## FASTENER TIGHTENING SPECIFICATIONS

**Fastener Tightening Specifications**

<table>
<thead>
<tr>
<th>Application</th>
<th>Specification</th>
<th>Metric</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Carrier Assembly Bearing Cap Bolts</td>
<td></td>
<td>63 N.m</td>
<td>46 lb ft</td>
</tr>
<tr>
<td>Differential Carrier Assembly Mounting Bracket to Carrier Bolts</td>
<td></td>
<td>155 N.m</td>
<td>114 lb ft</td>
</tr>
<tr>
<td>Differential Carrier Assembly Mounting Bracket to Frame Bolts</td>
<td></td>
<td>155 N.m</td>
<td>114 lb ft</td>
</tr>
<tr>
<td>Differential Housing Cover Bolts</td>
<td></td>
<td>30 N.m</td>
<td>22 lb ft</td>
</tr>
<tr>
<td>Intermediate Shaft Housing Assembly to Axle Housing Bolts</td>
<td></td>
<td>67 N.m</td>
<td>49 lb ft</td>
</tr>
<tr>
<td>Intermediate Shaft Housing to Outer Housing Bolts</td>
<td></td>
<td>48 N.m</td>
<td>35 lb ft</td>
</tr>
<tr>
<td>Pinion Shaft Lock Screw/Bolt</td>
<td></td>
<td>25 N.m</td>
<td>18 lb ft</td>
</tr>
<tr>
<td>Plug, Drain and Fill</td>
<td></td>
<td>32 N.m</td>
<td>24 lb ft</td>
</tr>
<tr>
<td>Ring Gear Bolts</td>
<td></td>
<td>120 N.m</td>
<td>89 lb ft</td>
</tr>
<tr>
<td>Third Point Mount Bolt</td>
<td></td>
<td>110 N.m</td>
<td>81 lb ft</td>
</tr>
</tbody>
</table>

## AXLE PRELOAD AND BACKLASH SPECIFICATIONS

**Axle Preload and Backlash Specifications**

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

### Sealers, Adhesives and Lubricants

<table>
<thead>
<tr>
<th>Application</th>
<th>Type of Material</th>
<th>GM Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Drive Axle</td>
<td>Lubricant</td>
<td>SAE 75W90 Synthetic Axle Lubricant GM P/N 89021677 (Canadian P/N 89021678) or equivalent meeting GM Specification 9986115</td>
</tr>
<tr>
<td>Pinion Yoke Splines</td>
<td>Sealant</td>
<td>GM P/N 12346004 (Canadian P/N 10953480) or equivalent</td>
</tr>
</tbody>
</table>

## COMPONENT LOCATOR

### FRONT DRIVE AXLE DISASSEMBLED VIEWS
Fig. 1: Front Drive Axle Disassembled Views
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 1

<table>
<thead>
<tr>
<th>Callout</th>
<th>Component Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nut - Pinion</td>
</tr>
<tr>
<td>2</td>
<td>Washer - Pinion</td>
</tr>
<tr>
<td>3</td>
<td>Flange Assembly - Pinion</td>
</tr>
<tr>
<td>4</td>
<td>Seal Assembly - Pinion</td>
</tr>
<tr>
<td>5</td>
<td>Bearing Assembly - Pinion Tail</td>
</tr>
<tr>
<td>6</td>
<td>Carrier Assembly</td>
</tr>
<tr>
<td>7</td>
<td>Connector - Vent</td>
</tr>
<tr>
<td>8</td>
<td>Bolt - Bracket to Support</td>
</tr>
<tr>
<td>9</td>
<td>Bushing - Mounting</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Bracket - Mounting</td>
</tr>
<tr>
<td>11</td>
<td>Seal Assembly - Shaft</td>
</tr>
<tr>
<td>12</td>
<td>Bearing Assembly - Shaft</td>
</tr>
<tr>
<td>13</td>
<td>Housing - Support</td>
</tr>
<tr>
<td>14</td>
<td>Pin - Locating</td>
</tr>
<tr>
<td>15</td>
<td>Gasket - Tube to Support</td>
</tr>
<tr>
<td>16</td>
<td>Washer - Thrust</td>
</tr>
<tr>
<td>17</td>
<td>Bearing Assembly - Shaft</td>
</tr>
<tr>
<td>18</td>
<td>Connector - Shaft</td>
</tr>
<tr>
<td>19</td>
<td>Bearing Assembly - Shaft</td>
</tr>
<tr>
<td>20</td>
<td>Washer - Thrust</td>
</tr>
<tr>
<td>21</td>
<td>Shaft - Output</td>
</tr>
<tr>
<td>22</td>
<td>Tube</td>
</tr>
<tr>
<td>23</td>
<td>Bolt - Tube to Support</td>
</tr>
<tr>
<td>24</td>
<td>Bolt - Tube to Carrier Assembly</td>
</tr>
<tr>
<td>25</td>
<td>Gasket - Tube to Carrier Assembly</td>
</tr>
<tr>
<td>26</td>
<td>Gasket - Cover Pan</td>
</tr>
<tr>
<td>27</td>
<td>Cover Assembly - Pan</td>
</tr>
<tr>
<td>28</td>
<td>Washer - Fill Plug</td>
</tr>
<tr>
<td>29</td>
<td>Plug - Fill</td>
</tr>
<tr>
<td>30</td>
<td>Bolt - Cover Pan</td>
</tr>
<tr>
<td>31</td>
<td>Spacer - Pinion Bearing</td>
</tr>
<tr>
<td>32</td>
<td>Bearing Assembly - Pinion Head</td>
</tr>
<tr>
<td>33</td>
<td>Shim - Pinion Bearing</td>
</tr>
<tr>
<td>34</td>
<td>Ring and Pinion Gear</td>
</tr>
<tr>
<td>35</td>
<td>Screw - Differential Case Cross Pin</td>
</tr>
<tr>
<td>36</td>
<td>Washer - Differential Side Gear Thrust</td>
</tr>
<tr>
<td>37</td>
<td>Gear - Differential Case</td>
</tr>
<tr>
<td>38</td>
<td>Pin - Differential Cross</td>
</tr>
<tr>
<td>39</td>
<td>Gear - Differential Pinion</td>
</tr>
<tr>
<td>40</td>
<td>Washer - Differential Pinion Gear Thrust</td>
</tr>
<tr>
<td>41</td>
<td>Gear - Differential Side</td>
</tr>
<tr>
<td>42</td>
<td>Washer - Differential Side Gear Thrust</td>
</tr>
<tr>
<td>43</td>
<td>Gear - Differential Pinion</td>
</tr>
<tr>
<td>44</td>
<td>Washer - Differential Pinion Gear Thrust</td>
</tr>
</tbody>
</table>
DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - FRONT 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 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 - Front Drive Axle in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - FRONT DRIVE AXLE

Before beginning diagnosis, review the system description and operation in order to familiarize yourself with the system functions. Refer to Front Drive Axle Description and Operation.

Classifying the Symptom

Front Drive Axle symptoms can usually be classified into the following categories:

- Leaks
- Noises
- Vibrations
Leak and noise related symptoms are diagnosed within the Front Drive Axle section. For vibration related symptoms, refer to Diagnostic Starting Point - Vibration Diagnosis and Correction.

Visual/Physical Inspection

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

Symptoms List

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

- **Front Drive Axle Noises**
  - Noisy in Drive
  - Noisy When Coasting
  - Intermittent Noise
  - Constant Noise
  - Noisy on Turns
  - Front Axle Lubricant Leak Diagnosis

FRONT 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 ring and pinion gear replacement or adjustment, depending on the mileage of the gear set.
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 front axle side bearing. This noise can be confused with front wheel bearing noise. Inspect and replace the bearings and the affected components as required.

Front Wheel Bearing Noise

A rough front 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 and/or noisy wheel bearing can be heard by spinning the 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 the differential case assembly and replace the components as necessary.

Backlash Clunk

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

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

Inspect, adjust or replace the affected components as necessary.

NOISY IN DRIVE

Noisy in Drive

<table>
<thead>
<tr>
<th>Checks</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive pinion to ring gear backlash</td>
<td>Adjust the pinion to ring gear backlash. Refer to <strong>Backlash Inspection and Adjustment</strong>.</td>
</tr>
</tbody>
</table>

NOISY IN DRIVE
Worn pinion and ring gear | Replace the pinion and the ring gear. Refer to the following:
- Differential Case Assembly Disassemble
- Differential Case Assembly Assemble
- Drive Pinion Bearings Replacement

Worn pinion bearings | Replace the pinion bearings. Refer to Drive Pinion Bearings Replacement.

Loose pinion bearings | Adjust the pinion bearings preload. Refer to Drive Pinion Bearings Replacement and to Backlash Inspection and 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 Case Assembly Disassemble and to Differential Case Assembly Assemble.

Loose differential bearings | Adjust the differential bearing preload. Refer to Backlash Inspection and Adjustment.

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 Front Axle Lubricant Level Inspection.

Wrong or poor grade oil | Drain and refill the system with the proper lubricant. Refer to Front Axle Lubricant Replacement.

NOISY WHEN COASTING

Noisy When Coasting

<table>
<thead>
<tr>
<th>Checks</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION: Noise is audible when slowing down and disappears when driving.</td>
<td></td>
</tr>
<tr>
<td>Worn pinion and ring gear</td>
<td>Adjust or replace the pinion and the ring gear. Refer to Drive Pinion and Ring Gear Replacement.</td>
</tr>
<tr>
<td>Pinion and ring gear too tight</td>
<td>Adjust the pinion and the ring gear backlash. Refer to Backlash Inspection and Adjustment.</td>
</tr>
</tbody>
</table>

INTERMITTENT NOISE

Intermittent Noise

<table>
<thead>
<tr>
<th>Checks</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CONSTANT NOISE

Constant Noise

<table>
<thead>
<tr>
<th>Checks</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warped ring gear</td>
<td>Replace the ring gear. Refer to Drive Pinion and Ring Gear Replacement.</td>
</tr>
<tr>
<td>Loose differential case assembly</td>
<td>Set the differential case assembly to the proper preload and backlash. Refer to Backlash Inspection and Adjustment.</td>
</tr>
</tbody>
</table>

NOISY ON TURNS

Noisy on Turns

<table>
<thead>
<tr>
<th>Checks</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat spot on the pinion or the ring gear teeth</td>
<td>Replace the pinion and the ring gear. Refer to Drive Pinion and Ring Gear Replacement</td>
</tr>
<tr>
<td>Flat spot on the pinion bearing</td>
<td>Replace the bearing. Refer to Drive Pinion Bearings Replacement.</td>
</tr>
<tr>
<td>Worn pinion splines</td>
<td>Replace the pinion. Refer to Drive Pinion and Ring Gear Replacement.</td>
</tr>
</tbody>
</table>

FRONT DRIVE AXLE BEARING WEAR (DIFFERENTIAL CASE/PINION BEARINGS)

Tapered 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.
Abrasive Roller Wear

Figure 2: Identifying Abrasive Roller Wear
Courtesy of GENERAL MOTORS CORP.

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

Abrasive Step Wear
Fig. 3: Identifying Abrasive Step Wear
Courtesy of GENERAL MOTORS CORP.

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

Galling
Fig. 4: Identifying Galling
Courtesy of GENERAL MOTORS CORP.

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

Etching
Fig. 5: 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. Inspect the seals. Inspect for proper lubrication.

Bent Cage
A damaged cage can be due to improper handling or improper tool usage. Replace the bearing.

Cage Wear

Fig. 6: Identifying Bent Roller Cage
Courtesy of GENERAL MOTORS CORP.
Wear around the outside diameter of the cage and the roller pockets can be caused by abrasive material. Wear can be caused from inefficient lubrication. Clean the related parts and the housings. Inspect the seals. Replace the bearings.

**Indentations**
Fig. 8: Inspecting Bearing Rollers & Races For Heat Discoloration
Courtesy of GENERAL MOTORS CORP.

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

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

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

Smearing of the metal can be 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. Inspect for proper fit and lubrication.

Stain Discoloration

Fig. 11: Identifying Stain Discoloration
Courtesy of GENERAL MOTORS CORP.

Discoloration ranges 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. Inspect the seals and the related parts for damage.

Heat Discoloration
Fig. 12: 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 inspect 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. Inspect the seals and the other related parts.

Misalignment
Fig. 13: Identifying Misalignment
Courtesy of GENERAL MOTORS CORP.

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

Cracked Inner Race
Fig. 14: Identifying Cracked Inner Race
Courtesy of GENERAL MOTORS CORP.

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

Fatigue Spalling
Fig. 15: Inspecting Bearing Rollers & Races For Pitting, Grooves, Spalling & Excessive Wear
Courtesy of GENERAL MOTORS CORP.

Flaking of surface metal results from fatigue. Replace the bearing. Clean all related parts.

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

**FRONT AXLE LUBRICANT LEAK DIAGNOSIS**

Front axle lubricant leaks can occur at the following locations:

- Axle shaft oil seals
- Differential carrier assembly mating surface
- Drain plug
- Fill plug
Inner axle tube assembly to differential carrier assembly mating surface
Pinion yoke oil seal
Vent tube

Determining the Cause

While most front 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 an oil seal may be caused by any of the following:

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

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

Sealing Surfaces

Front axles components are assembled using specific sealers. A leak at a surface sealed with sealant is usually caused by a poor fit of the components but can also be caused by the use of the wrong sealant. When correcting a sealant leak, inspect each component for distortion and for nicks or gouges that may prohibit the sealant from sealing properly and when re-assembling the component, use the proper sealant.

Differential Carrier Assembly

Lubricant leaks at the differential carrier assembly can occur at the following locations:
Drain and fill plug leaks are usually caused by a loose plug. A vent tube leak can be caused by a loose fitting vent hose or by a vent tube assembly whose interior shield is stuck in the upside down position. Inspect the vent plug's interior shield for unrestricted movement, repair or replace the plug as necessary. Drain or fill plug leaks can be repaired by either tightening the plug or by using an approved sealer on the threads on the plug.

REPAIR INSTRUCTIONS

FRONT AXLE LUBRICANT REPLACEMENT

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

2. Ensure that the vehicle is level.

3. Remove the Engine Protection Shield (EPS), if equipped. Refer to Engine Shield Replacement.

4. Remove the drain plug.

5. Drain axle fluid into a suitable container.

   **NOTE:** Refer to Fastener Notice.

6. Install the drain plug.

   **Tighten:** Tighten the drain plug to 32 N.m (24 lb ft).

7. Remove the fill plug.

8. Fill the drive axle with the proper fluid. Refer to Fluid and Lubricant Recommendations.

9. Inspect the fluid level. Refer to Front Axle Lubricant Level Inspection.

10. Install the fill plug.

   **Tighten:** Tighten the fill plug to 32 N.m (24 lb ft).

11. Install the EPS, if equipped. Refer to Engine Shield Replacement.

12. Lower the vehicle.
VENT HOSE REPLACEMENT

Removal Procedure

Fig. 17: View Of Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the engine protection shield (EPS), if equipped. Refer to Engine Shield Replacement.
Fig. 18: View Of Vent Hose At Front Differential Housing
Courtesy of GENERAL MOTORS CORP.

3. Remove the vent hose from the vent tube on the front differential housing.
4. Lower the vehicle.
Fig. 19: View Of Vent Hose At Radiator Core Support
Courtesy of GENERAL MOTORS CORP.

5. Remove the vent hose from the retainers on the radiator core support.

Installation Procedure
Fig. 20: View Of Vent Hose At Radiator Core Support
Courtesy of GENERAL MOTORS CORP.

1. Install the vent hose to the retainers on the radiator core support.
2. Raise the vehicle.
3. Install the vent hose to the vent tube on the front differential housing.

**IMPORTANT:** When installing the vent hose for the front differential, loop the vent hose so that foreign objects and debris are restricted from falling into the vent hose and blocking it.

4. Loop the vent hose about 3 inches and install in the upper retainer.
5. Install the EPS, if equipped. Refer to Engine Shield Replacement.
6. Lower the vehicle.

FRONT DRIVE AXLE INNER SHAFT AND INNER SHAFT HOUSING REPLACEMENT

Tools Required

- J 2619-01 Slide Hammer. See Special Tools.
Removal Procedure

**IMPORTANT:** When servicing the inner drive shaft housing, the inner drive shaft bearing must be replaced. The bearing IS NOT serviced with the inner drive shaft housing.

---

**Fig. 23: Identifying Differential Carrier Mounting Bracket**

*Courtesy of GENERAL MOTORS CORP.*

1. Remove the left differential carrier mounting bracket. Refer to **Differential Carrier Assembly Bushing and Bracket Replacement**.
2. Remove the retaining bolts (1) from the disconnect housing.
3. Remove the coupling housing (2).
4. Remove the coupler (3).
5. Remove the gasket (4).

6. Remove the intermediate housing retaining bolts (1).
7. Remove the intermediate housing (2).
8. Remove the intermediate housing gasket (3).
9. Install the intermediate shaft housing in a suitable clamping device.

Fig. 24: View Of Coupling Housing
Courtesy of GENERAL MOTORS CORP.
Fig. 25: Identifying J 29369-1 & J 2619-01
Courtesy of GENERAL MOTORS CORP.

10. Using the J 29369-1 (1) and the J 2619-01 (2), remove the inner drive shaft bearing. See Special Tools.
1. Using the **J 45232** (1) and the **J 8092** (2), install the inner drive shaft bearing. See **Special Tools**.
2. Apply a small amount of clean grease on the housing gasket to hold it in place (3).
3. Install the intermediate housing (2).

NOTE: Refer to Fastener Notice.

IMPORTANT: Perform the following:

- Clean the thread locking material from the bolts.
- Apply new thread locking material to the bolts (DRI-LOC 204 Red, GM P/N 12345493.)
4. Install the retaining bolts.

**Tighten:** Tighten the retaining bolts to 68 N.m (50 lb ft).

---

5. Install the intermediate shaft.
6. Apply a small amount of grease to the housing gasket (4) to hold it in place.
7. Install the coupler (3).
8. Position the coupler housing on the intermediate housing (2).
9. Install the retaining bolts (1).

**Tighten:** Tighten the retaining bolts to 60 N.m (44 lb ft).

---

*Fig. 28: View Of Inner Drive Shaft
 Courtesy of GENERAL MOTORS CORP.*
Fig. 29: Identifying Differential Carrier Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

10. Install the left differential carrier mounting bracket. Refer to **Differential Carrier Assembly Bushing and Bracket Replacement**.

11. Lower the vehicle.

FRONT DRIVE AXLE CLUTCH SHAFT BEARING REPLACEMENT

**Tools Required**

- J 29369-1 Bushing and Bearing Remover. See **Special Tools**.
- J 2619-01 Slide Hammer and Adapter. See **Special Tools**.
- J 45233 Differential Bearing Adjuster Needle Bearing Replacer - RH. See **Special Tools**.
- J 8092 Universal Driver Handle - 3/4 in - 10. See **Special Tools**.

**Removal Procedure**
Fig. 30: View Of Inner Drive Shaft  
Courtesy of GENERAL MOTORS CORP.

1. Remove the inner drive shaft. Refer to **Front Drive Axle Inner Shaft and Inner Shaft Housing Replacement**.
2. Install the inner shaft in a clamping devise.
3. Install the J 29369-1 to the J 2619-01. See Special Tools.
4. Using the J 29369-1 (1) and the J 2619-01 (2), remove the clutch bearing. See Special Tools.

Installation Procedure
Fig. 32: Installing Clutch Bearing
Courtesy of GENERAL MOTORS CORP.

1. Install the J 45233 to the J 8092. See Special Tools.
2. Using the J 45233 (1) and the J 8092 (2), install the clutch bearing. See Special Tools.
3. Remove the inner shaft from the clamping devise.
Fig. 33: View Of Inner Drive Shaft
Courtesy of GENERAL MOTORS CORP.

4. Install the inner shaft. Refer to Front Drive Axle Inner Shaft and Inner Shaft Housing Replacement.

FRONT DRIVE AXLE SEAL AND BEARING REPLACEMENT

Tools Required

- J 2619-01 Slide Hammer. See Special Tools.
- J 21426 Extension Housing Seal Installer
Removal Procedure

Fig. 34: View Of Front Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

1. Remove the wheel drive shaft. Refer to Wheel Drive Shaft Replacement.
Fig. 35: View Of Lower Control Arm Swaybar Link
Courtesy of GENERAL MOTORS CORP.

2. Remove the swaybar link from the lower control arm. Refer to Stabilizer Shaft Link Replacement.
3. Using the J 29369-2 (2) and the J 2619-01 (1), remove the axle seal. See Special Tools.
4. Using the J 29369-2 (1) and the J 2619-01 (2), remove the axle bearing. See Special Tools.

Installation Procedure
Fig. 38: Installing Axle Bearing
Courtesy of GENERAL MOTORS CORP.

1. Position the axle bearing in the intermediate housing.
2. Using the J 45232 (1) and the J 8092 (2), install the axle bearing. See Special Tools.
Fig. 39: Installing Axle Seal
Courtesy of GENERAL MOTORS CORP.

3. Using the J 21426 (1), install the axle seal.
Fig. 40: View Of Front Wheel Drive Shaft
Courtesy of GENERAL MOTORS CORP.

4. Install the wheel drive shaft. Refer to Wheel Drive Shaft Replacement.
5. Install the swaybar link to the lower control arm. Refer to Stabilizer Shaft Link Replacement.

6. Check in fluid level. Refer to Front Axle Lubricant Level Inspection.

7. Lower the vehicle.

DIFFERENTIAL CARRIER ASSEMBLY COVER AND/OR GASKET REPLACEMENT

Removal Procedure
Fig. 42: View Of Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the engine protection shield (EPS), if equipped. Refer to Engine Shield Replacement.
3. Drain the front differential assembly.
4. Remove the differential cover bolts.

**IMPORTANT:** The front differential housing cover gasket is reusable. **DO NOT** replace unless gasket is damaged.

5. Remove the differential cover and gasket.

Installation Procedure
1. Install the differential cover and gasket.

**NOTE:** Refer to **Fastener Notice**.

2. Install the differential cover bolts.

**Tighten:** Tighten the differential cover bolts to 30 N.m (22 lb ft).

3. Fill the front differential with fluid. Refer to **Front Axle Lubricant Replacement**.
Fig. 45: View Of Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.

4. Install the EPS, if equipped. Refer to Engine Shield Replacement.
5. Lower the vehicle.

FRONT DIFFERENTIAL DRIVE PINION FLANGE/YOKE, SEAL AND DUST DEFLECTOR REPLACEMENT

Tools Required

- J 8614-01 Flange and Pulley Holding Tool. See Special Tools.
J 21128 Axle Pinion Oil Seal Installer. See Special Tools.

Removal Procedure

Fig. 46: Measuring Pinion Rotation Torque - Front Axle
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the engine protection shield (EPS). Refer to Engine Shield Replacement.
3. Drain the drive axle. Refer to Front Axle Lubricant Replacement.
4. Remove the front propeller shaft. Refer to Front Propeller Shaft Replacement.
5. Remove the brake calipers. Refer to **Front Brake Caliper Replacement**.
6. Measure the torque required in order to rotate the pinion. Using an inch-pound torque wrench, record the torque value for reassembly. This will give the combined preload for the following components:
   - The pinion bearings
   - The pinion seal
   - The carrier bearings
   - The axle bearings
   - The axle seals

![Fig. 47: View Of Pinion Shaft & Pinion Yoke Alignment Marks](image)

**Fig. 47: View Of Pinion Shaft & Pinion Yoke Alignment Marks**
**Courtesy of GENERAL MOTORS CORP.**

7. Scribe an alignment line between the pinion shaft and the pinion yoke.
8. Install the J 8614-01 (1) onto the pinion, as shown. See Special Tools.

9. Remove the pinion nut while holding the J 8614-01 (1). See Special Tools.

10. Install the J 8614-2 (2) and the J 8614-3 (3) into the J 8614-01 (1), as shown. See Special Tools.

11. Remove the pinion yoke by turning the J 8614-3 (3) clockwise, while holding the J 8614-01 (1). See Special Tools.

**IMPORTANT:** Carefully remove the seal from the bore. Do not distort or scratch the aluminum case.

12. Remove the oil seal using a suitable seal removal tool.
13. Remove the dust deflector from the pinion yoke using a soft-faced hammer.
1. Install the new deflector onto the pinion yoke, using a soft-faced hammer.
2. Install the new oil seal by doing the following:
   1. Position the oil seal in the bore.
   2. Install the J 21128 over the oil seal. See Special Tools.
   3. Strike the J 21128 with a hammer, until the seal flange seats on the axle housing surface. See Special Tools.
3. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent, to the splines of the drive pinion yoke.
4. Install the pinion yoke.

Align the reference marks made during removal.

**IMPORTANT:** Drive the seal in straight, not at an angle, as this will damage the aluminum housing.
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.

5. 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.

6. Install the washer and a new pinion nut.

Fig. 52: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

7. Install the J 8614-01 (1) onto the pinion yoke, as shown. See Special Tools.

NOTE: Refer to Fastener Notice.
8. Tighten the pinion nut while holding the **J 8614-01** (1). See **Special Tools**.

**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.

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

Compare the measurement of the rotating torque to the measurement recorded earlier.

**Specification:** The rotating torque of the pinion nut should be 0.40-0.57 N.m (3-5 lb in) greater than the torque recorded during removal.

10. If the rotating torque is not within specifications, 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 0.40-0.57 N.m (3-5 lb in) greater than the torque recorded during removal.

11. 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.

12. Install the front propeller shaft. Refer to **Front Propeller Shaft Replacement**.

13. Install the EPS. Refer to **Engine Shield Replacement**.

14. Install the brake calipers. Refer to **Front Brake Caliper Replacement**.

15. Fill the drive axle. Refer to **Front Axle Lubricant Replacement**.

16. Lower the vehicle.

**DIFFERENTIAL CARRIER ASSEMBLY BUSHING AND BRACKET REPLACEMENT**
Fig. 53: Differential Carrier Assembly Bushing and Bracket Replacement
Courtesy of GENERAL MOTORS CORP.

Differential Carrier Assembly Bushing and Bracket Replacement

<table>
<thead>
<tr>
<th>Callout</th>
<th>Component Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Preliminary Procedures</strong></td>
</tr>
<tr>
<td>1</td>
<td>Remove the engine protection shield front. Refer to <strong>Fastener Tightening Specifications</strong>.</td>
</tr>
<tr>
<td>2</td>
<td>Remove the engine protection shield rear. Refer to <strong>Fastener Tightening Specifications</strong>.</td>
</tr>
<tr>
<td>3</td>
<td>Remove the front drive axle. Refer to <strong>Wheel Drive Shaft Replacement</strong>.</td>
</tr>
</tbody>
</table>

1. Front Drive Axle Mounting Bolt (Qty: 1)

**NOTE:**
Refer to **Fastener Notice**.

**Tip:**
The bushings for the mounting bracket is not serviced separately. They are serviced with the mounting bracket.

DO NOT completely tighten the bolts from the mounting bracket to the frame. Leave the bolts loose to allow the bracket alignment to the intermediate shaft housing.

**Tighten:** 152 N.m (112 lb ft)

- **2** Mounting Bracket to the Front Drive Axle Bolt (Qty: 4)
  - **Tighten:** 152 N.m (112 lb ft)
- **3** Mounting Front Drive Axle Bracket

**DIFFERENTIAL CARRIER ASSEMBLY REPLACEMENT**

---

**Fig. 54: Differential Carrier Assembly Replacement**

Courtesy of GENERAL MOTORS CORP.

**Differential Carrier Assembly Replacement**

<table>
<thead>
<tr>
<th>Callout</th>
<th>Component Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>MY</td>
<td></td>
</tr>
</tbody>
</table>

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NOTE:
Refer to Fastener Notice.

Fastener Tightening Specifications: Refer to Fastener Tightening Specifications.

Preliminary Procedures

1. Remove the engine protection shield front. Refer to Fastener Tightening Specifications.
2. Remove the engine protection shield rear. Refer to Fastener Tightening Specifications.
3. Drain the front drive axle. Refer to Front Axle Lubricant Replacement.
4. Remove the wheel drive shafts. Refer to Wheel Drive Shaft Replacement.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Qty:</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crossmember to Front Drive Axle Mounting Bolt</td>
<td>1</td>
<td>100 N.m (74 lb ft).</td>
</tr>
<tr>
<td>2</td>
<td>Crossmember to Frame Mounting Bolt</td>
<td>4</td>
<td>160 N.m (118 lb ft).</td>
</tr>
<tr>
<td>3</td>
<td>Crossmember to Frame Nut</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Transfer Case Crossmember</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mounting Bracket Bolt</td>
<td>2</td>
<td>Support the front drive axle with a transmission jack stand.</td>
</tr>
<tr>
<td>6</td>
<td>Front Drive Axle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FRONT AXLE LUBRICANT LEVEL INSPECTION

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Ensure the vehicle is level.
3. Inspect the front axle for leaks. Repair as necessary.
4. Remove the engine protection shield (EPS), if equipped. Refer to Engine Shield Replacement.
5. Clean the area around the front axle fill plug.
6. Remove the front axle fill plug and the washer.
7. Fabricate a dipstick from a pipe cleaner or similar item. Form the pipe cleaner into an "L".
IMPORTANT: Ensure that the pipe cleaner is resting on the bottom threads of the fill hole.

8. Insert the pipe cleaner into the fill plug opening with the stem "L" is facing down.
9. Remove the pipe cleaner and measure the distance from the bend in the pipe cleaner to the lubricant level.

**Specification:** The oil level should be between 0-8 mm (0-0.4 in) below the fill plug opening.

10. If the level is low, add fluid until the level is within the proper fluid level specification. Use the proper fluid. Refer to **Fluid and Lubricant Recommendations**.

**NOTE:** Refer to **Fastener Notice**.

11. Install the fill plug and the washer.

**Tighten:** Tighten the plug to 32 N.m (24 lb ft).

12. Install the EPS, if equipped. Refer to **Engine Shield Replacement**.
13. Lower the vehicle.

**DRIVE PINION AND RING GEAR REPLACEMENT**

**Tools Required**

- **J 8001** Dial Indicator Set. See **Special Tools**.
- **J 8614-01** Flange and Pulley Holding Tool. See **Special Tools**.
- **J 21128** Axle Pinion Oil Seal Installer. See **Special Tools**.
- **J 22536** Pinion Driver. See **Special Tools**.
- **J 22779** Side Bearing Backlash Gage. See **Special Tools**.
- **J 25025** Guide Pins. See **Special Tools**.
- **J 25588** Side Bearing Shim Installer. See **Special Tools**.

**Removal Procedure**

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle**.
2. Remove the differential carrier assembly. Refer to **Differential Carrier Assembly Replacement**.
3. Remove the drive pinion yoke and the oil seal. Refer to Front Differential Drive Pinion Flange/Yoke, Seal and Dust Deflector Replacement.

Fig. 55: Installing J 22536 Or J 44421 On Pinion
Courtesy of GENERAL MOTORS CORP.

4. Install the J 22536 as shown. See Special Tools.

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

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

Strike the J 22536 slowly. See Special Tools. Do not let the pinion fall out of the rear axle housing.
6. Remove the collapsible spacer from the pinion. Discard the spacer.
7. Remove the pinion bearings and the cups. Refer to Drive Pinion Bearings Replacement.
8. Remove the ring gear. Refer to Differential Case Assembly Disassemble.

Installation Procedure
Fig. 57: Installing Ring Gear Onto 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. Refer to Differential Case Assembly Disassemble.
2. Install the new ring gear bolts.

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

   **NOTE:** Refer to **Fastener Notice**.

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

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

4. Install the drive pinion bearing cups. Refer to **Drive Pinion Bearings Replacement**.
5. Determine the selective shim thickness for the pinion gear. See **Differential Side Bearing Preload Adjustment Procedure**.
6. Install the selective shim onto the pinion.
7. Install the inner pinion bearing onto the pinion. Refer to **Drive Pinion Bearings Replacement**.

---

**Fig. 58: View Of Collapsible Spacer & Pinion**
*Courtesy of GENERAL MOTORS CORP.*

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.

13. Apply sealant, GM P/N 12346004 (Canadian P/N 10953480) or equivalent, to the splines of the pinion yoke.
Fig. 60: View Of Pinion Shaft & Pinion Yoke Alignment Marks  
Courtesy of GENERAL MOTORS CORP.


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

**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**. See **Special Tools**.

**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.
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 carrier assembly. Refer to **Differential Carrier Assembly**
Replacement.

23. Perform a gear tooth contact pattern check on the pinion and the ring gear. Refer to Gear Tooth Contact Pattern Inspection.

24. Lower the vehicle.

Differential Side Bearing Preload Adjustment Procedure

**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.
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. 0.025-0.051 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.

33. Install the differential bearing caps and the bolts.

**Tighten:** Tighten the differential bearing cap bolts to 63 N.m (46 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 Inspection and Adjustment**.

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**.

**DRIVE PINION BEARINGS REPLACEMENT**

**Tools Required**

- **J 5590** Pinion Bearing Race Installer - Rear. See **Special Tools**.
- **J 7817** Outer Bearing Race Installer. See **Special Tools**.
- **J 8092** Universal Driver Handle- 3/4 in - 10. See **Special Tools**.
- **J 8614-01** Flange and Pulley Holding Tool. See **Special Tools**.
- **J 21128** Axle Pinion Oil Seal Installer. See **Special Tools**.
- **J 22912-B** Split-Plate Bearing Puller. See **Special Tools**.
- **J 29609** Rear Pinion Bearing Cup Installer. See **Special Tools**.
Removal Procedure

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the differential carrier assembly. Refer to Differential Carrier Assembly Replacement.
3. Remove the drive pinion from the axle. Refer to Drive Pinion and Ring Gear Replacement.
4. Press the bearing off of the pinion using the J 22912-B. See Special Tools.
5. Remove the shim.

Fig. 63: Removing Inner Pinion Bearing Using Hydraulic Press
Courtesy of GENERAL MOTORS CORP.
6. 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.
7. 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.

**Fig. 65: Removing Inner Pinion Bearing Cup**
*Courtesy of GENERAL MOTORS CORP.*

**Installation Procedure**
1. Install the outer pinion bearing cup using the J 7817 (1) and the J 8092 (2). See Special Tools.
2. Install the inner pinion bearing cup using the J 29609 (2) and the J 8092 (1). See Special Tools.

3. Determine the selective shim thickness for the pinion. Refer to Pinion Depth Adjustment.
4. Install the selective shim between the inner pinion bearing and the shoulder on the gear.
5. Install the inner pinion bearing using the J 5590. See Special Tools.
   Press the bearing on until the cone seats on the pinion shim.

6. Install a new collapsible spacer.

Fig. 68: Installing Inner Pinion Bearing
Courtesy of GENERAL MOTORS CORP.
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. 69: Installing Pinion Oil Seal**
*Courtesy of GENERAL MOTORS CORP.*

10. Install a new pinion oil seal using the **J 21128**. See **Special Tools**.

11. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the splines of the pinion yoke.
Fig. 70: 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.

Fig. 71: Holding Pinion Yoke With Special Tool
Courtesy of GENERAL MOTORS CORP.

15. Install the J 8614-01 onto the pinion yoke as shown. See Special Tools.

   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. See Special Tools.

   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.
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 carrier assembly. Refer to **Differential Carrier Assembly**
Replacement.
21. Lower the vehicle.

DIFFERENTIAL REPLACEMENT

Tools Required

- J 8001 Dial Indicator Set. See Special Tools.
- J 3289-20 Holding Fixture. See Special Tools.
- J 34178 Spreader Gage Adapter. See Special Tools.
- J 45222 Axle Housing Spreader. See Special Tools.
- J-45222-10 Axle Housing Spreader Adapters. See Special Tools.

Removal Procedure

1. Remove the differential carrier assembly from the vehicle. Refer to Differential Carrier Assembly Replacement.

Fig. 73: View Of Front Axle Shaft Housing Tube
Courtesy of GENERAL MOTORS CORP.
2. Remove the bolts retaining the front axle shaft housing tube to the front drive axle housing.
3. Remove the front axle shaft housing tube assembly.

**Fig. 74: View Of J-45935, J 3289-20, J 3289-22 & Set Screw**

**Courtesy of GENERAL MOTORS CORP.**

4. Install the **J-45935** (1) to the front drive axle housing using axle mounting bolts. See **Special Tools**.
5. Insert the **J-45935** (1) into the bench mounting fixture **J 3289-20** (2). See **Special Tools**.
6. Install the locking pin J 3289-22 (3), then tighten the set screw (4).
7. Remove the front axle housing cover bolts.
8. Remove the front axle housing cover and gasket.
Fig. 76: View Of J-45222-10 & J 45222 Installed On Front Axle Housing
Courtesy of GENERAL MOTORS CORP.

9. Install the **J-45222-10 (1)** to the front axle housing as shown. See Special Tools.
10. Install the **J 45222 (2)** to the **J-45222-10** as shown. See Special Tools.
11. 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.

12. Preload the J 8001-3 approximately 3/4 of a turn clockwise.

13. Rotate the indicator housing to align the indicator needle of the J 8001-3 (5) and the dial indicator face to ZERO.

14. Spread the axle housing by turning the clevis screw of the J 34178 while observing the J 8001-3. Spread the housing just enough to remove the differential assembly. DO NOT spread the housing more than 1.02 mm (0.040 in). See Special Tools.
15. Mark the bearing caps left and right then remove the bearing cap bolts and the bearing caps.
16. Remove the differential case from the axle housing using a pry bar and a block of wood.

**Fig. 79: Removing Differential Case From Axle Housing**

*Courtesy of GENERAL MOTORS CORP.*

**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.
17. Remove the bearing cups, the shims and the spacers as necessary. Mark the cups and shims left and right and in order as necessary. Place the cups and the shims with the bearing caps.

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


Installation Procedure

1. Lubricate the differential side bearings with axle lubricant. Use the proper fluid. Refer to Fluid and Lubricant Recommendations.
Fig. 80: View Of J-45222-10 & J 45222 Installed On Front Axle Housing
Courtesy of GENERAL MOTORS CORP.

2. Install the J-45222-10 (1) and the J 45222 (2) to the front axle housing as shown. See Special Tools.
3. 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.

4. Preload the **J 8001-3** (5) approximately 3/4 of a turn clockwise.

5. Rotate the indicator housing to align the indicator needle of the **J 8001-3** (5) and the dial indicator face to ZERO.

6. Spread the axle housing by turning the clevis screw of the **J 34178** while observing the **J 8001-3**. Spread the housing just enough to remove the differential assembly. DO NOT spread the housing more than 1.02 mm (0.040 in). See Special Tools.
7. Place the case with the bearing cups installed into the axle housing.
8. Install the bearing caps and bolts. Do not torque the bearing cap bolts at this time.
9. Adjust the differential side bearing preload. Refer to Drive Pinion and Ring Gear Replacement.
10. Adjust the backlash. Refer to Backlash Inspection and Adjustment.
11. Perform the gear tooth contact pattern check. Refer to Gear Tooth Contact Pattern Inspection.

   NOTE: Refer to Fastener Notice.

12. Tighten the bearing cap bolts.

   Tighten: Tighten the bearing cap bolts to 63 N.m (46 lb ft).

13. Install the front axle housing cover gasket.

14. Install the front axle housing cover and bolts.

   Tighten: Tighten the bolts to 30 N.m (22 lb ft).

15. Install the front axle shaft housing tube assembly to the front drive axle housing.

16. Install the bolts retaining the front axle shaft housing tube assembly to the front drive axle housing.

   Tighten: Tighten the front axle shaft tube to axle bolts to 60 N.m (44 lb ft).

17. Remove the J-45935 from the front drive axle housing. See Special Tools.

18. Install the differential carrier assembly to the vehicle. Refer to Differential Carrier Assembly Replacement.

DIFFERENTIAL CASE ASSEMBLY DISASSEMBLE

Tools Required

J 22888-D Side Bearing Remover Kit. See Special Tools.

Disassembly Procedure

1. Place the differential case in a vise.
Fig. 83: Removing Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.

2. Install the J 22888-20A (2) and the J 8107-2 (1) as shown.
Fig. 84: View Of Ring Gear Bolts
Courtesy of GENERAL MOTORS CORP.

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

4. Remove the ring gear bolts.
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.

Fig. 85: Removing Ring Gear
Courtesy of GENERAL MOTORS CORP.

5. Remove the ring gear from the differential case.

Drive the ring gear off with a brass drift, if necessary.
6. Remove the pinion shaft lock bolt.
7. Remove the pinion shaft.

Fig. 87: View Of Differential And Pinion Shaft
Courtesy of GENERAL MOTORS CORP.
8. Remove the differential pinion gears and the differential side gears.
   1. Mark the pinion gears top and bottom and the differential side gears left and right.
   2. Roll the differential pinion gears out of the case with the pinion thrust washers.
   3. Remove the differential side gears and the side gear thrust washers.

DIFFERENTIAL CASE BEARINGS INSPECTION

**IMPORTANT:** When replacing the worn or cracked bearings and the
cups, replace the bearings in sets.

- The low mileage bearings may have very small scratches and pits on the rollers and the bearing cups from the initial preload.

**Do not replace a bearing for this reason.**

1. Inspect the bearings for smooth rotation after oiling.
2. Inspect the bearing rollers for wear.
3. Inspect the bearing cups for the following conditions:
   - Wear
   - Cracks
   - Brinelling
   - Scoring

**DIFFERENTIAL CASE AND GEARS INSPECTION**

1. Inspect the following components for excessive wear and/or fit:
   - The pinion gear shaft
   - The thrust washers
   - The differential case for wear, cracks and scoring
   - The fit of the pinion gear shaft in the differential case
   - The fit of the differential side gears in the differential case
   - The fit of the side gears on the axle shafts
2. Inspect the teeth of the pinion gears and the differential side gears for the following conditions:
   - Wear
   - Cracks
   - Scoring
   - Spalling
3. Replace any worn or poor fitting components as necessary.

**PINION AND RING GEAR INSPECTION**

1. The ring and pinion gears are matched sets and must be replaced any time a replacement of either is necessary.
2. Inspect the pinion and the ring gear teeth for the following conditions:
   - Cracking
   - Chipping
   - Scoring
   - Excessive wear
3. Inspect the pinion gear splines for wear.
4. Inspect the pinion flange splines for wear.
5. Inspect the fit of the pinion flange on the pinion gear.
6. Inspect the sealing surface of the pinion flange for nicks, burrs or rough tool marks which will damage the inside diameter of the pinion seal and result in an oil leak.
7. Inspect all of the parts for wear and replace as necessary.

THRUST WASHERS, SHIMS AND ADJUSTER SLEEVES INSPECTION

1. Inspect the shims and the thrust washers for cracks and chips.
   The damaged shims should be replaced with an equally sized service shim.
2. Inspect the adjuster sleeves for damaged threads. Replace if required.

DIFFERENTIAL CASE ASSEMBLY ASSEMBLE

Tools Required

- J 8092 Universal Driver Handle - 3/4 in - 10. See Special Tools.

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 side gears and the thrust washers to their original locations.

4. Install the differential pinion gears and 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 gear directly opposite of the first gear.

3. Rotate the differential side gears until the pinion gears are directly opposite the opening in the differential case.

4. Install the thrust washers.

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

5. Install the pinion gear shaft.

   **NOTE:** Refer to Fastener Notice.

6. Install the new pinion gear shaft lock bolt.

   **Tighten:** Tighten the new pinion shaft lock bolt to 25 N.m (18 lb ft).
Fig. 90: 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.

7. Install the ring gear onto the differential case.
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 ring gear bolts alternately and in stages, gradually pulling the ring gear onto the differential case.

   **Tighten:** Tighten the ring gear bolts in sequence to 120 N.m (89 lb ft).
10. Install the differential side bearings by performing the following steps:

   1. In order to protect the differential case, install the J 8107-2 in the case on the side opposite the bearing installation.
2. Install the J 25299 (2) and the J 8092 (1) onto the differential case bearing as shown. See Special Tools.

3. Install the differential case bearings using the J 33790 and the J 8092. See Special Tools.

PINION DEPTH ADJUSTMENT

Tools Required

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

Adjustment Procedure

**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.
3. Assemble the J 21777-40 (1), the J 21777-43 (2), the J 21777-42 (3) and the J 23597-11 (4) into the axle housing as shown.

   **NOTE:** Refer to Fastener Notice.

4. While holding the J 21777-43 stationary, install an inch-pound torque wrench on the nut of the J 21777-43.
**Tighten:** Tighten the nut on the J 21777-43 until a rotating torque of 1.7-2.8 N.m (15-25 lb in) is obtained.

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

**Fig. 93: Assembling J 21777-45 & J 21777-1**

Courtesy of GENERAL MOTORS CORP.
7. Assemble the **J 21777-45** (1, 2) to the J 23597-1 (3) as shown.

8. Rotate the J 23597-1 within the **J 21777-45**. The J 23597-1 must rotate back and forth freely within the discs. If the J 23597-1 does not rotate freely, disassemble the components, inspect for proper seating and/or mis-aligned components and re-assemble.
Fig. 94: Identifying J 21777-1 & J 44416-3
Courtesy of GENERAL MOTORS CORP.

9. Align the plunger of the J 23597-1 (1) to the J 23597-11 (2).
10. Install the J 8001 to the J 23597-1 as follows:
    1. Loosely clamp the J 8001 onto the stem on the J 23597-1. See Special Tools.
    2. Place the contact pad of the J 8001 onto the mounting post of the J 23597-1. See Special Tools.
    3. With the contact pad of the J 8001 touching the mounting post of the J 23597-1, 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. See Special Tools.
    4. Tighten the clamp on the J 8001 finger tight. See Special Tools.
11. Move the plunger of the J 23597-1 back and forth until the needle of the J 8001 indicates the greatest deflection. See Special Tools.

The deflection is the point where the needle changes direction.
Fig. 95: Measuring Necessary Shim Thickness
Courtesy of GENERAL MOTORS CORP.

12. At the greatest point of deflection, move the housing of the J 8001 until the needle indicates ZERO. See Special Tools.
13. Move the plunger of the J 23597-1 back and forth again to verify the zero setting. Adjust the housing of the J 8001 as necessary to set the needle to zero. See Special Tools.
14. Rotate the plunger of the J 23597-1 away from the J 23597-11 until it no longer touches the J 23597-11 or the J 21777-29.
15. The value indicated on the J 8001 is the thickness of the shim needed in order to set the depth of the pinion. See Special Tools.
16. Select the shim that indicates the proper thickness. Measure the shim with a micrometer in order to verify that the thickness is correct.
17. Remove the pinion depth setting tools.
18. Remove the pinion bearings.
19. Install the pinion shim between the pinion gear and the inner pinion bearing. Refer to Drive Pinion Bearings Replacement.

BACKLASH INSPECTION AND ADJUSTMENT

Tools Required

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

Adjustment Procedure

Fig. 96: 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.

3. Set the **J 8001-3** so that the stem is aligned with the gear rotation and perpendicular to the tooth angle.

4. Preload the dial of the **J 8001-3**.

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

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. 97: 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 63 N.m (46 lb ft).

17. Recheck the backlash and adjust, if necessary.

18. Once backlash is correct, perform a gear tooth contact pattern check in order to ensure proper alignment between the ring and pinion gears. Refer to Gear Tooth Contact Pattern Inspection.

**GEAR TOOTH CONTACT PATTERN INSPECTION**

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

**Drive Pinion and Ring Gear Identification**

Production drive pinion and ring gears are manufactured by using a 2-cut or a 5-cut method. The 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. 98: 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.
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: Avoid turning the ring gear excessively.**

4. Using a wrench, turn the drive pinion flange/yoke so that the ring gear rotates 3 full revolutions.

5. Turn the drive pinion flange/yoke in the opposite direction so that the ring gear rotates 3 full revolutions in the opposite direction.

6. Observe the pattern on the ring gear teeth. Compare the pattern with the following illustrations.

**Correct Contact Pattern**

**Condition**

![Correct Gear Tooth Contact Pattern](image)

**Fig. 100: 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

![Diagram of Drive Side Heel - Coast Side Toe Contact Pattern](image)

**Fig. 101: 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 Inspection and Adjustment**.

Drive Side Toe - Coast Side Heel Contact Pattern
Fig. 102: 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 Inspection and Adjustment.

Drive Side Heel - Coast Side Heel Contact Pattern
Fig. 103: 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 Inspection and Adjustment.

Drive Side Toe - Coast Side Toe Contact Pattern
Fig. 104: 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 Inspection and Adjustment.

High Flank Contact Pattern
Fig. 105: 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. 106: Identifying Low Flank Contact Pattern
Courtesy of GENERAL MOTORS CORP.

Condition

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

Correction

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

DESCRIPTION AND OPERATION

FRONT DRIVE AXLE DESCRIPTION AND OPERATION

The Front Drive Axle consist of the following components:
The front axle on four wheel drive model vehicles has a central disconnect feature. The axle uses a conventional ring and pinion gear set in order to transmit the driving force of the engine to the wheels. The open differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing when going around corners and premature wear on internal axle parts. The ring and pinion set and the differential are contained within the carrier. The axle identification number on top of the differential carrier assembly or on a label on the right half of differential carrier assembly. The drive axles are completely flexible assemblies consisting of inner and outer constant velocity CV joints protected by thermoplastic boots and connected by a wheel drive shaft.

### SPECIAL TOOLS AND EQUIPMENT

#### SPECIAL TOOLS

**Special Tools**

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<td>J 5590 Pinion Bearing Race Installer - Rear</td>
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J 7817
Outer Bearing Race Installer

J 8001
Dial Indicator Set

J 8092
Driver Handle
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<tr>
<td>Axle Pinion Oil Seal Installer</td>
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<td>J 21426</td>
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J 22912-01
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