

Rear Drive Axle

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Important: Use a reliable torque wrench in order to tighten the parts listed. A reliable torque wrench will ensure proper tightening of the parts without straining or distorting the parts. The following specifications are for clean and lightly-lubricated threads only. Dry or dirty threads produce increased friction. Friction prevents the measurement of tightness.		
Differential Carrier Bearing Cap Bolt/Screw	75 N·m	55 lb ft
Differential Drive Pinion Gear Setting Gauge Nut	2.3 N·m	20 lb in
Differential Pinion Gear Shaft Lock Bolt/Screw	36 N·m	27 lb ft
Differential Ring Gear Bolt/Screw	120 N·m	89 lb ft
Rear Axle Housing Cover Bolt/Screw	30 N·m	22 lb ft
Rear Axle Housing Drain Plug	35 N·m	26 lb ft
Sensor Plug Mounting Bolt/Screw	10 N·m	89 lb in
Wheel Bolt	140 N·m	100 lb ft
Wheel Speed Sensor Mounting Plug	10 N·m	89 lb in

Rear Axle Specifications (General Specifications)

Application	Specification	
	Metric	English
Rear Axle Type	Semi-Floating Hypoid	
Drive and Torque	Through 4 Arms	
Ring and Drive Pinion Gear Set Type	Hypoid	
Rear Axle Lubricant Capacity	1.65 L	3.5 pt.
Rear Axle Lubricant	Synthetic 75W-90 Gear Lubricant (GM P/N 12378261) meeting GM spec. 9986115, or equivalent	
Standard and Limited Slip Differential		
Limited Slip Differential Additive (GM P/N 1052358), or equivalent	118 ml	4 fl. oz.

Rear Axle Specifications (Bearing Shim Thickness)

Metric	English
DEFINITION: The total thickness of both the production differential bearing shims removed.	
10.57 mm	0.416 in
10.92 mm	0.430 in
11.18 mm	0.440 in
11.43 mm	0.450 in
11.68 mm	0.460 in
11.94 mm	0.470 in
12.19 mm	0.480 in
12.45 mm	0.490 in
12.70 mm	0.500 in
12.95 mm	0.510 in
13.21 mm	0.520 in
13.46 mm	0.530 in
13.97 mm	0.550 in

Service Differential Bearing Shim Thickness (Standard Spacer)

Metric	English
DEFINITION: The total thickness of the service differential bearing shims to be used as a starting point.	
1.52 mm	0.060 in
1.78 mm	0.070 in
2.03 mm	0.080 in
2.29 mm	0.090 in
2.54 mm	0.100 in
2.79 mm	0.110 in
3.05 mm	0.120 in
3.30 mm	0.130 in
3.56 mm	0.140 in
3.81 mm	0.150 in
4.06 mm	0.160 in
4.32 mm	0.170 in
4.83 mm	0.190 in

Rear Axle Usage

Engine (RPO)	Transmission	Rear Axle Ratio	Rear Axle RPO	Ring Gear Diameter	Rear Brake	Teeth Ring Gear: Pinion
3800-V6 (L36)	5-SPD Manual (M49)	3.23	GU5	194 mm (7 5/8")	Disc	42:13
3800-V6 (L36) Y87 Package	5-SPD Manual (M49)	3.23	GU5	194 mm (7 5/8")	Disc	42:13
3800-V6 (L36)	4-SPD Automatic (M30)	3.08	GU4	194 mm (7 5/8")	Disc	40:13
3800-V6 (L36) Y87 Package	4-SPD Automatic (M30)	3.42	GU6	194 mm (7 5/8")	Disc	41:12
5.7L-V8 (LS1)	6-SPD Manual (MM6)	3.42	GU6	194 mm (7 5/8")	Disc	41:12
5.7L-V8 (LS1) WS6 Package	6-SPD Manual (MM6)	3.42	GU6	194 mm (7 5/8")	Disc	41:12
5.7L-V8 (LS1)	4-SPD Automatic (M30)	2.73	GU2	194 mm (7 5/8")	Disc	41:15
5.7L-V8 (LS1) WS6 Package	4-SPD Automatic (M30)	3.23	GU5	194 mm (7 5/8")	Disc	42:13

Pinion Bearing and Differential Bearing Preload

Application	Specification	
	Metric	English
Differential Drive Pinion Gear Inner and Outer Bearing Preload (Measured at the Drive Pinion Gear Nut)		
New Bearings (Rotating Torque With a New Seal)	1.7–3.4 N·m	15–30 lb in
Used Bearings (Rotating Torque With a New Seal)	1.0–1.7 N·m	10–15 lb in
Total Preload (Measured at the Drive Pinion Gear Nut)		
New Bearings (Rotating Torque With a New Seal)	3.6–6.2 N·m	32–55 lb in
Used Bearings (Rotating Torque With a New Seal)	1.8–3.1 N·m	16–28 lb in
Differential Ring Gear-to-Differential		
Drive Pinion Gear Backlash	0.13–0.23 mm	(0.005–0.009 in)

GM SPO Group Numbers

Application	GM SPO Group Number
Axle Shaft	5.000
Differential Carrier	5.000
Drive Pinion	5.000
Inner Bearing	5.000
Oil Seal and Bearing	5.000
Outer Bearing	5.000
Pinion Flange	5.000
Rear Axle	5.000
Rear Cover and Gasket	5.000

Diagnostic Information and Procedures

Noise Diagnosis

Many noises that are reported as coming from the rear axle actually originate from other components:

- The tires and wheels
- The road surfaces
- The wheel bearings
- The engine
- The transmission
- The muffler
- The body

Thoroughly inspect for the source of the noise before disassembling the rear axle. Noise that originates in other places cannot be corrected by adjustment or replacement of rear axle components. The rear axle differential gears are not absolutely quiet (like any other mechanical devices). The rear axle differential gears should be accepted as commercially quiet unless some abnormal noise exists.

Use the following procedure in order to inspect for axle noise under standard conditions:

1. Measure the rear axle lubricant in order to ensure the correct level.
2. Drive the vehicle far enough in order to thoroughly warm up the rear axle lubricant.
Select a level asphalt road, which reduces tire noise and body drumming.
3. Note the speed at which the noise occurs.
4. Stop the vehicle.
5. Determine if the exhaust muffler roar or other engine conditions cause the noise:
 - 5.1. Place the transmission range selector lever in NEUTRAL
 - 5.2. Run the engine slowly up and down through the engine speeds that correspond to the speed at which the noise was most pronounced.
6. Determine if the tires cause the noise:
 - 6.1. Temporarily inflate all of the tires to approximately 345 kPa (50 psi).
This will alter the noise caused by the tires, but will not affect the noise made by the rear axle.

- 6.2. Test drive the vehicle. Coast at speeds under 48 km/h (30 mph).

The following characteristics of tire and rear axle noise may help in determining if the tires cause the noise:

- Rear axle noise usually stops when the vehicle is coasting at speeds under 48 km/h (30 mph).
 - Tire noise usually continues. The tone of the tire noise becomes lower as the speed of the vehicle is reduced.
 - Rear axle noise usually sounds different during driving and during coasting. Tire noise remains the same during driving and during coasting.
 - Exhaust and axle noises change during sudden acceleration and deceleration. Tire noise remains constant during sudden changes in vehicle speed.
 - Tire noise is the most noticeable at the speeds of 32–48 km/h (20–30 mph).
 - Tire noise changes on different road surfaces, but rear axle noise does not change. Drive the vehicle over smooth pavement or dirt roads (not gravel) with the tires at normal pressure. Tire noise will noticeably change, or will disappear and reappear with the road surface.
7. Determine if loose or rough front wheel inner or outer bearings cause the noise.
 - Noise in front wheel inner or outer bearings does not change between drive and coast.
 - Light application of the brake pedal while holding the vehicle speed steady takes some weight off of the bearings. This action will often cause noise in front wheel inner or outer bearings to diminish.
 - Use the following steps in order to determine if the front wheel inner and outer bearings are loose:
 - 7.1. Jack up the tires and the wheels.
 - 7.2. Spin or shake the tires and the wheels in order to determine if the bearings are loose.
 8. Rear axle noise is dampened when the rear suspension rubber bushings and the spring insulators are correctly installed.
Determine if any metallic contact exists between the following components:
 - The spring and the spring opening in the underbody
 - The lower control arm bushings and the underbody or axle housing brackets

Metal-to-metal contact at these points may increase road noise and normal axle noise.

Rear Axle Noises

After verifying that a noise exists in the rear axle, determine the type of the noise. Determining the type of the rear axle noise will aid in repair.

Gear Noise

Gear noise (whine) is audible from 32–89 km/h (20–55 mph) under the following driving conditions:

- Drive — Acceleration or heavy pull
- Road Load — The vehicle driving load or the constant speed
- Float — Using enough throttle in order to keep the vehicle from driving the engine; the vehicle slows down gradually but the engine still pulls slightly.
- Coast — The throttle closes and the vehicle is in gear.

Gear noise is most noticeable when the vehicle is operating at the following speeds:

- 64–80 km/h (40–50 mph)
- 97–105 km/h (60–65 mph)

Bearing Noise

Poor bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise.

Bearing noise frequently “wow-wows” at constant RPMs. This noise may indicate that the following components are faulty:

- The differential drive pinion gear
- The side bearings

The “wow-wow” bearing noise may be confused with rear wheel bearing noise. Inspect and replace as necessary.

Rear Wheel Bearing Noise

The noise that is produced by a rough rear wheel bearing is evident under the following conditions:

- The vehicle is coasting at low speeds
- The transmission range selector lever is in NEUTRAL

The bearing noise may diminish with gentle braking.

Use the following steps in order to determine if a noise is caused by a rough rear wheel bearing:

1. Raise the rear tires and wheels.
2. Spin the rear tires and wheel by hand.
3. Listen at the hubs for evidence of rough (noisy) rear wheel bearings.

Knock At Low Speeds

One of the following conditions may cause a knock at low speeds:

- A worn universal joint
- A worn or oversized side gear hub counterbore in the differential case

Inspect and replace the above components as necessary.

Backlash Clunk

One of the following conditions may cause excessive backlash clunk with acceleration and deceleration:

- A worn differential drive pinion gear shaft
- A worn differential case
- Excessive clearance between the following components:
 - The rear axle shaft splines and the side gear splines
 - The side gear hub and the counterbore in the case
- A worn differential drive pinion gear and worn side gear teeth
- Worn differential pinion gear thrust washers
- Excessive differential ring gear-to-differential drive pinion gear backlash

Replace the worn components as necessary. Select close fitting replacement parts.

Adjust the differential ring gear-to-differential drive pinion gear backlash. Refer to *Backlash Adjustment*

Repair Instructions

Lubricant Level Check

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Clean any dirt or foreign material from around the rear axle housing drain plug.
3. Remove the rear axle housing drain plug.
4. Verify that the axle lubricant level is within the following range:
 - No higher than the bottom of the plug opening
 - No lower than 15 mm (9/16 in) below the plug opening
5. If necessary, add to or replace the axle lubricant. Use synthetic 75W-90 gear lubricant (GM P/N 12378261), meeting GM specification 9986115, or equivalent.
6. If the vehicle has a limited slip differential, add 118 ml (4 fl oz) of limited slip differential additive (GM P/N 1052358), or equivalent.

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

7. Install the rear axle housing drain plug.

Tighten

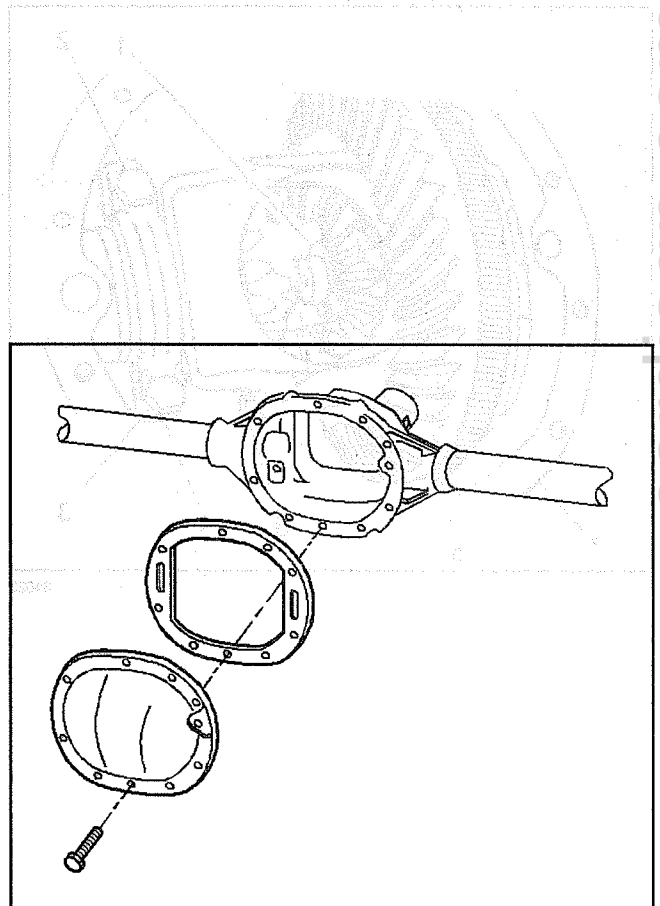
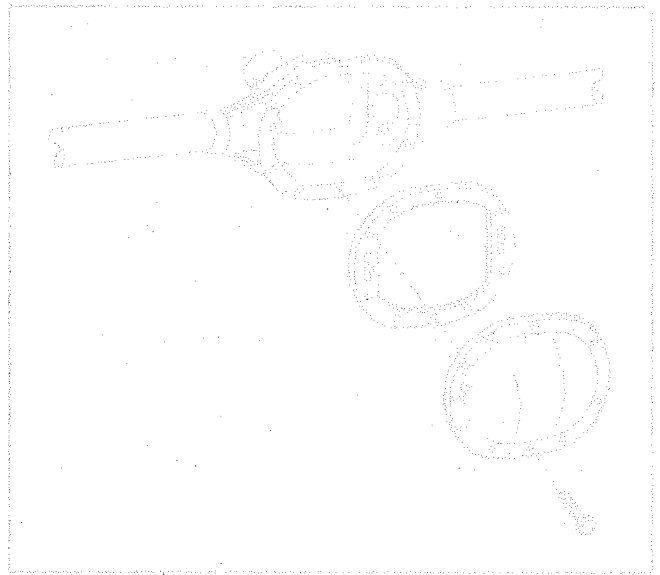
Tighten the rear axle housing drain plug to 35 N·m (26 lb ft).

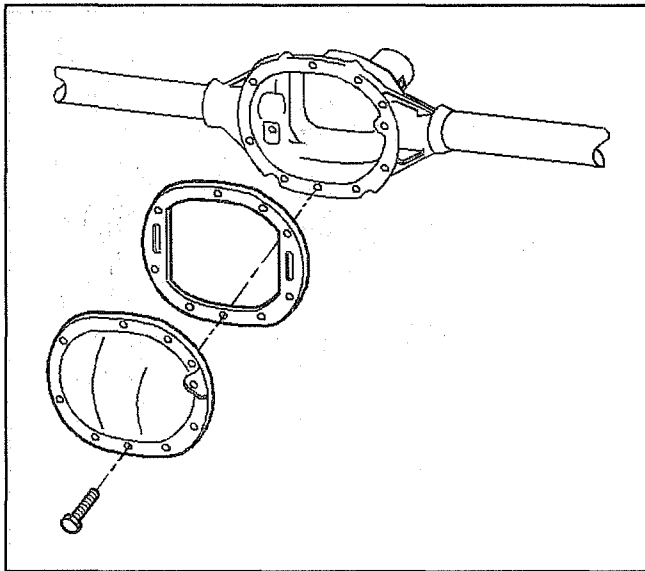
8. Lower the vehicle.

Rear Axle Housing Cover and Gasket Replacement

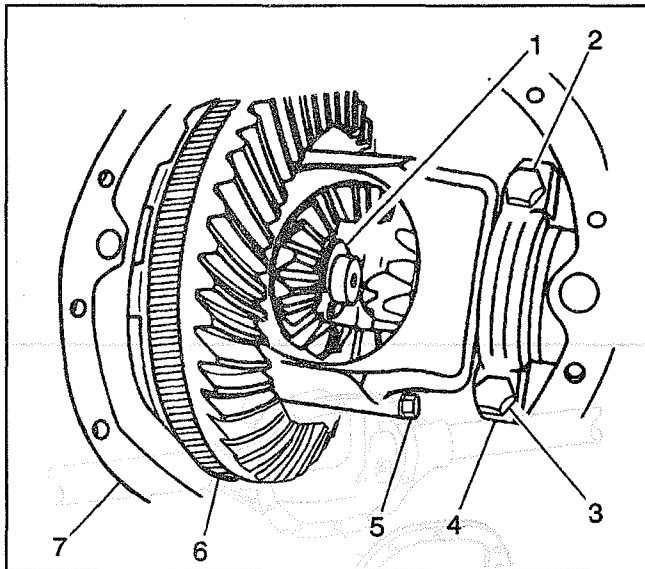
Removal Procedure

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Clean all of the dirt from the area of the rear axle housing cover before removing the cover.
3. Remove the following components:
 - The rear axle housing cover bolts/screws
 - The parking brake cable guides
4. Pry the rear axle housing cover loose. Remove the rear axle housing cover.
5. Allow lubricant to drain.
6. Remove the rear axle housing cover gasket.
7. Clean both of the gasket sealing surfaces with brake parts cleaner.





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Installation Procedure

1. Install a new rear axle housing cover gasket.
2. Install the rear axle housing cover.
3. Install the park brake cable guides.

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

4. Install the rear axle housing cover bolts/screws.

Tighten

Tighten the rear axle housing cover bolts/screws in a crosswise pattern to 30 N·m (22 lb ft).

5. Refill rear axle with lubricant. Refer to *Lubricant Level Check*.

6. Lower the vehicle.

Axle Shaft Replacement

Removal Procedure

Tools Required

J 39446 ABS Exciter Ring Protector Kit

1. Remove the rear tire and wheel. Refer to *Tire and Wheel Removal and Installation* in Tires and Wheels.
2. Remove the rear brake rotor. Refer to *Brake Rotor Replacement (Rear)* in Disc Brakes.
3. Remove the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
4. Install a J 39446 onto the speed sensor reluctor wheel (6) on vehicles that are equipped with non-traction control axles.
5. Remove the pinion gear shaft lock bolt/screw (5) from the differential case.
6. Remove the pinion gear shaft from the differential case.
7. Push the flanged end of the axle shaft into the rear axle housing (7) in order to access the rear axle shaft lock.
8. Remove the rear axle shaft lock (1).

Important: Do not damage the rear wheel speed sensor reluctor wheel (6) during axle shaft removal on vehicles that are equipped with traction control.

The rear wheel speed sensor reluctor wheel is located on the axle shaft.

If the rear wheel speed sensor reluctor wheel is damaged, replace the rear axle shaft.

9. Remove the rear axle shaft from the rear axle housing (7).

Installation Procedure

1. Install the rear axle shaft into place.
Ensure that the following conditions are met:
 - The splines on the end of the axle shaft do not damage the rear wheel bearing seal.
 - The splines on the end of the axle shaft engage with splines of the differential side gear.
2. Install the rear axle shaft lock (1).
Push the axle shaft outward so that the rear axle shaft lock (1) seats in the counterbore of the differential side gear.

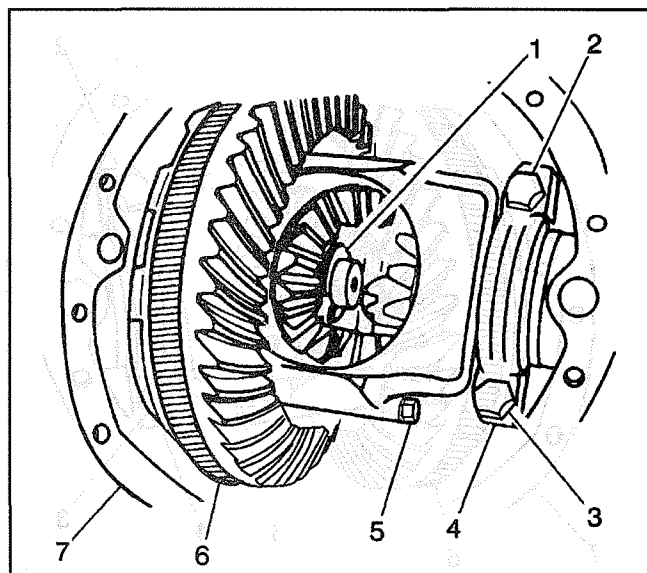
3. Install the pinion gear shaft through the following components:
 - The differential case
 - The pinion gear thrust washers
 - The pinion gears

Align the hole in the pinion gear shaft with the rear axle shaft lock bolt/screw hole in the differential case.

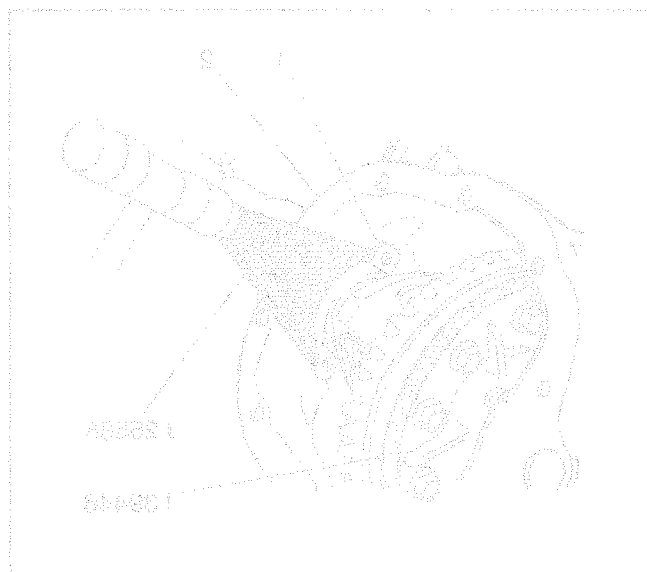
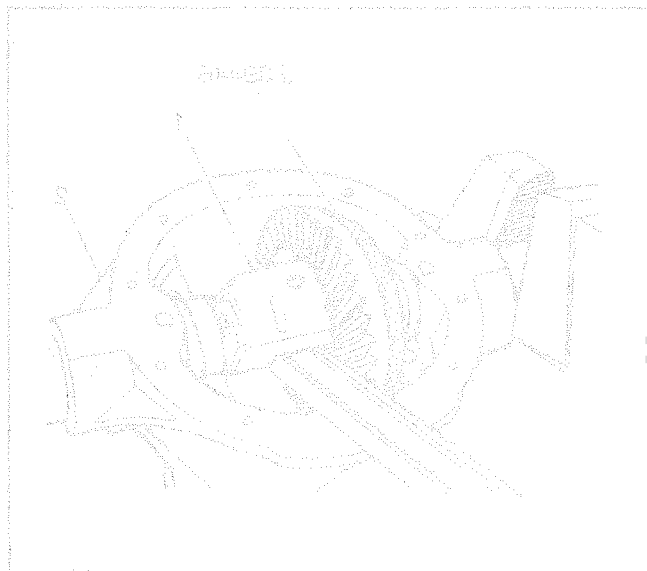
Notice: Refer to *Fastener Notice* in Cautions and Notices.

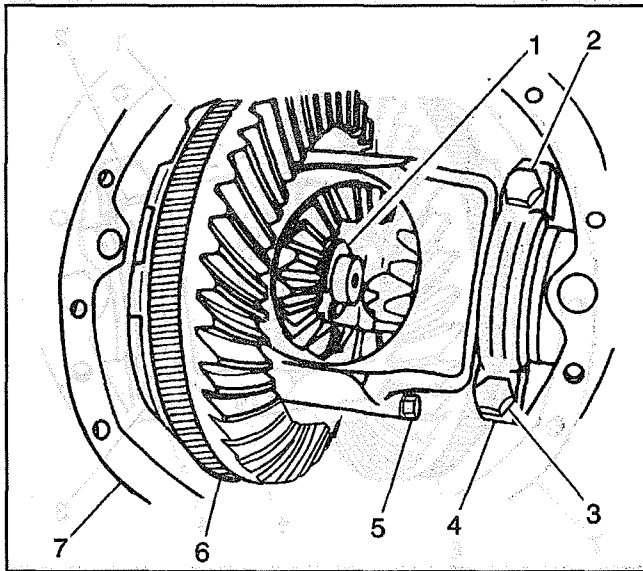
4. Coat the pinion gear shaft lock bolt/screw (5) with Loctite 242 or an equivalent.
5. Install the pinion gear shaft lock bolt/screw (5).
Tighten
Tighten the differential pinion gear shaft lock bolt/screw (5) to 36 N·m (27 lb ft).

6. Remove J 39446 from the speed sensor retractor wheel (6) if the vehicle has a standard rear axle.
If a new speed sensor retractor wheel (6) was installed, remove and discard the plastic covering.
7. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
8. Install the rear brake rotor. Refer to *Brake Rotor Replacement (Rear)* in Disc Brakes.
9. Install the rear tire and the rear wheel. Refer to *Tire and Wheel Removal and Installation in Tires and Wheels*.

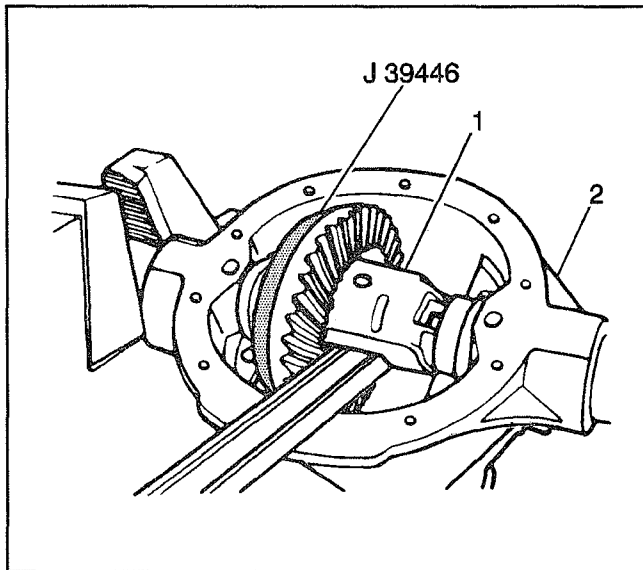


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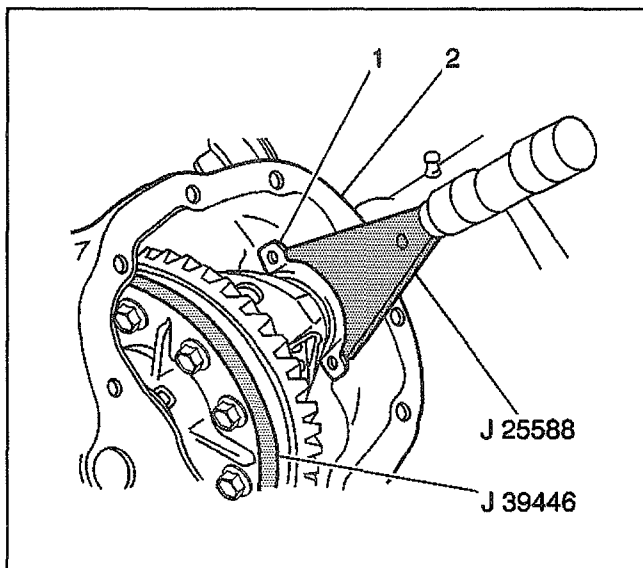




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Differential Carrier Replacement

Removal Procedure

1. Raise and suitably support vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Place drain pan under rear axle cover.
3. Remove the rear axle cover and the gasket. Drain the rear axle fluid. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
4. Remove rear axle shafts. Refer to *Axle Shaft Replacement*.
5. Remove the differential carrier bearing cap bolts (2,3).

Important: Move the bearing caps (4) back and forth slightly to loosen and remove. Never use screwdrivers to pry on the parting surfaces of the cap and the housing because surface damage will occur.

6. Remove the differential carrier bearing caps (4).

Important: Group the shims together with the original installed location labeled. If you remove or replace the ring and pinion gearset, perform the bearing preload, backlash, and tooth contact pattern test in order to ensure proper contact of the gears. If you reinstall or replace the differential carrier without replacing any other component (e.g. pinion & ring gear set, bearings, etc) then you may reinstall the carrier with the original shims in the original locations. Always perform a tooth contact pattern test, even when you remove only the carrier.

7. Remove the differential carrier (1) and the shims from the rear axle housing (2).

Installation Procedure

Tools Required

J 25588 Side Bearing Shim Installer

1. Install the differential carrier and the shims (1) into the housing (2) with the shims in the original location with J 25588 and a deadblow hammer.

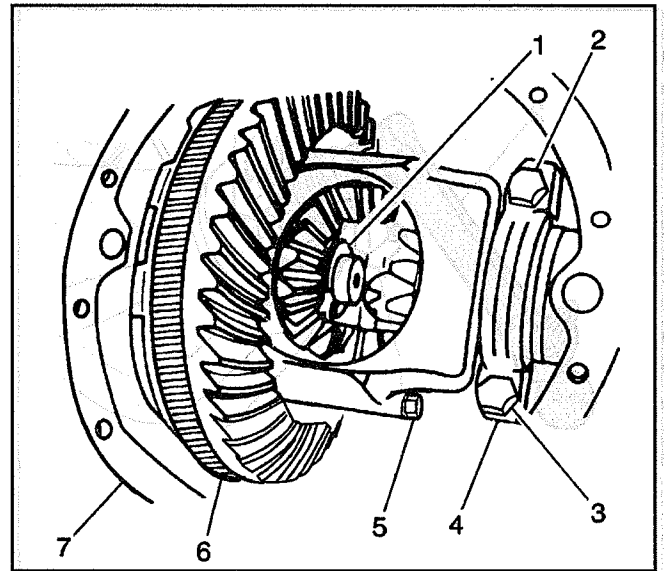
Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the differential bearing caps (4) and cap bolts (2,3).

Tighten

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

3. Perform a backlash adjustment. Refer to *Backlash Adjustment*.
4. Perform a tooth contact pattern test. Refer to *Gear Tooth Contact Pattern Check*.
5. Install the rear axle shafts. Refer to *Axle Shaft Replacement*.
6. Install the rear axle cover and the gasket. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
7. Lower the vehicle.
8. Road test the vehicle in order to ensure proper differential operation. If any whines or howls are now present, repeat the backlash and contact pattern test.



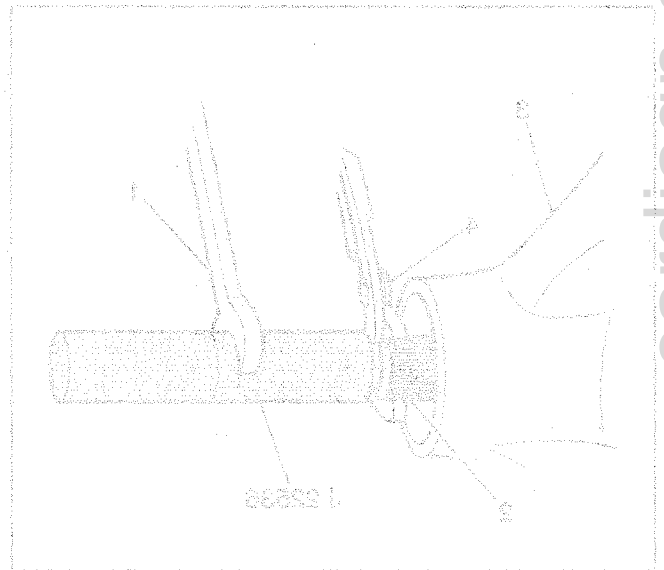
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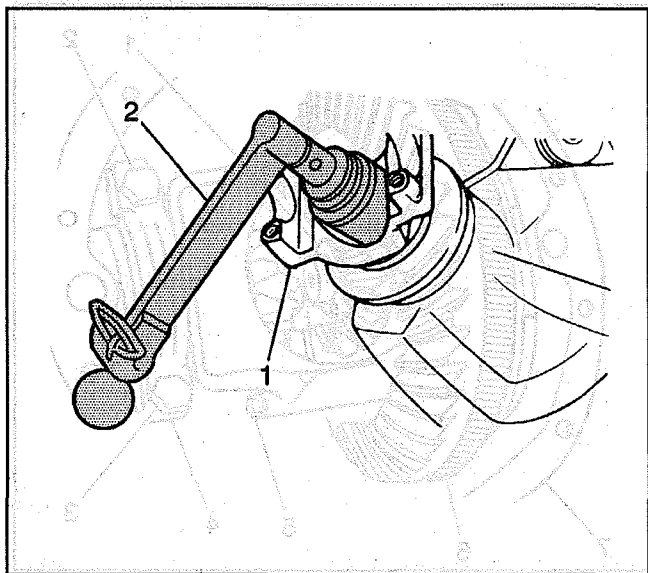
Rear Axle - Disassemble

Disassembly Procedure

Important: It is not necessary to remove the rear axle assembly for overhaul of the rear axle components because this can be done in the vehicle. If you are replacing the rear axle housing, remove the rear axle assembly from the vehicle and overhaul the assembly on the bench. If the rear axle housing is damaged, use the following procedure in order to remove and install the rear axle housing:

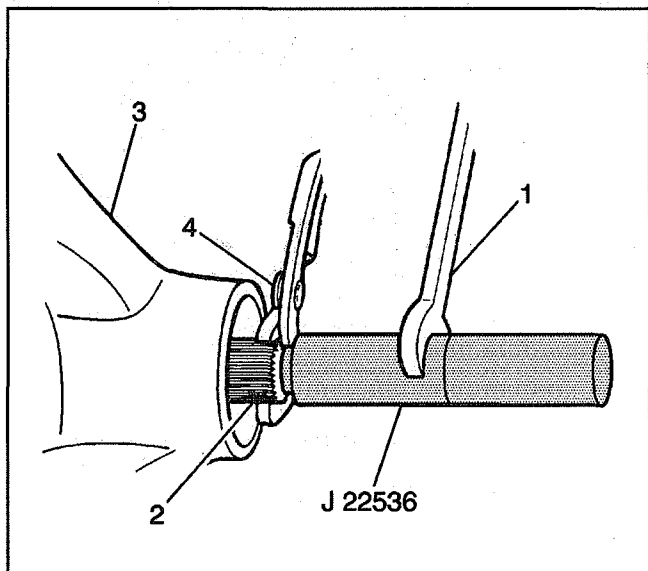
1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Support the rear axle with an adjustable lifting device.
3. Remove rear torque arm. Refer to *Torque Arm Replacement* in Rear Suspension.
4. Remove propeller shaft from vehicle. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece* in Propeller Shaft.
5. If the rear axle housing is being replaced, remove the rear axle assembly from the vehicle. Refer to *Rear Axle Replacement*.
6. Remove the rear axle cover and gasket from housing. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
7. Remove the axle shafts. Refer to *Axle Shaft Replacement*.
8. Remove the differential case from housing. Refer to *Differential Carrier Replacement*.
9. Remove the differential drive pinion gear and bearing races from housing. Refer to *Drive Pinion Assemble*.
10. Inspect all components for excessive wear. Replace as necessary.





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Drive Pinion Disassemble

Drive Pinion Removal Procedure

Tools Required

J 22536 Pinion Driver

1. Remove the differential case. Refer to *Rear Axle - Disassemble*.

2. Measure the differential drive pinion gear inner and outer bearing preload.

3. If no preload reading exists, then inspect for looseness of the drive pinion gear by shaking.

The following conditions may cause looseness:

- A worn drive pinion gear yoke
- Defective inner or outer drive pinion gear bearings

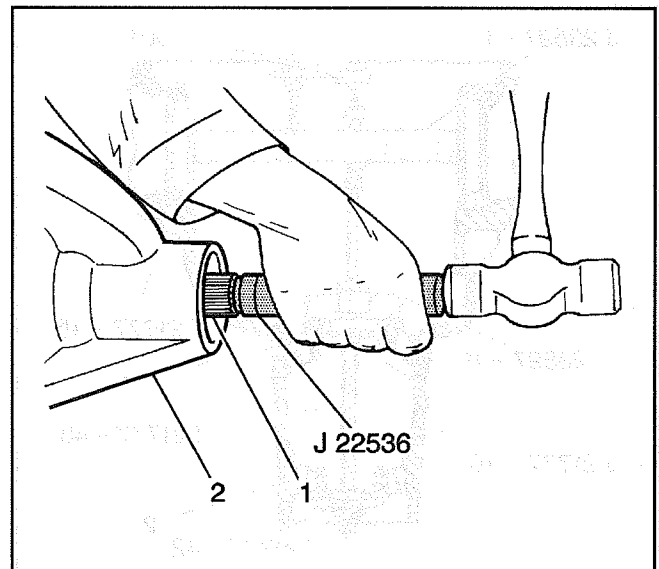
4. If the rear axle was opened for an extended period with very loose inner and outer drive pinion gear bearings, the following components will require replacement:

- The ring gear
- The drive pinion gear

5. Remove the differential drive pinion gear yoke (1). Refer to *Pinion Oil Seal Replacement*.

6. With channel-locking pliers (4) and a wrench (1), install J 22536 to the differential drive pinion gear (2).

7. Apply heavy hand pressure on *J 22536* toward the rear axle housing (2). This pressure keeps the outer drive pinion gear (1) bearing seated in order to avoid damage to the outer race.



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Outer Bearing Removal Procedure

1. Remove the differential drive pinion gear seal from the rear axle housing.
2. Remove the drive pinion gear outer bearing from the rear axle housing.
3. Use a punch in order to remove the drive pinion gear outer bearing race from the rear axle housing, if the drive pinion gear outer bearing is being replaced.

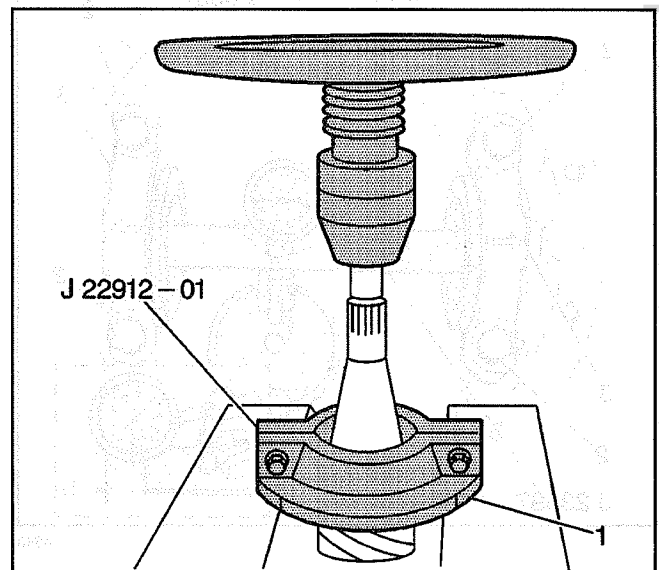
Place the punch into the slots in the rear axle housing.

Inner Bearing Removal Procedure

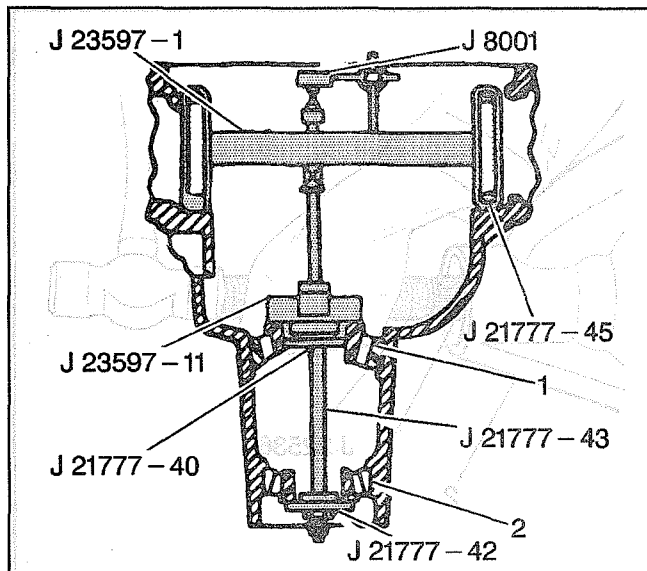
Tools Required

J 22912-01 Rear Pinion Bearing Cone Remover

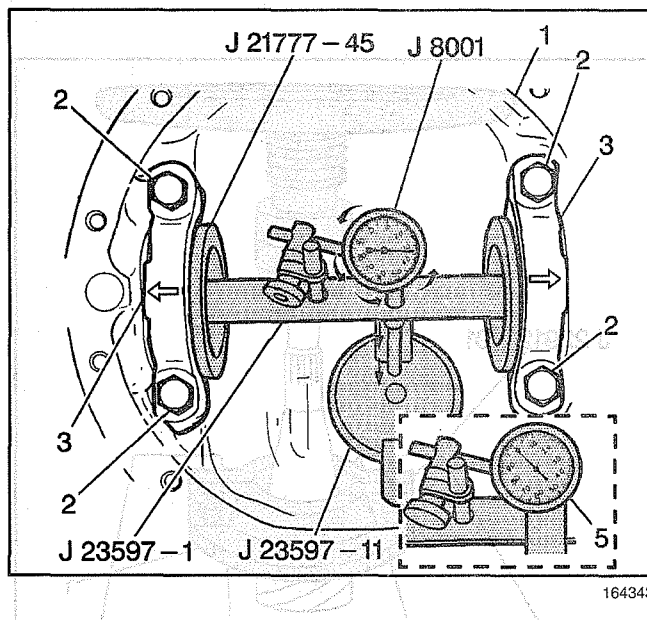
1. Remove the drive pinion gear bearing spacer from the drive pinion gear. Discard the drive pinion gear bearing spacer.
2. Use a punch in order to remove the drive pinion gear inner bearing race from the rear axle housing, if the inner drive pinion gear bearing is being replaced. Place the punch into the slots in the rear axle housing.
3. Use the *J 22912-01* in order to drive the inner drive pinion gear bearing from the drive pinion gear.



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Pinion Depth Adjustment

Tools Required

- J 8001 Dial Indicator Set
- J 23597-1 Pinion Setting Gauge Arbor
- J 23597-11 Pinion Setting Gauge Plate
- J 21777-40 Rear Pilot Washer
- J 21777-42 Front Pilot Washer
- J 21777-43 Stud Assembly-Bolt
- J 21777-45 Side Bearing Discs

Use a pinion setting gauge in order to measure differential drive pinion gear depth. The gauge provides a normal or zero pinion as a gauging reference.

1. Install J 21777-40, J 21777-42, J 21777-43, and J 21777-45.
2. Install J 23597-11.
3. Install J 21777-42 into the rear axle housing.

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

4. Install the drive pinion gear setting gauge nut into the rear axle housing.

Tighten

Tighten the differential drive pinion gear setting gauge nut to 2.3 N·m (20 lb in).

5. Rotate J 23597-11 in order to seat the following components:
 - The differential drive pinion gear outer bearing (2)
 - The differential drive pinion gear inner bearing (1)
6. Mount J 8001 onto J 23597-1.
7. Preload the dial indicator against the plunger about 1.27 mm (0.050 in).
8. Install J 21777-45 onto J 23597-11.

Position this unit into the rear axle housing.

9. Install the following components:
 - The carrier bearing caps (3)
 - The bearing cap bolts/screws (2)

Tighten

Tighten the differential carrier bearing cap bolt/screws (2) to 75 N·m (55 lb ft).

10. Use the following steps in order to measure the differential drive pinion gear depth:
 - 10.1. Rotate J 23597-1 slowly back and forth until J 8001 reads the greatest deflection. The deflection is the point where the needle changes direction.
 - 10.2. At the point of deflection, set J 8001 to zero.
 - 10.3. Repeat the rocking action in order to verify the zero setting.
 - 10.4. After obtaining the zero setting, rotate J 23597-1 until the plunger no longer touches J 23597-11.

This action provides the gauge reference of a zero or nominal drive pinion gear.

10.5. Use the following information in order to select the correct shim:

- Record the *J 8001* reading at the pointer position.

The required drive pinion gear shim thickness is equal to the *J 8001* reading.

For example, if the pointer moved counterclockwise 1.70 mm (0.067 in) to a dial reading of 0.84 mm (0.033 in), a shim thickness of 0.84 mm (0.033 in) is required.

- Drive pinion gear shims are available in 0.03–0.94 mm (0.001–0.037 in).

The thickness of each shim is etched on the flat surface of the shim.

11. Loosen the *J 21777-43*.

12. Remove all of the special tools from the rear axle housing.

13. Remove the inner (1) and the outer (2) drive pinion gear bearings from the rear axle housing.

14. Install the correct drive pinion gear shim on the drive pinion gear.

15. Use the following steps in order to set the proper drive pinion gear depth:

15.1. Use the set-up dimension determined by *J 8001* as a starting point.

15.2. Perform a ring gear tooth pattern test in order to fine tune the drive pinion gear depth.

The test may indicate additional necessary drive pinion gear shim changes.

Refer to *Pinion and Ring Gear Inspection*.

16. Install the following components:

- The drive pinion gear inner bearing
- The drive pinion gear outer bearing

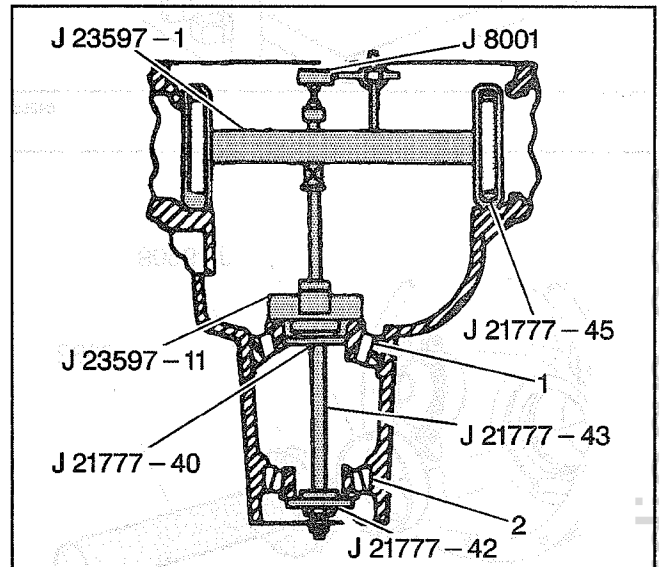
Refer to *Drive Pinion Assemble*.

17. Assemble the differential case. Refer to *Rear Axle - Assemble*.

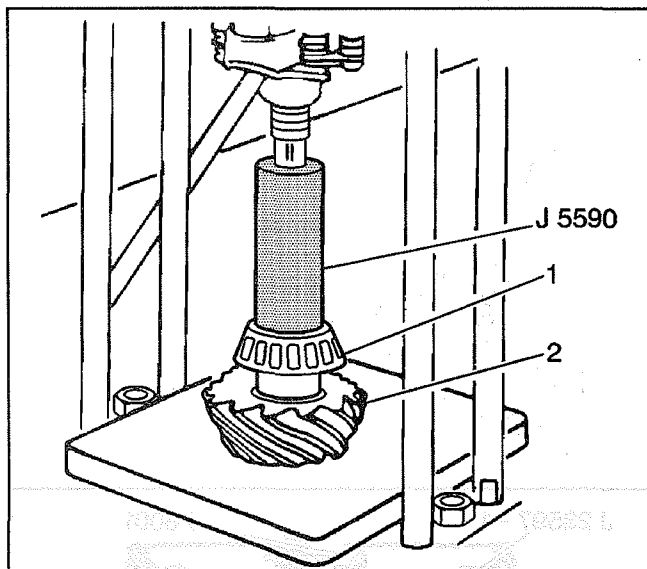
18. Measure the total preload at the drive pinion gear nut bearings.

The preload should measure within the following specifications:

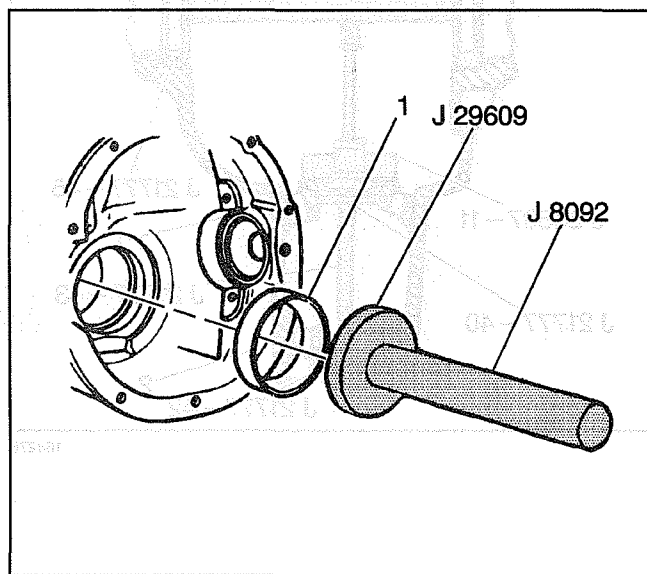
- With new inner and outer drive pinion gear bearings and a new drive pinion gear seal, the preload should measure 3.6–6.2 N·m (32–55 lb in).
- With used inner and outer drive pinion gear bearings and a new drive pinion gear seal, the preload should measure 1.8–3.1 N·m (16–28 lb in) when rotating with a new drive pinion gear seal.



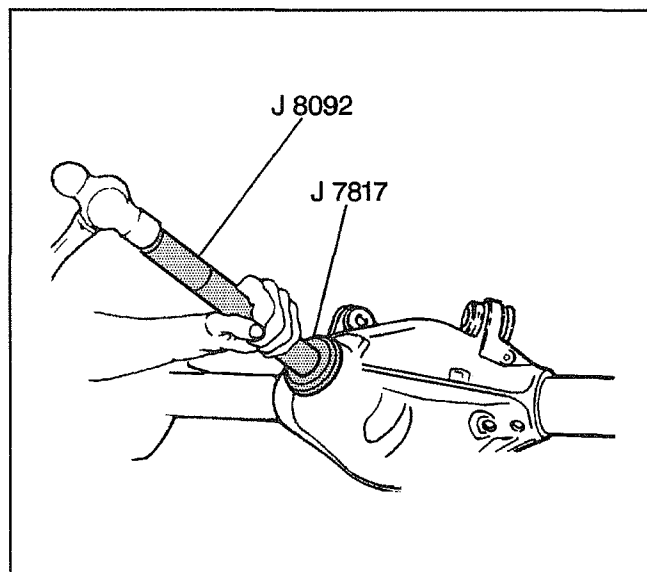
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Drive Pinion Assemble

Inner Bearing Installation Procedure

Tools Required

- J 8092 Driver Handle
- J 29609 Rear Pinion Bearing Cup Installer
- J 5590 Rear Pinion Bearing Cone Installer

1. Use J 5590 in order to install the inner drive pinion gear bearing (1) onto the drive pinion gear (2).

• Drive pinion gear shims are available in 0.03-0.04 mm (0.001-0.002 in). The thickness of each shim is etched on the flat surface of the shim.

11. Loosen the J 2177-43.
12. Remove all of the special tools from the rear axle housing.

13. Remove the inner (1) and the outer (2) drive pinion gear bearing from the rear axle housing.
2. Use J 8092 and J 29609 in order to drive the inner bearing race (1) into the rear axle housing, if the inner drive pinion gear bearing was replaced.

3. Install the new drive pinion gear bearing spacer onto the drive pinion gear.

15.1. Use the self-aligning point J 8001 as a starting point.

15.2. Perform a ring gear tooth pattern test in order to fine tune the drive pinion gear depth.

The test may indicate additional necessary drive pinion gear shim changes.

Refer to Pinion and Ring Gear Inspection.

16. Install the following components:
 - The drive pinion gear inner bearing
 - The drive pinion gear outer bearing

Refer to Drive Pinion Assemble.

17. Assemble the differential case. Refer to Rear Axle - Assemble.

Outer Bearing Installation Procedure

Tools Required

- J 8092 Driver Handle
- J 7817 Front Pinion Bearing Cup Installer

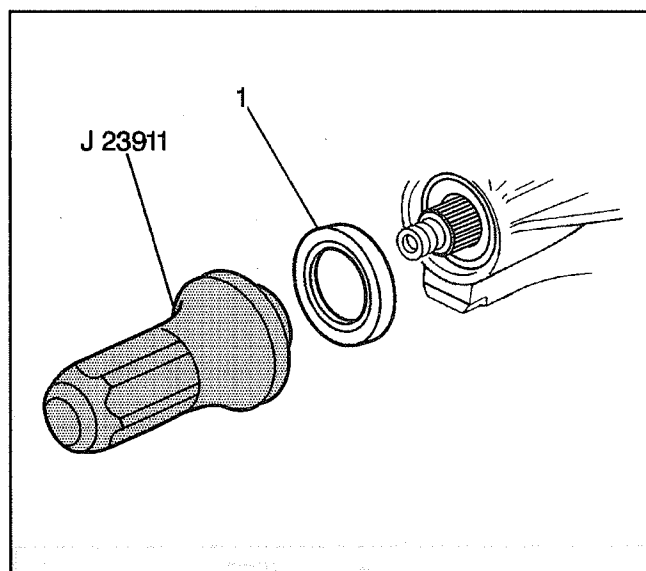
1. Use J 8092 and J 7817 in order to install the drive pinion gear outer bearing race into the rear axle housing if you remove the pinion gear outer bearing race.
2. Install the drive pinion gear outer bearing into the rear axle housing.
3. Install the differential drive pinion gear seal.

Drive Pinion Installation Procedure**Tools Required****J 7817 Front Pinion Bearing Cup Installer**

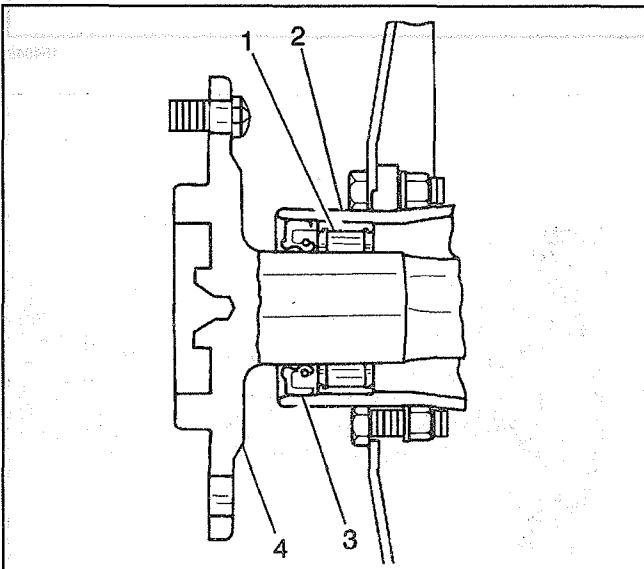
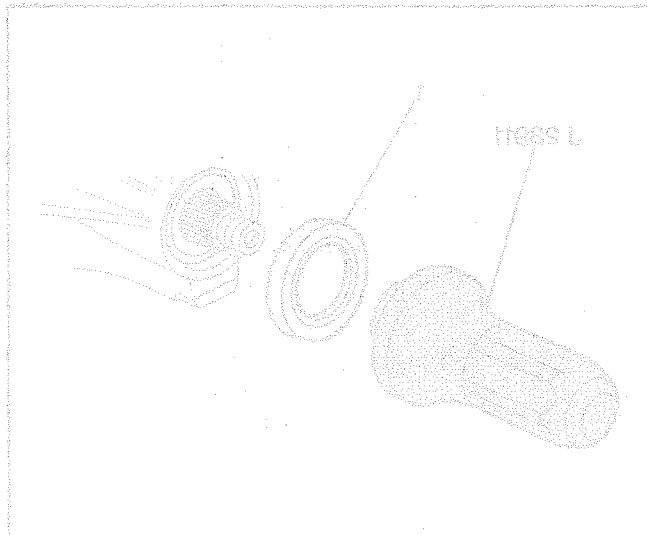
1. If a new ring gear and a new drive pinion gear will be installed, measure the differential drive pinion gear depth.
(Refer to *Pinion Depth Adjustment*).
2. Install the drive pinion gear into the rear axle housing.
3. Use **J 7817** in order to install the new drive pinion gear seal (1).
4. Apply pipe sealant (GM p/n 12346004) or an equivalent onto the pinion shaft splines.
5. Install the drive pinion gear yoke.
6. Install the drive pinion gear washer and nut.
Finger tighten the drive pinion gear washer and nut.
7. Perform the following actions in order to tighten the drive pinion gear nut.
 - Hold the drive pinion gear yoke in place.
 - Rotate the drive pinion gear in order to seat the inner and outer drive pinion gear bearings.
 - While rotating the drive pinion gear, tighten the drive pinion gear nut until the end play is taken up.

Important:

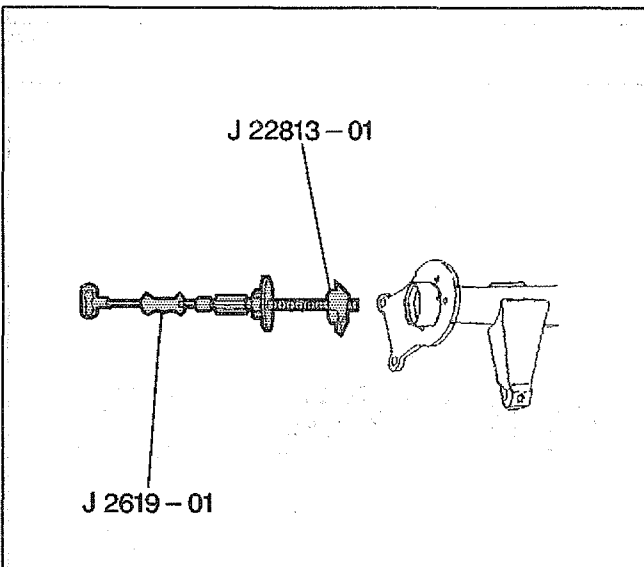
- Preload specifications are being approached when the following conditions occur:
 - The holder will no longer pivot freely as the drive pinion gear rotates.
 - No further end play exists
 Do not attempt further tightening until after measuring the preload if the above conditions exist.
 - Exceeding the preload specifications will compress the collapsible drive pinion gear bearing spacer too far.
8. Set the preload to the following specifications on the inner and outer drive pinion gear bearings:
 - 1.7–3.4 N·m (15–30 lb in) on new inner and outer drive pinion gear bearings
 - 1.0–1.7 N·m (10–15 lb in) on used inner and outer drive pinion gear bearings
 9. Rotate the drive pinion gear several times.
Ensure that the inner and outer drive pinion gear bearings seat.
 10. Carefully tighten the drive pinion gear nut.
 11. Continue to gradually tighten the drive pinion gear nut.
Measure the preload after each tightening.
(Additional tightening of the drive pinion gear nut may add additional torque).
 12. Measure the preload again.
 13. Reset the preload to specifications if the preload decreased by rotating the drive pinion gear.
 14. Install the differential case. Refer to *Rear Axle - Assemble*.



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Rear Axle - Assemble

Assembly Procedure

1. Inspect all components for excessive wear and replace as necessary.
2. Perform pinion depth measurement and adjustment. Refer to *Pinion Depth Adjustment*.
3. Install the differential drive pinion gear, bearing races, and new pinion seal from housing. Refer to *Drive Pinion Assemble*.
4. Install the differential carrier to housing. Refer to *Differential Carrier Replacement*.
5. Perform side bearing preload adjustment and measurement. Refer to *Differential Side Bearing Preload Adjustment*.
6. Perform a backlash adjustment and measurement. Refer to *Backlash Adjustment*.

Oil Seal and/or Bearing Replacement

Removal Procedure

Tools Required

- J 2619-01 Slide Hammer
- J 22813-01 Axle Bearing Remover

1. Remove the rear axle shaft. Refer to *Axle Shaft Replacement*.
2. Place a pry bar behind the steel case of the seal (3). Use the pry bar in order to remove the rear wheel bearing seal (3) from the rear axle housing (2).

Do NOT damage the housing (2).

3. Insert J 22813-01 into the bore.

Position J 22813-01 behind the rear wheel bearing so that the tangs on the tool engage the bearing outer race.

4. Use J 2619-01 in order to remove the rear wheel bearing.

Installation Procedure**Tools Required**

- J 8092 Driver Handle
- J 23765 Axle Bearing Installer
- J 23771 Axle Oil Seal Installer

1. Lubricate the new rear wheel bearing (1).

Use one of the following lubricants:

- Axle lubricant
- SAE 80W-90 GL-5 gear lubricant or an equivalent

2. Use J 23765 and J 8092 in order to install the rear wheel bearing.

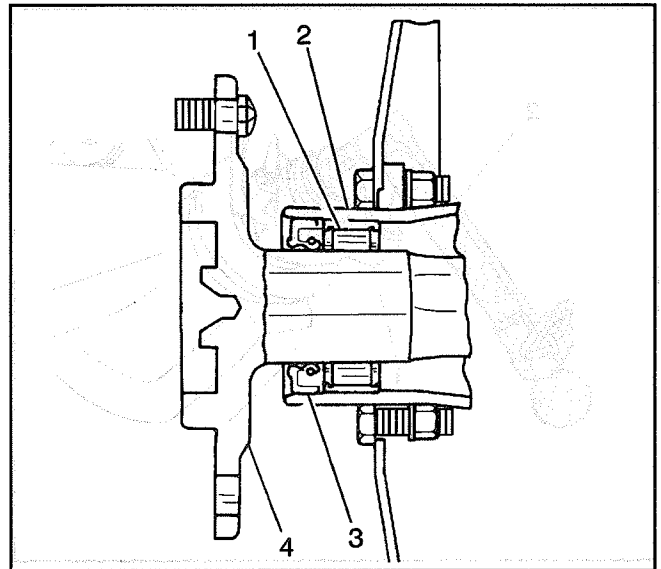
Ensure that the tool bottoms against the shoulder in the rear axle housing.

3. Lubricate the sealing lips. Use one of the following lubricants:

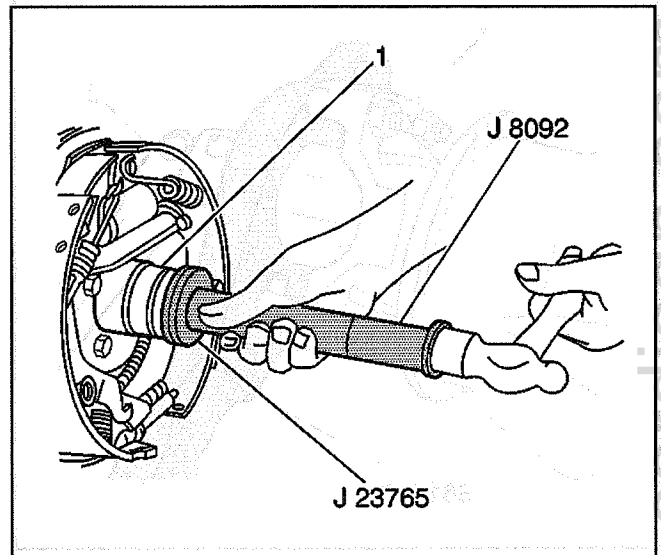
- Axle lubricant
- SAE 80W-90 GL-5 gear lubricant or an equivalent

4. Position the rear wheel bearing seal onto J 23771.**5. Use J 23771 in order to direct the bearing seal (3) into the housing bore.****6. Install the rear wheel bearing seal into place.**

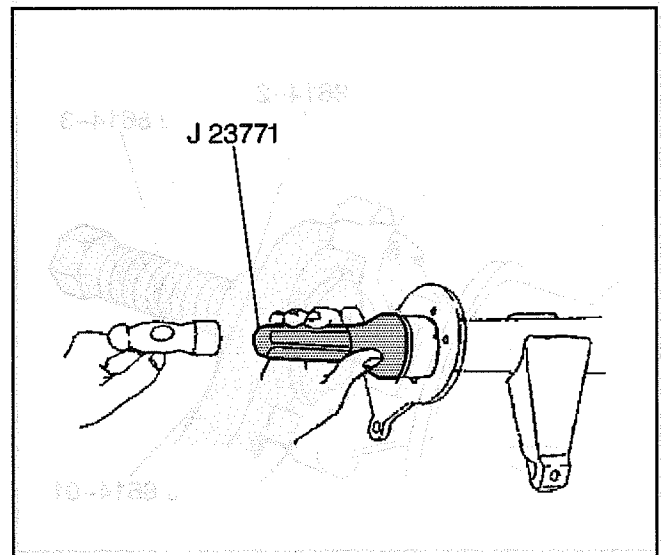
Ensure that the rear wheel bearing seal is flush with the axle tube.

7. Install the rear axle shaft. Refer to *Axle Shaft Replacement*.**8. Road test and Inspect for correct operation of the rear axle.**

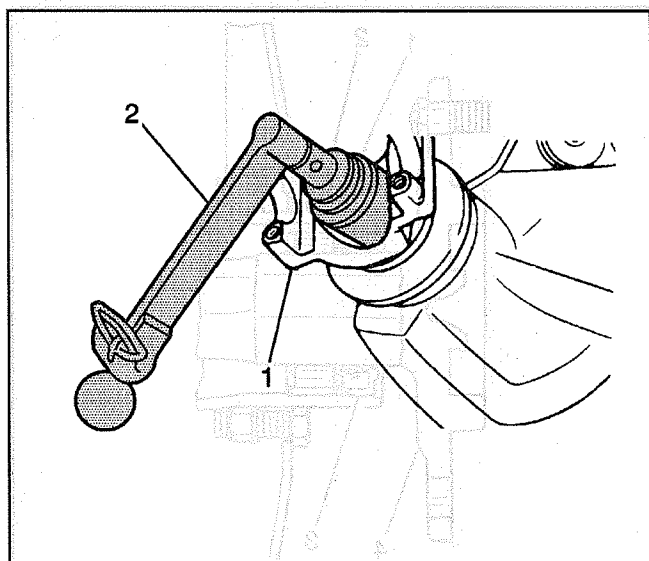
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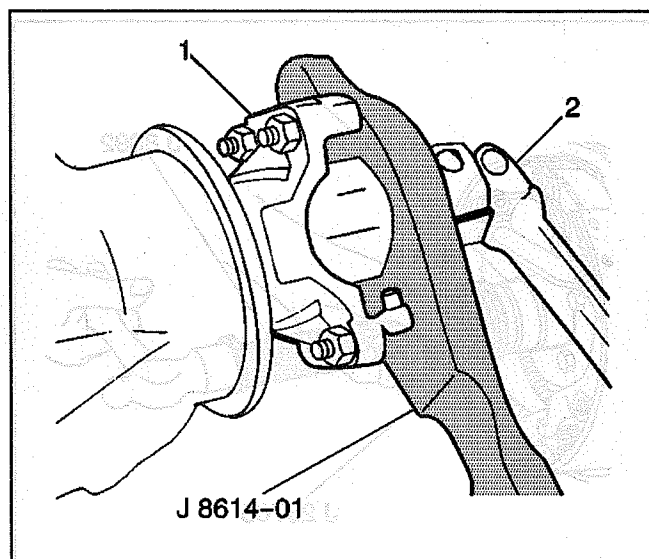
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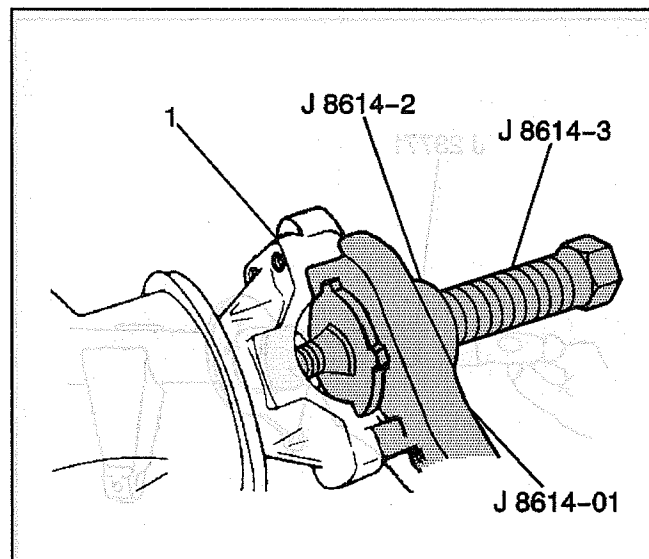
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Pinion Oil Seal Replacement

Removal Procedure

Tools Required

J 8614-01 Pinion Flange Remover and Installer

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece* in Propeller Shaft.
3. Mark the position of the following components before disassembly:

- The drive pinion gear yoke (1)
- The drive pinion gear
- The drive pinion gear nut

This action will ensure that the correct drive pinion gear inner and outer bearing preload can be maintained.

4. Use *J 8614-01* in order to remove the following components:

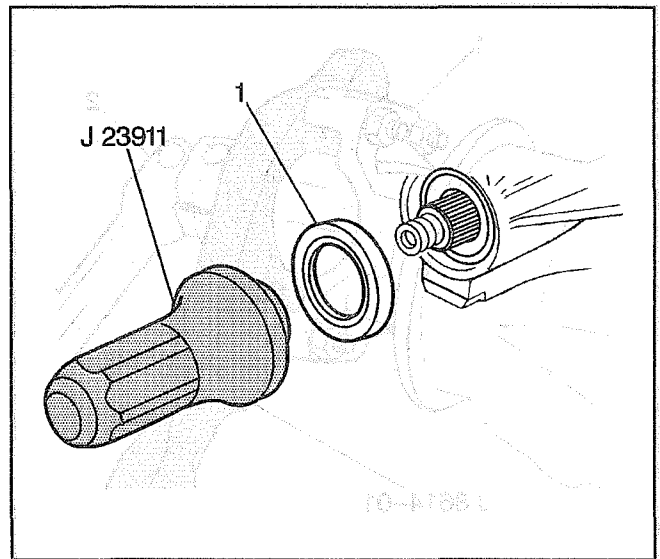
- The drive pinion gear nut
- The drive pinion gear washer

5. Use a suitable container in order to hold any fluid that may drain from the rear axle.

6. Use *J 8614-01* in order to remove the drive pinion gear yoke (1).

Important: Do not damage the rear axle housing when removing the drive pinion gear seal.

7. Use a blunt chisel in order to drive the drive pinion gear seal (1) out of the rear axle housing.
8. Inspect the drive pinion gear seal (1) surface of the drive pinion gear yoke for the following conditions:
 - Tool marks
 - Nicks
 - Damage, such as a groove worn by the drive pinion gear seal.
9. If the drive pinion gear yoke is damaged, replace the drive pinion gear yoke.
10. Inspect the housing bore for burrs. Burrs might cause leaks around the outer diameter (OD) of the drive pinion gear seal (1). Remove any burrs that might cause leaks around the outer diameter (OD) of the drive pinion gear seal (1).



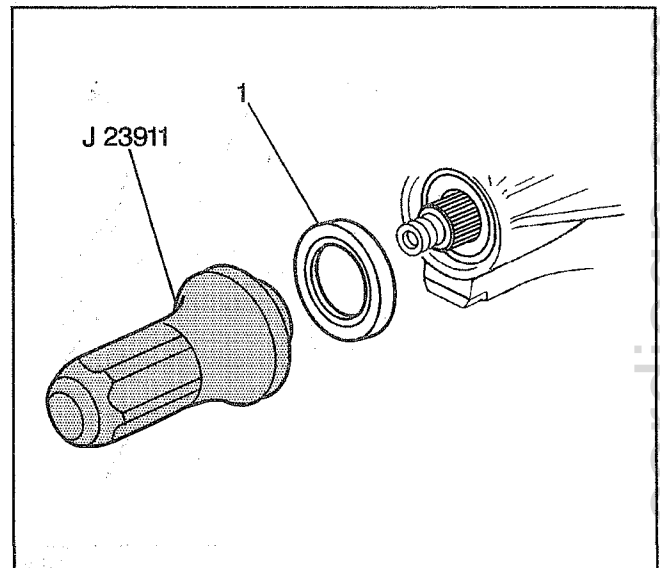
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Installation Procedure

Tools Required

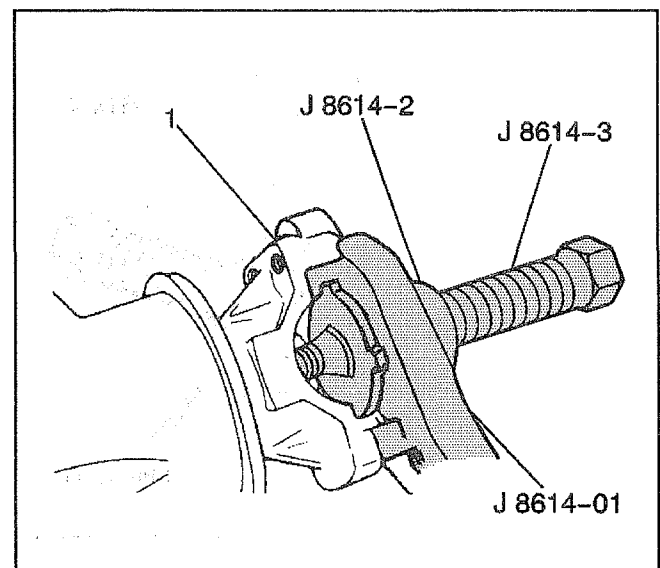
- J 8614-01 Pinion Flange Remover and Installer
- J 23911 Pinion Oil Seal Installer

1. Use the J 23911 in order to install a new drive pinion gear seal (1).
2. Apply chassis lubricant or an equivalent to the following components:
 - The outside diameter of the drive pinion gear yoke
 - The sealing lip of the new drive pinion gear seal (1)

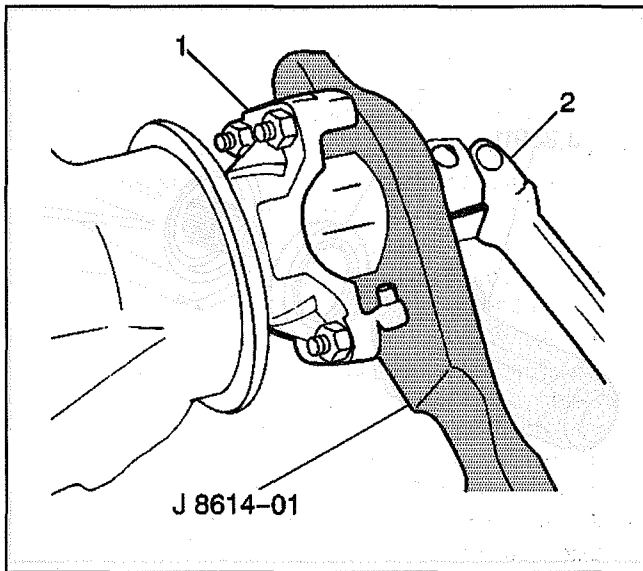


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3. Install the drive pinion gear yoke (1).
4. Install the following components:
 - The drive pinion gear washer
 - The drive pinion gear nut
 Finger tighten the drive pinion gear nut.



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

5. Hold the drive pinion gear yoke. Use *J 8614-01* in order to tighten the drive pinion gear nut to the position that was marked.

Tighten

Tighten the drive pinion gear nut to 1.59 mm (1/16 inch) beyond the alignment mark.

6. Install the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece* in Propeller Shaft.
7. Measure the rear axle lubricant level and add lubricant, if necessary. Refer to *Lubricant Level Check*.
8. Lower the vehicle.
9. Inspect for correct operation of the rear axle.

Inspection Before Disassembly

Important: If possible, determine the cause the axle problem before you disassemble the axle.

1. Remove the cover.
2. Drain the oil.

Important: Use this information in the diagnosis of an axle problem. Information on ring gear backlash also helps in setting shim packs for locating and preloading the differential case.

3. Inspect the ring gear backlash. Refer to *Backlash Adjustment*.
4. Inspect the case for metal chips and shavings. Determine the source of the chips and shavings, such as a broken gear or a bearing cage.

Rear Axle Housing Inspection

Before assembly, carefully and thoroughly inspect all drive unit parts for wear or stress. 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 you find any cracks.
- Inspect the housing for foreign material such as metal chips, dirt, or rust.

Differential Inspection

Before assembly, carefully and thoroughly inspect all drive unit parts for wear or stress. Replacement of worn parts eliminates costly drive component repair after assembly.

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

Bearings Inspection

Important: Bearings and cups are matched sets. Replace both bearing and cup when either part requires replacement.

- Before assembly, carefully and thoroughly inspect all drive unit parts for wear or stress. Replacement of worn parts eliminates costly drive component repair after assembly.
- Oil the bearings. Inspect the bearings for smooth rotation.
- Inspect the bearing rollers for wear.
- Inspect the bearing cups for wear, cracks, brinelling, and scoring.

Differential Side Bearing Preload Adjustment

Perform the differential bearing preload adjustment before installing the drive pinion gear. If the drive pinion gear is installed, remove the ring gear. Refer to *Rear Axle - Assemble*.

When adjusting the differential bearing preload, change the thickness of both the right and the left bearing shims by an equal amount. This will ensure that the original backlash remains constant.

Production bearing shims are cast iron. Production bearing shims vary in thickness from 5.33–6.91 mm (0.210–0.272 in) in increments of 0.05 mm (0.002 in).

Steel service bearing shims are available from 1.02–2.08 mm (0.040–0.082 in) in increments of 0.05 mm (0.002 in).

Standard service bearing spacers are 4.32 mm (0.170 in) thick.

Refer to Production Differential Bearing Shim Thickness (Standard Spacer) and Service Differential Bearing Shim Thickness (Standard Spacer) in *Rear Axle Specifications (General Specifications)*.

Important:

- Do not reinstall the production bearing shims. The production bearing shims may break when tapped by a hammer.
 - Service bearing shims are reusable. The differential bearings must have the original outer races in place when the bearings are reused.
1. Determine the approximate required thickness of the replacement bearing shims. Measure each production bearing shim, each service bearing spacer, and each bearing shim pack.
 2. Determine the necessary service bearing shims. Select a starting point in service bearing shim thickness. Refer to Service Differential Bearing Shim Thickness (Standard Spacer) in *Rear Axle Specifications (General Specifications)*.
 3. Position the following components into the rear axle housing:
 - The differential case
 - The differential bearing outer races
 4. Slip the correct service bearing spacer between each differential bearing race and the rear axle housing. Place the chamfered edge of the service bearing spacer against the rear axle housing.

Notice: Install the left side bearing cap loosely so the differential case may be moved while checking adjustments. Another differential bearing cap bolt/screw can be added in the lower right side differential bearing cap hole. This will prevent the case from dropping while making shim adjustments.

5. Select one or two bearing shims. Refer to Service Differential Bearing Shim Thickness in *Rear Axle Specifications (General Specifications)* for the correct total thickness.
6. Position the shims between the right side of the differential bearing race and the service bearing spacer.

Position the left side of the differential bearing race and the bearing spacer against the left side of the rear axle housing.

7. Insert progressively larger feeler gauge sizes between the right bearing shim and the service bearing spacer until you notice an increase in drag.

The following measurements are examples of progressively larger feeler gauge sizes:

- 0.25 mm (0.010 in)
- 0.30 mm (0.012 in)
- 0.36 mm (0.014 in)

8. Push a feeler gauge downward until the end of the gauge touches the rear axle housing bore. This position will ensure an accurate reading. You have selected the correct feeler gauge thickness at the point just before additional drag begins.

9. In order to ensure an even reading, rotate the differential case while using the feeler gauge.

The weight of the differential case against the rear axle housing causes the original light drag. The differential bearing preload causes the additional drag.

- Start with a thin feeler gauge. This provides a sense of feel that is necessary in order to recognize the beginning of the preload and obtain zero clearance.
- Work the differential case in, out, and to the left in order to insert the feeler gauge.

10. Remove the following components from the rear axle housing:

- The left side differential bearing cap
- The left side bearing shim

11. With no preload on the differential bearings, add the following measurements in order to obtain the size of the total shim pack:

- The feeler gauge reading measured in Step 7.
- The thickness of the bearing shims that were installed in Step 6.

12. Select two bearing shims of approximately equal size. The total thickness of the two shims must be equal to the value obtained in Step 9.

When installing the differential case into the rear axle housing, install the bearing shims between the following components:

- Each differential bearing race
- Each service bearing spacer

Add the additional preload after you install the differential case.

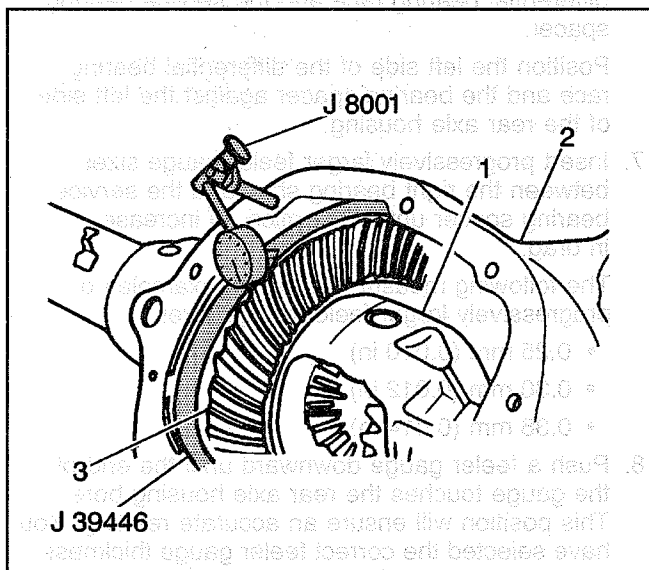
13. When the drive pinion gear is in position, install the ring gear. Refer to *Rear Axle - Assemble*.

Backlash Adjustment

Tools Required

J 8001 Dial Indicator Set

1. Remove the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
2. Rotate the differential case (1) several times in order to seat the bearings.
3. Mount the J 8001.
4. Use a small button on the indicator stem in order to make contact with the near heel end of the tooth.
5. Set the J 8001 so that the following conditions are met:
 - The stem is in line with the gear rotation
 - The stem is perpendicular to the tooth angle
6. Measure the backlash at three or four points around the ring gear (3). Hold the drive pinion gear stationary when checking backlash.



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7. The lash must not vary over 0.05 mm (0.002 in) around the ring gear (3). If the variation is over 0.05 mm (0.002 in), inspect for the following conditions and correct as necessary:

- Burrs
- Uneven bolting conditions
- A distorted case flange

8. The backlash at the point of minimum lash should be 0.13–0.23 mm (0.005–0.009 in) for all new gears. Adjust the backlash as necessary by increasing the thickness of one bearing shim and decreasing the thickness of the other bearing shim by the same amount.

Transfer 0.05 mm (0.002 in) in bearing shim thickness for each 0.03-mm (0.001-in) change in backlash desired.

For example, use the following steps in order to decrease the backlash by 0.03 mm (0.001 in):

- 8.1. Decrease the thickness of the right bearing shim by 0.05 mm (0.002 in).
- 8.2. Increase the thickness of the left bearing shim by 0.05 mm (0.002 in). Refer to *Differential Side Bearing Preload Adjustment* for further information.

9. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.

Gear Tooth Contact Pattern Check

Tools Required

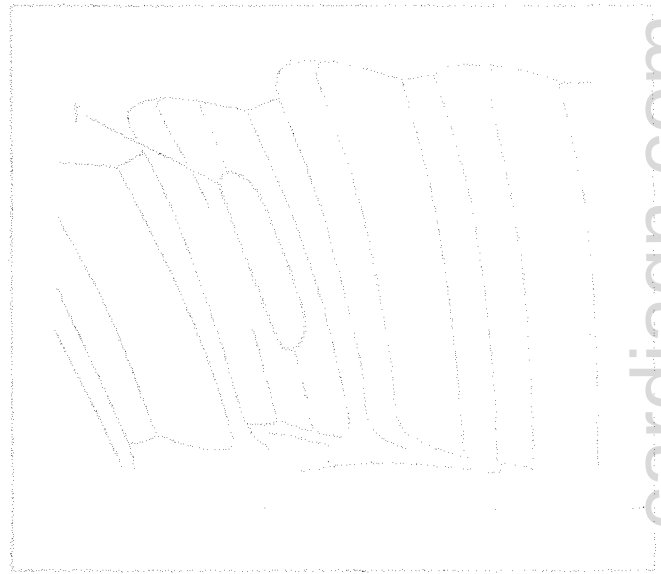
J 39446 ABS Exciter Ring Protector Kit

Notice: It is very important that tooth contact be tested after the differential is taken apart. Variations in the differential or differential drive pinion gear inner bearing may cause the differential drive pinion gear to be too far away from, or close to, the differential ring gear. Therefore, the tooth contact pattern must be tested and corrected, (if necessary) to prevent gear noise.

1. Clean all of the dirt from the area of the rear axle housing cover before removing the rear axle housing cover.
2. Remove the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.
3. Wipe the oil out of the rear axle housing.
4. Carefully clean each tooth of the ring gear.
5. Select the correct exciter ring protector from J 39446.

Attach the exciter ring protector to the speed sensor reluctor wheel on vehicles with non-traction control rear axles only.

6. Using a medium stiff brush, apply a mixture of gear marking compound sparingly to all of the ring gear teeth. The area of tooth contact of the differential drive pinion gear should remain visible



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

7. Tighten the differential carrier bearing cap bolts/screws.

Tighten

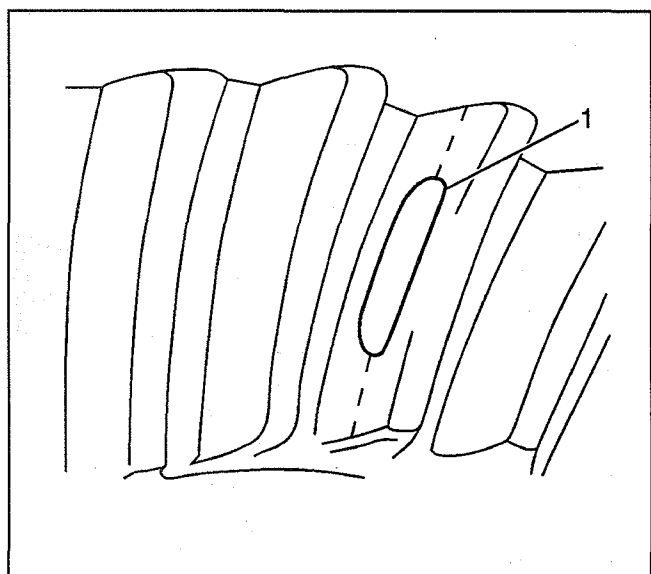
Tighten the differential carrier bearing cap bolts/screw to 75 N·m (55 lb ft).

8. Apply the park brake until a torque of 54–70 N·m (40–52 lb ft) is required in order to turn the drive pinion gear.

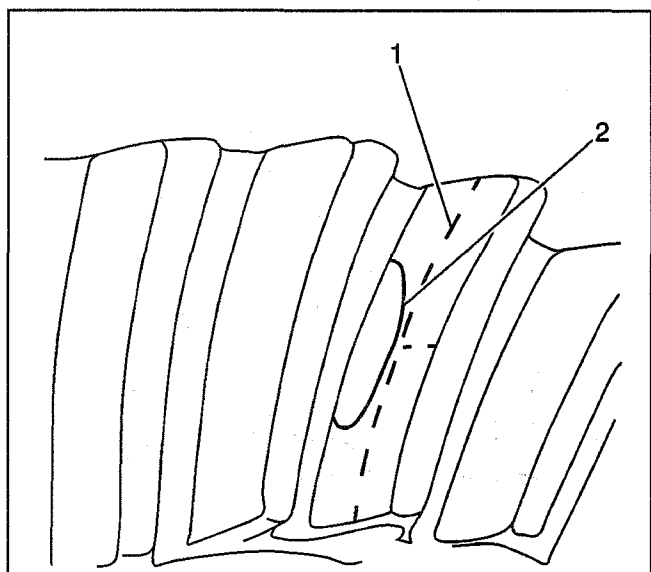
Important: A test made without loading the gears will not give a satisfactory pattern.

9. Use the following procedure in order to obtain a ring gear tooth contact pattern:
 - 9.1. Turn the pinion gear yoke with a wrench so that the ring gear rotates one full revolution.
 - 9.2. Reverse the rotation so that the ring gear rotates one revolution in the opposite direction.

10. Inspect the differential ring gear teeth for a tooth contact pattern (1).
11. The pattern is acceptable if the area of differential drive pinion gear contact (1) remains in the center of the differential ring gear tooth. If the pattern is not acceptable, proceed to Step 14.
12. If the differential ring gear tooth pattern is acceptable, remove *J 39446*.
13. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.



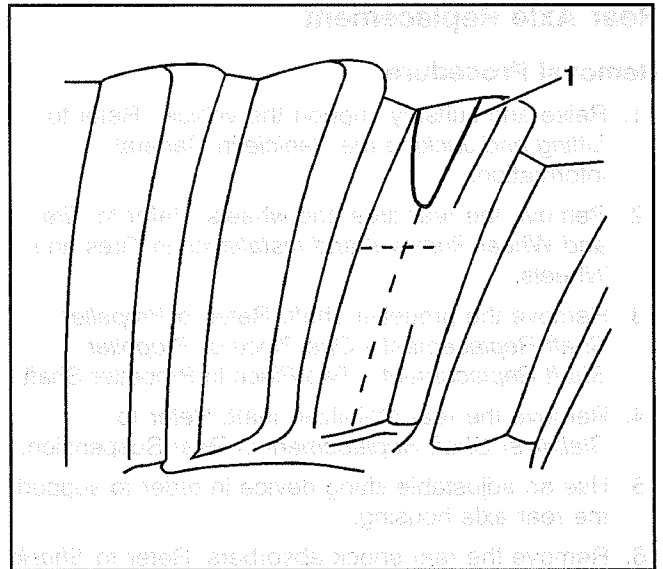
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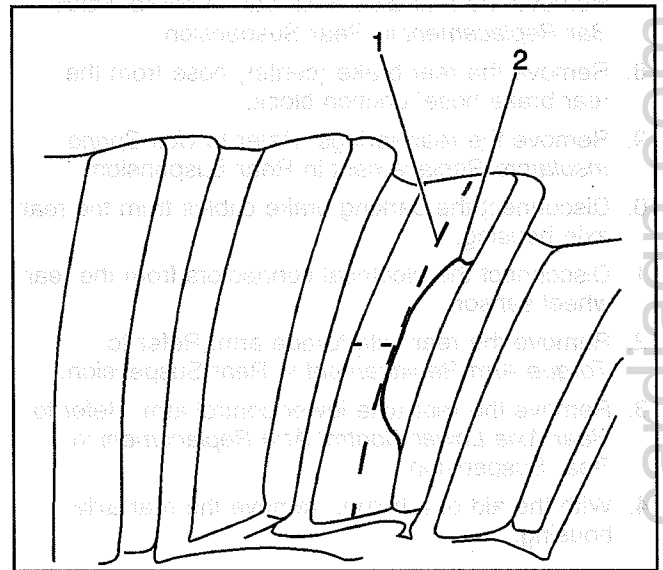
14. Inspect the differential ring gear teeth for a low flank contact pattern (2).
15. If this contact pattern (2) exists, repair the low flank contact by decreasing the shim thickness of the bearing on the differential drive pinion gear. This moves the smaller diameter of the contact (2) out toward the center line (1) of the differential ring gear.
16. Remove *J 39446*.
17. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.

18. Inspect the differential ring gear teeth for a heel contact pattern (1).
19. If this contact pattern (1) exists, repair the heel contact by decreasing the backlash. This moves the area of differential drive pinion gear contact (1) toward the toe.
20. Remove *J 39446*.
21. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.



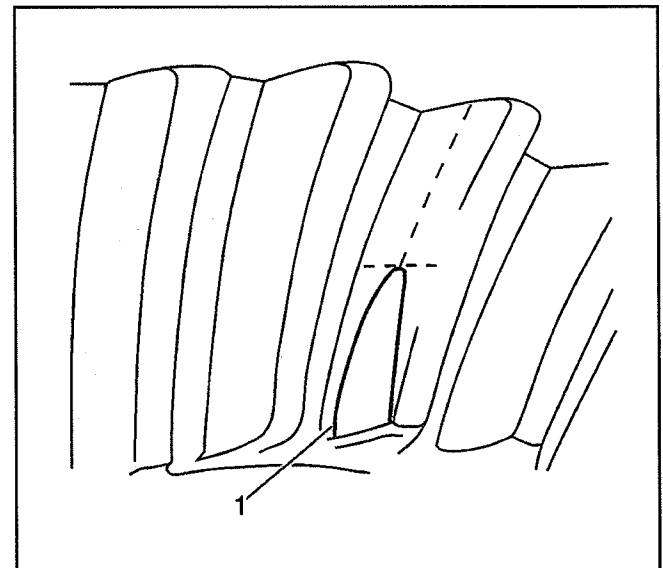
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22. Inspect the differential ring gear teeth for a high face contact pattern (2).
23. If this contact pattern (2) exists, repair the high face contact by increasing the thickness of the bearing shim of the differential drive pinion gear. This moves the area of differential drive pinion gear contact (2) out toward the differential ring gear center line (1).
24. Remove *J 39446*.
25. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.



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26. Inspect the differential ring gear teeth for a toe contact pattern (1).
27. If this contact pattern (1) exists repair the heel contact by increasing the backlash. This moves the area of differential drive pinion gear contact (1) toward the heel.
28. Remove *J 39446*.
29. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement*.



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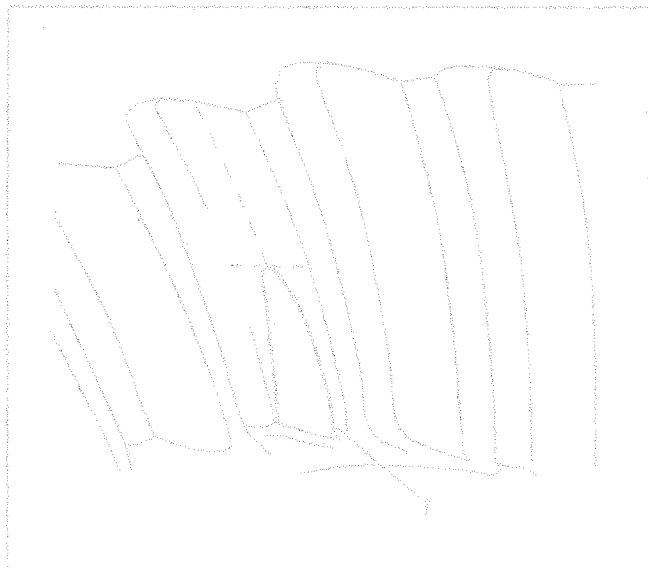
Rear Axle Replacement

Removal Procedure

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the rear tires and wheels. Refer to *Tire and Wheel Removal and Installation* in Tires and Wheels.
3. Remove the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece* in Propeller Shaft.
4. Remove the rear stabilizer shaft. Refer to *Stabilizer Shaft Replacement* in Rear Suspension.
5. Use an adjustable lifting device in order to support the rear axle housing.
6. Remove the rear shock absorbers. Refer to *Shock Absorber Replacement* in Rear Suspension.
7. Remove the rear axle track bar. Refer to *Track Bar Replacement* in Rear Suspension.
8. Remove the rear brake (center) hose from the rear brake hose junction block.
9. Remove the rear springs. Refer to *Coil Spring Insulators Replacement* in Rear Suspension.
10. Disconnect the parking brake cables from the rear axle housing.
11. Disconnect the electrical connectors from the rear wheel sensor.
12. Remove the rear axle torque arm. Refer to *Torque Arm Replacement* in Rear Suspension.
13. Remove the rear axle lower control arm. Refer to *Rear Axle Lower Control Arm Replacement* in Rear Suspension.
14. With the aid of a helper, remove the rear axle housing.

Installation Procedure

1. With the aid of a helper, install the rear axle housing.
2. Install the rear axle lower control arms. Refer to *Rear Axle Lower Control Arm Replacement* in Rear Suspension.
3. Install the rear axle torque arm. Refer to *Torque Arm Replacement* in Rear Suspension.
4. Connect the electrical connectors to the rear wheel sensor.
5. Connect the parking brake cables to the rear axle housing.
6. Install the rear springs. Refer to *Coil Spring Replacement* in Rear Suspension.
7. Install the rear brake (center) hose to the rear brake hose junction block.
8. Install the rear axle track bar. Refer to *Track Bar Replacement* in Rear Suspension.
9. Install the rear shock absorbers. Refer to *Shock Absorber Replacement* in Rear Suspension.
10. Remove the adjustable lifting device from the rear axle housing.
11. Install the rear stabilizer shaft. Refer to *Stabilizer Shaft Replacement* in Rear Suspension.
12. Install the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece* in Propeller Shaft.
13. Bleed the brake system. Refer to *Hydraulic Brake System Bleeding (Manual Bleeding)* in Hydraulic Brakes.
14. Install the rear tires and wheels. Refer to *Tire and Wheel Removal and Installation* in Tires and Wheels.
15. Refill the rear axle with lubricant. Refer to *Lubricant Level Check*.
16. Lower the vehicle.
17. Road test the vehicle in order to ensure proper rear axle operation.



29. Install the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement* in Rear Suspension.

30. Remove the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement* in Rear Suspension.

31. If this contact pattern (1) exists, repair the heel contact pattern (1) by increasing the backlash. This move the area of differential drive pinion gear contact (1) toward the heel.

32. Remove the rear axle housing cover. Refer to *Rear Axle Housing Cover and Gasket Replacement* in Rear Suspension.

33. Inspect the differential and gear (teeth) for a free contact pattern (1).

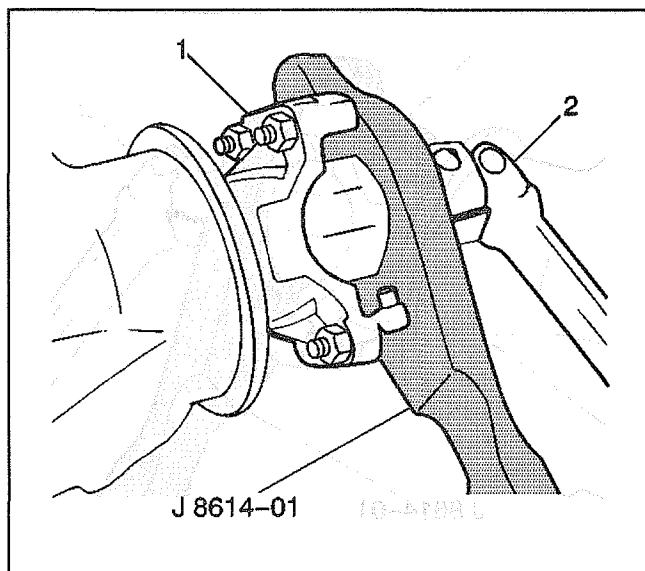
Pinion Flange Replacement

Removal Procedure

Tools Required

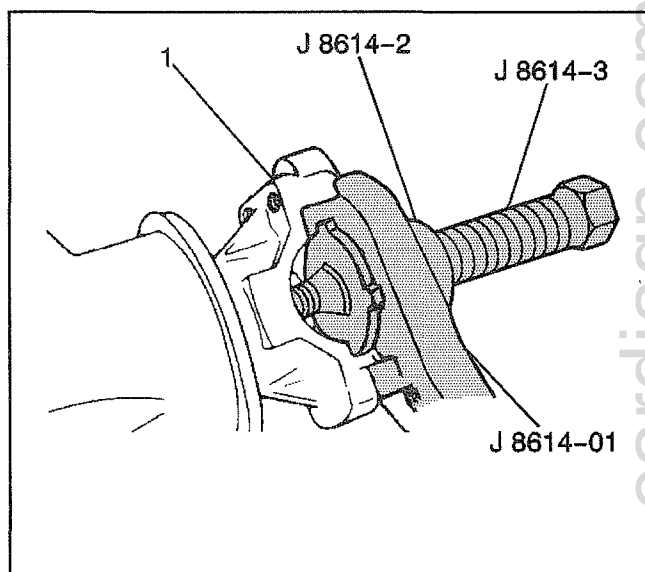
J 8614-01 Pinion Flange Holder

1. Raise and suitably support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece*.
3. Mark the following components with a punch in a straight line before disassembly:
 - The drive pinion gear flange
 - The drive pinion gear
 - The drive pinion gear nut
4. Use J 8614-01 in order to remove the following components:
 - The drive pinion gear nut
 - The drive pinion gear washer



164050

5. Remove the drive pinion gear flange (1).
6. If the drive pinion gear flange or flange seal is damaged, replace the component.



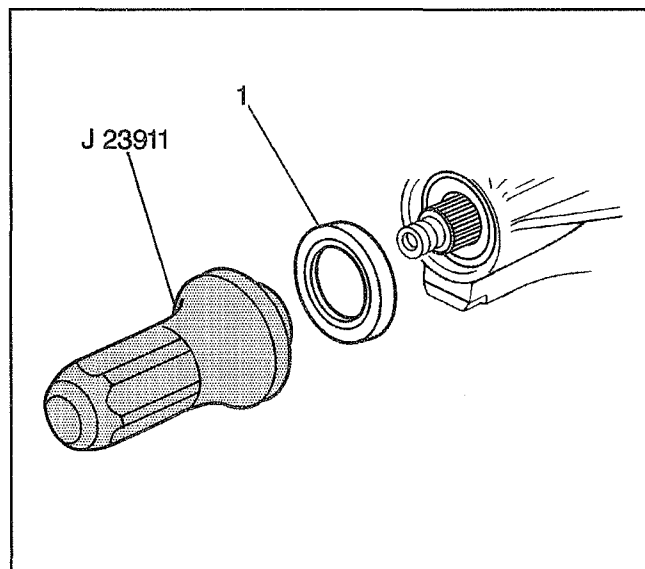
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Installation Procedure

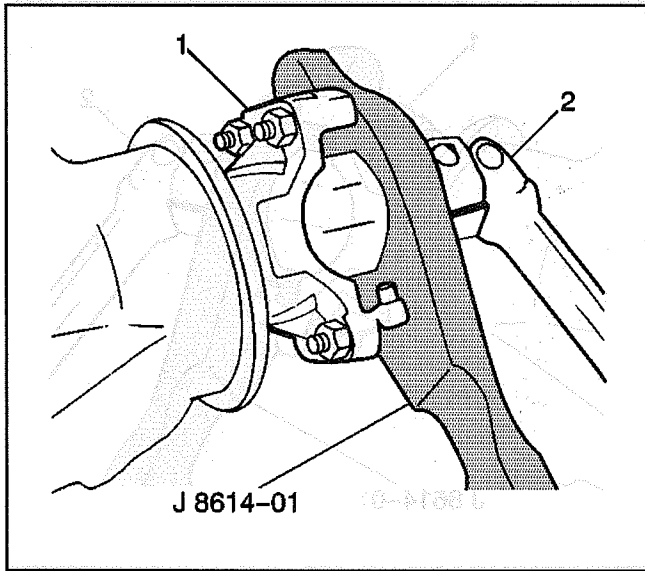
Tools Required

- J 8614-01 Pinion Flange Holder
- J 23911 Pinion Oil Seal Installer

1. Install new flange seal (1) with J 23911 into housing, if removed.
2. Apply chassis lubricant or an equivalent to the following components:
 - The outside diameter of the drive pinion gear flange
 - The sealing lip of the new drive pinion gear seal.
3. Install the drive pinion gear flange (1).
4. Install the following components:
 - The drive pinion gear washer
 - The drive pinion gear nut (finger tight)



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5. Hold the drive pinion gear flange.
6. Use *J 8614-01* in order to tighten the drive pinion gear nut to the position previously marked.

Tighten

- Tighten the nut to 1.59 mm (1/6 inch) beyond the alignment mark.
7. Install the propeller shaft. Refer to *Propeller Shaft Replacement - One Piece* or *Propeller Shaft Replacement - Two Piece*.
8. Lower the vehicle.
9. Road test for any abnormal rear axle operation, such as whines or howls.

Pinion and Ring Gear Inspection

Inspect the rear axle before disassembly. This will aid in determining the type of repairs or adjustments that are necessary.

The following conditions may cause rear axle noise:

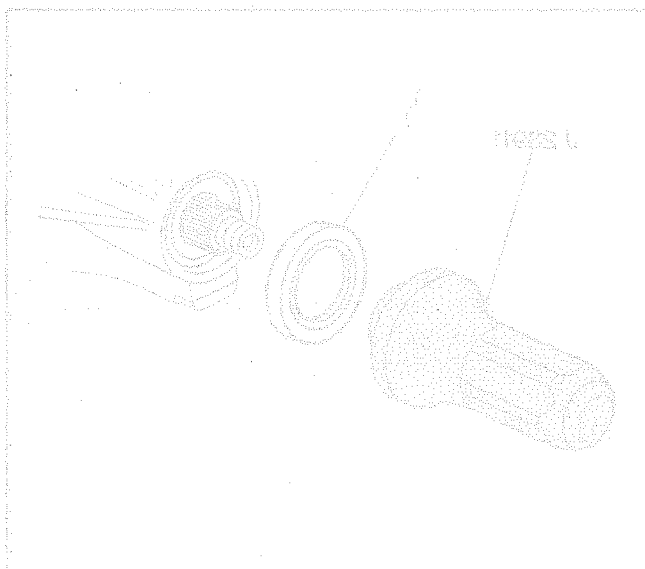
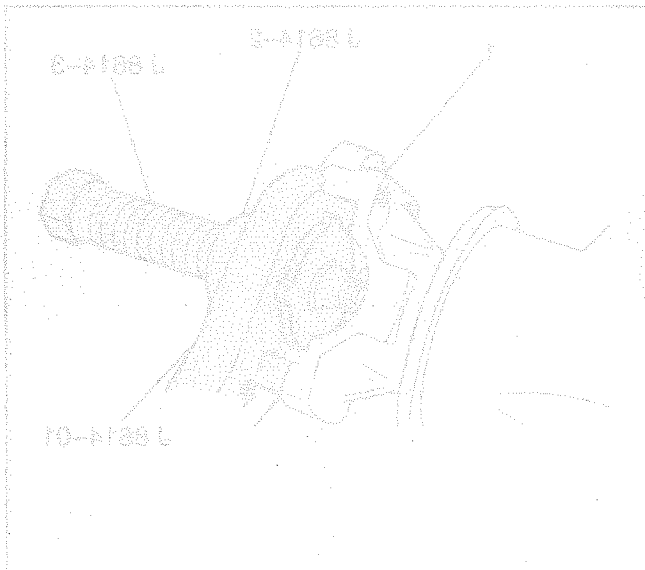
- Improper backlash
- The inner bearing preload of the differential drive pinion gear
- The outer bearing preload of the differential drive pinion gear
- The differential side bearing preload
- Any combination of the above items

Measure the following items before removing the differential case from the housing:

- The backlash
- The total differential preload
- The tooth contact pattern

Record and analyze these measurements before you remove the differential case from the housing.

Do not allow foreign matter (such as dirt or sand) near the rear axle. The presence of foreign matter in the rear axle may cause rear axle failure.



Differential Ring Gear Tooth Nomenclature

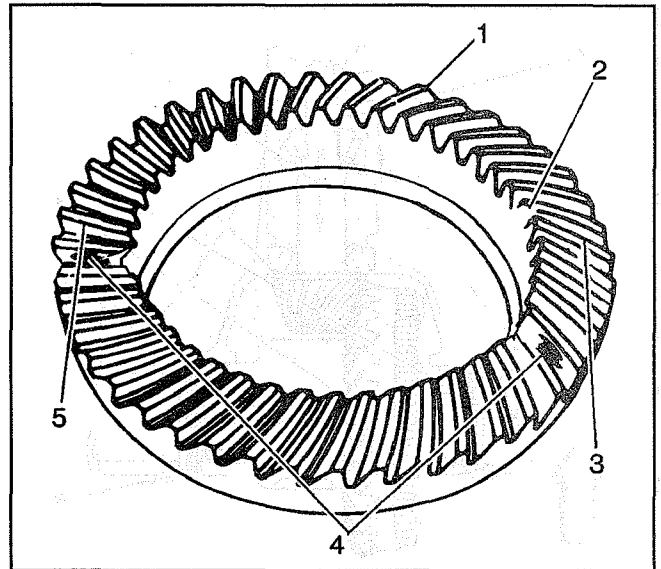
The drive side (5) of the differential ring gear tooth curves outward (convex).

The tooth contact (4) of the differential ring gear is the center area of the drive side (5) that makes the most physical contact with the pinion gear. Refer to Effects Of Increasing Load On Tooth Contact Pattern.

The coast side (3) of the differential ring gear tooth curves inward (concave).

The toe end (2) of the differential ring gear tooth is the end that is nearest to the center of the differential ring gear.

The heel end (1) of the differential ring gear tooth is the end that is farthest away from the center of the differential ring gear. The toe end of the tooth is smaller than the heel end.



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Effects Of Increasing Load On Tooth Contact Pattern

The load on the differential ring and on the drive pinion gear is increased during vehicle acceleration.

An increased load on the differential ring and on the drive pinion gear may cause the tooth contact (4) to spread out. Under a very heavy load, the tooth contact may extend from the near toe to the near heel on the drive side.

Increasingly heavier loads cause the following changes in tooth contact:

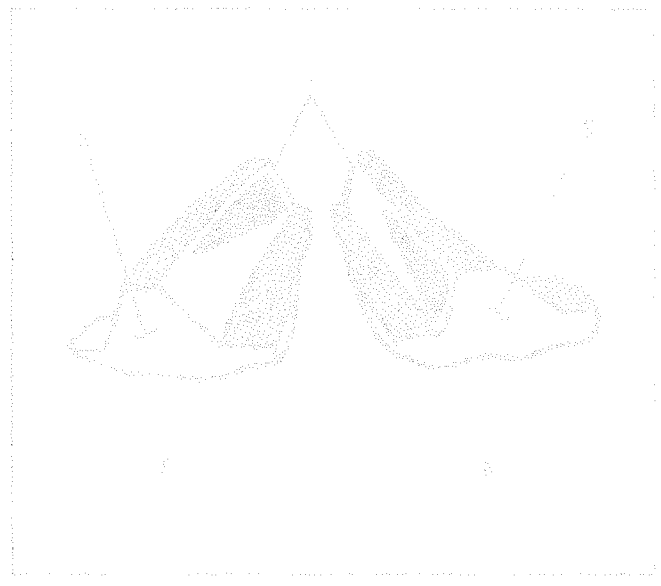
- The entire contact tends to shift toward the heel
- The entire contact becomes broader with respect to the tops and the bottoms of the teeth

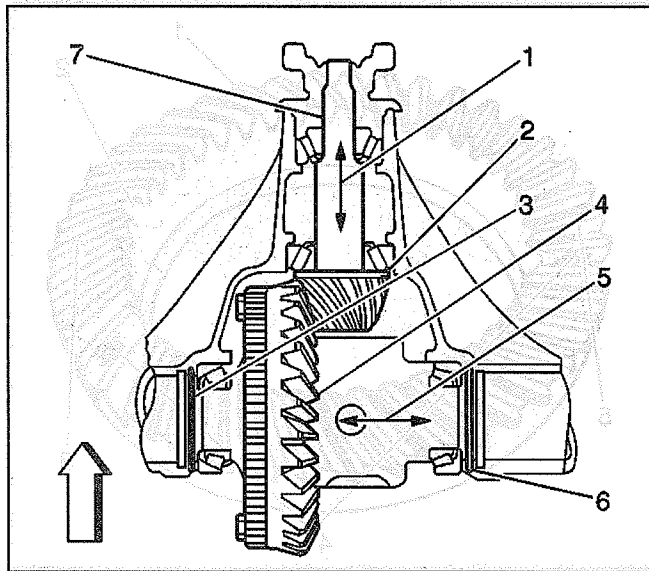
The following tooth contact pattern test recreates the effects of a light load. For this reason, the patterns that will be obtained by the following test will only extend to about half of their potential expansion.

Important: The contact pattern is centrally located up and down on the face of the differential ring gear teeth.

The following conditions may cause a change in the tooth contact pattern under a load:

- A drive pinion gear is insufficiently preloaded
- The differential bearings are insufficiently preloaded





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Adjustments Affecting Tooth Contact

The following two adjustments will affect the tooth contact pattern:

- An adjustment to the backlash
- An adjustment to the position of the drive pinion gear (7) in the rear axle housing

The effects of bearing preloads are not readily apparent on hand-loaded tooth contact pattern tests. Use differential bearing shims (6) in order to adjust the backlash. The shims (6) move the entire differential (5) closer to or farther from the drive pinion gear (7).

You can also use bearing shims (2) in order to set both the differential bearing preload and the pinion depth (1).

- Make the following changes in order to increase the backlash:
 - Increase the thickness of the right bearings shim (6)
 - Decrease the thickness of the left bearing shim (3)
- Make the following changes in order to decrease the backlash:
 - Decrease the thickness of the right bearings shim (6)
 - Increase the thickness of the left bearing shim (3)

You can adjust the position of the drive pinion gear (1) by changing the thickness of the shims (2) between the following components:

- The drive pinion gear head (7)
- The race of the differential drive pinion gear inner bearing

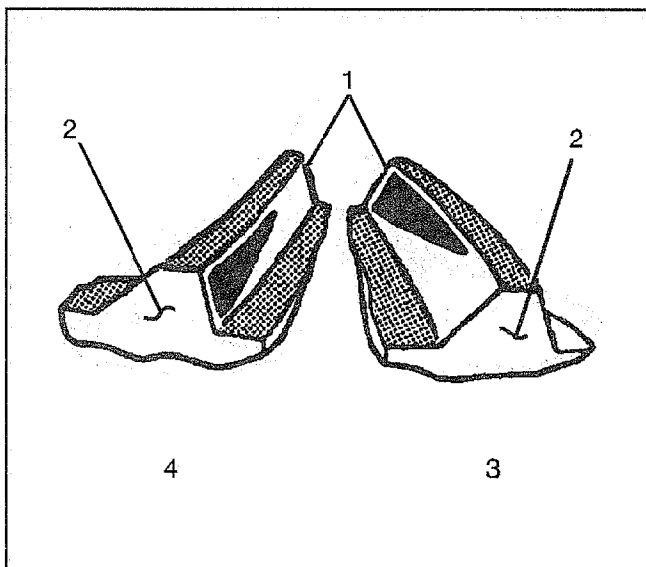
The drive pinion gear shim (2) is used in the rear axle in order to compensate for manufacturing tolerances.

- Increasing the shim thickness moves the drive pinion gear (7) closer to the centerline of the differential ring gear (4).
- Decreasing shim thickness moves the drive pinion gear (7) farther away from the centerline of the differential ring gear (4).

Effects Of Differential Drive Pinion Gear Position On Tooth Pattern

The following tooth contact pattern exists when the differential drive pinion gear is too far away from the centerline of the differential ring gear:

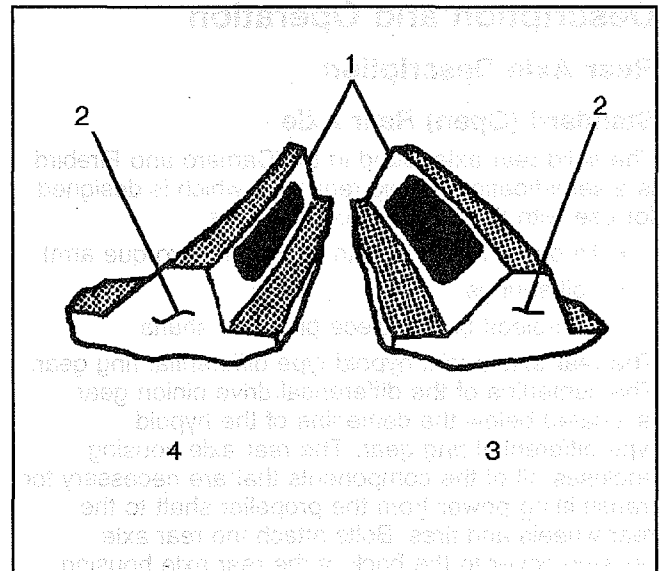
- High heel (2) contact on the drive side (4)
- High toe (1) contact on the coast side (3)



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Decrease the backlash in order to move the differential drive pinion gear closer to the centerline of the differential ring gear. This will cause the following tooth contact pattern:

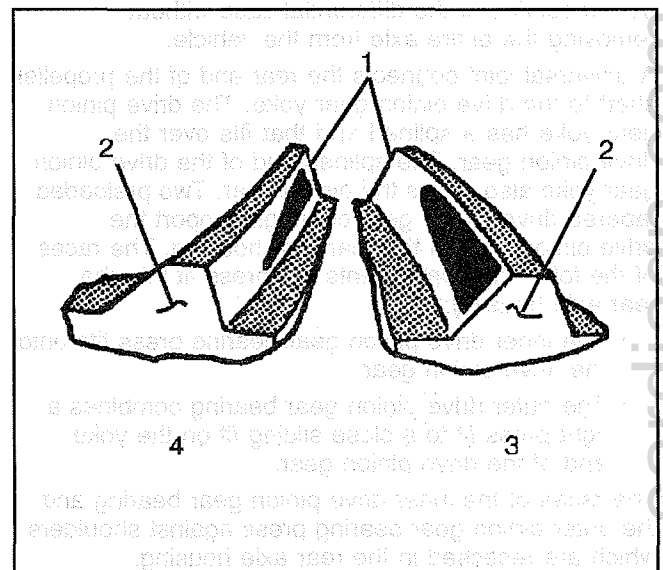
- High heel (2) contact on the drive side (4) moves down and toward the toe (1).
- High toe (1) contact on the coast side (3) moves down and toward the heel (2).



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The following tooth contact pattern exists when the differential drive pinion gear is too close to the centerline of the differential ring gear:

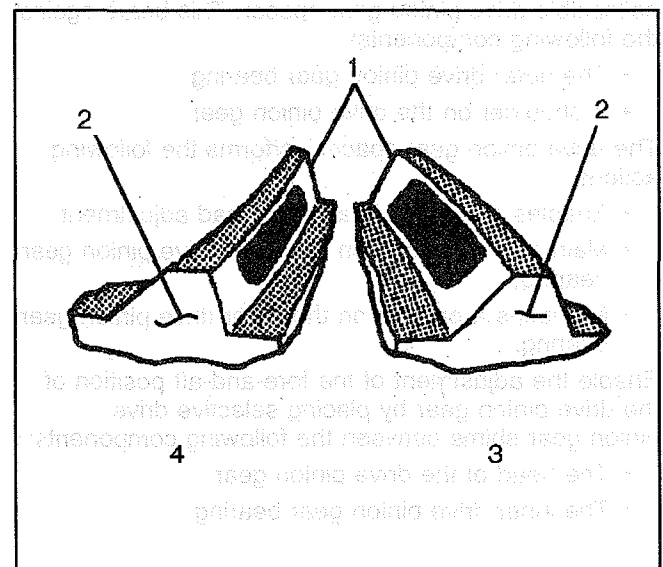
- Low toe (1) contact on the drive side (4)
- Low heel (2) contact on the coast side (3)



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Increase the backlash in order to move the differential drive pinion gear further away from the centerline of the differential ring gear. This will cause the following tooth contact pattern to exist:

- Low toe contact on the drive side (4) moves up and toward the heel (2).
- Low heel contact on the coast side (3) moves up and toward the toe (1).



7566

Description and Operation

Rear Axle Description

Standard (Open) Rear Axle

The solid rear axle found in the Camaro and Firebird is a semi-floating hypoid rear axle, which is designed for use with the following components:

- An open driveline (with or without a torque arm)
- Coil springs
- One-piece or two-piece propeller shafts

The rear axle has a hypoid type differential ring gear. The centerline of the differential drive pinion gear is located below the centerline of the hypoid type differential ring gear. The rear axle housing encloses all of the components that are necessary for transmitting power from the propeller shaft to the rear wheels and tires. Bolts attach the rear axle housing cover to the back of the rear axle housing. The rear axle housing cover is removable in order to permit service of the differential case without removing the entire axle from the vehicle.

A universal joint connects the rear end of the propeller shaft to the drive pinion gear yoke. The drive pinion gear yoke has a splined end that fits over the drive pinion gear. The splined end of the drive pinion gear yoke also drives the pinion gear. Two preloaded tapered drive pinion gear bearings support the drive pinion gear in the rear axle housing. The races of the following components are press fit into the rear axle housing:

- The inner drive pinion gear bearing press fits onto the drive pinion gear.
- The outer drive pinion gear bearing combines a light press fit to a close sliding fit on the yoke end of the drive pinion gear.

The races of the inner drive pinion gear bearing and the outer pinion gear bearing press against shoulders which are recessed in the rear axle housing.

Tightening the drive pinion gear nut compresses a collapsible drive pinion gear spacer. This bears against the following components:

- The outer drive pinion gear bearing
- A shoulder on the drive pinion gear

The drive pinion gear spacer performs the following actions:

- Enables automatic bearing preload adjustment.
- Maintains a preload on the inner drive pinion gear bearing.
- Maintains a preload on the outer drive pinion gear bearing.

Enable the adjustment of the fore-and-aft position of the drive pinion gear by placing selective drive pinion gear shims between the following components:

- The head of the drive pinion gear
- The inner drive pinion gear bearing

The differential case is one piece. Two differential side bearings support the differential case in the rear axle housing. The differential side bearings are preloaded by the insertion of differential bearing shims between the following components:

- The differential side bearings
- The rear axle housing

Vary the shim thickness from side to side. This positions the differential case for proper backlash between the differential ring gear and the differential drive pinion gear.

Bolts attach the differential ring gear to the differential case. The following components have splined bores used for driving the axle shaft:

- The left differential pinion gear
- The right differential pinion gear

The position of these pinion gears permits the gears to turn in counterbored cavities of the differential case. The following components have smooth bores:

- The upper differential pinion gear
- The lower differential pinion gear

The differential pinion gear shaft holds these pinion gears in position. The differential pinion gear shaft mounts and locks in the differential case. All four of the gears mesh with each other.

The following components turn freely on the pinion gear shaft:

- The upper differential pinion gear
- The lower differential pinion gear

These pinion gears act as idler gears when the rear wheels turn at different speeds.

The following components back the differential pinion gears:

- Differential pinion thrust washers
- Differential side gear thrust washers

Vehicles that are equipped with the standard rear axle and the Antilock Brake System (ABS) only, have a single rear wheel speed sensor mounted on the differential carrier behind the ring gear. A wheel speed sensor is bolted to the top of the rear axle housing opposite the reluctor wheel. This sensor provides wheel speed information to the electronic brake control module (EBCM).

Vehicles that are equipped with the limited slip rear axle, ABS, and a Traction Control System (TCS) have rear wheel speed sensors mounted on the axle shafts just behind the axle flange. The axle mounted reluctor wheels are an integral part of the rear axle shaft and cannot be replaced separately. If the wheel needs to be replaced, you must replace the entire axle.

Operation

When the vehicle turns a corner, the differential allows the outer rear tire and wheel assembly to turn faster than the inner tire and wheel assembly.

The inner tire and wheel assembly moves more slowly than the outer tire and wheel assembly. The inner tire and wheel assembly slows its (side) differential pinion gear. The side differential pinion gear is slowed because the axle shaft is splined to the side gear.

The differential pinion gears roll around the slowed (side) differential pinion gear. This action causes the other differential pinion gear and the tire and wheel assembly to move faster.

Limited Slip Rear Axle

Limited slip rear axles have several definite operating characteristics. An understanding of these characteristics is necessary in order to aid diagnostics. The rear axle limited slip differential found in Camaro and Firebird vehicles is the Zexel Torsen® rear axle. This axle differs from the previous Auburn® limited slip units. The Torsen® axle does not utilize clutches or cone clutches as in other limited slip units. The Zexel Torsen® axle is a unique design which utilizes parallel axis helical gearing to develop side gear separating force in an axial direction and planetary gear separating force in a radial direction.

There are not any major servicing differences between the Torsen® and Auburn® differentials except for a thrust block is used in the Torsen® differential for retention of the C-clip as compared to a pin used in the Auburn® differential.

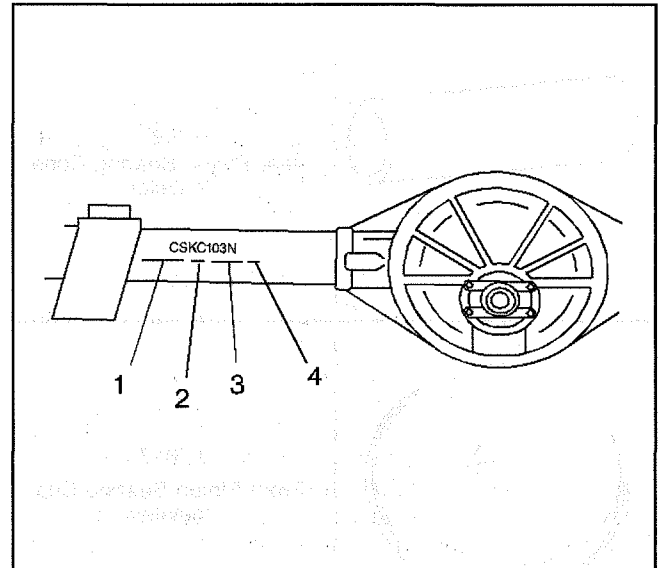
All the following rear axle components are interchangeable (except for the differentials):

- Vehicles with the limited slip rear axle
- Vehicles with the standard rear axle

The Zexel Torsen® limited slip differential is non-serviceable. The differential cases of the 2 vehicles are not interchangeable. The following procedures are the same for both the Torsen® limited slip differential case and the standard rear axle differential case:

- Removal of the differential
- Replacement of the differential
- Service of the side bearings
- Service of the ring and pinion gear set
- All backlash and tooth contact pattern procedures

Rear Axle Identification



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You must know the rear axle identification code (1) and the manufacturer's code (2) before adjusting or repairing the rear axle shafts or the differential.

The following information is stamped onto the forward side of the right axle tube or on a metal tag on the housing cover:

- The rear axle ratio
- The differential type
- The manufacturer's code (2)
- The build date (3)

RPO codes for the rear axle are also printed on the service parts identification label:

Maintenance and Lubrication

Refer to *Lubricant Level Check* for information on measuring or adding lubricant.

Special Tools and Equipment

Illustration	Tool Number/ Description
	J 2619-01 Slide Hammer With 1/2 X 13 Adapter

982

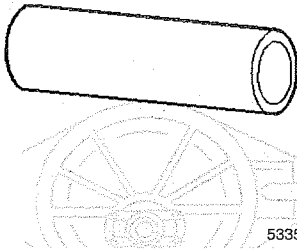
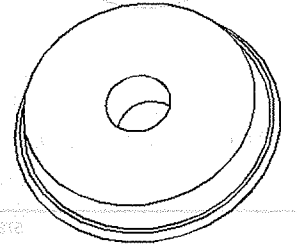
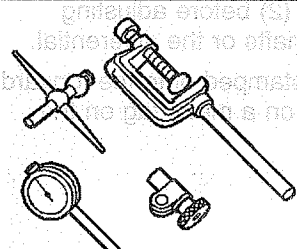
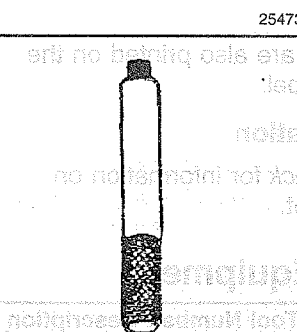
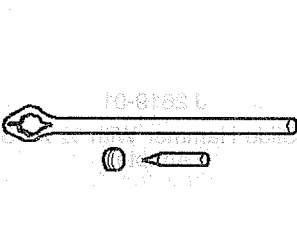
Illustration	Tool Number/ Description
	J 5590 Rear Pinion Bearing Cone Installer
	J 7817 Front Pinion Bearing Cup Installer
	J 8001 Dial Indicator Set
	J 8092 Driver Handle
	J 8614-01 Pinion Flange Remover and Installer

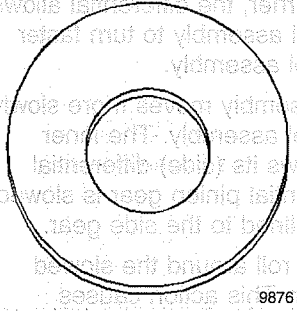
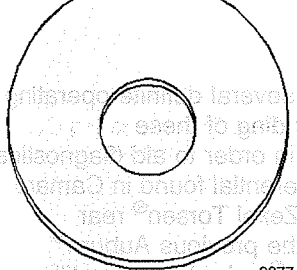
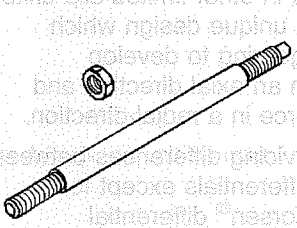
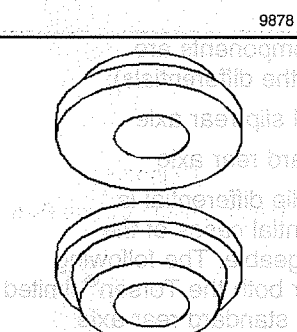
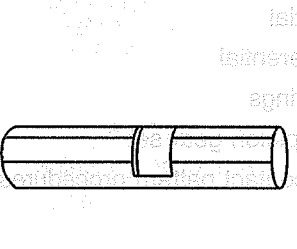
Illustration	Tool Number/ Description
	J 21777-40 Pinion Setting Gauge-Rear Pilot Washer
	J 21777-42 Pinion Setting Gauge-Front Pilot Washer
	J 21777-43 Pinion Setting Gauge-Stud Assembly Bolt
	J 21777-45 Pinion Setting Gauge-Side Bearing Discs
	J 22536 Pinion Driver

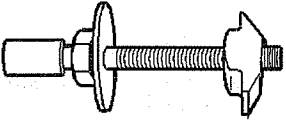
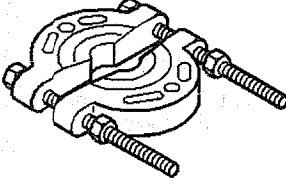
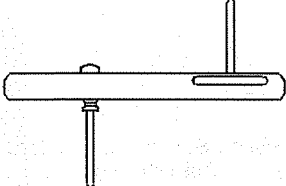
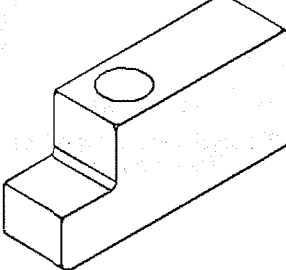
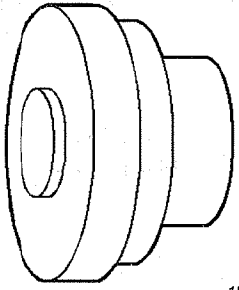
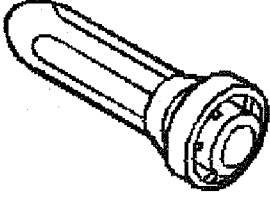
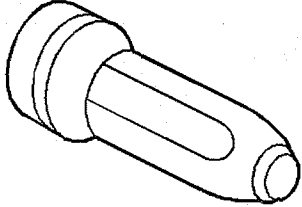
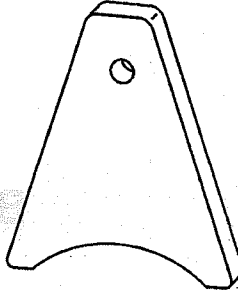
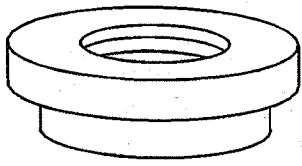
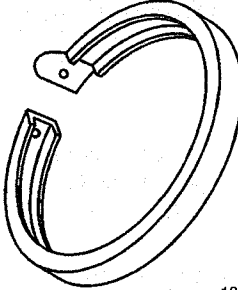
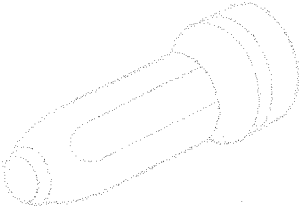
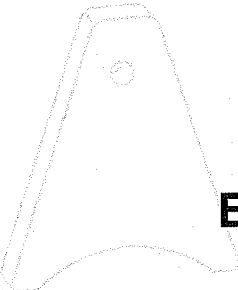
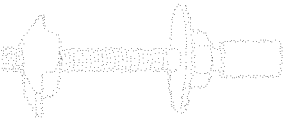
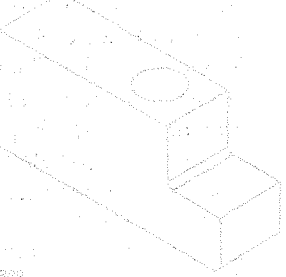
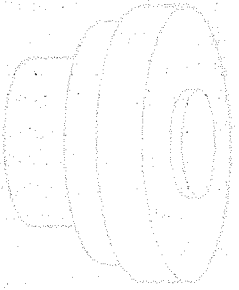
Illustration	Tool Number/ Description
 1508	J 22813-01 Axle Bearing Remover
 994	J 22912-01 Rear Pinion Bearing Cone Remover
 9880	J 23597-1 Pinion Setting Gauge Arbor
 9881	J 23597-11 Pinion Setting Gauge Plate
 1511	J 23765 Axle Bearing Installer

Illustration	Tool Number/ Description
 1510	J 23771 Axle Oil Seal Installer
 1509	J 23911 Pinion Oil Seal Installer
 180155	J 25588 Side Bearing Shim Installer
 180157	J 29609 Rear Pinion Bearing Cup Installer
 180158	J 39446 ABS Exciter Ring Protector Kit

Tool Number/Description	Illustration
J 25817 Axle Oil Seal Installer	
J 25817 Pinion Oil Seal Installer	
J 25835 Slide Bearing Shim Installer	
J 25835 Rear Pinion Bearing Cup Installer	
J 25845 ABS Excess Ring Protector Kit	

Tool Number/Description	Illustration
J 25813-01 Axle Bearing Remover	
J 25813-01 Rear Pinion Bearing Cone Remover	
J 25837-1 Pinion Setting Gauge Arbor	
J 25837-1 Pinion Setting Gauge Plate	
J 25835 Axle Bearing Installer	

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