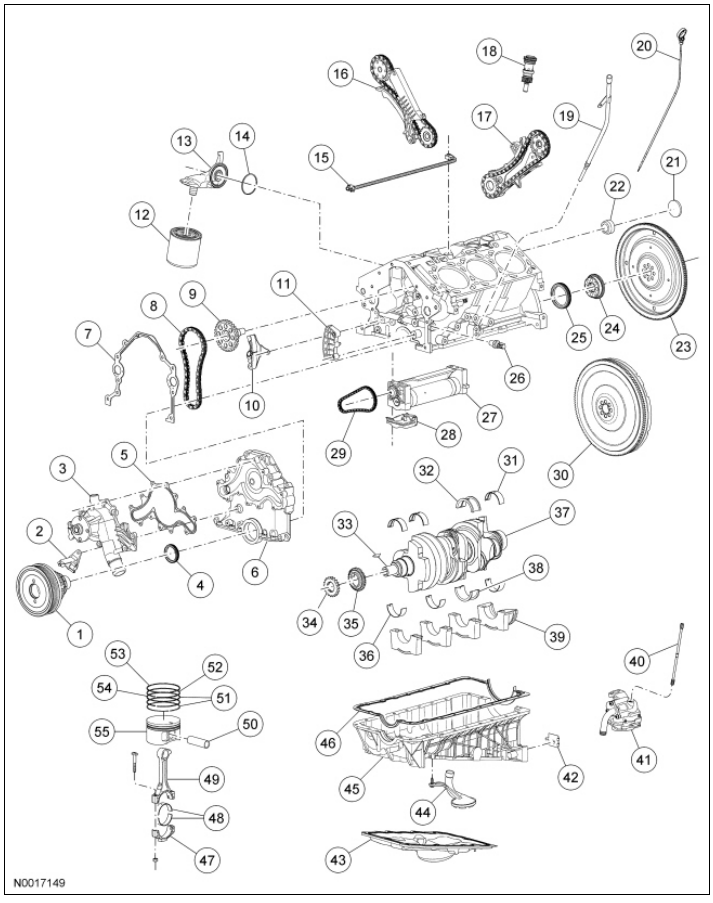
27	9448	LH exhaust manifold gasket
28	9431	LH exhaust manifold
29	6507	Intake valve (6 required)
30	6083	LH cylinder head gasket
31	6505	Exhaust valve (6 required)
32	12405	Spark plug (6 required)
33	6049	LH cylinder head
34	6049	RH cylinder head
35	6051	RH cylinder head gasket
36	6K254	RH hydraulic chain tensioner
37	9448	RH exhaust manifold gasket
38	9430	RH exhaust manifold
39	18696	Coolant tube
40	6A258	RH camshaft bearing cap (3 required)

Lower End



Item	Part Number	Description
1	6B321	Crankshaft pulley
2	6C315	Crankshaft Position (CKP) sensor
3	8501	Coolant pump
4	6700	Crankshaft front oil seal

5	8507	Coolant pump gasket
6	6019	Engine front cover
7	6020	Engine front cover gasket
8	6M270	Jackshaft chain
9	6M264	Jackshaft chain sprocket
10	6M271	Jackshaft chain tensioner
11	6M272	Jackshaft chain guide
12	6714	Oil filter
13	6884	Oil filter adapter
14	6L621	Oil filter adapter O-ring seal
15	12A699	Knock Sensor (KS)
16	6M290	RH camshaft drive cassette
17	6M289	LH camshaft drive cassette
18	6846	Oil pump drive assembly
19	6754	Oil level indicator tube
20	6750	Oil level indicator
21	6M296	Jackshaft seal
22	6M052	Jackshaft plug
23	6375	Flexplate
24	6434	Flexplate-to-crankshaft spacer
25	6701	Crankshaft rear oil seal
26	9278	Oil pressure sensor
27	6A311	Balance shaft (if equipped)
28	6K355	Balance shaft chain tensioner (if equipped)
29	6A364	Balance shaft chain (if equipped)
30	6375	Flywheel (manual transmission only)
31	6333	Crankshaft main bearing (3 required)
32	6337	Crankshaft main bearing cap
33	W702979	Woodruff key
34	6306	Jackshaft chain sprocket
35	6K350	Balance shaft chain sprocket (if equipped)
36	6A338	Crankshaft main bearing (3 required)
37	6303	Crankshaft
38	6A339	Crankshaft main bearing cap
39	6325	Crankshaft main thrust bearing
40	6A605	Oil pump drive shaft
41	6621	Oil pump
42	6C629	Shim (2 required)
43	6675	Oil pan
44	6617	Oil pump screen and pickup tube
45	6F092	Cylinder block cradle
46	6710	Cylinder block cradle gasket
47	6210	Connecting rod cap
48	6211	Connecting rod bearings

49	6200	Connecting rod
50	6135	Piston pin
51	6159	Oil control rings
52	6152	Lower compression ring
53	6150	Upper compression ring
54	6161	Oil control ring spacer
55	6110	Piston

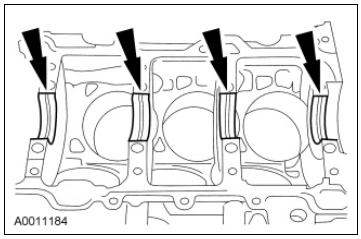
All vehicles

NOTICE: **If used as a leverage device, the fuel rail may be damaged. Care must be taken when working around the fuel rail.**

NOTE: During engine assembly it may be necessary to check the bearing clearances and crankshaft end play. For additional information, refer to Section 303-00 .

NOTE: Before engine assembly, use silicone gasket remover and metal surface prep and a suitable plastic or wooden scraper to clean the sealing surfaces. Follow the directions on the packaging. All sealing surfaces must be clean. Make sure coolant and oil passages are clear.

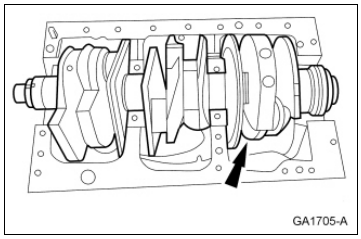
1. Install the crankshaft main bearings and the thrust bearing.
   - Lubricate the crankshaft main bearings with clean engine oil.



2. Install the lower main bearings in the bearing caps.

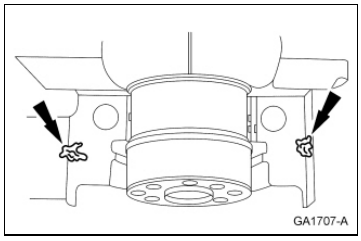
3. **NOTE:** The crankshaft main bearings are precision selective fit. Inspect the bearing clearance. For additional information, refer to Section 303-00 .

   Install the crankshaft.

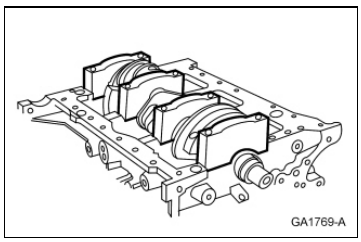


4. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

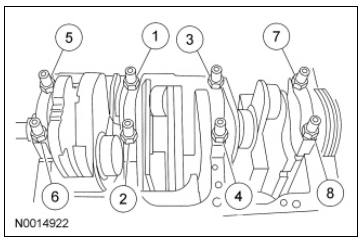
   Apply silicone gasket and sealant to the rear main bearing cap to cylinder block parting line.



5. Install the 4 main bearing caps in the same position from which they were removed.



6. Tighten the 8 bolts in the sequence shown in 2 stages.
   - Stage 1: Tighten to 35 Nm (26 lb-ft).
   - Stage 2: Tighten an additional 57 degrees.

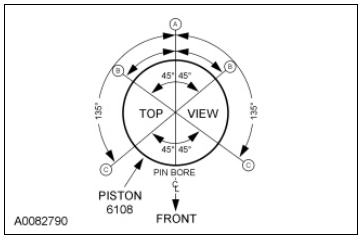


7. Check the piston to cylinder bore and ring clearance. For additional information, refer to Section 303-00 .

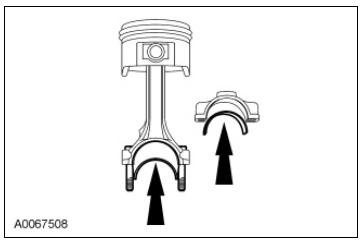
8. **NOTE:** Lubricate the piston rings with clean engine oil.

   Install the piston rings.

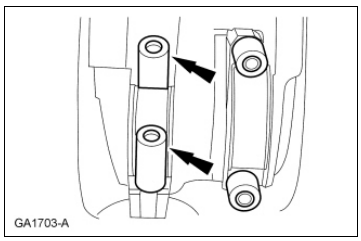
9. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.



10. Install the connecting rod bearings.



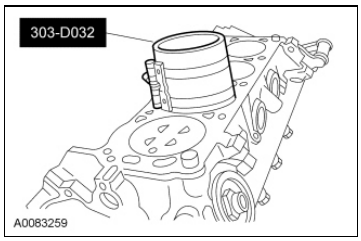
11. Install rubber hose pieces on the connecting rod bolts to protect the crankshaft.



12. **NOTE:** Position the piston with the indentation arrow toward the front of the cylinder block.

    Using the Piston Ring Compressor, install the pistons.

    - Rotate the crankshaft as necessary.



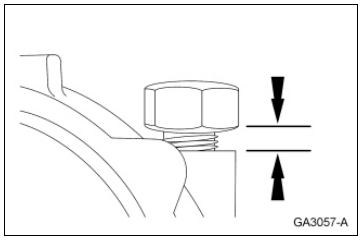
13. **NOTE:** The old nuts and bolts are used for checking clearances. New nuts and bolts must be used for reassembly.

    Check the clearance of each connecting rod bearing. For additional information, refer to Section 303-00 .

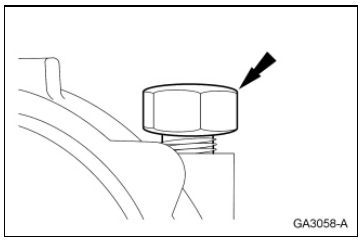
14. Rotate the crankshaft until the piston is at the bottom of its stroke.

15. **NOTE:** For cylinders 1, 2 and 3, remove the connecting rod nut at the oil split hole side first. For cylinders 4, 5 and 6, remove the opposite nut first.

    Loosen the first nut until the face is approximately 2 mm (0.08 in) over the end of the bolt.

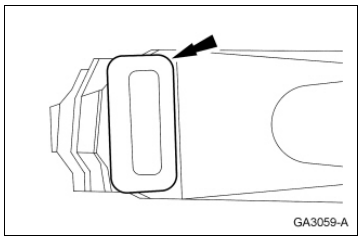


16. Tap on the nut until the bolt can be removed by hand.



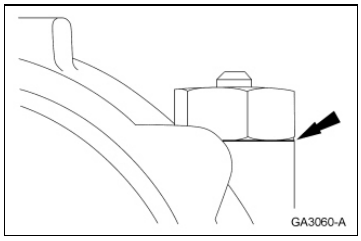
17. Repeat the previous 2 steps for the opposite bolt.

18. Install the 2 new bolts, making certain that the bolt head is parallel to the sideward face of the connecting rod.



19. Install the connecting rod cap in the original position.

20. Install and tighten the 2 connecting rod nuts finger-tight.



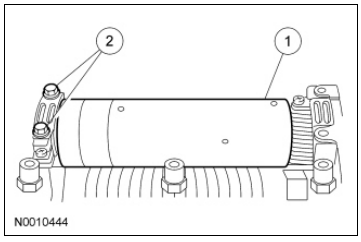
21. Tighten the 2 connecting rod nuts in 2 stages.
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten an additional 90 degrees.

22. Repeat the previous 4 steps for the remaining connecting rods.

23. Rotate the crankshaft until the No. 1 piston is at Top Dead Center (TDC).

Vehicles equipped with a balance shaft

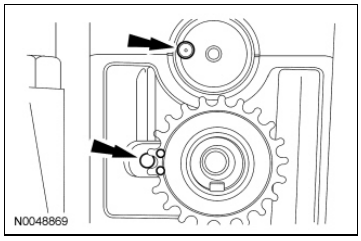
24. Install the balance shaft.
    1. Install the balance shaft assembly.
    2. Install the 2 bolts.
        - Tighten to 29 Nm (21 lb-ft).



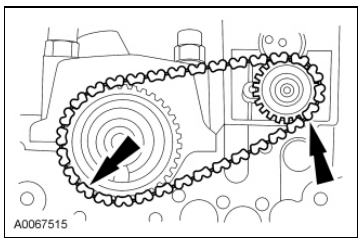
25. **NOTE:** Due to the gear ratio between the reversal shaft and the balance shaft, up to 7 complete turns of the balance shaft may be required to find the correct position.

    Align the timing marks.

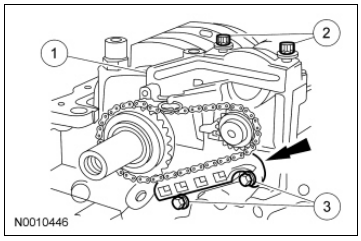
    - Install a 4 mm (0.16 in) pin to hold the shaft in place.



26. Install the balance shaft chain and crankshaft sprocket.

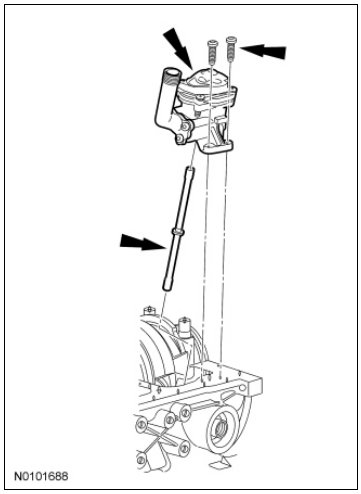


27. Install the balance shaft tensioner and chain guide.
    1. Install the balance shaft tensioner.
    2. Install the 2 bolts and tighten to 29 Nm (21 lb-ft).
    3. Position the balance shaft chain guide, install the 2 bolts and tighten to 10 Nm (89 lb-in).
    - Remove the pins from the tensioner and, if installed, the sprocket.

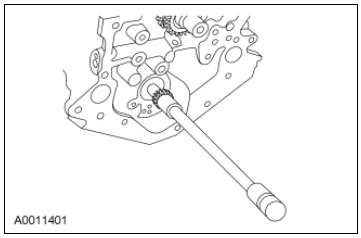


All vehicles

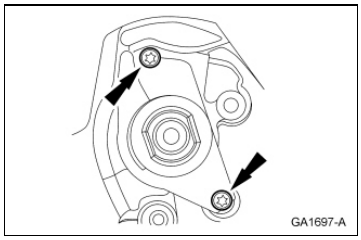
28. Install the oil pump intermediate shaft, the oil pump and the 2 bolts.
    - Tighten to 19 Nm (168 lb-in).



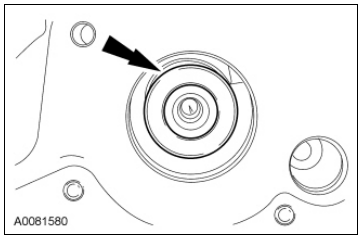
29. Install the jackshaft.



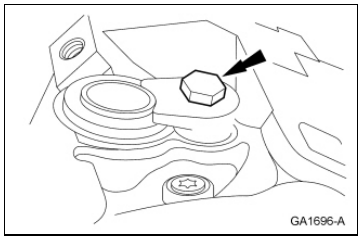
30. Install the jackshaft thrust plate and bolts.
    - Tighten to 11 Nm (97 lb-in).



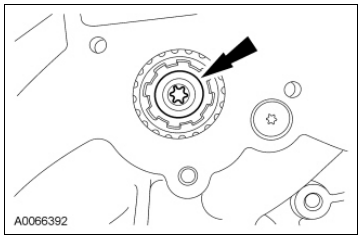
31. Install the jackshaft spacer.



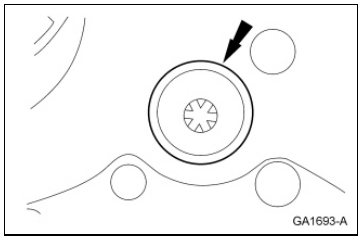
32. Install the oil pump drive and the hold down.
    - Tighten to 19 Nm (168 lb-in).



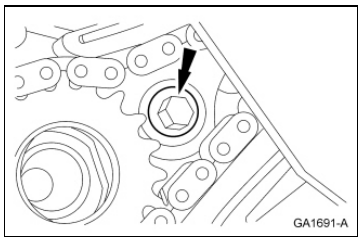
33. Position the RH camshaft drive cassette and install the sprocket bolt. Do not tighten the bolt at this time.



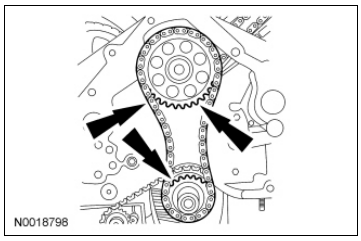
34. Install the RH drive cassette bolt and spacer.
    - Tighten to 18 Nm (159 lb-in).



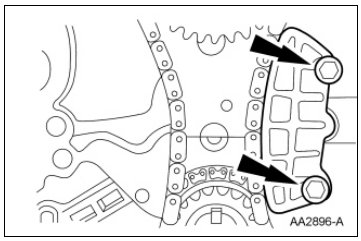
35. Install the LH cassette and the bolt.
    - Tighten to 19 Nm (168 lb-in).



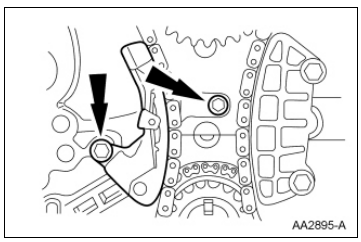
36. Install the crankshaft key. Position the jackshaft and crankshaft sprockets and the chain.



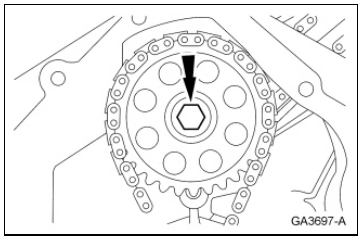
37. Install the chain guide and the 2 bolts.
    - Tighten to 19 Nm (168 lb-in).



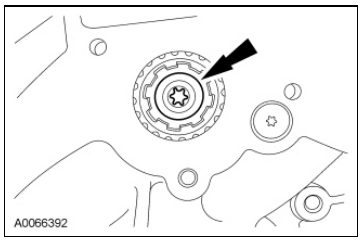
38. Install the chain tensioner and the 2 bolts.
    - Tighten to 9 Nm (80 lb-in).



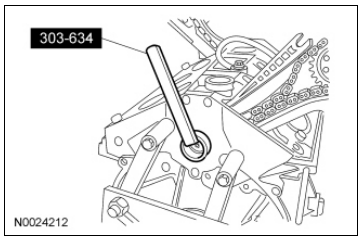
39. Install the jackshaft sprocket bolt. Do not tighten the bolt at this time.



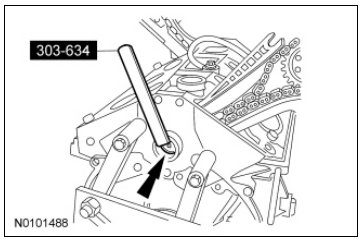
40. While holding the front jackshaft sprocket bolt secure, tighten the rear bolt.
    - Tighten to 20 Nm (177 lb-in).



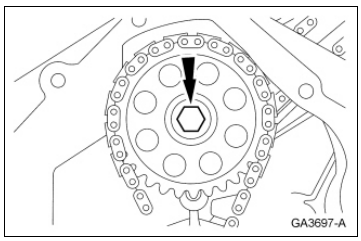
41. Install the Rear Jack Shaft Socket on the rear of the jackshaft.



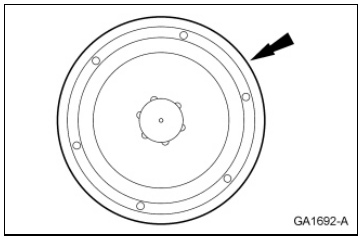
42. Using the Rear Jack Shaft Socket to hold the jackshaft, tighten the rear jackshaft bolt an additional 90 degrees.



43. Using the Rear Jack Shaft Socket to hold the jackshaft, tighten the front sprocket bolt in 2 stages.
    - Tighten to 45 Nm (33 lb-ft).
    - Tighten an additional 90 degrees.



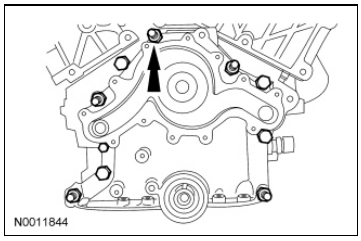
44. Remove the Rear Jack Shaft Sprocket and install the rear jackshaft plug.



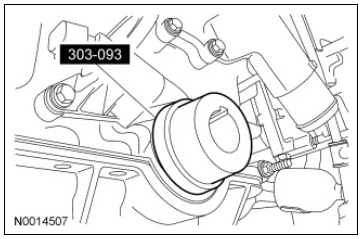
45. Position a new engine front cover gasket on the cylinder block.

46. **NOTE:** Apply thread sealant to the stud bolts and make sure that the stud bolts are installed in their original positions.

    Position the front cover and loosely install the 5 bolts and the 5 stud bolts.

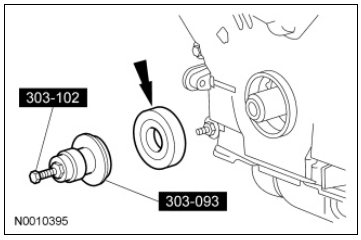


47. Install the Front Cover Aligner and tighten the 5 bolts and 5 stud bolts.
    - Tighten to 19 Nm (168 lb-in).



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

    Using the Front Cover Aligner and the Crankshaft Vibration Damper Installer, install the crankshaft front oil seal.



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

    Loosen the 8 cylinder block cradle inserts.