

Front Drive Axle

Principles of Operation

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart - Front Differential

Symptom Chart - Front Differential

Condition	Possible Sources	Actions
Axle overheating	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification. REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).
	• Incorrect or contaminated lubrication type	• INSPECT the axle for damage. REPAIR as necessary. CLEAN and REFILL the axle to specification as necessary. REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).
	• Bearing preload adjusted too tight	• CHECK the ring and pinion for damage. INSPECT the ring and pinion wear pattern. ADJUST the preload as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Excessive gear wear	• INSPECT all the axle gears for wear or damaged. INSTALL new components as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Incorrect ring gear backlash	• INSPECT the ring gear for scoring. INSPECT the ring and pinion wear pattern. ADJUST the ring gear backlash as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
Broken gear teeth on the ring gear or pinion	• Overloading the vehicle	• INSTALL a new ring and pinion. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
Differential side gears/pinion gears are scored	• Insufficient lubrication	• INSTALL new gears. FILL the axle to specification. REFER to: Differential Carrier (205-03 Front Drive Axle/Differential, Disassembly and Assembly).

Condition	Possible Sources	Actions
	Incorrect or contaminated lubricant type	INSTALL new gears. CLEAN and REFILL the axle to specification. REFER to: Differential Carrier (205-03 Front Drive Axle/Differential, Disassembly and Assembly).
Front axle will not disengage	Mode switch	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Wiring/relays	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	4x4 control module	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Shift motor	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Integrated Wheel End (IWE)	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Manual locking hubs	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Manual shift lever	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
Front axle will not engage	Mode switch	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Wiring/relays	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

Condition	Possible Sources	Actions
	4x4 control module	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Shift motor	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Integrated Wheel End (IWE)	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Manual locking hubs	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	Manual shift lever	Refer to section 308-07A Diagnosis and Testing DTC chart. REFER to: Four-Wheel Drive Systems - Electronic Shift (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
Gray or milky axle lubricant in low mileage vehicles	Marking compound in axle fluid or water contamination	Inspect axle housing and vent for damage or leaks. Refer to Axle Fluid Analysis in this section. REPLACE axle fluid as necessary.
Lubricant leaking from the pinion seal, axle shaft oil seals or support arm to the housing	Vent	CLEAN the axle housing vent.
	Damage in the seal contact area or dust slinger on the pinion flange dust shield	INSTALL a new pinion flange and the pinion seal if damage is found.

Symptom Chart - NVH

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart - NVH

Condition	Possible Sources	Actions
Axle howling or whine	Axle lubricant low	CHECK the lubricant level. FILL the axle to specification. REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).

Condition	Possible Sources	Actions
	• Axle housing damage	• INSPECT the axle housing for damage. REPAIR or INSTALL a new axle as necessary. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn wheel hub bearings	• CHECK for abnormal wheel hub bearing play or roughness. REFER to: Front Wheel Bearing and Wheel Hub (204-01B Front Suspension - 4WD, Removal and Installation).
	• Damaged or worn differential ring and pinion	• INSPECT and INSTALL a new differential ring and pinion as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn differential side or pinion bearings	• INSPECT and INSTALL new differential side or pinion bearings as necessary. REFER to: Differential Bearings (205-03 Front Drive Axle/Differential, Removal and Installation).
Driveline clunk - loud clunk when shifting from REVERSE to DRIVE	• Incorrect axle lubricant level	• CHECK the lubricant level. FILL the axle to specification. REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).
	• Excessive backlash in the axle	• CHECK for excessive axle backlash. ADJUST backlash as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn pinion bearings	• REPAIR or INSTALL new pinion bearings as necessary. REFER to: Differential Bearings (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
Driveline clunk “ occurs as the vehicle starts to move forward following a stop	• Loose axle mount	• CHECK the axle for loose bolts. TIGHTEN to proper torque. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
Driveline clunk “ occurs during acceleration or from cruise to coast/deceleration	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
High pitched chattering “ noise from the axle when the vehicle is turning	• Incorrect or contaminated lubricant	• CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). CLEAN and REFILL the axle to specification. REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).

Condition	Possible Sources	Actions
	Damaged or worn differential (differential side gears and pinion gears)	REPAIR or INSTALL new differential side gears or pinion gears as necessary. REFER to: Differential Carrier (205-03 Front Drive Axle/Differential, Disassembly and Assembly).
	Uneven tire sizes or high performance tires with soft compound	ROTATE the wheel and tire assemblies or INSTALL new wheel and tire assemblies as necessary. REFER to: Wheel and Tire - Vehicles With: Dual Rear Wheels (204-04A Wheels and Tires, Removal and Installation). REFER to: Wheel and Tire - Vehicles With: Single Rear Wheels (204-04A Wheels and Tires, Removal and Installation).
Grunting “normally associated with a shudder experienced during acceleration from a complete stop	Loose axle mount bolts or suspension fasteners	INSPECT the rear suspension and axle. TIGHTEN the fasteners to specification. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Howl “can occur at various speeds and driving conditions. Affected by acceleration and deceleration	Incorrect ring and pinion contact, incorrect bearing preload or gear damage	INSPECT and REPAIR as necessary. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
Chuckle “heard at coast/deceleration. Also described as a knock	Incorrect ring and pinion contact or damaged teeth on the coast side of the ring and pinion	INSPECT and REPAIR as necessary. Refer to Contact Pattern Location in this procedure.
Knock “noise occurs at various speeds. Not affected by acceleration or deceleration	Gear tooth damage to the drive side of the ring and pinion	INSTALL a new ring and pinion. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
Scraping noise “a continuous low pitched noise starting at low speeds	Worn or damaged pinion bearings	INSPECT and REPAIR or INSTALL new pinion bearings. REFER to: Differential Ring Gear and Pinion (205-03 Front Drive Axle/Differential, Removal and Installation).
Driveline shudder “occurs during acceleration from a slow speed or stop	Drive axle assembly mispositioned	CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	Loose axle bolts	CHECK the axle for loose bolts. TIGHTEN the bolts to specification. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	Loose or missing fasteners	CHECK all driveline fasteners for proper torque.

Axle Fluid Analysis

The appearance of milky or gray axle fluid in early mileage axles is a result of white marking compound used at the assembly plant to verify gear mesh contact pattern. The marking compound within the fluid will darken some over time. The appearance of milky or gray axle fluid can also be caused due to water contamination. The milky fluid appearance will diminish and cause no harm and does not require a fluid change. If internal axle damage is suspected and milky fluid is discovered upon inspection, the possible root cause can be water contamination. In this case identify the

root cause of water contamination, replace the fluid and repair any related damage.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source.

A plugged front axle housing vent can cause excessive pinion seal lip wear due to internal pressure buildup.

Verify the differential lubricant level is at the correct level.

REFER to: Differential Fluid Level Check (205-03 Front Drive Axle/Differential, General Procedures).

Axle Vent

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. If the vent cannot be cleared, install a new vent.

Drive Pinion Seal

Leaks at the drive pinion seal originate from the following causes:

- Damaged seal
- Worn seal journal surface

A new drive pinion flange must be installed if any of these conditions exist.

- Any damage to the seal bore (dings, dents, gouges or other imperfections) distorts the seal casing and allows leakage past the outer edge of the drive pinion seal.
- The drive pinion seal can be torn, cut or gouged if it is not installed correctly. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow fluid to pass the lip.
- Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the drive pinion flange and result in pinion seal wear.
- When a seal leak occurs, install a new drive pinion seal and check the vent to make sure it is clean and free of foreign material.

Differential Seals

NOTICE: When installing shafts, do not allow splines to contact seals during installation or damage to the seals may occur.

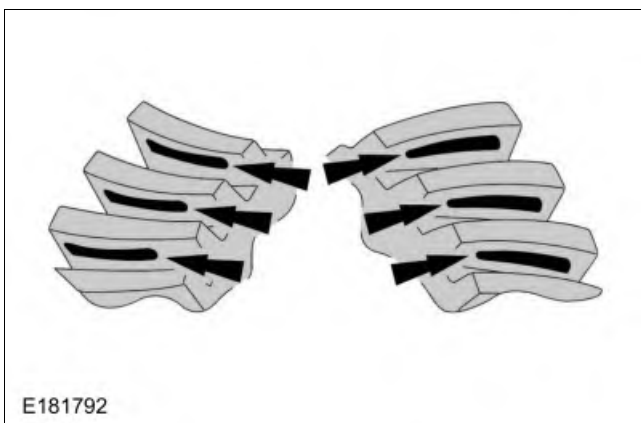
Halfshaft pilot bearing housing seals are susceptible to the same types of damage as drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

Contact Pattern

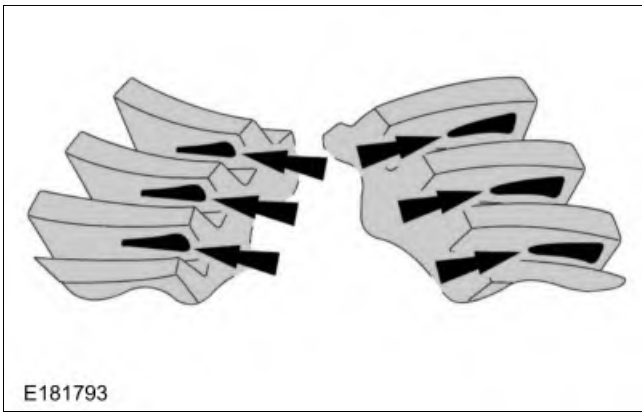
In general, desirable ring gear tooth patterns must have the following characteristics:

- Drive pattern on the drive side ring gear well centered on the tooth.
- Coast pattern on the coast side ring gear well centered on the tooth.
- Clearance between the pattern and the top of the tooth.
- No hard lines where the pressure is high.

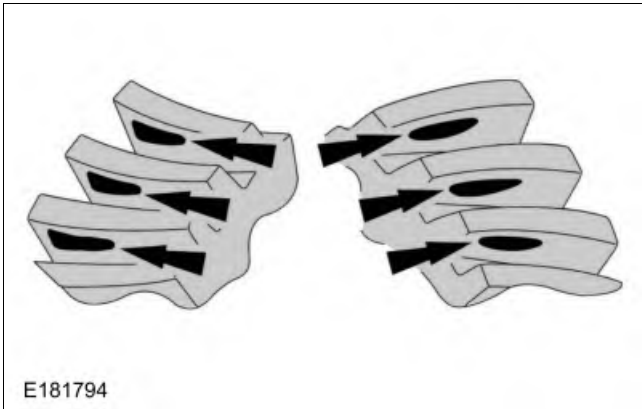
Acceptable ring gear tooth patterns for all axles.



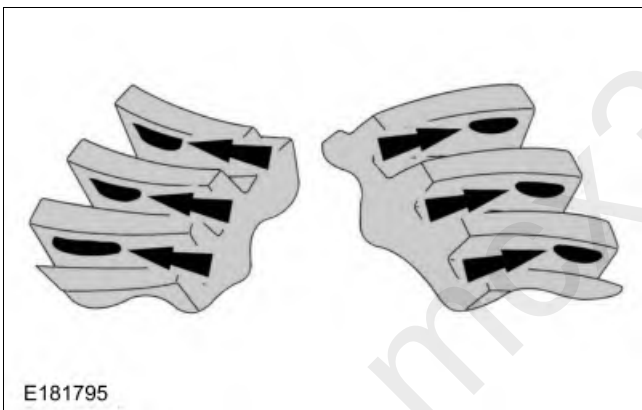
Correct backlash with a thinner pinion position shim required.



Correct backlash with a thicker pinion position shim required.



Correct pinion position shim that requires a decrease in backlash.



Correct pinion position shim that requires an increase in backlash.

