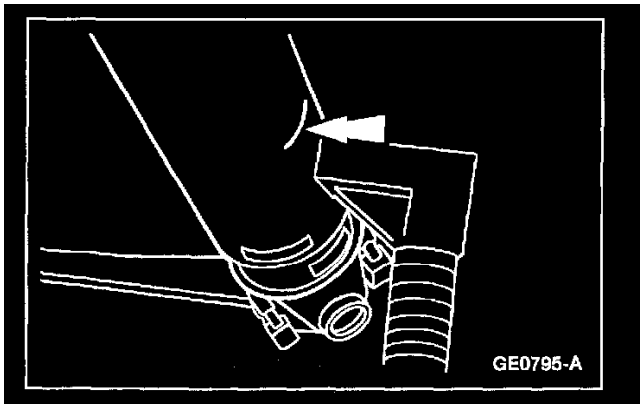
Differential Assembly: Testing and Inspection
Component Tests

Driveline Vibration
Driveline Vibration

NOTE: An analysis of driveline vibration can also be conducted using the Vibration Analyzer and following the manufacturer's directions.

Driveline vibration exhibits a higher frequency and lower amplitude than does high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is usually noticed at various speed ranges. Driveline vibration can be perceived as a tremor in the floor pan or is heard as a rumble, hum, or boom. Driveline vibration can exist in all drive modes, but may exhibit different symptoms depending upon whether the vehicle is accelerating, decelerating, floating, or coasting. Check the driveline angles if the vibration is particularly noticeable during acceleration or deceleration, especially at lower speeds. Driveline vibration can be duplicated by supporting the axle upon a hoist or upon jack stands, though the brakes may need to be applied lightly in order to simulate road resistance.

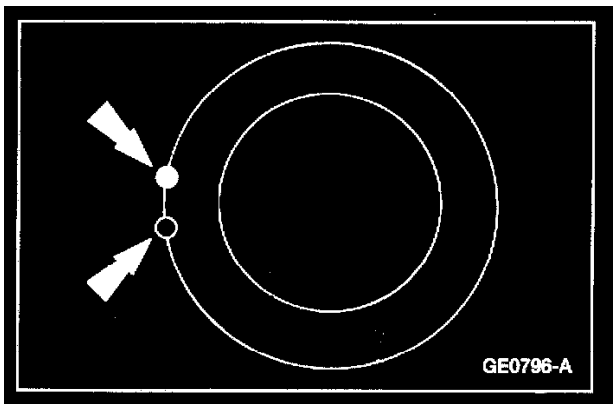
1. Raise the vehicle promptly after road testing. Use twin-post hoist or jack stands to prevent tire flat-spotting. Engage the drivetrain and accelerate to the observed road test speed to verify the presence of the vibration. If the vibration is not evident, check the non-driving wheels with a wheel balancer to rule out imbalance as a possible cause. If necessary, balance the non-driving wheels and repeat the road test. If the vibration is still evident, proceed to Step 2.
2. Mark the relative position of the drive wheels to the wheel bolts. Remove the wheels. Install all the wheel nuts in the reversed position (wheel nuts can be installed in their normal orientation on axles with dual rear wheels) and repeat the road speed acceleration. If the vibration is gone, refer to the tire and wheel runout procedure. If the vibration persists, proceed to Step 3.
3. Inspect the driveshaft(s) (for signs of physical damage, missing balance weight, undercoating, incorrect seating, wear and binding universal joints). Clean the driveshaft and install new universal joints or a driveshaft if damaged. Check the index marks (paint spots) on the rear of the driveshaft and pinion flange. If these marks are more than one quarter turn apart, disconnect the driveshaft and reindex it to align the marks as closely as possible. After any corrections are made, recheck for vibration at the road test speed. If the vibration is gone, reinstall the wheels and road test. If the vibration persists, proceed to Step 4.



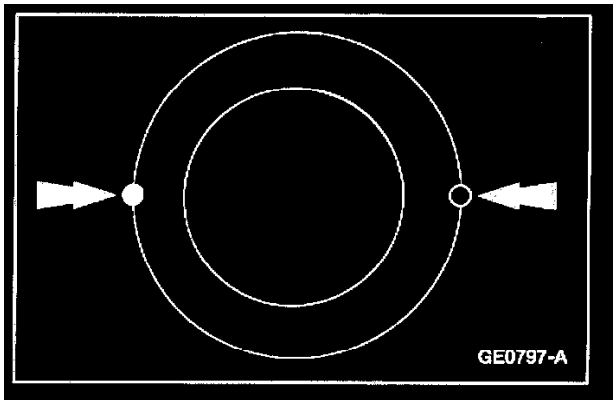
4. Raise the vehicle on a hoist and remove the wheels. Rotate the driveshaft by turning the axle and measure the runout at the front, the center, and the rear of the driveshaft with the indicator. If the runout exceeds **0.89 mm (0.035 inch)** at the front or center, install a new driveshaft. If the front and center are within this limit, but the rear runout is not, mark the rear runout high point and proceed to Step 5. If the runout is within the limits at all points, proceed to Step 7.

5. **NOTE:** Check the U-joints during re-indexing. If a U-joint feels stiff or gritty, install new U-joints.

   Scribe alignment marks on the driveshaft and the pinion flange. Disconnect the driveshaft, rotate it **one-half turn**, and reconnect it. Circular pinion flanges can be turned in **one-quarter** increments to fine tune the runout condition; half-round pinion flanges are limited to two positions. Check the runout at the rear of the driveshaft. If it is still over **0.89 mm (0.035 inch)**, mark the high point and proceed to Step 6. If the runout is no longer excessive, check for vibration at the road test speed. If vibration is still present, reindex the driveshaft slip yoke on the transmission output shaft **one-half turn** and road test the vehicle. If the vibration persists, proceed to Step 7.



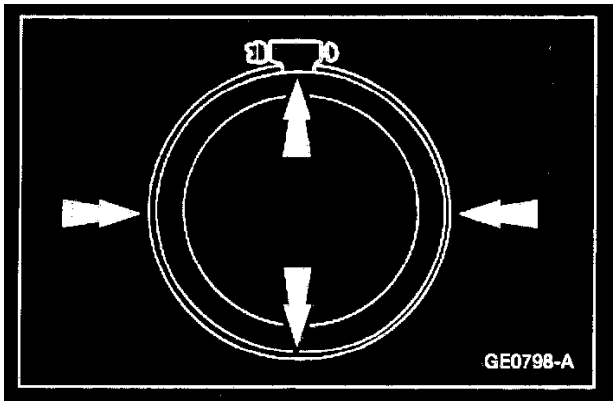
6. Excessive driveshaft runout may originate in the driveshaft itself or in the pinion flange. To determine which, compare the two high points marked in Steps 4 and 5. If the marks are close together, within about **25 mm (1 inch)**, install a new driveshaft and road test the vehicle.



If the marks are on opposite sides of the driveshaft, the pinion flange is responsible for the vibration.

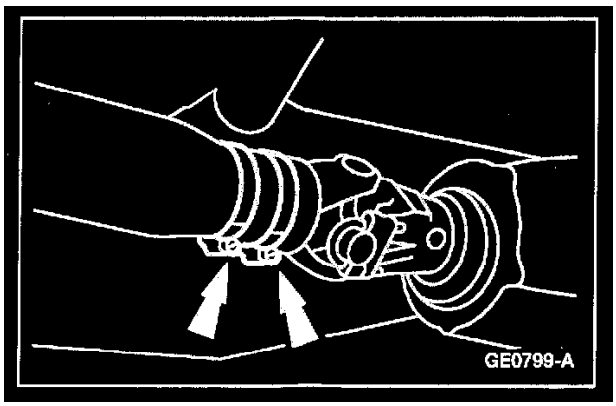
When installing a new pinion flange, the driveshaft runout must not exceed **0.89 mm (0.035 inch)**. When runout is within limits, recheck for vibration at road speed. If vibration persists, balance the driveshaft.

7. To balance the driveshaft, install one or two hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined by trial-and-error.

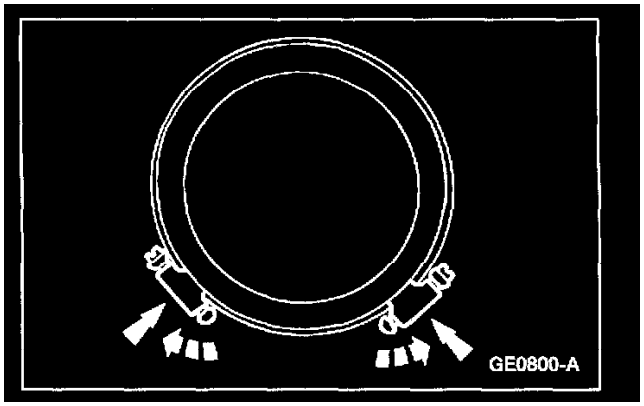


8. Mark the rear of the driveshaft into four approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No.1.

Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If two adjacent positions show equal improvement, position the clamp head between them.



9. If the vibration persists, add a second clamp at the same position and recheck for vibration.



If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 8. Separate the clamp heads about **13 mm (1/2 inch)** and recheck for vibration at the road speed.

Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

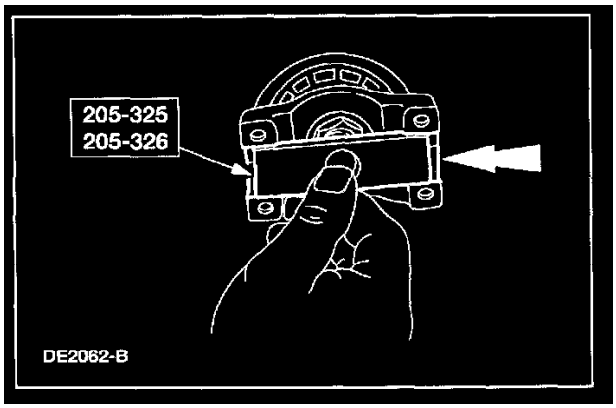
10. Install the wheels and road test (vibration noticeable on the hoist may not be evident during the road test). If the vibration is still not acceptable, install a new axle driveline vibration damper first, if so equipped. If the vibration is still not acceptable, refer to differential case and ring gear runout checks.

Runout Check - Half-Round Companion Flange (Ford Axles Only)

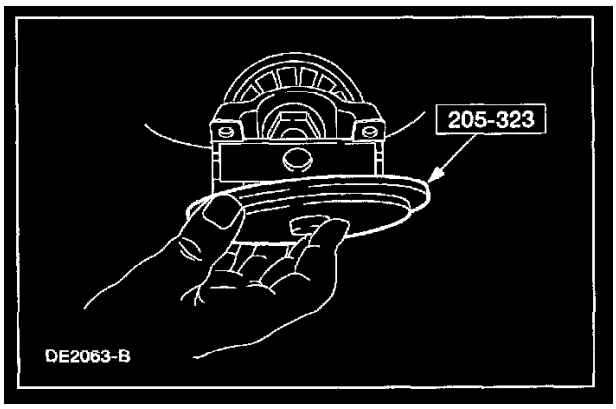
Runout Check - Half-Round Companion Flange (Ford Axles Only)

CAUTION: Pinion bearing preload must be reset if the pinion nut has been loosened or removed.

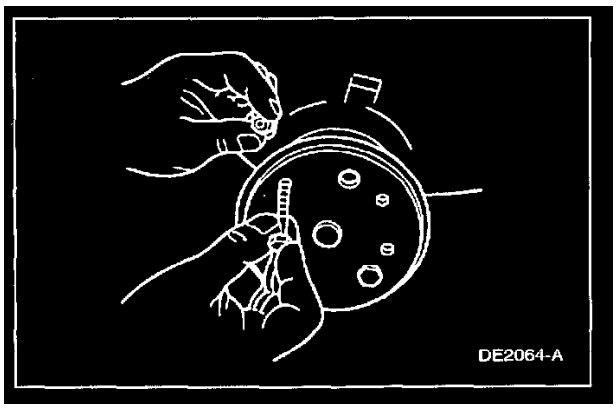
1. Raise the vehicle on a twin-post hoist that supports the rear axle.
2. Remove the driveshaft.
3. Check the pinion flange for damage.



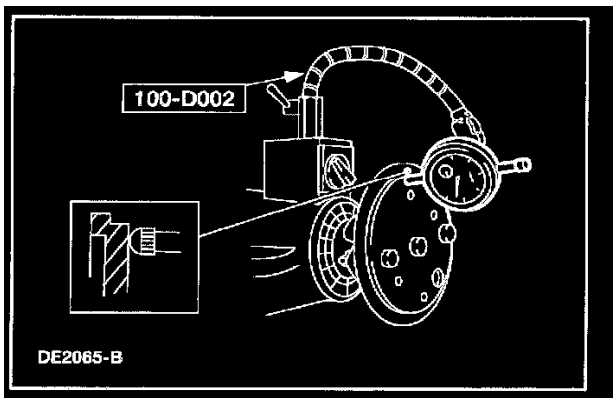
4. Insert the correct size special tool.



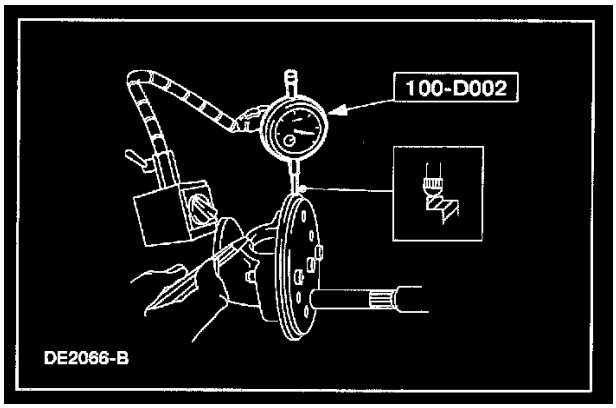
5. Position the special tool on the pinion flange.



6. Align the holes on the gauge with the holes in the pinion flange and install the bolts and nuts.
7. **NOTE:** Accurate tool setup will result in accurate final readings.



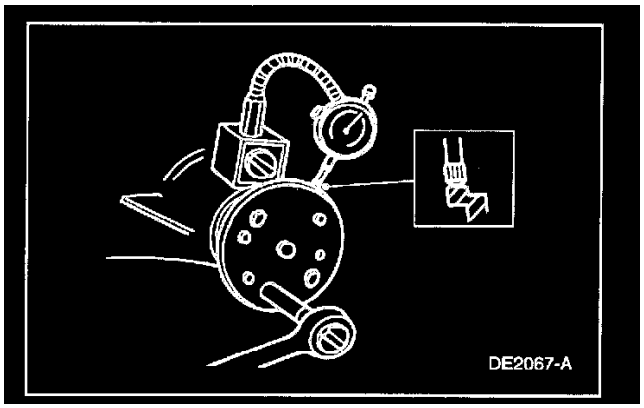
Position the special tool as shown. Adjust and lightly tighten the mounting bolts and nuts so the gauge runout is **0.254 mm (0.010 inch)** or less.



8. Position the special tool on the edge of the gauge. Turn the drive pinion runout gauge, and locate and mark the high spot on the pinion flange

with yellow paint.

If the flange runout exceeds **0.25 mm (0.010 inch)**, remove the pinion flange, reindex the flange **one-half turn** on the pinion, and reinstall it.



9. Check the runout again. If necessary, reindex the flange until an acceptable runout is obtained. If the flange runout is still **more than 0.25 mm (0.010 inch)**, install a new pinion flange.
10. If excessive runout is still evident after installing the new pinion flange, install a new ring and pinion. Repeat the above checks until the runout is within specifications.
11. Install the driveshaft.

Differential Check - Traction-Lok(R) Road Test (Ford)

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1. Place one wheel on a dry surface and the other wheel on ice, mud or snow.
2. Gradually open the throttle to obtain maximum traction prior to break away. The ability to move the vehicle demonstrates correct operation of a Traction-Lok(R) rear axle assembly.
3. When starting with one wheel on an excessively slippery surface, a slight application of the parking brake may be necessary to help energize the Traction-Lok(R) feature of the differential. Release the brake when traction is established. Use light throttle on starting to provide maximum traction.
4. If, with unequal traction, both wheels slip, the limited slip rear axle has done all it can possibly do.
5. In extreme cases of differences in traction, the wheel with the least traction may spin after the Traction-Lok(R) has transferred as much torque as possible to the non-slipping wheel.

Differential Check - Tractech(R) Truetrac(R) (Dana)

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1. Shift the transmission into NEUTRAL.
2. Raise and support the vehicle.
3. Spin either rear wheel.
   - Both wheels must spin with a fluid motion. Any feeling of gripping and release/roughness indicates that additional inspection of the axle assembly is necessary.
4. Shift the transmission into gear.
5. Spin either rear wheel.
   - The other wheel must spin with a fluid motion in the opposite direction and at the same speed of the wheel being spun. Any feeling of gripping and release/roughness indicates that further inspection of the axle assembly is necessary.

Differential Check - Trac-Lok(R) Road Test (Dana)

Differential Check - Trac-Lok(R) Road Test (Dana)

1. Drive the vehicle for at least **ten miles** to warm up the axle lubricant.
   - More miles may be necessary depending on the outside temperature.
2. Drive the vehicle in a tight circle for five minutes and then in the opposite direction for another five minutes.
3. Make a minimum of ten figure-eight turns.
4. If chatter is still present, drain and refill the axle with the specified type and amount of lubricant and friction modifier. For additional information, refer to Specifications.
5. Carry out the road test again.
   - There might be a slight chatter. If the chatter persists after **160 km (100 miles)** of vehicle operation, install a new differential.

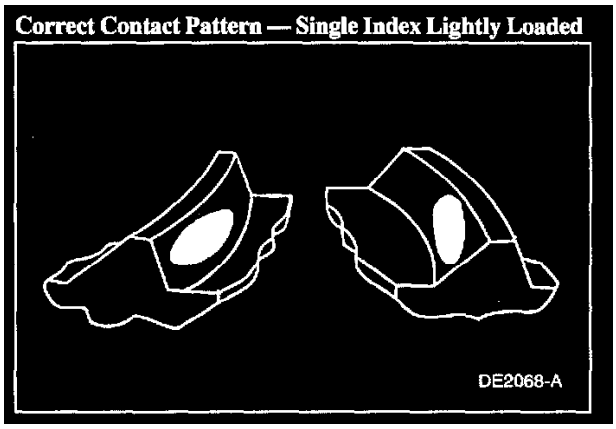
Tooth Contact Pattern Check

Tooth Contact Pattern Check - Gearset, Dana S135

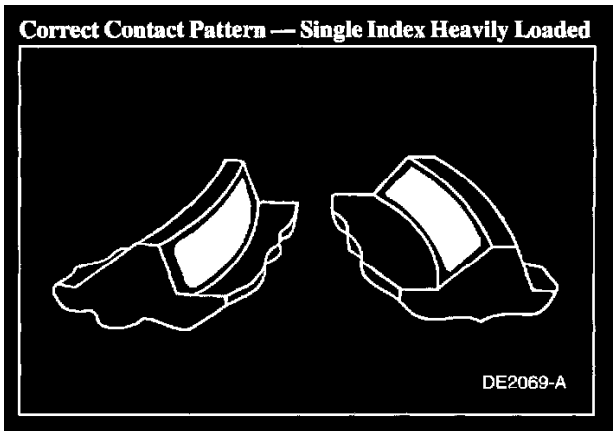
1. **CAUTION:** If reusing the differential ring gear and pinion, measure and record the backlash before disassembly. Reassembling the differential ring gear and pinion to the recorded backlash will match the established wear patterns. Hand- rolled patterns will cover less area than the

established patterns.

Paint one quarter of both the drive and the coast side of the differential ring gear with marking compound.



Correct Contact Pattern - Single Index Lightly Loaded



Correct Contact Pattern - Single Index Heavily Loaded

2. While applying a load, rotate the differential ring gear one complete revolution.
3. Verify the contact pattern is correct.
   - Tooth contact pattern can move only by adjusting backlash. Tooth contact pattern can move only in the direction of heel-to-toe, and toe-to-heel. Depth of the tooth contact pattern is not adjustable. Contact Spicer Service at 1-800-666-8688 for assistance if you are unable to establish an acceptable tooth contact pattern within the limits of backlash.

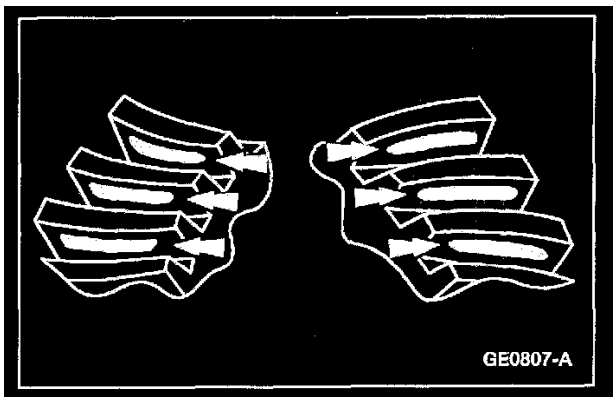
Tooth Contact Pattern Check - Gearset, Except Dana S135

1. To check the gear tooth contact, paint the gear teeth with the special marking compound. A mixture that is too wet will run and smear; a mixture that is too dry cannot be pressed out from between the teeth.
2. Use a box wrench on the ring gear bolts as a lever to rotate the differential ring gear several complete revolutions in both directions or until a clear tooth contact pattern is obtained.
3. Certain types of gear tooth contact patterns on the differential ring gear indicate incorrect adjustment. Incorrect adjustment can be corrected by readjusting the differential ring gear or the pinion.

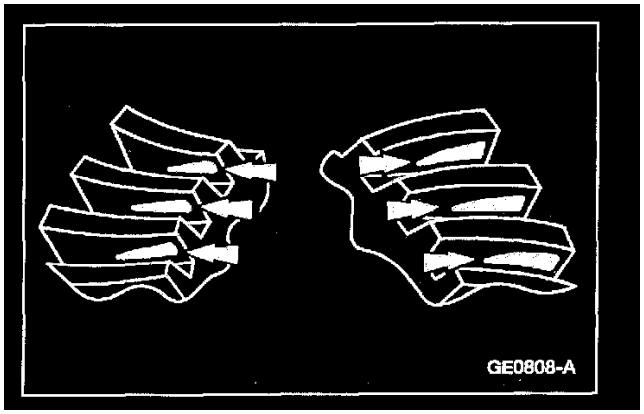
Contact Pattern Location - Except Dana S135

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

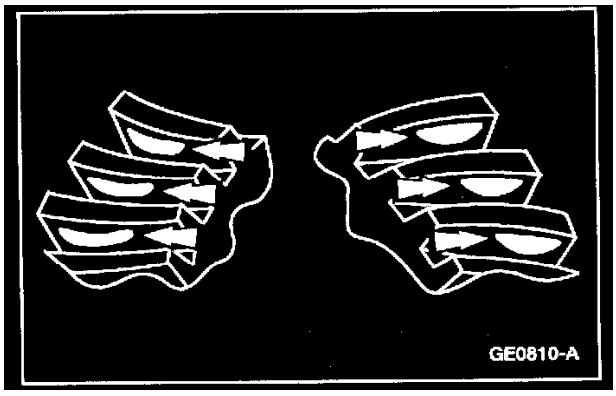
- Drive pattern on the drive side differential ring gear well centered on the tooth.
- Coast pattern on the coast side differential ring gear well centered on the tooth.
- Clearance between the pattern and the top of the tooth.
- No hard lines where the pressure is high.



Acceptable differential ring gear tooth patterns for all axles.



Correct backlash with a thicker pinion position shim as necessary.



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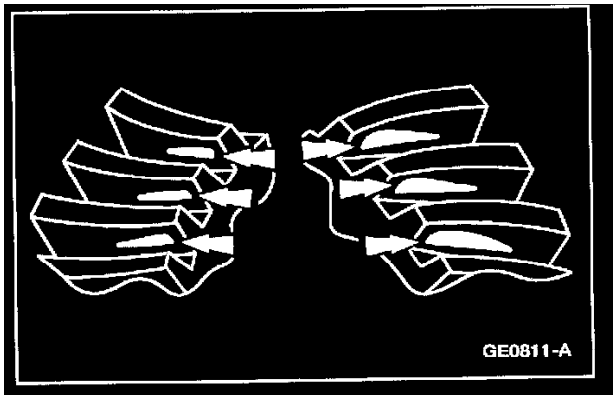
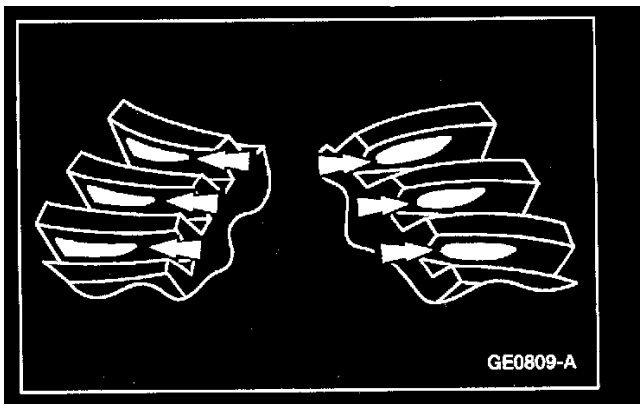


Correct pinion position shim that requires a decrease in backlash.



Correct pinion position shim that requires an increase in backlash.