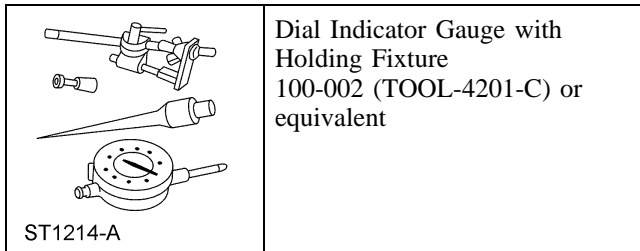


DIAGNOSIS AND TESTING

Rear Drive Axle and Differential

Special Tool(s)



Inspection and Verification

The technician should have a thorough knowledge of driveline system operation and accepted general driveline guidelines to detect any problems.

A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Certain conditions, such as road conditions and weather, will amplify normal vehicle noise.

Certain rear axle and driveline concern symptoms are also common to the engine, transmission, rear wheel bearings and tire. For this reason, be sure the cause of the concern is in the axle before repairing or installing any axle components.

The following is a guide to diagnose a driveline concern:

- Verify and document the customer concern.
 - Carry out a preliminary investigation.
 - Road test the vehicle.
 - Find the cause of the problem.
 - Inspect the components.
1. Verify and document the customer concern.
 - 1 When was it first noticed?
 - 2 Did it appear suddenly or gradually?
 - 3 Did anything unusual occur that would coincide with it or precede it?
 - 4 Has the driveline system been repaired before or new components installed?
 - Check the vehicle service record. Note any repairs other than driveline, such as brakes or suspension.
 - 5 Are there any special conditions affecting the concern or will alter the concern? For example:
 - road speed.

- type of road.
- drive mode.
- temperature.
- vehicle loaded or unloaded.

- 6 Is the condition constant or intermittent? Can the concern be duplicated at any time?
- 7 Check for TSBs, SSM and OASIS messages.

2. **NOTE:** If the inspection reveals an obvious concern, repair the vehicle.

Do a preliminary investigation. Visually inspect for obvious signs of damage.

- 1 Inspect the driveshaft:
 - for buildup of any foreign material.
 - for damage, such as a bent tube or missing weights.
 - U-joints or flex couplers for wear or damage.
- 2 Inspect the axle:
 - for signs of leakage at the drain or fill plug, differential seal, vent or halfshaft seals.
 - a plugged vent will cause a leak.
 - for damage, such as cracks, bent halfshafts or dented rear cover.
 - for missing fasteners.
- 3 Inspect other suspect components/systems:
 - inspect the halfshaft assemblies for damaged CV joints or torn CV boots.
 - inspect the suspension for broken springs, damaged shock absorbers and worn suspension bushings.
 - inspect the rear brake components — lines, cables and calipers.
 - inspect the tires; are they in good condition and do they match?
3. **NOTE:** A road test is necessary for any customer concern of noise or vibration. Road test the vehicle.
 - 1 During the road test, use the following driving methods to diagnose the problem. Is the concern most noticeable:
 - from a stop?

DIAGNOSIS AND TESTING (Continued)

- on shifts from REVERSE to DRIVE?
 - on turns?
 - sweeping type turn.
 - tight turn (to the stop).
 - in DRIVE?
 - accelerating the vehicle, definite throttle depression, applying engine torque?
 - in CRUISE?
 - maintain a constant speed with the throttle applied?
 - in COAST?
 - decelerating with the throttle closed?
- 2 Record when the concern occurs. Write down the kph (mph) range at which the noise/vibration occurs.
 - 4 Find the cause of the problem.
 - 1 Compare the inspection and road test results with the following chart.
 - 2 Use the following diagnostic routine chart to identify the probable cause and know what corrective actions should be taken to repair the component/vehicle, and to prevent a reoccurrence.

Diagnostic Routine Chart

Condition	Action
• Fluid loss	• GO to Diagnostic Routine — Fluid Loss
• Noise louder on turns (sweeping turn)	• GO to Diagnostic Routine — Noise Louder On Turns (Sweeping)
• Axle noise (growl) ^a in tight turn	• GO to Diagnostic Routine — Noise (Growl) In Tight Turn
• Axle noise (chatter/shudder) ^a in tight turn, limited slip differential	• GO to Diagnostic Routine — Noise (Chatter/Shudder) In Tight Turns, Limited Slip Differential
• Axle noise (whine) ^a in all or more than one drive mode	• GO to Diagnostic Routine — Noise (Whine) In All Or More Than One Drive Modes

Diagnostic Routine Chart (Continued)

Condition	Action
• Axle noise (tick/click) ^a in all or more than one drive mode (DRIVE, CRUISE, COAST)	• GO to Diagnostic Routine — Noise (Tick/Click) In All Or More Than One Drive Modes
• Axle noise (howl/moan) ^a in all or more than one drive mode (DRIVE, CRUISE, COAST)	• GO to Diagnostic Routine — Noise (Howl/Moan) In All Or More Than One Drive Modes
• Axle noise (clunk) ^a on changes in speed or direction of power	• GO to Diagnostic Routine — Noise (Clunk) On Changes In Speed Or Direction Of Power
• Vibration	• For driveline vibration diagnostics, REFER to Section 100-04

- a. Refer to Section 100-04 for a glossary of noise-related terms.
5. **NOTE:** If the conclusion of the road test points to an axle center section (ring and pinion or differential case) concern, carry out a visual inspection of the axle.

Inspect the axle components.

- 1 Remove the differential housing cover. Drain the axle lubricant through a white cloth. Check the fluid for:
 - any foreign material.
 - metal particles.
 - burnt odor.
- 2 **NOTE:** When inspecting the axle, do not clean the components immediately. Cleaning may remove diagnostic evidence.

Inspect the axle components.

 - Look for:
 - loose fasteners.
 - notches or visible steps or grooves created by wear.
 - pitting or cracking along gear contact lines.
 - scuffing or deformations.
 - discolorations.
 - nicks or ridges on gear teeth.

DIAGNOSIS AND TESTING (Continued)

- Clean the axle components for inspection.
 - Remove as much lubricant as possible with clean solvent. Wipe the components or blow them dry with compressed air.
- Re-inspect for:
 - loose fasteners.
 - notches or visible steps or grooves created by wear.
 - pitting or cracking along gear contact lines.
 - scuffing or deformations.
 - discolorations.
 - nicks or ridges on gear teeth.
- Check backlash and carry out a ring and pinion pattern test. Refer to Checking Differential Ring Gear Backlash and Checking Tooth Contact Pattern and Condition of the Ring and Pinion in this section.

Diagnostic Routines**Diagnostic Routine — Fluid Loss**

Possible Component	Reference/Action
• Vent	• CLEAN the axle vent.
• Overfilled axle	• CHECK the lubricant level for specific amount.
• Fill plug	• CLEAN the area around the plug. REMOVE the plug. APPLY pipe sealant and INSTALL the plug.
• Halfshaft oil seal	• INSTALL a new halfshaft oil seal.
• Pinion seal	• INSTALL a new pinion seal.
• Differential housing cover	• RESEAL the differential housing cover.

Diagnostic Routine — Noise Louder On Turns (Sweeping)

Possible Component	Reference/Action
• Wheel end bearing	• CHECK the wheel end bearing for wear or damage. INSTALL a new bearing.

Diagnostic Routine — Noise (Growl) In Tight Turn, Conventional Differential

Possible Component	Reference/Action
• Differential side gears and differential pinion gears	• DISASSEMBLE the differential carrier. INSPECT the differential case assembly. INSTALL new side gears and differential pinion gears or case assembly.

Diagnostic Routine — Noise (Chatter/Shudder) In Tight Turns, Limited Slip Differential

Possible Component	Reference/Action
• Clutch pack	• VERIFY the condition. With the vehicle in cold startup, MAKE SURE that the vehicle is in 2WD, to isolate the rear axle. TURN the wheel fully right (or fully left) and then ACCELERATE the vehicle. If the condition is verified to be in the rear axle, REMOVE and INSTALL new clutch packs.

DIAGNOSIS AND TESTING (Continued)**Diagnostic Routine — Noise (Whine) In All Or More Than One Drive Modes**

Possible Component	Reference/Action
• Axle ring and pinion	• REMOVE and INSTALL a new ring gear, pinion and bearings.

Diagnostic Routine — Noise (Tick/Click) In All Or More Than One Drive Modes

Possible Component	Reference/Action
• Axle ring and pinion	• REMOVE and INSTALL a new ring gear, pinion and bearings.

Diagnostic Routine — Noise (Howl/Moan) In All Or More Than One Drive Modes

Possible Component	Reference/Action
• Axle bearings	• INSPECT differential and pinion bearings. INSTALL new bearings.

Diagnostic Routine — Noise (Clunk) On Changes In Speed Or Direction Of Power

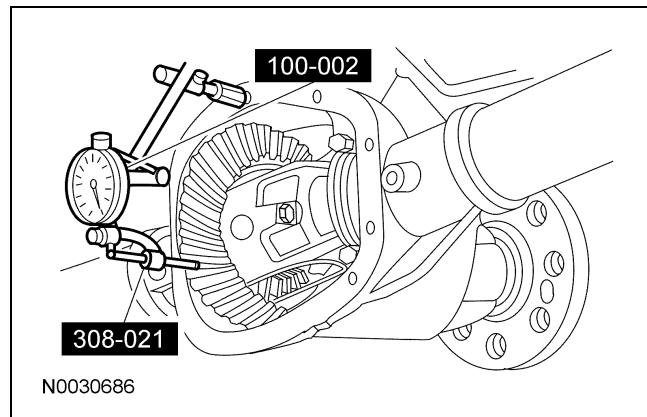
Possible Component	Reference/Action
• Axle and pinion system	• MEASURE total backlash. If end play and total backlash are within specification, INSTALL a new differential case assembly.
• Differential pinion shaft	• INSTALL a new differential pinion shaft and pin.
• Pinion bearings	• INSTALL new pinion and differential bearings and bearing cups.

Diagnostic Routine — Vibration

Possible Component	Reference/Action
• For additional information on driveline vibration, REFER to Section 100-04.	

Checking Differential Ring Gear Backlash

1. Remove the differential housing cover.
2. Using a suitable dial indicator and the special tool, measure and record the differential ring gear backlash in 4 opposing points on the ring gear.

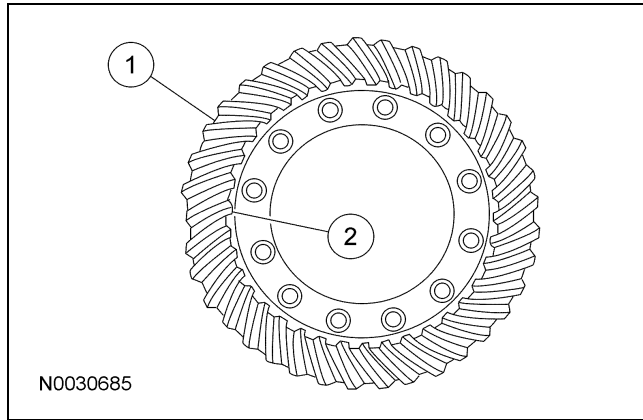


DIAGNOSIS AND TESTING (Continued)

Checking Tooth Contact Pattern and Condition of the Ring and Pinion

There are 2 basic types of conditions that will produce ring and pinion noise. The first type is a howl or chuckle produced by broken, cracked, chipped, scored or forcibly damaged gear teeth and is usually quite audible over the entire speed range. The second type of ring and pinion noise pertains to the mesh pattern of the gear pattern. This gear noise can be recognized as it produces a constant pitch or whine. Ring and pinion noise tends to peak in a narrow speed range or ranges and will tend to remain constant in pitch.

NOTE: In the following steps, the movement of the contact pattern along the length is indicated as toward the ‘heel’ or ‘toe’ of the differential ring gear.



Item	Description
1	Heel
2	Toe

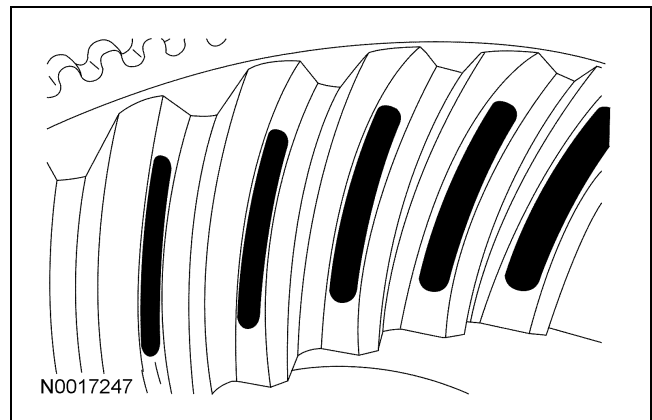
Apply a marking compound to 1/3 of the gear teeth on the differential ring gear. Rotate the differential ring gear several complete turns in both directions until a good, clear tooth pattern is obtained. Compare the contact patterns on the ring gear teeth with the following illustrations.

Good Contact Pattern

Pattern inspection allows the technician to detect gross errors in set up prior to complete assembly of the differential assembly. Pattern contact should be within the primary area of the ring gear tooth section. Avoid narrow or hard contact with the outer perimeter of the ring gear tooth. Pattern inspection should be on the drive side of the tooth. Correct assembly of the drive pattern will result in satisfactory coast performance.

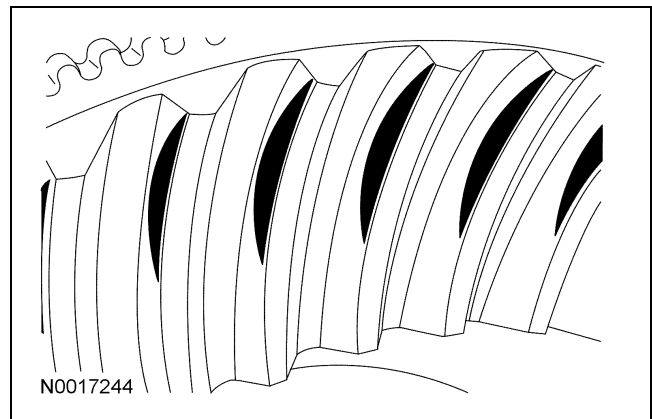
NOTE: If a gross pattern error is detected with the correct backlash, check the pinion shim selection.

Good Contact Pattern



Low Contact Pattern That Is Contacting More Toward the Heel

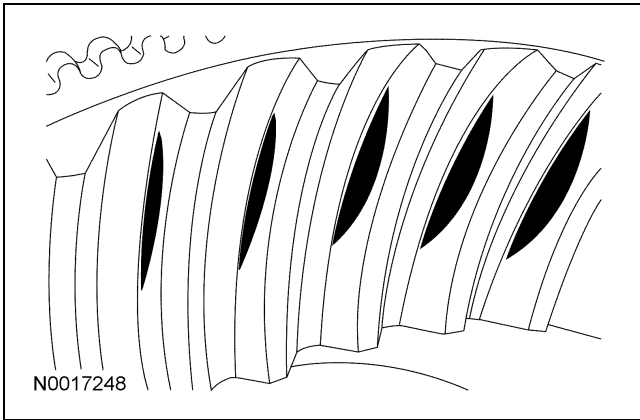
Gross Pattern Error



DIAGNOSIS AND TESTING (Continued)

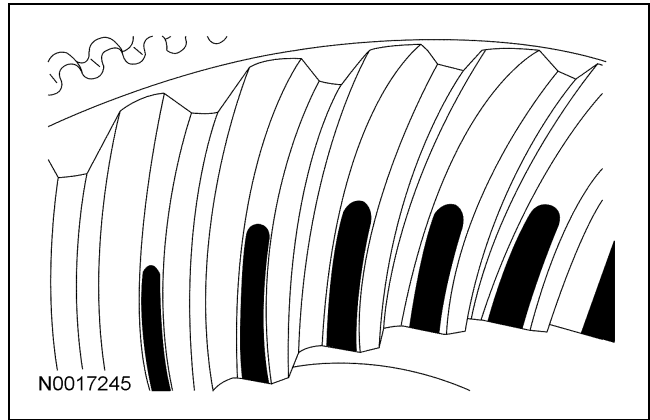
High, Thin Contact Pattern In the Center Of the Tooth

Gross Pattern Error



Thick Contact Pattern That Is Contacting Tooth Toward the Toe

Gross Pattern Error



Thick Contact Pattern That Is Contacting Tooth Toward the Heel

Gross Pattern Error

