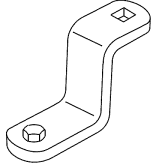
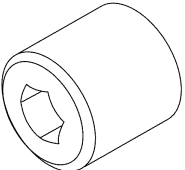
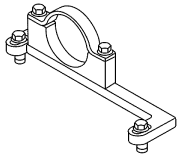
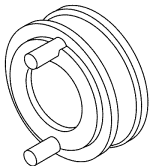

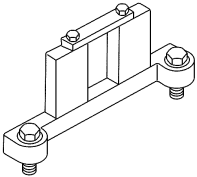


IN-VEHICLE REPAIR

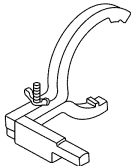
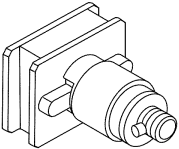
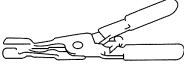
Cylinder Head

Special Tool(s)

 <p>ST1780-A</p>	Torque Wrench Extension 303-575 (T97T-6256-F) or equivalent
 <p>ST1781-A</p>	Socket, Camshaft Sprocket Nut 303-565 (T97T-6256-G) or equivalent
 <p>ST1777-A</p>	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B) or equivalent
 <p>ST1776-A</p>	Adapter for 303-564 303-578 (T97T-6256-A) or equivalent
 <p>ST1774-A</p>	Tensioner, Timing Chain 303-571 (T97T-6K254-A) or equivalent
 <p>ST1778-A</p>	Holding Tool, Camshaft 303-577 (T97T-6256-C) or equivalent

(Continued)

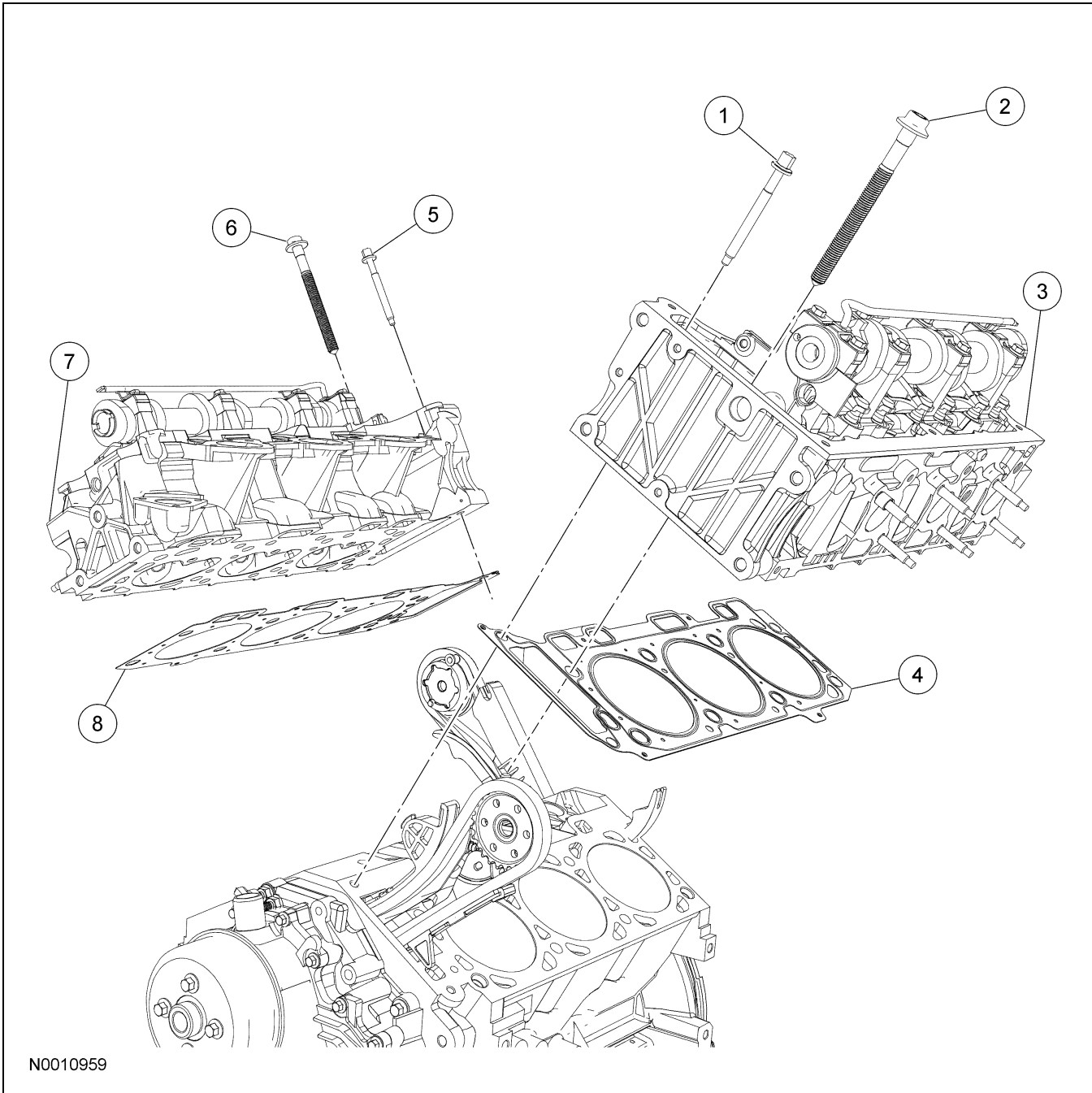
Special Tool(s)

 <p>ST1775-A</p>	Timing Tool, Crankshaft TDC 303-573 (T97T-6303-A) or equivalent
 <p>ST1779-A</p>	Adapter for 303-577 303-576 (T97T-6256-D) or equivalent
 <p>ST1394-A</p>	Remover, Spark Plug Wire 303-106 (T74P-6666A)

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor XO-5W30-QSP (in Canada Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12) or equivalent	WSS-M2C929-A

IN-VEHICLE REPAIR (Continued)



N0010959

Item	Part Number	Description
1	6065	LH cylinder head bolt (M8) (2 required)
2	6065	LH cylinder head bolt (M12) (8 required)
3	6M099	LH cylinder head
4	6083	LH cylinder head gasket

Item	Part Number	Description
5	6065	RH cylinder head bolt (M8) (2 required)
6	6065	RH cylinder head bolt (M12) (8 required)
7	6049	RH cylinder head
8	6051	RH cylinder head gasket

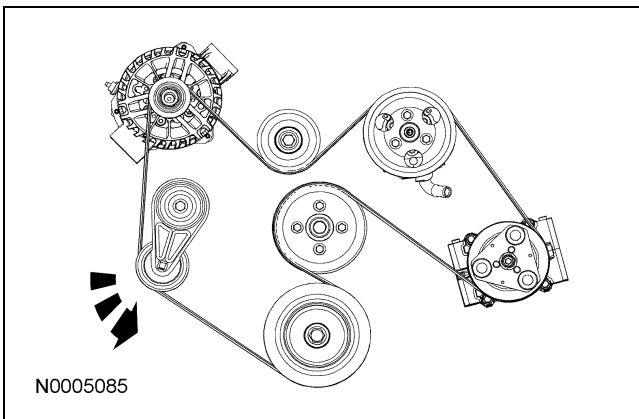
(Continued)

IN-VEHICLE REPAIR (Continued)**Removal**

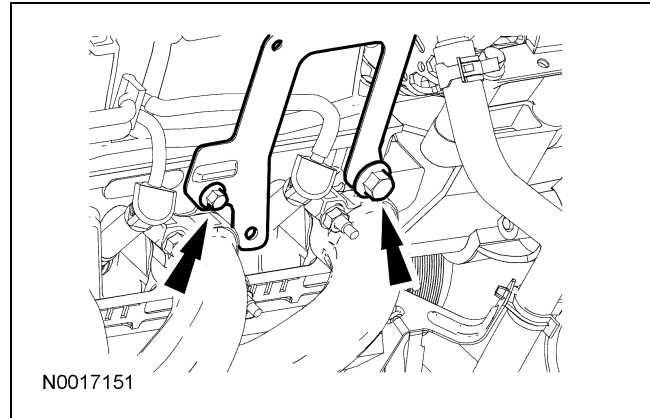
⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

Both sides

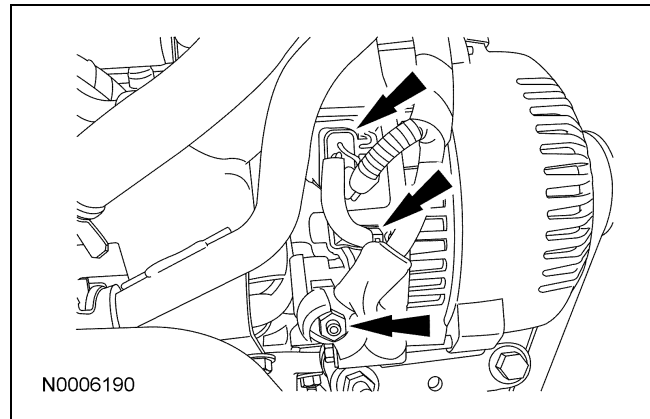
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. Drain the engine cooling system. For additional information, refer to Section 303-03.
3. Release the fuel system pressure. For additional information, refer to Section 310-00.
4. Remove the engine coolant temperature (ECT) sensor. For additional information, refer to Section 303-14.
5. Remove the intake manifold. For additional information, refer to Intake Manifold in this section.
6. Remove the hydraulic lash adjusters. For additional information, refer to Hydraulic Lash Adjuster in this section.
7. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.

**RH side**

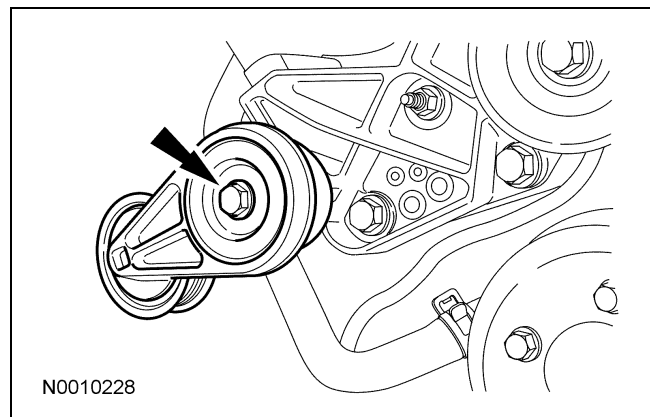
8. Remove the 2 coolant tube bracket bolts.



9. Disconnect the generator electrical connector, remove the nut and detach the B+ terminal.
 - Detach the pin-type retainer.

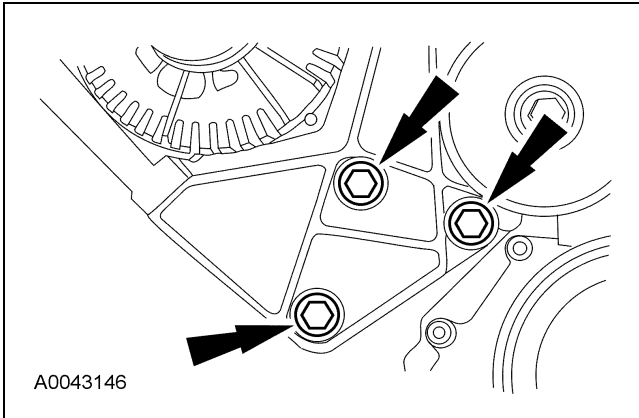


10. Remove the bolt and the accessory drive belt tensioner.

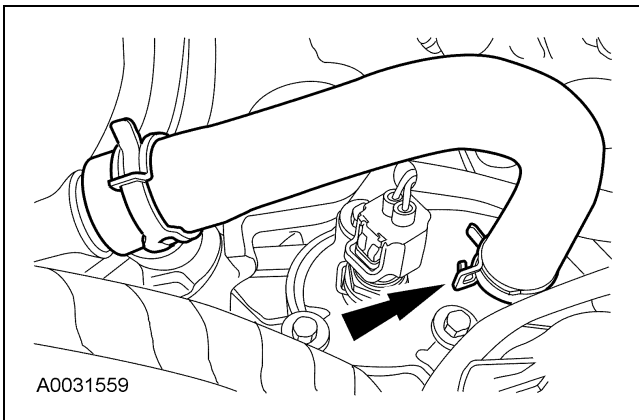


IN-VEHICLE REPAIR (Continued)

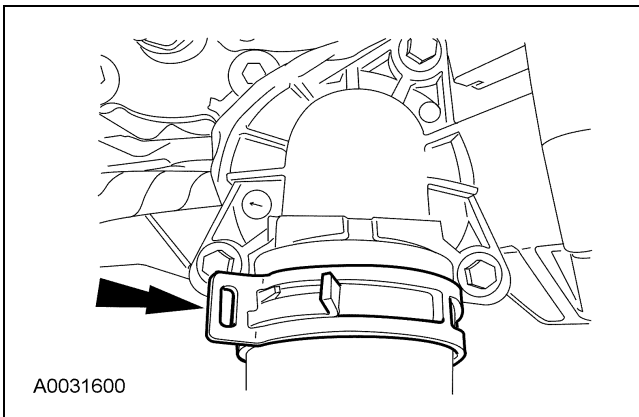
11. Remove the nut, the 2 bolts and the generator mounting bracket assembly.



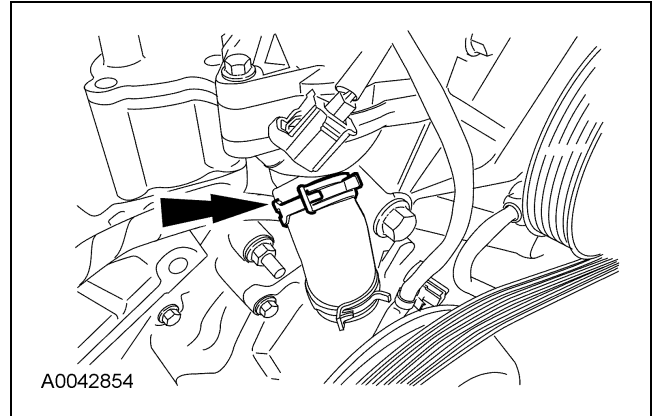
12. Disconnect the heater hose from the thermostat housing.



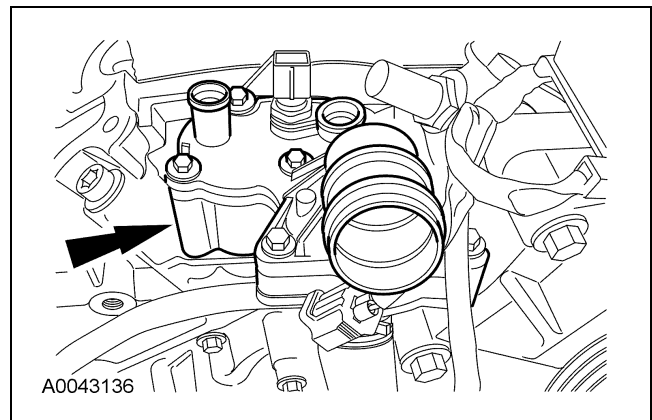
13. Disconnect the upper radiator hose.



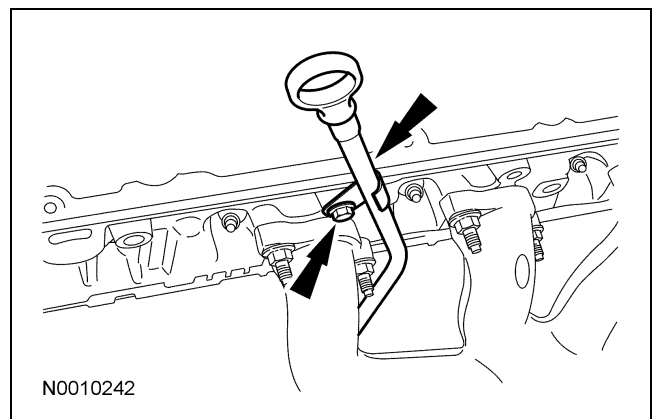
14. Position the coolant bypass hose clamp aside.



15. Remove the 3 bolts and the thermostat housing.

**LH side**

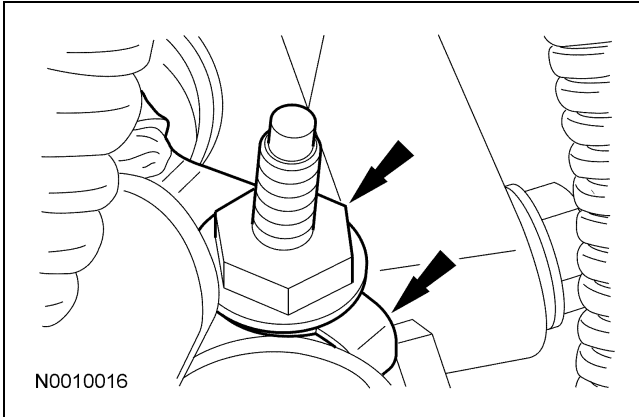
16. Remove the bolt and the oil level indicator tube.



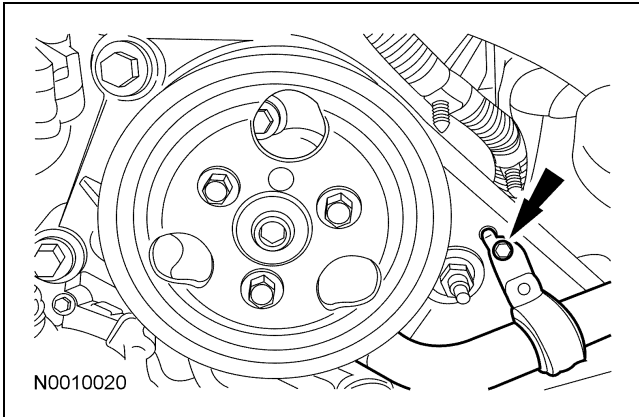
IN-VEHICLE REPAIR (Continued)

17. Remove the stud bolt and detach the ground strap.

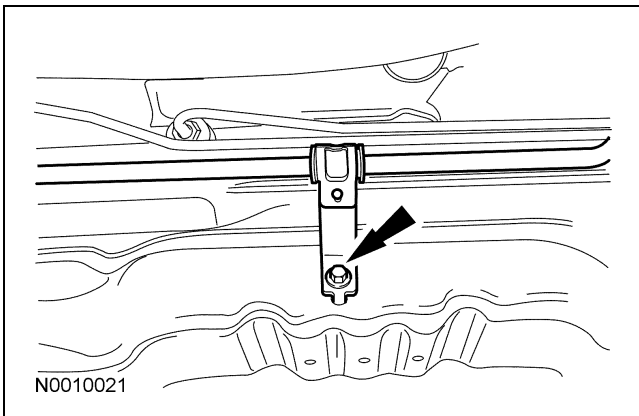
- Position the ground strap aside.



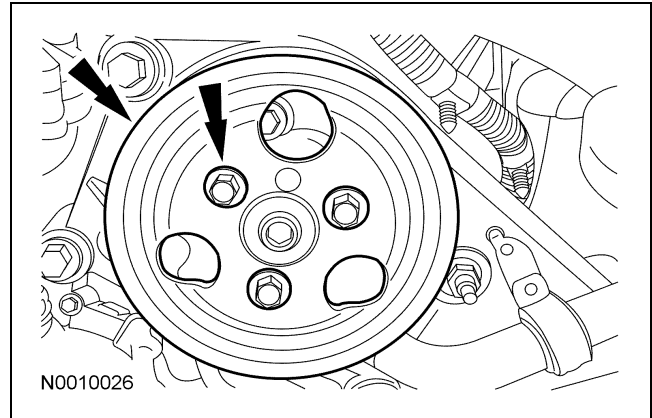
18. Remove the bolt and detach the power steering supply hose bracket from the front engine accessory drive (FEAD) bracket.



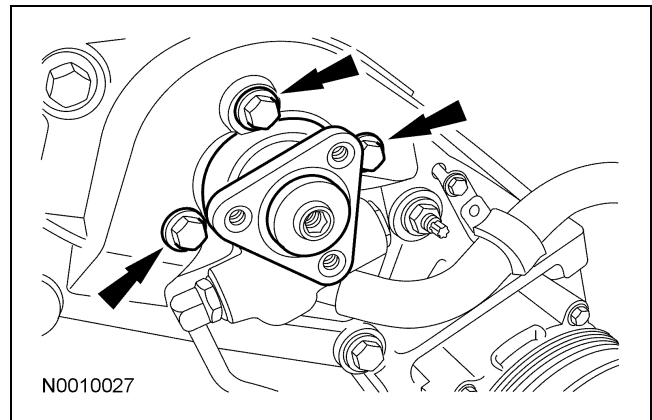
19. Remove the bolt and detach the power steering pressure (PSP) tube bracket from the crossmember.



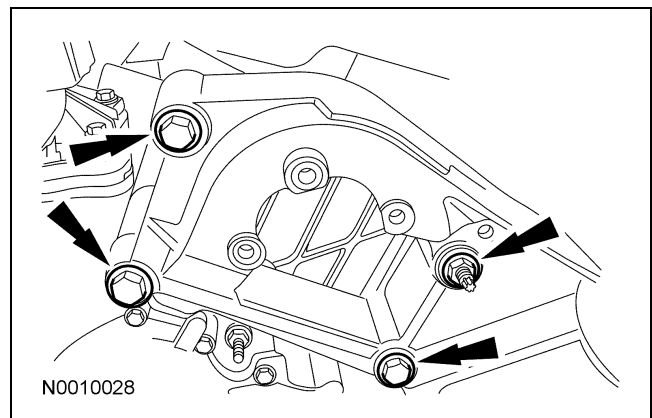
20. Remove the 3 bolts and the power steering pump pulley.



21. Remove the 3 bolts and position the power steering pump aside.

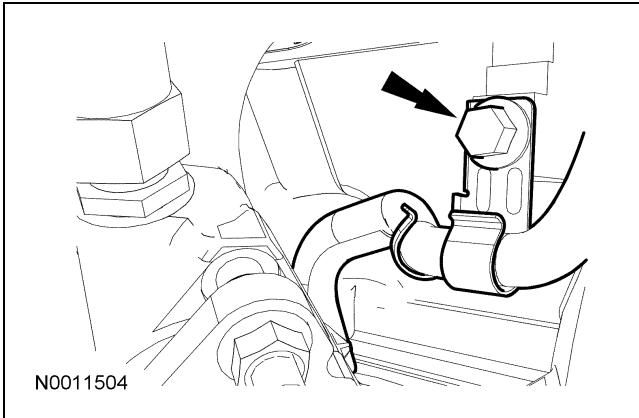


22. Remove the 3 bolts, the nut and position the FEAD bracket and A/C compressor aside.

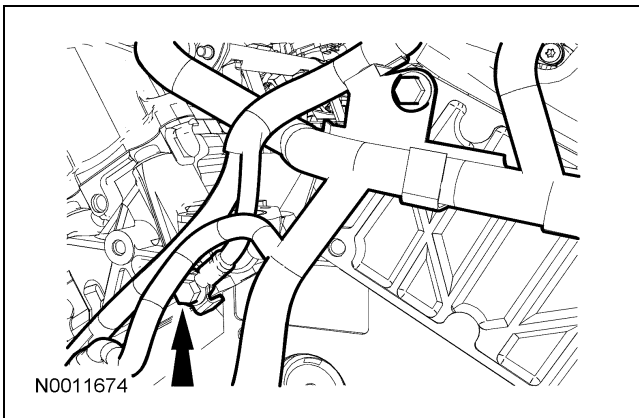


IN-VEHICLE REPAIR (Continued)

23. Remove the bolt and detach the starter motor wiring retainer bracket.

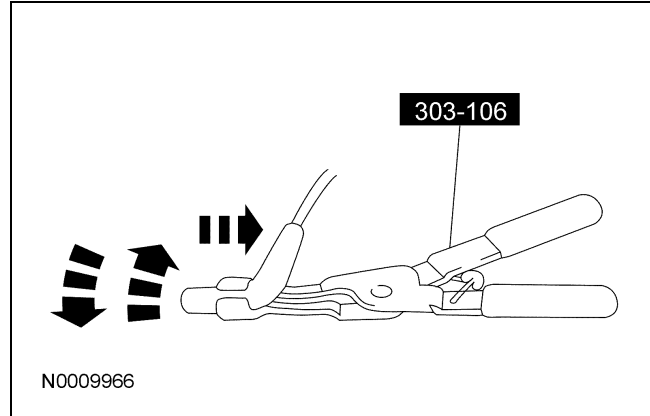


24. Remove the ground strap bolt and detach the wiring harness retainer from the backside of the cylinder head.

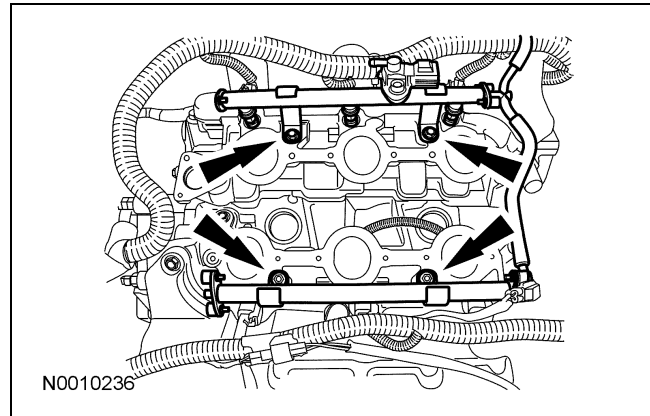
**Both sides**

25. **⚠ CAUTION:** It is important to twist the spark plug wire boots while pulling upward to avoid possible damage to the spark plug wires.

Using the special tool, disconnect the 6 spark plug wires from the spark plugs.



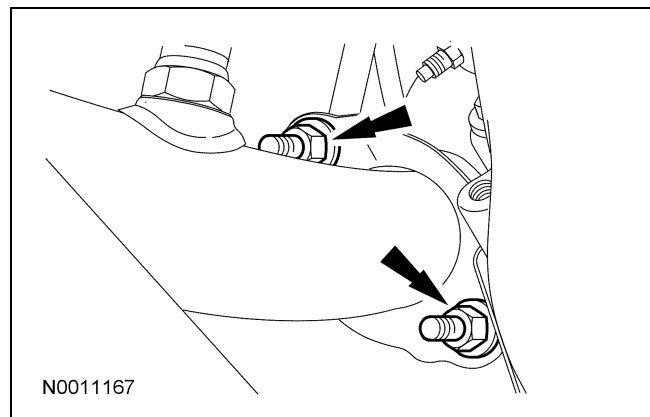
26. Remove the 4 bolts and the fuel rail and injectors.



27. Separate the 6 fuel injectors from the fuel rail and discard the O-ring seals.

28. **NOTE:** LH side shown, RH side similar.

Remove the 4 catalytic converter-to-manifold nuts.

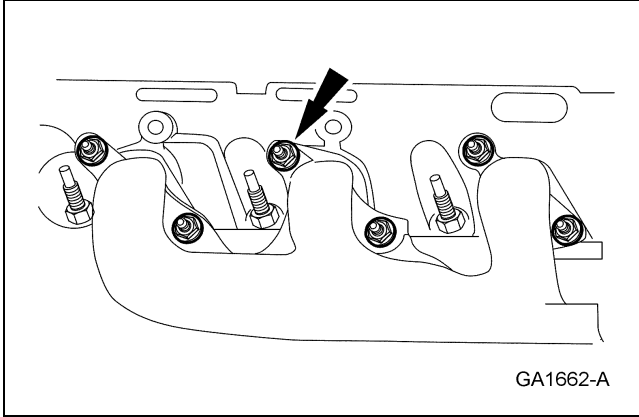


IN-VEHICLE REPAIR (Continued)

29. **NOTE:** LH side shown, RH side similar.

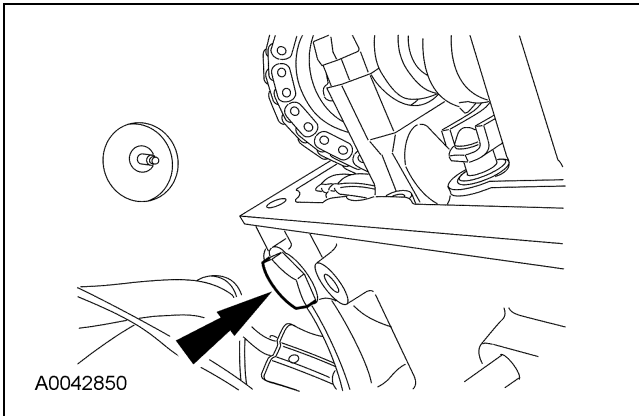
Remove the 12 nuts and the exhaust manifolds and gaskets.

- Discard the gaskets.



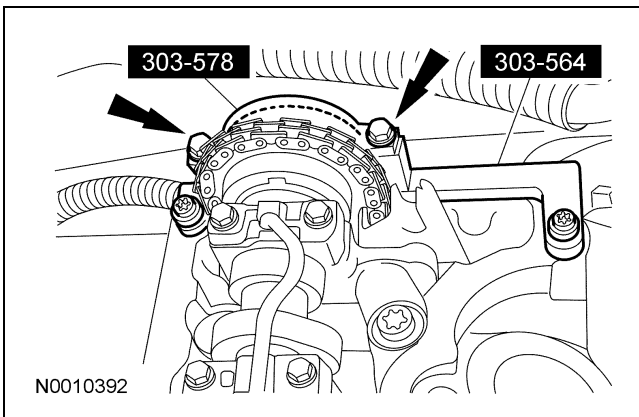
RH side

30. Remove the RH side hydraulic chain tensioner.



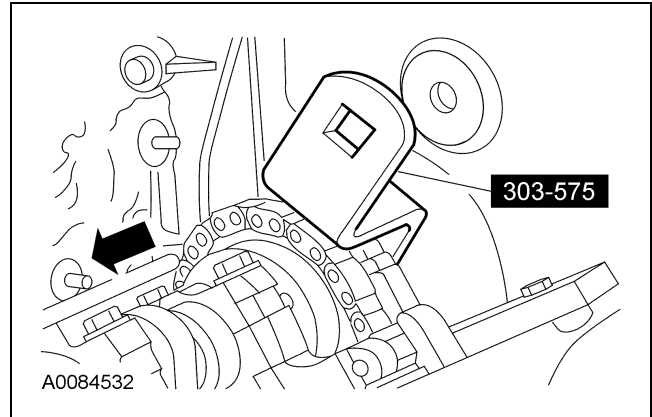
31. Install the special tools.

- Tighten the top clamp bolts to 10 Nm (89 lb-in).

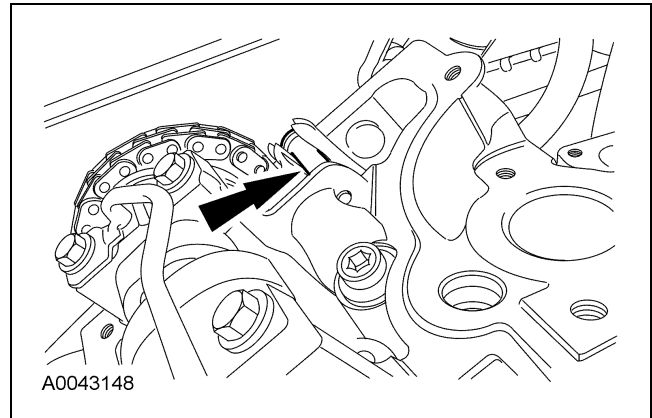


32. **CAUTION:** The RH camshaft sprocket bolt is a LH-threaded bolt.


Using the special tool with the Camshaft Sprocket Nut Socket 303-565, remove the RH camshaft bolt.



33. Remove the RH side cassette bolt.

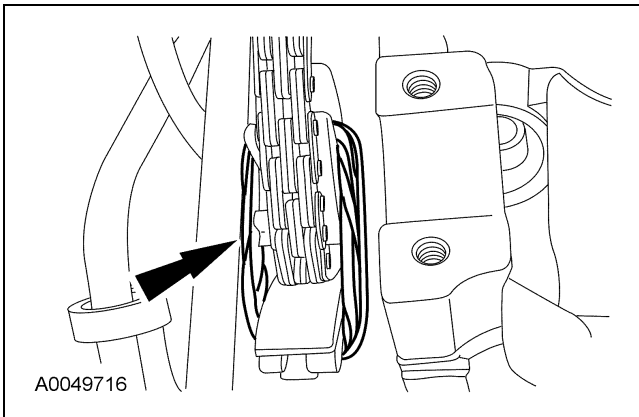


IN-VEHICLE REPAIR (Continued)

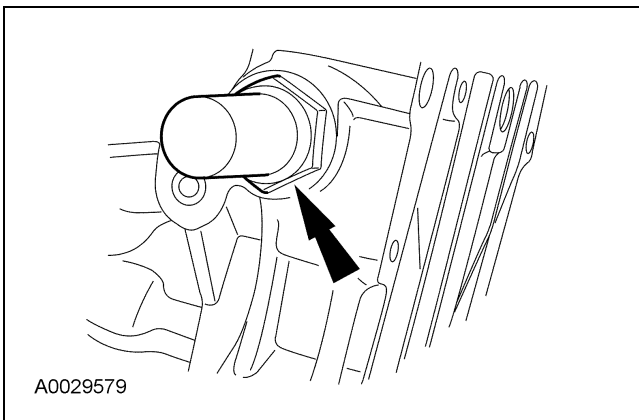
34.  **CAUTION:** Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head.

NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.

Remove the RH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.

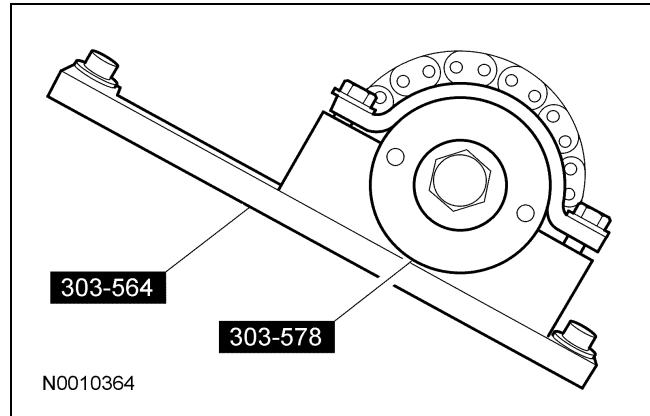
**LH side**

35. Remove the LH side hydraulic chain tensioner.

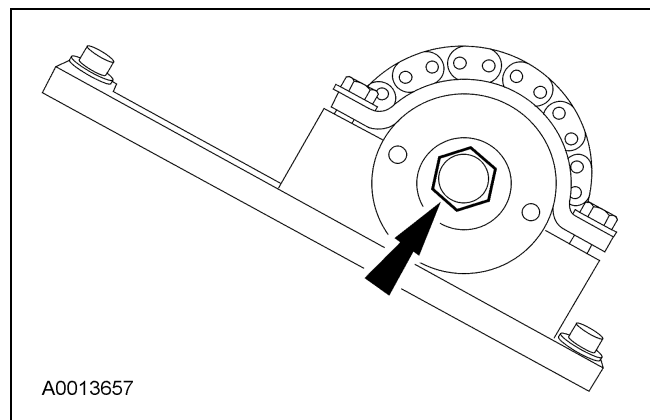


36. Install the special tools.

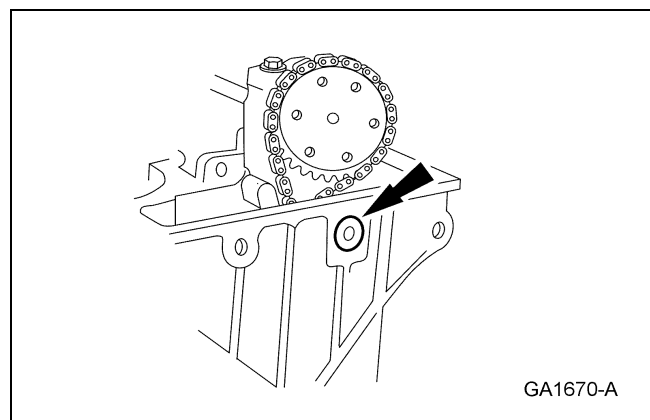
- Tighten to 10 Nm (89 lb-in).




37. Remove the LH side camshaft sprocket bolt.



38. Remove the LH side cassette bolt.

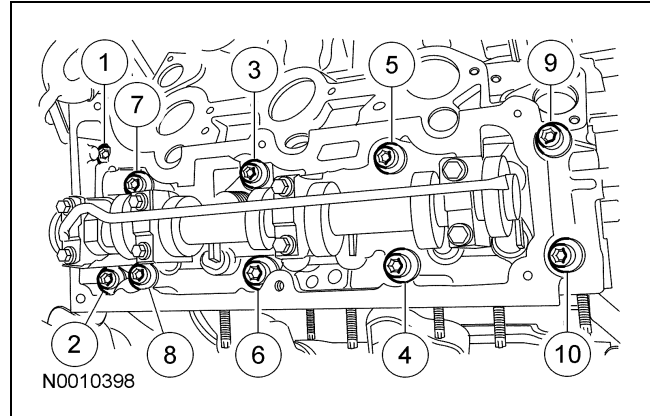
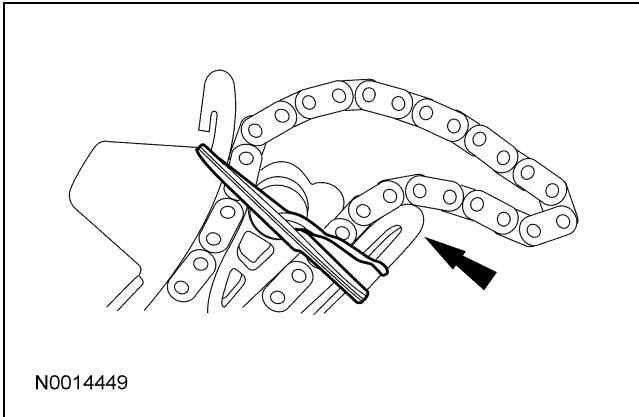



IN-VEHICLE REPAIR (Continued)

39.  **CAUTION:** Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head.

NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.


Remove the LH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.




41.  **CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket. Clean and inspect the mating surfaces.

42. Inspect the cylinder head and the cylinder block for flatness. For additional information, refer to Section 303-00.

Both sides

40.  **CAUTION:** To avoid damage to the timing chain cassette, an assistant will be required to help lift the cylinder head from the vehicle.

 **CAUTION:** On the RH side, when lifting the cylinder head, be careful to avoid contacting the A/C tube.

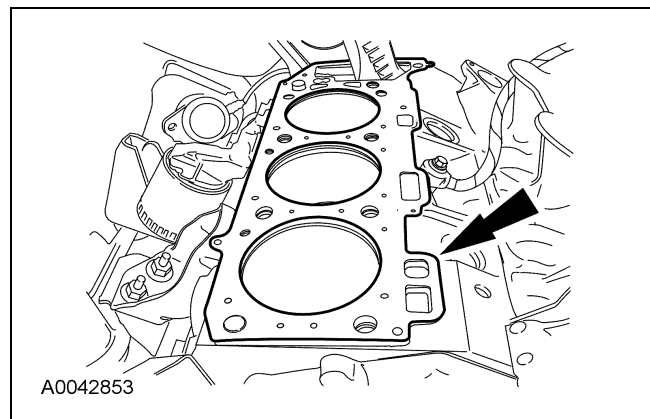
NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

Remove the cylinder heads.

- Remove the cylinder head bolts in the sequence shown. Discard all the bolts.
- Remove and discard the head gaskets.

Installation**Both sides**

1. Position the cylinder head gaskets on the block.



IN-VEHICLE REPAIR (Continued)

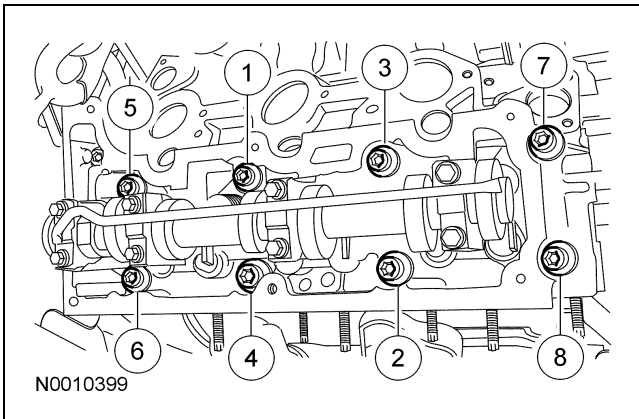
RH side

2. **⚠ CAUTION:** To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.

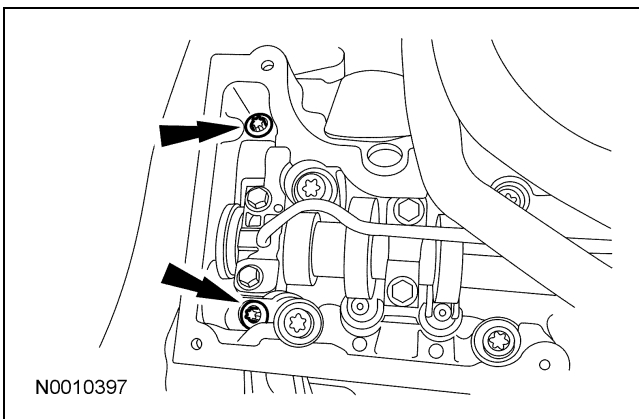
NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

Position the RH cylinder head. Install 8 new M12 bolts and tighten in the sequence shown in 2 stages.

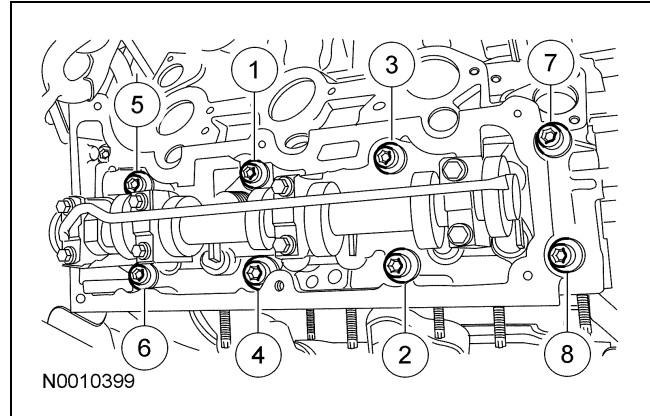
- Stage 1: Tighten to 12 Nm (9 lb-ft).
- Stage 2: Tighten to 25 Nm (18 lb-ft).



3. Install 2 new M8 bolts.
- Tighten to 32 Nm (24 lb-ft).



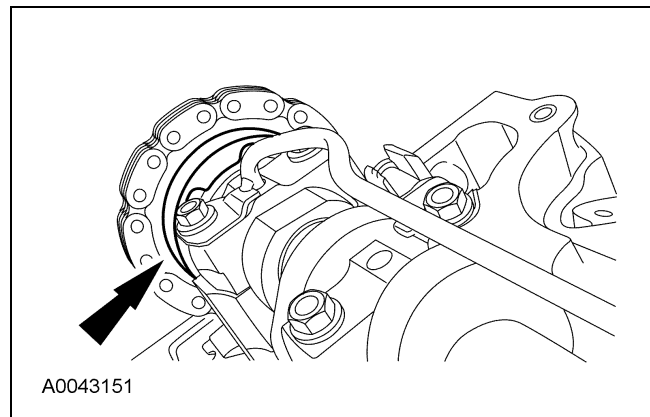
4. Tighten the 8 M12 bolts in the sequence shown in 2 stages.
- Stage 1: Tighten 90 degrees.
 - Stage 2: Tighten an additional 90 degrees.



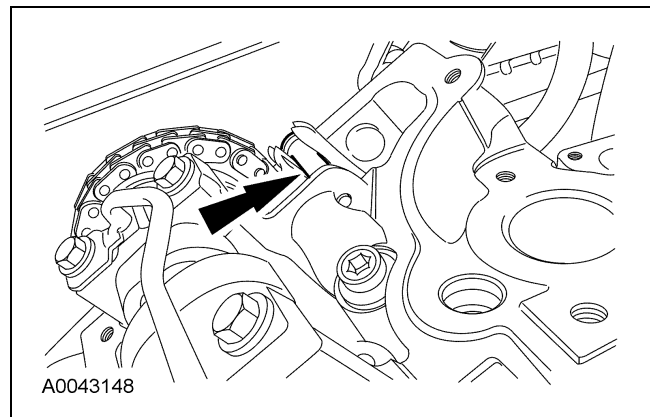
5. **⚠ CAUTION:** The camshaft gear must turn freely on the camshaft. **DO NOT** tighten the bolt at this time.

⚠ CAUTION: The right-hand camshaft sprocket bolt is a left-hand threaded bolt.

Remove the rubber band, position the camshaft sprocket and chain. Loosely install the bolt.



6. Install the RH side cassette bolt.
- Tighten to 12 Nm (9 lb-ft).



IN-VEHICLE REPAIR (Continued)

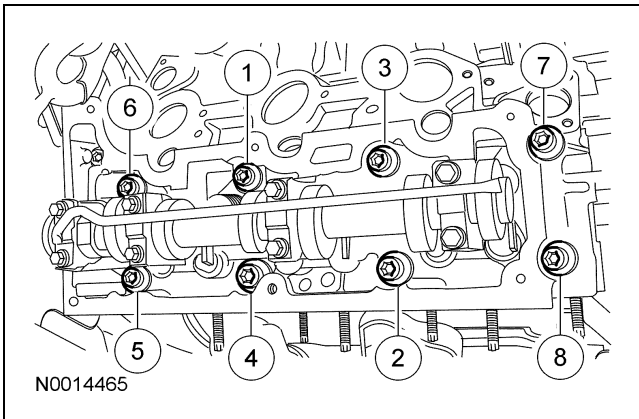
LH side

7. **⚠ CAUTION:** To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.

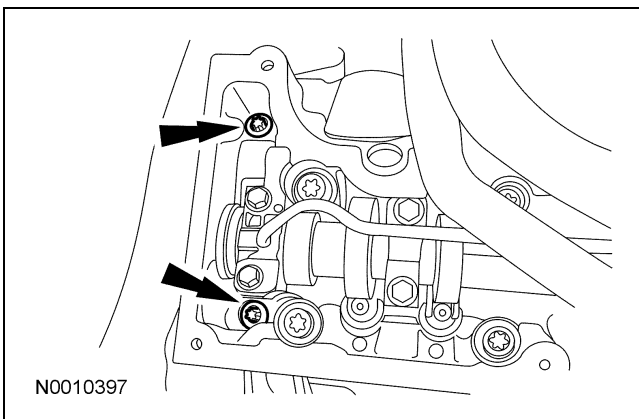
NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

Position the LH cylinder head. Install 8 new M12 bolts and tighten in the sequence shown in 2 stages.

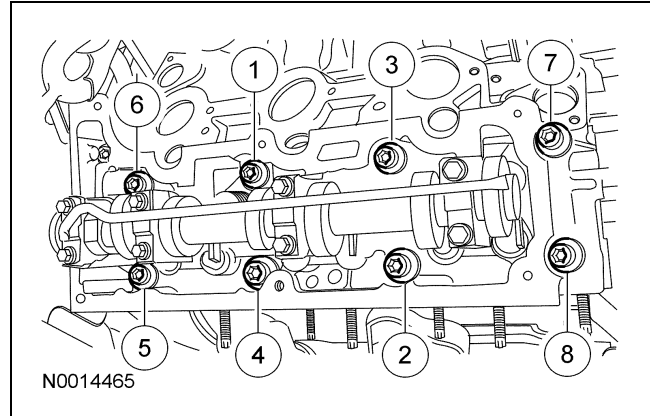
- Stage 1: Tighten to 12 Nm (9 lb-ft).
- Stage 2: Tighten to 25 Nm (18 lb-ft).



8. Install 2 new M8 bolts.
- Tighten to 32 Nm (24 lb-ft).

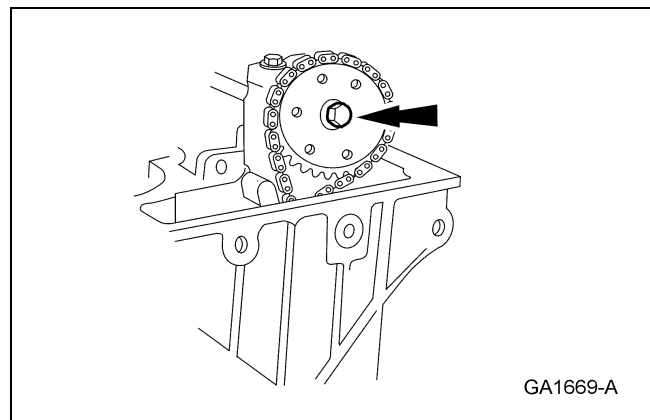


9. Tighten the 8 M12 bolts in the sequence shown in 2 stages.
- Stage 1: Tighten 90 degrees.
 - Stage 2: Tighten an additional 90 degrees.

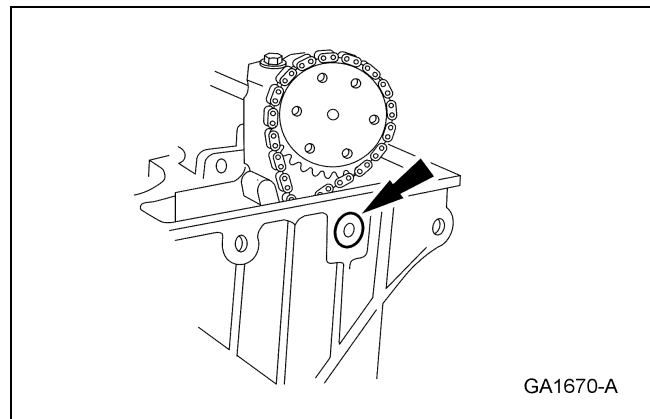


10. **⚠ CAUTION:** The camshaft gear must turn freely on the camshaft. **DO NOT** tighten the bolt at this time.

Remove the rubber band, position the camshaft sprocket and chain. Loosely install the bolt.



11. Install the LH side cassette bolt.
- Tighten to 19 Nm (14 lb-ft).

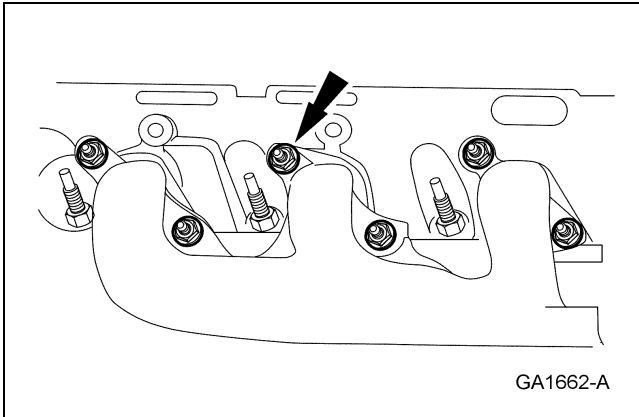


IN-VEHICLE REPAIR (Continued)**Both sides**

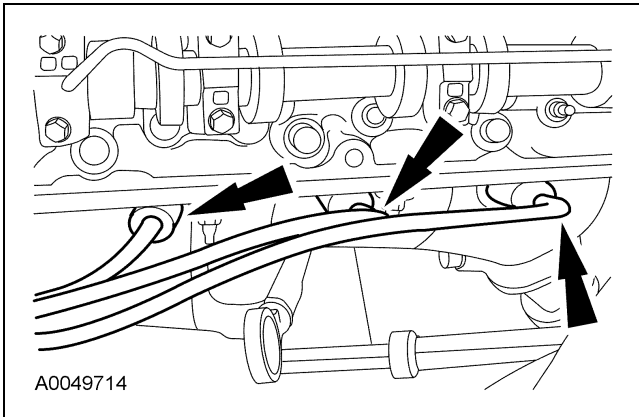
12. **NOTE:** LH side shown, RH side similar.

Position new gaskets and the exhaust manifolds.
Install the 12 nuts.

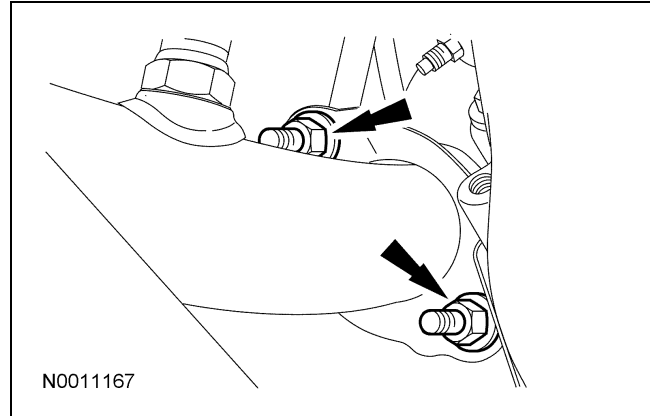
- Tighten to 22 Nm (16 lb-ft).



13. **NOTE:** Apply dielectric compound to the inside of the spark plug wire boots.
Connect the 6 spark plug wires to the spark plugs.



14. **NOTE:** LH side shown, RH side similar.
Install the 4 catalytic converter-to-exhaust manifold nuts.
• Tighten to 40 Nm (30 lb-ft).



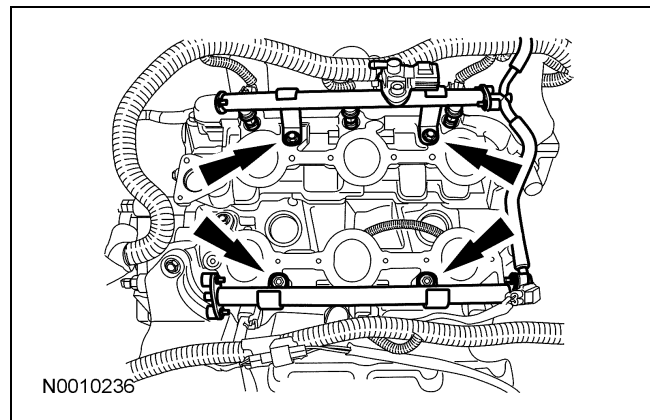
15. **NOTE:** Lubricate the new O-ring seals with clean engine oil.

Install the 6 fuel injectors.

- Install new O-ring seals on the injectors.
- Install the injectors.


16. Position the fuel rail and injectors and install the 4 bolts.

- Tighten to 24 Nm (18 lb-ft).



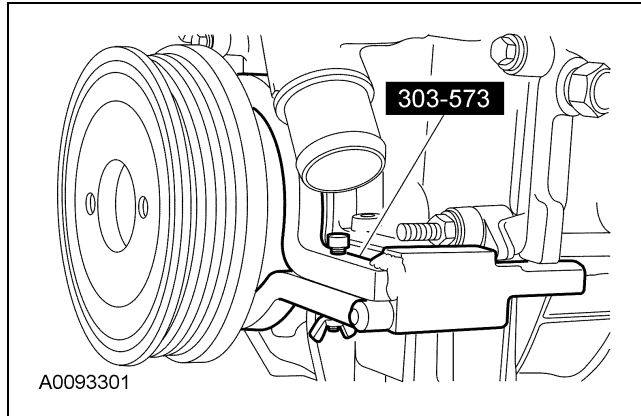
17. **NOTE:** The LH and RH camshafts must be retimed when either camshaft is disturbed.
Turn the crankshaft clockwise to position the number one cylinder at top dead center (TDC).

IN-VEHICLE REPAIR (Continued)

18.  **CAUTION:** Do not rotate the engine counterclockwise. Rotating the engine counterclockwise will result in incorrect timing of the engine.

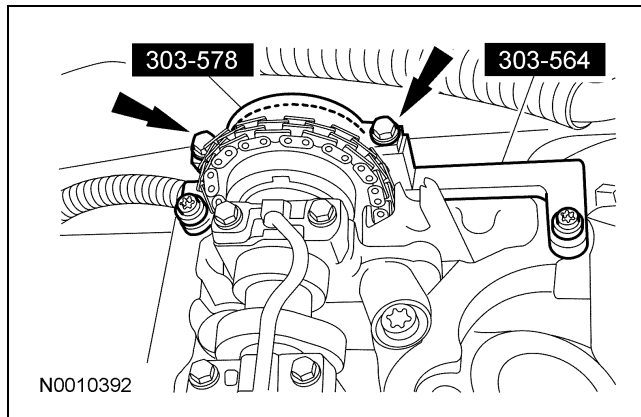
NOTE: The special tool must be installed on the damper and should contact the engine block, this positions the engine at TDC.

Install the special tool.



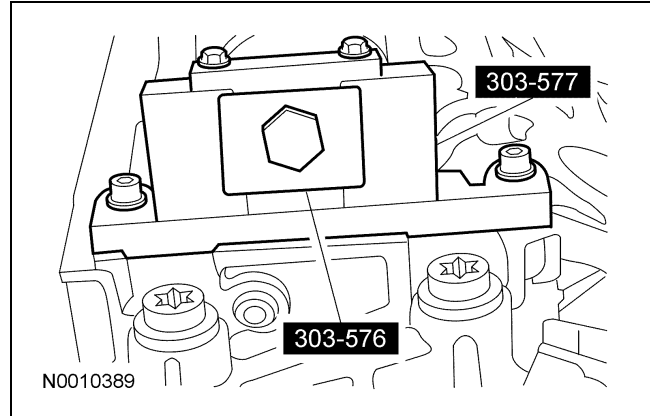
19. **NOTE:** Leave the top 2 special tool clamp bolts loose.

Install the special tools on the rear of the RH cylinder head.

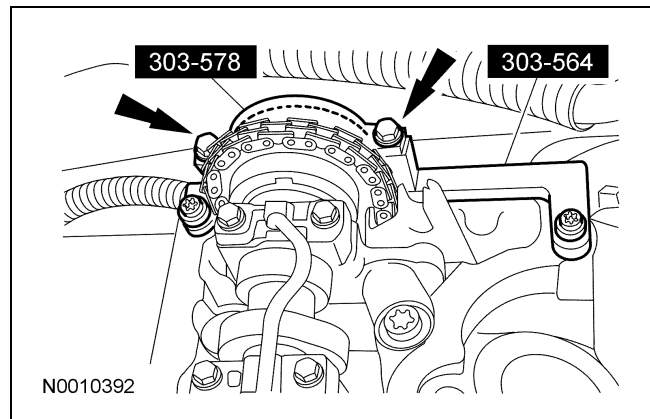


20. **NOTE:** The camshaft timing slots are off-center.

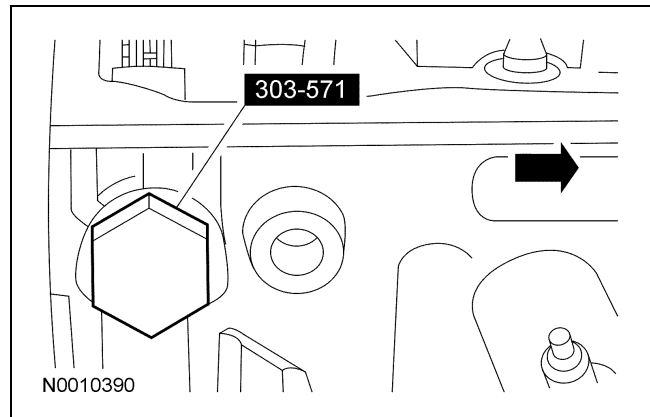
Position the camshaft timing slots below the centerline of the camshaft to correctly fit the special tools, and install the special tools on the front of the RH cylinder head.



21. Tighten the top clamp bolts to 10 Nm (89 lb-in).



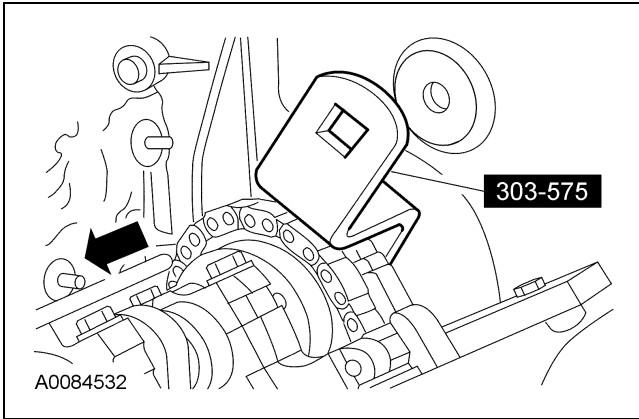
22. Install the special tool.



IN-VEHICLE REPAIR (Continued)

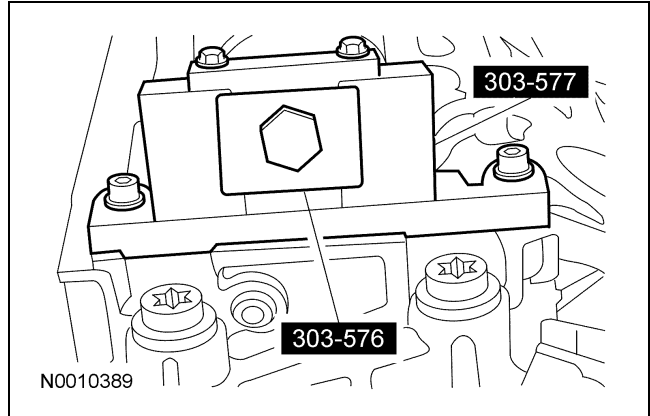
23. **⚠ CAUTION:** The RH camshaft sprocket bolt is a LH-threaded bolt.

Using the special tool with the Camshaft Sprocket Nut Socket 303-565, tighten the camshaft bolt to 85 Nm (63 lb-ft).



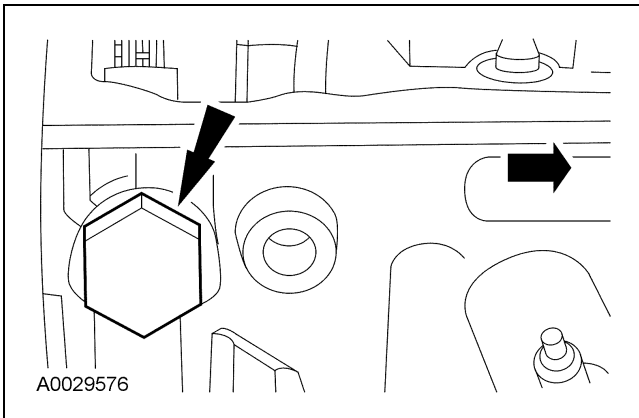
26. **NOTE:** The camshaft timing slots are off-center.

Position the camshaft timing slots below the centerline of the camshaft to correctly fit the special tools, and install the special tools on the rear of the LH cylinder head.

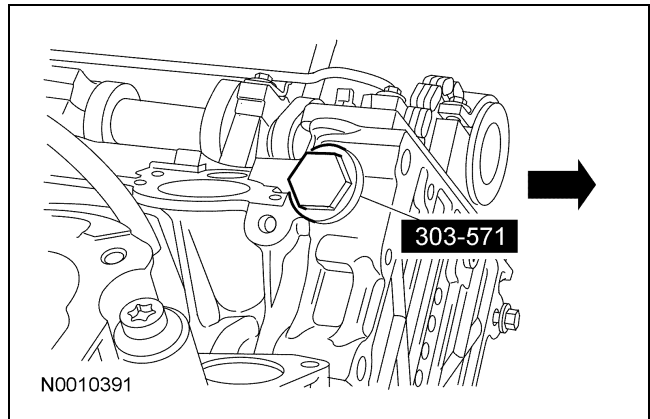


24. Install the RH camshaft tensioner.

- Tighten to 44 Nm (32 lb-ft).

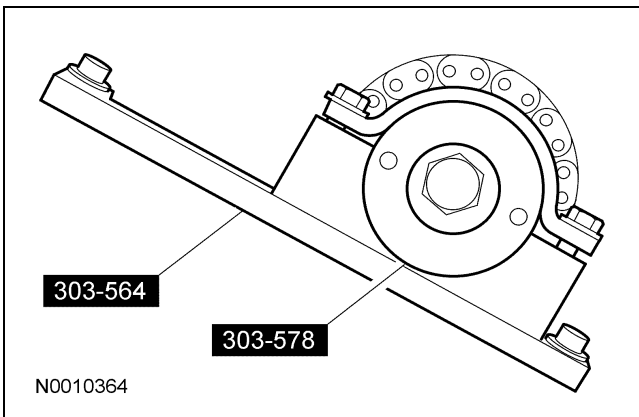


27. Install the special tool.



25. **NOTE:** Leave the top 2 special tool clamp bolts loose.

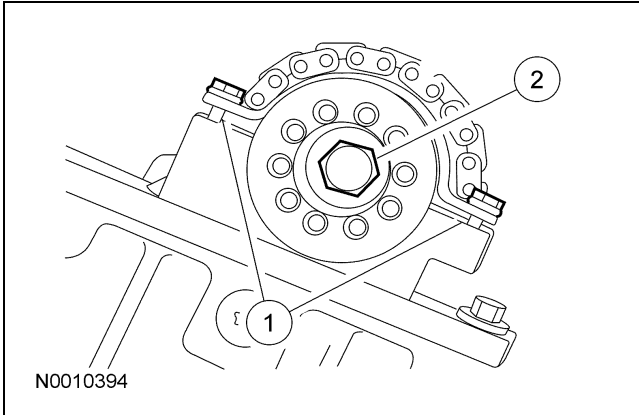
Install the special tools on the front of the LH cylinder head.



IN-VEHICLE REPAIR (Continued)

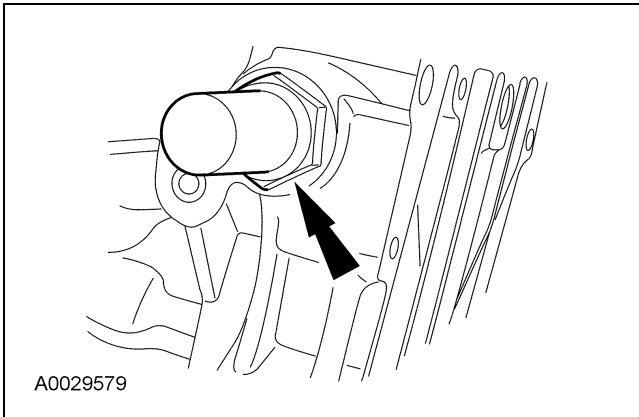
28. Tighten the bolts.

- 1 Tighten the special tool top 2 clamp bolts to 10 Nm (89 lb-in).
- 2 Tighten the camshaft bolt to 85 Nm (63 lb-ft).



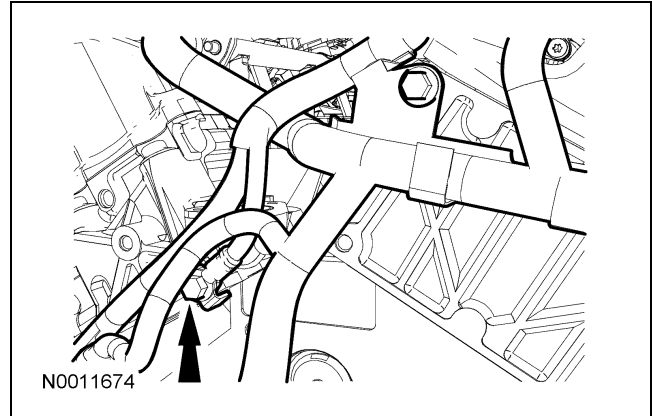
29. Install the LH camshaft tensioner.

- Tighten to 44 Nm (32 lb-ft).

**LH side**

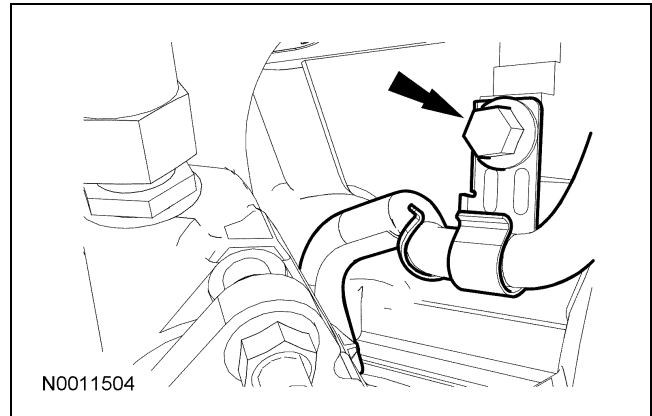
30. Position the ground strap and install the bolt.

- Tighten to 40 Nm (30 lb-ft).
- Attach the wiring harness retainer to the backside of the cylinder head.



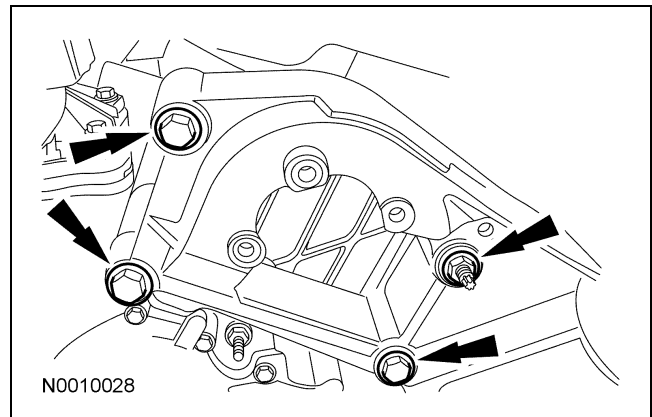
31. Position the starter motor wiring retainer bracket and install the bolt.

- Tighten to 40 Nm (30 lb-ft).



32. Position the front engine accessory drive (FEAD) bracket and A/C compressor. Install the 3 bolts and the nut.

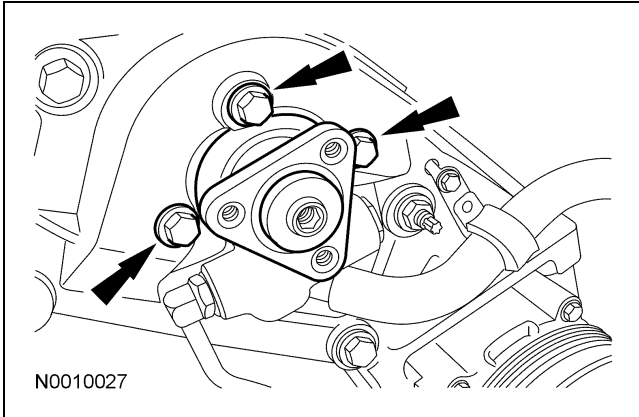
- Tighten to 47 Nm (35 lb-ft).



IN-VEHICLE REPAIR (Continued)

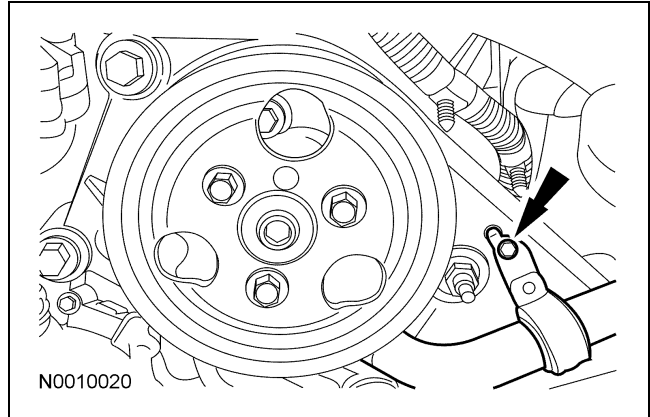
33. Position the power steering pump and install the 3 bolts.

- Tighten to 25 Nm (18 lb-ft).



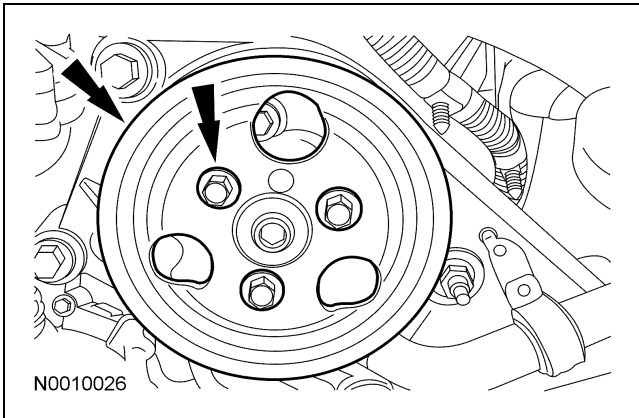
36. Attach the power steering supply hose bracket to the FEAD bracket and install the bolt.

- Tighten to 11 Nm (8 lb-ft).



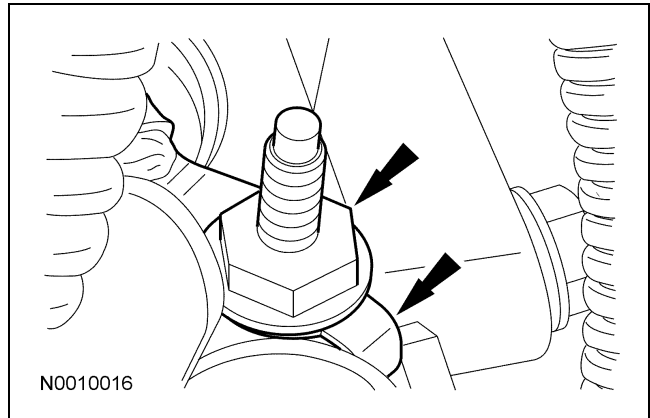
34. Position the power steering pump pulley and install the 3 bolts.

- Tighten to 25 Nm (18 lb-ft).



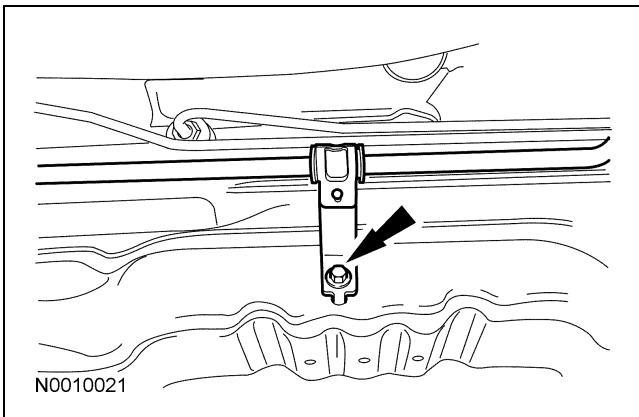
37. Position the ground strap and install the stud bolt.

- Tighten to 10 Nm (89 lb-in).



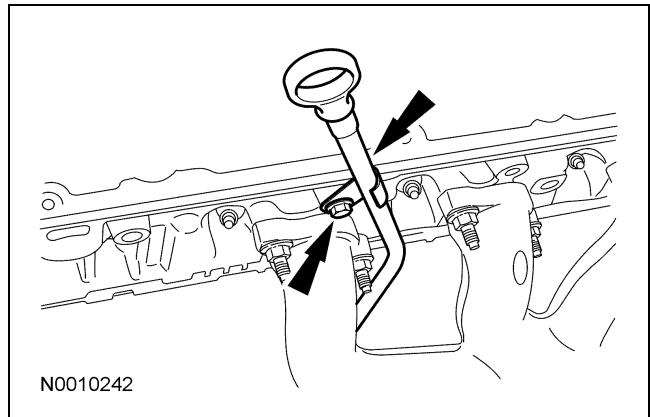
35. Attach PSP tube bracket to the crossmember and install the bolt.

- Tighten to 11 Nm (8 lb-ft).



38. Install the oil level indicator tube and bolt.

- Tighten to 11 Nm (8 lb-ft).

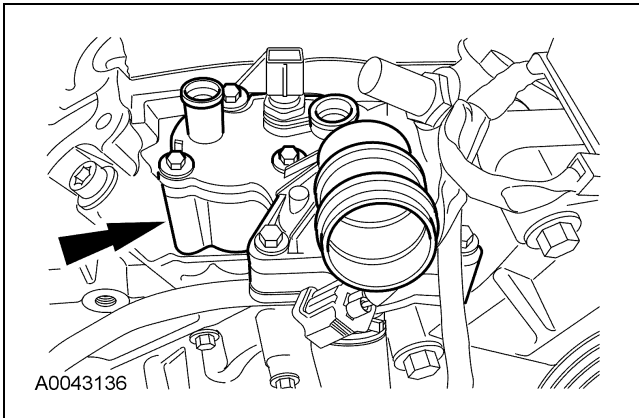


IN-VEHICLE REPAIR (Continued)**RH side**

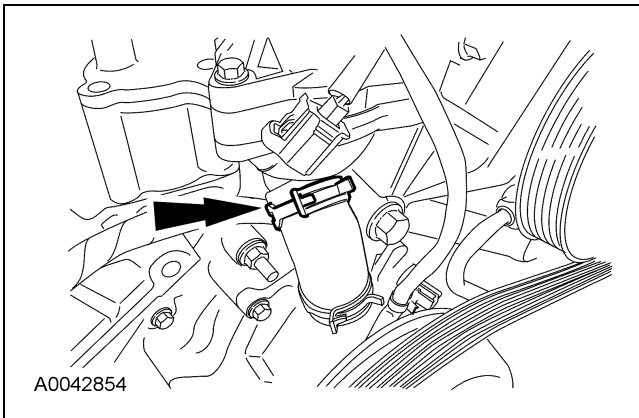
39. **NOTE:** Inspect the O-ring seal. Install a new O-ring seal if necessary.

Position the thermostat housing and install the 3 bolts.

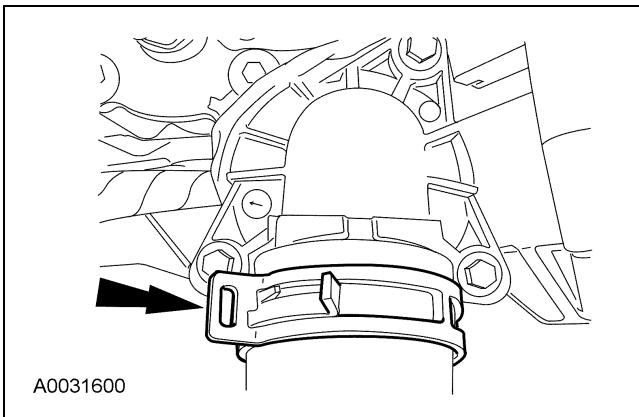
- Tighten to 11 Nm (8 lb-ft).



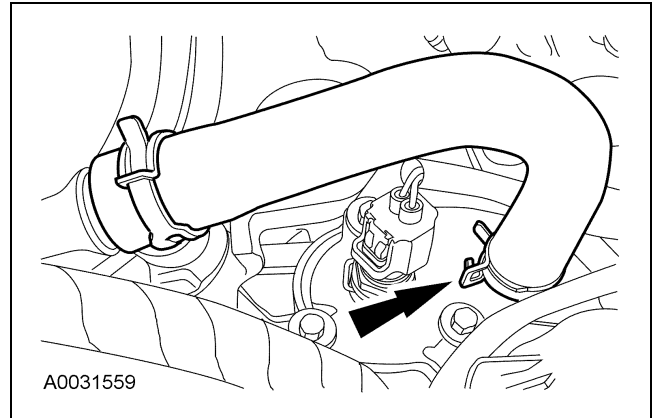
40. Position the coolant bypass hose clamp.



41. Install the upper radiator hose.

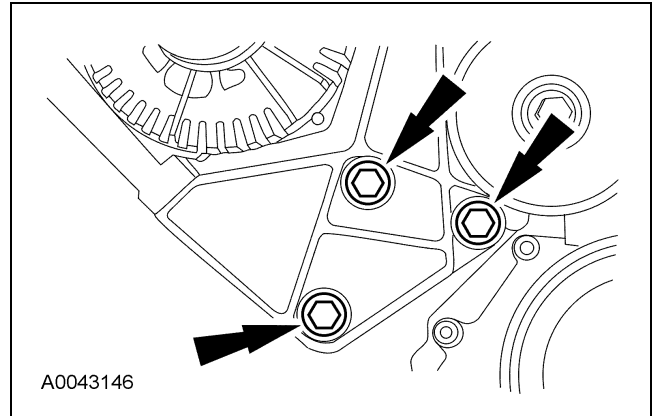


42. Connect the heater hose to the thermostat housing.



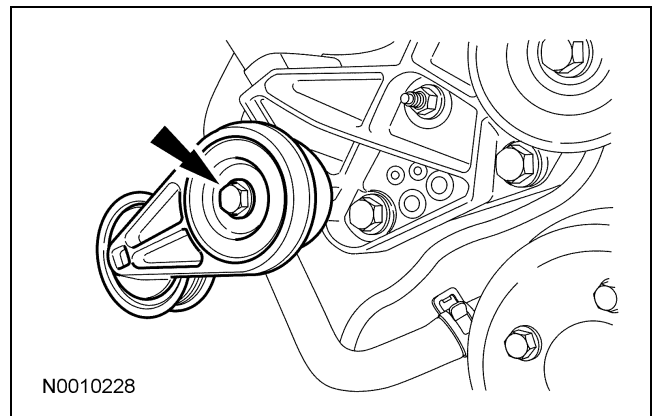
43. Position the generator mounting bracket assembly and install the 2 bolts and the nut.

- Tighten to 47 Nm (35 lb-ft).



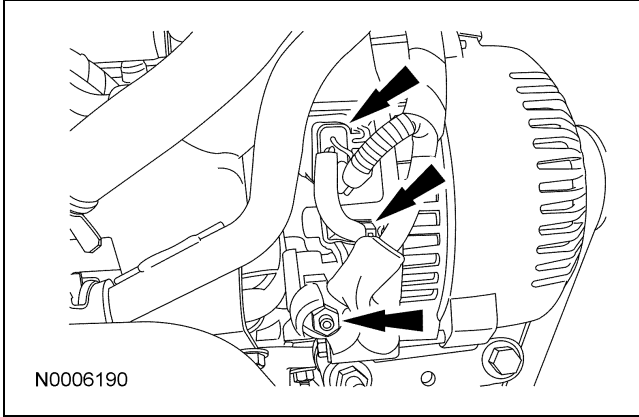
44. Install the accessory drive belt tensioner and bolt.

- Tighten to 47 Nm (35 lb-ft).

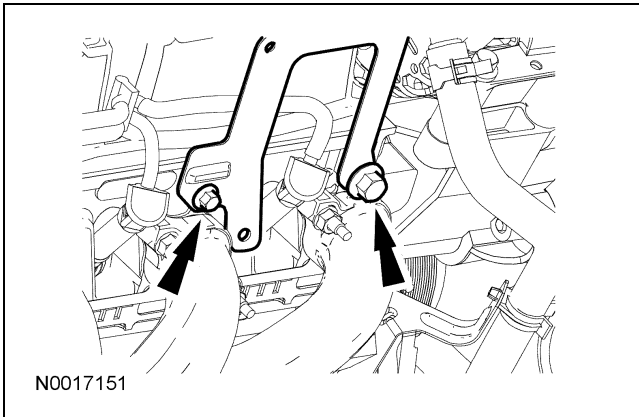


IN-VEHICLE REPAIR (Continued)

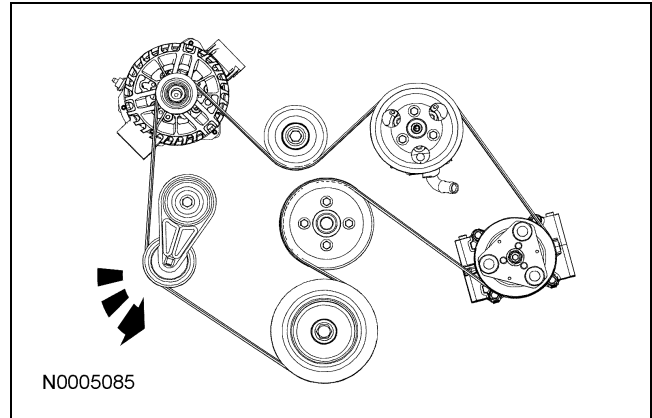
45. Connect the generator electrical connector.
Position the B+ terminal and install the nut.
- Tighten to 8 Nm (71 lb-in).
 - Attach the pin-type retainer.



46. Install the 2 coolant tube bracket bolts.
- Tighten the M12 bolt to 34 Nm (25 lb-ft).
 - Tighten the M8 bolt to 23 Nm (17 lb-ft).

**Both sides**

47. Rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.



48. Install the hydraulic lash adjusters. For additional information, refer to Hydraulic Lash Adjuster in this section.
49. Install the intake manifold. For additional information, refer to Intake Manifold in this section.
50. Install the engine coolant temperature (ECT) sensor. For additional information, refer to Section 303-14.
51. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03.