2008 Driveline/Axle

Rear Drive Axle - Ascender, Envoy & Trailblazer

SPECIFICATIONS

AXLE PRELOAD & BACKLASH SPECIFICATIONS

Application	Specification	
	Metric	English
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

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"
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"

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

SEALERS, ADHESIVES & LUBRICANTS

Application	Type of Material	GM Part Number	
		US	Canada
Pinion Yoke Splines	Sealant	12346004	10953480
Rear Drive Axle - All Axles	SAE 75W-90 Synthetic Axle Lubricant	89021677	89021678
Rear Drive Axle - 9.5 in LD Axle Only	Limited-Slip Axle Lubricant Additive	1052358	992694

LOCKING DIFFERENTIAL THRUST BLOCK SIZES

Color Code	8.0" Axle	8.6" Axle
Purple	31.75 mm (1.250")	33.58 mm (1.322")
White	31.85 mm (1.254")	33.68 mm (1.326")

Brown	31.95 mm (1.258")	33.78 mm (1.330")
Yellow	32.05 mm (1.262")	33.88 mm (1.334")
Orange	32.16 mm (1.266")	33.99 mm (1.338")
Pink	32.26 mm (1.270")	34.09 mm (1.342")
Green	32.36 mm (1.274")	34.19 mm (1.346")
Blue	32.46 mm (1.278")	34.29 mm (1.350")

COMPONENT LOCATOR

LOCKING DIFFERENTIAL DISASSEMBLED VIEWS

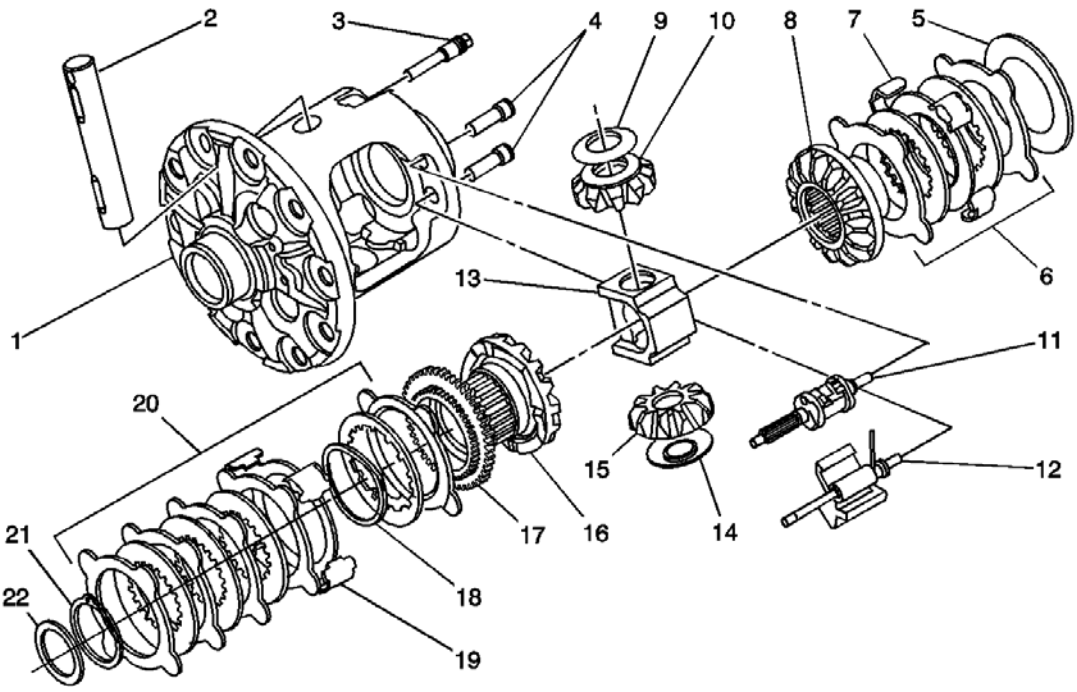


Fig. 1: View Of Locking Differential Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Differential Housing
2	Differential Pinion Gear Shaft
3	Differential Pinion Gear Shaft Lock Bolt
4	Locking Differential Governor and Lockout Assembly Bushings
5	Locking Differential Clutch Disc Thrust Washer
6	Locking Differential Clutch Disc Pack (5 Discs)
7	Locking Differential Clutch Disc Guide (4 Required)

8	Locking Differential Side Gear
9	Differential Pinion Gear Thrust Washer
10	Differential Pinion Gear
11	Locking Differential Governor Assembly
12	Locking Differential Latching Bracket Assembly
13	Locking Differential Thrust Block
14	Pinion Gear Thrust Washer
15	Differential Pinion Gear
16	Locking Differential Side Gear (Cam Faced)
17	Locking Differential Side Gear (Cam Plate)
18	Wave Washer
19	Locking Differential Clutch Disc Guide (4 Required)
20	Locking Differential Clutch Disc Pack (10 Discs)
21	Snap Ring
22	Locking Differential Clutch Disc Thrust Washer

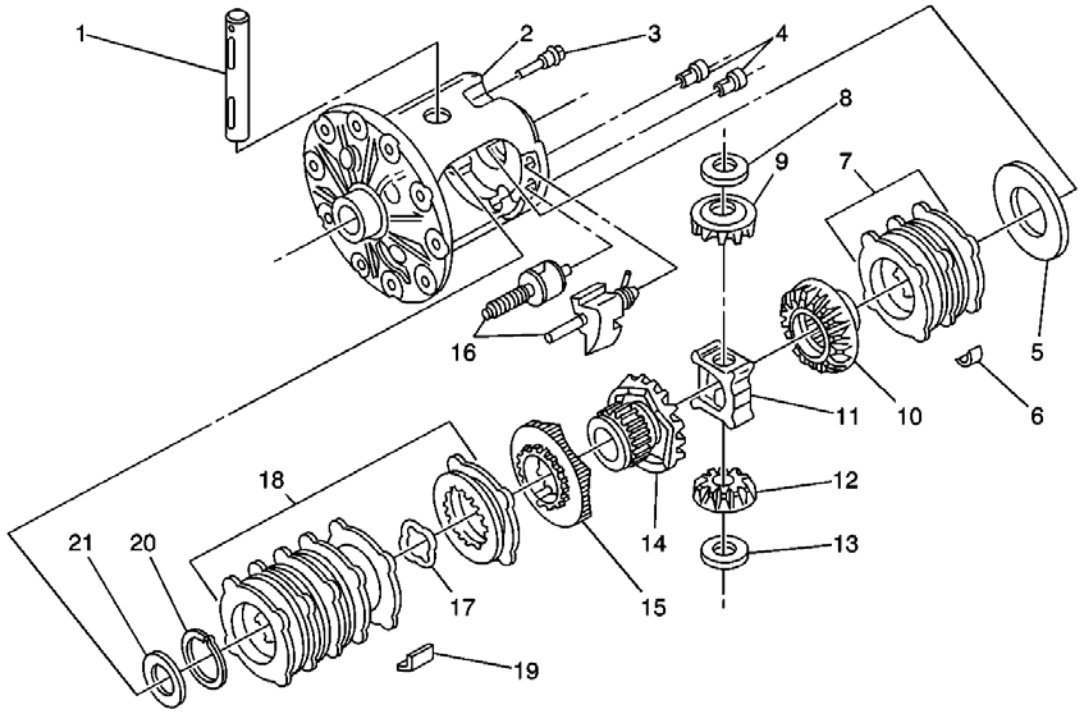


Fig. 2: View Of 8.6 Locking Differential Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Differential Pinion Gear Shaft

2	Differential Case
3	Differential Pinion Gear Shaft Lock Bolt
4	Locking Differential Lockout Bushings
5	Locking Differential Clutch Disc Thrust Washer
6	Locking Differential Clutch Disc Guide
7	Locking Differential Clutch Disc Set
8	Differential Pinion Gear Thrust Washer
9	Differential Pinion Gear
10	Locking Differential Side Gear
11	Locking Differential Thrust Block
12	Differential Pinion Gear
13	Differential Pinion Gear Thrust Washer
14	Locking Differential Side Gear, Cam-Faced
15	Locking Differential Cam
16	Locking Differential Governor
17	Wave Washer
18	Locking Differential Clutch Disc Set
19	Locking Differential Clutch Disc Guide
20	Locking Differential Snap Ring Retainer
21	Locking Differential Clutch Disc Thrust Washer

REAR AXLE DISASSEMBLED VIEWS

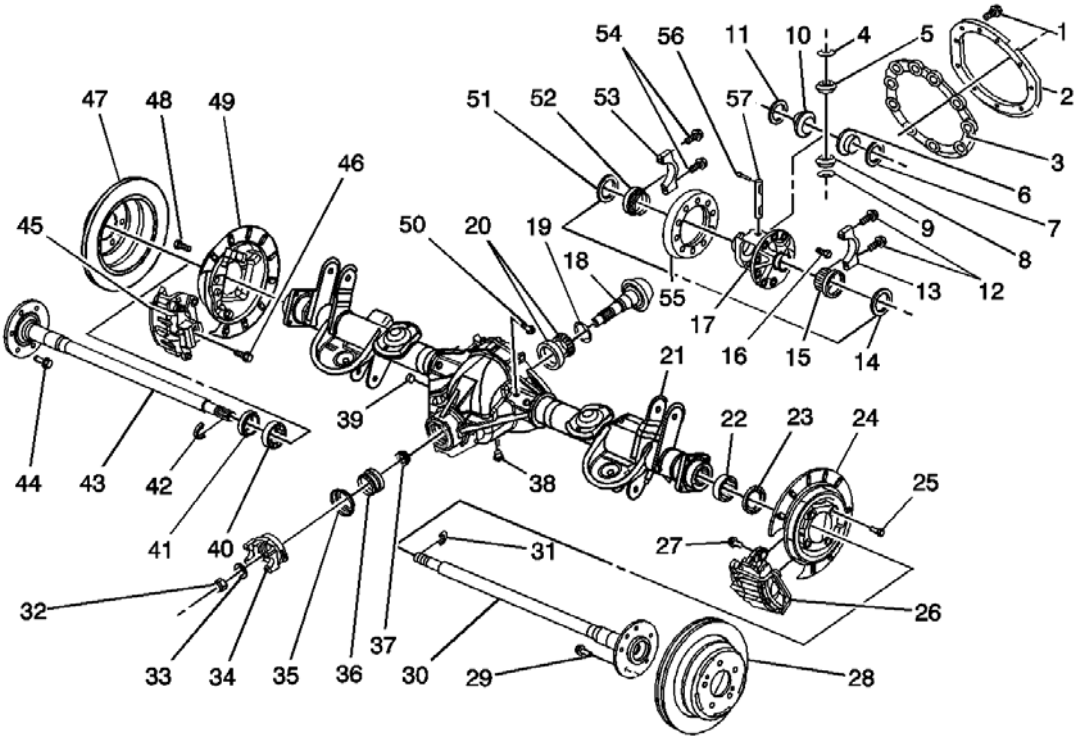


Fig. 3: View Of Rear Axle Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Bolt
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
37	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 & PROCEDURES

DIAGNOSTIC STARTING POINT - LOCKING/LIMITED SLIP REAR 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 exist. Reviewing the description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Locking/Limited Slip Rear Axle** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

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 - LOCKING/LIMITED SLIP REAR AXLE

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

Visual/Physical Inspection

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

Symptom List

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

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

SYMPTOMS - REAR DRIVE AXLE

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

Rear Axle Noise

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

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

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

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

Visual/Physical Inspection

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

Symptom List

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

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

REAR DRIVE AXLE NOISES

Gear Noise

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

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

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

Bearing Noise

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

Rear Wheel Bearing Noise

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

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

Knock at Low Speeds

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

Backlash Clunk

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

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

Inspect, adjust or replace the affected components as necessary.

NOISY IN DRIVE

Cause	Correction
DEFINITION: A noise heard during acceleration load.	
Excessive pinion to ring gear backlash	Adjust the pinion to ring gear backlash. Refer to **Backlash Adjustment (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.
Worn pinion and ring gear	Replace the pinion and the ring gear. Refer to **Drive Pinion and Ring**

	Gear Replacement.
Worn pinion bearings	Replace the pinion bearings. Refer to **Drive Pinion Bearings Replacement**.
Loose pinion bearings	Adjust the pinion bearings preload. Refer to **Pinion Depth Adjustment**.
Excessive pinion end play	Adjust the pinion end play. Refer to **Pinion Depth Adjustment**.
Worn differential bearings	Replace the differential bearings. Refer to **Differential Side Bearings Replacement**.
Loose differential bearings	Adjust the differential bearing preload. Refer to **Differential Carrier Bearing Preload Adjustment (8.0, 8.6 Inch Axle)** or **Differential Carrier Bearing Preload Adjustment (9.5 LD Inch Axle)**.
Excessive ring gear runout	Replace the ring gear. Refer to **Drive Pinion and Ring Gear Replacement**.
Low oil level	Fill the fluid level to specifications with the proper lubricant. Refer to **Rear Axle Lubricant Level Inspection (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Level Inspection (9.5 Inch LD Axle)**.
Wrong or poor grade oil	Drain and refill the system with the proper lubricant. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
Bent axle housing	Replace the axle housing. Refer to **Rear Axle Housing Replacement**.

NOISY WHEN COASTING

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 **Drive Pinion and Ring Gear Replacement**.
Pinion and ring gear too tight	Adjust the pinion and the ring gear backlash. Refer to **Backlash Adjustment (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.

INTERMITTENT NOISE

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

CONSTANT NOISE

Checks	Action
Flat spot on the pinion or the ring gear teeth	Replace the pinion and the ring gear. Refer to **Drive Pinion and Ring Gear Replacement**.

Flat spot on the pinion bearing	Replace the bearing. Refer to **Drive Pinion Bearings Replacement**.
Worn pinion splines	Replace the pinion. Refer to **Drive Pinion and Ring Gear Replacement**.
Worn axle shaft dowel holes	Replace the axle shaft. Refer to **Rear Axle Shaft Replacement**.
Worn hub studs	Replace the wheel studs. Refer to **Wheel Stud Replacement** .
Bent axle shaft	Replace the axle shaft. Refer to **Rear Axle Shaft Replacement**.

NOISY ON TURNS

Checks	Action
Worn axle shaft splines	Replace the axle shaft. Refer to **Rear Axle Shaft 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)

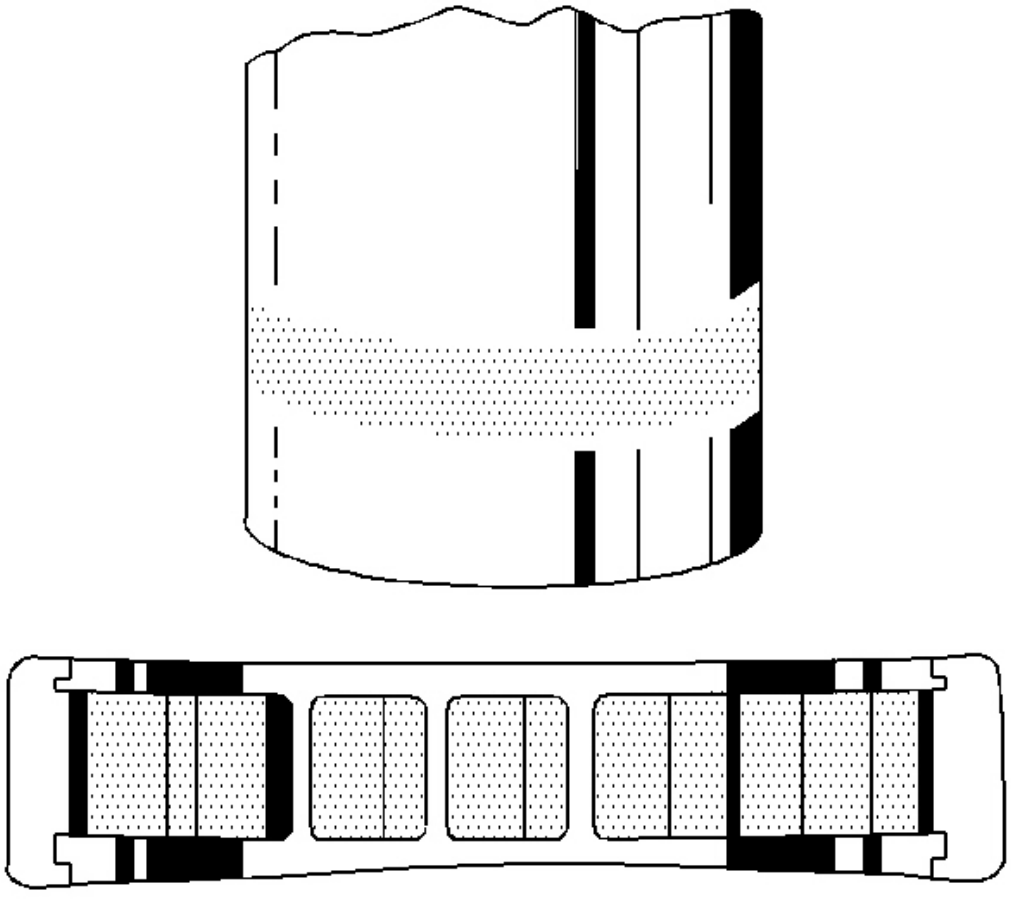


Fig. 4: Identifying Minor Wear
Courtesy of GENERAL MOTORS CORP.

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)

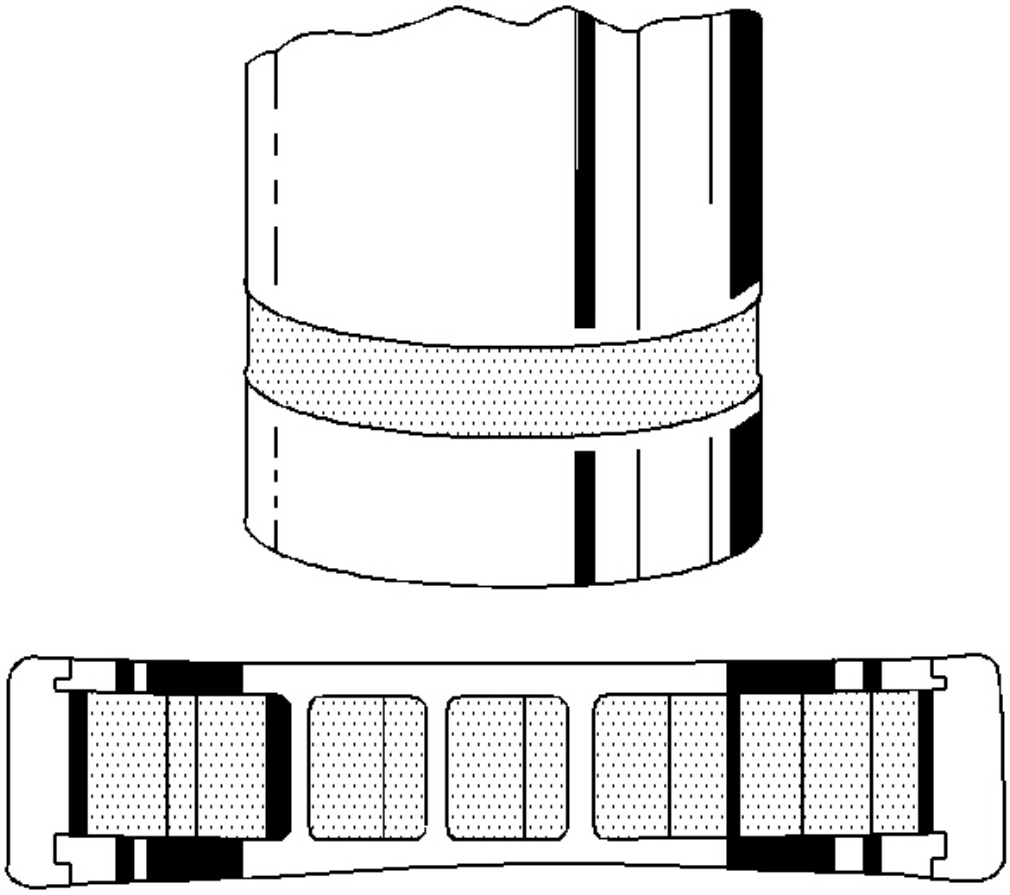


Fig. 5: Identifying Major Wear
Courtesy of GENERAL MOTORS CORP.

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

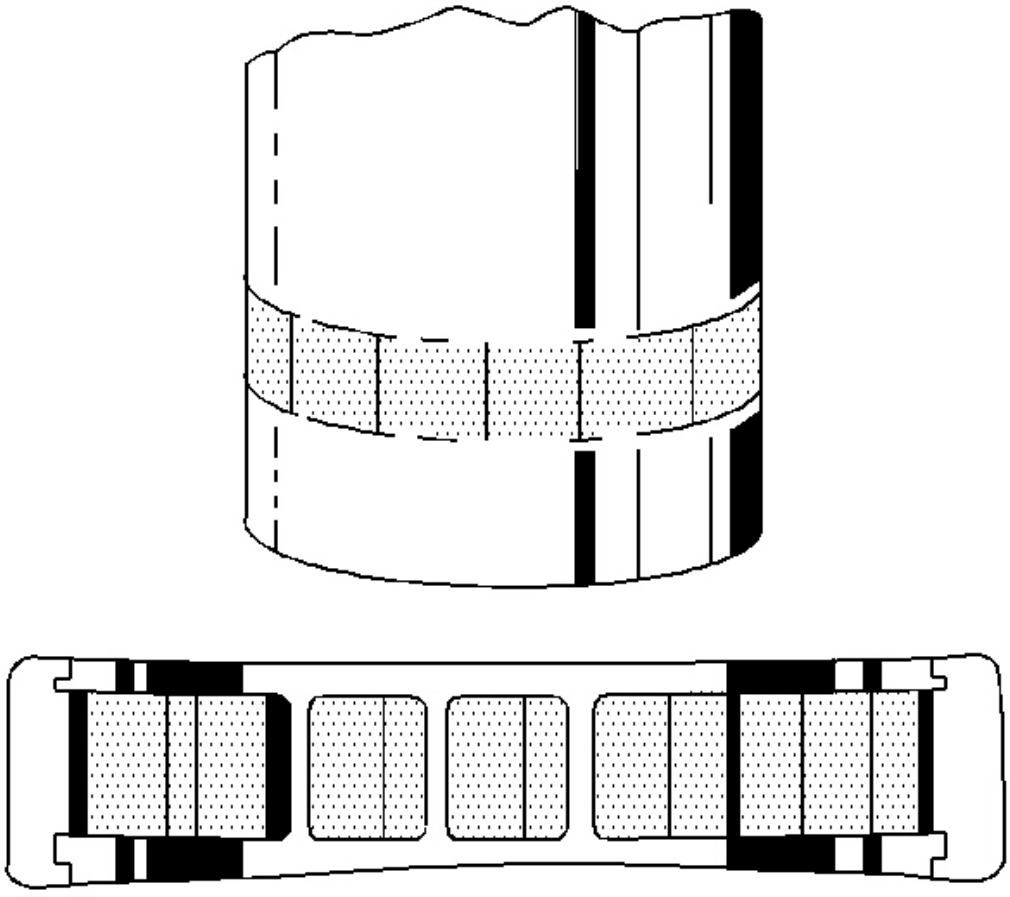


Fig. 6: Identifying Brinelling
Courtesy of GENERAL MOTORS CORP.

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

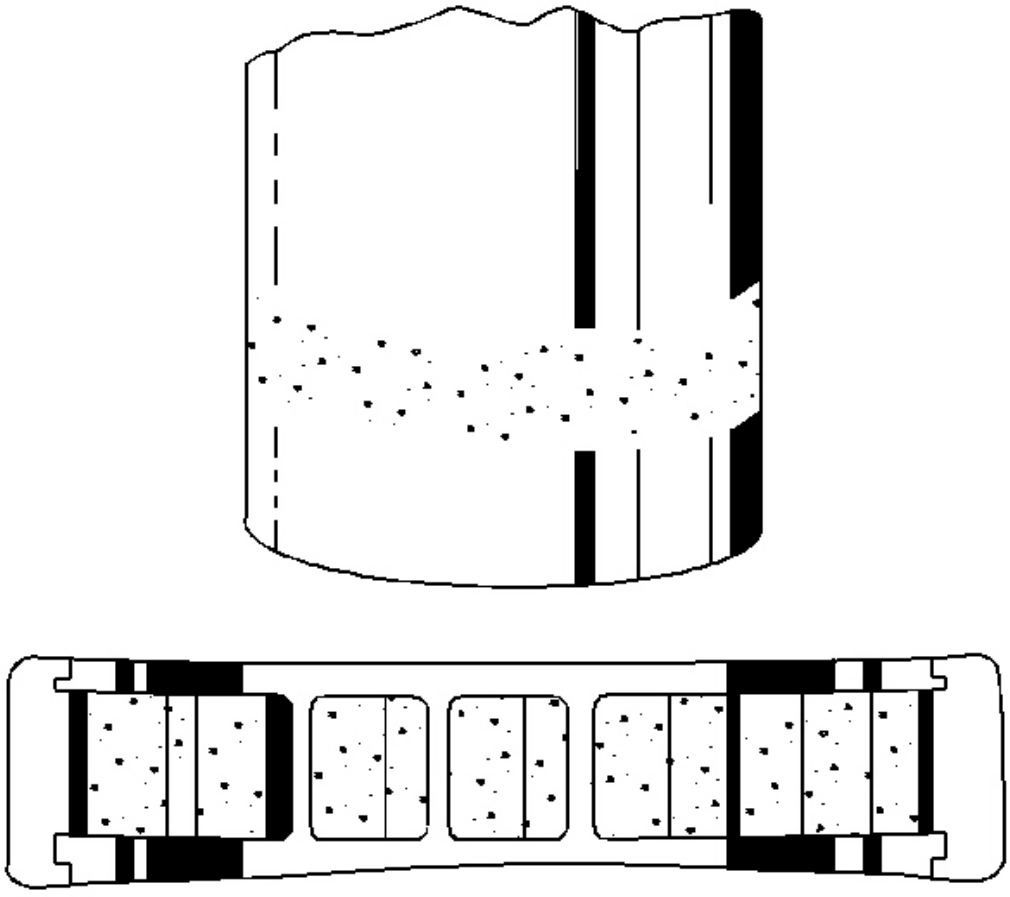


Fig. 7: Identifying Indentations
Courtesy of GENERAL MOTORS CORP.

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

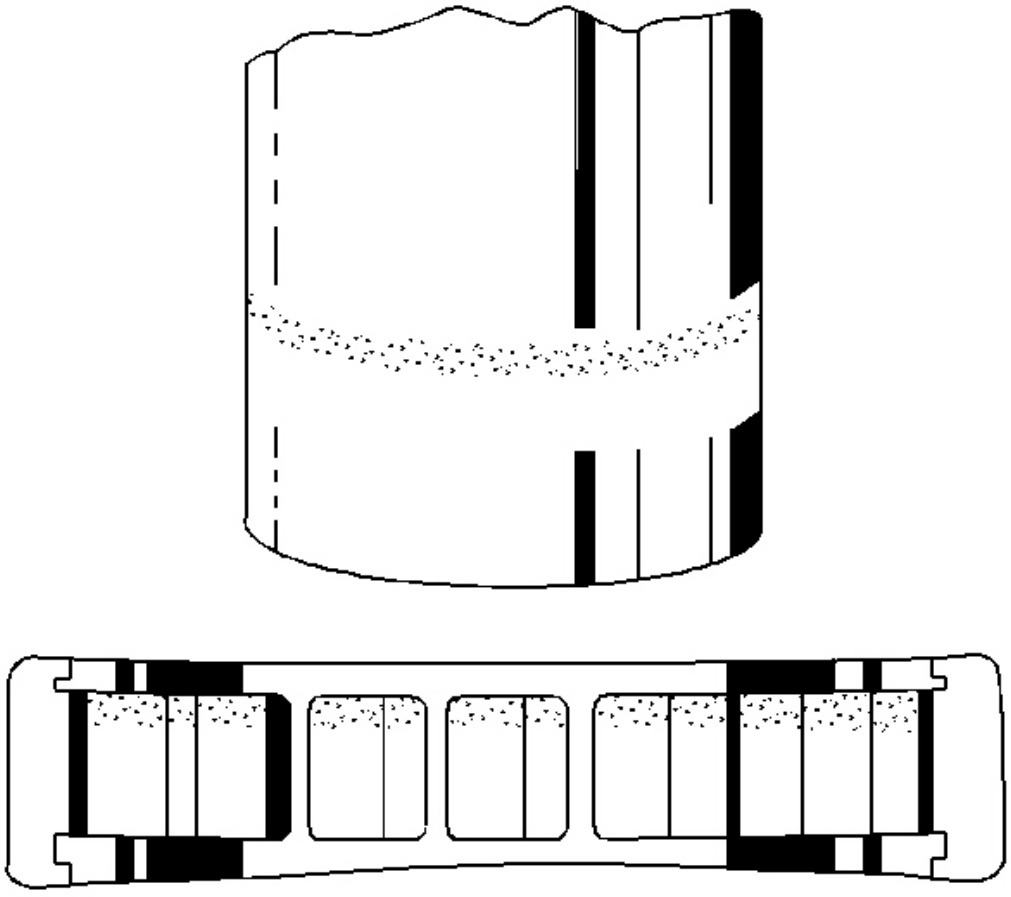


Fig. 8: Identifying Single Edge Pitting
Courtesy of GENERAL MOTORS CORP.

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

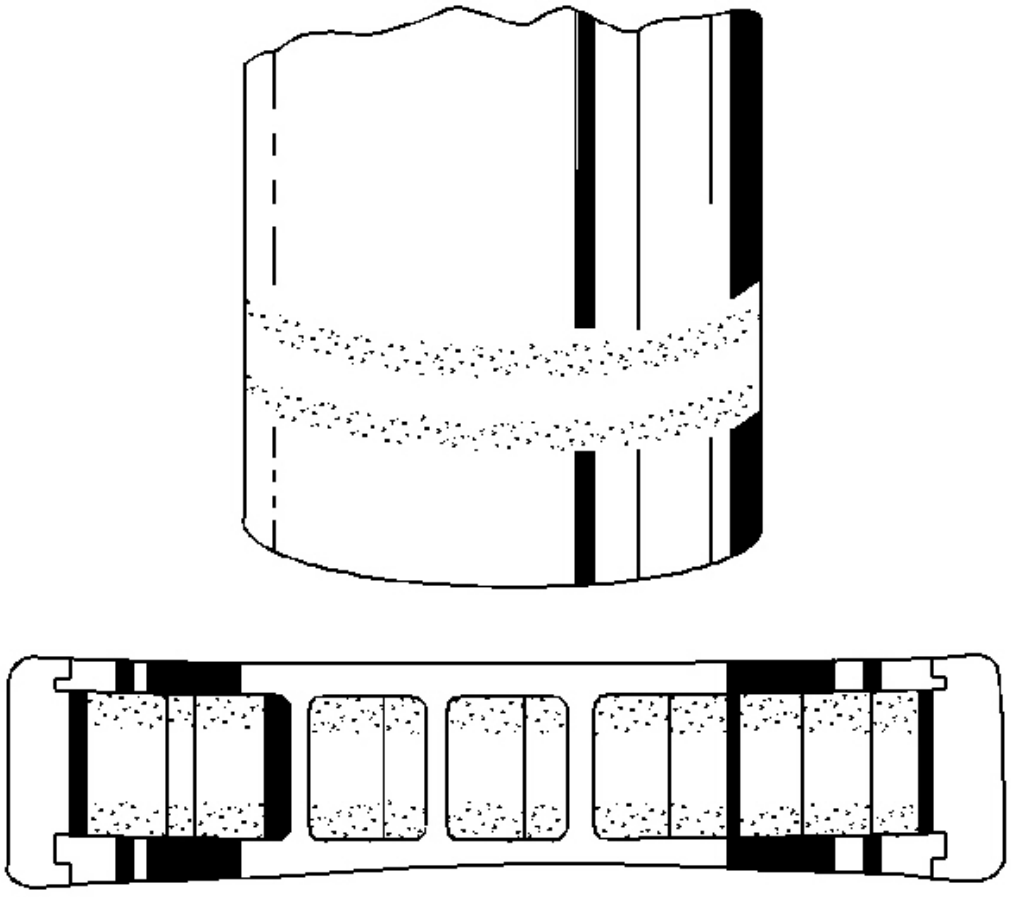


Fig. 9: Identifying Double Edge Pitting
Courtesy of GENERAL MOTORS CORP.

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

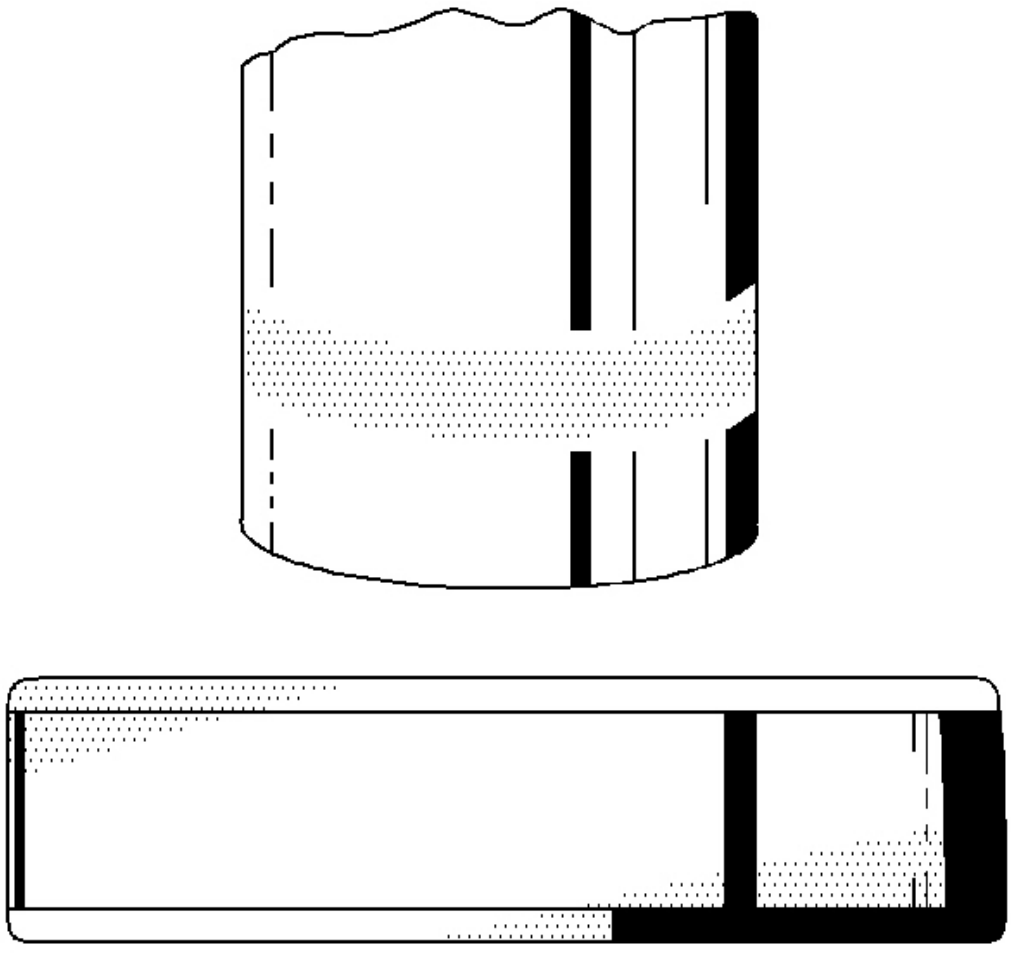


Fig. 10: Identifying Misalignment
Courtesy of GENERAL MOTORS CORP.

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.

Frettage

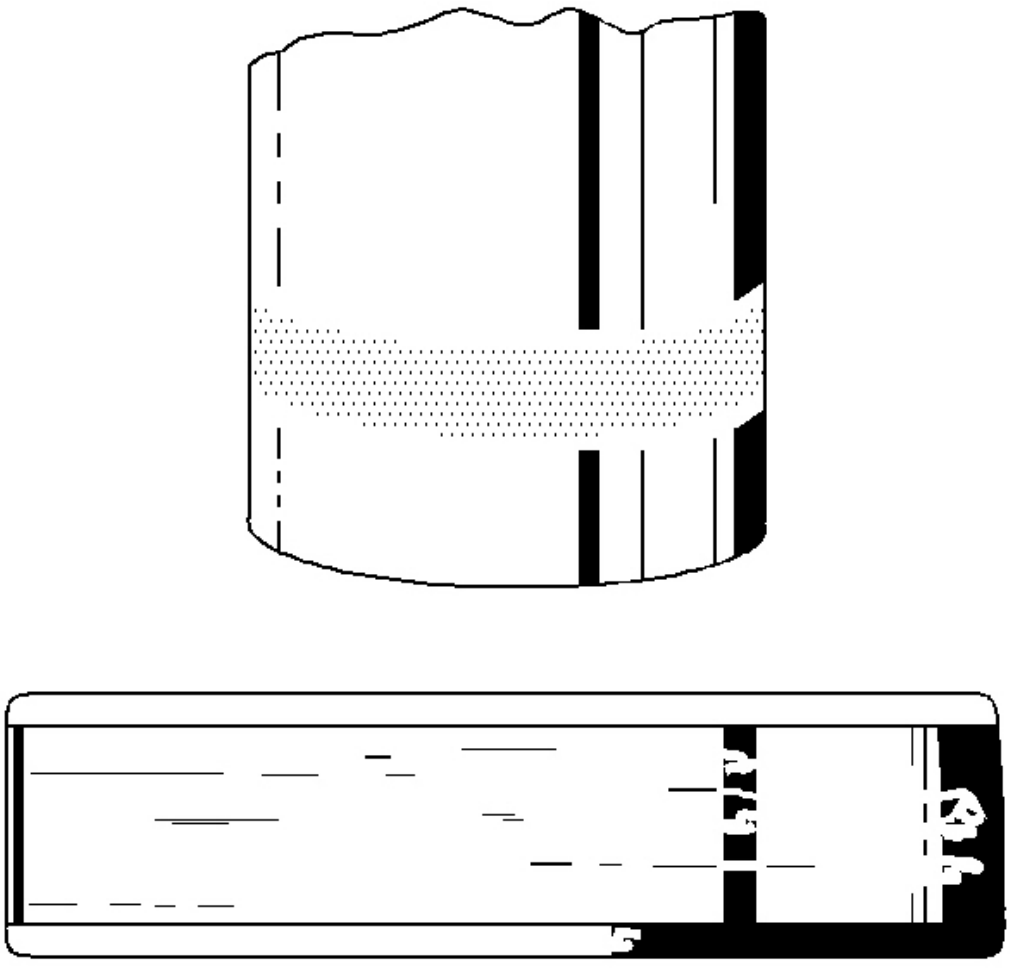


Fig. 11: Identifying Frettage
Courtesy of GENERAL MOTORS CORP.

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

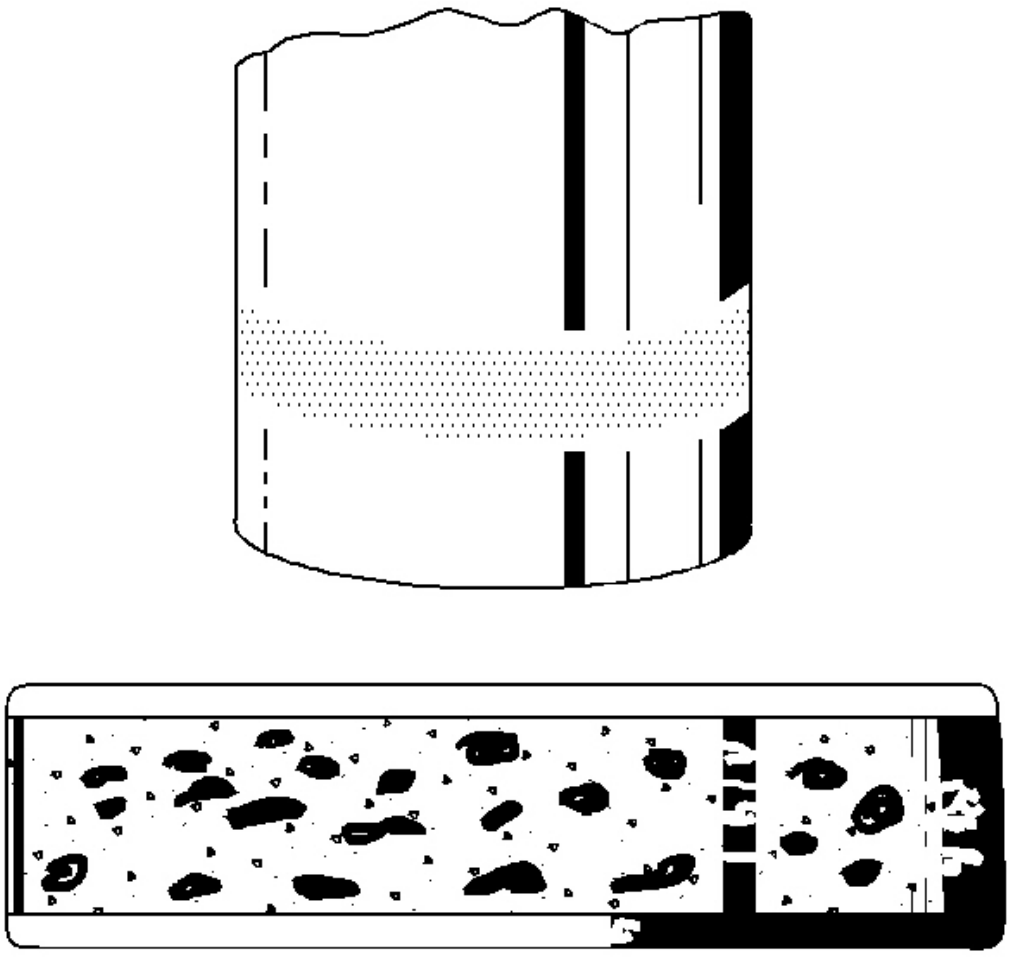


Fig. 12: Identifying Smears
Courtesy of GENERAL MOTORS CORP.

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.

WHEEL BEARING WEAR - REAR DRIVE AXLE (TAPERED)

Tapered Roller Bearing Diagnosis

Consider the following factors when diagnosing bearing condition:

- 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.

Abrasive Roller Wear

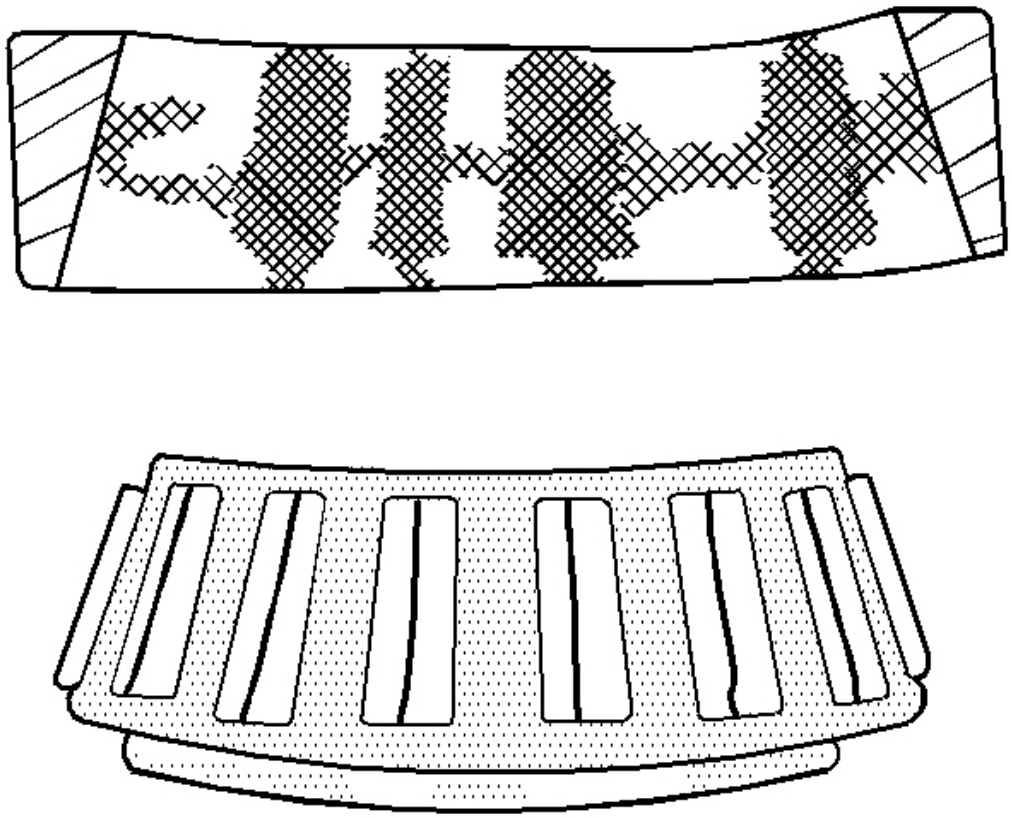


Fig. 13: Identifying Abrasive Roller Wear
Courtesy of GENERAL MOTORS CORP.

Pattern on the races and the rollers caused by fine abrasives. Clean all of the parts and the housings. Check the seals and the bearings. Replace any leaky, rough, or noisy bearings.

Abrasive Step Wear

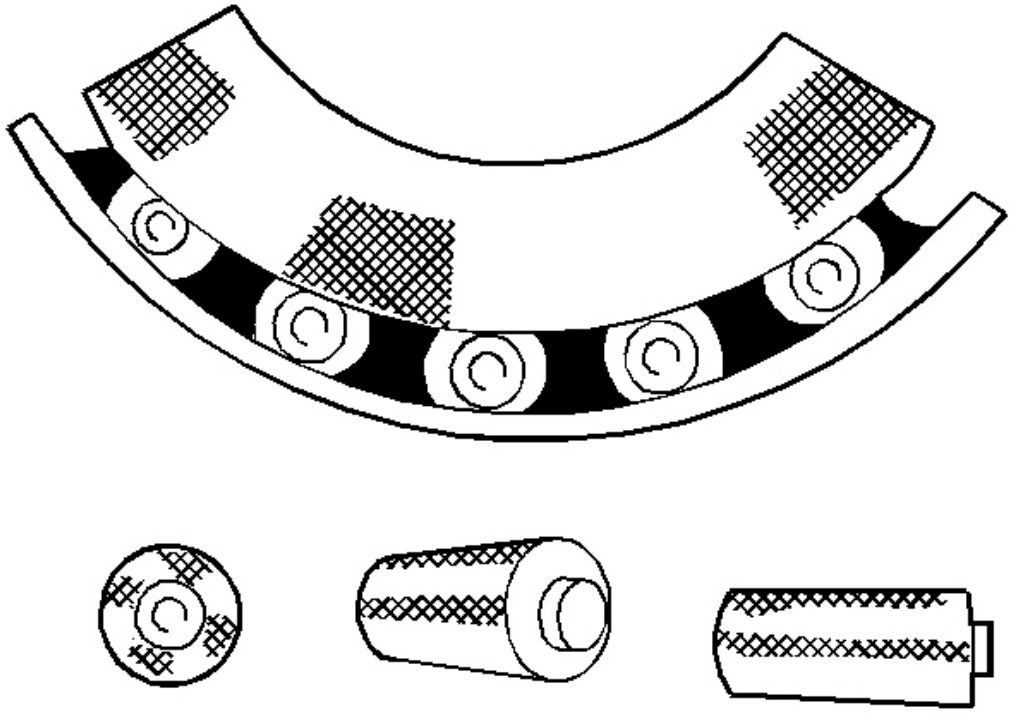


Fig. 14: Identifying Abrasive Step Wear
Courtesy of GENERAL MOTORS CORP.

Pattern on the roller ends caused by fine abrasives. Clean all of the parts and the housings. Check the seals and the bearings. Replace any leaky, rough, or noisy bearings.

Galling

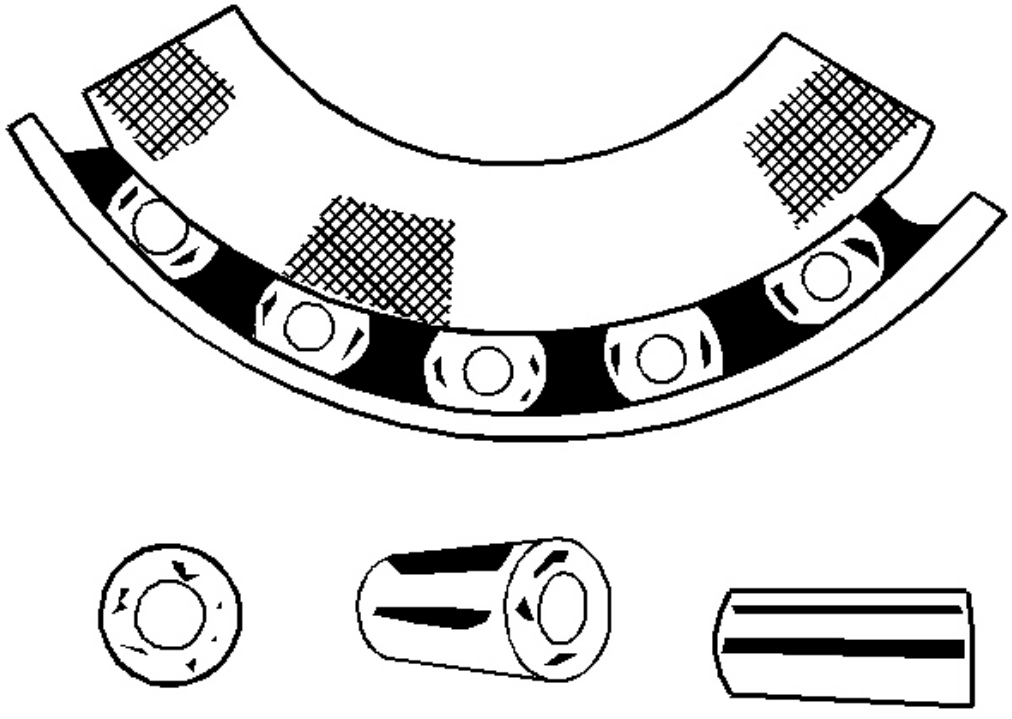


Fig. 15: Identifying Galling
Courtesy of GENERAL MOTORS CORP.

Metal smears on the roller ends due to overheating, lubricant failure, or lubricant overload. Replace the bearing. Check the seals. Check for proper lubrication.

Etching

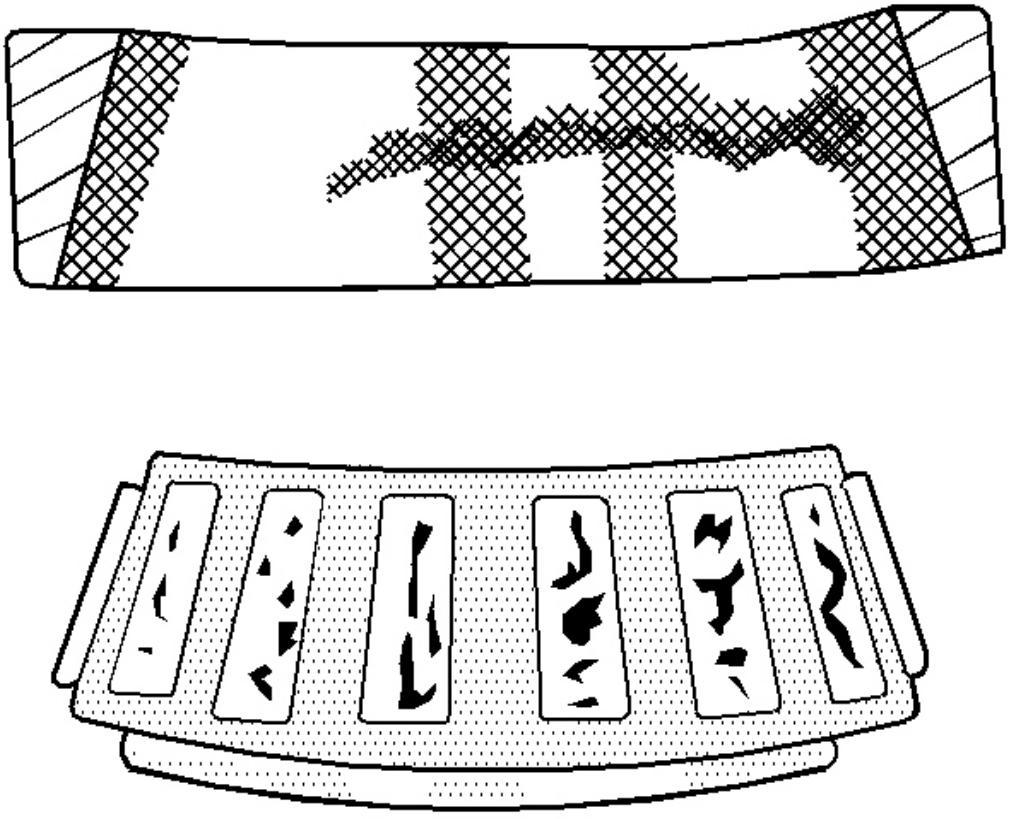


Fig. 16: Identifying Etching
Courtesy of GENERAL MOTORS CORP.

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

Bent Cage

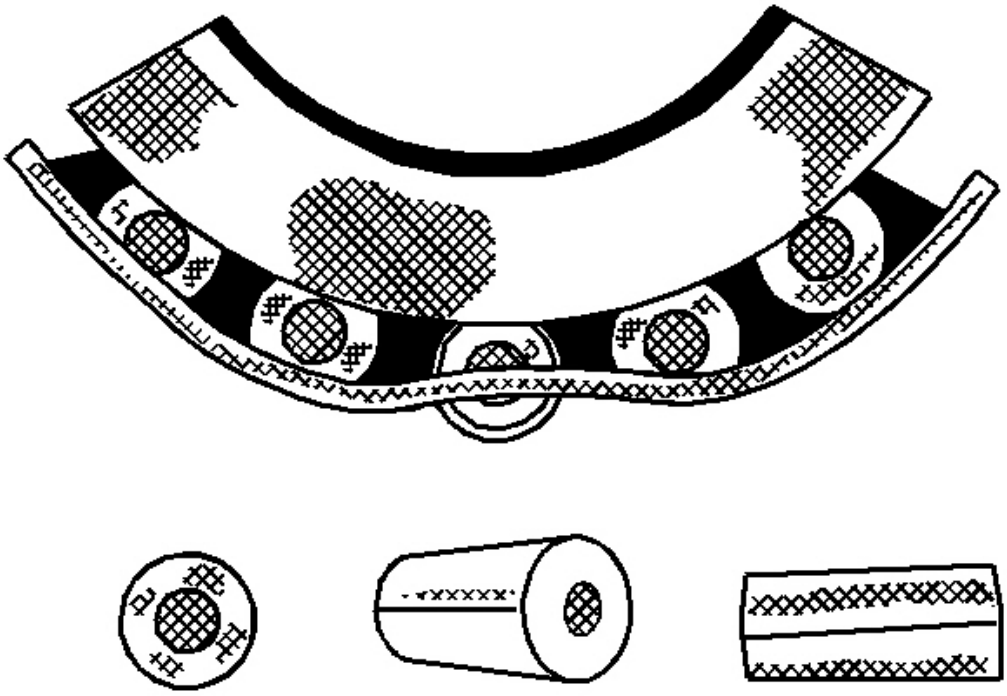


Fig. 17: Identifying Bent Roller Cage
Courtesy of GENERAL MOTORS CORP.

A damaged cage due to improper handling or improper tool usage. Replace the bearing.

Cage Wear

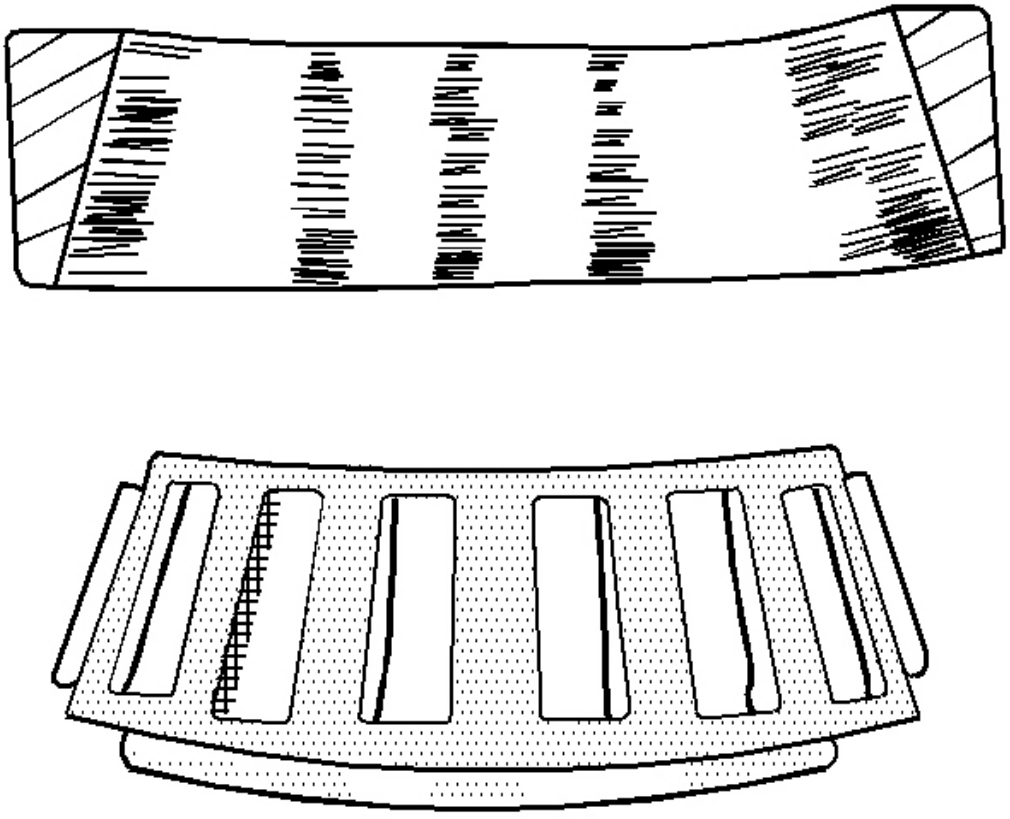


Fig. 18: Identifying Cage Wear
Courtesy of GENERAL MOTORS CORP.

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

Indentations

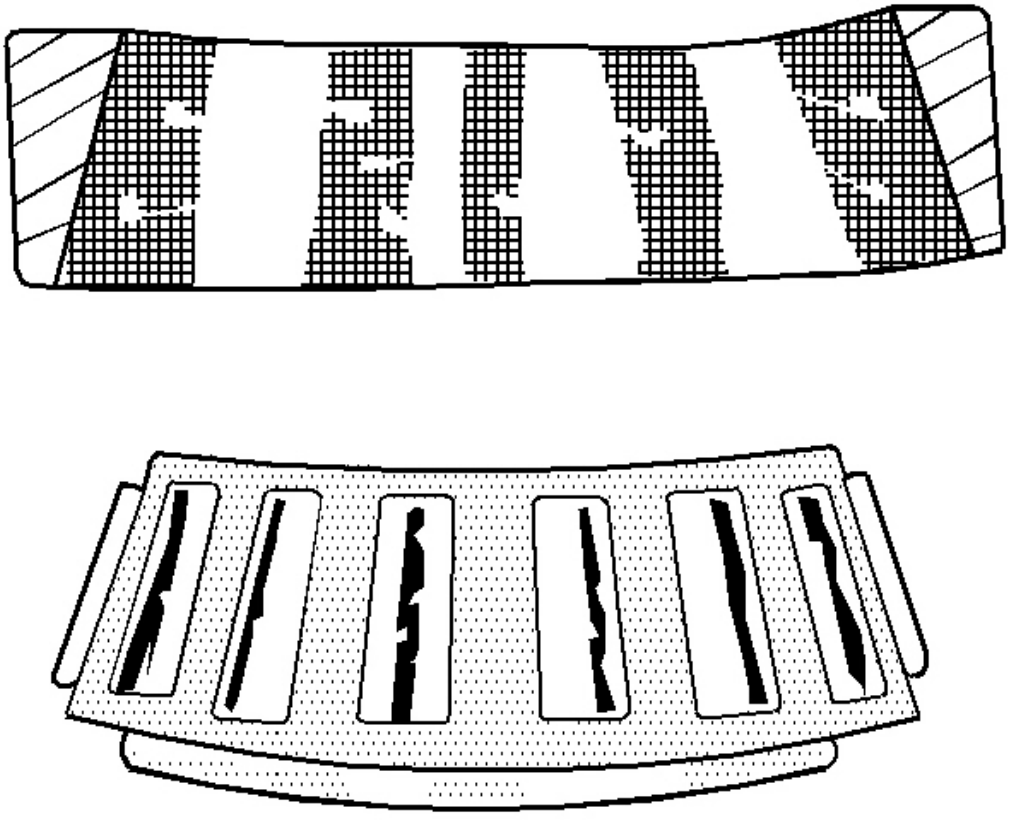


Fig. 19: Inspecting Bearing Rollers & Races For Heat Discoloration
Courtesy of GENERAL MOTORS CORP.

Surface depressions on the race and the rollers caused by hard particles of foreign matter. Clean all the parts and the housings. Check the seals. Replace rough or noisy bearings.

Frettage

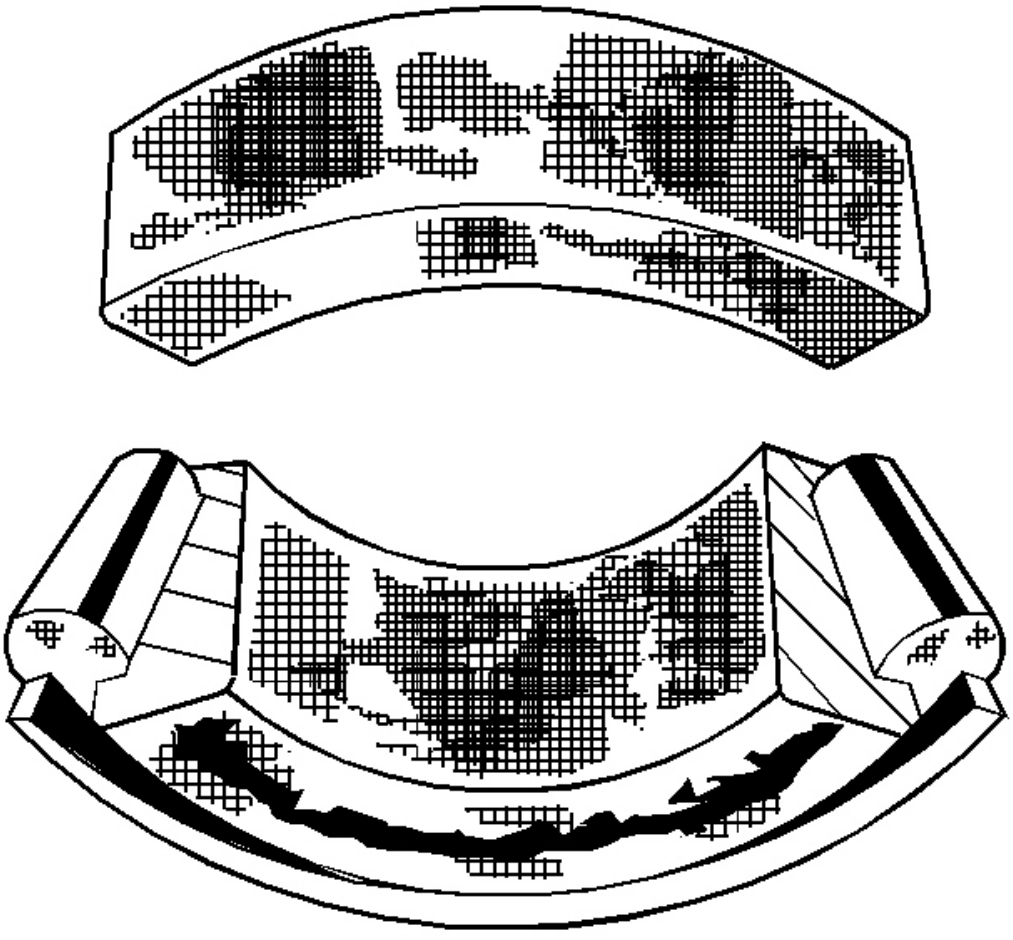


Fig. 20: Identifying Frettage
Courtesy of GENERAL MOTORS CORP.

Corrosion caused by small relative movement of parts with no lubrication. Replace the bearing. Clean the related parts. Check the seals. Check for proper lubrication.

Smears

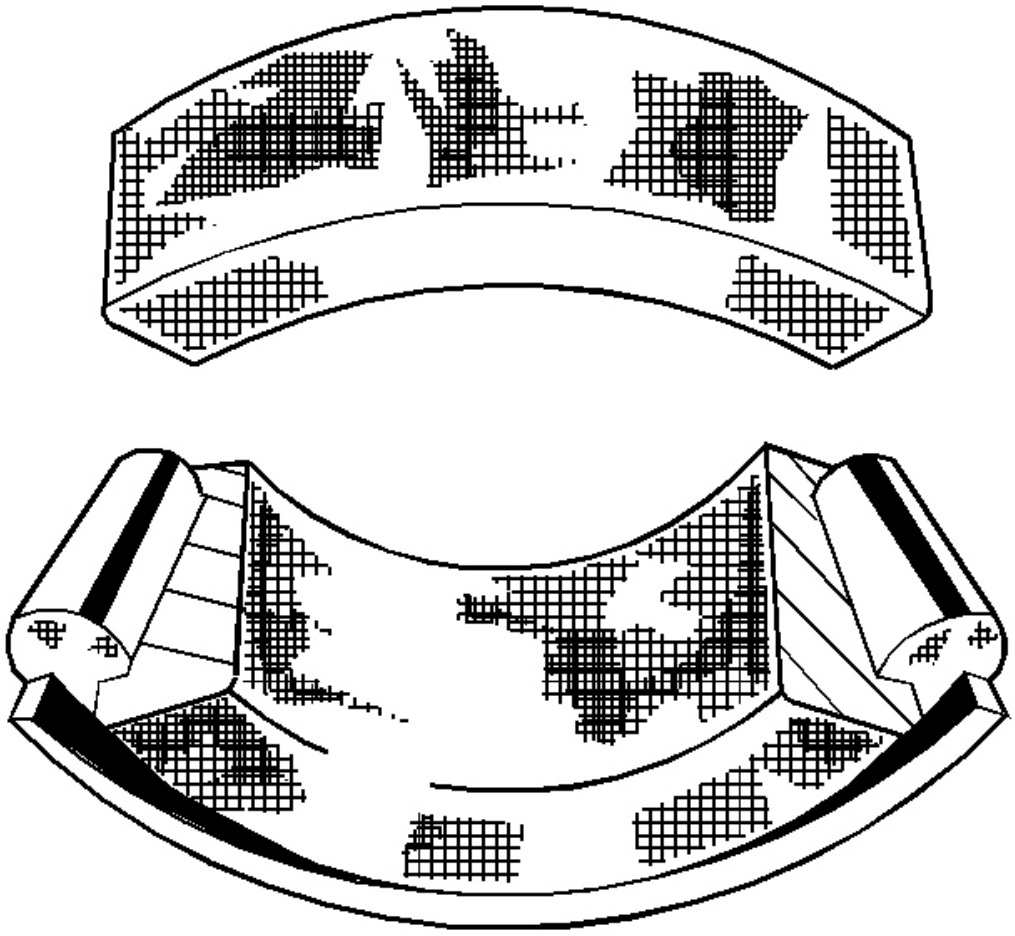


Fig. 21: Identifying Smears
Courtesy of GENERAL MOTORS CORP.

Smearing of the metal due to slippage. Slippage can be caused by the following factors:

- Poor fits
- Lubrication
- Overheating
- Overloads
- Handling damage

Replace the bearings. Clean the related parts. Check for proper fit and lubrication.

Stain Discoloration

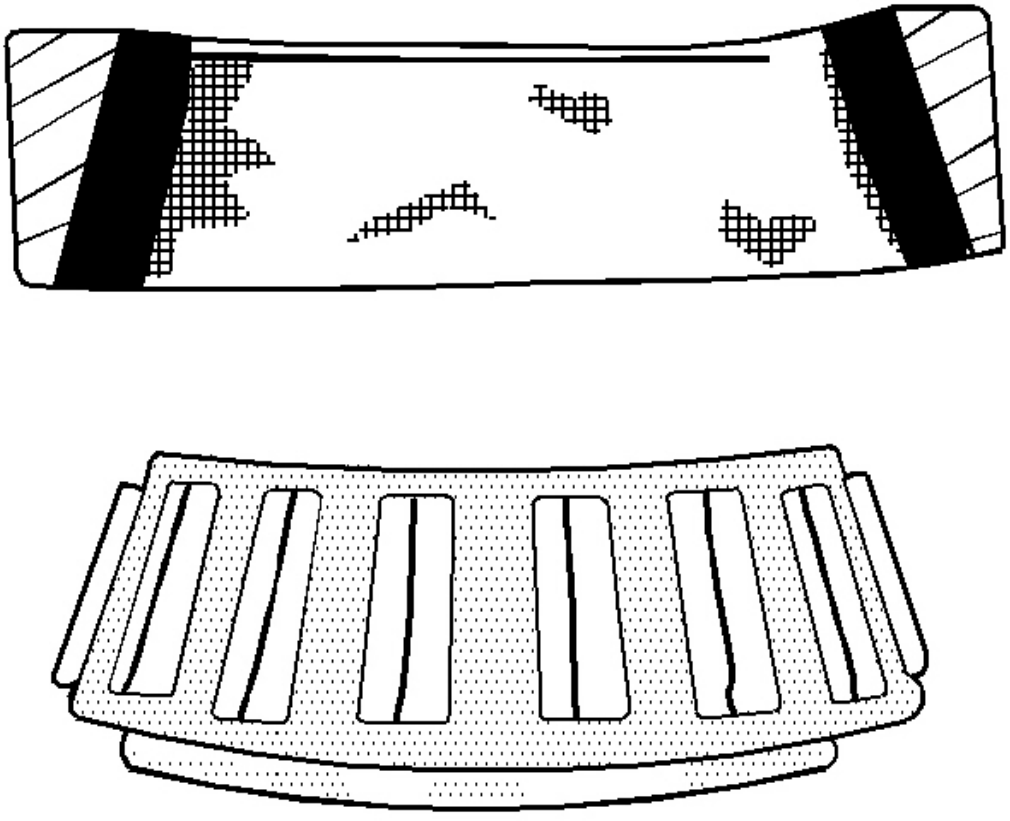


Fig. 22: Identifying Stain Discoloration
Courtesy of GENERAL MOTORS CORP.

Discoloration ranging from light brown to black. This discoloration is caused from incorrect lubrication or moisture. Reuse the bearing if you can remove the stains with light polishing. Reuse the bearing if there is no evidence of overheating. Check the seals and the related parts for damage.

Heat Discoloration

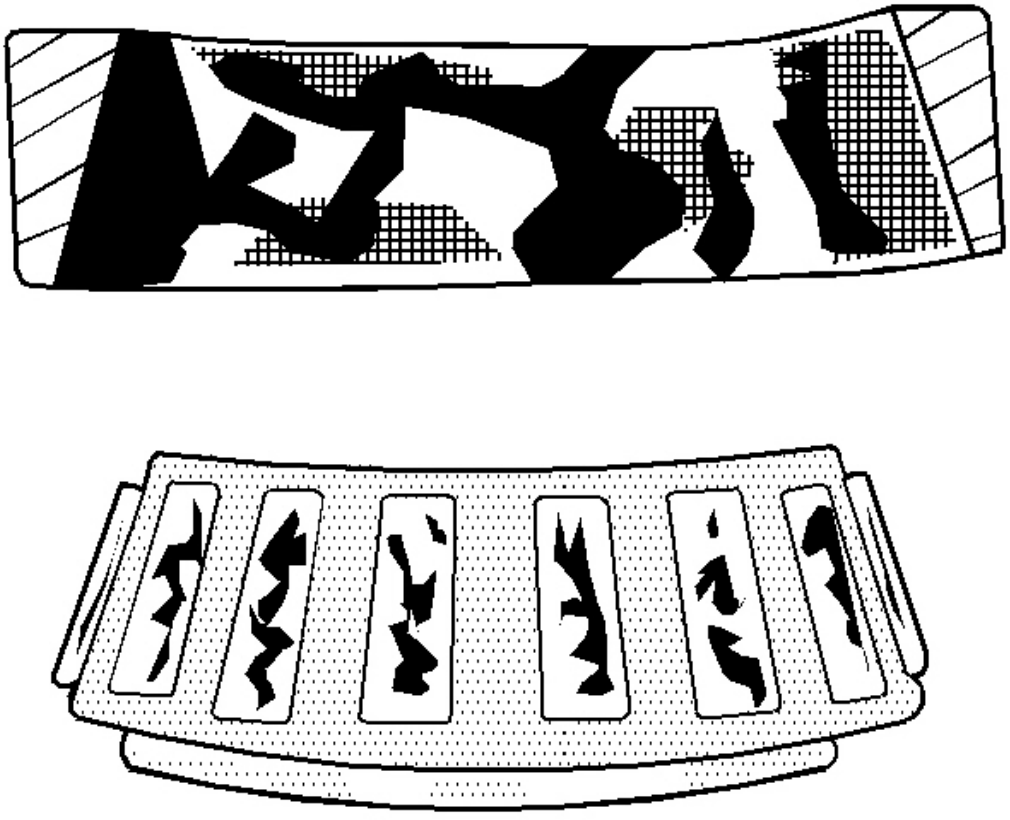


Fig. 23: Identifying Heat Discoloration
Courtesy of GENERAL MOTORS CORP.

Heat discoloration ranges from faint yellow to dark blue. This discoloration results from overload or an incorrect lubricant. Excessive heat causes softening of the races or the rollers. In order to check for loss of temper on the races and the rollers, perform a file test. A file drawn over a tempered part will grab and cut the metal. A file drawn over a hard part will glide readily with no metal cutting. Replace the bearings if overheating damage is indicated. The tempered part will fail the file test. Check the seals and the other related parts.

Misalignment

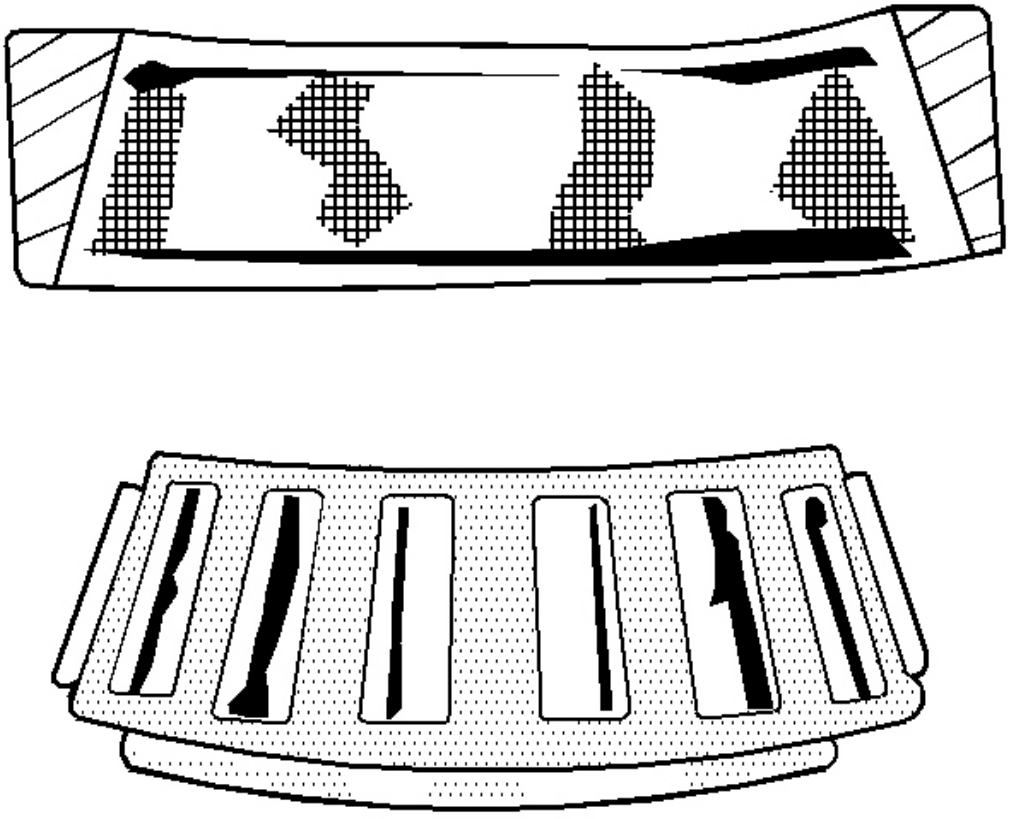


Fig. 24: Identifying Misalignment
Courtesy of GENERAL MOTORS CORP.

A misaligned outer race due to a foreign object. Clean the related parts. Replace the bearing. Ensure the races are properly sealed.

Cracked Inner Race

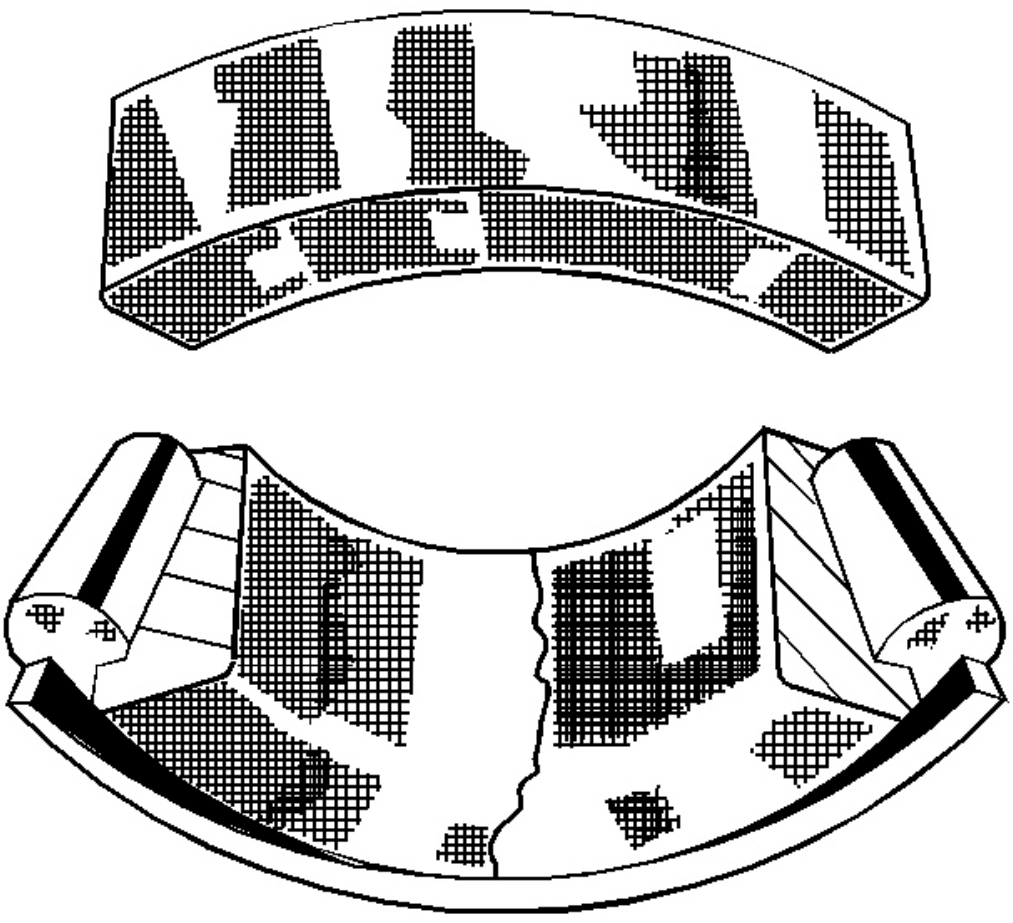


Fig. 25: Identifying Cracked Inner Race
Courtesy of GENERAL MOTORS CORP.

Cracked race due to improper fit, cocking, or poor bearing seats. Replace the bearing. Correct bearing seats.

Fatigue Spalling

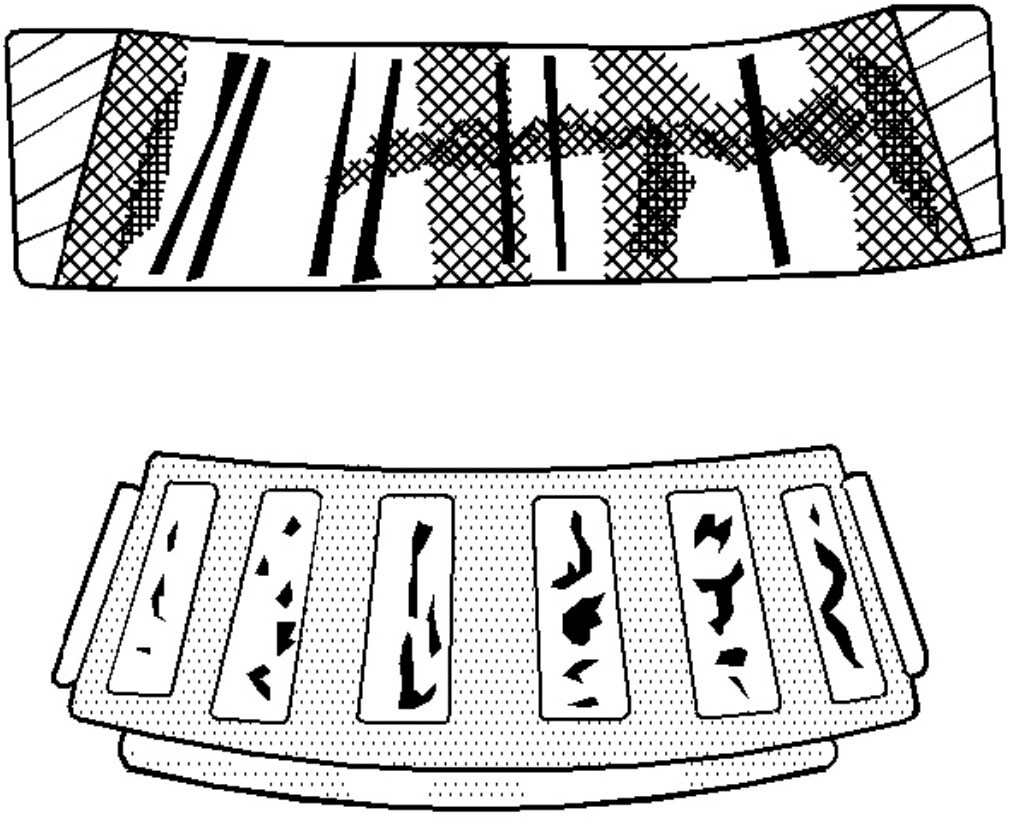


Fig. 26: Inspecting Bearing Rollers & Races For Pitting, Grooves, Spalling & Excessive Wear
Courtesy of GENERAL MOTORS CORP.

Flaked surface metal that results from fatigue. Replace the bearing. Clean all related parts.

Brinelling

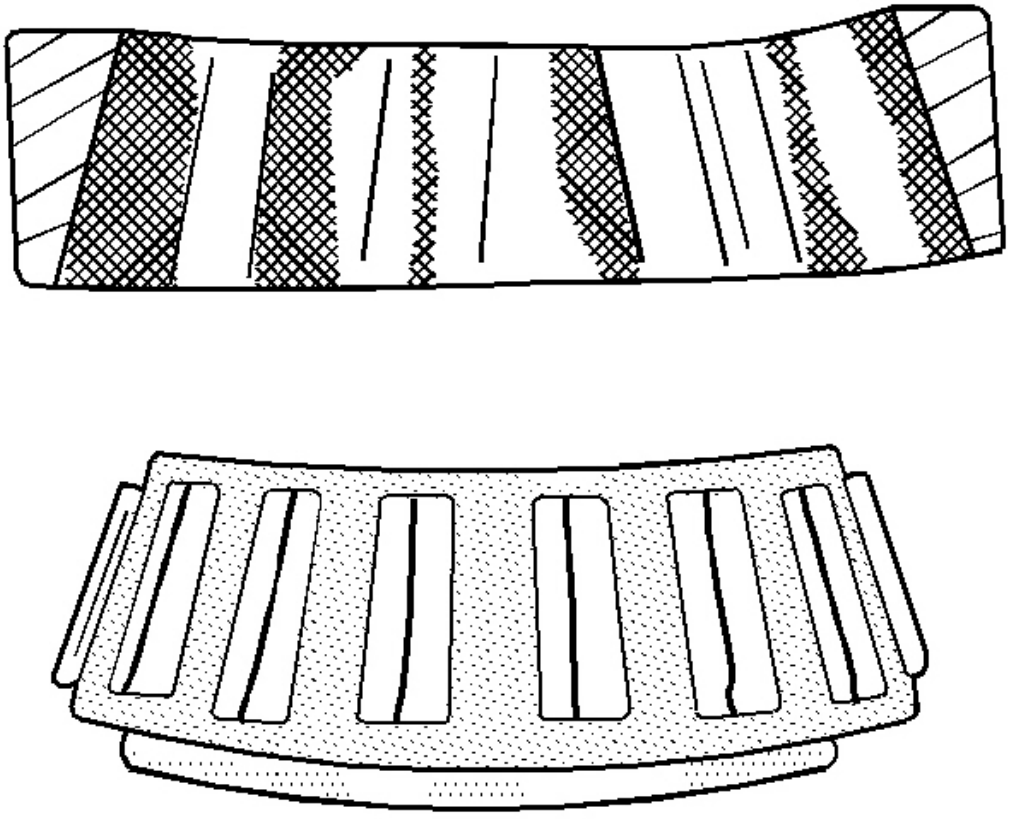


Fig. 27: Identifying Brinelling
Courtesy of GENERAL MOTORS CORP.

Surface indentations in the race way caused by the rollers under impact loading or caused from vibration while the bearing is not rotating. Replace a rough or noisy bearing.

REAR AXLE LUBRICANT LEAK DIAGNOSIS

Rear axle lubricant leaks can occur at the following locations:

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

- Pinion yoke oil seal
- Vent tube

Determining the Cause

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

Oil Seals

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

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

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

Gaskets

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

Rear Axle Housing

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

- Drain Plug
- Fill Plug

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

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

LOCKING DIFFERENTIAL DIAGNOSIS

1. Place the vehicle on a frame-contact hoist, allowing free rotation of the rear wheels.
2. Hold 1 wheel stationary. Slowly rotate the other wheel approximately 1/2 revolution per second in both the forward and reversed directions. The wheel should rotate freely. The differential is locking and is broken if both wheels attempt to turn together.
3. Raise the hoist to maximum height with 1 person in the vehicle.
4. Start the engine. Ensure that the engine is operating at low idle speed (warm engine).
5. Apply the service brake. Place the automatic transmission in drive. Depress the clutch and place the transmission in first gear with a manual transmission.
6. Lock 1 rear wheel by pulling one parking brake cable from under the vehicle with the aid of an assistant.
7. Release the service brakes or disengage the clutch slowly enough to start the free wheel turning. The locked rear wheel remains stationary.
8. Increase the speed of the free wheel. The differential will lock, causing the rotating wheel to stop or both wheels to turn at the same speed. The engine, if equipped with manual transmission, may stall. In order to cause the differential to lock, you may need to accelerate the engine until approximately 16 km/h (10 mph) is indicated on the vehicle speedometer. If the indicated speed can be increased beyond 32 km/h (20 mph) without causing the differential to lock, the unit is not functioning properly. Rapid release of the brakes or clutch, or rapid acceleration of the engine, will invalidate the test.
9. Lock the opposite rear wheel and repeat the procedure.

LOCKING REAR AXLE DOES NOT LOCK

Condition	Action
There is little or no preload on the latching bracket.	Replace the governor assembly and the latching bracket. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
Flyweights in the governor assembly are stuck closed.	Replace the governor assembly and the latching bracket. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
The drive teeth on the governor or cam gear assembly are broken.	Replace the cam plate, the governor assembly, and the latching bracket. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**
The clutch plates are broken.	Replace the clutch plates and the wave spring. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Clutch Disc Assembly Disassemble (8.0 Inch Axle)** or **Locking Differential Clutch Disc Assembly Disassemble (8.6 Inch Axle)**

	• **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**

LOCKING REAR AXLE LOCKS IN TURNS

Condition	Action
The governor assembly is tight in the case.	Free up the governor assembly. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
A governor flyweight spring is broken or weak.	Replace the governor assembly and the latching bracket. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
The flyweight in the governor assembly is stuck open.	Replace the governor assembly and the latching bracket. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
The cam plate or the governor drive teeth are broken.	Replace the cam plate, the governor assembly, and the latching bracket. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**

LOCKING REAR DRIVE AXLE CHATTERS IN TURNS

Checks	Action
The lubricant is contaminated.	Drain and flush the axle housing thoroughly. Refill with the correct lubricant. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
The clutch plates are deteriorated.	Replace the clutch plates. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Clutch Disc Assembly Disassemble (8.0 Inch Axle)** or **Locking Differential Clutch Disc Assembly Disassemble (8.6 Inch Axle)** • **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**

NOISE IN ADDITION TO NORMAL CLUTCH ENGAGEMENT

Checks	Action

The clutch plates are broken.	Replace the clutch plates. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Clutch Disc Assembly Disassemble (8.0 Inch Axle)** or **Locking Differential Clutch Disc Assembly Disassemble (8.6 Inch Axle)** • **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**
The thrust block is broken.	Replace the thrust block with a block of identical thickness. Check closely for other damage. Refer to **Locking Differential Disassemble** and **Locking Differential Assemble**.
The case is damaged.	Replace the unit. Refer to **Differential Replacement**.
The differential gears are broken.	Replace the gears. Refer to the following: • **Locking Differential Disassemble** • **Locking Differential Clutch Disc Assembly Disassemble (8.0 Inch Axle)** or **Locking Differential Clutch Disc Assembly Disassemble (8.6 Inch Axle)** • **Locking Differential Cam Unit Disassemble** • **Locking Differential Cam Unit Assemble** • **Locking Differential Assemble**

REPAIR INSTRUCTIONS

REAR AXLE LUBRICANT LEVEL INSPECTION (8.0/8.6 INCH AXLE)

IMPORTANT: All axle assemblies are filled by volume of fluid during production. They are not filled to reach a certain level. When checking the fluid level on any axle, variations in the readings can be caused by factory fill differences between the minimum and the maximum fluid volume. Also, if a vehicle has just been driven before checking the fluid level, it may appear lower than normal because the fluid has traveled out along the axle tubes and has not drained back to the sump area. Therefore, a reading taken five minutes after the vehicle has been driven will appear to have a lower fluid level than a vehicle that has been stationary for an hour or two. Remember that the rear axle assembly must be supported to get a true reading.

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

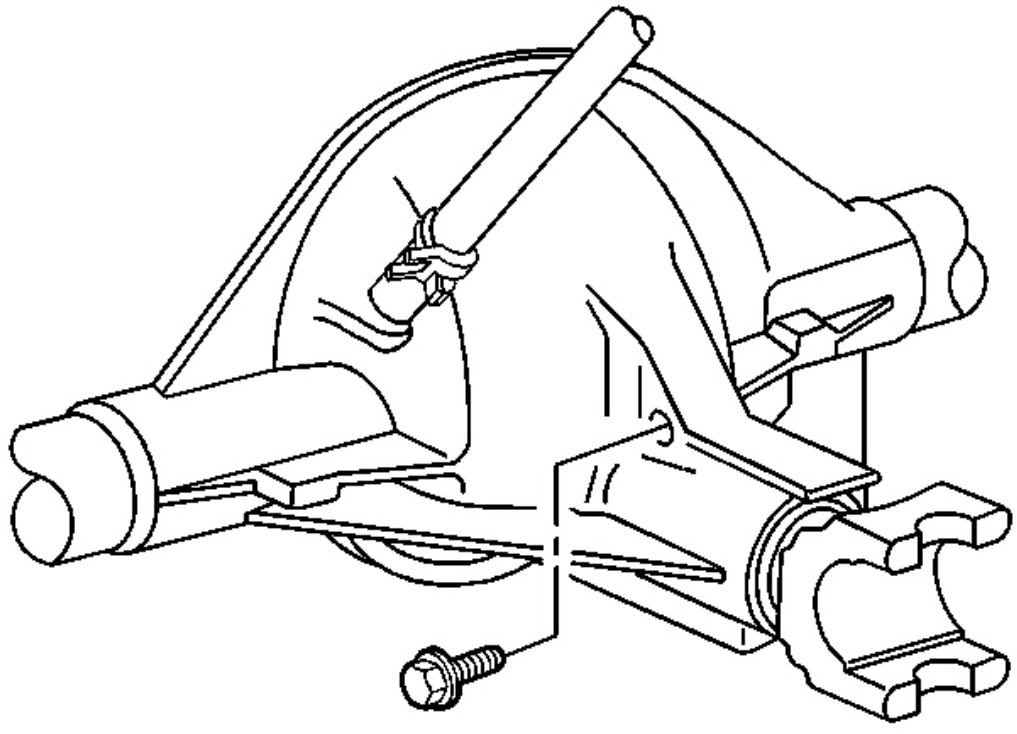


Fig. 28: View Of Rear Axle Fill Plug (9.5, 10.5 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

5. Remove the rear axle fill plug.
6. Inspect the lubricant level.

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

7. If the fluid level is low, add lubricant until the level is within specifications. Use the proper fluid. Refer to **Sealers, Adhesives, and Lubricants**.

   NOTE: Refer to Fastener Notice .

8. Install the rear axle fill plug.

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

9. Lower the vehicle.

REAR AXLE LUBRICANT LEVEL INSPECTION (9.5 INCH LD AXLE)

IMPORTANT: All axle assemblies are filled by volume of fluid during production. They are not filled to reach a certain level. When checking the fluid level on any axle, variations in the readings can be caused by factory fill differences between the minimum and the maximum fluid volume. Also, if a vehicle has just been driven before checking the fluid level, it may appear lower than normal because the fluid has traveled out along the axle tubes and has not drained back to the sump area. Therefore, a reading taken five minutes after the vehicle has been driven will appear to have a lower fluid level than a vehicle that has been stationary for an hour or two. Remember that the rear axle assembly must be supported to get a true reading.

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

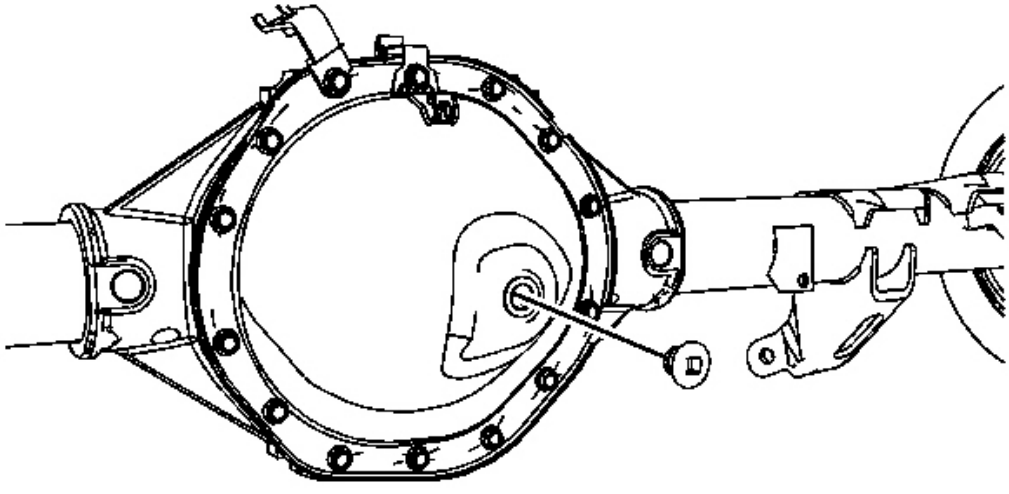


Fig. 29: View Of Rear Axle Fill Plug
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: Ensure 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 of the "L" facing down.
8. Inspect the lubricant level.

   Specification: The lubricant level should be between 15-40 mm (0.6-1.6 in) below the fill plug opening.

9. If the level is low, add lubricant until the level is within specifications. Use the proper fluid. Refer to **Sealers, Adhesives, and Lubricants**.

   NOTE: Refer to Fastener Notice .

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.

REAR AXLE LUBRICANT REPLACEMENT (8.0/8.6 INCH AXLE)

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Clean the area around the rear axle fill plug.
3. Remove the rear axle fill plug.
4. Remove the rear axle cover. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
5. Drain the lubricant into a suitable container.

Installation Procedure

1. Install the rear axle cover. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
2. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Approximate Fluid Capacities** and **Sealers, Adhesives, and Lubricants**.

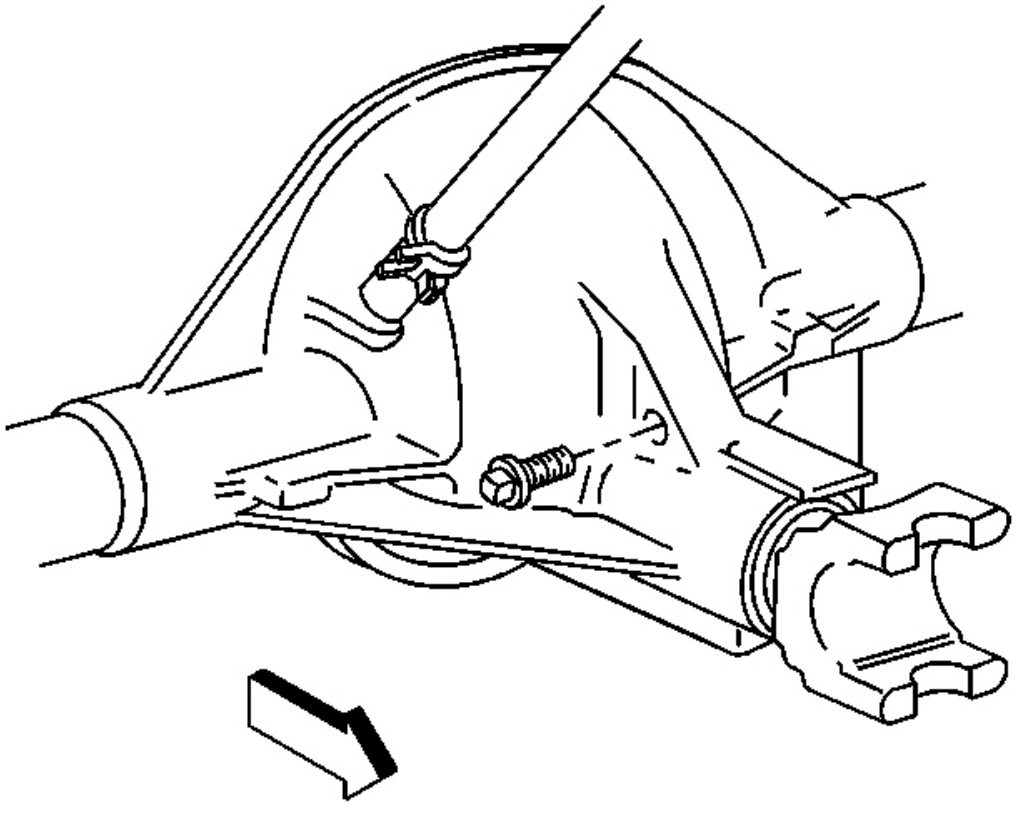


Fig. 30: View Of Rear Axle Fill Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

3. Install the rear axle fill plug.

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

4. Lower the vehicle.

REAR AXLE LUBRICANT REPLACEMENT (9.5 LD INCH AXLE)

Removal Procedure

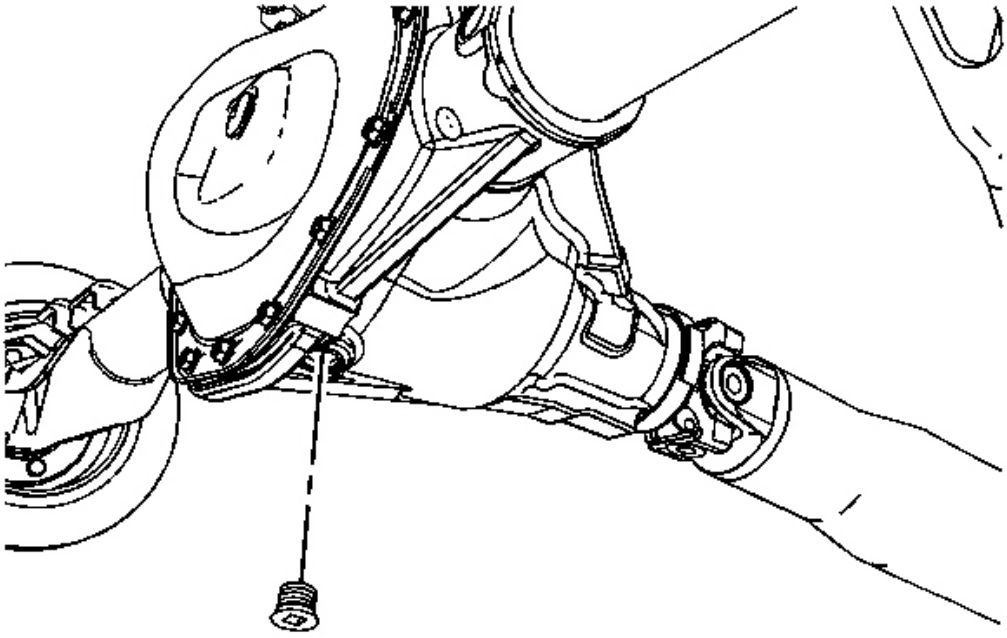


Fig. 31: View Of Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the drain plug.
3. Drain the lubricant into a suitable container.

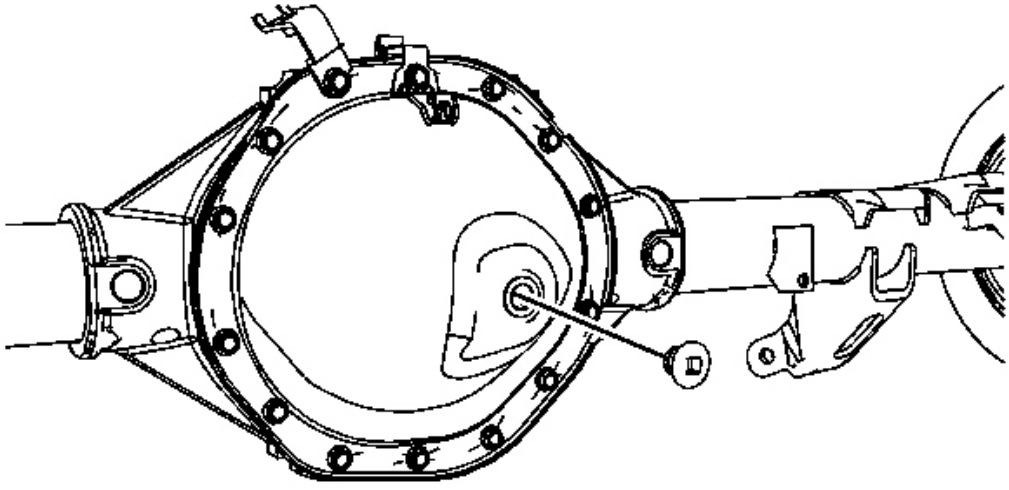


Fig. 32: View Of Rear Axle Fill Plug
Courtesy of GENERAL MOTORS CORP.

4. Remove the fill plug.

Installation Procedure

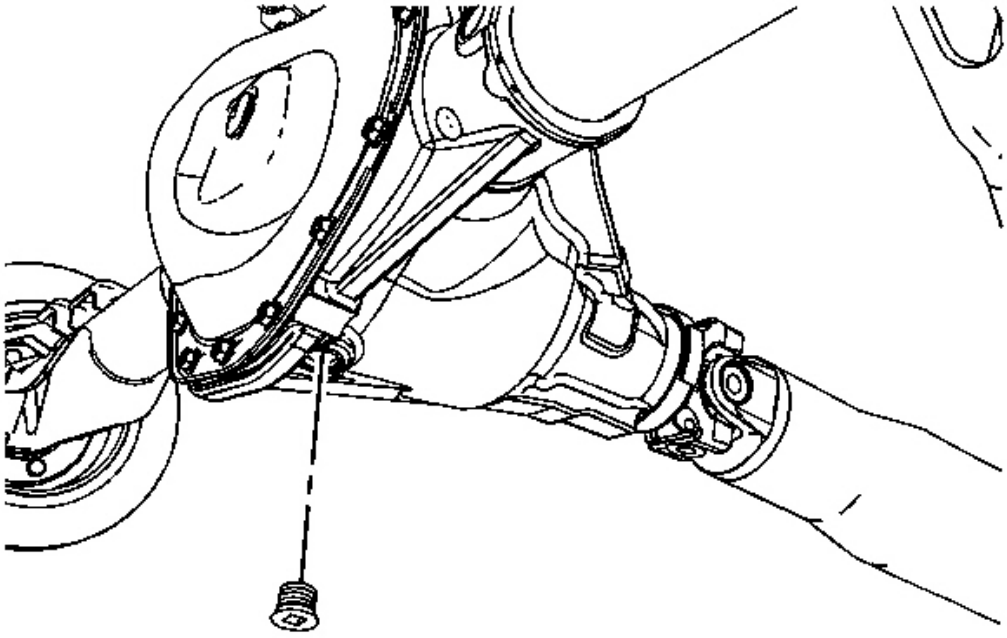


Fig. 33: View Of Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the drain plug.

   Tighten: Tighten the drain plug to 33 N.m (24 lb ft).

   IMPORTANT: Add the limited slip axle lubricant additive to the axle before filling the axle with axle lubricant.

2. Fill the axle with limited slip axle lubricant additive and lubricant.
   - Use the proper fluid, refer to **Sealers, Adhesives, and Lubricants**.
   - For the proper capacity, refer to **Approximate Fluid Capacities** .

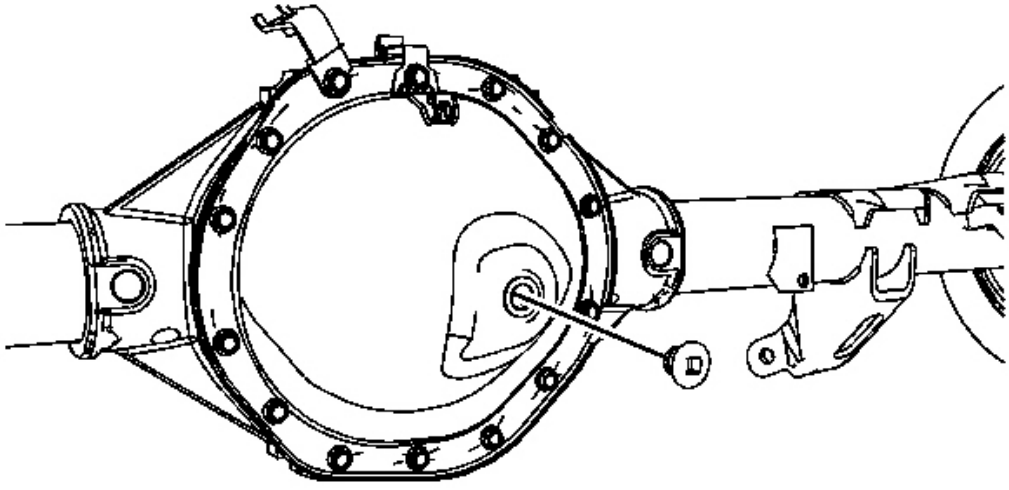


Fig. 34: View Of Rear Axle Fill Plug
Courtesy of GENERAL MOTORS CORP.

3. Install the fill plug.

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

4. 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** .

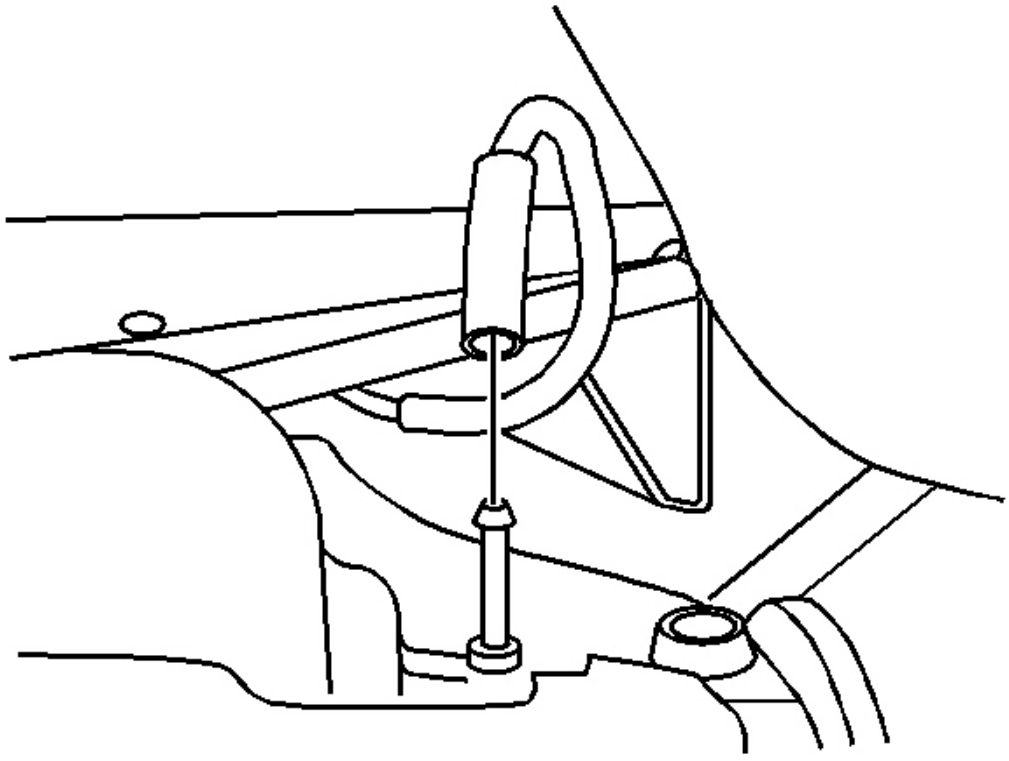


Fig. 35: View of Vent Hose
Courtesy of GENERAL MOTORS CORP.

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

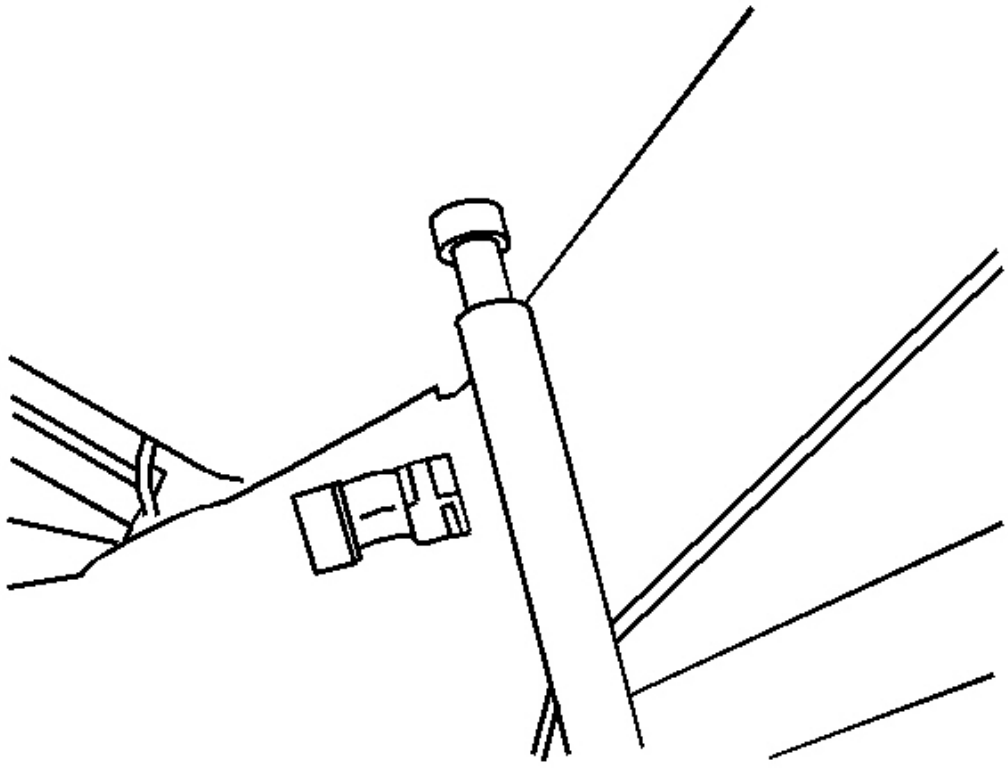


Fig. 36: View of Vent Hose Clip
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

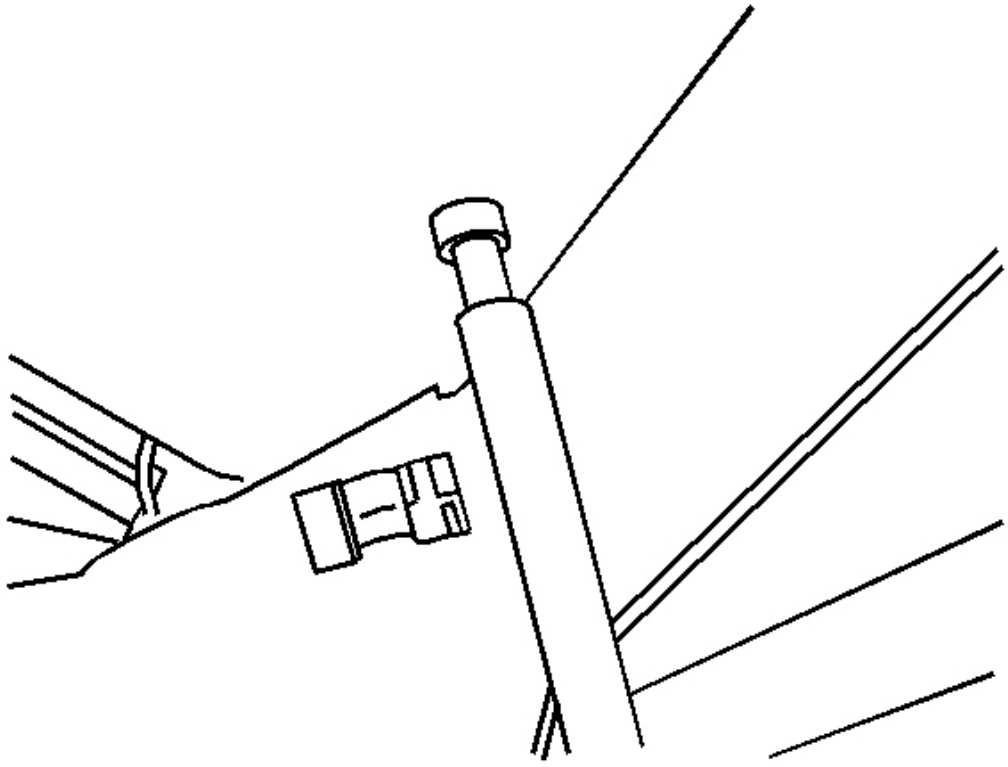


Fig. 37: View of Vent Hose Clip
Courtesy of GENERAL MOTORS CORP.

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.

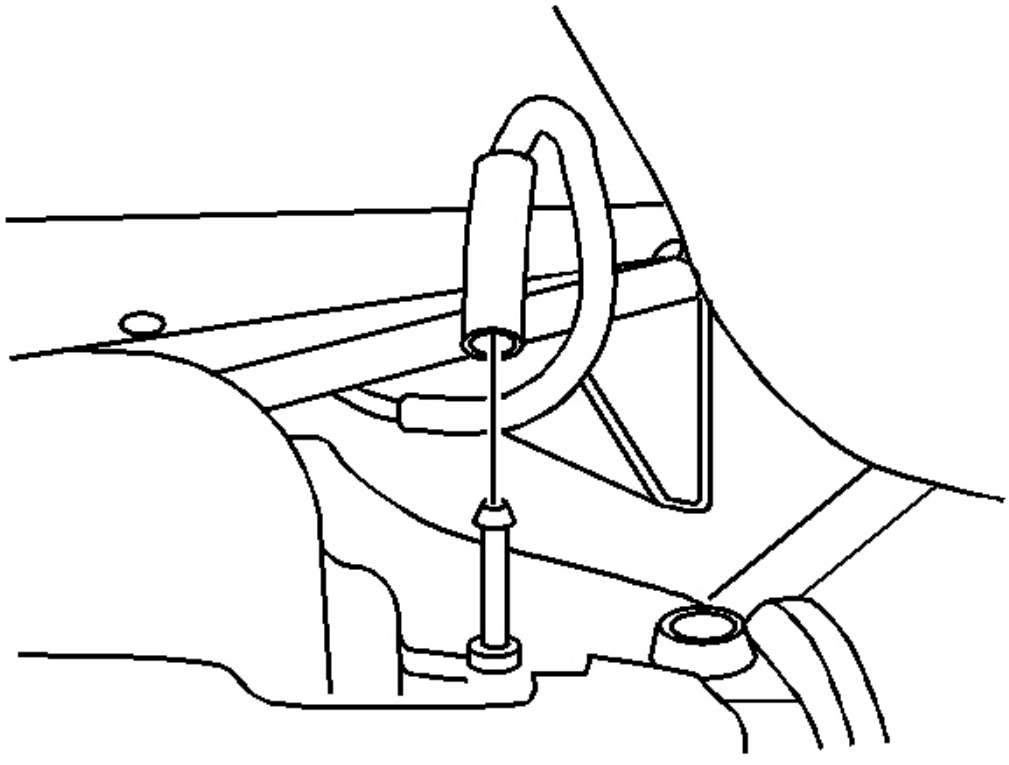


Fig. 38: View of Vent Hose
Courtesy of GENERAL MOTORS CORP.

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

REAR AXLE HOUSING COVER AND GASKET REPLACEMENT (8.0/8.6 INCH AXLE)

Removal Procedure

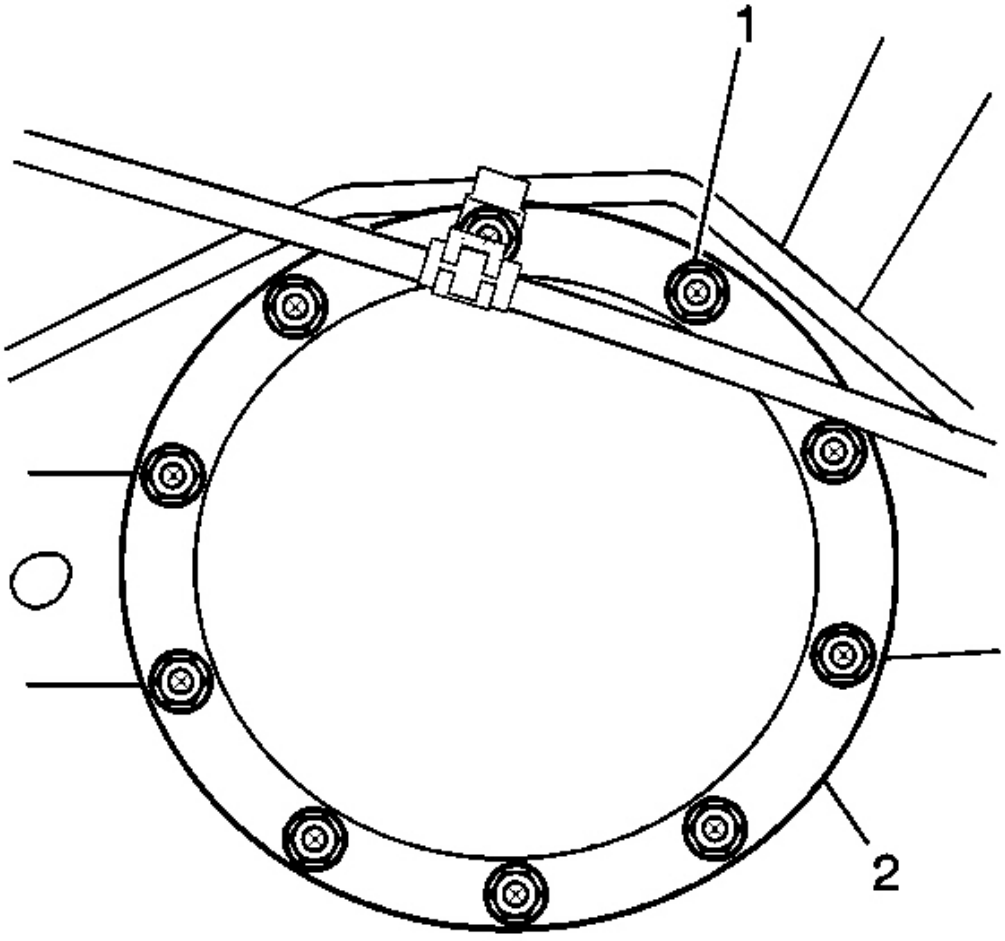


Fig. 39: Identifying Rear Axle Housing Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Drain the rear axle. Refer to **Rear Axle Lubricant Level Inspection (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Level Inspection (9.5 Inch LD 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.

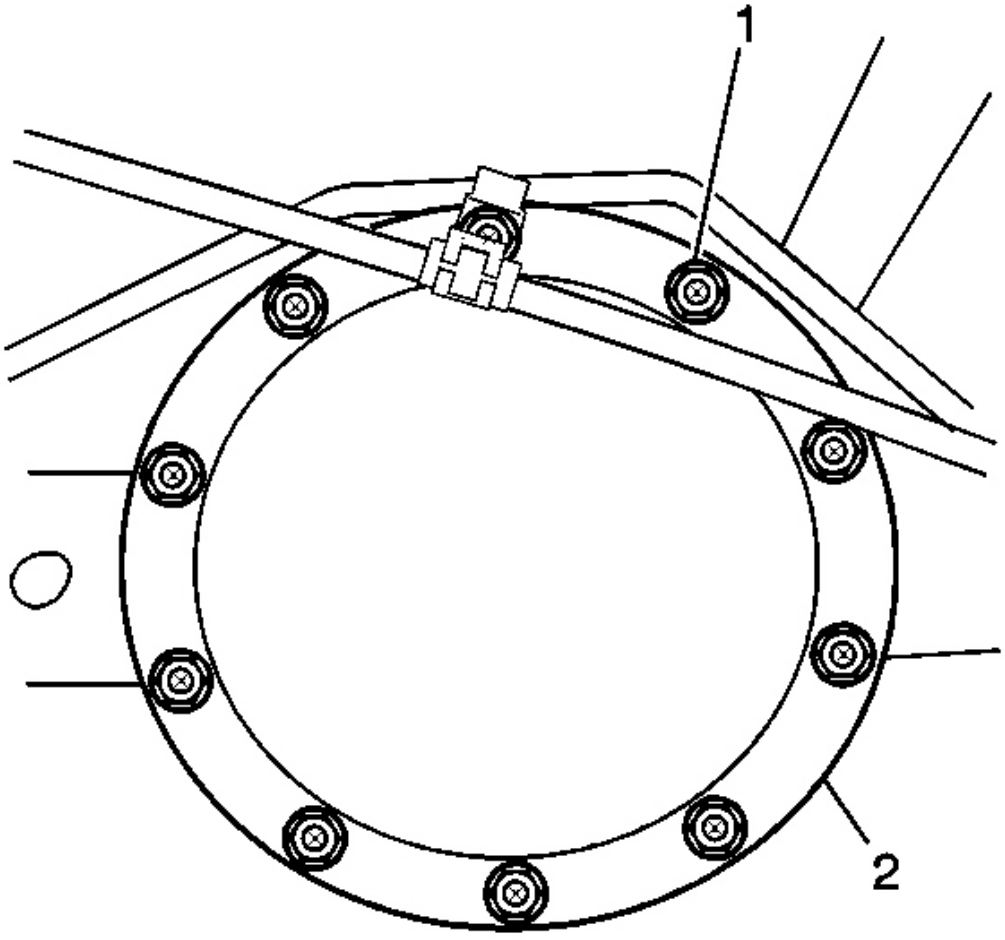


Fig. 40: Identifying Rear Axle Housing Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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 **Rear Axle Lubricant Level Inspection (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Level Inspection (9.5 Inch LD Axle)**.
7. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** .

REAR AXLE HOUSING COVER & GASKET REPLACEMENT (9.5 INCH AXLE)

Removal Procedure

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

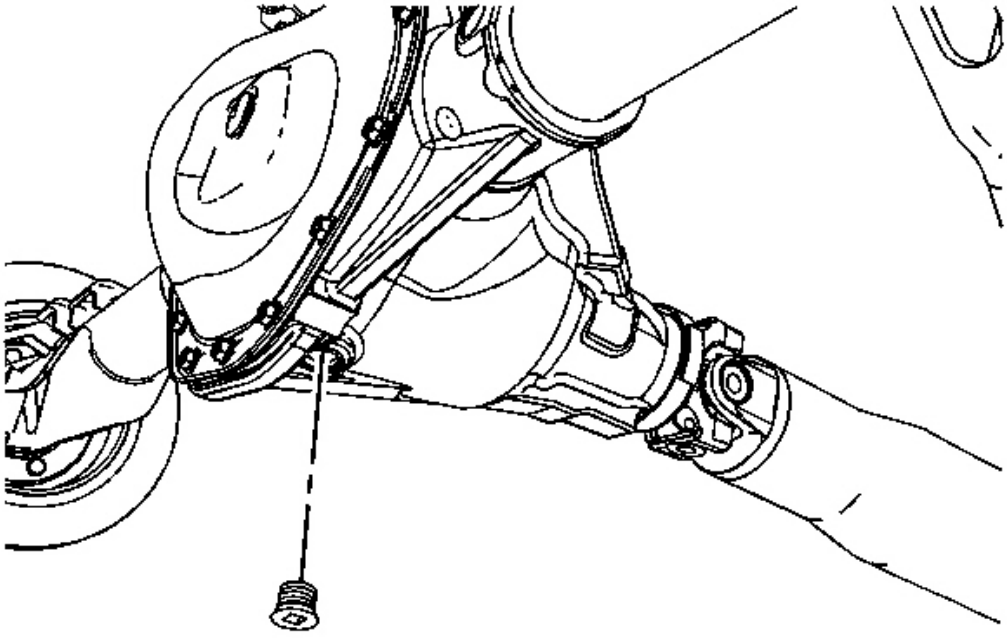


Fig. 41: View Of Drain Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the drain plug.

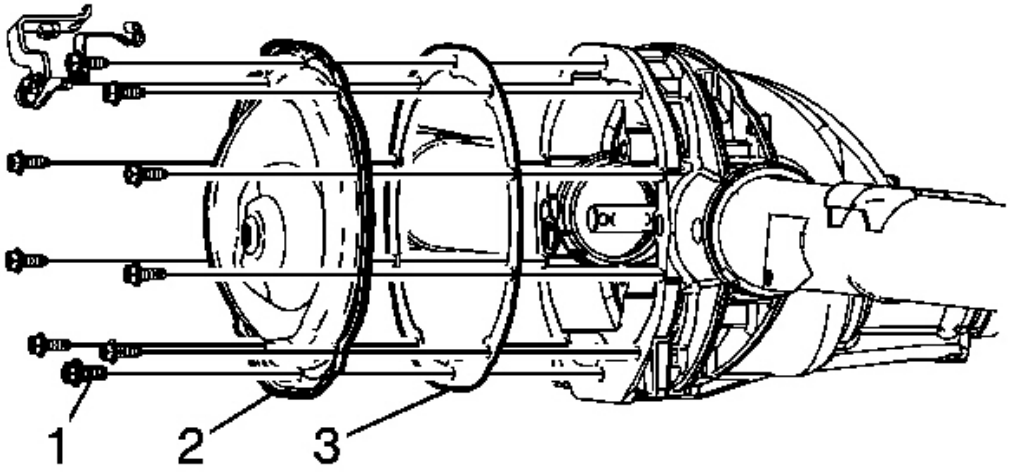


Fig. 42: View Of Rear Axle Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear axle cover bolts (1).
4. Remove the axle housing cover (2).
5. Remove the gasket (3).

Installation Procedure

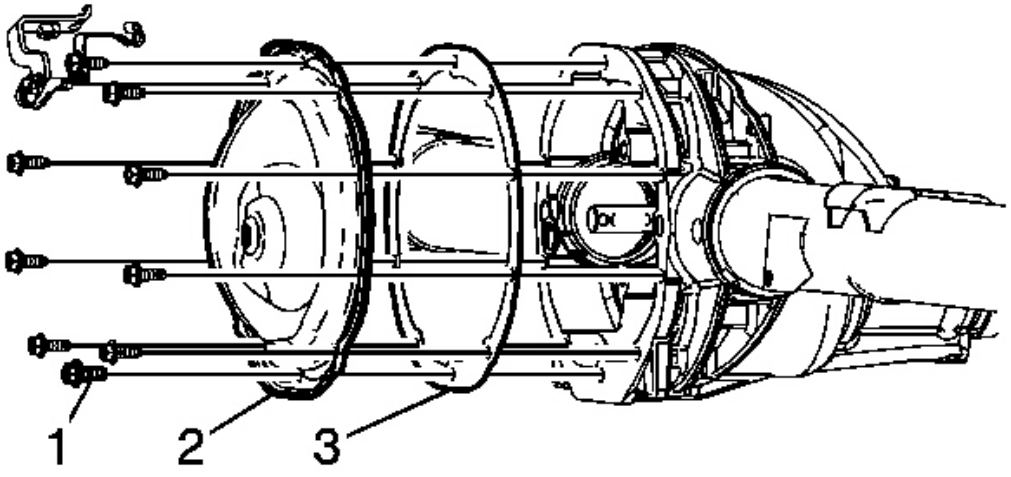


Fig. 43: View Of Rear Axle Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The axle housing gasket is reusable. Replace only if damaged.

1. Install the axle housing cover gasket (3).
2. Install the axle housing cover (2).

NOTE: Refer to Fastener Notice .

3. Install the mounting bolts (1).

Tighten: Tighten the bolts to 40 N.m (30 lb ft).

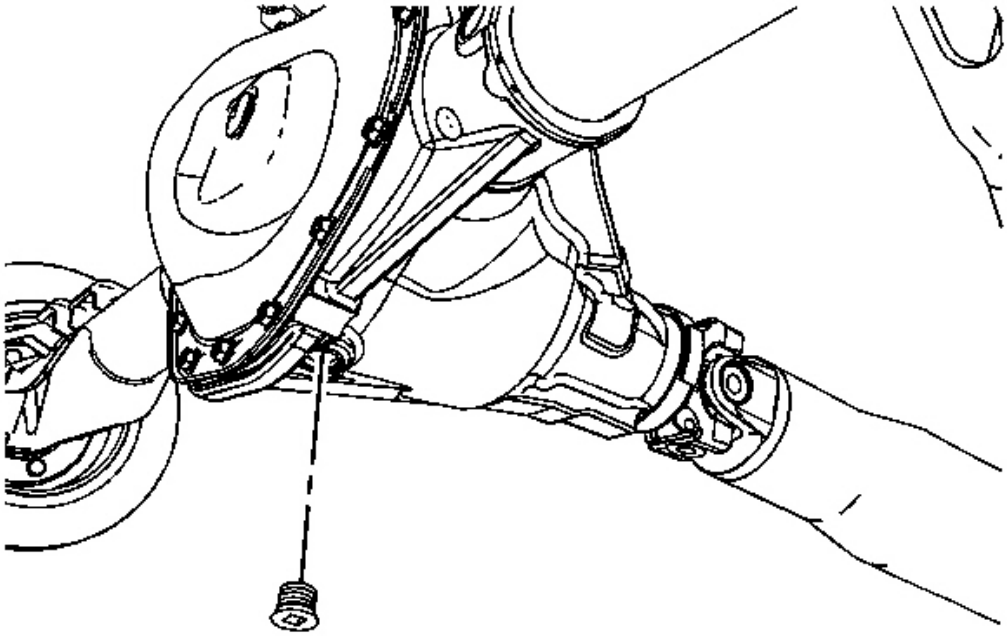


Fig. 44: View Of Drain Plug
Courtesy of GENERAL MOTORS CORP.

4. Install the drain plug.

   Tighten: Tighten the drain plug to 33 N.m (24 lb in).

5. Fill the rear axle with fluid.

   Specification: The lubricant level should be between 0-13 mm (0-0.5 inch) below the fill plug opening.

6. If the level is low, add lubricant until the level is even with the bottom of the fill plug opening. Use the proper fluid, refer to **Fluid and Lubricant Recommendations** .
7. Lower the vehicle.

REAR AXLE SHAFT REPLACEMENT

Tools Required

- **J 2619-01** Slide Hammer
- **J 45859** Axle Remover. See **Special Tools**.

Removal Procedure

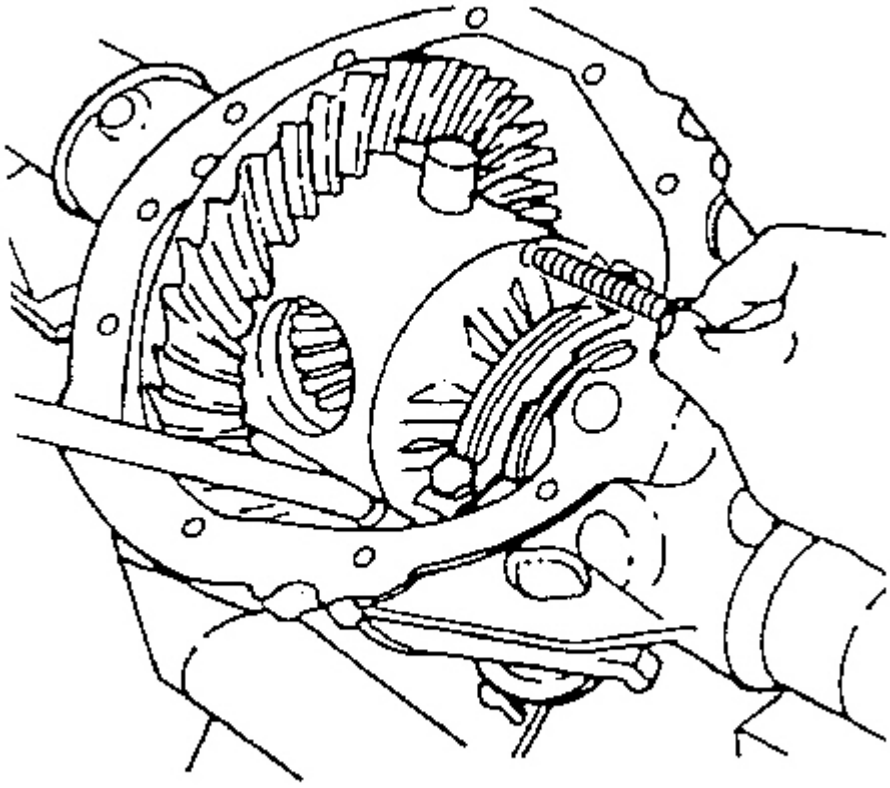


Fig. 45: View Of Pinion Shaft Locking Bolt
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the brake caliper. Refer to **Rear Brake Caliper Replacement** .
4. Remove the rear wheel speed sensor. Refer to **Rear Wheel Speed Sensor Replacement** .
5. Remove the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
6. Remove the pinion shaft locking bolt.

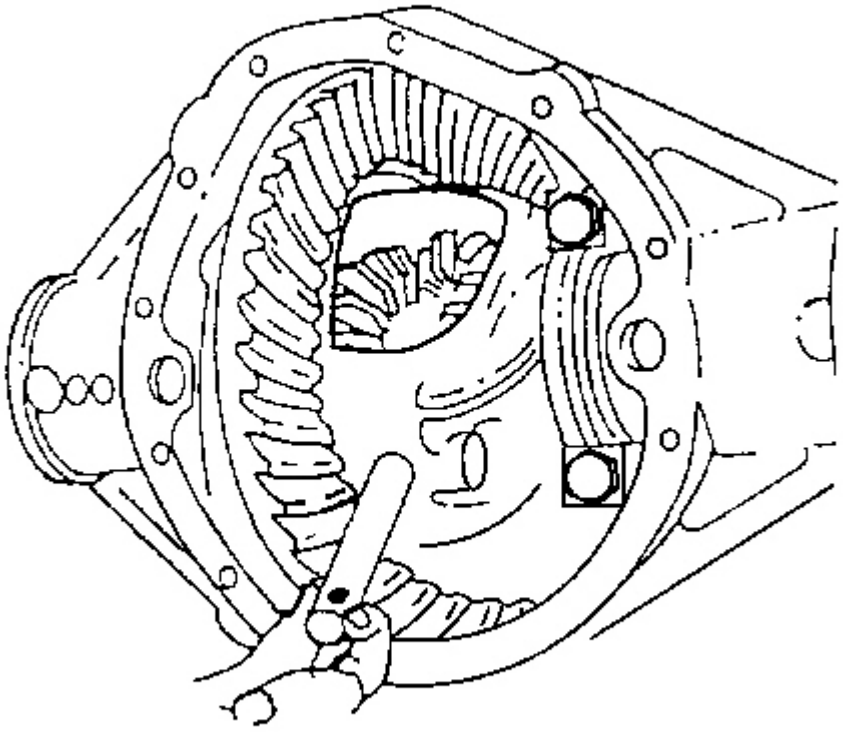


Fig. 46: View Of Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

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

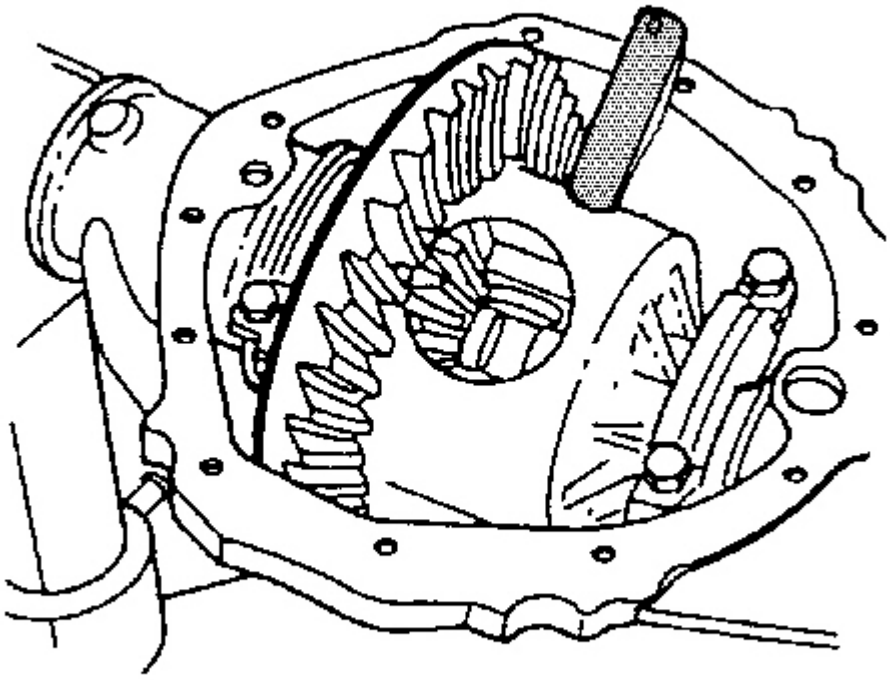


Fig. 47: View Of Pinion Shaft Contacting Axle Housing Top
Courtesy of GENERAL MOTORS CORP.

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

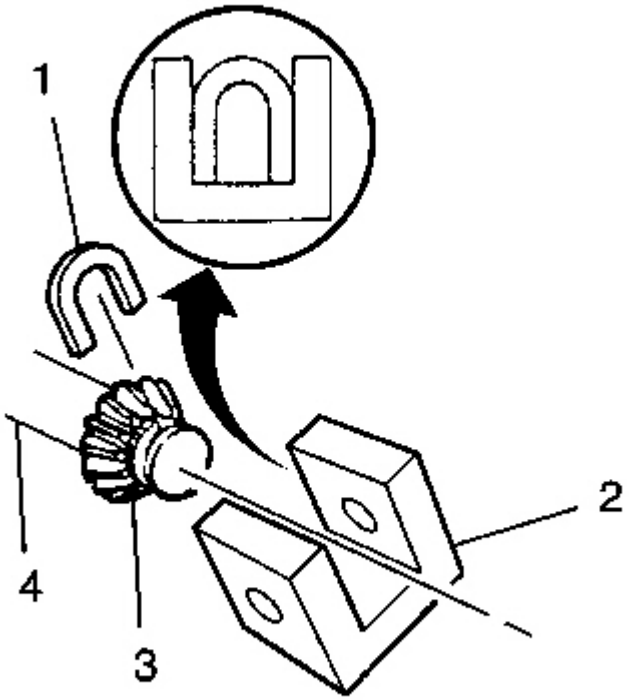


Fig. 48: View Of Axle Shaft, Lock & Thrust Block
Courtesy of GENERAL MOTORS CORP.

9. 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).
10. Push the flange of the axle shaft (1) toward the differential.

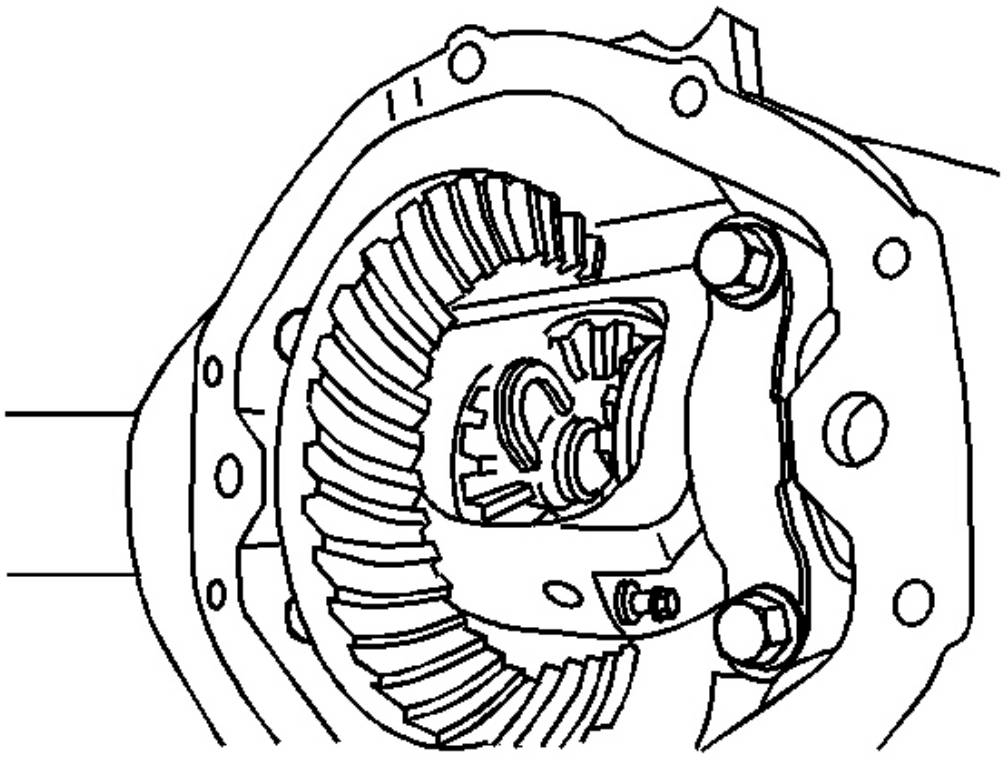


Fig. 49: View Of C-Lock From Button End Of Axle Shaft
Courtesy of GENERAL MOTORS CORP.

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

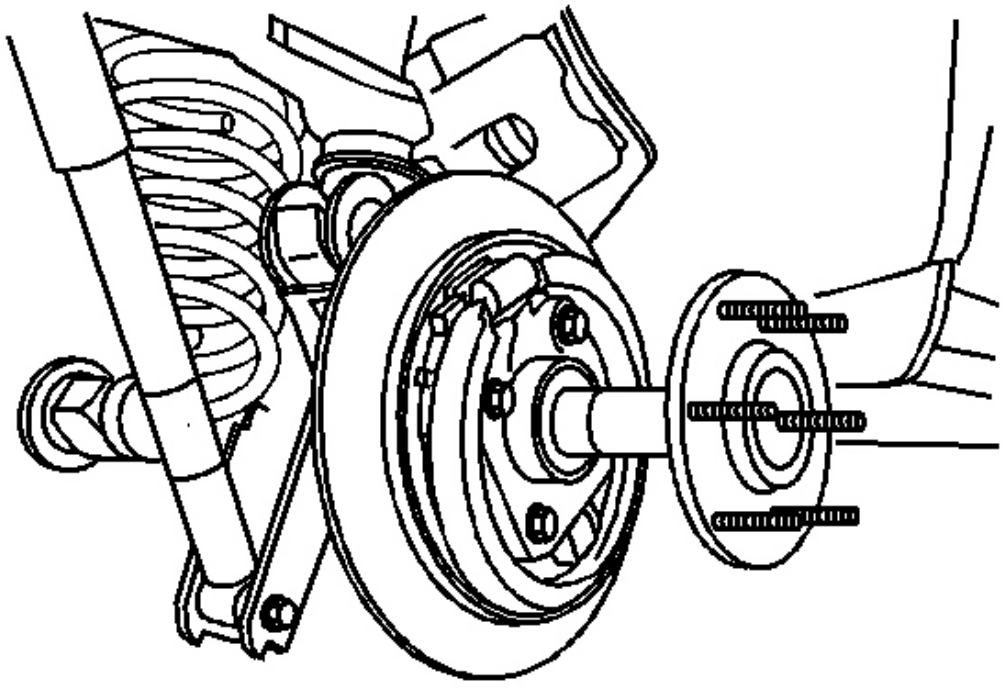


Fig. 50: View Of Rear Axle Assembly
Courtesy of GENERAL MOTORS CORP.

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.

12. Remove the axle shaft from the housing.

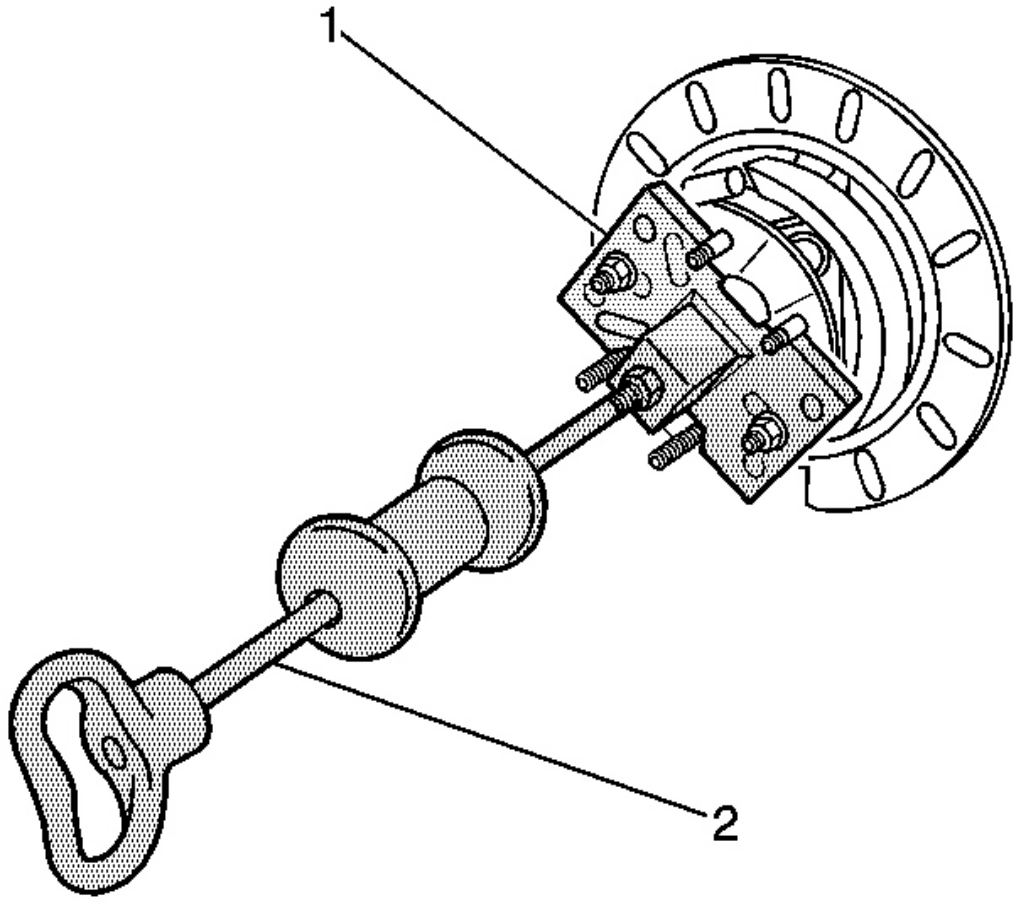


Fig. 51: Removing Axle Shaft Using J 45859 & J 2619-01
Courtesy of GENERAL MOTORS CORP.

13. If the axle is difficult to remove, use the **J 45859** (1) and the **J 2619-01** (2) to remove the axle shaft from the housing. See **Special Tools**.

Installation Procedure

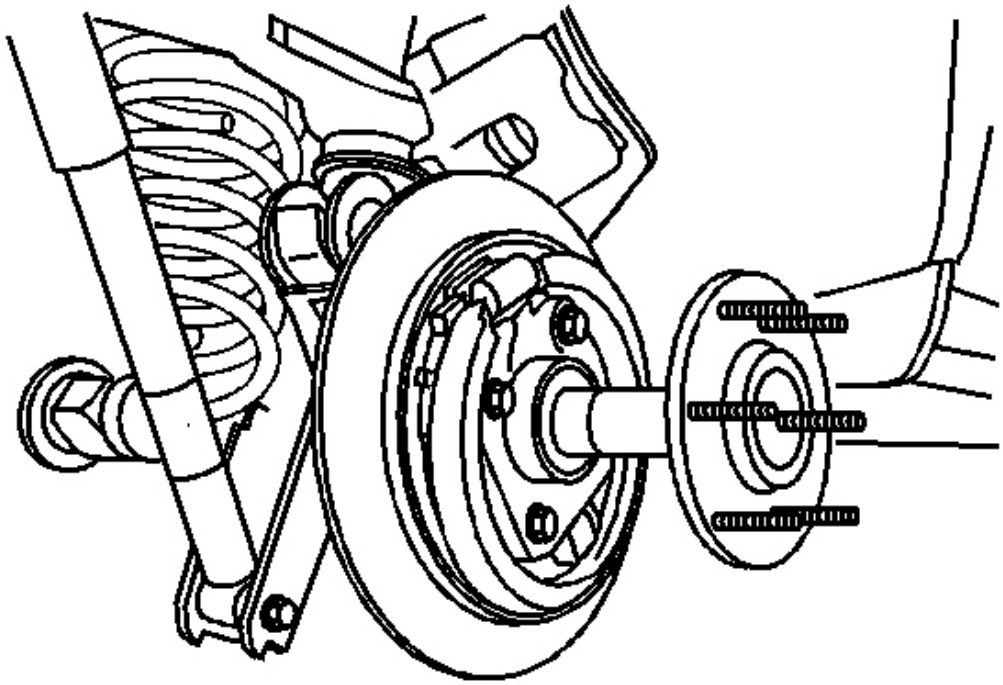


Fig. 52: View Of Rear Axle Assembly
Courtesy of GENERAL MOTORS CORP.

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.

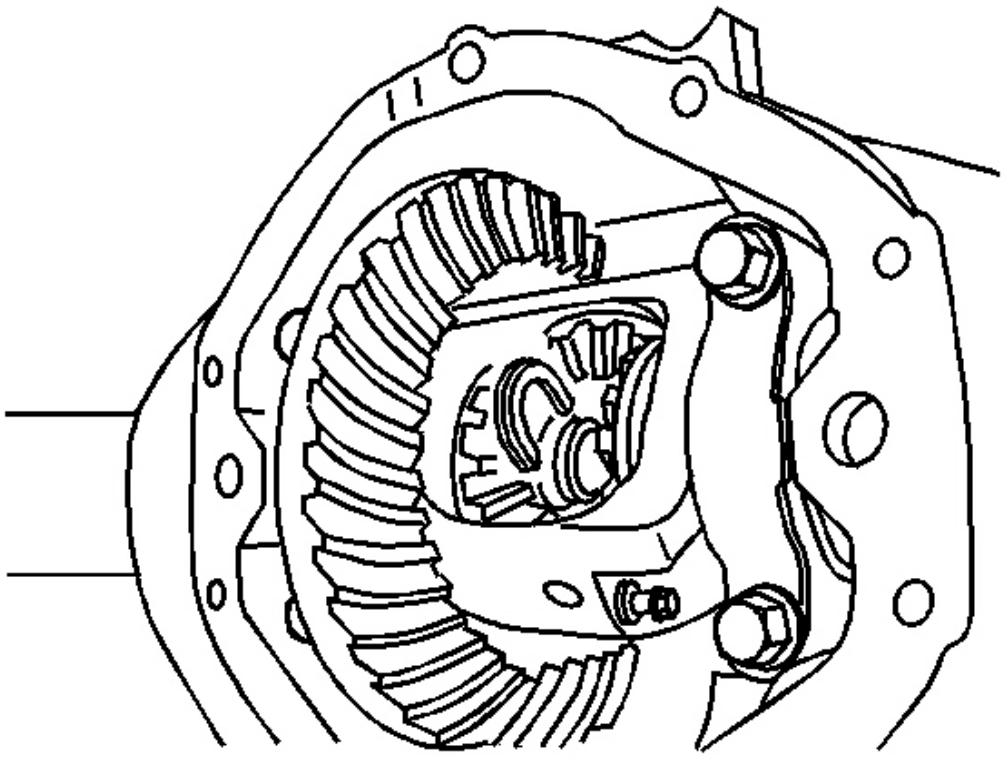


Fig. 53: View Of C-Lock From Button End Of Axle Shaft
Courtesy of GENERAL MOTORS CORP.

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.

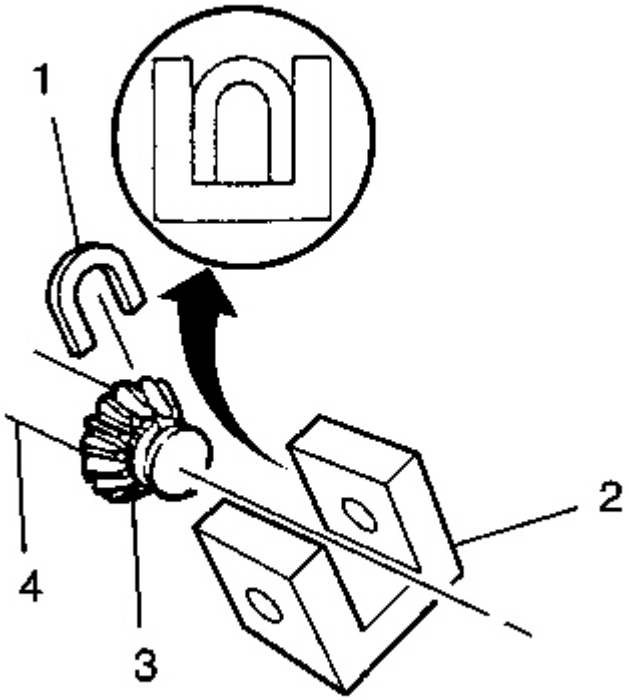


Fig. 54: View Of Axle Shaft, Lock & Thrust Block
Courtesy of GENERAL MOTORS CORP.

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.

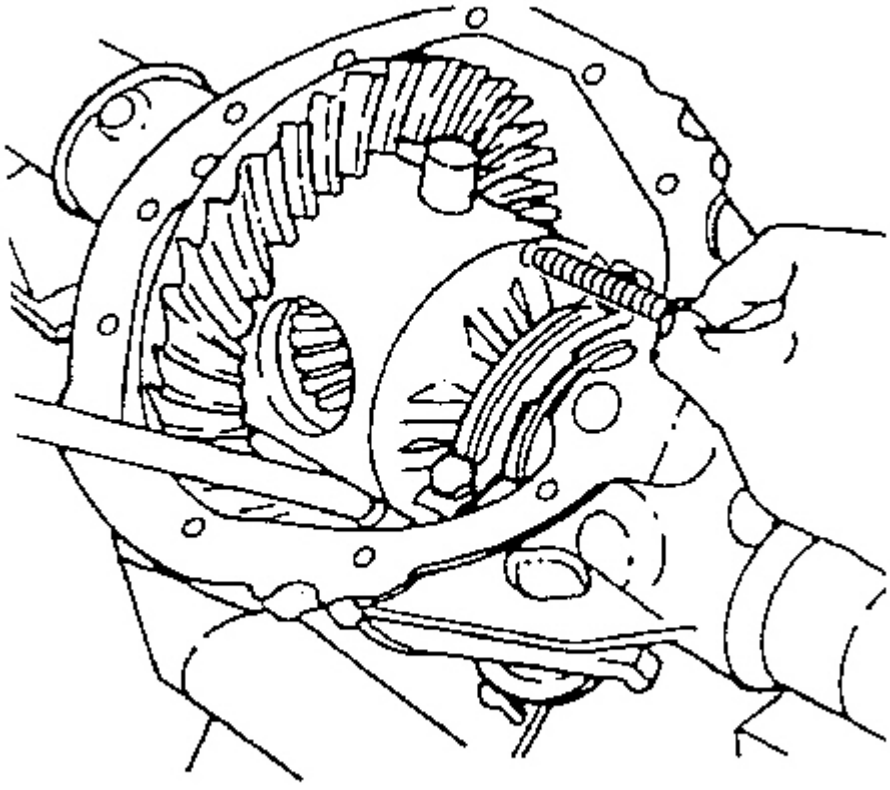


Fig. 55: View Of Pinion Shaft Locking Bolt
Courtesy of GENERAL MOTORS CORP.

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

NOTE: Refer to Fastener Notice .

8. Install the new pinion shaft locking bolt.

Tighten:

- For the 8.0/8.6 inch axle, tighten the pinion shaft locking bolt to 36 N.m (27 lb ft).
- For the 9.5 LD inch axle, tighten the pinion shaft locking bolt to 50 N.m (37 lb ft).

9. Install the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.

10. Install the brake caliper. Refer to **Rear Brake Caliper Replacement** .
11. Install the rear wheel speed sensor. Refer to **Rear Wheel Speed Sensor Replacement** .
12. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
13. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Rear Axle Lubricant Level Inspection (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Level Inspection (9.5 Inch LD Axle)**.
14. Lower the vehicle.

REAR AXLE SHAFT SEAL & BEARING REPLACEMENT

Tools Required

- **J 8092** Universal Driver Handle- 3/4 in - 10
- **J 21128** Axle Pinion Oil Seal Installer
- **J 23690** Bearing Installer
- **J 2619-01** Slide Hammer
- **J 45857** Tone Wheel and/or Bearing Remover

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the rear axle housing cover and the gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
4. Remove the axle shaft. Refer to **Rear Axle Shaft Replacement**.
5. To remove the seal only, use a suitable seal remover.

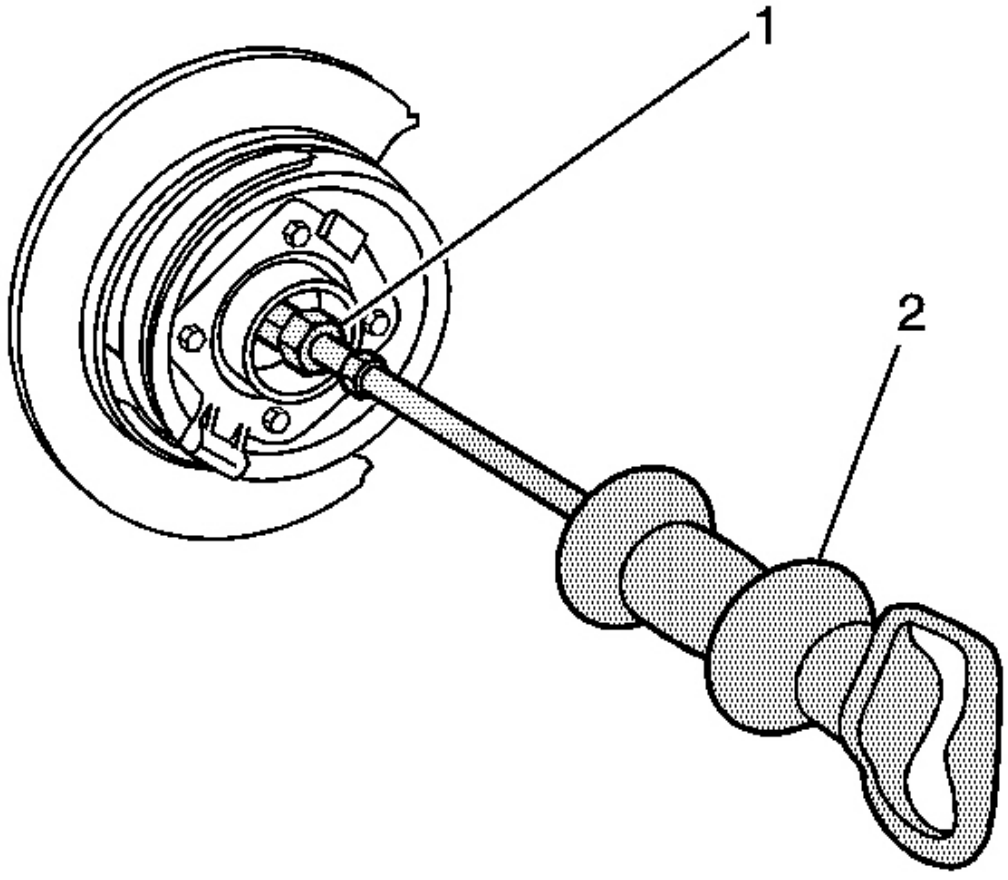


Fig. 56: View Of Wheel Speed Sensor Ring, Axle Housing & Removal Tool
Courtesy of GENERAL MOTORS CORP.

6. Remove the axle shaft seal and the bearing together from the axle housing, using the **J 45857** (1) and the **J 2619-01** (2).

Installation Procedure

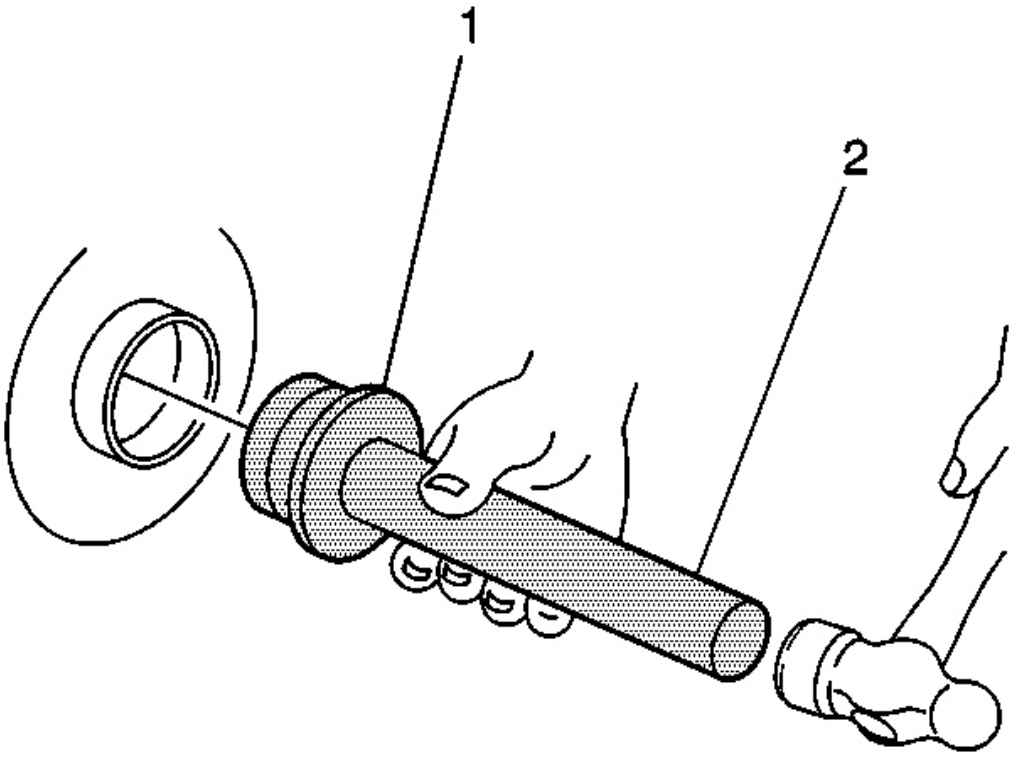


Fig. 57: Installing The Axle Shaft Bearing Using J 23690 Or J 29709 & J 8092
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 23690** (1) and the **J 8092** (2), install the axle shaft bearing.
2. Drive the axle shaft bearing into the axle housing until the tool bottoms against the tube.

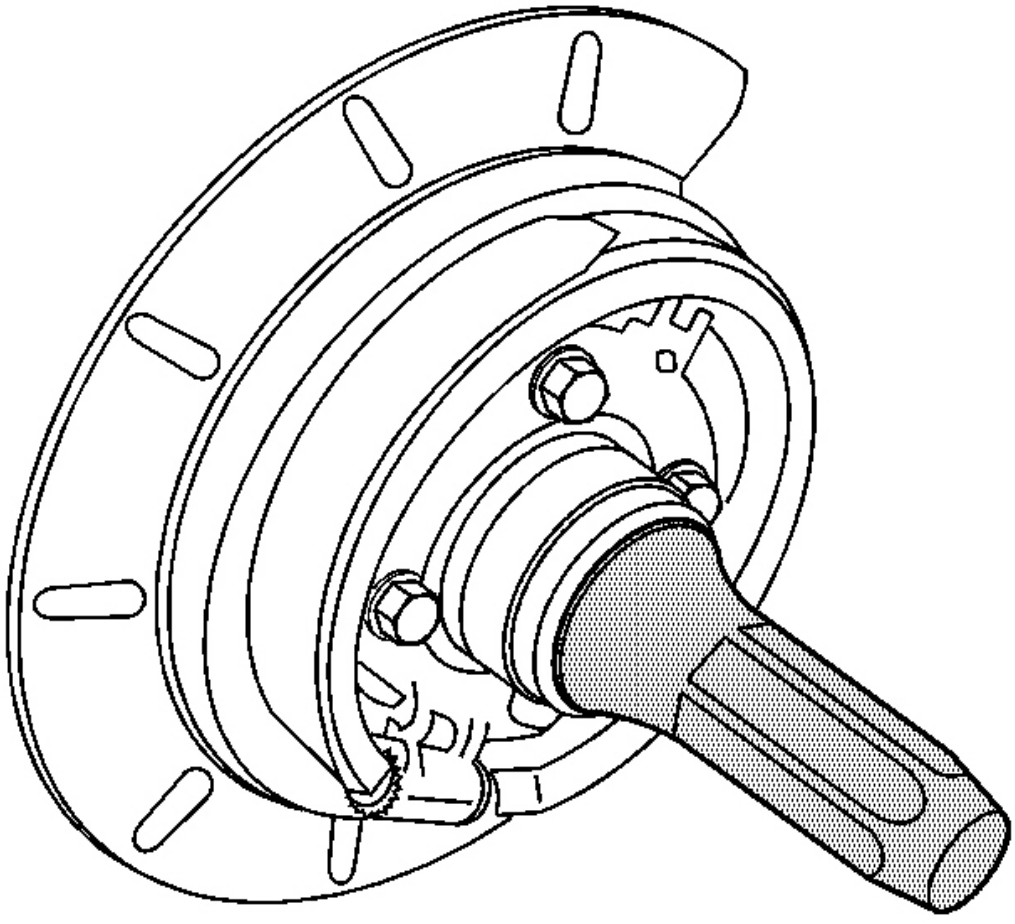


Fig. 58: View Of Axle Shaft Seal & J 21128
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 21128** , install the axle shaft seal.
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 (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
8. Fill the rear axle with axle lubricant. Use the proper fluid. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
9. Lower the vehicle.

DRIVE PINION FLANGE/YOKE & 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** .
2. Drain the drive axle. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
3. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
4. Remove the rear brake calipers. Refer to **Rear Brake Caliper Replacement** .
5. Remove the brake rotors. Refer to **Rear Brake Rotor Replacement** .
6. Remove the propeller shaft. Refer to **Rear Propeller Shaft Replacement** .

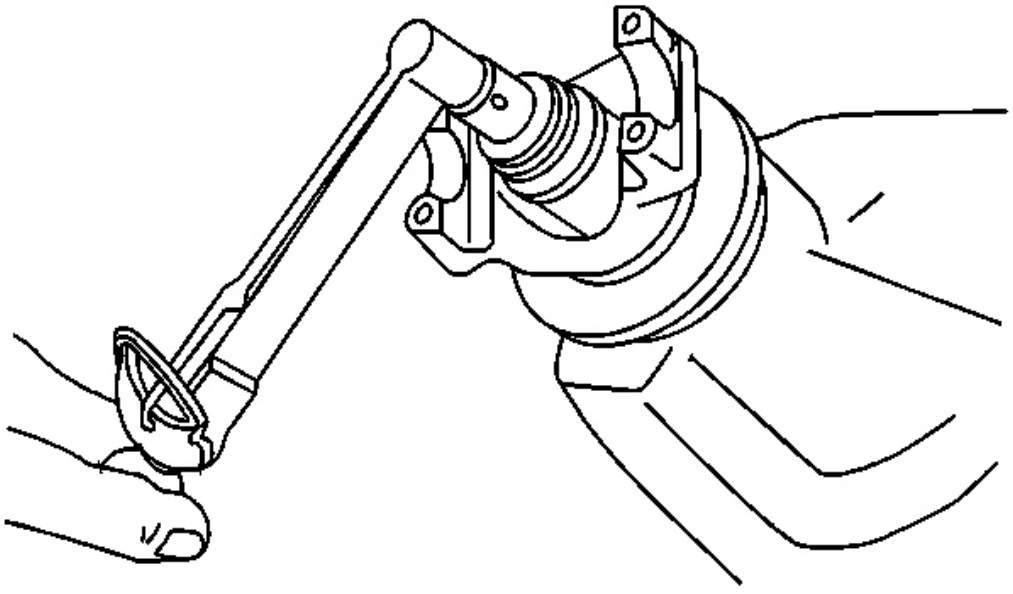


Fig. 59: Measuring Pinion Rotating Torque
Courtesy of GENERAL MOTORS CORP.

7. 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

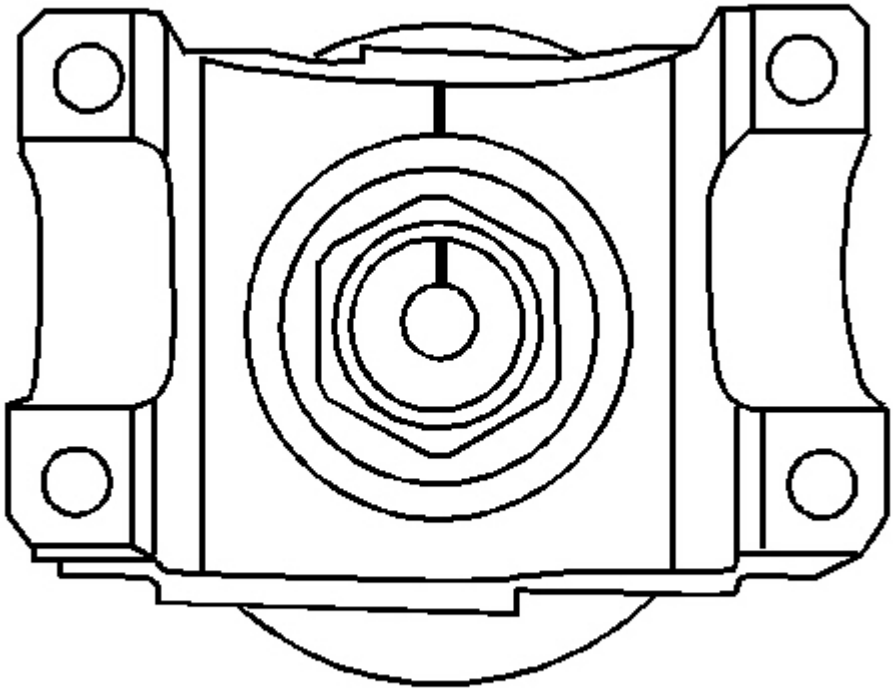


Fig. 60: View Of Pinion Shaft & Pinion Yoke Alignment Marks
Courtesy of GENERAL MOTORS CORP.

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

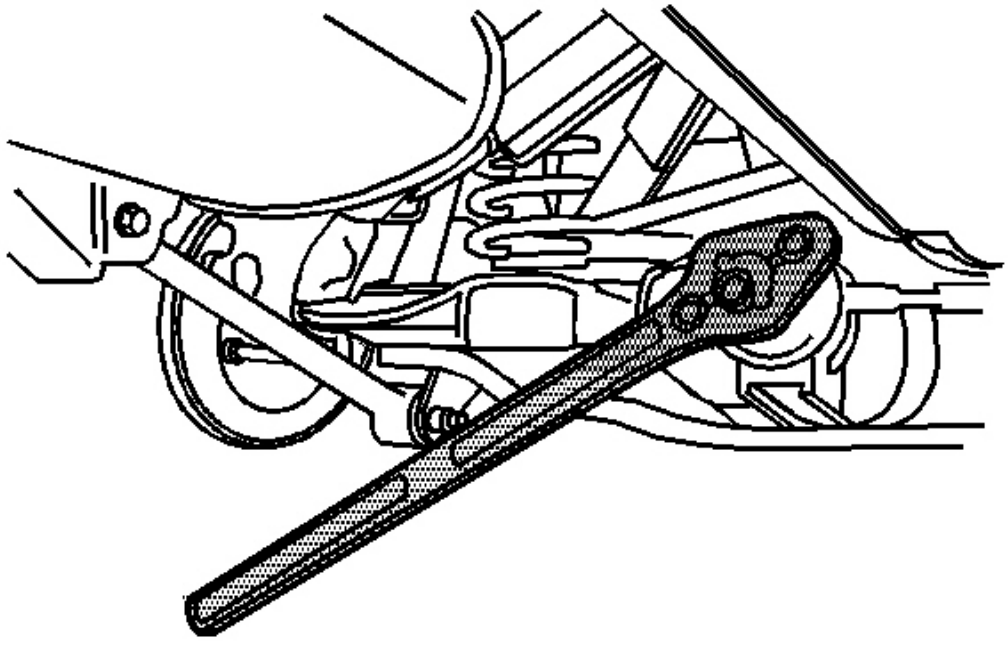


Fig. 61: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

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

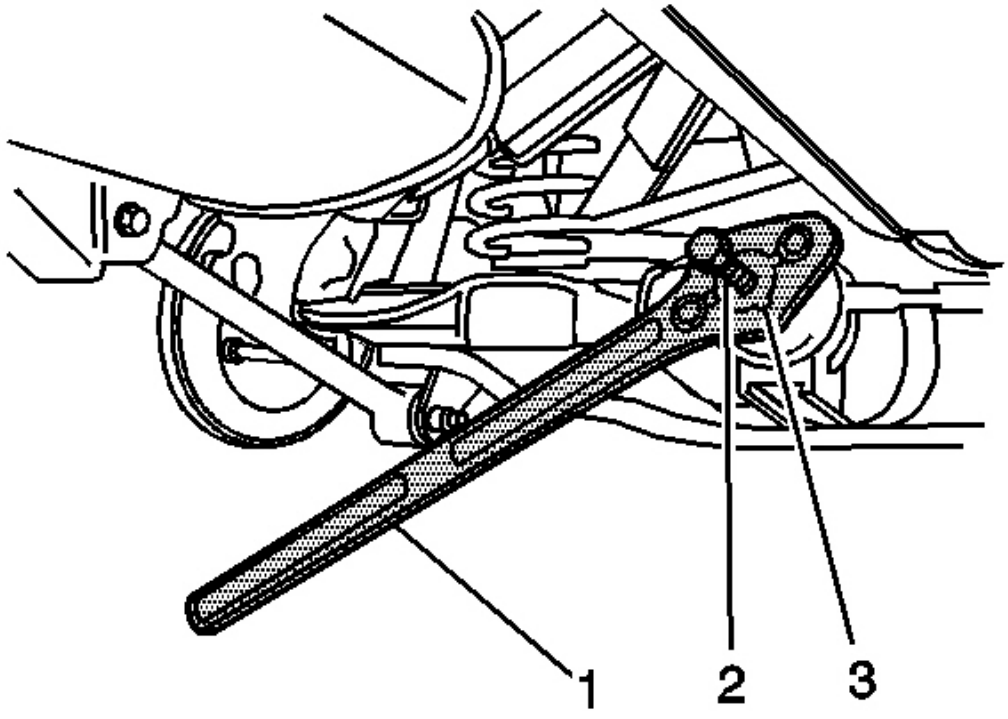


Fig. 62: Using J 8614-3, J 8614-2 & J 8614-01
Courtesy of GENERAL MOTORS CORP.

12. Install the J 8614-3 (2) and the J 8614-2 (3) into the **J 8614-01** (1) as shown.
13. 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.

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

Installation Procedure

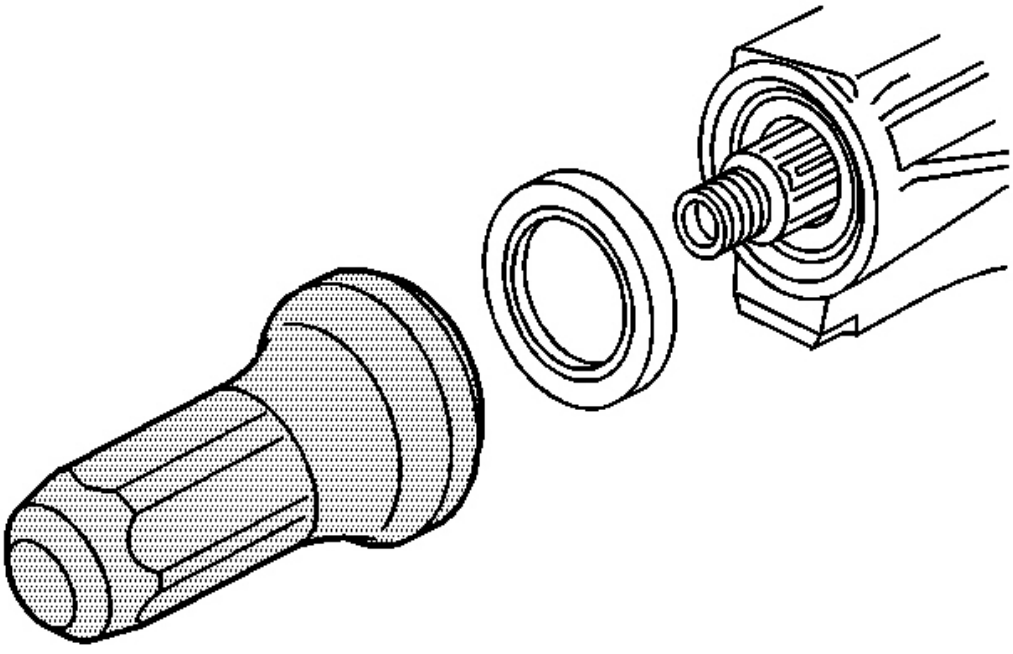


Fig. 63: View Of Pinion Gear Oil Seal & Installation Tool
Courtesy of GENERAL MOTORS CORP.

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.

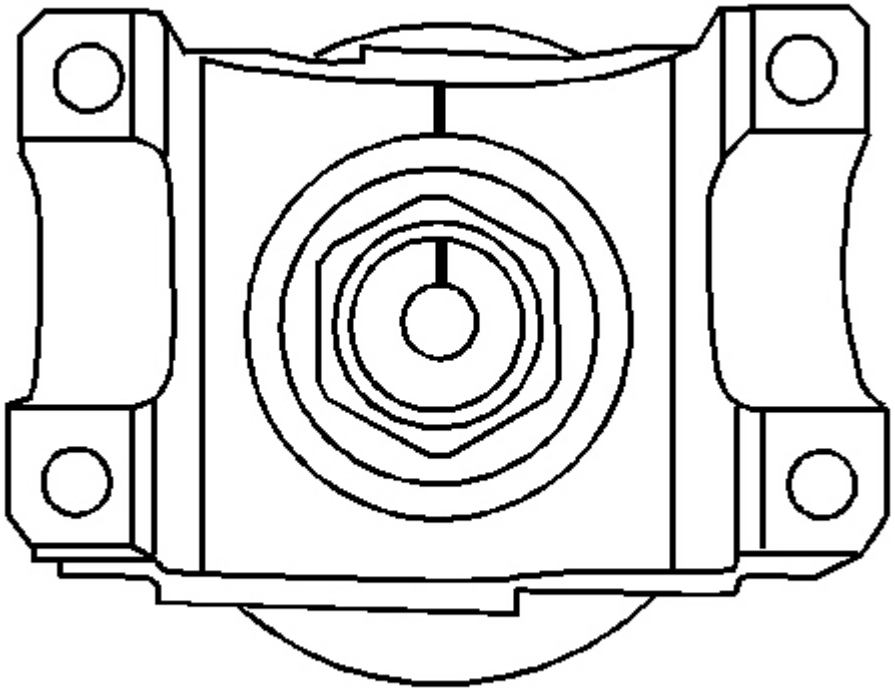


Fig. 64: View Of Pinion Shaft & Pinion Yoke Alignment Marks
Courtesy of GENERAL MOTORS CORP.

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.

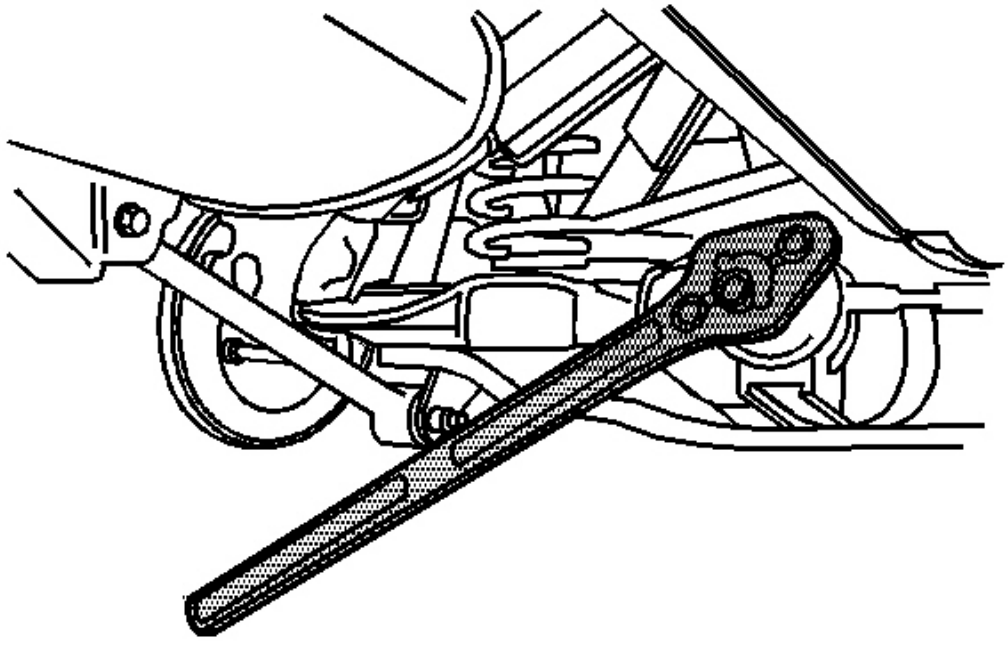


Fig. 65: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

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

NOTE: Refer to Fastener Notice .

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.

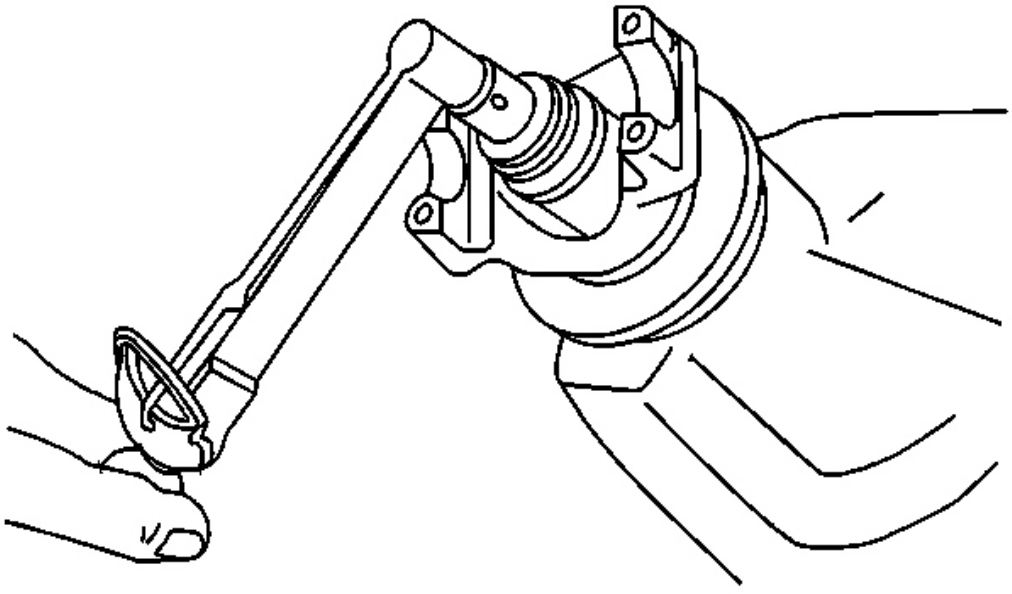


Fig. 66: Measuring Pinion Rotating Torque
Courtesy of GENERAL MOTORS CORP.

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 **Rear Propeller Shaft Replacement** .
11. Install the brake rotors. Refer to **Rear Brake Rotor Replacement** .
12. Install the brake calipers. Refer to **Rear Brake Caliper Replacement** .
13. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
14. Fill the drive axle. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch 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** .
2. Remove the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the axle shafts. Refer to **Rear Axle Shaft Replacement**.
4. Remove the differential assembly. Refer to **Differential Replacement**.
5. Remove the drive pinion yoke and the oil seal. Refer to **Drive Pinion Flange/Yoke and/or Oil Seal Replacement**.

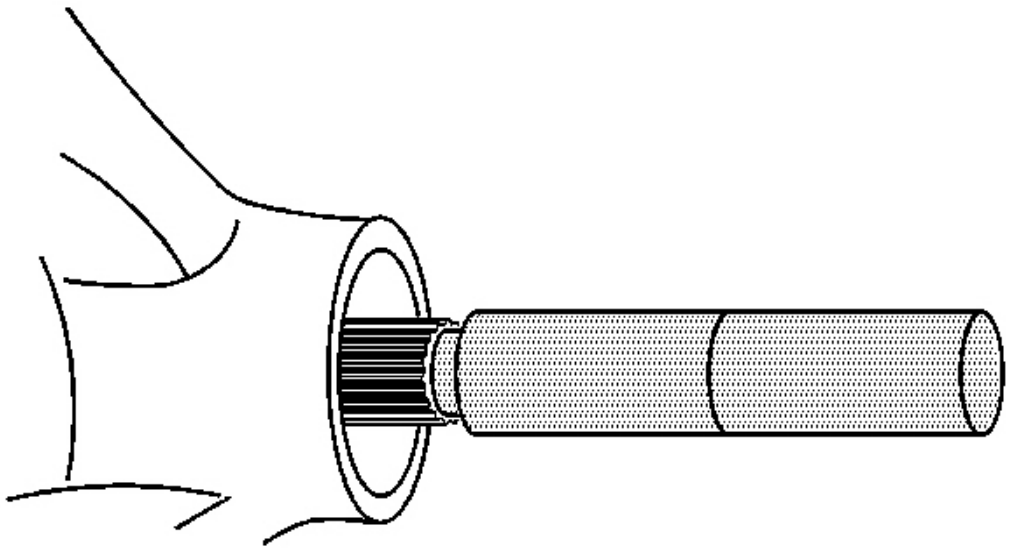


Fig. 67: View Of Special Tool J 22536 On Pinion
Courtesy of GENERAL MOTORS CORP.

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

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

7. Using the **J 22536** and a hammer, remove the drive the pinion. See **Special Tools**.
8. Strike the **J 22536** slowly. See **Special Tools**. Do not let the pinion fall out of the rear axle housing.

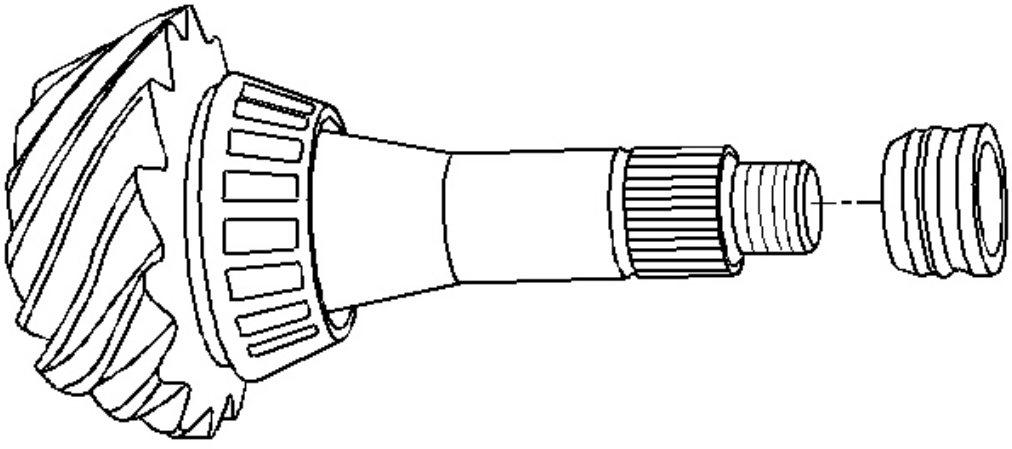


Fig. 68: View Of Collapsible Spacer & Pinion
Courtesy of GENERAL MOTORS CORP.

9. Remove the collapsible spacer from the pinion. Discard the spacer, DO NOT reuse.
10. Remove the pinion bearings and the cups. Refer to **Drive Pinion Bearings Replacement**.
11. Remove the left-hand threaded ring gear bolts. Discard the bolts, DO NOT reuse.
12. Remove the ring gear from the differential. Drive the gear off with a brass drift if necessary.

Installation Procedure

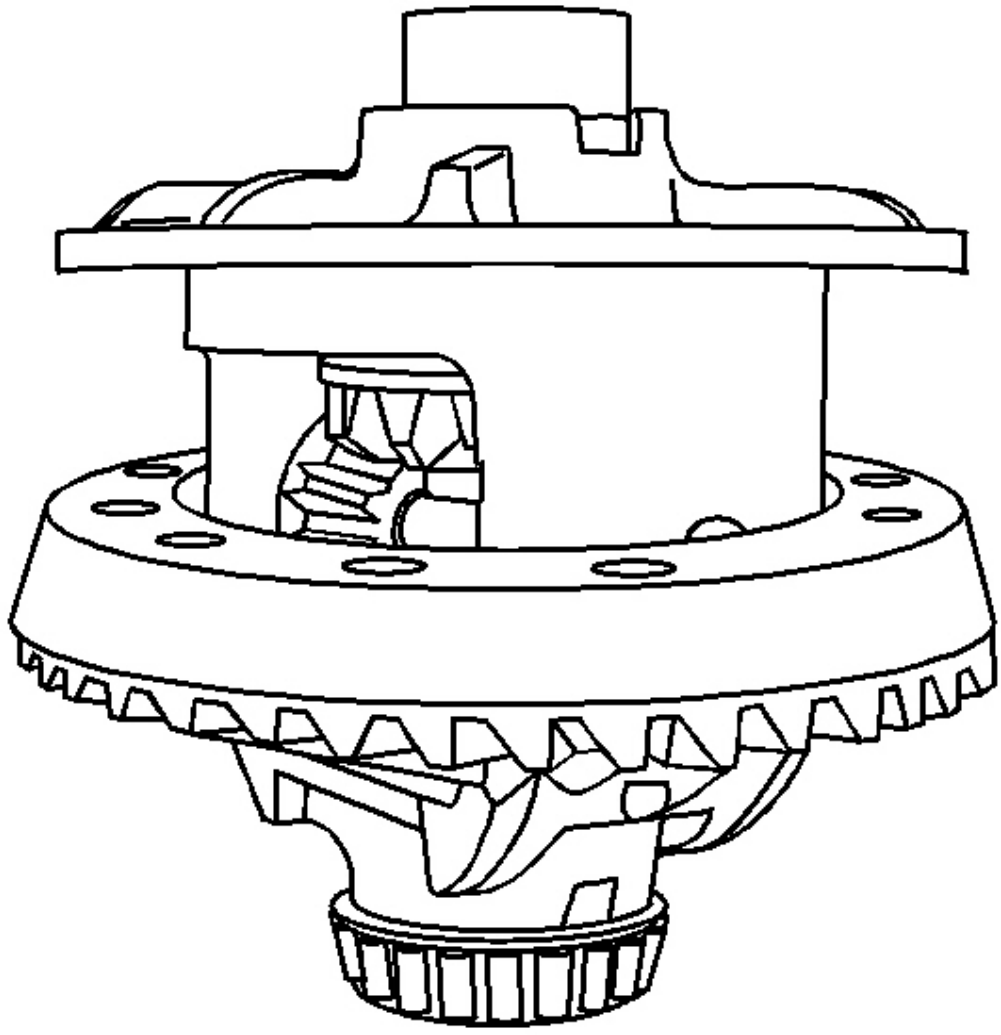


Fig. 69: Ring Gear & Differential Case
Courtesy of GENERAL MOTORS CORP.

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.

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

NOTE: Refer to Fastener Notice .

3. Tighten the ring gear bolts.

   Tighten:

   - For the 8.0/8.6 inch axle, tighten the ring gear bolts in sequence to 120 N.m (89 lb ft).
   - For the 9.5 inch axle, tighten the ring gear bolts in sequence to 140 N.m (103 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** .
10. Install the pinion to the axle housing.
11. Install the outer pinion bearing.

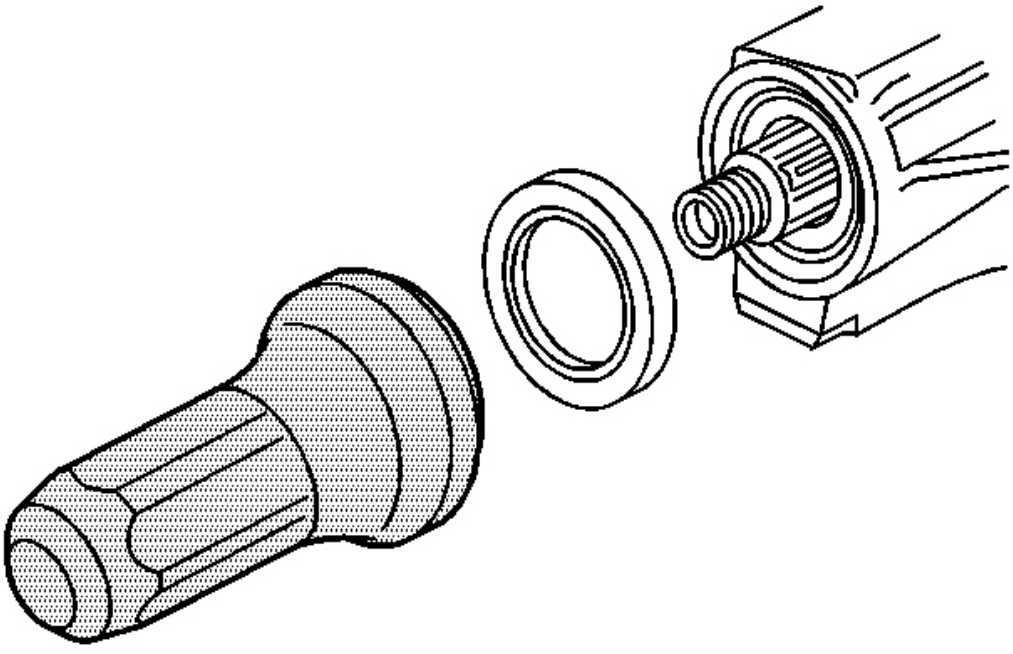


Fig. 70: View Of Pinion Gear Oil Seal & Installation Tool
Courtesy of GENERAL MOTORS CORP.

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

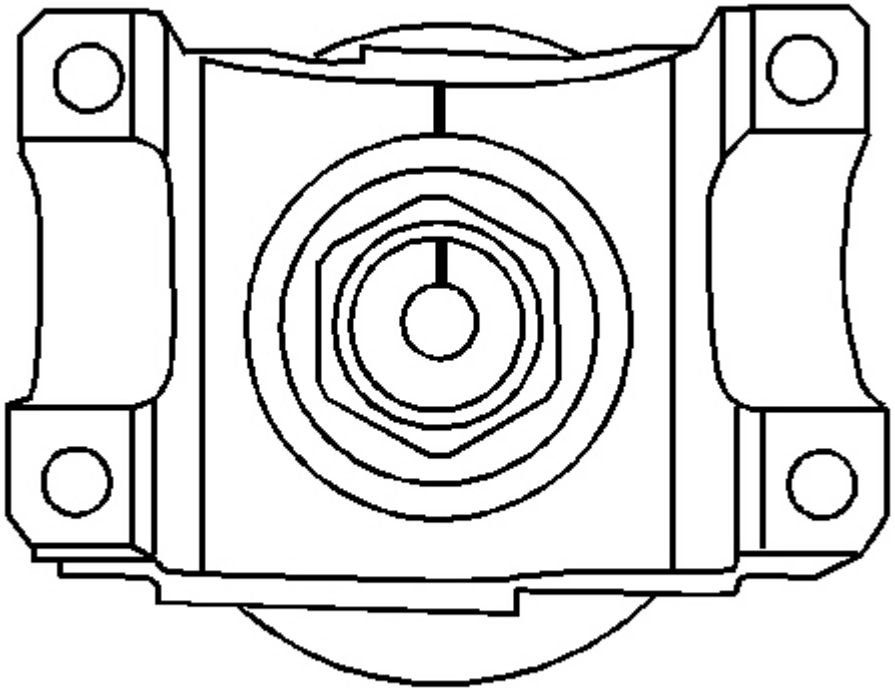


Fig. 71: View Of Pinion Shaft & Pinion Yoke Alignment Marks
Courtesy of GENERAL MOTORS CORP.

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.

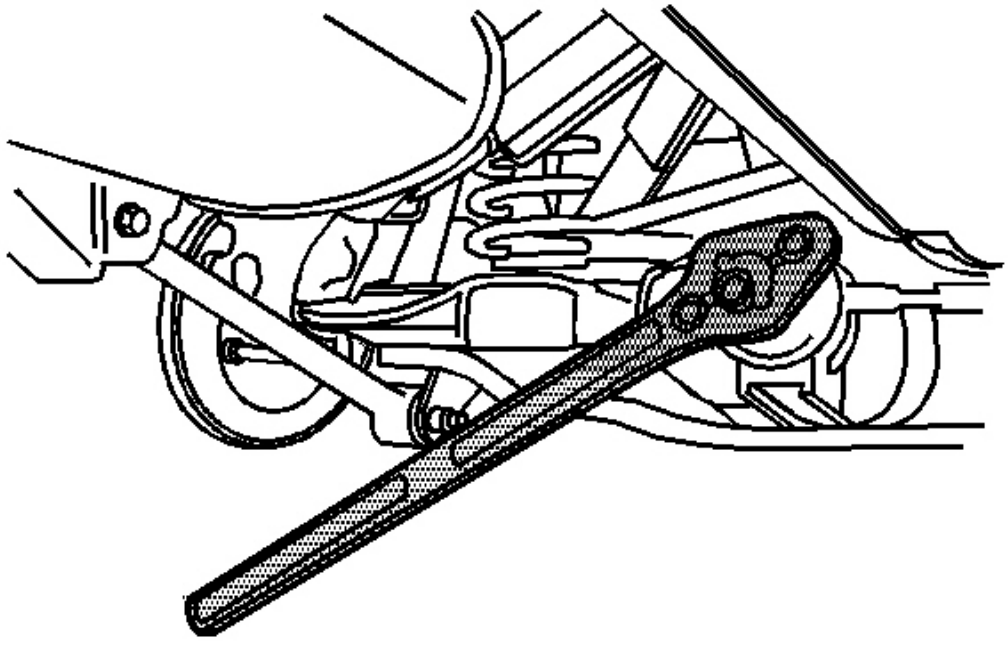


Fig. 72: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

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.

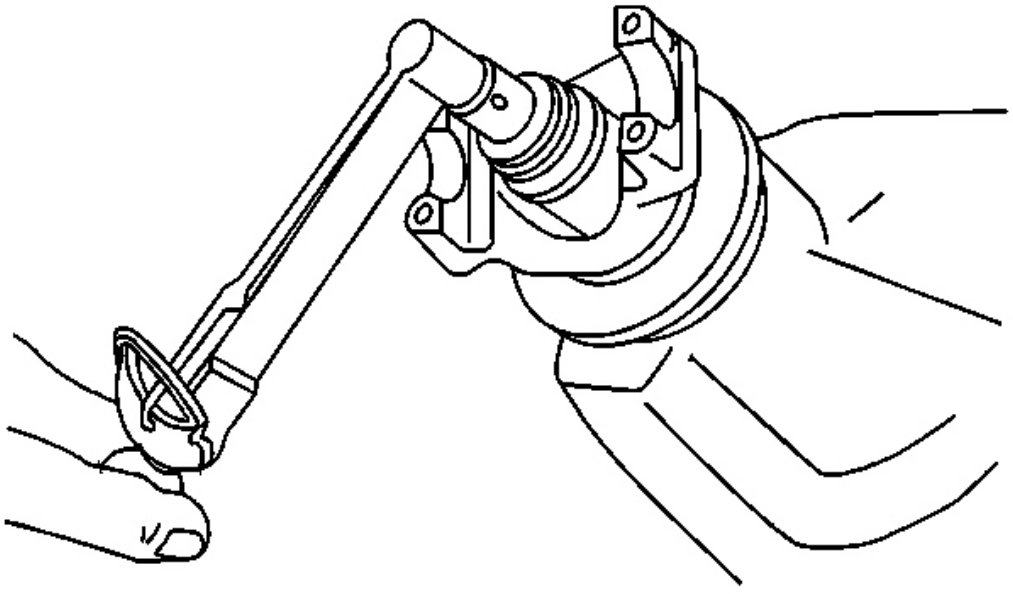


Fig. 73: Measuring Pinion Rotating Torque
Courtesy of GENERAL MOTORS CORP.

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**.
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 tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
26. Fill the axle with axle lubricant. Use the proper fluid. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
27. Lower the vehicle.

DRIVE PINION BEARINGS REPLACEMENT

Tools Required

- **J 7817** Outer Bearing Race Installer. See **Special Tools**.
- **J 7818** Inner 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 22306** Rear Pinion Clip Bearing Installer. See **Special Tools**.
- **J 22912-B** Split-Plate Bearing Puller
- **J 24433** Pinion Cone and Side Bearing Installer. See **Special Tools**.
- **J 36614** 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** .
2. Remove the differential. Refer to **Differential Replacement**.
3. Remove the drive pinion from the axle. Refer to **Drive Pinion and Ring Gear Replacement**.

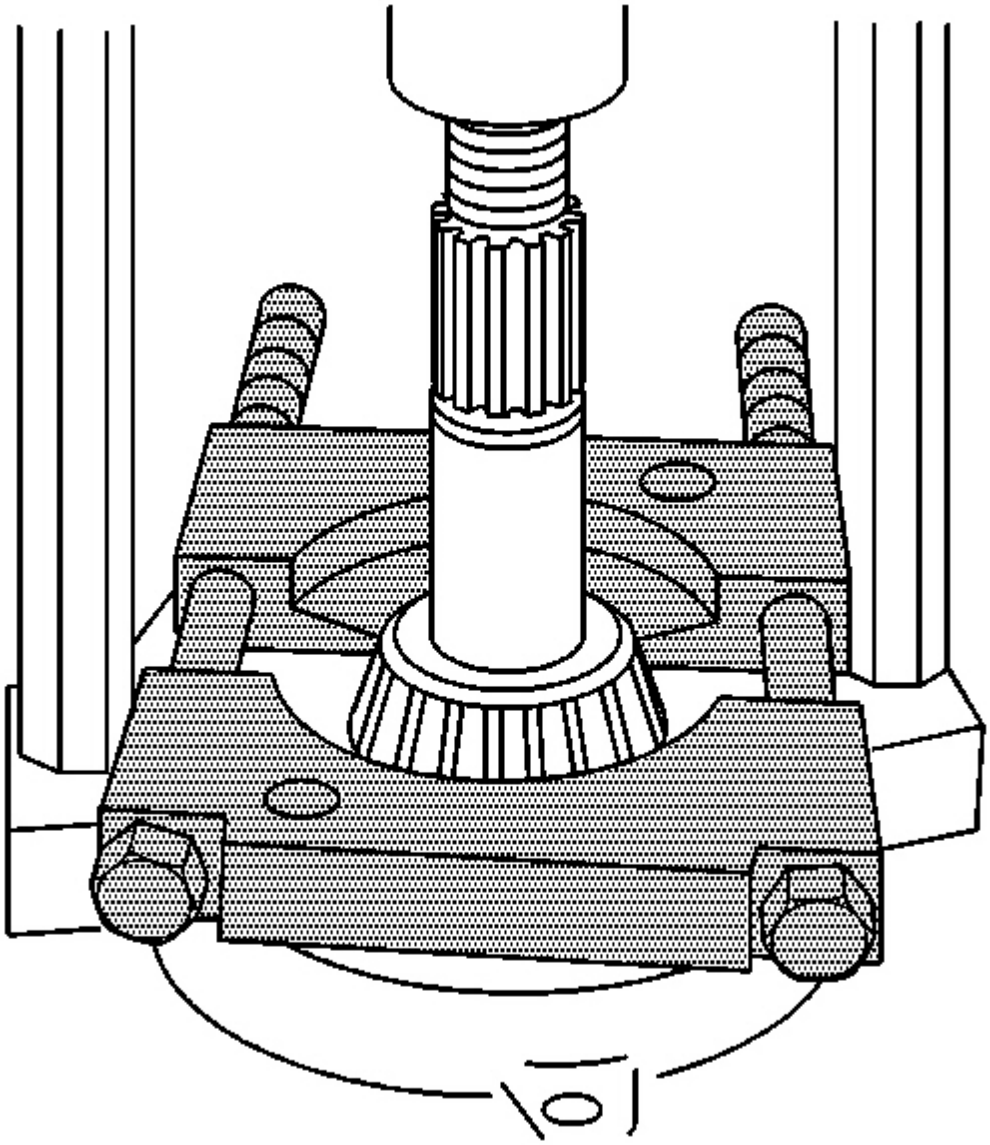


Fig. 74: View Of Inner Pinion Bearing & Hydraulic Press
Courtesy of GENERAL MOTORS CORP.

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

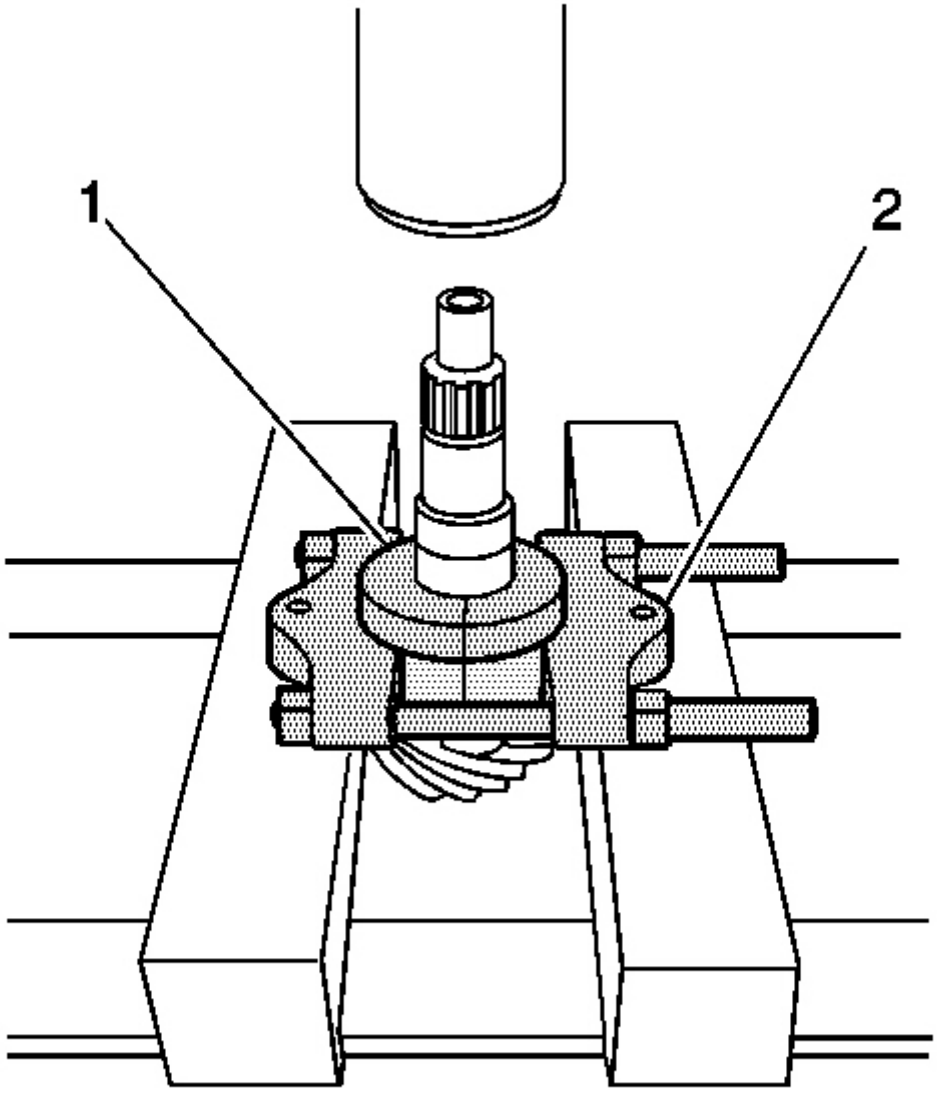


Fig. 75: Identifying J 45871 & J 22912-01
Courtesy of GENERAL MOTORS CORP.

5. For the 8.6 inch axle, install the **J 45871** (1) around the pinion bearing and the **J 22912-B** (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-B** . See **Special Tools**.
7. Remove the shim.

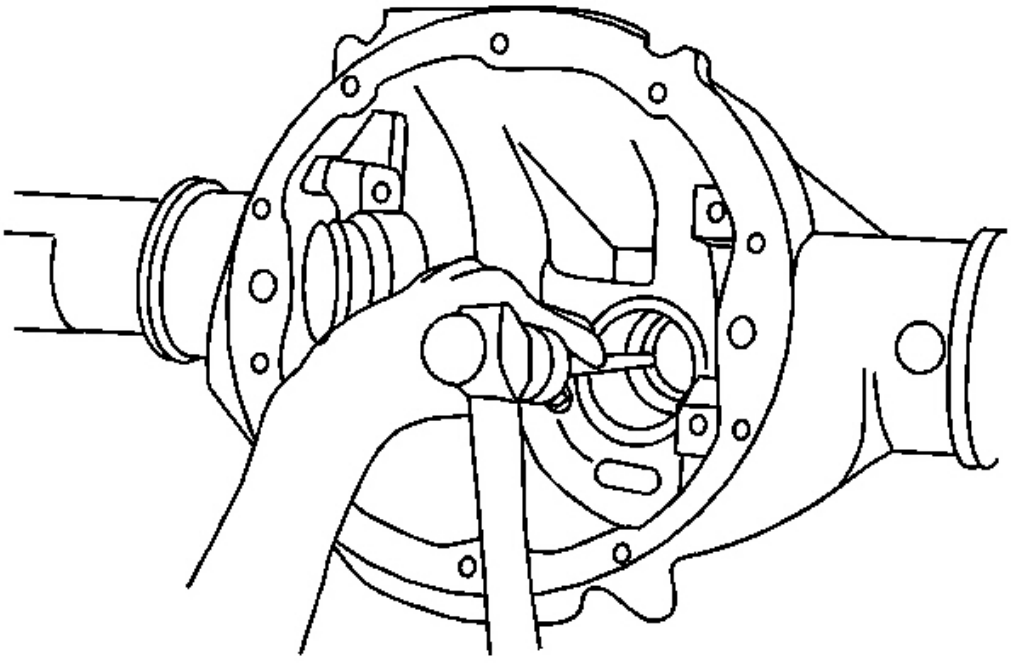


Fig. 76: Removing Outer Pinion Bearing Cup
Courtesy of GENERAL MOTORS CORP.

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.

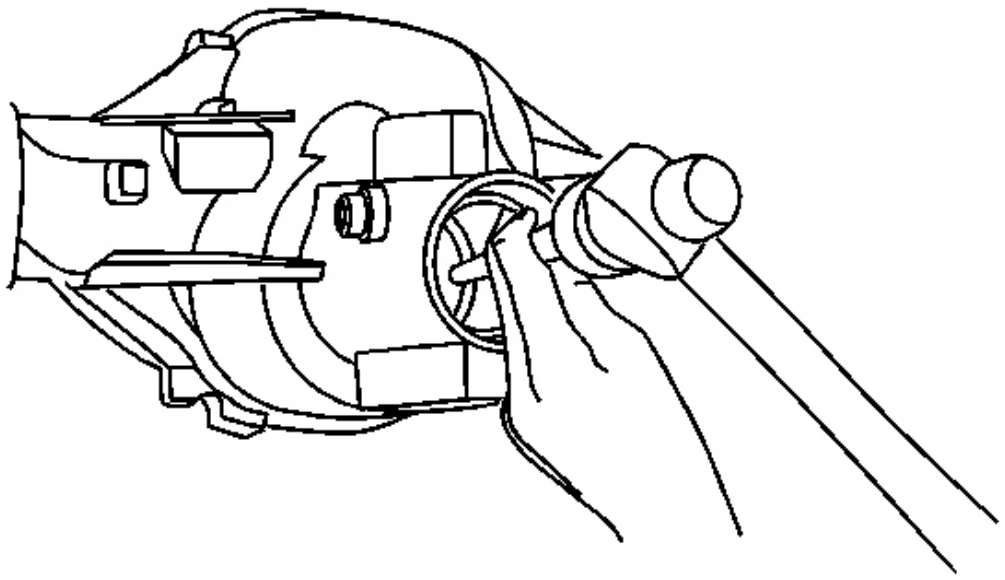


Fig. 77: Removing Inner Pinion Bearing Cup
Courtesy of GENERAL MOTORS CORP.

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

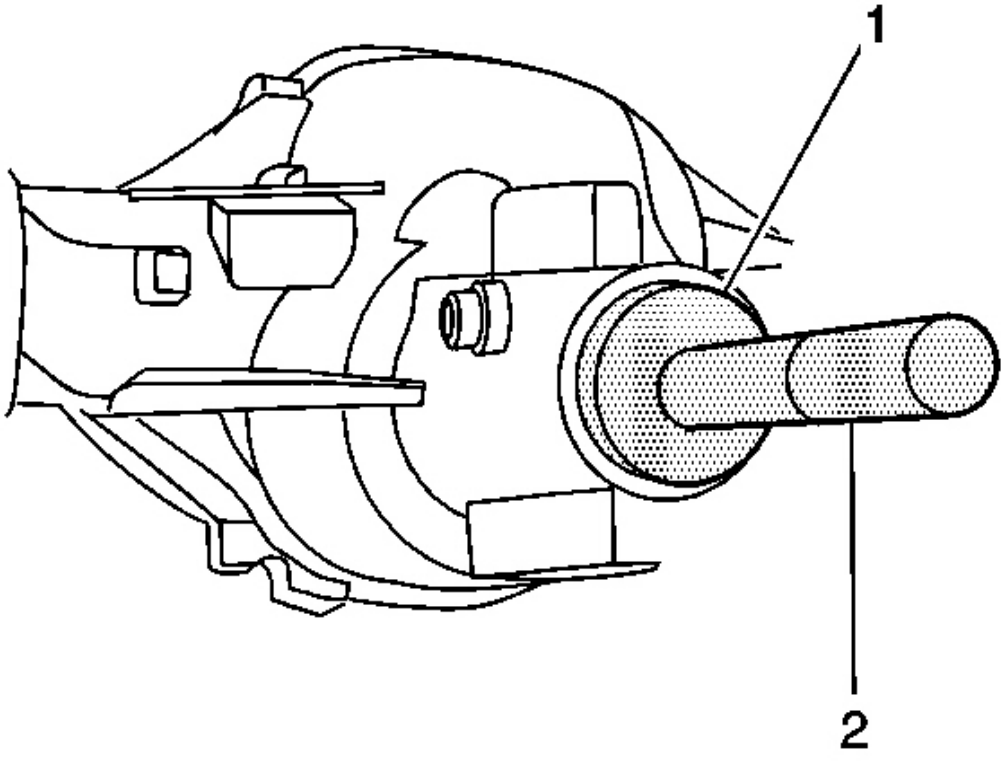


Fig. 78: View Of Outer Pinion Bearing Cup Installation Tool
Courtesy of GENERAL MOTORS CORP.

1. Install the outer pinion bearing cup.
    - For vehicles equipped with the 8.0 inch axle, use the **J 7817** (1). See **Special Tools**.
    - For vehicles equipped with the 8.6 inch axle, use the **J 8611-01** (1). See **Special Tools**.
    - For vehicles equipped with the 9.5 LD inch axle, use the **J 7818** (1). See **Special Tools**.
    - For vehicles with the 8.0/8.6 inch axles or the 9.5 LD inch axle, use the **J 8092** (2).

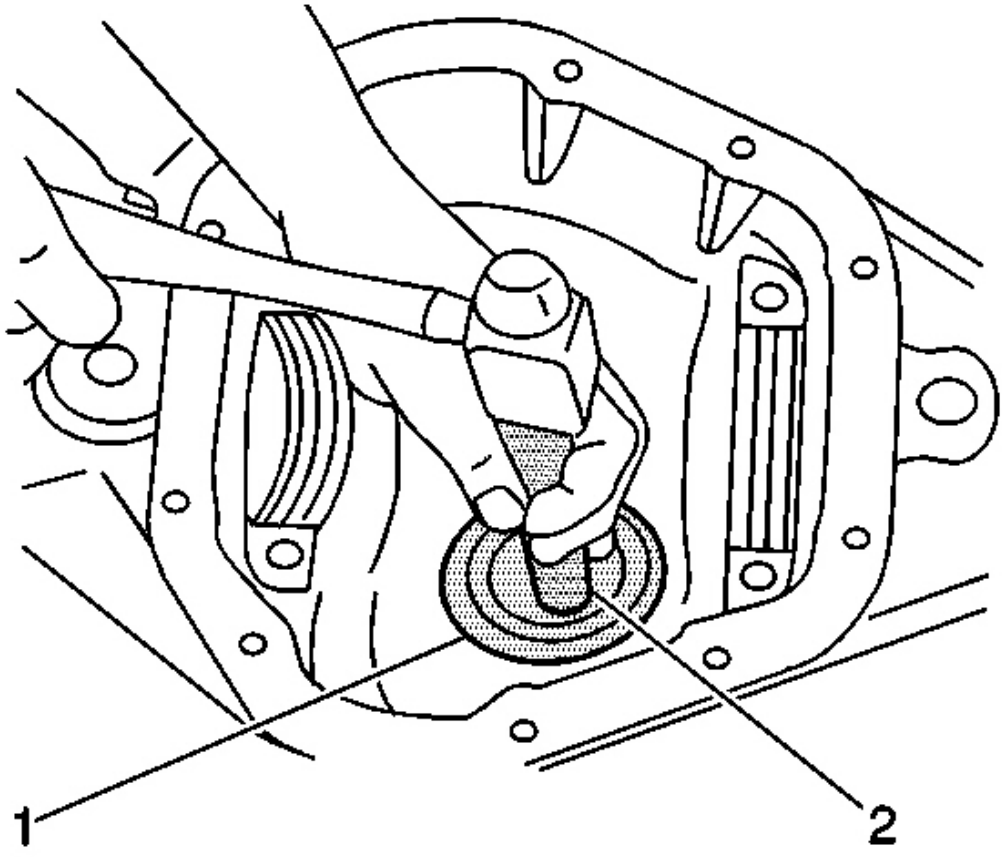


Fig. 79: View Of Inner Pinion Bearing Cup Installation
Courtesy of GENERAL MOTORS CORP.

2. Install the inner pinion bearing cup using the **J 8608** (2) and the **J 8092** (1).
   - For vehicles equipped with the 8.0/8.6 inch axle, **J 8608** (1).
   - For vehicles equipped with the 9.5 LD inch axle, **J 22306** (1). See **Special Tools**.
   - For vehicles with the 8.0/8.6 inch axles or the 9.5 LD inch axle, use the **J 8092** (2).
3. Determine the selective shim thickness for the pinion. Refer to **Pinion Depth Adjustment**.

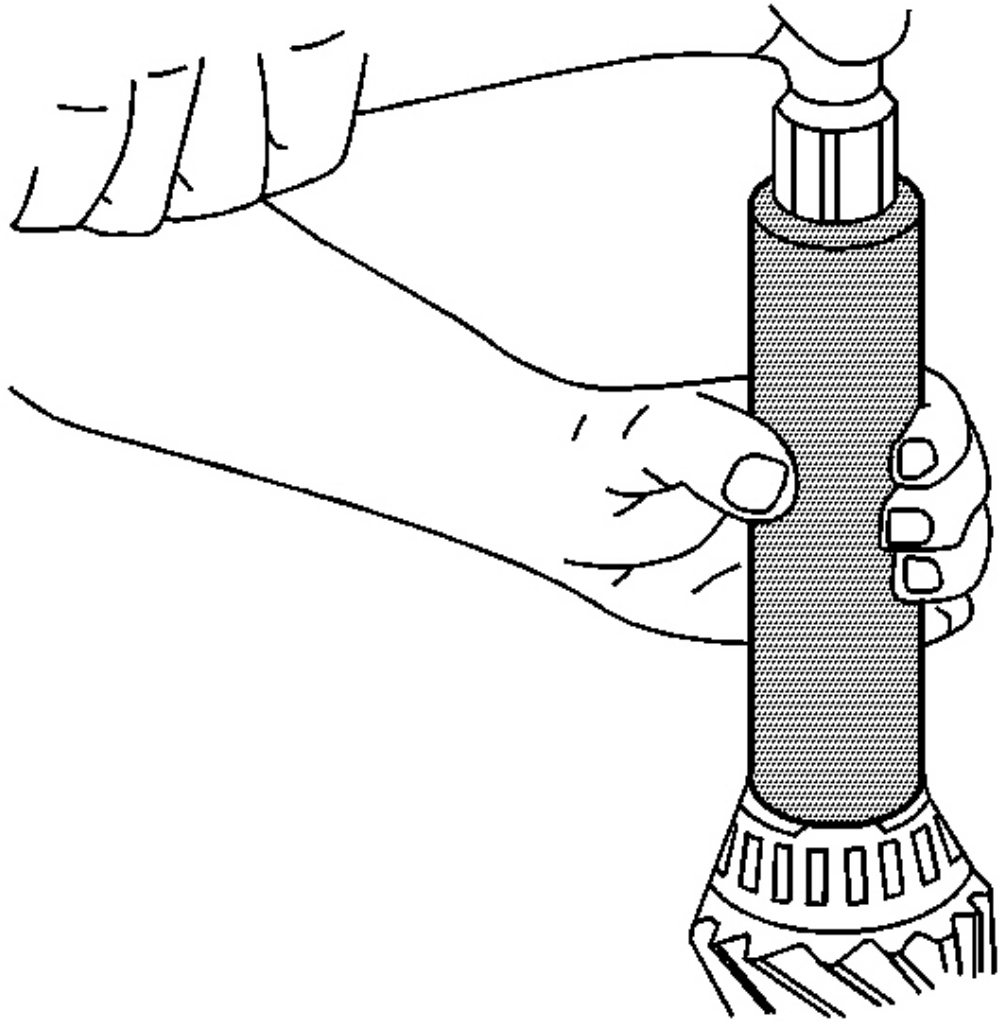


Fig. 80: Installing Inner Pinion Bearing Onto Pinion Gear
Courtesy of GENERAL MOTORS CORP.

4. Install the selective shim between the inner pinion bearing and the shoulder on the gear.
5. Using the **J 24433** or the **J 36614** , install the inner pinion bearing. 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 .

8. Install the pinion into the axle housing.
9. Install the outer pinion bearing onto the pinion.

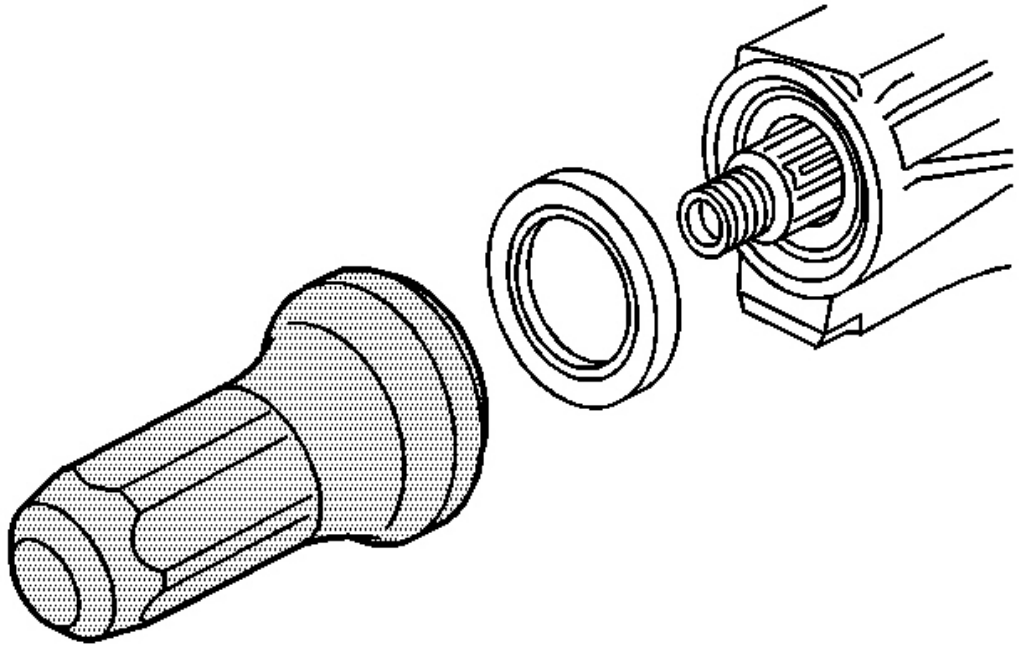


Fig. 81: View Of Pinion Gear Oil Seal & Installation Tool
Courtesy of GENERAL MOTORS CORP.

10. Install a new pinion oil seal.
    - For the 8.0 inch axle, use the **J 33782** .
    - For the 8.6 inch axle, use the **J 38694** . See **Special Tools**.
    - For the 9.5 LD inch axle, use the **J 22388** . See **Special Tools**.
11. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the splines of the pinion yoke.

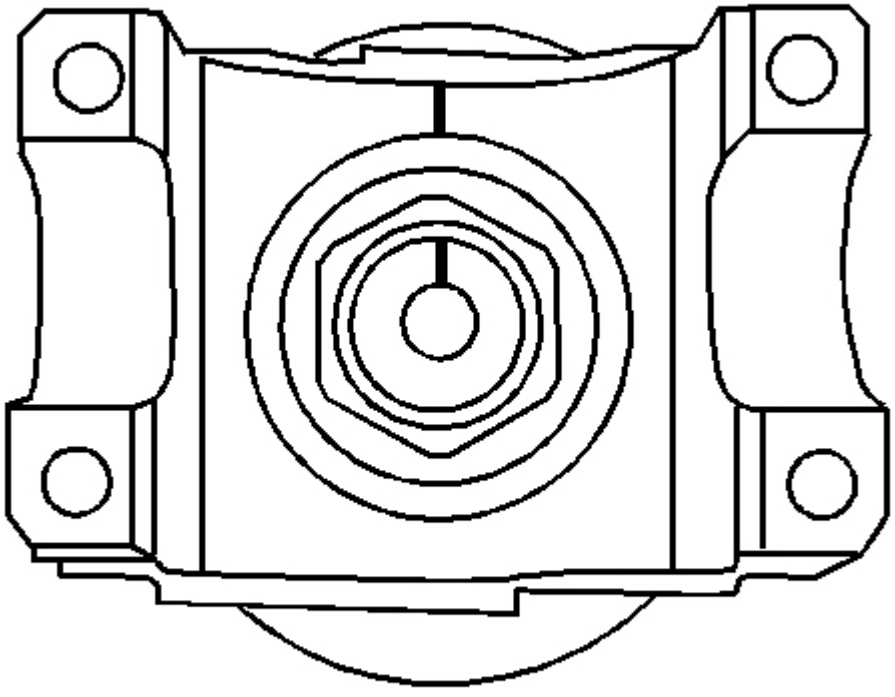


Fig. 82: View Of Pinion Shaft & Pinion Yoke Alignment Marks
Courtesy of GENERAL MOTORS CORP.

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.

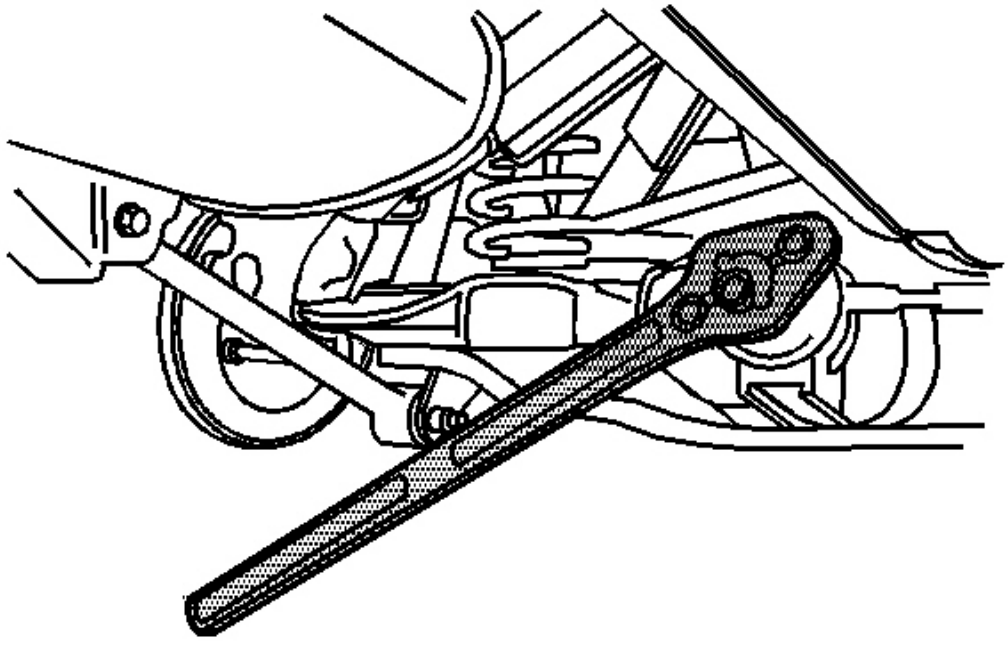


Fig. 83: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

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

NOTE: Refer to Fastener Notice .

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.

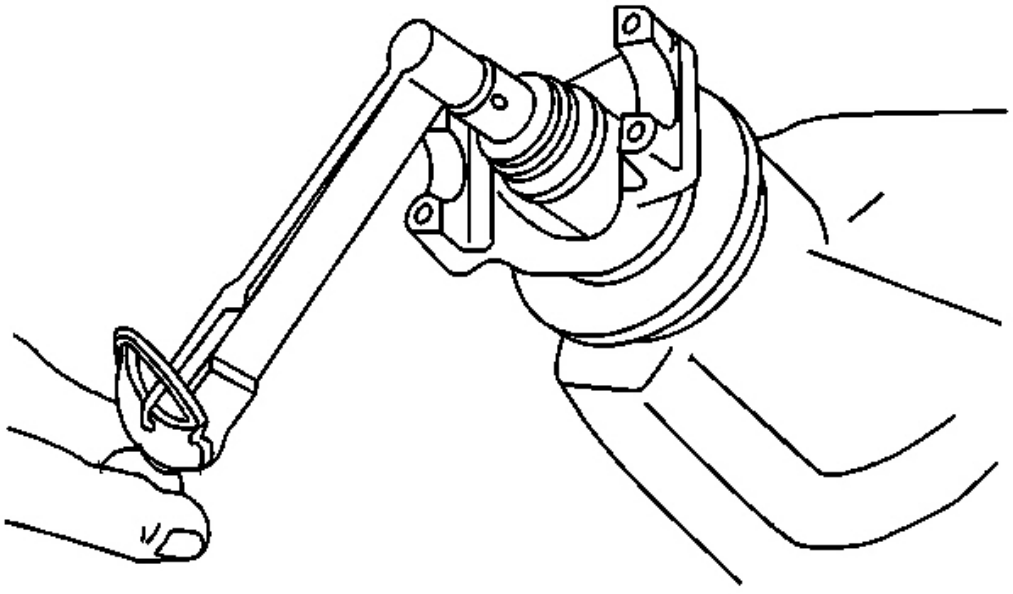


Fig. 84: Measuring Pinion Rotating Torque
Courtesy of GENERAL MOTORS CORP.

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 **Front Axle Lubricant Replacement** .
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
- **J 24429** Bearing Backlash Spanner. See **Special Tools**.

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** .
2. Remove the spare tire.
3. Remove the rear axle tie rod. Refer to **Rear Axle Tie Rod Replacement** .
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.

   IMPORTANT: The following procedure is for the right side of the 9.5 LD inch axle.

6. For vehicle equipped with the 9.5 LD inch axle, remove the differential bearing adjuster nut lock.

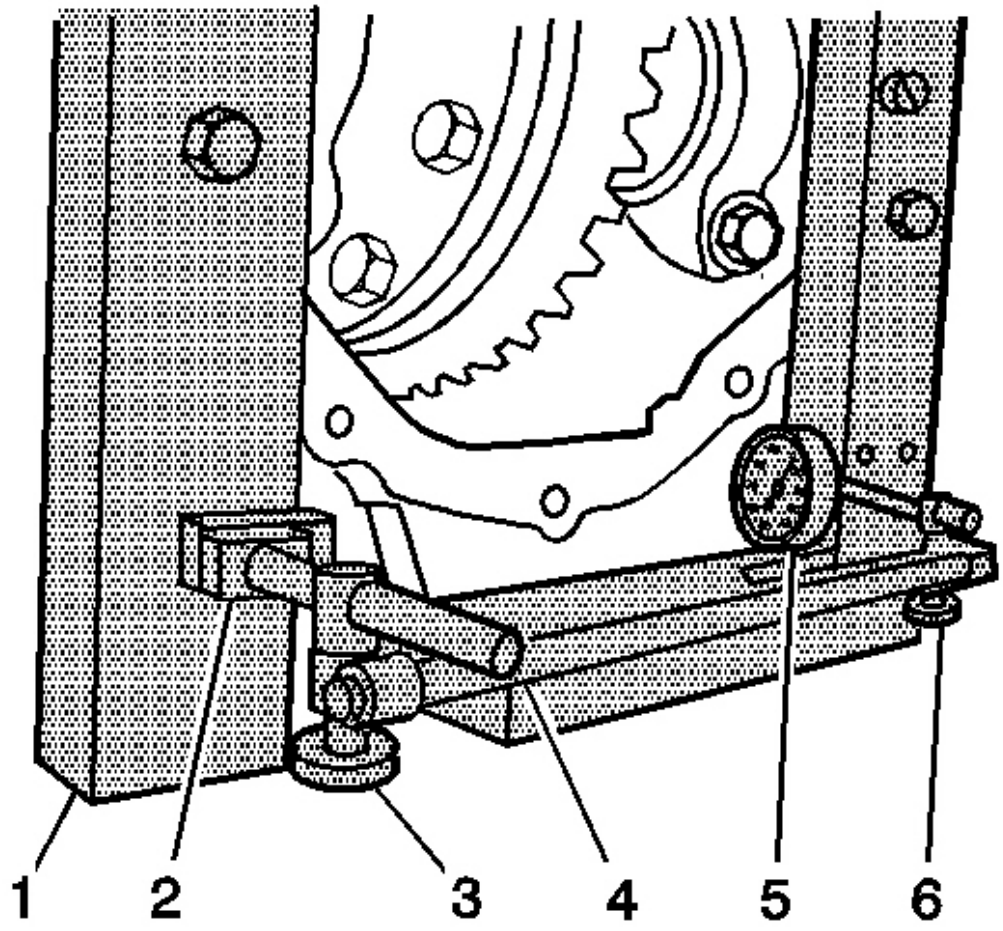


Fig. 85: View Of J 8001-1, J 8001-2, J 34178 & J 8001-3
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The following service procedure is for vehicles equipped with the 8.0/8.6 inch axles.

7. Install the **J 45222** onto the axle housing as shown. See **Special Tools**.
8. Install the **J 8001-1** (2), the **J 8001-2** (3), the **J 34178** (4, 6), and the **J 8001-3** (5) as shown. See **Special Tools**.
9. Preload the **J 8001-3** (5) approximately 3/4 of a turn clockwise. See **Special Tools**.
10. Rotate the indicator housing to align the indicator needle of the **J 8001-3** (5) and the dial indicator face to ZERO. See **Special Tools**.

11. Spread the axle housing by turning the clevis screw of the **J 34178** while observing the **J 8001-3** . See **Special Tools**.

    Spread the housing just enough to remove the differential assembly. Do not spread the housing more than 1.02 mm (0.040 in).

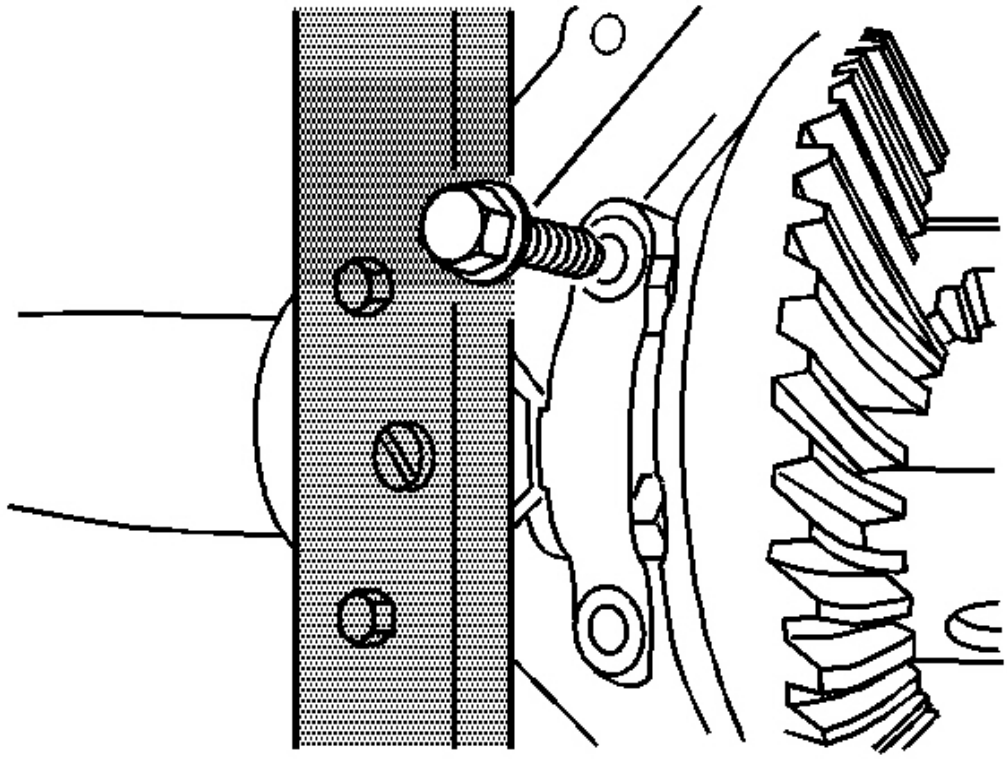


Fig. 86: View Of Bearing Caps Bolts
Courtesy of GENERAL MOTORS CORP.

12. 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.

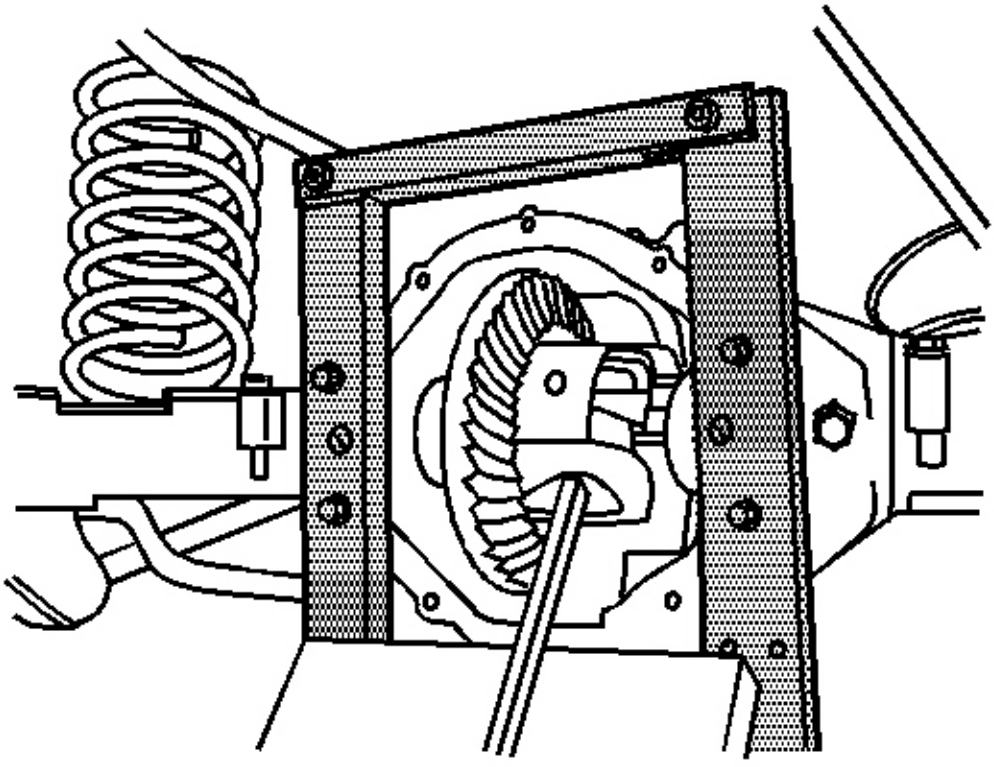


Fig. 87: View Of J 45222
Courtesy of GENERAL MOTORS CORP.

13. For vehicles equipped with the 8.0/8.6 inch axles, remove the differential from the axle housing using a pry bar and a block of wood.
14. For vehicles equipped with the 9.5 LD inch axle, use the **J 24429** to loosen the differential bearing adjuster nut. See **Special Tools**.
15. Remove the 9.5 LD inch axle from the differently assembly.
16. 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.

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

18. Remove the **J 45222** . See **Special Tools**.
19. Remove the differential side bearings, if necessary. Refer to **Differential Side Bearings Replacement**.
20. 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** .

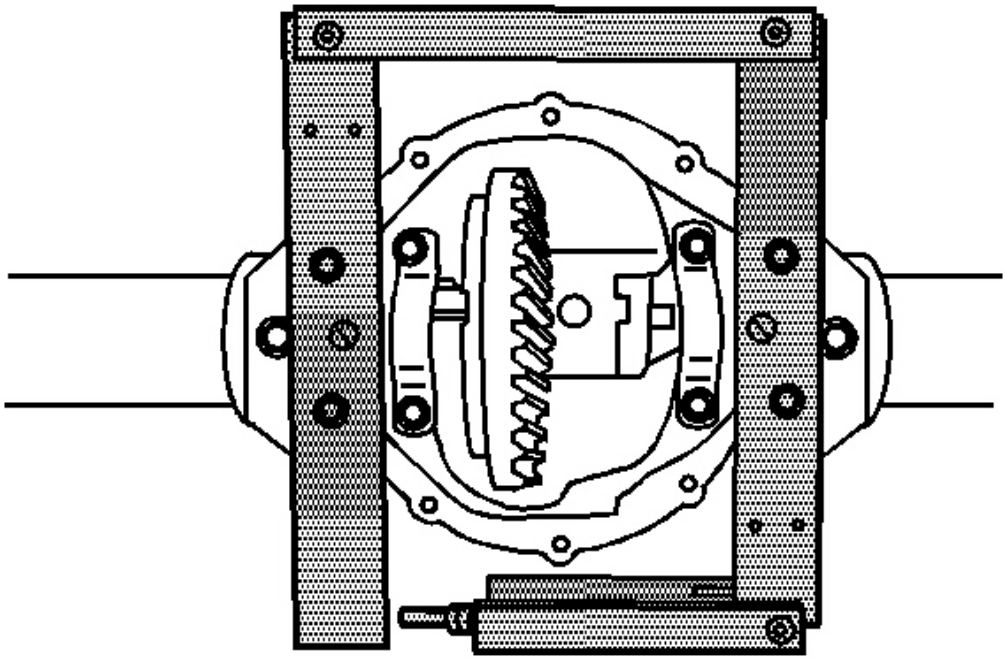


Fig. 88: View Of J 45222 & Axle Housing
Courtesy of GENERAL MOTORS CORP.

4. For vehicles equipped 8.0/8.5 inch axles, install the **J 45222** onto the axle housing as shown. See **Special Tools**.

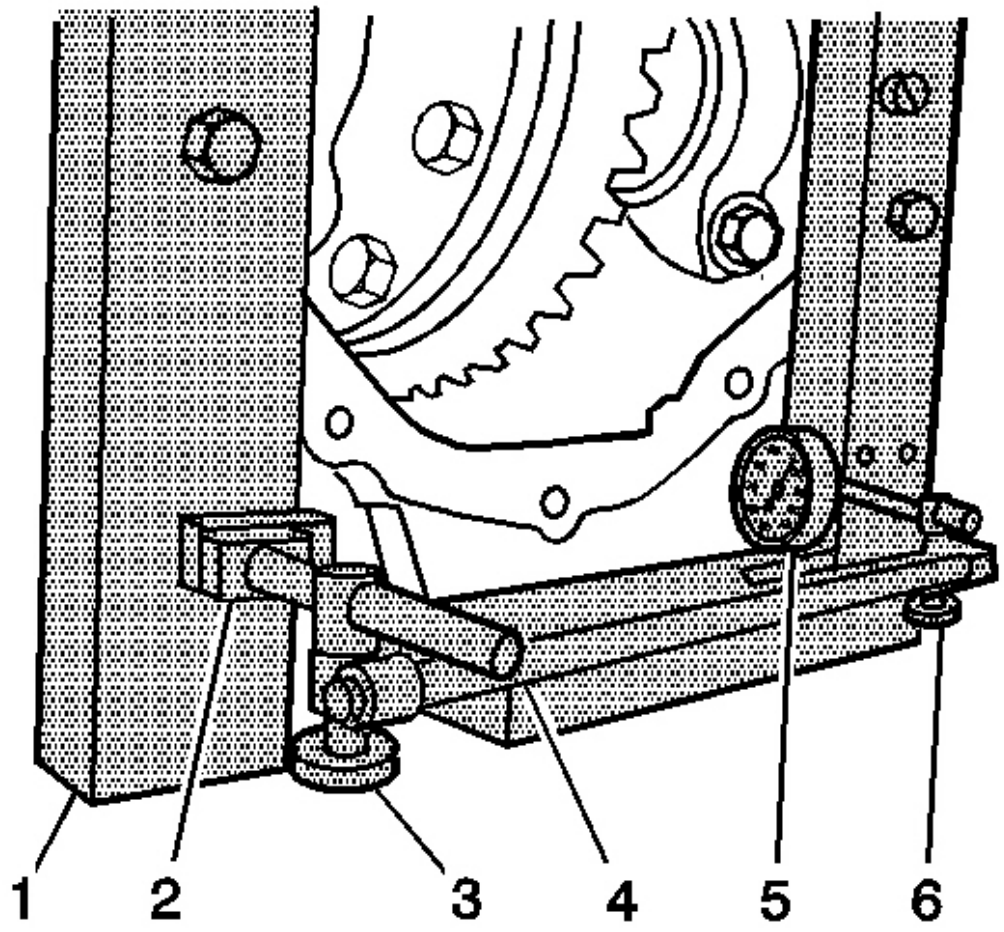


Fig. 89: View Of J 8001-1, J 8001-2, J 34178 & J 8001-3
Courtesy of GENERAL MOTORS CORP.

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

   Spread the housing just enough to install the differential assembly. Do not spread the housing more than 1.02 mm (0.040 in).

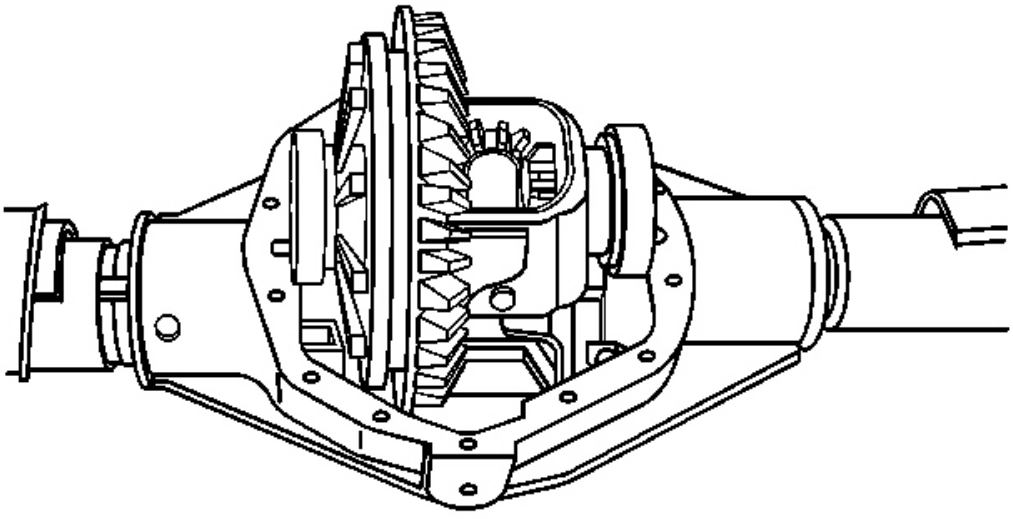


Fig. 90: View Of Differential Case & Axle Housing
Courtesy of GENERAL MOTORS CORP.

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.

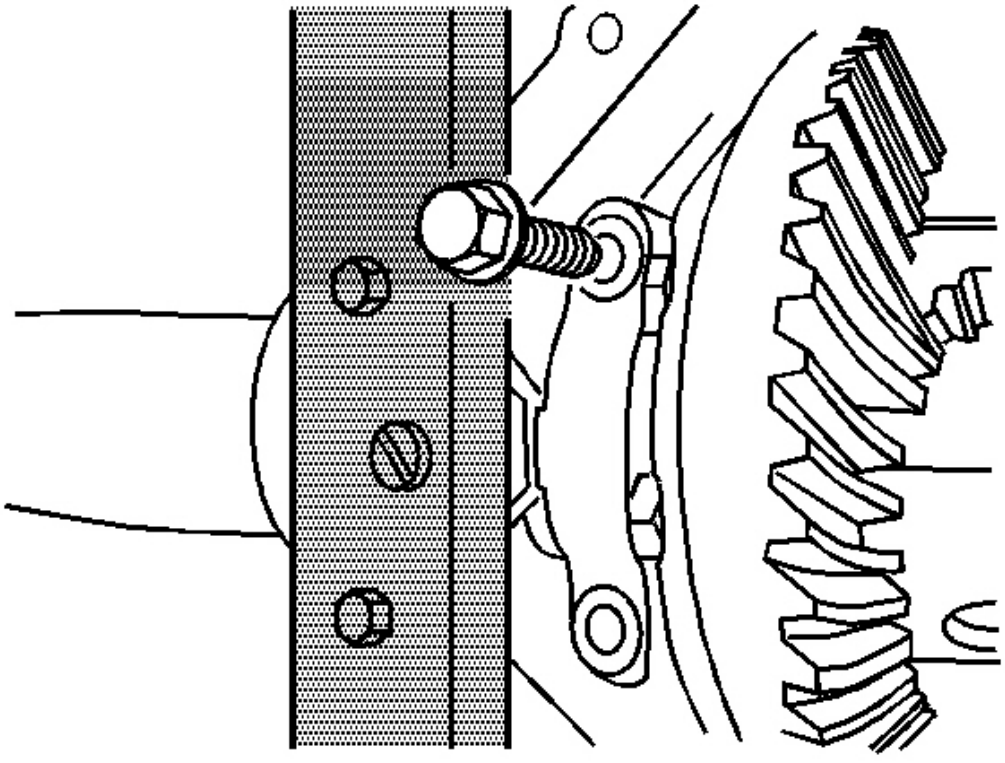


Fig. 91: View Of Bearing Caps Bolts
Courtesy of GENERAL MOTORS CORP.

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 Carrier Bearing Preload Adjustment (8.0, 8.6 Inch Axle)** or **Differential Carrier Bearing Preload Adjustment (9.5 LD Inch Axle)**.
12. Adjust the backlash. Refer to **Backlash Adjustment (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.
13. Perform a gear tooth contact pattern check. Refer to **Gear Tooth Contact Pattern Inspection**.

    NOTE: Refer to Fastener Notice .

14. Tighten the bearing cap bolts.

    Tighten: Tighten the bearing cap bolts to 85 N.m (63 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** .
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**.
- **J 29710** Differential Side Bearing Installer. See **Special Tools**.
- **J 36597** Side Bearing Puller Pilot - 9. See **Special Tools**.25 Inch Axle

Removal Procedure

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

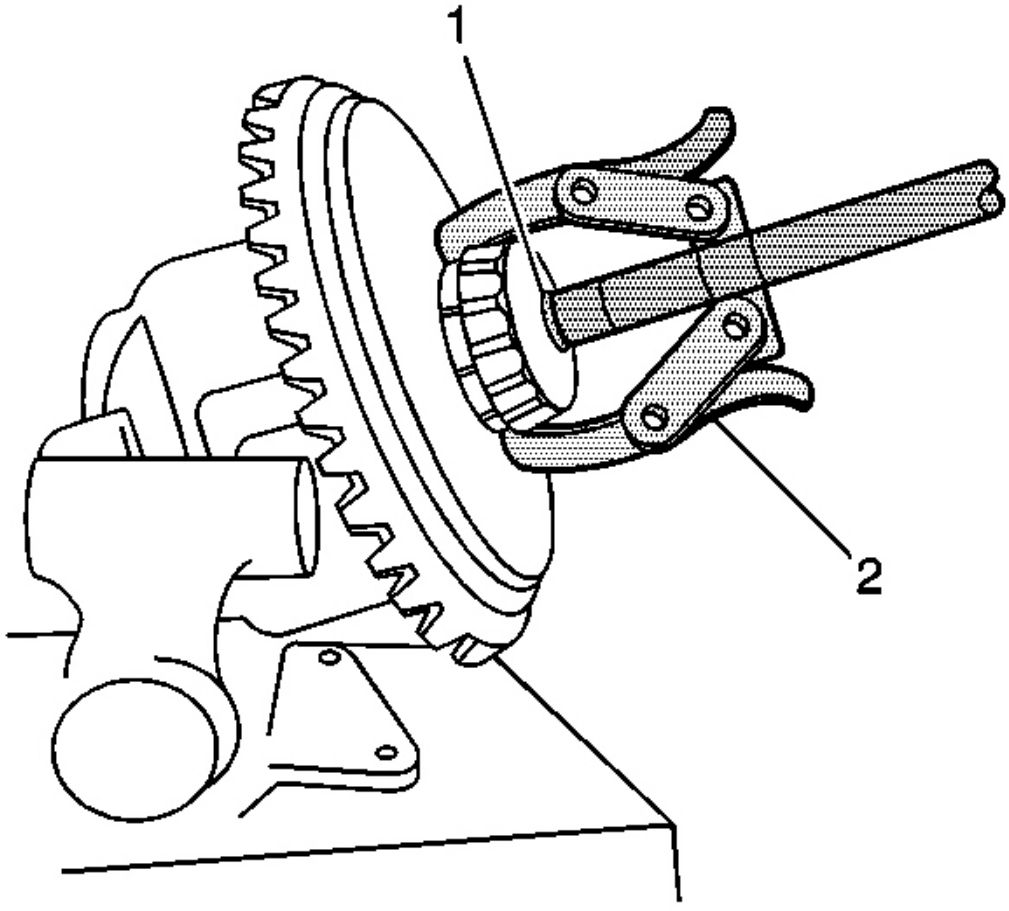


Fig. 92: Identifying Special Tool J 22888-20A & Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.

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, or the **J 36597** 9. See **Special Tools**.5 inch axle (1), as shown.
    3. Remove the differential side bearings using the **J 22888-20A** .
3. Remove the differential assembly from the vise.

Installation Procedure

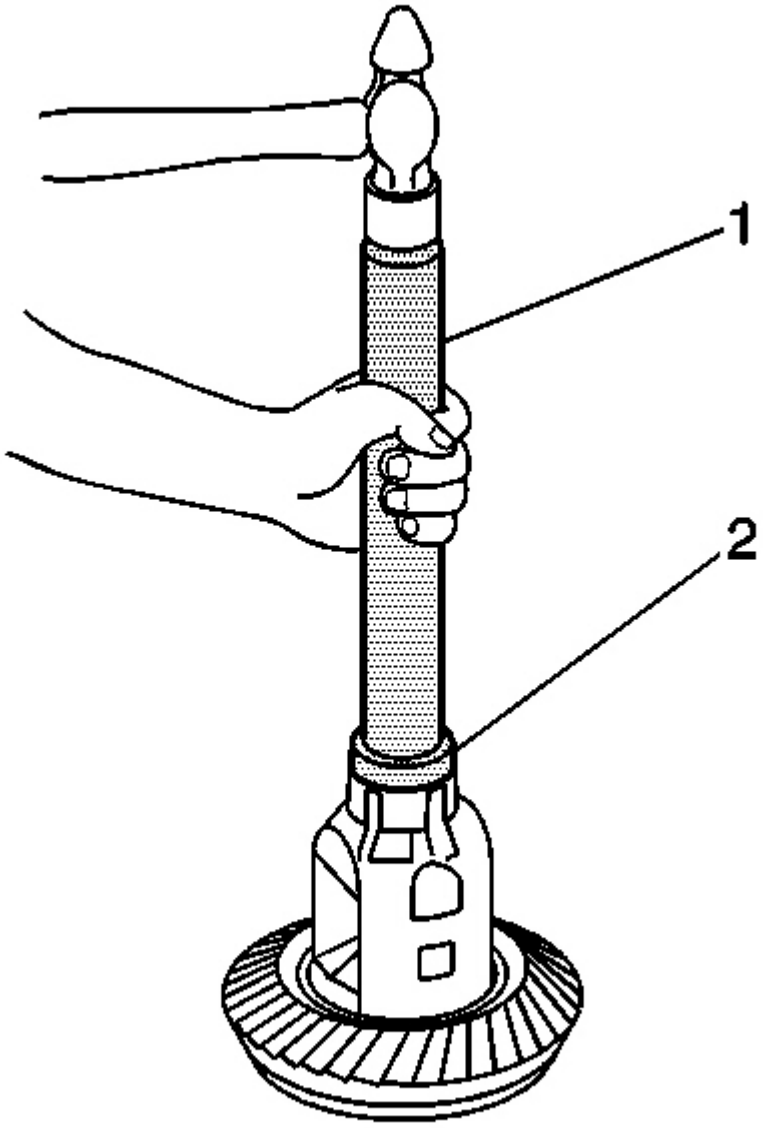


Fig. 93: Driving The Differential Side Bearing Into Position
Courtesy of GENERAL MOTORS CORP.

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, or the 9.5 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), or the **J 29710** for the 9. See **Special Tools**.5 (2) inch axle 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 .

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
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** .
5. Disconnect the rear axle vent tube.
6. Remove the rear propeller shaft. Refer to **Rear Propeller Shaft Replacement** .
7. Disconnect the left rear cable of the park brake from the rear axle. Refer to **Park Brake Cable Replacement** .
8. Disconnect the right rear cable of the park brake from the rear axle. Refer to **Park Brake Cable Replacement** .
9. Remove the caliper assemblies from the rear axle. Refer to **Front Brake Caliper Replacement** .
10. Remove the stabilizer shaft from the rear axle. Refer to **Stabilizer Shaft Replacement** .
11. Remove the coil springs. Refer to **Coil Spring Replacement** .
12. Disconnect the rear axle tie rod from the rear axle. Refer to **Rear Axle Tie Rod Replacement** .
13. Disconnect the lower control arms from the rear axle. Refer to **Rear Axle Lower Control Arm Replacement** .
14. Disconnect the upper control arms from the rear axle. Refer to **Rear Axle Upper Control Arm Replacement** .
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** .
3. Connect the lower control arm to the rear axle. Refer to **Rear Axle Lower Control Arm Replacement** .
4. Connect the rear axle tie rod to the rear axle. Refer to **Rear Axle Tie Rod Replacement** .
5. Install the coil springs. Refer to **Coil Spring Replacement** .

6. Install the stabilizer shaft to the rear axle. Refer to **Stabilizer Shaft Replacement** .
7. Install the caliper assemblies to the rear axle. Refer to **Front Brake Caliper Replacement** .
8. Connect the right rear cable of the park brake to the rear axle. Refer to **Park Brake Cable Replacement** .
9. Connect the left rear cable of the park brake to the rear axle. Refer to **Park Brake Cable Replacement** .
10. Install the propeller. Refer to **Rear Propeller Shaft Replacement** .
11. Connect the rear axle vent tube.
12. Install the rear tires and the rear wheels. Refer to **Tire and Wheel Removal and Installation** .
13. Fill the axle with lubricant. Use the proper fluid. Refer to **Approximate Fluid Capacities** and to **Fluid and Lubricant Recommendations** .
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** .
2. Drain the axle lubricant. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
3. Remove the rear axle assembly. Refer to **Rear Axle Replacement**.
4. Remove the brake caliper brackets. Refer to **Rear Brake Caliper Bracket Replacement** .
5. Remove the rear axle cover housing and gasket. Refer to **Rear Axle Housing Cover and Gasket Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
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 park brake supports. Refer to **Park Brake Support Replacement** .
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 Carrier Bearing Preload Adjustment (8.0, 8.6 Inch Axle)** or **Differential Carrier Bearing Preload Adjustment (9.5 LD Inch Axle)**.
4. Adjust the backlash. Refer to **Backlash Adjustment (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.
5. Perform a gear tooth contact pattern check. Refer to **Gear Tooth Contact Pattern Inspection**.
6. Install the park brake supports. Refer to **Park Brake Support Replacement** .

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 (8.0/8.6 Inch Axle)** or **Rear Axle Housing Cover and Gasket Replacement (9.5 Inch Axle)**.
9. Install the brake caliper brackets. Refer to **Rear Brake Caliper Bracket Replacement** .
10. Install the rear axle. Refer to **Rear Axle Replacement**.
11. Fill the axle with lubricant. Refer to **Rear Axle Lubricant Replacement (8.0/8.6 Inch Axle)** or **Rear Axle Lubricant Replacement (9.5 LD Inch Axle)**.
12. Lower the vehicle.

DIFFERENTIAL OVERHAUL

Disassembly Procedure

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

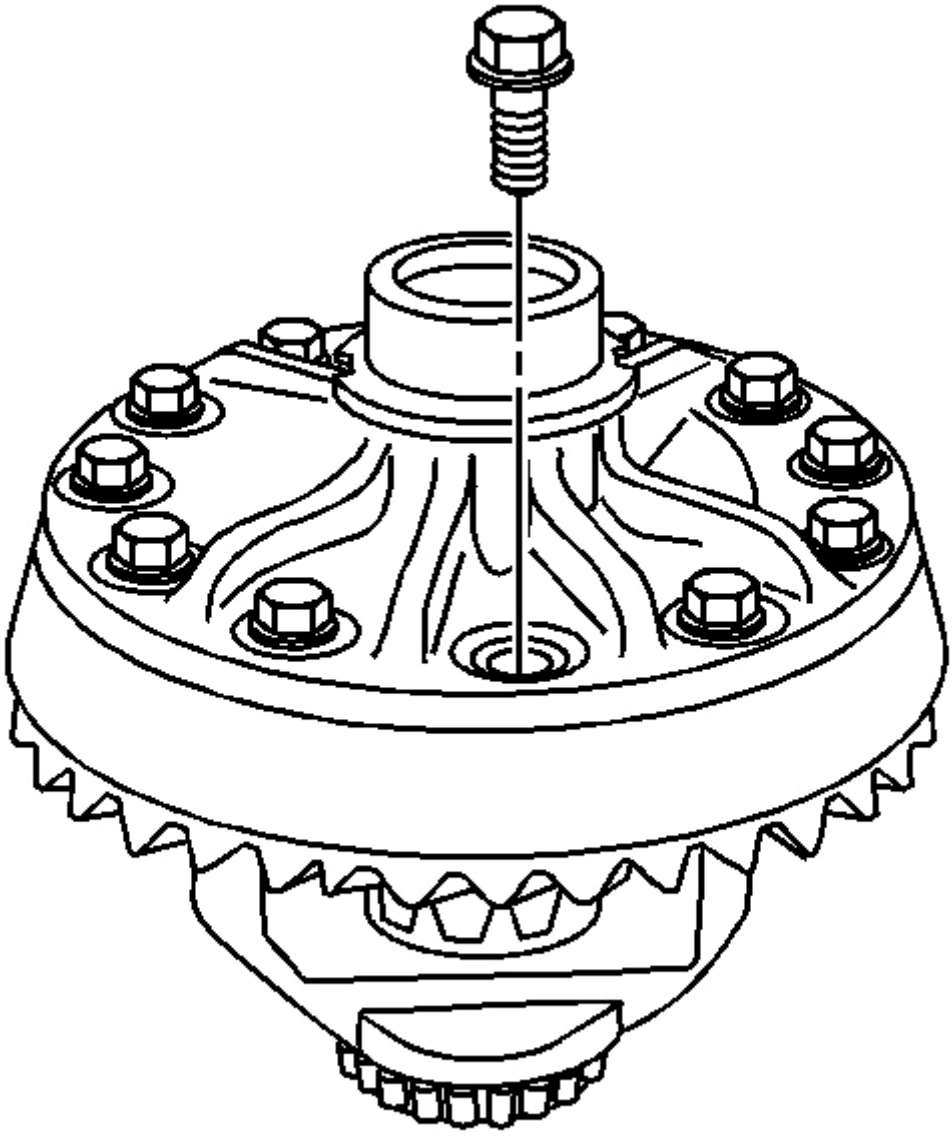


Fig. 94: Identifying Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

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

2. Remove the gear bolts. Discard the bolts.

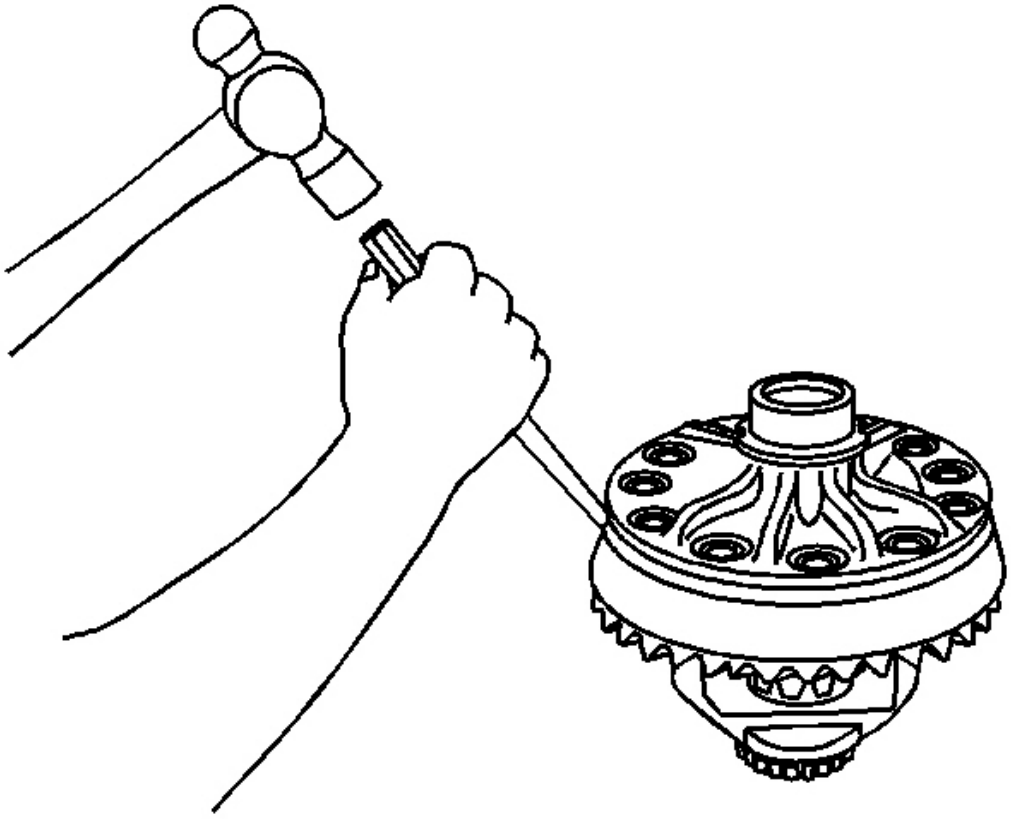


Fig. 95: Removing Ring Gear From Differential
Courtesy of GENERAL MOTORS CORP.

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.

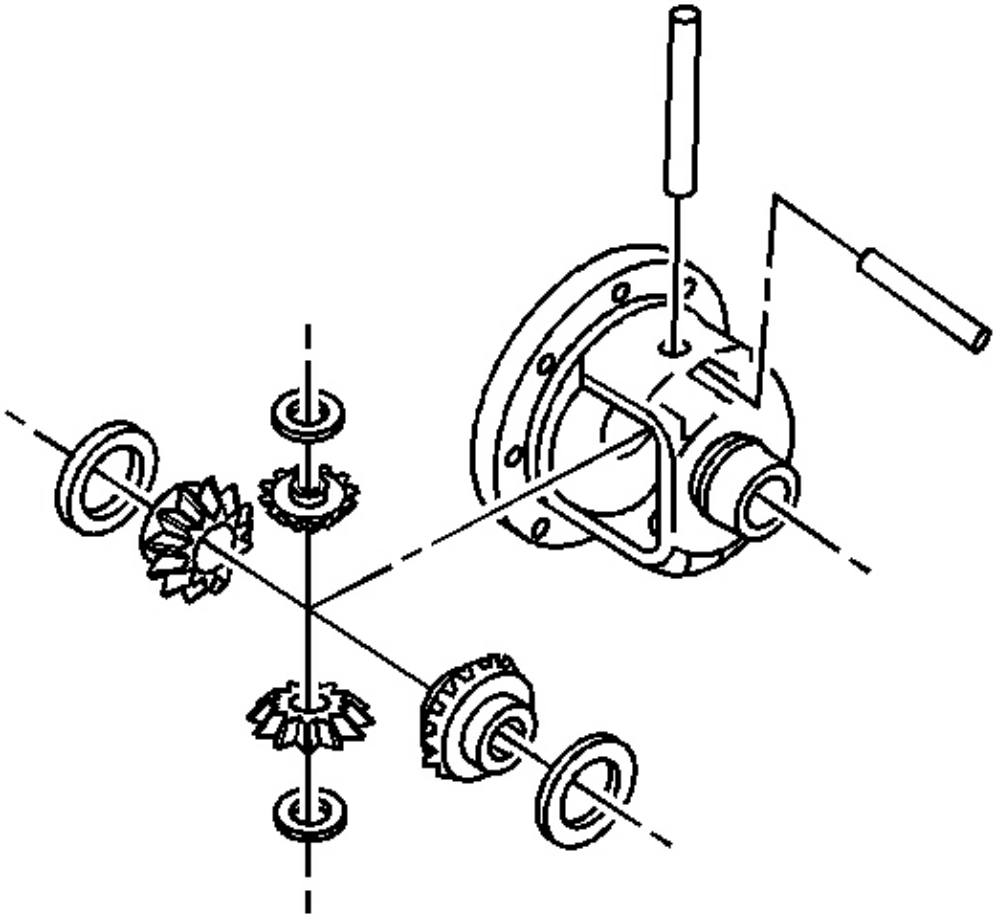


Fig. 96: View Of Differential Case Components
Courtesy of GENERAL MOTORS CORP.

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** .
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.

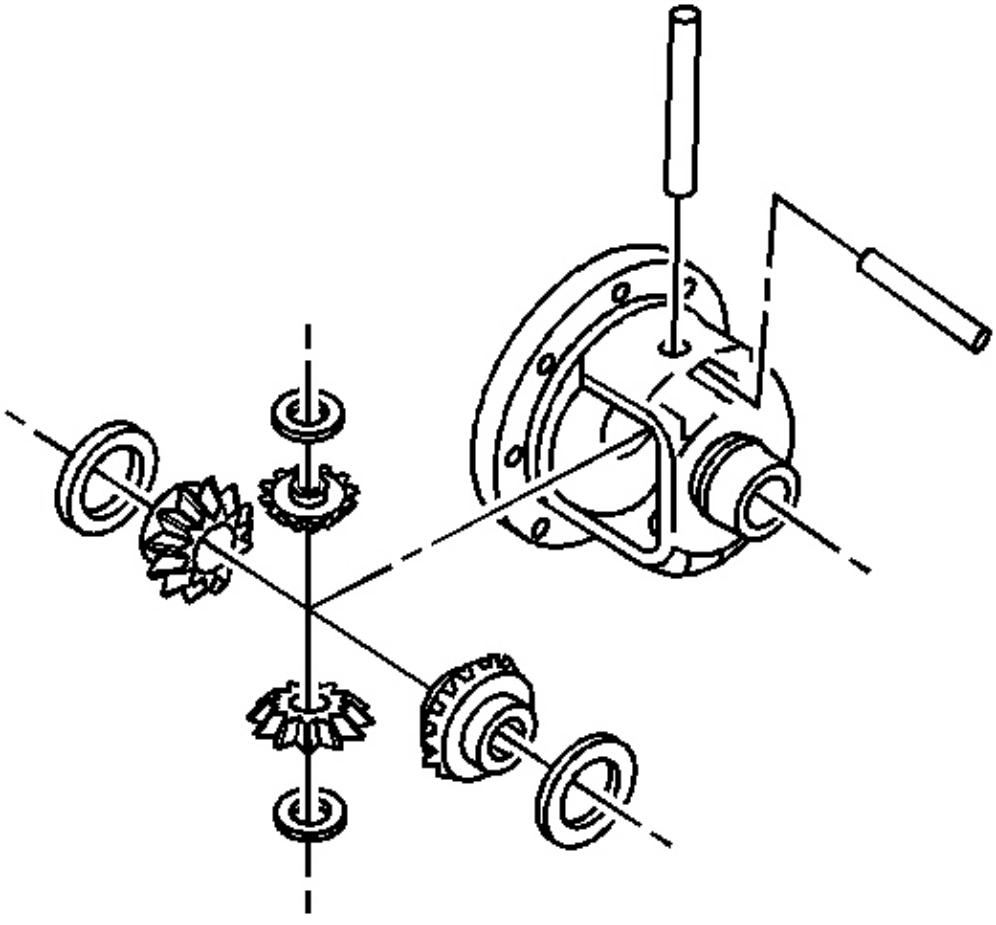


Fig. 97: View Of Differential Case Components
Courtesy of GENERAL MOTORS CORP.

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 .

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.

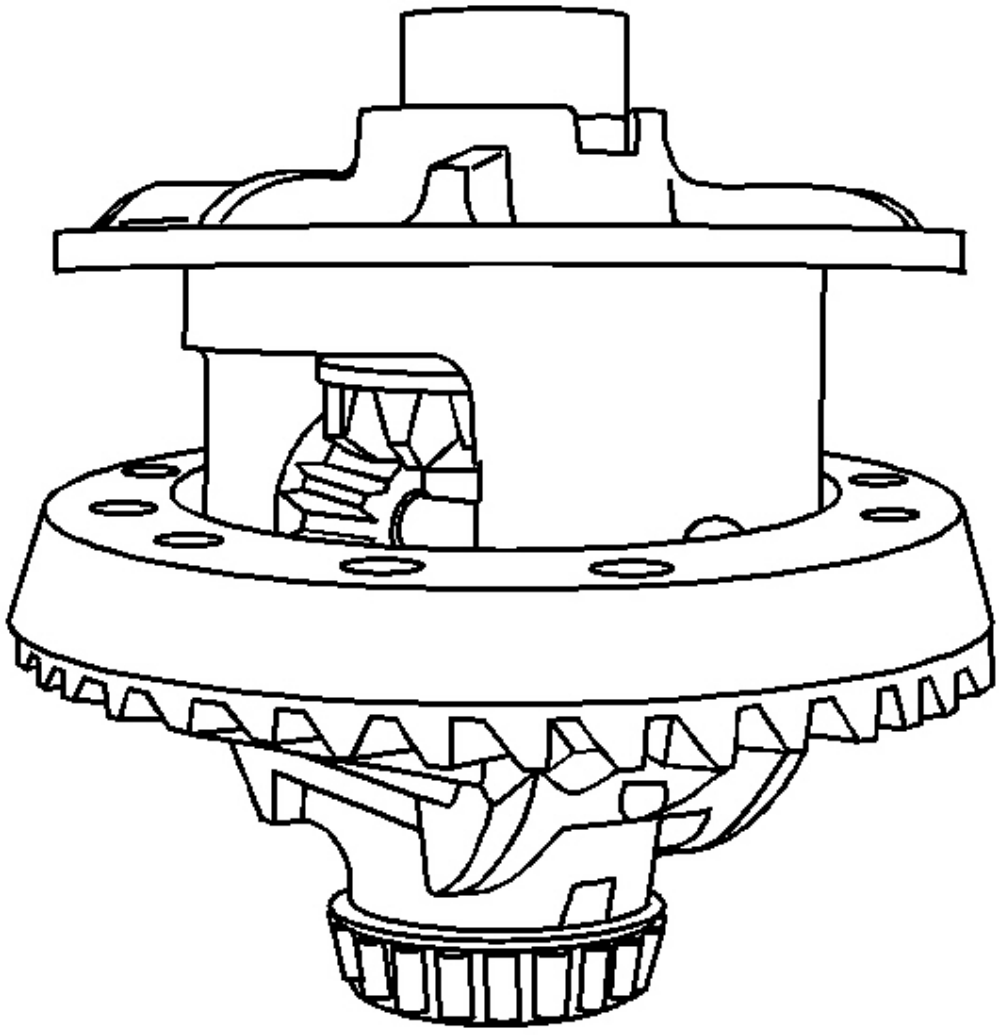


Fig. 98: Ring Gear & Differential Case
Courtesy of GENERAL MOTORS CORP.

7. Install the ring gear to the differential case.

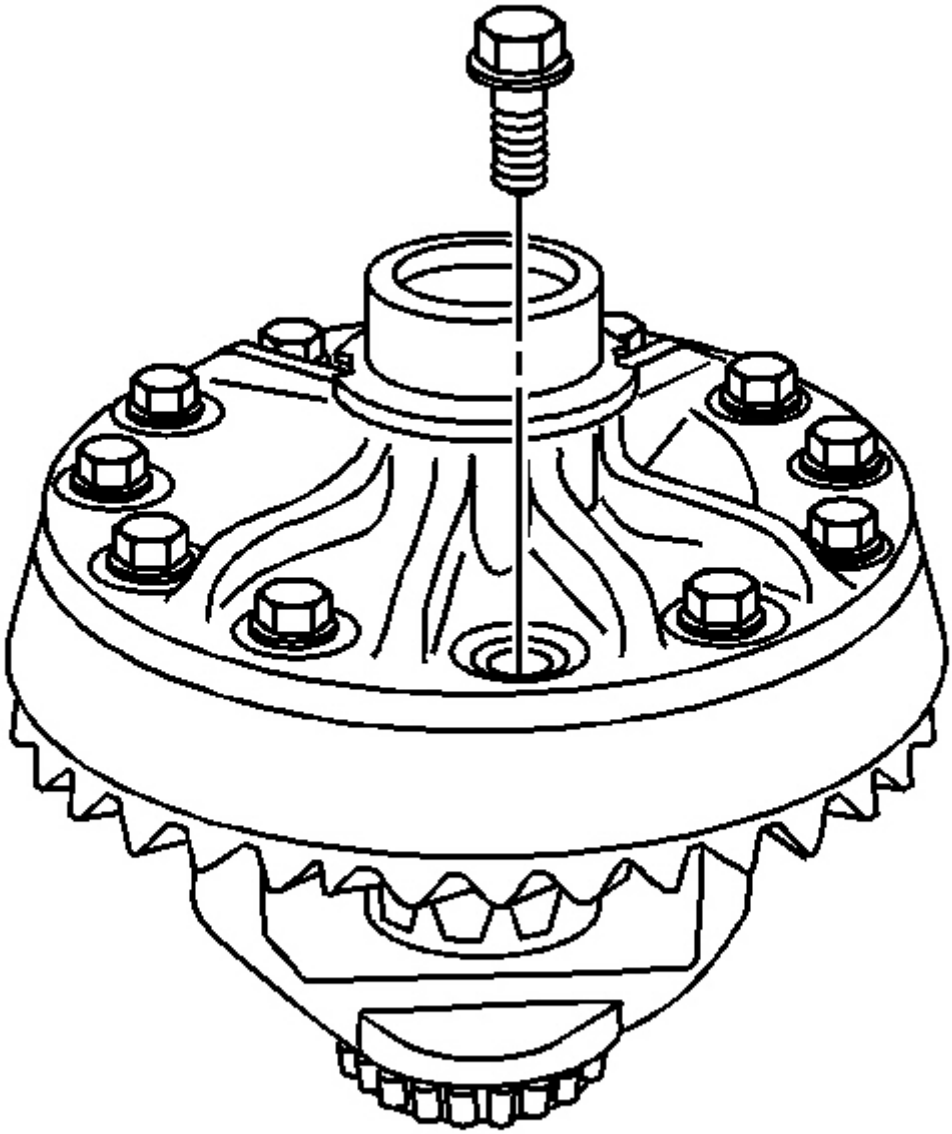


Fig. 99: Identifying Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

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 & RING GEAR INSPECTION

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

- Check the pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Check the pinion gear splines for wear.
- Check the pinion flange/yoke splines for wear.
- Check the fit of the pinion gear splines on the pinion flange/yoke.
- Check the sealing surface of the pinion flange/yoke for nicks, burrs or rough tool marks that could damage the seal and cause an oil leak.
- 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 21777-85** Gage and Plate. See **Special Tools**.
- **J 21777-86** Bearing Disc. See **Special Tools**. 9.5LD Inch Axle
- **J 34925** Pinion Setting Gage and Components. See **Special Tools**.
- **J 45230** Pinion Setting Gage Block. See **Special Tools**.
- **J 8001** Dial Indicator Set

Adjusting

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** .
2. Install the pinion bearings into the axle housing.

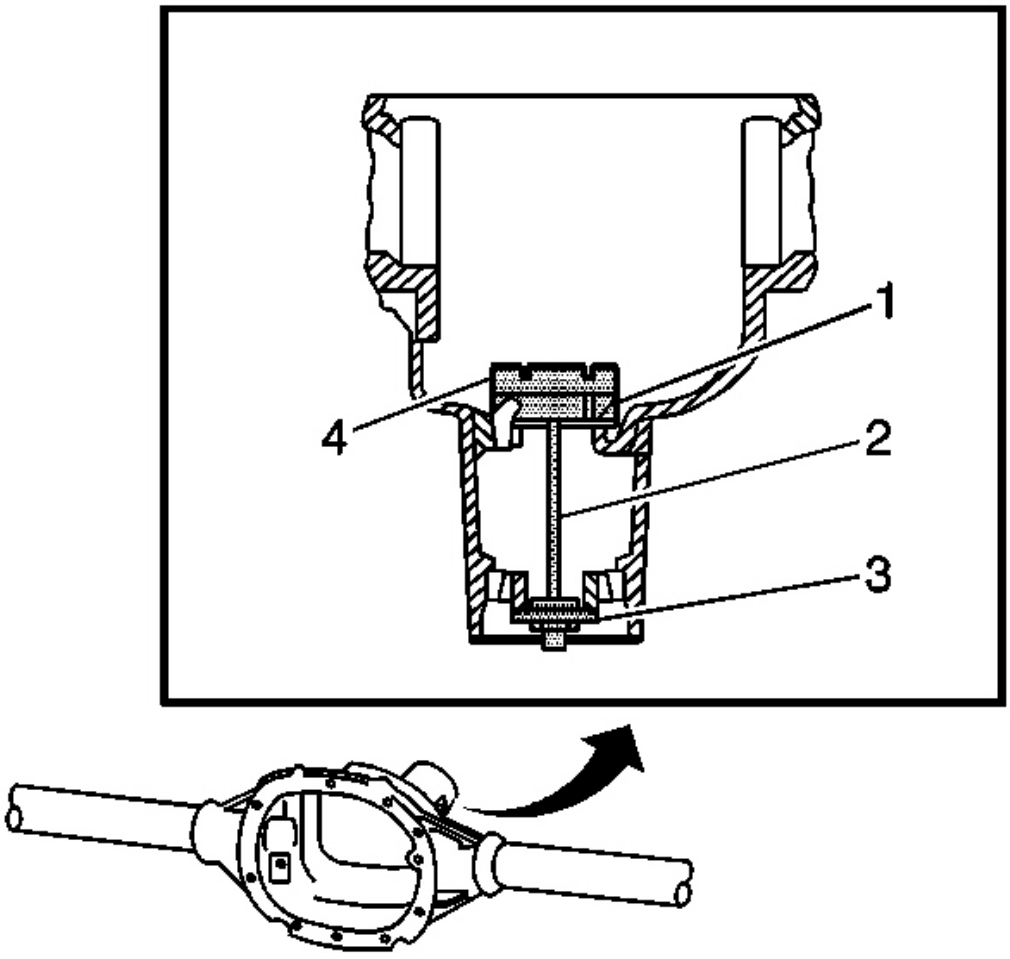


Fig. 100: View Of Special Tools In Axle Housing
Courtesy of GENERAL MOTORS CORP.

3. For the 8.0, 8.6 inch axle assemble the following components into the axle housing as shown.
   - Assemble the J 21777-35 (1)
   - Assemble the **J 21777-43** (2). See **Special Tools**.
   - Assemble the **J 21777-42** (3),. See **Special Tools**.
   - Assemble the **J 45230** , 8. See **Special Tools**.0 inch axle,
   - Assemble the J 21777-29, 8.6 inch axle (4)
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.

IMPORTANT: You will need 2 of the J 21777-85 , when assembling the tool in the axle housing. See Special Tools.

5. For the 9.5 LD inch axle assemble the following components into the axle housing as shown.
   - Assemble the J 21777-8 (1)
   - Assemble the **J 21777-43** (2). See **Special Tools**.
   - Assemble the **J 21777-42** (3). See **Special Tools**.
   - Assemble the **J 21777-85** (4). See **Special Tools**.
6. Rotate the assembly several times in both directions in order to seat the pinion bearings.
7. 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.

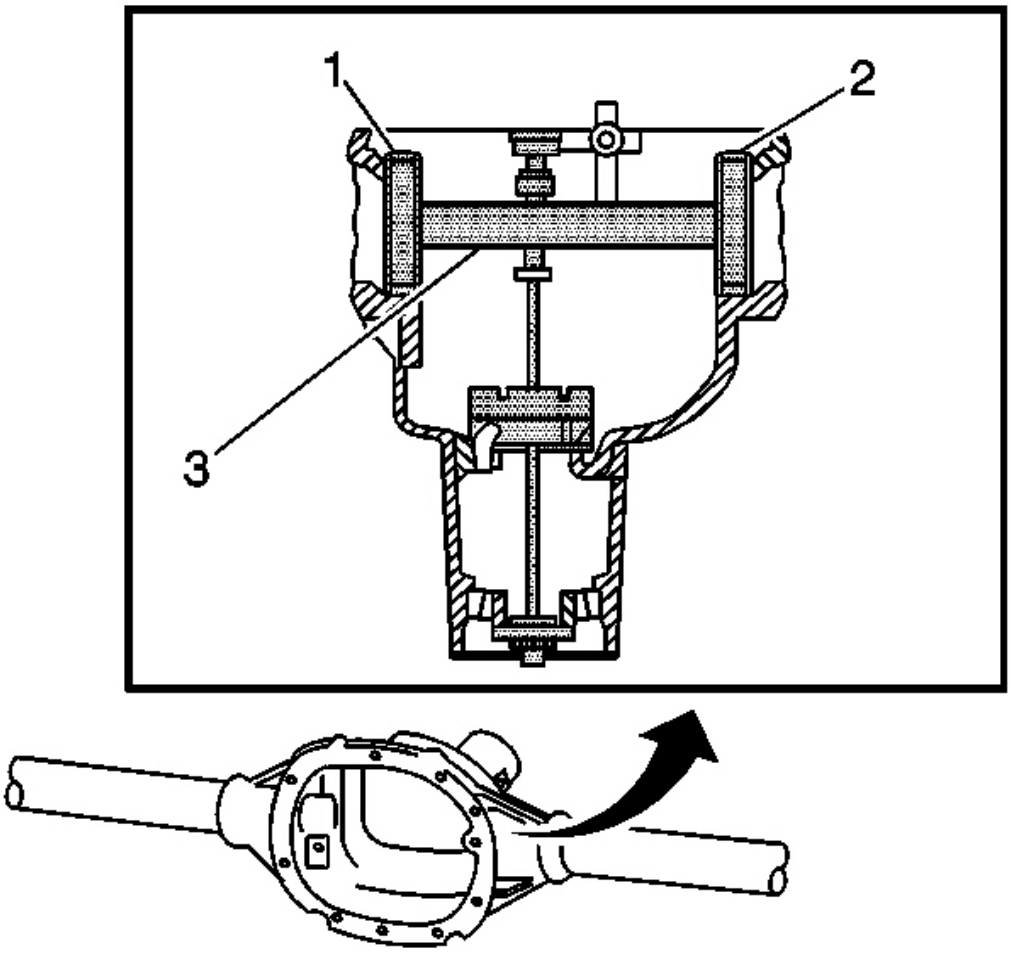


Fig. 101: View Of Special Tools In Differential Carrier Bore
Courtesy of GENERAL MOTORS CORP.

8. Assemble the following components into the differential carrier bore of the axle housing.
   - For the 8.0/ 8.6 inch axle, assemble the **J 21777-45** (1, 2) to the J 21777-1 (3). See **Special Tools**.
   - For the 9.5/9.5 LD inch axle, assemble the **J 21777-86** (1, 2) to the J 21777-1 (3). See **Special Tools**.
9. Install the bearing caps.

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

10. Rotate the J 21777-1 within the **J 21777-45** , 8. See **Special Tools**.6 inch axle. The J 21777-1 must rotate back and forth freely, disassemble the components, inspect for proper re-assemble.

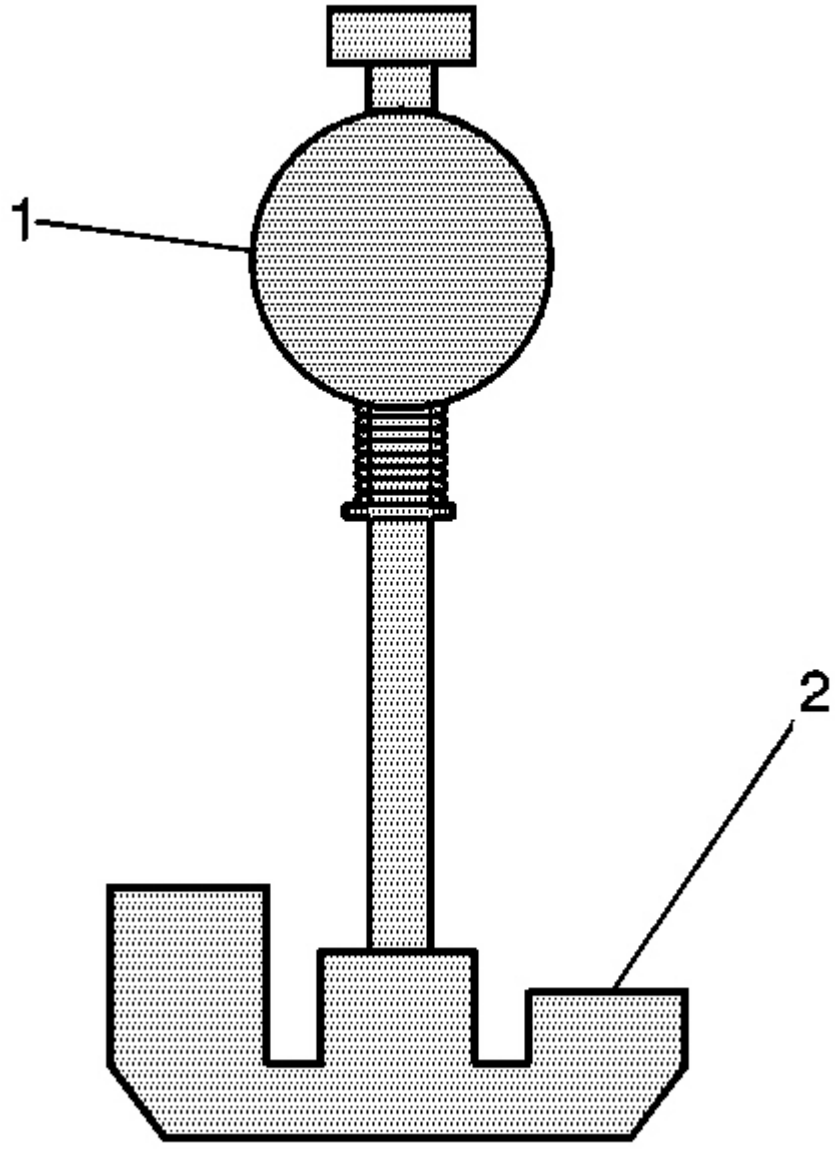


Fig. 102: Identifying J 21777-1 & J 44416-3
Courtesy of GENERAL MOTORS CORP.

11. 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), or the **J 21777-85** , 9. See **Special Tools**.5 LD inch axle.
12. 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.

13. 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.

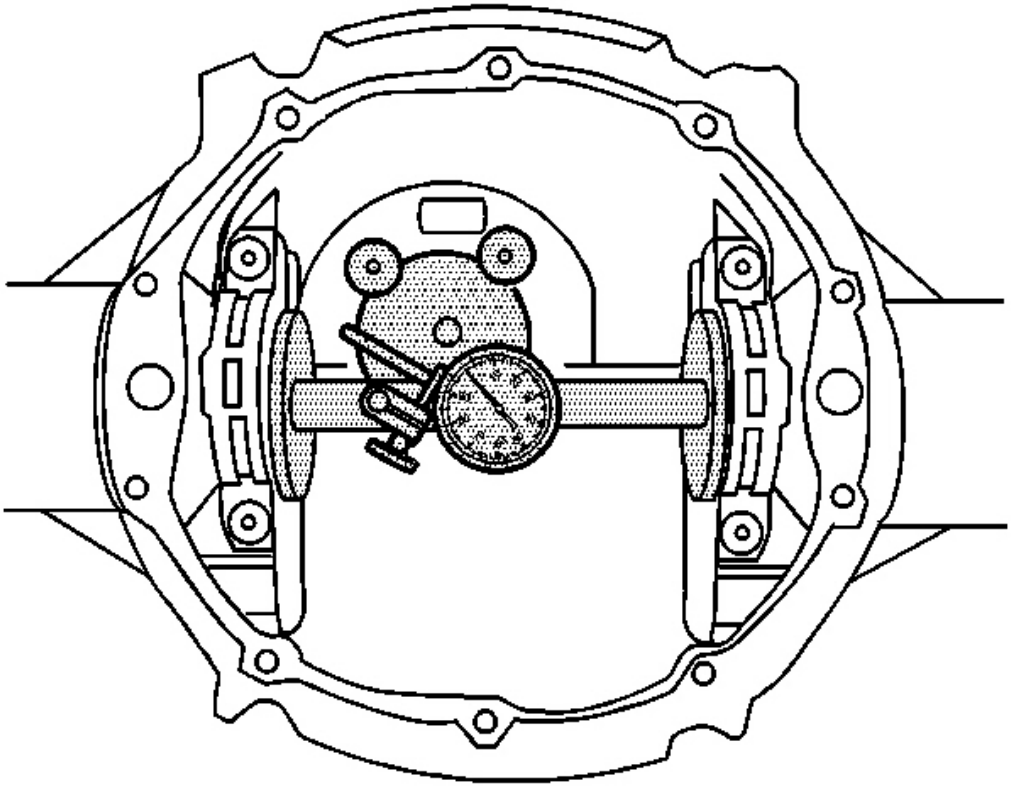


Fig. 103: Measuring Shim Thickness Using J 8001
Courtesy of GENERAL MOTORS CORP.

14. At the greatest point of deflection, move the housing of the **J 8001** until the needle indicates ZERO.
15. 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.

16. 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, or the **J 21777-85** , 9. See **Special Tools**.5 LD inch axle until it no longer touches the **J 45230** or the J 21777-29. See **Special Tools**.
17. The value indicated on the **J 8001** is the thickness of the shim needed in order to set the depth of the pinion.
18. Select the shim that indicates the proper thickness. Measure the shim with a micrometer in order to verify that the thickness is correct.
19. Remove the pinion depth setting tools.
20. Remove the pinion bearings.
21. Install the pinion shim between the pinion gear and the inner pinion bearing. Refer to **Drive Pinion Bearings Replacement**.

DIFFERENTIAL CARRIER BEARING PRELOAD ADJUSTMENT (8.0, 8.6 INCH AXLE)

Tools Required

- **J 22779** Side Bearing Backlash Gage. See **Special Tools**.
- **J 25588** Side Bearing Shim Installer. See **Special Tools**.

Adjusting

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.**

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. Side 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.

    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 .

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.

    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 (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 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**.

DIFFERENTIAL CARRIER BEARING PRELOAD ADJUSTMENT (9.5 LD INCH AXLE)

Tools Required

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

Adjusting

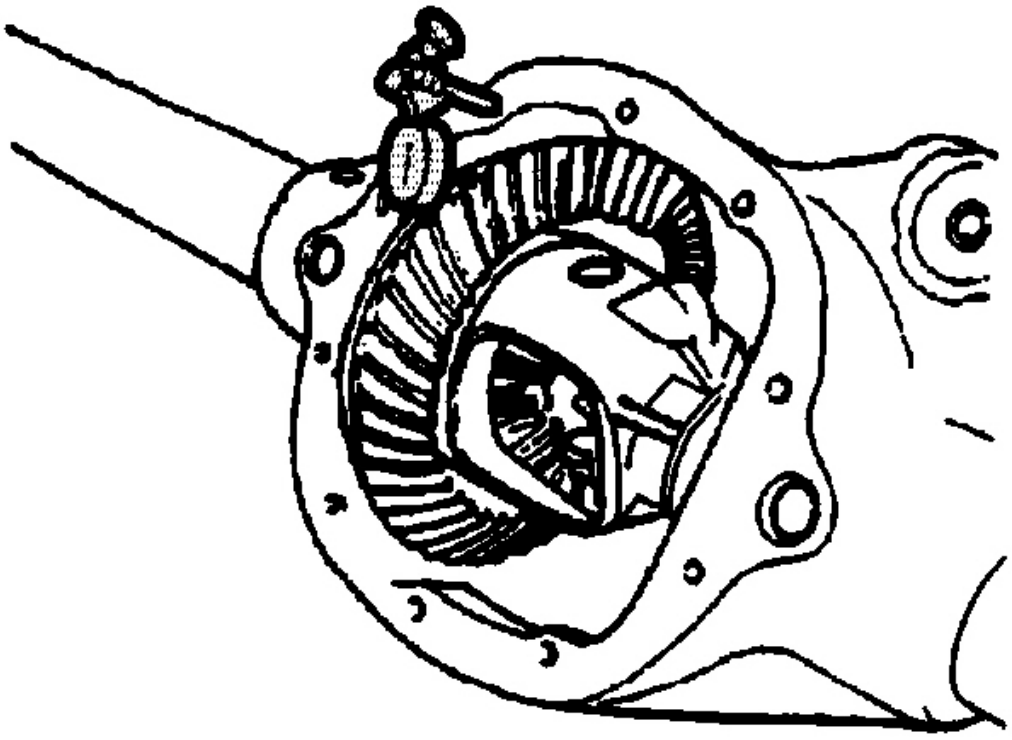


Fig. 104: Measuring Ring Gear Backlash
Courtesy of GENERAL MOTORS CORP.

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.

   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.

   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.

       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.

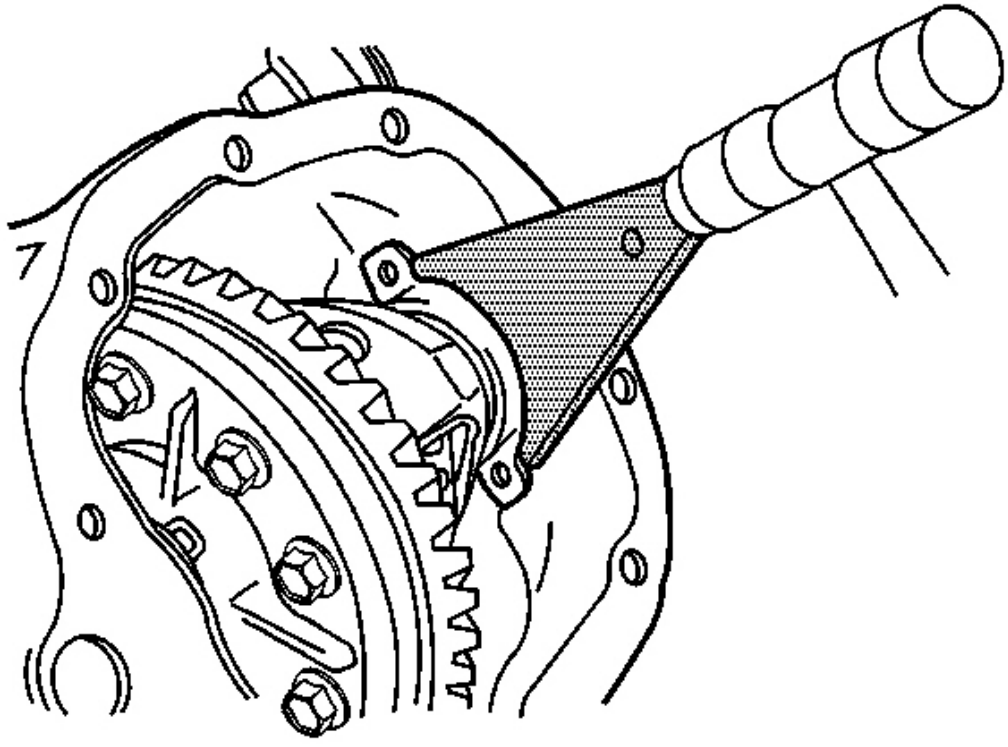


Fig. 105: Installing The Left Side Service Shim Using J 25588
Courtesy of GENERAL MOTORS CORP.

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 .

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**.

BACKLASH ADJUSTMENT (8.0, 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**.

Adjusting

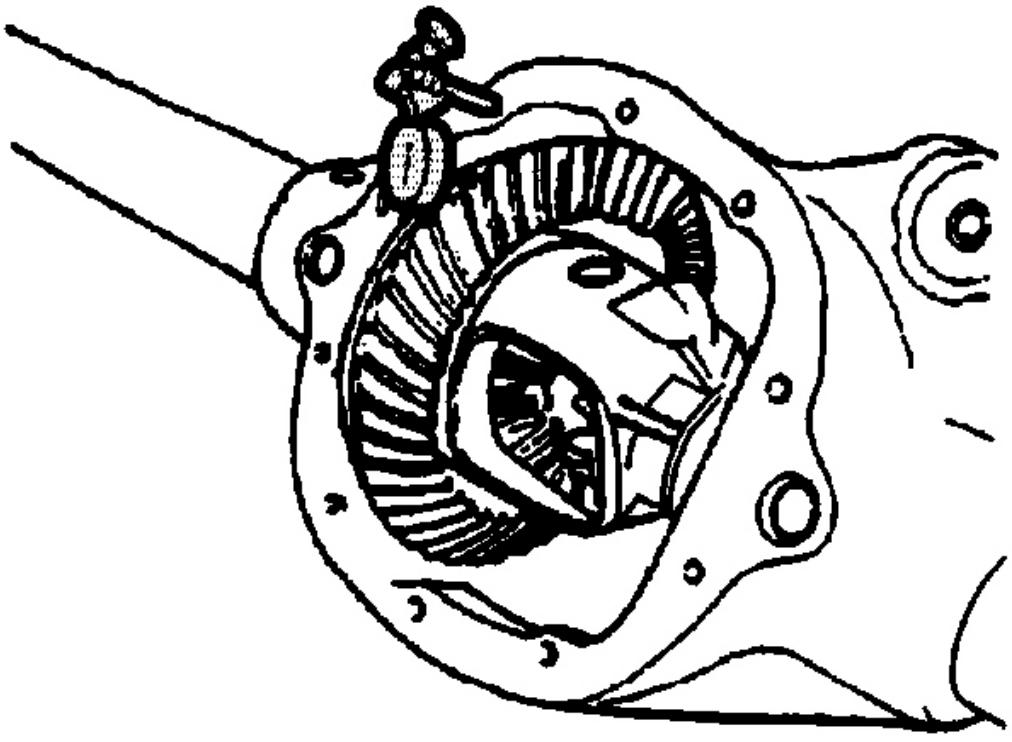


Fig. 106: Measuring Ring Gear Backlash
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 25025-1** and the **J 8001** to the axle housing as shown. See **Special Tools**.
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 8 points around the ring gear.

   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.

   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.

       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.

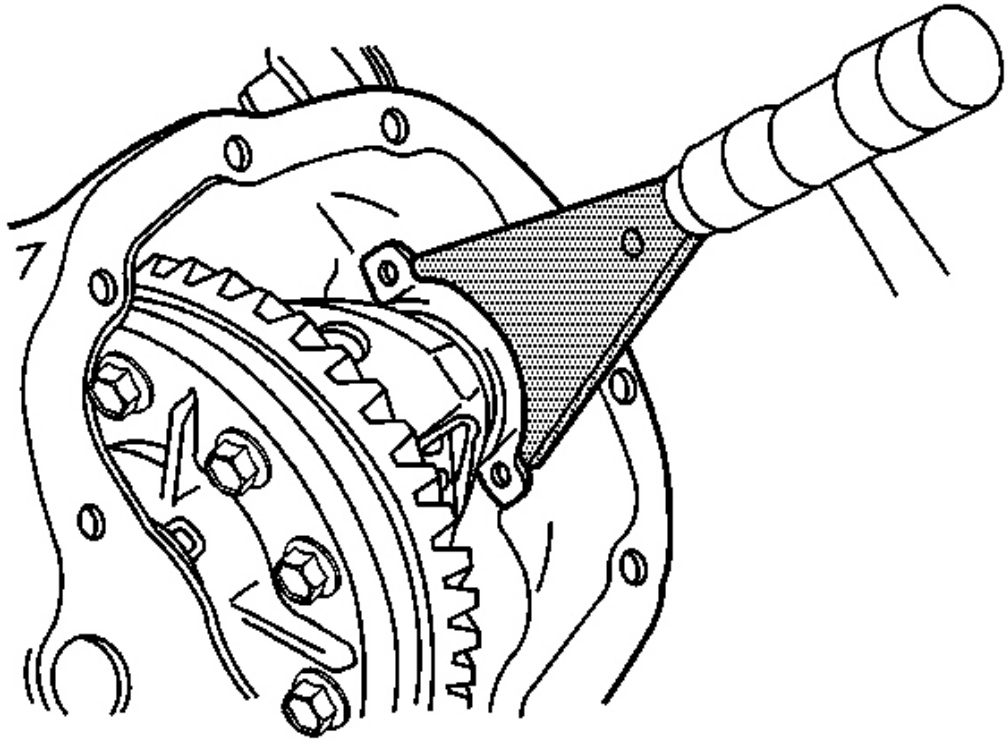


Fig. 107: Installing The Left Side Service Shim Using J 25588
Courtesy of GENERAL MOTORS CORP.

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 .

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**.

BACKLASH ADJUSTMENT (9.5 INCH AXLE)

Tools Required

- **J 8001** Dial Indicator Set
- **J 24429** Side Bearing Backlash Spanner. See **Special Tools**.
- **J 25025** Guide Pins. See **Special Tools**.

Adjusting

IMPORTANT:

- **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.**
- **The differential side bearings must be initially preloaded in order to determine the backlash of the gear set. After the backlash is set, the final bearing preload is set.**

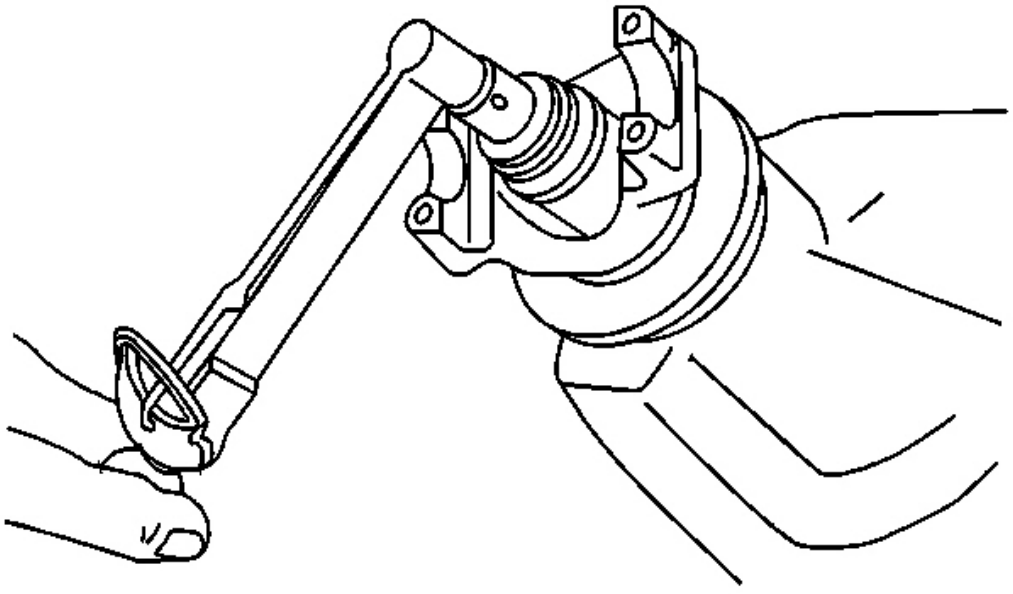


Fig. 108: Measuring Pinion Rotating Torque
Courtesy of GENERAL MOTORS CORP.

1. Measure the rotating torque of the drive pinion and differential assembly using an inch-pound torque wrench.

   Specification: The rotating torque of the drive pinion and differential assembly should be 3.4-6.2 N.m (30-55 lb in) for new bearings or 2.8-5.1 N.m (25-45 lb in) for used bearings.

2. If the rotating torque is too low, tighten the differential bearing adjuster nut in one slot increments until the specified rotating torque is obtained.
3. If the rotating torque is too high, loosen the differential bearing adjuster nut in one slot increments until the specified rotating torque is obtained.
4. If the specification for the rotating torque of the drive pinion and differential assembly cannot be obtained by adjusting the differential bearing adjuster nut, remove the differential assembly, measure the rotating torque of the drive pinion and adjust as necessary. Refer to **Differential Replacement** and **Drive Pinion Bearings Replacement**.

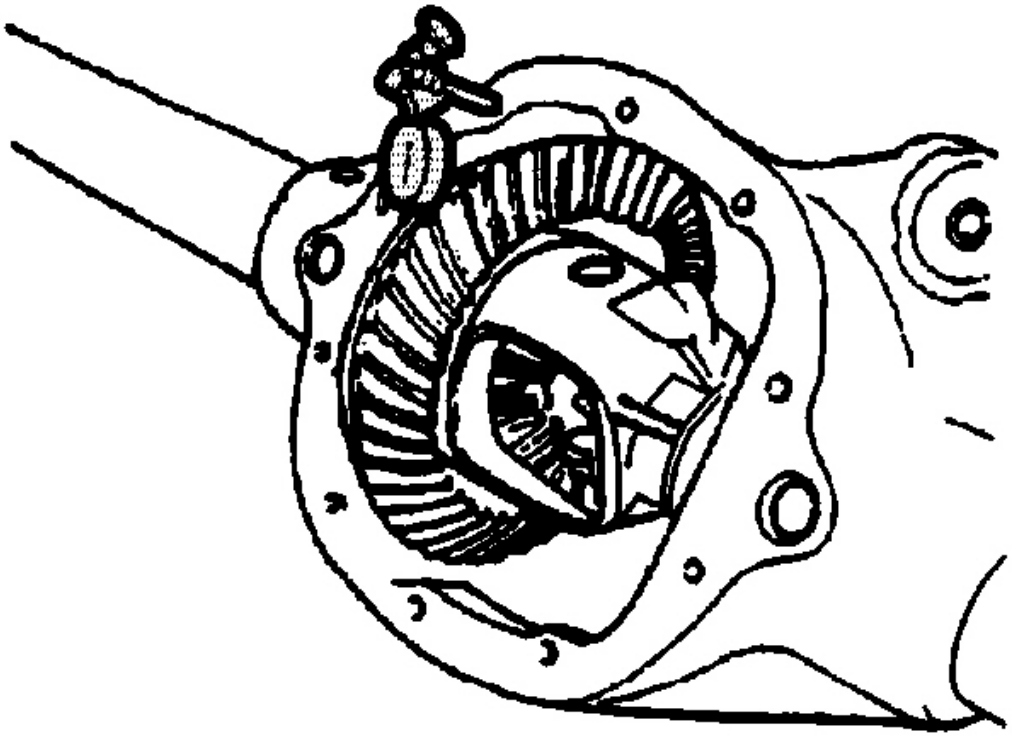


Fig. 109: Measuring Ring Gear Backlash
Courtesy of GENERAL MOTORS CORP.

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

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

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

   Measure and record the backlash.

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

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

11. 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
12. 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: Increasing or decreasing the shim thickness by 0.05 mm (0.002 in) will change the backlash adjustment approximately 0.03 mm (0.001 in).

13. If the backlash is not within specifications, adjust the backlash by performing the following procedure:
    1. Remove the differential bearing adjuster nut retainer bolt.
    2. Remove the differential bearing adjuster nut retainer.
    3. Loosen the bearing cap bolts.

       Do not remove the bearing cap bolts.

    4. Loosen the differential bearing adjuster nut using the **J 24429** . See **Special Tools**.
    5. Remove the differential side bearing shim.
    6. Measure the thickness of the shim.

       Measure the shim in 3 locations.

    7. Calculate the average of the 3 measurements.

       Record the measurement.

    8. If the backlash is too small, select a smaller shim than the one that was removed. For example, to increase the backlash by 0.05 mm (0.002 in), select a shim that is 0.10 mm (0.004 in) thinner than the shim that was removed.
    9. If the backlash is too large, select a larger shim than the one that was removed. For example, to increase the backlash by 0.05 mm (0.002 in), select a shim that is 0.10 mm (0.004 in) thicker than the shim that was removed.
    10. Install the shim.
14. Tighten the differential bearing adjuster nut using the **J 24429** until the differential bearing adjuster nut is seated against the bearing cup. See **Special Tools**.
15. Once the differential bearing adjuster is seated against the differential bearing, tighten the differential bearing adjuster nut using the **J 24429** the following additional amounts:. See **Special Tools**.

Tighten:

- For used bearings, tighten the differential bearing adjuster nut an additional 2 slots.
- For new bearings, tighten the differential bearing adjuster nut an additional 3 slots.

16. Tighten the differential bearing cap bolts.

    Tighten: Tighten the bearing cap bolts to 85 N.m (63 lb ft).

17. Recheck the backlash following the steps above to verify that the backlash is within specifications.
18. Install the differential bearing adjuster nut retainer.
19. Install the differential bearing adjuster nut retainer bolt.

    Tighten: Tighten the differential bearing adjuster nut retainer nut bolt to 26 N.m (19 lb ft).

20. Measure the drive pinion and differential case side bearing preload and adjust, if necessary following the steps above.
21. Once the backlash and bearing preload 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 & 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

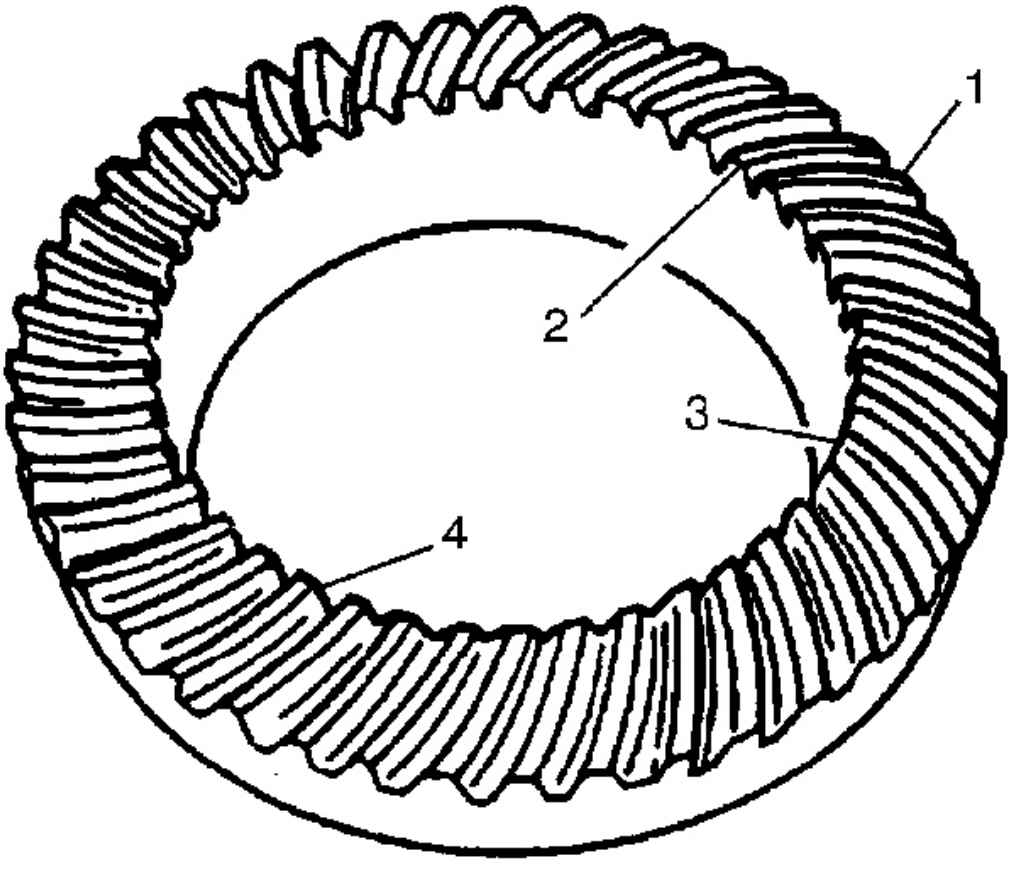


Fig. 110: Defining Gear Tooth Nomenclature
Courtesy of GENERAL MOTORS CORP.

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

Adjustments Affecting Tooth Contact

The following 2 adjustments affect the tooth contact pattern:

- Backlash adjustment
- Pinion depth adjustment

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

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.

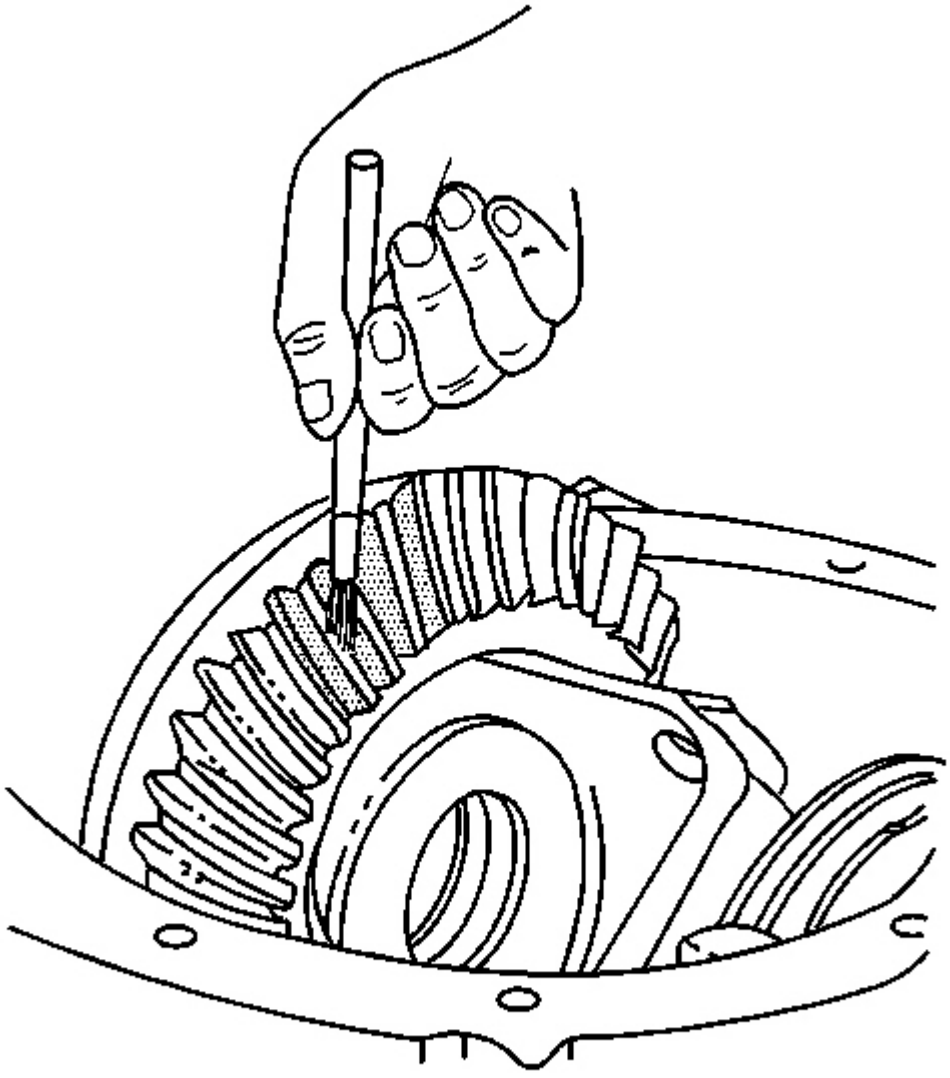


Fig. 111: Applying Gear Marking Compound To Ring Gear Teeth
Courtesy of GENERAL MOTORS CORP.

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

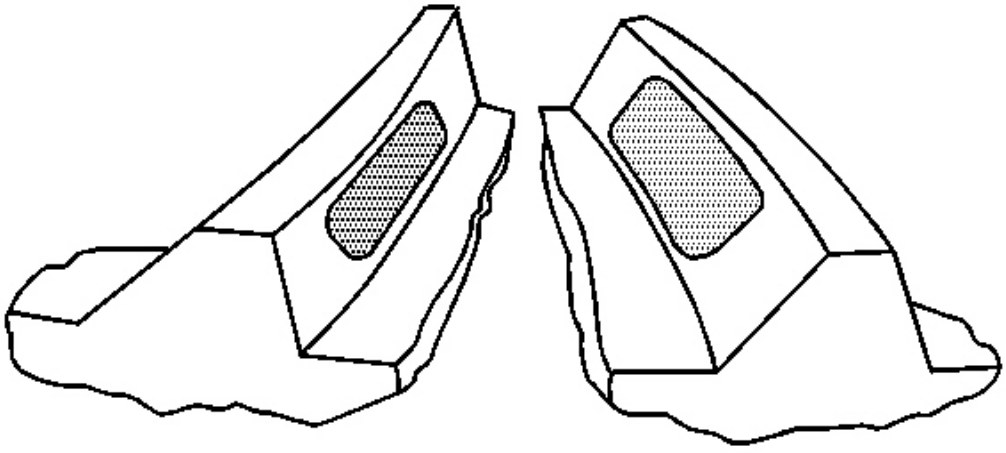


Fig. 112: Identifying Correct Gear Tooth Contact Pattern
Courtesy of GENERAL MOTORS CORP.

The backlash and pinion depth is correct.

Correction

None required.

Service Hints

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

- 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

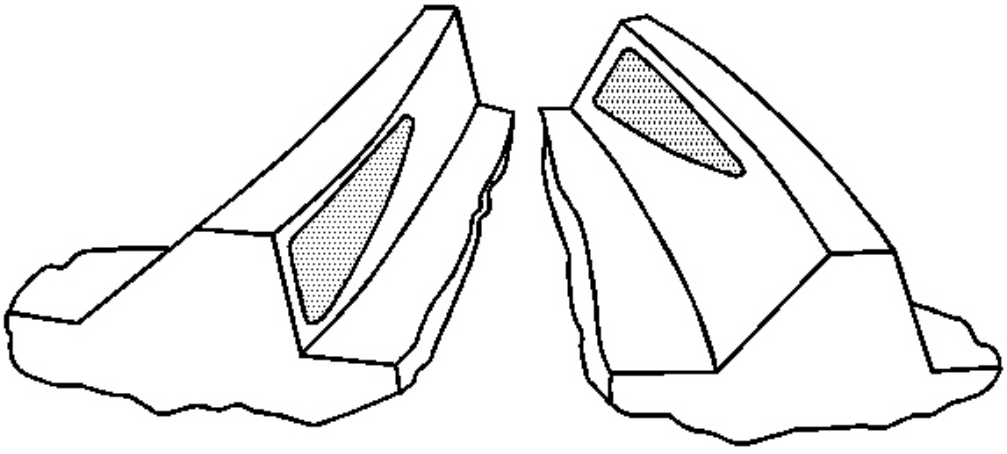


Fig. 113: Identifying Drive Side Heel - Coast Side Toe Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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 (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.

Drive Side Toe - Coast Side Heel Contact Pattern

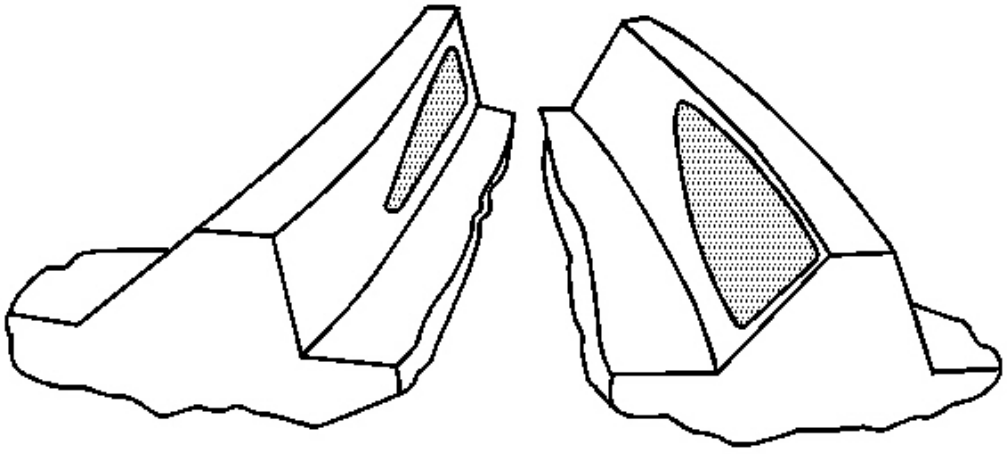


Fig. 114: Identifying Drive Side Toe - Coast Side Heel Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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 (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.

Drive Side Heel - Coast Side Heel Contact Pattern

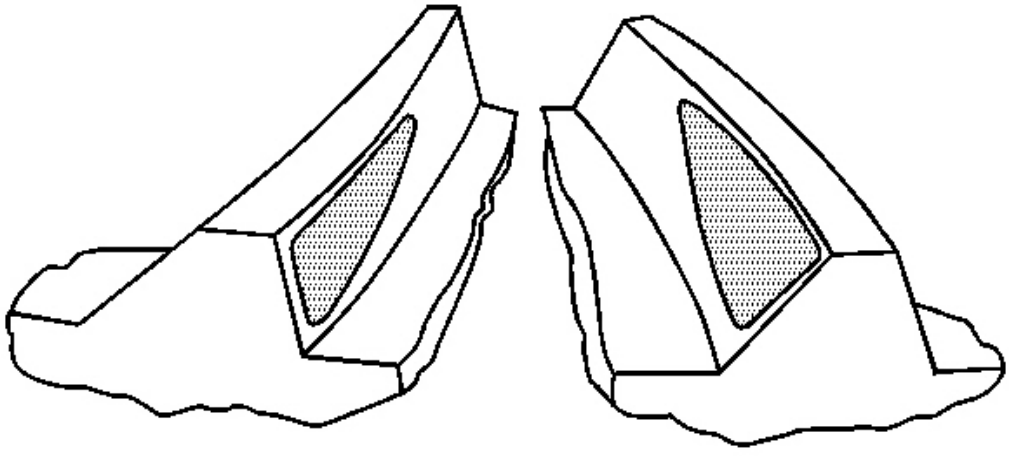


Fig. 115: Identifying Drive Side Heel - Coast Side Heel Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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 (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.

Drive Side Toe - Coast Side Toe Contact Pattern

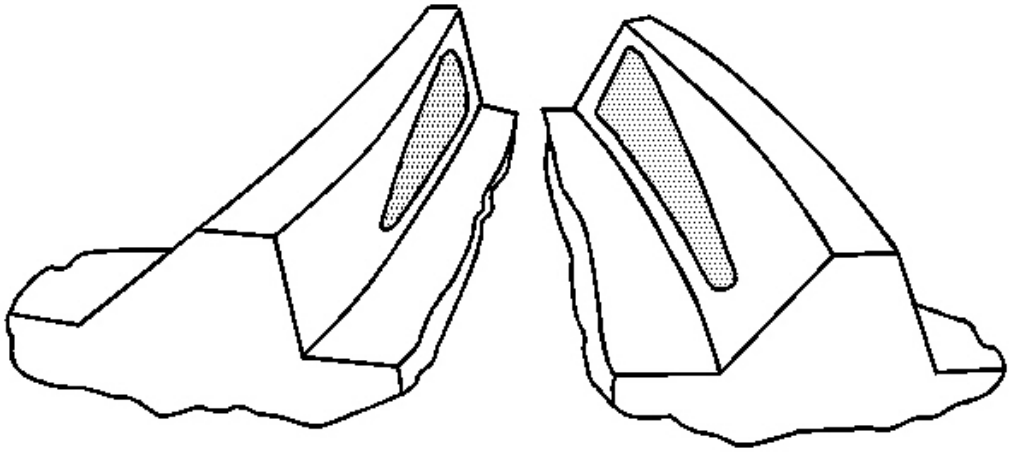


Fig. 116: Identifying Drive Side Toe - Coast Side Toe Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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 (8.0, 8.6 Inch Axle)** or **Backlash Adjustment (9.5 Inch Axle)**.

High Flank Contact Pattern

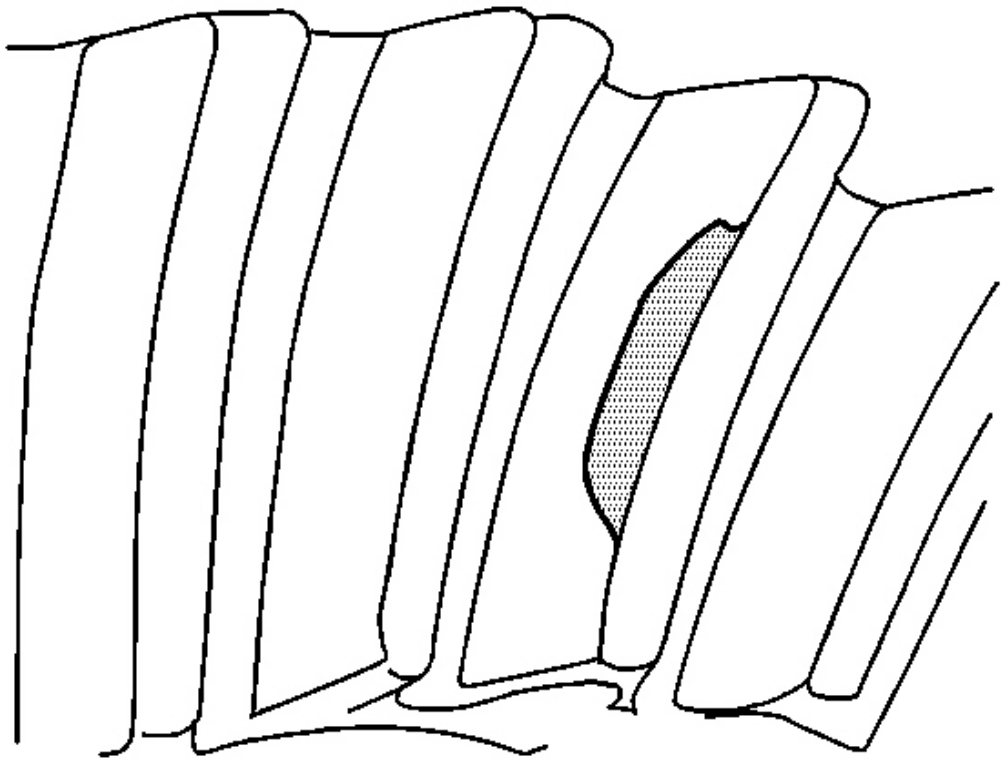


Fig. 117: Identifying High Flank Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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

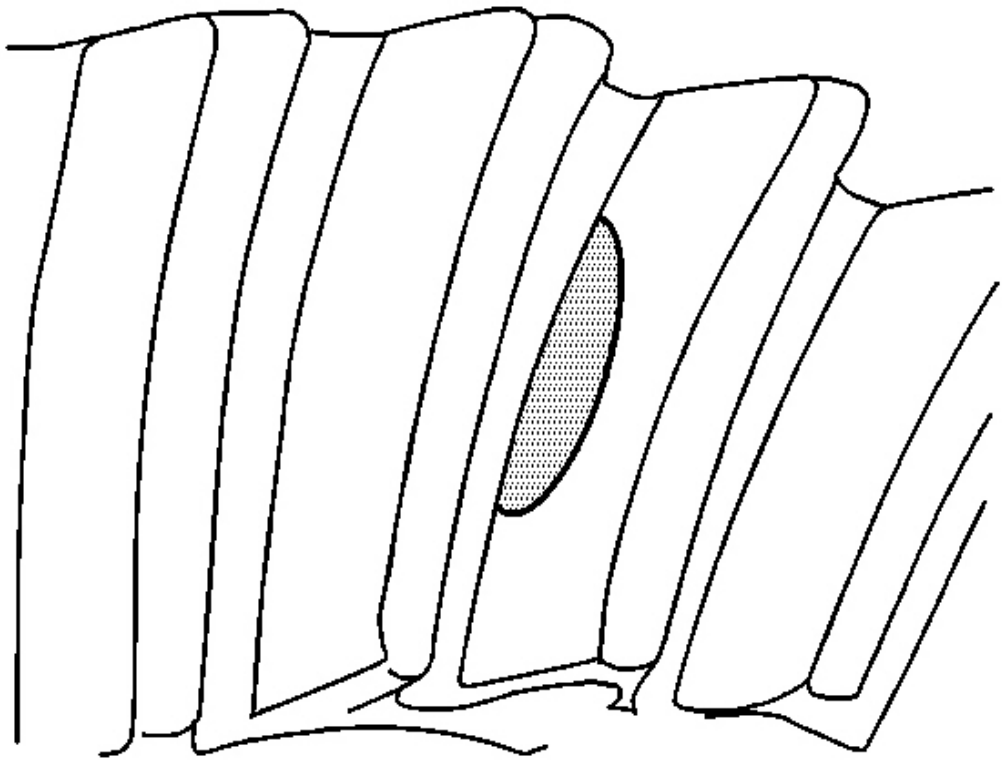


Fig. 118: Identifying Low Flank Contact Pattern
Courtesy of GENERAL MOTORS CORP.

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**.

LOCKING DIFFERENTIAL DISASSEMBLE

Tools Required

J 26252 Locking Differential Governor Remover. See **Special Tools**.

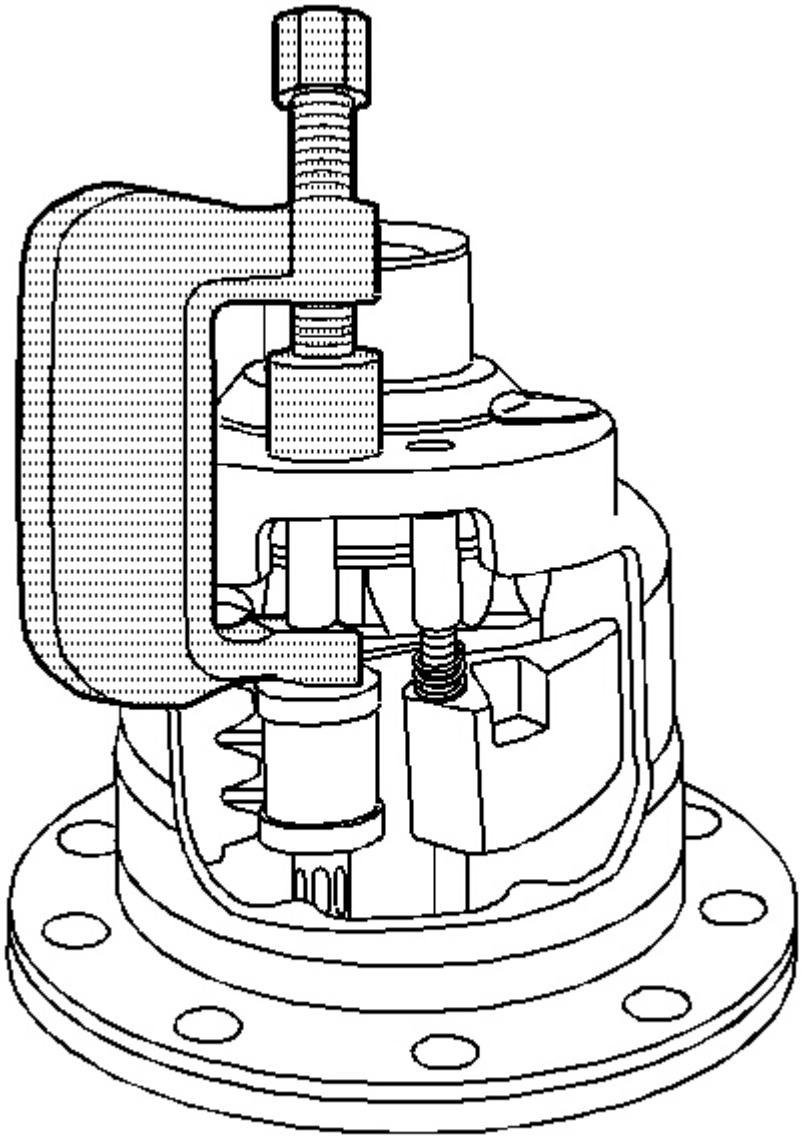


Fig. 119: View Of Governor Bushing & J 26252
Courtesy of GENERAL MOTORS CORP.

1. Remove the governor bushing using the **J 26252** . See **Special Tools**.
2. Remove the governor assembly.

To aid in the removal of the governor assembly, turn the side gear as necessary to position the governor

assembly between two of the side gear teeth.

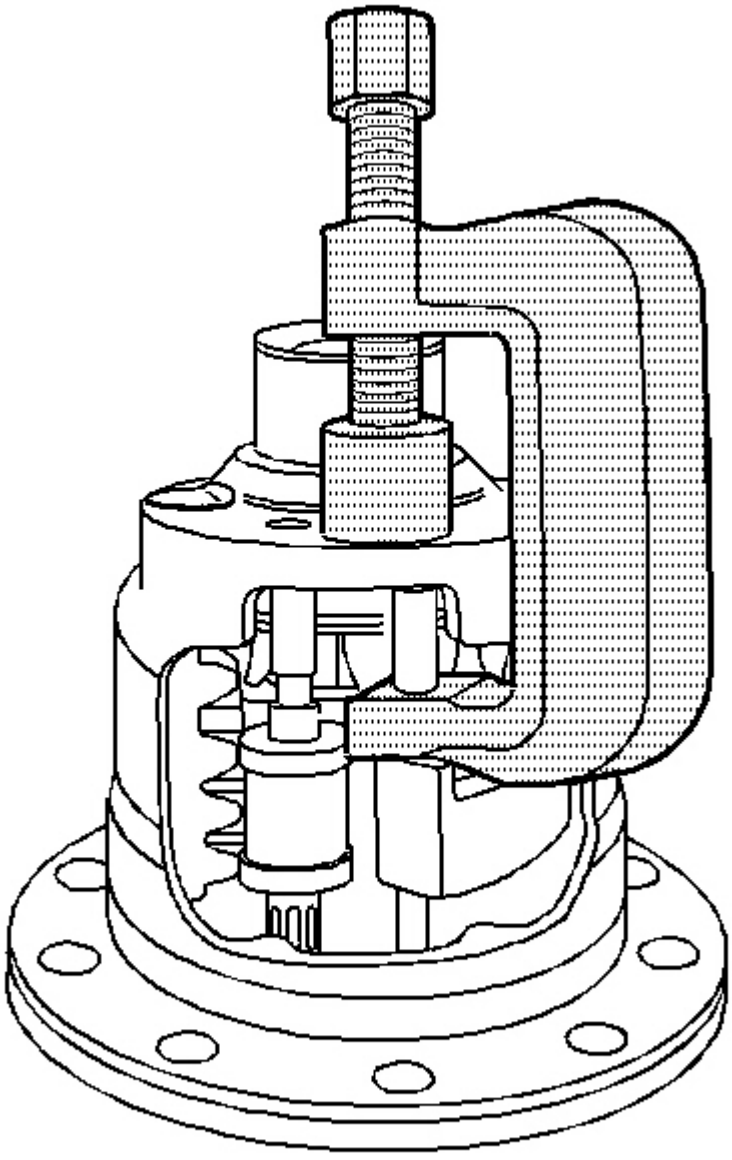


Fig. 120: View Of Latching Bracket Assembly & J 26252
Courtesy of GENERAL MOTORS CORP.

3. Remove the latching bracket assembly bushing using the **J 26252** . See **Special Tools**.

To aid in the removal of the latching bracket assembly, turn the side gear as necessary to position the latching bracket assembly between two of the side gear teeth.

4. Remove the pinion shaft lock bolt.
5. Remove the pinion shaft.
6. Remove the differential pinion gears and the thrust washers.

   Rotate the pinion gears and roll the pinion gears and the thrust washers out of the case through the differential window.

   Mark the pinion gears and thrust washers accordingly for re-assembly.

7. Remove the thrust block.
8. Remove the right side gear and clutch discs assembly.
9. Remove the right side shim.

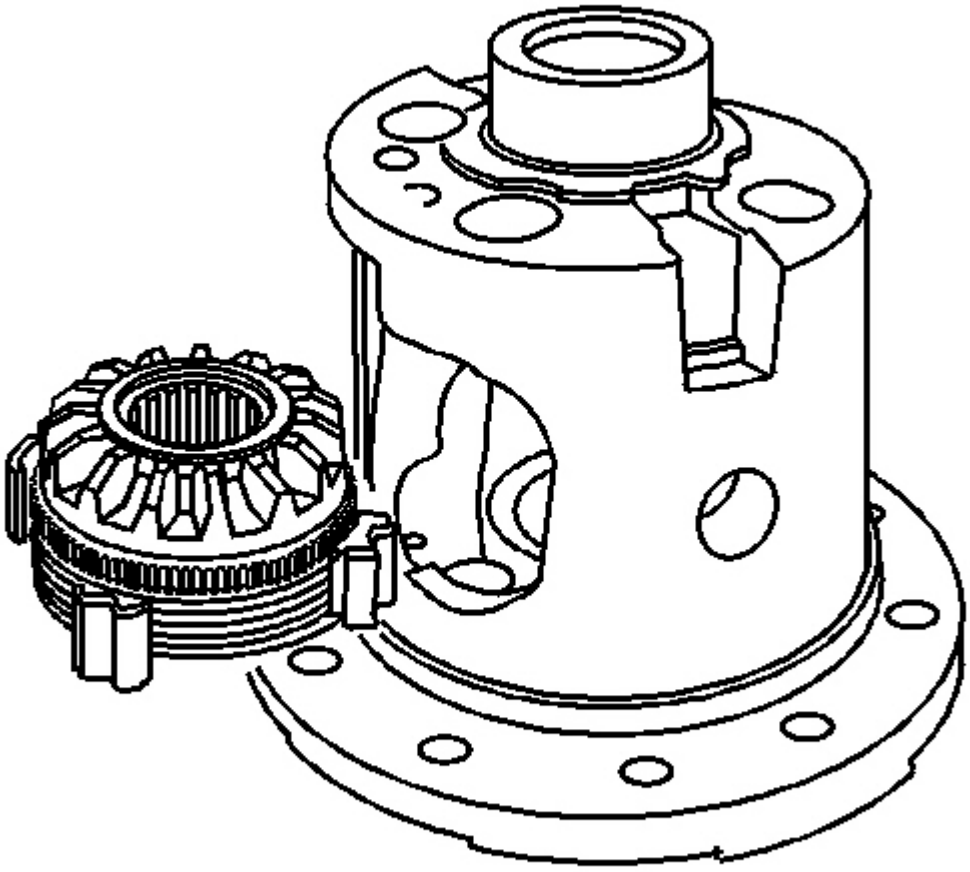


Fig. 121: View Of Left Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

10. Remove the left side gear (cam unit) and clutch discs assembly.

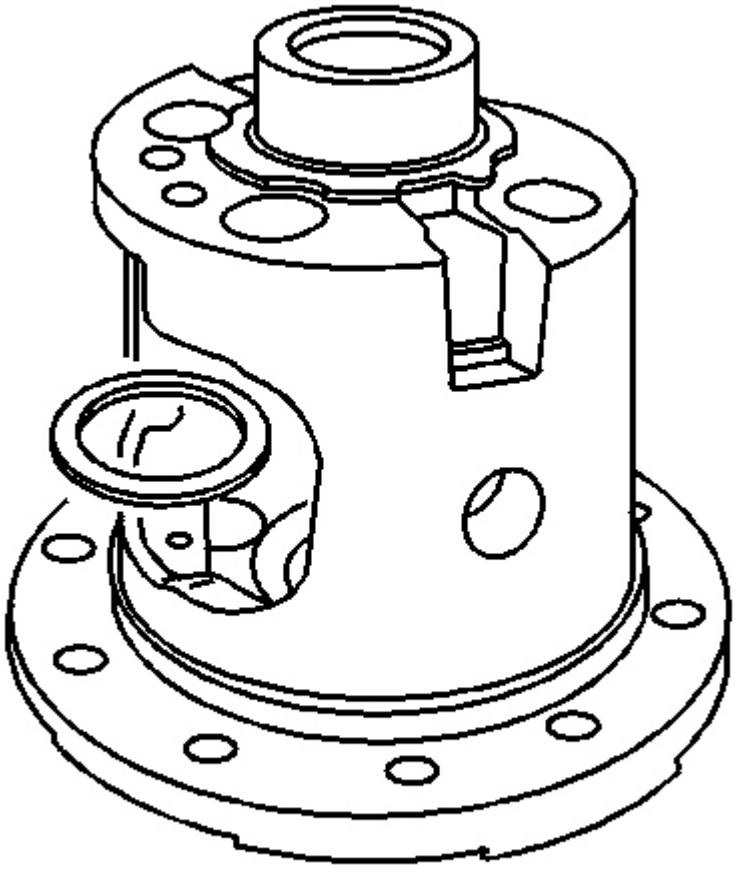


Fig. 122: View Of Left Side Gear Thrust Washer
Courtesy of GENERAL MOTORS CORP.

11. Remove the left side gear thrust washer.

LOCKING DIFFERENTIAL CLUTCH DISC ASSEMBLY DISASSEMBLE (8.0 INCH AXLE)

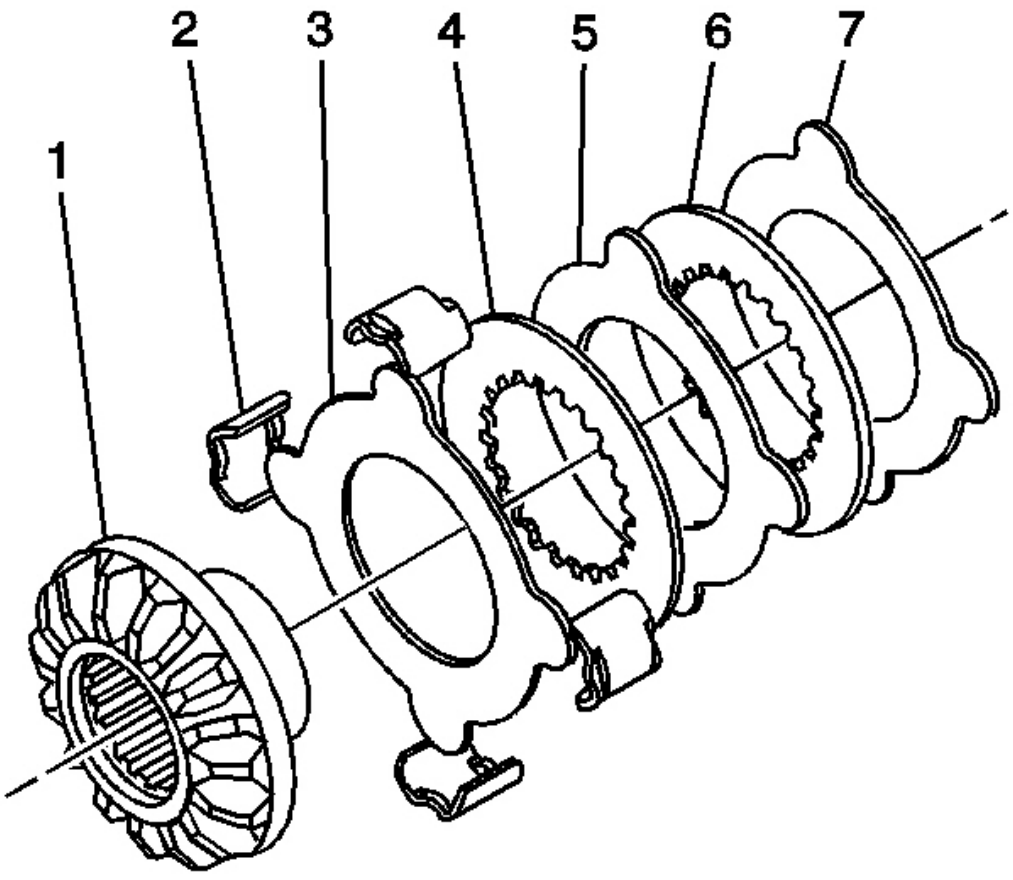


Fig. 123: View Of Locking Differential Clutch Disc Assembly (9.5 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

1. Remove the guide clips (2).
2. Remove the clutch discs and the splined discs (3 - 7) from the side gear (1).

LOCKING DIFFERENTIAL CLUTCH DISC ASSEMBLY DISASSEMBLE (8.6 INCH AXLE)

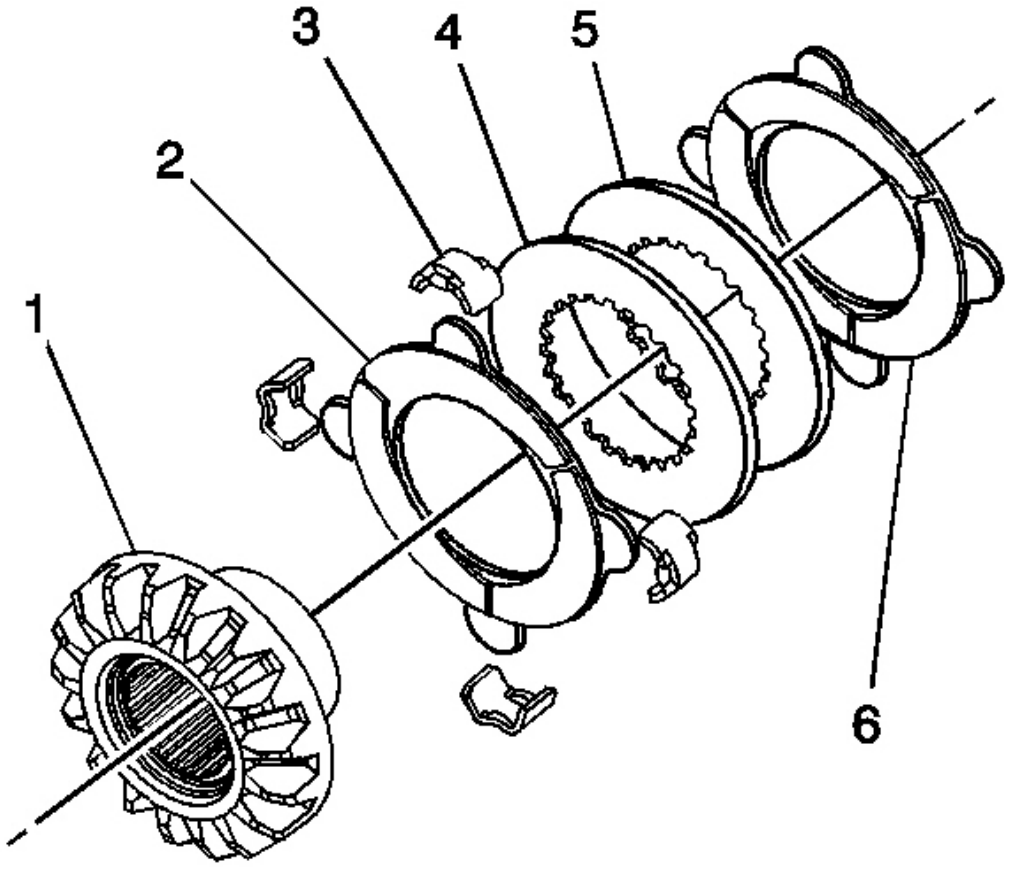


Fig. 124: View Of Locking Differential Clutch Disc Assembly (8.6 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

1. Remove the guide clips (3).
2. Remove the clutch discs and the splined discs (2, 4-6) from the locking differential side gear (1).

LOCKING DIFFERENTIAL CAM UNIT DISASSEMBLE

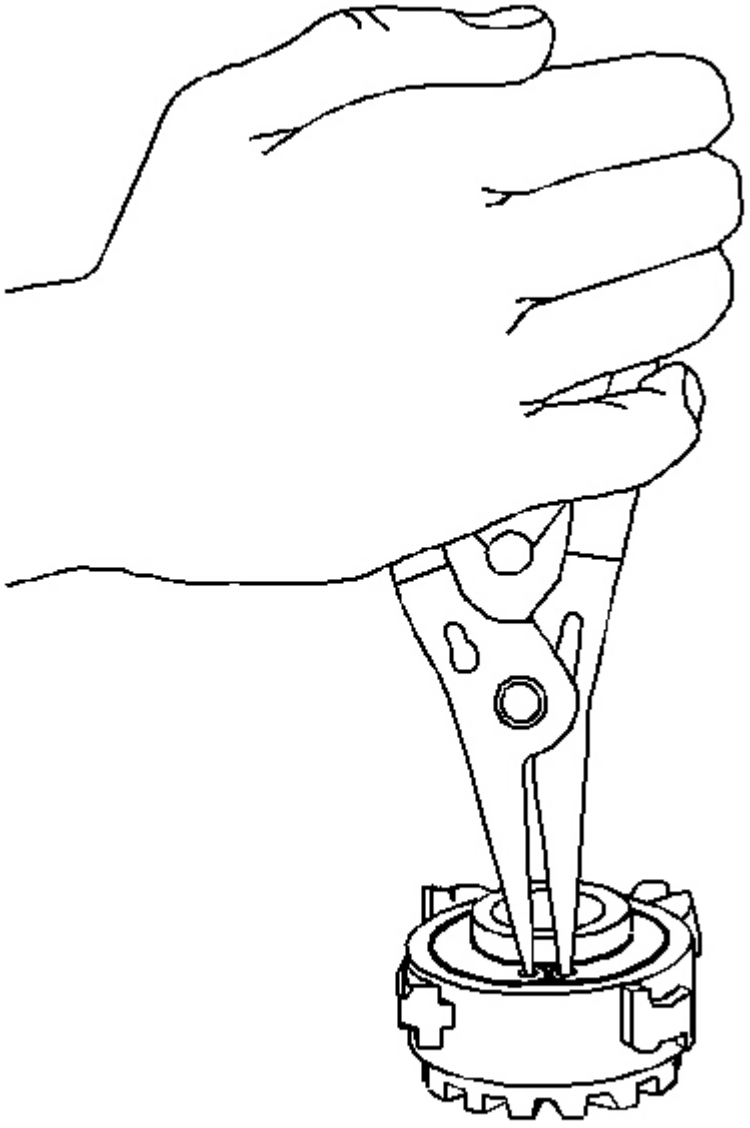


Fig. 125: Removing Locking Differential Retaining Ring (8.6 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

1. Remove the retaining ring.

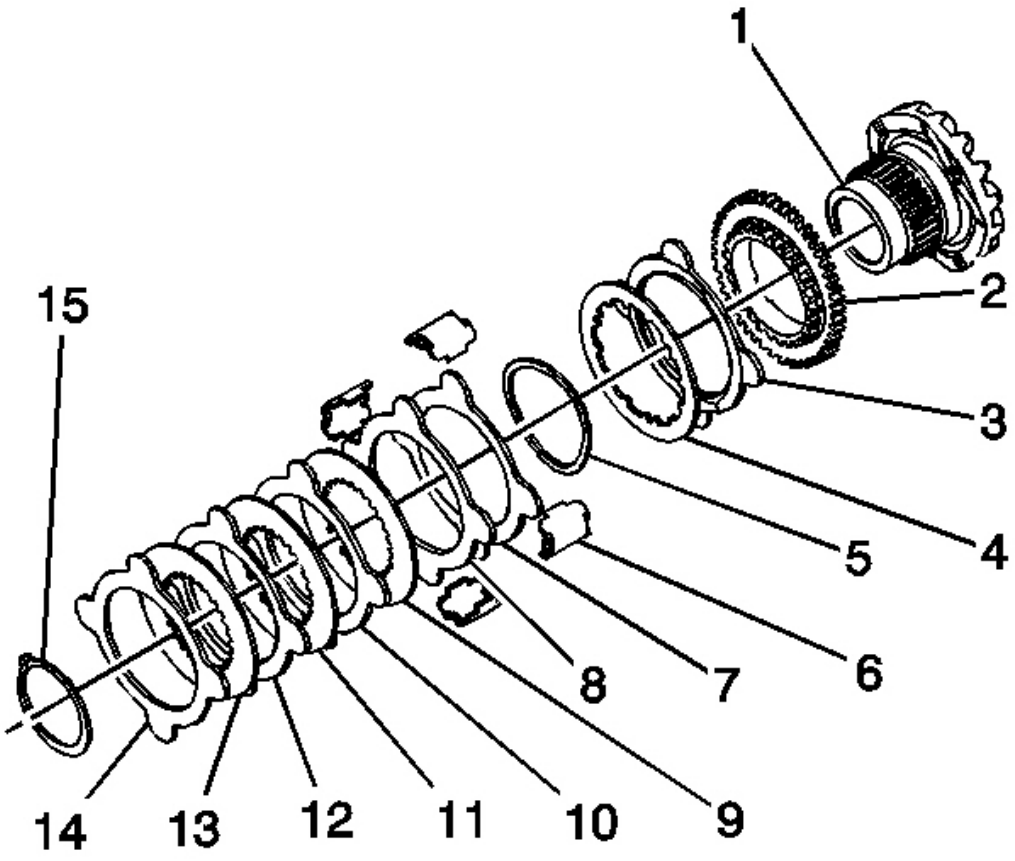


Fig. 126: View Of Locking Differential Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

2. Disassemble the cam unit and clutch disc assembly as follows:
    1. Remove the guide clips (6).
    2. Remove the clutch discs and the splined discs (7-14).
    3. Remove the wave washer (5).
    4. Remove the fuse disc (4).
    5. Remove the carbon eared disc (3).
    6. Disassemble the cam plate (2) from the cam side gear (1).

LOCKING DIFFERENTIAL CLEANING & INSPECTION

1. Clean all the parts with an approved solvent.

2. Visually inspect all the parts for excessive wear or breakage. Replace the parts if necessary.
3. Inspect the pinion gear and the side gear teeth for any the following conditions:
    - Wear
    - Cracks
    - Scoring
    - Spalling
4. Inspect the thrust washer and shim for wear.
5. Inspect the fit of the side gears on the axle shafts.
6. Inspect the differential case for cracks and scoring. Replace the differential if any damage to the case is found.
7. Inspect the side gear bore for scoring. If scoring is present, replace the differential.

IMPORTANT: Do not replace the thrust block unless it is necessary.

8. Inspect the thrust block for excessive wear.

LOCKING DIFFERENTIAL CAM UNIT ASSEMBLE

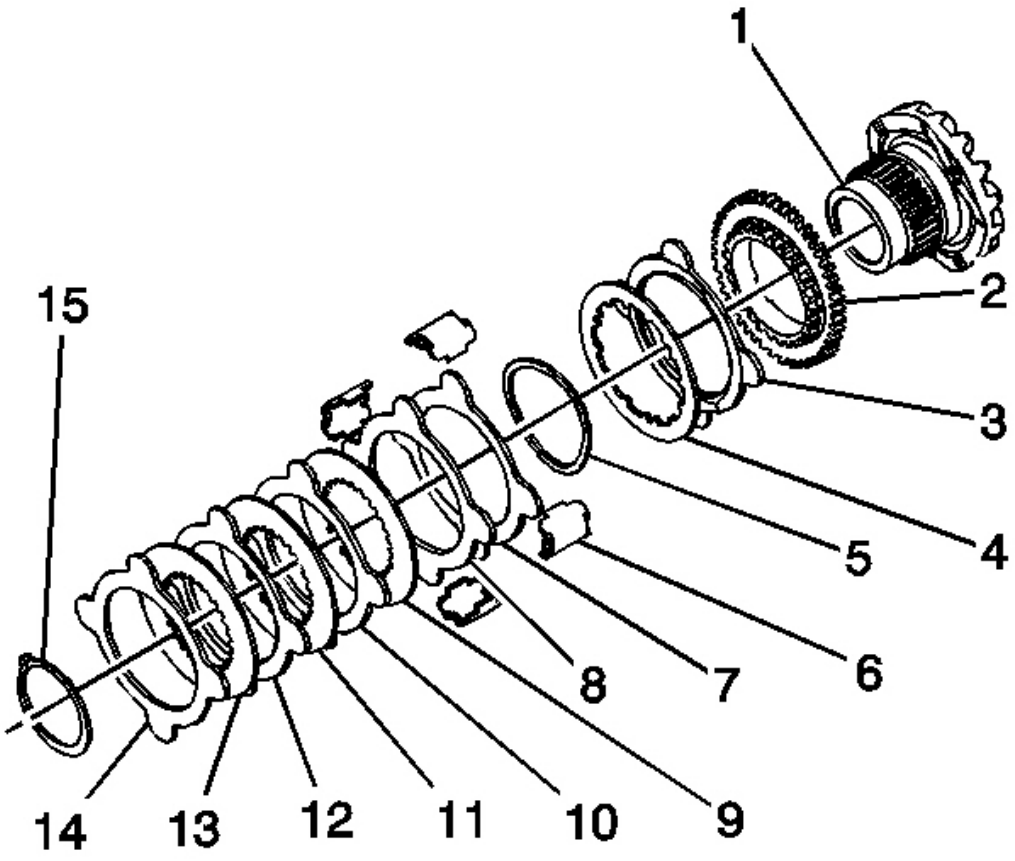


Fig. 127: View Of Locking Differential Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

1. Apply axle lubricant, GM P/N 12378261 (Canadian P/N 10953455) or equivalent, meeting GM Specification 9986115, to the surface of each disc.
2. Assemble the left side or the flange-end side cam unit and clutch disc assembly as follows:
    1. Install the cam plate (2) to the cam side gear (1).
    2. Install the carbon-faced eared disc (3).
    3. Install the fuse disc (4).
    4. Install the 1st non-carbon eared disc (7).
    5. Install the 2nd non-carbon eared disc (8).
    6. Install the wave washer (5).
    7. Install the 1st splined disc (9).
    8. Install the 3rd non-carbon eared disc (10).

9. Install the 2nd splined disc (11).
10. Install the 4th non-carbon eared disc (12).
11. Install the 3rd splined disc (13).
12. Install the 5th non-carbon eared disc (14).
13. Install the retaining ring (15).

    Compress the clutch disc pack and align the teeth on the 3rd splined disc with the teeth on the cam plate in order to seat the retaining ring in the groove on the cam side gear.

14. Install the guide clips (2) to the clutch disc pack.

    Apply grease to the guide clips in order to hold the clips in place on the disc ears.

LOCKING DIFFERENTIAL CLUTCH DISC ASSEMBLY ASSEMBLE (8.0 INCH AXLE)

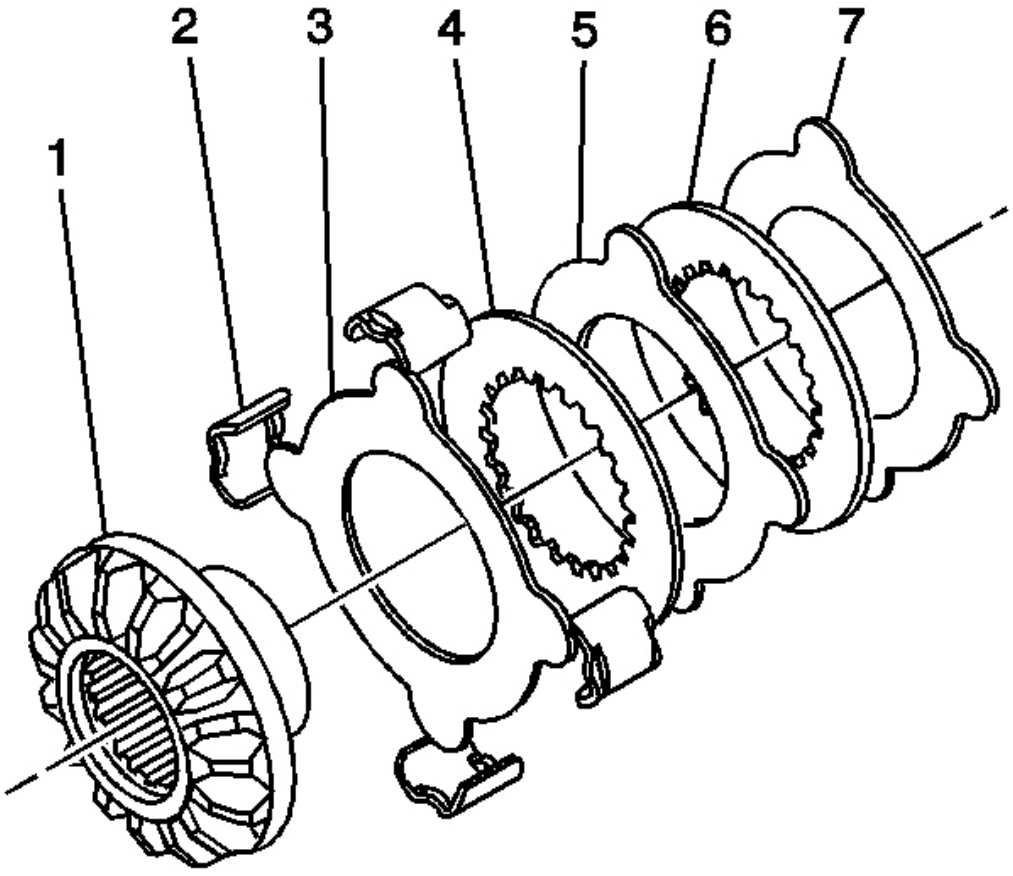


Fig. 128: View Of Locking Differential Clutch Disc Assembly (8.0 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

1. Apply axle lubricant, GM P/N 12378261 or equivalent meeting GM Specification 9986115, to the surface of each disc.
2. Assemble the right side or bell - end side clutch disc assembly as follows:
    1. Install the 1st non-carbon eared disc (3) to the side gear (1).
    2. Install the 1st splined disc (4).
    3. Install the 2nd non-carbon eared disc (5).
    4. Install the 2nd splined disc (6).
    5. Install the 3rd non-carbon eared disc (7).
    6. Install the guide clips (2) to the clutch discs (2-7).

        Apply grease to the guide clips in order to hold the clips in place on the disc ears.

LOCKING DIFFERENTIAL CLUTCH DISC ASSEMBLY ASSEMBLE (8.6 INCH AXLE)

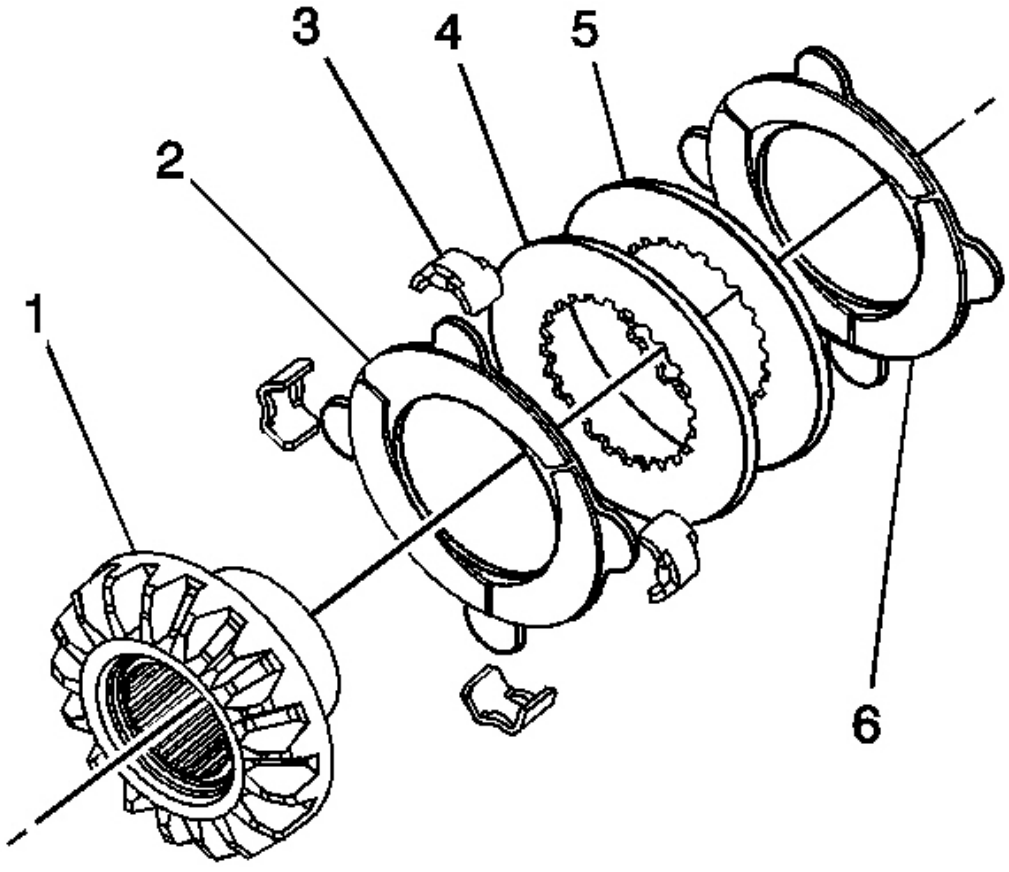


Fig. 129: View Of Locking Differential Clutch Disc Assembly (8.6 Inch Axle)
Courtesy of GENERAL MOTORS CORP.

1. Apply axle lubricant, GM P/N 12378261 (Canadian P/N 10953455) or equivalent meeting GM Specification 9986115, to the surface of each disc.
2. Assemble the right side or bell-end side clutch disc assembly as follows:
    1. Install the two-sided carbon eared disc (2) to the side gear (1).
    2. Install the 1st splined disc (4).
    3. Install the 2nd splined disc (5).
    4. Install the one-sided carbon eared disc (6).
    5. Install the guide clips (3) to the clutch discs (2, 4-6).

    Apply chassis grease, GM P/N 12377985 (Canadian P/N 88901242) or equivalent, to the guide clips in order to hold the clips in place on the disc ears.

LOCKING DIFFERENTIAL ADJUSTMENT

Tools Required

- **J 7872** Magnetic Base Dial Indicator. See **Special Tools**.
- **J 8001-2** Dial Indicator Sleeve. See **Special Tools**.
- **J 8001-3** Dial Indicator. See **Special Tools**.

Adjustment of the Differential

IMPORTANT: If it is necessary to replace the left side gear (cam unit) and disc assembly, the right side gear and disc assembly, or the thrust block, the entire differential must be adjusted. The differential is adjusted using selective thickness thrust washers between the clutch pack assemblies and the case and/or different selective thickness thrust blocks.

When adjusting the differential, note the following:

- Build up the clutch disc packs properly.

  Proper clearance between parts is critical to the operation of the unit.

- Adjust the backlash and thrust block clearance in the following order:
  1. The left side gear backlash
  2. The right side gear backlash
  3. The thrust block clearance

Left Side Gear Backlash Adjustment

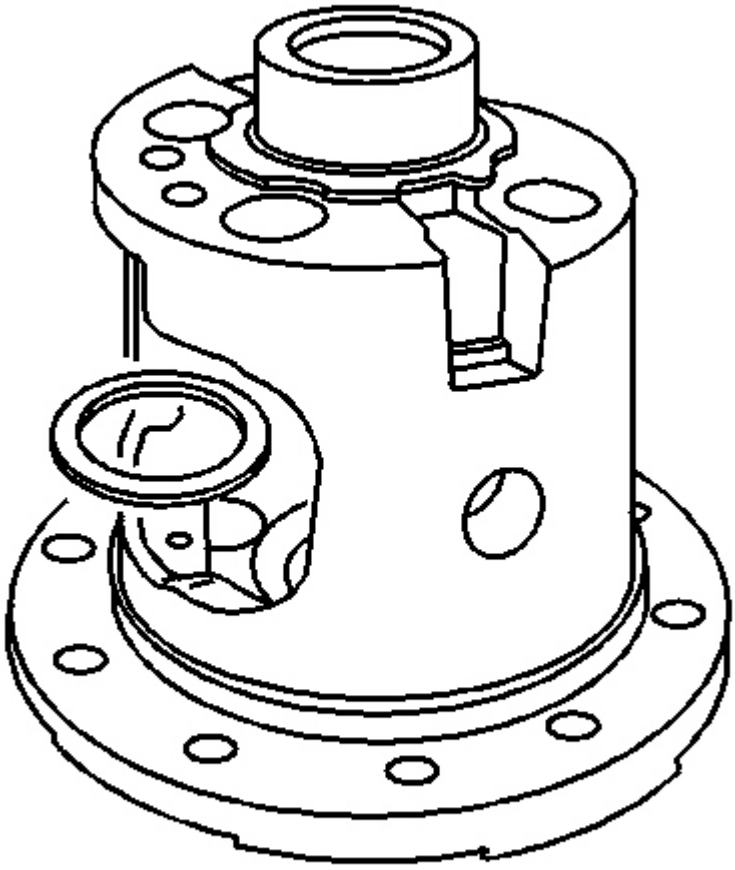


Fig. 130: View Of Left Side Gear Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Install the new left side thrust washer into the flange end of the differential case.

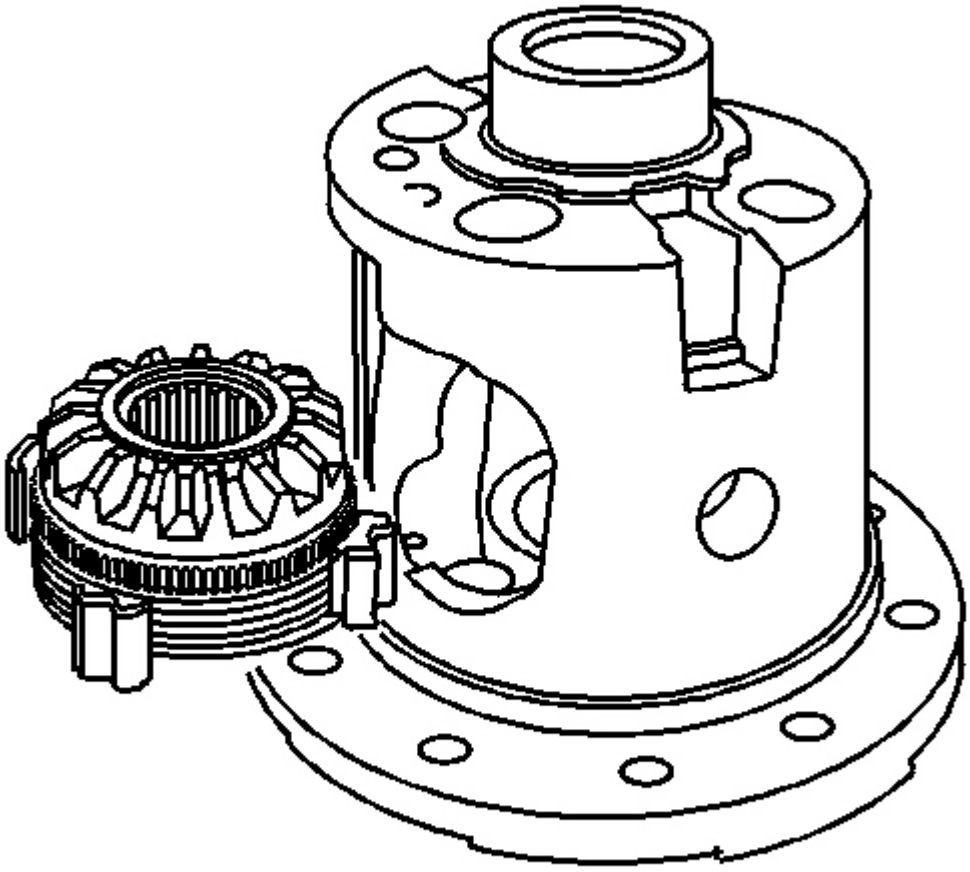


Fig. 131: View Of Left Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the left side gear (cam unit) and clutch pack assembly into the differential case.
3. Install the pinion gears with the pinion thrust washers into the differential case.

   Align the openings of the pinion gears and the pinion thrust washer to the pinion shaft opening in the differential case.

4. Install the pinion shaft. It may be necessary to press down on the side gear in order to align the pinion gear shaft opening with the pinion shaft opening in the differential case.

   If the pinion shaft cannot be installed after pressing on the side gear, replace the side gear thrust washer with a thinner washer.

NOTE: Refer to Fastener Notice .

5. Install the pinion shaft lock bolt.

   Tighten: Tighten the pinion shaft lock bolt finger tight.

6. Rotate the pinion gear closest to the lock bolt so that one of the teeth is pointing downward, perpendicular to the ring gear flange.
7. Install a brass drift between the side gear and the pinion shaft.

   Press the brass drift in far enough in order to compress the clutch discs.

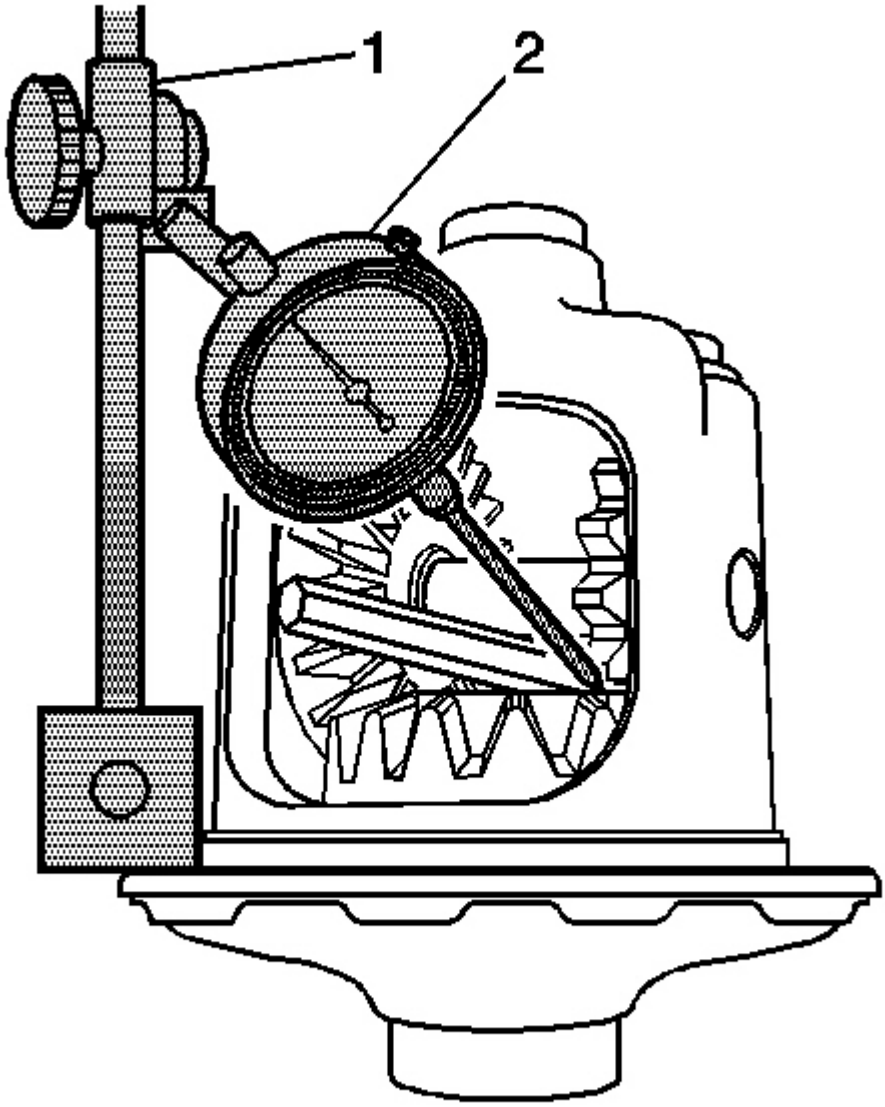


Fig. 132: Measuring Backlash Of Differential Pinion Gear & Side Gear
Courtesy of GENERAL MOTORS CORP.

8. Measure the backlash of the pinion gear and the side gear by doing the following:
    1. Install the **J 7872** (1) to the ring gear flange. See **Special Tools**.
    2. Loosely clamp the **J 8001-3** (2) onto the stem on the **J 7872** (1). See **Special Tools**.
    3. Place the contact pad of the **J 8001-3** on one of the teeth of the pinion gear closest to the pinion

shaft lock bolt. See **Special Tools**.

Turn the dial of the **J 8001-3** until the needle and the dial face indicate zero. See **Special Tools**.

Tighten: Tighten the lock nut of the **J 8001-2** finger tight. See **Special Tools**.

4. Pull the pinion gear firmly into the differential case seat.
5. Rotate the pinion gear back and forth.
6. Measure the backlash.

Specification: The backlash for the pinion gears should be 0.000-0.076 mm (0.000-0.003 in).

9. If the backlash is too large, install a thicker side gear thrust washer and inspect the backlash.
10. If the backlash is too small, install a thinner side gear thrust washer and inspect the backlash.

Left side gear thrust washers are available in the following sizes:

Washer Sizes:

- 0.56 mm (0.022 in)
- 0.68 mm (0.027 in)
- 0.81 mm (0.032 in)
- 0.91 mm (0.036 in)
- 1.02 mm (0.040 in)
- 1.12 mm (0.044 in)
- 1.22 mm (0.048 in)
- 1.32 mm (0.052 in)

Right Side Gear Backlash Adjustment

1. If necessary, remove the following from the differential case:
    1. The pinion lock shaft bolt
    2. The pinion shaft
    3. The pinion gears
    4. The pinion gear thrust washers
    5. The left side gear (cam unit) and clutch disc assembly
2. Install the right side gear thrust washer into the bell-end of the differential case.
3. Install the right side gear and clutch pack assembly into the differential case.
4. Install the pinion gears with the pinion thrust washers into the differential case.

Align the openings of the pinion gears and the pinion thrust washer to the pinion shaft opening in the differential case.

5. Press down on the side gear and install the pinion shaft.

   If the side gear cannot be pressed down far enough to install the pinion shaft, replace the side gear shim with a thinner shim.

6. Install the pinion shaft lock bolt.

   Tighten: Tighten the pinion shaft lock bolt finger tight.

7. Rotate the pinion gear so that one of the teeth is pointing downward, perpendicular to the ring gear flange.

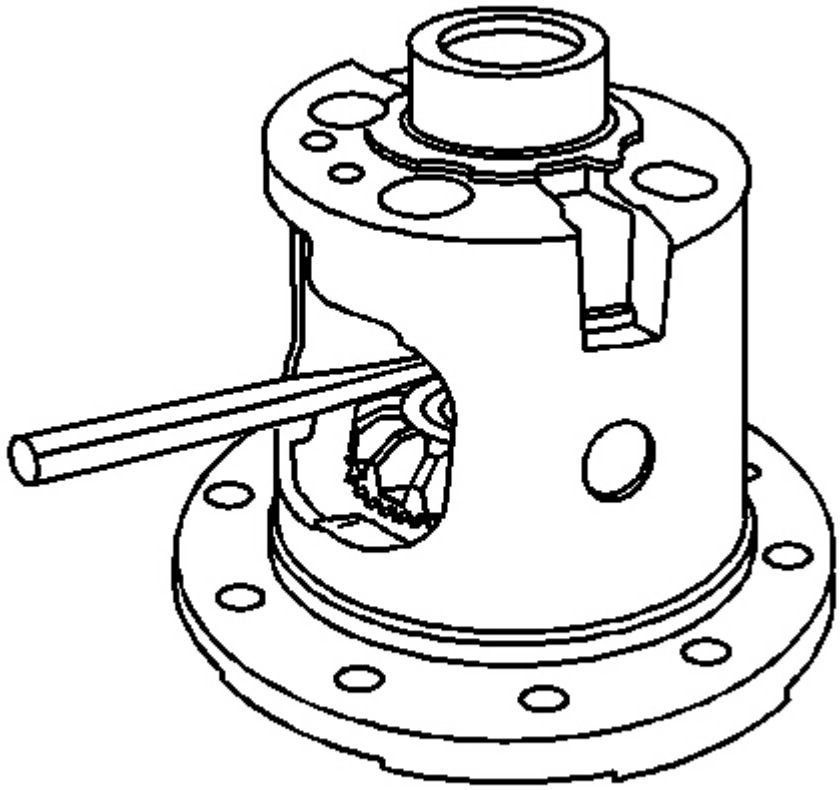


Fig. 133: View Of Brass Drift Placed Between Locking Differential Side Gear & Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

8. Install a brass drift between the side gear and the pinion shaft.

Press the brass drift in enough, in order to compress the clutch discs.

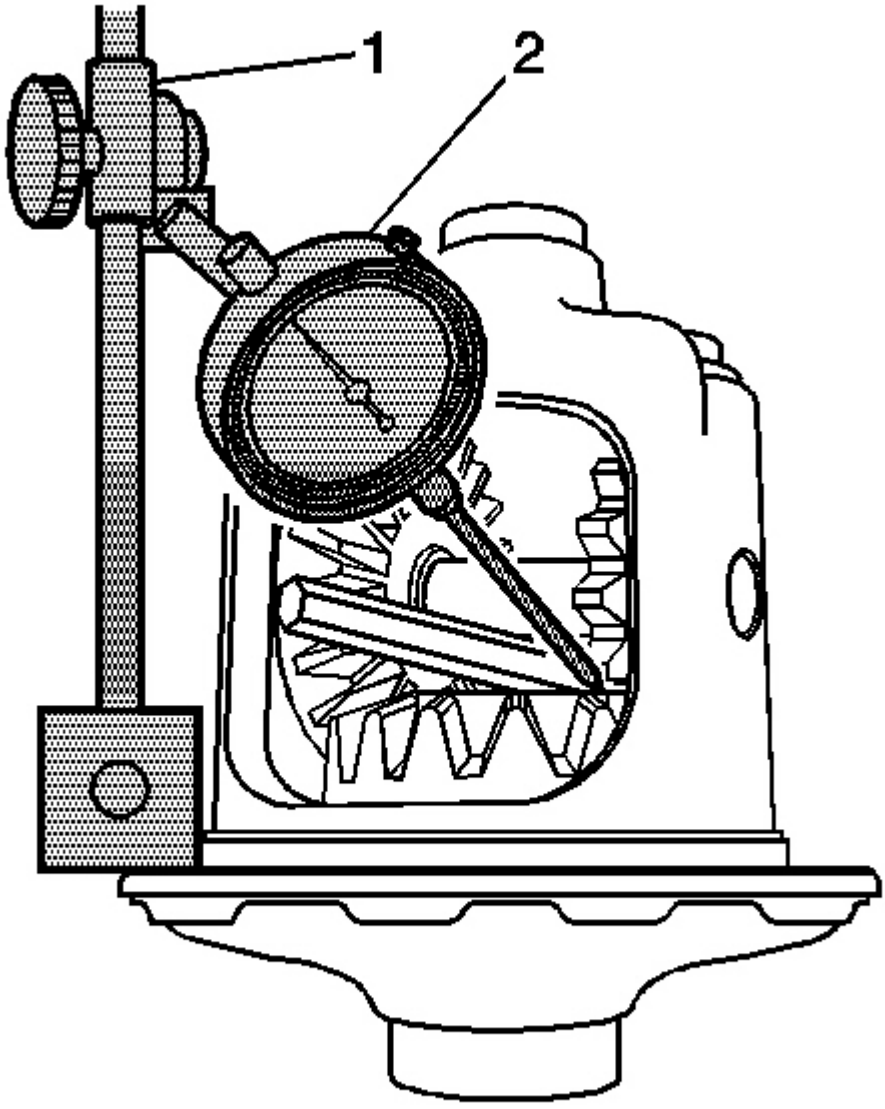


Fig. 134: Measuring Backlash Of Differential Pinion Gear & Side Gear
Courtesy of GENERAL MOTORS CORP.

9. Measure the backlash of the pinion gear and the right side gear by doing the following:
    1. Install the **J 7872** (1) to the ring gear flange. See **Special Tools**.

2. Loosely clamp the **J 8001-3** (2) onto the stem on the **J 7872** (1). See **Special Tools**.
3. Place the contact pad of the **J 8001-3** on one of the teeth of the pinion gear closest to the pinion shaft lock bolt. See **Special Tools**.

   Turn the dial of the **J 8001-3** until the needle and the dial face indicate zero. See **Special Tools**.

   Tighten: Tighten the lock nut of the **J 8001-2** finger tight. See **Special Tools**.

4. Pull the pinion gear firmly into the differential case seat.
5. Rotate the pinion gear back and forth.
6. Measure the backlash.

   Specification: The backlash for the pinion gears should be 0.000-0.076 mm (0.000-0.003 in).

10. If the backlash is too large, install a thicker side gear shim and recheck the backlash.
11. If the backlash is too small, install a thinner side gear shim and recheck the backlash again.

Right side gear shims are available in the following sizes:

Shim Sizes:

- 0.254 mm (0.010 in)
- 0.381 mm (0.015 in)
- 0.508 mm (0.020 in)
- 0.635 mm (0.025 in)
- 0.762 mm (0.030 in)
- 0.899 mm (0.035 in)
- 1.016 mm (0.040 in)
- 1.143 mm (0.045 in)

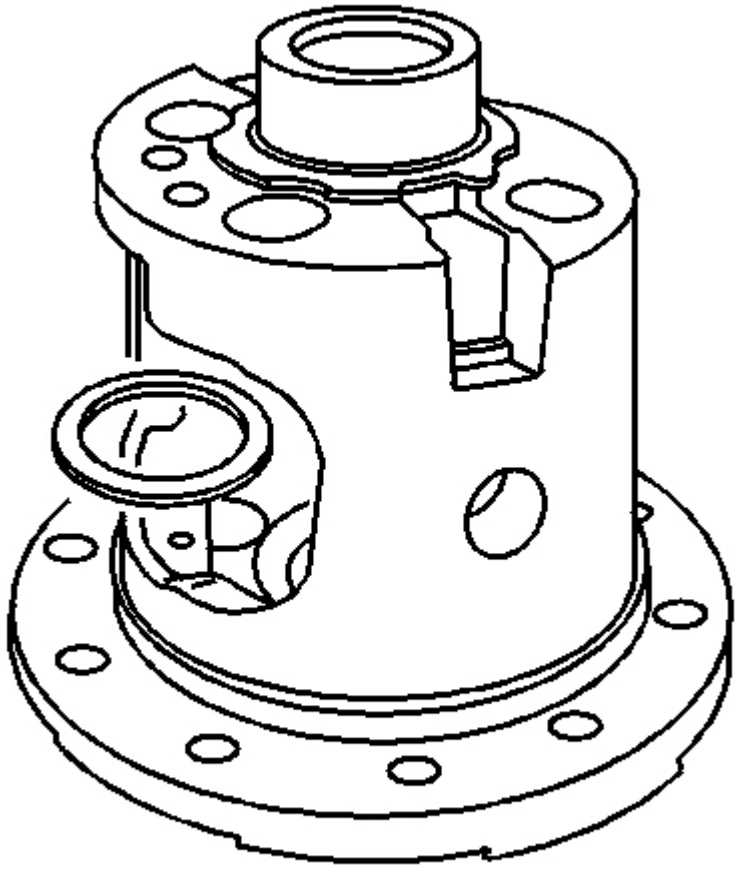


Fig. 135: View Of Left Side Gear Thrust Washer
Courtesy of GENERAL MOTORS CORP.

Thrust Block Clearance Adjustment

IMPORTANT: The left and right side gear backlash measurements must be done before the thrust block measurement can be completed.

1. Install the left side gear thrust washer into the differential case.

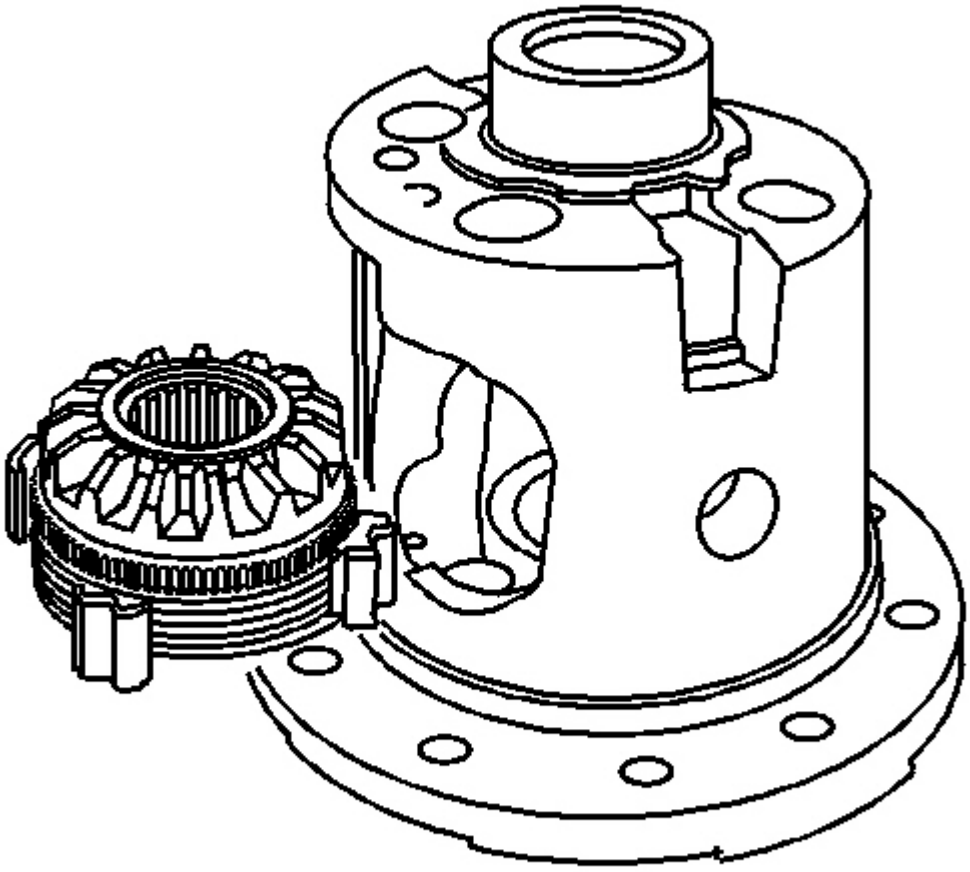


Fig. 136: View Of Left Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the left side gear (cam unit) and clutch disc assembly into the differential case.
3. Install the right side shim into the differential case.
4. Install the right side gear and clutch disc assembly into the differential case.
5. Install the pinion shaft.
6. Install the pinion shaft bolt.

Tighten: Tighten the pinion shaft bolt finger tight.

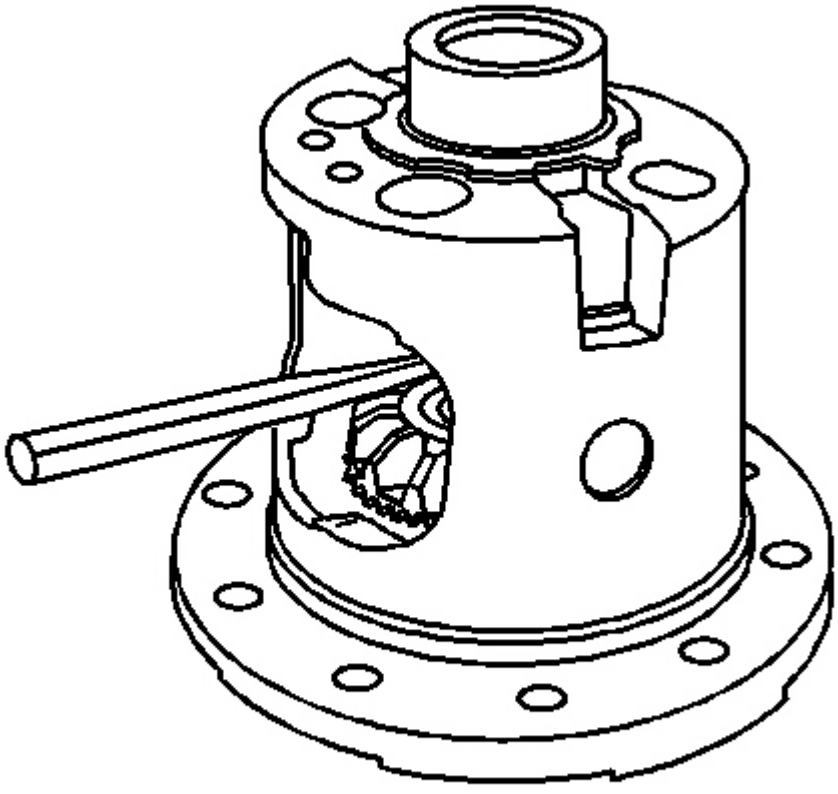


Fig. 137: View Of Brass Drift Placed Between Locking Differential Side Gear & Pinion Shaft
Courtesy of GENERAL MOTORS CORP.

7. Install a brass drift between the left side gear and the pinion shaft.

   Press the brass drift in far enough in order to compress the clutch disc assembly and hold the left side gear assembly in place.

8. Install a brass drift between the right side gear and the pinion shaft.

   Press the brass drift in far enough, in order to hold the right side gear assembly in place.

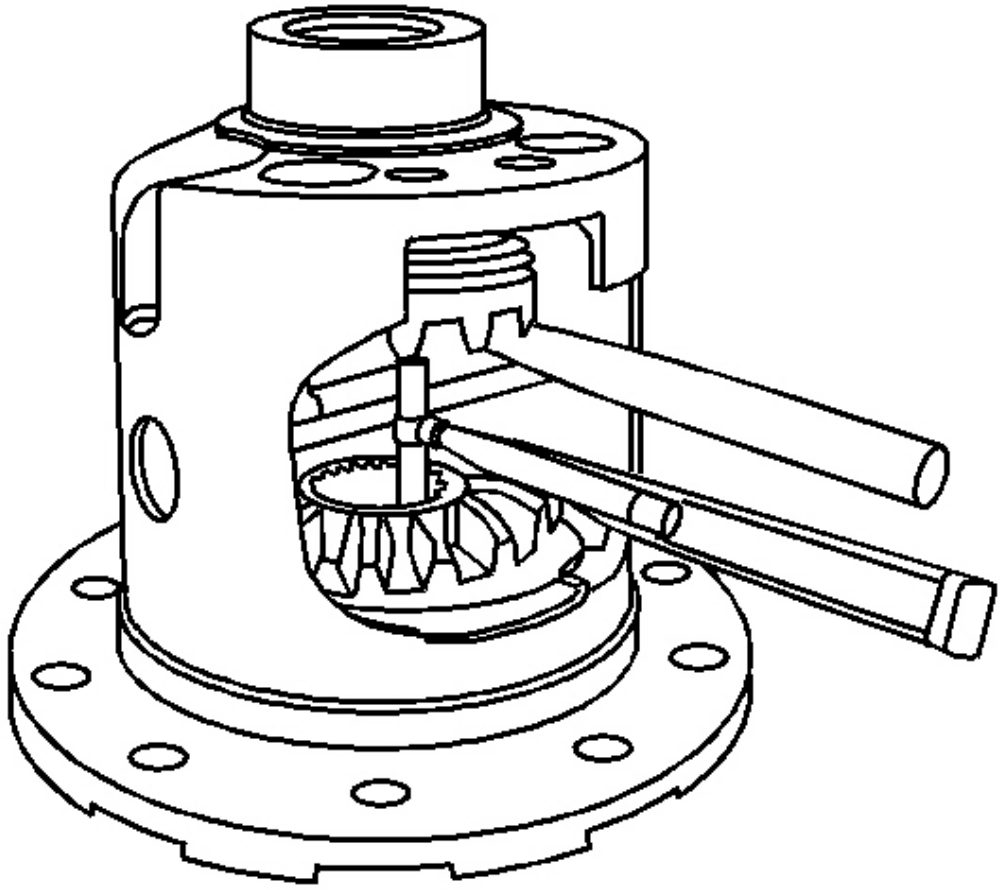


Fig. 138: Measuring Distance Between Side Gear Faces
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not measure the distance between the side gear teeth.

9. Measure the distance between the side gear faces using a 25.4-50.8 mm (1-2 in) telescoping gage.
10. Remove the telescoping gage.
11. Measure the telescoping gage with a micrometer. Record the measurement.
12. Compare the measurement obtained in step 11 to the thrust block sizes available. If the measurement is equal to one of the thrust blocks sizes available, then select that thrust block.
13. If the measurement obtained in step 11 is not equal to one of the thrust blocks sizes available, then select the thrust block that is smaller than the measurement.

For example, if the measurement is 32.13 mm (1.265 in), select the 32.05 mm (1.262 in) thrust block.

IMPORTANT: The backlash must be rechecked and adjusted to specification anytime the left and/or the right thrust washers are replaced.

14. If the measurement obtained in step 11 is less than 31.75 mm (1.25 in), then reduce the left side gear thrust washer or the right side gear shim thickness in order to increase the thrust block opening.
15. If the measurement obtained in step 11 is greater than 32.52 mm (1.28 in), then increase the left side gear thrust washer or the right side gear shim thickness in order to decrease the thrust block opening.
16. Inspect the left and/or right side gear backlash and adjust as necessary.
17. Inspect the thrust block clearance and adjust as necessary.

LOCKING DIFFERENTIAL ASSEMBLE

IMPORTANT: The left and right side gear backlash and thrust block thickness measurement must be completed before the components of the locking differential can be assembled.

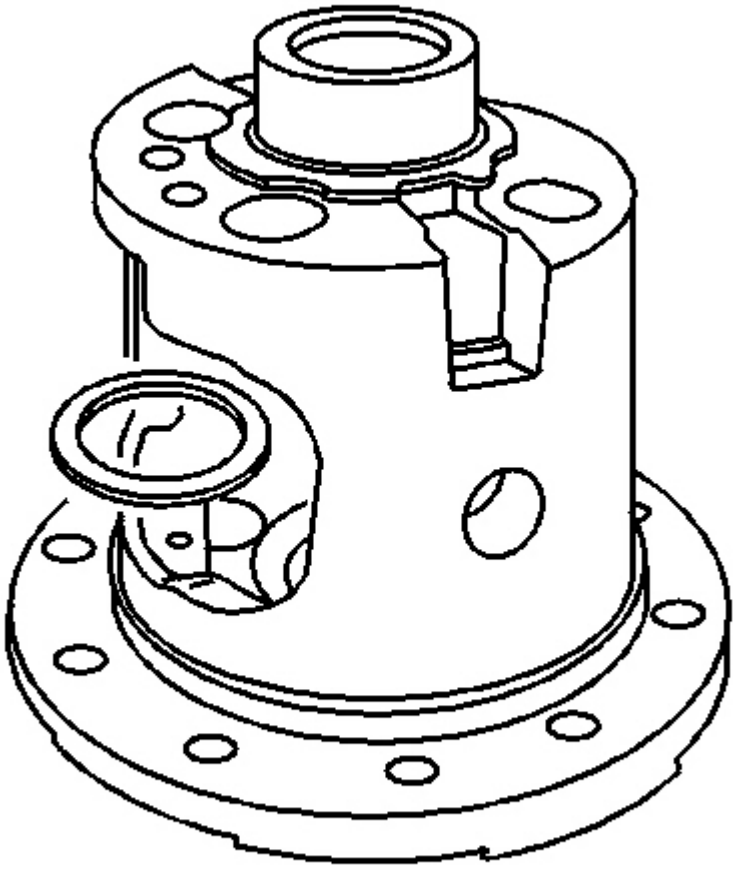


Fig. 139: View Of Left Side Gear Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Install the left side gear thrust washer.

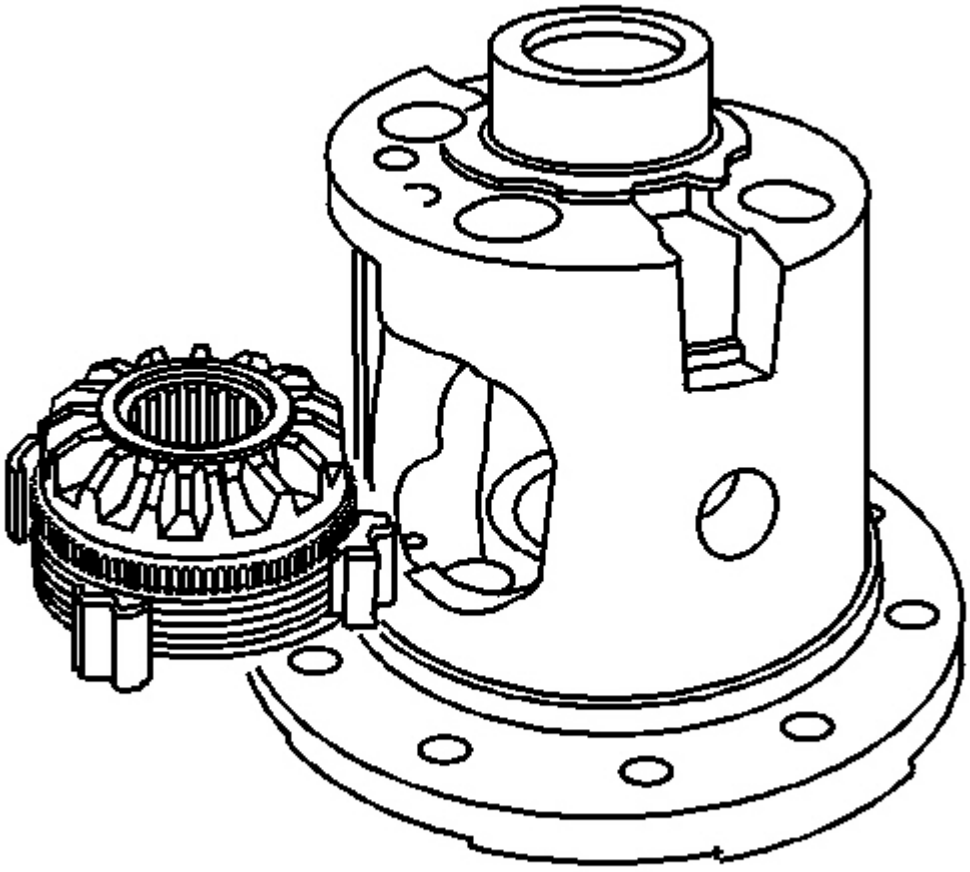


Fig. 140: View Of Left Side Gear Cam Unit & Clutch Disc Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the left side gear (cam unit) and clutch disc assembly.
3. Install the right side gear thrust washer.
4. Install the right side clutch pack assembly.
5. Install the right side gear.

IMPORTANT: If the original pinion gears and thrust washers are being re-used, install the pinion gears and thrust washers on the same side as when removed.

6. Install the pinion gear and the pinion thrust washers.

Place the pinion gears and the pinion thrust washers 180 degrees apart.

7. Rotate the pinion gears and the pinion thrust washers 90 degrees and align the pinion gears with the pinion shaft opening in the differential case.
8. Install the thrust block.

   The open side of the thrust block must face the window opening.

9. Install the pinion shaft.
10. Install the new pinion shaft lock bolt.

    Tighten the pinion shaft lock bolt finger tight.

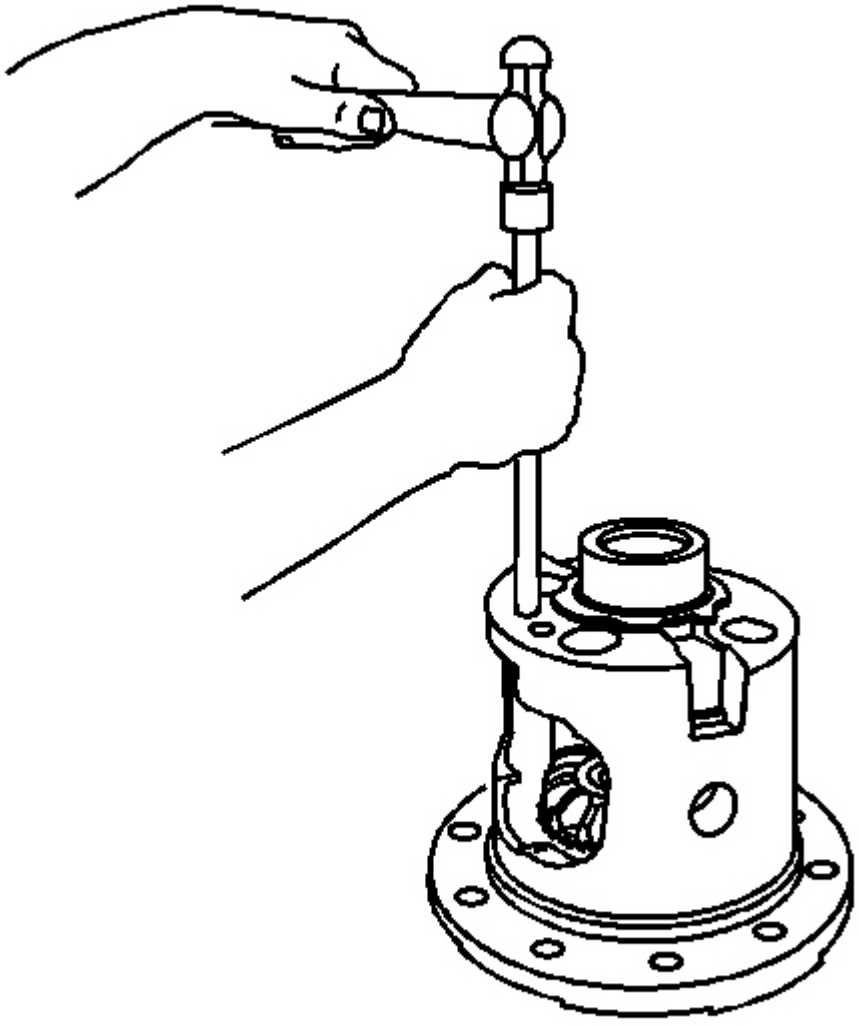


Fig. 141: Installing Governor Bushing Using Hammer & Brass Drift
Courtesy of GENERAL MOTORS CORP.

11. Install the governor assembly.
12. Install the governor bushing using a hammer and a brass drift.

Specification: Press the bushing into place until there is 0.25-1.27 mm (0.010-0.050 in) of shaft end play.

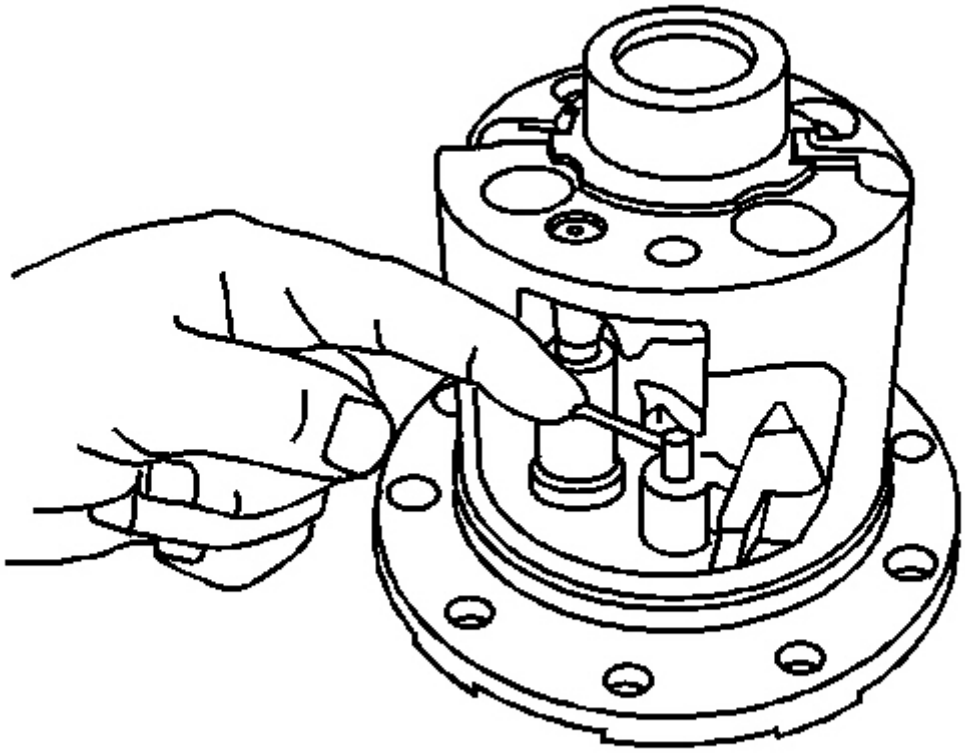


Fig. 142: Installing Latching Bracket Busing
Courtesy of GENERAL MOTORS CORP.

13. Install the latching bracket assembly.

    The straight end of the latching bracket spring must be over and outside the governor assembly shaft.

14. Install the latching bracket bushing using a hammer and a brass drift.

    Specification: Press the bushing into place until there is 0.000-0.051 mm (0.000-0.002 in) of shaft end play.

    NOTE: Refer to Fastener Notice .

15. Tighten the pinion shaft lock bolt.

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

DESCRIPTION & OPERATION

LOCKING DIFFERENTIAL DESCRIPTION & OPERATION

The locking differential consists of the following components:

- Differential case - 1 or 2 piece
- Locking differential spider - 2 piece case only
- Pinion gear shaft - 1 piece case only
- Differential pinion gear shaft lock bolt - 1 piece case only
- 2 clutch discs sets
- Locking differential side gear
- Thrust block
- Locking differential clutch disc guides
- Differential side gear shim
- Locking differential clutch disc thrust washer
- Locking differential governor
- Latching bracket
- Cam plate assembly
- Differential pinion gears
- Differential pinion gear thrust washers

The optional locking differential (RPO G80) enhances the traction capability of the rear axle by combining the characteristics of a limited-slip differential and the ability of the axle shafts to "lock" together when uneven traction surfaces exist. The differential accomplishes this in 2 ways. First by having a series of clutch plates at each side of the differential case to limit the amount of slippage between each wheel. Second, by using a mechanical locking mechanism to stop the rotation of the right differential side gear, or the left differential side gear on the 10.5 inch axle, in order to transfer the rotating torque of the wheel without traction to the wheel with traction. Each of these functions occur under different conditions.

Limited-Slip Function

Under normal conditions, when the differential is not locked, a small amount of limited-slip action occurs. The gear separating force developed in the right-hand (left-hand side on 10.5 inch axle) clutch pack is primarily responsible for this.

The operation of how the limited-slip function of the unit works can be explained when the vehicle makes a right-hand turn. Since the left wheel travels farther than the right wheel, it must rotate faster than the ring gear and differential case assembly. This results in the left axle and left side gear rotating faster than the differential case. The faster rotation of the left-side gear causes the pinion gears to rotate on the pinion shaft. This causes the right-side gear to rotate slower than the differential case.

Although the side gear spreading force produced by the pinion gears compresses the clutch packs, primarily the

right side, the friction between the tires and the road surface is sufficient to overcome the friction of the clutch packs. This prevents the side gears from being held to the differential case.

Locking Function

Locking action occurs through the use of some special parts:

- A governor mechanism with 2 flyweights
- A latching bracket
- The left side cam plate and cam side gear

When the wheel-to-wheel speed difference is 100 RPM or more, the flyweights of the governor will fling out and one of them will contact an edge of the latching bracket. This happens because the left cam side gear and cam plate are rotating at a speed different, either slower or faster, than that of the ring gear and differential case assembly. The cam plate has teeth on its outer diameter surface in mesh with teeth on the shaft of the governor.

As the side gear rotates at a speed different than that of the differential case, the shaft of the governor rotates with enough speed to force the flyweights outward against spring tension. One of the flyweights catches its edge on the closest edge of the latching bracket, which is stationary in the differential case. This latching process triggers a chain of events.

When the governor latches, it stops rotating. A small friction clutch inside the governor allows rotation, with resistance, of the governor shaft while one flyweight is held to the differential case through the latching bracket. The purpose of the governor's latching action is to slow the rotation of the cam plate as compared to the cam side gear. This will cause the cam plate to move out of its detent position.

The cam plate normally is held in its detent position by a small wave spring and detent humps resting in matching notches of the cam side gear. At this point, the ramps of the cam plate ride up on the ramps of the cam side gear, and the cam plate compresses the left clutch pack with a self-energizing action.

As the left clutch pack is compressed, it pushes the cam plate and cam side gear slightly toward the right side of the differential case. This movement of the cam side gear pushes the thrust block which compresses the right-hand side gear clutch pack.

At this point, the force of the self-energizing clutches and the side gear separating force combine to hold the side gears to the differential case in the locking stage.

The entire locking process occurs in less than 1 second. The process works with either the left or right wheel spinning, due to the design of the governor and cam mechanism. A torque reversal of any kind will unlatch the governor, causing the cam plate to ride back down to its detent position. Cornering or deceleration during a transmission shift will cause a torque reversal of this type. The differential unit returns to its limited-slip function.

The self-energizing process would not occur if it were not for the action of one of the left clutch discs. This energizing disc provides the holding force of the ramping action to occur. It is the only disc which is splined to the cam plate itself. The other splined discs fit on the cam side gear.

If the rotating speed of the ring gear and differential case assembly is high enough, the latching bracket will pivot due to centrifugal force. This will move the flyweights so that no locking is permitted. During vehicle driving, this happens at approximately 32 km/h (20 mph) and continues at faster speeds.

When comparing the effectiveness of the locking differential, in terms of percent-of-grade capability to open and limited-slip units, the locking differential has nearly 3 times the potential of the limited-slip unit under the same conditions.

Locking Differential Torque-Limiting Disc

The locking differential design was modified in mid-1986 to include a load-limiting feature to reduce the chance of breaking an axle shaft under abusive driving conditions. The number of tangs on the energizing disc in the left-hand clutch pack was reduced allowing these tangs to shear in the event of a high-torque engagement of the differential locking mechanism.

At the time of failure of the load-limiting disc, there will be a loud bang in the rear axle and the differential will operate as a standard differential with some limited-slip action of the clutch packs at low torques.

The service procedure, when the disc tangs shear, involves replacing the left-hand clutch plates and the wave spring. It is also necessary to examine the axle shafts for twisting because at high torques it is possible to not only shear the load-limiting disc, but to also twist the axle shafts.

REAR DRIVE AXLE DESCRIPTION & OPERATION

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

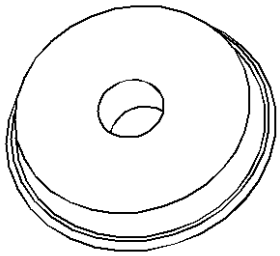
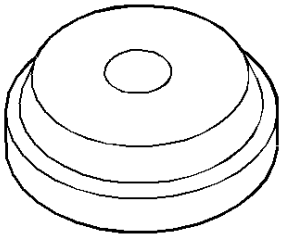
- Aluminum Differential Carrier Housing
- Differential Case Assembly (Open or Locking)
- Ring Gear and Drive Pinion Shaft
- Left and right axle shaft tubes
- Left and right axle shafts
- Fill Plug
- Drain Plug

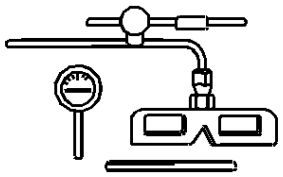
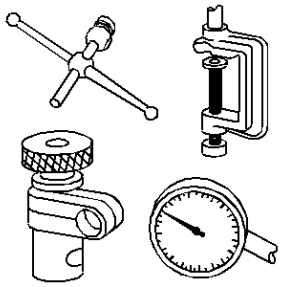
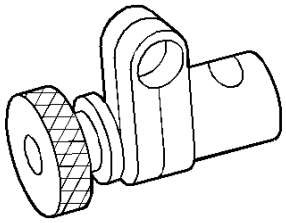
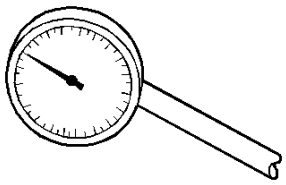
The rear axle receives power from the propeller shaft and transfers it to the drive pinion through the universal joint and the pinion yoke, which is attached to the drive pinion. The drive pinion transfers the power to the ring gear which is splined to the drive pinion at a 90 degree angle. The ring 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

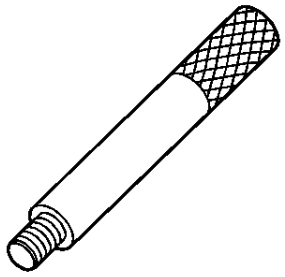
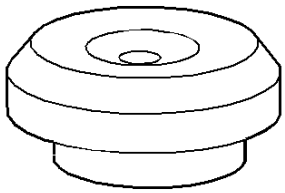
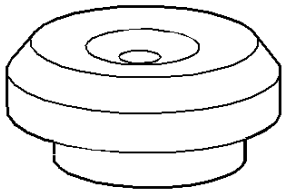
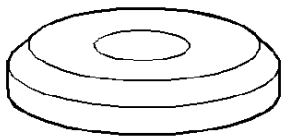
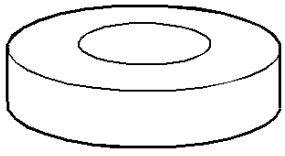
long as the input force is equal between the two axle shafts, the axle shafts could be solidly attached to the ring gear. The addition of the two pinion gears and the two side gears are needed to allow the axle shafts to turn at different speeds. When the vehicle turns a corner, the inner wheel turns 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**.

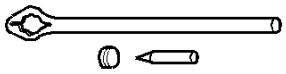
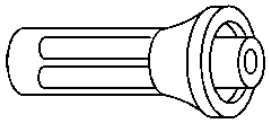
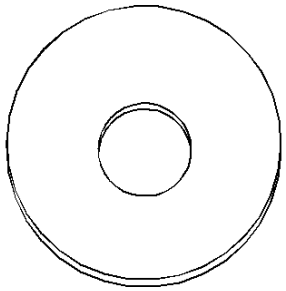
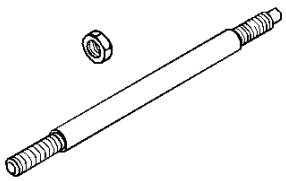
SPECIAL TOOLS & EQUIPMENT

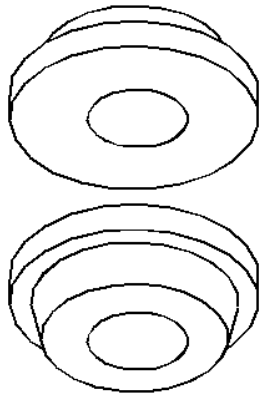
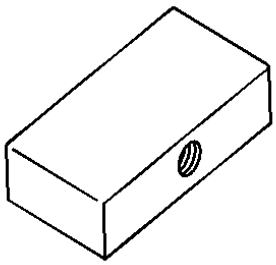
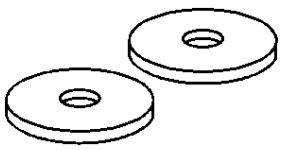
SPECIAL TOOLS

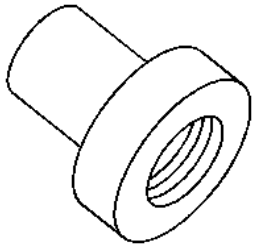
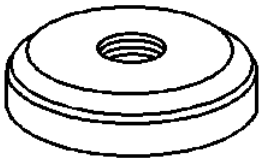
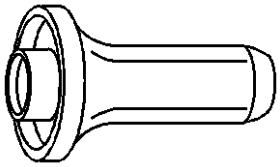
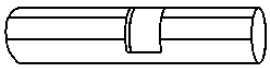
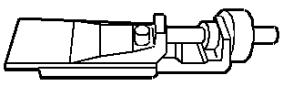
Illustration	Tool Number/Description
	J-2619-O1 Slide Hammer
	J-7817 Outer Bearing Race Installer
	J-7818 Inner Bearing Race Installer
	J-7872 Magnetic Base Dial Indicator

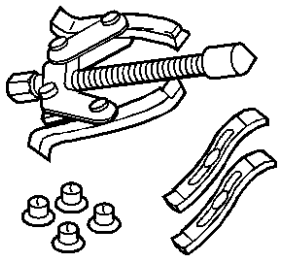
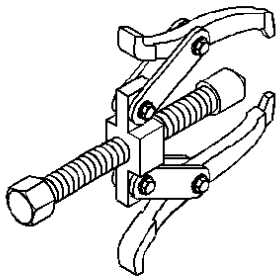
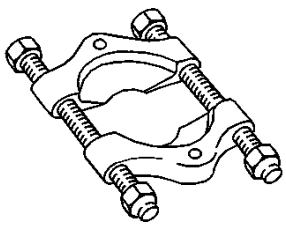
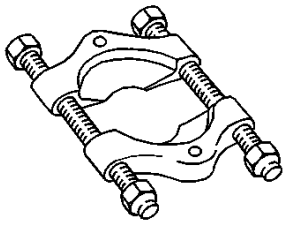
	
	J-8001 Dial Indicator Set
	J-8001-2 Dial Indicator Sleeve
	J-8001-3 Dial Indicator
	J-8092 Driver Handle

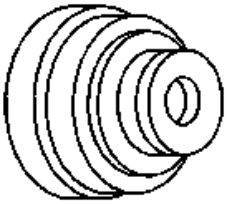
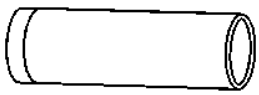
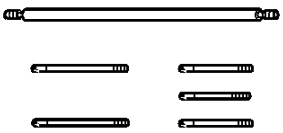
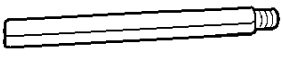
	
	J-8107-2 Side Bearing Puller Pilot
	J-8107-4 Side Bearing Puller Pilot
	J-8608 Rear Pinion Bearing Race Installer
	J-8611-01 Rear Pinion Bearing Race Installer

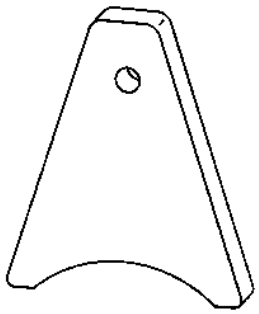
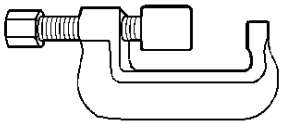
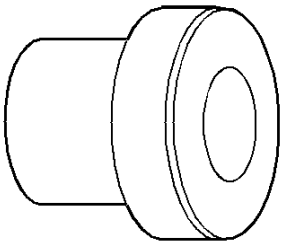
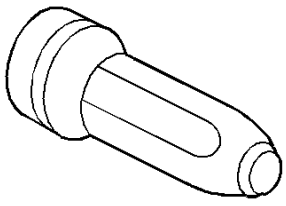
	J-8614-O1 Flange and Pulley Holding Tool
	J-21128 Axle Pinion Oil Seal Installer
	J-21777-42 Pinion Setting Pilot Washer
	J-21777-43 Stud Assembly Bolt
	J-21777-45 Side Bearing Discs

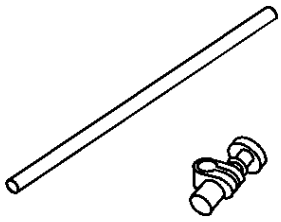
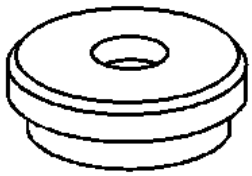
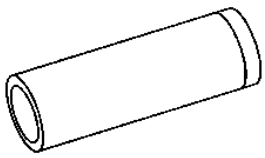
	
	J-21777-85 Gage and Plat - 9.5 in
	J-21777-86 Sede Bearing Disc - 9.5 in
	J-21784 Side Bearing Installer

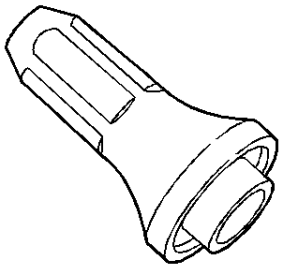
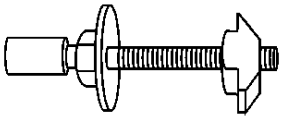
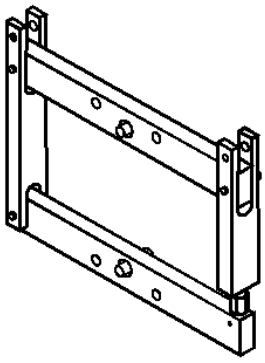
	
	J-22306 Pinion Cup Bearing Installer-Rear
	J-22388 Pinion Oil Seal Installer
	J-22536 Pinion Driver
	J-22779 Side Bearing Backlash Gage

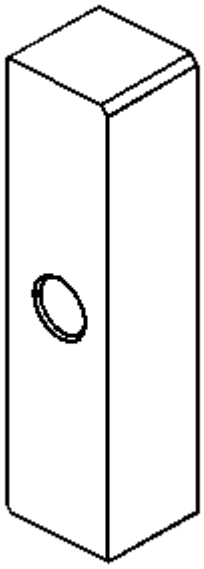
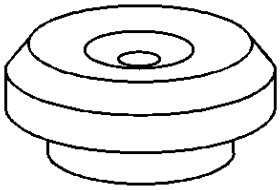
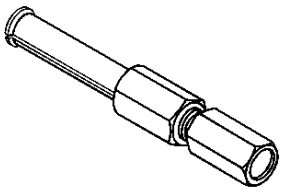
	J-22888-D Side Bearing Remover Kit
	J-22888-20A Universal Two Jaw Puller
	J-22912-01 Rear Pinion and Axle Bearing Remover
	J-22912-B Split plate Bearing Puller

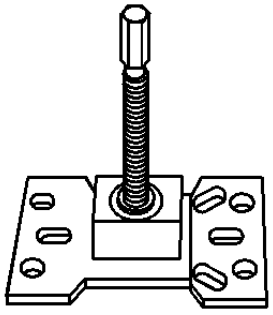
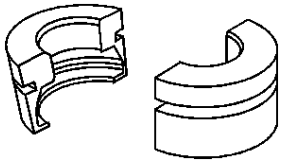
	J-23690 Bearing Installer
	J-24429 Side Bearing Backlash Spanner
	J-24433 Pinion Cone and Side Bearing Installer
	J-25025 Guide Pins
	J-25025-1 Dial Indicator Mounting Post
	J-25588 Side Bearing Shim Installer

	
	J-26252 Locking Differential Governor Remover
	J-29710 Differential Side Bearing Installer
	J-33782 Pinion Oil Seal Installer
	J-34178 Spreader Gage Adapter

	
	J-34925 Pinion Setting Gage and Components
	J-36597 Side Bearing Puller Pilot - 9.25 in
	J-36614 Inner Pinion Bearing Installer

	J-38694 Extension Housing Oil Pump/Seal Installer
	J-44685 Rear Axle Seal and Bearing Remover
	J-45222 Axle Housing Spreader
	J-45230 Pinion Setting Gage Block

	
	J-45231 Differential Side Bearing Installer
	J-45857 Tone Wheel and/or Bearing Remover

	J-45859 Axle Remover
	J-45871 Pinion Bearing Remover