

# DIFFERENTIAL

## ALL SERIES

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## DESCRIPTION AND OPERATION

### DESCRIPTION AND OPERATION OF STANDARD AND POSITIVE TRACTION DIFFERENTIAL

#### Standard Differential Description

The differential assembly is of the semi-floating type in which the car weight is carried on the axle housing. The differential assembly is designed for use with an open drive line and coil or leaf springs. The differential has a hypoid type ring gear and pinion with the centerline of the pinion gear below the centerline of the ring gear.

All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a Salisbury type axle housing (a carrier casting with tubes pressed and welded into the carrier to form a complete carrier and tube assembly). A removable steel cover bolted to the rear of the carrier permits service of the differential without removing the entire assembly from the car.

A universal joint connects the rear end of the propeller shaft to a pinion flange, having a splined end which fits over and drives the hypoid pinion gear. Two preloaded tapered roller bearings support the hypoid pinion gear in the carrier. The inner race of the rear bearing is a tight press fit on the pinion stem. The inner race of the front bearing combines a light press fit to a close sliding fit on the pinion flange end of the pinion stem. The outer race of each bearing is pressed against a shoulder recessed in the carrier. Tightening the pinion nut compresses a collapsible spacer, which bears against the inner race of the front bearing and a shoulder on the pinion stem. This spacer is used to enable accurate bearing preload adjustment and maintain a preload on both front and rear pinion bearings. Adjustment of the fore and aft position of the pinion is obtained by placing shims between the head of the drive pinion and the rear pinion bearing. The differen-

tial case is of one-piece construction and is supported in the carrier by two tapered roller side bearings. These are preloaded by inserting shims between the bearings and the carrier. The differential case assembly is positioned for proper ring gear to pinion backlash by varying the shim thickness from side to side. The ring gear is bolted to the case. Two side gears have splined bores for driving the axle shafts. They are positioned to turn in counterbored cavities in the case. The two differential pinions have smooth bores and are held in position by a solid pinion cross shaft, mounted and locked in the differential case. All four gears are in mesh with each other and, because the pinion gears turn freely on their shaft, they act as idler gears when the rear wheels are turning at different speeds. The pinions and side gears are backed by steel thrust washers.

#### Positive Traction Differential Description

The positive traction differential differs from the standard differential in that a different type of case assembly is used. The positive traction case assembly provides increased resistance to differential action and multiplies the tractive force available at the wheel with the least traction. This multiplied force is then available to the wheel with the better traction.

Three types of positive traction differential case assemblies are used: 1) Cone clutch type; 2) Plate clutch type (waffle pattern plates and rounded ear lugs); and 3) Plate clutch type (swirl pattern plates and square ear lugs). The cone clutch type is only serviced as a complete case assembly. The plate clutch type case assemblies are serviced individually; the internal parts are not interchangeable between types of differentials.

Rear axle assemblies having positive traction differentials may be identified by a rectangular stainless steel tag on the five o'clock inspection cover bolt, or by a red plastic triangular tag on the filler plug. In addition, identification may

be made by reading the code letters from the forward side of the right axle tube, three inches outboard of the carrier.

**Axle Shaft and Wheel Bearings** - Two types of axle shafts and wheel bearings are used. One type rolls directly on the axle shaft. With this type, the shaft is retained in the housing by 'C'-Locks in the differential side gears. This type may be identified by reading the code letters from the forward side of the right rear axle tube three inches outboard of the carrier. The third letter "C", "G", "K" or "P" identifies this type. For example, the code letters "WCG" would indicate a 3.08 ratio, standard differential, and direct-on type roller bearing, 'C'- Lock retained axle shaft. The second type wheel bearing has its own inner race and is retained on the axle shaft by a retainer ring. This type may be identified by reading the code letters on the right rear axle tube. The third letter "B" or "O" identifies this type. For example, the code letters "KCO" would indicate a 3.08 ratio, standard differential, unit roller wheel bearing retained in the axle housing by an outer retainer plate bolted to the housing end flange and retained on the shaft by a pressed on ring. See Figures 4B-51 and 4B-52.

**Operation - Standard Differential**

Power from the engine is transferred to the transmission

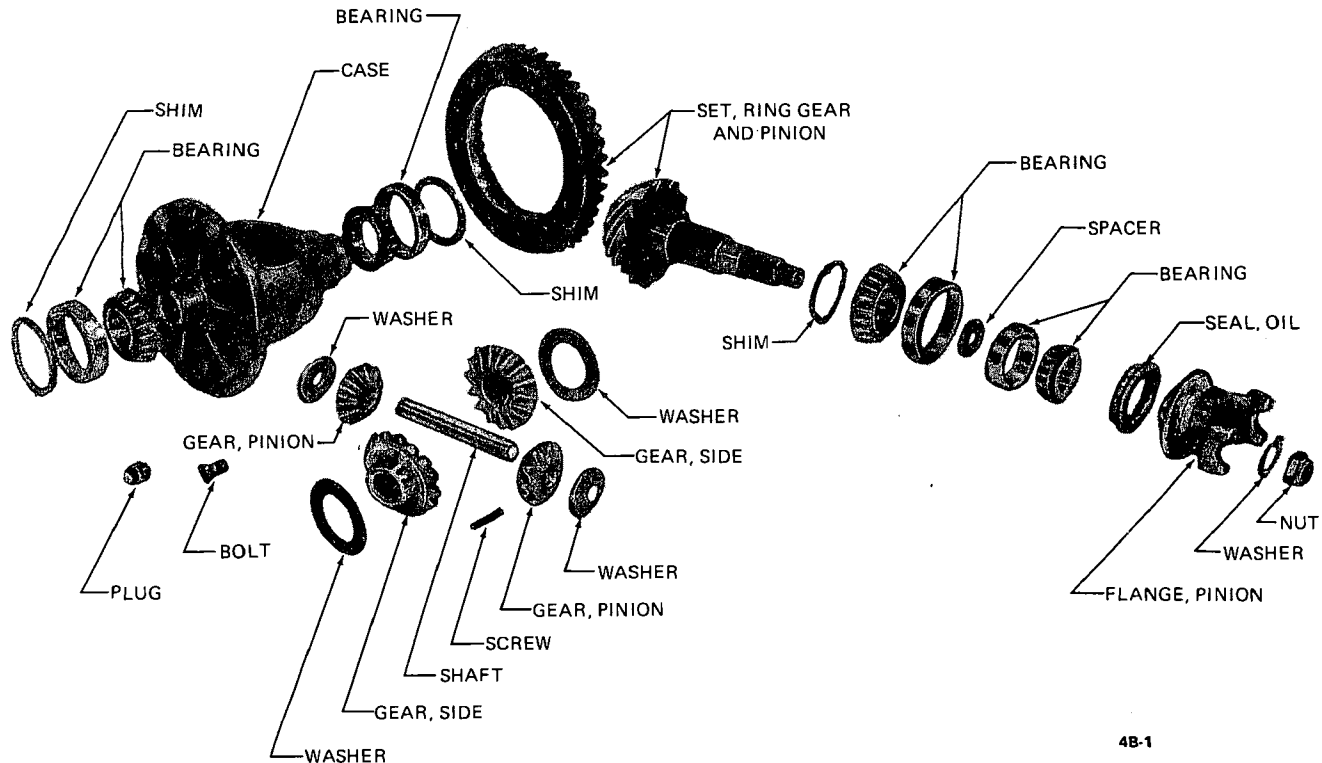
via a clutch or a fluid coupling. The transmission then provides the transfer of power to its output shaft, which is splined to the propeller shaft by means of a universal joint connection. Since the rear of the propeller shaft is connected to the differential drive pinion through the pinion flange, the transmission output shaft, propeller shaft, and differential drive pinion all turn at the same speed.

Power from the drive pinion gear is transmitted to the ring gear which is bolted to the differential case. When driving in a straight line and there is equal resistance on each rear wheel, the force through the drive pinion and ring gear turns the axle shafts at the same rate of speed and there is no movement between differential pinions and side gears.

When the vehicle turns a corner, the outer rear wheel must turn faster than the inner wheel. The inner wheel, turning slower with respect to the outer wheel, slows its differential side gear (as the axle shaft is splined to the side gear) and the differential pinion gears will roll around the slowed differential side gear, driving the other differential side gear and wheel faster. See Figure 4B-1.

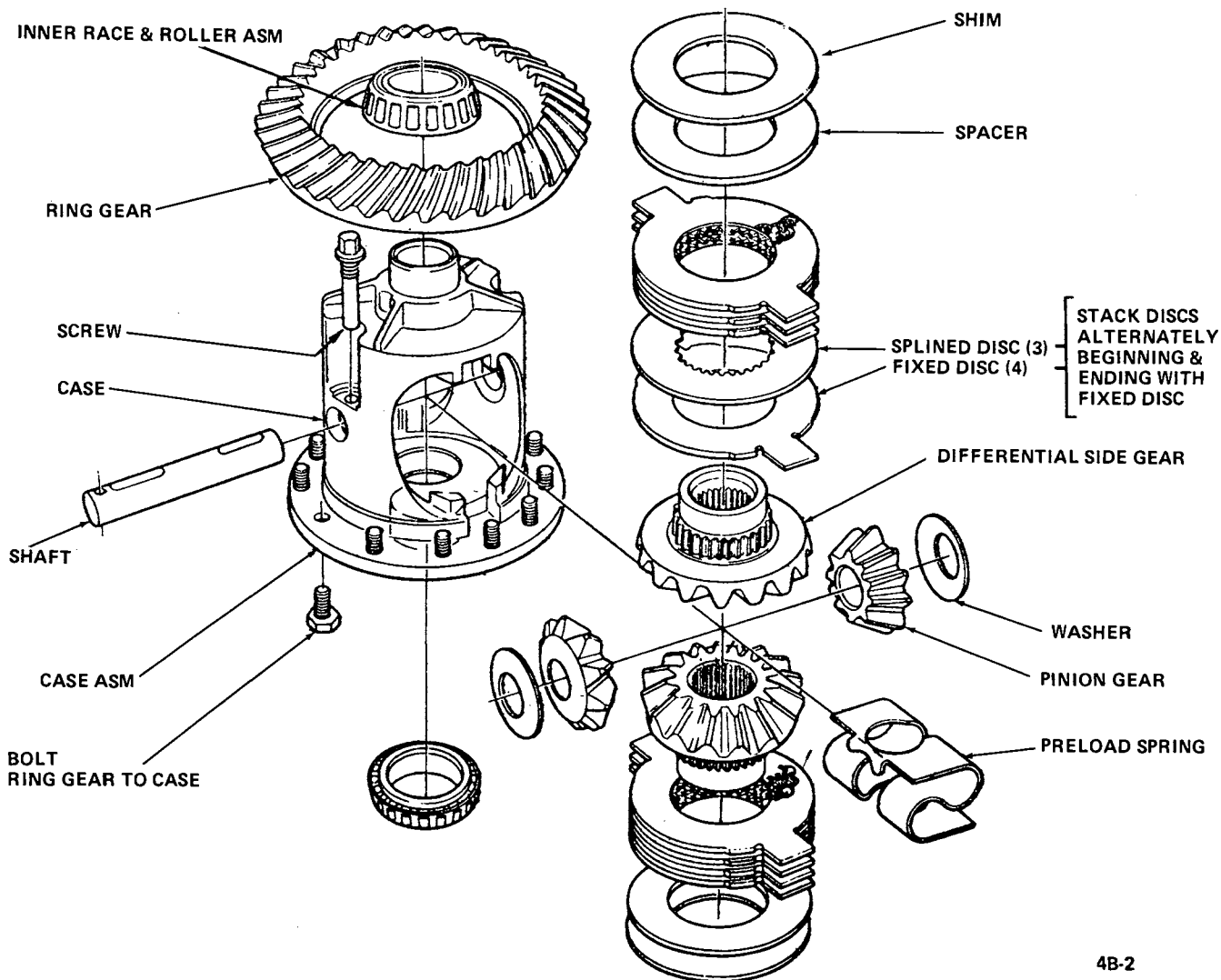
**Operation - Positive Traction Differential**

The operation of the positive traction differential is the same as the standard differential, except that there is addi-



4B-1

Figure 4B-1 Exploded View - Typical Standard Differential



4B-2

Figure 4B-2 Exploded View - Typical Positive Traction Differential

tional friction provided by the clutches (cone or plate type). Under ordinary driving and cornering conditions, the clutches slip, allowing the outside wheel to turn faster than the inner. Under poor traction conditions, such as ice, snow, or loose gravel under one driving wheel, the

increased friction provided by the clutches increases the driving torque available to the wheel with the better traction. The clutches (cone or plate type) are spring loaded to provide the increased driving torque under extremely low tractive conditions. See Figure 4B-2.

## DIAGNOSIS

Condition	Possible Cause
1. Noise is the same in "Drive" or "Coast".	1.a) Road Noise. b) Tire noise. c) Front wheel bearing noise. d) Front or rear U-joint angle to great.
2. Noise changes on a different type of road.	2.a) Road noise. b) Tire noise.
3. Noise lowers tone as car speed is lowered.	3. Tire noise.

Condition	Possible Cause
4. Similar noise is produced with car standing and driving.	4.a) Engine noise. b) Transmission noise. c) Driveline angle.
5. Vibration	5.a) Rough rear wheel bearing. b) Unbalanced or damaged propeller shaft. c) Tire unbalance. d) Worn universal joint in propeller shaft. e) Front or rear U-joint angle too great. f) Mis-indexed propeller shaft at pinion flange. g) Pinion flange runout too great.
6. A knock or click approximately every two revolutions of rear wheel.	6. A brinelled rear wheel bearing.
7. Noise most pronounced on turns.	7. Differential side gear and pinion.
8. A continuous low pitch whirring or scraping noise starting at relatively low speed.	8. Pinion bearing.
9. Drive noise, coast noise or float noise.	9. Ring and pinion gear.
10. Clunk on acceleration or deceleration.	10.a) Worn differential cross shaft in case. b) Engine dash pot out of adjustment.
11. Grunt on stops	11. No grease in propeller shaft slip yoke.
12. Groan in "Forward" or "Reverse".	12. Wrong lube in differential.
13. Chatter on turns.	13.a) Wrong lube in differential. b) Clutch plates worn.
14. Clunk or knock on rough road operation.	14. Excessive end play of axle shafts to differential cross shaft.

**PRE-REPAIR INVESTIGATION AND TROUBLE DIAGNOSIS**

A close examination of the differential prior to disassembly will often reveal valuable information as to the extent and type of repairs or adjustments necessary. The information thus gained, coupled with the report of malfunctioning, will provide a basis for determining the degree of disassembly required. Since frequent cause of axle noise are improper backlash, pinion bearing preload, or side bearing preload, or a combination, a few simple adjustments may be all that are necessary to correct a problem.

Therefore, before removing the differential from the housing, the following checks should be made with the results

recorded and analyzed: 1) Backlash; 2) Total Assembly Preload; and 3) Tooth Contact Pattern Test.

Use care at all times to keep dirt and other foreign matter, such as grinder dust, soot, or sand, away from differential to prevent possibility of subsequent failure.

The pinion and ring gear must be completely assembled, installed, and all preload and backlash adjustments completed prior to the start of this method of pinion depth setting. The following procedure can be used in place of the gauge method of pinion depth setting.

**Gear Tooth Nomenclature**

The side of the ring gear tooth which curves outward, or

is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end.

The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. It is very important that tooth contact be tested before the differential carrier assembly is disassembled. Variations in the carrier or pinion rear bearing may cause the pinion to be too far away from, or close to, the ring gear. Thus, the tooth contact must be tested and corrected, if necessary, or the gears may be noisy.

**Tooth Contact Pattern Test**

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.
2. Use gear marking compound and apply this mixture 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. Tighten bearing cap bolts to 55 lb. ft.
4. Expand brake shoes until a torque of 40-50 lb. ft. is required to turn the pinion.

A test made without loading the gears will not give a satisfactory pattern. Turn pinion flange with wrench so that ring gear rotates one full revolution, then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear may indicate good tooth pattern because one or two teeth are making proper contact.

5. Observe pattern on ring gear teeth and compare with Figures 4B-3 and 4B-4.

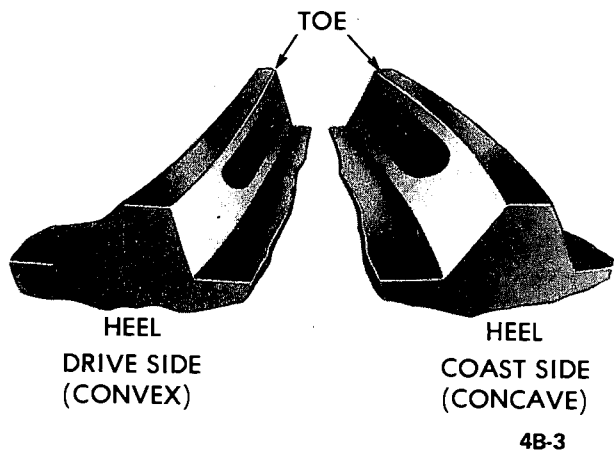
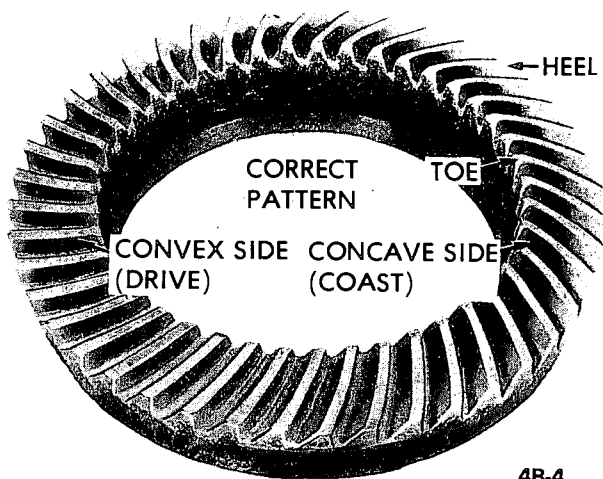


Figure 4B-3 Gear Teeth Nomenclature

**Effects of Increasing Load on Tooth Contact Pattern**

When "load" on ring and pinion gear is increased, such as when car is accelerated forward from standstill or from normal drive, the tooth contact will tend to spread out and, under very heavy load, will extend from near toe to near heel on the drive side. The entire contact also tends to shift toward heel under increasingly heavier loads and will become somewhat broader with respect to tops and bottoms of teeth. The patterns obtained by this tooth con-



4B-4

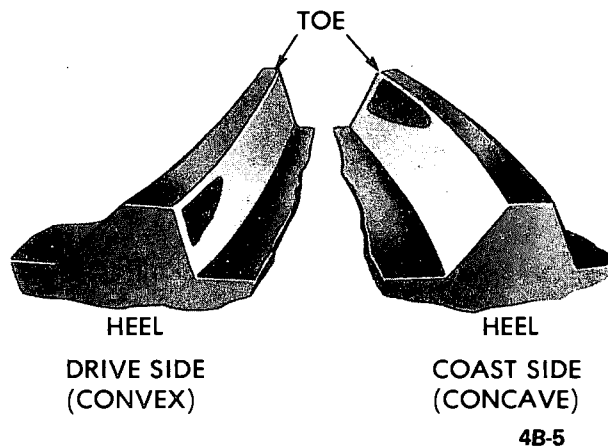
Figure 4B-4 Desired Tooth Contact Under Light Load  
 tact pattern test approximate a light load and, for this reason, they will extend only about halfway.

The important thing to note is that the contact pattern is centrally located up and down on the face of the ring gear teeth.

**Adjustments Affecting Tooth Contact**

Two adjustments can be made which will affect tooth contact pattern, backlash, and position of drive pinion in carrier. 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.

Backlash is adjusted by means of the side bearing adjusting shims which moves 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.) The position of the drive pinion is adjusted by increasing or decreasing the shim thickness between the pinion head and inner race of rear bearing. The shim is used in the differential to compensate for manufacturing tolerances. Increasing shim thickness will move the pinion closer to centerline of the ring gear. Decreasing shim thickness will move pinion farther away from centerline of the ring gear.



4B-5

Figure 4B-5 Tooth Pattern - Pinion Too Far Away From Ring Gear (Insufficient Shim Thickness)

**Effects of Pinion Position on Tooth Pattern**

When the drive pinion is too far away from centerline of the ring gear, the pattern will be a high heel contact on the drive side and high toe contact on coast side, provided backlash is within specifications of .007", .008", .009". See Figure 4B-5. Moving the pinion closer to centerline of the ring gear by increasing shim thickness will cause the high heel contact on drive side to lower and move toward the toe; the high toe contact on coast side will lower and move toward the heel. See Figure 4B-6.

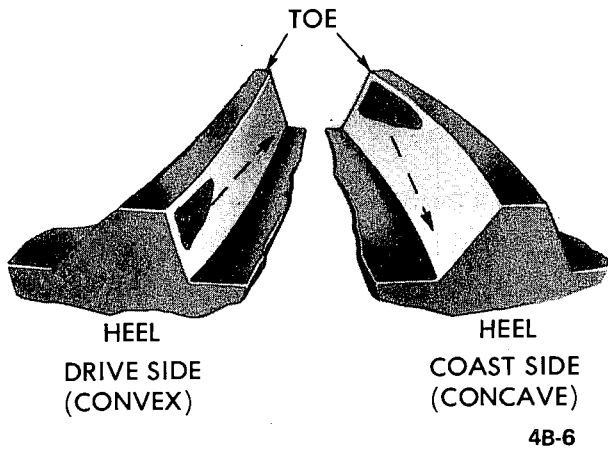


Figure 4B-6 Effect on Pattern As Shim Thickness is Increased

When the pinion is too close to the centerline of the ring gear, the pattern will be a low toe contact on drive side, and a low heel contact on coast, provided backlash is within specifications. See Figure 4B-7. Moving the pinion farther away from the ring gear by decreasing shim thickness will cause low toe contact on drive side to raise and move toward the heel; the low heel contact on coast side will raise and move toward the toe. See Figure 4B-8.

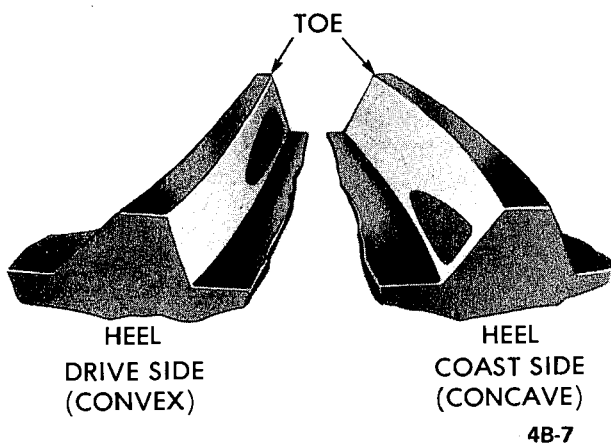


Figure 4B-7 Tooth Pattern - Pinion Too Close to Ring Gear (Excessive Shim Thickness)

Whenever the rear axle is overhauled to the point of requiring a new ring gear and pinion set, the rear axle should be filled ONLY with the lubricant included with the gear set. Whenever the rear axle is overhauled to the point of requiring only pinion and/or side bearings, it is recommended that lubricant 5.535 - 1051022, or equivalent, be

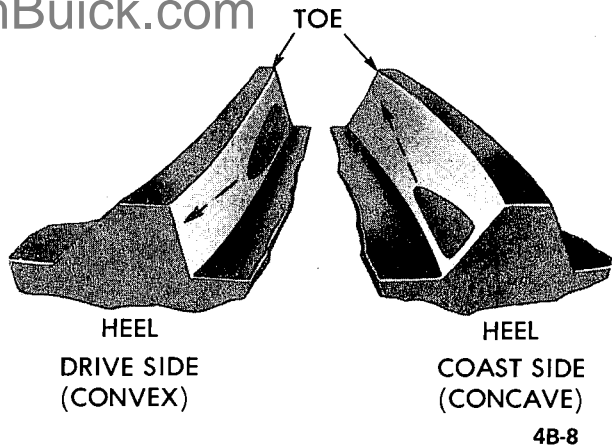


Figure 4B-8 Effect on Tooth Pattern As Shim Thickness is Decreased

used to refill for positive traction units and for regular units.

**Elimination of External Noises**

When a rear axle is suspected of being noisy, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, front wheel bearings, engine, transmission, or rear axle assembly. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in the rear axle assembly.

*Road Noise* Some 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 on 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.

*Test for Tire Noise* Tire noise changes with different road surfaces, but rear axle noise does not. Temporarily inflating all tires to approximately 50 pounds pressure, for test purposes only, will materially alter noise caused by tires but will not affect noise caused by rear axle. Rear axle noise usually ceases when coasting at speeds under 30 miles per hour; however, tire noise continues but with lower tone as car speed is reduced. Rear axle noise usually changes when comparing "pull" and "coast", but tire noise remains about the same.

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

*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 car speeds and conditions under which the noise is most pronounced; then stop car in a quiet place to avoid interfering noises. With transmission in neutral, run engine slowly up and down through engine speeds corresponding to car speed at which the noise was most pronounced. If a similar noise is produced with car standing, it is caused by the engine or transmission and not the rear axle.

### Rear Axle Noises

If a careful test of car shows that noise is not caused by external items, as described in subparagraph f, it is then reasonable to assume that noise is caused by rear axle assembly. The rear axle should be tested on a smooth level road to avoid road noise. It is not advisable to test rear axle for noise by running with rear wheels jacked up.

Noises in 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; noises may also be caused by 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 car coasting and transmission in neutral. A brinelled rear wheel bearing causes a knock or click approximately every two revolutions of rear wheel, since the bearing rollers do not travel at the same speed as the rear axle and wheel. With rear wheels jacked up, spin rear wheels *by hand* while listening at hubs for evidence of 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 Noise** Rough or brinelled pinion bearings produce a continuous low pitch whirring or scraping noise starting at relatively low speed.

**Ring and Pinion Gear Noise** Noise produced by the ring and pinion gear set generally shows up as drive noise, coast noise, or float noise. Drive noise is noise produced during vehicle acceleration; coast noise is noise produced while allowing car to coast with throttle closed; and float noise is noise occurring while just maintaining constant car speed at light throttle on a level road. Drive, coast, and float noises will vary in tone with speed and will be very rough and irregular if the differential or pinion shaft bearings are rough, worn, or loose.

### Body Boom Noise or Vibration

Objectional "body boom" noise or vibration at 55- 65 mph 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:

1. Undercoating or mud on the shaft, causing unbalance.
2. Shaft or pinion flange balance weights missing.
3. Shaft damage, such as bending, dents, or nicks.

4. Tire-type roughness. Switch tires from a known good car to determine tire fault.

### Oil Leaks

It is difficult to determine the source of some oil leaks. When there is evidence of an oil leak, determine source as follows:

1. Oil coming from the axle housing at the brake backing plate is caused by a leaking axle shaft seal.
2. Oil coming from between the pinion flange or the pinion flange slinger and the carrier is caused by a leaking pinion seal.
3. Oil leaking at the junction of the axle tubes to the carrier, or at the puddle weld holes, are difficult to repair. Under no circumstances should any welding be done in attempts to stop leaks in these areas. If the leak is severe, the complete rear axle housing should be replaced.

### Correcting Rear Axle Pinion Flange Spline Leaks

Check and confirm that it is not a pinion seal I.D. or O.D. leak, but a leak around the pinion flange washer or nut.

1. Mark propshaft and pinion flange to permit proper alignment at reinstallation. Disconnect propshaft from pinion flange and support shaft out of the way. If U-joint bearing cups are not held by a retainer strap, use a piece of wire or tape to retain bearing cups in place.
2. Mark the position of the pinion flange, pinion shaft, and nut so the proper pinion bearing preload can be maintained.
3. Remove pinion flange nut and washer.
4. Clean cavity under pinion flange washer with lacquer thinner or equivalent. See Figure 4B-8A.

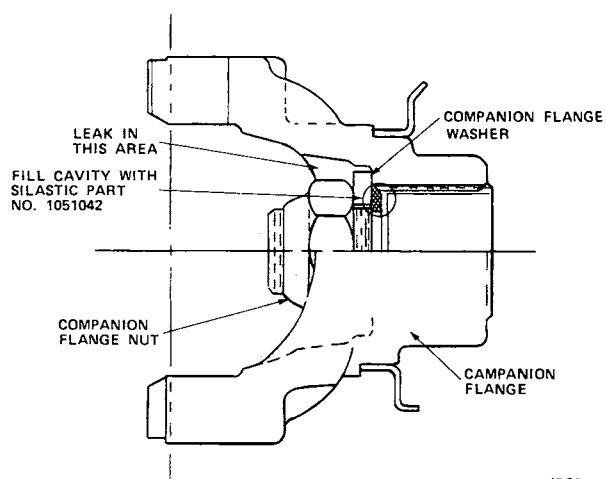


Figure 4B-8A Area to be Filled with Silastic

5. Fill cavity over full with Group 8.800, Part No. 1051042 (Silastic 732 R.T.V.) or equivalent so that when

the washer is reinstalled, the sealer will ooze out around the washer.

6. Install pinion flange nut and tighten to the same position as marked in Step 2. While holding pinion flange, tighten nut 1/16" beyond alignment marks.
7. Connect propshaft to pinion flange using alignment marks made in Step 1 as an index guide. Torque the four bolts to 15 lb.ft. on H, X, A Series and B Wagons; and 75 lb. ft. on B, C and E Series less B Wagons.

### Testing Positive Traction Differential

If there is a doubt that a Buick is equipped with a Positive Traction Differential, or to determine if this option is performing satisfactorily, a simple test can be performed.

1. Place transmission in neutral.
2. Raise one wheel off floor and place a block of wood in front and rear of opposite wheel.
3. Remove wheel cover and install torque wrench with extension on lug nut.
4. Disregard breakaway torque and observe only torque required to continuously turn wheel smoothly. If differential assembly is equipped with Positive Traction Differential, the rotating torque will be at least 35 lb. ft.

### Positive Traction Flushing Procedure

The following procedure is established for flushing the Positive Traction Differential in the event the wrong lubricant is accidentally added.

1. Drain original lubricant from differential housing.
2. Fill axle with a light, non-detergent engine oil.
3. Raise both rear wheels off floor.
4. With car properly supported, run car in "Drive" range for three to four minutes. Do not exceed 30 mph on speedometer or accelerate or decelerate rapidly.
5. Remove oil from axle.
6. Repeat Steps 2, 3, 4, and 5. It is important that the axle be flushed two times to ensure complete removal of the original lubricant.
7. Fill differential housing with positive traction lubricant, GM Part No. 1051022, or equivalent.

## MAJOR REPAIR

### REMOVAL AND INSTALLATION OF DIFFERENTIAL ASSEMBLY

It is not necessary to remove the rear axle assembly for any normal repairs. However, if the housing is damaged, the rear axle assembly may be removed and installed using the following procedure.

#### Removal of Rear Axle Assembly

1. Raise rear of car high enough to permit working underneath. Place a floor jack under center of axle housing so it just starts to raise rear axle assembly. Place jack stands solidly under frame members on both sides.

2. Mark rear universal joint and pinion flange for proper reassembly then disconnect rear universal joint from pinion flange by removing four bolts and two straps or U-bolts on the single joint connection, or by removing four bolts on the double cardan joint connection.

On the H car it will be necessary to disconnect the upper control arm from the differential end before propeller shaft can be disconnected.

3. Disconnect parking brake cables by removing adjusting nuts at equalizer. Slide center cable rearward and disconnect two rear cables at connectors to free from body.
4. Disconnect rear brake hose at floor pan. Cover brake hose and pipe openings to prevent entrance of dirt.
5. On all cars, except the X and B Wagons, disconnect shock absorbers at lower end and push shock absorbers up out of the way. Lower jack under housing until rear springs can be removed.
6. On the X and B Wagons, proceed as follows:
  - a. Raise car on hoist.
  - b. Disconnect shock at lower by removing nut.
  - c. Support car by placing jack stands at frame in front of leaf springs and at rear of leaf springs at bumper.
  - d. On the B Wagon disconnect right side of exhaust system by removing exhaust hanger screw to rear frame cross member.
  - e. Remove lower spring plate attaching nuts.
  - f. Remove front and rear attaching bolts and remove spring.
7. Roll assembly out from under car.

### Installation of Rear Axle Assembly

**CAUTION:** *Fasteners in the following steps are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

1. Connect lower control arms to housing. Control arm bushing bolts and shock absorbers to be tightened with suspension in normal load position.
2. Connect upper control arms to housing.
3. On all cars, except X and B Wagons, place rear springs in position and jack axle housing upward until shock absorbers will reach. Connect shock absorbers.
4. On X and B Wagons, proceed as follows:
  - a. Connect leaf spring at front attachment.
  - b. Attach lower spring plate. It may be necessary to lower axle to attach spring plate. Be sure spring cushions are in plate. Tighten nuts to specified torque.
  - c. Attach leaf spring at rear shackle. Tighten nut to specified torque.



- d. Tighten nut at front attachment to specified torque.
  - e. Reconnect shock.
  - f. Reconnect exhaust system on Estate Wagons.
5. Connect upper and lower control arm bolts. Tighten to specified torque.
  6. Connect and adjust parking brake cable.
  7. Connect rear universal joint to pinion flange aligning marks previously made. Tighten bolts evenly to 15 lb. ft. on single joints and tighten to 85 lb. ft. on double cardan joints.
  8. Connect rear brake hose at floor pan. Bleed both rear brakes and refill master cylinder.
  9. Fill rear axle with specified gear lubricant.

**REMOVAL AND INSTALLATION OF AXLE SHAFT, WHEEL BEARING OR OIL SEAL**

Most rear axle service repairs can be made with the rear axle assembly in the car by raising the rear end of the car with the rear axle hanging on the shock absorbers.

**Remove Axle Shaft Assemblies**

Design allows for maximum axle shaft end play of .018" on the "B" or "O" axles .022" on the "C", "G" or "K" axles and .032 on the "P" axle. This end play can be checked with the wheel and brake drum removed by measuring the difference between the end of the housing and the axle shaft flange while moving the axle shaft in and out by hand.

End play over the design specification is excessive. Compensating for all of the end play by inserting a shim in-board of the bearing in the housing is not recommended since it ignores the end play of the bearing itself, and may result in improper seating of the backing plate against the axle tube flange. If the end play is excessive, the axle shaft and bearing assembly should be removed and the cause of the excessive end play determined and corrected.

1. Remove wheels. Both right and left wheels have right hand threads.
2. Remove brake drums.

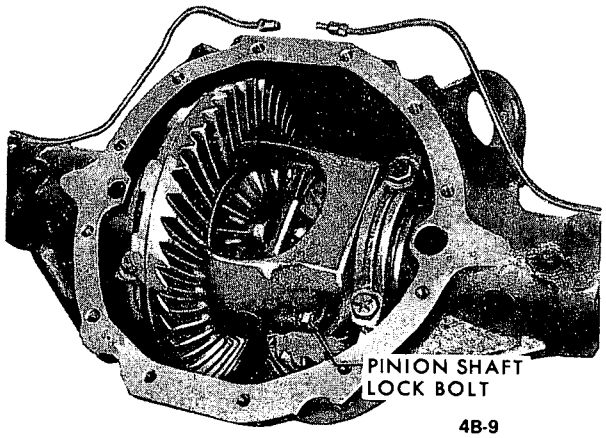


Figure 4B-9 Pinion Shaft Lock Bolt

3. For the "C", "G", "K" and "P" type axles, proceed as follows:
  - a. Remove bolts and differential carrier cover and allow lubricant to drain.
  - b. Remove pinion shaft lock bolt and pinion shaft. See Figure 4B-9
  - c. Push axle shafts inward to permit removal of "C" locks, then remove axle shafts. See Figure 4B-10.

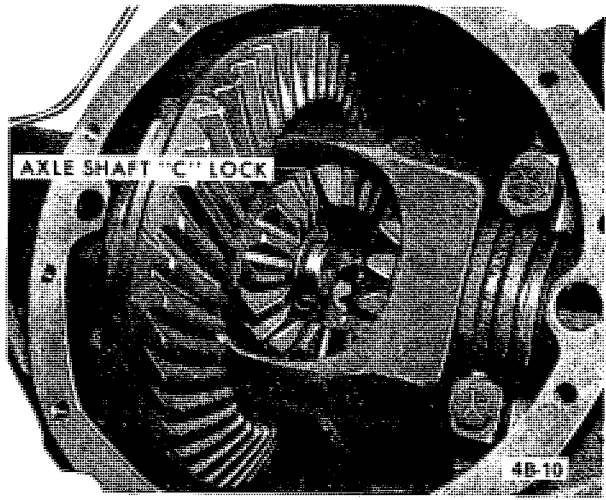


Figure 4B-10 Axle Shaft "C" Locks

4. For the "B or O" type axles, proceed as follows:
  - a. Remove nuts holding retainer plates to brake backing plates. Pull retainers clear of bolts and reinstall two opposite nuts finger tight to hold brake backing plate in position.
  - b. Pull out axle shaft assemblies, using Puller J- 21579 with a slide hammer. See Figure 4B-11.

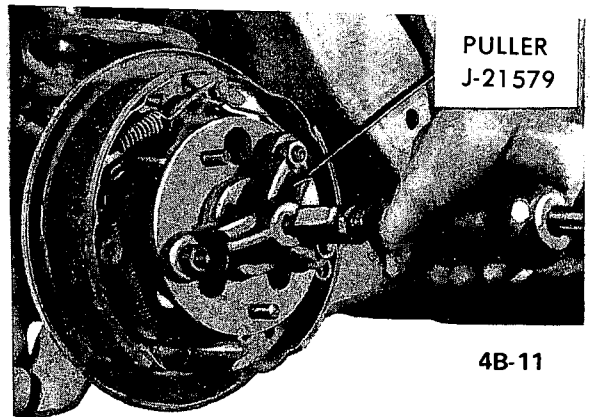


Figure 4B-11 Removing Rear Axle Shaft

**Remove and Install Axle Shaft Bearing and/or Seal ("B" or "O" Type Axles)**

The rear wheel bearing and bearing retainer ring both

have a heavy press fit on the axle shaft. Because of this fit they should be removed or installed separately. Both the retainer ring and the bearing must be removed to replace the seal.

1. Position and tighten axle shaft in vise so that the retainer ring rests on vise jaws. Use a heavy chisel and hammer to crack ring. See Figure 4B-12. Do not use torch.

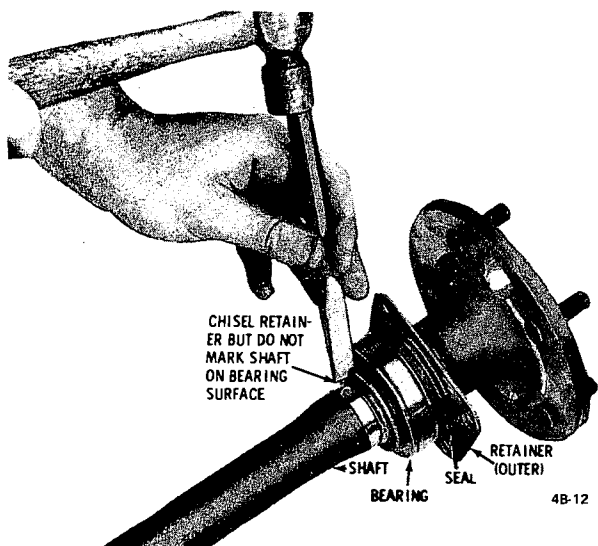


Figure 4B-12 - Removing Axle Shaft Bearing Retainer

2. Press axle shaft bearing off using Plate J- 23133. See Figure 4B-13. Avoid damaging seal when removing bearing.

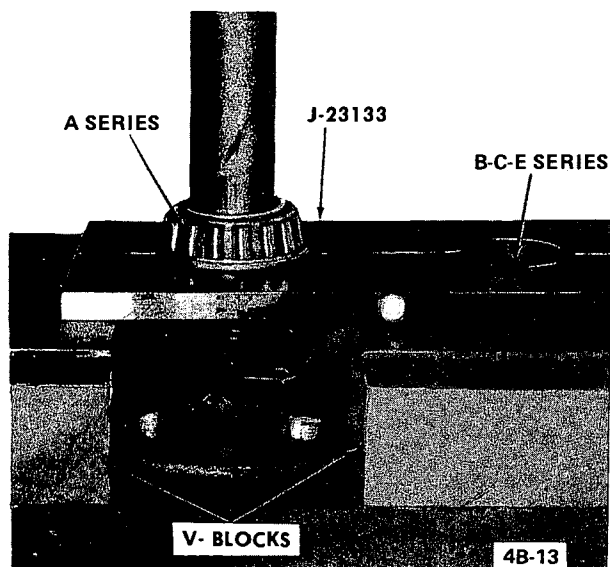


Figure 4B-13 Removing Axle Shaft Bearing

3. Remove axle shaft seal and examine seal running surface for bad spots. If necessary install new seal, applying a small amount of grease between seal lips. Insure against

damaging the seal lip. Retainer plate which retains axle shaft in housing must be installed on axle shaft before seal and bearing are installed.

4. Press new bearing against shoulder on axle shaft, using Installer J-21022 for A Series Cars except Wagon and Installer J-8609 for B-C-E Series cars.

5. Press new service retainer ring against bearing, using Installer J-21022 for A Series cars and Installer J-8609 for B-C-E Series cars. See Figure 4B-14.

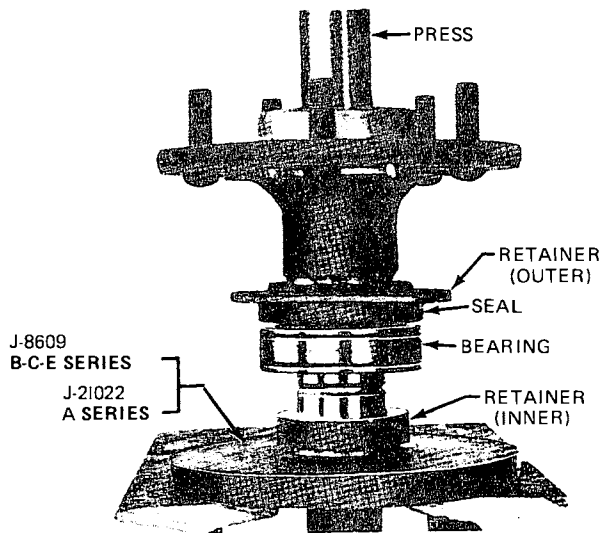


Figure 4B-14 Pressing New Retainer Ring Against Bearing

**Remove and Install Axle Shaft Bearing and/or Seal "C", "G", "K", "P" Type Axles**

1. Install axle shaft bearing and seal remover J-23689 for the 8-1/2" ring gear "B" car axles or J-22813-01 for the 8-1/2" ring gear "X" and "A" and 7-1/2" ring gear "H" car axles and remove bearing and seal. See Figures 4B-15 and 4B-16.

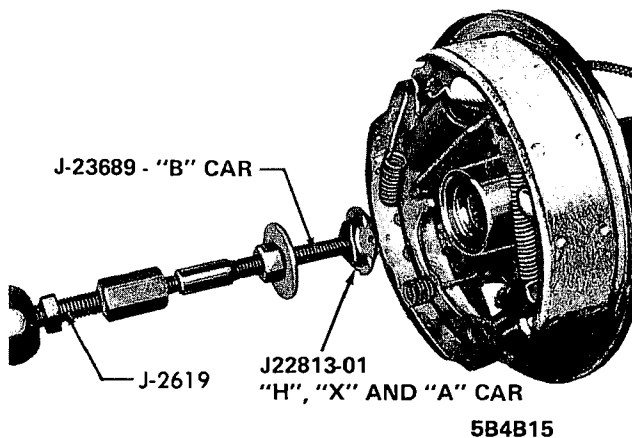


Figure 4B-15 Axle Shaft Bearing and Seal Remover

2. Using axle shaft bearing installer J-23690 for the 8-1/2" ring gear "B" car axles or J-23765 for the 8-1/2" ring gear

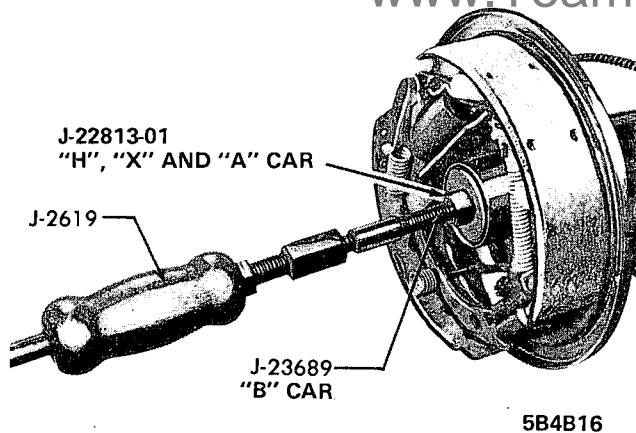


Figure 4B-16 Axle Shaft Bearing and Seal Remover Installed

"X" and "A" and 7-1/2" ring Gear "H" car axles and install the bearing. Make sure tool contacts end of tube to assure that bearing is at proper depth. See Figure 4B-17.

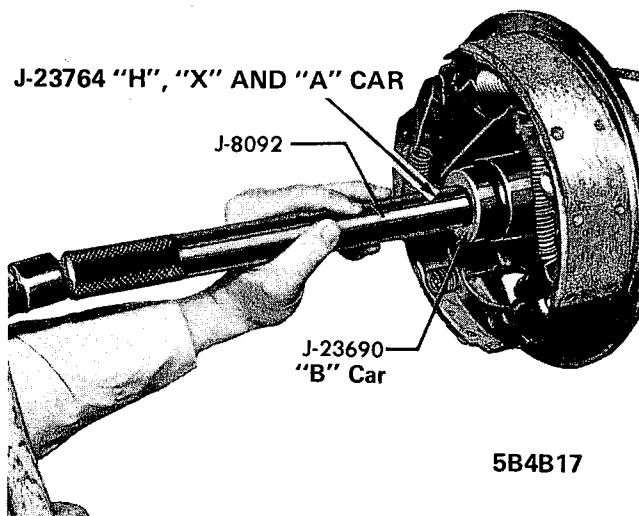


Figure 4B-17 Axle Shaft Bearing Installer

3. Install new seal using seal installer J-21128 car the 8-1/2" ring gear "B" car axles or J-23771 for the 8-1/2" ring gear "X" and "A" and 7-1/2" ring gear "H" car axles.

**Remove and Install Rear Wheel Bolt**

1. To remove and install a rear wheel bolt, axle shaft assembly must be out of car. Remove rear wheel bolt by pressing from axle flange.
2. Install new rear wheel bolt by pressing through axle flange. Check new bolt for looseness; if bolt is loose, axle shaft must be replaced.

**Install Axle Shaft Assembly**

Rear axle shafts are interchangeable between sides.

1. Apply a light coat of wheel bearing grease in wheel bearing and seal recess of housing.
2. On the "B" or "O" type axles, apply gear lubricant to the splines at the inner end of the axle shaft. Apply a coat of wheel bearing grease on the seal surface of the shaft.

Install axle shaft. If the axle to be installed is a positive traction axle, only positive traction type lubricant should be used.

3. For "C"- "G"- "K" or "P" type axles, proceed as follows:

- a. Insert axle shaft through the seal and bearing and, as far as possible, through the side gear. Do not let shaft drag across seal lip. It is necessary to apply a small amount of grease between seal lips.
- b. Install "C" lock onto axle shaft. Move axle shaft and "C" lock outward to bottom the "C" lock in the recess of the side gear.
- c. Install pinion shaft and secure with lock bolt (15 lb. ft.).
- d. Install new gasket and cover, torque bolts to 30 lb. ft. After 20 minutes, retorqued bolts to 30 lb.ft.
- e. Install specified quantity and type of lubricant.

**CAUTION:** Fasteners in Steps 4 and 5 are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number, or with an equivalent part, if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

4. Install retainer nuts and tighten to specified torque.
5. Install drum and wheel. Tighten lug nuts to specified torque.

**REMOVAL AND DISASSEMBLY OF DIFFERENTIAL CASE ASSEMBLY**

**Removal of Differential Case Assembly — Differential in Car**

1. Raise rear of car and support securely under rear of frame.
2. Loosen parking brake cables so that brake is not applied when axle assembly is lowered.
3. Mark rear universal joint and pinion flange for proper alignment at reassembly. Disconnect rear universal joint. On H Series cars it will be necessary to disconnect upper control arm at differential end.
4. Lower differential carrier assembly just far enough to clear lower portion of fuel tank.

The following steps also apply when making repairs with differential assembly removed from car.

5. Remove bolts securing cover to housing to drain lubricant.
6. While lubricant is draining, remove rear wheels and drums.
7. Remove rear axle shafts.

Before proceeding with following steps, it is advisable to check the existing ring gear to pinion backlash. This will indicate gear or bearing wear or an error in backlash or

preload setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, they may be reinstalled at original lash to avoid changing gear tooth contact.

8. Mark side bearing caps for proper installation at reassembly. Remove bolts holding differential side bearing caps to housing.

**WARNING: DO NOT DROP CASE ASSEMBLY, AS THIS MAY CAUSE INJURY OR DAMAGE PARTS.**

9. Differential case assembly can now be removed by prying against ring gear bolt, using a suitable pry bar. See Figure 4B-22. Remove case assembly and place right and left bearing outer races and shims in sets with marked bearing caps so that they can be reinstalled in their original positions.

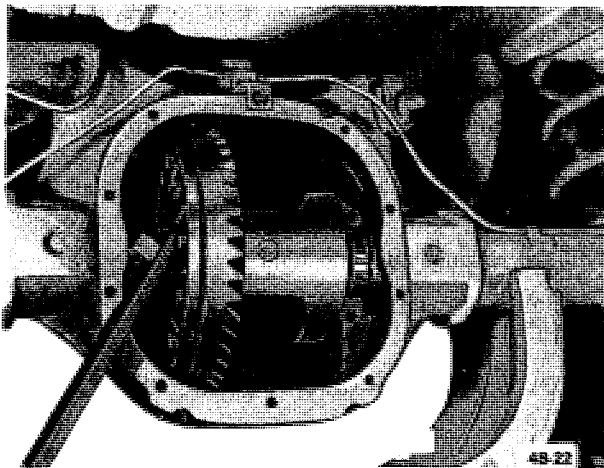


Figure 4B-22 Removing Differential Case Assembly

#### Disassemble Standard Differential Case Assembly

1. If differential side bearings are to be replaced, insert Remover Adapter J-2241-10 in center hole and pull bearing using Puller J-22588. See Figure 4B-23.

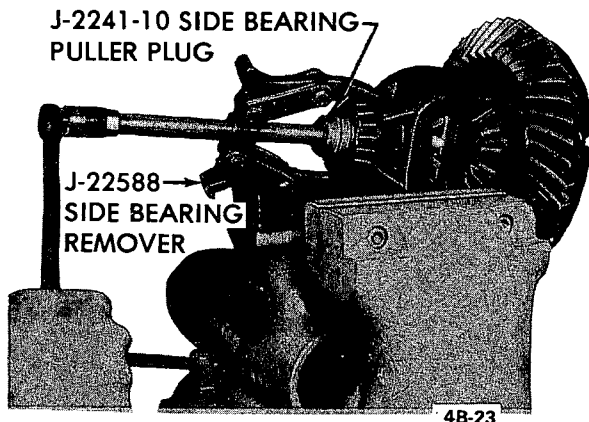


Figure 4B-23 - Removing Differential Side Bearings

2. Remove screw that retains differential pinion shaft. See Figure 4B-24. Remove differential pinions, side gears and thrust washers from case.

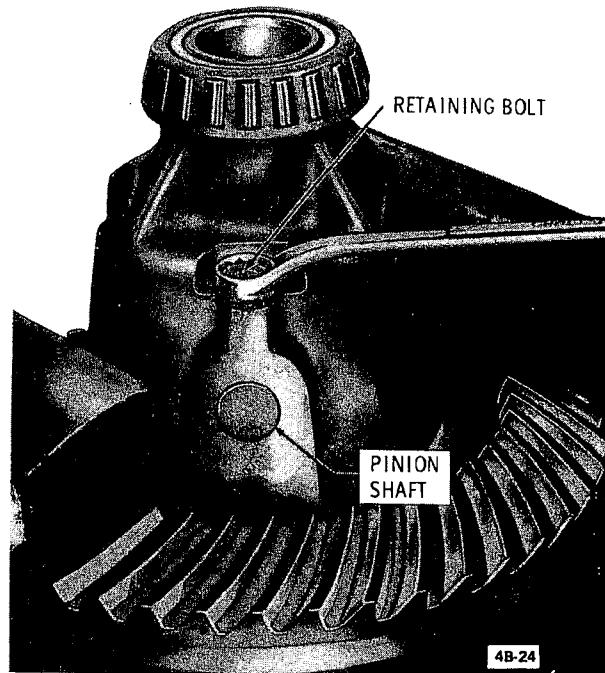


Figure 4B-24 - Removing Pinion Shaft Lock Screw

3. If ring gear is to be replaced and it is tight on case after removing bolts, tap it off using a soft hammer; do not pry between ring gear and case.

#### Disassemble Plate Type Positive Traction Differential Case Assembly

1. Remove screw that retains differential pinion shaft and remove differential cross shaft. Remove preload spring thrust blocks and springs from the case. See Figure 4B-25.

2. Rotate side gears until the pinions are in the open area of the case, remove the pinions and thrust washers.

3. Remove a side gear, clutch pack, and shims from the case, noting location to aid in reassembly. Remove the side gear, clutch pack, and shims from the opposite side.

4. Remove clutch plates from side gears, keeping plates in their original location in the pack.

#### Removal of Pinion and Bearings

1. Check pinion bearing preload.

If there is no preload reading, check for looseness of pinion assembly by shaking. Looseness indicates need for bearing replacement. If assembly is run long with very loose bearings, ring and pinion will also require replacement.

2. Install Holder J-8614 on flange by using two 5/16-18x2" bolts with flat washers. Remove pinion nut and washer. See Figure 4B-26.

3. Pull pinion flange from pinion using Puller J-8614. To

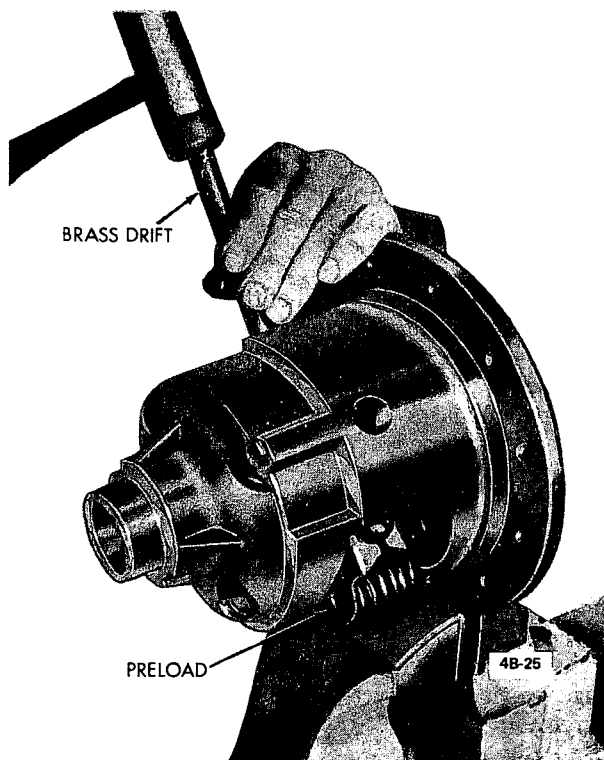


Figure 4B-25 Removing Preload Thrust Blocks and Springs

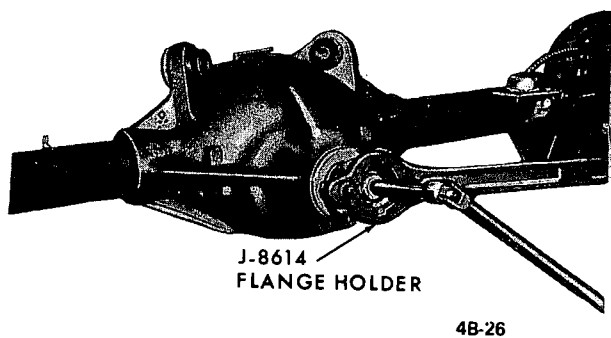


Figure 4B-26 - Removing Pinion Nut

install puller, back out puller screw, insert puller through holder, and rotate 1/8 turn. See Figure 4B-27.

4. Remove pinion assembly. If necessary, tap pinion out with soft hammer, while being careful to guide pinion with hand to avoid damage to bearing outer races.

5. If rear pinion bearing is to be replaced, remove rear pinion bearing from pinon shaft using Remover J-25320 on 7 1/2" ring gear axles or remover J-8612 on 8 1/2" or 8 7/8 inch ring gear axles or Remover J-9746 on 9 3/8 inch ring gear axles with Holder J-6407. See Figure 4B-28.

6. Pry pinion oil seal from carrier and remove front pinion bearing. If this bearing is to be replaced, drive outer race from carrier using a brass drift.

7. If rear pinion bearing is to be replaced, drive outer race

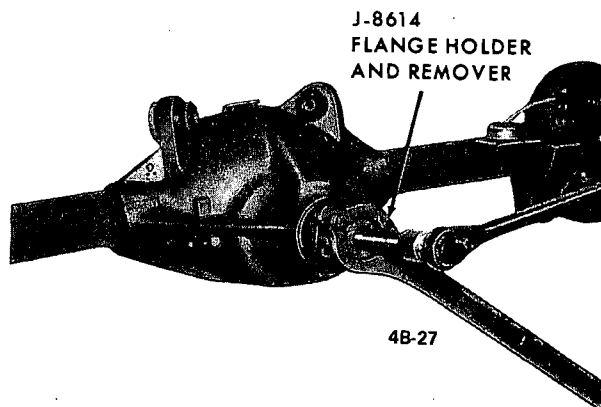


Figure 4B-27 - Removing Pinion Flange

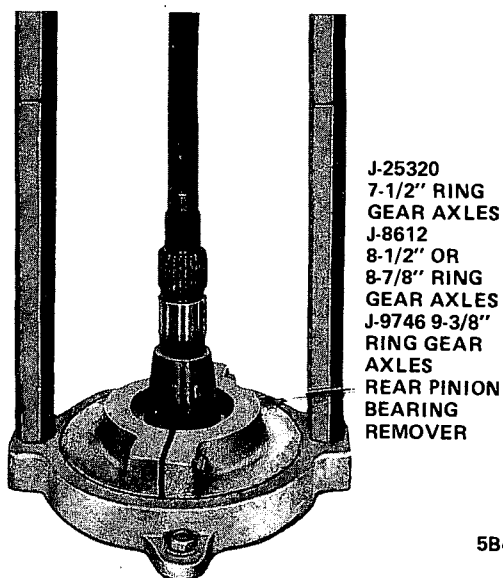


Figure 4B-28 - Removing Rear Pinion Bearing

from carrier using a brass drift in slots provided for this purpose.

### ASSEMBLY AND INSTALLATION OF DIFFERENTIAL CASE ASSEMBLY

Before installation of any parts, examine the wearing surfaces of all parts for scoring or unusual wear. Make certain that the interior of the carrier housing is absolutely clean and dry. Also make certain that the parts to be assembled are absolutely clean and that there are no burred edges. Lubricate all parts with the specified rear axle lubricant just before assembly.

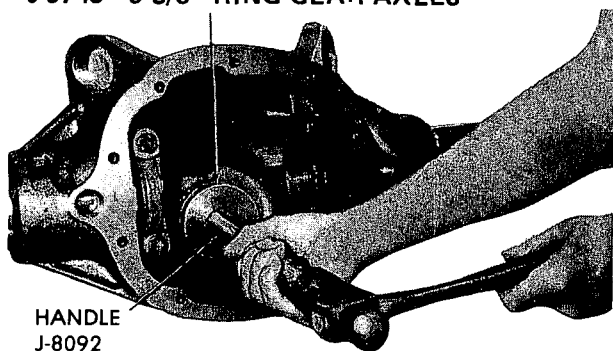
If the Buick is equipped with a Positive Traction Differential, only Positive Traction Lube, or equivalent, should be used.

If the ring gear and pinion are changed, only factory hypoid lubricant should be used for filling because of its special anti-scoring properties. For this reason the proper lubricant is included in the carton with the replacement gears as received.

**Install Pinion Bearing  
Outer Races in Carrier**

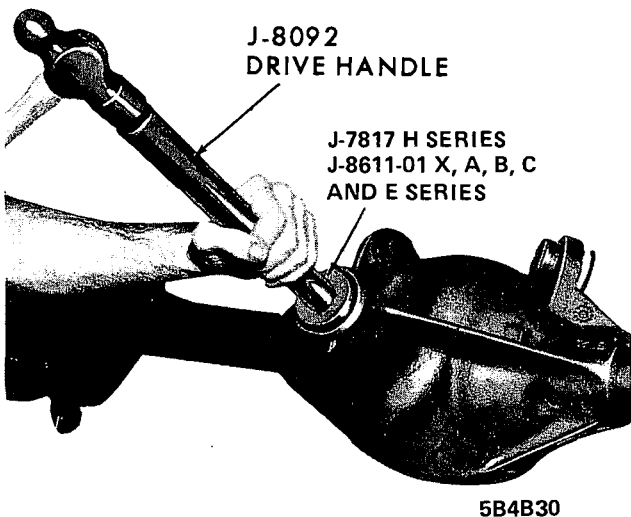
1. If rear pinion bearing race is to be replaced, use Installer J-7818 on 7 1/2 inch ring gear axles, J-8608 on 8 1/2 inch or 8 7/8 inch ring gear axles or Installer J-9745 on 9 3/8 inch ring gear axles with Driver Handle J-8092. See Figure 4B-29.

**INSTALLER**  
**J-7818 7-1/2" RING GEAR AXLES**  
**J-8608 8-1/2" AND 8-7/8" RING GEAR AXLES**  
**J-9745 9-3/8" RING GEAR AXLES**



5B4B29  
 Figure 4B-29 - Installing Rear Pinion Bearing Outer Race

2. If front pinion bearing race is to be replaced, install new outer race using Installer J-7817 on "H" Series cars and Installer J-8611-01 on all other cars with Driver Handle J-8092. See Figure 4B-30.



5B4B30  
 Figure 4B-30 - Installing Front Pinion Bearing Outer Race

**Set Pinion Depth**

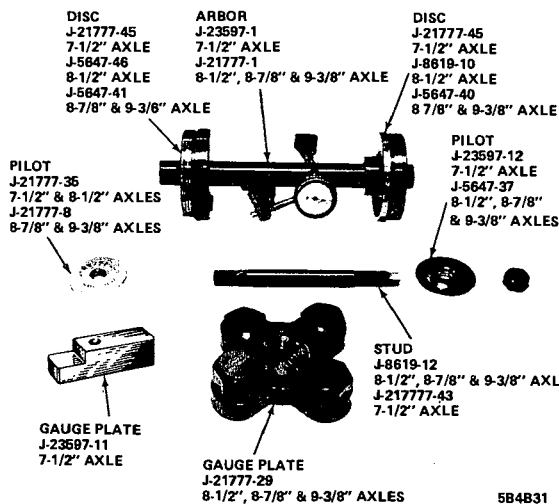
Ring and pinion gear sets are matched in a special test machine which permits adjustment of pinion depth in ring gear until a point is reached where best operation and proper tooth contact under load is obtained. At this point, the setting of the pinion with reference to the centerline of the ring gear is indicated by the machine. This setting

may vary slightly from the design or "nominal" setting due to allowable variation in machining the parts. However, most production pinions and all pinions used for service replacement are zero or nominal pinions.

If during repair, a pinion is found having a plus or minus reading recorded in thousandths on the pinion, this indicates that the pinion during testing was found to have best tooth contact at a position varying from design or nominal depth.

In order to compensate for all of the allowable machining variables, a procedure of gaging the carrier and shimming the pinion has been developed. After gaging a carrier, the assembler is able to install a shim between the front face of the pinion and its bearing so that pinion depth can be adjusted to an exact required specification for best tooth contact in each axle assembly.

Pinion depth for all axles is set with Pinion Setting Gauge J-21777. See Figure 4B-31 for gauge usage on the 7 1/2 inch ring gear axles, 8 1/2 inch ring gear axles, 8 7/8 inch ring gear axles and 9 3/8 inch ring gear axles. Although production pinions are marked, neither production nor service pinions have a gaging tooth. The pinion setting gauge provides in effect a nominal or zero pinion as a reference.



5B4B31  
 Figure 4B-31 - Pinion Setting Gauge

Set up pinion setting gauge as follows:

1. Make certain all gauge parts are clean. Check particularly the discs, gauge pin ends, dial indicator tip and gauge plate surface.
2. Lubricate front and rear pinion bearings which will be used in final reassembly and position them in their respective races in the carrier.
3. Thread stud into gauge plate. With bearings held in place in races, install gauge plate and stud assembly on rear pinion bearing inner race. Install pilot on front pinion bearing. See Figure 4B-32.
4. Install nut on stud (J-8619-13). Hold stud stationary with wrench positioned on flats on end of stud; tighten nut until a reading of 20 lb.ins. is obtained when rotating gauge plate assembly with a lb.in. torque wrench.
5. Make certain differential side bearing support bores are clean and free of burrs.

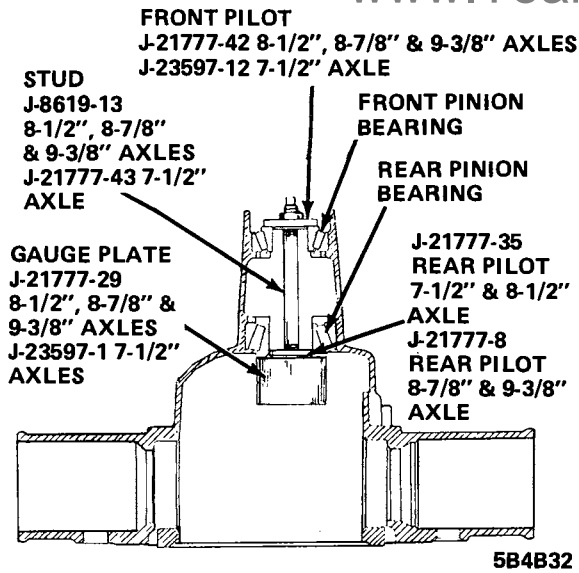


Figure 4B-32 Pinion Gauge Plate Installed in Carrier

6. Install discs on gauge shaft assembly, as shown in Figure 4B-33.
7. Position the gauge shaft assembly in the carrier so that the dial indicator rod is centered on the gauging area of the gauge block and the discs seated fully in the side bearing bores. See Figure 4B-33.

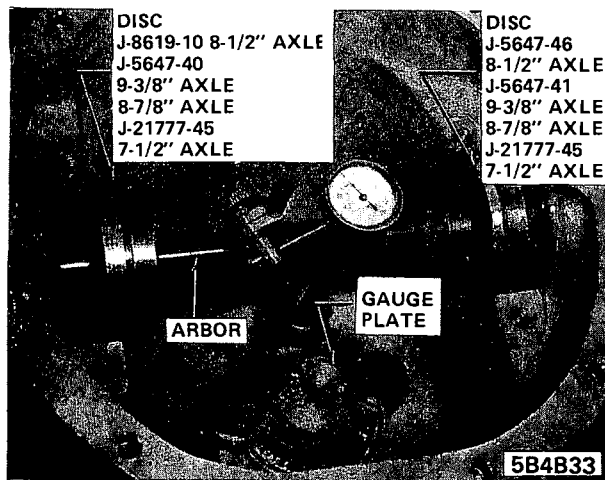


Figure 4B-33 Gauge Shaft Assembly in Carrier

8. Set dial indicator at ZERO. Then, position on mounting post of the gauge shaft with the contact button touching the indicator pad. Push dial indicator downward until the needle rotates approximately 3/4 turn clockwise. Tighten the dial indicator in this position and recheck.
9. Rotate gauge shaft slowly back and forth until the dial indicator reads the greatest deflection. At the point of greatest deflection, set the dial indicator to ZERO. Repeat rock action of gauge shaft to verify the ZERO setting.
10. After the ZERO setting is obtained, rotate gauge shaft until the dial indicator rod does not touch the gauge block.
11. Record dial reading at pointer position. EXAMPLE:

If pointer moved counterclockwise .067" to a dial reading of .033", this indicates a shim thickness of .033".

12. Select correct pinion shim to be used during pinion reassembly on the following basis:

**NOTE:** : All pinions will be marked in one of three places. See Figure 4B-34 for areas of pinion depth setting marking.

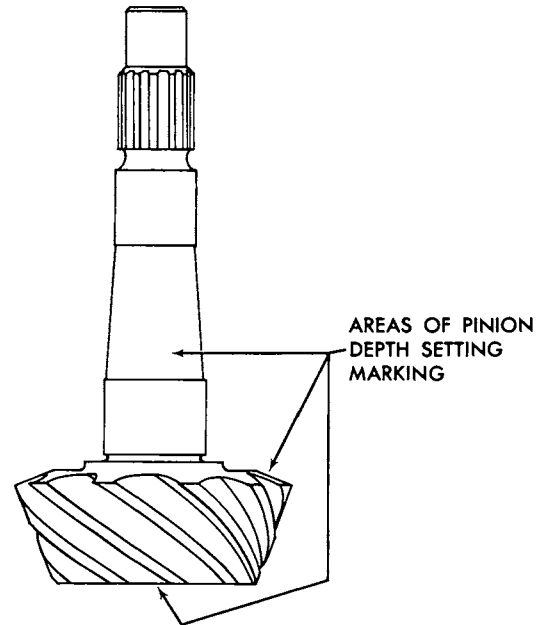


Figure 4B-34 Pinion Marking All Axles

- 1) If reusing production pinion and pinion is marked "+" (plus), correct shim will have a thickness equal to gauge reading, plus the amount specified on pinion.
- 2) If production pinion is marked "-" (minus), correct shim will have a thickness equal to gauge reading, less the amount specified on pinion.
- 3) If using production or service pinion which has no marking, the correct shim will have a thickness equal to the gauge reading.

13. Remove pinion gauge assembly and both bearings from case.

14. Position correct shim on pinion shaft and install rear pinion bearing. Use installer J-21022-02 on 7-1/2 inch ring gear axles J-8609 in 8-1/2 inch and 8-7/8 inch ring gear axles or installer J-6377-01 on 9-3/8 inch ring gear axles. See Figure 4B-36.

**Install Pinion Assembly and Adjust Pinion Preload**

1. Position pinion assembly in carrier and install collapsible spacer.
2. Place front pinion bearing in position on pinion. Hold pinion fully forward and drive bearing over pinion until seated. Use Installer J-22388.
3. Install pinion oil seal in carrier. Install seal on 8-1/2", 8-7/8" & 9-3/8" ring gear axles by using Installer J-22388. See Figure 4B-37. A correctly-installed pinion seal having a flanged case should be flush with nose of carrier casting.

taken up. See Figure 4B-38. When no further end play is detectable, and when Holder J-8614 will no longer pivot freely as pinion is rotated preload specifications are being neared. Further tightening should be done only after preload has been checked.

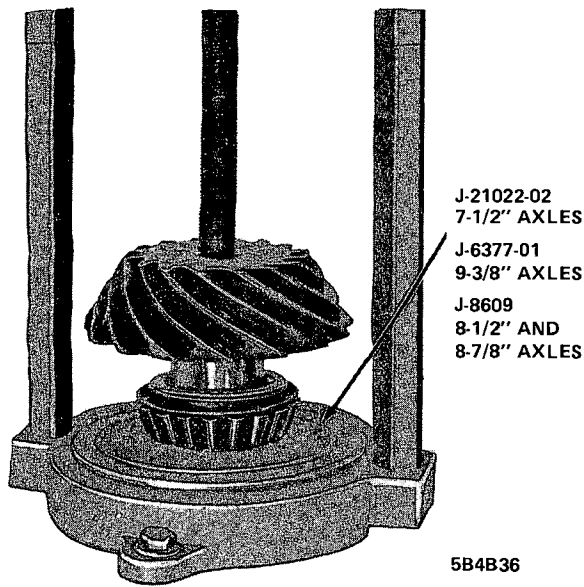


Figure 4B-36 - Installing Rear Pinion Bearing

On 7 1/2" ring gear axles install seal by placing spacer J-22804-2 over seal and against seal flange. The spacer insures proper seating of seal in carrier bore. Using Installer J-23911 press seal into carrier shoulder and seal flange. Turn spacer 180 degrees from installed position, seal must be square in carrier bore.

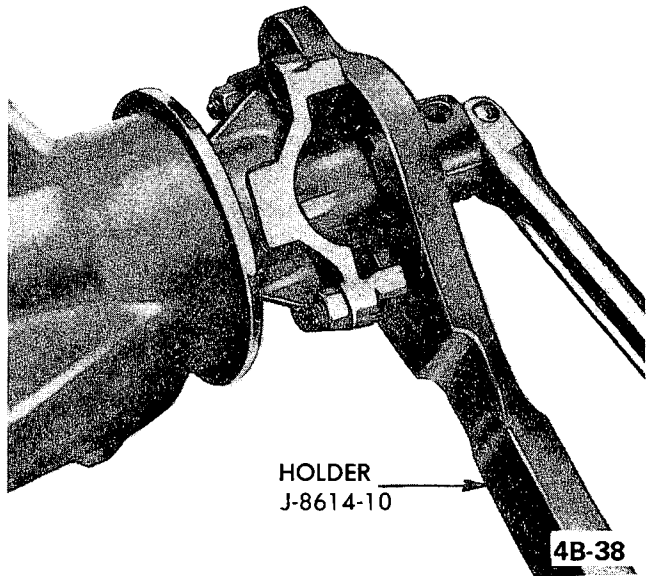


Figure 4B-38 - Installing Pinion Nut

6. Check preload by using a pound inch torque wrench as shown in Figure 4B-39.

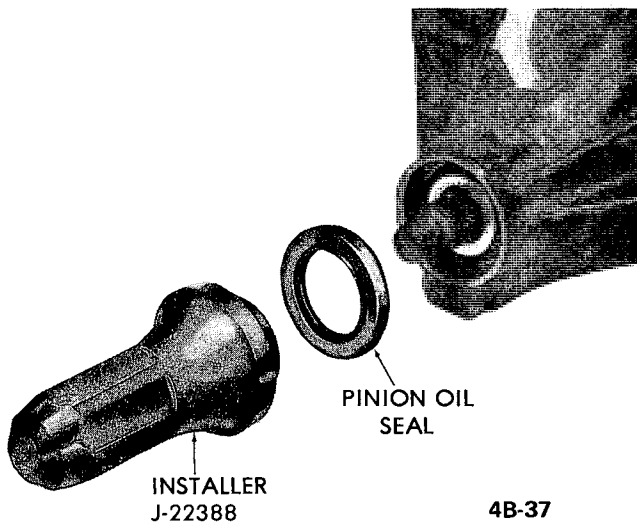


Figure 4B-37 - Installing Pinion Oil Seal 8 1/2", 8 7/8" and 9 3/8" Axles

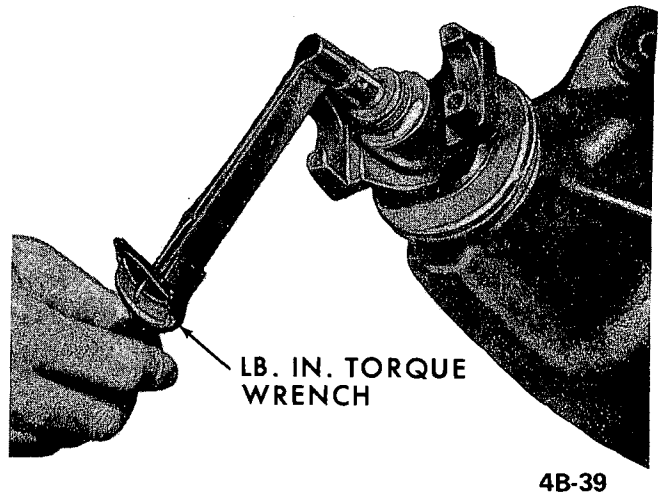


Figure 4B-39 - Checking Pinion Preload

4. Coat lips of pinion oil seal and seal surface of pinion flange with gear lube. Install pinion flange on pinion by tapping with a soft hammer until a few pinion threads project through flange.

5. Coat pinion flange splines with silastic and install pinion washer and nut. Hold pinion flange with Holder J-8614. While intermittently rotating pinion to seat bearings, tighten pinion nut until end play begins to be

After preload has been checked, final tightening should be done very cautiously. For example, if when checking, preload was found to be 5 pound inches, additional tightening of the pinion nut as little as 1/8 turn can add 5 additional pound inches drag. Therefore, the pinion nut should be further tightened only a little at a time and preload should be checked after each slight amount of tightening. Exceeding preload specifications will compress the collapsible spacer too far and requires its replacement.



7. While observing the preceding caution, carefully set preload drag at 20-25 lb. in. on new bearings or 10-15 lb. in. on reused bearings.

8. Rotate pinion several times to assure that bearings have been seated. Check preload again. If drag has been reduced by rotating pinion, re-set preload to specification.

**Assemble Standard Differential Case Assembly**

Before assembling the differential, examine the wearing surfaces of all parts for scoring or unusual wear. Also make certain that all parts are absolutely clean. Lubricate parts with rear axle lubricant just before assembly.

1. Place side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, replace in original sides.
2. Install the two pinion gears and washers, through the two big windows in the case, into mesh with the side gears making sure the pinion gear bores are 180 degrees apart.
3. Rotate the side and pinion gears as one assembly until the pinion gear bores are in alignment with the pinion shaft bores in the case.
4. Install pinion shaft and lock screw. Torque to 15 lb. ft.
5. After making certain that mating surfaces of case and ring gear are clean and free of burrs, thread two 7/16x20x2 (LH) studs into opposite sides of ring gear, then install ring gear on case. See Figure 4B-40. Install ring gear attaching bolts just snug. Torque bolts alternately in progressive stages to 85 lb. ft.

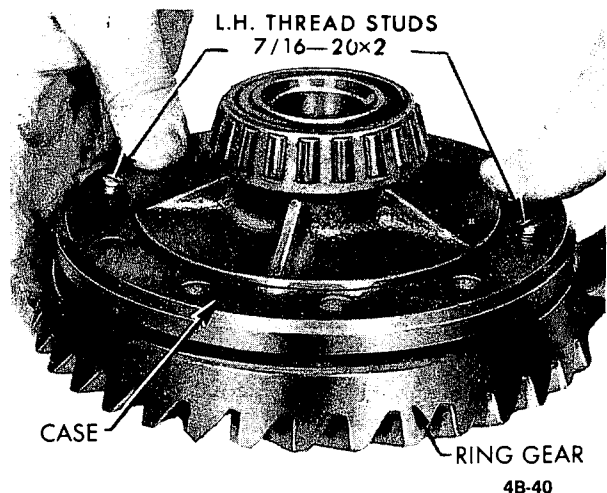


Figure 4B-40 - Installing Ring Gear On Differential Case

6. If differential side bearings were removed, install new bearings using Installer J-25299 on 7 1/2 inch ring gear axles, Installer J-22761 on 8 1/2 inch and 8 7/8 inch ring gear axles or Installer J-8606 on 9 3/8 inch ring gear axles with Driver Handle J-8092. See Figure 4B-41.

**Assemble Plate Type Positive Traction Differential Case Assembly**

1. Inspect cross shaft, pinions, and side gears. Replace any parts which are excessively scored, pitted, or worn. In-

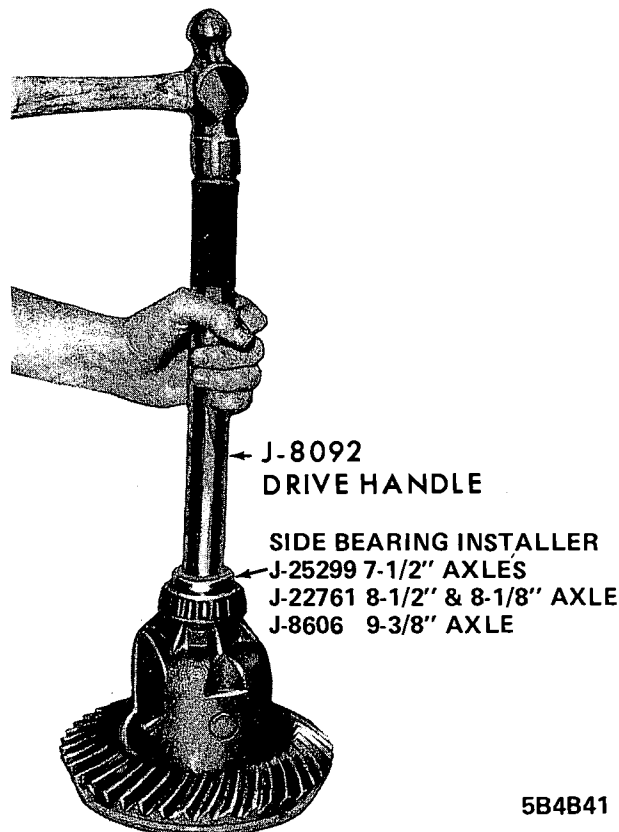


Figure 4B-41 - Installing Differential Side Bearings

spect clutch discs and plates for worn, cracked, or distorted condition. If any of these defects exist, new clutch packs must be installed.

2. Apply positive traction lubricant, or equivalent, to the clutch plates. Any other lubricant used may cause chatter.
3. Assemble the clutch packs as follows: Alternately position clutch plates on each side gear starting and ending with a clutch plate having external lugs. Assemble original spacer plate and shim to complete the stack.
4. On plate clutch type having rounded ear lugs, install ear guides over the lugs. The square ear lug type require no guides.
5. Install side gears and clutch pack assemblies into case on the same side from which they were removed. Install pinions, pinion thrust washers, and cross shaft.
6. Check the pinion to side gear backlash as follows:
  - a. Compress one clutch pack by inserting screwdriver or wedge between the cross shaft and side gear. See Figure 4B-46.
  - b. Mount dial indicator with contact button against tooth of pinion gear. Rotate pinion. Backlash should be .001" to .006".
  - c. If backlash is more than .006", add shims between clutch pack and case. If backlash is less than .001", remove shims. A .002" shim will change backlash approximately .001".
  - d. Repeat procedure with opposite side gear.

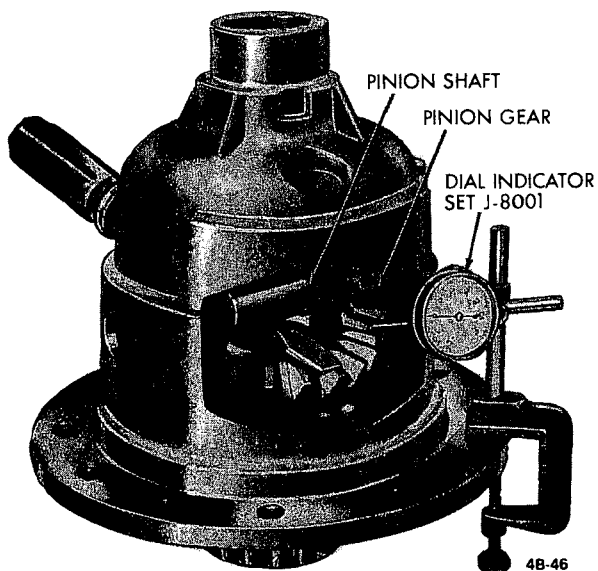


Figure 4B-46 Checking Side Gear to Pinion Gear Backlash

steel, adjusting shims are available in thicknesses ranging from .040" to .100" in increments of .002".

1. Before installation of case assembly, make sure that side bearing surfaces in carrier are clean and free of burrs. Side bearings must be oiled with gear lube and if same bearings are being reused, they must have original outer races in place.

2. Place differential case and bearing assembly in position in carrier. Use service type adjusting shim totaling same thickness as original production type adjusting shims if either new or reused bearings are to be used. Slip left shims in position at left bearing with steel shim next to bearing, then place nominal thickness shim for right side in position and drive steel shim carefully into position between bearing and cast shim using a soft hammer. See Figure 4B-48.

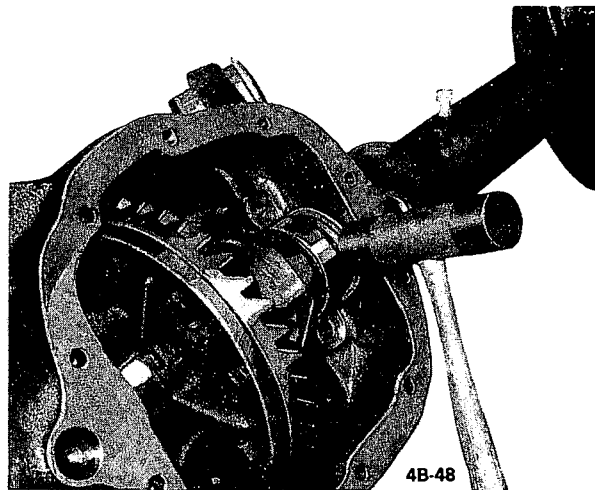


Figure 4B-48 - Installing Differential Adjusting Shims

7. Remove cross shaft. Drive preload spring into position between the side gears. See Figure 4B-47.

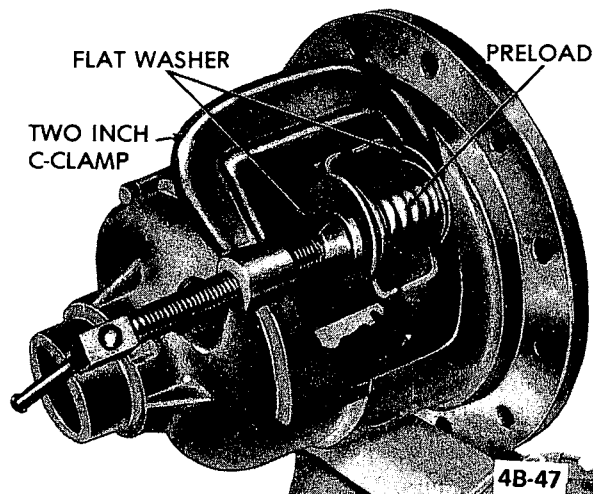


Figure 4B-47 Compressing Preload Springs

8. Assemble the cross shaft and lock screw, torque to 15 lb. ft.

### Install Differential Case and Adjust Side Bearing Preload

Differential side bearing preload is adjusted by changing the thickness of both the right and left shims by an equal amount. By changing the thickness of both shims equally, the original backlash will be maintained. All differential side bearing preload shims used in production are cast. Shims used during service repairs of the differential are of a stamped steel design and are used along with a production type, nominal thickness, cast shim. Stamped steel service shims must be used when differential repairs are made that require changing side bearing preload. Service,

Install side bearing caps, as previously marked and tighten bolts to 55 lb. ft. before checking side bearing preload or backlash.

3. Rotate differential case assembly several complete turns to seat bearings. Check bearing preload using an inch pound torque wrench connected at pinion nut.

Bearing preload should read 35-40 lb. in. of rotating torque with new bearings or 20-25 lb. in. of rotating torque with reused bearings. If preload is not according to these specifications, increase shim thickness on each side .002" for each additional 10 lb. in. preload desired, or decrease shim thickness .002" on each side for each 10 lb. in. preload to be subtracted.

### Adjust Differential Backlash

1. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Figure 4B-49. Use a small button on indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is as nearly as possible in line with gear rotation and perpendicular to tooth angle for accurate backlash reading.

2. With pinion locked to carrier, check gear lash at 3 or 4 points around ring gear. Lash must not vary over .001"

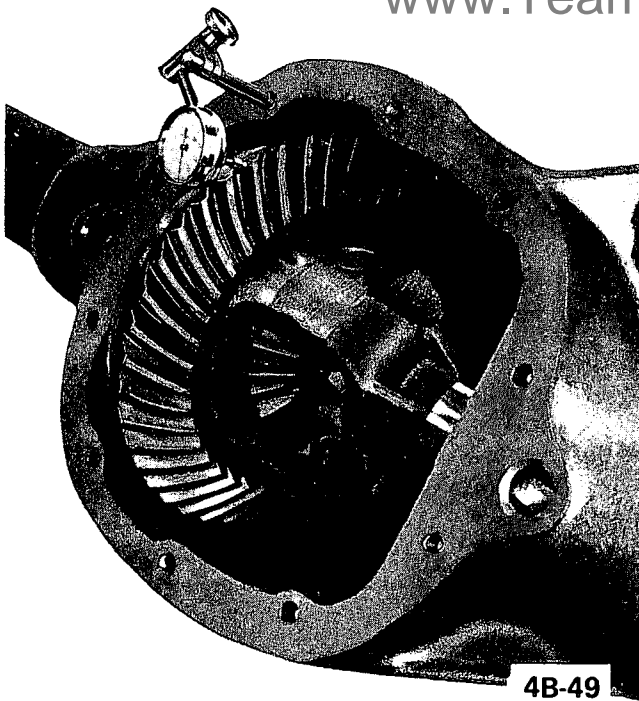


Figure 4B-49 - Checking Ring Gear to Pinion Backlash

around ring gear. If variation is over .001" check for burrs, uneven bolting conditions or distorted case flange and make corrections as necessary.

3. Gear lash at the point of minimum lash should be .006" to .008" for all new gears. If adjustment is necessary, adjust to .007".

If original gear set having a wear pattern is being reinstalled, original gear lash should be maintained with in plus or minus .001".

4. If gear backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. In this way, correct differential bearing preload will be maintained.

Shift .002" in shim thickness for each .001" change in backlash desired. If backlash is .002" too much, decrease thickness of right shim .004" and increase thickness of left shim .004". If backlash is .002" too little, increase thickness of right shim .004" and decrease thickness of left shim .004".

5. Install new cover gasket and cover torquing bolts to 30 lb. ft.

After waiting 20 minutes retorque bolts to 30 lb. ft.

#### Install Axle Shaft Assemblies

1. Apply a coat of wheel bearing grease in bearing recesses of housing.

2. On the "B" or "O" type axles, apply gear lubricant to the splines at the inner end of the axle shaft. Carefully install axle shaft assemblies until splines engage in differential to avoid damage to seals. If the axle to be installed is a positive traction axle, only positive traction type lubricant should be used.

3. For the "C" - "G" - "K" or "P" type axles, proceed as follows:

- a. Add a small amount of grease between seal lips and insert axle shaft through the seal and bearing and, as far as possible, through the side gear. Do not drag shaft across seal lip.
- b. Install "C" lock onto axle shaft. Move axle shaft and "C" lock outward to bottom the "C" lock in the recess of the side gear.
- c. Install pinion shaft and secure with lock bolt (15 lb.ft.).
- d. Install new gasket and cover, torque bolts to 30 lb.ft.
- e. After 20 minutes, retorque bolts to 30 lb.ft.
- f. Install specified quantity and type of lubricant.

**CAUTION:** *Fasteners in steps 4 and 6 are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. These must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

4. Place retainer over studs and install nuts. Tighten to specified torque.

5. Install brake drums over wheel bolts.

6. Install wheels and tighten wheel nuts to specified torque.

#### INSTALL PINION OIL SEAL WITH DIFFERENTIAL INSTALLED IN CAR

##### Removal

In case of pinion oil seal leak, remove old oil seal and install new one (with differential remaining in car) as follows:

Check pinion bearing preload before removing pinion flange. Proper preload can then be maintained if inspection of the flange after removal shows damage requiring replacement.

1. With rear wheels off floor, turn rear wheels and tap brake backing plates with a soft hammer to ensure that brakes are free.

2. Mark location of universal joint to pinion flange and remove retaining bolts which hold rear universal joint to pinion flange. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of bearing rollers when joint is disconnected if tie wire has been removed.

3. Scribe a line on end of pinion stem, extending down along side of stem threads and onto pinion flange nut to assure that parts are reassembled in the same relative position.

4. Punch a small mark on the line at pinion stem end and at top of lock nut, close to pinion stem threads.

Additional clearance to check preload can be obtained between differential and body by raising body a few inches by means of a jack or stand placed under frame at rear.

5. Using a lb. in. torque wrench with a 1/2" drive adapter and socket placed over drive pinion nut, turn two or three revolutions to ensure free movement. Then, take a torque reading while rotating pinion to measure bearing preload. Record reading. See figure 4B-39.

6. Count the number of exposed threads from top of pinion stem to lock nut. Remove lock nut with a heavy duty socket, while holding pinion flange with tool J-8614-10. See figure 4B-38.

7. Remove pinion flange.

When removing seal, use care to keep dirt and other foreign matter out of exposed front pinion bearing.

8. Remove oil seal by prying it out of carrier with a pointed tool, using care to keep tool away from the exposed front bearing. Discard seal. Do not damage seal bore in carrier.

**Replace**

1. Lubricate lip of new seal with clean gear lube. Install seal by tapping into place, using J-22388 or J-228042 and J-23911.

2. Before installing pinion flange, inspect for nicks, scratches or burred surfaces that may damage the seal. If any such damage is evident, hone carefully or install new flange.

a. If inspection shows the original pinion flange to be satisfactory, replace by holding companion flange with J-8614-10 and install nut to exactly the same position as before. Make sure punched holes and scribe line are in alignment. Tighten lock nut an additional 1/16" beyond this alignment.

If new pinion flange is required, see procedure for adjusting pinion bearing preload.

DO NOT exceed the additional tightening of the nut by a distance of more than 1/16" from its original position, as tightening the nut in excess of this amount will disturb the pinion and ring gear tooth contact pattern.

3. Align universal joint to pinion flange and tighten to specified torque.

**PINION FLANGE R & R ALL SERIES**

**Differential Installed in Car**

1. Raise car and remove both rear wheels and drums then disconnect propeller and support by wiring shaft to exhaust pipe. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of bearing rollers when joint is disconnected if tie wire has been removed.

2. Check pinion bearing pre-load with an inch pound torque wrench and record reading and remove pinion flange.

3. Coat the pinion flange splines with silastic and install pinion flange on pinion by taping with a soft hammer until a few pinion threads project through flange.

4. Install pinion flange washer and nut while holding pinion flange with holder, tighten the nut a little at a time while intermittently rotating pinion to seat bearing. Check pre-load until pre-load is 3-5 inch pound more than reading obtained in Step 2.

5. Connect propeller shaft to pinion flange and tighten to specified torque.

6. Install wheels and drums. Check and add lubricant as necessary.

**CHECKING REAR AXLE TOE AND CAMBER**

To check rear axle toe and camber, use front end alignment equipment following manufacturer's instructions for use. Best results will be obtained by backing on alignment equipment.

	<u>TOE (TOTAL)</u>	<u>CAMBER / WHEEL</u>
7 1/2" "H" Car	1/4" In to 5/64" Out	+1/2° to -1/2°
8 1/2" "X" Car	1/4" In to 5/64" Out	+1/2° tp -1/2°
8 1/2" "A" Car	1/16" In to 3/16" Out	+1/2° to -3/4°
8 1/2" "B" Car	1/16" In to 9/64" Out	+1/2° to -1/2°
8 7/8" "B-C-E" Car	1/8" In to 3/16" Out	+1/2° to -1/2°
9 3/8" "B-C-E"	0" In to 1/16" Out	+1/2° to -1/2°

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Figure 4B-50 Toe and Camber Specifications

1. Before making any checks of rear axle toe and camber these checks should be made:

a. The tires should have approximately the same wear and all tires must be inflated to specified pressures.

b. Check for run-out of wheels and tires.

2. If toe and camber does not meet the specifications as shown in Figure 4B-50, replace axle housing.

## SPECIFICATIONS

### DIFFERENTIAL SPECIFICATIONS

#### Tightening Specifications

Use a reliable torque wrench to tighten the parts listed to insure proper tightening without staining or distorting parts. These specifications are for clean and lightly-lubricated threads only; dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Part	Location	Thread Size	Torque Lb.Ft.
Bolt	Rear Universal Joint to Pinion Flange - H, X, A Series and B Wagon .....	5/16-24	15
Bolt	Rear Universal Joint to Pinion Flange - B-C-E Series Less B Wagon .....	7/16-14	75
Bolt	Rear Axle Housing Cover to Carrier .....	5/16-18	30
Nut	Brake Assembly to Rear Axle Housing - A Series .....	3/8-24	35
Nut	Brake Assembly to Rear Axle Housing - B-C-E Series .....	7/16-14	55
Bolt	Ring Gear to Differential Case .....	7/16-20 L.H.	85
Bolt	Bearing Cap to Carrier .....	7/16-14	60
Nut	Rear Wheel to Axle Shaft - H, X and A Series .....	7/16-20	70
Nut	Rear Wheel to Axle Shaft - B-C-E Series .....	1/2-20	90
*Nut	Upper and Lower Control Arm - A Series .....	1/2-13	80
*Bolt	Upper and Lower Control Arm - A Series .....	1/2-13	110
Nut	Upper Control Arm - H Series .....		115
*Nut	Upper Control Arm at Frame - B-C-E Series .....	9/16-12	115
*Bolt	Upper Control Arm at Frame - B-C-E Series .....	9/16-12	140
*Nut	Upper Control Arm at Axle - B-C-E Series .....	1/2-13	80
*Bolt	Upper Control Arm at Axle - B-C-E Series .....	1/2-13	115
*Nut	Lower Control Arm - B-C-E Series .....	9/16-12	115
*Bolt	Lower Control Arm - B-C-E Series .....	9/16-12	115
Nut	Lower End of Shock Absorber to Lower Control Arm Axle Bracket All Except H and X .....	1/2-20	65
Nut	Lower End of Shock Absorber - H and X Series .....	-	45
Nut	Pinion Nose Bumper - B-C-E Series (Less B Wagon) .....	-	10
Nut	Leaf Spring Rear Shackle - B Wagon .....	9/16-12	115
Nut	Leaf Spring Rear Shackle - X Series .....	-	50
Nuts	Bottom Leaf Spring Plate - B Wagon and X .....	7/16-20	40
Screw	Pinion Nose Bumper Bracket to Carrier - B Wagon .....		15
Nut	Pinion Nose Bumper to Bracket .....	-	20
Nut	Pinion Nose Bumper to Bracket - X Series .....	-	10
Screws	Rear Exhaust Hanger to Frame - B Wagon .....	-	72
Nut	Rear Axle Bumper Bracket - X Series .....	-	17
Nut	Rear Axle Bumper to Bracket - X Series .....	-	15
	Differential Pinion Lock - H Series .....		12
	Filler Plug - H Series .....		20
Nut	Lower Control Arm - H Series .....		80
Nut	Lower end of Shock Absorber to Lower Control Arm - H Series .....		45
Nut	Tie Rod Assembly - H Series .....		85
Bolt	Brake Assembly to Rear Axle Housing - H Series .....		20

\*Torquing of nut or bolt to be optional.

**General Specifications**

Rear Axle Type .....	Semi-Floating Hypoid
Drive and Torque - (Except B Wagons and X) .....	Through 4 Arms
Drive and Torque - B Wagons and X .....	Leaf Spring
Rear Axle Oil Capacity - B Wagons, A Wagons, C and E Series .....	5.4 Pints
Rear Axle Oil Capacity - X, A and B Except B Wagons .....	4.25 Pints
Rear Axle Oil Capacity - H Series .....	2.8 Pints
Ring and Pinion Gear Set Type .....	Hypoid
Differential Lubricant (Standard Axle) .....	SAE 90 GL-5
Differential Lubricant (Positive Traction Axle) .....	SAE 80W or 80W-90 GL-5

**Limits for Fitting and Adjusting**

Pinion Bearings Preload (Measured at Pinion Flange Nut)	
New Bearings X, A, B, C, E Series .....	20-25 Lb.In. Rotating Torque With New Seal
Reused Bearings X, A, B, C, E Series .....	10-15 Lb.In. Rotating Torque With New Seal
New Bearings - H Series .....	10-25
Used Bearings - H Series .....	8-12
Total Assembly Preload (Measured at Pinion Flange Nut)	
New Bearings .....	35-40 Lb.In. Rotating Torque W/New Seal-Ring Gear
Reused Bearings .....	20-25 Lb.In. Rotating Torque W/New Seal-Ring Gear
Ring Gear Position .....	.006"-.008" Backlash

**Differential Gear Ratios**

Rear axle ratio, differential type, manufacturer, and build date information is stamped on the right rear axle tube on the forward side. Refer to Figures 4B-51 and 4B-52. Any reports made on rear axle assemblies must include the full code letters and build date numbers.

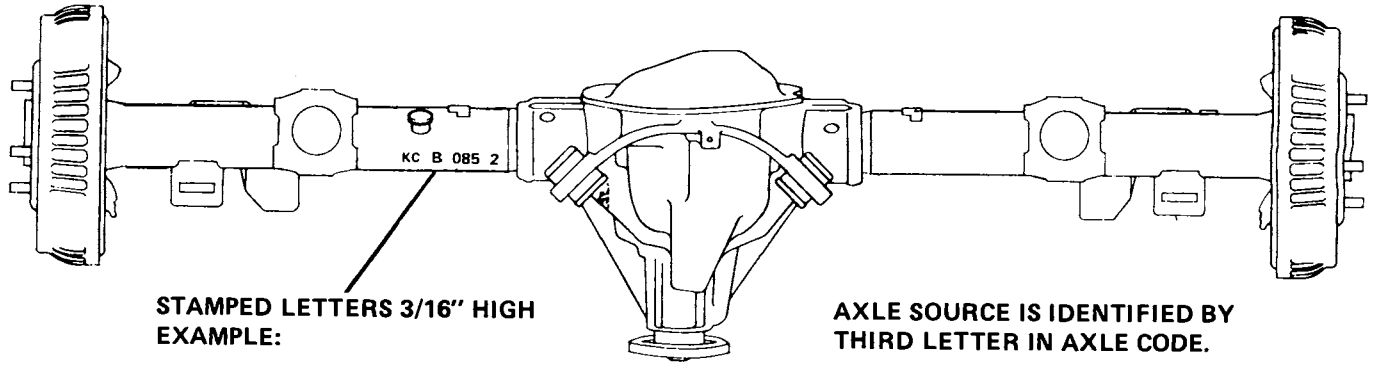
**Speedometer Gears**

Speedometer gears must correspond with axle ratios and tire sizes in order to have correct speedometer and odometer readings. See Figures 4B-53, 4B-54 and 4B-55.

AXLE ASSEMBLY RATIO USAGE H-X-A						
MODELS	ENGINE	TRANSMISSION	STANDARD			RING GEAR SIZE
			RATIO	REG. CODE	LTD. SLIP CODE	
H	231	4-SPEED MANUAL	2.56	DB	EB	7 1/2
		THM 350	2.56	DB	EB	7 1/2
X	250	3-SPEED MANUAL	3.08	GD	JX	8 1/2
		THM 350	2.73	GB	JV	8 1/2
	231	3-SPEED MANUAL	2.73	GJ	JR	8 1/2
		THM 350	2.56	GK	JS	8 1/2
	350	THM 350	2.56	GA	JU	8 1/2
	260	THM 350	2.56	GA	JU	8 1/2
A	231	3-SPEED MANUAL	2.73	AL	CL	8 1/2
		THM 350				
	350	THM 350	2.56	AH	CH	8 1/2
A WAGON	350	THM 350	3.08	WC	XC	8 7/8
			3.23	WD	XD	8 7/8

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Figure 4B-51 H, X and A Series Differential Identification



STAMPED LETTERS 3/16" HIGH  
EXAMPLE:

KC B 085 2

- SHIFT
- DAY OF YEAR BUILT
- AXLE BUILD SOURCE
- AXLE RATIO

AXLE SOURCE IS IDENTIFIED BY  
THIRD LETTER IN AXLE CODE.

EXAMPLE: AD B

- B — BUICK
- O — OLDSMOBILE
- C — CHEVROLET BUFFALO
- G — CHEVROLET GEAR & AXLE
- K — GM OF CANADA
- P — PONTIAC

AXLE ASSEMBLY RATIO USAGE B-C-E						
MODELS	ENGINE	TRANSMISSION	STANDARD			RING GEAR SIZE
			RATIO	REG CODE	Ltd. CODE SLIP (G80)	
B	350	THM 350	3.08	KC	LC	8 1/2
				UC	VC	8 1/2
	455	THM 400	2.73	UA	VA	8 7/8
	400	THM 400	2.73	KA	LA	8 1/2
Police Car Option	350	THM 350	3.08	UL	VL	8 7/8
	455	THM 400	2.73	UJ	VJ	8 7/8
B Wagon	455	THM 400	2.93	NH	RH	9 3/8
	400	THM 400	2.73	NG	NH	9 3/8
C	455	THM 400	2.73	NA	RA	8 7/8
				UU	VU	8 7/8
			3.23	NC	RC	8 7/8
				UX	VX	8 7/8
E	455	THM 400	2.93	UB	VB	8 7/8
			2.73	NA	RA	9 3/8

5B4B52

Figure 4B-52 B-C-E Series Differential Identification

X-MANUAL TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	E78-14	18	BROWN
	FR78-14		
	F78-14		
2.73	E78-14	19	NATURAL
	FR78-14		
	F78-14		
3.08	E78-14	22	GRAY
	FR78-14	21	RED
	F78-14		
3.23	E78-14	19	NATURAL
	FR78-14	18	BROWN
	F78-14		
3.42	E78-14	20	BLUE
	FR78-14	19	BROWN
	F78-14		
3.73	E78-14	22	GRAY
	FR78-14	21	RED
	F78-14		

X-THM 350 TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	E78-14	37	RED
	FR78-14		
	F78-14	36	WHITE
2.73	E78-14	39	BROWN
	FR78-14		
	F78-14	38	BLUE
3.08	E78-14	44	DARK GRAY
	FR78-14		
	F78-14	43	PURPLE
3.23	E78-14	37	RED
	FR78-14		
	F78-14	45	LIGHT BLUE
3.42	E78-14	40	BLACK
	FR78-14		
	F78-14	39	BROWN
3.73	E78-14	43	PURPLE
	FR78-14		
	F78-14	42	GREEN

H-MANUAL TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	BR78-13	18	BROWN
	BR70-13		
	BR78-13	18	BROWN
	BR70-13		

5B4B53

Figure 4B-53 - Speedometer Gear Chart - X and H Series



A-MANUAL TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOP
2.56	F78-14	18	BROWN
	FR78-15		
	G78-14		
	GR78-15		
	GR70-15		
2.73	F78-14	19	NATURAL
	FR78-15		
	G78-14		
	GR78-15	18	BROWN
	GR70-15		
	HR78-15		
3.08	F78-14	21	RED
	FR78-15		
	G78-14		
	GR78-15		
	GR70-15		
	HR78-15	20	BLUE
	H78-14		
HR70-15			
3.23	F78-14	22	GRAY
	FR78-15		
	G78-14		
	GR78-15		
	GR70-15		
	HR78-15		
	H78-14	21	RED
HR70-15			
3.42	F78-14	19	NATURAL
	FR78-15		
	G78-14		
	GR78-15	18	BROWN
	GR70-15		
	HR78-15		
3.73	F78-14	21	RED
	FR78-15		
	G78-14		
	GR78-15	20	BLUE
	GR70-15		
	HR78-15		
H78-14			
HR70-15			

A-AUTOMATIC TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	F78-14	36	WHITE
	FR78-15		
	G78-14	35	PINK
	GR78-15		
	GR70-15		
	2.73	HR78-15	34
H78-14			
HR70-15			
2.73	F78-14	38	BLUE
	FR78-15		
	G78-14	37	RED
	GR78-15		
	GR70-15		
	3.08	HR78-15	36
H78-14			
HR70-15			
3.08	F78-14	43	PURPLE
	FR78-15		
	G78-14	42	GREEN
	GR70-15		
	GR78-15		
	3.23	HR78-15	41
H78-14			
HR70-15			
3.23	F78-14	45	LIGHT BLUE
	FR78-15		
	G78-14	44	DARK GRAY
	GR78-15		
	GR70-15		
	3.42	HR78-15	43
H78-14			
HR70-15			
3.42	F78-14	39	BROWN
	FR78-15		
	G78-14	38	BLUE
	GR78-15		
	GR70-15		
	3.73	HR78-15	45
H78-14			
HR70-15			
3.73	F78-14	42	GREEN
	FR78-15		
	G78-14	41	YELLOW
	GR78-15		
	GR70-15		
	3.73	HR78-15	40
H78-14			
HR70-15			

5B4B54

Figure 4B-54 - Speedometer Gear Chart - A Series

B-C-E 350 TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	HR78-15	34	LIGHT GREEN
	JR78-15		
	H78-15		
	J78-15		
2.73	HR78-15	36	WHITE
	JR78-15		
	H78-15	35	PINK
	J78-15		
3.08	HR78-15	41	YELLOW
	JR78-15	40	BLACK
	H78-15		
	J78-15		
3.23	HR78-15	43	PURPLE
	JR78-15	42	GREEN
	H78-15		
	J78-15		
3.42	HR78-15	45	LIGHT BLUE
	JR78-15		
	H78-15	44	DARK GRAY
	J78-15		
3.73	HR78-15	39	BLACK
	JR78-15		
	H78-15		
	J78-15		BROWN

B-C-E 400 TRANSMISSION			
AXLE RATIO	TIRE SIZE	SPEEDO DRIVEN GEAR	
		NO. OF TEETH	IDENT. COLOR
2.56	JR78-15	34	LIGHT GREEN
	J78-15		
	LR78-15		
2.73	JR78-15	36	WHITE
	J78-15	35	PINK
	LR78-15		
	L78-15	34	LIGHT GREEN
2.93	JR78-15	38	BLUE
	J78-15		
	LR78-15		
	L78-15	37	RED
3.23	JR78-15	42	GREEN
	J78-15		
	LR78-15	41	YELLOW
	L78-15		
3.42	JR78-15	45	LIGHT BLUE
	J78-15	44	DARK GRAY
	LR78-15		
	L78-15	43	PURPLE

5B4B55

Figure 4B-55 - Speedometer Gear Chart - B-C-E Series