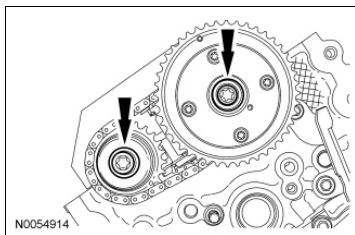
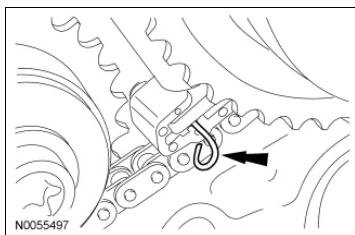


15. Install 2 new bolts and the original washer. Tighten in 4 stages.

- Stage 1: Tighten to 40 Nm (30 lb-ft).
- Stage 2: Loosen one full turn.
- Stage 3: Tighten to 10 Nm (89 lb-in).
- Stage 4: Tighten 90 degrees.

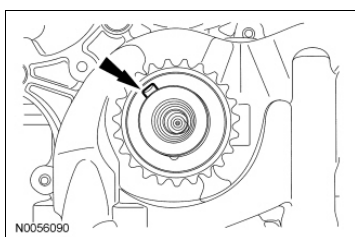


16. Remove the lockpin from the RH secondary timing chain tensioner.

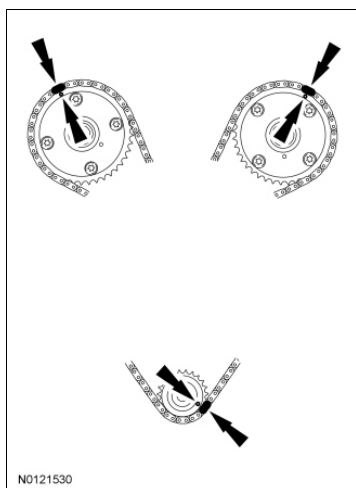


All camshafts

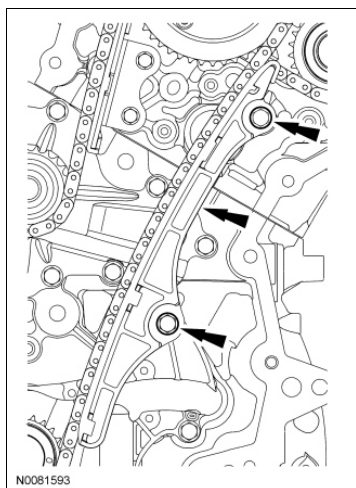
17. Rotate the crankshaft clockwise 60 degrees to the TDC position (crankshaft dowel pin at 11 o'clock).



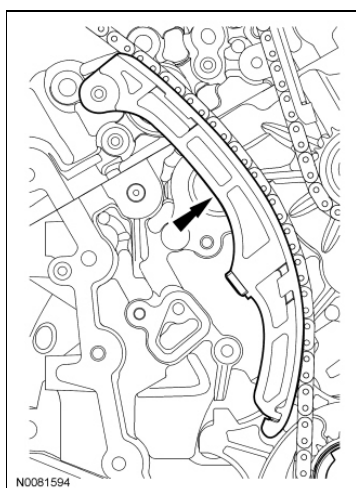
18. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.



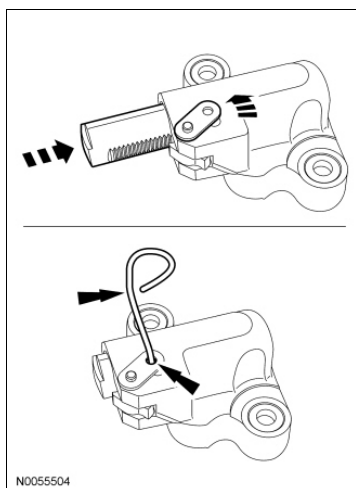
19. Install the lower LH primary timing chain guide and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).



20. Install the primary timing chain tensioner arm.



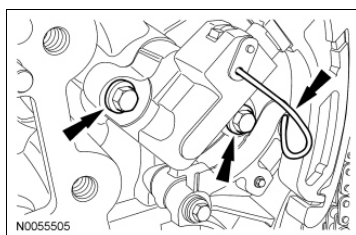
21. Reset the primary timing chain tensioner.
- Rotate the lever counterclockwise.
 - Using a soft-jawed vise, compress the plunger.
 - Align the hole in the lever with the hole in the tensioner housing.
 - Install a suitable lockpin.



22. **NOTE:** It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

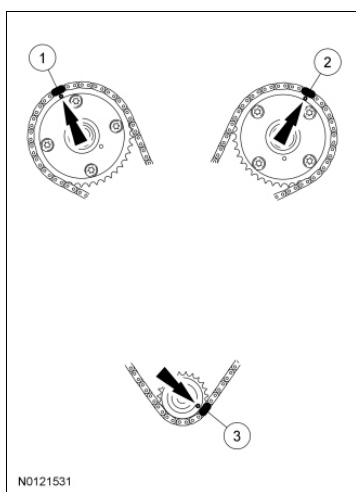
Install the primary tensioner and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).
- Remove the lockpin.

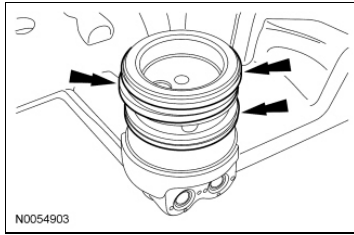


23. As a post-check, verify correct alignment of all timing marks.

- There are 38 links in between the RH intake VCT assembly colored link (1) and the LH intake VCT assembly colored link (2).
- There are 27 links in between LH intake VCT assembly colored link (2) and the crankshaft sprocket link (3).



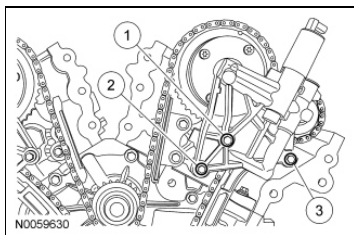
24. Inspect the VCT housing seals for damage and replace as necessary.



25. **NOTICE:** Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

Install the LH VCT housing and the 3 bolts.

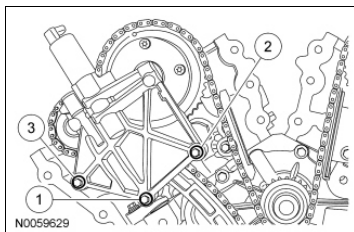
- Tighten in the sequence shown to 10 Nm (89 lb-in).



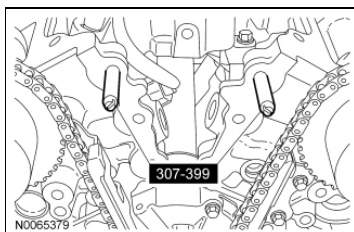
26. **NOTICE:** Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

Install the RH VCT housing and the 3 bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).



27. Install the Alignment Pins.



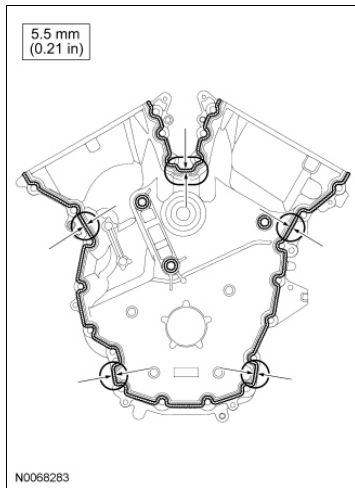
28. **NOTICE:** Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time

limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.

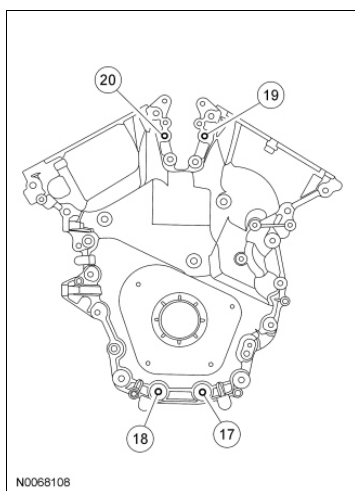
- Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.



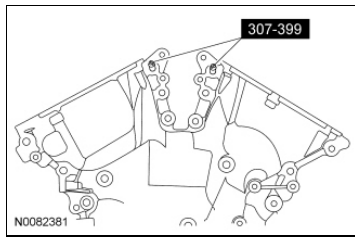
29. **NOTE:** Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

Install the engine front cover and bolts 17, 18, 19 and 20.

- Tighten in sequence to 3 Nm (27 lb-in).

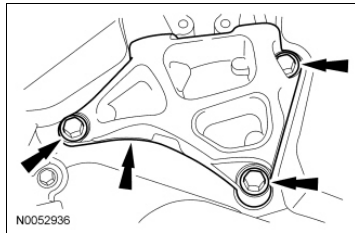


30. Remove the Alignment Pins.



31. **NOTE:** Do not tighten the bolts at this time.

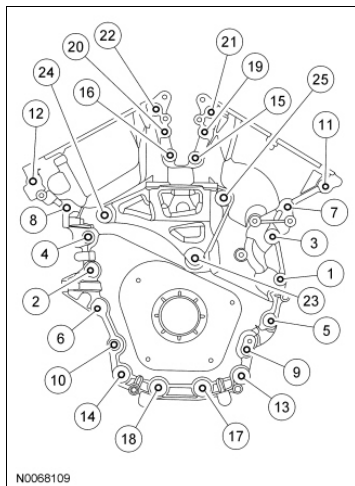
Install the engine mount bracket and the 3 bolts.



32. **NOTICE:** Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:

- Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (133 lb-in).
- Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

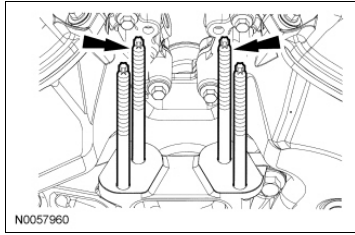


33. **NOTICE:** The thread sealer on the engine mount studs (including new engine mount studs if applicable) must be cleaned off with a wire brush and new thread sealer applied prior to installing the engine mount studs. Failure to follow this procedure may result in damage to the engine mount studs or engine.

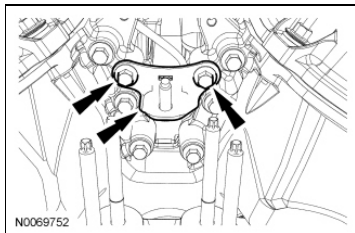
Install the engine mount studs in the following sequence.

1. Clean the front cover engine mount stud holes with pressurized air to remove any foreign material.

2. Clean all the thread sealer from the engine mount studs (old and new studs).
3. Apply new thread sealer to the engine mount stud threads.
4. Install the 2 engine mount studs.
 - ◆ Tighten to 20 Nm (177 lb-in).

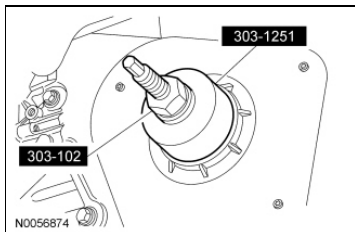


34. Install the engine mount bracket and the 2 bolts.
 - Tighten to 30 Nm (22 lb-ft).



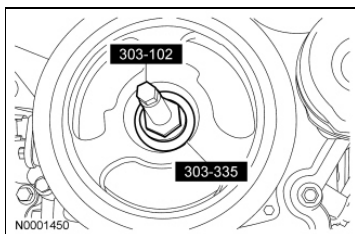
35. **NOTE:** Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

Using the Crankshaft Vibration Damper Installer and Front Crankshaft Seal Installer, install a new crankshaft front seal.

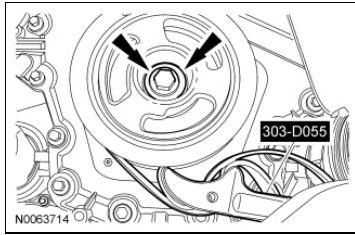


36. **NOTE:** Lubricate the outside diameter sealing surfaces with clean engine oil.

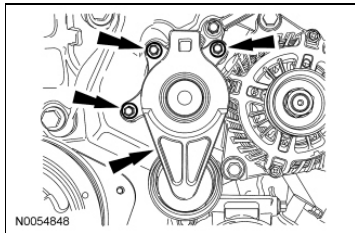
Using the Crankshaft Vibration Damper Installer and Front Cover Oil Seal Installer, install the crankshaft pulley.



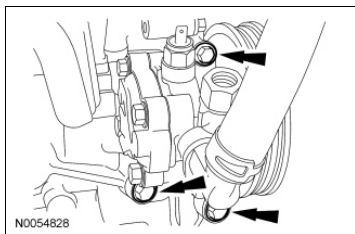
37. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
 - Stage 1: Tighten to 120 Nm (89 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 50 Nm (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.



38. Install the accessory drive belt tensioner and the 3 bolts.
- Tighten to 11 Nm (97 lb-in).



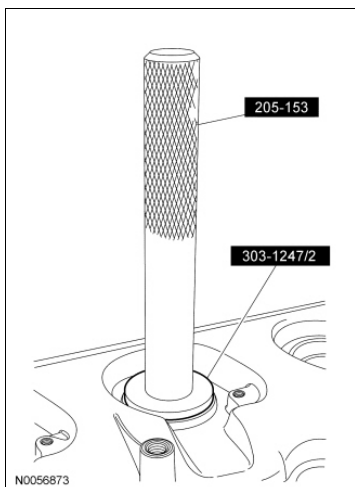
39. Install the power steering pump and the 3 bolts.
- Tighten to 24 Nm (18 lb-ft).



40. **NOTE:** Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, VCT seal installation similar.

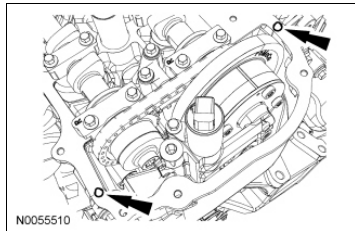
Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.



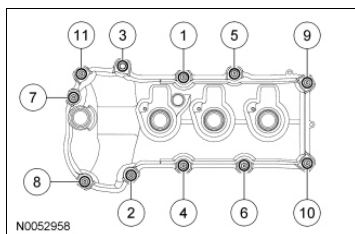
41. **NOTICE:** Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.



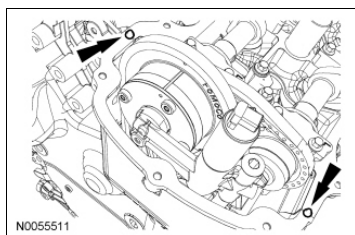
42. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
- Tighten in the sequence shown to 10 Nm (89 lb-in).



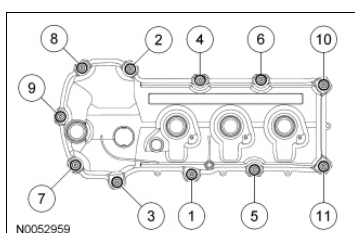
43. **NOTICE:** Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

Apply a 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.



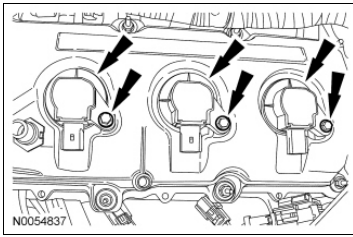
44. Using a new gasket, install the LH valve cover and 11 stud bolts.
- Tighten in the sequence shown to 10 Nm (89 lb-in).



45. **NOTE:** LH shown, RH similar.

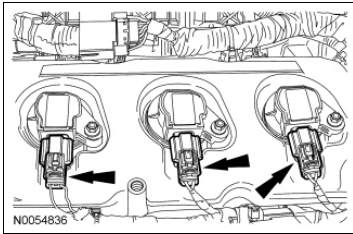
Install the 6 coil-on-plug assemblies and the 6 bolts.

- Tighten to 7 Nm (62 lb-in).

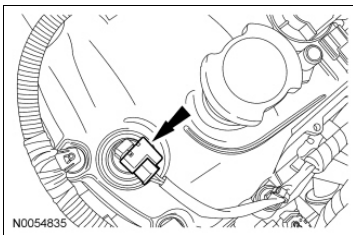


46. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.

47. Connect the 3 LH coil-on-plug electrical connectors.

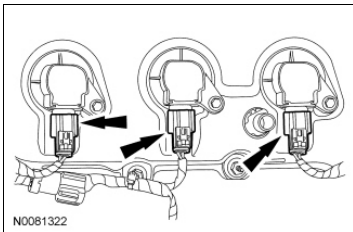


48. Connect the LH camshaft VCT solenoid electrical connector.

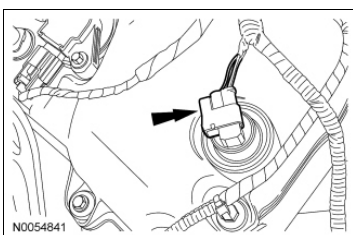


49. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.

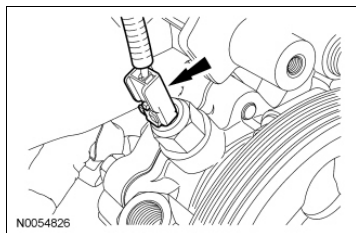
50. Connect the 3 RH coil-on-plug electrical connectors.



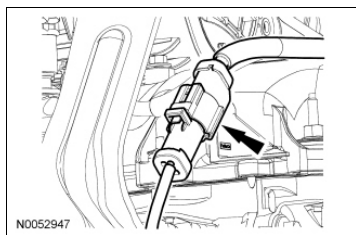
51. Connect the RH VCT solenoid electrical connector.



52. Connect the Power Steering Pressure (PSP) switch electrical connector.

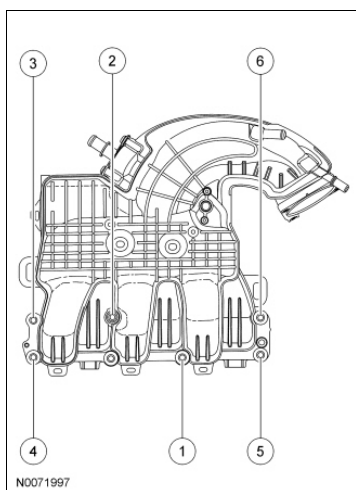


53. Connect the RH Catalyst Monitor Sensor (CMS) sensor electrical connector.



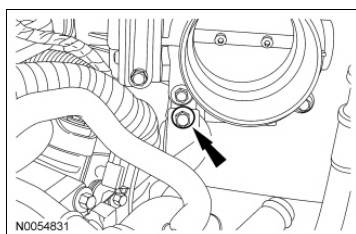
54. Using new gaskets, install the upper intake manifold and the 6 bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).



55. Install the upper intake manifold support bracket bolt.

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



56. Attach the wiring harness retainers to the upper intake manifold.