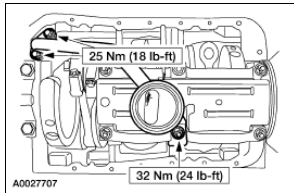
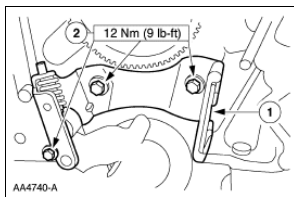


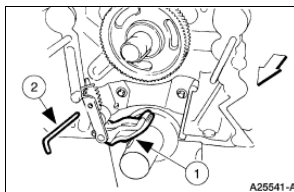
23. Install the oil pump screen cover and tube.
- Install the new gasket.
 - Position the oil pump screen cover and tube.
 - Install the bolts.
 - Install the nut.



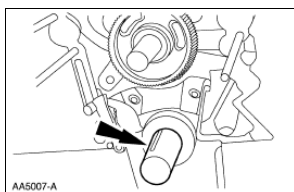
24. Install the timing chain tensioner.
1. Position the timing chain tensioner.
 2. Install the bolts.



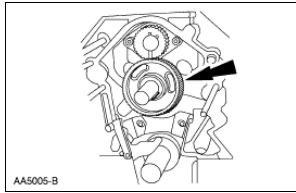
25. Retract the tensioner pad retracting mechanism.
1. Compress the tensioner pad retracting mechanism.
 2. Insert a retaining pin.



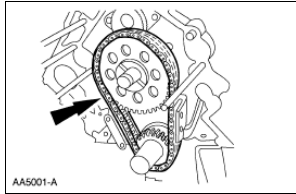
26. Rotate the crankshaft so the number one piston is at top dead center (TDC) and the key is at the 12 o'clock position.



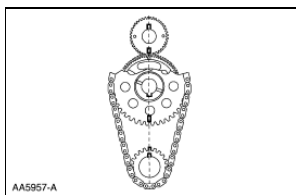
27. Turn the balance shaft drive gear so that the key is on the bottom of the camshaft.



28. Install the timing chain, the camshaft sprocket and the crankshaft sprocket as an assembly.

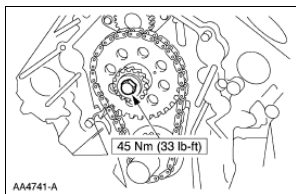


29. Make sure the timing marks and the keyways are aligned.

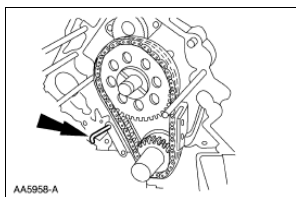


30. Install the camshaft position sensor drive gear.

- Position the camshaft position sensor drive gear.
- Install the bolt.

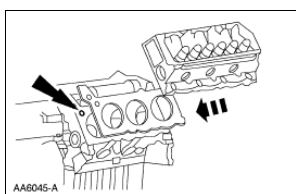


31. Remove the retaining pin.



⚠ CAUTION: The components removed should be marked for location. Make sure the used parts are installed in the correct location.

32. Install a new RH and LH head gasket on the cylinder block with the small hole to the front of the engine and position the RH and LH cylinder head.

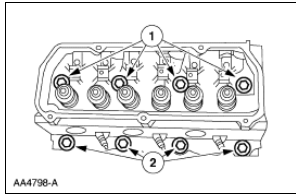


33. **⚠ CAUTION: Always use new bolts.**

NOTE: Lubricate the bolts with clean engine oil prior to installation. Make sure the bolts are installed in the correct location.

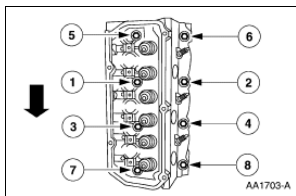
Install the new bolts.

1. Install new long bolts.
2. Install new short bolts.



34. Tighten the bolts in the sequence shown in three stages.

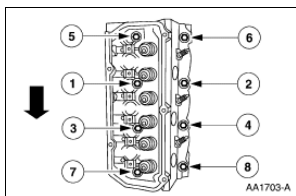
- Stage 1: Tighten to 20 Nm (14 lb-ft).
- Stage 2: Tighten to 40 Nm (29 lb-ft).
- Stage 3: Tighten to 50 Nm (36 lb-ft).



35. **⚠ CAUTION: Do not loosen all of the bolts at one time. Each bolt must be loosened and tightened prior to working on the next bolt in the sequence.**

Tighten the bolts in sequence in four stages: short bolts numbered 2, 4, 6 and 8:

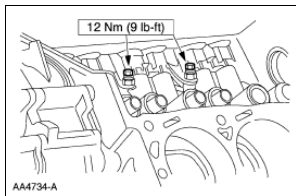
- Stage 1: Tighten to 25 Nm (18 lb-ft).
- Stage 2: Tighten an additional 175-185 degrees.
Long bolts numbered 1, 3, 5 and 7:
- Stage 3: Tighten to 45 Nm (33 lb-ft).
- Stage 4: Tighten an additional 175-185 degrees.



36. **NOTE:** Lubricate the valve tappets with clean engine oil prior to installing.

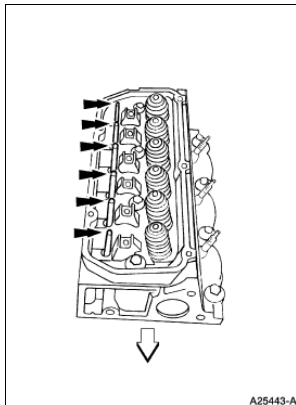
Install the valve tappets.

- Install the valve tappets.
- Install the tappet guide plates and retainers.
- Install the bolts.



37. **NOTE:** Lubricate the push rods with clean engine oil prior to installation.

Install the 12 push rods.

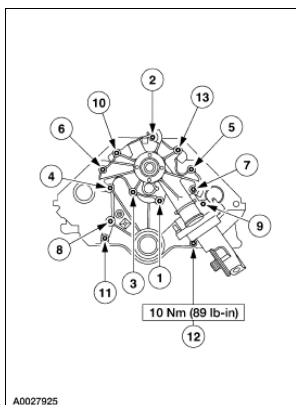


38. Install the 12 rocker arms. For additional information, refer to [Rocker Arm](#) in this section.

39. **NOTE:** Use pipe sealer on studs No. 4 and 6, and bolt No. 12.

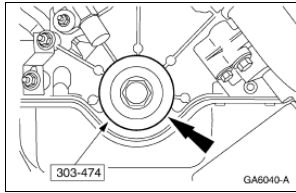
Install the engine front cover and engine front cover gasket.

- Position a new engine front cover gasket and the engine front cover on the dowels.
- Install a 135.5 mm (5.42 in) stud at location No. 5 and tighten to 7 Nm (62 lb-in).
- Install a 137 mm (5.48 in) stud at locations No. 4, 6, 7 and 10, and tighten to 7 Nm (62 lb-in).
- Install the water pump with a new gasket.
- Tighten bolt No. 12 to 10 Nm (89 lb-in). All other nuts and bolts are to be tightened to 28 Nm (21 lb-ft).
- Tighten the nuts and bolts in the sequence shown.

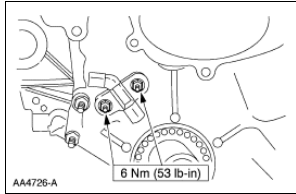


40. **NOTE:** Lubricate the parts with clean engine oil before assembly.

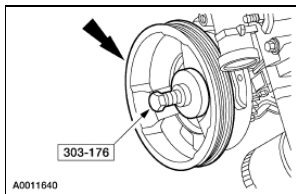
Using the special tool, install the front crankshaft oil seal.



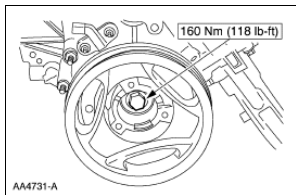
41. Install the crankshaft position sensor.



42. Apply a bead of sealant to the keyway in the crankshaft damper and use the special tool to position and install the crankshaft damper.

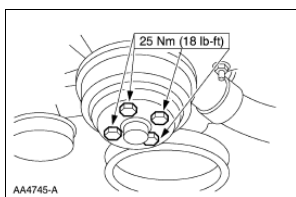


43. Install the crankshaft pulley bolt.



44. Install the camshaft synchronizer. For additional information, refer to [Section 303-14](#) .

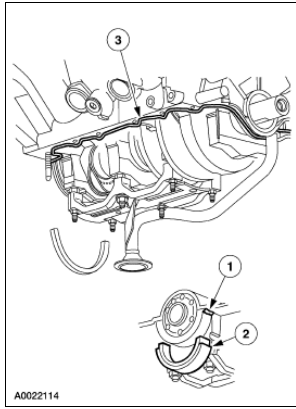
45. Install the water pump pulley.
• Install the bolts.



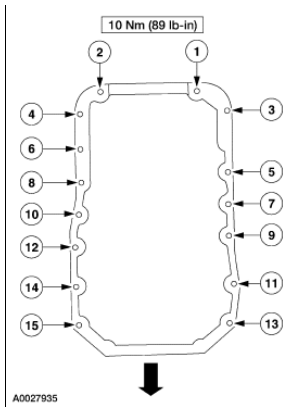
46. **NOTE:** If the oil pan is not installed within four minutes, remove the sealer and reapply.

Clean and apply the sealant to the oil pan sealing areas indicated and install the oil pan rear seal.

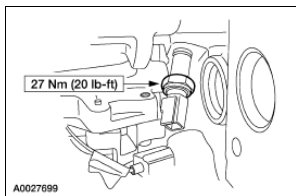
1. Apply the sealer to the rear main bearing cap.
2. Install the oil pan rear seal.
3. Apply the sealer to the oil pan mating surface.
 - Use metal surface cleaner.



47. Tighten the oil pan bolts in the sequence indicated.

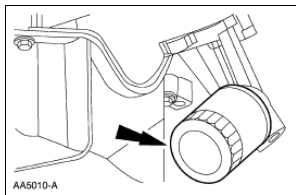


48. Install the oil pressure sensor.



49. Install a new oil bypass filter.

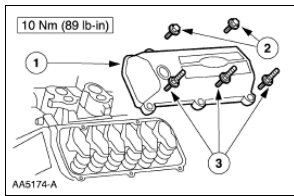
- Tighten to one-half turn after the gasket contacts the sealing surface.



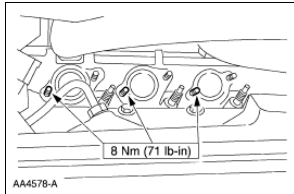
50. **NOTE:** Inspect the valve cover gaskets for damage. Install a new gasket, if necessary.

Install the valve covers.

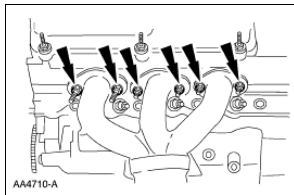
1. Position the valve covers.
2. Install the bolts.
3. Install the stud bolts.



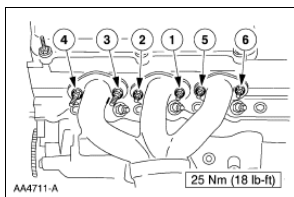
51. Install the lower exhaust manifold studs on both cylinder heads.



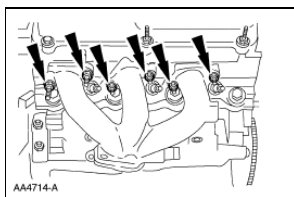
52. Install a new RH exhaust manifold gasket (9448) and position the RH exhaust manifold (9430). Loosely install the RH nuts.



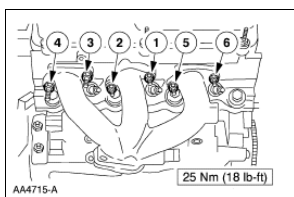
53. Tighten the bolts in the sequence indicated.



54. Install a new LH exhaust manifold gasket and position the LH exhaust manifold. Loosely install the LH nuts.



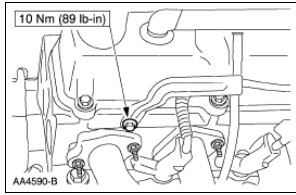
55. Tighten the bolts in the sequence indicated.



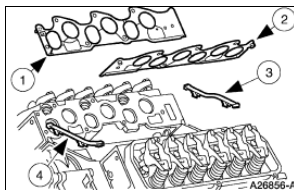
56. **NOTE:** Install a new oil level indicator tube O-ring seal.

Install the oil level indicator tube.

- Install the bolt.



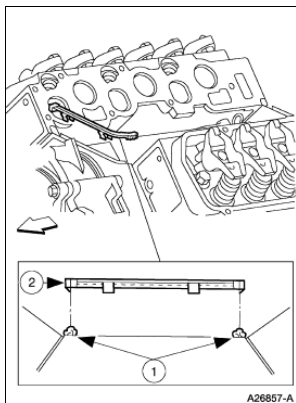
57. Refer to the illustration for intake manifold sealing components.



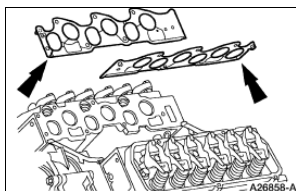
Item	Part Number	Description
1	9439	Intake manifold gasket RH
2	9439	Intake manifold gasket LH
3	9A424	Intake manifold rear end seal (part of 9439)
4	9A425	Intake manifold front end seal (part of 9439)

58. Install the lower intake manifold front and rear end seals.

1. Apply a bead of sealant to the intake manifold front and rear end seal mounting points as indicated.
2. Install the lower intake manifold front and rear end seals.



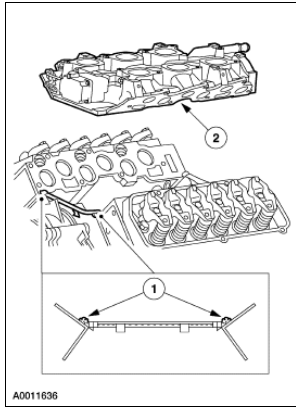
59. Position the intake manifold gaskets.



60. **NOTE:** The lower intake manifold must be installed within four minutes of applying the sealant.

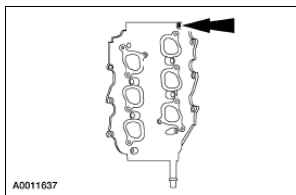
Position the lower intake manifold.

1. Apply a bead of sealant to the lower intake manifold mounting at the points indicated.
2. Position the lower intake manifold.

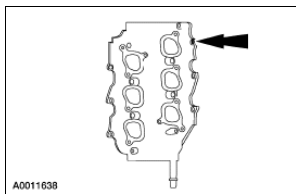


61. **NOTE:** Make sure the bolts are installed in the correct locations.

Install the six long bolts.

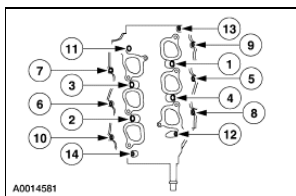


62. Install the eight short bolts.



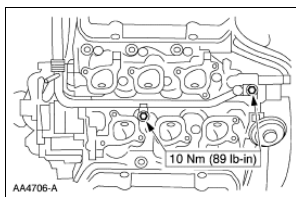
63. Tighten the lower intake manifold bolts in two stages, following the sequence shown.

- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten to 10 Nm (89 lb-in).

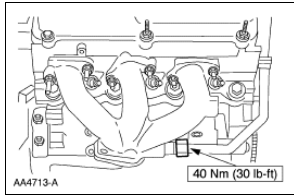


64. Connect the water bypass tube.

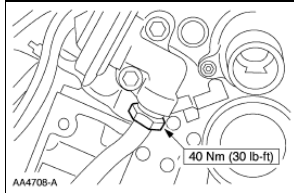
- Install the bolts.



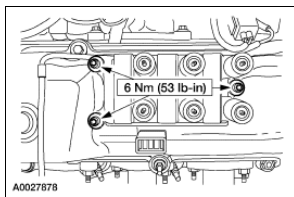
65. Install the EGR valve to exhaust manifold tube.



66. Install the EGR valve to exhaust manifold tube upper fitting.

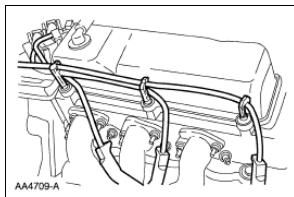


67. Install the ignition coil.

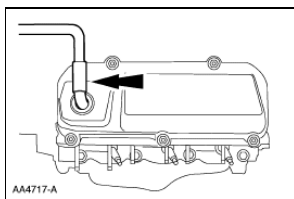


68. Connect the spark plug wires.

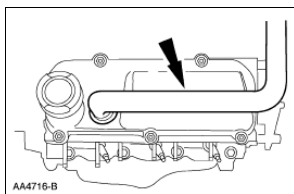
- Correctly route the spark plug wires.
- Connect the spark plug wires.



69. Install the PCV tube.

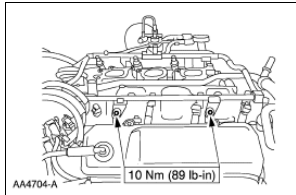


70. Install the PCV tube and the PCV valve.



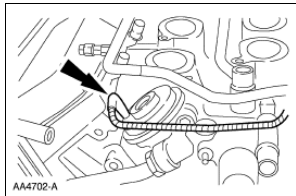
71. Install the fuel injectors and the fuel rail assembly.

- Install the fuel rail.
- Install the four bolts.



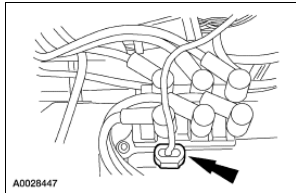
72. Position the vacuum harness.

73. Connect the EGR valve vacuum hose.

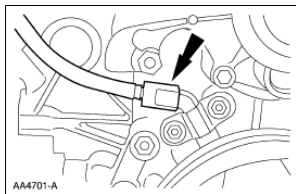


74. Position the engine wiring harness.

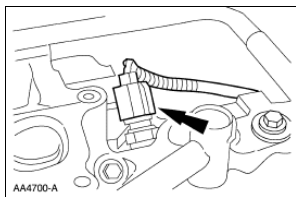
75. Connect the ignition coil electrical connectors.



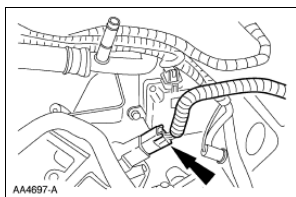
76. Connect the crankshaft position (CKP) sensor electrical connectors.



77. Connect the engine coolant temperature (ECT) sensor electrical connector.



78. Connect the camshaft position (CMP) sensor electrical connectors.



79. Connect the oil pressure sensor electrical connector.