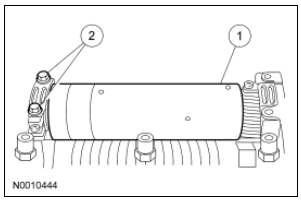
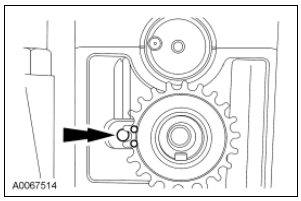
24. Install the balance shaft.
    1. Install the balance shaft assembly.
    2. Install the bolts.
        - ♦ Tighten to 27 Nm (20 lb-ft).



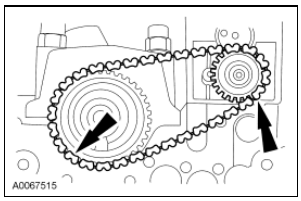
25. **NOTE:** Due to the gear ratio between the reversal shaft and the balance shaft, up to 7 complete turns of the balance shaft may be required to find the correct position.

    Align the timing marks.

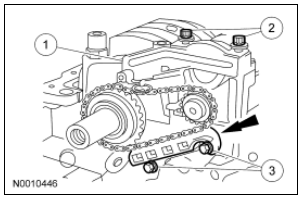
    - Install a 4-mm (0.16-in) pin to hold the shaft in place.



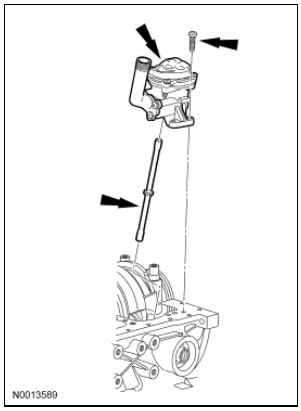
26. Install the balance shaft chain and crankshaft sprocket.



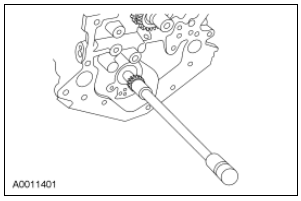
27. Install the balance shaft tensioner.
    1. Install the balance shaft tensioner.
    2. Install the bolts.
    3. Position the balance shaft chain guide and install the 2 bolts.
    - Remove the pins from the tensioner and the sprocket.
    - Install the crankshaft key.



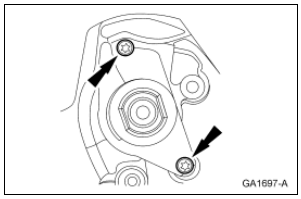
28. Install the oil pump intermediate shaft, the oil pump and the bolt.
    - Tighten to 19 Nm (14 lb-ft).



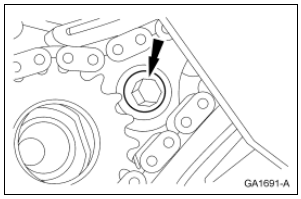
29. Install the jackshaft.



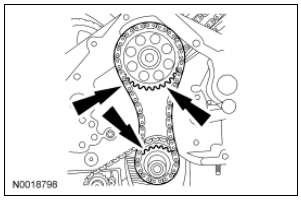
30. Install the jackshaft thrust plate and bolts.
    - Tighten to 11 Nm (8 lb-ft).



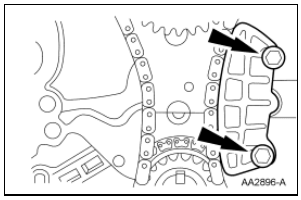
31. Install the front cassette and bolt.
    - Tighten to 19 Nm (14 lb-ft).



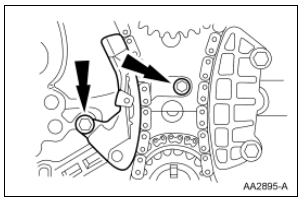
32. Position the jackshaft and crankshaft sprockets and the chain.



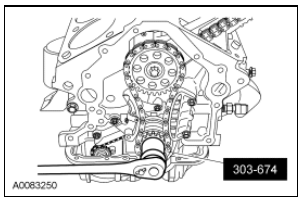
33. Install the chain guide and the bolts.
    - Tighten to 19 Nm (14 lb-ft).



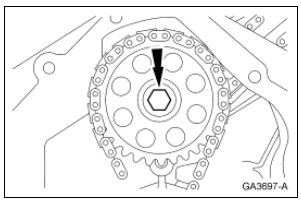
34. Install the chain tensioner and the bolts.
    - Tighten to 10 Nm (89 lb-in).



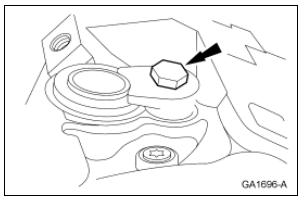
35. Using the special tool, hold the crankshaft.



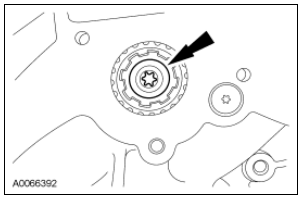
36. Install the jackshaft front bolt and tighten in 2 stages.
    - Stage 1: Tighten to 45 Nm (33 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



37. Install the oil pump drive and the bolt.
    - Tighten to 19 Nm (14 lb-in).

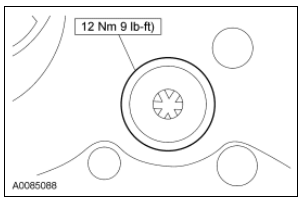


38. Install the RH cassette and sprocket to the jackshaft.
    - Install, but do not tighten the bolt at this time.

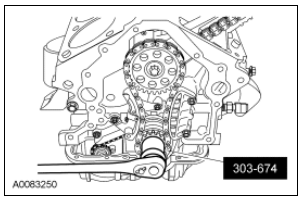


39. Install the RH cassette bolt.

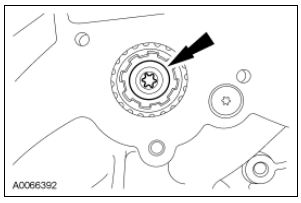
- Tighten to 12 Nm (9 lb-ft).



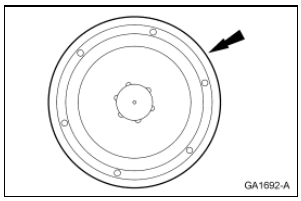
40. Using the special tool, hold the crankshaft.



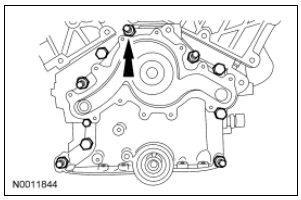
41. Tighten the rear jackshaft bolt in 2 stages.
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



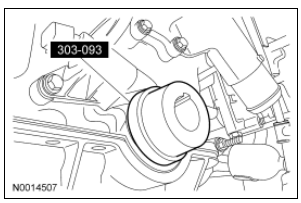
42. Install the rear jackshaft plug.



43. Position the front cover gasket, the front cover and loosely install the bolts.

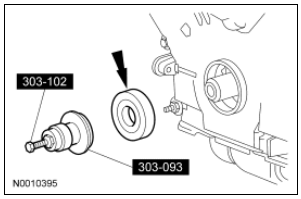


44. Install the special tool and tighten the front cover bolts.
    - Tighten to 19 Nm (14 lb-ft).



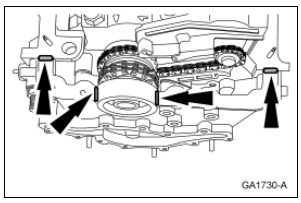
45. **NOTE:** Lubricate the seal lip with clean engine oil.

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



46. **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.

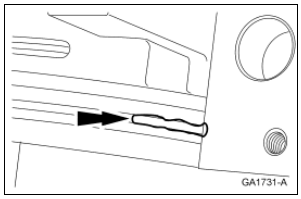
    Apply silicone gasket and sealant to the front cover in 4 places.



47. **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.

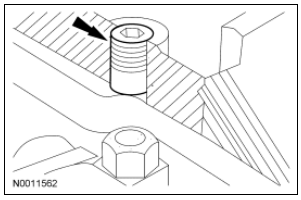
    Apply silicone gasket and sealant to the rear main bearing cap as shown.

    - Position the cylinder block cradle gasket.

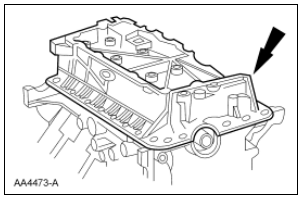


48. ⚠ **CAUTION: The cylinder block cradle inserts must be loosened completely or damage to the cylinder block cradle or oil leaks can result.**

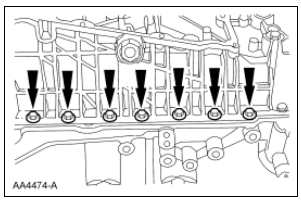
    Loosen the cylinder block cradle inserts.



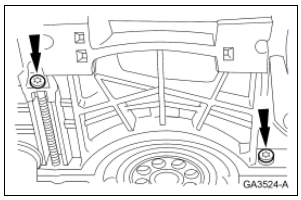
49. Position the cylinder block cradle and gasket assembly.



50. Install and finger-tighten the 20 bolts and 2 nuts.

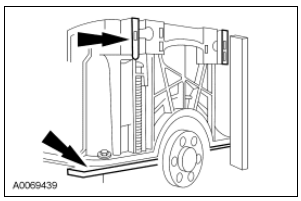


51. Install and finger-tighten the Torx bolts.

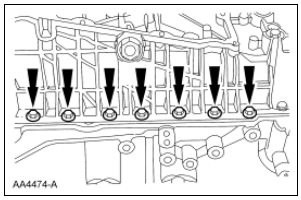


52. **NOTE:** The cylinder block cradle to the cylinder block alignment must be within a maximum mismatch of 0.25-mm (0.01-in) cylinder block cradle underflush or 0.05-mm (0.00196-in) cylinder block cradle protrusion.

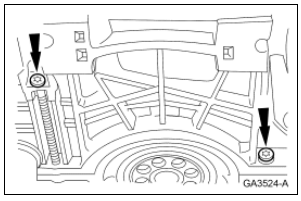
    Using a straightedge, align the transmission face of the cylinder block cradle with the rear face of the cylinder block.



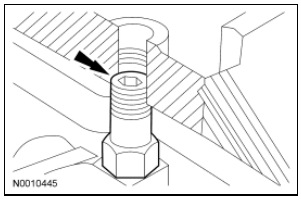
53. Tighten the 20 bolts and the 2 nuts.
    - Tighten to 10 Nm (89 lb-in).



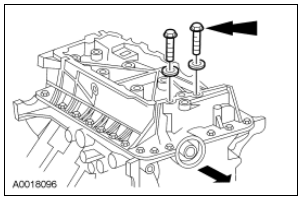
54. Tighten the Torx bolts.
    - Tighten to 8 Nm (81 lb-in).



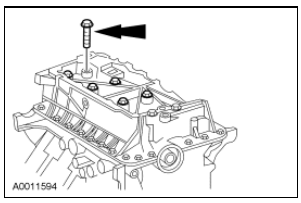
55. Tighten the inserts.
    - Tighten to 3 Nm (27 lb-in).



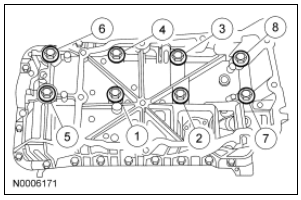
56. Install new seals on the 2 silver bolts and position them in the cylinder block cradle.



57. Position the 6 remaining bolts.

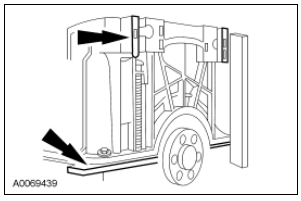


58. Tighten the cylinder block cradle inner bolts in the sequence shown 2 stages.
    - Stage 1: Tighten to 15 Nm (11 lb-ft).
    - Stage 2: Tighten to 34 Nm (25 lb-ft).

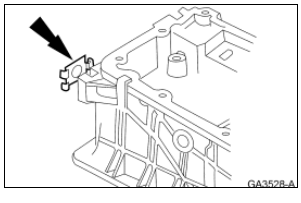


59. **NOTE:** Assemblies that measured out of specification must have the entire assembly procedure repeated.

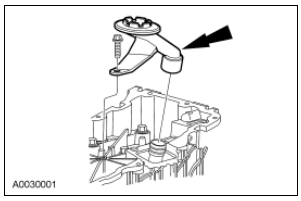
    Measure the step between the rear face of the cylinder block and the transmission face of the cylinder block cradle.



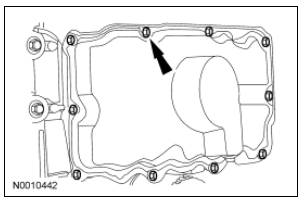
60. Repair all assemblies that exceed underflush specification by installing shims on one or both sides of the cylinder block cradle.



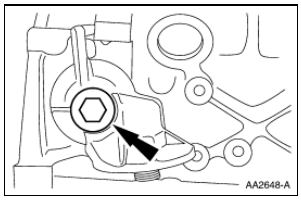
61. Install the oil pump screen cover and tube and the bolt.
    - Tighten to 10 Nm (89 lb-in).



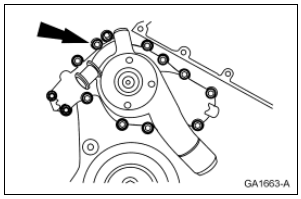
62. Install the gasket, the oil pan and the bolts.
    - Tighten to 9 Nm (80 lb-in).



63. Install the oil filter adapter and the bolt.
    - Tighten to 57 Nm (42 lb-in).

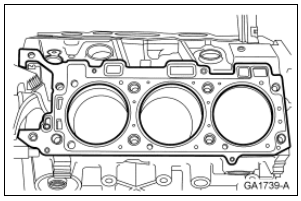


64. Install the coolant pump and the bolts.
    - Tighten to 10 Nm (89 lb-in).



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

    Install the cylinder head gaskets.

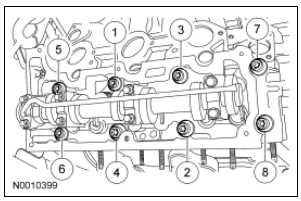


66. **NOTE:** New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

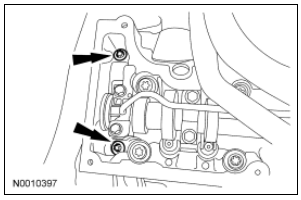
    Install the LH cylinder head and tighten the new bolts in the sequence shown in 2 stages.

    - Stage 1: Tighten the bolts to 12 Nm (9 lb-ft).

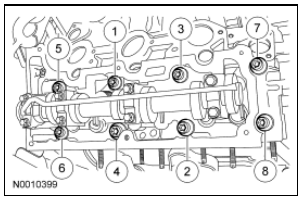
- Stage 2: Tighten the bolts to 25 Nm (18 lb-ft).



67. Install the 2 8-mm bolts.
    - Tighten to 32 Nm (24 lb-ft).



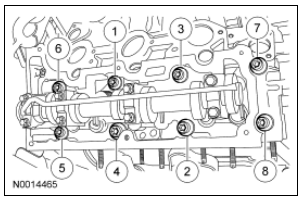
68. Tighten the bolts in the sequence shown in 2 stages.
    - Stage 1: Rotate 90 degrees.
    - Stage 2: Rotate an additional 90 degrees.



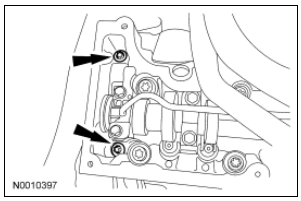
69. **NOTE:** New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Install the RH cylinder head. Install 8 new 12-mm 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).

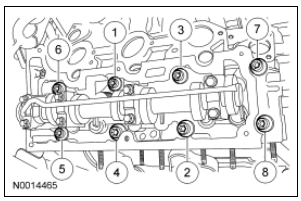


70. Install 2 new 8-mm bolts.
    - Tighten to 32 Nm (24 lb-ft).

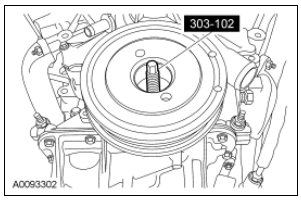


71. Tighten the 8 12-mm bolts in the sequence shown in 2 stages.
    - Stage 1: Rotate 90 degrees.

- Stage 2: Rotate an additional 90 degrees.



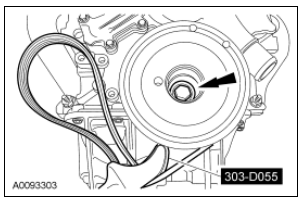
72. Using the special tool, install the crankshaft pulley.



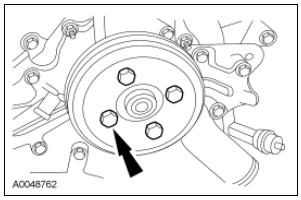
73. ⚠ **CAUTION: A new bolt must be used each time it is removed.**

    Using the special tool, tighten the bolt in 2 stages.

    - Stage 1: Tighten to 50 Nm (37 lb-ft).
    - Stage 2: Rotate an additional 90 degrees.

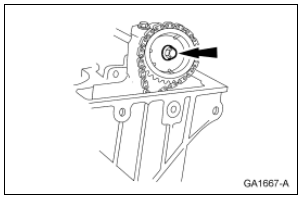


74. Install the coolant pump pulley and the bolts.
    - Tighten to 25 Nm (18 lb-ft).

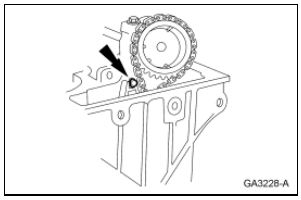


75. ⚠ **CAUTION: The camshaft sprocket must turn freely on the camshaft. DO NOT tighten the bolt.**

    Loosely install the RH camshaft sprocket bolt.

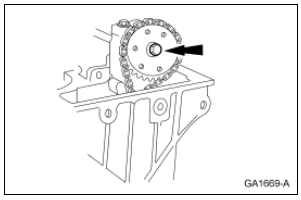


76. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

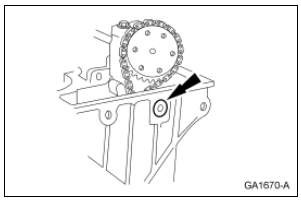


77. ⚠ **CAUTION: The camshaft sprocket must turn freely on the camshaft. DO NOT tighten the bolt.**

    Loosely install the LH camshaft sprocket bolt.



78. Install the bolt.
    - Tighten to 12 Nm (9 lb-ft).

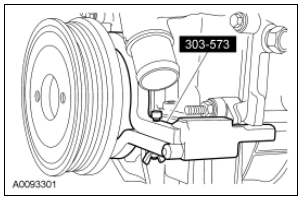


79. Turn the crankshaft one revolution clockwise.

80. ⚠ **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 top dead center (TDC).

    Install the special tool.



81. **NOTE:** Camshaft timing slots are off-center.

    NOTE: Position the camshaft timing slots below centerline of camshaft to correctly fit the special tools.

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