2010 DRIVELINE/AXLE

Propeller Shaft - Camaro

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Propeller Shaft Center Bearing Mounting Bolt	22 N.m	16 lb ft
Propeller Shaft Coupling Nut- Front	91 N.m	67 lb ft
Propeller Shaft Coupling Nut- Rear	91 N.m	67 lb ft
Propeller Shaft to Rear Differential Drive Flange Bolt	115 N.m	85 lb ft
Propeller Shaft to Transmission Output Flange Nut	97 N.m	72 lb ft

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - PROPELLER SHAFT

Before beginning diagnosis, review the system Description and Operation in order to familiarise yourself with the system function. Refer to **Propeller Shaft Description and Operation**.

Classifying the Symptom

Propeller Shaft symptoms can usually be classified into the following categories:

- Noises.
- Vibrations.

Visual/Physical Inspection

- Inspect the system for aftermarket devices which could affect the operation of the propeller shaft.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Universal Joint Noise**.
- **Ping, Snap, or Click Noise**.
- **Knock or Clunk Noise**.
- **Scraping Noise**.

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- **Squeak Noise**.

UNIVERSAL JOINT NOISE

Problem	Action
One or more of the universal joints are worn or damaged.	Replace the propeller shaft assembly. Refer to **Two-Piece Propeller Shaft Replacement**.
One or more of the universal joints have lost lubricant.	Replace the propeller shaft assembly. Refer to **Two-Piece Propeller Shaft Replacement**.
Rubber coupling bolts loose at transmission or axle flange.	Tighten the bolts to specifications. Refer to **Fastener Tightening Specifications**.
Rubber couple are excessively worn or damaged transmission or rear drive axle flange.	Replace the propellers shaft couplers. Refer to **Fastener Tightening Specifications**.
Bolts loose at propeller shaft flange and coupling.	Tighten the bolts to specifications. Refer to **Fastener Tightening Specifications**.

PING, SNAP, OR CLICK NOISE

Checks	Action
DEFINITION: A ping, snap or click is usually heard on initial load after the transmission is in gear, either in forward or reverse.	
The propeller shaft yoke or the differential pinion nut is loose.	Tighten the rubber coupling to propeller shaft yoke retaining bolt and nuts and/or the pinion nut to specified torque. Refer to **Two-Piece Propeller Shaft Replacement**.
The rubber coupling is damaged.	Replace the rubber coupling. Refer to **Two-Piece Propeller Shaft Replacement**.
The rubber coupling to propeller shaft retaining bolts and nuts are loose.	Tighten the bolts to specifications. Refer to **Two-Piece Propeller Shaft Replacement**.
The rubber coupling is damaged.	Replace the rubber coupling. Refer to **Two-Piece Propeller Shaft Replacement**.
The center bearing is damaged.	Replace the center bearing. Refer to **Two-Piece Propeller Shaft Replacement**.
The universal joint is worn or damaged.	Replace the complete propeller shaft. Refer to **Two-Piece Propeller Shaft Replacement**.

KNOCK OR CLUNK NOISE

Checks	Action
DEFINITION: Knocking or clunking noise occurs when operating the vehicle in high gear or coasting in neutral at 16 km/h (10 mph).	
The universal joint is worn or damaged.	Replace the complete propeller shaft. Refer to **Two-Piece Propeller Shaft Replacement**.

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The rubber front or rear coupling is damaged or worn.	Replace the rubber coupling. Refer to **Two-Piece Propeller Shaft Replacement**.
The rubber couplings to propeller shaft retaining bolts and nuts are loose.	Tighten the bolts to specifications. Refer to **Fastener Tightening Specifications**.
The center bearing is damaged.	Replace the center bearing. Refer to **Two-Piece Propeller Shaft Replacement**.
The side gear in the differential is worn or oversize.	Replace the differential case and/or the side gears. Refer to **Differential Replacement** .

SCRAPING NOISE

Checks	Action
DEFINITION: A scraping noise occurs when driving the vehicle at various speeds.	
The heat shield, exhaust or other part is touching the propeller shaft.	Correct the interference as necessary.
The pinion flange slinger or the center bearing is rubbing.	Correct the interference as necessary.

SQUEAK NOISE

Checks	Action
DEFINITION: When driving the vehicle at various speeds a squeaking sound occurs.	
The universal joint is worn or damaged.	Replace the complete propeller shaft. Refer to **Two-Piece Propeller Shaft Replacement**.

SHUDDER ON ACCELERATION AT LOW SPEED

Checks	Action
DEFINITION: When the vehicle is accelerating at low speed a shudder occurs.	
The center bearing rubber cushion is worn or damaged.	Replace the center bearing assembly. Refer to **Two-Piece Propeller Shaft Replacement**.
The universal joint is worn, damaged or too stiff.	Replace the center bearing assembly. Refer to **Two-Piece Propeller Shaft Replacement**.
The rubber couplings to propeller shaft retaining nuts and bolts are loose.	Tighten the rubber couplings to propeller shaft retaining nuts and bolts to specifications. Refer to **Fastener Tightening Specifications**.
The angle across the universal joints is too high.	Determine the cause of the excessive driveline angle. Check engine and transmission mounts, centre bearing mounting bracket, subframe and differential mounts.

REPAIR INSTRUCTIONS

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TWO-PIECE PROPELLER SHAFT REPLACEMENT

Removal Procedure

NOTE: The front and rear propeller shaft couplings can be serviced separately from the propeller shaft. If the propeller shaft coupling needs to be serviced, proceed to steps 11, and 12.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the exhaust heat shield. Refer to **Exhaust Muffler Intermediate Heat Shield Replacement** .

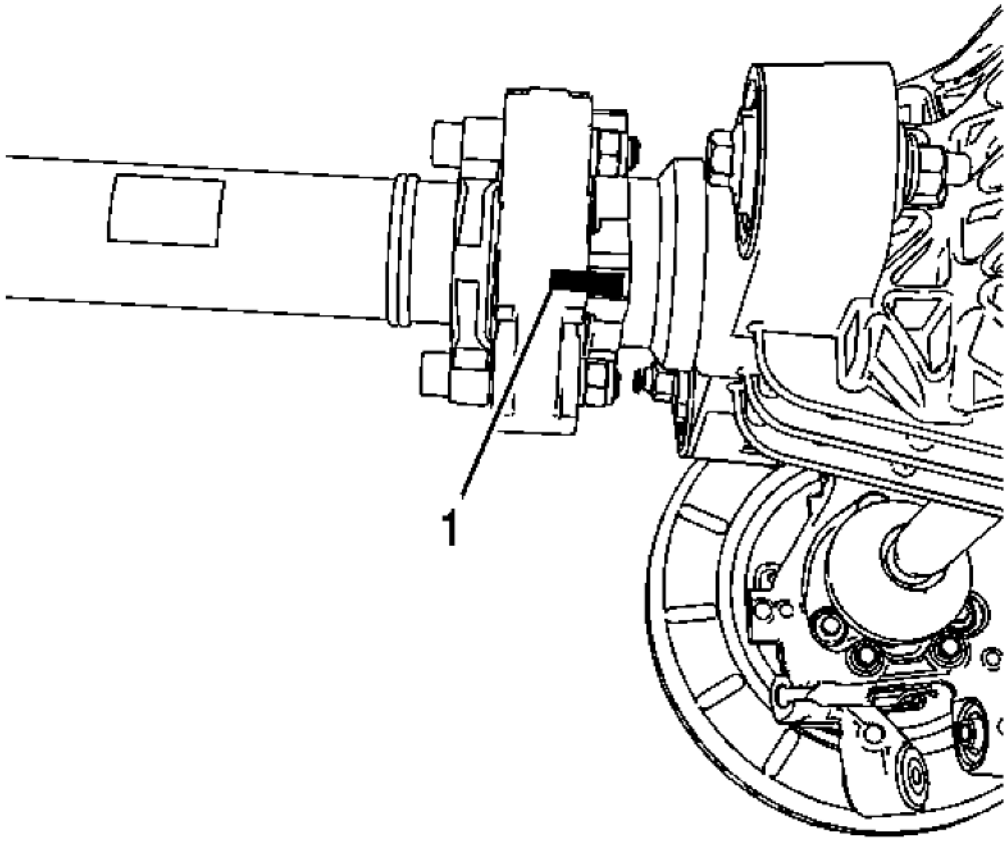


Fig. 1: Rear Drive Flange
Courtesy of GENERAL MOTORS CORP.

3. Reference the rear propeller shaft couple to the rear drive flange (1).

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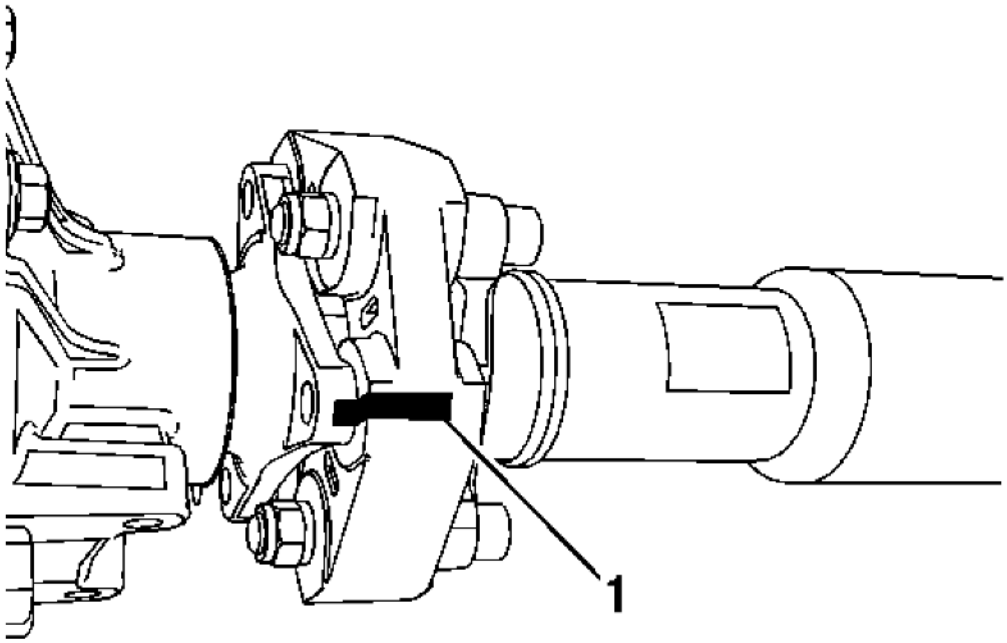


Fig. 2: Transmission Output Flange
Courtesy of GENERAL MOTORS CORP.

4. Reference the front propeller shaft couple to the transmission output flange (1).

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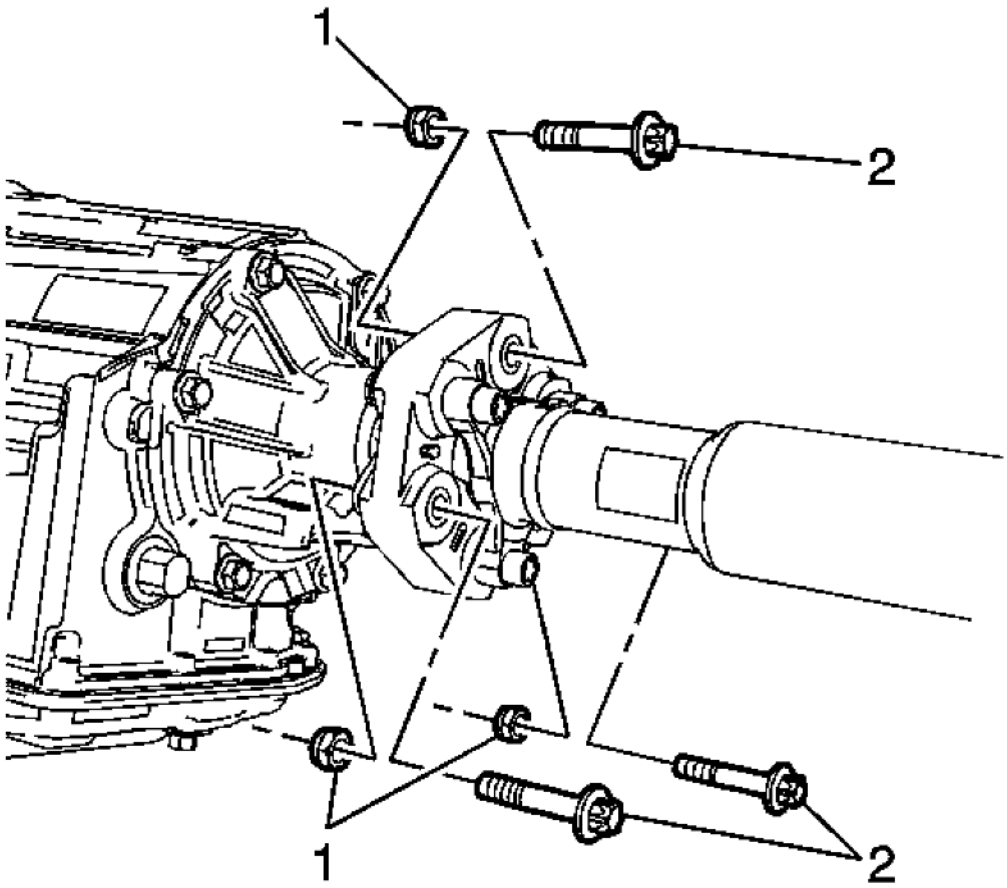


Fig. 3: Propeller Shaft To Transmission Output Flange Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT reuse the nuts (1). Discard and replace with NEW only.

5. Remove the bolts (2) and nuts (1) from the propeller shaft to the transmission output flange.
6. Support the propeller shaft with a suitable jack stand.

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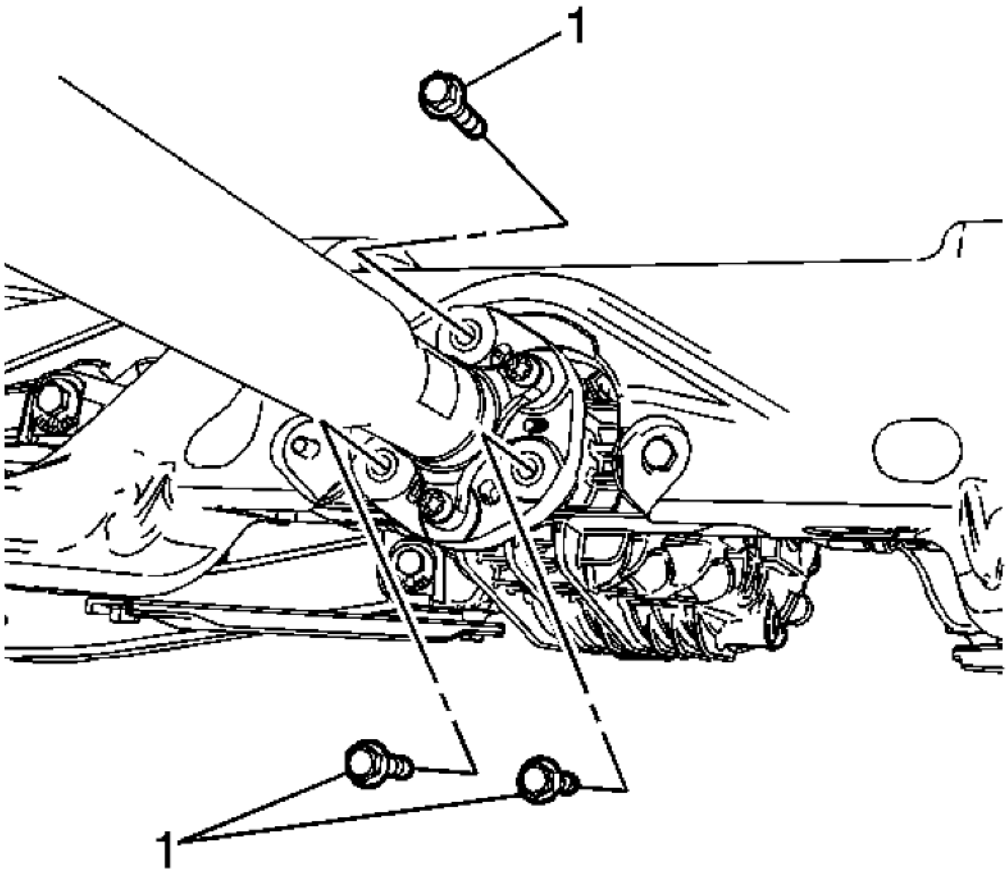


Fig. 4: Propeller Shaft To Drive Pinion Flange Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT reuse the bolts (1). Discard and replace with NEW only.

7. Remove and discard the bolts (1) from the propeller shaft to the drive pinion flange.
8. Support the propeller shaft with a suitable jack stand.

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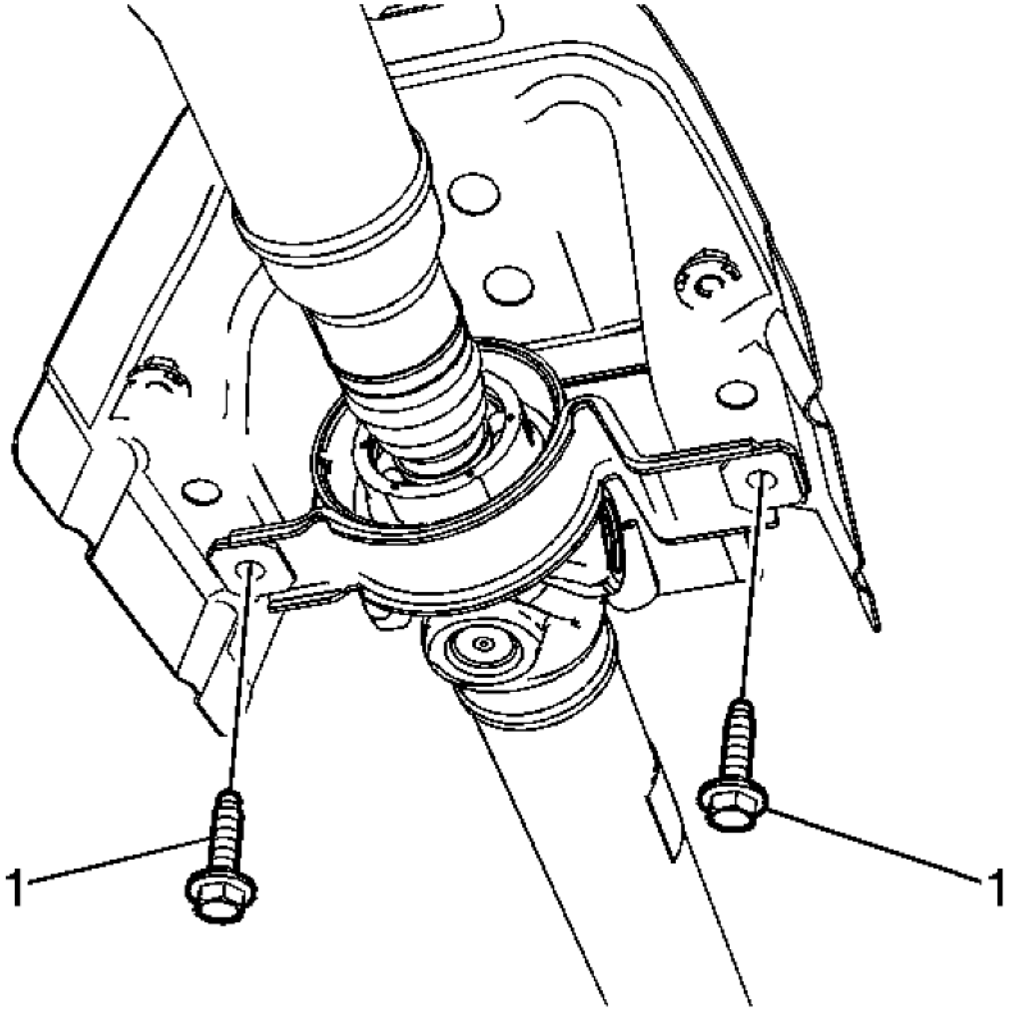


Fig. 5: Propeller Shaft Support Bearing Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the propeller shaft support bearing bolts (1).

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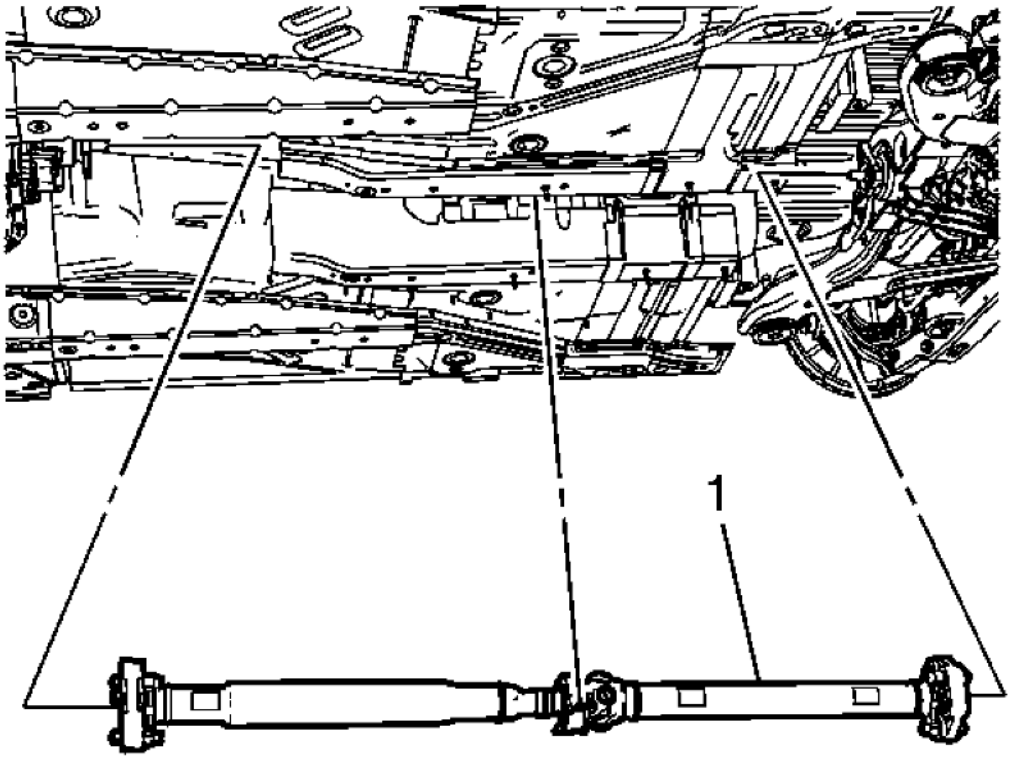


Fig. 6: Propeller Shaft
Courtesy of GENERAL MOTORS CORP.

NOTE: If the propeller shaft coupler is found to be excessively worn or damage, proceed to step 11.

10. Remove the propeller shaft (1) from the vehicle.

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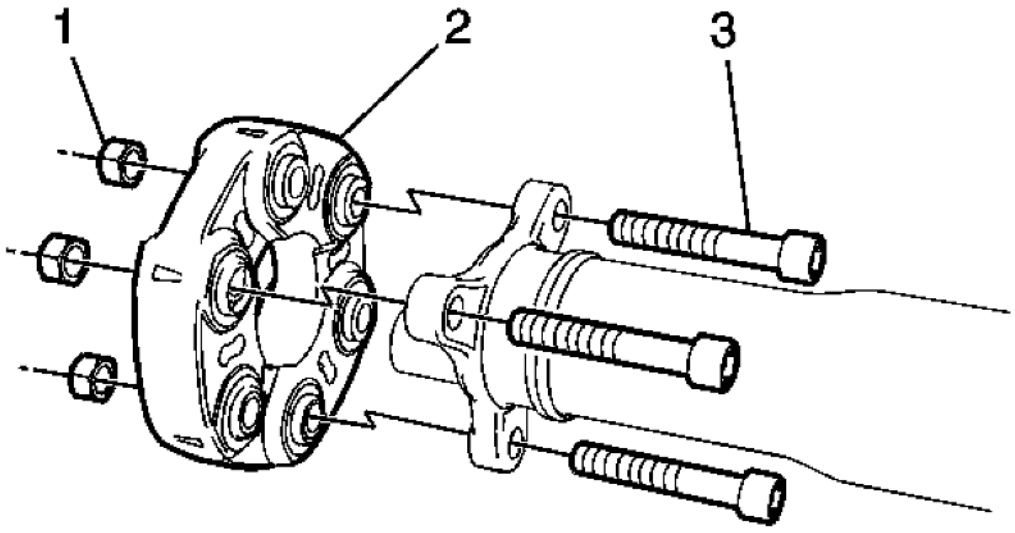


Fig. 7: Propeller Shaft To Propeller Shaft Coupler Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

11. Remove and discard the bolts (3) and the nuts (1) from the propeller shaft to the propeller shaft coupler (2).
12. Remove and discard the propeller shaft coupler (2).

Installation Procedure

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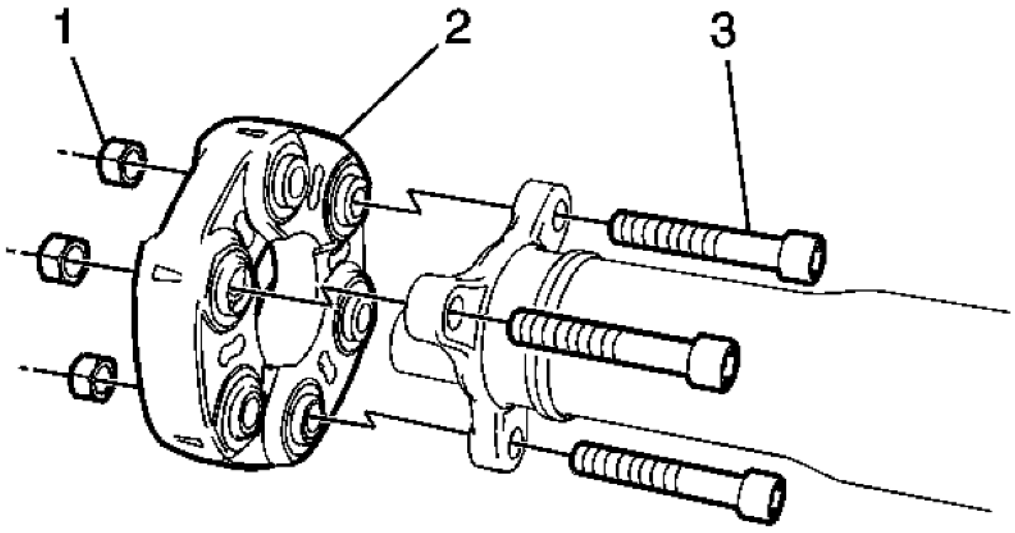


Fig. 8: Propeller Shaft To Propeller Shaft Coupler Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

NOTE: Steps 1 through 3 are to be performed only if the couplers are to be replaced.

1. Install the NEW propeller shaft coupler (2).
2. Install the NEW propeller shaft coupler bolts (3).

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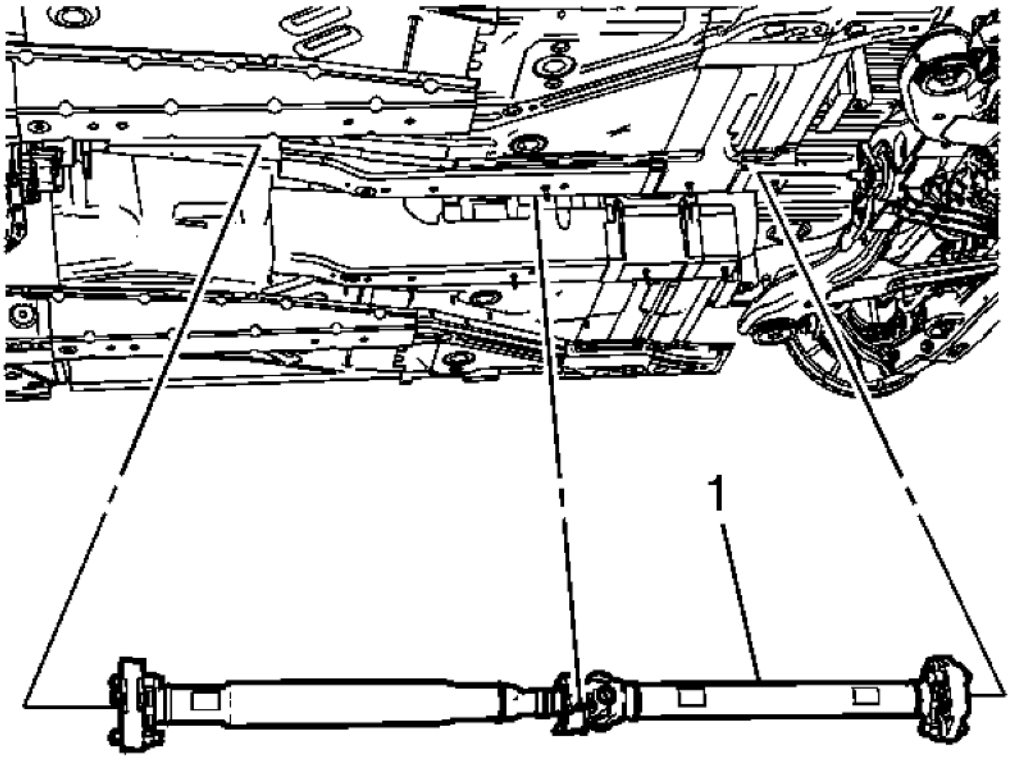


Fig. 9: Propeller Shaft
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Install NEW the propeller shaft coupler nuts (1) and tighten to 91 N.m (67 lb ft).
4. Apply a small amount of clean lubricant on the pilot shaft on the transmission drive flange and the differential drive flange.

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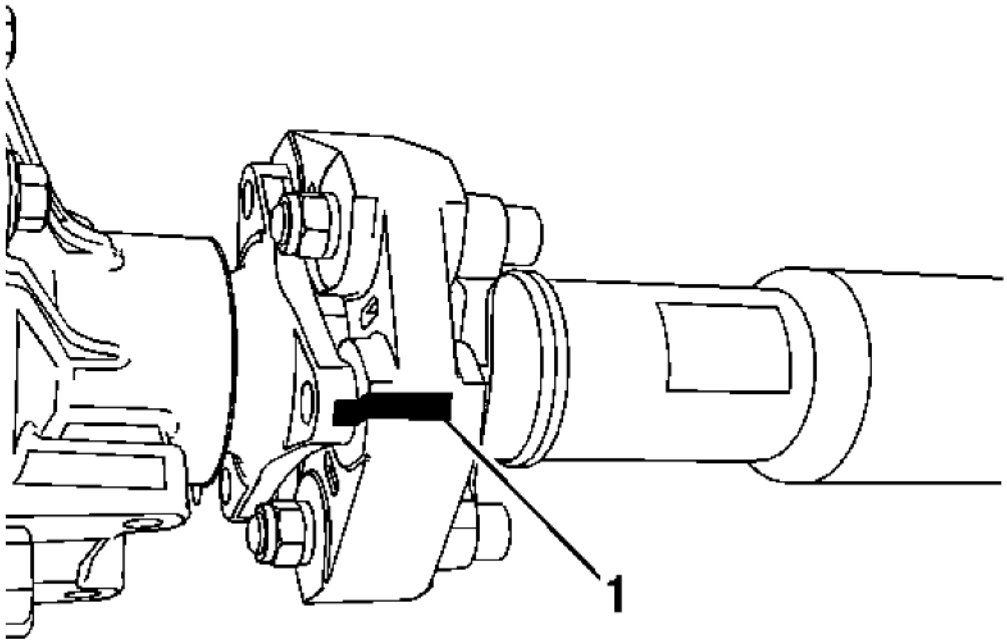


Fig. 10: Transmission Output Flange
Courtesy of GENERAL MOTORS CORP.

5. Align the reference marks (1) on the propeller shaft and the transmission drive flange.
6. Install the propeller shaft (1) to transmission drive flange.

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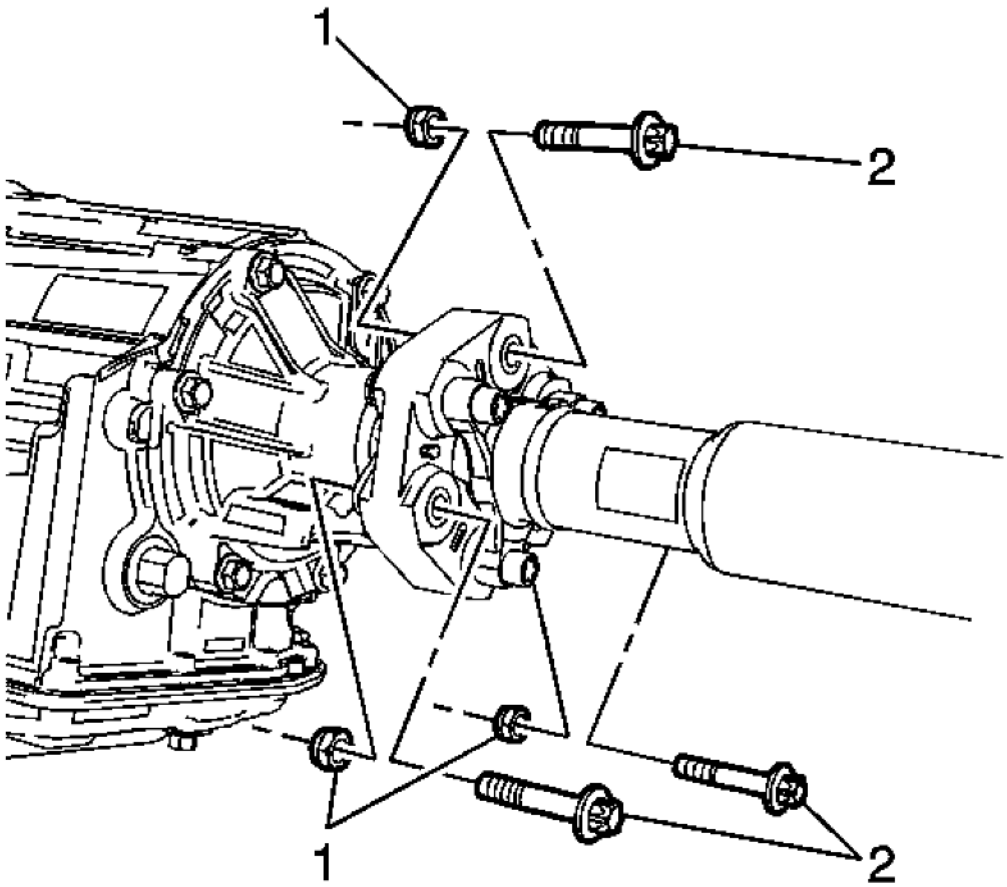


Fig. 11: Propeller Shaft To Transmission Output Flange Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install the propeller shaft bolts (2).
8. Install the NEW propeller shaft nuts (1) and tighten to 97 N.m (72 lb ft).

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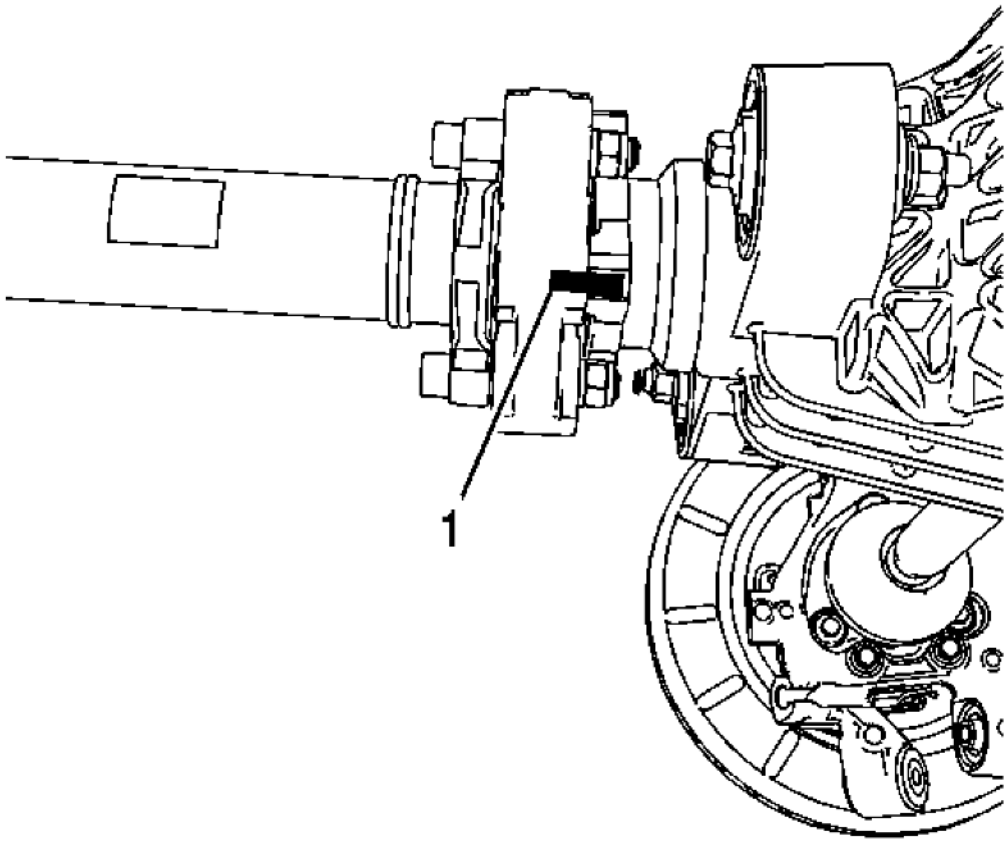


Fig. 12: Rear Drive Flange
Courtesy of GENERAL MOTORS CORP.

9. Align the reference marks (1) on the propeller shaft to the rear differential drive flange.

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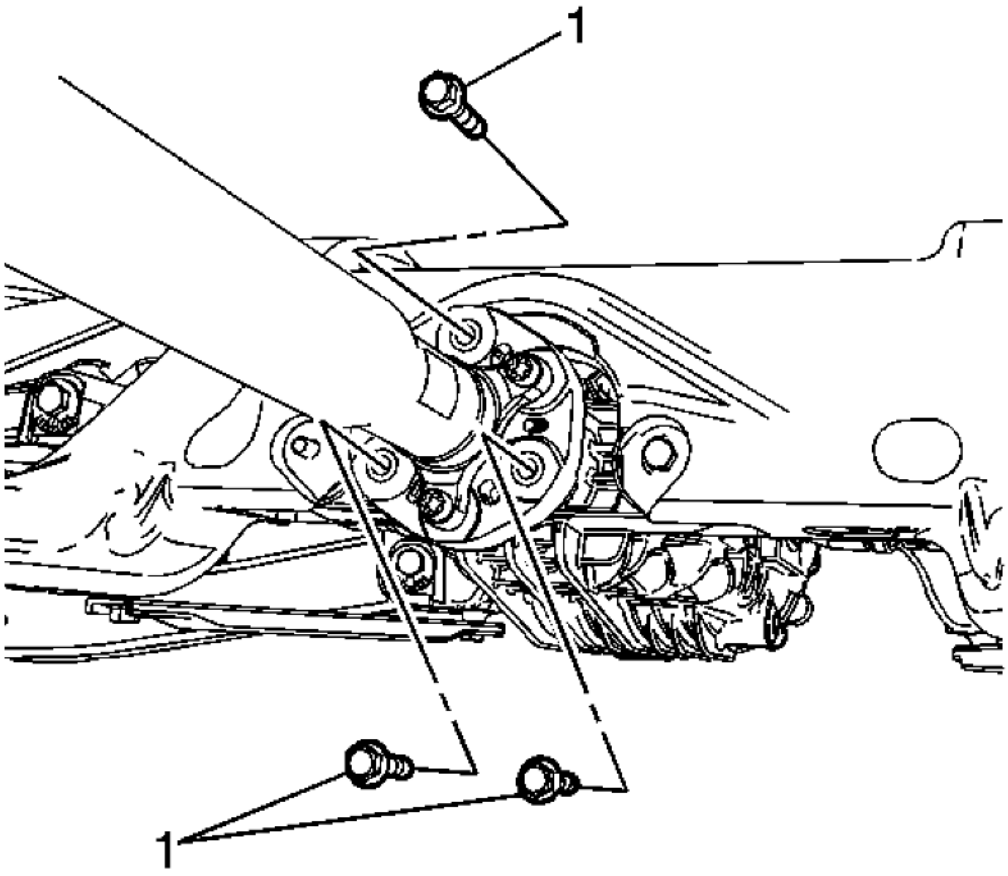


Fig. 13: Propeller Shaft To Drive Pinion Flange Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the NEW propeller shaft bolts (1) to the rear differential drive flange to tighten to 115 N.m (85 lb ft).

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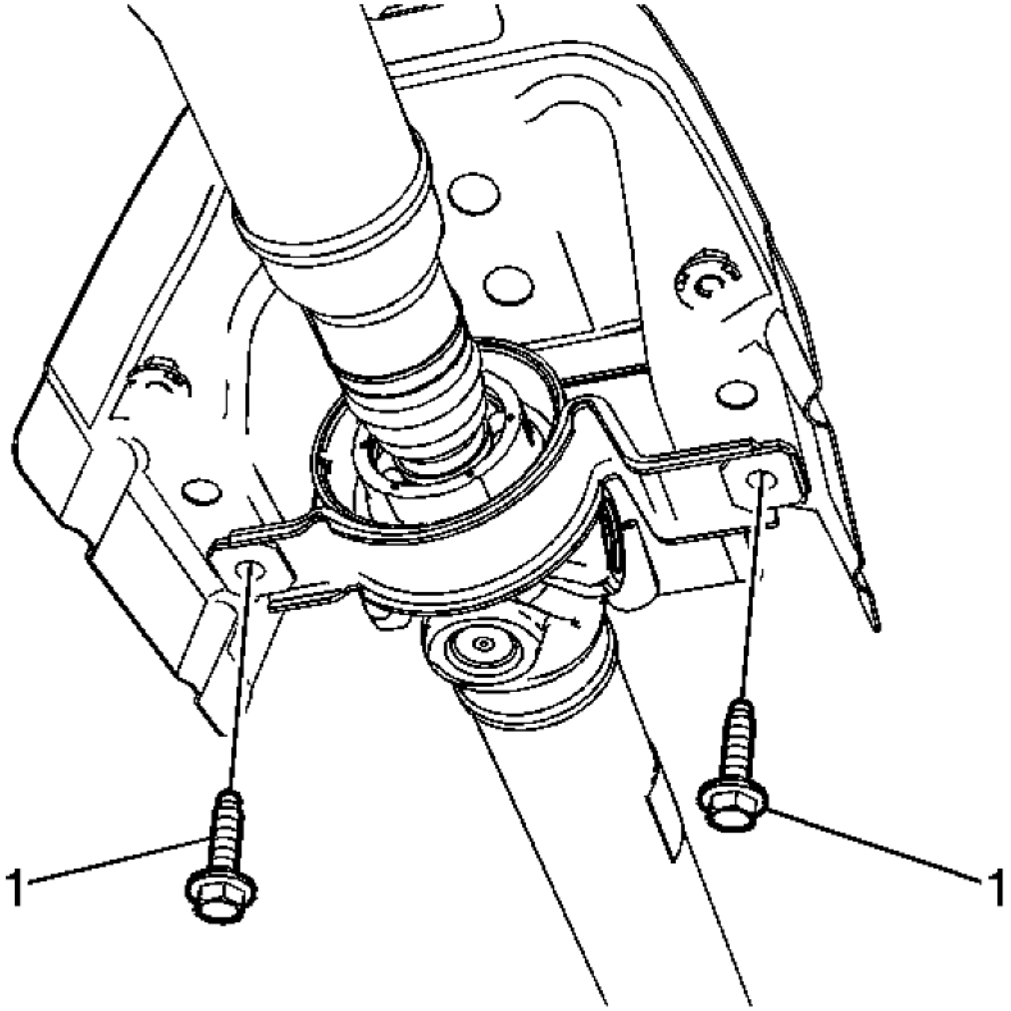


Fig. 14: Propeller Shaft Support Bearing Bolts
Courtesy of GENERAL MOTORS CORP.

11. Install the center support bearing bolts (1) and tighten to 22 N.m (16 lb ft).
12. Remove the exhaust heat shield. Refer to **Exhaust Muffler Intermediate Heat Shield Replacement** .
13. Remove the support and lower the vehicle.

PROPELLER SHAFT SLIP YOKE BOOT REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

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2. Remove the propeller shaft. Refer to **Two-Piece Propeller Shaft Replacement**.

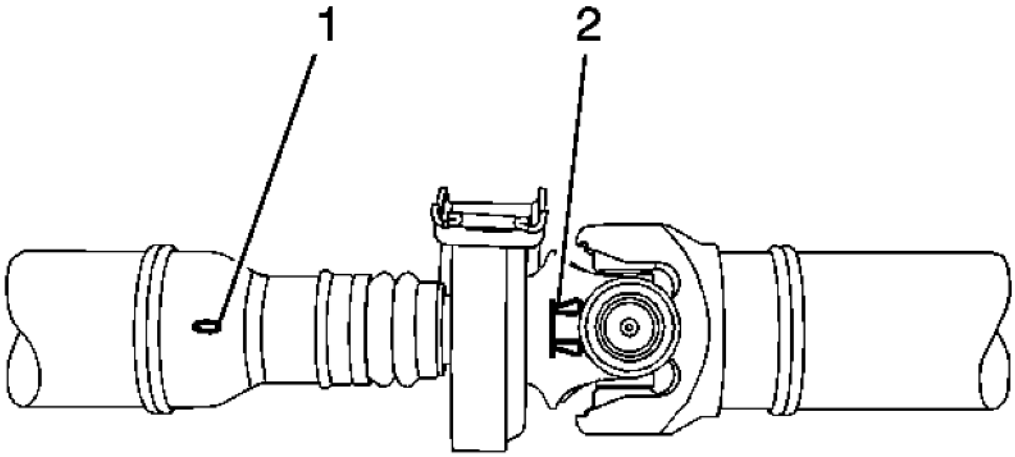


Fig. 15: Mark In Notch In Front Propeller Shaft & V On Slip Yoke
Courtesy of GENERAL MOTORS CORP.

NOTE: Mark the front propeller shaft to the slip yoke prior to removal of the boot. Failure to do so could cause the propeller shaft to be out of balance.

3. Match the mark in the notch (1) in the front propeller shaft with the V (2) on the slip yoke.

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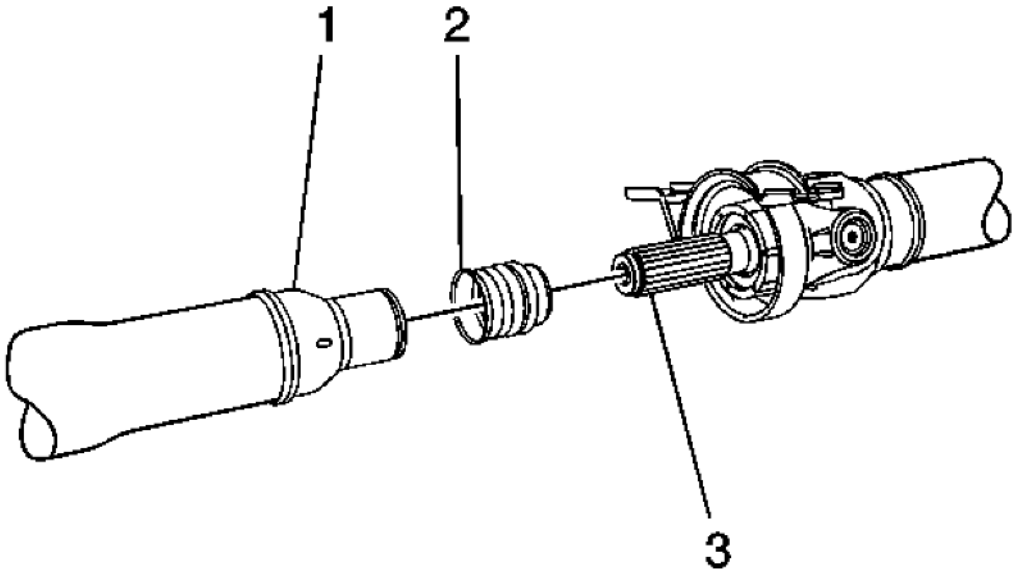


Fig. 16: Propeller Shaft & Boot
Courtesy of GENERAL MOTORS CORP.

4. Remove the propeller shaft boot (2) from the propeller shaft (1).

Installation Procedure

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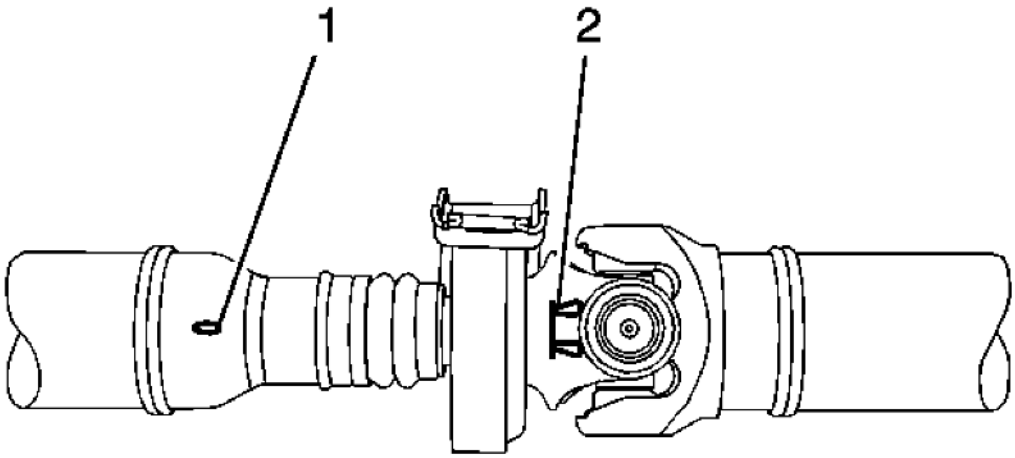
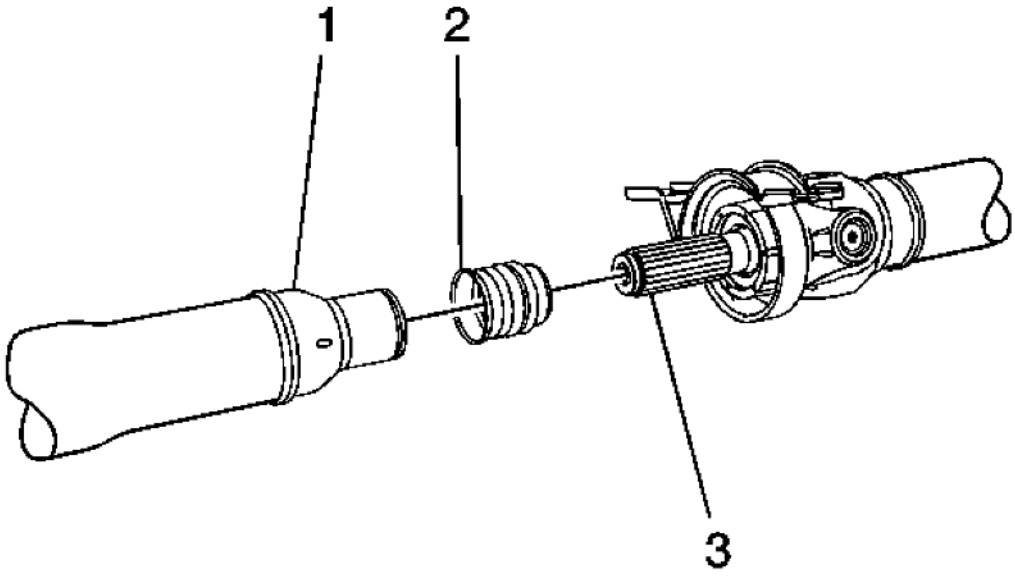


Fig. 17: Mark In Notch In Front Propeller Shaft & V On Slip Yoke
Courtesy of GENERAL MOTORS CORP.

1. Ensure that the marks on the propeller shaft and the slip joint yoke are aligned



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Fig. 18: Propeller Shaft & Boot
Courtesy of GENERAL MOTORS CORP.

NOTE: When installing the boot on the propeller shaft or the slip joint, snap or click should be heard or felt.

2. Install the boot (2) on the propeller shaft (1).
3. Install the boot (2) on the slip joint (3).
4. Install the propeller shaft. Refer to **Two-Piece Propeller Shaft Replacement**.
5. Remove the support and lower the vehicle.

DESCRIPTION AND OPERATION

PROPELLER SHAFT DESCRIPTION AND OPERATION

The propeller shaft is a two piece tube supported by a sealed for life centre bearing and non-servicable universal joint. It has a rubber coupling at each end joining the propeller shaft to the transmission and the differential. All propeller shafts are fixed to the rubber couplings by 3 bolts and 3 torque prevailing nuts which are discarded when removed. Torque prevailing nuts have a low friction coating to ensure no damage to the coupling when assembled, correct nuts must be used. The rubber couplings are then mounted to the differential with 3 bolts and the transmission with 3 bolts and 3 torque prevailing nuts which are also discarded when removed. The centre bearing assembly is fixed to the body with 2 bolts. The two-piece propeller shaft is used to transmit power from the transmission to the differential. The centre bearing and rubber couplings are used to support and connect the propeller shaft and decrease vibration, noise and harshness.

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2010 DRIVELINE/AXLE

Rear Drive Axle - Camaro

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Differential Case Bolts	74 N.m	55 lb ft
Differential Housing Cover Bolts	55 N.m	41 lb ft
Differential Front Support Mounting Nuts	80 N.m	59 lb ft
Differential Ring Gear Bolts	120 N.m	89 lb ft
Differential Rear Support Mounting Nuts	80 N.m	59 lb ft
Differential Side Bearing Cap Bolts	63 N.m	46 lb ft
Drain Plug	33 N.m	24 lb ft
Fill Plug	33 N.m	24 lb ft
Pinion Nut (Rotational Torque)		
• 195 mm Differential Assembly	2.05-2.06 N.m	18-23 lb ft
• 218 mm Differential Assembly	2.05-3.09 N.m	18-27 lb ft

LUBRICATION SPECIFICATIONS

Application	Quantity	
	Metric	English
Synthetic Differential Lubricant GL-5 75W90 G/M P/N 89021677 (Canadian P/N 89021678)		
NOTE: **The following is for vehicles equipped with the Limited Slip Differential option. The Limited Slip Additive container capacity is greater than the amount needed. Only add the amount specified, 0.075 L (2.6 oz.).** Limited Slip Differential Lubricant Additive. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.For vehicles equipped the Limited Slip Differential	1.0 L	1.1 Qt
For vehicles not equipped with the Limited Slip Differential	0.9 L	1.0 Qt

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		US	Canada
Rear Differential	Limited Slip Additive	1052358	992694

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Rear Differential Lubricant	75W90 Axle Lubricant (Synthetic)	89021677	89021678

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - LOCKING/LIMITED SLIP REAR AXLE

Review the system and operation in order to familiarize yourself with the system functions. Refer to Locking Differential Description and Operations.

Visual/Physical Inspection

1. Inspect the system for the following:
   - Loose or missing fasteners
   - Obvious damage or conditions which may cause the symptom.
2. Check the system for proper operation. Refer to Locking Differential Diagnosis.

Symptom List

Refer to a system diagnostic procedure from the following list in order to diagnose the symptom:

- Locking Rear Axle Does Not Lock
- Locking Rear Axle Locks in Turns
- Locking Rear Axle Chatters in Turns
- Noise in Addition to Normal Clutch Engagement

SYMPTOMS - REAR DRIVE AXLE

Review the system and operation in order to familiarize yourself with the system functions. Refer to **Rear Drive Axle Description and Operation**.

Rear Axle Noise

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

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

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

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Driveline noises may confuse even the best technician. Vehicle noises coming from tires, transmission, propeller shaft, universal joints, and front or rear wheel bearings are often mistaken for axle noise.

Visual/Physical Inspection

- Inspect the system for loose or missing fasteners.
- Inspect the system for leaking components.
- Inspect the system for obvious damage or conditions which may cause the symptom.

Symptom List

Refer to a system diagnostic procedure from the following list in order to diagnose the symptom:

- Rear Drive Axle Noises
- Noisy in Drive
- Noisy When Coasting
- Intermittent Noise
- Constant Noise
- Noisy on Turns

REAR DRIVE AXLE NOISES

Gear Noise

Gear noise or whine is audible from 32-89 km/h (20-55 mph) under 4 driving conditions:

- Drive- Acceleration or heavy pull
- Road Load-Vehicle driving load or constant speed
- Float-Using enough throttle to keep the vehicle from driving the engine, the vehicle slows down gradually but the engine still pulls slightly
- Coast-Throttle is closed and the vehicle is in gear

Gear noise most frequently has periods where the noise is more prominent, usually between 48-64 km/h (30-40 mph) and 80-85 km/h (50-53 mph). Gear whine is corrected by either ring and pinion gear replacement or adjustment, depending on the mileage of the gearset.

Bearing Noise

Faulty bearings produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise/hum will pulsate at a constant vehicle speed. This indicates a bad pinion or a bad rear axle side bearing. This noise can be confused with rear wheel bearing noise. Inspect and replace the bearings and the affected components as required.

Rear Wheel Bearing Noise

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A rough rear wheel bearing produces a noise which continues with the car coasting at low speed and the transmission in neutral. The noise may diminish some when the brakes are gently applied. The noise may also change when performing side-to-side maneuvers with the vehicle.

A rough/noisy rear wheel bearing can be heard by spinning the rear wheels by hand and listening at the hubs for the noise. Inspect and replace the bearings and the affected components as needed.

Knock at Low Speeds

A low speed knock can be caused by a differential case side gear bore that has worn oversize. Inspect the side gears and differential case and replace the components as necessary.

Backlash Clunk

Excessive backlash clunk under acceleration or deacceleration can be caused by any of the following:

- Worn differential pinion shaft
- Worn differential pinion and/or side gear teeth
- Worn thrust washers
- Excessive clearance between the side gears and the axle shafts
- Excessive clearance between differential side gears and the bore in the case
- Excessive drive pinon and ring gear backlash

Inspect, adjust or replace the affected components as necessary.

NOISY IN DRIVE

Cause	Correction
DEFINITION: A noise heard during acceleration load. Inspect for the proper gear oil levels prior to performing system diagnosis. Refer to Rear Axle Lubricant Level Inspection.	
Worn clutch disc and/or pressure plate assembly, if equipped	Repair or replace as required. Refer to Clutch Noisy.
Transmission noise	Repair or replace as required.
Worn axle shaft constant velocity joints	Replace the constant velocity joints as required.
Worn, loose, or damaged axle mount and/or bracket	Repair or replace the axle mount and/or bracket as required.
Wrong or poor grade oil	Drain and fill the system with the proper lubricant. Refer to Differential Oil Replacement.
Loose propeller shaft mounting bolts	Tighten the bolts as required. Refer to Fastener Tightening Specifications.
Worn propeller shaft constant velocity joint or coupler, if applicable.	Replace the propeller shaft assembly. Refer to Propeller Shaft Replacement. A worn propeller shaft constant velocity joint or coupler may create a

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	clicking, grinding, or snapping type noise.
Worn or loose center bearing assembly, if applicable	Replace the center bearing assembly as required. A worn center bearing may cause vehicle vibration or a grinding, squealing type of noise. Refer to Propeller Shaft Replacement.
Worn pinion bearings	Replace the pinion bearings. Refer to Differential Drive Pinion Gear Bearing Replacement.
Loose pinion bearings	Adjust the pinion bearings preload. Refer to Pinion Depth Adjustment.
Excessive pinion end play	Adjust the pinion end play. Refer to Pinion Depth Adjustment.
Worn differential bearings	Replace the differential bearings. Refer to Differential Bearing Replacement.
Loose differential bearings	Adjust the differential bearing preload. Refer to Differential Carrier Bearing Preload Adjustment.
Excessive ring gear runout	Replace the pinion and the ring gear set. Refer to Drive Pinion and Ring Gear Replacement.

NOISY WHEN COASTING

Checks	Action
DEFINITION: Noise is audible when slowing down and disappears when driving. Inspect for proper gear oil levels prior to performing system diagnosis.	
Loose propeller shaft mounting bolts	Tighten the bolts as required.
Worn Propeller shaft constant velocity joint, if applicable	Replace the propeller shaft assembly. A worn propeller shaft constant velocity joint may create a clicking, grinding, or snapping type of noise.
Worn or loose center bearing assembly, if applicable	Replace as required. A worn center bearing assembly may cause vehicle vibration or a grinding or squealing type of noise.
Worn universal joints, if applicable	Replace as required. A worn universal joint may create a clicking or a snapping type of noise.
Worn axle shaft constant velocity joints, if applicable	Replace or repair the constant velocity joints as required. A worn axle shaft constant velocity joint may create a clicking, grinding, or snapping type of noise.
Transfer Case or PTU noise	Refer to Transfer Case or PTU Diagnosis.
Worn or damaged axle mounting bushings, if applicable	Check the bushing position and replace the bushings as required. A worn bushing may create a clunk type of noise during acceleration or deceleration or wrong orientation.
Loose mounting bracket, if applicable	Tighten the bracket bolts as required.
Loose or damaged shield, if applicable	Repair or replace as required. A loose shield may contact the propeller shaft assembly and create a scraping or grinding type of noise.
Bearing noise within axle	Repair or replace as required.

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assembly	A grinding or roar type of noise will increase or decrease relative to vehicle speed.
Gear set whine noise within axle assembly created by incorrect gear backlash	Adjust the backlash, if applicable. Repair or replace as required. A whine type of noise will increase or decrease relative to vehicle speed.

CONSTANT NOISE

Checks	Action
DEFINITION: A noise heard in the rear axle assembly during all driving conditions. This noise may increase or decrease in volume based on different driving maneuvers and speeds.	
Low gear oil levels	**NOTE:** **Inspect for the proper gear oil levels prior to performing the rest of the system diagnosis. Refer to Rear Axle Lubricant Level Inspection.** Faulty oil seal or other type external leaks may contribute to lower than required fluid levels. Refer to Rear Axle Lubricant Leak Diagnosis.
Worn, loose, or damaged differential mounts or brackets, if applicable.	Repair or replace the differential mounts or brackets, as required.
Flat spot on the pinion or the ring gear teeth	Replace the pinion and ring gear set or differential assembly, as required.
Worn pinion splines, if applicable	Replace the pinion or differential assembly, as required.
Wrong or poor grade oil	Drain and refill the system with the proper lubricant. Refer to Rear Axle Lubricant Replacement.
Bearing noise within the differential assembly	Repair or replace the differential assembly as required. A grinding or roar type noise will increase or decrease relative to the vehicle speed.
Gear set whine noise within the differential assembly	Repair or replace the differential assembly as required. A whine type noise will increase or decrease relative to the vehicle speed, approximately 80-96 km/h (50-60 mph). Typical causes of a gear set whine type noise may include incorrect backlash and/or pinion depth adjustment or worn or scored gear set teeth.
Excessive or incorrect pinion to ring gear backlash	Adjust the pinion to ring gear backlash, if applicable, otherwise repair or replace the differential assembly as required.
Loose pinion bearings	Adjust the pinion bearings preload, if applicable, otherwise repair or replace the differential assembly as required.
Excessive pinion end play	Adjust the pinion end play, if applicable, otherwise repair or replace the differential assembly as required.
Incorrect differential bearing preload	Adjust the differential bearing preload, if applicable, otherwise repair or replace the differential assembly as required.
Worn pinion bearings	Replace the pinion bearings or differential assembly, as required.
Worn differential bearings	Replace the differential bearings or differential assembly, as required.

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Worn pinion and ring gear	Replace the pinion and ring gear set or differential assembly, as required.
Excessive ring gear runout	Replace the pinion and ring gear set or differential assembly, as required.
Worn propeller shaft constant velocity or universal joints	Replace the universal joints or propeller shaft assembly, as required.
Bent axle housing, if applicable	Replace the axle housing. Refer to Rear Axle Housing Replacement.
Worn axle shaft dowel holes, if applicable	Replace the axle shaft.
Worn wheel hub studs	Replace the wheel studs, as required. Refer to Wheel Stud Replacement.
Bent axle shaft, if applicable	Replace the axle shaft, as required.
Worn bearing in the torque tube assembly, if applicable	Replace the torque tube assembly.

NOISY ON TURNS

Checks	Action
DEFINITION: A noise is present only when the vehicle turns. **NOTE:** • **Inspect for the proper gear oil levels prior to performing system diagnosis. Refer to Rear Axle Lubricant Level Inspection.** • **Operate the vehicle turning in tight circles in both left and right directions. A moan, groan, chatter, or a pulsing type concern may indicate an incorrect type gear oil, lack of the friction modifier additive, pump problems, or worn friction discs and/or plates within the axle assembly.**	
Worn, damaged, or loose axle mount, bushing, or bracket, if applicable	Repair or replace, as required.
Worn, damaged, or loose torque tube bracket or bushing, if applicable	Repair or replace, as required.
Worn axle shaft constant velocity joints, if applicable	Replace the constant velocity joints, as required.
Worn wheel bearings	Replace the wheel bearings, as required.
Worn axle shaft splines	Replace the axle shaft or wheel drive shaft, as required. Refer to Rear Axle Shaft Replacement or Rear Wheel Drive Shaft Replacement.
Worn clutch plates, if applicable	Replace the friction discs/plates and drum, as required.
Worn differential side gears, pinion gears, thrust washers and/or pinion shaft, if applicable	Replace gears, washers, and/or shaft, as required.
Incorrect gear oil. Installation of the incorrect type	Replace with correct gear oil, and friction modifier additive, if

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gear oil may create a "moan" type noise within 7 770-25 900 km (3-10,000 miles). Fluid that is "black" in color is to be considered normal and is darkened by the carbon material in the clutch plates, if applicable.	applicable. Adding friction modifier to the existing fluid without draining will not correct this condition. Refer to Sealers, Adhesives, and Lubricants and Rear Axle Lubricant Replacement. Fluid replacement may not correct a "moan" condition caused by the use of incorrect oil. Refer to Differential Overhaul or Differential Replacement.

REAR AXLE LUBRICANT LEAK DIAGNOSIS

Rear axle lubricant leaks can occur at the following locations:

- Axle tube to differential carrier housing joint
- Axle shaft oil seal
- Axle housing porosity
- Differential housing cover gasket
- Drain plug
- Fill plug
- Pinion yoke oil seal
- Vent tube

Determining the Cause

While most rear axle leaks may be easy to find, determining the cause may not be. A thorough inspection of the area around the leak may assist in determining the cause of the leak.

Oil Seals

Lubricant leaks from a oil seal may be caused by any of the following:

- An improperly installed seal
- A distorted seal
- A worn seal
- A worn shaft
- A brittle seal lip
- A hardened seal lip

To determine the actual cause of the leak, clean the area around the leak. Observe the area of the leak and determine the if the seal or another component is causing the leak. A worn seal surface will cause a leak at the sealing lip while a misaligned seal or a seal installed into a housing with an excessive bore will cause the seal to leak at the outside surface of the seal. Hardened or cracked seal lips usually indicate the axle is operating beyond the normal temperature limits for the axle. A seal whose sealing surface has been nicked or cut may indicate that the shaft has a rough, burred, or gouged surface and will need to be inspected before the seal can be replaced.

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Gaskets

A leak at a gasket is usually caused by a poor fit of the components on each side of the gasket surface. Inspect each component for distortion and for nicks or gouges that may prohibit the gasket from sealing properly.

Rear Axle Housing

Rear axle housing lubricant leaks usually occur at the following locations:

- Drain Plug
- Fill Plug

Drain and fill plug leaks are usually caused by a loose plug. These leaks can by repaired by either tightening the plug or by using an approved sealer on the threads on the plug.

Other leaks such as axle tube to differential carrier housing or porosity leaks require the replacement of the rear axle housing.

REPAIR INSTRUCTIONS

REAR AXLE LUBRICANT LEVEL INSPECTION

Inspection Procedure

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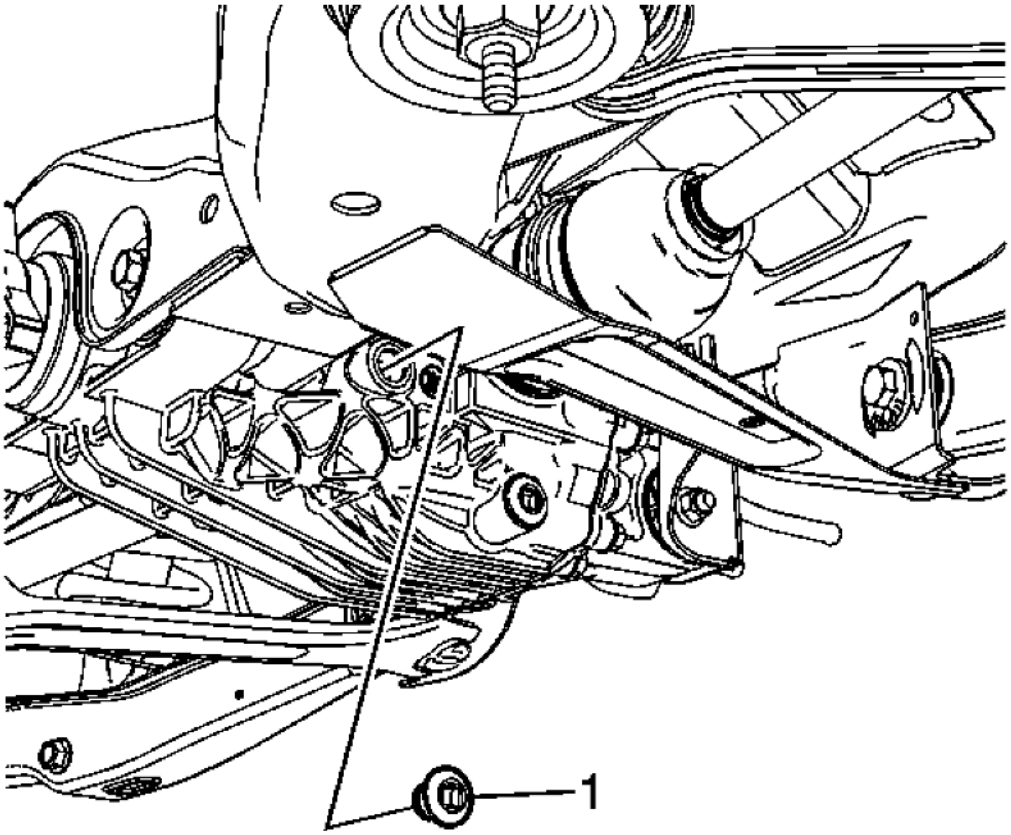


Fig. 1: Differential Fill Plug
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Clean any dirt from around the differential fill plug (1).
3. Remove the fill plug (1) from the differential.
4. Check the differential fluid level, it should be even with the bottom of the fill plug hole to no lower than 6 mm (0.25 in) below the opening.
5. Add new fluid if necessary. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

CAUTION: Refer to Fastener Caution .

6. Install the differential fill plug (1) to the differential and tighten to 33 N.m (24 lb ft).
7. Remove the support and lower the vehicle.

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DIFFERENTIAL OIL REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. **Lifting and Jacking the Vehicle** .

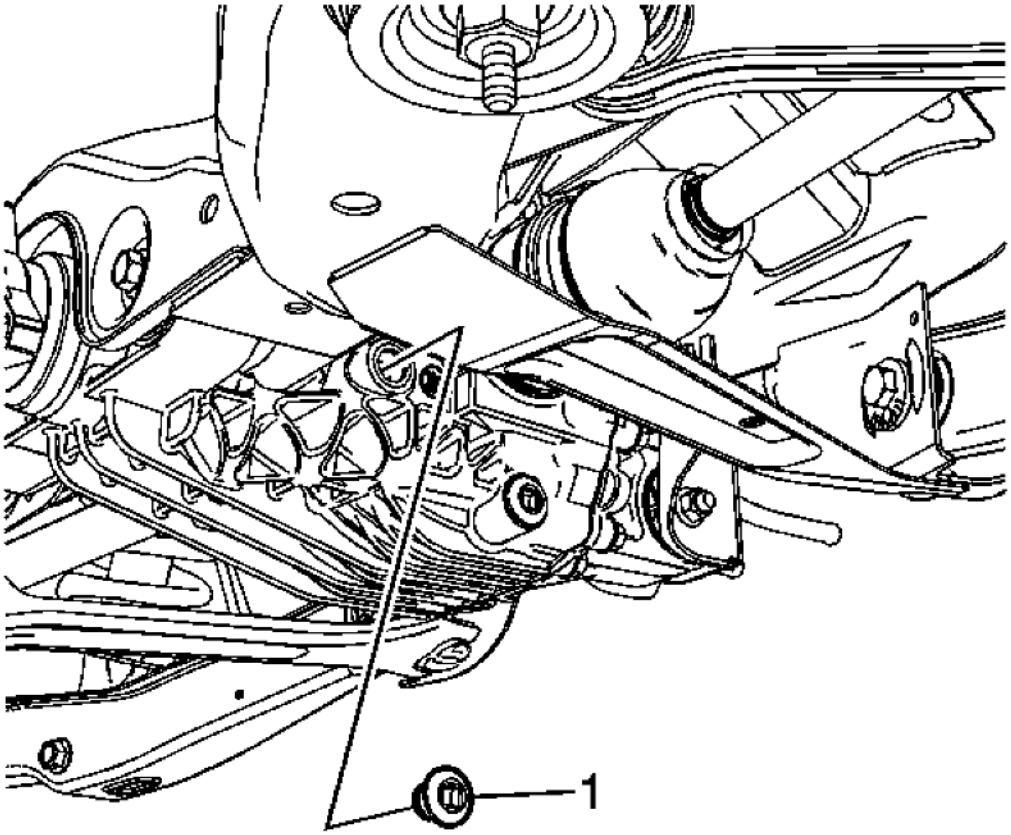


Fig. 2: Differential Fill Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the fill plug (1).

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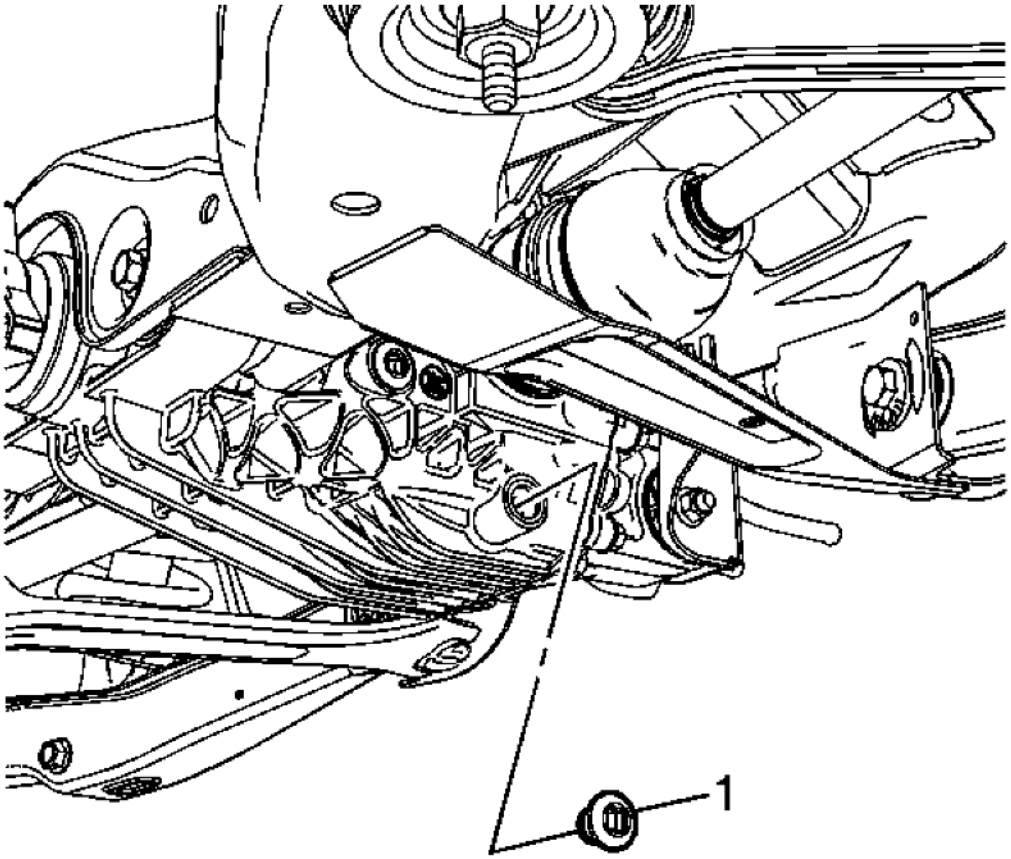


Fig. 3: Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Drain into a suitable container.

3. Remove the drain plug (1).

Installation Procedure

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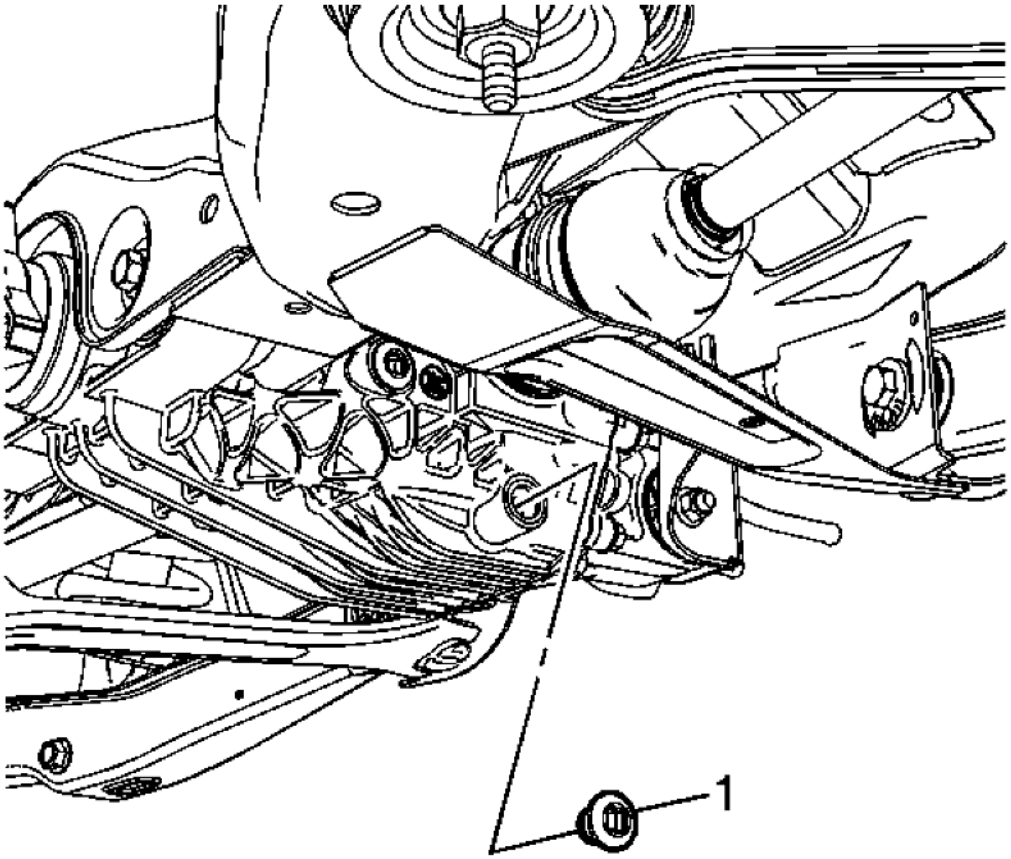


Fig. 4: Drain Plug
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the drain plug (1) and tighten to 33 N.m (24 lb ft).
2. Fill the rear differential with the proper fluid. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

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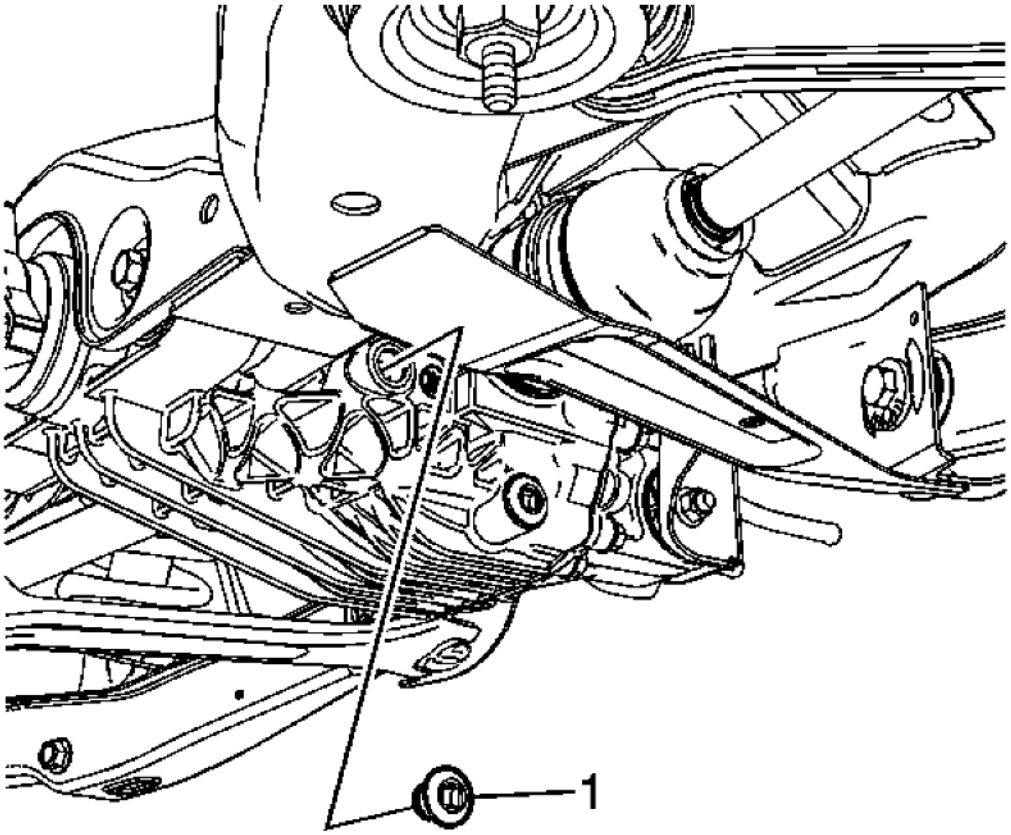


Fig. 5: Differential Fill Plug
Courtesy of GENERAL MOTORS CORP.

3. Install the rear differential fill plug (1) and tighten to 33 N.m (24 lb ft).
4. Remove the support and lower the vehicle.

REAR AXLE HOUSING COVER AND GASKET REPLACEMENT

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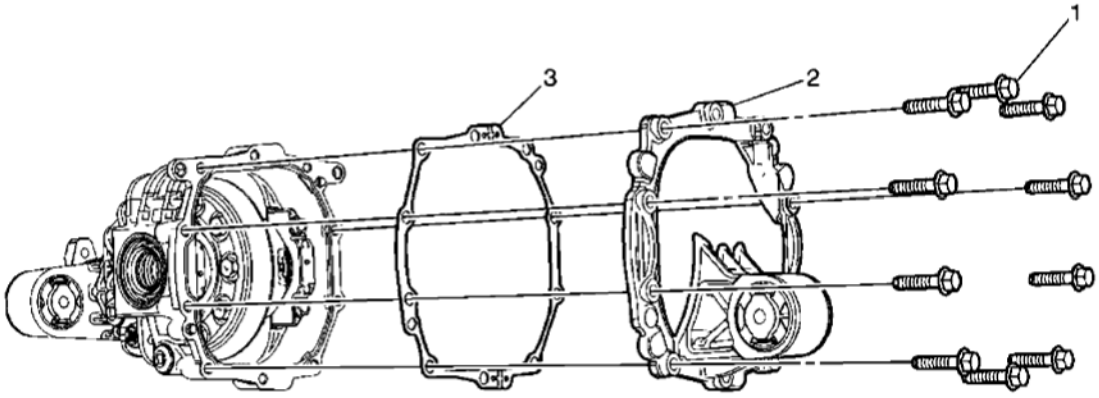


Fig. 6: Rear Axle Housing Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the rear differential assembly. Refer to **Differential Replacement**.	
1	Rear Differential Cover Bolt (Qty: 10) **CAUTION:** **Refer to Fastener Caution .** **Tighten:** 55 N.m (41 lb ft)
2	Rear Differential Cover
3	Rear Differential Gasket

REAR AXLE SHAFT SEAL REPLACEMENT - INNER

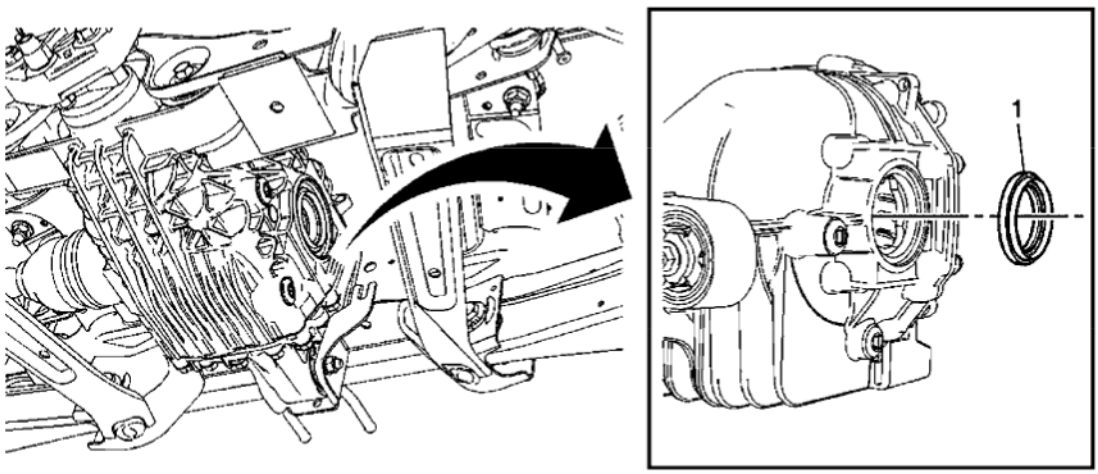


Fig. 7: Rear Axle Shaft Seal - Inner

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Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the rear wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement** .	
1	Rear Axle Shaft Seal **Procedure** • Using the appropriate tool, remove the axle shaft seal. • For the 195 mm differential, use the **J 22388:** installer to install the rear axle shaft seal. • For the 218 mm differential, use the **J 26234-A:** installer to install the rear axle shaft seal. • Check the rear axle fluid level. Refer to **Rear Axle Lubricant Level Inspection**. **Special Tool** • **J 22388:** Pinion Seal Installer • **J 26234-A:** installer

DRIVE PINION FLANGE/YOKE AND/OR OIL SEAL REPLACEMENT

Special Tools

- **J 21128:** Axle Pinion Oil Seal Installer
- **J 38694:** Extension Housing Pump/Seal Installer
- **J 45012:** Holding Fixture
- **J 45019:** Flange and Pinion Cage Remover

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the propeller shaft assembly. Refer to **Two-Piece Propeller Shaft Replacement** .

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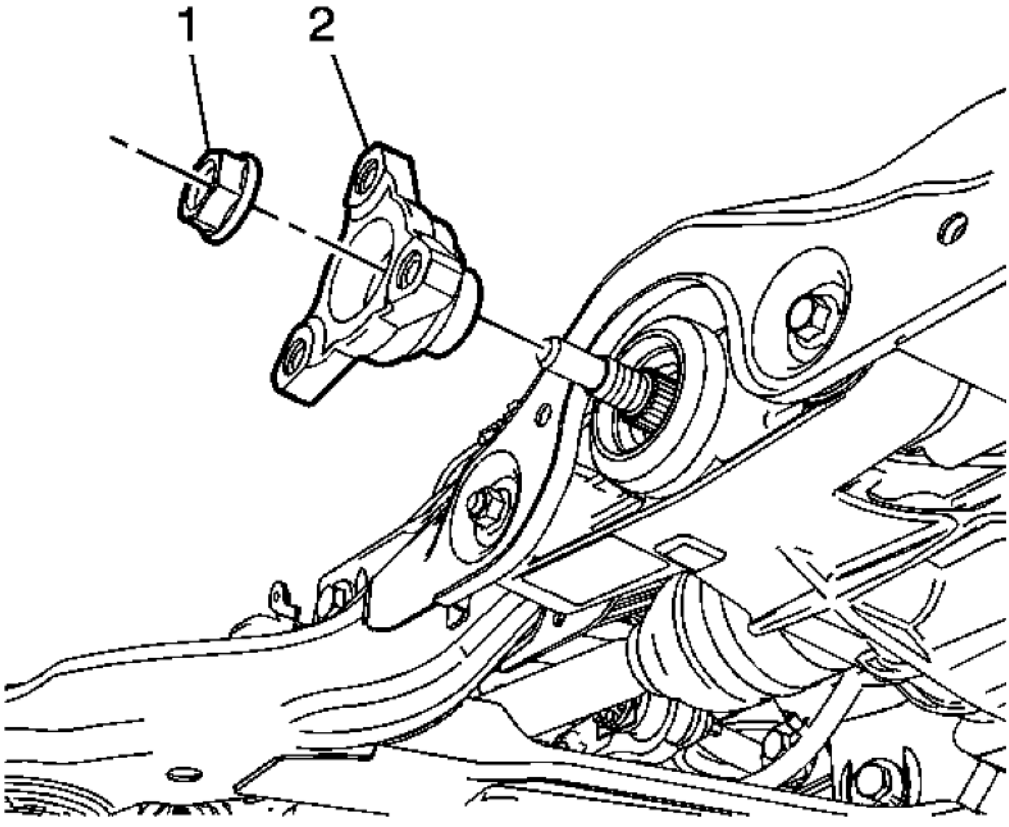


Fig. 8: Drive Pinion Flange & Pinion Nut
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 45012:** fixture, remove and discard the pinion nut (1).
4. Using the **J 45019:** remover, remove the drive pinion flange (2).

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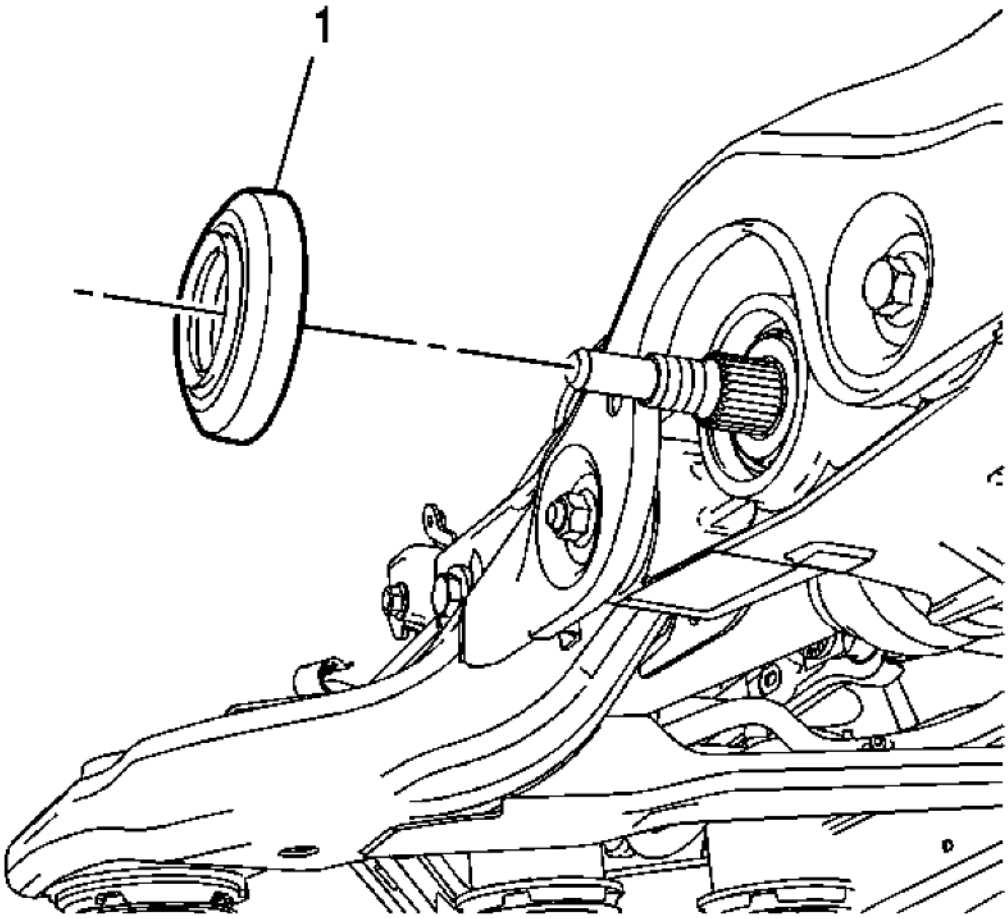


Fig. 9: Drive Pinion Seal
Courtesy of GENERAL MOTORS CORP.

5. Using the appropriate tool, remove the drive pinion seal (1).

Installation Procedure

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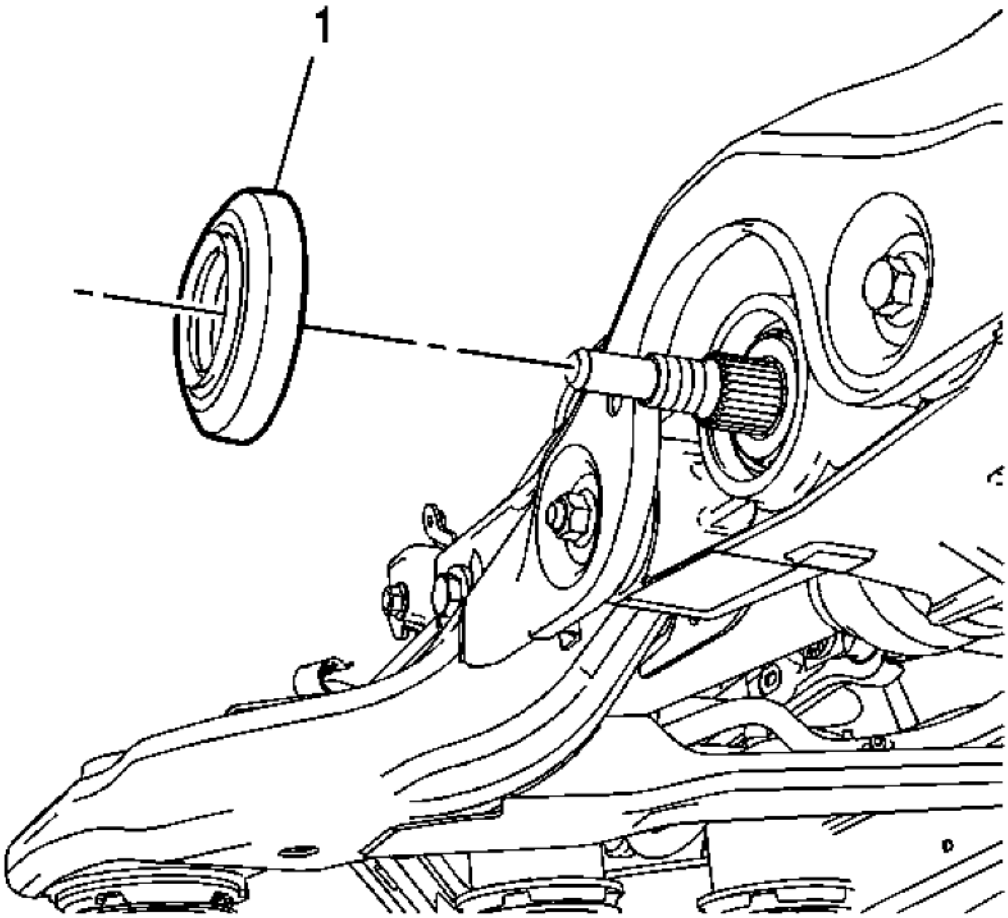


Fig. 10: Drive Pinion Seal
Courtesy of GENERAL MOTORS CORP.

1. Position the drive pinion seal (1) in the differential housing.

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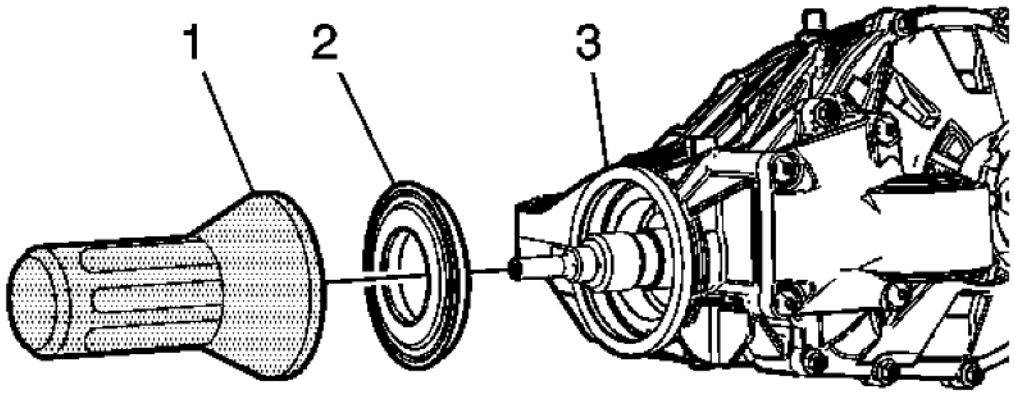


Fig. 11: Installing Pinion Seal
Courtesy of GENERAL MOTORS CORP.

2. Using the appropriate tool (1), install the drive pinion seal (2) in the rear axle housing (3).
   - For the 195 mm rear differential, use the **J 21128:** installer.
   - For the 218 mm rear differential, use the **J 38694:** installer.

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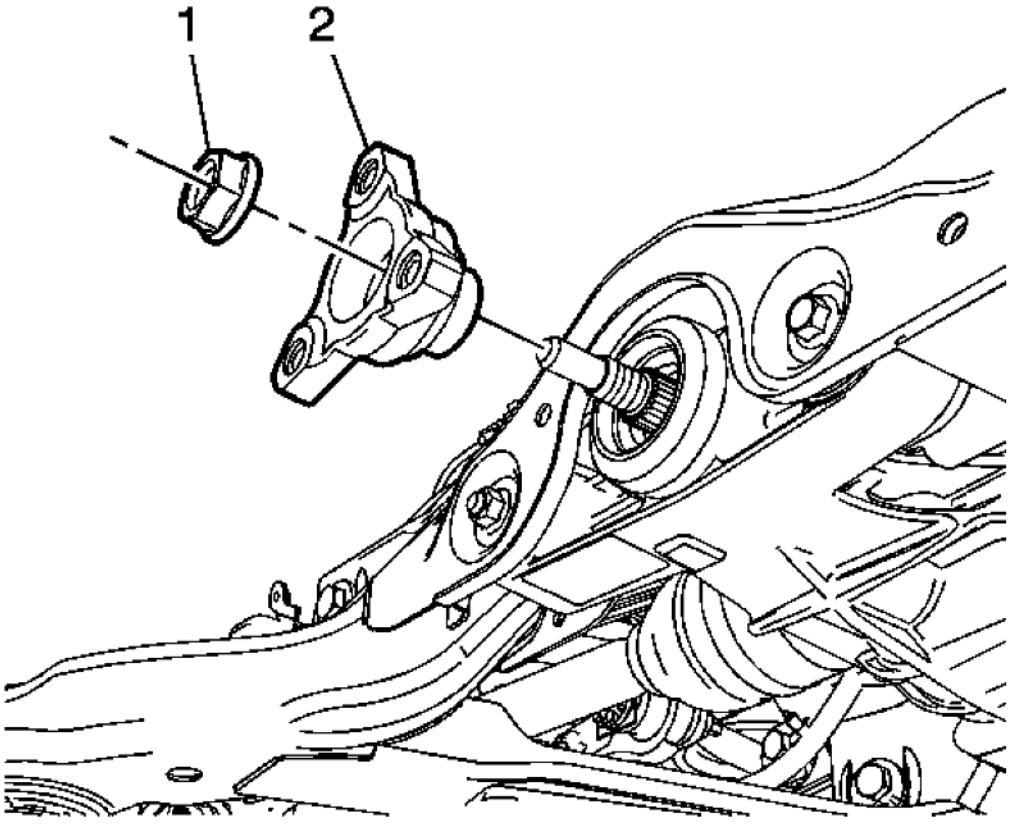


Fig. 12: Drive Pinion Flange & Pinion Nut
Courtesy of GENERAL MOTORS CORP.

3. Position the drive pinion flange (2) on the drive pinion shaft.

NOTE: Install the drive pinion flange on the drive pinon shaft so that there 3 to 4 threads showing.

4. Using a brass hammer, tap the drive flange (2) on the drive pinion shaft.
5. Using the **J 45019:** remover, install the drive flange.
6. Hand start the NEW drive pinon nut (1).

NOTE: Rotate the pinion while tightening the pinion nut to seat the bearings.

7. Using the **J 45012:** fixture, tighten the drive pinion flange nut until the pinion end play is just taken up.
8. Using the torque wrench, tighten the pinon nut in small increments until a rotating torque of 2.05-2.60

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N.m (18-23 in lb) for the 195 mm rear differential or 2.05-3.09 N.m (18-27 in lb) for the 218 mm rear differential.

9. Using a hammer and a punch, stake two sides of the drive pinion nut to the grooves in the drive pinion gear.
10. Check the fluid level of the rear drive axle. Refer to **Rear Axle Lubricant Level Inspection**.
11. Install the propeller shaft assembly. Refer to **Two-Piece Propeller Shaft Replacement**
12. Remove the support and lower the vehicle.

DRIVE PINION AND RING GEAR REPLACEMENT

Disassemble Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the differential assembly from the vehicle. Refer to **Differential Replacement**.
3. Remove the pinion yoke and the seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.

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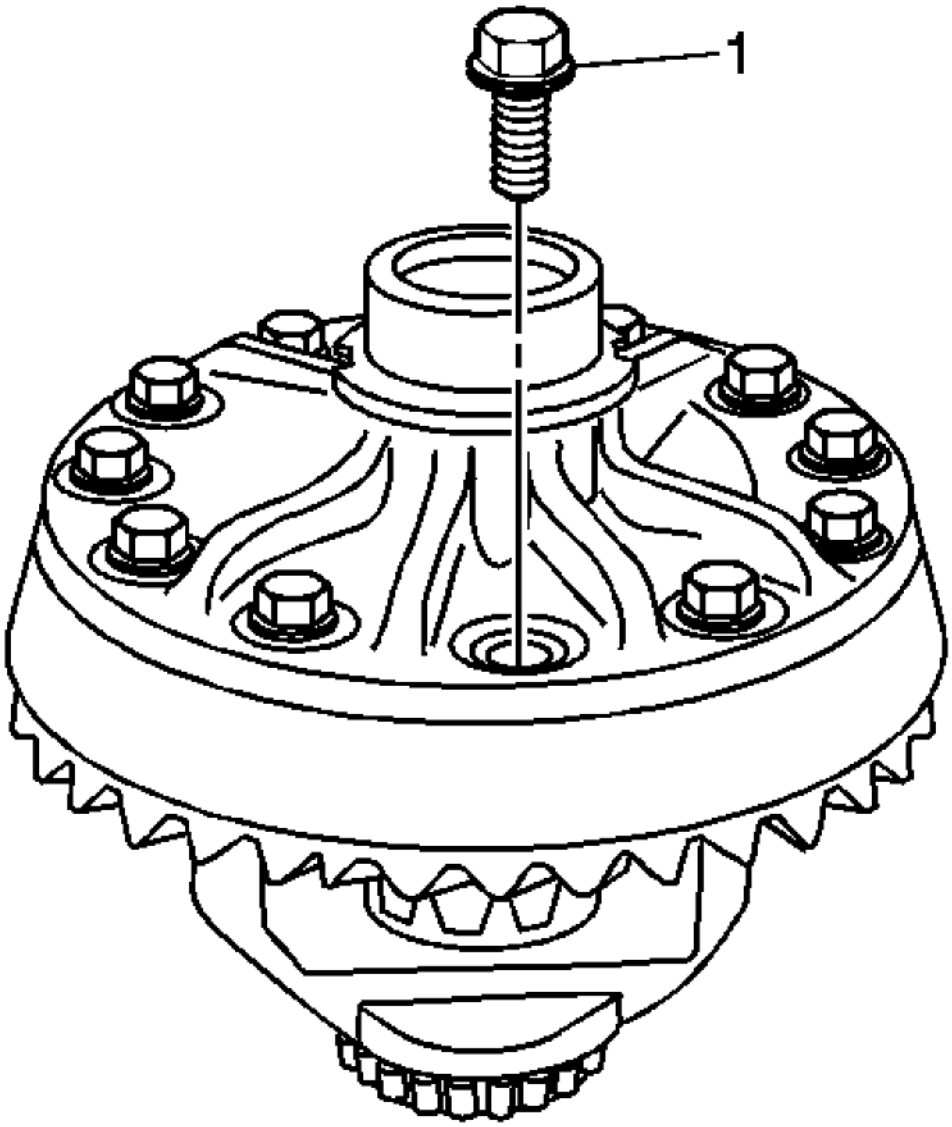


Fig. 13: Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: The ring gear bolts are left handed threads.

4. Remove the ring gear bolts (1) from the differential case (2).

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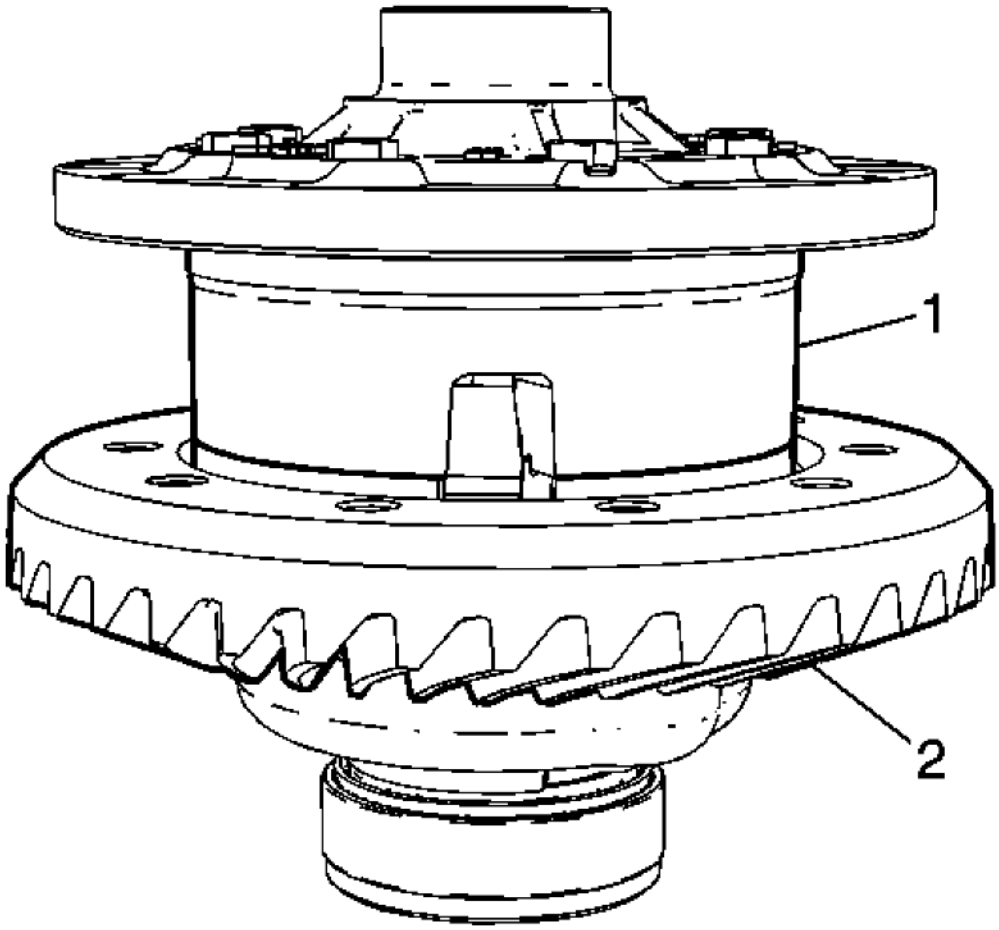


Fig. 14: Ring Gear & Differential Case
Courtesy of GENERAL MOTORS CORP.

5. Using a brass drift and a hammer, remove the ring gear (2) from the differential case (1).

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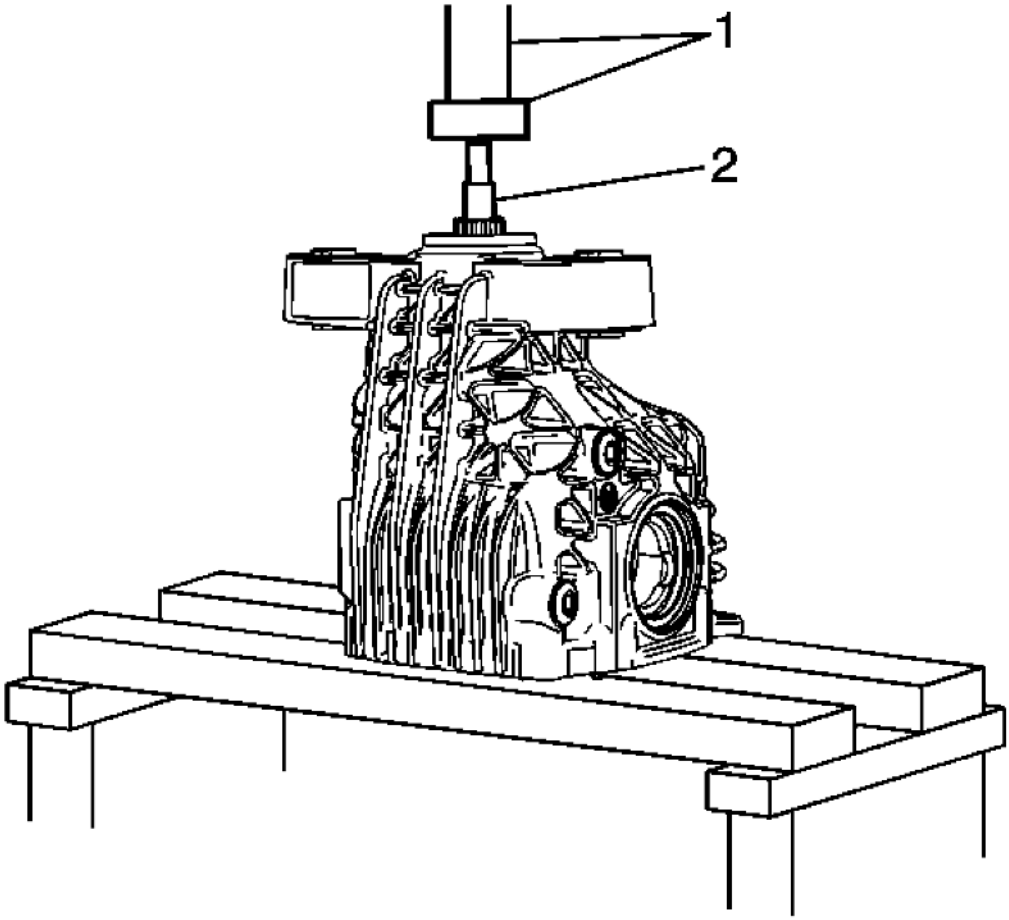


Fig. 15: Removing Pinion Gear
Courtesy of GENERAL MOTORS CORP.

NOTE: Position a piece of wood under the differential housing to protect the pinion gear.

6. Using a hydraulic press and a piece of wood (1), remove the pinion gear (2) from the differential housing.
7. Remove the pinion bearings from the pinion bearings. Refer to **Differential Drive Pinion Gear Bearing Replacement**.

Assemble Procedure

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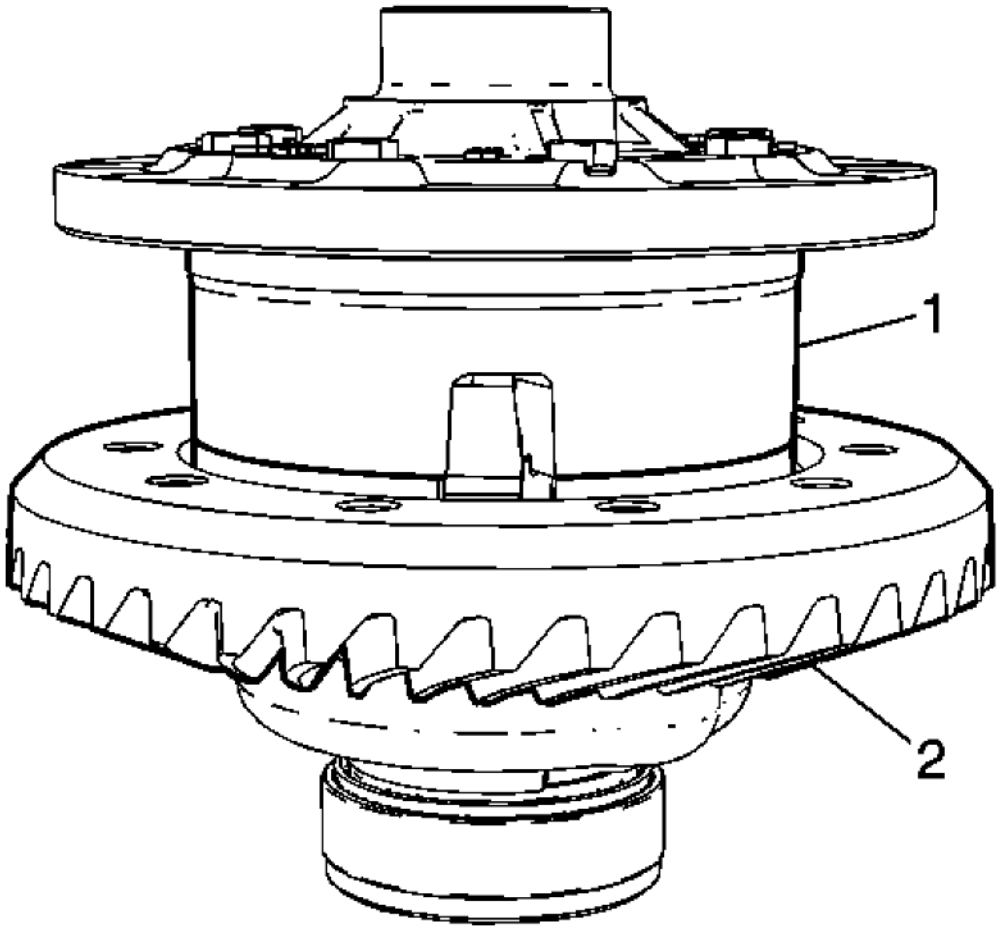


Fig. 16: Ring Gear & Differential Case
Courtesy of GENERAL MOTORS CORP.

1. Install the ring gear (2) on the differential case (1).

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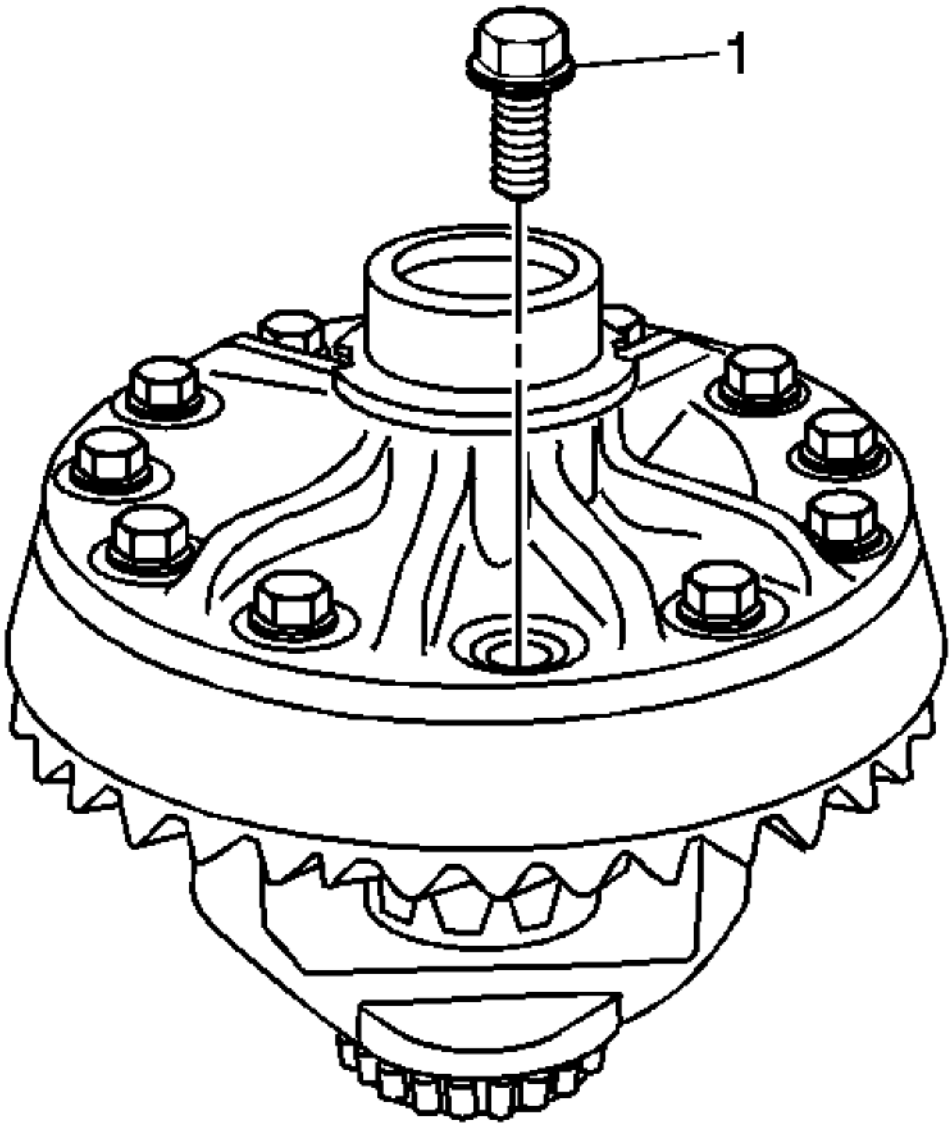


Fig. 17: Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Hand start the ring gear bolts in a criss cross pattern

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2. Install the ring gear bolts (1) and tighten in sequence to 120 N.m (89 lb ft).
3. Determine and install the selective shim for the pinion gear. Refer to **Pinion Depth Adjustment**.
4. Install the drive pinion bearings. Refer to **Differential Drive Pinion Gear Bearing Replacement**.
5. Install the drive pinion flange and the NEW pinion oil seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.
6. Install the rear differential assembly. Refer to **Differential Replacement**.
7. Using the proper axle fluid, fill the rear differential with fluid. Refer to **Differential Oil Replacement**.

DIFFERENTIAL DRIVE PINION GEAR BEARING REPLACEMENT

Special Tools

- **DT 49905:** Inner Pinion Bearing cup Remover
- **DT 49906:** Inner Pinion Bearing Cup Remover
- **J-7817:** Outer Pinion Bearing Race Installer
- **J-8092:** Driver Handle 3/4 in-10
- **J-21128:** Pinion Seal Installer
- **J-22306:** Inner Pinion race Installer
- **J-22912-B:** Split Plate Bearing Puller
- **J-24433:** Inner Pinion Bearing Installer
- **J 29609:** Rear Pinion Bearing Cup Installer
- **J-37758:** Outer Pinion Race Installer
- **J-38694:** Pinion Seal Installer
- **J-39441:** Inner Pinion Bearing Installer
- **J-42176:** Driver Handle (non-Threaded)
- **J-45012:** Holding Fixture
- **J-45019:** Flange and Pinion Cage Remover

For equivalent regional tools, refer to **Special Tools**.

Disassemble Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the differential pinion flange/yoke and/or oil seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.
3. Remove the differential assembly. Refer to **Differential Replacement**.

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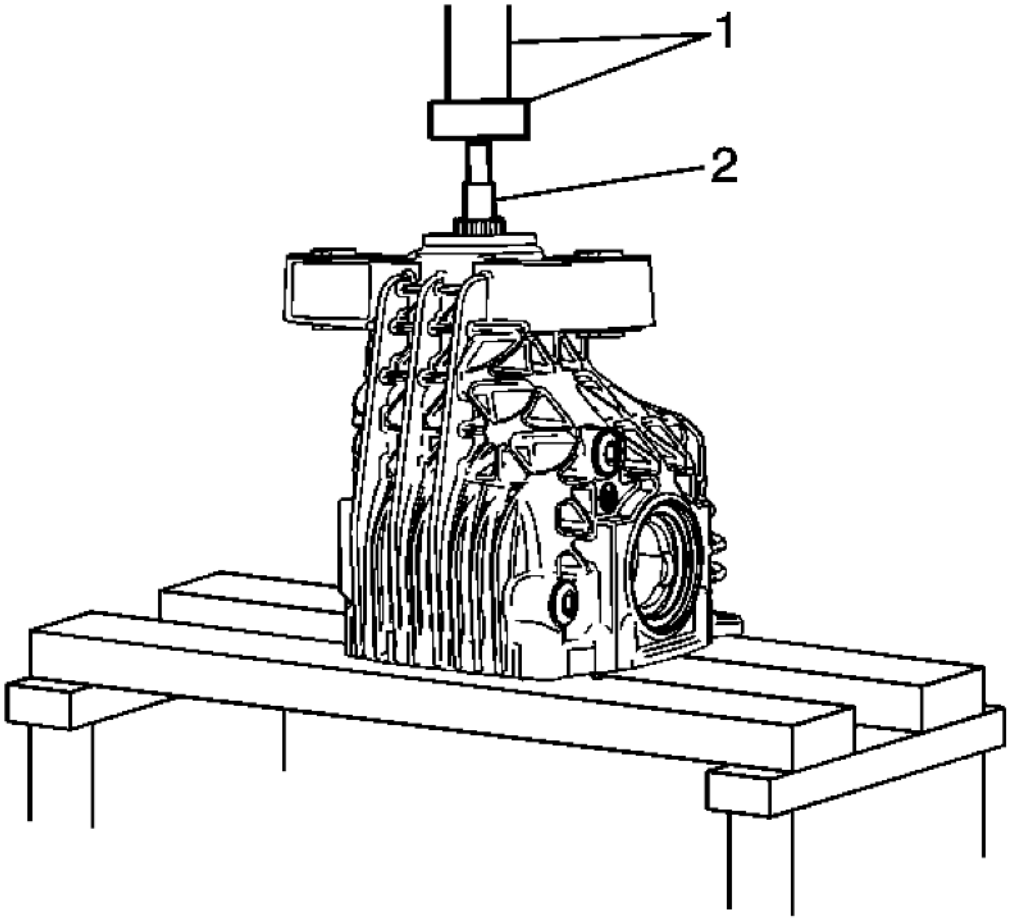


Fig. 18: Removing Pinion Gear
Courtesy of GENERAL MOTORS CORP.

NOTE: Position a block of wood under the differential housing to protect the pinion gear when removed.

4. Using a hydraulic press and a block of wood (1), remove the pinion gear (2).

NOTE: Use the slot on each side of the pinion bearing to position the brass drift to remove the bearing cup. Also, alternate from side to side when removing the bearing.

5. Using a hammer and a brass drift, remove the outer pinon bearing cup from the differential housing.

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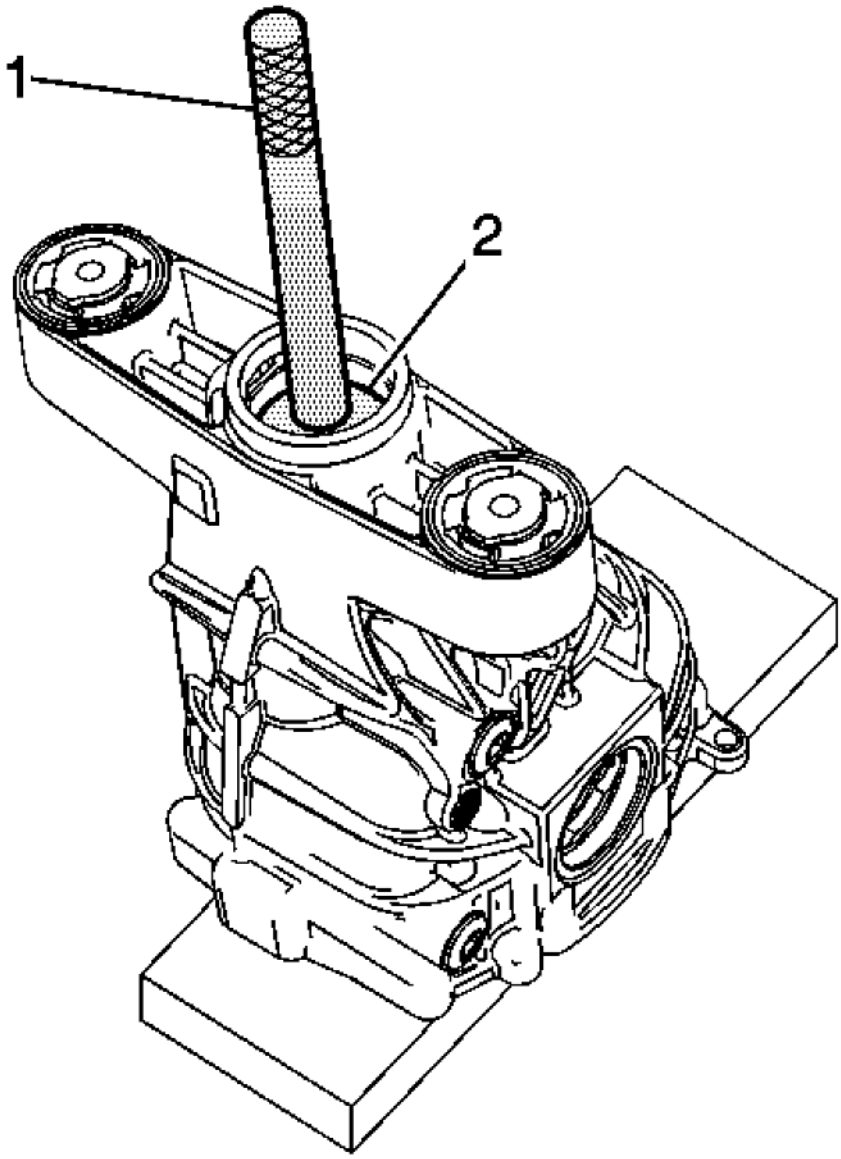


Fig. 19: Removing Inner Pinion Bearing Cup
Courtesy of GENERAL MOTORS CORP.

6. Using the following special tools to remove the inner pinion bearing cup.
   - For the 195 mm axle, use the **DT 49905:** Inner Pinion Bearing cup Remover (2) and the **J-42176:** handle (1).
   - For the 218 mm axle, use the **DT 49906:** Inner Pinion Bearing cup Remover (2) and the **J-42176:**

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handle (1).

Assemble Procedure

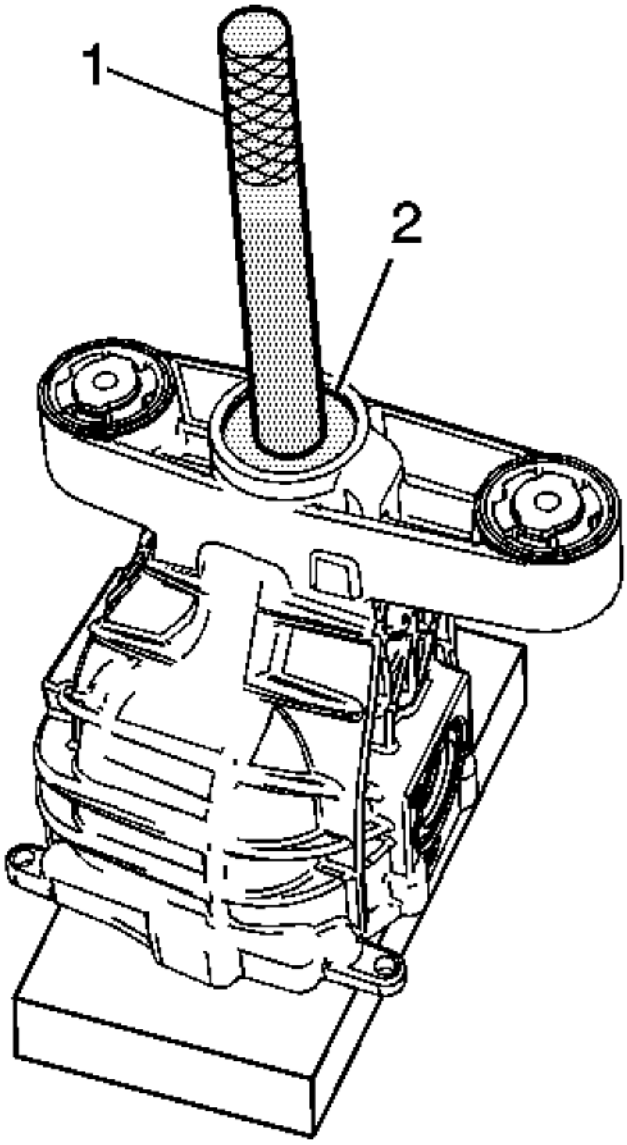


Fig. 20: Installing Outer Pinion Bearing Cup
Courtesy of GENERAL MOTORS CORP.

1. Using the following special tools, install the outer pinion bearing cup.

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- For the 195 mm axle, use the and the **J-7817:** installer (2) and the **J-8092:** handle (1).
- For the 218 mm axle, use the **J-37758:** installer (2) and the **J-8092:** handle

(1).

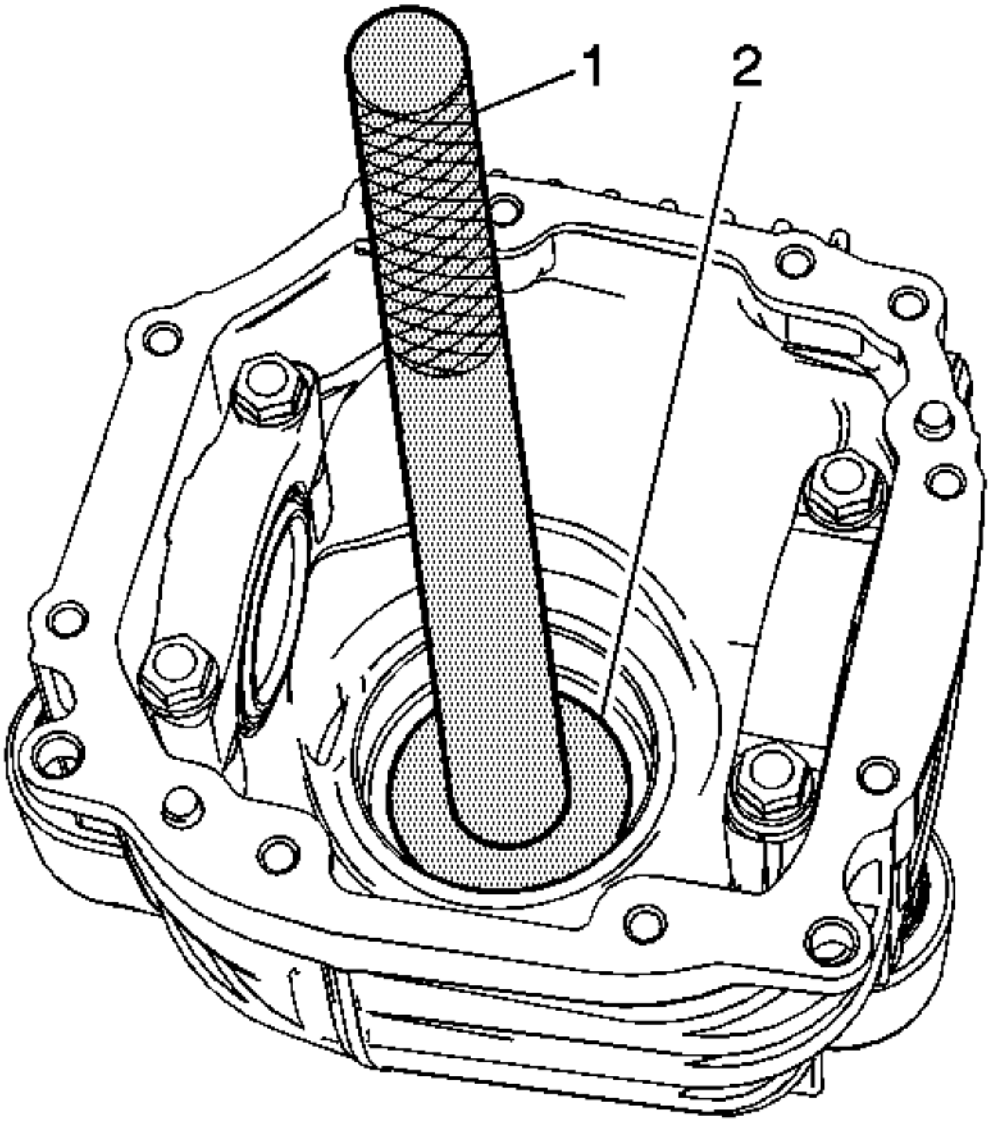


Fig. 21: installing Inner Pinion Bearing Cup
Courtesy of GENERAL MOTORS CORP.

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2. Using the following special tools, install the inner pinion bearing cup.
   - For the 195 mm axle, use the **J 29609:** installer (2) and the **J-8092:** handle (1).
   - For the 218 mm axle, use the **J-22306:** installer (2) and the **J-8092:** handle (1).
3. Determine the selective shim thickness for the pinion bearing. Refer to **Pinion Depth Adjustment**
4. Install the selective shim between the inner pinion bearing and the shoulder on the gear.

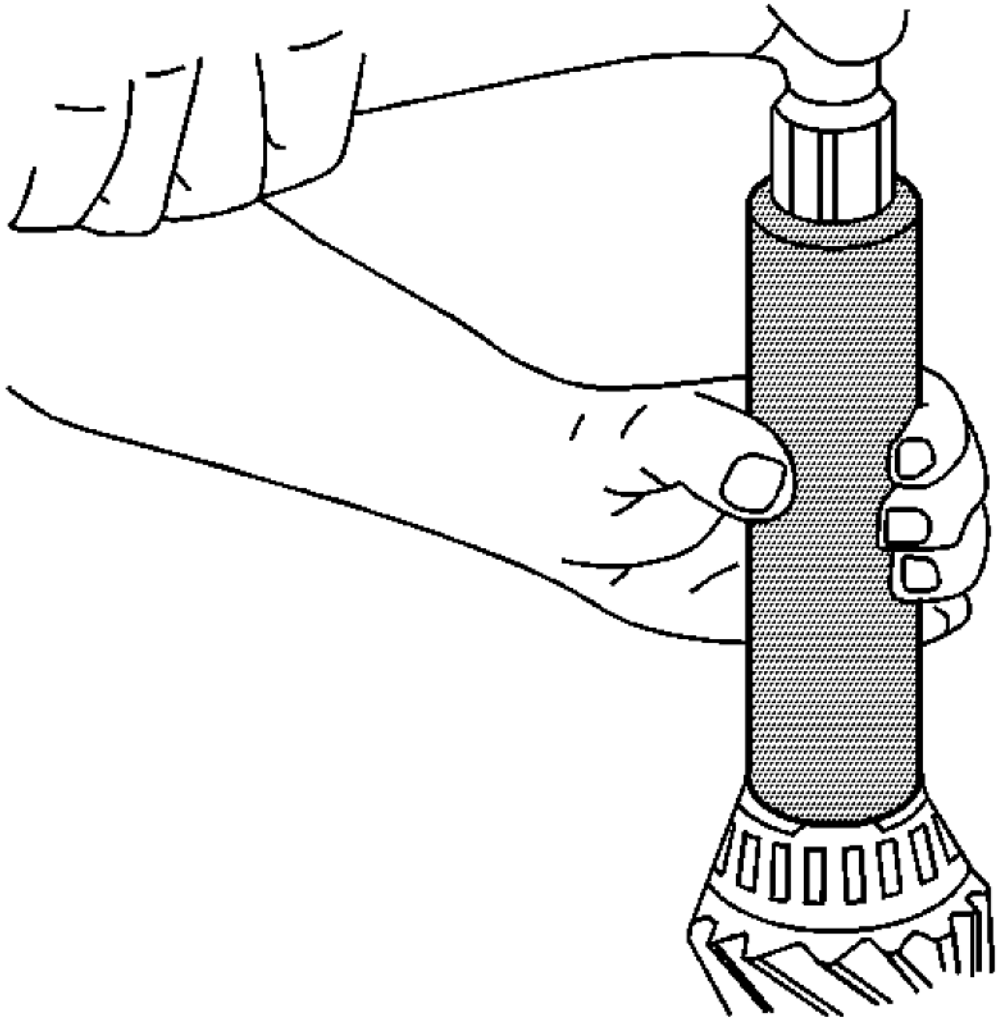


Fig. 22: Installing Inner Pinion Bearing Onto Pinion Gear
Courtesy of GENERAL MOTORS CORP.

NOTE: **Ensure the bearing is fully seated on the pinion gear.**

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5. Using the following special tool to install the inner pinion bearing.
   - For the 195 mm axle, use the **J-39441:** installer
   - For the 218 mm axle, use the **J-24433:** installer
6. Install the NEW collapsible spacer.
7. Use the proper axle lubricant on the pinion bearings, refer to **Adhesives, Fluids, Lubricants, and Sealers**.

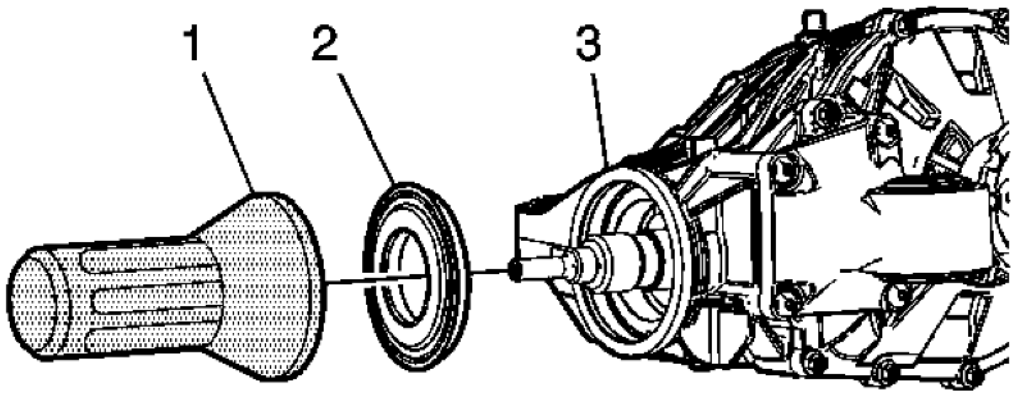


Fig. 23: Installing Pinion Seal
Courtesy of GENERAL MOTORS CORP.

8. Using the following special tool to install the NEW pinion seal (2).
   - For the 195 mm axle, use the **J-21128:** installer (1).
   - For the 218 mm axle, use the **J-38694:** installer (1).
9. Using a soft face hammer, to seat the pinion yoke onto the pinion shaft until a few pinion shaft threads show through the yoke.
10. Install the washer and a new pinion nut.
11. Using the **J-45012:** fixture, tighten the pinion nut until the pinion end play is just taken up.

NOTE: If the rotating torque is exceeded, the pinion will have to be removed and a new collapsible spacer installed.

12. Using an inch pound torque wrench, measure the rotating torque.
    - For the 195 mm axle, the torque should be 2.0-2.6 N.m (18-23 lb in) for NEW bearings or 1.0-2.3 N.m(9-20 lb in) for used bearings.
    - For the 218 mm axle, the torque should be 2.1-3.1 N.m (19-27 lb in) for NEW bearings or 1.0-2.3 N.m(9-20 lb in) for used bearings.

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13. If the rotating torque measurement is below the minimum torque value, continue to tighten the pinion nut in small increments until the torque is within the specifications.
14. Install the differential assembly. Refer to **Differential Replacement**.
15. Fill the axle with lubricant. Use the proper fluid. Refer to **Differential Oil Replacement**.
16. Lower the vehicle.

DIFFERENTIAL REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Drain the rear differential assembly. Refer to **Differential Oil Replacement**.
3. Remove the propeller shaft from the vehicle. Refer to **Two-Piece Propeller Shaft Replacement** .
4. Remove the wheel drive shafts from the vehicle. Refer to **Rear Wheel Drive Shaft Replacement** .
5. Support the rear drive axle assembly with a hydraulic jack stand.
6. Remove the vent tube from the rear axle housing.

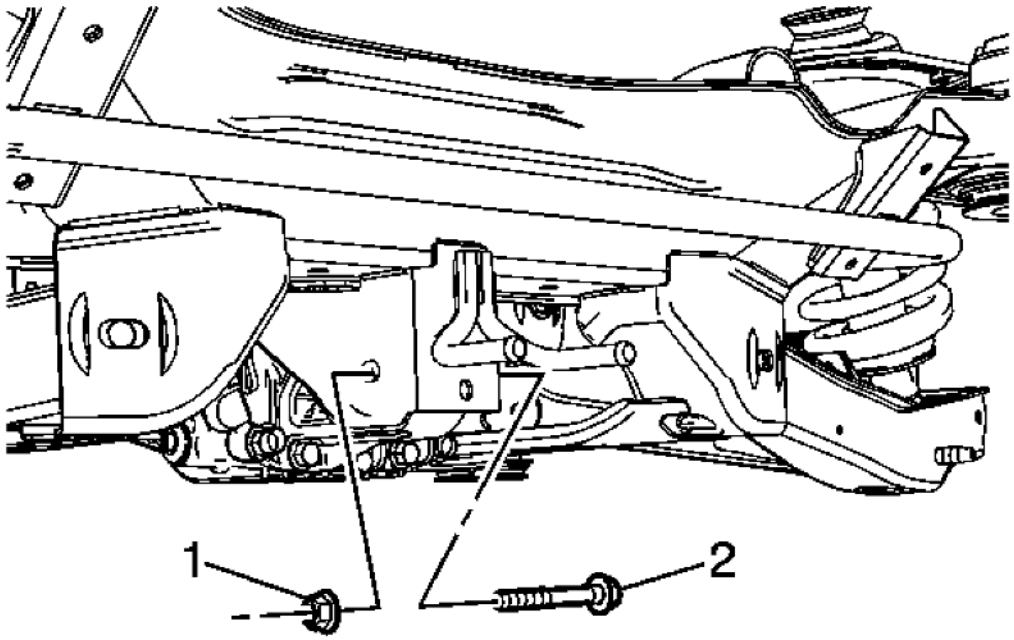


Fig. 24: Rear Differential Mount Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

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7. Remove the rear differential mount nut (1) and bolt (2).

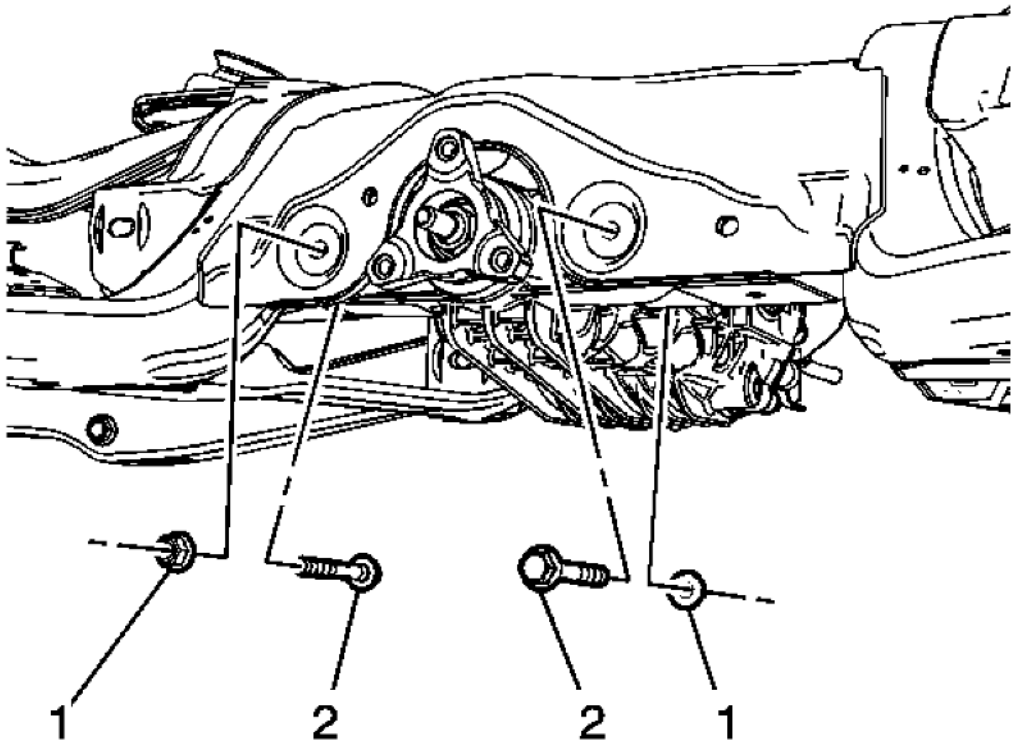


Fig. 25: Front Differential Mounting Nuts & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Remove the front differential mounting nuts (1) and bolts (2).

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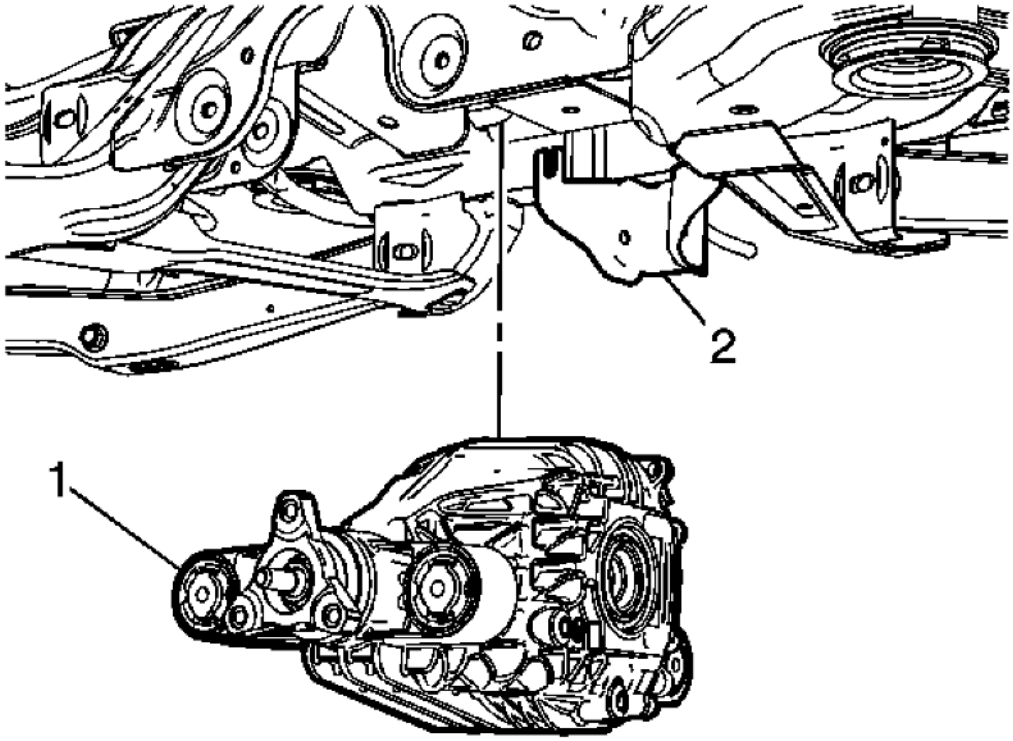


Fig. 26: Rear Differential Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the rear differential assembly (1) from the vehicle

Installation Procedure

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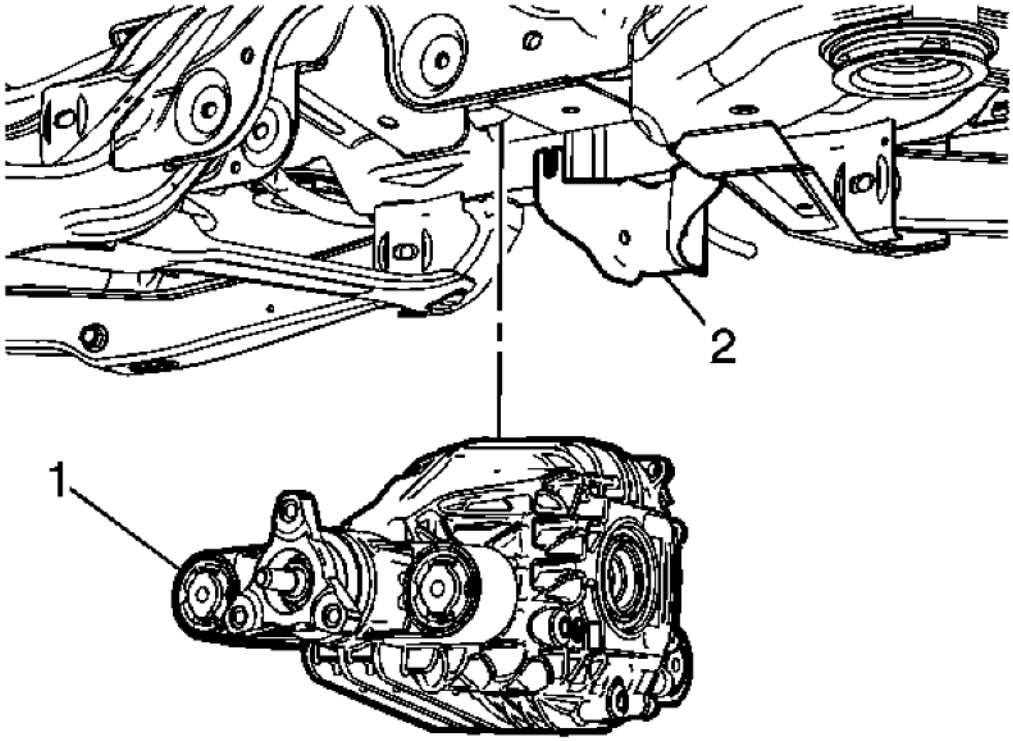


Fig. 27: Rear Differential Assembly
Courtesy of GENERAL MOTORS CORP.

1. Position the rear differential assembly (1) in the rear suspension carrier (2).

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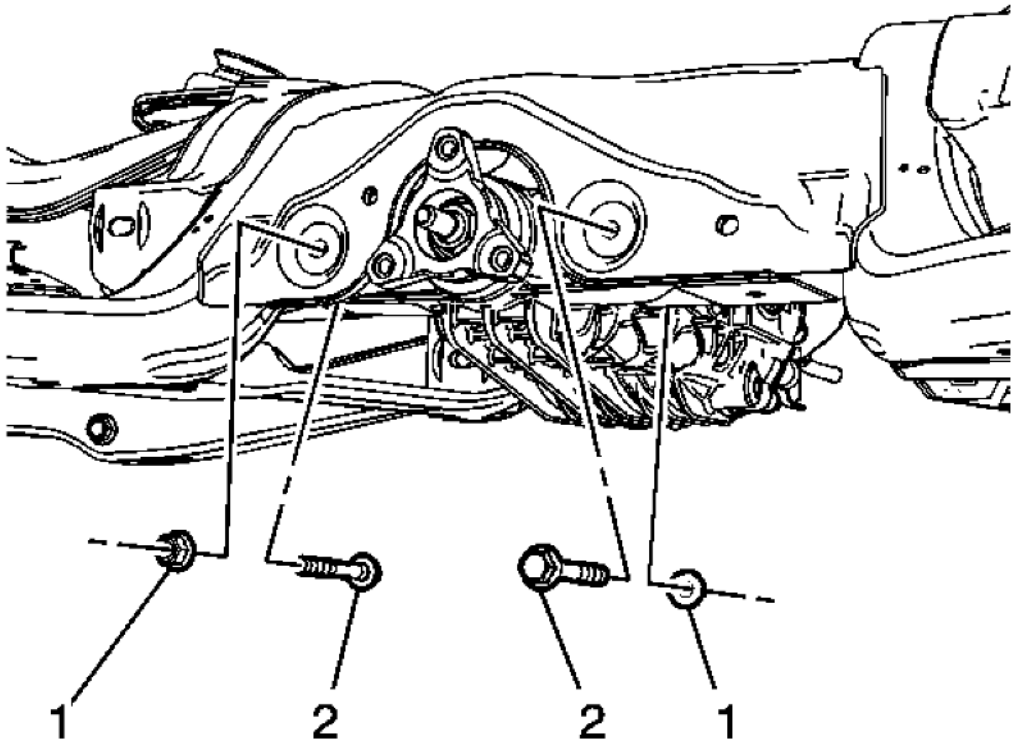


Fig. 28: Front Differential Mounting Nuts & Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the front differential mounting bolts (2) and (1) nuts.
3. Tighten the nuts (1) to 80 N.m (59 lb ft).

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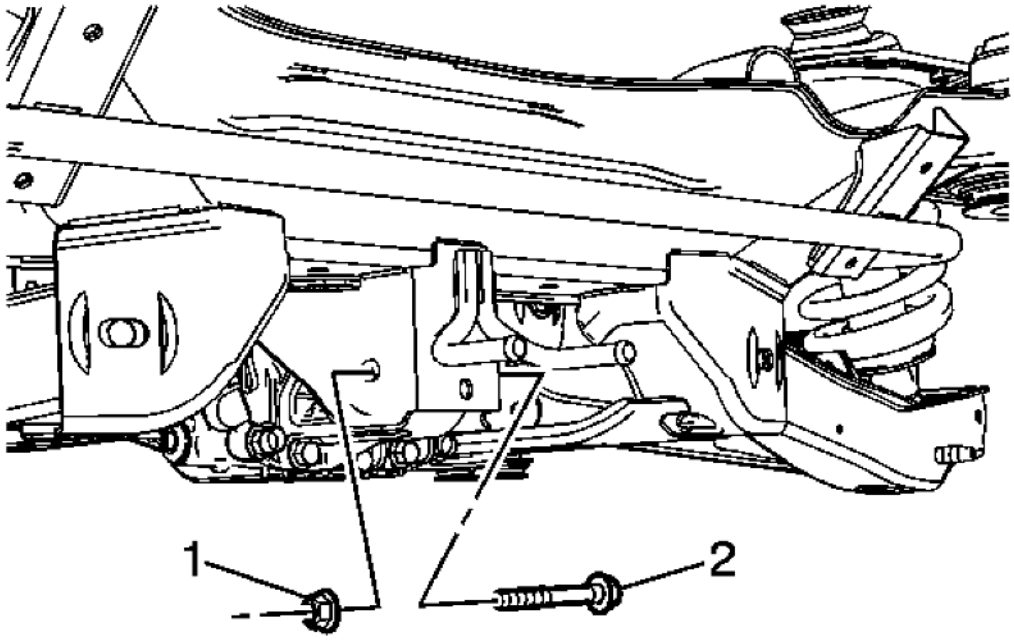


Fig. 29: Rear Differential Mount Nut & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Install the rear differential mounting nut (1) and bolt (2).
5. Tighten the nuts (1) to 80 N.m (59 lb ft).
6. Install the wheel drive shafts from the vehicle. Refer to **Rear Wheel Drive Shaft Replacement** .
7. Install the propeller shaft from the vehicle. Refer to **Two-Piece Propeller Shaft Replacement** .
8. Install the vent tube from the rear axle housing.
9. Fill the rear differential with fluid. Refer to **Differential Oil Replacement**.
10. Remove the support and lower the vehicle.

DIFFERENTIAL BEARING REPLACEMENT

Special Tools

- **DT 49907:** Side Bearing Installer
- **J 8092:** Universal Driver Handle-3/4 in - 10
- **J 8107-2:** Side Bearing Remover Plug
- **J 8107-4:** Side Bearing Remover Plug
- **J 22888-D:** Side Bearing Remover Kit

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- **J 25299:** Side Bearing Installer

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

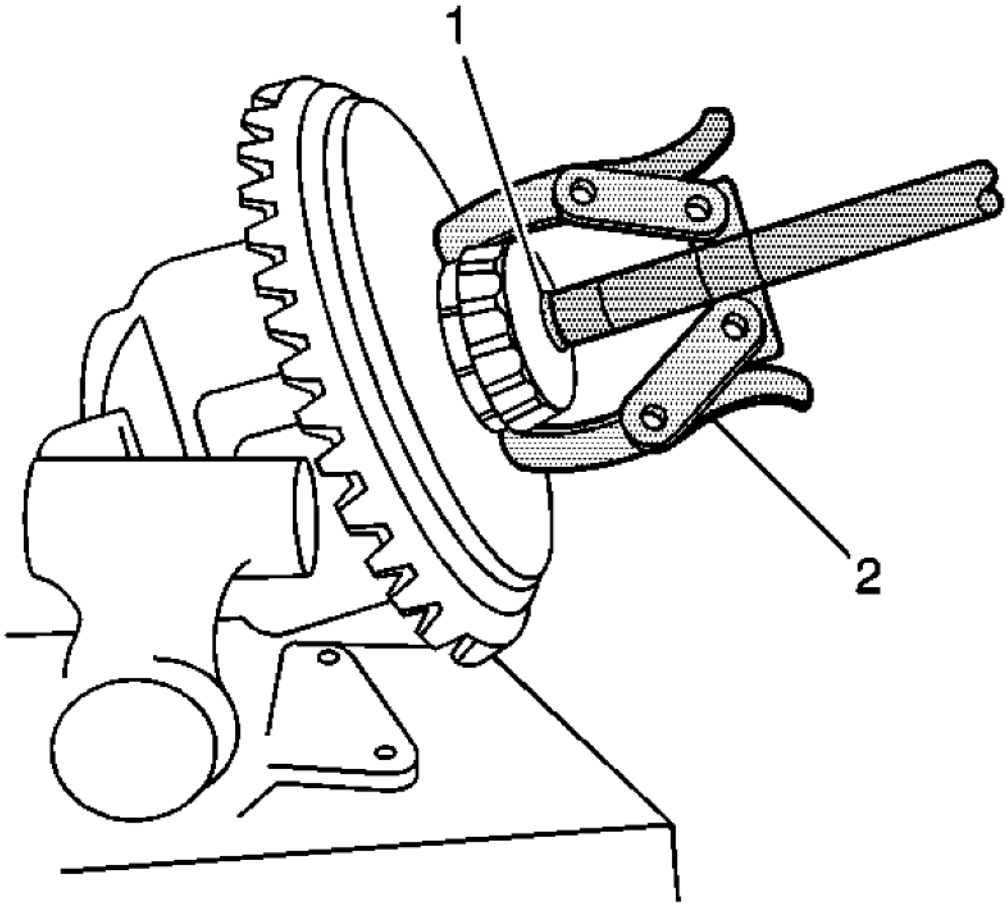


Fig. 30: Removing Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.

1. Remove the differential assembly. Refer to **Differential Replacement**.
2. Install the differential assembly in a soft jawed vise.
3. Using the **J 22888-D:** kit (2) and the **J 8107-4:** plug (1) for the 218 mm axle or **J 8107-2:** plug (1) for the 195 mm axle, remove the side bearing.

Installation Procedure

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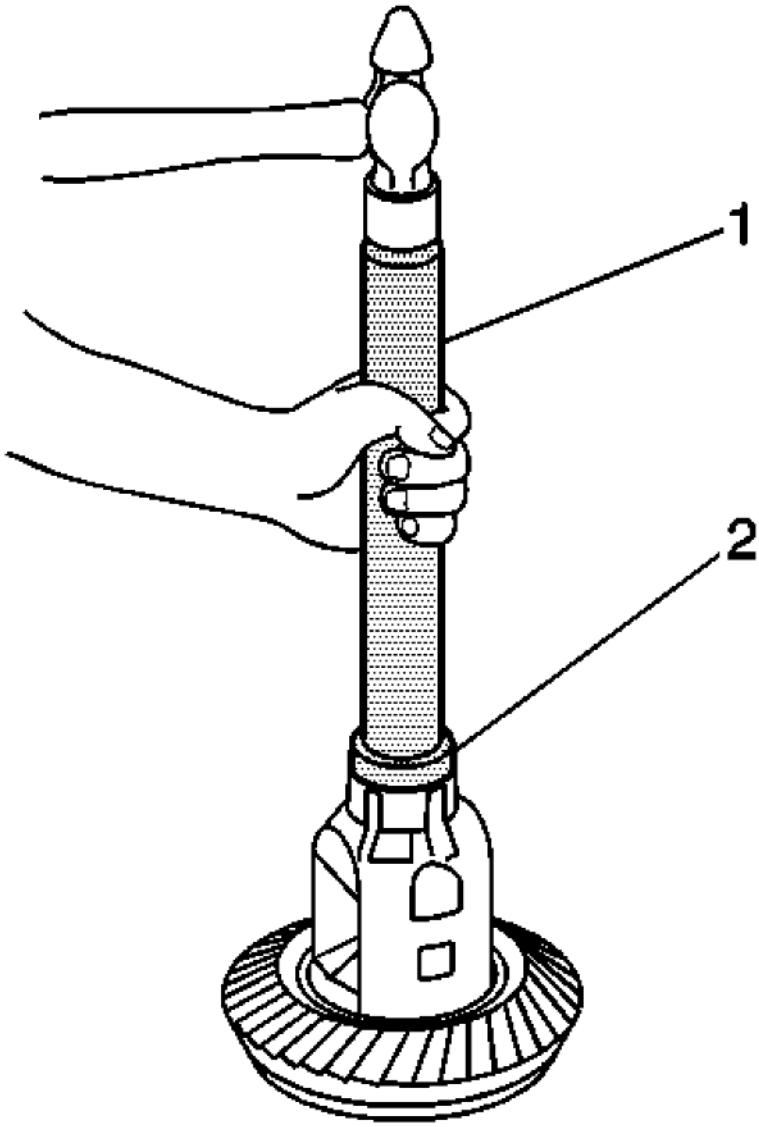


Fig. 31: Installing Differential Side Bearings
Courtesy of GENERAL MOTORS CORP.

NOTE: Use 2 blocks of wood to protect the differential case while performing the following service procedure

1. Using the **J 8092:** handle (1) and the **DT 49907:** installer (2) for the 218 mm **J 25299:** installer (2) for the 195 mm axle, install the side bearings.

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2. Remove the differential assembly from the vise.
3. Install the differential assembly. Refer to **Differential Replacement**.

DIFFERENTIAL OVERHAUL

Disassembly Procedure

1. Remove the differential side bearings. Refer to **Differential Bearing Replacement**.

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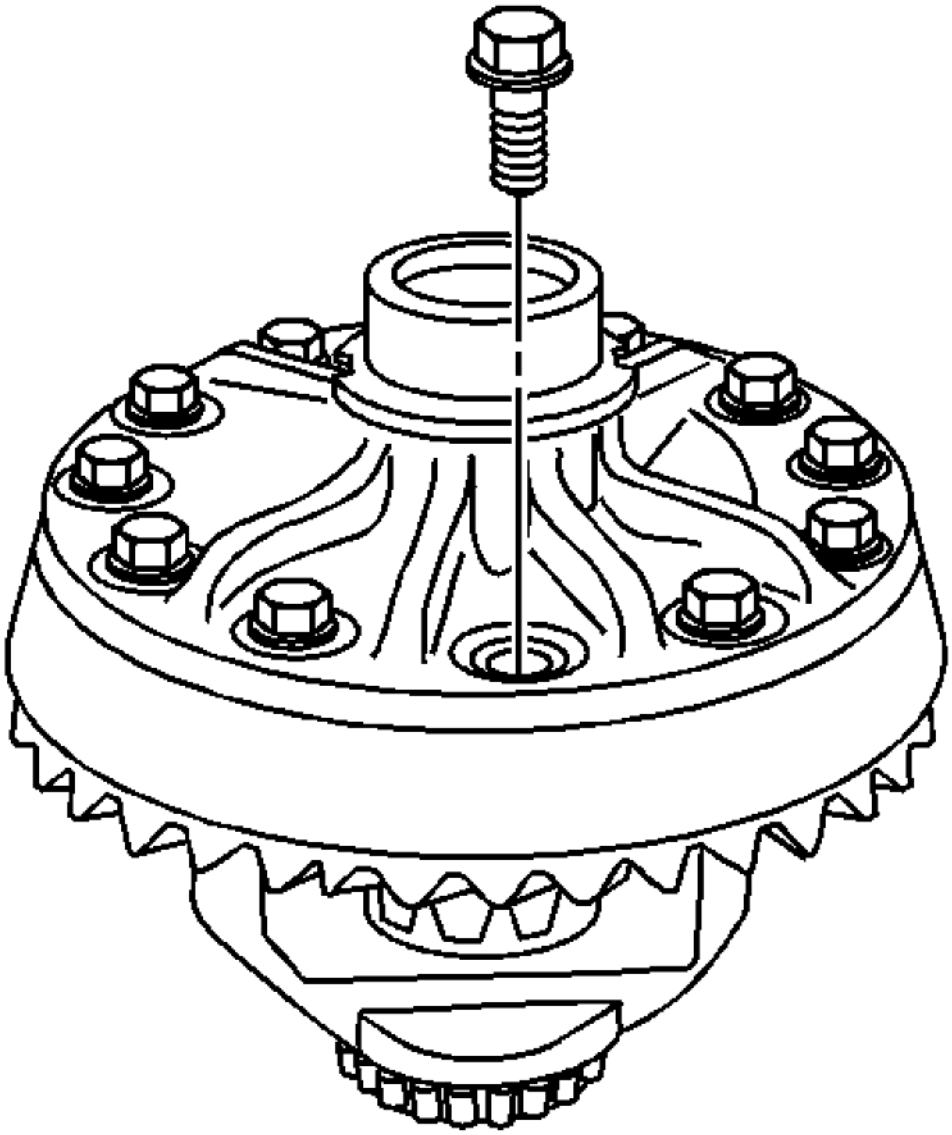


Fig. 32: Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: The ring gear bolts have left-hand threads.

2. Remove and discard the ring gear bolts.

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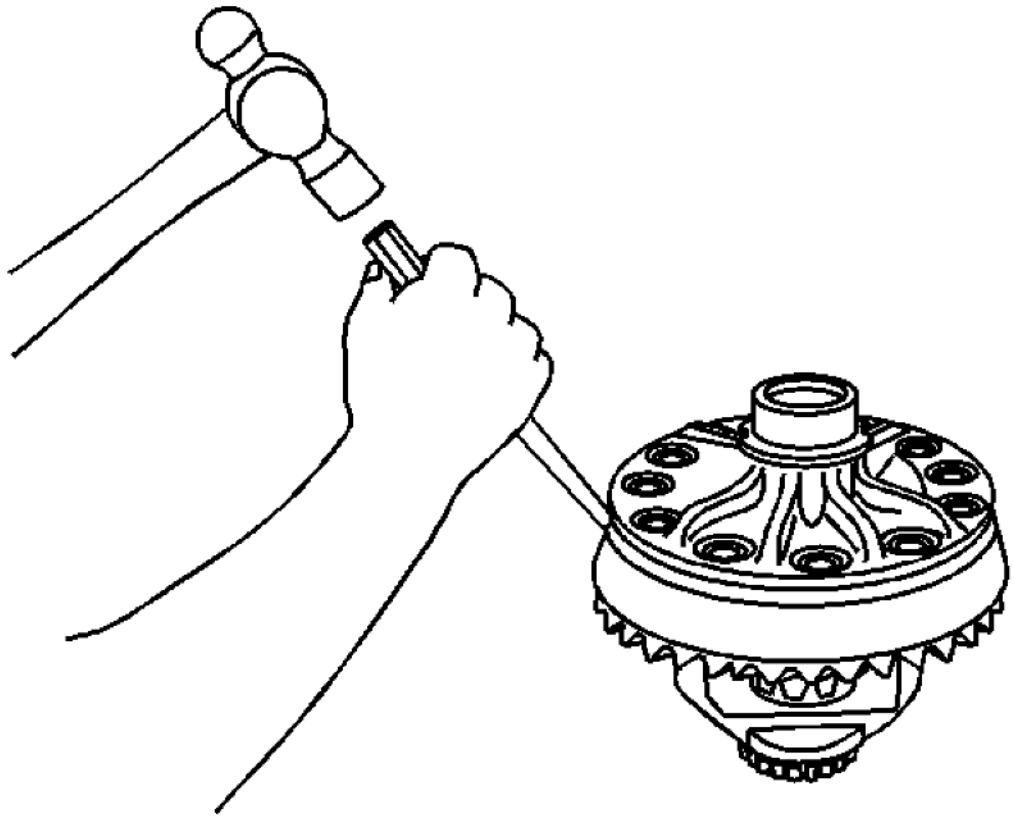


Fig. 33: Removing Ring Gear From Differential Case
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not pry the ring gear from the differential case. Prying the ring gear from the differential case may cause damage to the ring gear and/or the differential case.

NOTE: It maybe necessary to use a brass drift and a hammer to remove the ring gear.

3. Remove the ring gear from the differential case.

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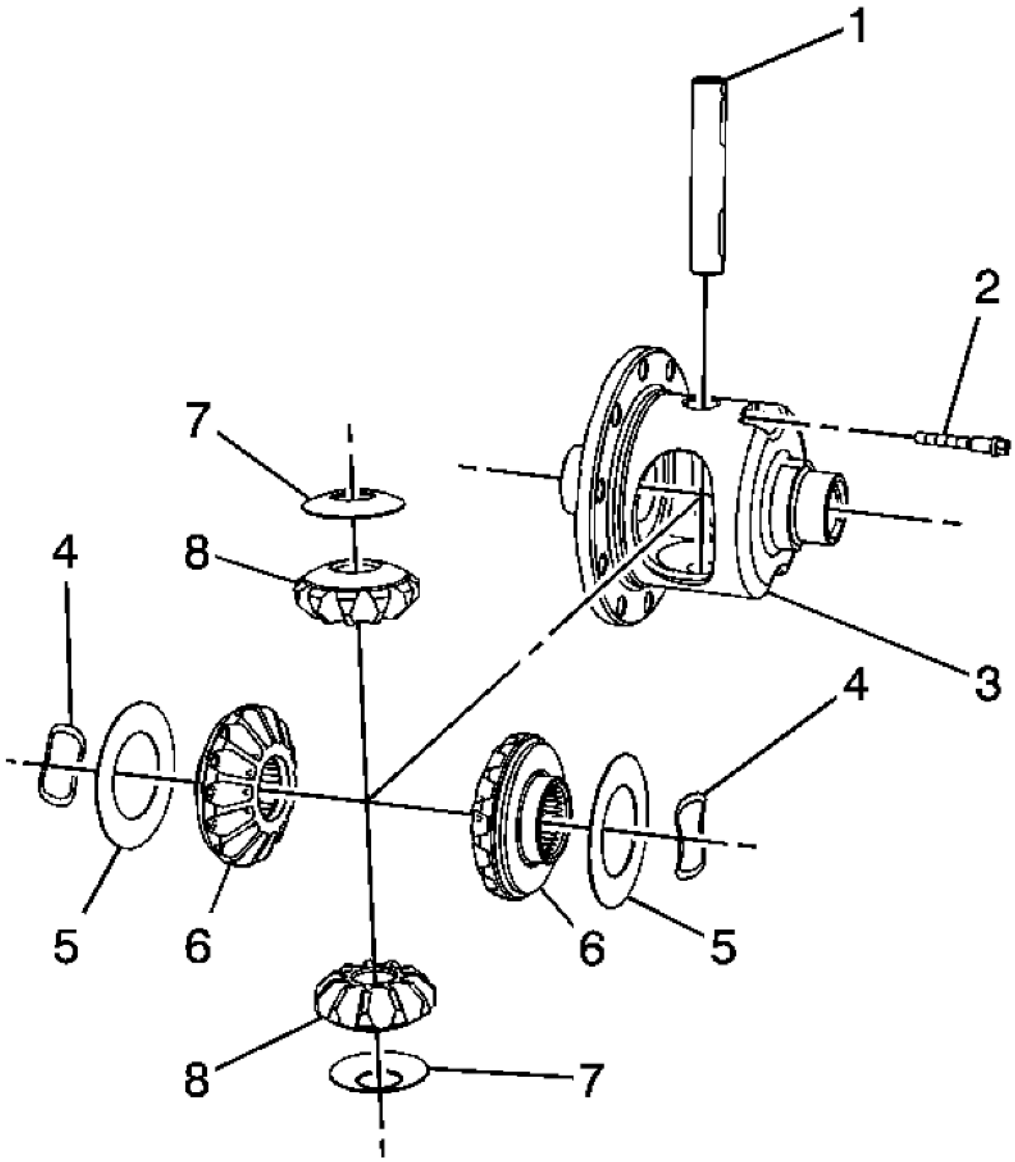


Fig. 34: Differential Components
Courtesy of GENERAL MOTORS CORP.

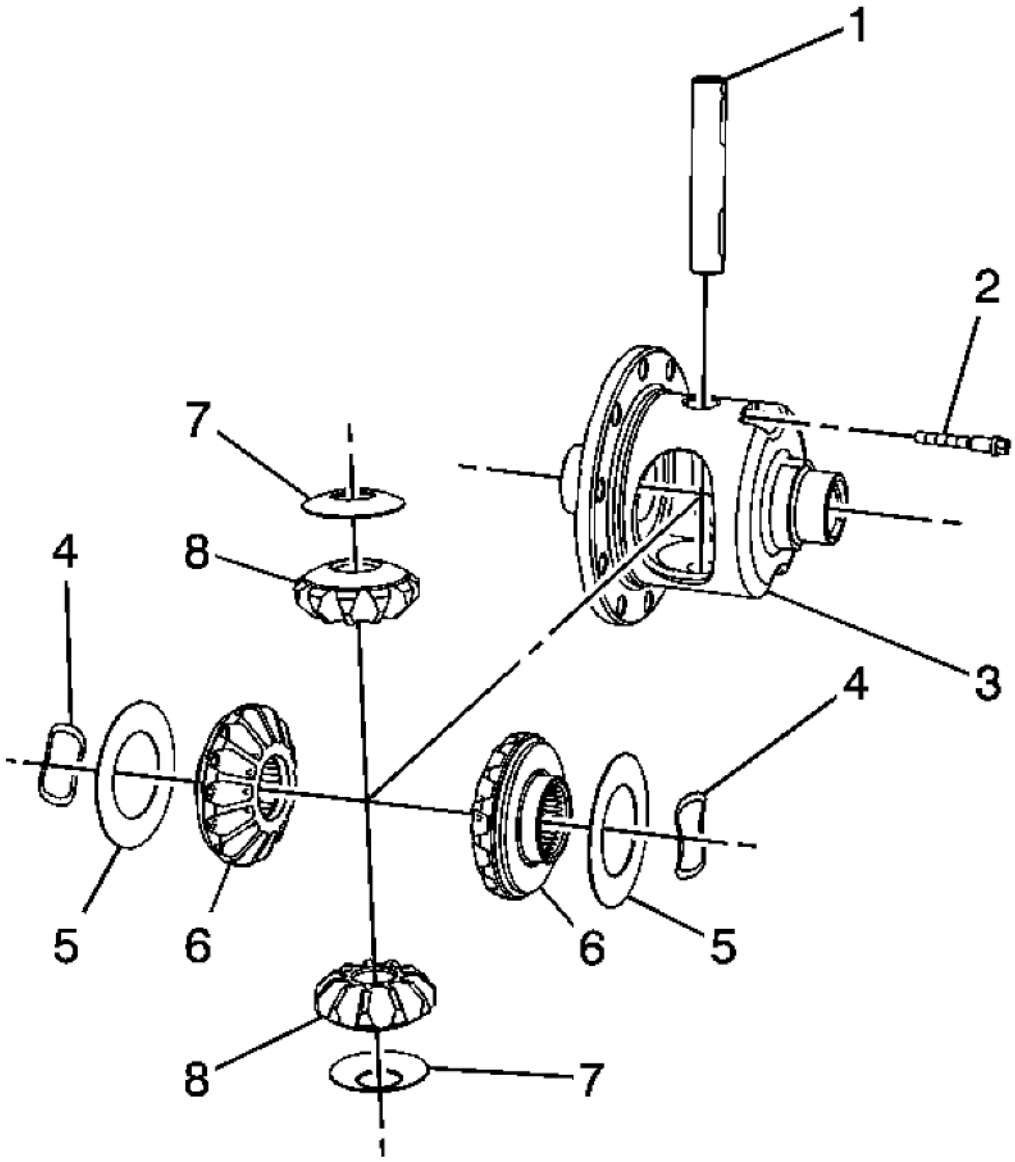
4. Mark the pinion gears top (8) and bottom and the differential side gears (6) left and right.
5. Remove the pinion shaft lock bolt (2).
6. Remove the pinion shaft (1).

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NOTE: Roll the differential pinion gears (8) and the thrust washers (7) out of the differential case (3).

7. Remove the differential pinion gears (8) and the thrust washers (7) from the differential case (3).
8. Remove the differential side gears (6), thrust washers (5) and the preload springs (4).

Assembly Procedure



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Fig. 35: Differential Components
Courtesy of GENERAL MOTORS CORP.

1. Using the proper axle lubricant, lubricate the pinion (8) and side gears (6). Refer to **Fluid and Lubricant Recommendations (USA and Canada)** .

NOTE: **If the same differential side gears and the thrust washers are being used, install the gears and the thrust washers to their original locations.**

2. Install the differential side gears (6), thrust washers (5) and the preload springs (4) into the differential case (3).
3. Position one pinion gear (8) between the differential side gears (6).

NOTE: **Install the second differential side gear directly opposite of the first gear.**

4. Position the second pinion gear (8) between the differential side gears (6).
5. Rotate the differential side gears (8) until the pinion gears is directly opposite the opening in the differential case.

NOTE: **Rotate the pinion gears toward the differential opening in order to permit the sliding in of the thrust washers.**

6. Install the thrust washers (7).
7. Install the pinion shaft (1).

CAUTION: Refer to Fastener Caution .

8. Install and tighten new pinion shaft lock bolt (2) to 25 N.m (18 lb ft).

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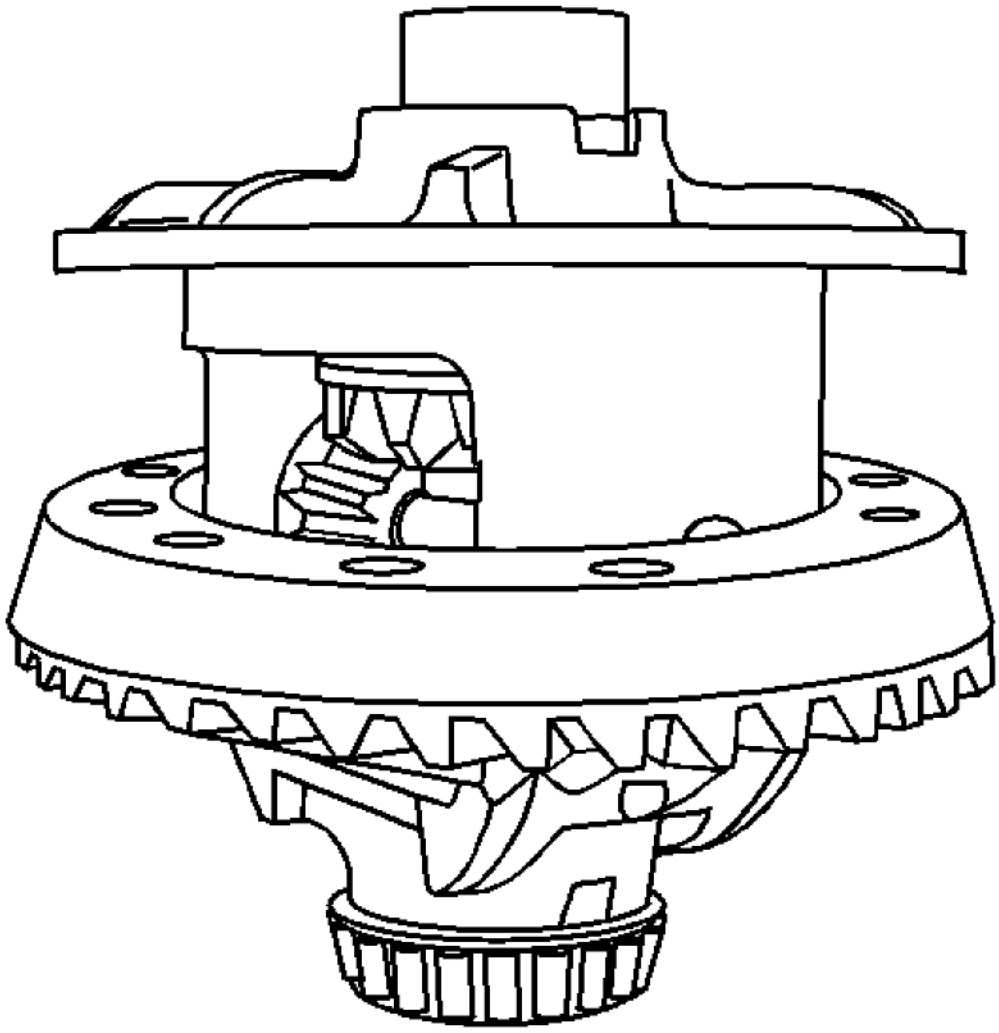


Fig. 36: Ring Gear & Differential Case
Courtesy of GENERAL MOTORS CORP.

NOTE: The mating surface of the ring gear and the differential case must be clean and free of burrs before installing the ring gear.

9. Install the ring gear to the differential case.

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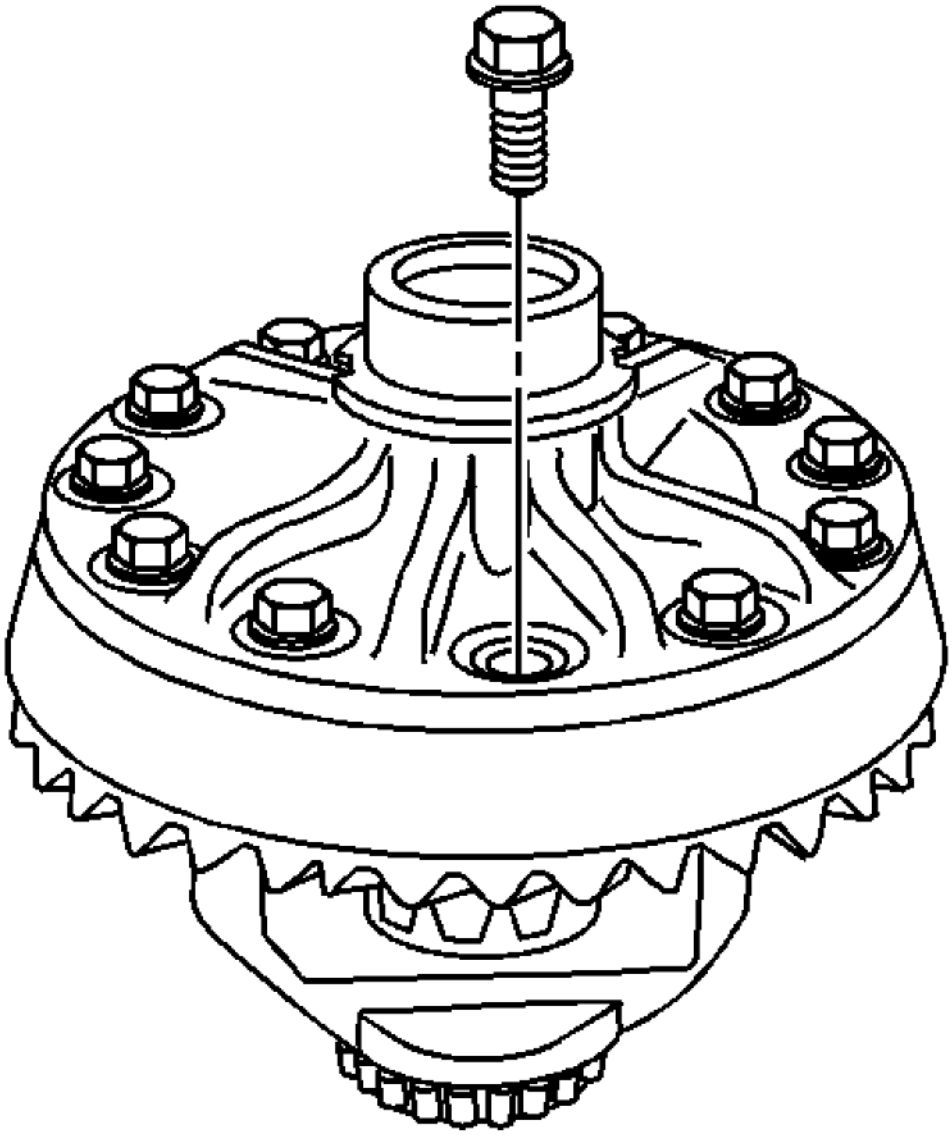


Fig. 37: Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE:

- **The ring gear bolts have left-hand threads.**
- **Hand start each bolt to ensure that the ring gear is properly installed to the differential case.**

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10. Install the new ring gear bolts.

NOTE: **Tightening the ring gear bolts in sequence will seat the ring gear evenly on the differential case.**

11. Tighten the ring gear bolts in sequence to 130 N.m (96 lb ft).
12. Install the differential side bearings. Refer to **Differential Bearing Replacement**.

DIFFERENTIAL CASE REPLACEMENT

Special Tools

- **DT 49909:** Axle Housing Spreader Adaptors (195-218 mm Axles)
- **J 8001:** Dial Indicator Set
- **J 34178:** Spreader Gauge Adapter
- **J 45222:** Axle Housing Spreader

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

1. Remove the rear differential carrier cover. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
2. Install the **J 45222:** spreader (2) and the **DT 49909:** adapters (1).
3. Install the rear differential assembly in a vise.

NOTE:
- **Preload the dial indicator and set to zero.**
- **DO NOT spread the differential carrier more than**

4. Using the **J 8001:** indicator set (2), and the **J 45222:** spreader (1), spread the differential carrier just enough to remove the differential case assembly. DO NOT spread the differential carrier more than 1.02 mm (0.040 in).

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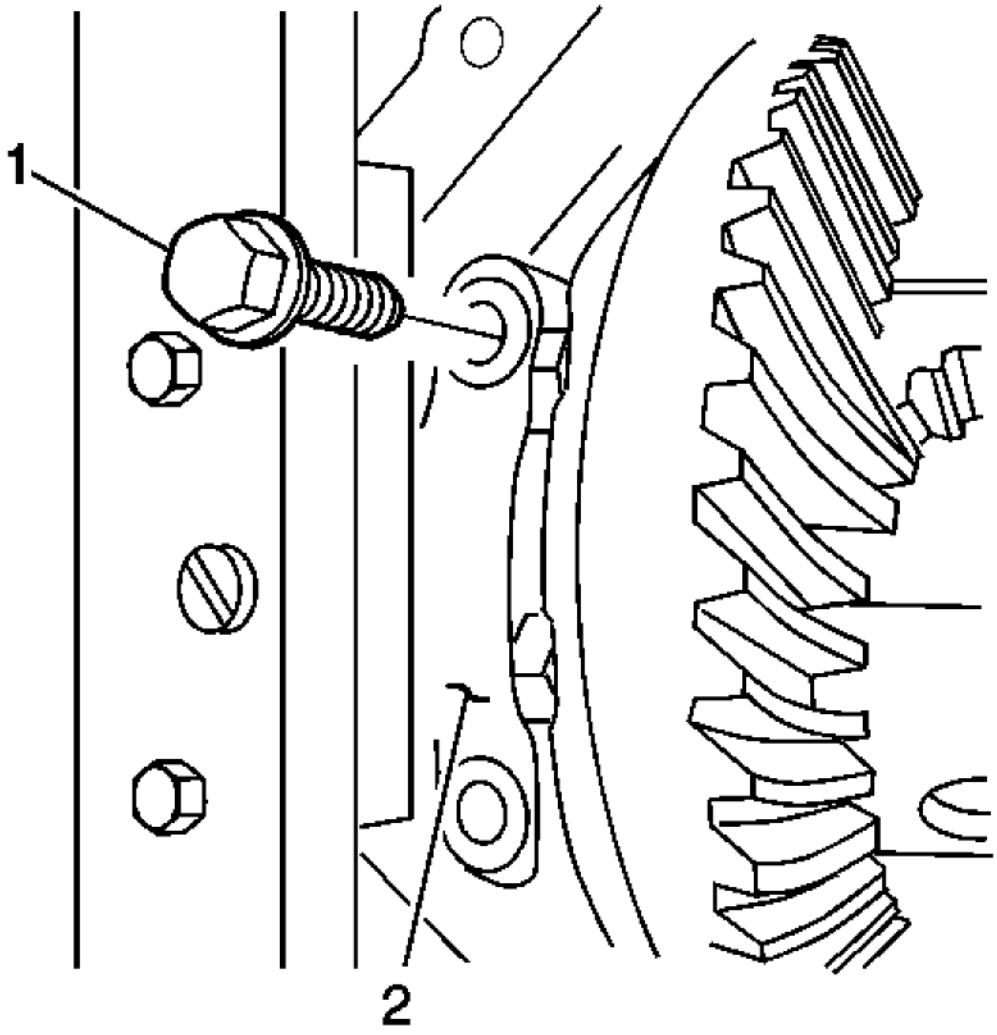


Fig. 38: Differential Bearing Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Mark the left and right bearing caps before removing them.

5. Remove the differential bearing caps (2) and the bolts (1)

NOTE: Steps 6 and 8 are for those vehicles equipped with the electronic locking differential.

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6. Remove the electronic locking differential coil bracket
7. Remove the electronic locking differential grommet by passing it into the differential case.
8. Relocate the electronic locking differential wire and grommet to the side so that it is not damaged during the differential case removal.
9. Remove the differential case assembly from the axle housing.

Installation Procedure

1. Lubricate the differential side bearings with axle lubricant. Use the proper fluid. Refer to **Fluid and Lubricant Recommendations (USA and Canada)** .
2. Install the differential case assembly in the differential carrier.

NOTE: Step 3 is for those vehicles equipped with the electronic locking differential.

3. Install the electronic locking differential coil wire and grommet in the differential housing.

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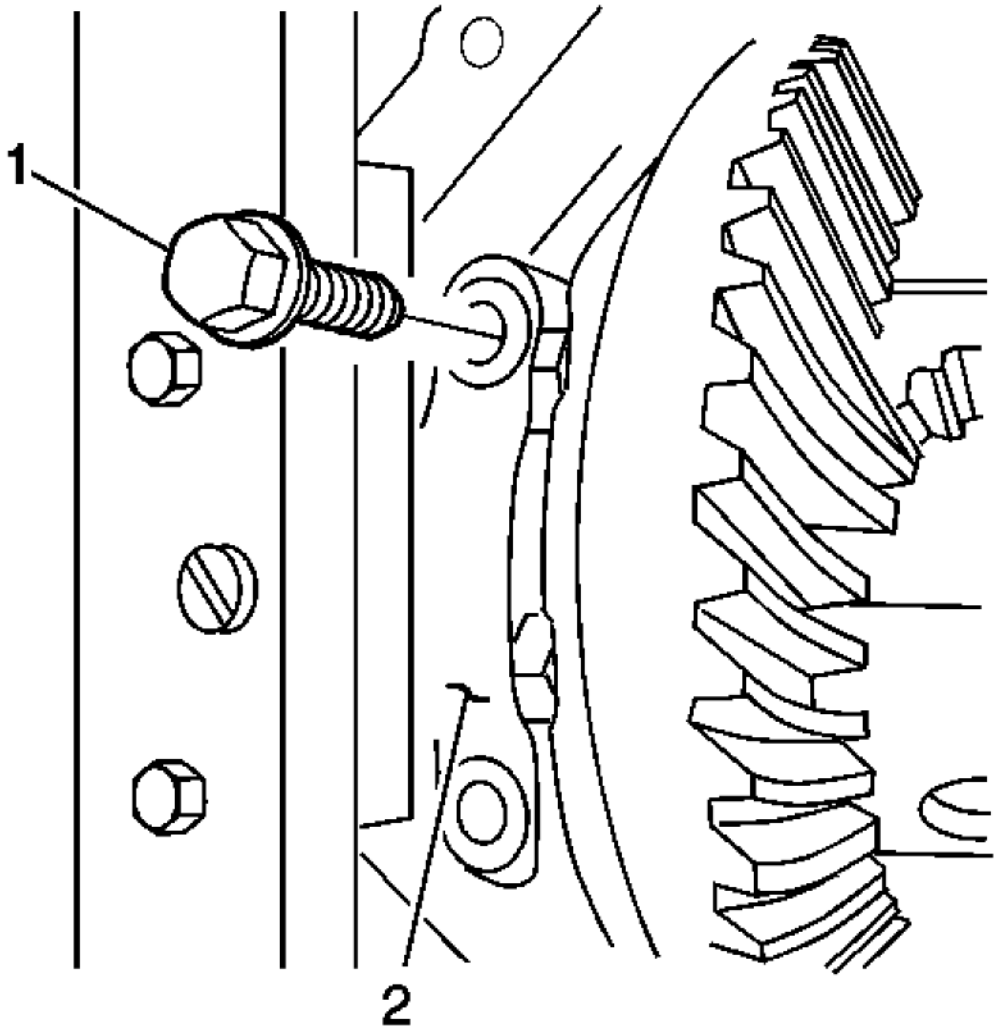


Fig. 39: Differential Bearing Caps & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the bearing caps (2) on the differential case.

NOTE: Step 5 is for those vehicles equipped with the electronic locking differential.

5. Install the electronic locking differential coil wire bracket on the side bearing caps.

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NOTE: **Do not torque the bearing cap bolts at this time. Hand tighten the bearing cap bolts.**

6. Install the bearing caps and bolts.
7. Adjust the differential side bearing preload. Refer to **Drive Pinion and Ring Gear Replacement**.
8. Adjust the backlash. Refer to **Backlash Adjustment**.
9. Perform the gear tooth contact pattern check. Refer to **Gear Tooth Contact Pattern Inspection**.

CAUTION: Refer to Fastener Caution .

10. Tighten the bearing cap bolts (1) to 63 N.m (46 lb ft).
11. Remove the **J 45935:** fixture and the **DT 49909:** adaptors from the front drive axle housing.
12. Install the rear differential carrier cover. Refer to **Rear Axle Housing Cover and Gasket Replacement**.

DIFFERENTIAL CASE CLEANING AND INSPECTION

Differential Case

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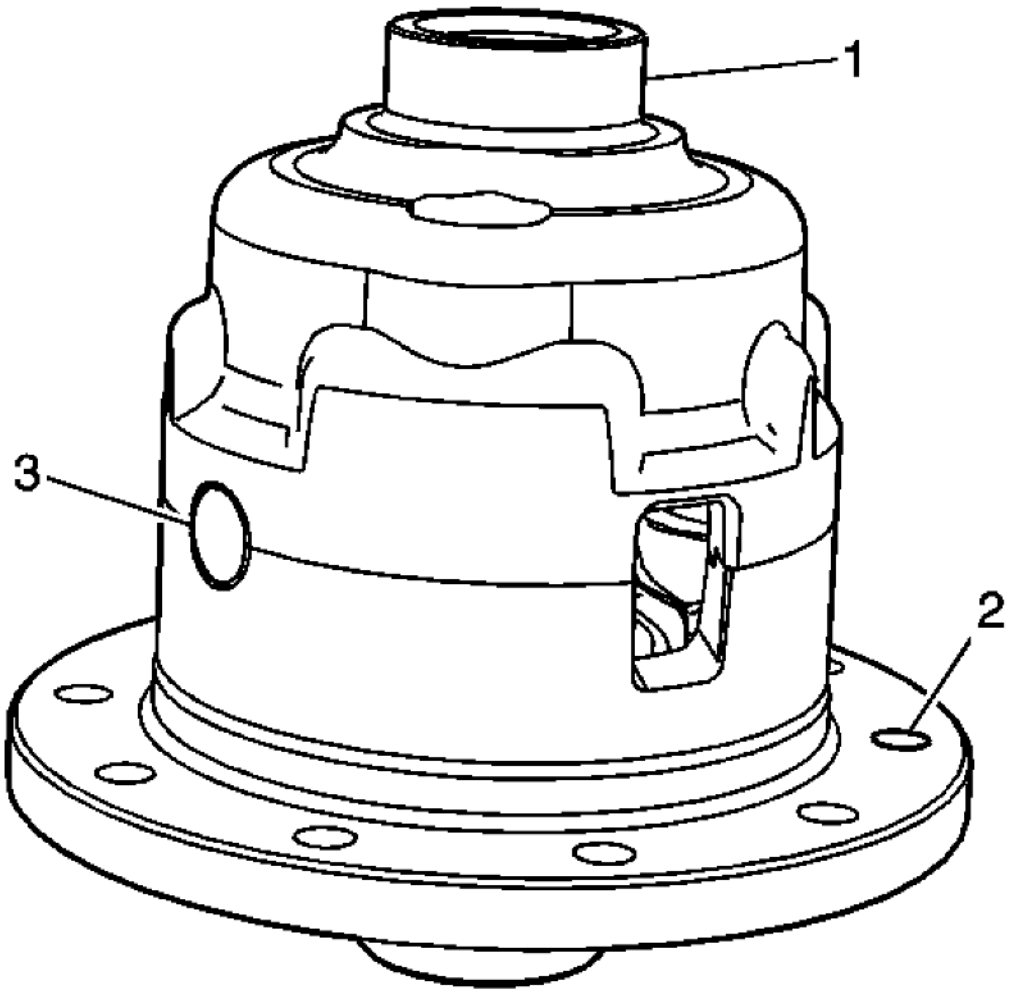


Fig. 40: Differential Case Components
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Safety Glasses Warning .

1. Clean the differential case in solvent.
2. Inspect the differential case for the following conditions:
   - Chips or cracks
   - Damage to the bolts holes (2)
   - Unusual wear, grooves or scoring

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- Damaged side bearing flanges (1)
- Heat discoloration
- Worn differential pin bores (3)

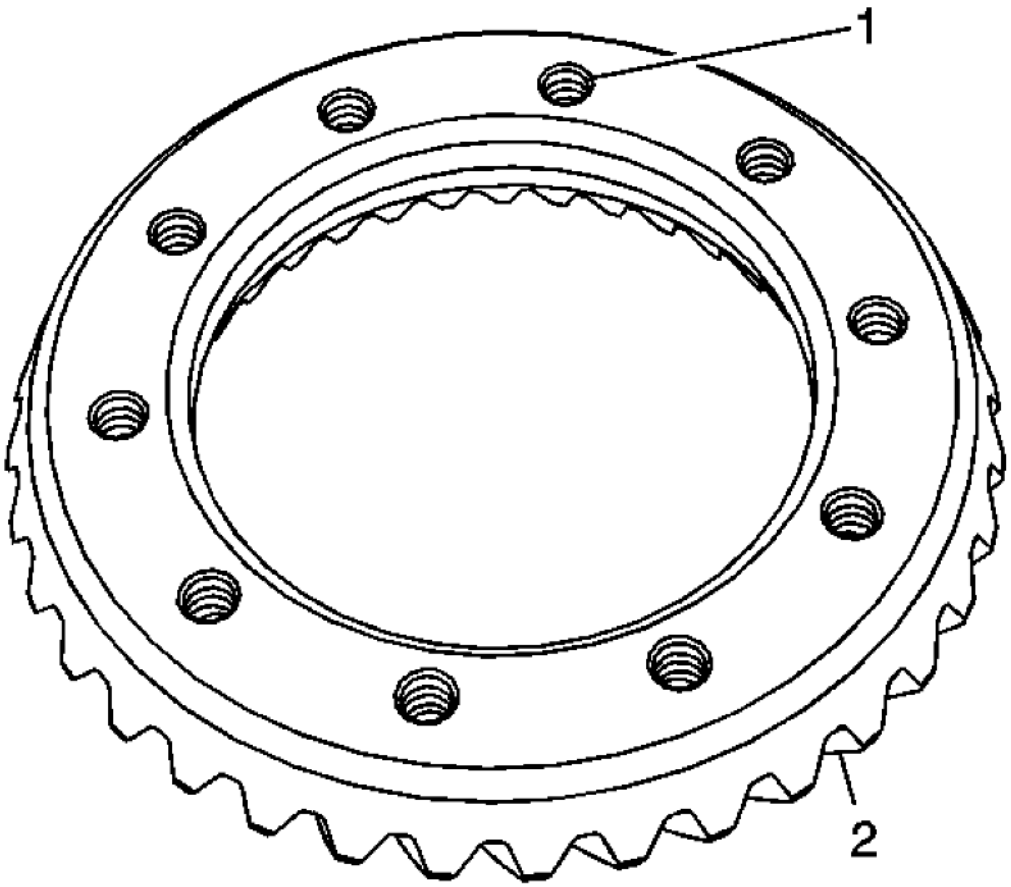


Fig. 41: Ring Gear Teeth & Threaded Holes
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Safety Glasses Warning .

3. Clean the ring gear in solvent.
4. Inspect the ring gear for the following conditions:
    - Damage to the threaded holes (1)

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- Unusual wear or heat discoloration to the gear teeth (2)

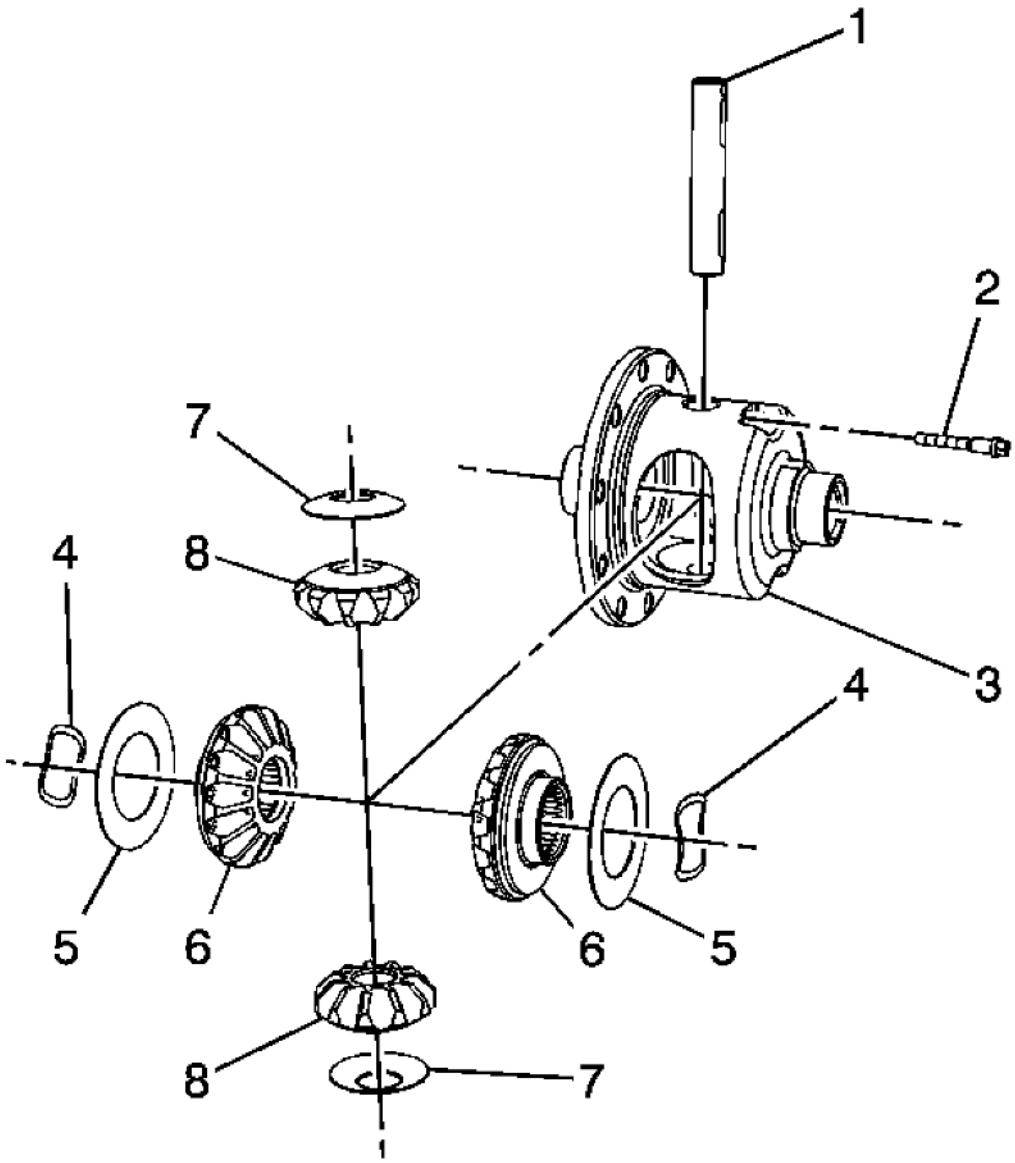


Fig. 42: Differential Components
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Safety Glasses Warning .

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5. Clean the pinion flange in solvent.
6. Inspect the following differential parts excessive wear or damage:
    - Inspect the pinion shaft lock bolt (2)
    - Inspect the pinion shaft (1)
    - Inspect the differential case (3)
    - Inspect the pinion gears (8)
    - Inspect the pinion gear thrust washers (7)
    - Inspect the differential side gears (6)
    - Inspect the differential side gear shims (5)
    - Inspect the differential side gear spring washers (4)

BEARINGS INSPECTION

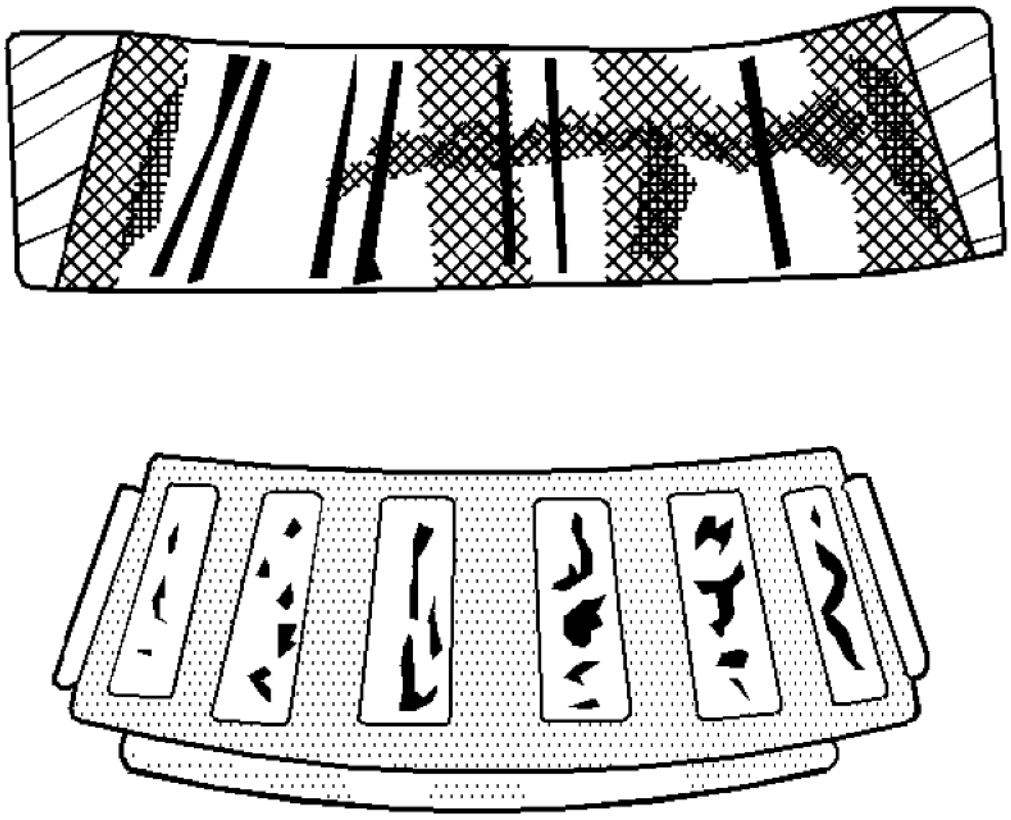


Fig. 43: Inspecting Bearing Rollers & Races For Pitting, Grooves, Spalling & Excessive Wear
Courtesy of GENERAL MOTORS CORP.

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1. Inspect the bearing rollers and races for the following conditions:
   - Pitting
   - Scoring or grooves
   - Excessive wear or other damage

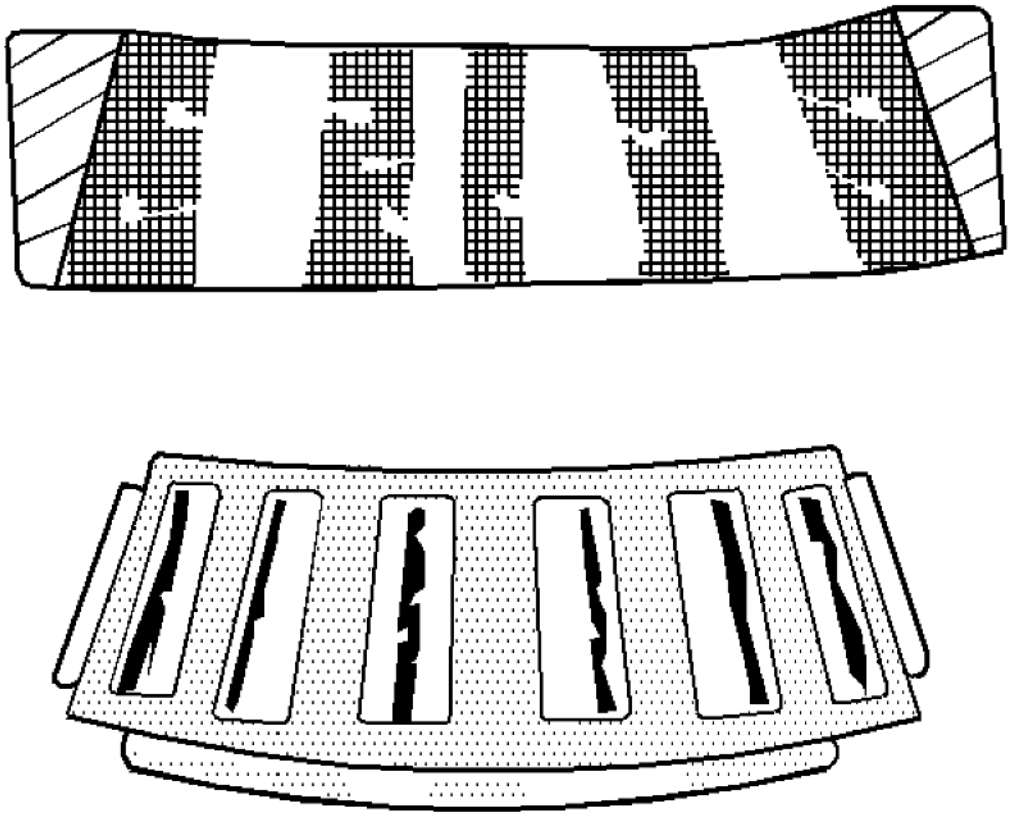


Fig. 44: Inspecting Bearing Rollers & Races For Heat Discoloration
Courtesy of GENERAL MOTORS CORP.

NOTE: Heat discoloration ranges from a faint yellow to a dark blue color. This discoloration may result from an overload or improper lubrication. Excessive heat causes softening of the rollers and races. Bearings or races with sign of heat discoloration must be replaced.

2. Inspect the bearing rollers and races for heat discoloration.

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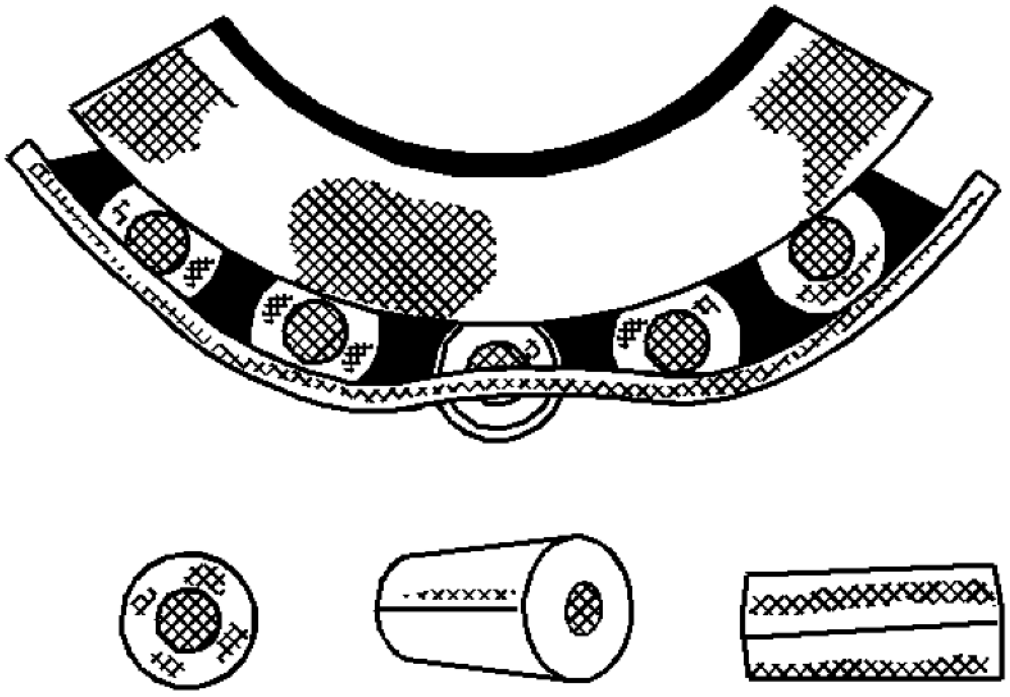


Fig. 45: Identifying Bent Roller Cage
Courtesy of GENERAL MOTORS CORP.

3. Inspect for bent bearing cages.

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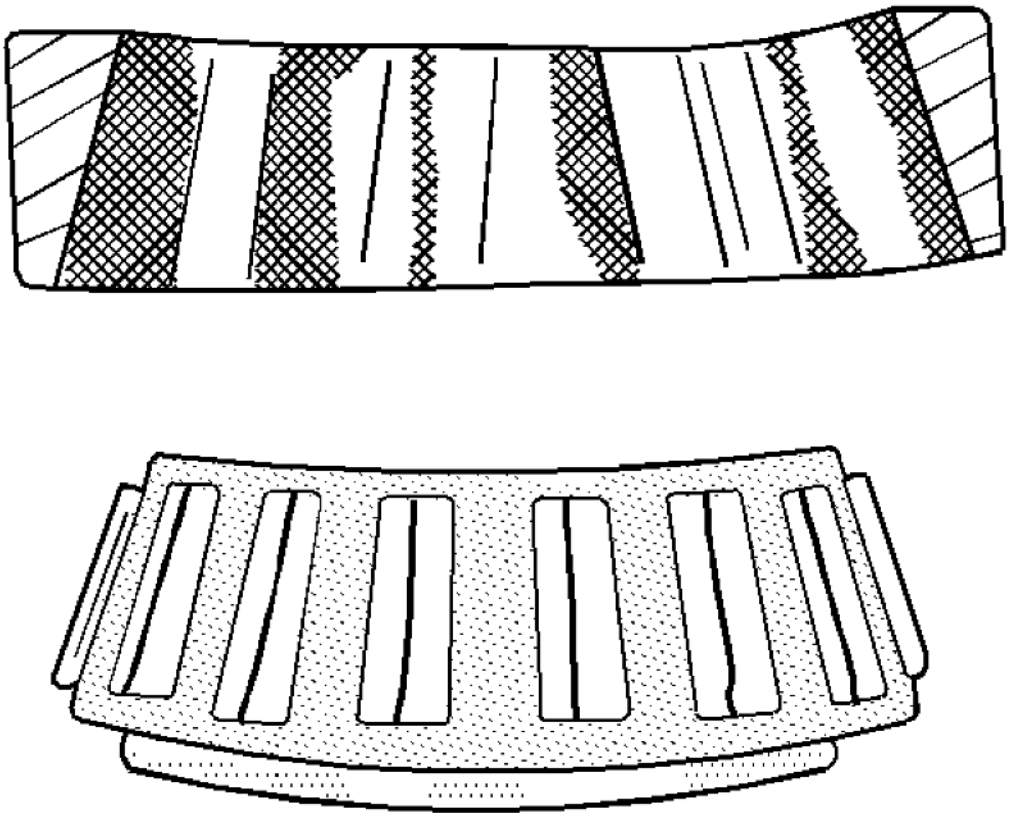


Fig. 46: Inspecting For Damaged Bearing Cages
Courtesy of GENERAL MOTORS CORP.

4. Inspect for damaged bearing cages.

PINION AND RING GEAR INSPECTION

Ring and pinion gears are matched sets. When replacement of one or the other is necessary, both the ring and pinion gear must be replaced.

- Check the pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Check the pinion gear splines for wear.
- Check the pinion flange/yoke splines for wear.
- Check the fit of the pinion gear splines on the pinion flange/yoke.
- Check the sealing surface of the pinion flange/yoke for nicks, burrs or rough tool marks that could damage the seal and cause an oil leak.

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- Check for worn or broken parts and replace as necessary.

REAR AXLE HOUSING INSPECTION

Carefully and thoroughly inspect all drive unit parts before assembly. Thorough inspection of the drive parts for wear or stress with subsequent replacement of worn parts eliminates costly drive component repair after assembly.

- Inspect for nicks or burrs that could prevent the outer diameter of the pinion seal from sealing. Remove any burrs.
- Inspect the bearing cup bores for nicks or burrs. Remove any burrs that are found.
- Inspect the housing for cracks. Replace the housing if any cracks are found.
- Inspect the housing for foreign material such as metal chips, dirt, or rust.

SHIMS INSPECTION

IMPORTANT:

- **Do not reinstall the original cast iron production shims, if removed. Once the cast iron shims are removed from the axle housing, they must be replaced with service shims and spacers.**
- **If service shims were previously installed, the shims can be reused.**

Inspect the shims for cracks and chips. Replace the damaged shims.

DIFFERENTIAL CARRIER BEARING PRELOAD ADJUSTMENT

Special Tools

- **J-22779:** Side Bearing Backlash Gauge
- **J-25588:** Side Bearing Shim Installer

For equivalent regional tools, refer to **Special Tools**.

Wedge Method

NOTE:

- **The differential side bearing preload adjustment must be completed before the backlash adjustment can be started.**
- **In order to maintain the original backlash, adjust the differential case side bearing preload by changing the thickness of the left and the right side shim packs equally.**
- **Measure the service shims and the spacers one at a time. Add the measurements together in order to obtain the total thickness of the left or the right side shim pack.**
- **Do not use or reuse the original cast iron production shims. Use service shims and spacers instead.**

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1. Install the drive pinion, if necessary. Refer to **Drive Pinion and Ring Gear Replacement**.

NOTE: Record the measurement.

2. Using an inch-pound torque wrench, measure the rotating torque of the drive pinion.
   - For the 195 mm axle the measurement should be 2.1-3.1 N.m (19-27 lb in) for new bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings
   - For the 218 mm axle the measurement should be 2.0-2.6 N.m (18-23 lb in) for new bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings
3. If the rotating torque for the drive pinion bearings is not within specifications, adjust as necessary. Refer to **Drive Pinion and Ring Gear Replacement**.

NOTE: Ensure that the differential side bearing surfaces in the axle housing are clean and free of burrs. If the original differential side bearings are to be reused, the original differential side bearing cups must also be used.

4. Install the differential assembly with the differential side bearings and differential side bearing cups into the axle housing.
5. Insert one 4.318 mm (0.170 in) thick service spacer into the left side of the axle housing.
6. Side the differential assembly towards the service spacer in order to hold the spacer in place.
7. Install the **J-22779:** gauge into the right side of the axle housing.

   The **J-22779:** gauge must be installed between the service spacer and the differential side bearing cup.

NOTE: Over-tightening of the J-22779: gauge may spread the housing and result in incorrect shim selection.

8. Tighten the knob on the **J-22779:** gauge until there is moderate drag when the **J-22779:** gauge is moved.
9. Remove the **J-22779:** gauge.
10. Remove the service spacer.
11. Using a micrometer, measure the thickness of the service spacer. Record the measurement.
12. Using a micrometer, measure the thickness of the **J-22779:** gauge in 3 locations. Calculate the average of the 3 measurements. Record the measurement.
13. Add the thickness of the service spacer, measured in Step 11 to the average thickness of the **J-22779:** gauge, measured in Step 12. The resulting value is the total service shim thickness without preload for the axle.
14. Insert one BENT 1.016 mm (0.040 in) service shim between the right side differential side bearing cup and the axle housing. The service shim must be installed between the service spacer and the differential side bearing cup.
15. Install the **J-22779:** gauge into the left side of the axle housing. The **J-22779:** gauge must be installed between the service spacer and the differential side bearing cup.
16. While rotating the ring gear back and forth, tighten the knob on the **J-22779:** gauge until there is approximately 0.025-0.051 mm (0.001-0.002 in) of backlash between the ring gear and the drive pinion.

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17. Once the correct amount of backlash is obtained, remove the **J-22779:** gauge.
18. Remove the differential assembly with the differential side bearings and the differential side bearing cups.
19. Remove the BENT service shim.
20. Using a micrometer, measure the thickness of the **J-22779:** gauge in 3 locations. Calculate the average of the 3 measurements. This value is the left side service shim thickness without preload.
21. In order to determine the right side service shim thickness, subtract the service shim thickness for the left side of the axle, calculated in step 20, from the total service shim thickness, calculated in step 13. This value is the service shim thickness for the right side of the axle without preload.
22. In order to preload of the differential side bearings and set the backlash to approximately 0.127-0.223 mm (0.005-0.009 in), take the value determined in step 21 and add 0.203 mm (0.008 in) service shim thickness to this amount.
23. Assemble the left side shim pack using one 4.318 mm (0.170 in) service spacer and the appropriate amount of service shims equaling the thickness determined in step 20. Measure the service spacer and the service shims separately. Add the measurements together in order to determine the total shim pack thickness.
24. Assemble the right side shim pack using one 4.318 mm (0.170 in) service spacer and the appropriate amount of service shims equaling the thickness determined in step 22. Measure the service spacer and the service shims separately. Add the measurements together in order to determine the total shim pack thickness.
25. Install the differential assembly with the differential side bearings and the differential side bearing cups.
26. Install the left side service spacer and service shim into the axle housing. The service shim must be installed between the service spacer and the differential side bearing cup.
27. Install the right side service spacer between the axle housing and the differential side bearing cup.
28. Install the right side service shim into the axle housing using the **J-25588:** installer, if necessary. The service shim must be installed between the service spacer and the differential side bearing cup.

CAUTION: Refer to Fastener Caution .

29. Install the differential bearing caps and the bolts, and tighten the bolts to 75 N.m (55 lb ft).
    - For the 195 mm axle, tighten the differential bearing cap bolts to 63 N.m (46 lb ft).
    - For the 218 mm axle, tighten the differential bearing cap bolts to 105 N.m (77 lb ft).
30. Rotate the pinion several times to ensure the drive pinion and differential side bearings have seated.

NOTE: Record the measurement.

31. Using an inch-pound torque wrench, measure the rotating torque of the drive pinion and differential side bearings should be approximately 0.57- 1.13 N.m (5-10 lb in) greater than the rotating torque of the drive pinion measured earlier.
32. Calculate the differential side bearing preload by subtracting the drive pinion preload, measured in Step 2, from the drive pinion and differential case bearing preload, measured in Step 33. Multiply the value obtained by the axle ratio and the preload should be 1.7-4.0 N.m (15-35 lb in).

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33. If the differential side bearing preload is not within specifications, add or subtract shim thickness equally from each shim pack as necessary in order to increase/decrease the side bearing preload.
34. Once the differential side bearing preload is correct, measure the backlash and adjust, if necessary. Refer to **Backlash Adjustment**.
35. Once the differential side bearing preload and backlash is correct, perform a gear tooth contact pattern check in order to ensure proper alignment between the ring and pinion gears. Refer to **Gear Tooth Contact Pattern Inspection**.

Shim Method

NOTE:

- **The differential side bearings must have preload before the backlash adjustment can be started.**
- **In order to maintain the original backlash, adjust the differential case side bearing preload by changing the thickness of the left and the right side shim packs equally.**
- **Measure the service shims and the service spacers one at a time. Add the measurements together in order to obtain the total thickness of the left or the right side shim pack.**
- **Do not use or reuse the original cast iron production shims. Use service shims and service spacers instead.**

1. Install the drive pinion, if necessary. Refer to **Drive Pinion and Ring Gear Replacement**.

   NOTE: Record the measurement.

2. Using an inch-pound torque wrench, measure the rotating torque of the drive pinion.
   - For the 195 mm axle should be 2.0-2.6 N.m (18-23 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings.
   - For the 218 mm axle should be 2.1-3.1 N.m (19-27 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings.
3. If the rotating torque for the drive pinion bearings is not within specifications, adjust as necessary. Refer to **Drive Pinion and Ring Gear Replacement**.

   NOTE: Before installation of the case assembly, ensure that the side bearing surfaces in the axle housing are clean and free of burrs. If the original bearings are to be reused, the original bearing cups must also be used.

4. Install the differential assembly with the differential side bearings and bearing cups into the axle housing.
5. Insert one BENT 1.016 mm (0.040 in) thick service shim into the right side axle housing. Side the differential assembly towards the bent service shim in order to hold the shim in place.
6. While holding the differential assembly against the bent service shim, install one 4.318 mm (0.170 in) thick service spacer into the left side axle housing.
7. Move the differential assembly to the right until the ring gear contacts the drive pinion. Once the ring

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gear contacts the drive pinion, continue to move the ring gear towards the drive pinion to until all backlash is removed.

8. While holding the ring gear against the drive pinion, insert progressively larger service shims between the service spacer and the differential side bearing cup until a moderate resistance can be felt.
9. Once the largest service shim has been determined, measure the thickness of the shim using a micrometer. Measure the service shim in 3 locations. Calculate the average of the 3 measurements. Use the average as the thickness for the shim. Record the measurement.
10. Install the service shim that was just measured back into the left side of the axle housing. The service shim must be installed between the service spacer and the differential side bearing cup.
11. Remove the BENT shim from the right side of the axle housing.
12. Insert one 4.318 mm (0.170 in) thick service spacer into the right side axle housing.
13. Move the differential assembly towards the left side of the axle housing. While holding the differential assembly against the left side shim pack, insert progressively larger service shims between the service spacer and the differential side bearing cup until a moderate resistance can be felt.
14. Once the largest service shim has been determined, measure the thickness of the shim using a micrometer. Verify the thickness of the service shim. Measure the service shim in 3 locations. Calculate the average of the 3 measurements. Use the average as the thickness for the shim. Record the measurement.
15. In order to preload the differential side bearing and set the initial backlash to approximately 0.127 mm (0.005 in), adjust the thickness of left and right side shims by doing the following:
    1. Subtract 0.152 mm (0.006 in) from the measurement recorded for the left side shim in step 9. Record the measurement.
    2. Add 0.356 mm (0.014 in) to the measurement recorded for the right side shim in step 14.
16. Select the correct service shim thickness for each side corresponding to the measurements determined above. Using a micrometer, verify the thickness of the service shim. Measure the service shim in 3 locations. Calculate the average of the 3 measurements. Use the average as the thickness for the shim.
17. Install the left side service shim into the axle housing. The service shim must be installed between the service spacer and the differential side bearing cup.
18. Move the differential assembly towards the left side of the axle housing.
19. Install the right side service shim into the axle housing using the **J-25588:** installer, if necessary. The service shim must be installed between the service spacer and the differential side bearing cup.
20. Install the differential bearing caps and bolts.
    - For the 195 mm axle, tighten the bearing cap bolts to 63 N.m (46 lb ft).
    - For the 218 mm axle, tighten the bearing cap bolts to 105 N.m (77 lb ft).
21. Rotate the pinion several times to ensure the bearings have seated.

NOTE: Record the measurement.

22. Using an inch-pound torque wrench, measure the rotating torque of drive pinion and differential case side bearings should be approximately 0.57- 1.13 N.m (5-10 lb in) greater than the rotating torque of the drive pinion measured earlier.

NOTE: If the differential side bearing preload is not within specifications, add or

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subtract shim thickness equally from each shim pack as necessary in order to increase/decrease the side bearing preload.

23. Determine the preload for the differential side bearings by performing the following calculation:
    1. Subtract the drive pinion rotating torque, measured in step 2, from the drive pinion and differential case side bearing rotating torque, measured in step 22.
    2. Multiply the value obtained by the axle ratio. This value equals the preload for the differential side bearings should be 1.7-4.0 N.m (15-35 lb in).
24. Once the differential side bearing preload is within specifications, measure the backlash between the ring gear and the drive pinion and adjust, if necessary. Refer to **Backlash Adjustment**.
25. Once backlash and differential side bearing preload is within specifications, perform a gear tooth contact pattern check in order to ensure proper alignment between the ring and pinion gears. Refer to **Gear Tooth Contact Pattern Inspection**.

PINION DEPTH ADJUSTMENT

Special Tools

- **DT 49911:** Pinion Shim Gauge Plate
- **J-8001:** Dial Indicator Set
- **J-21777-B:** Pinion Setting Gauge Set
- **J-34925:** Pinion Setting Gauge and Components

For equivalent regional tools, refer to **Special Tools**.

NOTE: Make sure all of the tools, the differential side bearing bores, and the pinion bearing cups are clean before proceeding.

1. Lubricate the pinion bearings with axle lubricant. Refer to **Fluid and Lubricant Recommendations (USA and Canada)** .
2. Install the pinion bearings into the axle housing.

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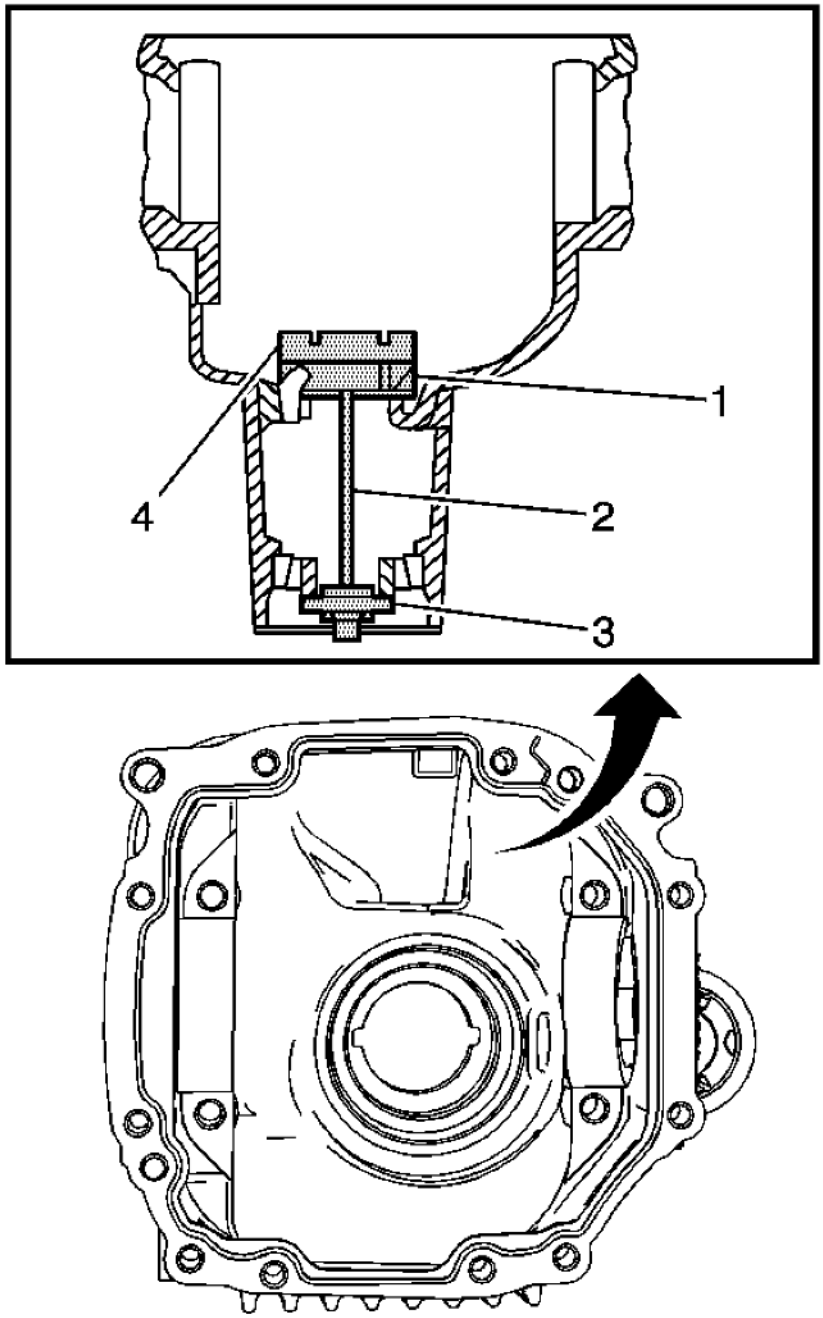


Fig. 47: Tools In Differential Carrier
Courtesy of GENERAL MOTORS CORP.

3. Position the following tools in the differential carrier.
   - For the 195 mm axle, use the J-21777-40 (1), the J-21777-43 (2), and the **DT 49911:** plate (4).

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- For the 218 mm axle, use the J-21777-8 (1), the J-21777-43 (2), the J-21777-42 (3), and the **DT 49911:** plate (4).

4. Using a torque wrench, tighten the nut on the J-21777-43 until the specified rotating torque is obtained.
   - For the 195 mm axle, 2.0-2.6 N.m (18-23 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings.
   - For the 218 mm axle, 2.1-3.1 N.m (19-27 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings.
5. Rotate the assembly several times in both directions in order to seat the pinion bearings and re-check the torque.
   - For the 195 mm axle, if the torque is less than 2.0 N.m (18 lb in) for NEW bearings or 1.0 N.m (9 lb in) for used bearings, tighten until a rotating torque of 2.0-2.6 N.m (18-23 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings is obtained.
   - For the 218 mm axle, if the torque is less than 2.1 N.m (19 lb in) for NEW bearings or 1.0 N.m (9 lb in) for used bearings, tighten until a rotating torque of 2.1-3.1 N.m (19-27 lb in) for NEW bearings or 1.0-2.3 N.m (9-20 lb in) for used bearings is obtained.

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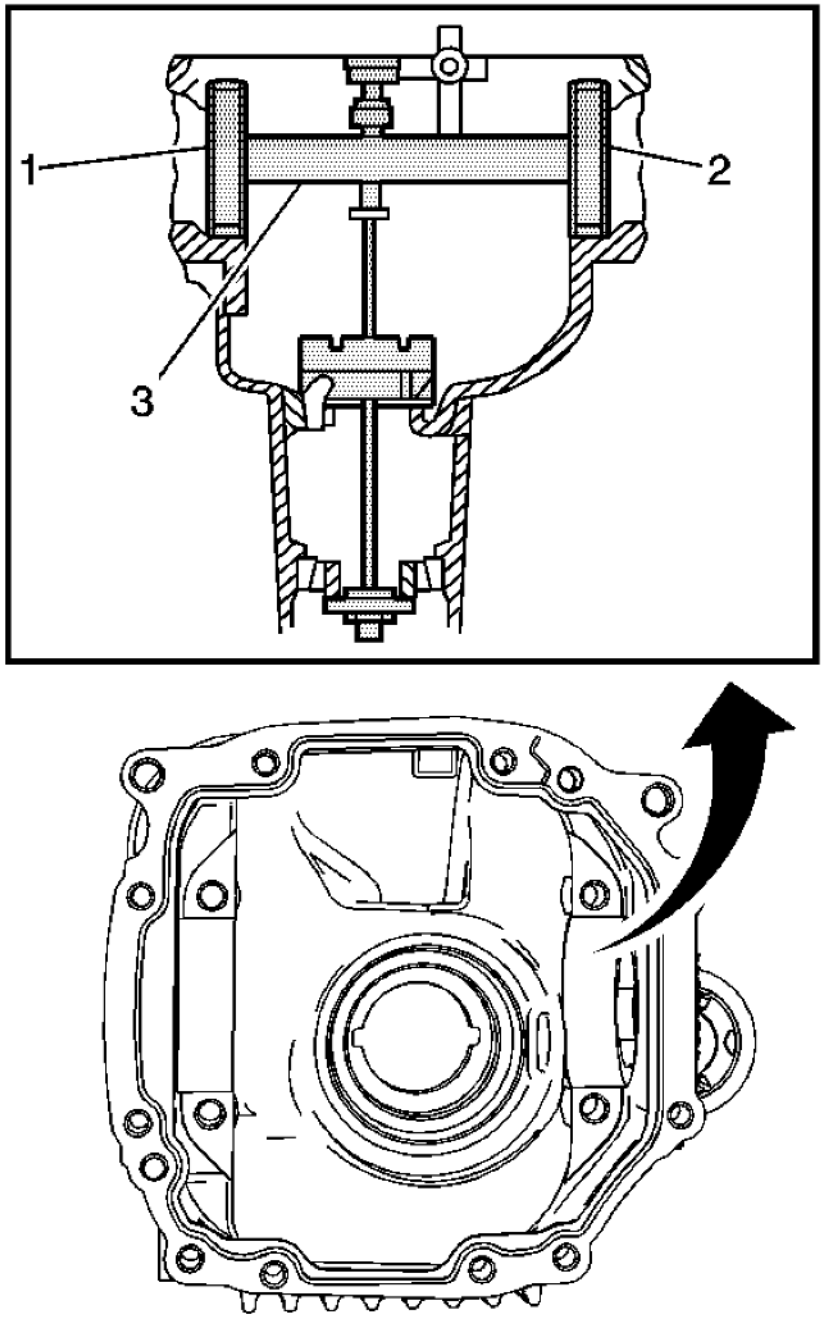


Fig. 48: Tools In Differential Carrier
Courtesy of GENERAL MOTORS CORP.

NOTE:

- **For the 195 mm axle, ensure that the smaller diameter of the J-21777-**

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45 (1-2) is facing outward toward the sides of the differential carrier.

- **Use the shorter (17 mm) step of the DT 49911 for the 195 mm axle. And the taller (29 mm) step for the 218 mm axle.**

6. Position the J-21777-45 (1-2) and the J-21777-1 (3) in the differential carrier and align the J-21777-1 (3) with the **DT 49911:** plate (2).

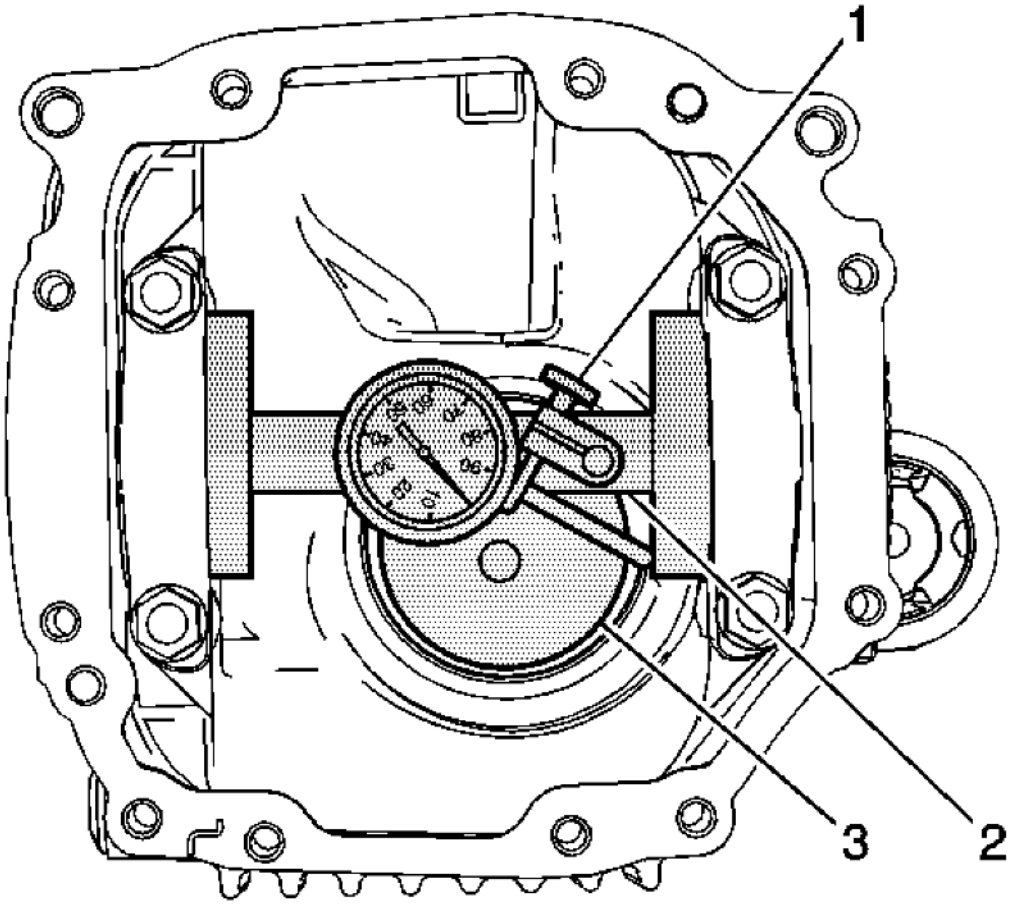


Fig. 49: Measuring Pinion Depth
Courtesy of GENERAL MOTORS CORP.

7. Using the **J-8001:** set (1) and set at zero, move the J-21777-1 (2) back and forth and recheck the zero setting. Readjust if needed.
8. Rotate the J-21777-1 (2) away from the **DT 49911:** plate (2) until it no longer touches the **DT 49911:** plate (2).

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9. The value indicated on the **J-8001:** set (1) is the thickness of the shim needed for the correct pinion depth.

NOTE: **Measure the shim to ensure that the shim is the correct thickness.**

10. Select the shim that is the proper thickness.
11. Remove the tools and pinion bearings.
12. Install the pinion shim between the pinion gear and the inner pinion bearing. Refer to **Differential Drive Pinion Gear Bearing Replacement**.

BACKLASH ADJUSTMENT

Special Tools

- **J 8001:** Dial Indicator Set
- **J 25025:** Guide Pins
- **J 25588:** Side Bearing Shim Installer

For equivalent regional tools, refer to **Special Tools**.

NOTE: **The following adjustment procedure applies to both left and right differential side bearings.**

1. Use the **J 25025:** pins and the **J 8001:** set to measure the axle backlash.
2. The difference between the backlash at all the measuring points should not vary by more than 0.005 (0.002 in).
3. If the difference between the backlash at all of the measuring points varies by more than 0.005 (0.002 in), inspect for the following conditions:
   - Burrs
   - A distorted case flange
   - Uneven bolting
4. If the difference between all the measuring points is within specifications, the backlash at the minimum lash point should be 0.08-0.25 mm (0.003-0.010 in) with a preferred backlash of 0.13-0.18 mm (0.005-0.007 in).
5. If the backlash is within specifications, proceed to step 25.
6. If the backlash is less then the specified value in step 5, proceed to step 14.

NOTE:

- **Use production shims and spacers when necessary.**
- **Adjust the thickness of the shim pack on each side of the differential in equal amounts. This will maintain the correct axle side bearing preload.**
- **Moving 0.05 mm (0.002 in) of shim thickness from one side of the differential to the other will change the backlash adjustment**

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approximately 0.03 mm (0.001 in)

- **Mark the bearing caps left and right**

7. Remove the bearing caps and the bolts.

NOTE: Mark the bearing cups and the shims left or right.

8. Remove the differential case assembly with the bearing caps and the shims.

NOTE: Measure each shim separately.

9. Measure the thickness of the left and right the shim packs in 3 locations.

NOTE: The combined average shim measurement is the thickness for the shim pack.

10. Calculate the average of the 3 measurements for each shim.
11. Assemble a new left side shim pack by decreasing the appropriate amount of thickness from the original right side shim pack. If the original shim is cast iron production shim, assemble the shim pack using a service spacer and service shim. For example, to increase the backlash by 0.05 mm (0.002 in), remove 0.10 mm (0.004 in) of thickness to the left side shim pack.

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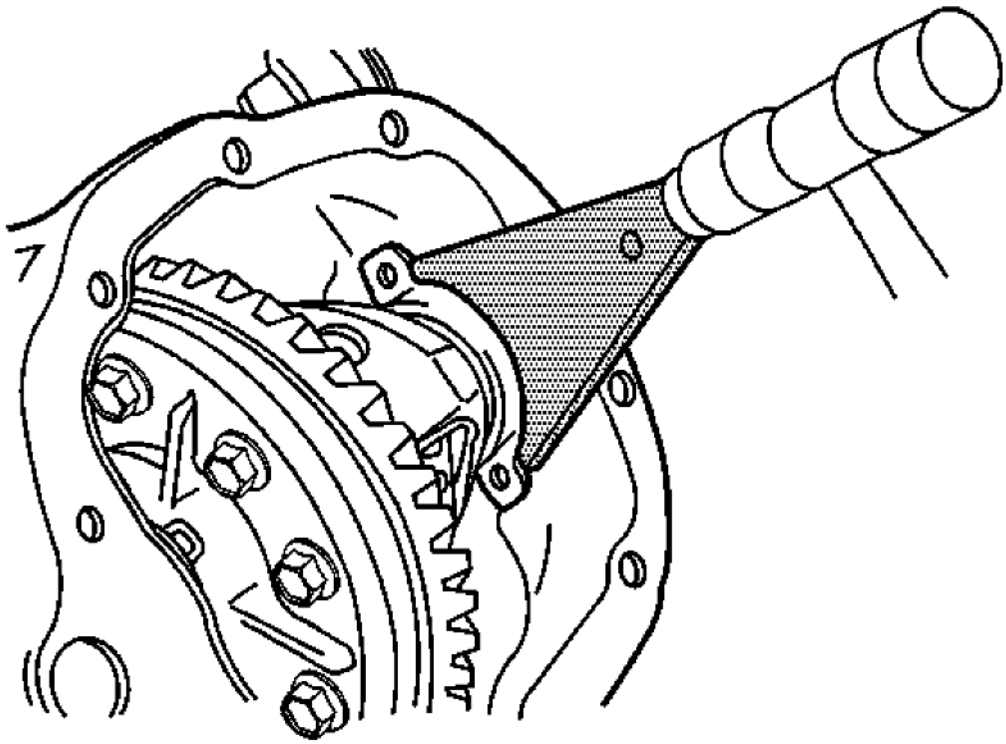


Fig. 50: Installing Service Shim
Courtesy of GENERAL MOTORS CORP.

NOTE: The service shim must be installed between the service spacer and the differential bearing cup.

12. Using the **J 25588:** installer, install service shim if necessary.

CAUTION: Refer to Fastener Caution .

13. Install the bearing caps and bolts and tighten the bolts to 63 N.m (46 lb ft).
14. Recheck the backlash and adjust, if necessary.
15. Once backlash is correct, perform a gear tooth contact pattern check in order to ensure proper alignment between the ring and pinion gears. Refer to **Gear Tooth Contact Pattern Inspection**.

GEAR TOOTH CONTACT PATTERN INSPECTION

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The gear contact pattern check is not a substitute for adjusting the pinion depth and backlash. Use this method in order to verify the correct running position of the ring gear and the drive pinion. Gear sets which are not positioned properly may be noisy and/or have a short life span. A pattern check ensures that when best contact has been obtained between the ring gear and the drive pinion, the system will produce low noise and have a long life.

Drive Pinion and Ring Gear Identification

Production drive pinion and ring gears are manufactured by using a 2-cut or a 5-cut method. The 2-cut drive pinions and ring gears can be identified by having a groove cut into the outside edge of the ring gear and a ring on the stem of the drive pinion. The gear tooth contact patterns that are produced from each style of gear set differ slightly. A 2-cut gear will produce a pattern that is bias from the toe to the heel of the tooth (drive side), while a 5-cut gear set will produce a square pattern from the toe to the heel of the tooth (drive side). When diagnosing the gear tooth contact pattern, regardless of what type of gear set it is, a correct pattern will be centered within the area of the tooth, from toe to heel and from top to bottom.

Gear Tooth Nomenclature

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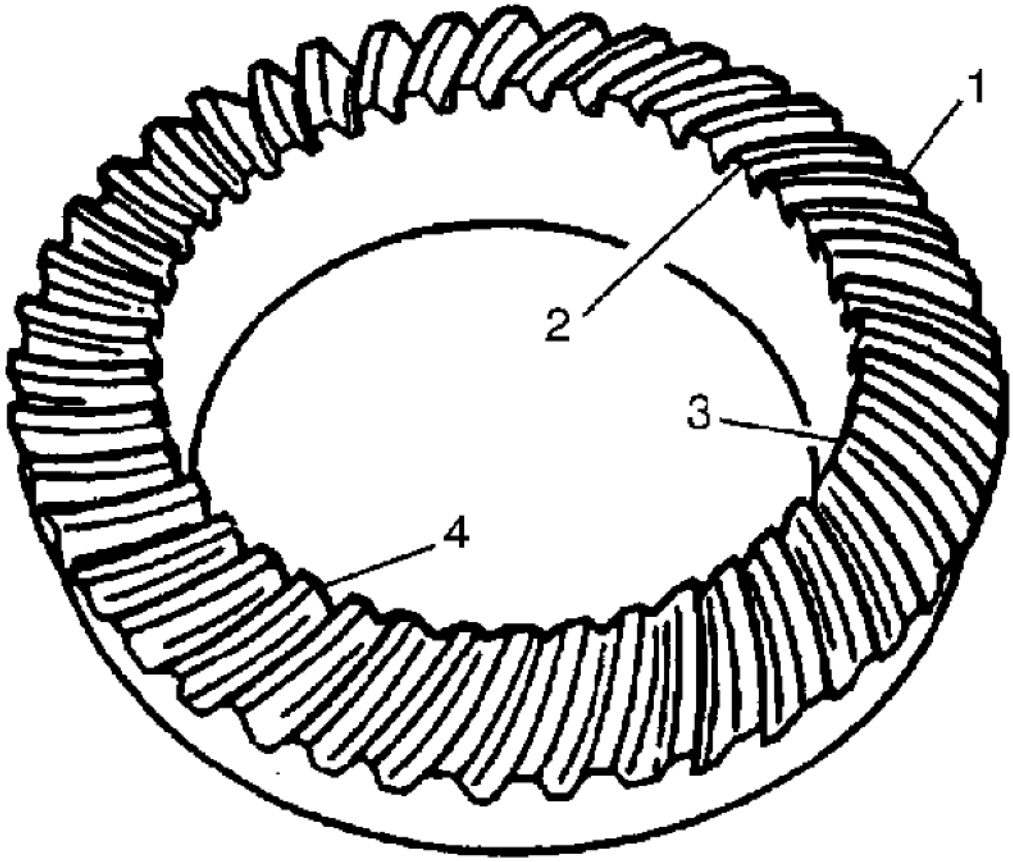


Fig. 51: Defining Gear Tooth Nomenclature
Courtesy of GENERAL MOTORS CORP.

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

Adjustments Affecting Tooth Contact

The following 2 adjustments affect the tooth contact pattern:

- Backlash adjustment
- Pinion depth adjustment

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

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Backlash Adjustment

The backlash can be adjusted by either varying the thickness of the side bearing shims from side to side or by moving the adjuster sleeve(s) in or out, or both. By adjusting the shim thickness or moving the adjuster sleeve (s), the case and ring gear assembly will move closer to or further away from the pinion. In most cases, adjusting the backlash will correct an abnormal contact pattern. This adjustment will also be used to set the side bearing preload.

- If the thickness of the right shim is increased or the adjuster sleeve is moved in (if applicable), along with an equal decrease in the thickness of the left shim or the adjuster sleeve is moved out (if applicable), the backlash will increase.
- If the thickness of the left shim is increased or the adjuster sleeve is moved in (if applicable), along with an equal decrease in the thickness of the right shim or the adjuster sleeve is moved out (if applicable), the backlash will decrease.

Pinion Depth Adjustment

Adjust the position of the pinion by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. Decreasing the distance moves the pinion closer to the centerline of the ring gear. Increasing the distance moves the pinion farther away from the centerline of the ring gear.

Testing Procedure

1. Wipe clean the differential case, the ring gear and the axle housing of lubricant. Carefully clean each tooth of the ring gear.

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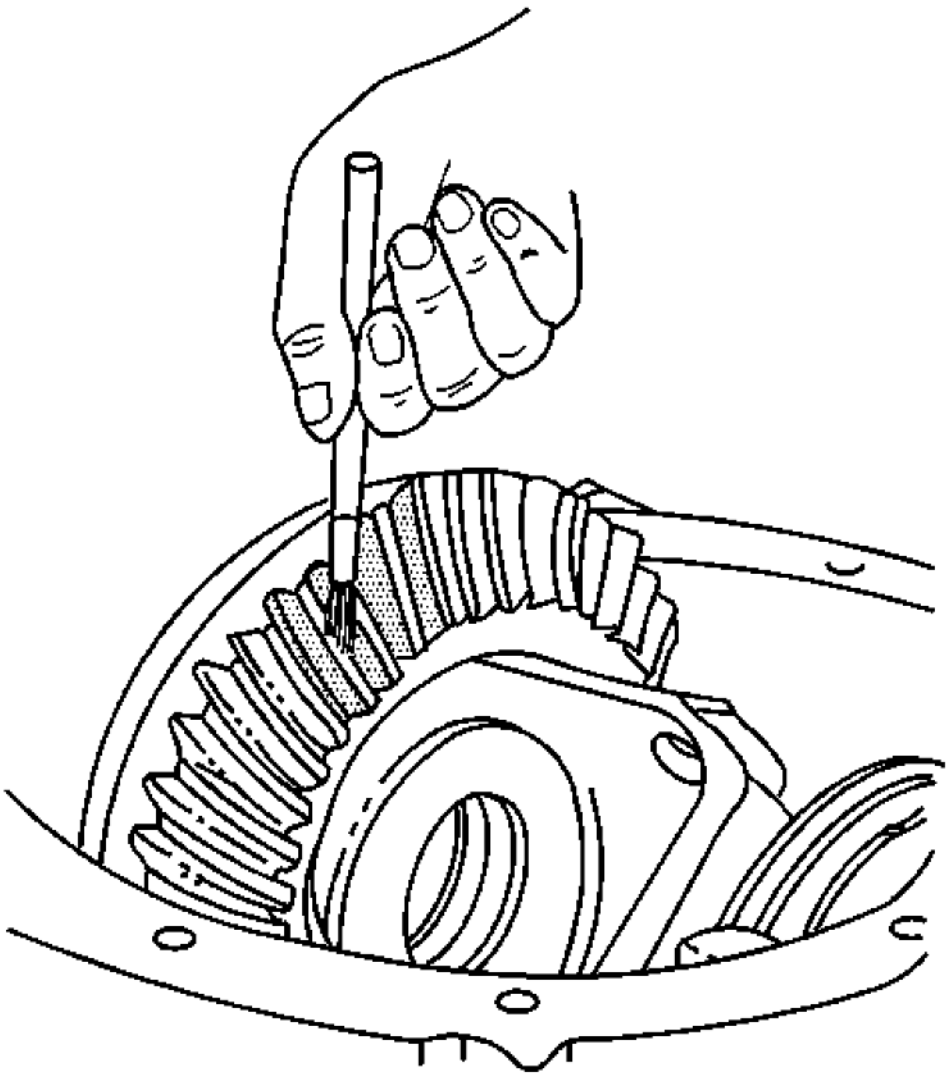


Fig. 52: Applying Gear Marking Compound To Ring Gear Teeth
Courtesy of GENERAL MOTORS CORP.

2. Use a medium stiff brush in order to sparingly apply gear marking compound, GM P/N 1052351 (Canadian P/N 10953497) or equivalent, to all of the ring gear teeth.
3. Torque the bearing caps bolts to specification.

IMPORTANT: Performing a test without loading the gears will not produce a satisfactory pattern.

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4. Apply the park brake until a torque load of 14 N.m (10 lb ft) is required in order to turn the pinion.

IMPORTANT: Avoid turning the ring gear excessively.

5. Using a wrench, turn the drive pinion flange/yoke so that the ring gear rotates 3 full revolutions.
6. Turn the drive pinion flange/yoke in the opposite direction so that the ring gear rotates 3 full revolutions in the opposite direction.
7. Observe the pattern on the ring gear teeth. Compare the pattern with the following illustrations.

Correct Contact Pattern

Condition

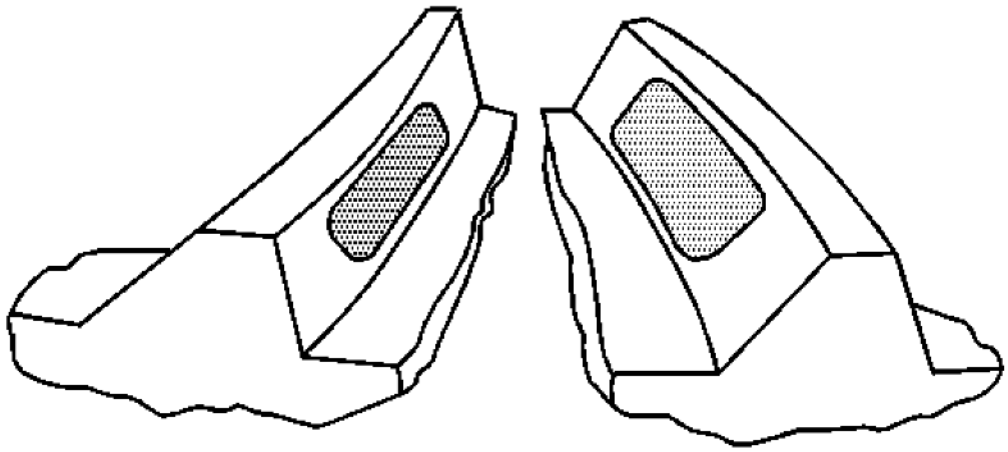


Fig. 53: Identifying Correct Gear Tooth Contact Pattern
Courtesy of GENERAL MOTORS CORP.

The backlash and pinion depth is correct.

Correction

None required.

Service Hints

Loose bearings on the drive pinion or in the differential case may cause patterns that vary. If the contact pattern varies, inspect the following preload settings:

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- Total assembly
- Differential case
- Pinion

If these settings are correct, inspect for damage or incorrectly assembled parts.

Drive Side Heel - Coast Side Toe Contact Pattern

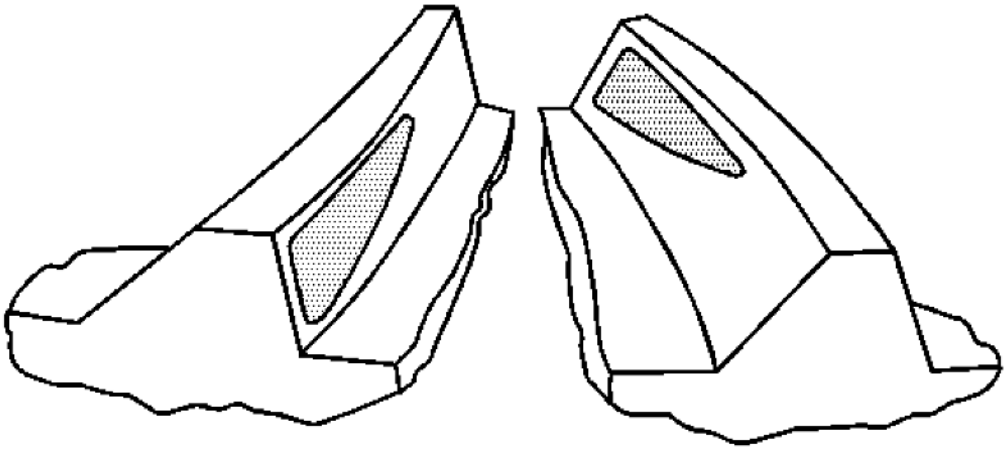


Fig. 54: Identifying Drive Side Heel - Coast Side Toe Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The backlash is incorrect. The ring gear is too far away from the pinion.

Correction

Decrease the backlash. Move the ring gear closer to the pinion by adjusting the side bearing shim thickness or the adjuster sleeve(s). Refer to **Backlash Adjustment**.

Drive Side Toe - Coast Side Heel Contact Pattern

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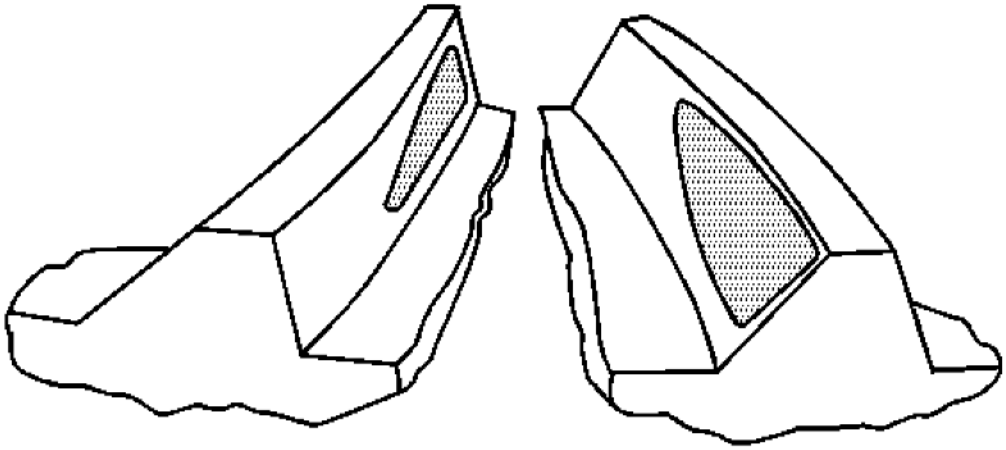


Fig. 55: Identifying Drive Side Toe - Coast Side Heel Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The backlash is incorrect. The ring gear is too close to the drive pinion.

Correction

Increase the backlash. Move the ring gear away from the pinion by adjusting the side bearing shim thickness or the adjuster sleeve(s). Refer to **Backlash Adjustment**.

Drive Side Heel - Coast Side Heel Contact Pattern

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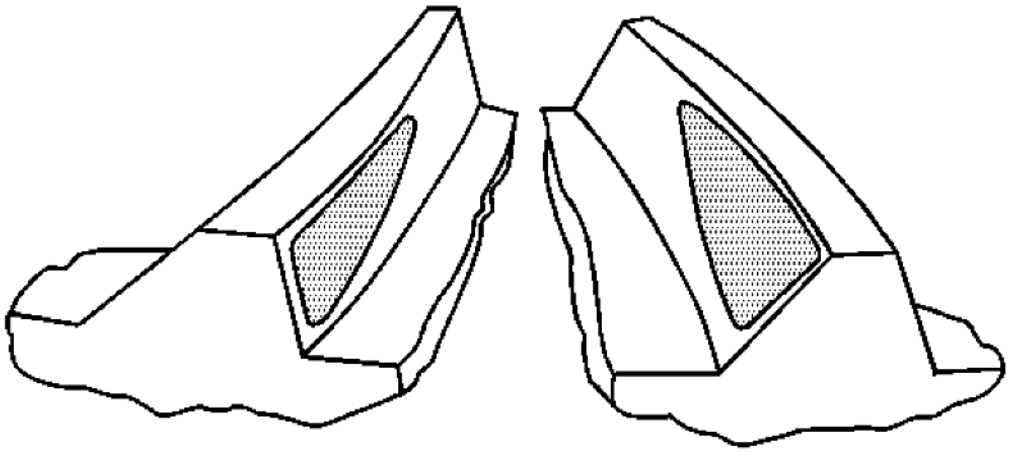


Fig. 56: Identifying Drive Side Heel - Coast Side Heel Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The backlash is incorrect. The ring gear is too far away from the pinion.

Correction

Decrease the backlash. Move the ring gear closer to the pinion by adjusting the side bearing shim thickness or the adjuster sleeve(s). Refer to **Backlash Adjustment**.

Drive Side Toe - Coast Side Toe Contact Pattern

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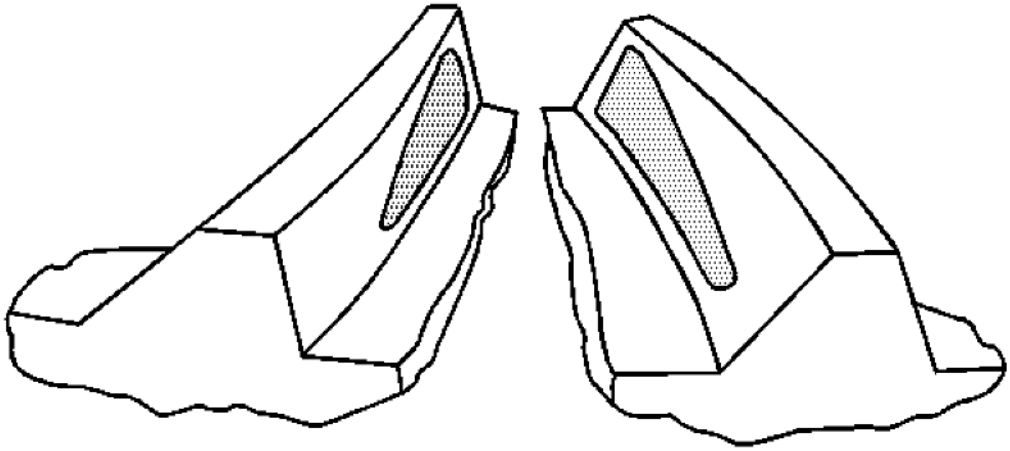


Fig. 57: Identifying Drive Side Toe - Coast Side Toe Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The backlash is incorrect. The ring gear is too close to the drive pinion.

Correction

Increase the backlash. Move the ring gear away from the pinion by adjusting the side bearing shim thickness or the adjuster sleeve(s). Refer to **Backlash Adjustment**.

High Flank Contact Pattern

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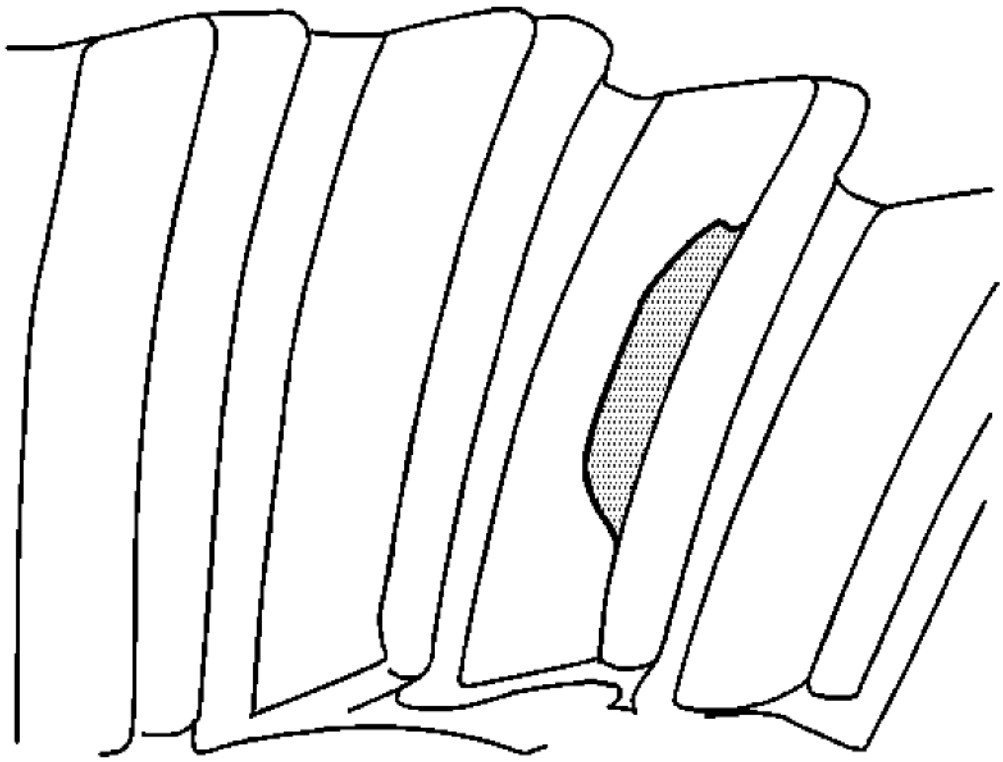


Fig. 58: Identifying High Flank Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The pinion depth is incorrect. The pinion gear is too far away from the ring gear.

Correction

Increase the pinion depth. Move the pinion gear closer to the ring gear by increasing the pinion shim thickness. Refer to **Pinion Depth Adjustment**.

Low Flank Contact Pattern

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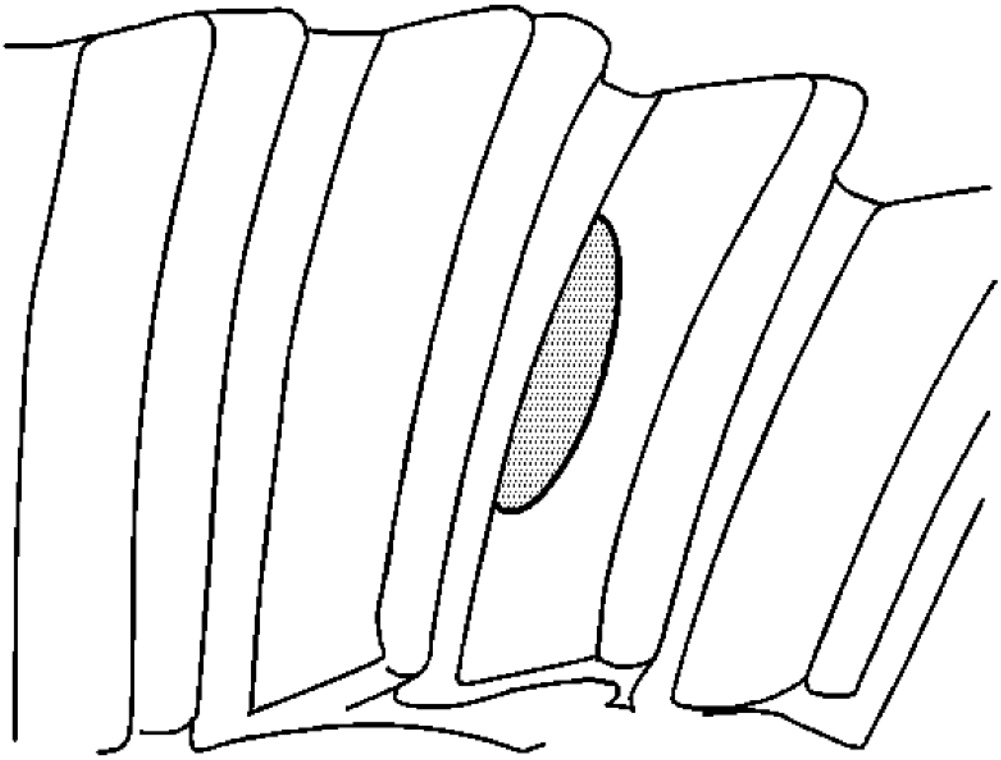


Fig. 59: Identifying Low Flank Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

The pinion depth is incorrect. The pinion gear is too close to the ring gear.

Correction

Decrease the pinion depth. Move the pinion gear away from the ring gear by decreasing the pinion shim thickness. Refer to **Pinion Depth Adjustment**.

LIMITED SLIP DIFFERENTIAL DISASSEMBLE

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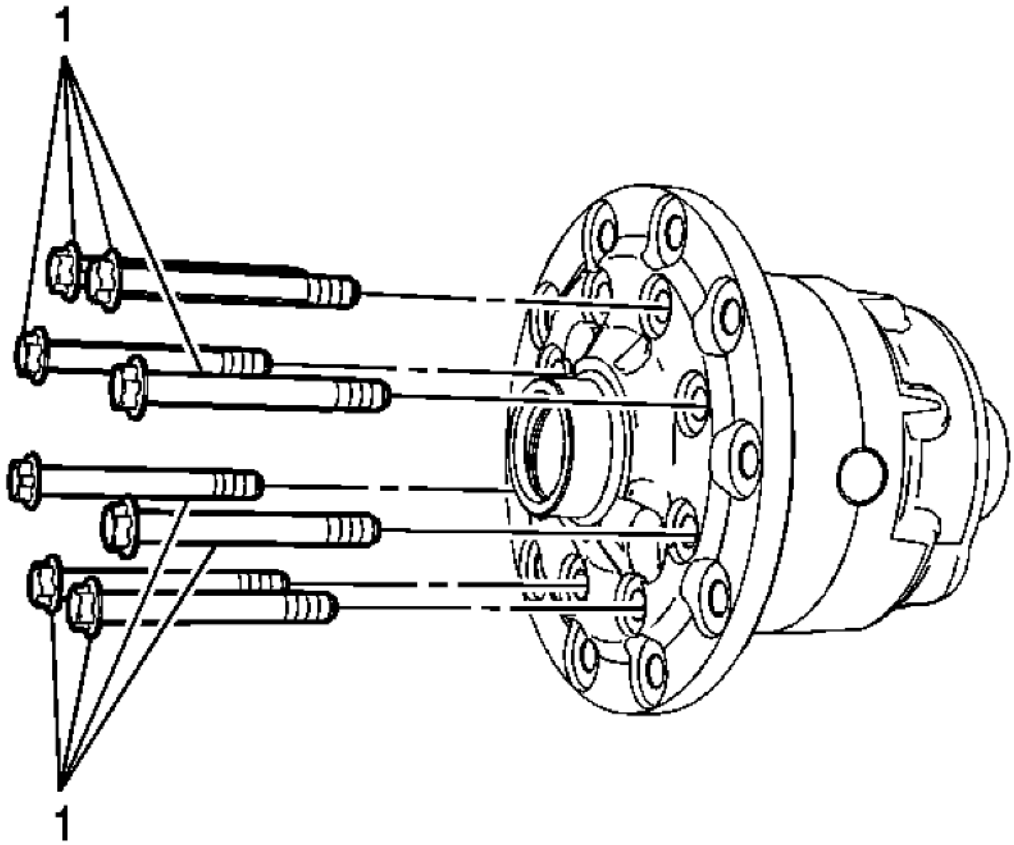


Fig. 60: Differential Case Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the differential case bolts (1).

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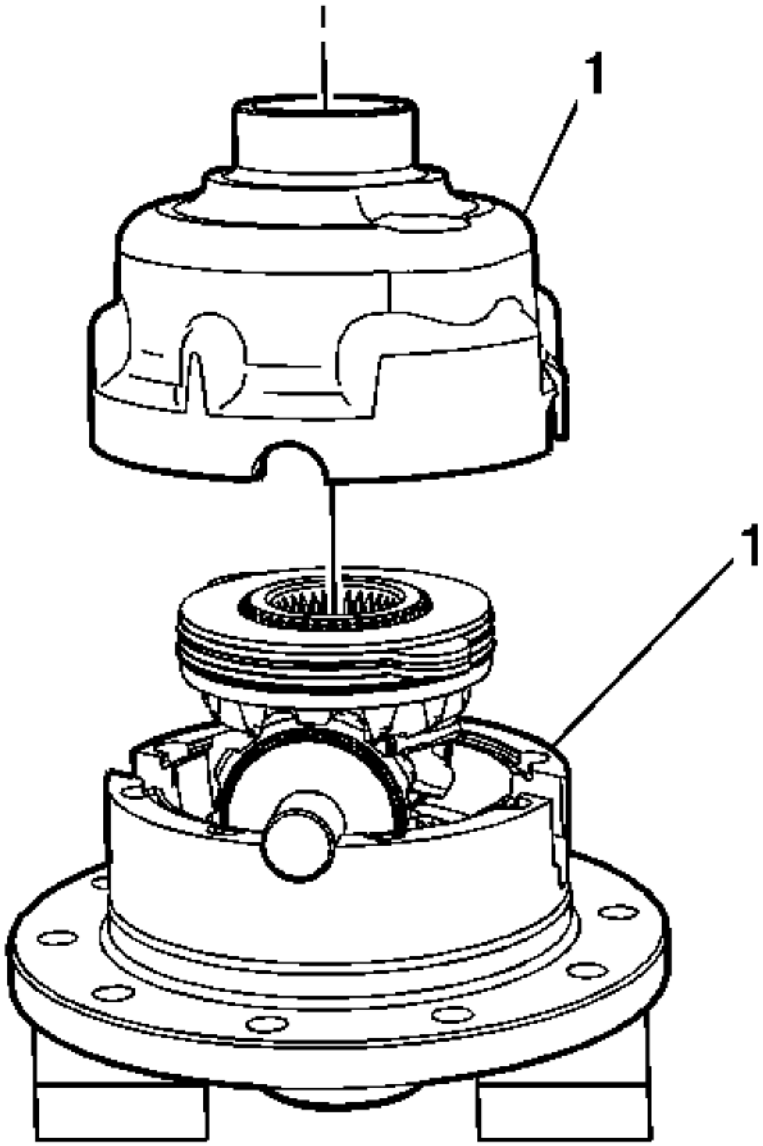


Fig. 61: Differential Case Halves
Courtesy of GENERAL MOTORS CORP.

2. Separate the differential case halves (1).

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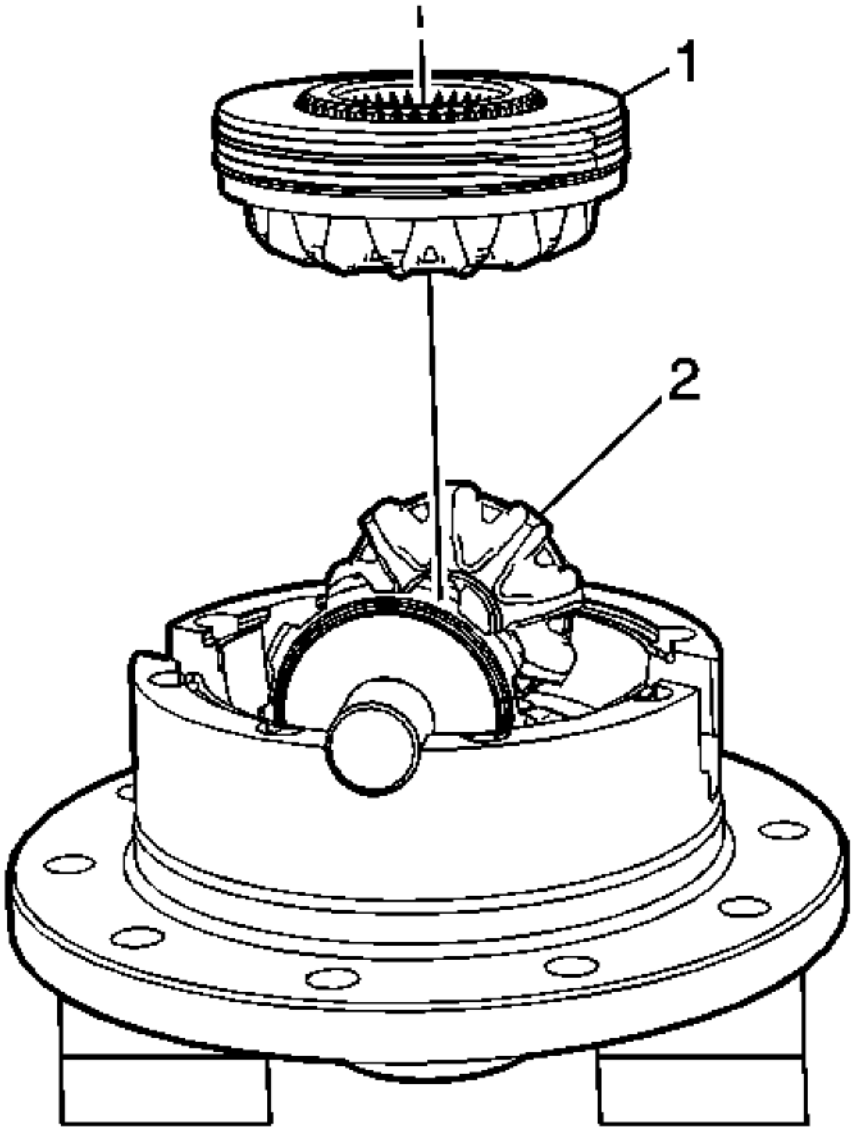


Fig. 62: Side Gear Assembly & Differential Case Halve
Courtesy of GENERAL MOTORS CORP.

3. Remove the side gear assembly (1) from the differential case halve (2).

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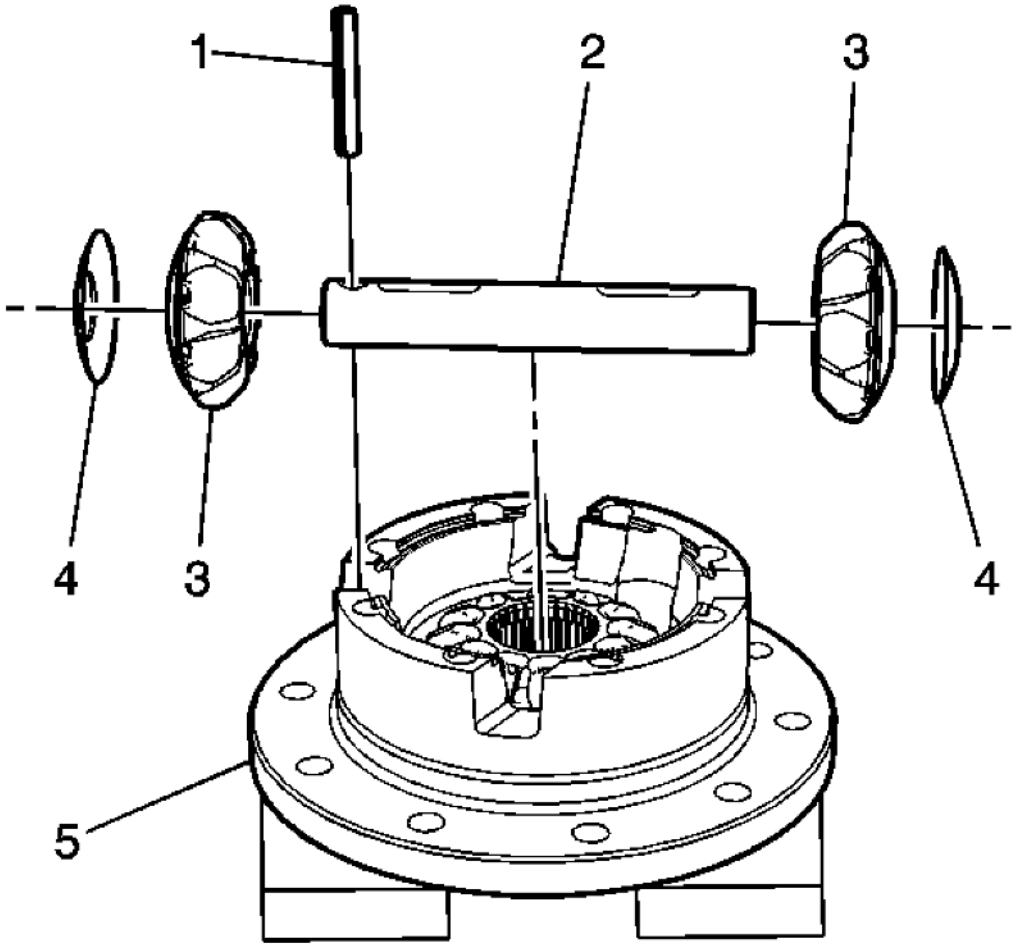


Fig. 63: Lock Pin, Thrust Washers, Pinion Gears & Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

4. Remove the lock pin (1), thrust washers (4), pinion gears (3) and the pinion shaft (2).

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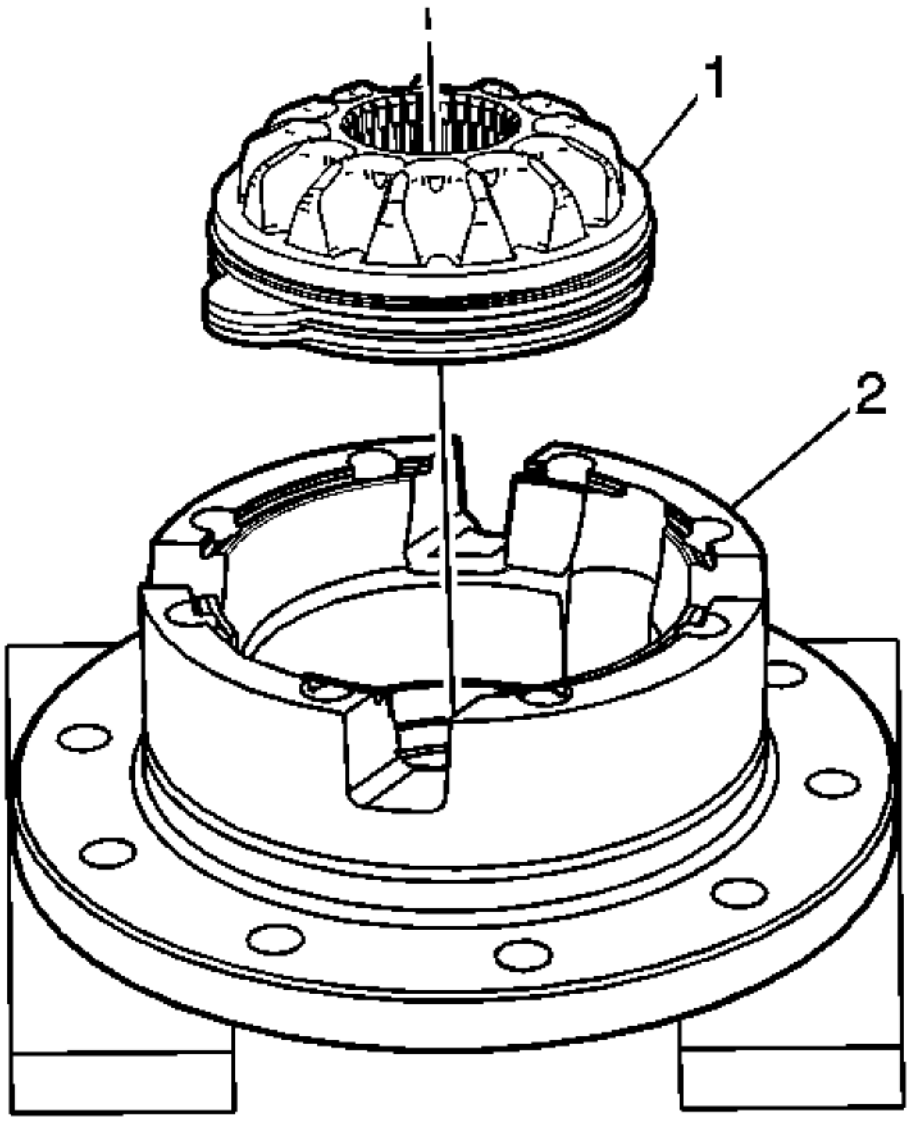


Fig. 64: Left Side Gear Assembly & Left Differential Case
Courtesy of GENERAL MOTORS CORP.

5. Remove the left side gear assembly (1) from the left differential case (2).

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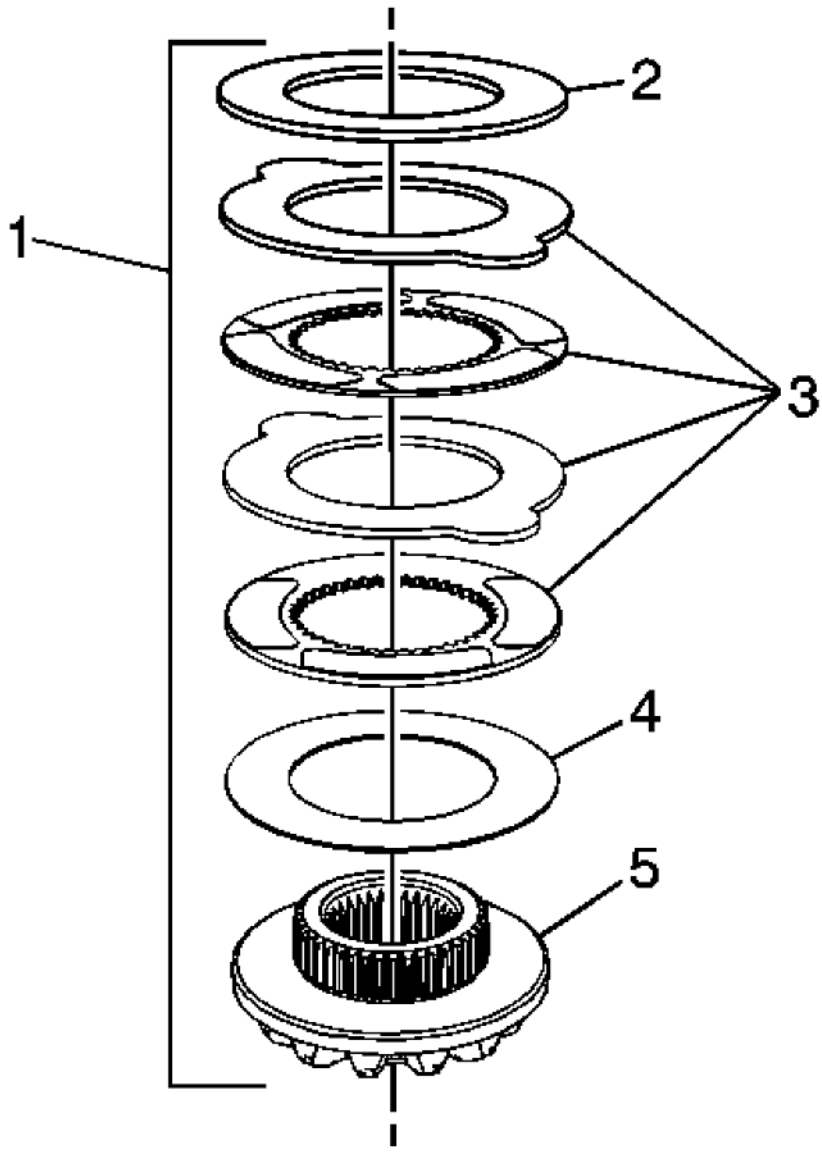


Fig. 65: Washer, Clutch Pack & Spring Washer
Courtesy of GENERAL MOTORS CORP.

NOTE: Clutch disc and plates develop wear patterns. Keep the components in the order in which they were removed.

6. Remove the washer (2), clutch pack (3) and the spring washer (4) from the side gear (5).

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LIMITED SLIP DIFFERENTIAL CLEANING AND INSPECTION

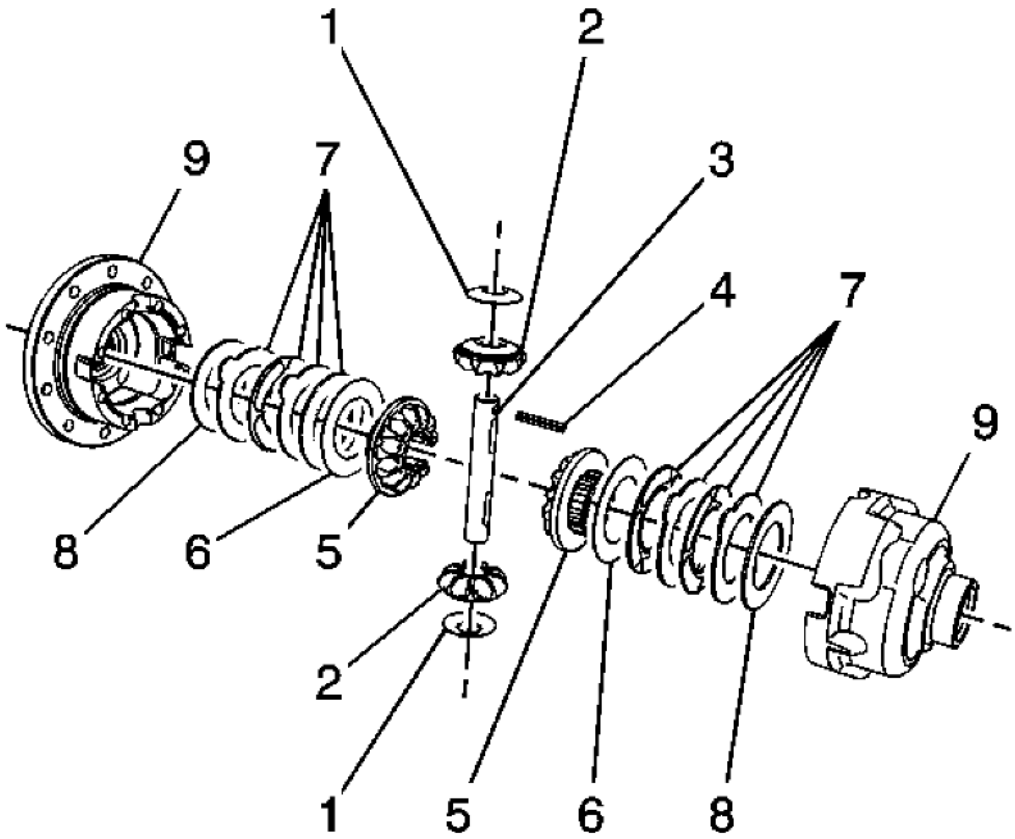


Fig. 66: Limited Slip Differential Components
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Safety Glasses Warning .

1. Clean all parts with an approved solvent.
2. Visually inspect all the parts for excessive wear or breakage. Replace the parts if necessary.
3. Inspect the differential pinion gears (2) and the side gears (5) for any of the following conditions:
   - Wear
   - Cracks
   - Scoring
   - Spalling

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4. Inspect the pinion gear shaft (1).
5. Inspect the pinon gear thrust washers (1).
6. Inspect the pinion shaft lock pin (4).
7. Inspect the differential clutch disc packs (7).
8. Inspect the differential clutch disc thrust washers (8).
9. Inspect the differential thrust washers for wear (6).
10. Inspect the differential case (9) for cracks and scoring.
11. Replace the differential assembly if there is damage to the differential carrier case.

LIMITED SLIP DIFFERENTIAL ASSEMBLE

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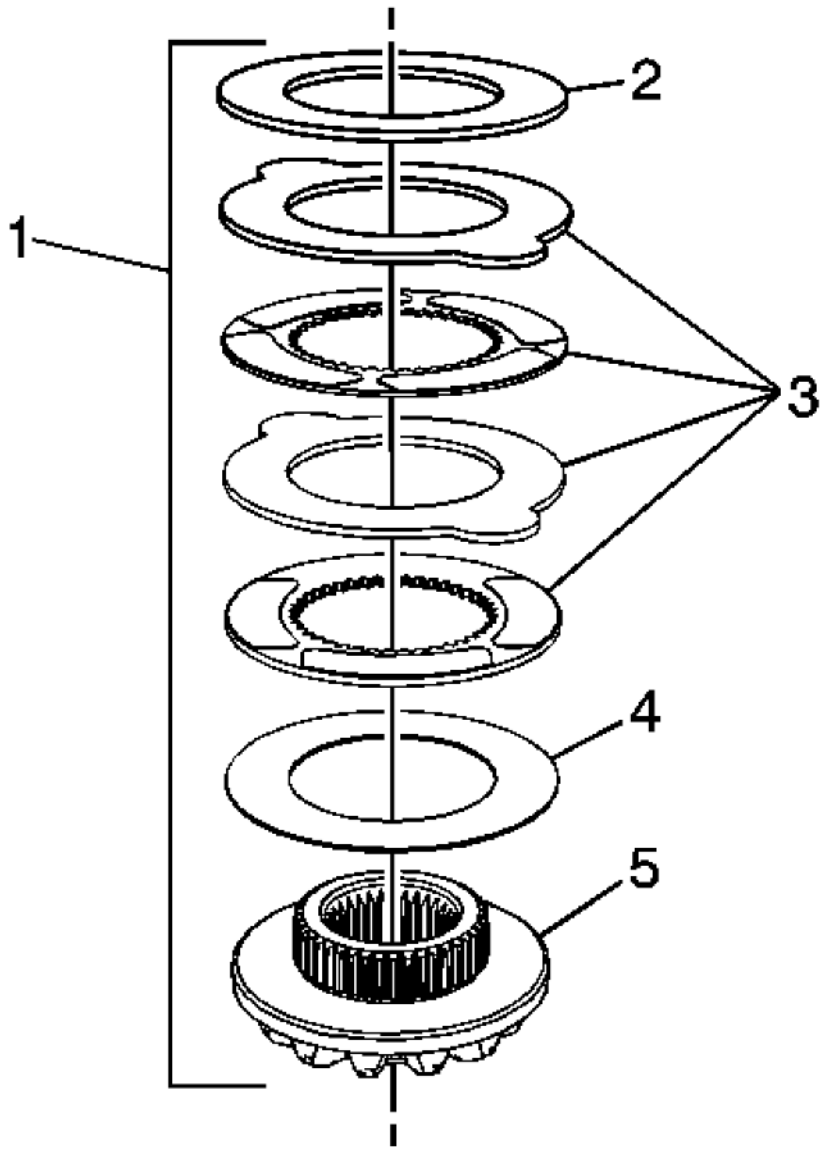


Fig. 67: Washer, Clutch Pack & Spring Washer
Courtesy of GENERAL MOTORS CORP.

1. Install the clutch disc thrust washers (4) on the pinion side gears with the bevel facing out.
2. Install the clutch pack (3) on the side gear (5).
3. Install the spacer (2) on the side gear (5).

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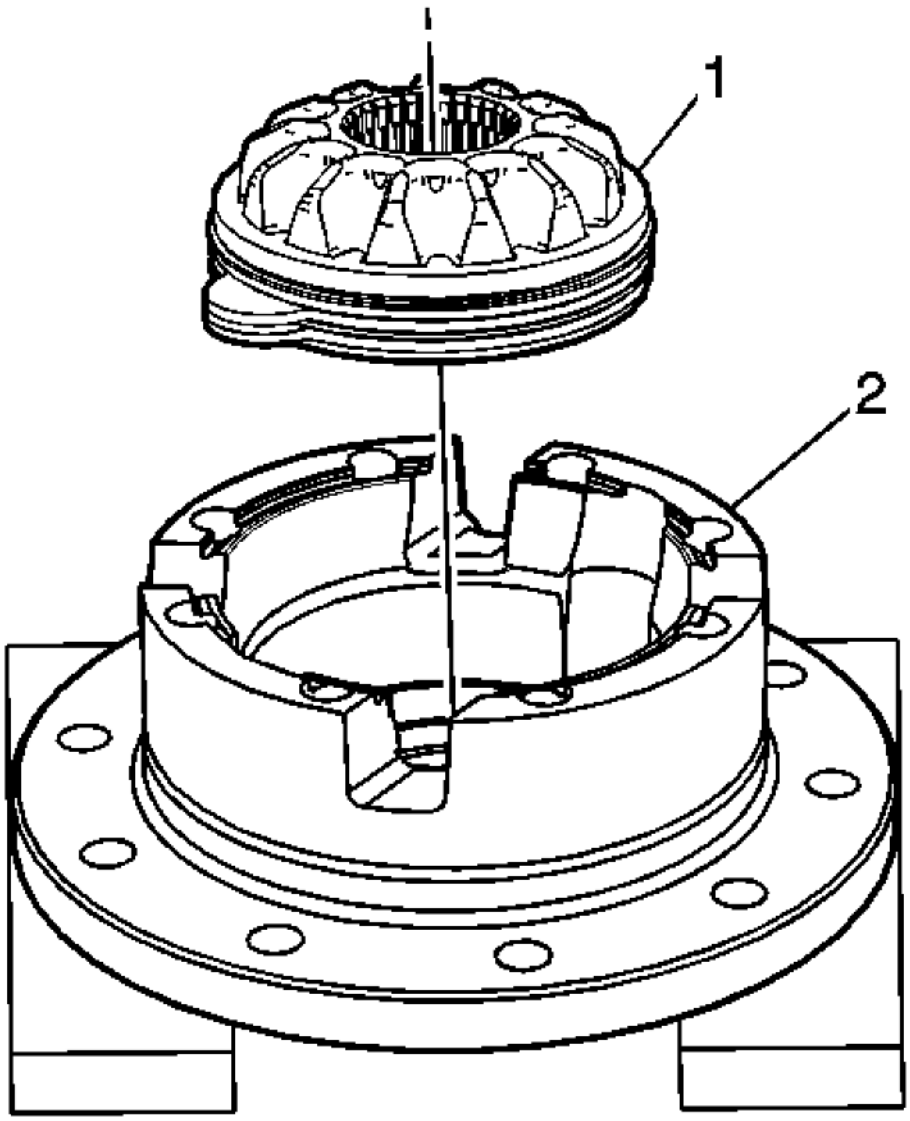


Fig. 68: Left Side Gear Assembly & Left Differential Case
Courtesy of GENERAL MOTORS CORP.

4. Install the side gear assembly (1) in the differential case (2).

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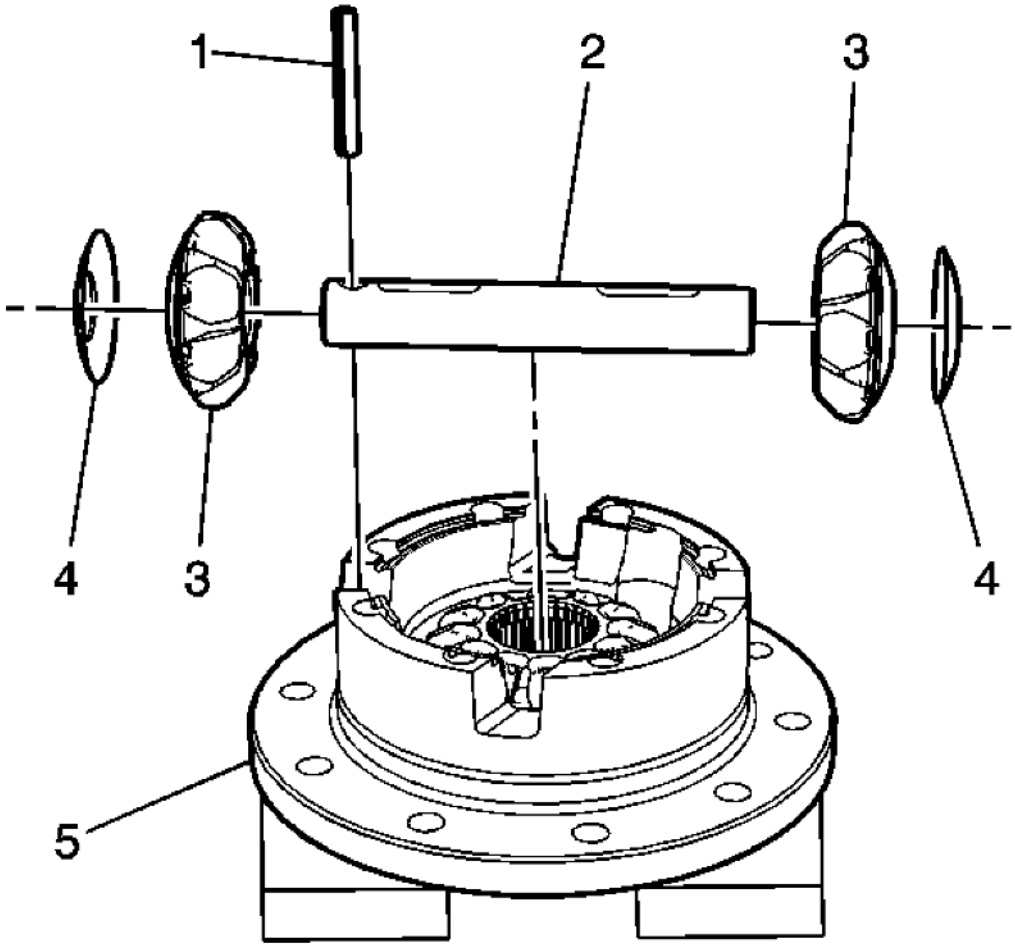


Fig. 69: Lock Pin, Thrust Washers, Pinion Gears & Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

5. Install the thrust washers (4), pinion gears (3), pinion shaft (2), and the lock pin (1) in the differential housing (5).

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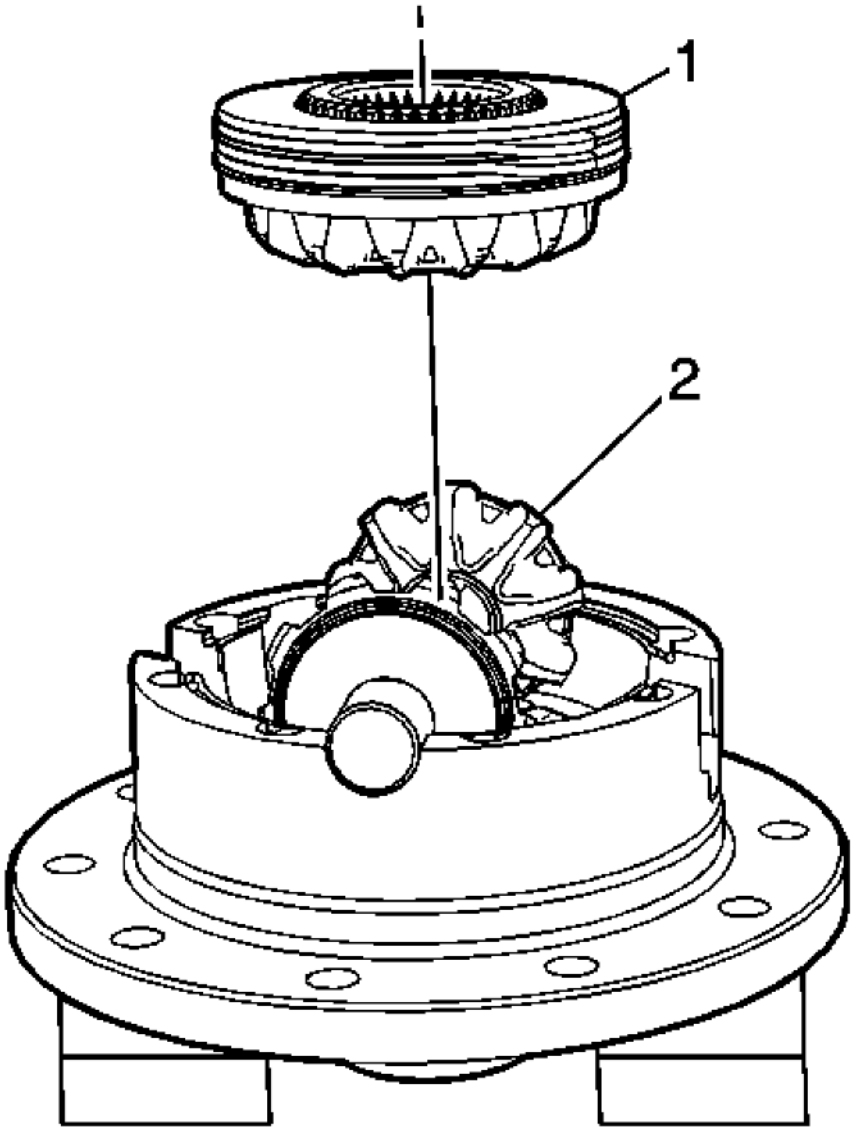


Fig. 70: Side Gear Assembly & Differential Case Halve
Courtesy of GENERAL MOTORS CORP.

6. Position the side gear assembly (1) on the pinion gear assembly (2).

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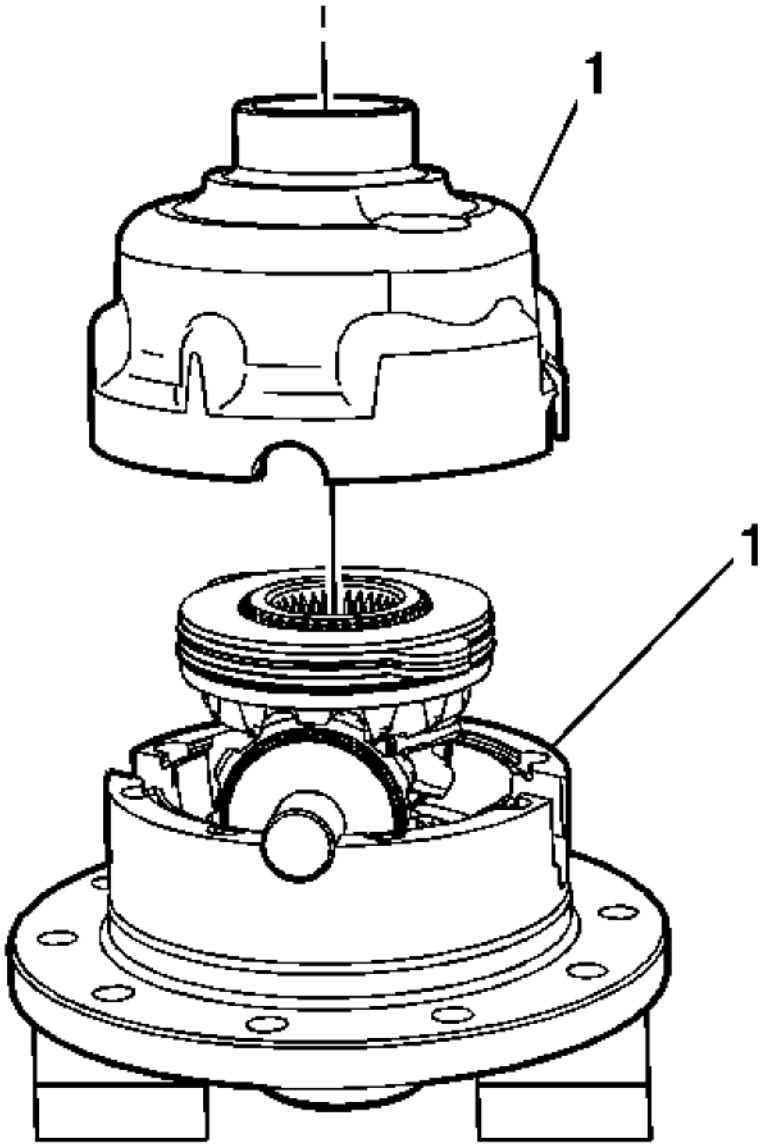


Fig. 71: Differential Case Halves
Courtesy of GENERAL MOTORS CORP.

7. Install the differential case halves (1).

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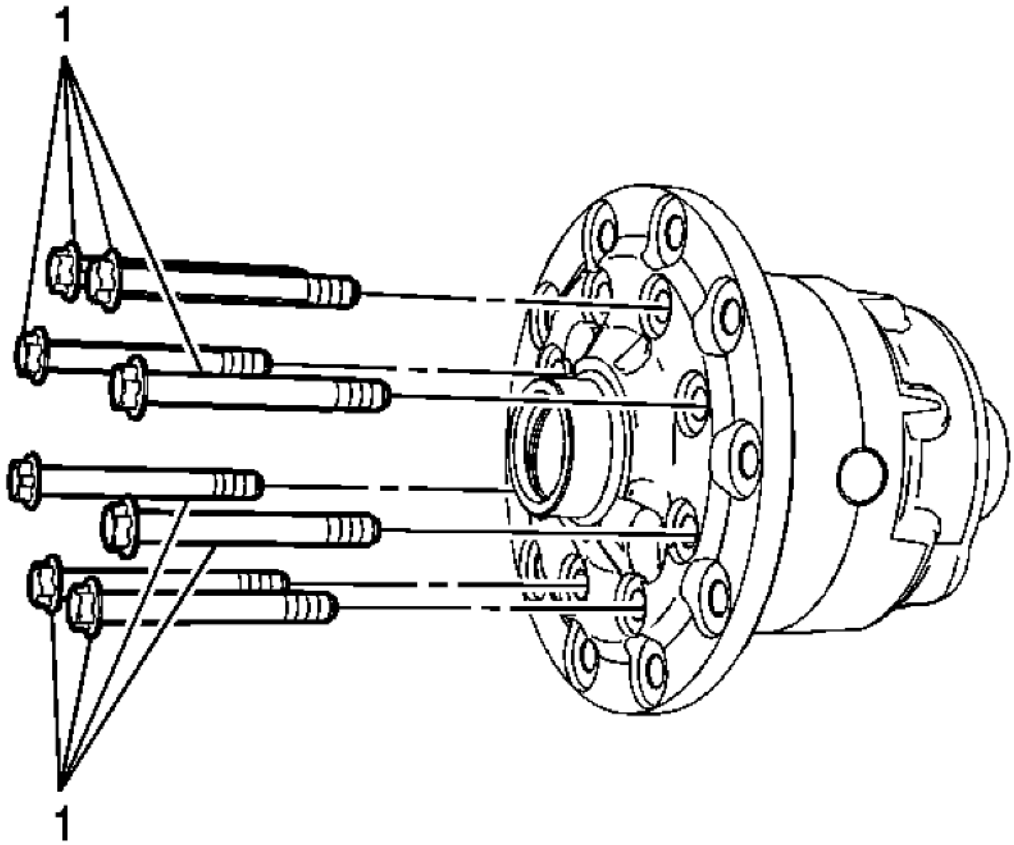


Fig. 72: Differential Case Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Start the differential case bolts by hand and tighten in an alternating sequence.

8. Install the differential case bolts in and tighten in sequence to 74 N.m (55 lb ft).

DESCRIPTION AND OPERATION

REAR DRIVE AXLE DESCRIPTION AND OPERATION

The rear axle for this vehicle consist of the following components:

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- Aluminum Differential Carrier Housing
- Differential Case Assembly (Open or Locking)
- Ring Gear and Drive Pinion Shaft
- Fill Plug
- Drain Plug

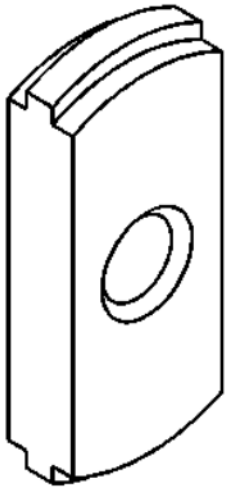
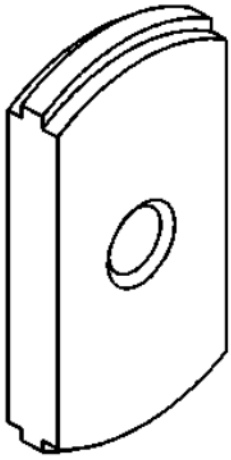
The rear axle receives power from the propeller shaft and transfers it to the drive pinion through the universal joint and the pinion yoke, which is attached to the drive pinion. The drive pinion transfers the power to the ring gear which is splined to the drive pinion at a 90 degree angle. The ring gear is attached to the differential case which contains four gears inside of it. Two of the gear are side gears and two are pinion gears. Each side gear is splined to an axle shaft so each axle shaft turns when it's side gear rotates. The pinion gears are mounted on a differential pinion shaft, and the pinion gears are free to rotate on this shaft. The pinion shaft is fitted into a bore in the differential case and is at right angles to the axle shafts. Power is transmitted through the differential as follows: the drive pinion rotates the ring gear. The ring gear rotates the differential case. The ring gear, as it rotates with the differential case, forces the pinion gears against the side gears. The side gears rotate the axle shafts to which the wheels are attached to. When both wheels have an equal amount of traction, the pinion gears do not rotate on the pinion shaft because of input force on the pinion gears is equally divided between the two side gears. Therefore, the pinion gears revolve with the pinion shaft, but do not rotate around the shaft itself. The addition of the two pinion gears and the two side gears are needed to allow the wheel drive shafts to turn at different speeds. When the vehicle turns a corner, the inner wheel turns slower than the outer wheel. The amount slower the inner wheel spins is equal to the same amount the outer wheel spins faster, as compared to the straight line speed. When this happens, the pinion gears rotate around the pinion shaft and allow the wheels to spin at different speeds.

SPECIAL TOOLS AND EQUIPMENT

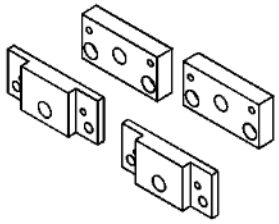
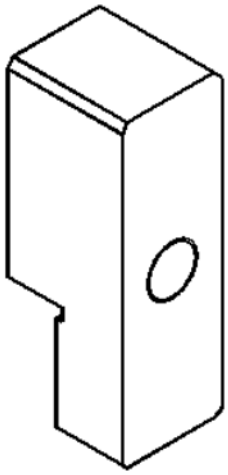
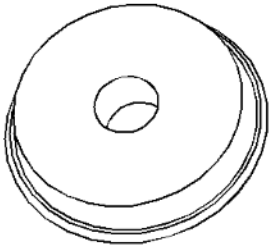
SPECIAL TOOLS

Illustration	Tool Number/Description
	DT 49905 Inner Pinion Bearing Cup Remover 195 mm Axle

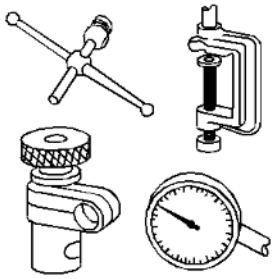
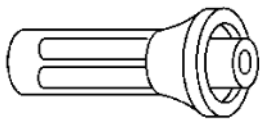
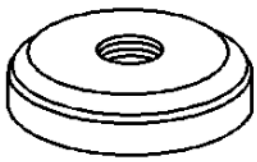
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	DT 49906 Inner Pinion Bearing Cup Remover 218 mm Axle
	DT 49909 Adapters 195/218 mm Axles

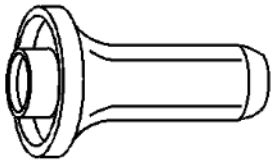
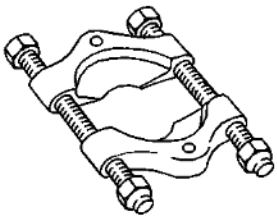
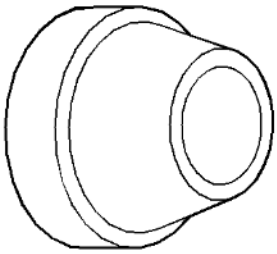
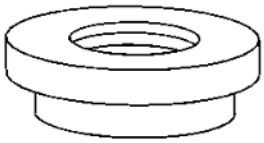
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	DT 49911 Pinion Bearing Gauge
	J 7817 Outer Pinion Bearing Installer
	J 8001 Dial Indicator Set

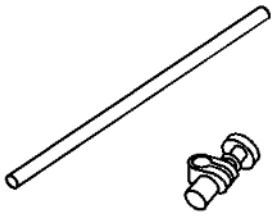
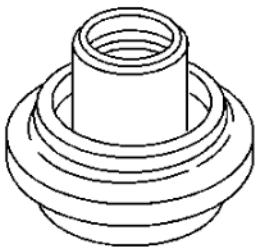
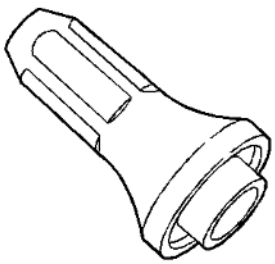
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	J 8092 Driver Handle
	J 21128 Axle Pinion oil Seal Installer
	J 22306 Inner Pinion Race Installer
	J 22388 Seal Installer

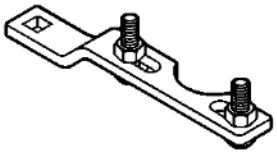
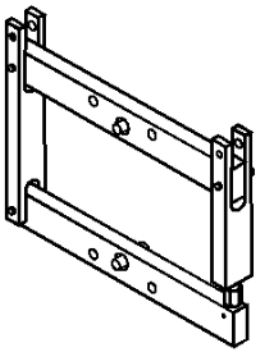
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	J 22888-D Side Bearing Remover Kit
	J 22912-B Split Plate Bearing Puller
	J 25299 Side Bearing Installer
	J 29609 Rear Pinion Bearing cup Installer

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	J 34178 Spreader Gauge Adapter
	J 34925 Pinion Setting Gauge and Components
	J 37758 Outer Pinion Race Installer
	J 38694 Extension Housing Oil Pump/Seal Installer

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	J 39441 Inner Pinion Bearing Installer
	J 45012 Holder Fixture
	J 45019 Flange and Pinion Cage Remover
	J 45222 Axle Housing Spreader

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2010 DRIVELINE/AXLE

Wheel Drive Shafts - Camaro

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Rear Wheel Drive Shaft Nut (New)	270 N.m	199 lb ft

DIAGNOSTIC INFORMATION AND PROCEDURES

CLUNK WHEN ACCELERATING FROM COAST

A clunk noise when accelerating from coast or a standing start may be caused by a worn or damaged constant velocity joint. The common cause of constant velocity joint damage is the loss of lubricating grease and/or the presence of foreign material and contaminates in the constant velocity joint. This usually occurs as a result of a torn or damaged constant velocity joint boot.

Carefully inspect the constant velocity joint boot for cuts, tears or other signs of damage that may allow the loss of the lubricating grease and/or the entry of contaminates. If there is no damage to the constant velocity joint boots, remove the wheel drive shaft from the vehicle and inspect the constant velocity joints. Rotate the constant velocity joints in a circular motion. Do not allow the constant velocity joint inner races to become disengaged from the outer race housings, or damage to the constant velocity joints will occur. The movement of the constant velocity joints should be smooth and even. If any binding or impeded motion is felt, the constant joint requires replacement.

SHUDDER OR VIBRATION DURING ACCELERATION

A shudder/vibration, or a groan/scraping noise during acceleration may be caused by a worn or damaged constant velocity joint. The common cause of constant velocity joint damage is the loss of lubricating grease and/or the presence of foreign material and contaminates in the constant velocity joint. This usually occurs as a result of a torn or damaged constant velocity joint boot.

Carefully inspect the joint boot for cuts, tears or other signs of damage that may allow the loss of the lubricating grease and/or the entry of contaminates. If the boot is torn check for contact with foreign matter or other parts in the surrounding area. If there is no damage to the joint boots, remove the wheel drive shaft from the vehicle and inspect the constant velocity joints. Rotate the constant velocity joints in a circular motion. Do not allow the constant velocity joint inner races to become disengaged from the outer race housings, or damage to the constant velocity joints will occur. The movement of the constant velocity joints should be smooth and even. If any binding or impeded motion is felt, the constant velocity joint requires replacement.

REPAIR INSTRUCTIONS

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REAR WHEEL DRIVE SHAFT REPLACEMENT

Special Tools

- **DT 48877:** Seal Protector
- **J 44394:** Seal Protector

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
3. For vehicles equipped with the high performance brakes (Brembo) proceed to step 4. All other vehicles proceed to step 8.

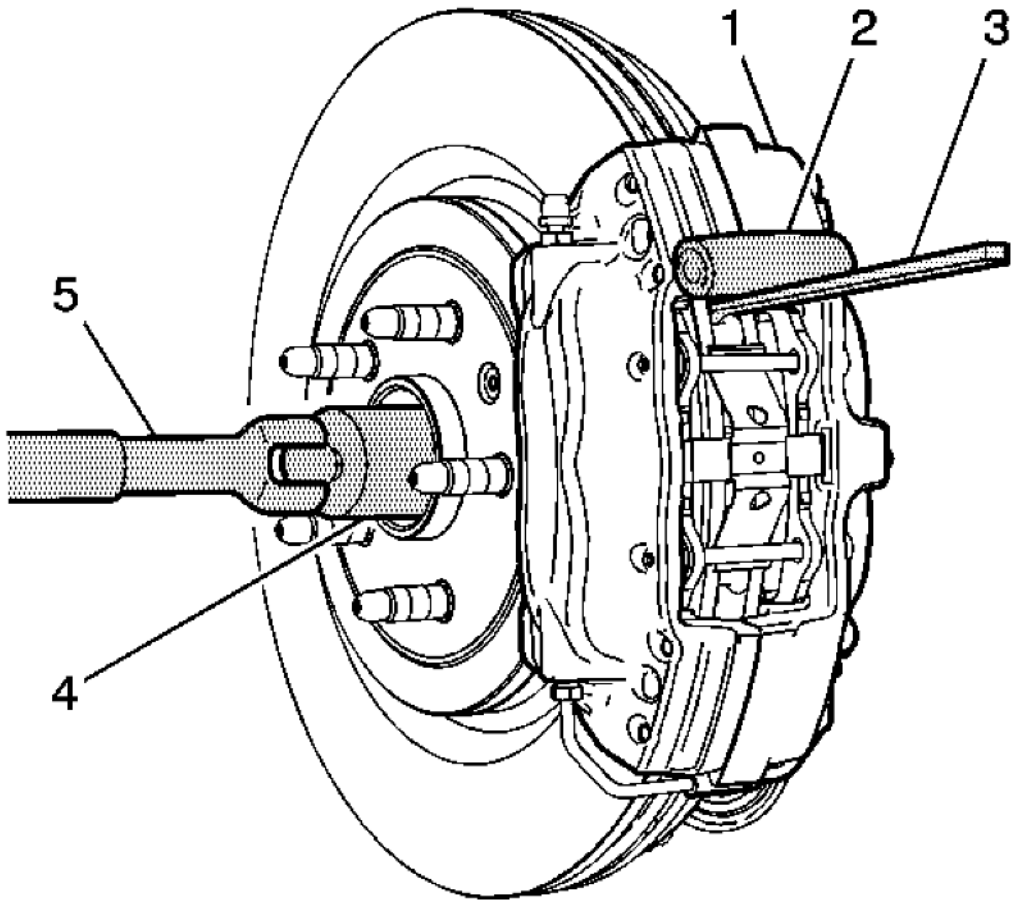


Fig. 1: Loosening Wheel Drive Shaft Nut

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Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT place the drift or flat bladed screwdriver against the bottom of those vehicles equipped with the high performance brakes (Brembo). Damage to the bottom cross over tube could be damaged causing brake failure.

4. Insert a drift or large flat bladed screwdriver (3) in the cooling fins of the brake rotor against the brake caliper (1).
5. Place a clean shop towel (2) between the drift or large flat bladed screwdriver (3) brake caliper (1).
6. Using a breaker bar (5) and the proper size socket (4), loosen the wheel drive shaft nut.

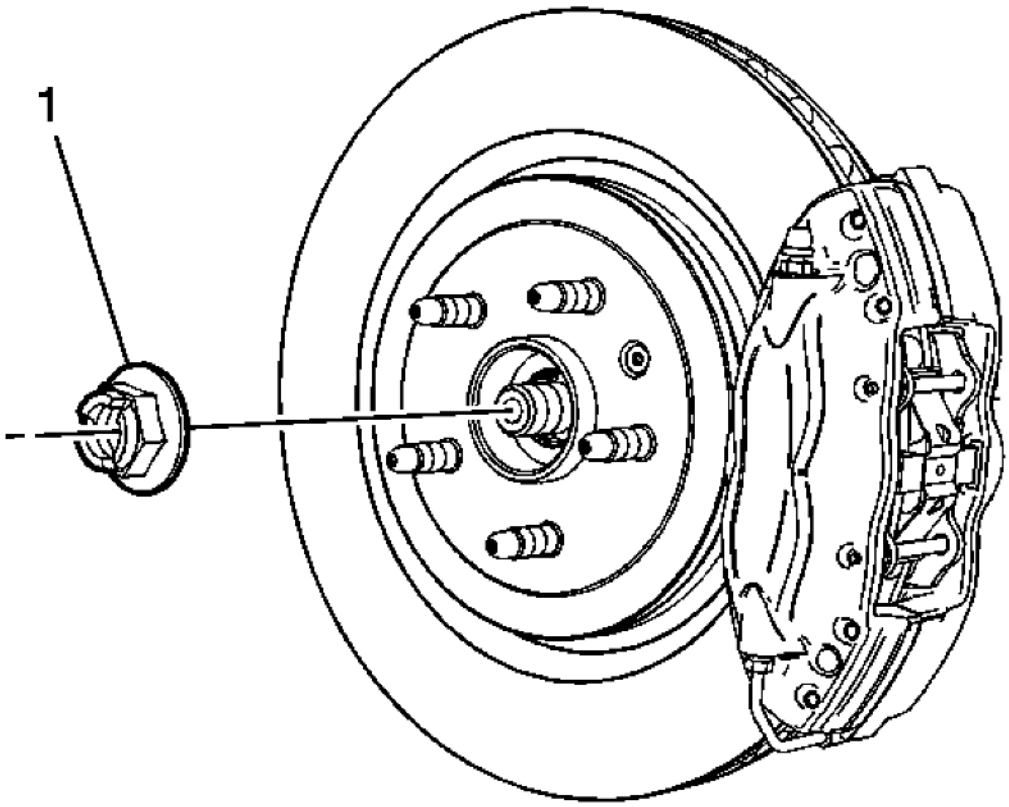


Fig. 2: Wheel Drive Shaft Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT re-use the wheel drive shaft nut, replace with NEW only.

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7. Remove the wheel drive shaft nut (1) and discard.

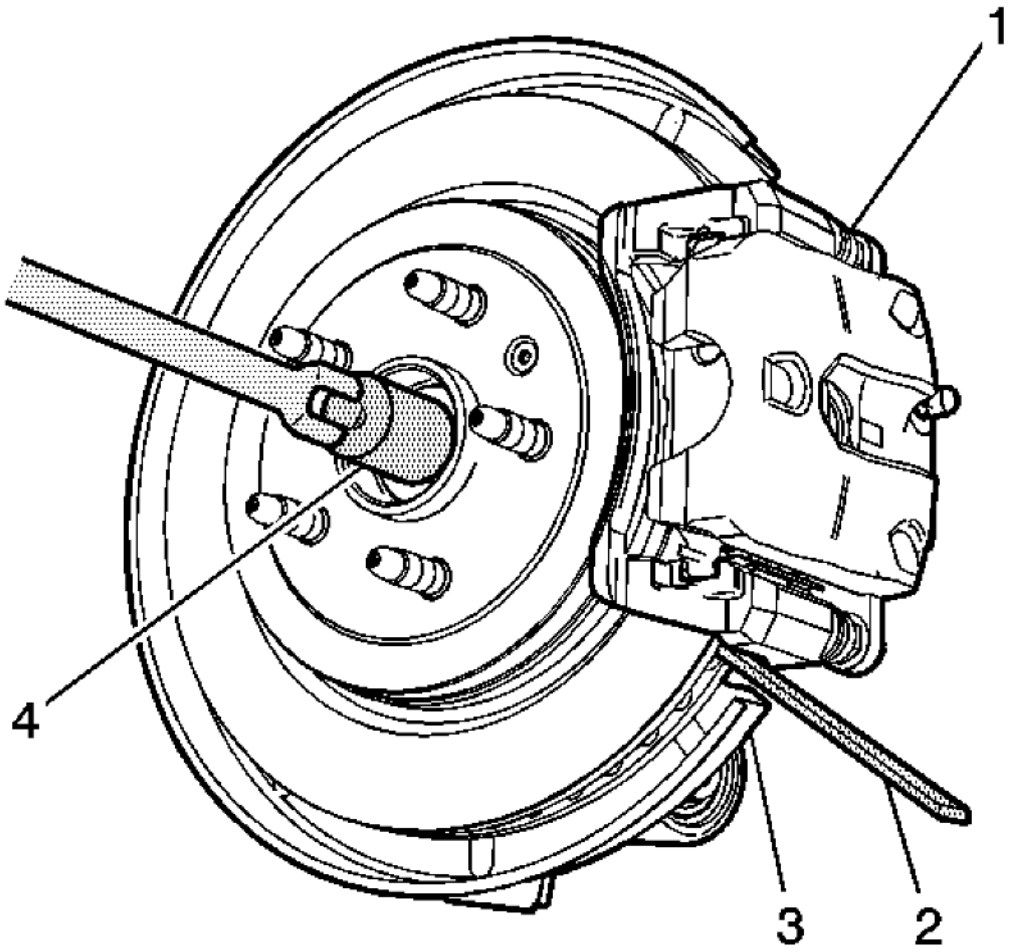


Fig. 3: Loosening Wheel Drive Shaft Nut
Courtesy of GENERAL MOTORS CORP.

8. Insert a drift or flat bladed screwdriver (2) in the cooling fins of the brake rotor (3) against the brake caliper mounting bracket (1).
9. Using a breaker bar and the proper size socket (4), loosen the wheel drive shaft nut.

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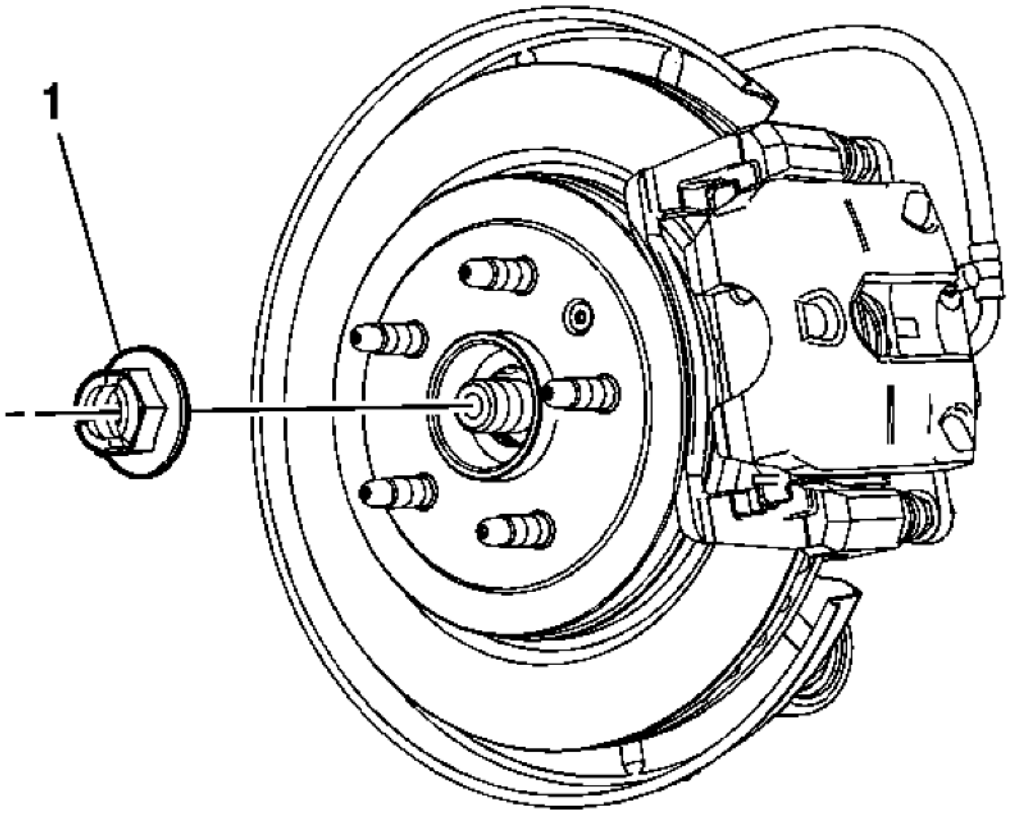


Fig. 4: Wheel Drive Shaft Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT re-use the wheel drive shaft nut, replace with NEW only.

10. Remove and discard the wheel drive shaft nut (1).
11. Using the appropriate tool, separate the wheel drive shaft from the knuckle.

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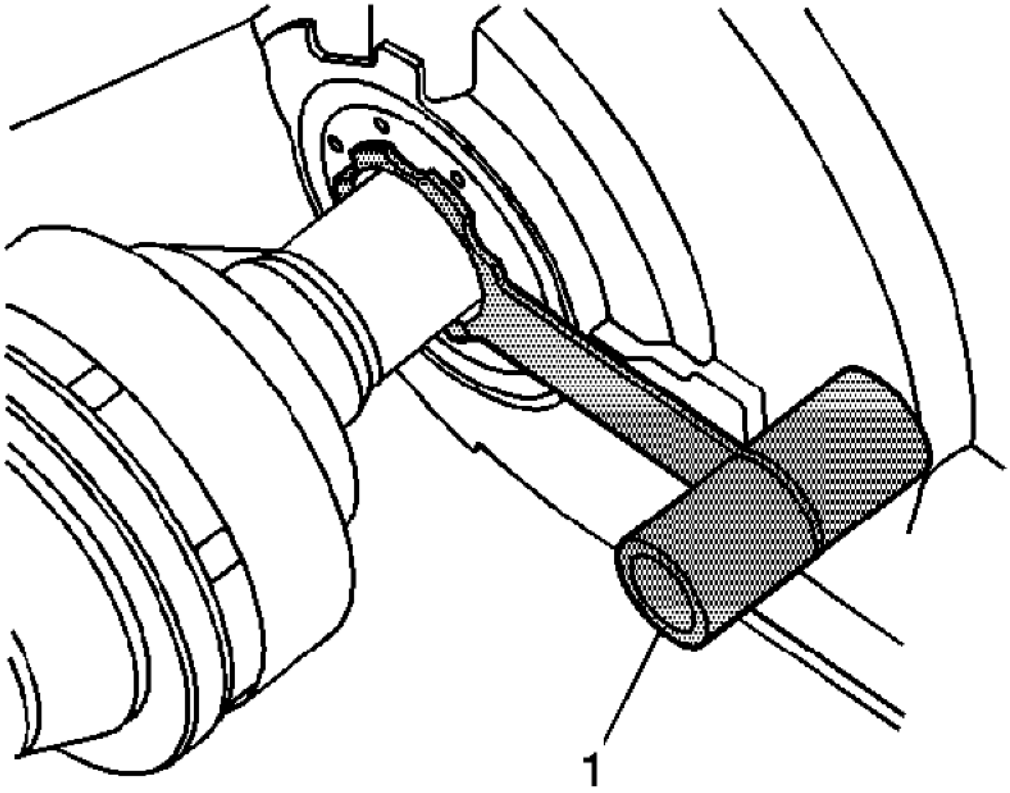


Fig. 5: View Of J 44394 Installed Into Differential Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

CAUTION: J-44394 must be installed into the differential output shaft seal prior to removing and installing the wheel drive shaft. Failure to install J-44394 as indicated may cause the splines of the wheel drive shaft to cut the differential output seal.

12. Carefully install the **J 44394:** protector for the 195 mm axle or the **DT 48877:** protector for the 218 mm axle over the wheel drive shaft.
13. Carefully slide the **J 44394:** protector for the 195 mm axle or the **DT 48877:** protector for the 218 mm axle into the differential output shaft seal.
14. Remove the knuckle assembly. Refer to **Knuckle Replacement** .

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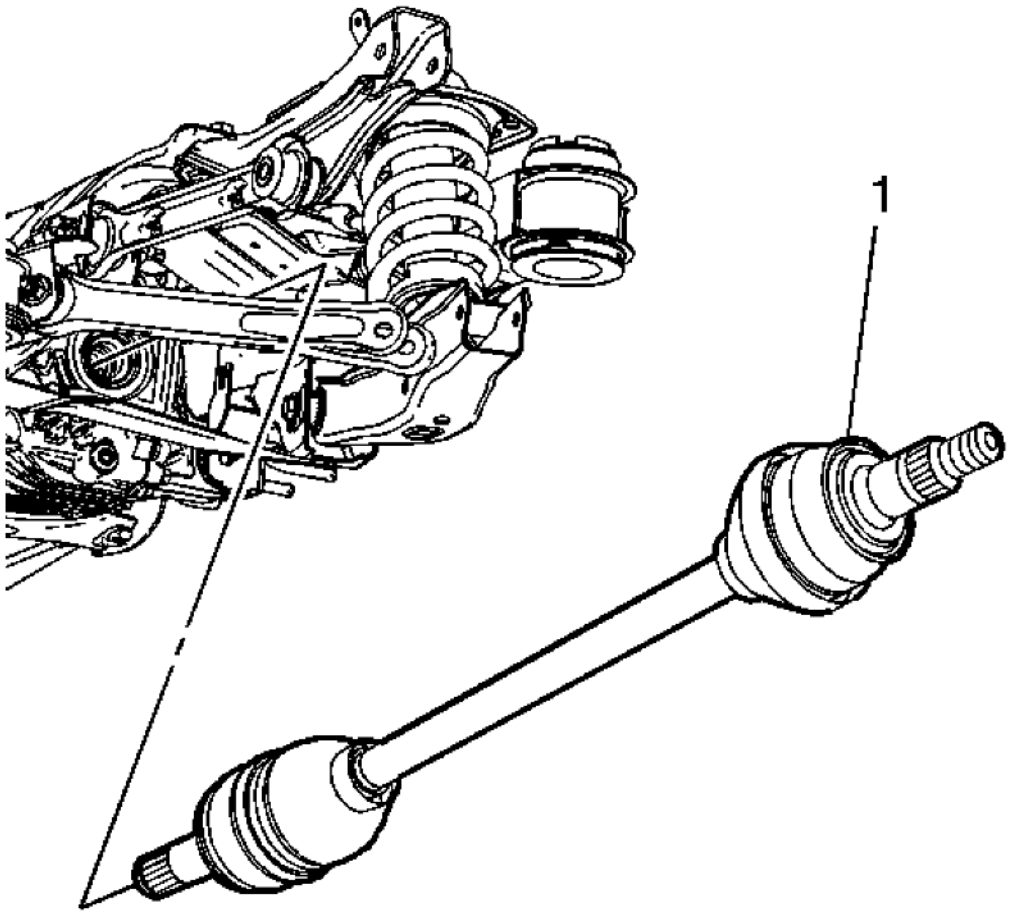


Fig. 6: Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

15. Remove the wheel drive shaft (1) from the vehicle.

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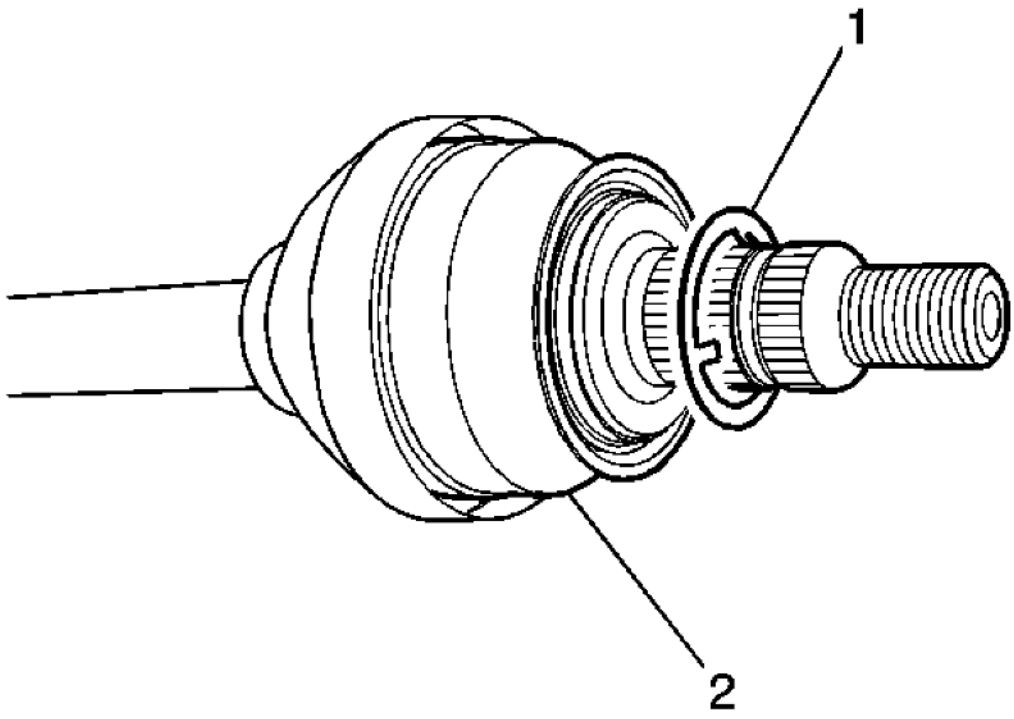


Fig. 7: Drive Shaft Washer
Courtesy of GENERAL MOTORS CORP.

NOTE: If there is no washer present on the wheel drive shaft when removed, install the NEW washer

16. Remove the washer (1) from the wheel drive shaft (2) and discard. Replace with NEW only.

Installation Procedure

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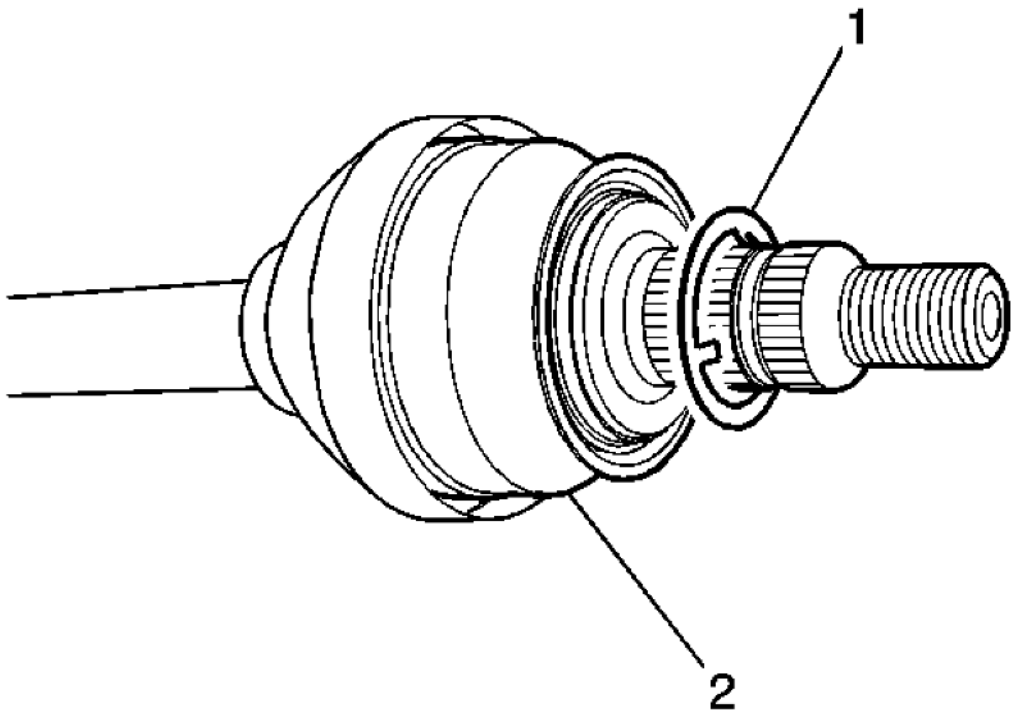


Fig. 8: Drive Shaft Washer
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT re-use the old washer, replace with NEW only.

1. Install the NEW washer (1) on the wheel drive shaft (2).

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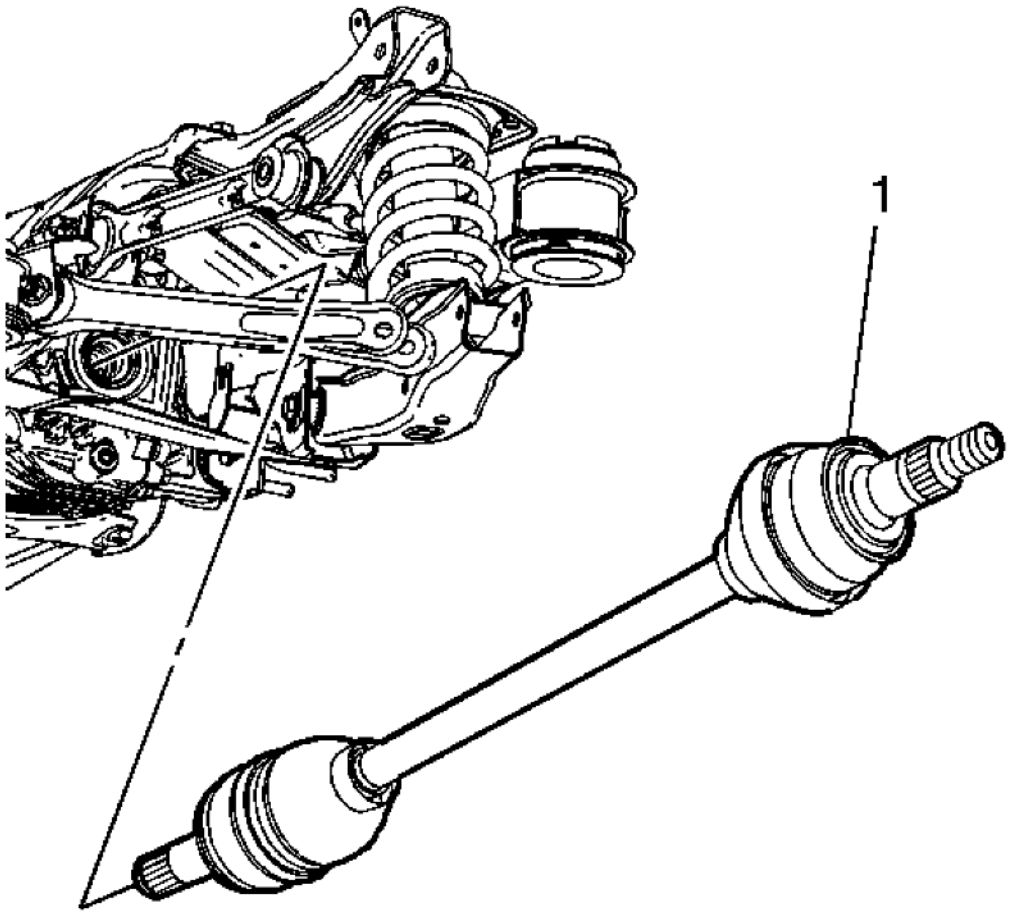


Fig. 9: Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

2. Install the wheel drive shaft (1) in the vehicle.

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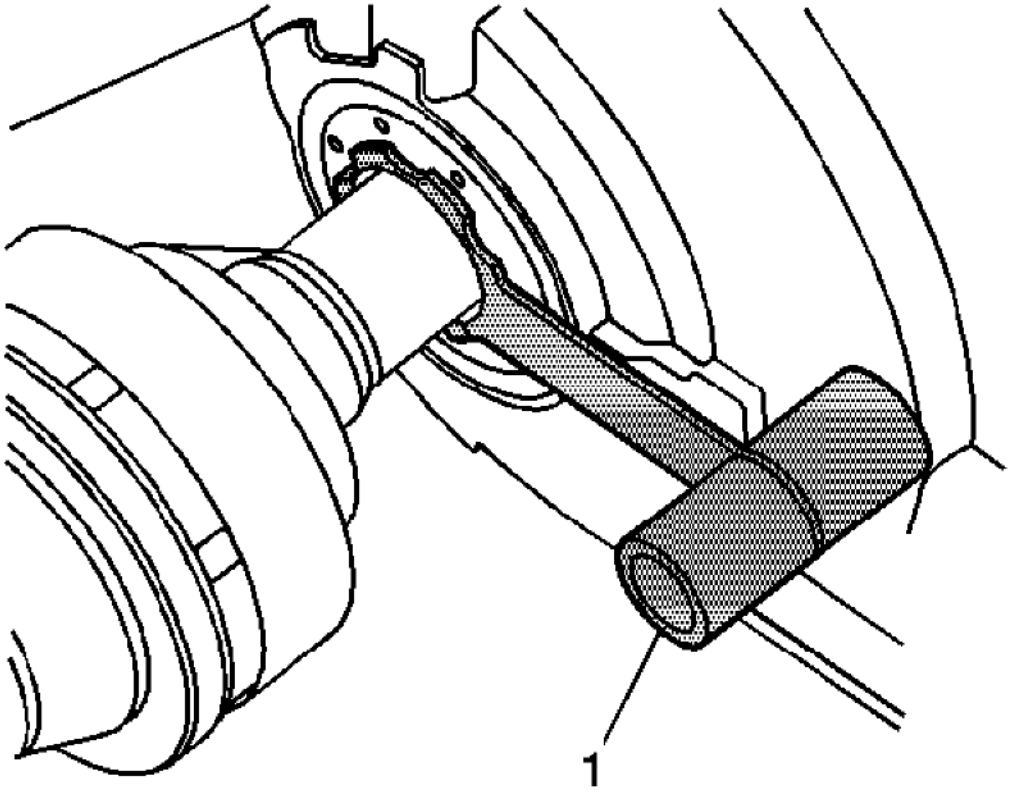


Fig. 10: View Of J 44394 Installed Into Differential Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

CAUTION: J-44394 must be installed into the differential output shaft seal prior to removing and installing the wheel drive shaft. Failure to install J-44394 as indicated may cause the splines of the wheel drive shaft to cut the differential output seal.

3. Carefully install the wheel drive shaft into the differential unit the splines are past the **J 44394:** protector for the 195 mm axle or the **DT 48877:** protector for the 218 mm axle.

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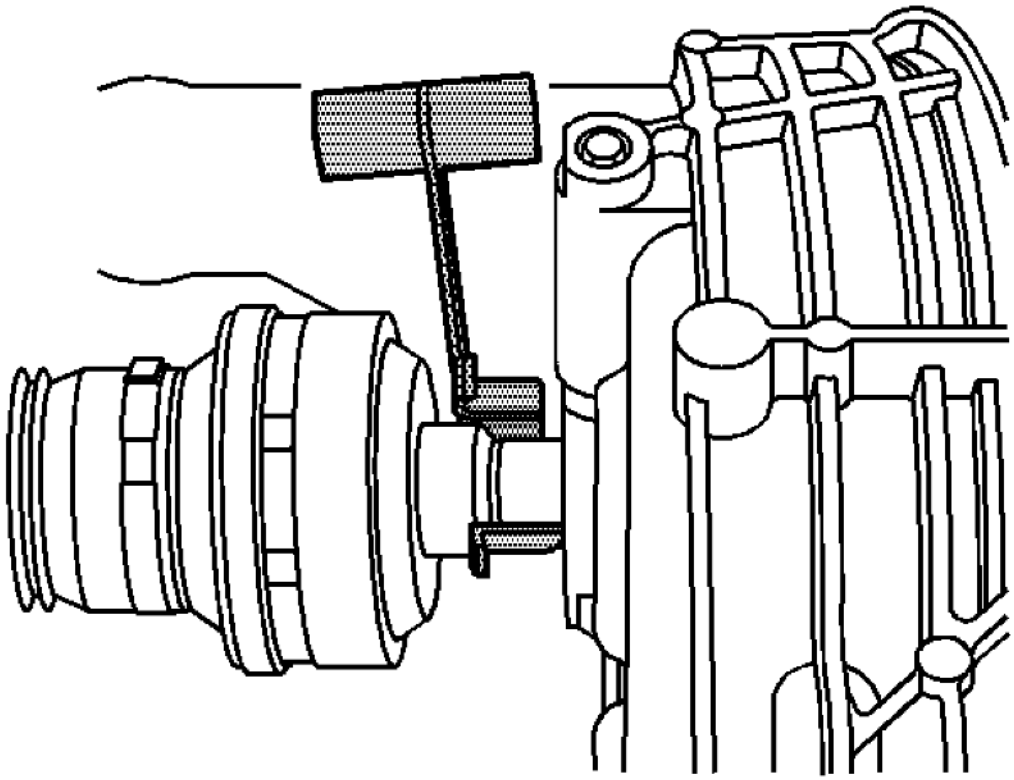


Fig. 11: Removing J 44394 From Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

4. Carefully remove the **J 44394:** protector for the 195 mm axle or the **DT 48877:** protector for the 218 mm axle from the differential output shaft seal.
5. Install the wheel drive shaft until the it is fully seated in the rear differential.
6. Install the knuckle assembly. Refer to **Knuckle Replacement** .
7. For vehicles equipped with the high performance brakes (Brembo) proceed to step 4. All other vehicles proceed to step 7.

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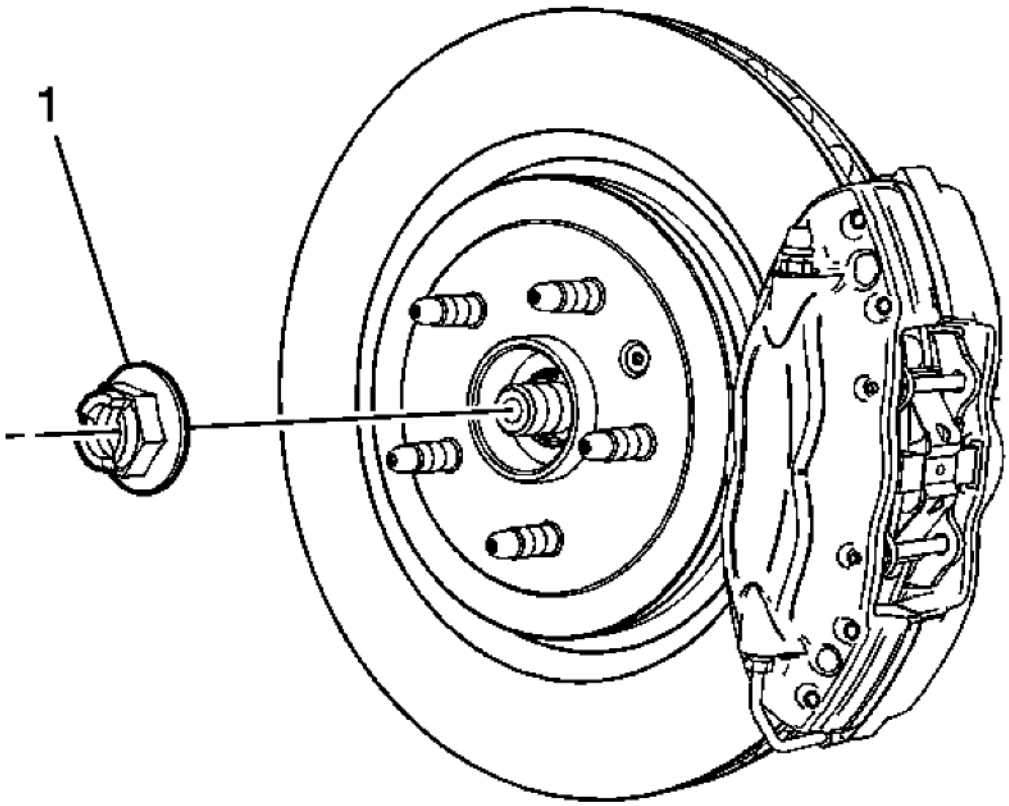


Fig. 12: Wheel Drive Shaft Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT re-use the wheel drive shaft nut, replace with NEW only.

8. Install the NEW wheel drive shaft nut (1).

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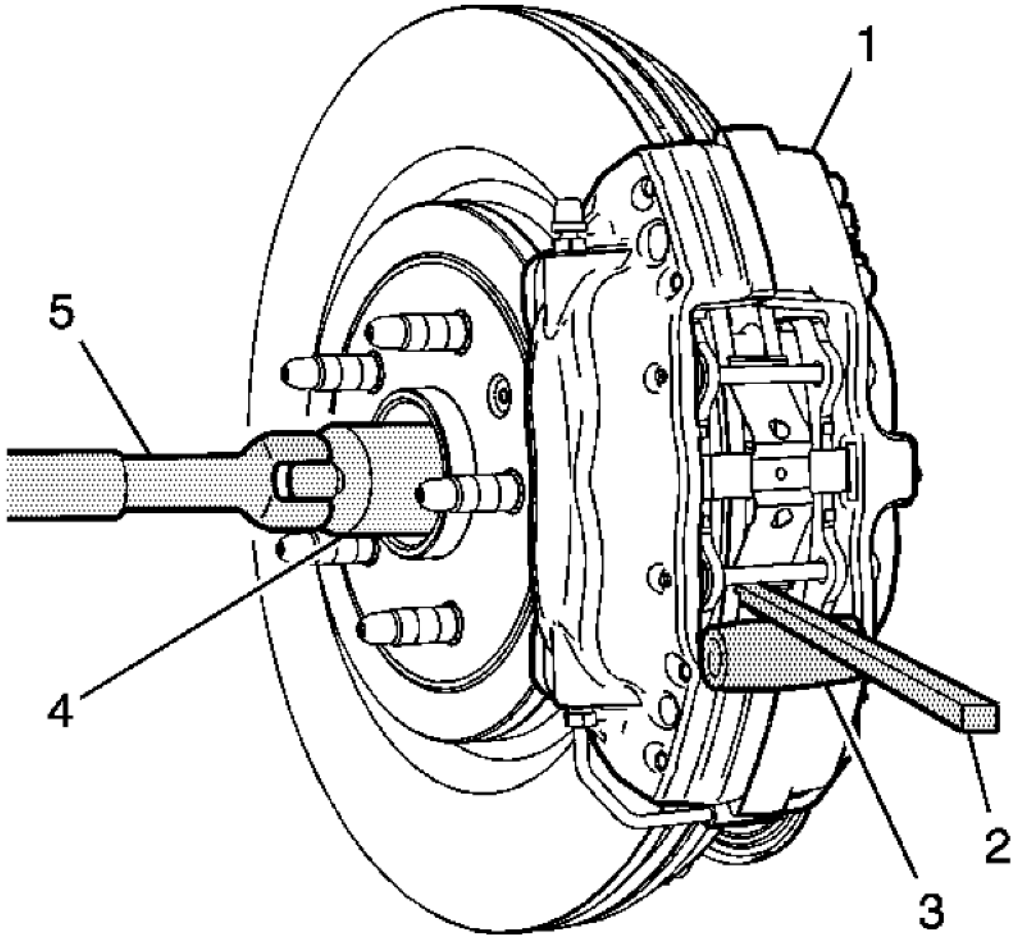


Fig. 13: Holding Brake Rotor
Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT place the drift or flat bladed screwdriver against the bottom of those vehicles equipped with the high performance brakes (Brembo). Damage to the bottom cross over tube could be damaged causing brake failure.**

9. Insert a drift or large flat bladed screwdriver (2) in the cooling fins of the brake rotor against the brake caliper (1).
10. Place a clean shop towel (3) between the drift or large flat bladed screwdriver (2) brake caliper (1).

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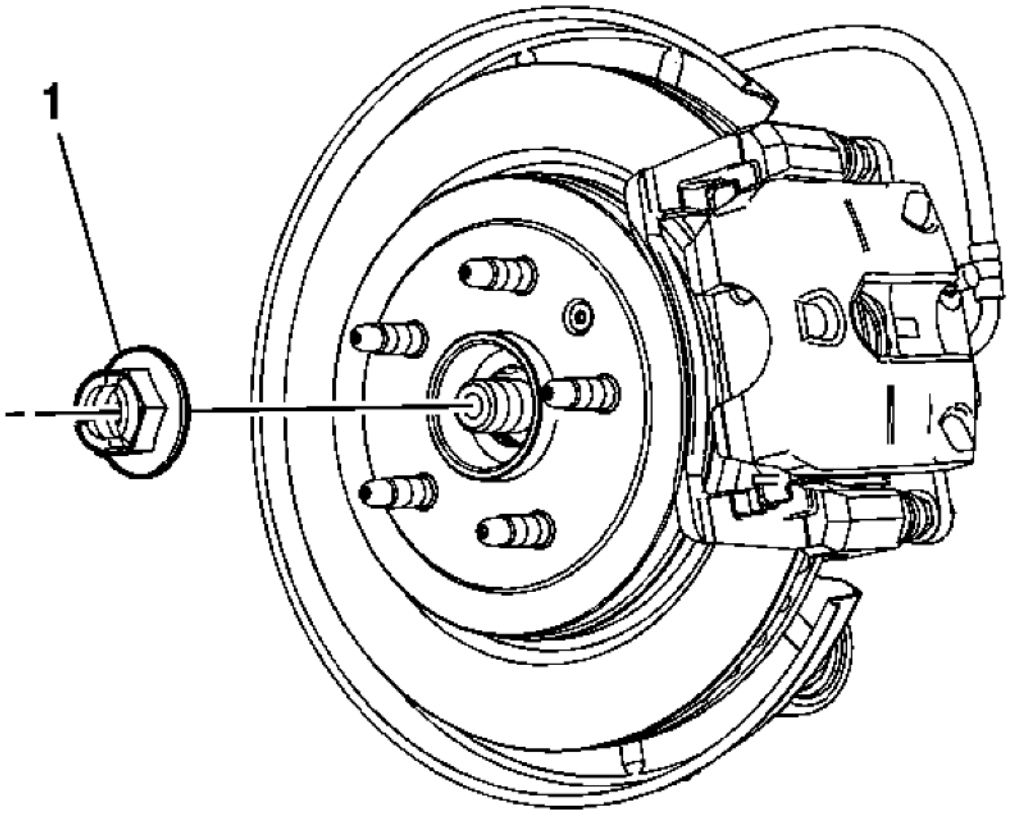


Fig. 14: Wheel Drive Shaft Nut
Courtesy of GENERAL MOTORS CORP.

11. Install the NEW wheel drive shaft nut (1).

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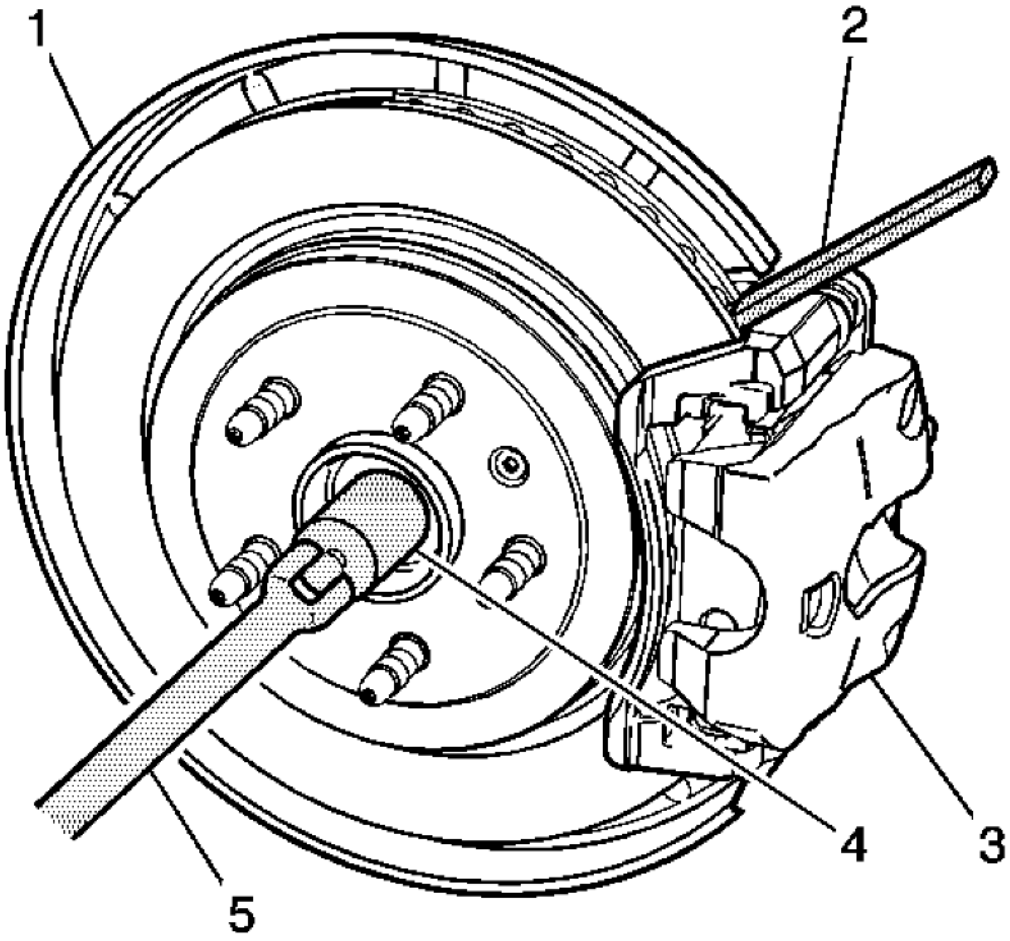


Fig. 15: Holding Brake Rotor
Courtesy of GENERAL MOTORS CORP.

12. Insert a drift or large flat bladed screwdriver (2) in the cooling fins of the brake rotor (1) against the brake caliper (3).

CAUTION: Refer to Fastener Caution .

NOTE: The following service procedure will cover the vehicles equipped with the high performance brakes (Brembo) and the standard brakes.

13. Using a torque wrench (5) and the proper size socket (4), tighten the wheel drive shaft nut to 270 N.m

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(199 lb ft).

14. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
15. Remove the support and lower the vehicle.

REAR WHEEL DRIVE SHAFT INNER JOINT AND BOOT REPLACEMENT

Special Tools

- **CH 48894:** Drive Axle Seal Clamp Pliers
- **J 35910:** Drive Axle Boot Clamp Pliers

For equivalent regional tools, refer to **Special Tools**.

Disassemble Procedure

1. Remove the wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement**.
2. Remove the outer CV joint and boot. Refer to **Rear Wheel Drive Shaft Outer Joint and Boot Replacement**.

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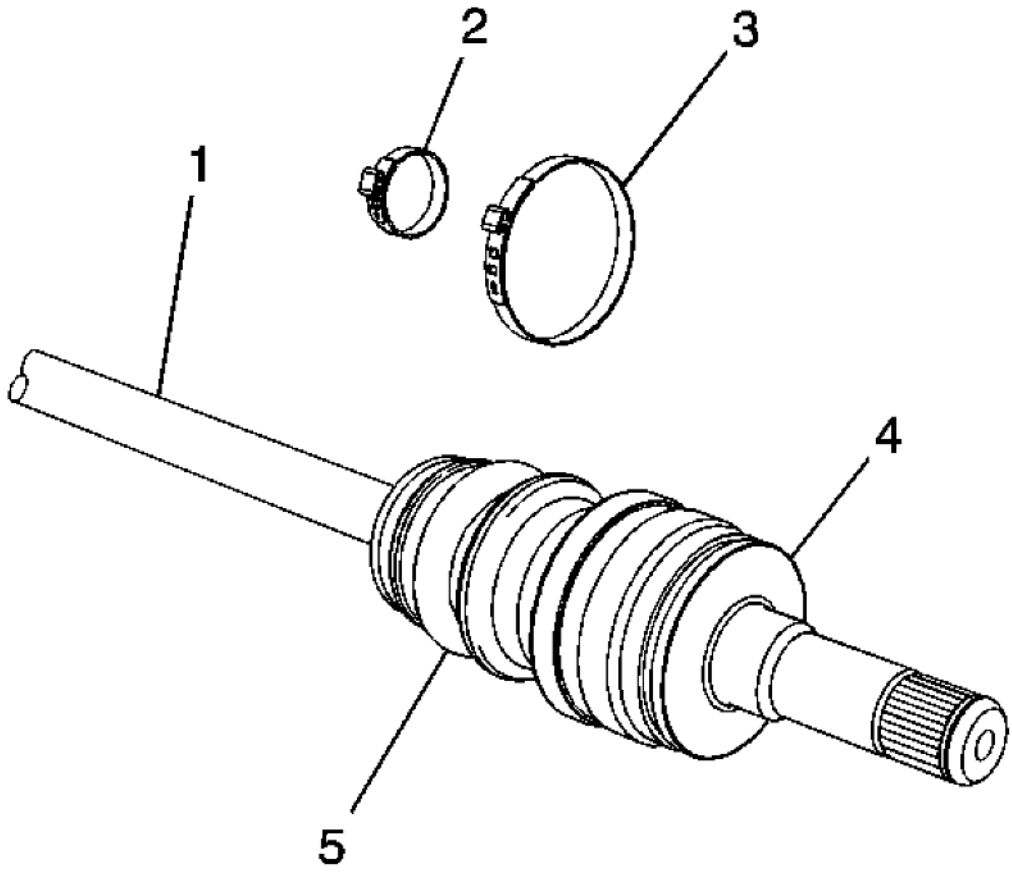


Fig. 16: Identifying CV Joint, Boot & Clamps
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not cut through the wheel drive shaft inboard or outboard boot during service. Cutting through the boot may damage the sealing surface of the housing and the tripot or the constant velocity joint bushing. Damage to the sealing surface may lead to water and dirt intrusion and premature wear of the constant velocity joint.

3. Using the appropriate tool, remove and discard the outer boot clamp (3) and the inner boot clamp (2) from the CV joint (4).

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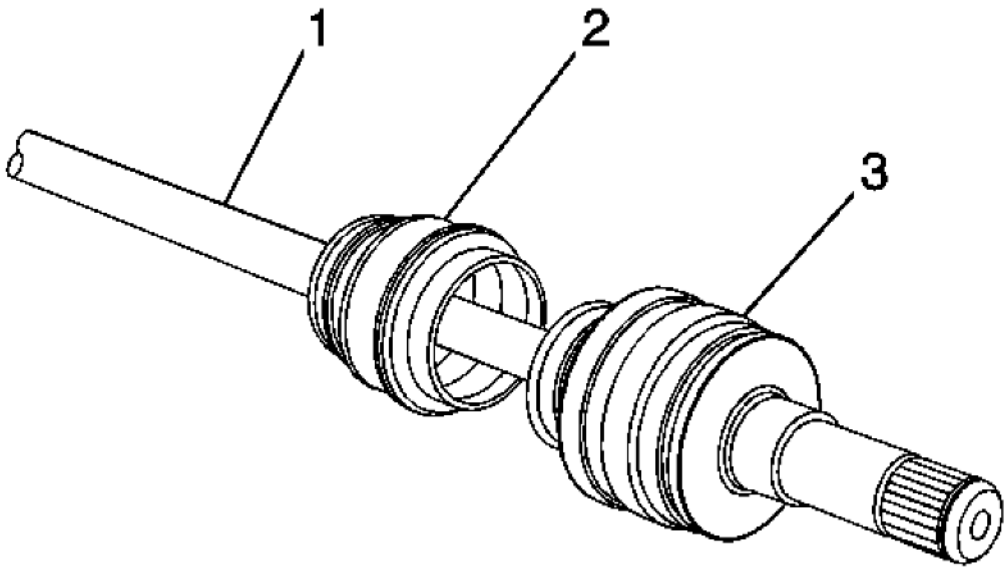


Fig. 17: Identifying CV Joint Boot, CV Joint & Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

NOTE: If the boot is damaged and either water or other foreign material are found in the CV joint, replace the wheel drive shaft as an assembly. The inner CV joint is NOT SERVICED.

4. Remove the CV joint boot (2) from the CV joint (3) and the wheel drive shaft (1).

NOTE: If the ball bearings for the CV joint have a dull surface on them, replace the wheel drive shaft as an assembly. The inner CV joint is NOT SERVICED.

5. Using the appropriate cleaner, remove the lubricant from the CV joint and the wheel drive shaft.

Assemble Procedure

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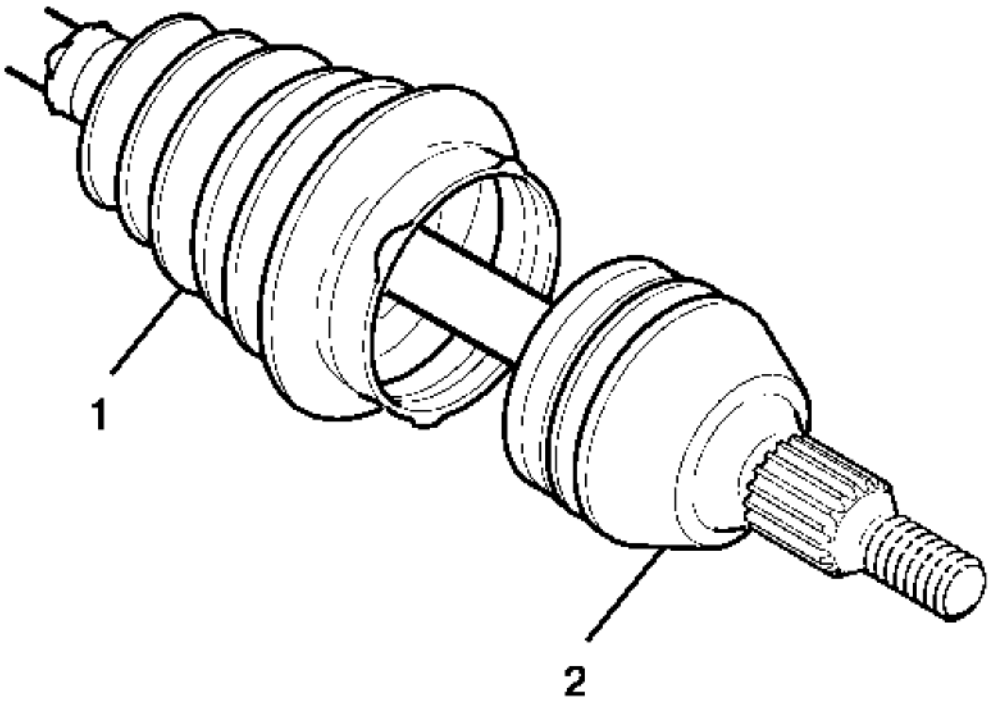


Fig. 18: View Of Outer Seal & C/V Joint
Courtesy of GENERAL MOTORS CORP.

1. Install the CV joint boot and clamp (1) on the wheel drive shaft and CV joint housing (2).

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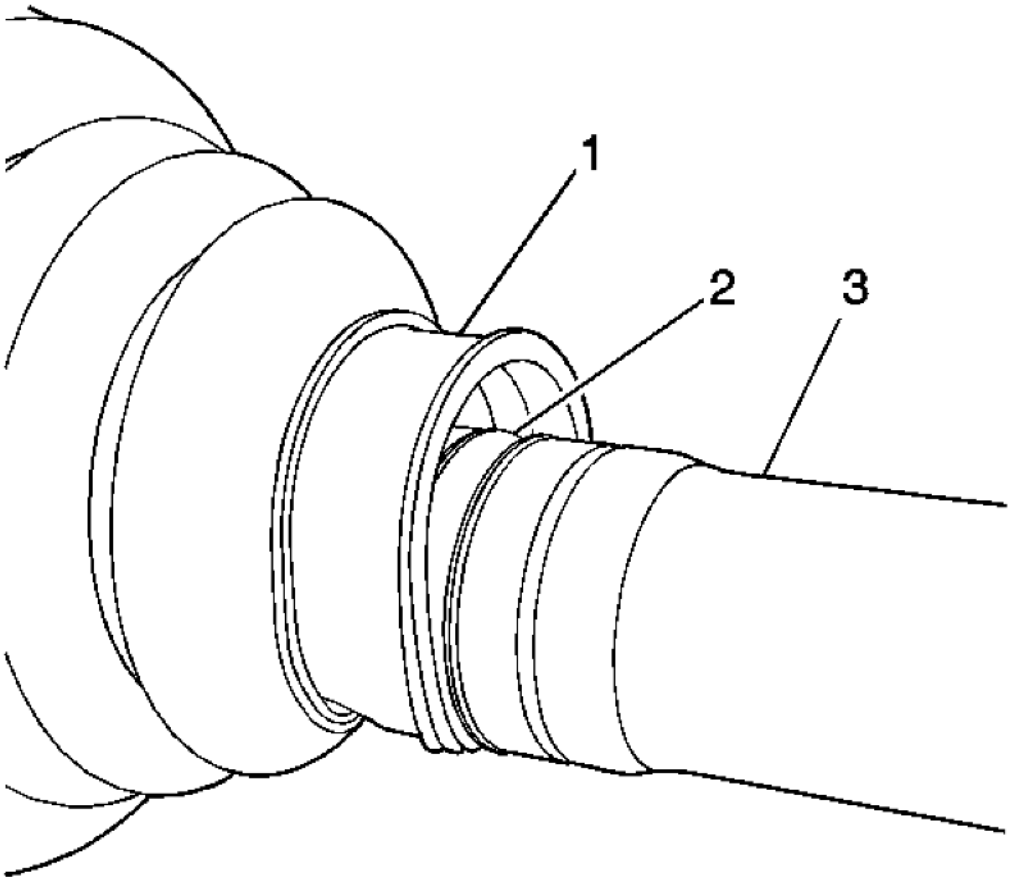


Fig. 19: Identifying Groove In Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

2. Ensure that the CV joint boot (1) is properly seated in the groove (2) in the wheel drive shaft (3).

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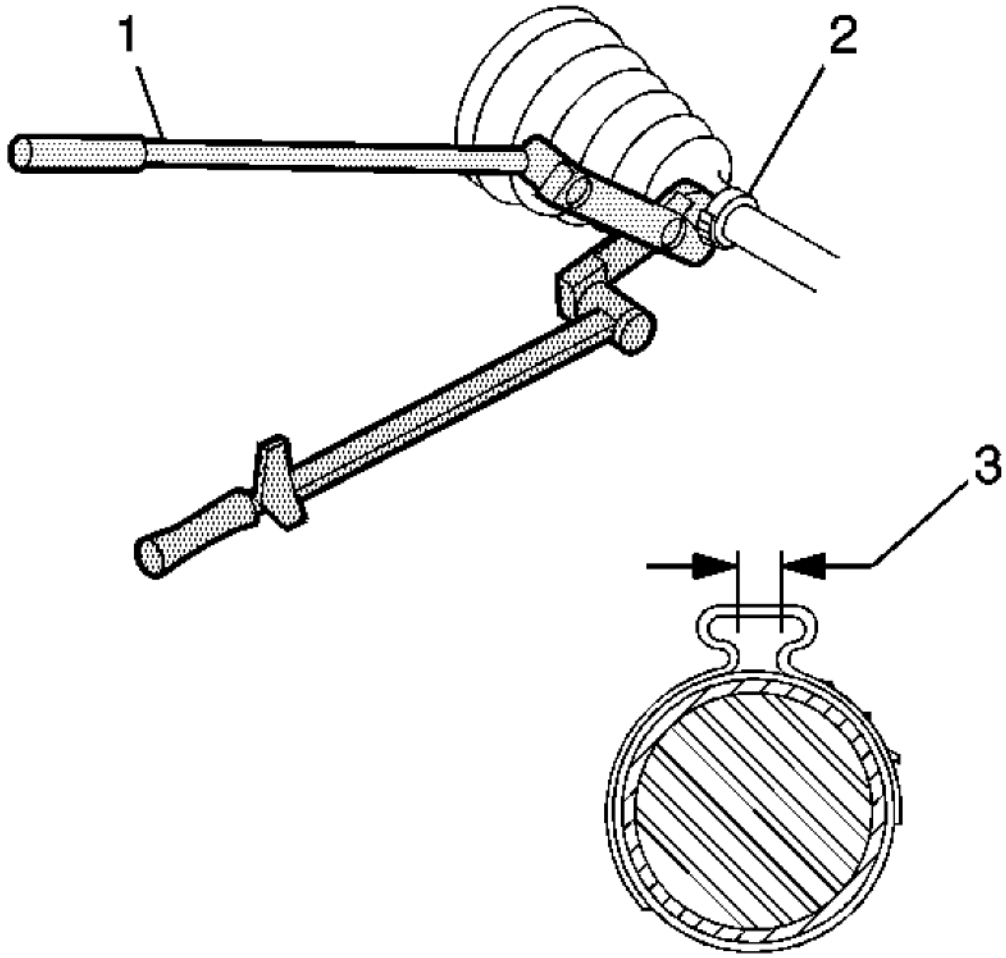


Fig. 20: Closing Clamp
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 35910:** pliers, breaker bar, torque wrench and or ratchet (1), close the clamp (2) until the gap (3) measures 1.8 mm (0.07 in).

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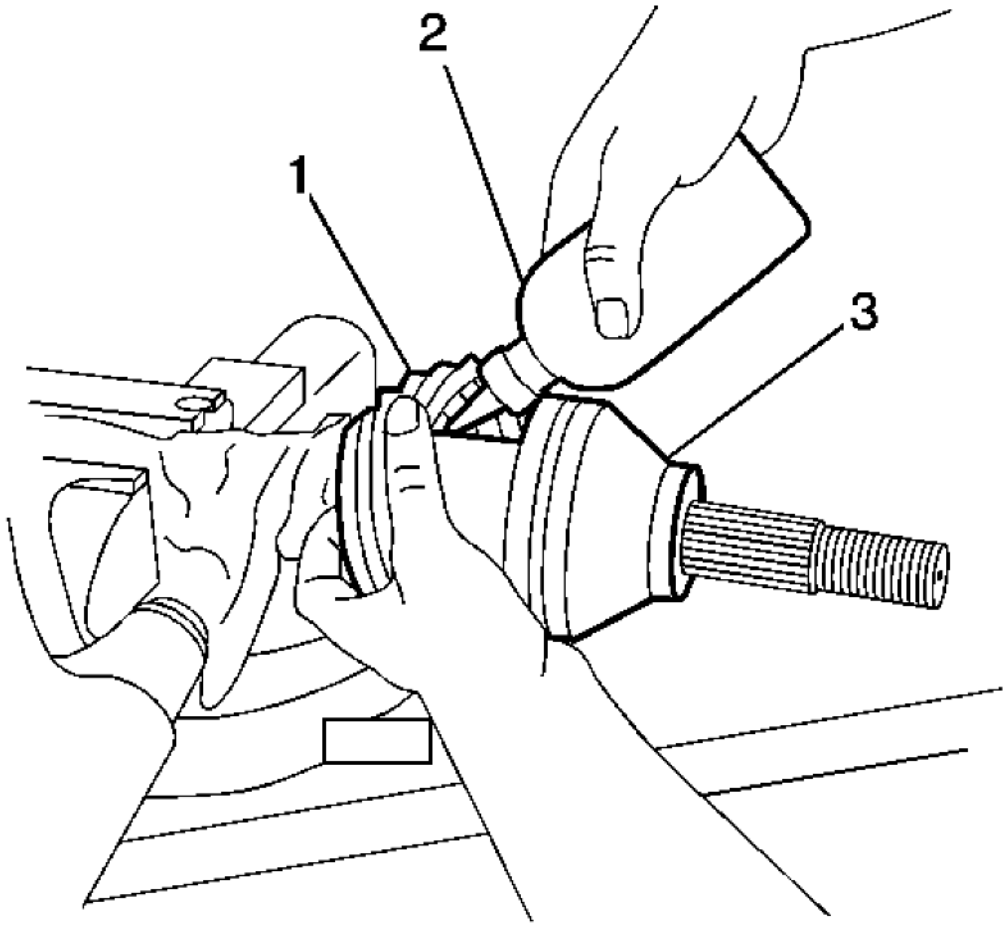


Fig. 21: Lubricating Boot Of Tripot Housing
Courtesy of GENERAL MOTORS CORP.

4. Place approximately half of the lubricant (1) in the CV joint boot (2) and the other half in the CV joint (3).
5. Install the CV joint boot and clamp (2) CV joint housing (1).

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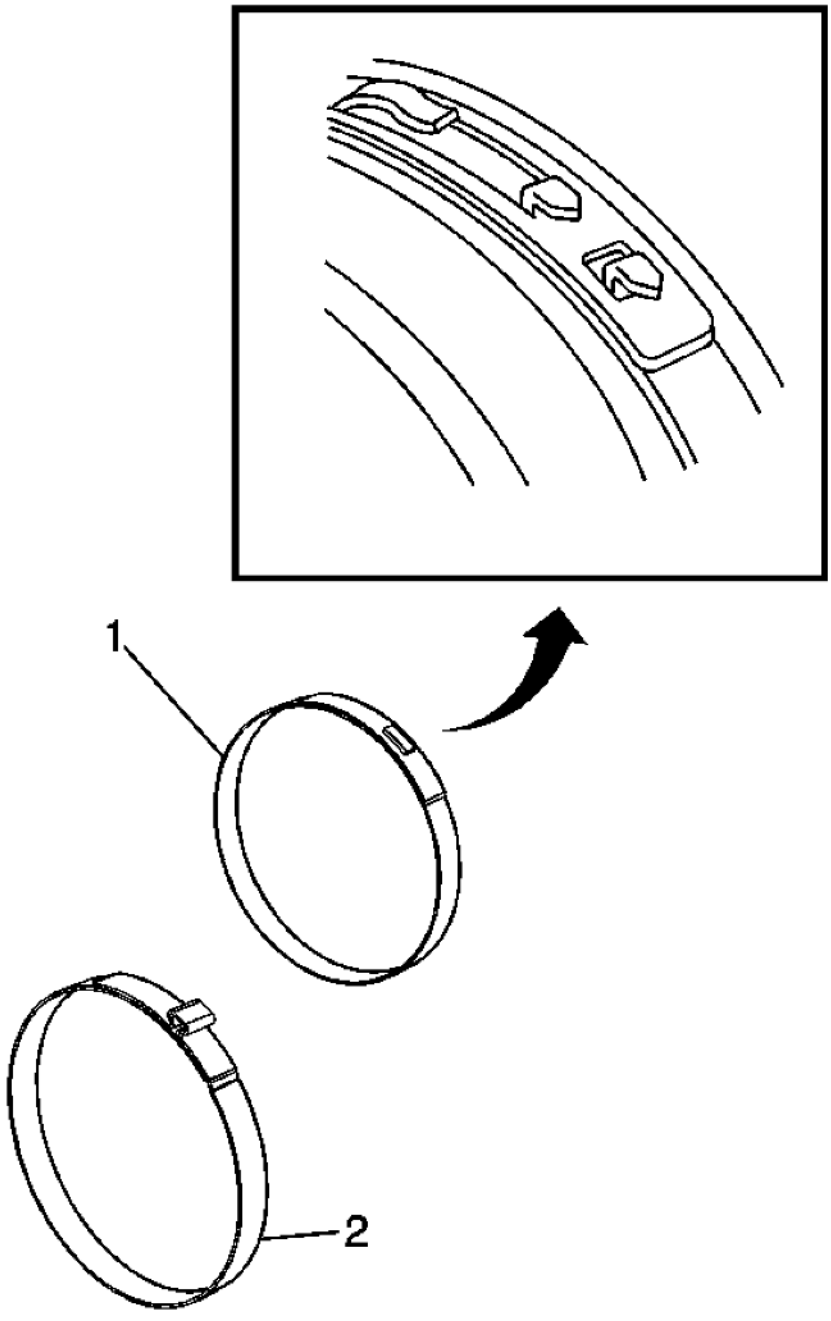


Fig. 22: View Of Ear Type Boot Clamp
Courtesy of GENERAL MOTORS CORP.

6. The following service procedure is for those vehicles equipped with the ear type boot clamp (2). For those vehicles equipped with the earless type (low profile) (1), proceed to step 8

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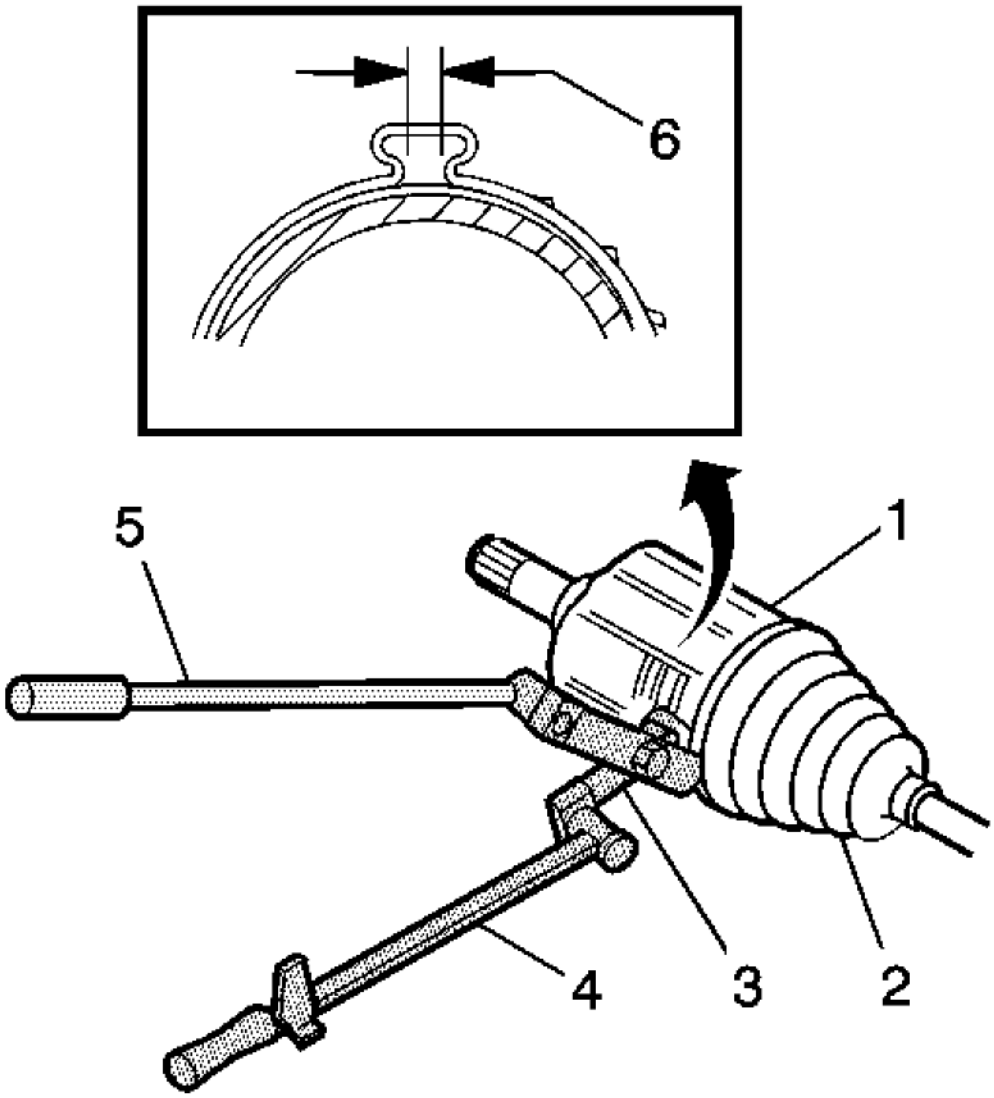


Fig. 23: Measuring Boot Clamp Gap
Courtesy of GENERAL MOTORS CORP.

7. Using the **J 35910:** pliers (3), breaker bar (5) and a torque or racket wrench (4), close the clamp until the gap measures 1.9 mm (0.07 in).

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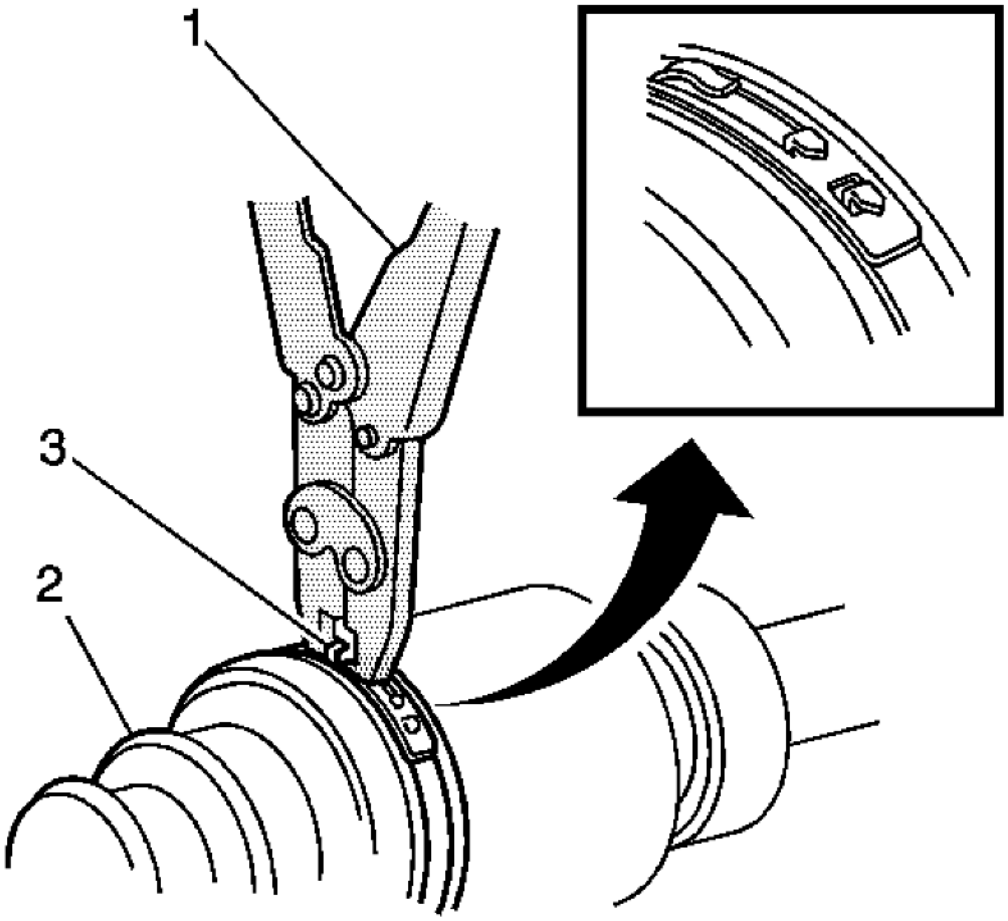


Fig. 24: Latching Large Seal Retaining Clamp
Courtesy of GENERAL MOTORS CORP.

NOTE: **Ensure that the boot clamp is securely closed and seated properly on the boot.**

8. Using the **CH 48894:** pliers (1), close the boot clamp (3).
9. Move the CV joint in a circular motion to distribute the lubricant inside the cv joint housing.
10. Clean any remaining lubricant from the outside of the CV joint.
11. Install the outer CV joint and boot. Refer to **Rear Wheel Drive Shaft Outer Joint and Boot Replacement**.
12. Install the wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement**.

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REAR WHEEL DRIVE SHAFT OUTER JOINT AND BOOT REPLACEMENT

Special Tools

- **CH 48894:** Drive Axle Boot Clamp Pliers
- **J 8059:** Snap Ring Pliers
- **J 35910:** Drive Axle Boot Clamp Pliers

For equivalent regional tools, refer to **Special Tools**.

Disassemble Procedure

1. Remove the wheel drive shaft from the vehicle. Refer to **Rear Wheel Drive Shaft Replacement**.

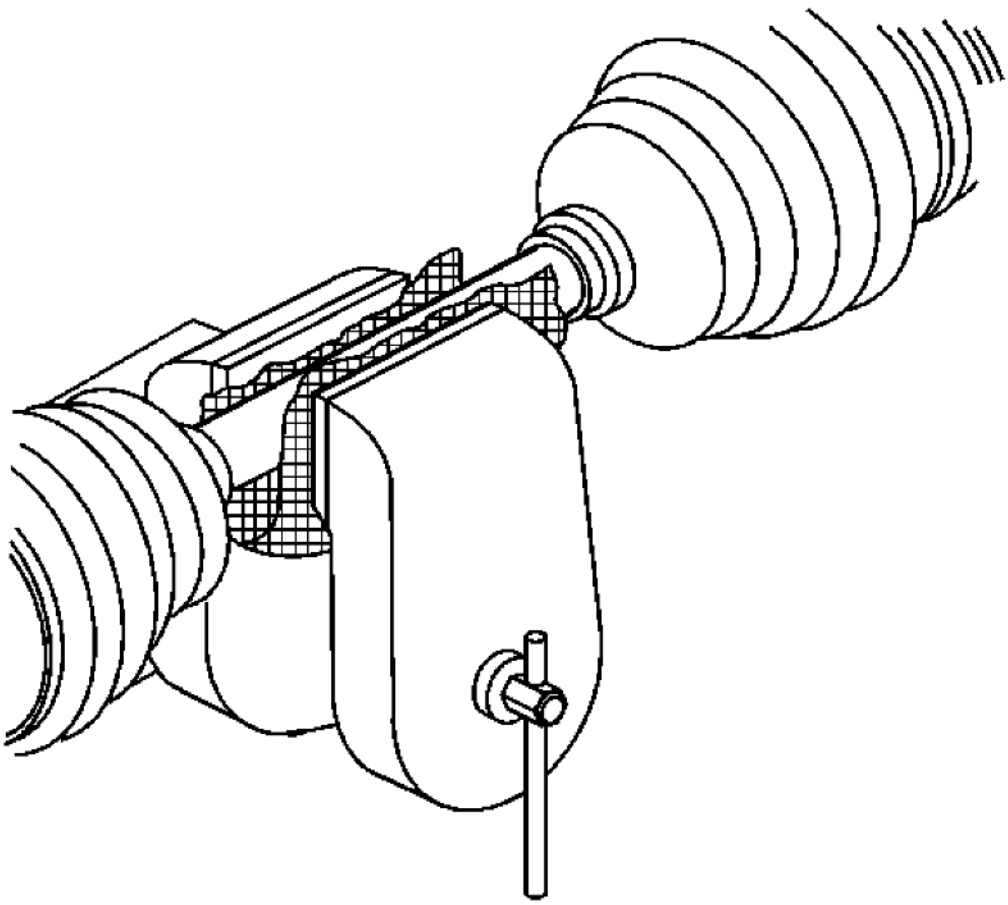


Fig. 25: Clamping Drive Axle Shaft In Vice

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Courtesy of GENERAL MOTORS CORP.

2. Install the wheel drive axle shaft in a soft jawed vice.

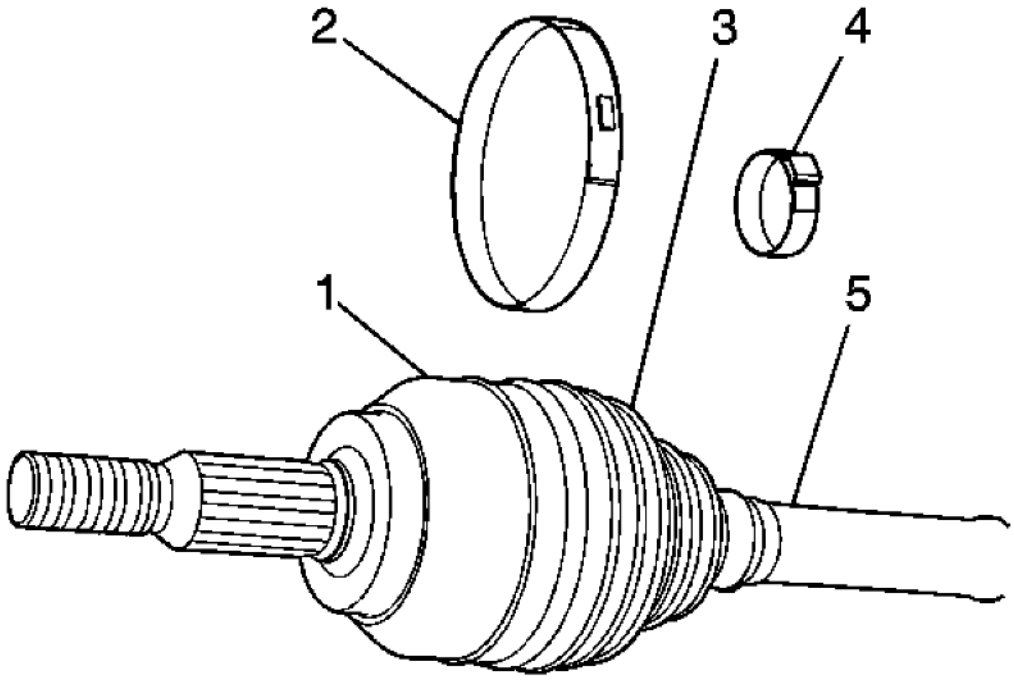


Fig. 26: Identifying Boot Clamps
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not cut through the wheel drive shaft inboard or outboard boot during service. Cutting through the boot may damage the sealing surface of the housing and the tripot or the constant velocity joint bushing. Damage to the sealing surface may lead to water and dirt intrusion and premature wear of the constant velocity joint.

NOTE: The following proceed is for the wheel drive shaft that have the low profile boot clamp. If the wheel drive shaft is equipped with the ear type boot clamp, proceed to step 6.

3. Using the appropriate tool, remove and discard the outer boot clamp (2) from the CV joint boot (3).
4. Using a pair of side cutters, remove and discard the inner boot clamp (4) from the CV joint boot (3).
5. Remove the CV joint boot (3) from the CV joint housing (1).

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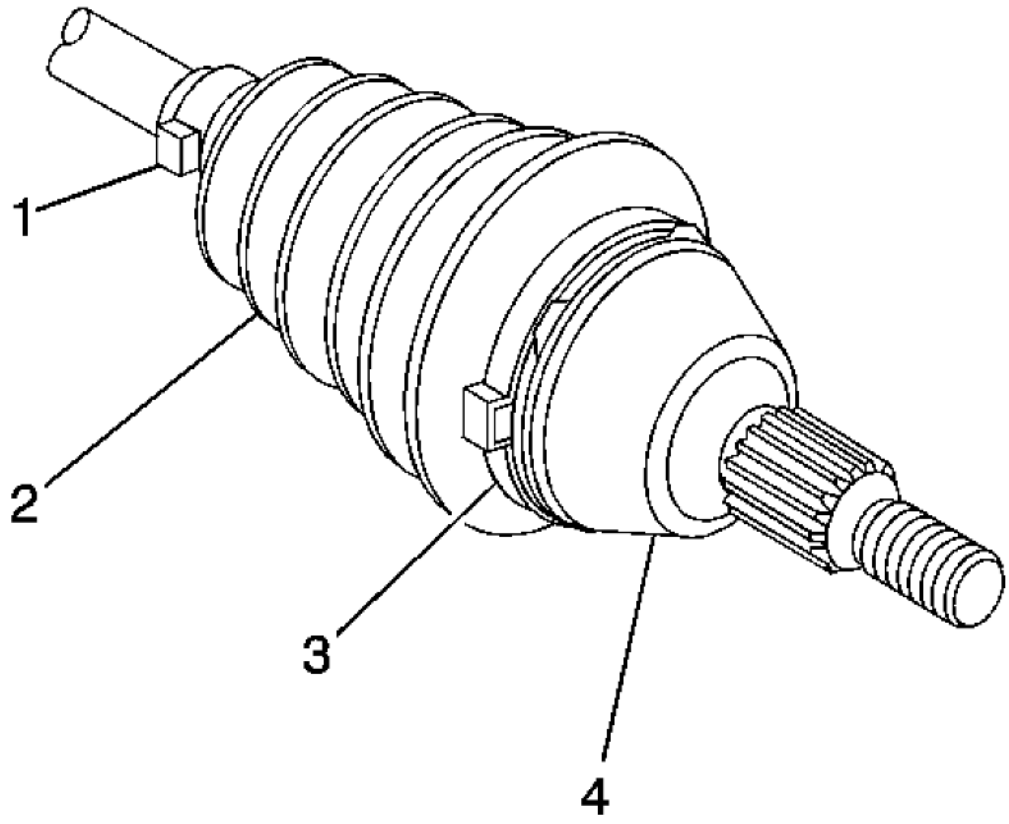


Fig. 27: Identifying Boot Components
Courtesy of GENERAL MOTORS CORP.

6. Using a pair of side cutters, remove and discard the outer boot clamp (3) and the inner boot clamp (1).
7. Remove the CV joint boot (2) from the CV joint housing (4).

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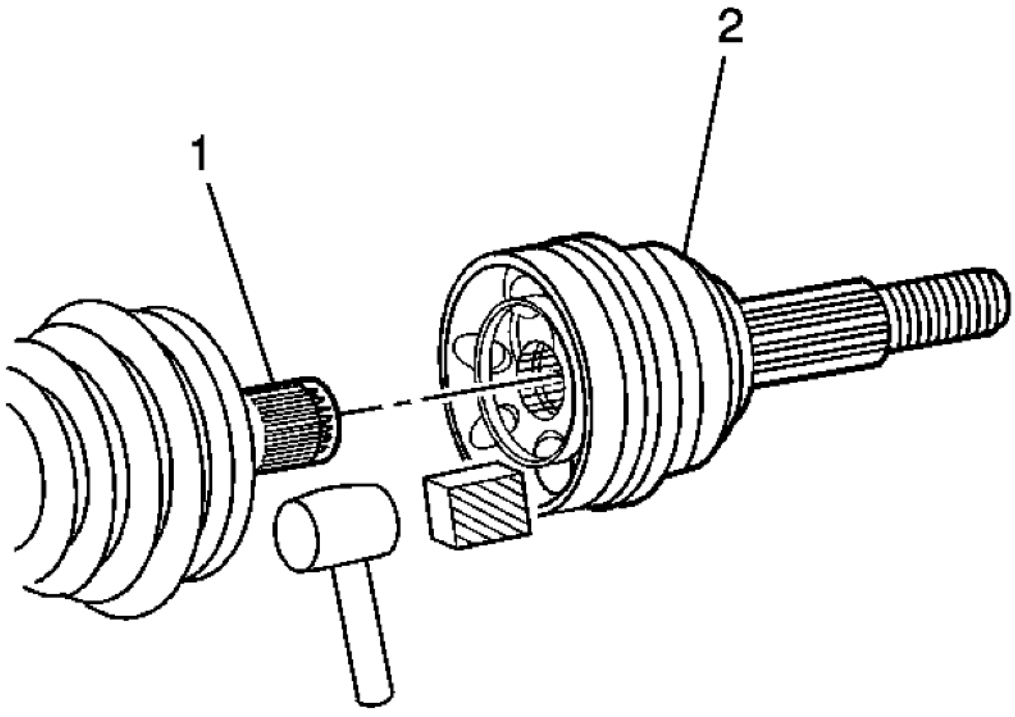


Fig. 28: Separating CV Joint From Axle Shaft
Courtesy of GENERAL MOTORS CORP.

8. Using a hammer and a block of wood, remove the CV joint (2) from the wheel drive shaft (1).

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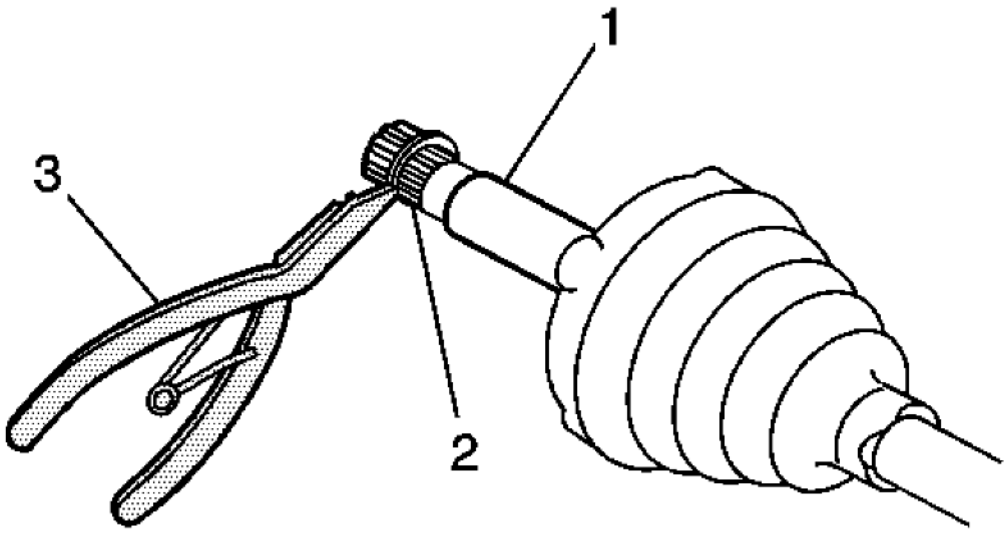


Fig. 29: Removing/Installing Retaining Ring
Courtesy of GENERAL MOTORS CORP.

9. Using the **J 8059:** pliers, remove the retaining ring (2) from the wheel drive shaft.

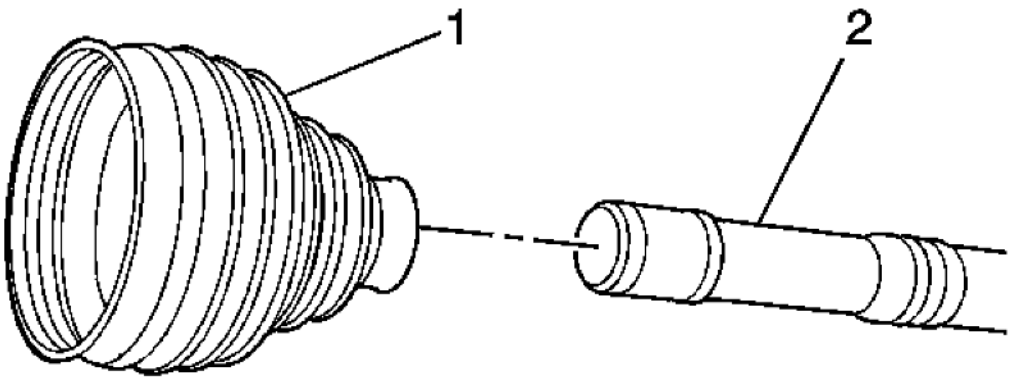


Fig. 30: Identifying Boot
Courtesy of GENERAL MOTORS CORP.

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10. Remove the CV joint boot (1) from the wheel drive shaft (2).
11. Inspect the wheel drive shaft CV joint. Refer to **Wheel Drive Shaft Outer Joint Inspection**.

Assemble Procedure

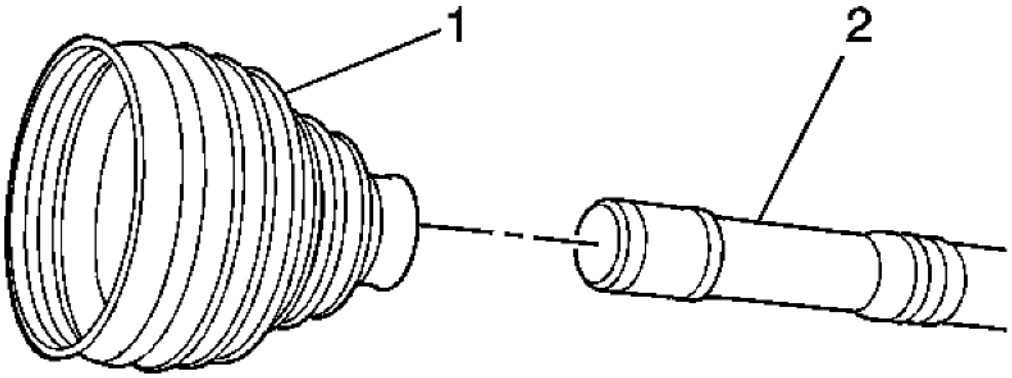


Fig. 31: Identifying Boot
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT crimp the boot clamp at this time.

1. Position the boot and the clamp (1) on the wheel drive shaft (2).

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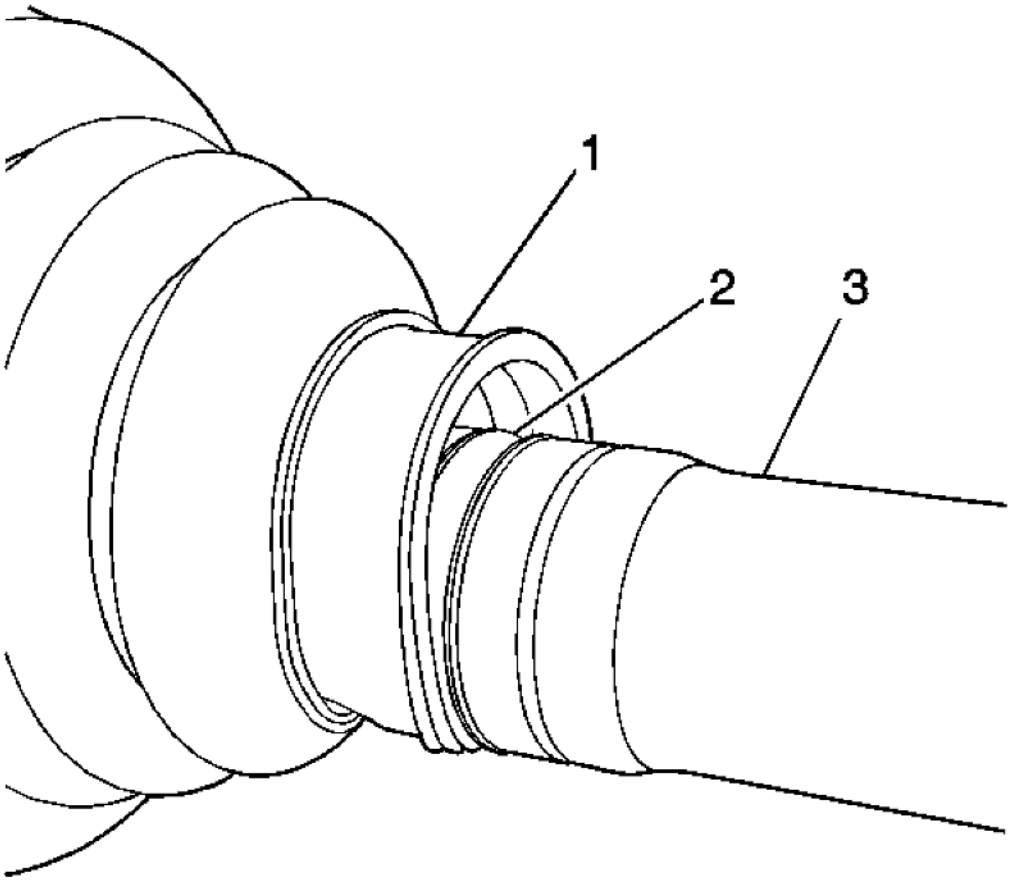


Fig. 32: Identifying Groove In Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

2. Ensure that the boot (1) is properly seated in the groove (2) in the wheel drive shaft (3).

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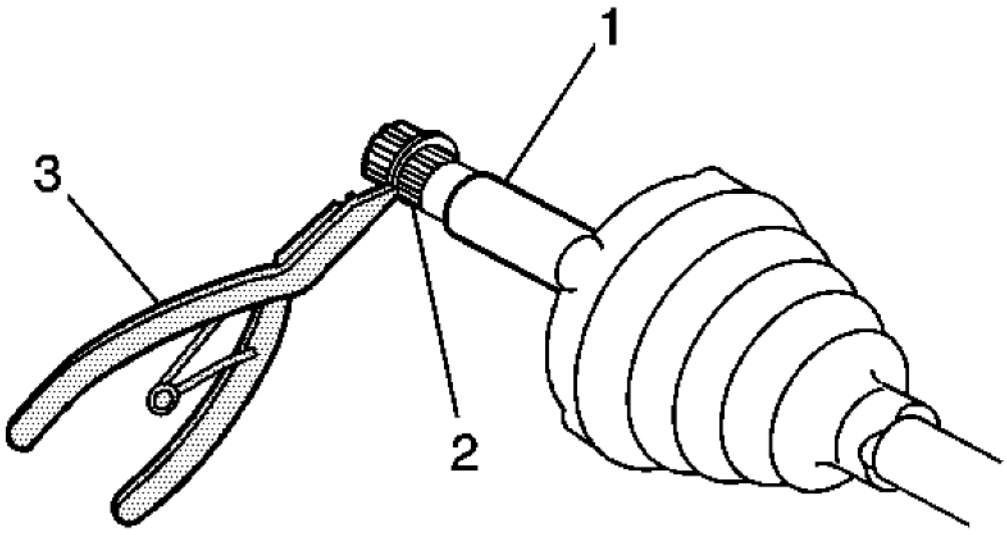


Fig. 33: Removing/Installing Retaining Ring
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 8059:** pliers, install the retaining ring (2) on the wheel drive shaft (1).
4. Using the **J 35910:** drive axle boot clamp pliers (1), close the boot clamp (2) until the gap (3) measures 2.15 mm (0.85 in).

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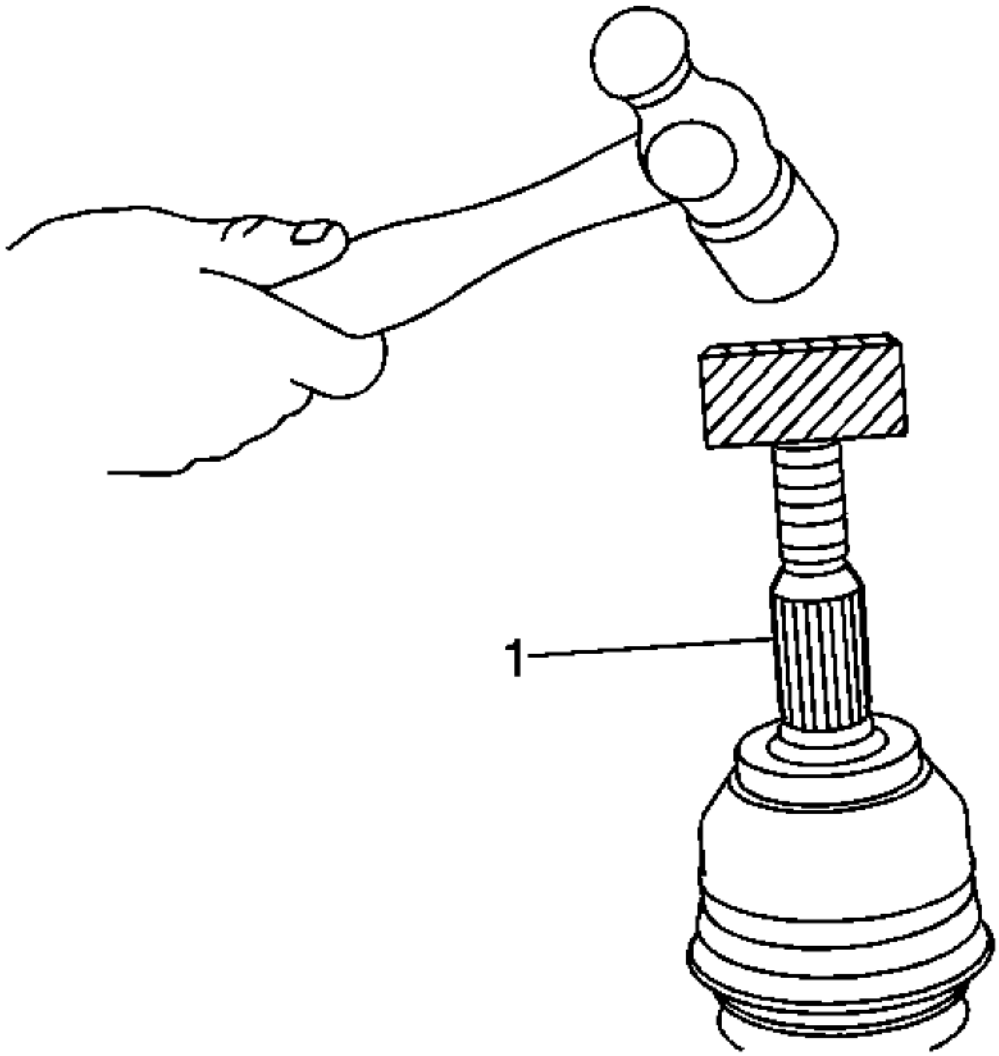


Fig. 34: Installing CV Joint
Courtesy of GENERAL MOTORS CORP.

NOTE: The CV joint should just touch the inner retaining ring.

5. Using a block of wood and a hammer, install the CV joint (1) on the wheel drive shaft.

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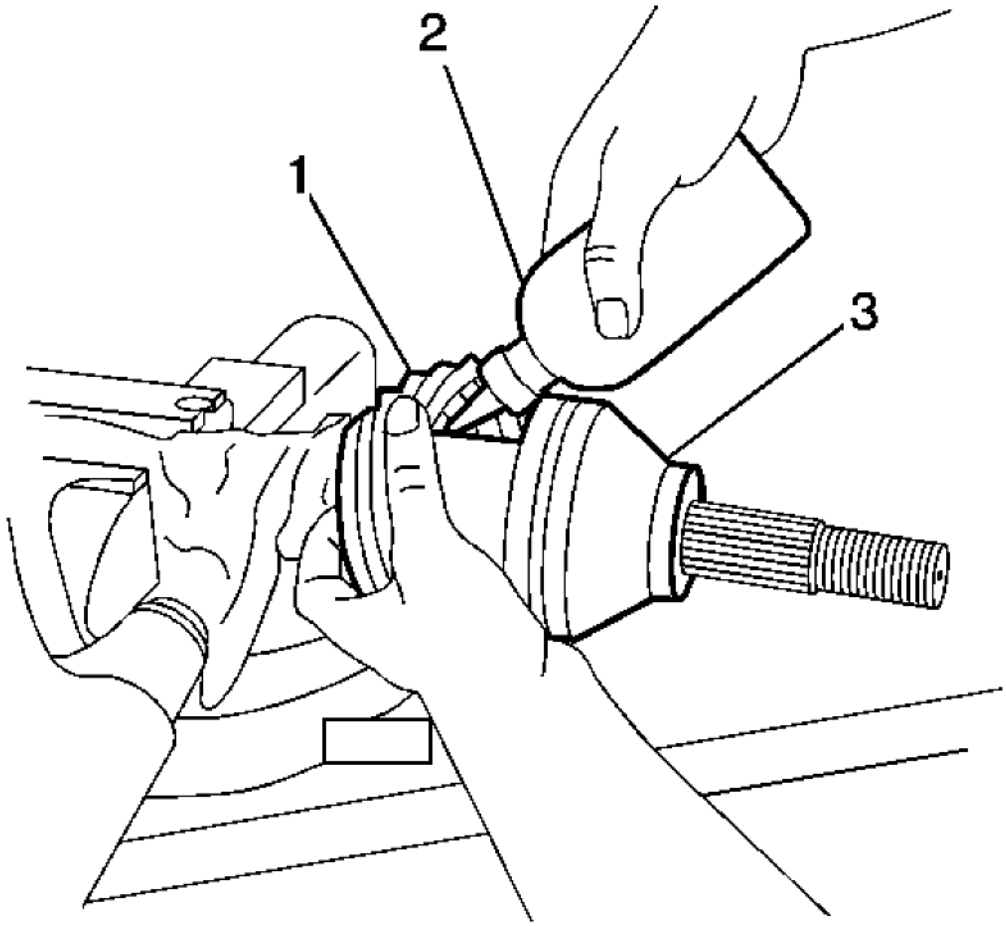


Fig. 35: Lubricating Boot Of Tripot Housing
Courtesy of GENERAL MOTORS CORP.

6. Place approximately half of the lubricant (2) inside the CV boot (1) and other half in the CV joint (3).
7. Remove any excess lubricant on the CV joint housing or the boot.

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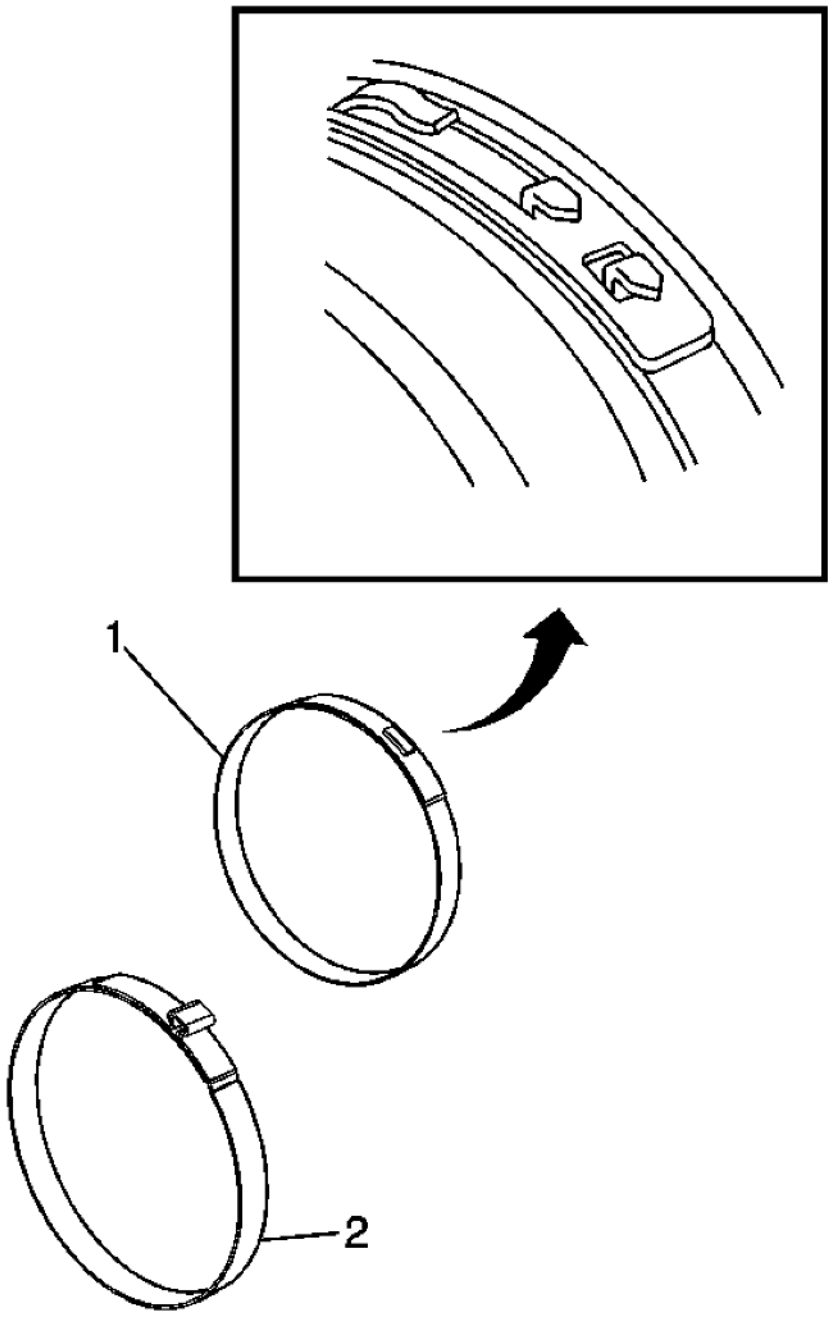


Fig. 36: View Of Ear Type Boot Clamp
Courtesy of GENERAL MOTORS CORP.

8. If working with a wheel drive that has the ear type clamp (2), proceed to step 9. If the wheel drive shaft has the low profile clamp (1), skip step 9 and proceed to step 10.

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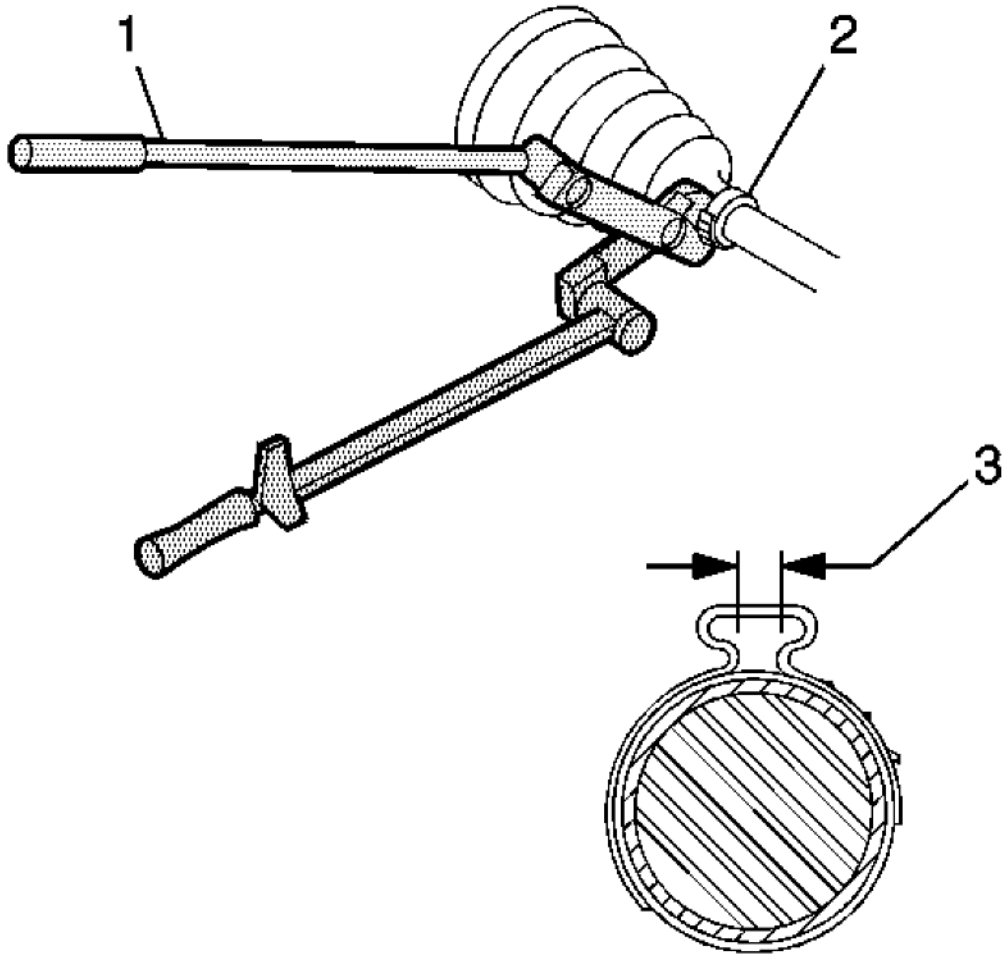


Fig. 37: Closing Clamp
Courtesy of GENERAL MOTORS CORP.

NOTE: When measuring the clamp end gap dimension, the gap should not exceed 2.15 mm (0.85 in).

9. Using the **J 35910:** pliers (1), torque or ratchet wrench and breaker bar, close the boot clamp until the gap (3) measures 2.15 mm (0.85 in).

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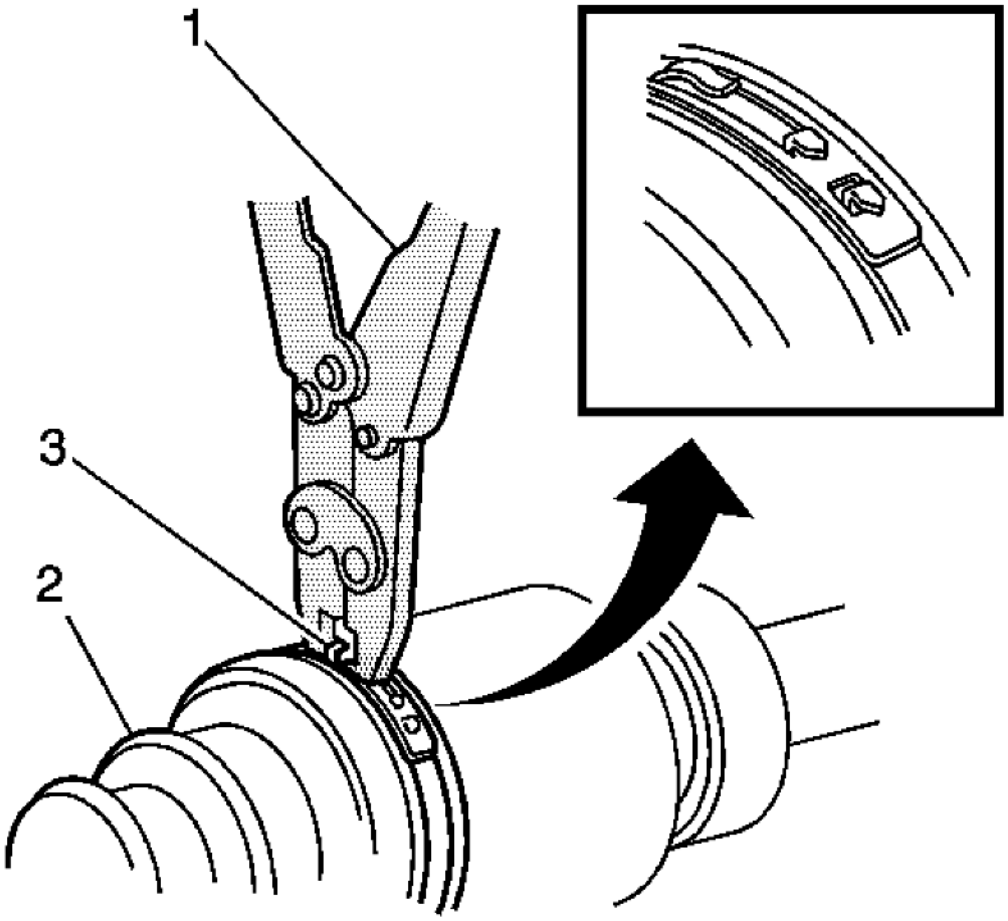


Fig. 38: Latching Large Seal Retaining Clamp
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure that the locking tabs on the clamp are fully locked in place.

10. Using the **CH 48894:** pliers (1), close the boot clamp (3).
11. Move the CV joint in a circular motion 4 to 5 times to distribute the lubricant.
12. Remove the wheel drive shaft from the vise.
13. Install the wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement**.

WHEEL DRIVE SHAFT OUTER JOINT INSPECTION

Disassembly Procedure

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1. Remove the outer constant velocity (CV) joint and boot from the wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement**.
2. Remove any lubricant from the CV joint.

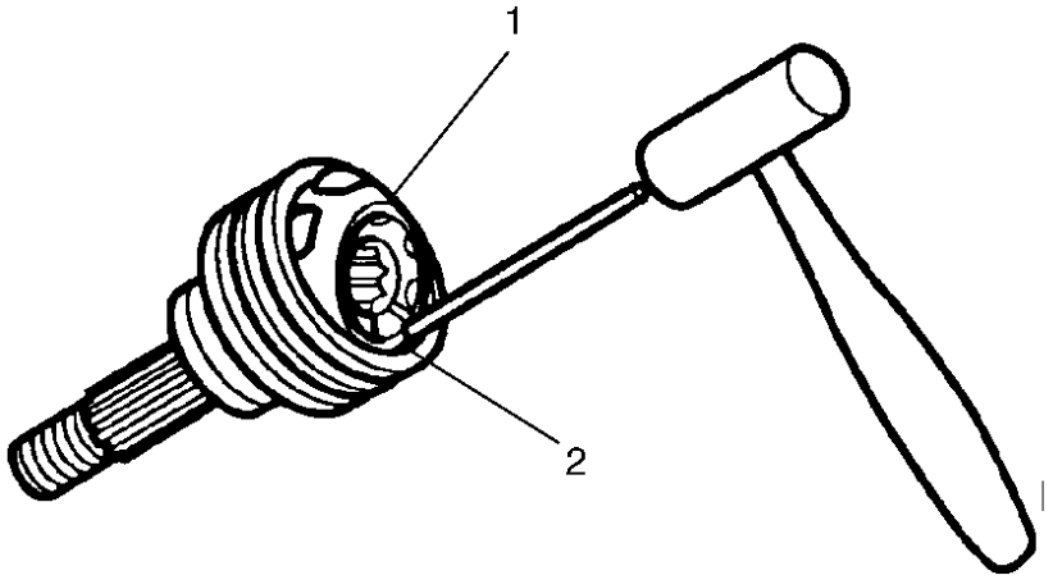


Fig. 39: Tilting Cage
Courtesy of GENERAL MOTORS CORP.

NOTE: Position the cage and the inner race so they are level.

3. Install the outer CV joint assembly in a soft jawed vise.

NOTE: The following procedure will have to be repeated until all the ball bearing are removed form the cage.

4. Using a brass drift (2), gentle tap the cage until the ball bearing can be removed from the cage.

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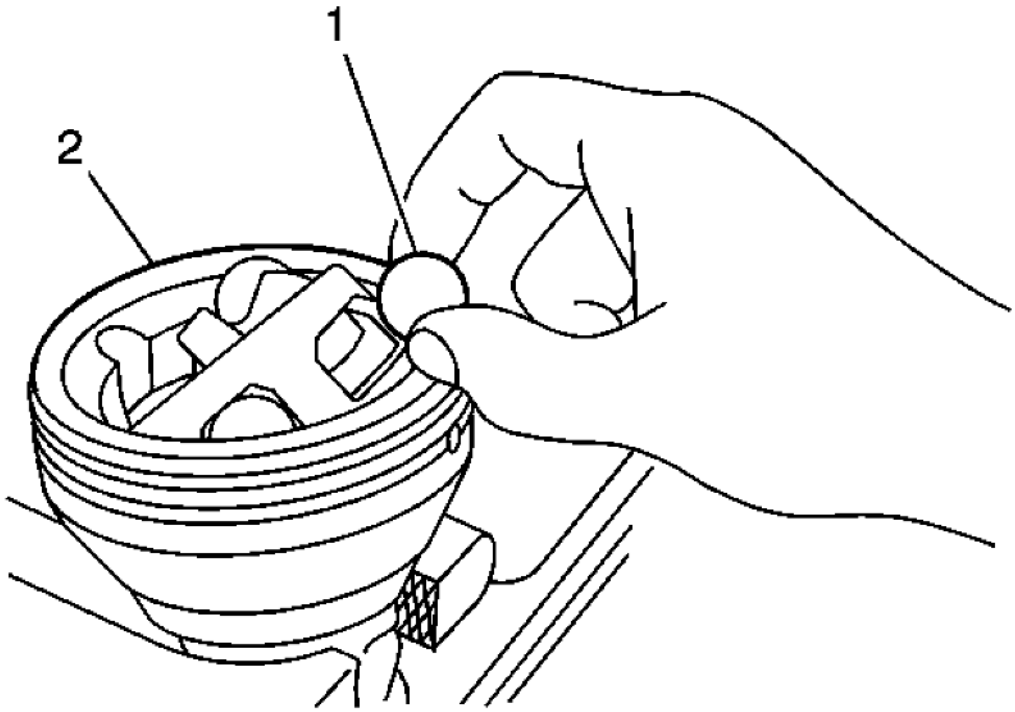


Fig. 40: Removing/Installing Ball Bearings From CV Joint
Courtesy of GENERAL MOTORS CORP.

5. Using a small screwdriver, remove the ball bearings (1) from the CV joint (2).

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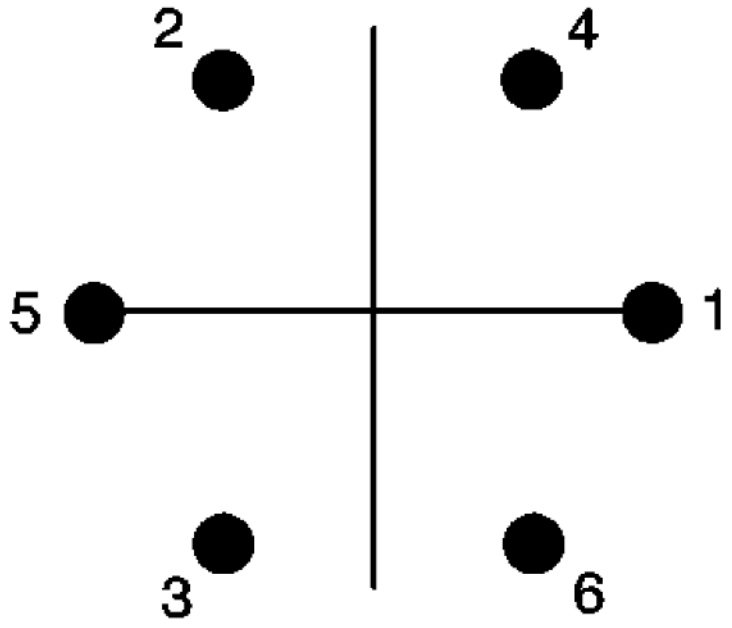


Fig. 41: Identifying Ball Removal/Installation Sequence
Courtesy of GENERAL MOTORS CORP.

6. Remove the ball bearings from the CV joint in sequence.

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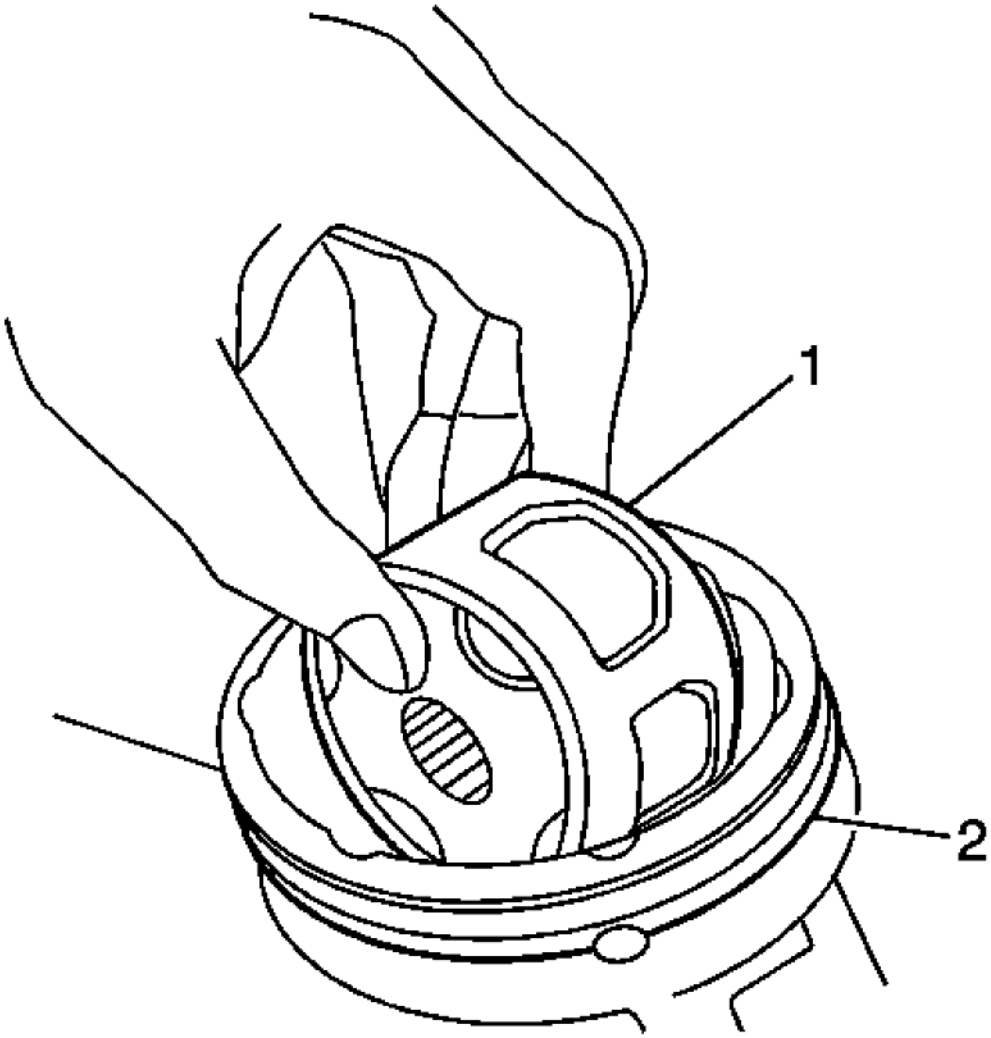


Fig. 42: Positioning Cage
Courtesy of GENERAL MOTORS CORP.

NOTE: Position the cage so that the larger radius corners of the cage windows are facing up.

7. Position the cage (1) at a 90 degrees to the centerline of the outer race (2).
8. Align the cage windows with the lands of the outer race (2).
9. Lift and remove the cage (1) and the inner race from the outer race (2).

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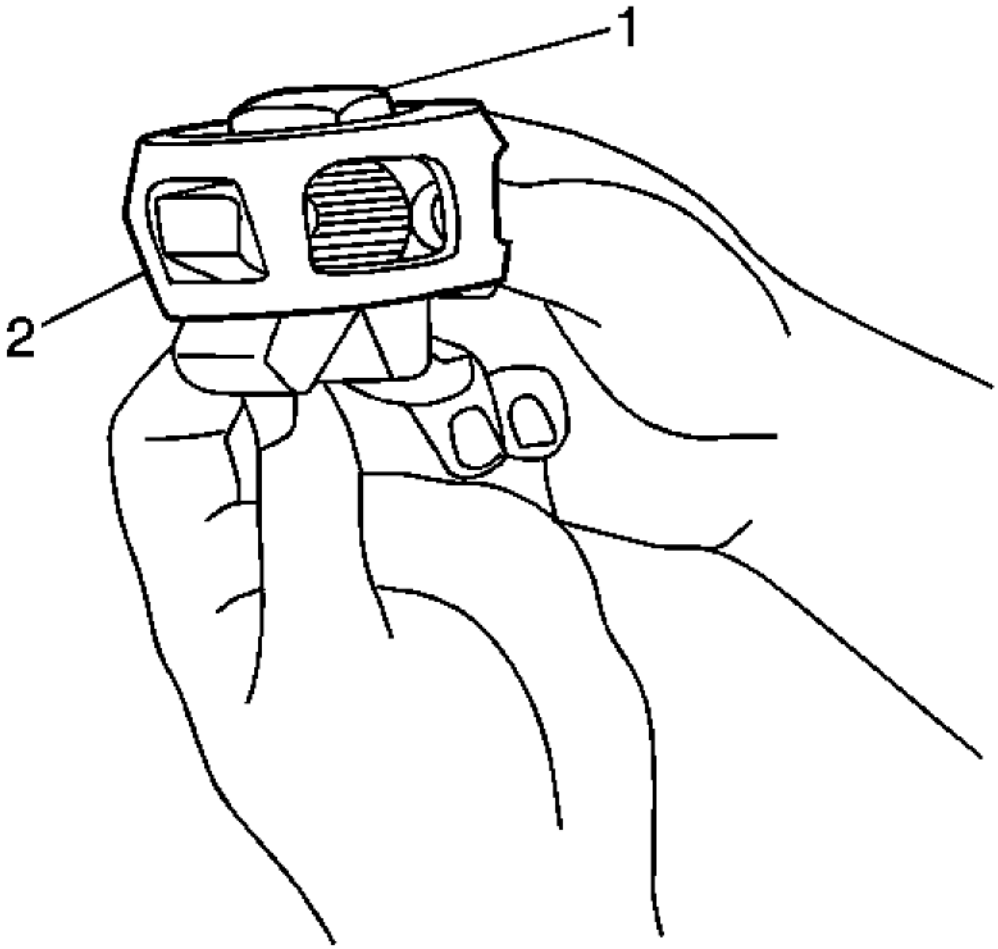


Fig. 43: Positioning Cage & Inner Race
Courtesy of GENERAL MOTORS CORP.

10. Position the cage (2) and the inner race (1) so that the larger radius corners of the cage windows are up.
11. Rotate the inner race (1) 90 degrees to the center line of the cage (2).
12. Align the lands of the inner race (1) with the windows of the cage (2).
13. Move the inner race (1) land into the cage window (2).
14. Rotate the inner race (1) down and remove it from the cage (2).
15. Clean the following items thoroughly with the proper cleaning solvent:
    - The inner race
    - The outer race

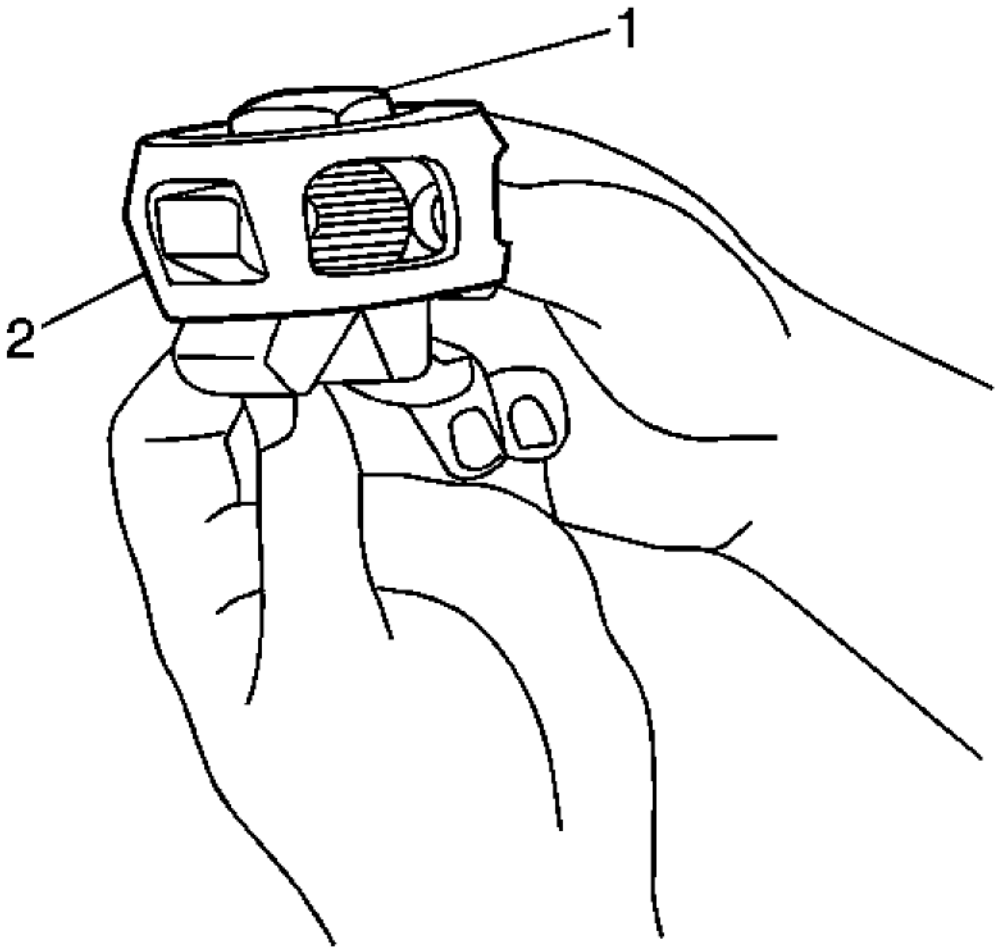
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- The cage
- The ball bearings
- The exposed end of the wheel drive shaft

NOTE: The internal parts of the CV joint are NOT SERVICED separately. The outer CV joint is serviced as an assembly.

16. If any of the above items are found to have excessive wear or are damaged, replace the outer CV joint as an assembly.

Assembly Procedure



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Fig. 44: Positioning Cage & Inner Race
Courtesy of GENERAL MOTORS CORP.

1. Position the cage (2) so that the larger radius corners of the cage windows are up.
2. Position the inner race (1) 90 degrees to the centerline of the cage (2).
3. Insert the inner race (1) through the bottom of the cage (2).
4. Align the lands of the inner race (1) with the windows of the cage (2).
5. Move the inner race (1) land into the cage window (2).
6. Rotate the inner race (1) down and remove it from the cage (2).
7. Rotate the inner race (1) within the cage (2) so that the grooved surface of the inner race (1) is facing up.
8. Align the inner race (1) ball bearing tracks with the cage (2) windows.

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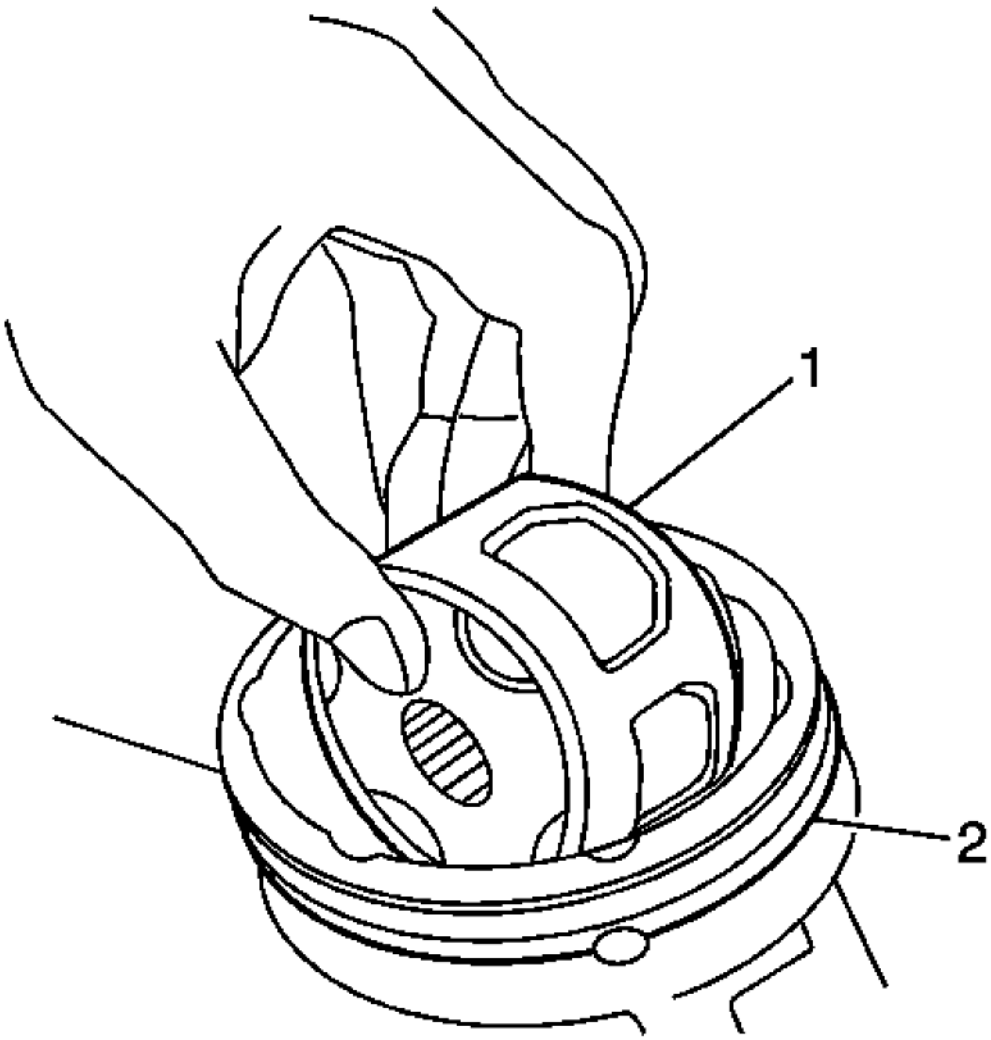


Fig. 45: Positioning Cage
Courtesy of GENERAL MOTORS CORP.

9. Wrap a clean shop towel around the CV joint outer race splined shaft.
10. Place the outer race (2) vertically in a bench vise.
11. Position the cage (1) and the inner race at a 90 degrees to the centerline of the outer race (2).
12. With the inner race and the cage (1) assembly in a vertical position, insert the cage and the inner race into the outer race (2).

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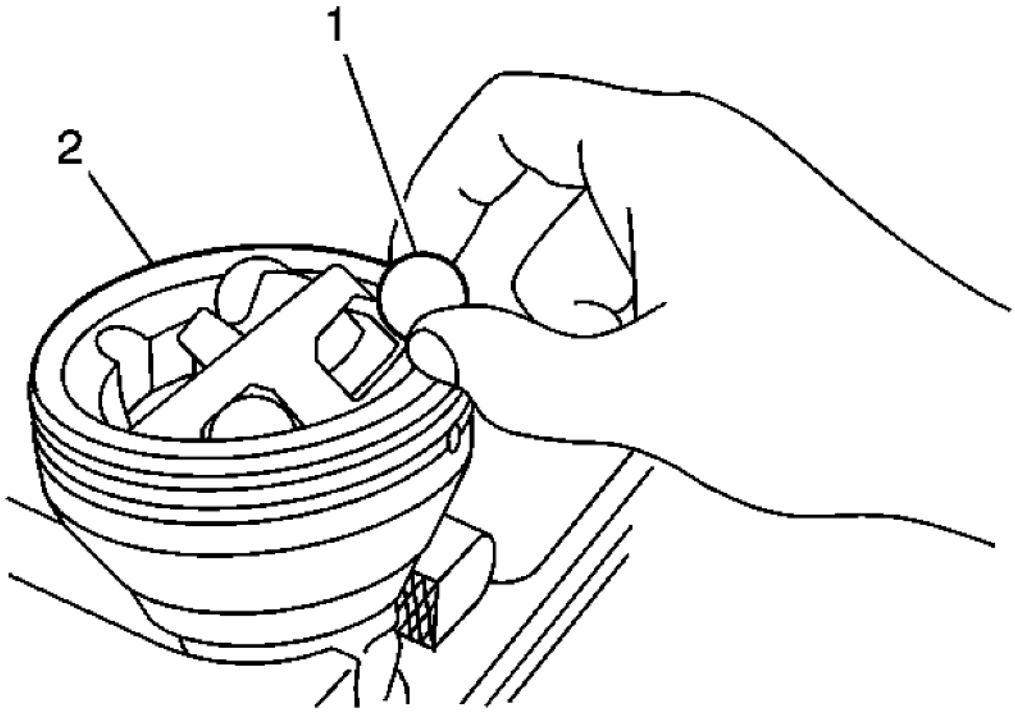


Fig. 46: Removing/Installing Ball Bearings From CV Joint
Courtesy of GENERAL MOTORS CORP.

NOTE: The larger radius corners of the cage windows should be positioned up and the grooved surface of the inner race should be visible.

13. Position the cage (2) and the inner race so that they are level in the vise.
14. Rotate the appropriate component(s), and align the cage windows and the inner race ball bearing (1) tracks with the outer race ball bearing tracks.
15. Position a cage window and the inner race ball bearing track for the ball bearing installation.

NOTE: When performing the following procedure, the opposing cage (2) window and the inner ball bearing (1) track will be accessible for the ball bearing installation.

16. Press down on the cage following one of the outer race ball bearing (1) tracks.
17. Install the ball bearing through the cage window onto the inner race ball bearing (1) track.

NOTE: The following service procedure will have to be performed after each ball

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bearing (1) has been installed.

18. After the first ball bearing (1) has been installed, use a brass drift and a hammer and gently tap the cage in order to drive the cage and the inner race down completely in the outer race.

NOTE: After the ball bearing (1) has been installed, there should be NO GAP between the ball bearing and the inner race.

19. Position the cage and the inner race so that they are level.
20. Using a plastic hammer, lightly tap the ball bearing (1) into place.

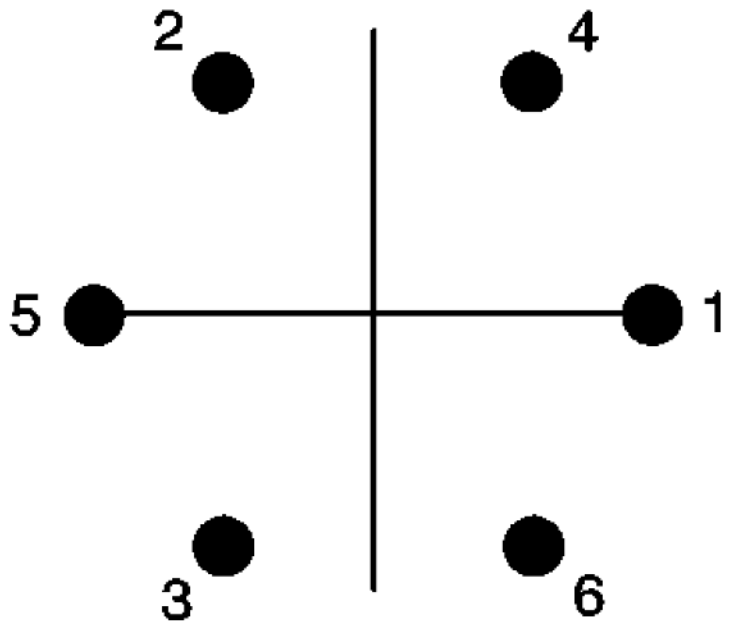


Fig. 47: Identifying Ball Removal/Installation Sequence
Courtesy of GENERAL MOTORS CORP.

21. Install the ball bearings in sequence.
22. Repeat steps 18 through 20 until all the ball bearings are installed.
23. Install the outer CV joint and boot on the wheel drive shaft. Refer to **Rear Wheel Drive Shaft Replacement**.

WHEEL DRIVE SHAFT INNER JOINT INSPECTION

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Inspection Procedure

1. Remove the front wheel drive shaft inner joint and boot. Refer to **Rear Wheel Drive Shaft Replacement**.

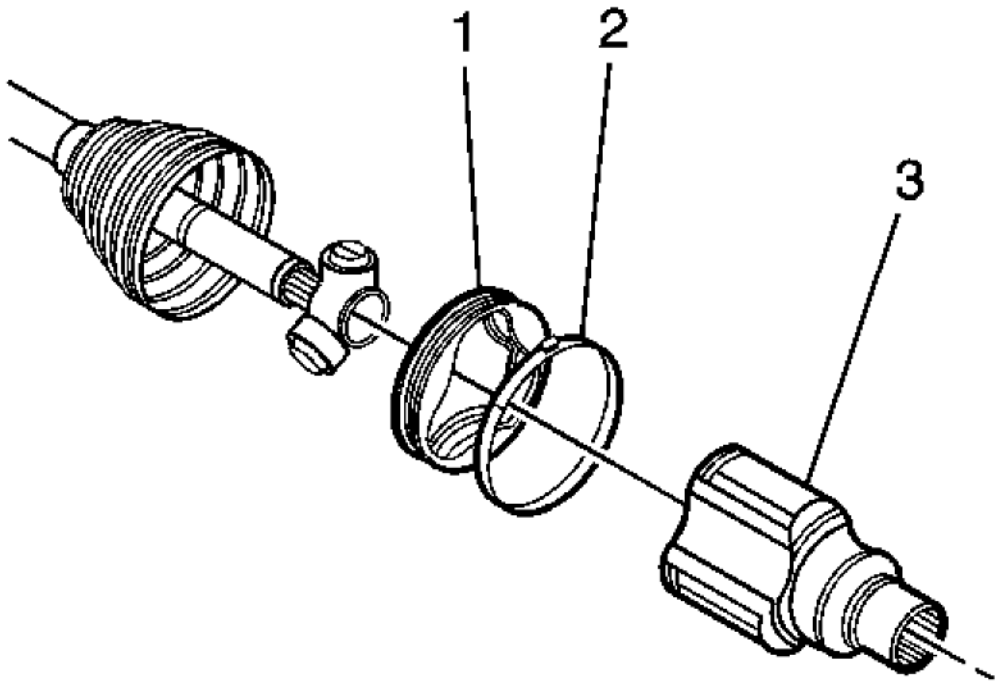


Fig. 48: Identifying Wheel Drive Shaft Inner Joint Inspection Areas
Courtesy of GENERAL MOTORS CORP.

2. Remove the wheel drive shaft tripod bushing (1) from the tripod housing (3).
3. Remove the wheel drive shaft tripod housing (1) from the wheel drive shaft.
4. Remove the wheel drive shaft tripod joint boot bushing (1).
5. Using a suitable cleaner, remove the excess grease from the tripod assembly.
6. Inspect the following items for damage or excessive wear:
    - The wheel drive shaft tripod boot
    - The wheel drive shaft tripod assembly
    - The wheel drive shaft tripod joint housing
    - The wheel drive shaft tripod joint bushing
    - The wheel drive shaft

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7. If any of the internal parts are found to be excessively worn or damaged, replace the wheel drive shaft inner joint and boot. Refer to **Rear Wheel Drive Shaft Replacement**.

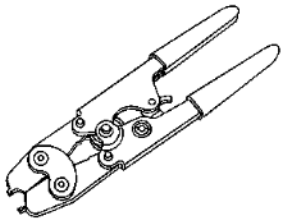
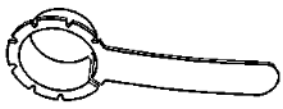
DESCRIPTION AND OPERATION

WHEEL DRIVE SHAFTS DESCRIPTION AND OPERATION

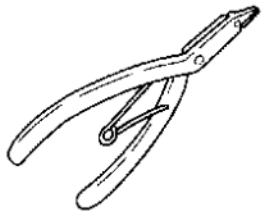
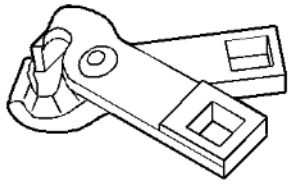
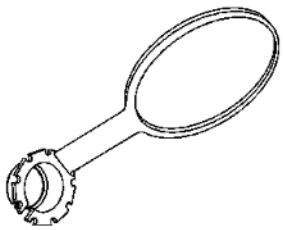
The wheel drive shaft assemblies are flexible assemblies consisting of an inner and outer constant velocity joint connected by a interconnecting shaft. The inner constant velocity joint is flexible and can move in and out. The inner constant velocity joint is replaceable. The outer constant velocity joint is flexible, but cannot move in or out. The outer constant velocity joint is pressed onto the interconnecting shaft and is replaced as a complete outer constant velocity joint and interconnecting shaft assembly. Both constant velocity joints use rubber joint boots to protect and seal the constant velocity joints from dirt, water, and atmospheric conditions. The joint boots also contain lubricating grease required by the constant velocity joints for lubrication and quiet operation. Inner and outer joint boot kits are available and can be replaced individually as required. The inner constant velocity joints incorporate a male spline and interlock with the differential gears using barrel type snap rings. The snap rings are replaced after removal. The outer constant velocity joint is secured to the wheel/hub assembly with a locking nut and washer. The nut must be peened over into the keyway of the outer constant velocity joint stem to secure. The nut is discarded after removal. The wheel drive shafts transmit power from the differential to the wheel hubs. The constant velocity joints enable the wheel drive shafts to transmit the power with a flexible and quiet operation.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	CH 48894 Wheel Drive Shaft Clamping Pliers
	DT 48877 Seal Protector

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	J 8059 Snap Ring Pliers
	J 35910 Drive Shaft Boot Clamp Pliers
	J 44394 Seal Protector

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