

INSTALLATION

ENGINE

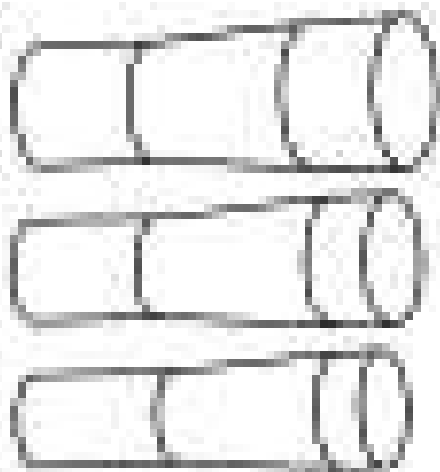
Special Tool(s)

SPECIAL TOOL CHART



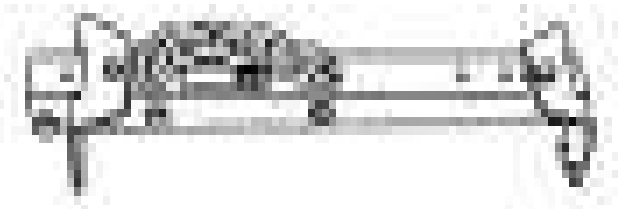
Installer, Power Steering Pump Pulley
211-185 (T91P-3A733-A)

ST1586-A



Installer Set, Teflon® Seal
211-D027 (D90P-3517-A)

ST1444-A



Lifting Bracket, Engine
303-F047 (014-00073) or equivalent

ST1377-A



Vehicle Communication Module (VCM) and
Integrated Diagnostic System (IDS) software
with appropriate hardware, or equivalent
scan tool

ST2834-A

Material

MATERIAL SPECIFICATIONS

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

1. Position the engine in the vehicle and remove the floor crane.
2. Install the LH engine support insulator through bolt.

- Tighten to 350 Nm (258 lb-ft).

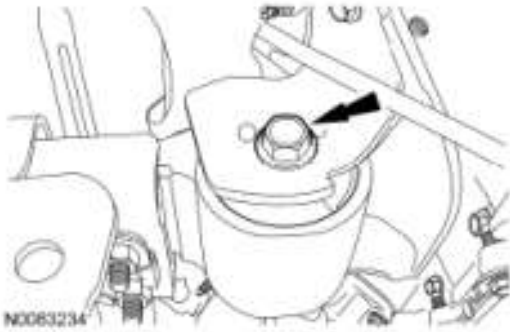


Fig. 524: Locating LH Engine Support Insulator Bolt
Courtesy of FORD MOTOR CO.

3. Install the 2 RH engine support insulator nuts.
 - Tighten to 250 Nm (184 lb-ft).

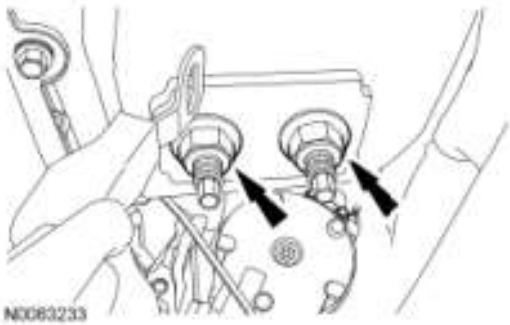


Fig. 525: Locating RH Engine Support Insulator Nuts
Courtesy of FORD MOTOR CO.

4. Tighten the 2 transmission mount nuts.
 - Tighten to 103 Nm (76 lb-ft).

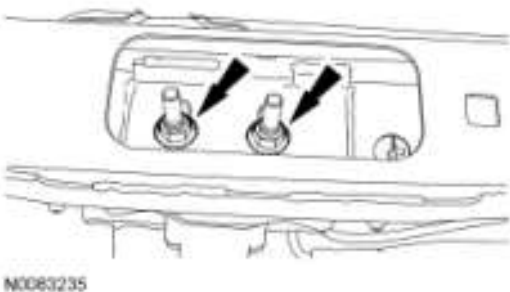


Fig. 526: Locating Transmission Mount Nuts
Courtesy of FORD MOTOR CO.

5. Install the 5 lower transmission-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).

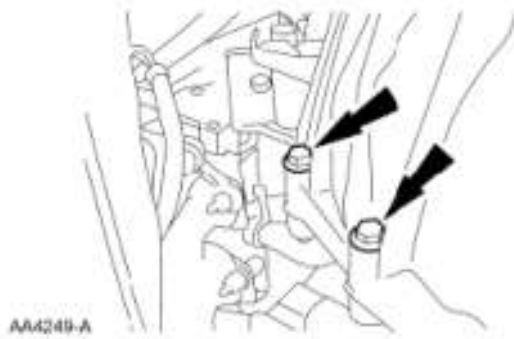


Fig. 527: Locating Lower Transmission-To-Engine Bolts
Courtesy of FORD MOTOR CO.

6. Install 4 new torque converter-to-flexplate nuts.
 - Tighten to 44 Nm (32 lb-ft).

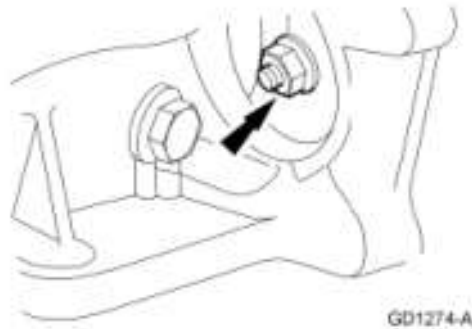


Fig. 528: Locating Torque Converter To Flexplate Nuts
Courtesy of FORD MOTOR CO.

7. Install the cylinder block opening cover.

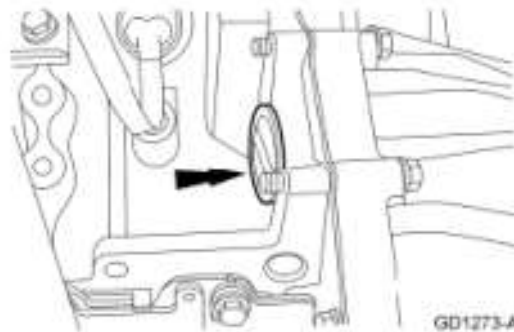


Fig. 529: Locating Cylinder Block Opening Cover
Courtesy of FORD MOTOR CO.

8. Position the flexplate inspection cover and install the 2 bolts.
 - Tighten to 35 Nm (26 lb-ft).

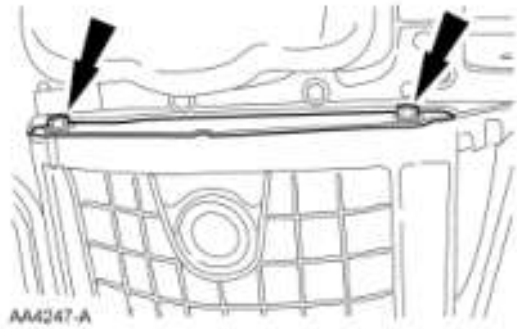


Fig. 530: Locating Flexplate Inspection Cover And Bolts
 Courtesy of FORD MOTOR CO.

9. Install the 4 exhaust manifold-to-dual converter Y-pipe nuts.
 - Tighten to 40 Nm (30 lb-ft).

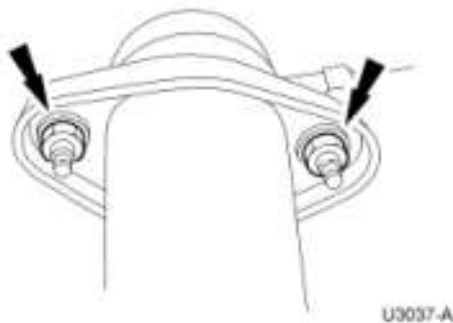


Fig. 531: Locating Exhaust Manifold-To-Dual Converter Y-Pipe Nuts
 Courtesy of FORD MOTOR CO.

10. Install the starter. For additional information, refer to **STARTING SYSTEM** .
11. Position the A/C compressor and install the 3 bolts.
 - Tighten to 25 Nm (18 lb-ft).

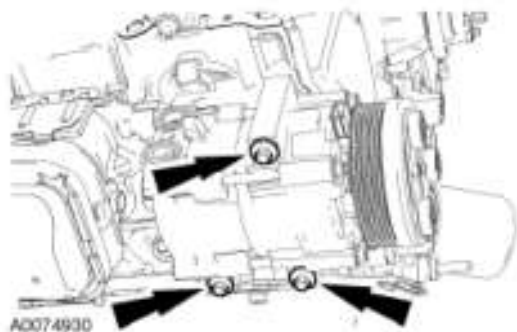


Fig. 532: Locating Bolts And A/C Compressor
 Courtesy of FORD MOTOR CO.

12. Remove the Engine Lifting Bracket.



Fig. 533: Identifying Engine Lifting Bracket (303-F047)
 Courtesy of FORD MOTOR CO.

13. Position the fuel and Evaporative Emission (EVAP) tube support bracket and install the upper 2 transmission-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).

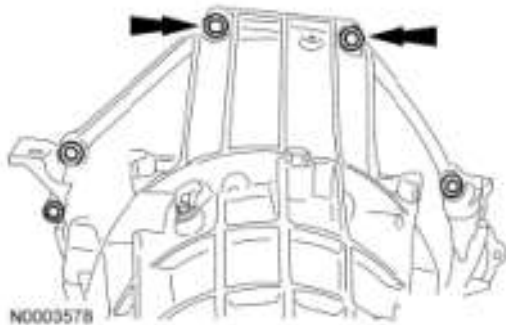


Fig. 534: Locating Upper Transmission-To-Engine Bolts
 Courtesy of FORD MOTOR CO.

14. If equipped, correctly position the transfer case vent hose.
15. Position the engine control wiring harness, connect the 4 LH ignition coil electrical connectors and attach the 2 wiring harness retainers to the valve cover studs.

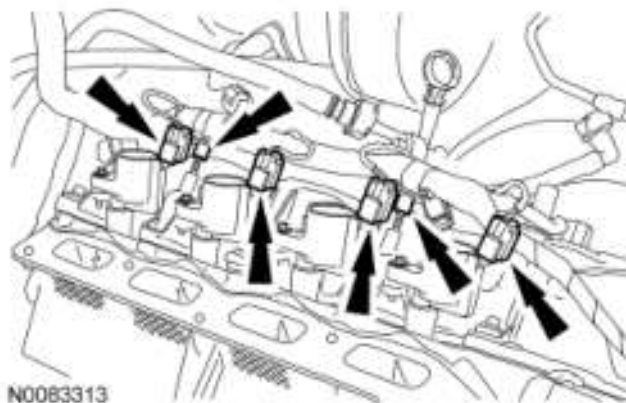


Fig. 535: Locating Ignition Coil Electrical Connectors And Wiring Harness Retainers
 Courtesy of FORD MOTOR CO.

16. Attach the 2 wiring harness retainers and the LH radio interference capacitor electrical connector

retainer and connect the LH radio interference capacitor, the LH Variable Camshaft Timing (VCT) sensor and the LH Camshaft Position (CMP) sensor electrical connectors.

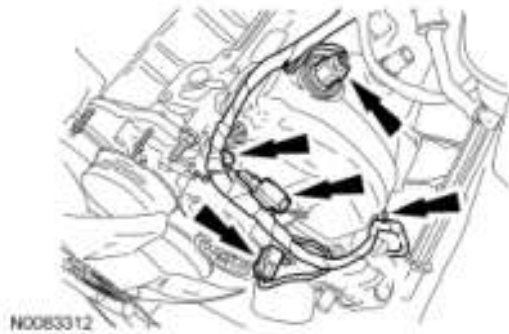


Fig. 536: Locating Radio Interference Capacitor Electrical Connector Retainer And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

17. Attach the transmission wiring harness retainer to the heater supply tube.

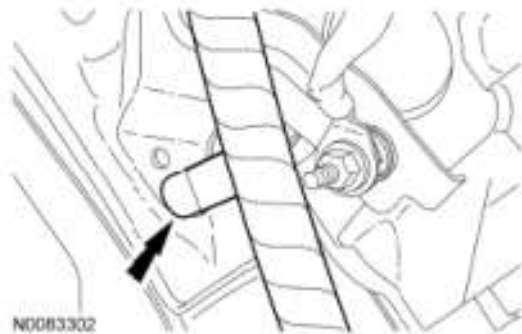


Fig. 537: Locating Transmission Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

18. Connect the Knock Sensor (KS) electrical connector, attach the Cylinder Head Temperature (CHT) sensor electrical connector retainer to the heater supply tube and connect the CHT sensor electrical connector.

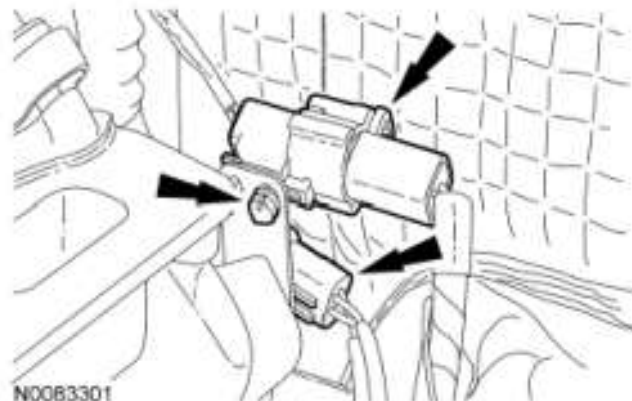


Fig. 538: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector And Connector Retainer
Courtesy of FORD MOTOR CO.

19. Attach the wiring harness retainer to the heater supply tube.

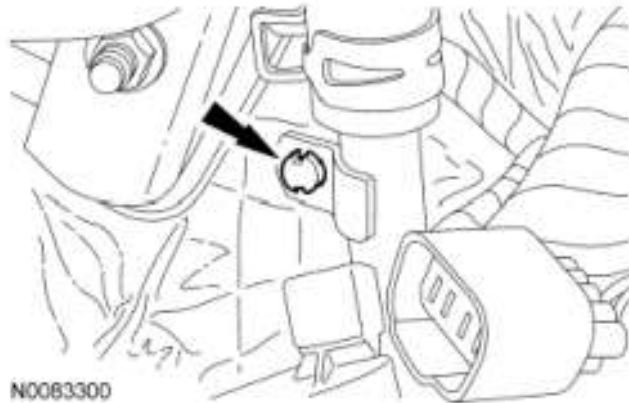


Fig. 539: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

20. Connect the 4 RH ignition coil electrical connectors and attach the 2 wiring harness retainers to the valve cover studs.

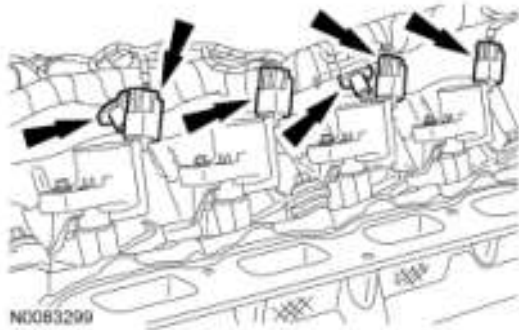


Fig. 540: Locating Ignition Coil Electrical Connectors And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

21. Connect the RH VCT solenoid and RH radio interference capacitor electrical connector and attach the wiring harness retainer to the crankcase vent tube.



Fig. 541: Locating Variable Camshaft Timing (VCT) Solenoid And Radio Ignition Interference Capacitor Electrical Connectors

Courtesy of FORD MOTOR CO.

22. Connect the RH CMP sensor electrical connector and attach the 2 wiring harness retainers to the valve cover.

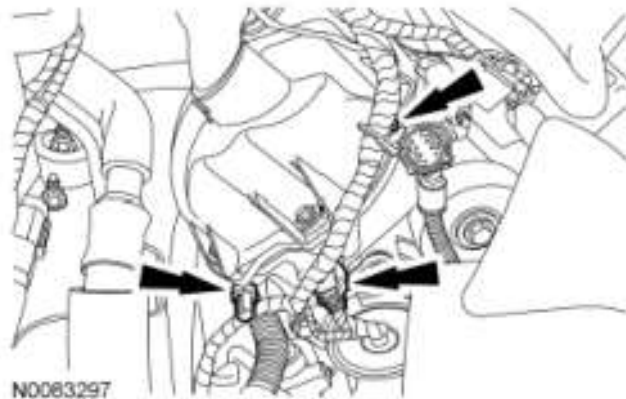


Fig. 542: Locating RH CMP Sensor Electrical Connector And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

23. Connect the heater coolant hose.



Fig. 543: Locating Heater Coolant Hose
Courtesy of FORD MOTOR CO.

24. Position the ground strap and install the bolt.
 - Tighten to 10 Nm (89 lb-in).



Fig. 544: Locating Ground Strap And Bolt
Courtesy of FORD MOTOR CO.

25. Connect the PCM electrical connector and attach the wiring harness retainer.

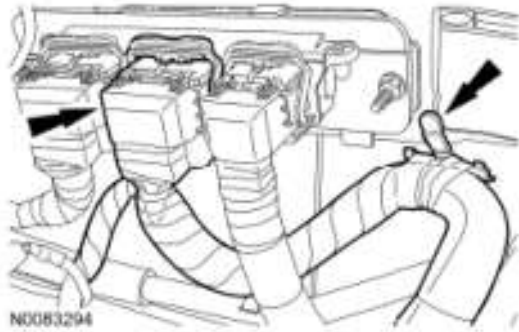


Fig. 545: Locating PCM Electrical Connector
Courtesy of FORD MOTOR CO.

26. Attach the wiring harness and electrical connector retainers and connect the electrical connector.



Fig. 546: Locating Wiring Harness And Electrical Connector Retainers
Courtesy of FORD MOTOR CO.

27. Connect the Crankshaft Position (CKP) sensor electrical connector.

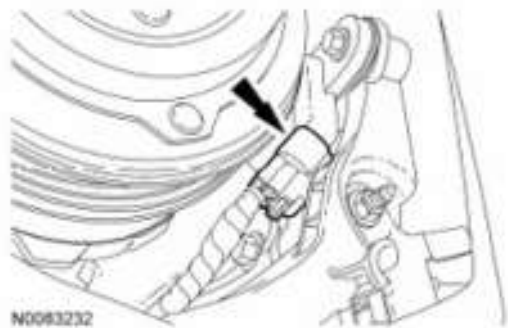


Fig. 547: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

28. Connect the A/C compressor clutch electrical connector and attach the wiring harness retainer.



Fig. 548: Locating A/C Compressor Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

29. Attach the wiring harness retainers to the engine block, the power steering pump stud bolt and the engine block and connect the oil pressure switch.

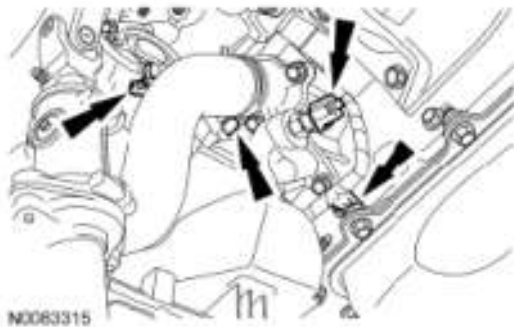


Fig. 549: Locating Engine Oil Pressure (EOP) Switch Electrical Connector And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

30. Connect the power steering fluid reservoir-to-power steering pump hose to the power steering pump.

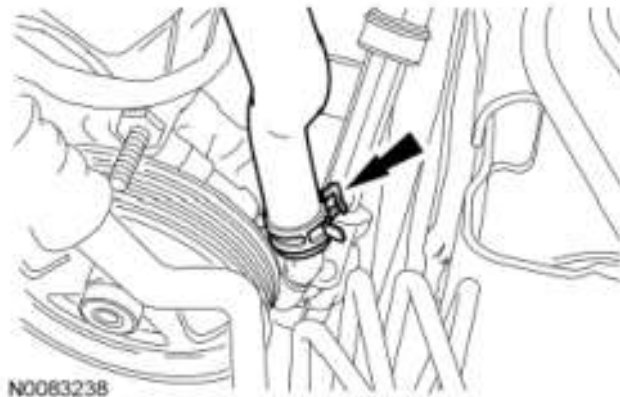
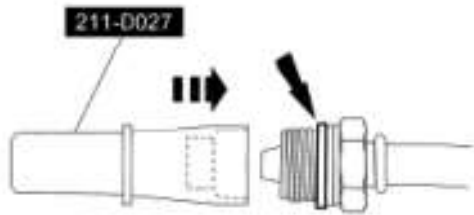


Fig. 550: Locating Power Steering Fluid Reservoir-To-Power Steering Pump Hose
Courtesy of FORD MOTOR CO.

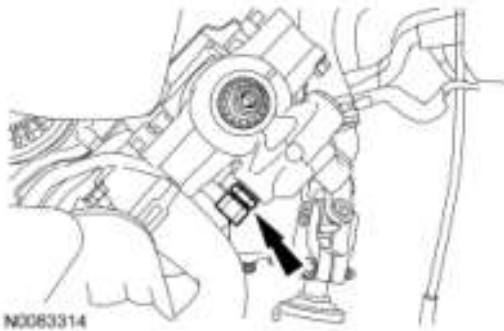
31. Using the appropriate Teflon® Seal Installer, install a new Teflon® seal on the Power Steering Pressure (PSP) hose-to-pump fitting.



N0032102

Fig. 551: Identifying Teflon® Seal Installer (211-D027)
Courtesy of FORD MOTOR CO.

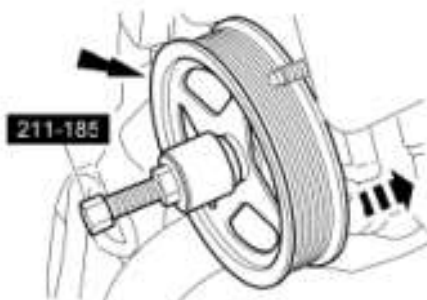
32. Connect the **PSP** hose to the power steering pump.
 - Tighten to 65 Nm (48 lb-ft).



N0063314

Fig. 552: Locating PSP Hose
Courtesy of FORD MOTOR CO.

33. Using the Power Steering Pump Pulley Installer, install the power steering pump pulley.



N0057823

Fig. 553: Installing Power Steering Pump Pulley Using Power Steering Pump Pulley Installer
Courtesy of FORD MOTOR CO.

34. Position the power steering hose clamp plate to the power steering gear and install the bolt.
 - Tighten to 23 Nm (17 lb-ft).

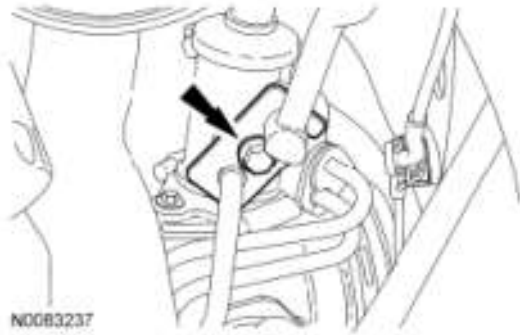


Fig. 554: Locating Power Steering Hose Clamp Plate And Bolt
 Courtesy of FORD MOTOR CO.

35. Position the PSP hose bracket and install the nut.
 - Tighten to 40 Nm (30 lb-ft).

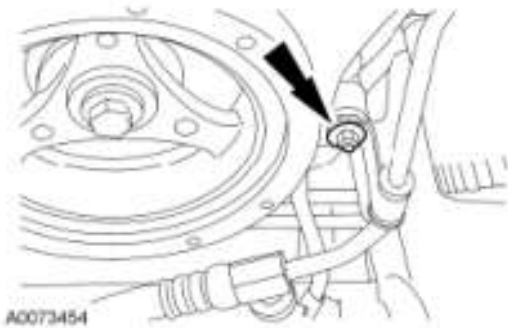


Fig. 555: Locating Nut And Power Steering Pressure (PSP) Hose Support Bracket
 Courtesy of FORD MOTOR CO.

36. Roughly position the accessory drive belt on the accessory drive pulleys.
37. Position the generator, the generator bracket and the wiring harness on the generator studs as an assembly.

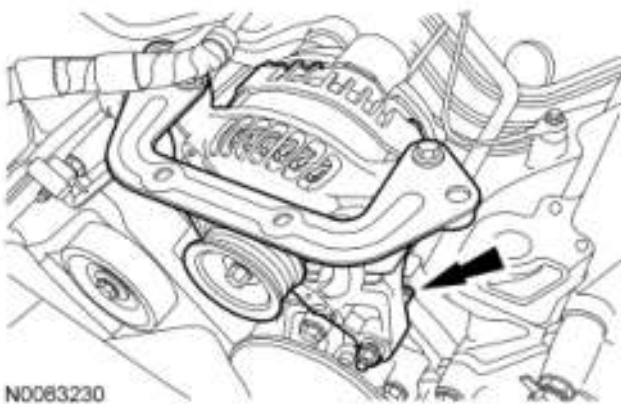


Fig. 556: Locating Generator Studs
 Courtesy of FORD MOTOR CO.

38. Position the Power Distribution Box (PDB) and the wiring harness on the engine.
39. Install the cooling module. For additional information, refer to **ENGINE COOLING**.

40. Position the generator aside.

NOTE: If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.

41.

Install the intake manifold. For additional information, refer to INTAKE MANIFOLD.

42. **NOTE:** Align the index marks made during hood removal.

Position the hood and install the 4 bolts.

- Tighten to 12 Nm (106 lb-in).

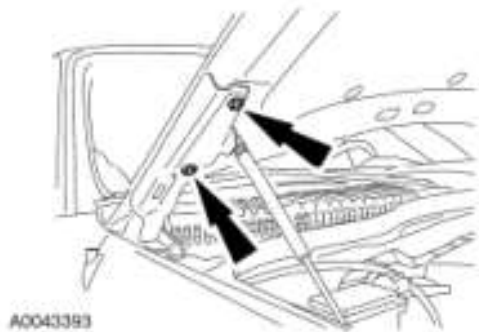


Fig. 557: Locating Bolts And Hood
Courtesy of FORD MOTOR CO.

43. Connect the windshield washer hose.

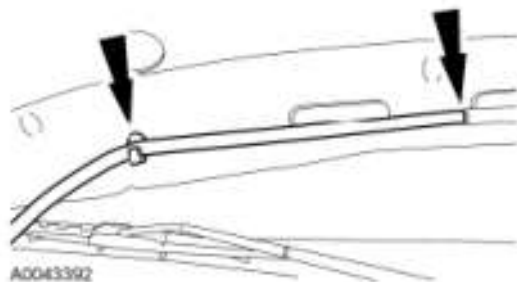


Fig. 558: Locating Windshield Washer Hose
Courtesy of FORD MOTOR CO.

44. Fill the engine with clean engine oil.

45. Fill and bleed the cooling system. For additional information, refer to ENGINE COOLING .

46. Carry out the fluid level check for the transmission. For additional information, refer to AUTOMATIC TRANSAXLE/TRANSMISSION - 6R80 .

47. Evacuate, leak test and charge the A/C system. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS .

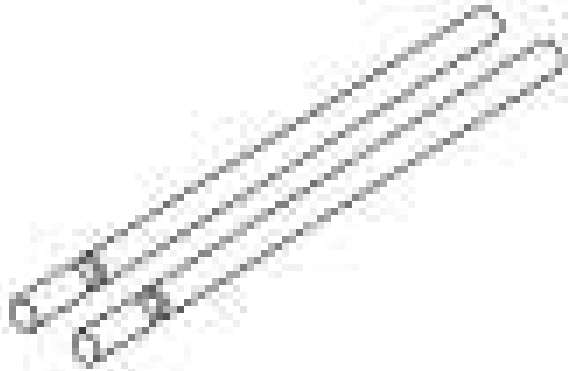
48. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile

Correction procedure following the on-screen instructions.

CYLINDER HEAD

Special Tool(s)

SPECIAL TOOL CHART



ST2606-A

Alignment Pins, Cylinder Head
303-1040 (SR-015486)



ST2604-A

Compressor, Valve Spring
303-1039



ST2197-A

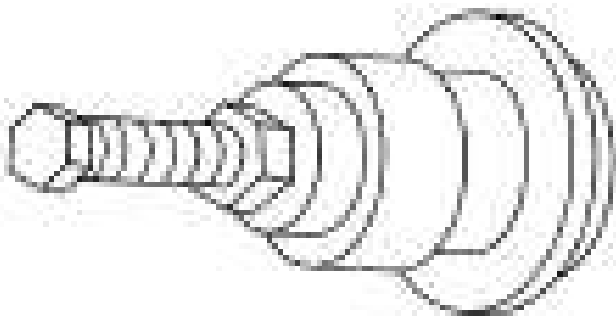
Installer, Crankshaft Front Seal
303-635



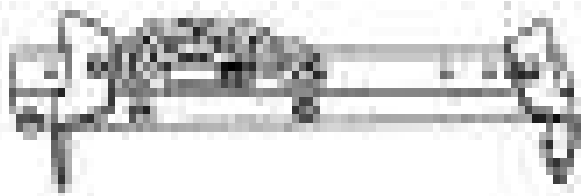
ST2428-A

Installer, Crankshaft Vibration Damper
303-102 (T74P-6316-B)

Installer, Front Cover Seal
303-335 (T88T-6701-A)



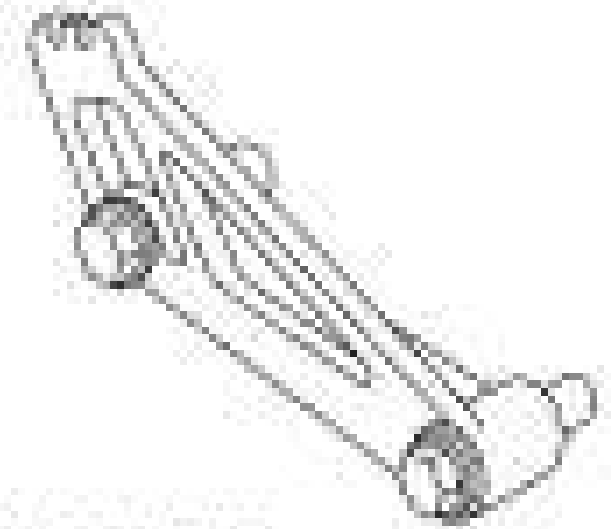
ST1328-A



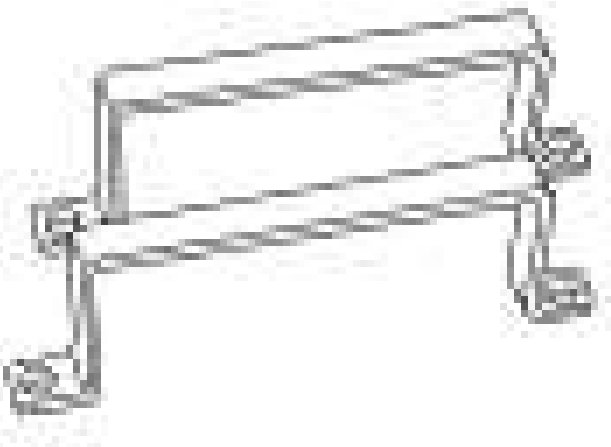
Lifting Bracket, Engine
303-F047 (014-00073) or equivalent

ST1377-A

Locking Tool, Cam Phaser
303-1046



ST2807-A



ST1658-A

Remover/Installer, Cylinder Head
303-572 (T97T-6000-A)

General Equipment

GENERAL EQUIPMENT

Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA

Material

MATERIAL SPECIFICATIONS

Item	Specification
Motorcraft® Metal Surface Prep	-

ZC-31-A	
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (US); Motorcraft® Premium Gold Engine Coolant (Canada) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-

All cylinder heads

- NOTE:** Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore. Failure to follow this instruction may result in engine damage.
- 1.

NOTE: The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.

NOTE: The cylinder head bolts must be discarded and new bolts installed. They are a tighten-to-yield design and cannot be reused.

NOTE: Do not turn the crankshaft until instructed to do so.

NOTE: LH shown in illustration, RH similar.

Using the Cylinder Head Alignment Pins, position the cylinder head gaskets and cylinder heads over the dowels and install the 10 cylinder head bolts loosely.

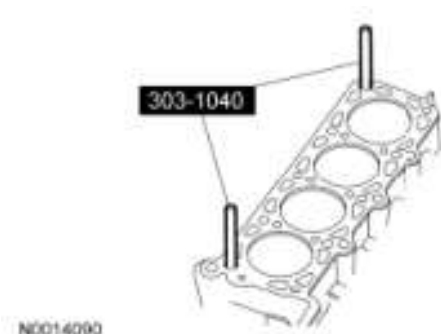


Fig. 559: Identifying Cylinder Head Alignment Pins (303-1040)
 Courtesy of FORD MOTOR CO.

LH cylinder head

2. Tighten the 10 LH cylinder head bolts in 6 stages, in the sequence shown in illustration.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Loosen all 10 bolts a minimum of 1 full turn (360 degrees).
 - Stage 4: Tighten to 40 Nm (30 lb-ft).
 - Stage 5: Tighten an additional 90 degrees.
 - Stage 6: Tighten an additional 90 degrees.

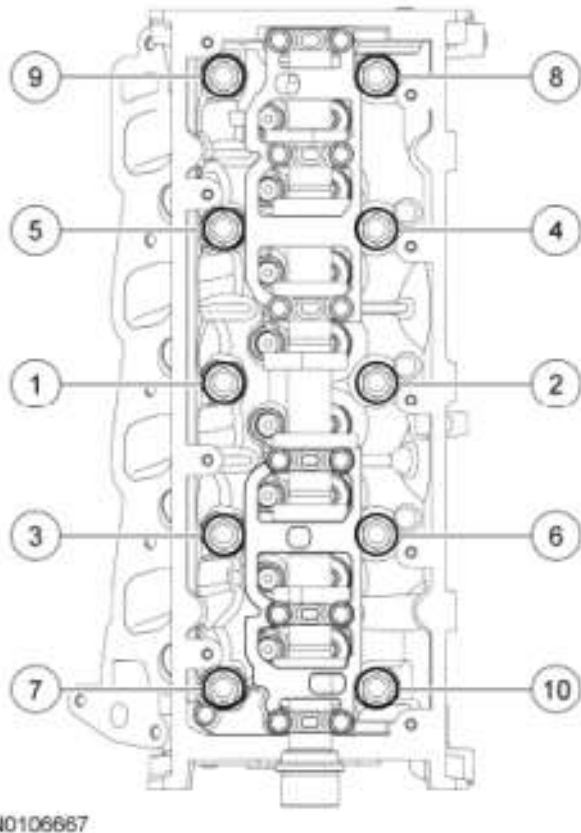


Fig. 560: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Remove the Cylinder Head Remover/Installer from the LH cylinder head.

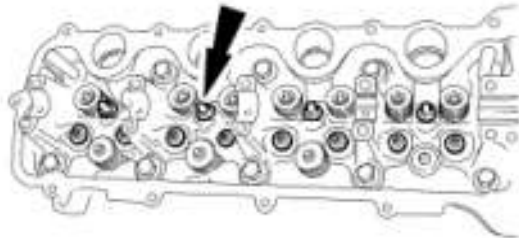


Fig. 561: Identifying Cylinder Head Remover/Installer (303-572)
Courtesy of FORD MOTOR CO.

4. **NOTE:** Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

NOTE: The hydraulic lash adjusters must be installed in their original locations.

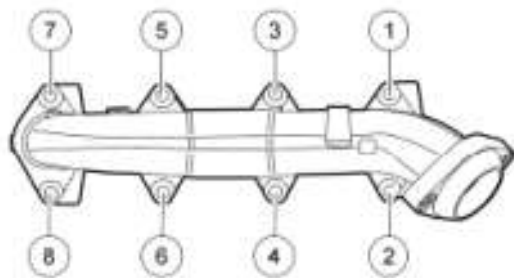
Install the hydraulic lash adjusters into the LH cylinder head.



A0074892

Fig. 562: Locating Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

5. Remove the oil level indicator tube, install a new O-ring seal, and lubricate the O-ring seal with clean engine oil. Position the oil level indicator tube loosely in the engine block before installing the LH exhaust manifold.
6. Inspect the LH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** .
7. Install 8 new LH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
8. Position 2 new gaskets, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown in illustration.
 - Tighten to 25 Nm (18 lb-ft).



N0040497

Fig. 563: Identifying Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

9. Position the LH exhaust manifold heat shield and install the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).

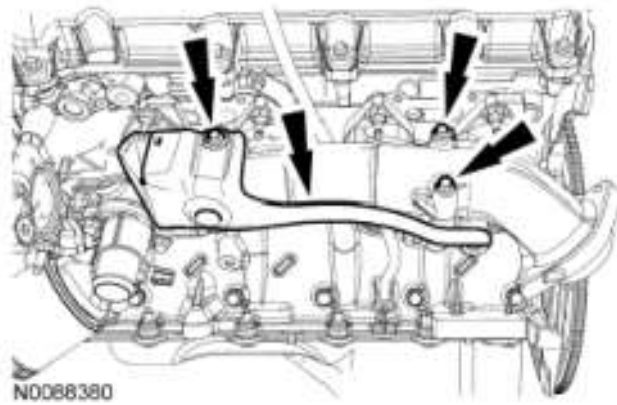


Fig. 564: Locating Exhaust Manifold Heat Shield And Bolts
 Courtesy of FORD MOTOR CO.

RH cylinder head

10. Tighten the 10 RH cylinder head bolts in 6 stages, in the sequence shown in illustration.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Loosen all 10 bolts a minimum of 1 full turn (360 degrees).
 - Stage 4: Tighten to 40 Nm (30 lb-ft).
 - Stage 5: Tighten an additional 90 degrees.
 - Stage 6: Tighten an additional 90 degrees.

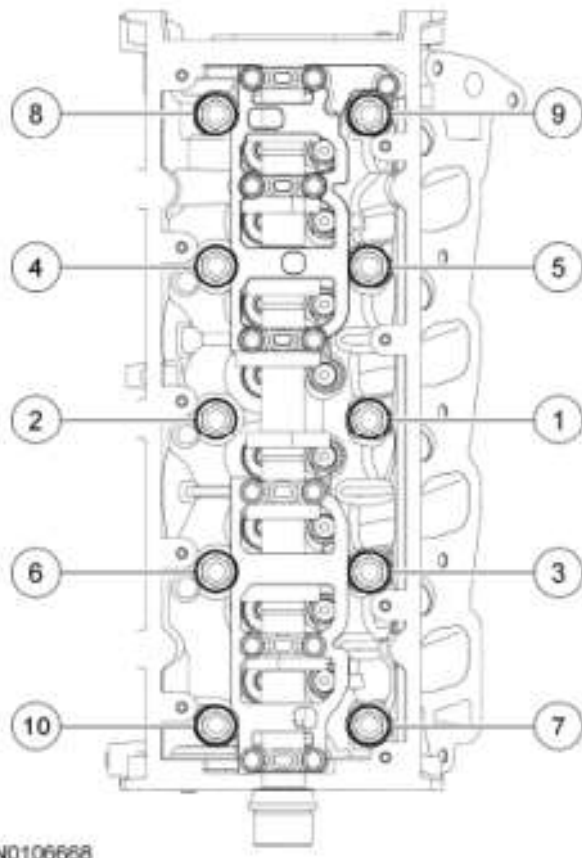


Fig. 565: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Remove the Cylinder Head Remover/Installer from the RH cylinder head.



Fig. 566: Identifying Cylinder Head Remover/Installer (303-572)
Courtesy of FORD MOTOR CO.

12. **NOTE:** Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

NOTE: The hydraulic lash adjusters must be installed in their original locations.

Install the hydraulic lash adjusters into the RH cylinder head.

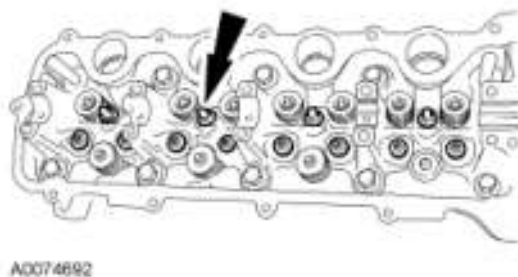
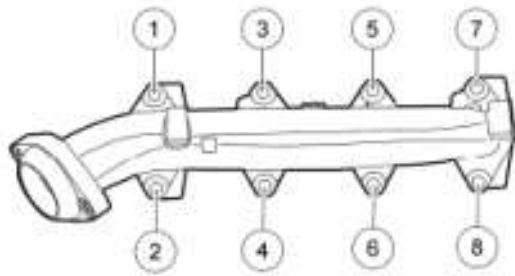


Fig. 567: Locating Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

13. Inspect the RH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION**.
14. Install 8 new RH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
15. Position new gaskets, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown in illustration.
 - Tighten to 25 Nm (18 lb-ft).



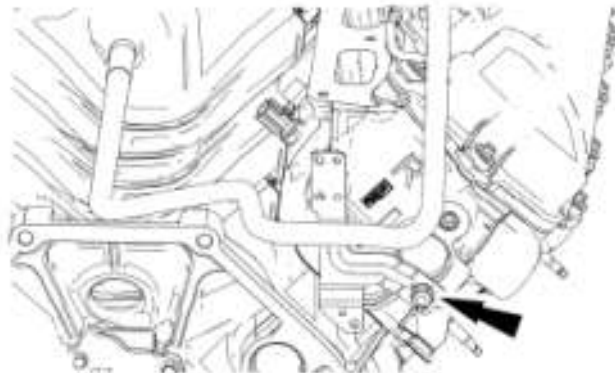
N0040498

Fig. 568: Identifying Exhaust Manifold Nuts In Sequence
 Courtesy of FORD MOTOR CO.

16. **NOTE:** Install 2 new O-ring seals and lubricate the O-ring seals with clean engine coolant.

Position the heater supply tube and the hoses as an assembly and install the stud bolt.

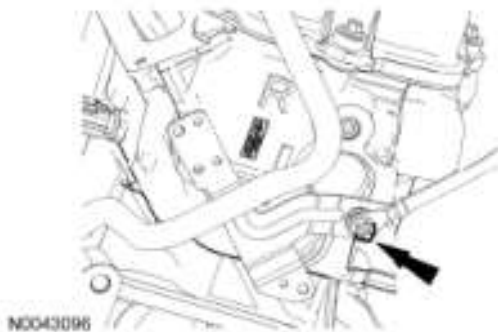
- Tighten to 10 Nm (89 lb-in).



N0042831

Fig. 569: Locating Stud Bolt And Heater Supply Tube
 Courtesy of FORD MOTOR CO.

17. Position the ground strap and install the nut.
- Tighten to 10 Nm (89 lb-in).



N0043096

Fig. 570: Locating Ground Strap Nut
 Courtesy of FORD MOTOR CO.

18. Attach the Knock Sensor (KS) electrical connector to the heater coolant tube.

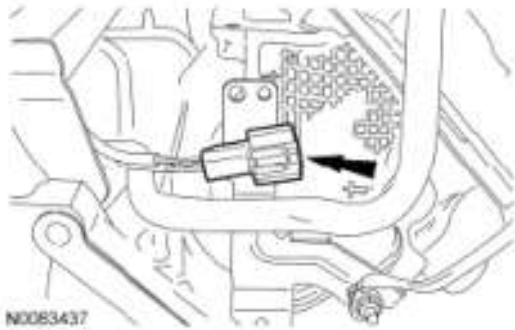


Fig. 571: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

19. Position the Cylinder Head Temperature (CHT) sensor wiring and attach the wiring retainer to the heater coolant tube.

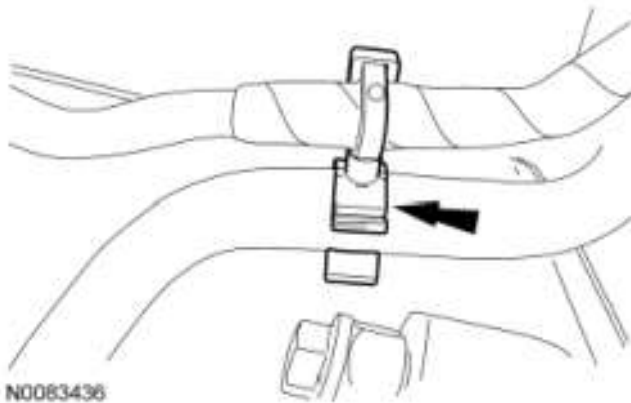


Fig. 572: Locating CHT Sensor Jumper Wire Retainer
Courtesy of FORD MOTOR CO.

20. Connect the CHT sensor electrical connector.

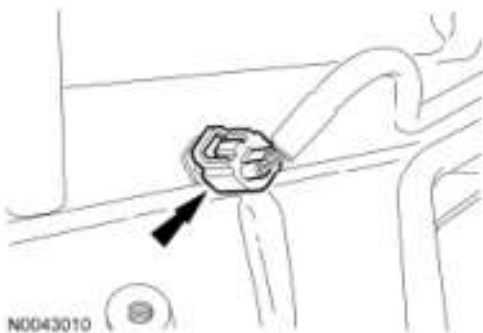


Fig. 573: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

All cylinder heads

- 21.

21. **NOTE:** Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

Install the LH and RH camshafts.

22. **NOTE:** LH shown in illustration, RH similar.

NOTE: Lubricate the camshaft bearing caps with clean engine oil.

Install the LH and RH camshaft bearing caps in their original locations.

- Position the front camshaft bearing cap.
- Position the remaining camshaft bearing caps.
- Install the 10 bolts loosely.
- Tighten to 10 Nm (89 lb-in) in the sequence shown in illustration.

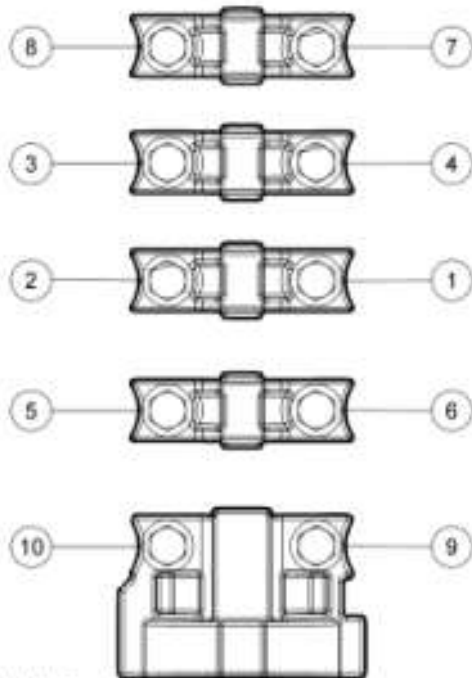


Fig. 574: Identifying Camshaft Bearing Cap Bolt In Sequence
Courtesy of FORD MOTOR CO.

23. **NOTE:** Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

NOTE: LH shown in illustration, RH similar.

Install the camshaft phaser sprockets and new camshaft phaser bolts finger-tight.

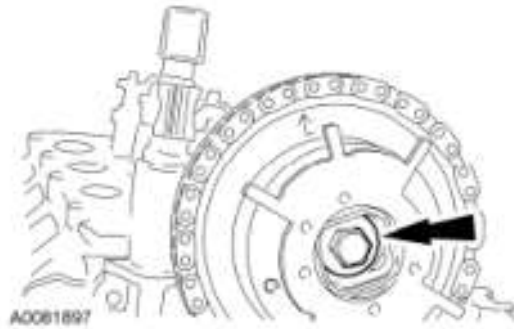


Fig. 575: Locating Camshaft Phaser And Sprocket Bolt
Courtesy of FORD MOTOR CO.

24. **NOTE:** Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: LH shown in illustration, RH similar.

Using the Cam Phaser Locking Tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.

- Stage 1: Tighten to 40 Nm (30 lb-ft).
- Stage 2: Tighten an additional 90 degrees.

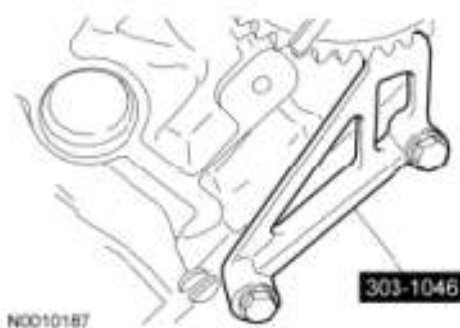


Fig. 576: Identifying Cam Phaser Locking Tool (303-1046)
Courtesy of FORD MOTOR CO.

25. Install the crankshaft sprocket, making sure the flange faces forward.

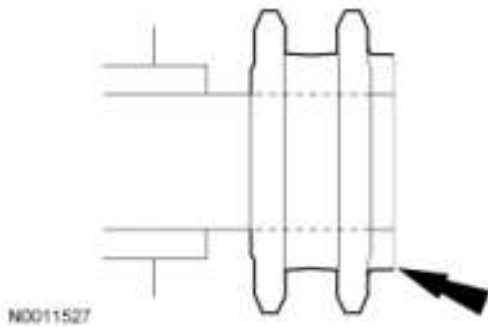


Fig. 577: Locating Crankshaft Sprocket
 Courtesy of FORD MOTOR CO.

26. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.



Fig. 578: Locating Crankshaft Sprocket Timing Mark
 Courtesy of FORD MOTOR CO.

27. Rotate the camshaft sprockets to position the RH camshaft sprocket timing mark in the 11 o'clock position and the LH camshaft sprocket timing mark in the 12 o'clock position.

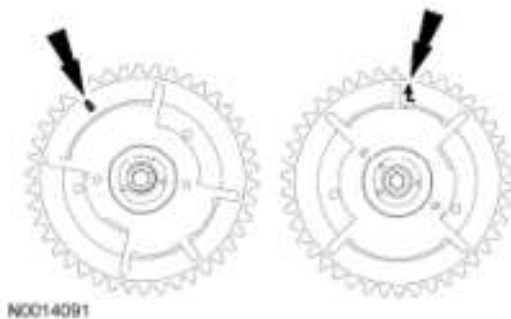


Fig. 579: Locating Camshaft Sprocket Timing Mark
 Courtesy of FORD MOTOR CO.

NOTE: If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. Any cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead, will require replacement of the tensioner. Failure to follow this instruction may result in engine damage.

- 28.

Inspect the RH and LH timing chain tensioners.

- Install new tensioners, as necessary.

29. **NOTE:** Timing chain procedures must be followed exactly or damage to valves and pistons will result.

Compress the tensioner plunger, using a vise.

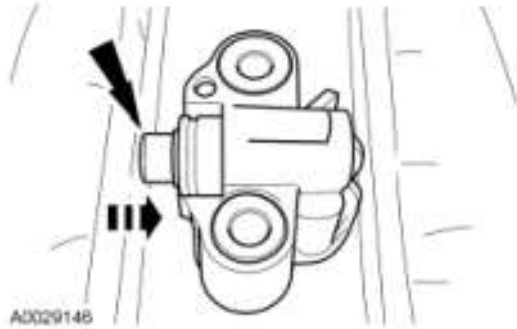


Fig. 580: Compressing Tensioner Plunger
Courtesy of FORD MOTOR CO.

30. Install a Hydraulic Chain Tensioner Retaining Clip on the tensioner to hold the plunger in during installation.

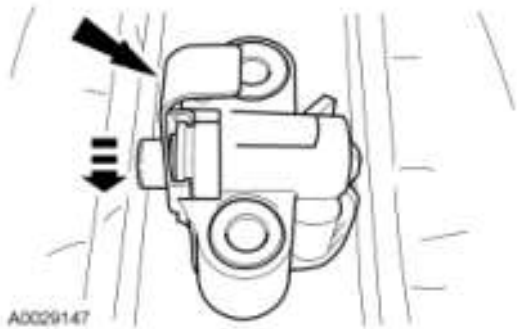


Fig. 581: Locating Retaining Clip
Courtesy of FORD MOTOR CO.

31. Remove the tensioner from the vise.
32. If the copper links are not visible, mark one link on one end and one link on the other end and use as timing marks.

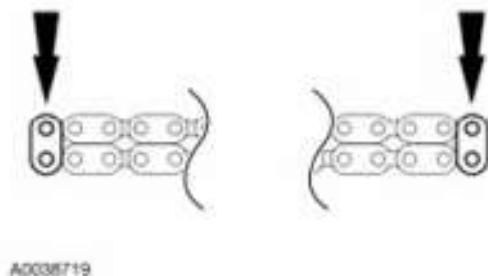
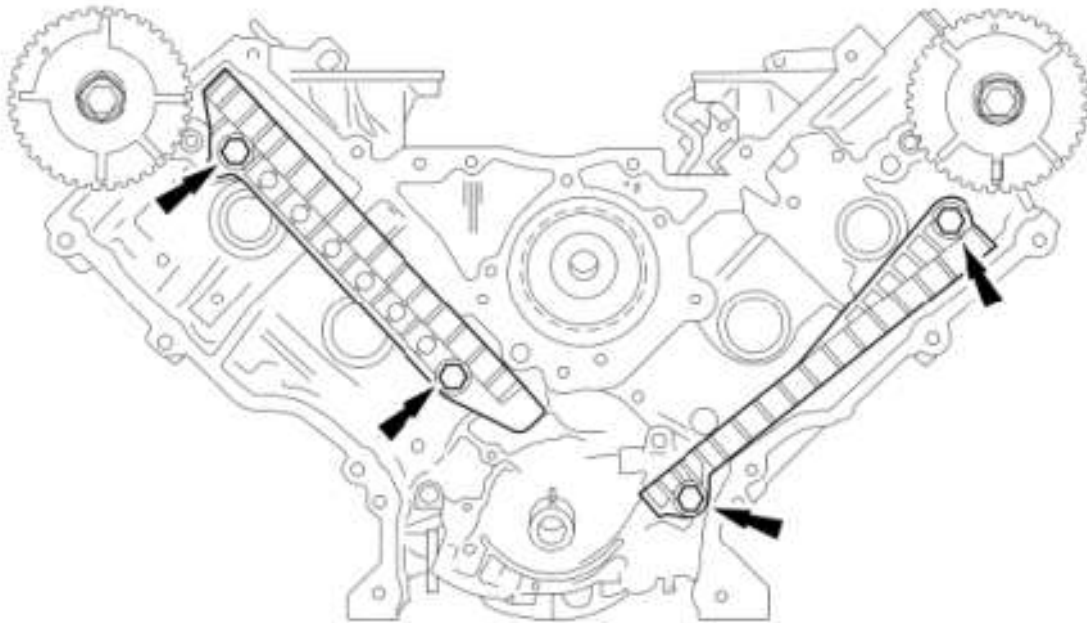


Fig. 582: Locating Timing Chain Colored Links
Courtesy of FORD MOTOR CO.

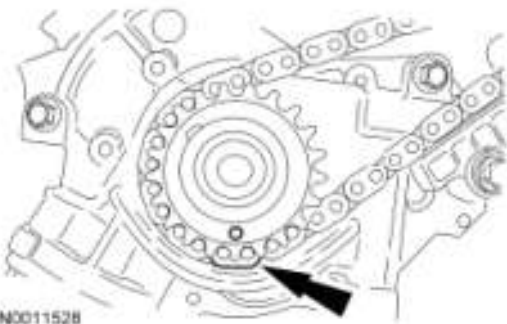
33. Position the LH and RH timing chain guides and install the 4 bolts.
- Tighten to 10 Nm (89 lb-in).



N0006303

Fig. 583: Locating Timing Chain Guides And Bolts
Courtesy of FORD MOTOR CO.

34. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



N0011528

Fig. 584: Aligning Timing Mark On Outer Flange Of Crankshaft Sprocket With Single Colored (Marked) Link On Chain
Courtesy of FORD MOTOR CO.

- NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.
- 35.

Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

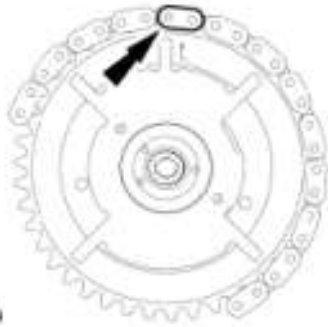


Fig. 585: Locating Camshaft Sprocket Timing Mark With Copper Link
 Courtesy of FORD MOTOR CO.

36. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and 2 bolts.

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

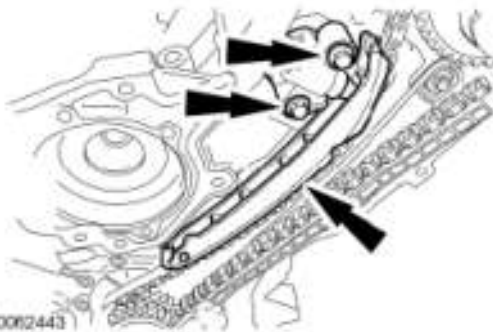


Fig. 586: Locating Bolts And LH Timing Chain Tensioner
 Courtesy of FORD MOTOR CO.

37. Remove the Hydraulic Chain Tensioner Retaining Clip from the LH timing chain tensioner.

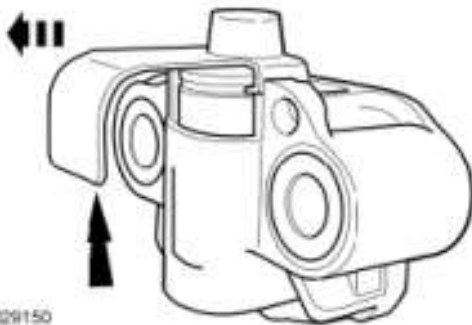


Fig. 587: Locating Retaining Clip
 Courtesy of FORD MOTOR CO.

38. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing

mark on the sprocket with the single copper (marked) chain link.



Fig. 588: Aligning Timing Mark On Sprocket With Single Colored (Marked) Chain Link
Courtesy of FORD MOTOR CO.

39. **NOTE:** The lower half of the timing chain must be positioned above the tensioner arm dowel.

NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

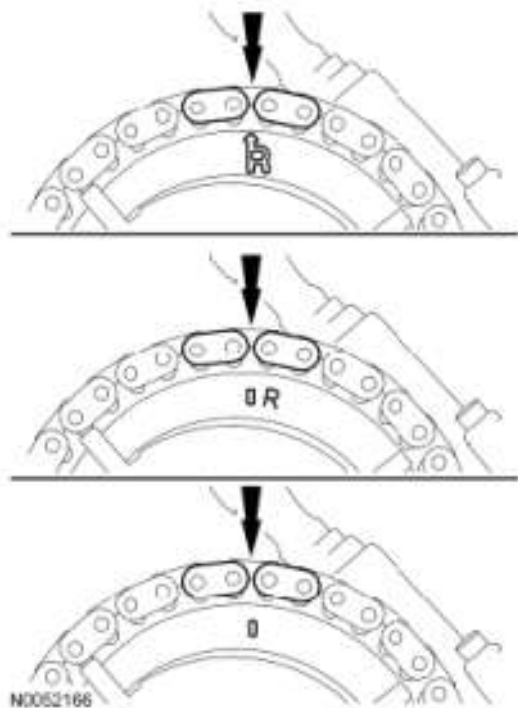


Fig. 589: Locating Timing Marks
Courtesy of FORD MOTOR CO.

40. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and 2 bolts.

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

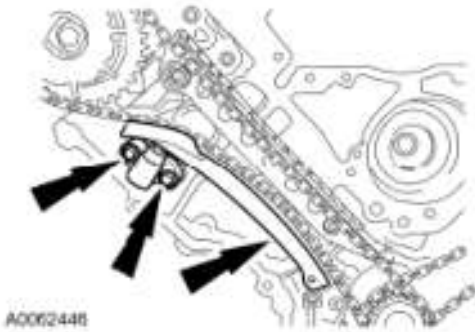


Fig. 590: Locating RH Timing Chain Tensioner And Bolts
 Courtesy of FORD MOTOR CO.

41. Remove the Hydraulic Chain Tensioner Retaining Clip from the RH timing chain tensioner.

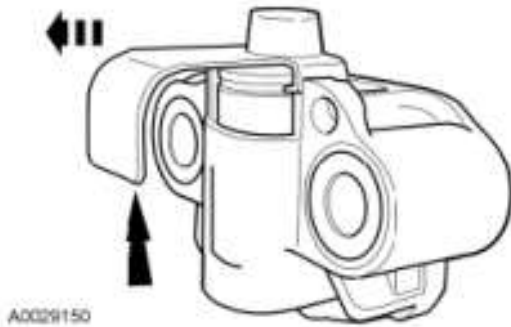


Fig. 591: Locating Retaining Clip
 Courtesy of FORD MOTOR CO.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

42. As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.

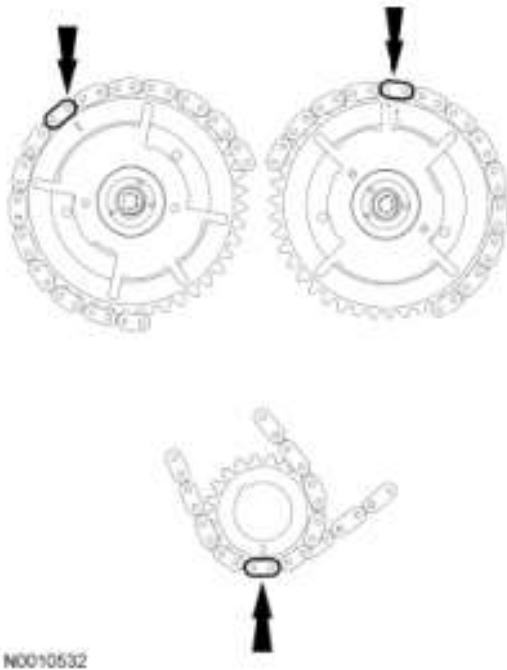


Fig. 592: Locating Timing Marks
 Courtesy of FORD MOTOR CO.

43. Install the crankshaft sensor ring on the crankshaft.

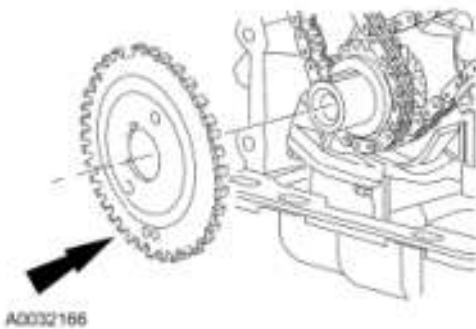


Fig. 593: Locating Crankshaft Sensor Ring
 Courtesy of FORD MOTOR CO.

44. **NOTE:** Lubricate the roller followers with clean engine oil prior to installation.

Using the Valve Spring Compressor, install all of the camshaft roller followers.



Fig. 594: Identifying Valve Spring Compressor (303-1039)
Courtesy of FORD MOTOR CO.

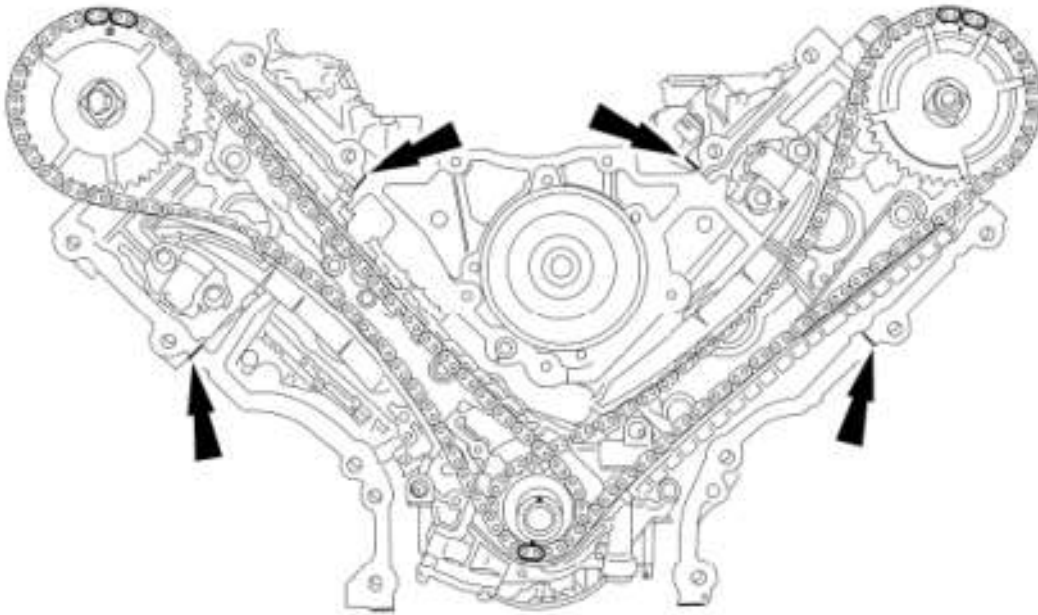
45.

NOTE: 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 which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: If the engine front cover is not secured 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.

NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

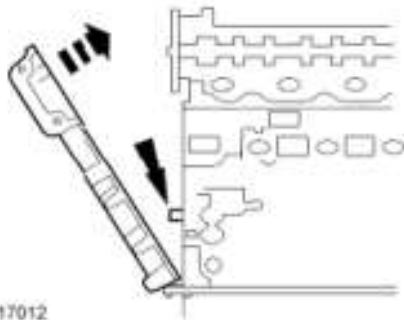
Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown in illustration.



N0010501

Fig. 595: Locating Silicone Gasket And Sealant Area
 Courtesy of FORD MOTOR CO.

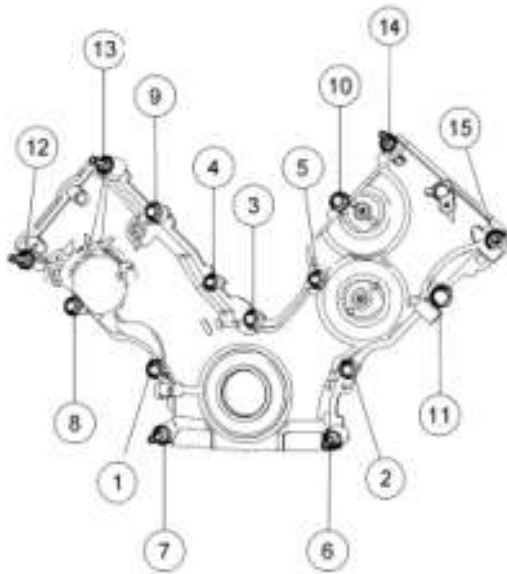
46. Install 3 new engine front cover gaskets on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.



N0017012

Fig. 596: Installing Engine Front Cover
 Courtesy of FORD MOTOR CO.

47. Tighten the 15 engine front cover fasteners in the sequence shown in illustration to 25 Nm (18 lb-ft).



N0089343

Fig. 597: Identifying Engine Front Cover Fasteners In Sequence
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806586	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 86.35
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1

48. Loosely install the 4 bolts, then tighten the bolts in 2 stages, in the sequence shown in illustration.
- Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten an additional 60 degrees.

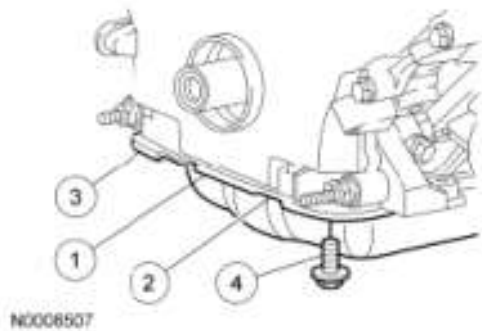


Fig. 598: Identifying Oil Pan Bolts In Sequence
 Courtesy of FORD MOTOR CO.

49. Lubricate the engine front cover and the new crankshaft seal inner lip with clean engine oil.

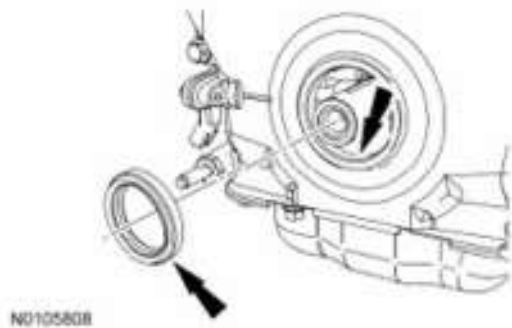


Fig. 599: Locating Engine Front Cover And Crankshaft Seal Inner Lip
 Courtesy of FORD MOTOR CO.

50. Using the Crankshaft Front Seal Installer, the Crankshaft Vibration Damper Installer and the Front Cover Seal Installer, install the new crankshaft front seal into the engine front cover.

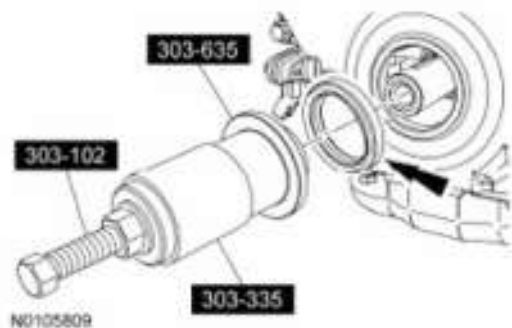


Fig. 600: Identifying Crankshaft Vibration Damper Installer, Front Cover Seal Installer And Crankshaft Front Seal Installer
 Courtesy of FORD MOTOR CO.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



N0010530

Fig. 601: Locating Woodruff Key Slot
Courtesy of FORD MOTOR CO.

52. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

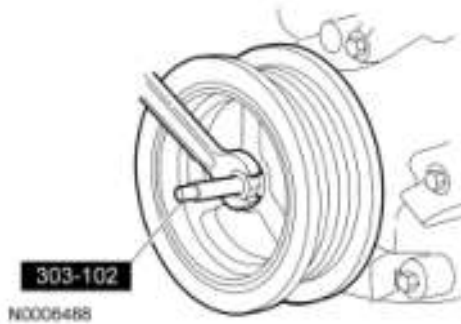
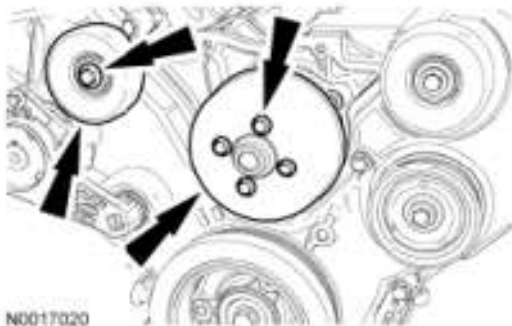


Fig. 602: Identifying Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

53. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
- Stage 1: Tighten to 120 Nm (89 lb-ft).
 - Stage 2: Loosen 360 degrees.
 - Stage 3: Tighten to 50 Nm (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.
54. Install the RH side accessory drive belt idler pulley, the coolant pump pulley and the 5 bolts.
- Tighten to 25 Nm (18 lb-ft).



N0017020

Fig. 603: Locating Accessory Drive Belt Idler Pulley And Bolts
Courtesy of FORD MOTOR CO.

55. **NOTE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

56. **NOTE:** If not secured 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 silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

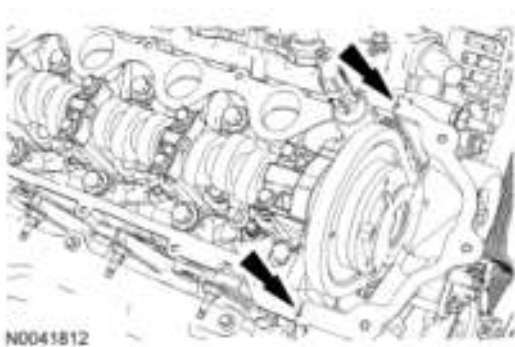


Fig. 604: Locating Silicone Gasket And Sealant Applying Area
Courtesy of FORD MOTOR CO.

57. **NOTE:** Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.

Position the RH valve cover and gasket on the cylinder head and tighten the 9 bolts in the sequence shown in illustration.

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

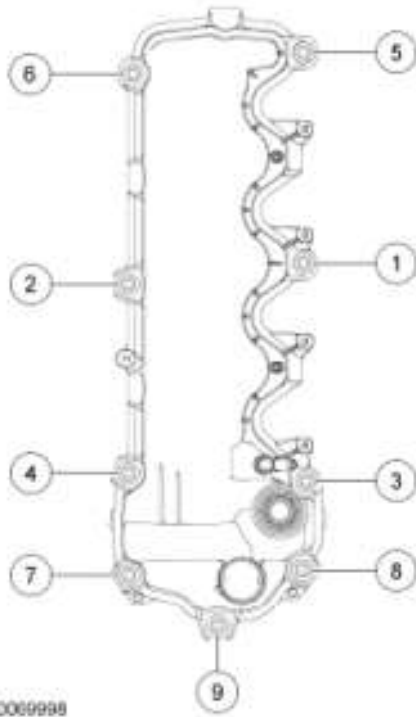


Fig. 605: Identifying RH Valve Cover In Sequence
 Courtesy of FORD MOTOR CO.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

58.

Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

NOTE: If not secured 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.

59.

Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

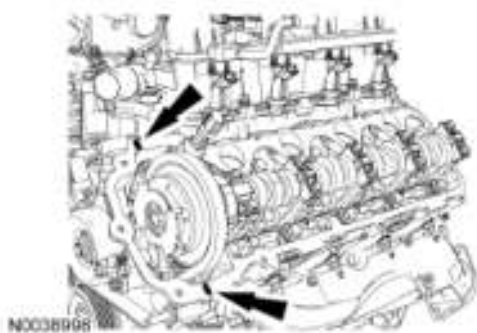


Fig. 606: Locating Silicone Gasket And Sealant Applying Area
Courtesy of FORD MOTOR CO.

60. **NOTE:** Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.

Position the LH valve cover and gasket on the cylinder head and tighten the 10 bolts in the sequence shown in illustration.

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

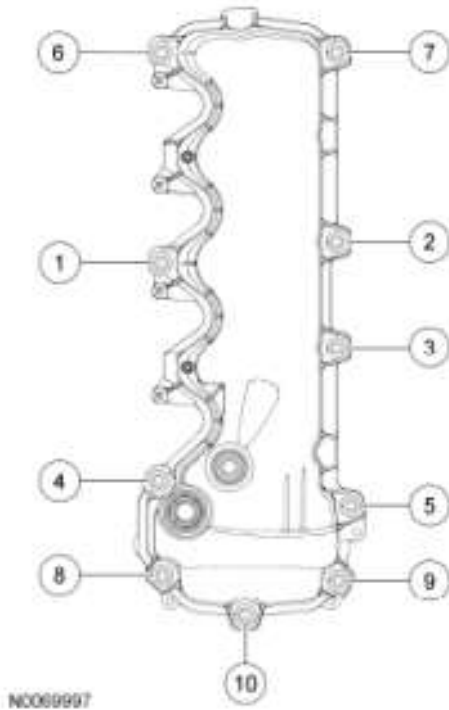


Fig. 607: Identifying LH Valve Cover Bolt In Sequence
Courtesy of FORD MOTOR CO.

61. Position the oil level indicator tube and install the bolt.
- Tighten to 10 Nm (89 lb-in).



Fig. 608: Locating Oil Level Indicator Bolt
Courtesy of FORD MOTOR CO.

62. **NOTE:** LH shown in illustration, RH similar.

Install the 8 ignition coils and the 8 bolts.

- Tighten to 6 Nm (53 lb-in).

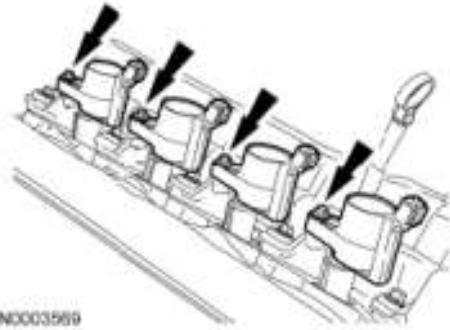


Fig. 609: Locating Ignition Coils And Bolts
Courtesy of FORD MOTOR CO.

63. **NOTE:** Lubricate the oil filter gasket with clean engine oil.

Install a new oil filter.

- Tighten the oil filter until the gasket makes contact, then use an oil filter strap wrench to tighten the filter an additional 270 degrees.

64. Connect the PCV hose to the LH valve cover.

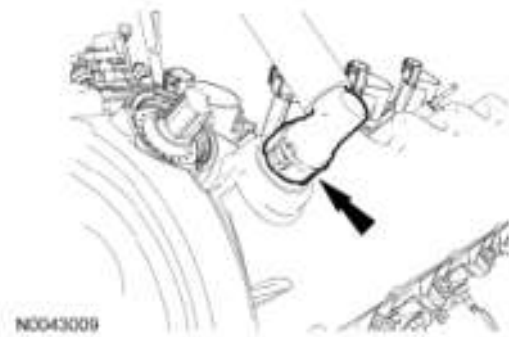


Fig. 610: Locating PCV Hose
Courtesy of FORD MOTOR CO.

65. Connect the breather tube to the RH valve cover.

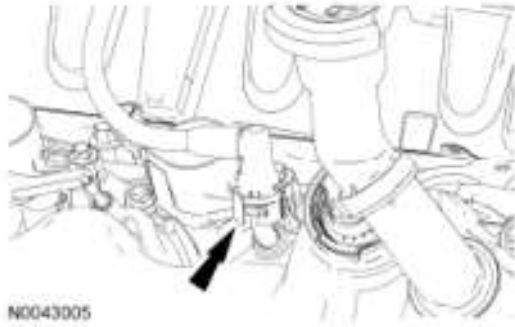


Fig. 611: Locating Breather Tube
Courtesy of FORD MOTOR CO.

66. Position the LH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

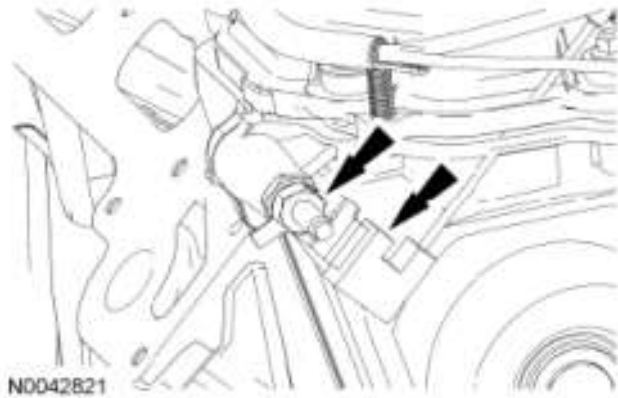


Fig. 612: Locating LH Radio Interference Capacitor And Nut
Courtesy of FORD MOTOR CO.

67. Position the RH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

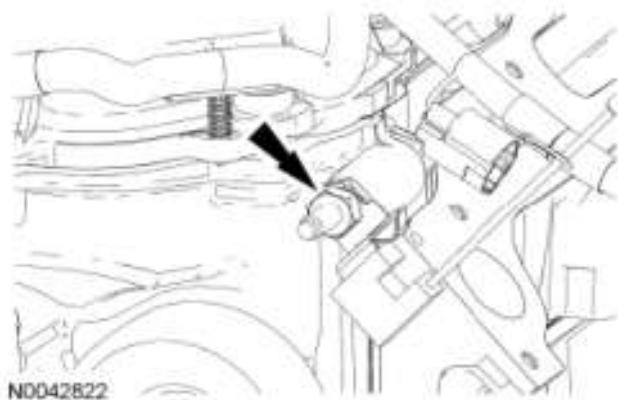


Fig. 613: Locating RH Radio Interference Capacitor And Nut
Courtesy of FORD MOTOR CO.

68. Install the lower radiator hose and position the clamp.



Fig. 614: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

69. Install the Engine Lifting Bracket.

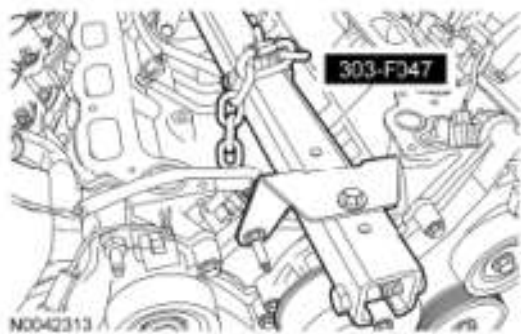


Fig. 615: Identifying Engine Lifting Bracket (303-F047)
Courtesy of FORD MOTOR CO.

70. Using a suitable floor crane, remove the engine from the engine stand.
71. Install the engine. For additional information, refer to **ENGINE**.