















205-03 Front Drive Axle/Differential
DISASSEMBLY AND ASSEMBLY


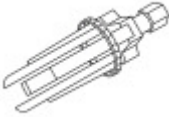






2006 F-Super Duty 250-550
Procedure revision date: 02/17/2015

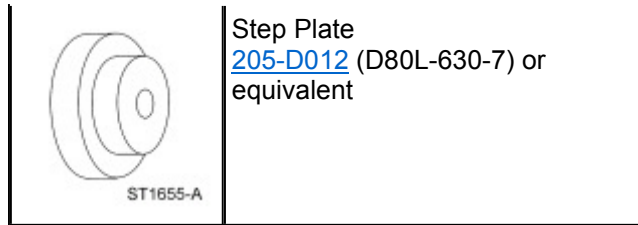
Axle

Special Tool(s)

| | |
|---|--|
|  ST1494-A | C-Frame and Screw 211-023 (T74P-3044-A1) |
|  ST1214-A | Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent |
|  ST1544-A | Depth Gauge, Drive Pinion 205-S156 (T80T-4020-A) |
|  ST2210-A | Drawbar, Rear Axle 205-098 (T75T-1176-A) |
|  ST1348-A | Gauge, Clutch Housing 308-021 (T75L-4201-A) |
|  ST1434-A | Gauge Tube 205-D033 (D80T-4020-F48) or equivalent |
| | Handle 205-D055 (D81L-4000-A) or equivalent |

| | |
|---|--|
|  <p>ST1653-A</p> | |
|  <p>ST1884-A</p> | <p>Holding Fixture, Drive Pinion Flange 205-012 (T57T-4851-B)</p> |
|  <p>ST1357-A</p> | <p>Installer, Differential Carrier Bearing 205-D044 (D81T-4221-A) or equivalent</p> |
|  <p>ST2211-A</p> | <p>Installer, Drive Pinion Bearing Cup 205-006 (T56T-4616-B) (B1 for use on outer pinion bearing cup, B2 for use on inner pinion bearing cup)</p> |
|  <p>ST2504-A</p> | <p>Installer, LH Differential Carrier Oil Seal 205-427</p> |
|  <p>ST1883-A</p> | <p>Installer, Rear Axle Bearing/Oil Seal 205-092 (T75L-1165-DA)</p> |
|  <p>ST2503-A</p> | <p>Installer, RH Differential Carrier Oil Seal 205-426</p> |
|  <p>ST1254-A</p> | <p>Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)</p> |

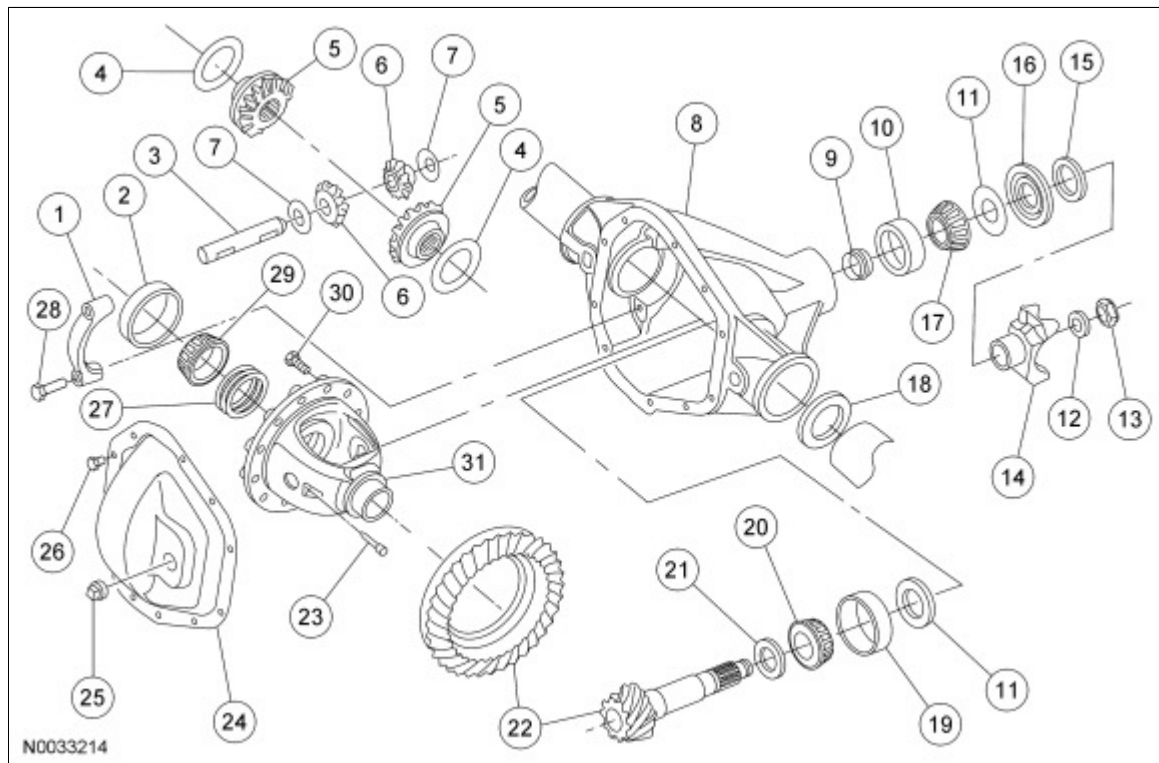
| | |
|---|--|
|  <p>ST1347-A</p> | <p>Puller, Drive Pinion/Differential Carrier 205-D036 (D81L-4220-A) or equivalent</p> |
|  <p>ST1213-A</p> | <p>Remover, Bushing 307-001 (TOOL-1175-AC) or equivalent</p> |
|  <p>ST1512-A</p> | <p>Remover, Drive Pinion Flange 205-018 (T65L-4851-B)</p> |
|  <p>ST1651-A</p> | <p>Remover/Installer, Bearing Cup 205-D051 (D81T-4628-A) or equivalent (inner pinion bearing cup remover)</p> |
|  <p>ST1651-A</p> | <p>Remover/Installer, Bearing Cup 205-D054 (D81T-4628-D) or equivalent (outer pinion bearing cup remover)</p> |
|  <p>ST1545-A</p> | <p>Set, Dummy Bearing 205-D047 (D81T-4222-DR) or equivalent</p> |
|  <p>ST1351-A</p> | <p>Slide Hammer 100-001 (T50T-100-A)</p> |
|  <p>ST2505-A</p> | <p>Spreader Bar, Oil Seal 205-428</p> |



Material

| Item | Specification |
|---|---------------|
| Motorcraft® Clear Silicone Rubber TA-32 | ESB-M4G92-A |
| Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant (US); Motorcraft® SAE 80W-90 Premium Axle Lubricant (Canada) XY-80W90-QL (US); CXY-80W90-1L (Canada) | WSP-M2C197-A |

Front Drive Axle, Disassembled View



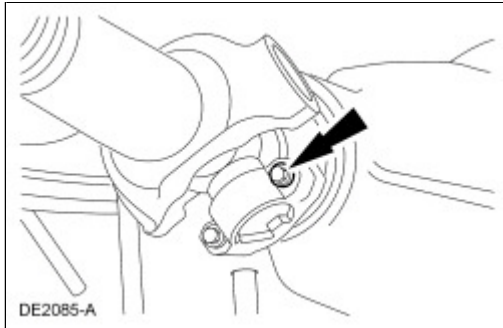
| Item | Part Number | Description |
|------|-------------|--|
| 1 | — | Differential bearing cap (part of 3B092) |
| 2 | 4222 | Differential bearing cup |
| 3 | 4211 | Differential pinion shaft |
| 4 | 4230 | Differential side gear thrust washers (part of 3204) |
| 5 | 4236 | Differential side gears (part of 3204) |

| | | |
|----|--------------|--|
| 6 | 4215 | Differential pinion gears (part of 3222) |
| 7 | 372632 -S | Differential pinion gear thrust washers |
| 8 | 3B092 | Differential housing |
| 9 | 4662 | Collapsible spacer |
| 10 | 4628 | Differential drive pinion bearing cup |
| 11 | 386989 | Front axle pinion shaft oil seal kit |
| 12 | 372632 -S | Washer |
| 13 | 354845 -S | Pinion nut |
| 14 | 4851 | Pinion flange |
| 15 | 4859 | Drive pinion oil seal deflector (part of 3N296) |
| 16 | 3N134 | Front axle drive pinion seal (part of 3N296) |
| 17 | 4621 | Differential pinion bearing |
| 18 | 3N267 | Axle shaft oil seal |
| 19 | 4628 | Front axle pinion bearing cup |
| 20 | 4630 | Differential pinion bearing |
| 21 | 4663 | Drive pinion position shim |
| 22 | 3A410 | Differential ring gear and pinion |
| 23 | — | Differential pinion shaft lockpin (part of 3204) |
| 24 | 4033 | Differential housing cover |
| 25 | 4N282 | Fill plug |
| 26 | 4346 | Differential housing cover bolt |
| 27 | 4067 | Differential bearing shim |
| 28 | — | Differential bearing cap bolt (part of 3B092) |
| 29 | 4221 | Differential bearing |
| 30 | 4346 | Differential ring gear bolt |
| 31 | 4205 | Differential case assembly |

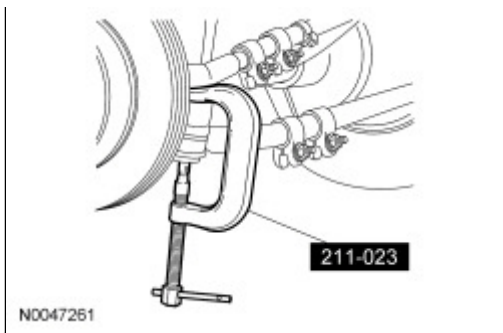
Disassembly

1. Remove the axle shafts and seals. Refer to [Axle Shaft Seal](#).
2. **NOTE:** *Index-mark the driveshaft to the pinion flange to maintain correct driveline balance.*

Remove and discard the 4 driveshaft flange bolts and 2 retainers. Position the driveshaft aside.

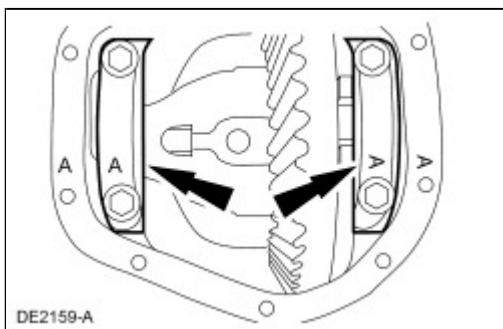


3. Remove the cotter pin, retainer cap and the RH outer tie-rod end nut.
 - Discard the cotter pin.
4. Using the C-Frame and Screw, disconnect the RH tie-rod and the drag link. Position the drag link aside.



5. Remove the 10 bolts and the differential housing cover. Drain the lubricant.
 - Clean the gasket material from the differential housing and the differential housing cover.
6. **NOTE:** Prior to removal, note the stamped mating letters positioning on the bearing caps and the differential housing for correct reassembly.

Remove the 4 bearing cap bolts and the 2 bearing caps.



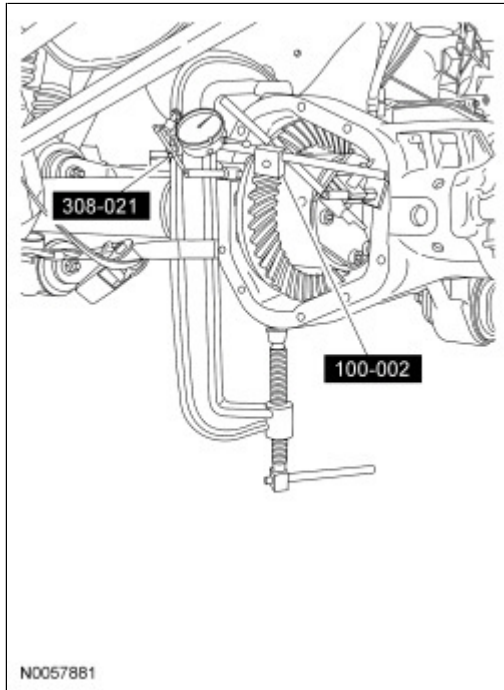
7. **NOTICE:** Do not spread the differential housing more than specified or damage to the housing may occur.

NOTE: Install the C-clamp at the 12 o'clock and 6 o'clock positions to allow the horizontal spread of the housing. Use a safety strap to restrain the C-clamp from rotation.

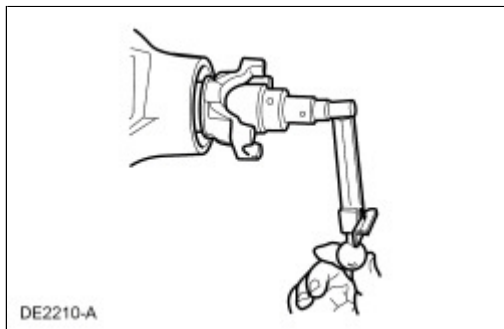
NOTE: Use a C-clamp with a minimum 15-in opening and a 16,250 pound load limit.

Using a C-clamp, the Dial Indicator Gauge with Holding Fixture and the Clutch Housing Gauge, spread the differential housing 0.38 mm (0.015 in).

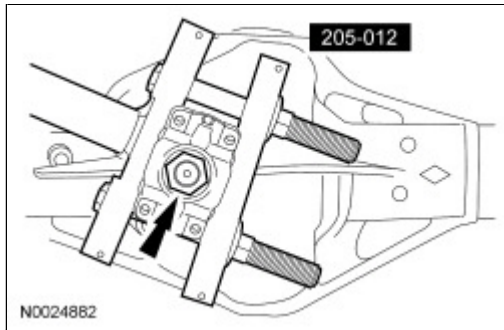
- Remove the Dial Indicator Gauge after spreading the differential housing.



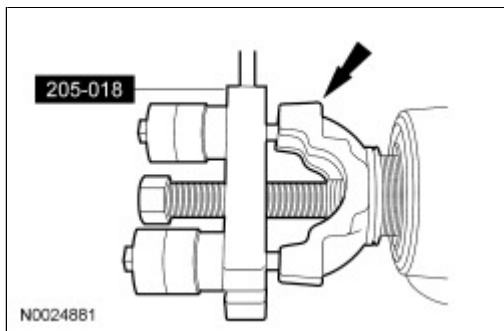
- Using a pry bar, remove the differential with the bearing cups.
 - Remove the C-clamp after removing the differential.
- Measure the pinion bearing torque preload. Record the reading.
 - Rotate the pinion with a Nm (lb-in) torque wrench. Record the torque necessary to maintain rotation of the pinion through several revolutions.



- Using the Drive Pinion Flange Holding Fixture to prevent the flange from turning, remove and discard the pinion nut and washer.



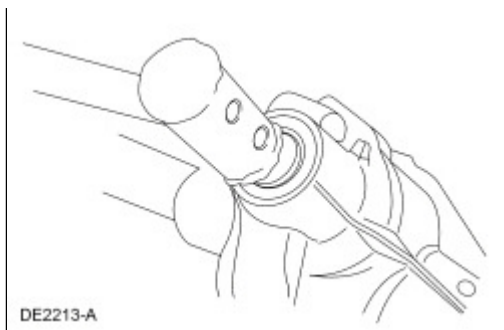
11. Using the Drive Pinion Flange Remover, remove the flange.



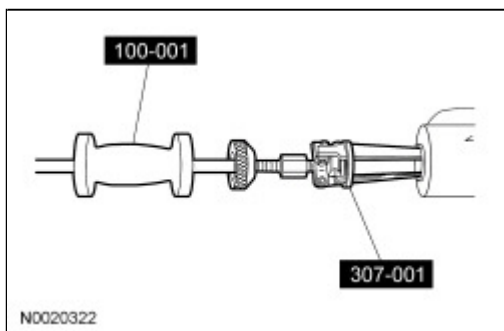
12. **NOTICE: Do not damage the pinion, the bearings or the cup.**

Remove the pinion.

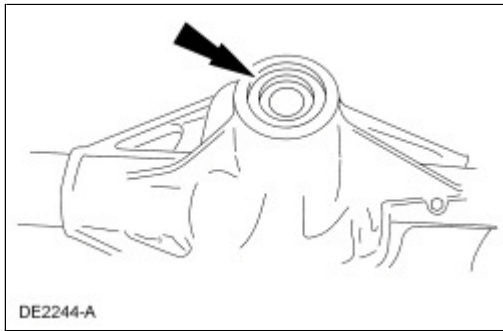
- Using a soft-faced hammer, tap the pinion through the outer bearing. Remove the pinion through the rear of the differential housing.



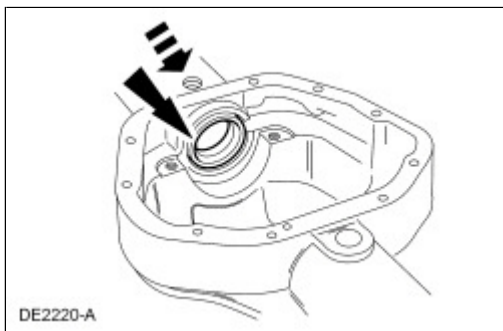
13. Using the Slide Hammer and Bushing Remover, remove and discard the pinion seal.



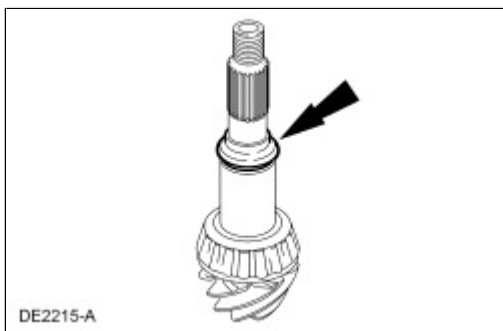
14. Remove the oil slinger and the differential pinion bearing.



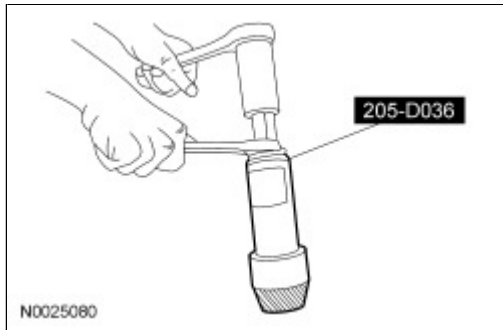
15. Using a suitable tool, remove the outer pinion bearing cup, the inner pinion bearing cup and the oil baffle.
- Use the Handle and the Bearing Cup Remover/Installer (205-D051) to remove the inner pinion bearing cup.
 - Use the Handle and the Bearing Cup Remover/Installer (205-D054) to remove the outer pinion bearing cup.
16. Using a suitable tool, drive the inner axle shaft oil seals out of the differential housing from the axle tubes. Discard the seals.



17. Remove and discard the collapsible spacer.



18. Using the Drive Pinion/Differential Carrier Puller, remove the differential pinion bearing.



19. **NOTE:** *Discard the drive pinion position shim if bent or nicked. Measure and record the shim thickness if discarding the shim.*

Remove the drive pinion position shim.

20. **NOTE:** *Always use new solvent when cleaning the bearings.*

NOTE: *Do not spin dry the bearings with compressed air.*

NOTE: *Oil the bearings immediately, to prevent rusting.*

Carry out the following inspection.

- Thoroughly clean all parts, including the differential housing and inside of the differential case.
- Inspect all parts for damage.
- Discard the complete differential if excessive wear is visible on all parts.
- Discard both differential pinion gears and both differential side gears if any one of these gears are worn/damaged.
- Inspect the flange lugs for damage. The end of the flange that contacts the bearing cone as well as the nut counterbore and the seal contact area must be smooth and free of nicks.
- Verify that the differential and pinion bearing bores are smooth. Remove any nicks/burrs from the mounting surfaces of the differential housing.

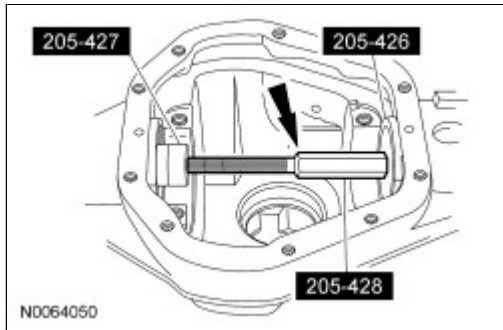
Assembly

1. **NOTE:** *To ease installation, coat the seal axle tube mating surfaces with lubricant.*

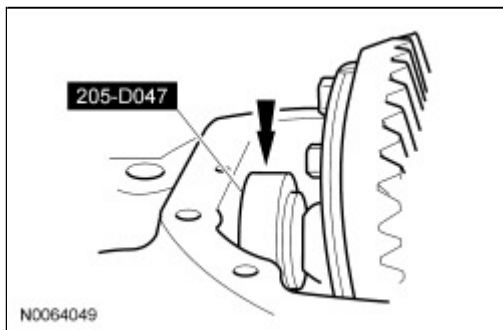
NOTE: *The inner axle shaft oil seals are installed with the black rubber lip towards the center of the axle housing.*

Using the RH Differential Carrier Oil Seal Installer, LH Differential Carrier Oil Seal Installer and Oil Seal Spreader Bar, install the axle shaft oil seals.

- Place the axle shaft oil seals onto the Installers and position the assembly into the differential housing. Lengthen the Spreader Bar as necessary until both seals start evenly in the axle tubes. Continue to lengthen the tool until both step plates bottom out against the housing.



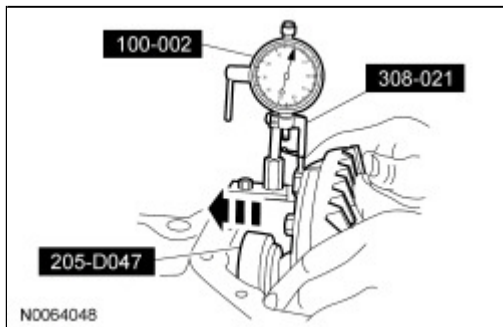
2. Place the Dummy Bearing Set on the differential case hubs and position the assembly into the differential housing.



3. **NOTE:** Repeat this step until there is a consistent reading.

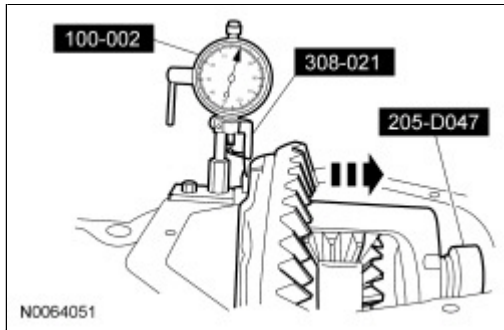
Determine the total thickness of differential bearing shims to install on the differential case hubs, less the preload, which is calculated later in this procedure.

- Force the ring gear as far as possible to the ring gear side and zero the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.

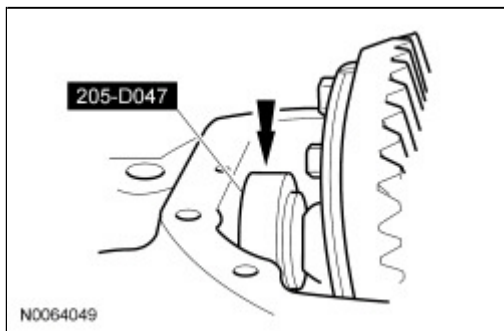


4. **NOTE:** Repeat this step until there is a consistent reading.

Force the ring gear as far as possible to the pinion gear side. Record this measurement as the total case end play.



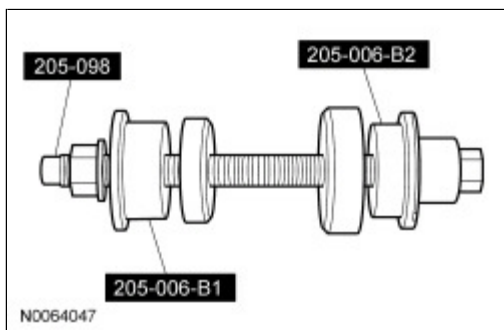
5. Remove the differential case and the Dummy Bearing Set from the differential housing.
 - Do not remove the Dummy Bearing Set from the differential case hubs.



6. **NOTE:** Make sure the inner oil baffle is squarely under the inner pinion bearing cup.

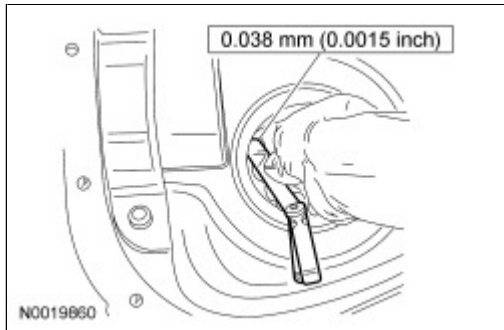
Install the inner oil baffle and the inner and outer pinion bearing cups.

7. Using the Rear Axle Drawbar and Drive Pinion Bearing Cup Installer, install the pinion bearing cups.
 - Place the Installers on the inner and outer bearing cups.
 - Place Installer 205-006-B1 on the outer pinion bearing cup.
 - Place Installer 205-006-B2 on the inner pinion bearing cup.
 - Install and tighten Rear Axle Drawbar 205-098 to seat the cups.



8. **NOTE:** If the feeler gauge can fit between a cup and the bottom of its bore at any point around the cup, remove and reseal the cup.

Check that the cups have seated correctly in their bores.

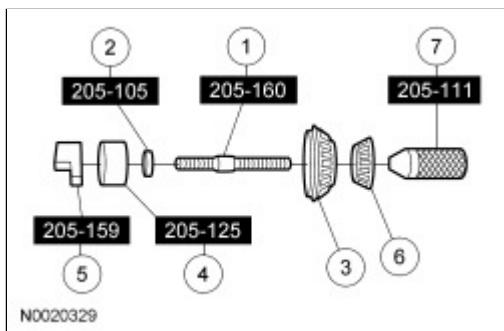


9. **NOTE:** *If any of the gauge surfaces have nicks in them, remove the high spots with a medium India oilstone to prevent erroneous readings.*

NOTE: *Apply only a light oil film on the pinion bearings before assembling the tools.*

Assemble and position the following in the differential housing in the following sequence:

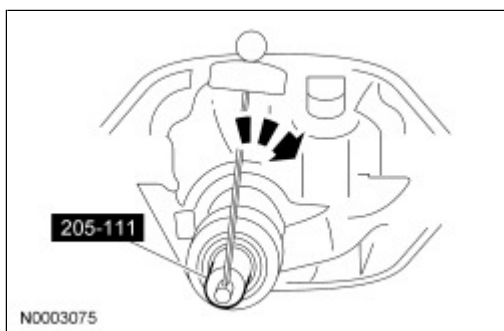
1. Position the Adapter 205-160.
2. Position the Adapter 205-105.
3. Position the inner pinion bearing.
4. Position the Adapter 205-125.
5. Position the Adapter 205-159.
6. Position the outer pinion bearing.
7. Thread on the Adapter 205-111.



10. **NOTE:** *This step simulates pinion bearing preload.*

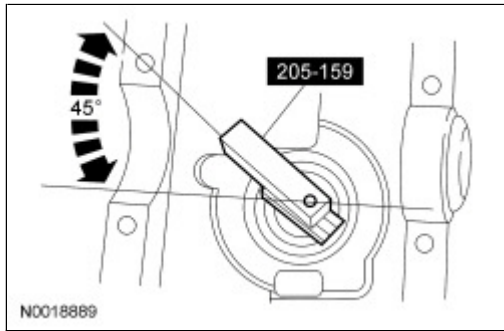
Using a Nm (lb-in) torque wrench, tighten the Adapter to set the rotational torque.

- Tighten to a rotational torque of 2.2 Nm (20 lb-in).

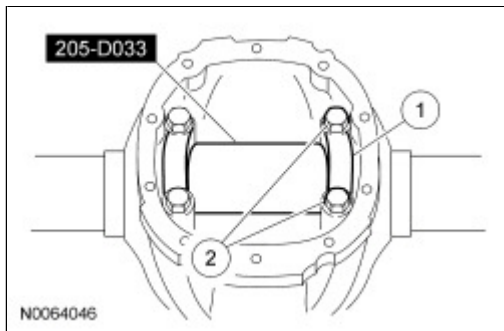


11. **NOTE:** *Offset the Adapter to obtain an accurate reading.*

Rotate the Adapter several half-turns to seat the pinion bearings. Position the Adapter as shown.



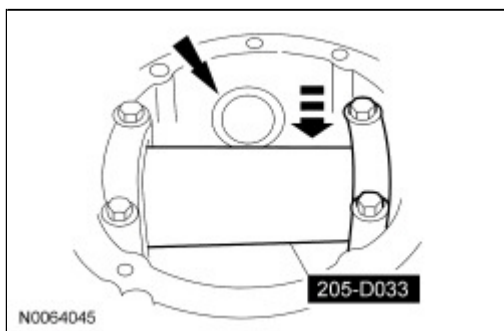
12. Install the Gauge Tube.
 1. Install the 2 bearing caps.
 2. Install the 4 bolts.
 - Tighten to 108 Nm (80 lb-ft).



13. **NOTE:** Use a feeler gauge or flat, clean drive pinion position shims as a measuring device.

NOTE: Do not attempt to force the gauge or shim between the Adapter and Gauge Tube. A slight drag indicates a correct selection.

Using a feeler gauge or flat, clean drive pinion position shims, measure the gap between the Adapter and Gauge Tube. Record the measurement.

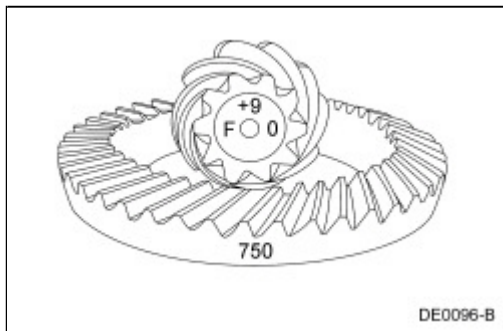


14. **NOTE:** The differential ring gear and pinion is only available in a matched set. Matching numbers etched on both the differential ring gear and pinion are for verification. If installing a new differential ring gear and pinion, verify these numbers match before proceeding with assembly. The end of the pinion with the etched figures is the "button" end.

NOTE: Use the gear contact pattern method to verify the final pinion position is valid. Refer to [Section 205-00](#).

Install the correct thickness drive pinion position shim on the pinion.

- Etched on the button end of each pinion is a zero (0), or a plus (+) or minus (-) with a number. This number indicates the best running position for each particular differential ring gear. Shimming behind the inner pinion bearing controls this dimension.
- For example, a pinion etched with m+8 (+3) requires 0.08 mm (0.003 in) less shimming than a pinion etched "0". This means to increase the mounting distance by the amount etched in the pinion, subtract 0.08 mm (0.003 in) from the drive pinion position shim selected for installation. A pinion etched m-8 (-3), requires 0.08 mm (0.003 in) more shimming than a pinion etched "0". In this instance, add 0.08 mm (0.003 in) to the drive pinion position shim selected for installation to decrease the pinion mounting distance by the amount etched in the pinion.

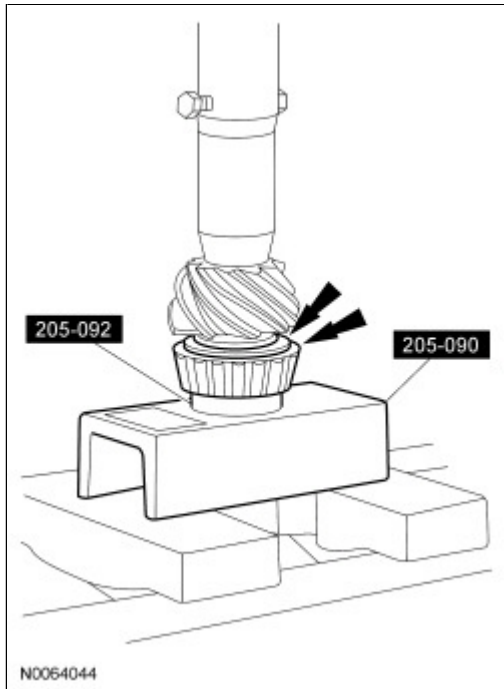


15. To change the pinion adjustment, drive pinion position shims are available in the thickness shown in the following chart. Measure each shim separately with a micrometer.

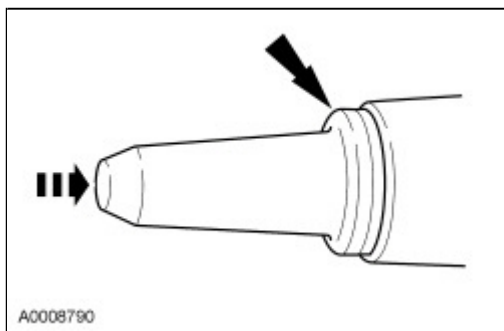
Available Drive Pinion Position Shims

| mm | Inches |
|------|--------|
| 1.22 | 0.048 |
| 1.27 | 0.050 |
| 1.32 | 0.052 |
| 1.37 | 0.054 |
| 1.42 | 0.056 |
| 1.47 | 0.058 |
| 1.52 | 0.060 |
| 1.57 | 0.062 |

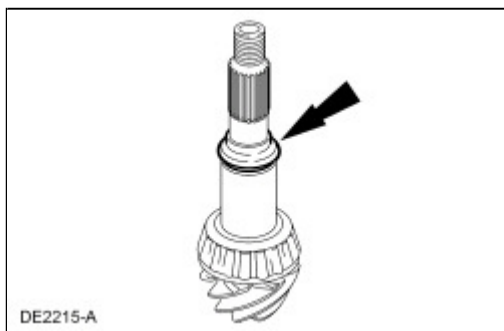
16. Using the Bearing/Oil Seal Plate and Rear Axle Bearing/Oil Seal Installer, install the selected pinion bearing shim and the differential pinion bearing.



17. Using a suitable driver, install the pinion seal.
- Lightly coat the pinion seal lip with lubricant.

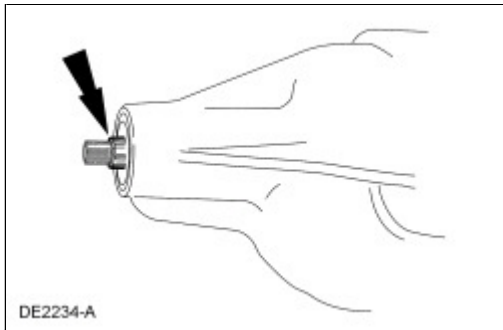


18. Install a new collapsible spacer.



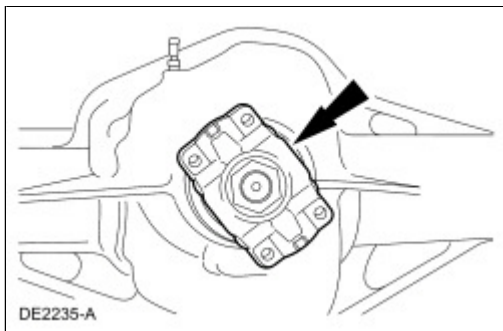
19. **NOTICE: Do not damage the pinion, the bearings, the seal or the cup.**

Insert the pinion into the differential housing, and seat the inner bearing into the bearing cup.



20. **NOTE:** *Never use a metal hammer on the pinion flange or install the flange with power tools. If necessary, use a plastic hammer to tap on a tight fitting flange while holding the backside of the drive pinion.*

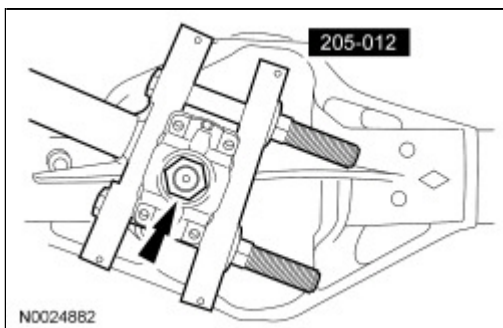
Lightly coat the flange splines and seal mating area with lubricant, then install the flange with a new washer and nut.

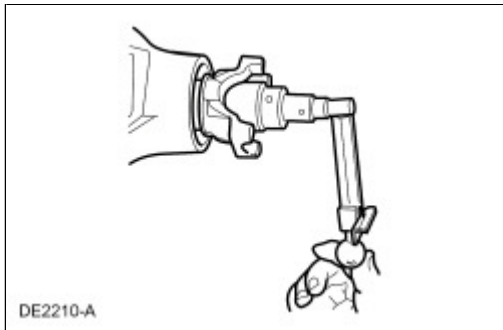


21. **NOTE:** *Never back off the pinion nut to reduce preload. If preload reduction is necessary, install a new collapsible spacer and pinion nut.*

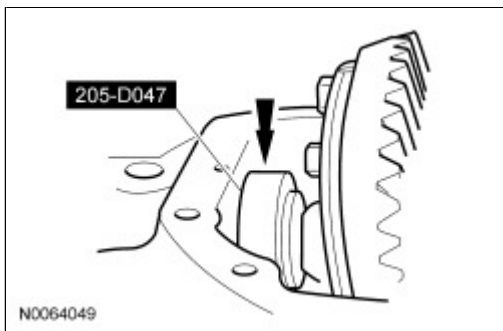
Tighten the nut.

- Use the Drive Pinion Flange Holding Fixture to prevent the flange from turning while tightening the nut. Remove the Drive Pinion Flange Holding Fixture when taking pinion bearing torque preload readings.
- Rotate the pinion occasionally to verify that the bearings are seating correctly.
- Take frequent pinion bearing torque preload readings.
 - If installing new differential pinion bearings, tighten the pinion nut to specifications. For additional information, refer to Specifications in this section.
 - If installing the original pinion bearings, the final reading must be 0.56 Nm (5 lb-in) more than the initial reading taken during disassembly.





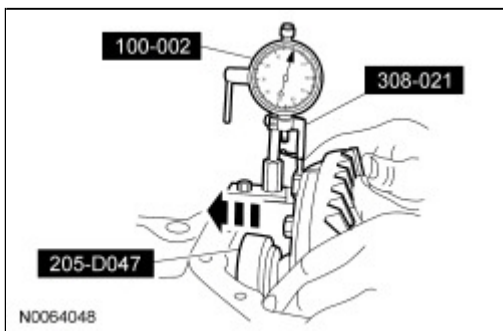
22. Position the differential case with the Dummy Bearing Set into the differential housing.



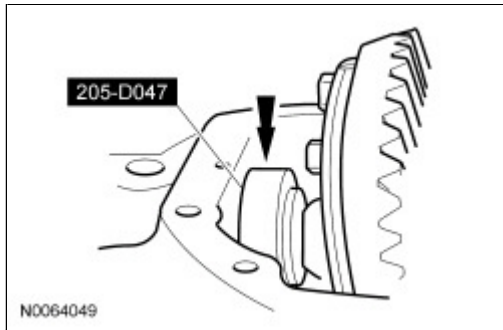
23. **NOTE:** Repeat this step until there is a consistent reading.

Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, determine the total thickness of differential bearing shims to install under the differential bearing on the ring gear side of the differential case. Record this measurement, as the shim thickness required for the ring gear side of the differential case.

- Force the ring gear away from the pinion and zero the Dial Indicator Gauge.
- Force the ring gear into mesh with the pinion.
 - Rock the ring gear to allow the teeth of the gears to mesh.
- Record the reading.



24. Remove the differential case with the Dummy Bearing Set from the differential housing.

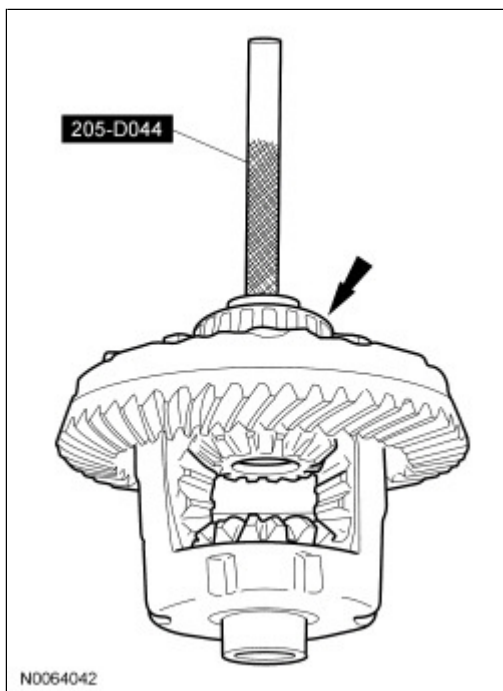


25. Place the required thickness of differential bearing shims on the ring gear side of the differential case. Refer to the measurement recorded, as the shim thickness required for the ring gear side of the differential case. Differential bearing shims are available in the thickness shown in the following chart.
- For example, a reading of 1.14 mm (0.045 in), requires that 1.14 mm (0.045 in) shims be placed on the ring gear side of the differential case.

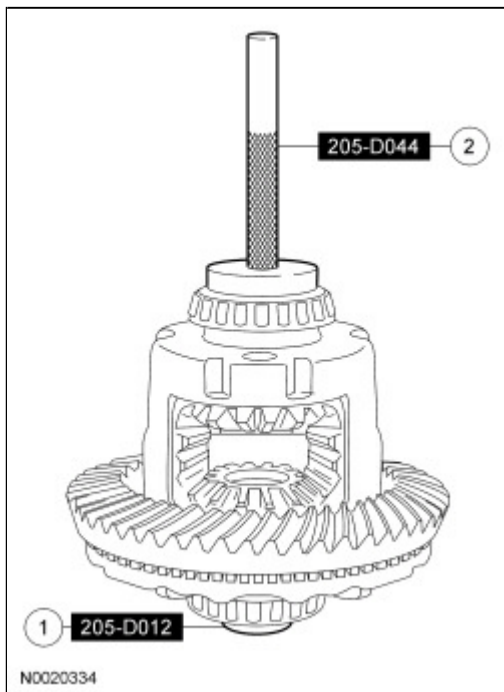
Available Differential Bearing Shims

| mm | Inch |
|-------|-------|
| 0.076 | 0.003 |
| 0.127 | 0.005 |
| 0.254 | 0.010 |
| 0.762 | 0.030 |

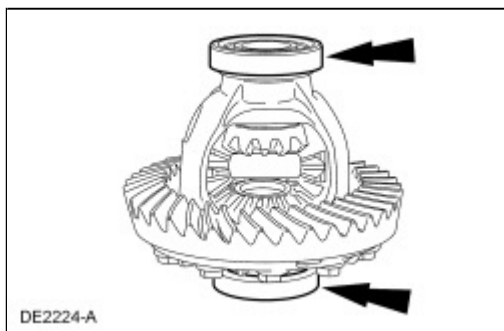
26. Using the Differential Carrier Bearing Installer, install the selected differential bearing shim and the differential bearing.



27. Determine the total thickness of differential bearing shims to install under the differential bearing on the drive pinion side of the differential case.
 - Subtract the measurement recorded, as the shim thickness required for the ring gear side of the differential case, from the total case end play measurement taken at the beginning of the assembly procedure. Then, add 0.38 mm (0.015 in) to the total. This is the total amount of differential bearing shims to install under the differential bearing on the drive pinion side of the differential case.
28. Place the amount of differential bearing shims, as determined by the calculation made in the previous step, on the drive pinion side of the differential case.
29. Using the Differential Carrier Bearing Installer and Step Plate, install the selected differential bearing shim and the differential bearing on the drive pinion side of the case.
 1. Place the Step Plate under the bearing to protect it during the bearing installation.
 2. Using the Differential Carrier Bearing Installer, install the bearing.



30. Position the differential bearing cups on the bearings.



31. **NOTICE: Do not spread the differential housing more than specified or damage to the housing can occur.**

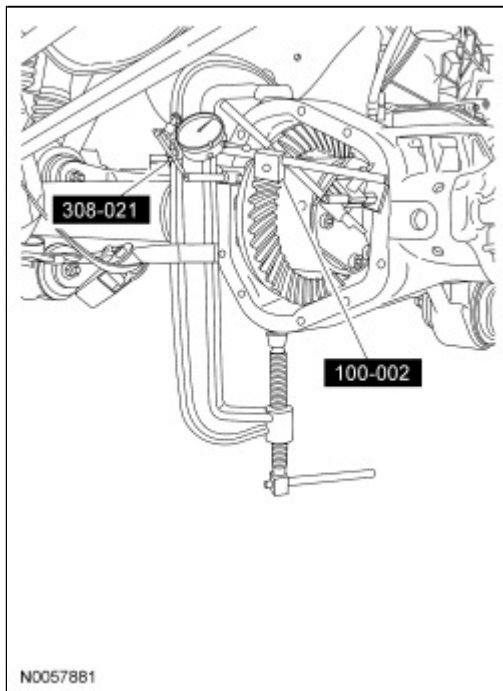
NOTE: Install the C-clamp at the 12 o'clock and 6 o'clock positions to allow the horizontal spread of the housing.

NOTE: Use a safety strap to keep the C-clamp from rotating.

NOTE: Use a C-clamp with a minimum 15-in opening and a 16,250 pound load limit.

Using a C-clamp with the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, spread the differential housing 0.38 mm (0.015 in) and install the differential carrier in the following sequence.

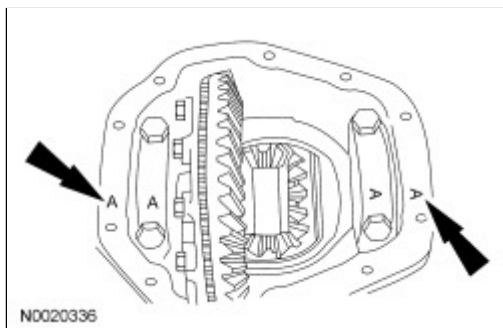
1. Remove the Dial Indicator Gauge and Clutch Housing Gauge after measuring the housing spread.
2. Using a soft-faced hammer, seat the differential into the differential housing.
 - Remove the C-clamp after seating the differential in the differential housing.



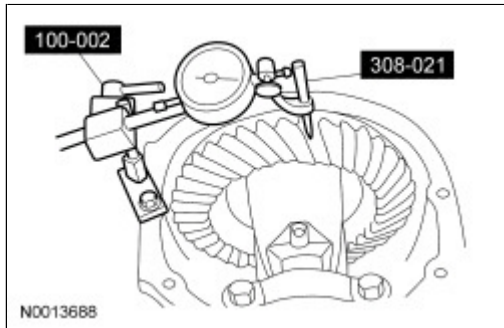
32. **NOTE:** Match the positioning of the mating letters on the bearing caps and the differential housing.

Install the 2 bearing caps and 4 bolts.

- Tighten to 108 Nm (80 lb-ft).



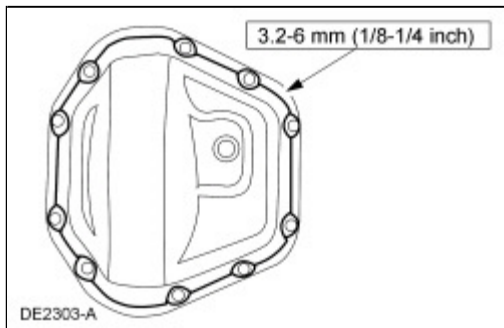
33. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, measure backlash at 3 equally spaced points.
- The backlash must be within the specifications and cannot vary more than 0.05 mm (0.002 in) between points checked. A backlash variation or more than 0.05 mm (0.002 in) indicates gear/case runout.
 - Make the necessary corrections by moving shims from one side of the differential case to the other, until the correct backlash adjustment is achieved.
 - Correct for high backlash by moving the ring gear toward the pinion.
 - Correct for low backlash by moving the ring gear away from the pinion.



34. Check the gear tooth contact pattern. Refer to [Section 205-00](#).
35. **NOTE:** Clean the differential housing cover mounting surfaces with a suitable solvent to remove all traces of oil film or foreign material.

NOTE: Install the differential housing cover within 15 minutes of applying the silicone material.

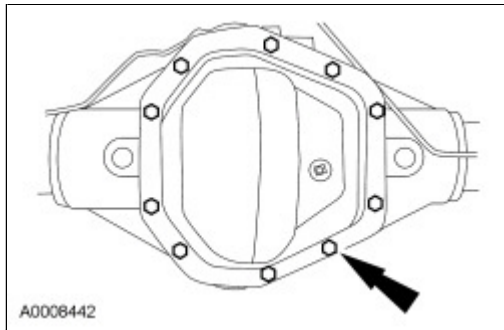
Apply the specified bead of silicone rubber sealer as shown.



36. **NOTE:** Place 2 cover bolts into the differential housing cover at the 2 o'clock and 8 o'clock positions. This will help to position the differential housing cover onto the differential housing.

Install the differential housing cover and the 10 differential cover bolts.

- Tighten to 61 Nm (45 lb-ft).



37. Position the driveshaft in the front axle flange. Install the 4 new flange bolts.
 - Tighten to 35 Nm (26 lb-ft).
38. Install the axle shafts and seals. Refer to [Axle Shaft Seal](#).
39. **NOTE:** *If possible, allow one hour curing time before filling the axle with lubricant.*

Fill the axle with the specified type and quantity of lubricant.

40. **NOTICE:** **Make sure that the nut retainer cap is correctly positioned to allow for cotter pin installation. Do not tighten or loosen the nut to align the retainer cap with the cotter pin hole. Overtightening of the fasteners may result in premature failure of steering linkage components.**

Position the RH tie-rod and drag link. Install the tie-rod nut, retainer cap and new cotter pin.

- Tighten to 115 Nm (85 lb-ft).

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