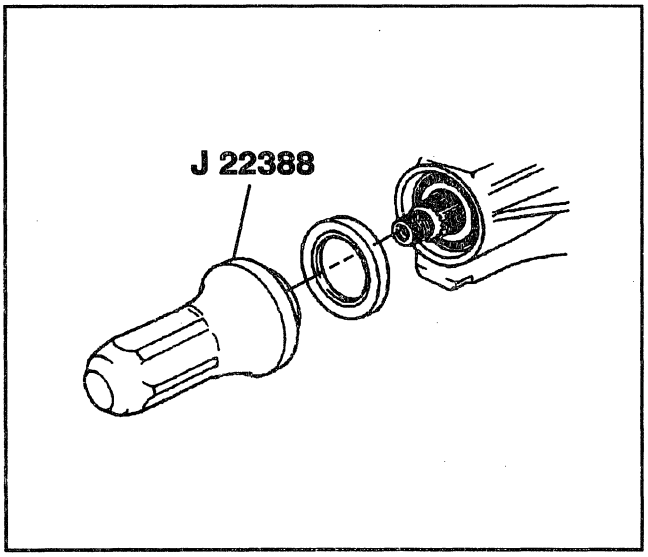


Figure 15—Installing the Pinion Oil Seal

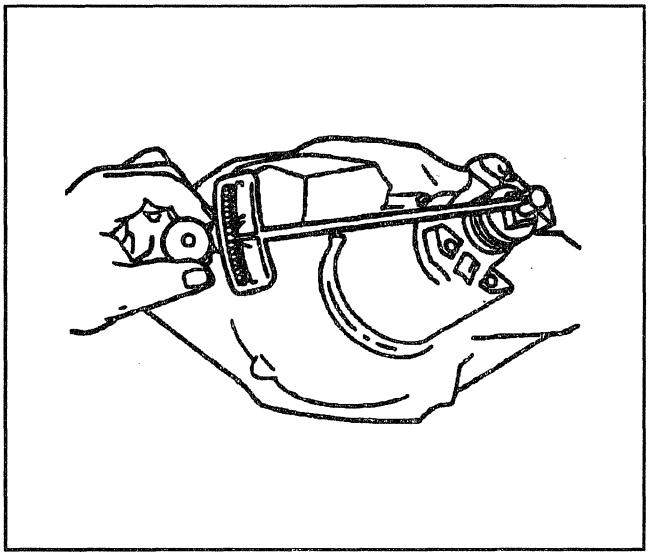


Figure 17—Checking Pinion Bearing Preload

C. If the preload torque is below the preloads given above, continue tightening the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload. If the bearing preload is exceeded, the pinion will have to be removed and a new collapsible spacer installed.
D. Once the preload has been obtained, rotate the pinion several times to ensure the bearings have seated. Recheck the preload, and adjust if necessary.

8. Differential case. Refer to "Backlash Adjustment" in this section.

Differential Case Assembly

Tools Required:
J 8107-4 Differential Side Bearing Remover Plug
J 8092 Driver Handle
J 22761 Differential Side Bearing Installer

- Lubricate all parts with axle lubricant.

Install or Connect (Figure 1)

1. Side gear thrust washers (19) to the side gears (22).
2. Side gears (22) to the differential case (24).
   - Reinstall the side gears on the same side as removed.
3. Pinion gears (21) to the differential without the thrust washers (20).
   - Place one pinion gear onto the side gears so the holes in the pinion gears are 180 degrees apart.
   - Rotate the pinion gears into place, and verify that the pinion gears line up with the pinion shaft holes.
4. Pinion thrust washers (20).
   - Rotate the pinion gears toward the differential opening enough to slide in the pinion thrust washers.
   - Make sure the mating surfaces of the differential case and ring gear are clean and burr free.
5. Ring gear (7) to the differential case (24).
   A. Thread two left-hand threaded studs into the ring gear on opposite sides (Figure 18).
   B. Place the ring gear onto the case and align the holes in the case with the studs.
   C. Press the ring gear onto the case far enough to start the bolts using J 8107-4 to protect the differential from the press ram (Figure 19).
6. Ring gear bolts (23).
   - Tighten the ring gear bolts alternately in stages gradually pulling the ring gear onto the differential case.

Tighten

- The ring gear bolts in sequence to 120 N·m (90 lb. ft.).

7. Differential side bearings (8) using J 22761, J 8107-4, and J 8092 (Figure 20).
   A. Place J 8107-4 into the differential on the side opposite of bearing installation to protect the differential case.
   B. Drive the bearing onto the case using J 22761 and J 8092.
8. Differential case (24) to the axle housing. Refer to "Side Bearing Preload Adjustment" in this section.

Side Bearing Preload Adjustment

Tool Required:
J 22779 Side Bearing Backlash Gage

- The differential side bearing preload is adjusted by changing the thickness of the left and right shims equally. This will not change the original backlash.
- Production shims are cast iron and are not to be reused.
- Service spacer thickness is nominal at 4.32 mm (0.170 inch).
- Service shims are available from 1.02 mm to 2.54 mm (0.040 to 0.100 inch) in increments of 0.101 mm (0.004 inch).
- Make sure the side bearing surfaces are clean and free of burrs.

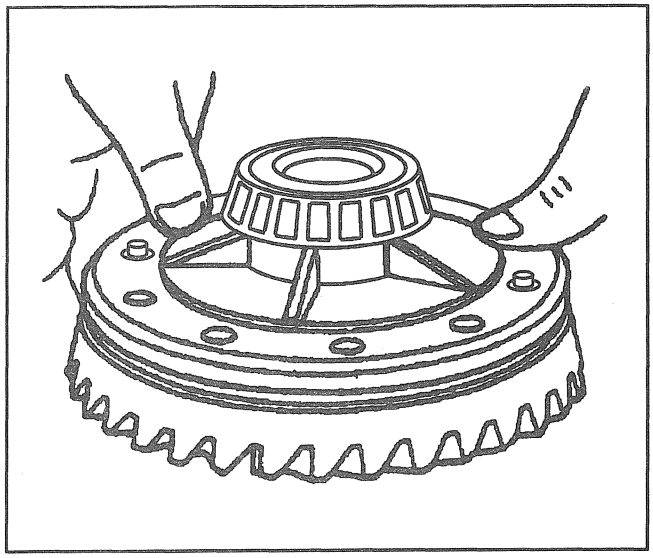


Figure 18—Aligning the Ring Gear Studs

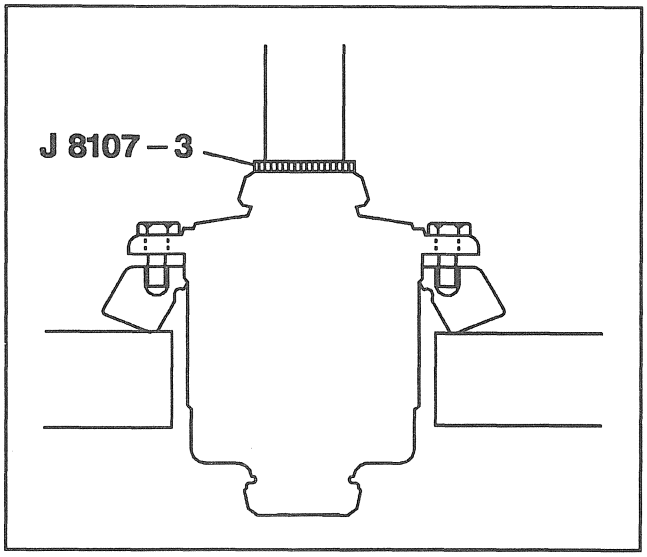


Figure 19—Installing the Ring Gear to the Case

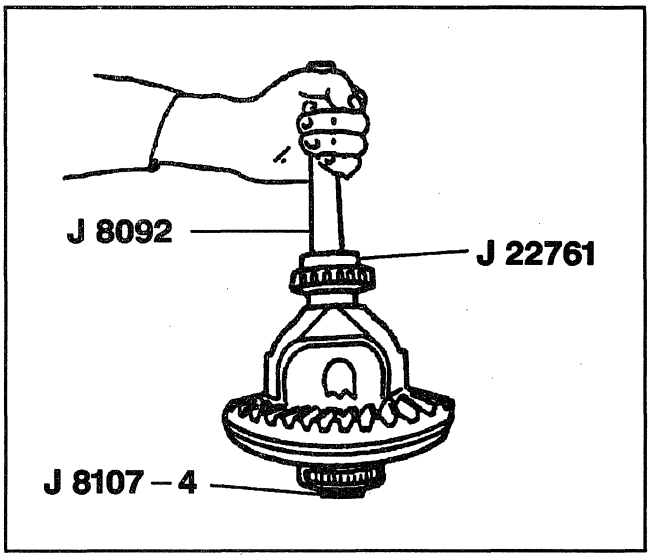


Figure 20—Installing the Side Bearing

1. Place the differential case and the bearing cups into the axle housing.
   A. Lubricate the axle bearings with axle lubricant.
   B. Support the case to keep it from falling into the axle housing.
2. Install the strap from J 22779 on the left bearing with the cap bolts. Tighten the bolts snugly.
3. Push the ring gear towards the pinion.
   - Engage the ring gear with the pinion tightly, to a backlash of 0.000 inch (No noticeable looseness).
4. Insert J 22779 between the axle housing and left bearing cup (Figure 21).
5. Move the tool back and forth in the bore while turning the adjusting nut clockwise until a noticeable drag is produced (Figure 22).
   A. Tighten the lock bolt on the side of the tool.
   B. Leave the tool in place.
6. Install a service spacer (9) and service shim (9) between the right bearing cup and axle housing.

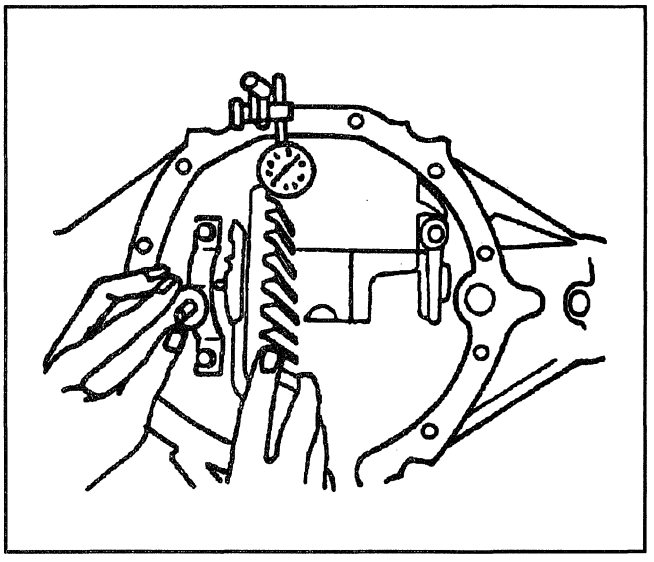


Figure 21—Installing Side Bearing Gaging Tool

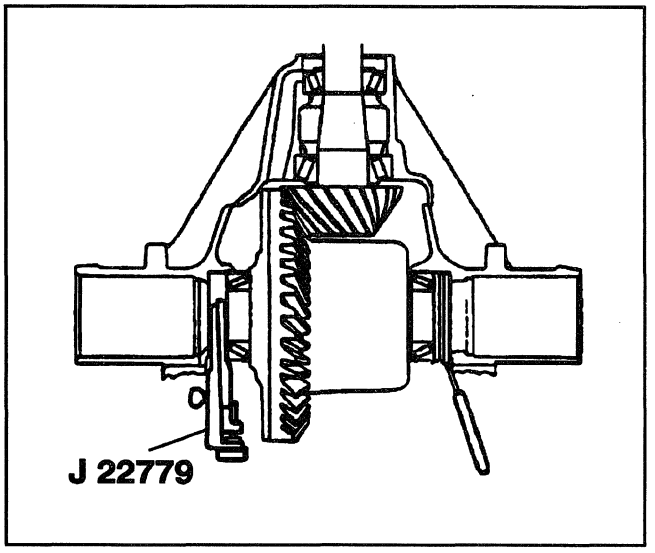


Figure 22—Measuring Side Bearing Shim Requirements

7. Determine bearing preload by inserting progressively larger feeler gauge sizes between the carrier and service shim.
   - Push the feeler gauge downward so it contacts the shim at the top and bottom and then contacts the axle housing.
   - The point just before additional drag begins is the correct feeler gauge thickness. This is the zero setting without preload.
8. Remove the strap, J 22779, the service spacer, service shim, feeler gauge, and differential case from the axle housing.
9. Measure J 22779 in three places using a micrometer. Average the readings (Figure 23).
10. Add the dimensions of the right side service spacer, service shim, and feeler gauge.

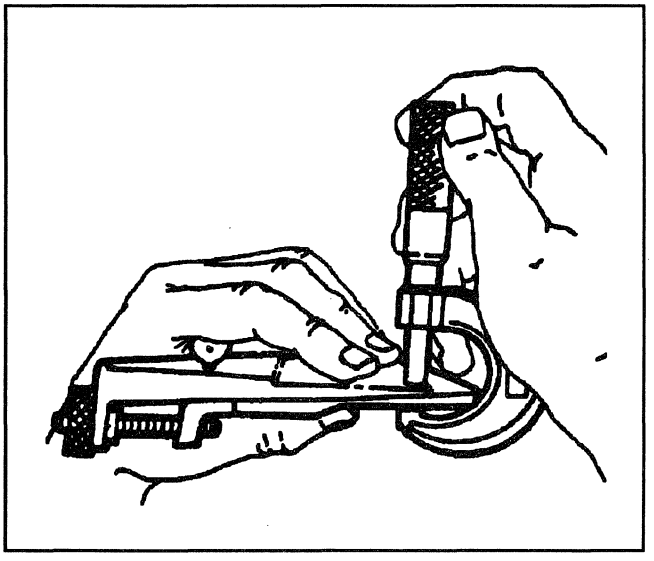


Figure 23—Measuring the Gage Plate Thickness

11. For an initial backlash setting, move the ring gear away from the pinion by subtracting 0.010 inch from the ring gear side shim pack and adding 0.010 inch to the shim pack on the opposite side.
12. To obtain the proper preload on the side bearings add 0.10 mm (0.004 inch) to the measurement of each shim pack.
13. Install the differential. Refer to "Backlash Adjustment" in this section.

Backlash Adjustment

1. Install the differential case, bearing cups, spacers, and shims as determined from the "Side Bearing Preload Adjustment" in this section (Figure 24).
   - Tap the final shim into position, using a soft faced hammer.
2. Rotate the case several times to seat the bearings.
3. Install a dial indicator to the case using a magnetic base.

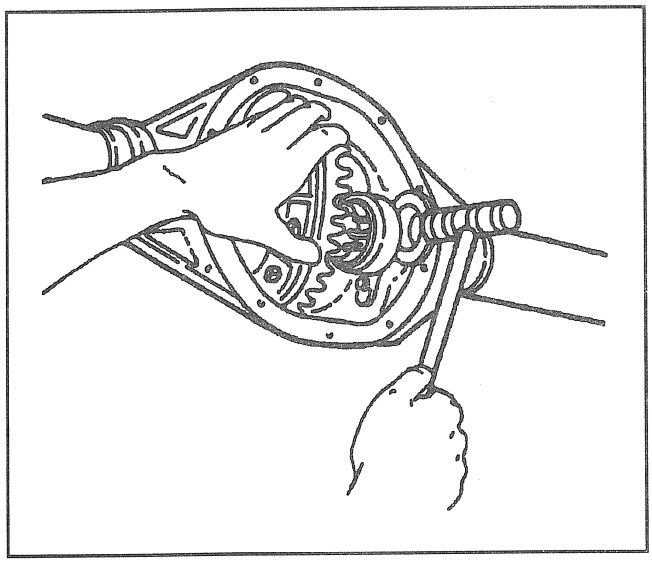


Figure 24—Installing the Final Preload Shim

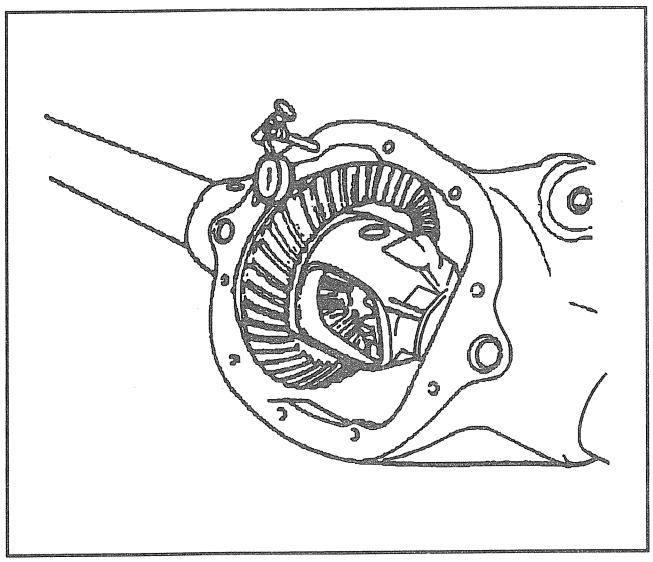


Figure 25—Checking Ring Gear Backlash

4. Place the indicator stem at the heel end of a tooth.
   - Set the dial indicator so the stem is in line with the gear rotation and perpendicular to the tooth angle (Figure 25).
5. Install the differential caps and bolts.

Tighten

   - The bolts to 80 N.m (60 lb. ft.).
6. Check and record the backlash at three or four points around the ring gear.
   - The pinion must be held stationary when checking backlash.
   - The backlash should be the same at each point within 0.05 mm (0.002 inch). If the backlash varies more than 0.05 mm (0.002 inch), check for burrs, a distorted case flange, uneven bolting conditions, or foreign matter between the case and ring gear.
7. Backlash at the minimum lash point measured should be between 0.13 to 0.23 mm (0.005 to 0.009 inch) for all new gear sets.
8. If the backlash is not within specifications, move the ring gear in or out from the pinion by increasing the thickness of one shim, and decreasing the thickness of the other shim the same amount. This will maintain the correct axle side bearing preload.
   - Moving 0.003 inch worth of shim from one side of the differential to the other will change the backlash adjustment by 0.002 inch.
9. Recheck the backlash and correct as necessary.

GEAR TOOTH PATTERN CHECK

Before final assembly of the differential, a gear tooth contact pattern check should be performed.

A gear tooth contact pattern check is NOT a substitute for adjusting pinion depth and backlash as previously outlined. It is a method to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy, have a short life, or both. With a pattern check, the best contact between the ring gear and the drive pinion for low noise level and long life can be ensured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side (4). The concave side is the "coast" side (3). The end of the tooth nearest the center of ring gear is referred to as the "toe" end (2). The end of the tooth farthest away from the center is the "heel" end (1). The toe end of the tooth is smaller than the heel end (Figure 26).

Test

1. Wipe oil out of axle housing and carefully clean each tooth of the ring gear.
2. Apply gear marking compound sparingly to all ring gear teeth using a medium stiff brush.
3. Use the service brake to apply a load until a torque of 54-68 N.m (40-50 lb. ft.) is required to turn the pinion.

   A test made without loading the gears will not give a satisfactory pattern. Turn the companion flange with a wrench so that the ring gear

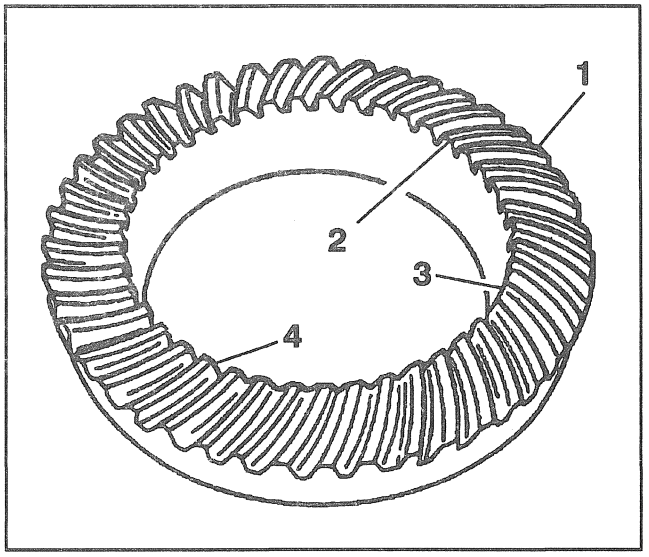


Figure 26—Gear Tooth Nomenclature

rotates one full revolution. Then reverse the rotation so that the ring gear rotates one revolution in the opposite direction. Excessive turning of the ring gear is not recommended.

4. Observe the pattern on the ring gear teeth and compare with Figure 27.

ADJUSTMENTS AFFECTING TOOTH CONTACT

Two adjustments can be made that affect tooth contact pattern: backlash and drive pinion depth. The effects of bearing preloads are not readily apparent on hand-loaded tooth contact pattern tests. However, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims that move the case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload).

If the thickness of the right shim is increased (along with decreasing the left shim thickness), backlash will increase.

If the thickness of the left shim is increased (along with decreasing the right shim thickness), backlash will decrease.

Final Assembly

Tools Required:
J 8092 Driver Handle
J 23765 Axle Shaft Bearing Installer
J 23771 Axle Shaft Seal Installer
J 23911 Pinion Oil Seal Installer

Install or Connect (Figures 1, 28 through 30)

1. Bearing (27) with J 23765 and J 8092 until the tool bottoms against the housing shoulder (Figure 28).
   - Lubricate the bearing with axle lubricant.
2. Oil seal using J 23771 until the oil seal is flush with the axle tube (Figure 29).
   - Lubricate the seal lips with gear lubricant.
3. Axle shafts (33) into the axle housing (1).
   - Be careful not to damage the oil seal.
   - The splines at the end of the axle shaft must engage with the splines of the axle side gear.
4. "C" locks (34) on the axle shaft (33).
   - Pull the axle shaft (33) outward so the "C" lock (34) seats in the counterbore of the axle side gear (Figure 30).
5. Pinion shaft (17) through the case (24) and differential gears (22).
   - Align the hole in the pinion shaft with the lock bolt hole.
6. Pinion shaft lock bolt (15).

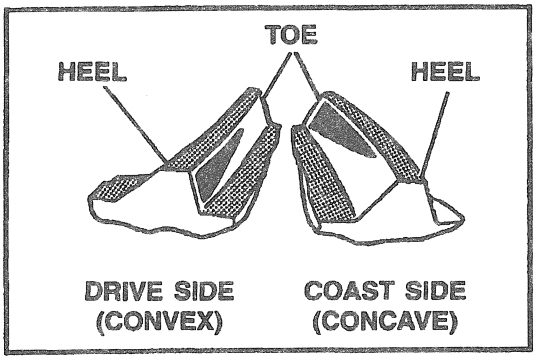
   Tighten
   - Lock bolt (15) to 34 N·m (25 lb. ft.).
7. Cover gasket (11) and cover (12).

   Tighten
   - Cover bolts (14) to 27 N·m (20 lb. ft.).
8. Lubricant into the axle.
   - Lubricant to a level within 9.5 mm (3/8 inch) of the filler plug hole.

   Tighten
   - Fill plug (3) to 35 N·m (26 lb. ft.)

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO FAR AWAY FROM RING GEAR.



CORRECTION:

INCREASE THE PINION SHIM THICKNESS.

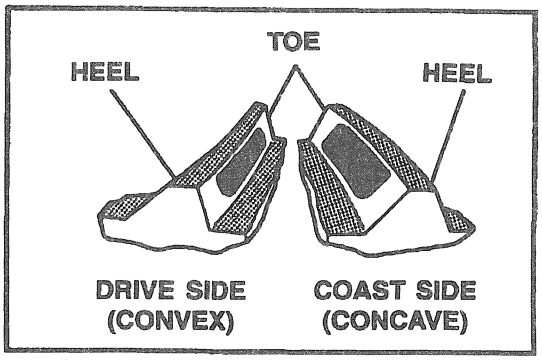
SERVICE HINTS:

HOW TO CHECK PATTERNS:

- BRUSH GEAR MARKING COMPOUND ON THE RING GEAR TEETH.
- APPLY BRAKES SO THAT THE PINION CAN BE ROTATED WITH 50 LB. FT. EFFORT.
- ROTATE THE PINION SIX TIMES CLOCKWISE AND SIX TIMES COUNTERCLOCKWISE.
- OBSERVE THE TOOTH CONTACT PATTERN AND MAKE ANY NECESSARY CORRECTIONS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH CORRECT.



CORRECTION:

NONE.

SERVICE HINTS:

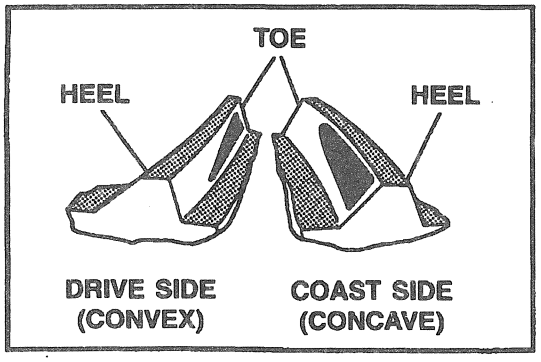
PATTERNS THAT MAY VARY MAY BE CAUSED BY LOOSE BEARINGS ON THE PINION OR THE DIFFERENTIAL CASE CHECK THESE BEARING PRELOAD SETTINGS:

- TOTAL ASSEMBLY
- DIFFERERTIAL CASE
- PINION

IF THESE SETTINGS ARE GOOD, LOOK FOR DAMAGED OR INCORRECTLY ASSEMBLED PARTS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO CLOSE TO RING GEAR.



CORRECTION:

DECREASE THE PINION SHIM THICKNESS.

SERVICE HINTS:

PINION DEPTH SHIM LOCATIONS:

- BETWEEN THE INNER PINION BEARING CONE AND THE HEAD OF THE PINION GEAR.
- BETWEEN HTE INNER PINION BEARING CUP AND THE REAR AXLE HOUSING.

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Figure 27—Gear Tooth Pattern

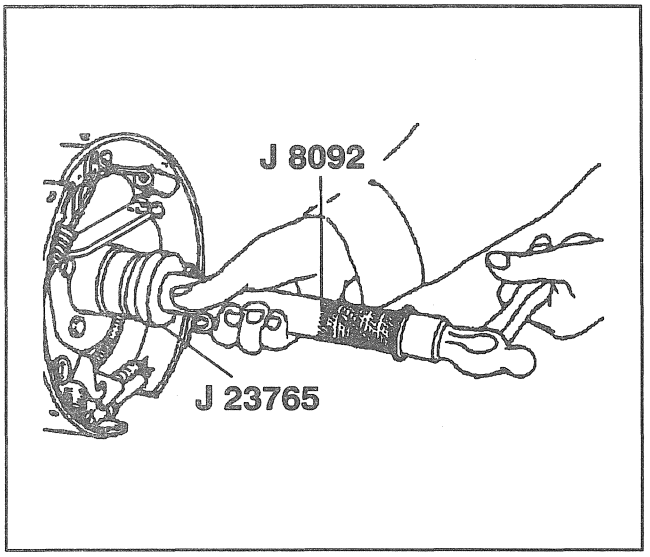


Figure 28—Installing the Axle Bearing

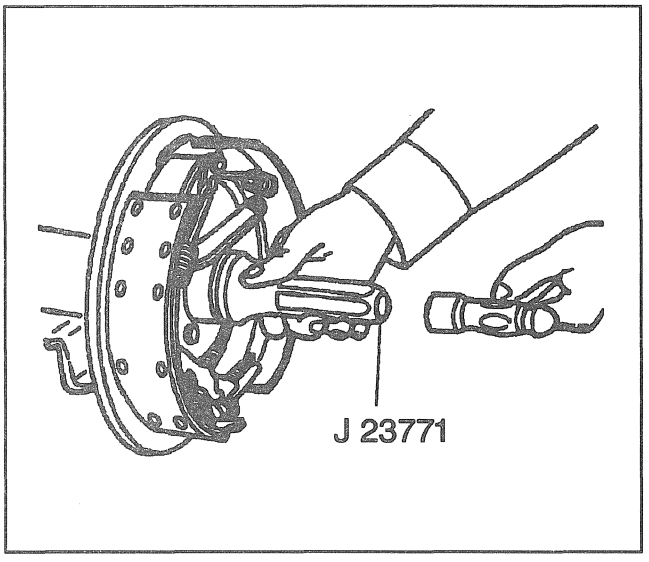


Figure 29—Installing the Axle Seal

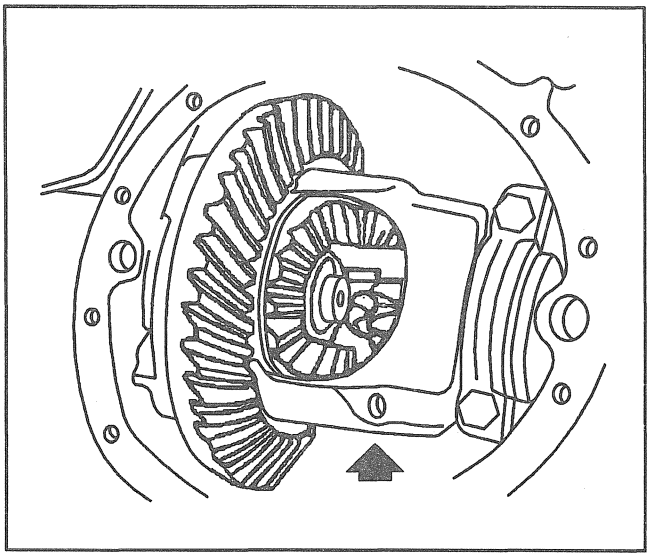


Figure 30—"C" Lock and Axle Shaft Seated In The Side Gear

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Axle Cover Bolts	27	20
Bearing Cap Bolts	80	60
Filler Plug	35	26
Ring Gear Bolts	120	90

SPACER AND SHIM SPECIFICATIONS

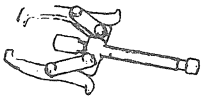
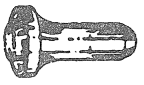
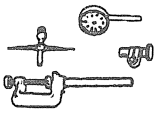
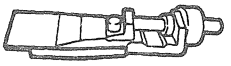
Spacer and Shim Sizes	Size
Differential Side Bearing Spacer	0.170-inch
Differential Side Bearing Shim Kits	0.040-0.044-inch 0.046-0.050-inch 0.052-0.056-inch 0.058-0.063-inch 0.064-0.070-inch 0.072-0.078-inch 0.080-0.086-inch 0.088-0.094-inch 0.096-0.100-inch
Pinion Bearing Shim Kits	0.020-0.024-inch 0.025-0.029-inch 0.030-0.034-inch 0.035-0.039-inch

LUBRICATION

Lubricant	80W-90 GL-5

T2509

SPECIAL TOOLS

1.		J 8611-01	8.		J 8608
2.		J 8612-B	9.		J 22888
3.		J 8092	10.		J 22399
4.		J 8001	11.		J 22761
5.		J 8609-01	12.		J 22779
6.		J 8614-01	13.		J 5590
7.		J 8107-4			

1. Front Pinion Bearing Cup Installer
2. Rear Pinion Bearing Cone Remover
3. Driver Handle
4. Dial Indicator Set
5. Rear Pinion Bearing Cone Installer
6. Pinion Flange Remover
7. Differential Side Bearing Remover Plug
8. Rear Pinion Bearing Remover Plug
9. Side Bearing Remover
10. Pinion Oil Seal Installer
11. Differential Side Bearing Installer
12. Side Bearing Backlash Gauge
13. Rear Pinion Bearing Cone Installer

Not Shown:

J 21777-1 Arbor
J 21777-29 Gauge Plate
J 21777-35 Rear Pilot Washer
J 21777-42 Front Pilot Washer
J 21777-43 Stud Assembly—Bolt
J 21777-45 Side Bearing Disc

F4660

SECTION 4B3

9 1/2-INCH RING GEAR

NOTICE: *Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.*

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GENERAL DESCRIPTION

The corporate 9 1/2 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. The gear set transfers this driving force at a 90 degree angle from the propeller shaft to the axle shafts.

This axle is semi-floating. The axle shafts are supported at the wheel end of the shaft by roller bearings pressed into the housing. The shafts are retained into the housing by retaining clips in the differential. The pinion gear is supported by two tapered roller bearings.

The pinion depth is set by a shim pack located between the pinion gear end and roller bearing. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.

The ring gear bolts to the differential case with left-hand thread bolts.

The differential case is supported by two tapered roller bearings. The differential and ring gears are located in relationship to the pinion using selective shims between the bearing and axle housing. To move the ring gear, change shim and adjust nut. The differential bear-

ing preload is set by a threaded differential bearing adjusting nut located between the axle housing and differential bearing cap. Two bearing caps hold the differential in the axle housing.

The differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing on turns and premature wear on internal axle parts.

The axle is sealed with a pinion seal, a seal at each axle shaft end, and RTV sealant between the cover and axle housing.

All corporate rear axles are identified by an alphanumeric broadcast code on the right axle tube near the carrier. The axle housing cover does not have a drain plug.

CHECKING THE AXLE BEFORE DISASSEMBLY

- Remove the housing cover and drain the lubricant.

Inspect

1. Ring gear backlash. Refer to "Backlash Adjustment" in this section. This information can be used to determine the cause of the problem. It will also help when setting up the shim packs for locating and preloading the differential case.
2. Case for metal chips and shavings. Determine where these chips and shavings came from, such as a broken gear or bearing cage.
   - Determine the cause of the axle problem before disassembly if possible.

DISASSEMBLY OF THE REAR AXLE

Tools Required:

J 8107-3 Differential Side Bearing Puller Plug
J 22813-01 Axle Bearing Remover
J 2619-01 Slide Hammer
J 22888-20 Differential Side Bearing Remover
J 8614-01 Pinion Flange Remover
J 22912-01 Rear Pinion Bearing Cone Remover

Remove or Disconnect (Figures 1 through 9)

- Place the axle in a suitable support.
- Drain the lubricant.

1. The cover bolts (24) and cover (25).
   - Refer to "Checking the Axle Before Disassembly" in this section.
2. Pinion shaft lock bolt (29) (Figure 2).
3. Pinion shaft (28).
4. "C" clip (37) from the end of the axle shaft (3).
   - Push the axle shaft (3) in towards the center of the differential case (27).
5. Axle shaft (3) from the axle housing (12).
6. Oil seal (4) using a seal removal tool behind the seal lip.
   - Be careful not to damage the housing.
7. Bearing (5) using J 2619-01 and J 22813-01.
   - The tangs of the tool should engauge the bearing outer race.
8. Pinion (31) and side gears (33).
   A. Remove thrust washer.
   B. Roll the pinion gears out of the case with the pinion thrust washer (30).
   C. Remove the side gears (33) and the side gear thrust washers (32). Mark the gears and the differential case as left and right.
9. Lock bolt (18).
10. Lock (16).
    - Loosen the adjusting nut (17).
11. Bearing cap bolts (20).
12. Bearing caps (19).
    - Mark the caps and the housing as left and right.

NOTICE: ***When prying the differential case out of the axle housing, be careful not to damage the cover gasket surface. The differential case must be supported when it is being removed to prevent the case from falling and damaging the case.***

13. Differential case (27).
    - Pry the case from the axle housing at the differential "window" (Figure 3).
14. Bearing outer races (22), shims (21), and adjusting nut (17).
    - Mark the races and the shims as left and right, and place them with the bearing caps.
15. Differential side bearings using J 8107-3 and J 22888-20 (Figure 4).
    - The jaws of J 22888-20 must pull from beneath the bearing cone and not the cage. Use the slots provided for this purpose.
16. Ring gear bolts (26).
    - Ring gear bolts have left-hand threads.

NOTICE: ***Do not pry the ring gear from the case. This will damage the ring gear and the differential case.***

17. Ring gear (15) from the differential.
    - Drive the ring gear off with a brass drift if necessary.

Inspect

- Drive pinion bearing preload with an inch pound torque wrench and record for use when reassembling the pinion (Figure 5).
- Pinion assembly for looseness by moving it back and forth. Looseness indicates excessive bearing wear.

18. Pinion flange nut (6) and washer (7) using J 8614-01 to hold the pinion flange (Figure 6).
19. Pinion flange using J 8614-01 (Figure 7).
20. Pinion (15) from the axle housing.
    A. Thread the pinion nut halfway onto the pinion.
    B. Replace the axle housing cover (25) with two bolts (24) to keep the pinion from falling.
    C. Drive the pinion out of the housing with a hammer and soft drift (Figure 8).
       - Remove the cover (25) and the pinion (15).
21. Collapsible spacer (11) from the pinion.
22. Outer seal (9) and outer pinion bearing (10).

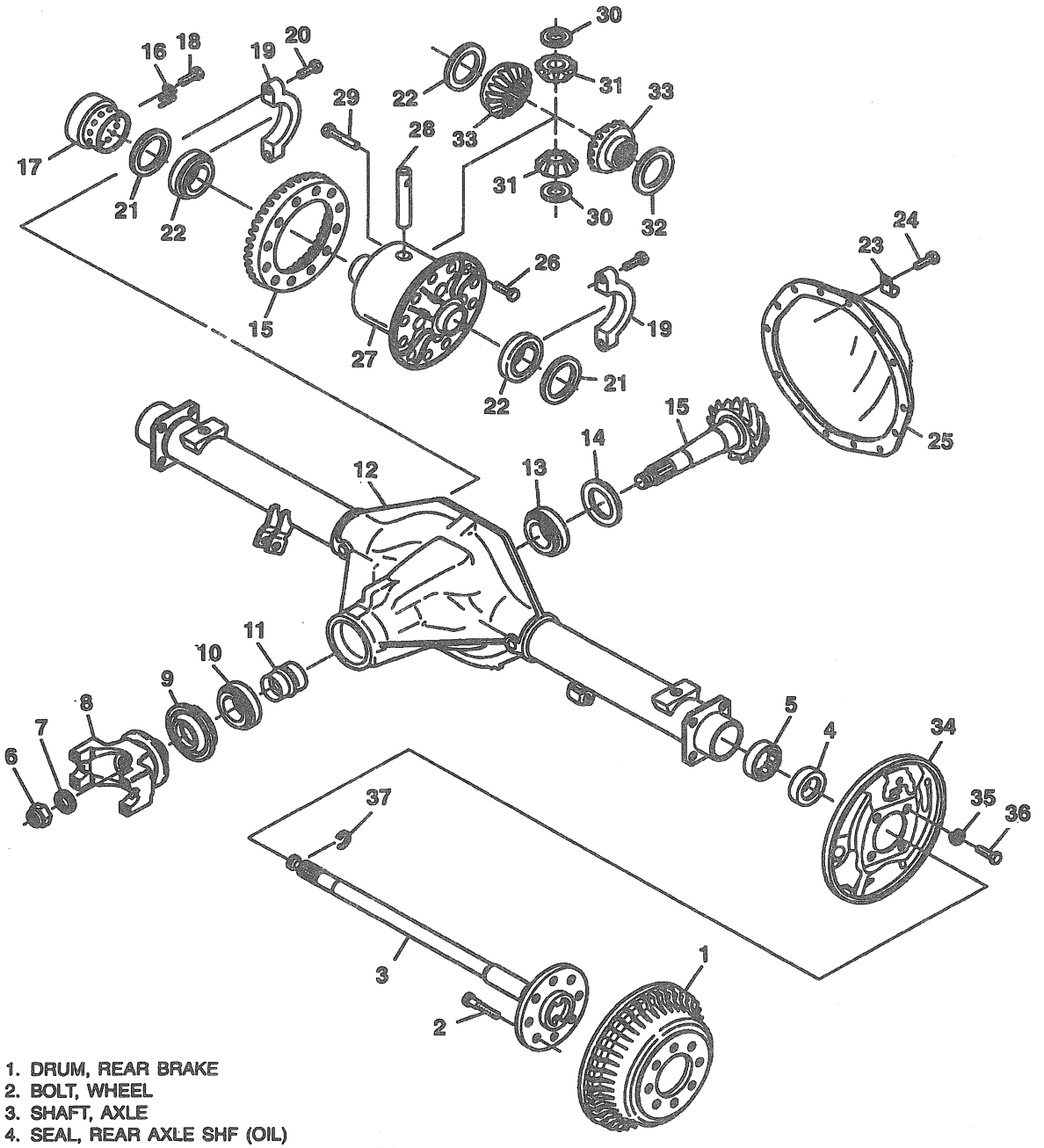


Figure 1—Rear Axle Components

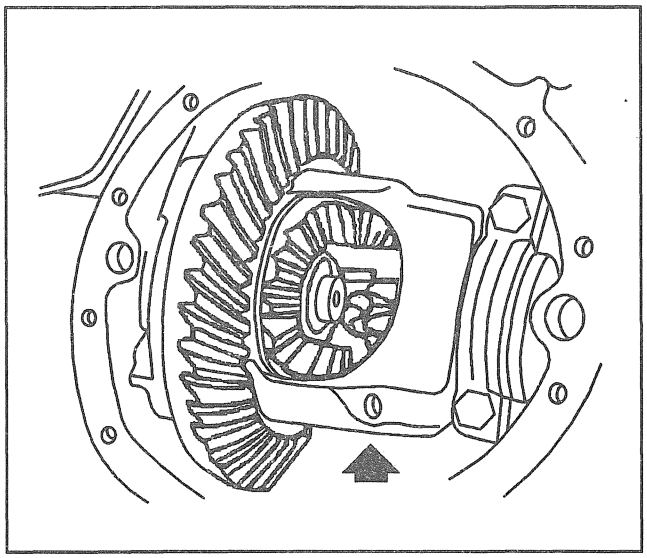


Figure 2—Pinion Shaft Lock Bolt

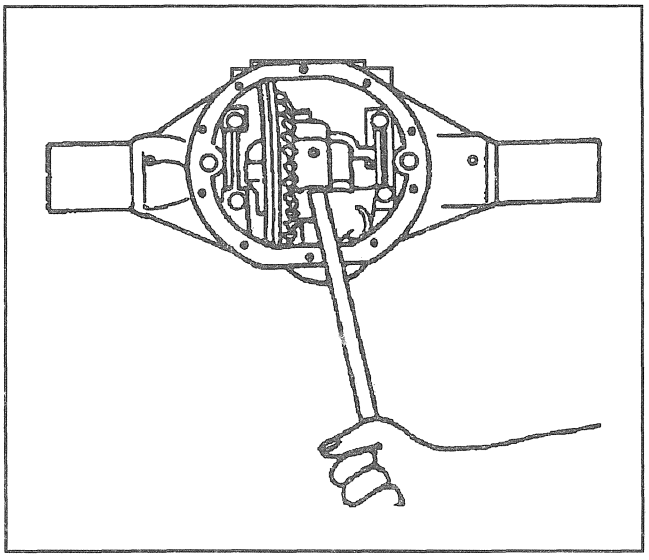


Figure 3—Removing the Differential Case

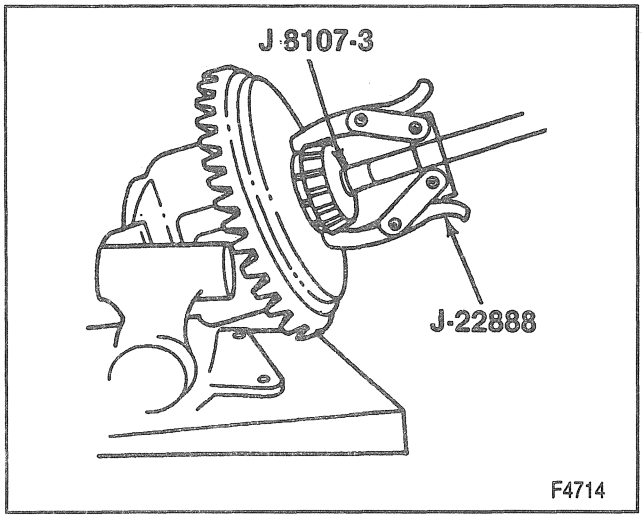


Figure 4—Removing Differential Side Bearings

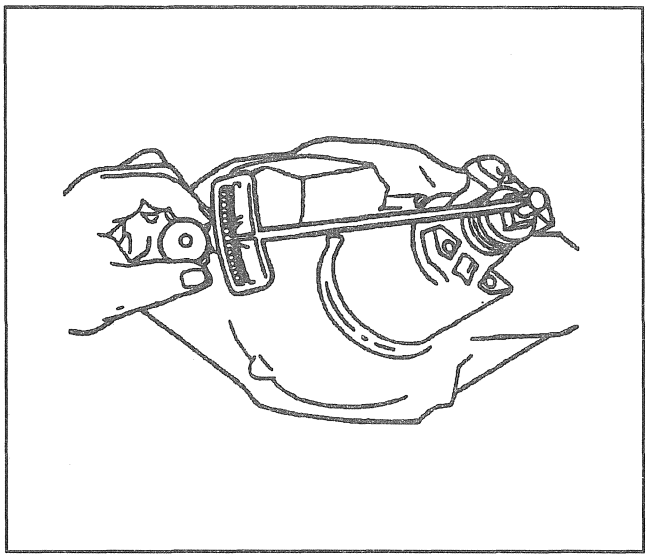


Figure 5—Checking Pinion Preload

23. Inner bearing (13) and shim (14) from the pinion.
    A. Press the bearing off the pinion using J 22912-01 (Figure 9).
    B. Remove the shim.
24. Bearing cups (10 and 13) from the axle housing using a hammer and punch.
    - Work the cups out of the housing evenly, moving the punch back and forth between one side of the cup and the other.

CLEANING

Do not steam-clean drive parts that have ground and polished surfaces such as gears, bearings, and shafts. All parts should be disassembled before cleaning. These parts should be cleaned in a suitable solvent.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow the bearings to spin while drying them with compressed air.

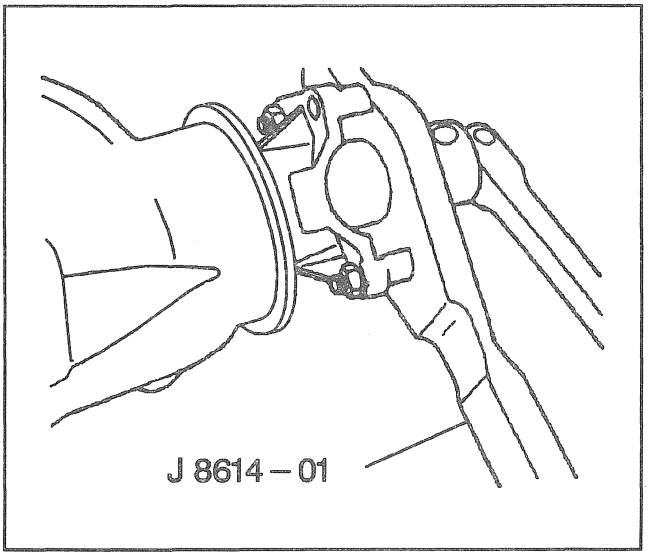


Figure 6—Removing the Drive Pinion Nut

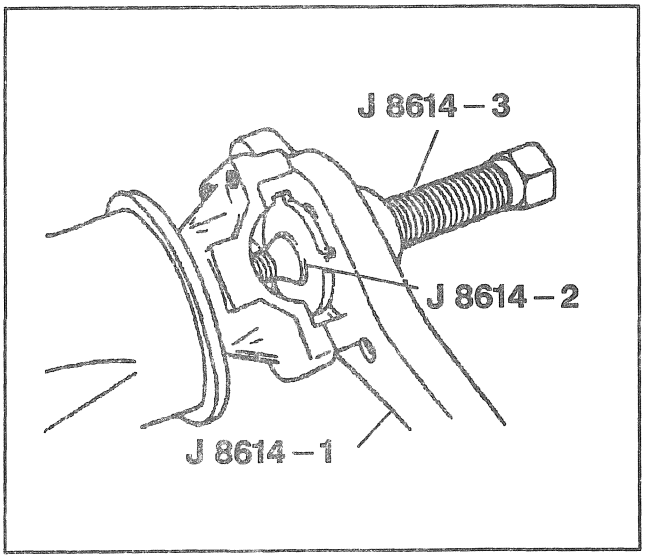


Figure 7—Removing the Pinion Flange

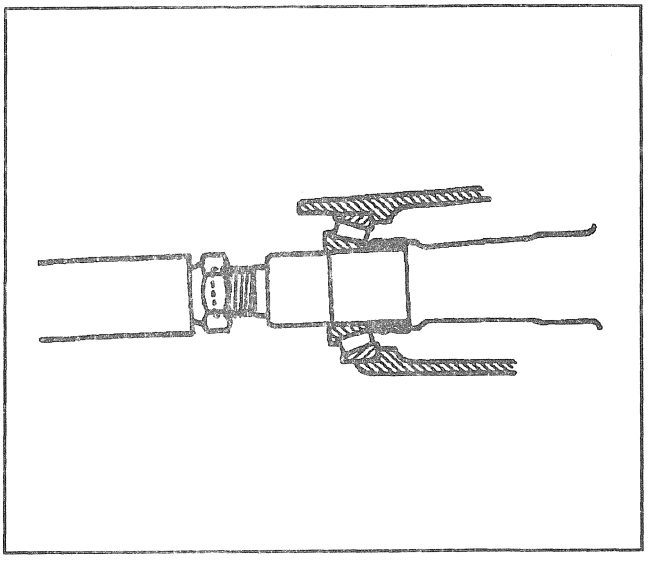


Figure 8—Removing the Drive Pinion

INSPECTION

It is critical to carefully and thoroughly inspect all drive unit parts before reassembly.

Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

Axle Housing

Inspect

- The carrier bore for nicks or burrs that can prevent the outer diameter of the pinion seal from sealing. Remove any that are found.
- The bearing cup bores for nicks or burrs. Remove any that are found.
- The housing for cracks. Replace the housing if any are found.

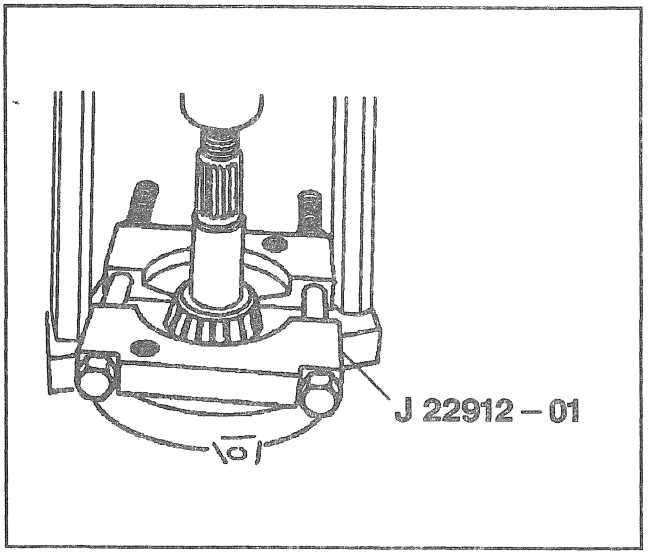


Figure 9—Removing the Pinion Rear Bearing

- The housing for foreign material such as metal chips, dirt, or rust. Refer to "Cleaning" in this section.

Differential

Inspect

- Pinion gear shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- All parts for wear and replace if necessary .

Pinion and Ring Gear

- Ring and pinion gears are matched sets and both are replaced any time a replacement of either is necessary. A new pinion flange must be replaced when both ring and pinion gear are replaced to maintain proper system balance.

Inspect

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion gear splines on the pinion flange.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks that could cause damage to the seal's inside diameter and result in an oil leak.
- All worn or broken parts and replace if necessary.

Bearings

Inspect

- Bearings for smooth rotation after oiling them.

- Bearing rollers for wear.
- Bearing cups for wear, cracks, brinelling, and scoring.

Important

- When replacing worn or cracked bearings and cups, be sure to replace them in sets.
- Ring gear and pinion gear for wear. If worn, replace them as a set.

Important

- Low mileage bearings may have very small scratches and pits on the rollers and the bearing cups from the initial preload. Do not replace a bearing for this reason.

Shims

Inspect

- Shims for cracks and chips. Damaged shims should be replaced with an equal size service shim.

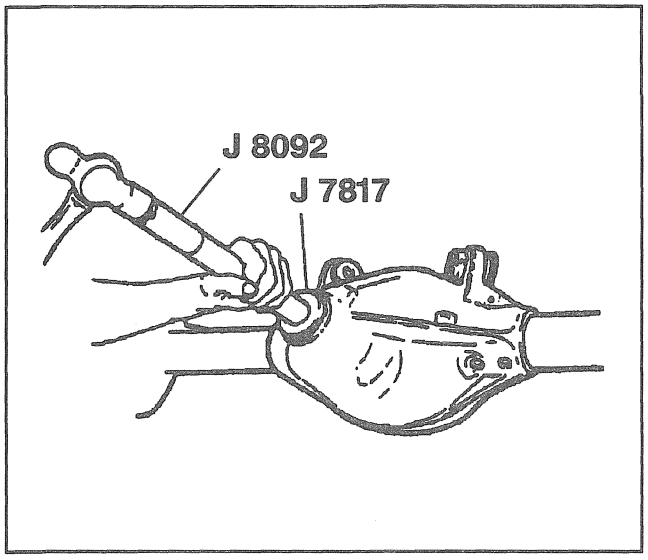


Figure 10—Installing the Front Pinion Bearing Cup

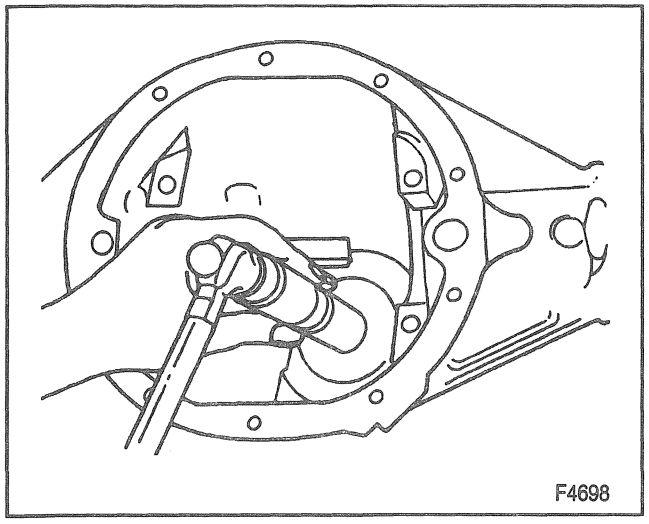


Figure 11—Installing the Rear Pinion Bearing Cup

ASSEMBLY OF THE REAR AXLE

Tools Required:
J 7817 Front Pinion Bearing Cup Installer
J 22306 Rear Pinion Bearing Cup Installer
J 8092 Driver Handle

Install or Connect (Figures 1, 10, and 11)

1. Front pinion bearing cup (10) using J 7817 and J 8092.
2. Rear pinion bearing cup (13) using J 22306 and J 8092.

Pinion Depth Adjustment (Figures 12 through 14)

Tools Required:
J 8001 Dial Indicator Gauge Set
J 21777-1 Arbor
J 21777-8 Rear Pilot Washer
J 21777-42 Front Pilot Washer
J 21777-43 Stud Assembly—Bolt
J 21777-85 Gauge Plate
J 21777-86 Side Bearing Disc

1. Clean all gauge parts.
2. Lubricate the front and rear pinion bearings with axle lubricant.
3. Place the bearings (10 and 13) into the pinion bearing cups.
4. Install J 21777-8, J 21777-42, J 21777-85, and J 21777-43 to the pinion bore (Figure 12).
5. Hold the stud stationary at the flats of the stud.

Tighten

- Stud nut to 2.2 N·m (20 lb. in.).

6. Rotate the gauge plate and bearings several complete revolutions to seat the bearings.
7. Tighten the stud nut until a torque of 1.6 to 2.2 N·m (15 to 25 lb. in.) is obtained to keep the gauge plate in rotation.
8. Assemble J 21777-86, J 21777-1, and J 8001 to the differential bearing bore (Figure 13).
   - The bearing bores must be clean and burr free.
9. Install the side bearing caps.

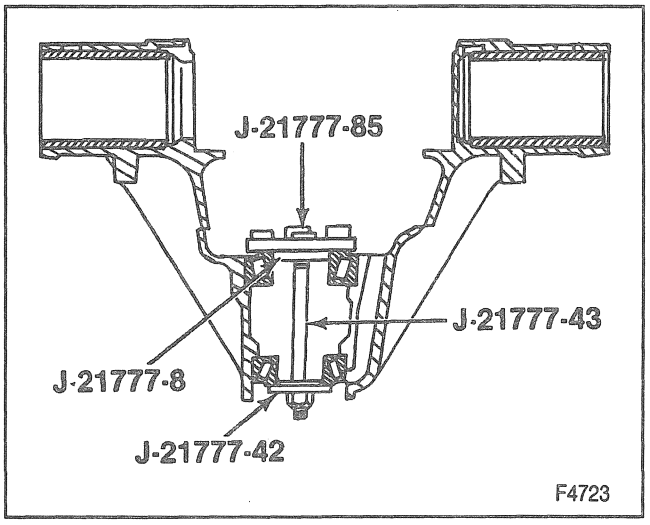


Figure 12—Gauge Plate Tools

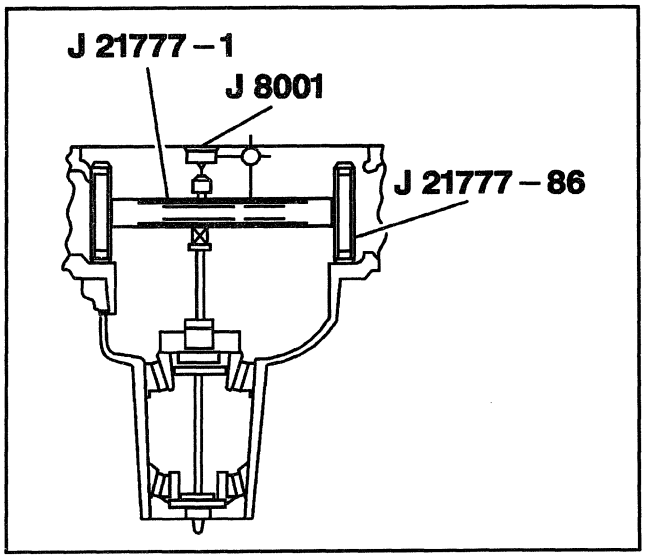


Figure 13—Pinion Depth Tools

Tighten

- Bolts to 74 N·m (55 lb. ft.).

10. Rotate the gauge plate until the proper gauging area is parallel with the disks.
11. Position the gauge shaft assembly in the carrier so the dial indicator rod is centered on the gauging area of the gauge block.
12. Set the dial indicator at zero. Push the indicator down on the indicator shaft until the needle rotates approximately 3/4 of a turn to the right. Tighten the dial indicator in this position (Figure 14).
13. Rotate the gauge shaft slowly back and forth until the dial indicator reads the greatest deflection (when the indicator needle is centered between movement to the left and to the right).
14. At the point of greatest deflection, set the dial indicator to zero. Repeat the rocking action of the gauge shaft to verify the zero setting.
15. Rotate the gauge shaft until the dial indicator rod does not touch the gauge block.
16. Record the actual number on the dial indicator and not the number which represents how far the needle travels. This is the nominal pinion setting.
    EXAMPLE: If the indicator needle moved counter-clockwise 1.70 mm (0.067 inch) to a dial reading of 0.84 mm (0.033 inch) as shown in Figure 14, record the dial reading of 0.84 mm (0.033 inch), not 1.70 mm (0.067 inch).
17. All drive pinions are manufactured to a nominal depth. There are no markings on the drive pinion relating to depth. The dial indicator reading is used for shim selection.
18. Remove bearing caps (19) and depth gauging tools.
19. Install the correct pinion shim (14) to the pinion according to this procedure.

NOTICE: ***Proper pinion depth setting is a two-step procedure.***

1. ***Setup dimension arrived at with the indicator to be considered a starting point.***
2. ***Gear tooth pattern check is necessary to "fine tune" the pinion depth and may indicate additional shim changes to the pinion stem. Both procedures must be performed to ensure proper axle performance and prevent system damage.***

Pinion Installation (Figures 1, 15 through 18)

Tools Required:
J 22388 Pinion Oil Seal Installer
J 22804-1 Pinion Oil Seal Spacer
J 5590 Rear Pinion Bearing Cone Installer

Install or Connect

- The bearing cups should have been installed in "Pinion Depth Adjustment."

1. The pinion inner bearing (13) to the pinion.

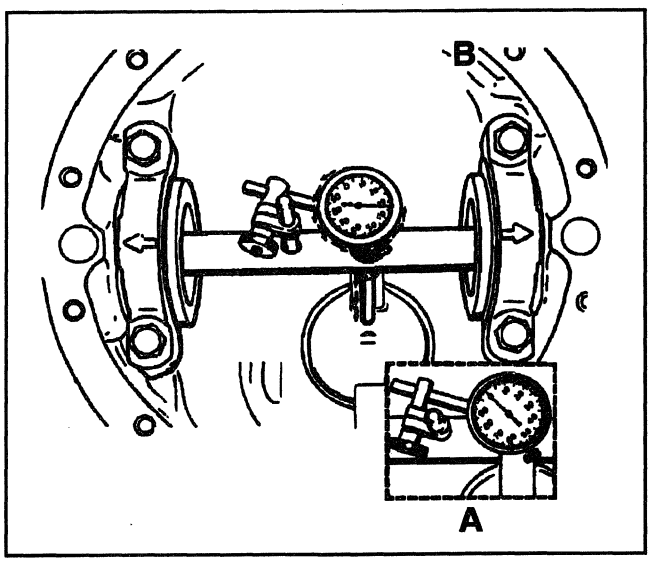


Figure 14—Checking Pinion Depth

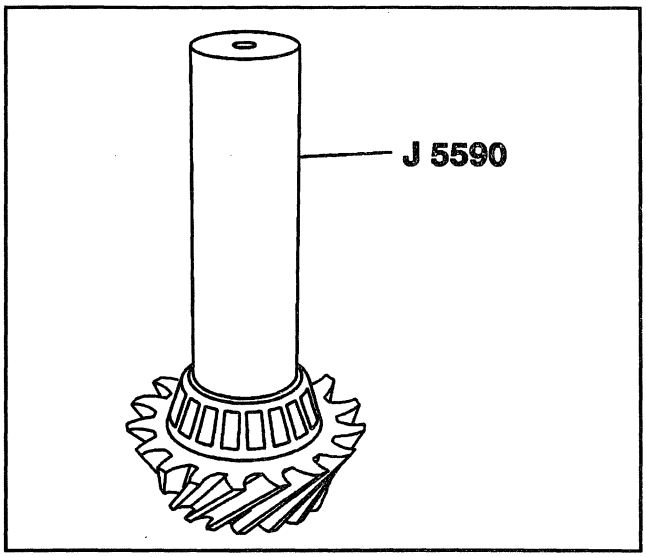


Figure 15—Installing the Pinion Inner Bearing

- Press the bearing onto the pinion until the bearing cone seats on the pinion shim(s) (Figure 15).

2. A new collapsible spacer (11).
   - Lubricate the pinion bearings with axle lubricant.
3. Pinion (15) to the axle housing.
4. Outer pinion bearing (10) onto the pinion using J 5590.
   - Hold the pinion forward from inside the case while driving the bearing onto the pinion.
5. Pinion oil seal (9) using J 22388 (Figure 16).
6. The pinion flange (8) to the pinion by tapping it with a soft-faced hammer until a few threads show through the pinion flange.
7. The pinion washer (7) and nut (6) while holding the pinion flange with J 8614-01 (Figure 17).

Tighten

- The nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is no end play in the pinion, the preload torque should be rechecked.
- Remove J 8614-01. Using an inch-pound torque wrench, check the pinion preload by rotating the pinion with the wrench. Preload should be at or below 1.7 to 3.4 N·m (15 to 30 lb. in.) on new bearings, or 1.1 to 1.7 N·m (10 to 15 lb. in.) for used bearings (Figure 18).
- If the preload torque is below the preload values given above, continue tightening the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload by several pounds. If the bearing preload is exceeded, the pinion will have to be removed and a new collapsible spacer installed.
- Once the preload has been obtained, rotate the pinion several times to make sure the bearings are seated. Recheck the preload and adjust if necessary.

8. Differential case. Refer to "Backlash Adjustment" in this section.

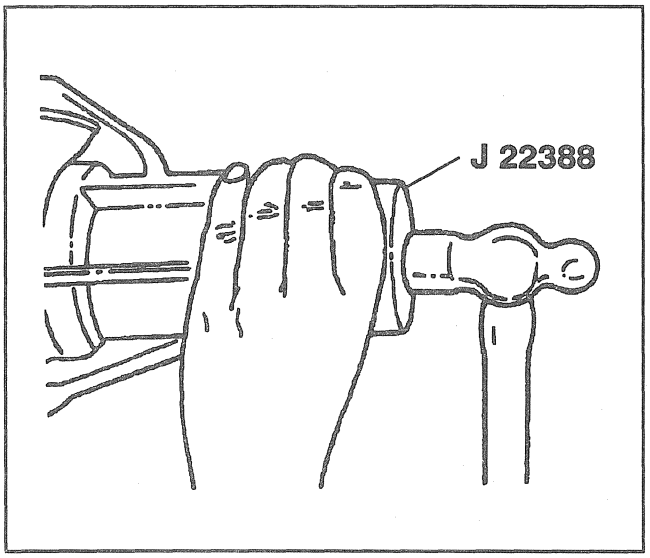


Figure 16—Installing the Pinion Oil Seal

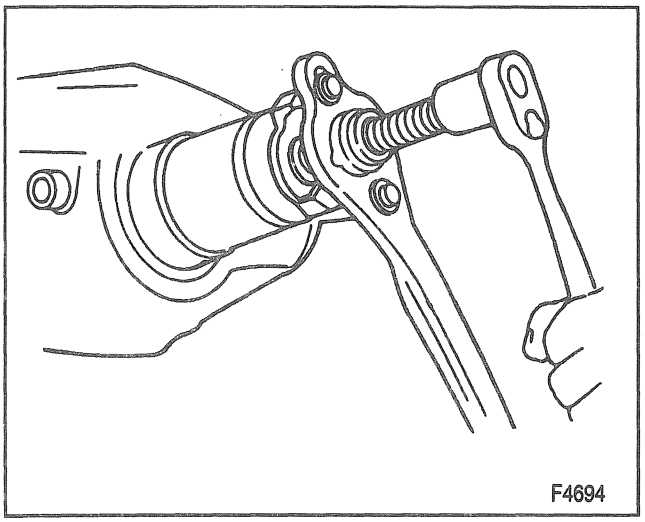


Figure 17—Installing the Pinion Flange

Differential Case Assembly

Install or Connect (Figures 1 and 19 through 22)

Tools Required:
J 8107-3 Differential Side Bearing Removal Plug
J 8092 Driver Handle
J 29710 Differential Side Bearing Installer

1. Lubricate all parts with axle lubricant.
2. Side gear thrust washers (32) to the side gears (33).
3. Side gears (33) to the differential case (27).
   - Install the side gears on the same side as when removed.
4. Pinion gears (31) to the differential without the pinion thrust washers (30).
   A. Install the pinion gears onto the side gears so the holes in the pinion gears are 180 degrees apart.

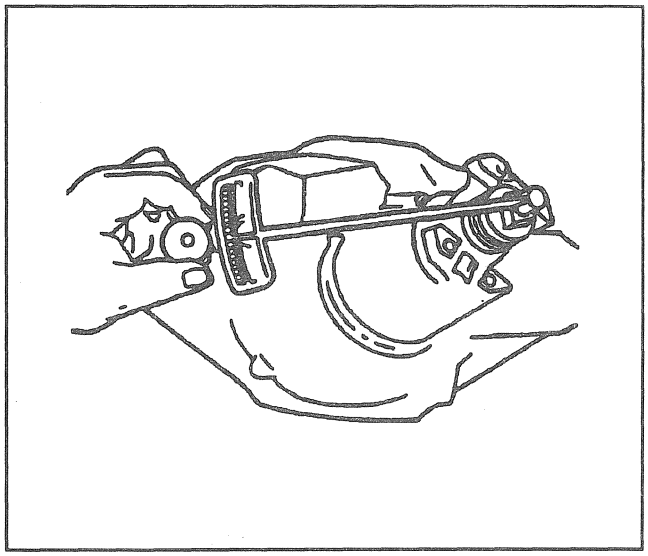


Figure 18—Checking Pinion Bearing Preload

B. Rotate the pinion gears into place, and verify the pinion gears line up with the pinion shaft holes.

5. Pinion thrust washers (30).
   - Rotate the pinion gears toward the differential opening enough to slide in the pinion thrust washers.
   - Make sure the mating surfaces of the differential case and ring gear are clean and burr free.
6. Ring gear (15) to the differential case (27).
   A. Thread two left-hand threaded bolts into the ring gear on opposite sides.
   B. Place the ring gear onto the case, and align the holes in the case with the bolts (Figure 19).
   C. Press the ring gear onto the case far enough to start the bolts using J 8107-3 to protect the differential from the press ram (Figure 20).

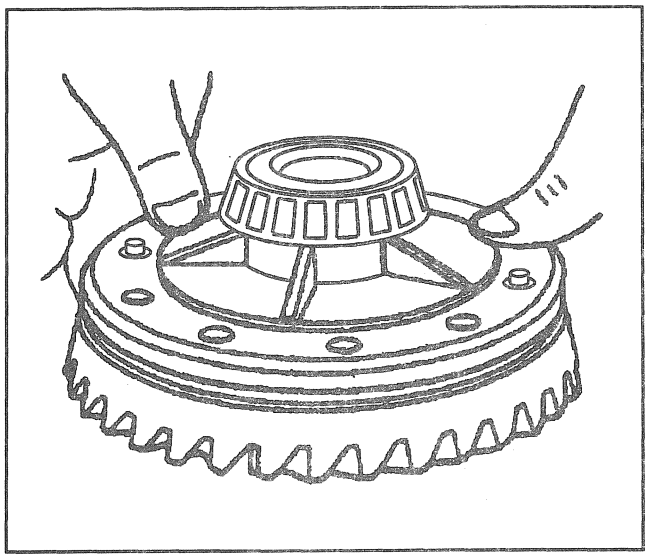


Figure 19—Aligning the Ring Gear Studs

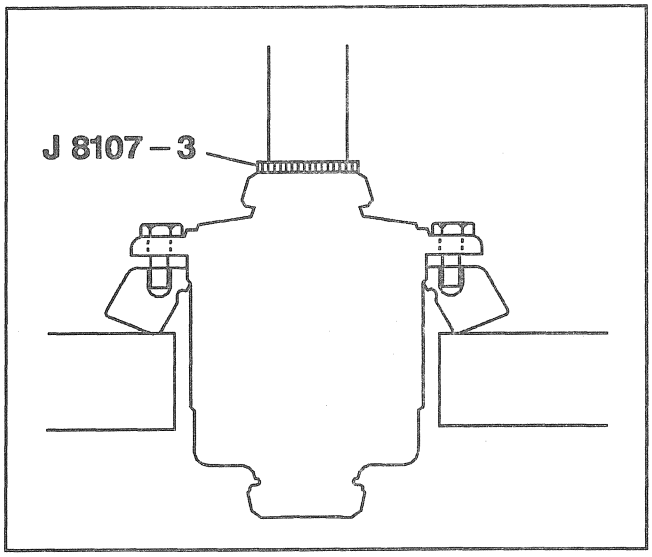


Figure 20—Installing the Ring Gear to the Case

7. Ring gear bolts (26).
   - Tighten the ring gear bolts alternately, and in stages gradually pulling the ring gear onto the differential case.

Tighten

   - Bolts (26) to 145 N·m (105 lb. ft.).
8. Differential side bearings (22) using J 29710, J 8107-3, and J 8092 (Figure 21).
   - Place J 8107-3 into the differential on the side opposite the bearing installation to protect the differential case.
   - Drive the bearing onto the case using J 29710 and J 8092.
9. Differential case (27) to the axle housing. Refer to "Side Bearing Preload Adjustment" in this section.

Side Bearing Preload Adjustment

- The differential side bearing preload is adjusted by a nut in the differential bearing bore. The bore and bearing cap provide the mating threads for the nut.
- The differential must be initially preloaded in order to determine the backlash of the gear set. After the backlash has been set, the final bearing preload is set.

Tool Required:
J 24429 Side Bearing Backlash Adjusting Wrench

Install or Connect (Figures 1, 22, and 23)

1. The bearing cups (22) to the differential bearings in their original locations.
2. Differential assembly in the axle housing.
3. Bearing shims (21).
   - Push the case away from the pinion towards the axle housing.
4. Adjusting nut (17).
   A. Tighten the adjusting nut using J 24429.
   B. Turn the pinion to seat the bearings.
   C. Back off the adjusting nut.

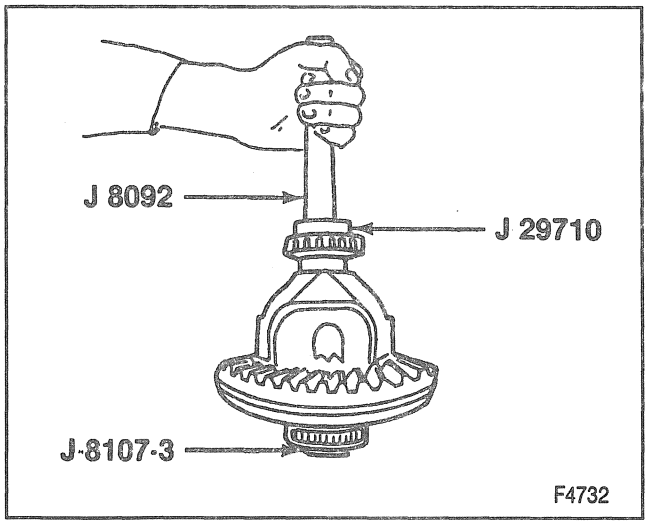


Figure 21—Installing the Side Bearing

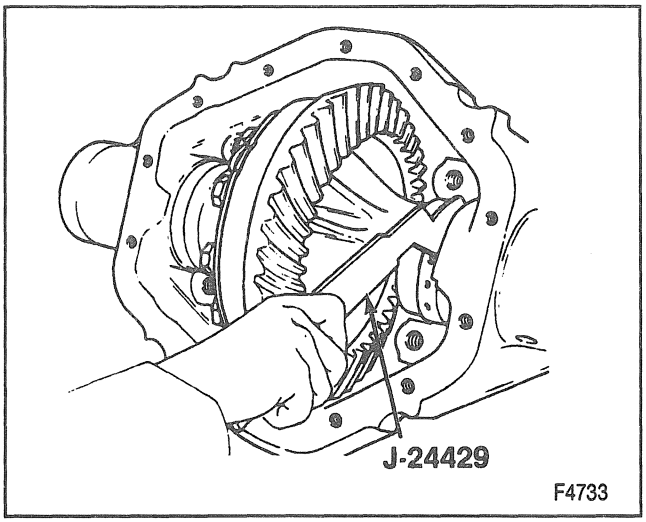


Figure 22—Adjusting the Nut

5. Bearing caps (19) and bolts (20) in their original positions.
   A. Assemble the caps loosely.
   B. Turn the adjusting nut until the nut contacts the shim. Then tighten the nut three additional slots (Figure 22).

Tighten

- Bolts (20) to 80 N·m (60 lb. ft.).

6. Adjusting nut lock (16) and lock bolt (18).
   - Measure the ring gear to pinion backlash. Refer to "Backlash Adjustment" in this section.

Tighten

- Bolt (18) to 30 N·m (22 lb. ft.) after setting the backlash.

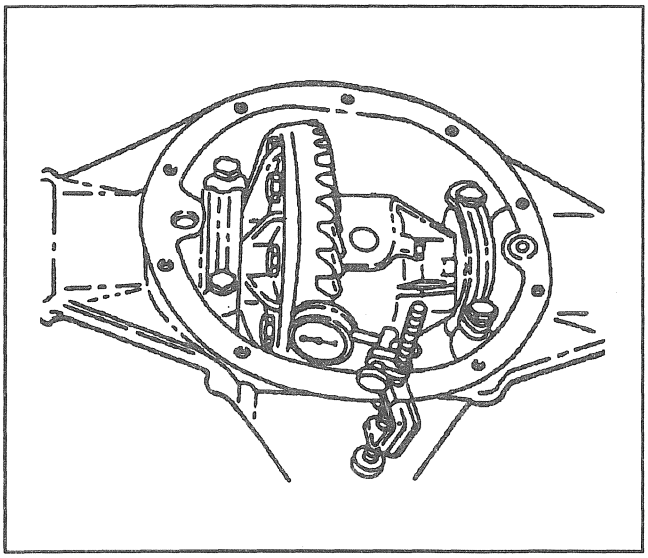


Figure 23—Checking Ring Gear Backlash

Backlash Adjustment

1. Install a dial indicator on the case using a magnetic base.
2. Place the indicator stem at the heel end of a tooth.
   - Set the dial indicator so the stem is in line with the gear rotation and perpendicular to the tooth angle.
3. Check and record the backlash at three or four points around the ring gear (Figure 23).
   - The pinion must be held stationary when checking backlash.
   - The backlash should be the same at each point within 0.05 mm (0.002 inch). If the backlash varies more than 0.05 mm (0.002 inch), check for burrs, a distorted case flange, uneven bolting conditions, or foreign matter between the case and ring gear.
4. Backlash at the minimum lash point measured should be between 0.125-0.200 mm (0.005-0.008 inch).
   A. If the reading is too high, increase the shim pack between the differential flange side of the case and the axle housing (opposite the adjusting nut side).
   B. If the reading is too low, decrease the shim pack between the differential flange side of the case and the axle housing (opposite the adjusting nut side).
5. Adjust the side bearing preload. Refer to "Side Bearing Preload Adjustment" in this section.

GEAR TOOTH PATTERN CHECK

Before final assembly of the differential, a gear tooth contact pattern check should be performed.

A gear tooth contact pattern check is NOT a substitute for adjusting pinion depth and backlash as previously outlined. It is a method to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy, have a short life, or both. With a pattern check, the best contact between the ring gear and the drive pinion for low noise level and long life can be ensured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side (4). The concave side is the "coast" side (3). The end of the tooth nearest the center of ring gear is referred to as the "toe" end (2). The end of the tooth farthest away from the center is the "heel" end (1). The toe end of the tooth is smaller than the heel end (Figure 24).

Test

1. Wipe oil out of axle housing and carefully clean each tooth of the ring gear.
2. Apply gear marking compound sparingly to all ring gear teeth using a medium stiff brush.
3. Use the service brake to apply a load until a torque of 54-68 N·m (40-50 lb. ft.) is required to turn the pinion.

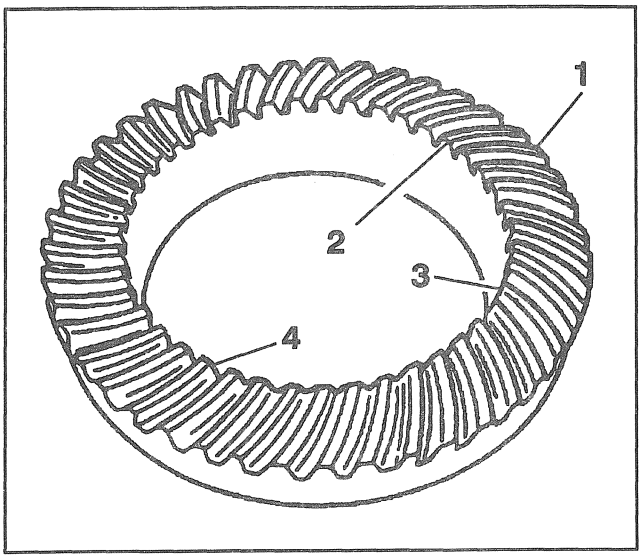


Figure 24—Gear Tooth Nomenclature

A test made without loading the gears will not give a satisfactory pattern. Turn the pinion flange with a wrench so that the ring gear rotates one full revolution. Then reverse the rotation so that the ring gear rotates one revolution in the opposite direction. Excessive turning of the ring gear is not recommended.

4. Observe the pattern on the ring gear teeth and compare with Figures 25.

Adjustments Affecting Tooth Contact

Two adjustments can be made that affects tooth contact pattern; backlash and pinion depth. The effects of bearing preloads are not readily apparent on hand loaded tooth contact pattern tests. However, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted using side bearing adjusting shims that move the entire case and ring gear assembly closer to or farther from the drive pinion. The adjusting shims are also used to set side bearing preload.

If the thickness of the right shim is increased (along with decreasing the left shim thickness), backlash will increase.

If the thickness of the left shim is increased (along with decreasing the right shim thickness), backlash will decrease.

Final Assembly

Tools Required:
- J 8092 Driver Handle
- J 23765 Axle Shaft Bearing Installer
- J 23771 Axle Shaft Seal Installer
- J 23911 Pinion Oil Seal Installer

Install or Connect (Figures 1, 2, 26, and 27)

1. Bearing (5) with J 23765 and J 8092 until the tool bottoms against the housing shoulder (Figure 26).
   - Lubricate the bearing with axle lubricant.
2. Oil seal using J 23771 until the seal is flush with the axle tube (Figure 27).
   - Lubricate the seal lips with axle lubricant.
3. Axle shafts (3) into the axle housing (12).
   - Be careful not to damage the oil seal.
   - The splines at the end of the axle shaft must engage with the splines of the axle side gear.
4. "C" clips (37) on the axle shaft (3).
   - Pull the axle shaft (3) outward so the "C" clip (37) seats in the counterbore of the axle side gear.
5. Pinion shaft (28) through the case (27) and differential gears (33).
   - Align the hole in the pinion shaft (28) with the lock bolt hole.

Important

- Anytime a differential pinion shaft locking screw is removed, it is important to coat the screw threads with Loctite 242 before reinstalling. These screws are coated with an adhesive which helps to prevent the screw from loosening in the case. When this screw is removed, the adhesive is also removed.

6. New pinion shaft lock bolt (29).

Tighten

- Lock bolt (29) to 36 N.m (27 lb. ft.).

7. A new cover gasket and cover (25).

Tighten

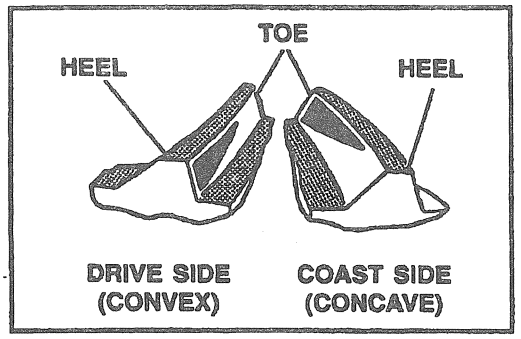
- Cover bolts (24) to 27 N.m (20 lb. ft.).

8. Lubricant in the axle.
   - Lubricant to a level within 9.5 mm (3/8 inch) of the filler plug hole.
9. Fill plug.

Tighten

- Fill plug to 35 N.m (26 lb. ft.).

CONDITION:
- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO FAR AWAY FROM RING GEAR.



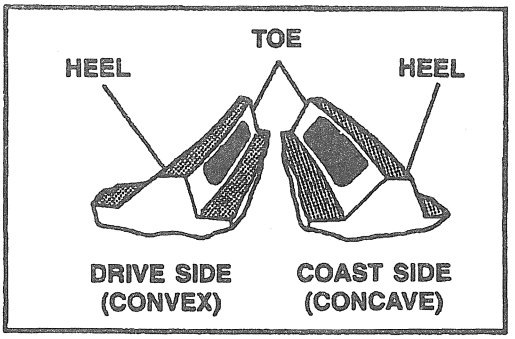
CORRECTION:

INCREASE THE PINION SHIM THICKNESS.

SERVICE HINTS:

HOW TO CHECK PATTERNS:
- BRUSH GEAR MARKING COMPOUND ON THE RING GEAR TEETH.
- ROTATE THE PINION SIX TIMES CLOCKWISE AND SIX TIMES COUNTERCLOCKWISE.
- OBSERVE THE TOOTH CONTACT PATTERN AND MAKE ANY NECESSARY CORRECTIONS.

CONDITION:
- BACKLASH CORRECT.
- PINION DEPTH CORRECT.



CORRECTION:

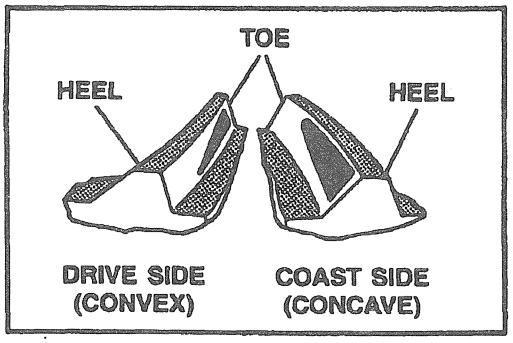
NONE.

SERVICE HINTS:

PATTERNS THAT MAY VARY MAY BE CAUSED BY LOOSE BEARINGS ON THE PINION OR THE DIFFERENTIAL CASE CHECK THESE BEARING PRELOAD SETTINGS:
- TOTAL ASSEMBLY
- DIFFERERTIAL CASE
- PINION

IF THESE SETTINGS ARE GOOD, LOOK FOR DAMAGED OR INCORRECTLY ASSEMBLED PARTS.

CONDITION:
- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO CLOSE TO RING GEAR.



CORRECTION:

DECREASE THE PINION SHIM THICKNESS.

SERVICE HINTS:

PINION DEPTH SHIM LOCATIONS:
- BETWEEN THE INNER PINION BEARING CONE AND THE HEAD OF THE PINION GEAR.
- BETWEEN THE INNER PINION BEARING CUP AND THE REAR AXLE HOUSING.

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Figure 25 Gear Tooth Pattern

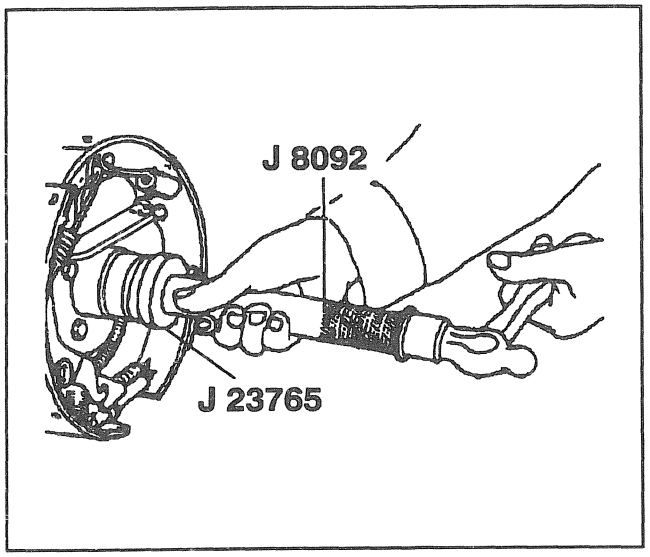


Figure 26—Installing the Axle Bearing

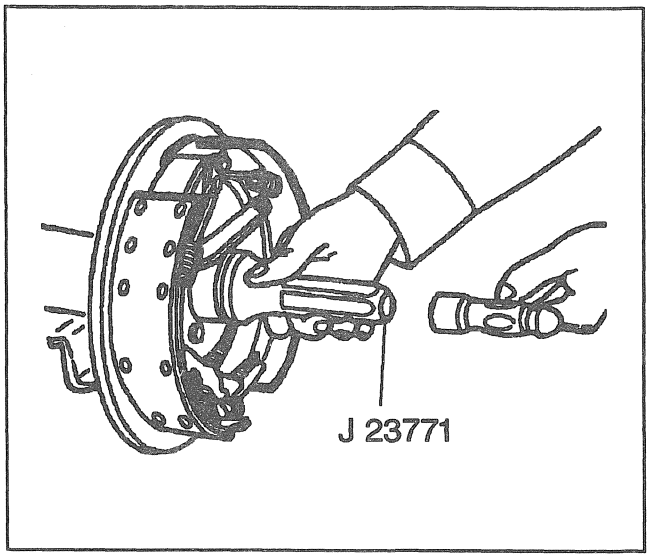


Figure 27—Installing the Axle Seal

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Adjusting Nut Lock Bolt	30	22
Axle Cover Bolts	27	20
Bearing Cap Bolts	80	60
Filler Plug	35	26
Pinion Shaft Lock Bolt	36	27
Ring Gear Bolts	145	105

SPACER AND SHIM SPECIFICATIONS

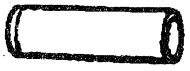
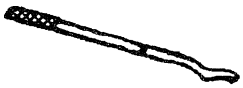
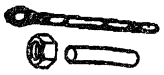
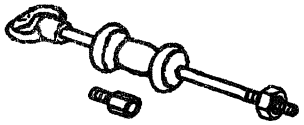
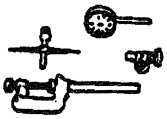
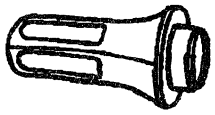
Spacer and Shim Sizes	Size
Differential Side Bearing Spacer	0.170-inch 0.040-0.044-inch
Differential Side Bearing Shim Kits	5.59 mm (0.220-inch) 5.64 mm (0.222-inch) 5.69 mm (0.224-inch) 5.74 mm (0.226-inch) 5.79 mm (0.228-inch) 5.84 mm (0.230-inch) 5.89 mm (0.232-inch) 5.94 mm (0.234-inch) 5.99 mm (0.236-inch) 6.05 mm (0.238-inch) 6.10 mm (0.240-inch) 6.15 mm (0.242-inch) 6.20 mm (0.244-inch) 6.25 mm (0.246-inch) 6.30 mm (0.248-inch) 6.35 mm (0.250-inch) 6.40 mm (0.252-inch) 6.45 mm (0.254-inch) 6.50 mm (0.256-inch) 6.55 mm (0.258-inch)
Pinion Bearing Shim Kits	0.5080-0.5842 mm (0.020-0.023-inch) 0.6096-0.7112 mm (0.024-0.028-inch) 0.7366-0.8382 mm (0.029-0.033-inch) 0.8636-0.9398 mm (0.034-0.037-inch)

LUBRICATION

Type	80W-90 GL-5
Capacity	2.7 Liters (5.5 Pints)

T2510

SPECIAL TOOLS

1.		J 8107 – 3	10.		J 22888
2.		J 23765	11.		J 24433
3.		J 24429	12.		J 22388
4.		J 22912 – 01	13.		J 8614 – 01
5.		J 5590	14.		J 22813 – 01
6.		J 7817	15.		J 2619 – 01
7.		J 8092			
8.		J 8001 – M	16.		J 23771
9.		J 29710	17.		J 23911

1. Differential Side Bearing Plug
2. Axle Shaft Bearing Installer
3. Side Bearing Adjustment Spanner
4. Rear Pinion Bearing Cone Remover
5. Rear Pinion Bearing Cone Installer
6. Front Pinion Bearing Cup Installer
7. Driver Handle
8. Dial Indicator
9. Differential Side Bearing Installer
10. Side Bearing Remover
11. Rear Pinion Bearing Cone Installer
12. Pinion Oil Seal Installer
13. Pinion Flange Remover
14. Axle Bearing Remover
15. Slide Hammer
16. Axle Shaft Seal Installer
17. Pinion Oil Seal Installer

Refer to Figures 12 and 13 for these tools:

J – 21777 – 1	Arbor
J – 21777 – 8	Rear Pilot Washer
J – 21777 – 42	Front Pilot Washer
J – 21777 – 43	Stud Assembly – Bolt
J – 21777 – 85	Gauge Plate
J – 21777 – 86	Side Bearing Disc

BLANK

SECTION 4B4

10 1/2-INCH RING GEAR

NOTICE: *Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.*

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GENERAL DESCRIPTION

The corporate 10 1/2 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this driving force at a 90 degree angle from the propeller shaft to the axle shafts.

This axle is full-floating. The axle shaft is supported at the wheel ends by the wheel hubs. The bolts that attach the shaft to the hub also support the axle at the hub. The splined end of the shaft is supported by the differential.

The pinion gear is supported in a pinion cage by three bearings; a pinion front bearing, a pinion rear bearing, and a pilot bearing. The pinion cage is separate from the axle housing. Selective shims are used between the pinion cage and the axle housing to set the pinion depth. The pinion bearing preload is set by crushing a collapsible spacer between the front and rear bearings in the pinion cage.

The ring gear is bolted to the differential case with left-hand thread bolts.

The differential case is supported by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using two different bearing adjusting nuts. These allow the differential to be moved from side to side by adjusting the nuts in or out. The differential side bearing preload is accomplished by tightening the bearing adjusting nuts after the ring gear backlash has been set. Two bearing caps are used to hold the differential into the axle housing and supply half of the threads for the bearing adjusting nuts.

The differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing on turns and premature wear on internal axle parts.

The axle is sealed with a pinion seal, a gasket at each axle shaft end, and a gasket between the cover and axle housing.

All corporate rear axles are identified by the alphanumeric broadcast code on the right axle tube near the carrier. The carrier cover does not have a drain plug.

CHECKING THE AXLE BEFORE DISASSEMBLY

Inspect

- Remove the axle cover and drain the axle lubricant.

1. Ring gear backlash. Refer to "Backlash Adjustment" in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential case.
2. Case for metal chips and shavings. Determine where these chips and shavings came from; such as a broken gear or bearing cage.

Determine the cause of the axle problem before disassembly if possible.

DISASSEMBLY OF THE REAR AXLE

Tools Required:

J 8107 Side Bearing Remover Plug
J 22888-20 Differential Side Bearing Remover
J 8614-01 Pinion Flange Remover
J 22912-01 Rear Pinion Cone Remover
J 22888-20 Universal Puller

Remove or Disconnect (Figures 1 through 9)

- Place the axle in a suitable support.

1. Cover bolts (25) and cover (24).
   - Drain the gear lubricant.
2. Outer axle shaft bolts (46).
3. Axle shafts (47).
4. Adjusting nut lock bolts (22).
5. Adjusting nut lock (21).
   - Loosen the adjusting nuts (19).
6. Bearing cap bolts (28) and washers (27).
7. Bearing caps (20).
   - Mark the caps and the housing as left and right.
8. Adjusting nuts (19) and bearing cups (18).
   - Mark the nuts and cups as left and right.
9. Differential case (34).
10. Bearings using J 22888-20 (Figure 2).
    A. The jaws of J 22888-20 must pull from beneath the bearing cone and not the cage.
    B. Scribe a mark across the differential case.
11. Ring gear bolts (36) and washers (35).

NOTICE: ***Do not pry the ring gear from the case. This will damage the ring gear and the differential case.***

12. Ring gear (14) from the differential.
    - Drive the ring gear off with a brass drift if necessary.
13. Side gears (29) and thrust washers (30).
    - Mark the gears and the case halves as left and right.
14. Pinion spider (33).
15. Pinion gears (32) and thrust washers (31) from the spider (33).

Inspect

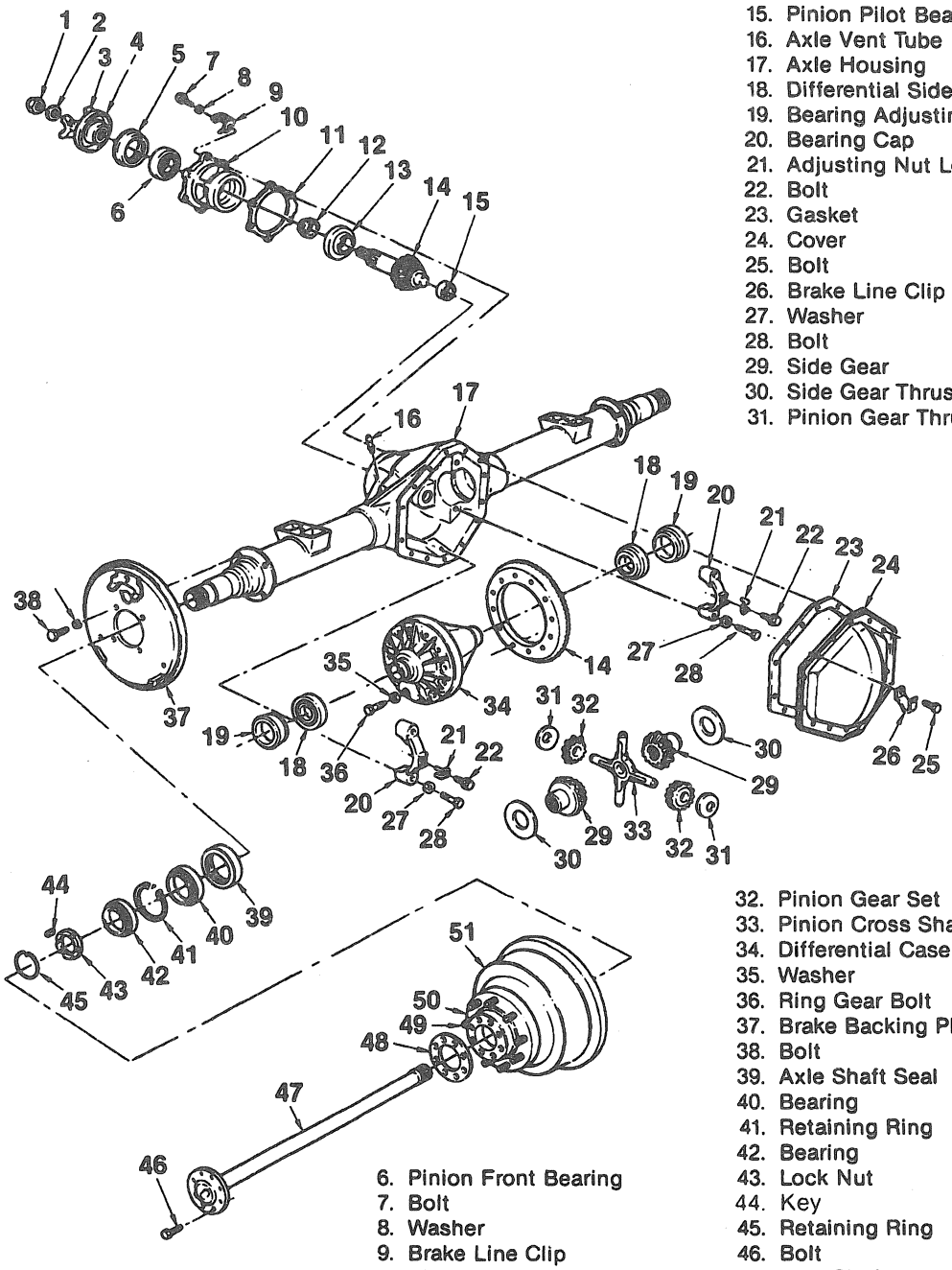
- Drive pinion bearing preload and record (Figure 3).
- For looseness of the pinion assembly by moving it back and forth. Looseness indicates excessive bearing wear.

16. Pinion assembly cage bolts (7) and washers (8).
17. Pinion cage (10).
    - Tap on the pilot end of the pinion with a hammer and brass drift if necessary.
18. Pinion cage shims (11).
    A. Keep the shims together for measurement later in this procedure.
    B. Place the pinion cage in a soft-jawed vise.
19. Pinion flange nut (1) and washer (2) using J 8614-01 to hold the flange (Figure 4).
20. Pinion flange using J 8614-01 (Figure 5).
21. Pinion (14) from the pinion cage (10).
    - Place the cage into an arbor press as shown in (Figure 6) and press the pinion from the cage. Do not let the pinion fall.
22. Collapsible spacer (12) from the pinion.
23. Inner bearing (13) from the pinion (14).
    - Press the bearing from the pinion using J 22912-01 (Figure 7).
24. Pinion seal (5) from the cage.
    - Drive the seal from the cage with a hammer and punch.
25. Front bearing (6) from the cage.
26. Bearing cups from the cage.
27. Pilot bearing (15) from the axle housing using a hammer and brass drift (Figure 8).

CLEANING

Do not steam clean drive parts that have ground and polished surfaces such as gears, bearings, and shafts. All parts should be disassembled before cleaning. These parts should be cleaned in a suitable solvent.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow bearings to spin while drying them with compressed air.



1. Pinion Nut
2. Washer
3. Pinion Flange
4. Slinger
5. Pinion Oil Seal
6. Pinion Front Bearing
7. Bolt
8. Washer
9. Brake Line Clip
10. Pinion Cage
11. Shim
12. Collapsable Spacer
13. Pinion Rear Bearing
14. Pinion and Ring Gear Set
15. Pinion Pilot Bearing
16. Axle Vent Tube
17. Axle Housing
18. Differential Side Bearing
19. Bearing Adjusting Nut
20. Bearing Cap
21. Adjusting Nut Lock
22. Bolt
23. Gasket
24. Cover
25. Bolt
26. Brake Line Clip
27. Washer
28. Bolt
29. Side Gear
30. Side Gear Thrust Washer
31. Pinion Gear Thrust Washer
32. Pinion Gear Set
33. Pinion Cross Shaft
34. Differential Case
35. Washer
36. Ring Gear Bolt
37. Brake Backing Plate
38. Bolt
39. Axle Shaft Seal
40. Bearing
41. Retaining Ring
42. Bearing
43. Lock Nut
44. Key
45. Retaining Ring
46. Bolt
47. Axle Shaft
48. Gasket
49. Wheel Stud
50. Wheel Hub
51. Brake Drum

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Figure 1—Rear Axle Components

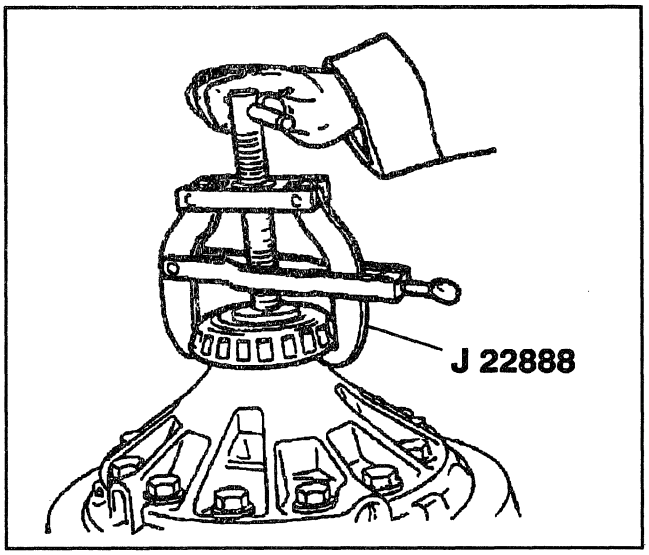


Figure 2—Removing the Differential Side Bearings

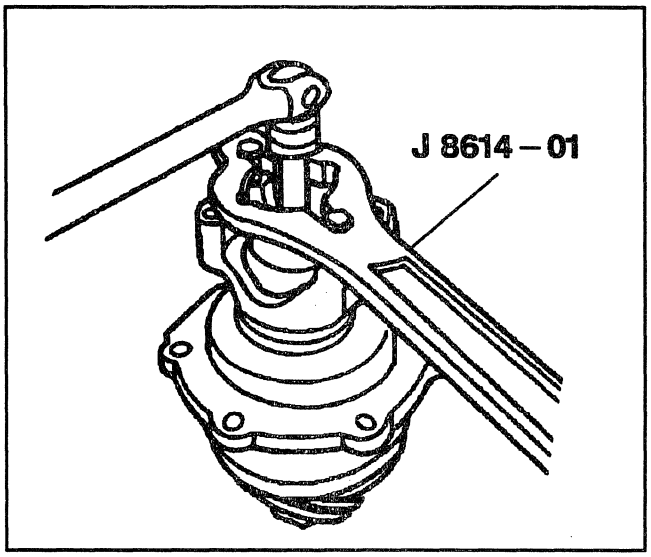


Figure 4—Removing the Drive Pinion Nut

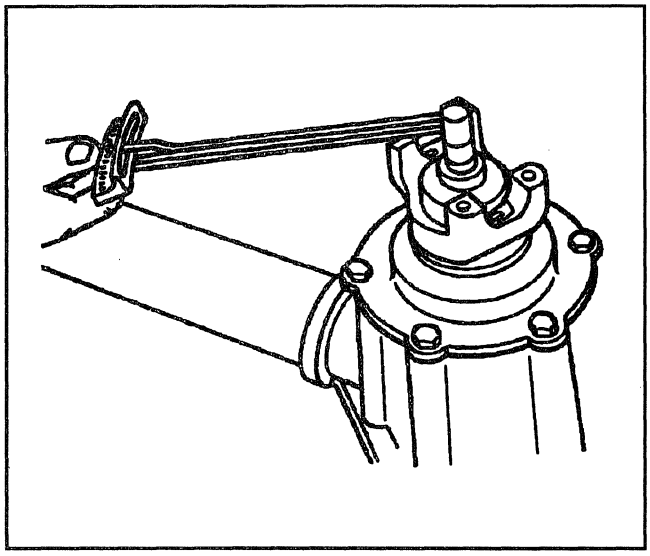


Figure 3—Checking Pinion Preload

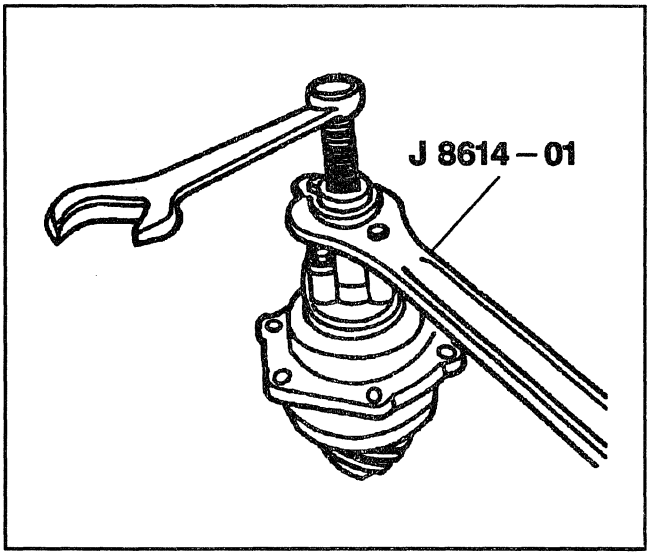


Figure 5—Removing the Pinion Flange

INSPECTION

It is critical to carefully and thoroughly inspect all drive unit parts before reassembly.

Thorough inspection of drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

Axle Housing

Inspect

- The axle housing bore for nicks or burrs that can prevent the outer diameter of the pinion seal from sealing. Remove any burrs that are found.
- The bearing cup bores for nicks or burrs. Remove any burrs.
- The housing for cracks. Replace the housing if any cracks are found.
- The housing for foreign material such as metal chips, dirt, or rust. Refer to "Cleaning" in this section.

Differential

Inspect

- Pinion shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- All parts for wear and replace if necessary.

Pinion and Ring Gear

- Ring and pinion gears are matched sets and both are replaced any time a replacement of either is necessary. A new pinion flange must be replaced when both ring gear and pinion gear are replaced to maintain proper system balance.

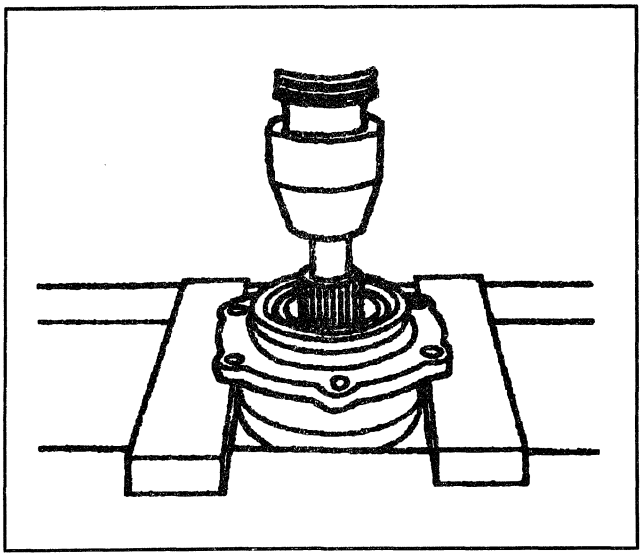


Figure 6—Pressing the Drive Pinion from the Cage

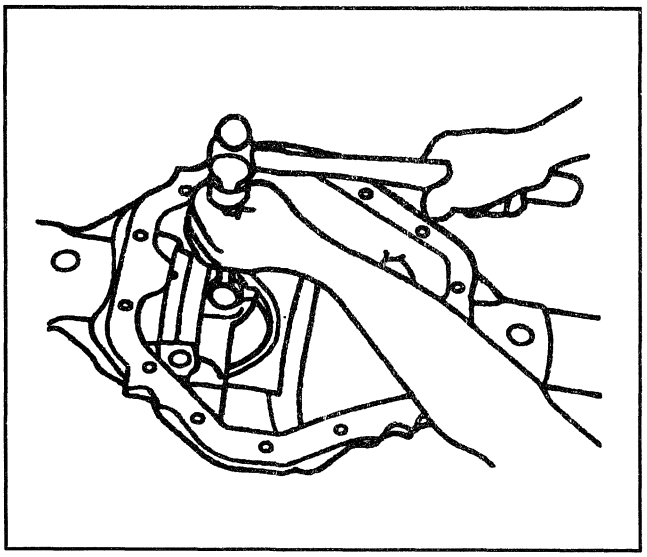


Figure 8—Removing the Pilot Bearing

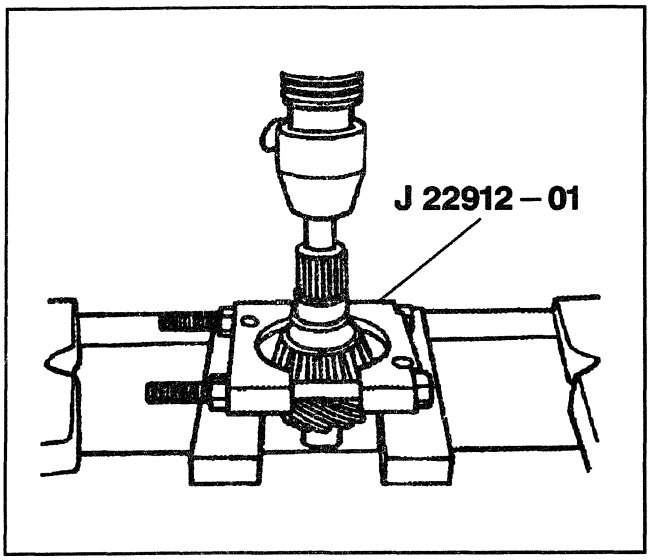


Figure 7—Removing the Pinion Inner Bearing

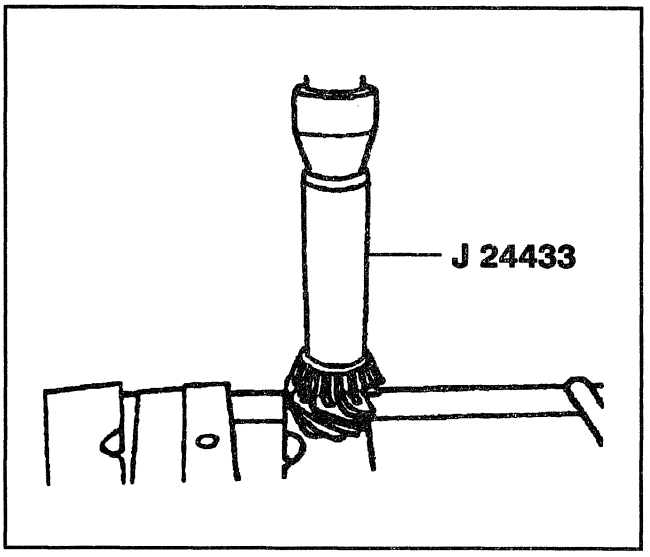


Figure 9—Installing the Inner Pinion Bearing

Inspect

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion gear splines on the pinion flange.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks which would cause damage to the seal's inside diameter and result in an oil leak.
- All worn or broken parts and replace if necessary.

Bearings

Inspect

- Bearings for smooth rotation after oiling them.
- Bearing rollers for wear.
- Bearing cups for wear, cracks, brinelling, and scoring.

Important

- When replacing worn or cracked bearings and cups, make sure to replace them in sets.
- Ring gear and pinion gear for wear. If worn, replace them as a set.

Important

- Low mileage bearings may have very small scratches and pits on the rollers and bearing cups from the initial preload. Do not replace a bearing for this reason.

Shims

Inspect

- Shims for cracks and chips. Damaged shims should be replaced with an equal size service shim.

ASSEMBLY OF THE REAR AXLE

Tools Required:
- J 24433 Rear Pinion Bearing Cone Installer
- J 8092 Driver Handle
- J 8608 Outer Pinion Bearing Cup Installer
- J 8614-01 Pinion Flange Holder

Pinion Assembly

Install or Connect (Figures 1 and 9 through 13)

- Lubricate all parts with axle lubricant.

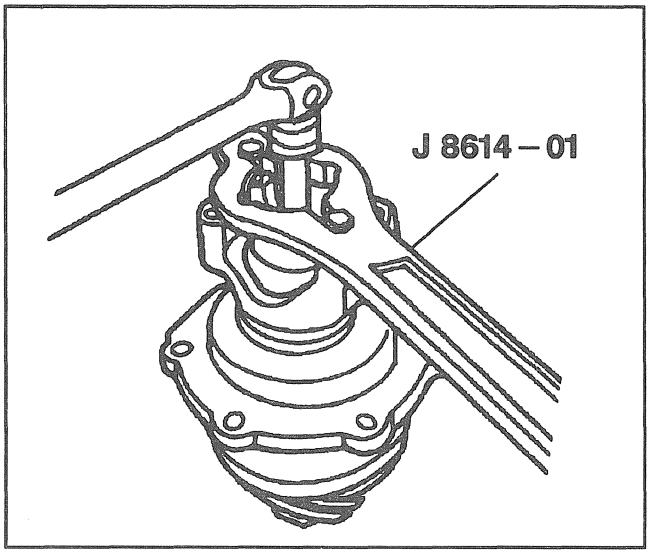


Figure 10—Installing the Pinion Nut

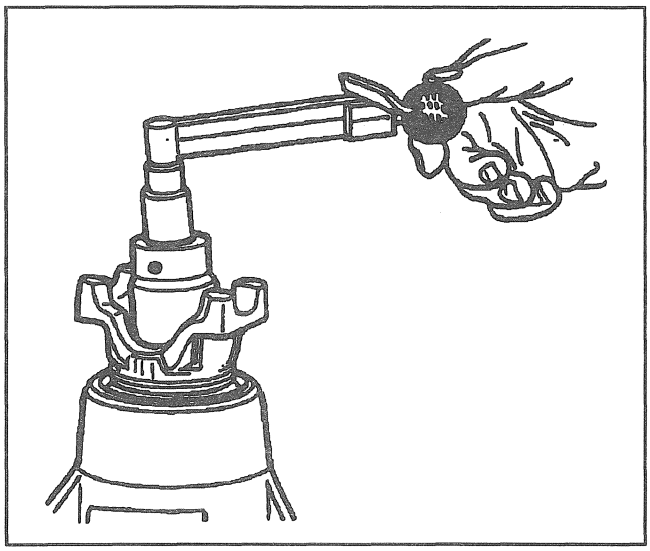


Figure 11—Checking Pinion Preload

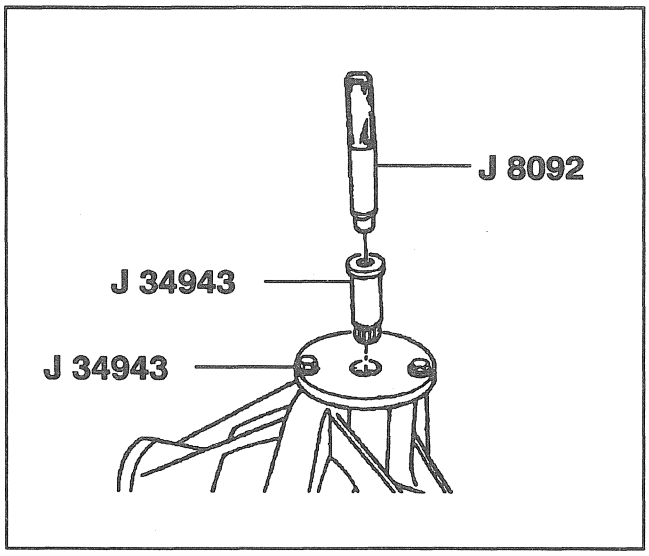


Figure 12—Installing the Pilot Bearing

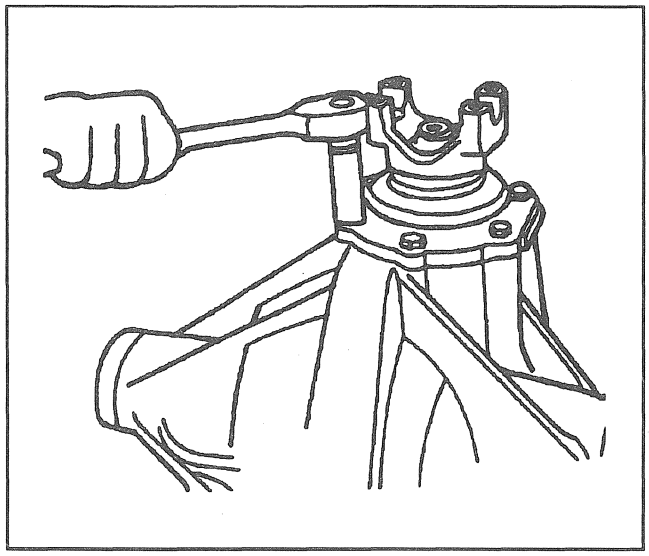


Figure 13—Installing the Pinion Cage

1. Pinion rear bearing (13) onto the pinion.
   - Press the bearing onto the pinion using J 24433 (Figure 9).
2. Outer pinion bearing cup (6) using J 8608 and J 8092.
3. Inner pinion bearing cup (13) using J 24432 and J 8092.
4. A new collapsible spacer (12) to the pinion.
5. Pinion (14) into the cage (10).
6. Pinion outer bearing (6) onto the pinion.
   - Press the bearing onto the pinion.
7. Pinion oil seal (5) using J 24433 and J 8092.
8. Pinion flange oil deflector (4) and pinion flange (3) to the pinion splines.
9. Washer (2) and pinion nut (1).
   A. Place the pinion cage assembly into the vise.
   B. Flange holder J 8614-01 to the pinion flange.

Tighten (Figure 10)

- The nut until the pinion end play is taken up. Rotate the pinion while tightening in order to seat the bearings. Once there is no end play in the pinion, the preload torque should be checked.
- Remove J 8614-01. Using an inch-pound torque wrench, check the pinion preload by rotating the pinion with the wrench. Preload should be at or below 2.8 to 4.0 N·m (25 to 35 lb. in.) for new bearings, or 0.56 to 1.7 N·m (5-15 lb. in.) for used bearings (Figure 11).
- If the preload torque is below the values given above, continue torquing the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload by several pounds. If the bearing preload is exceeded, the pinion will have to be removed, and a new collapsible spacer installed.
- Once the preload has been obtained, rotate the pinion several times to ensure that the bearings have seated. Recheck the preload and adjust if necessary.

10. Pinion cage (10) to the axle housing. Refer to "Pinion Installation" in this section.

NOTICE: ***Proper pinion depth setting is a two-step procedure.***

1. ***Setup dimension arrived at with the indicator to be considered a starting point.***
2. ***Gear tooth pattern check is necessary to "fine tune" the pinion depth and may indicate additional shim changes to the pinion stem. Both procedures must be performed to ensure proper axle performance and prevent system damage.***

Pinion Installation

Tools Required:
J 34943 Pinion Pilot Bearing Installer
J 8092 Driver Handle

Install or Connect (Figures 12 and 13)

1. Pinion pilot bearing (15) using J 34943 and J 8092 (Figure 12).
   A. Bolt the guide plate to the axle housing.
   B. Place the bearing (15) onto the guide.
   C. Drive the bearing into the housing. The part number of the bearing must face the pinion flange.
2. Measure the pinion bearing shims (11). If a new ring and pinion is installed, the pinion bearing shim pack must be adjusted.
   - Pinion service shims are available in sizes from 0.152 to 0.6096 mm (0.006 to 0.024 inch).
   - If the original pinion is being reused, the original pinion shims should also be reused.
3. Pinion bearing shims (11) to the pinion cage.
   - The shims, housing, and cage must be clean.
4. Pinion cage (10) to the axle housing (Figure 13).
5. Cage bolts (7).

Tighten

- Bolts to 88 N·m (65 lb. ft.).

Differential Case Assembly

Tools Required:
J 24429 Side Bearing Adjustment Spanner
J 8092 Driver Handle
J 8107 Side Bearing Puller Plug

Install or Connect (Figures 1, 14, and 15)

- Lubricate all parts with axle lubricant.

1. Pinion gears (32) and pinion gear thrust washers (31) to the pinion cross shaft spider (33).
2. Differential side gears (29) and side gear thrust washers (30) to the differential case halves in their original locations.
3. Pinion cross shaft spider (33) to the differential.
4. Case halves.

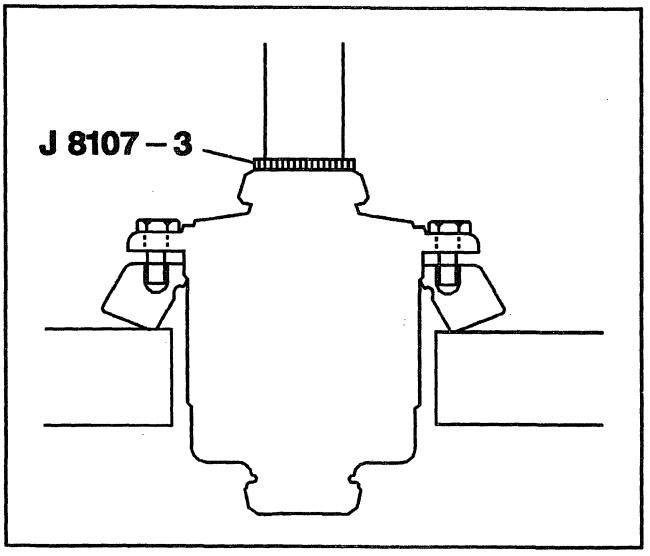


Figure 14—Installing the Ring Gear to Case

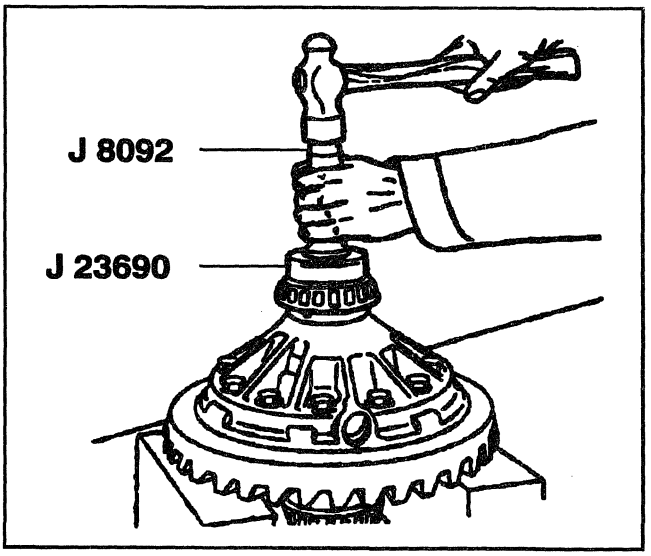


Figure 15—Installing Differential Bearings

A. Align the scribe marks on the case halves.
B. Check that the mating surfaces of the differential case and the ring gear are clean and burr free.

5. Ring gear (14) to the differential (Figure 14).
   A. Thread two left-hand threaded studs into the ring gear on opposite sides.
   B. Place the ring gear onto the case, and align the holes in the case with the studs.
   C. Press the ring gear onto the case far enough to start the bolts using J 8107 to protect the differential from the press ram.
6. Ring gear bolts (36).

Tighten

   A. The ring gear bolts alternately in stages gradually pulling the ring gear onto the differential case.
   B. The ring gear bolts in sequence to 163 N·m (120 lb. ft.).
7. Differential side bearings (18) using J 24429 and J 8092 (Figure 15).
   A. Place J 8107 into the differential on the side opposite of bearing installation to protect the differential case.
   B. Drive the bearing onto the case using J 24429 and J 8092.
8. Differential case (34) to the axle housing. Refer to "Side Bearing Preload Adjustment" in this section.

Side Bearing Preload Adjustment

- The differential side bearing preload is adjusted by two adjusting nuts in the bearing bore. The bore and the bearing cap provide the mating threads for the bearing nut.
- The differential must be initially preloaded in order to determine the backlash of the gear set. After the backlash has been set, the final bearing preload is set.

Tool Required:
J 24429 Side Bearing Adjustment Wrench

Install or Connect (Figures 1 and 16)

1. Bearing caps (20) to the bearings in their original locations.
2. Differential assembly to the housing.
3. Adjusting nuts (19).
4. Bearing caps (20) and bolts (28) in their original positions.
   A. Assemble the caps finger tight.
   B. Loosen the right side adjusting nut and tighten the left side nut using J 24429 until the ring gear contacts the drive pinion (Figure 16). Do not force the gears into contact. This is the zero lash point.
   C. Back off the left adjusting nut approximately two slots to obtain the initial backlash adjustment.
5. Adjusting nut lock (21) and lock bolt (22) to the left nut.
   A. Do not tighten.
   B. Tighten the right adjusting nut firmly to force the case into solid contact with the left adjusting nut. Rotate the pinion several times to seat the bearings.
   C. Loosen the right adjusting nut until it is free from its bearing.
   D. Tighten the right adjusting nut until it just contacts the bearing. Additionally tighten the nut two slots for used bearings, or three slots if new bearings are installed.

Tighten

- Bearing cap bolts (28) to 183 N·m (135 lb. ft.).
- Measure the ring gear to pinion backlash. Refer to "Backlash Adjustment" in this section.

Backlash Adjustment

1. Install a dial indicator to the case using a magnetic base (Figure 17).
2. Place the indicator stem at the heel end of a tooth.
   - Set the dial indicator so that the stem is in line with the gear rotation and perpendicular to the tooth angle.

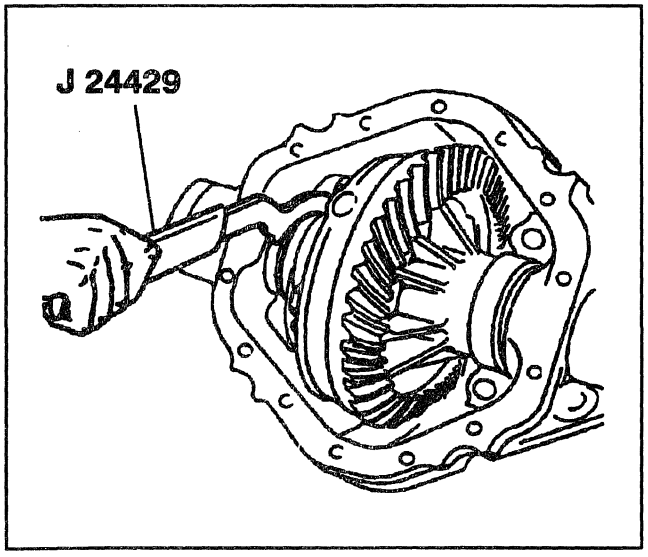


Figure 16—Adjusting the Differential Preload

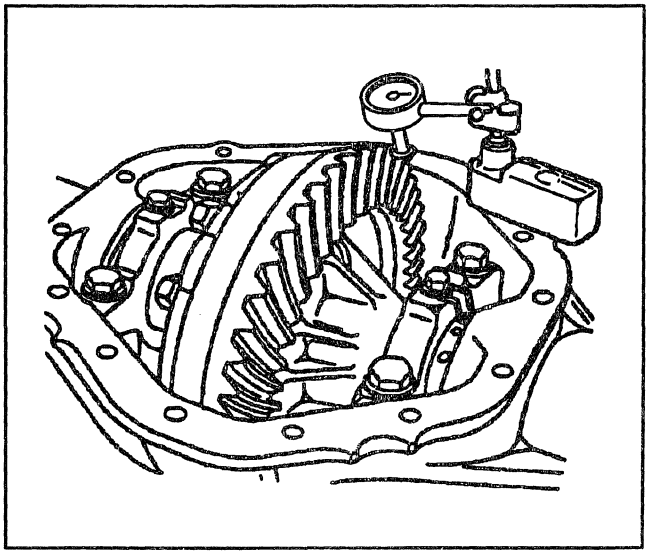


Figure 17—Measuring Gear Set Backlash

3. Check and record the backlash at three or four points around the ring gear.
   - The pinion must be held stationary when checking backlash.
   - The backlash should be the same at each point within 0.05 mm (0.002 inch). If the backlash varies more than 0.05 mm (0.002 inch), check for burrs, a distorted case flange, uneven bolting conditions, or foreign matter between the case and the ring gear.
4. The backlash at the minimum lash point measured should be between 0.125 to 0.200 mm (0.005 to 0.008 inch). The maximum acceptable reading is 0.076 to 0.203 mm (0.003 to 0.008 inch).
5. If the reading is too high, remove the adjusting nut locks, and loosen the right nut one slot. Then tighten the left nut one slot (Figure 16).
6. If the reading is too low, remove the adjusting nut locks, and loosen the left nut one slot. Then tighten the right nut one slot.
   - The side bearing preload will not change as long as the adjusting nut is tightened an equal amount to the nut which was loosened.

GEAR TOOTH PATTERN CHECK

Before final assembly of the differential, a gear tooth contact pattern check should be performed.

A gear tooth contact pattern check is NOT a substitute for adjusting pinion depth and backlash as previously outlined. It is a method to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy, have a short life, or both. With a pattern check, the best contact between the ring gear and the drive pinion for low noise level and long life can be ensured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side (4). The concave side is the "coast" side (3). The end of the tooth nearest the center of ring gear is referred to as the "toe" end (2). The end of the tooth farthest away from the center is the "heel" end (1). The toe end of the tooth is smaller than the heel end (Figure 18).

Test

1. Wipe oil out of axle housing and carefully clean each tooth of the ring gear.
2. Apply gear marking compound sparingly to all ring gear teeth using a medium stiff brush.
3. Use the service brake to apply a load until a torque of 54-68 N.m (40-50 lb. ft.) is required to turn the pinion.

   A test made without loading the gears will not give a satisfactory pattern. Turn the companion flange with a wrench so that the ring gear rotates one full revolution. Then reverse the rotation so that the ring gear rotates one revolution in the opposite direction. Excessive turning of the ring gear is not recommended.
4. Observe the pattern on the ring gear teeth and compare with Figure 19.

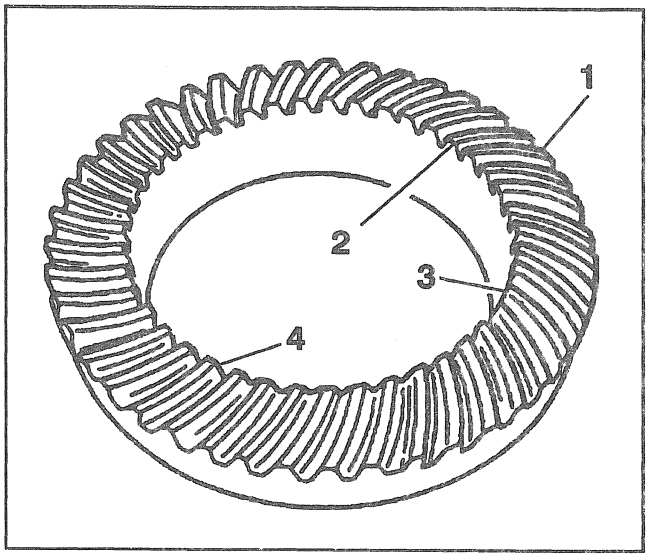


Figure 18—Gear Tooth Nomenclature

ADJUSTMENTS AFFECTING TOOTH CONTACT

Two adjustments can be made that affect tooth contact pattern: backlash and pinion depth. The effects of bearing preloads are not readily apparent on hand loaded tooth contact pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

Pinion depth is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. The shim is used in the axle to compensate for manufacturing tolerances. Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims and/or adjusting nuts. These move the case and ring gear closer to, or farther from, the drive pinion. The adjusting shims are also used to set side bearing preload.

If the thickness of the right shim is increased (along with an equal decrease in the left shim thickness), backlash will increase.

If the thickness of the left shim is increased (along with an equal decrease in the right shim thickness), backlash will decrease.

FINAL ASSEMBLY

Install or Connect

1. Drive axles.
2. Gasket (23) and cover (24) to the housing.
3. Cover bolts (25).

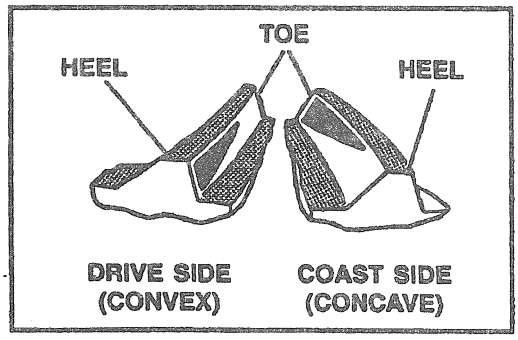
Tighten

- Cover bolts (25) to 41 N.m (30 lb. ft.).

4. Lubricant to the axle.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO FAR AWAY FROM RING GEAR.



CORRECTION:

INCREASE THE PINION SHIM THICKNESS.

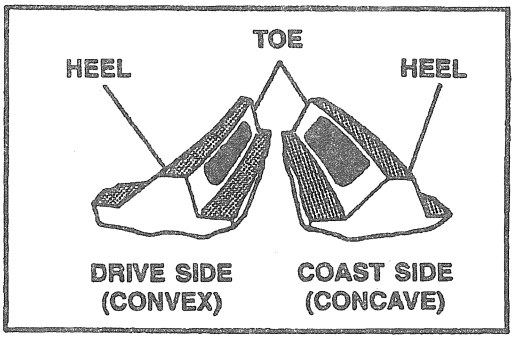
SERVICE HINTS:

HOW TO CHECK PATTERNS:

- BRUSH GEAR MARKING COMPOUND ON THE RING GEAR TEETH.
- ROTATE THE PINION SIX TIMES CLOCKWISE AND SIX TIMES COUNTERCLOCKWISE.
- OBSERVE THE TOOTH CONTACT PATTERN AND MAKE ANY NECESSARY CORRECTIONS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH CORRECT.



CORRECTION:

NONE.

SERVICE HINTS:

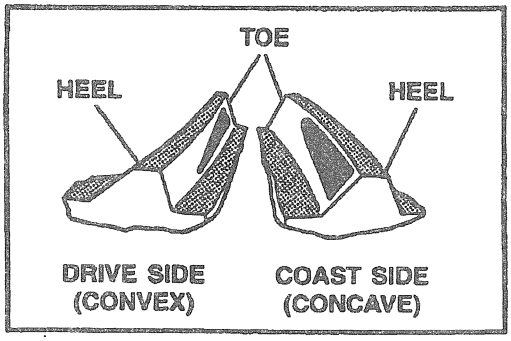
PATTERNS THAT MAY VARY MAY BE CAUSED BY LOOSE BEARINGS ON THE PINION OR THE DIFFERENTIAL CASE CHECK THESE BEARING PRELOAD SETTINGS:

- TOTAL ASSEMBLY
- DIFFERERTIAL CASE
- PINION

IF THESE SETTINGS ARE GOOD, LOOK FOR DAMAGED OR INCORRECTLY ASSEMBLED PARTS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO CLOSE TO RING GEAR.



CORRECTION:

DECREASE THE PINION SHIM THICKNESS.

SERVICE HINTS:

PINION DEPTH SHIM LOCATIONS:

- BETWEEN THE INNER PINION BEARING CONE AND THE HEAD OF THE PINION GEAR.
- BETWEEN THE INNER PINION BEARING CUP AND THE REAR AXLE HOUSING.

3704r5056

Figure 19—Gear Tooth Pattern

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Adjusting Nut Lock Bolts	30	22
Axle Cover Bolts	41	30
Bearing Cap Bolts	183	135
Filler Plug	35	26
Pinion Cage to Axle Housing	88	65
Ring Gear Bolts	163	120

SPACER AND SHIM SPECIFICATIONS

Spacer and Shim Sizes	Size
Pinion Bearing Shims	0.006-inch
	0.007-inch
	0.008-inch
	0.009-inch
	0.010-inch
	0.011-inch
	0.012-inch
	0.013-inch
	0.014-inch
	0.015-inch
	0.016-inch
	0.017-inch
	0.018-inch
	0.019-inch
	0.020-inch
	0.021-inch
	0.022-inch
	0.023-inch
	0.024-inch

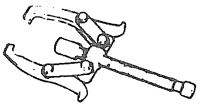
LUBRICATION

Type	80W-90 GL-5
Capacity	3.4 Liters (7.2 Pints)

T2511

SPECIAL TOOLS

1.  J 8614-01

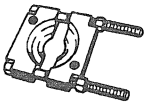
2.  J 22888

3.  J 8608

4.  J 8092

5.  J 24433

6.  J 24429

7.  J 22912-01

1. Pinion Flange Remover
2. Side Bearing Remover
3. Rear Pinion Bearing Cup Installer
4. Driver Handle
5. Rear Pinion Bearing Cone Installer
6. Side Bearing Adjustment Spanner
7. Rear Pinion Bearing Cone Remover
8. Pinion Pilot Bearing Installer (Not Illustrated)

F4662

SECTION 4B5

DANA MODEL 80 (11 INCH RING GEAR)

NOTICE: *Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.*

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GENERAL DESCRIPTION

The Dana 11 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. The gear set transfers the driving force at a 90 degree angle from the propeller shaft to the axle shafts.

This axle is full-floating. The axle shafts are supported at the wheel ends by the wheel hubs. The shaft at the wheel end is supported and splined to the hub inner-diameter. The other splined end of the shaft is supported by the differential.

The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack between the inner pinion bearing cup and axle housing. The pinion bearing preload is set by a shim pack at the front of the axle housing between the bearing cone and pinion gear.

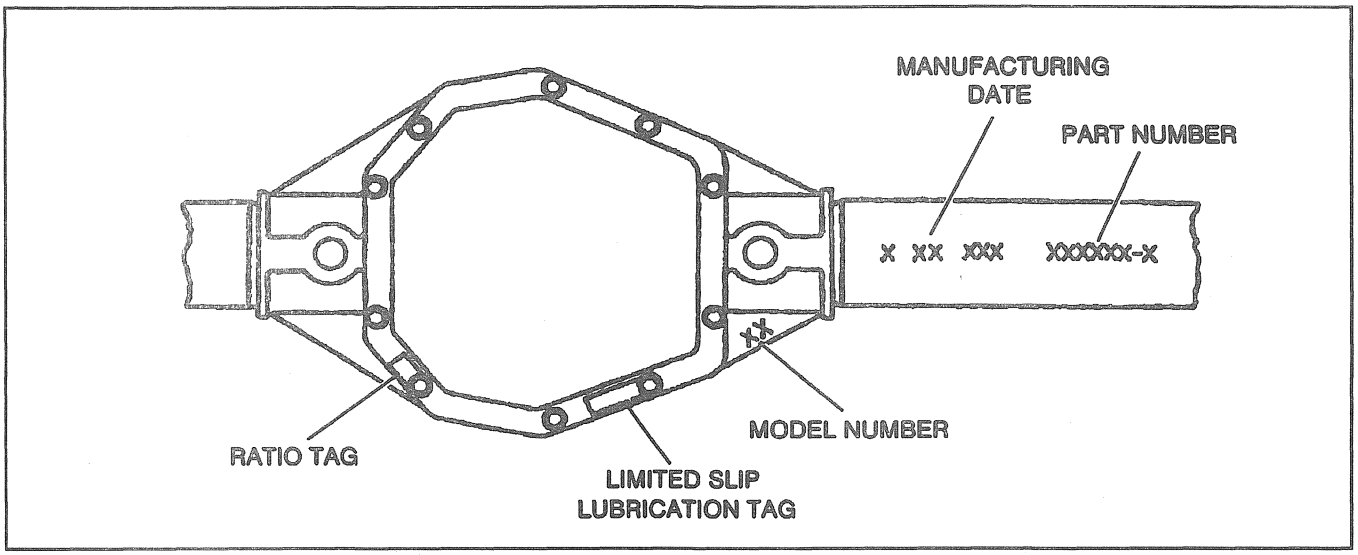


Figure 1—Axle Identification

The ring gear bolts to the differential case.

The differential case is supported by two tapered roller bearings. The differential bearing preload and drive gear to pinion gear backlash is controlled by two methods. One method uses a 0.76 mm (0.030 inch) hardened shim located between each differential bearing cone and the differential case, and a selective outboard spacer shim located between each differential bearing cup and housing. The other method uses selective shims between each differential bearing cone and the differential case, with outboard spacers between each differential bearing cup and housing. To move the ring gear with outboard selective shims, choose shims of different thickness to accommodate the change. For example: if a shim that is 0.13 mm (0.005 inch) thinner is required on the ring gear side, then one that is 0.13 mm (0.005 inch) thicker will be required on the opposite side. If the change is required on a axle that is built using the other method, gear movement may be accomplished by moving shims from one side of the differential case to the other. If the differential preload needs to be changed, equal amounts must be added or subtracted from each side.

The axle housing is spread to remove the differential from the housing. When the spreader is removed, the housing sets the bearing preload. Two bearing caps hold the differential in the axle housing. The axle is sealed with a pinion seal, hub seal, and RTV between the cover and the housing.

All Dana axles are identified by a part number and manufacturing date on the right axle tube, cover plate side. The model number is cast on the carrier. The axle ratio and Limited Slip lubrication information are located on tags attached to the differential cover plate. The carrier does not have a drain plug.

CHECKING THE AXLE BEFORE DISASSEMBLY

1. Remove the cover and drain the lubricant.

Inspect

1. Ring gear backlash. Refer to "Backlash Adjustment" in this section.
   - This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential case.
2. Case for metal chips and shavings. Determine where these chips and shavings came from, such as a broken gear or bearing cage.
   - Determine the cause of the axle problem before disassembly, if possible.

DISASSEMBLY OF THE REAR AXLE

CAUTION: When disassembling the carrier, ensure that the entire axle is held tight in an approved stand or rack. Improperly supported axles can cause serious injury.

Tools Required:
- J 8107-3 Side Bearing Puller Plug
- J 8614-01 Pinion Flange Holder
- J 24385-01 Differential Housing Spreader
- J 29721 Differential Side Bearing Remover
- J 29721-70 Side Bearing Adapters
- J 39709 Universal Handle
- J 39331 Bearing Cup Remover (Outer)
- J 8001 Dial Indicator Set or Equivalent
- J 39330 Bearing Cup Remover

Remove or Disconnect (Figures 2 through 13)

- Place the axle in a suitable support.

1. Bolts (17) and cover (14).
   - Drain the lubricant.

1. AXLE HOUSING
2. RING GEAR AND PINION SET
3. INNER PINION BEARING
4. SHIMS
6. PRELOAD SHIMS
7. BEARING
8. SLINGER
9. PINION OIL SEAL
10. PINION FLANGE/YOKE
11. WASHER
12. PINION NUT
14. COVER
16. PLUG
17. BOLT
18. BEARING CAP
19. BOLT
20. BEARING
21. SHIM
22. DIFFERENTIAL CASE
23. RING GEAR BOLT
24. PINION GEAR
25. SIDE GEAR
26. PINION THRUST WASHER
27. SIDE GEAR THRUST WASHER
28. PINION SHAFT
29. ROLL PIN
30. SHIM
31. BOLT
32. GASKET
37. I.D. TAG
38. AXLE SHAFT

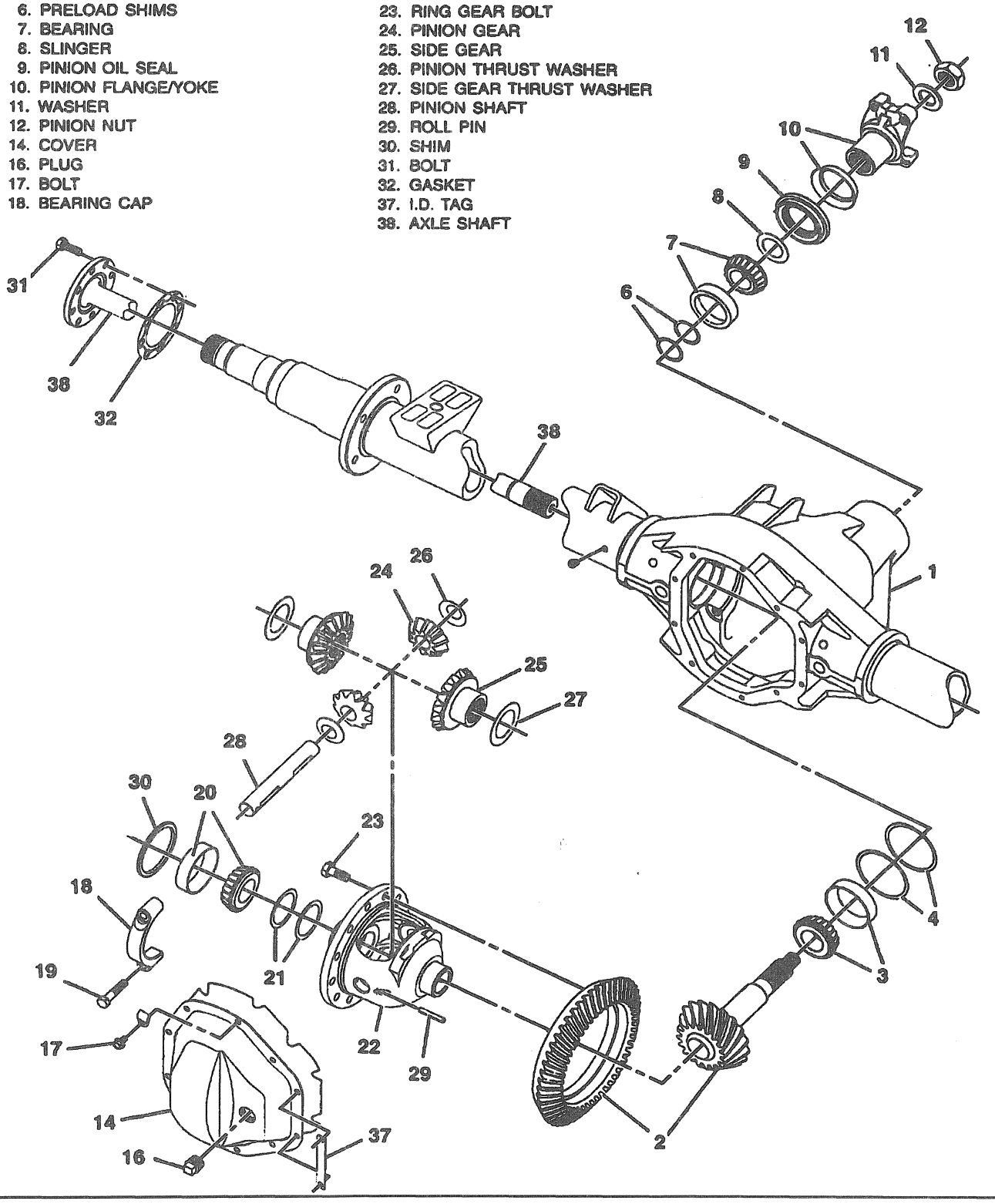


Figure 2—Rear Axle Components

2. Axle shafts far enough to clear the differential case.
3. Bearing cap bolts (19).
4. Bearing caps (18).
   A. Corresponding letters are stamped on the caps and axle housing. The caps must be reassembled exactly as removed.
   B. Assemble J 24385-01 to the differential housing as shown in (Figure 3).
   C. Assemble the dial indicator. Preset the gage at least 5 mm (0.200 inch), then rotate the indicator housing to zero the dial.

NOTICE: ***Do not spread the axle housing more than 0.38 mm (0.015 inch). Overspreading the housing can damage or distort it.***

   D. Spread the housing while examining the dial indicator. Do not spread the housing more than 0.38 mm (0.015 inch).

CAUTION: Do not allow the case to fall. It can strike legs or feet and may cause serious injury. Also, gear teeth may have sharp edges. When handling, use care to avoid cutting hands.

5. Case (22) from the housing (1) using two pry bars (Figure 4).
6. J 24385-01 from the housing (1).
7. Bearing cups (20).
   • Mark the cups left and right, and place them with the proper bearing caps.
8. Bearings (20) using J 8107-3, J 29721, and J 29721-70 (Figure 5).
   • Mark the bearings left and right, and place them with their corresponding bearing caps.
9. Shims (21).
   • Mark the shims left or right.

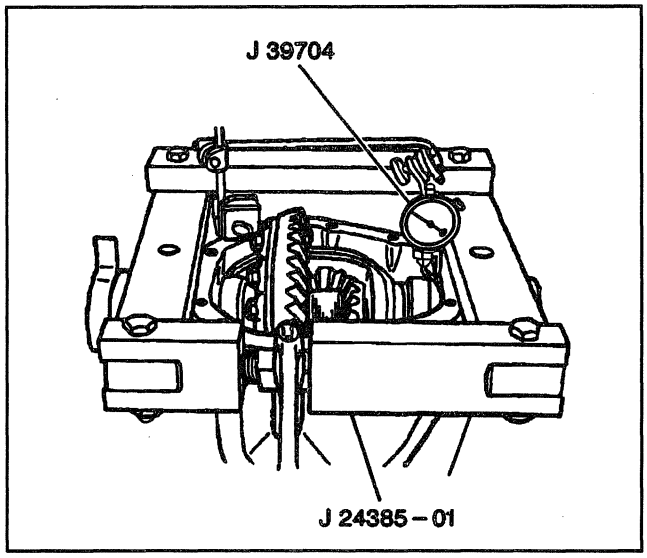


Figure 3—Spreading the Differential Case

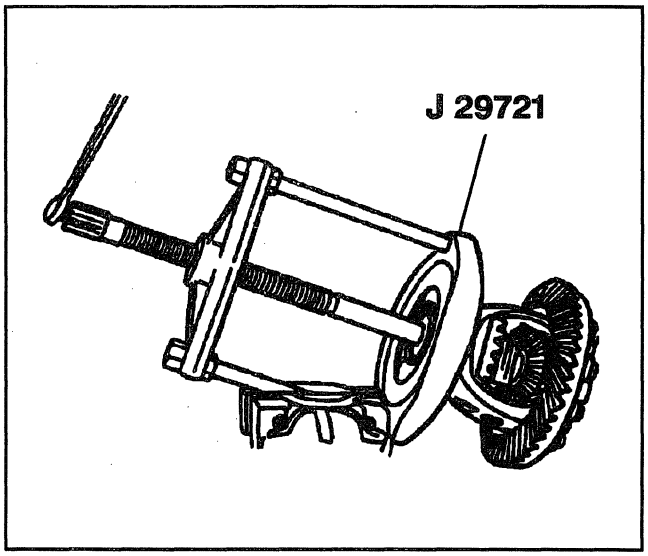


Figure 5—Removing the Differential Side Bearings

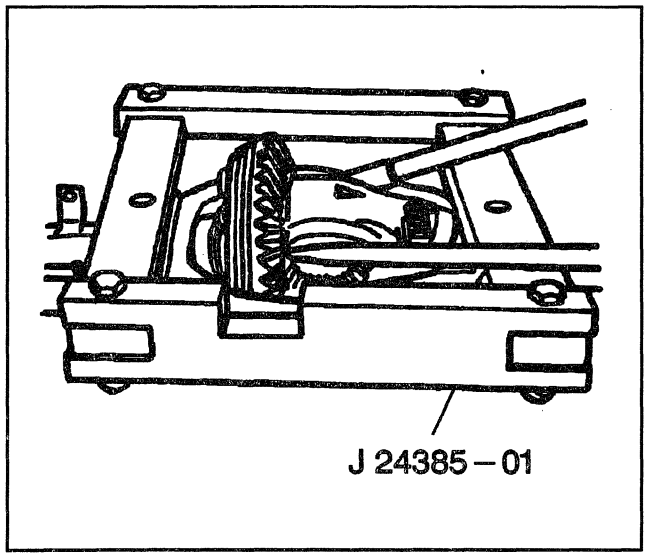


Figure 4—Removing the Differential

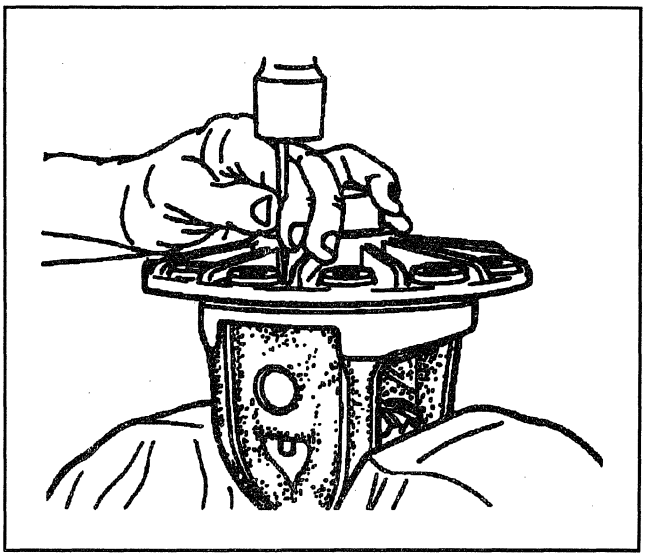


Figure 6—Removing the Roll Pin

- Check outboard spacers for damage (e.g. bent, or deep grooves caused by worn bearings). If damaged, they should be replaced with new ones at time of assembly.
- Note the ring gear fastener strength for later use. Refer to "Specifications"in this section.

10. Ring gear bolts (23) and discard.

Important

- Ring gear bolts are to be replaced with new ones at time of assembly.
- Place shop towels over the vise jaws and put the case in the vise.

11. Ring gear (2) from the case using a soft-faced hammer.
    A. Ring gear (2) from the vise.
    B. Put the case back in the vise.

NOTICE: ***Do not pry the ring gear from the case. This will damage the ring gear and case.***

12. Roll pin (29) from the case using a hammer and punch (Figure 6).
13. Pinion shaft (28) using a hammer and brass drift (Figure 7).
14. Pinion gears (24) and thrust washers (26).
    - Rotate the side gears until the pinion gears are in the opening of the case (Figure 8).
15. Side gears (25) and thrust washers (27).
    - Mark the gears and washers left and right.
16. Replace the cover (14) using two bolts (17) to keep the pinion from falling.

Inspect

- Drive pinion rotating torque and record (Figure 9).

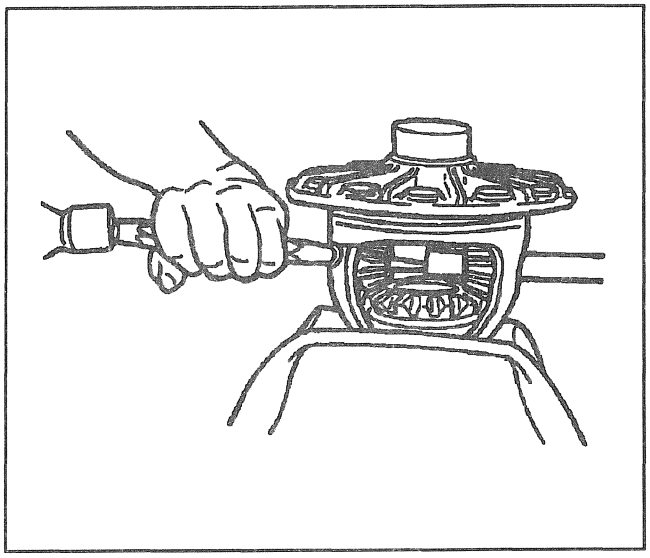


Figure 7—Removing the Pinion Shaft

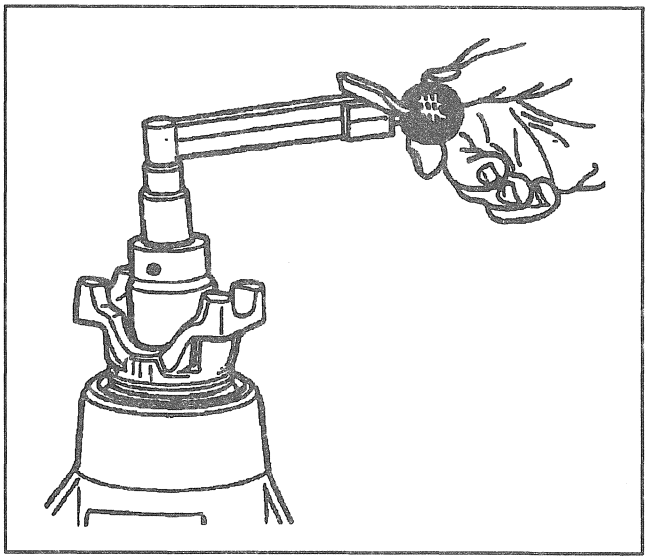


Figure 9—Checking the Pinion Preload

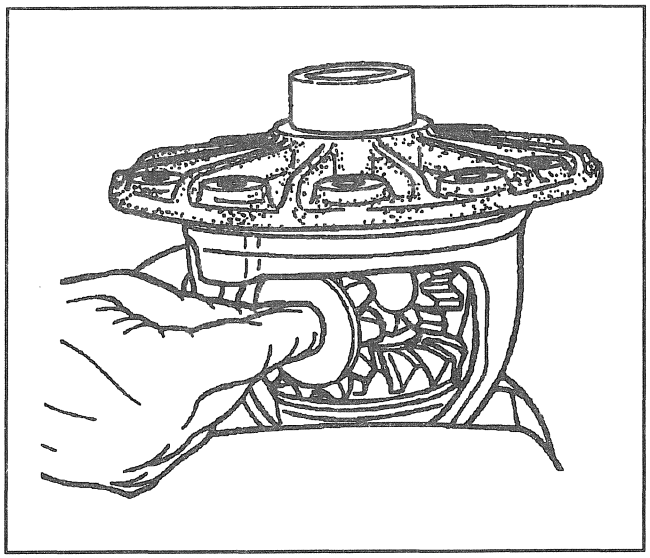


Figure 8—Removing/Installing the Pinion Gears

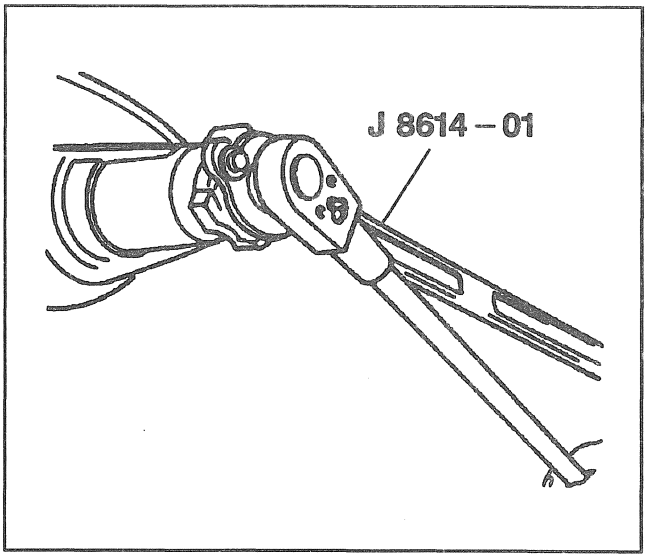


Figure 10—Removing the Drive Pinion Nut

- For looseness of the pinion assembly by moving it back and forth. (Looseness indicates excessive bearing or pinion wear).

17. Pinion nut (12) and washer (11) using J 8614-01 to hold the pinion (Figure 10).
18. Pinion flange (10) using J 8614-01 (Figure 11).
19. Pinion (2) from the housing using a soft-faced hammer to tap the pinion.

CAUTION: Do not allow the pinion to fall. It can strike legs or feet and may cause serious injury. Also, gear teeth may have sharp edges. When handling, use care to avoid cutting hands.

20. Cover (14) and pinion (2).
21. Pinion preload shims (6).
    - Keep the shims together.
22. Pinion seal (9).
23. Outer bearing (7) and oil slinger (8).

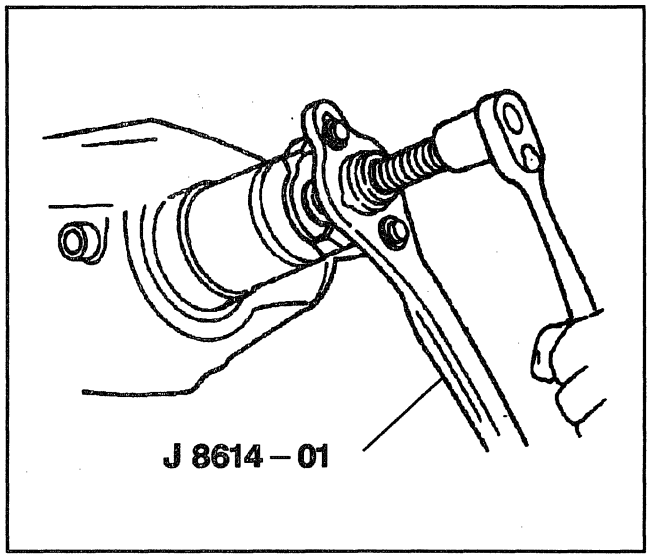


Figure 11—Removing the Pinion Flange

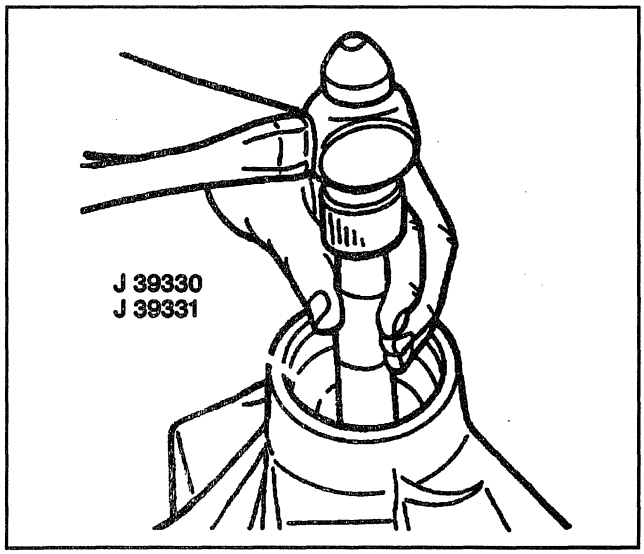


Figure 12—Removing the Bearing Cups

24. Bearing cups (3 and 7) from the axle housing using J 39330 and J 39331 (Figure 12).
25. Pinion adjusting shims (4) and baffle (if used).
    - Keep the shims together.
26. Pinion inner bearing (3) using J 29721 and J 29721-70. (Figure 13).

CLEANING

Do not steam-clean drive parts that have ground and polished surfaces such as gears, bearings, and shafts. All parts should be disassembled before cleaning. These parts should be cleaned in a suitable solvent.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow the bearings to spin while drying them with compressed air.

INSPECTION

Carefully and thoroughly inspect all drive unit parts before assembly.

Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after assembly.

Axle Housing

Inspect

- The axle housing bore for nicks or burrs that could prevent the outer diameter of the pinion seal from sealing. Remove any burrs that are found.
- The bearing cup bores for nicks or burrs. Remove any burrs that are found.
- The housing for cracks. Replace the housing if any cracks are found.
- The housing for foreign material such as metal chips, dirt, or rust. Refer to "Cleaning" in this section.

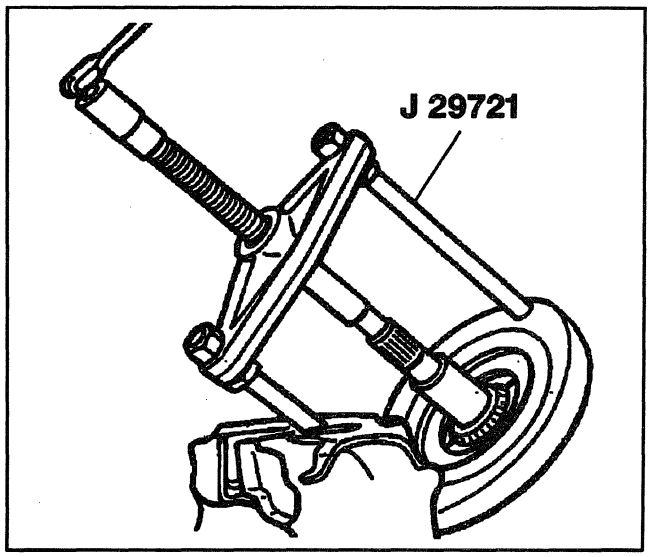


Figure 13—Removing the Pinion Inner Bearing

Differential

Inspect

- Pinion gear shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- All parts for wear and replace if necessary.

Pinion and Ring Gear

- Ring and pinion gears are matched sets and both are replaced any time a replacement of either is necessary.

Inspect

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion gear splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion gear splines on the pinion flange.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks that could cause damage to the inside diameter of the seal and result in an oil leak.
- All worn or broken parts and replace if necessary.

Bearings

Inspect

- Bearings for smooth rotation after oiling them.
- Bearing rollers for wear.
- Bearing cups for wear, cracks, brinelling, and scoring.

Important

- When replacing worn or cracked bearings and cups, make sure to replace them in sets.
- Ring gear and pinion gear for wear and replace them as a set if worn.
- Low mileage bearings may have small scratches on the rollers and the bearing cups from the initial preload. Do not replace a bearing for this reason.

Shims

Inspect

- Shims for cracks and chips. Damaged shims should be replaced with an equal size service shim.

ASSEMBLY OF THE REAR AXLE

Differential Case Assembly

Tools Required:
J 24385 Differential Case Spreader
J 39705 Master Differential Bearings

Install or Connect (Figures 2, 14, and 15)

1. Lubricate all parts with axle lubricant.
2. New side gear thrust washers (27) to the side gears (25).
3. Side gears (25) to the differential case.
   - Install the side gears on the same side as removed.
4. Pinion gears (24) to the differential without the thrust washers (26).
   A. Install the pinion gears to the side gears so the holes in the pinion gears are 180 degrees apart.
   B. Rotate the pinion gears into place, and verify that the pinion gears line up with the pinion shaft holes.
5. New pinion thrust washers (26).
   - Rotate the pinion gears toward the differential opening enough to slide in the pinion thrust washers.

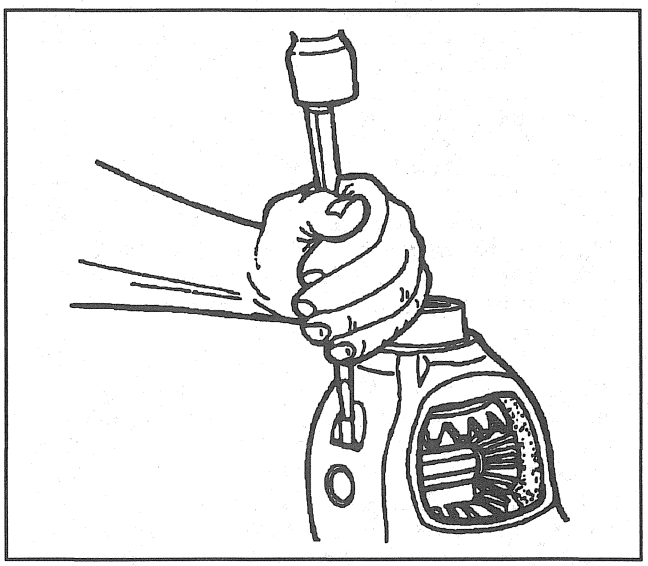


Figure 14—Installing the Roll Pin

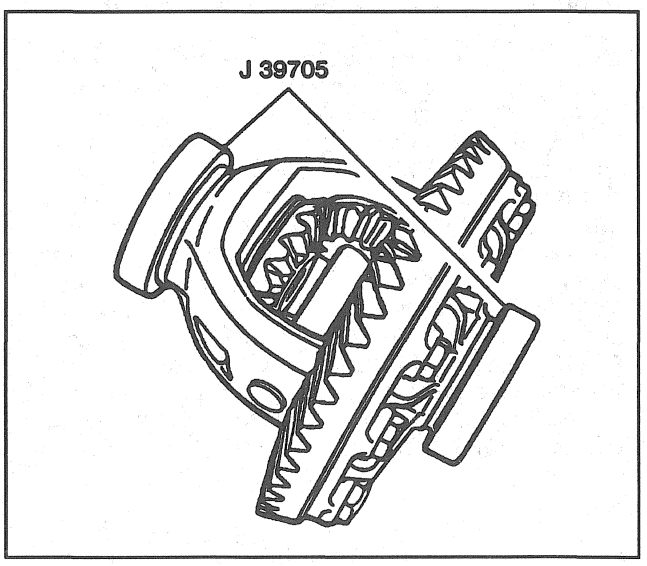


Figure 15—Differential With Master Bearings Installed

6. Pinion shaft (28).
   - Align the roll pin holes in the case and shaft.
7. Roll pin (29) (Figure 14).
   A. Peen metal from the case over the lock pin in two places, 180 degrees apart.
   B. Make sure the mating surfaces of the differential case and the ring gear are clean and free of burrs.
8. Ring gear to the case (2).
   A. Align the holes in the case with the holes in the ring gear.
   B. Press the ring gear onto the case.
9. New ring gear bolts (23).

Tighten

   A. Ring gear bolts in stages, gradually pulling the ring gear onto the differential case.
   B. Ring gear bolts in sequence to 298 N.m (220 lb. ft.).
10. Master differential bearings J 39705 to the differential (Figure 15).
    - Refer to "Determining Total Shim Pack Size" in this section.
    - Outboard spacers, if used, should be in place.

Determining Total Shim Pack Size

NOTICE: ***Both methods for setting differential bearing preload and gear backlash are described. All Model 80 axle assemblies can be serviced by using the outboard selective shim method.***

NOTICE: ***If the original axle assembly has the outboard selective shims, it should not be serviced using the inboard shims for preload/backlash adjustment. In other words, if you have outboard selective shims, you must stay with that method. If the axle assembly uses inboard shims and outboard spacers (non-selective), you may use the outboard selective shim method for service.***

NOTICE: ***If your axle assembly has selective outboard spacers and one 0.76 mm (0.030 inch) shim (each side) between the differential case and bearing cone. Make your measurements with the outboard spacers removed, but with the 0.76 mm (0.030 inch) shim assembled on the differential case trunnion placed between the case and the master differential bearings. The selective outboard spacers are available in sizes (thickness) from 5.18 mm (0.2040 inch) to 6.10 mm (0.2400 inch), in 0.08 mm (0.003 inch) increments. The dial indicator should have the capability of making measurements up to 12.7 mm (0.500 inch).***

NOTICE: ***If your axle assembly has outboard spacers, but controls the preload and backlash by using selective shims (each side) between the differential case and bearing cone. Make the measurements with the outboard spacers installed in the housing, but do not place any shims on the differential case hubs between the case and master differential bearings. The selective shims placed between the bearing cone and differential case are available in 0.08, 0.13, 0.25, 0.76 mm (0.003, 0.005, 0.010, 0.030 inch) sizes. The dial indicator should have the capability of making measurements up to 3.81 mm (0.150 inch).***

1. Assemble the case (22) to the axle housing. The pinion must not be installed.
2. Mount a dial indicator having a minimum travel of 5 mm (0.200 inch) with a magnetic base on the ring gear bolt side of the housing (Figure 16).
3. Force the differential assembly as far as possible in the direction toward the indicator.
4. Preload the dial indicator one half of its travel. Place the tip of the indicator on a flat surface on the differential, next to a ring gear bolt. Mark this location with a piece of chalk.
5. Zero the dial indicator.
6. Force the differential case in the opposite direction as far as it will go. Repeat this Step until the same reading is obtained. Record the number of thousandths that the dial indicator traveled, not the reading on the dial. This will be the measurement of the shim pack without the bearing preload (which will be added later).
7. Remove the dial indicator.
8. Remove the differential from the housing.
   - Do not remove the master bearings from the differential.
9. Remove the spacers from the housing, if used.
   - NOTE: Spacers are removed to prevent them from falling out while installing the pinion gear.

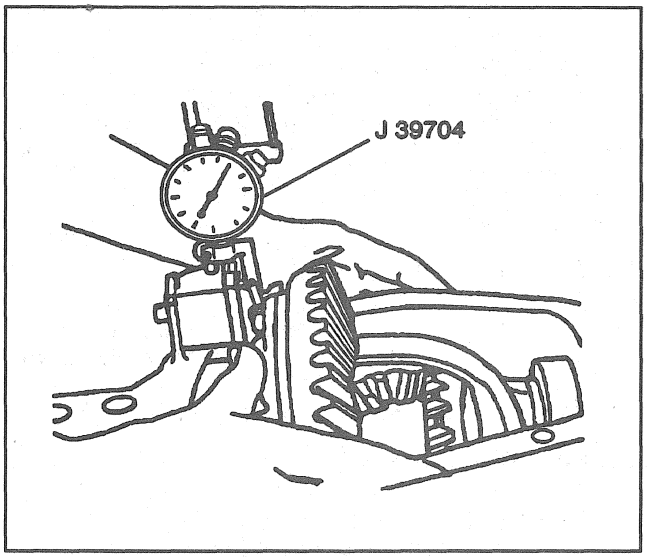


Figure 16—Determining Differential Shim Pack

Tag spacers and indicate from which side they were removed. They must be reassembled as removed or the reading taken in Step 6 will not be correct.

Pinion Depth Adjustment

Tools Required:

- J 39704 Dial Indicator
- J 39702 Arbor
- J 39701 Master Discs
- J 41690 Master Pinion Block
- J 41689 Pinion Height Block
- J 41691 Adapter Cone
- J 41692 Threaded Rod
- J 39708 Handle
- J 39707 Cup Installer (Inner Pinion Bearing Cup)
- J 8092 Driver Handle
- J 7818 Rear Pinion Bearing Cup Installer

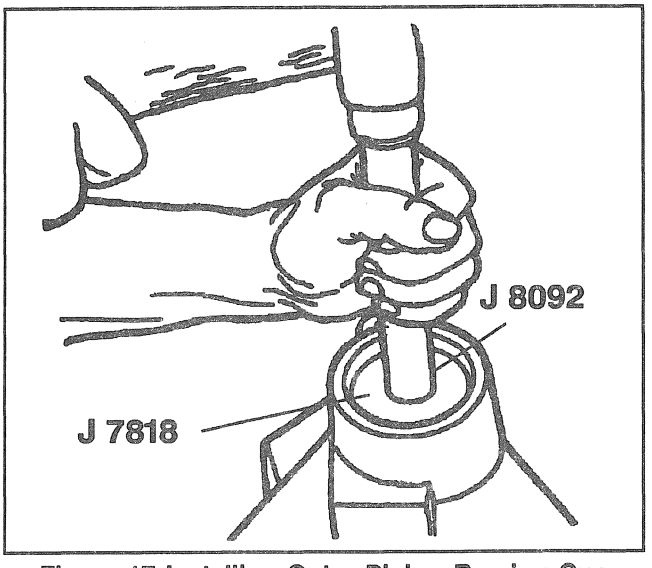


Figure 17 Installing Outer Pinion Bearing Cup

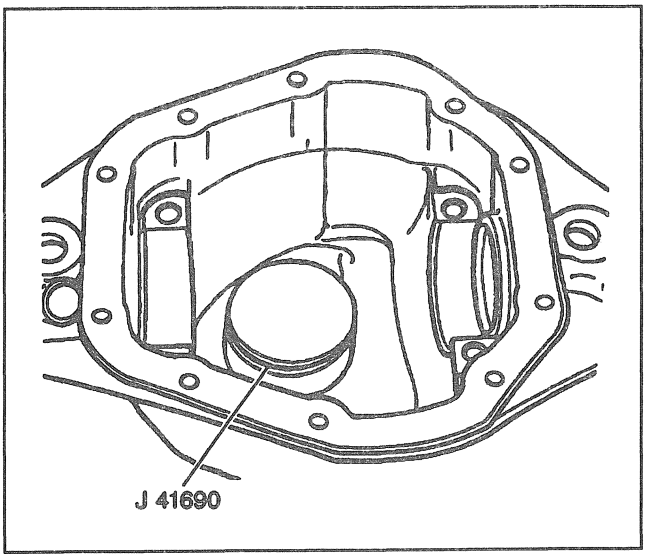


Figure 18—Master Pinion Block

NOTICE: ***You may use the older style gage set if you already have them. The new style gages use the bearings as part of the gage system, while the older style uses a Master Block that acts as a Master Bearing.***

1. Clean the carrier bores and all tools. The pinion bore must be free of nicks and dirt.
2. Drive the inner bearing cup into the axle assembly using J 39708 and J 39707. The cup must be seated.
3. Drive the outer bearing cup into the axle assembly using J 7818 and J 8092 (Figure 17).
4. Assemble inner bearing cone into cup.
5. Assemble master pinion block J 41690, pinion height block J 41689 into carrier housing using adapter cone J 41691 and screw J 41692 (Figure 18). The outer bearing cone will be used with the adapter cone and should be assembled at this time.
6. Hand tighten the cone until all end-play is removed from gage assembly.
7. Place J 39704 onto the height block (Figure 19).
   - Place the gage on the upper Step of the height block. Apply pressure to the gage block, pushing down on the height block. While applying pressure, set the dial indicator at zero.
8. Slide the gage over the arbor (Figure 20).
9. Record the reading at the point of greatest deflection (when the dial indicator needle is centered between movement to the left and right).
   A. This reading indicates the amount of shims needed for a nominal pinion setting. The pinion marking may change the pinion depth by adding or deleting shims from the nominal pinion setting.
   B. A positive (+) pinion marking indicates that the distance between the ring gear centerline and the pinion head must increase by the number of thousandths marked on the pinion. This means that the shim pack will decrease by the same number of thousandths.

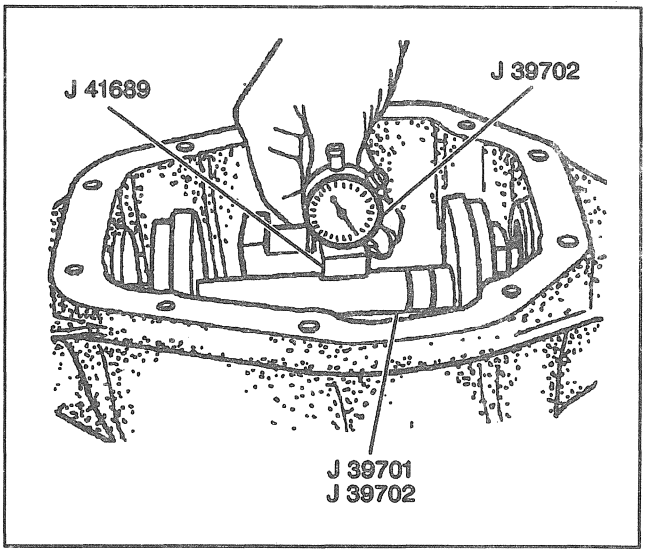


Figure 19—Dial Indicator On The Height Block

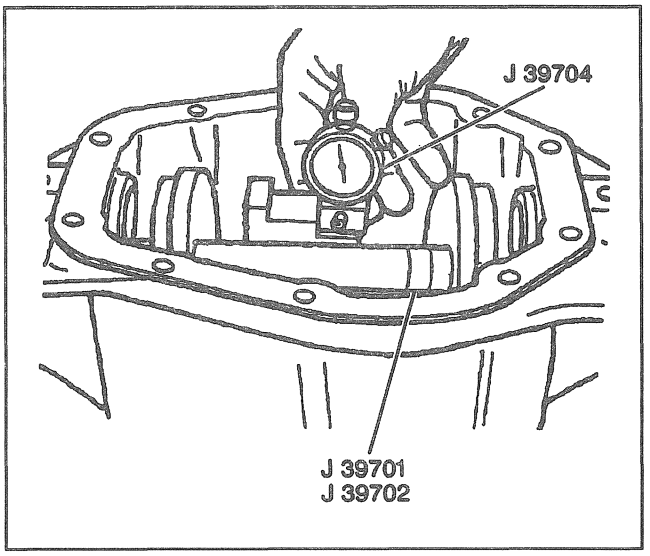


Figure 20—Dial Indicator On The Arbor

C. A negative (-) pinion marking indicates that the distance between the ring gear centerline and the pinion head must decrease by the number of thousandths marked on the pinion. This means that the shim pack will increase by the same number of thousandths.
D. A pinion etched zero (0) will use the nominal setting determined by this procedure.

10. After making the measurement, remove the gage tools and the inner pinion bearing cone and cup.
11. Measure each shim separately with a micrometer and add the dimensions together to obtain the total shim pack thickness. If a baffle or slinger is used, these also must be measured and included in the shim pack.

Pinion Installation

Tools Required:
- J 5590 Rear Pinion Bearing Cone Installer
- J 8614-01 Pinion Flange Remover
- J 8001 Dial Indicator Set or Equivalent
- J 41696 Pinion Seal Installer
- J 39708 Handle
- J 39707 Rear Pinion Bearing Cup Installer

Install or Connect (Figures 21 through 24)

1. Place the required amount of shims (and baffle if used) in the inner bearing bore.
2. Drive the inner bearing cup into the axle assembly using J 39708 and J 39707. The cup must be seated on the shims (Figure 21).
3. Inner bearing cone (and slinger if used) on pinion. Drive the bearing cone onto the Pinion shaft using J 5590 (Figure 22).

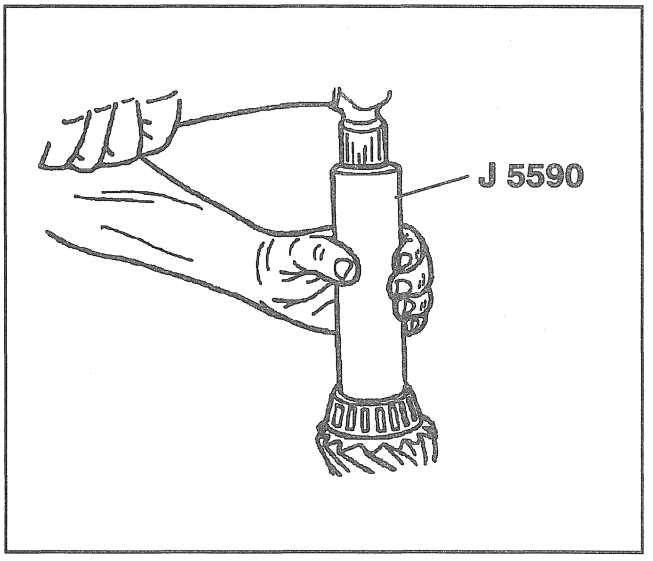


Figure 22—Installing Inner Bearing

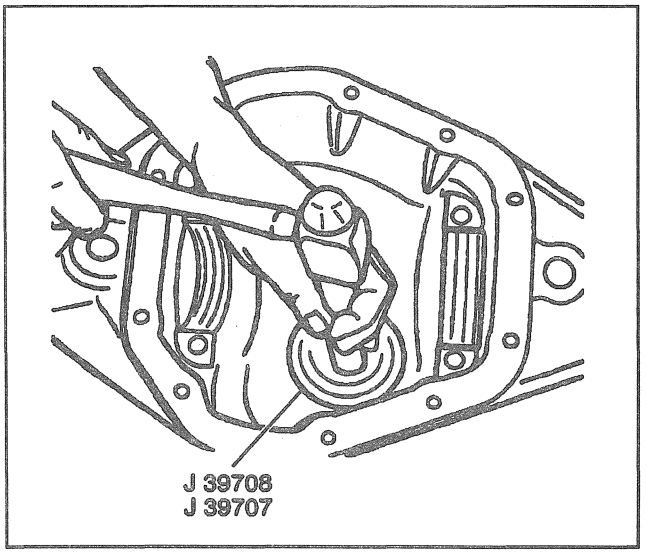


Figure 21—Installing Inner Pinion Bearing Cup

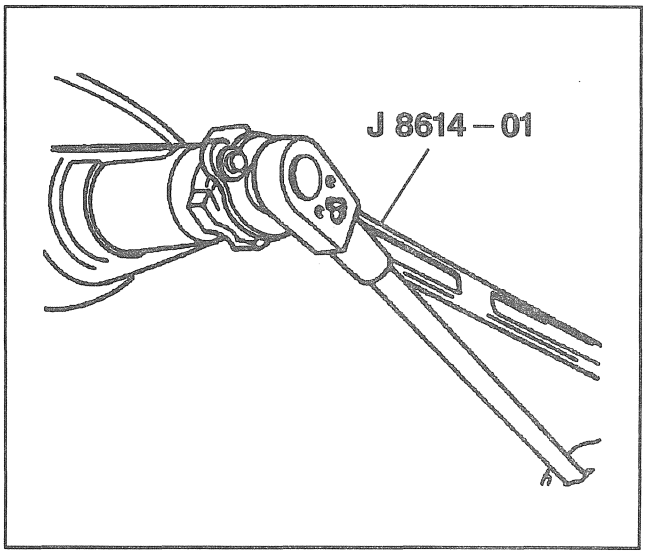


Figure 23—Tightening Pinion Nut

4. Outer bearing cone (7), slinger, and oil seal, using J 41696 pinion seal installer.
   - Apply a light coat of axle lubricant to the pinion seal lip.
5. Preload shims (6) onto pinion gear.
6. Pinion into the axle housing.
7. Pinion flange (10).
8. Washer (11) and old nut (12).

Tighten

- Nut (12) to 637 N·m (470 lb. ft.) while holding the pinion with J 8614-01 (Figure 23).
  A. The nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is no end play in the pinion, the preload torque should be checked.
  B. Remove J 8614-01. Using an inch pound torque wrench, check the pinion preload by rotating the pinion with the wrench (Figure 24). Preload should be at or below 2.8 to 5.1 N·m (25 to 45 lb. in.) on new bearings, or 1.0 to 1.4 N·m (8 to 12 lb. in.) for used bearings.
  C. Once the specified preload has been obtained, rotate the pinion several times to ensure the bearings have seated. Recheck the preload and adjust if necessary.

Assembling the Differential into the Axle Housing

Tools Required:
J 8092 Driver Handle
J 23690 Differential Side Bearing Installer
J 24385-01 Differential Carrier Spreader
J 39705/J 39705 Master Differential Bearings
J 8001 Dial Indicator Set or Equivalent

NOTICE: *If your axle assembly has selective outboard spacers and one 0.76 mm (0.030 inch) shim (each side) between the differential case and bearing cone, make your measurements with the outboard spacers removed, but with the 0.76 mm (0.030 inch) shim assembled on the differential case trunnion placed between the case and the master differential bearing. The selective outboard spacers are available in sizes (thickness) from 5.18 mm (0.2040 inch) to 6.10 mm (0.2400 inch), in 0.08 mm (0.003 inch) increments. The dial indicator should have the capability of making measurements up to 12.7 mm (0.500 inch).*

NOTICE: *If your axle assembly has outboard spacers, but controls the preload and backlash by using selective shims (each side) between the differential case and bearing cone, make the measurements with the outboard spacers installed in the housing, but do not place any shims on the differential case hubs between the case and master differential bearings. The selective shims placed between the bearing cone and differential case are available in 0.08, 0.13, 0.25. 0.76 mm (0.003, 0.005, 0.010, 0.030 inch). The dial indicator should have the capability of making measurements up to 3.81 mm (0.150 inch).*

1. Force the ring gear to mesh with the pinion. Rock the ring gear to allow the teeth of the gears to mesh.
2. Assemble the differential (22) with master bearings installed to the axle. The pinion must be installed.
3. Mount a dial indicator with a magnetic base on the ring gear bolt side of the housing (Figure 25).
4. Place the indicator tip on the chalk mark made earlier.
5. With the force still applied to the differential case, set the dial indicator to zero.

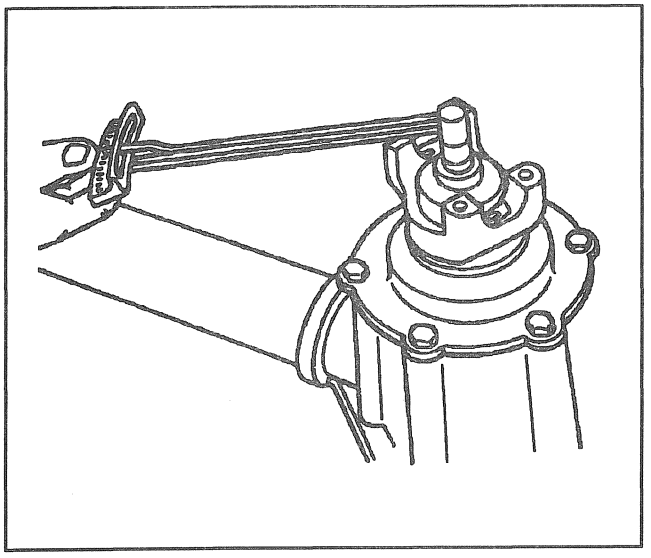


Figure 24—Checking Pinion Preload

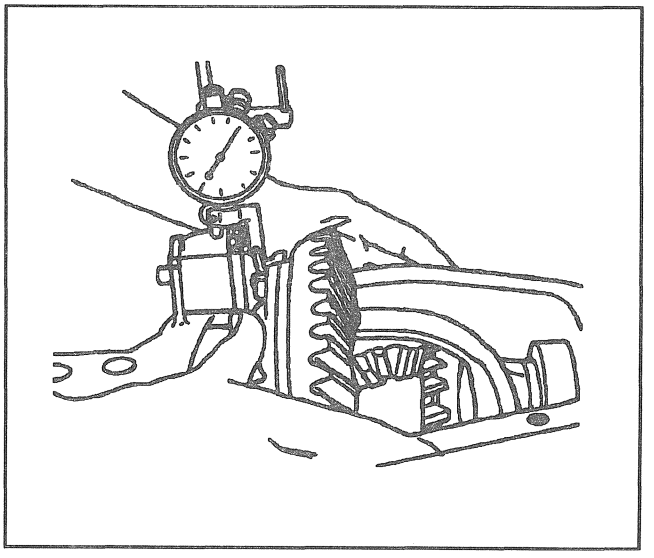


Figure 25—Measuring Differential Movement

6. Force the differential case away from the pinion gear to obtain an indicator reading. Repeat this action until a consistent reading is obtained. Record the reading.
7. Remove the indicator and the differential case from the axle housing.
8. Remove the master bearings from the differential case.
9. Using the total shim pack size determined earlier, (Refer to "Determining Total Shim Pack Size" in this section.) subtract the reading found in Step 6 from the total reading. The reading found in Step 6 will be the shim size on the ring gear side. The remaining portion of the shim pack will be used on the side opposite the ring gear. Add an additional 0.25 mm (0. 010 inch) of shims to the side opposite the ring gear to preload the bearings.
10. Place the proper shims on the differential side of bearing hub (ring gear side) and drive the differential bearing onto the hub using J 8092 and J 23690 (Figure 26).

Important

- If the axle assembly uses the outboard selective spacers, place the 0.76 mm (0.030 inch) shim on the hub that was used along with the master bearings to make the measurement. Then select the appropriate outboard selective spacer and assemble into housing.

11. Place the proper shims on the differential side bearing hub (opposite the ring gear) and drive the differential bearing onto the hub using J 8092 and J 23690.

Important

- If the axle assembly uses the outboard selective spacers, place the 0.76 mm (0.030 inch) shim on the hub that was used along with the master bearings to make the measurement. Then select the appropriate outboard selective spacer and assemble into housing.

12. Assemble J 24385-01 to the axle (Figure 27).
13. Assemble the dial indicator. Preset the gage at least 0.05 mm (0.020 inch), then rotate the indicator housing to zero the dial.

NOTICE: ***Do not spread the axle housing more than 0.38 mm (0.015 inch). Over-spreading can damage or distort the housing.***

14. Spread the housing while examining the dial indicator.
15. Remove the dial indicator.
16. Place the bearing cups (20) onto the bearings.
17. Install the differential assembly into the carrier.
    - Use a soft-faced hammer to seat the differential assembly in the axle housing.
18. Remove the spreader.
19. Install the bearing caps (18) in their original positions.
20. Install the bearing cap bolts (19).

Tighten

- Bolts (19) to 115 N.m (85 lb. ft.).

Checking Backlash

1. Mount a dial indicator with a magnetic base to the axle housing (Figure 28).
2. Place the indicator tip at the heel end of the tooth.
3. Check the backlash at three equally spaced points. The backlash should be 0.13-0.23 mm (0.005-0.009 inch). The measurement must not vary more than 0.05 mm (0.002 inch) between the points checked.
   A. High backlash is corrected by moving the ring gear closer to the pinion.
   B. Low backlash is corrected by moving the ring gear away from the pinion.
4. To adjust the backlash, the differential case must be removed from the housing, and the shims adjusted from one side to the other. For example: if the shim thickness needs to be reduced on the ring

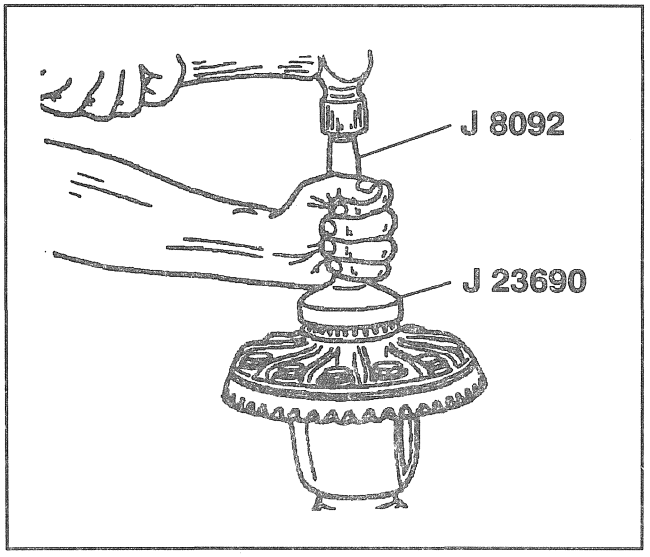


Figure 26—Installing Differential Bearings

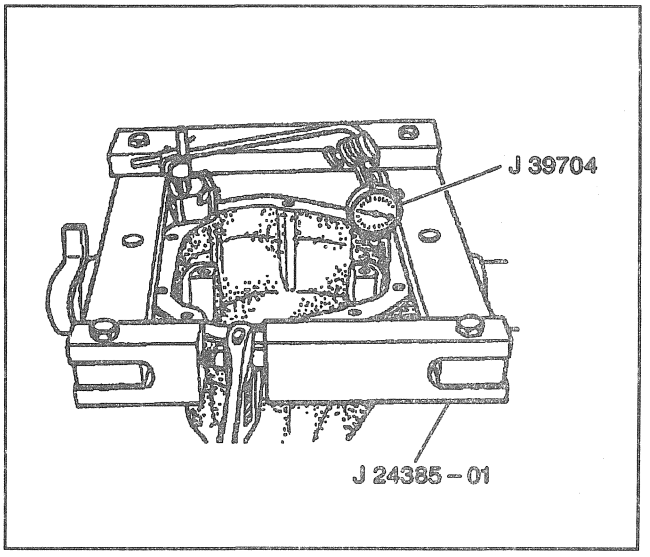


Figure 27—Mounting The Spreader

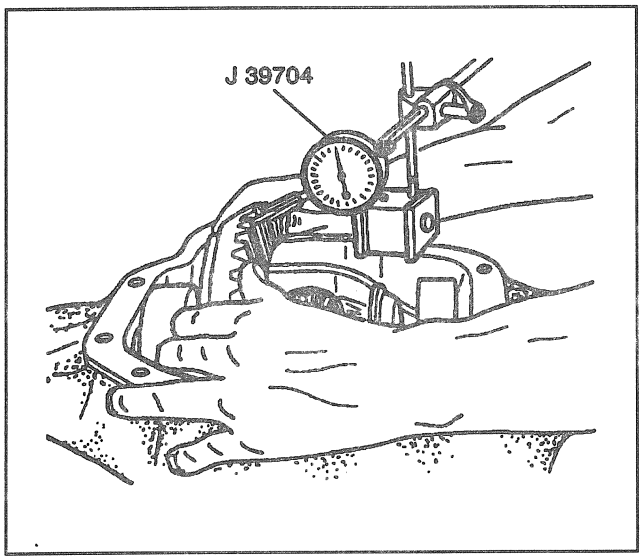


Figure 28—Measuring Backlash

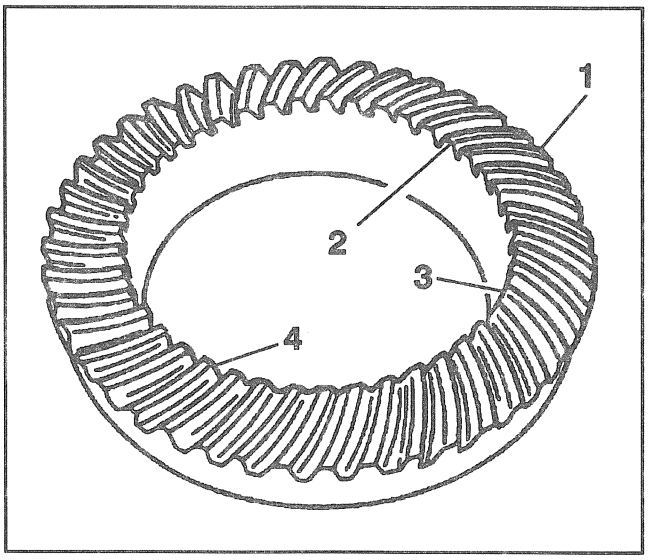


Figure 29—Gear Tooth Nomenclature

gear side by 0.13 mm (0.005 inch), then 0.13 mm (0.005 inch) must be added to the other side. If backlash is correct and the preload must be changed, then change each side by an equal amount.

5. Make the final gear pattern check.

GEAR TOOTH PATTERN CHECK

Before final assembly of the differential, a gear tooth contact pattern check should be performed.

A gear tooth contact pattern check is NOT a substitute for adjusting pinion depth and backlash as previously outlined. It is a method to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy, have a short life, or both. With a pattern check, the best contact between the ring gear and the drive pinion for low noise level and long life can be ensured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side (4). The concave side is the "coast" side (3). The end of the tooth nearest the center of ring gear is referred to as the "toe" end (2). The end of the tooth farthest away from the center is the "heel" end (1). The toe end of the tooth is smaller than the heel end (Figure 29).

Test

1. Wipe oil out of axle housing and carefully clean each tooth of the ring gear.
2. Apply gear marking compound sparingly to all ring gear teeth using a medium stiff brush.
3. Use the service brake to apply a load until a torque of 54-68 N.m (40-50 lb. ft.) is required to turn the pinion.

   A test made without loading the gears will not give a satisfactory pattern. Turn the companion flange with a wrench so that the ring gear rotates one full revolution. Then reverse the rotation so that the ring gear rotates one revolution in the opposite direction. Excessive turning of the ring gear is not recommended.
4. Observe the pattern on the ring gear teeth and compare with Figure 30.

ADJUSTMENTS AFFECTING TOOTH CONTACT

Two adjustments can be made that affect tooth contact pattern: backlash and drive pinion depth. The effects of bearing preloads are not readily apparent on hand loaded tooth contact pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims that move the case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload).

If the thickness of the right shim is increased (along with an equal decrease in the left shim thickness), backlash will increase.

If the thickness of the left shim is increased (along with an equal decrease in the right shim thickness), backlash will decrease.

Final Assembly

Install or Connect

1. RTV to the axle cover.
2. Axle cover (14) to the housing.

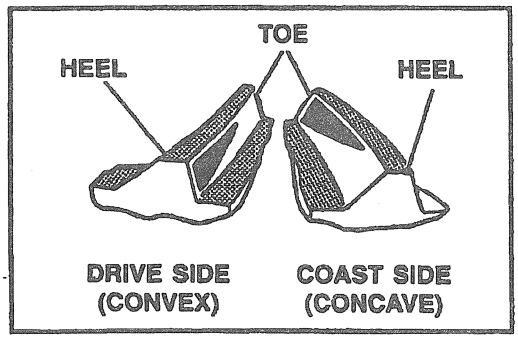
Tighten

- Cover bolts (17) to 47 N.m (35 lb. ft.).

3. Lubricant to the axle.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO FAR AWAY FROM RING GEAR.



CORRECTION:

INCREASE THE PINION SHIM THICKNESS.

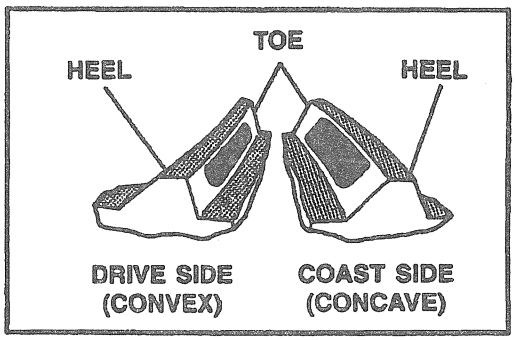
SERVICE HINTS:

HOW TO CHECK PATTERNS:

- BRUSH GEAR MARKING COMPOUND ON THE RING GEAR TEETH.
- ROTATE THE PINION SIX TIMES CLOCKWISE AND SIX TIMES COUNTERCLOCKWISE.
- OBSERVE THE TOOTH CONTACT PATTERN AND MAKE ANY NECESSARY CORRECTIONS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH CORRECT.



CORRECTION:

NONE.

SERVICE HINTS:

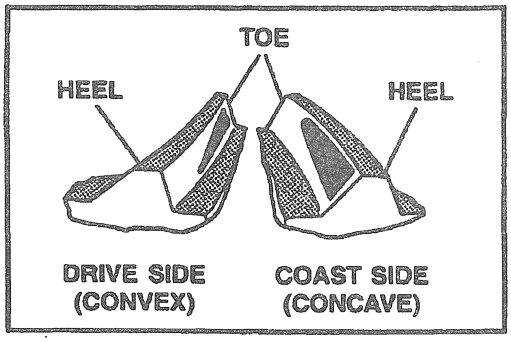
PATTERNS THAT MAY VARY MAY BE CAUSED BY LOOSE BEARINGS ON THE PINION OR THE DIFFERENTIAL CASE CHECK THESE BEARING PRELOAD SETTINGS:

- TOTAL ASSEMBLY
- DIFFERERTIAL CASE
- PINION

IF THESE SETTINGS ARE GOOD, LOOK FOR DAMAGED OR INCORRECTLY ASSEMBLED PARTS.

CONDITION:

- BACKLASH CORRECT.
- PINION DEPTH INCORRECT–PINION GEAR IS TOO CLOSE TO RING GEAR.



CORRECTION:

DECREASE THE PINION SHIM THICKNESS.

SERVICE HINTS:

PINION DEPTH SHIM LOCATIONS:

- BETWEEN THE INNER PINION BEARING CONE AND THE HEAD OF THE PINION GEAR.
- BETWEEN THE INNER PINION BEARING CUP AND THE REAR AXLE HOUSING.

3704r5056

Figure 30—Gear Tooth Patterns

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Axle Cover Bolts	47	35
Bearing Cap Bolts	115	85
Drive Pinion Nut		
Model 80	637	470
Fill Plug	33	24

RING GEAR BOLTS

Model	N·m	Lb. Ft.
80	298	220

AVAILABLE SHIM SIZES

Differential Bearing Adjusting Shim	0.0762mm (0.003 inch)
	0.127mm (0.005 inch)
	0.254mm (0.010 inch)
	0.762mm (0.030 inch)
Outer Pinion Bearing Preload Shim	0.3556mm (0.014 inch)
	0.381mm (0.015 inch)
	0.4064mm (0.016 inch)
	0.4572mm (0.018 inch)
	0.508mm (0.020 inch)
	0.5334mm (0.021 inch)
	0.5588mm (0.022 inch)
	0.5842mm (0.023 inch)
	0.762mm (0.030 inch)
Inner Pinion Bearing Shim	0.0762mm (0.003 inch)
	0.127mm (0.005 inch)
	0.254mm (0.010 inch)
Selective Outboard Spacers	5.18mm (0.2040 inch)
	5.26mm (0.2070 inch)
	5.33mm (0.2100 inch)
	5.41mm (0.2130 inch)
	5.49mm (0.2160 inch)
	5.56mm (0.2190 inch)
	5.64mm (0.2220 inch)
	5.72mm (0.2250 inch)
	5.79mm (0.2280 inch)
	5.87mm (0.2310 inch)
	5.94mm (0.2340 inch)
	6.02mm (0.2370 inch)
	6.10mm (0.2400 inch)
Inboard Shim	0.84/0.69mm (0.33/0.027 inch)
(Used with selective outboard shims)	
Outboard Spacers (Non Selective Type)	4.98/4.88mm (.196/.192 inch)

(used with differential bearing adjusting shims 0.076, 0.127, 0.254, 0.762 mm (0.003, 0.005, 0.010, 0.030 inch)

PINION BEARING AND DIFFERENTIAL BEARING PRELOAD SPECIFICATION

	Lb. In.
Torque to Rotate Drive Pinion Only	
New bearings	25-45
Ratios 4.63 to 5.13	6-8*
Torque to Rotate Drive Pinion and Differential Case (Less Axle Shafts, New Bearings)	31-53

Additional Torque to Rotate Required for Differential Bearing Preload (new bearings only) by Ratio: 4.63 to 5.13

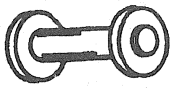
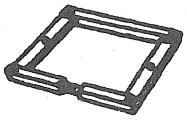
* Added to Pinion Torque for Final Reading

LUBRICATION

Capacity	4.0 Liters (8.2 Pints)
Type	SAE 80-W-90 GL5 Gear Lubricant

T3038

SPECIAL TOOLS

1.		J 39702	8.		J 8092
2.		J 39704	9.		J 5590
3.		J 39705	10.		J 8614 – 01
4.		J 39707	11.		J 23690
5.		J 39709	12.		J 29721
6.		J 8107 – 03	13.		J 24385 – 01
7.		J 7818	14.		J 29721 – 70

1. MASTER DISCS AND ARBOR
2. SCOOTER GAGE
3. MASTER DIFFERENTIAL BEARINGS
4. CUP INSTALLER
5. HANDLE
6. DIFFERENTIAL SIDE BEARING REMOVAL PLUG
7. FRONT PINION BEARING CUP INSTALLER
8. DRIVER HANDLE
9. REAR PINION BEARING CONE INSTALLER
10. PINION FLANGE REMOVER
11. DIFFERENTIAL SIDE BEARING INSTALLER
12. DIFFERENTIAL SIDE BEARING REMOVER
13. DIFFERENTIAL CARRIER SPREADER
14. SIDE BEARING ADAPTERS

SECTION 4B7

LOCKING DIFFERENTIAL

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repair.

NOTICE: ***Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.***

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LOCKING DIFFERENTIALS

7 5/8, 8 1/2, 8 5/8 AND 9 1/2 inch RING GEAR

Tools Required:
J 26252 Governor Remover

Disassembly of the Differential

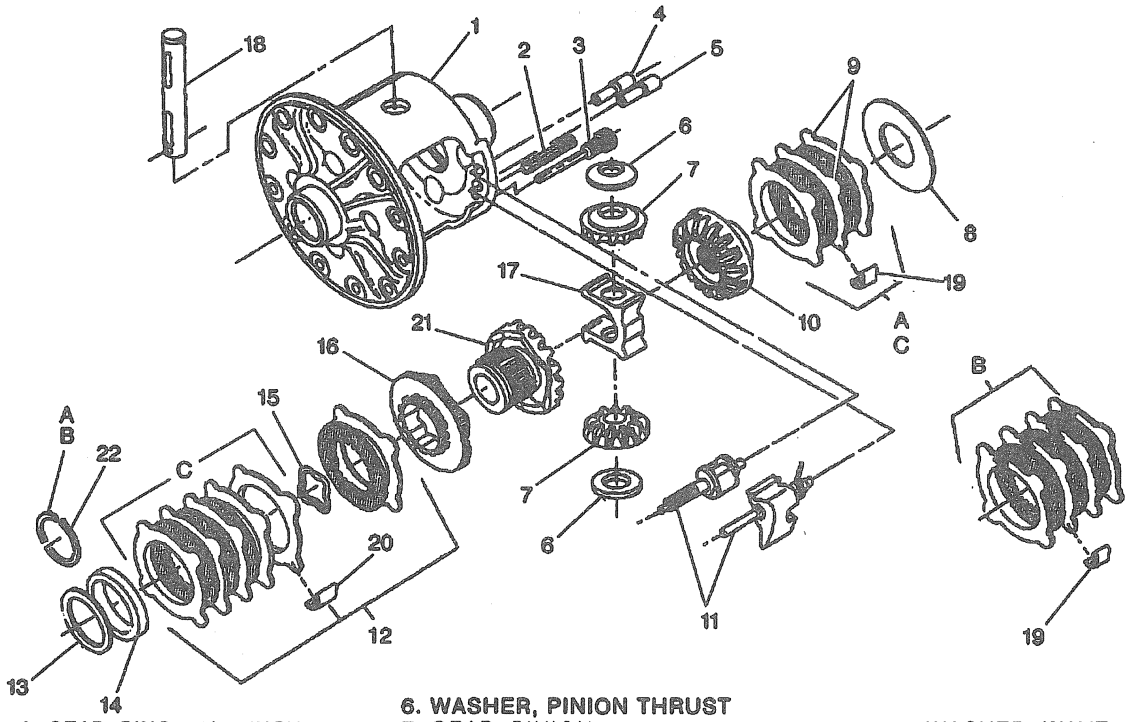
Remove or Disconnect (Figures 1 through 7)

1. Governor bushing using J 26252 (Figure 2).
2. The E-clips that hold the latching bracket in place on the bracket shaft.
   - Move the bracket down the shaft.
3. Latching bracket bushing (5) using J 26252.
4. Latching bracket (5), shaft, and spring from the case.
5. Governor assembly (11) from the case.
6. Stop pin (2) (9 1/2 inch only).
7. Lock screw (3).
8. Pinion shaft (18).
9. Differential pinion gears (7) and pinion thrust washers (6).
   - Roll the gears out of the case by rotating one of the side gears.
10. Thrust block (17).
11. Right side gear (10).
12. Right clutch plates (9) and side thrust washer.
13. Left side gear (21), cam plate (16), and clutch plates (12) as an assembly (cam unit).
14. Side gear thrust washer (13).

Cam Unit Disassembly - 7 5/8, 8 1/2 and 8 5/8 inch

Remove or Disconnect (Figures 1 and 3)

1. Retaining ring (22) (Figure 3).
2. Clutch plates (12).
3. Guide clips (20).



A. GEAR, RING 7 1/2 – INCH
B. GEAR RING 8 1/2 – INCH
C. GEAR, RING 9 1/2 – INCH
1. CASE, DIFFERENTIAL
2. PIN, STOP (9 1/2 ONLY)
3. SCREW, LOCK
4. BUSHING, GOVERNOR
5. BUSHING LATCHING BRACKET
6. WASHER, PINION THRUST
7. GEAR, PINION
8. WASHER, SIDE GEAR THRUST
9. PLATES, CLUTCH
10. GEAR, SIDE
11. GOVERNOR
12. PLATES, CLUTCH
13. WASHER, SIDE GEAR THRUST
14. SLEEVE, SIDE THRUST (9 1/2 ONLY)
15. WASHER, WAVE
16. PLATE, CAM
17. BLOCK, THRUST
18. SHAFT, PINION
19. CLIP, GUIDE
20. CLIP, GUIDE
21. GEAR, SIDE CAM
22. RING, RETAINING

6404R5914

Figure 1—Differential Components

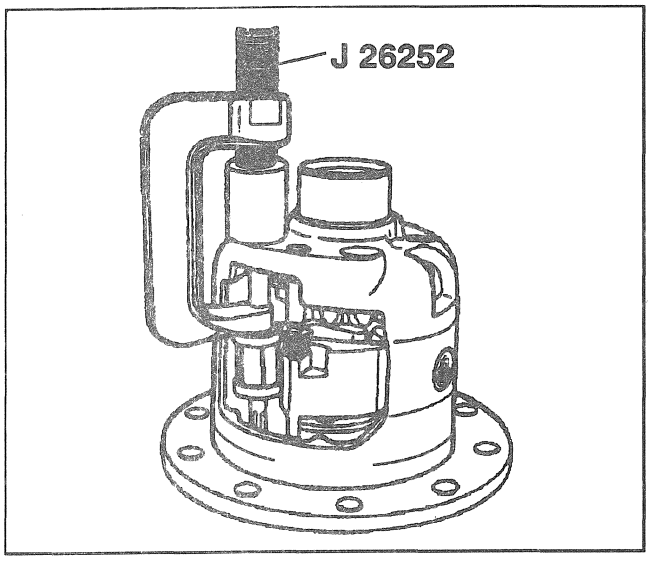


Figure 2—Removing the Governor Bushings

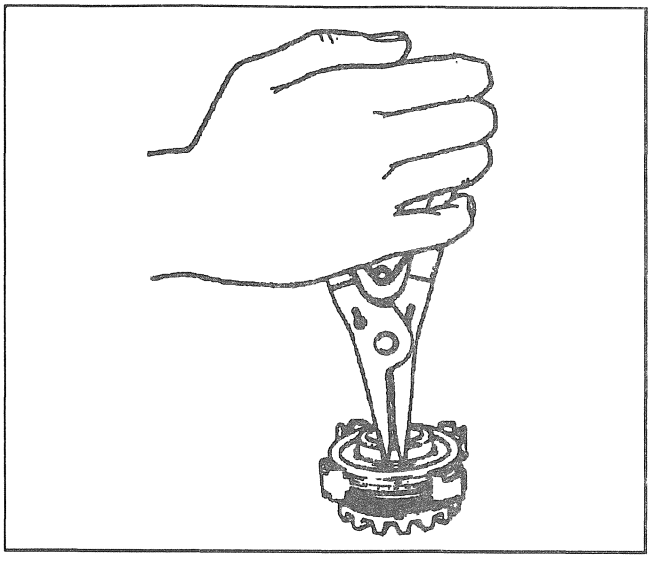


Figure 3—Removing the Retaining Ring

4. Wave washer (15).
5. Cam plate (16).
6. Side cam gear (21).

Cam Unit Disassembly 9 1/2 inch

Tools Required:
J 22912-01 Bearing Remover

Remove or Disconnect (Figures 1 and 4)

- Measure and record the overall length of the gear assembly from the front of the gear to the back of the side thrust sleeve (14) including the side gear thrust washer(13).

1. Guide clips (20).
2. Side thrust sleeve (14) using J 22912-01.
   - Press the sleeve from the side gear (Figure 4).
3. Clutch plates (12).
4. Wave washer (15).
5. Cam plate (16).
6. Side cam gear (21).

Cleaning and Inspection

Clean

- All parts with an approved solvent.

Inspect

- All parts for excessive wear or breakage and replace if necessary.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washer for wear.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- Thrust sleeve for excessive wear. Do not replace the thrust sleeve unless necessary. Inspect the side gear bore for scoring. If scoring is present, replace the entire differential.

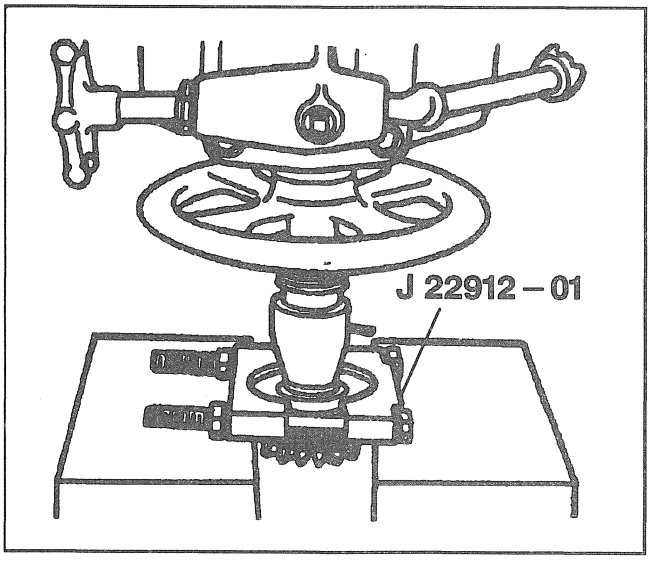


Figure 4—Removing the Thrust Sleeve

Cam Unit Assembly 7 5/8, 8 1/2 AND 8 5/8 Inch

Install or Connect (Figures 1 and 3)

1. Cam plate (16) to the side cam gear (21).
2. Wave washer (15).
3. Clutch plates (12) (7 5/8 = 8 plates. 8 1/2 and 8 5/8 = 10 plates).
   - Alternate the plates as shown in Figure 1.
4. Retaining ring (22) (Figure 3).
5. Guide clips (20) to the clutch plates (12).
   - Use grease in the clips to hold them in place on the plates.

Cam Unit Assembly 9 1/2 Inch

Install or Connect

1. Cam plate (16) to the side cam gear (21).
2. Wave washer (15).
3. Clutch plates (12).
   - Alternate the plates as shown in Figure 1.

4. Thrust sleeve (14).
   - Press the thrust sleeve flush with the side gear disc splines.
5. Guide clips (20) to the clutch plates (12).
   - Use grease in the clips to hold them in place on the plates.
   - If the side cam gear or side thrust sleeve has been replaced, measure and record the overall length of the gear assembly from the front of the gear to the back of the side thrust sleeve (14) including the side gear thrust washer (13).
   - Compare this reading with the reading obtained earlier in this section.
   - If the new reading is more than 0.0762 mm (0.003 inch) higher or lower than the original, select a thrust washer that will return the reading closest to the original reading.

Adjustment of the Differential

- If it is necessary to replace the cam gear, right side gear, or thrust block, the entire differential must be adjusted. The differential is adjusted by using selective thickness thrust washers behind each side gear and selective thickness reaction blocks.
- It is important to build up the differential properly. The proper clearance between parts is critical to the operation of the unit.
- There are three adjustments needed:
  (1) Left side gear backlash.
  (2) Right side gear backlash.
  (3) Thrust block clearance.

Left Side Gear Backlash Adjustment

1. Install the cam unit and side thrust washer (13) to the flange end of the case.
2. Place the pinion gears (7) and side gear thrust washers into the differential.
   - Align them with the pinion shaft hole.
3. Press down the side gear, and install the pinion shaft (18) and lock screw (3).
   - If the side gear cannot be pressed down far enough to install the pinion shaft, replace the side gear thrust washer with a thinner washer.
4. Rotate the pinion gear closest to the lock screw so one of the teeth is pointing downward (perpendicular to the ring gear flange).
5. Insert a large tapered tool, like a screwdriver, firmly between the side gear and the pinion shaft.
6. Mount a dial indicator to the ring gear flange and place the stem of the indicator on one of the teeth on the pinion gear closest to the lock screw (Figure 5).
7. Pull the pinion gear firmly into its seat, and rotate the gear back and forth while reading the dial indicator. Record the reading.
8. Repeat Steps 4 through 7 on the opposite pinion gear.
9. The backlash should be between 0.254 and 0.457 mm (0.010 and 0.018 inch).
10. If the backlash is too high, use a thicker side gear thrust washer.
11. If the backlash is too low, use a thinner side gear thrust washer.

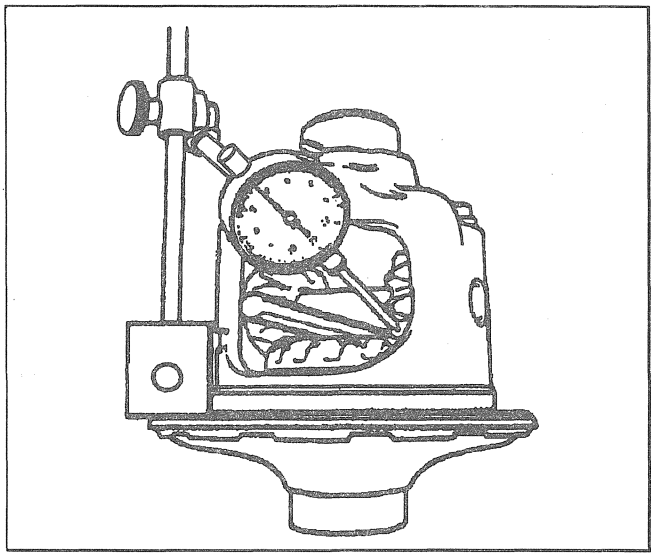


Figure 5—Checking Cam Gear Backlash

Right Side Gear Backlash Adjustment

1. Assemble the clutch plates.
   - Alternate the plates as shown in Figure 1.
2. Assemble the guide clips (19) to the plates.
   - Use grease in the clips to hold them in place on the plates.
3. Install the side gear thrust washer (8), clutch plate assembly (9), and right side gear to the differential.
4. Place the pinion gears (7) and thrust washers (6) into the differential.
   - Align them with the pinion shaft hole.
5. Press down on the side gear, and install the pinion shaft (18) and lock screw (3).
   - If the side gear cannot be pressed down far enough to install the pinion shaft, use a thinner side gear thrust washer.
6. Rotate the pinion gear closest to the lock screw so that one of the teeth is pointing downward (perpendicular to the ring gear flange).
7. Insert a large tapered tool, like a screwdriver, firmly between the side gear and the pinion shaft.
8. Mount a dial indicator to the ring gear flange, and place the stem of the indicator on one of the teeth on the pinion gear closest to the lock screw (Figure 5).
9. Pull the pinion gear firmly into its seat, and rotate the gear back and forth while reading the dial indicator. Record the reading.
10. Repeat Steps 6 through 9 on the opposite pinion gear.
11. The backlash should be between 0.051 and 0.243 mm (0.002 - 0.010 inch).
12. If the backlash is too high, use a thicker side gear thrust washer.
13. If the backlash is too low, use a thinner side gear thrust washer.

Thrust Block Clearance Adjustment

Install or Connect (Figures 1, 6, and 7)

1. Left thrust washer (13) to the differential.
2. Cam unit to the differential.
3. Right side gear thrust washer (8) to the differential.

4. Clutch plates with guide clips to the differential.
   • Assemble alternately as shown in Figure 1.
5. Right side gear (10) to the differential.
6. Pinion shaft (18) and lock screw (3). Insert a large tapered tool, like a screwdriver, firmly between each side gear and the pinion shaft.
7. A 1-2 inch telescoping gage between the side gear faces, not the gear teeth.

Measure

1. Measure the side gear spread (Figure 6).
2. Remove the telescoping gage.
3. Measure the telescoping gage with a micrometer.
4. Measure the original thrust block at the outer corner with a micrometer (Figure 7).

Adjust

- If the thrust block thickness is not 0.000 to 0.1524 mm (0.000 to 0.006 inch) less than the side gear spread, adjust the clearance by:
  A. Selecting a new thrust block the correct size to obtain 0.000 to 0.1524 mm (0.000 to 0.006 inch) clearance.
  B. Reshimming the right and/or left clutch plates. The backlash must be rechecked and adjusted to specification if necessary.

Assembly of the Differential

Install or Connect (Figures 1 and 8)

1. Left side gear thrust washer (13).
2. Cam unit. Refer to "Cam Unit Assembly" in this section.
3. Right side gear thrust washer (8).
4. Right clutch plates with guide clips (19).
   • Assemble alternately as shown in Figure 1.
5. Right side gear (10).
6. Thrust block (17), pinion thrust washer (6), and pinion gear (7).

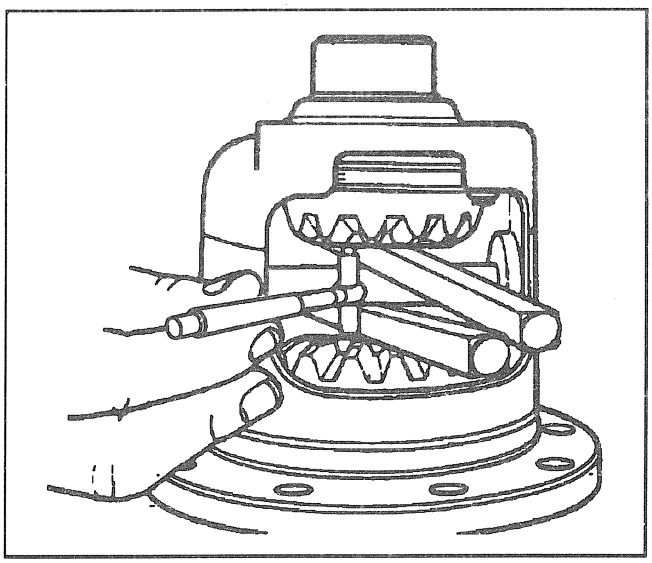


Figure 6—Measuring Side Gear Spread

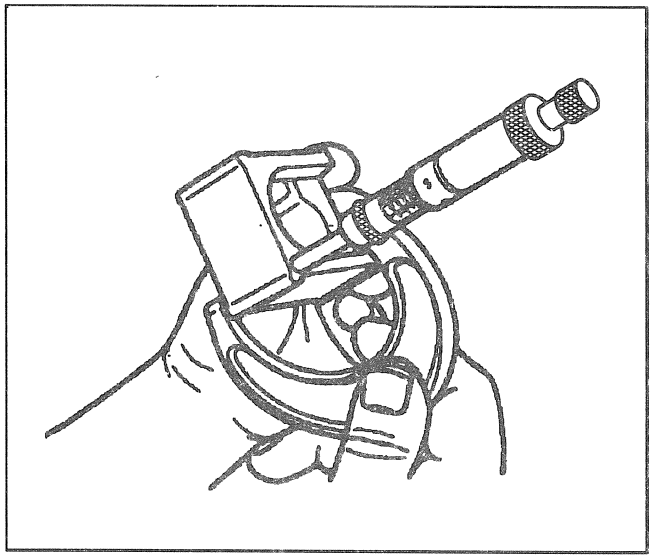


Figure 7—Measuring the Thrust Block

   A. Place the pinion gears into the differential 180 degrees apart.
   B. Rotate the gears and thrust block into position.
   C. The open side of the thrust block must face the small window opening.
7. Pinion shaft (18).
8. A new lockscrew (3). Install finger tight.
   • Tighten to specifications after installed in the vehicle.
9. Governor assembly (11) and latching bracket (5).
   • The straight end of the latching bracket spring must be over and outside the governor assembly shaft (Figure 8).
10. Stop pin (2) (9 1/2 inch only).
    • Press the pin flush with the case.
11. Governor bushing (4).
    • Use the bushing with a straight hole, not a tapered hole.
    • Press the bushing in far enough to give 0.1016 to 0.508 mm (0.004 to 0.020 inch) shaft end play.

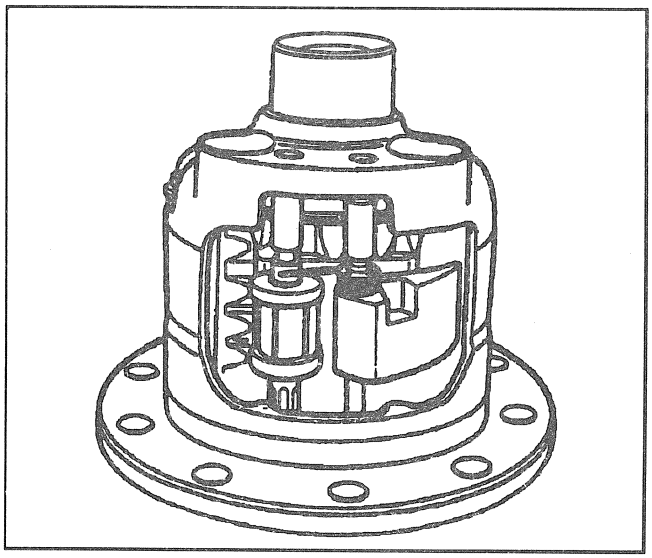


Figure 8—Governor and Latching Bracket

12. Latching bracket bushing (5).
    - Press in far enough to eliminate all end play. Some 9 1/2 inch bushings have a tapered hole. Do not use a straight bushing, use only a tapered bushing.

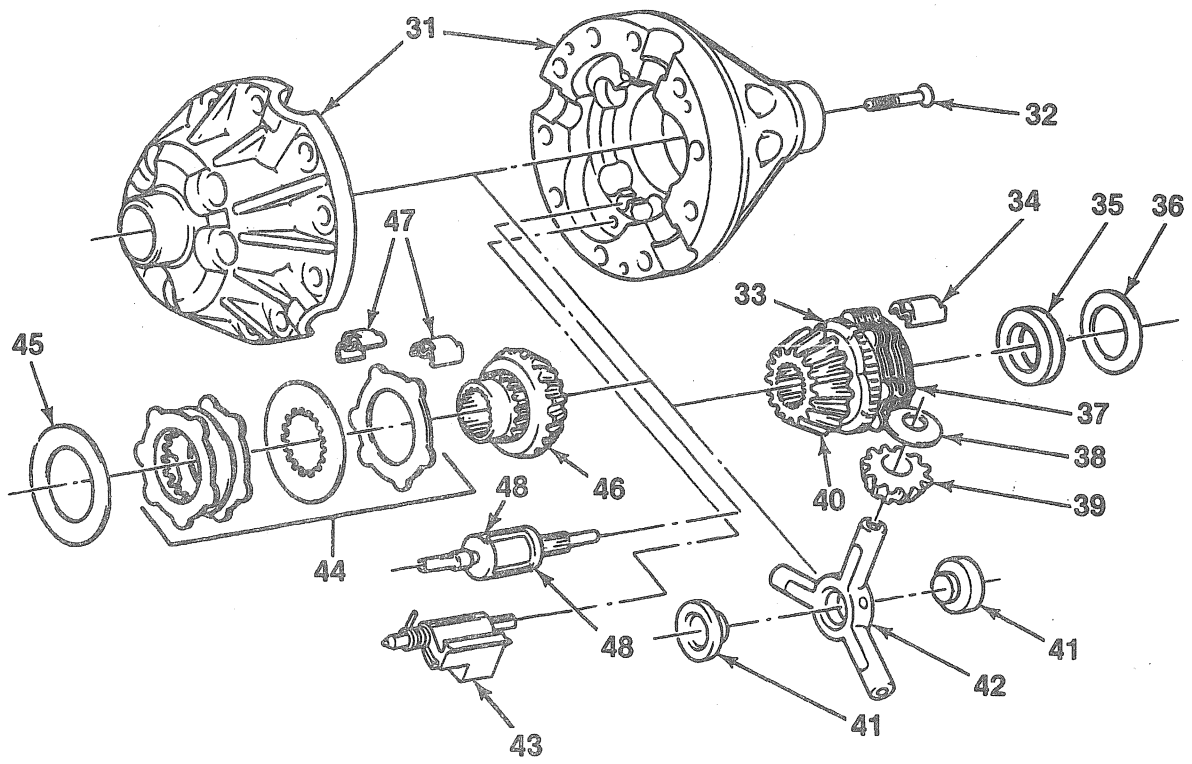
10 1/2 inch RING GEAR

Disassembly of the Differential

Tools Required:
J 22912-01 Bearing Remover

Remove or Disconnect (Figures 9, 10, and 11)

1. The ring gear and differential side bearings. Refer to "Disassembly of the Rear Axle 10 1/2 inch Ring Gear" in this section.
2. Case screws (32).
    - Set the unit on the right side case half.
3. Case halves (Figure 10).
    A. Pry the halves apart at the yoke hole location.
    B. Hold the side gear in the left side case half.
4. Governor assembly (48).
5. Latching bracket assembly (43).
6. Left side gear (46).
7. Left side clutch plates (44) and guide clips (47).
8. Left side gear thrust washer (45).
9. Reaction blocks (41), pinion yoke (42), pinion gears (39), and pinion thrust washers (38).
10. Right cam unit from the differential.
11. Right side gear thrust washer (36).
    - Measure and record the overall length of the gear assembly from the front of the gear to the back of the thrust sleeve (35) including the side gear thrust washer (36).
12. Thrust sleeve (35) using J 22912-01.
    - Press the sleeve from the side gear (Figure 11).
13. Clutch plates (37).
14. Guide clips (34).
15. Wave washer (15).
16. Cam plate (33).
17. Side cam gear (40).



31. Differential Case Halves
32. Screw
33. Cam Plate
34. Guide Clip
35. Thrust Sleeve
36. Side Gear Thrust Washer
37. Plates
38. Pinion Thrust Washer
39. Pinion Gear
40. Side Cam Gear
41. Reaction Block
42. Pinion Yoke
43. Governor and Latching Bracket
44. Plates
45. Side Gear Thrust Washer
46. Side Gear
47. Guide Clip
48. Governor

F5915

Figure 9—Differential Components

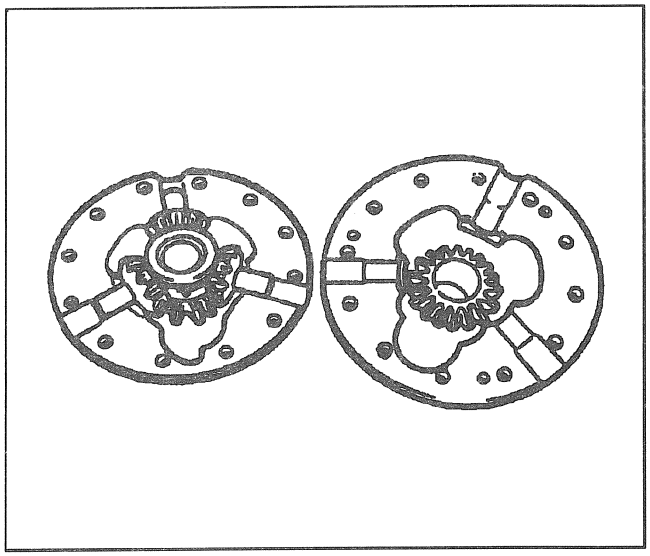


Figure 10—Differential Case Halves

Cleaning and Inspection

Clean

- All parts with an approved solvent.

Inspect

- All parts for excessive wear and breakage.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- Thrust sleeve for excessive wear.
- All parts and replace them if necessary.

Important

- Do not replace the thrust sleeve unless necessary.
- Side gear bore for scoring. If scoring is present, replace the differential.

Important

- If any damage to the differential case is found, the differential must be replaced.

Cam Unit Assembly

Install or Connect (Figures 9 and 12)

1. Cam plate (33) to the side cam gear (40).
2. Wave washer (15).
3. Clutch plates.
   - Alternate the plates and position the wave washer as shown in Figure 12.
4. Thrust sleeve (35).
   - Press the thrust sleeve flush with the side gear disc spline.
5. Guide clips (34) to the plates.
   - Use a chassis grease in the clips to hold them in place on the plates.
   A. If the side gear or thrust sleeve has been replaced, measure and record the overall length of the gear to the back of the thrust sleeve (35) including the side gear thrust washer (36).
   B. Compare this reading with the reading obtained earlier.
   C. If the new reading is more than 0.0762 mm (0.003 inch) higher or lower than the original, select a side gear thrust washer that will return the reading closest to the original reading.

Adjustment of the Differential

- If it is necessary to replace the cam gear, the right hand side gear, or the reaction blocks, the entire differential must be adjusted. The differential is adjusted using selective thickness thrust washers behind each side gear, and selective thickness thrust washers between the reaction blocks.

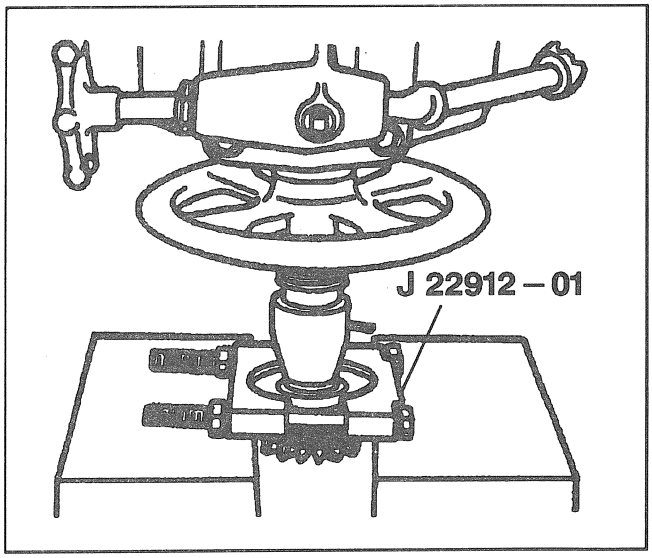


Figure 11—Removing the Thrust Sleeve

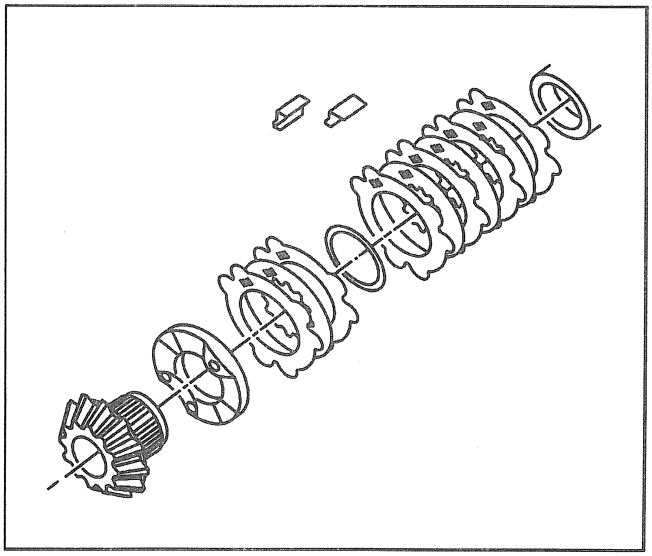


Figure 12—Cam Unit Components

- It is important to build up the differential properly. The proper clearance between parts is critical to the operation of the unit.
- There are three adjustments needed:
  (1) Left side gear backlash.
  (2) Right side gear backlash.
  (3) Thrust block clearance.

Right Side Gear Backlash Adjustment

1. Install the cam unit and side gear thrust washer (36) to the right case half.
2. Clamp the cam unit in place using a set of washers, nut, and a bolt long enough to hold the cam unit in place (Figure 13).
3. Place the pinion gears and pinion thrust washers on the pinion yoke.
4. Install the yoke firmly to the differential case half (Figure 14).
5. Loosen the nut, and index one pinion gear tooth to point downward (perpendicular to the case half face). Tighten the nut.

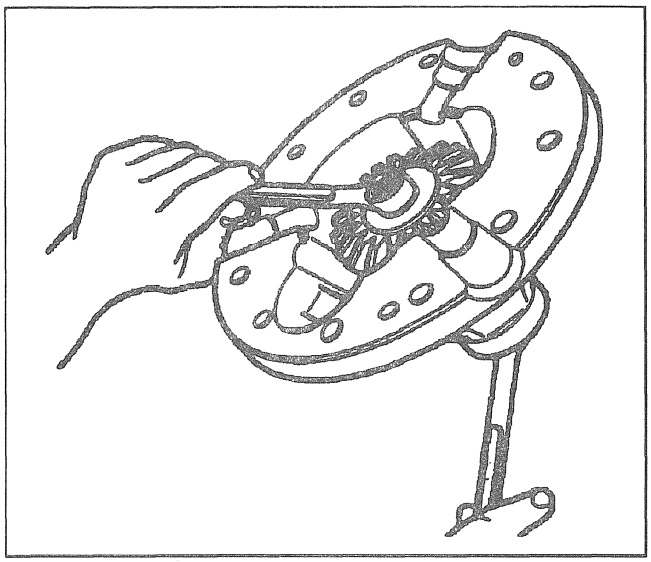


Figure 13—Clamping the Cam Unit in Place

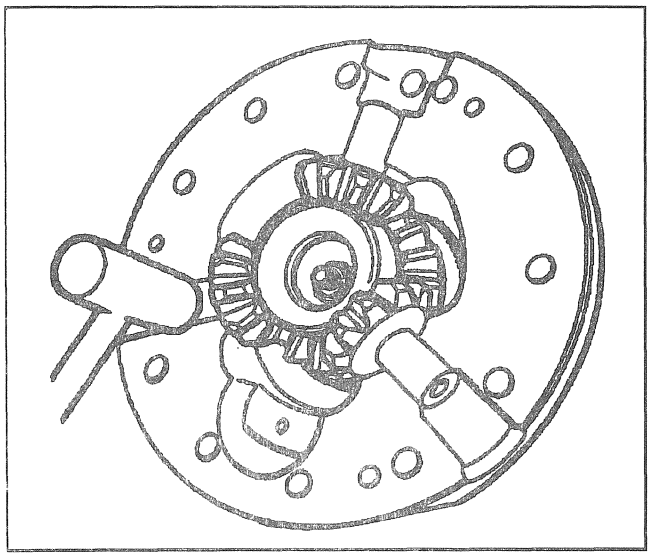


Figure 14—Installing the Pinion Yoke

6. Mount a dial indicator on the case half face using a magnetic base (Figure 15).
7. Place the stem of the dial indicator on the pinion gear tooth.
8. Pull the pinion gear firmly into its seat, and rotate the gear back and forth while reading the dial indicator. Record the reading.
   - Do not unseat the pinion yoke. This will make the backlash reading inaccurate.
9. Repeat Steps 5 through 8 on the remaining 2 pinions.
10. The backlash should be between 0.254 and 0.457 mm (0.010 and 0.018 inch).
11. If the backlash is too high, use a thicker side gear thrust washer.
12. If the backlash is too low, use a thinner side gear thrust washer.

Left Side Gear Backlash Adjustment

1. Assemble the clutch plates.
   - Alternate the plates as shown in Figure 12.
2. Assemble the guide clips (47) to the plates.
   - Use grease in the clips to hold them in place on the plates.
3. Install the side gear thrust washer (45), clutch plate assembly (44), and left side gear to the differential.
4. Clamp the side gear in place using a set of washers, a nut, and a bolt long enough to hold the side gear in place (Figure 13).
5. Place the pinion gears and pinion thrust washers on the pinion yoke.
6. Install the yoke firmly to the differential case half.
7. Loosen the nut and index one pinion gear tooth to point downward (perpendicular to the case half face). Tighten the nut.
8. Mount a dial indicator on the case half face using a magnetic base (Figure 15).
9. Place the stem of the dial indicator on the pinion gear tooth.
10. Pull the pinion gear firmly into its seat, and rotate the gear back and forth while reading the dial indicator. Record the reading.

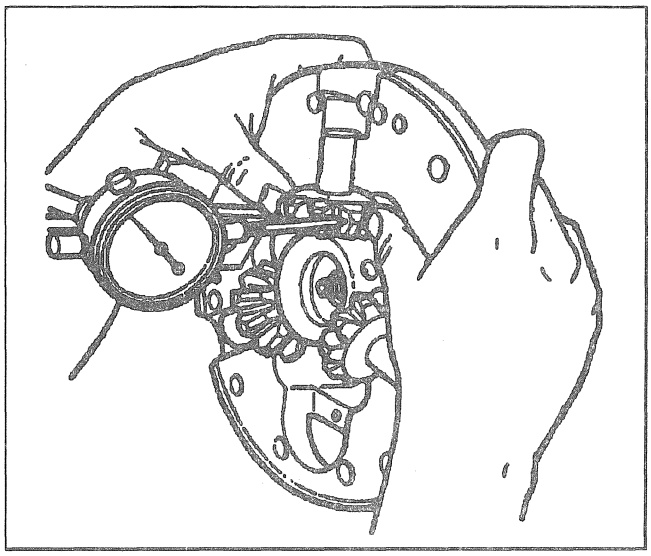


Figure 15—Measuring Backlash

- Do not unseat the pinion yoke. This will make the backlash reading inaccurate.

11. Repeat Steps 7 through 10 on the other 2 pinions.
12. The backlash should be between 0.051 and 0.254 mm (0.002 and 0.010 inch).
13. If the backlash is too high, use a thicker pinion thrust washer.
14. If the backlash is too low, use at thinner pinion thrust washer.

Reaction Block Clearance Adjustment

Install or Connect (Figures 16 and 17)

1. Left side gear thrust washer, clutch plates, and side gear. Bolt them into position. Refer to "Left Side Gear Backlash Adjustment" in this section.
2. Right side gear thrust washer and cam assembly. Bolt them into position. Refer to "Right Side Gear Backlash Adjustment" in this section.

Measure

- The distance from the side gear face to the case half face (Figure 16).
  - A. The thickness of the straight edge must be subtracted from the reading.
  - B. Add the measurement of both sides together. This is the side gear spread.

1. The thickness of the original reaction blocks and reaction block thrust washers together (Figure 17).
2. If the combined reaction block and thrust washer thickness is not 0.000 to 0.1524 mm (0.000 to 0.006 inch) less than the side gear spread, adjust the clearance by:
   - A. Selecting new reaction block thrust washer of the correct thickness to obtain 0.000 to 0.1524 mm (0.000 to 0.006 inch) clearance. B Reshim the left and/or right clutch disc pack. The side gear backlash must be maintained. Refer to "Right Side and/or Left Side Gear Backlash Adjustment" in this section.
     - Some older locking differentials had select fit reaction blocks without the thrust washer between them. These models require replacing the reaction blocks with the correct thickness reaction block.

Assembly of the Differential

Install or Connect (Figures 9 and 12)

1. Right thrust washer.
2. Right cam unit. Refer to "Cam Unit Assembly" in this section.
3. Reaction blocks (41), reaction block thrust washer, pinion yoke (42), pinion gears (39), and pinion thrust washers (38).
4. Left thrust washer (45).
   - Assemble the plates as shown in Figures 9 and 12.

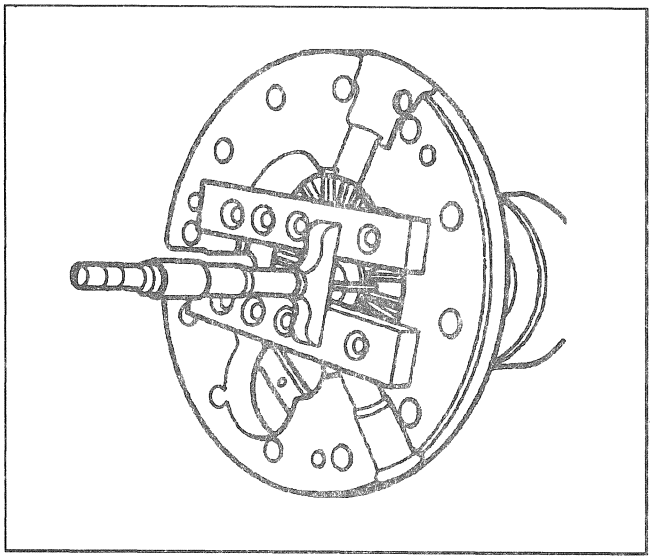


Figure 16—Side Gear Spread

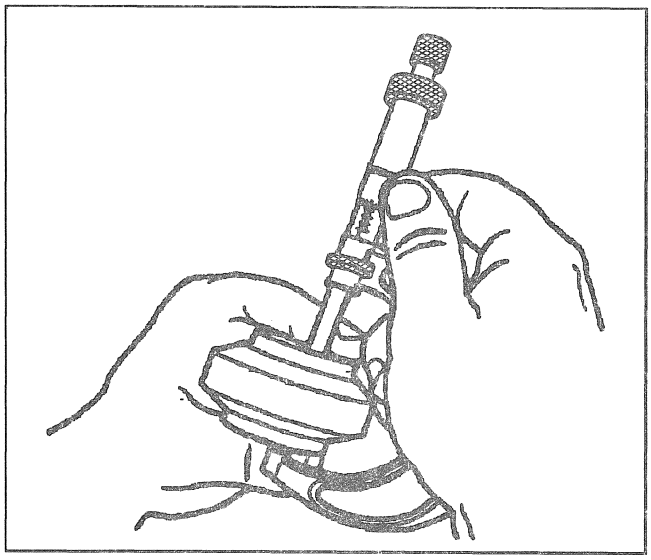


Figure 17—Measuring the Reaction Block

5. Left side gear (46).
6. Latching bracket assembly (43).
7. Governor assembly (48).
   - The straight end of the latching bracket spring must be over and outside the governor assembly shaft.
8. Case halves (31) together.
   - Hold the side gear in the left side case half.
9. Case screws (32).
10. The ring gear and differential side bearings. Refer to "Assembly of the Rear Axle 10 1/2 inch Ring Gear" in this section.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Differential Lockscrew		
7 5/8, 8 1/2 and 8 5/8 inch	36	27
9 1/2 inch	50	37

THRUST BLOCK SIZES

Color Code	7 5/8 Inch	8 1/2 and 8 5/8 Inch	9 1/2 Inch
Purple	1.260 inch	1.322 inch	1.598 inch
White	1.264 inch	1.326 inch	1.602 inch
Brown	1.268 inch	1.330 inch	1.606 inch
Yellow	1.272 inch	1.334 inch	1.610 inch
Orange	1.276 inch	1.338 inch	1.614 inch
Pink	1.280 inch	1.342 inch	1.618 inch
Green	1.284 inch	1.346 inch	1.622 inch
Blue	1.288 inch	1.350 inch	1.626 inch
Black	—	—	1.630 inch

REACTION BLOCK SIZE — 10 1/2 INCH

0.787 inch

RIGHT SIDE GEAR THRUST WASHER

7 5/8, 8 1/2, 8 5/8 and 9 1/2 Inch Axles	10 1/2 Inch Axles
0.010 inch	0.022 inch
0.015 inch	0.027 inch
0.020 inch	0.032 inch
0.025 inch	0.036 inch
0.030 inch	0.040 inch
0.035 inch	0.042 inch
0.040 inch	0.044 inch
0.045 inch	0.048 inch
	0.052 inch

REACTION BLOCK THRUST WASHERS

0.787 inch

0.022	0.030	0.038	0.046
0.023	0.031	0.039	0.047
0.024	0.032	0.040	0.048
0.025	0.033	0.041	0.049
0.026	0.034	0.042	0.050
0.027	0.035	0.043	0.051
0.028	0.036	0.044	0.052
0.029	0.037	0.045	

REACTION BLOCK THRUST WASHERS

7 5/8 Inch	8 1/2 and 8 5/8 Inch	9 1/2 Inch	10 1/2 Inch
0.022 inch	0.022 inch	0.022 inch	0.010 inch
0.027 inch	0.027 inch	0.027 inch	0.015 inch
0.032 inch	0.032 inch	0.032 inch	0.020 inch
0.036 inch	0.036 inch	0.036 inch	0.025 inch
0.040 inch	0.040 inch	0.040 inch	0.030 inch
—	—	0.042 inch	0.035 inch
0.044 inch	0.044 inch	0.044 inch	0.040 inch
0.048 inch	0.048 inch	0.048 inch	0.045 inch
0.052 inch	0.052 inch	0.052 inch	

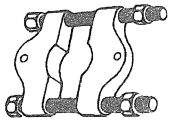
SPECIFICATIONS

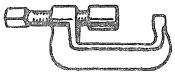
FASTENER TIGHTENING SPECIFICATIONS

LUBRICATION

Lubricant 80W90 GL-5
(Do not use limited slip additive)
T3324

SPECIAL TOOLS

1.  J 22912-01

2.  J 26252

1. Rear Pinion Bearing Cone Remover
2. Locking Differential Governor Remover

F4804

BLANK

SECTION 4C

FRONT DRIVING AXLE

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: ***Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will also call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.***

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GENERAL DESCRIPTION

The front axle on four-wheel drive model vehicles have a central disconnect feature that, under most conditions, allows shifting into and out of four-wheel drive when the vehicle is in motion. It is engaged by an electronically-activated thermal actuator.

The thermal actuator contains a coil, fluid, and a plunger. When the coil is heated, the liquid changes to a gas and extends the plunger, which engages the front axle. To disengage, the gas must cool to a liquid.

The axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the wheels. The differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing when going around corners and premature wear on internal axle parts. The ring and pinion set and the differential are contained within an aluminum carrier. The axle identification number is located on a tag attached to the right axle tube.

The drive axles (halfshafts) are completely flexible assemblies consisting of inner and outer constant velocity (CV) joints protected by thermoplastic boots and connected by an axle shaft (output shaft).

DIAGNOSIS OF FRONT AXLE

FRONT AXLE NOISE DIAGNOSIS

Any gear-driven unit produces a certain amount of noise that is normal and cannot be eliminated by conventional repairs or adjustment. Slight noise that is heard only at a certain speed or under unusual or remote conditions is acceptable. For example, this noise tends to reach a peak at speeds from 60 to 100 km/h (40 to 60 mph) depending upon road and load conditions, or upon gear ratio and tire size, and does not indicate trouble in the axle assembly.

When an axle is suspected of being noisy, make a thorough test to determine whether the noise originates in the tires, road surface, wheel bearings, engine, transmission, propeller shaft, or axle assembly. Raising tire pressure to eliminate tire noise (although this will not silence tread noise of mud and snow tires) and listening for the noise at varying speeds and road surfaces, in drive, float, and coast conditions will help to locate the source of noise.

Determining The Type of Noise

Road Noise - Some road surfaces, such as brick or rough-surfaced concrete, cause noise which may be mistaken for tire or axle noise. Driving on a different type of road, such as smooth asphalt or dirt, will quickly show whether the road surface is the cause of noise. Road noise usually is the same on drive or coast.

Tire Noise - Tire noise may easily be mistaken for axle noise. Tire noise changes with different road surfaces; axle noise does not. Temporarily inflating all tires to 345 kPa (50 psi) pressure, for test purposes only will materially alter noise caused by tires but will not affect noise caused by the axle. Axle noise usually stops when coasting at speeds under 30 miles per hour; however, tire noise continues with lower tone as the vehicle speed is reduced.

Engine and Transmission Noises - To determine which unit is causing the noise, take note of approximate vehicle speeds and conditions under which the noise is most pronounced, then stop the vehicle in a quiet place to stop interfering noises. With the transmission in neutral, run the engine slowly up and down the engine speeds corresponding to the vehicle speed at which the noise was most pronounced. If a similar noise is produced with the vehicle standing still, it is caused by the engine or transmission and not the axle.

Wheel Bearing Noise - A brinelled wheel bearing causes a knock or click approximately every two revolutions of the wheel, since the bearing rollers do not travel at the same speed as the axle and wheel. With the wheels jacked up, spin the wheels by hand while listening at the hubs for evidence of a rough or brinelled wheel bearing or loose bearings.

Gear Noise - There are two basic types of gear noise. The first type is produced by broken, bent, or forcibly damaged gear teeth, which is usually quite audible over the entire speed range, and presents no difficulty in diagnosis. For example, hypoid gear tooth scoring generally results from the following: insufficient lubricant, improper break-in, wrong lubricant, insufficient gear backlash, improper ring and pinion alignment, or loss of drive pinion nut torque. The scoring will progressively lead to complete erosion of the gear tooth or gear tooth pitting and then eventual fracture if the initial scoring is not corrected (Figure 1). Another cause of hypoid gear fracture is extended overloading of the gear set, which will produce fatigue fracture, or shock loading, and can result in sudden failure.

Differential pinion and side gears are most often trouble free. Common causes of differential failure are shock loading, extended overloading, and seizure of the differential pinions to the cross shaft resulting from excessive wheel spin and consequent lubrication breakdown.

The second type of gear noise pertains to the mesh pattern of the gear teeth. This form of abnormal gear noise can be recognized because it produces a cycling pitch (whine) and will be very pronounced in the speed range at which it occurs, appearing under either drive, float, or coast conditions. Gear noise tends to peak in a narrow speed range or ranges and will tend to remain constant in pitch. Bearing noise will vary in pitch with vehicle speeds.

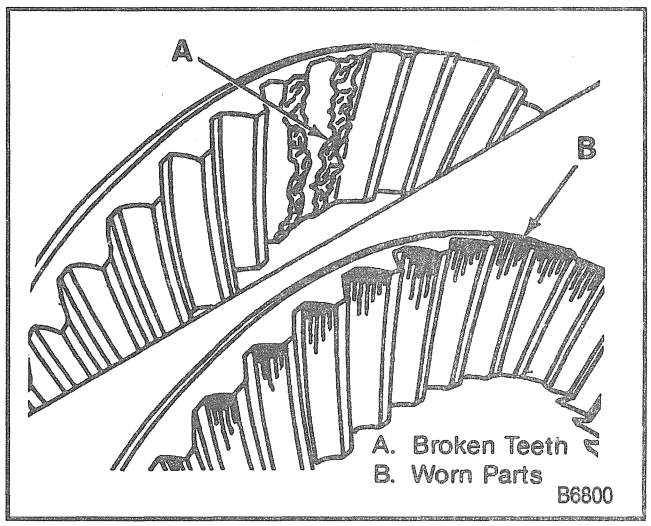


Figure 1—Causes of Gear Noise

DIAGNOSIS OF DRIVE AXLES (HALFSHAFTS)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Clicking Noise in Turns	Worn out or damaged CV joint.	Replace.
"Clunk" when Accelerating from "Coast".	1. Loose CV joint to output shaft bolts. 2. Damaged inner CV joint.	1. Tighten. 2. Replace.
Shudder or Vibration during Acceleration	1. Excessive CV joint angle. 2. Worn or damaged CV joints. 3. Sticking spider assembly (inner CV joint). 4. Sticking joint assembly (outer CV joint).	1. Repair. 2. Replace. 3. Lubricate or replace. 4. Lubricate or replace.
Vibration at Highway Speeds	1. Out of balance or out of round tires. 2. Front end out of alignment.	1. Balance or replace. 2. Align.
Front Drive Axle Leaks	1. Worn differential output seals. 2. Inspect mating area between axle tube and differential housing. 3. Inspect vent hose connector.	1. Repair seals. 2. Reseal differential housing mating area with RTV sealant. 3. Replace vent hose connector.
		D0012

DIAGNOSIS OF FOUR-WHEEL DRIVE

PROBLEM	POSSIBLE CAUSE	CORRECTION
Four-Wheel Drive Will Not Engage	1. Blown fuse. (A/C-HTR fuse). 2. Feed wire to transfer case switch open. 3. Transfer case switch faulty. 4. Wires to front axle actuator open. 5. Front axle actuator faulty. 6. Axle damaged internally.	1. Replace. 2. Repair open wire. 3. Replace transfer case switch. 4. Repair open wiring. 5. Replace axle actuator. 6. Repair as necessary. Refer to SECTION 4D1.
Four-Wheel Drive Will Not Disengage	1. Transfer case switch faulty. 2. Front axle actuator faulty. 3. Internal axle damage.	1. Replace switch. 2. Replace actuator. 3. Repair as necessary. Refer to SECTION 4D1.
Four-Wheel Drive Indicator Light Will Not Turn Off	Front axle switch faulty.	Replace front axle switch.
Four-Wheel Drive Engages But Indicator Light Will Not Come On	1. Bulb burned out. 2. Front axle switch faulty.	1. Replace. 2. Replace the switch.
		D0273

ON-VEHICLE SERVICE

FRONT DIFFERENTIAL CARRIER SHIELD REPLACEMENT

Remove or Disconnect (Figure 2)

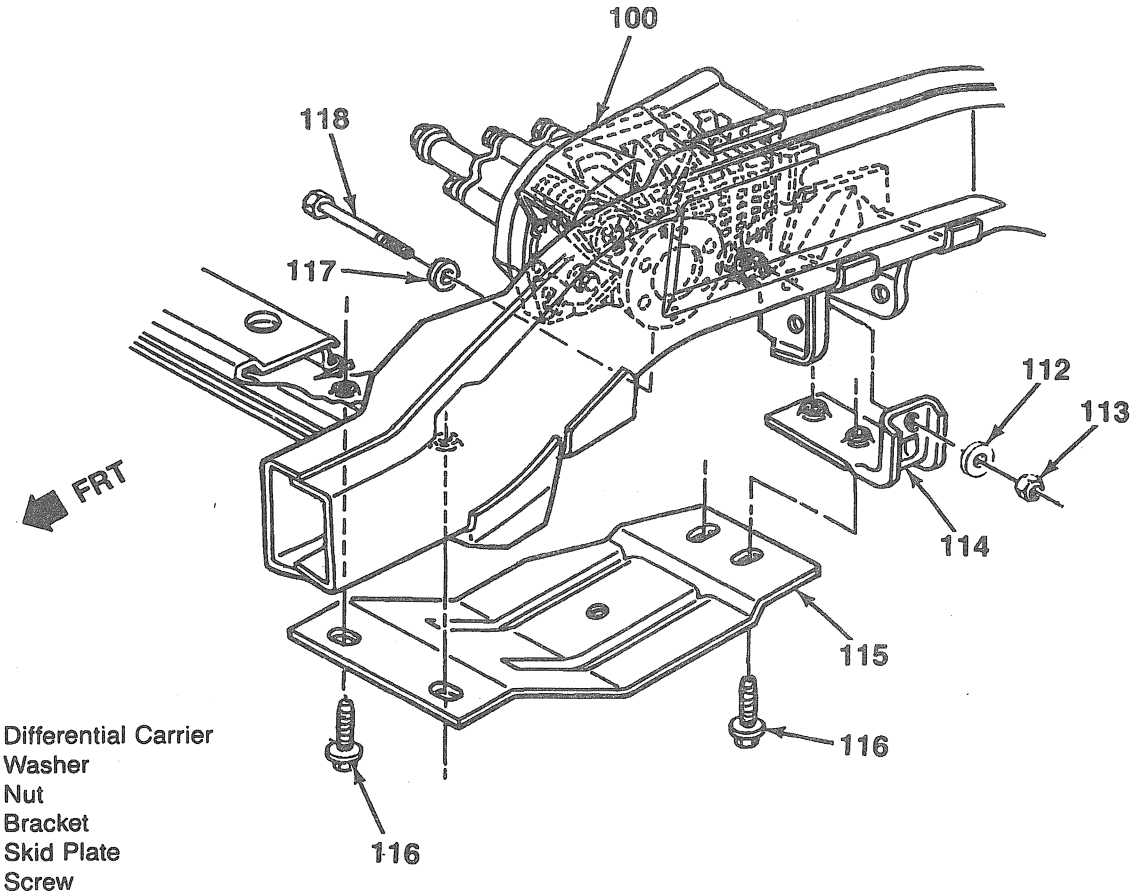
1. Bolts (116).
2. Front differential carrier shield (115).

Install or Connect (Figure 2)

1. Front differential carrier shield (115).
2. Bolts (116).

Tighten

- Bolts to 34 N.m (25 lb. ft.).



100. Differential Carrier
112. Washer
113. Nut
114. Bracket
115. Skid Plate
116. Screw
117. Washer
118. Screw

F3612

Figure 2—Front Differential Carrier Shield

DRAIN AND FILL

Remove or Disconnect (Figure 3)

1. Front differential carrier shield (115), if equipped. Refer to "Front Differential Carrier Shield Replacement" in this section.
2. Fill plug (26).
3. Drain plug (27) and the washer (28).
4. Drain fluid from differential.

Install or Connect (Figure 3)

1. Washer (28) and drain plug (27).

Tighten

- Plug (27) to 33 N·m (24 lb. ft.).

2. Fill differential. Refer to "Specifications" in this section.
3. Fill plug (26).

Tighten

- Plug (26) to 33 N·m (24 lb. ft.).

4. Front differential carrier shield (115), if equipped. Refer to "Front Differential Carrier Shield Replacement" in this section.

INDICATOR SWITCH REPLACEMENT

Remove or Disconnect (Figure 3)

1. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.
2. Electrical connector from the indicator switch located on the upper right side of the differential.

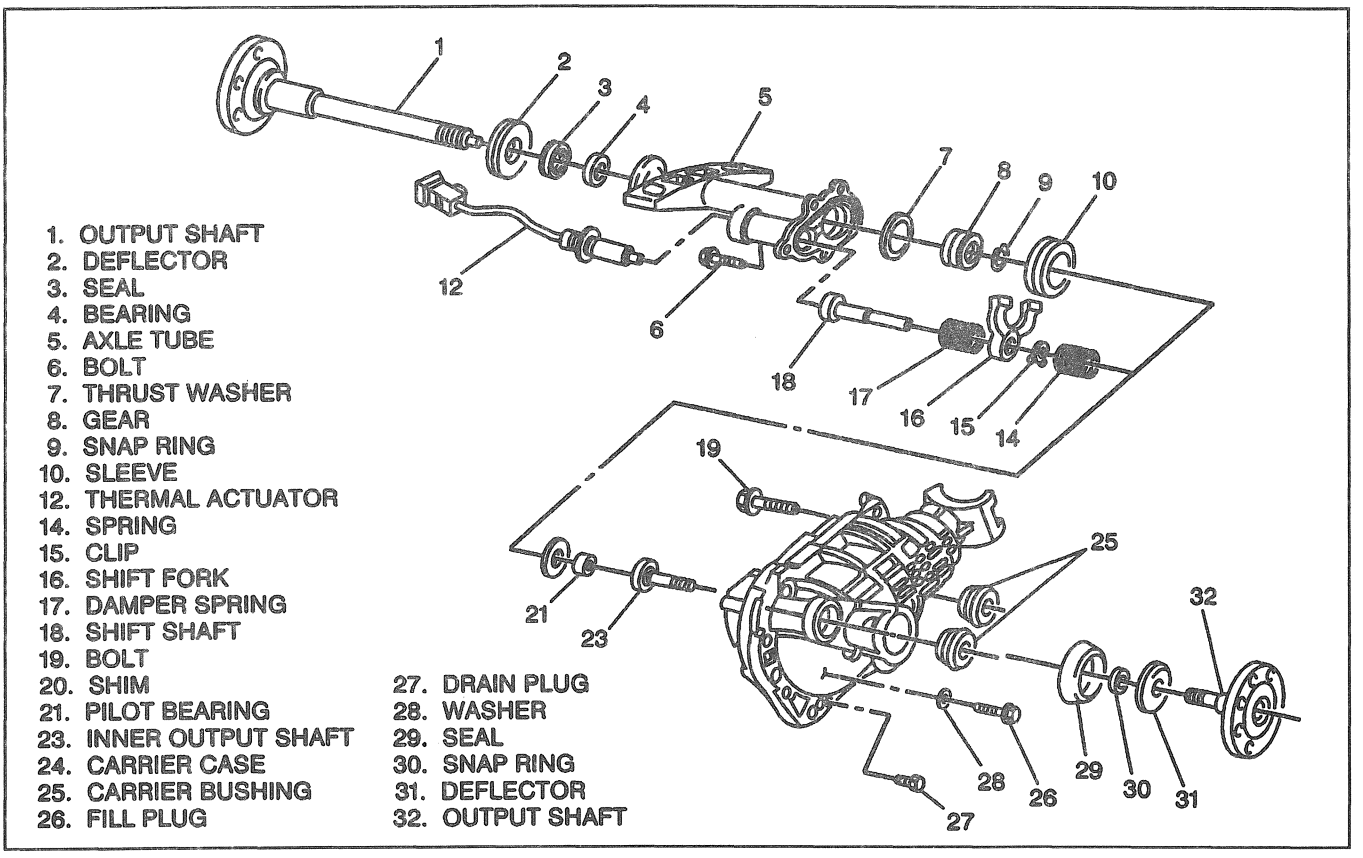


Figure 3—Front Axle Components

3. Indicator switch.

Install or Connect (Figure 3)

- Coat the switch threads with sealer GM P/N 1052942 or equivalent.

1. Indicator switch.
2. Electrical connector.
3. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.

THERMAL ACTUATOR REPLACEMENT

Remove or Disconnect (Figure 3)

1. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.
2. Electrical connector from the actuator.
3. Thermal actuator (12) by unthreading.

Install or Connect (Figure 3)

1. Thermal actuator (12).
   - Coat the threads with sealant GM P/N 1052942 or equivalent.

Tighten

- Actuator to 22 N·m (16 lb. ft.).

2. Electrical connector.
3. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.

FRONT AXLE VENT HOSE REPLACEMENT

Remove or Disconnect (Figure 4)

1. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.
2. Clamp (52).
3. Vent hose (53) from the axle.
   - Note routing to aid in reassembly.
4. Bolt (50).
5. Clip (54).
6. Vent hose (53).

Install or Connect (Figure 4)

1. Hose (53) to the vehicle.
   - Route the same way as when removed.
   - Make sure it is free of kinks and is routed clear of sharp components.
   - Make sure the vent is not plugged.
2. Clip (54).
3. Bolt (50) and clamp (51).
4. Vent hose to the axle fitting.
5. Clamp (52).

6. Front differential carrier shield (if equipped). Refer to "Front Differential Carrier Shield Replacement" in this section.

DRIVE AXLE (HALFSHAFT) REPLACEMENT

Tools Required:
J 28733-B Axle Remover
J 24319-B Steering Linkage Puller
J 36605 Front Knuckle Seal Installer

Remove or Disconnect (Figures 5 through 12)

- Raise vehicle and support it with safety stands.

1. Wheel and tire assembly.
   - Insert a drift or large screwdriver through the brake caliper into one of the brake rotor vanes to prevent drive axle (halfshaft) from turning (Figure 6).
2. Drive axle (halfshaft) hub nut (203) and washer (202) (Figure 5).
   - Loosen, but do not remove the 6 bolts (200) securing inboard C/V joint drive flange to the output shaft companion flange (Figure 5).
3. Wrap shop towels around both the inner and outer C/V joint boots to avoid damage to the boots during removal and installation.
4. Brake pipe support bracket from upper control arm to allow extra travel of knuckle (Figure 7).
5. Cotter pin and nut from outer tie rod.
6. Separate the outer tie rod ball stud from the steering knuckle using J 24319-B (Figure 8).

NOTICE: ***Do not disengage the joint by driving a wedge-type tool between the joint and the knuckle. This may cause seal damage.***

   - Push linkage to opposite side of the vehicle and secure outer tie rod up and out of the way. This will provide the needed clearance to remove the drive axle (halfshaft).
7. Lower shock mounting nut and bolt (Figure 9).
   - Collapse the shock absorber and secure if necessary.
8. Stabilizer shaft components as follows (Figure 12):
   - Remove stabilizer shaft bushing and bracket.
   - Remove stabilizer shaft bolt, spacer, and nut assembly at the lower control arm.

NOTICE: ***This is required on "K" vehicles with 8050 lb. and below GVW rating to provide needed clearance for drive axle (halfshaft) removal.***

9. Position floor jack or stand behind the steering knuckle.

CAUTION: The floor jack or stand must remain under the control arm while servicing the drive axle (halfshaft) to maintain torsion bar and control arm position. Failure to do so could result in personal injury.

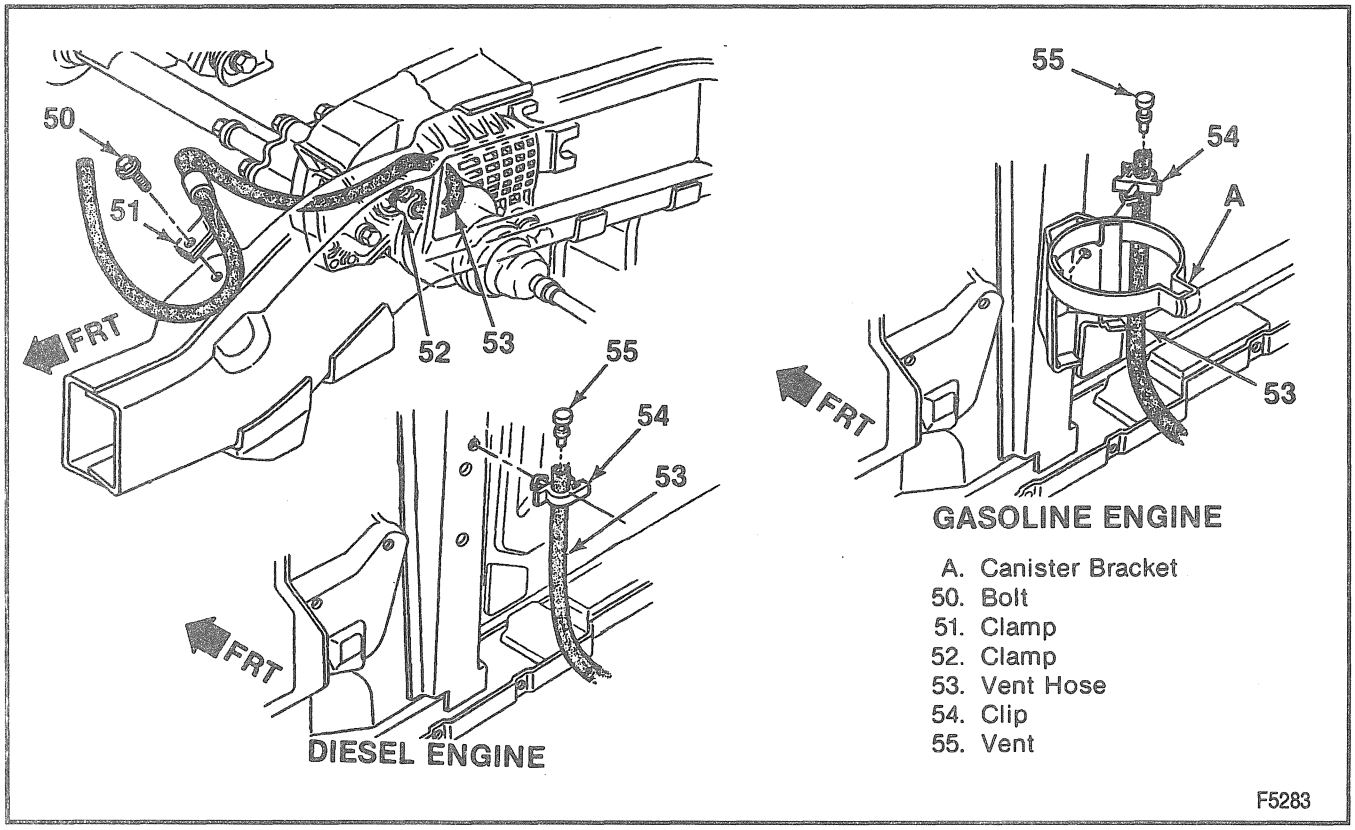


Figure 4—Vent Hose

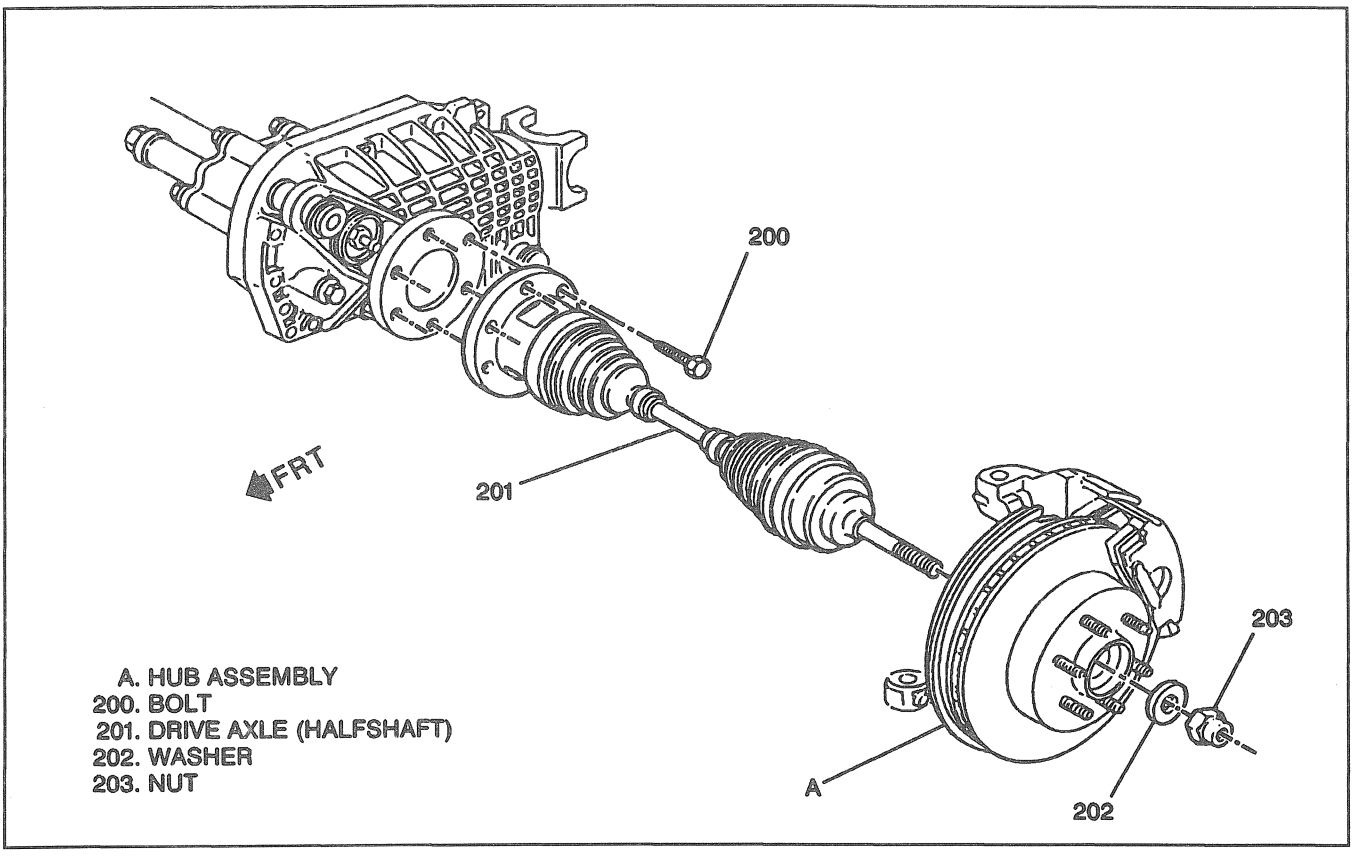


Figure 5—Drive Axle (Halfshaft)

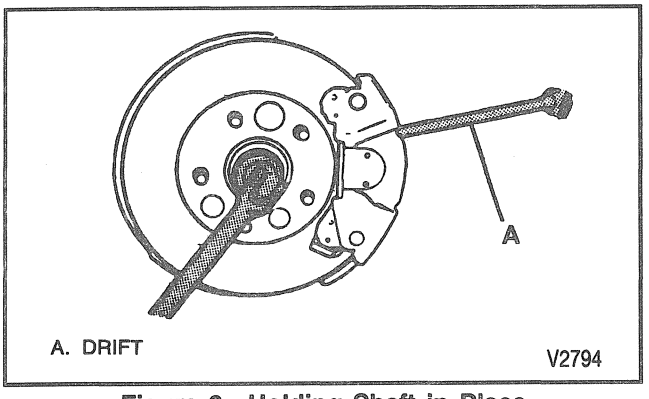


Figure 6—Holding Shaft in Place

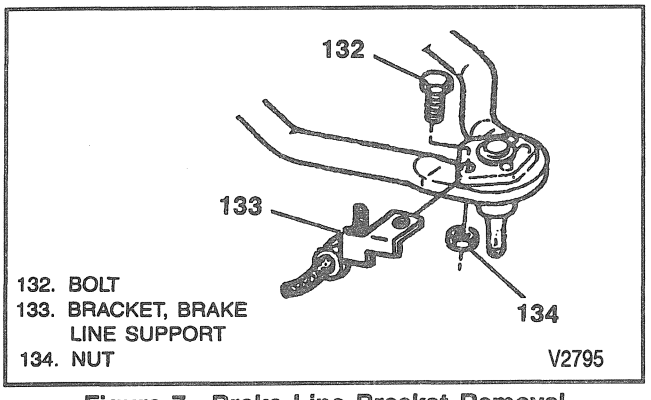


Figure 7—Brake Line Bracket Removal

10. Cotter pin (138) from the upper control arm ball joint stud.
    - Loosen (do not remove at this time) the stud nut on the upper ball joint stud.
    - Loosen the stud from the knuckle.
11. Nut (139) (Figure 10).
12. Stud (137) from knuckle (Figure 10).

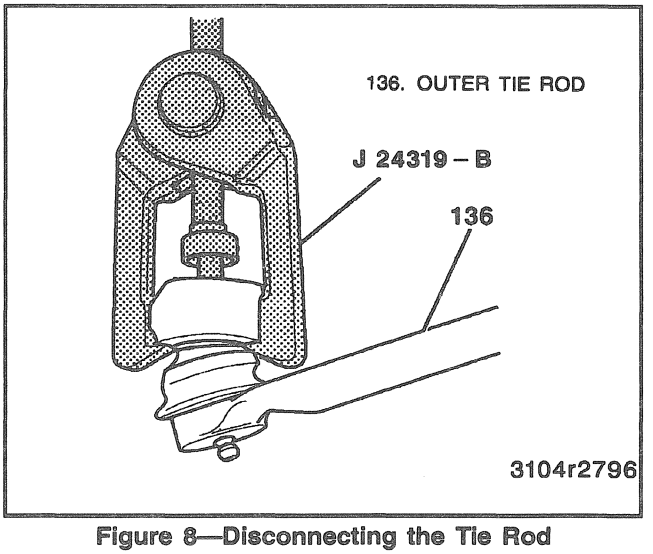


Figure 8—Disconnecting the Tie Rod

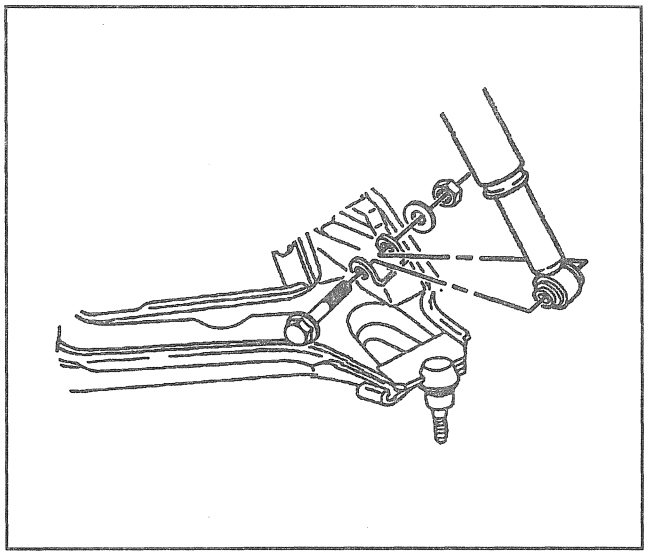


Figure 9—Disconnecting Lower Shock Mount

Important

- Cover the shock mounting bracket and the ball stud on the lower control arm with a shop towel to prevent possible drive axle (halfshaft) boot damage during removal and installation.

13. Knuckle assembly using J 28733-B or equivalent and separate outer C/V joint splined shank from knuckle hub (Figure 11).
14. Six bolts (200) from inboard joint flange (Figure 5).
    - Support inboard end of drive axle (halfshaft). Move knuckle and hub assembly outward to free splined shank from hub.
15. Drive axle (halfshaft) from vehicle.
    - For unit repair of the drive axle (halfshaft), refer to SECTION 4D1.

Important

- Wipe the wheel bearing seal area on the knuckle clean.

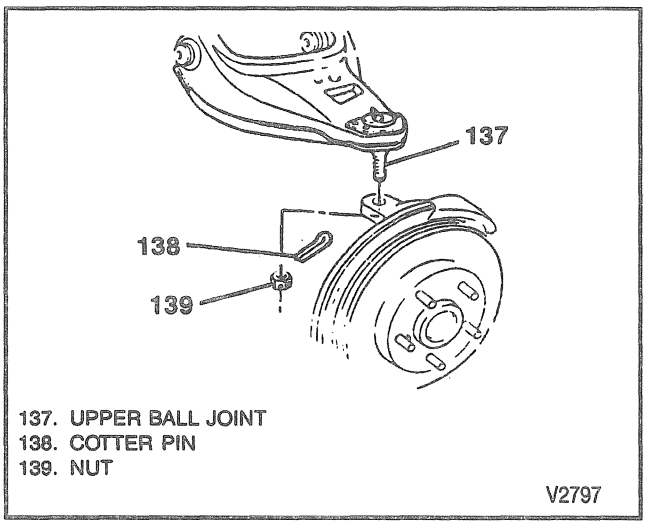


Figure 10—Ball Joint and Knuckle Separation

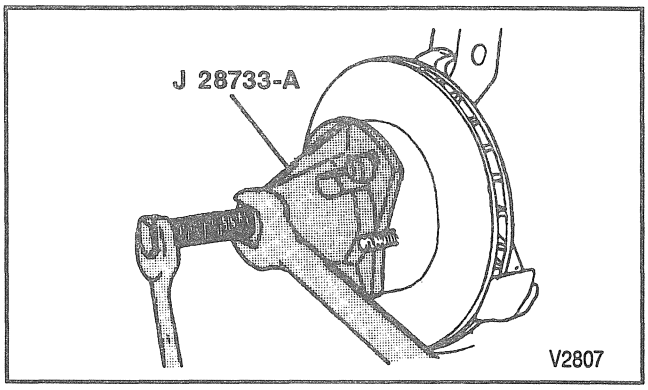


Figure 11—Splined Shank and Knuckle Separation

Inspect

- Check the seal for cuts or tears.

16. Lubricate the seal lip.
    - If seal is cut or torn, inspect the wheel bearing for damage and replace the seal.
17. Replace the seal as follows:
    - Pry old seal from knuckle and discard.
    - Lubricate the new seal lip.
    - Use J 36605 to install the seal in the knuckle.

Install or Connect (Figures 5 through 12)

- Prior to drive axle (halfshaft) installation, cover the shock mounting bracket, lower control arm ball stud, and all other sharp edges with shop towels so that drive axle (halfshaft) boot is not damaged during assembly.

Important

- Do not lubricate the drive axle (halfshaft) splines and knuckle with grease.

1. Insert outer C/V joint splined shank into knuckle hub and secure inboard C/V joint flange to companion flange with bolts. Do not tighten.
2. Upper ball joint to the steering knuckle.
3. Stud nut.

Tighten

- Stud nut to 100 N·m (75 lb. ft.).

4. Cotter pin.
    - Lubricate the upper ball joint until grease appears at the seal.
5. Stabilizer shaft bushing (65) and bracket (64) and bolts (63) (Figure 12).

Tighten

- Bolts (63) to 33 N·m (24 lb. ft.).

6. Stabilizer shaft link bolt assembly (62), spacer (56), and nut assembly (50).

Tighten

- Obtain torque by running nut assembly to the unthreaded portion of the bolt, then tighten to 18 N·m (13 lb. ft.).
- Remove floor jack or stand from beneath lower control arm.

7. Shock absorber to the lower shock mounting bracket.
8. Shock mounting bolt washer and nut (Figure 9).

Tighten

- Nut to 73 N·m (54 lb. ft.).

9. Outer tie rod to steering knuckle.
10. Outer tie rod nut.

Tighten

- Nut to 47 N·m (35 lb. ft.).

Important

- Advance the nut to align the nut slot with the cotter pin hole. Never back the nut off to align the cotter pin hole.

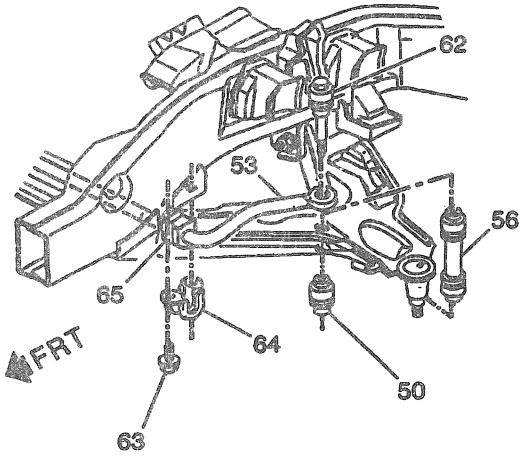
11. Install new cotter pin and spread the ends to secure.
12. Brake pipe support bracket to the upper control arm.

Tighten

- Nut to 17 N·m (13 lb. ft.).

Important

- Make sure that the brake hose is not twisted or kinked, or damage to the hose could result.



50. NUT/BUSHING ASSEMBLY
53. STABILIZER SHAFT
56. SPACER ASSEMBLY
62. LINK BOLT ASSEMBLY
63. BOLTS
64. BRACKETS
65. RUBBER BUSHING

Figure 12—Stabilizer Bar Components

13. Hub nut washer (202) and nut (203). Seat shank splines in hub.
14. Insert a drift through brake caliper to prevent drive axle (halfshaft) from turning.

Tighten

- Inboard flange bolts to 78 N·m (58 lb. ft.).

15. Hub nut.

Tighten

- Hub nut to 225 N·m (165 lb. ft.).

16. Remove drift and install wheels.
17. Remove safety stands, and lower the vehicle.

AXLE SHAFT (OUTPUT SHAFT), BEARING, SEAL AND TUBE ASSEMBLY REPLACEMENT (RIGHT SIDE)

Remove or Disconnect (Figures 3, 5, 12, and 13)

- Raise the vehicle and support it using safety stands.

1. Drive axle (halfshaft). Refer to "Drive Axle (Halfshaft) Replacement" in this section.
2. Drain front axle. Refer to "Drain and Fill" in this section.
3. Electrical connectors (131) (Figure 13).
4. Axle shaft (output shaft) nuts (130) and washers (126) (Figure 13).
5. Axle shaft (output shaft) bolts (6) from carrier (24) (Figure 3).
6. Axle shaft (output shaft) tube from carrier.
   - Take care to keep the open end of the tube up.

Disassemble (Figure 3)

Tools Required:
J 29369-1 Bearing Remover (K2 models)
J 29369-2 Bearing Remover (K3 models)

- Hold the axle shaft (output shaft) tube in a vise by the mounting flange.

1. Sleeve (10).
2. Gear (8).
3. Thrust washer (7).
4. Axle shaft (output shaft) (1). Tap out with a soft mallet.
5. Deflector (2). Pry out with a screwdriver.
6. Seal (3). Pry out with a screwdriver.
7. Bearing (4). Use J 29369-1 (K2 models) or J 29369-2 (K3 models) and a slide hammer.

Clean

- Parts in a suitable solvent.
- Gasket surfaces on the axle shaft (output shaft) tube and carrier housing.

Assemble (Figures 3 and 13)

Tools Required:
J 36609 Bearing Installer
J 36600 Seal Installer (K2 Models)
J 22833 Seal Installer (K3 Models)

1. New bearing (4). Use J 36609. Apply axle lubricant to the bearing.
2. New seal (3). Use J 36600 (K2 models) or J 22833 (K3 models). Coat the seal lips with grease.
3. Deflector (2).
4. Axle shaft (output shaft) (1).
5. Thrust washer (7). Use grease to hold it in place. Make sure the tabs on the washer align with the slot in the axle shaft (output shaft) tube.
6. Gear (8).
7. Sleeve (10).

Install or Connect (Figures 3, 5, 12, and 13)

- Apply sealant GM P/N 12345739 or equivalent to the carrier sealing surface.

1. Axle shaft (output shaft) tube (5) to carrier (24) (Figure 3).
2. Bolts (6).

Tighten

- Bolts to 40 N·m (30 lb. ft.).

3. Axle shaft (output shaft) tube washers (126) and nuts (130) to frame (Figure 13).
   - Nuts (130) to specifications:

Tighten

- K2 models to 100 N·m (75 lb. ft.).
- K3 models to 145 N·m (106 lb. ft.).

4. Drive axle (halfshaft). Refer to "Drive Axle Replacement (Halfshaft)" in this section.
5. Electrical connectors (131) (Figure 13).
6. Fill front axle. Refer to "Drain and Fill" in this section.

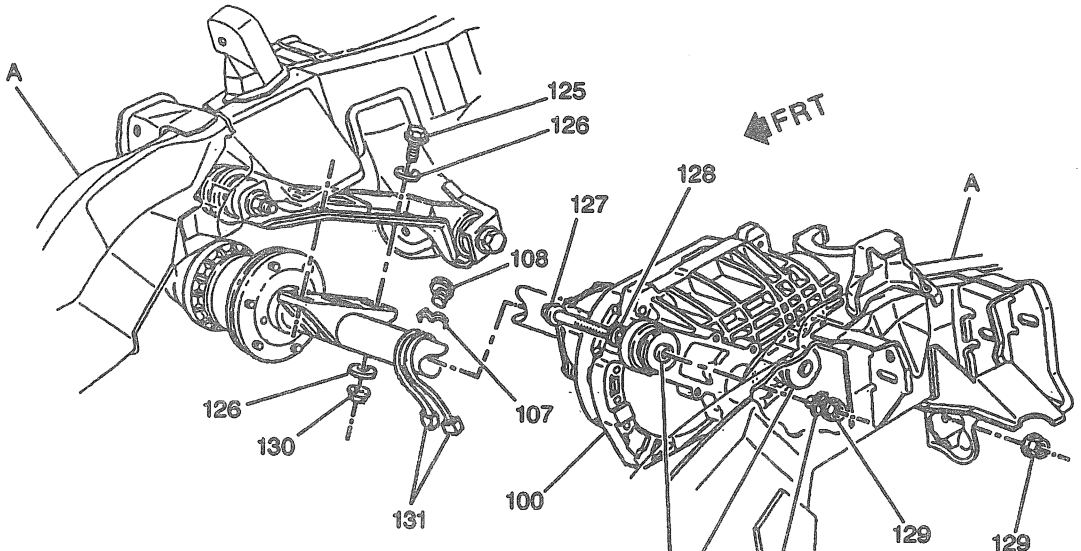
AXLE SHAFT (OUTPUT SHAFT) AND SEAL REPLACEMENT (LEFT SIDE)

Tools Required:
J 36600 Seal Installer (K2 models)
J 22833 Seal Installer (K3 models)

Remove or Disconnect (Figure 3)

- Raise the vehicle. Support with jack stands.

1. Drain front axle. Refer to "Drain and Fill" in this section.
2. Drive axle (halfshaft). Refer to "Drive Axle Replacement (Halfshaft)" in this section.
3. Axle shaft (output shaft) (32). Attach a slide hammer with adapter to the axle shaft (output shaft) and pull it from the carrier case. Take care not to damage the case.



100. DIFFERENTIAL CARRIER
101. BUSHING
107. CLAMP
108. BOLT
125. BOLT
126. WASHER
127. BOLT
128. WASHER
129. NUT
130. NUT
131. CONNECTORS
A. FRAME

Figure 13—Differential Carrier Mounting

4. Deflector (31).
5. Seal (29). Pry out with a screwdriver.
6. Bearing using slide hammer J 23907.

Install or Connect (Figure 3)

- It may be necessary to attach a 1/2 inch by 13 inch long extension handle onto the slide hammer for easier pulling of the bearing.

1. Bearing (square shoulder in) using J 22761
2. New seal (29). Using J 36600 (K2 models) or J 22833 (K3 models) to install. Lubricate the seal lips with grease prior to installation.
3. Deflector (31).
4. Axle shaft (output shaft) (32). Carefully tap the axle shaft (output shaft) into place with a soft mallet.
5. Drive axle (halfshaft). Refer to "Drive Axle Replacement (Halfshaft)" in this section.
6. Fill front axle. Refer to "Drain and Fill" in this section.

SHIFT FORK REPLACEMENT

Remove or Disconnect (Figure 3)

1. Axle shaft (output shaft) and tube assembly. Refer to "Axle Shaft (Output Shaft) and Tube Assembly Replacement" in this section.
2. Shift shaft (18), damper spring (17), fork (16), and clip (15) assembly.
3. Spring (14) from the carrier case, taking care not to dislodge the shim (20) from the axle shaft (output shaft).

Install or Connect (Figure 3)

1. Spring (14) into the carrier case.
2. Shift shaft (18), damper spring (17), fork (16), and clip (15) assembly into axle tube.
   - Make sure the clip is fully seated into the groove on the shift lever.
3. Axle shaft (output shaft) and tube assembly. Refer to "Axle Shaft (Output Shaft) and Tube Assembly Replacement" in this section.

DIFFERENTIAL PILOT BEARING REPLACEMENT

Tools Required:
J 34011 Pilot Bearing Remover
J 33842 Pilot Bearing Installer

Remove or Disconnect (Figure 3)

1. Axle shaft (output shaft) and tube assembly. Refer to "Axle Shaft (Output Shaft) and Tube Assembly Replacement" in this section.
2. Shim (20).
3. Differential pilot bearing (21). Use J 34011.

Install or Connect (Figure 3)

1. Shim (20).
2. Differential pilot bearing (21). Use J 33842.
   - Lubricate the bearing with axle lubricant.
3. Axle shaft (output shaft) and tube assembly. Refer to "Axle Shaft (Output Shaft) and Tube Assembly Replacement" in this section.

PINION FLANGE, DUST DEFLECTOR, OIL SEAL REPLACEMENT

Tools Required:
J 8614-01 Companion Flange Holder and Remover
J 36366 Seal Installer

Remove or Disconnect (Figures 14 through 17)

- Raise the vehicle on a hoist.

1. Propeller shaft from the axle. Refer to SECTION 4A.
   - Tie the propeller shaft to a frame rail or cross-member.

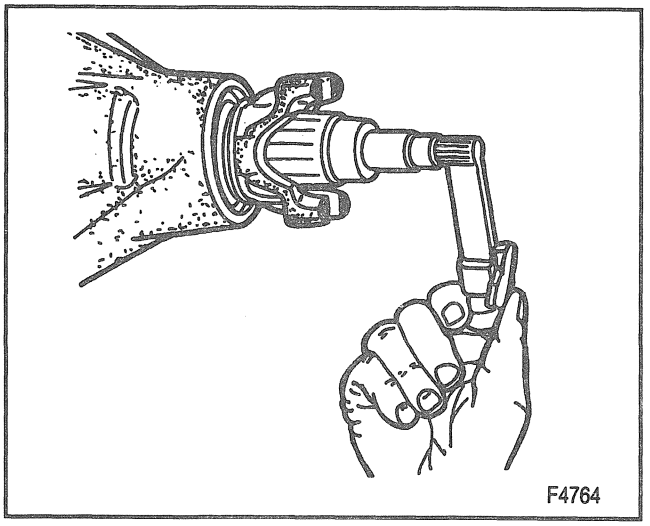


Figure 14—Measuring the Pinion Rotating Torque

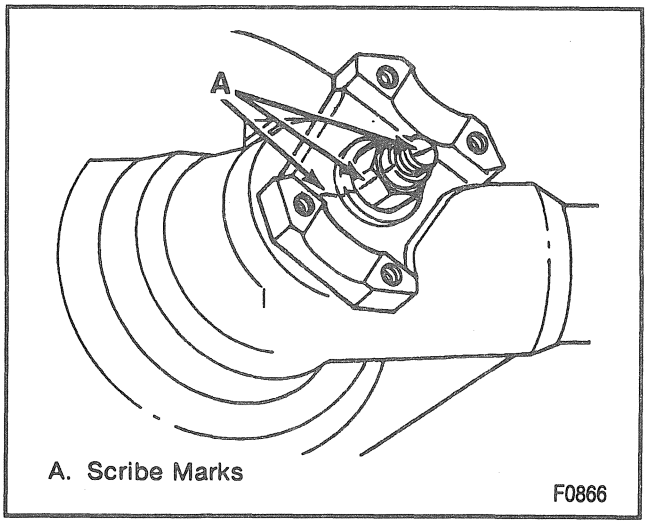


Figure 15—Scribed Marks

Measure

- The torque required to rotate the pinion. Record the torque value for reassembly (Figure 14).

Important

- Scribe a line on the pinion stem, pinion nut and the companion flange and record the number of exposed threads on the pinion stem (Figure 15).

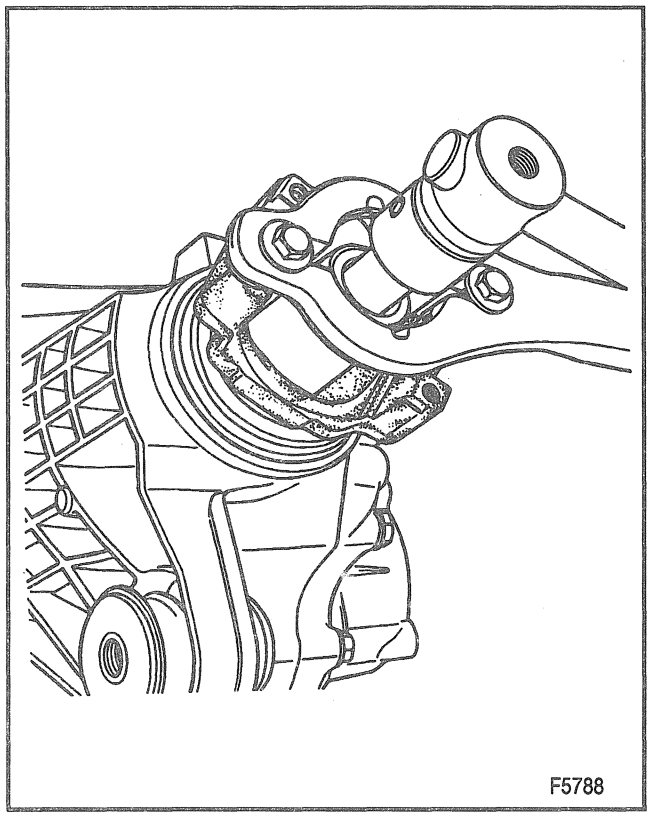


Figure 16—Removing/Installing the Pinion Nut

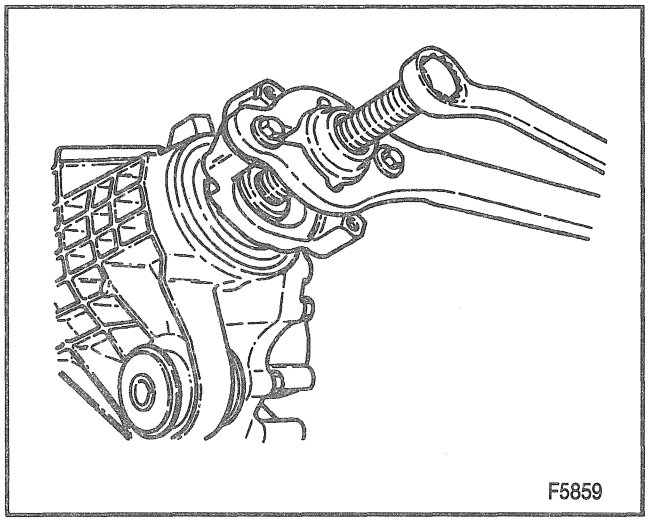


Figure 17—Removing/Installing the Pinion Flange

2. Nut using J 8614-01 (Figure 16).
   - Position J 8614-01 on the flange so that the four notches on the tool face the flange.
3. Flange using J 8614-01 (Figure 17).
   - Use the special nut and forcing screw to remove the flange.
4. Oil seal.
   - Carefully pry the seal from the bore. Do not distort or scratch the aluminum case.

Inspect

- The pinion flange for a smooth oil seal surface.
- The pinion flange for worn drive splines.
- Replace if necessary.

5. Dust deflector.
   - Tap the deflector from the flange.
   - Clean up the stake points on the flange.

Install or Connect (Figures 17 and 18)

1. Dust deflector on the flange.
   - Stake the new deflector at three new equally spaced positions. Staking must be such that the seal operating surface is not damaged.
2. Oil seal using J 36366 (Figure 18).
   - Position the oil seal in the bore, then place J 36366 over the oil seal. Strike J 36366 with a hammer until the seal flange is seated on the axle housing surface. Drive the seal in straight, not at an angle, as this will damage the aluminum housing.

NOTICE: ***Do not hammer the pinion flange onto the pinion shaft or the pinion flange may be damaged.***

3. Flange onto the pinion using J 8614-01 (Figure 17).
   - Place the washer and a new nut on the pinion threads and tighten the nut to the original scribed position using the scribe marks and exposed threads as a reference.

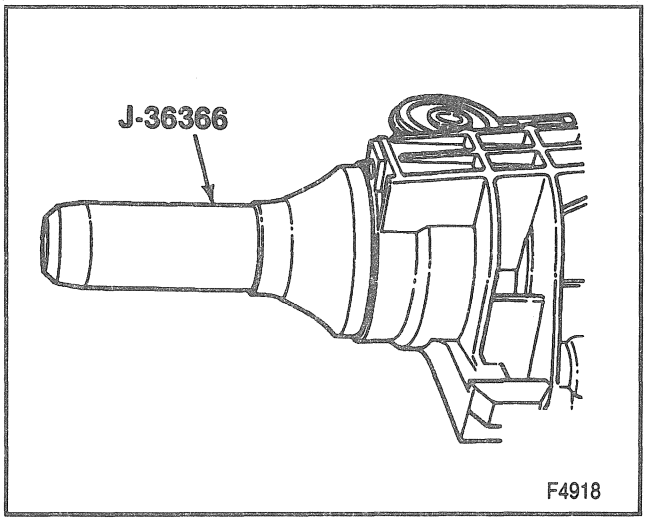


Figure 18—Installing the Pinion Seal

Measure

- The rotating torque of the pinion and compare this with the rotating torque recorded earlier.

Tighten

- The pinion nut by small increments until the torque required to rotate the pinion is 0.35 N·m (3 lb. in.) greater than the original torque.

4. Propeller shaft. Refer to SECTION 4A.
5. Lower the vehicle.

CARRIER REPLACEMENT

Remove or Disconnect (Figure 14)

- Raise the vehicle. Support with jack stands.

1. Drain front axle. Refer to "Drain and Fill" in this section.
2. Front propeller shaft at the carrier yoke. Refer to SECTION 4A. Wire the propeller shaft out of the way.
3. Left and right drive axle (halfshaft). Refer to "Drive Axle Replacement" in this section.
4. Screws (125), nuts (130) and washers (126).
5. Wiring at the axle.
6. Vent hose at the axle.
7. Carrier lower mounting bolt.
8. Right side inner tie rod end from the relay rod. Refer to SECTION 3B3.
9. Engine oil filter (some models).
10. Attach a transmission jack to the carrier.
11. Upper carrier mounting bolt.
12. Carrier from the vehicle. Refer to SECTION 4C2.

Install or Connect (Figure 14)

1. Carrier to the vehicle.
2. Carrier mounting bolts (127), nuts (129), and washers (128).

Tighten

- Bolts (127) to 110 N·m (80 lb. ft.).

3. Remove the transmission jack.
4. New engine oil filter (if removed).
5. Tie rod. Refer to SECTION 3B3.
6. Axle tube bolts (125), nuts (130), and washers (126).

- Nuts (130) to specifications:

Tighten

- K2 models: 100 N·m (75 lb. ft.).
- K3 models: 145 N·m (106 lb. ft.).

7. Vent hose.
8. Wiring.
9. Left and right drive axle (halfshaft). Refer to "Drive Axle (Halfshaft) Replacement" in this section.
10. Front propeller shaft to the carrier yoke.

Tighten

- Universal joint clamp bolts to 20 N·m (15 lb. ft.).

11. Fill front axle. Refer to "Drain and Fill" in this section.
12. Add engine oil as necessary. Refer to SECTION 0B.

CARRIER CASE BUSHING REPLACEMENT

Tool Required:
J 36616 Bushing Remover and Installer

Remove or Disconnect (Figures 3, 24, and 30)

1. Carrier. Refer to "Carrier Replacement" in this section.
2. Carrier bushing using J 36616 (Figure 30).

Install or Connect (Figures 3, 14, and 19)

1. Carrier bushing using J 36616 (Figure 19).
2. Carrier. Refer to "Carrier Replacement" in this section.

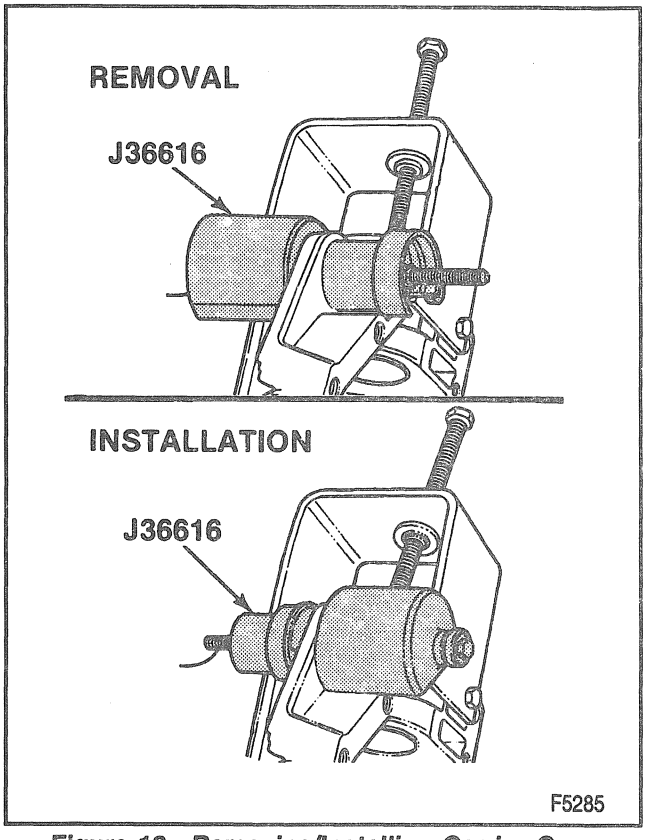


Figure 19—Removing/Installing Carrier Case Bushings

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.
Axle Shaft Tube to Carrier Bolts	40	30
Brake Pipe Support Bracket Nut	18	13
Carrier Frame Screws	22	16
Carrier Mounting Bolts and Nuts	110	80
Drive Axle (Halfshaft) Nut at Front Hub	225	165
Drive Axle (Halfshaft) Bolts	78	58
Engagement Switch	20	15
Front Differential Carrier Shield Bolts	34	25
Lower Shock Absorber Mounting Nut	73	54
Outer Tie Rod Nut	47	35
Plug, Drain and Fill	33	24
Right Side Axle Tube to Frame Nuts		
K1, K2 Models	100	75
K3 Models	145	106
Stabilizer Bar Clamp to Frame Bolts	33	24
Thermal Actuator	22	16
Universal Joint Clamp Bolts	20	15
Upper Control Arm Stud Nut	100	75

LUBRICATION

Capacity		
Fill to the level of the filler plug hole.		
K2 Models	1.66L	1.75 Qt.
K3 Models	2.13L	2.25 Qt.
Type Recommended	SAE 80W-90 GL5 Gear Lubricant (SAE 80W GL5 in Canada)	

T2111

SPECIAL TOOLS

1. AXLE TUBE BEARING REMOVER (K2 MODELS)
2. AXLE TUBE BEARING REMOVER (K3 MODELS)
3. DIFFERENTIAL PILOT BEARING REMOVER
4. AXLE TUBE SEAL INSTALLER (K3 MODELS)
5. AXLE TUBE SEAL INSTALLER (K2 MODELS)
6. AXLE TUBE BEARING INSTALLER
7. DIFFERENTIAL PILOT BEARING INSTALLER
8. CARRIER CASE BEARING INSTALLER
9. DRIVE AXLE BOOT CLAMP PROTECTOR INSTALLER
10. SEAL CLAMP TOOL
11. KNUCKLE SEAL INSTALLER
12. STEERING LINKAGE PULLER
13. PINION FLANGE HOLDER
14. FRONT HUB SPINDLE REMOVER
15. SNAP RING PLIERS

1. J 29369-1
2. J 29369-2

3. J 34011

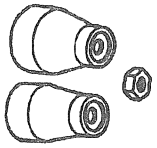
4. J 22833
5. J 36600

6. J 36609

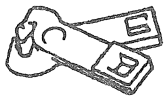
7. J 33842

8. J 36616

9. J 36845



10. J 35910



11. J 36605

12. J 24319-B

13. J 8614-01

14. J 28733-B

15. J 8059

3104r5287

BLANK

SECTION 4C2

8 1/4 AND 9 1/4 INCH RING GEAR

NOTICE: *Always use the correct fastener in the correct location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.*

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GENERAL DESCRIPTION

The front axle used on K model vehicles has a center disconnect feature that, under most conditions, allows shifting into and out of four-wheel drive when the vehicle is in motion. The axle is shifted by a thermal actuator.

The axle uses a conventional ring and pinion gear set to transmit the driving force of the engines to the wheels. The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the pinion bearings in the axle housing.

The ring gear is bolted onto the differential case with left-hand thread bolts.

The differential is used to allow the wheels to turn at different rates of speed while the front axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using threaded adjusters.

The axle identification is an alphabetic broadcast code located on a tag attached to the right axle tube.

The axle is produced with 8 1/4 inch and 9 1/4 inch ring gears. The 8 1/4 inch ring gear is used on K1 and K2 models; the 9 1/4 inch ring gear is used on K3 models.

The drive axles are completely flexible assemblies consisting of inner and outer constant velocity (CV) joints protected by thermoplastic boots and connected by an axle shaft.

DISASSEMBLY OF AXLE

INSPECTION

Perform the following checks before disassembling the axle:

1. Remove the drain plug from the axle and drain the axle lubricant.
2. Check the ring gear backlash. Refer to "Adjusting Backlash" in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential case.
3. Inspect the case for metal chips. Determine where the metal chips came from, such as a broken gear or bearing cage.
4. Determine the cause of the axle problem before disassembly if possible.

DISASSEMBLY

Tools Required:

J 29369-1 Bearing Remover (K1 and K2 Models)
J 29369-2 Bearing Remover (K3 Models)
J 29307 Slide Hammer
J 34011 Pilot Bearing Remover
J 36599 Adjusting Sleeve Wrench
J 36615 Adjuster Plug Wrench (K3 Models)
J 8614-01 Pinion Remover
J 36598 Holding Fixture and Pinion Service Tool
J 8612-B Pinion Bearing Remover (K1 and K2 Models)
J 36606 Pinion Bearing Remover (K3 Models)
J 22888 Side Bearing Puller
J 8107-2 Side Bearing Puller Pilot (K1 and K2 Models)
J 36597 Side Bearing Puller Pilot (K3 Models)
J 36616 Bushing Replacer

Remove or Disconnect (Figures 1 through 19)

1. Differential actuator.
2. Engagement switch.
3. Bolts.
4. Axle tube with right output shaft.
5. Differential sleeve.
6. Shift shaft, damper spring, shift fork, and shifter shaft ring.
7. Spring.
8. Shim.
9. Carrier connector with retainer ring (K1 and K2 models).
   - Clamp the axle tube in a vise. Clamp only on the mounting flange.
   - Strike the inside of the shaft flange with a brass hammer to dislodge the carrier connector.
10. Snap ring and washer and thrust washer (K3 models) (Figure 8).
11. Right output shaft with deflector.
12. Seal and output shaft bearing. Use J 29369-1 (K1, and K2 models) or J 29369-2 (K3 models) with J 29307 (Figure 12).
13. Output shaft.
14. Differential pilot bearing. Use J 34011 (Figure 12).
15. The left output shaft with deflector using tool J 2619-1 (Figure 13).
16. Seal. Pry out with seal removal tool.
17. Bearings. Use the tools listed in step 12.
18. Bolts.
19. Right side carrier half. Tap on the cast lugs provided.
20. Differential assembly.
    - Pry up on the locks (right side only on K3).
21. Bolt and lock (K3 models) (Figure 15).
22. Sleeve(s) and side bearing cups (right side only on K3).
    - Turn the sleeve(s) to push the bearing cup(s) out of the bore(s). Use J 36599 (Figure 14).

23. Adjuster plug with side bearing cup and O-ring seal (K3 models). Use J 36615 (Figure 15).
24. Nut. Use J 8614-01 to hold the pinion flange (Figure 16).
25. Washer.
26. Pinion flange with deflector. Use J 8614-01 (Figure 16).
    - Mount the left carrier case in J 36598. Be sure to use the adapter plate (J 36598-6) for K1 and K2 models.
27. Ring and pinion with shim, bearing cone, and spacer. Use J 36598 (Figure 17).
28. Spacer from the pinion.
29. Pinion bearing. Use J 8612-B (K1 and K2 models) or J 36606 (K3 models) and a press (Figure 18).
30. Shim.
31. Seal, and bearing cup and cone. Use J 36598-6 (Figure 19).
32. Bearing cup. Use J 36598-6 (Figure 20).
33. Side bearings. Use J 22888-D and J 8107-2 (K1 and K2 models) or J 36597 (K3 models) (Figure 21).
34. Ring gear bolts.
    - Ring gear bolts have left-handed threads.

NOTICE: ***Do not pry the ring gear from the case. This will damage the ring gear and the differential case.***

35. Ring gear from the differential case.
    - Drive the ring gear off with a brass drift.
36. Pin (K1 and K2 models). Drive out with a drift and hammer (Figure 22).
37. Bolt (K3 models).
38. Shaft.
39. Differential pinion gears and side gears.
    A. Roll the pinion gears out of the case with the pinion thrust washers.

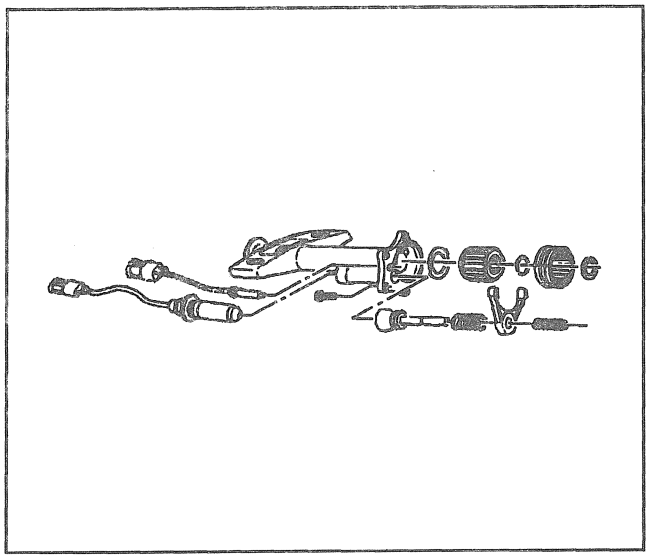


Figure 1—Right Axle Tube (K1, K2 Models)

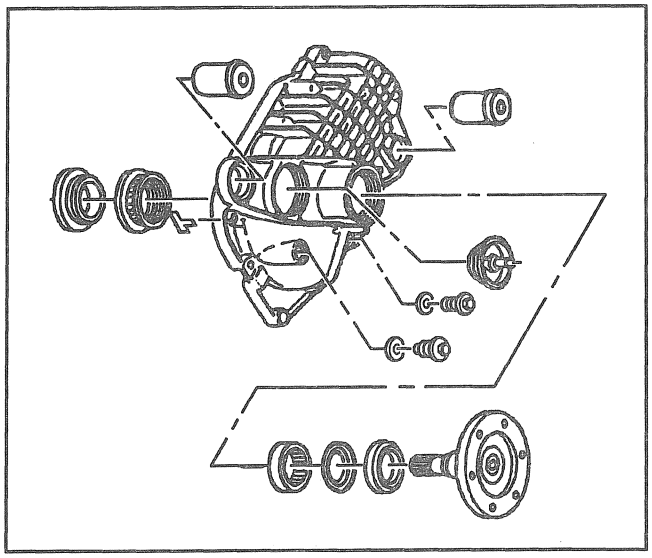


Figure 2—Left Output Shaft (K1, K2 Models)

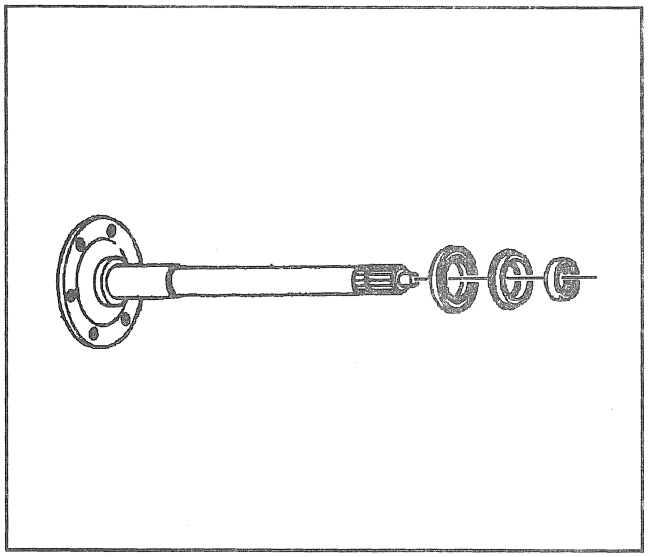


Figure 3—Right Output Shaft

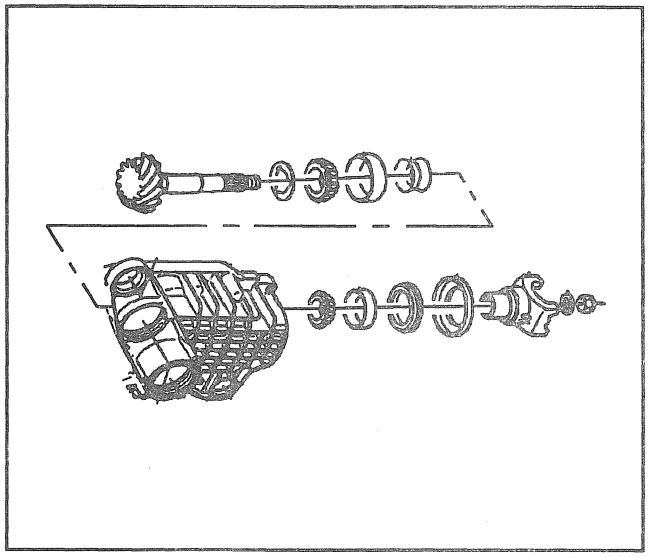


Figure 4—Pinion Gear

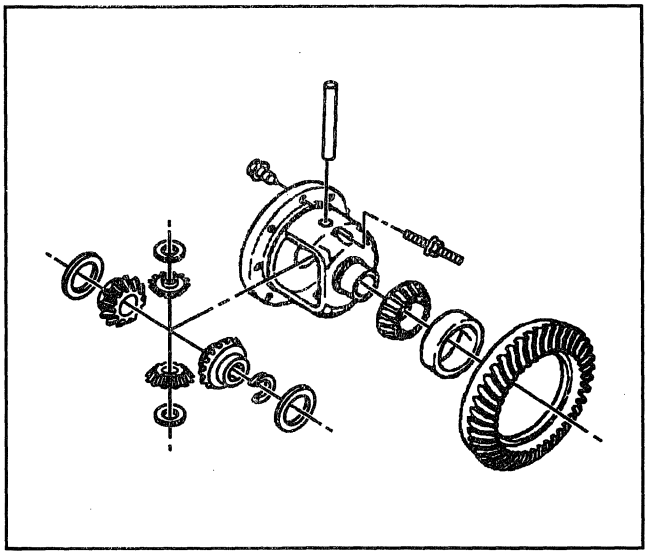


Figure 5—Differential Case and Bearings

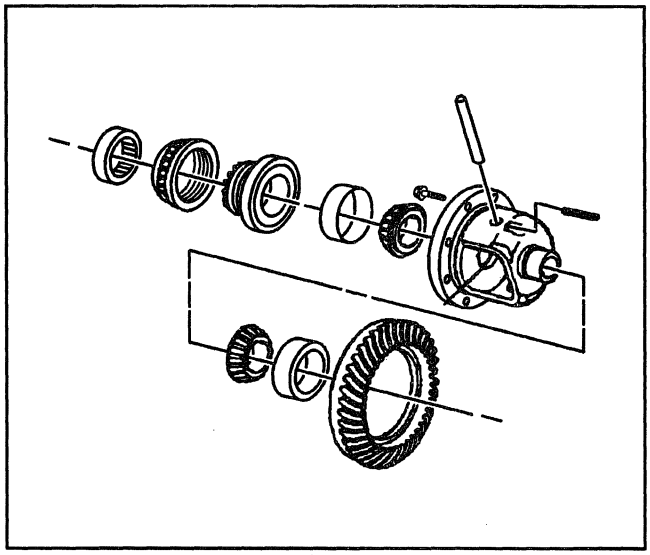


Figure 6—Ring Gear and Differential Case Bearings

B. Remove the side gears and the side gear thrust washers. Mark the gears and the differential case as left and right.
C. Remove spacer (K3 models only).

40. Vent plug. Use a 6-point deep socket.
41. Bushings. Use J 36616 (Figures 23 and 24).

CLEANING

- Do not steam-clean drive parts having ground and polished surfaces such as gears, bearings, and shafts. All parts should be disassembled before cleaning. These parts should be cleaned in a suitable solvent.
- Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow the bearings to spin while drying them with compressed air.

INSPECTION

It is very important to carefully and thoroughly inspect all drive unit parts before assembly.

Thorough inspection of the parts for wear or stress and replacement of worn parts will help prevent costly drive component repair after reassembly.

Axle Housing

Inspect

- Axle housing bore for nicks or burrs that would prevent the outer diameter of the pinion seal from sealing. Remove any burrs that are found.
- Bearing cup surfaces for nicks or burrs. Remove any burrs that are found.
- Housing for cracks. Replace the housing if any cracks are found.
- Housing for foreign material such as metal chips, dirt, or rust. Refer to "CLEANING" in thiis section.

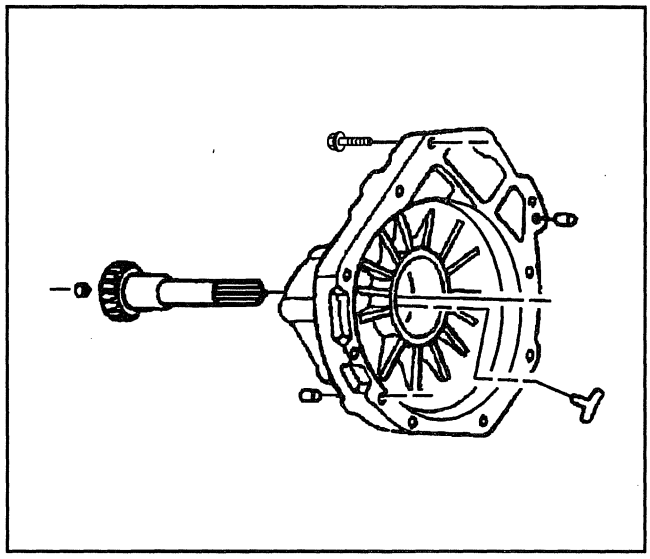


Figure 7—Right Case Half

Differential

Inspect

- Pinion gear shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the differential side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- All parts for wear and replace if necessary.

Pinion and Ring Gear

- Ring and pinion gears are matched sets and must both be replaced any time a replacement of either is necessary.

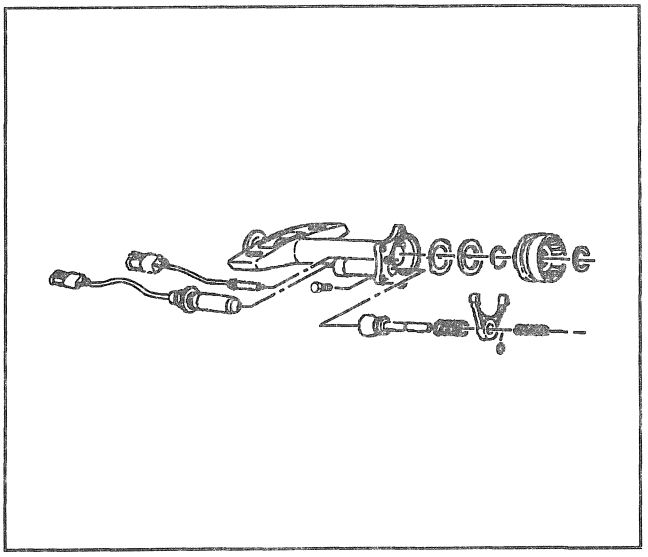


Figure 8—Right Axle Tube (K3 Models)

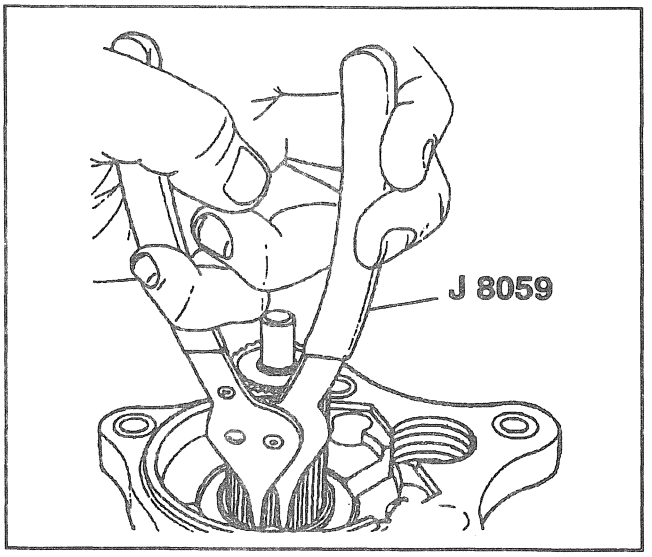


Figure 10—Removing the Snap Ring (K3 Models)

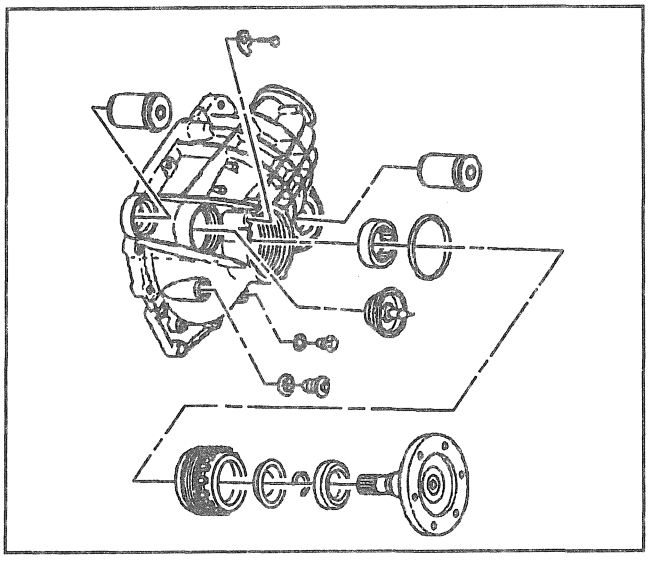


Figure 9—Left Output Shaft (K3 Models)

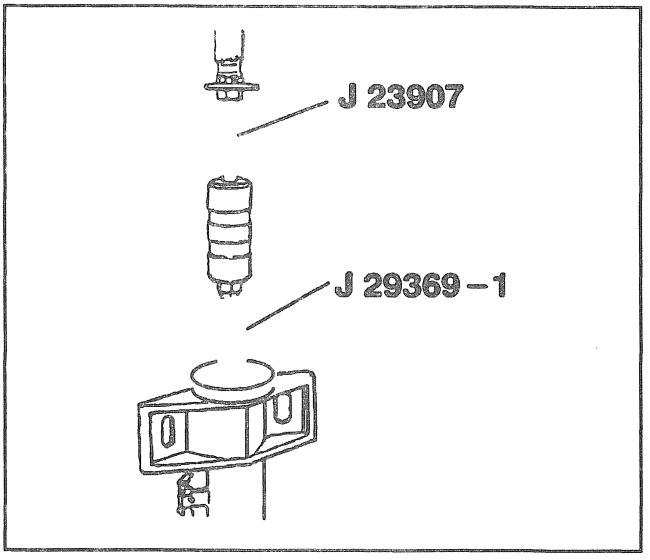


Figure 11—Removing the Axle Bearing

Inspect

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion gear splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion flange on the pinion gear.
- Sealing surface of the pinion flange for nicks, burrs, or rough tool marks which would cause damage to the inside diameter of the pinion seal and result in an oil leak.
- All parts for wear and replace if necessary.

Bearings

Inspect

- Bearings for smooth rotation after oiling them.
- Bearing rollers for wear.
- Bearing cups for wear, cracks, brinelling and scoring.

Important

- When replacing worn or cracked bearings and cups, make sure to replace bearings in sets.
- Low mileage bearings may have very small scratches and pits on the rollers and the bearing cups from the initial preload. Do not replace a bearing for this reason.

Shims, Thrust Washers, and Adjuster Sleeves

Inspect

- Shims and thrust washers for cracks and chips. *Damaged shims should be replaced with an equally sized service shim.*
- Adjuster sleeves for damaged threads. Replace if required.

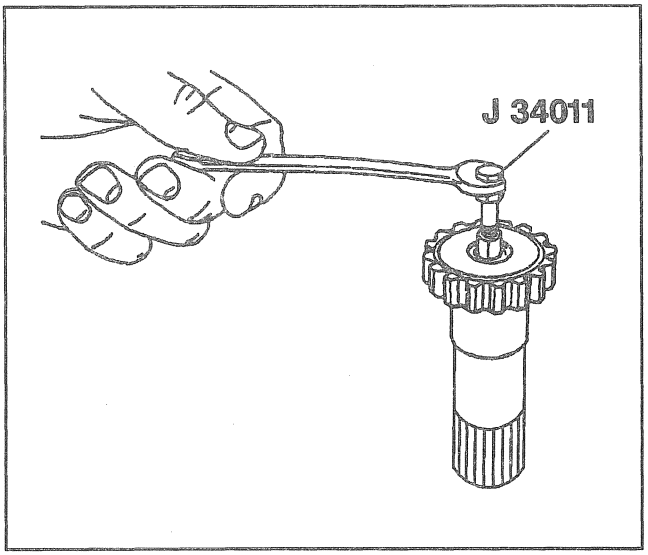


Figure 12—Removing the Pilot Bearing

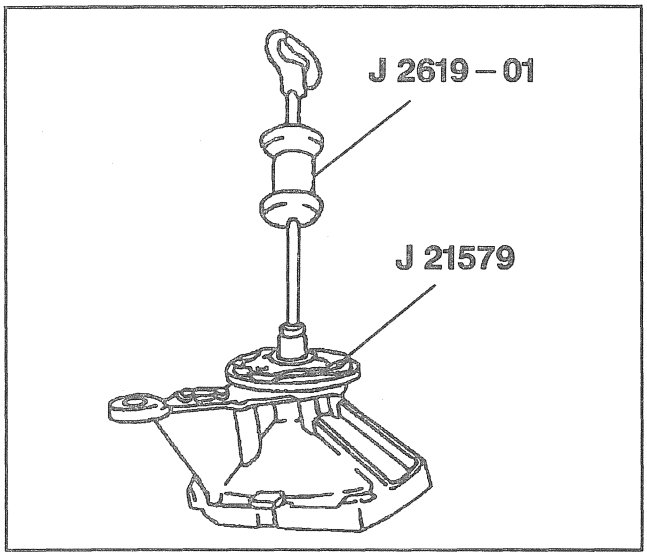


Figure 13—Removing the Left Shaft

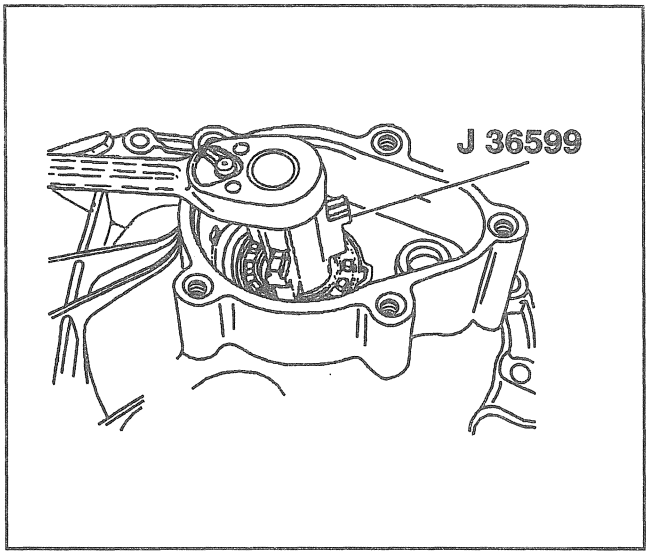


Figure 14—Turning the Adjuster Sleeve

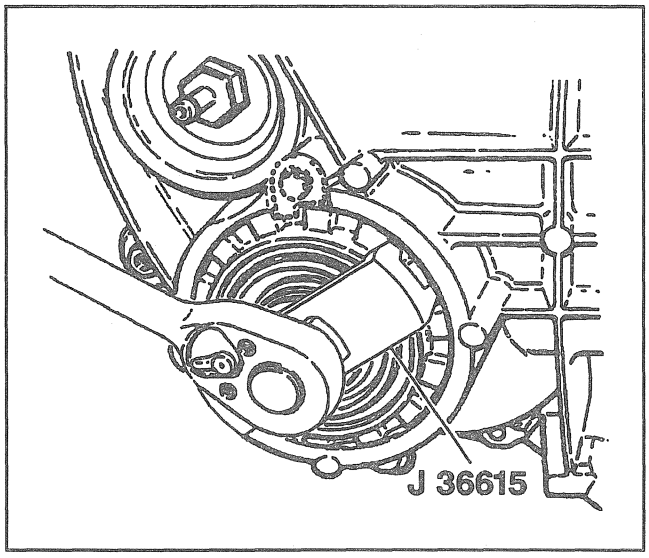


Figure 15—Turning the Adjuster Plug (K3 Models)

Shift Mechanism

Inspect

- Carrier connector (if used) for damaged splines and teeth. Replace as required.
- Shift fork for wear, scoring, and damage to thrust surfaces. Replace if needed.
- Differential sleeve and inner output shaft for damaged splines and teeth. Replace if necessary.
- Damper spring for breakage.
- Differential actuator and engagement switch for damage and frayed wiring.

Actuator Check

- Apply 12-volt battery voltage to the actuator terminals. The plunger should extend within several seconds.
- Disconnect the actuator from the power source. The plunger should retract within several seconds.
- If the actuator does not operate as specified, it should be replaced.

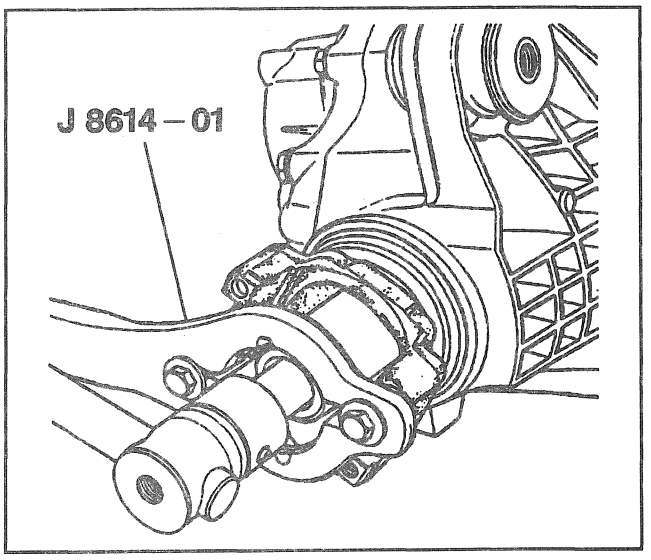


Figure 16—Removing the Pinion Nut and Flange

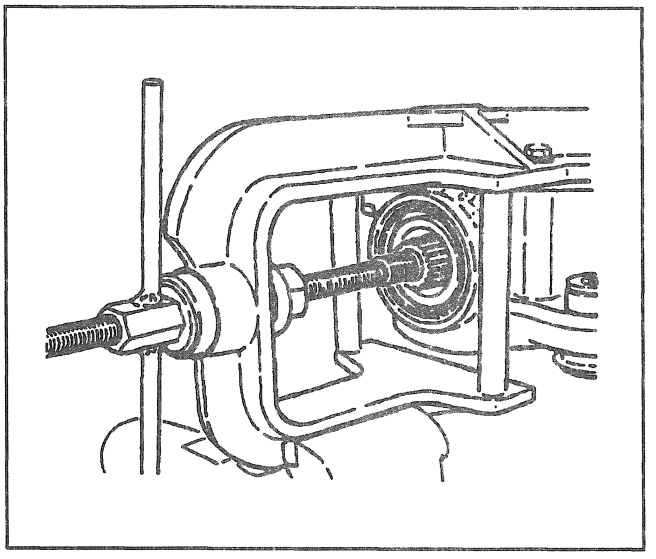


Figure 17—Removing the Pinion

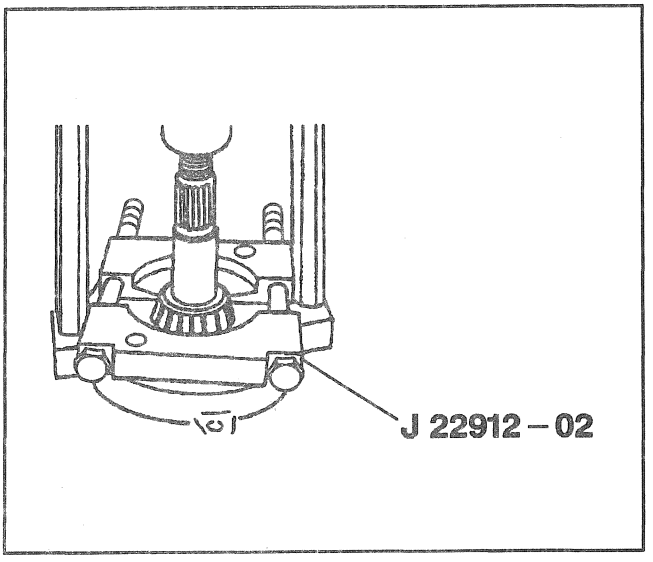


Figure 18—Removing the Pinion Bearing

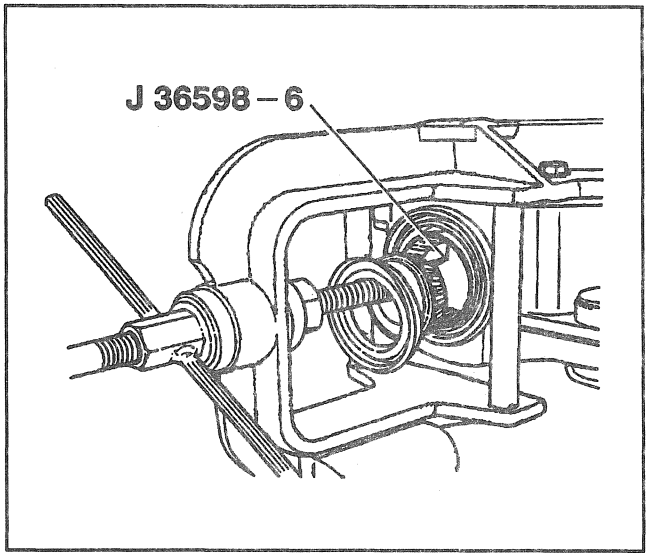


Figure 19—Removing the Outer Pinion Bearing and Seal

ASSEMBLY OF THE AXLE

Important

- Apply axle lubricant to all bearings, seal lips, gears, thrust washers, and bearing surfaces at assembly.

PINION BEARING CUP INSTALLATION

Tool Required:
J 36598 Holding Fixture and Pinion Service Tool

Install or Connect (Figures 1 through 9, 25, and 26)

- Mount the left carrier case in J 36598. Use the J 36598-6 adapter plate for K1 and K2 models. **Tighten the attaching bolts securely.**

1. Outer bearing cup. Use the forcing screw and J 36598-3 (K1 and K2 models) or J 36598-4 (K3 model) (Figure 25).
2. Inner bearing cup.
   A. Remove J 36598-3 or J 36598-4 from the forcing screw.
   B. Place pilot J 36598-15 in the pinion seal bore.
   C. Extend the forcing screw through the pinion bore.
   D. Install J 36598-3 (K1 and K2 models) or J 36598-4 (K3 models) on the forcing screw (Figure 26).
   E. Rotate the forcing screw until the installer is snug against the bearing cup.

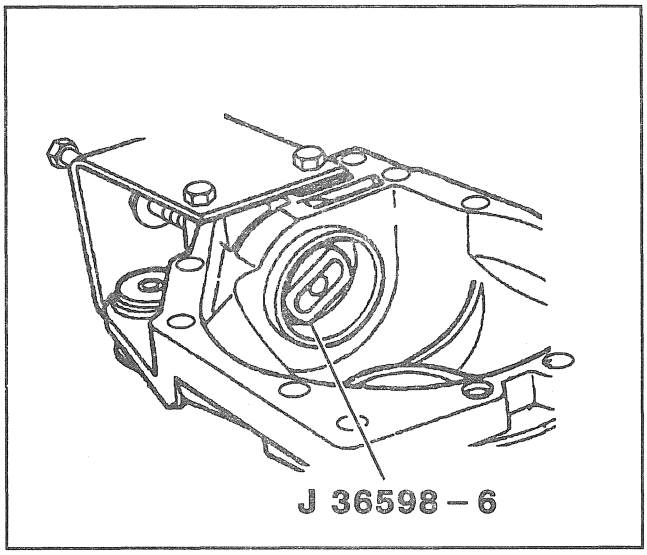


Figure 20—Removing the Inner Bearing Cap

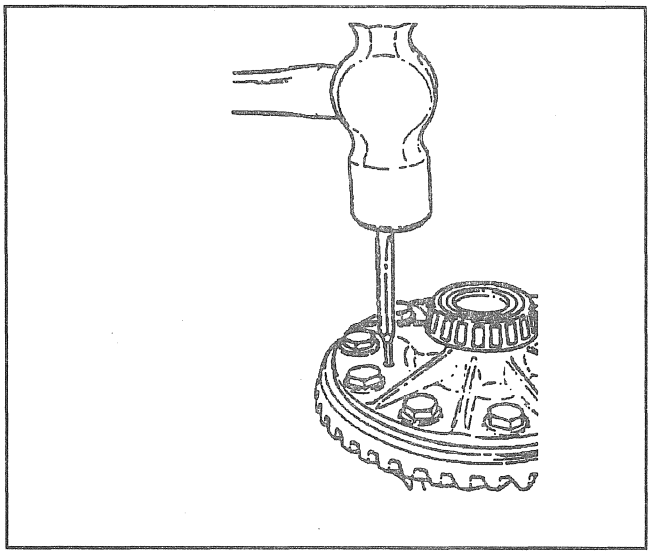


Figure 22—Removing the Pin (K1, 2 Models)

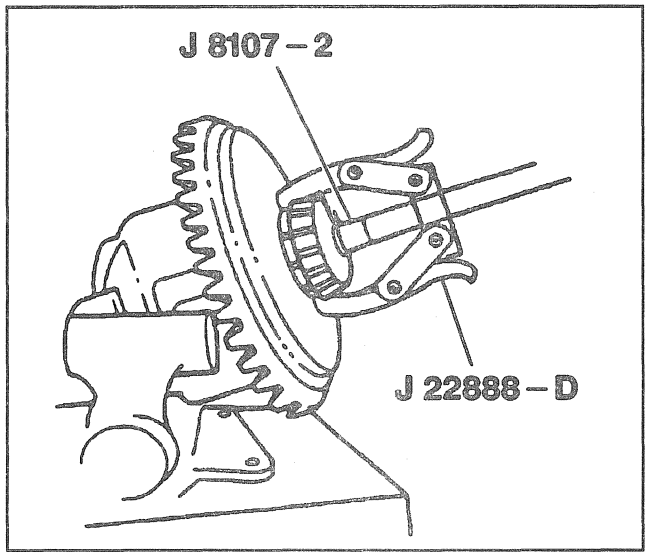


Figure 21—Removing the Side Bearings

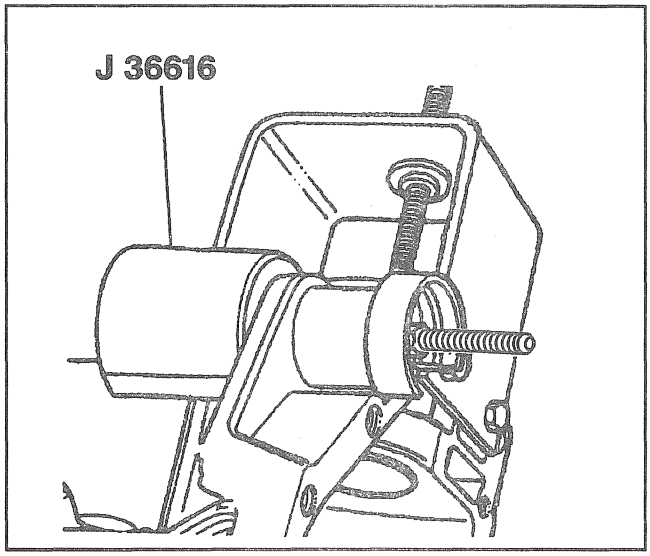


Figure 23—Removing the Carrier Bushings

F. Rotate the tool several times to make sure the bearing cup is not cocked in the bore.

- Pull the bearing cup into place with the forcing screw (Figure 26).

PINION DEPTH ADJUSTMENT

Tools Required:
J 36601 Pinion Depth Setting Gauge
J 29763 Dial Indicator
J 21777 Pinion Setting Gauge Set

1. Refer to (Figures 1 through 9, 27, 28 and 29).
2. Pinion depth is adjusted by selecting a shim of the proper thickness.
3. Lubricate the pinion bearings liberally with axle lubricant.
4. Assemble J 29763 to the proper gaging arm (J 36601-4 for K1 and K2 models, J 36601-3 for K3 models).
5. Install the pinion bearings and hold them in place.
6. Insert the threaded rod of J 36601 through the pinion bearings.
7. Install the proper pilot, washer, and nut.
8. Tighten the nut while holding the threaded rod with a wrench to adjust bearing preload. Adjust the nut to obtain a preload of 1.0-1.6 N·m (10-15 lb. in.) using an inch pound torque wrench. Rotate the shaft several times to make sure the bearings have seated, then measure again.
9. Push the dial indicator downward until the needle rotates about 3/4 turns.
10. Tighten the dial indicator in this position.
11. Set the button of J 36601 on the differential bearing bore (Figure 27).
12. Rotate the tool slowly back and forth until the dial indicator reads the lowest point of the bore. Set the dial indicator to ZERO. Repeat the rocking action of the tool to verify the ZERO setting.
13. After the ZERO setting is obtained and verified, grasp the gauging arm by the flats and move the

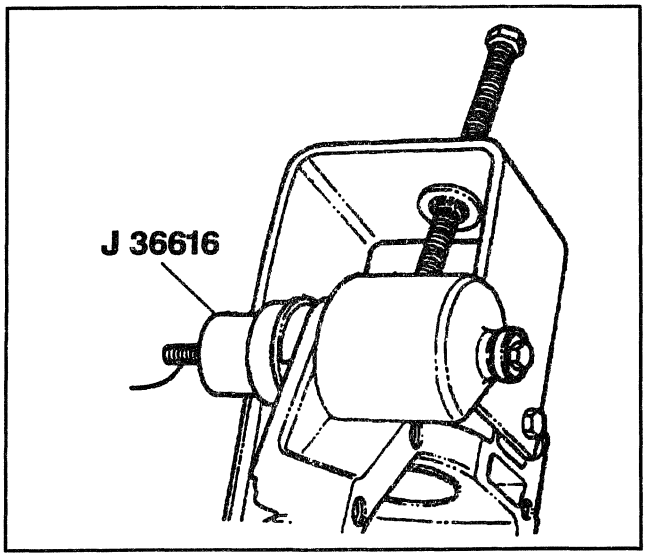


Figure 24—Installing the Carrier Bushings

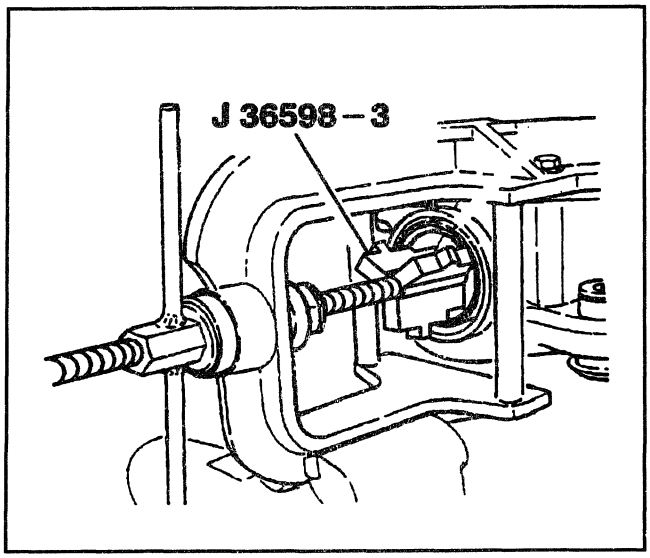


Figure 25—Installing the Outer Pinion Bearing Cup

tool button out of the differential side bearing bore (Figure 28). Record the dial indicator reading.

14. The dial indicator reading is equal to the required shim size. Example: If the dial indicator reads 0.508 mm in Step 8, a 0.508 shim is required. Available shim sizes are listed in "Specifications" in this section.

NOTICE: ***Proper pinion depth setting is a two-step procedure. Both procedures must be performed to ensure proper axle performance and prevent system damage.***

- ***A. Setup dimension arrived at with the indicator is to be considered a starting point.***
- ***B. Gear tooth pattern check is necessary to "fine-tune" the pinion depth and may indicate additional shim changes to the pinion stem.***

15. Remove the tool and bearing cones.

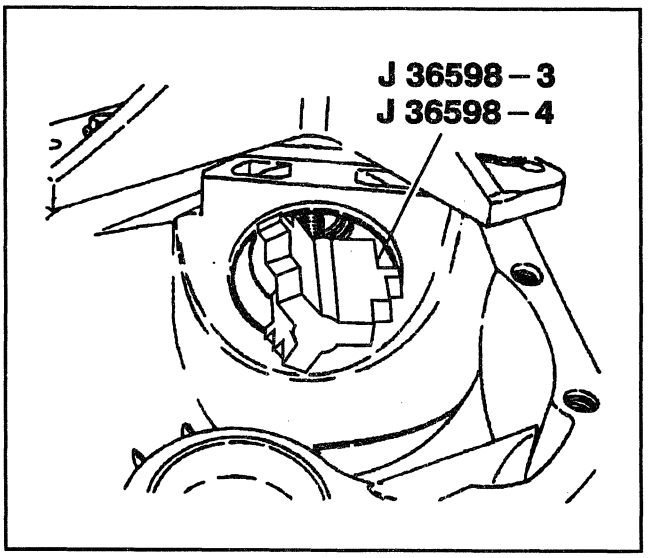


Figure 26—Installing the Inner Pinion Bearing Cup

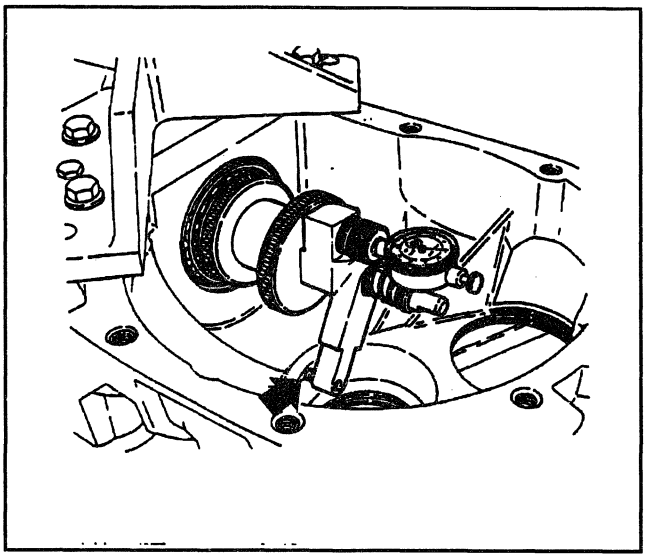


Figure 27—Measuring Pinion Depth-Button Located in Bearing Bore

PINION INSTALLATION

Tools Required:
- J 35512 Bearing Installer (K1 and K2 Models)
- J 36614 Bearing Installer (K3 Models)
- J 8614-01 Pinion Flange Remover
- J 36333 Seal Installer

Install or Connect (Figures 1 through 9, 16, 30, and 31)

1. Shim to the pinion gear.
   - The shim must be of the proper size, as selected previously.
2. Bearing onto the pinion gear using J 35512 (K1 and K2 models) or J 36614 (K3 models) (Figure 30).
3. New spacer onto the pinion gear.
4. Bearing into the case.

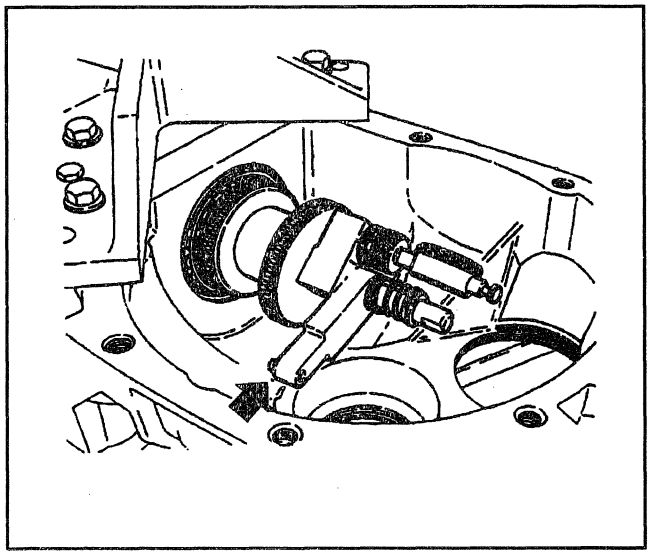


Figure 28—Measuring Pinion Depth-Button Moved Out of Bearing Bore

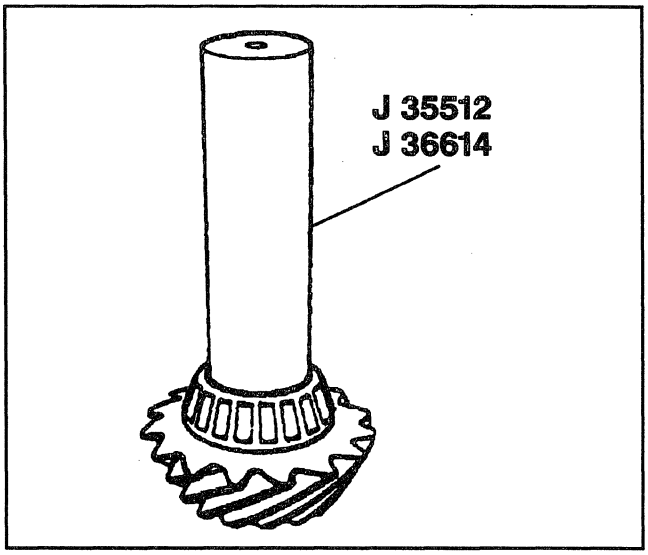


Figure 30—Installing the Pinion Bearing

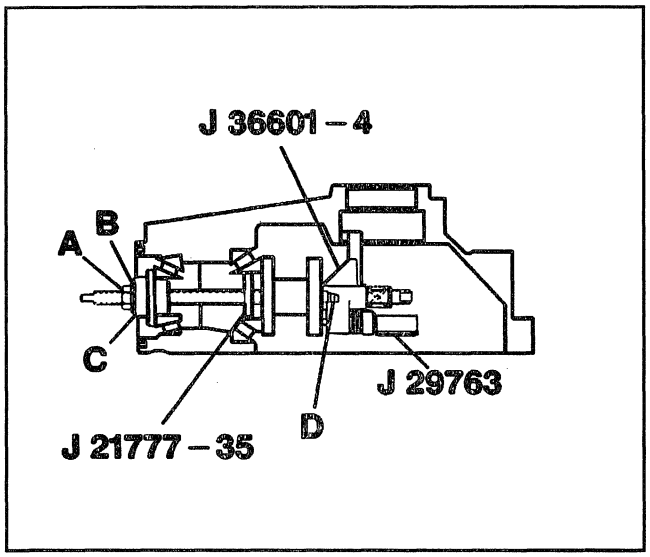


Figure 29—Measuring Pinion Depth

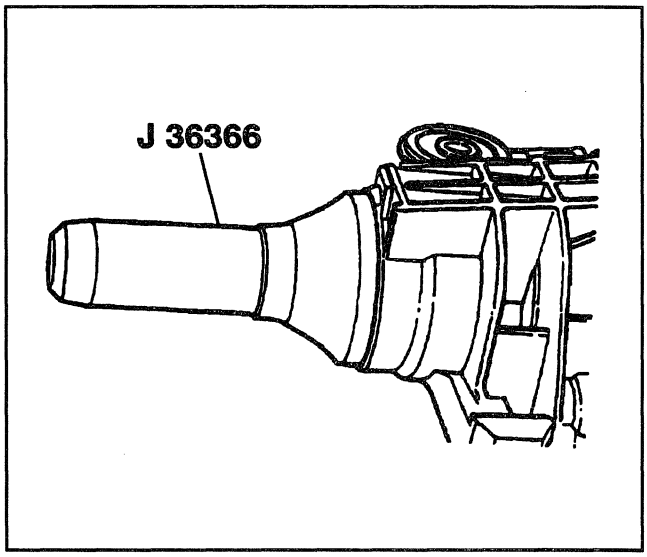


Figure 31—Installing the Pinion Seal

5. Seal into the case using J 36366 (Figure 31).
6. Pinion gear, with bearing and spacer, to the case.
7. Deflector, flange, washer, and nut.
   - Apply PST Sealant GM P/N 1052080 or equivalent to the pinion gear threads and on both sides of the washer.
   - Tighten nut until no end play is detectable while holding the flange with J 8614-01 (Figure 16).
   - No further tightening should be attempted until the bearing preload has been checked.

Measure (Figure 32)

- Pinion bearing preload. Use an inch-pound torque wrench (Figure 32). The correct preload is 1.7 to 2.8 N·m (15-25 lb. in.).
  1. Rotate the pinion with the torque wrench and observe the reading.
  2. If the preload torque is below specifications, continue torquing the pinion nut in small increments. Check the preload after each tightening. Each tightening will increase the bearing preload by several inch pounds. If the bearing preload is exceeded, the pinion will have to be removed, and a new collapsible spacer installed.
  3. Once the preload has been obtained, rotate the pinion several times to make sure that the bearings have seated. Recheck the preload, and adjust if necessary.

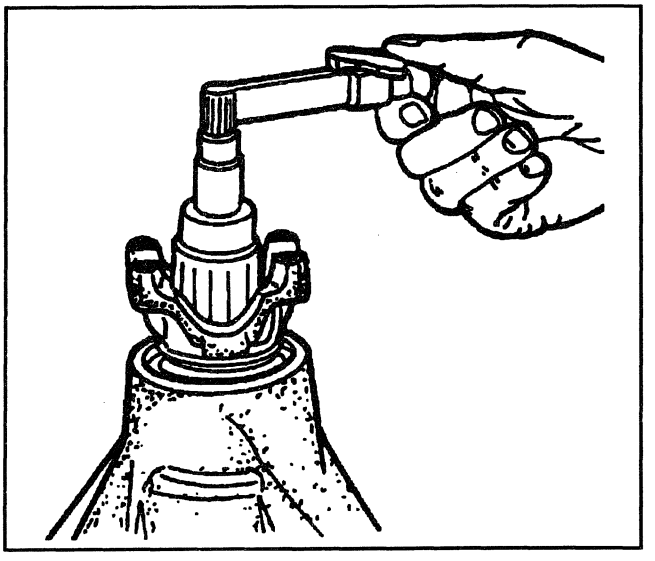


Figure 32—Measuring Pinion Bearing Preload

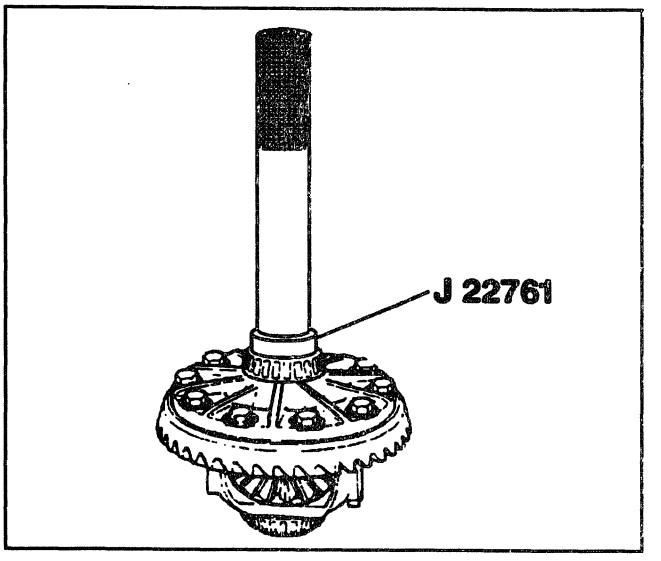


Figure 33—Installing the Differential Side Bearing

DIFFERENTIAL CASE ASSEMBLY

Tools Required:
J 22761 Side Bearing Installer (K1 and K2 Models)
J 29710 Side Bearing Installer (K3 Models)
J 8092 Driver Handle

Install or Connect (Figures 1 through 9, and 33)

1. Thrust washers and side gears into the differential case.
   - If the same gears and washers are being used, install them on the same side they were removed from.
2. Pinion gears.
   - Position one pinion gear between the side gears and rotate the gears until the pinion gear is directly opposite the opening in the case.
   - Place the other pinion gear between the side gears, making sure the hole in both pinion gears line up.
3. Thrust washers.
   - Rotate the pinion gears toward the opening just enough to permit the sliding in of the thrust washers.
4. Shaft and pin (K1 and K2 models) or bolt (K3 models).
5. Ring gear onto the differential case.
6. Bolts. The bolts have left hand threads.

Important

- Always install new bolts. Never reuse the old bolts.

Tighten

- Bolts alternating in progressive steps to 120 N.m (88 lb. ft.).

7. Side bearings, using J 22761 (K1 and K2 models) or J 29710 (K3 models) and J 8092 (Figure 33).

DIFFERENTIAL ASSEMBLY INSTALLATION

Tools Required:
J 36612 Bearing Installer (K1 and K2 Models)
J 36613 Bearing Installer (K3 Models)
J 8092 Driver Handle
J 36599 Sleeve Adjusting Wrench
J 36615 Adjuster Plug Wrench (K3 Models)
J 36603 Side Bearing Cup Installer

Install or Connect (Figures 1 through 9 and 34 through 38)

1. Bearings to the sleeves and/or adjuster plug (K3 models).
   - Use J 8092 and J 36612 (K1 and K2 models) or J 36613 (K3 models) (Figure 34).
2. New O-ring seal to the adjuster plug (K3 models).
3. Sleeves and/or adjuster plug to the carrier case.

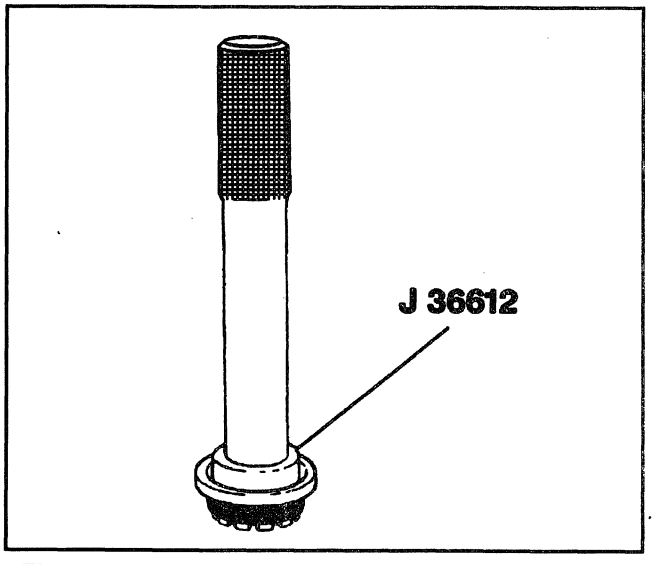


Figure 34—Installing the Adjuster Sleeve Bearing

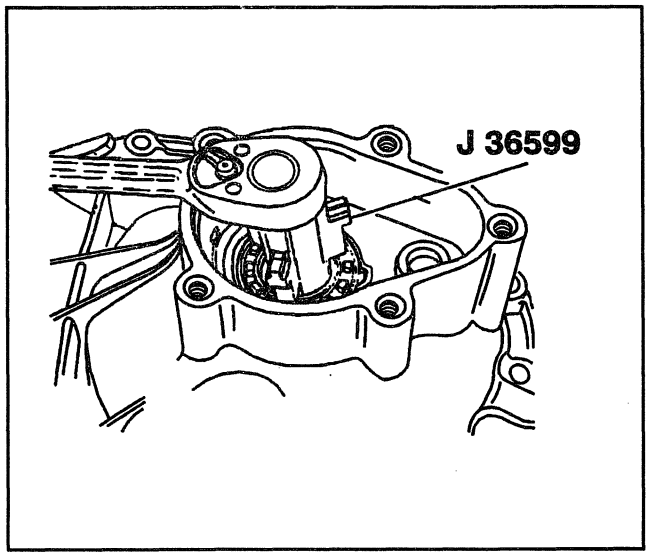


Figure 35—Turning the Adjuster Sleeve

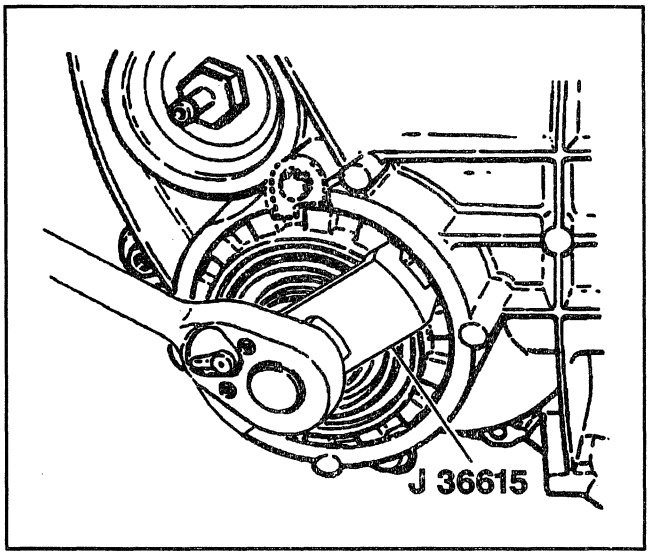


Figure 36—Turning the Adjuster Plug (K3 Models)

- K1 and K2 models: Use J 36599 (Figure 35).
- K3 models: Use J 36599 for the right sleeve (Figure 35). Use J 36615 for the adjuster plug (Figure 36).

4. Side bearing cups. Use J 36603 with J 8092 (Figure 37).
5. Differential assembly to the carrier case half.
   - Place the differential assembly into the carrier case half which contains the pinion gear.
   - Turn the left sleeve (K1 and K2 models) or adjuster plug (K3 models) in until backlash is felt between the ring and pinion.
     - K1 and K2 models: Use J 36599 (Figure 35).
     - K3 models: Use J 36615 (Figure 36).
   - Remove the carrier case from J 36599.
6. Carrier case halves. Do not use sealer at this time.
   - If the carrier halves do not make complete contact, back out the right sleeve. Use J 36599 (Figure 35).
7. Bolts.

Tighten

- Bolts to 47 N·m (35 lb. ft.).

ADJUSTING BACKLASH

Tools Required:
J 8001 Dial Indicator Set

1. Refer to Figures 1 through 9
2. Tighten the right sleeve to 140 N·m (100 lb. ft.) using J 36599 (Figure 35).
3. Tighten the left sleeve (K1 and K2 models) or adjuster plug (K3 models) to 140 N·m (100 lb. ft.).
   - Use J 36599 (K1 and K2 models) (Figure 35).
   - Use J 36615 (K3 models) (Figure 36).
4. Mark the location of the adjusting sleeves in relation to the carrier halves, so the notches in the adjusting sleeves can be counted when turned.
5. Turn the right sleeve OUT two notches.
6. Turn the left sleeve (K1 and K2 models) or adjuster plug (K3 models) In one notch.
7. Rotate the pinion several times to seat the bearings.

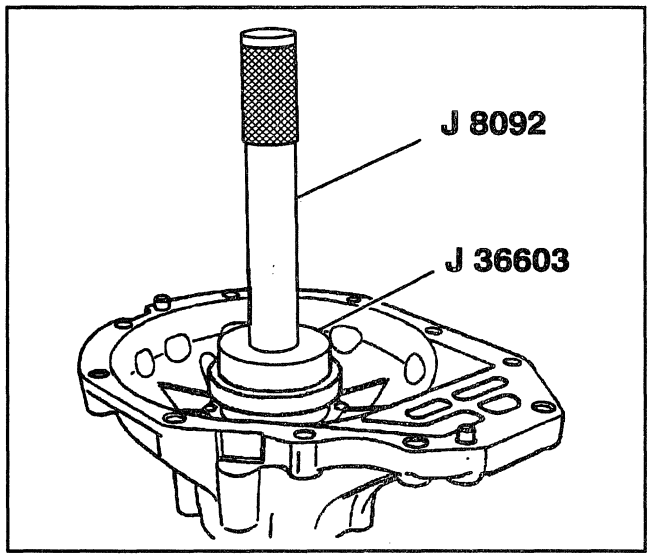


Figure 37—Installing the Side Bearing Cups

Measuring Backlash

1. Install a dial indicator so the button contacts the outer edge of the pinion flange. The plunger must be at a right angle to the pinion flange (Figure 38).
2. Move the pinion flange through its free play while holding the differential carrier. Record the dial indicator reading.
3. Divide the dial indicator reading by 2 to obtain the actual backlash when using this method. Example: A dial indicator reading of 0.16 mm means that there is actually 0.08 mm backlash.
4. Follow the steps for adjusting backlash.
   - Gear backlash should be between 0.08 to 0.25 mm (0.003 to 0.010 inch) with a preferred specification of 0.13 to 0.18 mm (0.005 to 0.007 inch).
   - If the backlash is incorrect, adjust the sleeves as necessary. Always maintain the "one notch" preload on the side bearings. Example: If it is necessary to turn the RIGHT sleeve IN one

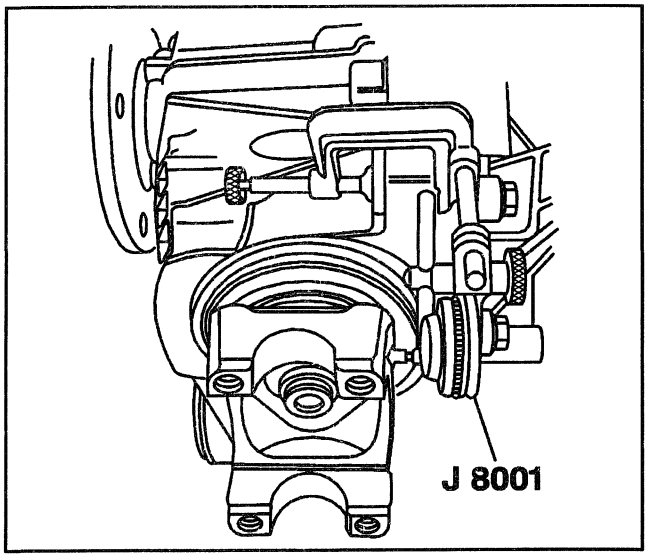


Figure 38—Measuring Backlash at the Pinion Flange

notch, the LEFT sleeve must be turned OUT one notch.

- To increase backlash, turn the left sleeve in, and turn the right sleeve out an identical amount. To decrease backlash, turn the right sleeve in and turn the left sleeve out an identical amount.
- Changing the sleeves one notch will change backlash about 0.08 mm (0.003 inch).

GEAR TOOTH CONTACT PATTERN CHECK

Before final assembly of the differential, a gear tooth contact pattern check should be performed.

A gear tooth contact pattern check is NOT a substitute for adjusting pinion depth and backlash as previously outlined. It is a final check to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy, or have a short life, or both. With a pattern check, the best contact between the ring gear and the drive pinion for low noise level and long life can be ensured.

Gear Tooth Terms

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side (4). The concave side is the "coast" side (3). The end of the tooth nearest center of ring gear is referred to as the "toe" end (2). The end of the tooth farthest away from the center is the "heel" end (1). The toe end of the tooth is smaller than the heel end (Figure 39).

Test

1. Wipe oil out of carrier and carefully clean each tooth of the ring gear.
2. Apply gear marking compound sparingly to all ring gear teeth using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Using a torque wrench, apply a load until a torque of 62 N.m (45 lb. ft.) is required to turn the pinion.

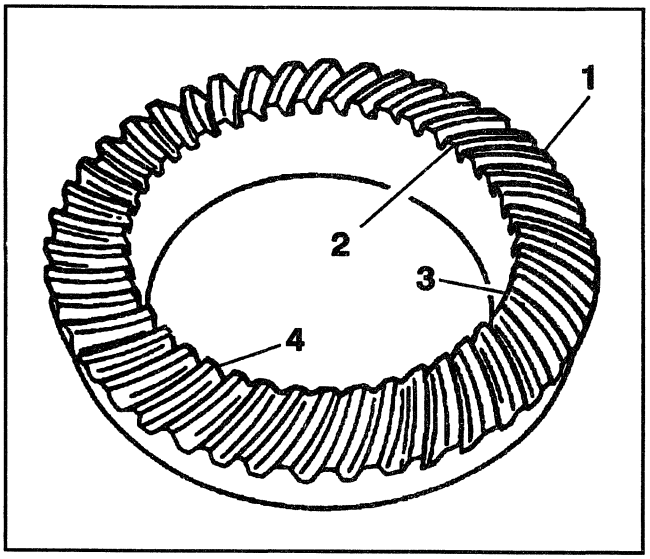


Figure 39—Gear Tooth Terms

- A test made without loading the gears will not give a satisfactory pattern. Turn the companion flange with a wrench so that the ring gear rotates one full revolution then reverse the rotation so that the ring gear rotates one revolution in the opposite direction. Excessive turning of the ring gear is not recommended.

4. Observe the pattern on the ring gear teeth and compare with Figures 40 through 42.

Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect the tooth contact pattern. These are backlash and pinion depth. The effects of bearing preloads are not easily seen on hand loaded teeth pattern tests. These adjustments should be within specifications before proceeding with the backlash and the drive pinion adjustments.

It may be necessary to adjust both pinion depth and the backlash to obtain the correct pattern.

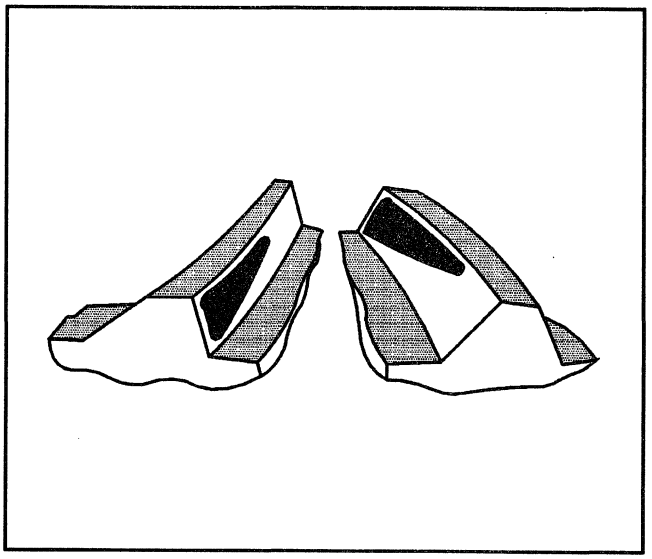


Figure 40—Pinion Gear is too Far Away

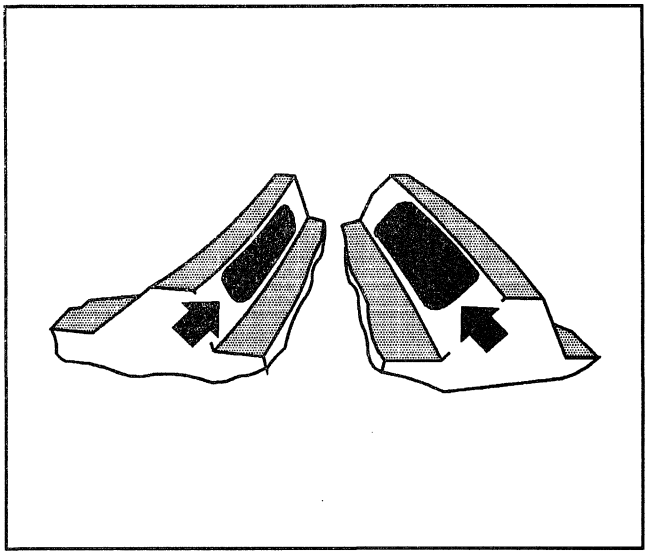


Figure 41—Gear Tooth Contact Pattern Is Correct

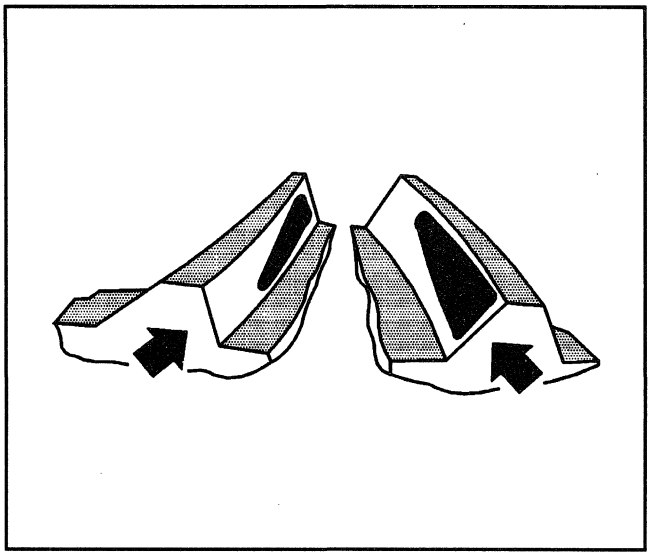


Figure 42—Pinion Gear is too Close to Ring Gear

Pinion depth is adjusted by increasing or decreasing the shim thickness between the pinion head and the inner race of the rear bearing. The shim is used in the differential to compensate for manufacturing tolerances. Increasing the shim thickness will move the pinion closer to the centerline of the ring gear. Decreasing the shim thickness will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting sleeves which move the entire case and ring gear assembly closer to, or farther from the drive pinion. (The adjusting sleeves are also used to set side bearing preload). To increase backlash turn the left sleeve in and turn the right sleeve out an identical amount. To decrease backlash, turn the right sleeve in and turn the left sleeve out an identical amount.

It is important that the contact pattern be centrally located up and down on the face of the ring gear teeth.

CARRIER CASE ASSEMBLY

Tools Required:
- J 36600 Output Shaft Seal Installer (K1, 2)
- J 22833 Output-Shaft Seal Installer (K3).
- J 33842 Pilot Bearing Installer
- J 36616 Bushing Replacer Set

Remove or Disconnect (Figures 1 through 9)

1. Bolts.
2. Right carrier case half.

Clean

- Carrier case and axle tube sealing surfaces. Remove all grease and oil.

Install or Connect (Figures 1 through 9, 23, 24, and 43)

- Bend the lock over the sleeves. (Right side only on K3 models).
- Bolt and lock (K3 models).
- Apply a bead of sealer GM P/N 1052942 or equivalent to one carrier case half sealing surface.

1. Right carrier case half.
2. Bolts.

Tighten

- Bolts to 47 N.m (35 lb. ft.).

3. Left seal. Use J 36600 (K1 and K2 models) or J 22833 (K3 models). Drive into place with a soft faced hammer.
4. Shaft with deflector. Drive in place with a brass hammer.
5. Bearing to the output shaft. Use J 33842 (Figure 43).
6. Output shaft to the carrier.
7. Vent plug. Use a small amount of sealer GM P/N 1052942 or equivalent on the threads.
8. Bushings. Use J 36616 (Figures 23 and 24).

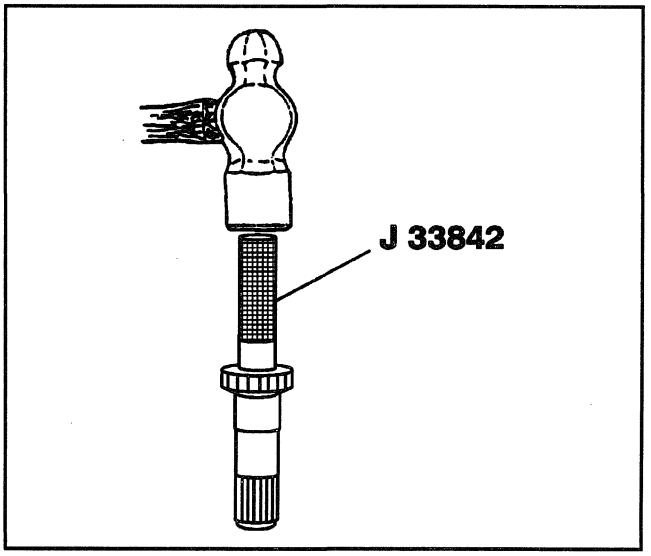


Figure 43—Installing the Pilot Bearing

AXLE TUBE ASSEMBLY

Tools Required:
J 36609 Bearing Installer
J 36600 Seal Installer (K1 and K2 Models)
J 22833 Seal Installer (K3 Models)

Assembly

Install or Connect (Figures 1 through 9 and 44)

1. Bearing. Use J 36609. Drive into place with a hammer.
2. Seal. Use J 36600 (K1 and K2 models) or J 22833 (K3 models) (Figure 44).
3. Shaft with deflector to the axle tube.
4. Washer. Align the tabs with the slots in the tube.
5. Gear with retaining ring (K1 and K2 models). Drive gear into place with a plastic hammer.
6. Washer and new snap ring (K3 models). Make sure the snap ring seats properly in the groove.

Output Shaft Shim Selection

- Refer to Figures 1 through 9.
- It is necessary to select the proper size output shaft shim if any of the following components were replaced:
- Shaft.
- Axle tube.
- Output shaft.
- Carrier case.
- Ring and pinion gears.
- Differential case.
- Bearings.
- Carrier connector (K1 and K2 models).

Preferred Method:

Tool Required:
J 34672 Depth Gage (or equivalent)

- Refer to Figures 45 through 48

1. Push on the inner end of the shaft, and move the shaft outboard as far as it will go. The shaft must be in this position when measuring dimension "A".
2. Measure dimension "A." Use J 34672 or equivalent (Figures 45 and 47).
   - K1 and K2: Tube flange machined surface to inner surface of connector.
   - K3: Tube flange machined surface to inner surface of axle shaft shoulder.
3. Measure dimension "B." (Figure 46 and 48)
   - Carrier machined surface to outer surface of output shaft.
4. Subtract dimension "A" from dimension "B."
5. The correct shim size will be one size smaller than the Figure obtained in step 5. Examples:
   - If the Figure obtained in step 5 was 3.53 mm, use a 3.30-mm shim.
   - If the Figure obtained in step 5 was 3.30 mm, use a 2.70-mm shim (K1 and K2 models) or 2.80-mm shim (K3 models).

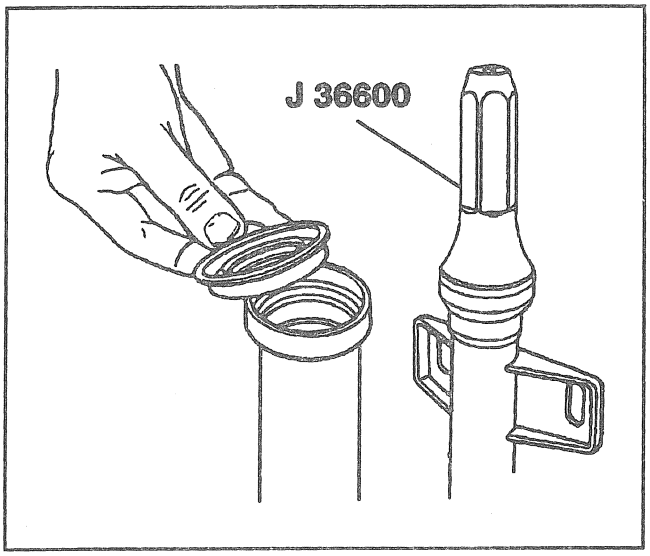


Figure 44—Installing the Axle Tube Seal

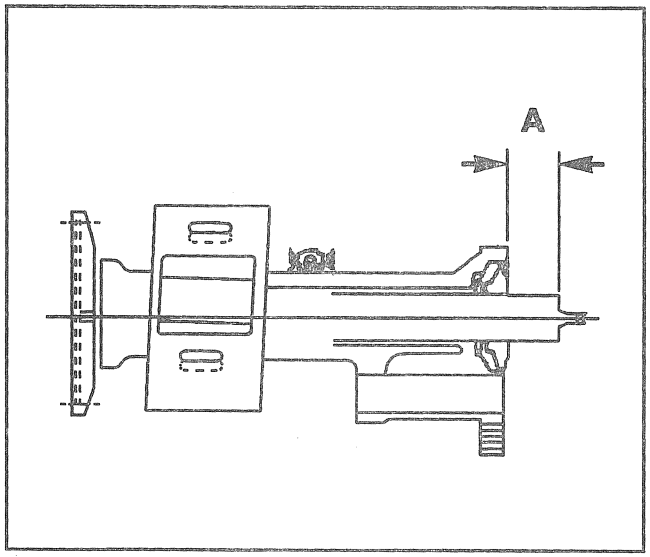


Figure 45—Measuring to Calculate Shim Size-Axle Shaft

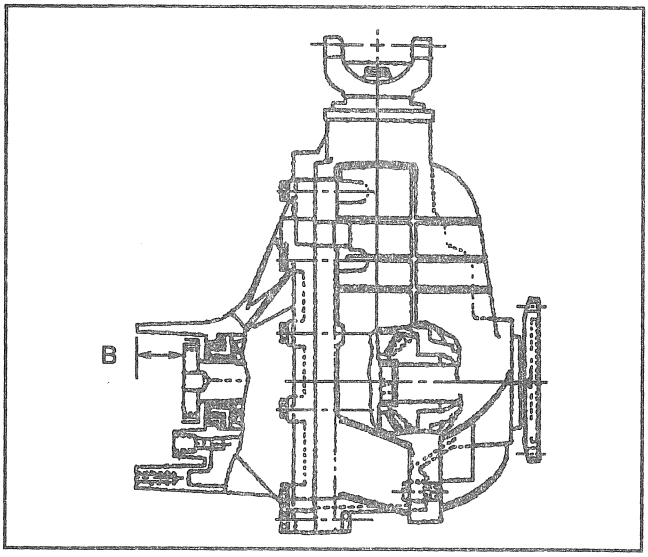


Figure 46—Measuring to Calculate Shim Size-Carrier Case

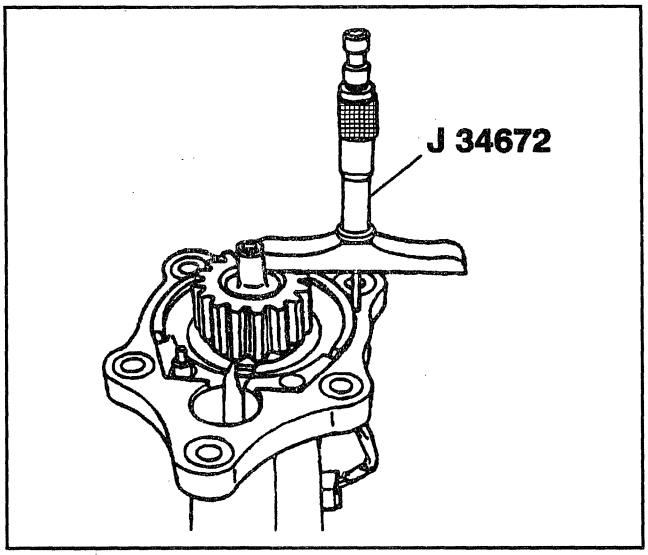


Figure 47—Measuring to Calculate Shim Size-Dimension "A"

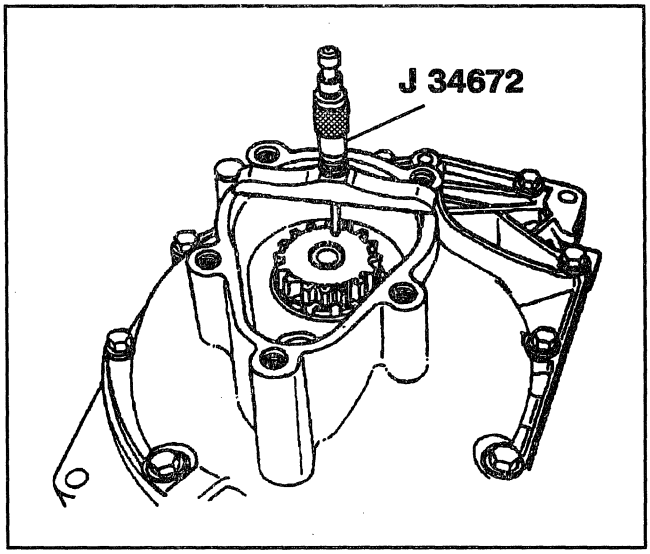


Figure 48—Measuring to Calculate Shim Size-Dimension "B"

6. Shims are available in the following sizes:
   - K1 and K2 models: 1.27 mm 1.78 mm, 2.29 mm, 2.70-mm, 3.30 mm, 3.81 mm.
   - K3 models: 1.80 mm, 2.30 mm, 2.80 mm, 3.30 mm, 3.80 mm, 4.30 mm, 4.80 mm.

Alternate Method

Use only if proper tools for calculating the shim size are not available.

Tool Required:
J 8001 Dial Indicator (or equivalent)

Install or Connect (Figures 1 through 9)

1. Original shim to the shaft. Use chassis grease to hold it in place.
2. Assembled axle tube and shaft to the carrier. Use no sealer at this time.
3. Bolts.

Tighten

- Bolts to 40 N·m (30 lb. ft.).

Measure (Figure 49)

- Shaft end play.

1. Install a dial indicator (J 8001) or equivalent on the axle tube end. The plunger of the indicator must be at a right angle to the axle flange (Figure 49).
2. Move the shaft back and forth and read the end play. Correct end play is 0.03 to 0.51 mm (0.001 to 0.020 inch).
3. If end play is incorrect, install a thicker or thinner shim as needed to bring end play into the specified range.

1. Bolts.
2. Axle tube assembly.

FINAL ASSEMBLY

Clean (Figures 1 through 9)

- Sealing surfaces of the tube and carrier assembly. Remove all oil and grease.

Install or Connect (Figures 1 through 9)

1. Shim, as selected previously, to the output shaft. Use grease to hold it in place.
2. Sleeve.
3. Spring.
4. Shift shaft, spring, shift fork, and clip assembly to the carrier case.
   - Damper spring fits into shift fork indentation.
   - Make sure clip is seated in groove of shift shaft.
   - Apply a bead of sealer GM P/N 1052942 or equivalent to the tube sealing surface.
5. Assembled tube to the carrier assembly.

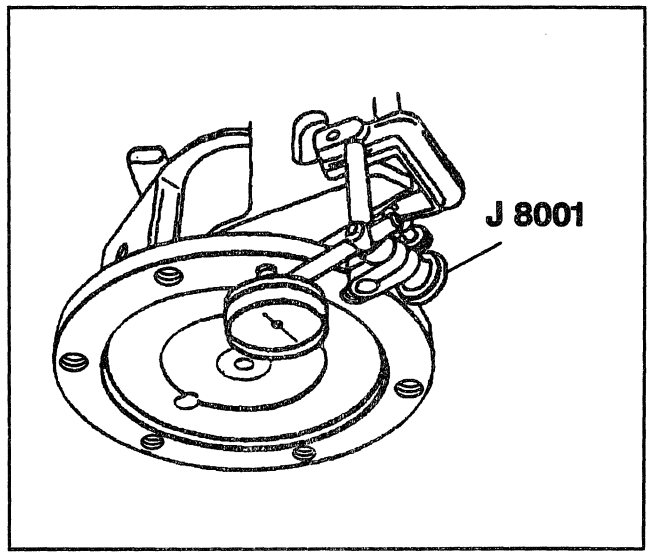


Figure 49—Measuring Axle Shaft End Play

6. Bolts.

Tighten

- Bolts to 40 N·m (30 lb. ft.).

Inspect (Figure 50)

- Shift mechanism operation. Insert a drift into the actuator hole in the axle tube. Rotate the axle flange while moving the shift fork with the drift. The shift mechanism should work smoothly, without binding.

7. Actuator. Apply sealer GM P/N 1052942 or equivalent to the threads.
8. Switch. Apply sealer GM P/N 1052942 or equivalent to the threads.
9. Axle lubricant, as specified.
10. Drain and fill plugs with sealing washers

Tighten

- Actuator bolts to 22 N·m (16 lb. ft.)
- Switch bolts to 5 N·m (45 lb. in.)
- Drain and fill plug to 33 N·m (24 lb. ft.)

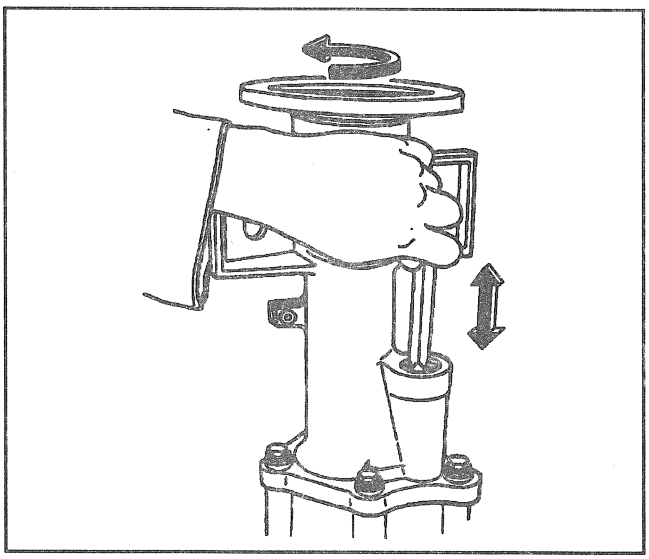


Figure 50—Checking the Shift Mechanism

DRIVE AXLE ASSEMBLY

OUTER DEFLECTOR RING REPLACEMENT

Remove or Disconnect (Figures 51 and 52)

- Clamp the axle shaft in a vise.
- Use soft metal or wood to protect the shaft.

1. Deflector ring from C/V outer race with a brass drift and a hammer (Figure 51).
   - Discard deflector ring.

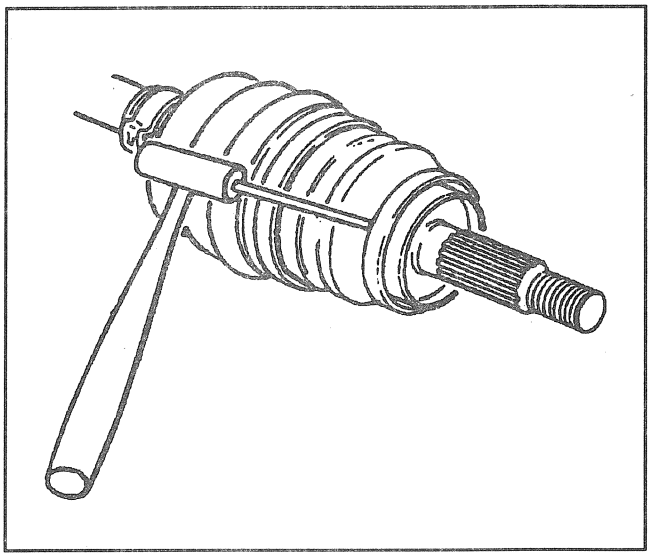


Figure 51—Removing Outer Deflector Ring

Install or Connect

- Position and square up the deflector ring at the press diameter of C/V outer race.
- Using a (1) 3-inch pipe coupling (K1 and K2) or 4-inch pipe coupling (K3), a (2) fabricated sheet metal sleeve, and a (3) M24 x 2.0 nut, as shown in (Figure 52), tighten nut until deflector bottoms against shoulder of C/V outer race.

ABS SENSOR RING REPLACEMENT

Tools Required:
J-39245-1 Sensor Ring Installer
J-39245-2 Sensor Ring Spacer (K1 and K2)

Remove or Disconnect (Figure 53)

1. Deflector ring from C/V outer race and discard.
2. Sensor ring with a drift (Figure 53).

Install or Connect

1. Light film of oil onto the inside of the sensor ring.
   - Ring must face with chamfer side up.
2. Sensor ring with J 39245.
   - On K1 and K2 models use both the large fixture and smaller spacer.
   - On K3 models use only the larger fixture.
3. Deflector ring.
   A. Position and square up the deflector ring at the press diameter of the outer race.
   B. Using a 3-inch pipe coupling (K1 and K2) or 4-inch pipe coupling (K3), M24 x 2.0 nut, and fabricated sheet metal sleeve, tighten nut until deflector bottoms against shoulder of C/V outer race.

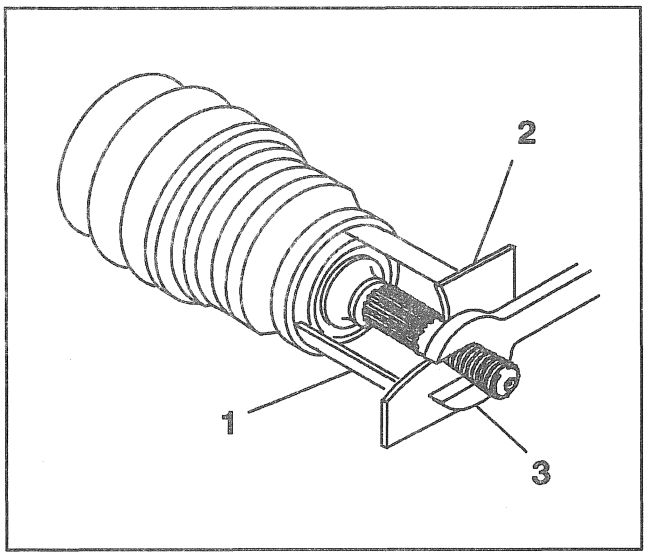


Figure 52—Installing Outer Deflector Ring

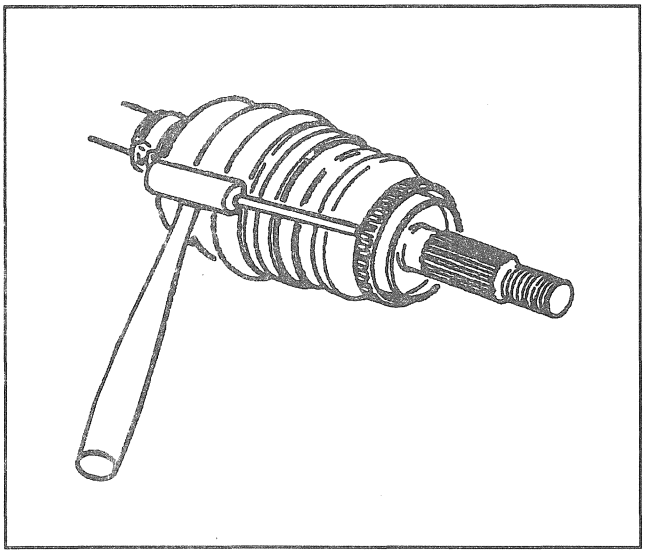


Figure 53—Removing ABS Sensor Ring

OUTER JOINT SEAL REPLACEMENT

Remove or Disconnect (Figures 54)

Tools Required:
J 8059 Snap Ring Pliers
J 35910 Seal Clamp Tool
J 36652 Swage Clamp Tool

1. Large swage ring from the C/V joint, using a chisel and discard.

Important

- Do not cut through the seal and damage the sealing surface of C/V outer housing with the chisel.

2. Small seal-retaining clamp on axle shaft using J 35910 (Figure 54).
   - Discard small seal retaining clamp.

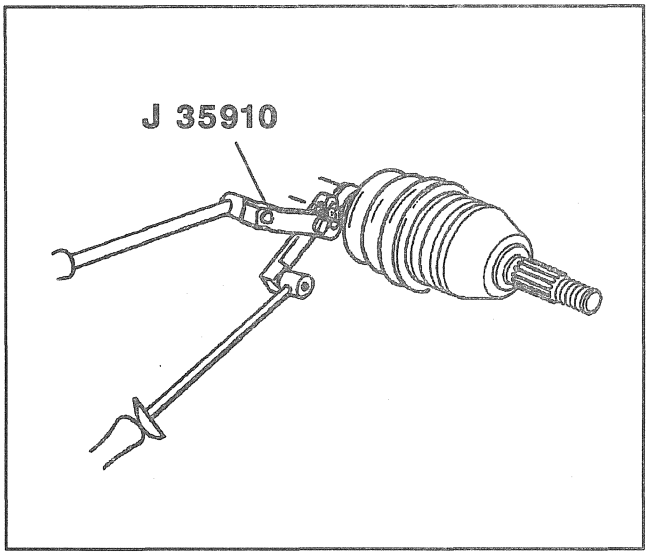


Figure 54—Removing C/V Joint

   A. Separate the joint seal from the C/V joint race at large diameter and slide the seal away from joint along the axle shaft.
   B. Wipe excess grease from face of C/V inner race.
   C. Spread the ears on the race retaining ring with J 8059 and remove the C/V joint assembly from the axle shaft.
3. Seal from the axle shaft.
   - Disassemble the joint and flush grease prior to installing the new seal. Refer to "Outer Joint Assembly Replacement" in this section.

Install or Connect (Figures 55 through 58)

1. Small seal-retaining clamp on the neck of the new seal. Do not crimp.
   A. Slide the seal onto the axle shaft and position the neck of the seal in the seal groove on the axle shaft.
   B. Crimp the self retaining clamp with J 35910 to 136 N·m (100 lb. ft.) (Figure 56).
   C. Place approximately half of the grease provided inside the seal and repack the C/V with the remaining grease.
2. Swage ring.
   A. Pinch by hand slightly to distort into an oval shape and slide onto large diameter of the seal.
   B. Push C/V joint onto axle shaft until retaining ring is seated in groove on axle shaft (Figure 55).
   C. Slide large diameter of the seal with the large swage ring in place over the outside of the C/V joint race and locate the seal lip in the housing groove.

Important

- The seal must not be dimpled, stretched or out of shape in any way. If the seal is not shaped correctly, carefully insert a thin flat blunt tool (no sharp edges) between the

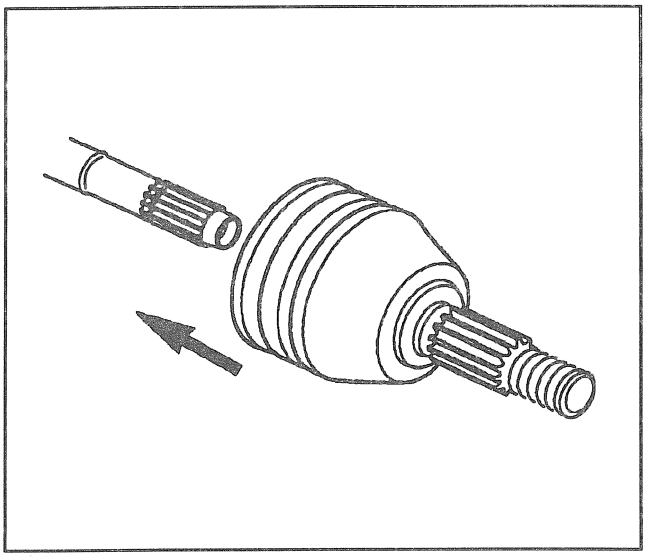


Figure 55—Installing C/V Joint

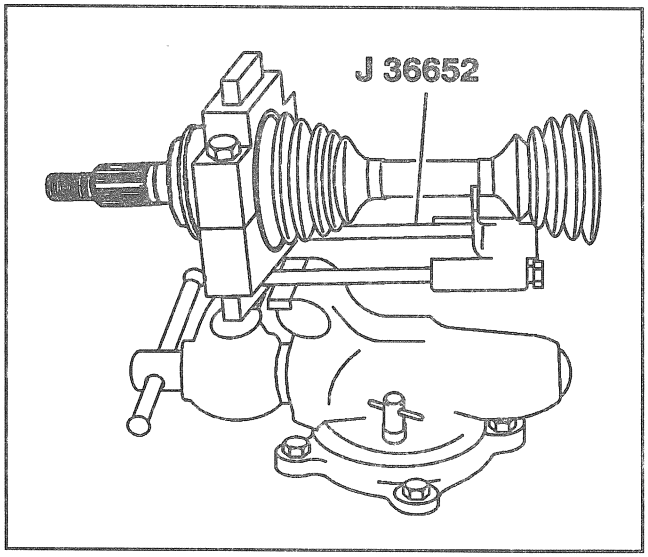


Figure 57—Installing Swage Ring

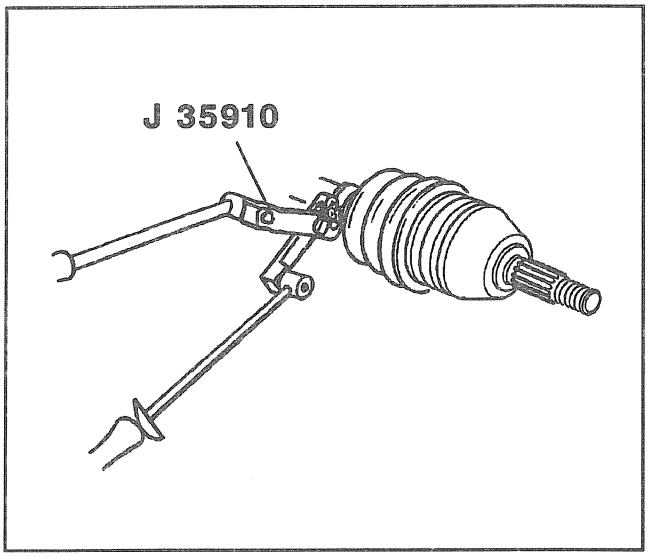


Figure 56—Installing Seal Retaining Clamp

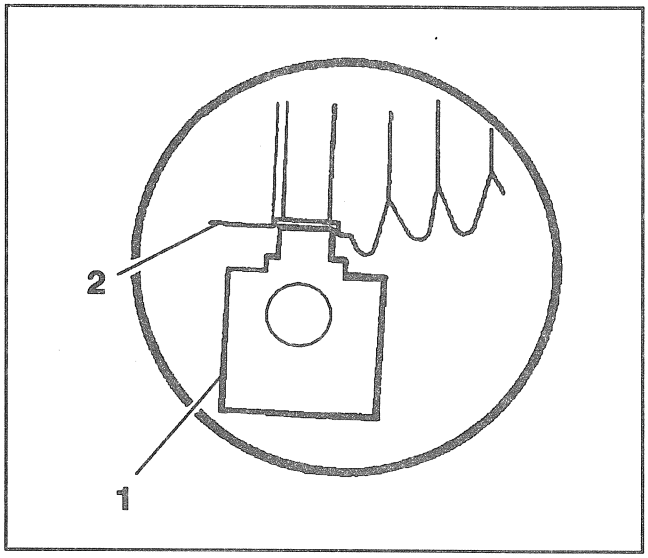


Figure 58—Swage Ring In Proper Alignment

large seal opening and the outer race at maximum clearance of oval ring to release the air. Shape the seal by hand and remove the tool.

D. Select the correct size swage clamp tool J 36652.

E. Mount the proper size swage clamp tool in the vise and proceed as follows:
   a. Position the **outboard** end of the axle assembly in the tool.
   b. Place the top half of the tool on the lower half of the tool and check for proper alignment (Figures 57 and 58).
   c. Insert the bolts and tighten by hand until snug.

Important

- Make sure the seal, (2) housing, and (3) swage ring all remain in alignment (Figures 57 and 58).

   d. Continue to tighten each bolt 180 degrees at a time alternately until both sides are bottomed.

F. Remove the axle assembly from the tool.

OUTER JOINT ASSEMBLY REPLACEMENT

Disassemble (Figures 59 and 60)

1. Perform Steps 1 through 3 in "Outer Joint Seal Replacement" in this section.
2. Use a brass drift and hammer to gently tap on the C/V joint cage until it is tilted enough to remove the first chrome alloy ball (Figure 59).
3. Tilt the cage in opposite direction to remove opposing ball.
   - Repeat this process until all six balls are removed.

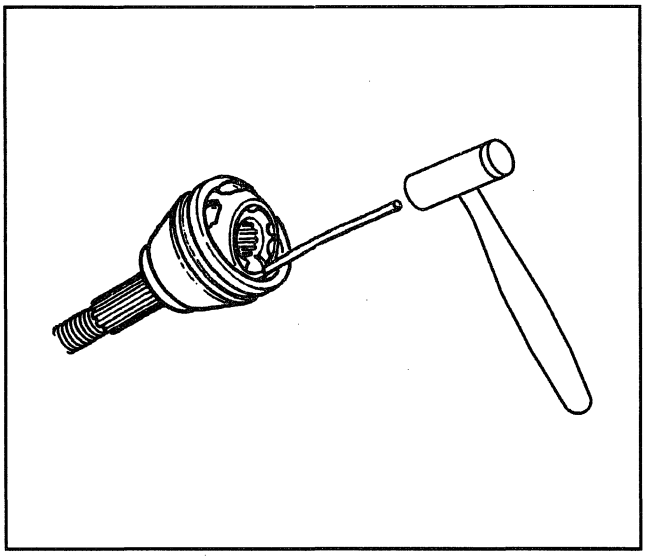


Figure 59—Removing C/V Joint Balls

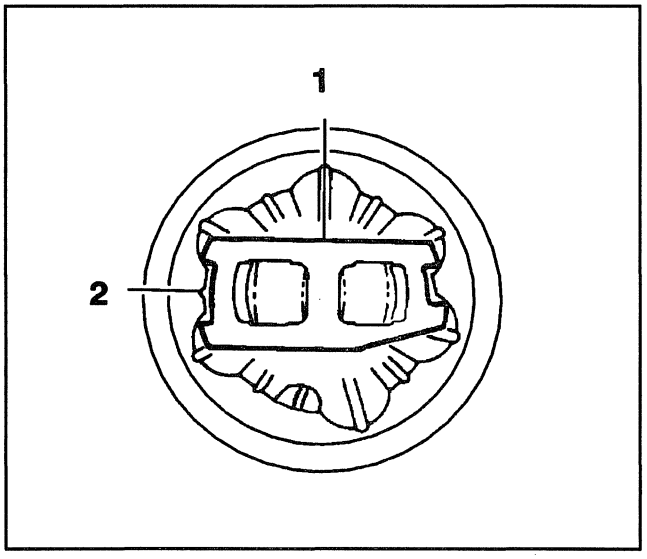


Figure 60—Separating Outer Race and Cage

4. Position the cage and the inner race 90 degrees to the centerline of the outer race and align the (1) cage windows with the (2) lands of the outer race (Figure 60).
5. Separate the cage and the inner race from the outer race.
6. Rotate the inner race 90 degrees to the center line of the cage with the lands of the inner race aligned with the windows of the cage (Figure 60).
7. Pivot the inner race into the cage window and remove the inner race.

Assemble (Figures 59 through 61)

- Apply chassis grease to the ball grooves of the inner race, and outer race.

1. Inner race to the cage.
   A. Rotate (3) inner race 90 degrees to center line of cage with (1) lands of inner race aligned with (2) windows of cage (Figure 61).

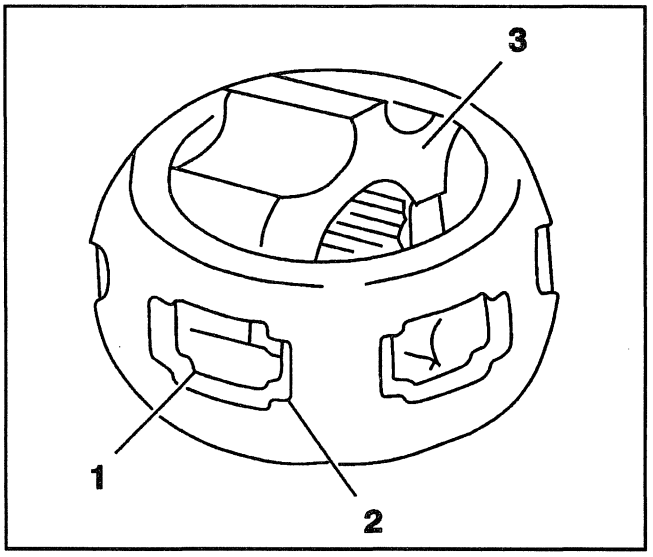


Figure 61—Separating Inner Race and Cage

   B. Align the (1) cage windows with the (2) lands. Pivot the cage into position (Figure 60).
   C. Make sure the retaining ring side of the inner race faces out.
2. Balls.
   A. Tap on the cage with a brass drift to tilt it enough to install the balls (Figure 59).
   B. Pack the joint with chassis grease.

Important

- Be sure that retaining ring side of inner race faces the axle shaft.

3. Install outer joint seal. Refer to "Outer Joint Seal Replacement" in this section.

INNER TRIPOT SEAL REPLACEMENT

Tools Required:
J 8059 Snap Ring Pliers
J 35910 Seal Clamp Tool
J 36652 Swage Clamp Tool

Remove or Disconnect (Figures 57, 58, and 62 through 65)

1. Large swage ring from the in-pot joint, using a chisel, and discard.

Important

- Do not cut through the seal with the chisel and damage the sealing surface of the tripot outer housing.

2. Small seal-retaining clamp from the axle shaft with a side cutter, and discard.
   - Separate seal from the tripot housing at the large diameter and slide the seal away from the joint along the axle shaft.
3. Tripot housing from the spider and shaft.
   - Spread the spacer ring with J 8059 and slide the spacer ring and the tripot spider back on the axle shaft (Figure 62).

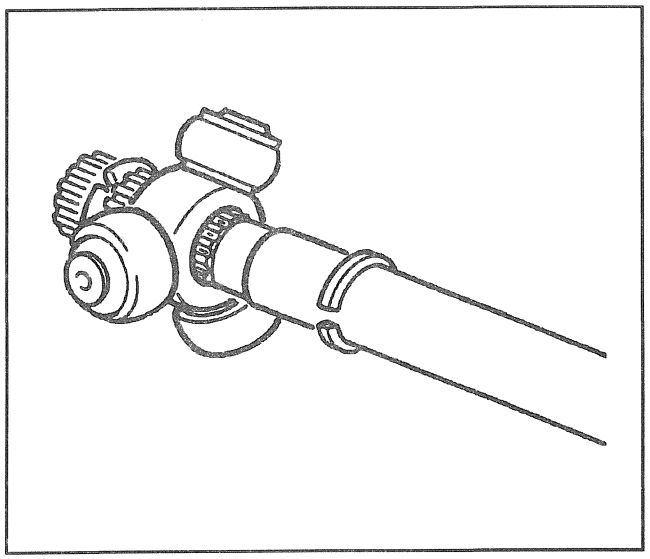


Figure 62—Removing Spider Assembly

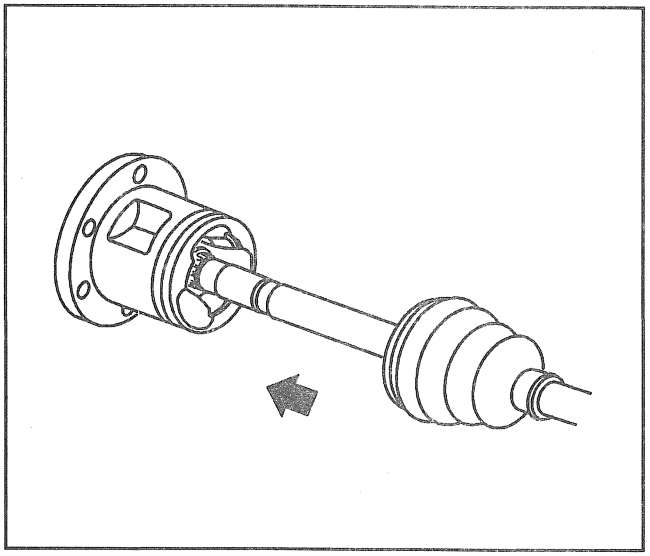


Figure 64—Installing Tripot to Housing

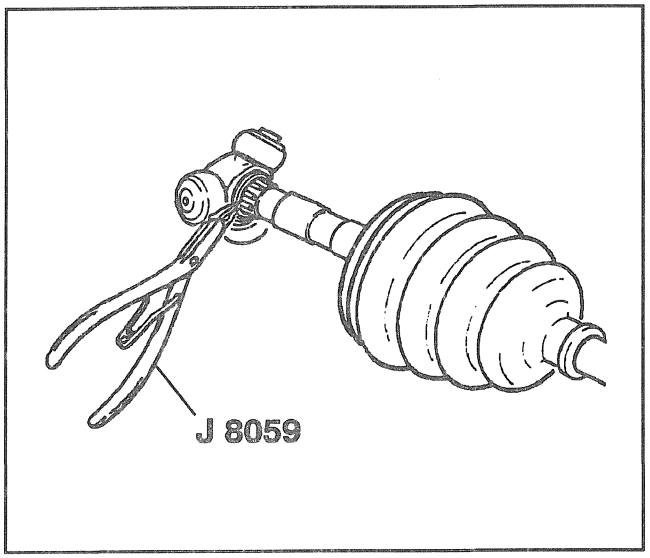


Figure 63—Installing Spider Assembly

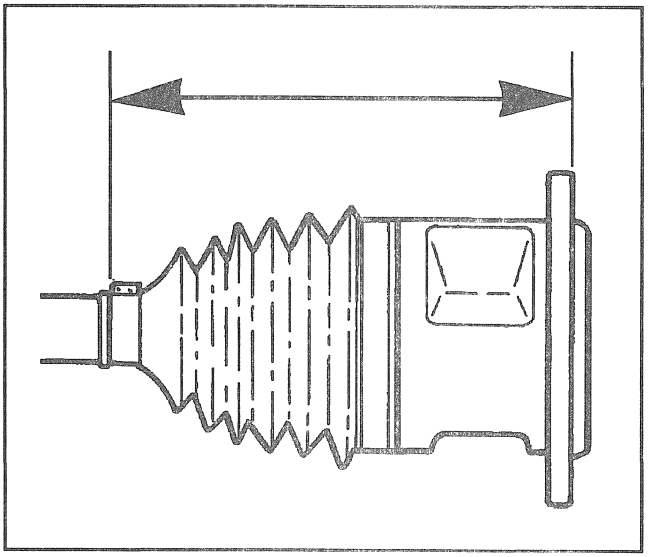


Figure 65—Tripot Seal Installation Measurements

4. Shaft retaining ring from the groove on the axle shaft and slide the spider assembly off the shaft.

Important

- Handle the tripot spider assembly with care or the tripot balls and needle rollers may separate from the spider trunions.

5. Remove the spacer ring and the seal from the axle shaft.
6. Flush grease from the housing.

Install or Connect (Figures 56, 63 through 65)

1. Small seal-retaining clamp on the neck of the seal.
   - Do not crimp.
2. Slide the seal onto the shaft and position the neck of the seal in the seal groove on the axle shaft.
   - Crimp seal retaining clamp using J 35910 to 136 N.m (100 lb. ft.) (Figure 56).
3. Spacer ring on the front axle shaft and beyond the second groove as shown (Figure 63).
   - Slide the tripot spider assembly against the spacer ring and the shaft.

Important

- Be sure that the counterbored face of the tripot spider faces the end of the shaft.

4. Shaft retaining ring in the groove of the axle shaft with J 8059.
5. Slide the tripot spider towards the end of the shaft and reseat the spacer ring in the groove on the axle (Figure 63).
   A. Place approximately half of the grease provided in the seal and use the remainder to repack the tripot housing.
6. Pinch the swage ring by hand slightly to distort it into an oval shape and slide it onto the large diameter of the seal.

7. Slide the tripot housing over the tripot spider assembly on the shaft (Figure 64).
8. Slide the large diameter of the seal with the large swage ring in place over the outside of the tripot housing and locate the seal lip in the housing groove.
9. Position the tripot assembly at the proper vehicle dimension as shown in Figure 65.

Important

- The seal must not be dimpled, stretched or out of shape in any way. If the seal is not shaped correctly, slide the swage ring off the seal and onto the housing. Carefully insert a thin, flat, blunt tool **(no sharp edges)** between the seal opening and the housing to release the air. Shape the seal properly by hand and remove the tool.

10. Return the swage ring to position on the seal.
    - Select the proper size swage clamp tool J 36652.
11. Mount the swage clamp tool in the vise and proceed as follows:
    A. Position the **inboard** end of the axle assembly in the tool.
    B. Place the top half of the proper size tool on the lower half of tool and check for proper alignment and dimension (Figures 57, 58 and 65).
    C. Insert the bolts and tighten by hand until snug.

Important

- Make sure that the seal, housing and swage ring all remain in alignment (Figures 57 and 58).

    D. Continue to tighten each bolt 180 degrees at a time, alternating until both sides are bottomed.
12. Remove the axle assembly from the tool.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Item	N·m	Lb. Ft.	Lb. In.
Actuator	22	16	—
Axle Tube Bolts	40	30	—
Carrier Case Bolts	47	35	—
Drain and Fill Plugs	33	24	—
Front Axle Switch	5.0	—	45
Ring Gear Bolts	120	88	—
Seal Retaining Clamp	136	100	—

AVAILABLE SHIM SIZES

Pinion Shaft Shims	
(K15-25 Models)	0.020-0.024-inch 0.025-0.029-inch 0.030-0.034-inch 0.035-0.039-inch
(K35 Models)	0.508-0.5842 mm 0.6096-0.7112 mm 0.7366-0.8382 mm 0.8386-0.9398 mm
Output Shaft Shims	
K15-25 Models	1.27, 1.78, 2.29, 2.70, 3.30, 3.81 mm
K35 Models	1.80, 2.30, 2.80, 3.30, 3.80, 4.30, 4.80 mm

PINION PRELOAD AND BACKLASH

Pinion Preload	1.7-2.8 N·m (15-25 lbs. in.)
Backlash	0.08-0.25 mm (0.003-0.010-inch)
(Preferred)	0.13-0.18 mm (0.005-0.007-inch)

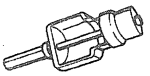
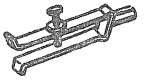
LUBRICATION

Capacity	Liters	Pints
8 1/4 Inch Ring Gear	2.0	4.5
9 1/4 Inch Ring Gear	2.8	6.0

Type.....SAE 80-W-90 GL-5 Gear Lubricant

T2518

SPECIAL TOOLS

1		J 29307	10		J 36616
2		J 36612	11		J 22761
3		J 36613	12		J 29710
4		J 8092	13		J 22888
5		J 8107-2	14		J 36609
6		J 36597			
7		J 3612-B	15		J 29369-1
8		J 36606	16		J 29369-2
9		J 8614-01	17		J 33842
			18		J 34011

1. Slide Hammer
2. Output Shaft Bearing Installer (K15-25)
3. Output Shaft Bearing Installer (K35)
4. Driver Handle
5. Side Bearing Puller Pilot (K15-25)
6. Side Bearing Puller Pilot (K35)
7. Pinion Bearing Remover (K15-25 Models)
8. Pinion Bearing Remover (K35 Models)
9. Pinion Flange Remover
10. Case Bushing Replacer
11. Differential Side Bearing Installer (K15-25 Models)
12. Differential Side Bearing Installer (K35 Models)
13. Differential Side Bearing Puller
14. Axle Tube Bearing Installer
15. Axle Tube Bearing and Seal Remover (K15-25 Models)
16. Axle Tube Bearing and Seal Remover (K35 Models)
17. Differential Pilot Bearing Installer
18. Differential Pilot Bearing Remover

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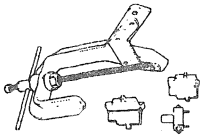
19  J 35512
20 J 36614

21  J 36366
22 J 36600
23 J 22833

24  J 36598

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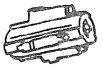
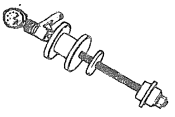
26  J-36599

27  J 36601

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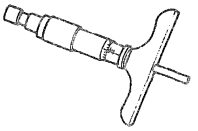
30  J 34672

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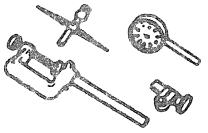
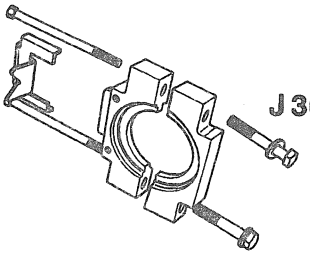
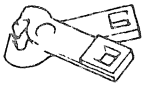
32  J 8001

33  J 36652

34  J 8059

35  J 35910

36  J 36603

19. Pinion Bearing Installer (K15-25 Models)
20. Pinion Bearing Installer (K35 Models)
21. Pinion Seal Installer
22. Axle Seal Installer (K15-25 Models)
23. Axle Seal Installer (K35 Models)
24. Holding Fixture and Pinion Service Tool
25. Dial Indicator Adapter
26. Side Bearing Adjuster Wrench
27. Pinion Depth Setting Gage
28. Dial Indicator
29. Dial Indicator
30. Depth Gage
31. Side Bearing Adjuster Wrench
32. Dial Indicator Set
33. Clamp Swage Tool Set
34. Snap Ring Pliers
35. Drive Axle Seal Clamp Pliers
36. Side Bearing Cup Installer

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BLANK

SECTION 4D1

DRIVE AXLE UNIT REPAIR

NOTICE: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

NOTICE: Handle drive axles with care when they are removed from the vehicle. Allowing the inboard joint to over-extend can cause separation of internal components and joint failure.

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GENERAL DESCRIPTION

Drive axles are flexible shaft assemblies that transmit rotational force from the transaxle to the front wheel assemblies. The axle assembly is made up of an inner and an outer constant-velocity (CV) joint connected to an axle shaft. The inner joint is completely flexible and has the ability of in-and-out movement. The outer joint is also flexible, but cannot move in-and-out.

Two types of joints are used in the drive axle. The outboard joint uses a Rzeppa design and the inner joint uses a tripot design. For trucks, the tripot housing is flanged and the flanged housing bolts to the front axle assembly.

The splined shaft end mating with the knuckle and hub assembly is a helical spline which provides a tight press-fit. This assures that no end play will exist between the hub bearing and the drive shaft assembly, for added durability and reduced bearing noise.

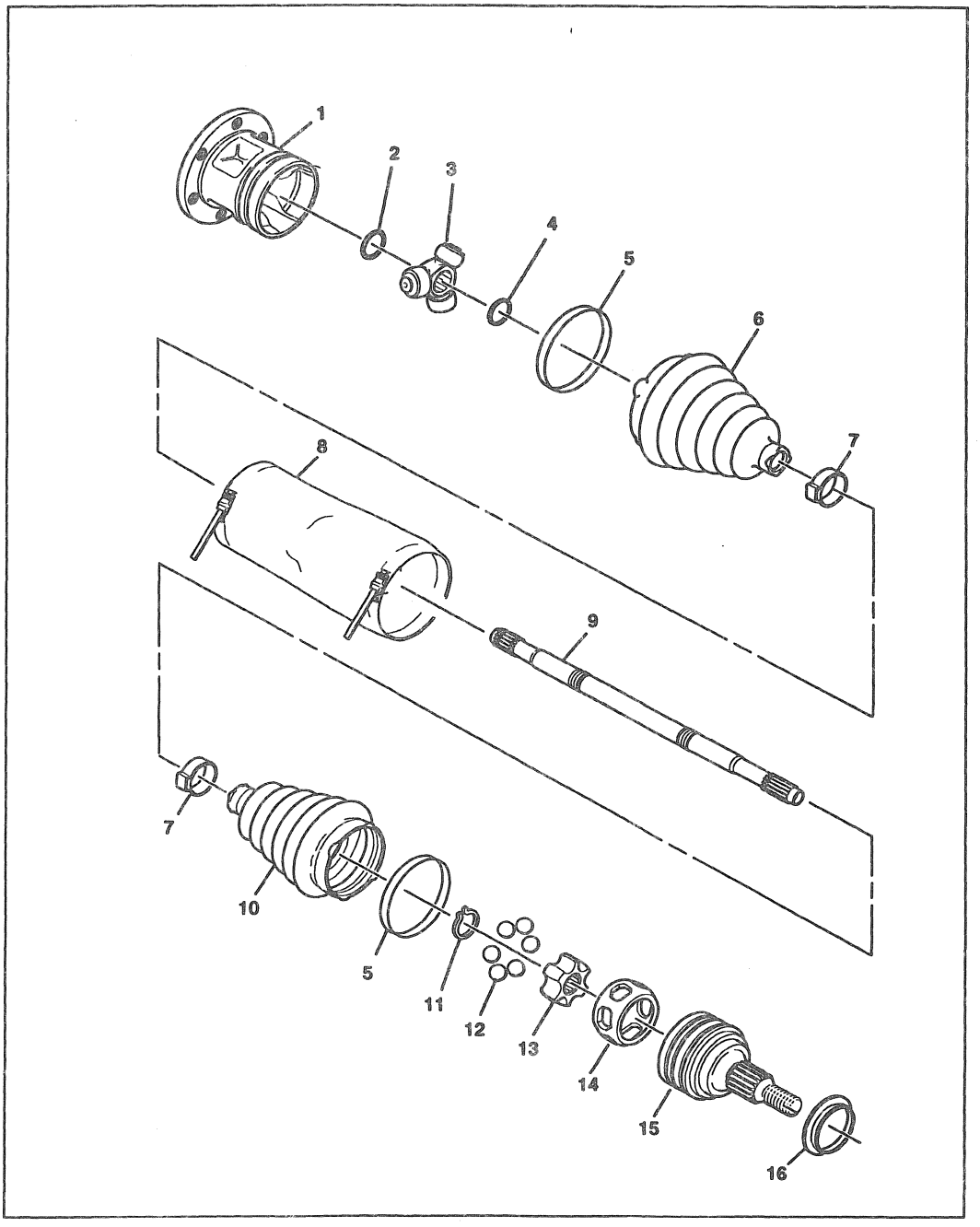
Drive Axle Unit Repair
GM K-Series 4x4 Trucks

Specifications

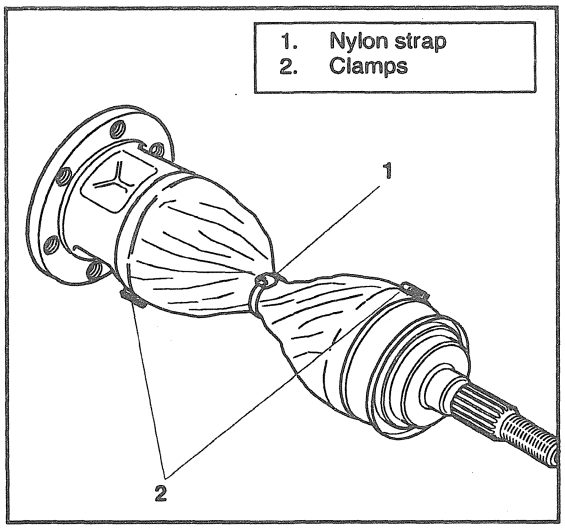
Fastener Tightening Specifications

Application	N·m	Lbs Ft	Lbs In
Small Seal Retaining Clamp	136	100	—

Drive Axle Components, Disassembled View



1. Tripot Housing Assembly
2. Drive Shaft Retaining Ring
3. Tripot Joint Spider Assembly
4. Spacer Ring
5. Swage Ring
6. Tripot Joint Seal
7. Small Seal Retaining Clamp
8. Drive Axle Seal Cover (Optional)
9. Drive Axle Shaft
10. CV Joint Seal
11. Race Retaining Ring
12. Ball
13. CV Joint Inner Race
14. CV Joint Cage
15. CV Joint Outer Race
16. Deflector Ring



Remove and Reinstall the CV Joint and Seal

Required Tools

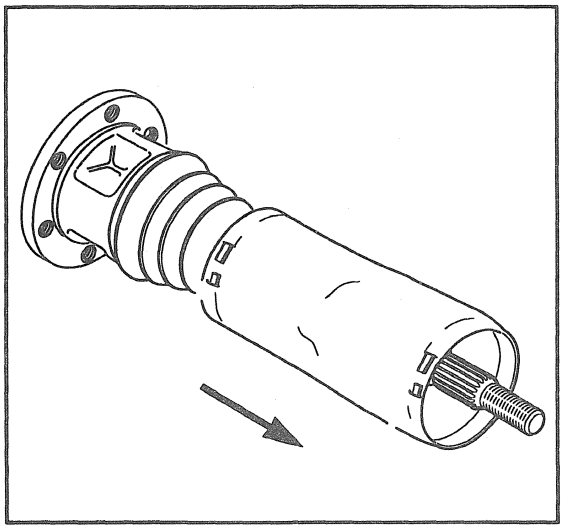
The joint and seal replacement procedures require the following special tools (or equivalent):

- J 8059 Snap Ring Pliers
- J 35910 Seal Clamp Tool

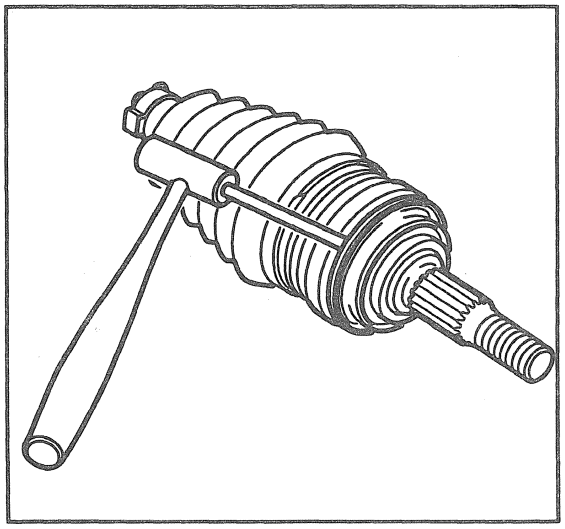
Remove the Drive Axle Seal Cover (Optional)

1. Use side cutters to cut the drive axle seal cover clamps and the nylon strap.

Important: If the drive axle seal cover will be reused, do not damage the drive axle seal cover while removing the clamps.



2. Slide the drive axle seal cover off of the drive axle, over the CV joint end.
3. Check the drive axle seal cover for rips, tears, worn spots or other damage. Reuse the drive axle seal cover if there is no damage visible.



Remove the Deflector Ring from the CV Joint Assembly

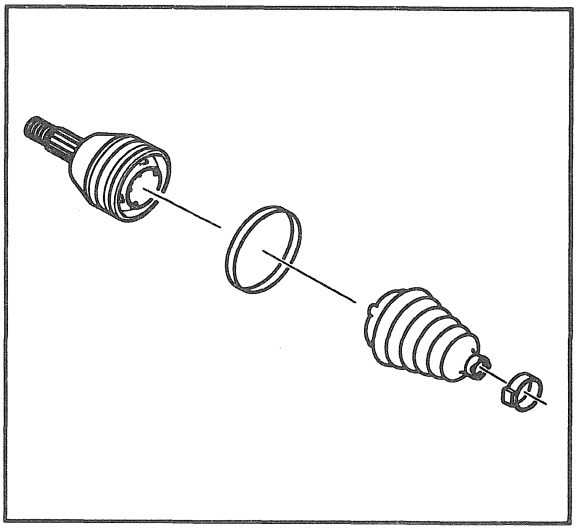
Use the following procedure to remove the deflector ring.

1. Inspect the deflector ring. Replace the deflector ring if the deflector ring is damaged.
2. Use a hammer and a brass drift to tap the damaged deflector ring off of the CV joint. Discard the deflector ring.

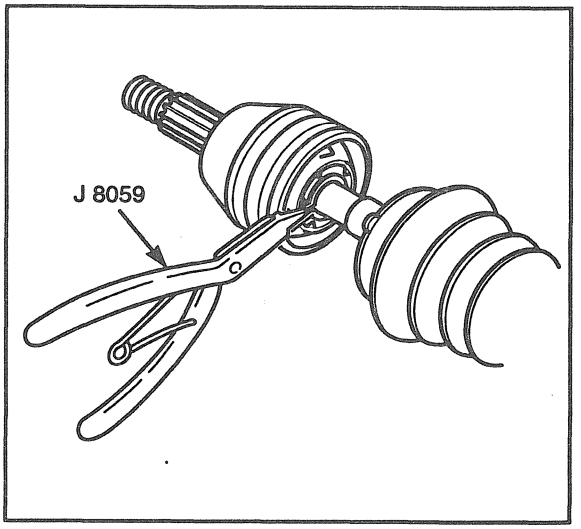
Disassemble the CV Joint and Seal

Remove the CV Joint and Seal from the Drive Axle

1. Place protective covers over the vise jaws. Place the drive axle in the vise.
2. Use a hand grinder to cut through the swage ring. Do not damage the outer race.
3. Use side cutters to cut off the small seal clamp.



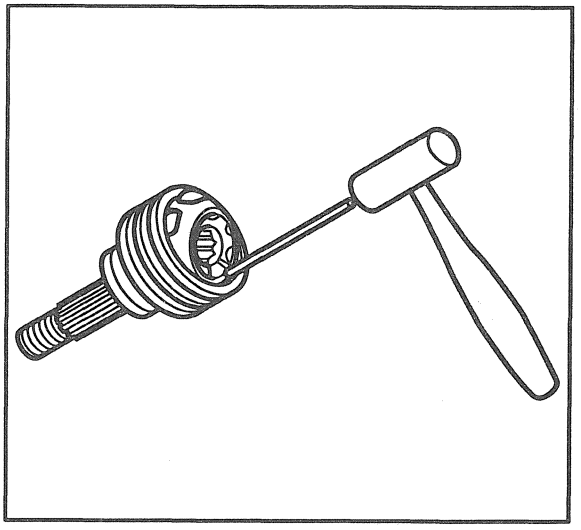
4. Slide the seal down the axle shaft and away from the CV joint outer race. Wipe all grease away from the face of the CV joint.
5. Find the axle shaft retaining snap ring, which is located in the inner race. Spread the snap ring ears apart with the snap ring pliers J 8059 (or equivalent).
6. Pull the CV joint and the CV joint seal from the axle shaft. Discard the old CV joint seal.

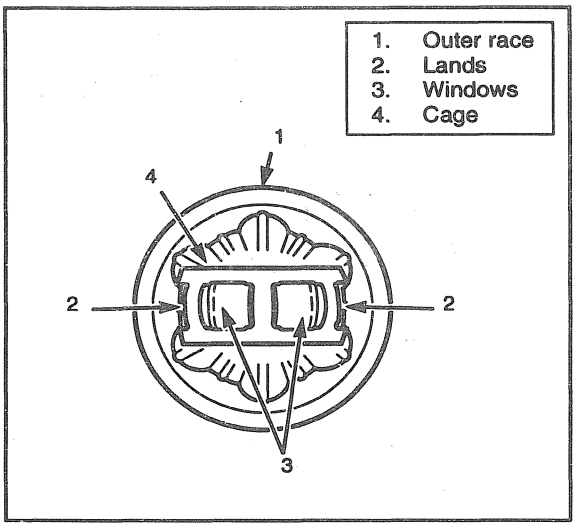


Disassemble the CV Joint

Use the following procedure to disassemble the CV joint.

1. Place a brass drift against the cage. Tap gently on the brass drift in order to tilt the cage. Remove the first ball when the cage tilts.
2. Repeat step 1. to remove all of the balls.

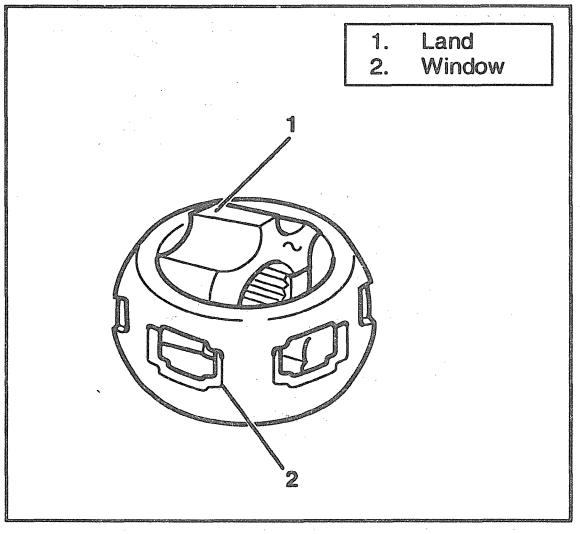




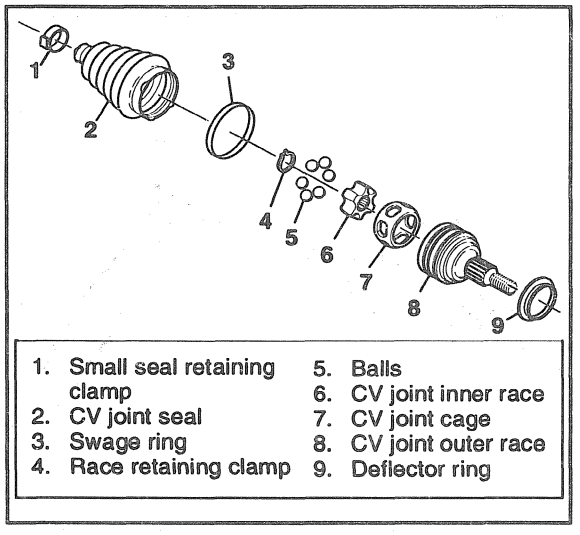
3. Pivot the cage and the inner race 90° to the center line of the outer race.

   At the same time, align the cage windows with the lands of the outer race.

   Lift out the cage and the inner race.



4. Remove the inner race from the cage by rotating the inner race upward.
5. Thoroughly degrease all of the CV joint parts.
6. Check the CV joint assembly for unusual wear, cracks, or other damage. Replace any damaged parts.
7. Clean the axle shaft. Use a wire brush to remove any rust in the seal mounting area (grooves).



Assemble the CV Joint and Seal

Required Tools

CV joint and seal assembly procedures require the following tools:

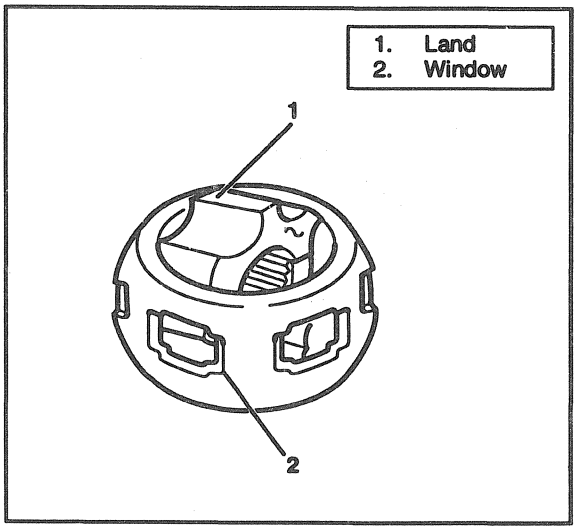
- J 35910 Seal Clamp Tool
- J 36652 Swage Clamp Tool
- J 36652-1 Split Plate Swage Clamp (K10/K20 models)
- J 36652-2 Split Plate Swage Clamp (K30 models)

Assemble the CV Joint

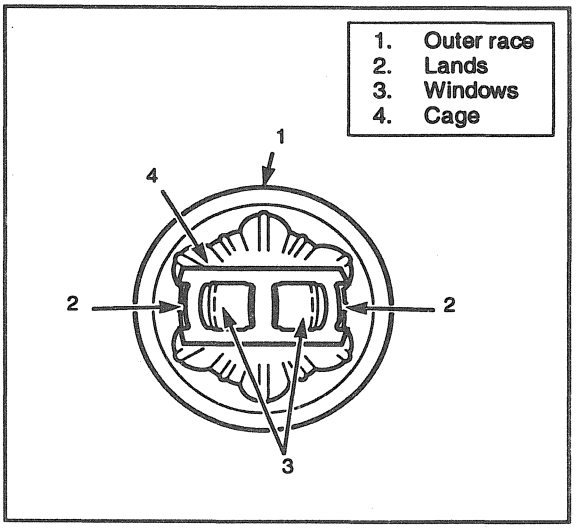
Use the following procedure to assemble the CV joint.

1. Inspect all of the parts for unusual wear, cracks, or other damage. Replace the joint assembly if necessary.
2. Put a light coat of the recommended grease on the inner and the outer race grooves.

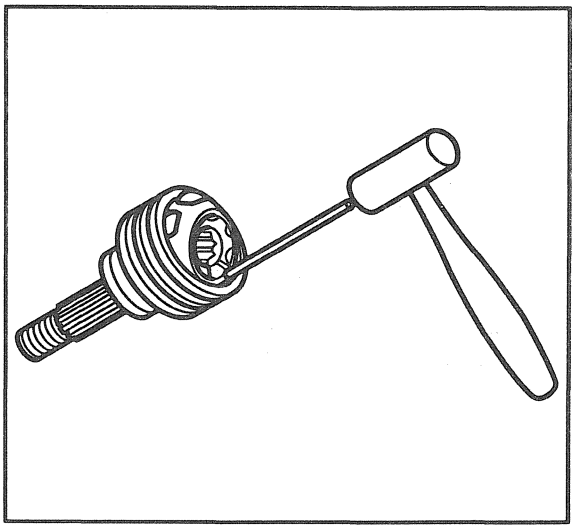
3. Insert the inner race into the cage by rotating the inner race downward:
   a. Hold the inner race at 90° to the centerline of the cage.
   b. Align the lands of the inner race with the windows of the cage.
   c. Insert the inner race into the cage, by rotating the inner race downward.

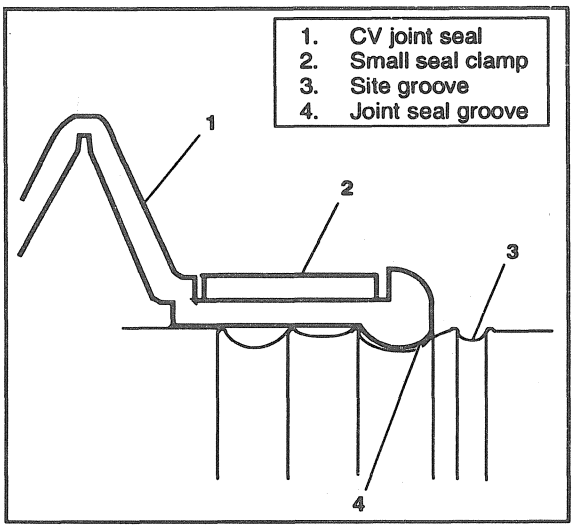


4. Insert the cage and inner race into the outer race.



5. Place a brass drift against the cage. Tap gently on the brass drift in order to tilt the cage. Install the first ball when the cage tilts. Tilt the cage in the opposite direction. Install the second ball on the side opposite the first ball.
6. Repeat step 5 to reinstall all of the balls.

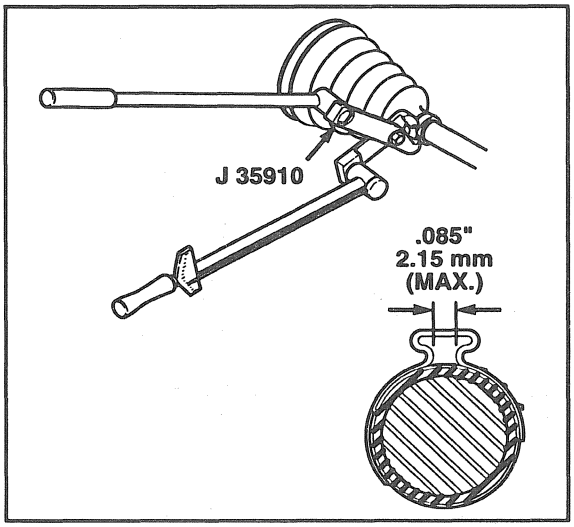




Reinstall the CV Joint and Seal onto the Drive Axle

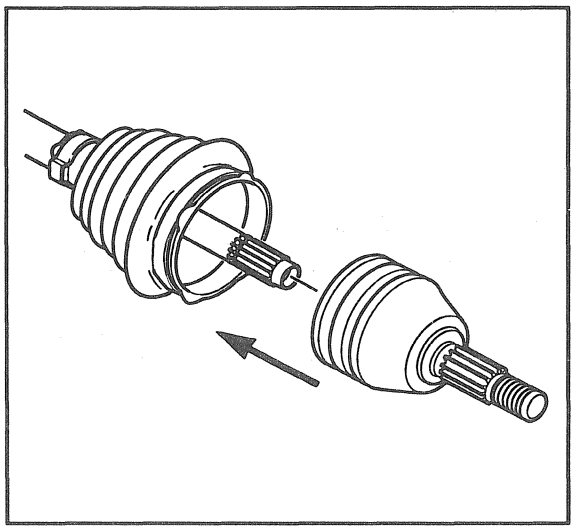
1. Pack the CV joint seal and the CV joint assembly with the grease supplied in the kit. The amount of grease supplied in this kit has been pre-measured for this application.
2. Place the new small seal clamp onto the CV joint seal.
3. Slide the CV joint seal onto the axle shaft.

   Position the small end of the CV joint seal into the joint seal groove on the axle shaft.



4. Secure the small seal clamp with tool J 35910 (or equivalent), a breaker bar, and a torque wrench.

   Torque the small clamp to 136 N•m (100 lb. ft.). Check the gap dimension on the clamp ear.



5. Pinch the new swage ring slightly by hand to distort it into an oval shape

   Slide the distorted swage ring over the large diameter of the seal.

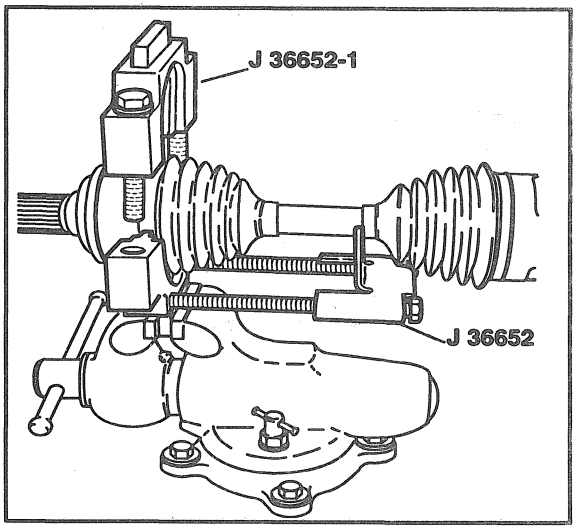
Important: Be sure that the retaining ring side of the CV joint inner race faces the axle shaft before installation.

6. Slide the CV joint onto the axle shaft. The retaining snap ring inside of the inner race engages in the axle shaft groove with a "click" when the CV joint is in the proper position.

   Pull on the CV joint to verify engagement.

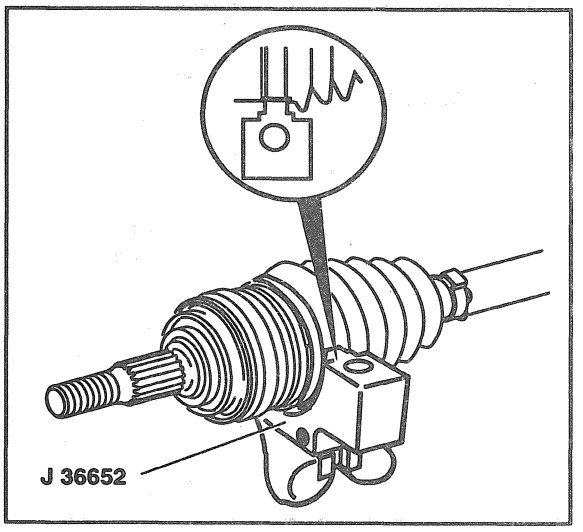
7. Slide the large diameter of the CV joint seal, with the large swage ring in place, over the outside edge of the CV joint outer race.

8. Clamp the CV joint seal tightly to the CV joint outer race with the large swage ring, using the following procedure:
   a. Mount the J 36652 Swage Clamp Tool in a vise.
   b. Install the bottom half of the split-plate swage clamp on the J 36652 Swage Clamp tool:
      - J 36652-1 Split Plate Swage Clamp (K10/K20 models)
      - J 36652-2 Split Plate Swage Clamp (K30 models)
   c. Position the CV joint end (outboard end) of the drive axle (halfshaft) assembly in the bottom half of the Swage Clamp tool.



Important: Make sure that the seal, housing and swage ring all remain in alignment during this procedure.

   d. Install the top half of the Swage Clamp tool onto the lower half of the Swage Clamp tool, over the CV joint and seal.
   e. Align the swage ring and the swage ring clamp.
   f. Insert the bolts into the Swage Clamp tool. Hand tighten the bolts until the bolts are snug.
   g. Tighten each bolt 180° at a time. Tighten each bolt alternately until both sides of the top half of the Swage Clamp tool touch the bottom half of the Swage Clamp tool.
   h. Loosen the bolts and remove halfshaft assembly from the Swage Clamp tool.



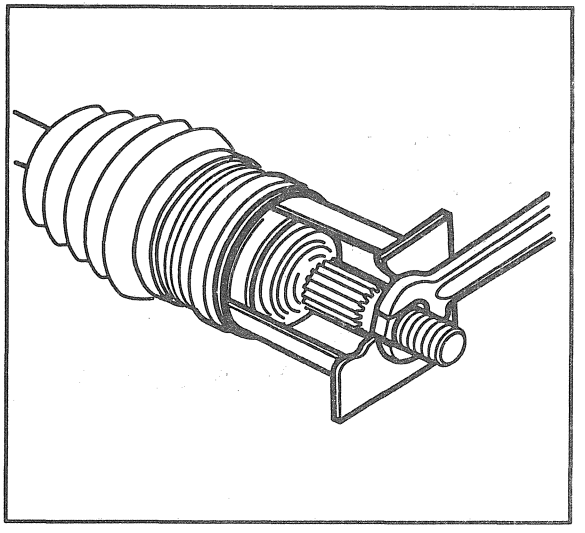
Install the Deflector Ring onto the CV Joint Assembly

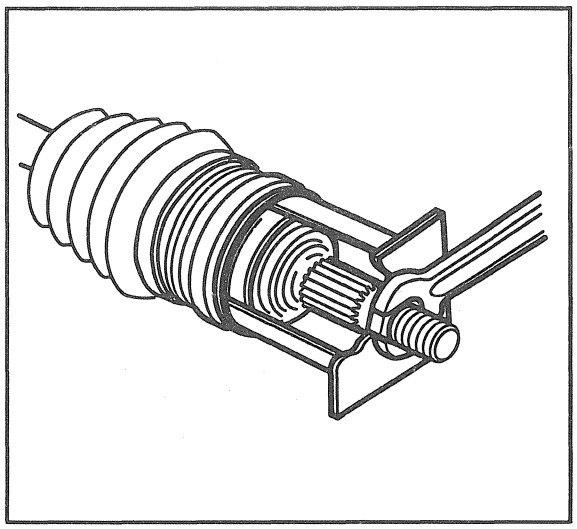
Required Tools

Deflector ring replacement procedures require a fabricated tool made from the following items:

- 3 inch or 4 inch pipe coupling
- 12 mm x 12 mm steel plate with a 28 mm hole drilled in the center. The plate must be at least 3 mm thick.
- M24 x 2.0 nut

1. Put the new deflector ring into position on the CV joint.
2. Put the 3 inch or 4 inch pipe coupling against the deflector ring. Put the 12 mm x 12 mm steel plate over the pipe. The axle shaft will protrude through the 28 mm hole in the steel plate.





3. Install the M24 x 2.0 nut on the axle shaft. Tighten the M24 x 2.0 nut until the deflector ring bottoms against the CV joint.
4. Remove the nut, the steel plate and the pipe coupling.

Notice: If the tripot end of the drive axle (halfshaft) assembly does not require service, follow the directions for installation of the drive axle seal cover, found at the end of this section.

Remove and Reinstall the Tripot Joint and Seal

Required Tools

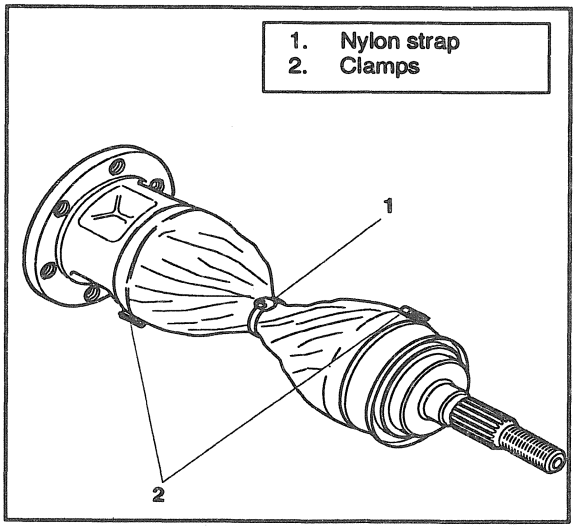
The joint and seal replacement procedures require the following special tools (or equivalent):

- J 8059 Snap Ring Pliers
- J 35910 Seal Clamp Tool

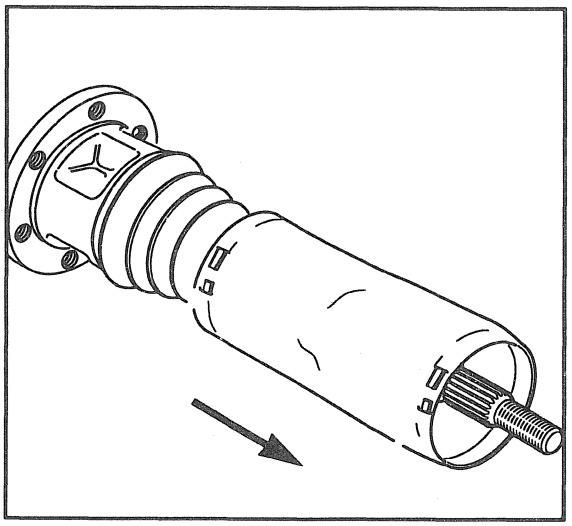
Remove the Drive Axle Seal Cover (Optional)

1. Use a side cutters in order to cut the drive axle seal cover clamps and the nylon strap.

Important: If the drive axle seal cover will be reused, do not damage the drive axle seal cover while removing the clamps.



2. Slide the drive axle seal cover off of the drive axle, over the CV joint end.
3. Check the drive axle seal cover for rips, tears, worn spots or other damage. Reuse the drive axle seal cover if there is no damage visible.



Disassemble the Tripot Joint and Seal

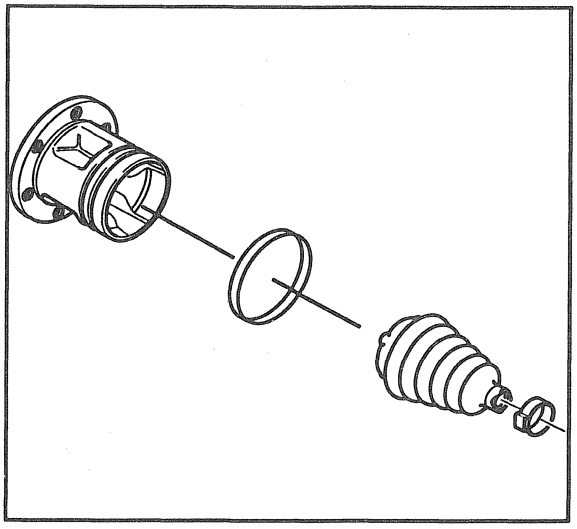
Remove the Tripot Joint and Seal from the Drive Axle

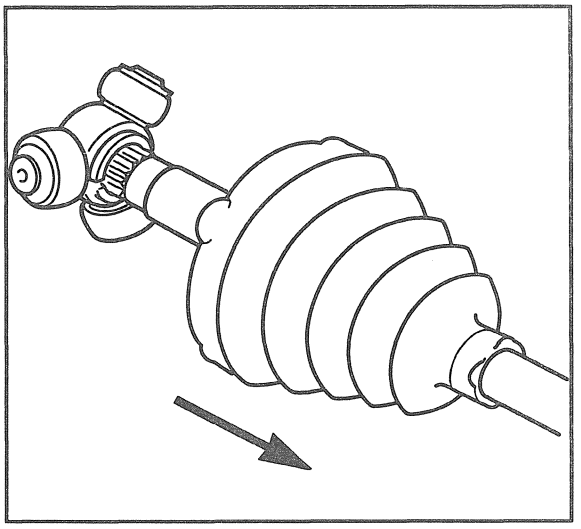
Required Tools

Seal removal procedures require the following special tool (or equivalent):

- J 8059 Snap Ring Pliers

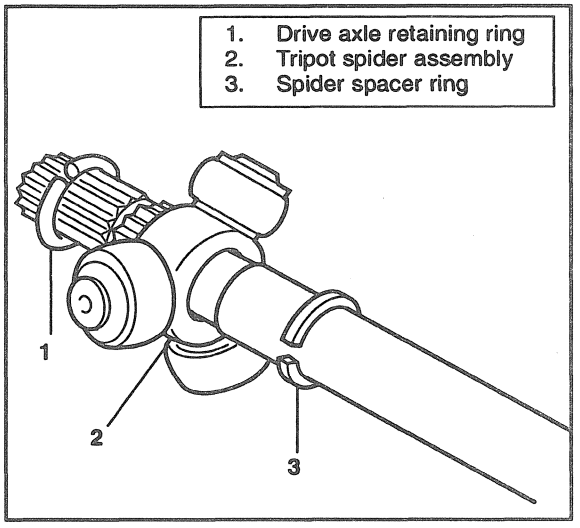
1. Use a hand grinder in order to cut through the swage ring. Do not damage the tripot housing.
2. Remove the tripot housing from the drive axle. Wipe the grease off of the tripot assembly roller bearings and the tripot housing. Thoroughly degrease the tripot housing. Allow the tripot housing to dry prior to assembly.





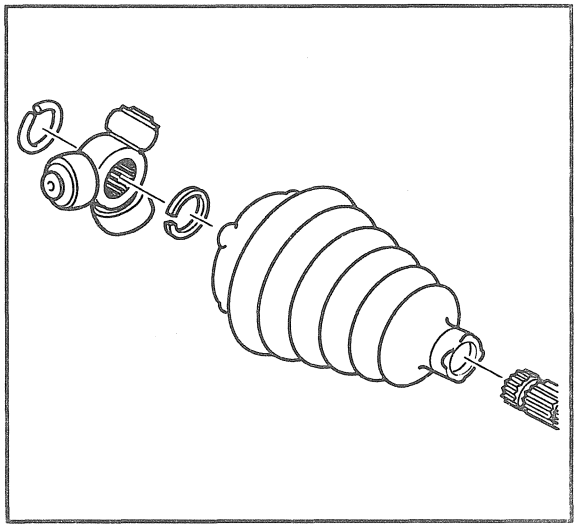
Important: Handle the tripot spider assembly with care. Tripot balls and needle rollers may separate from the spider trunnion if the tripot balls and needle rollers are not handled carefully.

3. Use side cutters to cut away the small seal clamp.
4. Slide the tripot seal up the drive axle shaft, away from the tripot spider assembly toward the outboard (CV joint assembly) end of the drive axle.



5. Move the tripot spider assembly in the following manner:
   a. Spread the spider spacer ring with tool J 8059 (or equivalent).
   b. Slide the spider spacer ring and the tripot spider assembly up on the drive axle.

   This will provide access to the drive axle retaining ring which is in the groove at the end of the drive axle.



6. Remove the retaining ring, spider assembly, spacer ring, and tripot seal.
7. Clean the drive axle. Use a wire brush in order to remove any rust in the seal mounting area (grooves).

   Inspect the needle rollers, needle bearings, and trunnion. Check the tripot housing for unusual wear, cracks, or other damage. Replace any damaged parts.

Assemble the Tripot Joint and Seal

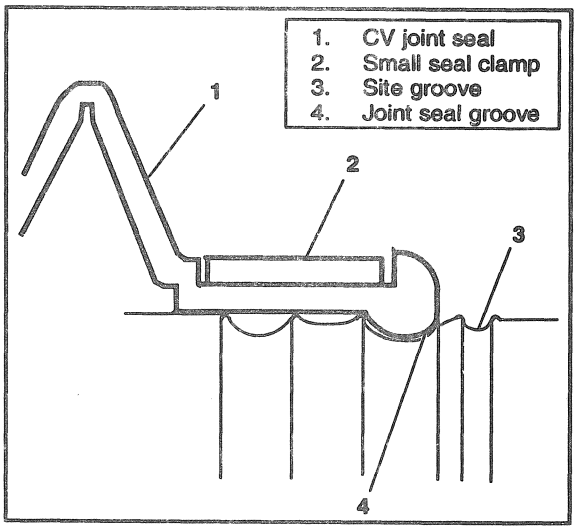
Install the Tripot Joint and Seal onto the Drive Axle

Required Tools

Joint and seal assembly procedures require the following tools:

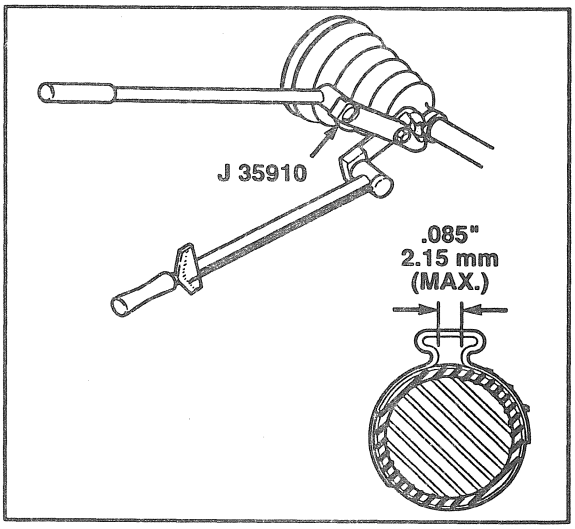
- J 35910 Seal Clamp Tool
- J 36652 Swage Clamp Tool
- J 36652-1 Split Plate Swage Clamp (K10/K20 models)
- J 36652-2 Split Plate Swage Clamp (K30 models)
- 784076 Convolute Retainer

Use the following procedure in order to assemble the tripot joint and joint seal.

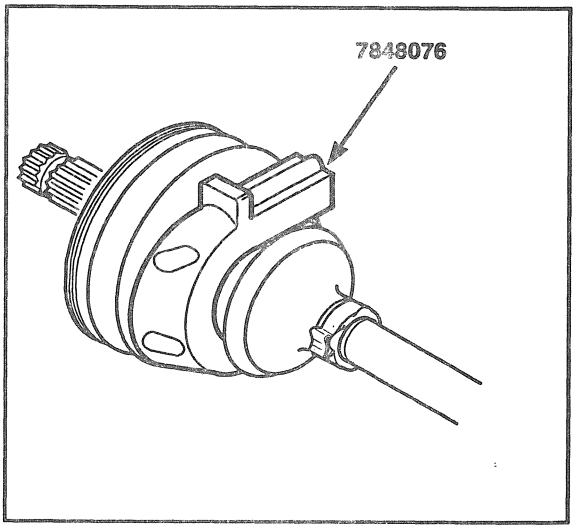


1. Place the new small seal clamp onto the small end of the joint seal. Slide the joint seal and small seal clamp onto the axle shaft.
2. Position the small end of the joint seal into the joint seal groove on the axle shaft.
3. Secure the small seal clamp with the tool J 35910 (or equivalent), a breaker bar, and a torque wrench.

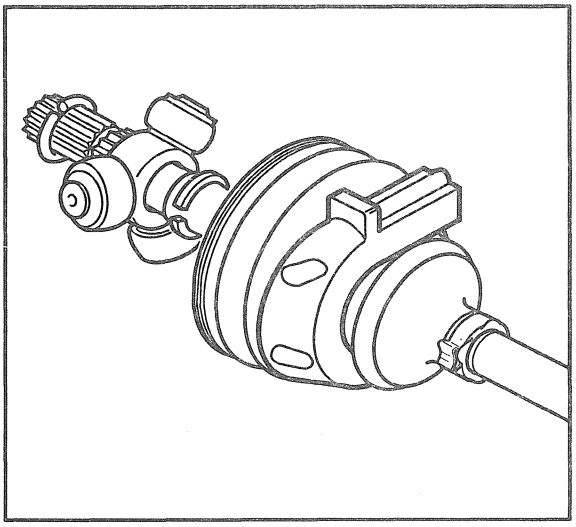
   Torque the small seal clamp to 136 N·m (100 lb. ft.). Check the gap dimension on the clamp ear.



4. Install the convolute retainer (tool 7848076) over the inboard joint seal, being sure to capture three convolutions.



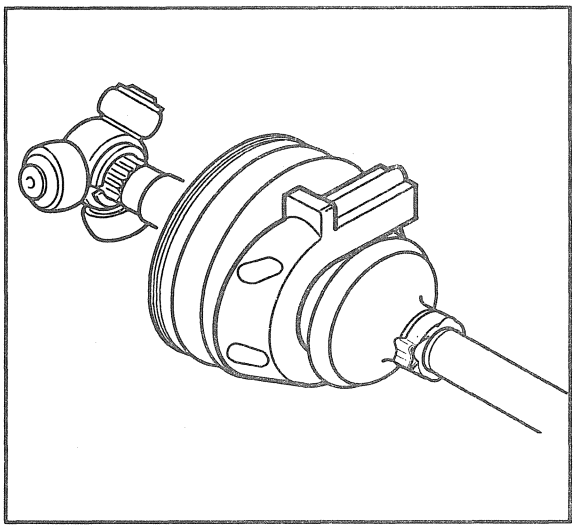
Important: You must assemble the joint with the convolute retainer (tool 7848076) in the correct position, as illustrated. The joint seal will be damaged if the joint assembly does not meet the specified dimension.



5. Install the spider spacer ring and tripot spider assembly onto the axle shaft with the counterbore towards the end of the axle shaft.

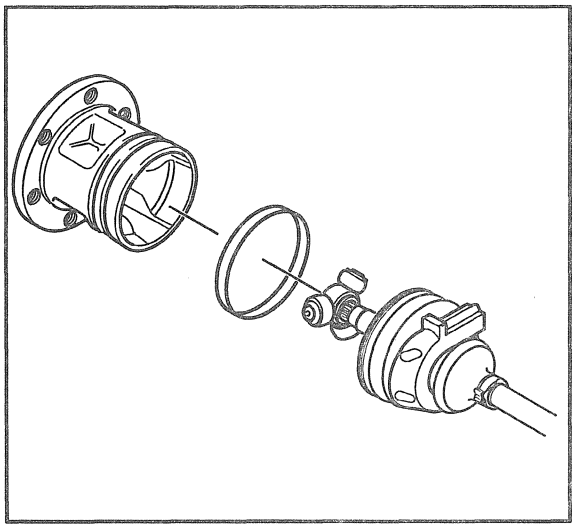
   Push the spider spacer ring and the tripot spider assembly onto the axle shaft far enough to allow for installation of the retaining ring in the groove at the end of the axle shaft.

6. Install the retaining ring in the groove at the end of the axle shaft.



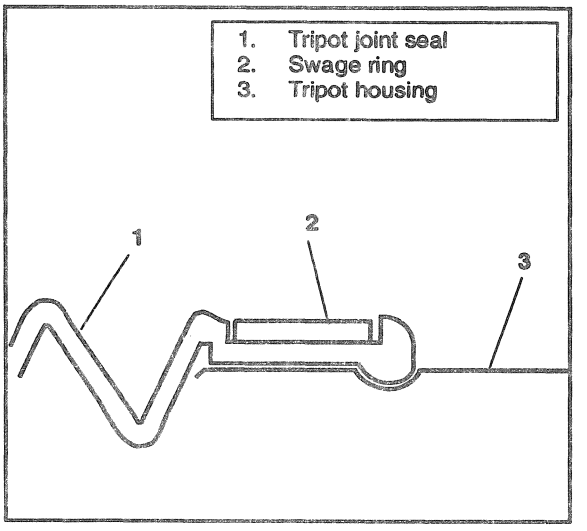
7. Push the spider assembly back toward the end of the axle shaft until the retaining ring is covered by the spider assembly counterbore.

8. Move the spider spacer ring back toward the end of the axle shaft. Seat the spider spacer ring in the spacer ring groove. Make sure the spider spacer ring is fully seated.

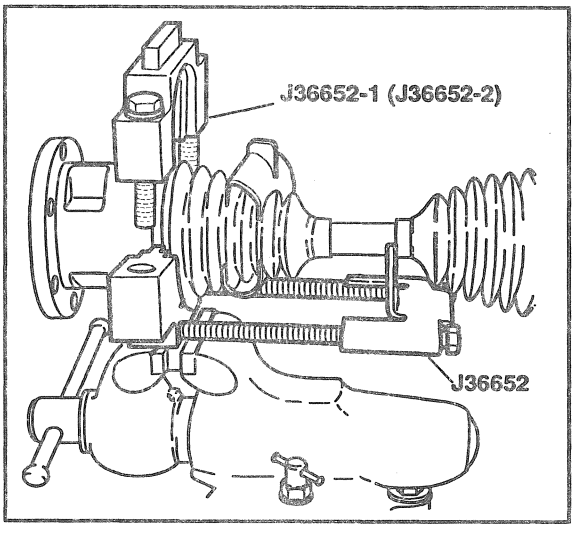


9. Pack the tripot seal and the tripot housing with the grease supplied in the kit. The amount of grease supplied in this kit has been pre-measured for this application.

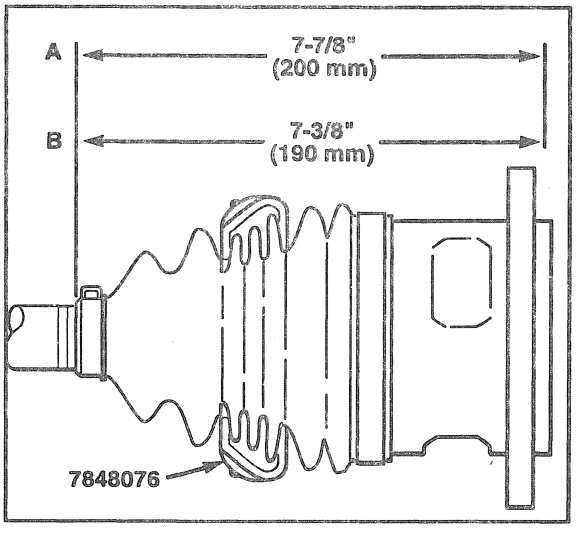
10. Reassemble the tripot housing and the tripot seal using the following procedure:
    a. Pinch the swage ring slightly by hand in order to distort it into an oval shape
    b. Slide the distorted swage ring over the large diameter of the seal.
    c. Place the housing over the spider assembly.
    d. Install the seal onto the housing.
    e. Align the tripot seal, with the swage ring in place, over the flat area on the tripot housing.

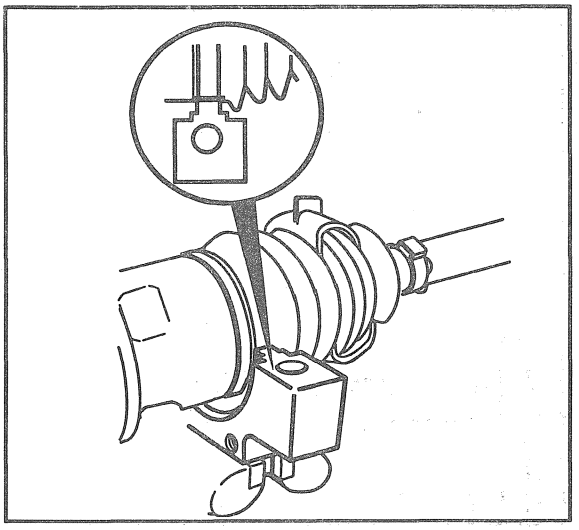


11. Mount the J 36652 Swage Clamp Tool in a vise.
12. Install the bottom half of the proper split plate swage clamp on the J 36652 Swage Clamp tool:
    - J 36652-1 for K10 and K20 models
    - J 36652-2 for K30 models



13. Check the inboard stroke position.
    Use measurement A for the K10 and the K20 models.
    Use measurement B for the K30 models.

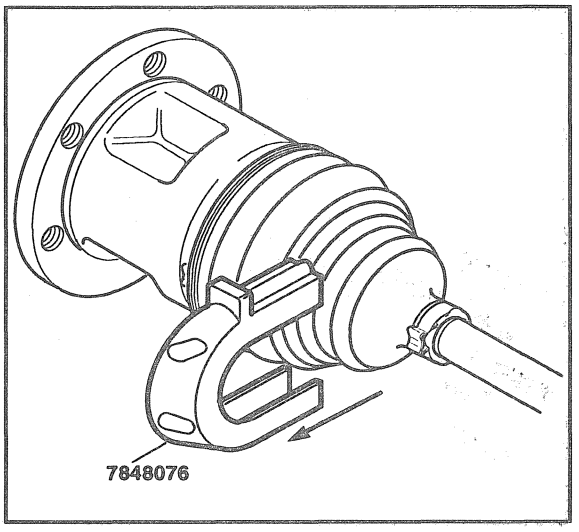




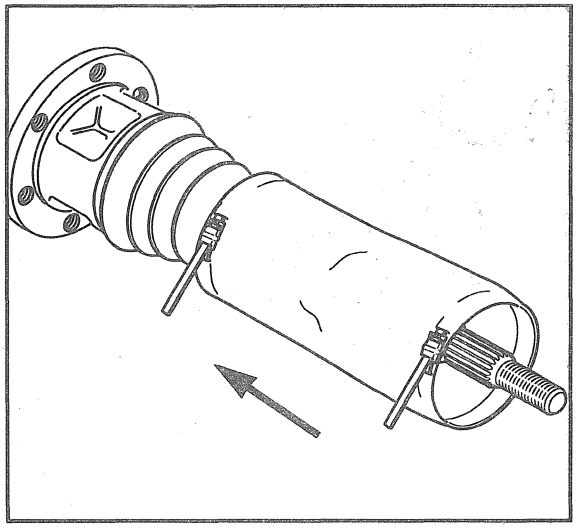
14. Position the inboard end (tripot end) of the drive axle (halfshaft) assembly in the Swage Clamp tool.
15. Install the top half of the proper size tool on the lower half of the tool.
    a. Align the swage ring and the swage ring clamp.
    b. Insert the bolts and hand tighten until snug.

Important: Make sure that the seal, housing and swage ring all remain in alignment during this procedure.

16. Tighten each bolt 180° at a time. Tighten each bolt alternately until both sides touch the bottom half of the tool.
17. Loosen bolts and remove halfshaft assembly from the tool.



18. Remove the convolute retainer (tool 7848076) from the seal.



Install the Drive Axle Seal Cover (Optional)

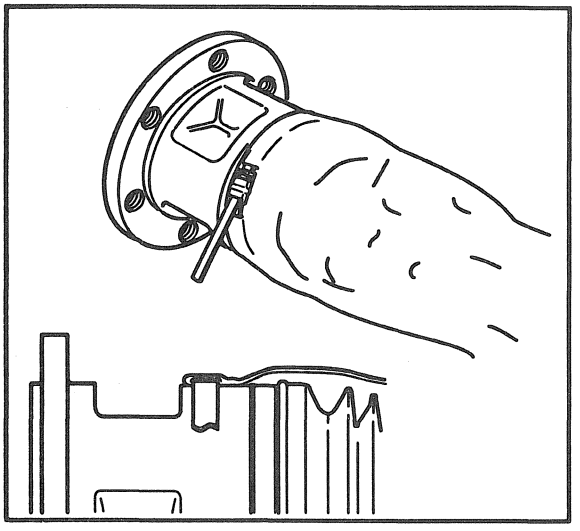
Tools Required

Installing the drive axle seal cover requires the following special tool (or equivalent):

- J 41187 Band-it type tool

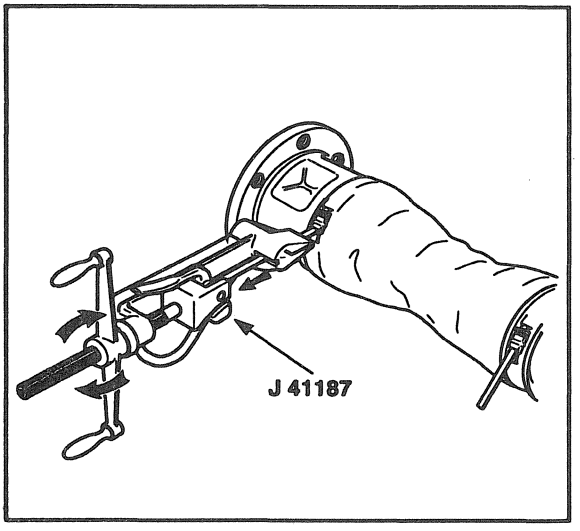
1. Insert new clamps into the original drive axle seal cover (if you are reusing the original drive axle seal cover).
2. Slide the drive axle seal cover onto the drive axle halfshaft assembly, starting at the outboard (CV joint) end.

3. Align the inboard clamp on the inboard joint. Align the seal cover seam so the seam is straight.

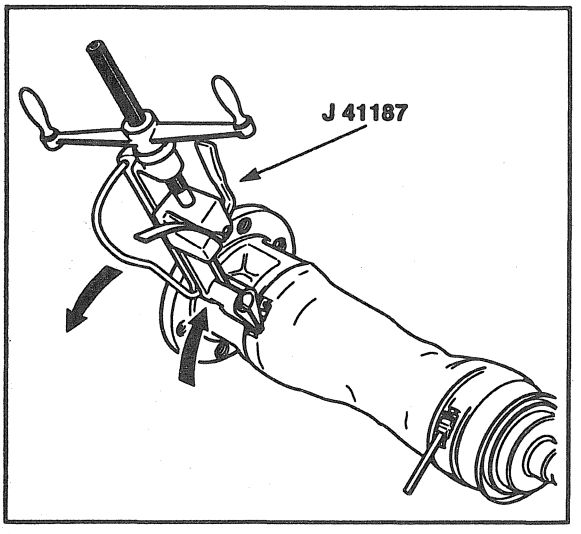


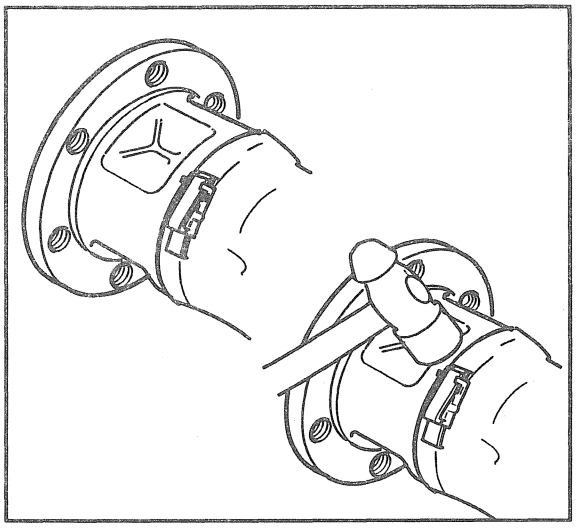
4. Use the tool J 41187 in order to tighten the inboard seal cover clamp.

Important: Tighten the seal cover clamp as tight as possible without deforming the retaining clip. Clamps that are not tight enough allow the cover to slide upon the joint. This causes shortened service life.

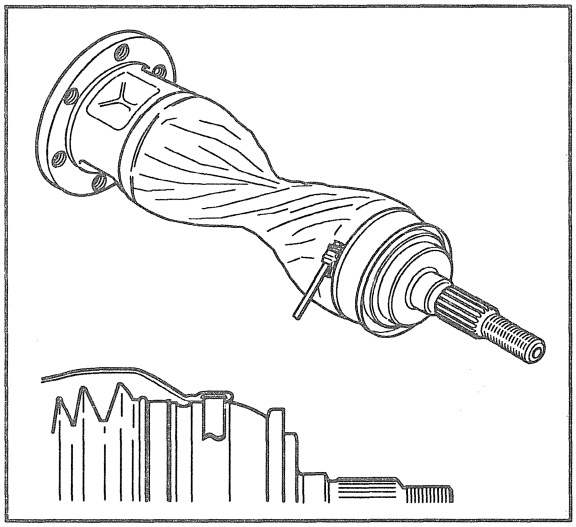


5. Rotate the tool toward the clip in order to bend the band onto the clip.
6. Pull on the tool's cutting handle in order to cut off the excess band.



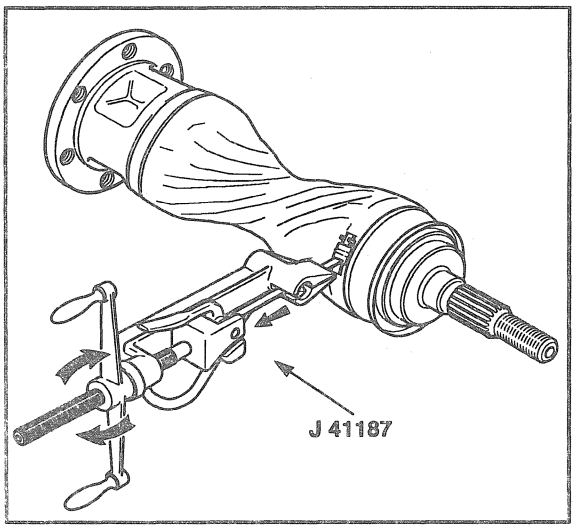


7. Pound the band flat between the latch tabs. Peen the latch tabs over in order to lock the band into position.



8. Twist the drive axle seal cover 180°. Position the outboard end of the drive axle seal cover over the CV joint flat.

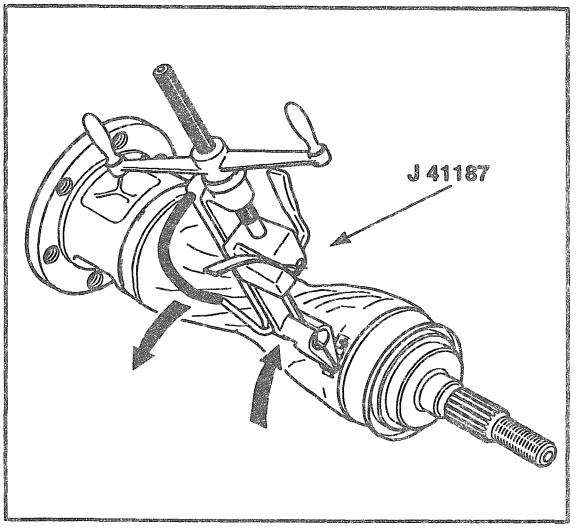
Important: Be sure that the inboard tab of the drive axle seal cover is 180° opposite the outboard tab of the drive axle seal cover before proceeding.



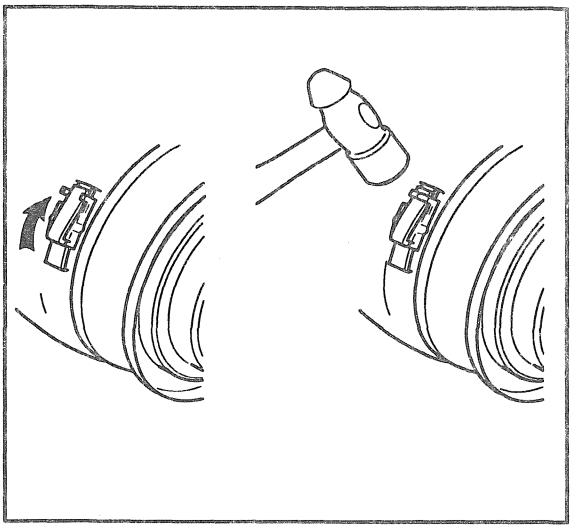
9. Use the J 41187 in order to tighten the outboard cover clamp.

Important: Tighten the seal cover clamp as tight as possible without deforming the retaining clip. Clamps that are not tight enough allow the cover to slide upon the joint. This causes shortened service life.

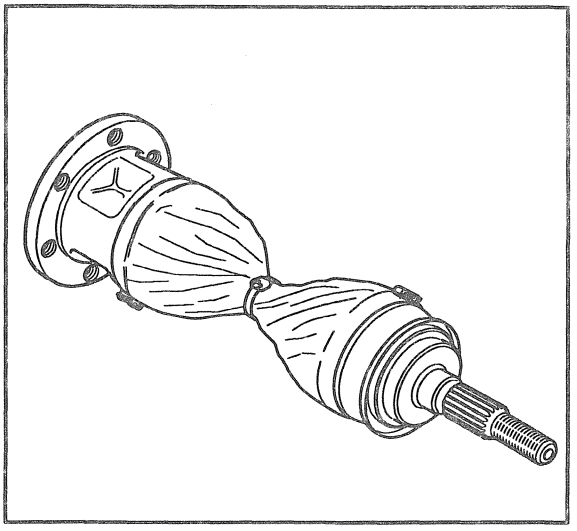
10. Rotate the tool toward the clip in order to bend the band onto the clip.
11. Pull the tool's cutting handle in order to cut off excess band.



12. Pound the band flat between the latch tabs. Peen the latch tabs over in order to lock the band into position.



13. Gather the drive axle seal cover material at the center. Wrap the drive axle seal cover tightly with the nylon strap, which is provided in the kit.



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