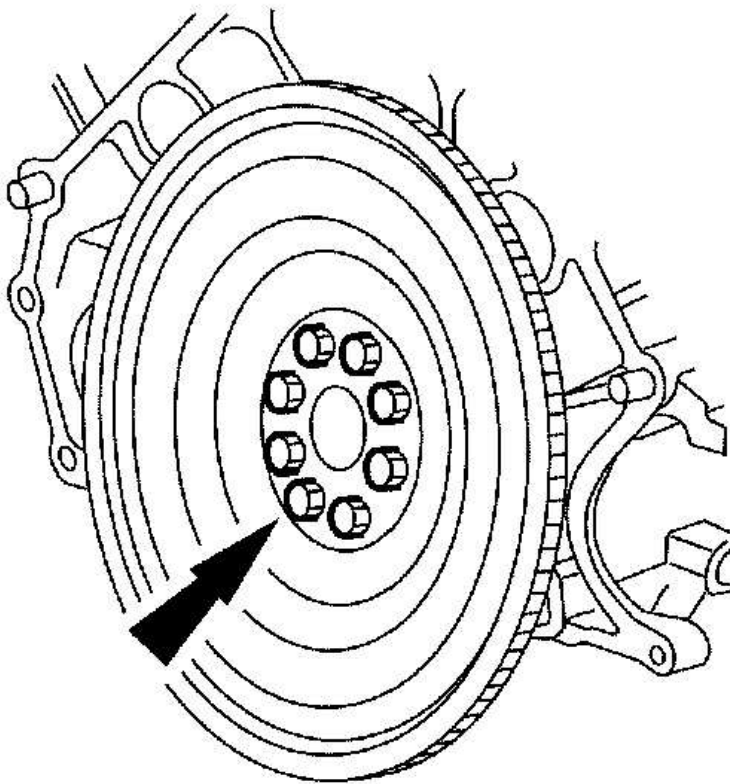


Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-

All cylinder heads

1. Remove the engine. For additional information, refer to **ENGINE** .
2. Remove the bolts and the flexplate.



A26551-A

Fig. 278: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

3. Install the engine onto a suitable engine stand.

4. Remove the special tool.

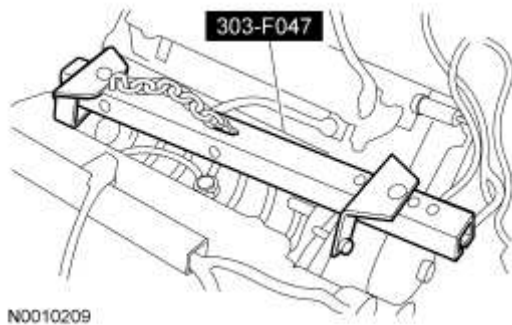


Fig. 279: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH engine support insulator.

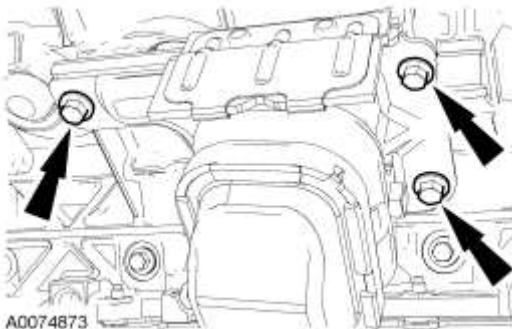


Fig. 280: Identifying RH Engine Support Insulator Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

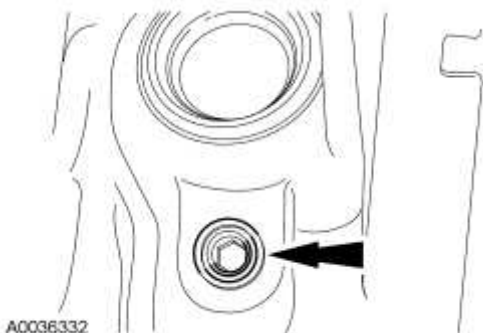


Fig. 281: Locating Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

6. Remove the cylinder block drain plugs and drain the coolant into a suitable container.

NOTE: LH shown, RH similar.

7. Install the cylinder block drain plugs.
 - Tighten to 24 N.m (18 lb-ft).

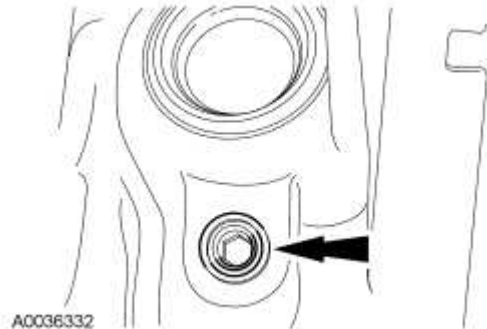


Fig. 282: Locating Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

8. Disconnect the RH camshaft position (CMP) sensor electrical connector.

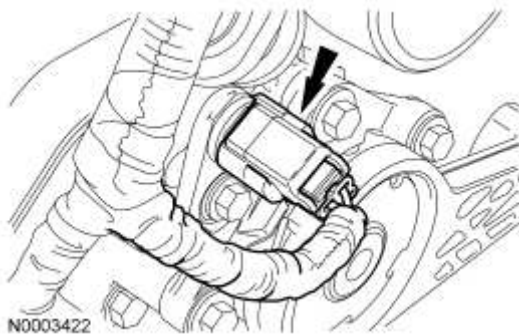


Fig. 283: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

9. Remove the stud bolt and the RH radio ignition interference capacitor.

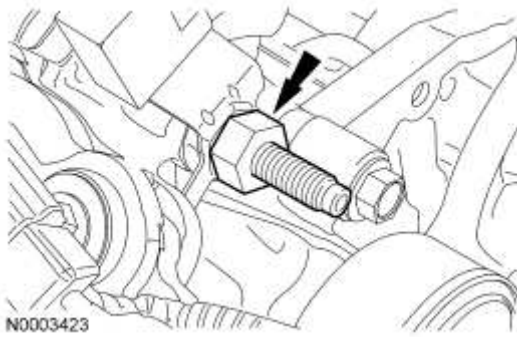


Fig. 284: Identifying RH Radio Ignition Interference Capacitor Stud Bolt
Courtesy of FORD MOTOR CO.

10. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

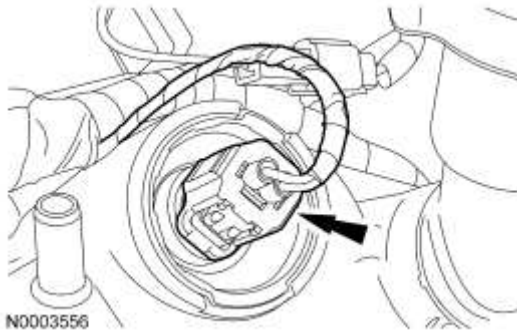


Fig. 285: Locating Camshaft Timing (VCT) Solenoid Electrical Connectors
Courtesy of FORD MOTOR CO.

11. Disconnect the 2 engine wiring harness retainers from the RH valve cover studs.

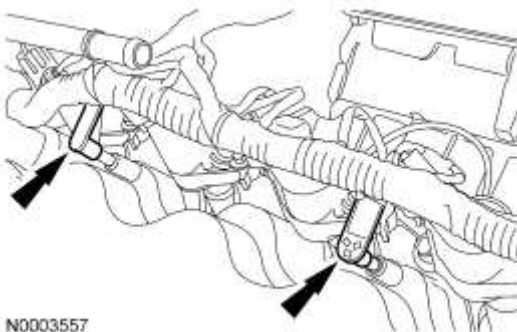


Fig. 286: Locating Engine Wiring Harness Retainers At RH Valve Cover

Courtesy of FORD MOTOR CO.

12. Disconnect the electrical connector retainer from the coolant tube.

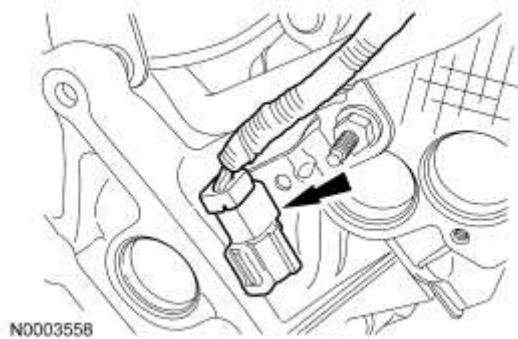


Fig. 287: Locating Electrical Connector Retainer At Coolant Tube Support Bracket

Courtesy of FORD MOTOR CO.

13. Disconnect the 4 RH ignition coil electrical connectors.

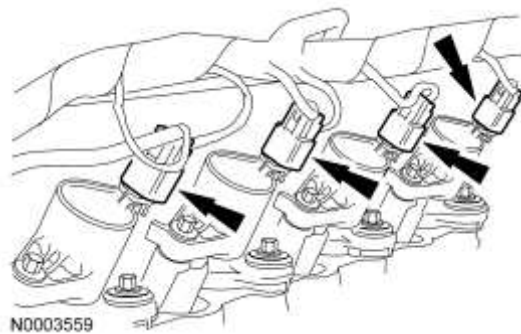


Fig. 288: Locating Ignition Coil Electrical Connectors

Courtesy of FORD MOTOR CO.

14. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

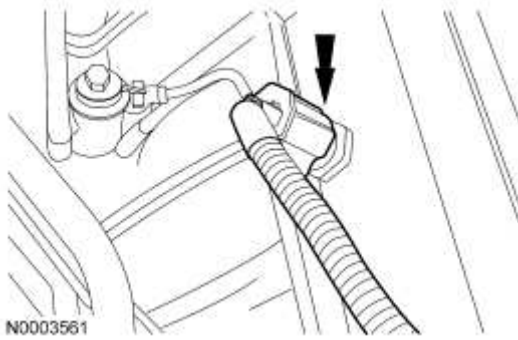


Fig. 289: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector

Courtesy of FORD MOTOR CO.

15. Remove the stud bolt and the LH radio ignition interference capacitor.

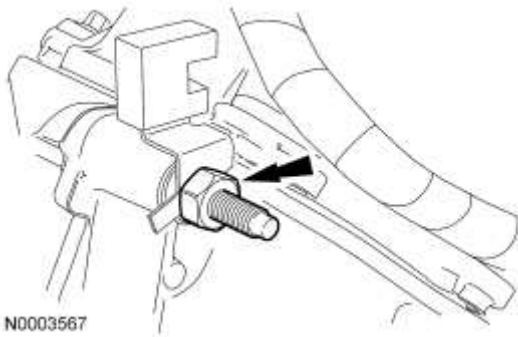


Fig. 290: Identifying LH Radio Ignition Interference Capacitor And Stud Bolt

Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

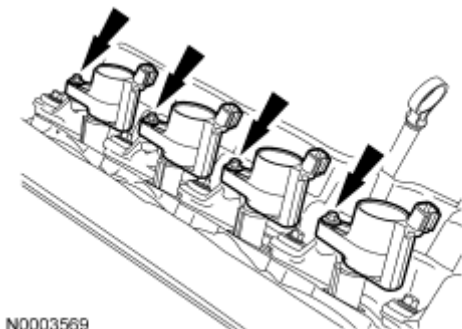


Fig. 291: Identifying Ignition Coils And Bolts

Courtesy of FORD MOTOR CO.

16. Remove the 8 bolts and the 8 ignition coils.
17. Remove the engine wiring harness from the engine assembly.
18. Remove the bolt and the oil level indicator tube.
 - Discard the O-ring seal.

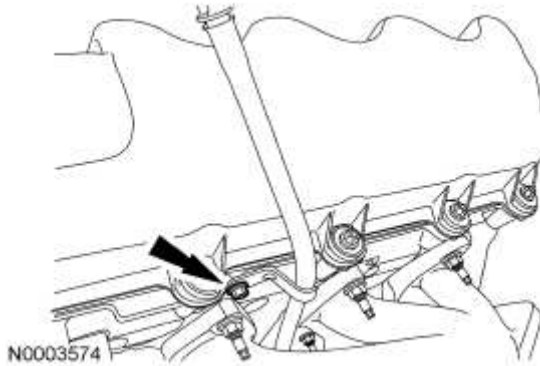


Fig. 292: Locating Oil Level Indicator Tube Bolt
Courtesy of FORD MOTOR CO.

19. Remove the bolt and the RH CMP sensor.

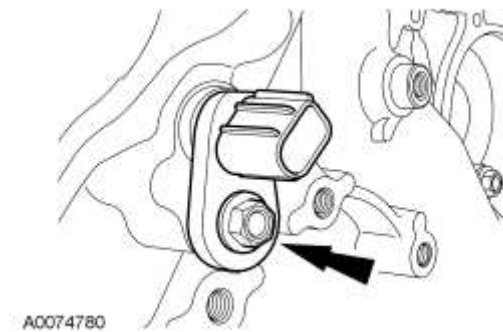


Fig. 293: Locating Camshaft (CMP) Sensor Bolt
Courtesy of FORD MOTOR CO.

20. Remove the bolt and the LH CMP sensor.

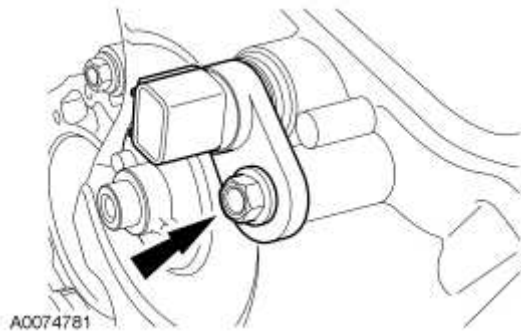


Fig. 294: Locating Bolt And LH CMP Sensor
Courtesy of FORD MOTOR CO.

21. Remove the bolt and the CKP sensor.

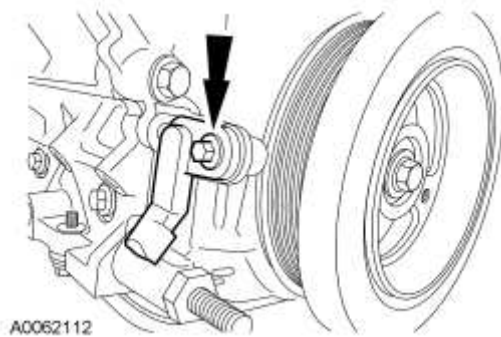


Fig. 295: Locating Crankshaft Position (CKP) Sensor Bolt
Courtesy of FORD MOTOR CO.

CAUTION:

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.

When removing the valve cover, make sure to avoid damaging the VCT solenoid.

NOTE:

The fasteners are part of the valve cover and should not be removed.

LH shown, RH similar.

22. Loosen the fasteners and remove the valve covers.

- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.

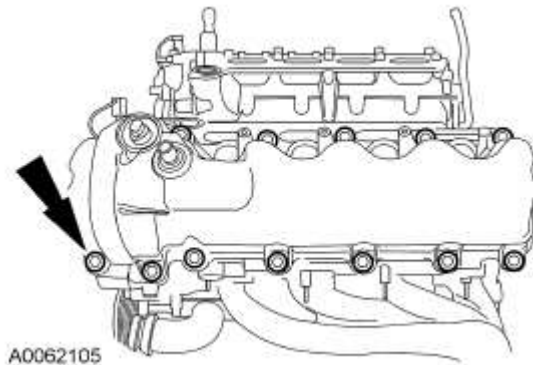


Fig. 296: Locating Valve Cover Bolts
Courtesy of FORD MOTOR CO.

23. Remove the bolts, the coolant pump pulley and the 3 accessory drive belt idler pulleys.

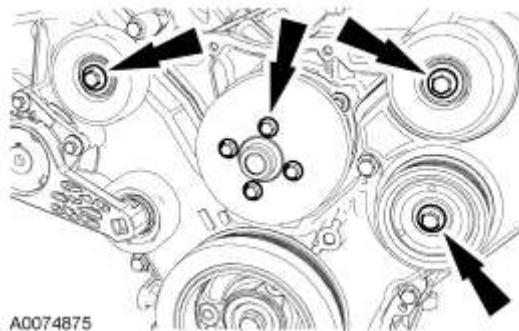


Fig. 297: Locating Coolant Pump Pulley And Accessory Drive Belt Idler Pulley Bolts
Courtesy of FORD MOTOR CO.

24. Remove the bolts and the accessory drive belt tensioner.

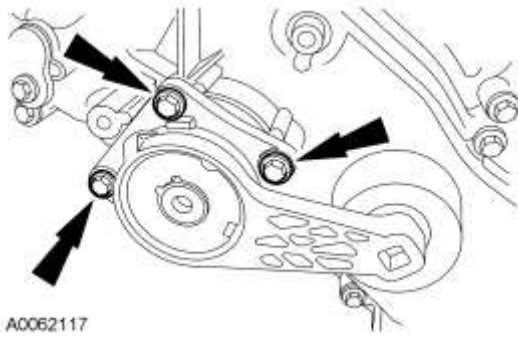


Fig. 298: Identifying Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

25. Remove and discard the crankshaft pulley bolt. Using the special tool, remove the crankshaft pulley.

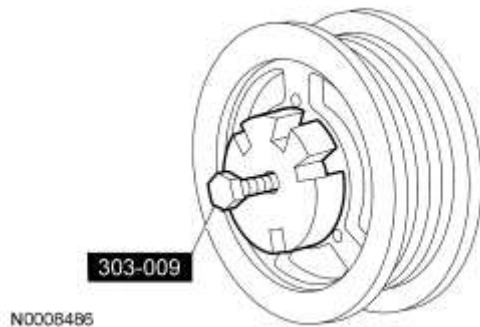


Fig. 299: Removing Crankshaft Pulley Using Special Tool
Courtesy of FORD MOTOR CO.

26. Using the special tool, remove and discard the crankshaft front seal.

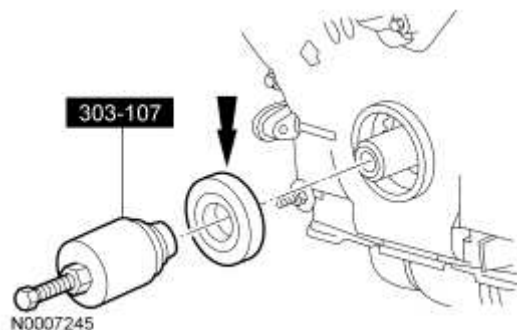
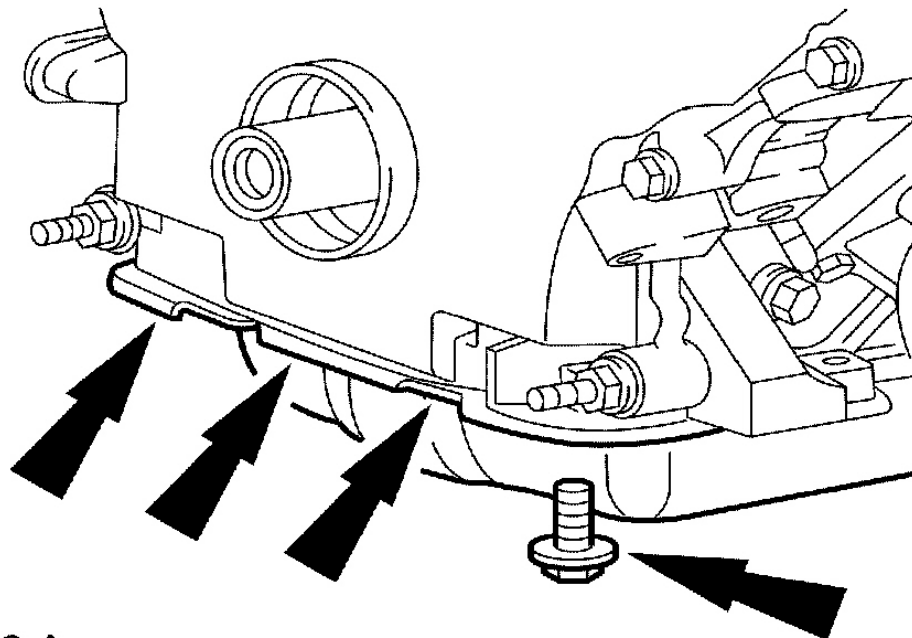


Fig. 300: Removing Crankshaft Front Seal Using Special Tool
Courtesy of FORD MOTOR CO.

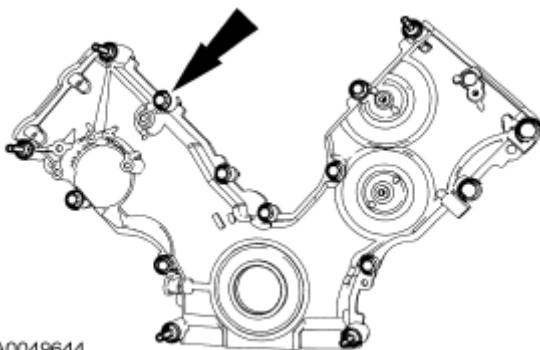
27. Remove the front 4 oil pan bolts.



AA4226-A

Fig. 301: Locating Oil Pan Bolts-To-Front Cover
Courtesy of FORD MOTOR CO.

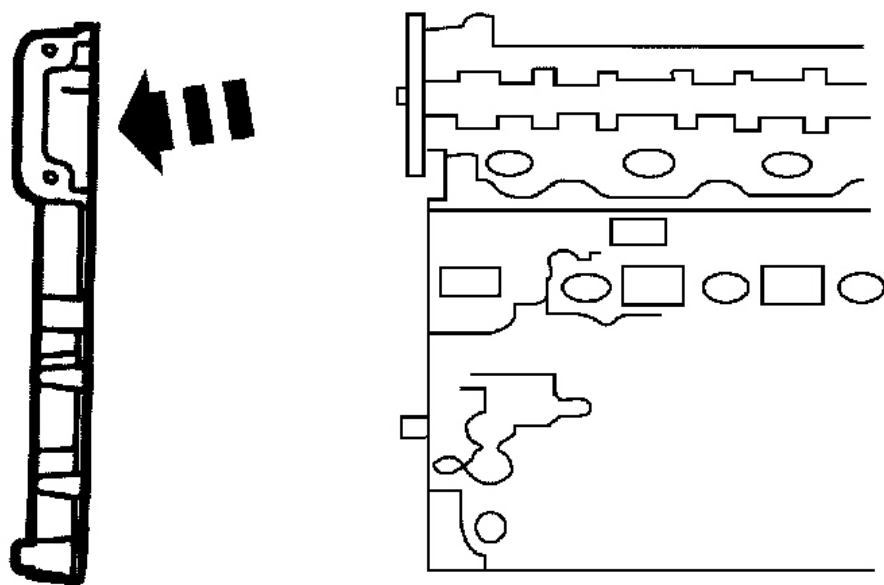
NOTE: Correct fastener location is essential for assembly procedure. Record fastener location.



A0049644

Fig. 302: Locating Cylinder Block Fasteners
Courtesy of FORD MOTOR CO.

28. Remove the fasteners.
29. Remove the engine front cover from the cylinder block.



AA1665-A

Fig. 303: Locating Engine Front Cover
Courtesy of FORD MOTOR CO.

30. Remove the crankshaft sensor ring from the crankshaft.

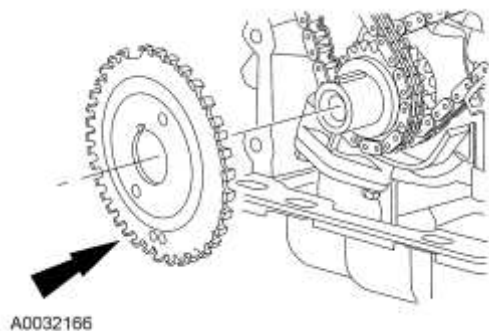


Fig. 304: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

31. Position the crankshaft keyway at the 12 o'clock position.

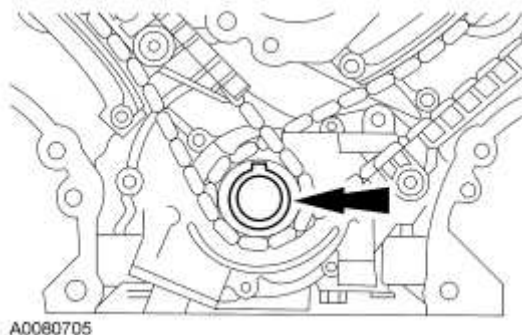


Fig. 305: Positioning Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown in Fig. 306, the crankshaft will require one full additional rotation to 12 o'clock.

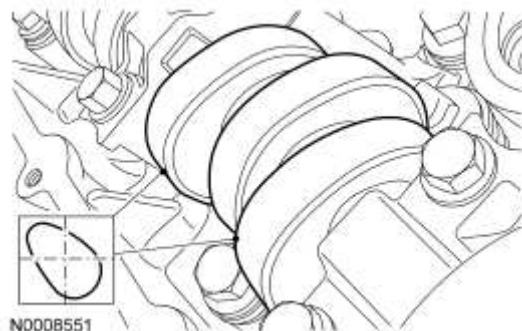
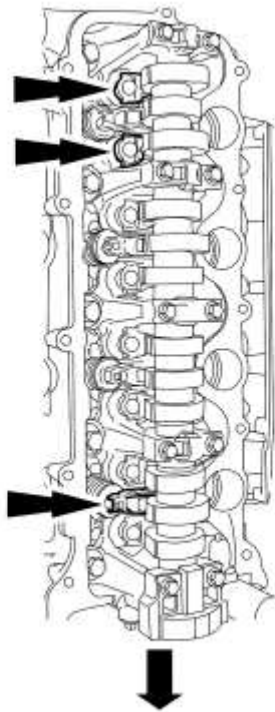


Fig. 306: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

32. The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.

CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.



A0083248

Fig. 307: Identifying RH Cylinder Head Camshaft Roller Followers And Bolts

Courtesy of FORD MOTOR CO.

33. Remove only the 3 camshaft roller followers shown in **Fig. 307** from the RH cylinder head.

CAUTION: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.

NOTE: It may be necessary to push the valve down while compressing the spring.

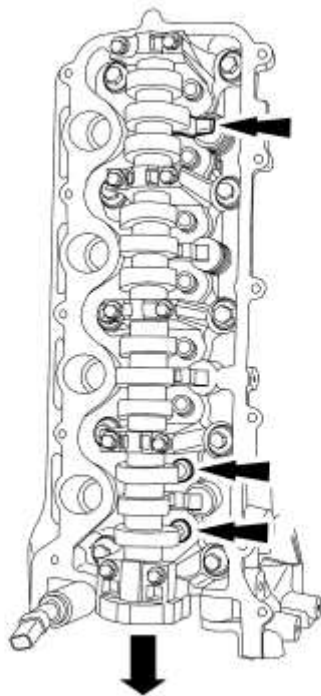


Fig. 308: Identifying Special Tool For Removing/Installing Camshaft Roller Followers

Courtesy of FORD MOTOR CO.

34. Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the RH cylinder head.

CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.



A0084479

Fig. 309: Locating LH Cylinder Head Camshaft Roller Followers And Bolts

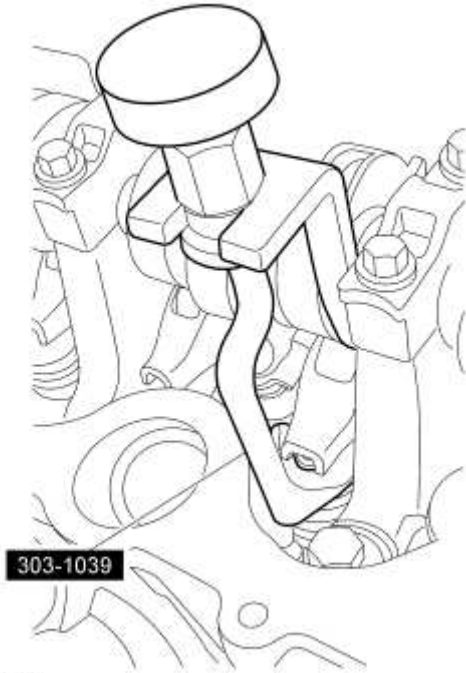
Courtesy of FORD MOTOR CO.

35. Remove only the 3 camshaft roller followers shown in **Fig. 309** from the LH cylinder head.

CAUTION: Do not allow the valve keepers to fall off the

valve or the valve may drop into the cylinder.

NOTE: It may be necessary to push the valve down while compressing the spring.



N0010191

Fig. 310: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

36. Using the special tool, remove the 3 designated camshaft roller followers in the previous step from the LH cylinder head.

CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set.

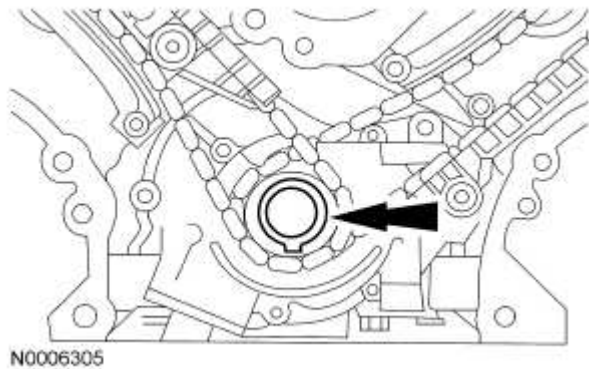


Fig. 311: Identifying Crankshaft Keyway Position
Courtesy of FORD MOTOR CO.

37. Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.

CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.

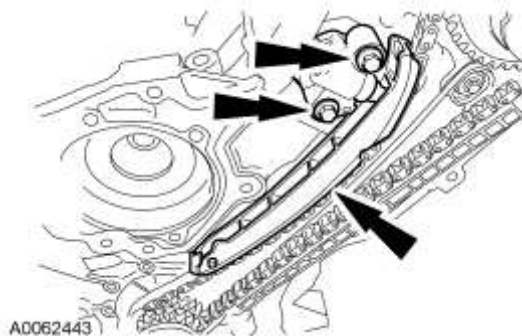


Fig. 312: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

38. Remove the bolts, the LH timing chain tensioner and tensioner arm.

CAUTION: If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead

must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner.

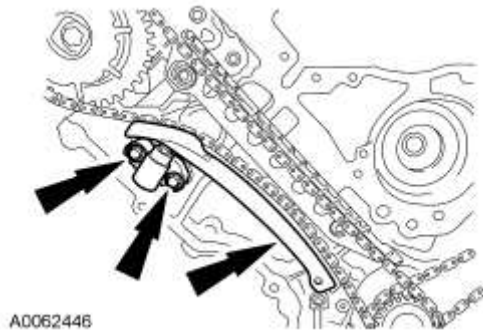


Fig. 313: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts

Courtesy of FORD MOTOR CO.

39. Remove the bolts, the RH timing chain tensioner and tensioner arm.
40. Remove the RH and LH timing chains and the crankshaft sprocket.
 - Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Remove the LH timing chain from the camshaft sprocket.
 - Remove the LH timing chain and crankshaft sprocket.

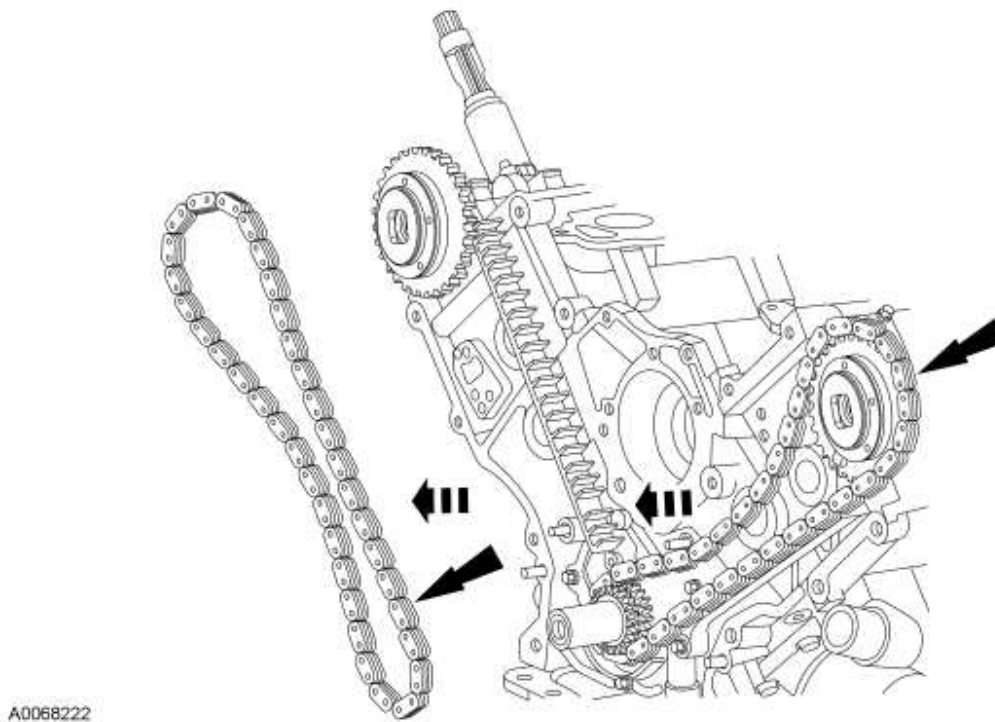


Fig. 314: Identifying RH/LH Timing Chains
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

41. Remove the LH and RH timing chain guides.
 - Remove the bolts.
 - Remove both timing chain guides.

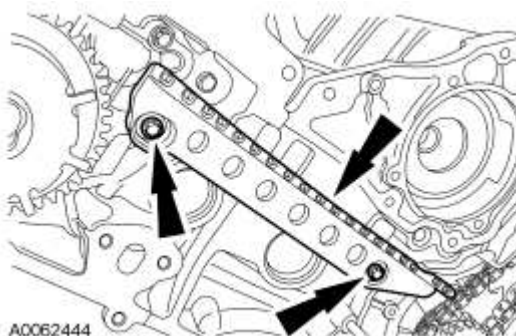


Fig. 315: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

CAUTION:

Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

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

42. Using the special tool, remove the bolt and the RH VCT phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

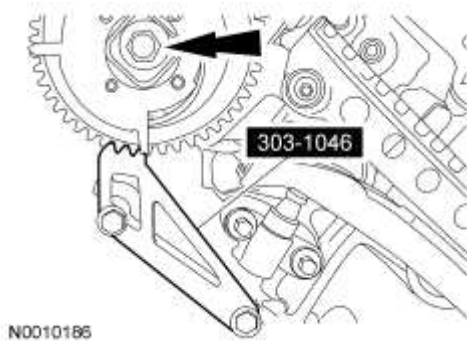


Fig. 316: Identifying VCT Phaser Sprocket Bolt And Holder Tool
Courtesy of FORD MOTOR CO.

CAUTION:

Damage to the VCT phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

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

43. Using the special tool, remove the bolt and the LH VCT phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

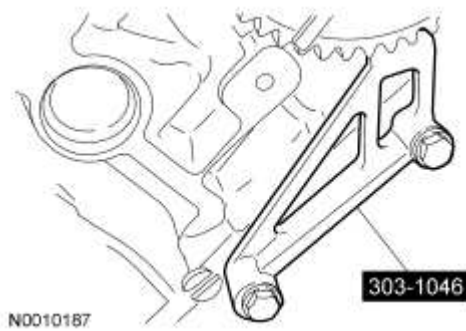


Fig. 317: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

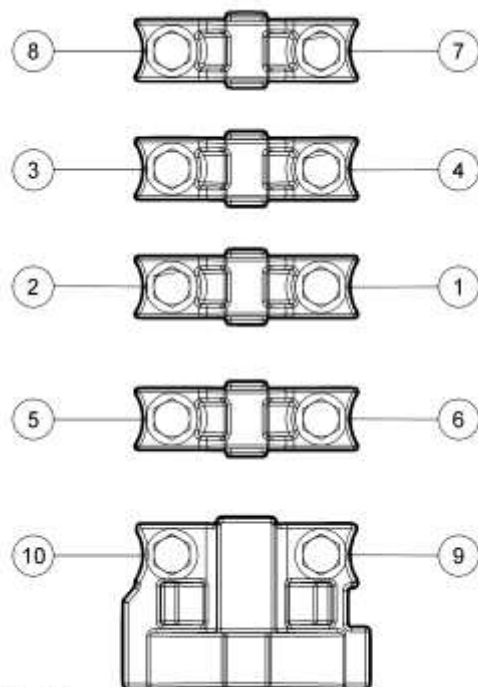
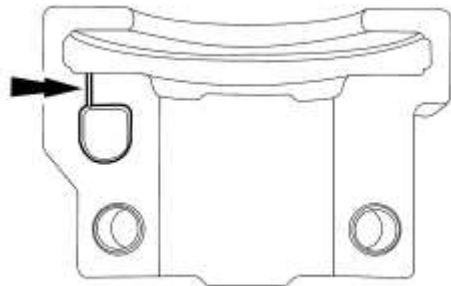


Fig. 318: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence

Courtesy of FORD MOTOR CO.

44. Remove the bolts in the sequence shown in **Fig. 318** and remove the RH cylinder head front camshaft bearing cap and then the remaining bearing caps.
45. Clean and inspect the RH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

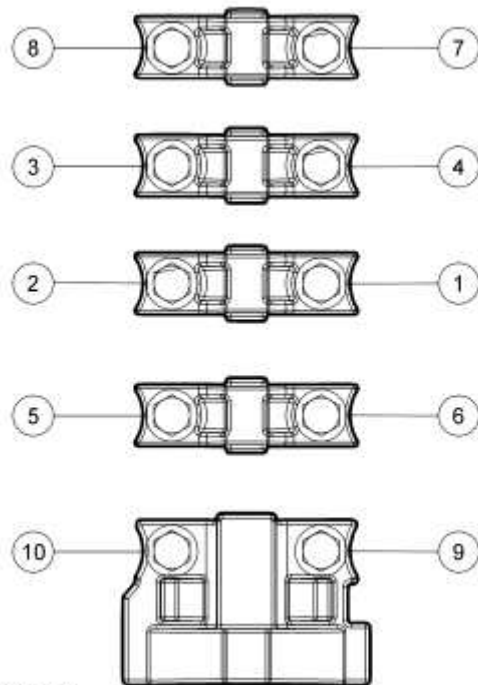
Fig. 319: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove

Courtesy of FORD MOTOR CO.

46. Remove the RH camshaft.

CAUTION: When removing the front thrust camshaft bearing cap, use care as the cap may be damaged from sideloading when removing the cam unequally in height from the bearing towers.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

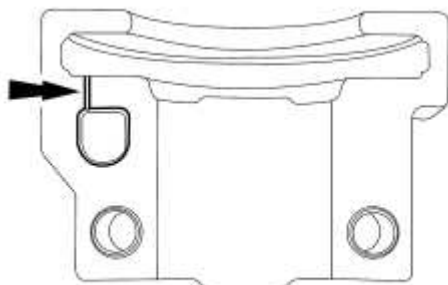


N0011337

Fig. 320: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence

Courtesy of FORD MOTOR CO.

47. Remove the bolts in the sequence shown in **Fig. 320** and remove the LH cylinder head front camshaft bearing cap and then the remaining bearing caps.
48. Clean and inspect the LH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 321: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove

Courtesy of FORD MOTOR CO.

49. Remove the LH camshaft.

CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.

50. Remove all of the remaining camshaft roller followers from the cylinder heads.

LH cylinder head

CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.

51. Remove the hydraulic lash adjusters from the LH cylinder head.

52. Install the special tool onto the LH cylinder head.

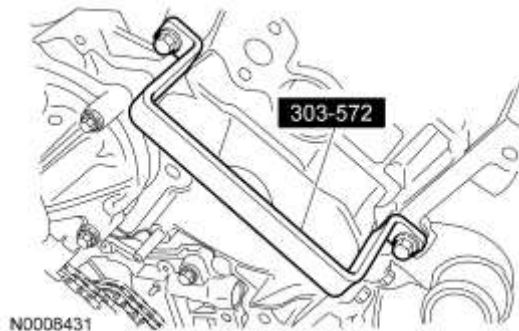


Fig. 322: Identifying Special Tool Onto Cylinder Head
Courtesy of FORD MOTOR CO.

53. Remove the 8 nuts and the LH exhaust manifold.

- Discard the gasket.
- Inspect the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION** .

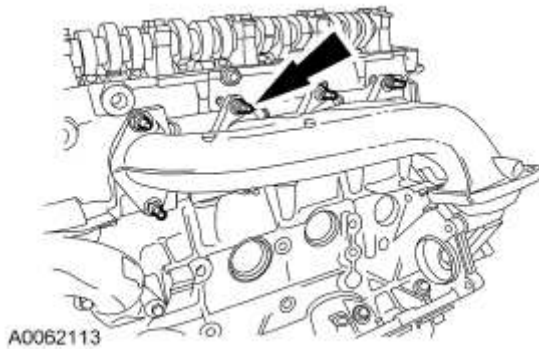


Fig. 323: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

RH cylinder head

CAUTION: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into the original locations.

54. Remove the hydraulic lash adjusters from the RH cylinder heads.
55. Install the special tool onto the RH cylinder head.

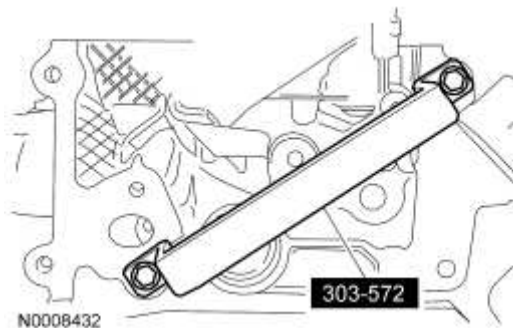


Fig. 324: Identifying Special Tool On Cylinder Head
Courtesy of FORD MOTOR CO.

56. Remove the 8 nuts and the RH exhaust manifold.
 - Discard the gasket.
 - Inspect the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION** .

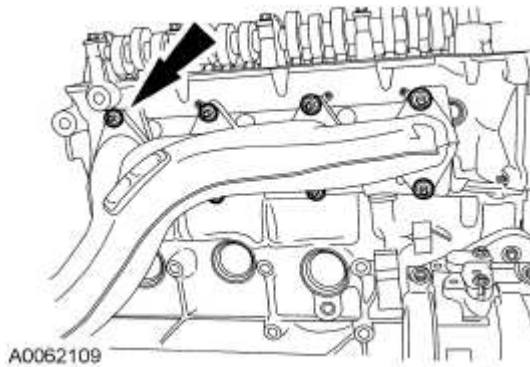


Fig. 325: Locating RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

57. Remove the stud bolt and the coolant tube.
- Discard the O-ring seals.

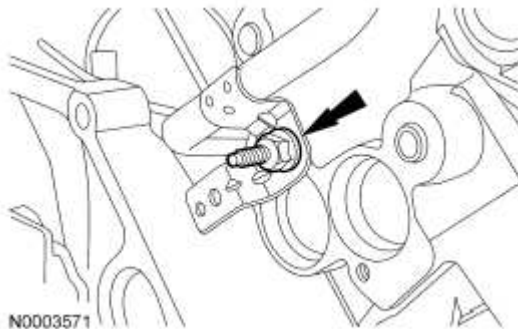


Fig. 326: Identifying Coolant Tube Stud Bolt
Courtesy of FORD MOTOR CO.

All cylinder heads

CAUTION:

The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.

Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

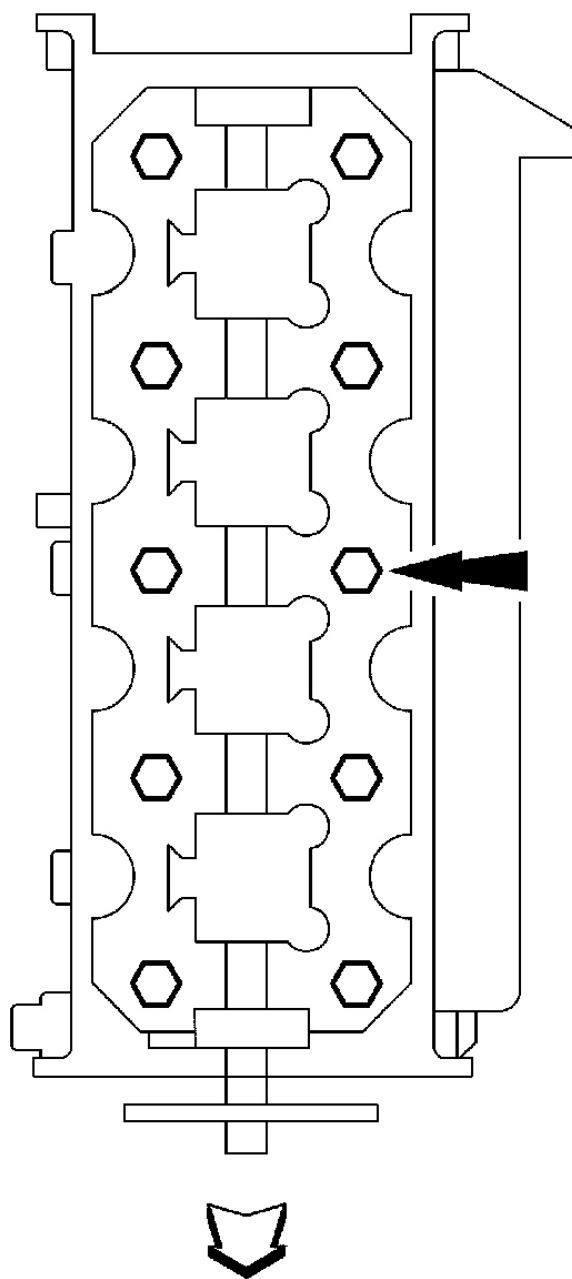
The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield designed and cannot be reused.

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 that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: RH shown, LH similar.

58. Remove the bolts and the cylinder head.
- Discard the cylinder head gasket.
 - Discard the cylinder head bolts.



A26253-A

Fig. 327: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION:

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 that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

59. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block.
1. Remove any large deposits of silicone or gasket material with a plastic scraper.
 2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
 3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
 4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

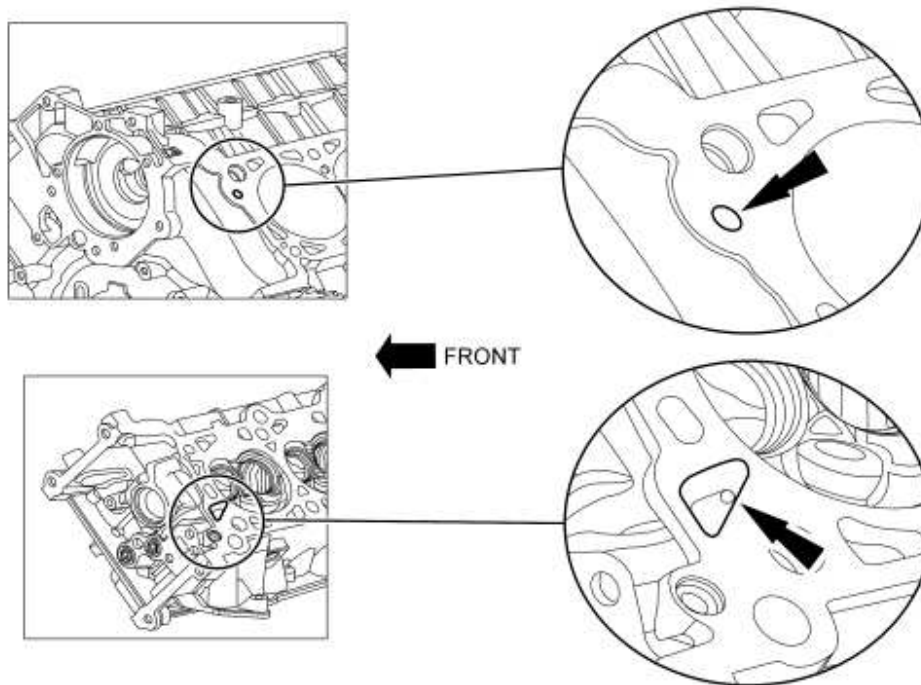
NOTE:

Make sure all cylinder head surfaces are clear of any gasket material, RTV, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

Use a straightedge that is calibrated by the

manufacturer to be flat within 0.005 mm (0.0002 in) per running foot length. For example, if the straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

LH shown, RH similar.



A0079634

Fig. 328: Identifying Cylinder Head/Cylinder Block Oil Pressure Feed Areas

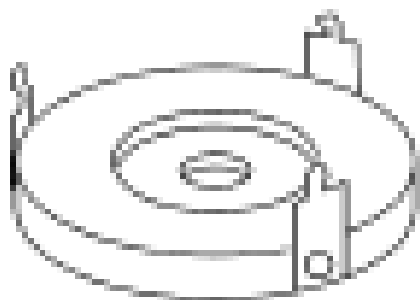
Courtesy of FORD MOTOR CO.

60. Support the cylinder head on a bench with the head gasket side up. Inspect all areas of the deck face with a straightedge, paying particular attention to the oil pressure feed area. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches longer than 0.0254 mm (0.001 in).

DISASSEMBLY

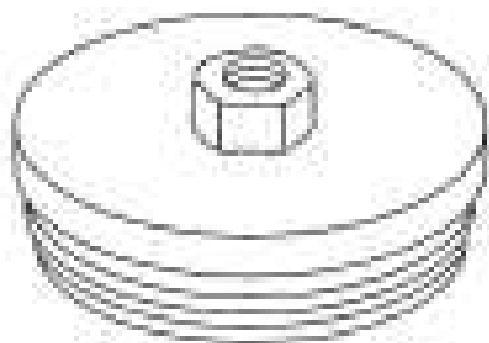
ENGINE

SPECIAL TOOL(S)



ST1481-A

Remover, Crankshaft Rear Slinger
303-514 (T95P-6701-AH)



ST1382-A

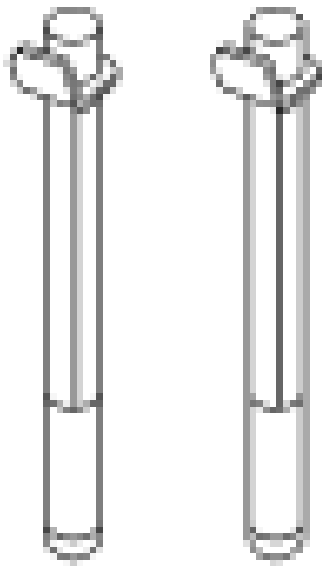
Remover, Crankshaft Rear Seal
303-519 (T95P-6701-EH)



ST1185-A

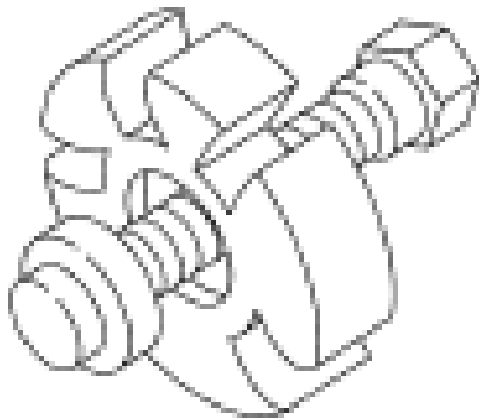
Slide Hammer
100-001 (T50T-100-A)

Installer, Connecting Rod



ST1337-A

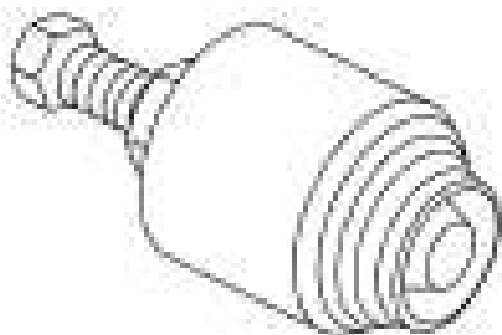
303-442 (T93P-6136-A)



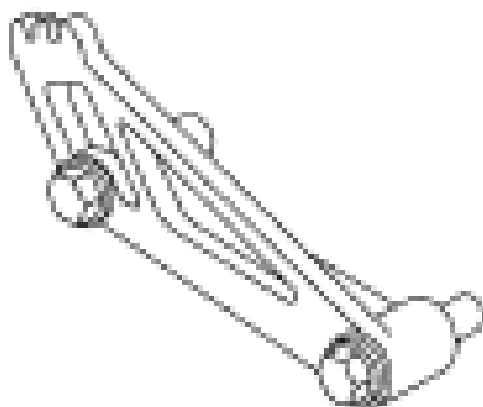
ST1286-A

Remover, Crankshaft Vibration
Damper
303-009 (T58P-6316-D)

Remover, Crankshaft Front Seal
303-107 (T74P-6700-A)

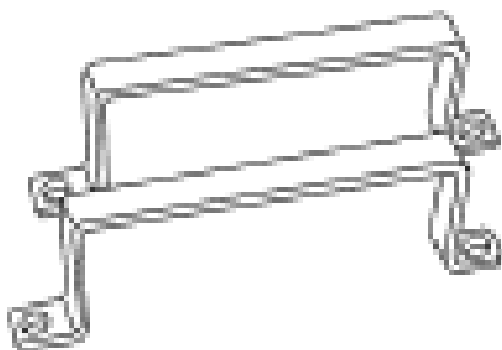


ST1730-A



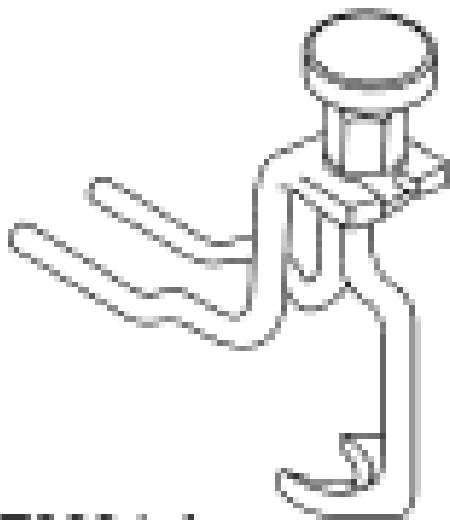
ST2807-A

Locking Tool, Camshaft Phaser
Sprocket
303-1046



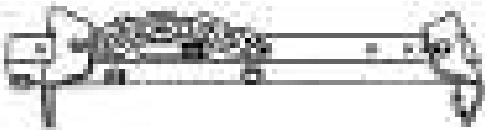
ST1668-A

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



ST2804-A

Compressor, Valve Spring
303-1039



ST1377-A

Modular Engine Lift Bracket
303-F047 (014-00073)

MATERIALS

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-

CAUTION:

Remove the cylinder heads before removing the crankshaft. Failure to do so can result in engine damage.

During engine repair procedures, cleanliness is

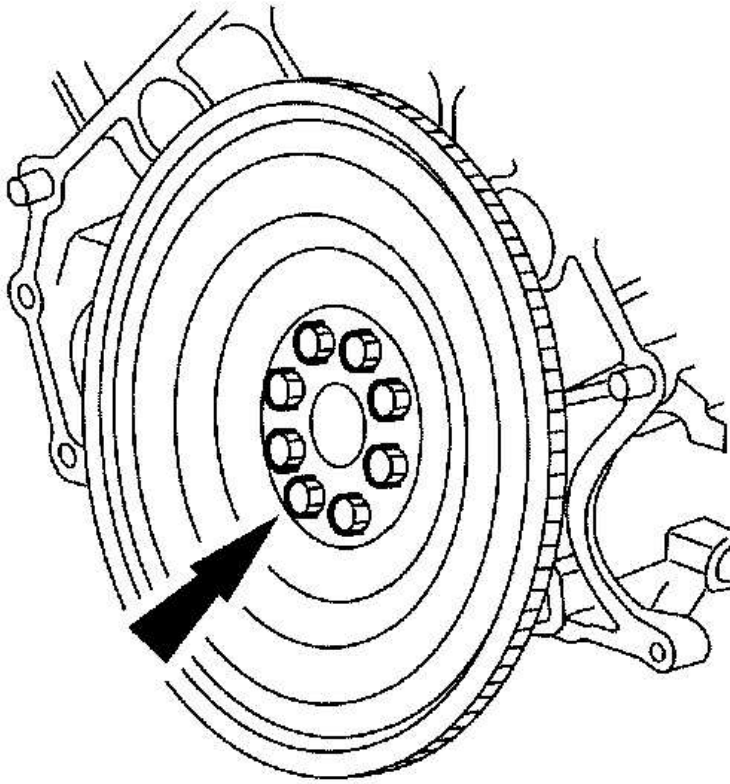
extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE:

The flexplate, crankshaft rear seal and the crankshaft rear oil slinger must be removed before mounting the engine on the engine stand.

For additional information, refer to Fig. 406 under the assembly procedure in this article.

1. Remove the bolts and the flexplate.



A26551-A

Fig. 329: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

2. Using the special tools, remove and discard the crankshaft rear oil slinger.

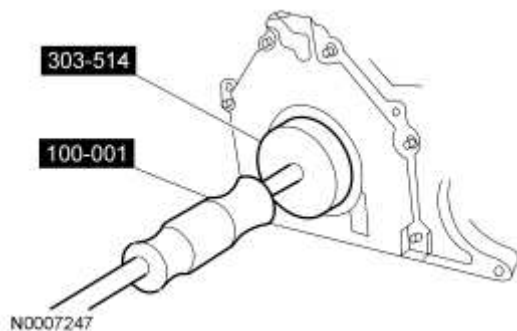


Fig. 330: Removing Crankshaft Rear Oil Seal Slinger
Courtesy of FORD MOTOR CO.

3. Using the special tools, remove and discard the crankshaft rear seal.

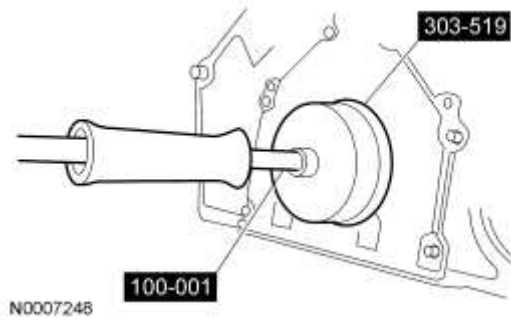
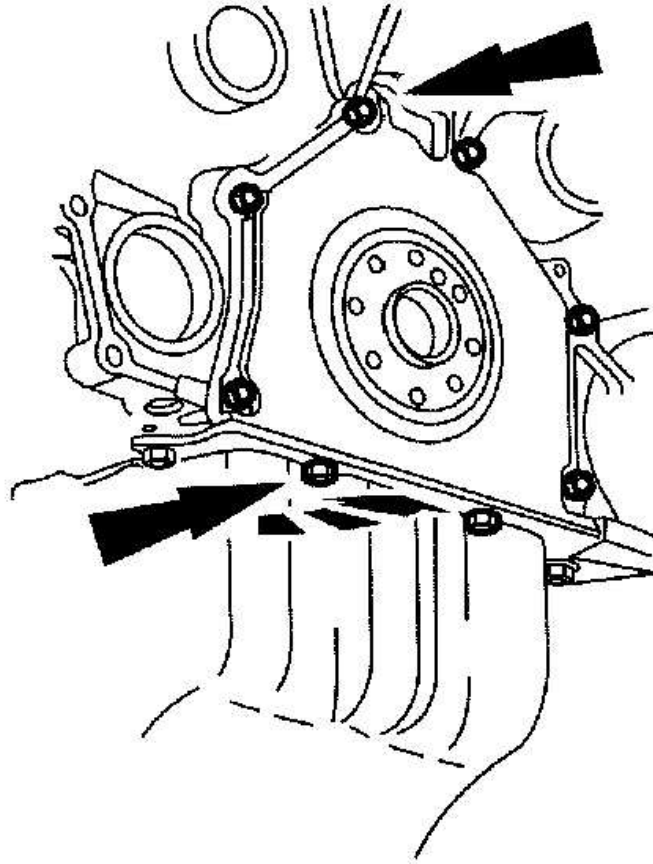


Fig. 331: Removing Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

4. Remove the 8 bolts and the crankshaft rear seal retainer plate.



DA0723-B

Fig. 332: Identifying Bolts And Crankshaft Rear Seal Retainer Plate
Courtesy of FORD MOTOR CO.

5. Mount the engine on a suitable work stand.
6. Remove the special tool.

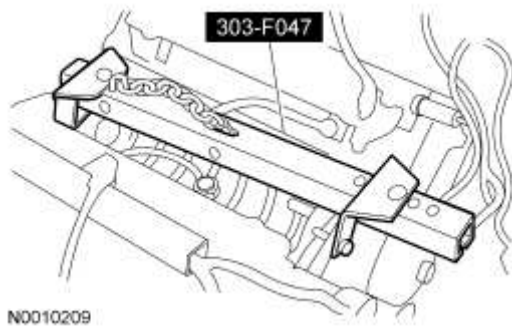


Fig. 333: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the RH engine support insulators.

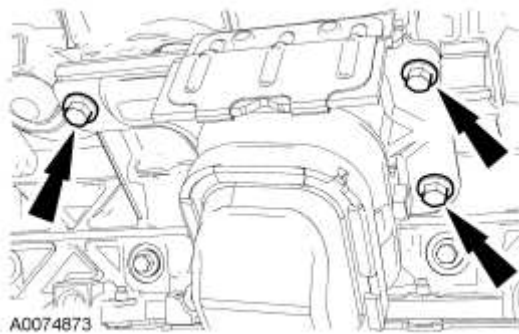


Fig. 334: Identifying RH Engine Support Insulator Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

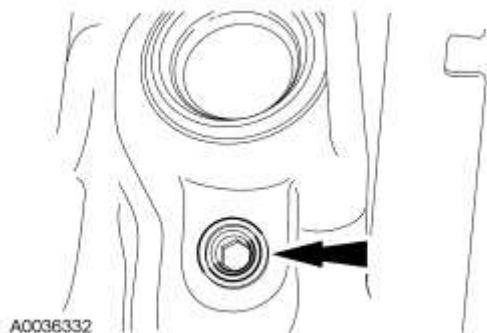


Fig. 335: Locating Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

8. Remove the cylinder block drain plugs and drain the coolant into a suitable

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for your reading.**

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**Then Get More
Information.**