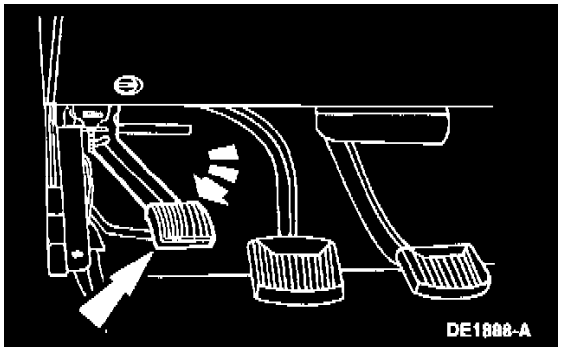
Differential Assembly: Service and Repair
Rear Drive Axle/Differential-Dana S135

Removal and Installation
Axle Assembly

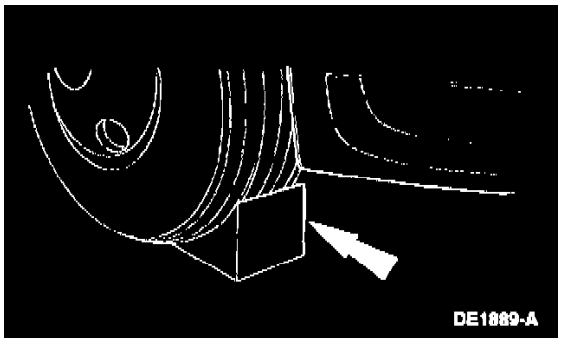
Special Tools

Special Tool(s)

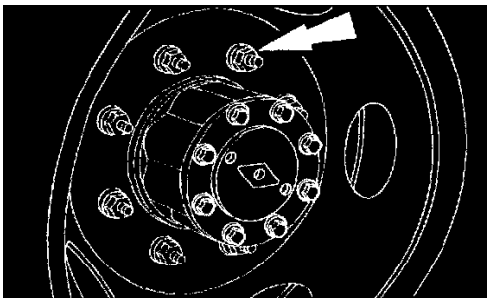
Removal



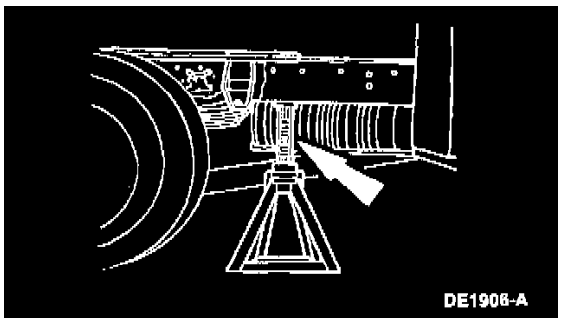
1. Set the parking brake.



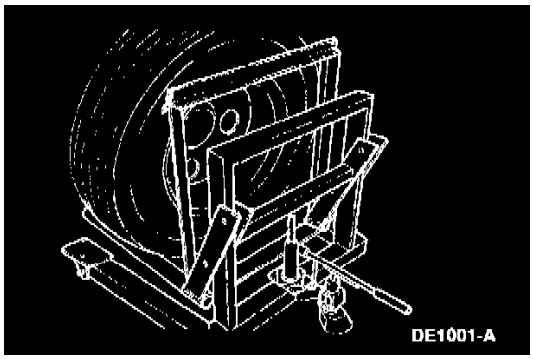
2. Chock the front wheels.



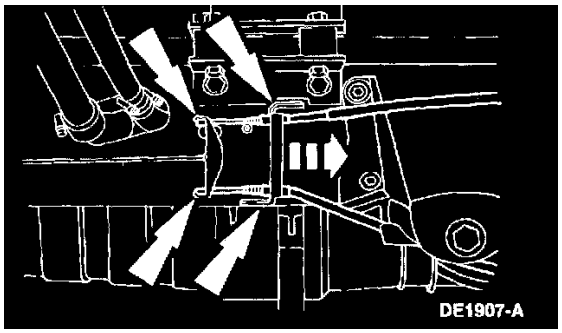
3. Loosen, but do not remove, the rear wheel lug nuts.



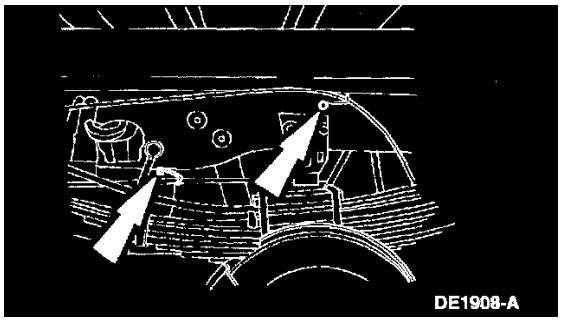
4. Raise and support the rear of the vehicle high enough so that it will clear the axle assembly when removing it.



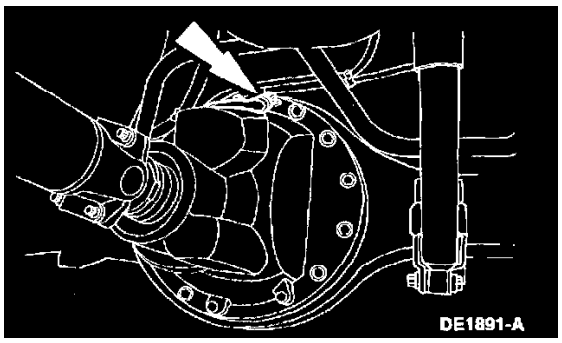
5. Remove the rear wheels using the Wheel Dolly.



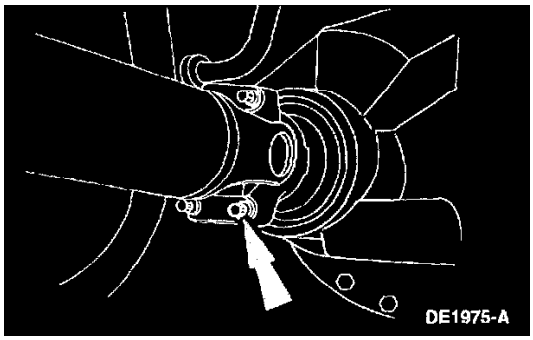
6. Release the parking brake cable tension, and disconnect the cables at the equalizer and the anchor plate.



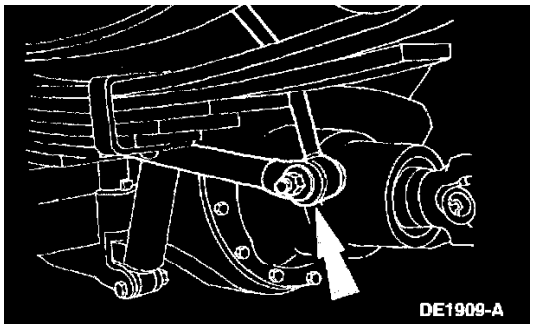
7. Remove the frame anchors, and position the parking brake cables aside.



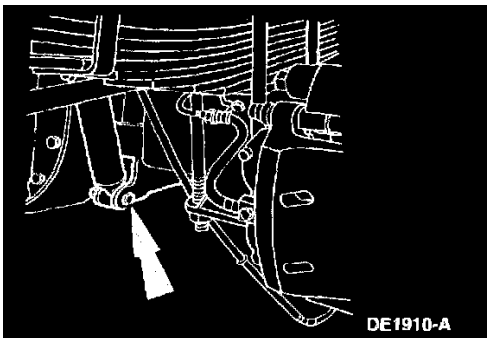
8. Disconnect the rear anti-lock brake sensor electrical connector. Release the harness clips and position the harness aside.



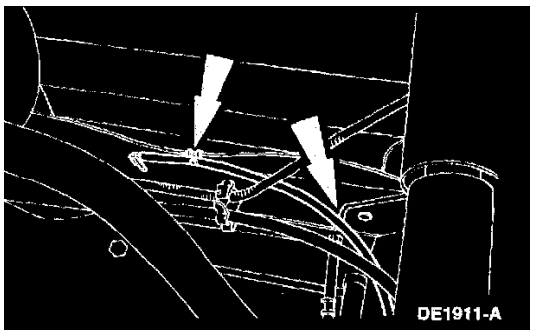
9. Index and disconnect the driveshaft, and position it aside.



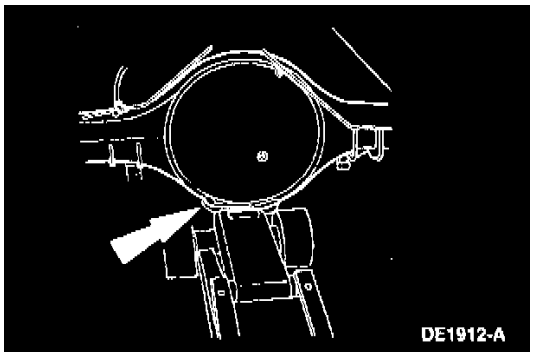
10. Disconnect the sway bar at the sway links.



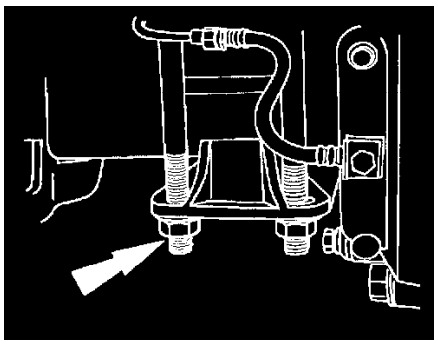
11. Disconnect the shock absorbers at the axle.



12. Disconnect the hydraulic brake hose and axle vent hose at the crossmember. Plug the brake hose and brake line, and position the hoses aside.

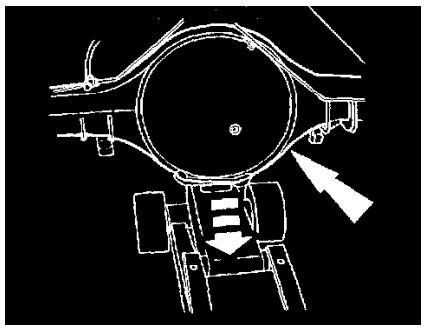


13. Support the axle with a suitable floor jack.



14. **NOTE:** Mark the front of each spring seat cap for proper orientation during installation.

    Remove the U-bolt nuts, the spring seat caps and the U-bolts.



15. **WARNING: Watch for obstructions while lowering and removing the axle.**

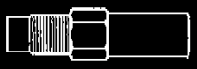
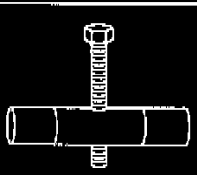
    Carefully lower the axle and remove it.

Installation

1. Follow the removal procedure in reverse order.
2. Bleed the brakes.
3. Make sure the axle lubricant level is proper.

Drive Pinion

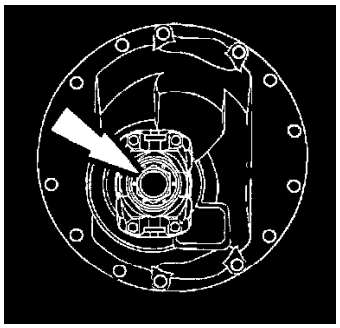
Drive Pinion

 ST2225-A	Pinion Seal Installer Set 205-S438 (Pinion Seal Driver Tube 205-440, Pinion Seal Driver 205-439)
 ST2226-A	Yoke Installer 205-S434 (Yoke Installer Thread Sleeve 205-436, Yoke Installer Tube 205-435, Yoke Installer Drive Nut 205-437)
 ST2224-A	Yoke Remover 205-433

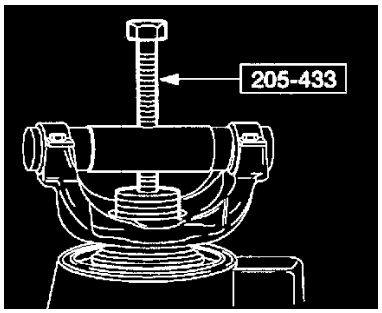
Special Tools

Special Tool(s)

Disassembly

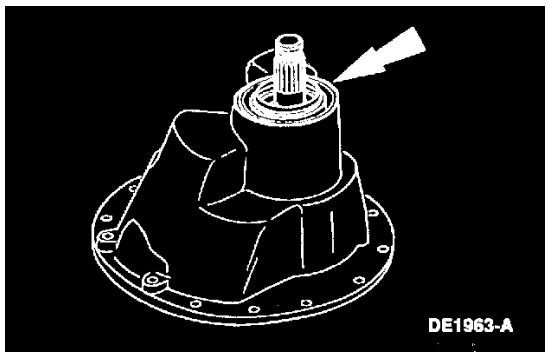


1. Remove the hex nut.

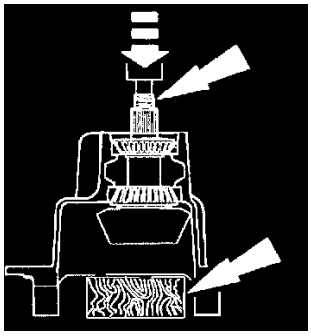


2. **CAUTION:** Hammering on the pinion flange will close in the bearing bores and misalign the flange lugs. This will result in premature failure of the journal needle bearings/other driveline components. Serious damage will also occur internally to the differential ring gear and pinion set/pinion bearings by hammering on external parts.

   Using the special tool, remove the pinion flange.



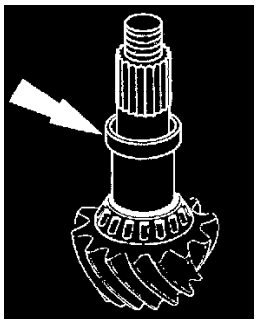
3. Remove the pinion seal.



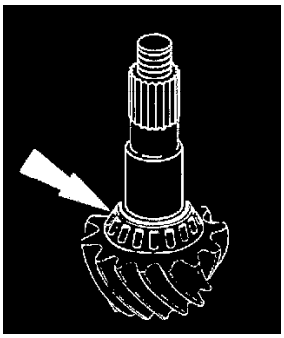
4. **CAUTION:** Position a block of wood under the pinion to avoid damage to the gear teeth.

   NOTE: The outer bearing is press fit.

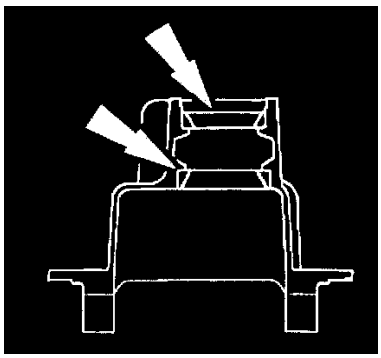
   Press the pinion through the outer pinion bearing, and remove the pinion.



5. Remove the pinion preload spacer.
   - Measure and record the spacer thickness. Set the spacer aside for use in assembly.



6. If reusing the gear set, remove the inner pinion bearing with a suitable puller.



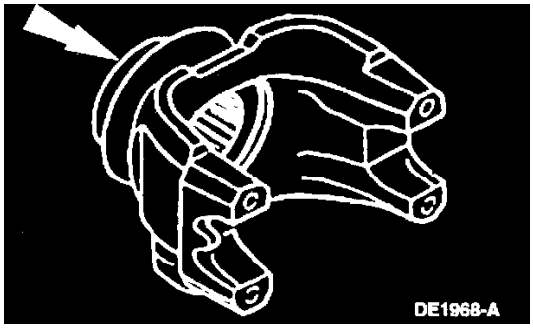
7. If discarding the pinion bearings, remove the outer and inner pinion bearing cups.
8. **CAUTION:** Alkaline cleaning solutions will damage machine surfaces. Use only emulsion cleaners or petroleum based cleaning solvent.

   CAUTION: Use soft, clean, listless towels to dry the components.

   CAUTION: Never spin-dry bearings with compressed air. This will damage the mating surfaces due to a lack of lubrication.

   CAUTION: After drying, lightly coat the parts with rust inhibitor or clean lubricant to prevent damage from corrosion. Wrap all parts that are going to be in storage for a prolonged period in wax paper.

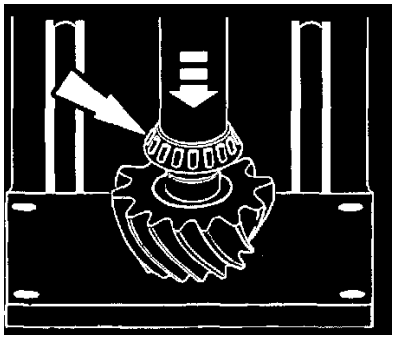
   Clean and dry the components as necessary.



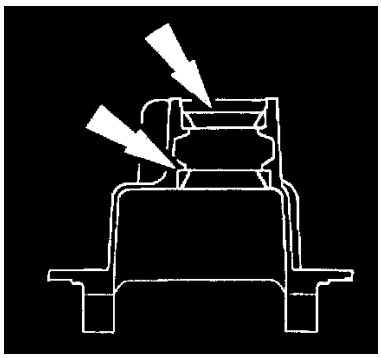
9. Inspect the pinion flange for grooves in the sealing surface caused by contamination.
   - If grooves are detectable with a fingernail, repair the flange with a CR approved sleeve or install a new flange.

Assembly

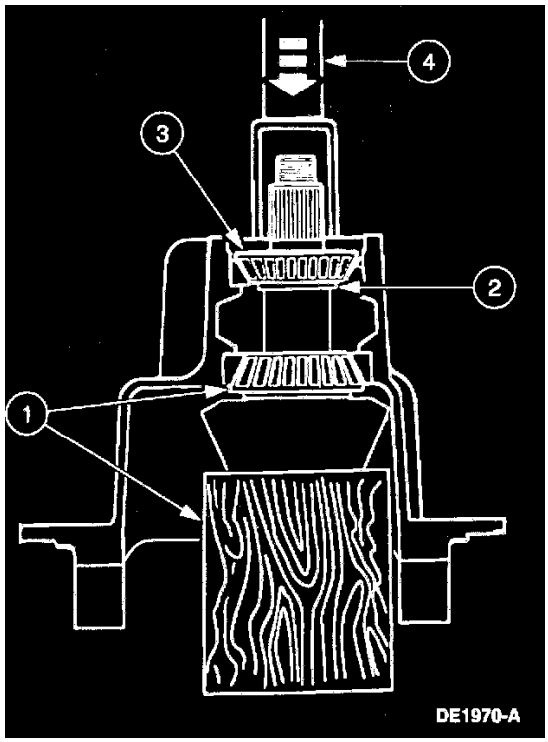
Initial Assembly



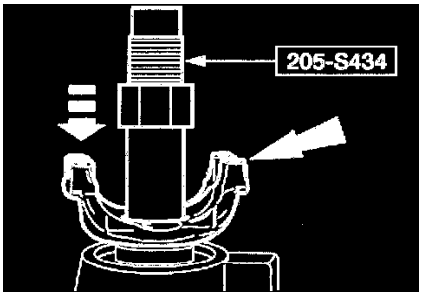
1. Press the inner pinion bearing onto the pinion.



2. Press the inner and outer pinion bearing cups into the carrier until seated.
   - Use a **0.0381 mm (0.0015 inch)** feeler gauge to verify the bearing cups have completely seated in the bearing bores.
   - Lubricate the bearing cups and cone.

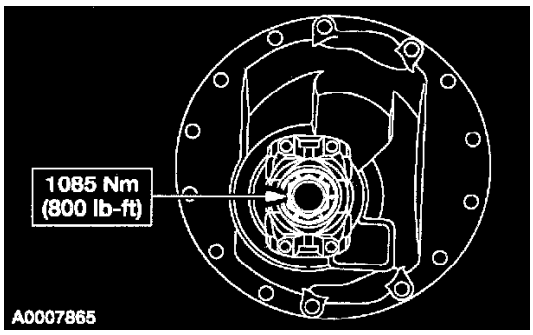


3. Seat the outer pinion bearing on the pinion.
   1 Seat the inner pinion bearing into the cup by positioning a **152.4 x 152.4 x 152.4 mm (6 x 6 x 6 inch)** block of-wood under the pinion.
   2 Place the original pinion preload spacer onto the pinion.
   3 Place the outer pinion bearing onto the pinion.
   4 Using a suitable press, seat the outer bearing on the pinion.

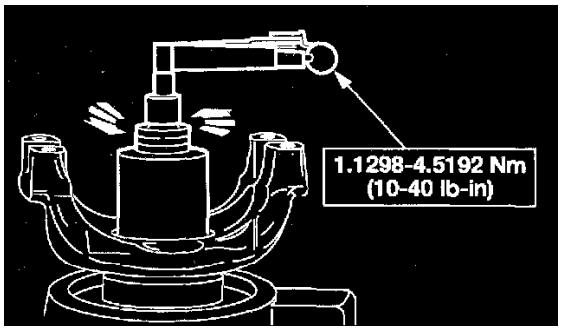


4. **NOTE:** Do not install the pinion seal at this time.

   Using the special tool, install the pinion flange.

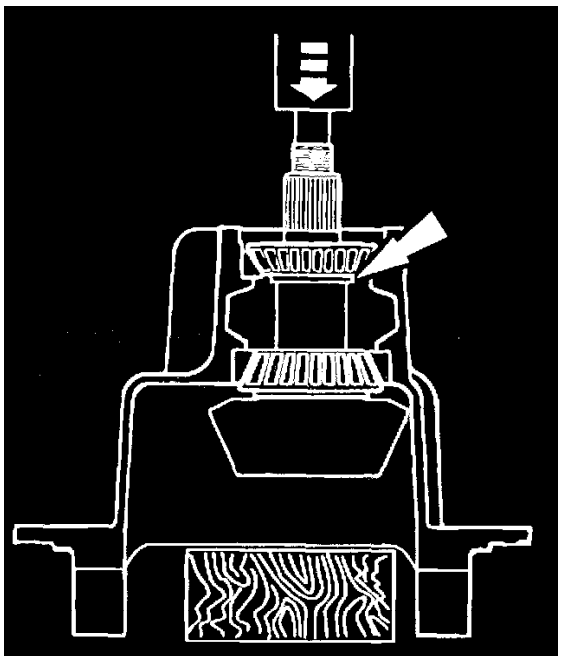


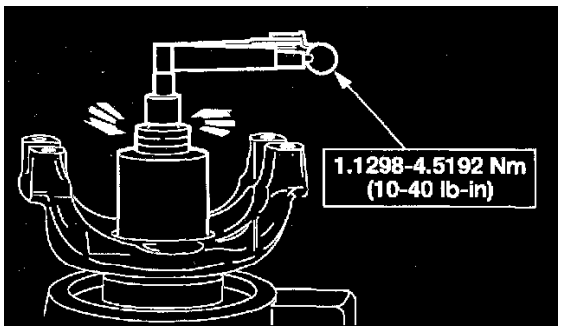
5. Install the hex nut.
   - Using a suitable torque multiplier, tighten the hex nut.



Measuring pinion bearing preload torque

6. Measure the torque to rotate.
   - Take torque measurements every fourth revolution.
   - Proceed to Pinion bearing preload adjustment in this procedure if the bearing preload torque is not within the specifications. Proceed to Final assembly in this procedure if the bearing preload torque is within the specifications.

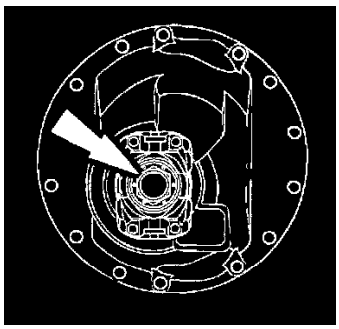




Pinion bearing preload adjustment

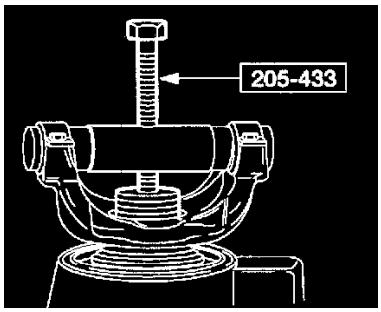
7. **NOTE:** Also refer to the following illustration.

   Adjust the pinion bearing preload by installing a new pinion bearing preload spacer.
   - To increase the preload, install a thinner spacer. To decrease the preload, install a thicker spacer.
   - The pinion bearing preload spacers are available in sizes from **7.26 to 8.00 mm (0.286 to 0.315 inch)**.
   - Always measure the new spacer before installing it.
   - On a flat surface, sand the next thicker size spacer with emery cloth to the required thickness to obtain a closer adjustment. Thoroughly wash the spacer to remove the emery cuttings before installation.
   - A **0.0254 mm (0.001 inch)** change in the spacer thickness will change the torque rate approximately **3.3894 Nm (30 inch lbs.).**
   - Repeat Measuring pinion bearing preload torque and Pinion bearing preload adjustment in this procedure until the rotational torque is within specifications.



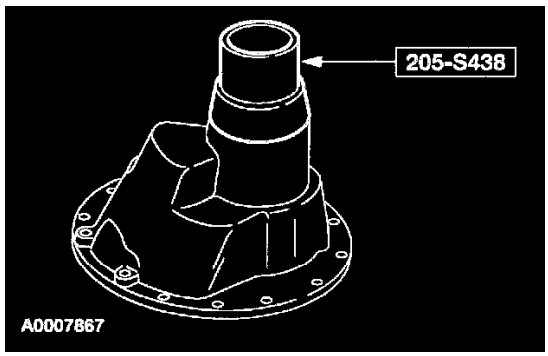
Final assembly

8. Using a suitable torque multiplier, remove the hex nut.

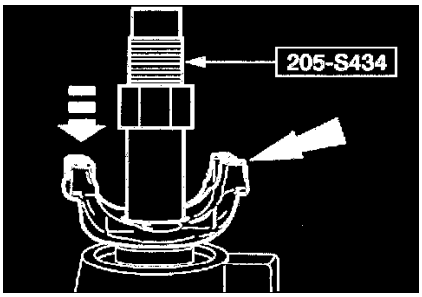


9. **CAUTION:** Hammering on the pinion Range will close in the bearing bores and misalign the flange lugs. This will result in premature failure of the journal needle bearings/other driveline components. Serious damage will also occur internally to the differential ring gear and pinion set/pinion bearings by hammering on external parts.

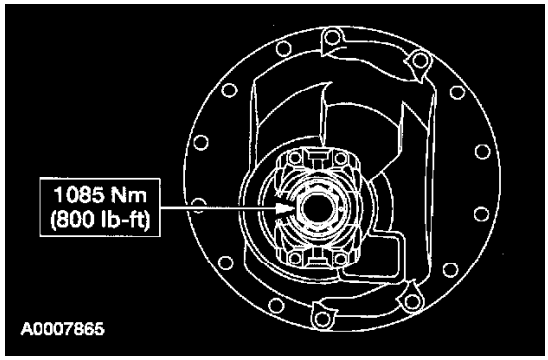
   Using the special tool, remove the pinion flange.



10. Using the special tool, install the pinion seal.
    - A rotational torque of **1.6947 - 5.0841 Nm (15 - 45 inch lbs.)** is acceptable with the pinion seal installed.



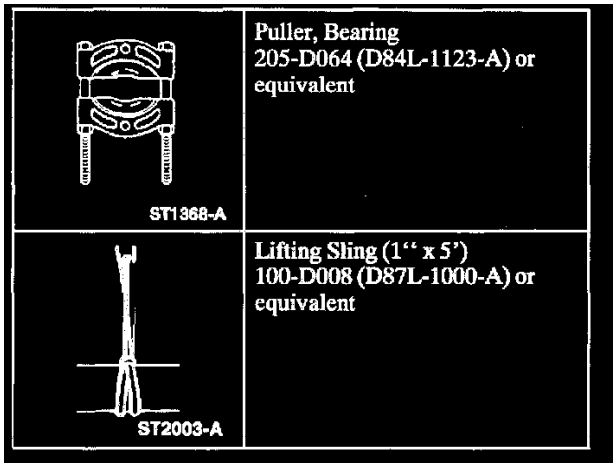
11. Using the special tool, install the pinion flange.



12. Apply Stud and Bearing Mount EOAZ-19554-BA or equivalent meeting Ford specification WSK-M2G349-A1 to the pinion threads, and install a new hex nut.
    - Using a suitable torque multiplier, tighten the nut.
13. Assemble the carrier.

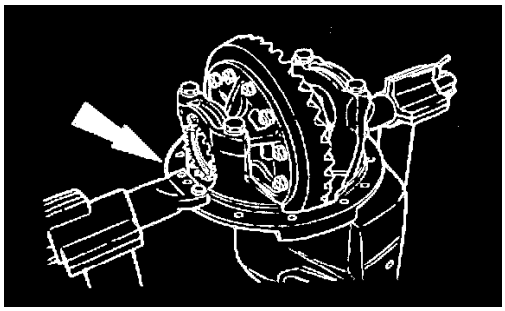
Differential Case and Ring Gear

Differential Case and Ring Gear

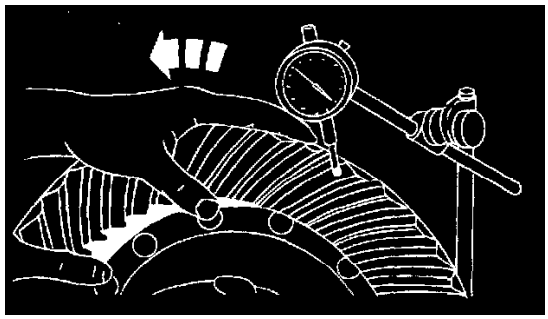


Special Tool(s)

Disassembly

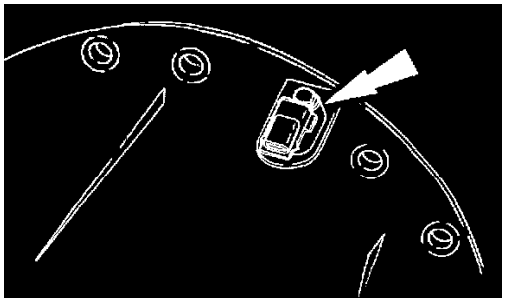


1. Mount the carrier housing in a suitable repair stand.

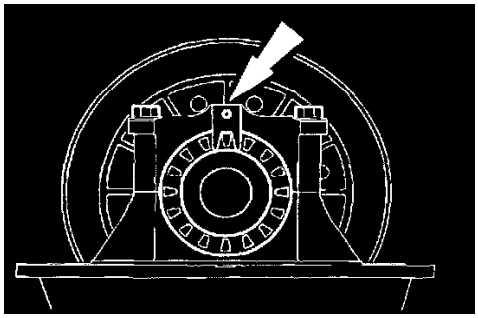


2. **CAUTION:** If reusing the differential ring gear and pinion measure and record the backlash before disassembly. Re-assembling the differential ring gear and pinion to the recorded backlash will match the established wear patterns. Hand rolled patterns will cover less area than the established patterns.

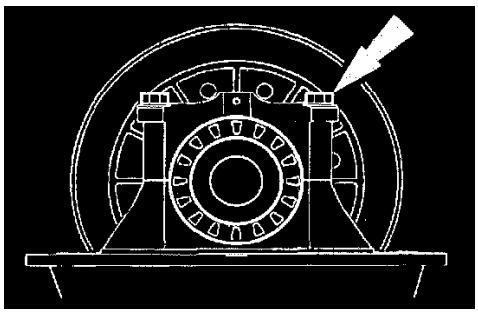
   Measure and record the differential ring gear and pinion backlash.
   - Check the backlash in four equally spaced positions around the differential ring gear.
     The acceptable backlash tolerance is **+ 0.0508 mm (0.002 inch)** from the backlash etched in the differential ring gear.
   - The tooth contact pattern can move only by adjusting backlash. The 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.



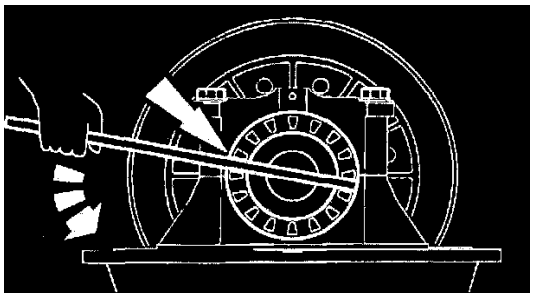
3. Remove the rear anti-lock brake sensor.



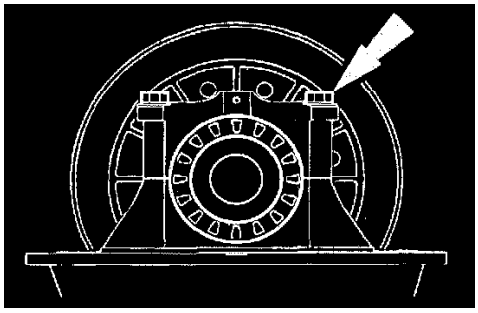
4. Remove the adjusting ring locks (4143).



5. Loosen, but do not remove, the four bolts.

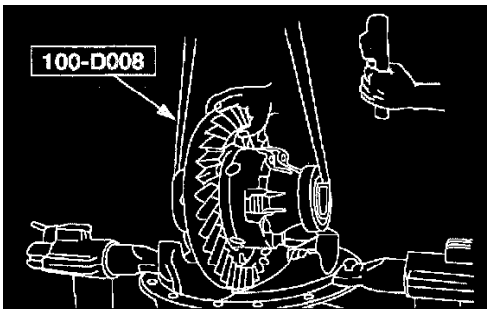


6. Relieve the bearing preload.
   - Loosen each differential bearing adjusting ring.



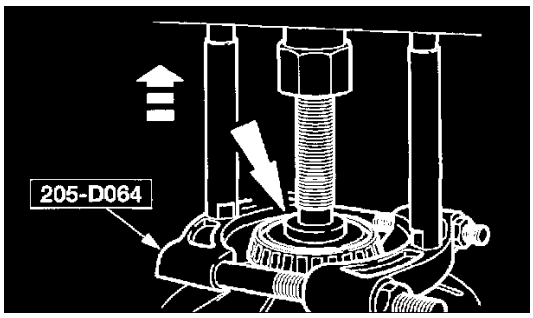
7. **NOTE:** The differential bearing caps are match marked at the factory.

   Remove the bolts, bearing caps and adjusting rings.

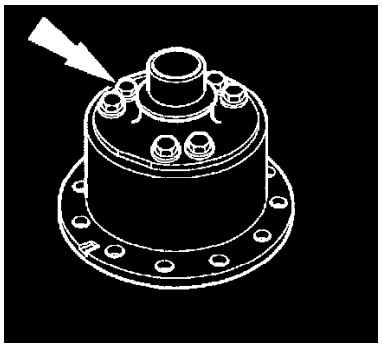


8. **CAUTION:** Do not damage the differential ring gear and pinion.

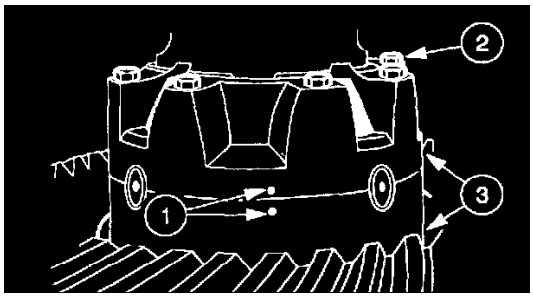
   Using the special tool, carefully lift the differential subassembly out of the carrier.



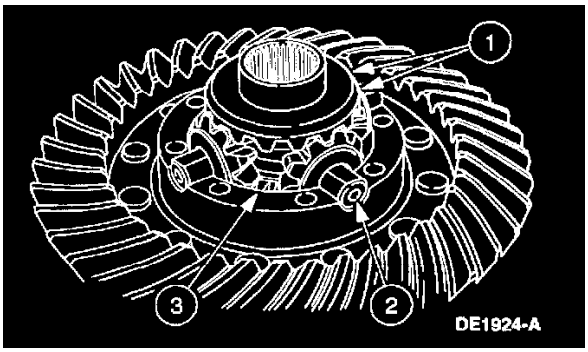
9. Using the special tool, and a suitable puller, remove the differential side bearings if worn/damaged.



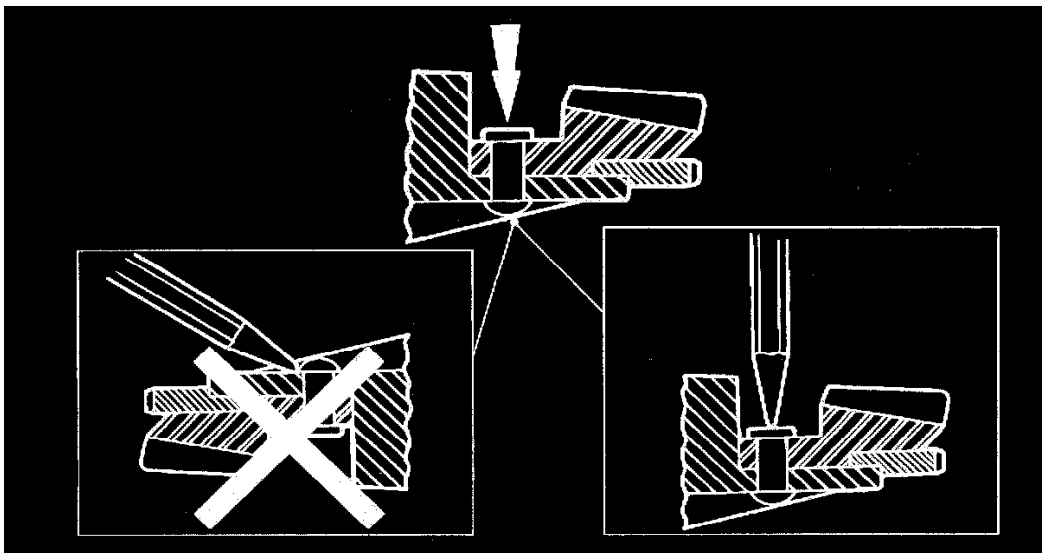
10. The Truetrac differential assembly is non-repairable. Discard the entire assembly if it is worn/damaged.



11. On the conventional differential assembly separate the differential case halves.
    1 Match mark the case halves.
    2 Remove the bolts.
    3 Separate the case halves.



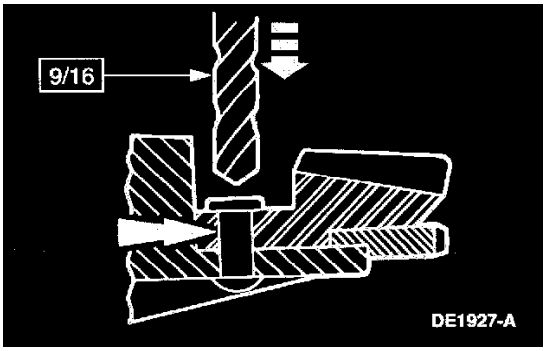
12. On the conventional differential assembly, remove the gear assembly.
    1 Remove the thrust washer and differential side gear.
    2 Remove the differential cross shaft with the pinion mates and the thrust washers.
    3 Remove the differential side gear and thrust washer.



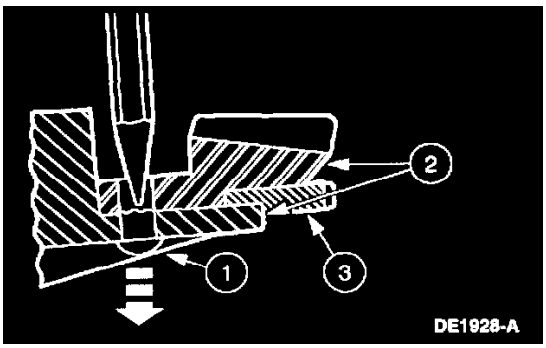
13. **CAUTION:** Do not use a chisel to remove the rivet heads. This will damage the differential case.

    CAUTION: Use a soft hammer to strike the punch.

    If discarding the pinion/differential ring gear, carefully center punch each differential ring gear rivet.



14. Drill the rivet heads to the depth shown using the specified size drill bit.



15. Separate the differential ring gear from the case.

    1 **CAUTION:** Use a soft hammer to strike the punch.

    Drive out the remaining rivet portions with a rounded type punch.
    2 Separate the differential ring gear from the case.

    3 **CAUTION:** Discard the anti-lock speed sensor ring (4B409) if separating it from the case half.

    If necessary, remove the anti-lock speed sensor ring and discard it.

16. **CAUTION:** Alkaline cleaning solutions will damage machine surfaces. Use only emulsion cleaners or petroleum based cleaning solvent.

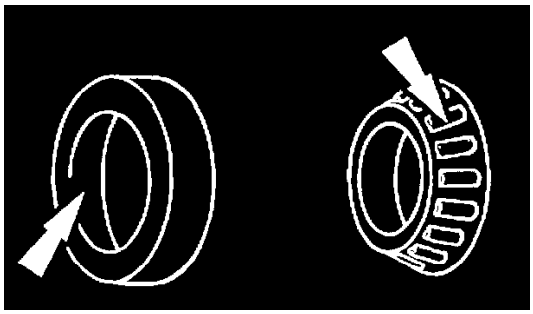
    CAUTION: Use soft, clean, lintless towels to dry the components.

CAUTION: Never spin-dry bearings with compressed air. This will damage the mating surfaces due to a lack of lubrication.

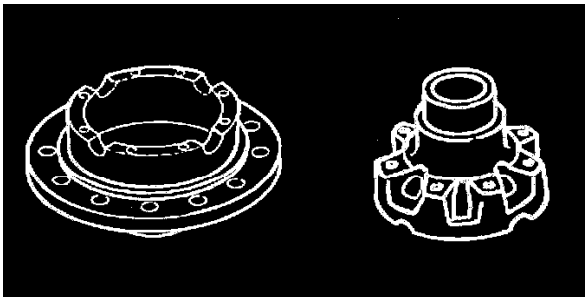
CAUTION: After drying, lightly coat the parts with rust inhibitor or clean lubricant to prevent damage from corrosion. Wrap all parts that are going to be in storage for a prolonged period in wax paper.

NOTE: For Truetrac differentials, submerge the entire differential assembly in a suitable solvent to wash away contaminants from within the housing.

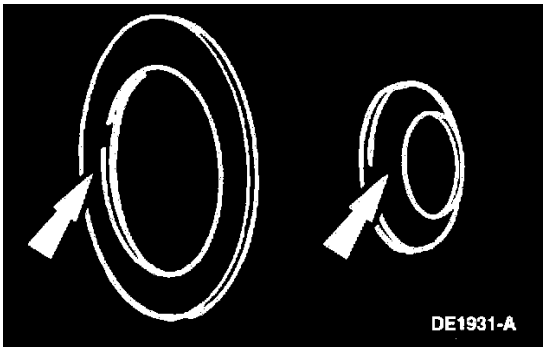
Clean and dry the components.



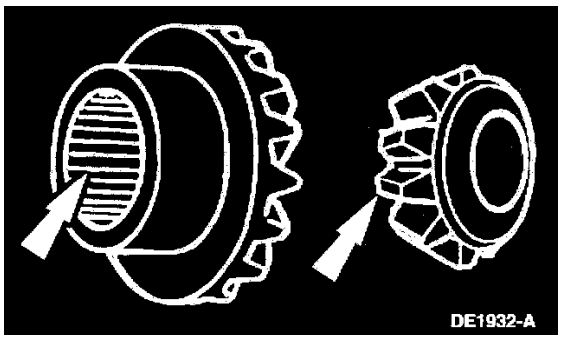
17. Inspect the bearing surfaces for pitting, wear and overheating.



18. Inspect the following:
    - the differential case machine surfaces.
    - the differential ring gear mounting holes for deformities, such as egg shaping.
    - all surfaces for nicks and cracks.

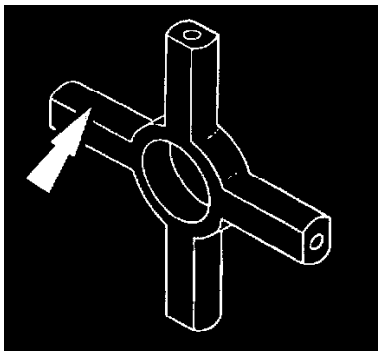


19. Inspect the thrust washers for scoring and cracking.



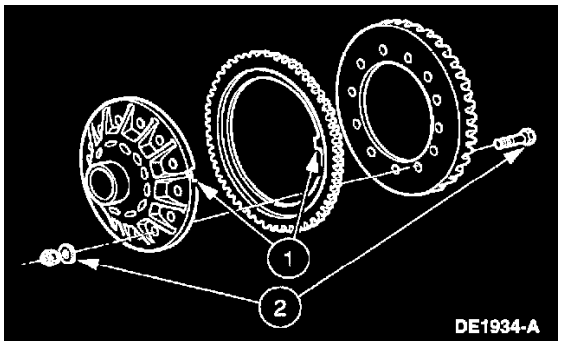
20. **CAUTION:** Discard all gears in sets if one or more sustains wear/damage.

    Inspect the gears for pitting, scoring, wear and damage.

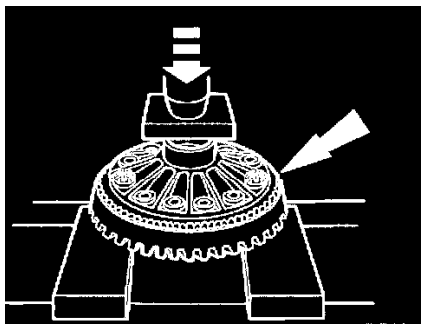


21. Inspect the shafts for nicks and scores.
22. Refer to Drive Pinion if disassembly is necessary.

Assembly

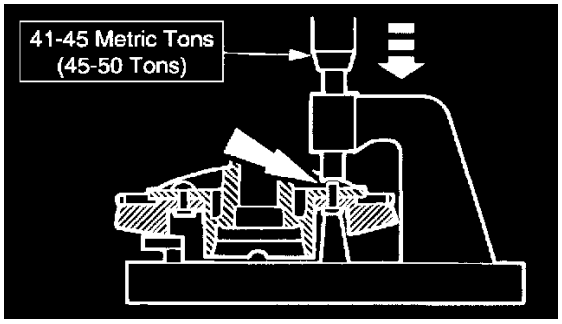


1. Assemble the differential ring gear and, if removed, a new anti-lock speed sensor ring to the differential case.
   1 Align the tab on the sensor ring with the notch in the case flange.
   2 Bolt the differential ring gear to the case in three places, 120 degrees apart.



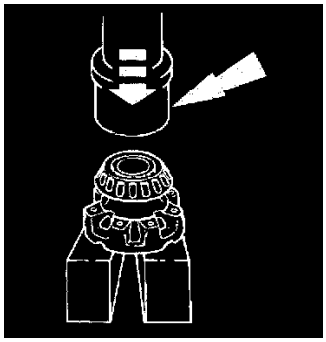
2. **NOTE:** Proceed to the next step of this procedure if not installing a new anti-lock speed sensor ring.

   Press the anti-lock speed sensor ring on the case flange.



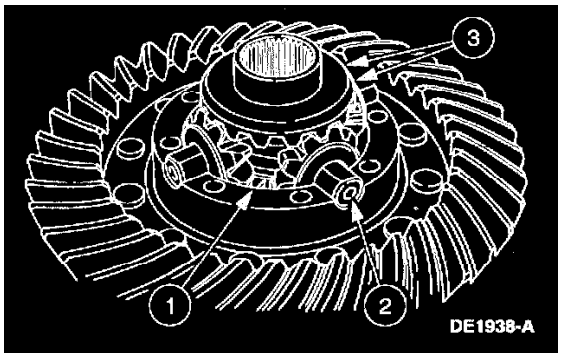
3. **CAUTION:** Compress the rivet before removing the bolts from the differential ring gear and case to prevent differential ring gear runout.

   Install each rivet, using a suitable hydraulic or mechanical press and riveting fixture and applying the force specified.



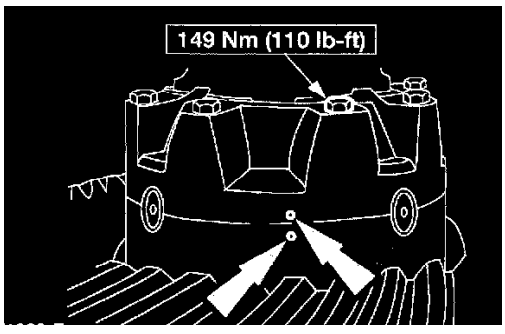
4. **CAUTION:** Place the differential side bearing cups on the differential side bearings after pressing the bearings on the case. This will prevent bearing damage during the remaining assembly process.

   Press the differential side bearings on the differential case halves, and place the bearing cups on the bearings.



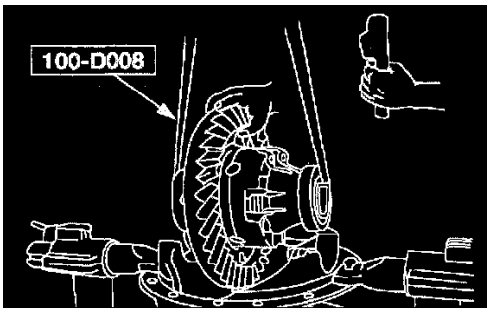
5. **NOTE:** Lightly lubricate all of the mating surfaces with clean axle lubricant. This will aid in assembly and provide initial lubrication.

   On the conventional differential, install the gear assembly.
   1 Position the thrust washer and the differential side gear into the case half.
   2 Position the differential cross shaft with the pinion mates and the thrust washers into the case half.
   3 Position the differential side gear and thrust washer on the differential pinion mates.



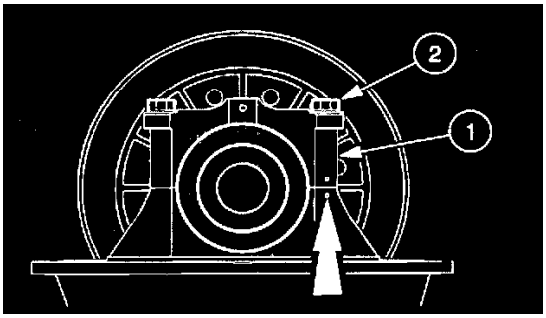
6. **CAUTION:** Align the match marks.

On the conventional differential, assemble the differential case halves.



7. **CAUTION:** Do not damage the differential ring gear and pinion.

   Using the special tool, carefully position the differential subassembly into the carrier.



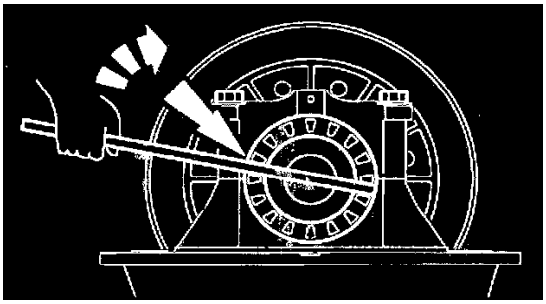
8. **CAUTION:** The bearing cups must seat on the differential side bearings.

   CAUTION: Align the match marks.

   Install the differential bearing caps.
   1 Position the bearing cap onto the leg.

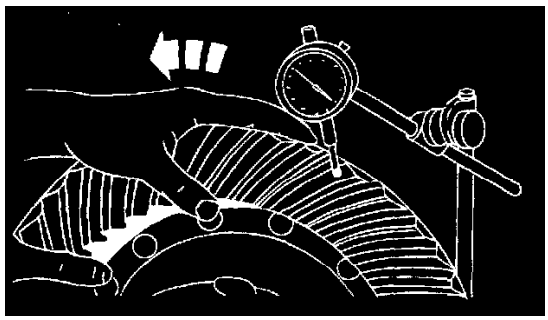
   2 **CAUTION:** The bolt threads must be clean.

   Apply Threadlock 262 E2FZ-19554-B or equivalent meeting Ford specification WSK-M2G351-A6 to the bolt threads, and install the bolts. Tighten the bolts enough to eliminate visible space between the bearing cap and leg. Do not tighten the bolts to the appropriate torque at this time.



9. **CAUTION:** Align the differential assembly within the bearing bores before applying preload or damage to the bearings will result.

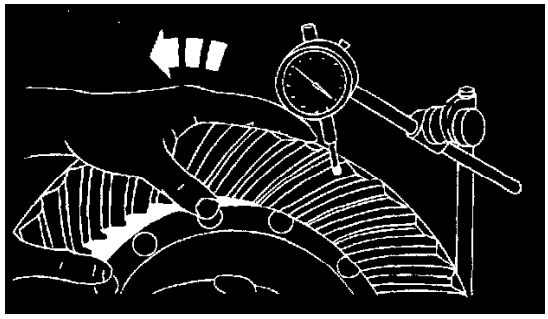
   Install the differential bearing adjusting rings.
   - Tighten both adjusting rings until there is zero end play, and some backlash between the differential ring gear and pinion. Make sure the adjusting ring tooth aligns so that installation of the adjusting ring lock is possible.



10. Set the backlash at zero.

    NOTE: The adjusting ring tooth must always align so that installation of the adjusting ring lock is possible.

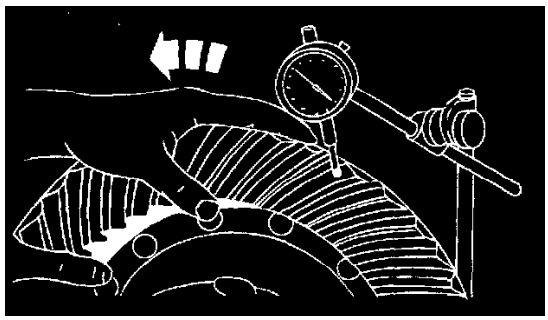
    Loosen the adjusting ring on the tooth side of the differential ring gear one tooth and tighten the opposite adjusting ring one tooth. Repeat this process until backlash is at zero.



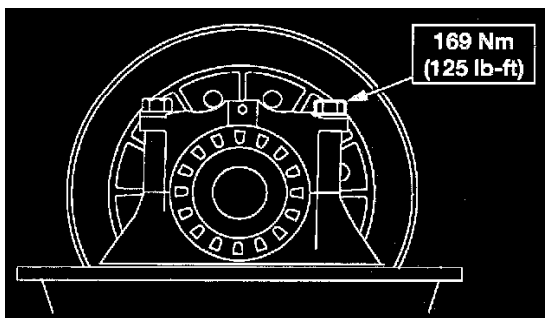
11. Set the backlash and the bearing preload to specifications.
    - With a new matched set installed, set the backlash to the specification etched in the differential ring gear.
    - With the original matched set installed, set the backlash to the specification recorded prior to disassembly.

    NOTE: The adjusting ring tooth must always align so that installation of the adjusting ring lock is possible.

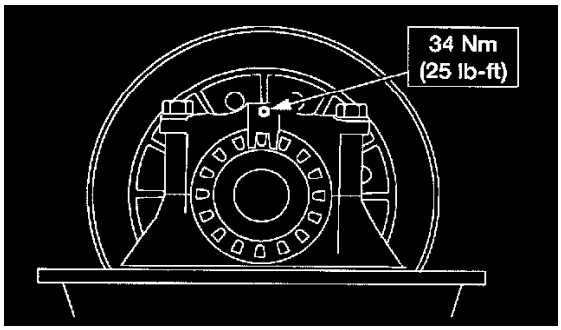
    Tighten the adjusting ring on the tooth side of the differential ring gear until backlash is within specifications.



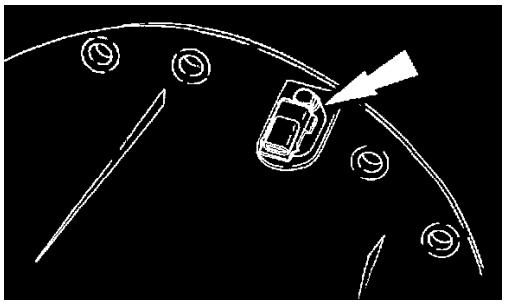
12. Check the differential ring gear and pinion backlash in four equally spaced positions around the differential ring gear.
    - The acceptable backlash tolerance is **0.0508 mm (0.002 inch)** from the backlash etched in the differential ring gear.
    - If the backlash tolerance varies more than **0.080 mm (0.003 inch)** between the four positions, remove the differential and determine the cause.



13. Tighten the bolts.
    - Check the differential ring gear and pinion backlash, as described in the previous step, after tightening the bolts.



14. Install the adjusting ring locks.



15. Install the rear anti-lock brake sensor.
16. Install the carrier.