

1997-99 DRIVE AXLES

Differentials & Axle Shafts - Catera

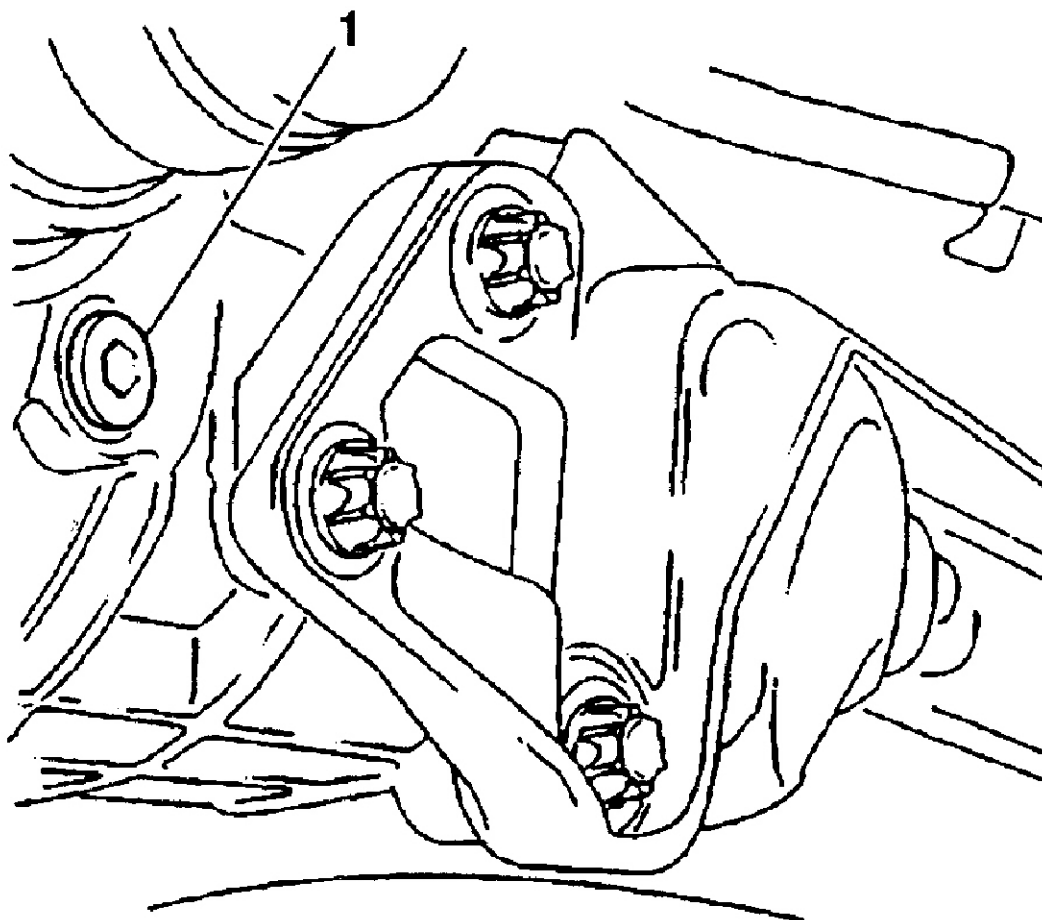
LUBRICATION

NOTE: Numbers in parenthesis correspond with numbers in illustration.

LUBRICANT LEVEL CHECK

Perform these steps to check the lubricant level:

1. Ensure the vehicle is level.
2. Clean the area around the rear axle housing filler plug.
3. Remove the rear axle housing filler plug (1) from the passenger side of the rear axle differential. See **Fig. 1**.
4. The lubricant level is to be maintained at the bottom edge of the filler plug hole WHEN COLD. Use only the recommended lubricant. See **LUBRICATION SPECIFICATIONS** table.
5. Install the rear axle housing filler plug (1) into the rear axle differential. Tighten the rear axle housing filler plug (1). See **Fig. 1** and **TORQUE SPECIFICATIONS**.



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Fig. 1: Locating Rear Axle Housing Filler Plug
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LUBRICATION SPECIFICATIONS

Application	Specification
Capacity	1.65 Liters (1.74 Quarts)

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Application		SAE 80W-90 Gear Oil	Lubricant GM P/N
Capacity		1.65 Liters (1.74 Quarts)	12345977

TROUBLE SHOOTING

BACKLASH CLUNK

The following conditions cause excessive clunk with acceleration and deceleration:

- A worn differential drive pinion gear.
- A worn differential case.
- An excessive clearance between the inner CV joint shaft and the differential side gear splines.
- An excessive clearance between the differential side gear hub and the counterbore in case.
- A worn differential pinion and side gear teeth.
- An excessive differential drive pinion gear-to-differential ring backlash.

The entire differential assembly should be disassembled and inspected if it is determined that the differential components are damaged or excessively worn.

COMMON CAUSES OF GEAR RELATED NOISES

The following list are common causes of gear related noises:

- A low lubricant level.
- An incorrect lubricant used.
- An incorrect meshing of the gear teeth (i.e. incorrect pinion positioning shim or incorrect backlash setting adjustment).
- Scored gear teeth. Scored gear teeth are usually the result of incorrect lubricant type or incorrect lubricant level.
- End play in the bearings.
- Bruised teeth.
- Chipped teeth.
- An excessive runout of the differential drive pinion gear head.
- Ring gear backlash.
- Ring gear creeping on the differential carrier. Ring gear creeping on the differential carrier results from loose ring gear bolts. This noise usually appears as sharp metallic sound when shifting from reverse to first gear.

DIFFERENTIAL SIDE & PINION GEAR NOISE

The noise produced by the differential side gear and the pinion gear occurs when there is an excessive wear between the side gear hubs and the differential case bores. This can cause a clucking noise when the vehicle is driven at low speeds. Noise produced due to excessive wear between the gear teeth is most pronounced on turns.

DRIVELINE SNAP

A snap sudden start, either forward or reverse, may be caused by a loose pinion flange. Replace the nut or the flange if the pinion flange is loose. See **PINION OIL SEAL & FLANGE** .

ENGINE & OTHER CONTRIBUTING FACTORS

The following noises are occasionally confused with the differential noises:

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- Noises which originate from the engine.
- Noises which originate from the transmission.
- Noises which originate from the muffler.

Perform the following steps to isolate these noises:

1. Carefully note the approximate vehicle speed and the conditions where supposed differential noise is most pronounced.
2. Ensure the vehicle is in a quiet place to avoid interfering noises.
3. Ensure the vehicle is stationary.
4. Run the engine up and down slowly through the engine speeds that correspond to the vehicle speeds at which the noise was prominent.
5. Observe whether there is any similarity to a differential noise.
6. Muffler noises are usually readily identified, the exception being when a muffler emits a high-pitched periodic whistling noise that may be confused with a bearing noise.

NOISE DIAGNOSIS

Noise Diagnosis

Condition	Cause
Noise is the same in drive or coast.	<ul style="list-style-type: none"> • Road noise. • Tire noise. • Front wheel bearing noise. • Rear wheel bearing noise. • Incorrect driveline angles.
Noise changes on a different type of road.	<ol style="list-style-type: none"> 1. Road noise. 2. Tire noise.
Noise tone is lower as the vehicle speed is lowered.	Tire noise.
Noise is produced with the vehicle standing and driving.	<ul style="list-style-type: none"> • Engine noise. • Automatic transmission noise.
Vibration	<ul style="list-style-type: none"> • Unbalanced propeller shaft. • Damaged propeller shaft. • Tire unbalance. • Worn universal joint in the propeller shaft. • Incorrect driveline angles.
A knock or a click approximately every two revolutions of the rear wheel.	Rear wheel bearing.
Noise is most pronounced on turns.	<ul style="list-style-type: none"> • Rear wheel bearing. • Worn rear tie rod ends.
A continuous low pitch whirring or scraping noise starting at a relatively low speed.	Differential drive pinion gear inner or outer bearing noise.
Drive noise, coast noise, or float noise.	Differential ring gear and differential drive pinion gear noise.
Clunk on acceleration or deceleration	<ul style="list-style-type: none"> • A worn differential drive pinion gear or differential side gear hub counterbore worn oversize. • A worn universal joint on propeller shaft.
Groan in forward or reverse	<ul style="list-style-type: none"> • Wrong axle lubricant in axle. • Differential drive pinion gear bearing worn.
Clunk or knock on rough road operation.	Worn rear tie rod ends.

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Fig. 2: Identifying Noise Diagnosis
 Courtesy of GENERAL MOTORS CORP.

RING & PINION GEAR NOISE

Noise produced by the ring and pinion gearset is of a cyclic nature. The following is a list of the noises:

• Drive Noise

A drive noise is most pronounced on constant acceleration through the speed range of 33-60 mph (50-90 km/h).

- **Coast Noise**

A coast noise is most pronounced when the vehicle is allowed to coast through the speed range from 60-33 mph.

- **Flat Noise**

A flat noise is most pronounced while the vehicle is kept at a constant speed for periods between 33-60 mph (50-90 km/h).

Differential noise always changes when comparing drive and coast. Differential noise usually ceases when coasting with the transmission in neutral at speeds under 33 mph.

TIRE NOISE

The noise can easily be mistaken for differential noise even though the noisy tires may be located on the front of the vehicle. The noise may change with different road conditions, whereas, differential noise is more speed and/or torque (load) sensitive. First check for and eliminate tire noise before proceeding to diagnose a differential noise.

WHEEL BEARINGS

The following conditions cause a noise similar to tire noise:

- Worn wheel bearings.
- Brinelled wheel bearings.
- Chipped wheel bearings.
- Damaged wheel bearings.

The noise is constant, if the noise does not vary on drive or coast and if the noise still persists when coasting with the transmission in neutral. This noise does not noticeably change on differing road surfaces to the same degree as does tire noise. Although not so pronounced, wheel bearing noise can also be compared to a road surface noise, which is produced when the vehicle is traveling over uneven or rough road surfaces.

REMOVAL & INSTALLATION

REAR AXLE HOUSING COVER & GASKET

NOTE: Numbers in parenthesis correspond with numbers in illustration.

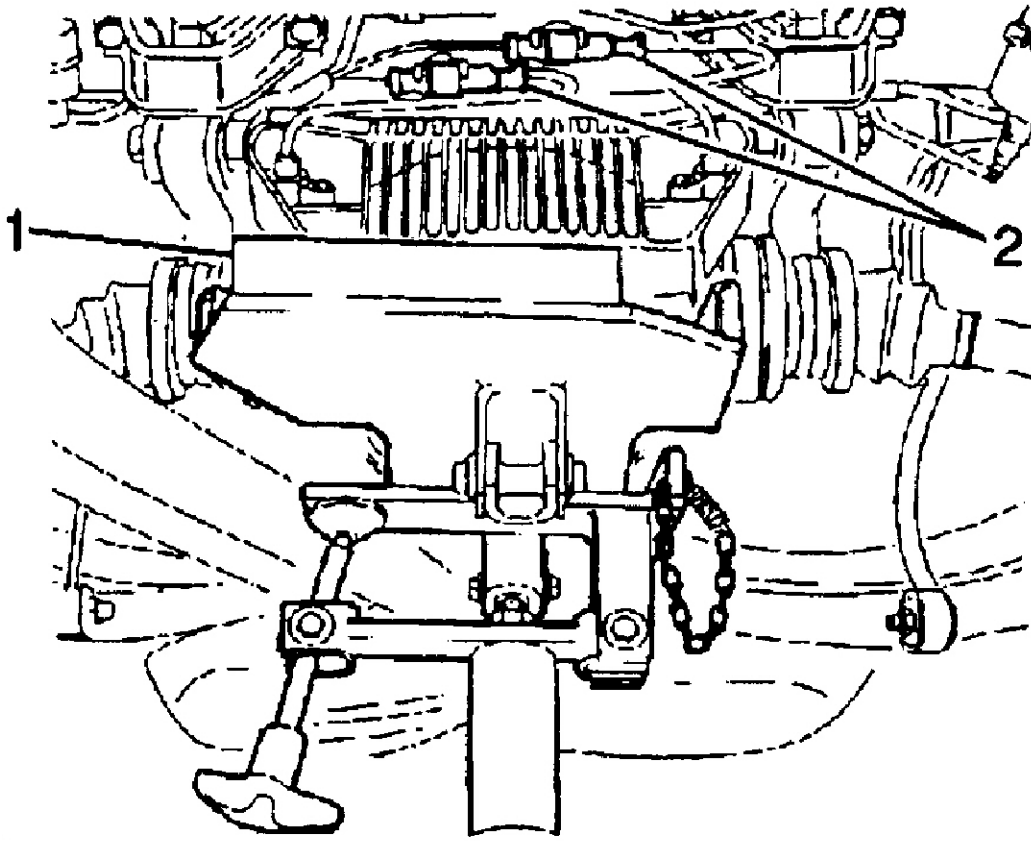
Removal

1. Raise and support the vehicle.
2. Support the differential with a transmission jack (1). See **Fig. 3**.
3. Remove the ABS sensor connectors (2). See **Fig. 3**.
4. Remove the differential support bracket bolts (1) from the differential support bracket (2). See **Fig. 4**.
5. Remove the differential bushing bolts (1) from the differential. See **Fig. 5**.

NOTE: The differential may be lowered slightly (4- 5 inches) without the removal of the drive axles or the propeller shaft from the differential. This provides sufficient clearance to remove the rear axle housing cover.

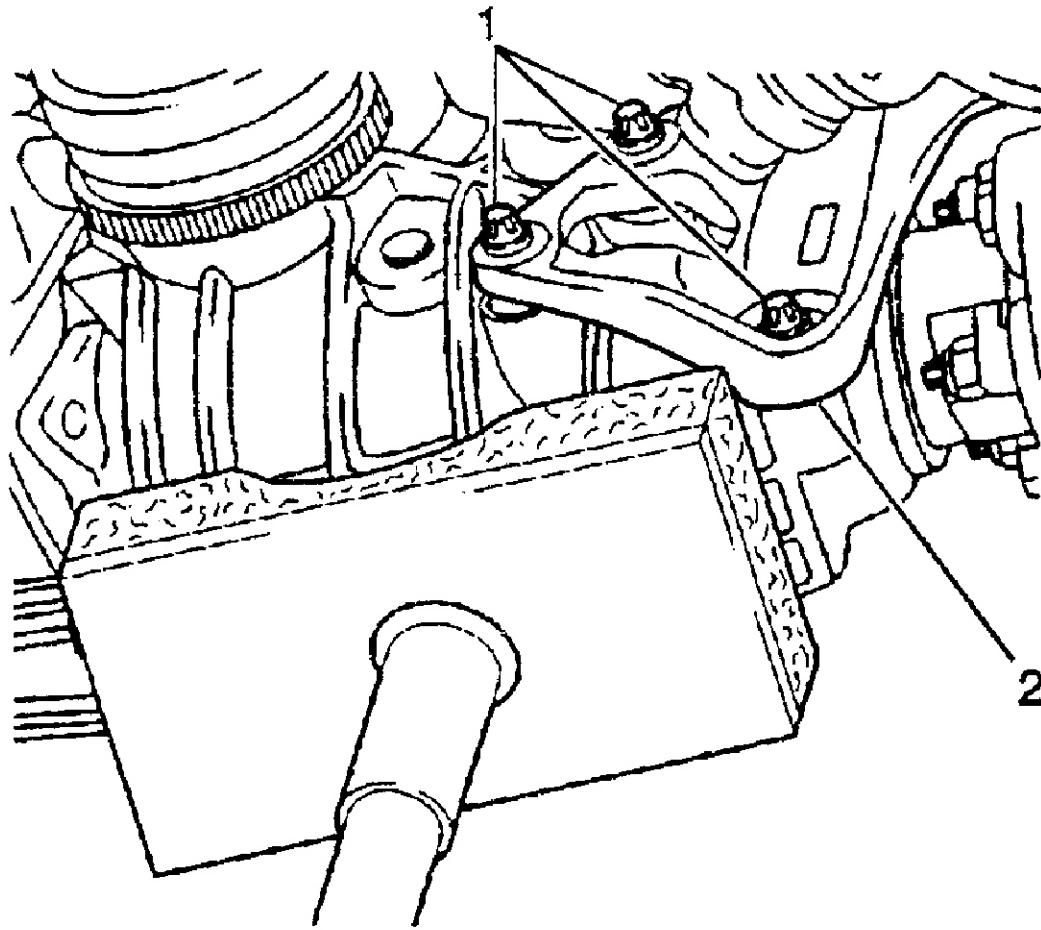
6. Lower the differential slightly.

7. Place a drain pan underneath the differential.
8. Remove the rear axle housing cover bolts (1). See **Fig. 6** .
9. Remove the rear axle housing cover from the rear axle housing. See **Fig. 7** .
10. Clean the sealing surfaces on the rear axle housing.
11. Clean the sealing surfaces on the rear axle housing cover.
12. Remove the ABS sensor bolts from the cover. See **Fig. 7**
13. Remove the ABS sensors from the cover. See **Fig. 7** .



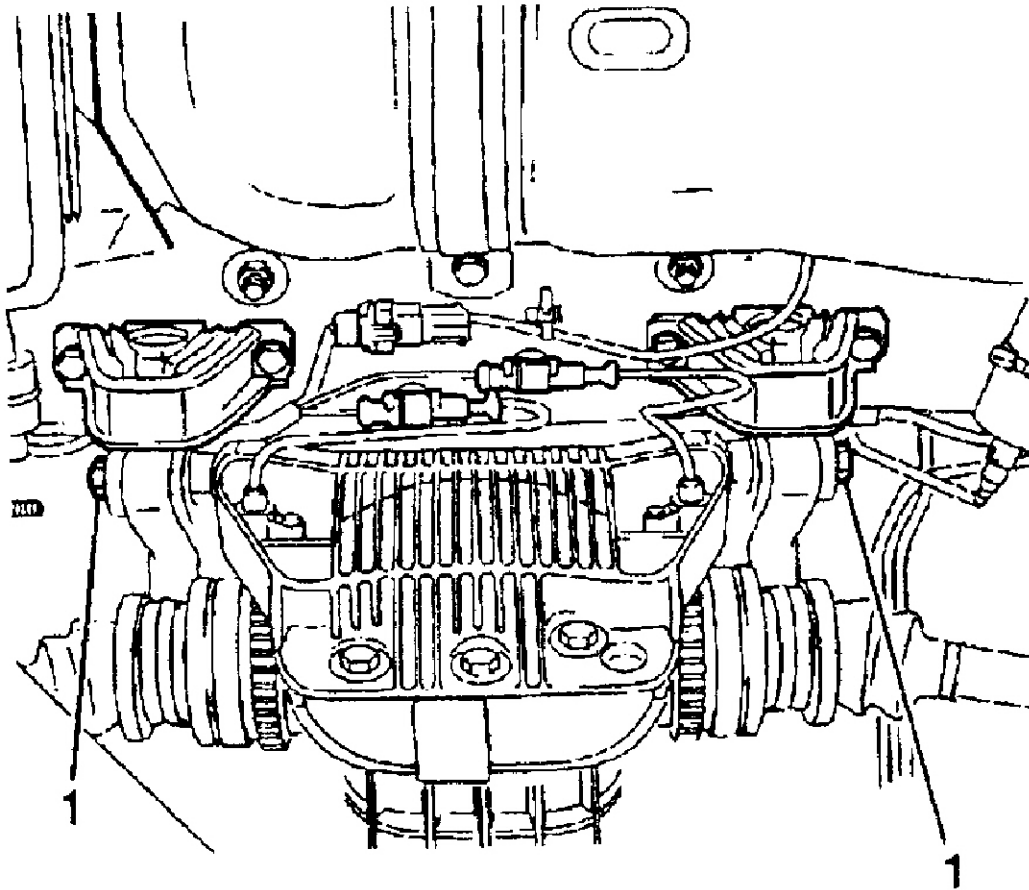
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Fig. 3: Removing & Installing Jack & ABS Connectors
Courtesy of GENERAL MOTORS CORP.



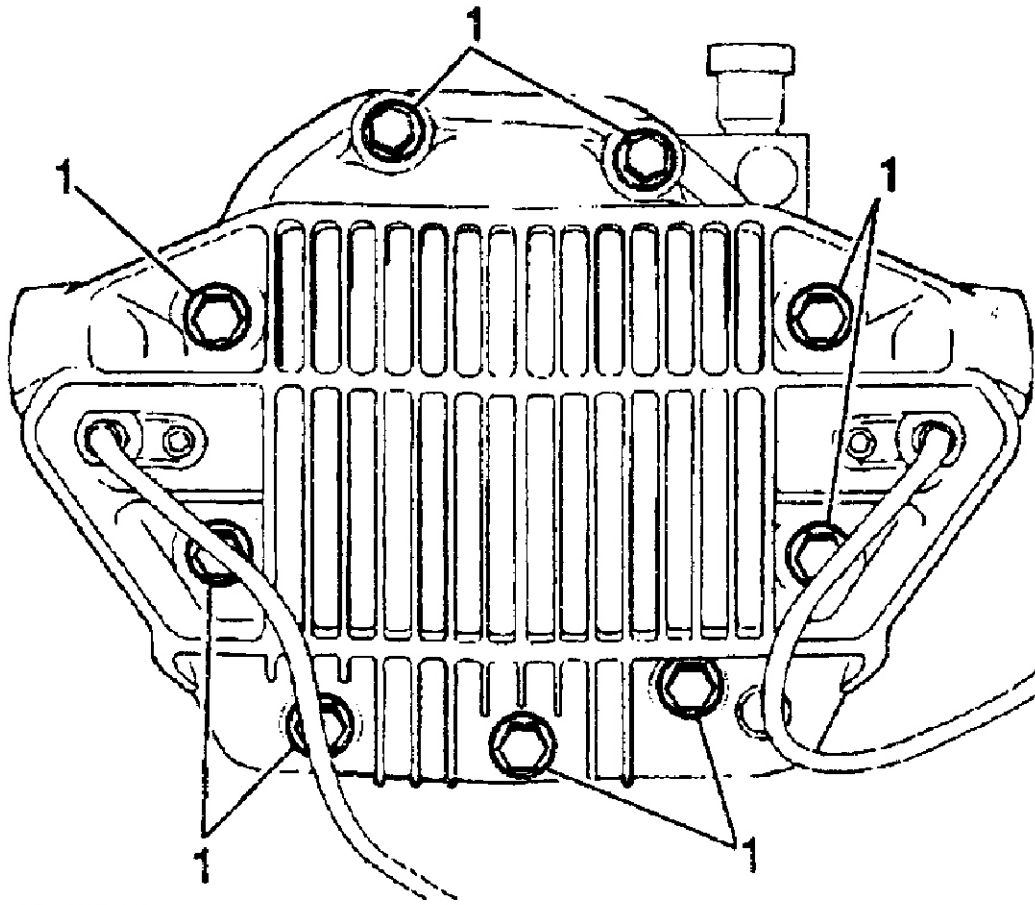
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Fig. 4: Removing & Installing Differential Support Bolts From Bracket
Courtesy of GENERAL MOTORS CORP.



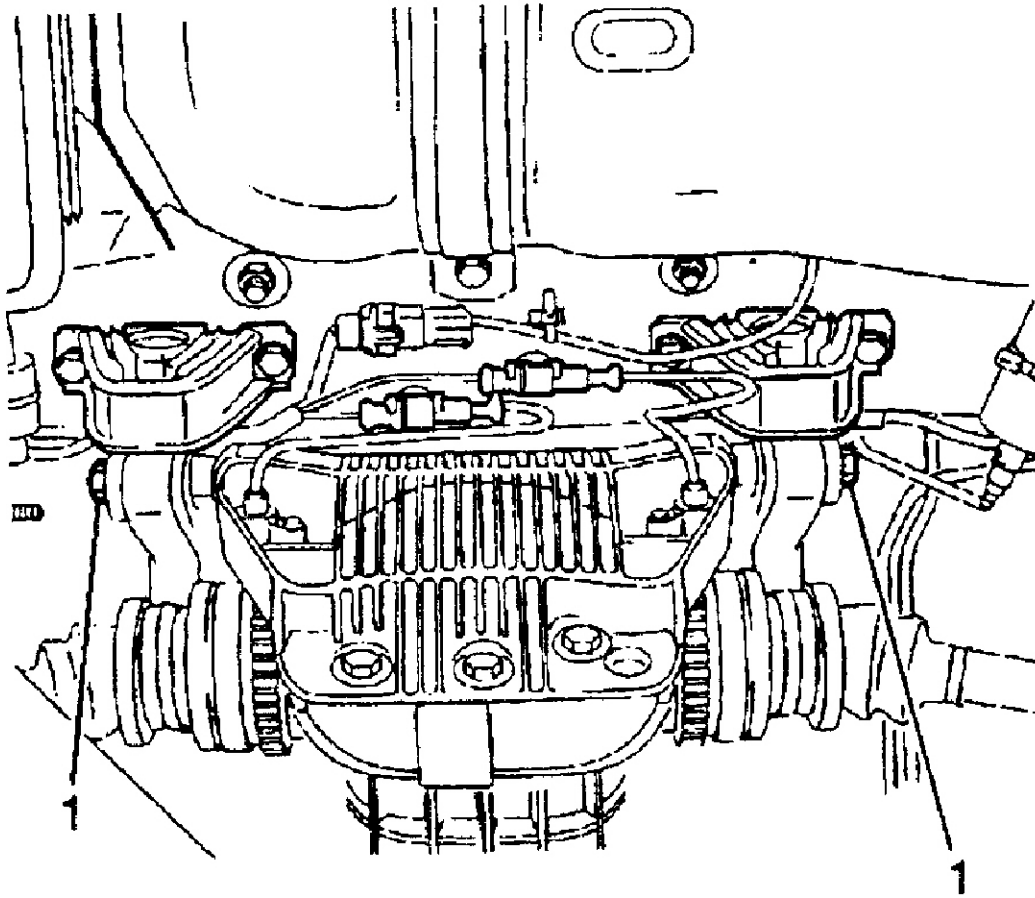
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Fig. 5: Removing & Installing Rear Differential Bolts From Differential
Courtesy of GENERAL MOTORS CORP.



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Fig. 6: Removing & Installing Rear Axle Housing Cover Bolts
Courtesy of GENERAL MOTORS CORP.



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Fig. 7: Removing & Installing Rear Axle Housing Cover & ABS Sensor
 Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the ABS sensor to the cover. See **Fig. 7** .
2. Install the ABS sensor bolts to the cover. Tighten the ABS sensor bolts. See **Fig. 7** . See **TORQUE SPECIFICATIONS** .
3. Coat the sealing surfaces uniformly with sealant, GM P/N 12346141 or equivalent.
4. Install the rear axle housing cover to the rear axle housing. See **Fig. 7** .
5. Install the rear axle housing cover bolt (1). Tighten the rear axle housing cover bolts. See **Fig. 6** . See **TORQUE SPECIFICATIONS** .
6. Raise the differential into place.
7. Install the differential support bracket bolts (1) to the differential support bracket (2). Tighten the differential support bracket bolts. See **Fig. 4** and **TORQUE SPECIFICATIONS** .
8. Install the rear differential bushing bolts (1) to the differential. Tighten the rear differential bushing bolts. See **Fig. 5** and **TORQUE SPECIFICATIONS** .
9. Install the ABS sensor connectors (2). See **Fig. 3** .
10. Remove the transmission jack (1). See **Fig. 3** .
11. Refill the rear axle with proper lubricant. See **LUBRICATION** .
12. Lower the vehicle.
13. Test drive the vehicle.
14. Inspect the vehicle for leaks.

DIFFERENTIAL

NOTE: Numbers in parenthesis correspond with numbers in illustration.

Removal

1. Raise and support the vehicle.
2. Support the rear axle differential with a transmission jack (1). See **Fig. 3**.
3. Remove the ABS sensor connectors (2). See **Fig. 3**.
4. Remove the axle shafts. For 1997 models, see **AXLE SHAFTS - REAR** article. For 1998-01 models, see **AXLE SHAFTS -- CATERA** article.
5. Remove the propeller shaft. See **DRIVESHAFT & UNIVERSAL JOINTS -- CATERA** article.
6. Remove the rear propeller shaft coupling.
7. Remove the differential support bracket bolts (1) from the differential support bracket (2). See **Fig. 4**.
8. Remove the rear differential bushing bolts (1) from the differential. See **Fig. 5**.
9. Remove the differential.

Installation

1. Use the transmission jack to raise the differential into the mounting position.
2. Install the rear differential bushing bolts (1) to the differential. Tighten the rear differential bushing bolts. See **Fig. 5** and **TORQUE SPECIFICATIONS**.
3. Install the differential support bracket bolts (1) to the differential support bracket (2). Tighten the differential support bracket bolts. See **Fig. 4** and **TORQUE SPECIFICATIONS**.
4. Install the rear propeller shaft coupling.
5. Install the rear propeller shaft. See **DRIVESHAFT & UNIVERSAL JOINTS -- CATERA** article.
6. Install the axle shafts. For 1997 models, see **AXLE SHAFTS - REAR** article. For 1998-01 models, see **AXLE SHAFTS -- CATERA** article.
7. Install the ABS sensor connectors (2). See **Fig. 3**.
8. Remove the transmission jack (1). See **Fig. 3**.
9. Fill and check the lubricant level. See **LUBRICATION**.
10. Lower the vehicle.
11. Test drive the vehicle.
12. Inspect the vehicle for leaks.

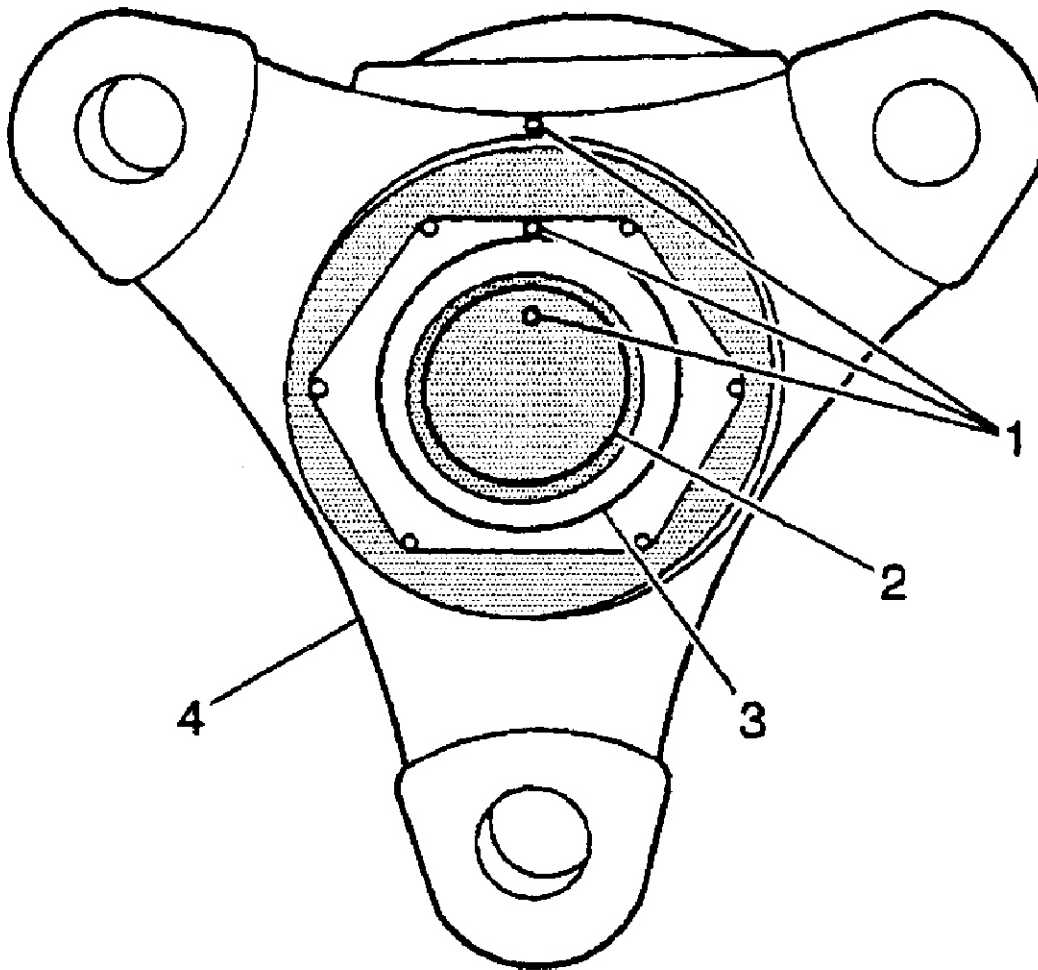
PINION OIL SEAL & FLANGE

NOTE: Numbers in parenthesis correspond with numbers in illustration.

Removal (Flange)

1. Raise and support the vehicle.
2. Remove the propeller shaft from the rear axle. See **DRIVESHAFT & UNIVERSAL JOINTS -- CATERA** article.
3. Remove the propeller shaft coupling from the rear axle.
4. The flange runout is minimized and the pinion bearing preload is maintained by reassembling in the original position. Lightly center punch the alignment marks (1) on the following as an aid for reassembly: See **Fig. 8**.
 - On the differential drive pinion flange nut (3). See **Fig. 8**.

- On the differential drive pinion flange (4). See **Fig. 8** .
 - On the differential drive pinion gear end (2). See **Fig. 8** .
5. Install the Rear Hub Holding Adapter (J 42066) onto the differential drive pinion flange. See **SPECIAL TOOLS** .
 6. Use the Rear Hub Holding Adapter (J 42066) to hold the differential drive pinion flange. See **SPECIAL TOOLS** .
 7. Remove the differential drive pinion flange nut.
 8. Remove the Rear Hub Holding Adapter (J 42066).
 9. Install a universal gear puller to the pinion flange.
 10. Remove the pinion flange from the differential drive pinion gear.



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Fig. 8: Identifying Differential Drive Pinion Alignment Marks
 Courtesy of GENERAL MOTORS CORP.

Installation (Flange)

1. Ensure that the drive pinion gear shaft threads are free from burrs.
2. Coat the splines with the recommended rear axle lubricant.
3. Seal the surface of the pinion flange with rear axle lubricant.
4. Install the differential drive pinion flange onto the differential drive pinion gear.

CAUTION: The pinion flange has an interference fit on the pinion gear shaft splines. The pinion flange should only be pulled into place by tightening

the retaining nut. DO NOT use force or hammer the flange during the installation of the drive pinion flange onto the drive pinion.

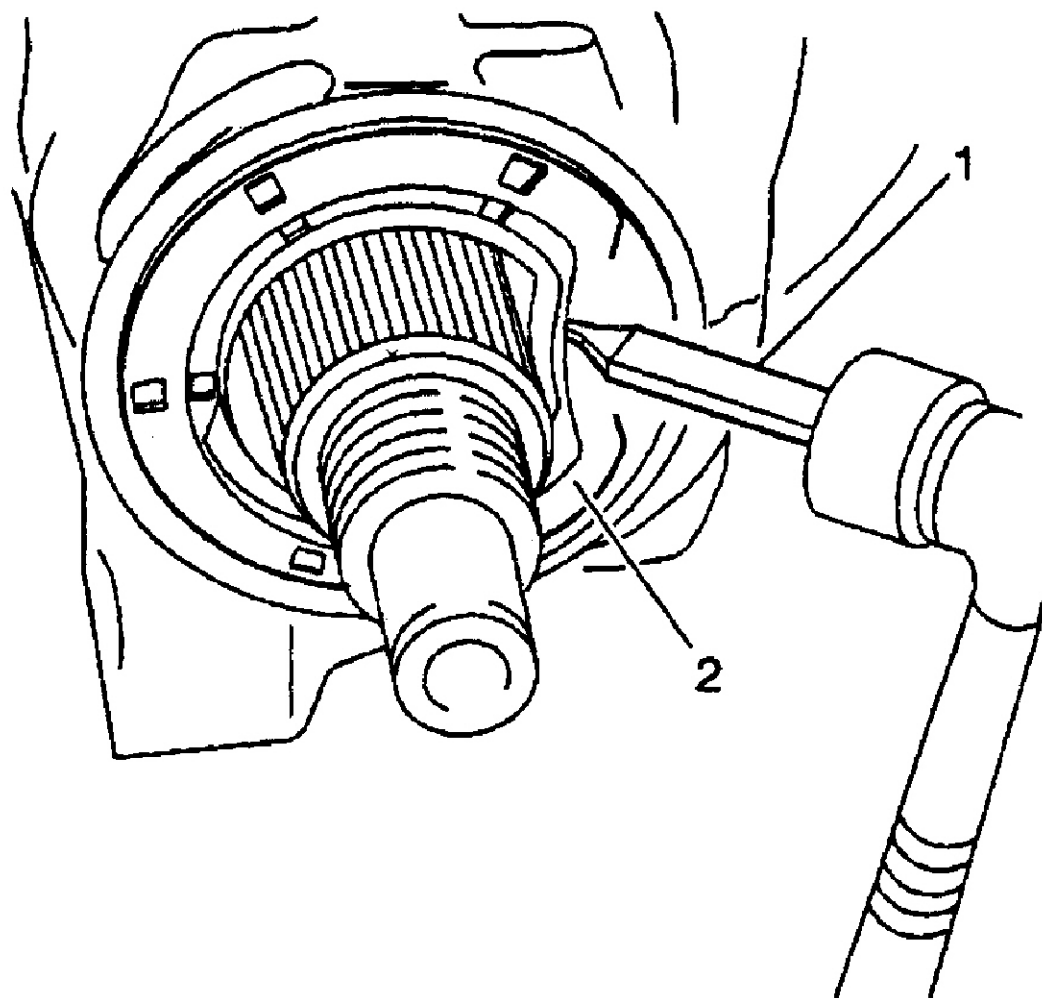
5. Install the differential drive pinion flange nut. Gradually tighten the flange nut until the pinion shaft end play is reduced to approximately 0.50 mm (.020 in).
6. If REUSING the drive pinion flange continue tightening the nut while alternatively turning the pinion gear to seat the bearings until the alignment marks (1) align. Then, further tighten the nut but no more than an additional 5 degrees. Backing off the pinion flange nut to compensate for overtightening the nut will not properly set preload. See **Fig. 8**.
7. If a NEW drive pinion flange is installed, the differential must be removed to set the drive pinion bearing preload. Set the preload without the carrier installed and with the bearings lubricated. See **AXLE ASSEMBLY SPECIFICATIONS** and **Fig. 27**.
 - The preload specifications are being approached when no further end play is detectable and when the holder will no longer pivot freely as the differential drive pinion gear is rotated.
 - DO NOT attempt further tightening until the preload is checked.
 - Carefully perform the final tightening only after the preload has been checked.
 - Minute tightening of the nuts adds significant inch pounds of turning torque.
 - Further tightening the nut slightly while checking the preload after each tightening.
 - Exceeding the preload specifications compresses the collapsible spacer too far, thus requiring the installation of a new spacer.
8. Install the rear propeller shaft coupling.
9. Install the propeller shaft. See **DRIVESHAFT & UNIVERSAL JOINTS -- CATERA** article.
10. Fill and check lubricant level. See **LUBRICATION**.
11. Lower the vehicle.

Removal (Seal)

1. Remove the drive pinion flange, if not previously removed.

CAUTION: Position the drift on an angle to drive the seal inward away from the housing surface to prevent affecting the surface condition of the housing. Take care not to damage the differential housing as this could result in a leak after reassembly.

2. Use a drift (1) and use a dead-blow hammer to remove the differential drive pinion oil seal (2) from the rear axle housing. See **Fig. 9**.



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Fig. 9: Removing Oil Seal From Rear Axle Housing
Courtesy of GENERAL MOTORS CORP.

Installation (Seal)

1. Lubricate the new seal with rear axle lubricant.
2. Lightly coat the outside of the replacement seal with a non-hardening gasket cement.
3. Use the Pinion Seal Driver (J 42108) to drive the seal (1) over the pinion gear (2) squarely into the rear axle housing until the tool bottoms on the differential housing. See **Fig. 10** .

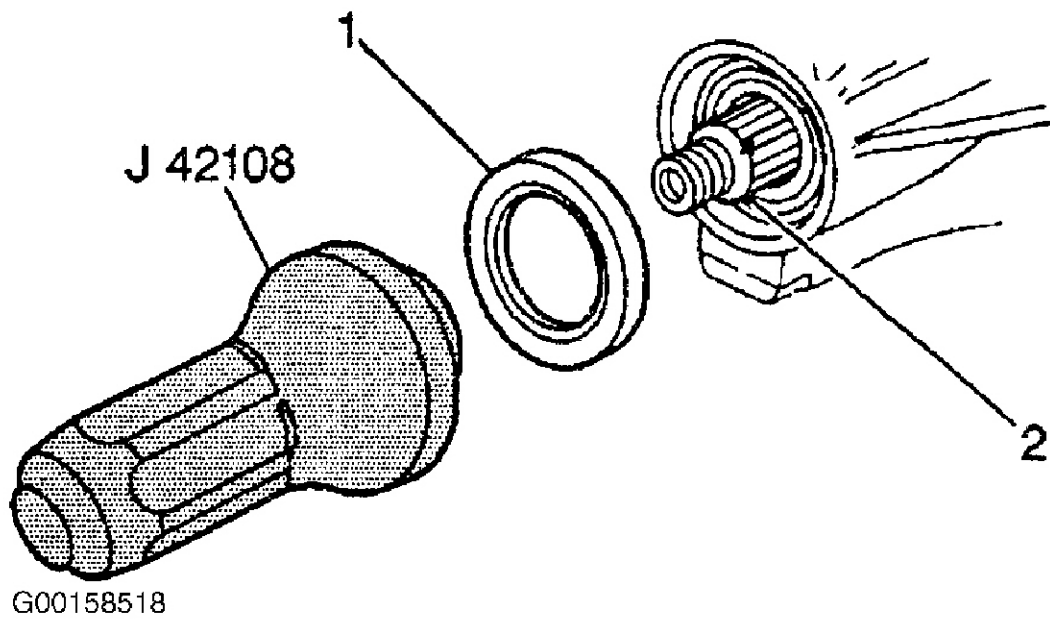


Fig. 10: Installing Pinion Seal

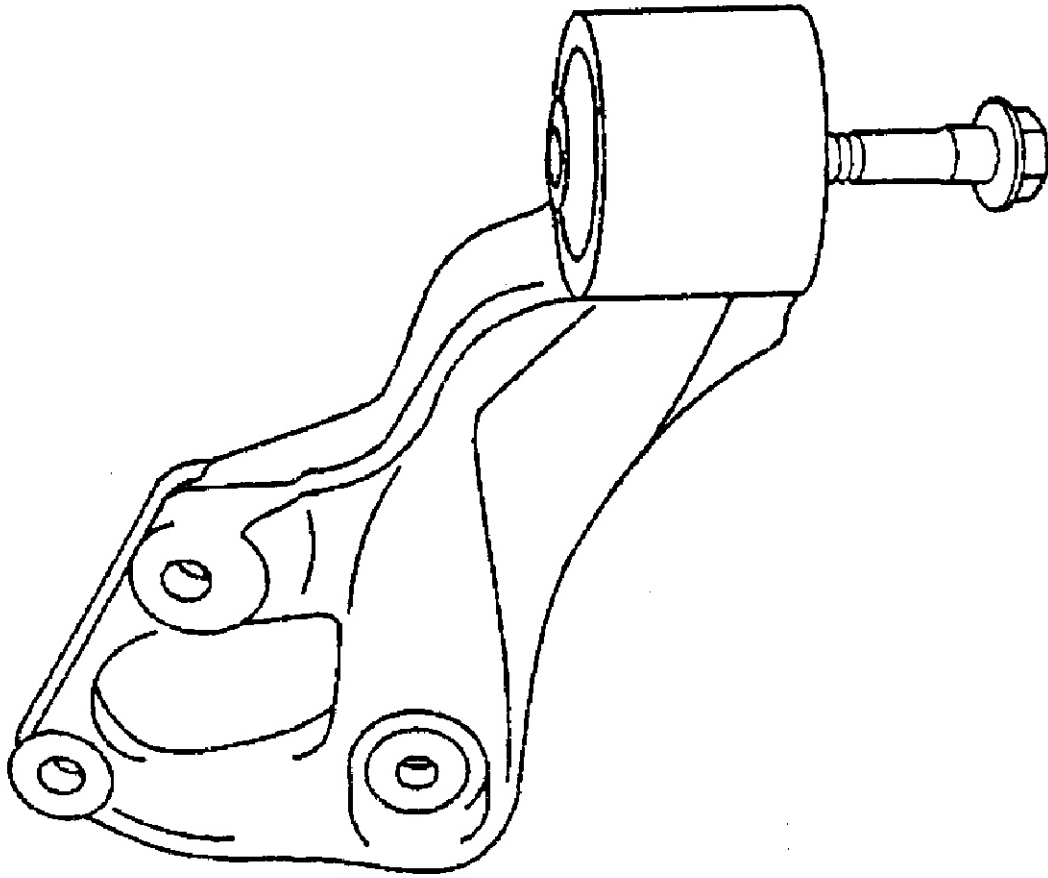
Courtesy of GENERAL MOTORS CORP.

FRONT DAMPING BUSHING

NOTE: Numbers in parenthesis correspond with numbers in illustration.

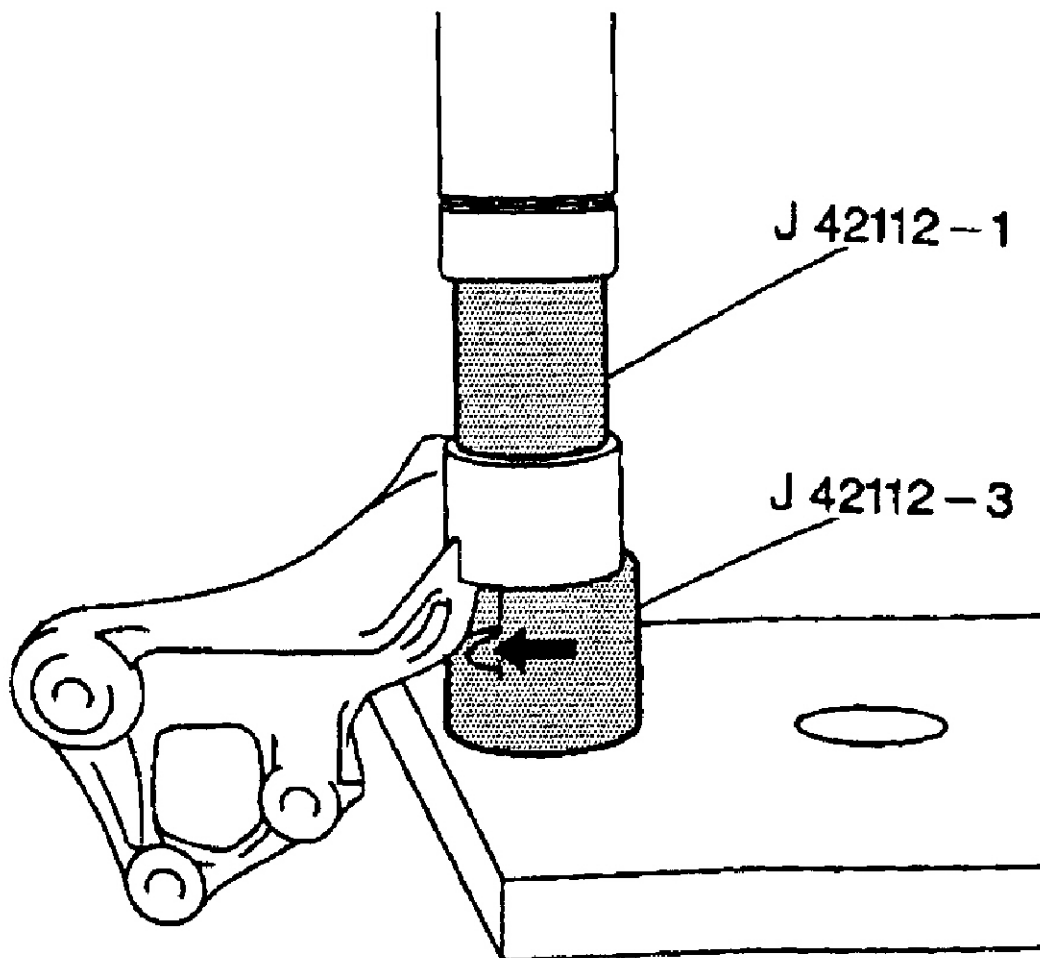
Removal

1. Raise and support the vehicle.
2. Use a transmission jack to support the differential.
3. Remove the differential support bracket lower bolts (1) from the differential support bracket (2). See **Fig. 4**.
4. Slightly lower the front of the rear axle differential.
5. Remove the differential support bracket upper bolt from the differential support bracket. See **Fig. 11**.
6. Remove the differential support bracket. See **Fig. 11**.
7. Use the following tools to press the bushing out of the bracket:
 - Use the Bushing Driver/Installer (J 42112-2). See **Fig. 12**.
 - The correct position of the recess (arrow) on the Bushing Receiver (J 42112-3). Use the Bushing Receiver (J 42112-3). See **Fig. 12**.
 - Use a suitable press.



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Fig. 11: Removing Differential Support Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

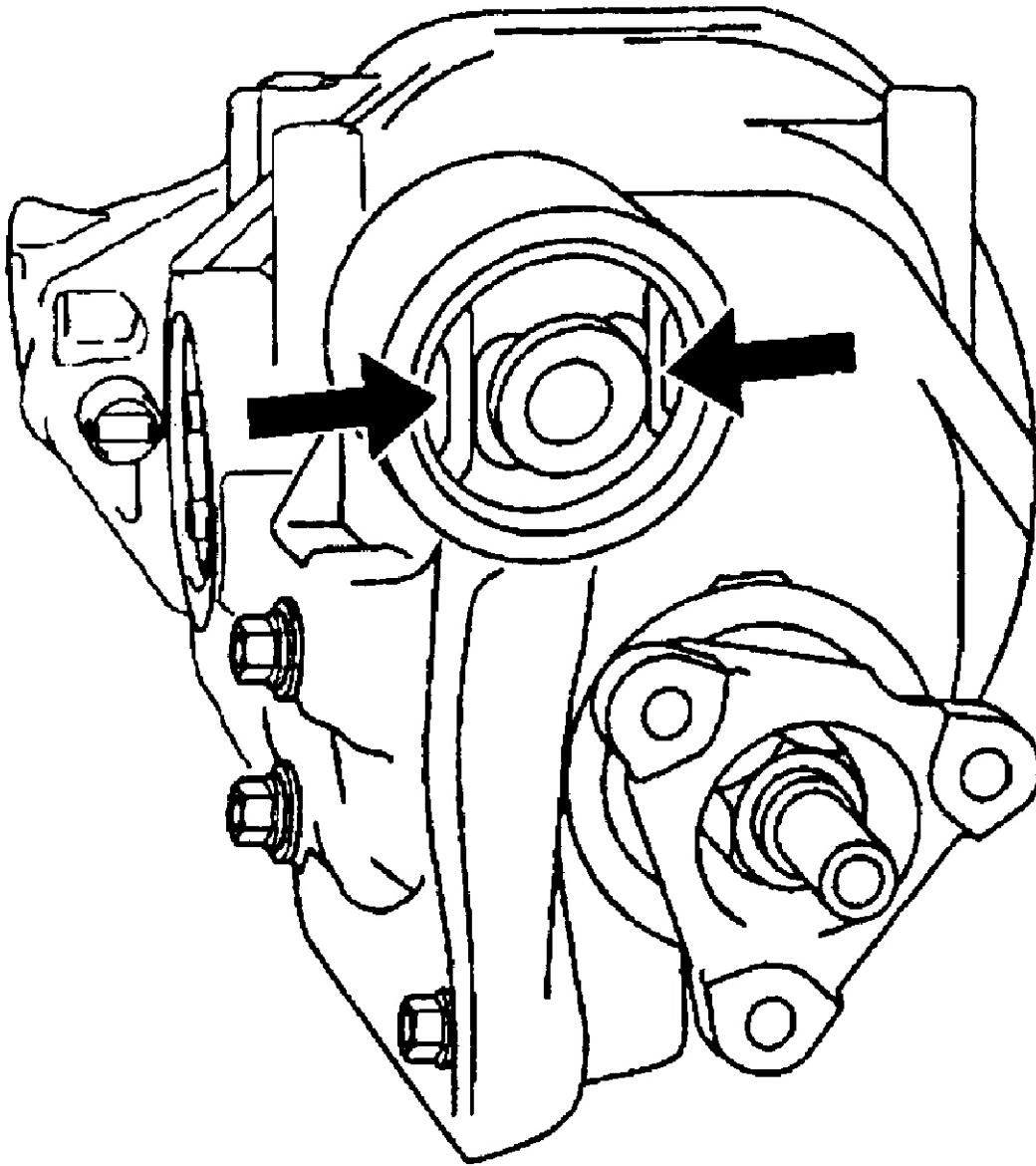


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Fig. 12: Pressing Bushing Out Of Bracket
 Courtesy of GENERAL MOTORS CORP.

Installation

1. Align the new bushing in the bracket so that the slots (arrows) on the rubber are parallel to the bracket. See **Fig. 13**.
2. Use the following tools to press the new bushing into the bracket:
 - Use the Bushing Driver/Installer (J 42112-2). See **Fig. 12**.
 - The correct position of the recess (arrow) on the Bushing Receiver (J 42112-3). Use the Bushing Receiver (J 42112-3). See **Fig. 12**.
 - Use a suitable press.
3. Install the upper bracket (1) through the bushing. The bolt cannot be inserted into the bracket when the bracket is installed position. See **Fig. 11**.
4. Install the differential support bracket to the differential.
5. Install the differential support bracket lower bolts (1) to the differential support bracket (2). Tighten the differential support bracket lower bolts. See **Fig. 4**.
6. Slightly raise the front of the differential.
7. Install the differential support bracket to the rear suspension cradle.
8. Install the differential support bracket upper bolt (1) to the rear suspension cradle. Tighten the differential support bracket upper bolt. See **Fig. 4**.
9. Remove the transmission jack.
10. Lower the vehicle.



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Fig. 13: Aligning New Bushing In Bracket
 Courtesy of GENERAL MOTORS CORP.

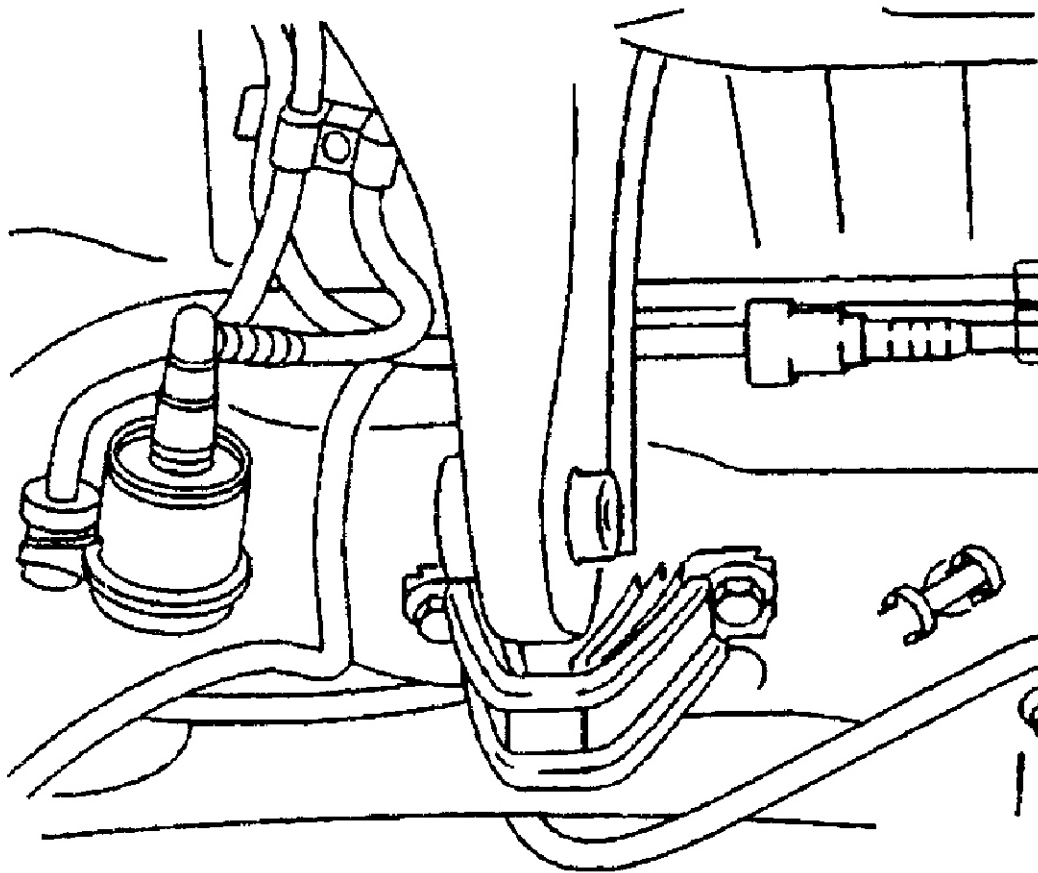
REAR DAMPING BUSHING (RIGHT SIDE)

CAUTION: The rear differential bushings are removed from the inside outward. Once the rear differential bushings are removed they are not reusable. Therefore, the rear differential bushings must be replaced.

Removal

1. Raise and support the vehicle.
2. Lower the rear axle differential. See **DIFFERENTIAL**.
3. Remove the engine fuel filter retaining strap. See **Fig. 14**.
4. Suspend the engine fuel filter to one side. See **Fig. 14**.
5. Perform the following steps using the components from the Control Arm Bushing Set (J 21474-01) to press the bushing out of the cradle. See **SPECIAL TOOLS**.
 - Install the Bushing Receiver (J 21474-5) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
 - Insert the assembly through the bushing from the outside of the bushing.

- Install the Bushing Driver/Remover (J 42112-4) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
 - Install the 3/8 Inch Nut (J 21474-18) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
6. Hold the 3/8 Inch Bolt (J 21474-19) while tightening the 3/8 Inch Nut (J 21474-18) until the bushing is removed from the suspension cradle. See **Fig. 15**.



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Fig. 14: Removing Engine Fuel Filter Retaining Strap
Courtesy of GENERAL MOTORS CORP.

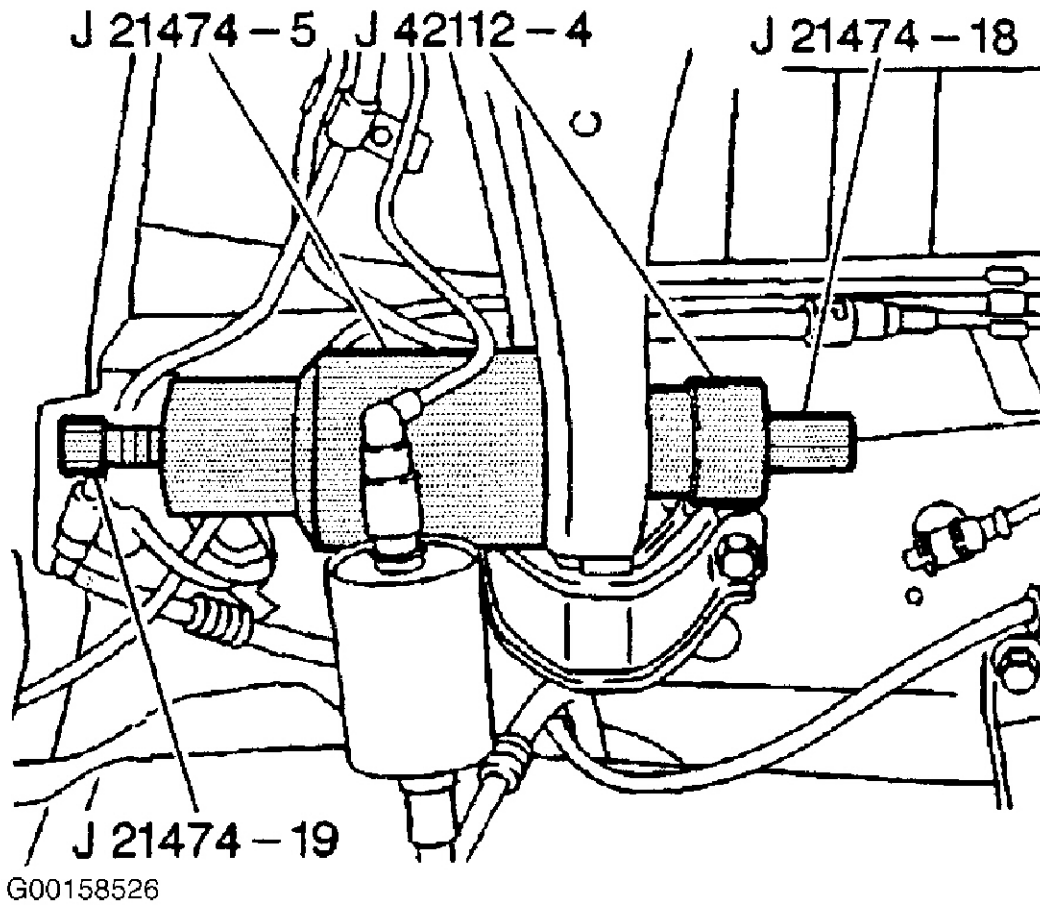
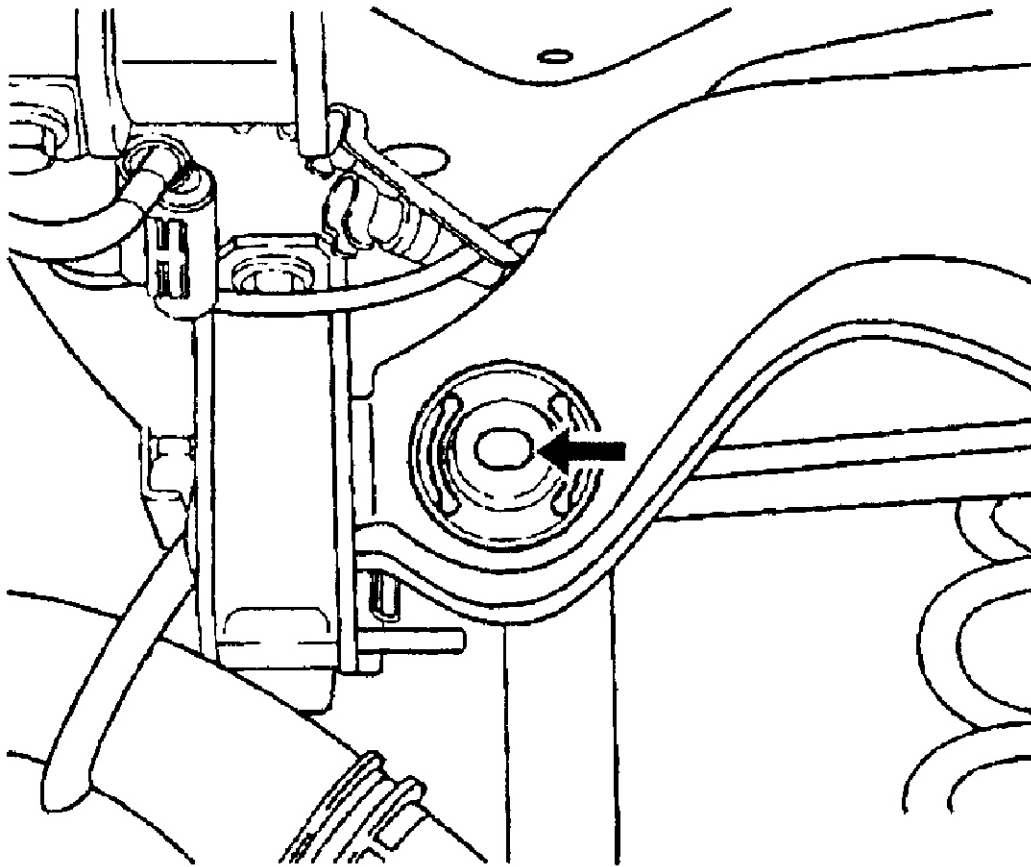


Fig. 15: Pressing Bushing Out Of The Cradle
 Courtesy of GENERAL MOTORS CORP.

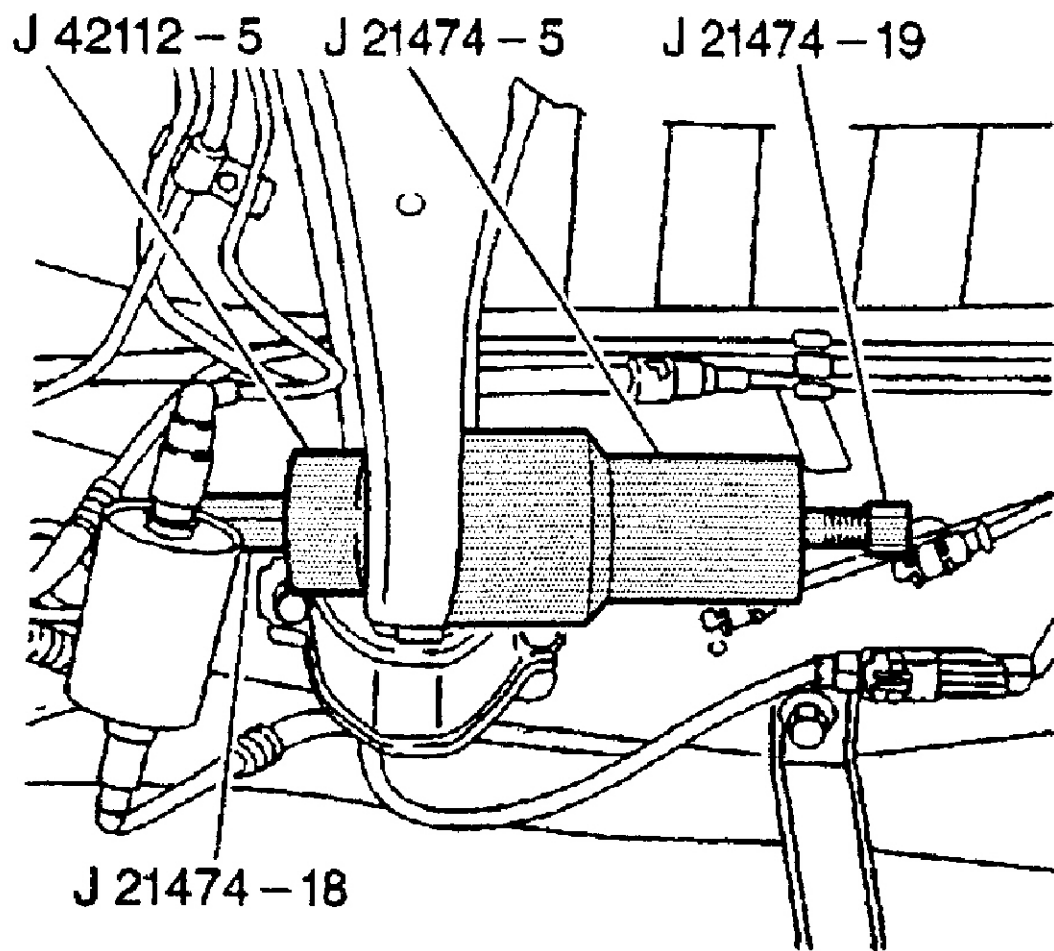
Installation

1. The bushing must be installed into the suspension cradle with the correct orientation as shown. See **Fig. 16** .
2. Perform the following steps to install the bushing: See **Fig. 17** and **SPECIAL TOOLS** .
 - Fit the Bushing Receiver (J 21474-5) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 17** .
 - Insert the assembly through the cradle bushing bore from the inside outward.
 - Position the bushing onto 3/8 Inch Bolt (J 21474-19). Then, into the cradle bushing bore. See **Fig. 17** .
 - Install the Bushing Driver/Installer (J 42112-5) onto the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - Install the 3/8 Inch Nut (J 21474-18) onto the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - Draw the bushing into the bore with the correct orientation by holding the 3/8 Inch Nut (J 21474-18) stationary while tightening the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - The bushing is positioned when the Bushing Driver/Installer (J 42112-5) bottoms on the suspension cradle.
3. Measure the distance between the inside surfaces of the bushings. The distance should be between 11.81-11.88 in. (300-302 mm). See **Fig. 18** .
4. Remove the tools.
5. Reposition the engine fuel filter. See **Fig. 14** .
6. Fasten the engine fuel filter retaining strap around the filter. See **Fig. 14** .
7. Install the differential. See **DIFFERENTIAL** .
8. Lower the vehicle.



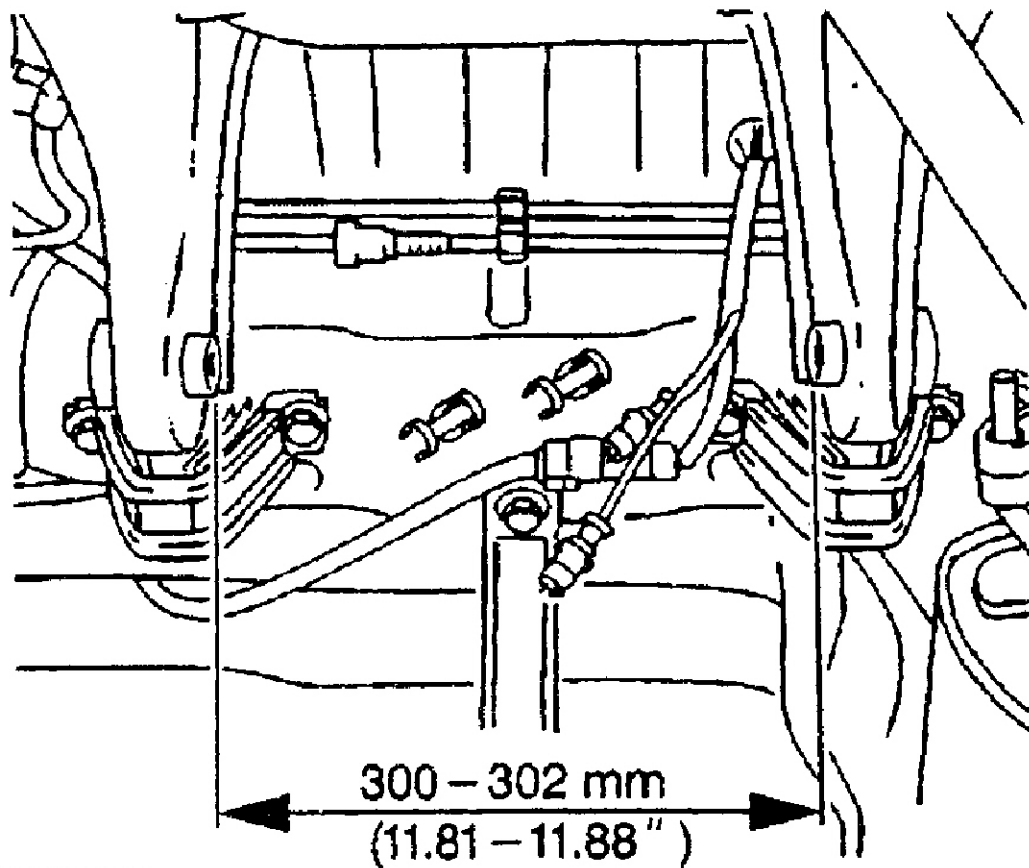
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Fig. 16: Installing Bushing Into Suspension Cradle
Courtesy of GENERAL MOTORS CORP.



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Fig. 17: Installing Bushing
Courtesy of GENERAL MOTORS CORP.



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Fig. 18: Measuring Distance Between Inside Surface Of Bushing
 Courtesy of GENERAL MOTORS CORP.

REAR DAMPING BUSHING (LEFT SIDE)

CAUTION: The rear differential bushings are removed from the inside outward. Once the rear differential bushings are removed they are not reusable. Therefore, the rear differential bushings must be replaced.

Removal

1. Raise and support the vehicle.
2. Lower the rear axle differential. See **DIFFERENTIAL**.
3. Perform the following steps using the components from the Control Arm Bushing Set (J 21474-01) to press the bushing out of the cradle. See **SPECIAL TOOLS**.
 - Install the Bushing Receiver (J 21474-5) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
 - Insert the assembly through the bushing from the outside of the bushing.
 - Install the Bushing Driver/Remover (J 42112-4) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
 - Install the 3/8 Inch Nut (J 21474-18) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 15**.
4. Hold the 3/8 Inch Bolt (J 21474-19) while tightening the 3/8 Inch Nut (J 21474-18) until the bushing is removed from the suspension cradle. See **Fig. 15**.

Installation

1. The bushing must be installed into the suspension cradle with the correct orientation as shown. See **Fig. 16**.
2. Perform the following steps to install the bushing. See **Fig. 17** and **SPECIAL TOOLS**.
 - Fit the Bushing Receiver (J 21474-5) onto the 3/8 Inch Bolt (J 21474-19). See **Fig. 17**.

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- Insert the assembly through the cradle bushing bore from the inside outward.
 - Position the bushing onto 3/8 Inch Bolt (J 21474-19). Then, into the cradle bushing bore. See **Fig. 17** .
 - Install the Bushing Driver/Installer (J 42112-5) onto the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - Install the 3/8 Inch Nut (J 21474-18) onto the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - Draw the bushing into the bore with the correct orientation by holding the 3/8 Inch Nut (J 21474-18) stationary while tightening the 3/8 Inch Bolt (J21474-19). See **Fig. 17** .
 - The bushing is positioned when the Bushing Driver/Installer (J 42112-5) bottoms on the suspension cradle.
3. Install the differential. See **DIFFERENTIAL** .
 4. Lower the vehicle.

OVERHAUL

DIFFERENTIAL SIDE BEARINGS

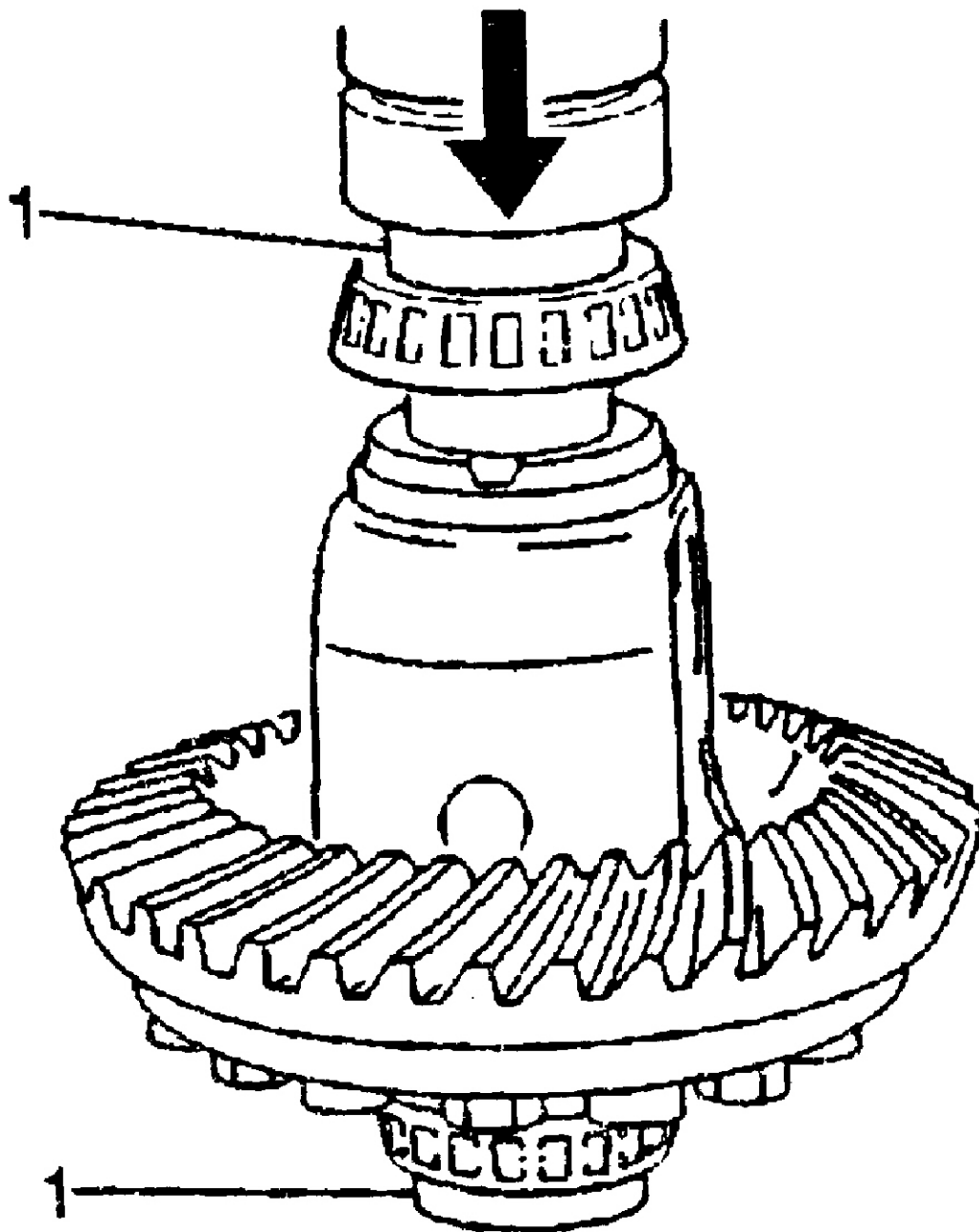
NOTE: Numbers in parenthesis correspond with numbers in illustration.

Disassemble

1. Install the Universal Puller (J 22888-20) onto the differential carrier. See **SPECIAL TOOLS** .
2. Remove the differential carrier side bearings from the differential carrier.

Reassemble

1. Lubricate the differential carrier side bearings and the carrier bearing surface with rear axle lubricant prior to installation.
2. Use a press to install the differential carrier side bearings (1) onto the carrier. See **Fig. 19** .



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Fig. 19: Installing Differential Side Bearings
 Courtesy of GENERAL MOTORS CORP.

DRIVE PINION

NOTE: Numbers in parenthesis correspond with numbers in illustration.

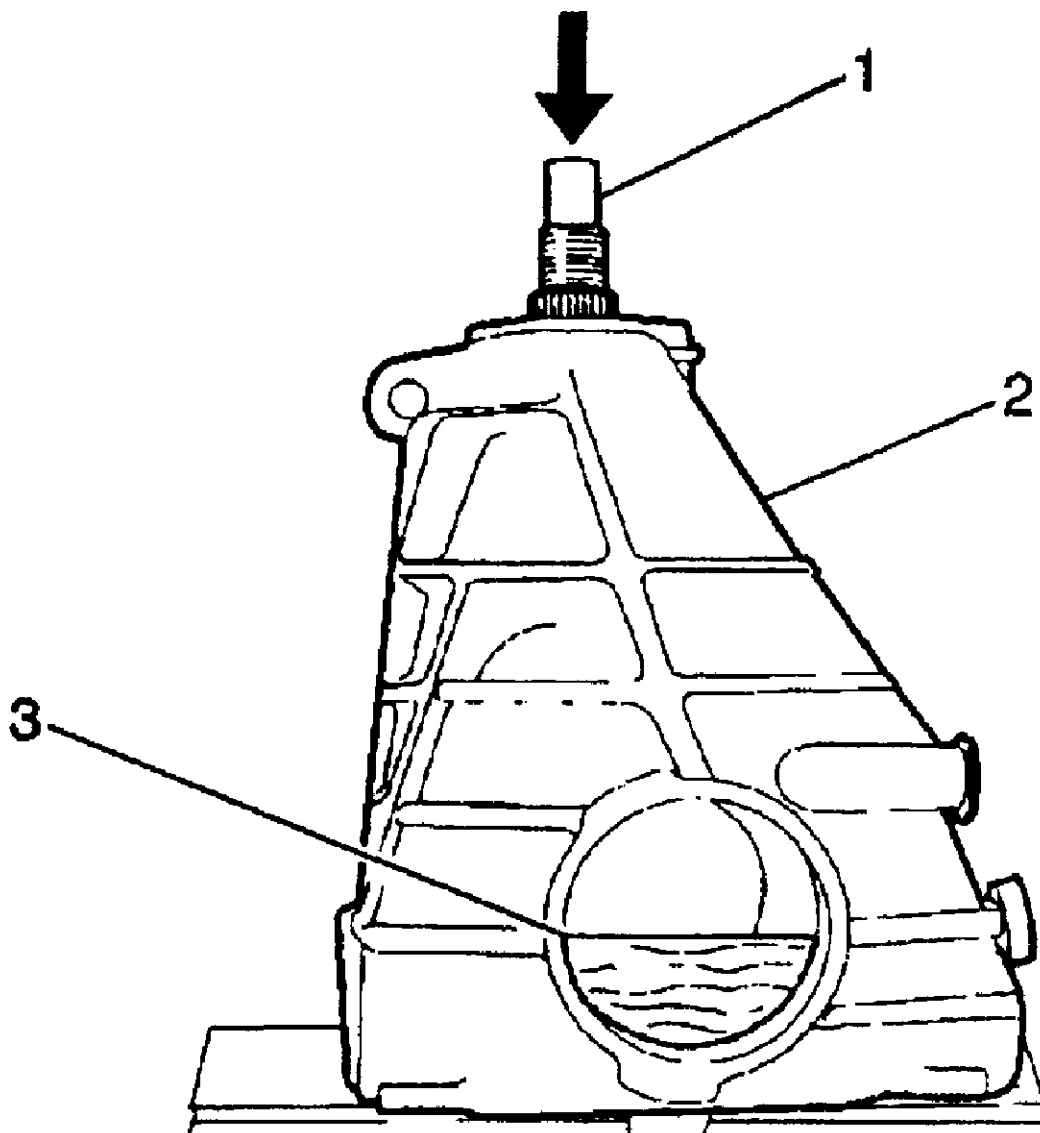
Disassemble

1. Check the differential drive pinion gear inner and outer bearing preload.
2. Shake the differential drive pinion gear inner and outer bearing to check for differential drive pinion gear looseness if there is no preload reading. Defective bearings or worn pinion flange could cause looseness.
3. The ring gear and the differential drive pinion gear may require replacement if the rear axle was operated for an extended period with very loose differential drive pinion gear bearings.
4. Remove the differential drive pinion flange. See **PINION OIL SEAL & FLANGE** .

CAUTION: Support the differential drive pinion gear as it is driven from the

housing or place a piece of wood (3) for the differential drive pinion gear to drop onto, upon removal. See Fig. 20 .

5. Use a rubber faced dead-blow hammer to drive the pinion gear (1) from the differential housing (2). See Fig. 20 .
6. Remove the differential drive pinion gear bearing spacer (1) from the differential drive pinion gear (2). See Fig. 21 .
7. Remove the differential pinion gear inner bearing from the differential drive pinion gear if replacing the bearing and/or replacing the differential drive pinion gear.



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Fig. 20: Removing Pinion Gear From Differential Housing
Courtesy of GENERAL MOTORS CORP.

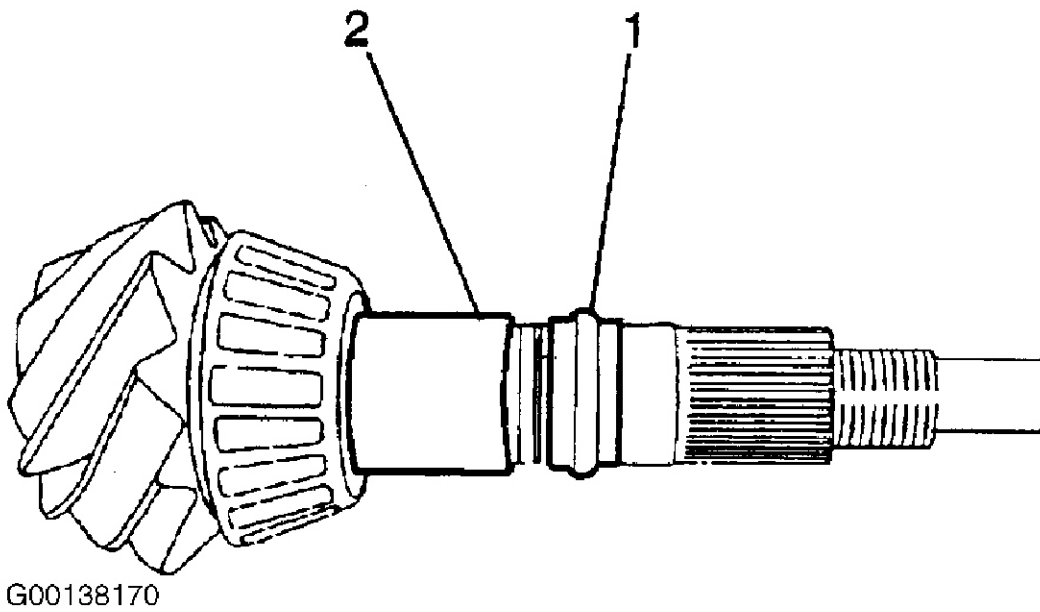
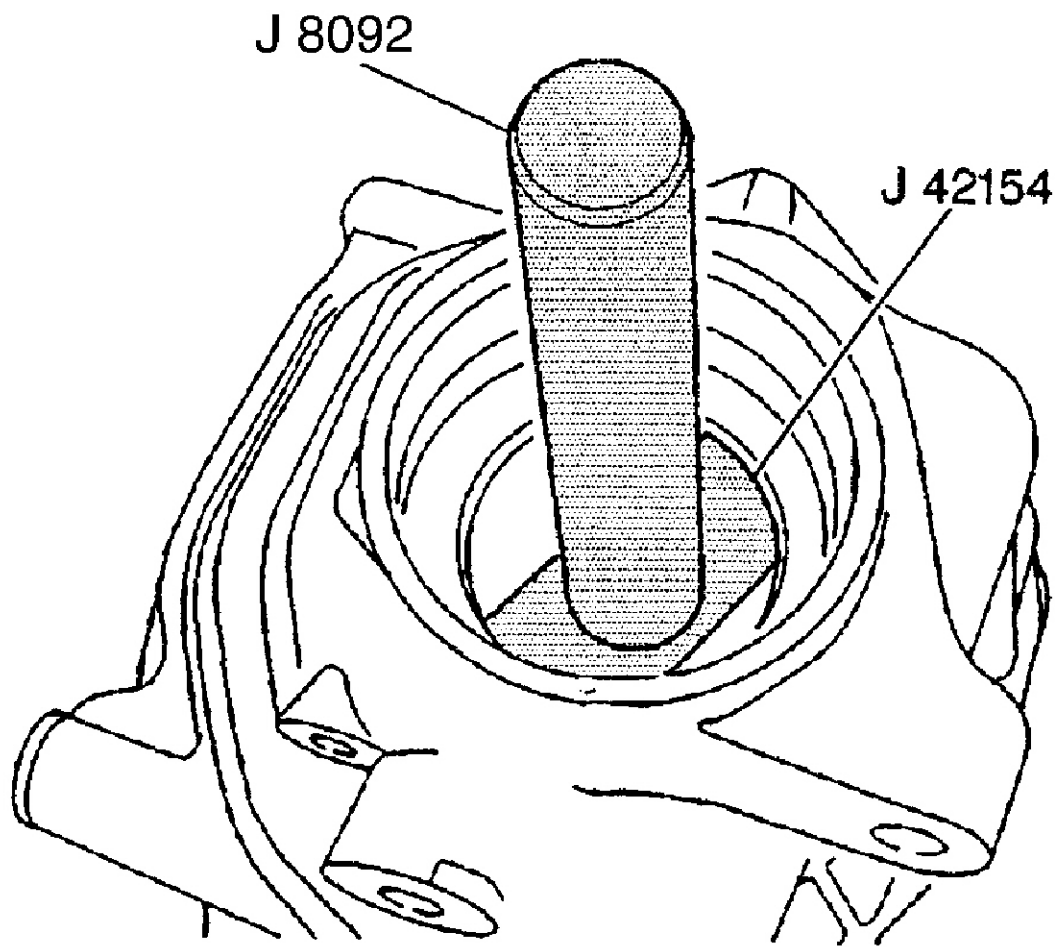


Fig. 21: Removing & Installing Gear Bearing Spacer From Pinion Gear
Courtesy of GENERAL MOTORS CORP.

Disassembly (Drive Pinion Inner Bearing)

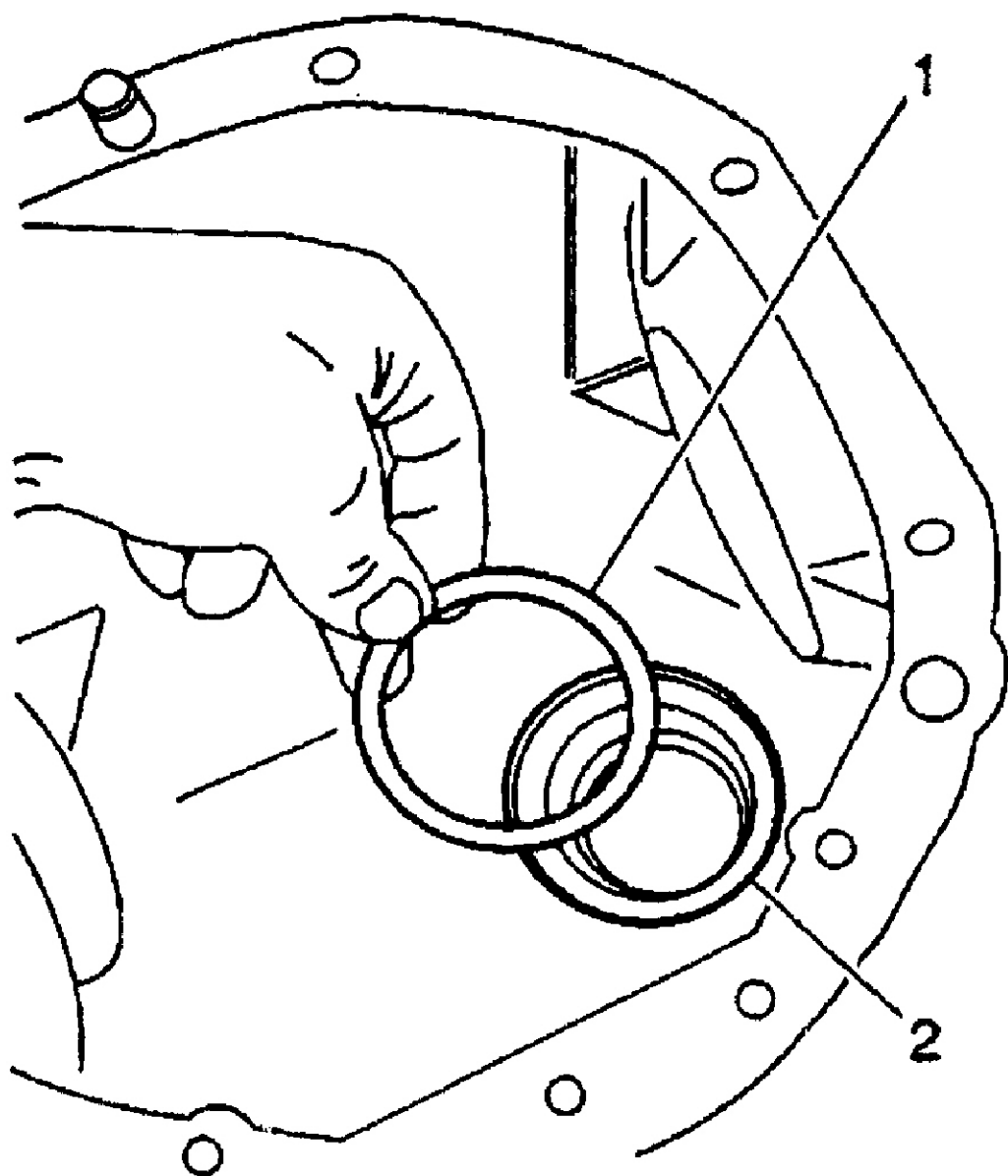
NOTE: Numbers in parenthesis correspond with numbers in illustration.

1. Remove the differential drive pinion seal from the rear axle housing.
2. Perform the following steps if replacing the inner bearing:
 - Mount the Inner/Outer Race Remover/Driver (J 42154) on the Driver Handle (J 8092). See **Fig. 22** and **SPECIAL TOOLS**.
 - Position the Inner/Outer Race Remover/Driver (J 42154) off center of the race to one side or the other where the tool can firmly seat on the race. See **Fig. 22** and **SPECIAL TOOLS**.
 - Use a hammer or use a press to drive the differential drive pinion gear inner bearing race from the rear axle housing while rotating the tool around the edge of the race.
3. Remove the differential drive pinion gear shim (1) from the differential housing (2). See **Fig. 23**.
4. Use the Inner Pinion Bearing Remover (J 22912-01) and press to separate the differential drive pinion bearing from the differential drive pinion gear. See **SPECIAL TOOLS**.



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Fig. 22: Replacing Inner Bearing
Courtesy of GENERAL MOTORS CORP.



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Fig. 23: Removing Pinion Gear Shim From Housing
Courtesy of GENERAL MOTORS CORP.

Disassembly (Drive Pinion Outer Bearing)

1. Remove the differential drive pinion gear outer bearing from the housing.
2. Use the Inner Race Remover/Driver (J 42154) and the Driver Handle (J 8092) with a dead-blow hammer or a press to remove the bearing. See **Fig. 24** .

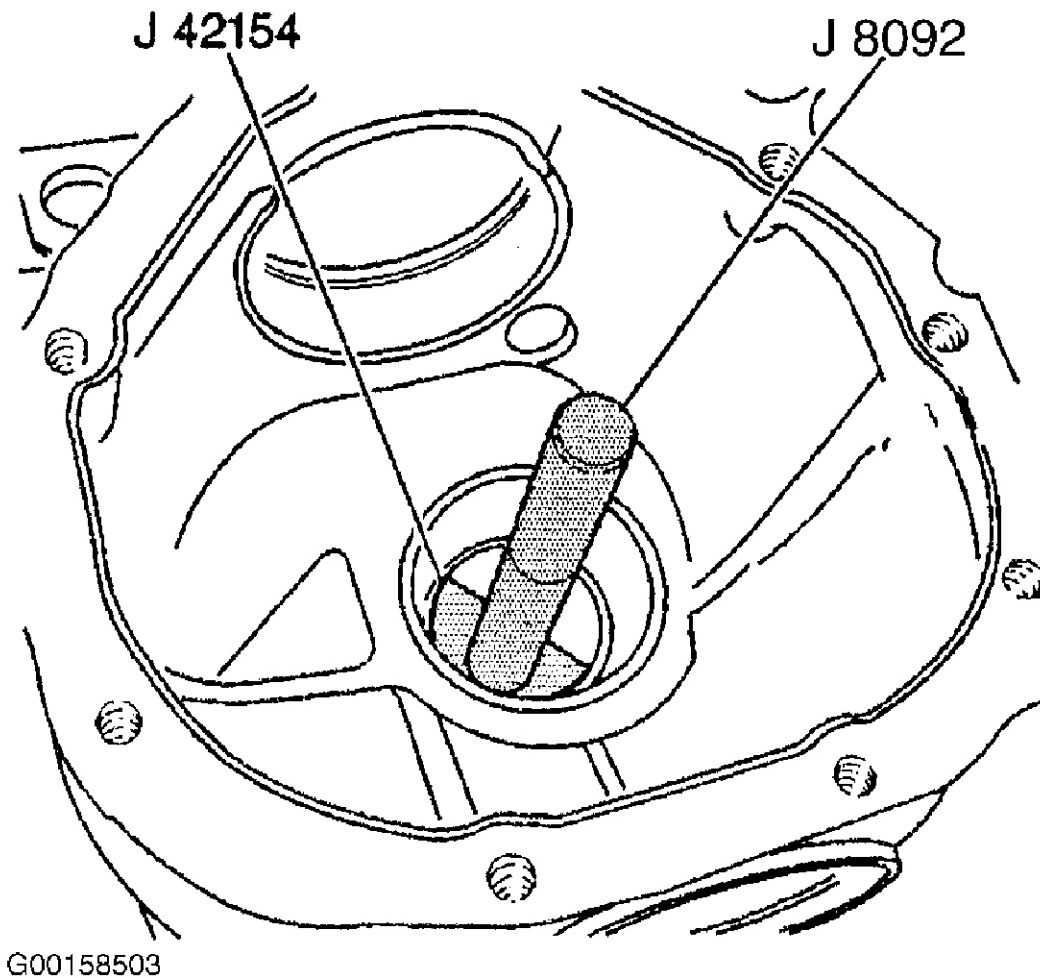


Fig. 24: Removing Outer Bearing
 Courtesy of GENERAL MOTORS CORP.

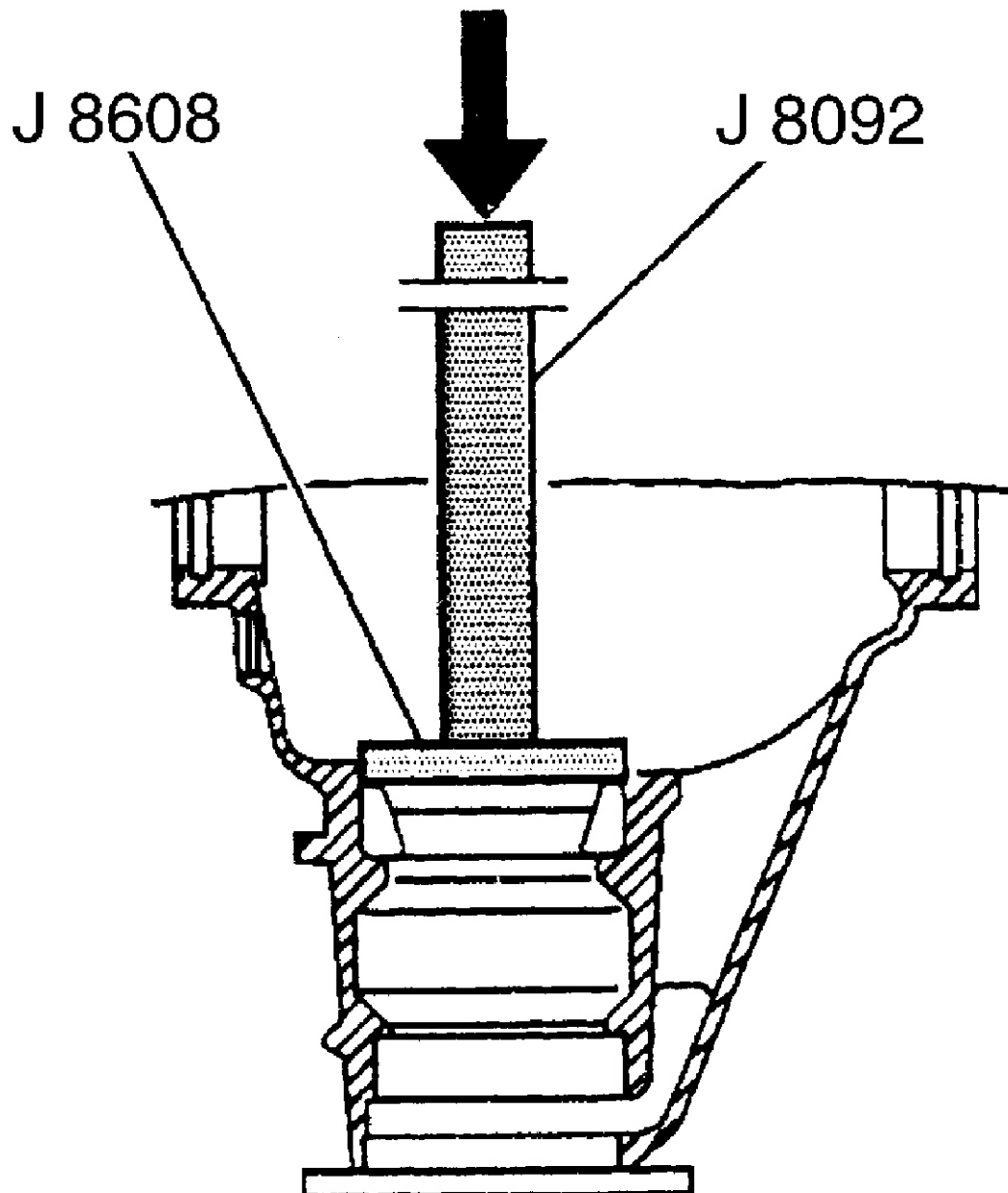
Pinion Depth Adjustment

For adjustment procedures, see **ADJUSTMENTS** .

Reassembly (Drive Pinion Inner Bearing)

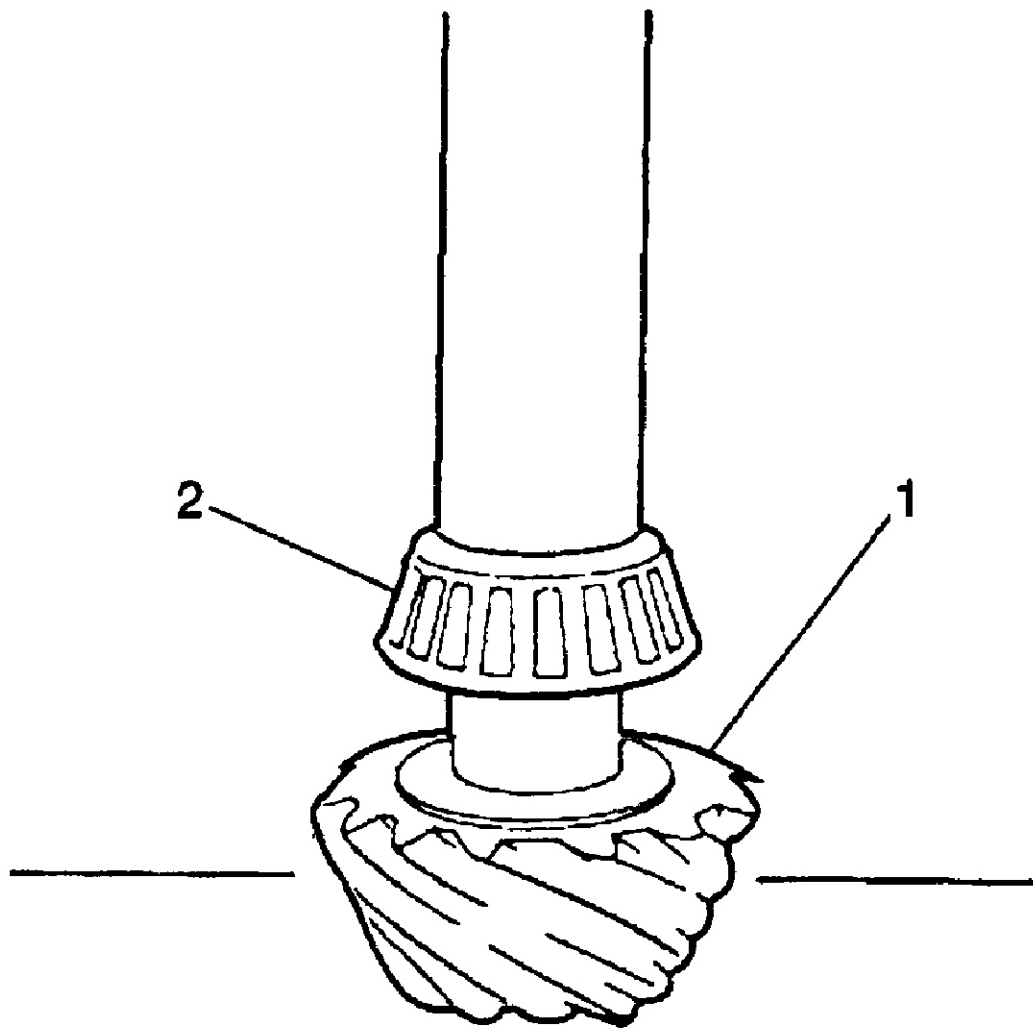
1. Install the pinion shim (1) to the housing (2). See **Fig. 23** .
2. Install the inner bearing race to the housing, if removed, with the Diver Handle (J 8092), the Inner Pinion Bearing Race Installer (J 8608), and a dead-blow hammer or press. See **Fig. 25** .
3. Lubricate the differential drive pinion gear inner bearing and the drive pinion gear shaft with rear axle lubricant and use a press to install the differential drive pinion gear inner bearing (2) to the differential drive pinion gear (1). See **Fig. 26** .
4. Install the differential drive pinion gear bearing spacer (1) onto the differential drive pinion gear (2). See **Fig. 21** .
5. Install the drive pinion gear into the rear axle housing and set pinion depth. See **PINION DEPTH** .
6. Install the differential drive pinion seal.
7. To install the pinion flange, hold the pinion flange, tighten the nut until the end play begins to disappear while intermittently rotating the differential drive pinion gear to seat the inner and outer bearings.
8. Set the preload without the carrier installed and with the bearings lubricated. See **AXLE ASSEMBLY SPECIFICATIONS** and **Fig. 27** .
 - The preload specifications are being approached when no further end play is detectable and when the holder will no longer pivot freely as the differential drive pinion gear is rotated.

- DO NOT attempt further tightening until the preload is checked.
 - Carefully perform the final tightening only after the preload has been checked.
 - Minute tightening of the nuts adds significant inch pounds of turning torque.
 - Further tightening the nut slightly while checking the preload after each tightening.
 - Exceeding the preload specifications compresses the collapsible spacer too far, thus requiring the installation of a new spacer.
9. Rotate the differential drive pinion gear several times to assure that the inner and the outer bearings have been seated.
 10. Perform the differential ring gear-to-differential drive pinion gear backlash measurement if installing a new differential ring and pinion gearset. See **BACKLASH INSPECTION & ADJUSTMENT** .
 11. Check the preload again.
 12. Reset the preload to the proper specifications, if the preload was reduced by rotating the differential drive pinion gear.



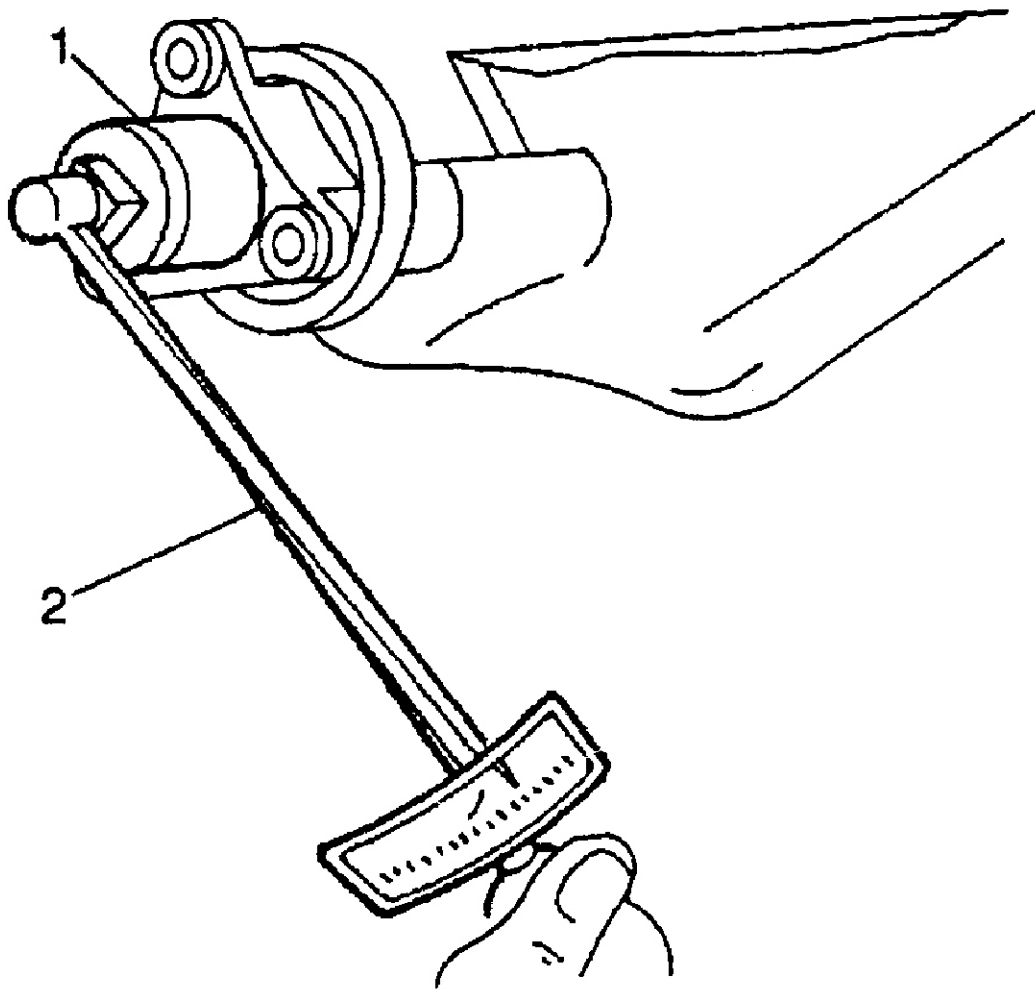
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Fig. 25: Installing Inner Race To Housing
Courtesy of GENERAL MOTORS CORP.



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Fig. 26: Installing Inner Bearing To Drive Pinion Gear
Courtesy of GENERAL MOTORS CORP.



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Fig. 27: Setting Preload W/O Carrier Installed & Bearings Lubricated
Courtesy of GENERAL MOTORS CORP.

Reassembly (Drive Pinion Outer Bearing)

NOTE: Numbers in parenthesis correspond with numbers in illustration.

1. Install the differential drive pinion gear outer bearing race to the housing using the Outer Race Installer/Driver (J 42147), the Driver Handle (J 8092) and a dead-blow hammer or press. See **Fig. 28** and **SPECIAL TOOLS**.

NOTE: Lubricate the differential drive pinion gear outer bearing with rear axle lubricant prior to installation.

2. Install the differential drive pinion gear outer bearing into the housing.
3. Install the pinion seal.

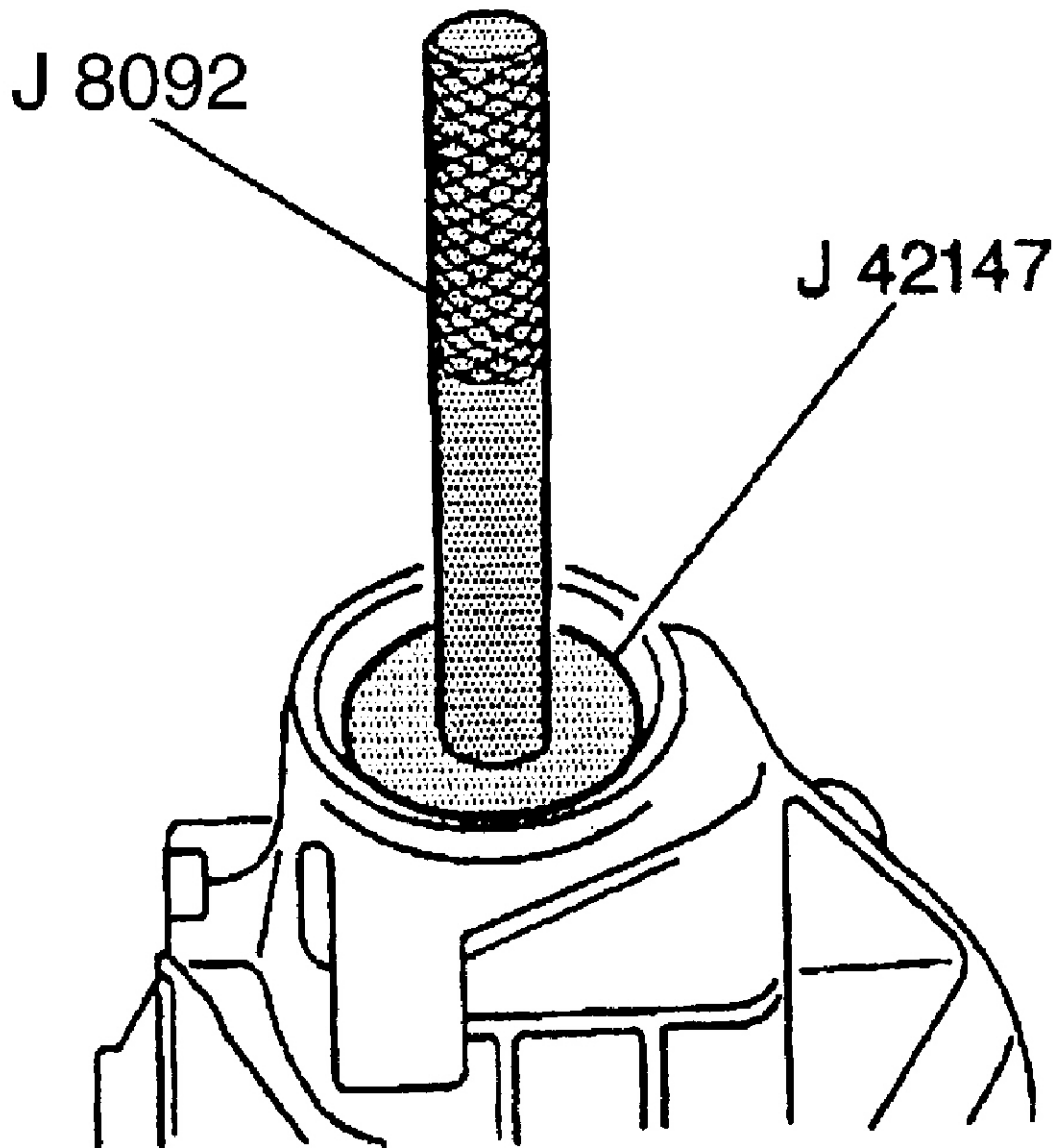


Fig. 28: Installing Outer Bearing Outer Race To Housing
Courtesy of GENERAL MOTORS CORP.

DIVE PINION GEAR BEARING SPACER

NOTE: Numbers in parenthesis correspond with numbers in illustration.

Disassembly

1. Raise and support the vehicle.
2. Remove the differential drive pinion gear. See **DRIVE PINION**.

NOTE: The use of needle nose pliers may be used to remove the spacer.

3. Remove the differential drive pinion gear bearing spacer (1) from the differential drive pinion gear (2). See **Fig. 21**.

Reassembly

1. Install the NEW bearing spacer (1) onto the differential drive pinion gear (2). See **Fig. 21**.
2. Install the differential drive pinion gear. See **DRIVE PINION**.

3. Lower the vehicle.
4. Road test the vehicle and check for leaks.

INNER DRIVE AXLE SEAL

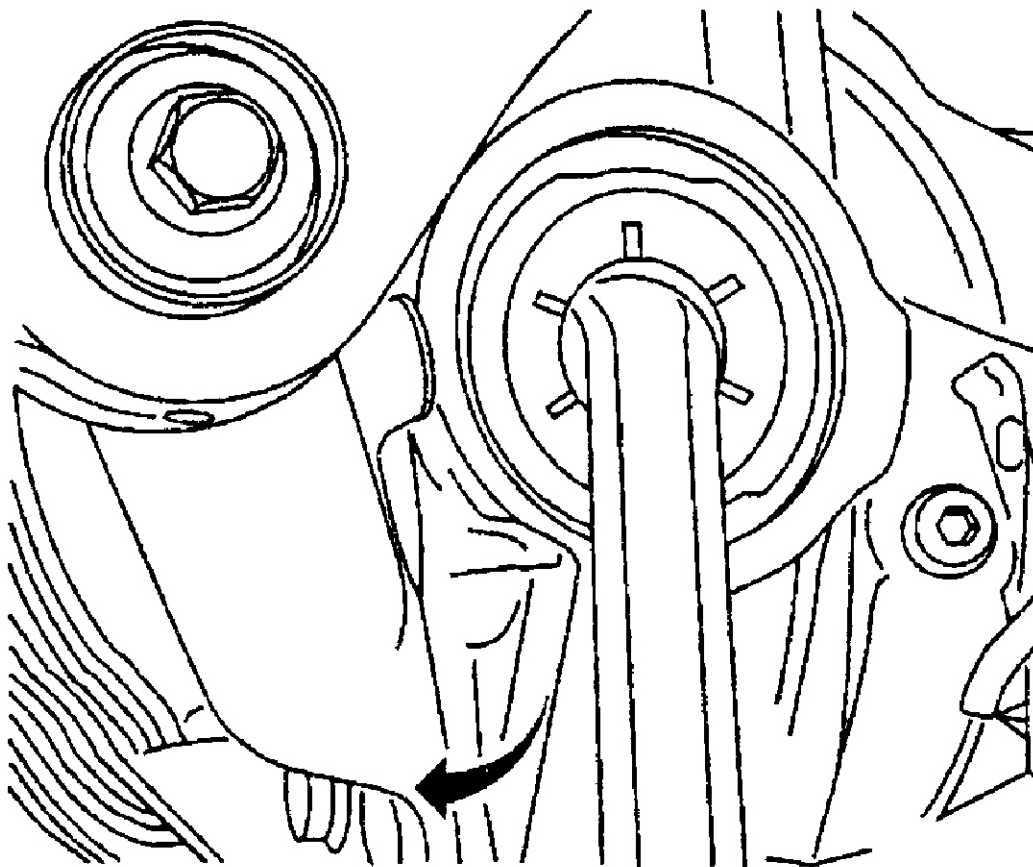
NOTE: Numbers in parenthesis correspond with numbers in illustration.

Removal

1. Raise and support the vehicle.
2. Remove the axle shaft. For 1997 models, see AXLE SHAFTS - REAR article. For 1998-01 models, see AXLE SHAFTS -- CATERA article.
3. Use a suitable pry bar to remove the seal from the rear axle. See Fig. 29 .

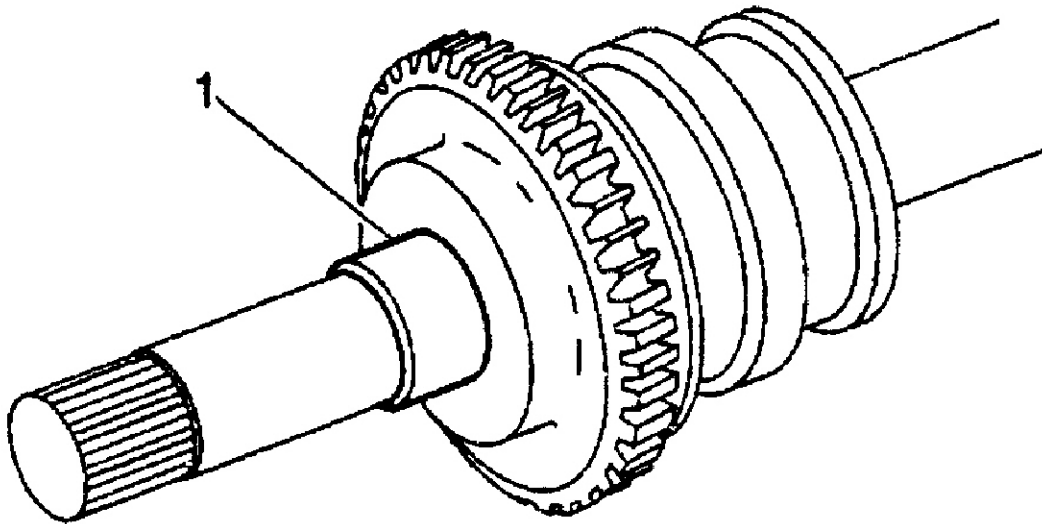
CAUTION: Take care not to damage the differential housing or the differential carrier side bearing outer race. Damage may result in leaks upon the reassembly.

4. Inspect the sealing surface (1) of the drive axle. See Fig. 30 .
5. Remove any nicks or burrs.
6. Replace the axle shaft should this surface should be irreparable.



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Fig. 29: Removing Seal From Rear Axle
Courtesy of GENERAL MOTORS CORP.



G00158520

Fig. 30: Inspecting Sealing Surface Of The Drive Axle
 Courtesy of GENERAL MOTORS CORP.

Installation

1. Lubricate the new seal with rear axle lubricant.
2. Use the Drive Axle Seal Driver (J 26234) to install the drive axle seal (1) until the tool bottoms on the outer race. See **Fig. 35**.
3. Install the axle shaft. For 1997 models, see **AXLE SHAFTS - REAR** article. For 1998-01 models, see **AXLE SHAFTS -- CATERA** article.
4. Check and fill the lubricant as necessary. See **LUBRICATION**.

REAR AXLE

NOTE: Numbers in parenthesis correspond with numbers in illustration.

Disassemble

1. Use the differential bearing bracket bolts to install the Holding Fixture Adapter (J 42177) onto the rear axle differential. Tighten the differential bearing bracket bolts until fully seated and not stripped. See **SPECIAL TOOLS**.
2. Mount the differential into the Holding Fixture Bench Mounted (J 3289-20). See **SPECIAL TOOLS**.
3. Remove the rear axle housing cover bolts (1). See **Fig. 6**.
4. Remove the rear axle housing cover.
5. Use a suitable pry-bar to remove the drive axle seals from the rear axle.

WARNING: Take care not to damage the differential housing or to damage the differential carrier side bearing outer race. Damage to the differential housing or damage to the differential carrier side bearing outer race may result in leaks upon reassembly.

6. Use the rear axle housing cover bolts to install the Side Bearing Preload Clamp (J 42143) onto the right side of the rear axle housing cover surface. Tighten the rear axle housing cover bolts until seated. Do not strip the rear axle housing cover bolts. See **Fig. 31**.

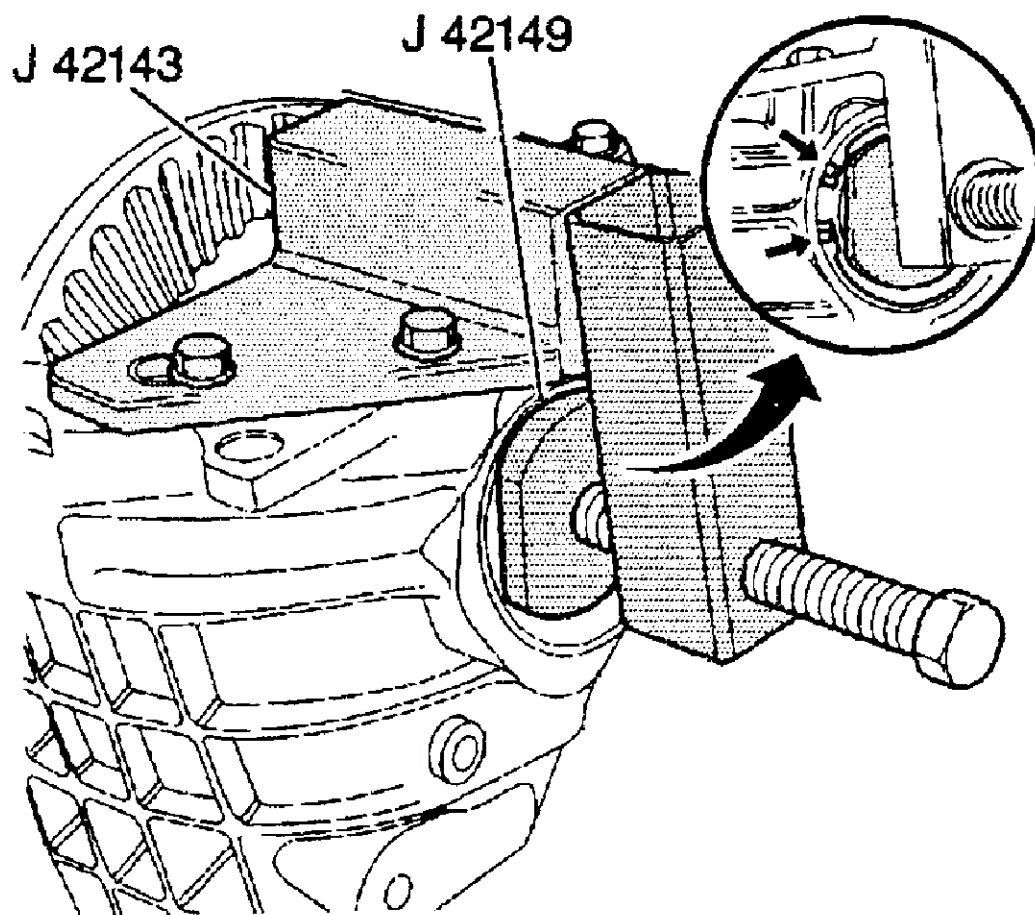
7. Install the Side Bearing Preload Clamp (J 42143) onto the right differential side bearing outer race. See **Fig. 31** .

CAUTION: Tighten the clamp only enough to relieve a significant amount of bearing preload from the snap ring, DO NOT OVERTIGHTEN. Once the clamp starts to flex the majority of the preload has been relieved.

8. Tighten the clamp onto the Side Bearing Preload Clamp Plate (J 42149). See **Fig. 31** .
9. Use a hammer and use a drift to rotate the rear axle differential adjuster ring so that the ring opening is accessible.
10. Use a heavy duty snap ring pliers to remove the adjuster ring from the right bearing bore. See **Fig. 32** .
11. Remove the Side Bearing Preload Clamp Plate (J 42149) from the rear axle housing.
12. Remove the Side Bearing Preload Clamp (J 42143) from the rear axle housing.
13. Use heavy duty snap ring pliers to remove the adjuster ring (2) from the left side of the rear axle housing (1). See **Fig. 33** .
14. Use a rubber faced mallet and use a piece of wood to drive out the right differential side bearing outer race from the cover opening of the differential. See **Fig. 34** .
15. Inspect the differential side bearing seal on the side bearing outer race for damage or for deterioration. Service as necessary.

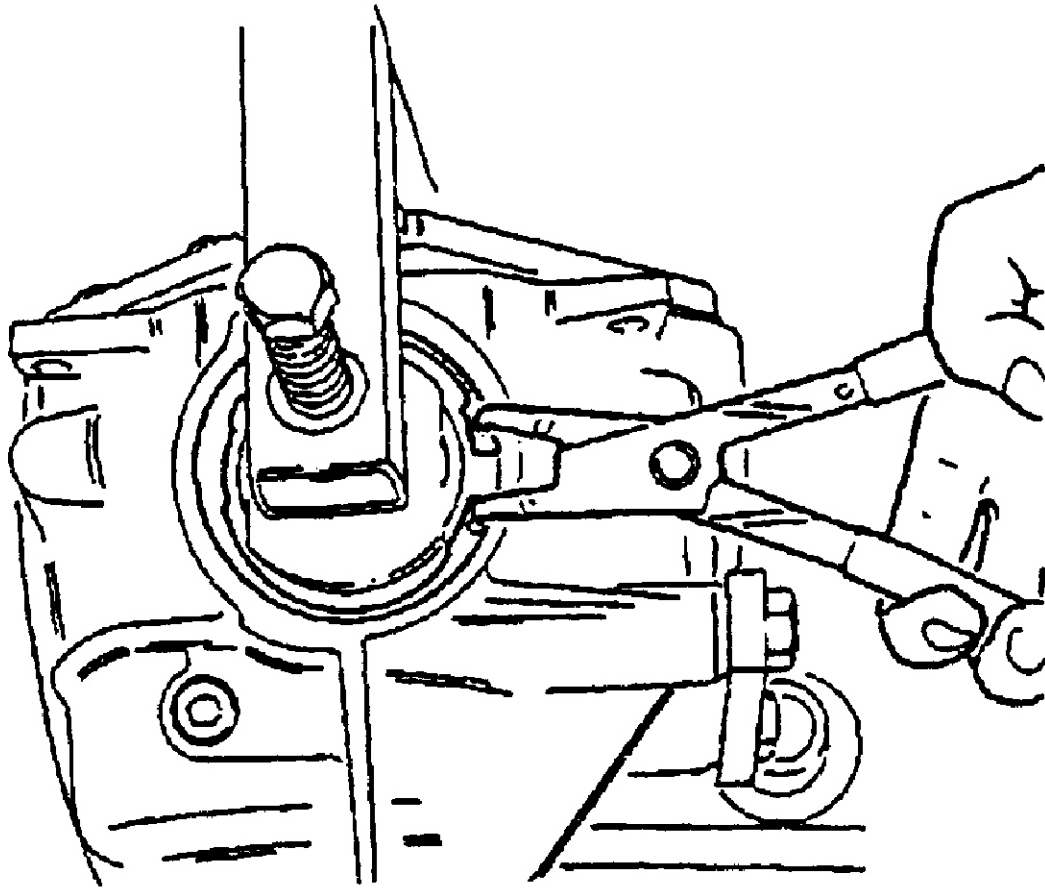
WARNING: DO NOT mix the right and the left side bearing races.

16. Lightly, tap the carrier through the right side bearing bore using a rubber mallet and using a piece of wood to drive out the left differential side bearing outer race out of the housing. See **Fig. 34** .
17. Inspect the differential side bearing seal on the side bearing outer race for damage or for deterioration. Service as necessary.
18. Remove the differential carrier from the rear axle housing
19. Remove the differential drive pinion gear. See **DRIVE PINION** .
20. Remove the differential drive pinion seal from the differential.
21. Remove the differential drive pinion gear inner bearing from the differential drive pinion gear bore.
22. Remove the inner pinion bearing outer races from the rear axle housing, if replacing the bearings.
23. Remove the outer pinion bearing outer races from the rear axle housing, if replacing the bearings.



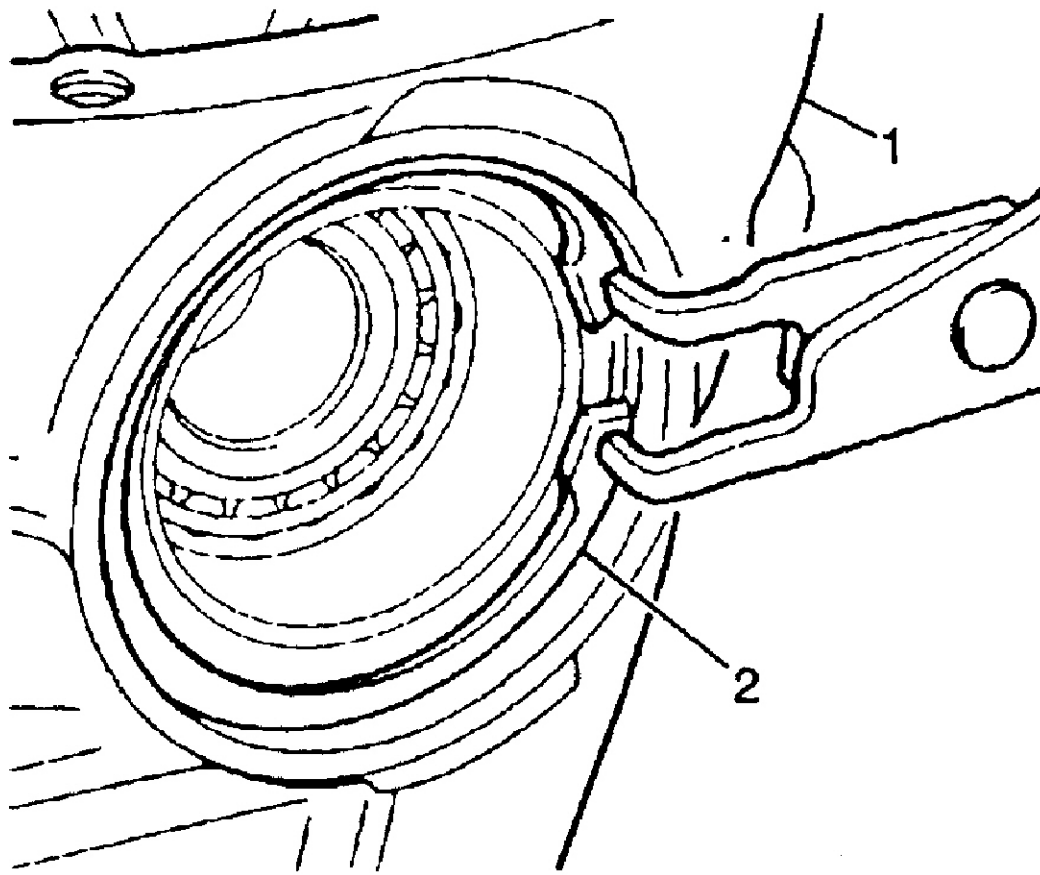
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Fig. 31: Installing Side Bearing Preload Clamp & Plate
Courtesy of GENERAL MOTORS CORP.



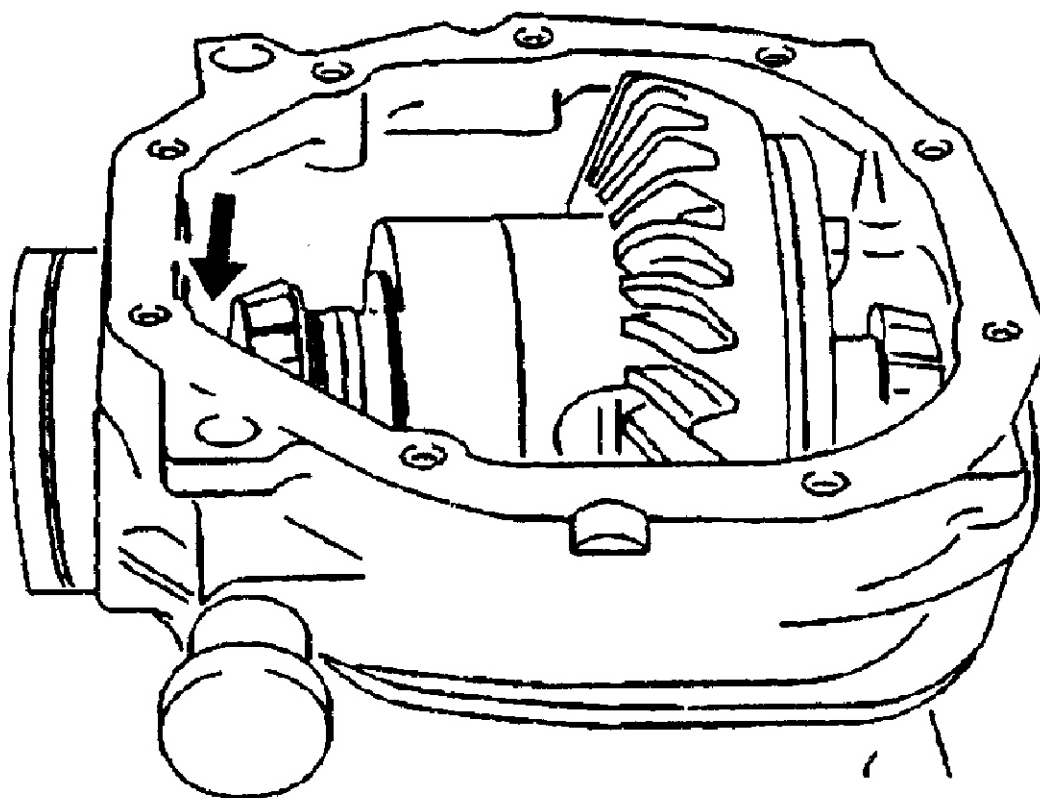
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Fig. 32: Removing Adjuster Ring From Right Bearing Bore
Courtesy of GENERAL MOTORS CORP.



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Fig. 33: Removing Adjuster Ring From Left Side Of Rear Axle Housing
Courtesy of GENERAL MOTORS CORP.



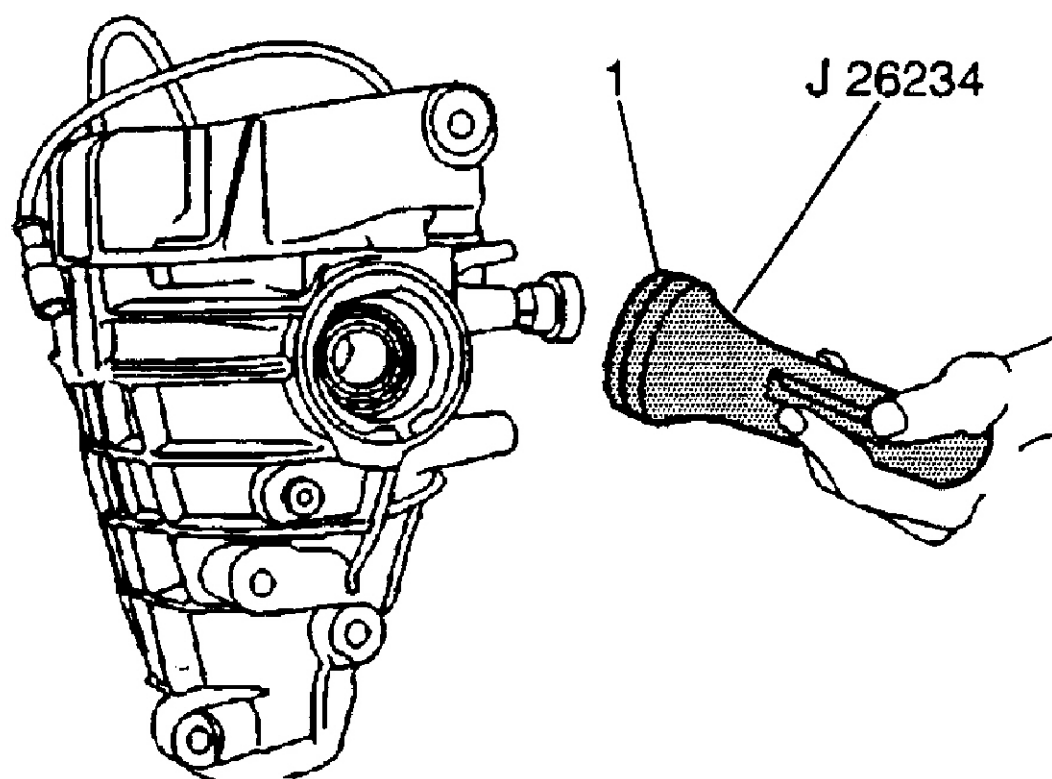
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Fig. 34: Removing Differential Side Bearing Outer Race

Courtesy of GENERAL MOTORS CORP.

Reassemble

1. Install the inner pinion bearing outer races to the housing, if removed.
2. Install the outer pinion bearing outer races to the housing, if removed.
3. Install the differential drive pinion gear inner bearing to the differential drive pinion gear.
4. Install the differential drive pinion seal to the differential.
5. Measure the side bearing preload. See SIDE BEARING PRELOAD INSPECTION & ADJUSTMENT.
6. Install the differential carrier.
7. Establish the pinion gear depth. See PINION DEPTH.
8. Install the drive pinion to the rear axle housing. See DRIVE PINION.
9. Install the differential carrier.
10. Use snap rings of the proper thickness. See SIDE BEARING PRELOAD INSPECTION & ADJUSTMENT.
11. Check and correct the backlash, if necessary. See BACKLASH INSPECTION & ADJUSTMENT.
12. Use the Drive Axle Seal Driver (J 26234) to install the drive axle seals (1) to the bearing cups. See Fig. 35.
13. Install the rear axle housing cover.
14. Install the rear axle housing cover bolts (1). Tighten the bolts. See Fig. 6 and TORQUE SPECIFICATIONS.
15. Remove the Holding Fixture (J 42177) from the differential.



G00158515

Fig. 35: Installing Drive Axle Seals To Bearing Cups
 Courtesy of GENERAL MOTORS CORP.

NOTE: Numbers in parenthesis correspond with numbers in illustration.

Disassemble

1. Clamp differential carrier in a soft jaw vice. See [Fig. 36](#) .

NOTE: The ring gear bolts are standard thread.

2. Remove the differential ring gear bolts. See [Fig. 36](#) .

CAUTION: DO NOT allow the ring gear to drop onto the vice. Place rags or place a piece of wood on the vice to protect the ring gear upon removal.

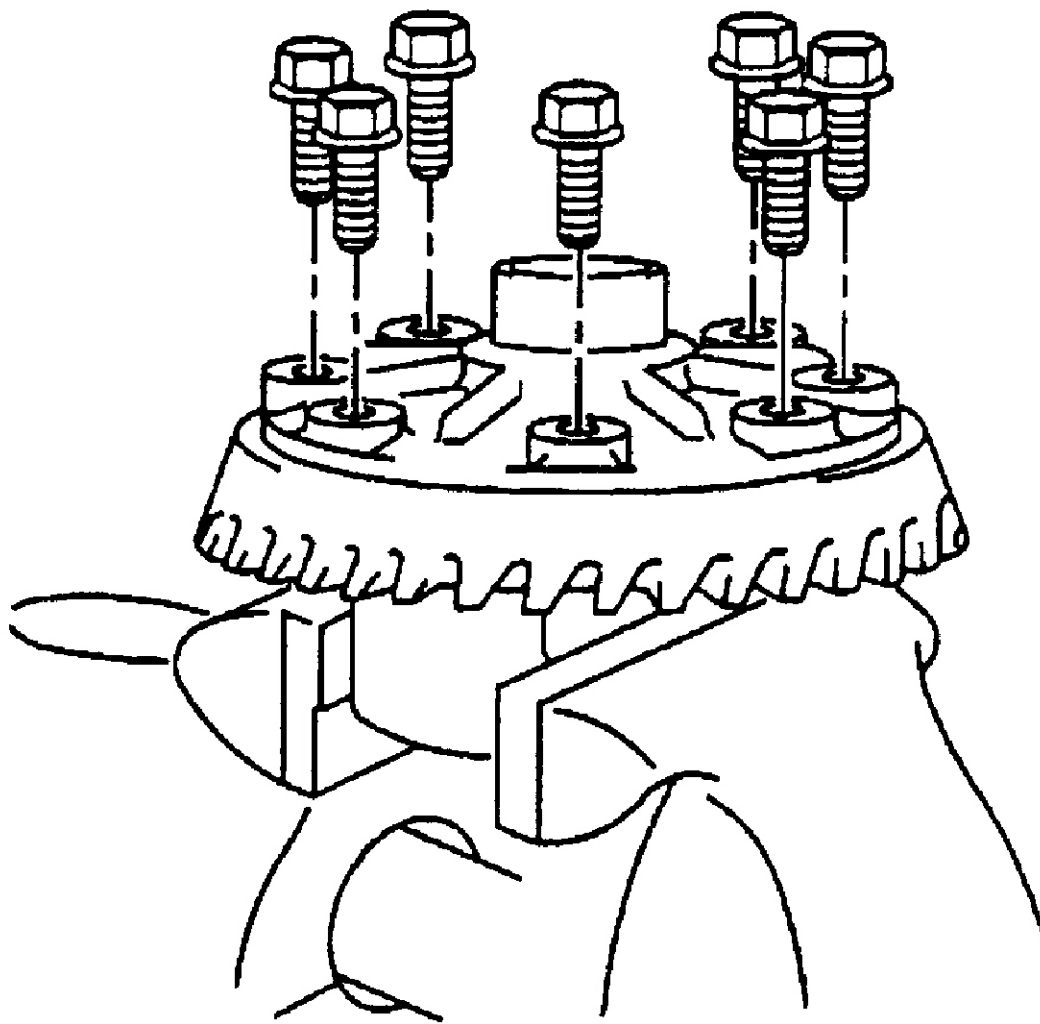
3. Use a piece of hardwood or use a brass drift and dead-blow hammer to drive off the ring gear from the differential carrier. See [Fig. 37](#) .

NOTE: Drive out the pinion shaft from the side of carrier at the machined recession in the shaft.

4. Use a drift and a dead-blow hammer or use a press to drive out the differential pinion gear shaft (1) from the differential carrier. See [Fig. 38](#) .
5. Remove the differential pinion gear shaft retaining ring (1) from the differential carrier (2). See [Fig. 39](#) .
6. Clamp the counterpiece of the Pinion and Side Gear Alignment Kit (J 42178) in a vice.
7. Place the differential carrier onto the Pinion and Side Gear Alignment Kit (J 42178) with the ring gear flange towards the bottom, facing up.
8. Attach the counterpiece of the Pinion and Side Gear Alignment Kit (J 42178) and attach a 1/2 in. drive ratchet to the drive shaft pinion gear.
9. Use a ratchet to rotate the Pinion and Side Gear Alignment Kit (J 42178) to walk the differential pinion gears (2) and the accompanying washer from the installed position while holding the differential carrier (1). See [Fig. 40](#)
10. Clean all parts being reused.
11. Inspect all the parts being reused for wear.

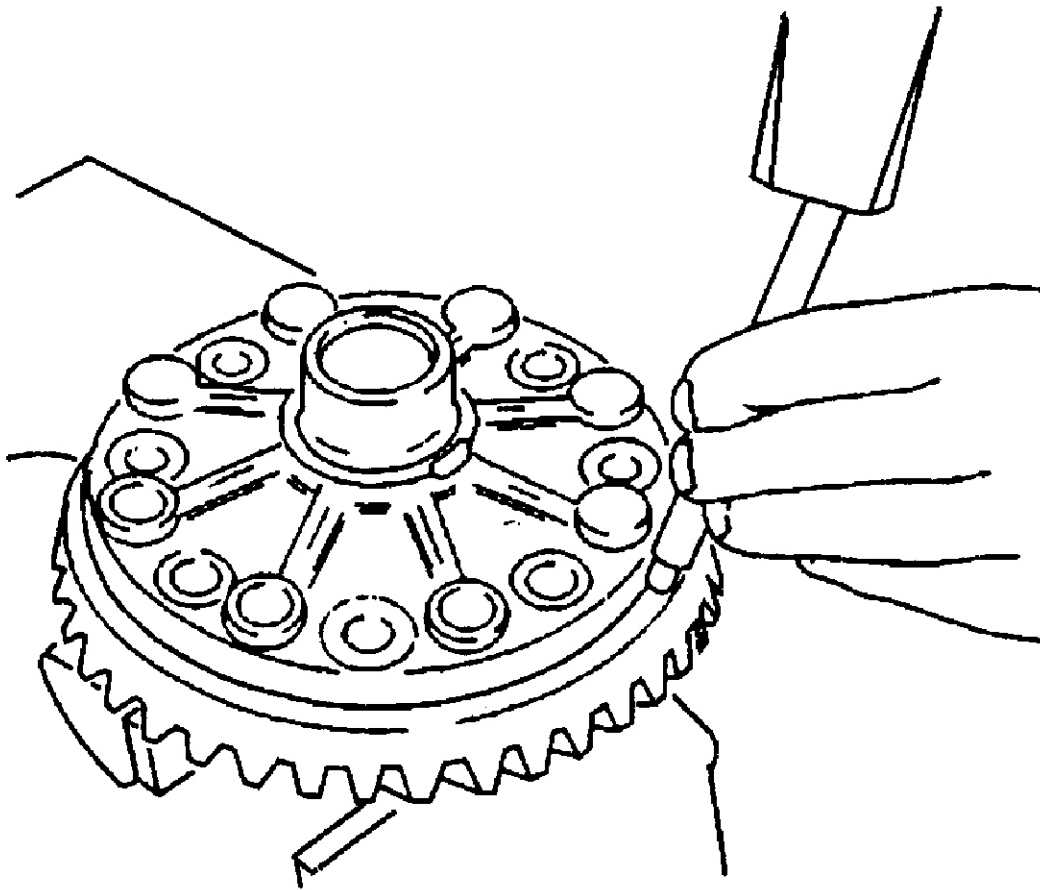
NOTE: Keep the shims with the differential side gears as they were originally installed.

12. Remove the differential side gears from the differential carrier.
13. Remove the shims from the differential carrier.



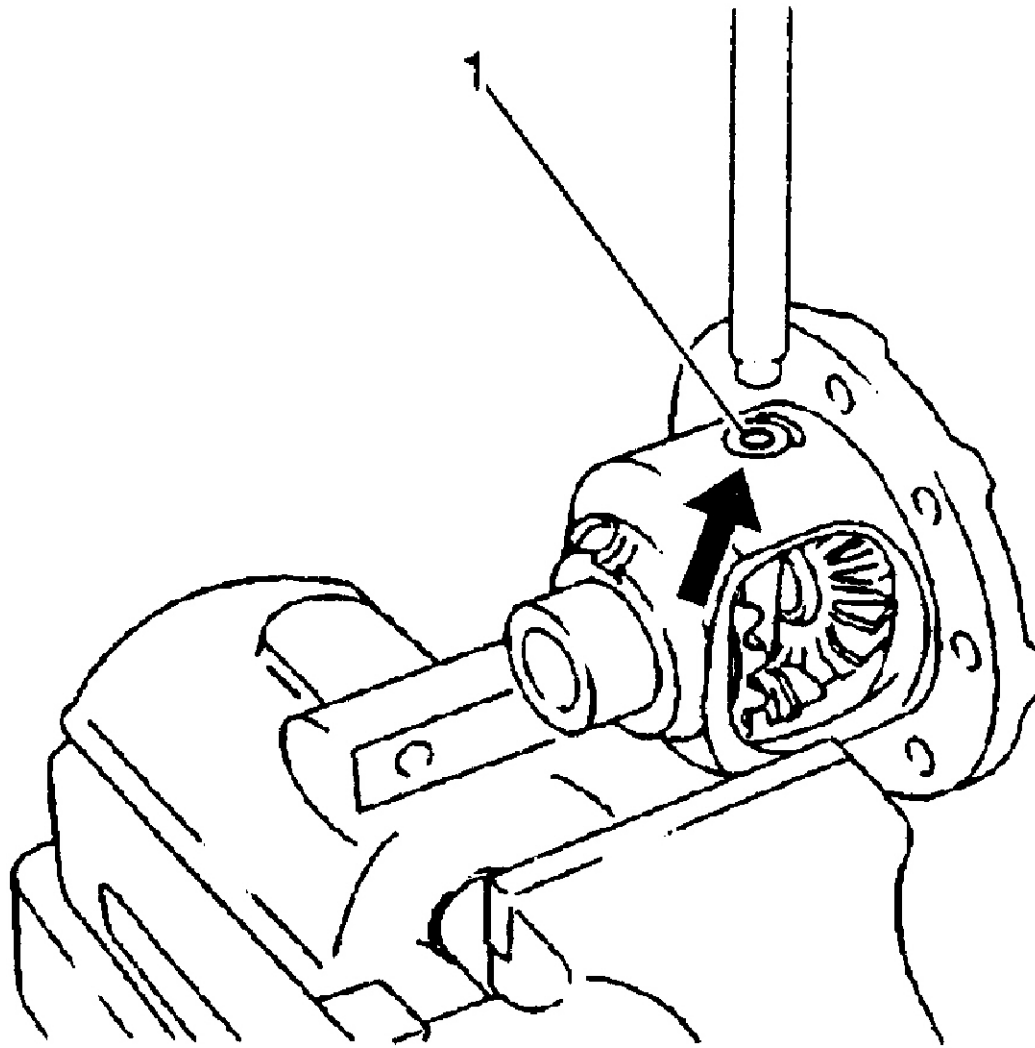
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Fig. 36: Removing Differential Ring Bolts
Courtesy of GENERAL MOTORS CORP.



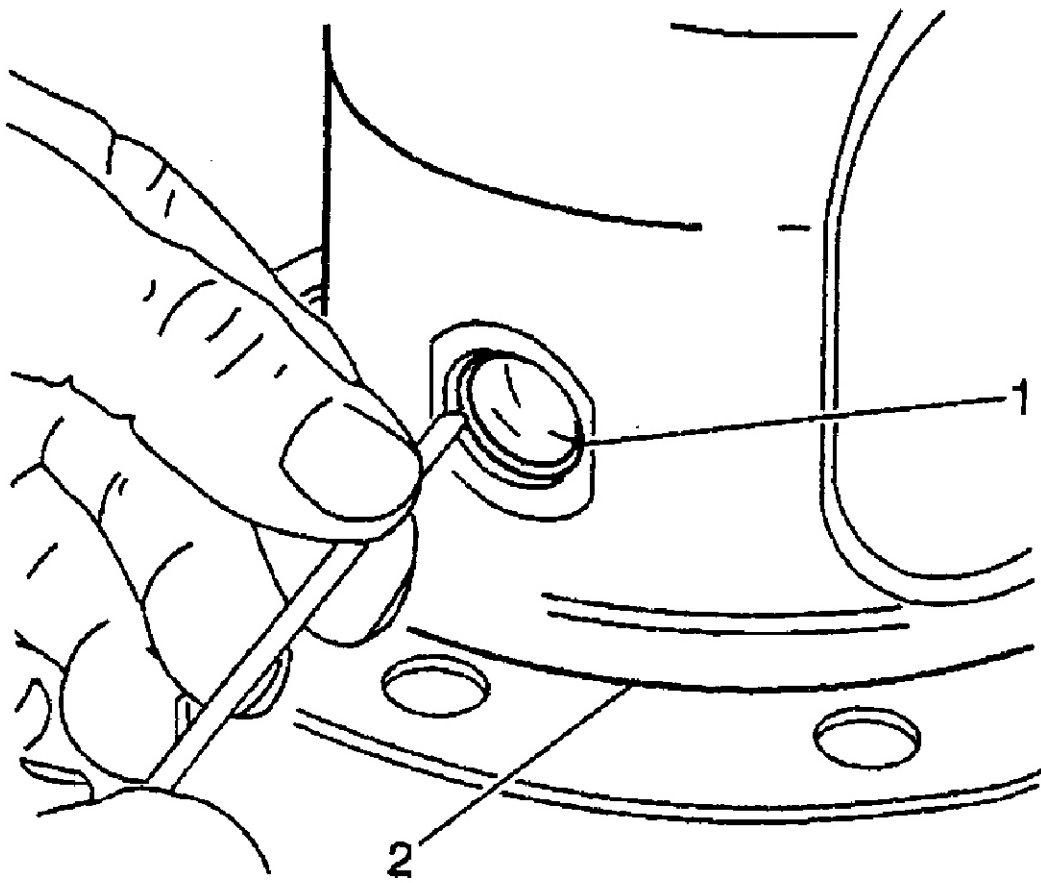
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Fig. 37: Removing Ring Gear From Differential Carrier
Courtesy of GENERAL MOTORS CORP.



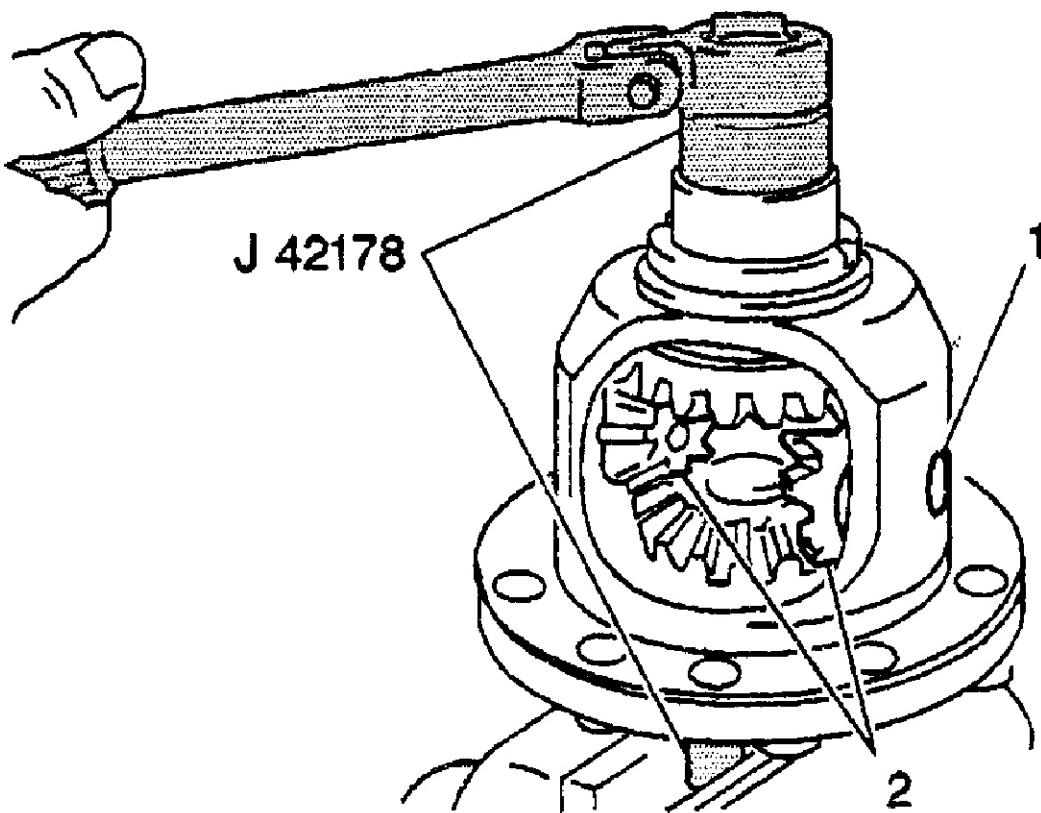
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Fig. 38: Driving Out Differential Pinion Gear Shaft
Courtesy of GENERAL MOTORS CORP.



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Fig. 39: Removing & Installing Differential Pinion Gear Shaft Retaining Ring
Courtesy of GENERAL MOTORS CORP.

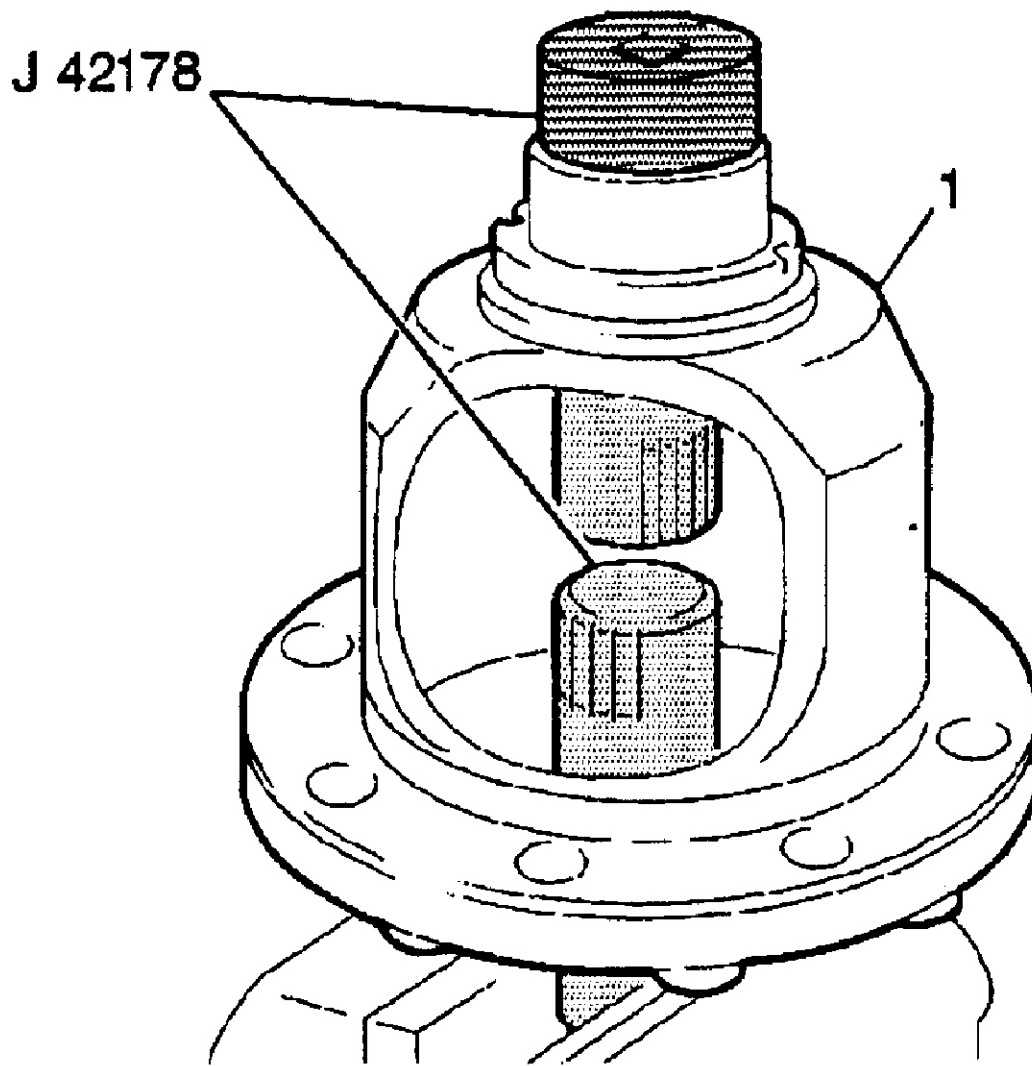


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Fig. 40: Walking Differential Pinion Gears
Courtesy of GENERAL MOTORS CORP.

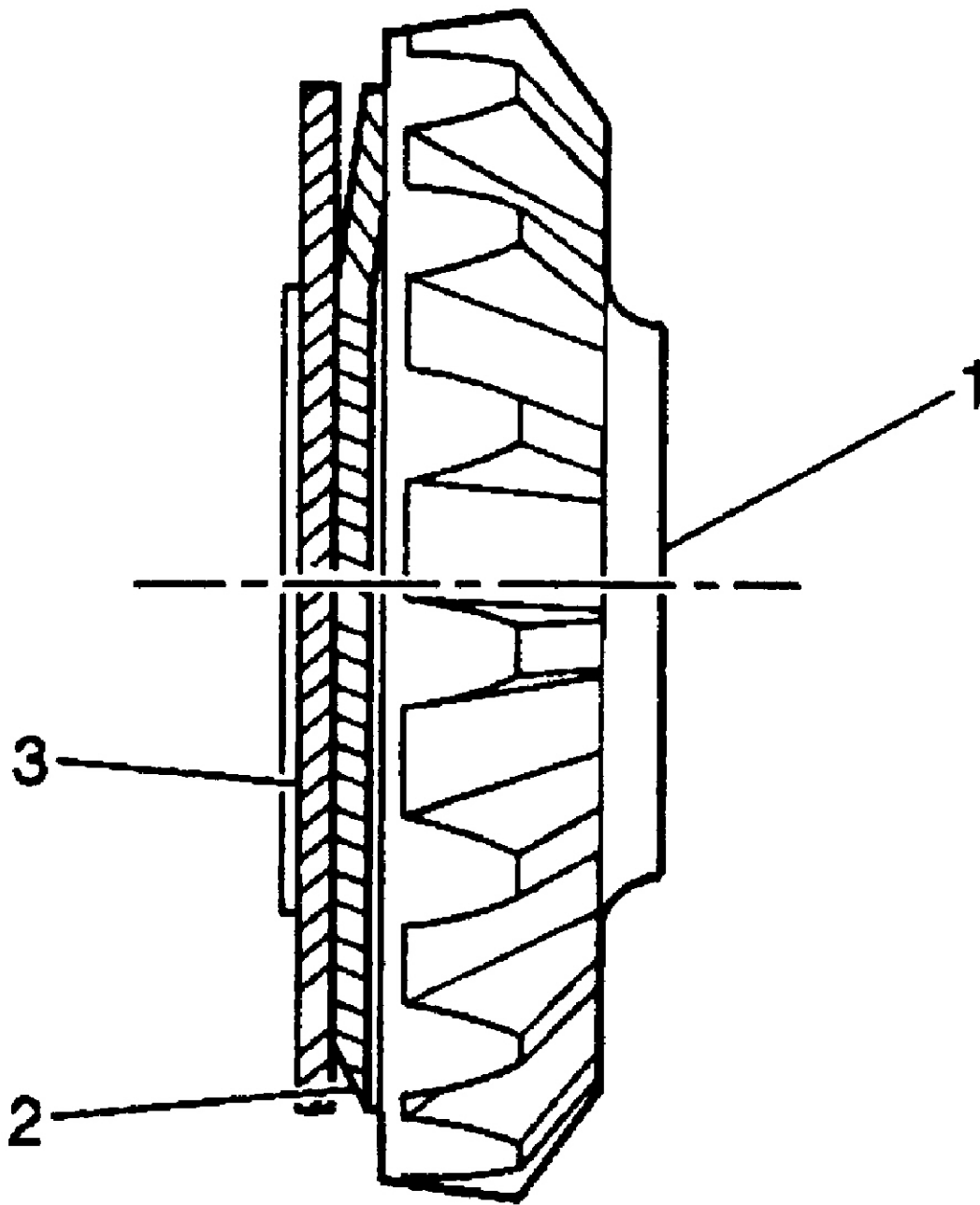
Reassemble

1. Place the differential carrier on the Differential Side and Pinion Alignment Kit (J 42178), clamped in the vice, with the ring gear flange downwards. See **Fig. 41** .
2. Install the counterpiece of the Differential Side and Pinion Alignment Kit (J 42178) into the opposing differential carrier bore (1). See **Fig. 41** .
3. Install a NEW differential pinion gear retaining ring (1) into the differential carrier (2). See **Fig. 39** .
4. Thoroughly clean all components.
5. Place the shims on the differential side gears.
 - Coat the gears and the shims with rear axle lubricant.
 - Install the thicker shim (the shim has notches around the outer edge) (3) toward the carrier. See **Fig. 42** .
 - Install the thinner (conical) washer toward the differential side gear (1). See **Fig. 42** .
6. Place the differential side gears with the previously installed shims into the differential carrier and onto both pieces of the Differential Side and Pinion Alignment Kit (J 42178).
7. Lubricate with gear lubricant and engage the differential pinion gears (2) and engage the conical washers (1) with the differential side gears to align. Align them so that they are exactly opposite each other in the carrier window. This may require the use of a helper. See **Fig. 43** .
8. Move the differential pinion gear conical washers (1) forward in the intended rotational direction so that they will start or lead the pinion gears (2) into the mounting position. See **Fig. 43** .
9. Use a ratchet to rotate the Differential Side and Pinion Alignment Kit (J 42178) to draw the pinion gears into position. Ensure that the conical washers also move into position. It may be necessary to use a drift and a small hammer to assist the washers into position. The pinion gears typically move into position quicker and easier than the conical washers do.
10. Use a dead-blow hammer to drive the rear axle pinion gear shaft (1) into its carrier bore (2) after aligning the differential pinion gears and washers with the pinion gear shaft bores. See **Fig. 44** .
11. Because of the tension of the retaining ring, it may be necessary to recruit a helper to use a small screwdriver to keep the ring centered in its bore while the shaft (1) is driven in. See **Fig. 44** .
12. Attach a torque wrench to the Differential Side and Pinion Alignment Kit (J 42178).
13. Check for proper pinion rotating torque and check for proper side rotating torque. The acceptable rotating torque should read between 11 and 22 ft. lbs.
14. Heat the ring gear to approximately 100° C (212° F). DO NOT overheat.
15. Install the ring gear onto the differential carrier.
16. Install NEW ring gear bolt. Tighten the ring gear bolts, bolts must be torqued in sequence shown. See **Fig. 45** and **TORQUE SPECIFICATIONS** .



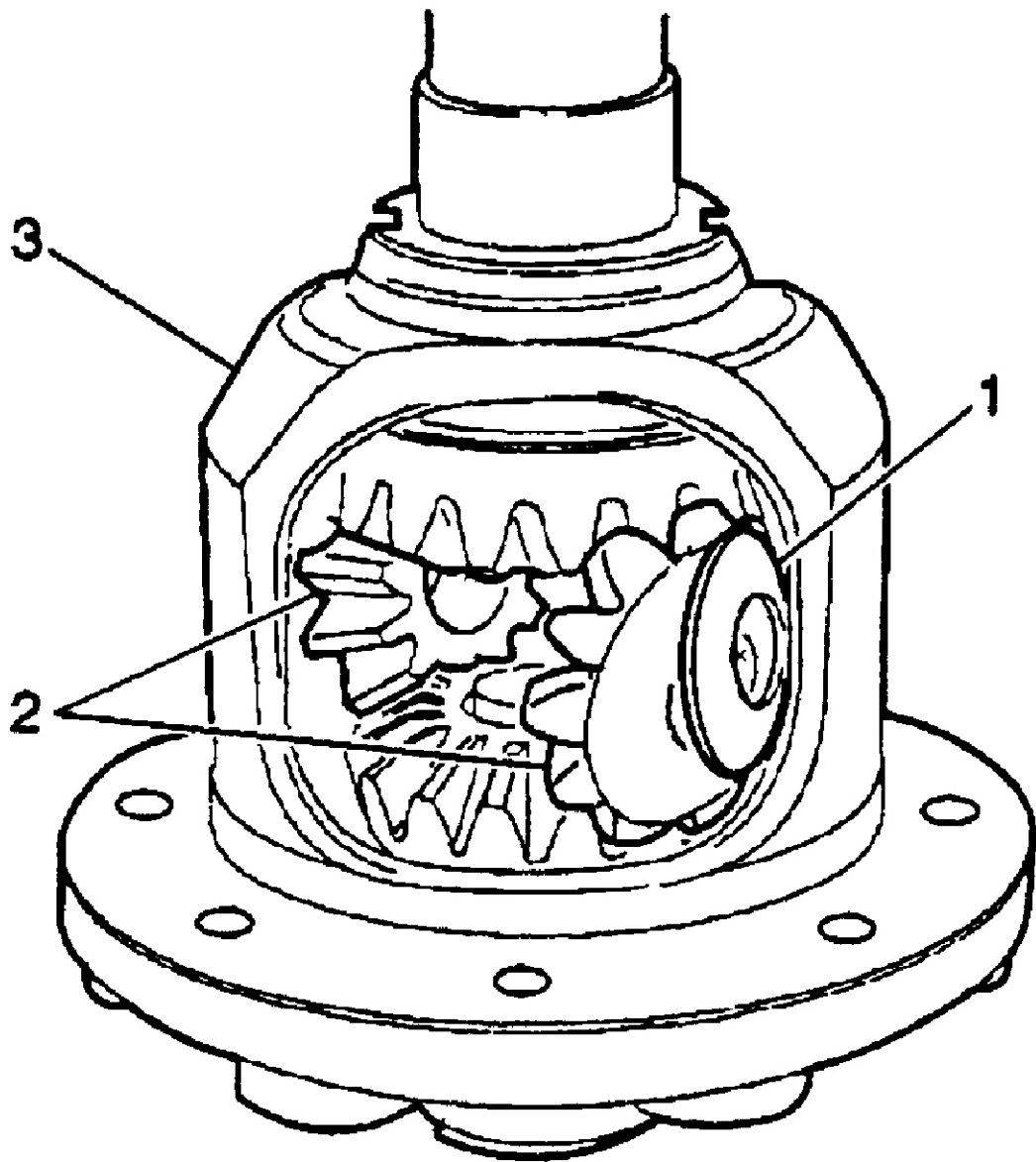
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Fig. 41: Installing Special Tool Into Differential Carrier Bore
Courtesy of GENERAL MOTORS CORP.



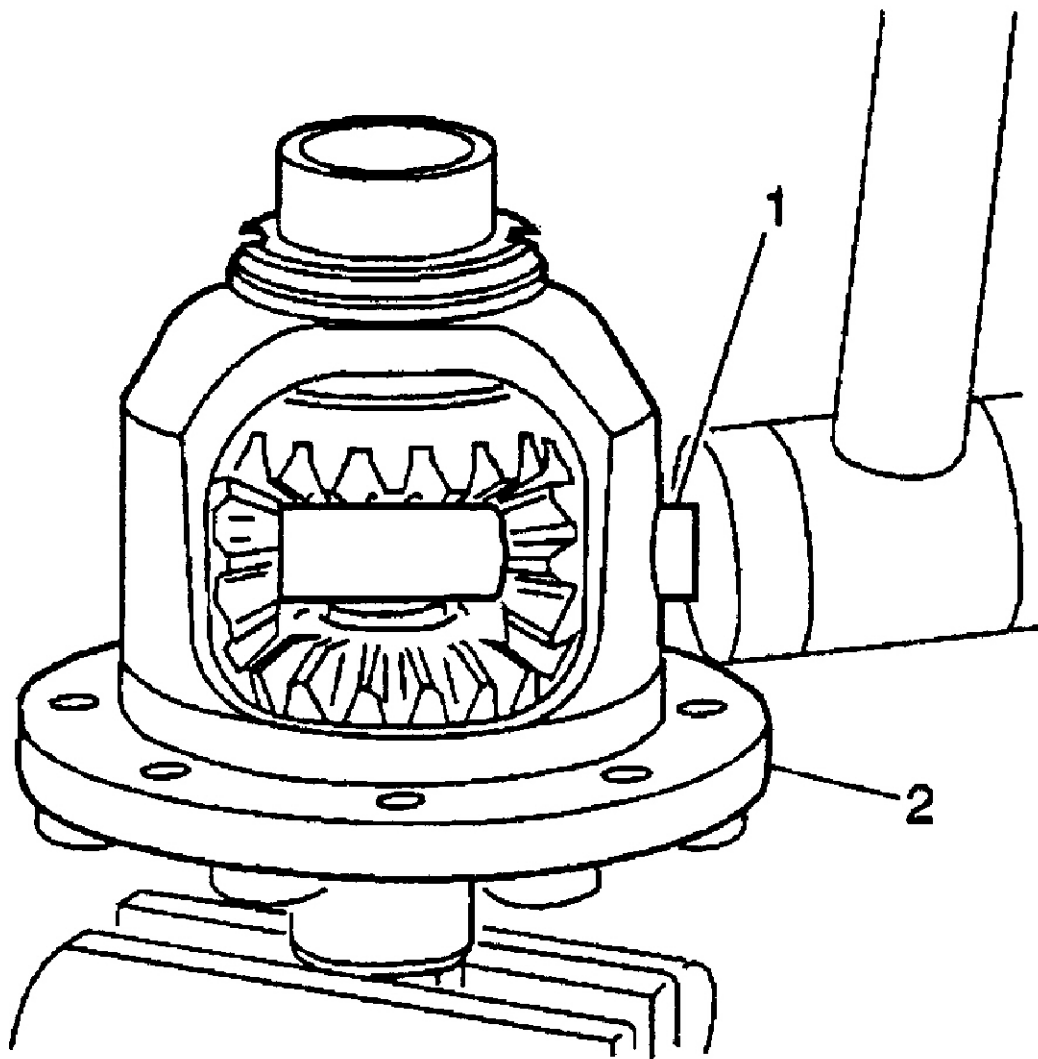
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Fig. 42: Installing Shim & Washer
Courtesy of GENERAL MOTORS CORP.



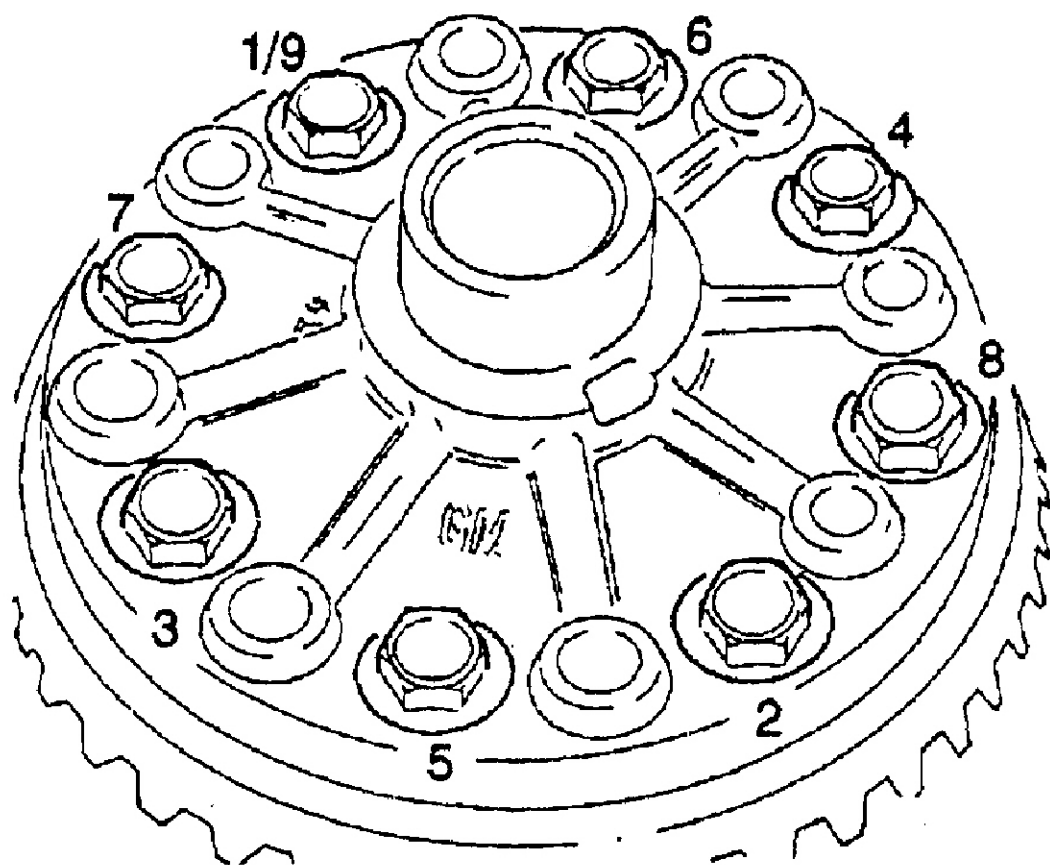
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Fig. 43: Installing Conical Washers & Pinion Gears
Courtesy of GENERAL MOTORS CORP.



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Fig. 44: Driving Rear Axle Pinion Gear Shaft Into Its Carrier Bore
Courtesy of GENERAL MOTORS CORP.



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Fig. 45: Identifying Ring Gear Bolts Torque Sequence
 Courtesy of GENERAL MOTORS CORP.

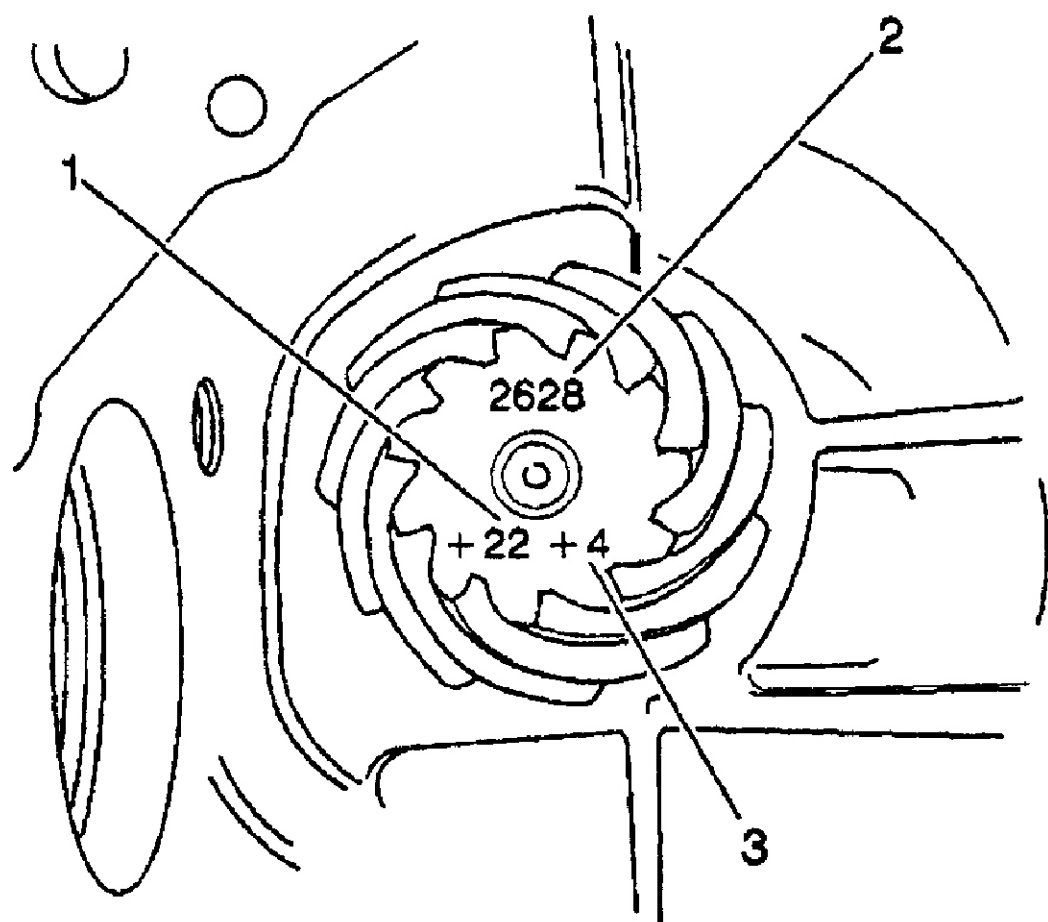
ADJUSTMENTS

PINION DEPTH

NOTE: Numbers in parenthesis correspond with numbers in illustration.

When replacing the differential ring and pinion set, it is important to note that the replacement drive pinion gear will most likely contain markings on the gear face. These markings indicate adjustments that need to be made to the shim thickness as a result of the production tolerances of the gear. The differential drive pinion gear face contains the following 3 engraved values:

1. The CHECK VALUE (1). The check value shows in the hundredths of a millimeter (+) 22 = 0.008 in. (0.22 mm) how deep the drive pinion should be installed relative to drive pinion gear zero line. Compare this value (+)0.008 (0.22 mm) of the replacement pinion gear with the value of the original pinion gear, i.e. (+) 0.003 in. (+ 0.08 mm). Adjust the pinion shim accordingly, which in this case would result in adding 0.005 in. (0.13 mm) to the drive pinion shim. Now perform a tooth contact pattern test. See **Fig. 46** and **GENERAL INFORMATION**.
2. The PARING VALUE (2) for the drive pinion and the differential ring gear. This marking is stamped on both the ring gear and on the pinion gear identifying the paring as a matched gearset. See **Fig. 46**.
3. The UNDERLINED VALUE (3). The underlined value does not concern service. See **Fig. 46**.



G00138147

Fig. 46: Pinion Depth Adjustment Diagram
 Courtesy of GENERAL MOTORS CORP.

Establishing the differential drive pinion gear depth is initiated by reassembling the differential with the original pinion gear shim that was previously installed and by performing a pattern test. Only reuse the shim if it is intact and if it is undamaged. Measure the thickness of the shim if the shim is damaged. Replace the damaged shim with a new shim of the corresponding thickness. Perform the differential drive pinion gear-to-differential drive pinion gear backlash check once the assembly is assembled with the original thickness of the shim. See **BACKLASH INSPECTION & ADJUSTMENT**.

SIDE BEARING PRELOAD INSPECTION & ADJUSTMENT

The differential carrier side bearing preload is maintained by the thickness of the differential side bearing adjuster rings (snap rings). It is recommended that you have a selection of adjuster rings nearby when setting the side bearing preload.

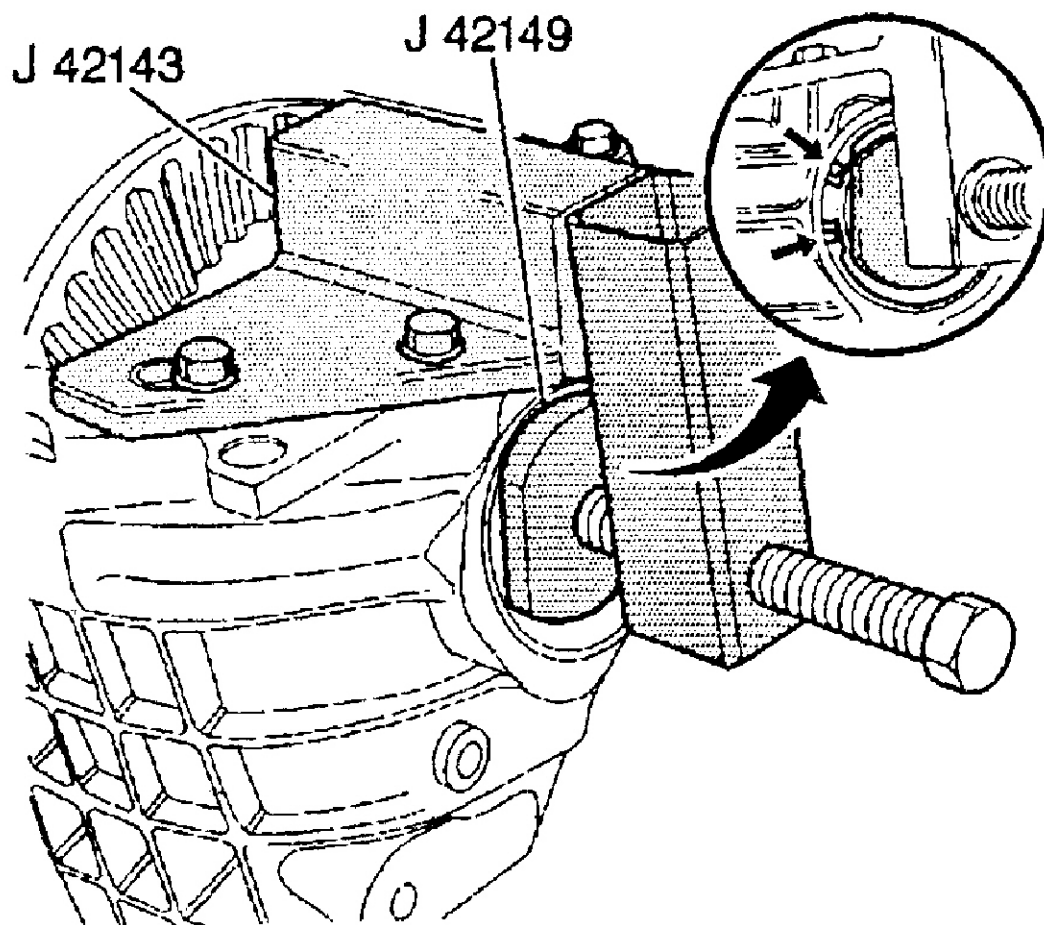
If it necessary to vary the adjuster ring thickness, once the side bearing preload has been established, then always maintain the same total thickness between the two snap rings to maintain the preload. For instance, if it was required that 0.002 inches be removed from the left side adjuster ring thickness to correctly establish the backlash and to correct the contact pattern, then 0.002 inches must be added to the right side adjuster ring thickness in order to maintain the side bearing preload.

1. Use the cover bolts to install the Differential Side Bearing Preload Clamp Plate (J 42149) onto the rear axle housing cover surfaces. Tighten the cover bolts until fully seated. DO NOT strip. See **Fig. 47** and **TORQUE SPECIFICATIONS**.
2. Install the Differential Side Bearing Preload Clamp Plate (J 42149) between the side bearing race and the Differential Side Bearing Preload Clamp (J 42143). See **Fig. 47** and **SPECIAL TOOLS**.

3. Install the Dial Indicator Set (J 8001) on to the Differential Side Bearing Preload Clamp (J 42143) with the indicator button resting on the ring gear surface. See **SPECIAL TOOLS** .
4. Install the differential carrier with the bearing races into the rear axle housing.
5. Use heavy duty snap ring pliers to install the left adjuster ring. See **Fig. 48** .
6. Install the right snap rings of various thickness until you are able to read no movement of the differential carrier on the Dial Indicator Set (J 8001). See **SPECIAL TOOLS** .

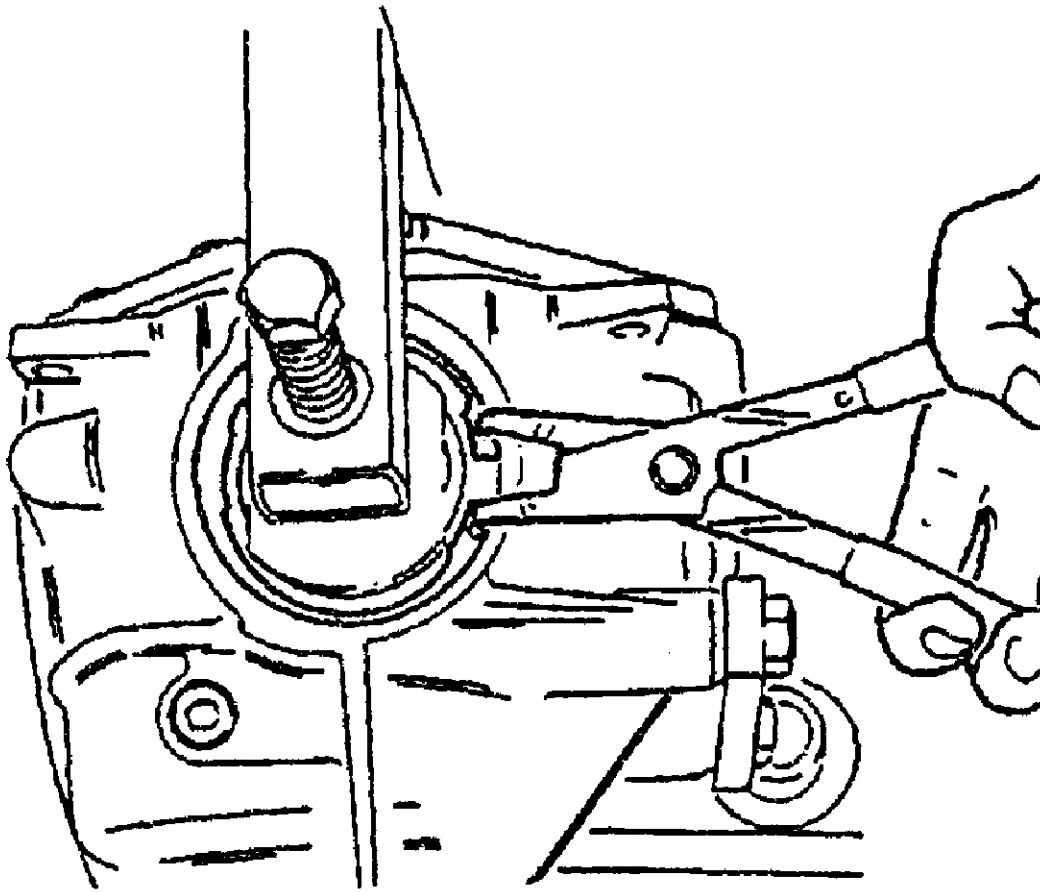
NOTE: The total preload on the bearings is 0.010 in. (0.25 mm). The side preload is now correctly established.

7. Add an additional 0.005 in. (0.125 mm) to each side in the adjuster ring thickness once the zero carrier movement is achieved.
8. The rotating torque of the carrier should be between 5 and 6 INCH lbs. (+/-0.5) with lubricated bearings. Use the following tools to verify the rotating torque of the differential carrier as installed with the correct adjuster rings:
 - Differential Side & Pinion Alignment Kit (J 42178). See **SPECIAL TOOLS** .
 - Appropriate Adapters.
 - INCH Pound Torque Wrench.



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Fig. 47: Installing Preload Clamp Plate To Rear Axle Housing Cover
 Courtesy of GENERAL MOTORS CORP.



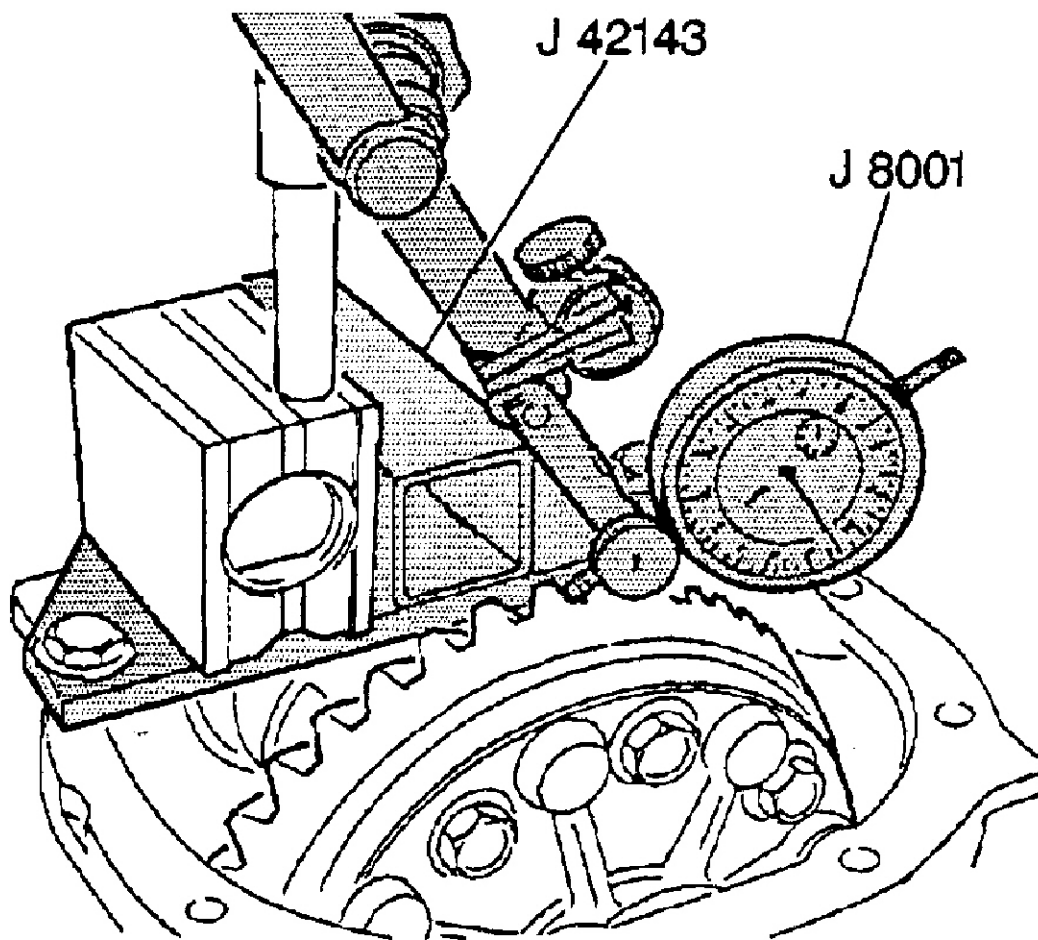
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Fig. 48: Installing Heavy-Duty Snap Ring Pliers
 Courtesy of GENERAL MOTORS CORP.

BACKLASH INSPECTION & ADJUSTMENT

1. Install the differential carrier into the rear axle housing.
2. Use the cover bolts to install the Differential Side Bearing Preload Clamp (J 42143) onto the rear axle housing cover surface. Tighten the cover bolts until fully seated. DO NOT strip the cover bolts. See **Fig. 49** and **TORQUE SPECIFICATIONS**.
3. Rotate the differential carrier several times to seat the bearings.
4. Perform the following steps to mount the Dial Indicator Set (J 8001) onto the Differential Side Bearing Preload Clamp (J 42143). See **Fig. 49** and **SPECIAL TOOLS**.
 - Use a small button on the indicator stem so that contact can be made near the heel end of the tooth.
 - Set the Dial Indicator Set (J 8001) so that the stem is in line with the gear rotation and is perpendicular to the tooth angle for an accurate backlash reading. See **SPECIAL TOOLS**.
5. The lash must not vary over 0.002 in. (0.05 mm) around the ring gear.
6. Check for the following conditions if a variation is over 0.002 in. (0.05 mm):
 - Check for burrs, make corrections as necessary.
 - Check for uneven bolting conditions, make corrections as necessary.
 - Check for a distorted differential housing flange, make corrections as necessary.
7. Hold the drive pinion gear stationary when checking the backlash.
8. The backlash at point of minimum lash should be between 0.004 in. and 0.008 in. (0.10 mm and 0.20 mm).
9. Transfer 0.0016 in. (0.04 mm) in the differential side bearing adjuster ring thickness for each 0.001 in. (0.025 mm) change in backlash desired.

10. Check the backlash at the four points around the ring gear.



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Fig. 49: Mounting Special Tools
 Courtesy of GENERAL MOTORS CORP.

GENERAL INFORMATION

ADJUSTMENTS AFFECTING TOOTH CONTACT

NOTE: Numbers in parenthesis correspond with numbers in illustration.

The following 2 adjustments can be made which will affect the tooth contact pattern:

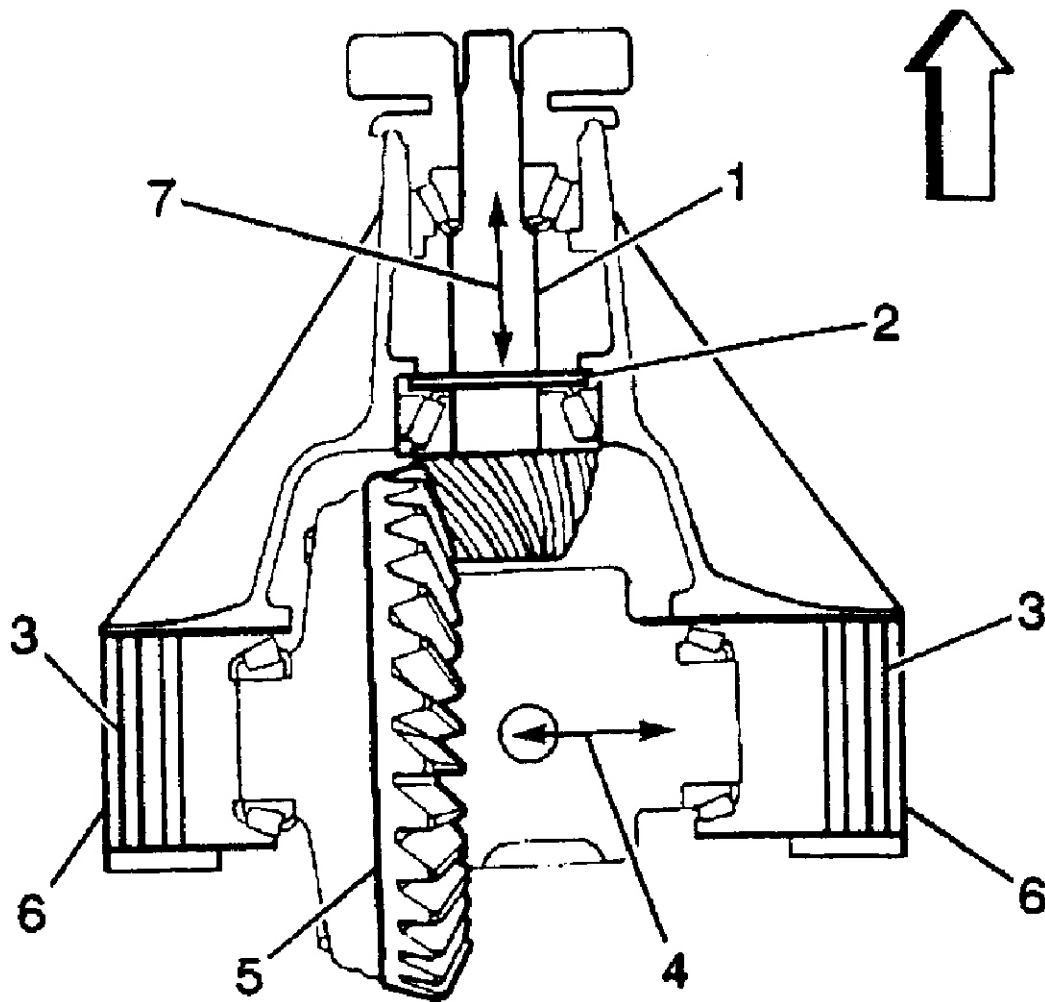
- The backlash.
- The position of the drive pinion gear (1) in the housing. See **Fig. 50**

The effects of bearing preloads are readily apparent on hand-loaded tooth contact pattern tests.

Backlash is adjusted by means of variable thickness adjuster rings (3). They move the entire differential closer to, or farther from, the drive pinion gear (1). These are also used to set the differential bearing carrier bearing preload. If the thickness of the right snap ring (3) is increased, along with decreasing the left snap ring (3), backlash (4) increases. The backlash decreases if the left snap ring thickness is increased, along with a decrease in the right snap ring thickness. See **Fig. 50**.

The position of the differential drive pinion gear is adjusted by increasing or decreasing the drive pinion gear bearing shim (2) thickness between the drive pinion gear inner bearing and the housing. A shim (2) is used in the

axle to compensate for manufacturing tolerances. Increasing the thickness moves the drive pinion gear (1) closer to the centerline of the ring gear (5). Decreasing the shim thickness moves the drive pinion gear (1) farther away from the centerline of the ring gear (5). See **Fig. 50** .



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Fig. 50: Adjustments Affecting Tooth Contact Diagram
Courtesy of GENERAL MOTORS CORP.

COMMON CAUSES OF BEARING RELATED NOISES

The following are common causes of bearing related noises:

1. Low lubricant level.
2. Incorrect lubricant used.
3. Foreign matter in the lubricant.
4. Incorrect preload setting.
5. Incorrectly mounted bearing, e.g. dirt trapped behind abutment faces during the assembly.

DIFFERENTIAL CARRIER SIDE BEARINGS

Side bearings produce a constant grinding noise of a slower nature than pinion bearings. Side bearing noise cannot be determined by the diagnosis procedure for rear wheel bearing noise, but is in the same frequency as the rear wheel bearings.

DIFFERENTIAL PINION GEAR BEARINGS

Worn bearings, Rough bearings, and Loose bearings tend to perform the following conditions:

- Tend to aggravate and magnify the drive.
- Tend to float and coast the noise.
- Tend to result in heavy, irregular drive noise on constant acceleration and float.
- Tend to result in an irregular noise on deceleration.

Rough or brinelled pinion bearings produce a continuous whine. The whine persists when coasting with the transmission in neutral even to a low speed. End play in the pinion gear bearings, even from natural wear, which permits the pinion to feed back into the ring gear, causes a noise on overrun or coast.

DIFFERENTIAL RING GEAR TOOTH NOMENCLATURE

The drive side of the gear tooth curves outward, or convex. The concave side is the coast side. The end of the tooth nearest the center of the ring gear is the toe end. The end of the tooth farthest away from the center is the heel end. The toe end of the tooth is smaller than the heel end.

INSPECTION & DIAGNOSIS

A close examination of the differential prior to taking it apart often reveals valuable information as to the extent and type of repairs or adjustment necessary. This information and the report of the malfunction provides a basis for determining the degree of tear down required. frequent causes of axle noise are improper backlash, differential drive pinion gear bearing preload, or a combination, or a combination of these items. A few simple adjustment may be all that are necessary to correct the problem. Check the following items, record them and analyze the results before removing the differential case from the housing:

- Check the backlash.
- Check the total differential preload.
- Check the tooth contact pattern.

Use care at all times to keep dirt and other foreign matter, such as grinder shavings, dirt, or particulate containments, away from the rear axle to prevent the possibility of subsequent failure.

REAR WHEEL BEARINGS

Rough or pitted rear wheel bearings that are can be are responsible for a growling noise. The fist impression of this growling noise could be suspected as a differential noise. The noise, however, does not vary on drive or coast. Additionally, the noise persist when coasting with the transmission in neutral. Frequently this noise can be readily identified by the sound being conveyed in an eccentric form. the noise can also be intermittent as the noise may fade for a short period. Perform the following steps to confirm the diagnoses of a rear wheel bearing noise:

1. Support the rear of the vehicle on safety stands.
2. Start the engine.
3. Disengage the traction control.
4. Raise the engine speed up to a fast idle with the top gear engaged.
5. Use a stethoscope to compare the noise of one bearing against the other.
6. Keep the volume adjustment down low to obtain the best results.
7. A difference in the noise of the rear wheel bearings can also be discerned by placing a steel-shafted screwdriver to the ear and in close proximity to each bearing in turn.

A noticeable difference in noise can usually be observed between a good and an excessively worn bearing.

TOOTH CONTACT PATTERN TEST

CAUTION: It is very important that the tooth contact be tested before the differential is taken apart. Variations in the differential and/or drive pinion gear inner bearing may cause the drive gear to be too close, or too far away, from the ring gear.

1. Remove the rear axle differential from the vehicle. See **DIFFERENTIAL**
2. Clean all the dirt from the cover area before removing the cover.
3. Remove the housing cover. See **REAR COVER & GASKET**
4. Wipe the axle lubricant out of the housing.
5. Carefully clean each tooth of the ring gear.
6. Use a medium stiff brush to apply gear marking compound, GM P/N 1052351 or equivalent, sparingly to all the ring gear teeth. When properly applied the area of the differential drive pinion gear tooth contact is visible when hand load is applied.
7. Insert the Differential Side & Pinion Alignment Kit (J 42178) to the differential side bearing bore. See **SPECIAL TOOLS** .
8. Use a ratchet to hold the Differential Side & Pinion Alignment Kit (J 42178) stationary. See **SPECIAL TOOLS** .
9. Rotate the pinion gear flange so that the ring gear rotates one full revolution.
10. Reverse the rotation so that the ring gear rotates one revolution in the opposite direction.
11. Observe the pattern on the ring gear teeth and compare to the following:

- **Low Flank Contact (Evident By Contact In The Valley Between The Gear Teeth)**

Decrease the pinion gear bearing shim thickness, this will move the pinion gear out toward the ring gear centerline.

- **High Face Contact (Evident By Contact On The Outboard Edge Of The Gear Tooth)**

Increase the pinion gear bearing shim thickness, this will move the pinion gear in toward the ring gear centerline.

- **Toe Contact (Evident By Contact On The Lower Edge Of The Gear Tooth)**

Increase the backlash, this will move the area of the pinion gear contact with the ring gear toward the heel.

- **Heel Contact (Evident By Contact On The Upper Edge Of The Gear Tooth)**

Decrease the backlash, this will move the area of the pinion gear contact with the ring gear toward the toe.

- **Desired Contact Pattern**

Pinion gear contact in center of the ring gear tooth.

12. Reinstall the housing cover. See **REAR COVER & GASKET** .
13. Install the rear axle differential to the vehicle. See **DIFFERENTIAL** .

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

1998 Cadillac Catera

1997-99 DRIVE AXLES Differentials & Axle Shafts - Catera

Application	INCH Lbs. (N.m)
Differential Carrier (Without Pinion Gear In Housing)	5- 6 +/- 0.5 (0.56-0.67 +/- 0.5)
Pinion Gear Bearing & Seal Installed	
New Bearing & Seal	9-15 (1.0- 1.7)
Used Bearing & Seal	8-11 (0.9- 1.2)

AXLE SPECIFICATIONS**AXLE SPECIFICATIONS**

Applicationl	Specification
ABS Sensor Air Gap	0.005-0.039 in (0.13-1.0 mm)
Axle Type	Ridgidly Mounted Housing, Non-Locking
Gear Ratio	3.90:1
Gear Type	Hypoid
Number Of Drive Pinion Gear Teeth	10
Number Of Ring Gear Teeth	39
Ring Gear Diameter	7.401 in (188 mm)
Ring Gear To Drive Pinion Backlash	0.004-0.008 in (0.10-0.20 mm)

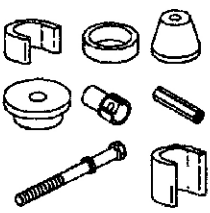
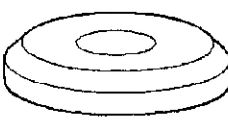
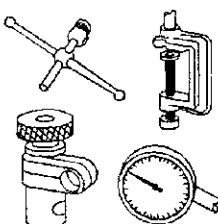
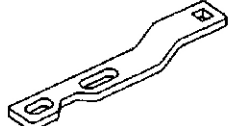
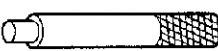

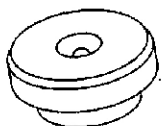
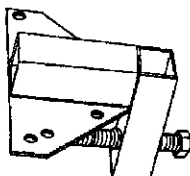
TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Differential Ring Gear Bolt	85 (115)
Differential Support Bracket Upper Bolt	74 (100)
Differential Support Bracket Lower Bolt	66 + 38° (90 + 38°)
Rear Axle Housing Cover Bolt	44 (60)
Rear Axle Housing Filler Plug	15 (22)
Rear Differential Bushing Bolt	74 (100)
Wheel Lug Nut	80 (100)
	INCH Lbs. (N.m)
ABS Sensor Bolt	62 (7)

SPECIAL TOOLS

1998 Cadillac Catera

1997-99 DRIVE AXLES Differentials & Axle Shafts - Catera

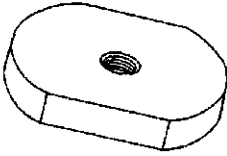
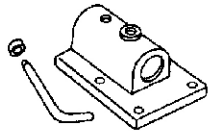
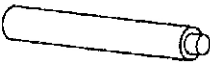
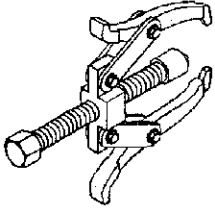
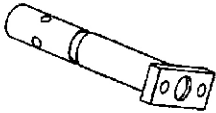
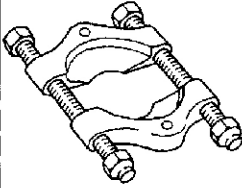
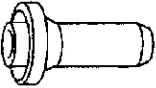
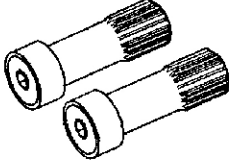
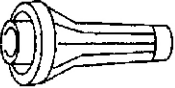
Illustration	Tool Number/Description	Illustration	Tool Number/Description
	J 21474-01 Control Arm Bushing Set		J 8608 Inner Pinion Bearing Race Installer
	J 8001 Dial Indicator Set		J 42066 Rear Hub Holding Adapter
	J 8092 Driver Handle		J 42112 Rear Differential Bushing Kit
	J 42147 Outer Pinion Bearing Race Installer		J 42143 Differential side Bearing Preload Clamp

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Fig. 51: Identifying Special Tools (1 Of 2)
 Courtesy of GENERAL MOTORS CORP.

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1997-99 DRIVE AXLES Differentials & Axle Shafts - Catera

Illustration	Tool Number/Description	Illustration	Tool Number/Description
	J 42149 Differential Side Bearing Preload Clamp Plate		J 3289-20 Bench Mounted Holding Fixture
	J 42176 Driver Handle		J 22888-20A Side Bearing Remover Kit
	J 42177 Holding Fixture		J 22912-01 Inner Pinion Bearing Remover
	J 26234 Drive Axle Seal Driver		J 42178 Differential Side and Pinion Alignment Kit
	J 42108 Pinion Seal Driver		

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Fig. 52: Identifying Special Tools (2 Of 2)
Courtesy of GENERAL MOTORS CORP.

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