

## 2006 Buick Rainier

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer

### 2006 Driveline/Axle

Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer

## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

#### Fastener Tightening Specifications

Application	Specification	
	Metric	English
Bearing Cap Bolts	75 N.m	55 lb ft
Differential Housing Cover Bolts, 8.0" Axle	30 N.m	20 lb ft
Differential Housing Cover Bolts, 8.6" Axle	25 N.m	18 lb ft
Drain Plug	48 N.m	35 lb ft
Fill Plug	33 N.m	24 lb ft
Pinion Shaft Lock Bolt	36 N.m	27 lb ft
Ring Gear Bolts	120 N.m	89 lb ft

### DIFFERENTIAL ADJUSTMENT SHIM SPECIFICATIONS

#### 8.0, 8.6 Inch Axle Differential Adjustment Shims Specifications

Number of Notches		Specification	
Inside	Outside	Metric	English
0	3	1.016 mm	0.040"
0	4	1.067 mm	0.042"
0	5	1.118 mm	0.044"
1	1	1.168 mm	0.046"
1	2	1.219 mm	0.048"
1	3	1.270 mm	0.050"
1	4	1.321 mm	0.052"
1	5	1.372 mm	0.054"
2	1	1.422 mm	0.056"
2	2	1.473 mm	0.058"
2	3	1.524 mm	0.060"
2	4	1.575 mm	0.062"
2	5	1.626 mm	0.064"

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3	1	1.676 mm	0.066"
3	2	1.727 mm	0.068"
3	3	1.778 mm	0.070"
3	4	1.829 mm	0.072"
3	5	1.880 mm	0.074"
4	1	1.930 mm	0.076"
4	2	1.981 mm	0.078"
4	3	2.032 mm	0.080"
4	4	2.083 mm	0.082"
4	5	2.134 mm	0.084"
5	1	2.184 mm	0.086"
5	2	2.235 mm	0.088"
5	3	2.286 mm	0.090"
5	4	2.337 mm	0.092"
5	5	2.388 mm	0.094"
6	1	2.438 mm	0.096"
6	2	2.489 mm	0.098"
6	3	2.540 mm	0.100"

**AXLE PRELOAD AND BACKLASH SPECIFICATIONS****Axle Preload and Backlash Specifications**

<b>Application</b>	<b>Specification</b>	
	<b>Metric</b>	<b>English</b>
Backlash	0.08-0.25 mm	0.003-0.010 in
Backlash (Preferred)	0.13-0.18 mm	0.005-0.007 in
Pinion Bearing Preload, New Bearings	1.7-3.4 N.m	15-30 lb in
Pinion Bearing Preload, Used Bearings	1.1-2.3 N.m	10-20 lb in
Pinion and Differential Case Bearing Preload, New Bearings	3.4-6.2 N.m	30-55 lb in
Pinion and Differential Case Bearing Preload, Used Bearings	2.8-5.1 N.m	25-45 lb in

**SEALERS, ADHESIVES, AND LUBRICANTS****Sealers, Adhesives, and Lubricants**

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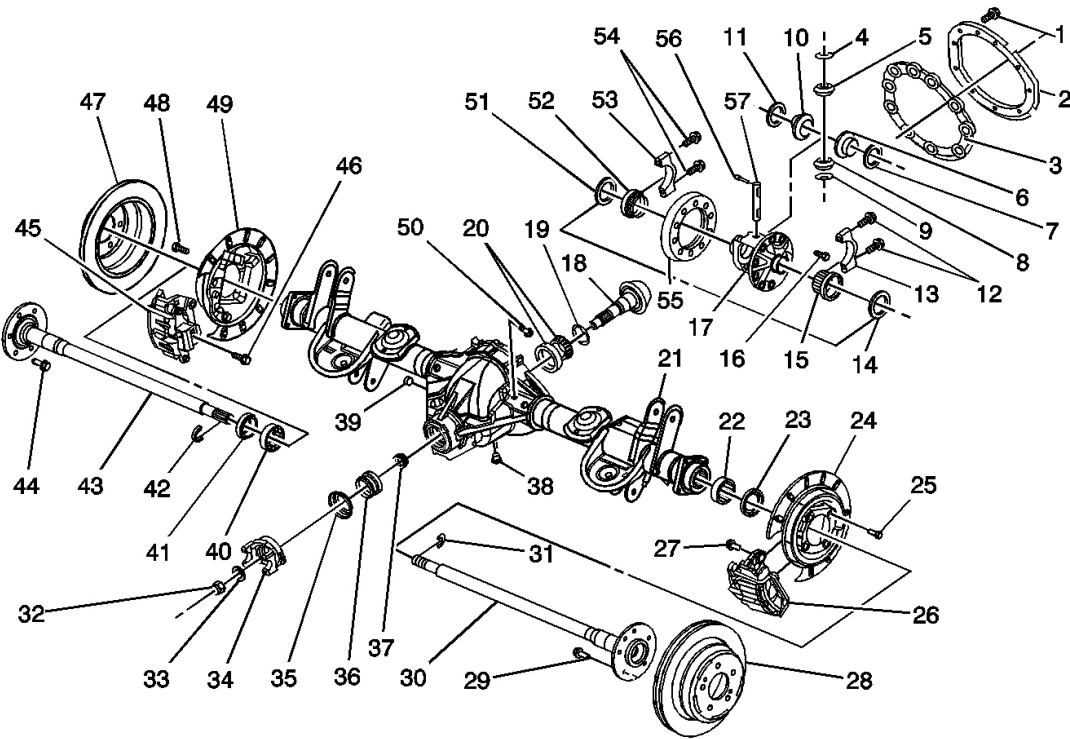
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Application	Type of Material	GM Part Number
Rear Drive Axle	Lubricant	SAE 75W-90 Synthetic Axle Lubricant 12378261 (Canadian P/N 10953455) or equivalent meeting GM Specification 9986115
Pinion Yoke Splines	Sealant	12346004 (Canadian P/N 10953480) or equivalent

**COMPONENT LOCATOR**

**REAR AXLE DISASSEMBLED VIEWS**



**Fig. 1: Rear Axle Disassembled View**  
**Courtesy of GENERAL MOTORS CORP.**

**Callouts For Fig. 1**

Callout	Component Name
1	Bolt

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2	Rear Axle Housing Cover
3	Rear Axle Housing Cover Gasket
4	Thrust Washer
5	Differential Pinion Gear
6	Differential Side Gear
7	Thrust Washer
8	Differential Pinion Gear
9	Thrust Washer
10	Differential Side Gear
11	Thrust Washer
12	Bearing Cap Bolts
13	Bearing Cap
14	Differential Bearing Shim
15	Differential Bearing and Cup
16	Differential Ring Gear Bolt
17	Differential Case
18	Pinion Gear Shaft
19	Pinion Gear Bearing Shim
20	Inner Pinion Bearing and Cup
21	Rear Axle Housing
22	Wheel Bearing
23	Rear Axle Shaft Seal
24	Brake Backing Plate
25	Brake Backing Plate Bolt
26	Brake Caliper
27	Brake Caliper Bolt
28	Brake Rotor
29	Wheel Stud
30	Rear Axle Shaft
31	Rear Axle Shaft Lock
32	Pinion Yoke Nut
33	Pinion Yoke Washer
34	Pinion Yoke
35	Pinion Gear Seal
36	Outer Pinion Bearing and Cup

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	Pinion Gear Bearing Spacer
38	Rear Axle Housing Drain Plug
39	Rear Axle Housing Fill Plug
40	Wheel Bearing
41	Rear Axle Shaft Seal
42	Rear Axle Shaft Lock
43	Rear Axle Shaft
44	Wheel Stud
45	Brake Caliper
46	Brake Caliper Bolt
47	Brake Rotor
48	Brake Backing Plate Bolt
49	Brake Backing Plate
50	Rear Axle Vent Hose Connector
51	Differential Bearing Shim
52	Differential Bearing and Cup
53	Bearing Cap
54	Bearing Cap Bolts
55	Differential Ring Gear
56	Differential Pinion Gear Shaft Bolt
57	Differential Pinion Gear Shaft

## DIAGNOSTIC INFORMATION AND PROCEDURES

### DIAGNOSTIC STARTING POINT - REAR DRIVE AXLE

Begin the system diagnosis by reviewing the system Description and Operation. Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Rear Drive Axle** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

### 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**.

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### 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.

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

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### **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**

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 de-acceleration can be caused by any of the following:

- Worn differential pinion shaft
- Worn differential pinion and/or side gear teeth

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- 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 pinion and ring gear backlash

Inspect, adjust or replace the affected components as necessary.

### NOISY IN DRIVE

#### Noisy in Drive

Checks	Action
Excessive pinion to ring gear backlash	Adjust the pinion to ring gear backlash. Refer to <b><u>Backlash Adjustment (7.6, 8.6 Inch Axle)</u></b> .
Worn pinion and ring gear	Replace the pinion and the ring gear. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Worn pinion bearings	Replace the pinion bearings. Refer to <b><u>Drive Pinion Bearings Replacement</u></b> .
Loose pinion bearings	Adjust the pinion bearings preload. Refer to <b><u>Pinion Depth Adjustment</u></b> .
Excessive pinion end play	Adjust the pinion end play. Refer to <b><u>Pinion Depth Adjustment</u></b> .
Worn differential bearings	Replace the differential bearings. Refer to <b><u>Differential Side Bearings Replacement</u></b> .
Loose differential bearings	Adjust the differential bearing preload. Refer to <b><u>Differential Side Bearing Preload Adjustment</u></b> .
Excessive ring gear runout	Replace the ring gear. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Low oil level	Fill the fluid level to specifications with the proper lubricant. Refer to <b><u>Lubricant Level Inspection - Rear Drive Axle</u></b> .
Wrong or poor grade oil	Drain and refill the system with the proper lubricant. Refer to <b><u>Lubricant Replacement - Rear Drive Axle</u></b> .
Bent axle housing	Replace the axle housing. Refer to <b><u>Rear Axle Housing Replacement</u></b> .

### NOISY WHEN COASTING

#### Noisy When Coasting

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Checks	Action
DEFINITION: Noise is audible when slowing down and disappears when driving.	
Worn pinion and ring gear	Adjust or replace the pinion and the ring gear. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Pinion and ring gear too tight	Adjust the pinion and the ring gear backlash. Refer to <b><u>Backlash Adjustment (7.6, 8.6 Inch Axle)</u></b> .

### INTERMITTENT NOISE

#### Intermittent Noise

Checks	Action
Warped ring gear	Replace the ring gear. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Loose differential case bolts	Tighten differential case bolts to specifications. Refer to <b><u>Fastener Tightening Specifications</u></b> .

### CONSTANT NOISE

#### Constant Noise

Checks	Action
Flat spot on the pinion or the ring gear teeth	Replace the pinion and the ring gear. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Flat spot on the pinion bearing	Replace the bearing. Refer to <b><u>Drive Pinion Bearings Replacement</u></b> .
Worn pinion splines	Replace the pinion. Refer to <b><u>Drive Pinion and Ring Gear Replacement</u></b> .
Worn axle shaft dowel holes	Replace the axle shaft. Refer to <b><u>Rear Axle Shaft Replacement</u></b> .
Worn hub studs	Replace the wheel studs. Refer to <b><u>Wheel Stud Replacement</u></b> in Rear Suspension.
Bent axle shaft	Replace the axle shaft. Refer to <b><u>Rear Axle Shaft Replacement</u></b> .

### NOISY ON TURNS

#### Noisy on Turns

Checks	Action
Worn axle shaft splines	Replace the axle shaft. Refer to <b><u>Rear Axle Shaft</u></b>

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### Replacement.

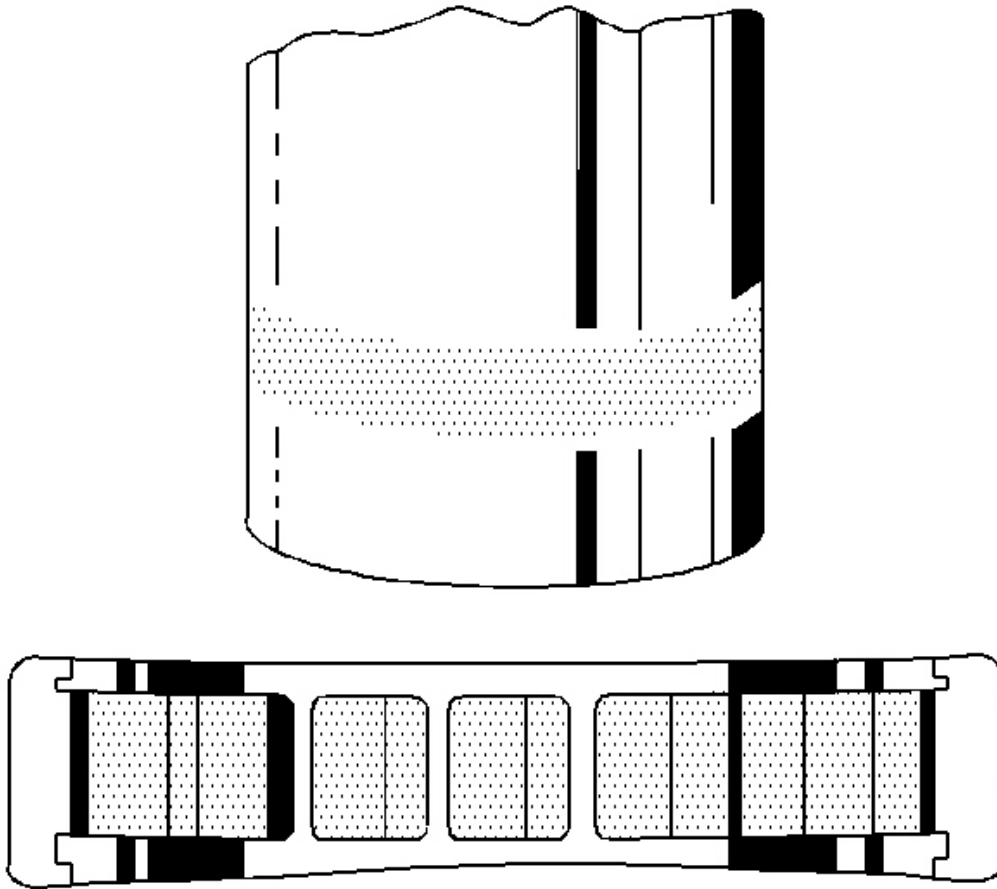
#### **WHEEL BEARING WEAR - REAR DRIVE AXLE (STRAIGHT)**

##### **Straight Roller Bearing Diagnosis**

Consider the following factors when diagnosing a bearing condition:

- Note the general condition of all parts during disassembly and inspection.
- Classify the failure with the aid of the illustrations.
- Determine the cause.
- Make all repairs following recommended procedures.

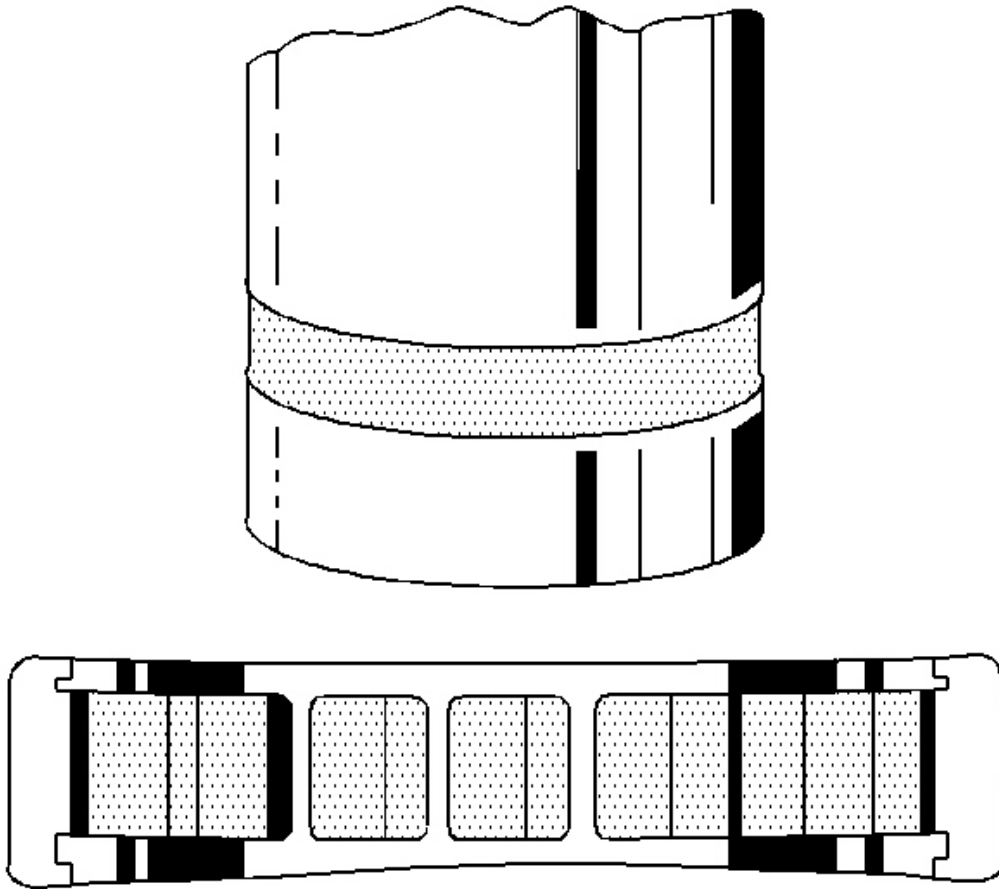
##### **Wear (Minor)**



**Fig. 2: Identifying Minor Wear**  
**Courtesy of GENERAL MOTORS CORP.**

Light pattern on races and rollers can be caused by fine abrasives. Clean all of the parts including the housings. Check the seals. Replace the bearings if rough or noisy. Replace the shaft if damaged.

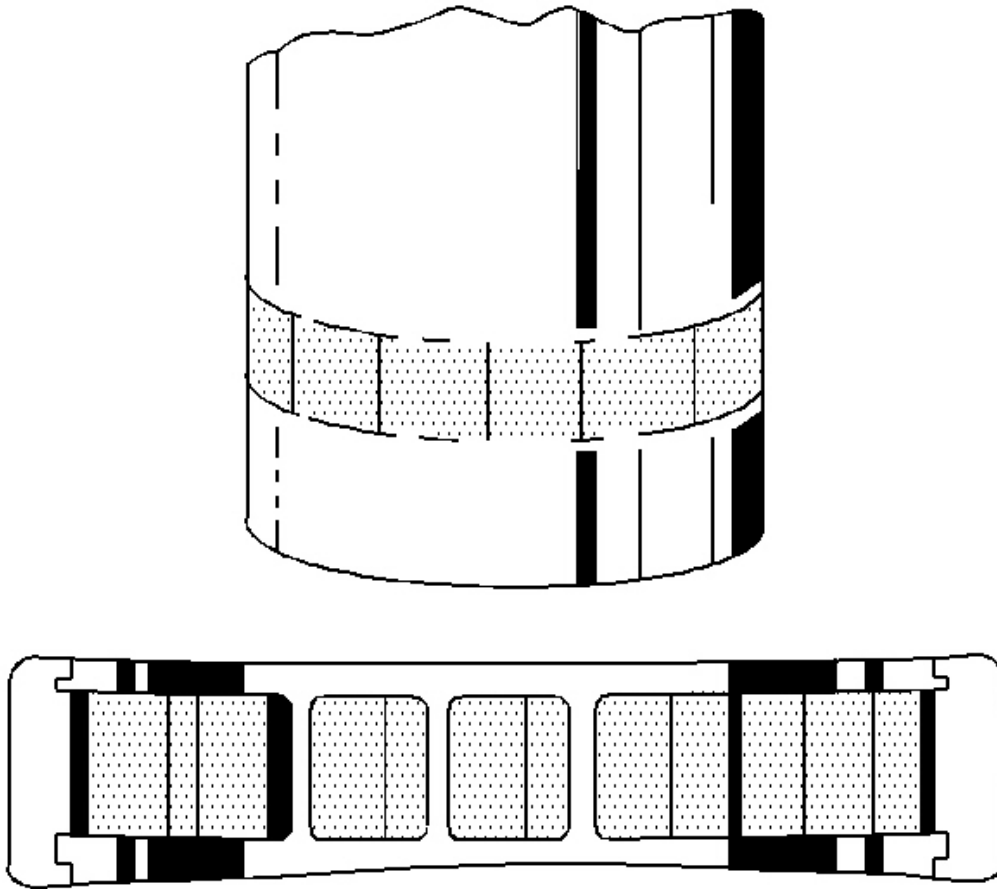
**Wear (Major)**



**Fig. 3: Identifying Major Wear**  
**Courtesy of GENERAL MOTORS CORP.**

Heavy pattern on races and rollers can be caused by fine abrasives. Clean all of the parts including the housing. Check the seals. Replace the bearings if rough or noisy. Replace the shaft if damaged.

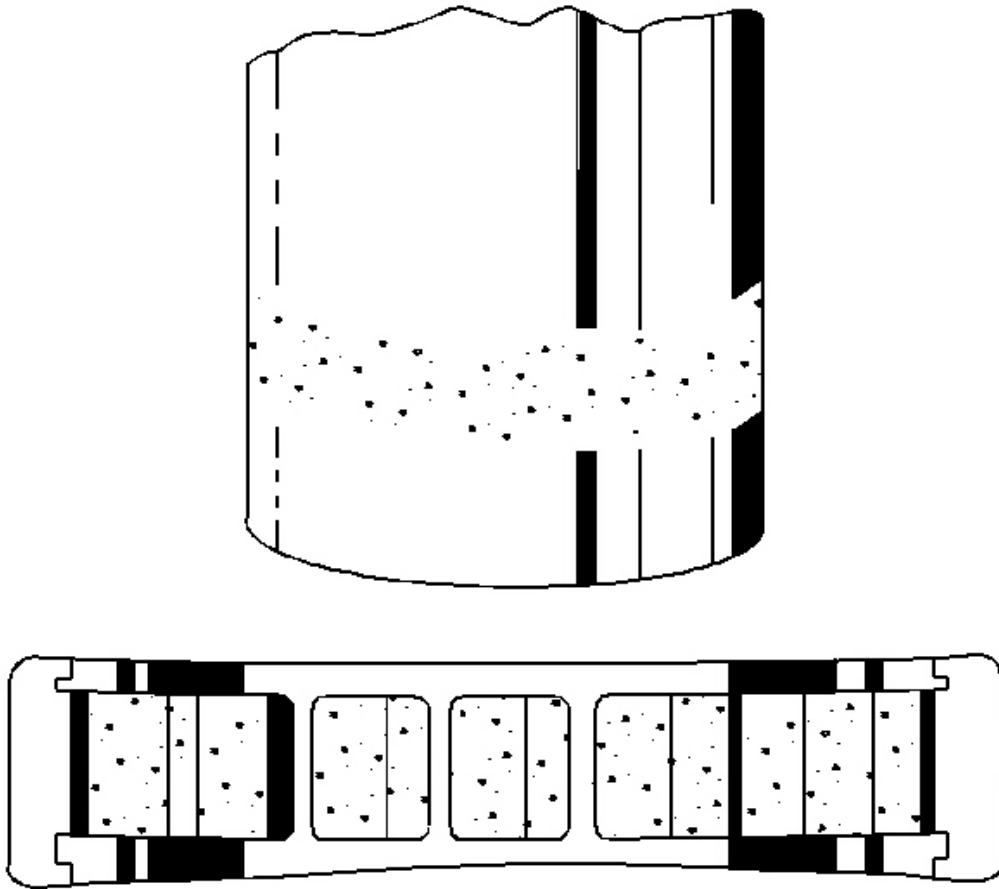
**Brinelling**



**Fig. 4: Identifying Brinelling**  
**Courtesy of GENERAL MOTORS CORP.**

Surface indentations in the raceway can be caused by roll either under impact loading or vibration while the bearing is not rotating. Replace the bearing if rough or noisy. Replace the shaft if damaged.

**Indentations**

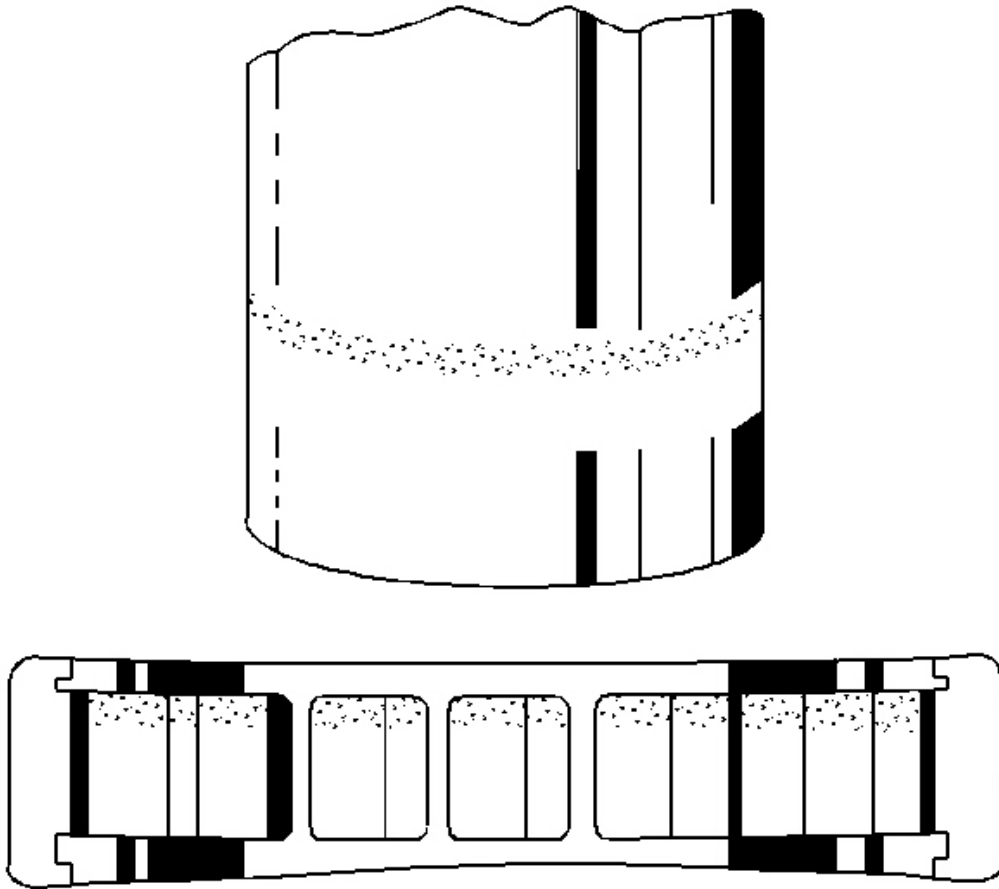


**Fig. 5: Identifying Indentations**

**Courtesy of GENERAL MOTORS CORP.**

Surface depressions on race and rollers can be caused by hard particles of foreign material. Clean all of the parts, including the housing. Check the seals. Replace the bearings if rough or noisy. Replace the shaft if damaged.

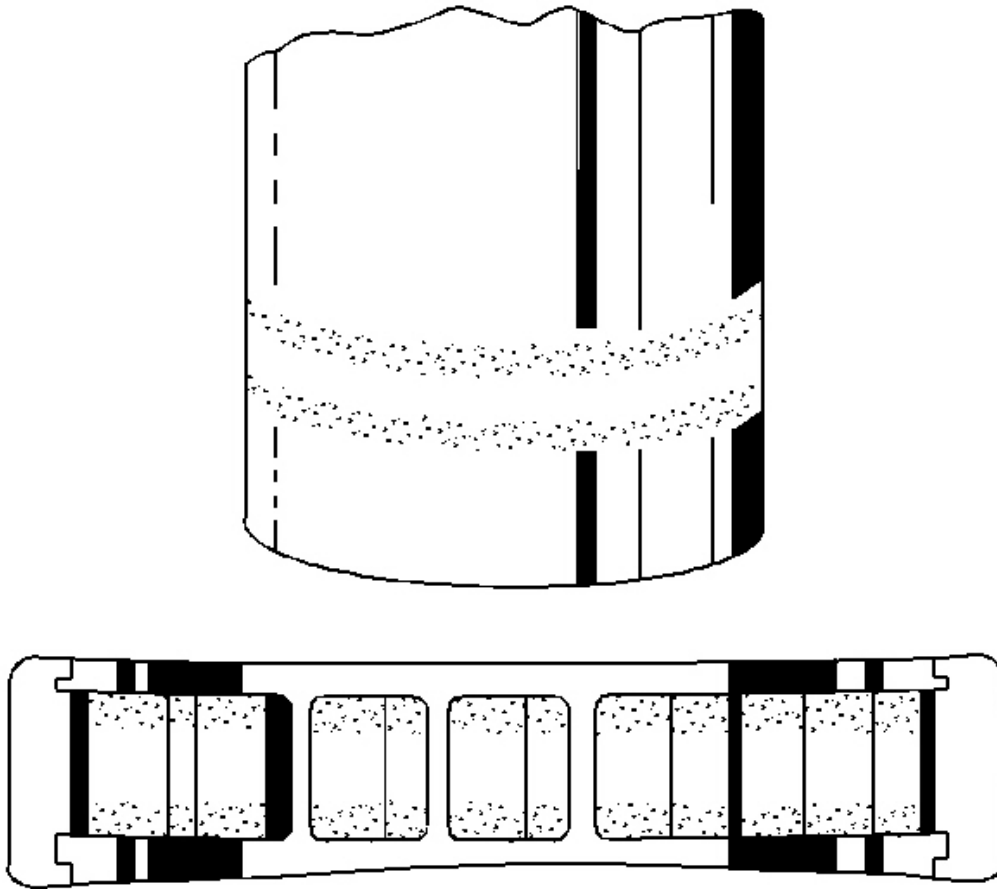
**Single Edge Pitting**



**Fig. 6: Identifying Single Edge Pitting**  
**Courtesy of GENERAL MOTORS CORP.**

Flaking of surface metal results from fatigue, usually at one edge of race and rollers. Replace the bearing. Clean all related parts. Replace the shaft if damaged.

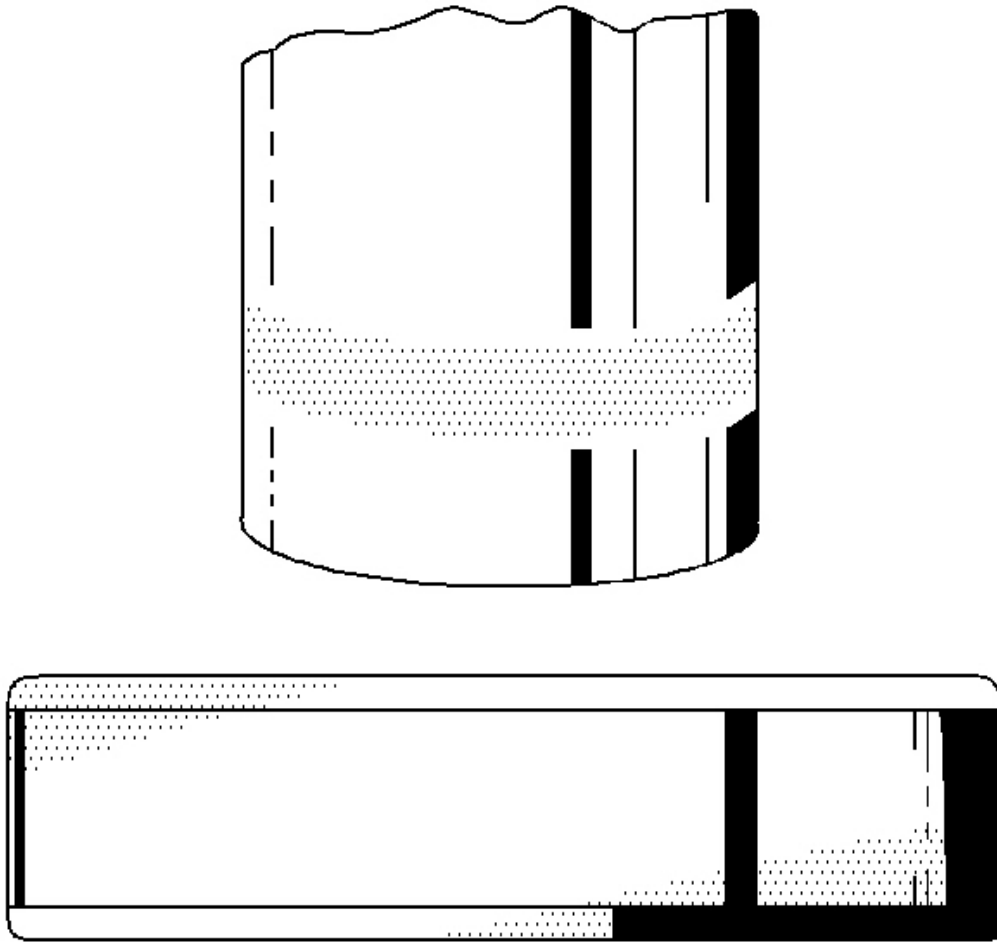
**Double Edge Pitting**



**Fig. 7: Identifying Double Edge Pitting**  
**Courtesy of GENERAL MOTORS CORP.**

Flaking of surface metal results from fatigue, usually at both edges of the race and rollers. Replace the bearing. Clean all related parts. Replace the shaft if damaged.

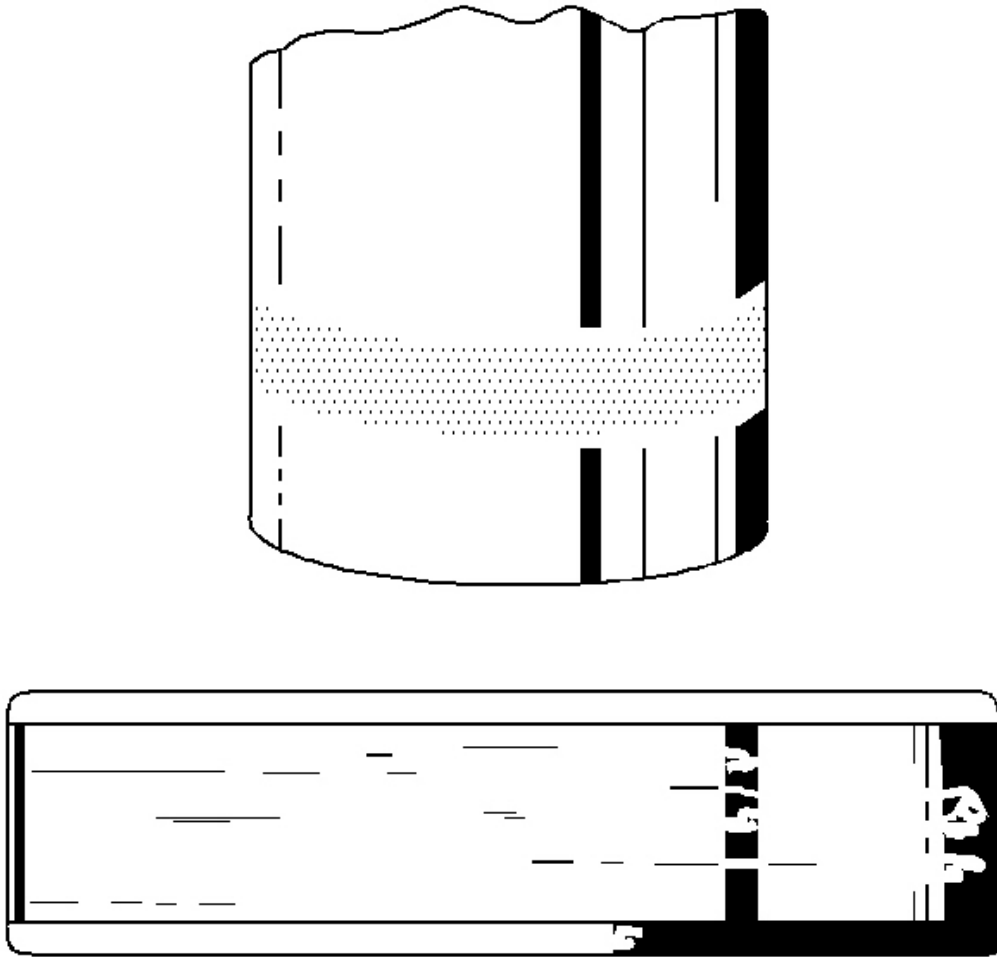
**Misalignment**



**Fig. 8: Identifying Misalignment**  
**Courtesy of GENERAL MOTORS CORP.**

Outer misalignment due to a foreign object. Replace the bearing. Ensure races are properly seated. Replace the shaft if the bearing operating surface is damaged.

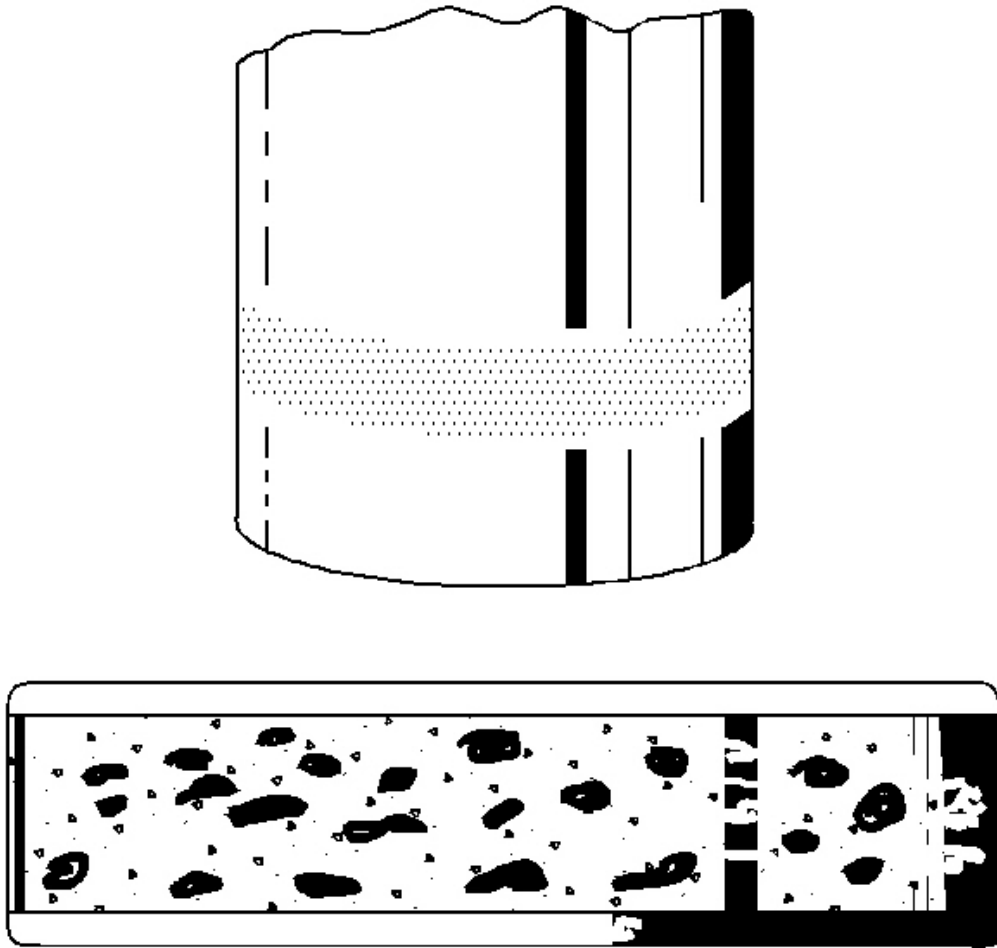
**Fretting**



**Fig. 9: Identifying Frettage**  
**Courtesy of GENERAL MOTORS CORP.**

Corrosion set up by a small relative movement of parts with no lubrication. Replace the bearing. Clean all the relative parts. Check the seals. Check for proper fit and lubrication. Replace the shaft if damaged.

**Smears**



**Fig. 10: Identifying Smears**

**Courtesy of GENERAL MOTORS CORP.**

Smearing of metal due to slippage. Slippage can be caused by poor fits, lack of lubrication, overheating, overloads or handling damage. Replace the bearing. Clean all the related parts. Check for proper fit and lubrication.

#### **REAR AXLE LUBRICANT LEAK DIAGNOSIS**

Rear axle lubricant leaks can occur at the following locations:

- Axle tube to differential carrier housing joint

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- 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 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.

### 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

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

- Drain Plug
- Fill Plug

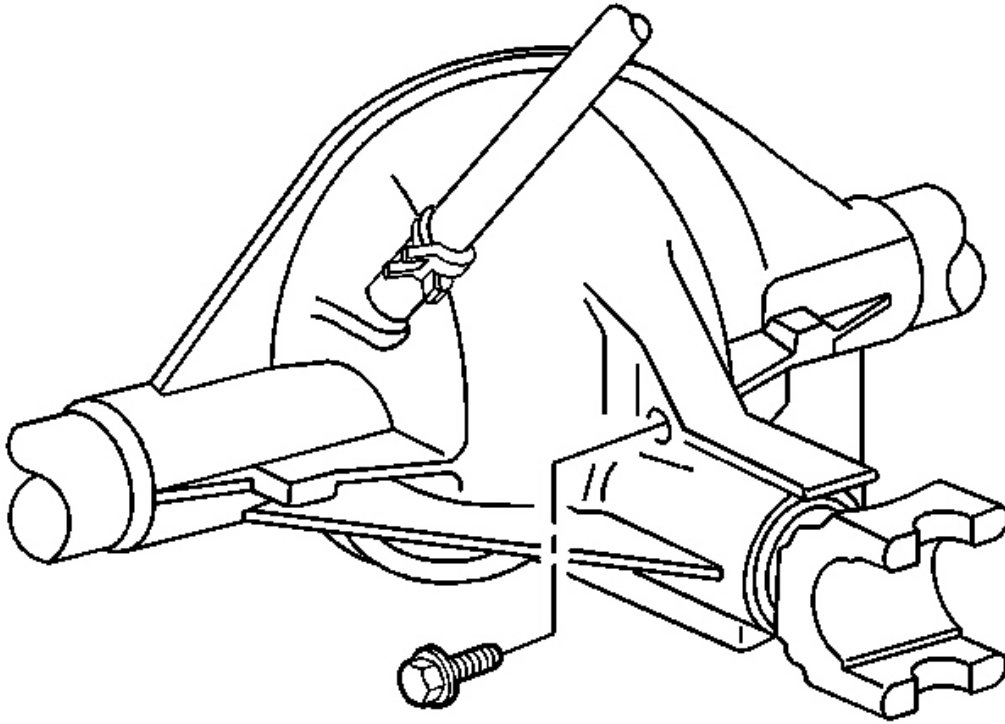
Drain and fill plug leaks are usually caused by a loose plug. These leaks can be repaired by either tightening the plug or by using an approved sealer on the threads on the plug.

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

## **REPAIR INSTRUCTIONS**

### **LUBRICANT LEVEL INSPECTION - REAR DRIVE AXLE**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Make sure the vehicle is level.
3. Inspect the rear axle for leaks. Repair as necessary.
4. Clean the area around the rear axle fill plug.



**Fig. 11: Removing Rear Axle Fill Plug (9.5, 10.5 Inch Axle)**  
**Courtesy of GENERAL MOTORS CORP.**

5. Remove the rear axle fill plug.
6. Fabricate a dipstick from a pipe cleaner or similar item. Form the pipe cleaner into the shape of an "L".

**IMPORTANT:** Ensure that the pipe cleaner is resting on the bottom threads of the fill hole.

7. Insert the pipe cleaner into the fill plug opening with the stem "L" is facing down.
8. Inspect the lubricant level.

**Specification:** The lubricant level should be between 0-10 mm (0-0.4 in) below the fill plug opening.

9. If the fluid level is low, add lubricant until the level is even with the bottom edge of the fill

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plug opening. Use the proper fluid. Refer to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.

**NOTE:** Refer to **Fastener Notice** in Cautions and Notices.

10. Install the rear axle fill plug.

**Tighten:** Tighten the rear axle fill plug to 33 N.m (24 lb ft).

11. Lower the vehicle.

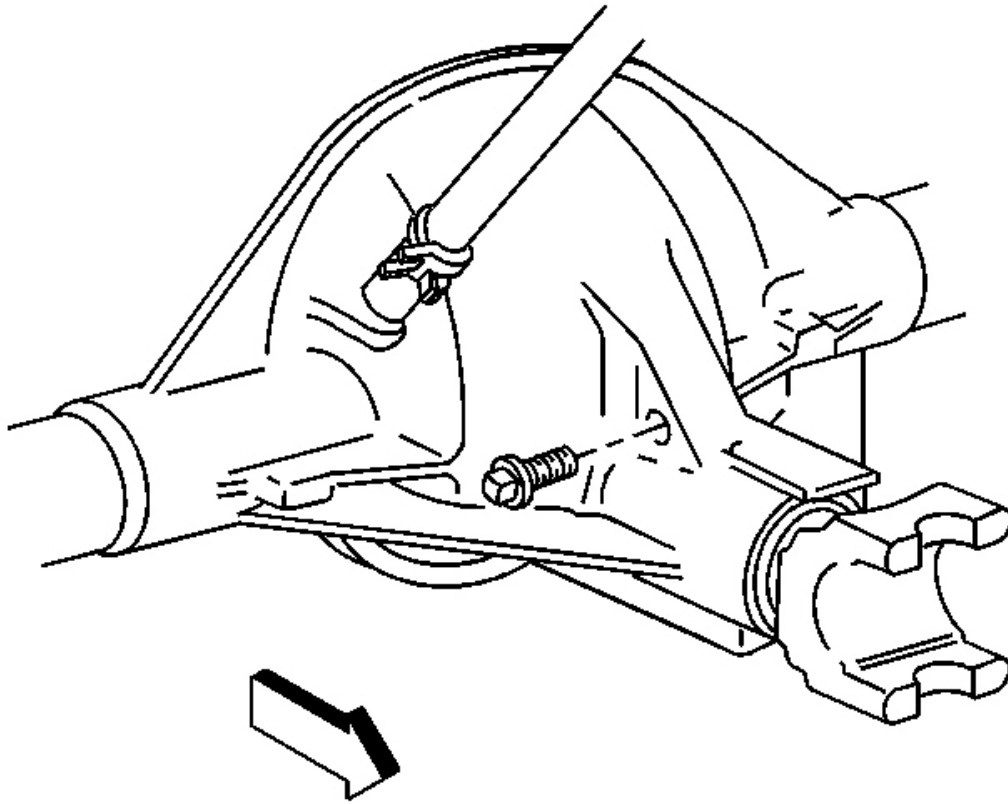
### LUBRICANT REPLACEMENT - REAR DRIVE AXLE

#### Removal Procedure

1. Clean the area around the rear axle fill plug.
2. Remove the rear axle fill plug.
3. Remove the rear axle cover. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
4. Drain the lubricant into a suitable container.

#### Installation Procedure

1. Install the rear axle cover. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
2. Inspect the fluid level. Refer to **Lubricant Level Inspection - Rear Drive Axle**.
3. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Capacities - Approximate Fluid** and **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.



**Fig. 12: View Of Rear Axle Fill Plug**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

4. Install the rear axle fill plug.

**Tighten:** Tighten the rear axle fill plug to 33 N.m (24 lb ft).

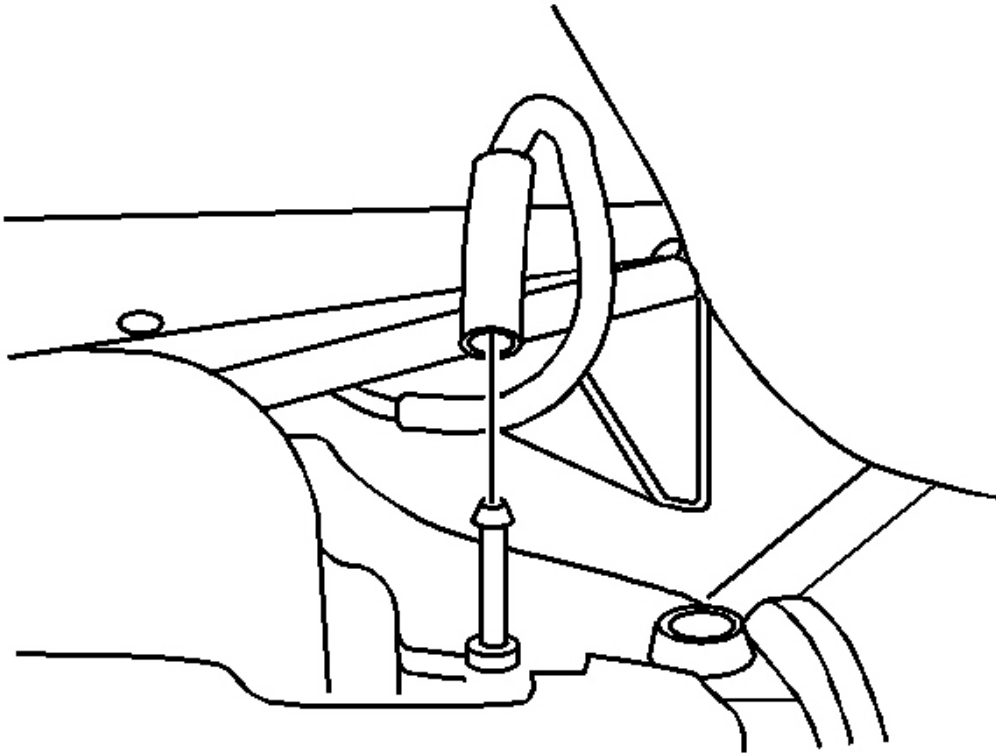
5. Lower the vehicle.

## VENT HOSE REPLACEMENT

### Removal Procedure

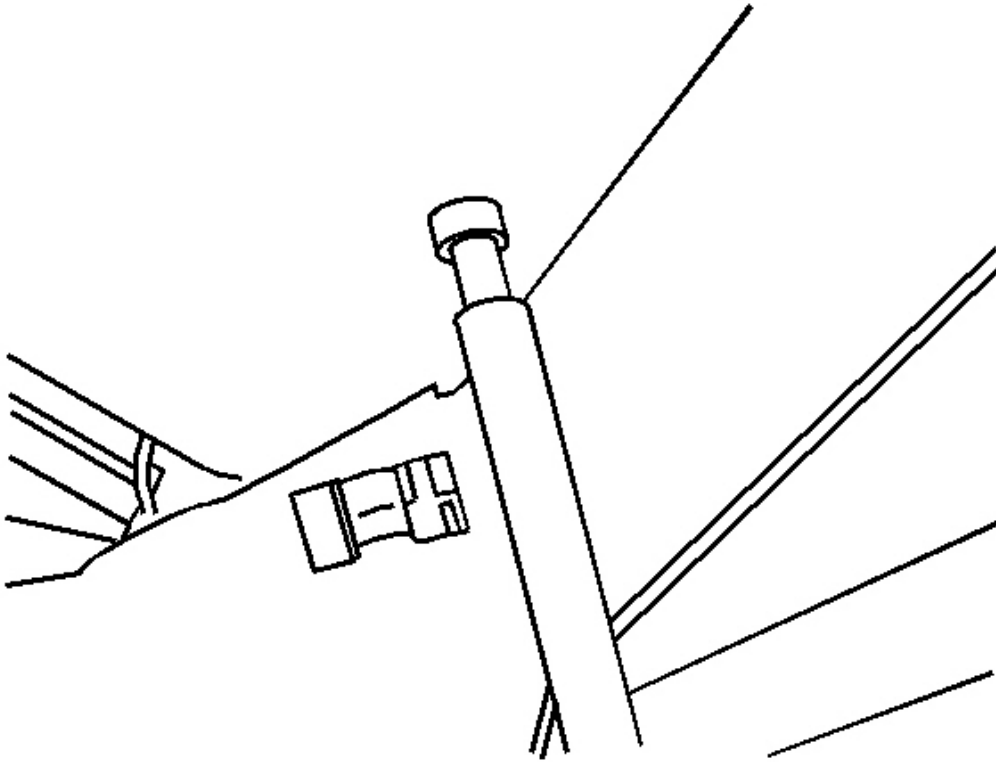
**IMPORTANT:** Make note of the routing in order to aid in reassembly.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.



**Fig. 13: Vent Hose Removed From Rear Axle**  
Courtesy of GENERAL MOTORS CORP.

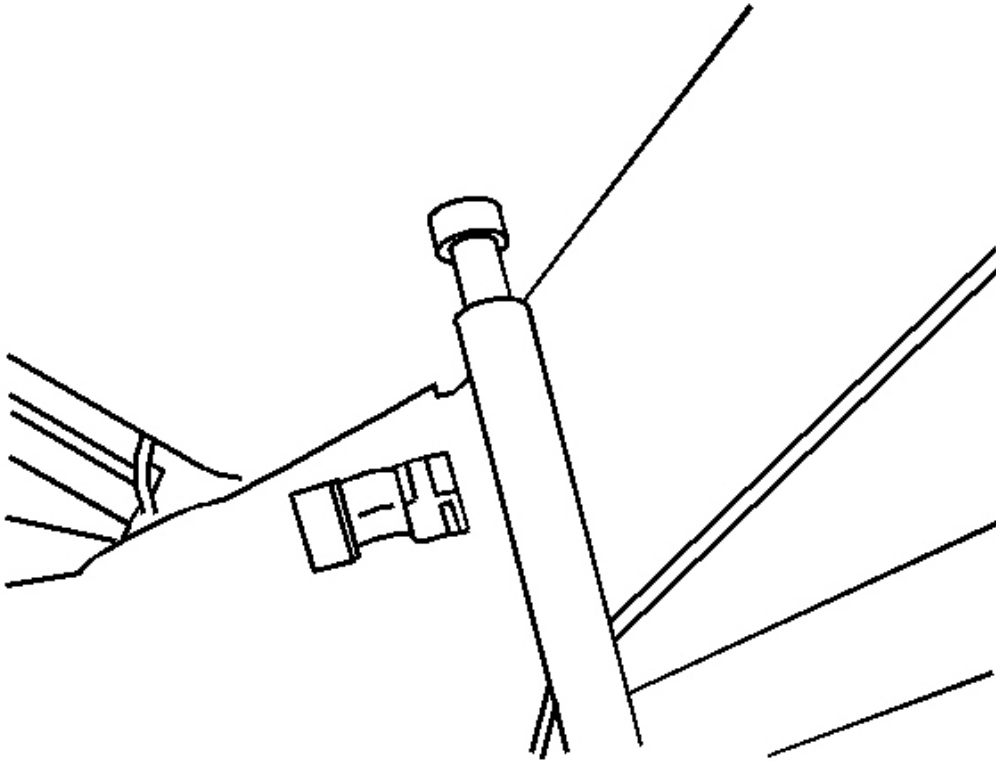
2. Remove the vent hose from the top of the rear axle.



**Fig. 14: Vent Hose Removed Clip Attached To Frame**  
Courtesy of GENERAL MOTORS CORP.

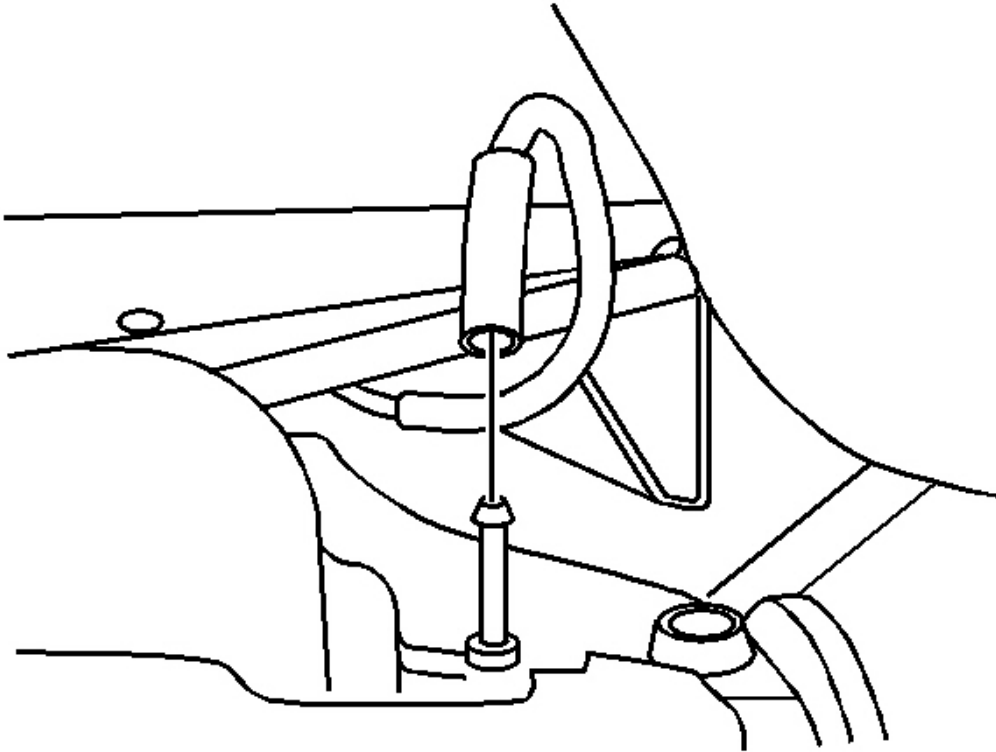
3. Remove the vent hose from the clip attached to the frame.

#### Installation Procedure



**Fig. 15: Vent Hose Removed Clip Attached To Frame**  
**Courtesy of GENERAL MOTORS CORP.**

1. Install the vent hose to the clip attached to the frame.
  - Route the same way as when removed.
  - Ensure that the hose is free of kinks and is routed clear of sharp objects.
  - Ensure that the vent is not plugged.

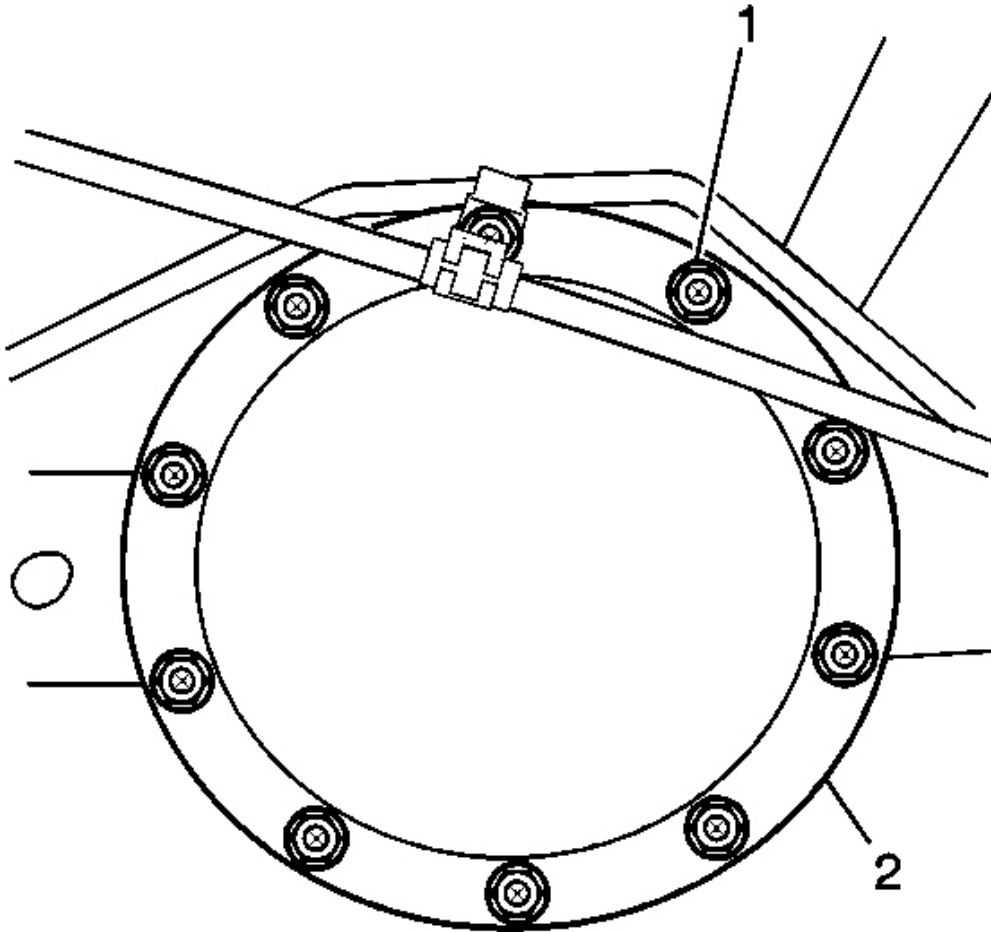


**Fig. 16: Vent Hose Removed From Rear Axle**  
**Courtesy of GENERAL MOTORS CORP.**

2. Install the vent hose to the top of the rear axle.
3. Lower the vehicle.

## **REAR AXLE HOUSING COVER AND GASKET REPLACEMENT**

### **Removal Procedure**



**Fig. 17: Identifying Rear Axle Housing Cover & Bolts**  
Courtesy of GENERAL MOTORS CORP.

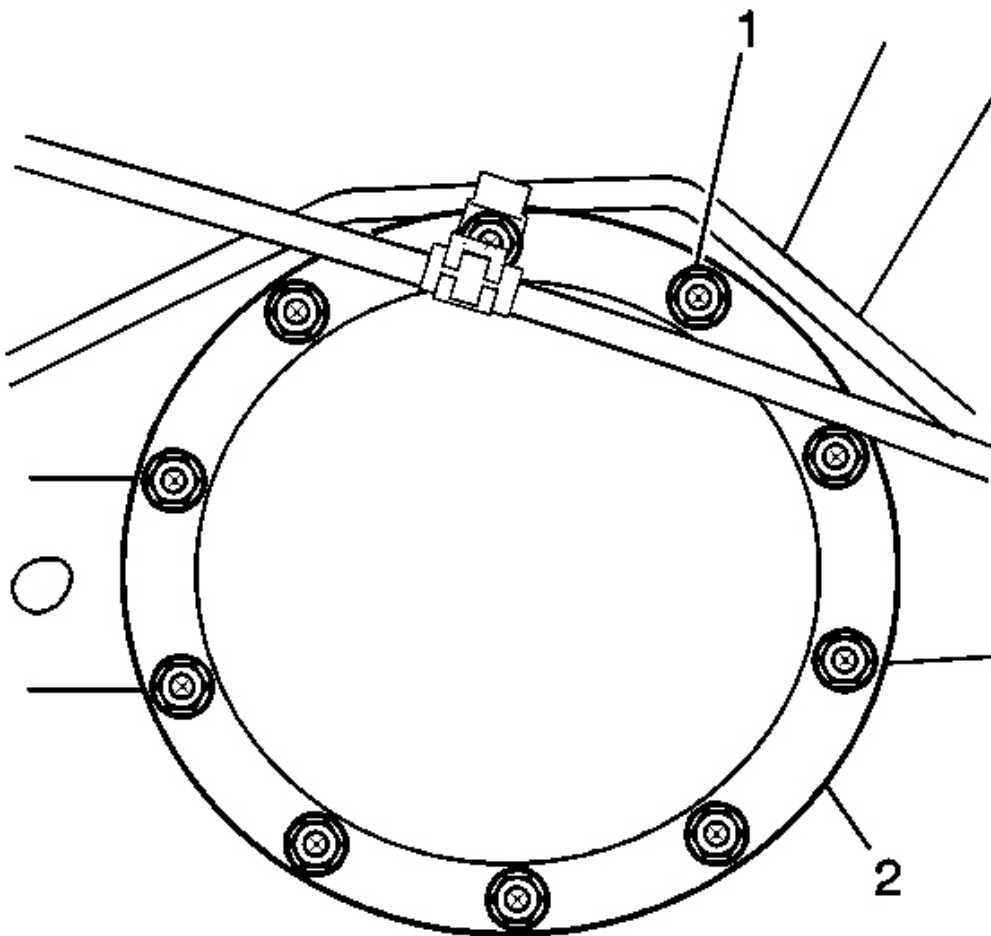
1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Drain the rear axle. Refer to **Lubricant Level Inspection - Rear Drive Axle**.
3. Remove the rear axle housing cover bolts (1).

**IMPORTANT: Do not nick or cut the rear axle housing cover gasket.**

4. Remove the rear axle housing cover (2) from the axle housing.
5. Drain the axle lubricant into a suitable container.

### Installation Procedure

1. Inspect the rear axle cover gasket for nicks, cuts or damage that may cause the gasket to not seal properly. If any of these conditions exist, replace the gasket.
2. If the gasket is to be reused, clean the rear axle housing cover gasket a suitable cleaner.
3. Clean the rear axle housing cover gasket surface and the rear axle housing gasket surface with a suitable cleaner.



**Fig. 18: Identifying Rear Axle Housing Cover & Bolts**  
Courtesy of GENERAL MOTORS CORP.

## 2006 Buick Rainier

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

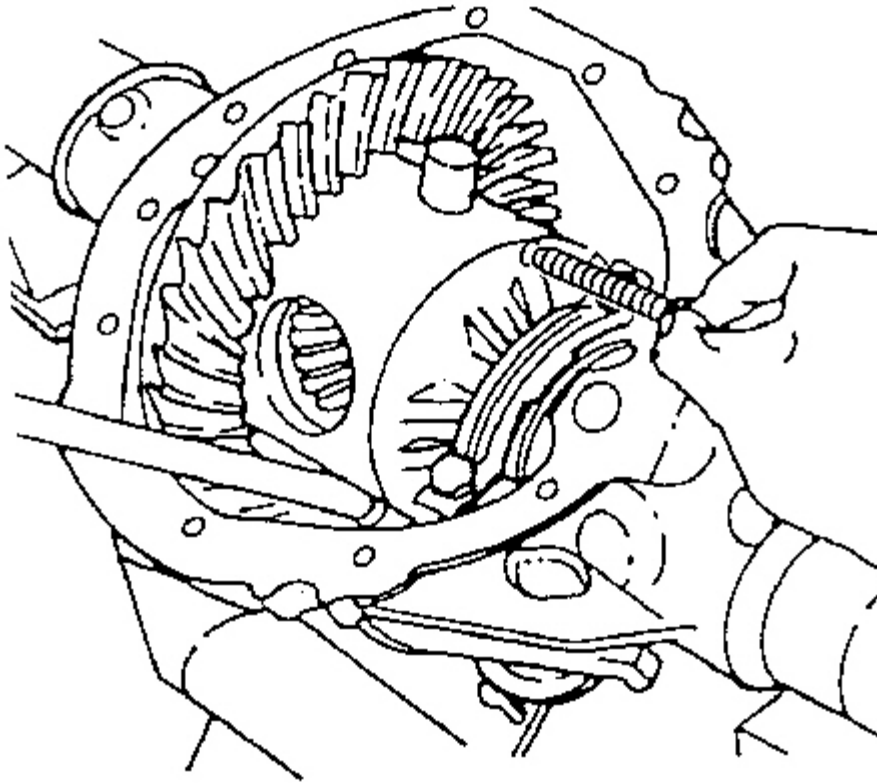
4. Install the rear axle housing cover gasket and the rear axle housing cover (2).
5. Install the rear axle housing cover bolts (1).

**Tighten:**

- For the 8.0 inch axle, tighten the rear axle housing cover bolts in a crosswise pattern to 30 N.m (20 lb ft).
  - For the 8.6 inch axle, tighten the rear axle housing cover bolts in a crosswise pattern to 25 N.m (18 lb ft).
6. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to Lubricant Level Inspection - Rear Drive Axle.
  7. Lower the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.

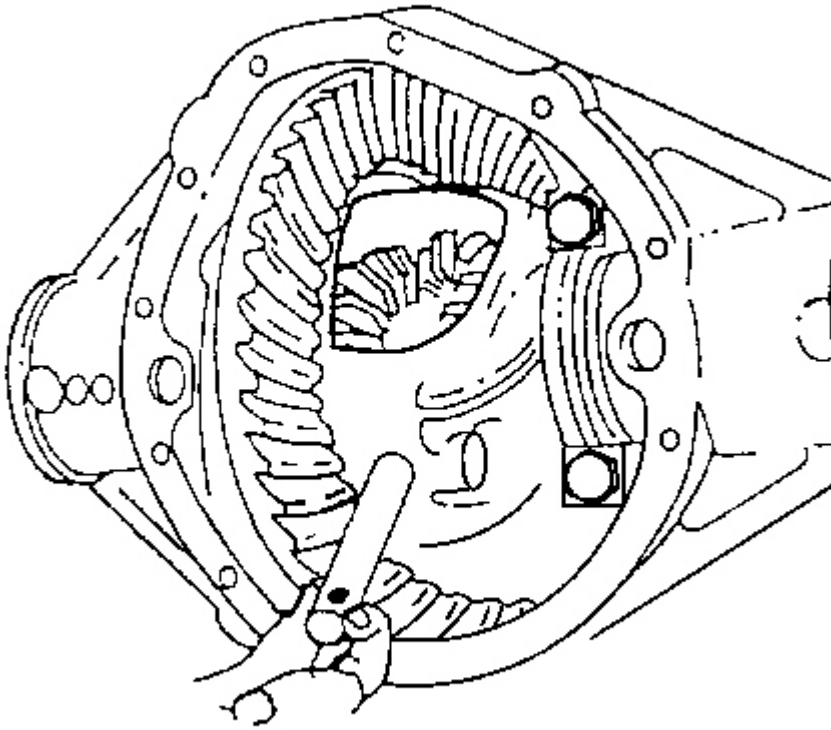
### REAR AXLE SHAFT REPLACEMENT

#### Removal Procedure



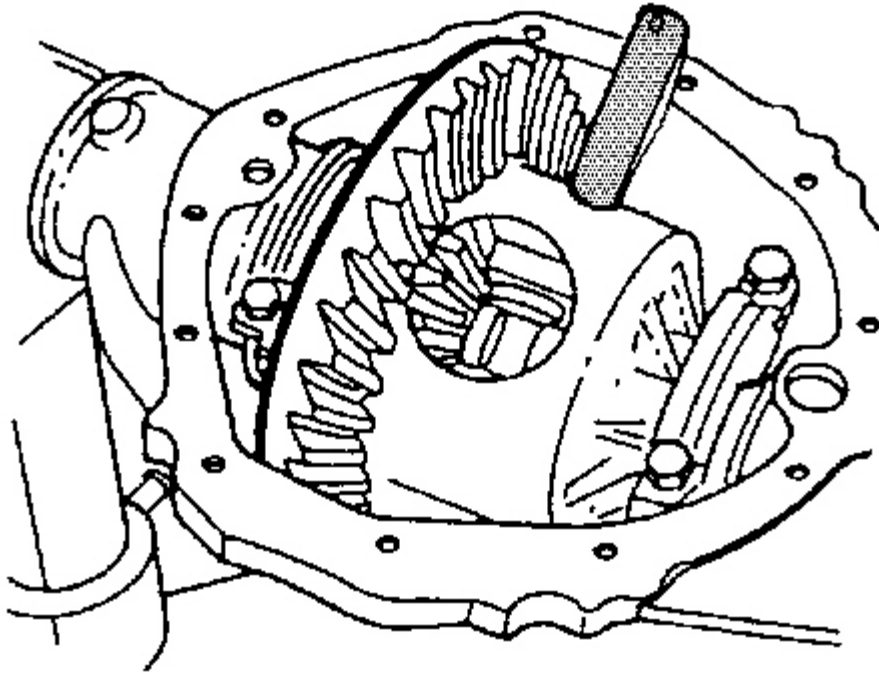
**Fig. 19: View Of Pinion Shaft Locking Bolt**  
**Courtesy of GENERAL MOTORS CORP.**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the brake caliper. Refer to **Brake Caliper Replacement - Rear** in Disc Brakes.
4. Remove the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
5. Remove the pinion shaft locking bolt.



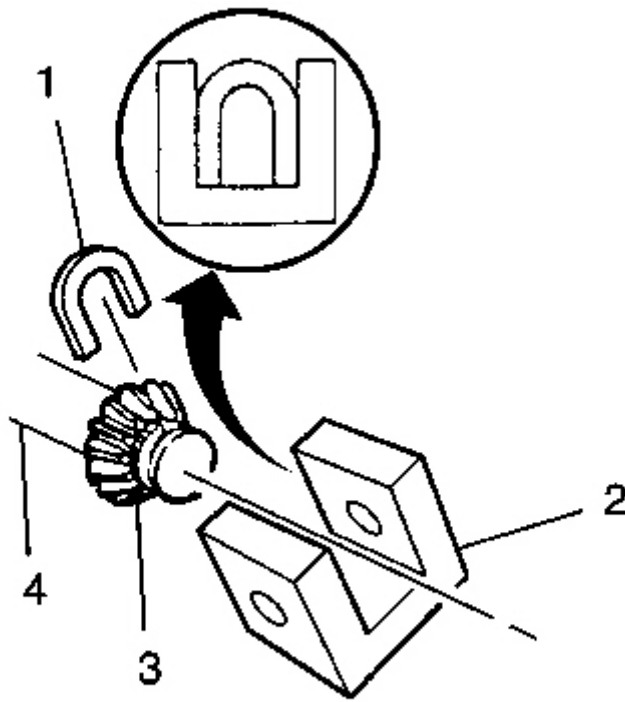
**Fig. 20: View Of Pinion Shaft**  
**Courtesy of GENERAL MOTORS CORP.**

6. On axles without a locking differential, remove the pinion shaft.



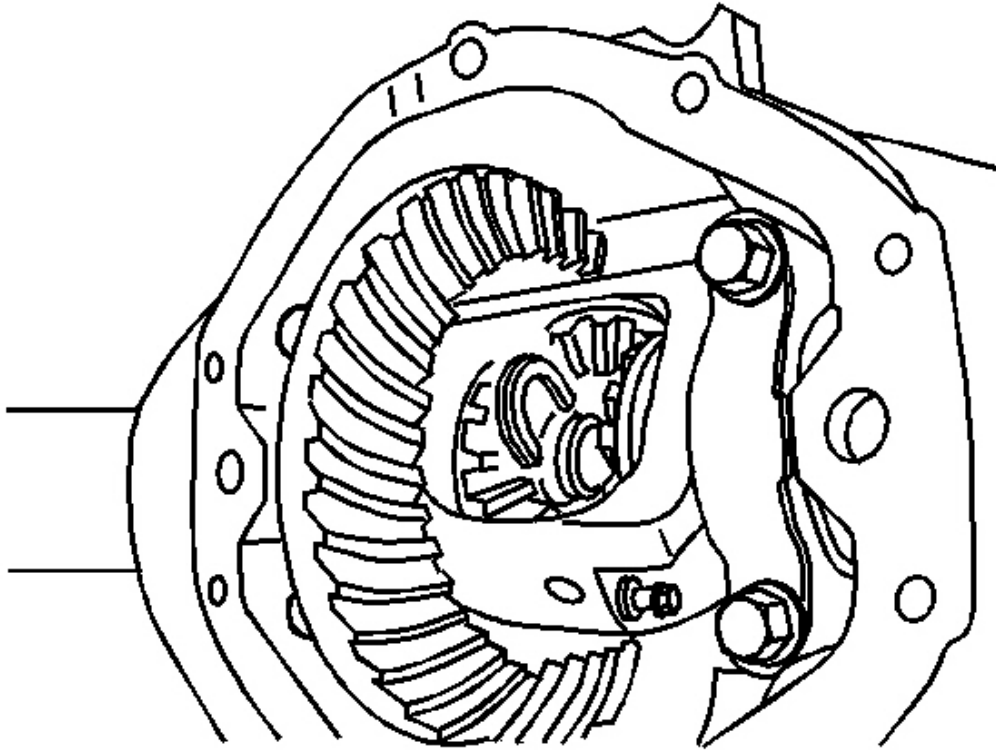
**Fig. 21: Pinion Shaft Touching Housing**  
**Courtesy of GENERAL MOTORS CORP.**

7. On axles with a locking differential, remove the shaft part way. Rotate the case until the pinion shaft touches the housing.



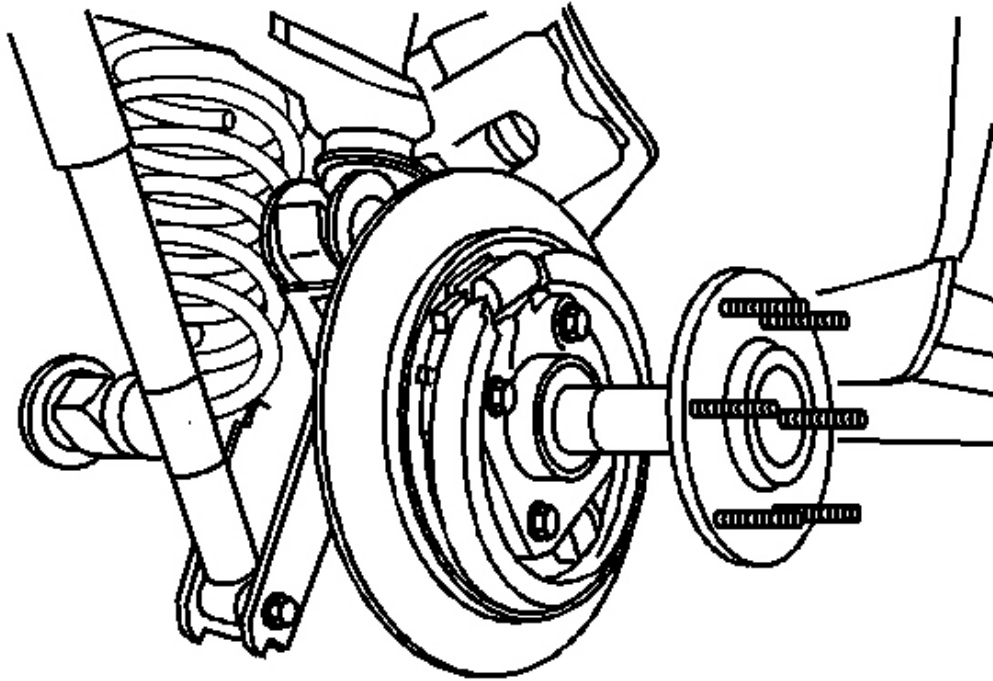
**Fig. 22: View Of Axle Shaft, Lock & Thrust Block**  
**Courtesy of GENERAL MOTORS CORP.**

8. On axles with a locking differential, use a screwdriver, or a similar tool, in order to enter the differential case and rotate the C-lock (1) until the C-lock aligns with the thrust block (2).
9. Push the flange of the axle shaft (1) toward the differential.



**Fig. 23: C-Lock From Button End Of Axle Shaft**  
**Courtesy of GENERAL MOTORS CORP.**

10. Remove the C-lock from the button end of the axle shaft.

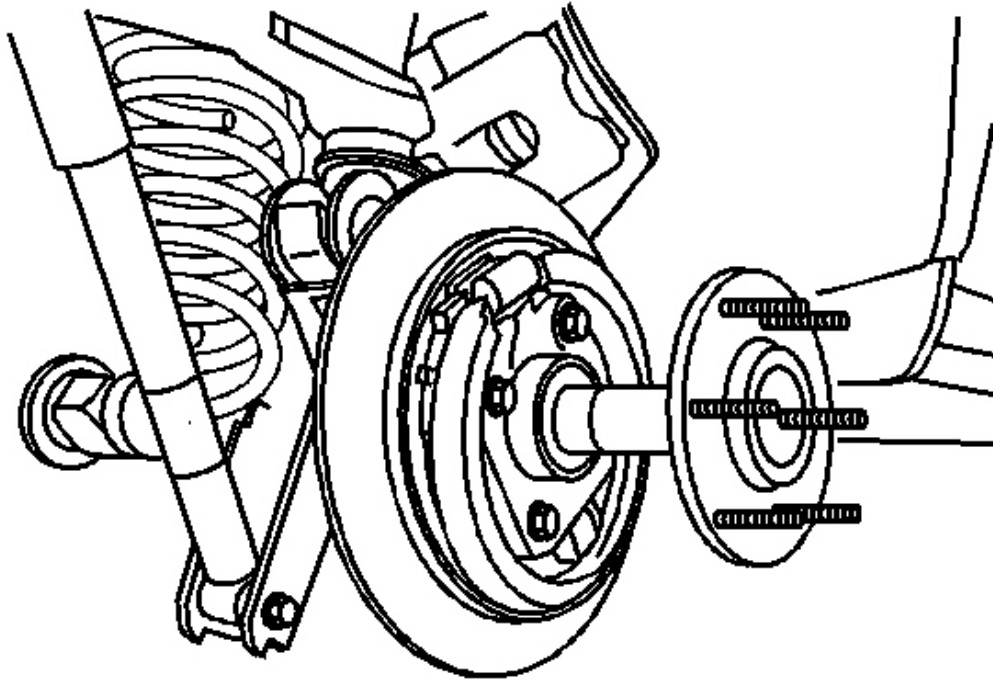


**Fig. 24: View Of Rear Axle Assembly**  
Courtesy of GENERAL MOTORS CORP.

**IMPORTANT:** When removing the axle shaft, do not rotate the shaft. Rotating the shaft will misalign the gears. Misaligning the gears will make the installing of the axle shaft difficult.

11. Remove the axle shaft from the housing.

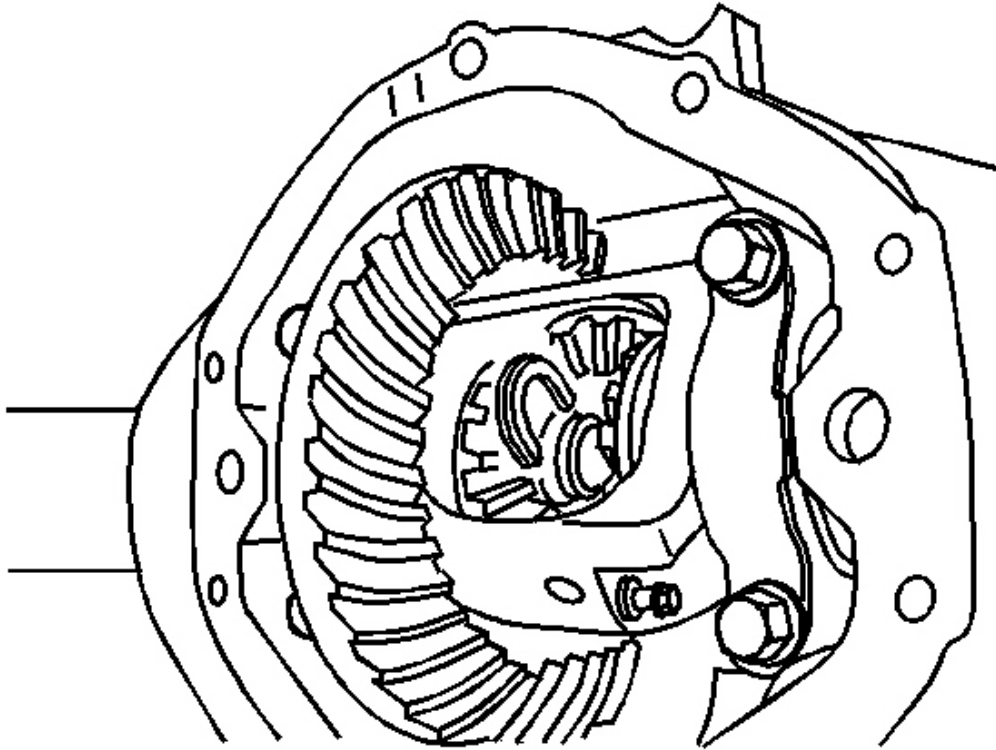
#### Installation Procedure



**Fig. 25: View Of Rear Axle Assembly**  
**Courtesy of GENERAL MOTORS CORP.**

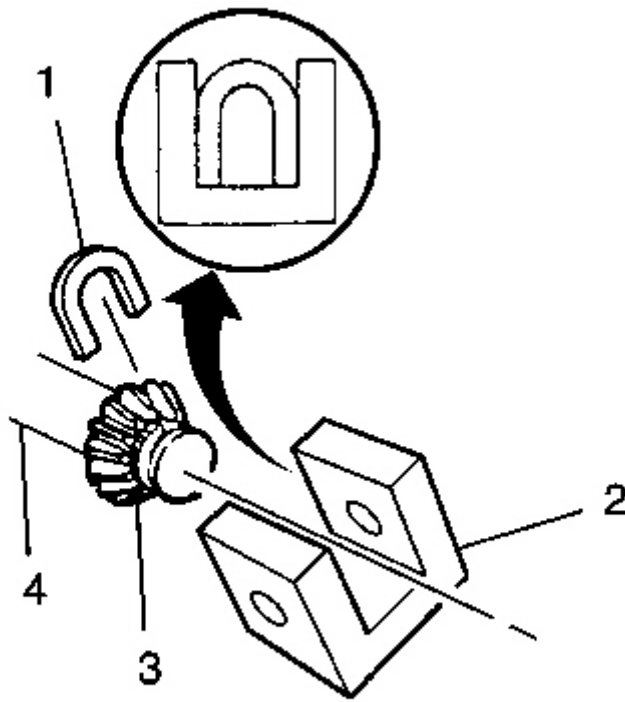
**IMPORTANT:** Carefully insert the axle shaft in order to not damage the seal.

1. Install the axle shaft into the rear axle housing.
2. Slide the axle shaft into place allowing the splines to engage the differential side gear.



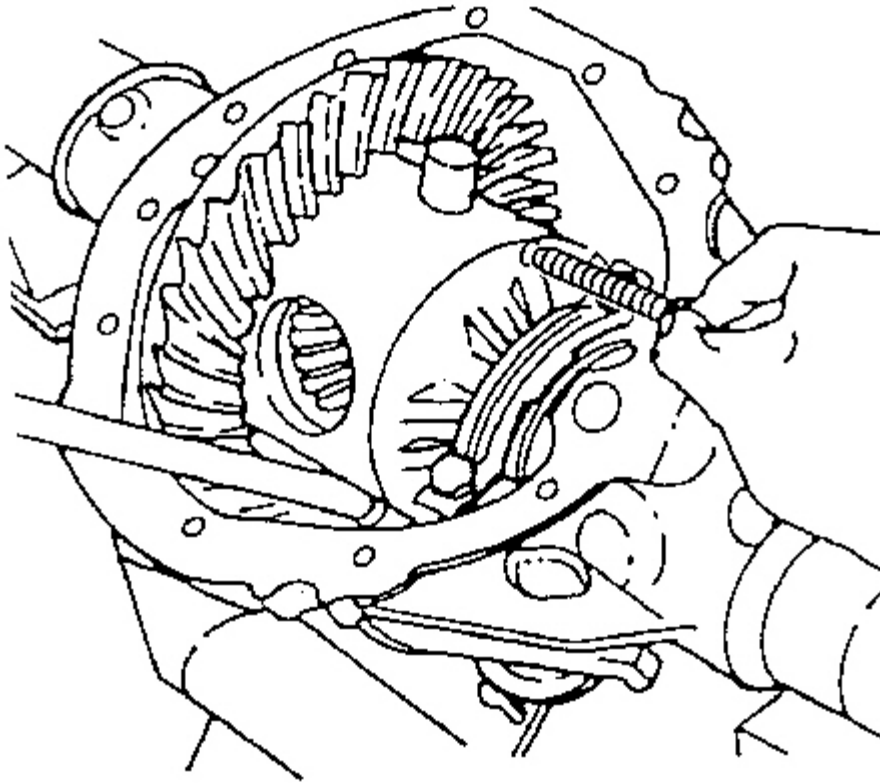
**Fig. 26: C-Lock From Button End Of Axle Shaft**  
**Courtesy of GENERAL MOTORS CORP.**

3. On axles without a locking differential, place the C-lock on the button end of the axle shaft.
4. On axles with a locking differential, keep the pinion shaft partially withdrawn.



**Fig. 27: View Of Axle Shaft, Lock & Thrust Block**  
**Courtesy of GENERAL MOTORS CORP.**

5. On axles with a locking differential, place the C-lock (1) on the axle shaft (3) so that the ends are flush with the thrust block (2).
6. Pull the shaft flange outward in order to seat the C-lock in the differential gear.



**Fig. 28: View Of Pinion Shaft Locking Bolt**  
**Courtesy of GENERAL MOTORS CORP.**

7. Align the hole in the pinion shaft with the bolt hole in the differential case.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

8. Install the new pinion shaft locking bolt.

**Tighten:** Tighten the pinion shaft locking bolt to 36 N.m (27 lb ft).

9. Install the rear axle housing cover and the gasket. Refer to Rear Axle Housing Cover and Gasket Replacement.
10. Install the brake caliper. Refer to Brake Caliper Replacement - Rear in Disc Brakes.

## 2006 Buick Rainier

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer

11. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
12. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Lubricant Level Inspection - Rear Drive Axle**.
13. Lower the vehicle.

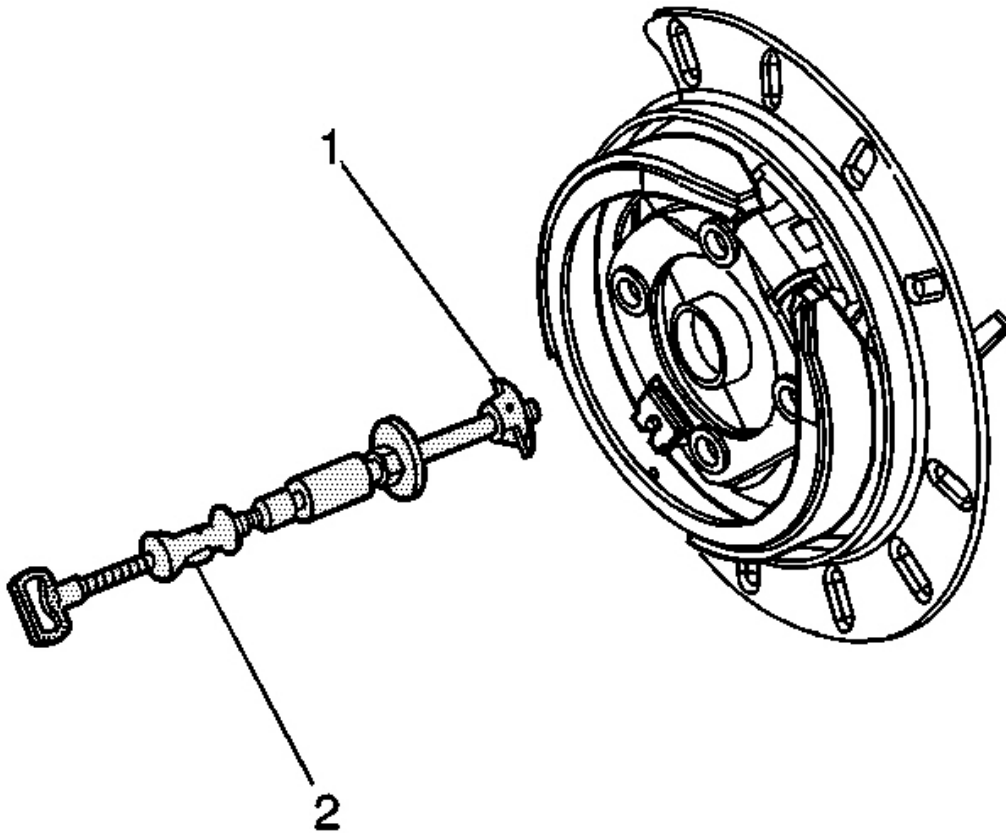
### REAR AXLE SHAFT SEAL AND/OR BEARING REPLACEMENT

#### Tools Required

- **J 8092** Universal Driver Handle- 3/4 in - 10
- **J 21128** Axle Pinion Oil Seal Installer. See **Special Tools**.
- **J 23690** Bearing Installer. See **Special Tools**.
- **J 2619-01** Slide Hammer
- **J 44685** Rear Axle Seal and Bearing Remover. See **Special Tools**.

#### Removal Procedure

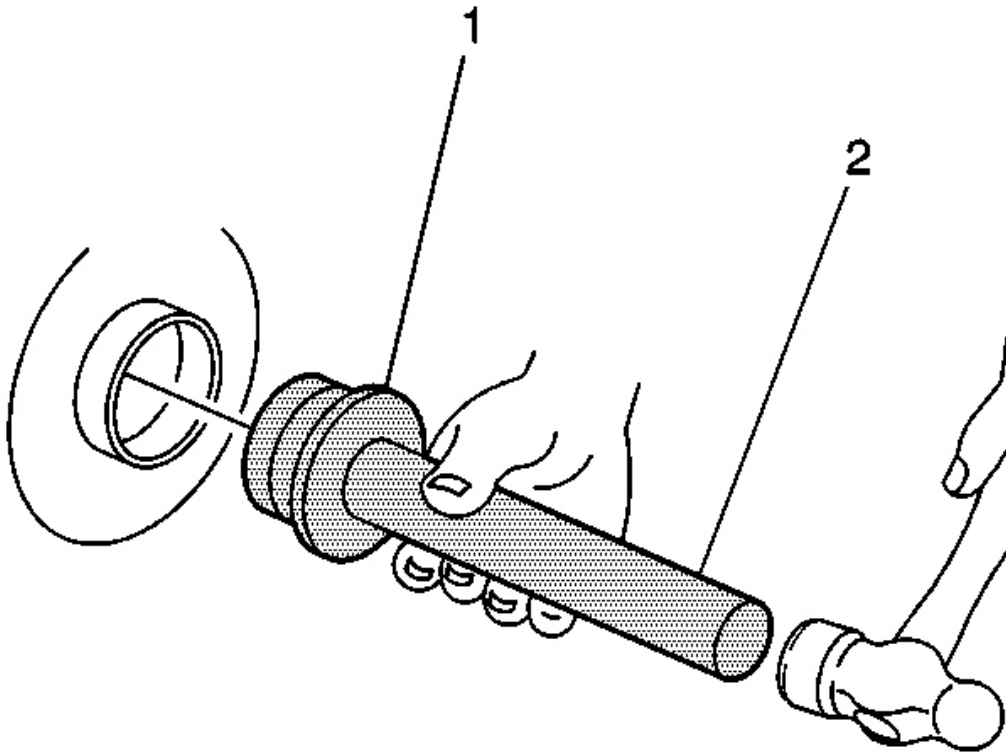
1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
4. Remove the axle shaft. Refer to **Rear Axle Shaft Replacement**.



**Fig. 29: J 44685 & J 2619-01**  
**Courtesy of GENERAL MOTORS CORP.**

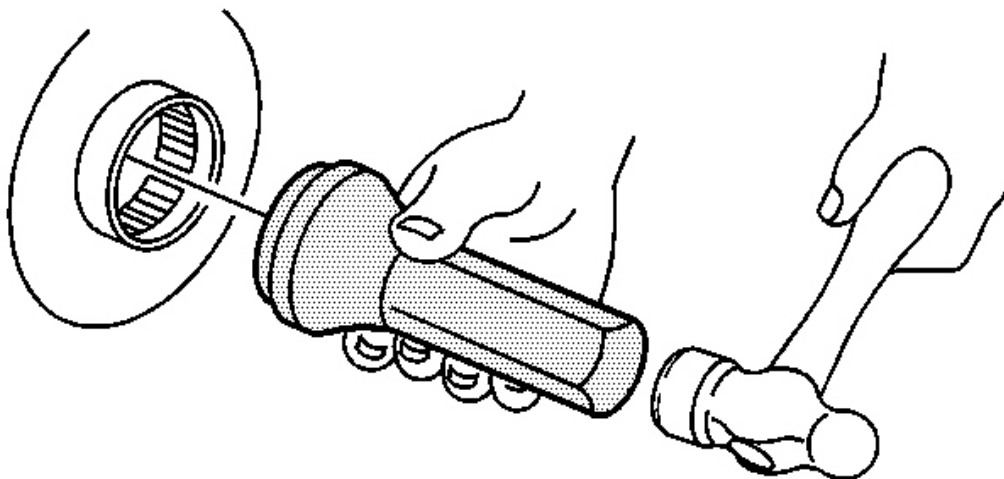
5. Remove the axle shaft seal and/or the bearing from the axle housing using the **J 44685** (1) and the **J 2619-01** (2). See **Special Tools**.

**Installation Procedure**



**Fig. 30: Installing The Axle Shaft Bearing Using J 23690 Or J 29709 & J 8092**  
**Courtesy of GENERAL MOTORS CORP.**

1. Install the axle shaft bearing using the **J 23690** (1) and the **J 8092** (2). See **Special Tools**.
2. Drive the axle shaft bearing into the axle housing until the tool bottoms against the tube.



**Fig. 31: Driving J 21128 Or J 29713 Into The Bore Until The Axle Shaft Seal Bottoms Flush With The Tube**  
Courtesy of GENERAL MOTORS CORP.

3. Install the axle shaft seal using the **J 21128** . See **Special Tools**.
4. Drive the tool into the bore until the axle shaft seal bottoms flush with the tube.
5. Install the axle shaft. Refer to **Rear Axle Shaft Replacement**.
6. Install the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Lubricant Replacement - Rear Drive Axle**.
9. Lower the vehicle.

#### **DRIVE PINION FLANGE/YOKE AND/OR OIL SEAL REPLACEMENT**

##### **Tools Required**

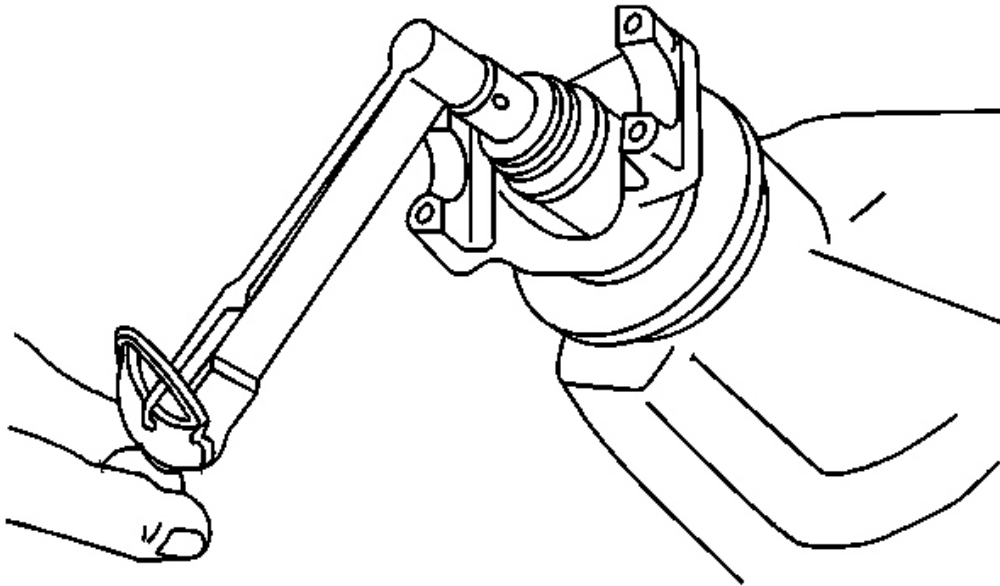
- **J 8614-01** Flange and Pulley Holding Tool
- **J 33782** Pinion Oil Seal Installer

- **J 38694** Extension Housing Oil Pump/Seal Installer. See Special Tools.

#### Removal Procedure

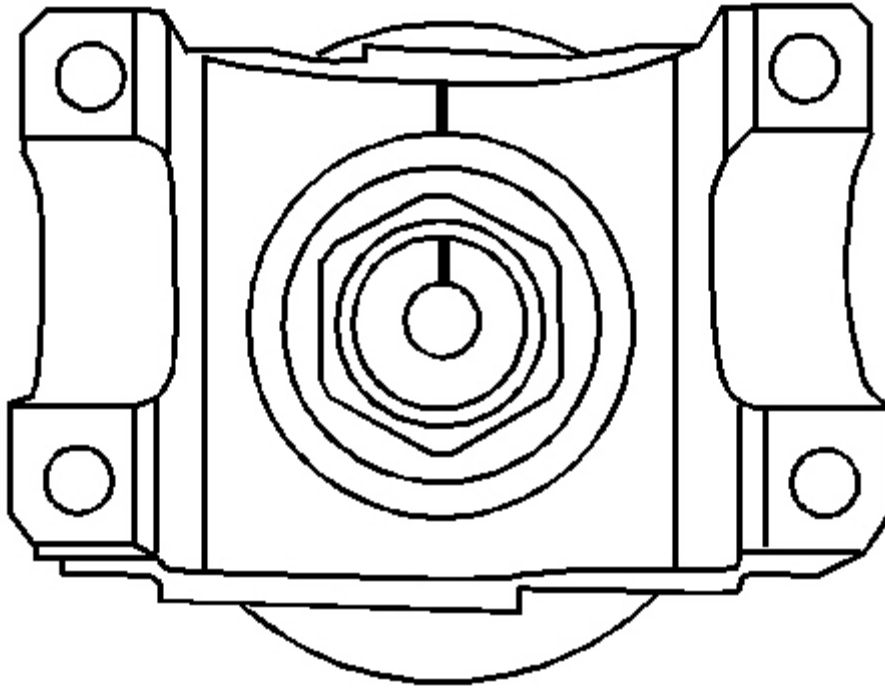
**IMPORTANT:** Observe and mark the positions of all the driveline components, relative to the propeller shaft and the axles, prior to disassembly. These components include the propeller shafts, drive axles, pinion flanges, output shafts, etc. Reassemble all the components in the exact places in which you removed the parts. Follow any specifications, torque values, and any measurements made prior to disassembly.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Remove the tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
3. Remove the rear brake calipers. Refer to Brake Caliper Replacement - Rear in Disc Brakes.
4. Remove the brake rotors. Refer to Brake Rotor Replacement - Rear in Disc Brakes.
5. Remove the propeller shaft. Refer to Propeller Shaft Replacement - Rear in Propeller Shaft.



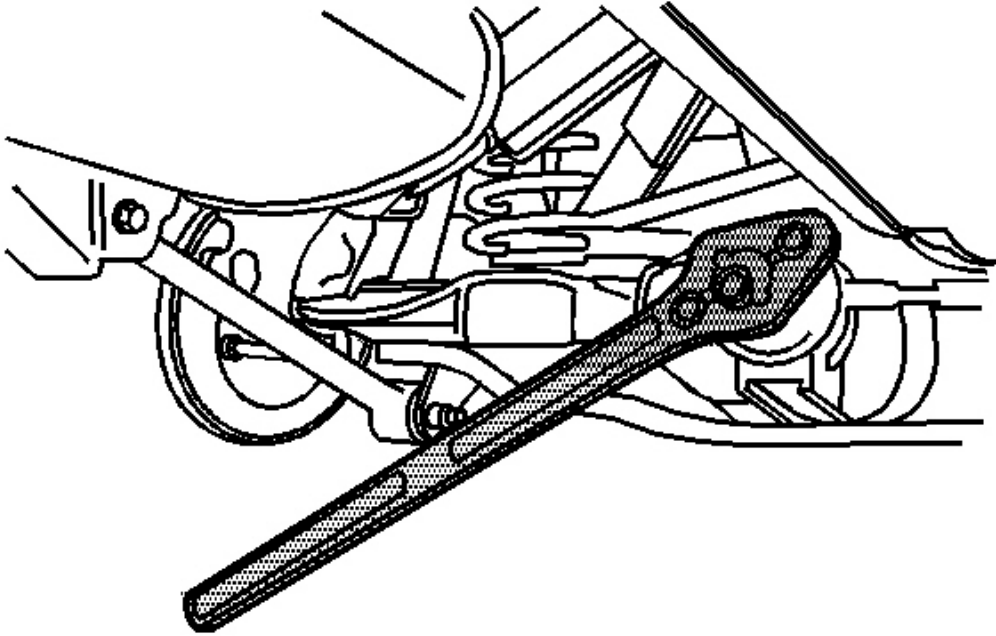
**Fig. 32: Measuring Pinion Rotating Torque**  
**Courtesy of GENERAL MOTORS CORP.**

6. Measure the amount of torque required to rotate the pinion. Use an inch-pound torque wrench. Record this measurement for reassembly. This will give the combined preload for the following components:
  - The pinion bearings
  - The pinion oil seal
  - The differential case bearings
  - The axle bearings
  - The axle seals



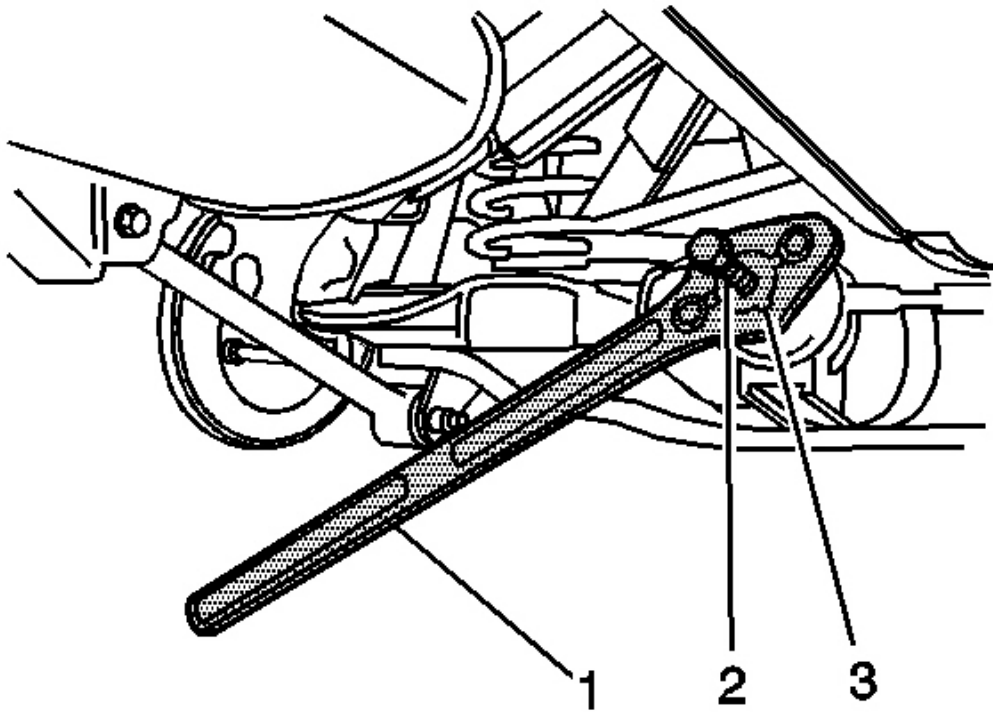
**Fig. 33: View Of Pinion Shaft & Pinion Yoke Alignment Marks**  
**Courtesy of GENERAL MOTORS CORP.**

7. Place an alignment mark between the pinion and the pinion yoke.



**Fig. 34: Holding Pinion Yoke With Special Tool**  
**Courtesy of GENERAL MOTORS CORP.**

8. Install the **J 8614-01** as shown.
9. Remove the pinion nut while holding the **J 8614-01** .
10. Remove the washer.



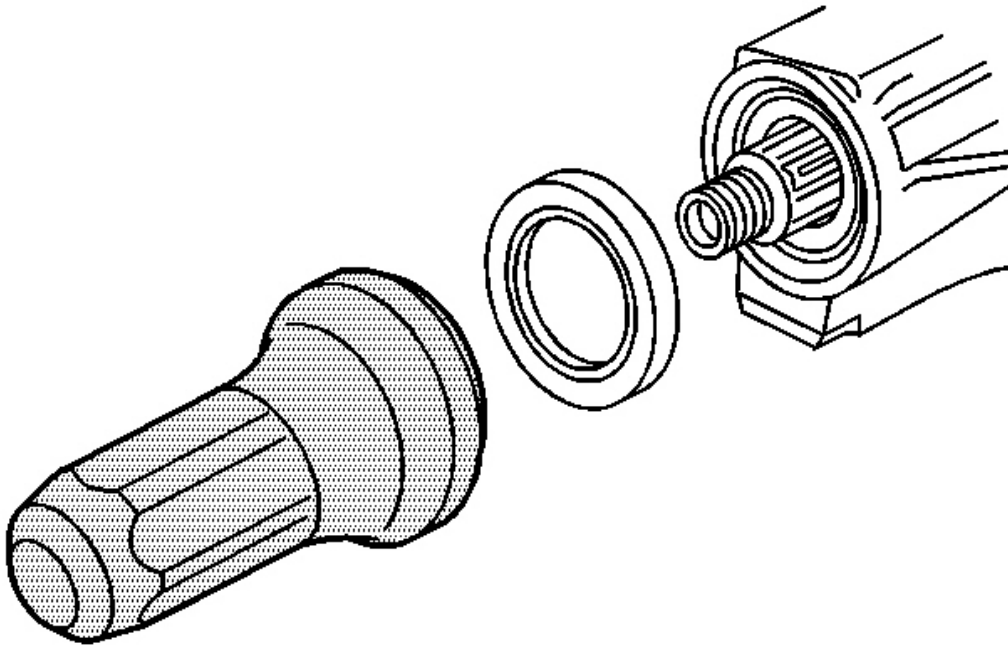
**Fig. 35: Installing J 8614-3 And J 8614-2 Into J 8614-01**  
**Courtesy of GENERAL MOTORS CORP.**

11. Install the J 8614-3 (2) and the J 8614-2 (3) into the **J 8614-01** (1) as shown.
12. Remove the pinion yoke by turning the J 8614-3 (3) clockwise while holding the **J 8614-01** (1).

Use a container in order to retrieve the lubricant.

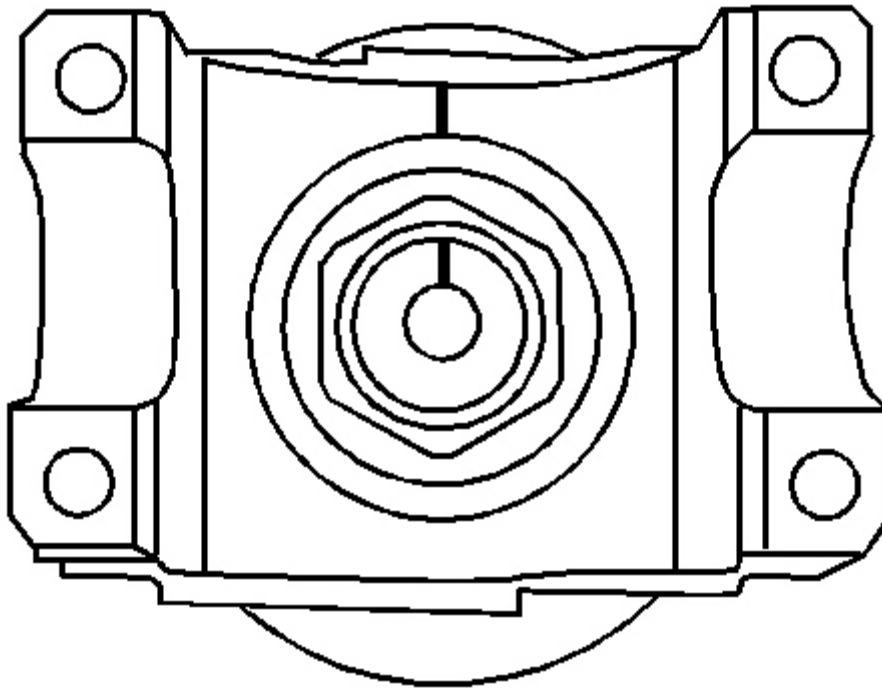
13. Remove the pinion oil seal. Use a suitable seal removal tool. Do not damage the housing.

#### **Installation Procedure**



**Fig. 36: Installing Pinion Oil Seal**  
**Courtesy of GENERAL MOTORS CORP.**

1. Install a new pinion oil seal using the **J 33782** , 8.0 inch axle or the **J 38694** 8. See **Special Tools**.6 inch axle.
2. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the splines of the pinion yoke.



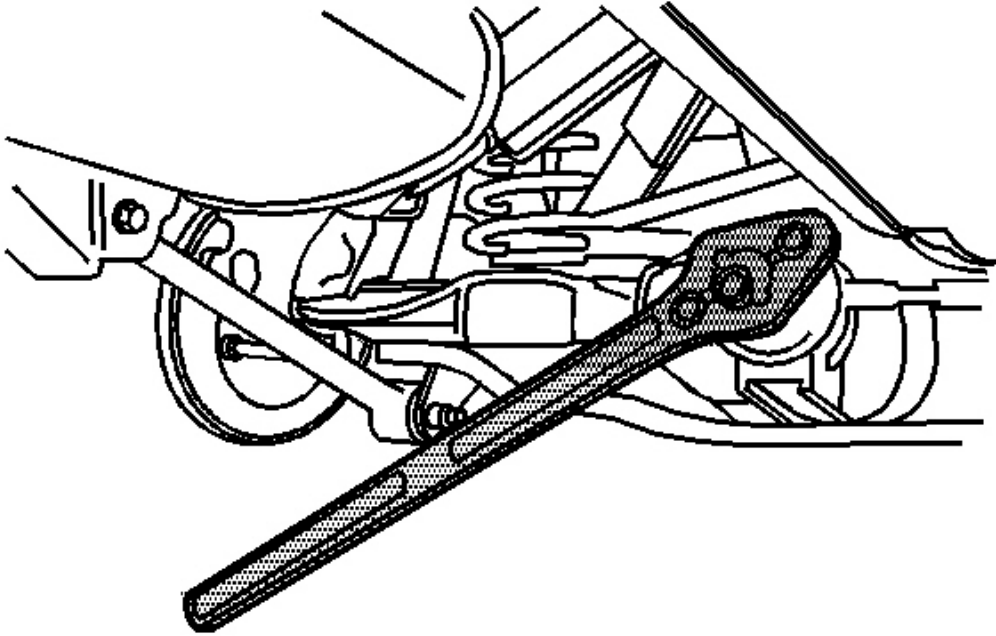
**Fig. 37: View Of Pinion Shaft & Pinion Yoke Alignment Marks**  
**Courtesy of GENERAL MOTORS CORP.**

3. Install the pinion yoke.

Align the marks made during removal.

**NOTE:**      **Do not hammer the pinion flange/yoke onto the pinion shaft. Pinion components may be damaged if the pinion flange/yoke is hammered onto the pinion shaft.**

4. Seat the pinion yoke onto the pinion shaft by tapping it with a soft-faced hammer until a few pinion shaft threads show through the yoke.
5. Install the washer and a new pinion nut.



**Fig. 38: Holding Pinion Yoke With Special Tool**  
Courtesy of GENERAL MOTORS CORP.

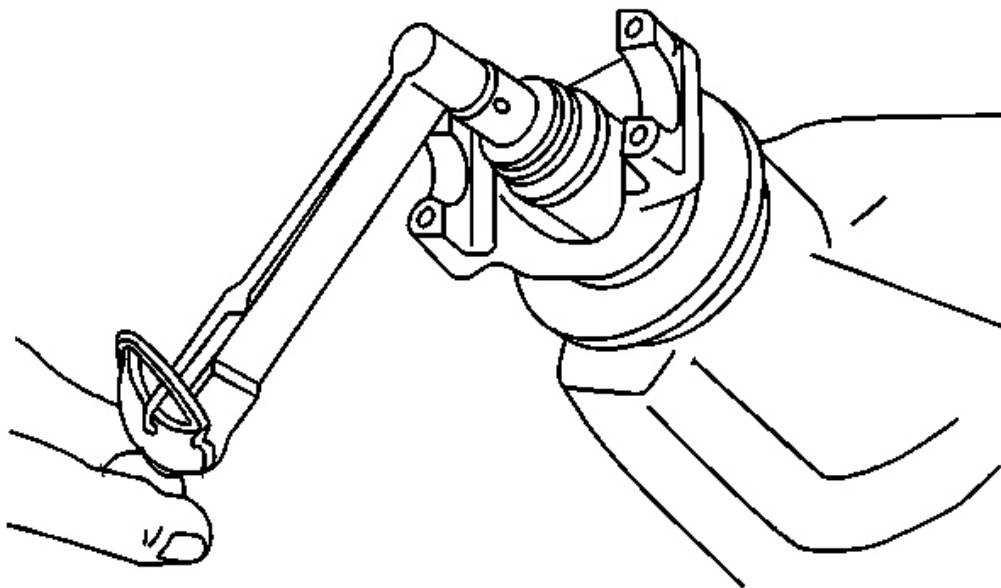
6. Install the **J 8614-01** onto the pinion yoke as shown.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

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

7. Tighten the pinion nut while holding the **J 8614-01**.

**Tighten:** Tighten the nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings.



**Fig. 39: Measuring Pinion Rotating Torque**  
 Courtesy of GENERAL MOTORS CORP.

8. Measure the rotating torque of the pinion. Compare this measurement with the rotating torque recorded during removal.

**Tighten:** Tighten the nut in small increments, as needed, until the rotating torque is 0.40-0.57 N.m (3-5 lb in) greater than the rotating torque recorded during removal.

9. Once the specified torque is obtained, rotate the pinion several times to ensure the bearings have seated. Recheck the rotating torque and adjust if necessary.
10. Install the propeller shaft. Refer to **Propeller Shaft Replacement - Rear** in Propeller Shaft.
11. Install the brake rotors. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
12. Install the brake calipers. Refer to **Brake Caliper Replacement - Rear** in Disc Brakes.
13. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
14. Inspect and add axle lubricant to the axle housing, if necessary. Refer to **Lubricant Replacement - Rear Drive Axle**.

15. Lower the vehicle.

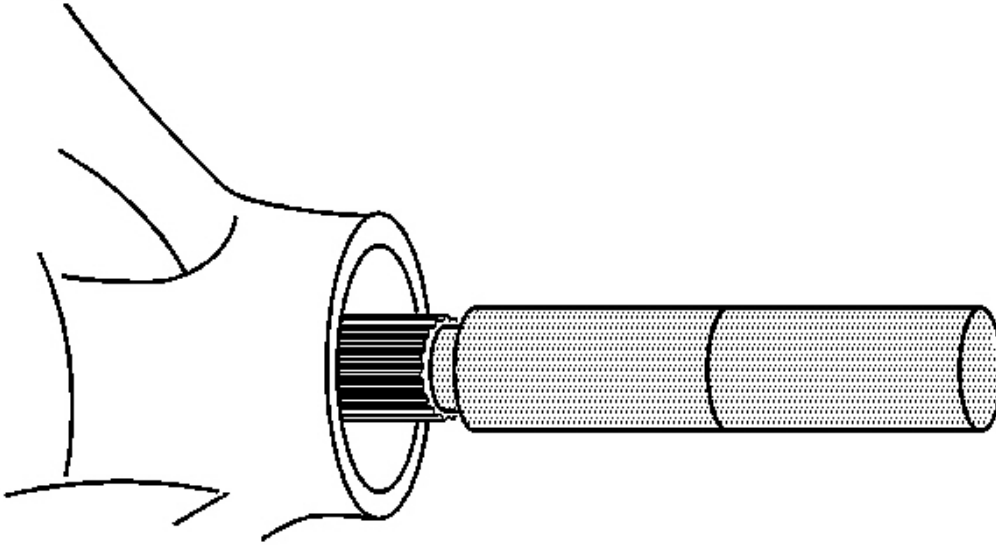
## **DRIVE PINION AND RING GEAR REPLACEMENT**

### **Tools Required**

- **J 8614-01** Flange and Pulley Holding Tool
- **J 22536** Pinion Driver. See **Special Tools**.
- **J 38694** Extension Housing Oil Pump/Seal Installer. See **Special Tools**.

### **Removal Procedure**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the brake calipers. Refer to **Brake Caliper Replacement - Rear** in Disc Brakes.
4. Remove the brake rotors. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
5. Remove the axle shafts. Refer to **Rear Axle Shaft Replacement**.
6. Remove the differential assembly. Refer to **Differential Replacement**.
7. Remove the drive pinion yoke and the oil seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.



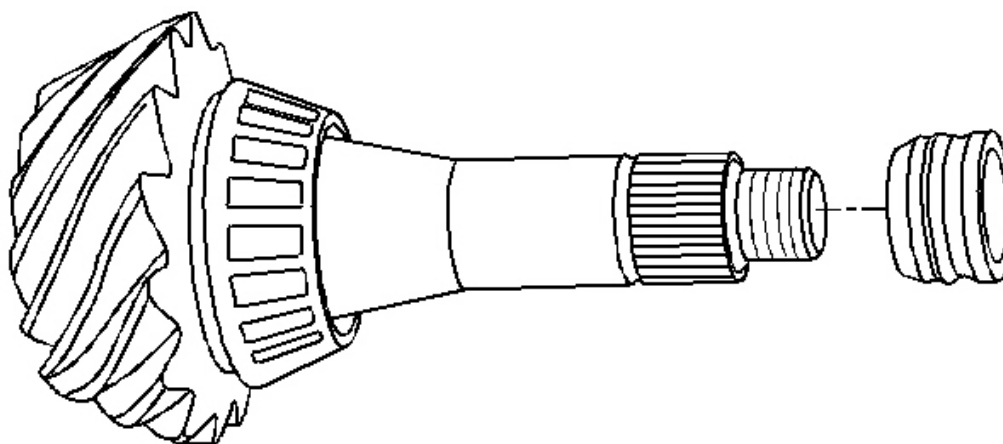
**Fig. 40: Installing J 22536 Or J 44421 On Pinion**  
Courtesy of GENERAL MOTORS CORP.

8. Install the **J 22536** as shown. See **Special Tools**.

Ensure that the **J 22536** is firmly seated on the pinion. See **Special Tools**.

9. Drive the pinion out using the **J 22536** and a hammer. See **Special Tools**.

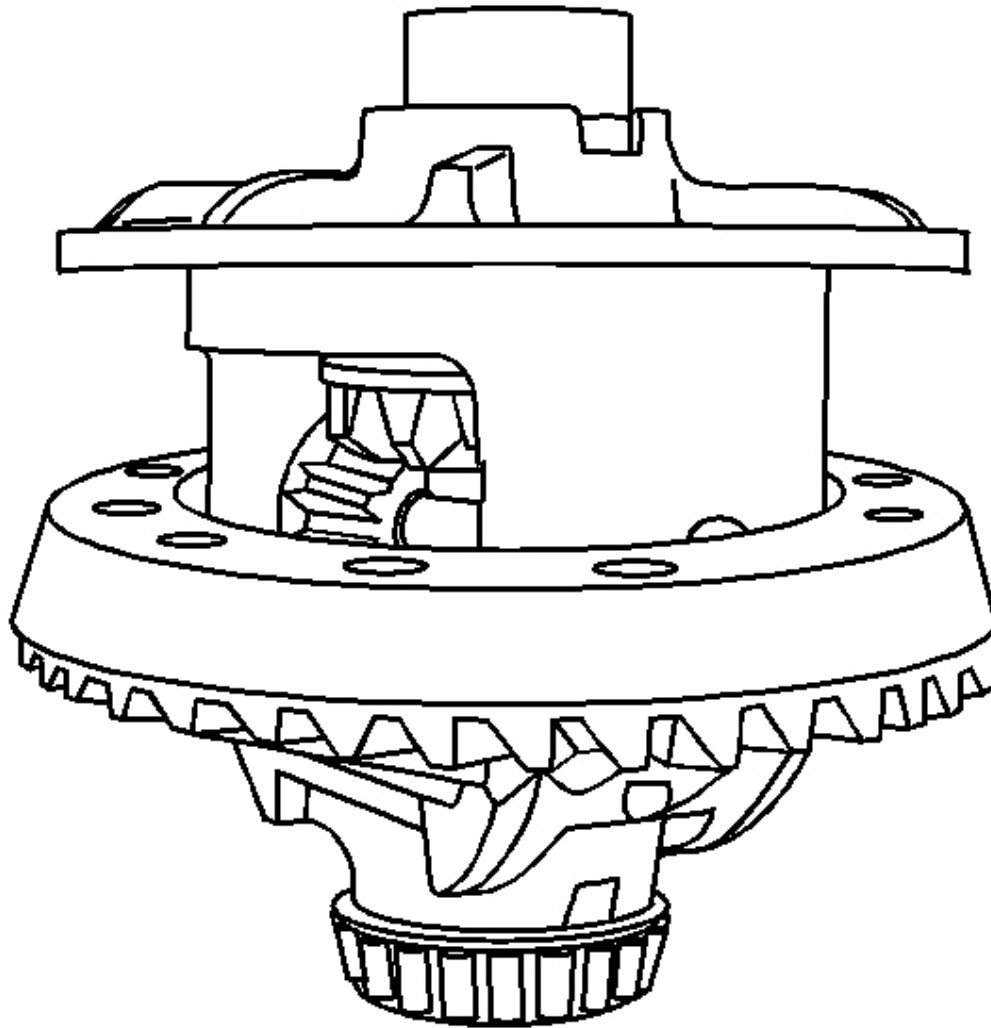
Strike the **J 22536** slowly. See **Special Tools**. Do not let the pinion fall out of the rear axle housing.



**Fig. 41: View Of Collapsible Spacer & Pinion**  
**Courtesy of GENERAL MOTORS CORP.**

10. Remove the collapsible spacer from the pinion. Discard the spacer.
11. Remove the pinion bearings and the cups. Refer to **Drive Pinion Bearings Replacement**.
12. Remove the left-hand threaded ring gear bolts. Discard the bolts.
13. Remove the ring gear from the differential. Drive the gear off with a brass drift if necessary.

**Installation Procedure**



**Fig. 42: Ring Gear & Differential Case**  
**Courtesy of GENERAL MOTORS CORP.**

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

1. Install the ring gear to the differential case.
2. Install the new ring gear bolts.

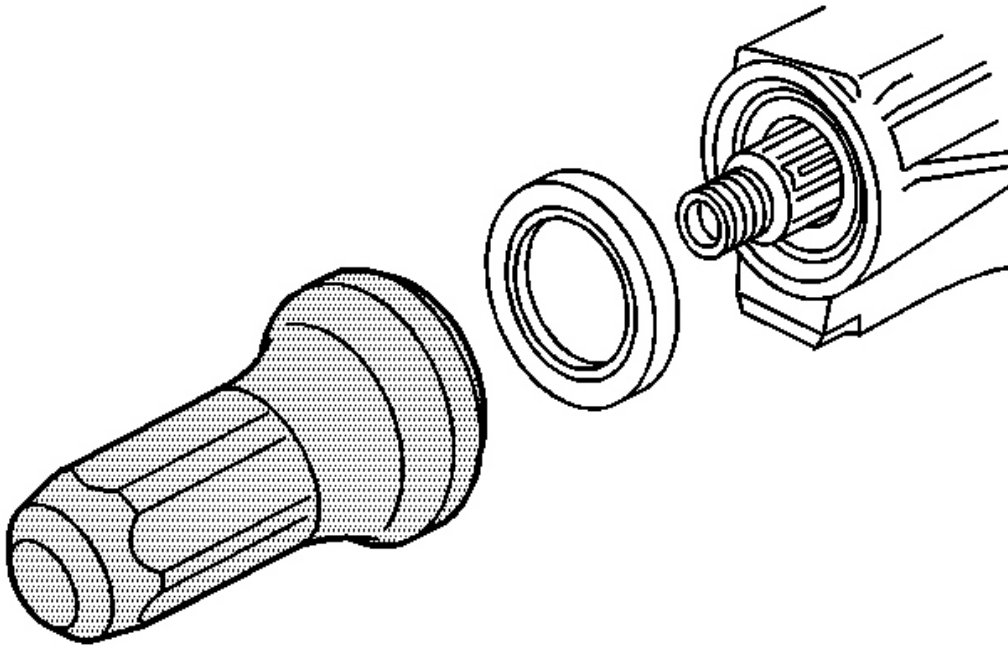
Hand start each bolt to ensure that the ring gear is properly installed to the differential case.

**NOTE:** Refer to **Fastener Notice** in **Cautions and Notices**.

3. Tighten the new ring gear bolts alternately and in stages, gradually pulling the ring gear onto the differential case.

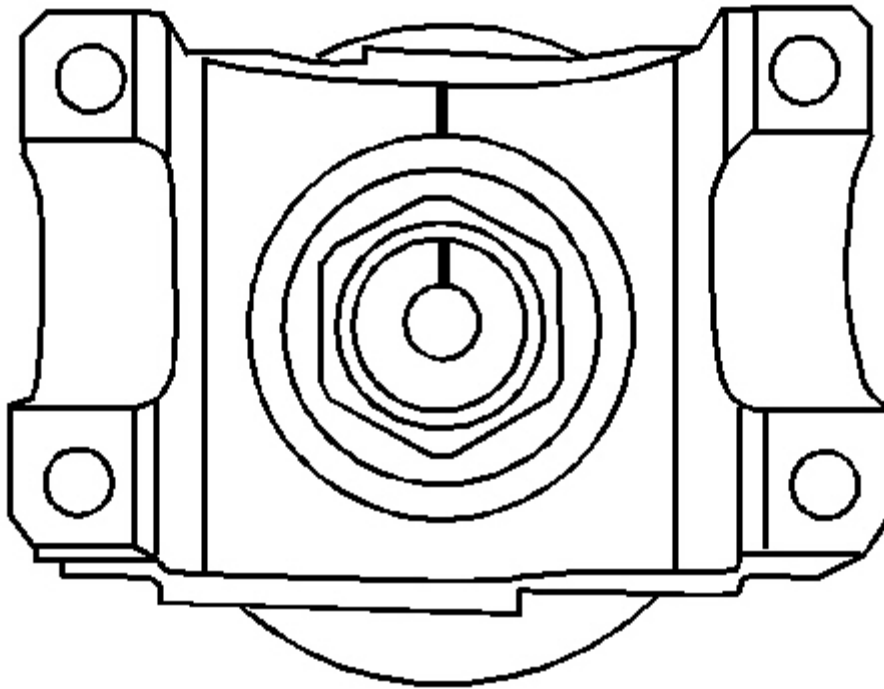
**Tighten:** Tighten the ring gear bolts in sequence to 120 N.m (89 lb ft).

4. Install the drive pinion bearing cups. Refer to **Drive Pinion Bearings Replacement**.
5. Determine the selective shim thickness for the pinion gear. Refer to **Pinion Depth Adjustment**.
6. Install the selective shim onto the pinion.
7. Install the inner pinion bearing onto the pinion. Refer to **Drive Pinion Bearings Replacement**.
8. Install a new collapsible spacer.
9. Lubricate the pinion bearings with axle lubricant. Refer to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.
10. Install the pinion to the axle housing.
11. Install the outer pinion bearing.



**Fig. 43: Installing Pinion Oil Seal**  
**Courtesy of GENERAL MOTORS CORP.**

12. Install a new pinion oil seal using the **J 38694** . See **Special Tools**.
13. Apply sealant, GM P/N 12346004 (Canadian P/N 10953480) or equivalent, to the splines of the pinion yoke.

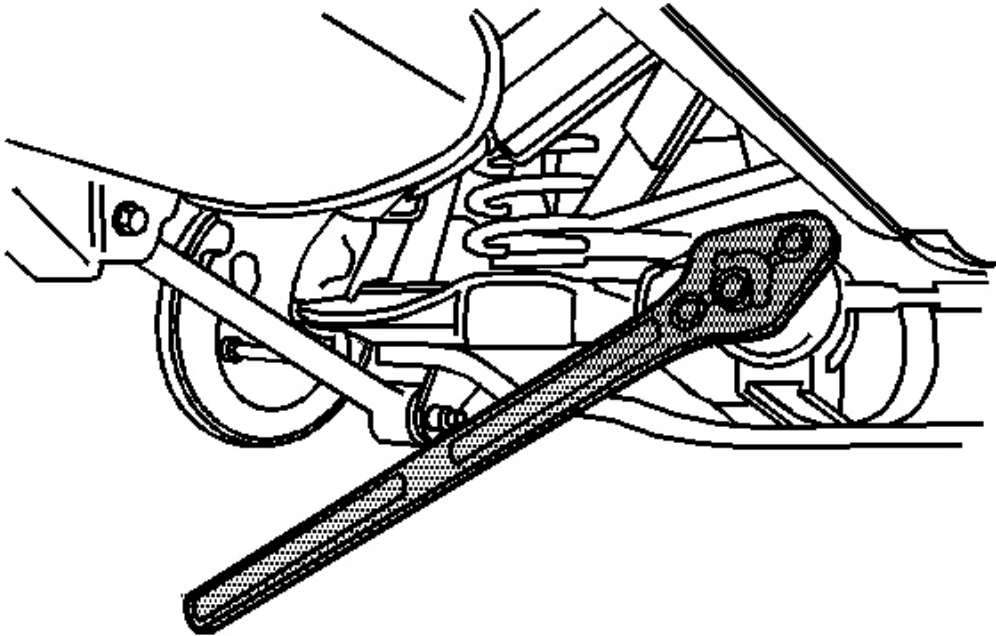


**Fig. 44: View Of Pinion Shaft & Pinion Yoke Alignment Marks**  
**Courtesy of GENERAL MOTORS CORP.**

14. Install the pinion yoke.

Align the marks made during removal.

15. Seat the pinion yoke onto the pinion shaft by tapping it with a soft-faced hammer until a few pinion shaft threads show through the yoke.
16. Install the washer and a new pinion nut.



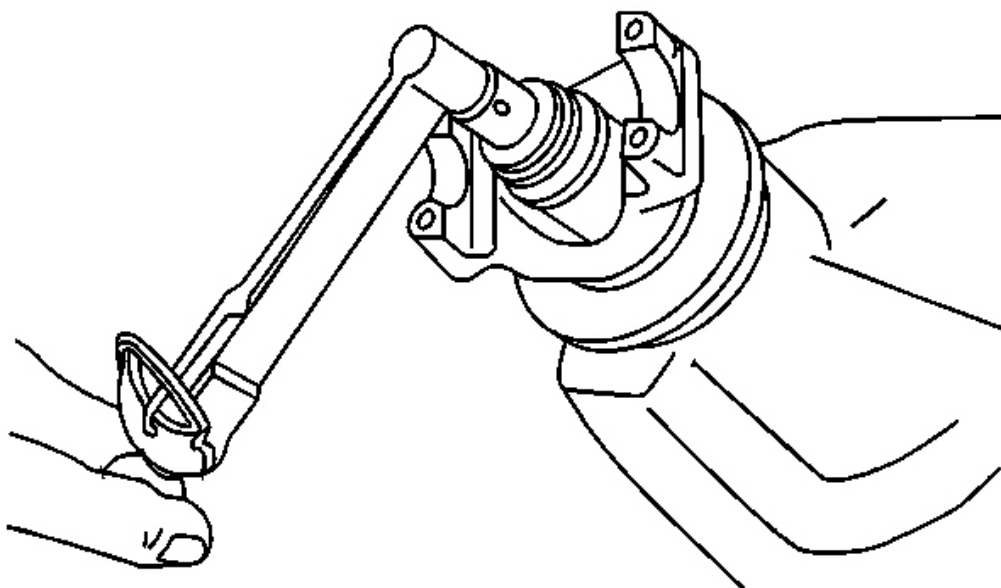
**Fig. 45: Holding Pinion Yoke With Special Tool**  
Courtesy of GENERAL MOTORS CORP.

17. Install the **J 8614-01** onto the pinion yoke as shown.

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

18. Tighten the pinion nut while holding the **J 8614-01** .

**Tighten:** Tighten the pinion nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings.



**Fig. 46: Measuring Pinion Rotating Torque**  
**Courtesy of GENERAL MOTORS CORP.**

19. Measure the rotating torque of the pinion using an inch-pound torque wrench.

**Specification:** The rotating torque of the pinion should be 1.0-2.3 N.m (10-20 lb in) for used bearings or 1.7-3.4 N.m (15-30 lb in) for new bearings.

20. If the rotating torque measurement is below 1.0 N.m (10 lb in) for used bearings, or 1.7 N.m (15 lb in) for new bearings, continue to tighten the pinion nut.

**Tighten:** Tighten the pinion nut, in small increments, as needed, until the torque required in order to rotate the pinion is 1.0-2.3 N.m (10-20 lb in) for used bearings or 1.7-3.4 N.m (15-30 lb in) for new bearings.

21. Once the specified torque is obtained, rotate the pinion several times to ensure the bearings have seated.

Recheck the rotating torque and adjust if necessary.

22. Install the differential. Refer to **Differential Replacement**.

## 2006 Buick Rainier

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23. Perform a gear tooth contact pattern check on the pinion and the ring gear. Refer to **Gear Tooth Contact Pattern Inspection**.
24. Install the axle shafts. Refer to **Rear Axle Shaft Replacement**.
25. Install the brake rotors. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
26. Install the brake calipers. Refer to **Brake Caliper Replacement - Rear** in Disc Brakes.
27. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
28. Fill the axle with axle lubricant. Use the proper fluid. Refer to **Lubricant Replacement - Rear Drive Axle**.
29. Lower the vehicle.

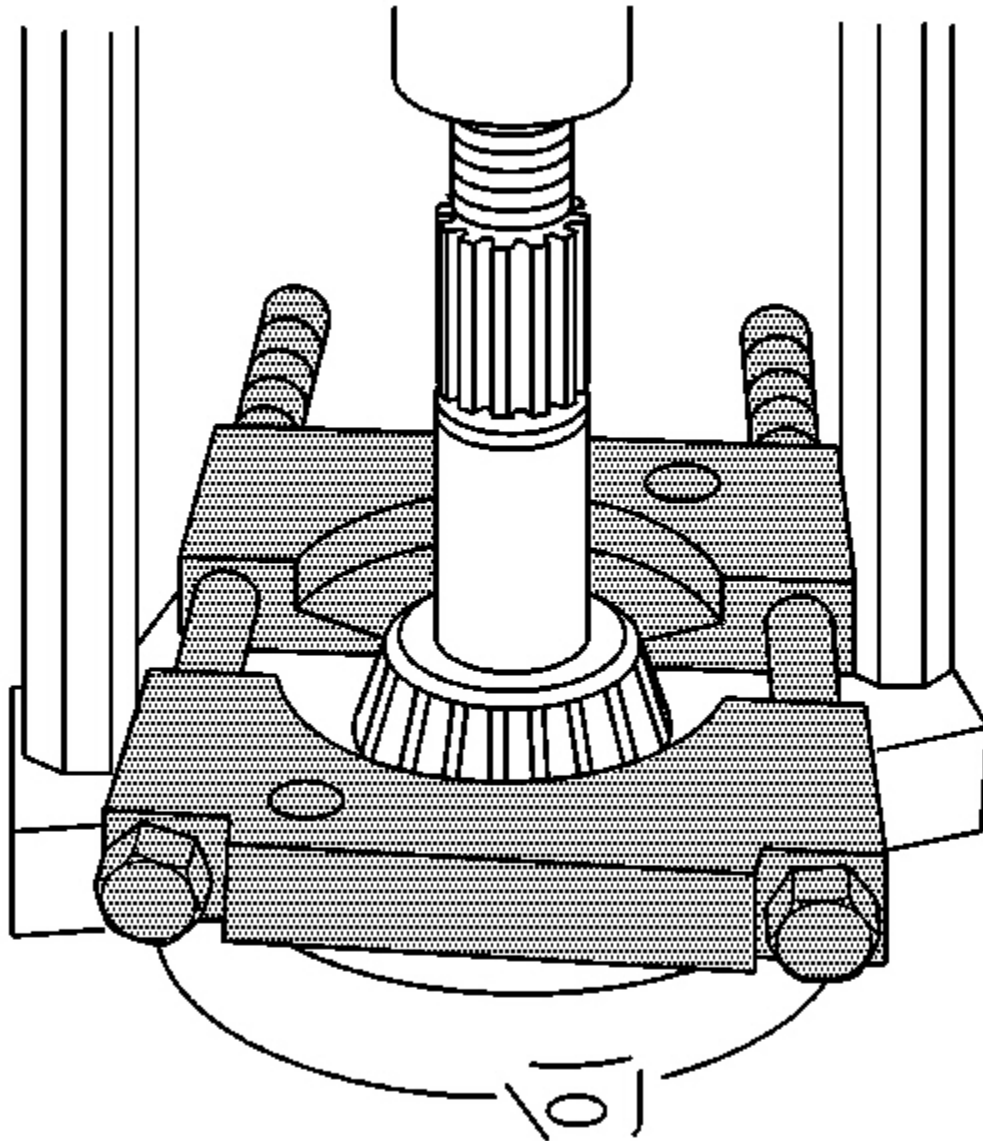
### DRIVE PINION BEARINGS REPLACEMENT

#### Tools Required

- **J 7817** Outer Bearing Race Installer. See **Special Tools**.
- **J 8092** Universal Driver Handle- 3/4 in - 10
- **J 8608** Rear Pinion Bearing Race Installer
- **J 8611-01** Rear Pinion Bearing Race Installer. See **Special Tools**.
- **J 8614-01** Flange and Pulley Holding Tool
- **J 22912-01** Split-Plate Bearing Puller
- **J 24433** Pinion Cone and Side Bearing Installer. See **Special Tools**.
- **J 33782** Pinion Oil Seal Installer
- **J 38694** Extension Housing Oil Pump/Seal Installer. See **Special Tools**.
- **J 45871** Pinion Bearing Remover. See **Special Tools**.

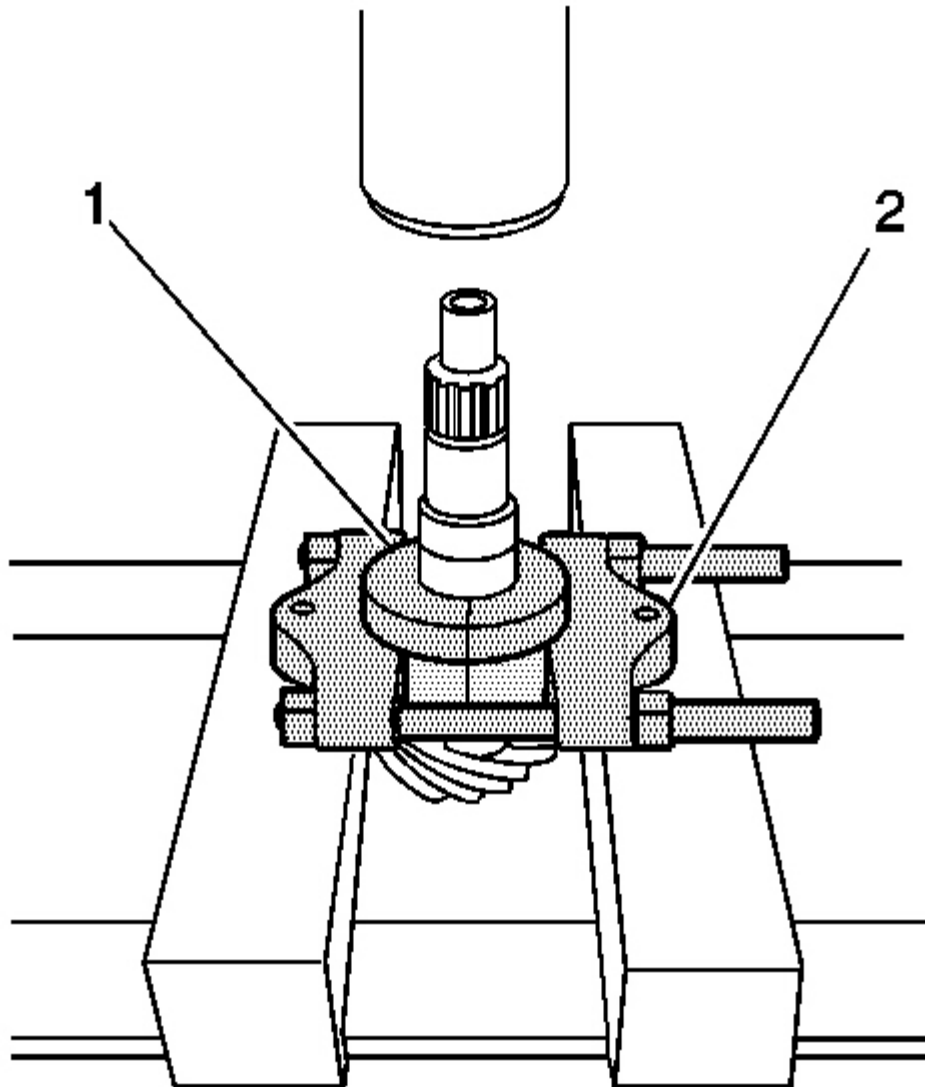
#### Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the differential. Refer to **Differential Replacement**.
3. Remove the drive pinion from the axle. Refer to **Drive Pinion and Ring Gear Replacement**.



**Fig. 47: Removing Inner Pinion Bearing Using Hydraulic Press**  
**Courtesy of GENERAL MOTORS CORP.**

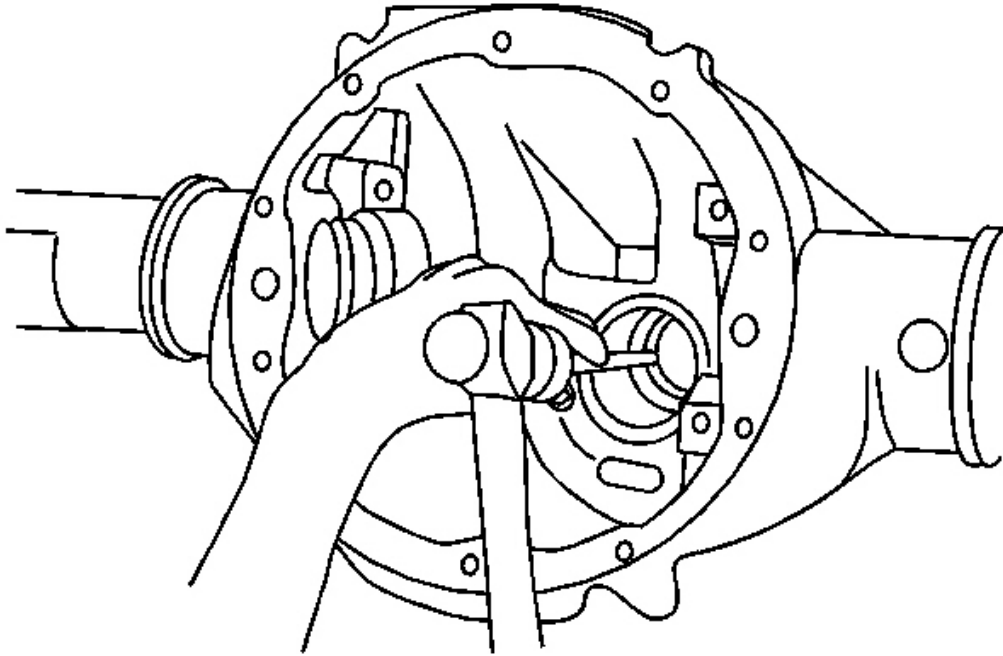
4. For the 8.0 inch axle, press the bearing off of the pinion using the **J 22912-01** .



**Fig. 48: J 45871 & J 22912-01**  
**Courtesy of GENERAL MOTORS CORP.**

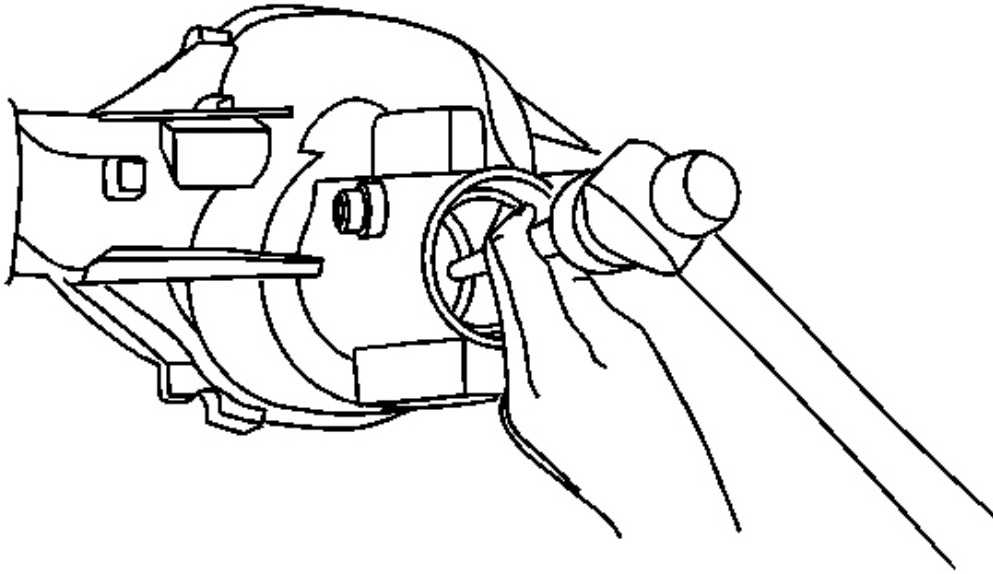
5. For the 8.6 inch axle, install the **J 45871** (1) around the pinion bearing and the **J 22912-01** (2) in the inverted position around the **J 45871** . See **Special Tools**.
6. Press the bearing off of the pinion using the **J 45871** and the **J 22912-01** . See **Special Tools**.

7. Remove the shim.



**Fig. 49: Removing Outer Pinion Bearing Cup**  
Courtesy of GENERAL MOTORS CORP.

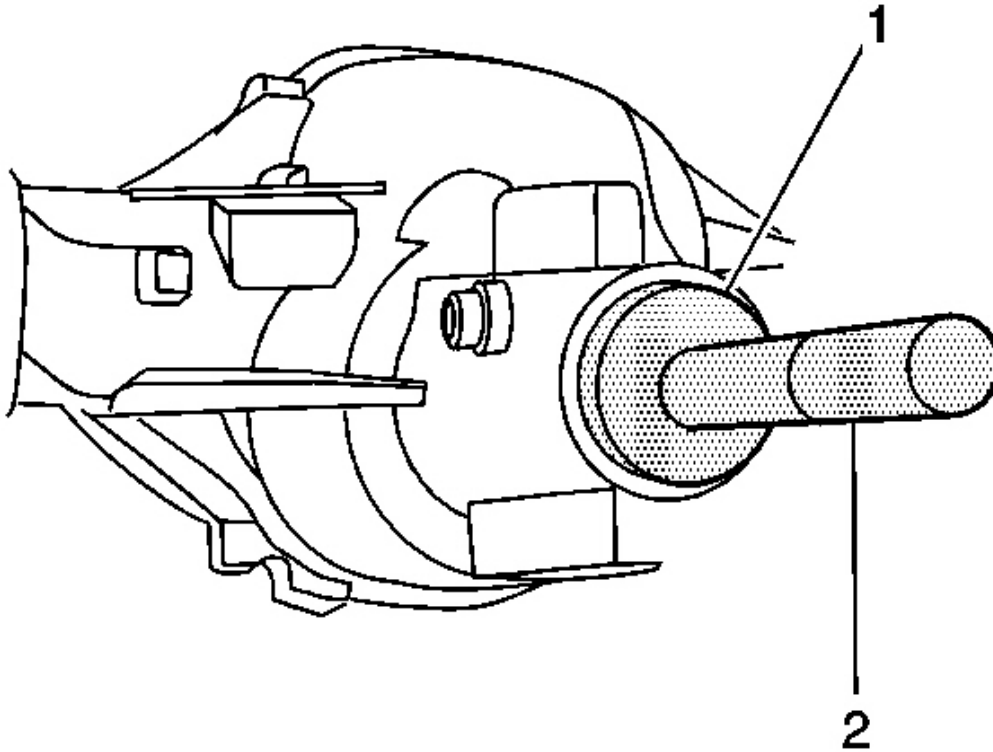
8. Remove the outer pinion bearing cup from the axle housing using a hammer and a brass drift in the slots provided. Move the drift back and forth between one side of the cup and the other in order to work the cups out of the housing evenly.



**Fig. 50: Removing Inner Pinion Bearing Cup**  
**Courtesy of GENERAL MOTORS CORP.**

9. Remove the inner pinion bearing cup from the axle housing using a hammer and a brass drift in the slots provided. Move the drift back and forth between one side of the cup and the other in order to work the cups out of the housing evenly.

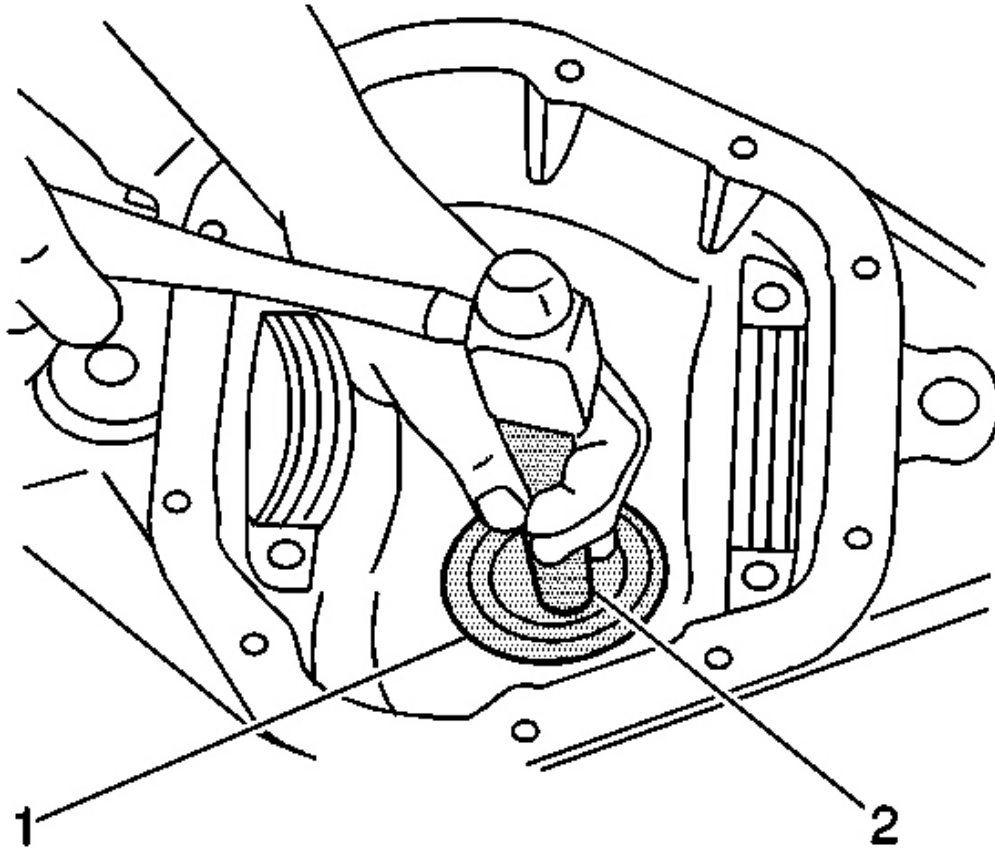
**Installation Procedure**



**Fig. 51: Install The Outer Pinion Bearing Cup Using J 8611-01, J 7818 Or J 8608 & J 8092**

**Courtesy of GENERAL MOTORS CORP.**

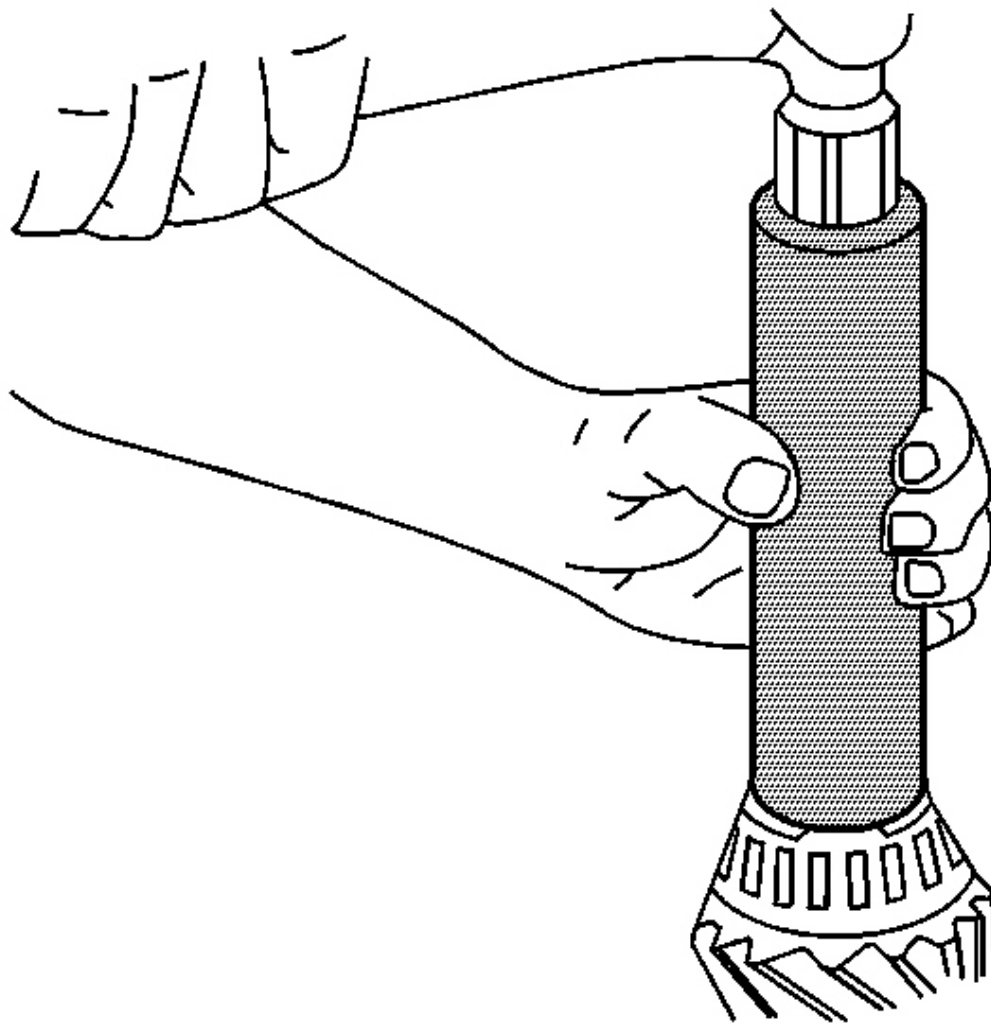
1. Install the outer pinion bearing cup using the **J 7817** , 8. See **Special Tools**.0 inch axle, or the **J 8611-01** , 8. See **Special Tools**.6 inch axle (1), and the **J 8092** (2).



**Fig. 52: Install The Inner Pinion Bearing Cup Using J 45900, J 22306 Or J 44417 & J 8092**

**Courtesy of GENERAL MOTORS CORP.**

2. Install the inner pinion bearing cup using the **J 8608** (2) and the **J 8092** (1).
3. Determine the selective shim thickness for the pinion. Refer to **Pinion Depth Adjustment**.



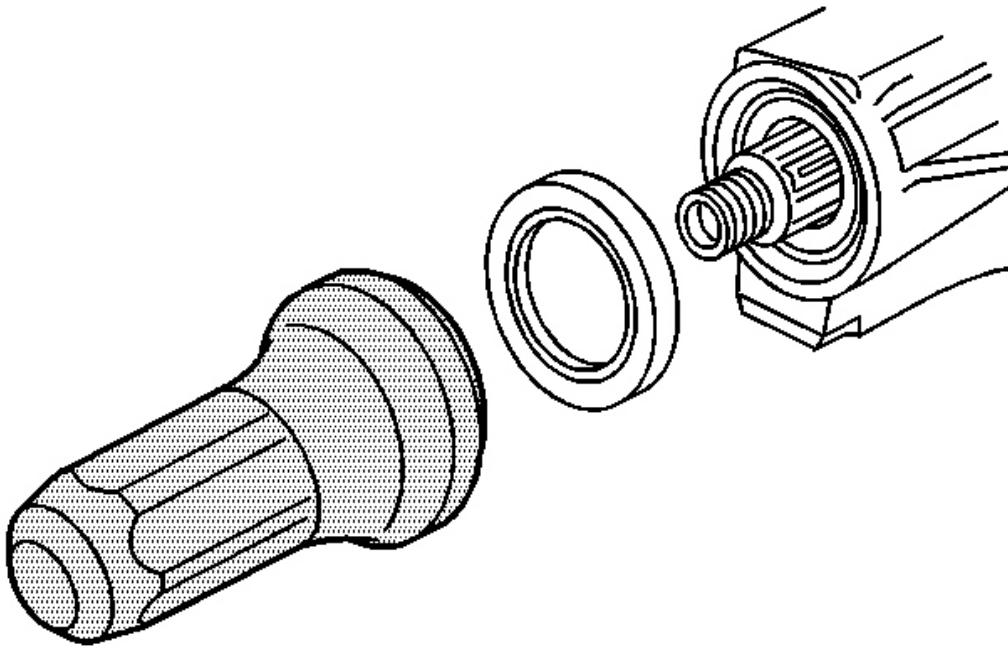
**Fig. 53: Installing Inner Pinion Bearing Onto Pinion Gear**  
Courtesy of GENERAL MOTORS CORP.

4. Install the selective shim between the inner pinion bearing and the shoulder on the gear.
5. Install the inner pinion bearing using the **J 24433** . See **Special Tools**.

Press the bearing on until the cone seats on the pinion shim.

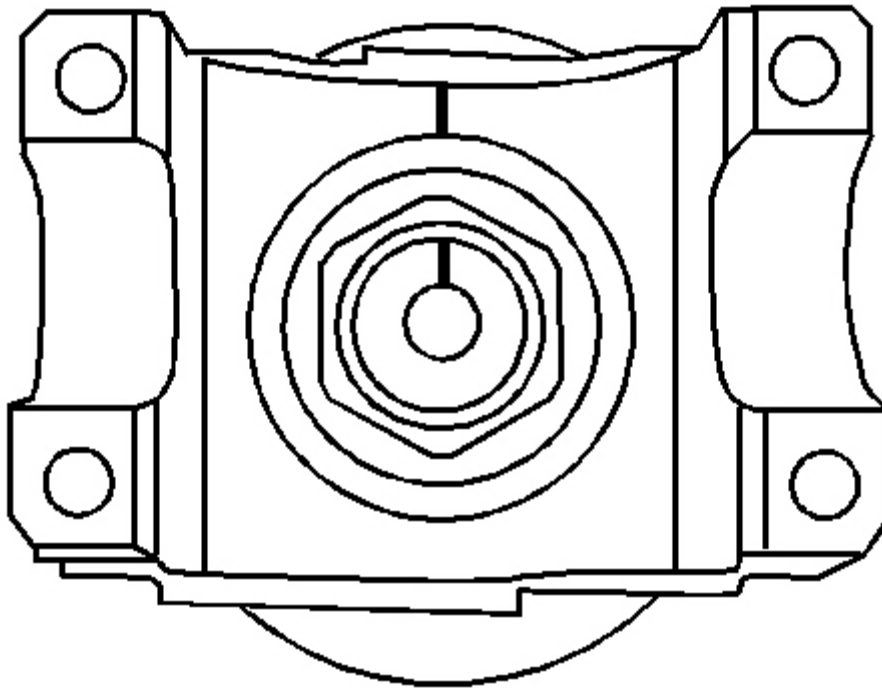
6. Install a new collapsible spacer.

7. Lubricate the pinion bearings with axle lubricant. Use the proper fluid. Refer to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.
8. Install the pinion into the axle housing.
9. Install the outer pinion bearing onto the pinion.



**Fig. 54: Installing Pinion Oil Seal**  
Courtesy of GENERAL MOTORS CORP.

10. Install a new pinion oil seal using the **J 33782** , 8.0 inch axle, or the **J 38694** , 8. See **Special Tools**.6 inch axle.
11. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the splines of the pinion yoke.

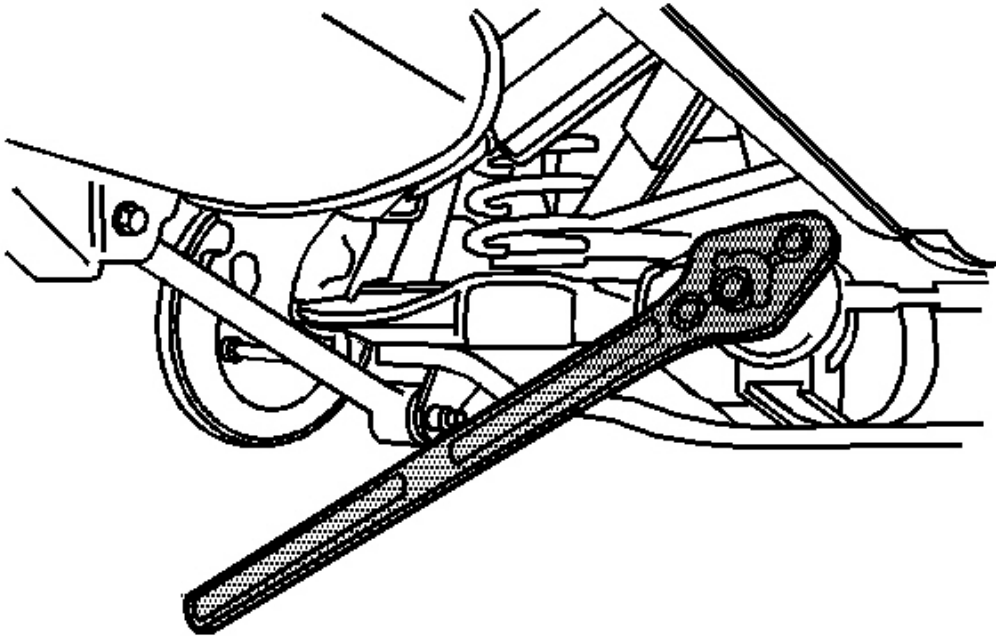


**Fig. 55: View Of Pinion Shaft & Pinion Yoke Alignment Marks**  
**Courtesy of GENERAL MOTORS CORP.**

12. Install the pinion yoke.

Align the marks made during removal.

13. Seat the pinion yoke onto the pinion shaft by tapping it with a soft-faced hammer until a few pinion shaft threads show through the yoke.
14. Install the washer and a new pinion nut.



**Fig. 56: Holding Pinion Yoke With Special Tool**  
Courtesy of GENERAL MOTORS CORP.

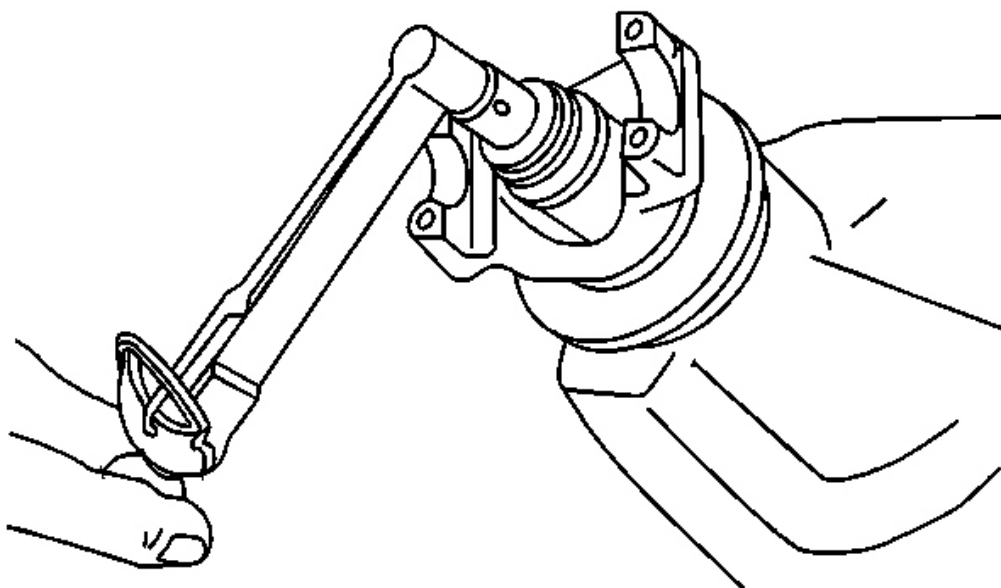
15. Install the **J 8614-01** onto the pinion yoke as shown.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

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

16. Tighten the pinion nut while holding the **J 8614-01**.

**Tighten:** Tighten the pinion nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings.



**Fig. 57: Measuring Pinion Rotating Torque**  
**Courtesy of GENERAL MOTORS CORP.**

17. Measure the rotating torque of the pinion using an inch-pound torque wrench.

**Specification:** The rotating torque of the pinion should be 1.0-2.3 N.m (10-20 lb in) for used bearings, or 1.7-3.4 N.m (15-30 lb in) for new bearings.

18. If the rotating torque measurement is below 1.0 N.m (10 lb in) for used bearings, or 1.7 N.m (15 lb in) for new bearings, continue to tighten the pinion nut.

**Tighten:** Tighten the pinion nut, in small increments, as needed, until the torque required in order to rotate the pinion is 1.0-2.3 N.m (10-20 lb in) for used bearings, or 1.7-3.4 N.m (15-30 lb in) for new bearings.

19. Once the specified torque is obtained, rotate the pinion several times to ensure the bearings have seated.

Recheck the rotating torque and adjust if necessary.

20. Install the differential. Refer to **Differential Replacement**.

21. Fill the axle with axle lubricant lubricant. Use the proper fluid. Refer to **Lubricant Replacement - Front Drive Axle** .
22. Lower the vehicle.

## **DIFFERENTIAL REPLACEMENT**

### **Tools Required**

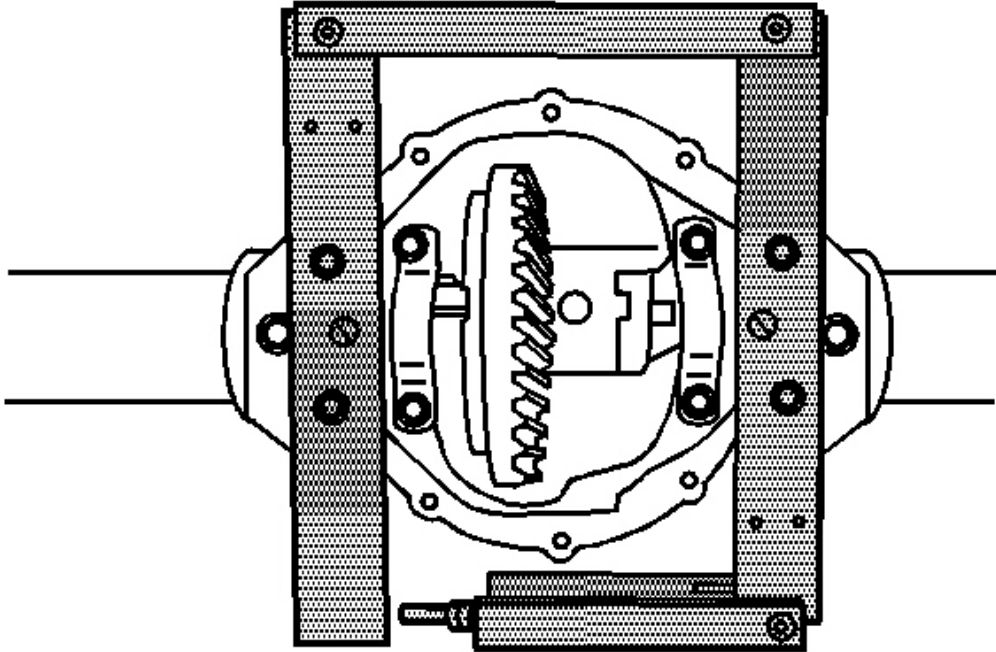
- **J 34178** Spreader Gage Adapter
- **J 45222** Axle Housing Spreader. See **Special Tools**.
- **J 8001** Dial Indicator Set

### **Removal Procedure**

**IMPORTANT:** Group and mark the shims together as originally removed. If you remove or replace the ring and pinion gearset, perform the bearing preload, backlash, and gear tooth contact pattern check in order to ensure proper contact of the gears. If you reinstall or replace the differential carrier without replacing any other component (i.e. pinion and ring gear set, bearings. etc.) then you may reinstall the carrier with the original shims in their original locations. Always perform a gear tooth contact pattern check, even when you remove only the carrier.

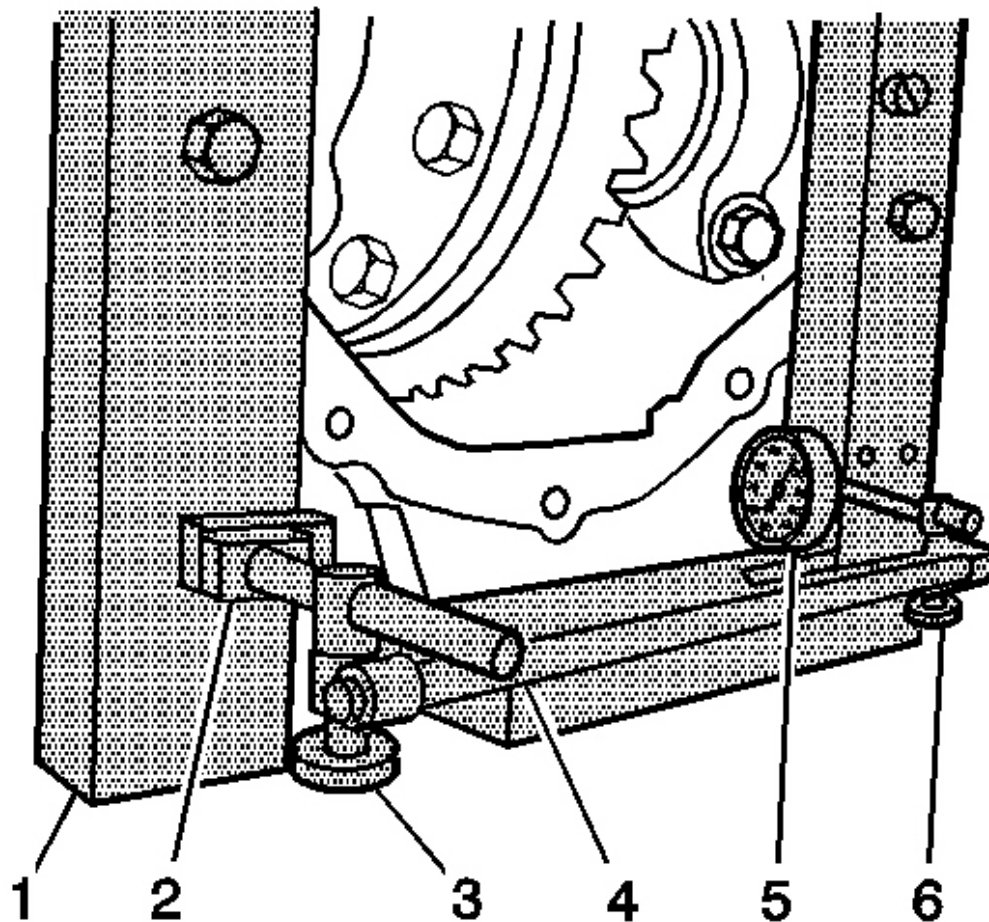
1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the spare tire.
3. Remove the rear axle tie rod. Refer to **Rear Axle Tie Rod Replacement** in Rear Suspension.
4. Remove the axle shafts. Refer to **Rear Axle Shaft Replacement**.
5. Loosen the bearing cap bolts.

Do not remove the bearing cap bolts at this time.



**Fig. 58: Installing J 45222 Onto Axle Housing**  
**Courtesy of GENERAL MOTORS CORP.**

6. Install the **J 45222** onto the axle housing as shown. See **Special Tools**.

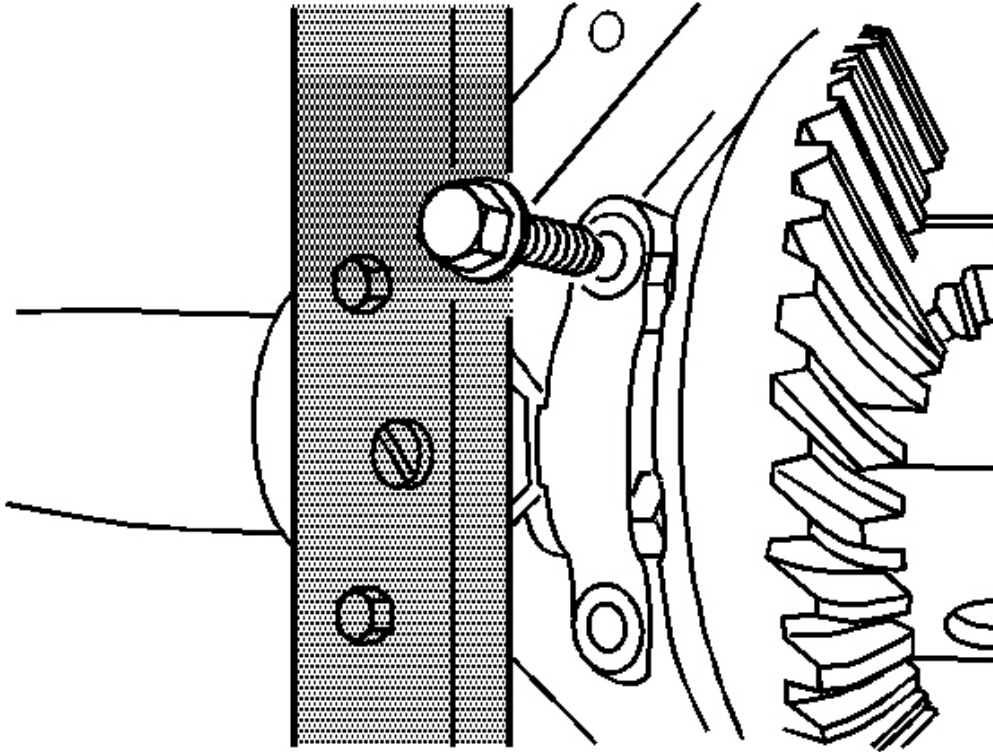


**Fig. 59: J 8001-1, J 8001-2, J 34178, & J 8001-3**  
**Courtesy of GENERAL MOTORS CORP.**

7. Install the J 8001-1 (2), the J 8001-2 (3), the **J 34178** (4, 6), and the J 8001-3 (5) as shown.
8. Preload the J 8001-3 (5) approximately 3/4 of a turn clockwise.
9. Rotate the indicator housing to align the indicator needle of the J 8001-3 (5) and the dial indicator face to ZERO.
10. Spread the axle housing by turning the clevis screw of the **J 34178** while observing the J 8001-3.

Spread the housing just enough to remove the differential assembly. Do not spread the

housing more than 1.02 mm (0.040 in).



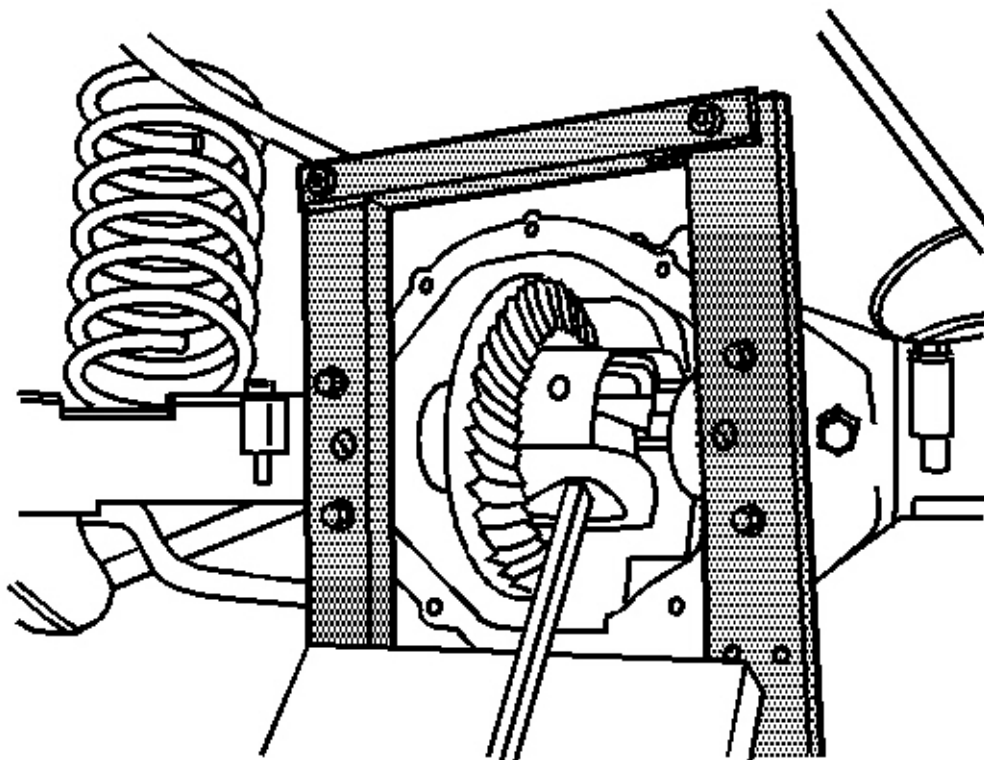
**Fig. 60: View Of Bearing Caps Bolts**  
Courtesy of GENERAL MOTORS CORP.

11. Remove the bearing caps bolts and the caps. Mark the bearing caps left and right.

**CAUTION:** To prevent personal injury and/or component damage, support the differential case when removing the case from the axle housing. If the case is not supported, the differential case could fall and cause personal injury or damage to the differential case.

**NOTE:** When removing the differential case from the axle housing, do not damage the cover gasket surface. If the cover gasket

surface is damaged, lubricant may leak from the axle and cause premature failure of the axle assembly.



**Fig. 61: J 45222**

Courtesy of GENERAL MOTORS CORP.

12. Remove the differential from the axle housing using a pry bar and a block of wood.
13. Remove the bearing cups, the shims, and the spacers as necessary.

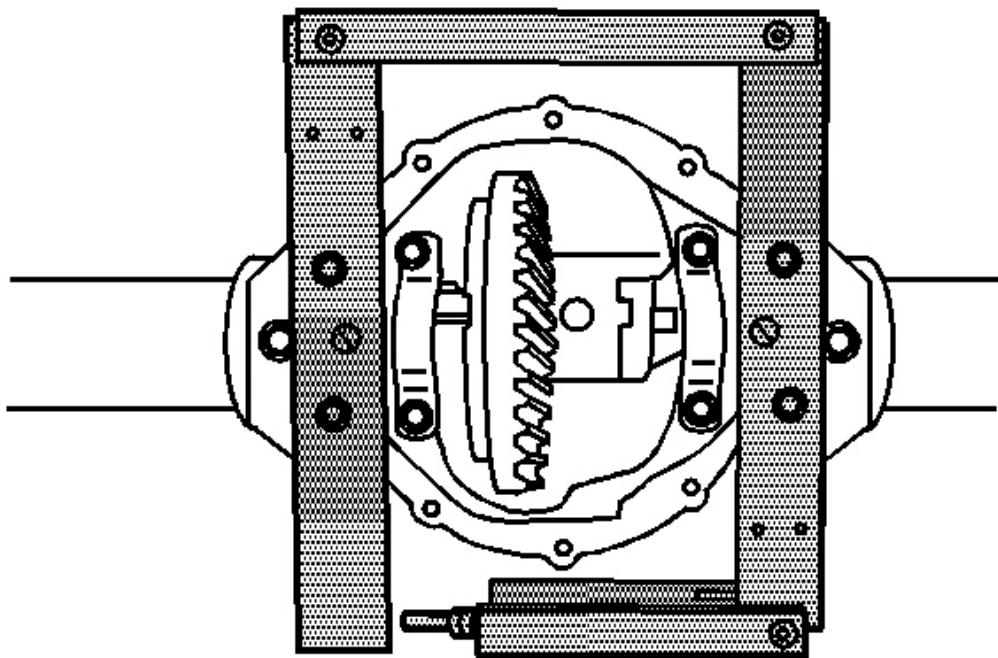
Mark the cups and shims left and right and in the proper order as necessary. Place the cups and the shims with the bearing caps.

14. Remove the J 8001-1, the J 8001-2, the **J 34178** , and the J 8001-3.
15. Remove the **J 45222** . See Special Tools.

16. Remove the differential side bearings, if necessary. Refer to Differential Side Bearings Replacement.
17. Remove the ring gear, if necessary. Refer to Drive Pinion and Ring Gear Replacement.

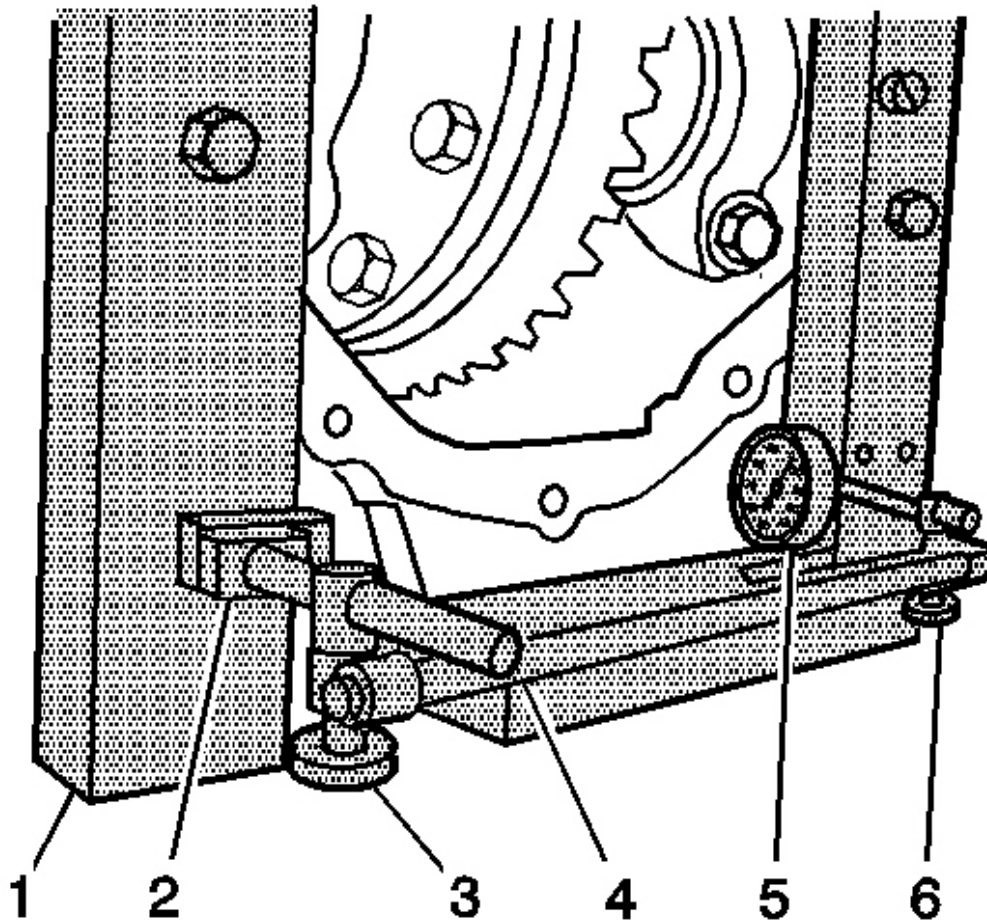
#### Installation Procedure

1. Install the ring gear, if necessary. Refer to Drive Pinion and Ring Gear Replacement.
2. Install the differential side bearings, if necessary. Refer to Differential Side Bearings Replacement.
3. Lubricate the differential side bearings with axle lubricant. Use the proper fluid. Refer to Fluid and Lubricant Recommendations in Maintenance and Lubrication.



**Fig. 62: Installing J 45222 Onto Axle Housing**  
Courtesy of GENERAL MOTORS CORP.

4. Install the **J 45222** onto the axle housing as shown. See Special Tools.

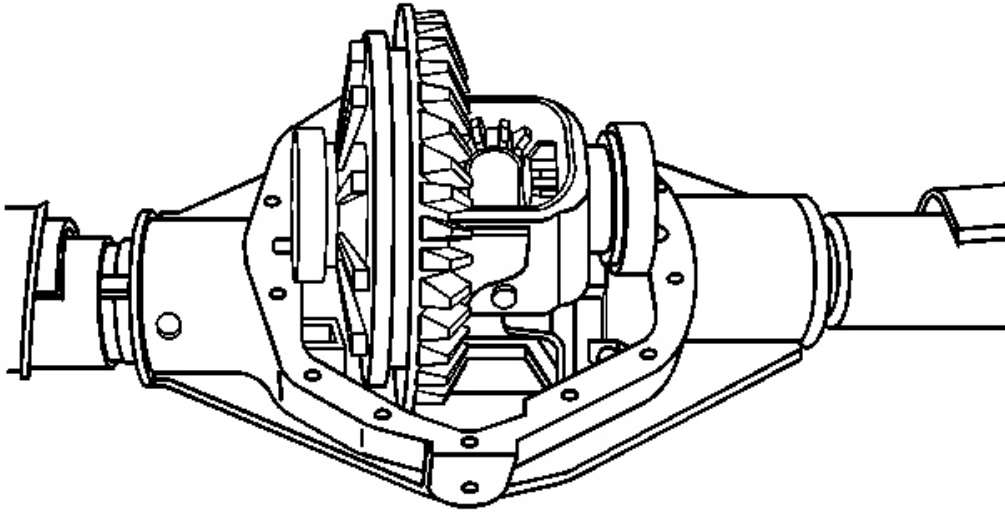


**Fig. 63: J 8001-1, J 8001-2, J 34178, & J 8001-3**  
**Courtesy of GENERAL MOTORS CORP.**

5. Install the J 8001-1 (2), the J 8001-2 (3), the **J 34178** (4, 6), and the J 8001-3 (5) as shown.
6. Preload the J 8001-3 (5) approximately 3/4 of a turn clockwise.
7. Rotate the indicator housing to align the indicator needle of the J 8001-3 (5) and the dial indicator face to ZERO.
8. Spread the axle housing by turning the clevis screw of the **J 34178** while observing the J 8001-3.

Spread the housing just enough to install the differential assembly. Do not spread the

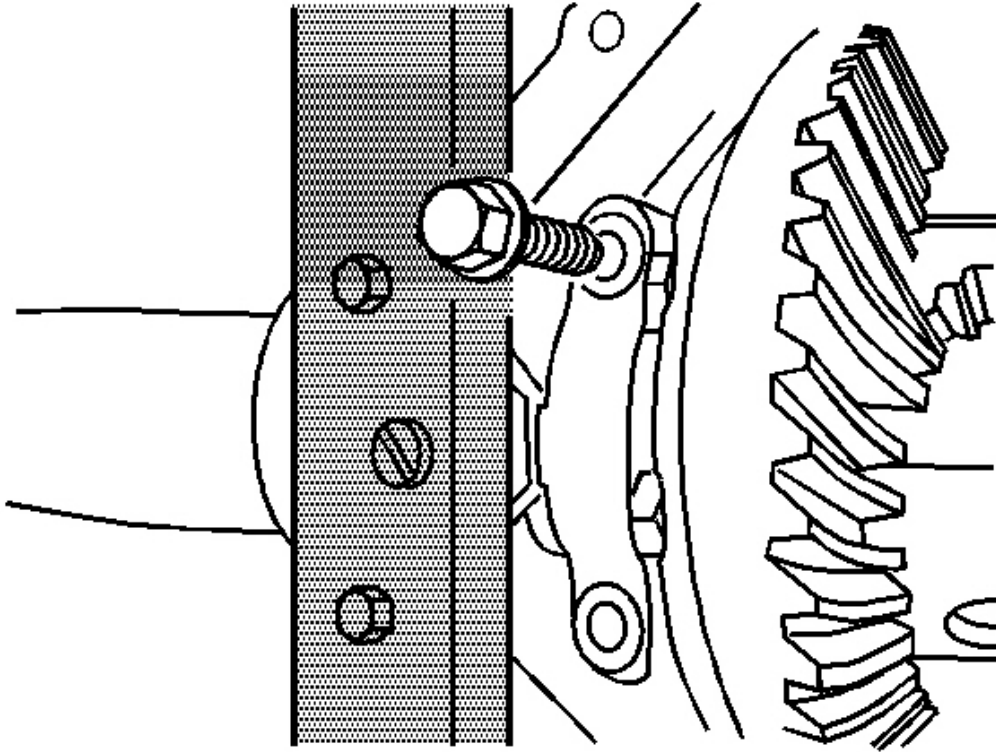
housing more than 1.02 mm (0.040 in).



**Fig. 64: View Of Differential Case And Axle Housing**  
**Courtesy of GENERAL MOTORS CORP.**

9. Place the case, with the bearing cups installed, into the axle housing.

Support the case in order to keep the case from falling out of the axle housing.



**Fig. 65: View Of Bearing Caps Bolts**  
**Courtesy of GENERAL MOTORS CORP.**

10. Install the bearing caps and the bolts.

Do not torque the bearing cap bolts at this time.

11. Adjust the differential side bearing preload. Refer to **Differential Side Bearing Preload Adjustment**.
12. Adjust the backlash. Refer to **Backlash Adjustment (7.6, 8.6 Inch Axle)**.
13. Perform a gear tooth contact pattern check. Refer to **Gear Tooth Contact Pattern Inspection**.

**NOTE:** Refer to **Fastener Notice** in Cautions and Notices.

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14. Tighten the bearing cap bolts.

**Tighten:** Tighten the bearing cap bolts to 75 N.m (55 lb ft).

15. Install the axle shafts. Refer to **Rear Axle Shaft Replacement**.

16. Install the rear axle tie rod. Refer to **Rear Axle Tie Rod Replacement** in Rear Suspension.

17. Install the spare tire.

18. Lower the vehicle.

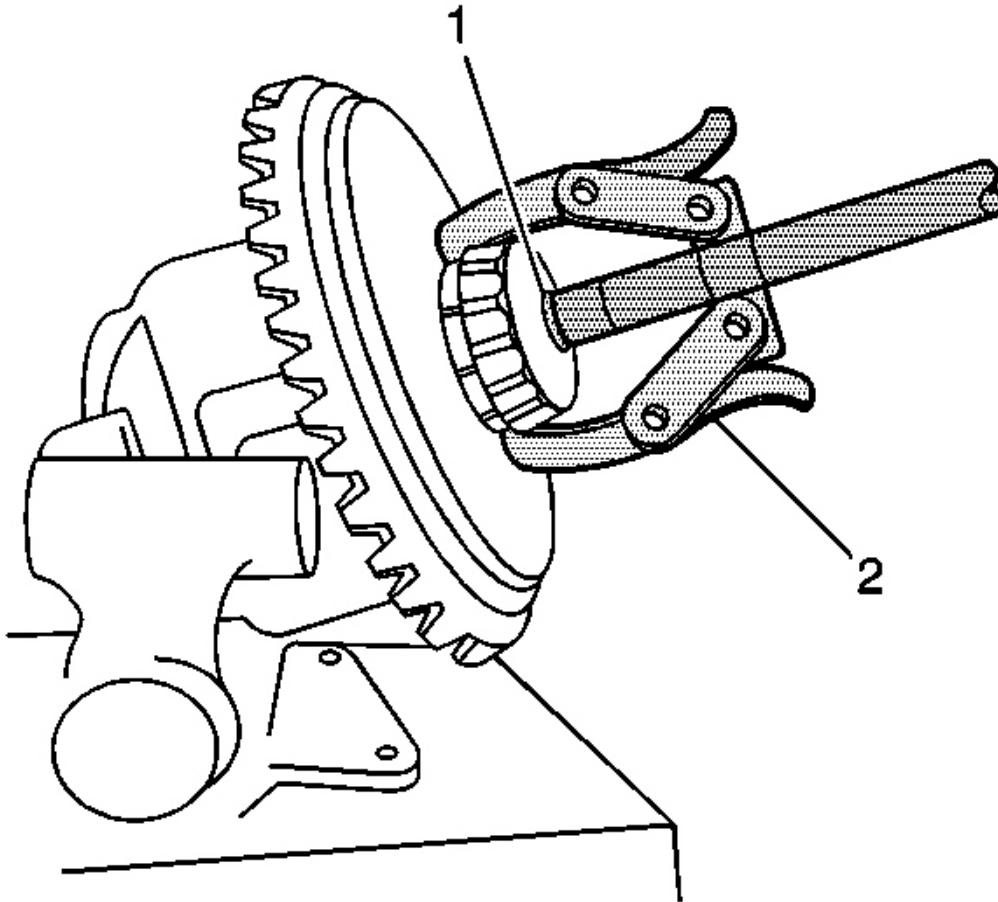
### DIFFERENTIAL SIDE BEARINGS REPLACEMENT

#### Tools Required

- **J 8092** Universal Driver Handle- 3/4 in - 10
- **J 21784** Side Bearing Installer. See **Special Tools**.
- **J 22888-D** Side Bearing Puller Kit
- **J 45231** Differential Side Bearing Installer. See **Special Tools**.

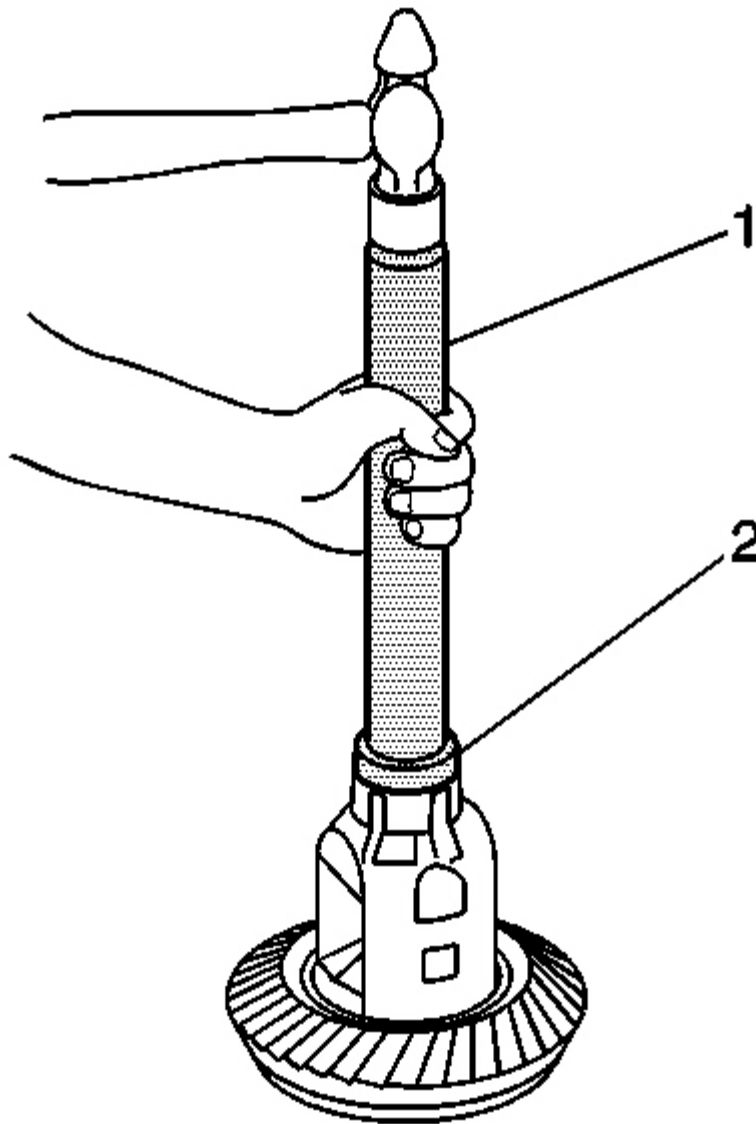
#### Removal Procedure

1. Remove the differential. Refer to **Differential Replacement**.



**Fig. 66: Removing Differential Side Bearing**  
Courtesy of GENERAL MOTORS CORP.

2. Remove the differential side bearings by performing the following steps:
  1. Install the differential assembly in a vise.
  2. Install the **J 22888-20A** (2) and the **J 8107-2** , 8. See Special Tools.0 inch axle, or the **J 8107-4** , 8. See Special Tools.6 inch axle (1), as shown.
  3. Remove the differential side bearings using the **J 22888-20A** .
3. Remove the differential assembly from the vise.



**Fig. 67: Driving The Differential Side Bearing Into Position**  
Courtesy of GENERAL MOTORS CORP.

1. Install the differential side bearings by doing the following:
  1. In order to protect the differential case, install the **J 8107-2** , 8. See **Special Tools**.0 inch axle, or the **J 8107-4** , 8. See **Special Tools**.6 inch axle, in the case on the side

opposite the bearing installation.

2. Install the **J 45231** , 8. See **Special Tools**.0 inch axle, or the **J 21784** , 8. See **Special Tools**.6 inch axle (2), and the **J 8092** (1) onto the differential case bearing as shown.
3. Drive the bearing onto the case using the **J 45231** , 8. See **Special Tools**.0 inch axle, or the **J 21784** , 8. See **Special Tools**.6 inch axle (2) and the **J 8092** (1).
2. Install the differential. Refer to **Differential Replacement**.

## **REAR AXLE REPLACEMENT**

### **Removal Procedure**

**IMPORTANT: If the vehicle is equipped with an air suspension the system will need to be depressurized. Refer to Air Suspension Depressurization Procedure in Air Suspension.**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Place safety stands (such as GMDE 123-B67313) at the front-end of the vehicle.
3. Support the rear axle with safety stands.
4. Remove the rear tires and the rear wheels. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
5. Disconnect the rear axle vent tube.
6. Remove the rear propeller shaft. Refer to **Propeller Shaft Replacement - Rear** in Propeller Shaft.
7. Disconnect the left rear cable of the park brake from the rear axle. Refer to **Park Brake Cable Replacement** in Park Brake.
8. Disconnect the right rear cable of the park brake from the rear axle. Refer to **Park Brake Cable Replacement** in Park Brake.
9. Remove the caliper assemblies from the rear axle. Refer to **Brake Caliper Replacement - Front** in Disc Brakes.
10. Remove the stabilizer shaft from the rear axle. Refer to **Stabilizer Shaft Replacement** in Rear Suspension.
11. Remove the coil springs. Refer to **Coil Spring Replacement** in Rear Suspension.
12. Disconnect the rear axle tie rod from the rear axle. Refer to **Rear Axle Tie Rod Replacement** in Rear Suspension.
13. Disconnect the lower control arms from the rear axle. Refer to **Rear Axle Lower Control Arm Replacement** in Rear Suspension.

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14. Disconnect the upper control arms from the rear axle. Refer to **Rear Axle Upper Control Arm Replacement** in Rear Suspension.
15. Remove the rear-axle assembly from the vehicle.

### Installation Procedure

1. Install the rear-axle assembly to the vehicle.
2. Connect the upper control arm to the rear axle. Refer to **Rear Axle Upper Control Arm Replacement** in Rear Suspension.
3. Connect the lower control arm to the rear axle. Refer to **Rear Axle Lower Control Arm Replacement** in Rear Suspension.
4. Connect the rear axle tie rod to the rear axle. Refer to **Rear Axle Tie Rod Replacement** in Rear Suspension.
5. Install the coil springs. Refer to **Coil Spring Replacement** in Rear Suspension.
6. Install the stabilizer shaft to the rear axle. Refer to **Stabilizer Shaft Replacement** in Rear Suspension.
7. Install the caliper assemblies to the rear axle. Refer to **Brake Caliper Replacement - Front** in Disc Brakes.
8. Connect the right rear cable of the park brake to the rear axle. Refer to **Park Brake Cable Replacement** in Park Brake.
9. Connect the left rear cable of the park brake to the rear axle. Refer to **Park Brake Cable Replacement** in Park Brake.
10. Install the propeller. Refer to **Propeller Shaft Replacement - Rear** in Propeller Shaft.
11. Connect the rear axle vent tube.
12. Install the rear tires and the rear wheels. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
13. Fill the axle with lubricant. Use the proper fluid. Refer to **Capacities - Approximate Fluid** and to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.
14. Remove the safety stands.
15. Lower the vehicle.

### REAR AXLE HOUSING REPLACEMENT

#### Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Drain the axle lubricant. Refer to **Lubricant Replacement - Rear Drive Axle**.

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3. Remove the rear axle assembly. Refer to **Rear Axle Replacement**.
4. Remove the brake caliper brackets. Refer to **Brake Caliper Bracket Replacement - Rear** in Disc Brakes.
5. Remove the rear axle cover housing and gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
6. Remove the axle shafts. Refer to **Rear Axle Shaft Replacement**.
7. Remove the differential assembly. Refer to **Drive Pinion and Ring Gear Replacement**.
8. Remove the brake backing plates. Refer to **Disc Brake Backing Plate Replacement - Rear**.
9. Remove the drive pinion shaft yoke and the seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.
10. Remove the drive pinion. Refer to **Drive Pinion and Ring Gear Replacement**.

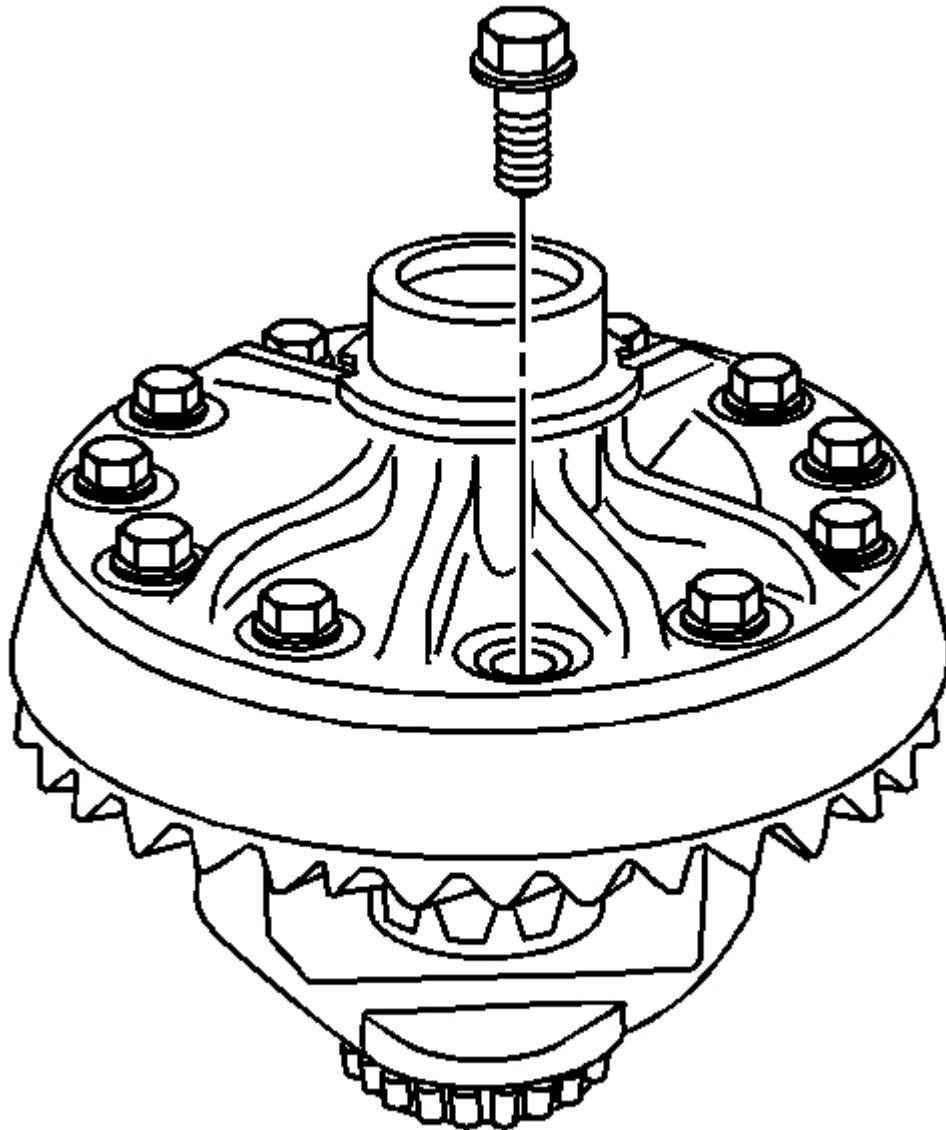
### Installation Procedure

1. Install the drive pinion. Refer to **Drive Pinion and Ring Gear Replacement**.
2. Install the differential assembly. Refer to **Drive Pinion and Ring Gear Replacement**.
3. Adjust the differential side bearing preload. Refer to **Differential Side Bearing Preload Adjustment**.
4. Adjust the backlash. Refer to **Backlash Adjustment (7.6, 8.6 Inch Axle)**.
5. Perform a gear tooth contact pattern check. Refer to **Gear Tooth Contact Pattern Inspection**.
6. Install the brake backing plates. Refer to **Disc Brake Backing Plate Replacement - Rear**.
7. Install the axle shafts. Refer to **Rear Axle Shaft Replacement**.
8. Install the rear axle housing cover and gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement**.
9. Install the brake caliper brackets. Refer to **Brake Caliper Bracket Replacement - Rear** in Disc Brakes.
10. Install the rear axle. Refer to **Rear Axle Replacement**.
11. Fill the axle with lubricant. Refer to **Lubricant Replacement - Rear Drive Axle**.
12. Lower the vehicle.

### DIFFERENTIAL OVERHAUL

#### Disassembly Procedure

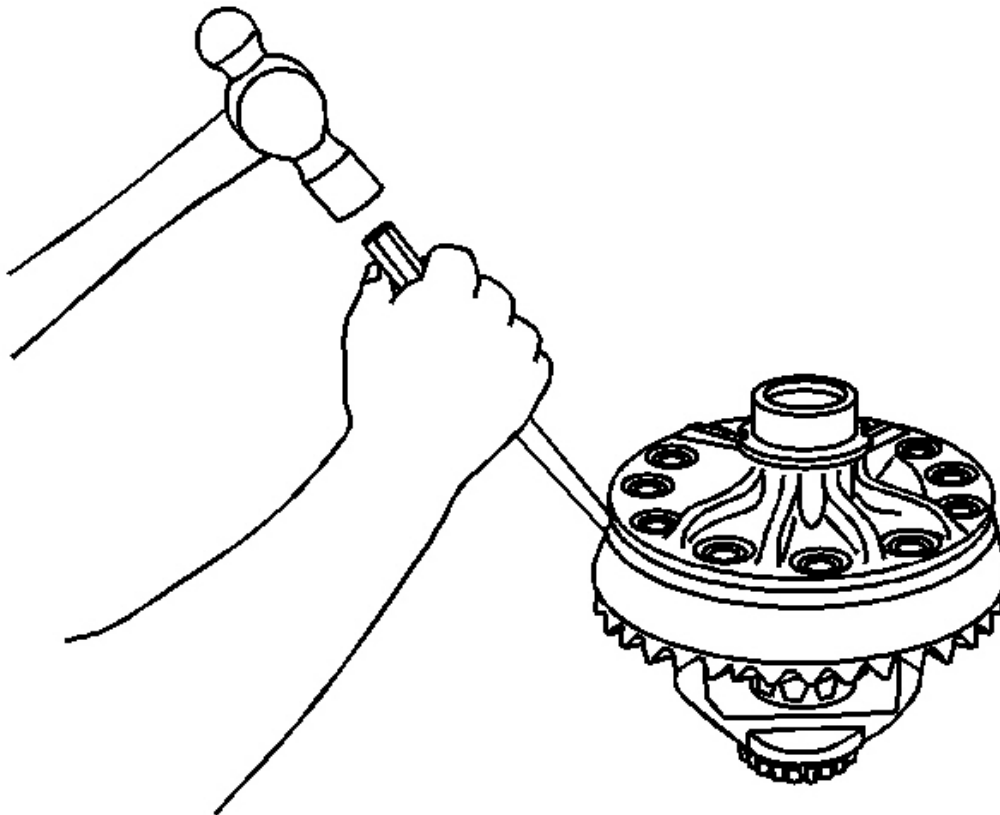
1. Remove the differential side bearings. Refer to Differential Side Bearings Replacement.



**Fig. 68: Identifying Ring Gear Bolts**  
Courtesy of GENERAL MOTORS CORP.

**IMPORTANT:** The ring gear bolts have left-hand threads.

2. Remove the gear bolts. Discard the bolts.

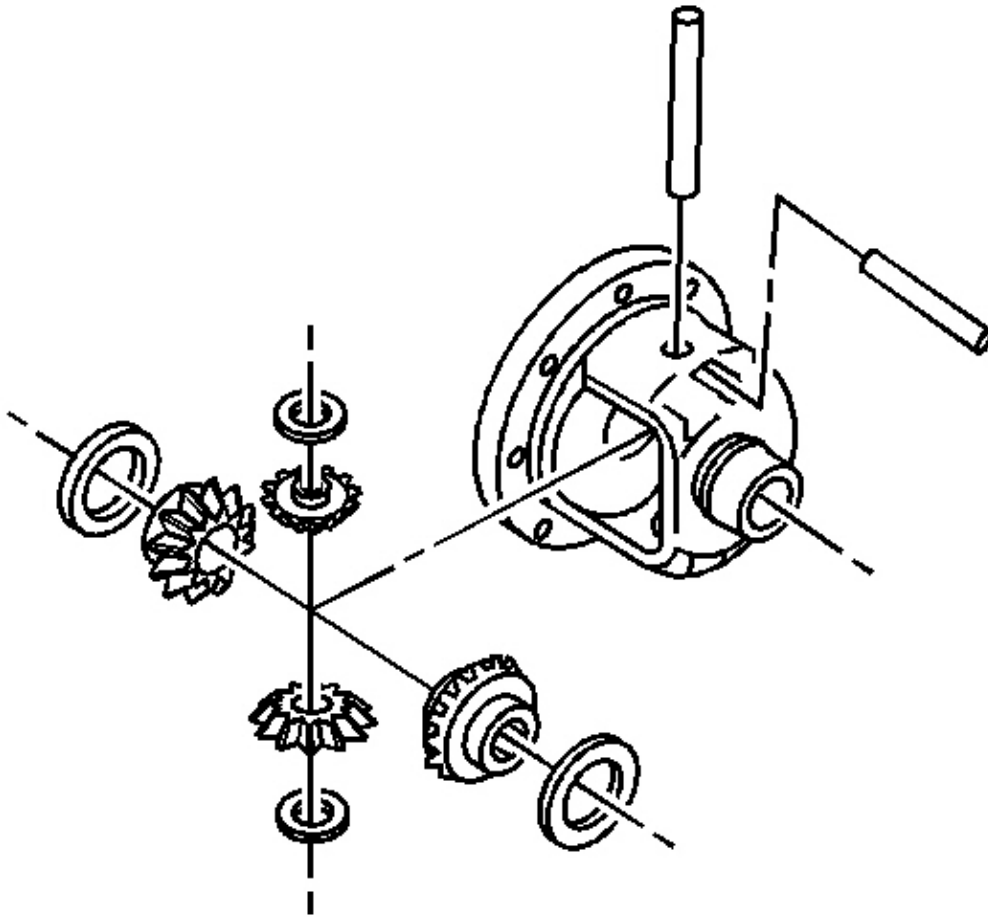


**Fig. 69: Removing Ring Gear From Differential**  
Courtesy of GENERAL MOTORS CORP.

**NOTE:** 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.

3. Remove the ring gear from the differential case.

Drive the ring gear off with a brass drift if necessary.



**Fig. 70: Exploded View Of Differential Case**  
**Courtesy of GENERAL MOTORS CORP.**

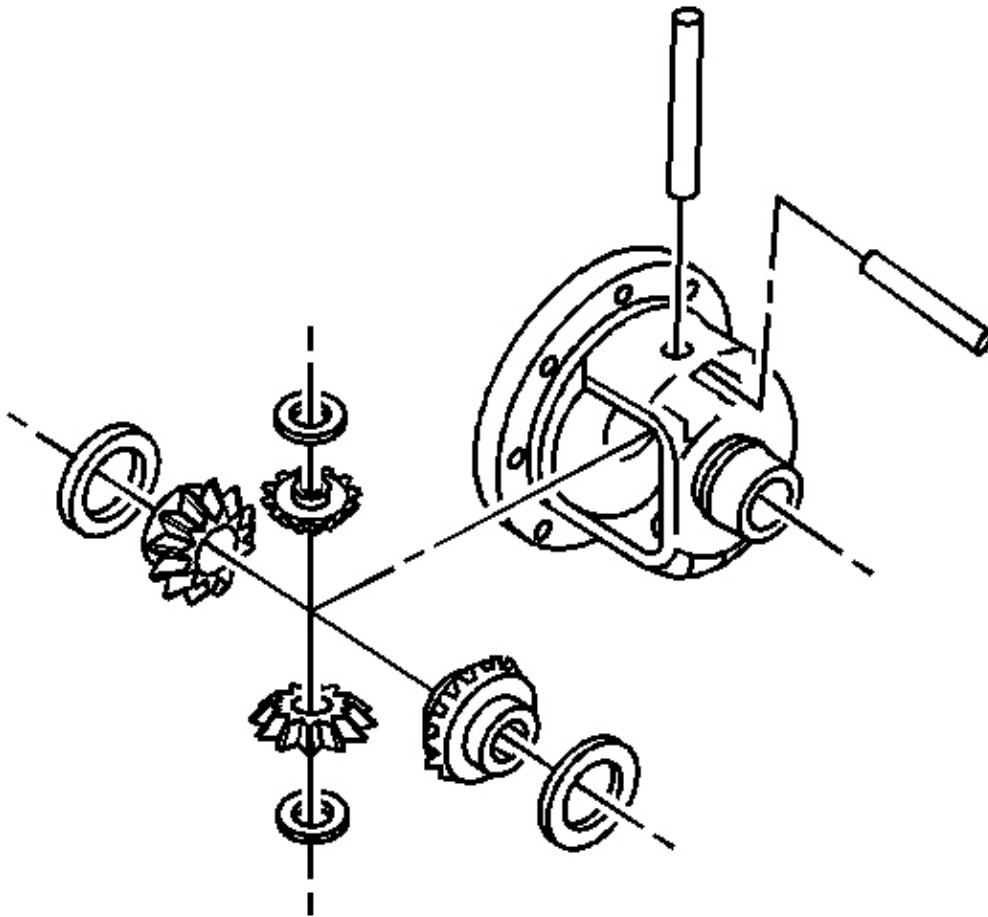
4. Remove the differential pinion gears and the differential side gears by performing the following steps:
  1. Remove the pinion shaft lock bolt.
  2. Remove the pinion shaft.
  3. Roll the differential pinion gears out of the case with the pinion gear thrust washers.
  4. Remove the differential side gears and the side gear thrust washers.

Mark the pinion gears top and bottom and the differential side gears left and right.

**Assembly Procedure**

1. Lubricate the pinion and side gears using axle lubricant. Use the proper fluid. Refer to **Fluid and Lubricant Recommendations** in Maintenance and Lubrication.
2. Install the differential side gear thrust washers to the differential side gears.
3. Install the differential side gears and thrust washers into the differential case.

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



**Fig. 71: Exploded View Of Differential Case**  
Courtesy of GENERAL MOTORS CORP.

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4. Install the differential pinion gears and pinion gear thrust washers by performing the following steps:
  1. Position one pinion gear between the differential side gears.
  2. Position the second pinion gear between the differential side gears directly opposite the of the first gear.
  3. Rotate the differential side gears until the pinion gears is directly opposite the opening in the differential case.
  4. Install the thrust washers.

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

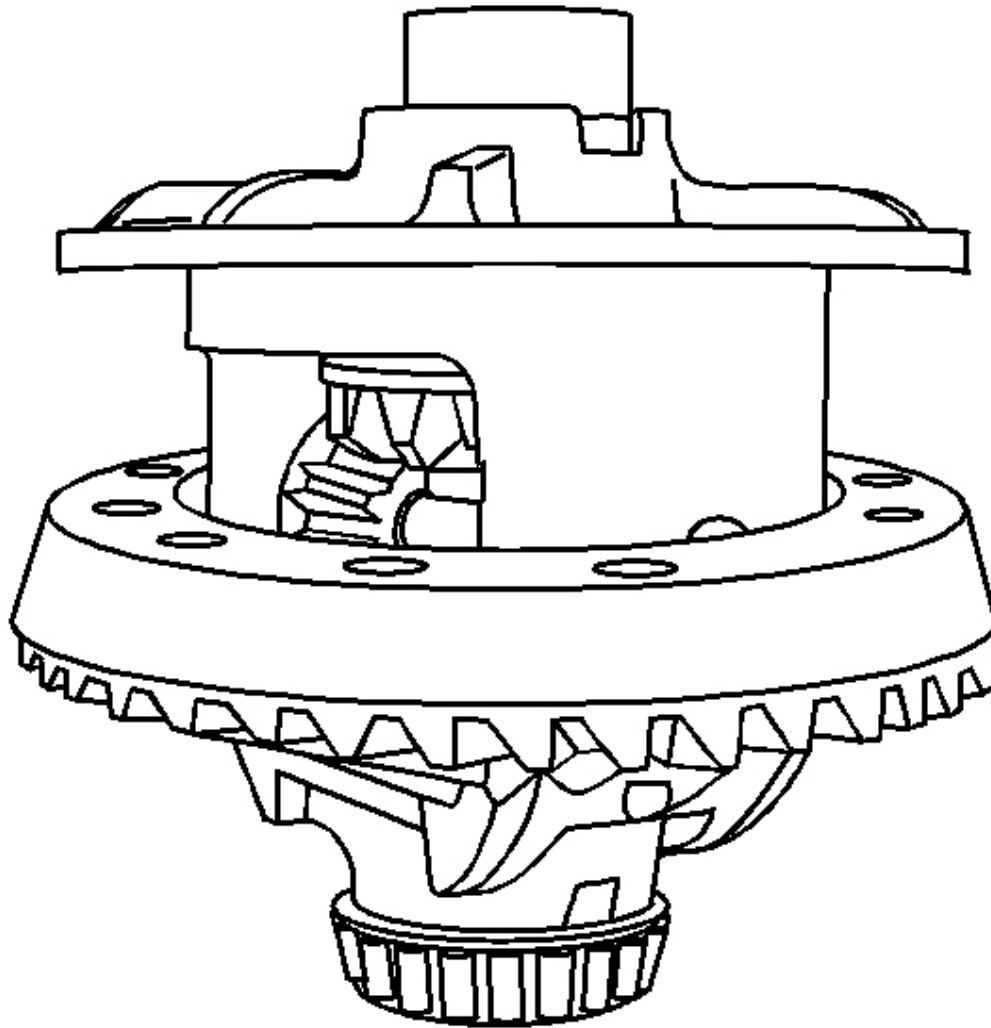
5. Install the pinion shaft.

**NOTE:** Refer to Fastener Notice in Cautions and Notices.

6. Install a new pinion shaft lock bolt.

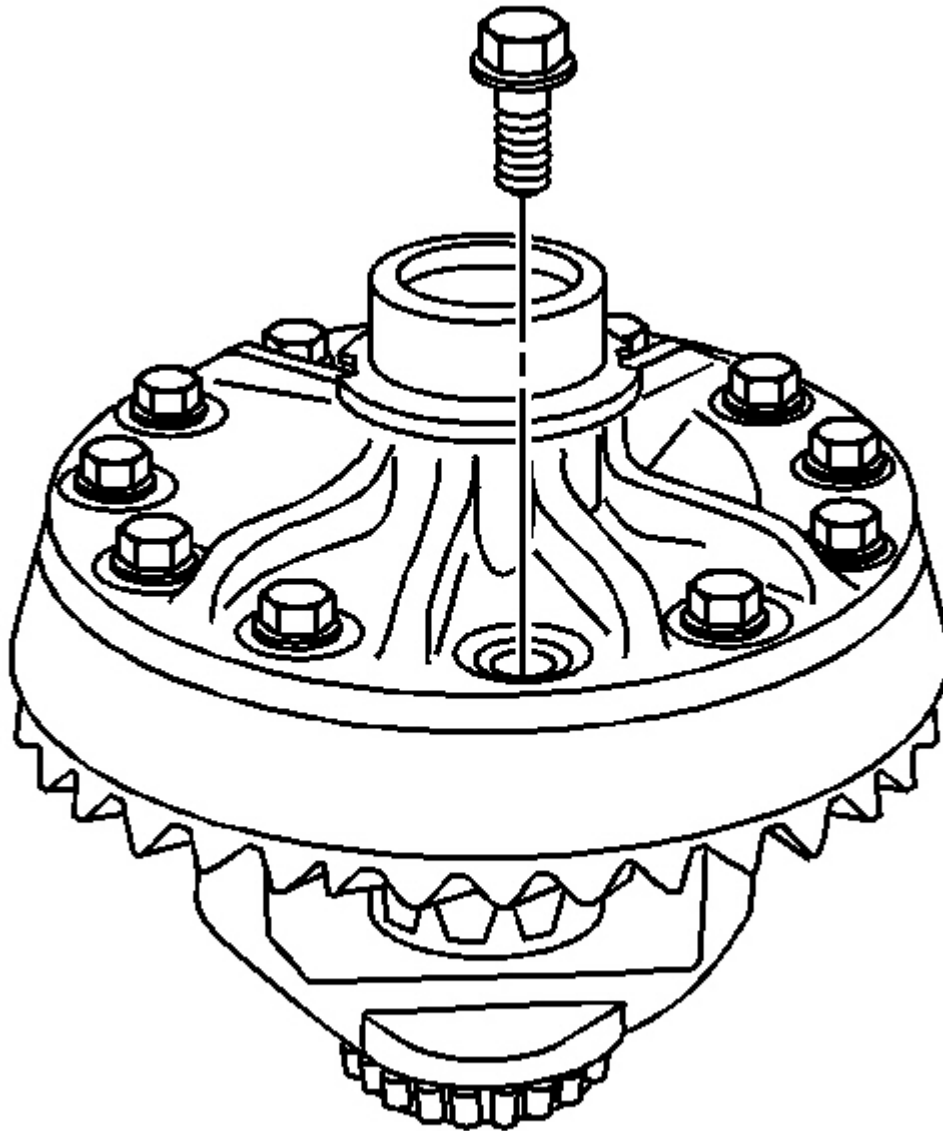
**Tighten:** Tighten the new pinion shaft lock bolt to 36 N.m (27 lb ft).

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



**Fig. 72: Ring Gear & Differential Case**  
**Courtesy of GENERAL MOTORS CORP.**

7. Install the ring gear to the differential case.



**Fig. 73: Identifying Ring Gear Bolts**  
Courtesy of GENERAL MOTORS CORP.

**IMPORTANT:** The ring gear bolts have left-hand threads.

8. Install the new ring gear bolts.

Hand start each bolt to ensure that the ring gear is properly installed to the differential case.

9. Tighten the ring gear bolts. Tighten the bolts alternately and in stages, gradually pulling the ring gear onto the differential case.

**Tighten:** Tighten the ring gear bolts in sequence to 120 N.m (89 lb ft).

10. Install the differential side bearings. Refer to **Differential Side Bearings Replacement**.

### BEARINGS 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.

**IMPORTANT: The differential bearings and the bearing cups are matched sets. Replace both the bearing and the cup when either part requires replacement.**

- Lubricate the bearings with axle lubricant. Inspect the bearings for smooth rotation.
- Inspect the bearing rollers for wear.
- Inspect the bearing cups for wear, cracks, brinelling, and scoring.

### DIFFERENTIAL INSPECTION

- Check the pinion gear shaft for unusual wear.
- Check the pinion and the side gear teeth for wear, cracks, scoring and spalling.
- Check the thrust washers for wear.
- Check the fit of the side gears in the differential case and on the axle shafts.
- Check the differential case for cracks and scoring and replace all of the worn parts as necessary.

### 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.

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- 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.
- 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.

### PINION DEPTH ADJUSTMENT

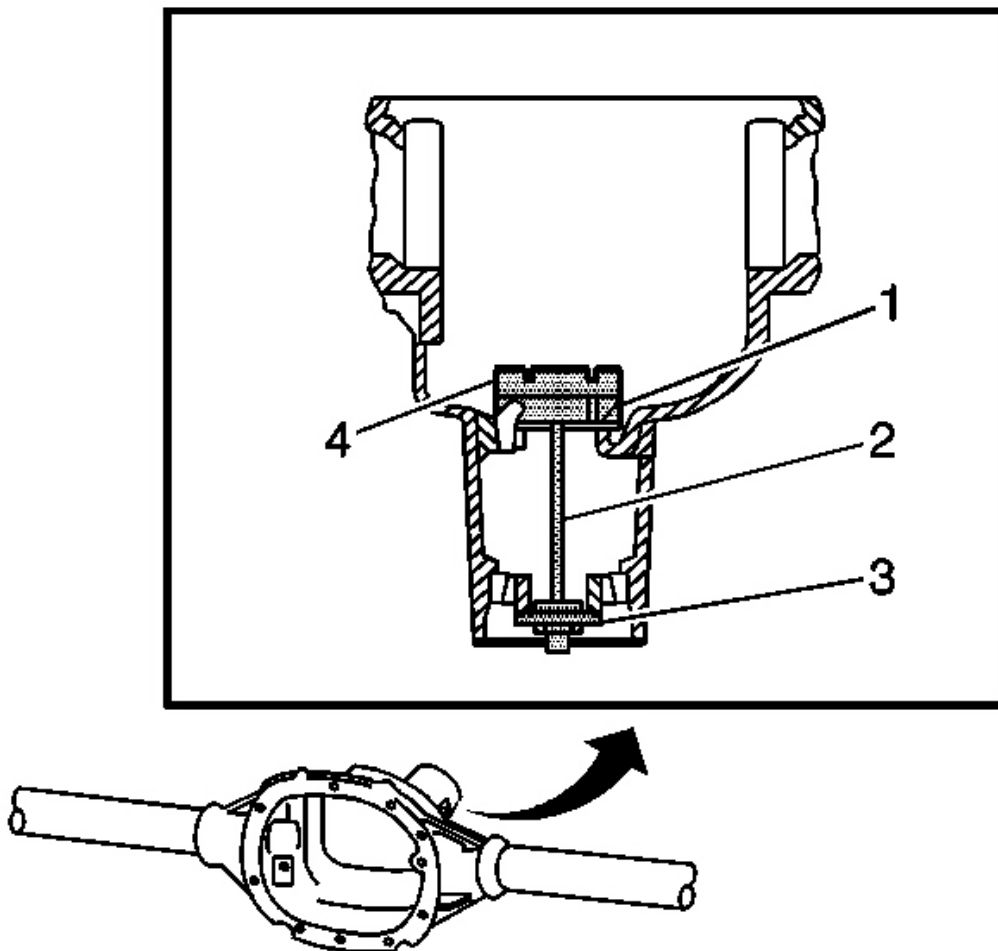
#### Tools Required

- **J 34925** Pinion Setting Gage and Components. See **Special Tools**.
- **J 45230** Pinion Setting Gage Block. See **Special Tools**.
- **J 8001** Dial Indicator Set

**IMPORTANT:** 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** in Maintenance and Lubrication.
2. Install the pinion bearings into the axle housing.



**Fig. 74: Assembling Special Tools In Axle Housing**  
Courtesy of GENERAL MOTORS CORP.

3. Assemble the J 21777-35 (1), the J 21777-43 (2), the J 21777-42 (3), and the J 45230 , 8. See **Special Tools**.0 inch axle, or the J 21777-29, 8.6 inch axle (4) into the axle housing as

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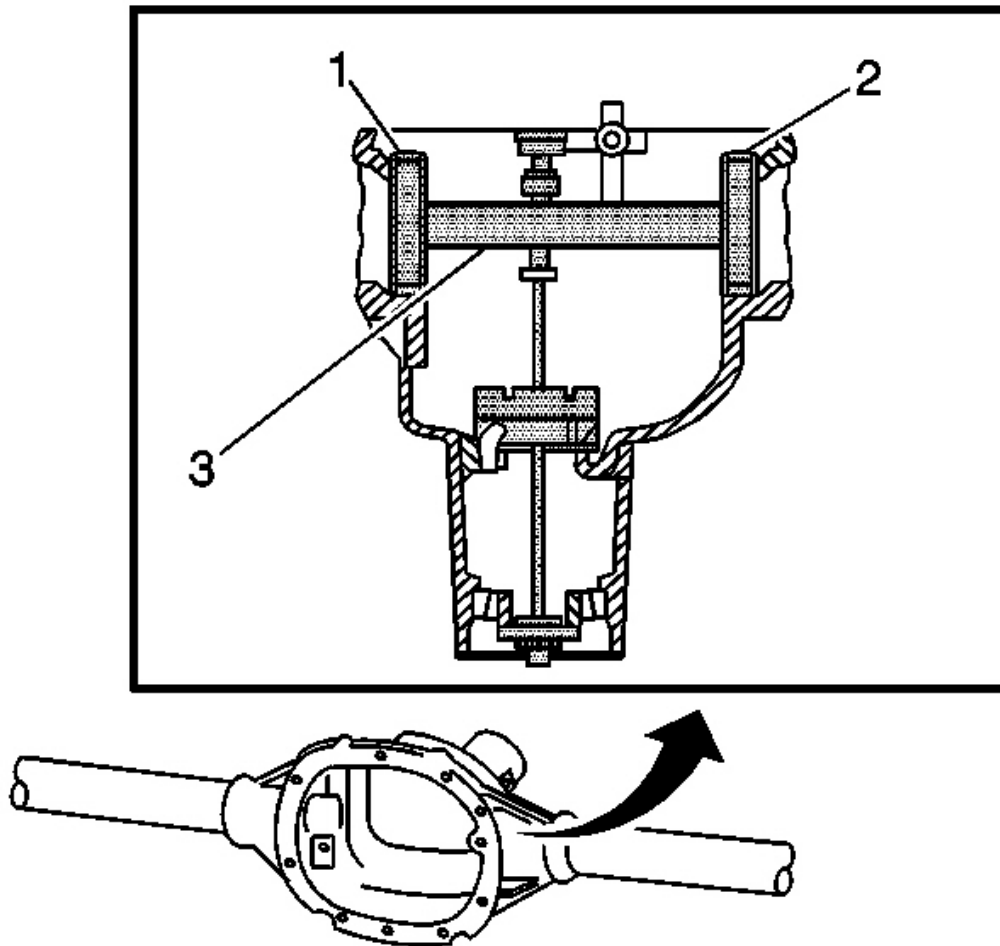
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shown.

4. While holding the **J 21777-43** stationary, install an inch-pound torque wrench on the nut of the **J 21777-43** . See **Special Tools**.

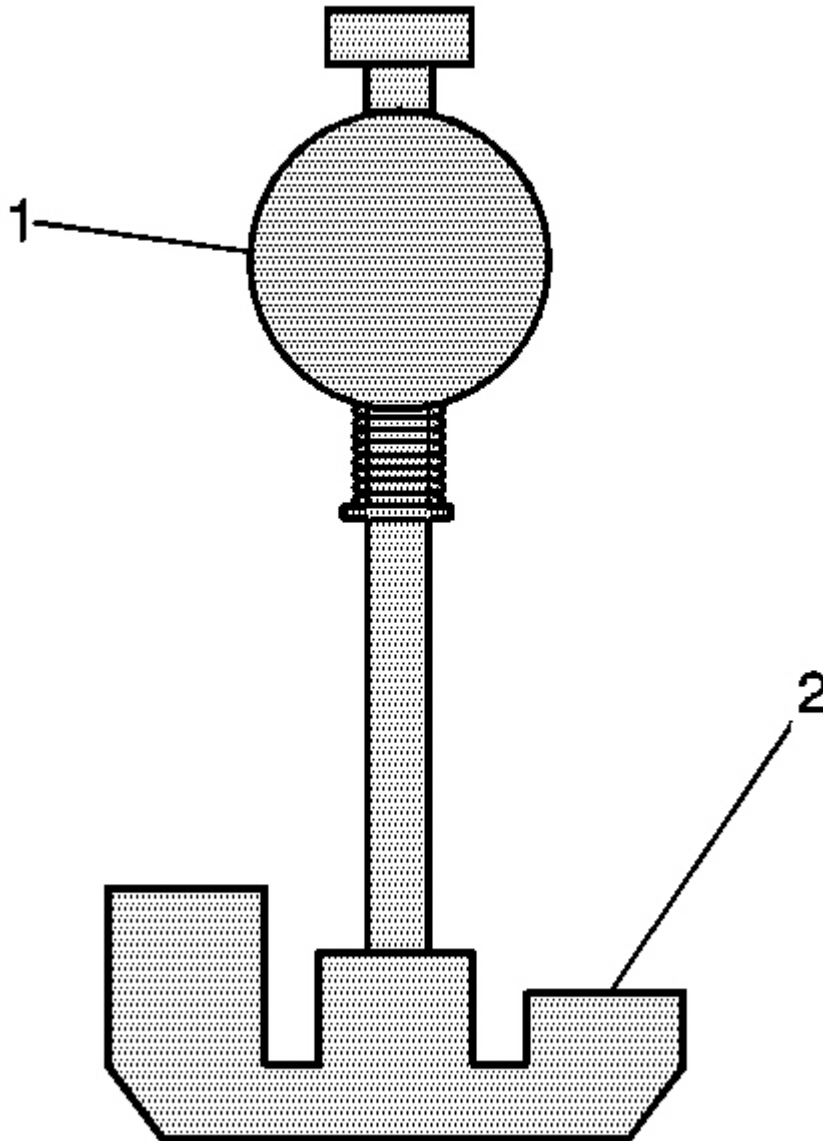
**Tighten:** Tighten the nut on the **J 21777-43** until a rotating torque of 1. See **Special Tools**. 7-2.8 N.m (15-25 lb in) is obtained.

5. Rotate the assembly several times in both directions in order to seat the pinion bearings.
6. Check the rotating torque of the assembly. If the torque is less than 1.7 N.m (15 lb in), continue to tighten the nut on the **J 21777-43** until a rotating torque of 1. See **Special Tools**. 7-2.8 N.m (15-25 lb in) is obtained.



**Fig. 75: Assembling Special Tools In Differential Carrier Bore**  
**Courtesy of GENERAL MOTORS CORP.**

7. Assemble the **J 21777-45** (1,2) to the **J 21777-1** (3) as shown. See **Special Tools**.
8. Rotate the **J 21777-1** within the **J 21777-45** . See **Special Tools**. The **J 21777-1** must rotate back and forth freely within the discs. If the **J 21777-1** does not rotate freely, disassemble the components, inspect for proper seating and/or mis-aligned components and re-assemble.

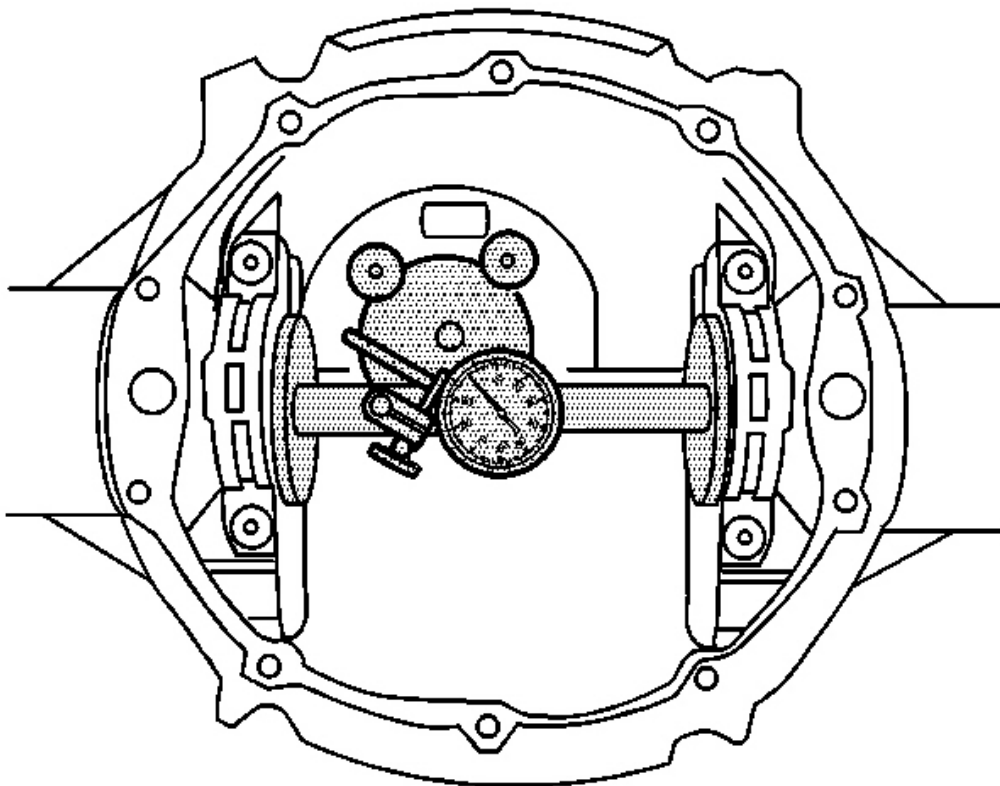


**Fig. 76: J 21777-1 & J 44416-3**  
**Courtesy of GENERAL MOTORS CORP.**

9. Align the plunger of the J 21777-1 (1) to the **J 45230** , 8. See **Special Tools**.0 inch axle, or the J 21777-29, 8.6 inch axle (2).
10. Install the **J 8001** to the J 21777-1 as follows:

1. Loosely clamp the **J 8001** onto the stem on the J 21777-1.
  2. Place the contact pad of the **J 8001** onto the mounting post of the J 21777-1.
  3. With the contact pad of the **J 8001** touching the mounting post of the J 21777-1, loosen the lock nut on the **J 8001** and push down on the **J 8001** until the needle the **J 8001** has turned 3/4 of a turn clockwise.
  4. Tighten the clamp on the **J 8001** finger tight.
11. Move the plunger of the J 21777-1 back and forth until the needle of the **J 8001** indicates the greatest deflection.

The deflection is the point where the needle changes direction.



**Fig. 77: Moving The Housing J 8001**  
**Courtesy of GENERAL MOTORS CORP.**

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12. At the greatest point of deflection, move the housing of the **J 8001** until the needle indicates ZERO.
13. Move the plunger of the J 21777-1 back and forth again to verify the zero setting. Adjust the housing of the **J 8001** as necessary to set the needle to zero.
14. Rotate the plunger of the J 21777-1 away from the **J 45230** , 8. See Special Tools. 0 inch axle, or the J 21777-29, 8.6 inch axle, until it no longer touches the **J 45230** or the J 21777-29. See Special Tools.
15. The value indicated on the **J 8001** is the thickness of the shim needed in order to set the depth of the pinion.
16. Select the shim that indicates the proper thickness. Measure the shim with a micrometer in order to verify that the thickness is correct.
17. Remove the pinion depth setting tools.
18. Remove the pinion bearings.
19. Install the pinion shim between the pinion gear and the inner pinion bearing. Refer to Drive Pinion Bearings Replacement.

### DIFFERENTIAL SIDE BEARING PRELOAD ADJUSTMENT

#### Tools Required

- **J 22779** Side Bearing Backlash Gage. See Special Tools.
- **J 25588** Side Bearing Shim Installer. See Special Tools.
- **J 25025** Guide Pins. See Special Tools.
- **J 8001** Dial Indicator Set

#### IMPORTANT:

- 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**.
2. Measure the rotating torque of the drive pinion using an inch-pound torque wrench.

**Specification:** The rotating torque of the drive pinion should be 1.7-3.4 N.m (15-30 lb in) for new bearings or 1.1-2.3 N.m(10-20 lb in) for used bearings.

3. Record the measurement.

**IMPORTANT:** Before installation of the differential 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 side bearings and 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. Slide the differential assembly towards the service spacer in order to hold the spacer in place.
7. Install the **J 22779** between the right side differential side bearing cup and the axle housing. See **Special Tools**.

**IMPORTANT:** Over-tightening may spread the housing and result in incorrect shim selection.

8. Tighten the knob on the **J 22779** until there is moderate drag when the **J 22779** is moved. See **Special Tools**.
9. Remove the **J 22779** . See **Special Tools**.
10. Remove the service spacer.
11. Using a micrometer, measure the thickness of the **J 22779** in 3 locations. See **Special Tools**.
12. Calculate the average of the 3 measurements.

Record the measurement.

13. Using a micrometer, measure the thickness of the service spacer.

Record the measurement.

14. Add the thickness of the service spacer to the average thickness of the **J 22779** . See **Special**

**Tools.**

The resulting value is the total service shim thickness without preload for the axle.

15. Insert one 1.016 mm (0.040 in) service shim between the right side differential side bearing cup and the axle housing.
16. Insert one BENT 1.016 mm (0.040 in) service shim between the right side differential side bearing cup and the service shim.
17. Install the **J 22779** on the left side of the differential assembly. See **Special Tools**.
18. While rotating the ring gear back and forth, tighten the knob on the **J 22779** until there is approximately 0. See **Special Tools**.025-0.051 mm (0.001-0.002 in) of backlash between the ring gear and the drive pinion.
19. Once the amount of backlash is obtained, remove the **J 22779** . See **Special Tools**.
20. Remove the differential case with the differential side bearings and the bearing cups.
21. Remove the service shims.
22. Using a micrometer, measure the thickness of the **J 22779** in 3 locations. See **Special Tools**.
23. Calculate the average of the 3 measurements.

This value is the left side service shim thickness without preload.

24. Subtract the service shim thickness for the left side of the axle, calculated in step 23, from the total service shim thickness, calculated in step 14.

This value is the service shim thickness for the right side of the axle without preload.

25. In order to initially set the preload of the differential side bearings and the backlash to approximately 0.013-0.023 mm (0.005-0.009 in), take the value determined in step 24 and add 0.0203 mm (0.008 in) service shim thickness to this amount.
26. Assemble the left side shim pack using one 4.318 mm (0.170 in) service spacer and the appropriate amount of selective service shims equaling the thickness determined in step 23.

Measure the service spacer and the service shims separately.

Add the measurements together in order to determine the total shim pack thickness.

27. Assemble the right side shim pack using one 4.318 mm (0.170 in) service spacer and the appropriate amount of selective service shims equaling the thickness determined in step 25.

Measure the service spacer and the service shims separately.

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Add the measurements together in order to determine the total shim pack thickness.

28. Install the differential assembly with the differential side bearings and the differential side bearing cups.
29. Install the left side service spacer between the axle housing and the differential assembly.
30. Install the left side selective service shim or shims.

The service shim or shims must be installed between the service spacer and the differential side bearing cup.

31. Install the right side service spacer between the axle housing and the differential assembly.
32. Install the right side selective service shim or shims using the **J 25588** , if necessary. See **Special Tools**.

The service shim or shims must be installed between the service spacer and the differential side bearing cup.

**NOTE:** Refer to **Fastener Notice** in **Cautions and Notices**.

33. Install the differential bearing caps and the bolts.

**Tighten:** Tighten the differential bearing cap bolts to 75 N.m (55 lb ft).

34. Measure the drive pinion and differential side bearing preload using an inch-pound torque wrench.

Rotate the pinion several times to ensure the differential side bearings have seated.

**Specification:** The rotating torque of the drive pinion and differential side bearings should be 3.9-6.2 N.m (30-55 lb in) for new bearings or 2.8-5.1 N.m (25-45 lb in) for used bearings.

Record the measurement.

35. 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.

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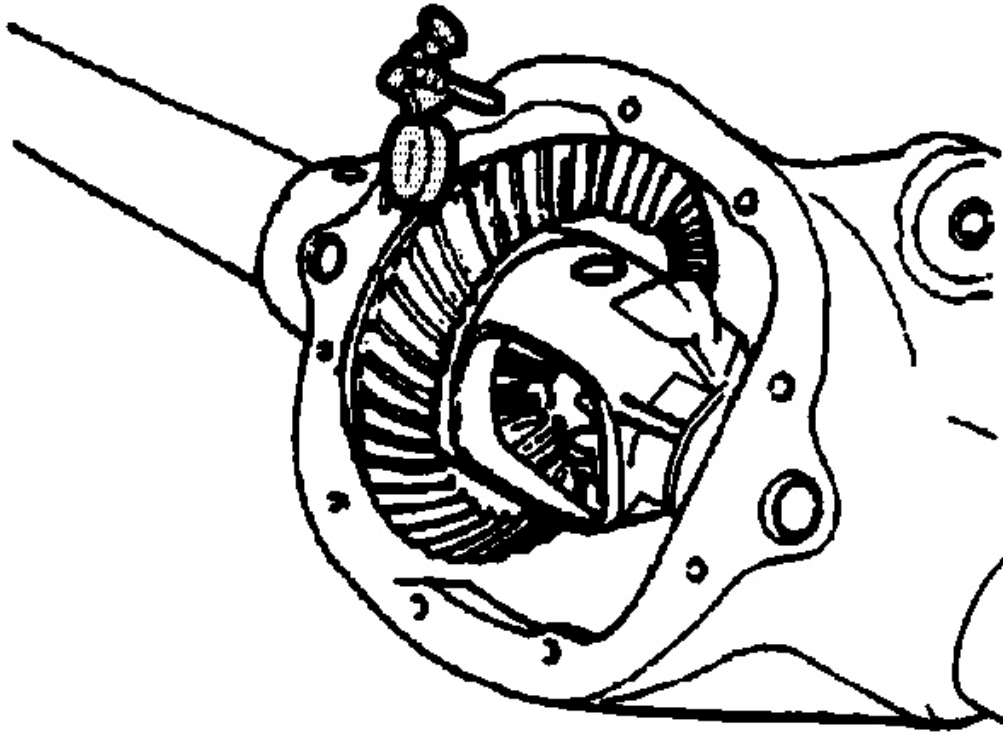
**Specification:** The differential case side bearing preload should be 1.7-4.0 N.m (15-35 lb in).

36. 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.
37. Once the differential side bearing preload is correct, measure the backlash and adjust, if necessary. Refer to **Backlash Adjustment (7.6, 8.6 Inch Axle)**.
38. 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**.

### BACKLASH ADJUSTMENT (7.6, 8.6 INCH AXLE)

#### Tools Required

- **J 8001** Dial Indicator Set
- **J 25025** Guide Pins. See **Special Tools**.
- **J 25588** Side Bearing Shim Installer. See **Special Tools**.



**Fig. 78: Measuring Ring Gear Backlash**  
**Courtesy of GENERAL MOTORS CORP.**

1. Install the **J 25025-1** and the **J 8001** to the axle housing as shown.
2. Place the indicator stem of the **J 8001-3** at the heel end of a gear tooth. See **Special Tools**.
3. Set the **J 8001-3** so that the stem is aligned with the gear rotation and perpendicular to the tooth angle. See **Special Tools**.
4. Preload the dial of the **J 8001-3** . See **Special Tools**.

Align the needle and the dial face of the **J 8001-3** to ZERO. See **Special Tools**.

5. While holding the drive pinion stationary, move the ring gear back and forth.

Measure and record the backlash.

6. Repeat the measuring procedure at eight points around the ring gear.

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**Specification:** The difference between the backlash at all of the measuring points should not vary by more than 0.05 mm (0.002 in).

7. If the difference between the backlash at all of the measuring points varies by more than 0.05 mm (0.002 in), inspect for the following conditions:
  - Burrs
  - A distorted case flange
  - Uneven bolting
8. If the difference between all the measuring points is within specifications, the backlash at the minimum lash point measured should be:

**Specification:** The backlash between the ring gear and the drive pinion should be between 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).

**IMPORTANT:**

- **Do not use the original cast iron production shims to adjust the backlash. Use service shims and spacers instead.**
- **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 approximately 0.03 mm (0.001 in).**

9. If the backlash is too small, increase the backlash using the following procedure:
  1. Remove the bearing cap bolts and the bearing caps.

Mark the bearing caps left or right.

2. Remove the differential case assembly with the bearing cups and the shims.

Mark the bearing cups and the shims left or right.

3. Measure the thickness of left side shim pack.

Measure the production shim or the shim and service spacer in 3 locations.

Measure each shim separately.

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4. Calculate the average of the 3 measurements for each shim.

Add the average of each of the shim measurements together.

Record the measurement. This is the thickness for the left side shim pack.

5. Assemble a new left side shim pack by decreasing the appropriate amount of thickness from the original left side shim pack. If the original shim is cast iron production shim, assemble the shim pack using a service spacer and service shims. For example, to increase the backlash by 0.05 mm (0.002 in), remove 0.10 mm (0.004 in) of thickness from the left side shim pack.

6. Measure the thickness of right side shim pack.

Measure the shim or the shim and service spacer in 3 locations.

Measure each shim separately.

7. Calculate the average of the 3 measurements for each shim.

Add the average of each of the shim measurements together.

Record the measurement. This is the thickness for the right side shim pack.

8. Assemble a new right side shim pack by increasing the appropriate amount of thickness to 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 shims. For example, to increase the backlash by 0.05 mm (0.002 in), add 0.10 mm (0.004 in) of thickness to the right side shim pack.

10. If the backlash is too large, decrease the backlash using the following procedure:

1. Remove the bearing cap bolts and the bearing caps.

Mark the bearing caps left or right.

2. Remove the differential case assembly with the bearing cups and the shims.

Mark the bearing cups and the shims left or right.

3. Measure the thickness of left side shim pack.

Measure the production shim or the shim and service spacer in 3 locations.

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Measure each shim separately.

4. Calculate the average of the 3 measurements for each shim.

Add the average of each of the shim measurements together.

Record the measurement. This is the thickness for the left side shim pack.

5. Assemble a new left side shim pack by increasing the appropriate amount of thickness to the original left side shim pack. If the original shim is cast iron production shim, assemble the shim pack using a service spacer and service shims. For example, to increase the backlash by 0.05 mm (0.002 in), add 0.10 mm (0.004 in) of thickness to the left side shim pack.
6. Measure the thickness of right side shim pack.

Measure the shim or the shim and service spacer in 3 locations.

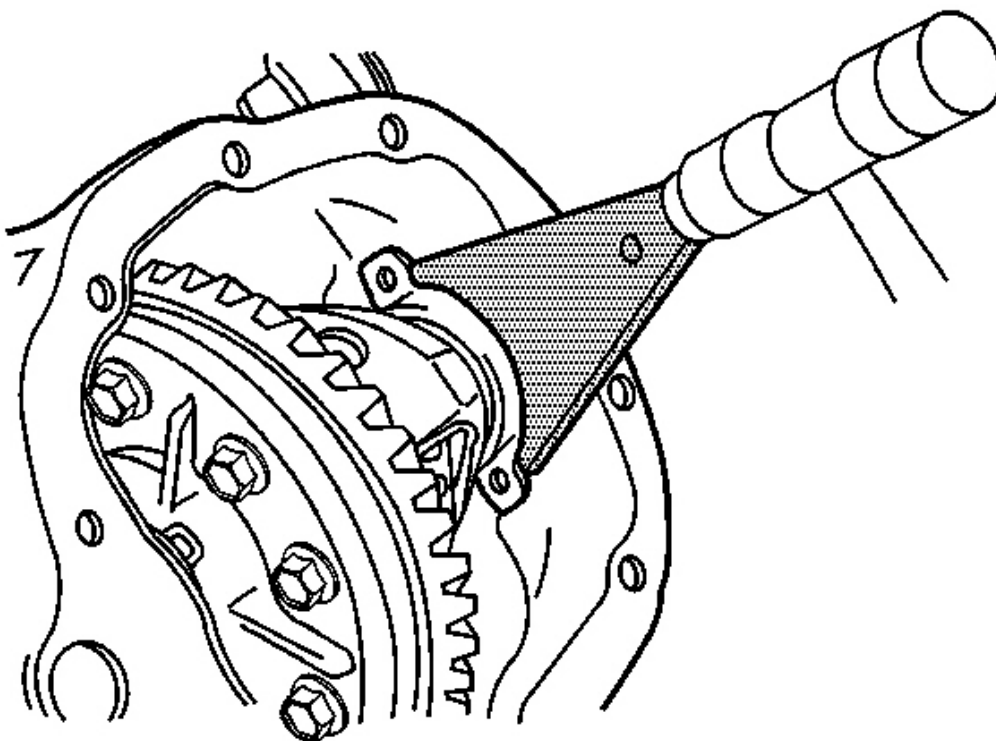
Measure each shim separately.

7. Calculate the average of the 3 measurements for each shim.

Add the average of each of the shim measurements together.

Record the measurement. This is the thickness for the right side shim pack.

8. Assemble a new right side shim pack by decreasing the appropriate amount of thickness to 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 shims. For example, to decrease the backlash by 0.05 mm (0.002 in), remove 0.10 mm (0.004 in) of thickness to the right side shim pack.
11. Install the differential case assembly with the bearing cups.
12. Install the left side service spacer between the axle housing and the differential case.
13. Install the right side service spacer between the axle housing and the differential case.



**Fig. 79: Installing The Left Side Service Shim Using J 25588**  
**Courtesy of GENERAL MOTORS CORP.**

14. Install the left side service shim using the **J 25588** , if necessary. See **Special Tools**.

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

15. Install the right side service shim using the **J 25588** , if necessary. See **Special Tools**.

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

**NOTE:**      Refer to **Fastener Notice** in **Cautions and Notices**.

16. Install the bearing caps and bolts.

**Tighten:** Tighten the bolts to 75 N.m (55 lb ft).

17. Recheck the backlash and adjust, if necessary.
18. 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**.

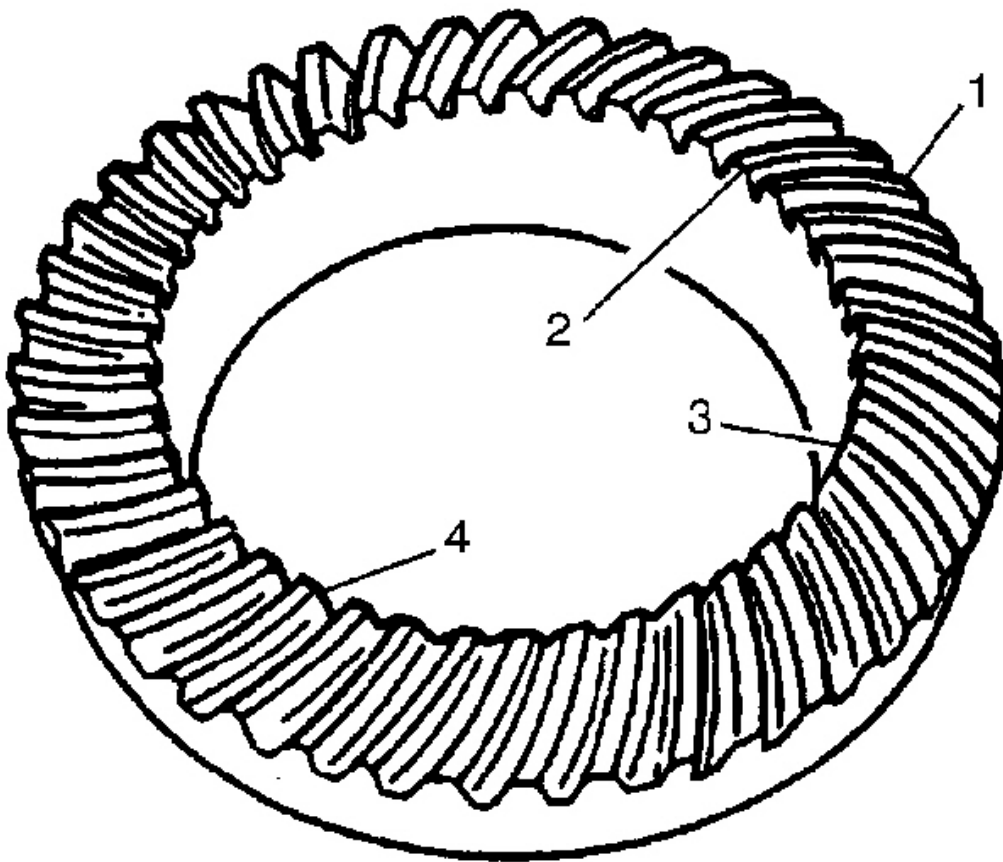
## **GEAR TOOTH CONTACT PATTERN INSPECTION**

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**



**Fig. 80: 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

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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.

### 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.

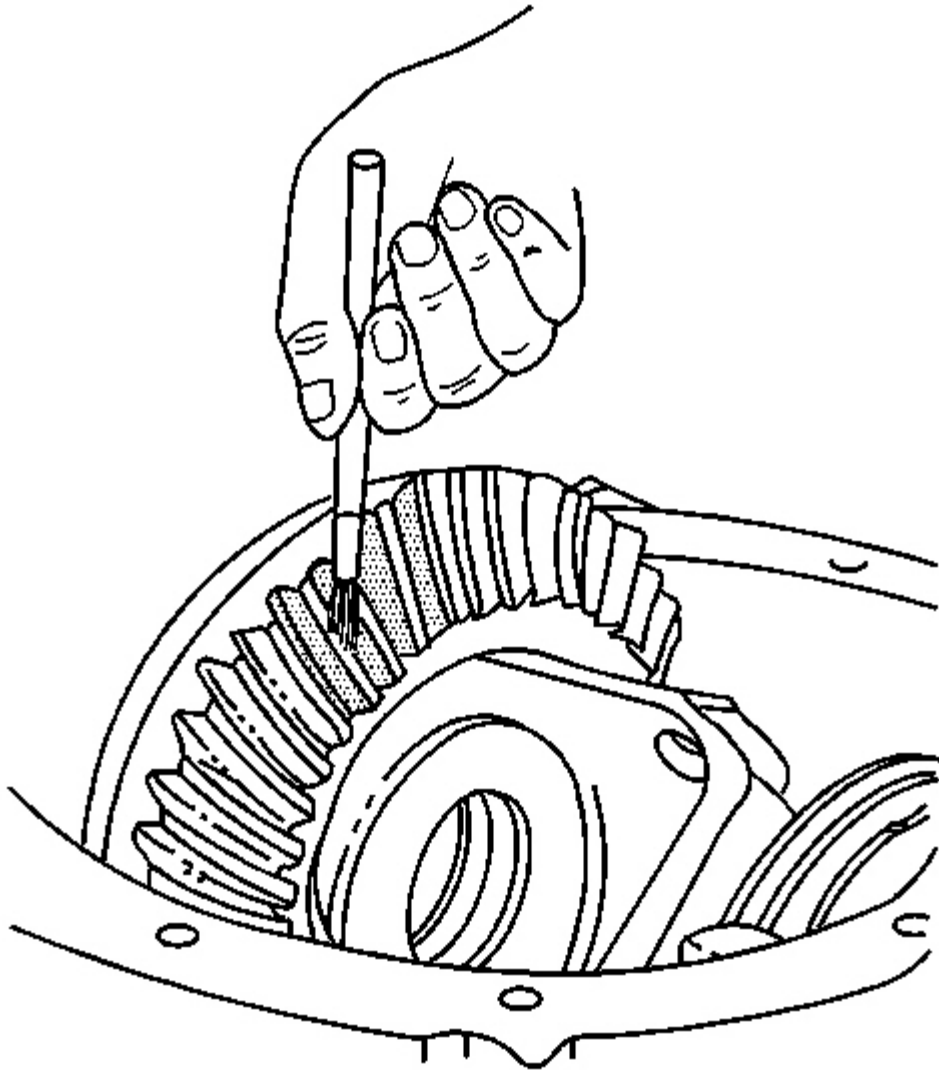
- If the thickness of the right shim is increased or the adjuster sleeve is moved in (if applicable), along with an equal decrease in the thickness of the left shim or the adjuster sleeve is moved out (if applicable), the backlash will increase.
- If the thickness of the left shim is increased or the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



**Fig. 81: 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.**

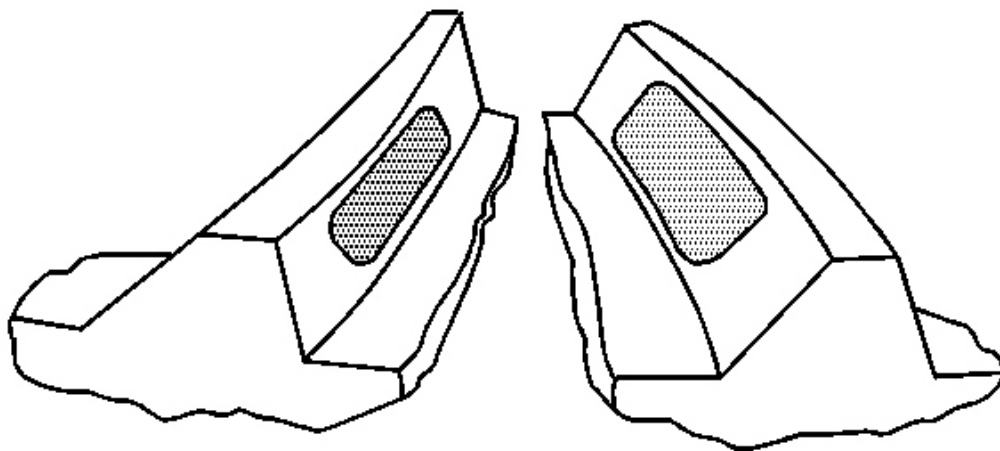
4. Apply the park brake until a torque load of 14 N.m (10 lb ft) is required in order to turn the pinion.

**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. 82: Identifying Correct Gear Tooth Contact Pattern**  
**Courtesy of GENERAL MOTORS CORP.**

The backlash and pinion depth is correct.

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### Correction

None required.

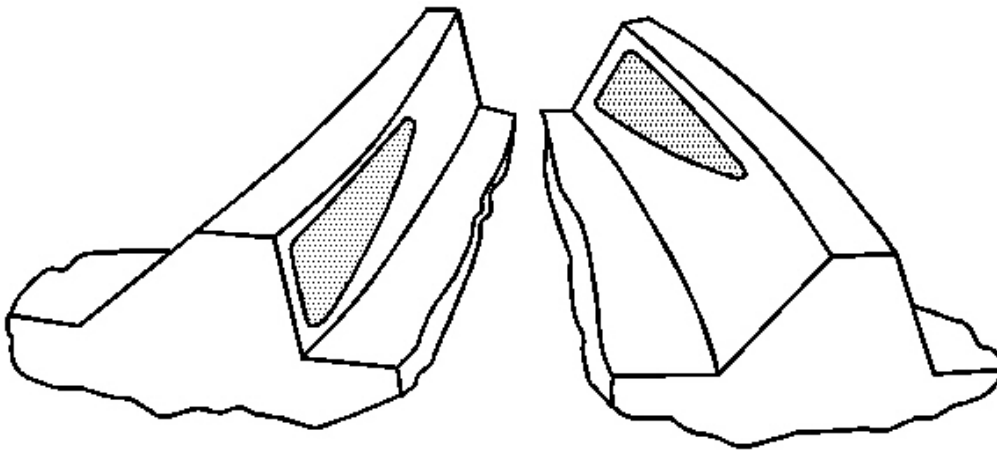
### Service Hints

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:

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

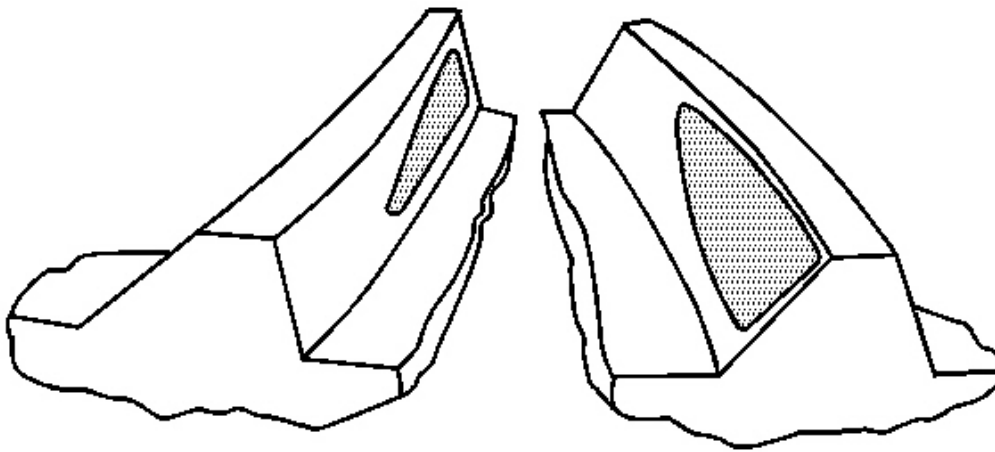
### Condition

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 (7.6, 8.6 Inch Axle)**.

**Drive Side Toe - Coast Side Heel Contact Pattern**



**Fig. 84: Identifying Drive Side Toe - Coast Side Heel Contact Pattern**  
Courtesy of GENERAL MOTORS CORP.

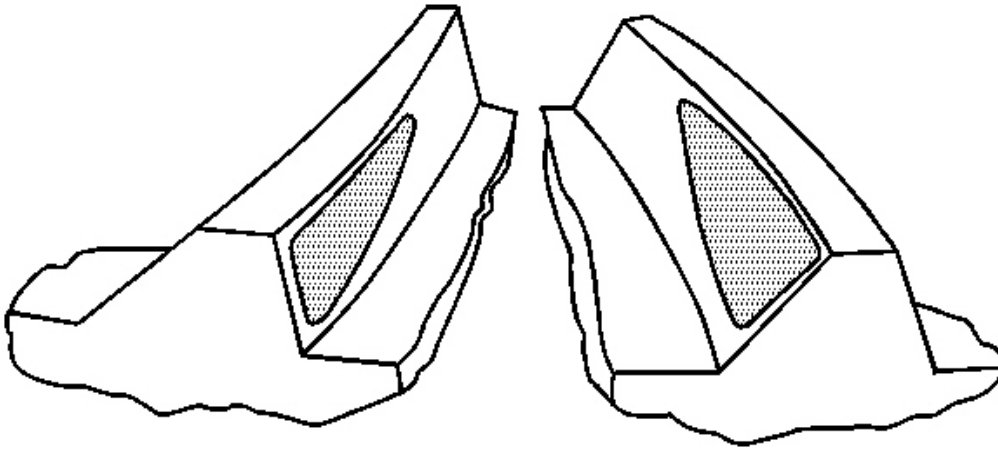
**Condition**

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 (7.6, 8.6 Inch Axle)**.

**Drive Side Heel - Coast Side Heel Contact Pattern**



**Fig. 85: Identifying Drive Side Heel - Coast Side Heel Contact Pattern**  
Courtesy of GENERAL MOTORS CORP.

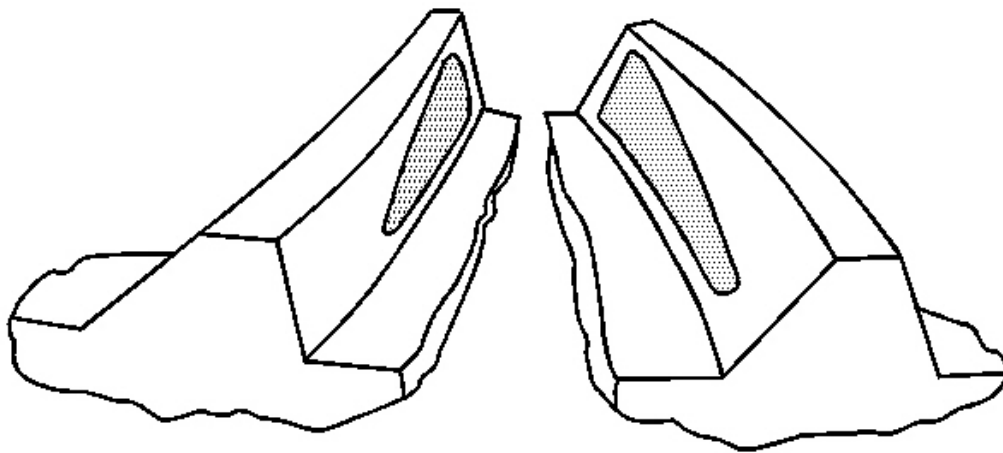
**Condition**

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 (7.6, 8.6 Inch Axle)**.

**Drive Side Toe - Coast Side Toe Contact Pattern**



**Fig. 86: Identifying Drive Side Toe - Coast Side Toe Contact Pattern**  
Courtesy of GENERAL MOTORS CORP.

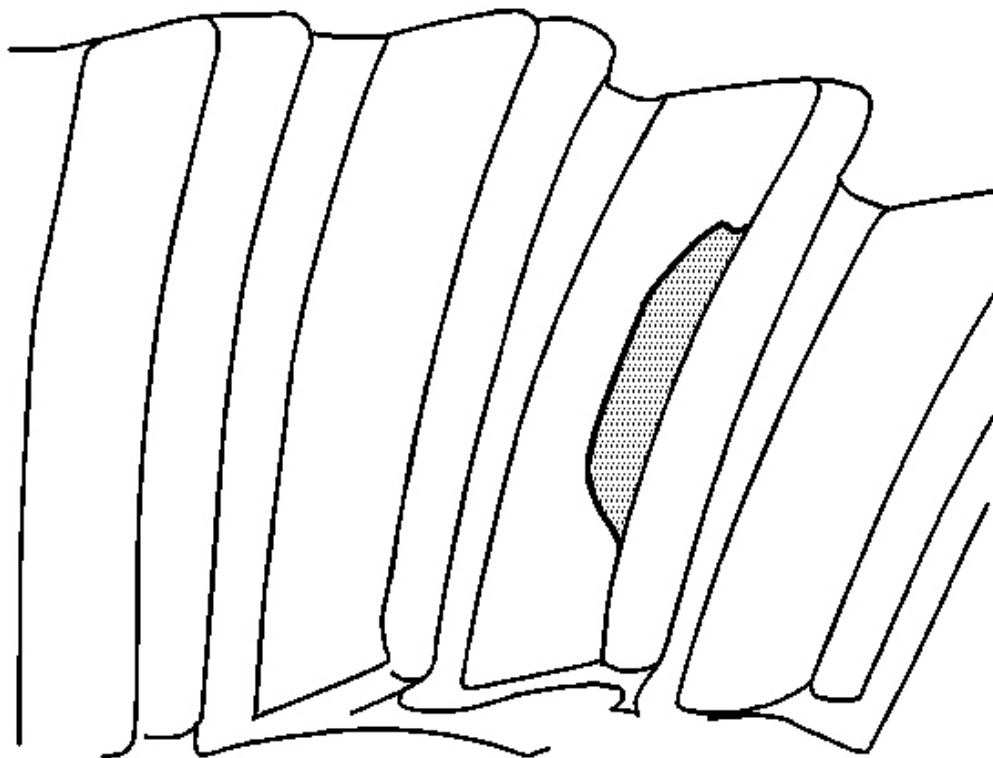
**Condition**

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 (7.6, 8.6 Inch Axle)**.

**High Flank Contact Pattern**



**Fig. 87: Identifying High Flank Contact Pattern**  
Courtesy of GENERAL MOTORS CORP.

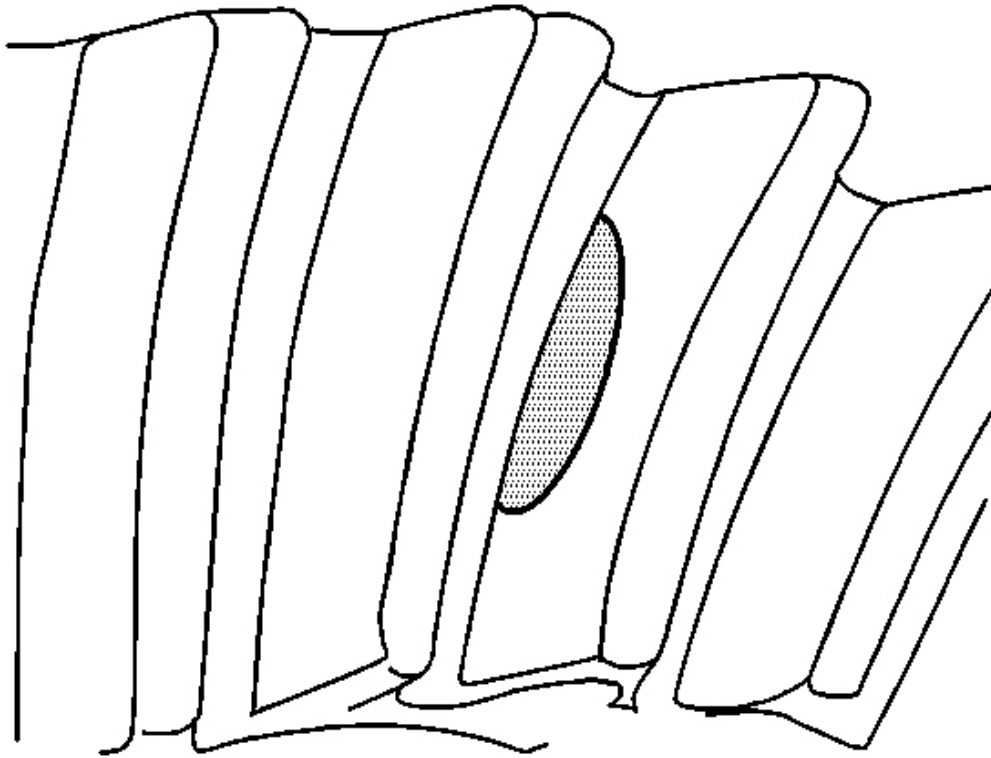
**Condition**

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**



**Fig. 88: 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**.

## DESCRIPTION AND OPERATION

### REAR DRIVE AXLE DESCRIPTION AND OPERATION

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

## 2006 Buick Rainier

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer

- Aluminum Differential Carrier Housing
- Differential Case Assembly (Open or Locking)
- Ring Gear and Drive Pinion Shaft
- Left and right axle shaft tubes
- Left and right axle shafts
- 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. As long as the input force is equal between the two axle shafts, the axle shafts could be solidly attached to the ring gear. The addition of the two pinion gears and the two side gears are needed to allow the axle 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. For information regarding the description and operation of a locking differential, refer to **Locking Differential Description and Operation** in Locking Differential.

## SPECIAL TOOLS AND EQUIPMENT

### SPECIAL TOOLS

#### Special Tools

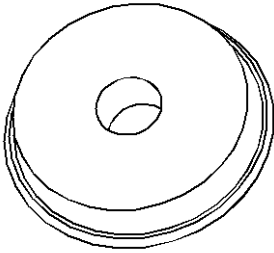
Illustration	Tool Number/Description

## 2006 Buick Rainier

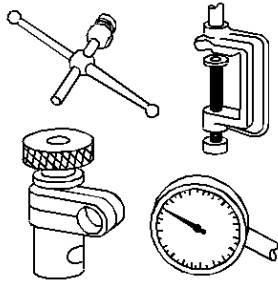
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



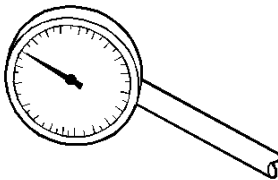
J 2619-O1  
Slide Hammer



J 7817  
Outer Bearing Race Installer



J 8001  
Dial Indicator Set

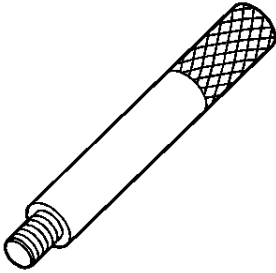


J 8001-3  
Dial Indicator

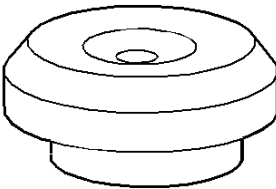
J 8092  
Driver Handle

## 2006 Buick Rainier

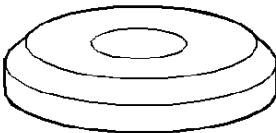
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



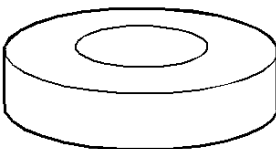
J 8107-2  
Side Bearing Puller Pilot



J 8107-4  
Side Bearing Puller Pilot



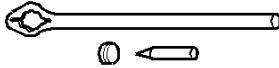
J 8608  
Rear Pinion Bearing Race Installer



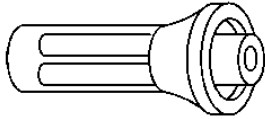
J 8611-01  
Rear Pinion Bearing Race Installer

## 2006 Buick Rainier

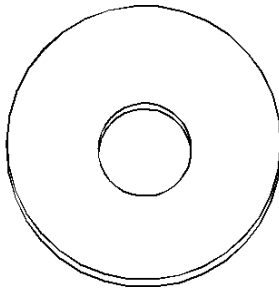
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



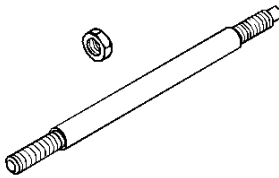
J 8614-O1  
Flange and Pulley Holding Tool



J 21128  
Axle Pinion Oil Seal Installer



J 21777-42  
Pinion Setting Pilot Washer

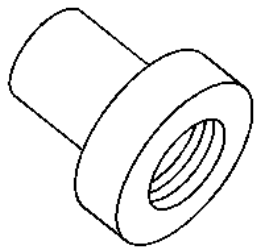
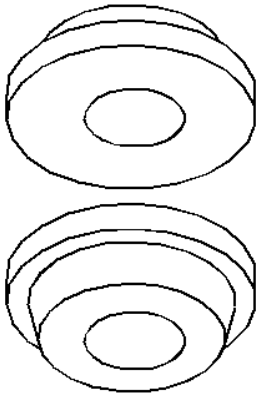


J 21777-43  
Stud Assembly Bolt

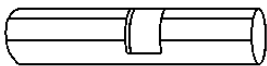
J 21777-45  
Side Bearing Discs

**2006 Buick Rainier**

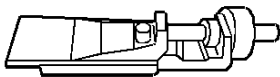
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



J 21784  
Side Bearing Installer



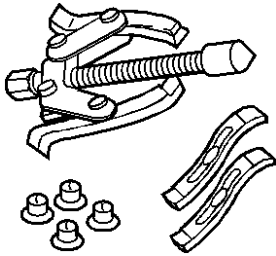
J 22536  
Pinion Driver



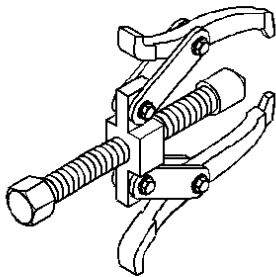
J 22779  
Side Bearing Backlash Gage

## 2006 Buick Rainier

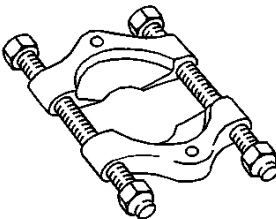
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



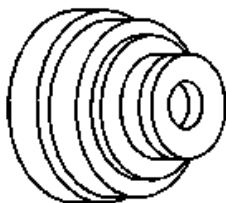
Side Bearing Remover Kit



J 22888-20A  
Universal Two Jaw Puller



J 22912-01  
Rear Pinion and Axle Bearing Remover



J 23690  
Bearing Installer

## 2006 Buick Rainier

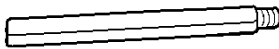
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



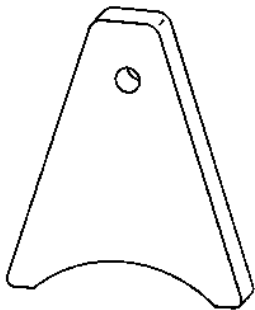
J 24433  
Pinion Cone and Side Bearing Installer



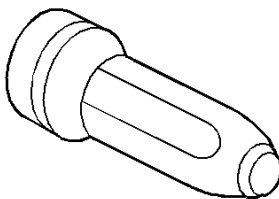
J 25025  
Guide Pins



J 25025-1  
Dial Indicator Mounting Post



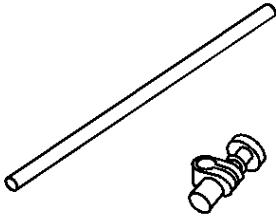
J 25588  
Side Bearing Shim Installer



J 33782  
Pinion Oil Seal Installer

## 2006 Buick Rainier

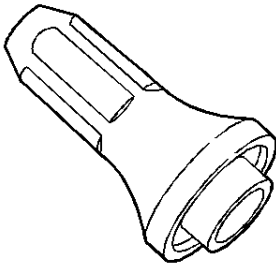
2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



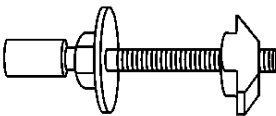
J 34178  
Spreader Gage Adapter



J 34925  
Pinion Setting Gage and Components



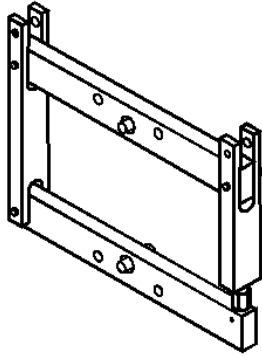
J 38694  
Extension Housing Oil Pump/Seal Installer



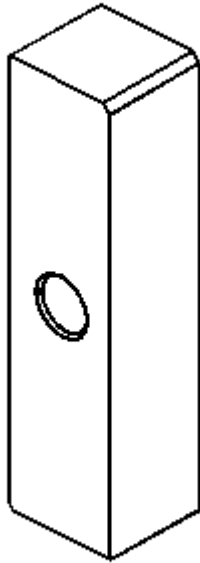
J 44685  
Rear Axle Seal and Bearing Remover

## 2006 Buick Rainier

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



J 45222  
Axle Housing Spreader

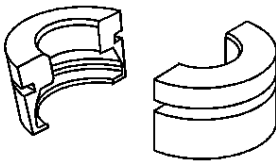
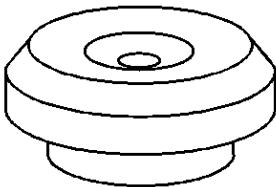


J 45230  
Pinion Setting Gage Block

J 45231  
Differential Side Bearing Installer

**2006 Buick Rainier**

2006 Driveline/Axle Rear Drive Axle - Ascender, Envoy, Rainier & TrailBlazer



J 45871  
Pinion Bearing Remover