

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis

2011 ENGINE**Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis****SPECIFICATIONS****MATERIAL SPECIFICATIONS****MATERIAL SPECIFICATIONS TABLE**

Item	Specification	Item
Gasket Maker TA-16	WSK-M2G348-A5	-
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	-
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (bittered in US only) 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	5.9L (6.2 qt) includes filter change
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Silicone Gasket Remover ZC-30	-	-

GENERAL SPECIFICATIONS**GENERAL SPECIFICATIONS TABLE**

Item	Specification
Engine	
Displacement	4.6L (281 CID) (2V)
No. cylinders	8
Bore	90.2 mm (3.5512 in)
Stroke	90 mm (3.5433 in)
Firing order	1-3-7-2-6-5-4-8

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Oil pressure hot @ 2,500 rpm	40-70 psi
Compression ratio	9.37:1
Engine weight (without accessory drive components and flexplate)	233.1 kg (514 lb)
Cylinder Head and Valve Train	
Combustion chamber volume	43.95 ± 1.5 cc (2.68 ± 0.092 ci)
Valve arrangement (front to rear) LH	EIEIEIEI
Valve arrangement (front to rear) RH	IEIEIEIE
Valve guide bore diameter	7.044-7.015 mm (0.2773-0.2762 in)
Valve stem diameter (intake)	6.995-6.975 mm (0.2753-0.2746 in)
Valve stem diameter (exhaust)	6.970-6.949 mm (0.2744-0.2735 in)
Valve stem-to-guide clearance (intake)	0.069-0.020 mm (0.0027-0.0007 in)
Valve stem-to-guide clearance (exhaust)	0.095-0.046 mm (0.0037-0.0018 in)
Valve head diameter (intake)	44.6 mm (1.7559 in)
Valve head diameter (exhaust)	36.1 mm (1.4212 in)
Valve face runout limit	0.05 mm (0.0019 in)
Valve face angle	45.5°
Valve seat width (intake)	2.1-1.9 mm (0.0827-0.0748 in)
Valve seat width (exhaust)	2.1-1.9 mm (0.0827-0.0748 in)
Valve seat runout Total Indicated Runout (TIR)	0.025 mm (0.0009 in)
Valve seat angle	45.00°
Valve spring free length (intake)	50.2 mm (1.9763 in)
Valve spring free length (exhaust)	50.2 mm (1.9763 in)
Valve spring out-of-square limit (intake)	2.5°
Valve spring out-of-square limit (exhaust)	2.5°
Valve spring compression pressure (intake)	633.3-701.3 N @ 28.02 mm (1.1031 in)
Valve spring compression pressure (exhaust)	633.3-701.3 N @ 28.02 mm (1.1031 in)
Valve spring installed height (intake)	40.6-43.6 mm (1.5984-1.7165 in)
Valve spring installed height (exhaust)	40.6-43.6 mm (1.5984-1.7165 in)
Valve spring installed pressure (intake)	272.1-306.1 N @ 40.0 mm (1.5748 in)
Valve spring installed pressure (exhaust)	272.1-306.1 N @ 40.0 mm (1.5748 in)
Valve spring installed pressure service limit (intake)	274.6 N @ 40.01 mm (1.5752 in)
Valve spring installed pressure service limit (exhaust)	274.6 N @ 40.01 mm (1.5752 in)
Roller follower ratio	1.75:1
Head gasket surface flatness	0.025 mm (0.001 in) in any 25 mm (1 in) x 25 mm (1 in) area; 0.050 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.1 mm (0.004 in) overall
Hydraulic Lash Adjuster	
Diameter	15.988-16.00 mm (0.6294-0.6299 in)
Clearance to bore	0.018-0.069 mm (0.0007-0.0027 in)
Service limit	0.016 mm (0.0006 in)

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Hydraulic leakdown rate	5-25 seconds
Collapsed lash adjuster gap	0.45-0.85 mm (0.0177-0.0334 in)
Camshaft Theoretical valve lift @ zero lash (intake)	12.0 mm (0.4724 in)
Theoretical valve lift @ zero lash (exhaust)	12.0 mm (0.4724 in)
Lobe lift (exhaust) (LH)	7.4974 mm (0.2951 in)
Lobe lift (exhaust) (RH)	7.4979 mm (0.2952 in)
Lobe lift (intake)	7.1103 mm (0.2799 in)
Allowable lobe lift loss	0
Journal diameter	26.96-26.93 mm (1.0615-1.0605 in)
Journal bore inside diameter (cap assembled)	27.01-26.99 mm (1.0635-1.0625 in)
Camshaft journal-to-bearing clearance	0.076-0.025 mm (0.0030-0.0010 in)
Runout: Full indicator measurement on all journals when supported on front and rear journal	0.09 mm (0.0035 in) (4 places)
Camshaft end play	0.03-0.19 mm (0.0011-0.0075 in)
Cylinder Block	
Cylinder bore diameter	90.200-90.213 (Grade 1)
Cylinder bore diameter	90.213-90.226 (Grade 2)
Cylinder bore diameter	90.226-90.239 (Grade 3)
Cylinder bore maximum taper	0.013 mm (0.00051 in)
Cylinder bore maximum out-of-round	0.015 mm (0.00059 in)
Main bearing bore inside diameter	72.40-72.424 mm (2.8504-2.8513 in)
Head gasket surface flatness	0.03 mm (0.001 in) in any 40 mm (1.5 in) x 40 mm (1.5 in) area; 0.05 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.15 mm (0.006 in) overall
Crankshaft	
Main bearing journal diameter	67.483-67.503 mm (2.6568-2.6576 in)
Main bearing journal maximum taper	0.004 mm (0.0002 in)
Main bearing journal maximum-out-of-round	0.0075 mm (0.0003 in) between cross sections
Main bearing journal-to-cylinder block clearance	0.066-0.024 mm (0.0259-0.0009 in)
Connecting rod journal diameter	53.003-52.983 mm (2.0867-2.0859 in)
Connecting rod journal maximum taper (straightness)	0.004 mm (0.0002 in)
Connecting rod journal maximum-out-of-round	0.0075 mm (0.0003 in) between cross sections
Crankshaft maximum end play	0.301 mm (0.0118 in)
Piston and Connecting Rod	
Piston diameter	
Grade 1	90.191-90.206 mm (3.5508-3.5514 in)
Grade 2	90.203-90.220 mm (3.5513-3.5519 in)
Grade 3	90.217-90.232 mm (3.5518-3.5524 in)
Piston-to-cylinder bore clearance (at grade size)	0.017-0.047 mm (0.0007-0.0019 in)
Piston ring end gap (top)	0.15-0.30 mm (0.0059-0.0118 in)
Piston ring end gap (intermediate)	0.15-0.30 mm (0.0059-0.0118 in)

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Piston ring end gap (oil control)	0.15-0.30 mm (0.0059-0.0118 in)
Ring groove width (top)	1.520-1.540 mm (0.0598-0.0606 in)
Ring groove width (intermediate)	1.520-1.540 mm (0.0598-0.0606 in)
Ring groove width (oil control)	3.03-3.055 mm (0.1193-0.1203 in)
Piston ring width (top)	1.5 mm (0.05 in)
Piston ring width (intermediate)	1.5 mm (0.05 in)
Piston ring-to-groove clearance (top)	0.020-0.060 mm (0.0008-0.0024 in)
Piston ring-to-groove clearance (intermediate)	0.020-0.060 mm (0.0008-0.0023 in)
Piston ring-to-groove clearance (oil control)	0.030-0.070 mm (0.0012-0.0028 in)
Piston pin bore diameter	22.0065-22.0110 mm (0.8664-0.8666 in)
Piston pin diameter	21.995-21.997 mm (0.8659-0.8660 in)
Piston pin length	61.870-62.120 mm (2.4358-2.4456 in)
Piston pin-to-piston fit	0.0095-0.016 mm (0.0004-0.0006 in)
Piston-to-connecting rod clearance	6.58-7.58 mm (0.259-0.298 in)
Connecting rod-to-pin clearance	0.016-0.038 mm (0.0006-0.0015 in)
Connecting rod pin bore diameter	22.02-22.01 mm (0.8671-0.8666 in)
Connecting rod length (centerline bore-to-bore)	150.7 mm (5.9330 in)
Connecting rod maximum allowable bend	±0.038 mm (0.0015 in)
Connecting rod maximum allowable twist	±0.05 mm (0.0019 in)
Connecting rod bearing bore diameter	56.86-56.89 mm (2.2388-2.2396 in)
Connecting rod bearing-to-crankshaft clearance	0.06-0.02 mm (0.0026-0.0010 in)
Connecting rod side clearance (standard)	0.015-0.45 mm (0.0006-0.0177 in)
Connecting rod side clearance (maximum)	0.50 mm (0.0197 in)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS TABLE**

Description	Nm	lb-ft	lb-in
A/C compressor stud bolts	25	18	-
Accessory drive idler pulley bolt	25	18	-
Camshaft bearing cap bolts ⁽¹⁾	-	-	-
Camshaft sprocket bolt ⁽¹⁾	-	-	-
Catalytic converter-to-exhaust manifold nut	48	35	-
Connecting rod bearing cap bolts ⁽¹⁾	-	-	-
Coolant bypass tube stud bolt	25	18	-
Coolant outlet adapter bolts	25	18	-
Coolant pump bolts	25	18	-
Coolant pump pulley bolts	25	18	-
Crankshaft main bearing cap bolts ⁽¹⁾	-	-	-
Crankshaft pulley bolt ⁽¹⁾	-	-	-

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Crankshaft rear seal retainer plate bolts ⁽¹⁾	-	-	-
Cylinder head bolt ⁽¹⁾	-	-	-
Engine block coolant drain plug	20	-	177
Engine front cover ⁽¹⁾	-	-	-
Engine mount bolts	70	52	-
Engine mount nuts	90	66	-
Engine Oil Pressure (EOP) switch ⁽¹⁾	-	-	-
EGR tube	43	32	-
Exhaust manifold heat shield bolts	10	-	89
Exhaust manifold nuts ⁽¹⁾	-	-	-
Exhaust manifold studs	12	-	106
Flexplate bolts ⁽¹⁾	-	-	-
Generator battery cable nut	9	-	80
Generator bolts	25	18	-
Generator bracket bolts	10	-	89
Ground strap nut	10	-	89
Ground strap-to-RH cylinder head stud bolt	25	18	-
Ground strap bolt	10	-	89
Heated Oxygen Sensor (HO2S) ⁽¹⁾	-	-	-
Ignition coil bolts	6	-	53
Intake manifold bolts ⁽¹⁾	-	-	-
Intake manifold crash bracket bolts	25	18	-
Intake manifold shield bolts	10	-	89
Intermediate steering shaft pinch bolt	30	22	-
Jackscrews ⁽¹⁾	-	-	-
Knock Sensor (KS) nut	20	-	177
Oil cooler mounting bolt	46	34	-
Oil filter adapter bolts ⁽¹⁾	-	-	-
Oil level indicator tube bolt	10	-	89
Oil pan bolts ⁽¹⁾	-	-	-
Oil pan drain plug	23	17	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube-to-oil pump bolts	10	-	89
Oil pump screen and pickup tube spacer	25	18	-
Oil pump screen and pickup tube-to-spacer bolt	25	18	-
Power steering pump bolts	25	18	-
Power steering tube bracket nut	10	-	89

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Shield bolts	25	18	-
Spark plugs	18	-	159
Support bracket nuts	10	-	89
Timing chain guide bolts	10	-	89
Timing chain tensioner bolts	25	18	-
Torque converter inspection cover bolts	19	-	168
Torque converter nuts	36	27	-
Transmission bellhousing bolts	48	35	-
Transmission cooler tube bracket bolt	15	-	133
Transmission cooler tube bracket nut	9	-	80
Transmission mount insulator bolts	90	66	-
Transmission mount insulator nuts	30	22	-
Valve cover studs and bolts ⁽¹⁾	-	-	-

(1) Refer to the appropriate procedure in this service information.

DESCRIPTION AND OPERATION

ENGINE

NOTE: For information, refer to the exploded view under the Assembly procedure in this service information.

The 4.6L (281 CID) is a V-8 engine with the following features:

- Single overhead camshafts
- Two valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- Aluminum cylinder heads
- Cast iron, 90-degree V-cylinder block
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Electronic ignition system with 8 ignition coils
- Electronic returnless fuel system

Engine Identification

Always refer to these labels when installation of new parts is necessary or when checking engine calibrations. The engine parts often differ within a CID family. Verification of the identification codes will make sure that the correct parts are obtained. These codes contain all the pertinent information relating to the dates, optional equipment and revisions.

ENGINE CODE INFORMATION LABEL

The engine code information label, located on the side of the valve cover, contains the following:

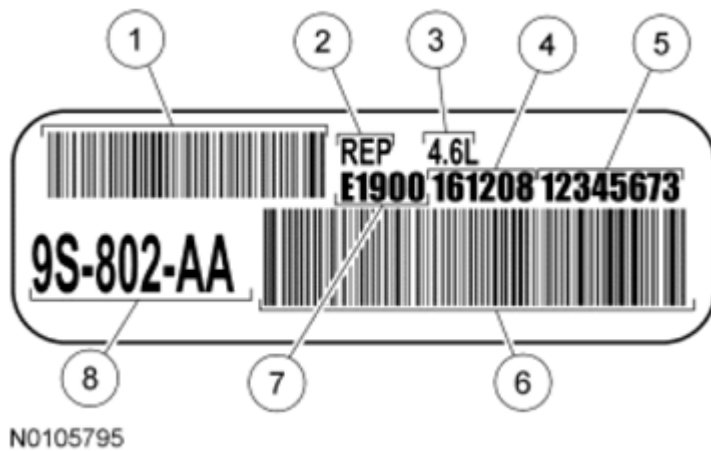


Fig. 1: Identifying Engine Code Information Label
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Description
1	Bar code
2	Engine plant (Romeo)
3	Engine displacement
4	Engine build date (DDMMYY)
5	Running number
6	Bar code
7	Plant shift line
8	Engine part number

Engine Cylinder Identification

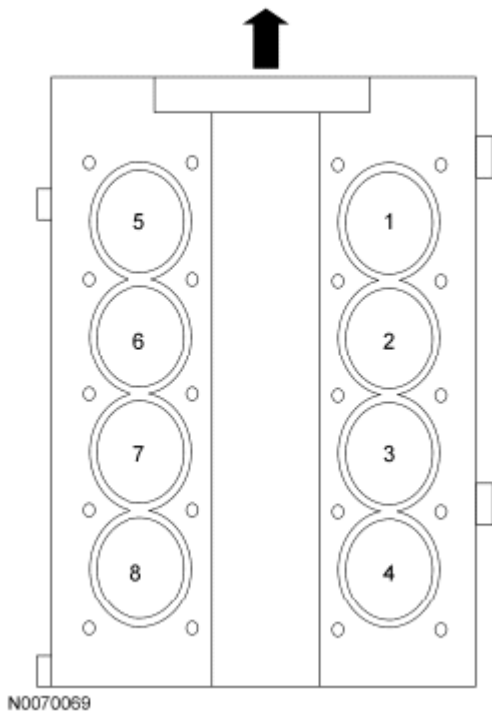


Fig. 2: Identifying Engine Cylinder Identification
Courtesy of FORD MOTOR CO.

Exhaust Emission Control System

Operation and necessary maintenance of the exhaust emission control devices used on this engine are covered in the **INTRODUCTION - GASOLINE MODELS**.

Induction System

The SFI provides the fuel/air mixture needed for combustion in the cylinders. The 8 solenoid-operated fuel injectors:

- are mounted in the intake manifold.
- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.
- are connected in series with the fuel pressure sensor.

A constant fuel pressure is maintained across the fuel injectors by the fuel pressure sensor. The fuel pressure sensor:

- is positioned upstream from the fuel injectors on the fuel rail.

Valve Train

The valve train operates as follows:

- Ball-tip hydraulic lash adjusters provide automatic lash adjustment.
- Roller followers ride on the camshaft lobe, transferring the up-and-down motion of the camshafts to the valves in the cylinder heads.

PCV System

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the upper intake manifold.

Lubrication System

The engine lubrication system operates as follows:

- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the left front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to both cylinder heads.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.
- The left cylinder head is fed from a drilling into the supply passage feeding the main gallery at the front of the cylinder block. The right cylinder head is fed from a drilling into the rear of the main gallery. Main gallery pressure is reduced as it enters the cylinder head galleries through fixed serviceable orifices, located at the upper part of the feed passages. It is this reduced pressure in the cylinder head galleries which feeds the camshaft journals, the hydraulic lash adjusters and the primary and secondary timing chain tensioners.
- The camshaft lobe and roller followers are lubricated by splash created through valve train operation.

Oil Pump

The lubrication system of the 4.6L (2V) engine is designed to provide optimum oil flow to critical components of the engine through its entire operating range. The heart of the system is a positive displacement internal gear oil pump using top seal rotors. Generically this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure, both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

DIAGNOSIS AND TESTING

ENGINE

Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article for basic mechanical concerns or refer to the **INTRODUCTION - GASOLINE MODELS** article.

IN-VEHICLE REPAIR

INTAKE MANIFOLD

Intake Manifold (View 1 of 3)

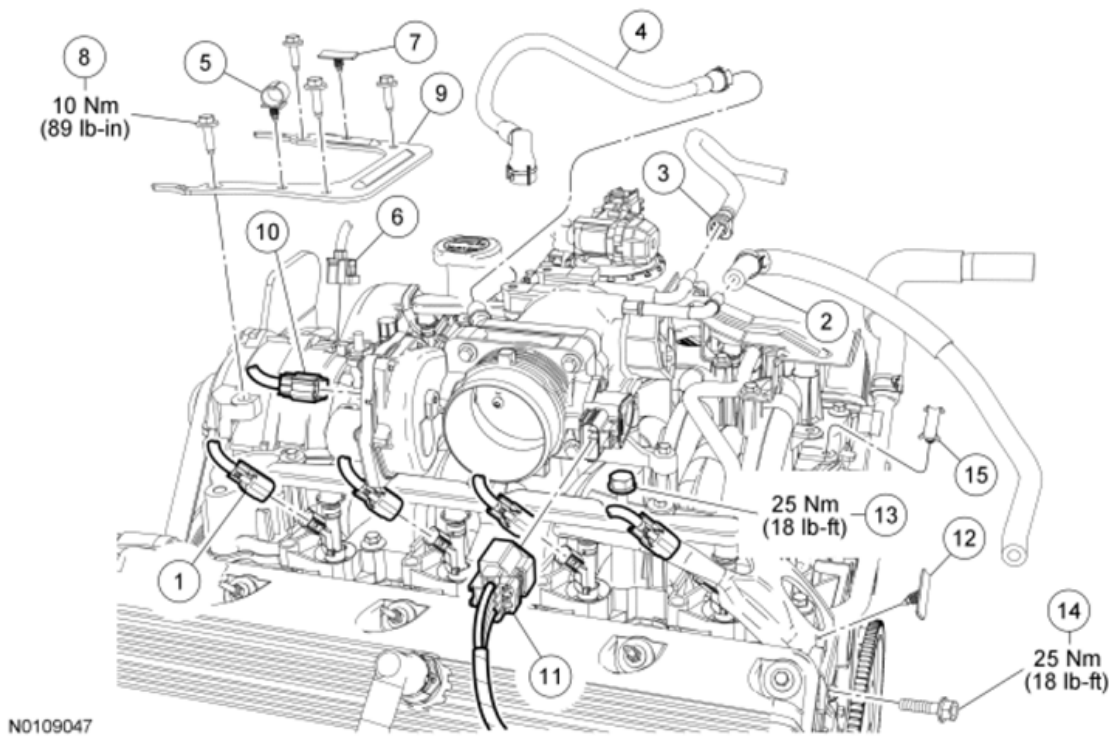


Fig. 3: Exploded View Of Intake Manifold Components With Torque Specifications (View 1 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	Fuel injector electrical connector (part of 12B637) (4 required)
2	9C490	Brake booster vacuum hose
3	9D289	Evaporative Emission (EVAP) canister purge valve tube
4	6K817	PCV tube
5	-	Generator wiring harness retainer
6	14A464	Generator electrical connector (part of 12B637)

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7	-	Generator B+ wiring harness retainer
8	N807309	Generator bracket bolt (4 required)
9	10153	Generator bracket
10	14A464	Throttle control electrical connector (part of 12B637)
11	14A464	Throttle Position (TP) sensor electrical connector (part of 12B637)
12	13A506	Wire harness retainer
13	W705793	Intake manifold crash bracket bolt
14	W701725	Intake manifold crash bracket bolt
15	13A506	Wire harness retainer

Intake Manifold (View 2 of 3)

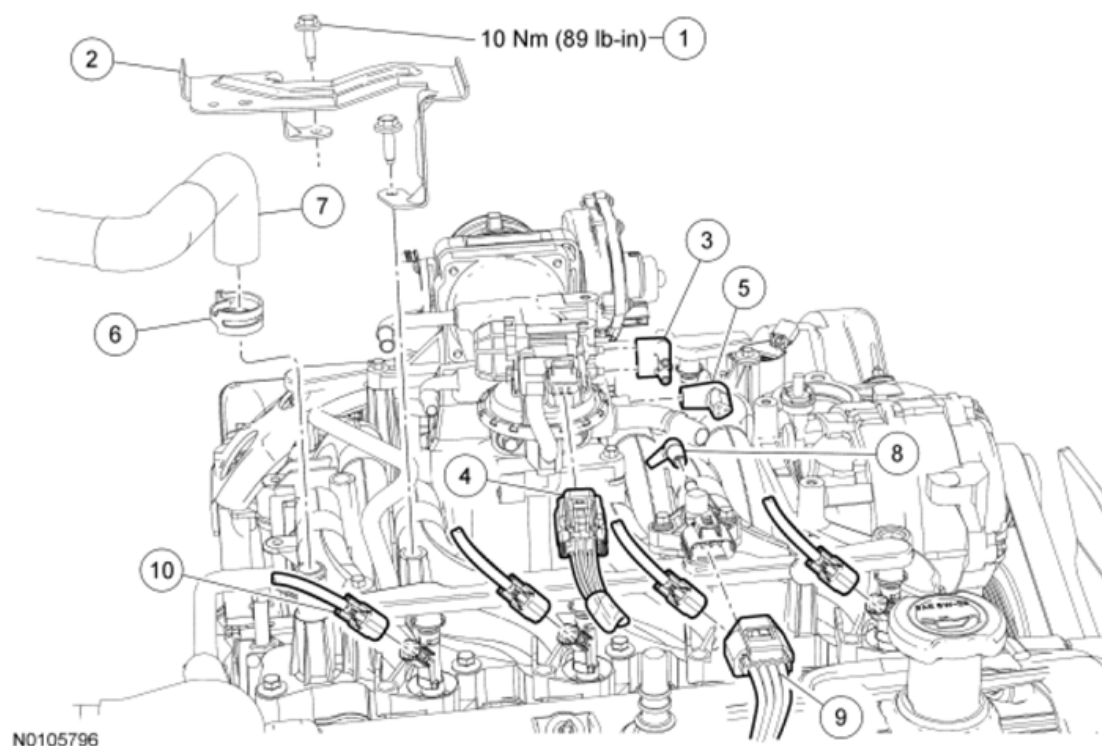


Fig. 4: Exploded View Of Intake Manifold Components With Torque Specifications (View 2 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Item
1	N807309	Intake manifold shield bolt (2 required)
2	9F460	Intake manifold shield
3	9E489	EGR system module vacuum connector
4	14A464	EGR system module electrical connector (part of 12B637)
5	9E499	Intake manifold vacuum hose connector
6	15161	Heater hose spring clamp

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7	18D334	Heater hose
8	9E489	Fuel rail pressure and temperature sensor vacuum connector
9	14A464	Fuel rail pressure and temperature sensor electrical connector (part of 12B637)
10	14A464	Fuel injector electrical connector (part of 12B637) (4 required)

Intake Manifold (View 3 of 3)

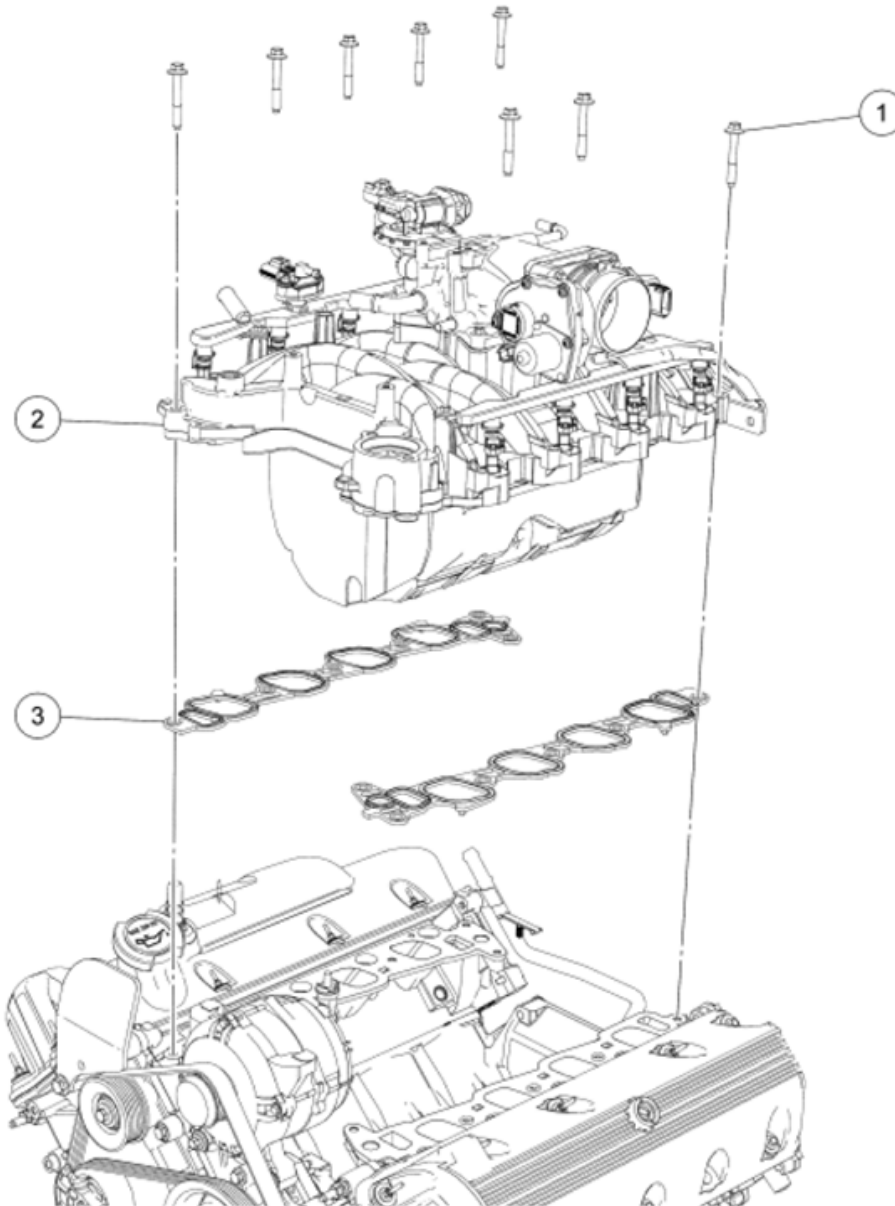


Fig. 5: Exploded View Of Intake Manifold Components (View 3 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

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Item	Part Number	Item
1	W503301	Intake manifold bolt (8 required)
2	9424	Intake manifold
3	9439	Intake manifold gasket (2 required)

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the fuel tube spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.
4. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING SYSTEM**
5. Remove the Air Cleaner (ACL) and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.
6. Remove the wiper mounting arm and pivot shaft. For additional information, refer to **WIPER SYSTEM & WASHER SYSTEM** article.
7. Disconnect the 8 fuel injector electrical connectors.
8. Remove the 8 ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION SYSTEM - 4.6L (2V)** article.
9. Remove the 2 bolts and the intake manifold shield.
10. Disconnect the brake booster vacuum hose from the intake manifold.
11. Disconnect the quick connect coupling Evaporative Emission (EVAP) canister purge valve hoses from the Throttle Body (TB) spacer and from the EVAP canister purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
12. Disconnect the quick connect coupling PCV tube from the TB spacer. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
13. Disconnect the EGR system module vacuum and electrical connectors.
14. Disconnect the intake manifold-to-TBspacer vacuum hose.
15. Disconnect the generator electrical connector.
16. Detach the 2 generator wiring harness retainers from the generator bracket.
17. Remove the 4 generator bracket bolts and the bracket.
18. Remove the coolant thermostat. For additional information, refer to **ENGINE COOLING SYSTEM** article.
19. Disconnect the throttle control and the Throttle Position (TP) sensor electrical connectors.
20. Release the heater hose spring clamp and disconnect the heater hose.

21. Remove the EGR system module tube. For additional information, refer to **ENGINE EMISSION CONTROL SYSTEM** article.
22. If equipped, detach the wire harness retainer from the intake manifold crash bracket.
23. Remove the intake manifold crash bracket bolt and prevent the bolt from contacting the cylinder head with a rubber band or tie strap.

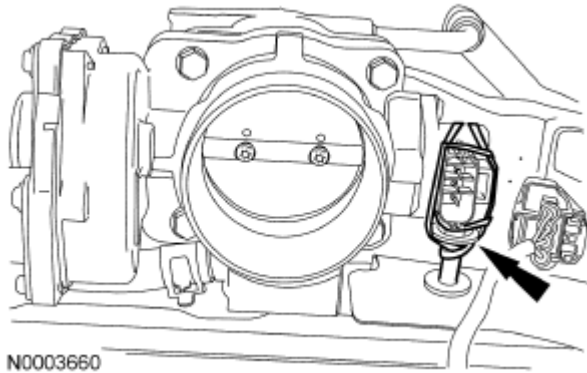


Fig. 6: Locating Intake Manifold Crash Bracket With Tie Strap
Courtesy of FORD MOTOR CO.

24. Remove the intake manifold crash bracket bolt.
25. Disconnect the fuel rail pressure and temperature sensor vacuum and electrical connectors.
26. Remove the wire harness retainer from the rear of the intake manifold.
27. Remove the 8 bolts and the intake manifold.
 - Remove and discard the intake manifold gaskets.
 - Clean the sealing surfaces.

Installation

NOTE: Align the gasket locator tabs with the slots in the cylinder head.

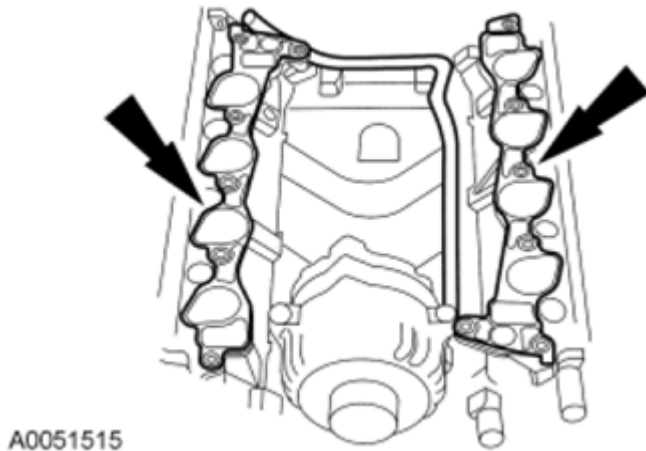
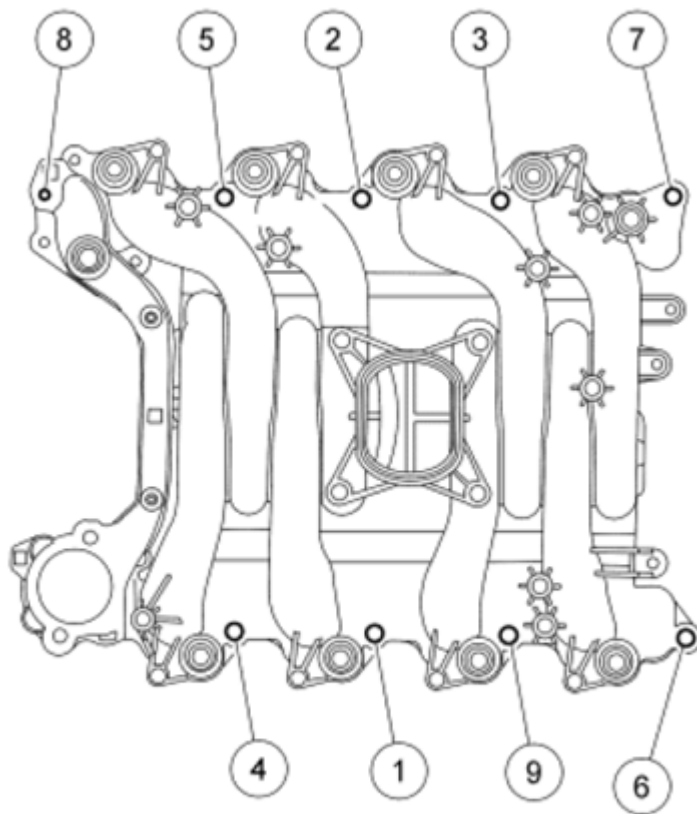


Fig. 7: Locating Gasket Locator Tabs
Courtesy of FORD MOTOR CO.

1. Install new intake manifold gaskets.
2. Install the intake manifold and hand-tighten the 8 bolts.
3. Install the 8 ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION SYSTEM - 4.6L (2V)** article.
4. Position the intake manifold crash bracket and loosely install the bolt and stud bolt.
5. Tighten the bolts in the sequence shown in the illustration.
 - Tighten to 25 Nm (18 lb-ft).



N0037509

Fig. 8: Identifying Intake Manifold Crash Bracket Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Tighten the intake manifold crash bracket bolt.
 - Tighten to 25 Nm (18 lb-ft).
7. Install the EGR system module tube. For additional information, refer to **ENGINE EMISSION CONTROL SYSTEM** article.
8. Install the intake manifold shield and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).
9. Connect the throttle control and the TP sensor electrical connectors.
 10. Install the coolant thermostat. For additional information, refer to **ENGINE COOLING SYSTEM** article.
 11. Install the generator bracket and the 4 bracket bolts.
 - Tighten to 10 Nm (89 lb-in).
 - Connect the generator electrical connector.
 12. Attach the 2 generator wiring harness retainers to the generator bracket.
 13. Connect the EVAP canister purge valve hoses to the TB and the EVAP canister purge valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
 14. Connect the intake manifold vacuum hose to the TB spacer.
 15. Connect the EGR system module vacuum and electrical connectors.
 16. Connect the PCV tube quick connect coupling to the TB spacer. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
 17. Connect the brake booster vacuum hose to the intake manifold.
 18. Install the heater hose and spring clamp.
 19. Connect the fuel rail pressure and temperature sensor vacuum and electrical connectors.
 20. Connect the 8 fuel injector electrical connectors.
 21. Install the wire harness retainer to the rear of the intake manifold.
 22. If equipped, attach the wire harness retainer to the intake manifold crash bracket.
 23. Install the wiper mounting arm and pivot shaft. For additional information, refer to **WIPER SYSTEM & WASHER SYSTEM** article.
 24. Connect the fuel spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
 25. Install the ACL and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.
 26. Connect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.
 27. Fill and bleed the engine cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

28. If equipped with a fire suppression system, repower the system.

VALVE COVER - RH

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-

Valve Cover - RH (View 1 of 4)

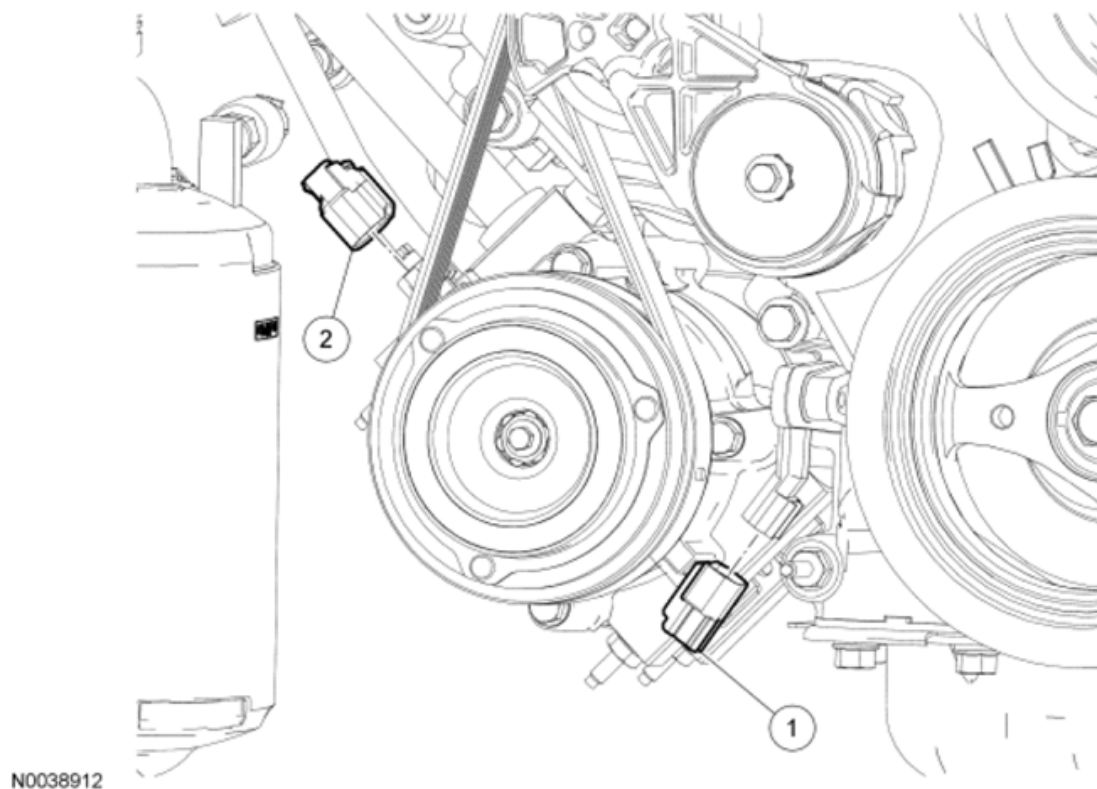
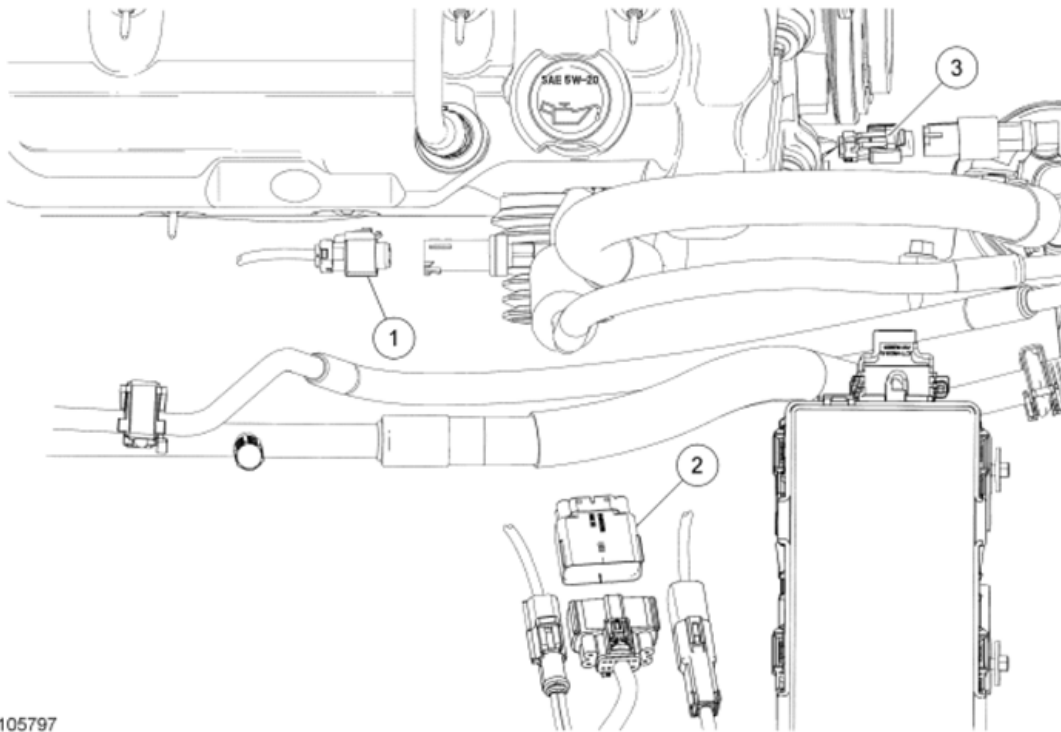


Fig. 9: Identifying Valve Cover Components - RH (View 1 Of 4)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	Crankshaft Position (CKP) sensor electrical connector (part of 12B637)
2	14A464	A/C compressor electrical connector (part of 12B637)

Valve Cover - RH (View 2 of 4)



N0105797

Fig. 10: Identifying Valve Cover Components - RH (View 2 Of 4)

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	A/C pressure sensor electrical connector (part of 12B637)
2	14A464	Electronic engine control electrical connector (part of 12B637)
3	14A464	A/C accumulator switch electrical connector (part of 12B637)

Valve Cover - RH (View 3 of 4)

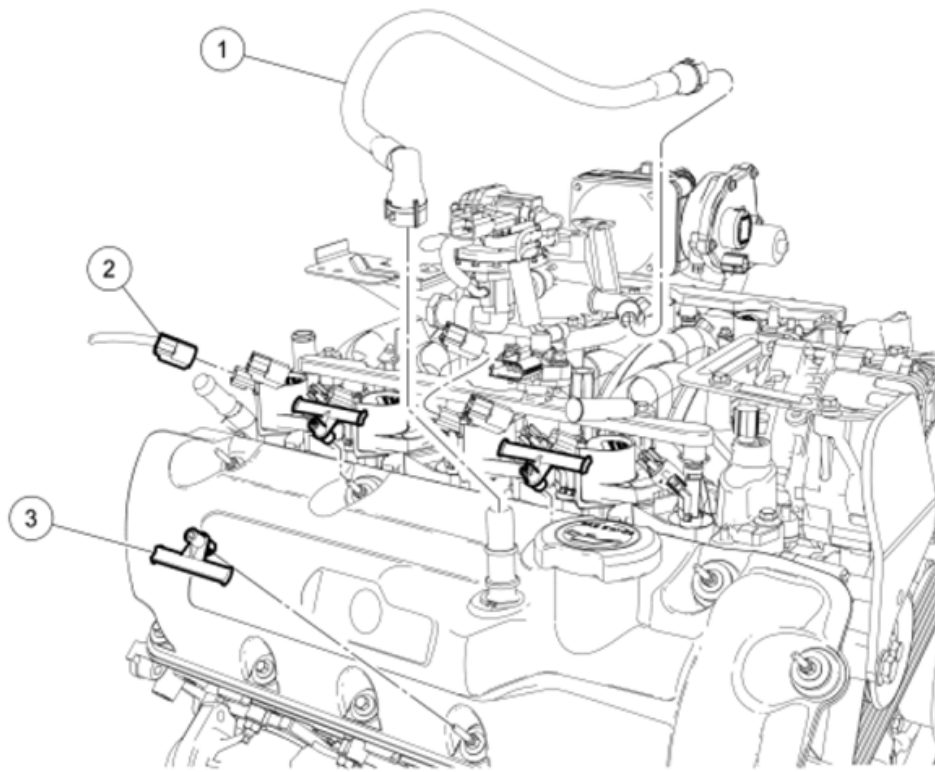


Fig. 11: Identifying Valve Cover Components - RH (View 3 Of 4)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6K817	PCV tube
2	14A464	Ignition coil electrical connector (part of 12B637) (4 required)
3	14A163	Engine wire harness retainer (part of 12B637) (3 required)

Valve Cover - RH (View 4 of 4)

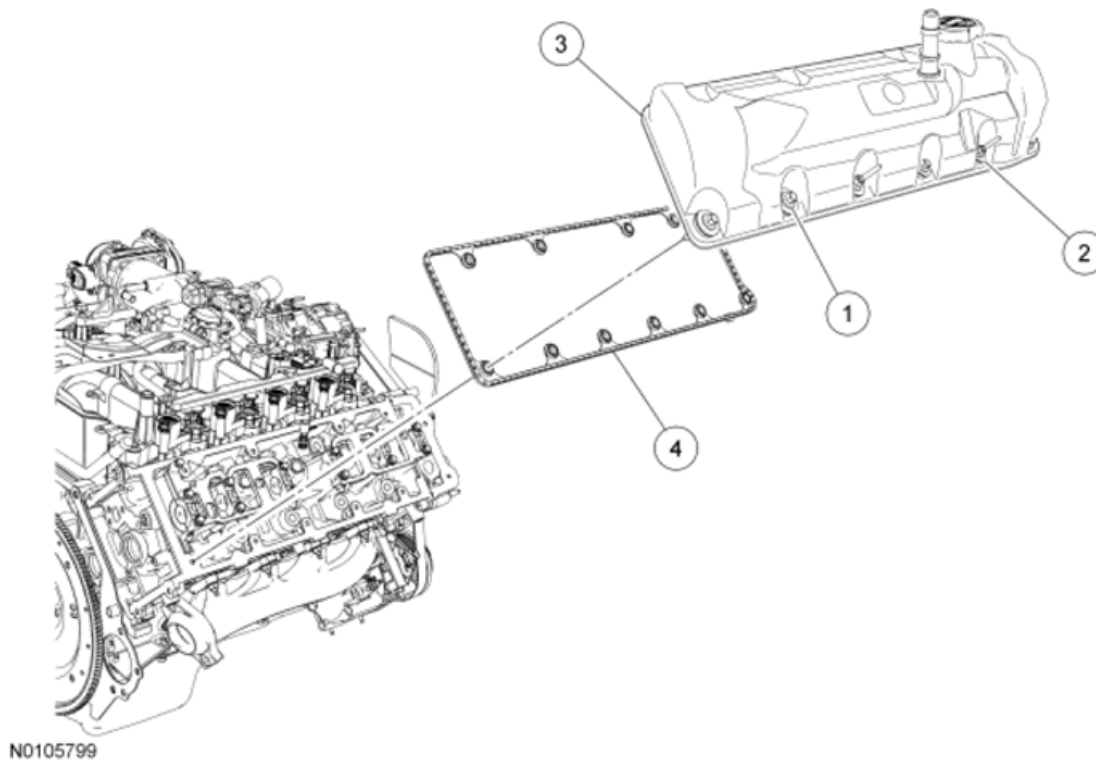


Fig. 12: Identifying Valve Cover Components - RH (View 4 Of 4)
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N806183	RH valve cover bolt (3 required)
2	W705644	RH valve cover stud bolt (8 required)
3	6582	RH valve cover
4	6584	RH valve cover gasket

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the fuel tube spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.
4. Remove the LH engine mount. For additional information, refer to **ENGINE MOUNT - LH** in this

service information.

5. Remove the Evaporative Emission (EVAP) canister purge valve. For additional information, refer to **EVAPORATIVE EMISSIONS SYSTEM** article.
6. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
7. Disconnect the A/C compressor electrical connector.
8. Disconnect the A/C pressure sensor electrical connector.
9. Disconnect the electronic engine control electrical connector.
10. Disconnect the A/C accumulator switch electrical connector.
11. Disconnect the PCV tube quick connect coupling from the PCV valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
12. Disconnect the 4 RH ignition coil electrical connectors.
13. Disconnect the 3 wire harness retainers from the valve cover and position wire harness aside.
14. Lower the engine.

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

15. Loosen the 8 studs, the 3 bolts and remove the valve cover and discard the gasket.
 - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
 - Discard the valve cover gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.

Installation

NOTE: If the valve cover is not installed and the fasteners tightened 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. Failure to follow this procedure can cause future oil leakage.

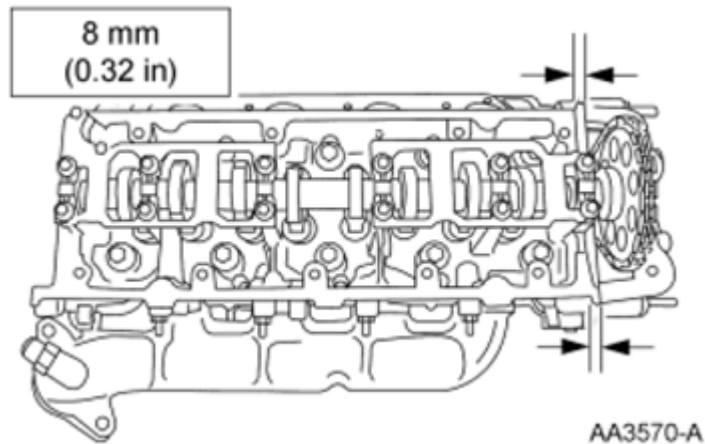


Fig. 13: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications

Courtesy of FORD MOTOR CO.

1. Apply a bead of silicone gasket and sealant in 2 locations shown in the illustration where the engine front cover meets the cylinder head.
2. Install a new valve cover gasket and the valve cover.
 - Tighten the fasteners in the sequence shown in the illustration to 10 Nm (89 lb-in).

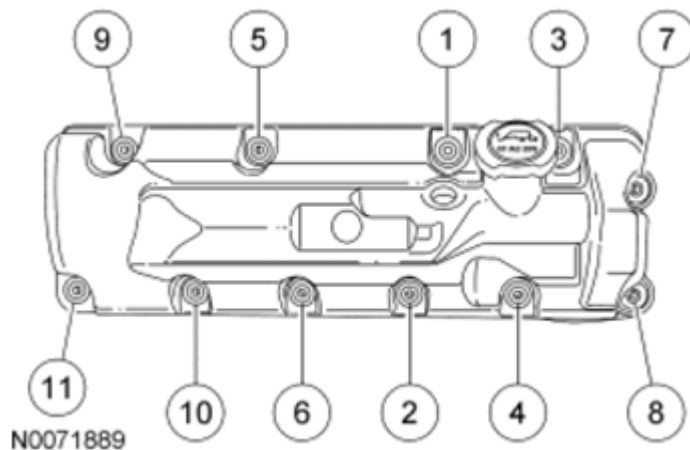


Fig. 14: Identifying Valve Cover Fasteners Tightening Sequence

Courtesy of FORD MOTOR CO.

3. Raise the engine.
4. Position wire harness and connect the 3 wire harness retainers to the valve cover.
5. Connect the 4 RH ignition coil electrical connectors.
6. Connect the PCV tube quick connect coupling to the PCV valve. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Connect the A/C accumulator switch electrical connector.
8. Connect the 3 electronic engine control electrical connectors.

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9. Connect the A/C pressure sensor electrical connector.
10. Connect the A/C compressor electrical connector.
11. Connect the CKP sensor electrical connector.
12. Install the EVAP canister purge valve. For additional information, refer to **EVAPORATIVE EMISSIONS SYSTEM** article.
13. Install the LH engine mount. For additional information, refer to **ENGINE MOUNT - LH** in this service information.
14. Connect the fuel tube spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
15. Connect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** . Failure to follow these instructions may result in serious personal injury.

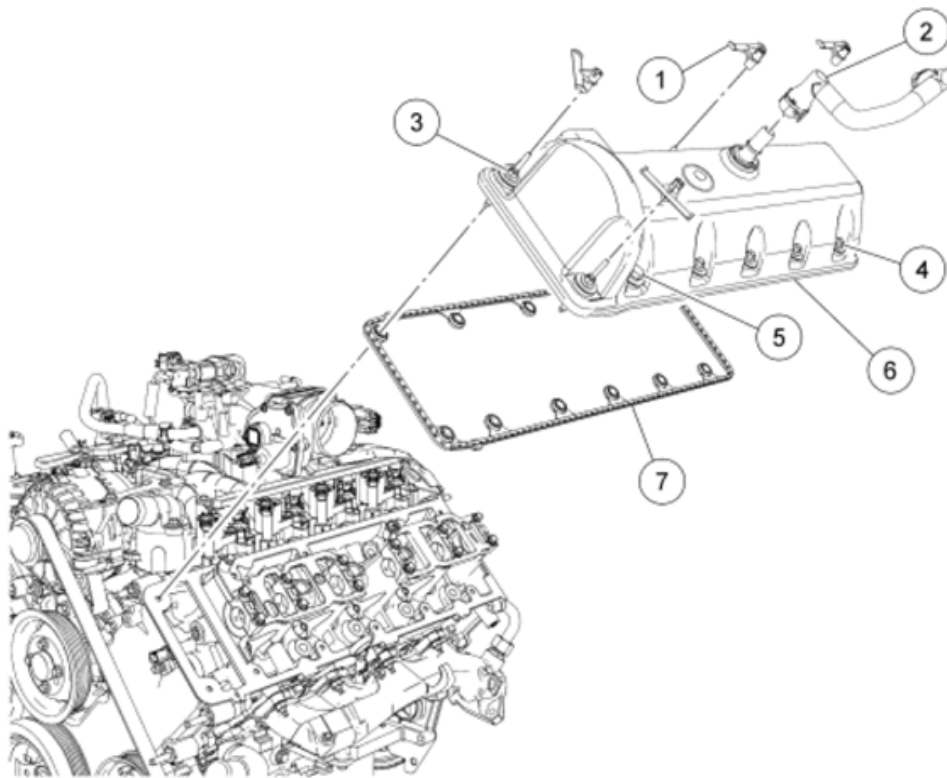
16. If equipped with a fire suppression system, repower the system.

VALVE COVER - LH

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-



N0087769

Fig. 15: Exploded View Of Valve Cover (LH)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	13A506	Wire harness retainer (part of 12B637) (4 required)
2	6758	Crankcase ventilation tube
3	W705644	Valve cover stud bolt (5 required)
4	N806183	Valve cover bolt (6 required)
5	W705787	Valve cover bolt
6	6A505	LH valve cover
7	6A559	LH valve cover gasket

Removal

1. Remove the Air Cleaner (ACL) and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.
2. Disconnect the 4 wiring harness retainers from the valve cover and position the wire harness aside.
3. Disconnect the crankcase ventilation tube quick connect coupling from the valve cover. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other

abrasive means to clean the sealing surface. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the gasket material.

4. Loosen the 11 fasteners and remove the LH valve cover and gasket.
 - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
 - Discard the valve cover gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.

Installation

NOTE: If the valve cover is not installed and the fasteners tightened 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. Failure to follow this procedure can cause future oil leakage.

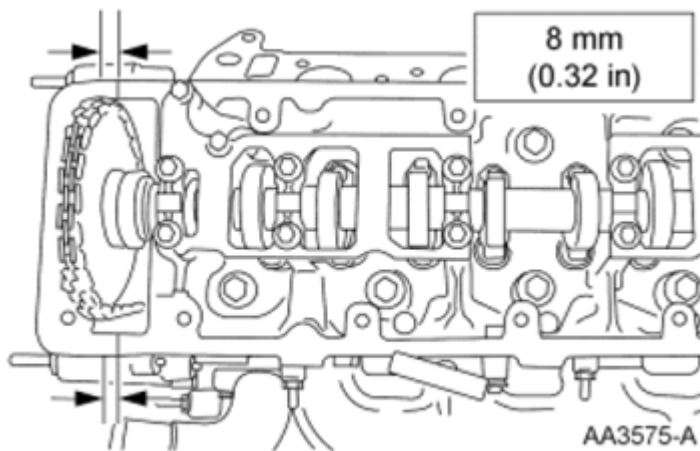


Fig. 16: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications

Courtesy of FORD MOTOR CO.

1. Apply a bead of silicone gasket and sealant in 2 locations shown in the illustration where the engine front cover meets the cylinder head.
2. Position the LH valve cover and new gasket on the cylinder head.
 - Tighten the fasteners in the sequence shown in the illustration to 10 Nm (89 lb-in).

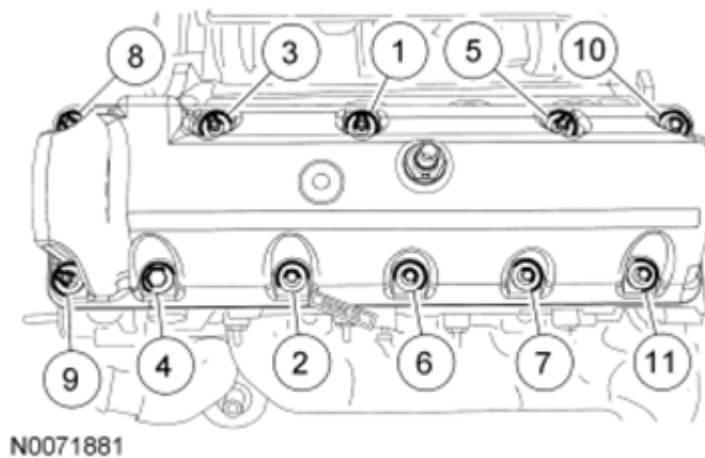
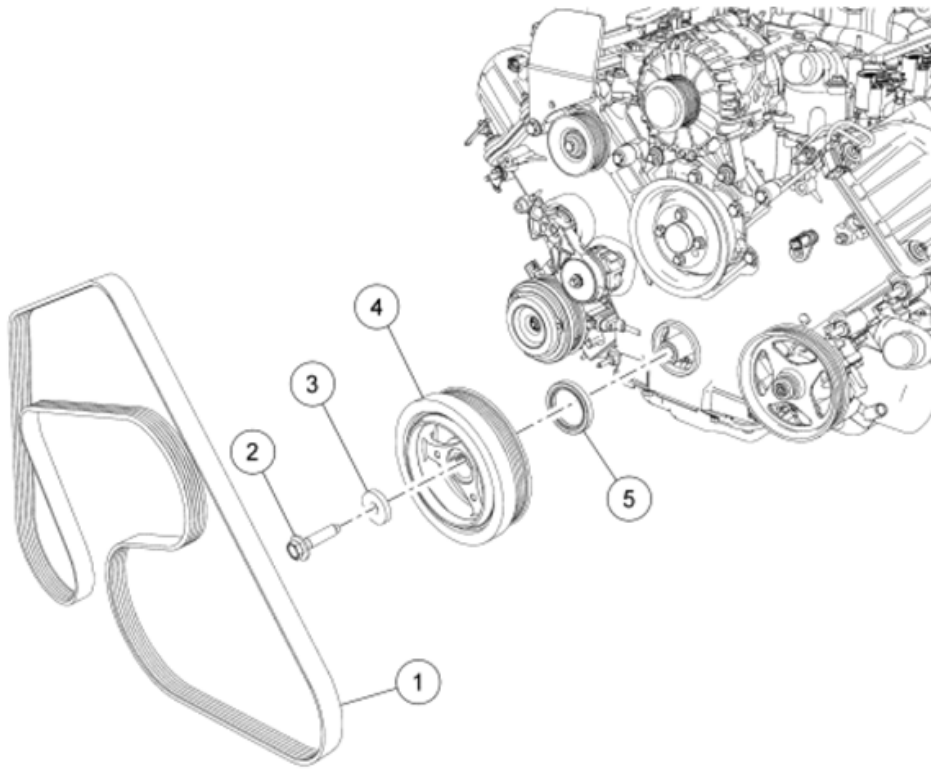


Fig. 17: Identifying Valve Cover Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Connect the crankcase ventilation tube quick connect coupling to the valve cover. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
4. Position the wire harness and connect the 4 wiring harness retainers to the valve cover.
5. Install the ACL and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.

LOWER END COMPONENTS - EXPLODED VIEW, CRANKSHAFT PULLEY AND CRANKSHAFT FRONT SEAL



N0038016

Fig. 18: Exploded View Of Crankshaft Pulley and Crankshaft Front Seal Lower End Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	8620	Accessory drive belt
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley bolt washer
4	6316	Crankshaft pulley
5	6700	Crankshaft front seal

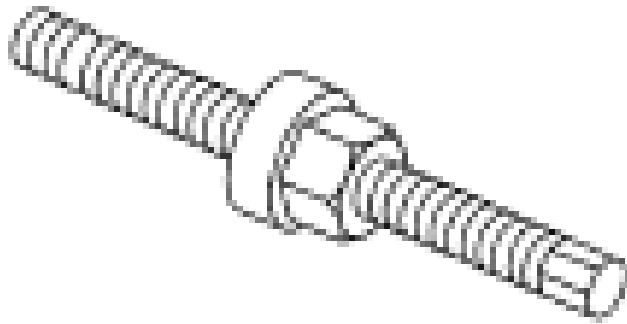
1. For additional information, refer to the appropriate procedure(s) in this service information.

CRANKSHAFT PULLEY

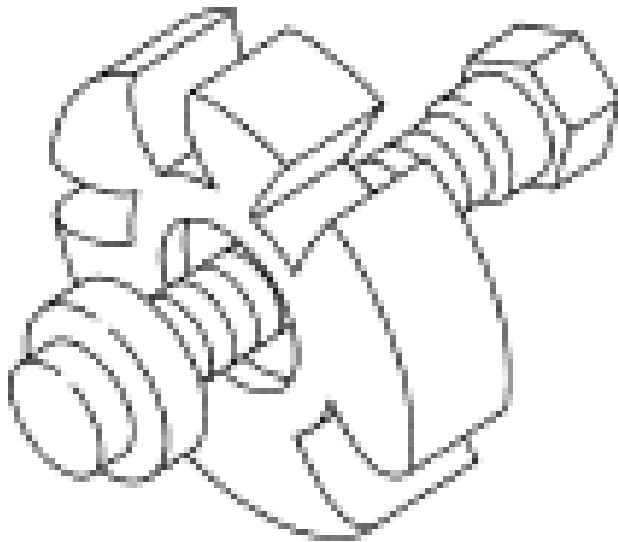
Special Tool(s)

SPECIAL TOOL(S)

	Installer, Crankshaft Vibration Damper 303-102(T74P-6316-B)
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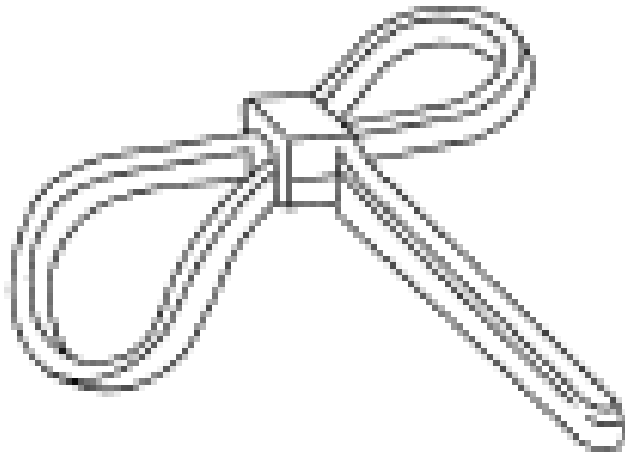
ST1287-A



ST1286-A

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

Strap Wrench
303-D055(D85L-6000-A) or equivalent



ST1438-A

Material Specifications**MATERIAL SPECIFICATIONS TABLE**

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Removal

1. Remove the engine cooling fan motor and shroud. For additional information, refer to **ENGINE COOLING SYSTEM** article.
2. Rotate the tensioner clockwise and remove the accessory drive belt.



Fig. 19: Rotating Tensioner Clockwise
Courtesy of FORD MOTOR CO.

3. Remove the crankshaft pulley bolt.

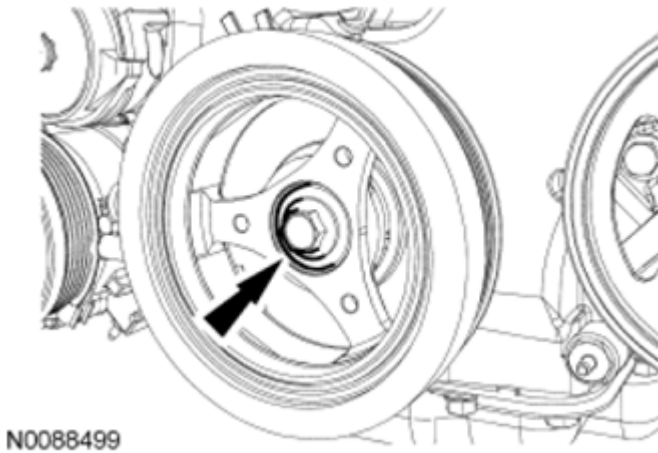


Fig. 20: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

4. Using the Crankshaft Vibration Damper Remover, remove the crankshaft pulley.

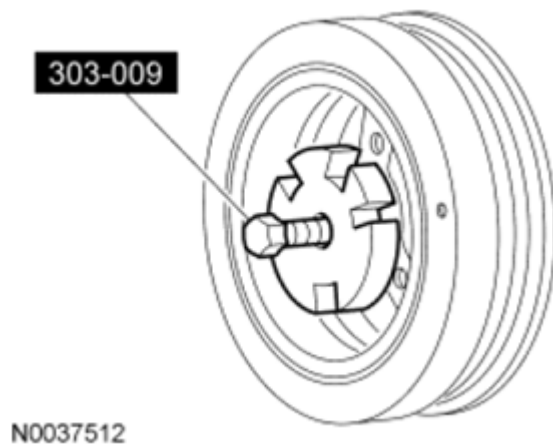


Fig. 21: Removing Crankshaft Pulley Using Crankshaft Vibration Damper Remover
Courtesy of FORD MOTOR CO.

Installation

NOTE: The crankshaft pulley must be installed within 4 minutes after applying the silicone.

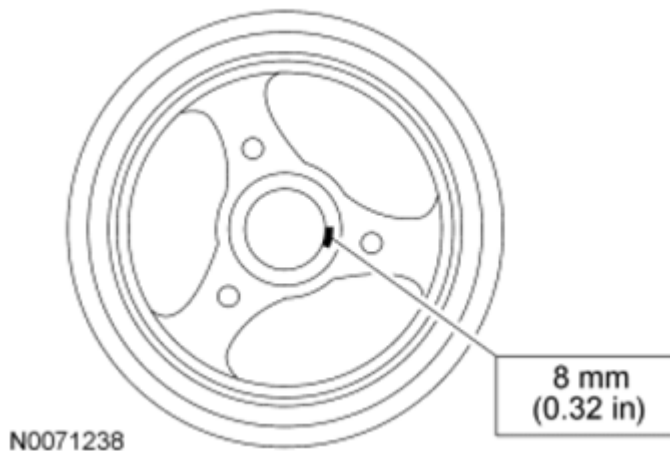


Fig. 22: Identifying Sealant Applying Area Of Woodruff Key Slot On Crankshaft Pulley With Specifications
Courtesy of FORD MOTOR CO.

1. Apply sealant to the Woodruff key slot on the crankshaft pulley.
2. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

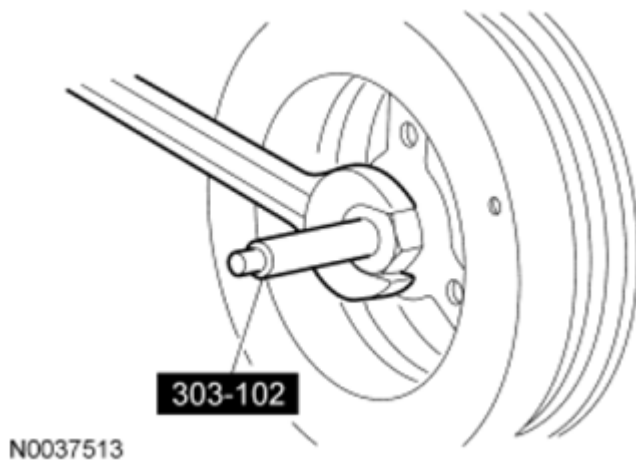


Fig. 23: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

NOTE: Use the Strap Wrench to hold the crankshaft pulley.

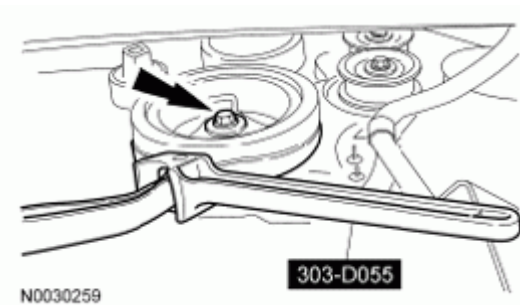


Fig. 24: Holding Crankshaft Pulley Using Strap Wrench
Courtesy of FORD MOTOR CO.

3. Install the bolt and washer. Tighten the bolt in 4 steps.
 - Step 1: Tighten to 120 Nm (89 lb-ft).
 - Step 2: Loosen the bolt one full turn.
 - Step 3: Tighten to 50 Nm (37 lb-ft).
 - Step 4: Tighten an additional 90 degrees.
4. Rotate the tensioner clockwise and install the accessory drive belt.



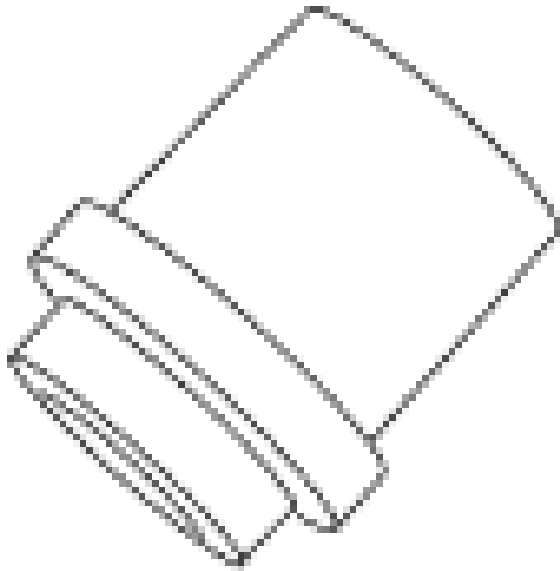
Fig. 25: Rotating Tensioner Clockwise
Courtesy of FORD MOTOR CO.

5. Install the engine cooling fan motor and shroud. For additional information, refer to **ENGINE COOLING SYSTEM** article.

CRANKSHAFT FRONT SEAL

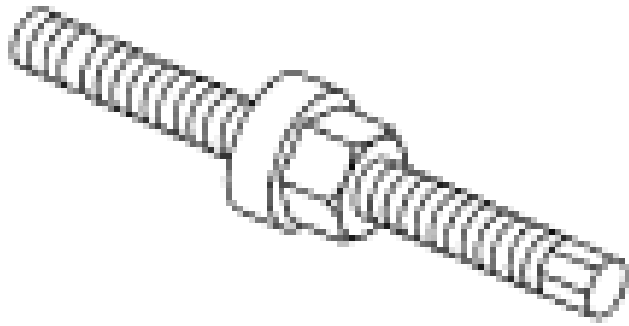
Special Tool(s)

SPECIAL TOOL(S)

 ST2197-A	Installer, Crankshaft Front Oil Seal 303-635
	Installer, Crankshaft Vibration Damper

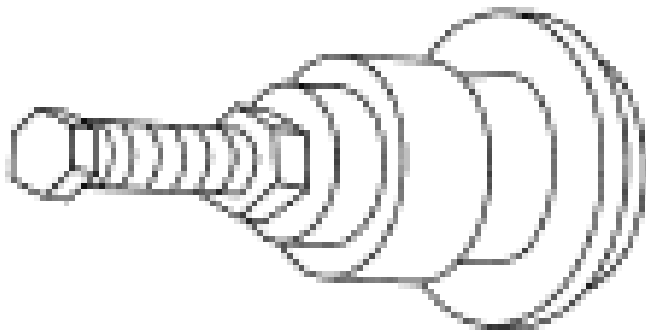
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303-102(T74P-6316-B)

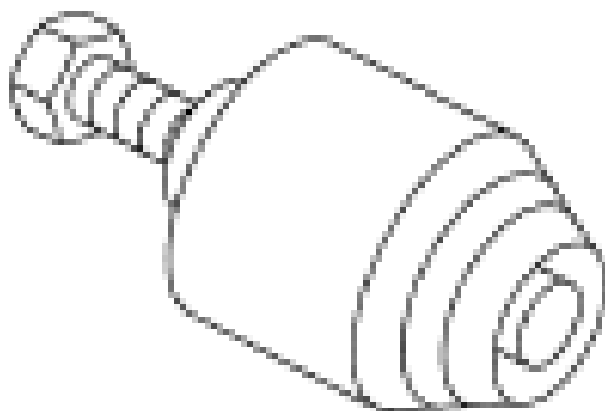
ST1287-A



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

ST1328-A

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



ST1288-A

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	ISpecification
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

Removal

1. Remove the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY** in this service information.
2. Using the Crankshaft Front Oil Seal Remover, remove the crankshaft front seal.

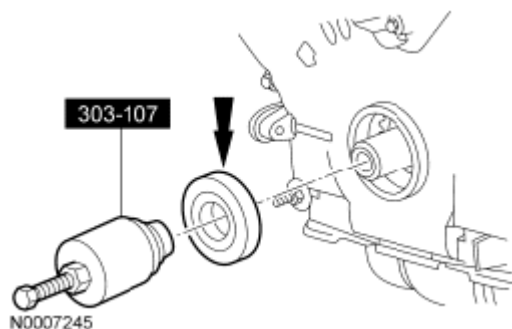


Fig. 26: Removing Crankshaft Front Seal Using Crankshaft Front Oil Seal Remover

Courtesy of FORD MOTOR CO.

Installation

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

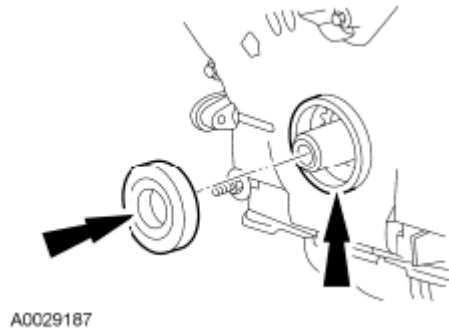


Fig. 27: Locating Crankshaft Seal And Crankshaft Seal Inner Lip
Courtesy of FORD MOTOR CO.

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

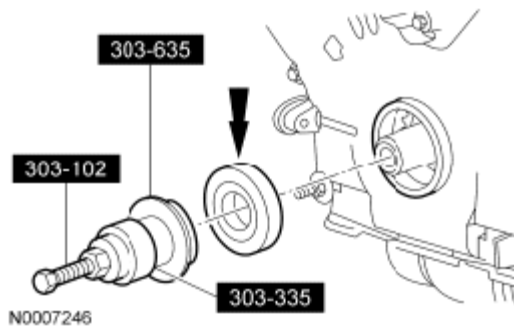


Fig. 28: Installing Crankshaft Front Seal Into Engine Front Cover Using Special Tools
Courtesy of FORD MOTOR CO.

3. Install the crankshaft pulley. For additional information, refer to [CRANKSHAFT PULLEY](#) in this service information.

ENGINE FRONT COVER

Material Specifications

MATERIAL SPECIFICATIONS TABLE

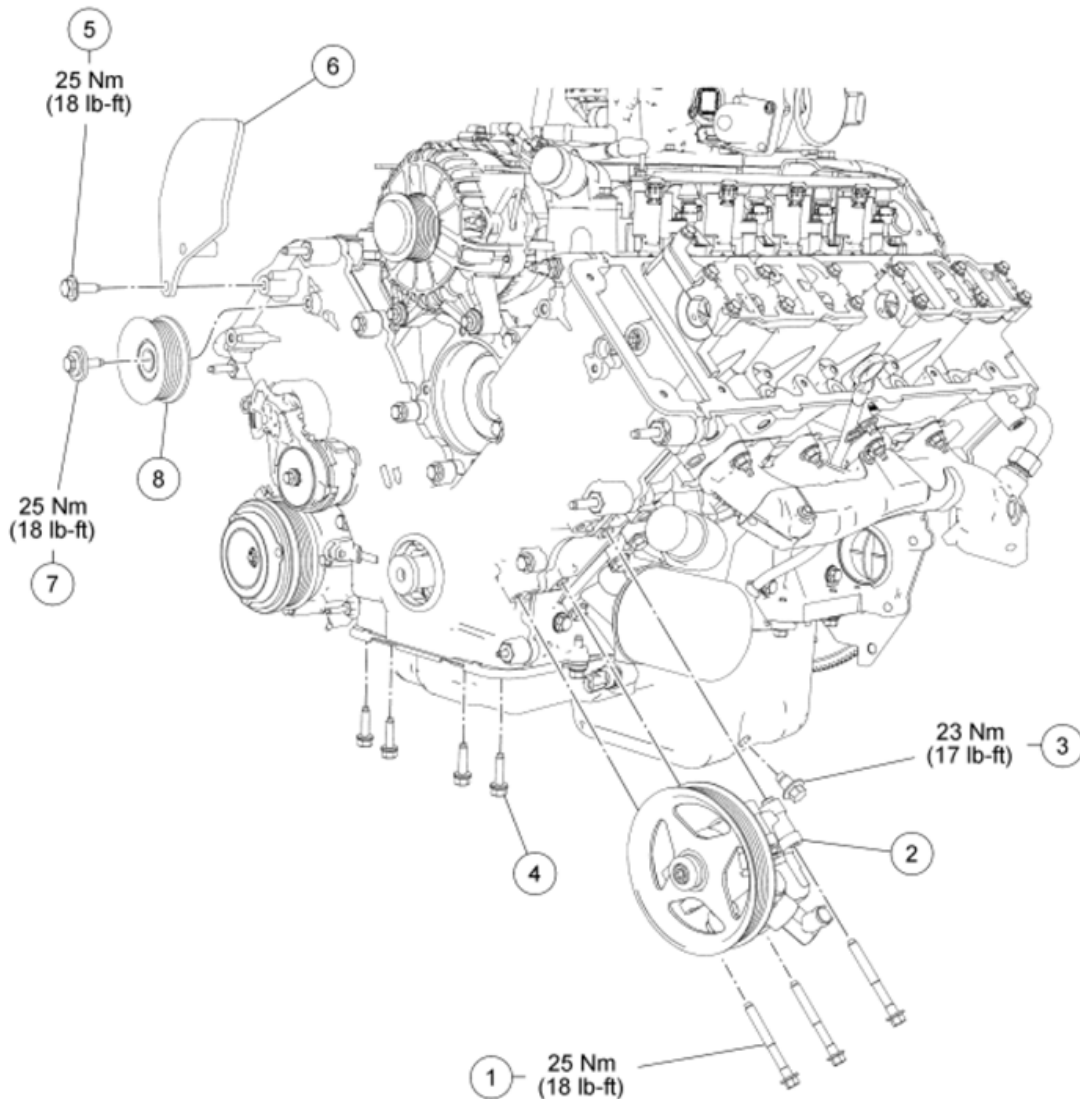
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend	WSS-M2C930-A

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Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover	ZC-30-

Engine Front Cover (View 1 of 2)



N0071900

Fig. 29: Exploded View Of Engine Front Cover Components With Torque Specifications (View 1 Of 2)
Courtesy of FORD MOTOR CO.

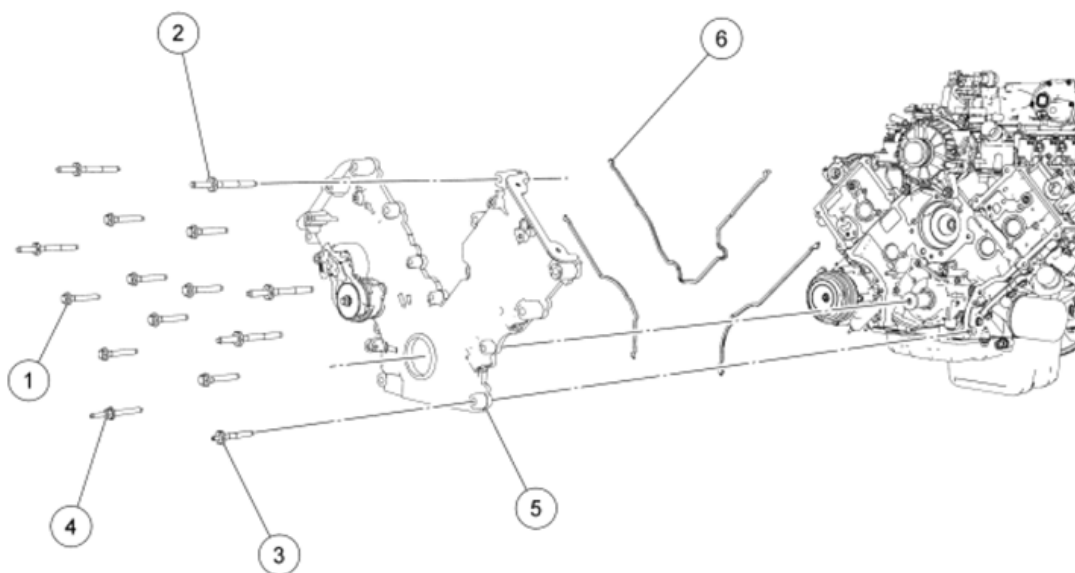
ITEM DESCRIPTION

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Item	Part Number	Description
1	W500315	Power steering pump bolt (3 required)
2	3A674	Power steering pump assembly
3	6730	Oil pan drain plug
4	W701605	Oil pan bolt (4 required)
5	W701725	Shield bolt
6	9G609	Shield
7	N808102	Accessory drive idler pulley bolt
8	19A216	Accessory drive idler pulley

Engine Front Cover (View 2 of 2)



N0087527

Fig. 30: Exploded View Of Engine Front Cover Components With Torque Specifications (View 2 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

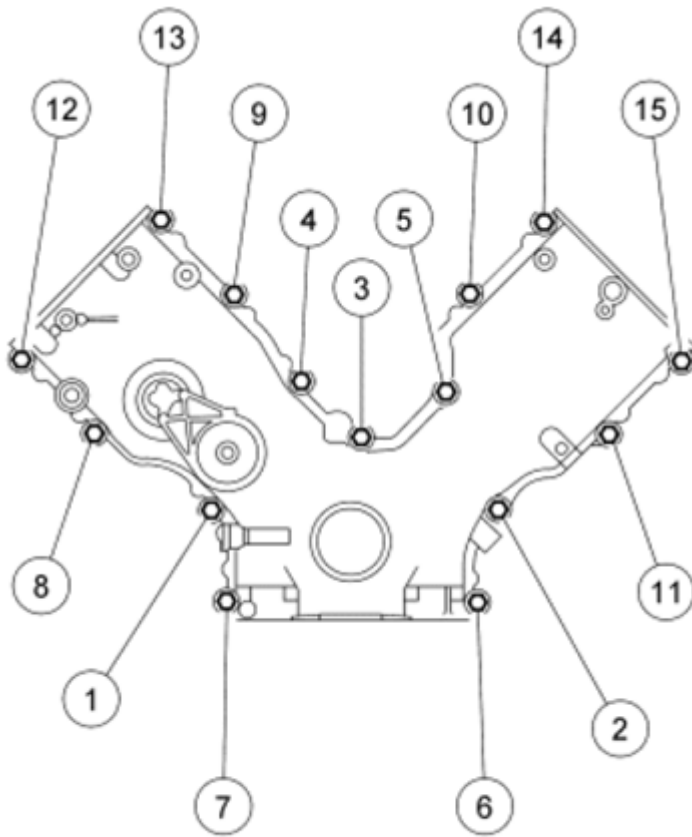
Item	Part Number	Description
1	N806177	Engine front cover bolt (8 required)
2	N806300	Engine front cover stud bolt (5 required)
3	W706508	Engine front cover bolt
4	N808586	Engine front cover bolt
5	6D080	Engine front cover
6	6D081	Engine front cover gasket (3 required)

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system,

depower the system by following the procedure in FIRE SUPPRESSION SYSTEM article. Failure to follow the instructions may result in serious personal injury.

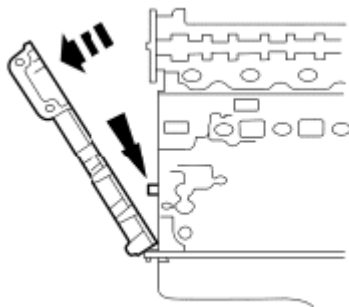
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove both valve covers. For additional information, refer to **VALVE COVER - RH** or **VALVE COVER - LH** in this service information.
3. Remove the coolant pump. For additional information, refer to **ENGINE COOLING SYSTEM** article.
4. Remove the crankshaft front seal. For additional information, refer to **CRANKSHAFT FRONT SEAL** in this service information.
5. Remove the 3 bolts and position the power steering pump aside.
6. Drain the engine oil.
 - Install the drain plug when finished.
 - Tighten to 23 Nm (17 lb-ft).
7. Remove the 4 front oil pan-to-engine front cover bolts.
8. Remove the bolt and the shield.
9. Remove the bolt and the accessory drive idler pulley.
10. Remove the bolts and the stud bolts in the sequence shown in the illustration.



N0037514

Fig. 31: Identifying Stud Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

11. Remove the engine front cover from the front cover-to-cylinder block dowel.



A26122-A

Fig. 32: Removing Engine Front Cover From Front Cover-To-Cylinder Block Dowel
Courtesy of FORD MOTOR CO.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surface. These tools cause scratches

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

12. Clean the gasket surfaces with a plastic scraping tool and metal surface prep.

Installation

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.

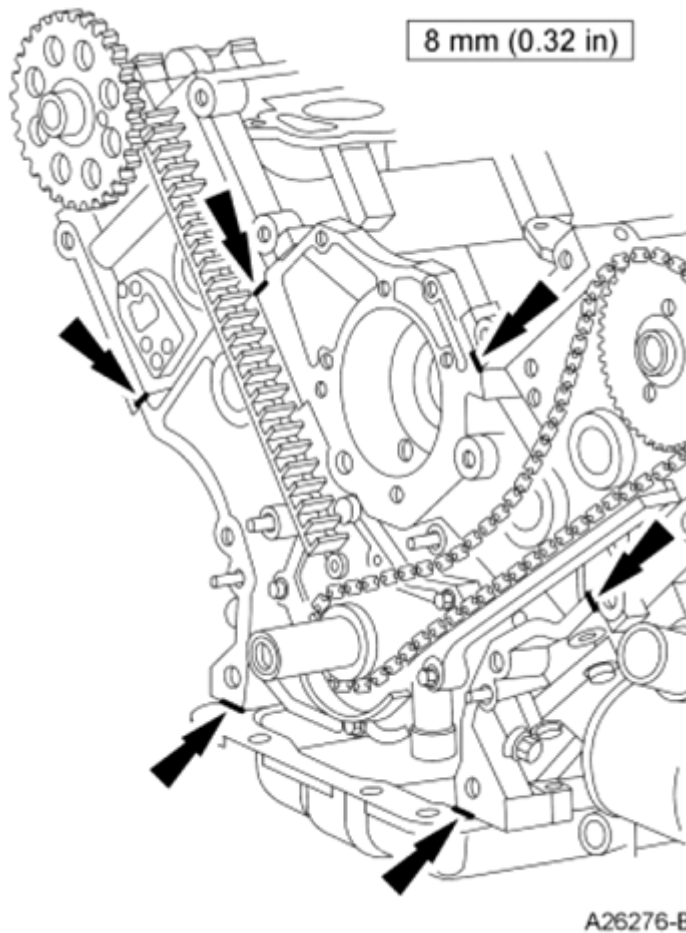


Fig. 33: Locating Silicone Gasket And Sealant Application Points On Cylinder Head-To-Block Surface With Specifications
 Courtesy of FORD MOTOR CO.

1. Apply silicone gasket and sealant along the cylinder head-to-block surface and the oil pan-to-cylinder block surface.
2. Position the new engine front cover gaskets.
3. Install the engine front cover on the front cover-to-cylinder block dowel and loosely install the bolts.

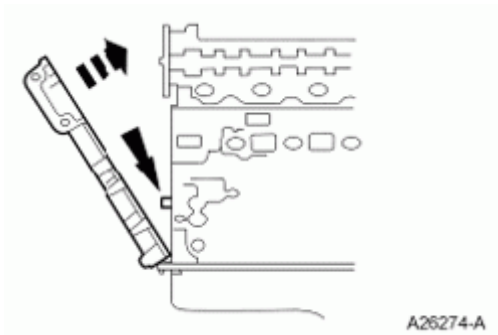
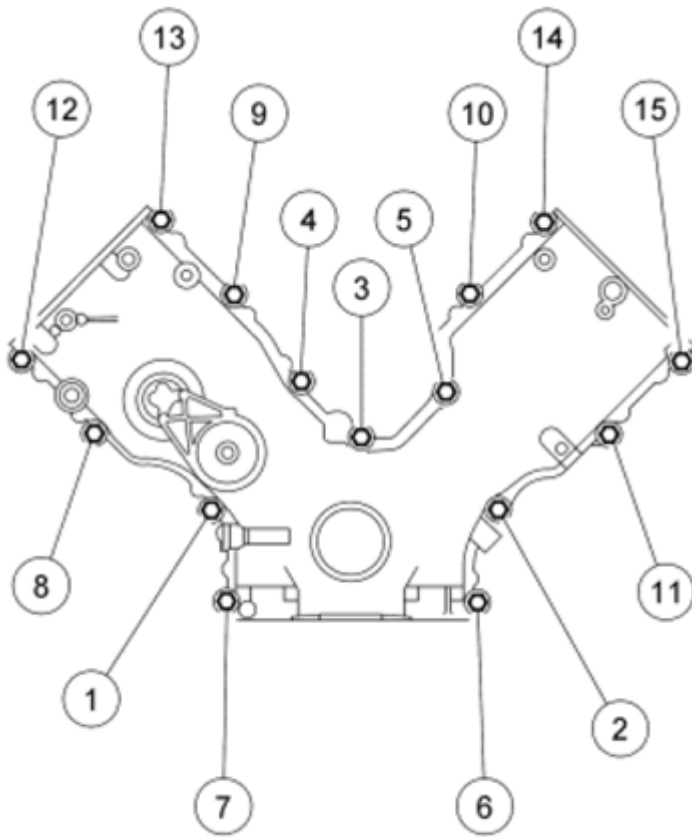


Fig. 34: Installing Engine Front Cover On Front Cover-To-Cylinder Block Dowel
Courtesy of FORD MOTOR CO.

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

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-head pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N808586	Stud, washer hex-head pilot, M8 x 1.25 - M6 x 1.0 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	N806300	Stud, hex-shoulder pilot, M8 x 1.25 x 1.25 x 91.1
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



N0037514

Fig. 35: Identifying Stud Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

5. Install the accessory drive idler pulley and the bolt.
 - Tighten to 25 Nm (18 lb-ft).
6. Install the shield and the bolts.
 - Tighten to 25 Nm (18 lb-ft).
7. Loosely install the 4 front oil pan bolts.

NOTE: Make sure to tighten the bolts in 2 stages.

8. Tighten the 4 front oil pan bolts in 2 stages.
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten an additional 60 degrees.

NOTE: The front lower hole in the power steering pump is not used.

9. Position the power steering pump and install the 3 bolts.

- Tighten to 25 Nm (18 lb-ft).
- 10. Install a new crankshaft front seal. For additional information, refer to **CRANKSHAFT FRONT SEAL** in this service information.
- 11. Install the coolant pump. For additional information, refer to **ENGINE COOLING SYSTEM** article.
- 12. Install the valve covers. For additional information, refer to **VALVE COVER - RH** or **VALVE COVER - LH** in this service information.
- 13. Fill the engine with clean engine oil.

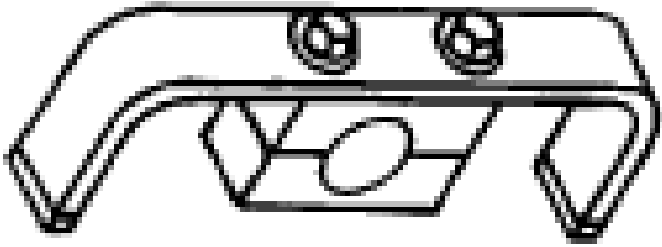
WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

- 14. If equipped with a fire suppression system, repower the system.

TIMING DRIVE COMPONENTS

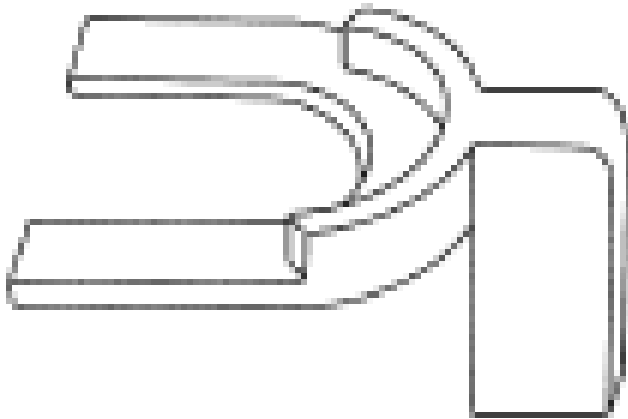
Special Tool(s)

SPECIAL TOOL(S)

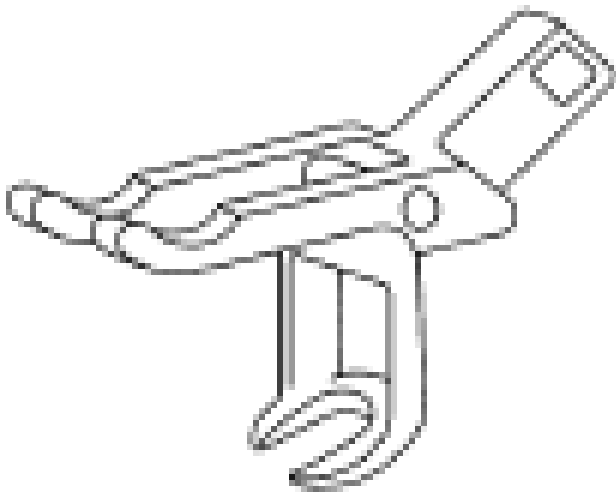
	Aligner, Camshaft Position 303-557(T96T-6256-B)
	Compressor Spacer, Valve Spring 303-382(T91P-6565-AH)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1331-A



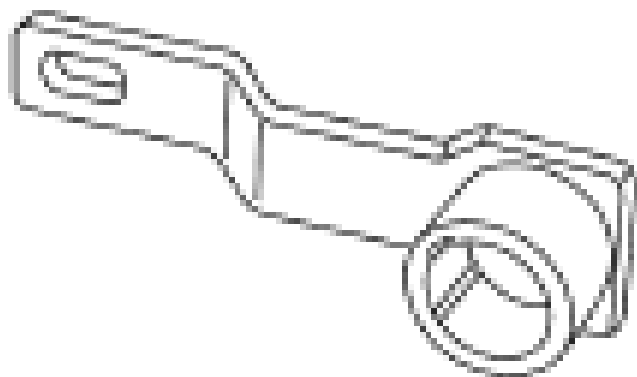
ST1330-A

Compressor, Valve Spring
303-581(T97T-6565-A)

Holding Tool, Crankshaft
303-448(T93P-6303-A)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1335-A

General Equipment

GENERAL EQUIPMENT TABLE

Hydraulic Chain Tensioner Clip - 1L3Z-6P250-AA
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Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

Removal

NOTE: Since the engine is not free-wheeling, timing procedures must be followed exactly or piston and valve damage can occur.

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

2. Remove the engine front cover. For additional information, refer to **ENGINE FRONT COVER** in this service information.
3. Remove the crankshaft sensor ring from the crankshaft.

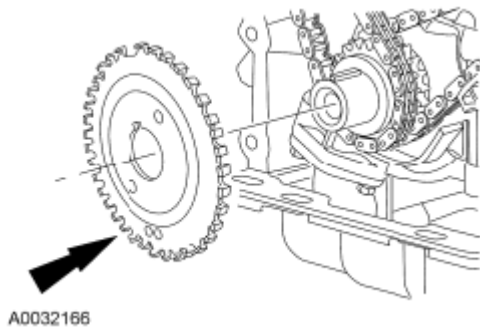


Fig. 36: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

4. Disconnect the 8 ignition coil electrical connectors (4 shown in the illustration).

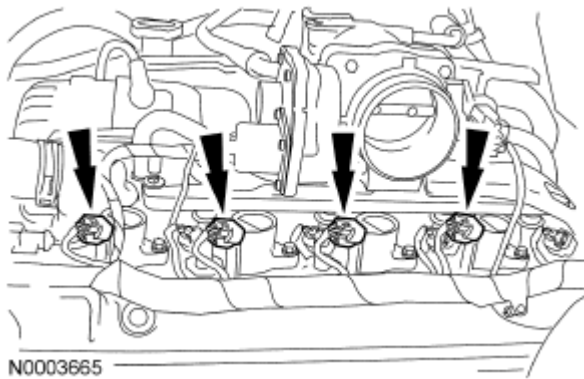


Fig. 37: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

5. Remove the bolts and the 8 ignition coils (4 shown in the illustration).

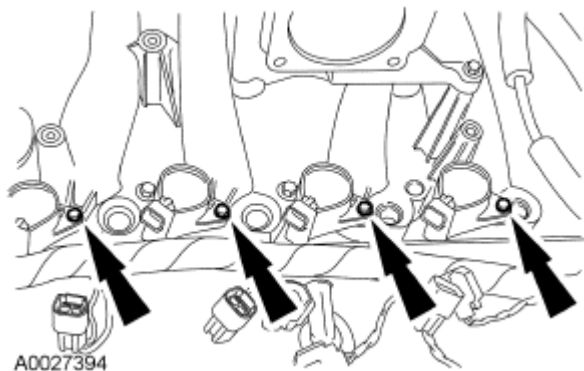
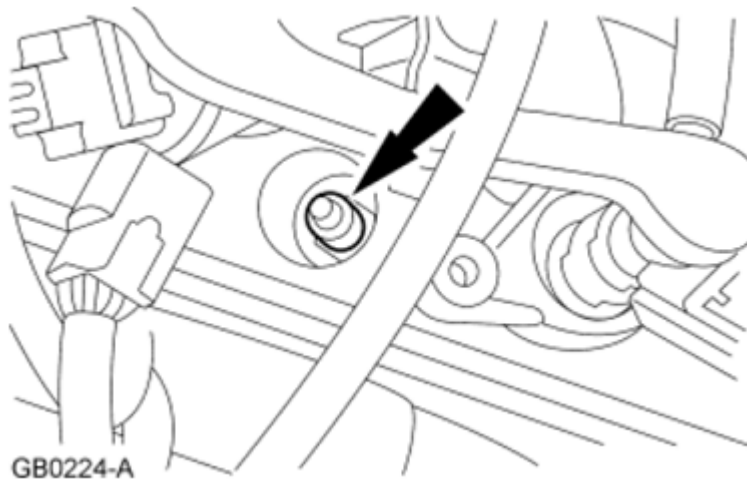


Fig. 38: Locating Ignition Coil Bolts

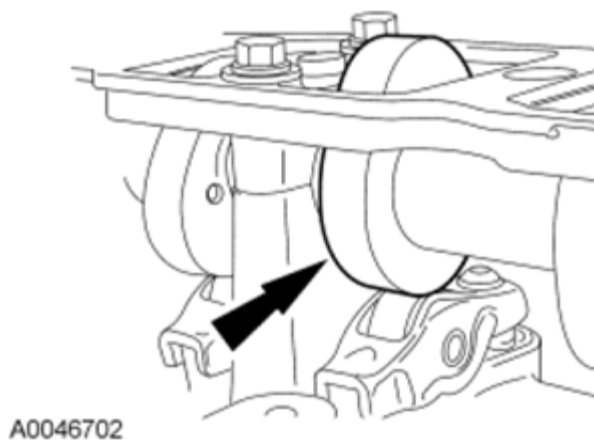
Courtesy of FORD MOTOR CO.

- NOTE:** Only use hand tools when removing or installing the spark plugs, damage may occur to the cylinder head or spark plug.
- NOTE:** Use compressed air to remove any foreign material from the spark plug wells before removing the spark plugs.

**Fig. 39: Locating Spark Plugs**

Courtesy of FORD MOTOR CO.

6. Remove the 8 spark plugs.
7. Position the lobe of the camshaft up.

**Fig. 40: Identifying Lobe Of Camshaft Up**

Courtesy of FORD MOTOR CO.

8. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal

damage.

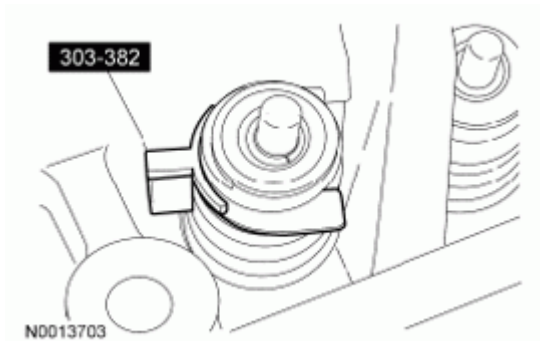


Fig. 41: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.

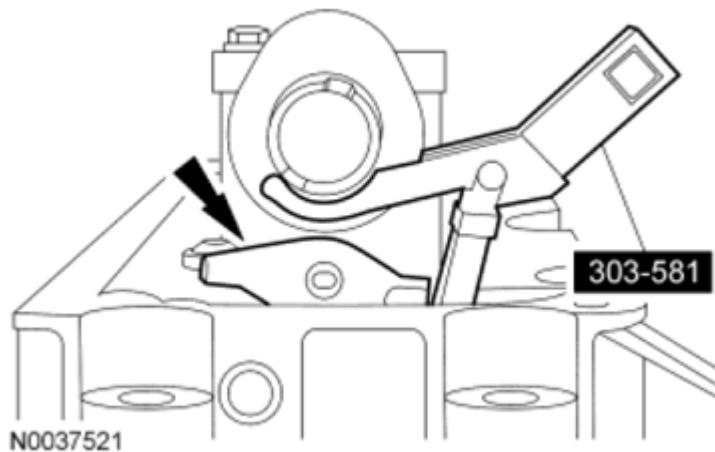


Fig. 42: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

9. Using the Valve Spring Compressor, compress the valve spring and remove the camshaft roller followers.
10. Position the crankshaft with the keyway at the 12 o'clock position.

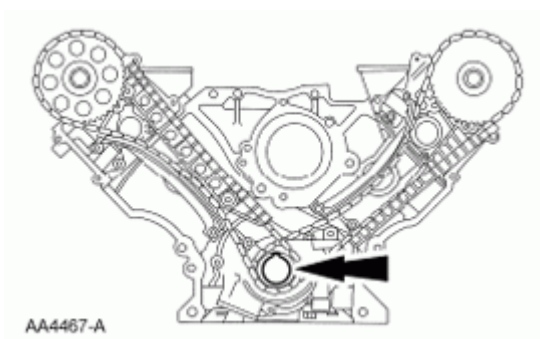


Fig. 43: Locating Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

11. Remove the timing chain tensioning system from both timing chains.
 1. Remove the bolts.
 2. Remove the timing chain tensioners.
 3. Remove the timing chain tensioner arms.

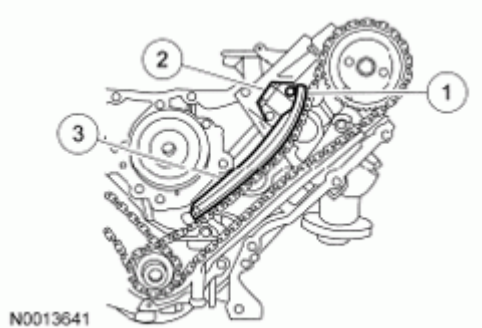
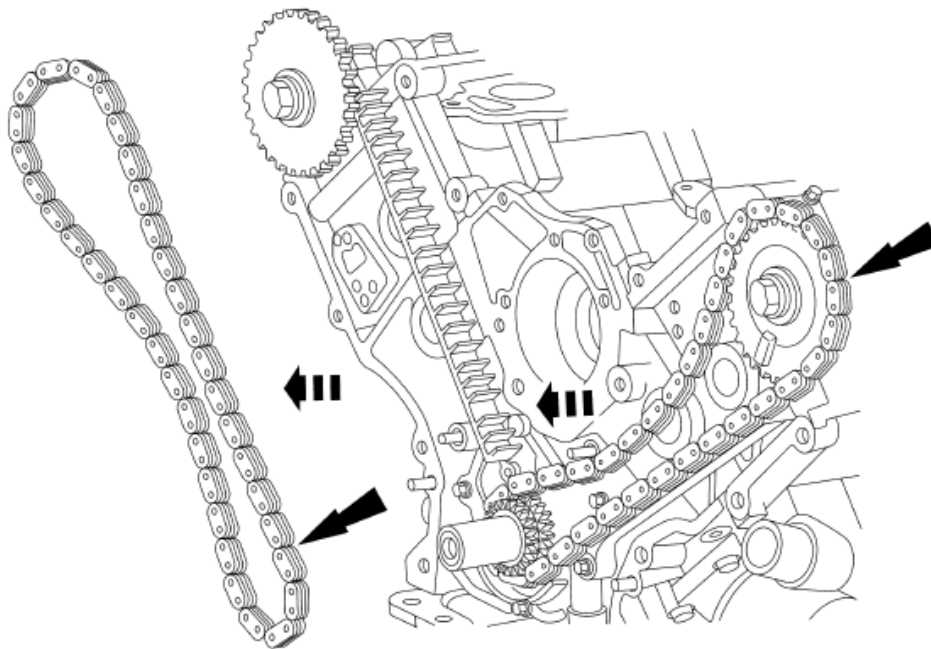


Fig. 44: Identifying Timing Chain Tensioner Arm, Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

12. Remove the LH and RH timing chains and the crankshaft sprocket.
 - Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Repeat for the LH timing chain and crankshaft sprocket.



A0029151

Fig. 45: Removing LH And RH Timing Chains And Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the timing chain guides.
 - Remove the bolts.
 - Remove the LH timing chain guide.
 - Remove the bolts.
 - Remove the RH timing chain guide.

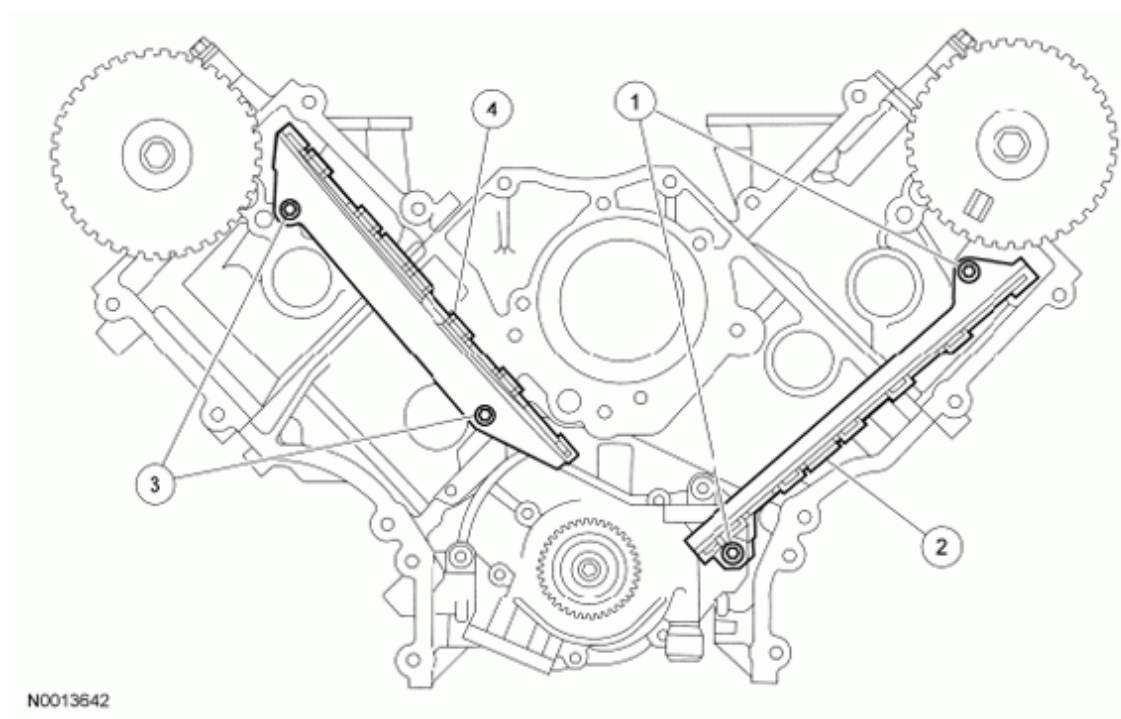


Fig. 46: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

NOTE: RH shown in the illustration, LH similar.

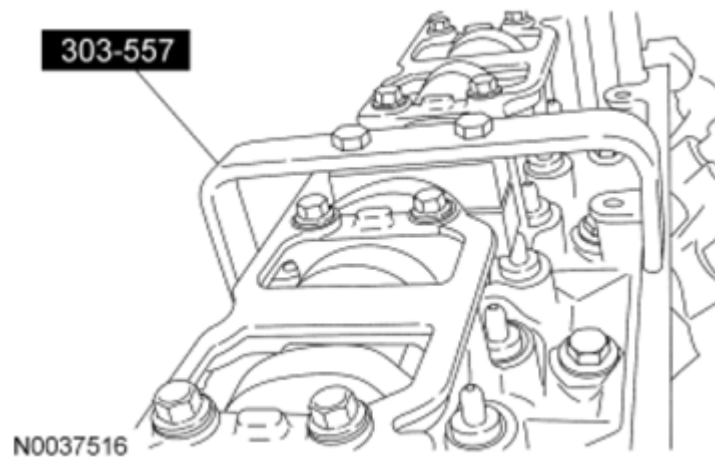


Fig. 47: Installing Camshaft Position Aligner
Courtesy of FORD MOTOR CO.

14. Install the Camshaft Position Aligner.

NOTE: RH shown in the illustration, LH similar.

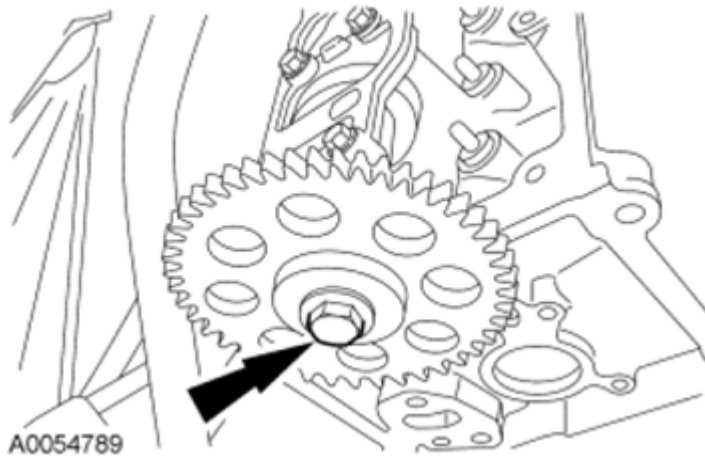


Fig. 48: Locating Camshaft Gear Mounting Bolt
Courtesy of FORD MOTOR CO.

15. Remove the bolt and the camshaft gear.

Installation

Engines with ratcheting timing chain tensioners

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

NOTE: Do not compress the ratchet assembly. This will damage the ratchet assembly.

NOTE: LH shown in the illustration, RH similar.

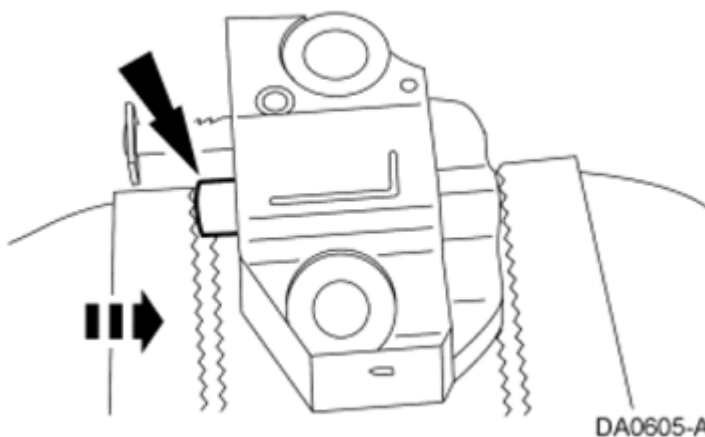


Fig. 49: Compressing Each Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

1. Compress each tensioner plunger, using an edge of a vise.
2. Using a small screwdriver or pick, push back and hold the ratchet mechanism.

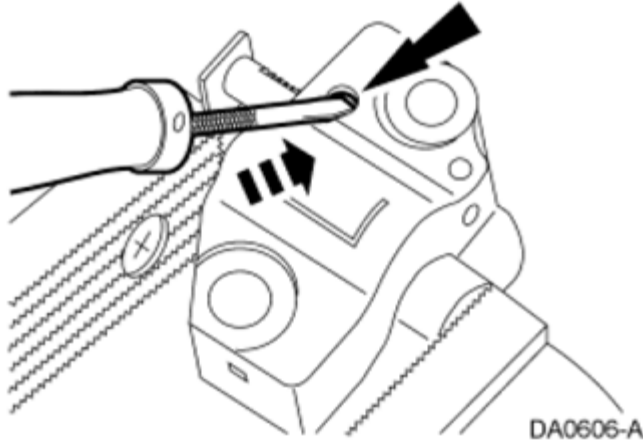


Fig. 50: Holding Ratchet Mechanism
Courtesy of FORD MOTOR CO.

3. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.

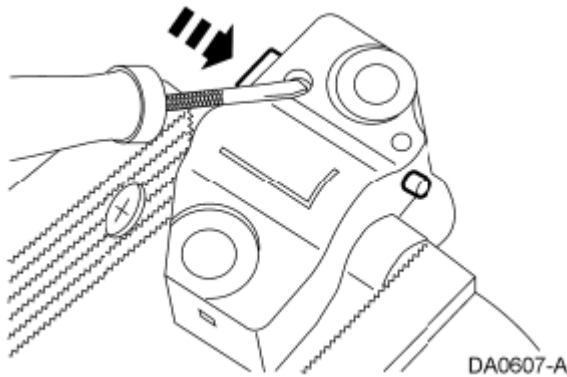
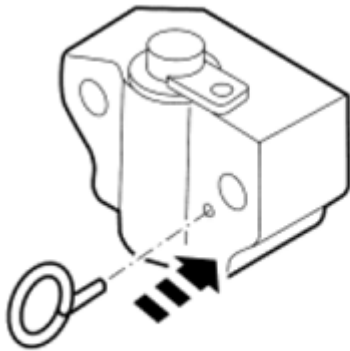


Fig. 51: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

4. Install a paper clip into the hole of each tensioner housing to hold the ratchet assembly and plunger in during installation.
 - Remove the tensioner from the vise.



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Fig. 52: Installing Paper Clip Into Hole Of Tensioner Housing
Courtesy of FORD MOTOR CO.

Engines with non-ratchet timing chain tensioners

NOTE: If one or both 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 or engine damage may occur.

5. Inspect the RH and LH timing chain tensioners.
 - Install new tensioners as necessary.

NOTE: The timing chain procedure must be followed exactly or damage to valves and pistons will result.

NOTE: LH shown in the illustration, RH similar.

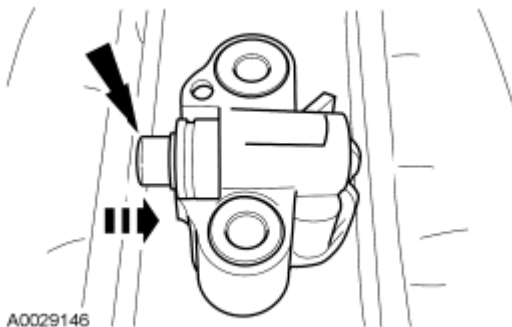


Fig. 53: Compressing Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

6. Compress each tensioner plunger, using a vise.

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

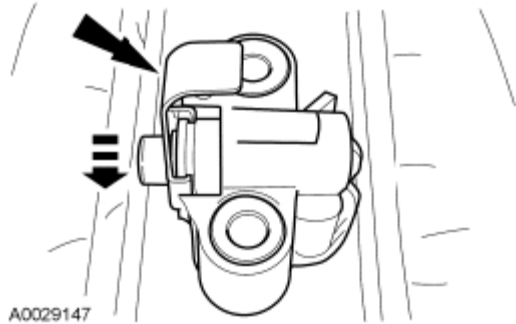


Fig. 54: Installing Hydraulic Chain Tensioner Retaining Clip On Tensioner
Courtesy of FORD MOTOR CO.

All engines

8. If the colored links are not visible, mark one link on one end and one link on the other end, and use as timing marks.

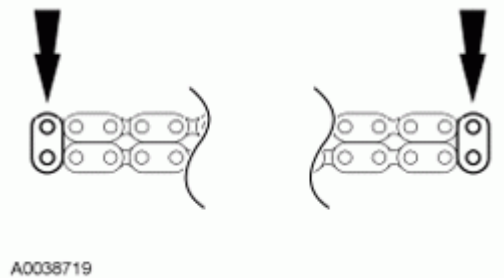


Fig. 55: Locating Timing Chain Colored Links
Courtesy of FORD MOTOR CO.

9. Install the camshaft sprockets and new bolts. Tighten the bolts in 2 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).

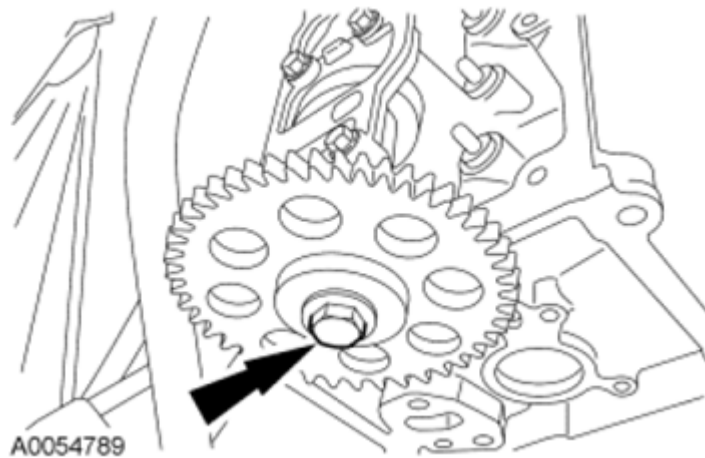
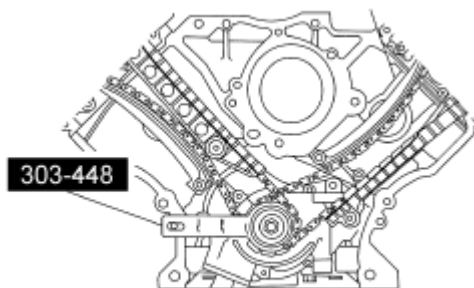


Fig. 56: Locating Camshaft Gear Mounting Bolt
Courtesy of FORD MOTOR CO.

10. Using the Crankshaft Holding Tool, position the crankshaft so the No. 1 cylinder is at Top Dead Center (TDC).



N0007254

Fig. 57: Positioning Crankshaft Using Crankshaft Holding Tool
Courtesy of FORD MOTOR CO.

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

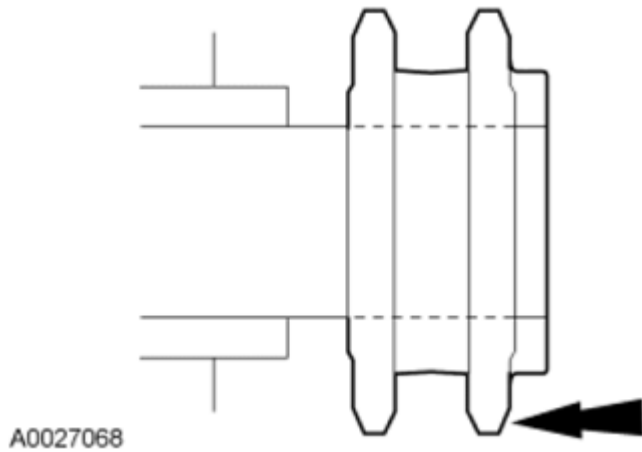


Fig. 58: Locating Crankshaft Sprocket Flange
Courtesy of FORD MOTOR CO.

12. Install the timing chain guide.
 1. Position the LH timing chain guide.
 2. Install and tighten the LH bolts to 10 Nm (89 lb-in).
 3. Position the RH timing chain guide.
 4. Install and tighten the RH bolts to 10 Nm (89 lb-in).

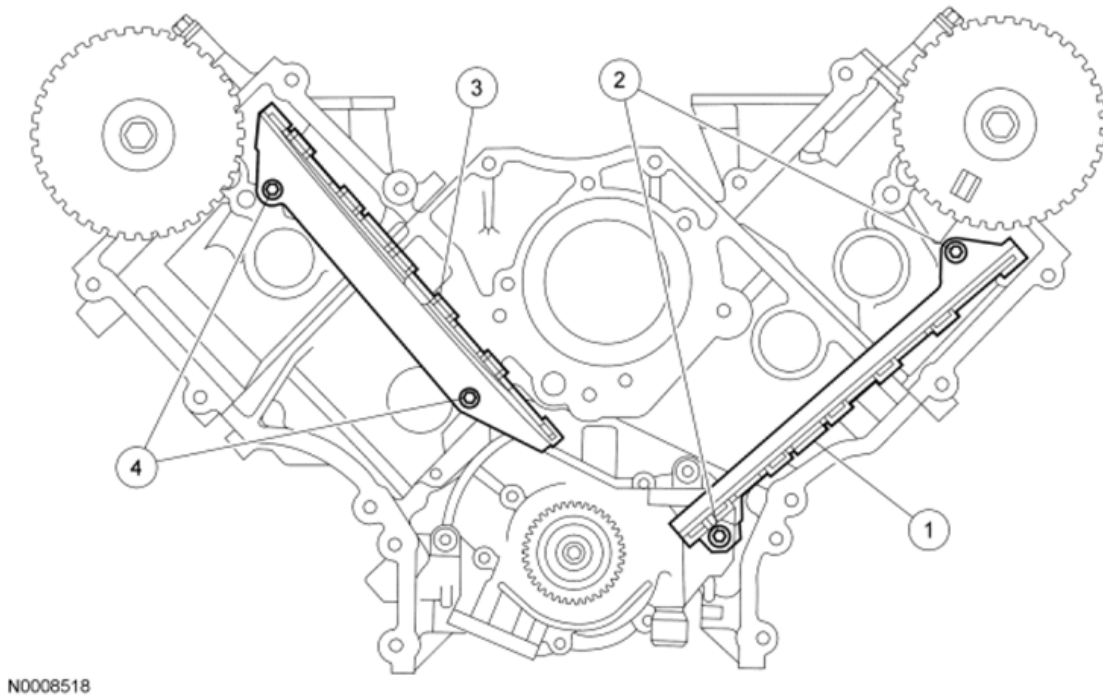
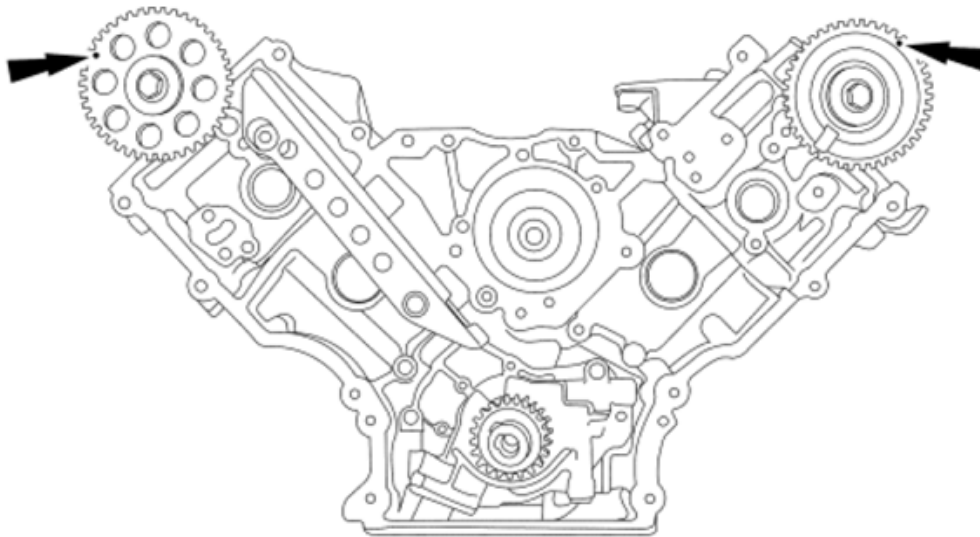


Fig. 59: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

13. Rotate the RH camshaft sprocket until the timing mark is approximately at the 11 o'clock position. Rotate

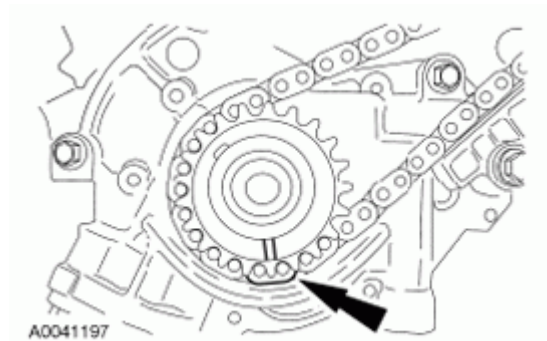
the LH camshaft sprocket until the timing mark is approximately at the 1 o'clock position.



N0071884

Fig. 60: Locating Camshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

14. Position the LH (inner) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.



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Fig. 61: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

15. Install the LH timing chain on the sprocket, aligning the colored (marked) link with the timing marks on the sprocket.

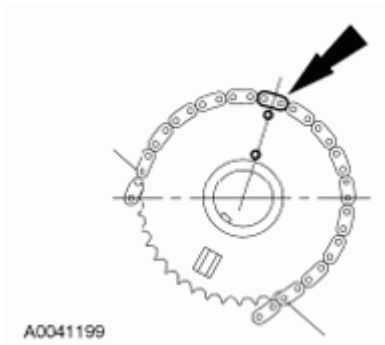


Fig. 62: Locating Colored (Marked) Link With Timing Marks On Sprocket
Courtesy of FORD MOTOR CO.

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

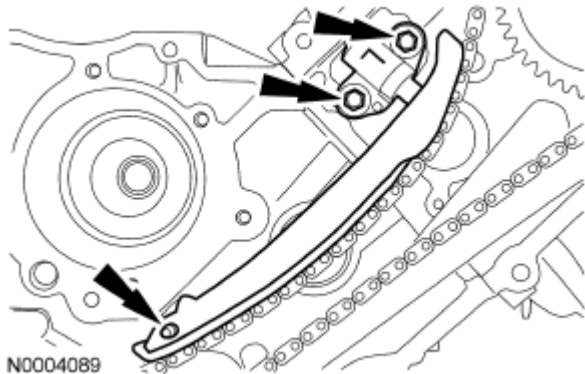
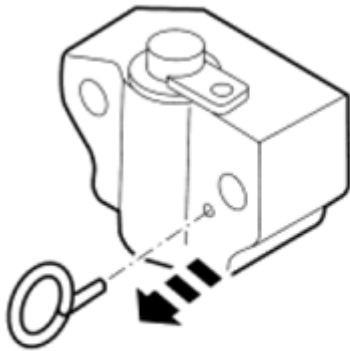


Fig. 63: Locating Timing Chain Tensioner Arm Dowel Pin
Courtesy of FORD MOTOR CO.

16. Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner.
 - Tighten to 25 Nm (18 lb-ft).

Engines with ratcheting timing chain tensioners

17. Remove the paper clip from the LH timing chain tensioner.

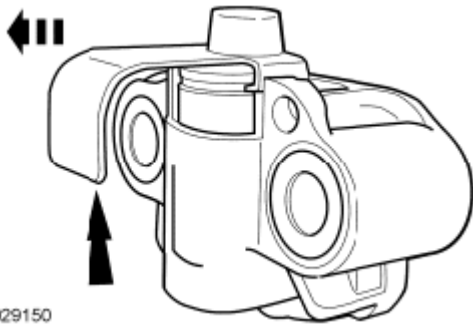


A26273-A

Fig. 64: Removing Retaining Clip From Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

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

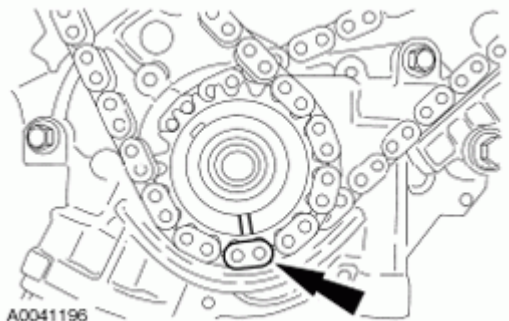


A0029150

Fig. 65: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All engines

19. Position the RH (outer) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.



A0041196

Fig. 66: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

20. Install the RH timing chain on the camshaft sprocket, aligning the colored (marked) link with the timing marks on the sprocket.

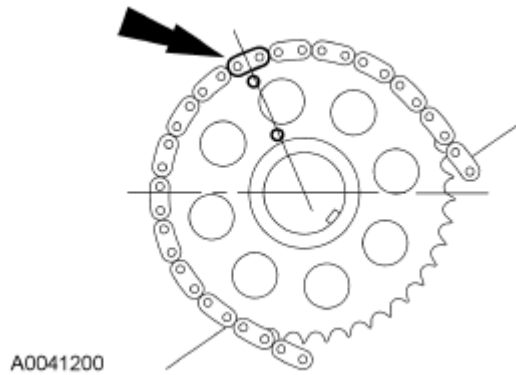


Fig. 67: Locating Sprocket Timing Marks
Courtesy of FORD MOTOR CO.

21. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner.
 - Tighten to 25 Nm (18 lb-ft).

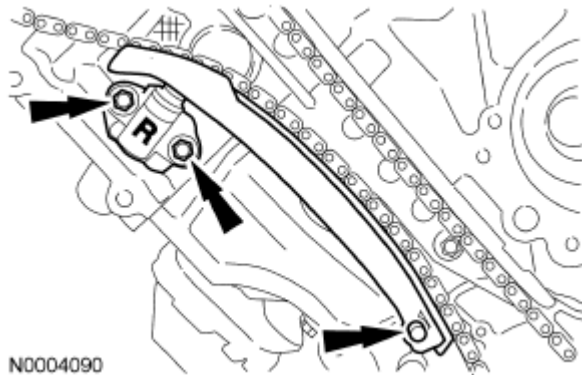
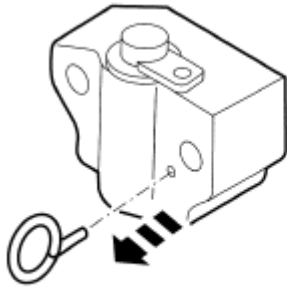


Fig. 68: Locating Dowel Pin And Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

Engines with ratcheting timing chain tensioners

22. Remove the paper clip from the RH timing chain tensioner.

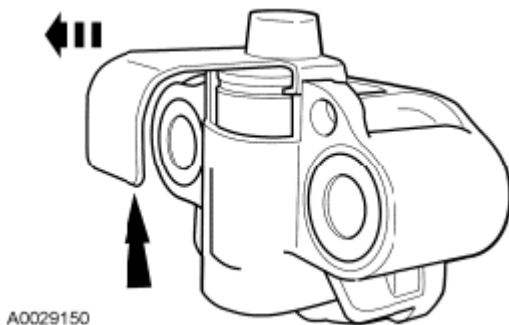


A26273-A

Fig. 69: Removing Paper Clip From RH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

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

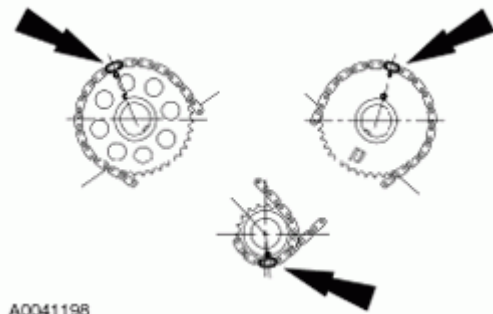


A0029150

Fig. 70: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All engines

24. Make sure that the colored (marked) chain links are lined up with the dots on the crankshaft sprocket and the camshaft sprockets.



A0041198

Fig. 71: Identifying Colored (Marked) Chain Links Are Lined Up With The Dots On Crankshaft Sprocket And Camshaft Sprockets

Courtesy of FORD MOTOR CO.

25. Rotate the camshaft until the lobe is in the up position.

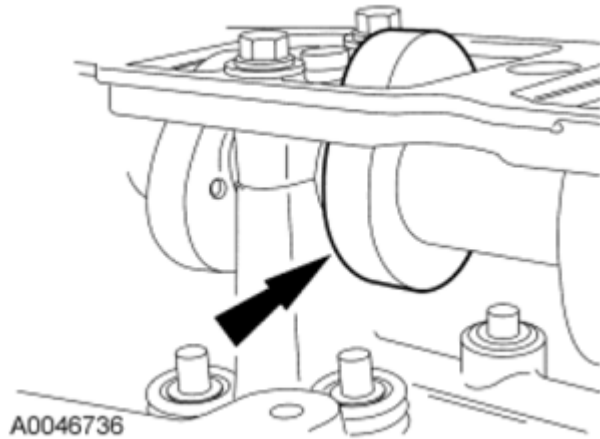


Fig. 72: Locating Camshaft Lobe In Up Position
Courtesy of FORD MOTOR CO.

26. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

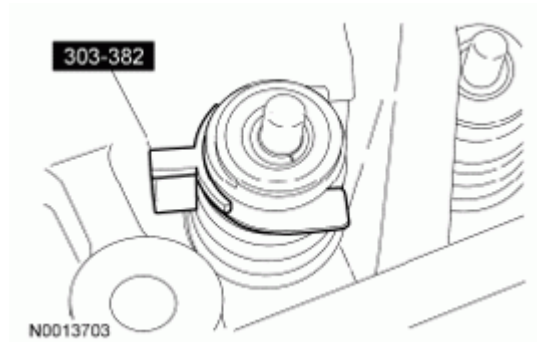


Fig. 73: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the camshaft roller followers using clean engine oil.

27. Install the camshaft roller followers.
1. Install the Valve Spring Compressor.
 2. Compress the valve spring.
 3. Install the camshaft roller followers in their original locations.

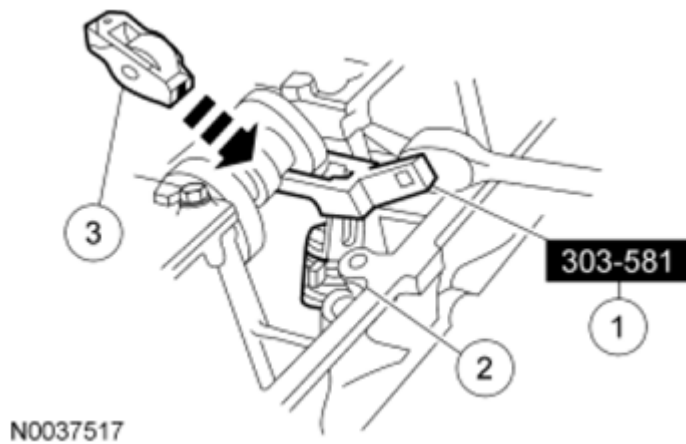


Fig. 74: Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools when removing or installing the spark plugs, damage may occur to the cylinder head or spark plug.

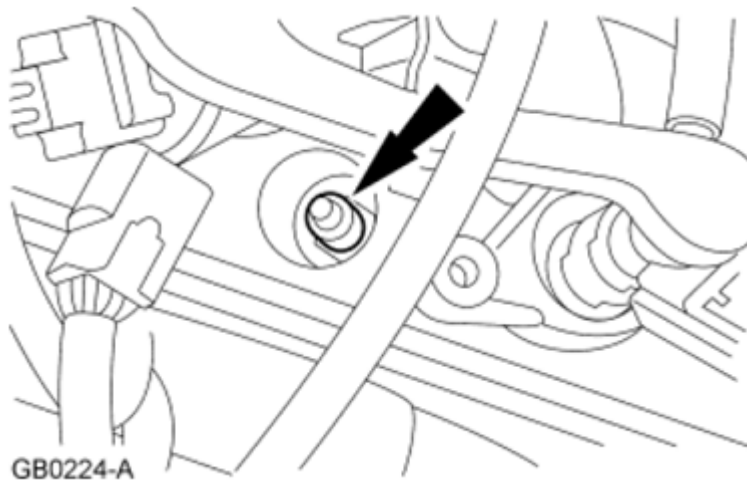


Fig. 75: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

28. Install the 8 spark plugs.
 - Tighten to 18 Nm (159 lb-in).
29. Install the 8 ignition coils and bolts (4 shown in the illustration).
 - Tighten to 6 Nm (53 lb-in).

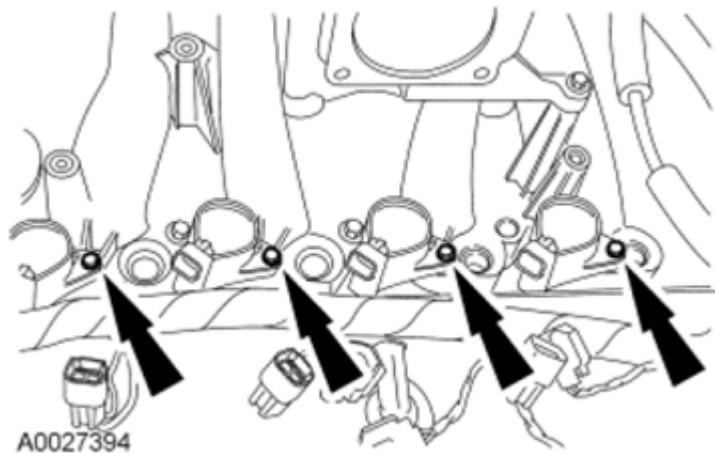


Fig. 76: Locating Ignition Coils And Mounting Bolts
Courtesy of FORD MOTOR CO.

30. Connect the 8 ignition coil electrical connectors (4 shown in the illustration).

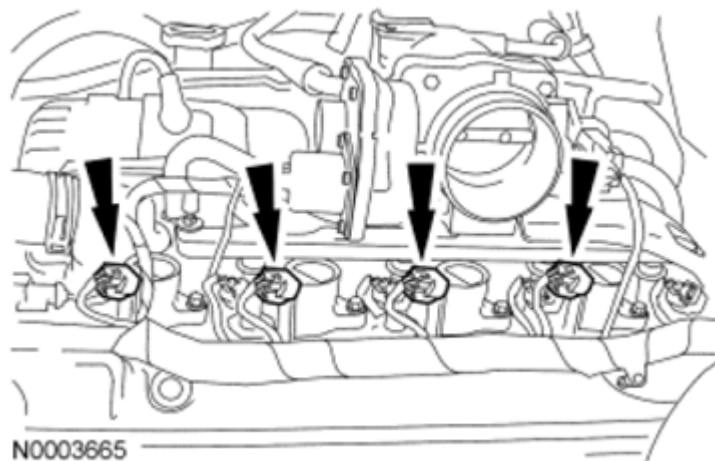


Fig. 77: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

31. Install the crankshaft sensor ring on the crankshaft.

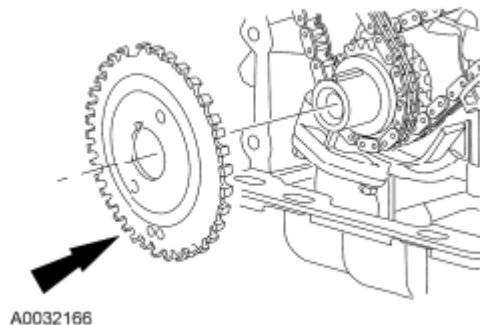


Fig. 78: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

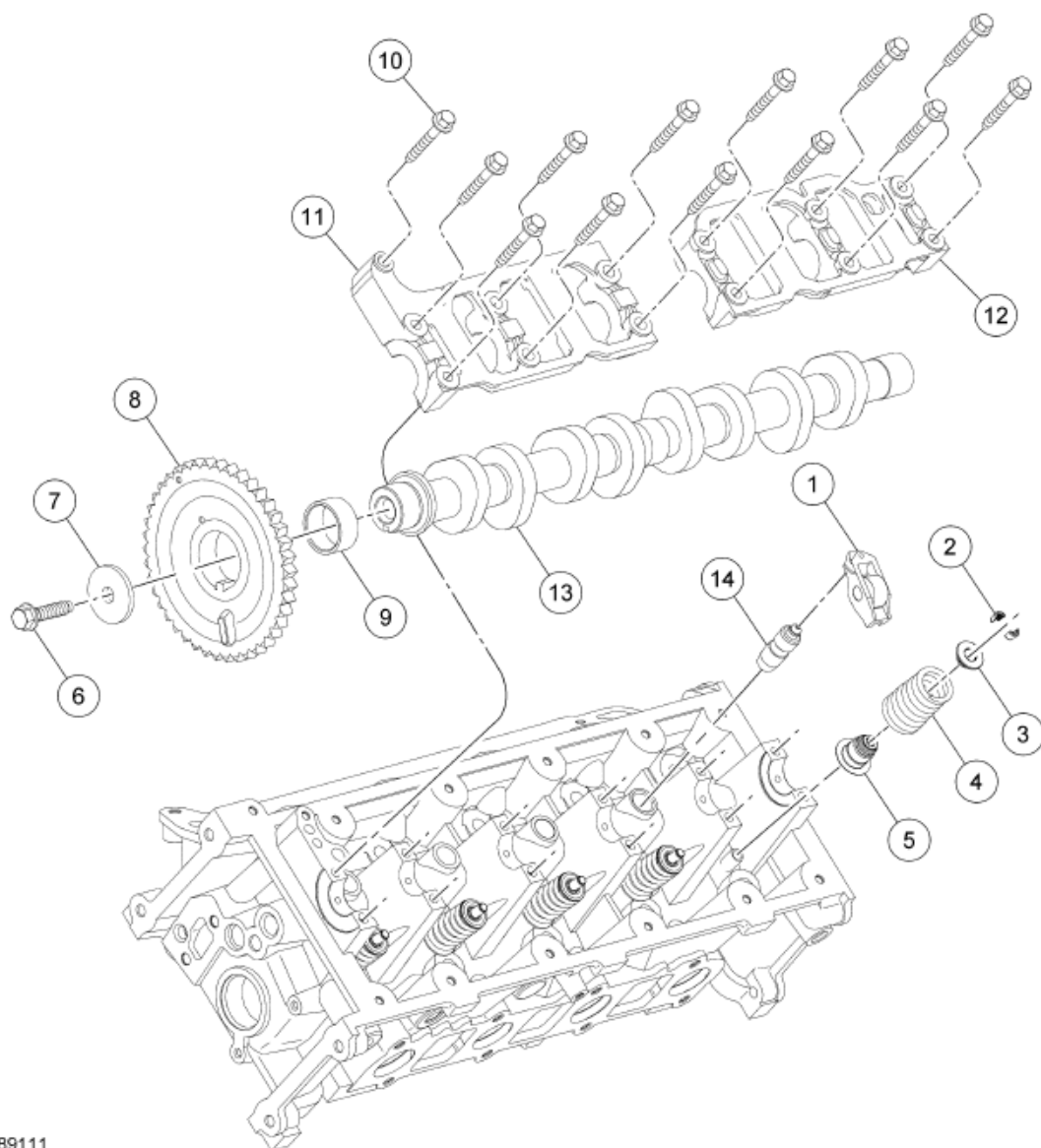
32. Install the engine front cover. For additional information, refer to **ENGINE FRONT COVER** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

33. If equipped with a fire suppression system, repower the system.

VALVE TRAIN COMPONENTS - EXPLODED VIEW

NOTE: LH shown in the illustration, RH similar.



N0089111

Fig. 79: Exploded View Of Valve Train Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6529	Camshaft roller follower (8 required)
2	6518	Valve spring retainer key (16 required)
3	6514	Valve spring retainer (8 required)
4	6513	Valve spring (8 required)
5	6A517	Valve stem seal (8 required)
6	N811085	Camshaft sprocket bolt
7	N806164	Camshaft sprocket bolt washer
8	6256	Camshaft sprocket

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis

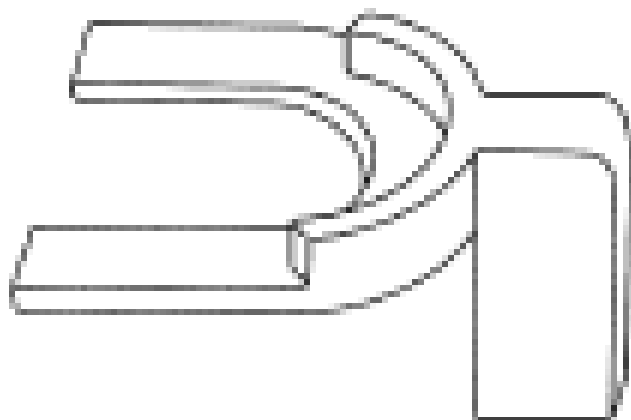
9	6265	Camshaft gear spacer
10	N807352	Camshaft bearing cap assembly bolt (13 required)
11	6B280	Camshaft bearing cap
12	6B280	Camshaft bearing cap
13	6A274	Camshaft
14	6C501	Hydraulic lash adjuster (8 required)

1. For additional information, refer to the appropriate procedures in this service information.

VALVE SPRINGS

Special Tool(s)

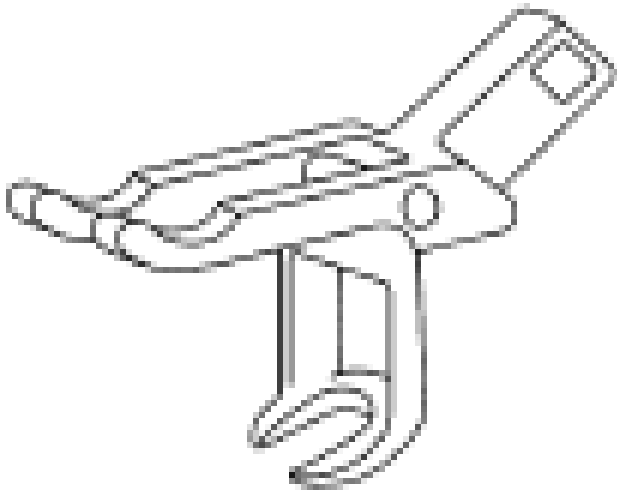
SPECIAL TOOL(S)



ST1331-A

Compressor Spacer, Valve Spring
303-382(T91P-6565-AH)

Compressor, Valve Spring
303-581(T97T-6565-A)

**ST1330-A****Removal**

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER** in this service information.
3. Position the piston at the top of the stroke.
4. Remove the spark plugs. For additional information, refer to **ENGINE IGNITION SYSTEM - 4.6L (2V)** article.
5. Install compressed air in the cylinder to hold both valves in position.

NOTE: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal or engine damage may occur.

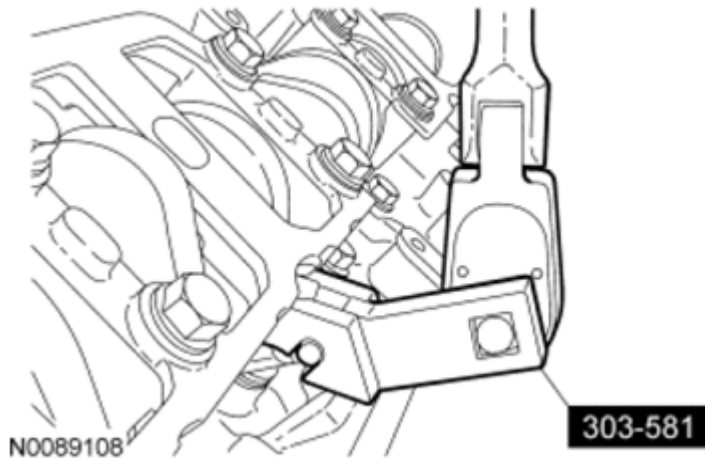


Fig. 80: Compressing Valve Springs Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

6. Using the Valve Spring Compressor, compress the valve springs.
7. Remove the valve spring retainer keys, the valve spring retainer and the valve spring.

Installation

1. Position the valve spring and the valve spring retainer.
2. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

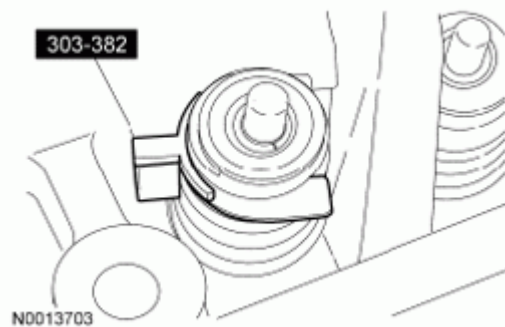


Fig. 81: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

3. Using the Valve Spring Compressor, compress the valve spring. Install the valve spring retainer keys.

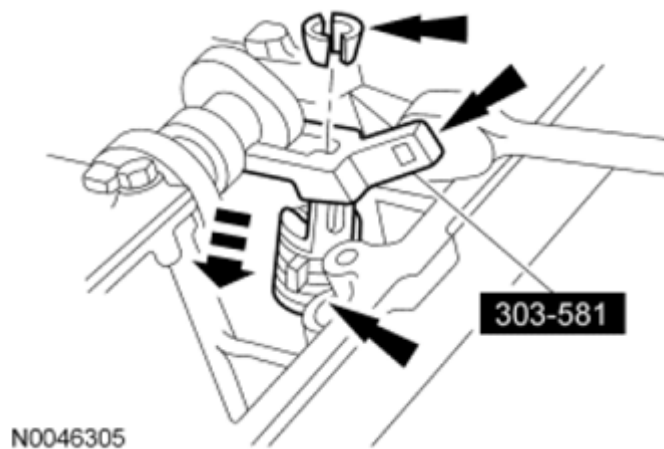


Fig. 82: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

4. Remove the Valve Spring Compressor and Valve Spring Compressor Spacer.
5. Install the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER** in this service information.
6. Install the spark plugs. For additional information, refer to **ENGINE IGNITION SYSTEM - 4.6L (2V)** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

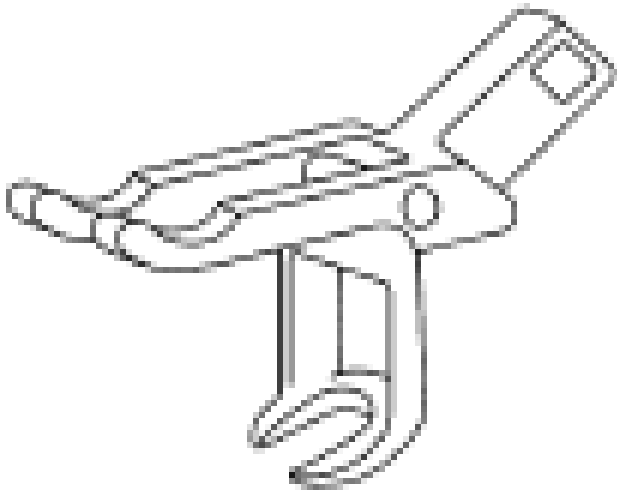
7. If equipped with a fire suppression system, repower the system.

VALVE SEALS

Special Tool(s)

SPECIAL TOOL(S)

Compressor, Valve Spring
303-581(T97T-6565-A)



ST1330-A



ST1332-A

Installer, Valve Stem Oil Seal
303-383(T91P-6571-A)

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

2. Remove the valve springs. For additional information, refer to **VALVE SPRINGS** in this service information.
3. Remove the valve stem seals.

Installation

NOTE: The valve stem seal must be bottomed on the valve seat.

NOTE: Make sure that the garter spring is present in the valve stem seal.

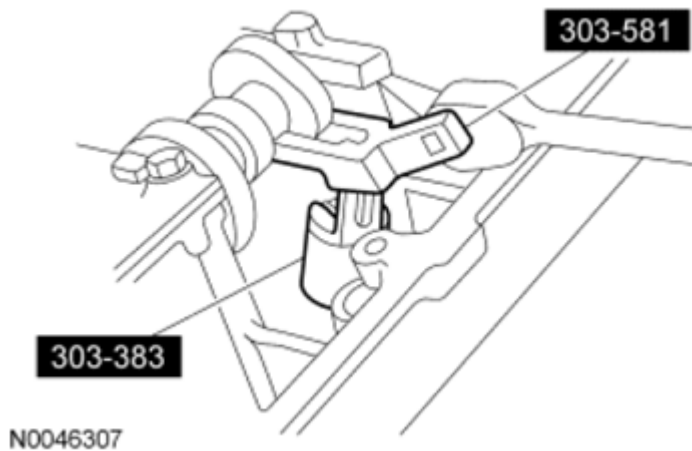


Fig. 83: Installing Valve Stem Seals Using Valve Spring Compressor And Valve Stem Oil Seal Installer

Courtesy of FORD MOTOR CO.

1. Use the Valve Spring Compressor and Valve Stem Oil Seal Installer to install the valve stem seals.
2. Install the valve springs. For additional information, refer to **VALVE SPRINGS** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

3. If equipped with a fire suppression system, repower the system.

HYDRAULIC LASH ADJUSTER**Removal and Installation**

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions

may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER** in this service information.
3. Remove the hydraulic lash adjusters.

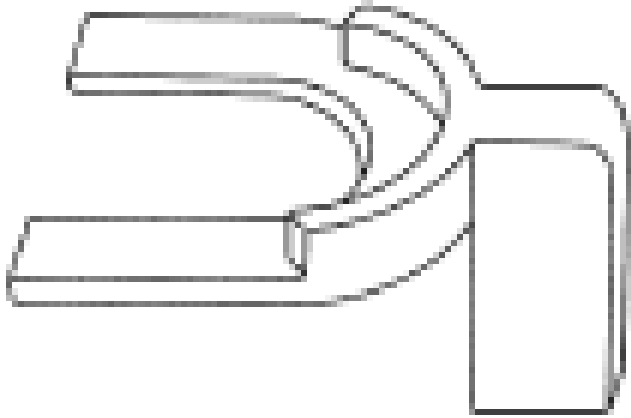
WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

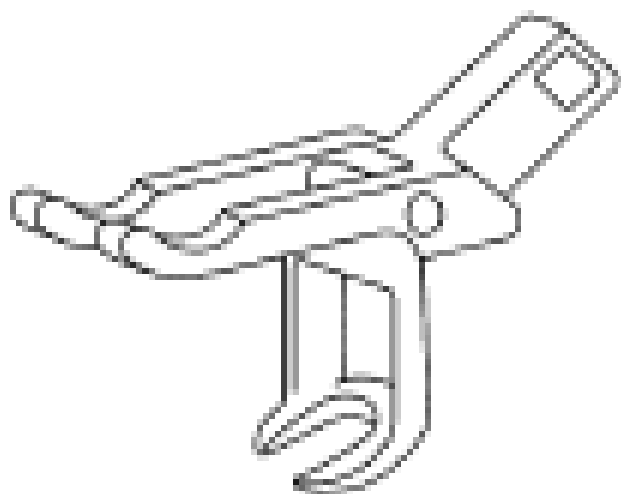
4. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.

CAMSHAFT ROLLER FOLLOWER

Special Tool(s)

SPECIAL TOOL(S)

 ST1331-A	Compressor Spacer, Valve Spring 303-382(T91P-6565-AH)
	Compressor, Valve Spring 303-581(T97T-6565-A)



ST1330-A

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in FIRE SUPPRESSION SYSTEM article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to JACKING & LIFTING article.
2. Remove the valve covers. For additional information, refer to VALVE COVER - RH or VALVE COVER - LH in this service information.
3. Position the piston of the cylinder being repaired at the bottom of the stroke.
4. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

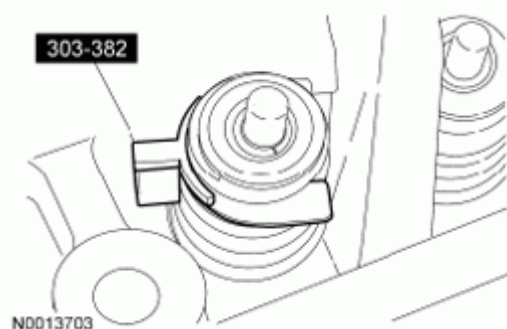


Fig. 84: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

5. Using the Valve Spring Compressor, compress the valve springs and remove the camshaft roller followers.

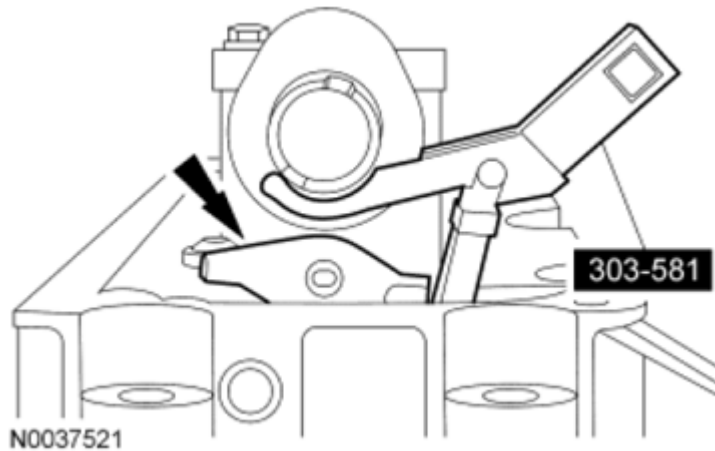


Fig. 85: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

Installation

1. Using the Valve Spring Compressor, compress the valve spring and install the camshaft roller followers.

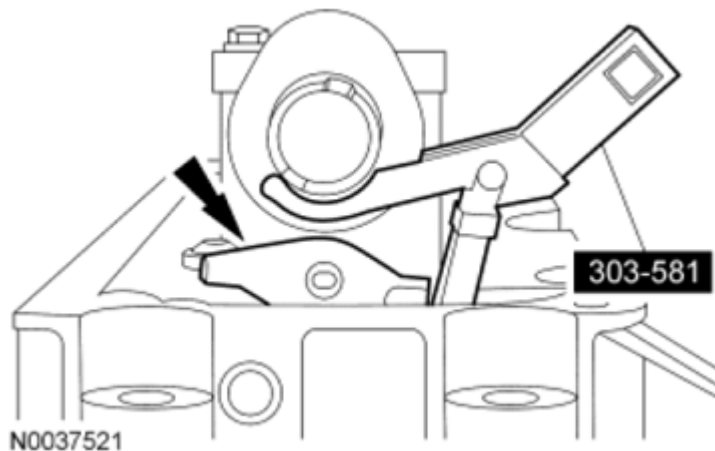


Fig. 86: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

2. Remove the Valve Spring Compressor from between the valve spring.



Fig. 87: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

3. Install the valve covers. For additional information, refer to VALVE COVER - RH or VALVE COVER - LH in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to FIRE SUPPRESSION SYSTEM article. Failure to follow these instructions may result in serious personal injury.

4. If equipped with a fire suppression system, repower the system.

CAMSHAFT

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in FIRE SUPPRESSION SYSTEM article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to JACKING & LIFTING article.

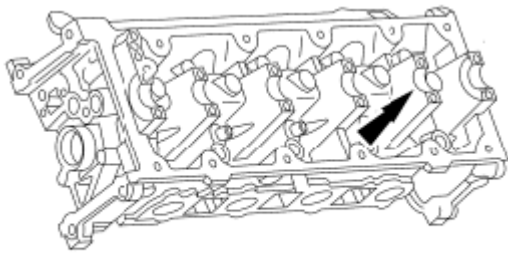
NOTE: At no time, when the timing chains are removed and the cylinder heads are

installed, may the crankshaft or camshaft be rotated. Severe piston and valve damage will occur.

2. Remove the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER** in this service information.
3. Remove the timing chain. For additional information, refer to **TIMING DRIVE COMPONENTS** in this service information.
4. Remove the bolt and the camshaft sprocket and spacer.
5. Remove the 13 camshaft bearing cap bolts.
6. Remove the camshaft bearing cap.
7. Remove the camshaft from the cylinder head.

Installation

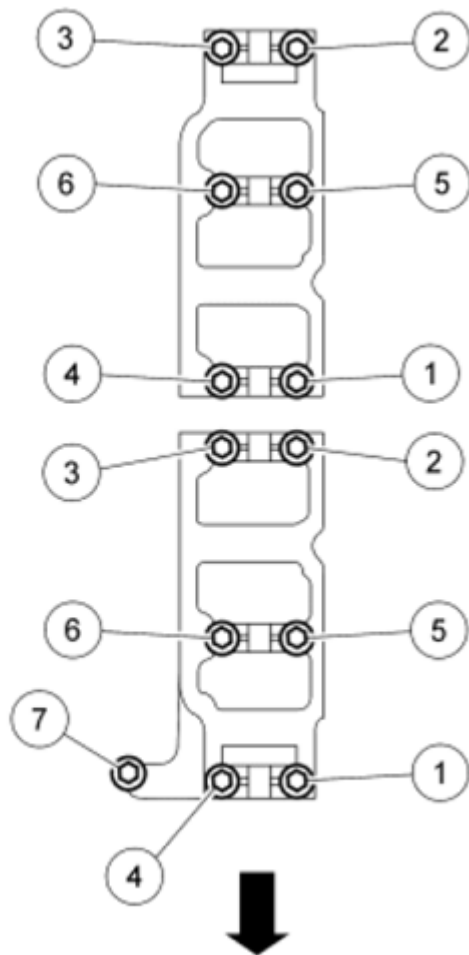
1. Lubricate the camshaft journals with clean engine oil.



GA0983-A

Fig. 88: Locating Camshaft Journals
Courtesy of FORD MOTOR CO.

2. Install the camshaft onto the cylinder head.
3. Lubricate the camshaft bearing cap with clean engine oil.
4. Install the camshaft bearing caps and loosely install the bolts.
5. Tighten the bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).



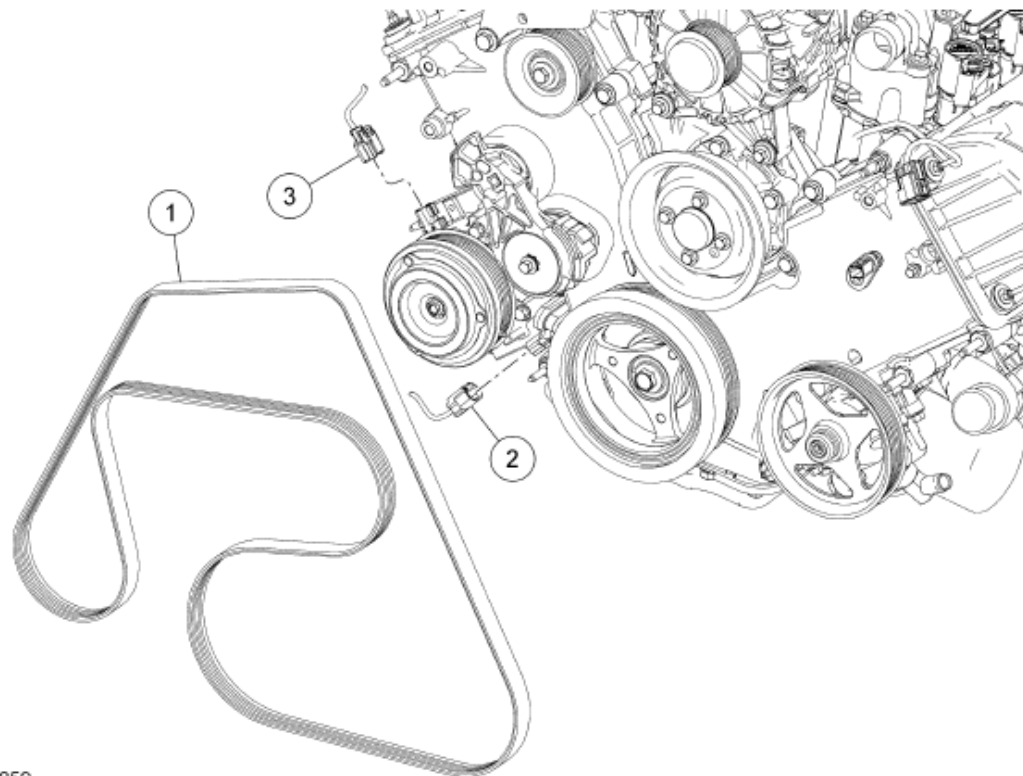
N0089110

Fig. 89: Identifying Camshaft Bearing Caps Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Install the camshaft sprocket and bolt. Tighten the bolt in 2 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).
7. Install the timing chains. For additional information, refer to **TIMING DRIVE COMPONENTS** in this service information.
8. Install the roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

9. If equipped with a fire suppression system, repower the system.

EXHAUST MANIFOLD - RH**Exhaust Manifold - RH (View 1 of 3)**

N0037859

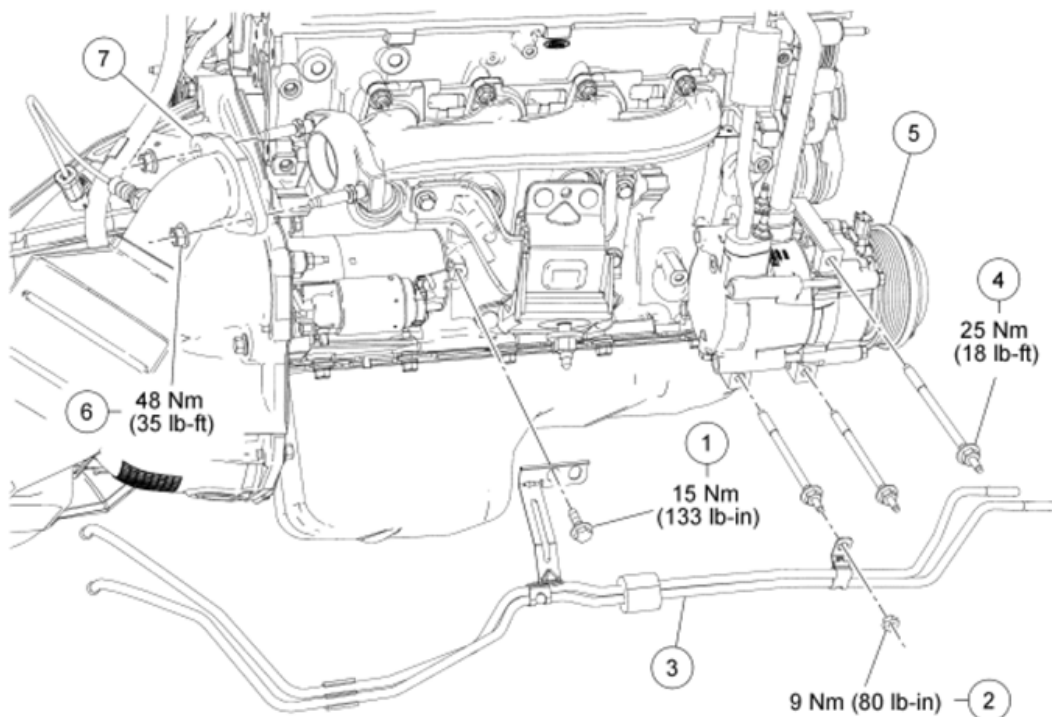
Fig. 90: Identifying Exhaust Manifold Components - RH (View 1 Of 3)

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	8620	Accessory drive belt
2	14A464	Crankshaft Position (CKP) sensor electrical connector (part of 12B637)
3	14A464	A/C compressor electrical connector (part of 12B637)

Exhaust Manifold - RH (View 2 of 3)



N0087528

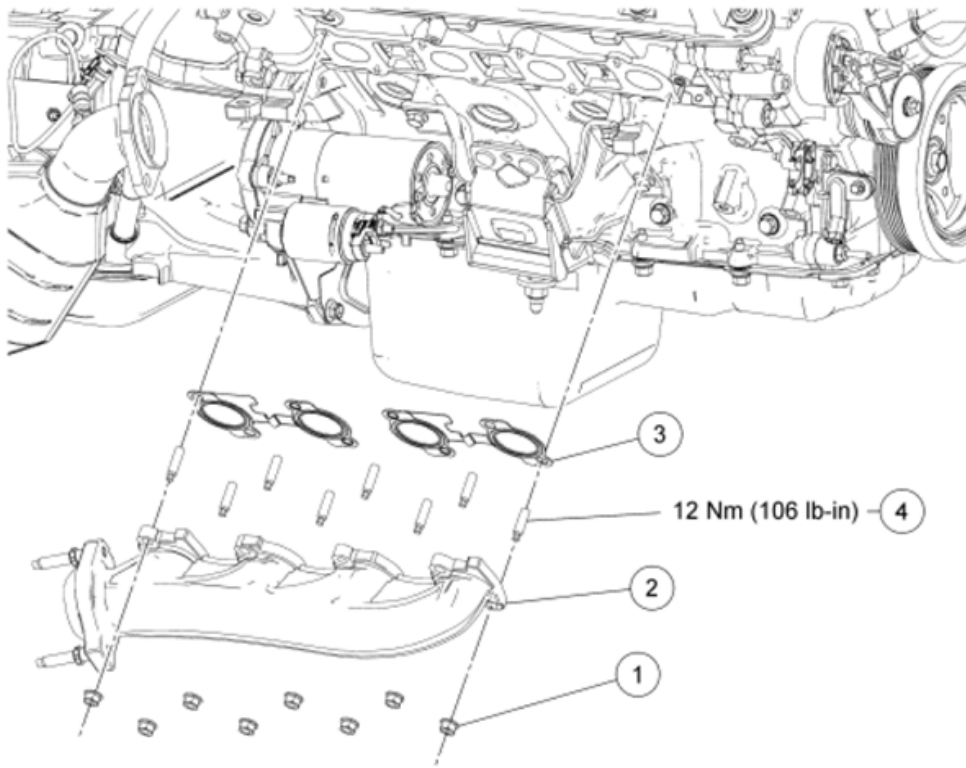
Fig. 91: Exploded View Of Exhaust Manifold Components With Torque Specifications - RH (View 2 Of 3)

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N807218	Transmission cooler tube bracket bolt
2	W705443	Transmission cooler tube bracket nut
3	7H420	Transmission cooler tube assembly
4	W707821	A/C compressor stud bolt (3 required)
5	19D629	A/C compressor
6	N811485	Catalytic converter-to-exhaust manifold nut (2 required)
7	5F250	Catalytic converter flange

Exhaust Manifold - RH (View 3 of 3)



N0087529

Fig. 92: Exploded View Of Exhaust Manifold Components With Torque Specifications - RH (View 3 Of 3)

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W701706	Exhaust manifold nut (8 required)
2	9430	Exhaust manifold
3	9Y431	Exhaust manifold gasket (2 required)
4	W707747	Exhaust manifold stud (8 required)

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.

3. Rotate the drive belt tensioner clockwise and remove the drive belt.



Fig. 93: Rotating Tensioner Clockwise
Courtesy of FORD MOTOR CO.

4. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
5. Disconnect the A/C compressor electrical connector.
6. Remove the bolt from the transmission cooler tube bracket.
7. Remove the nut and position aside the transmission cooler tube assembly.
8. Remove the 3 bolts and position aside the A/C compressor.
9. Remove the catalytic converter-to-exhaust manifold nuts and position aside the catalytic converter flange.
 - Discard the nuts.
10. Remove the 8 nuts, the exhaust manifold and the gasket.
 - Discard the nuts and gasket.
11. Remove and discard the 8 exhaust manifold studs.
12. Clean and inspect the exhaust manifold for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

Installation

1. Install the 8 new exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
2. Install a new exhaust manifold gasket, the exhaust manifold and 8 new nuts.
 - Tighten in sequence shown in the illustration to 20 Nm (177 lb-in).

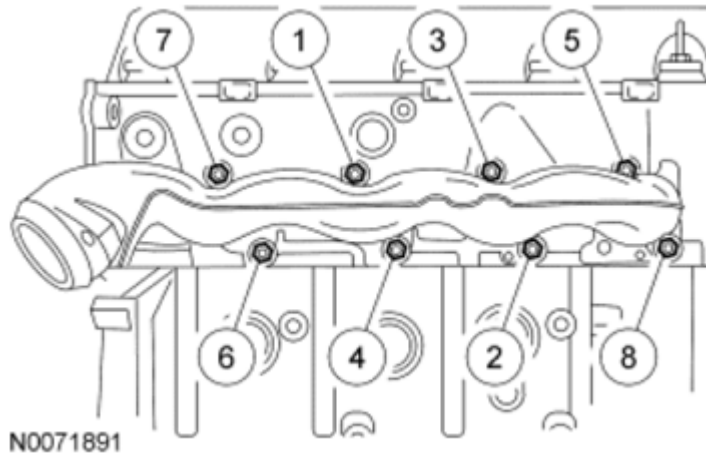


Fig. 94: Identifying Exhaust Manifold Gasket And Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Position the catalytic converter flange and install the new catalytic converter-to-exhaust manifold nuts.
 - Tighten to 48 Nm (35 lb-ft).
4. Position the A/C compressor and install the 3 bolts.
 - Tighten to 25 Nm (18 lb-ft).
5. Position the transmission cooler tube assembly and install the nut.
 - To install, tighten to 9 Nm (80 lb-in).
6. Install the transmission cooler tube bracket bolt.
 - To install, tighten to 15 Nm (133 lb-in).
7. Connect the A/C compressor electrical connector.
8. Connect the CKP sensor electrical connector.
9. Rotate the drive belt tensioner clockwise and install the drive belt.

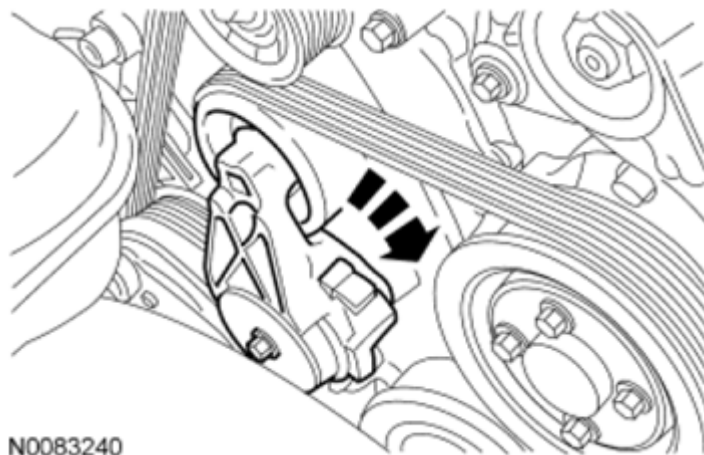


Fig. 95: Rotating Tensioner Clockwise
Courtesy of FORD MOTOR CO.

10. Connect the battery ground cable. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

11. If equipped with a fire suppression system, repower the system.

EXHAUST MANIFOLD - LH

Exhaust Manifold - LH (View 1 of 2)

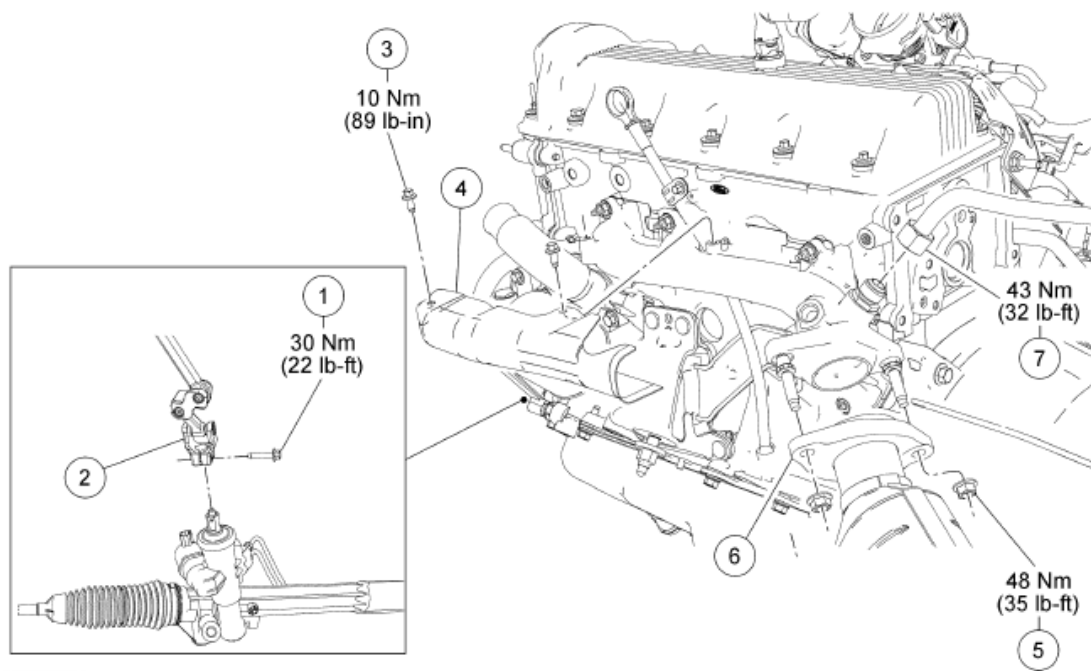
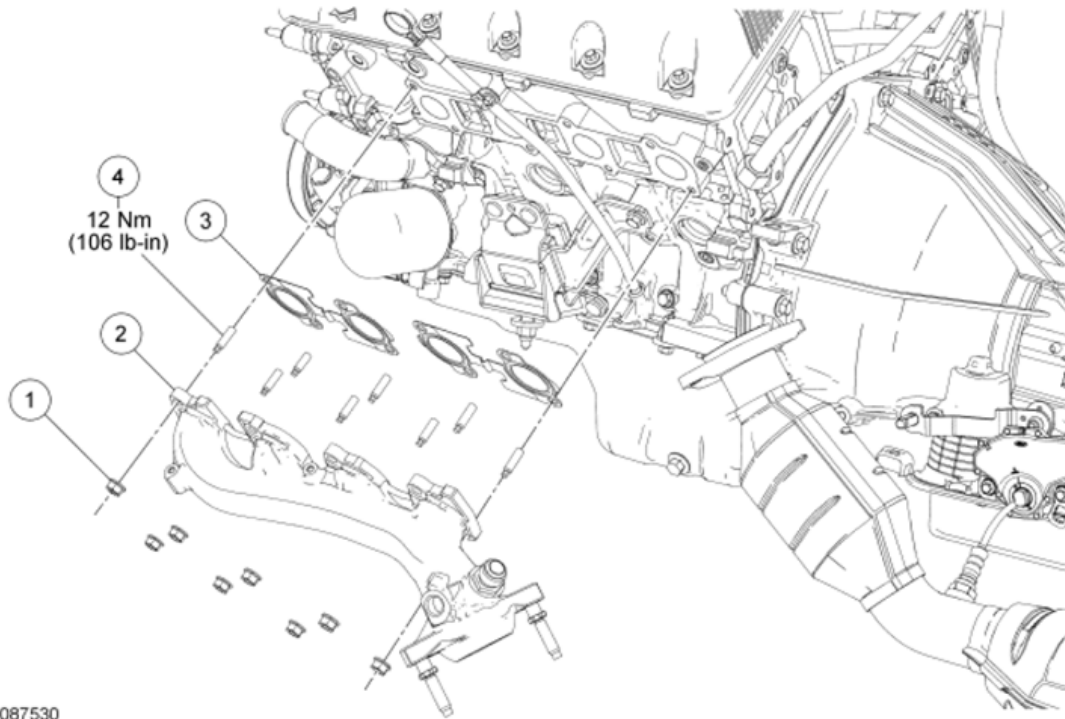


Fig. 96: Identifying Exhaust Manifold Components With Torque Specifications - LH (View 1 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W710821	Intermediate steering shaft pinch bolt
2	3C662	Intermediate steering shaft
3	W707130	Exhaust manifold heat shield bolt (2 required)
4	9Y427	Exhaust manifold heat shield
5	N811485	Catalytic converter-to-exhaust manifold nut (2 required)
6	5F250	Catalytic converter flange
7	9D477	EGR system module tube

Exhaust Manifold - LH (View 2 of 2)



N0087530

Fig. 97: Identifying Exhaust Manifold Components With Torque Specifications - LH (View 2 Of 2)
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W701706	Exhaust manifold nut (8 required)
2	9431	Exhaust manifold
3	9Y431	Exhaust manifold gasket (2 required)
4	W707747	Exhaust manifold stud (8 required)

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.

NOTE: Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).

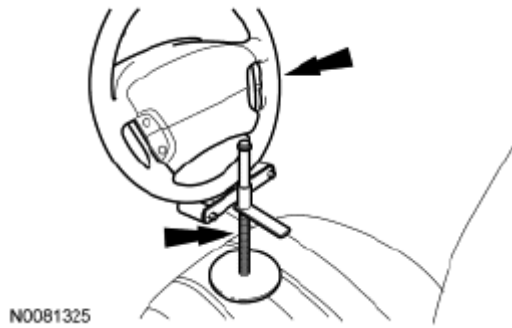


Fig. 98: Holding Steering Wheel Using A Suitable Holding Device
Courtesy of FORD MOTOR CO.

2. Using a suitable holding device, hold the steering wheel in the straight-ahead position.

NOTE: Do not allow the intermediate shaft to rotate while it is disconnected from the steering gear or damage to the clockspring may result. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

3. Remove the intermediated shaft pinch bolt and detach the intermediate shaft from the steering gear and position aside.
4. Remove the 2 exhaust manifold heat shield bolts and the shield.
5. Remove the 2 catalytic converter-to-exhaust manifold nuts and position aside the catalytic converter flange.
 - Discard the nuts.
6. Disconnect the EGR system module tube from the exhaust manifold.
7. Remove the LH Heated Oxygen Sensor (HO2S). For additional information, refer to **ENGINE CONTROLS - ELECTRONIC ENGINE CONTROLS** article.
8. Remove the 8 nuts, the exhaust manifold and the gasket.
 - Discard the nuts and gasket.
9. Remove and discard the 8 exhaust manifold studs.
10. Clean and inspect the exhaust manifold for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

Installation

1. Install the 8 new exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
2. Install a new exhaust manifold gasket, the exhaust manifold and 8 new nuts.
 - Tighten in sequence shown in the illustration to 20 Nm (177 lb-in).

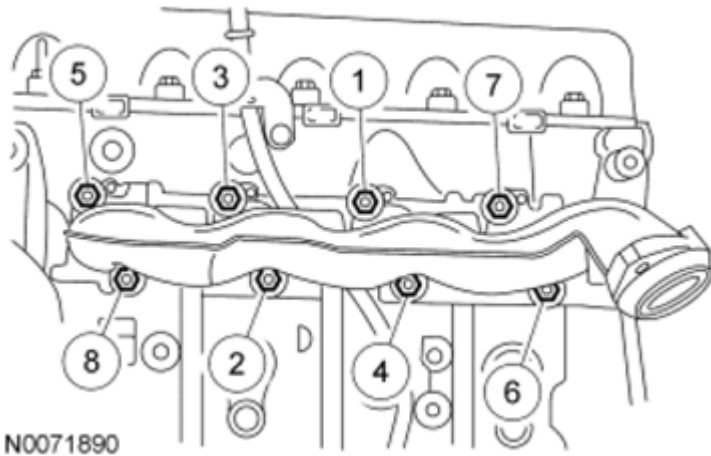


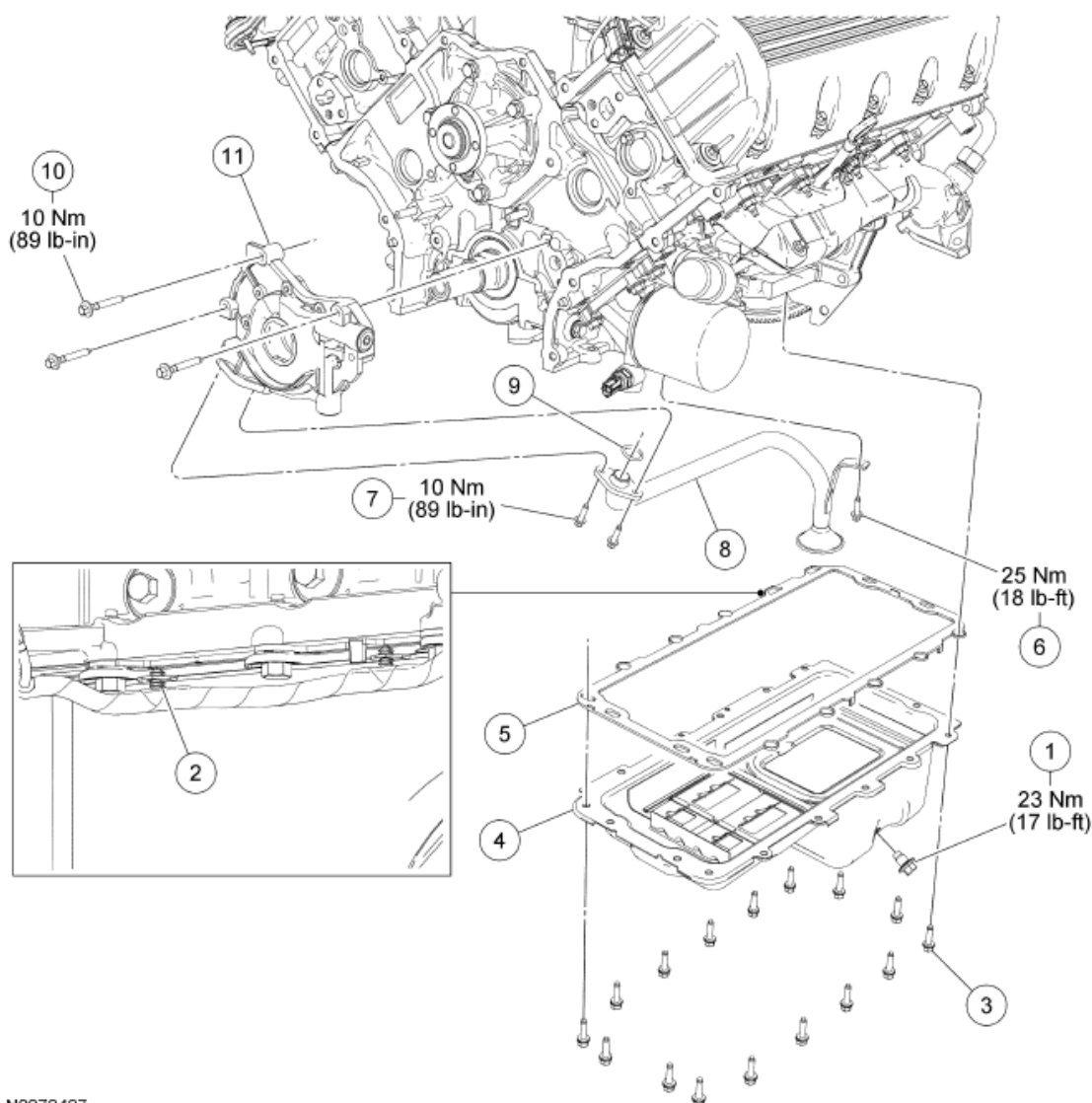
Fig. 99: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the LH HO2S. For additional information, refer to **ENGINE CONTROLS - ELECTRONIC ENGINE CONTROLS** article.
4. Connect the EGR system module tube to the exhaust manifold.
 - Tighten to 43 Nm (32 lb-ft).
5. Position the catalytic converter flange and install the new catalytic converter-to-exhaust manifold nuts.
 - Tighten to 48 Nm (35 lb-ft).
6. Install the exhaust manifold heat shield and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).
7. Position the intermediate shaft on the steering gear and install the pinch bolt.
 - Tighten to 30 Nm (22 lb-ft).

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

8. If equipped with a fire suppression system, repower the system

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW, OIL PAN, OIL PUMP, OIL PUMP SCREEN AND PICKUP TUBE



N0072427

Fig. 100: Removing Crankshaft Oil Slinger Using Crankshaft Rear Oil Slinger Remover And Slide Hammer

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6730	>Oil pan drain plug
2	-	Pin-type wire harness retainer (part of 12B637) (2 required)
3	W701605	Oil pan bolt (16 required)
4	6675	Oil pan
5	6710	Oil pan gasket
6	N605904	Oil pump screen and pickup tube-to-spacer bolt
7	N806155	Oil pump screen and pickup tube-to-oil pump bolt (2 required)
8	6622	Oil pump screen and pickup tube

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9	6625	Oil pump screen and tube O-ring seal
10	N806183	Oil pump bolt (3 required)
11	6621	Oil pump

1. For additional information, refer to the appropriate procedures in this service information.

OIL PAN

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
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	-

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the front crossmember. For additional information, refer to **BODY SYSTEM - UNI-BODY, SUBFRAME & MOUNTING SYSTEM** article.
3. Remove the bolt and the nut. Position the transmission cooler tubes aside.

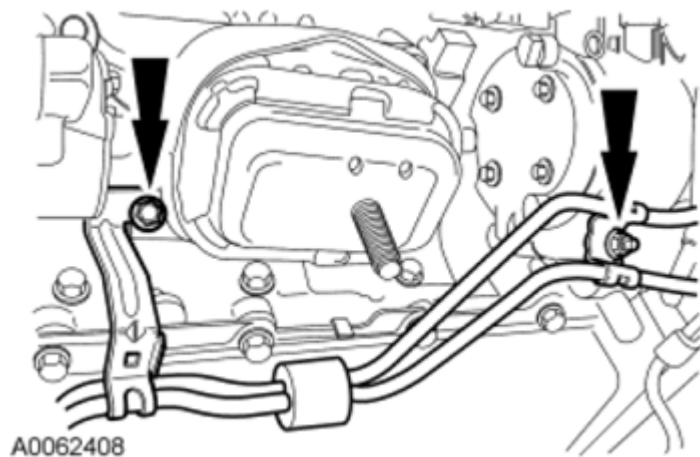


Fig. 101: Locating Transmission Cooler Tubes Mounting Bolt And Nuts
Courtesy of FORD MOTOR CO.

4. Drain the engine oil.
 - Install the drain plug when finished.
 - Tighten to 23 Nm (17 lb-ft).
5. Detach the 2 pin-type wire harness retainers.
6. Remove the oil pan bolts in the sequence shown in the illustration.

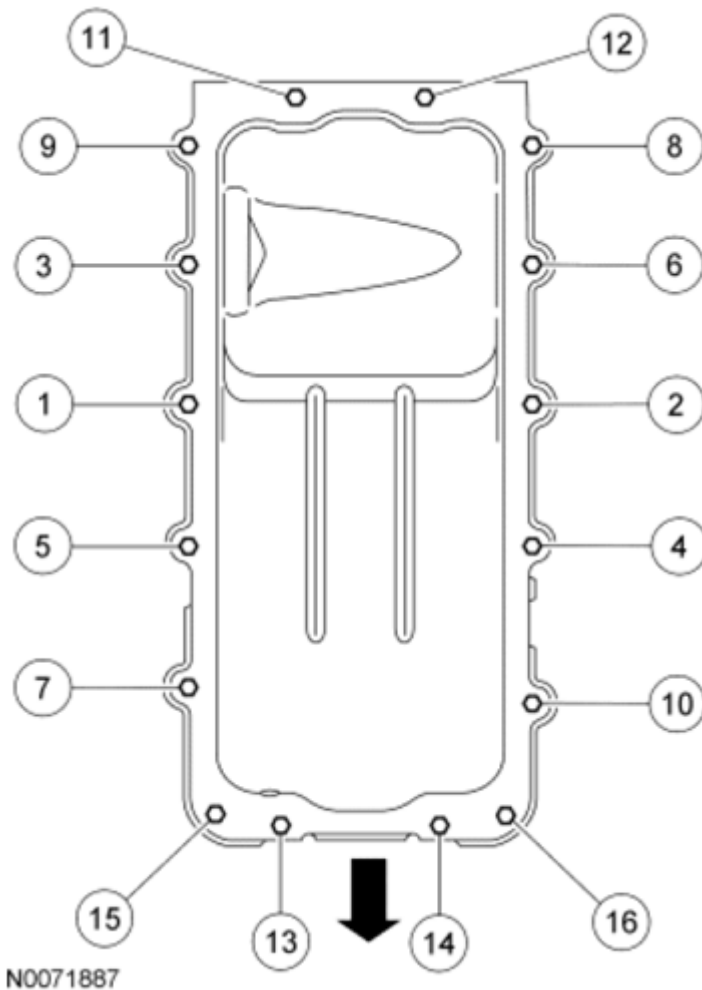


Fig. 102: Identifying Oil Pan Bolts Removal/Installing Sequence
Courtesy of FORD MOTOR CO.

7. Remove the oil pan and the gasket.

Installation

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

1. Clean and inspect the mating surfaces.

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.

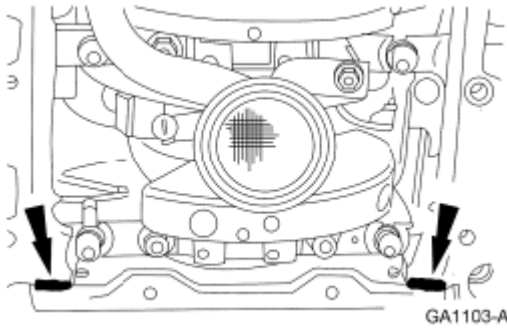
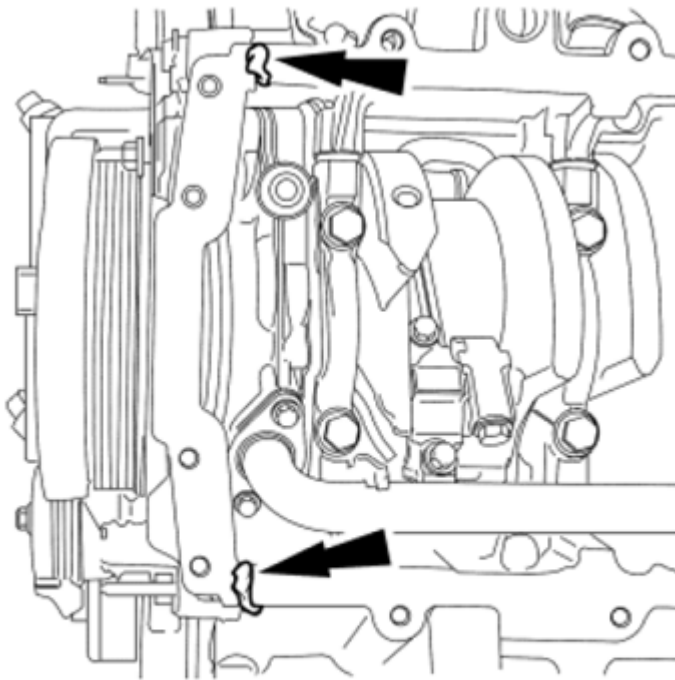


Fig. 103: Locating Crankshaft Rear Seal Retainer Plate-To-Cylinder Block Sealing Surface
 Courtesy of FORD MOTOR CO.

2. Apply silicone gasket and sealant at the rear seal retainer-to-cylinder block sealing surface.

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.



A0072750

Fig. 104: Locating Silicone Gasket And Sealant Application Areas For Engine Front Cover-To-Cylinder Block Mating Surface
 Courtesy of FORD MOTOR CO.

3. Apply silicone gasket and sealant at the engine front cover-to-cylinder block mating surface.
4. Position the oil pan gasket and the oil pan.
5. Tighten the bolts in 2 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Rotate an additional 60 degrees.

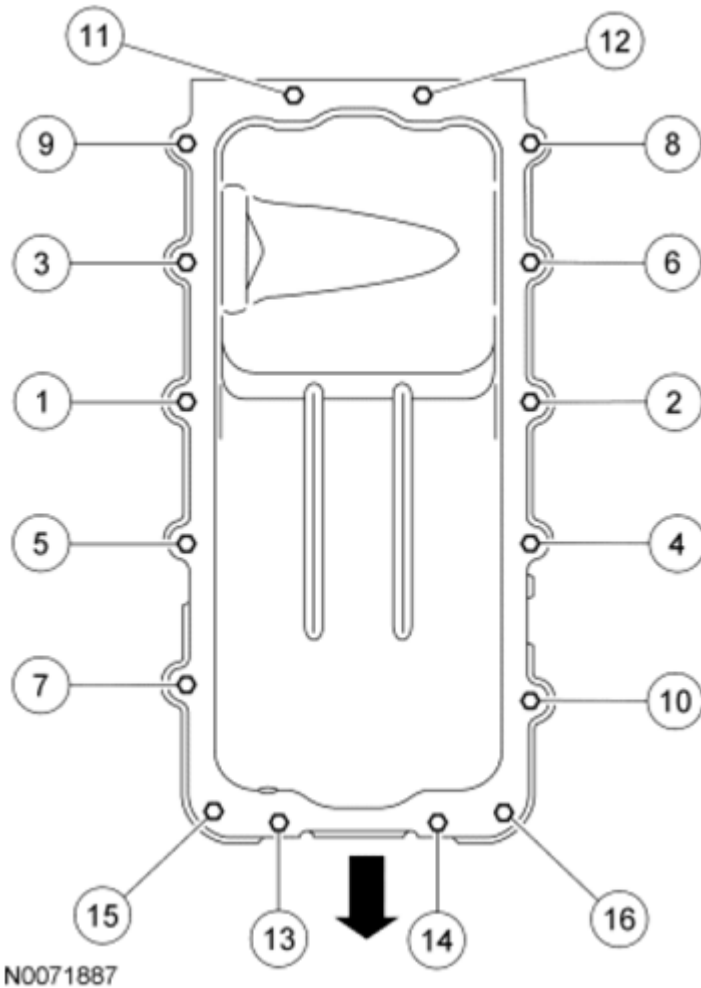


Fig. 105: Identifying Oil Pan Bolts Removal/Installing Sequence
 Courtesy of FORD MOTOR CO.

6. Attach the 2 pin-type wire harness retainers.
7. Position the transmission cooler tubes and install the bolt and the nut.
 1. Tighten the bolt to 15 Nm (133 lb-in).
 2. Tighten the nut to 9 Nm (80 lb-in).

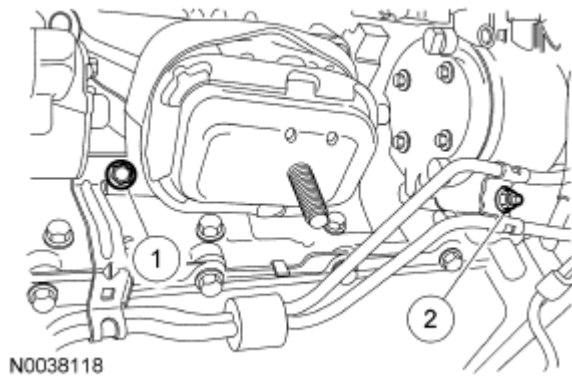


Fig. 106: Identifying Transmission Cooler Tubes Mounting Nuts
Courtesy of FORD MOTOR CO.

8. Install the front crossmember. For additional information, refer to **BODY SYSTEM - UNI-BODY, SUBFRAME & MOUNTING SYSTEM** article.
9. Fill the engine with clean engine oil.
10. Start the engine and check for leaks.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

11. If equipped with a fire suppression system, repower the system.

OIL PUMP

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
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

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW, OIL PAN, OIL PUMP, OIL PUMP SCREEN AND PICKUP TUBE AND OIL PAN** in this service information.
3. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS** in this service information.
4. Remove the 3 bolts, the oil pump screen and pickup tube.
 - Discard the O-ring seal.
5. Remove the 3 bolts and the oil pump.

Installation

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.

1. Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging. Inspect the mating surfaces.
2. Position the oil pump and install the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).

NOTE: Make sure the O-ring seal is in place and not damaged. A missing or damaged O-ring seal can cause foam in the lubrication system, low oil pressure and severe engine damage.

NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil prior to installation.

3. Position the oil pump screen and pickup tube and install the bolts.
 - Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
 - Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).
4. Install the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS** in this service information.
5. Install the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW, OIL PAN, OIL PUMP, OIL PUMP SCREEN AND PICKUP TUBE AND OIL PAN** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

6. If equipped with a fire suppression system, repower the system.

OIL PUMP SCREEN AND PICKUP TUBE

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW, OIL PAN, OIL PUMP, OIL PUMP SCREEN AND PICKUP TUBE AND OIL PAN** in this service information.
3. Remove the 3 bolts, the oil pump screen and pickup tube.
 - Discard the O-ring seal.

Installation

NOTE: Make sure the O-ring seal is in place and not damaged. A missing or damaged O-ring seal can cause foam in the lubrication system, low oil pressure and severe engine damage.

NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil prior to installation.

1. Position the oil pump screen and pickup tube and install the bolts.
 - Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
 - Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).
2. Install the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW, OIL PAN, OIL PUMP, OIL PUMP SCREEN AND PICKUP TUBE AND OIL PAN** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

3. If equipped with a fire suppression system, repower the system.

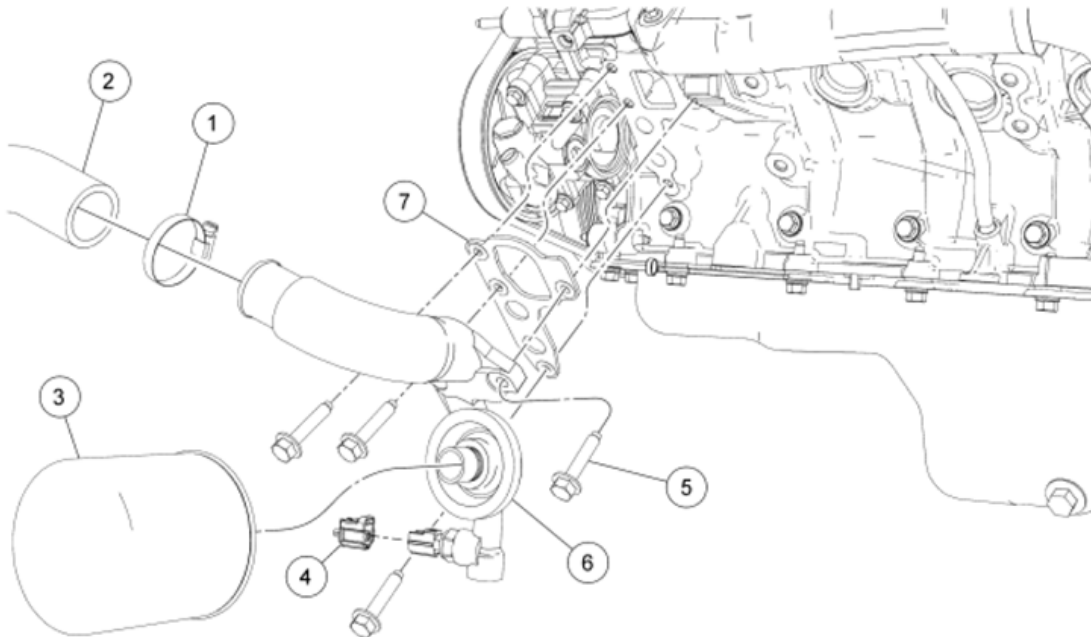
OIL FILTER ADAPTER

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

Oil Filter Adapter Without Oil Cooler



N0093722

Fig. 107: Exploded View Of Oil Filter Adapter Without Oil Cooler Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description

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2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis

1	W525939	Lower radiator hose clamp
2	8B273	Lower radiator hose
3	6714	Oil filter
4	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12B637)
5	W705128	Oil filter adapter bolt (4 required)
6	6881	Oil filter adapter
7	6A636	Oil filter adapter gasket

Oil Filter Adapter With Oil Cooler

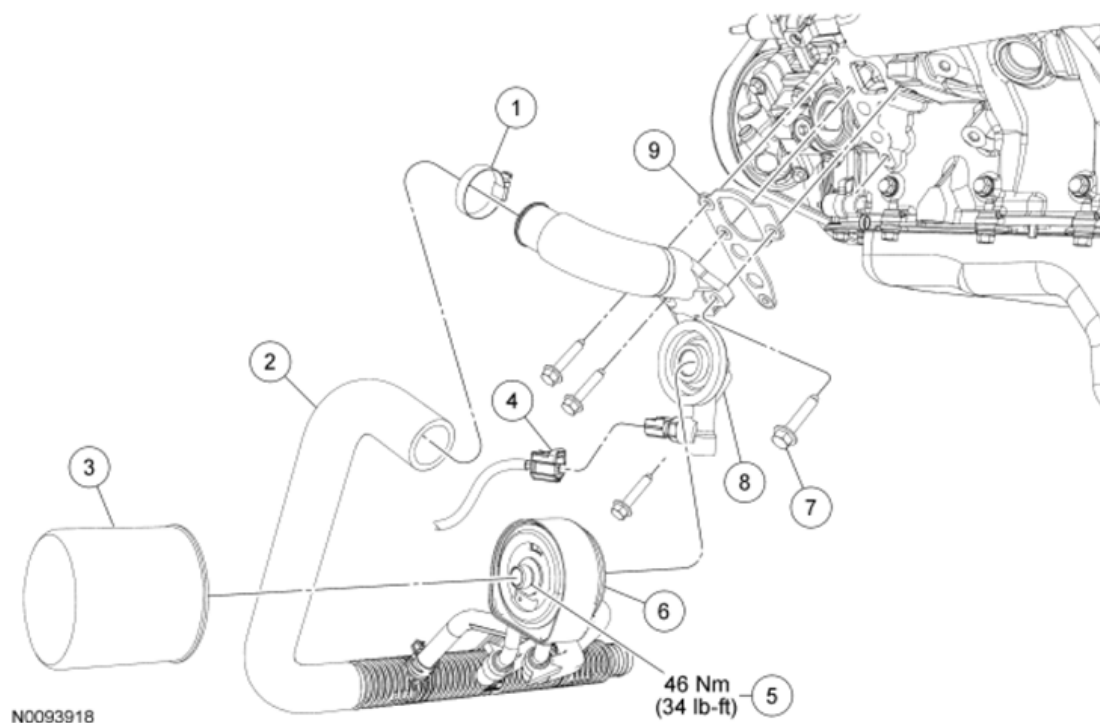


Fig. 108: Exploded View Of Oil Filter Adapter With Oil Cooler Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W525939	Lower radiator hose clamp
2	8B273	Lower radiator hose
3	6714	Oil filter
4	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12B637)
5	6890	Oil cooler mounting bolt
6	6A642	Oil cooler
7	W705128	Oil filter adapter bolt (4 required)
8	6881	Oil filter adapter
9	6A636	Oil filter adapter gasket

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Drain the cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.
3. Disconnect the lower radiator hose from the oil filter adapter.
4. Remove and discard the oil filter.
5. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
6. If equipped, remove the oil cooler mounting bolt and position the oil cooler aside.
7. Remove the 4 bolts and the oil filter adapter and gasket.
 - Discard the oil filter adapter gasket.

Installation

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

1. Clean the sealing surfaces.
2. Install a new gasket and the oil filter adapter and tighten the 4 bolts in the sequence shown in the illustration.
 - Tighten to 25 Nm (18 lb-ft).

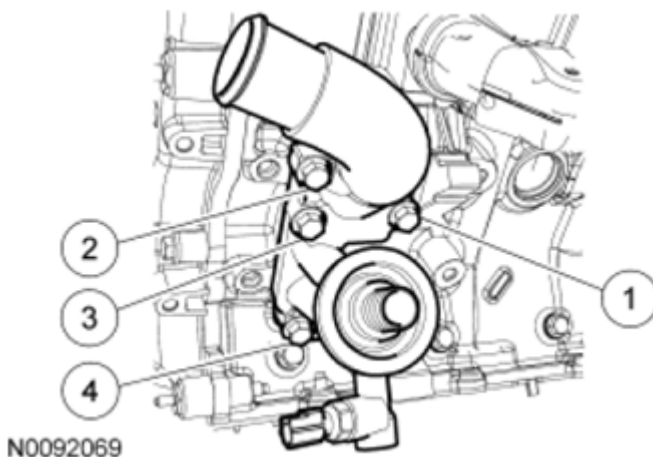


Fig. 109: Identifying Gasket And Oil Filter Adapter Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the oil cooler-to-oil filter adapter seal with clean engine oil.

3. If equipped, position the oil cooler and install the oil cooler mounting bolt.
 - Tighten to 46 Nm (34 lb-ft).
4. Connect the EOPswitch electrical connector.

NOTE: Lubricate the oil filter seal with clean engine oil.

5. Install the oil filter.
6. Connect the lower radiator hose to the oil filter adapter.
7. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

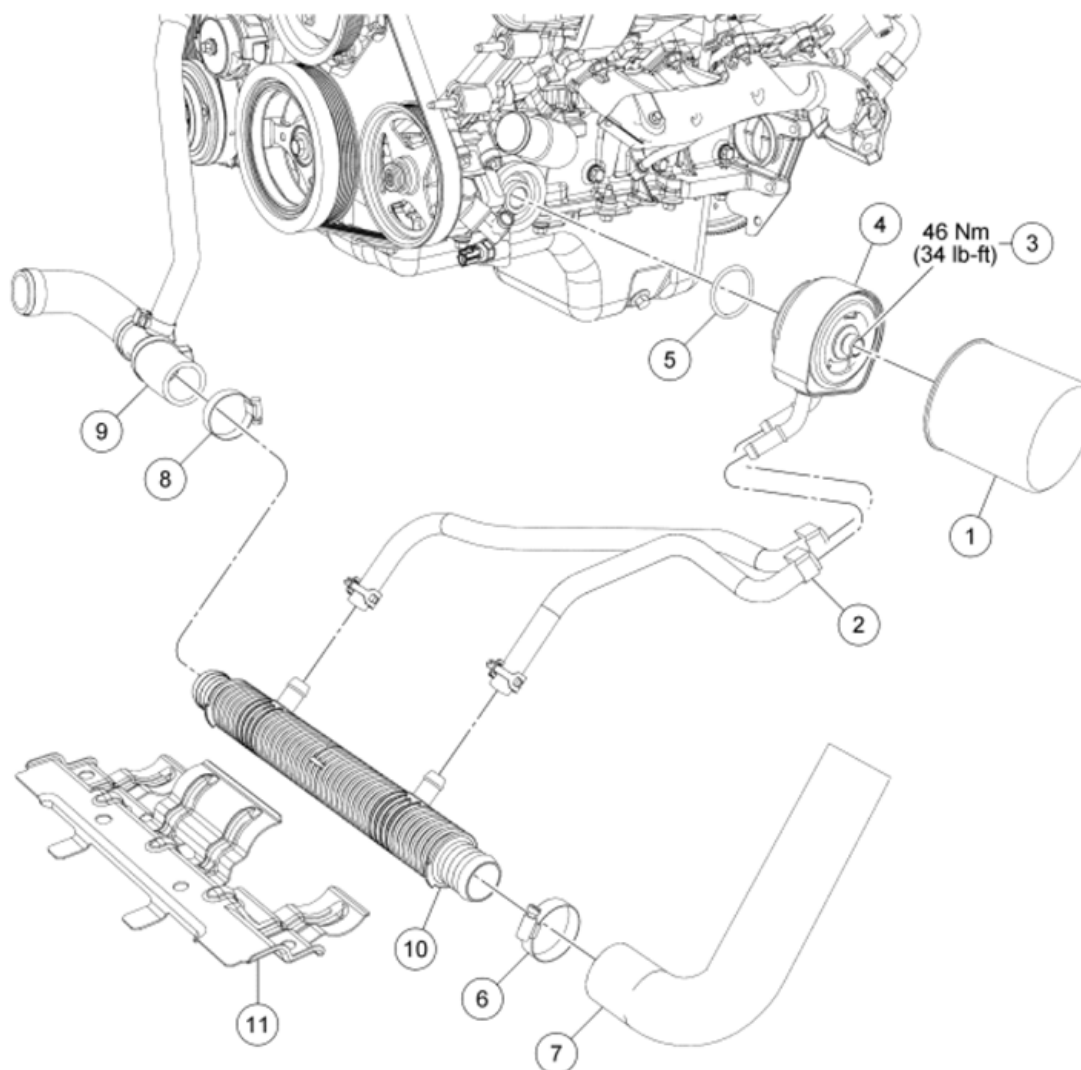
8. If equipped with a fire suppression system, repower the system.

OIL COOLER

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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



N0091704

Fig. 110: Exploded View Of Oil Cooler Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6714	Oil filter
2	8B273	Oil cooler coolant hose (2 required)
3	6890	Oil cooler mounting bolt
4	6A642	Oil cooler
5	-	Oil cooler-to-oil filter adapter O-ring seal
6	15161	Coolant hose clamp
7	8286	Coolant hose
8	15161	Coolant hose clamp
9	8286	Coolant hose

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10	-	Coolant tube
11	-	Cooler tube mounting bracket

Removal and Installation

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Drain the cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.
3. Remove and discard the oil filter.
 - To install, lubricate the new oil filter O-ring seal with clean engine oil.

NOTE: For correct installation, the white lines on the coolant hoses must be aligned with the black dots on the oil cooler tubes. If the black dots are not visible, mark the oil cooler tube with a permanent marker before disconnecting the hoses. Failure to follow this instruction may result in damage to the coolant hoses.

4. Disconnect the 2 coolant hoses from the oil cooler.
 - To install, align the white lines on the coolant hoses with the black dots on the cooler tubes.

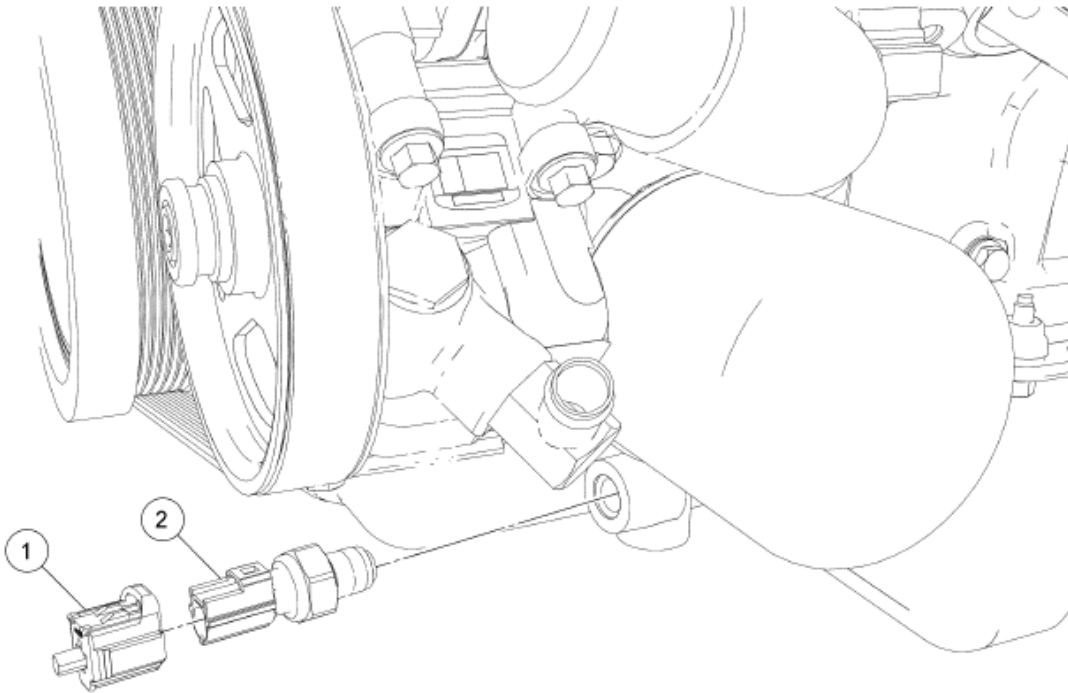
NOTE: If metal or aluminum material is present in the oil cooler, mechanical concerns exist. Severe damage to the engine may occur. To diagnose mechanical concerns, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article. Failure to follow this instruction may result in additional engine damage.

5. Remove the oil cooler mounting bolt and the oil cooler and inspect.
 - To install, lubricate the oil cooler-to-oil filter adapter O-ring seal with clean engine oil.
 - To install, tighten to 46 Nm (34 lb-ft).

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

6. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.

ENGINE OIL PRESSURE (EOP) SWITCH



N0038117

Fig. 111: Identifying Engine Oil Pressure (EOP) Switch Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12B637)
2	9278	EOPswitch

Removal and Installation

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Disconnect the Engine Oil Pressure (EOP) switch electrical connector and remove the EOPswitch.
 - To install, tighten to 14 Nm (124 lb-in), then tighten an additional 180 degrees.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

3. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.

OIL LEVEL INDICATOR AND TUBE

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

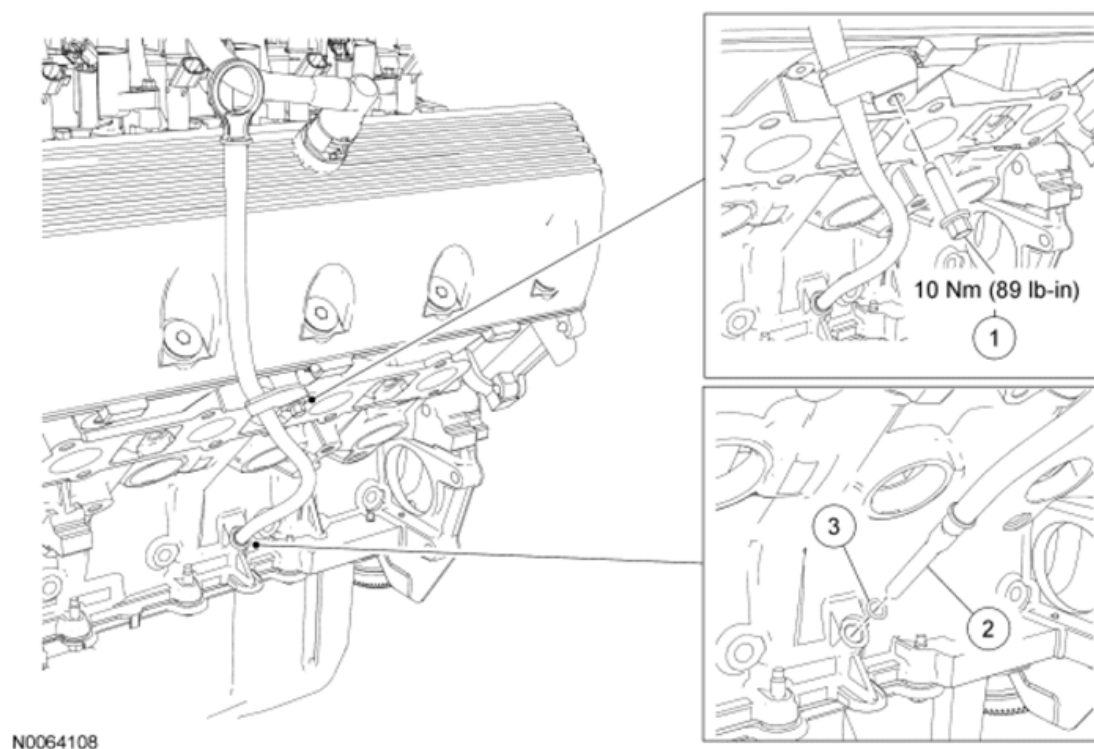


Fig. 112: Identifying Oil Level Indicator And Tube Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N806155	Oil level indicator tube bolt
2	6754	Oil level indicator tube
3	-	Oil level indicator tube O-ring seal

Removal and Installation

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the LH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD - LH** in this service information.
3. Remove the oil level indicator.
4. Remove the bolt and the oil level indicator tube.
 - To install, tighten to 10 Nm (89 lb-in).

NOTE: Failure to lubricate the O-ring seal and the oil level indicator tube-to-engine block mating surface with clean engine oil may result in engine oil leaks.

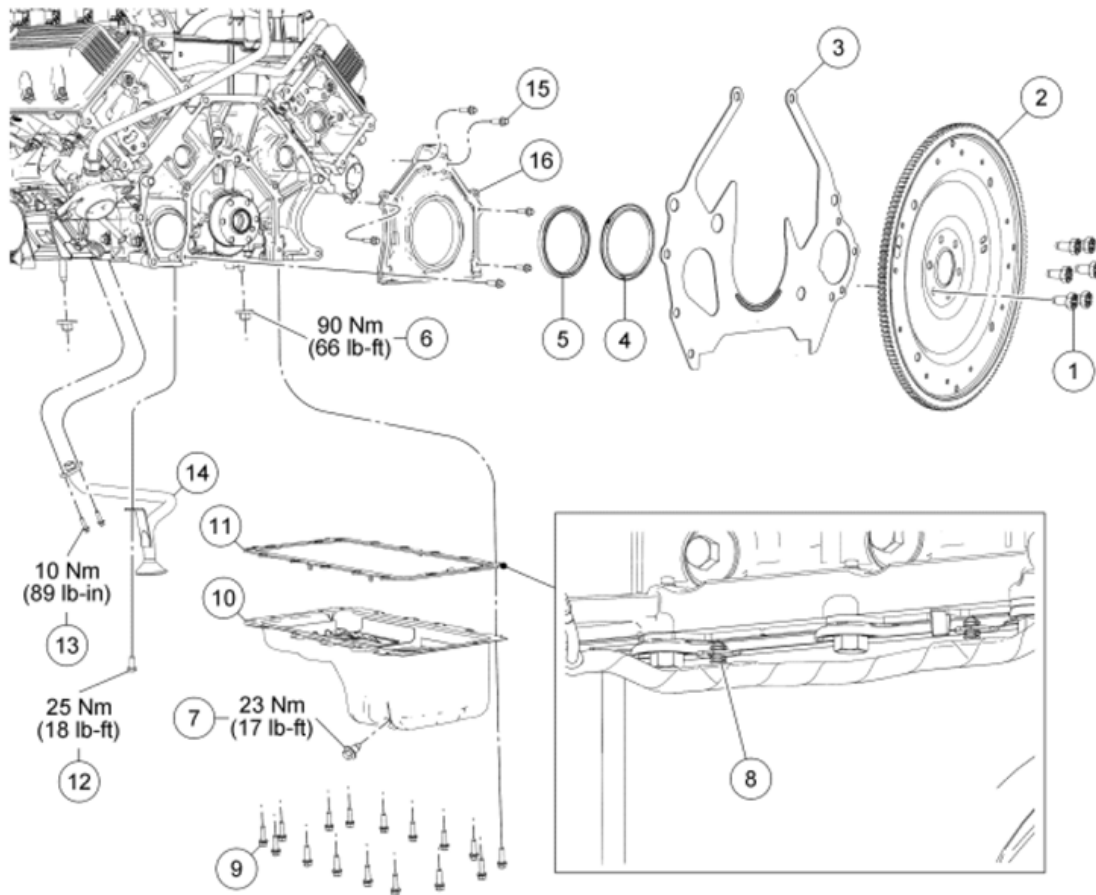
NOTE: Make sure the O-ring seal remains in position and does not roll up the indicator tube during installation or engine oil leaks may occur.

5. Remove the O-ring seal and discard.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

6. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.
 - Lubricate the new O-ring seal and engine mating surface with clean engine oil.

LOWER END COMPONENTS - EXPLODED VIEW, FLEXPLATE AND CRANKSHAFT REAR SEAL WITH RETAINER PLATE



N0071895

Fig. 113: Exploded View Of Flexplate and Crankshaft Rear Seal with Retainer Plate Lower End Components With Torque Specifications
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N806168	Flexplate bolt (6 required)
2	6375	Flexplate
3	6A373	Engine-to-transmission spacer plate
4	6310	Crankshaft oil slinger
5	6701	Crankshaft rear seal
6	W707492	Engine mount nut (2 required)
7	6730	Oil pan drain plug
8	-	Wire harness pin-type retainer (2 required)
9	W701605	Oil pan bolt (16 required)
10	6675	Oil pan
11	6710	Oil pan gasket

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12	N605904	Oil pump screen and pickup tube bolt
13	N806155	Oil pump screen and pickup tube bolt (2 required)
14	6622	Oil pump screen and pickup tube
15	N806155	Crankshaft rear seal retainer plate bolt (6 required)
16	6K318	Crankshaft rear seal retainer plate

1. For additional information, refer to the appropriate procedures in this service information.

FLEXPLATE

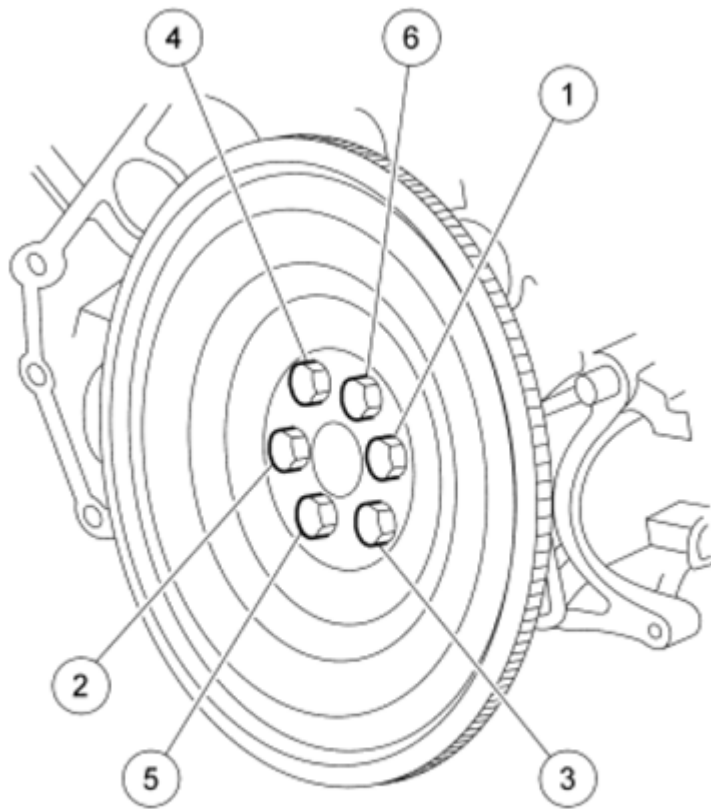
Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article
2. Remove the transmission. For additional information, refer to **AUTOMATIC TRANSMISSION - AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E** article
3. Remove the 6 bolts and the flexplate.

Installation

1. Position the flexplate and loosely install the 6 bolts. Tighten the bolts in the sequence shown in the illustration to 80 Nm (59 lb-ft).



N0071888

Fig. 114: Identifying Flexplate Mounting Bolts Tightening Sequence

Courtesy of FORD MOTOR CO.

2. Install the transmission. For additional information, refer to **AUTOMATIC TRANSMISSION - AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E** article.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

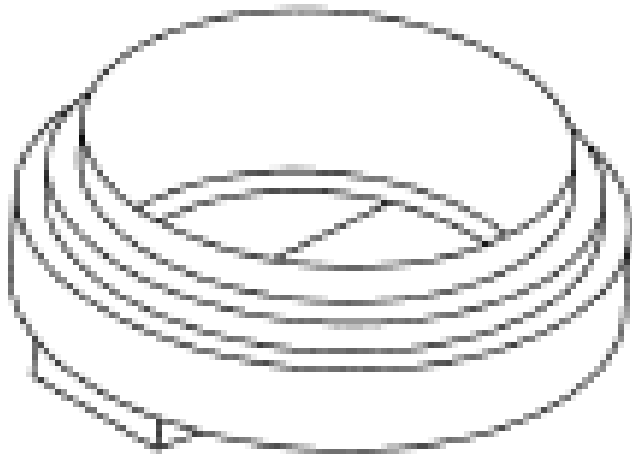
3. If equipped with a fire suppression system, repower the system.

CRANKSHAFT REAR SEAL

Special Tool(s)

SPECIAL TOOL(S)

Installer, Crankshaft Rear Oil Seal 303-516(T95P-6701-BH)
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ST1479-A



ST1480-A

Installer, Crankshaft Rear Oil Seal
303-518(T95P-6701-DH)

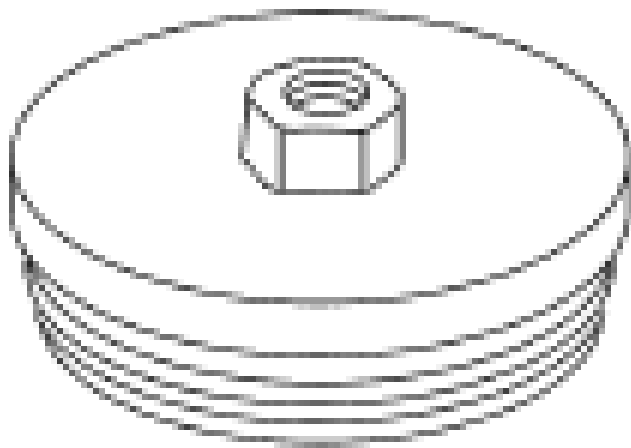
Installer, Crankshaft Rear Oil Slinger
303-517(T95P-6701-CH)

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ST1482-A



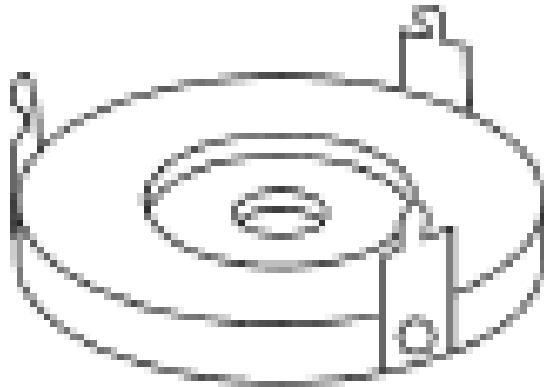
ST1382-A

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

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

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ST1481-A



ST1185-A

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

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the flexplate. For additional information, refer to **FLEXPLATE** in this service information.
3. Using the Crankshaft Rear Oil Slinger Remover and Slide Hammer, remove the crankshaft oil slinger.

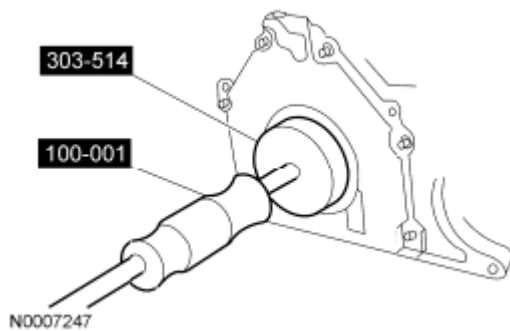


Fig. 115: Removing Crankshaft Oil Slinger Using Crankshaft Rear Oil Slinger Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

4. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove the crankshaft rear seal.

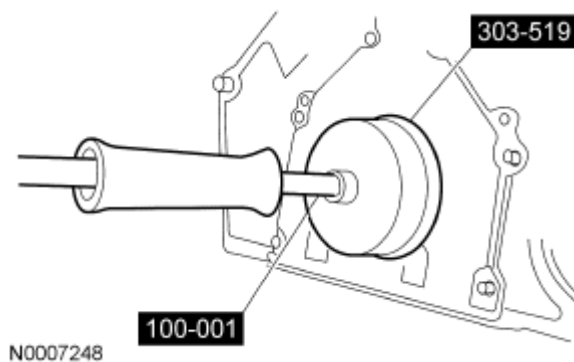


Fig. 116: Removing Crankshaft Rear Seal Using Crankshaft Rear Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

Installation

NOTE: Lubricate the inner lip of the crankshaft rear seal with engine oil.

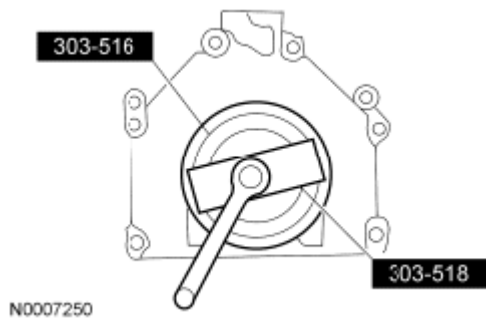


Fig. 117: Installing Crankshaft Rear Oil Seal Using Crankshaft Rear Oil Seal Installer
Courtesy of FORD MOTOR CO.

1. Using the Crankshaft Rear Oil Seal Installers, install the crankshaft rear seal.
2. Using the Crankshaft Rear Oil Slinger Installer and Crankshaft Rear Oil Seal Installers, install the crankshaft oil slinger.

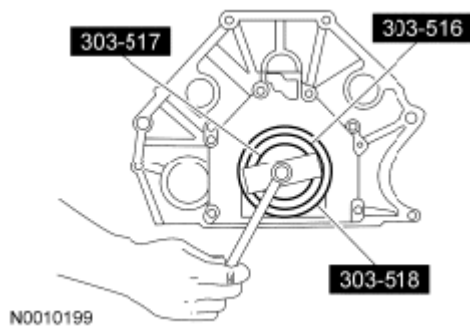


Fig. 118: Installing Crankshaft Rear Oil Slinger Using Crankshaft Rear Seal Installer
Courtesy of FORD MOTOR CO.

3. Install the flexplate. For additional information, refer to **FLEXPLATE** in this service information.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

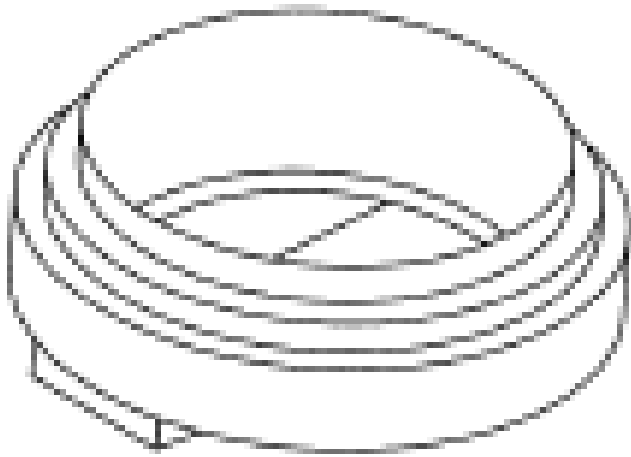
4. If equipped with a fire suppression system, repower the system.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tool(s)

SPECIAL TOOL(S)

	Installer, Crankshaft Rear Oil Seal 303-516(T95P-6701-BH)
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ST1479-A



ST1480-A

Installer, Crankshaft Rear Oil Seal
303-518(T95P-6701-DH)

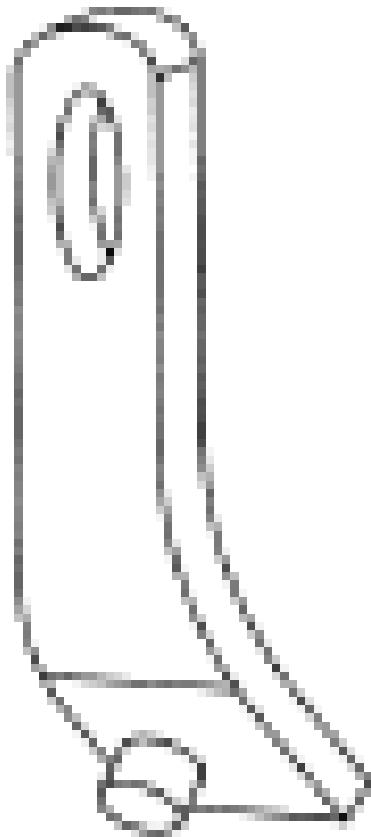
Installer, Crankshaft Rear Oil Slinger
303-517(T95P-6701-CH)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1482-A

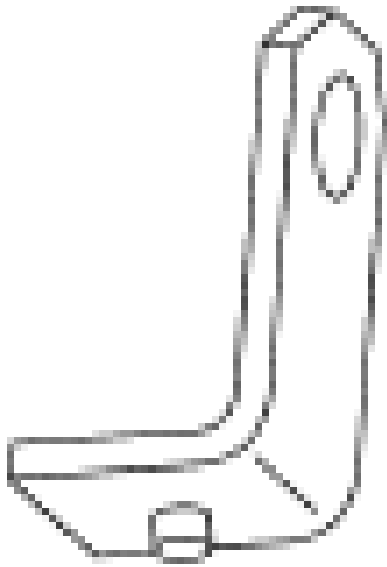


ST1603-A

Lifting Bracket, Engine
303-D087(D93P-6001-A1) or equivalent

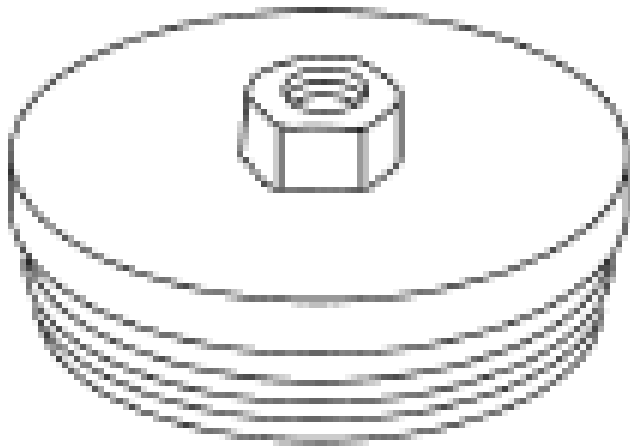
2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1604-A

Lifting Bracket, Engine
303-D088(D93P-6001-A2) or equivalent



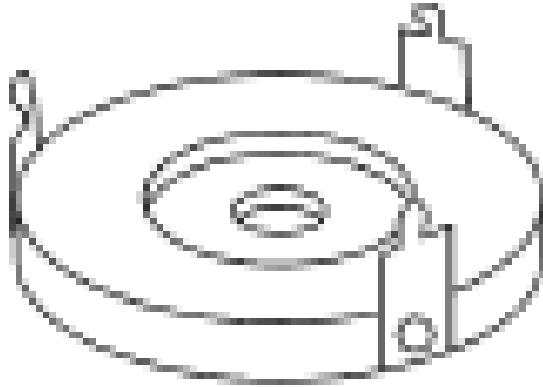
ST1382-A

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

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

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1481-A



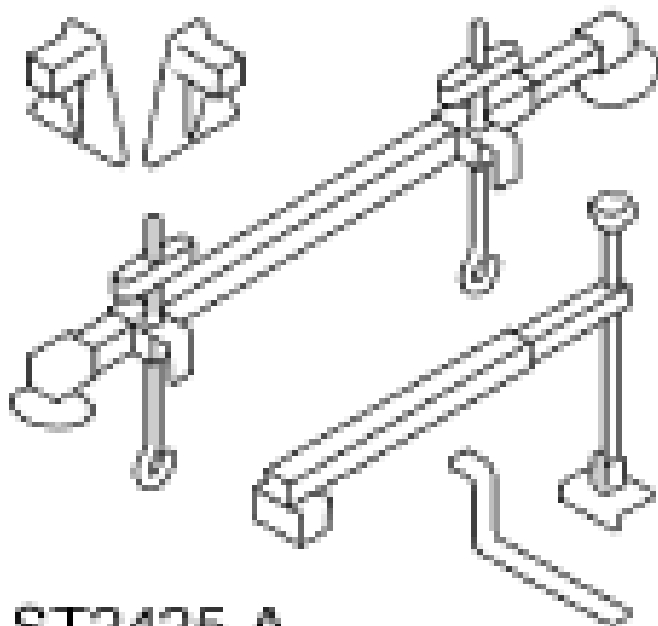
ST1185-A

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

303-F072

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



Support Bar, Engine

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Gasket Maker TA-16	WSK-M2G348-A5
Motorcraft® Metal Surface Prep ZC-31-A	-
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	-

Removal

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions

may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the flexplate. For additional information, refer to **FLEXPLATE** in this service information.
3. Remove the engine-to-transmission spacer plate.

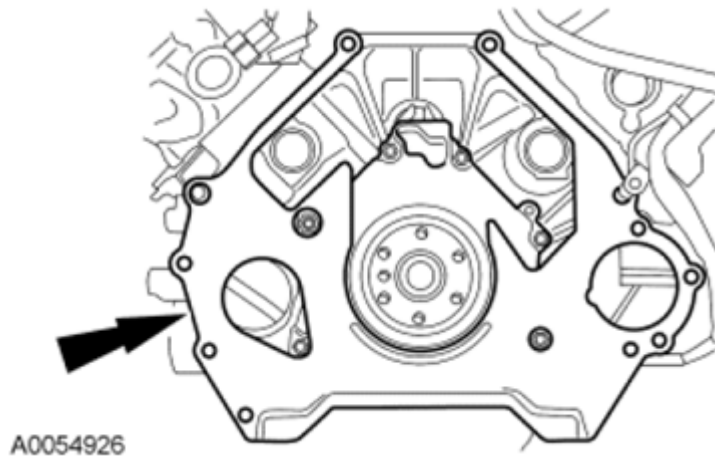


Fig. 119: Locating Engine/Transmission Spacer Plate
 Courtesy of FORD MOTOR CO.

4. Using the Crankshaft Rear Oil Slinger Remover and Slide Hammer, remove the crankshaft oil slinger.

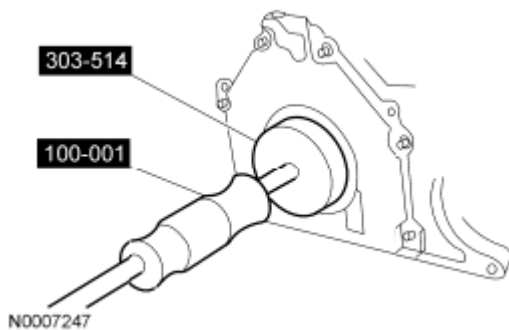


Fig. 120: Removing Crankshaft Rear Oil Seal Slinger Using Crankshaft Oil Slinger
 Courtesy of FORD MOTOR CO.

5. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove the crankshaft rear seal.

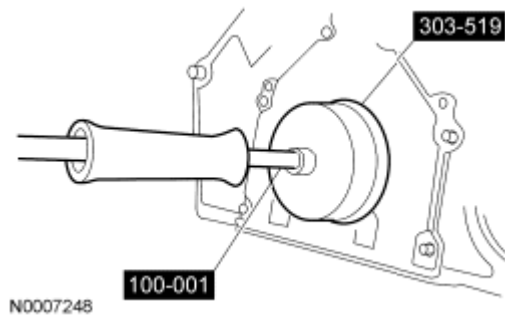


Fig. 121: Removing Crankshaft Rear Seal Using Crankshaft Rear Oil Seal Remover And Slide Hammer

Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

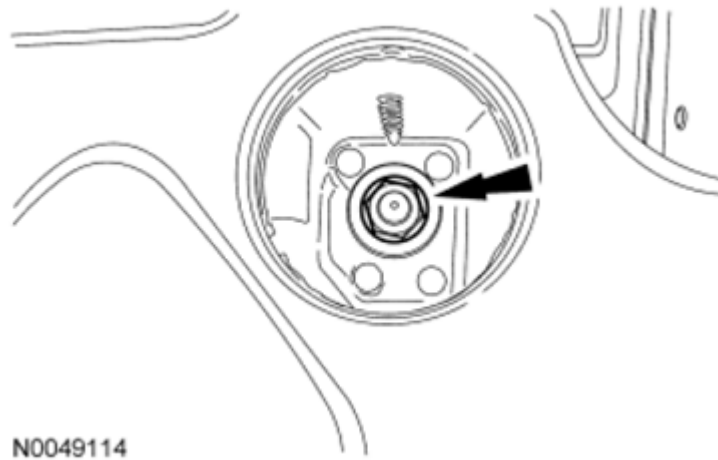


Fig. 122: Locating Engine Mount Nuts

Courtesy of FORD MOTOR CO.

6. Remove the 2 engine mount nuts.
7. Install the Engine Lifting Bracket to the RH cylinder head.

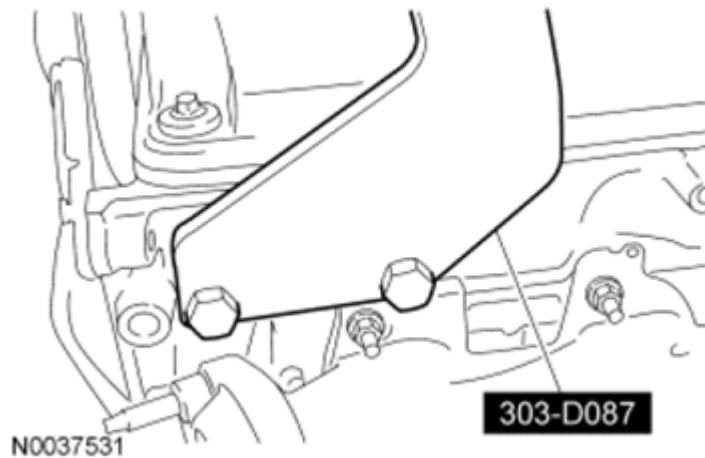


Fig. 123: Installing Engine Lifting Bracket To RH Cylinder Head
Courtesy of FORD MOTOR CO.

8. Install the Engine Lifting Bracket to the LH cylinder head.

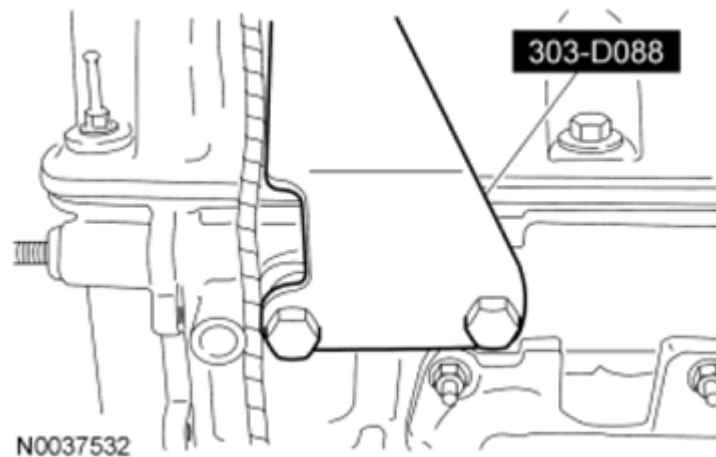


Fig. 124: Installing Engine Lifting Bracket To LH Cylinder Head
Courtesy of FORD MOTOR CO.

9. Install the Engine Support Bar.

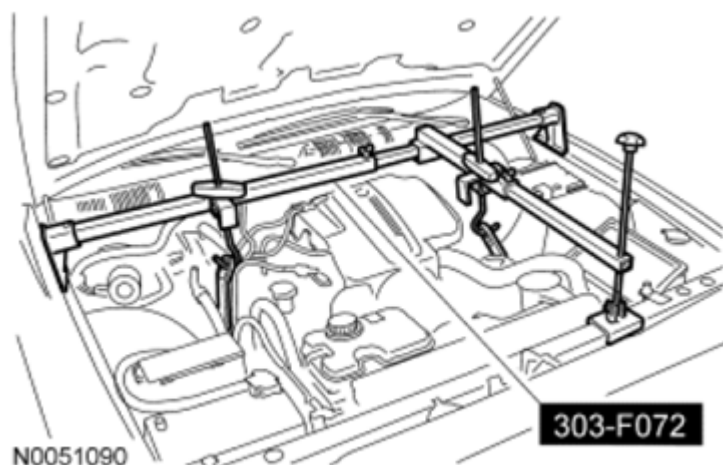


Fig. 125: Installing Engine Support Bar
Courtesy of FORD MOTOR CO.

10. Using the Engine Support Bar, raise the engine.

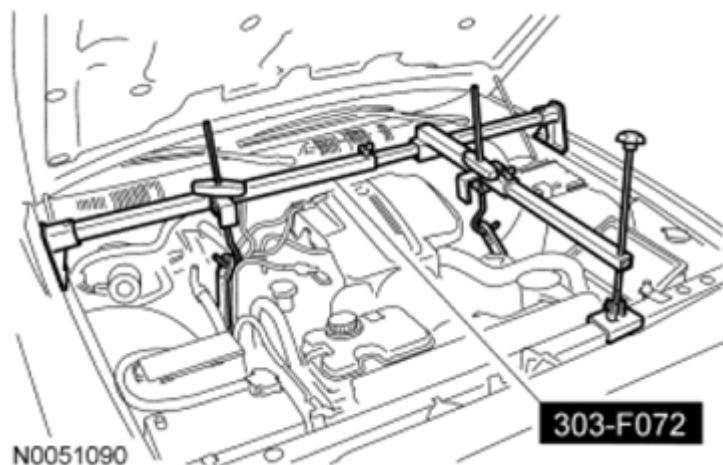


Fig. 126: Raising Engine Using Engine Support Bar
Courtesy of FORD MOTOR CO.

11. Drain the engine oil.
 - Install the drain plug when finished.
 - Tighten to 23 Nm (17 lb-ft).
12. Detach the 2 pin-type wire harness retainers.
13. Remove the oil pan bolts in the sequence shown in the illustration and partially lower the oil pan.

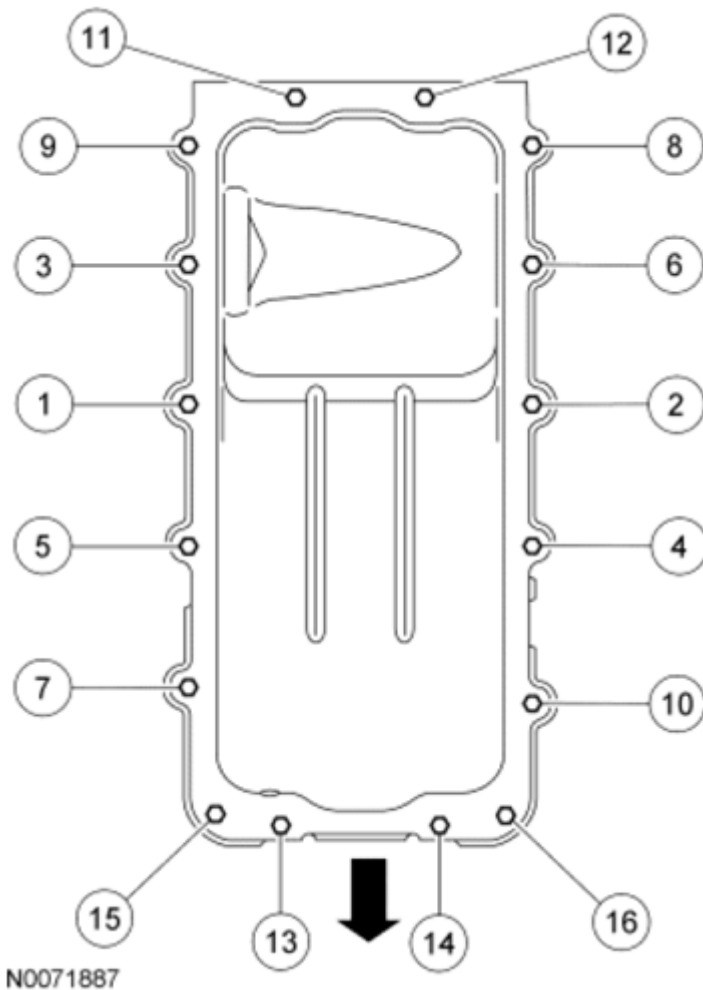


Fig. 127: Identifying Oil Pan Bolts Removal/Installing Sequence
Courtesy of FORD MOTOR CO.

14. Remove the 3 bolts and position the oil pump screen and pickup tube into the oil pan and remove the oil pan.
 - Discard the pickup tube O-ring seal.
 - Discard the oil pan gasket.
15. Remove the 6 bolts and the crankcase rear seal retainer plate.

Installation

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 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.

1. Clean and inspect the mating surface.

NOTE: The rear crankshaft seal retainer plate does not have a sealant groove. Gasket maker must be applied to the rear crankshaft seal retainer mating surface on the engine block.

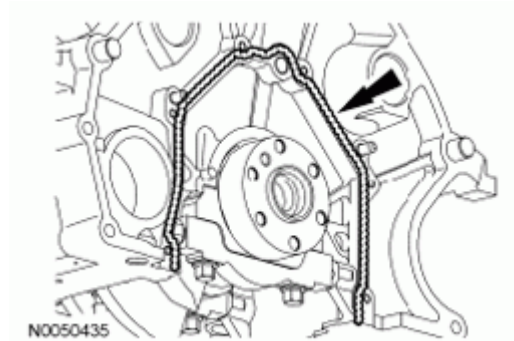


Fig. 128: Identifying Crankshaft Rear Seal Retainer Plate Mating Surface Gasket Maker Applying Area

Courtesy of FORD MOTOR CO.

2. Apply a bead of gasket maker to the rear crankshaft seal retainer mating surface on the engine block.
3. Install the rear oil seal retainer plate and loosely install the 6 crankcase rear seal retainer plate bolts.
4. Tighten the rear seal retainer plate bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).

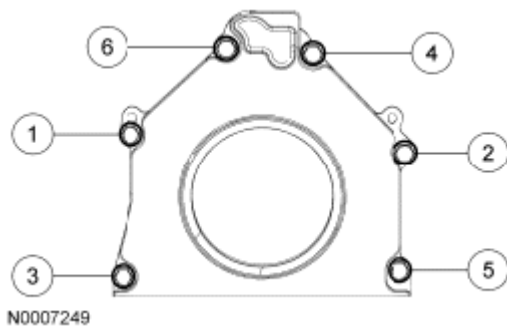


Fig. 129: Identifying Retainer Plate Bolts Tightening Sequence

Courtesy of FORD MOTOR CO.

NOTE: Lubricate the inner lip of the crankshaft rear seal with engine oil.

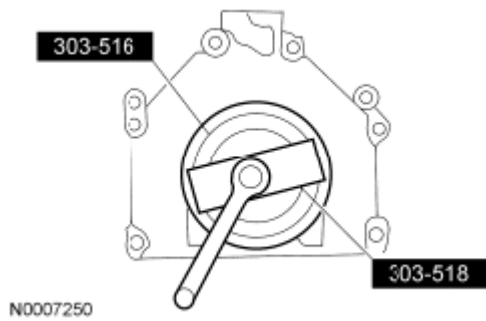


Fig. 130: Installing Crankshaft Rear Oil Seal Using Crankshaft Rear Oil Seal Installer
Courtesy of FORD MOTOR CO.

5. Using the Crankshaft Rear Oil Seal Installers, install the crankshaft rear seal.
6. Using the Crankshaft Rear Oil Slinger Installer and Crankshaft Rear Oil Seal Installers, install the crankshaft oil slinger.

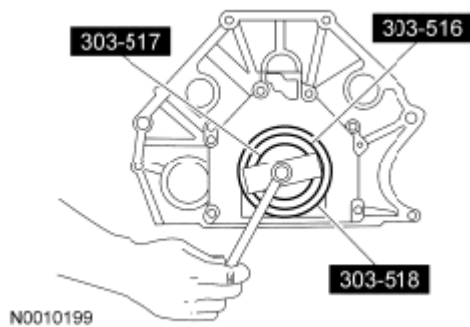


Fig. 131: Installing Crankshaft Rear Oil Slinger Using Crankshaft Rear Seal Installer
Courtesy of FORD MOTOR CO.

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.

7. Inspect the oil pan. Clean the mating surface for the oil pan with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
8. Position the oil pump screen and pickup tube in the oil pan and position the oil pan and new gasket into the vehicle.

NOTE: Make sure to install a new O-ring seal. A missing or damaged O-ring seal may cause foam in the lubrication system, low oil pressure and severe engine damage.

NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil prior to installation.

9. Position the oil pump screen and pickup tube and install the bolts.
 - Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).
 - Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).

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.

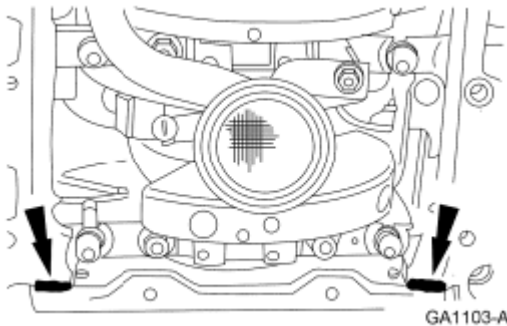
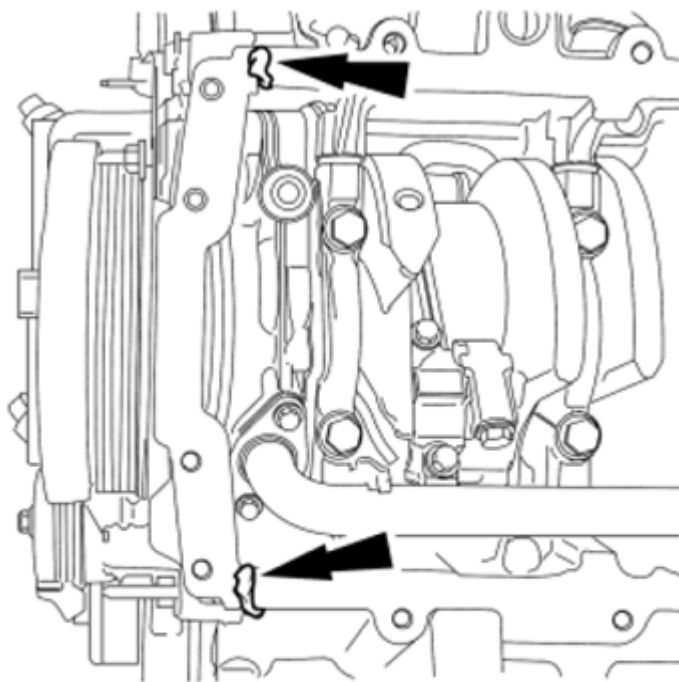


Fig. 132: Locating Crankshaft Rear Seal Retainer Plate-To-Cylinder Block Sealing Surface
Courtesy of FORD MOTOR CO.

10. Apply silicone gasket and sealant at the rear seal retainer-to-cylinder block sealing surface.

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.



A0072750

Fig. 133: Locating Silicone Gasket And Sealant Application Areas For Engine Front Cover-To-Cylinder Block Mating Surface
Courtesy of FORD MOTOR CO.

11. Apply silicone gasket and sealant at the engine front cover-to-cylinder block mating surface.
12. Install the oil pan bolts, tighten in the sequence shown in the illustration, in 2 stages.
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Rotate an additional 60 degrees.

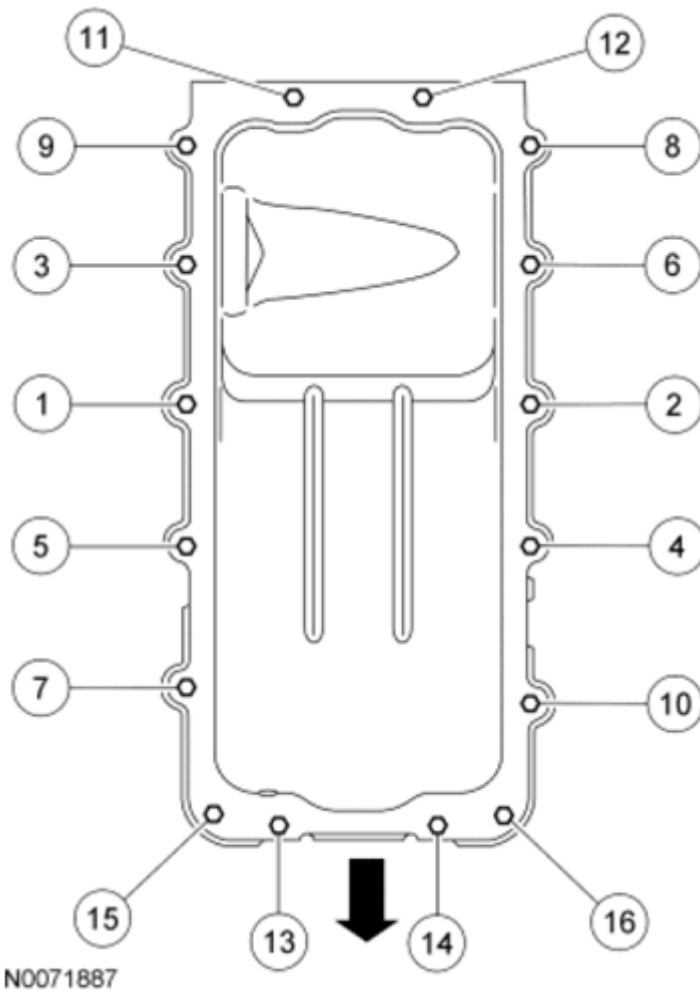


Fig. 134: Identifying Oil Pan Bolts Removal/Installing Sequence
 Courtesy of FORD MOTOR CO.

13. Attach the 2 pin-type wire harness retainers.
14. Align the engine mount studs and lower the engine.

NOTE: LH shown in the illustration, RH similar.

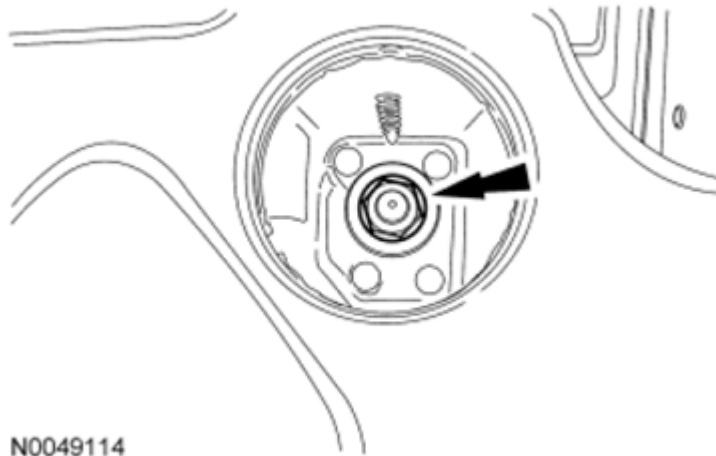


Fig. 135: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

15. Install the 2 engine mount nuts.
 - Tighten to 90 Nm (66 lb-ft).
16. Install the engine-to-transmission spacer plate.

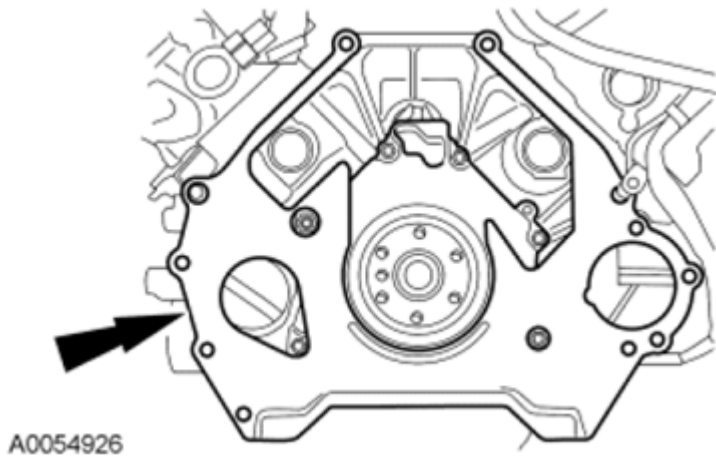


Fig. 136: Locating Engine/Transmission Spacer Plate
Courtesy of FORD MOTOR CO.

17. Install the flexplate. For additional information, refer to **FLEXPLATE** in this service information.
18. Fill the engine with clean engine oil.
19. Start the engine and check for leaks.

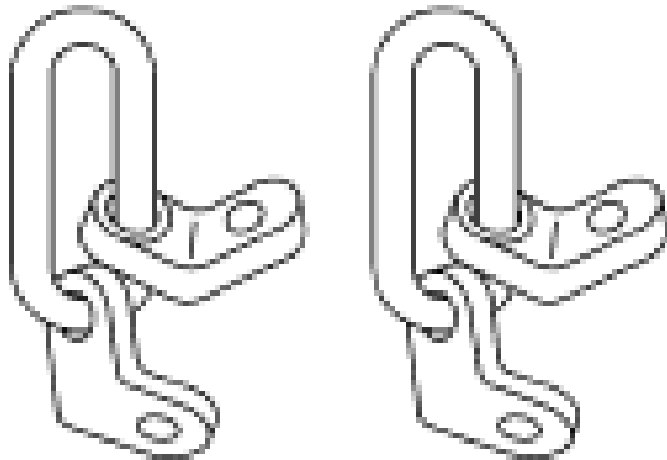
WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

20. If equipped with a fire suppression system, repower the system.

ENGINE MOUNT - RH

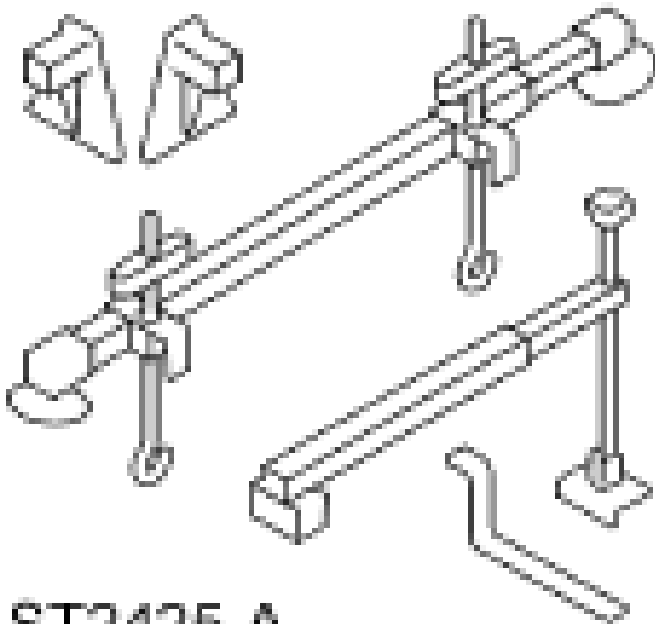
Special Tool(s)

SPECIAL TOOL(S)



ST1595-A

Lifting Bracket, Engine
303-050(T70P-6000)



ST2425-A

Support Bar, Engine
303-F072

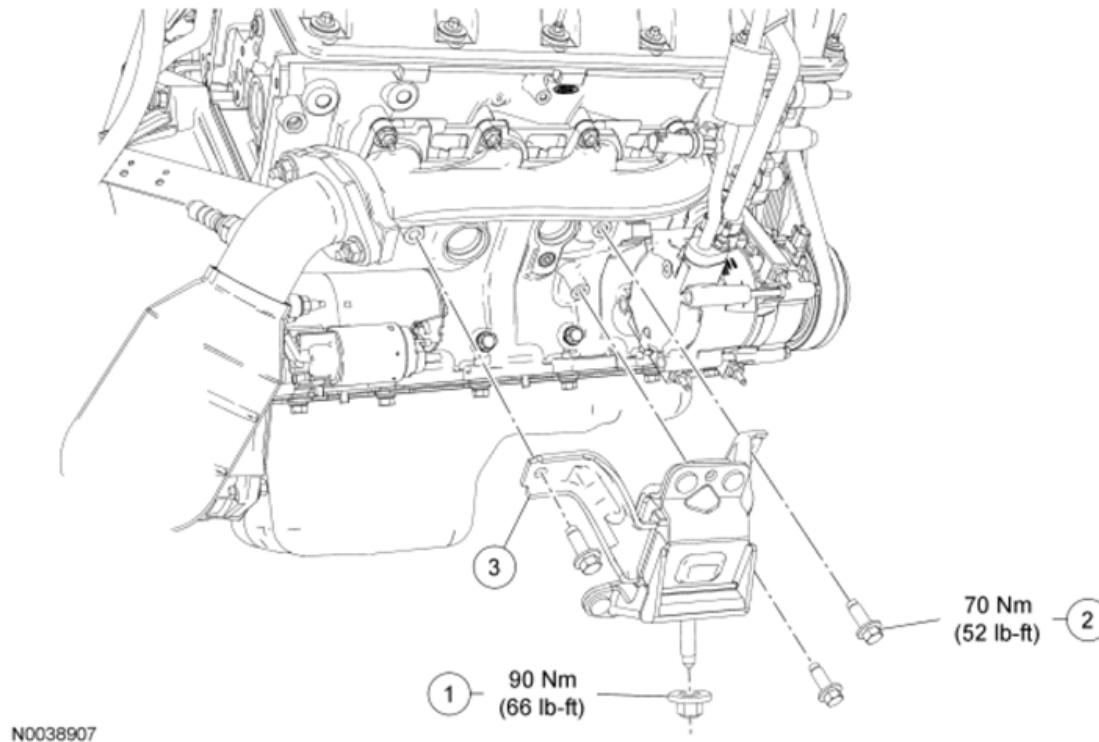


Fig. 137: Exploded View Of Engine Mount Components With Torque Specifications (RH)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W707492	RH engine mount nut
2	W710646	RH engine mount bolt (3 required)
3	6038	RH engine mount

Removal and Installation

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

1. If equipped with a fire suppression system, repower the system.
2. Remove the generator. For additional information, refer to **CHARGING SYSTEM** article.
3. Install the Engine Lifting Bracket.



Fig. 138: Installing Engine Lifting Bracket
Courtesy of FORD MOTOR CO.

4. Install the Engine Support Bar.

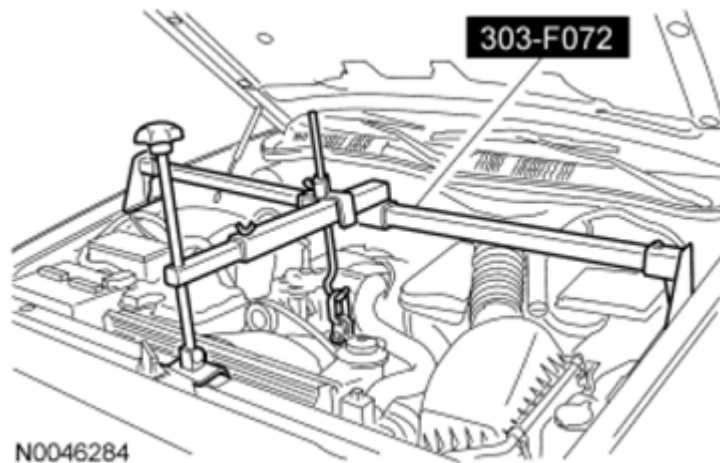


Fig. 139: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

5. Remove the RH and LH lower engine mount nuts.
 - To install, tighten to 90 Nm (66 lb-ft).
6. Using the Engine Support Bar, raise the engine.

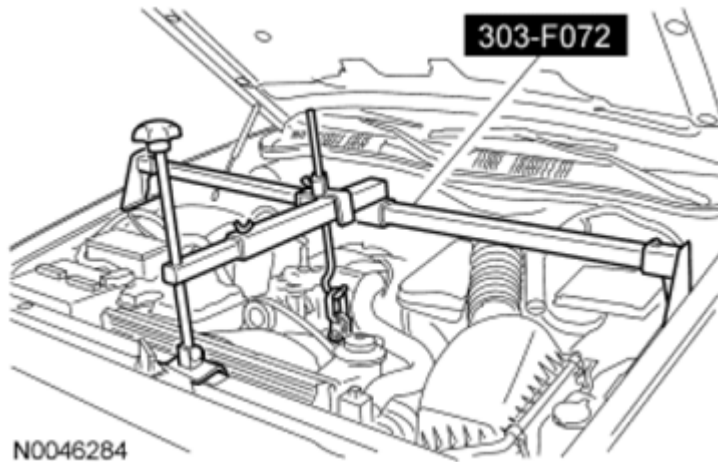


Fig. 140: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

7. Remove the 3 RH engine mount bolts.
 - To install, tighten to 70 Nm (52 lb-ft).
8. Remove the RH engine mount.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

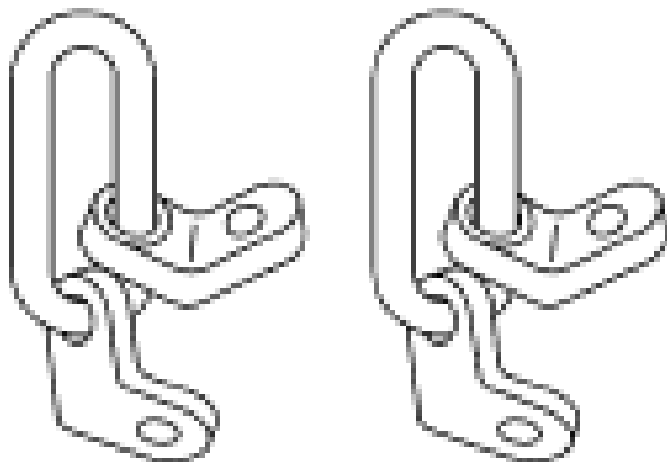
9. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.

ENGINE MOUNT - LH

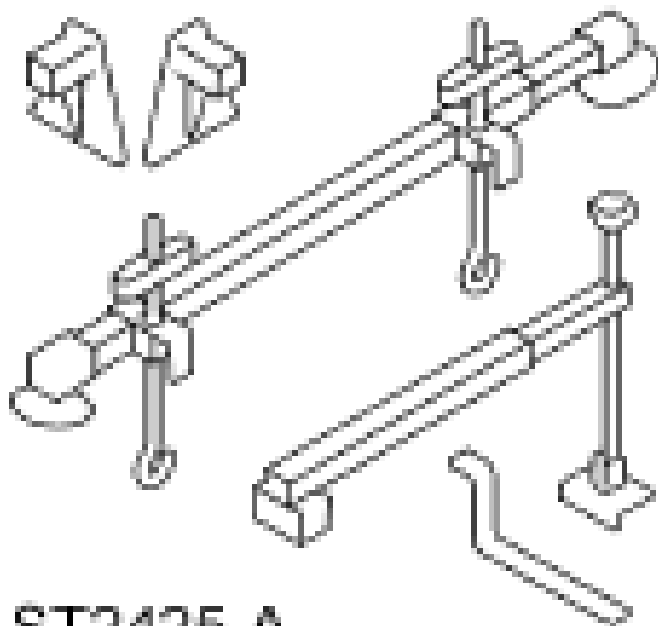
Special Tool(s)

SPECIAL TOOL(S)

	Lifting Bracket, Engine 303-050(T70P-6000)
--	---



ST1595-A



ST2425-A

Support Bar, Engine
303-F072

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil	WSS-M2C930-A

XO-5W20-QSP (US); Motorcraft® SAE 5W-20
Super Premium Motor Oil
CXO-5W20-LSP12 (Canada); or equivalent

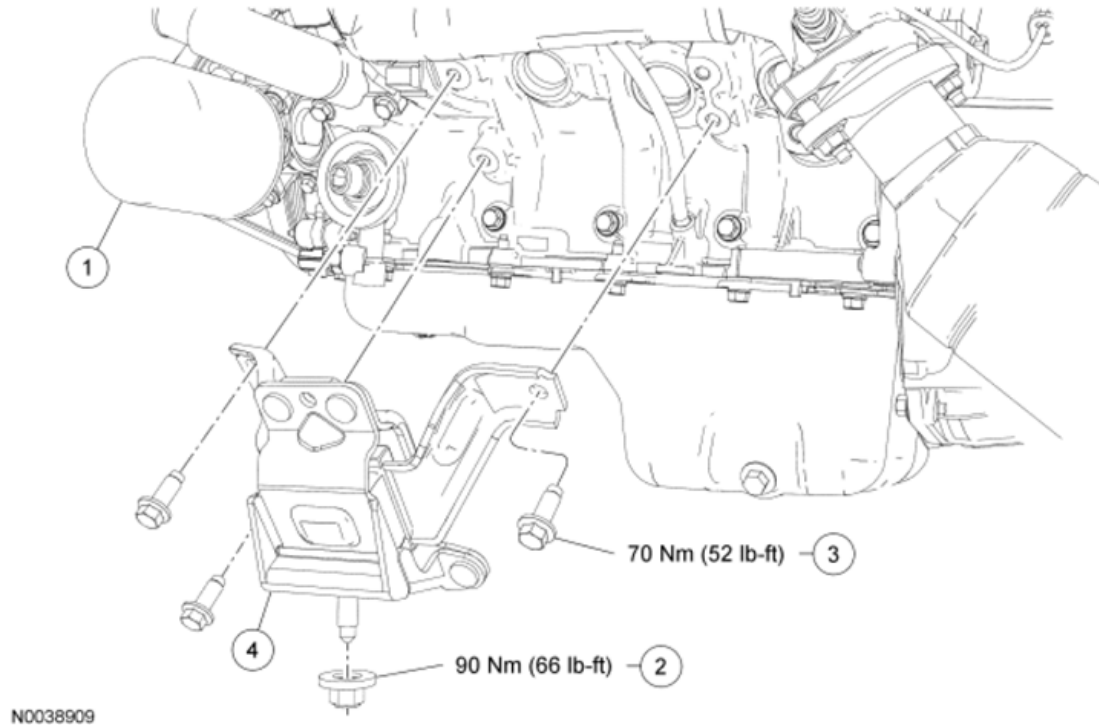


Fig. 141: Exploded View Of Engine Mount With Torque Specifications (LH)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Item
1	6714	Oil filter
2	W707492	LH engine mount nut
3	W710646-S439	LH engine mount bolt (3 required)
4	6B032	LH engine mount

Removal and Installation

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the generator. For additional information, refer to **CHARGING SYSTEM** article.
3. Install the Engine Lifting Bracket.



Fig. 142: Installing Engine Lifting Bracket
Courtesy of FORD MOTOR CO.

4. Install the Engine Support Bar.

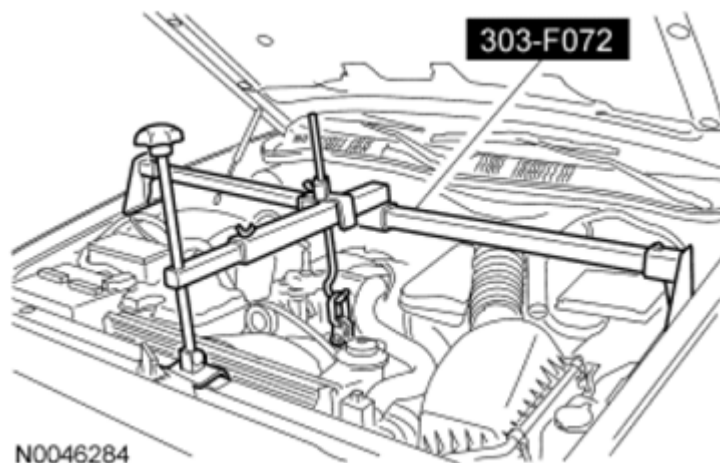


Fig. 143: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

5. Remove the oil filter and discard.
 - Lubricate the new oil filter O-ring seal with clean engine oil prior to installation.
6. Remove the LH and RH lower engine mount nuts.
 - To install, tighten to 90 Nm (66 lb-ft).
7. Using the Engine Support Bar, raise the engine.

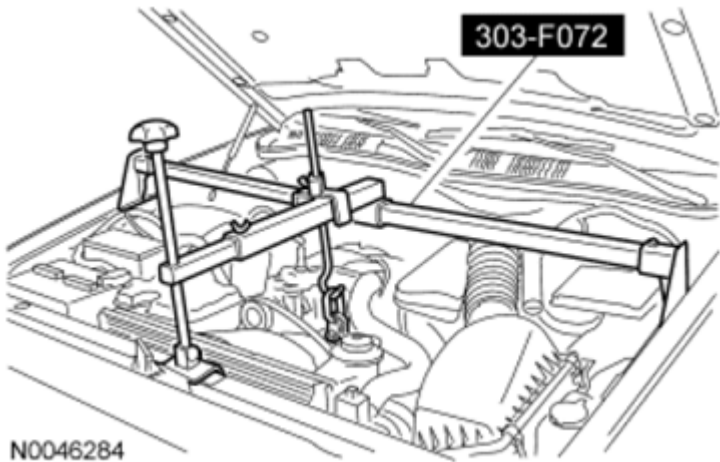


Fig. 144: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

8. Remove the 3 bolts and the LH engine mount.
- To install, tighten to 70 Nm (52 lb-ft).

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

9. To install, reverse the removal procedure. If equipped with a fire suppression system, repower the system.

CYLINDER HEAD

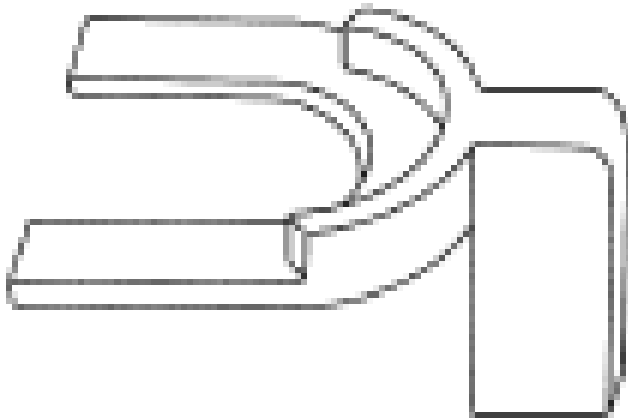
Special Tool(s)

SPECIAL TOOL(S)

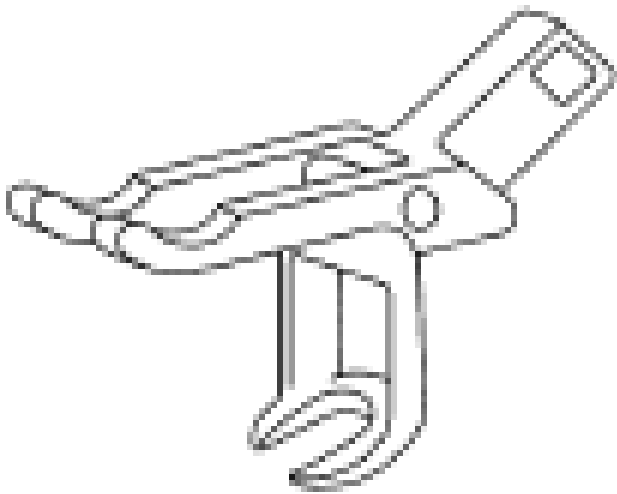
	Compressor Spacer, Valve Spring 303-382(T91P-6565-AH)
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2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1331-A



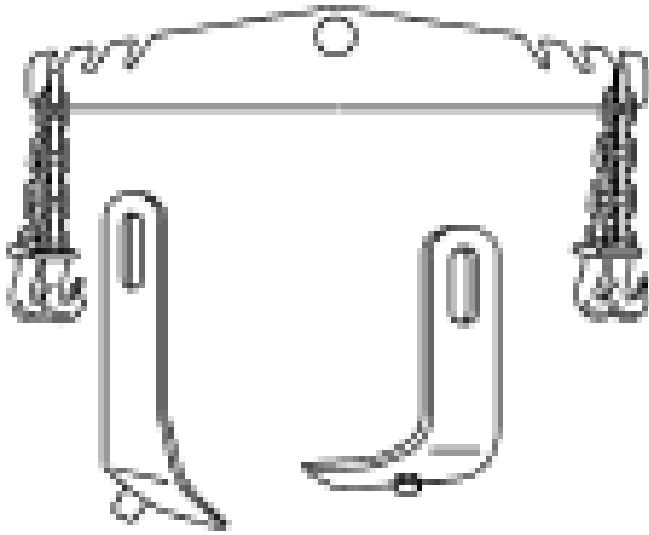
ST1330-A

Compressor, Valve Spring
303-567(T97P-6565-AH)

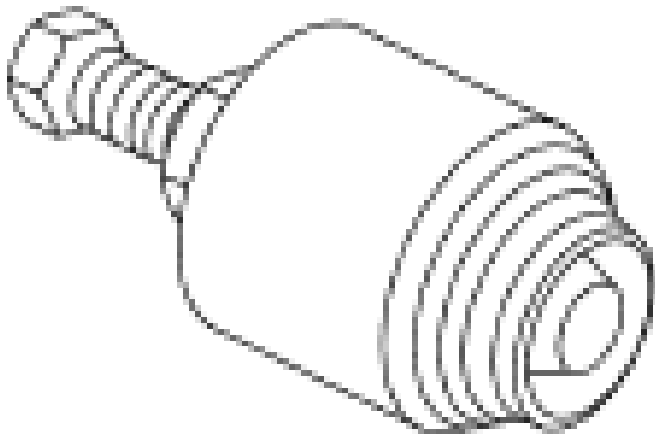
Lifting Bracket Set, Engine
303-DS086(D93P-6001-A) or equivalent

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST2443-A



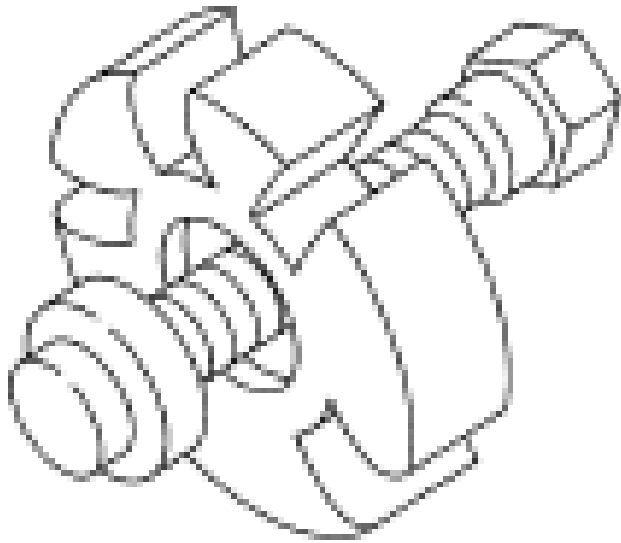
ST1730-A

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

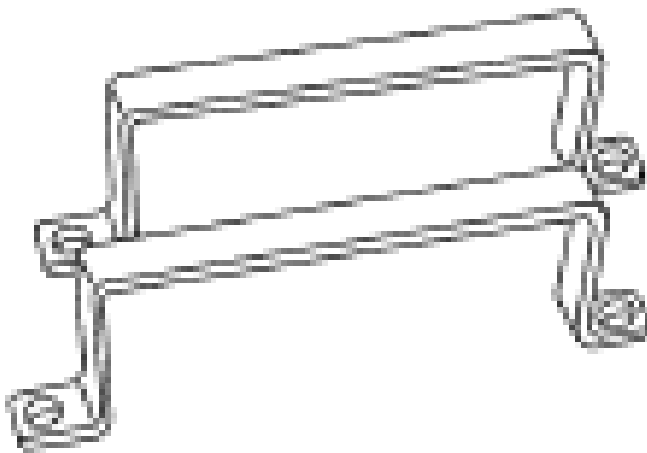
Remover, Crankshaft Vibration Damper
303-009(T58P-6316-D)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1286-A



ST1668-A

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

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-

Silicone Gasket Remover
ZC-30

Removal

Cylinder heads

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Remove the engine. For additional information, refer to **ENGINE** in the Removal portion of this service information.
3. Remove the bolts and the flexplate.

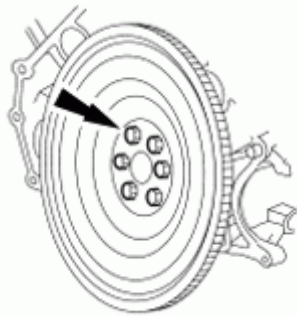


Fig. 145: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

4. Remove the engine/transmission spacer plate.

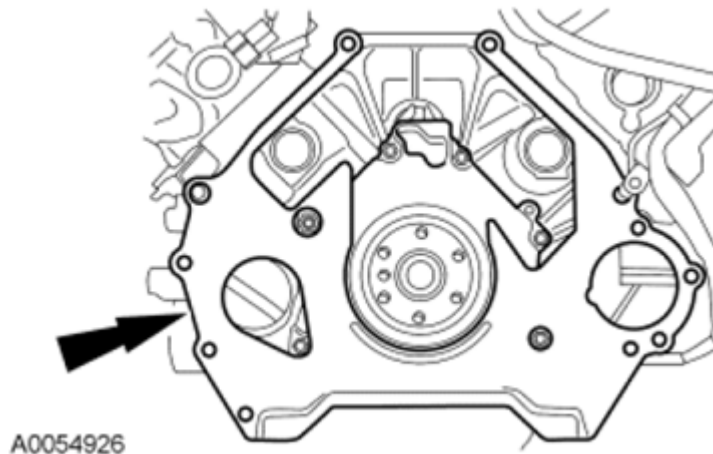


Fig. 146: Locating Engine/Transmission Spacer Plate
Courtesy of FORD MOTOR CO.

5. Using the Engine Lifting Bracket Set, mount the engine on a suitable engine stand.

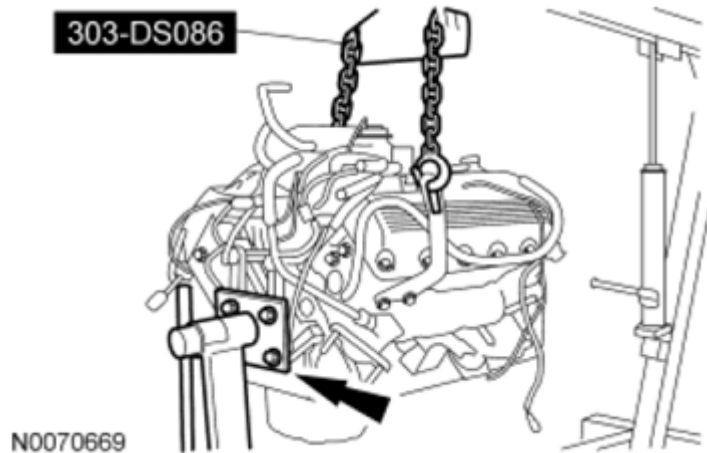


Fig. 147: Identifying Engine Lifting Bracket Set (303-DS086)
Courtesy of FORD MOTOR CO.

6. If equipped with cylinder block drain plugs, remove the bolts and the RH engine mount.

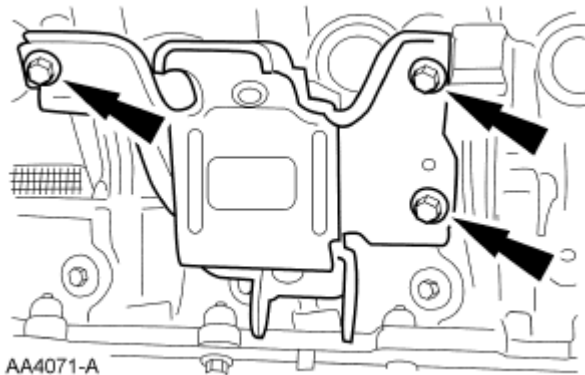


Fig. 148: Locating Engine Mount And Cylinder Drain Plugs Mounting Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

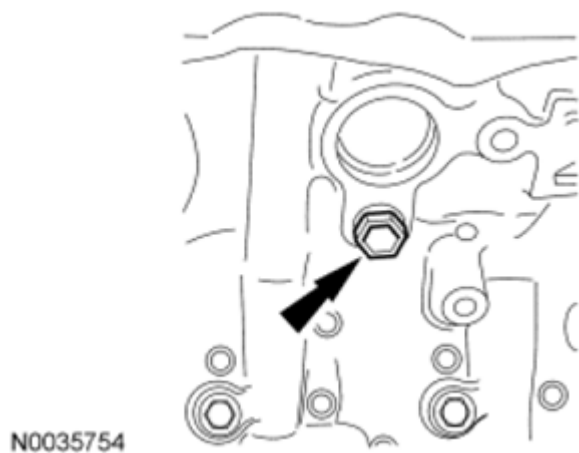


Fig. 149: Locating Engine Block Drain Plug And Mounting Bolt
Courtesy of FORD MOTOR CO.

7. If equipped, remove the drain plugs from the engine block. Allow the coolant to completely drain.
 - Install the drain plugs when finished.
 - To install, tighten to 20 Nm (177 lb-in).
8. Remove the bolt and the battery cables from the engine.



Fig. 150: Locating Bolt And Battery Cables
Courtesy of FORD MOTOR CO.

9. Disconnect the EGR tube from the exhaust manifold.

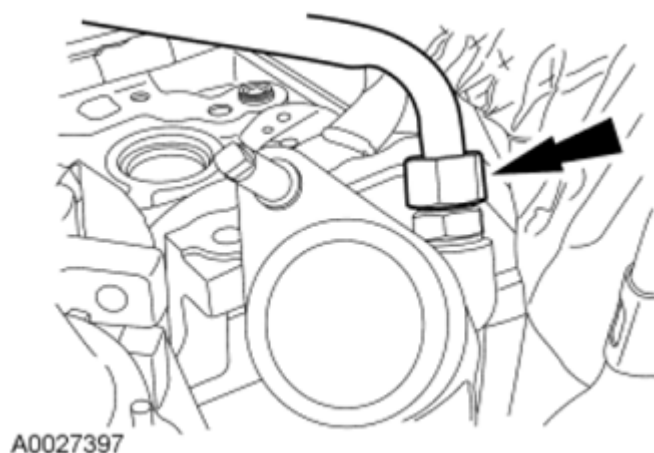


Fig. 151: Locating Exhaust Gas Recirculation Tube
Courtesy of FORD MOTOR CO.

10. Disconnect the 8 ignition coil electrical connectors (4 shown in the illustration).

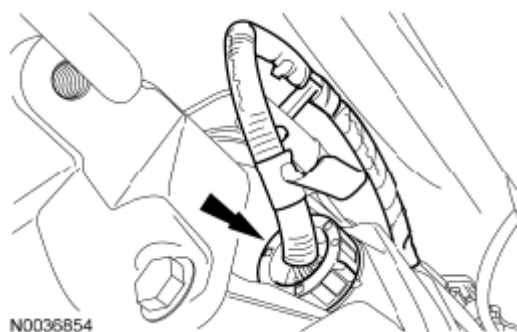


Fig. 152: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

11. Disconnect the 8 fuel injector electrical connectors (4 shown in the illustration).

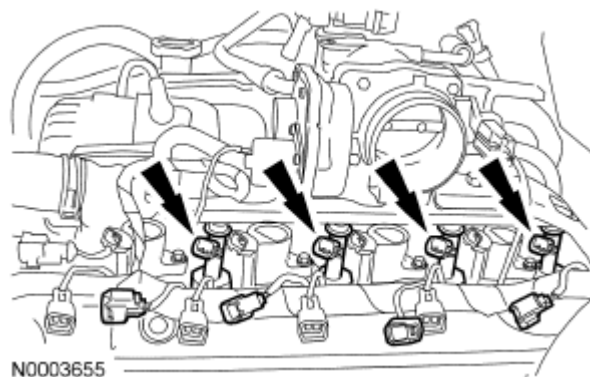


Fig. 153: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

12. Remove the 2 bolts and the intake manifold shield.

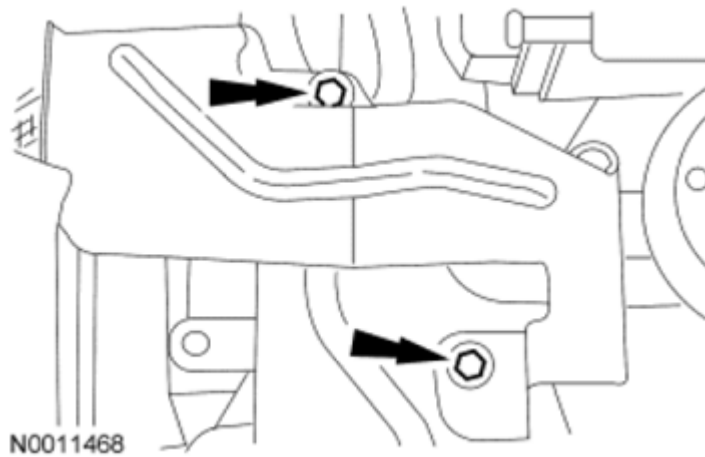


Fig. 154: Locating Intake Manifold Shield Mounting Bolt
Courtesy of FORD MOTOR CO.

13. Remove the crankcase ventilation tube.

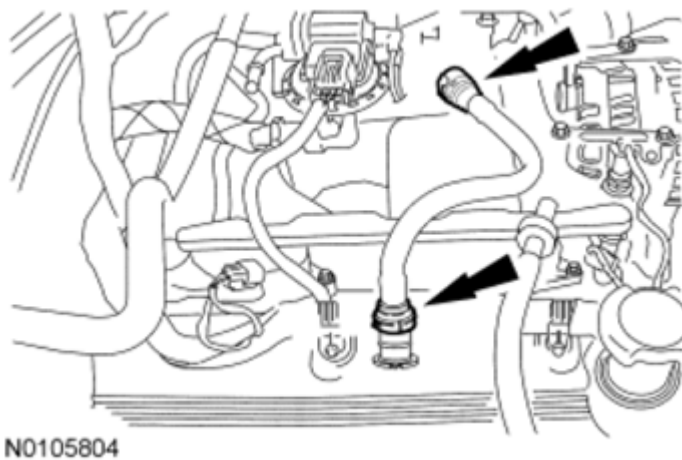


Fig. 155: Locating Crankcase Ventilation Tube
Courtesy of FORD MOTOR CO.

14. Disconnect the generator electrical connector and detach the wire harness retainer.

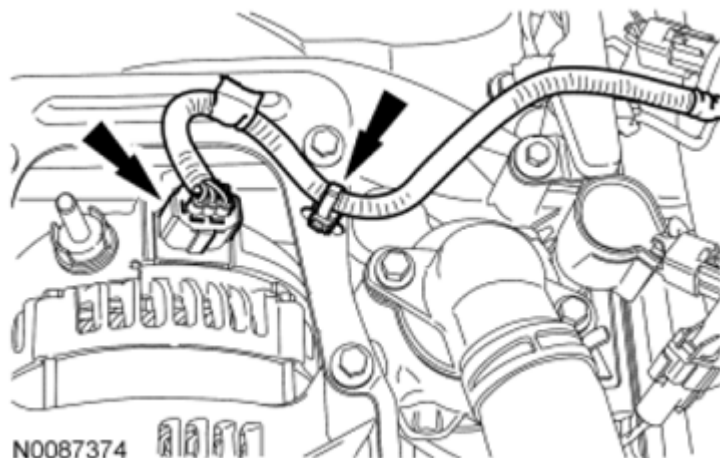


Fig. 156: Locating Generator Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

15. Remove the generator mounting bracket.
- Remove the 4 bolts.
 - Remove the bracket.

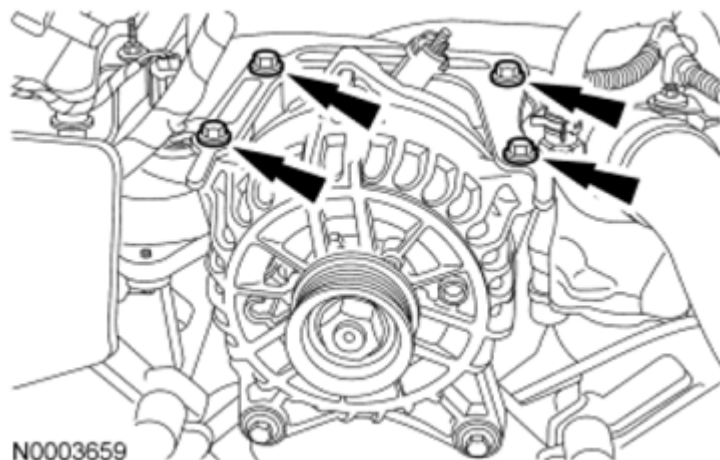


Fig. 157: Locating Generator Mounting Bracket And Mounting Bolts
Courtesy of FORD MOTOR CO.

16. Disconnect the throttle control and the Throttle Position (TP) sensor electrical connectors.

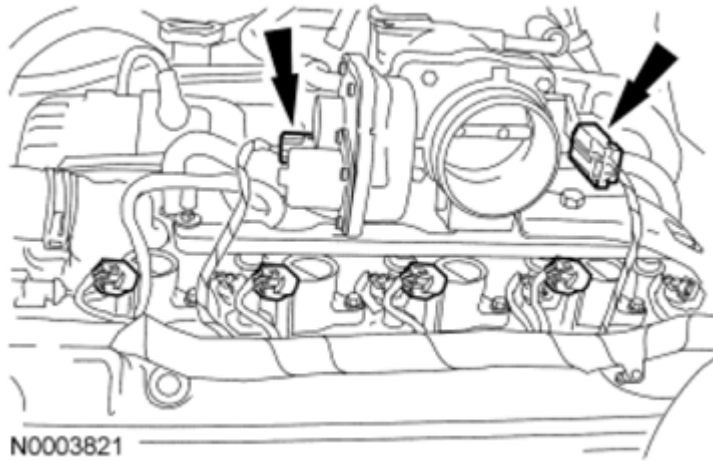


Fig. 158: Locating Throttle Control And Throttle Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

17. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.

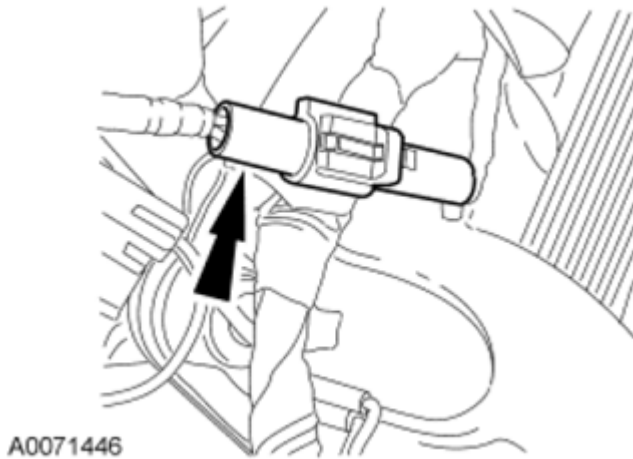


Fig. 159: Locating Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the Camshaft Position (CMP) sensor electrical connector.

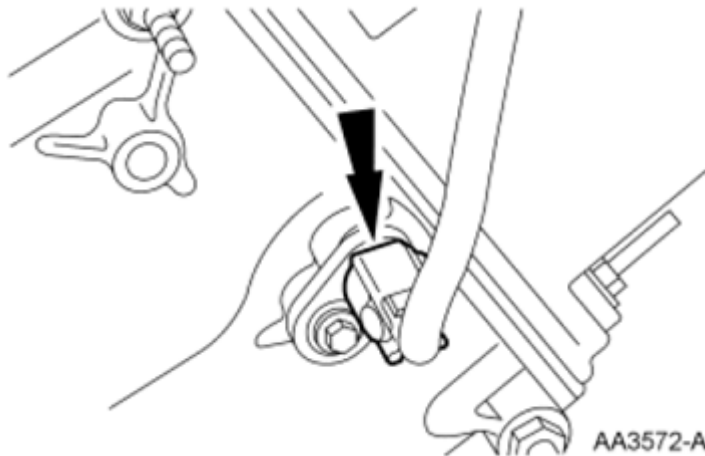


Fig. 160: Locating Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the radio ignition interference capacitor and remove the engine control sensor wiring.

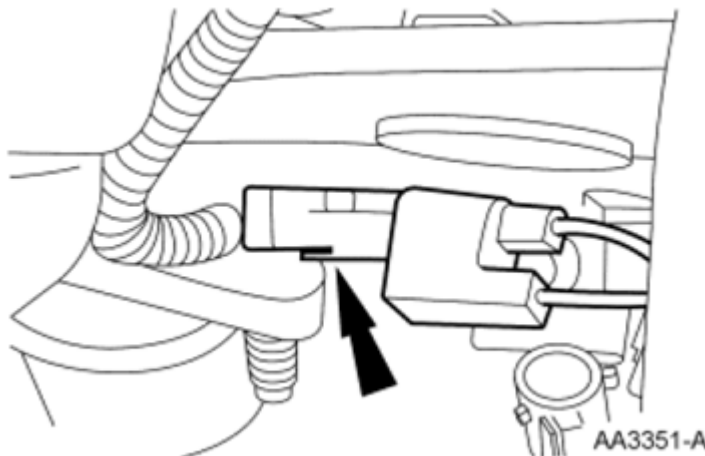


Fig. 161: Locating Radio Interference Capacitor
Courtesy of FORD MOTOR CO.

20. Disconnect the fuel charging wiring from the crash bracket and the wiring support bracket and remove the harness from the engine.

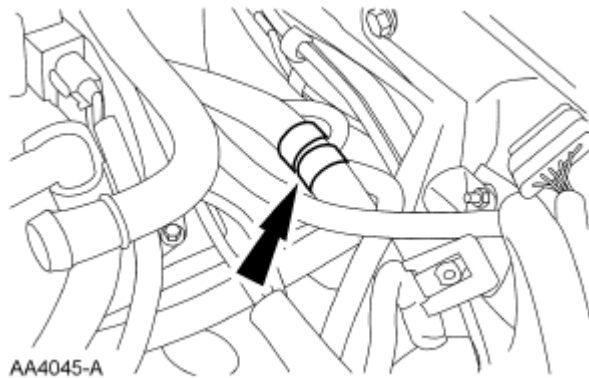


Fig. 162: Locating Wiring Support Bracket
Courtesy of FORD MOTOR CO.

21. Disconnect the EGR tube nut from the EGR system module.

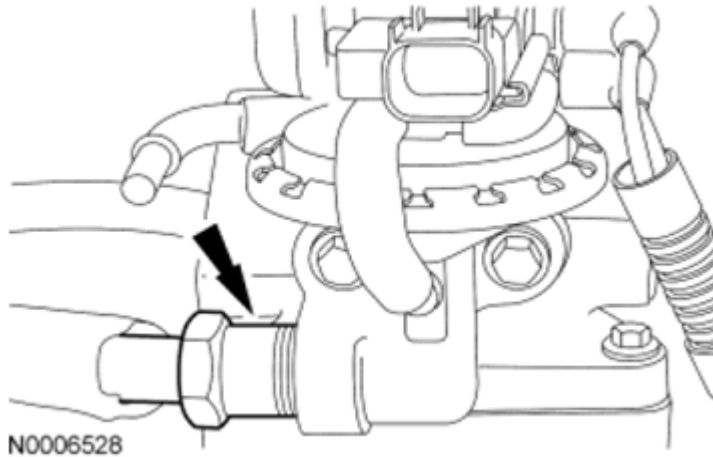


Fig. 163: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

22. Remove the generator.
1. Remove the 2 bolts.
 2. Remove the generator.

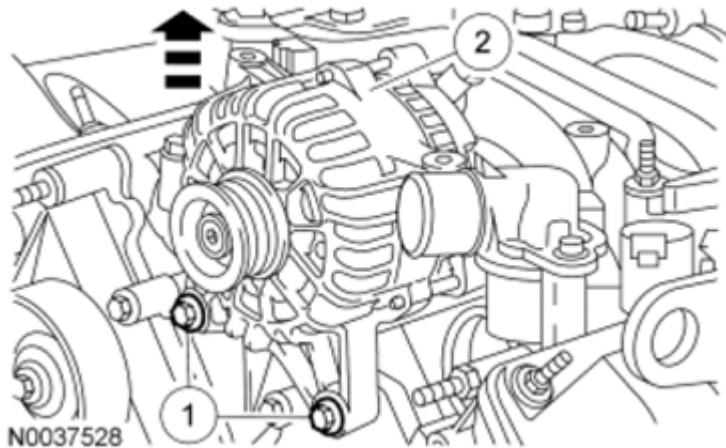


Fig. 164: Removing Generator
Courtesy of FORD MOTOR CO.

23. Remove the intake manifold crash bracket bolt and prevent the bolt from contacting the cylinder head with a rubber band or tie strap.

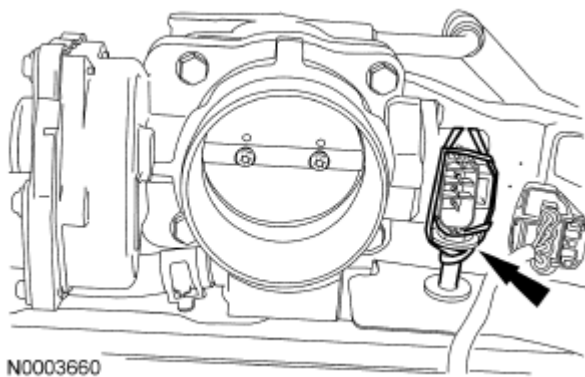


Fig. 165: Locating Intake Manifold Crash Bracket With Tie Strap
Courtesy of FORD MOTOR CO.

24. Remove the intake manifold crash bracket stud bolt.

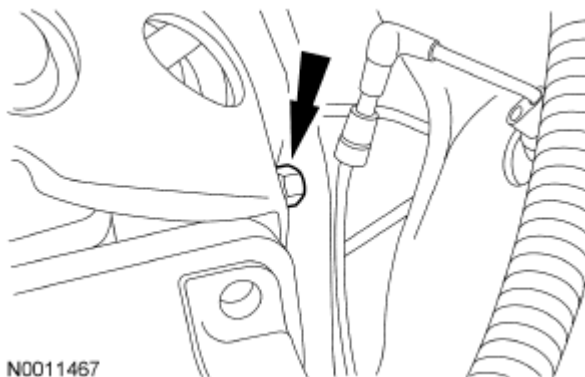


Fig. 166: Locating Intake Manifold Crash Bracket Stud Bolt
Courtesy of FORD MOTOR CO.

25. Remove the 8 bolts and the 8 ignition coils (4 shown in the illustration).

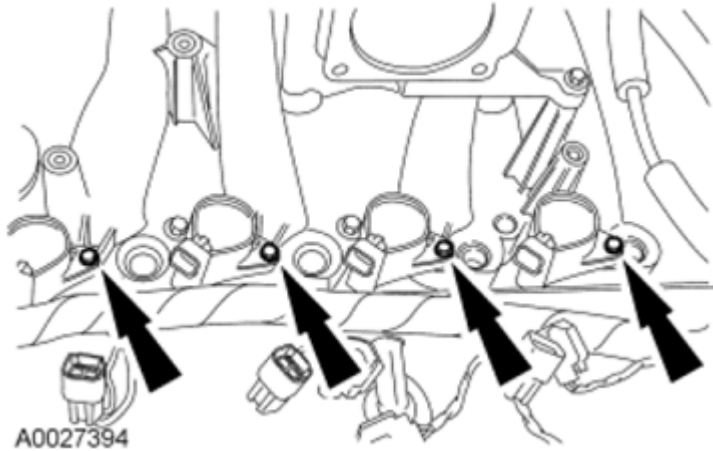


Fig. 167: Locating Ignition Coils And Mounting Bolts
Courtesy of FORD MOTOR CO.

26. Remove the 2 bolts and the coolant outlet adapter.

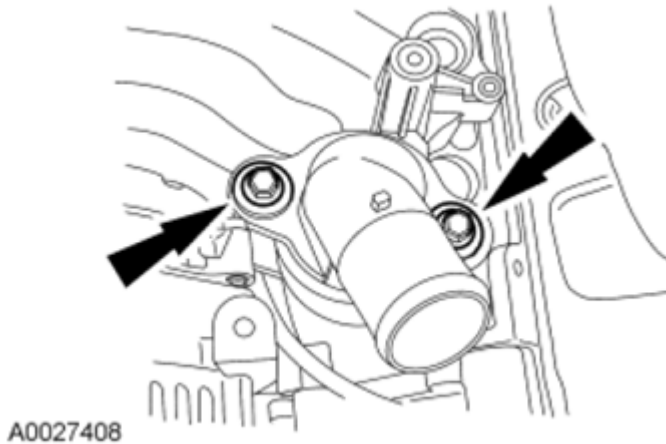
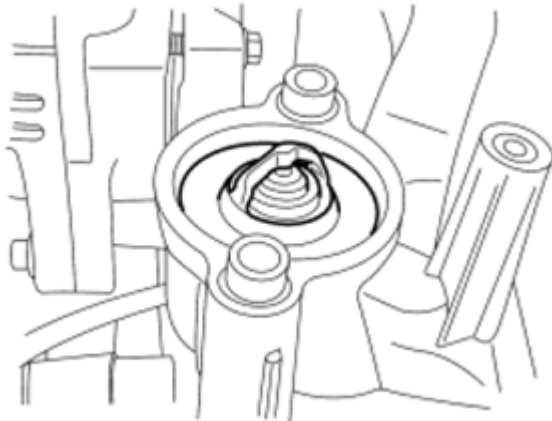


Fig. 168: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

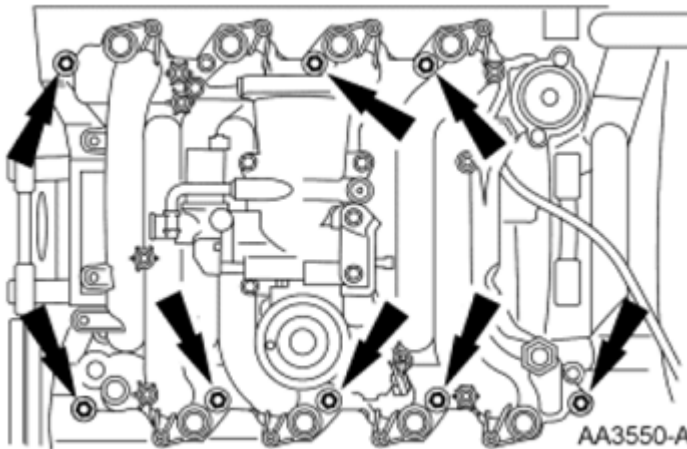
27. Remove the thermostat.



A0027409

Fig. 169: Locating Thermostat And O-Ring
Courtesy of FORD MOTOR CO.

28. Remove the 8 bolts and the intake manifold.
- Discard the intake manifold gaskets.



AA3550-A

Fig. 170: Locating Intake Manifold Gasket Mounting Bolts
Courtesy of FORD MOTOR CO.

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.

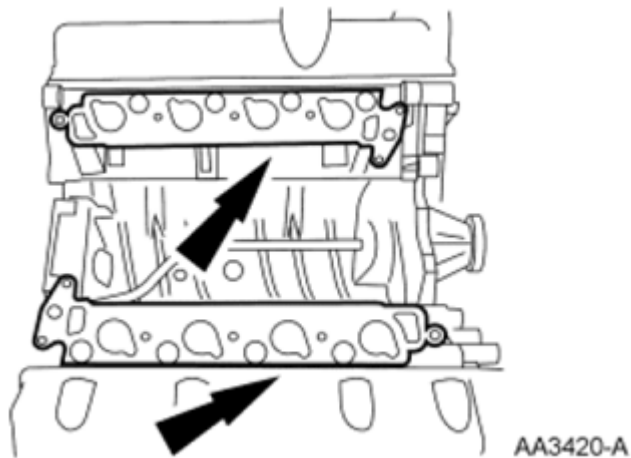


Fig. 171: Locating Sealing Surfaces
Courtesy of FORD MOTOR CO.

29. Clean the sealing surfaces.
30. Remove the coolant bypass tube.
 1. Remove the retaining nut.
 2. Remove the ground strap.
 3. Remove the coolant bypass tube.

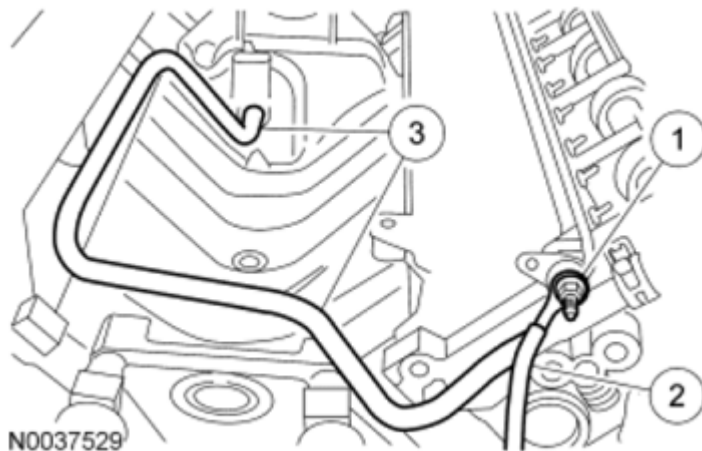


Fig. 172: Identifying Retaining Nut, Ground Strap And Coolant Bypass Tube
Courtesy of FORD MOTOR CO.

31. Loosen the studs and bolts and remove the LH valve cover.
 - Clean the mating surface and discard gasket.

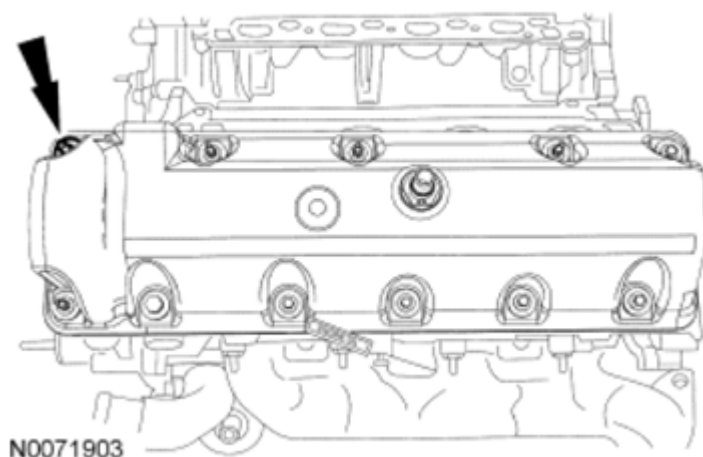


Fig. 173: Locating LH Valve Cover Mounting Bolts And Studs
Courtesy of FORD MOTOR CO.

32. Loosen the studs and bolts and remove the RH valve cover.
- Discard the gasket.

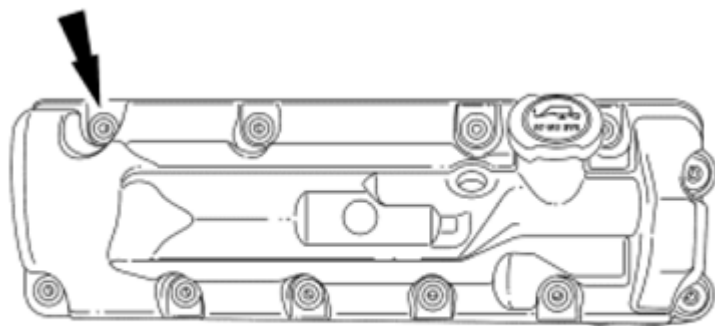


Fig. 174: Locating RH Valve Cover Mounting Bolts And Studs
Courtesy of FORD MOTOR CO.

- NOTE:** Only use hand tools when removing or installing the spark plugs, damage may occur to the cylinder head or spark plug.
- NOTE:** Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

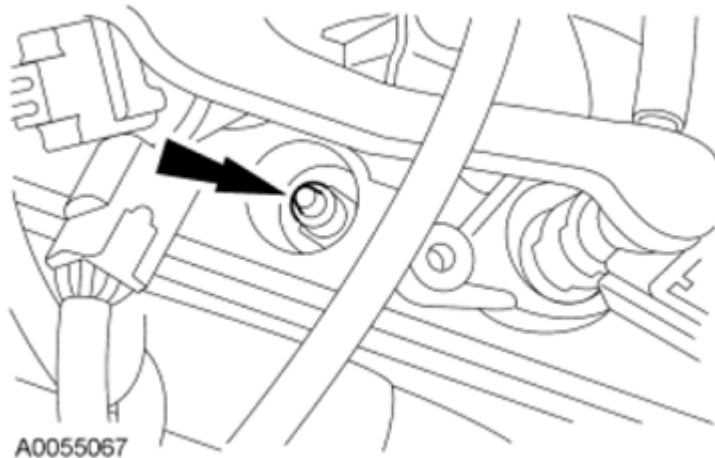


Fig. 175: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

33. Remove the spark plugs.
34. Position the lobe of the camshaft upward.

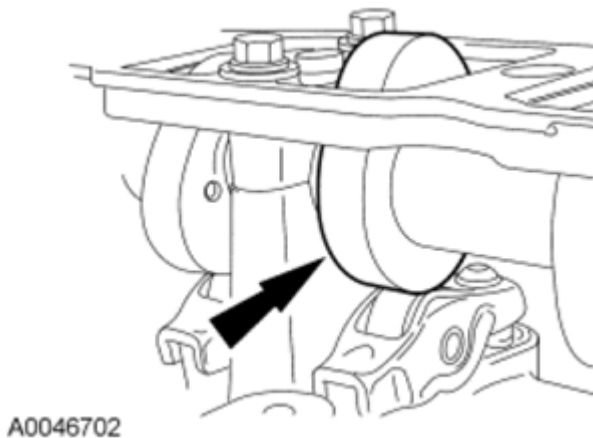


Fig. 176: Identifying Lobe Of Camshaft Up
Courtesy of FORD MOTOR CO.

35. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

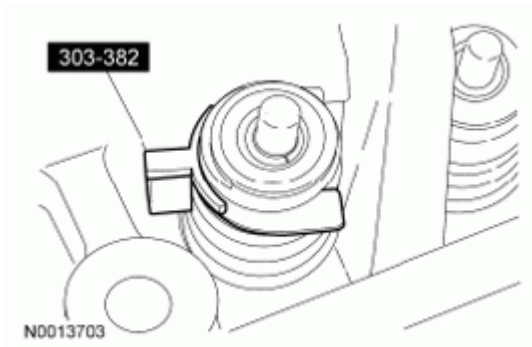


Fig. 177: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.

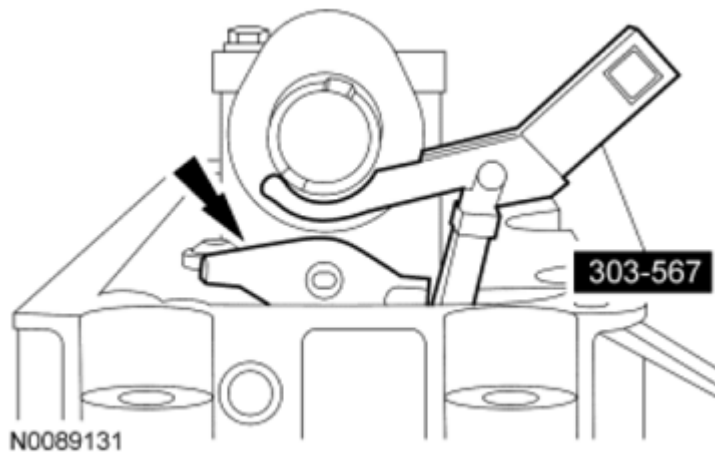


Fig. 178: Compressing Valve Springs Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

36. Using the Valve Spring Compressor, compress the valve springs and remove the camshaft roller followers.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.

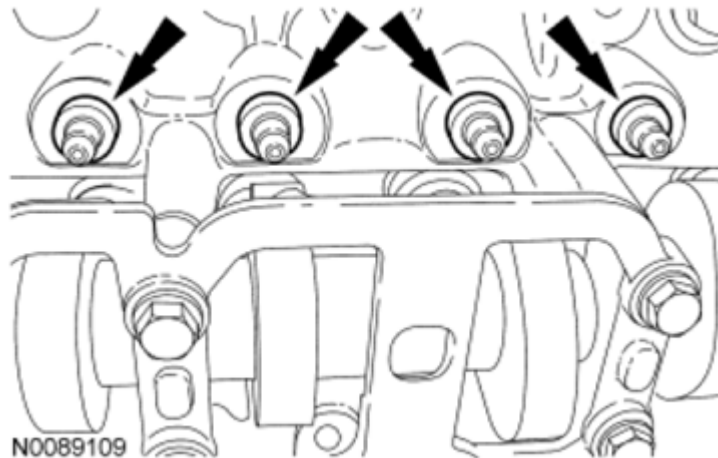


Fig. 179: Locating Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

37. Remove the 16 hydraulic lash adjusters (4 shown in the illustration).
38. Remove the bolt and the belt idler pulley.

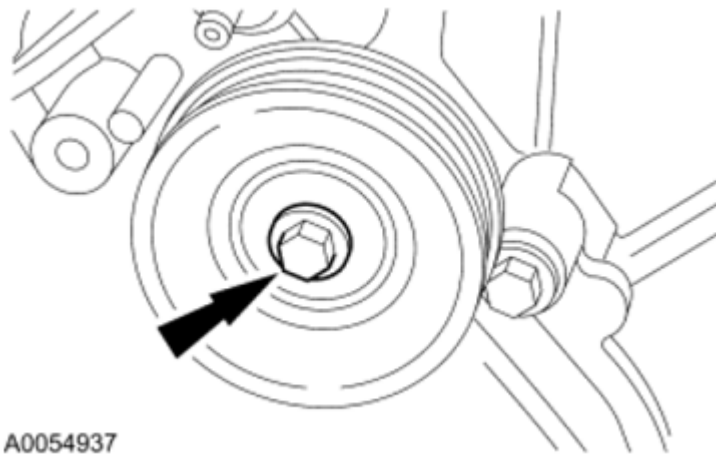


Fig. 180: Locating Belt Idler Pulley Mounting Bolt
Courtesy of FORD MOTOR CO.

39. Remove the coolant pump pulley.

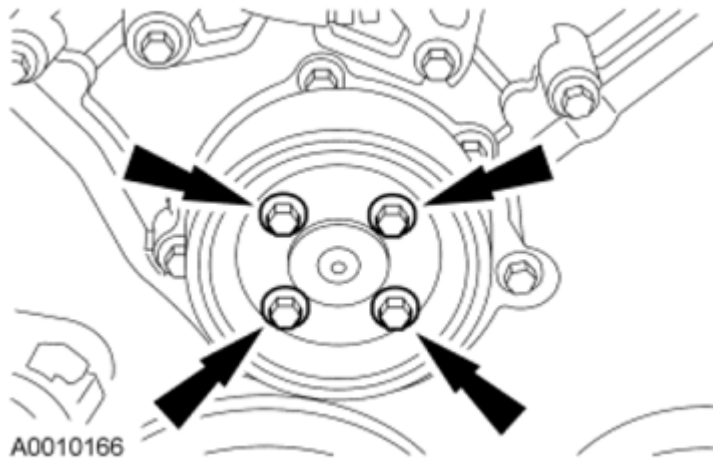


Fig. 181: Locating Coolant Pump Pulley Mounting Bolts
Courtesy of FORD MOTOR CO.

40. Remove the crankshaft pulley bolt.

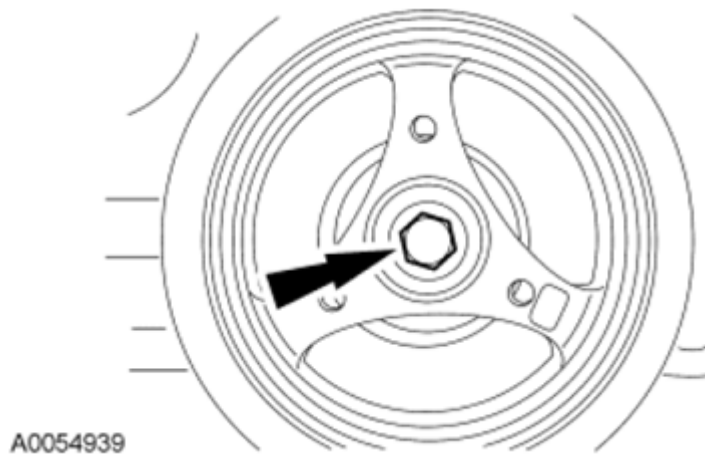


Fig. 182: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

41. Using the Crankshaft Vibration Damper Remover, remove the crankshaft pulley.

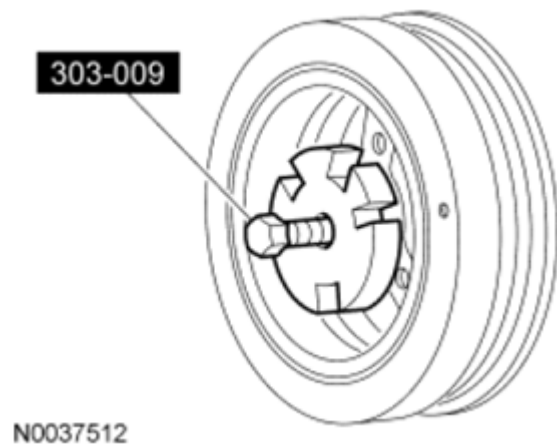


Fig. 183: Removing Crankshaft Pulley Using Crankshaft Vibration Damper Remover
Courtesy of FORD MOTOR CO.

42. Using the Crankshaft Front Oil Seal Remover, remove the crankshaft front oil seal.

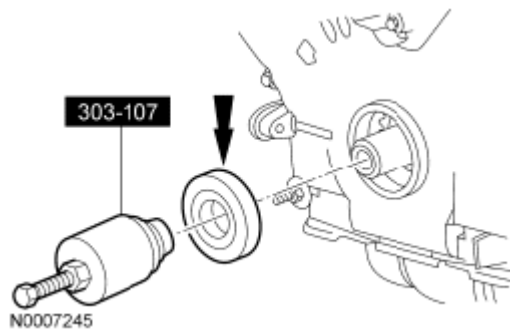


Fig. 184: Removing Crankshaft Front Seal Using Crankshaft Front Oil Seal Remover
Courtesy of FORD MOTOR CO.

43. Remove the front 4 oil pan bolts.

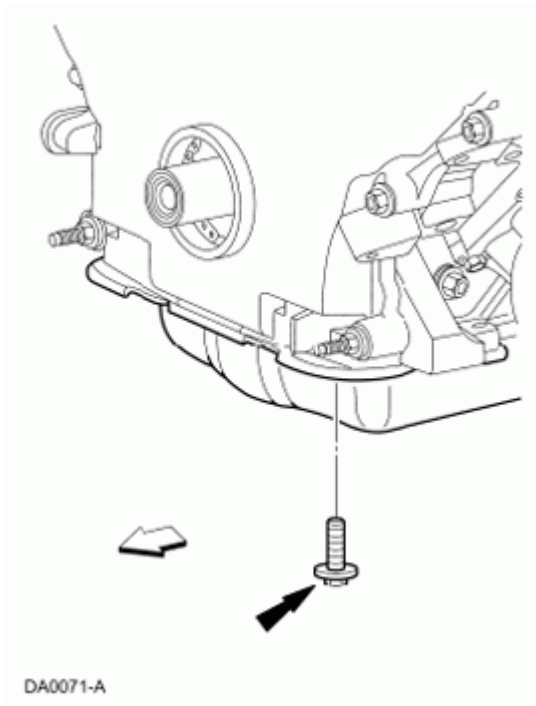
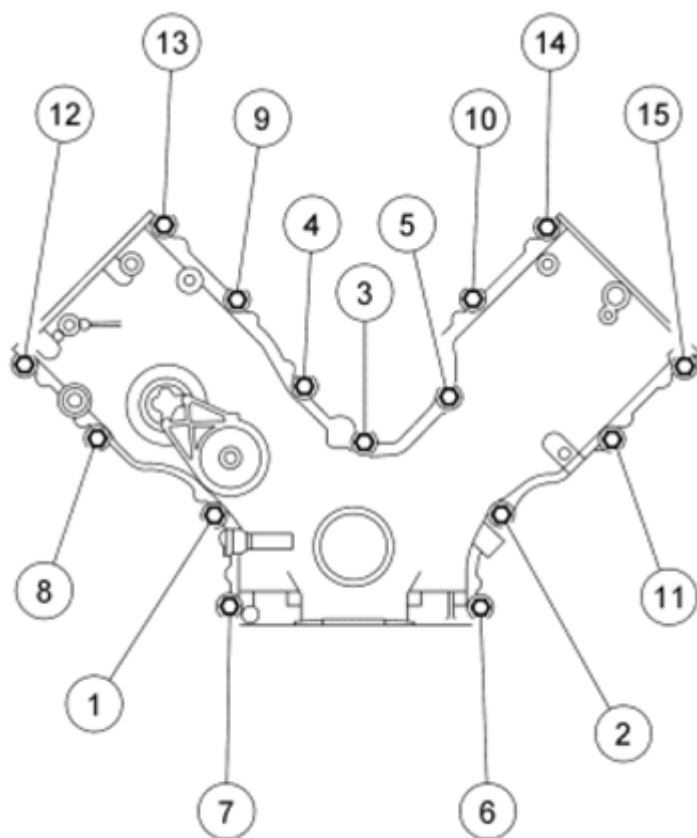


Fig. 185: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE: Correct fastener location is essential for the installation. Record fastener location.



N0037514

Fig. 186: Identifying Stud Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

44. Remove the 15 fasteners in the sequence shown in the illustration.
45. Remove the engine front cover from the cylinder block.
 - Discard the gaskets.

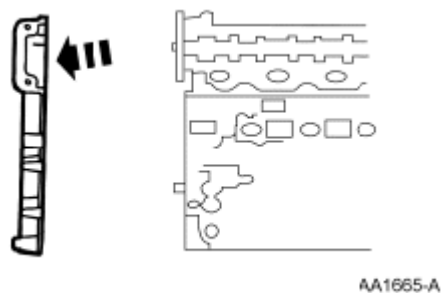


Fig. 187: Removing Engine Front Cover From Cylinder Block
Courtesy of FORD MOTOR CO.

46. Remove the crankshaft sensor ring.

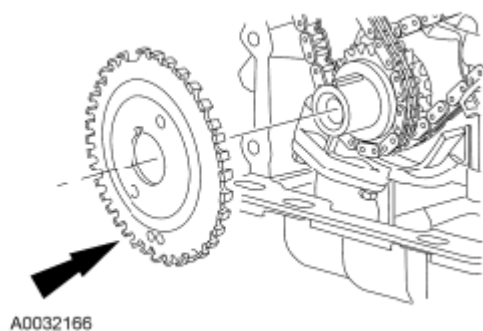


Fig. 188: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

47. Position the crankshaft with the keyway at the 12 o'clock position.

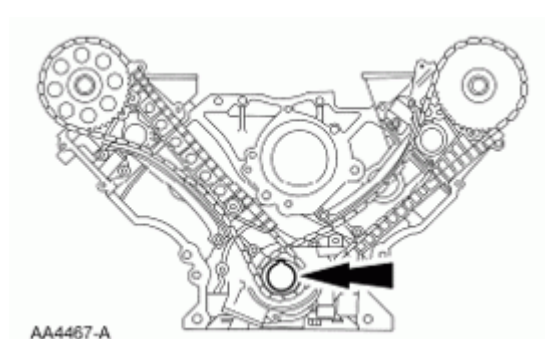


Fig. 189: Locating Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

48. Remove the timing chain tensioning system from both timing chains.
1. Remove the bolts.
 2. Remove the timing chain tensioners.
 3. Remove the timing chain tensioner arms.

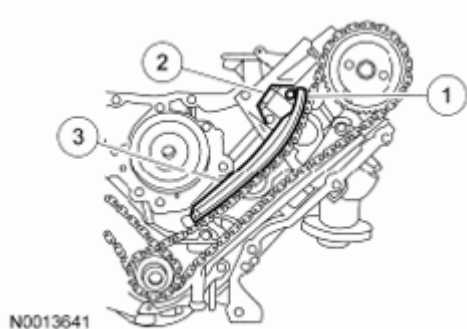


Fig. 190: Identifying Timing Chain Tensioner Arm, Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

49. Remove the LH and RH timing chains and the crankshaft sprocket.
- Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Repeat for the LH timing chain and crankshaft sprocket.

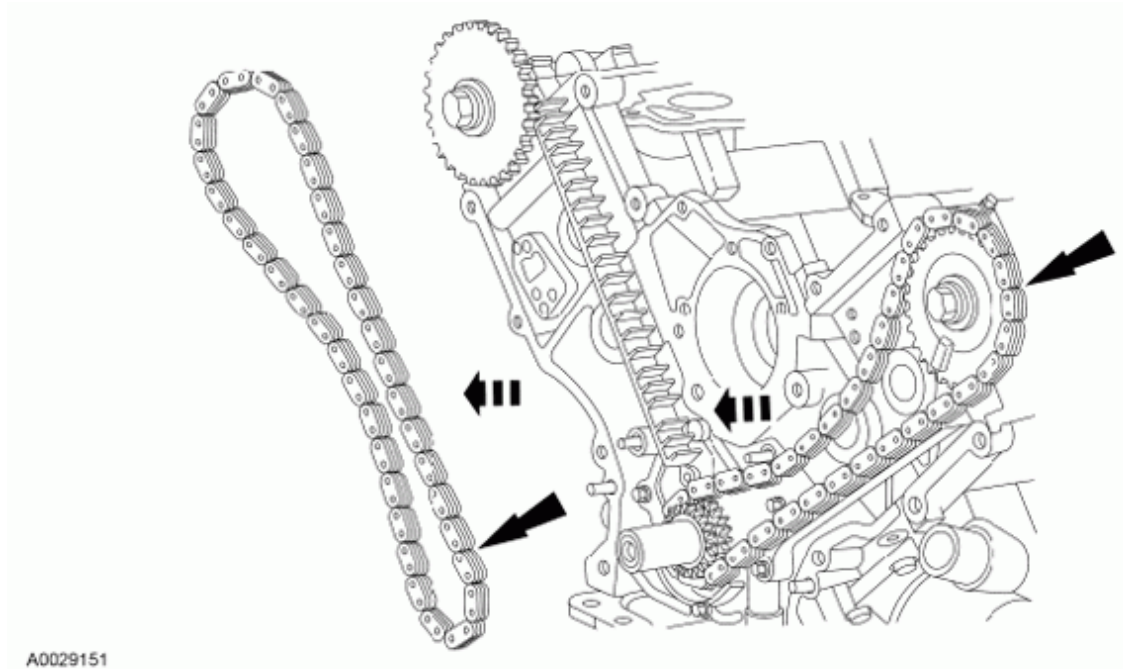


Fig. 191: Removing Timing Chains And Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

50. Remove both timing chain guides.
1. Remove the bolts.
 2. Remove the LH timing chain guide.
 3. Remove the bolts.
 4. Remove the RH timing chain guide.

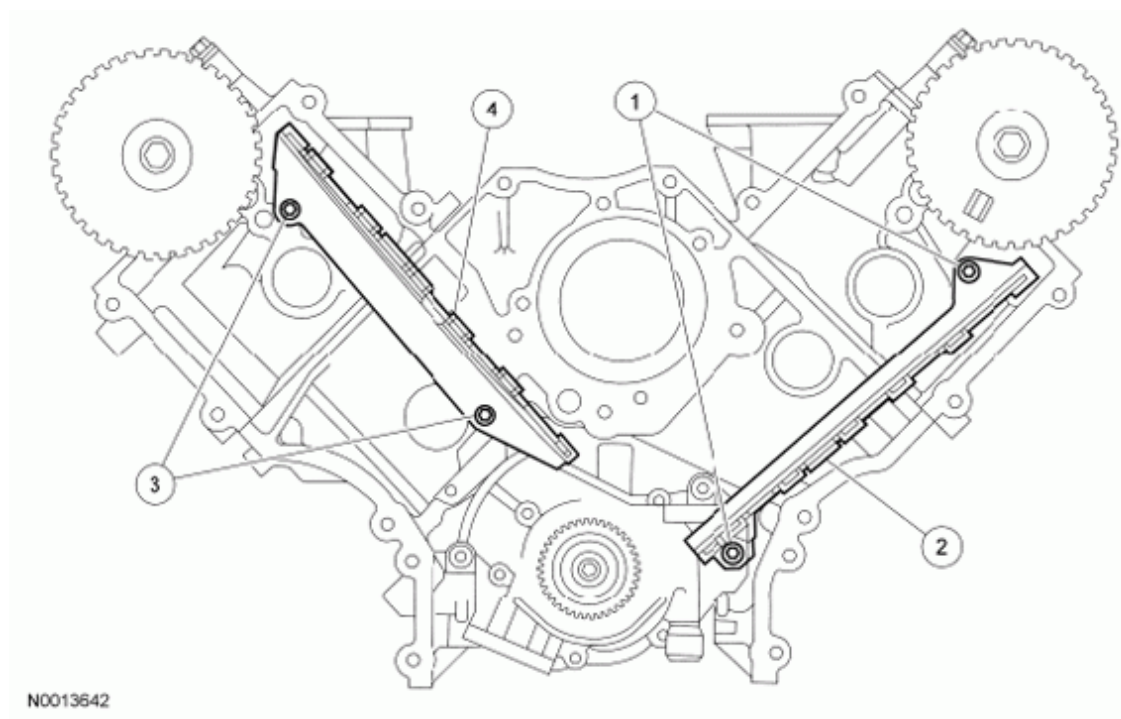


Fig. 192: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

RH cylinder head

51. Remove the RH exhaust manifold.
 1. Remove the nuts and discard.
 2. Remove the RH exhaust manifold.
 3. Remove and discard the RH exhaust manifold gasket.

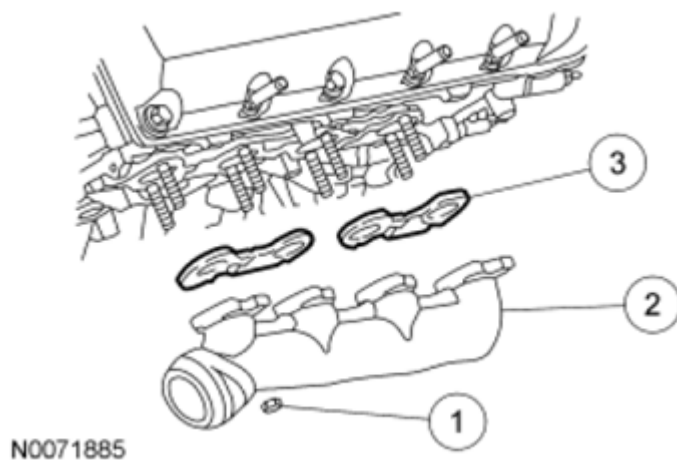


Fig. 193: Identifying Exhaust Manifold And Exhaust Manifold Gasket
Courtesy of FORD MOTOR CO.

52. Remove and discard the 8 RH exhaust manifold studs.

LH cylinder head

53. Remove the LH exhaust manifold.
1. Remove the nuts and discard.
 2. Remove the LH exhaust manifold.
 3. Remove and discard the LH exhaust manifold gaskets.

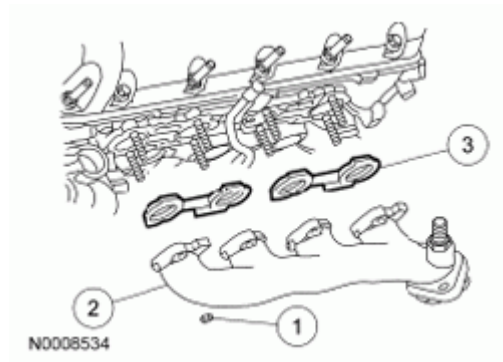


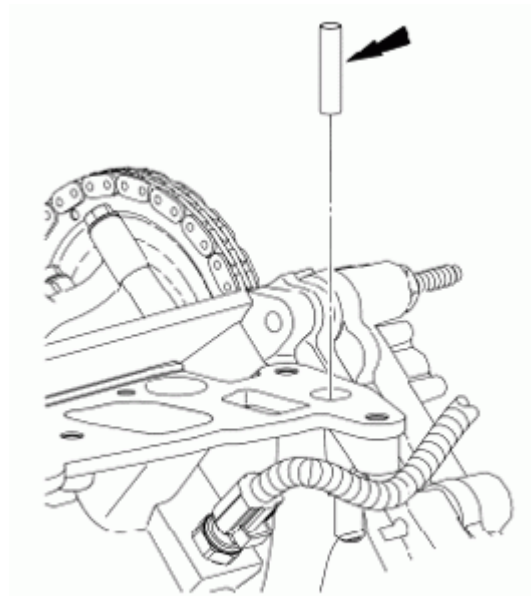
Fig. 194: Identifying Exhaust Manifold Gaskets And Nuts
Courtesy of FORD MOTOR CO.

54. Remove and discard the 8 LH exhaust manifold studs.
55. Remove the bolt and the oil level indicator tube.



Fig. 195: Locating Oil Level Indicator Tube Mounting Bolt
Courtesy of FORD MOTOR CO.

56. Remove the cylinder head insert from the LH cylinder head.

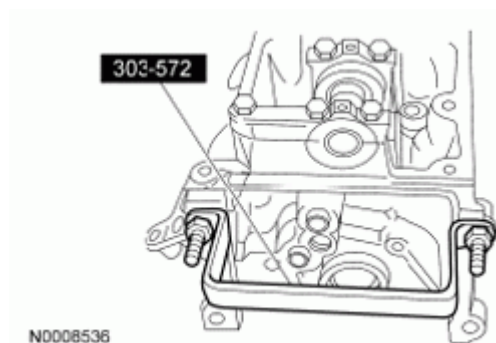


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Fig. 196: Locating Cylinder Head Insert
Courtesy of FORD MOTOR CO.

Both cylinder heads

57. Clean and inspect the exhaust manifolds. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
58. Install the Cylinder Head Remover/Installer on both ends of the cylinder head.



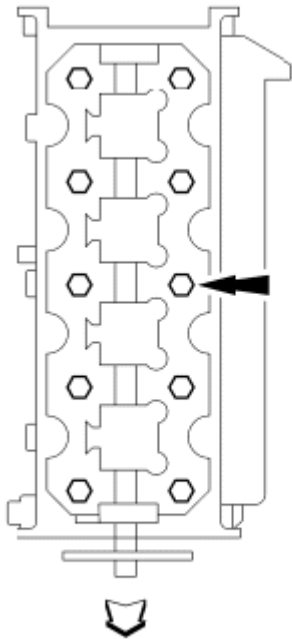
N0008536

Fig. 197: Installing Cylinder Head Remover/Installer On Both Ends Of Cylinder Head
Courtesy of FORD MOTOR CO.

RH cylinder head

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

- NOTE:** Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface. The scratches may cause leak paths.
- 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 that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.
- NOTE:** Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.
- NOTE:** The cylinder head bolts must be discarded and new bolts installed. They are a tighten-to-yield design and cannot be reused.



A26253-A

Fig. 198: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

59. Remove the bolts and the RH cylinder head.
- Discard the cylinder head gasket.
 - Discard the cylinder head bolts.

LH cylinder head

- NOTE:** The cylinder head must be cool before removing it from the engine.

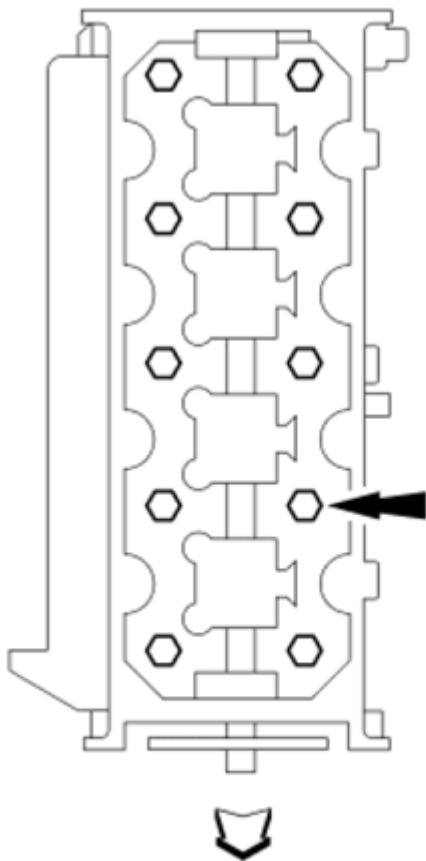
Cylinder head warpage may result if a warm or hot cylinder head is removed.

NOTE: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface. The scratches may cause leak paths.

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

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

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



A26254-A

Fig. 199: Identifying LH Cylinder Head Bolts

Courtesy of FORD MOTOR CO.

60. Remove the bolts and the LH cylinder head.

- Discard the cylinder head gasket.
- Discard the cylinder head bolts.

Both cylinder heads

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

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

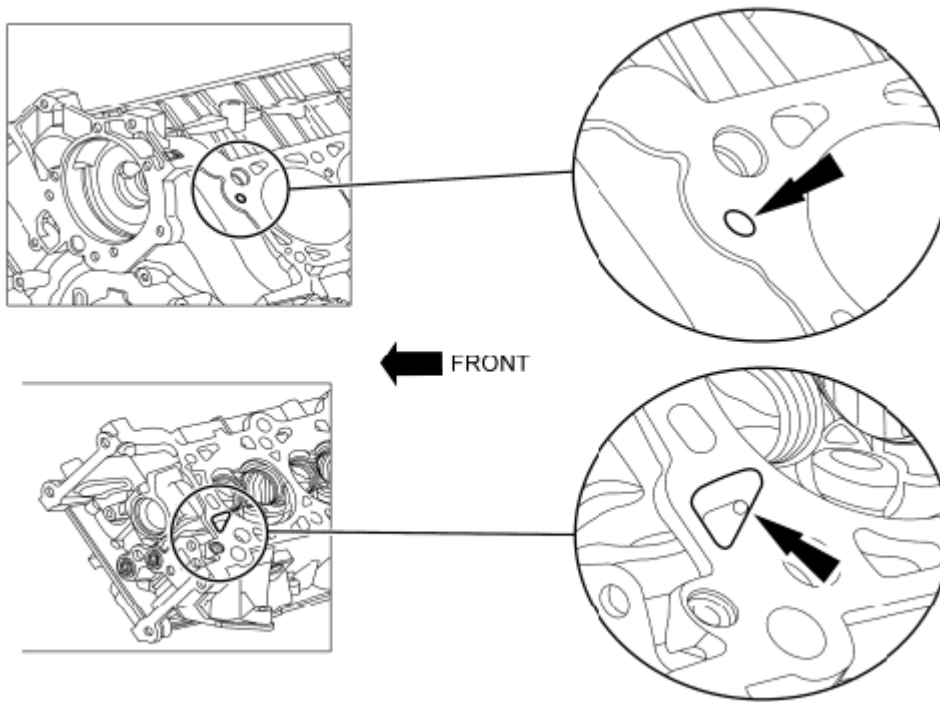
NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

61. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block in the following sequence.

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: LH shown in the illustration, RH similar.

62. Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion, paying particular attention to the oil pressure feed area. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.



A0079634

Fig. 200: Identifying Oil Pressure Feed Area
Courtesy of FORD MOTOR CO.

ENGINE

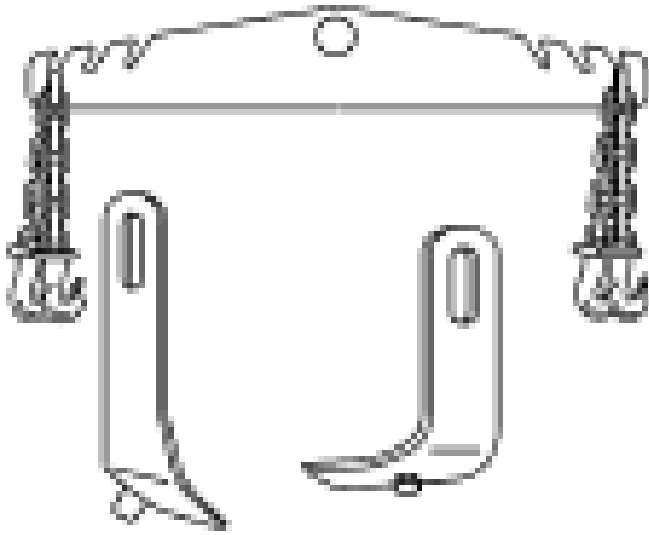
Special Tool(s)

SPECIAL TOOL(S)

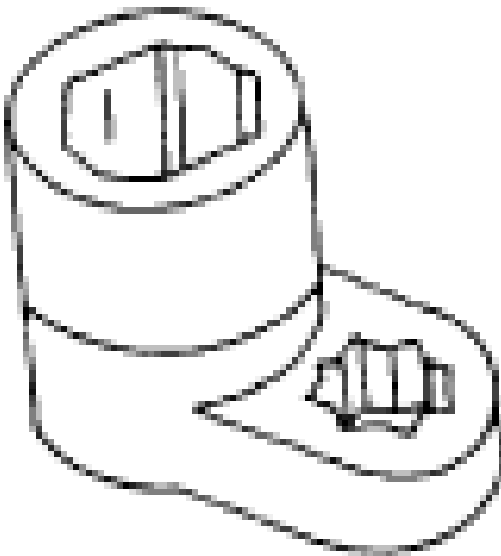
Lifting Bracket Set, Engine
303-DS086(D93P-6001-A)
Includes Lifting Bracket, Engine
303-D087 and 303-D088 or equivalent

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST2443-A



ST1448-A

Socket, Exhaust Gas Oxygen Sensor
303-476(T94P-9472-A)

Material Specifications

MATERIAL SPECIFICATIONS

Item	Specification
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-

1. Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

With the vehicle in NEUTRAL, position it on a hoist. For additional information refer to **JACKING & LIFTING** article.

2. Release the fuel pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the hood.
4. Disconnect both battery cables. For additional information, refer to **BATTERY, BATTERY MOUNTING & BATTERY CABLES** article.
5. Remove the Air Cleaner (ACL) and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.
6. Remove the wiper mounting arm and pivot shaft. For additional information, refer to **WIPER SYSTEM & WASHER SYSTEM** article.
7. Remove the 2 nuts and the support bracket.

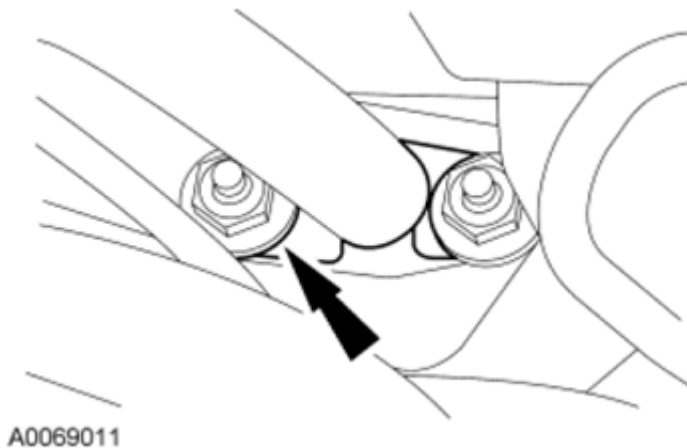


Fig. 201: Locating Support Bracket Mounting Nut
Courtesy of FORD MOTOR CO.

8. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE BELT** article.
9. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.
10. Disconnect the vacuum hose.

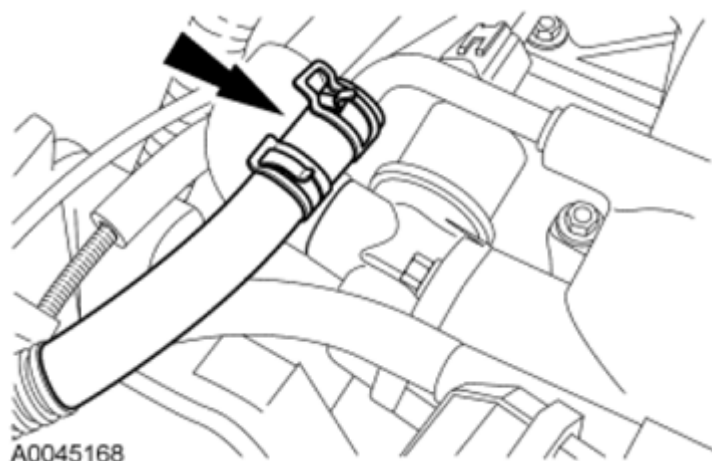


Fig. 202: Locating Vacuum Hose
Courtesy of FORD MOTOR CO.

11. Disconnect the Evaporative Emission (EVAP) canister purge valve.
 - Disconnect the 2 quick release EVAP hoses.
 - Disconnect the electrical connector.

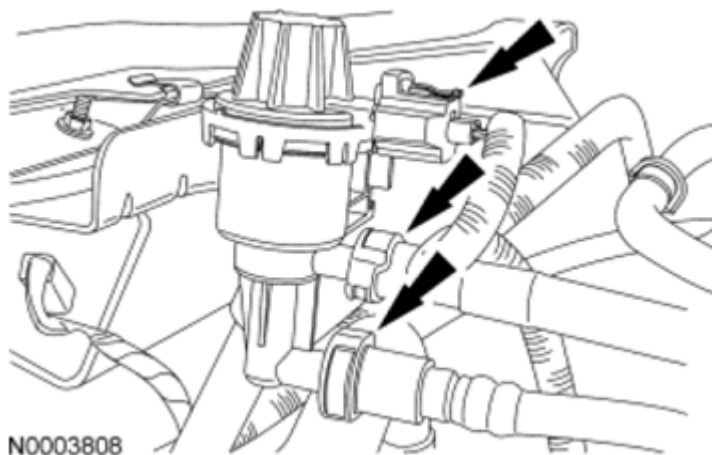


Fig. 203: Locating Quick Release EVAP Hoses And Electrical Connector
Courtesy of FORD MOTOR CO.

12. Disconnect the fuel tube spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
13. Detach the generator battery cable retainer from the RH valve cover stud bolt.

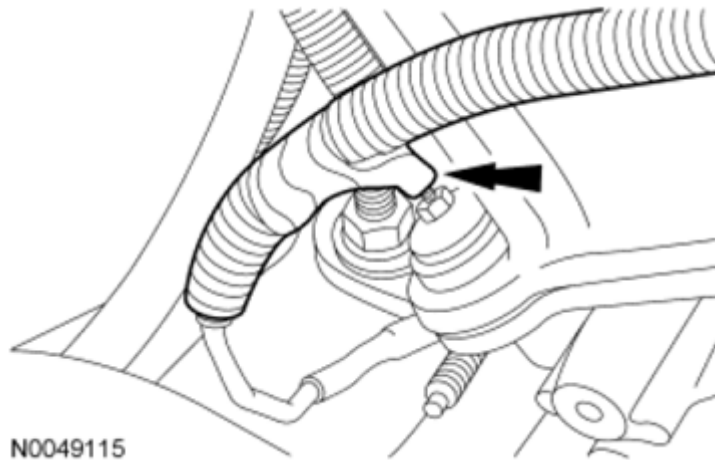


Fig. 204: Locating Generator Battery Cable Retainer
Courtesy of FORD MOTOR CO.

14. Remove the nut and disconnect the generator battery cable.
 - Detach the generator battery cable pin-type retainer.

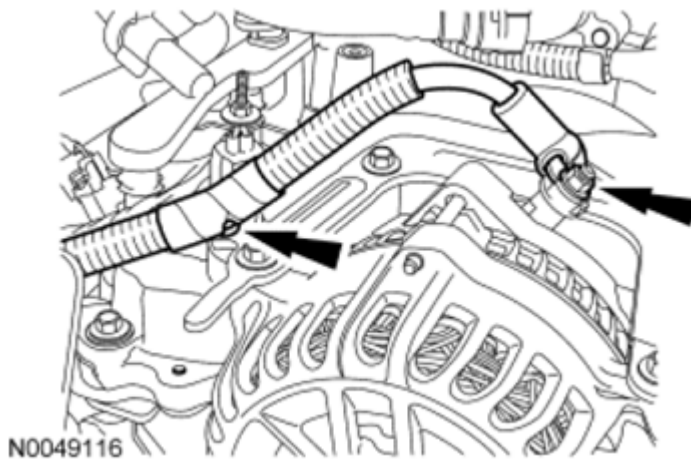


Fig. 205: Locating Generator Battery Cable Pin-Type Retainer
Courtesy of FORD MOTOR CO.

15. Disconnect the PCM electrical connectors.

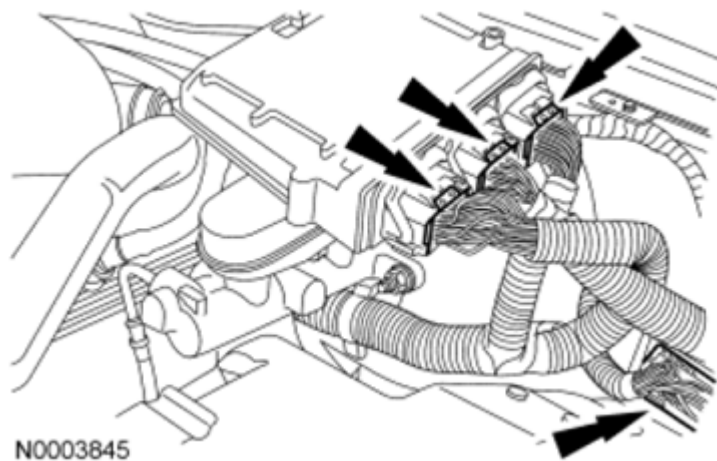


Fig. 206: Locating PCM Electrical Connectors
Courtesy of FORD MOTOR CO.

16. Remove the bolt and ground wire.

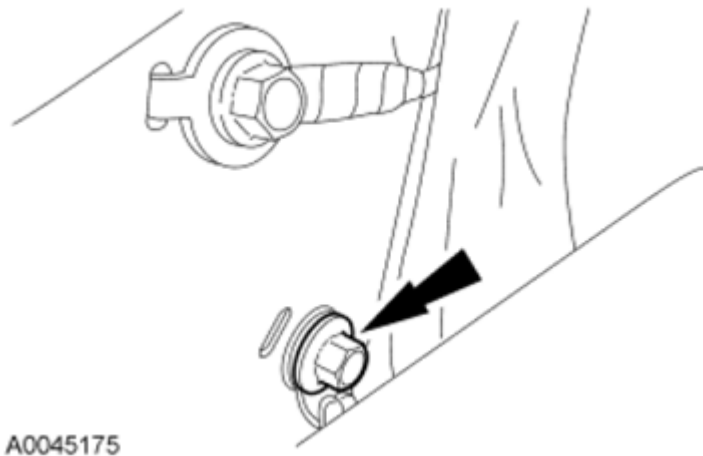


Fig. 207: Locating Ground Wire Mounting Bolt
Courtesy of FORD MOTOR CO.

17. Disconnect the A/C electrical connector.

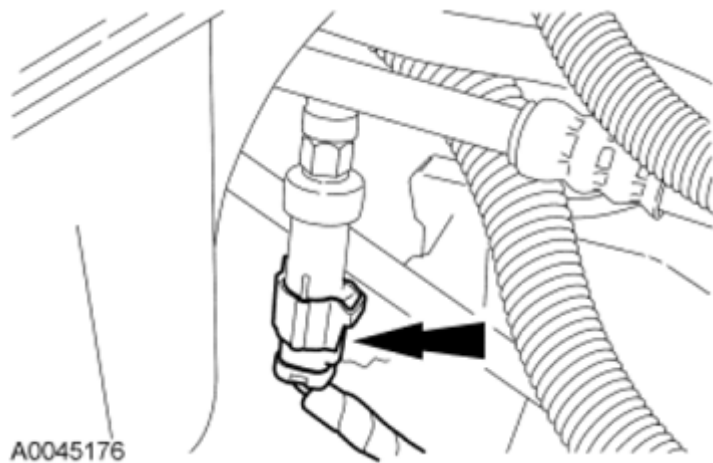


Fig. 208: Locating A/C Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the A/C low charge protection switch electrical connector.

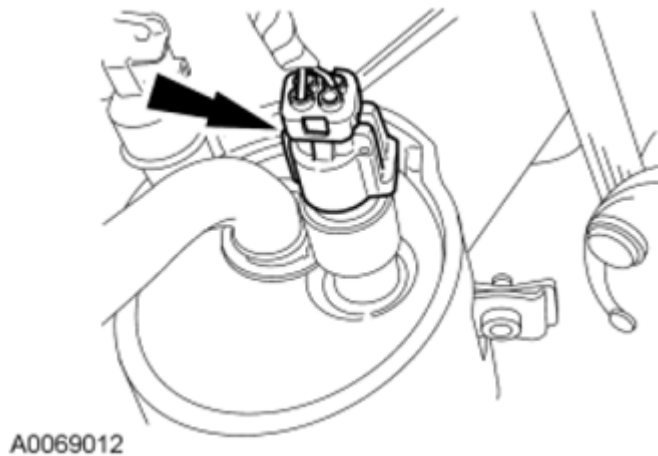


Fig. 209: Locating A/C Low Charge Protection Switch Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the heater hoses.

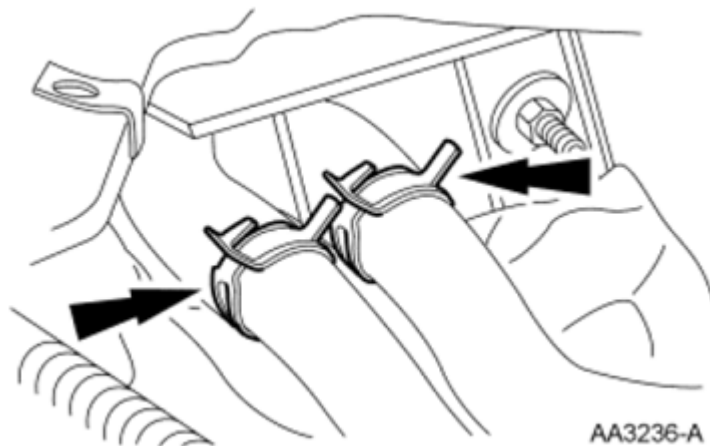


Fig. 210: Locating Heater Hoses
Courtesy of FORD MOTOR CO.

20. Remove the bolt and the ground strap.

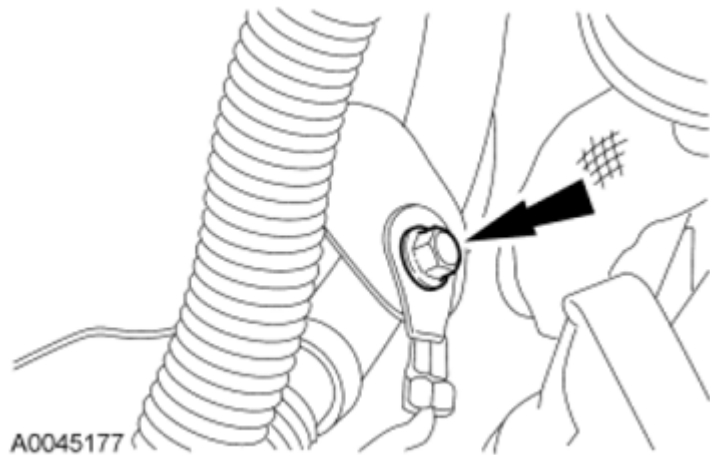


Fig. 211: Locating Ground Strap Mounting Bolt
Courtesy of FORD MOTOR CO.

21. Disconnect the upper radiator hose from the hose connection. Secure the hose to the radiator assembly.

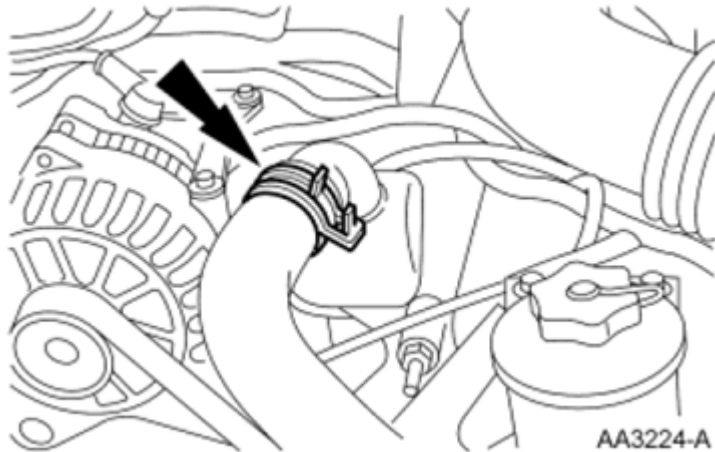


Fig. 212: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

22. Disconnect the lower radiator hose from the oil filter adapter.

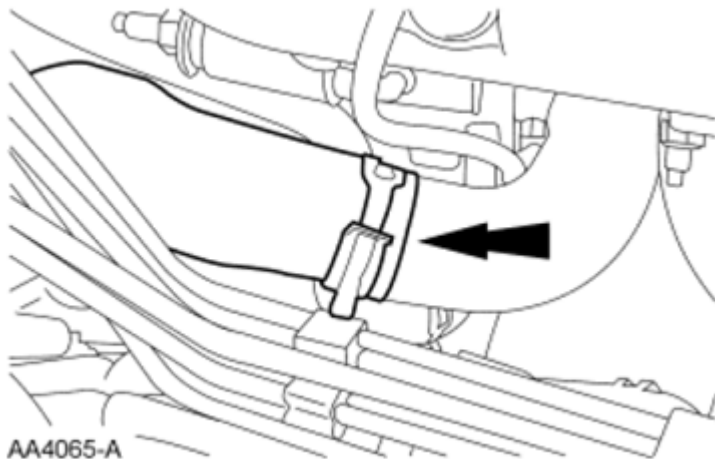


Fig. 213: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

23. Remove the cooling fan. For additional information, refer to **ENGINE COOLING SYSTEM** article.
24. Drain the engine oil.
- Install the drain plug when finished.
 - To install, tighten to 23 Nm (17 lb-ft).

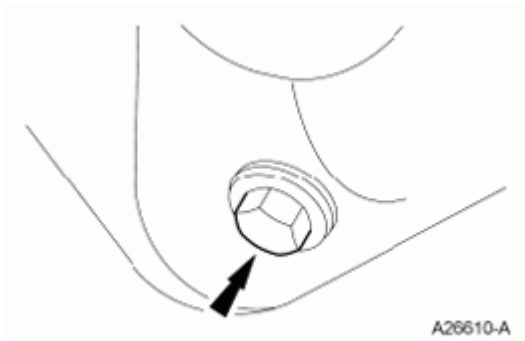


Fig. 214: Locating Engine Oil Drain Plug
Courtesy of FORD MOTOR CO.

25. Remove and discard the oil filter.
26. If equipped, disconnect the block heater electrical connector.
27. Disconnect the power steering electrical connector.

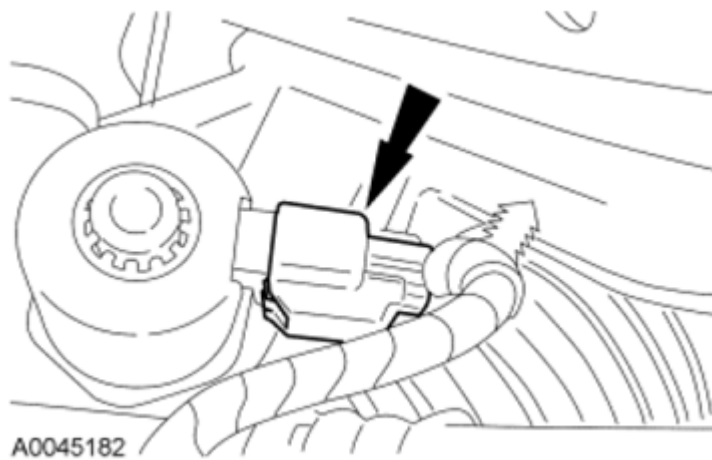


Fig. 215: Locating Power Steering Electrical Connector
Courtesy of FORD MOTOR CO.

28. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.

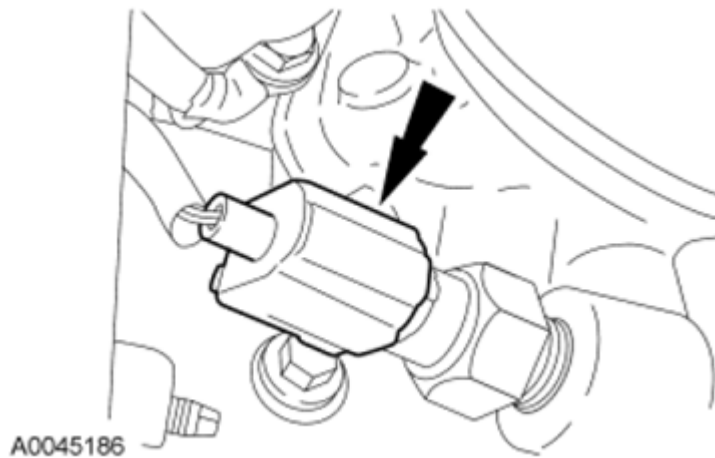


Fig. 216: Locating Engine Oil Pressure (EOP) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

29. Disconnect the Power Steering Pressure (PSP) switch electrical connector.

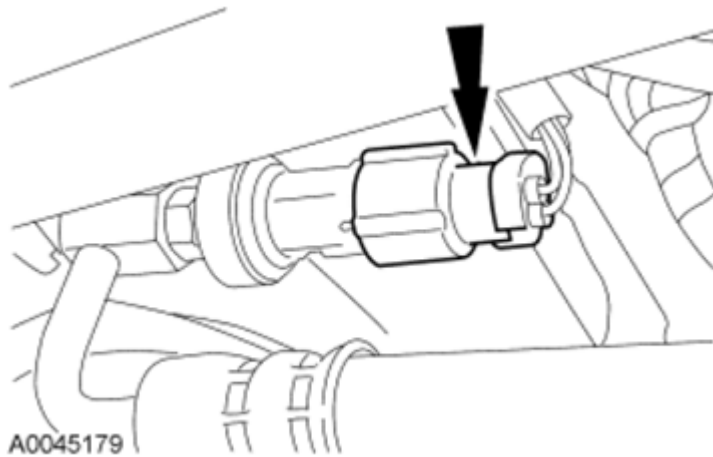


Fig. 217: Locating Power Steering Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: For correct installation, the white lines on the coolant hoses must be aligned with the black dots on the oil cooler tubes. If the black dots are not visible, mark the oil cooler tube with a permanent marker before disconnecting the hoses. Failure to follow this instruction may result in damage to the coolant hoses.

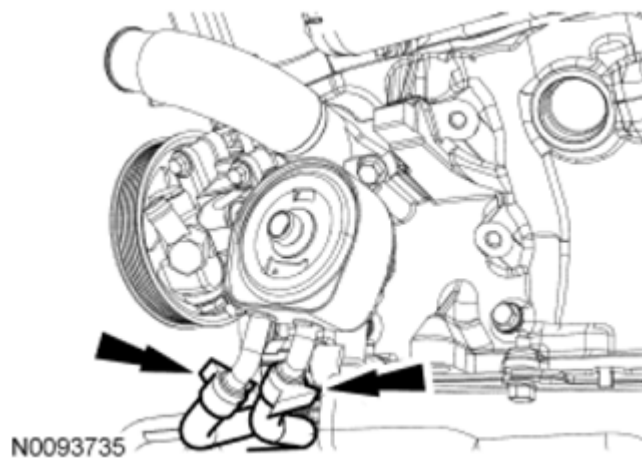


Fig. 218: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

30. If equipped, disconnect the 2 coolant hoses from the oil cooler.
31. Remove the nut and the transmission cooler tube support bracket.

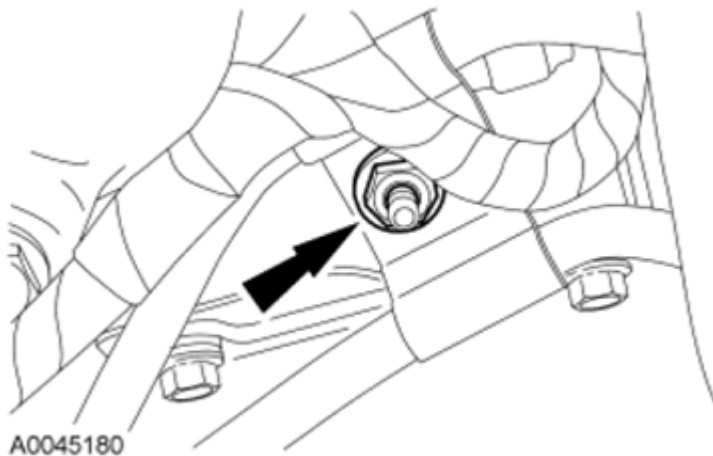


Fig. 219: Locating Transmission Cooler Tube Support Bracket
Courtesy of FORD MOTOR CO.

32. Remove the transmission oil cooler tube bracket bolt.

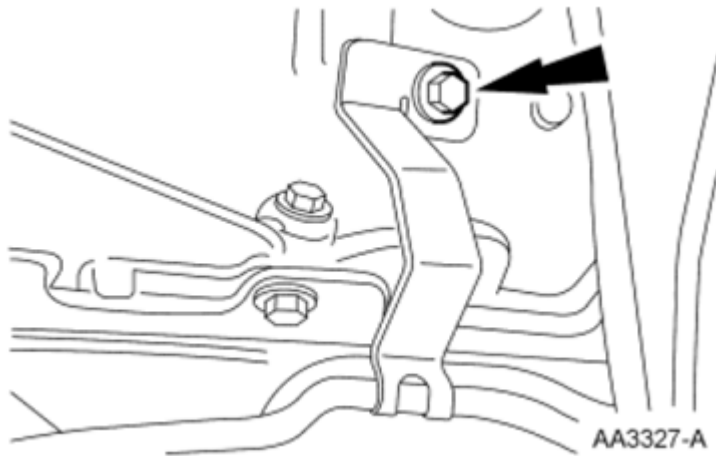


Fig. 220: Locating Transmission Oil Cooler Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

33. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

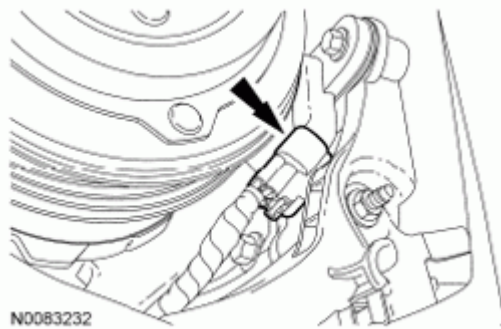


Fig. 221: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

34. Position the power steering tube bracket aside.

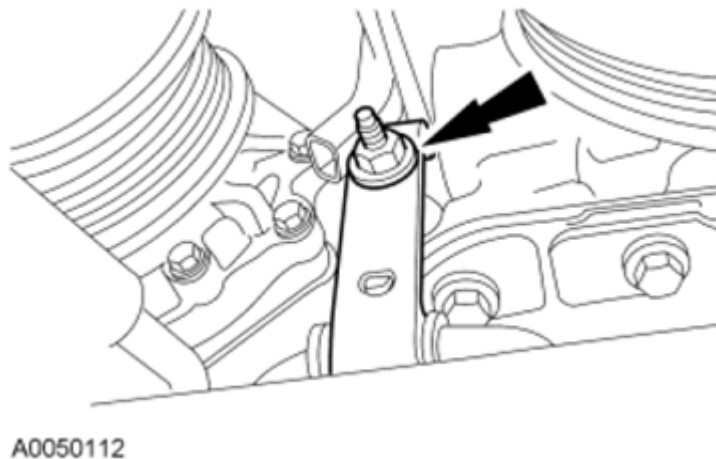


Fig. 222: Locating Power Steering Tube Bracket Mounting Nut
Courtesy of FORD MOTOR CO.

35. Disconnect the engine wiring harness retainers from the A/C compressor.

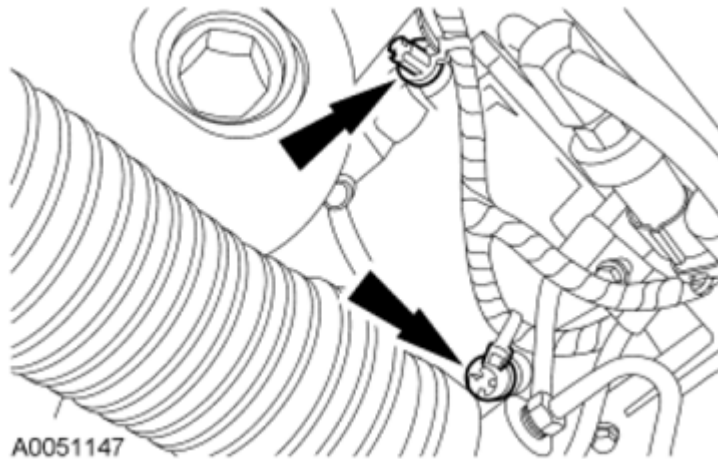


Fig. 223: Locating A/C Compressor Engine Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

36. Disconnect the A/C compressor electrical connector.



Fig. 224: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

37. Remove the 3 bolts and position the A/C compressor aside.

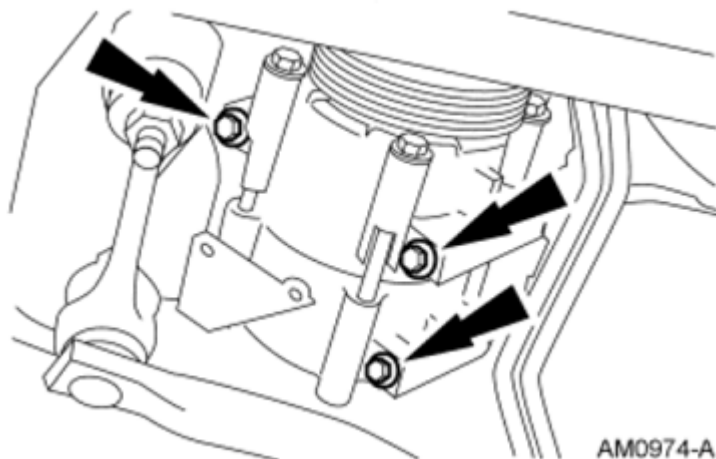


Fig. 225: Locating A/C Compressor Mounting Bolts
Courtesy of FORD MOTOR CO.

38. Remove the 3 bolts and position the power steering pump aside.

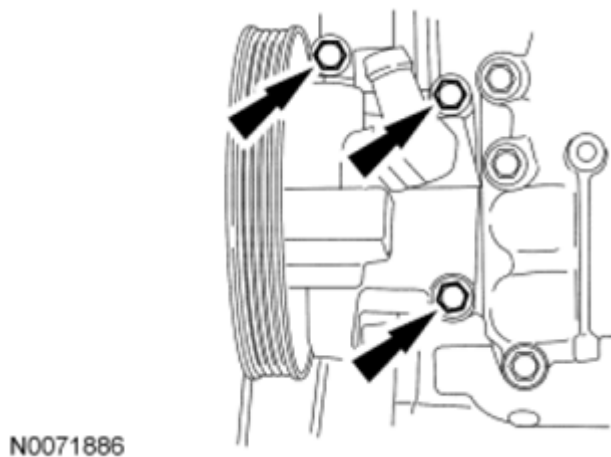


Fig. 226: Locating Power Steering Pump Mounting Bolts
Courtesy of FORD MOTOR CO.

39. Remove the starter motor. For additional information, refer to **STARTING SYSTEM** article.
40. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connectors.

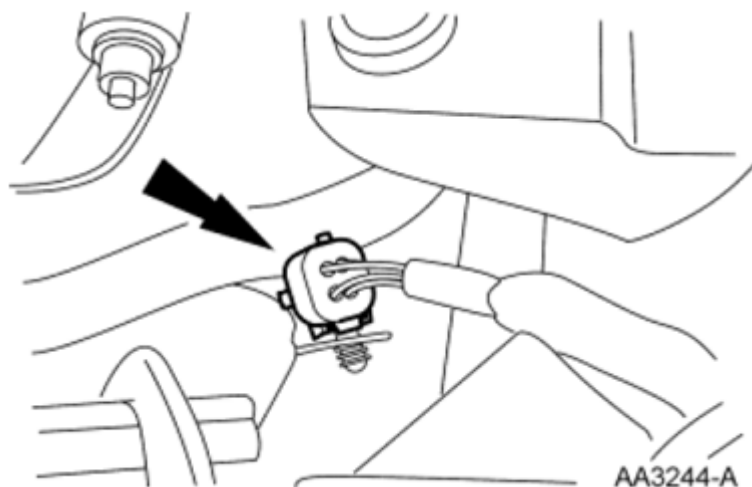


Fig. 227: Locating Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

41. Disconnect the LH HO2S electrical connector.

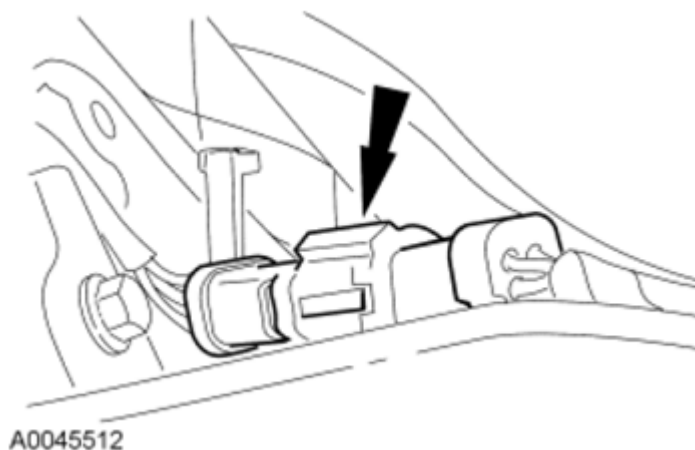


Fig. 228: Locating LH HO2S Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

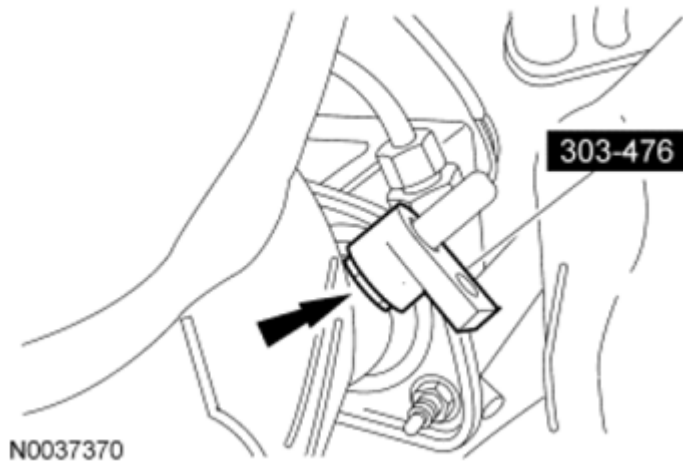


Fig. 229: Locating Exhaust Gas Oxygen Sensor Socket
Courtesy of FORD MOTOR CO.

42. Using the Exhaust Gas Oxygen Sensor Socket, remove the LH HO2S.
43. Support the exhaust and remove the 4 nuts.
 - Discard the 4 nuts.

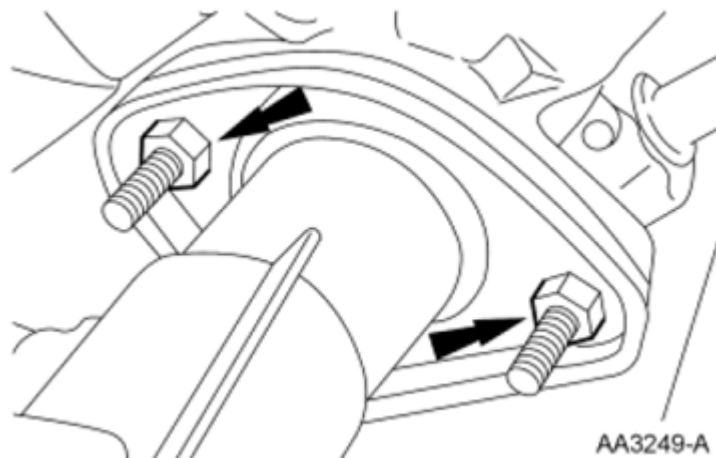


Fig. 230: Locating Exhaust Mounting Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

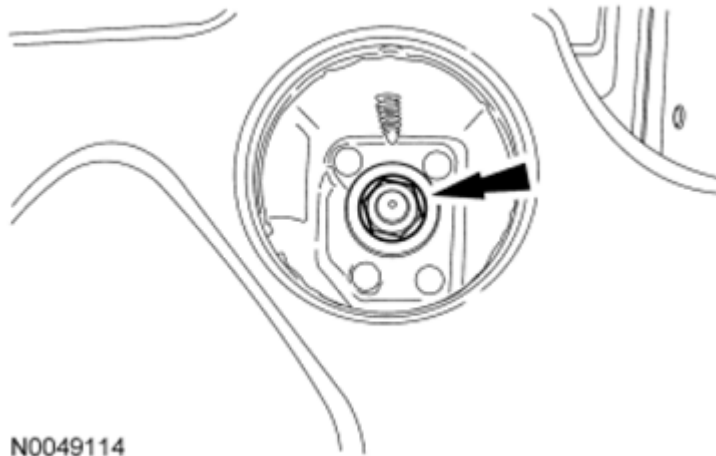


Fig. 231: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

44. Remove the 2 engine mount nuts.
45. Install a suitable lifting device under the transmission and support.
46. Remove the rear transmission insulator nuts.

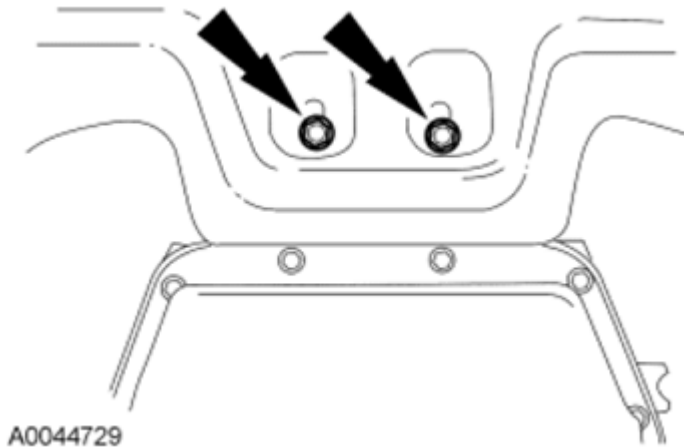


Fig. 232: Locating Rear Transmission Insulator Nuts
Courtesy of FORD MOTOR CO.

47. Raise the transmission and remove the rear transmission insulator bolts.

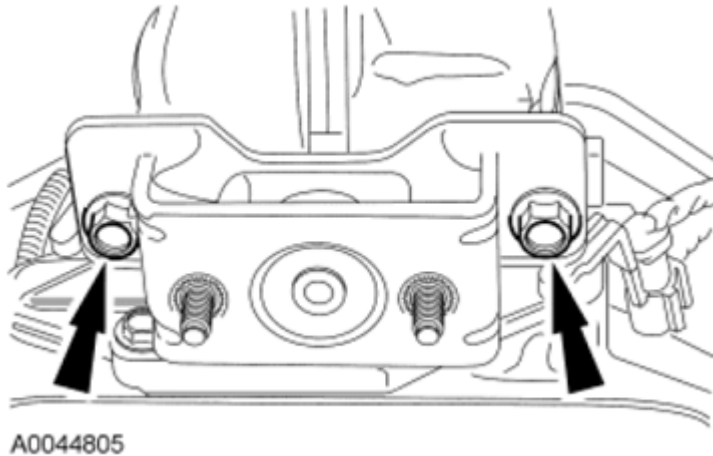


Fig. 233: Locating Rear Transmission Insulator Bolts
Courtesy of FORD MOTOR CO.

48. Remove the transmission rear insulator and lower the transmission down to rest on the rear crossmember.
49. Disconnect the **HO2S** sensor and the solenoid body sensor electrical connectors.

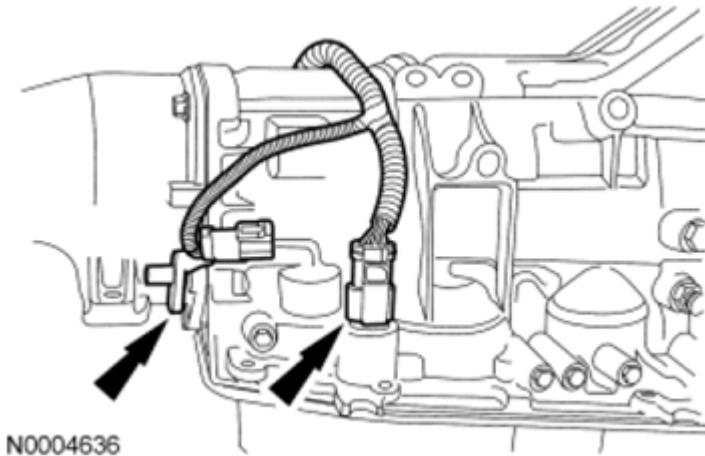


Fig. 234: Locating Heated Oxygen Sensor And Solenoid Body Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

50. Disconnect the Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor and the Turbine Shaft Speed (TSS) sensor electrical connectors.

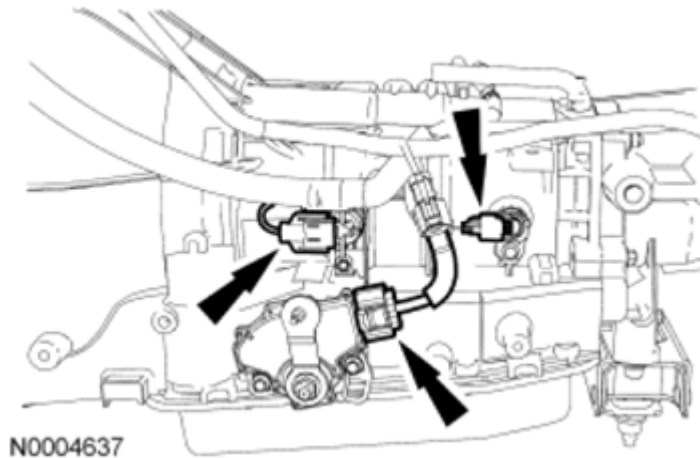


Fig. 235: Locating Output Shaft Speed Sensor, Transmission Range Sensor And Turbine Shaft Speed Sensor Electrical Connectors

Courtesy of FORD MOTOR CO.

51. Release the wiring harness from the retainers on the transmission.
52. Remove the 3 bolts and the inspection cover.

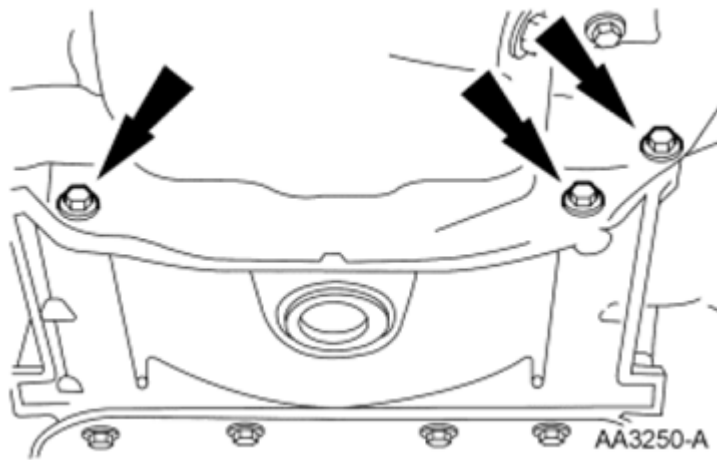


Fig. 236: Locating Inspection Cover Mounting Bolts

Courtesy of FORD MOTOR CO.

53. Remove the torque converter nut access plug.
 - Remove the 4 nuts.

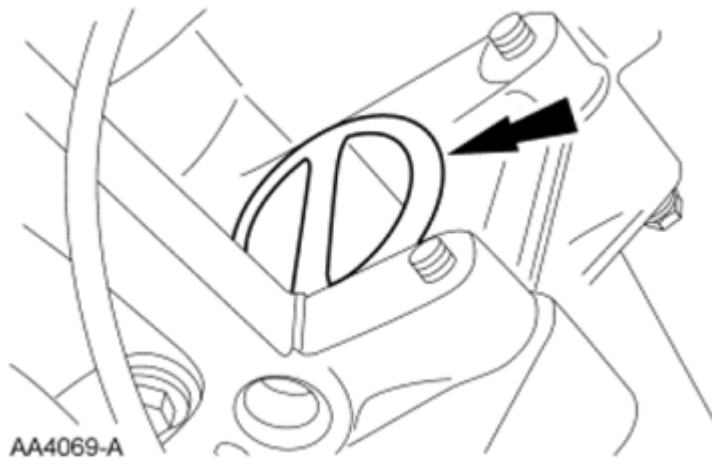


Fig. 237: Locating Torque Converter Nut Access Plug
Courtesy of FORD MOTOR CO.

54. Remove the 4 bolts and 1 stud (2 bolts shown in the illustration).

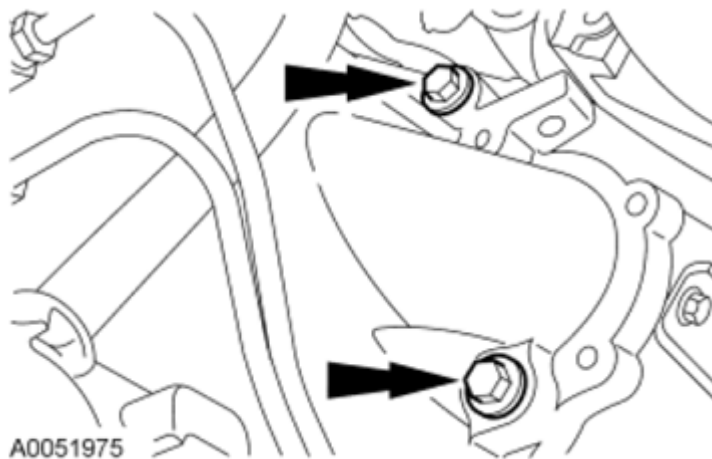


Fig. 238: Locating Bolts And Stud
Courtesy of FORD MOTOR CO.

55. Install the Engine Lifting Bracket to the RH cylinder head.

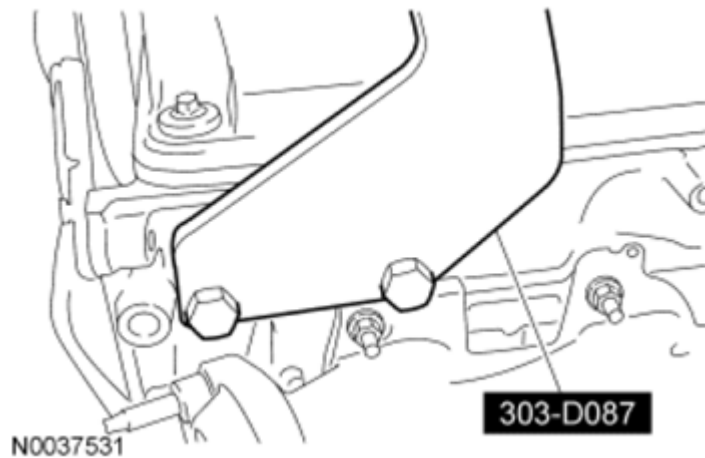


Fig. 239: Installing Engine Lifting Bracket To RH Cylinder Head
Courtesy of FORD MOTOR CO.

56. Install the Engine Lifting Bracket to the LH cylinder head.

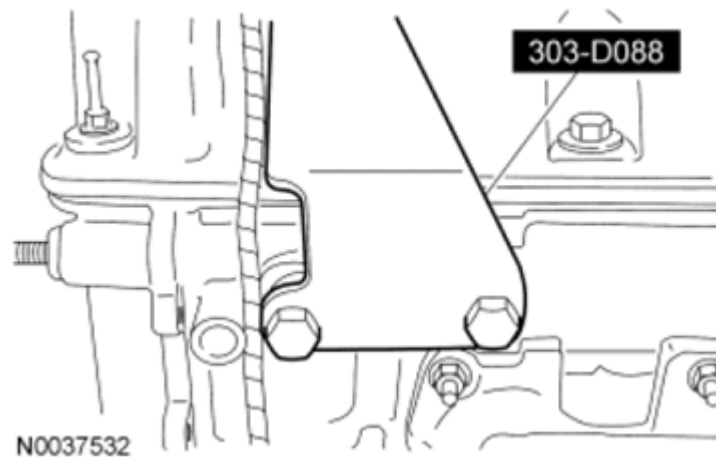


Fig. 240: Installing Engine Lifting Bracket To LH Cylinder Head
Courtesy of FORD MOTOR CO.

57. Install the Engine Lifting Bracket Set.

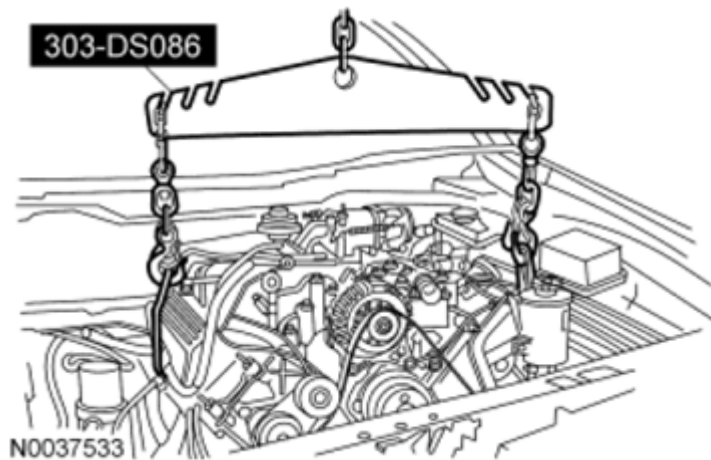


Fig. 241: Identifying Engine Lifting Bracket Set
Courtesy of FORD MOTOR CO.

58. Remove the 2 bellhousing bolts.

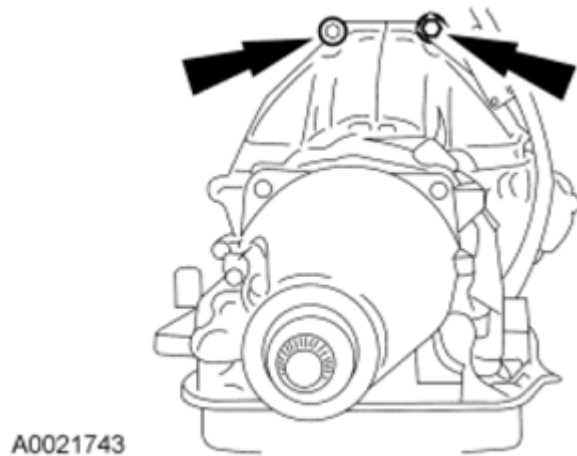


Fig. 242: Locating Bellhousing Bolts
Courtesy of FORD MOTOR CO.

59. Remove the engine assembly from the vehicle.

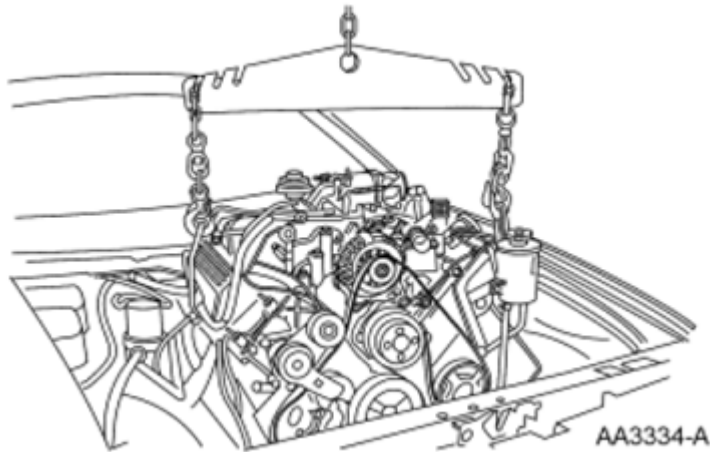


Fig. 243: Removing Engine Assembly From Vehicle
Courtesy of FORD MOTOR CO.

DISASSEMBLY

ENGINE

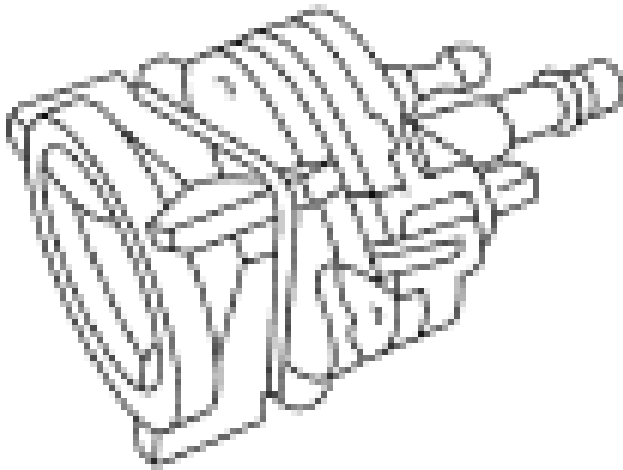
Special Tool(s)

SPECIAL TOOL(S)

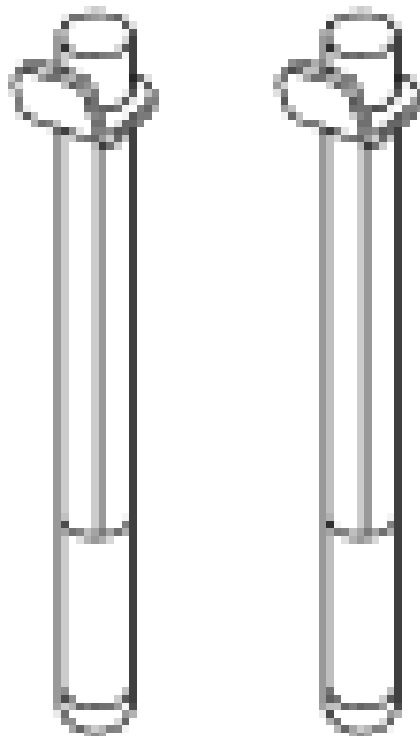


Compressor, Valve Spring
303-567 (T97P-6565-AH)

Cylinder Ridge Reamer
303-016 (T64L-6011-EA)



ST1276-A



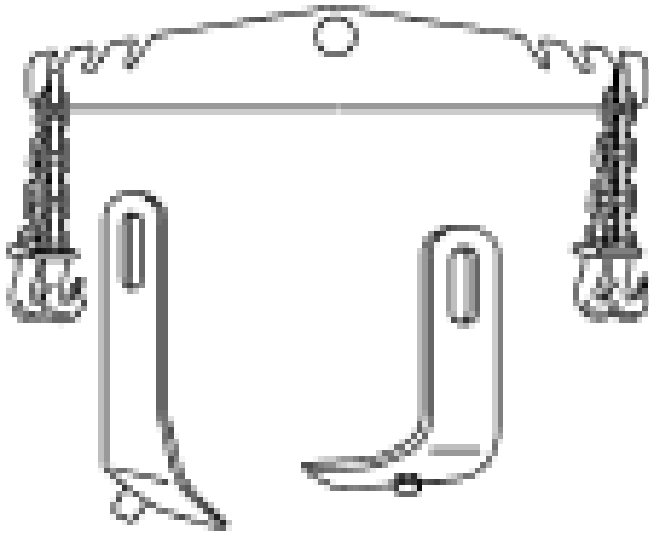
ST1337-A

Installer, Connecting Rod
303-442 (T93P-6136-A)

Lifting Bracket Set, Engine

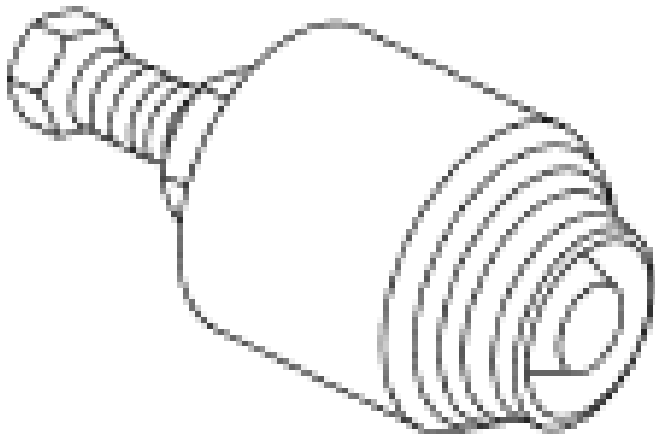
2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST2443-A

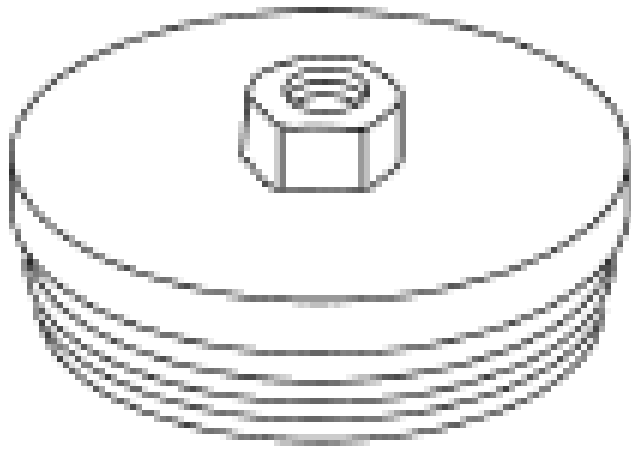
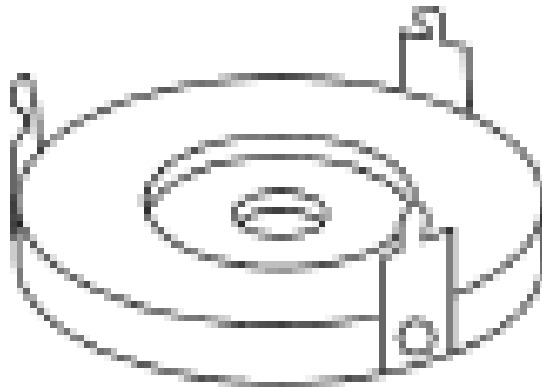
303-DS086 (D93P-6001-A)
Includes Lifting Bracket, Engine
303-D087 and 303-D088 or equivalent



ST1730-A

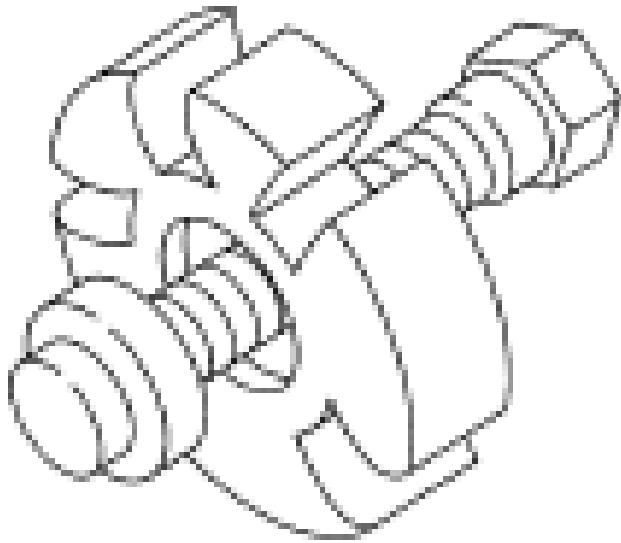
Remover, Crankshaft Front Oil Seal
303-107 (T74P-6700-A)

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

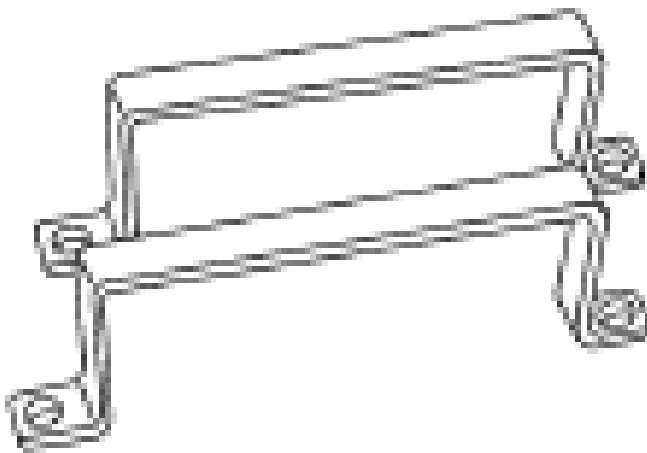
**ST1382-A****ST1481-A**

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

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



ST1286-A



ST1668-A

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

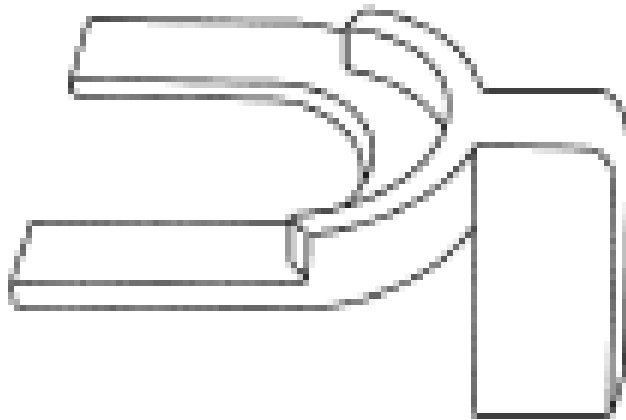
Slide Hammer
100-001 (T50T-100-A)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1185-A



ST1331-A

Spacer, Valve Spring Compressor
303-382 (T91P-6565-AH)

Material Specifications

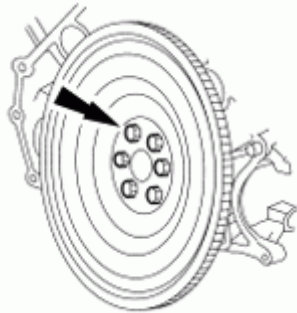
MATERIAL SPECIFICATIONS TABLE

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

Disassembly

- NOTE:** Servicing the bottom end of the engine (crankshaft, bearings) requires that cylinder heads be removed. Failure to do so may result in engine damage.
- NOTE:** 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 may cause engine failure.
- NOTE:** The crankshaft rear seal, the rear oil seal slinger and the crankshaft rear seal retainer plate must be removed before mounting the engine on the engine stand.
- NOTE:** For additional information, refer to the appropriate exploded views under engine Assembly in this service information.

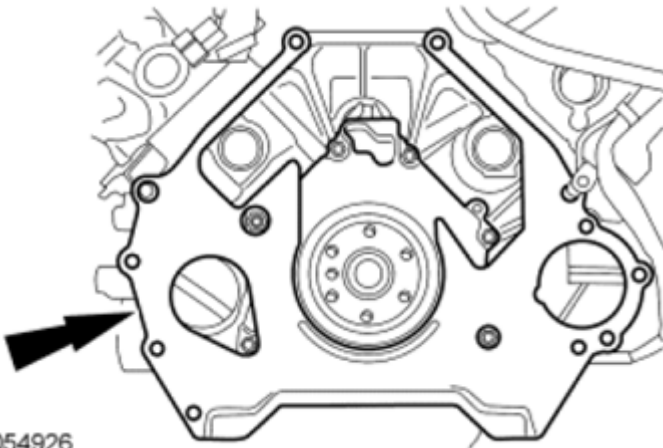
1. Remove the 6 bolts and the flexplate.



N0037603

Fig. 244: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

2. Remove the engine/transmission spacer plate.



A0054926

Fig. 245: Locating Engine/Transmission Spacer Plate
Courtesy of FORD MOTOR CO.

3. Using the Crankshaft Rear Oil Slinger Remover and Slide Hammer, remove the crankshaft rear seal slinger.

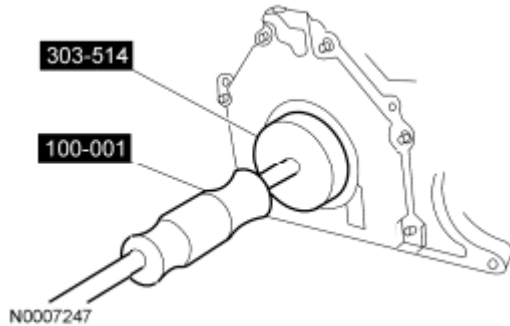


Fig. 246: Removing Crankshaft Rear Oil Seal Slinger Using Crankshaft Oil Slinger
Courtesy of FORD MOTOR CO.

4. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove the crankshaft rear seal.

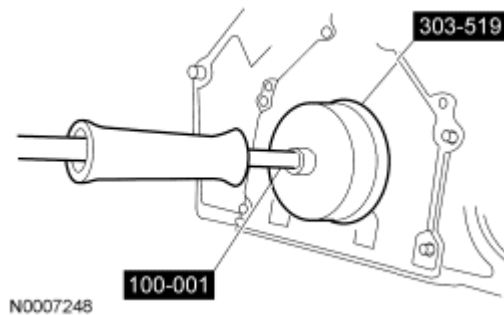


Fig. 247: Removing Crankshaft Rear Seal Using Crankshaft Rear Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

5. Remove the 2 oil pan-to-crankcase rear seal retainer plate bolts and the 6 crankcase rear seal retainer plate bolts.

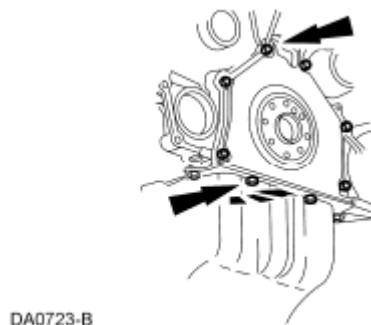


Fig. 248: Locating Crankshaft Rear Seal Retainer Plate Mounting Bolts
Courtesy of FORD MOTOR CO.

6. Using the Engine Lifting Bracket Set, mount the engine on a suitable engine stand.

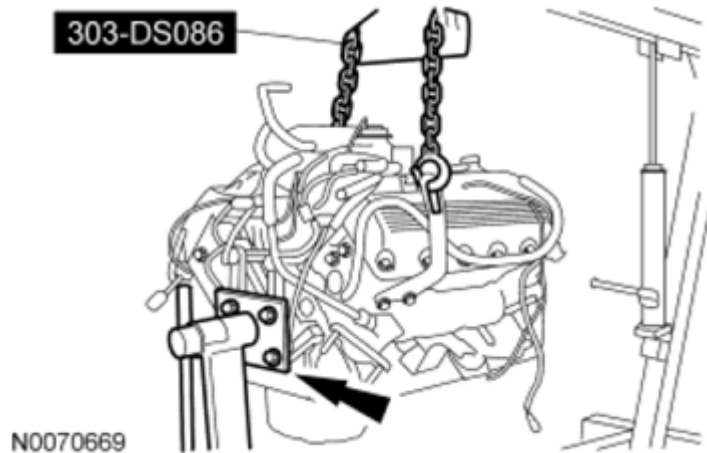


Fig. 249: Identifying Engine Lifting Bracket Set (303-DS086)
Courtesy of FORD MOTOR CO.

NOTE: RH shown in the illustration, LH similar.

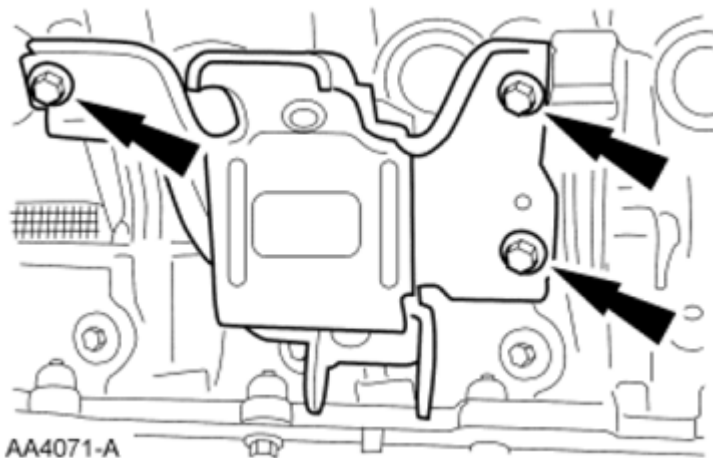


Fig. 250: Locating RH Engine Mount And Bolts
Courtesy of FORD MOTOR CO.

7. Remove the bolts and the LH and RH engine mounts.

NOTE: LH shown in the illustration, RH similar.

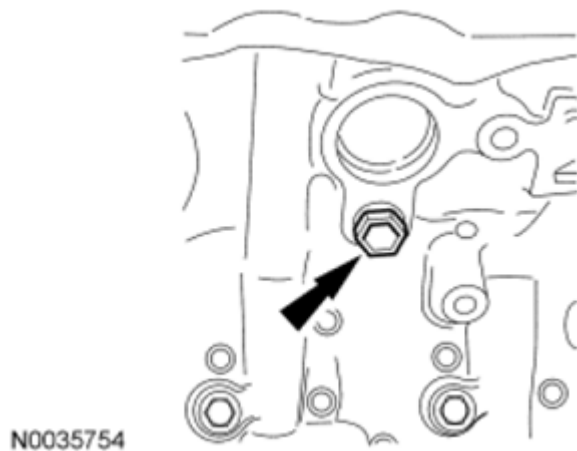


Fig. 251: Locating Engine Block Drain Plug And Mounting Bolt
Courtesy of FORD MOTOR CO.

8. If equipped, remove the drain plugs from the engine block. Allow the coolant to completely drain.
 - Install the drain plugs when finished.
 - To install, tighten to 20 Nm (177 lb-in).
9. Remove the bolt and the battery cables from the engine.

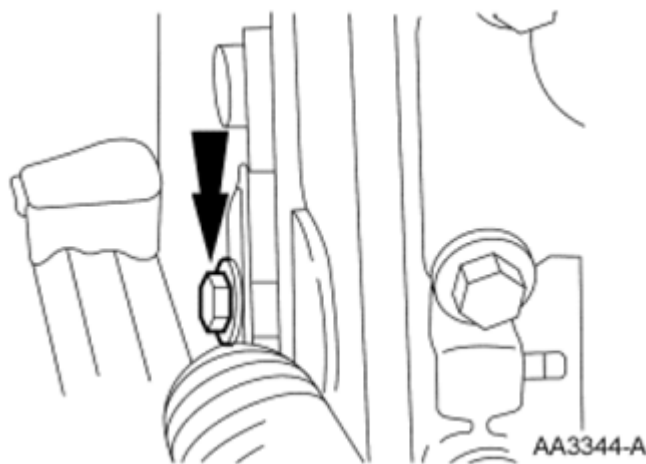


Fig. 252: Locating Bolt And Battery Cables
Courtesy of FORD MOTOR CO.

10. Disconnect the EGR tube from the exhaust manifold.

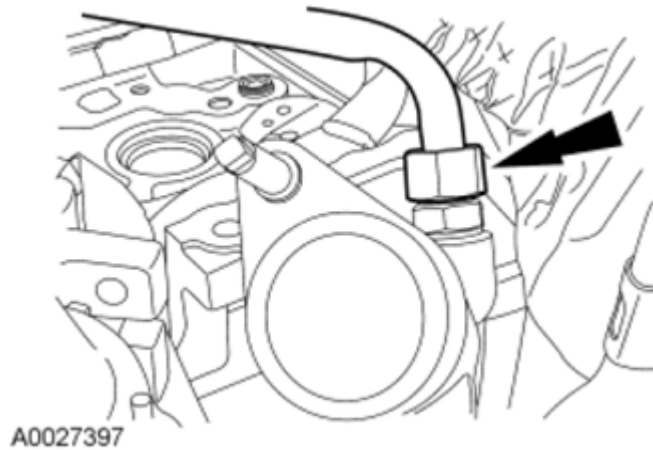


Fig. 253: Locating Exhaust Gas Recirculation Tube
Courtesy of FORD MOTOR CO.

11. Disconnect the 8 ignition coil electrical connectors (4 shown in the illustration).

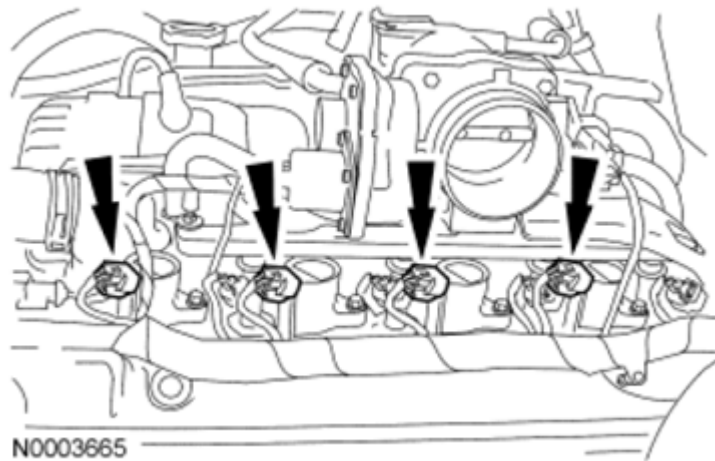


Fig. 254: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

12. Disconnect the 8 fuel injector electrical connectors (4 shown in the illustration).

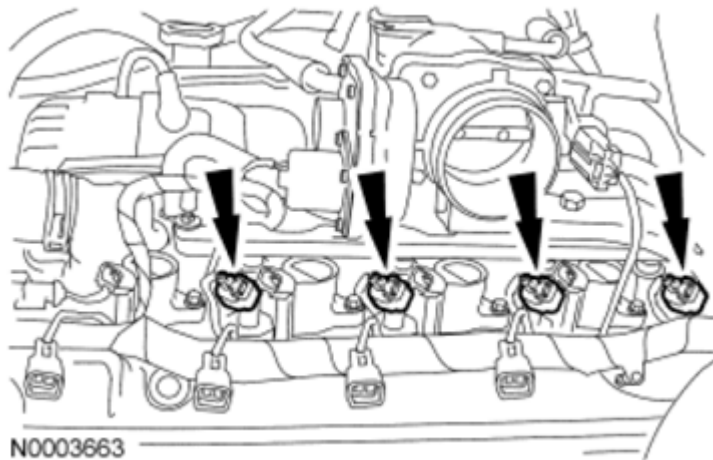


Fig. 255: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the intake manifold shield.

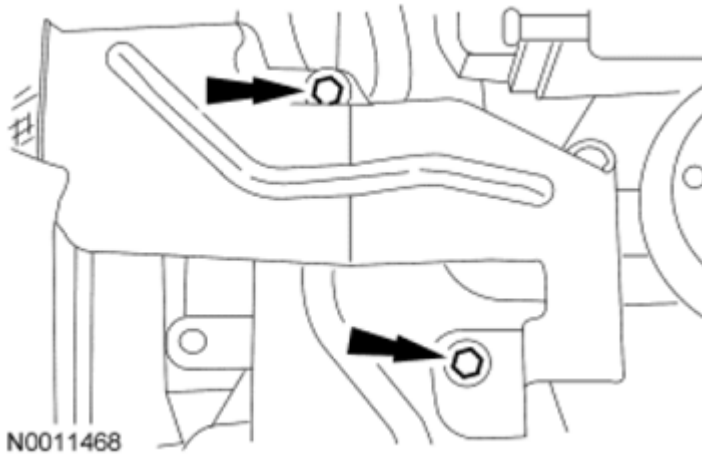


Fig. 256: Locating Intake Manifold Shield Mounting Bolt
Courtesy of FORD MOTOR CO.

14. Disconnect and remove the crankcase ventilation tube.

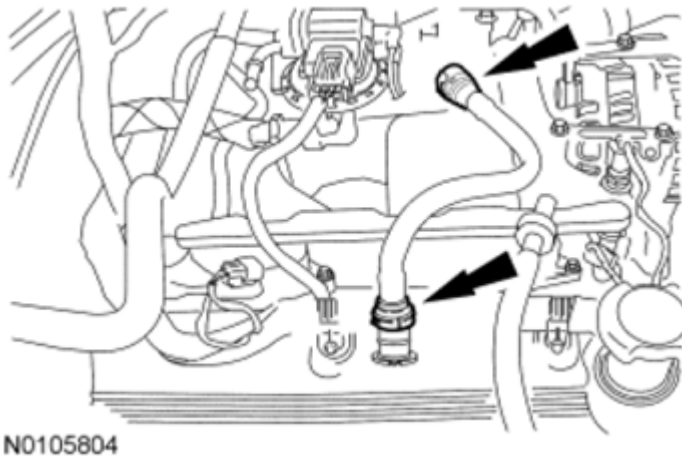


Fig. 257: Locating Crankcase Ventilation Tube
Courtesy of FORD MOTOR CO.

15. Disconnect the generator electrical connector and detach the wiring harness retainer.

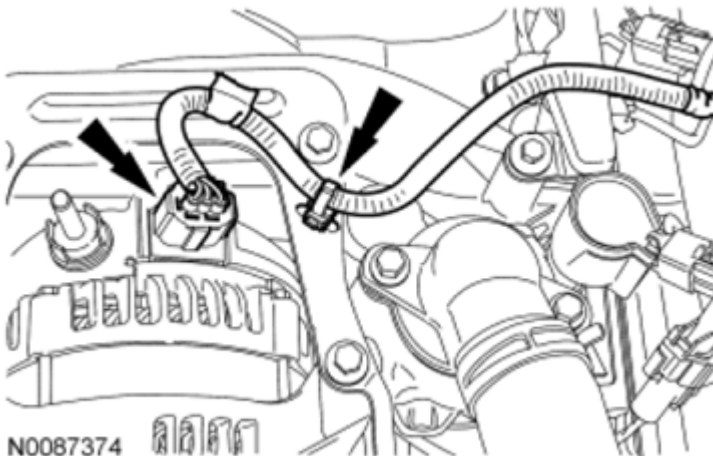


Fig. 258: Locating Generator Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

16. Remove the 4 generator mounting bracket bolts and the bracket.

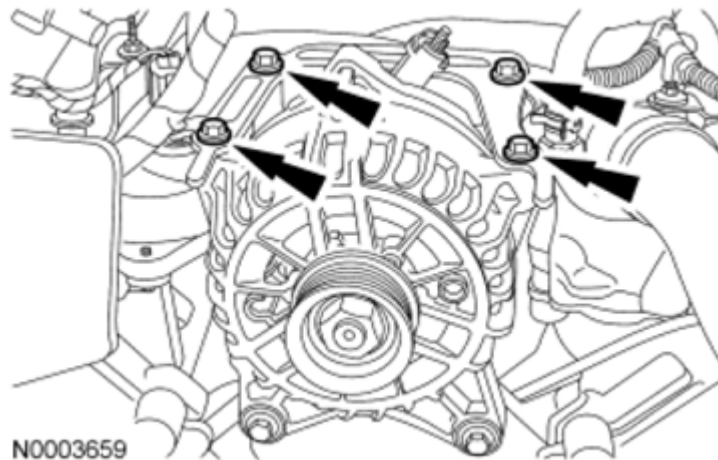


Fig. 259: Locating Generator Mounting Bracket And Mounting Bolts
Courtesy of FORD MOTOR CO.

17. Disconnect the throttle control and the Throttle Position (TP) sensor electrical connectors.

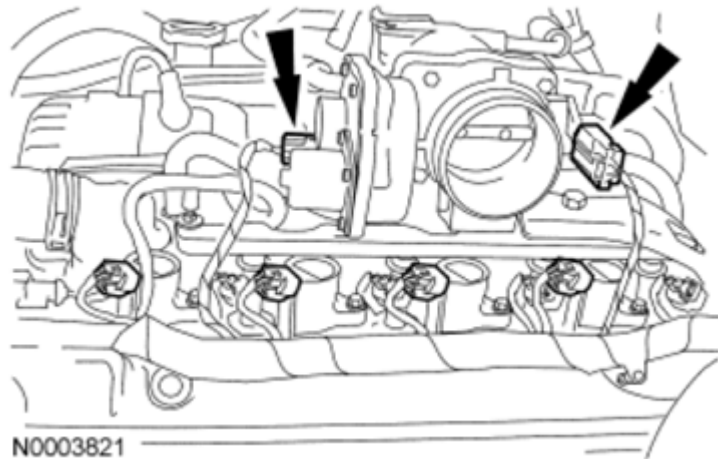


Fig. 260: Locating Throttle Control And Throttle Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

18. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.

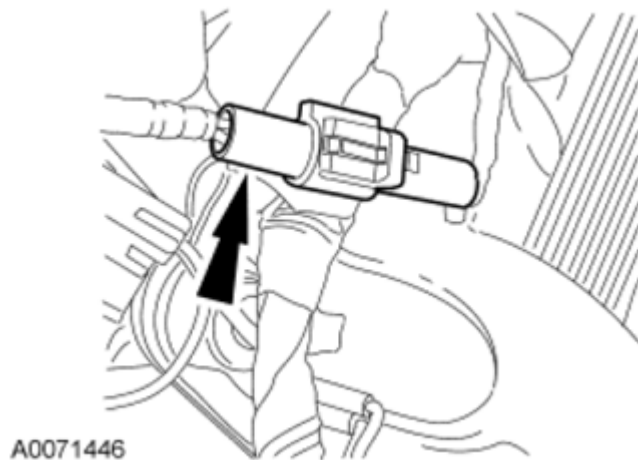


Fig. 261: Locating Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the Camshaft Position (CMP) sensor electrical connector.

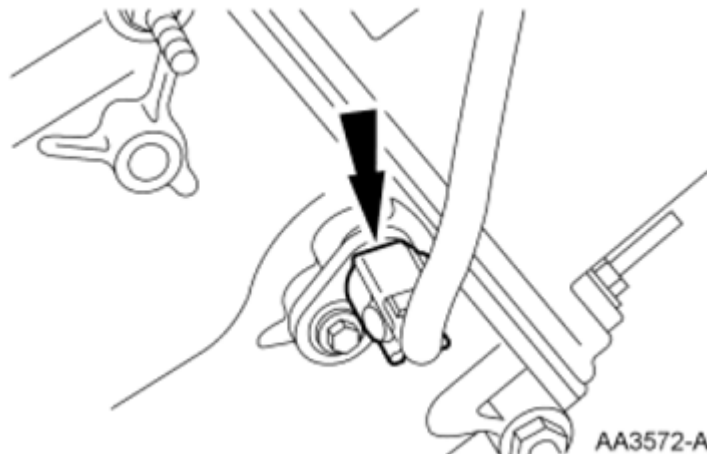


Fig. 262: Locating Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

20. Disconnect the radio ignition interference capacitor and remove the engine control sensor wiring.

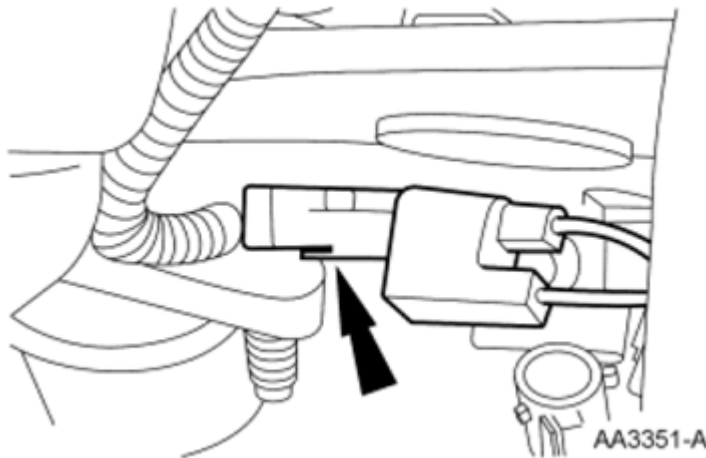


Fig. 263: Locating Radio Interference Capacitor
 Courtesy of FORD MOTOR CO.

21. Disconnect the Knock Sensor (KS) electrical connector and the wiring harness pin-type retainer.

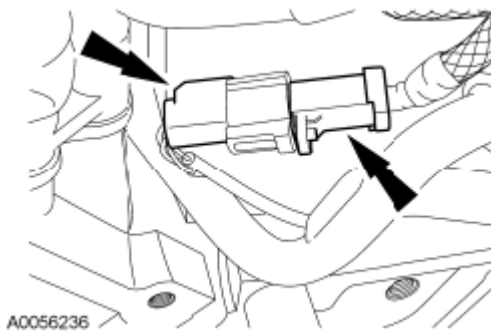


Fig. 264: Locating Knock Sensor (KS) Electrical Connector
 Courtesy of FORD MOTOR CO.

22. Disconnect the vacuum hoses and the electrical connector.

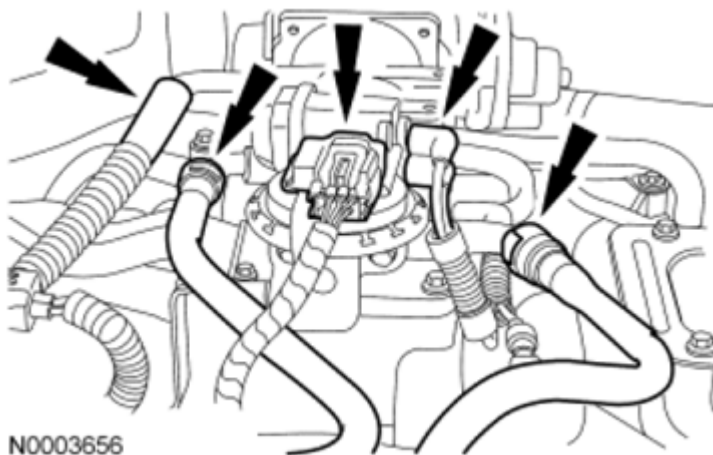


Fig. 265: Locating Electrical Connector And Vacuum Hoses
Courtesy of FORD MOTOR CO.

23. Disconnect the fuel charging wiring from the intake manifold crash bracket and remove the harness from the engine assembly.

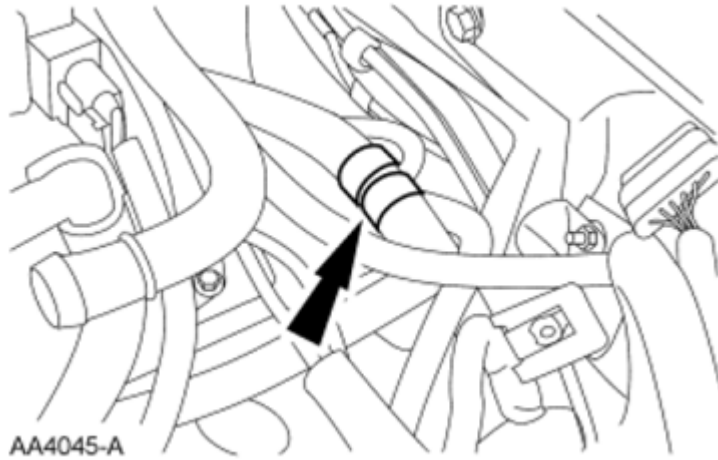


Fig. 266: Locating Intake Manifold Crash Bracket
Courtesy of FORD MOTOR CO.

24. Disconnect the EGR tube nut from the EGR valve.

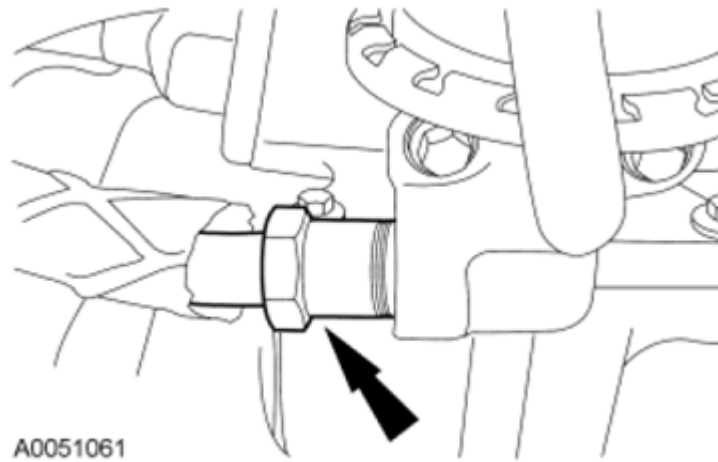


Fig. 267: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

25. Remove the 2 generator bolts and the generator.

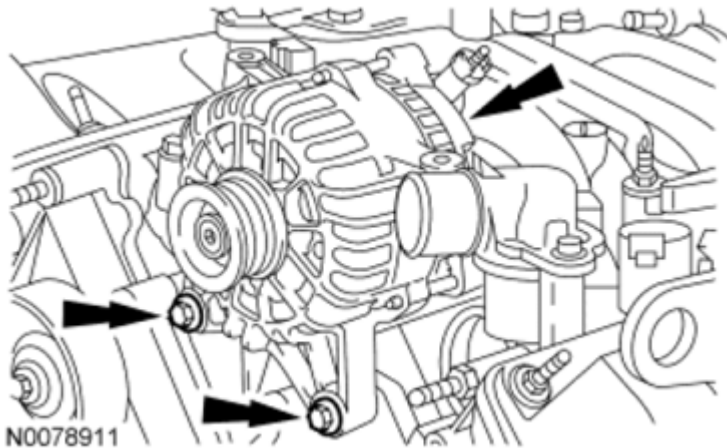


Fig. 268: Locating Generator Bolts
Courtesy of FORD MOTOR CO.

26. Remove the intake manifold crash bracket bolt and prevent the bolt from contacting the cylinder head with a rubber band or tie strap.

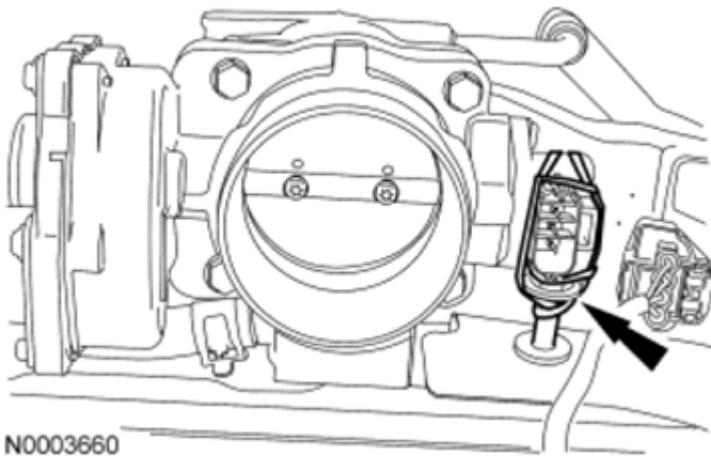


Fig. 269: Locating Intake Manifold Crash Bracket With Tie Strap
Courtesy of FORD MOTOR CO.

27. Remove the intake manifold crash bracket stud bolt.

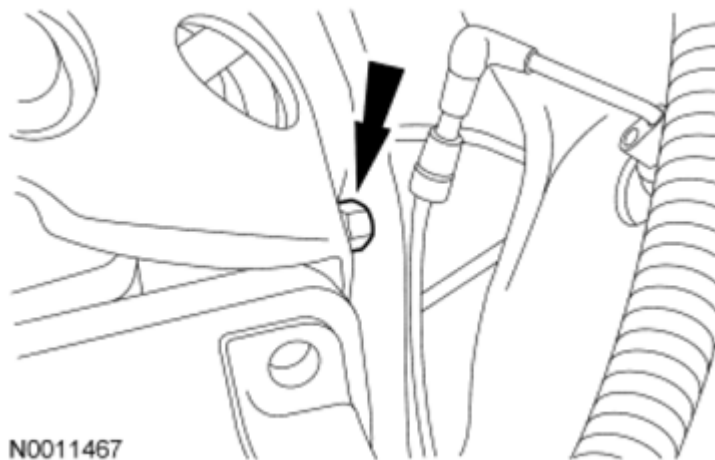


Fig. 270: Locating Intake Manifold Crash Bracket Stud Bolt
Courtesy of FORD MOTOR CO.

28. Remove the 8 bolts and the 8 ignition coils (4 shown in the illustration).

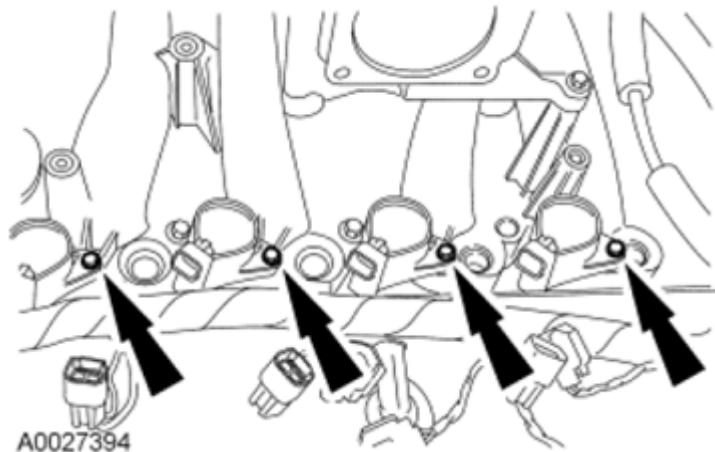


Fig. 271: Locating Ignition Coils And Mounting Bolts
Courtesy of FORD MOTOR CO.

29. Remove the 2 bolts and the coolant outlet adapter.

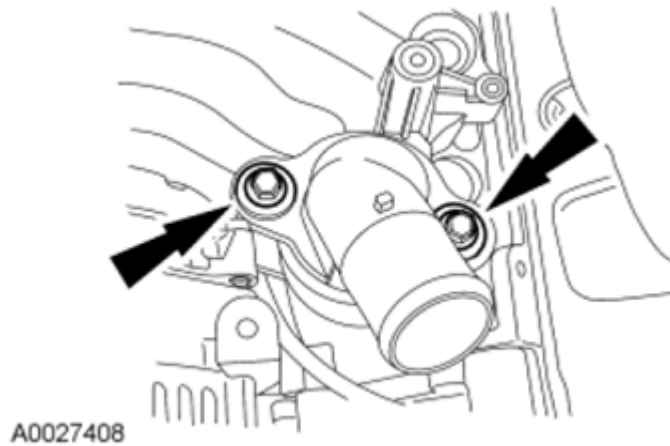


Fig. 272: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

30. Remove the thermostat.



Fig. 273: Locating Thermostat And O-Ring
Courtesy of FORD MOTOR CO.

31. Remove the 8 bolts and the intake manifold.
- Discard the intake manifold gaskets.

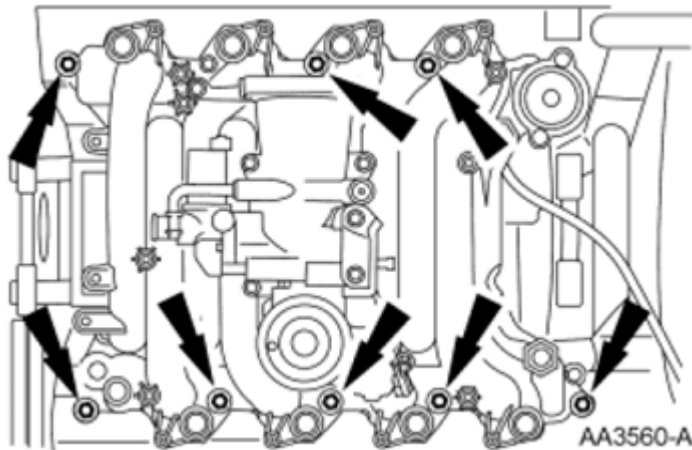


Fig. 274: Locating Intake Manifold Gaskets
Courtesy of FORD MOTOR CO.

32. Remove the cylinder head insert from the LH cylinder head.

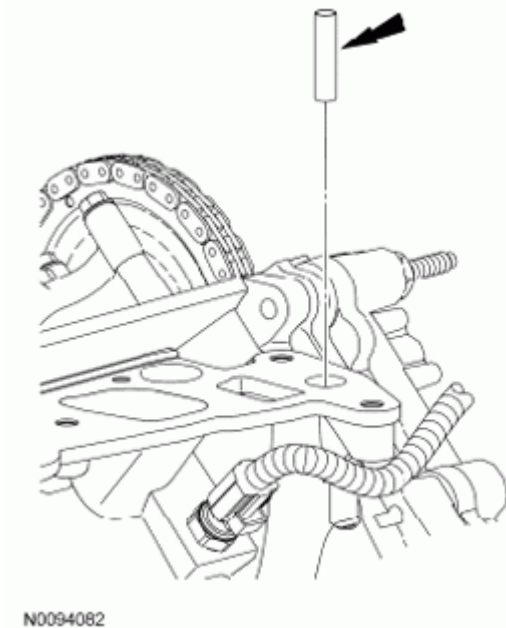


Fig. 275: Locating Cylinder Head Insert
Courtesy of FORD MOTOR CO.

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.

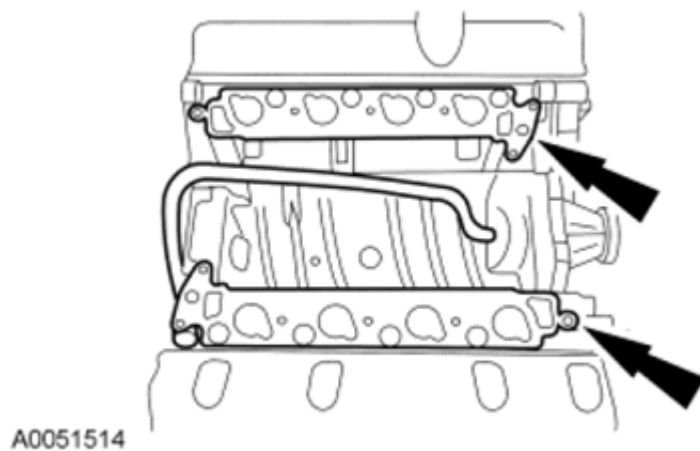


Fig. 276: Locating Sealing Surfaces
Courtesy of FORD MOTOR CO.

33. Clean the sealing surfaces.
34. Remove the coolant bypass tube.
 1. Remove the retaining nut.
 2. Remove the ground strap.
 3. Remove the coolant bypass tube.

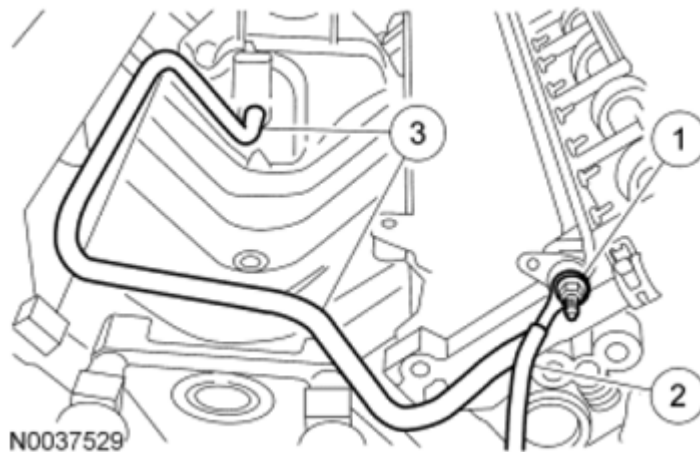


Fig. 277: Identifying Retaining Nut, Ground Strap And Coolant Bypass Tube
Courtesy of FORD MOTOR CO.

35. Remove the nut and the KS.

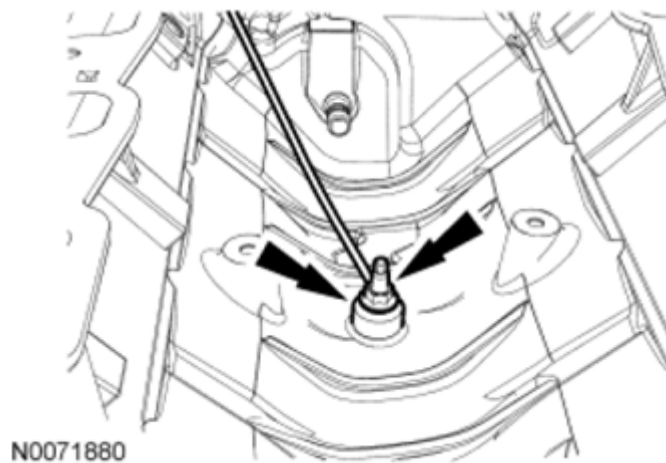


Fig. 278: Locating Knock Sensor And Mounting Nut
Courtesy of FORD MOTOR CO.

36. Loosen the 6 studs and 5 bolts and remove the LH valve cover.
- Discard the gasket.

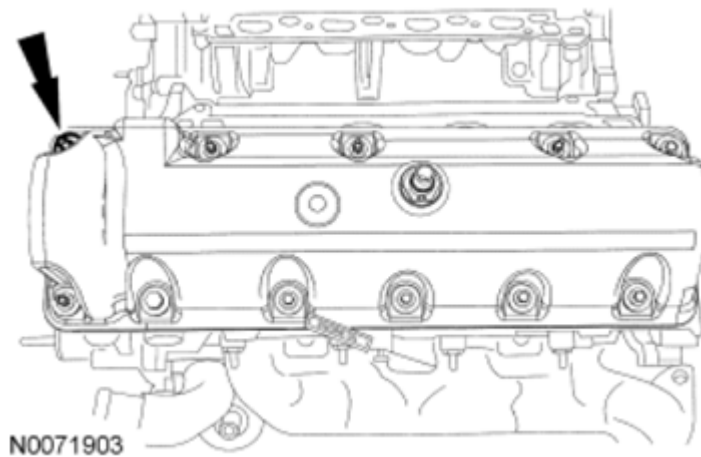
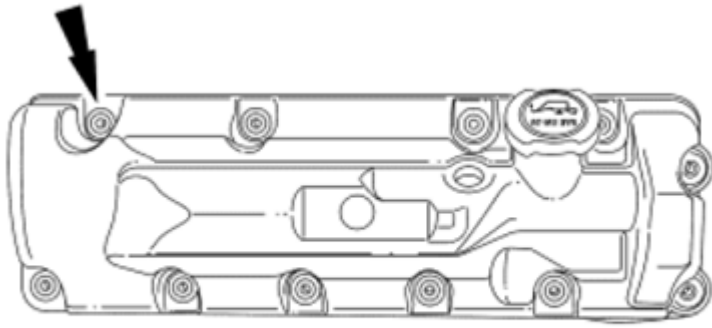


Fig. 279: Locating LH Valve Cover Mounting Bolts And Studs
Courtesy of FORD MOTOR CO.

37. Loosen the 7 studs and 4 bolts and remove the RH valve cover.
- Discard the gasket.

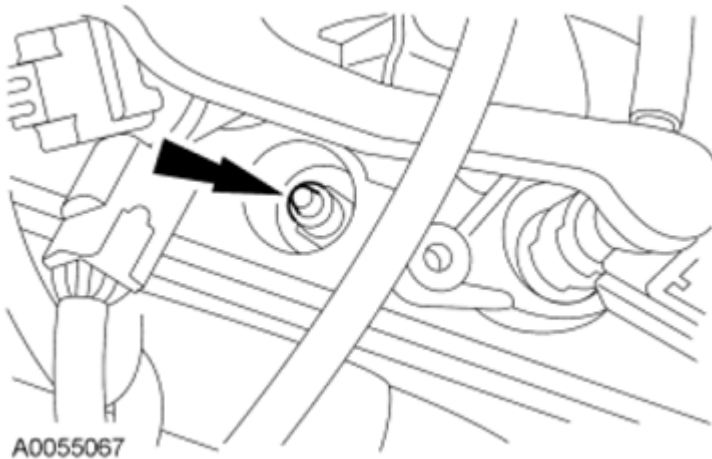


N0087788

Fig. 280: Locating RH Valve Cover Mounting Bolts And Studs
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools when removing or installing the spark plugs, damage may occur to the cylinder head or spark plug.

NOTE: Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.



A0055067

Fig. 281: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

38. Remove the 8 spark plugs.
39. Position the lobe of the camshaft upward.

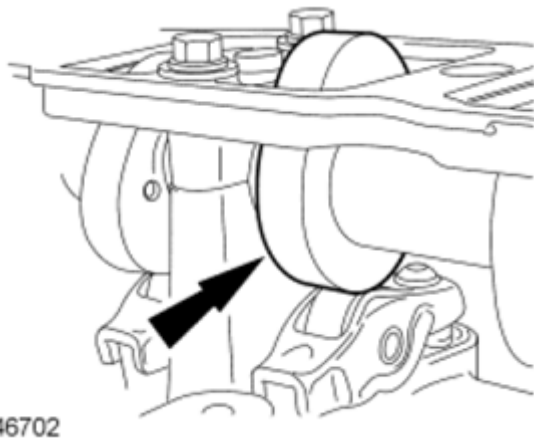


Fig. 282: Identifying Lobe Of Camshaft Up
Courtesy of FORD MOTOR CO.

40. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

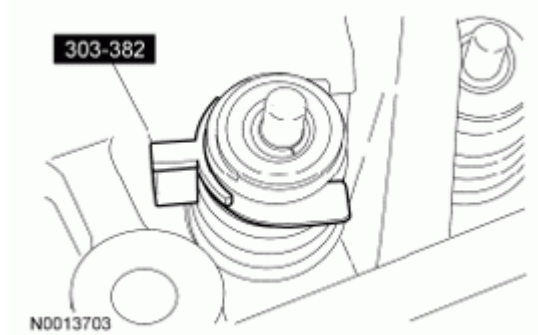


Fig. 283: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.

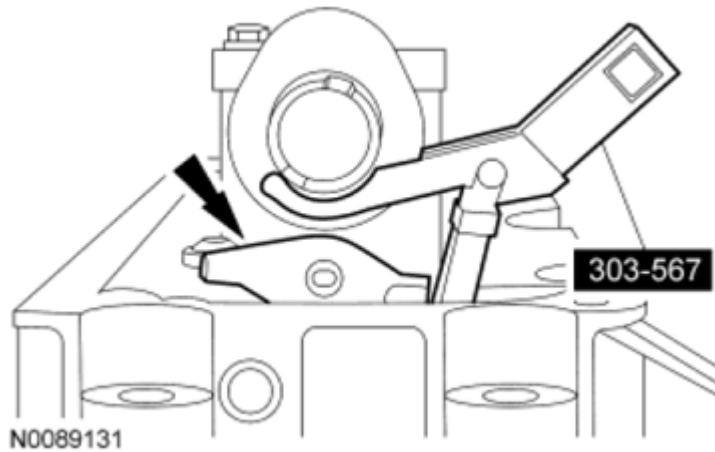


Fig. 284: Compressing Valve Springs Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

41. Using the Valve Spring Compressor, compress the valve springs and remove the 16 camshaft roller followers.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.

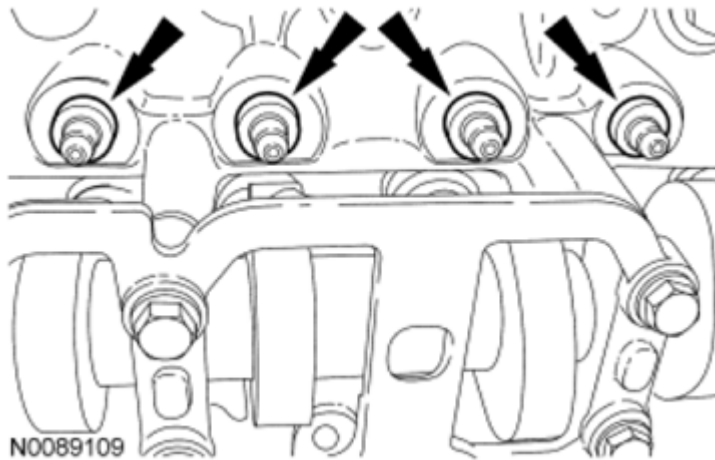


Fig. 285: Locating Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

42. Remove the 16 hydraulic lash adjusters (4 shown in the illustration).
43. Remove the bolt and the accessory drive belt idler pulley.

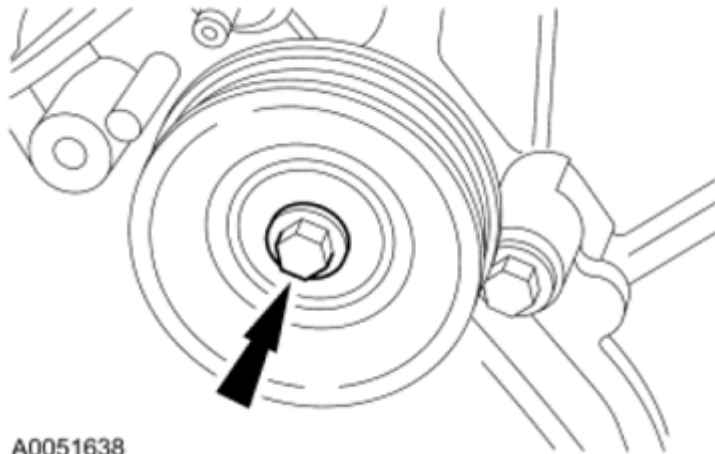


Fig. 286: Locating Drive Belt Idler Pulley Mounting Bolt
Courtesy of FORD MOTOR CO.

44. Remove the 4 bolts and the coolant pump pulley.

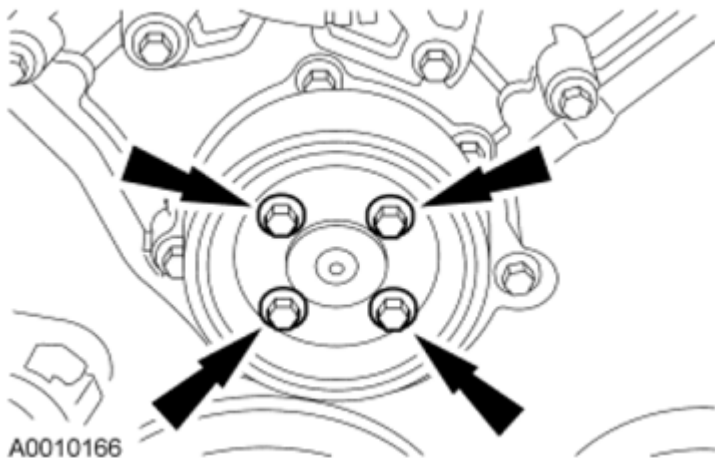


Fig. 287: Locating Coolant Pump Pulley Mounting Bolts
Courtesy of FORD MOTOR CO.

45. Remove the 4 bolts and the coolant pump.

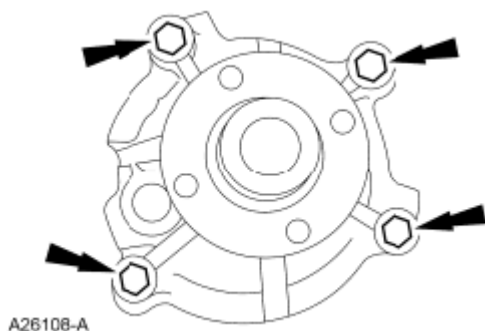


Fig. 288: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

46. Remove the crankshaft pulley bolt.

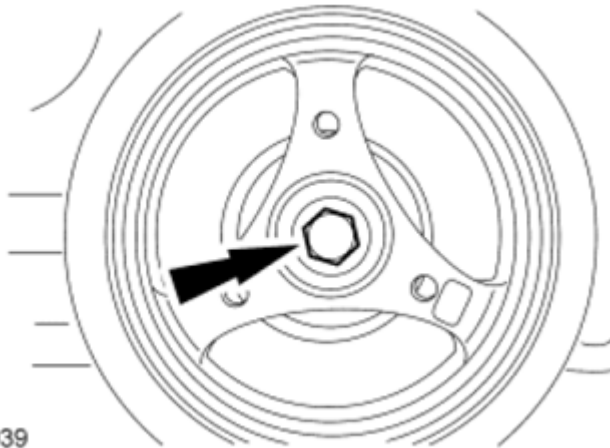


Fig. 289: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

47. Using the Crankshaft Vibration Damper Remover, remove the crankshaft pulley.

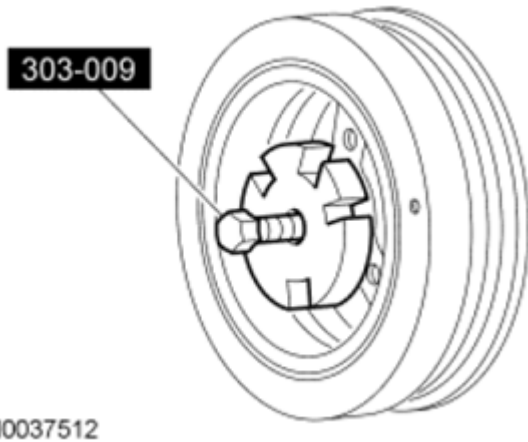


Fig. 290: Removing Crankshaft Pulley Using Crankshaft Vibration Damper Remover
Courtesy of FORD MOTOR CO.

48. Using the Crankshaft Front Oil Seal Remover, remove the crankshaft front seal.

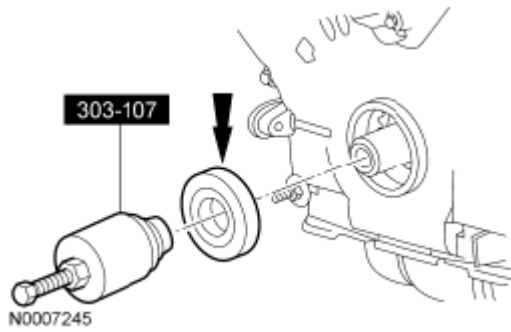


Fig. 291: Removing Crankshaft Front Seal Using Crankshaft Front Oil Seal Remover
Courtesy of FORD MOTOR CO.

49. Remove the 16 bolts and the oil pan.
 - Discard the gasket.

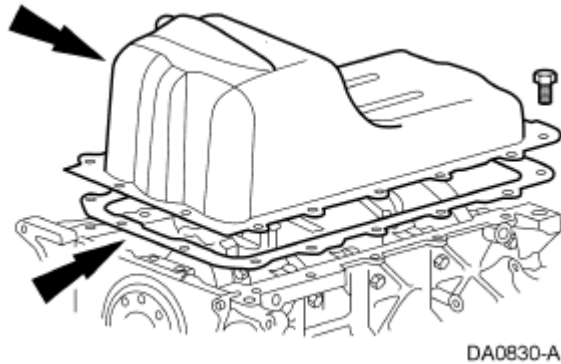


Fig. 292: Locating Oil Pan Mounting Bolts
Courtesy of FORD MOTOR CO.

50. Remove the 3 bolts, the oil pump screen and pickup tube.

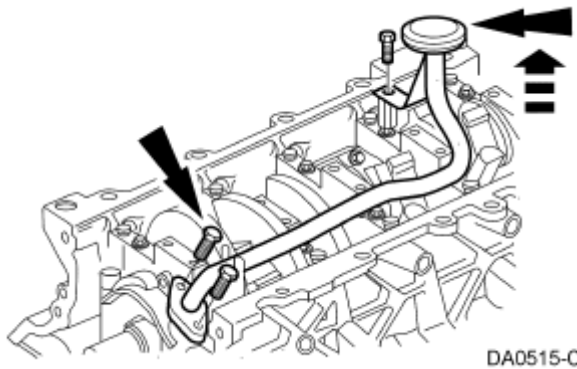


Fig. 293: Removing Oil Pump Screen And Pickup Tube
Courtesy of FORD MOTOR CO.

51. Remove the oil pump screen and pickup tube spacer.

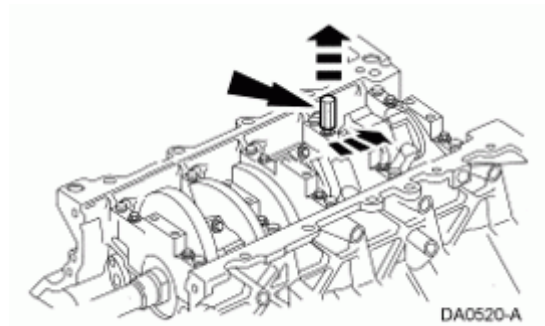
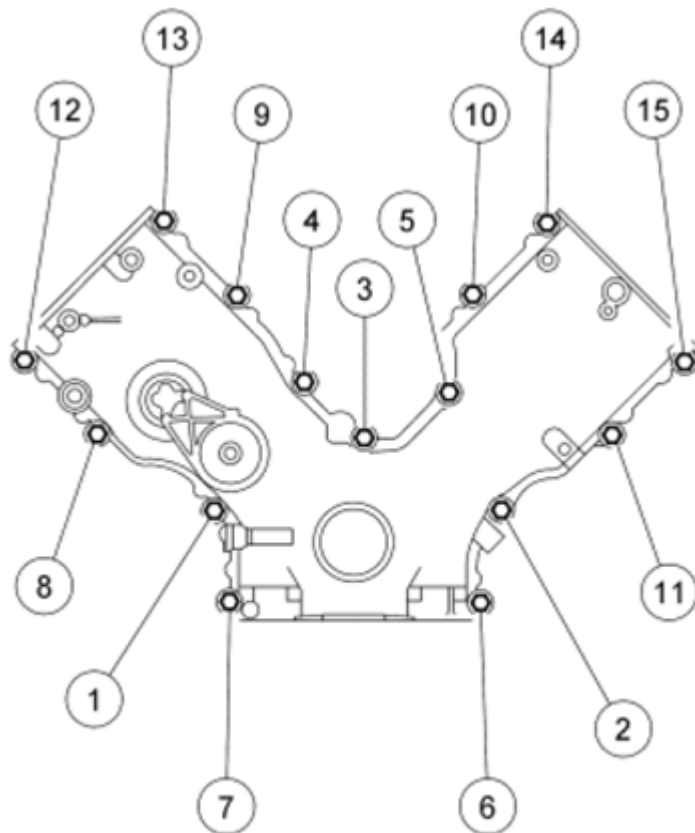


Fig. 294: Removing Oil Pump Screen And Pickup Tube Spacer
Courtesy of FORD MOTOR CO.

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



N0037514

Fig. 295: Identifying Stud Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

52. Remove the 15 fasteners in the sequence shown in the illustration.

53. Remove the engine front cover from the cylinder block.

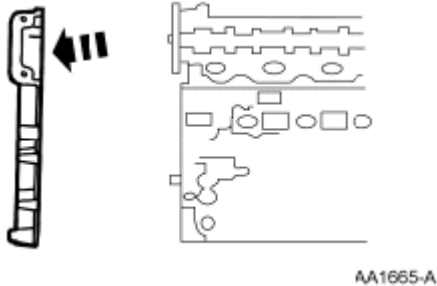


Fig. 296: Removing Engine Front Cover From Cylinder Block
Courtesy of FORD MOTOR CO.

54. Remove the crankshaft sensor ring from the crankshaft.

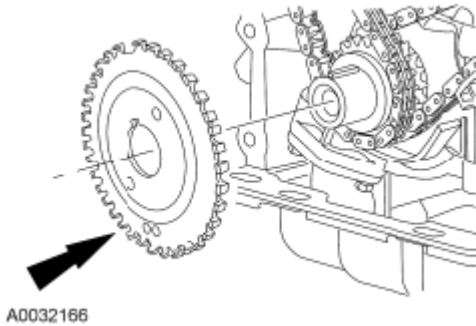


Fig. 297: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

55. Position the crankshaft with the keyway at the 12 o'clock position.

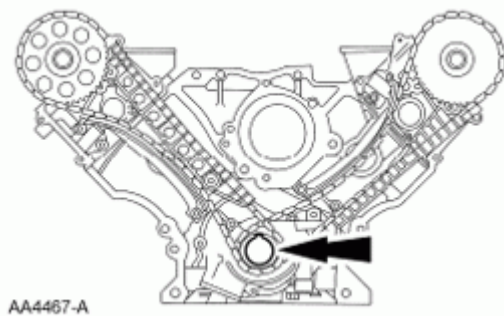


Fig. 298: Locating Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

56. Remove the timing chain tensioning system from both timing chains.
1. Remove the 4 bolts.
 2. Remove the timing chain tensioners.

3. Remove the timing chain tensioner arms.

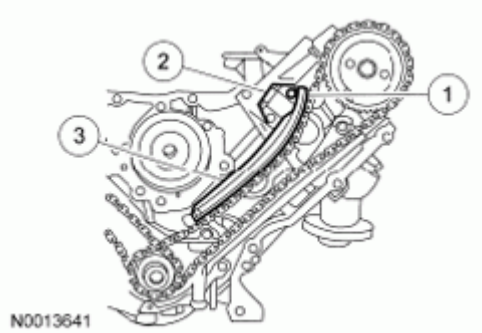


Fig. 299: Identifying Timing Chain Tensioner Arm, Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Unless otherwise instructed, at no time when the timing chains are removed and the cylinder heads are installed is the crankshaft or camshaft to be rotated. Severe piston and valve damage will occur.

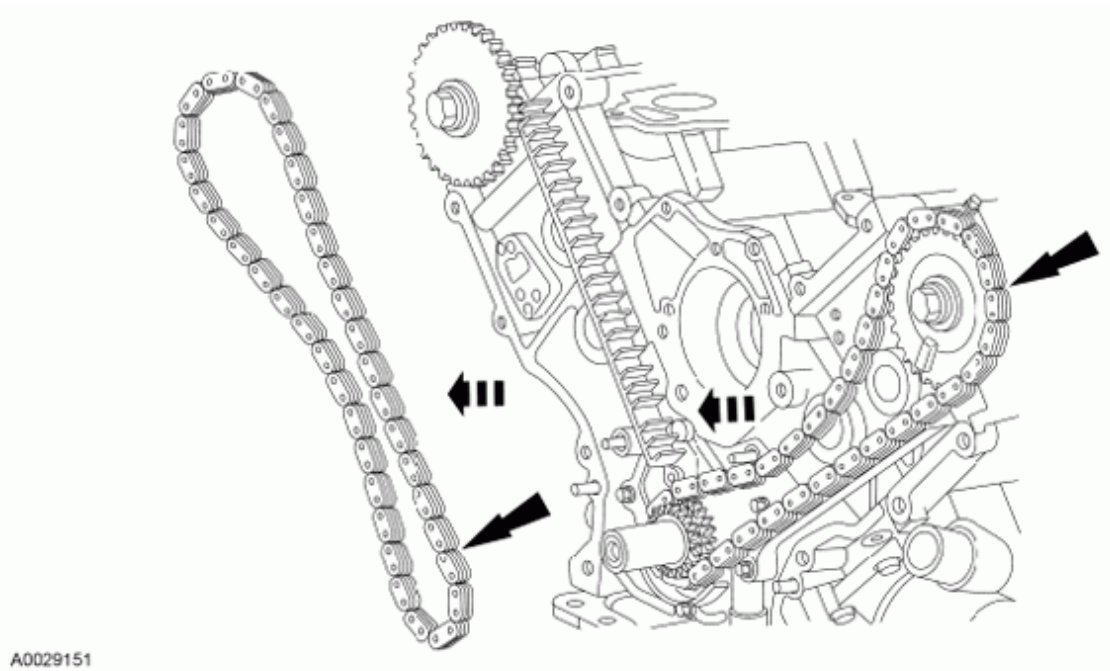


Fig. 300: Removing Timing Chains And Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

57. Remove the LH and RH timing chains and the crankshaft sprocket.
 - Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Repeat for the LH timing chain and crankshaft sprocket.
58. Remove both timing chain guides.

1. Remove the 4 bolts.
2. Remove the LH timing chain guide.
3. Remove the bolts.
4. Remove the RH timing chain guide.

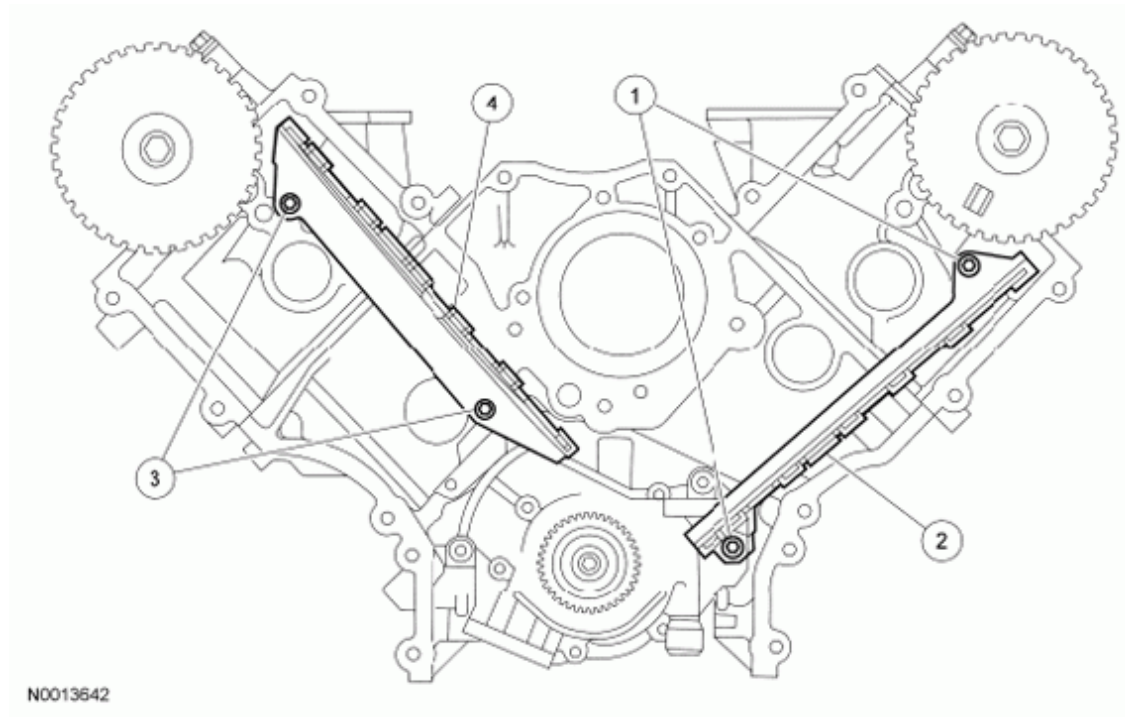


Fig. 301: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

59. Remove the RH exhaust manifold.
 1. Remove the 8 nuts and discard.
 2. Remove the RH exhaust manifold.
 3. Remove the RH exhaust manifold gasket and discard.

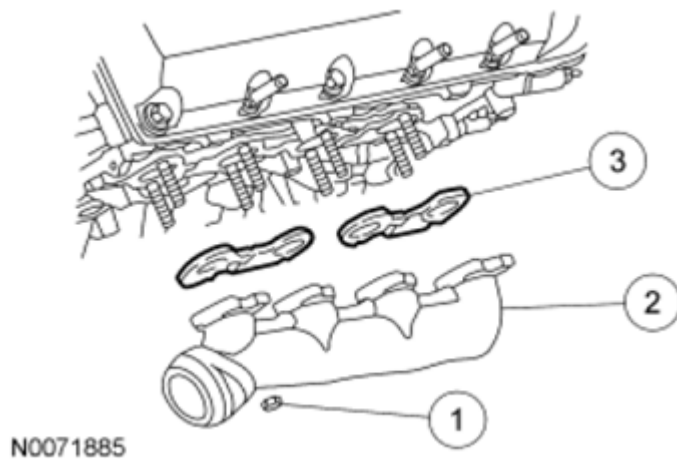


Fig. 302: Identifying Exhaust Manifold And Exhaust Manifold Gasket
Courtesy of FORD MOTOR CO.

60. Remove and discard the 8 RH exhaust manifold studs.
61. Remove the LH exhaust manifold.
 1. Remove the 8 nuts and discard.
 2. Remove the LH exhaust manifold.
 3. Remove the LH exhaust manifold gaskets and discard.

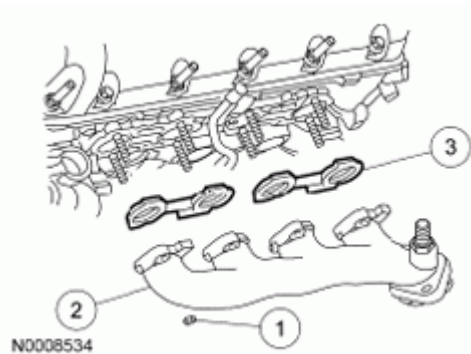
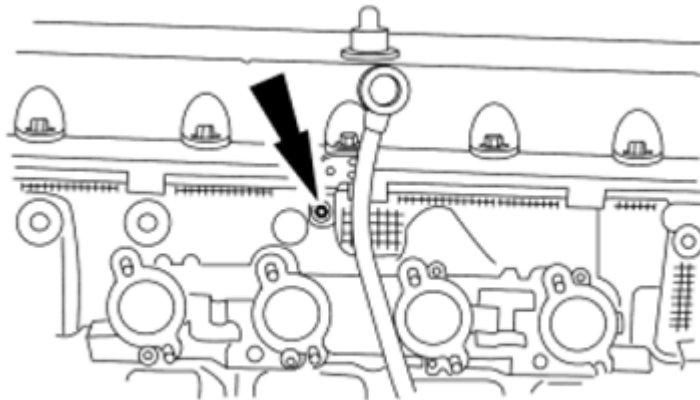


Fig. 303: Identifying Exhaust Manifold Gaskets And Nuts
Courtesy of FORD MOTOR CO.

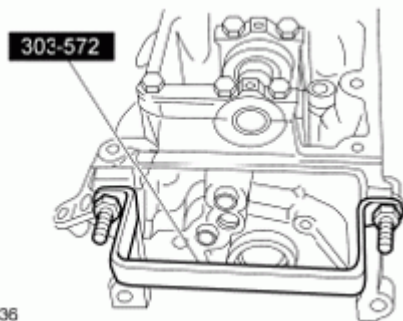
62. Remove and discard the 8 LH exhaust manifold studs.
63. Clean and inspect the exhaust manifolds. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
64. Remove the bolt and the oil level indicator tube.



N0013540

Fig. 304: Locating Oil Level Indicator Tube And Mounting Bolt
Courtesy of FORD MOTOR CO.

65. Install the Cylinder Head Remover/Installer on both ends of the cylinder head.

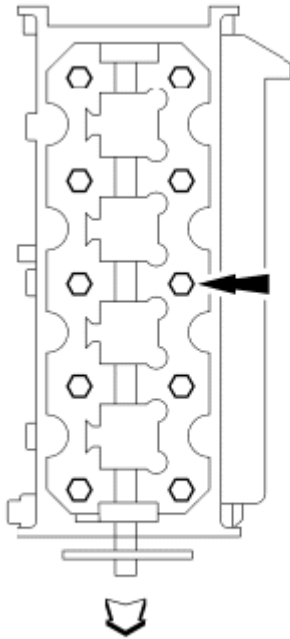


N0008536

Fig. 305: Installing Cylinder Head Remover/Installer On Both Ends Of Cylinder Head
Courtesy of FORD MOTOR CO.

- NOTE:** The cylinder head must be cool before removing it from the engine. Cylinder head warpage may result if a warm or hot cylinder head is removed.
- NOTE:** Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface. The scratches may cause leak paths.
- 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 that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.
- NOTE:** Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

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



A26253-A

Fig. 306: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

66. Remove the 10 bolts and the RH cylinder head.

- Discard the cylinder head gasket.
- Discard the cylinder head bolts.

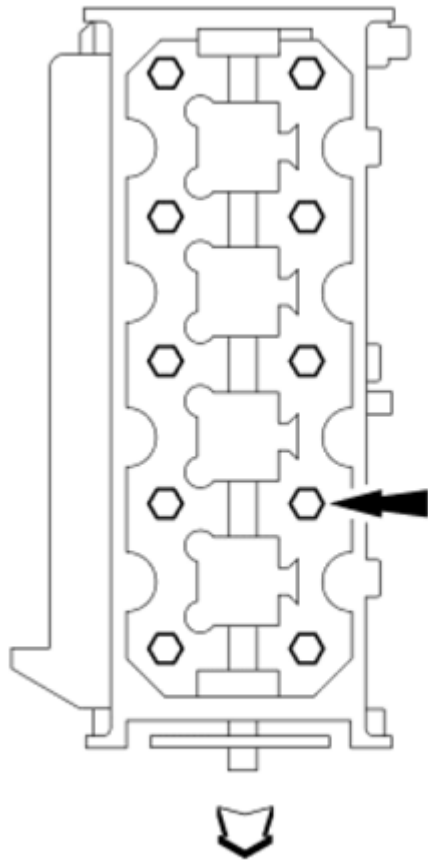
NOTE: The cylinder head must be cool before removing it from the engine. Cylinder head warpage may result if a warm or hot cylinder head is removed.

NOTE: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface. The scratches may cause leak paths.

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

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

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



A26254-A

Fig. 307: Identifying LH Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

67. Remove the 10 bolts and the LH cylinder head.

- Discard the cylinder head gasket.
- Discard the cylinder head bolts.

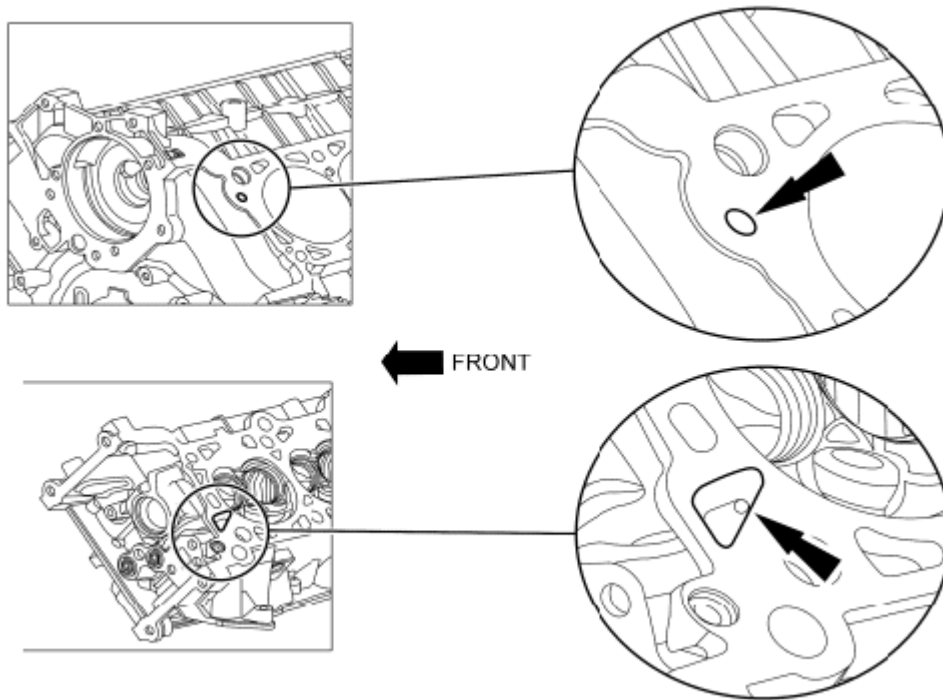
NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

NOTE: 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.

68. Clean the cylinder head-to-cylinder block mating surfaces of both cylinder heads and the cylinder block in the following sequence.
 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: LH shown in the illustration in the illustration, RH similar.



A0079634

Fig. 308: Identifying Oil Pressure Feed Area
Courtesy of FORD MOTOR CO.

69. Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion paying particular attention to the oil pressure feed area. For additional information, refer to ENGINE SYSTEM - GENERAL INFORMATION article.

NOTE: The oil cooler must be replaced or severe damage to the engine can occur.

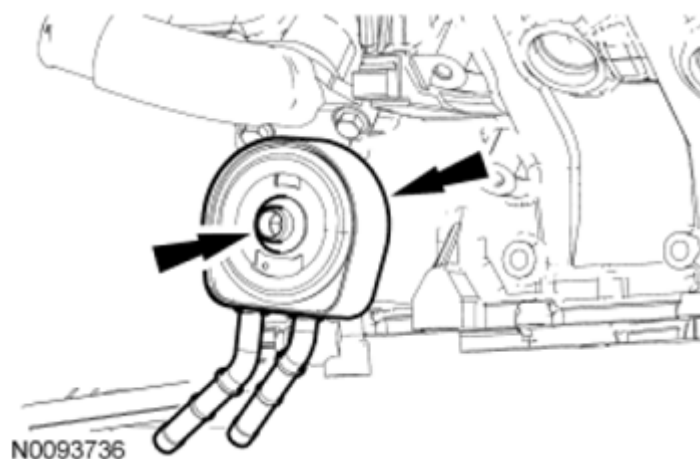


Fig. 309: Locating Oil Cooler Mounting Bolt
Courtesy of FORD MOTOR CO.

70. If equipped, remove the oil cooler mounting bolt and remove and discard the oil cooler.
71. Remove the 4 bolts and the oil filter adapter.
 - Discard the gasket.

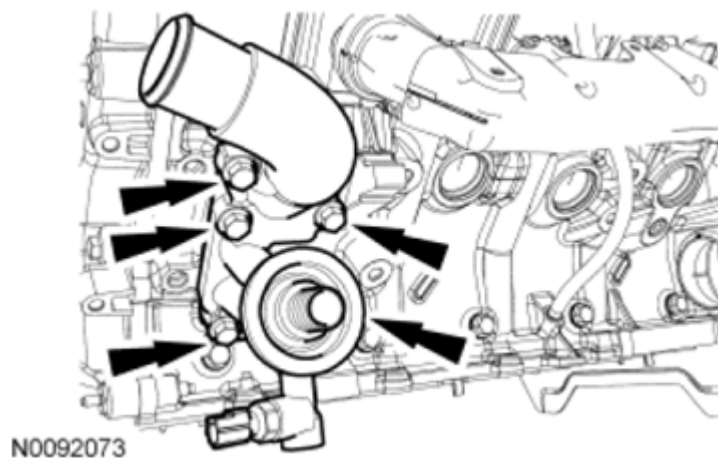


Fig. 310: Locating Oil Filter Adapter And Mounting Bolts
Courtesy of FORD MOTOR CO.

72. Remove the 3 oil pump bolts and the oil pump.

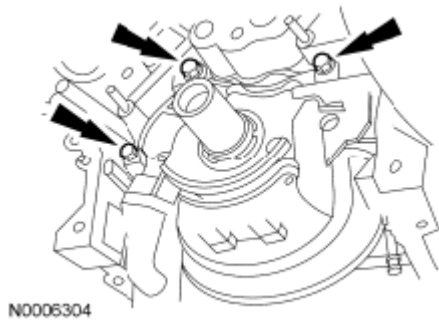
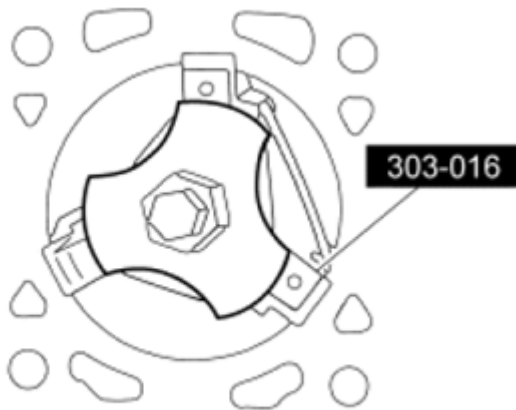


Fig. 311: Locating Oil Pump And Bolts
Courtesy of FORD MOTOR CO.

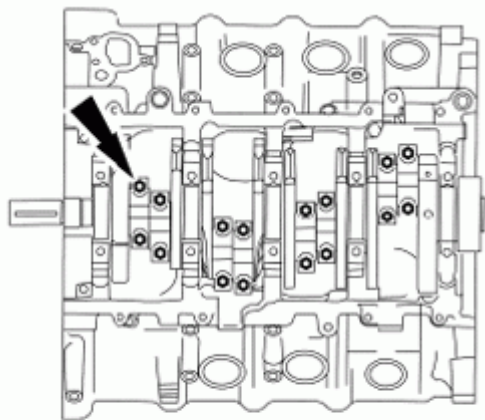
73. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using a Cylinder Ridge Reamer, following the manufacturer instructions.



N0039334

Fig. 312: Removing Ridge/Carbon Deposits From Cylinder Using Cylinder Ridge Reamer
Courtesy of FORD MOTOR CO.

NOTE: Verify that the connecting rods and rod caps have orientation numbers cast into them. If not, number the connecting rods and rod caps for correct orientation.

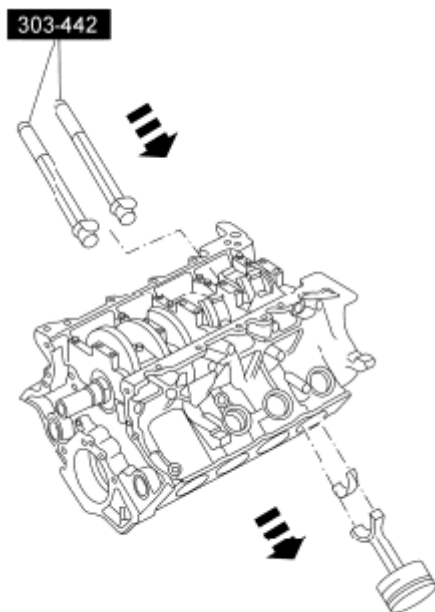


DA0578-A

Fig. 313: Locating Connecting Rod Caps And Bolts
Courtesy of FORD MOTOR CO.

74. Remove the 2 bolts and the connecting rod cap.
- Discard the bolts.

NOTE: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.



N0010189

Fig. 314: Pushing Piston Through Top Of Cylinder Block Using Connecting Rod Installer
Courtesy of FORD MOTOR CO.

75. Using the Connecting Rod Installer, push the piston through the top of the cylinder block.

NOTE: Servicing the bottom end of the engine (crankshaft, bearings) requires that cylinder heads be removed. Failure to do so may result in engine damage.

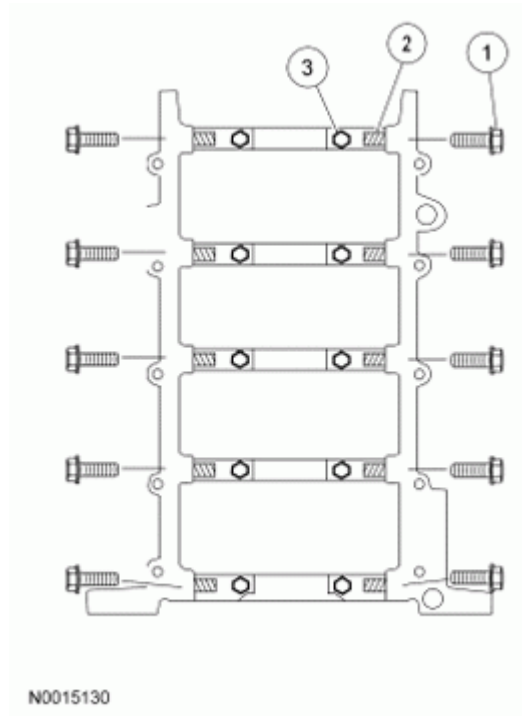


Fig. 315: Identifying Crankshaft Bearing Cap Fasteners
Courtesy of FORD MOTOR CO.

76. Remove the crankshaft bearing cap fasteners.
1. Remove and discard the 10 cross-mounted main cap bolts.
 2. Loosen the 10 jack screws.
 3. Remove and discard the 10 main cap bolts.
77. Remove the 5 main bearing caps and the lower crankshaft main bearings.

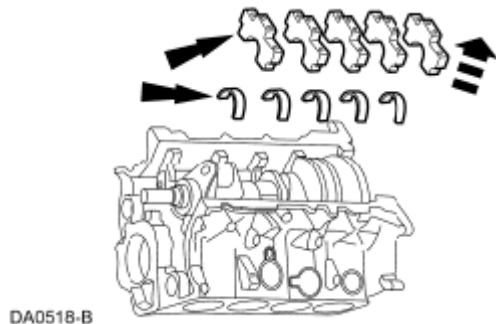


Fig. 316: Locating Main Bearing Caps
Courtesy of FORD MOTOR CO.

78. Remove the crankshaft and the upper crankshaft main bearings from the cylinder block.

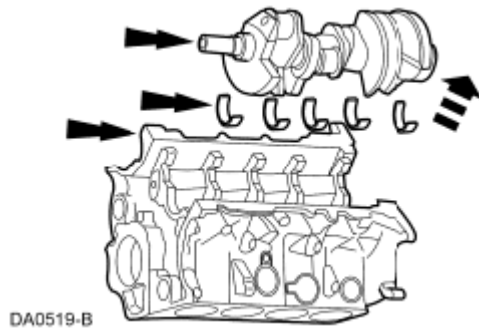


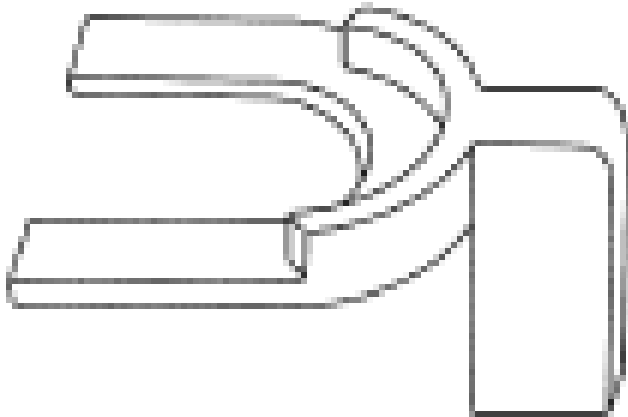
Fig. 317: Removing Crankshaft And Upper Crankshaft Main Bearings From Cylinder Block
Courtesy of FORD MOTOR CO.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

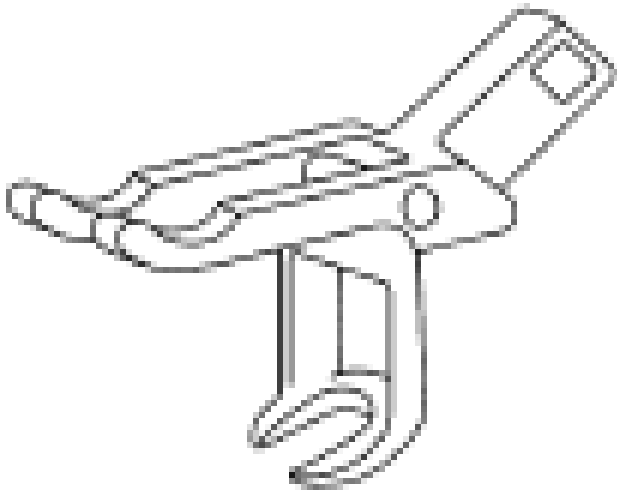
Special Tool(s)

SPECIAL TOOL(S)

 ST1331-A	Compressor Spacer, Valve Spring 303-382 (T91P-6565-AH)
	Compressor, Valve Spring 303-567 (T97P-6565-AH)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1330-A



ST1332-A

Installer, Valve Stem Oil Seal
303-383 (T91P-6571-A)

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil	WSS-M2C930-A

XO-5W20-QSP (US); Motorcraft® SAE 5W-20
Super Premium Motor Oil CXO-5W20-LSP12
(Canada); or equivalent

NOTE: LH shown in the illustration, RH similar.

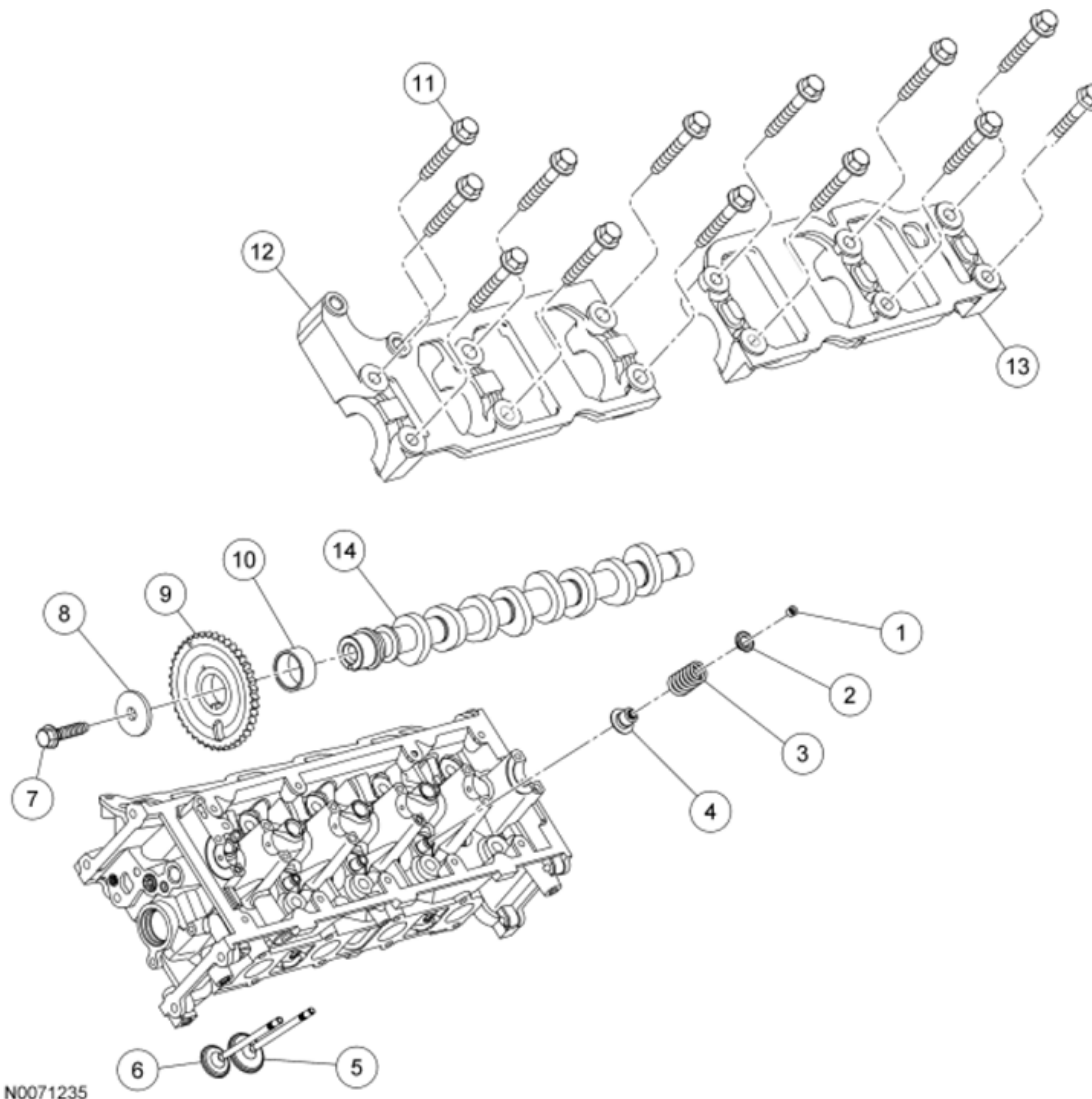


Fig. 318: Exploded View Of Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6518	Valve spring retainer key (16 required)
2	6514	Valve spring retainer (8 required)
3	6513	Valve spring (8 required)
4	6A517	Valve stem seal (8 required)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis

5	6505	Intake valve (4 required)
6	6507	Exhaust valve (4 required)
7	N811085	Camshaft sprocket bolt
8	N806164	Camshaft sprocket bolt washer
9	6256	Camshaft sprocket
10	6265	Camshaft sprocket spacer
11	N807352	Camshaft bearing cap bolt (13 required)
12	6B280	Camshaft bearing cap
13	6B280	Camshaft bearing cap
14	6A274	Camshaft

Disassembly

NOTE: Place cylinder head on a cardboard or wood surface to prevent damage to the joint face.

NOTE: Do not remove the camshaft before removing the roller followers.

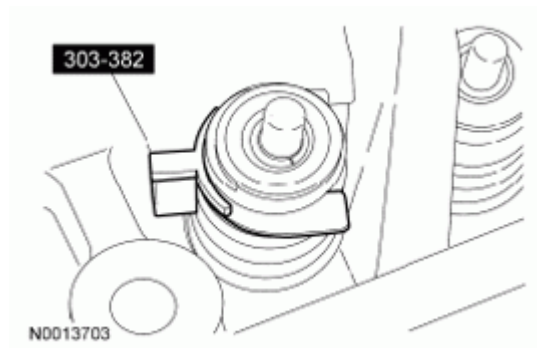


Fig. 319: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

1. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.
2. Using the Valve Spring Compressor, compress the valve springs.

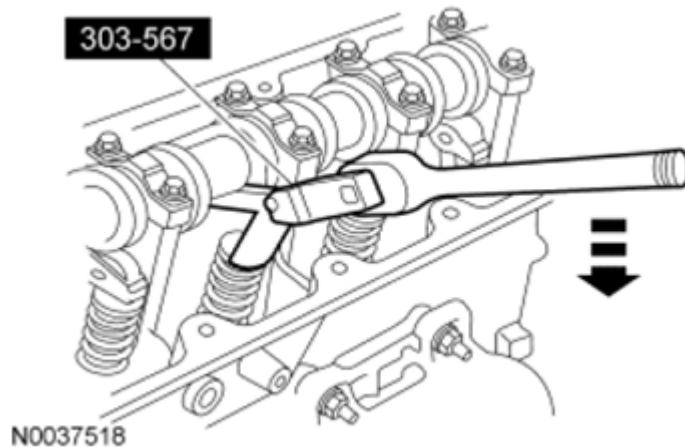


Fig. 320: Compressing Valve Springs Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

NOTE: Keep valves and valve spring retainer keys in order so they can be installed in their original positions.

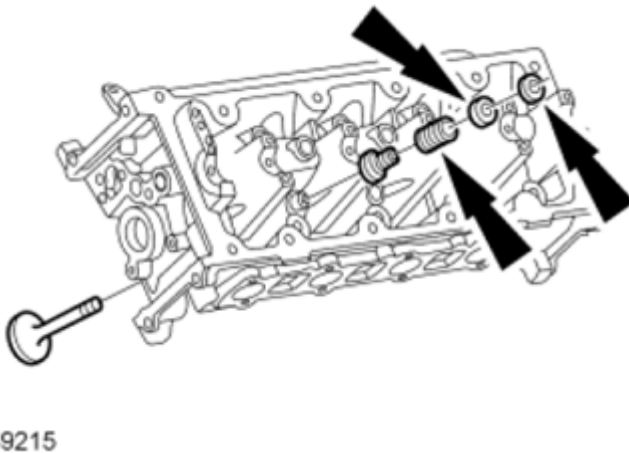
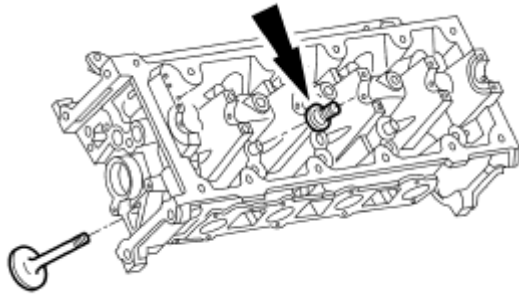


Fig. 321: Locating Valve Spring Retainer Keys, Valve Spring Retainers, Valve Springs And Valves
Courtesy of FORD MOTOR CO.

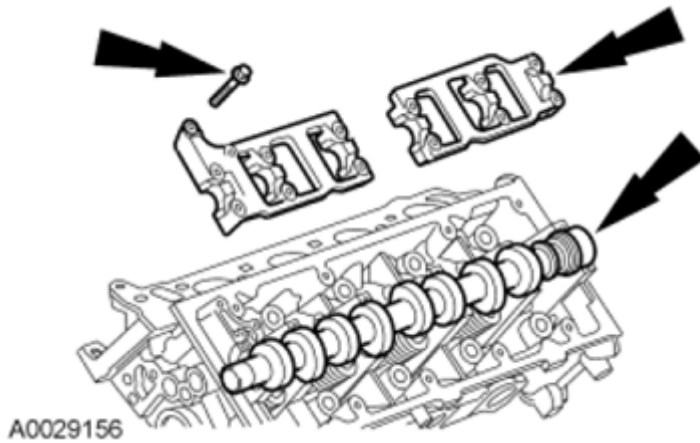
3. Remove the valve spring retainer keys, the valve spring retainers, the valve springs and the valves.
4. Remove the valve stem seals.



DA0055-B

Fig. 322: Locating Valve Stem Seals
Courtesy of FORD MOTOR CO.

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



A0029156

Fig. 323: Locating Bearing Caps And Camshaft
Courtesy of FORD MOTOR CO.

5. Remove the bolts, the bearing caps and the camshaft.

Assembly

NOTE: Do not use metal scrapers or other tools to clean the cylinder head.

1. Use a plastic scraper and metal surface prep to clean the cylinder head.
2. Lubricate the camshaft journals with clean engine oil.

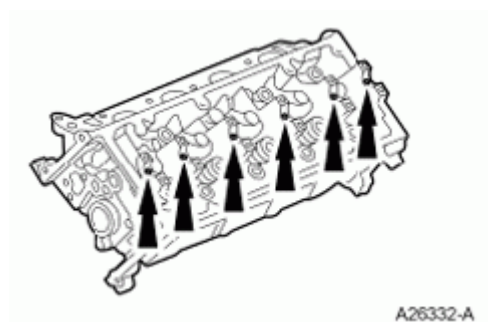


Fig. 324: Locating Camshaft Journals
Courtesy of FORD MOTOR CO.

3. Install the camshaft and the camshaft bearing caps.
 - Lubricate with clean engine oil and position the camshaft bearing caps.
 - Install the bolts loosely.

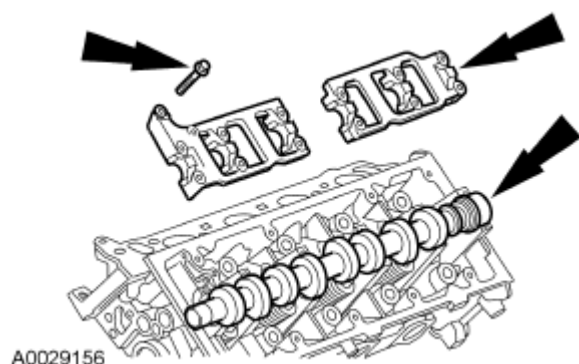
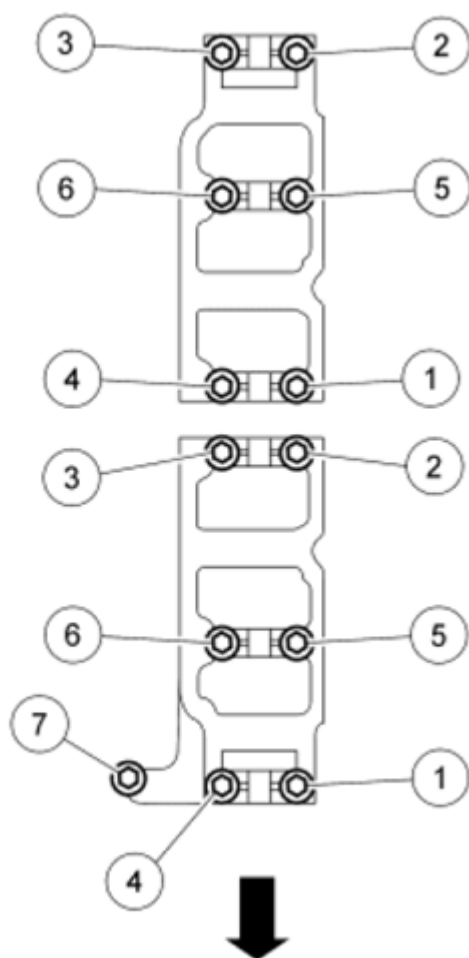


Fig. 325: Locating Camshaft And Camshaft Bearing Caps
Courtesy of FORD MOTOR CO.

4. Tighten the camshaft bearing caps bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).



N0089110

Fig. 326: Identifying Camshaft Bearing Caps Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the valve stems with clean engine oil.

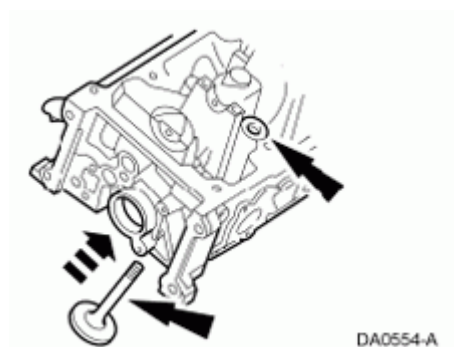


Fig. 327: Installing Valves In Valve Guides
Courtesy of FORD MOTOR CO.

5. Install the valves in the cylinder head.

NOTE: Lubricate the valve stems seals with clean engine oil.

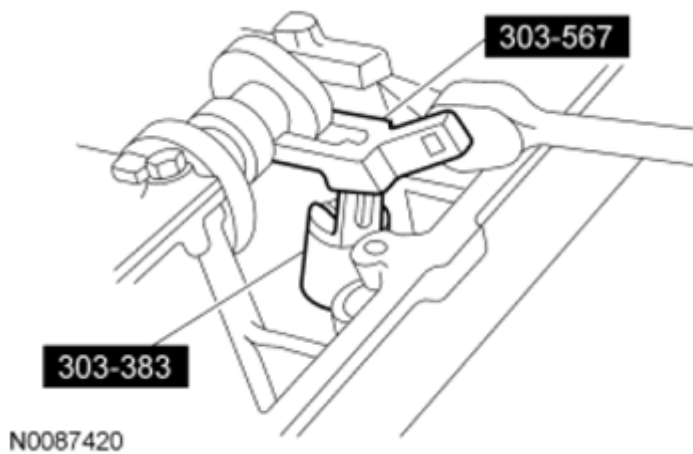


Fig. 328: Installing Valve Stem Seals Using Valve Stem Oil Seal Installer And Valve Spring Compressor
Courtesy of FORD MOTOR CO.

6. Using the Valve Stem Oil Seal Installer and Valve Spring Compressor, install the valve stem seals.
7. Install the valve springs and the valve spring retainers onto the valves.

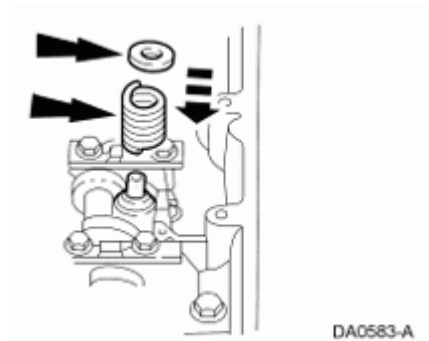


Fig. 329: Installing Valve Springs And Valve Spring Retainers Onto Valves
Courtesy of FORD MOTOR CO.

8. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

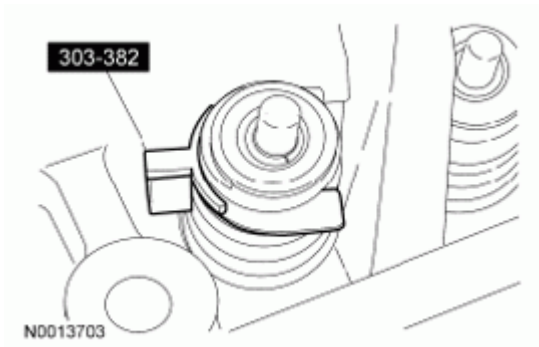


Fig. 330: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

9. Using the Valve Spring Compressor, compress the valve springs and install the valve spring retainer keys.

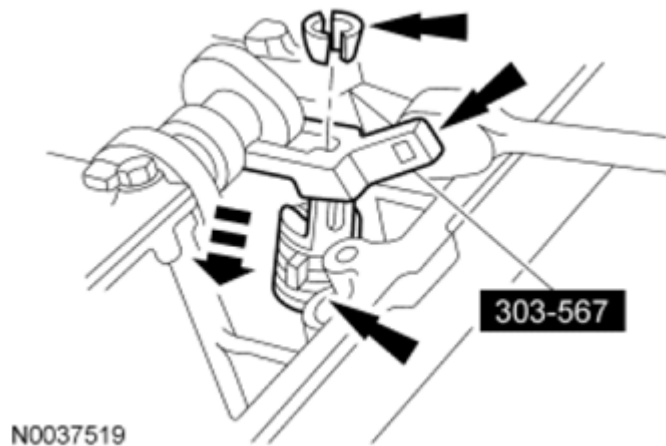


Fig. 331: Compressing Valve Springs Using Valve Spring Compressor
Courtesy of FORD MOTOR CO.

10. Remove the Valve Spring Compressor Spacer.



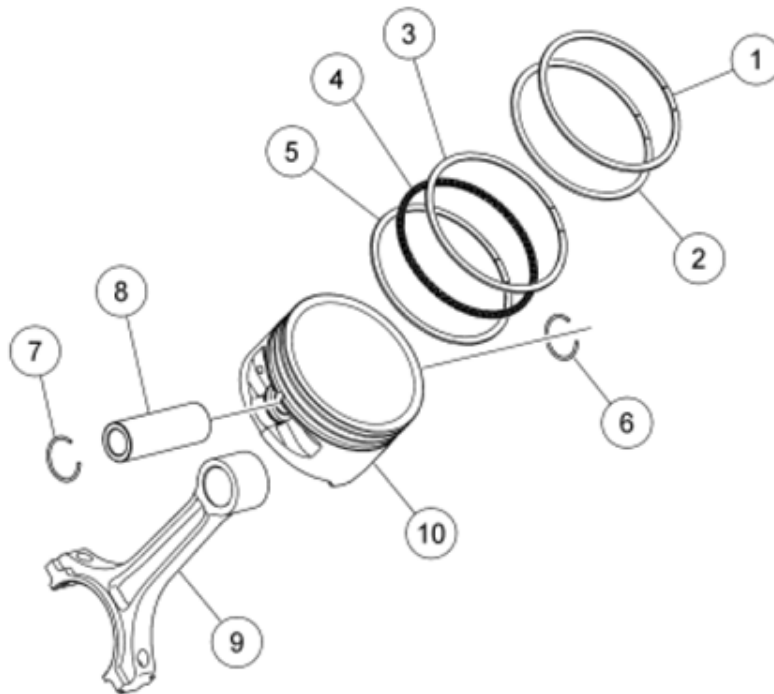
Fig. 332: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

PISTON

Material Specifications

MATERIAL SPECIFICATIONS TABLE

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



N0004114

Fig. 333: Exploded View Of Piston Components

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6150	Piston compression upper ring
2	6152	Piston compression lower ring
3	6159	Piston oil control upper segment ring
4	6161	Piston oil control spacer
5	6159	Piston oil control lower segment ring
6	6140	Piston pin retainer
7	6140	Piston pin retainer
8	6135	Piston pin

9	6200	Connecting rod
10	6110	Piston

Disassembly

1. Remove the upper piston compression ring.
2. Remove the lower piston compression ring.
3. Remove the upper piston oil control segment ring.
4. Remove the piston oil control spacer.
5. Remove the lower piston oil control segment ring.
6. Remove the 2 piston pin retainers.
7. Remove the piston pin and remove the connecting rod from the piston.

Assembly

NOTE: Connecting rod must be installed into piston with identification markings toward front.

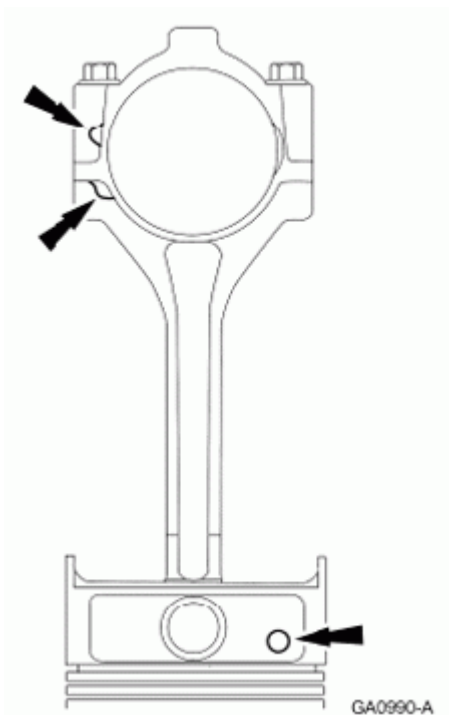


Fig. 334: Locating Connecting Rod And Piston Identification Marks
Courtesy of FORD MOTOR CO.

1. Position the connecting rod in the piston.

NOTE: Lubricate the piston pin and retainers with clean engine oil.

2. Install the piston pin and the 2 piston pin retainers.

NOTE: Lubricate all the piston rings and piston oil control spacer with clean engine oil.

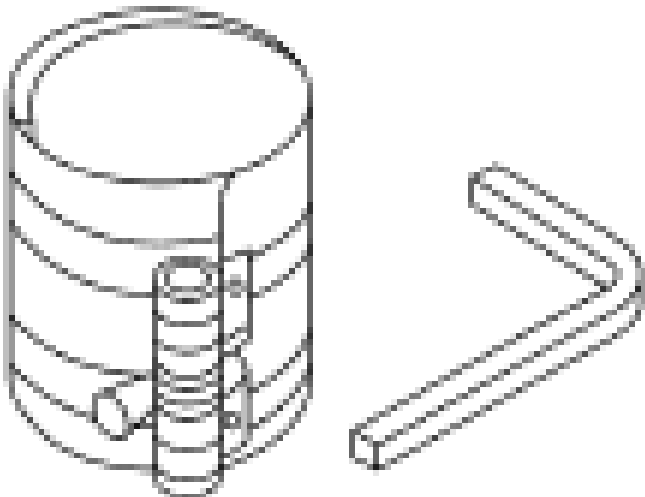
3. Install the lower piston oil control segment ring.
4. Install the piston oil control spacer.
5. Install the upper piston oil control segment ring.
6. Install the lower piston compression ring.
7. Install the upper piston compression ring.

ASSEMBLY

ENGINE

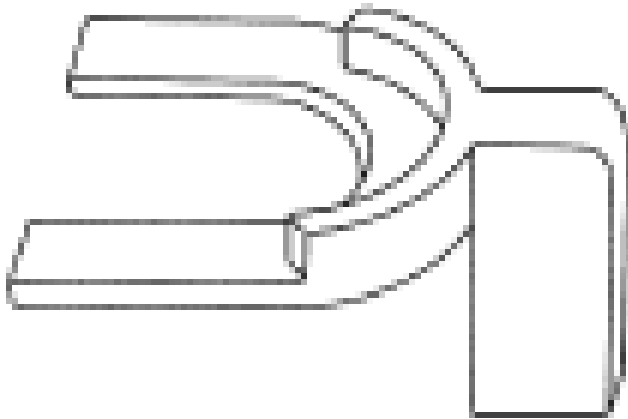
Special Tool(s)

SPECIAL TOOL(S)

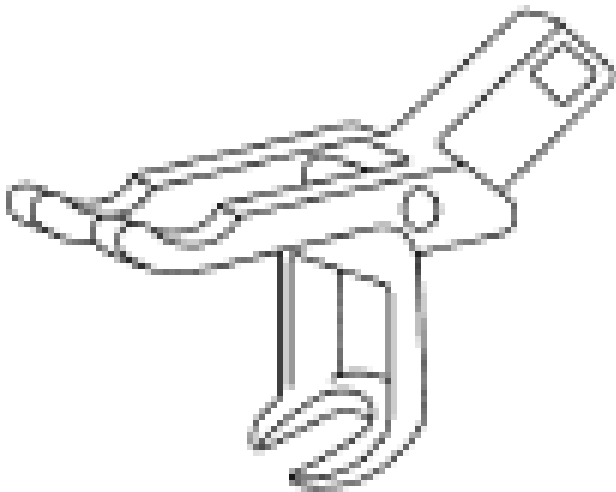
 ST1376-A	Compressor, Piston Ring 303-D032 (D81L-6002-C) or equivalent
	Compressor Spacer, Valve Spring 303-382 (T91P-6565-AH)

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2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1331-A



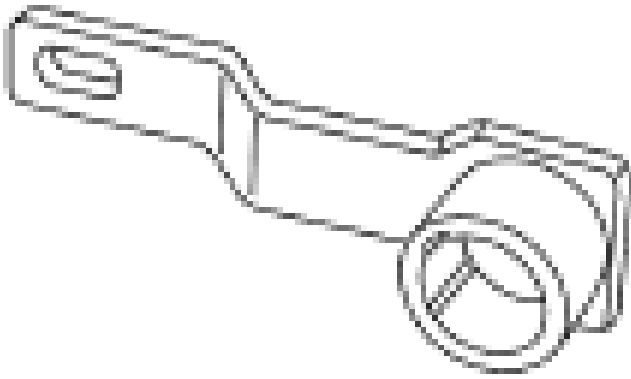
ST1330-A

Compressor, Valve Spring
303-567 (T97P-6565-AH)

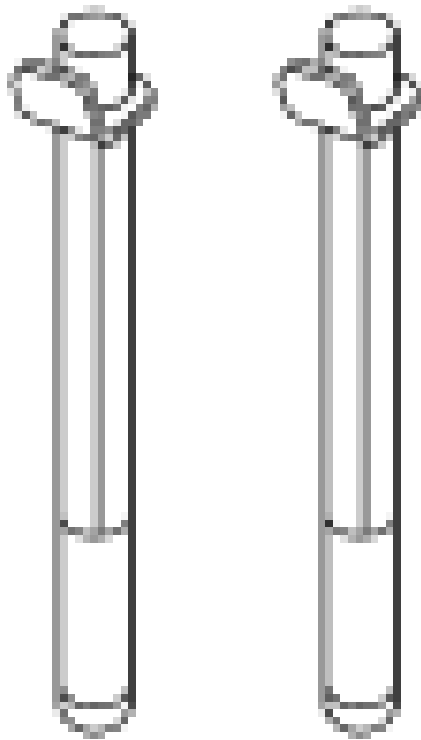
Holding Tool, Crankshaft
303-448 (T93P-6303-A)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



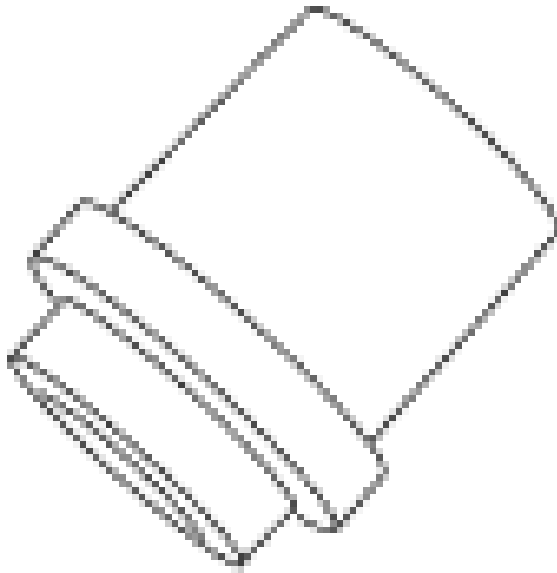
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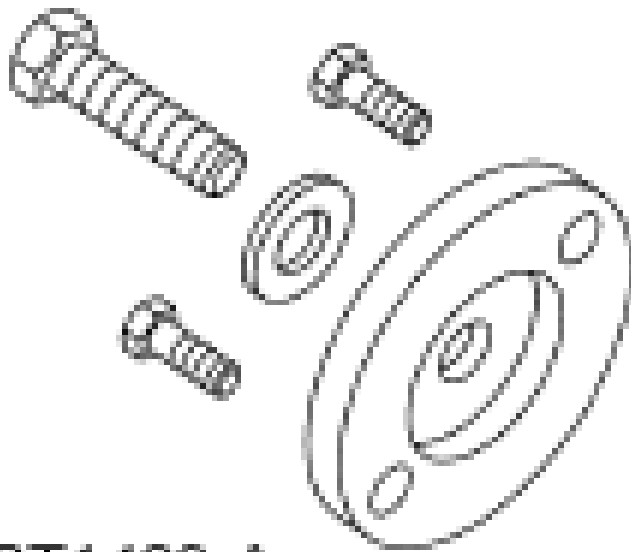
ST1337-A

Installer, Connecting Rod
303-442 (T93P-6136-A)

Installer, Crankshaft Front Oil Seal
303-635



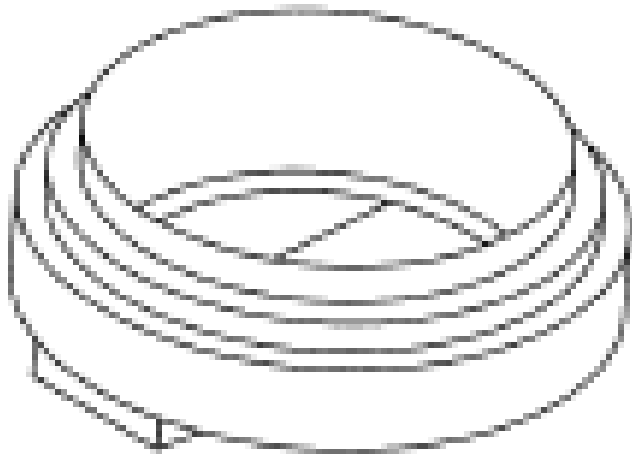
ST2197-A



ST1480-A

Installer, Crankshaft Rear Oil Seal
303-518 (T95P-6701-DH)

Installer, Crankshaft Rear Oil Seal
303-516 (T95P-6701-BH)



ST1479-A



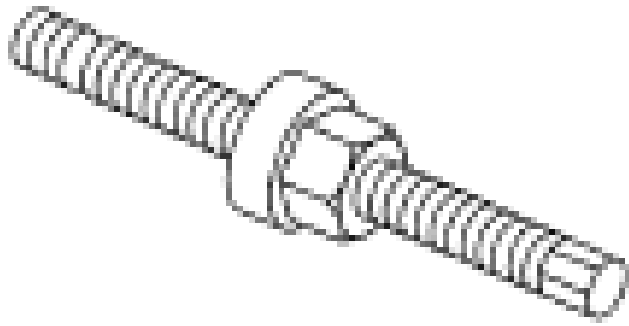
ST1482-A

Installer, Crankshaft Rear Oil Slinger
303-517 (T95P-6701-CH)

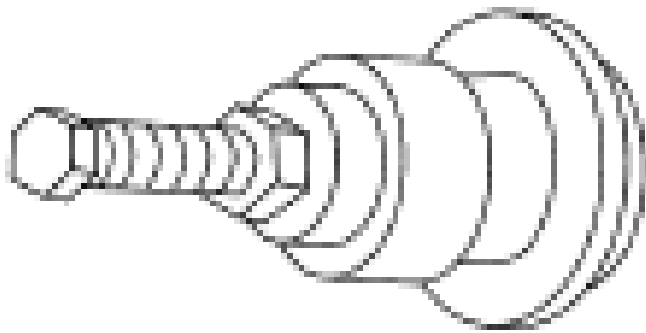
Installer, Crankshaft Vibration Damper
303-102 (T74P-6316-B)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1287-A



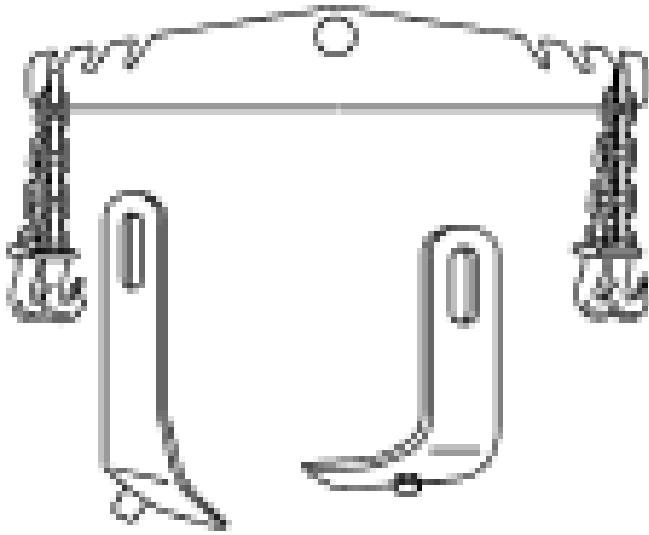
ST1328-A

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

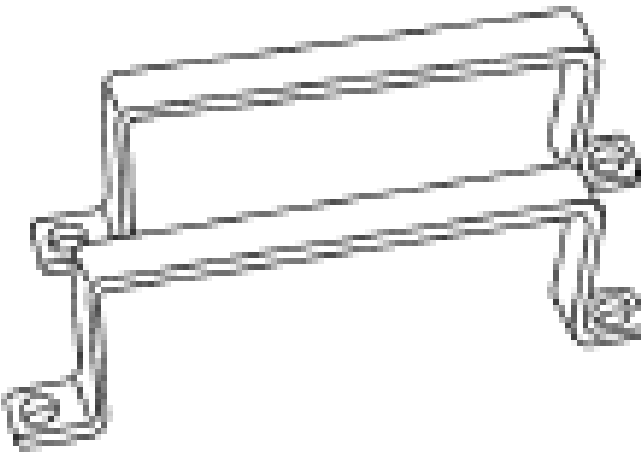
Lifting Bracket Set, Engine
303-DS086 (D93P-6001-A)
Includes Lifting Bracket, Engine
303-D087 and 303-D088 or equivalent

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ST2443-A



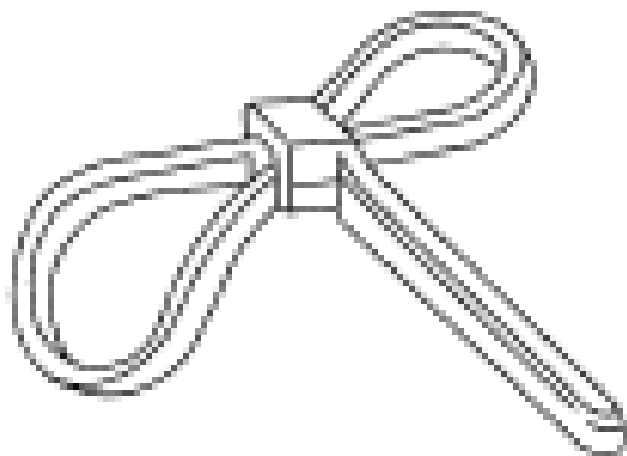
ST1668-A

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

Strap Wrench
303-D055 (D85L-6000-A) or equivalent

2011 Mercury Grand Marquis LS

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ST1438-A

General Equipment

GENERAL EQUIPMENT TABLE

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

Material Specifications

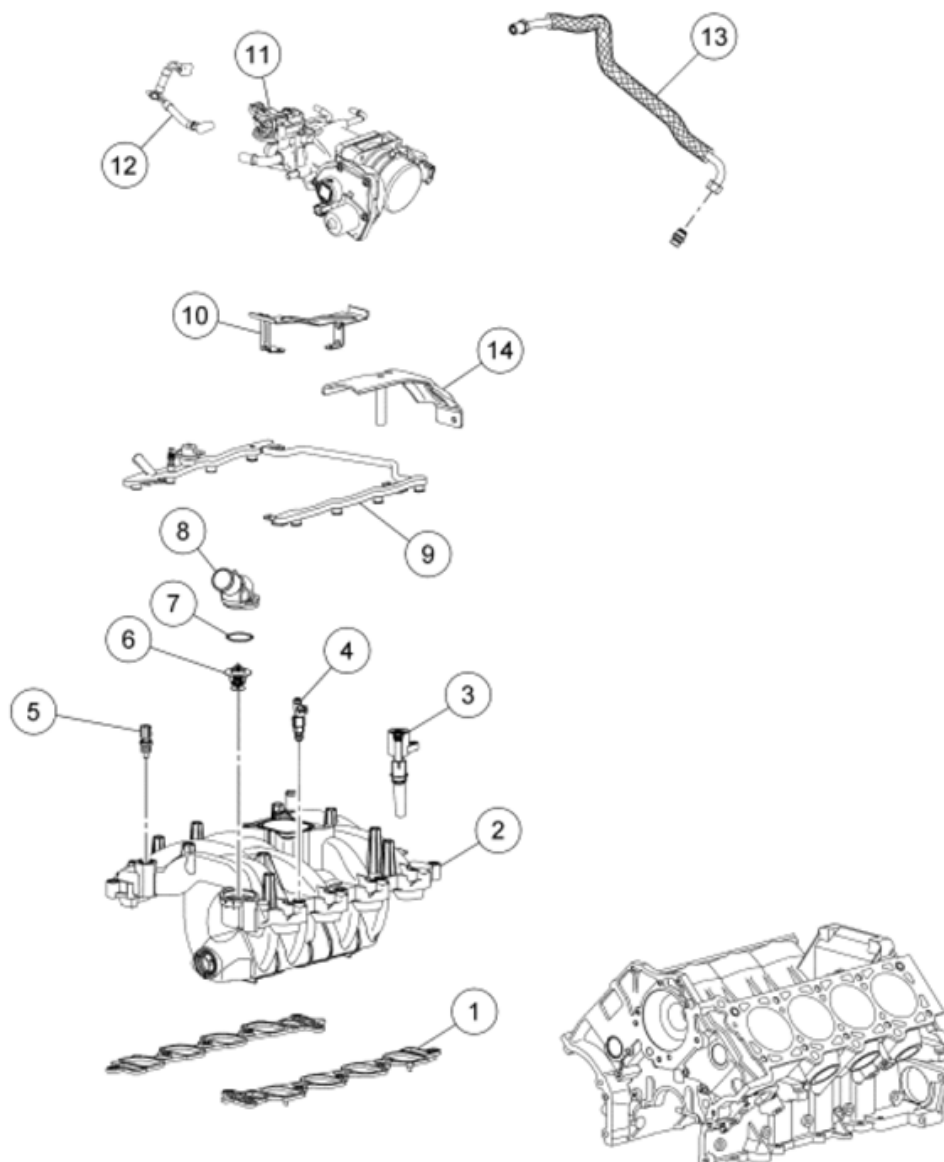
MATERIAL SPECIFICATIONS TABLE

Item	Specification
Gasket Maker TA-16	WSK-M2G348-A5
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (bittered in US only) 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

-

Engine Induction System



N0066814

Fig. 335: Exploded View Of Engine Induction System Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

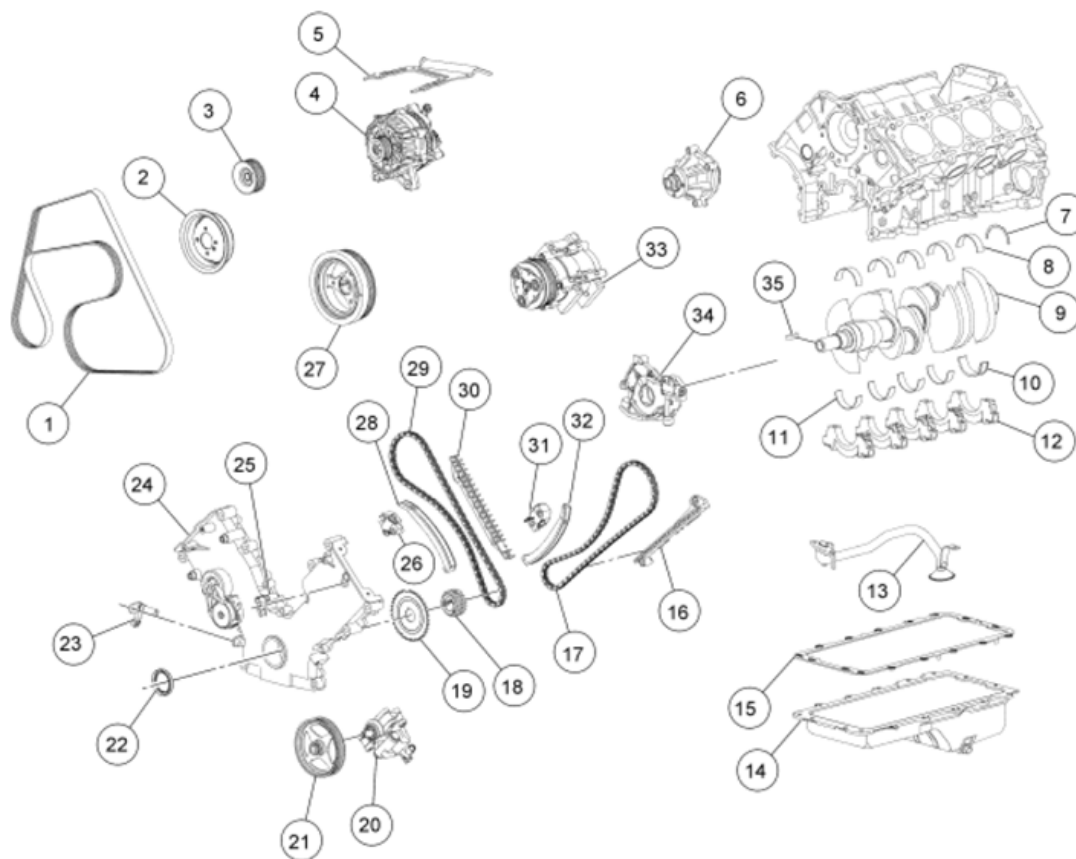
Item	Part Number	Description
1	9439	Intake manifold gasket (2 required)
2	9424	Intake manifold
3	12A366	Ignition coil (8 required)

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4	9F593	Fuel injector (8 required)
5	10884	Engine Coolant Temperature (ECT) sensor
6	8575	Coolant thermostat
7	N806807	O-ring seal
8	8594	Coolant outlet adapter
9	9F792	Fuel rail
10	9F460	Intake manifold shield
11	9E822	Throttle Body (TB)
12	9E498	Vacuum harness
13	9D477	EGR-to-exhaust manifold tube
14	9G609	Intake manifold bracket

Engine - Front End and Lower End



N0092151

Fig. 336: Exploded View Of Engine (Front End And Lower End) Components
 Courtesy of FORD MOTOR CO.

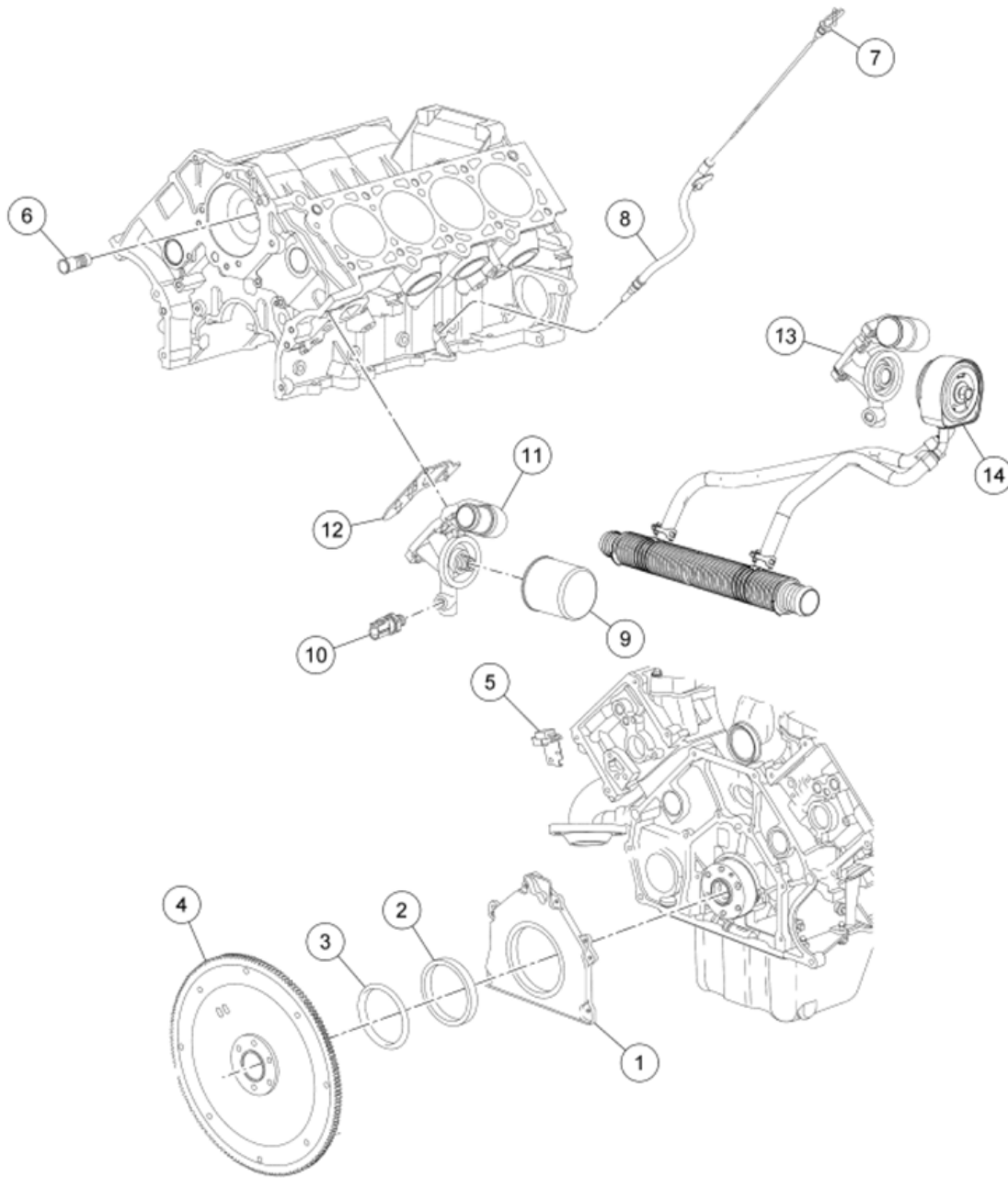
2011 Mercury Grand Marquis LS

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ITEM DESCRIPTION

Item	Part Number	Description
1	8620	Accessory drive belt
2	8A528	Coolant pump pulley
3	19A216	Idler pulley
4	10300	Generator
5	10153	Generator bracket
6	8501	Coolant pump
7	6A341	Crankshaft thrust washer
8	6333	Crankshaft main bearing (5 required)
9	6303	Crankshaft
10	6A339	Crankshaft thrust main bearing
11	6A338	Crankshaft main bearing (4 required)
12	6325	Main bearing cap (5 required)
13	6622	Oil pump screen cover and tube
14	6675	Oil pan
15	6710	Oil pan gasket
16	6B274	Timing chain guide
17	6268	Timing chain
18	6306	Crankshaft sprocket
19	12A227	Ignition pulse ring
20	3A674	Power steering pump
21	3D673	Power steering pump pulley
22	6700	Crankshaft front seal
23	6C315	Crankshaft position sensor
24	6C086	Engine front cover
25	6B288	Camshaft position sensor
26	6L266	Timing chain tensioner
27	6316	Crankshaft damper
28	6L253	Timing chain tensioner arm
29	6268	Timing chain
30	6M289	Timing chain guide
31	6M256	Timing chain tensioner
32	6L253	Timing chain tensioner arm
33	19D629	A/C compressor
34	6621	Oil pump
35	N806201	Crankshaft keyway

Engine - Flex Plate and Engine Lubrication



N0092068

Fig. 337: Exploded View Of Engine (Flex Plate And Engine Lubrication) Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

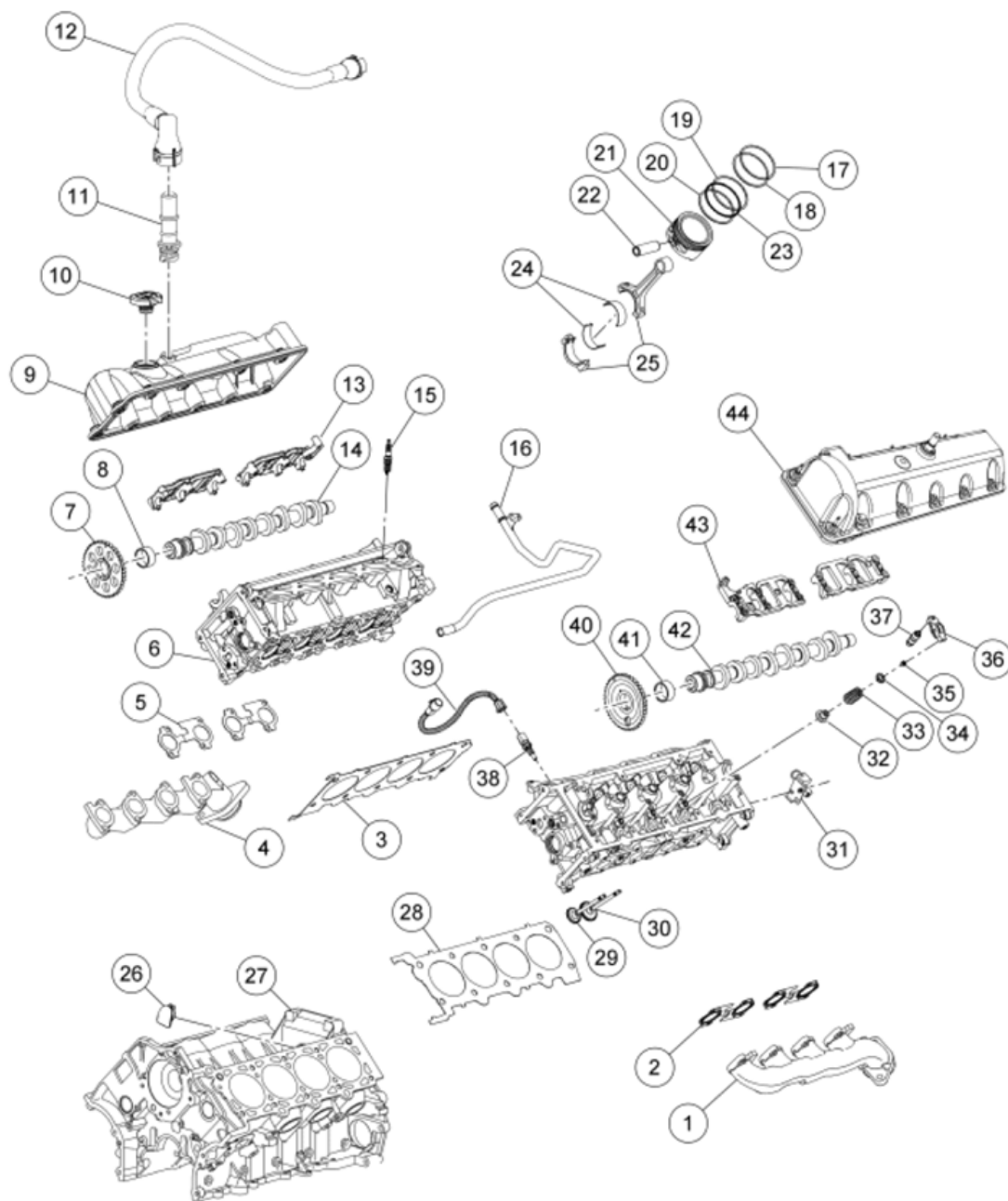
Item	Part Number	Description
1	6K318	Crankshaft rear oil seal retainer
2	6701	Crankshaft rear oil seal
3	6310	Crankshaft oil slinger

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4	6375	Flywheel
5	18801	Radio ignition interference capacitor
6	18B402	Coolant bypass tube
7	6750	Oil level indicator
8	6754	Oil level indicator tube
9	6714	Oil filter
10	9278	Engine Oil Pressure (EOP) switch
11	6881	Oil filter adapter
12	6A636	Oil filter adapter gasket
13	6881	Oil filter adapter
14	6A642	Engine oil cooler

Engine - Upper End



N0109048

Fig. 338: Exploded View Of Engine (Upper End) Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	9431	Exhaust manifold
2	9Y431	Exhaust manifold gasket (2 required)
3	6051	Head gasket

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4	9430	Exhaust manifold
5	9Y431	Exhaust manifold gasket (2 required)
6	6049	Cylinder head
7	6256	Camshaft sprocket
8	6265	Camshaft sprocket spacer
9	6582	Valve cover
10	6766	Oil filler cap
11	6A666	PCV valve
12	6K817	Crankcase vent connector and hose
13	6B280	Camshaft bearing cap
14	6250	Camshaft
15	12405	Spark plug (8 required)
16	18663	Heater coolant bypass tube
17	6150	Top compression ring (8 required)
18	6152	Lower compression ring (8 required)
19	6159	Top oil control ring (8 required)
20	6159	Lower oil control ring (8 required)
21	6110	Piston (8 required)
22	6135	Piston pin (8 required)
23	6161	Oil ring spacer (8 required)
24	6211	Connecting rod bearings (16 required)
25	6205	Connecting rod assembly (8 required)
26	6C070	Torque converter inspection hold cover
27	6010	Cylinder block
28	6083	Head gasket
29	6505	Exhaust valve (8 required)
30	6507	Intake valve (8 required)
31	18801	Radio capacitor
32	6A517	Valve stem seal (16 required)
33	6513	Valve spring (16 required)
34	6514	Valve spring retainer (16 required)
35	6518	Valve spring retainer key (32 required)
36	6529	Roller follower (16 required)
37	6C501	Hydraulic lash adjuster (16 required)
38	6G004	Cylinder Head Temperature (CHT) sensor
39	12A654	CHT sensor harness
40	6256	Camshaft sprocket
41	6265	Camshaft sprocket spacer
42	6A274	Camshaft
43	6B280	Camshaft bearing cap
44	6A505	Valve cover

Assembly**All engines**

1. Record the main bearing code found on the front of the engine block.

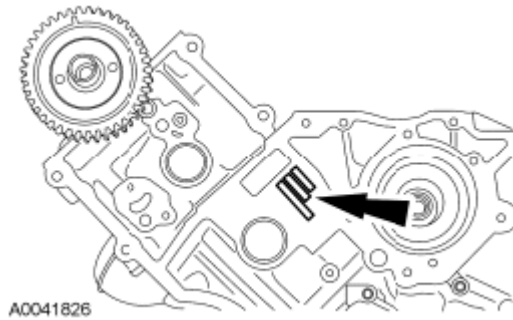


Fig. 339: Locating Main Bearing Code Label Location (Engine Block)
Courtesy of FORD MOTOR CO.

2. Record the main bearing code found on the back of the crankshaft.

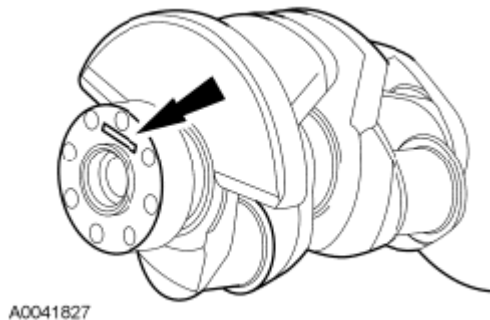


Fig. 340: Locating Main Bearing Code On Back Of Crankshaft
Courtesy of FORD MOTOR CO.

3. Using the data recorded earlier and the Bearing Select Fit Chart, Standard Bearings Chart determine the required bearing grade for each main bearing.
 - Read the first letter of the engine block main bearing code and the first letter of the crankshaft main bearing code.
 - Read down the column below the engine main bearing code letter, and across the row next to the crankshaft main bearing code letter, until the 2 intersect. This is the required bearing grade for the No. 1 crankshaft main bearing.
 - As an example, if the engine block code letter is "F" and the crankshaft code letter is "D," the correct bearing grade for this main bearing is "2."
 - Repeat this process for the remaining 4 main bearings.

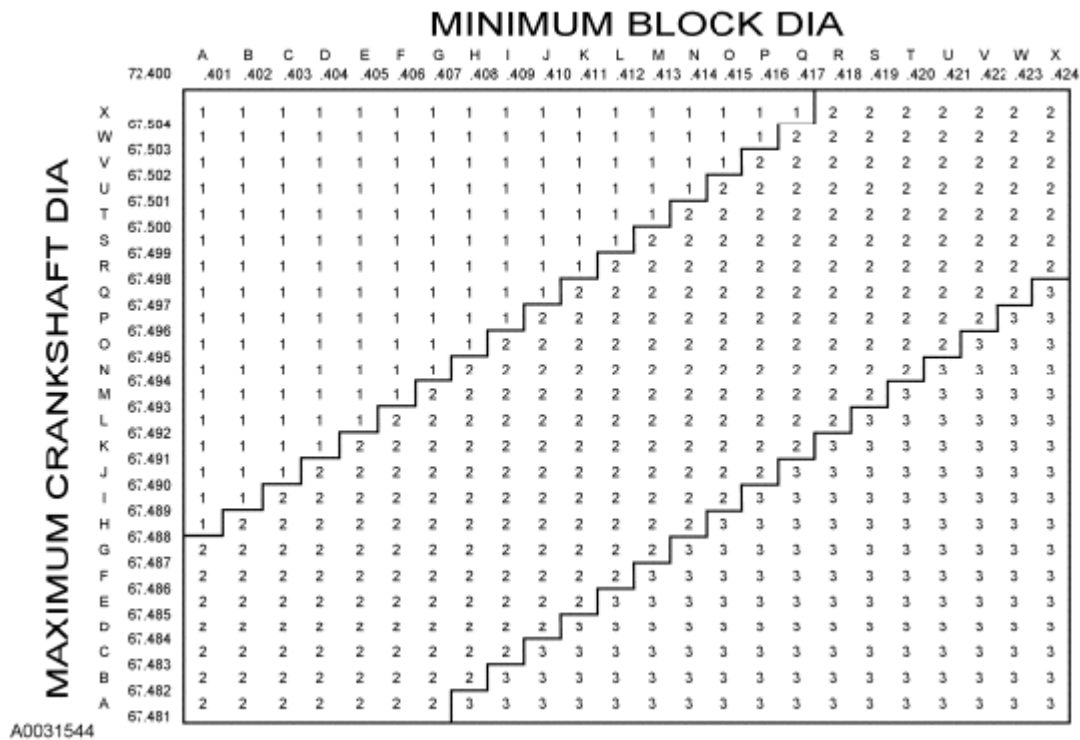


Fig. 341: View Of Bearing Select Fit Chart (Standard Bearings)
 Courtesy of FORD MOTOR CO.

- If oversize bearings are being used, use the procedure in the previous step and the Bearing Select Fit Chart, Oversize Bearing Chart to determine the required grade for each main bearing.

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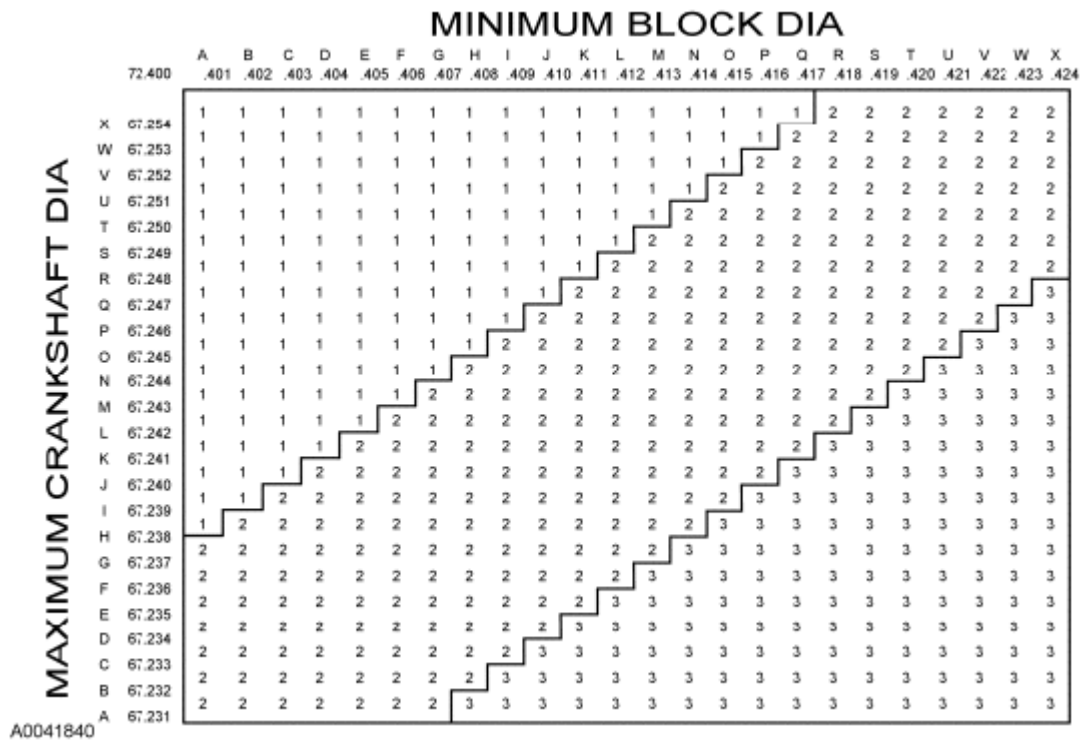


Fig. 342: View Of Bearing Select Fit Chart (Oversize Bearings)
 Courtesy of FORD MOTOR CO.

NOTE: Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.

5. Lubricate with clean engine oil and install the crankshaft upper main bearings into the cylinder block.
6. Install the crankshaft onto the upper crankshaft thrust bearing and main bearings.

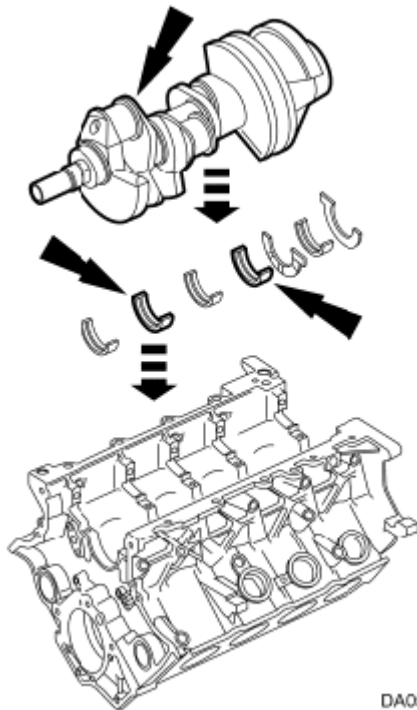


Fig. 343: Installing Crankshaft Onto Upper Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

NOTE: To aid in assembly, apply petroleum jelly to the back of the crankshaft thrust washer.

NOTE: The oil groove on the thrust washer must face toward the rear of the engine (crankshaft surface).

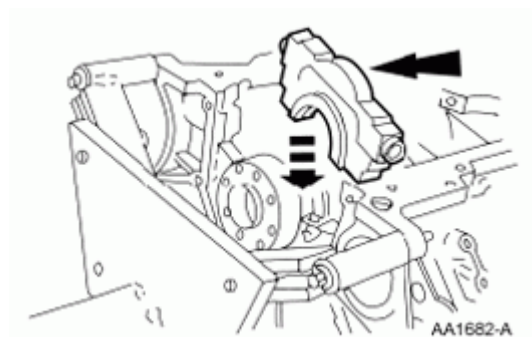
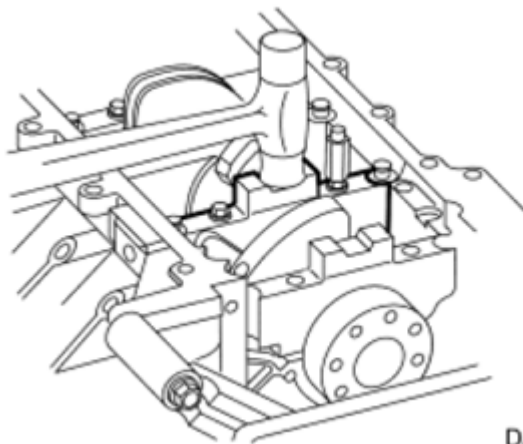


Fig. 344: Installing Rear Main Bearing Cap
Courtesy of FORD MOTOR CO.

7. Install the rear main bearing cap.
8. Install the crankshaft lower main bearings, thrust bearing and thrust washer into the main bearing caps. Locate the main bearing cap on the cylinder block and tap into place using a plastic or dead-blow hammer.

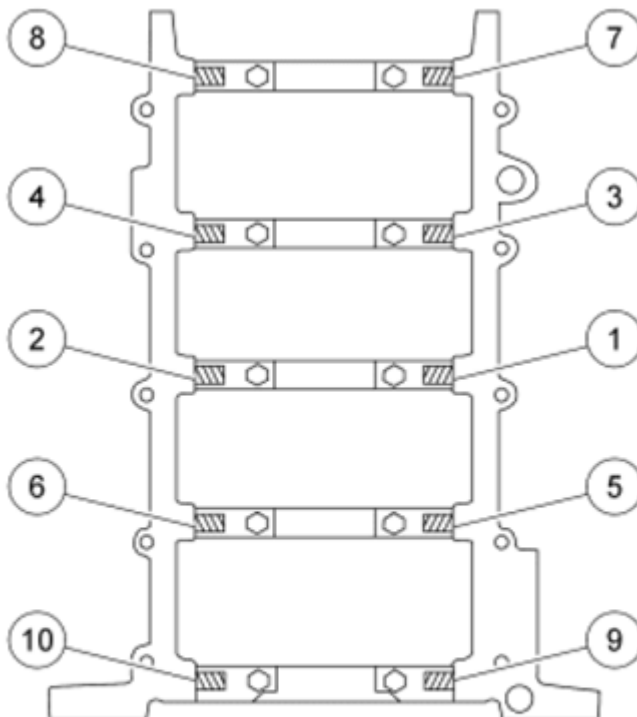


DA0599-A

Fig. 345: Installing Crankshaft Lower Main Bearings, Thrust Bearing And Thrust Washer Into Main Bearing Caps

Courtesy of FORD MOTOR CO.

NOTE: The jackscrews are a part of the main bearing cap assembly and are screwed into the main caps, not the cylinder block.

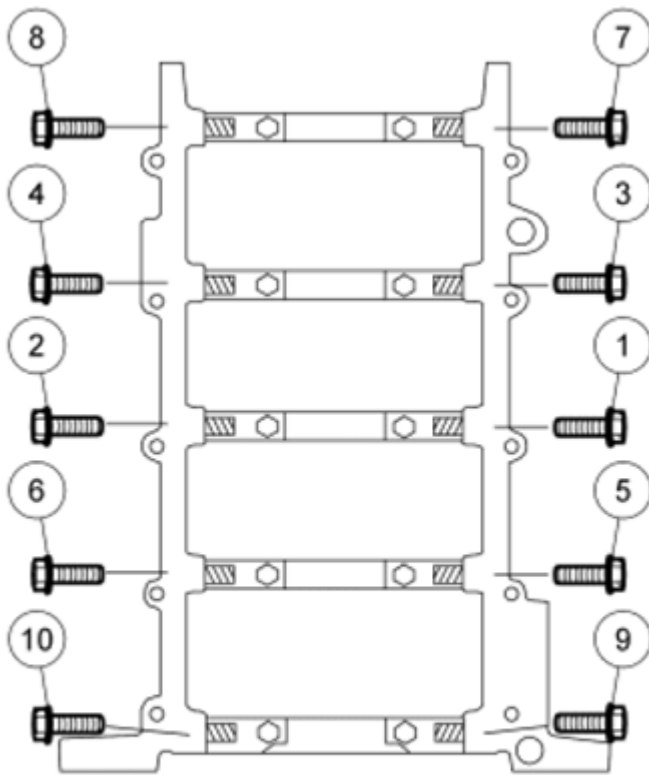


N0071894

Fig. 346: Identifying Cylinder Block Jackscrews Tightening Sequence

Courtesy of FORD MOTOR CO.

9. Back out the 10 jackscrews against the cylinder block in 2 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 10 Nm (89 lb-in).
10. Install the 10 main bearing cap bolts and tighten in 2 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten to 21 Nm (15 lb-ft).



N0071893

Fig. 347: Identifying Main Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Tighten the 10 main bearing cap bolts in 2 stages, in the sequence shown in the illustration in the illustration.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

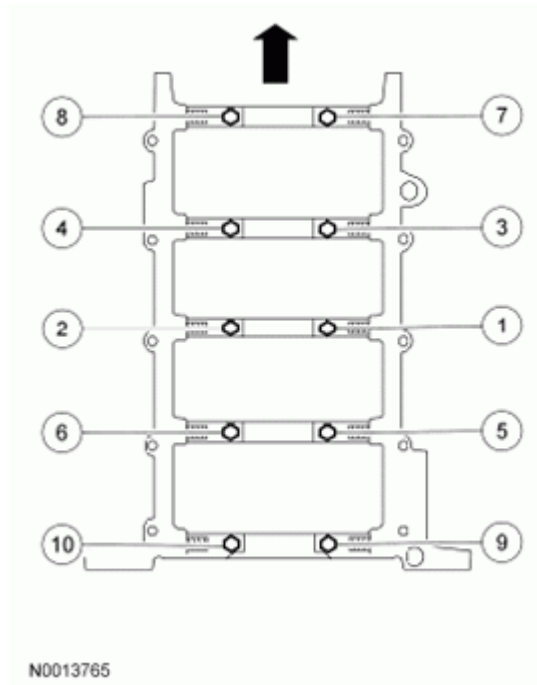


Fig. 348: Identifying Tightening Sequence Of Main Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

12. Check piston-to-cylinder block and ring clearances. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
13. Assemble the 8 pistons. For additional information, refer to **PISTON** in this service information.
14. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.

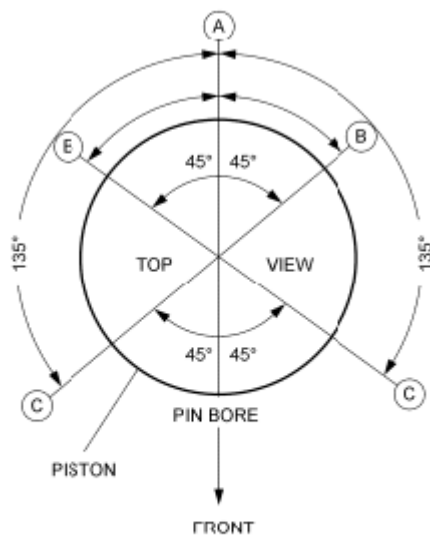


Fig. 349: Identifying Piston Ring Gaps Dimensions
Courtesy of FORD MOTOR CO.

15. Make sure the dimple in the piston faces the front of the engine.

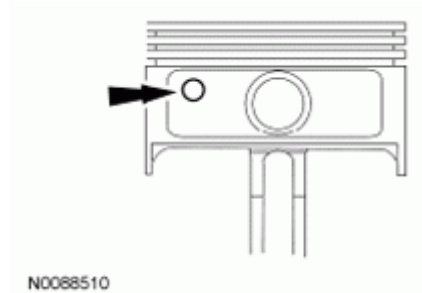


Fig. 350: Locating Dimple In Piston Faces
Courtesy of FORD MOTOR CO.

NOTE: Do not scratch the cylinder walls or crankshaft journals with the connecting rod or engine failure may occur.

NOTE: Make sure the piston arrow is facing forward.

NOTE: The next 3 steps are for all 8 connecting rods, rod caps and pistons. Only one connecting rod, rod cap and piston is shown in the illustration.

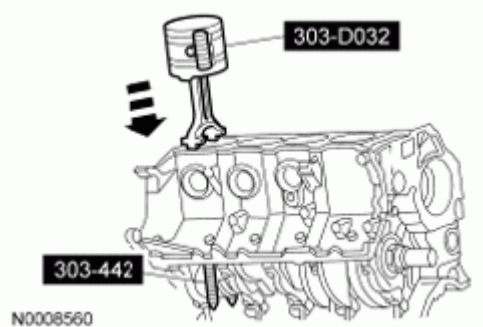


Fig. 351: Installing Piston And Connecting Rod Assemblies Using Piston Ring Compressor And Connecting Rod Installer
Courtesy of FORD MOTOR CO.

16. Use the Piston Ring Compressor and Connecting Rod Installer to install the piston and connecting rod assemblies.
 - Lubricate the piston and ring with clean engine oil.
 - Lubricate the rod bearings with clean engine oil.
 - Rotate the crankshaft as necessary.

NOTE: Do not scratch the cylinder walls or crankshaft journals with the

connecting rod.

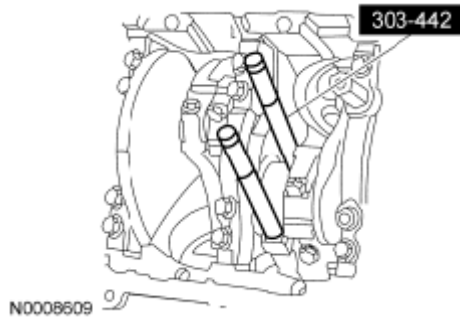


Fig. 352: Removing Connecting Rod Installer
Courtesy of FORD MOTOR CO.

17. Once the connecting rod is seated on the crankshaft journal, remove the Connecting Rod Installer.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

NOTE: The connecting rod caps have a cracked design and must make mate with the connecting rod ends. Excessive bearing clearance will result if not mated correctly.

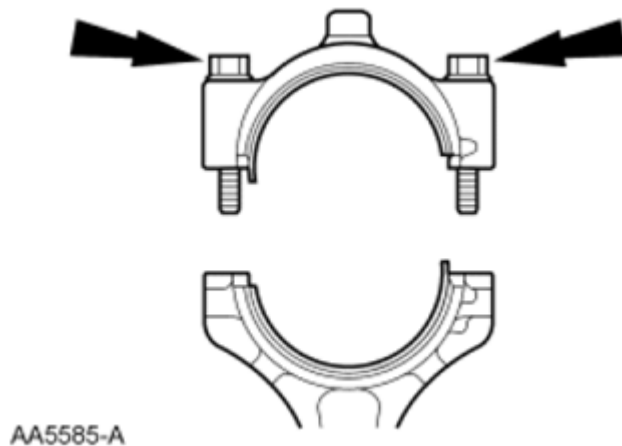
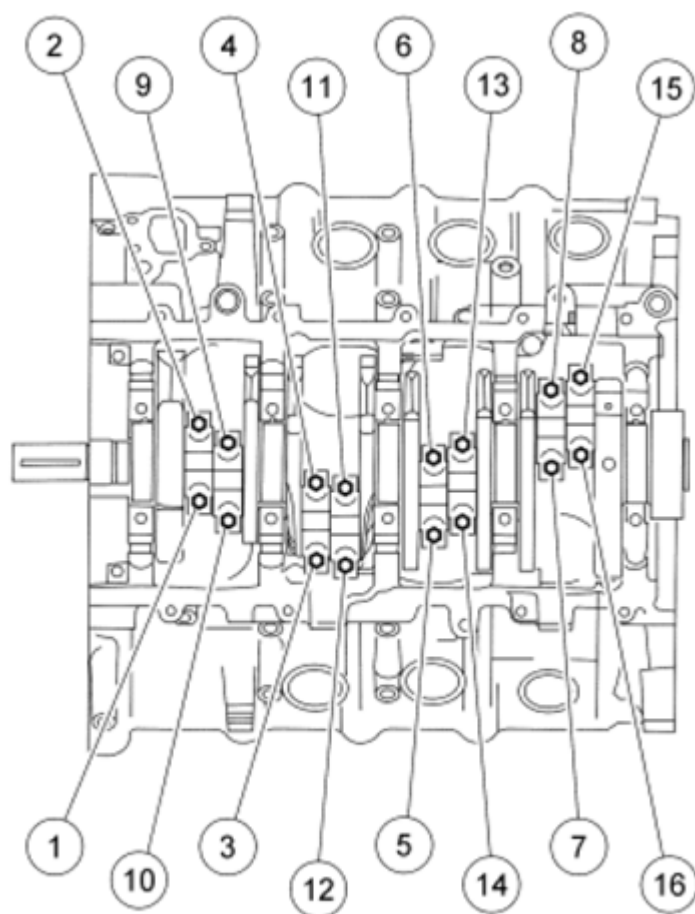


Fig. 353: Locating Lower Bearing And Connecting Rod Cap Bolts
Courtesy of FORD MOTOR CO.

18. Position the lower bearing and connecting rod bearing cap, and install the 2 new bolts loosely.
19. Tighten the 16 connecting rod bearing cap bolts in 3 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 23 Nm (17 lb-ft).
 - Stage 2: Tighten to 43 Nm (32 lb-ft).
 - Stage 3: Rotate an additional 90-120 degrees.



N0071892

Fig. 354: Identifying Connecting Rod Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

20. Position the oil pump and install the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).



Fig. 355: Locating Oil Pump And Bolts
Courtesy of FORD MOTOR CO.

Both cylinder heads

- NOTE:** The gasket sealing surfaces on the cylinder head and cylinder block must be clean. For additional information, refer to CYLINDER HEAD in this service information.
- NOTE:** The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.
- NOTE:** The new gasket has a film coating which is crucial to the gasket's ability to seat correctly. Do not scratch the gasket.
- NOTE:** RH head gasket shown in the illustration, LH head gasket similar.

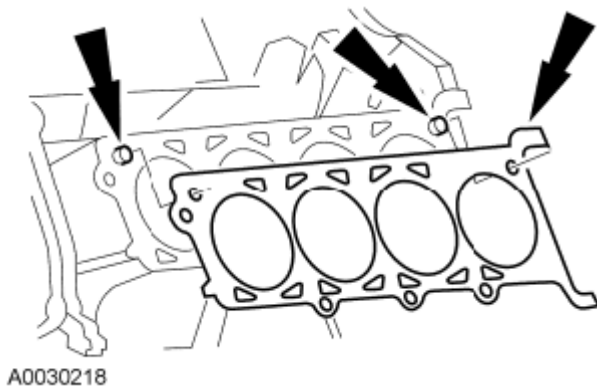


Fig. 356: Locating Head Gasket Dowel Pins
Courtesy of FORD MOTOR CO.

21. Install the head gaskets over the dowel pins.

- NOTE:** Cylinder head machining or milling is not authorized by the Ford Motor Company. Cylinder head flatness must be within 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area.
- NOTE:** The gasket sealing surfaces on the cylinder head and cylinder block must be clean. For additional information, refer to CYLINDER HEAD in this service information.
- NOTE:** The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.
- NOTE:** Do not allow the dowels to scratch the sealing of the cylinder head during cylinder head installation.
- NOTE:** RH cylinder head shown in the illustration, LH cylinder head similar.

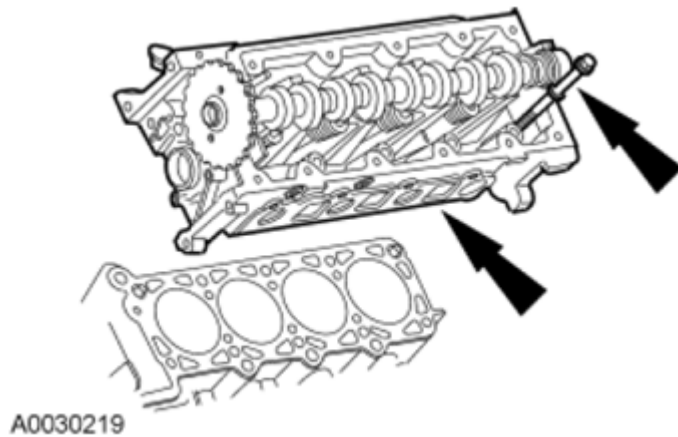


Fig. 357: Locating Cylinder Head Dowels
Courtesy of FORD MOTOR CO.

22. Install the cylinder head on the dowels and the head gasket. Loosely install new bolts.
23. Tighten the 10 cylinder head bolts in 6 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).
 - Stage 3: Loosen a minimum of one full turn (360 degrees).
 - Stage 4: Tighten to 40 Nm (30 lb-ft).
 - Stage 5: Tighten an additional 90 degrees (one-fourth turn).
 - Stage 6: Tighten an additional 90 degrees (one-fourth turn).

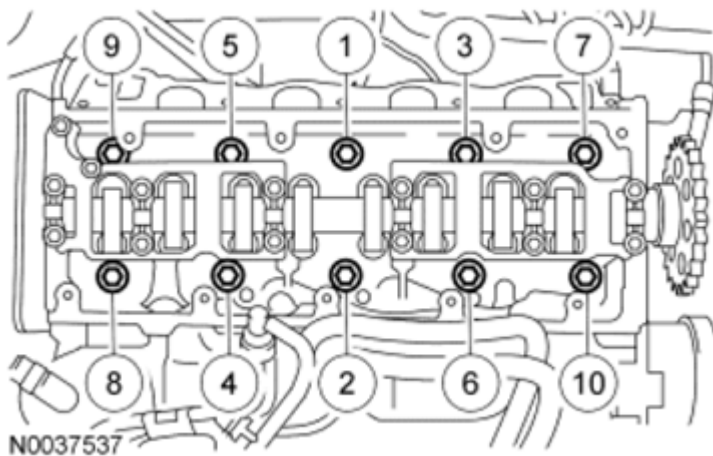


Fig. 358: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

24. Remove the Cylinder Head Remover/Installer from both ends of the cylinder head.

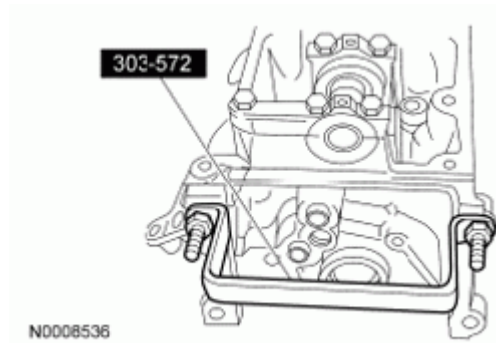


Fig. 359: Installing Cylinder Head Remover/Installer On Both Ends Of Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the O-ring seal with clean engine oil.

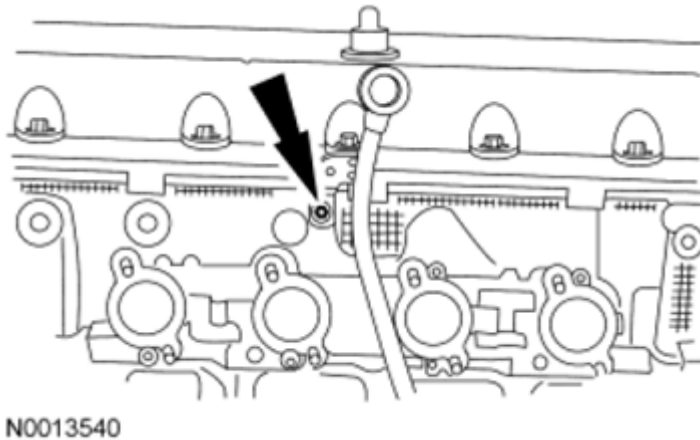


Fig. 360: Locating Oil Level Indicator Tube And Mounting Bolt
Courtesy of FORD MOTOR CO.

25. Install a new O-ring seal on the oil level indicator tube and install the oil level indicator tube and bolt.
 - Tighten to 10 Nm (89 lb-in).
26. Install the new 8 LH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
27. Install a new LH exhaust manifold gasket the LH exhaust manifold and 8 new nuts.
 - Tighten to 20 Nm (177 lb-in) in the sequence shown in the illustration.

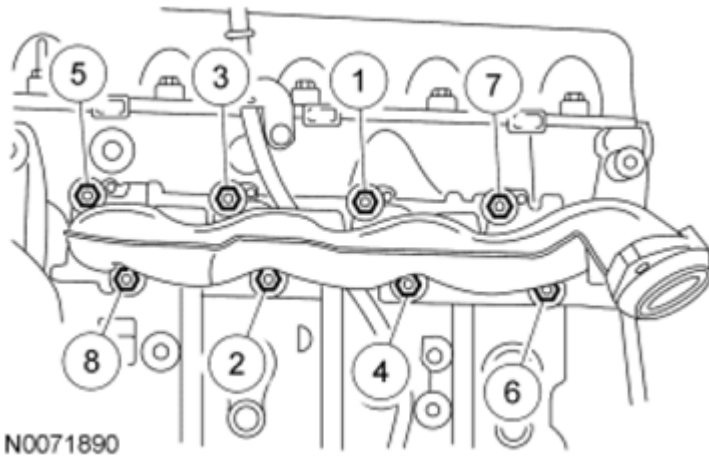


Fig. 361: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

28. Install the new 8 RH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
29. Install a new RH exhaust manifold gasket the RH exhaust manifold and 8 new nuts.
 - Tighten to 20 Nm (177 lb-in) in the sequence shown in the illustration.

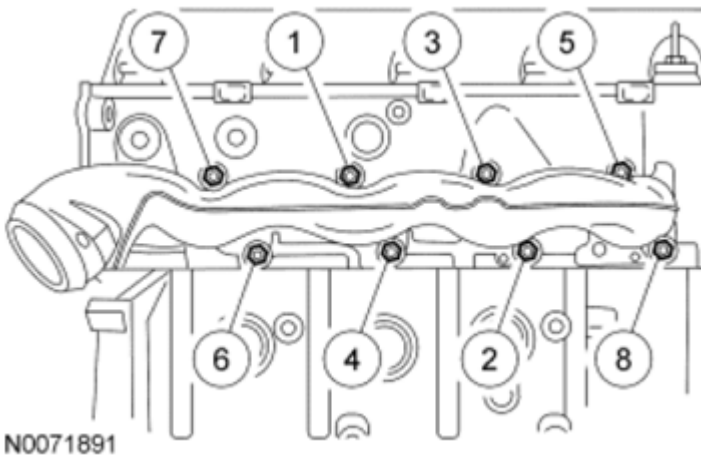


Fig. 362: Identifying Exhaust Manifold Gasket And Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

Engines with ratcheting timing chain tensioners

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

NOTE: Do not compress the ratchet assembly. This will damage the ratchet assembly.

NOTE: LH shown in the illustration, RH similar.

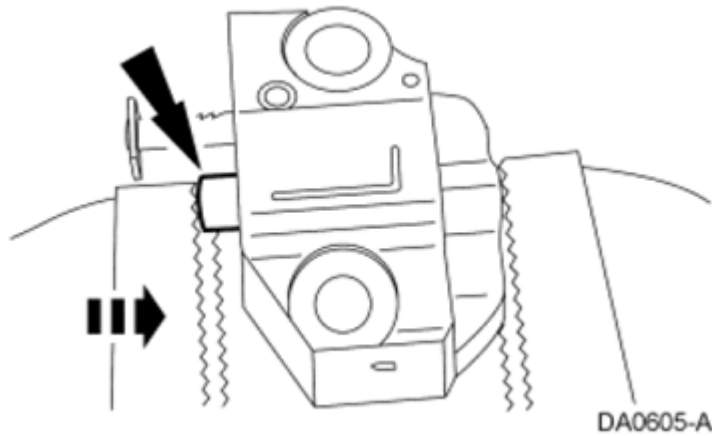


Fig. 363: Compressing Each Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

30. Compress each tensioner plunger, using an edge or a vise.
31. Using a small screwdriver or pick, push back and hold the ratchet mechanism.

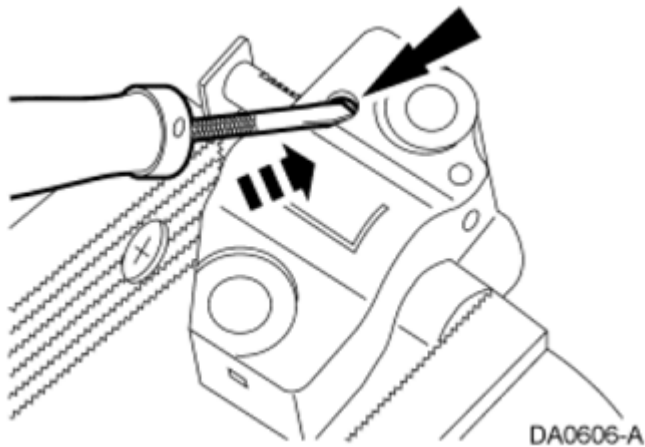


Fig. 364: Holding Ratchet Mechanism
Courtesy of FORD MOTOR CO.

32. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.

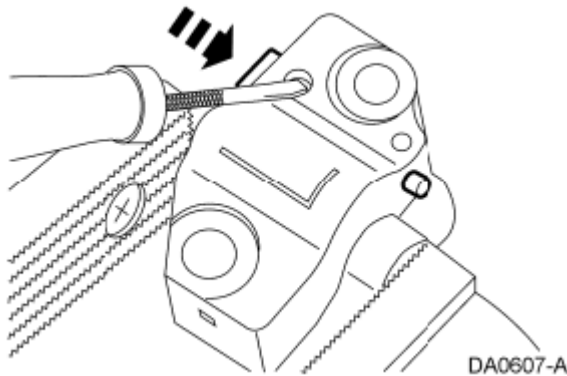
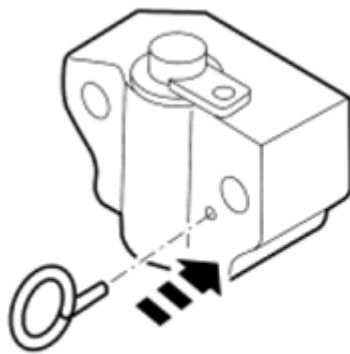


Fig. 365: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

33. Install a paper clip into the hole of each tensioner housing to hold the ratchet assembly and plunger in during installation.
 - Remove the tensioner from the vise.



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Fig. 366: Installing Paper Clip Into Hole Of Tensioner Housing
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

NOTE: If one or both 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 or engine damage may occur.

34. Inspect the RH and LH timing chain tensioners.
 - Install new tensioners as necessary.

NOTE: Timing chain procedures must be followed exactly or damage to valves

and pistons will result.

NOTE: LH shown in the illustration, RH similar.

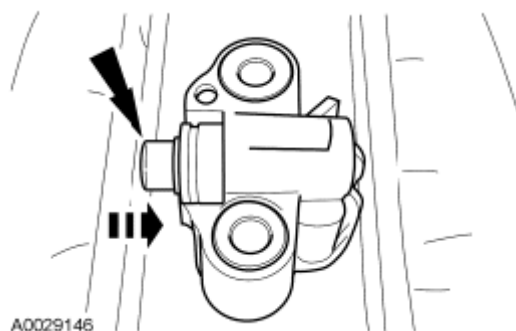


Fig. 367: Compressing Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

35. Compress each tensioner plunger, using a vise.
36. Install a Hydraulic Chain Tensioner Retaining Clip on the tensioner to hold the plunger in during installation.

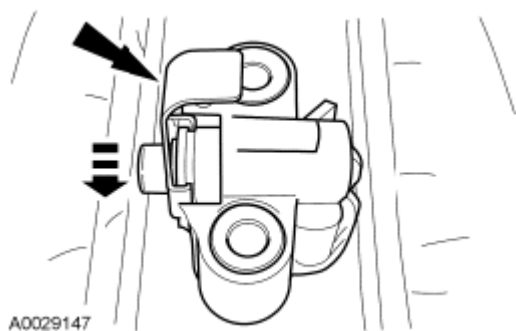


Fig. 368: Installing Hydraulic Chain Tensioner Retaining Clip On Tensioner
Courtesy of FORD MOTOR CO.

All engines

37. If the colored links are not visible, mark one link on one end and one link on the other end, and use as timing marks.

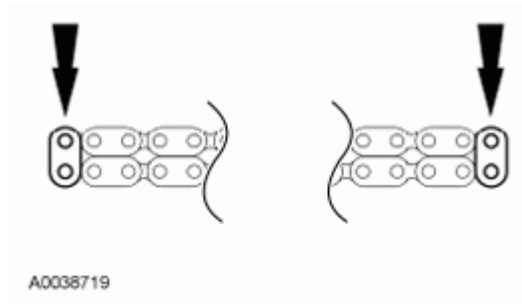


Fig. 369: Locating Timing Chain Colored Links
Courtesy of FORD MOTOR CO.

38. Using the Crankshaft Holding Tool, position the crankshaft.
 - Remove the Crankshaft Holding Tool after crankshaft positioning.

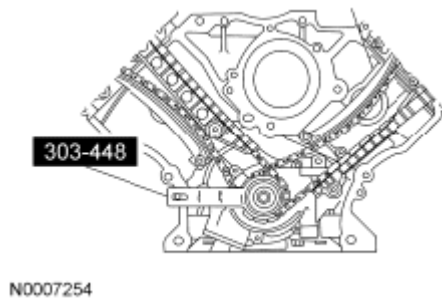


Fig. 370: Positioning Crankshaft Using Crankshaft Holding Tool
Courtesy of FORD MOTOR CO.

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

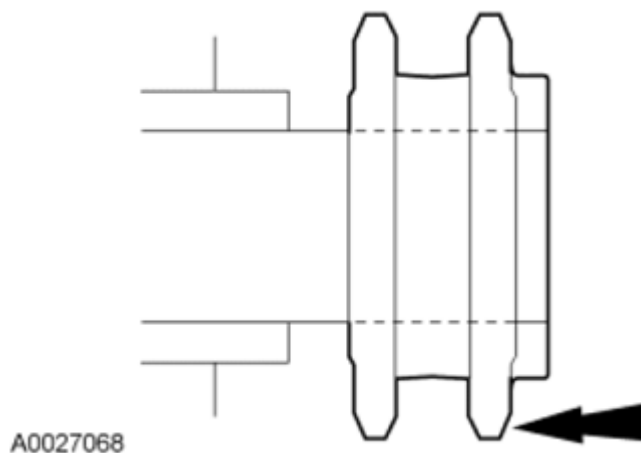


Fig. 371: Locating Crankshaft Sprocket Flange
Courtesy of FORD MOTOR CO.

40. Install the timing chain guides.
 1. Position the LH timing chain guide.

2. Install and tighten the 2 LH bolts to 10 Nm (89 lb-in).
3. Position the RH timing chain guide.
4. Install and tighten the 2 RH bolts to 10 Nm (89 lb-in).

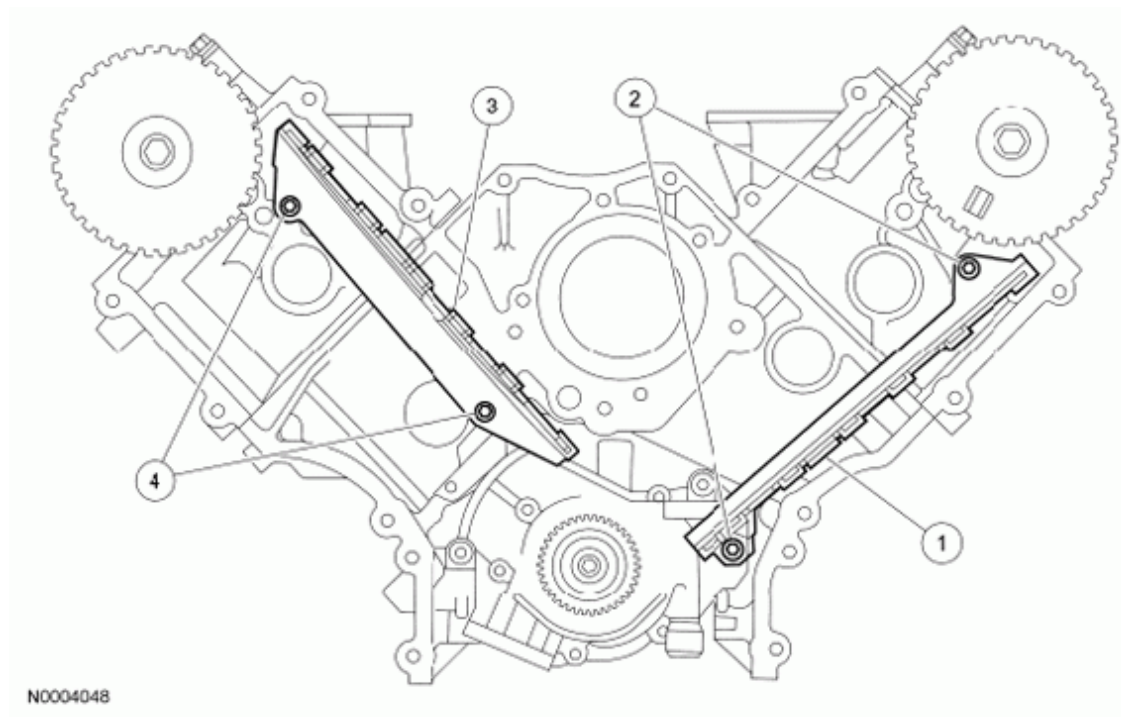


Fig. 372: Identifying Timing Chain Guides And Bolt
Courtesy of FORD MOTOR CO.

41. Rotate the RH camshaft sprocket until the timing mark is approximately at the 11 o'clock position. Rotate the LH camshaft sprocket until the timing mark is approximately at the 1 o'clock position.

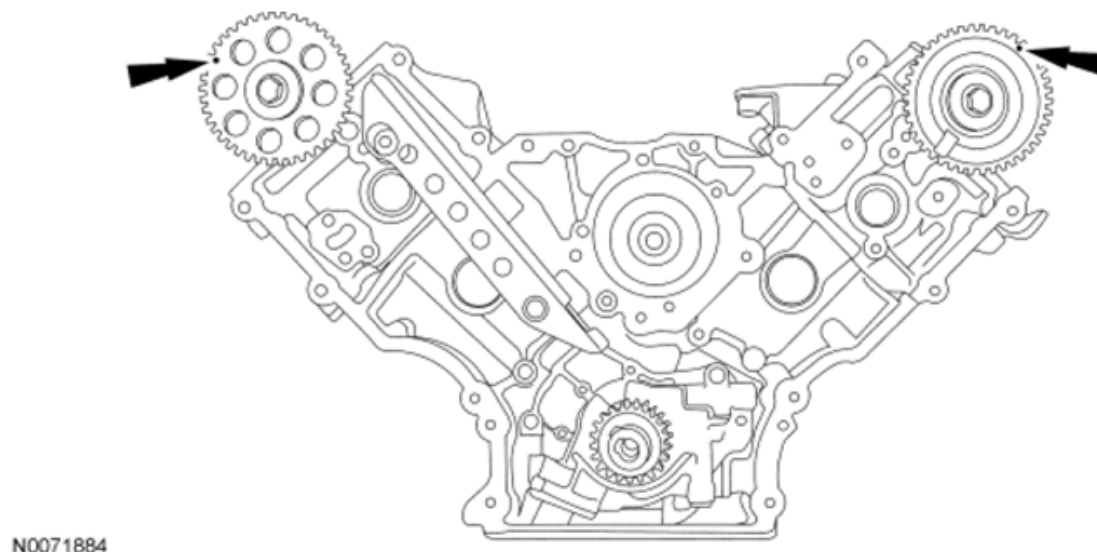


Fig. 373: Locating Camshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

42. Position the LH (inner) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.

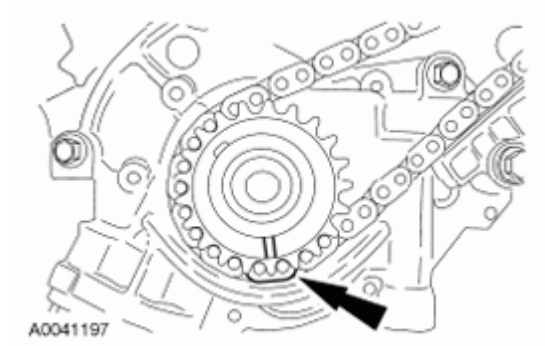


Fig. 374: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

43. Install the LH timing chain on the camshaft sprocket, aligning the colored (marked) link with the timing marks on the sprocket.

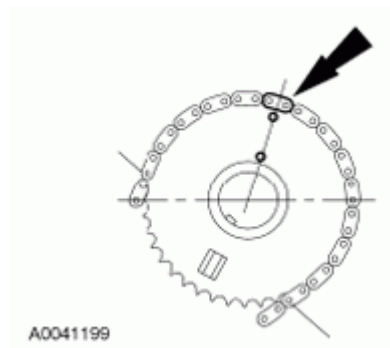


Fig. 375: Locating Colored (Marked) Link With Timing Marks On Sprocket
Courtesy of FORD MOTOR CO.

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

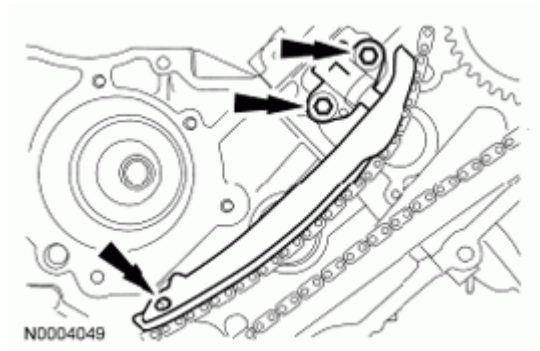
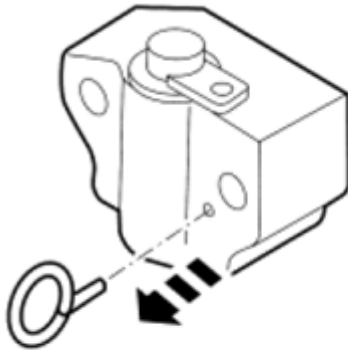


Fig. 376: Locating Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

44. Position the LH timing chain tensioner on the dowel pin and install the LH timing chain tensioner and 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

Engines with ratcheting timing chain tensioners

45. Remove the paper clip from the LH timing chain tensioner.



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Fig. 377: Removing Retaining Clip From Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

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

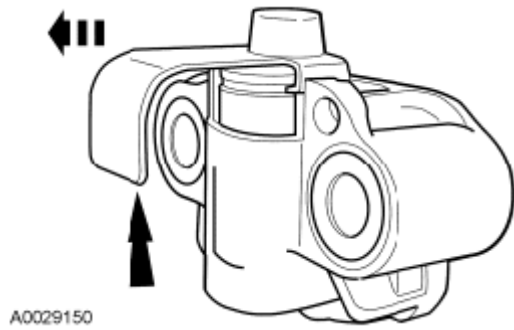


Fig. 378: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All engines

47. Position the RH (outer) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.

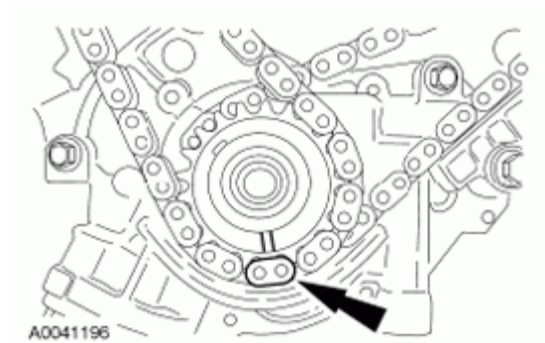


Fig. 379: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

48. Install the RH timing chain on the camshaft sprocket, aligning the colored (marked) link with the timing marks on the sprocket.

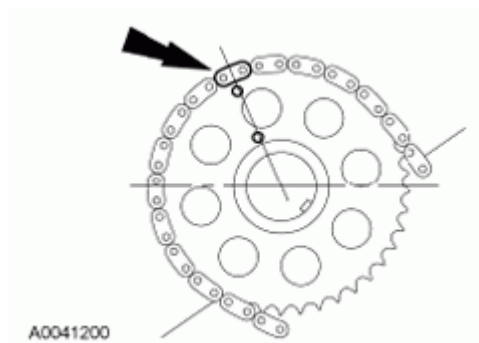


Fig. 380: Locating Camshaft Sprocket Timing Chain
Courtesy of FORD MOTOR CO.

49. 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).

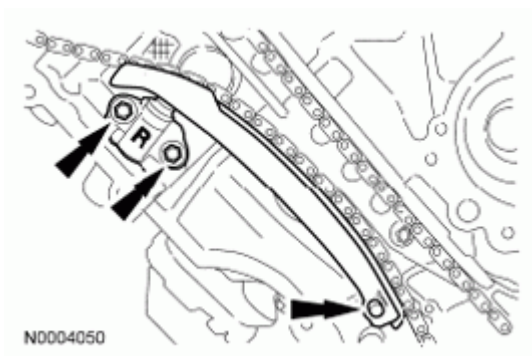


Fig. 381: Locating Timing Chain Tensioner And Mounting Bolts
Courtesy of FORD MOTOR CO.

Engines with ratcheting timing chain tensioners

50. Remove the paper clip from the RH timing chain tensioner.

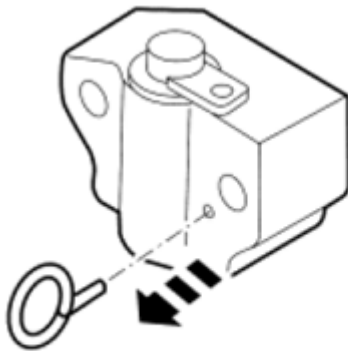


Fig. 382: Removing Retaining Clip From Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

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

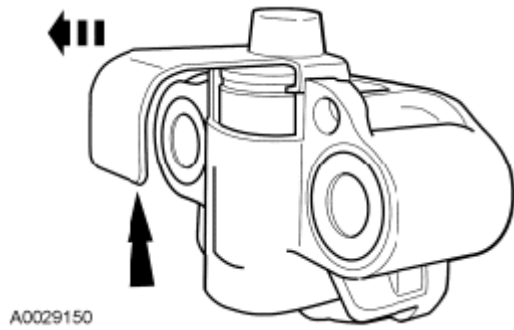


Fig. 383: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All engines

52. Make sure that the colored (marked) chain links are lined up with the dots on the crankshaft sprockets and the camshaft sprocket.

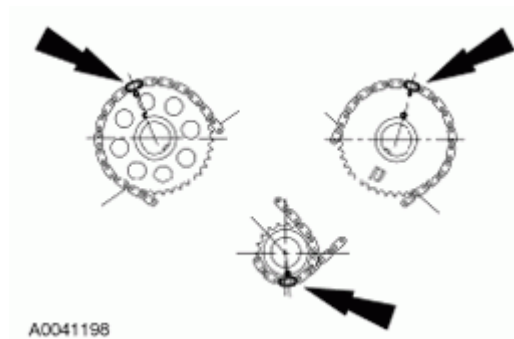


Fig. 384: Identifying Colored (Marked) Chain Links Are Lined Up With The Dots On Crankshaft Sprocket And Camshaft Sprockets
Courtesy of FORD MOTOR CO.

53. Rotate and camshaft until the lobe is in the upward position.

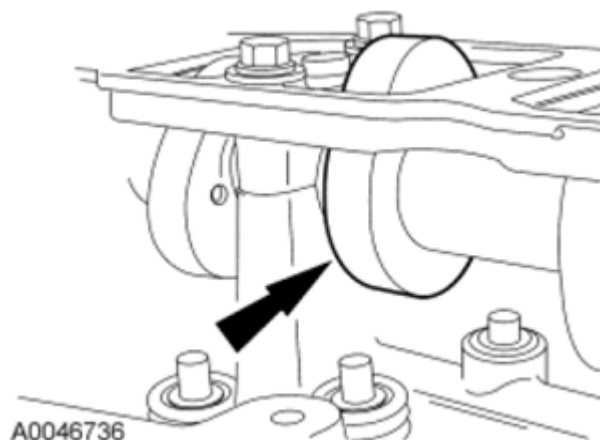
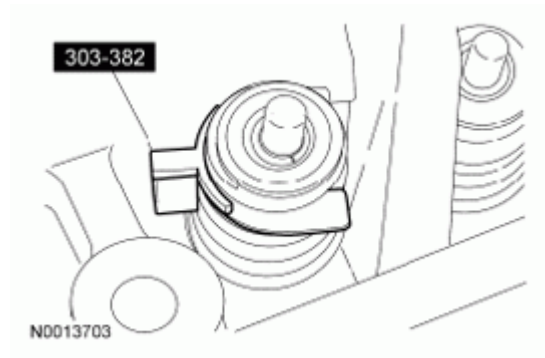


Fig. 385: Locating Camshaft Lobe In Up Position

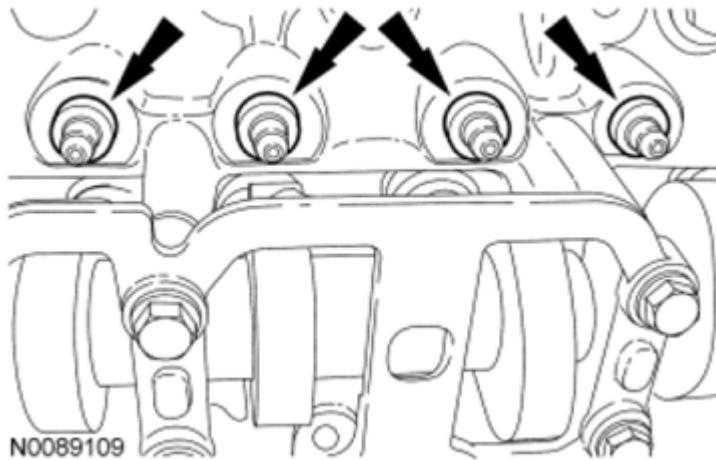
Courtesy of FORD MOTOR CO.

54. Install the Valve Spring Compressor Spacer between the valve spring coil to prevent valve stem seal damage.

**Fig. 386: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils**

Courtesy of FORD MOTOR CO.

NOTE: Lubricate the hydraulic lash adjusters with clean engine oil.

**Fig. 387: Locating Hydraulic Lash Adjusters**

Courtesy of FORD MOTOR CO.

55. Install the 16 hydraulic lash adjusters in their original locations (4 shown in the illustration).

NOTE: Lubricate the camshaft roller followers using clean engine oil.

NOTE: Position the cam lobe away from the camshaft roller follower location prior to installing each camshaft roller follower.

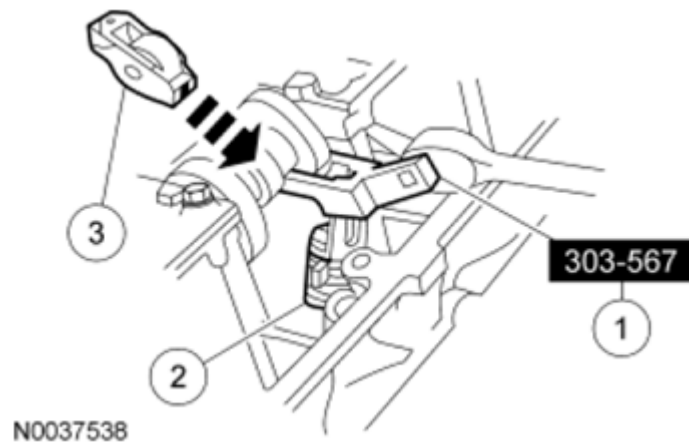


Fig. 388: Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

56. Install the 16 camshaft roller followers.
 1. Install the Valve Spring Compressor.
 2. Compress the valve spring.
 3. Install the 16 camshaft roller followers in their original locations.
57. Remove the Valve Spring Compressor Spacer.

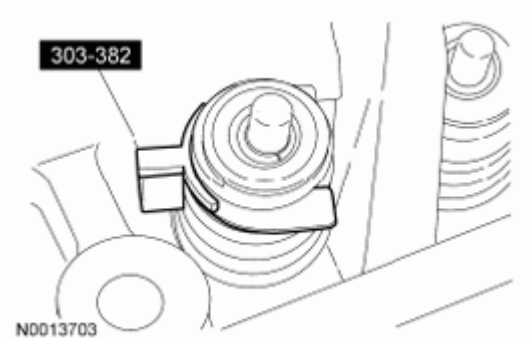


Fig. 389: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools when removing or installing the spark plugs or damage may occur to the cylinder head or spark plug.

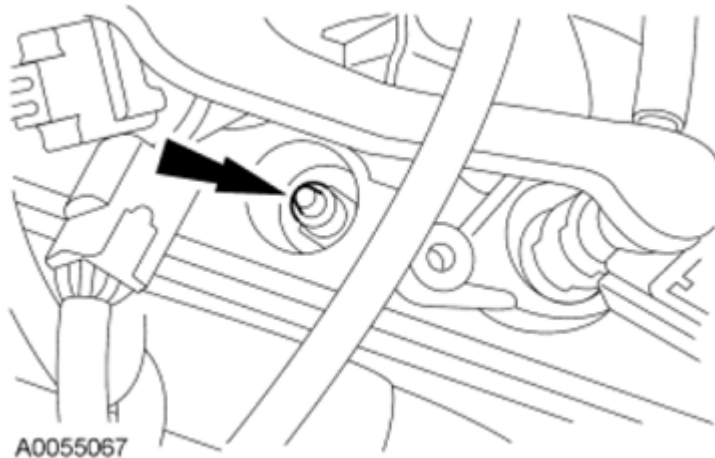


Fig. 390: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

58. Install all 8 spark plugs.
 - Tighten to 18 Nm (159 lb-in).
59. Install the crankshaft sensor ring.

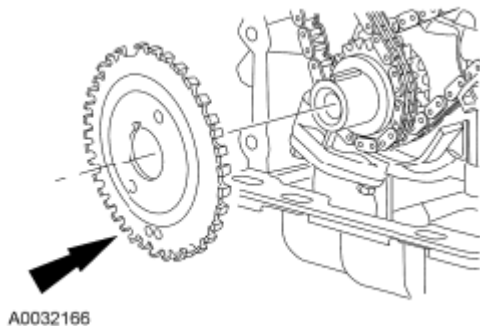


Fig. 391: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

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.

NOTE: RH timing chain removed for clarity.

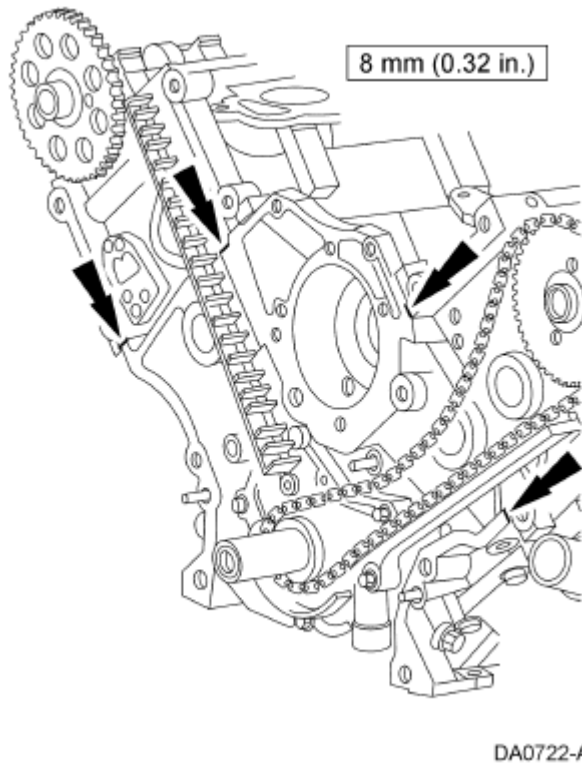


Fig. 392: Locating Sealant Bead Applying Location On Head To Block Surface With Specifications
Courtesy of FORD MOTOR CO.

60. Apply a bead of sealant along the head-to-block surface and the oil pan-to-block surface as specified.
61. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger-tight.

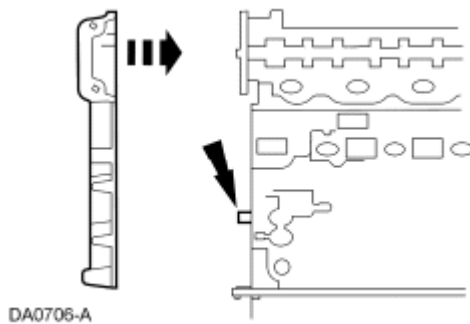


Fig. 393: Installing Engine Front Cover Gasket On Engine Front Cover
Courtesy of FORD MOTOR CO.

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

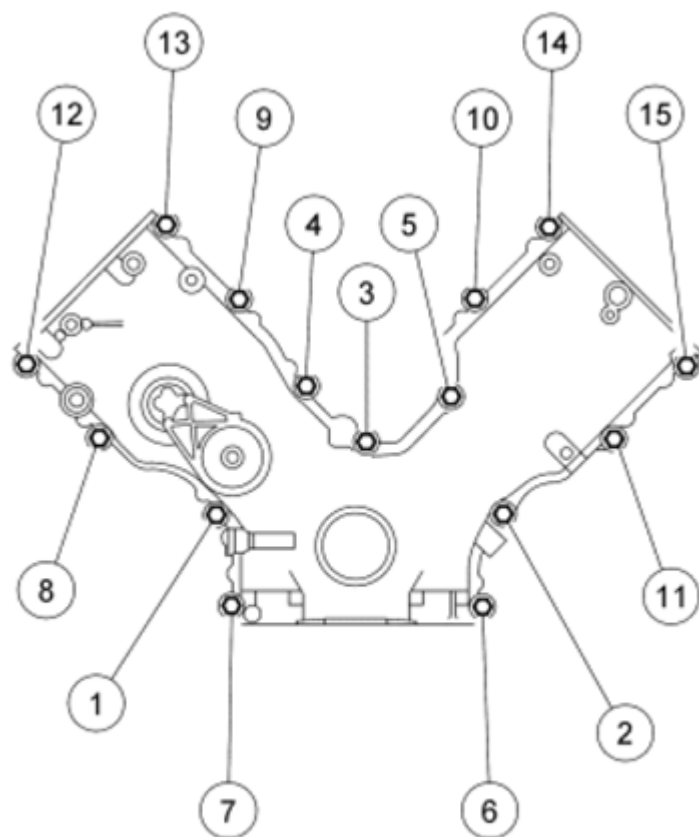
ITEM DESCRIPTION

Item	Part Number	Description
1	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis

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-head pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N808586	Stud, washer hex-head pilot, M8 x 1.25 - M6 x 1.0 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	N806300	Stud, hex-shoulder pilot, M8 x 1.25 x 1.25 x 91.1
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



N0037514

Fig. 394: Identifying Stud Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

NOTE: RH shown in the illustration, LH similar.

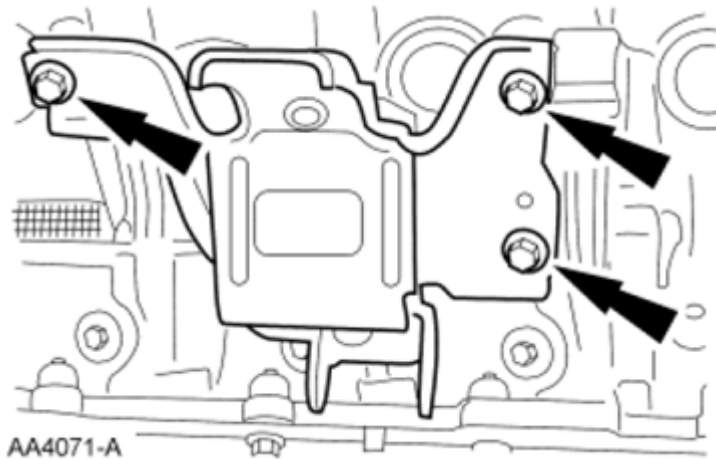


Fig. 395: Locating RH Engine Mount And Bolts
Courtesy of FORD MOTOR CO.

63. Install the RH and LH engine mounts and the 6 bolts.
 - Tighten to 70 Nm (52 lb-ft).
64. Lubricate the engine front cover and the front oil seal inner lip with clean engine oil.

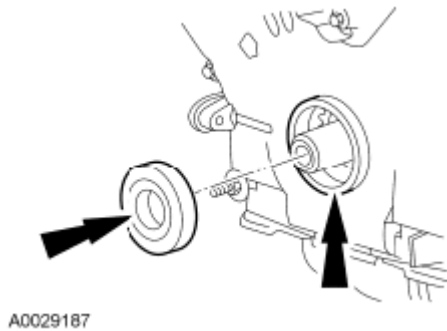


Fig. 396: Locating Crankshaft Seal And Crankshaft Seal Inner Lip
Courtesy of FORD MOTOR CO.

65. Using the Crankshaft Front Oil Seal Installer, Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the front oil seal.

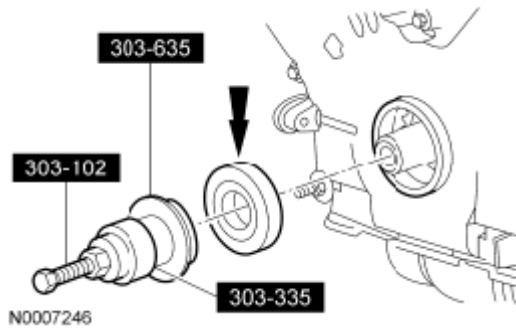


Fig. 397: Installing Crankshaft Front Seal Into Engine Front Cover Using Special Tools
Courtesy of FORD MOTOR CO.

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.

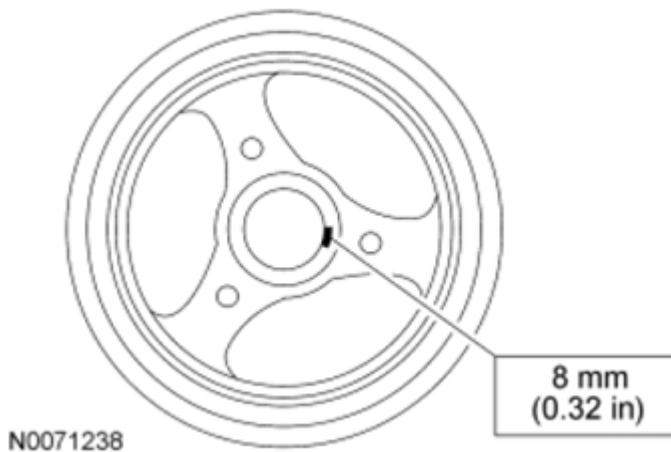


Fig. 398: Identifying Sealant Applying Area Of Woodruff Key Slot On Crankshaft Pulley With Specifications
Courtesy of FORD MOTOR CO.

66. Apply sealant to the Woodruff key slot on the crankshaft pulley.
67. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

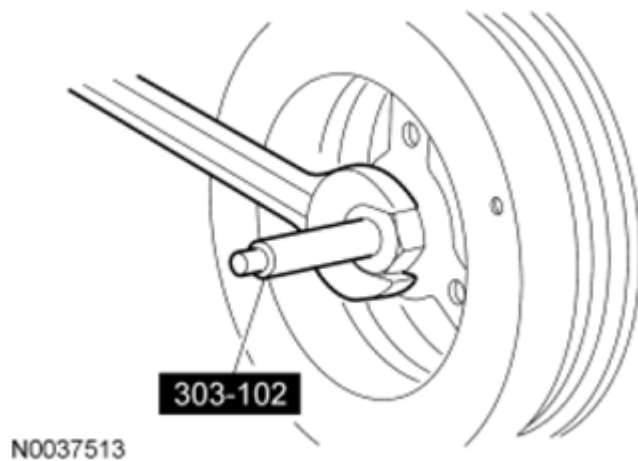


Fig. 399: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

NOTE: Use the Strap Wrench to hold the crankshaft pulley.

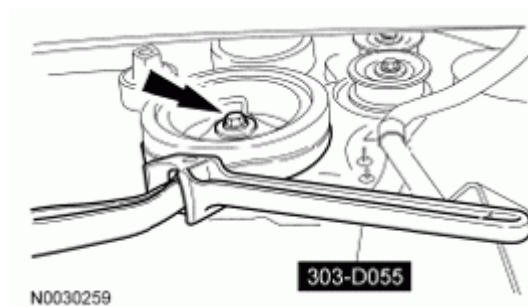


Fig. 400: Holding Crankshaft Pulley Using Strap Wrench
Courtesy of FORD MOTOR CO.

68. Install the bolt and washer and tighten the crankshaft pulley 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: Rotate an additional 90 degrees (one-fourth turn).

NOTE: Make sure the O-ring seal is in place and not damaged. A missing or damaged O-ring seal may cause foam in the lubrication system, low oil pressure and severe engine damage.

NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil.

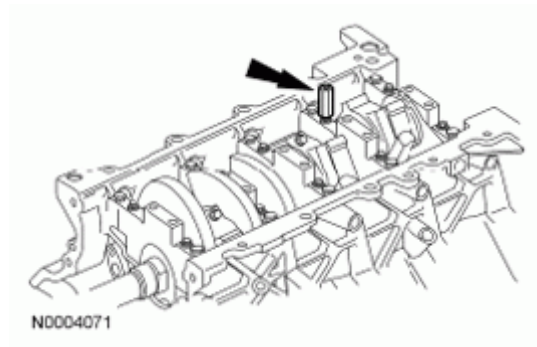


Fig. 401: Locating Pickup Tube Spacer
Courtesy of FORD MOTOR CO.

69. Install the oil pump screen and pickup tube spacer.
 - Tighten to 25 Nm (18 lb-ft).
70. Position the oil pump screen and pickup tube, and install the 3 bolts.
 1. Tighten to 25 Nm (18 lb-ft).
 2. Tighten to 10 Nm (89 lb-in).

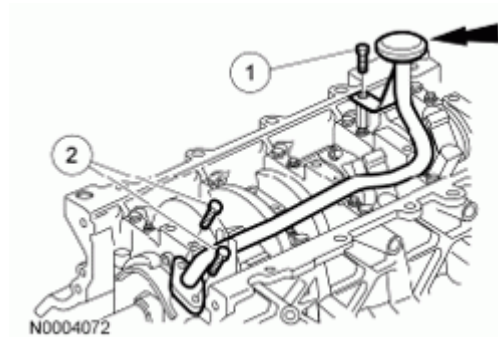


Fig. 402: Locating Oil Pump Screen, Pickup Tube And Bolts
Courtesy of FORD MOTOR CO.

71. Install the new oil filter adapter gasket, oil filter adapter and the 4 bolts.
 - Tighten to 25 Nm (18 lb-ft) in the sequence shown in the illustration.

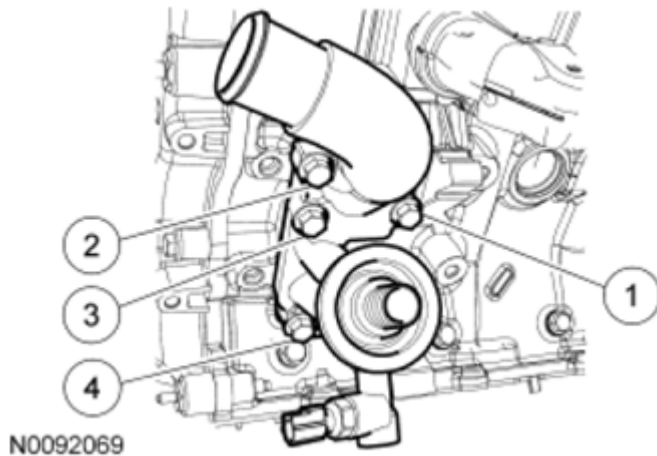


Fig. 403: Identifying Gasket And Oil Filter Adapter Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: The oil cooler must be replaced or severe damage to the engine can occur.

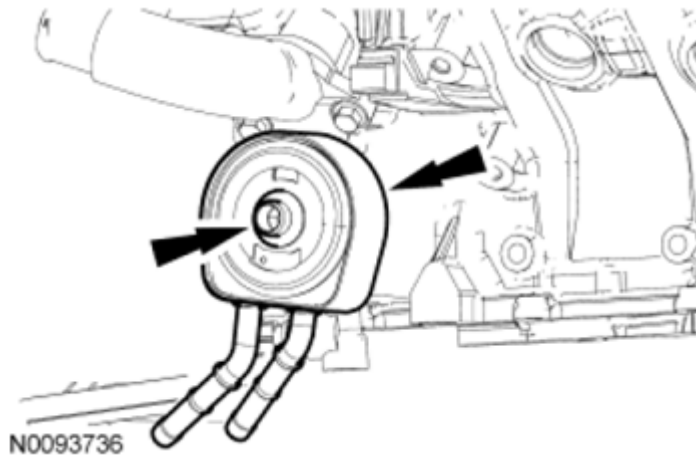


Fig. 404: Locating Oil Cooler Mounting Bolt
Courtesy of FORD MOTOR CO.

72. If equipped, install the new oil cooler and install the oil cooler mounting bolt.
 - Tighten to 46 Nm (34 lb-ft).

NOTE: Do not rotate the coolant pump housing once the coolant pump has been positioned in the cylinder block. Damage to the O-ring seal will occur.

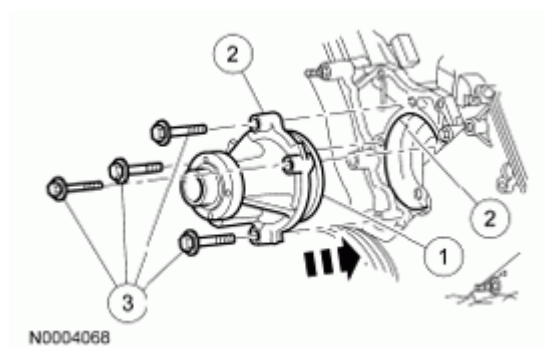


Fig. 405: Installing Coolant Pump Bolt
Courtesy of FORD MOTOR CO.

73. Install the coolant pump.
 1. Lubricate the new O-ring seal using clean engine coolant.
 2. Position the coolant pump into the engine block.
 3. Install the 4 bolts and tighten to 25 Nm (18 lb-ft).
74. Position the coolant pump pulley on the coolant pump and install the 4 bolts.
 - Tighten to 25 Nm (18 lb-ft).

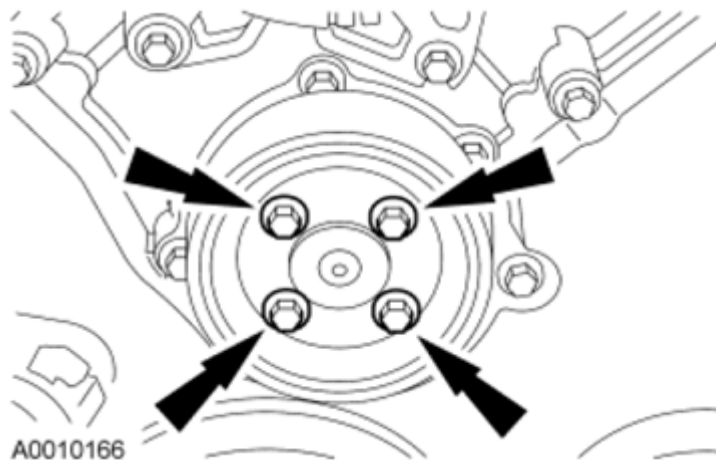


Fig. 406: Locating Coolant Pump Pulley Mounting Bolts
Courtesy of FORD MOTOR CO.

75. Position the accessory drive belt idler pulley and install the bolt.
 - Tighten to 25 Nm (18 lb-ft).

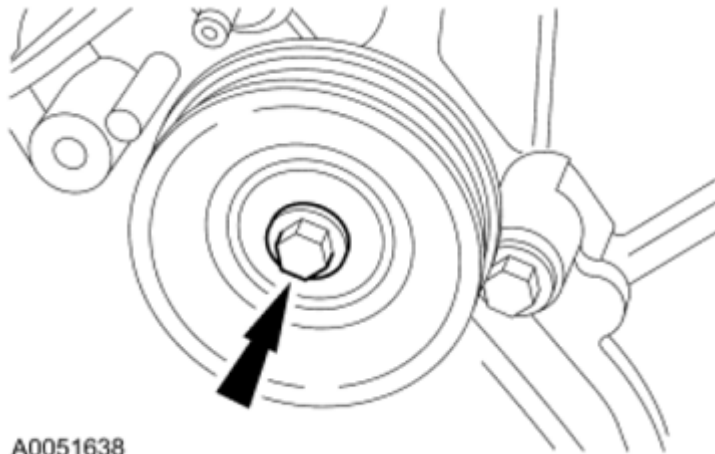


Fig. 407: Locating Drive Belt Idler Pulley Mounting Bolt
Courtesy of FORD MOTOR CO.

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.

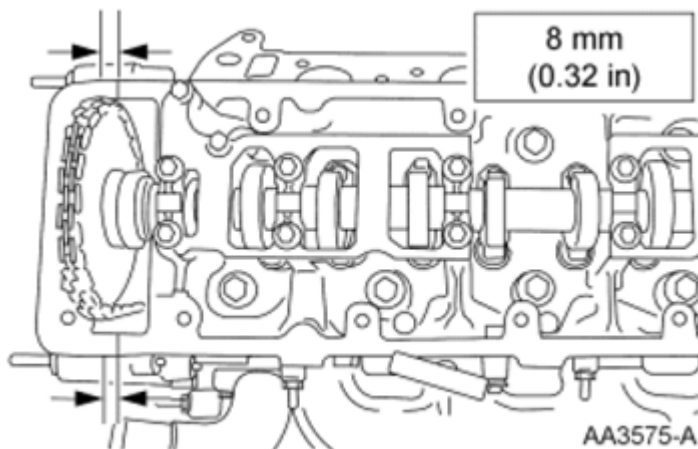


Fig. 408: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications
Courtesy of FORD MOTOR CO.

76. Apply sealant in 2 places where the engine front cover meets the cylinder head.
77. Install the new LH gasket into the valve cover and position on the cylinder head. Tighten the bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).

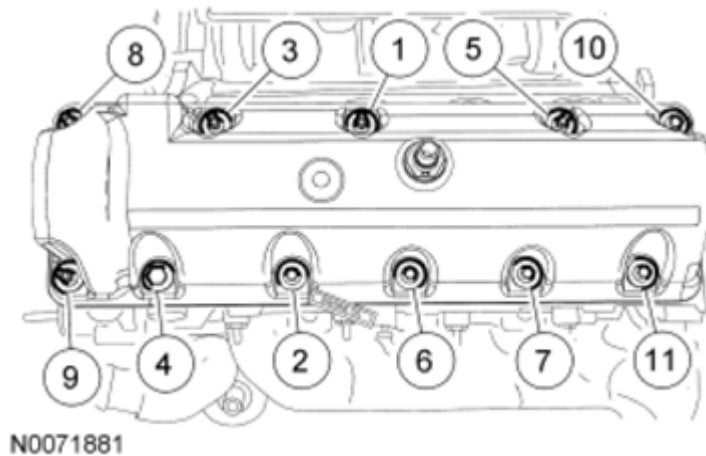


Fig. 409: Identifying Valve Cover Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

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.

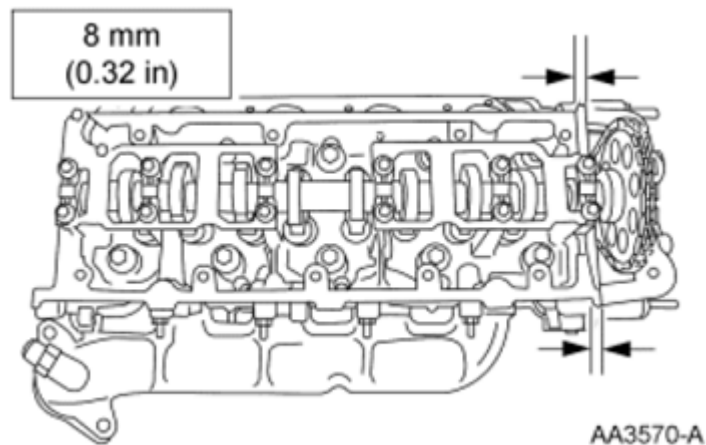


Fig. 410: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications
Courtesy of FORD MOTOR CO.

78. Apply sealant in 2 places where the engine front cover meets the cylinder head.
79. Install the new RH gasket into the valve cover and position on the cylinder head. Tighten the 11 bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).

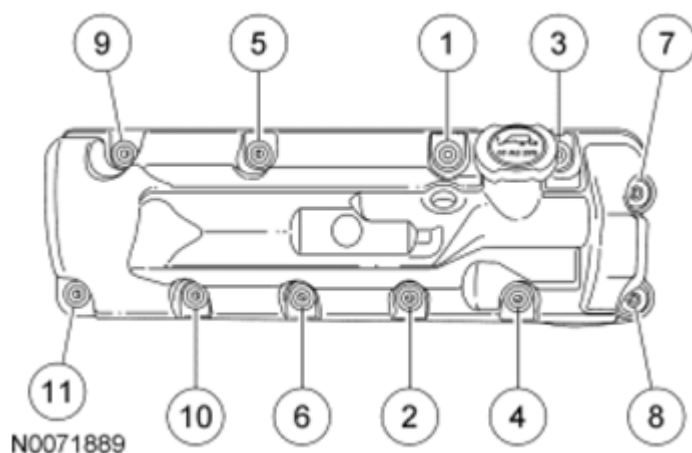


Fig. 411: Identifying Valve Cover Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

80. Install the Knock Sensor (KS) and the nut.
- Tighten to 20 Nm (177 lb-in).

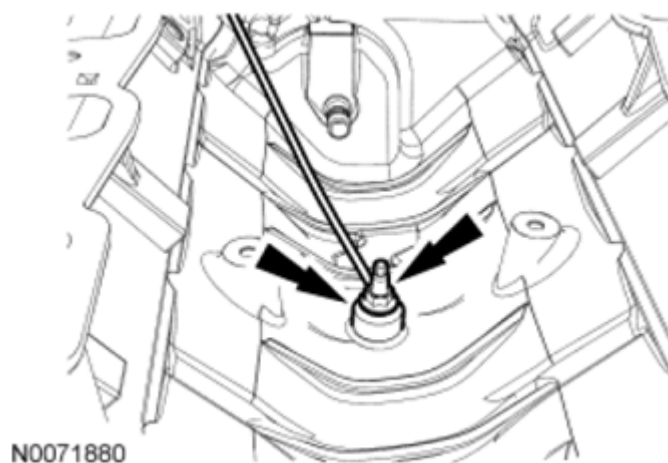


Fig. 412: Locating Knock Sensor And Mounting Nut
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the O-ring seal with clean engine coolant.



Fig. 413: Locating O-Ring Seals
Courtesy of FORD MOTOR CO.

81. Inspect the O-rings seals. Install new seals, if necessary.
82. Install the coolant bypass tube.

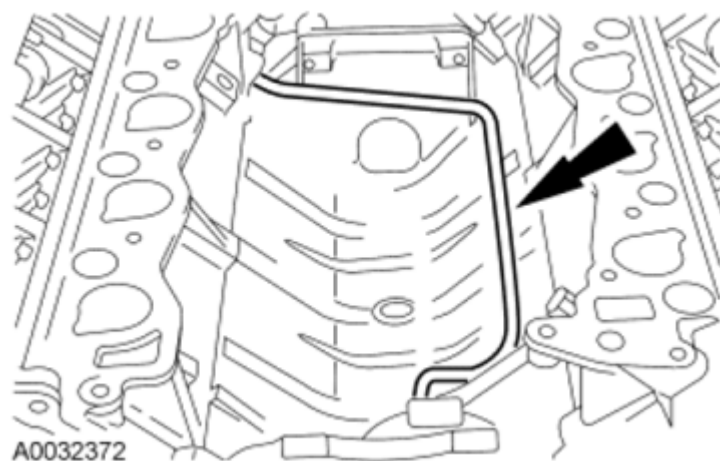
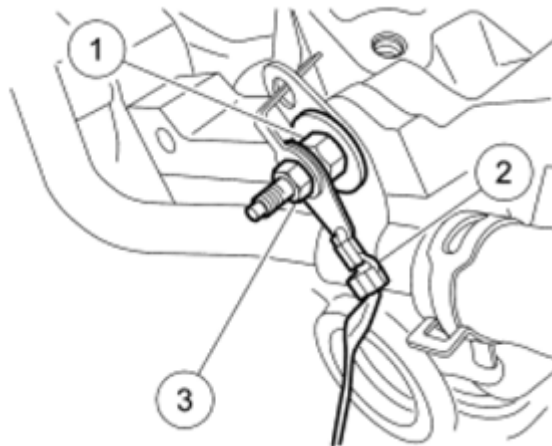


Fig. 414: Locating Coolant Bypass Tube
Courtesy of FORD MOTOR CO.

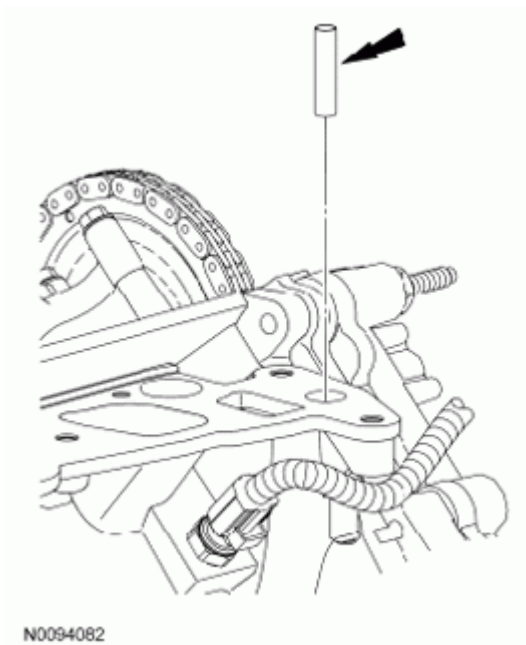
83. Install the ground strap on the rear of the RH cylinder head.
 1. Install the stud bolt and tighten to 25 Nm (18 lb-ft).
 2. Install the ground strap.
 3. Install the retaining nut and tighten to 10 Nm (89 lb-in).



N0037539

Fig. 415: Identifying Stud Bolt And Ground Strap
Courtesy of FORD MOTOR CO.

84. Install the insert into the LH cylinder head.



N0094082

Fig. 416: Locating Cylinder Head Insert
Courtesy of FORD MOTOR CO.

NOTE: **Align the gasket locator tabs to slots in cylinder head.**

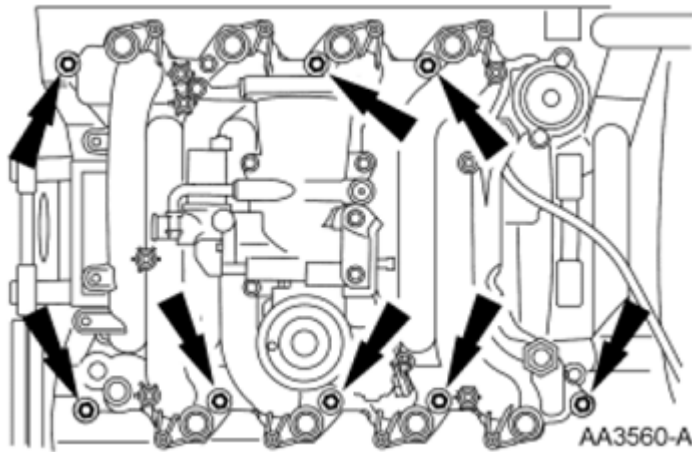


Fig. 417: Locating Intake Manifold Gaskets
Courtesy of FORD MOTOR CO.

85. Install the new intake manifold gaskets, intake manifold and hand-tighten the 8 bolts at the locations shown in the illustration.
86. Install the 8 ignition coils and tighten the 8 bolts (4 shown in the illustration).
 - Tighten to 6 Nm (53 lb-in).

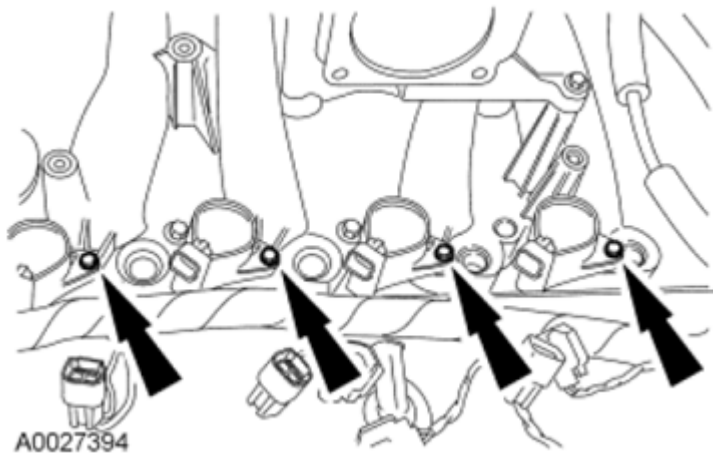


Fig. 418: Locating Ignition Coils And Mounting Bolts
Courtesy of FORD MOTOR CO.

87. Install the intake manifold crash bracket bolt and loosely install the bolt and the stud bolt.



Fig. 419: Locating Crash Bracket And Mounting Bolt
Courtesy of FORD MOTOR CO.

88. Install the thermostat.



Fig. 420: Locating Thermostat And O-Ring
Courtesy of FORD MOTOR CO.

89. Install the coolant outlet adapter and loosely install the 2 bolts.

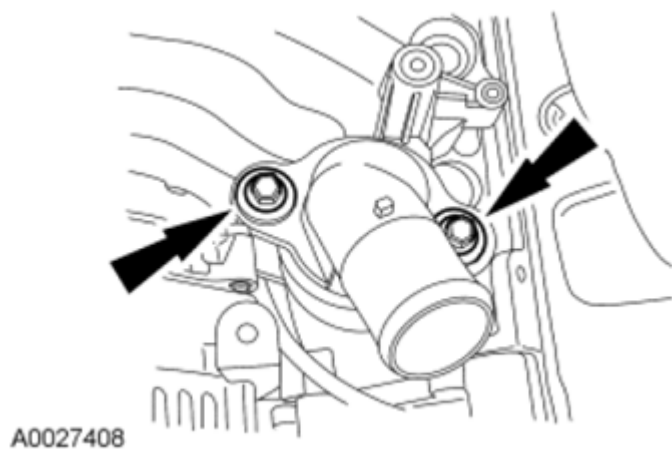


Fig. 421: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

90. Tighten the 9 bolts in the sequence shown in the illustration.
- Tighten to 25 Nm (18 lb-ft).

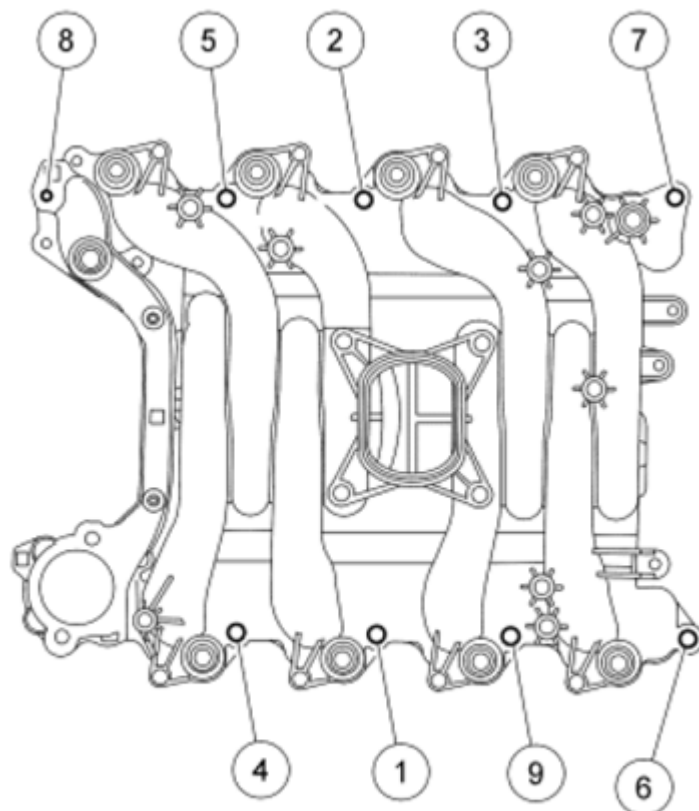


Fig. 422: Identifying Intake Manifold Crash Bracket Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

91. Tighten the stud bolt.
- Tighten to 25 Nm (18 lb-ft).

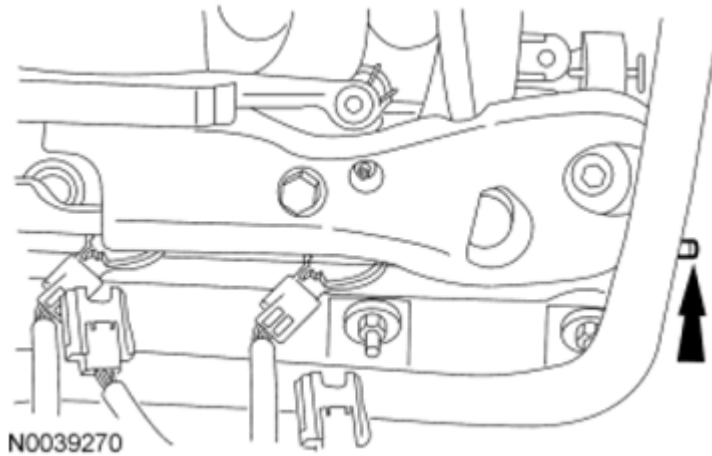


Fig. 423: Locating Stud Bolt
Courtesy of FORD MOTOR CO.

92. Tighten the 2 coolant outlet adapter bolts.
- Tighten to 25 Nm (18 lb-ft).

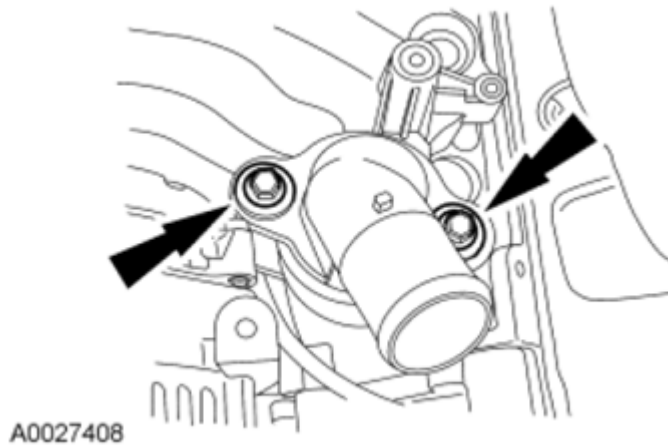


Fig. 424: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

93. Connect the throttle control and throttle positioning sensor electrical connector.

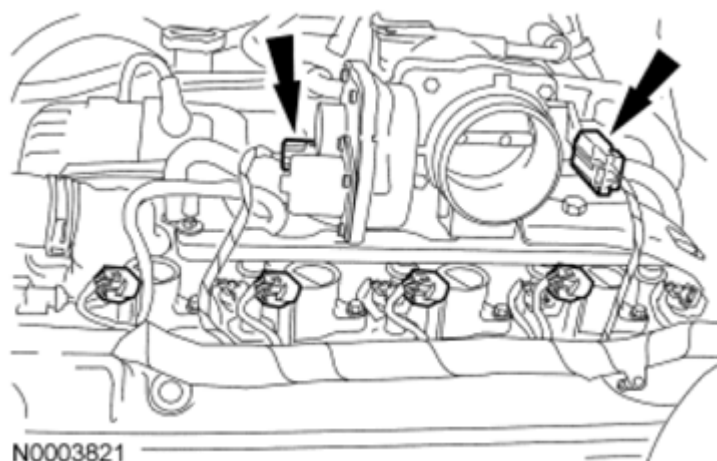


Fig. 425: Locating Throttle Control And Throttle Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

94. Connect the EGR tube to the EGR valve.
- Tighten to 43 Nm (32 lb-ft).

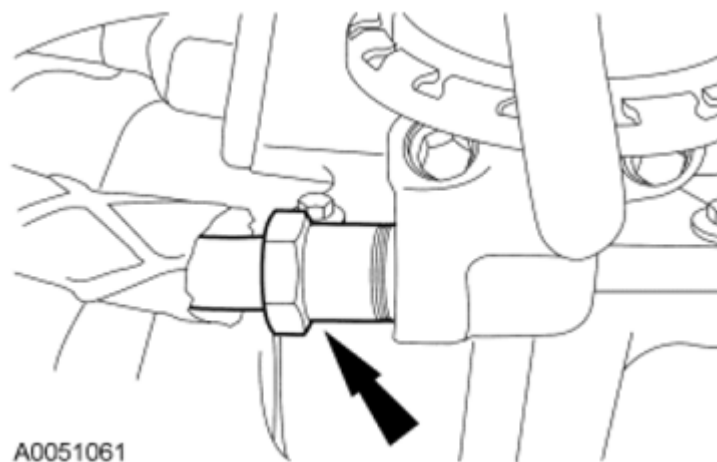


Fig. 426: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

95. Connect the EGR tube to the exhaust manifold.
- Tighten to 43 Nm (32 lb-ft).

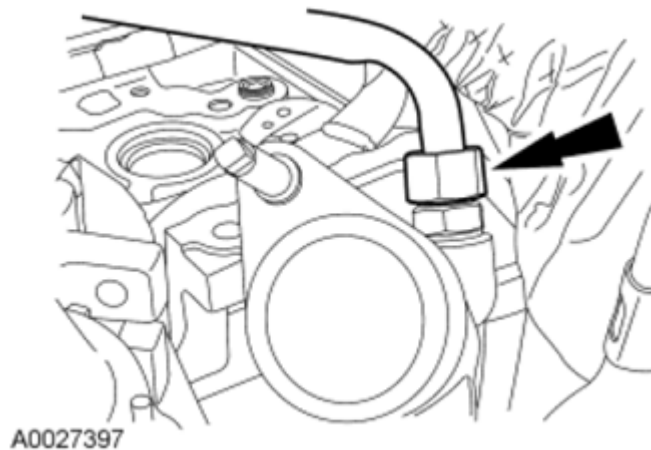


Fig. 427: Locating Exhaust Gas Recirculation Tube
Courtesy of FORD MOTOR CO.

96. Position the fuel charging wiring at 2 locations at the back of the intake manifold.
97. Install the generator and the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

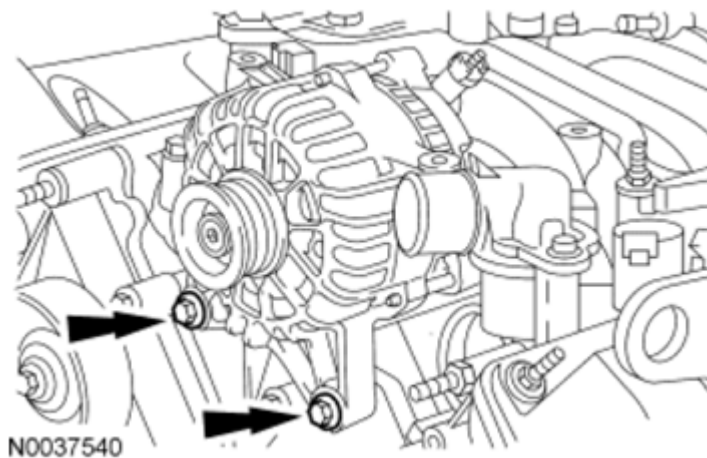


Fig. 428: Locating Generator Mounting Bolts
Courtesy of FORD MOTOR CO.

98. Install the generator mounting bracket and the 4 bolts.
 - Tighten to 10 Nm (89 lb-in).

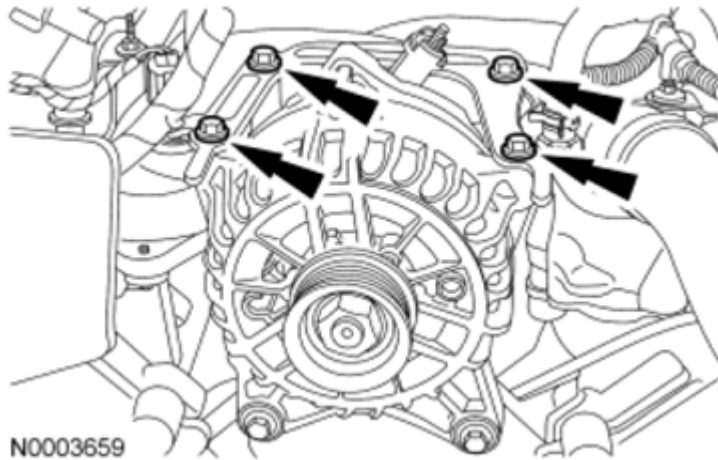


Fig. 429: Locating Generator Mounting Bracket And Mounting Bolts
Courtesy of FORD MOTOR CO.

99. Attach the wire harness retainer and connect the generator electrical connector.

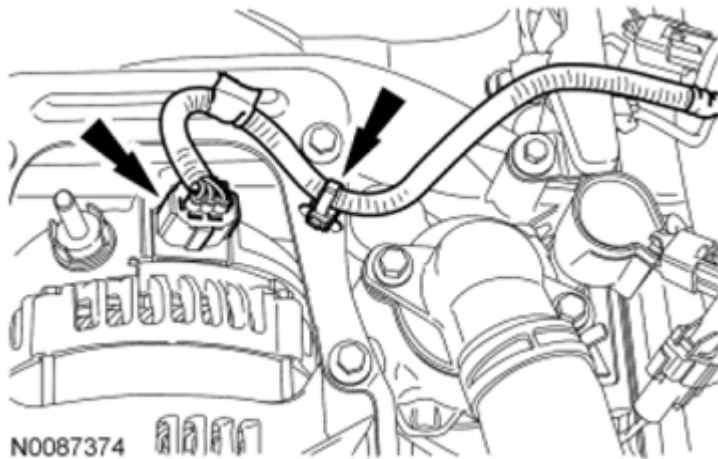


Fig. 430: Locating Generator Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

100. Position the vacuum harness and connect the vacuum hoses for the Evaporative Emission (EVAP) canister purge valve, the main chassis hose and the EGR valve.

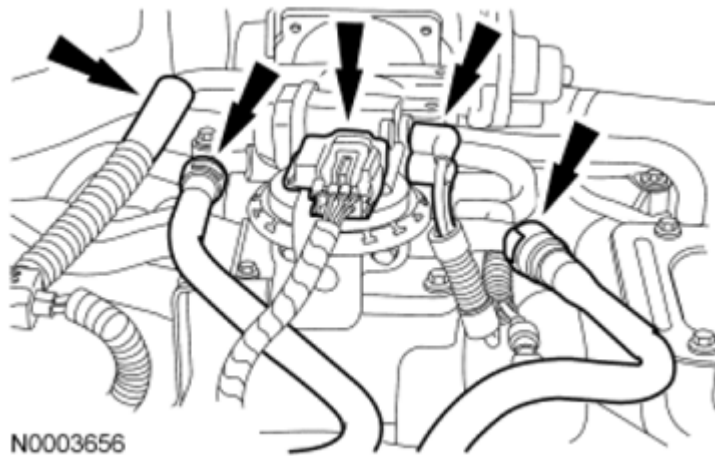


Fig. 431: Locating Electrical Connector And Vacuum Hoses
Courtesy of FORD MOTOR CO.

101. Connect the crankcase ventilation tube.

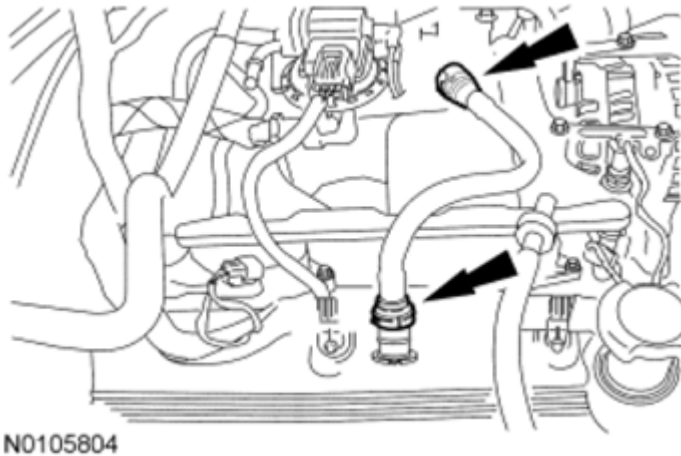


Fig. 432: Locating Crankcase Ventilation Tube
Courtesy of FORD MOTOR CO.

102. Install the intake manifold shield and 2 bolts.
- Tighten to 10 Nm (89 lb-in).

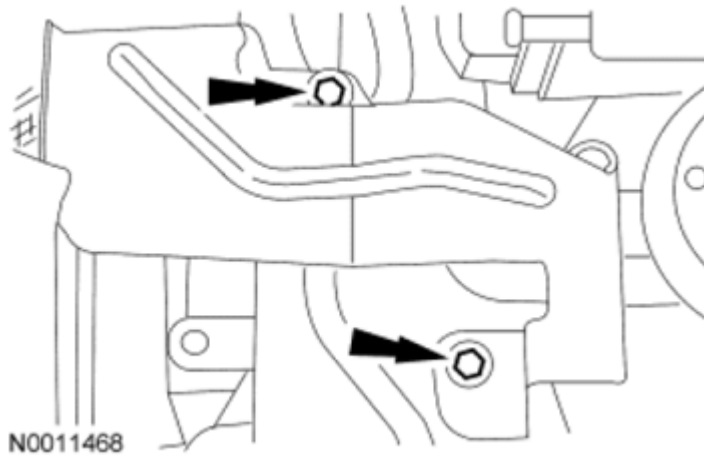


Fig. 433: Locating Intake Manifold Shield Mounting Bolt
Courtesy of FORD MOTOR CO.

103. Connect the 8 fuel injector electrical connectors (4 shown in the illustration).

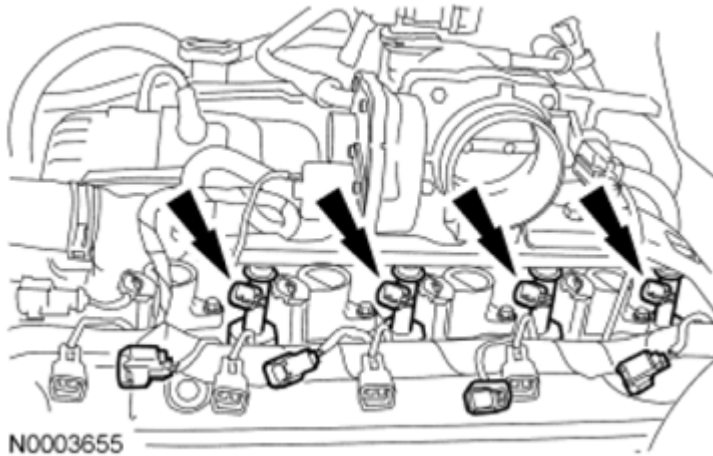


Fig. 434: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

104. Connect the 8 ignition coil electrical connectors (4 shown in the illustration).

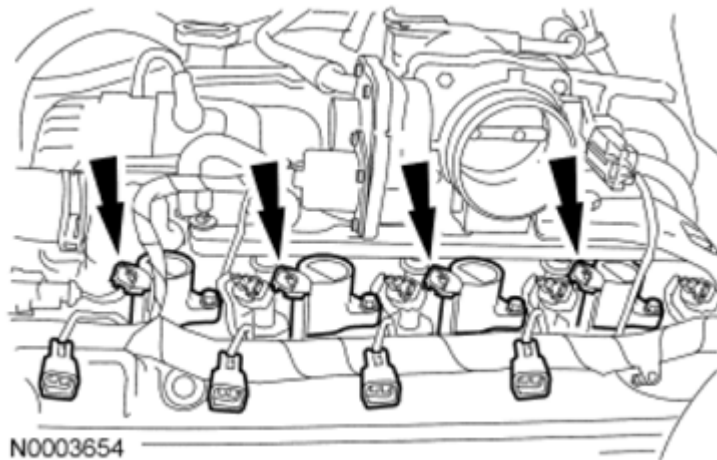


Fig. 435: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

105. Connect the Camshaft Position (CMP) sensor electrical connector.

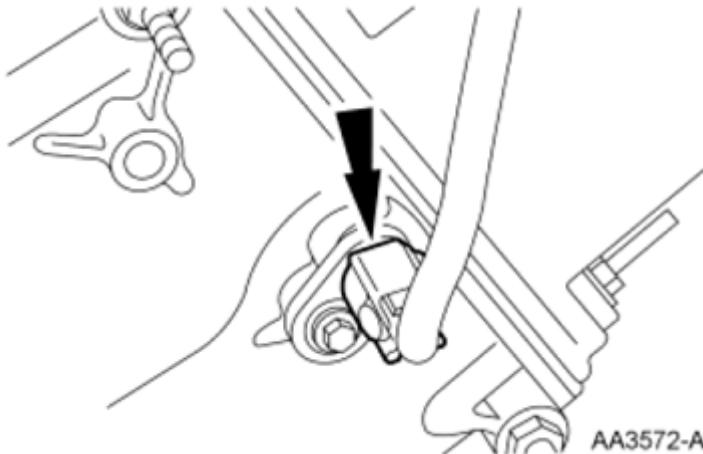


Fig. 436: Locating Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

106. Connect the radio interference capacitor electrical connector.

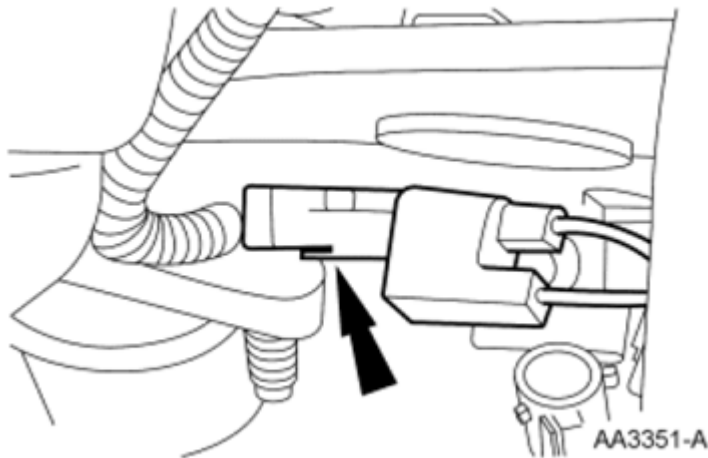


Fig. 437: Locating Radio Interference Capacitor
Courtesy of FORD MOTOR CO.

107. Connect the KS electrical connector and install the harness retainer to the intake manifold.

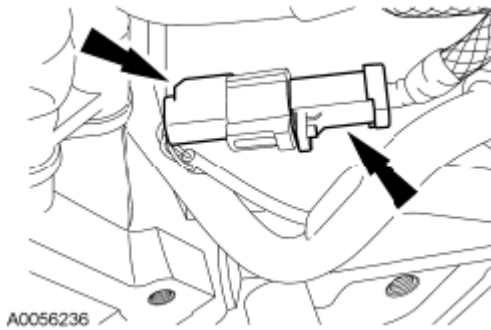


Fig. 438: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

108. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

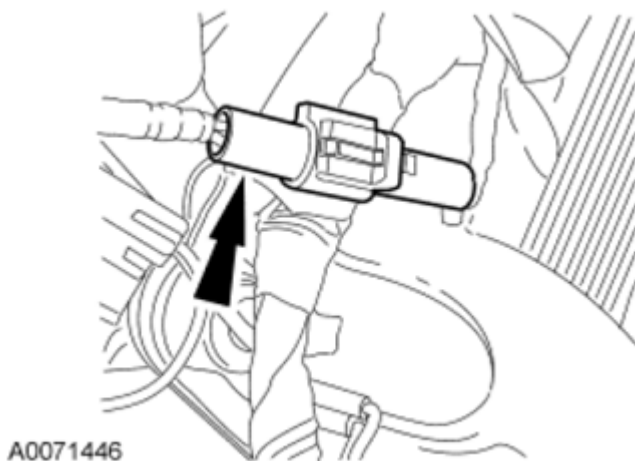


Fig. 439: Locating Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

109. Install the battery cables and the bolt.
110. Install the Engine Lifting Bracket to the RH cylinder head.

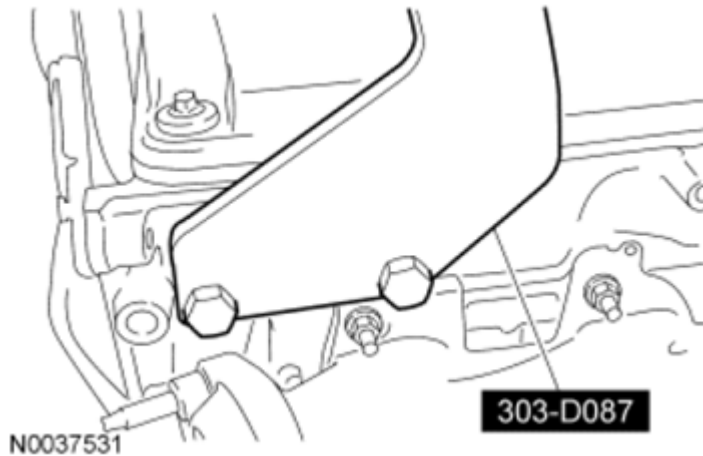


Fig. 440: Installing Engine Lifting Bracket To RH Cylinder Head
Courtesy of FORD MOTOR CO.

111. Install the Engine Lifting Bracket to the LH cylinder head.

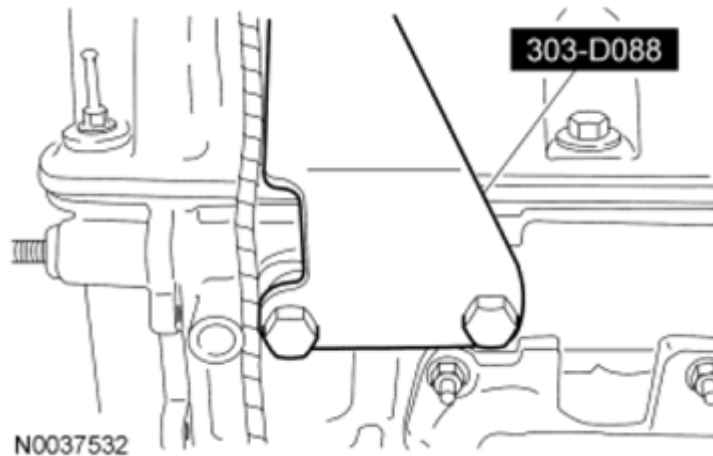


Fig. 441: Installing Engine Lifting Bracket To LH Cylinder Head
Courtesy of FORD MOTOR CO.

112. Using the Engine Lifting Bracket Set, remove the engine from the engine stand.

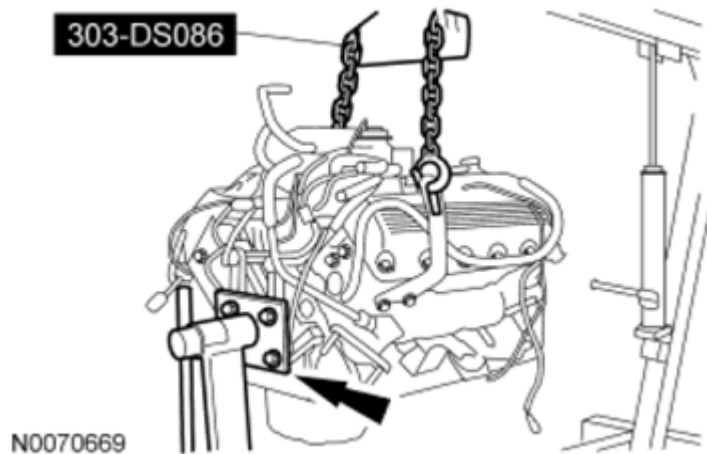


Fig. 442: Identifying Engine Lifting Bracket Set (303-DS086)
Courtesy of FORD MOTOR CO.

NOTE: The rear crankshaft seal retainer plate does not have a sealant groove. Gasket maker must be applied to the rear crankshaft seal retainer mating surface on the engine block.

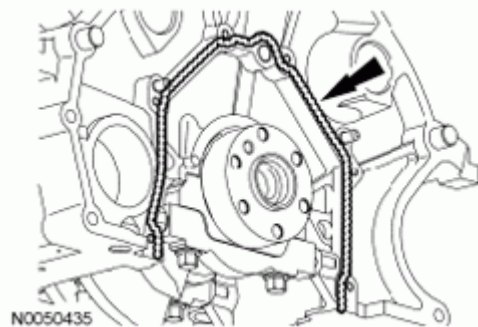


Fig. 443: Identifying Crankshaft Rear Seal Retainer Plate Mating Surface Gasket Maker Applying Area
Courtesy of FORD MOTOR CO.

113. Apply a bead of gasket maker to the crankshaft rear seal retainer plate mating surface on the engine block.
114. Install the crankshaft rear seal retainer plate and loosely install the 6 bolts.

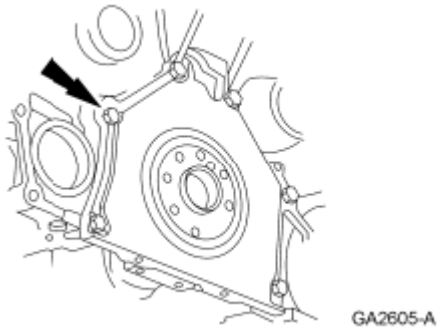


Fig. 444: Locating Crankshaft Rear Seal Retainer Plate And Bolts
Courtesy of FORD MOTOR CO.

115. Tighten the 6 crankshaft rear seal retainer plate bolts in the sequence shown in the illustration.
- Tighten to 10 Nm (89 lb-in).

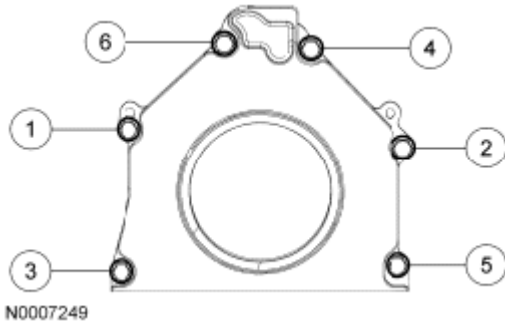


Fig. 445: Identifying Retainer Plate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

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.

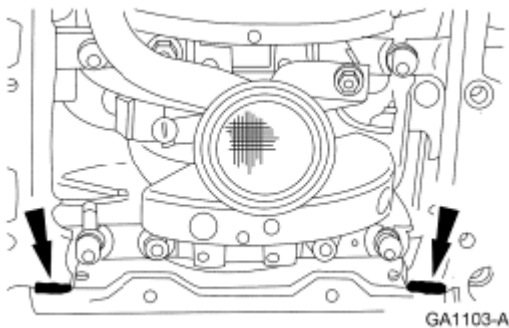


Fig. 446: Locating Crankshaft Rear Seal Retainer Plate-To-Cylinder Block Sealing Surface
Courtesy of FORD MOTOR CO.

116. Apply the sealant at the rear oil seal retainer to cylinder block sealing surface.
117. Apply sealant at the front cover-to-cylinder block sealing surface.

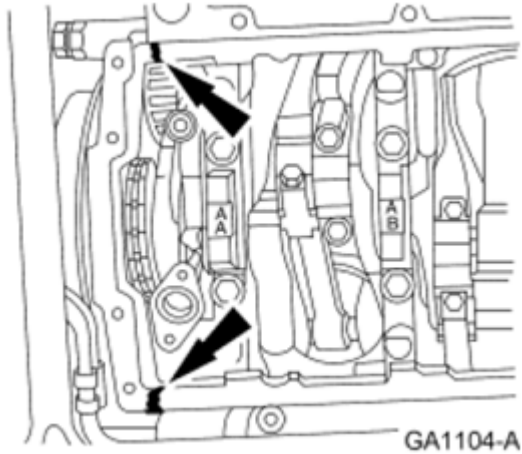


Fig. 447: Locating Area For Applying Sealant At Front Cover-To-Cylinder Block Sealing Surface
Courtesy of FORD MOTOR CO.

118. Position the new oil pan gasket, the oil pan and the loosely install the 16 bolts.

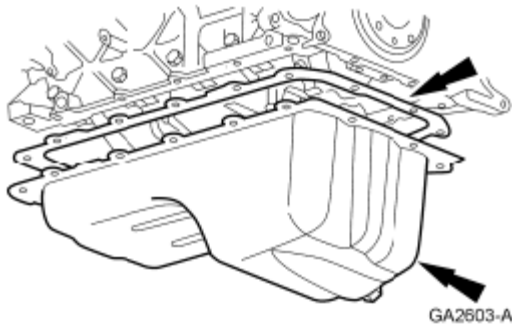


Fig. 448: Locating Oil Pan Gasket And Oil Pan
Courtesy of FORD MOTOR CO.

119. Tighten the 16 bolts in 2 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Rotate an additional 60 degrees.

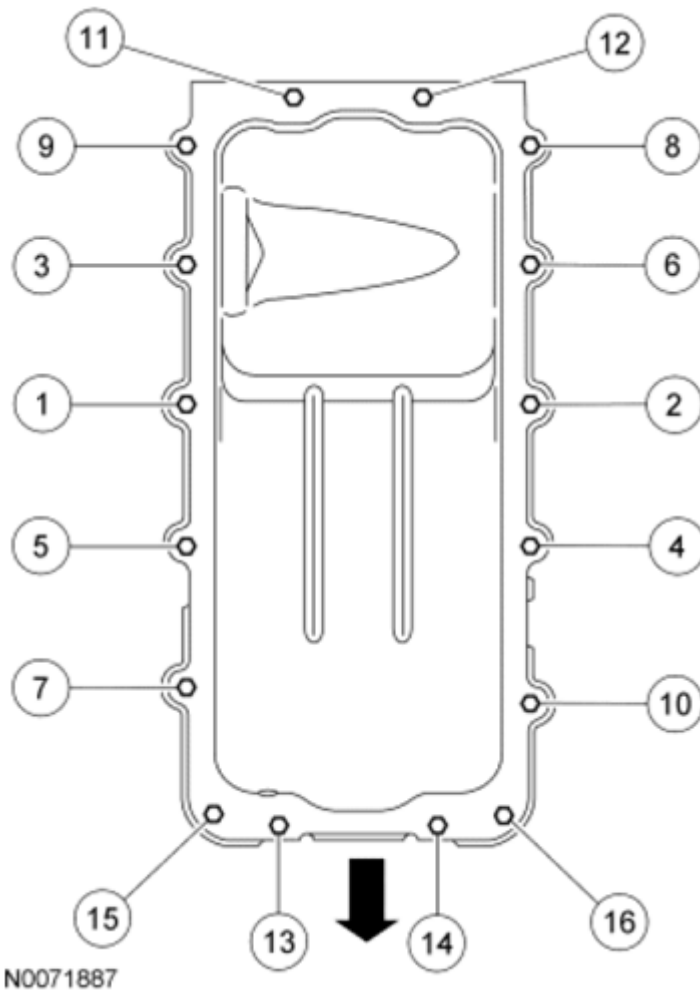


Fig. 449: Identifying Oil Pan Bolts Removal/Installing Sequence
Courtesy of FORD MOTOR CO.

120. Using the Crankshaft Rear Oil Seal Installers, install the crankshaft rear oil seal.

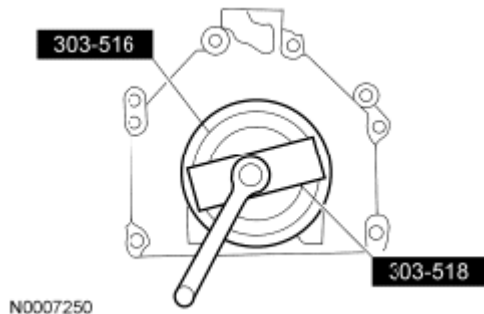


Fig. 450: Installing Crankshaft Rear Oil Seal Using Crankshaft Rear Oil Seal Installer
Courtesy of FORD MOTOR CO.

121. Using the Crankshaft Rear Oil Seal Installer and Crankshaft Rear Oil Slinger Installer, install the

crankshaft oil slinger.

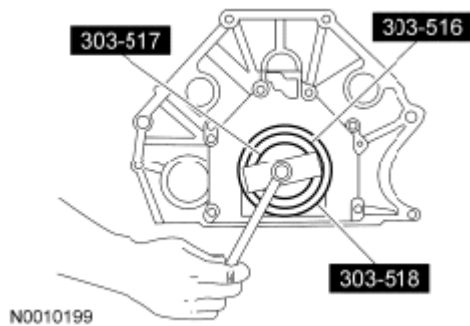


Fig. 451: Installing Crankshaft Rear Oil Slinger Using Crankshaft Rear Seal Installer
Courtesy of FORD MOTOR CO.

122. Install the engine/transmission spacer plate.

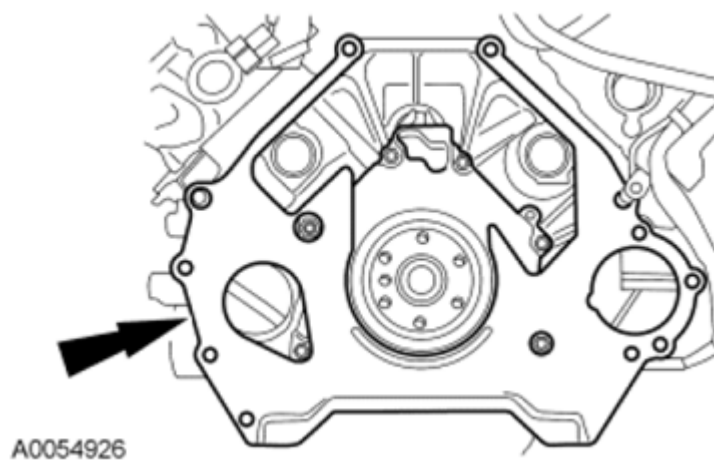
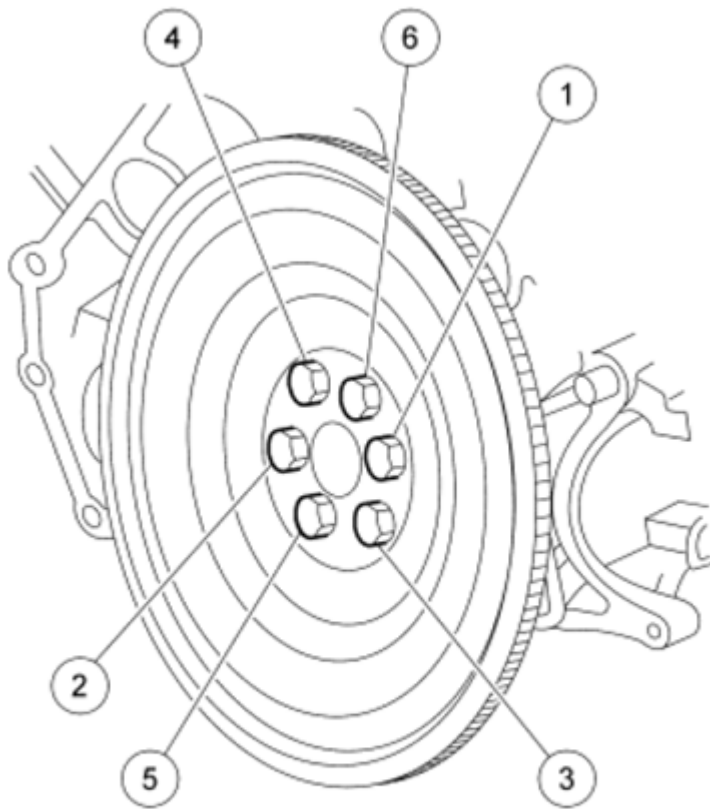


Fig. 452: Locating Engine/Transmission Spacer Plate
Courtesy of FORD MOTOR CO.

123. Position the flexplate and install the 6 bolts in the sequence shown in the illustration.

- Tighten to 80 Nm (59 lb-ft).



N0071888

Fig. 453: Identifying Flexplate Mounting Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

INSTALLATION

CYLINDER HEAD

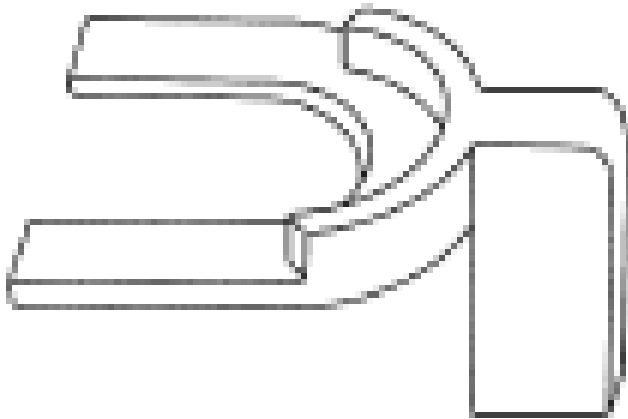
Special Tool(s)

SPECIAL TOOL(S)

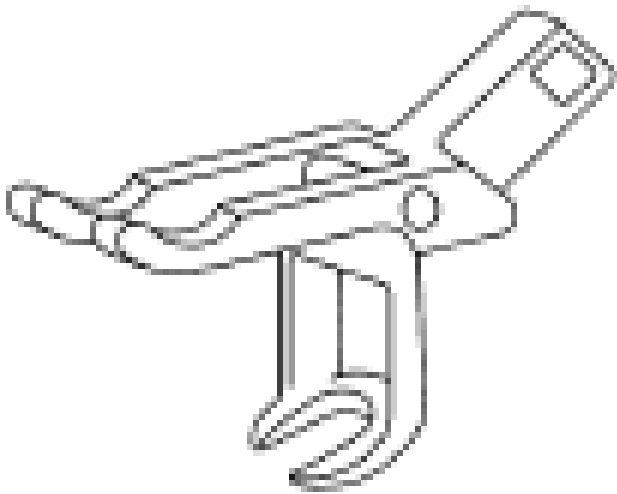
Compressor Spacer, Valve Spring
 303-382 (T91P-6565-AH)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



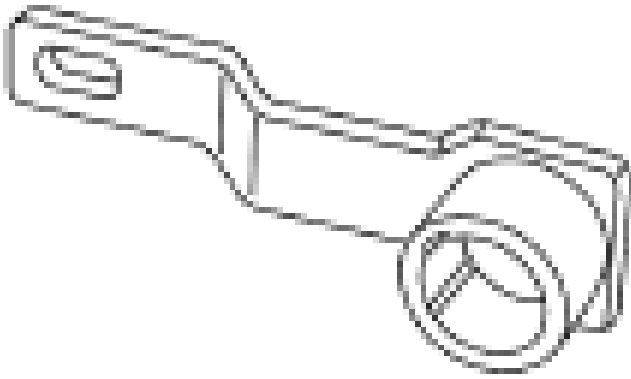
ST1331-A



ST1330-A

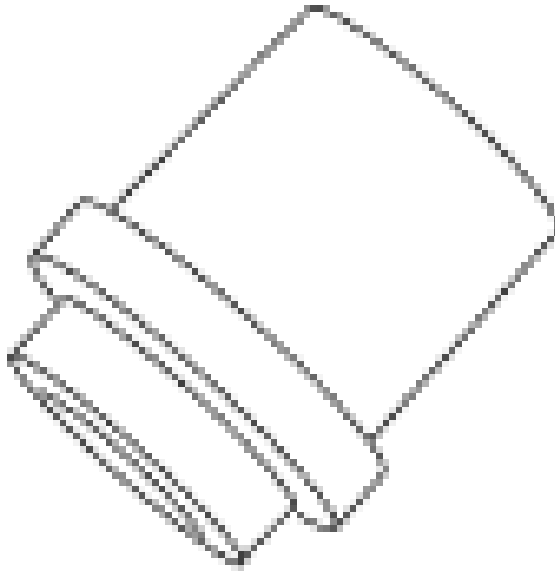
Compressor, Valve Spring
303-567 (T97P-6565-AH)

Holding Tool, Crankshaft
303-448 (T93P-6303-A)



ST1335-A

Installer, Crankshaft Front Oil Seal
303-635

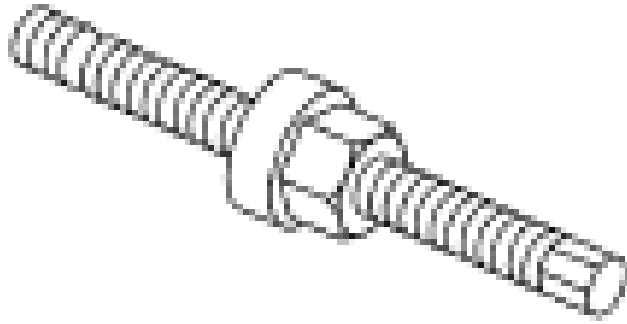


ST2197-A

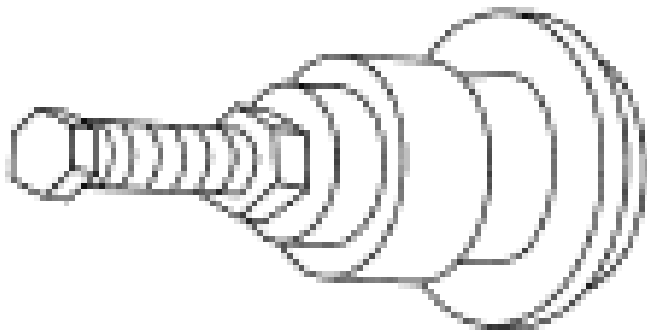
Installer, Crankshaft Vibration Damper
303-102 (T74P-6316-B)

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1287-A



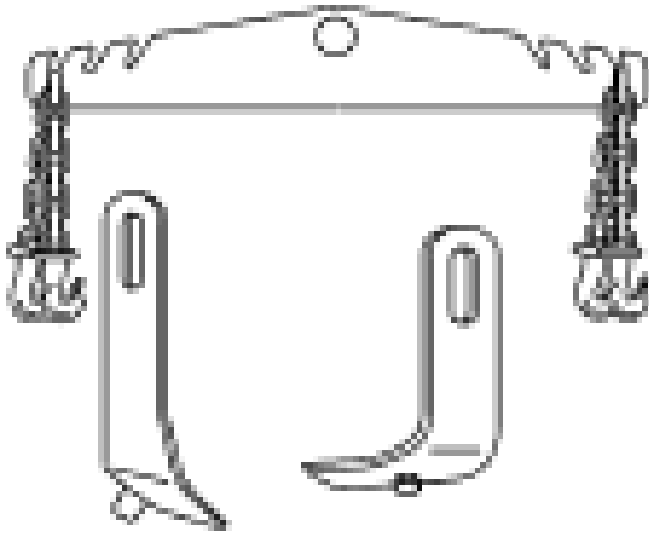
ST1328-A

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

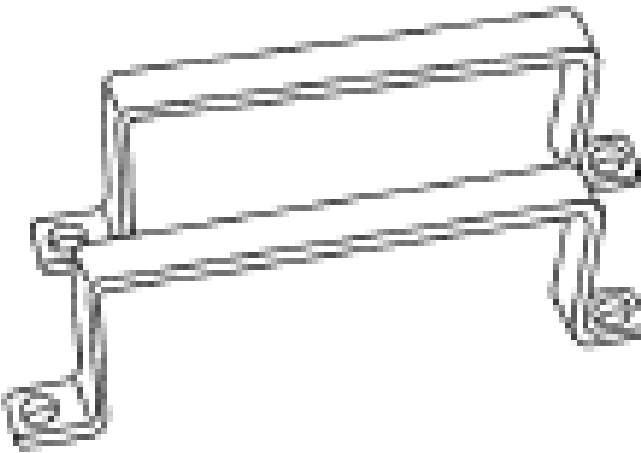
Lifting Bracket Set, Engine
303-DS086 (D93P-6001-A)
Includes Lifting Bracket, Engine
303-D087 and 303-D088 or equivalent

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST2443-A



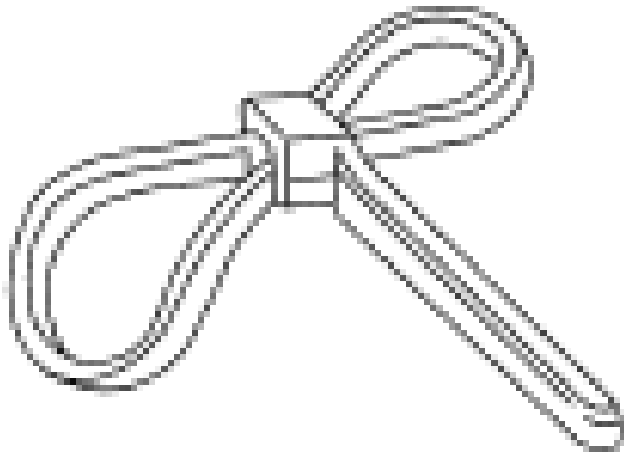
ST1668-A

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

Strap Wrench
303-D055 (D85L-6000-A) or equivalent

2011 Mercury Grand Marquis LS

2011 ENGINE Engine Mechanical - 4.6L (2V) - Crown Victoria & Grand Marquis



ST1438-A

General Equipment

GENERAL EQUIPMENT TABLE

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

Material Specifications

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
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	-

Installation

Both cylinder heads

- NOTE:** The gasket sealing surfaces on the cylinder head and cylinder block must be clean. For additional information, refer to CYLINDER HEAD in the Removal portion of this service information
- NOTE:** The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.
- NOTE:** The new gasket has a film coating which is crucial to the gasket's ability to seal correctly. Do not scratch the gasket.
- NOTE:** RH head gasket shown in the illustration, LH head gasket similar.

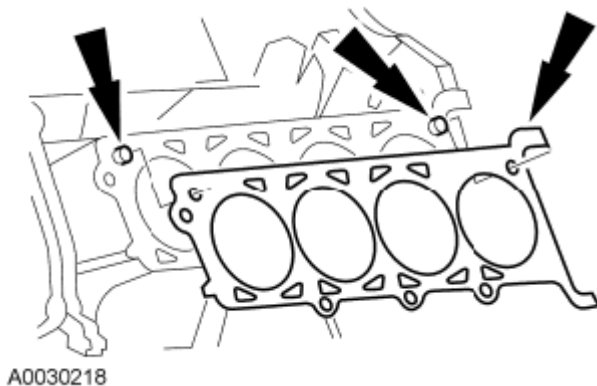


Fig. 454: Locating Head Gasket Dowel Pins
Courtesy of FORD MOTOR CO.

1. Install the new head gasket over the dowel pins.

- NOTE:** Cylinder head machining or milling is not authorized by the Ford Motor Company. Cylinder head flatness must be within 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area.
- NOTE:** The gasket sealing surfaces on the cylinder head and cylinder block must be clean. For additional information, refer to CYLINDER HEAD in the Removal portion of this service information.
- NOTE:** The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.
- NOTE:** Do not allow the dowels to scratch the sealing surface of the cylinder head during cylinder head installation.
- NOTE:** RH cylinder head shown in the illustration, LH cylinder head similar.

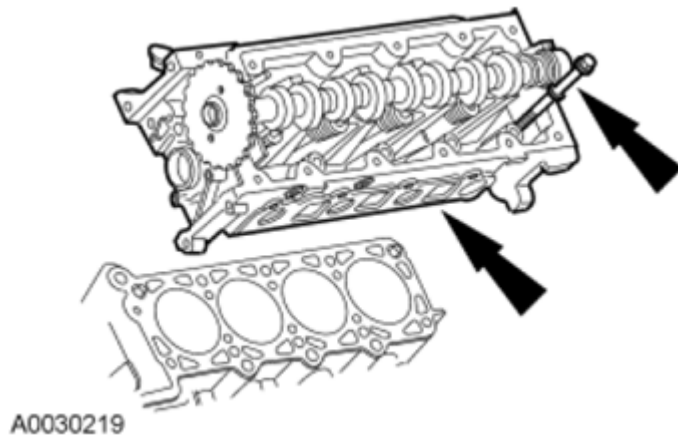


Fig. 455: Locating Cylinder Head Dowels
Courtesy of FORD MOTOR CO.

2. Install the cylinder head on the dowels and the head gasket. Loosely install new bolts.
3. Tighten the cylinder head bolts in 6 stages, in the sequence shown in the illustration.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).
 - Stage 3: Loosen a minimum of one full turn (360 degrees).
 - Stage 4: Tighten to 40 Nm (30 lb-ft).
 - Stage 5: Tighten an additional 90 degrees (one-fourth turn).
 - Stage 6: Tighten an additional 90 degrees (one-fourth turn).

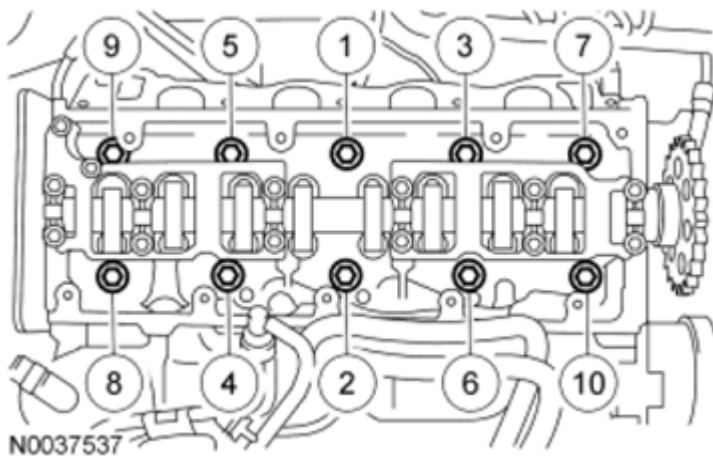


Fig. 456: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Remove the Cylinder Head Remover/Installer from both ends of the cylinder head.

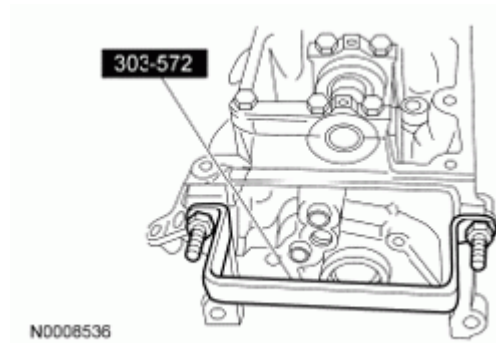


Fig. 457: Installing Cylinder Head Remover/Installer On Both Ends Of Cylinder Head
Courtesy of FORD MOTOR CO.

LH cylinder head

NOTE: Lubricate the O-ring seal with clean engine oil.

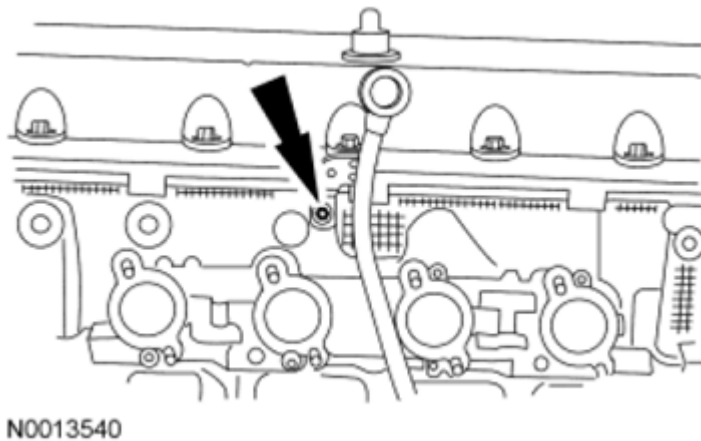


Fig. 458: Locating Oil Level Indicator Tube And Mounting Bolt
Courtesy of FORD MOTOR CO.

5. Install a new O-ring seal on the oil level indicator tube and install the oil level indicator tube and bolt.
 - Tighten to 10 Nm (89 lb-in).
6. Install the 8 new LH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
7. Install a new LH exhaust manifold gasket the LH exhaust manifold and 8 new nuts.
 - Tighten to 20 Nm (177 lb-in) in the sequence shown in the illustration.

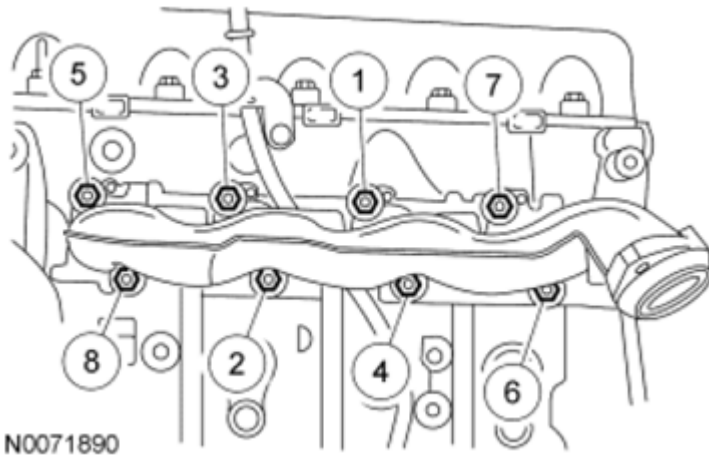


Fig. 459: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

RH cylinder head

8. Install the 8 new RH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
9. Install a new RH exhaust manifold gasket the RH exhaust manifold and 8 new nuts.
 - Tighten to 20 Nm (177 lb-in) in the sequence shown in the illustration.

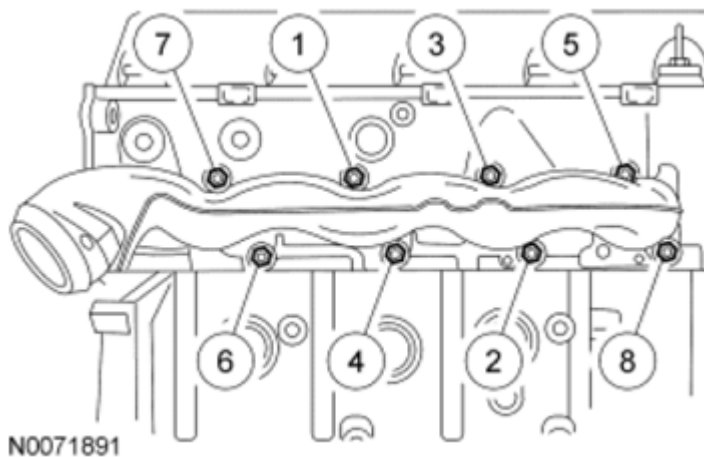


Fig. 460: Identifying Exhaust Manifold Gasket And Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

Engines with ratcheting timing chain tensioners

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

NOTE: Do not compress the ratchet assembly. This will damage the ratchet

assembly.

NOTE: LH shown in the illustration, RH similar.

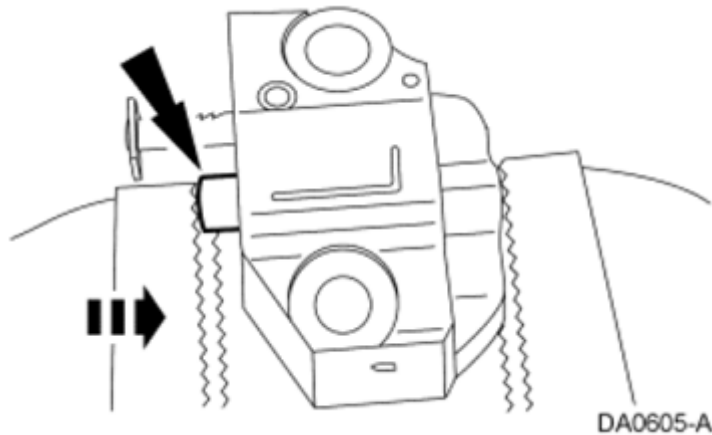


Fig. 461: Compressing Each Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

10. Compress each tensioner plunger, using an edge of a vise.
11. Using a small screwdriver or pick, push back and hold the ratchet mechanism.

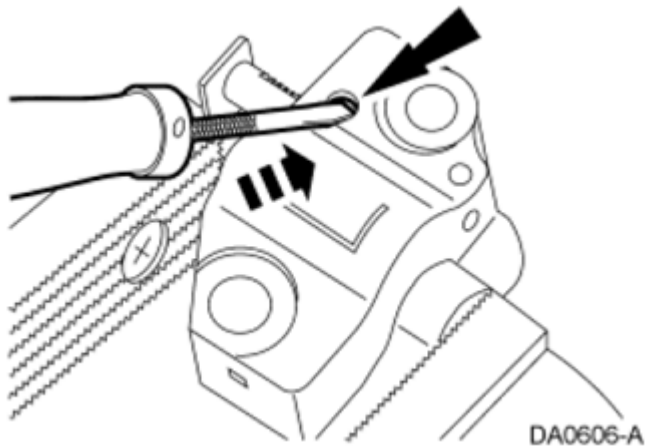


Fig. 462: Holding Ratchet Mechanism
Courtesy of FORD MOTOR CO.

12. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.

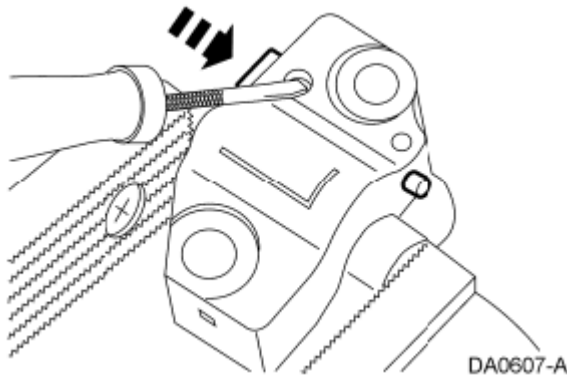
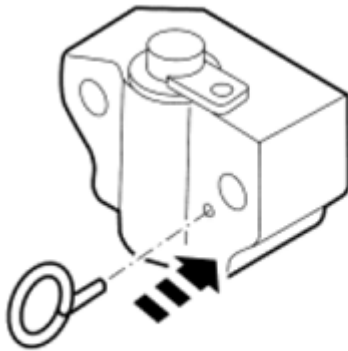


Fig. 463: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

13. Install a paper clip into the hole of each tensioner housing to hold the ratchet assembly and plunger in during installation.
 - Remove the tensioner from the vise.



A26917-A

Fig. 464: Installing Paper Clip Into Hole Of Tensioner Housing
Courtesy of FORD MOTOR CO.

Engines with non-ratcheting timing chain tensioners

NOTE: If one or both 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 or engine damage may occur.

14. Inspect the RH and LH timing chain tensioners.
 - Install new tensioners as necessary.

NOTE: Timing chain procedures must be followed exactly or damage to valves

and pistons will result.

NOTE: LH shown in the illustration, RH similar.

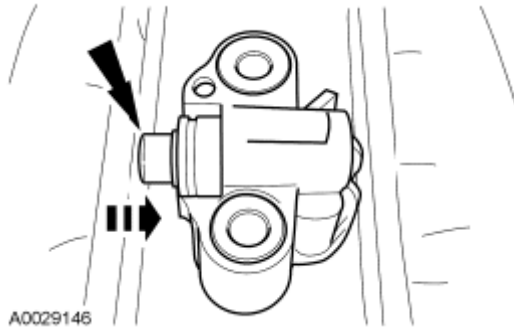


Fig. 465: Compressing Tensioner Plunger Using Vise
Courtesy of FORD MOTOR CO.

15. Compress each tensioner plunger, using an edge of a vise.
16. Install a Hydraulic Chain Tensioner Retaining Clip on the tensioner to hold the plunger in during installation.

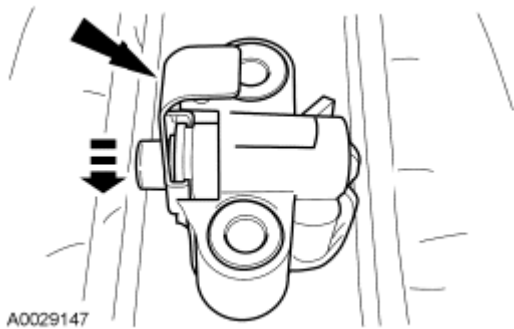


Fig. 466: Installing Hydraulic Chain Tensioner Retaining Clip On Tensioner
Courtesy of FORD MOTOR CO.

Both cylinder heads

17. If the colored links are not visible, mark one link on one end and one link on the other end, and use as timing marks.

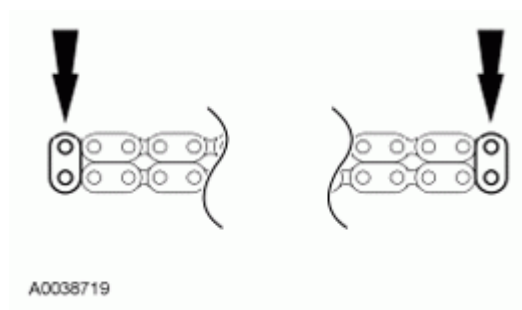


Fig. 467: Locating Timing Chain Colored Links
Courtesy of FORD MOTOR CO.

18. Using the Crankshaft Holding Tool, position the crankshaft.
 - Remove the Crankshaft Holding Tool after crankshaft positioning.

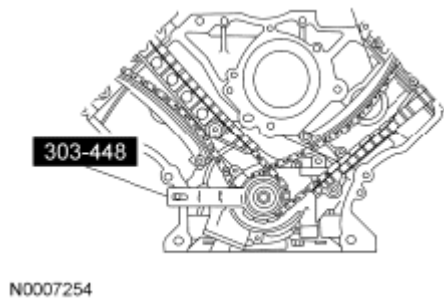


Fig. 468: Positioning Crankshaft Using Crankshaft Holding Tool
Courtesy of FORD MOTOR CO.

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

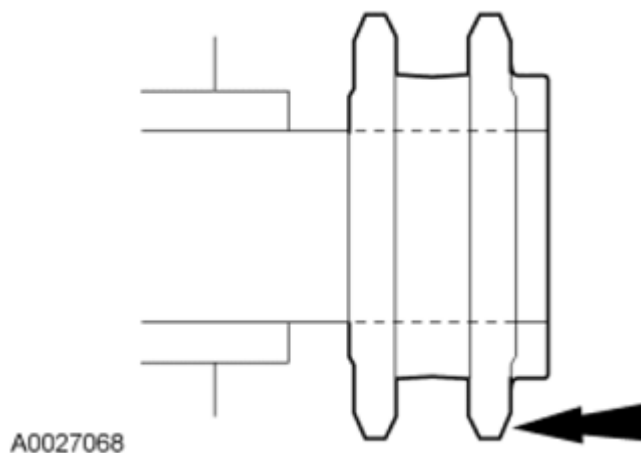


Fig. 469: Locating Crankshaft Sprocket Flange
Courtesy of FORD MOTOR CO.

20. Install the timing chain guides.
 1. Position the LH timing chain guide.

2. Install and tighten the LH bolts to 10 Nm (89 lb-in).
3. Position the RH timing chain guide.
4. Install and tighten the RH bolts to 10 Nm (89 lb-in).

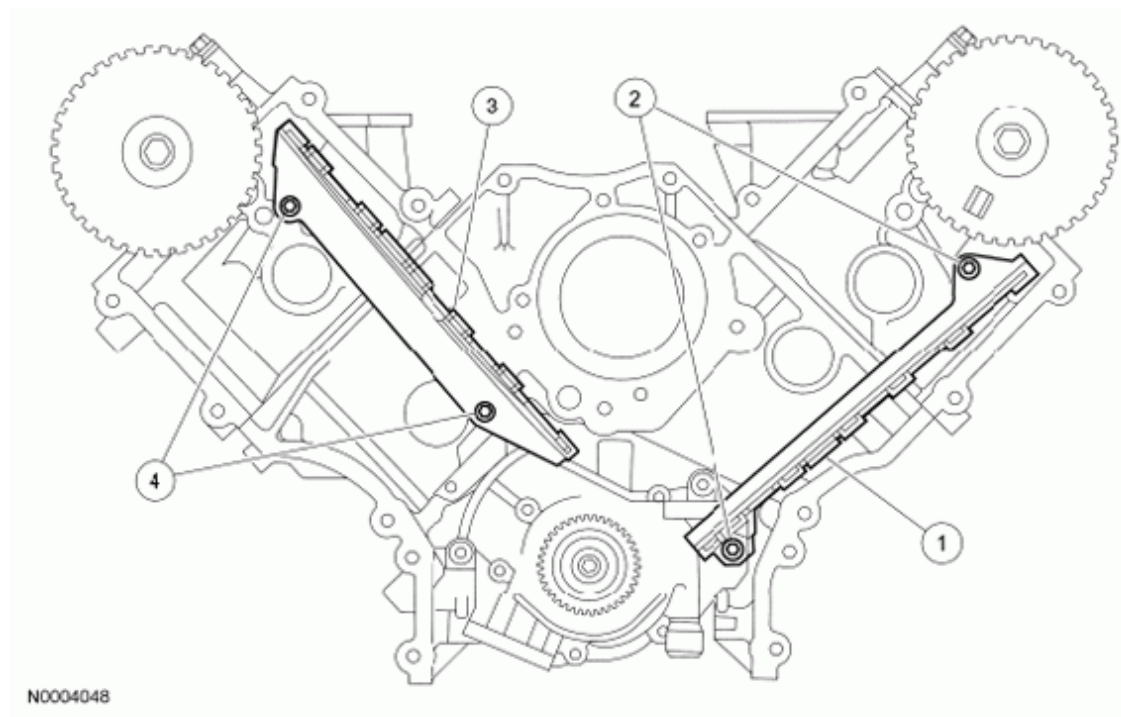


Fig. 470: Identifying Timing Chain Guides And Bolt
Courtesy of FORD MOTOR CO.

21. Rotate the RH camshaft sprocket until the timing mark is approximately at the 11 o'clock position. Rotate the LH camshaft sprocket until the timing mark is approximately at the 1 o'clock position.

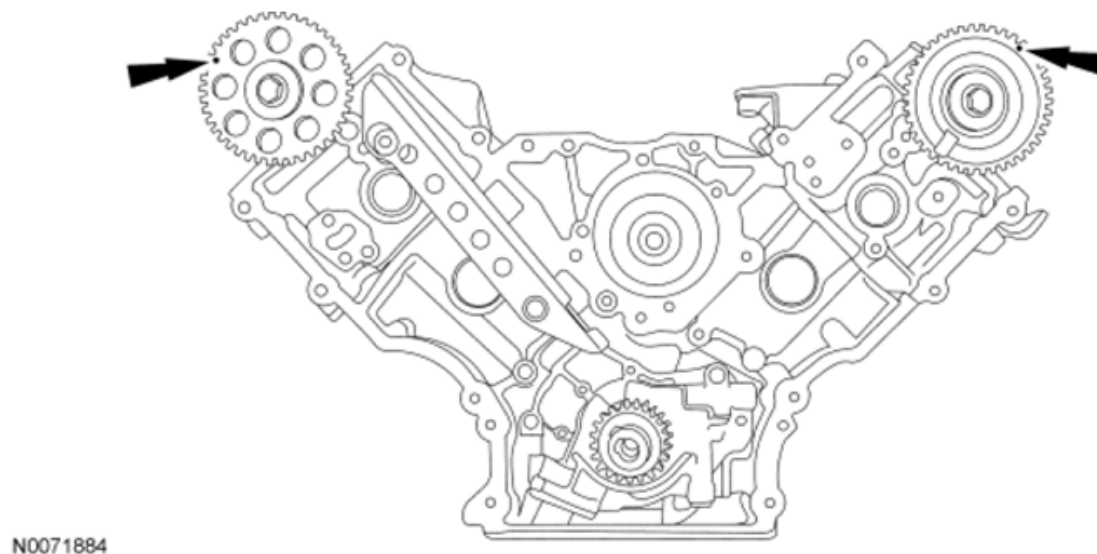


Fig. 471: Locating Camshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

22. Position the LH (inner) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.

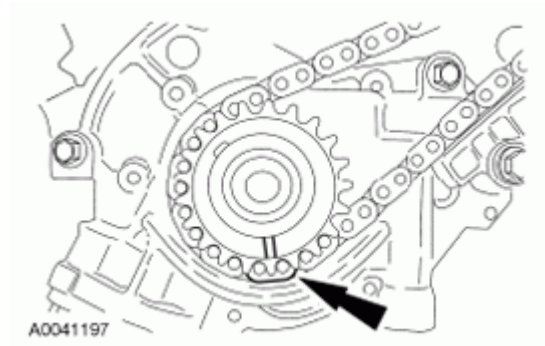


Fig. 472: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

23. Install the LH timing chain on the camshaft sprocket, aligning the colored (marked) link with the timing marks on the sprocket.

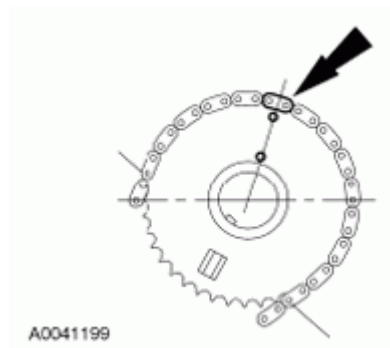


Fig. 473: Locating Colored (Marked) Link With Timing Marks On Sprocket
Courtesy of FORD MOTOR CO.

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

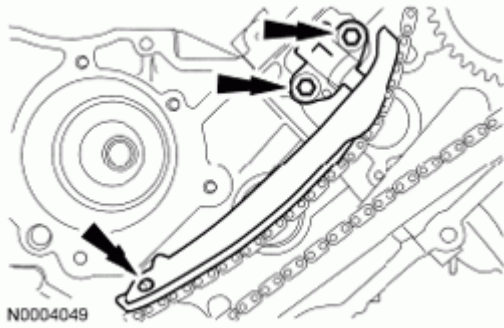


Fig. 474: Locating Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

24. Position the LH timing chain tensioner on the dowel pin and install the LH timing chain tensioner.
 - Tighten to 25 Nm (18 lb-ft).
25. Remove the Hydraulic Chain Tensioner Retaining Clip from the LH timing chain tensioner.

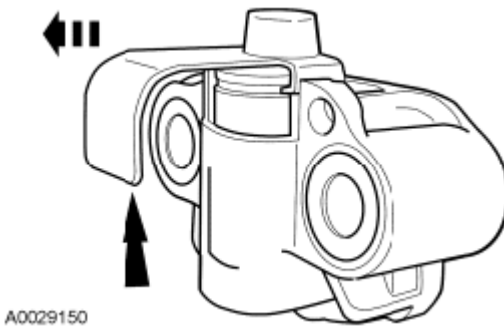


Fig. 475: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

26. Position the RH (outer) timing chain on the crankshaft sprocket, aligning the colored (marked) link with the timing mark on the sprocket.

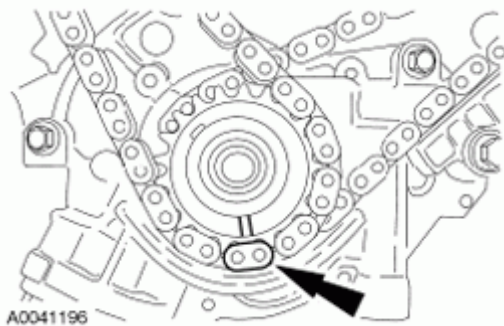


Fig. 476: Locating Colored Link With Timing Mark On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

27. Install the RH timing chain on the camshaft sprocket, aligning the colored (marked) link with the timing

marks on the sprocket.

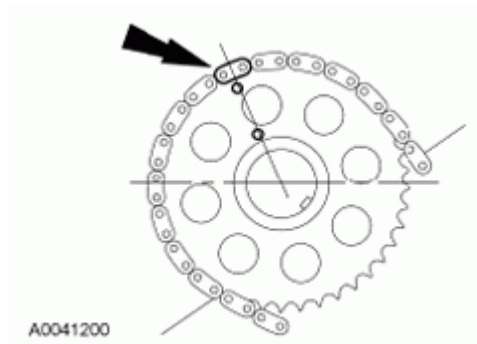


Fig. 477: Locating Camshaft Sprocket Timing Chain
Courtesy of FORD MOTOR CO.

28. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner.
 - Tighten to 25 Nm (18 lb-ft).

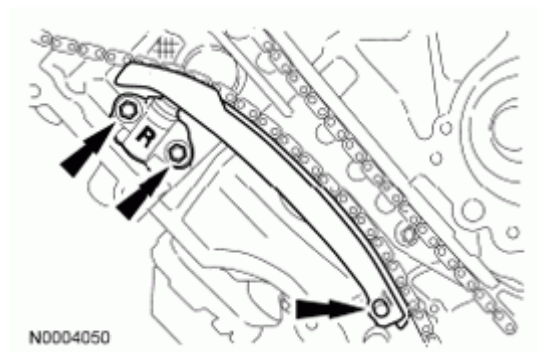


Fig. 478: Locating Timing Chain Tensioner And Mounting Bolts
Courtesy of FORD MOTOR CO.

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

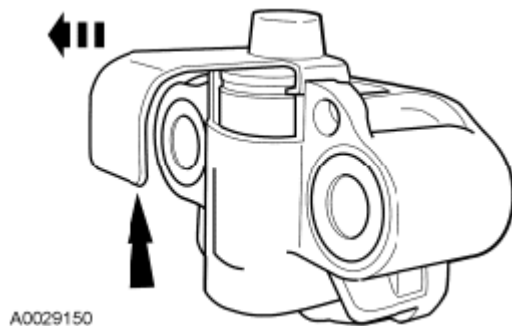


Fig. 479: Removing Retaining Clip From LH Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

30. Make sure that the colored (marked) chain links are lined up with the dots on the crankshaft sprockets and

the camshaft sprocket.

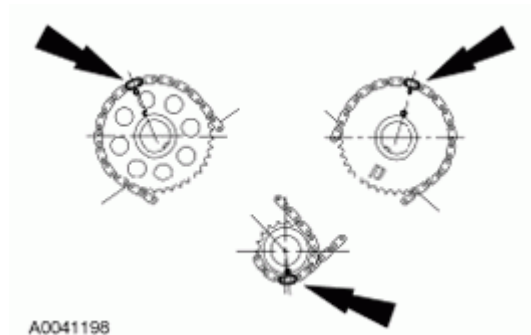


Fig. 480: Identifying Colored (Marked) Chain Links Are Lined Up With The Dots On Crankshaft Sprocket And Camshaft Sprockets
 Courtesy of FORD MOTOR CO.

31. Rotate the camshaft until the lobe is in the upward position.

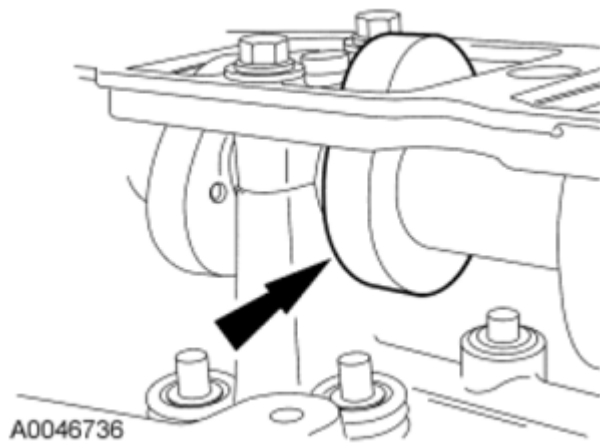


Fig. 481: Locating Camshaft Lobe In Up Position
 Courtesy of FORD MOTOR CO.

32. Install the Valve Spring Compressor Spacer between the valve spring coils to prevent valve stem seal damage.

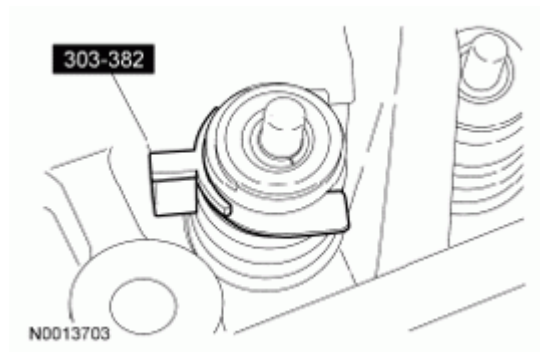


Fig. 482: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the hydraulic lash adjusters with clean engine oil.

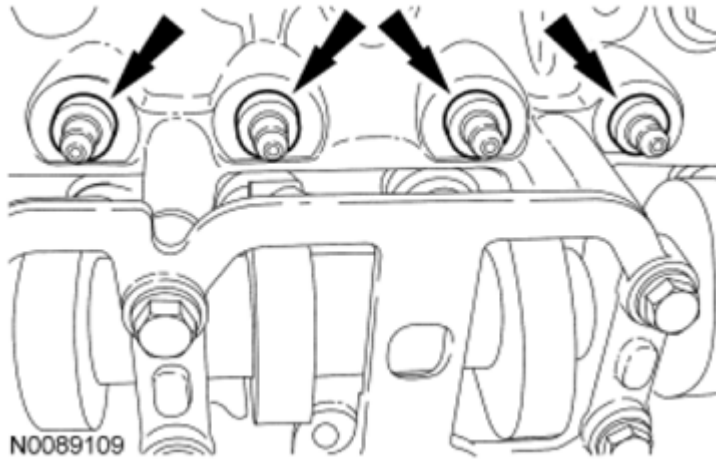


Fig. 483: Locating Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

33. Install the 16 hydraulic lash adjusters in their original locations (4 shown in the illustration).

NOTE: Lubricate the camshaft roller followers using clean engine oil.

NOTE: Position the cam lobe away from the camshaft roller follower location prior to installing each camshaft roller follower.

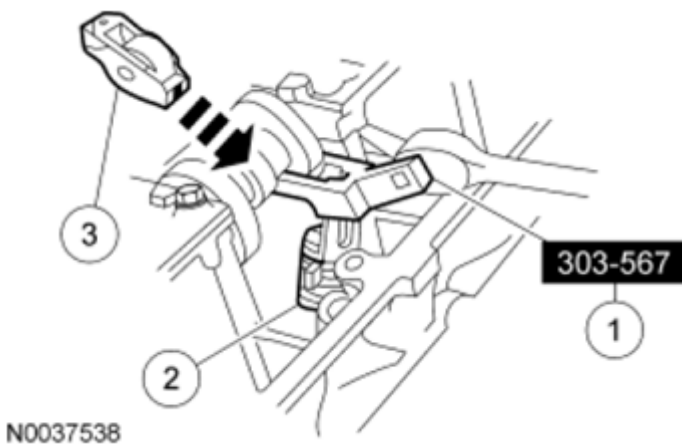


Fig. 484: Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

34. Install the camshaft roller follower.

1. Install the Valve Spring Compressor.
2. Compress the valve spring.
3. Install the camshaft roller followers in their original locations.
35. Remove the Valve Spring Compressor Spacer.

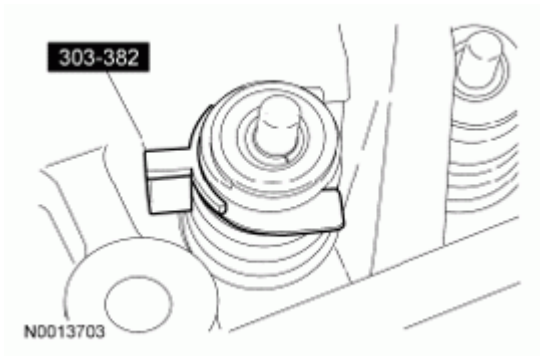


Fig. 485: Remove/Install Valve Spring Compressor Spacer Between Valve Spring Coils
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools when removing or installing the spark plugs, damage may occur to the cylinder head or spark plug.

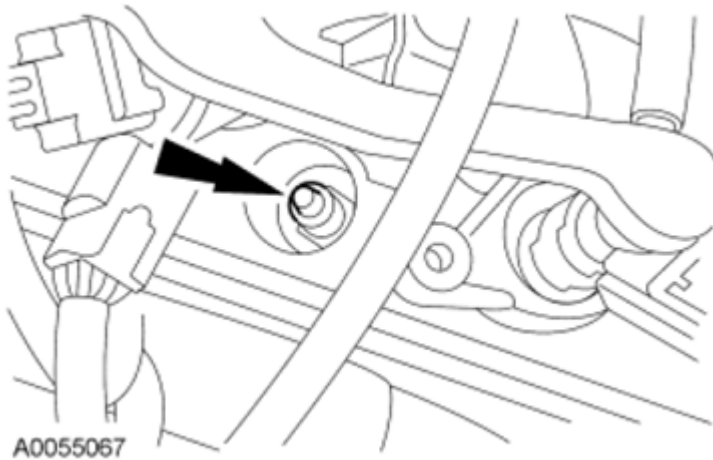


Fig. 486: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

36. Install all 8 spark plugs.
 - Tighten to 18 Nm (159 lb-in).
37. Install the crankshaft sensor ring.

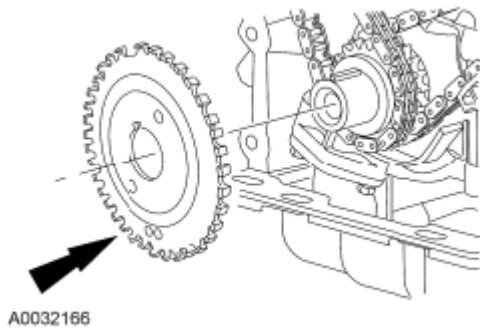


Fig. 487: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

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.

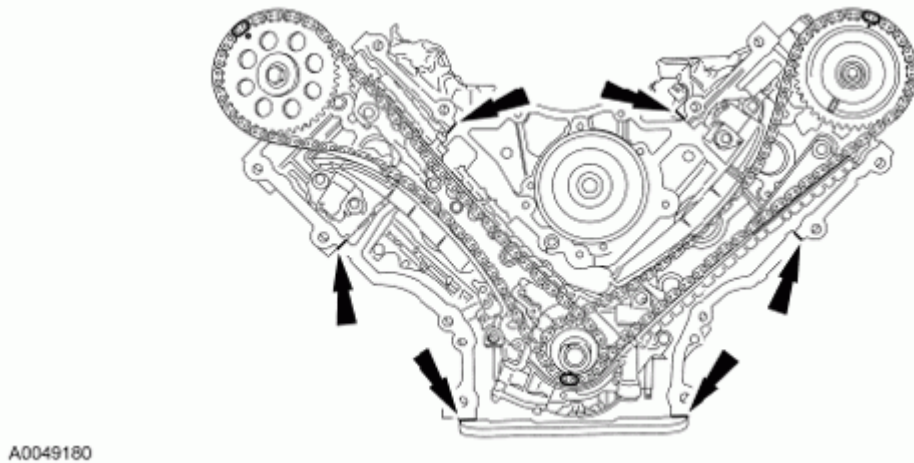


Fig. 488: Locating Head-To-Block Surface And Oil Pan-To-Block Surface Sealant Applying Area
Courtesy of FORD MOTOR CO.

38. Apply a bead of sealant along the head-to-block surface and the oil pan-to-block surface as specified.
39. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger-tight.

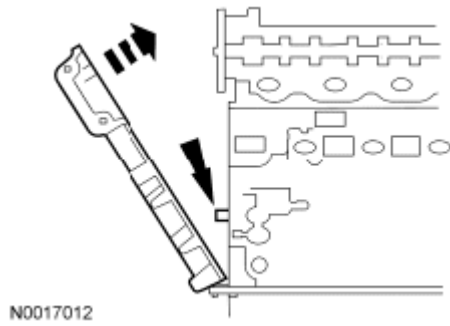
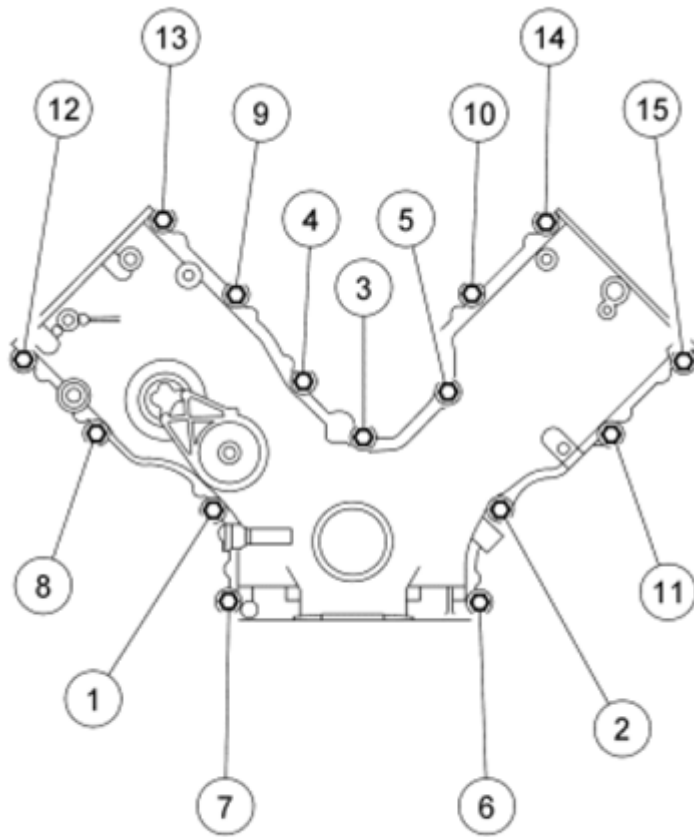


Fig. 489: Installing Engine Front Cover Gasket On Engine Front Cover
Courtesy of FORD MOTOR CO.

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

ITEM DESCRIPTION

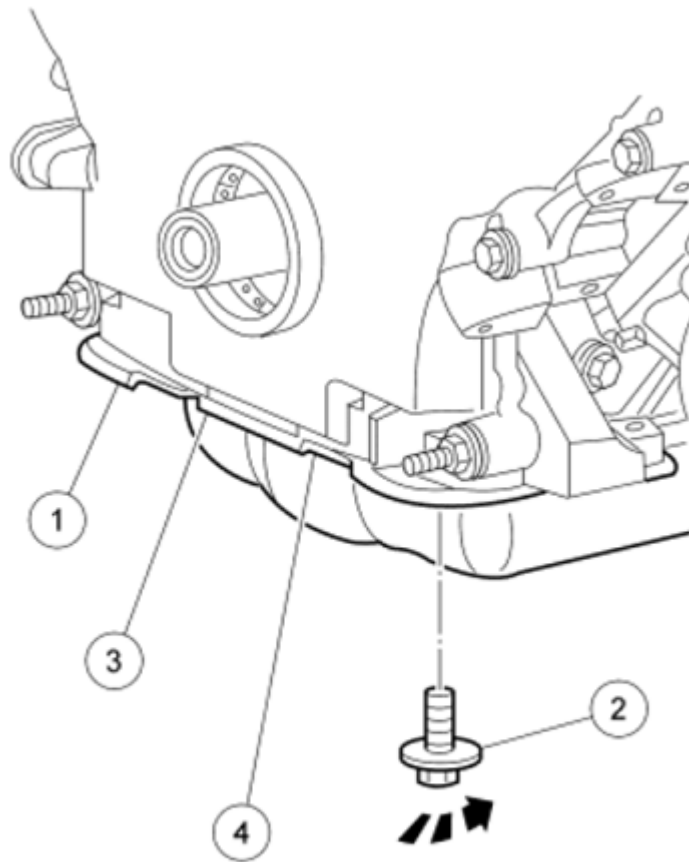
Item	Part Number	Description
1	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53
2	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53
3	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53
4	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53
5	N806177	Bolt, hex flange head pilot, M8 x 1.25 x 53
6	W706508	Stud, hex-head pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N808586	Stud, washer hex-head pilot, M8 x 1.25 - M6 x 1.0 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	N806300	Stud, hex-shoulder pilot, M8 x 1.25 x 1.25 x 91.1
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



N0037514

Fig. 490: Identifying Stud Bolts Removal Sequence
 Courtesy of FORD MOTOR CO.

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



N0037542

Fig. 491: Identifying Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: RH shown in the illustration, LH similar.

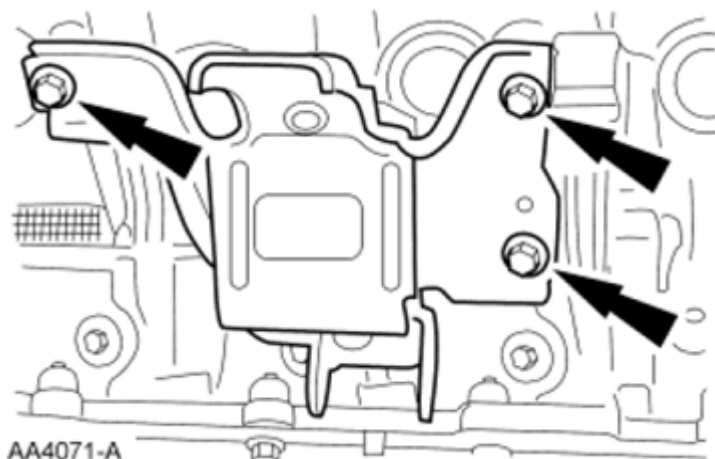


Fig. 492: Locating RH Engine Mount And Bolts
Courtesy of FORD MOTOR CO.

42. Install the RH and LH engine mounts and the bolts.
 - Tighten to 70 Nm (52 lb-ft).
43. Lubricate the engine front cover and the front oil seal inner lip with clean engine oil.

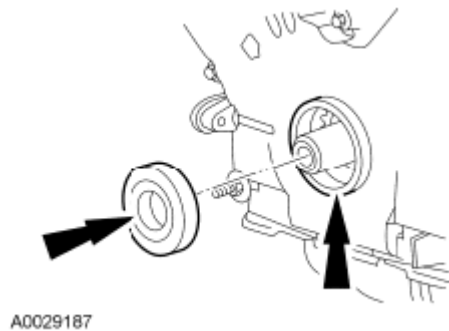


Fig. 493: Locating Crankshaft Seal And Crankshaft Seal Inner Lip
Courtesy of FORD MOTOR CO.

44. Using the Crankshaft Front Oil Seal Installer, Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the front oil seal.

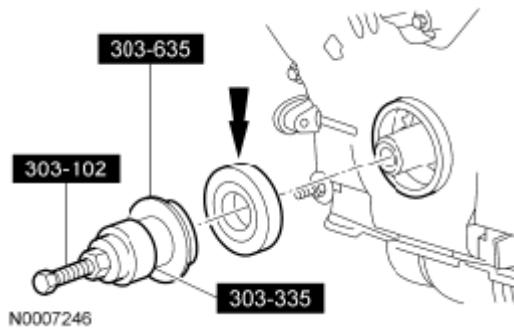


Fig. 494: Installing Crankshaft Front Seal Into Engine Front Cover Using Special Tools
Courtesy of FORD MOTOR CO.

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.

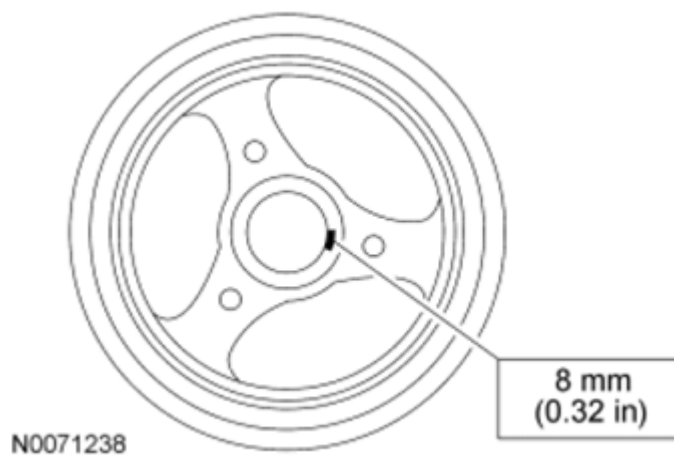


Fig. 495: Identifying Sealant Applying Area Of Woodruff Key Slot On Crankshaft Pulley With Specifications
Courtesy of FORD MOTOR CO.

45. Apply sealant to the Woodruff key slot on the crankshaft pulley.
46. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

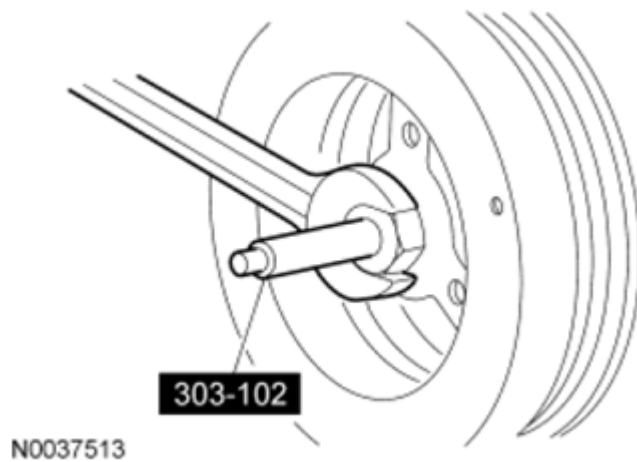


Fig. 496: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

NOTE: Use a Strap Wrench to hold the pulley.

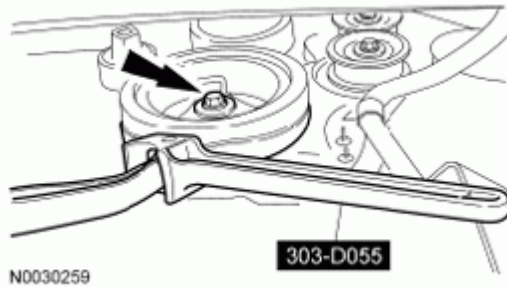


Fig. 497: Holding Crankshaft Pulley Using Strap Wrench
Courtesy of FORD MOTOR CO.

47. Tighten the crankshaft pulley 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: Rotate an additional 90 degrees (one-fourth turn).
48. Position the coolant pump pulley on the coolant pump and install the bolts.
 - Tighten to 25 Nm (18 lb-ft).

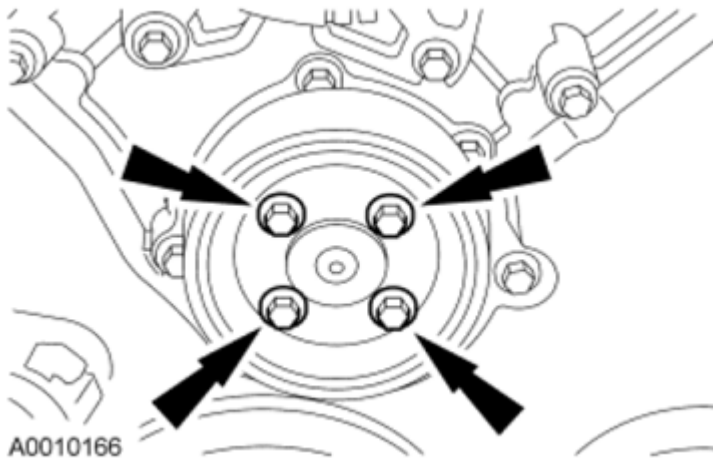


Fig. 498: Locating Coolant Pump Pulley Mounting Bolts
Courtesy of FORD MOTOR CO.

49. Install the accessory drive belt idler pulley and bolt.
 - Tighten to 25 Nm (18 lb-ft).

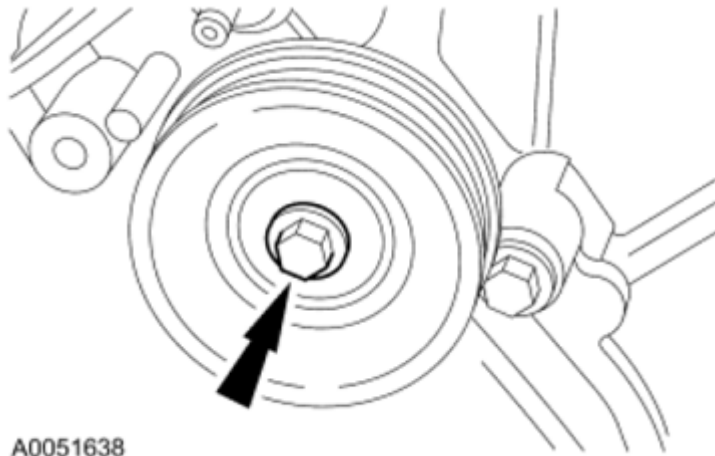


Fig. 499: Locating Drive Belt Idler Pulley Mounting Bolt
Courtesy of FORD MOTOR CO.

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.

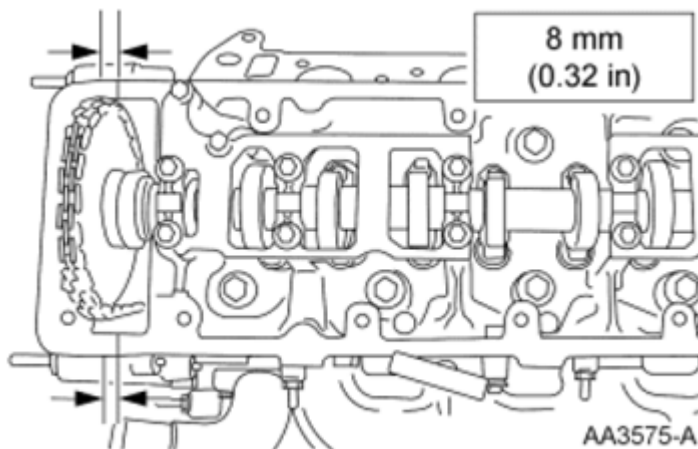


Fig. 500: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications
Courtesy of FORD MOTOR CO.

50. Apply sealant in 2 places where the engine front cover meets the cylinder head.
51. Install the new valve cover gasket into the valve cover and position on the cylinder head. Tighten the bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).

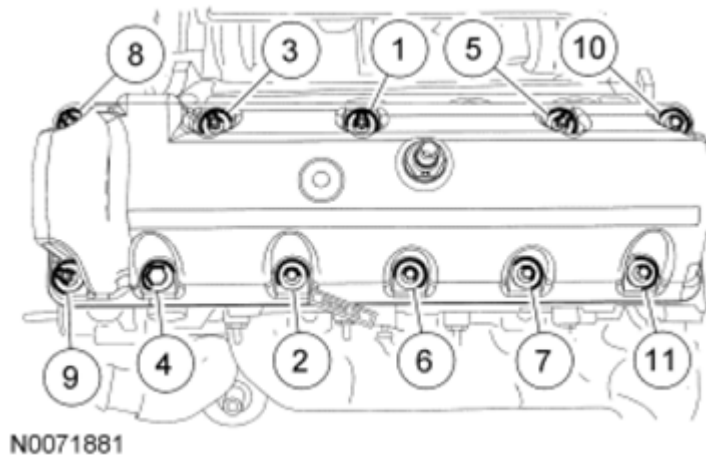


Fig. 501: Identifying Valve Cover Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

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.

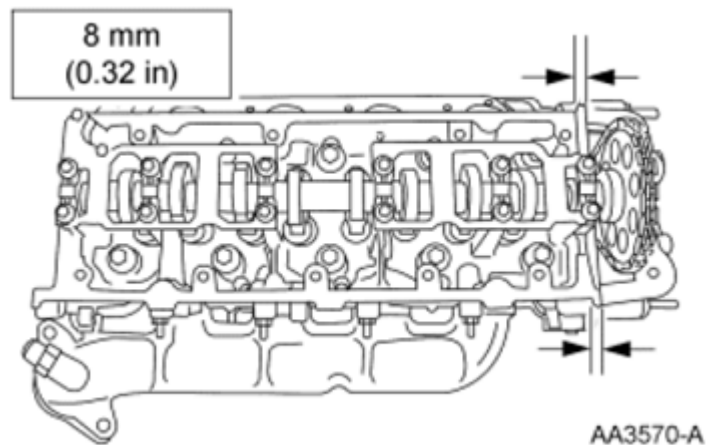


Fig. 502: Identifying Engine Front Cover And Cylinder Head Sealant Apply Area With Specifications
Courtesy of FORD MOTOR CO.

52. Apply sealant in 2 places where the engine front cover meets the cylinder head.
53. Install the gasket into the valve cover and position on the cylinder head. Tighten the bolts in the sequence shown in the illustration.
 - Tighten to 10 Nm (89 lb-in).

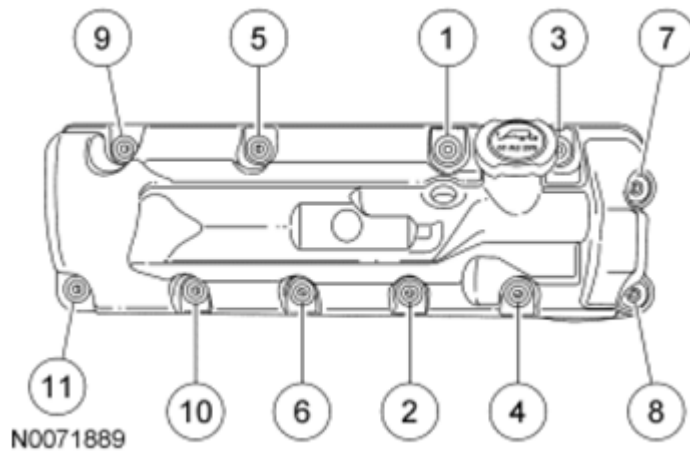


Fig. 503: Identifying Valve Cover Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

54. Inspect the O-ring seals. Install new seals if necessary.



Fig. 504: Locating O-Ring Seals
Courtesy of FORD MOTOR CO.

55. Install the coolant bypass tube.



Fig. 505: Locating Coolant Bypass Tube
Courtesy of FORD MOTOR CO.

56. Install the ground strap on the rear of the RH cylinder head.
 1. Install the stud bolt and tighten to 25 Nm (18 lb-ft).
 2. Install the ground strap.
 3. Install the retaining nut and tighten to 10 Nm (89 lb-in).

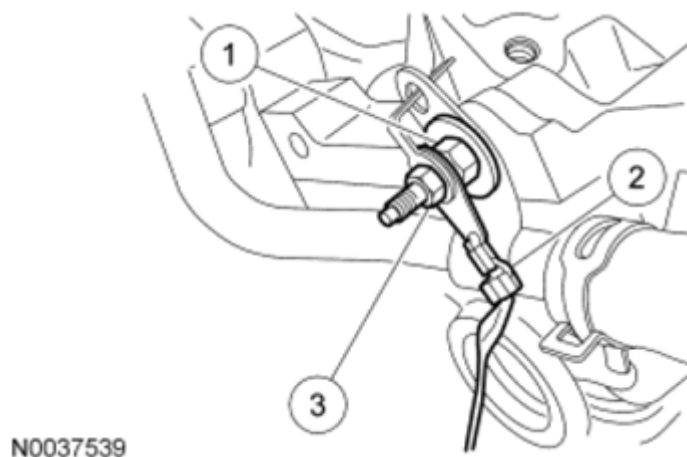
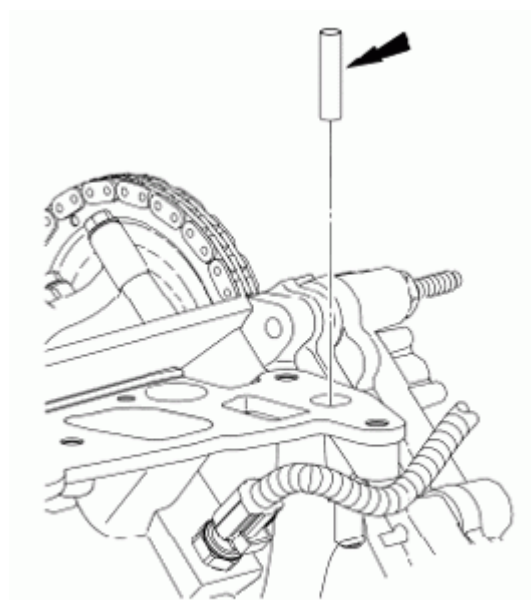


Fig. 506: Identifying Stud Bolt And Ground Strap
Courtesy of FORD MOTOR CO.

57. Install the insert into the LH cylinder head.



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Fig. 507: Locating Cylinder Head Insert
Courtesy of FORD MOTOR CO.

NOTE: Align the gasket locator tabs to slots in cylinder head.

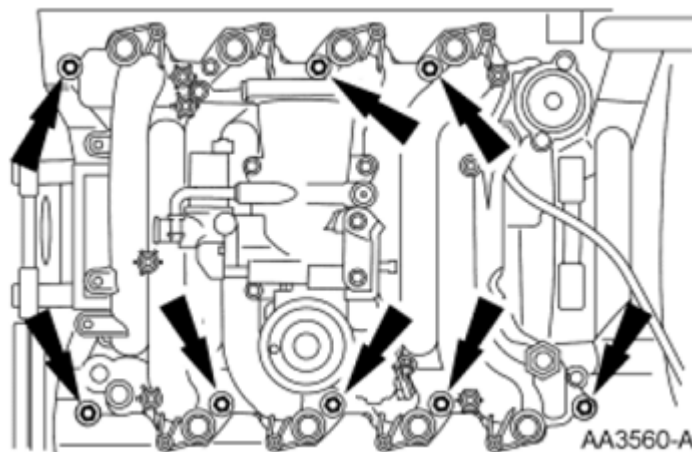


Fig. 508: Locating Intake Manifold Gaskets
Courtesy of FORD MOTOR CO.

58. Install the new intake manifold gaskets, intake manifold and hand-tighten the bolts at the locations shown in the illustration.
59. Install the 8 ignition coils and tighten the 8 bolts (4 shown in the illustration).
 - Tighten to 6 Nm (53 lb-in).

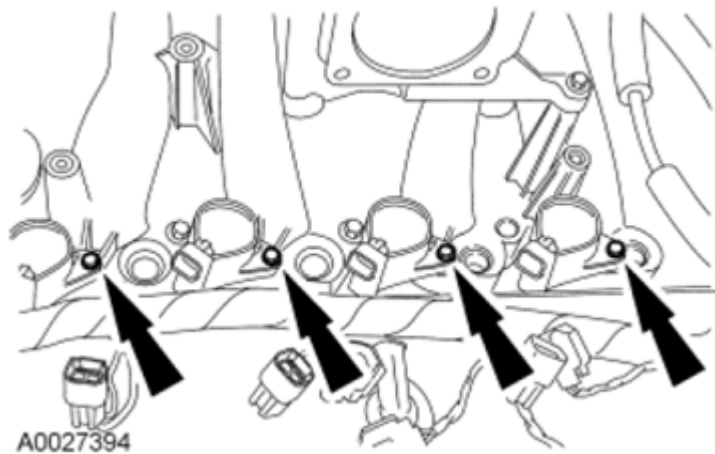


Fig. 509: Locating Ignition Coils And Mounting Bolts
Courtesy of FORD MOTOR CO.

60. Install the intake manifold bracket and loosely install the bolt and the stud bolt.



Fig. 510: Locating Crash Bracket And Mounting Bolt
Courtesy of FORD MOTOR CO.

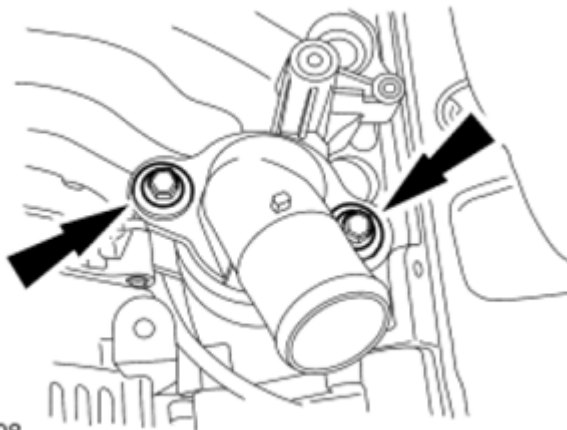
61. Install the thermostat.



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Fig. 511: Locating Thermostat And O-Ring
Courtesy of FORD MOTOR CO.

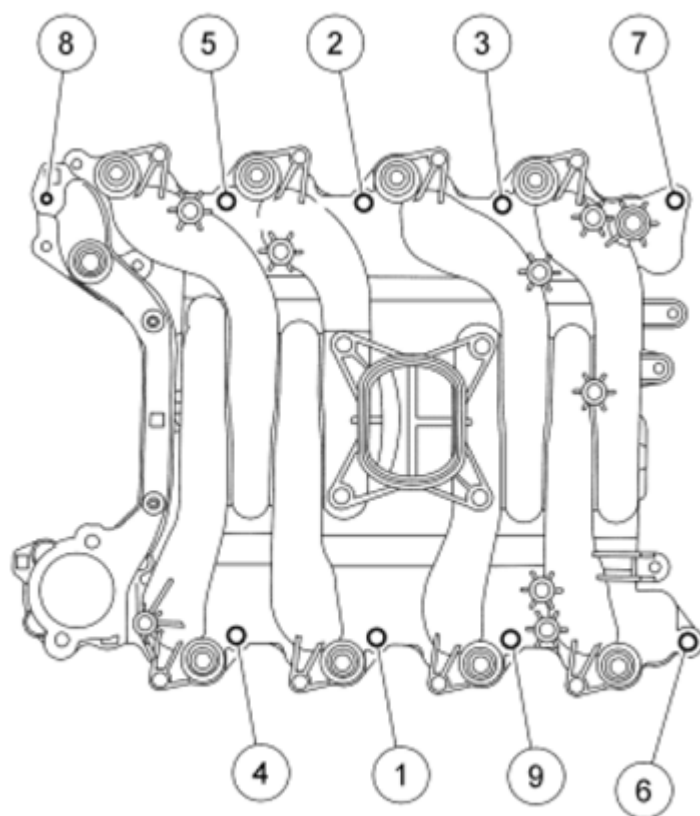
62. Install the coolant outlet adapter and loosely install the 2 bolts.



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Fig. 512: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

63. Tighten the bolts in the sequence shown in the illustration.
- Tighten to 25 Nm (18 lb-ft).



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Fig. 513: Identifying Intake Manifold Crash Bracket Mounting Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

64. Tighten the stud bolt.
 - Tighten to 25 Nm (18 lb-ft).

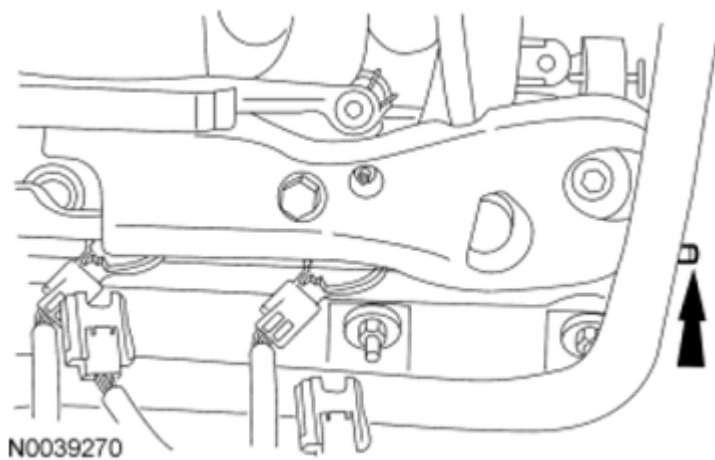


Fig. 514: Locating Stud Bolt
Courtesy of FORD MOTOR CO.

65. Tighten the bolts.
- Tighten to 25 Nm (18 lb-ft).

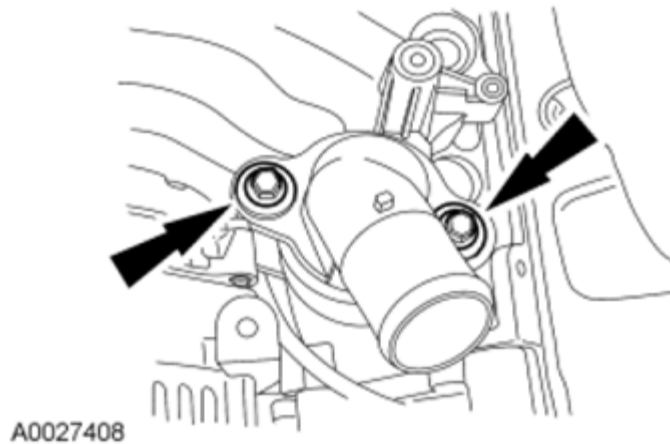


Fig. 515: Locating Coolant Outlet Adapter Mounting Bolts
Courtesy of FORD MOTOR CO.

66. Connect the EGR tube to the EGR valve.
- Tighten to 43 Nm (32 lb-ft).

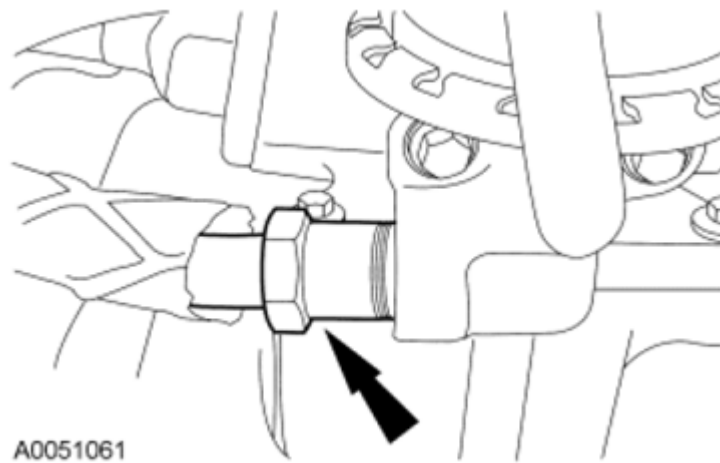


Fig. 516: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

67. Connect the EGR tube-to-exhaust manifold connector.
- Tighten to 43 Nm (32 lb-ft).

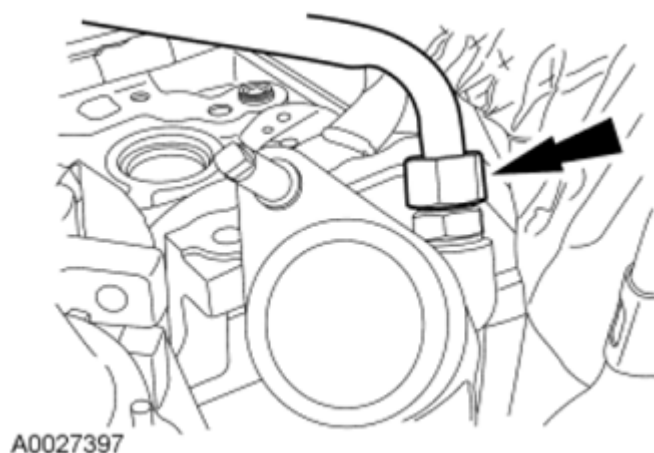


Fig. 517: Locating Exhaust Gas Recirculation Tube
Courtesy of FORD MOTOR CO.

68. Position the fuel charging wiring at 2 locations at the back of the intake manifold.
69. Install the generator and the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

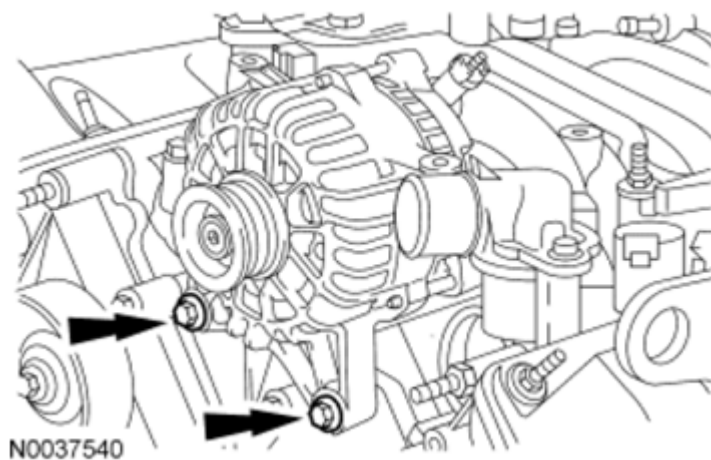


Fig. 518: Locating Generator Mounting Bolts
Courtesy of FORD MOTOR CO.

70. Connect the throttle control and the Throttle Position (TP) sensor electrical connector.

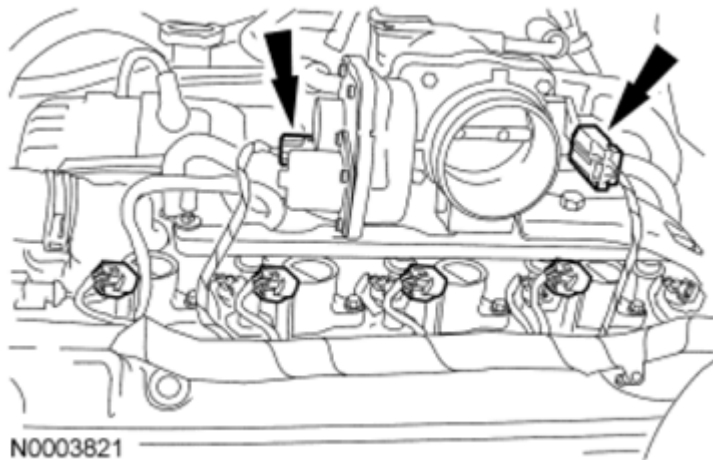


Fig. 519: Locating Throttle Control And Throttle Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

71. Install the generator mounting bracket and the 4 bolts.
- Tighten to 10 Nm (89 lb-in).

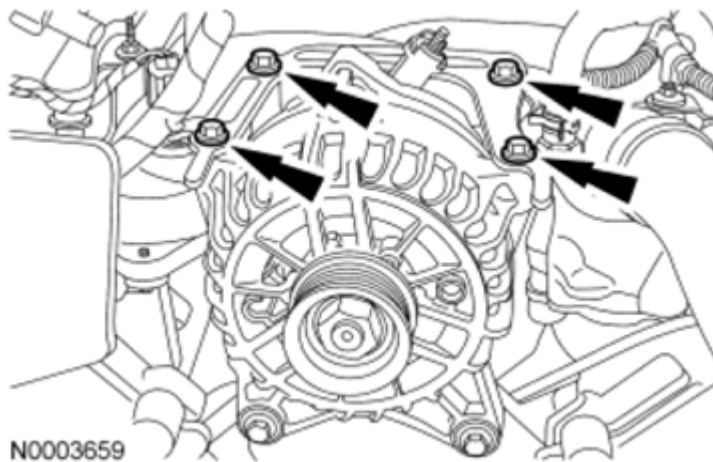


Fig. 520: Locating Generator Mounting Bracket And Mounting Bolts
Courtesy of FORD MOTOR CO.

72. Attach the wire harness retainer and connect the generator electrical connector.

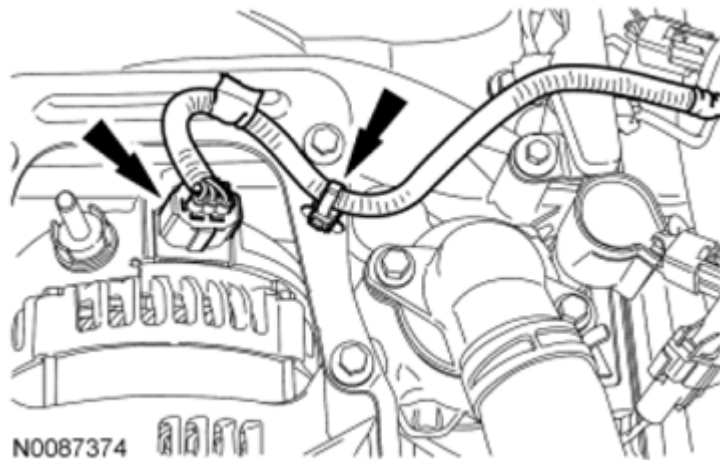


Fig. 521: Locating Generator Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

73. Connect the electrical connector to the EGR vacuum regulator solenoid.

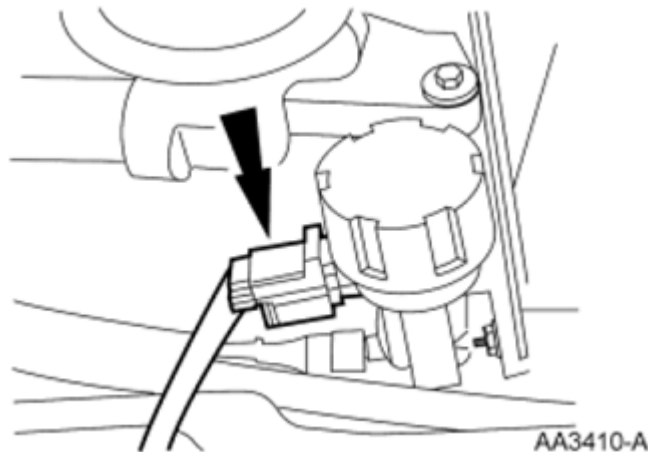


Fig. 522: Locating EGR Vacuum Regulator Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

74. Connect the crankcase ventilation tube.

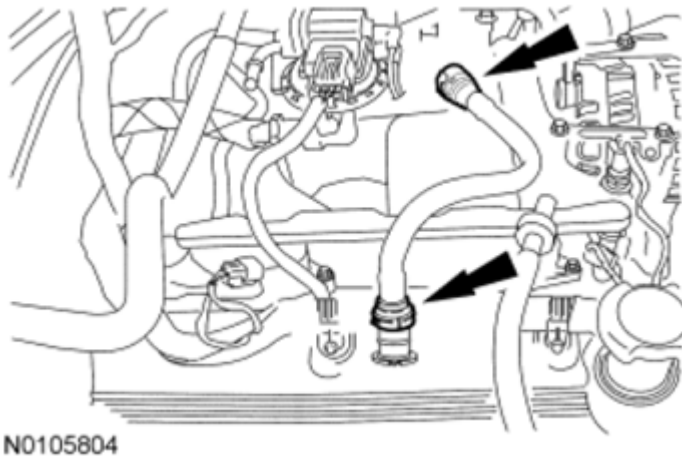


Fig. 523: Locating Crankcase Ventilation Tube
Courtesy of FORD MOTOR CO.

75. Install the intake manifold shield and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).

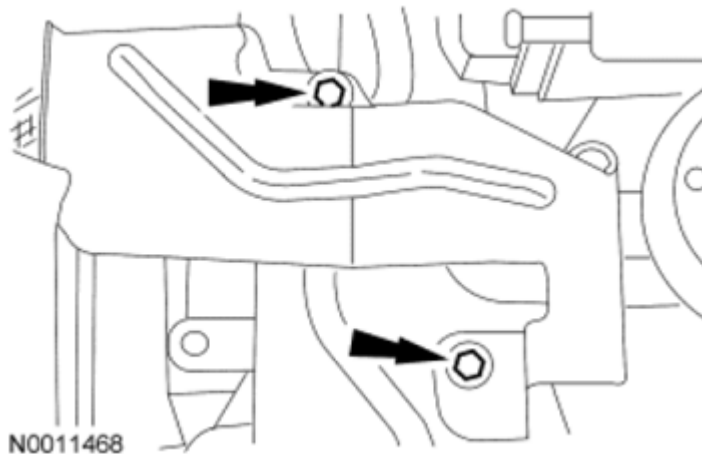


Fig. 524: Locating Intake Manifold Shield Mounting Bolt
Courtesy of FORD MOTOR CO.

76. Connect the 8 fuel injector electrical connectors (4 shown in the illustration).

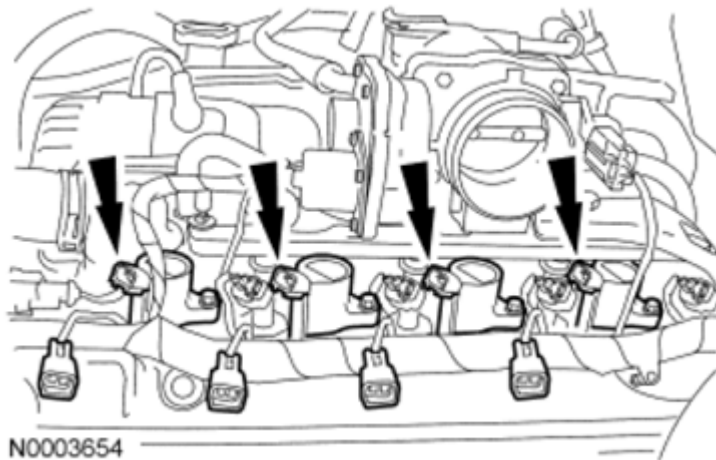


Fig. 525: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

77. Connect the 8 ignition coil electrical connectors.

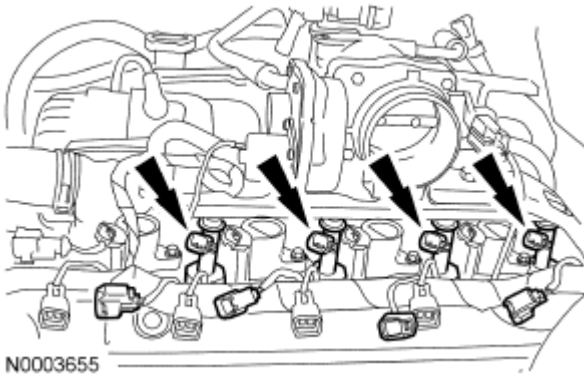


Fig. 526: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

78. Connect the Camshaft Position (CMP) sensor electrical connector.

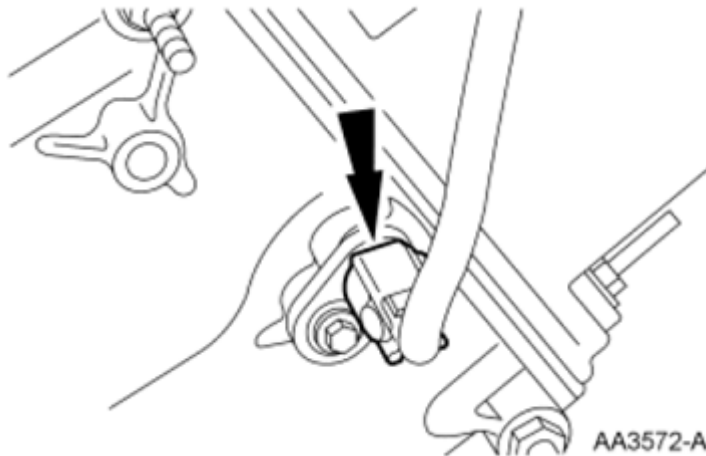


Fig. 527: Locating Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

79. Connect the radio interference capacitor electrical connector.

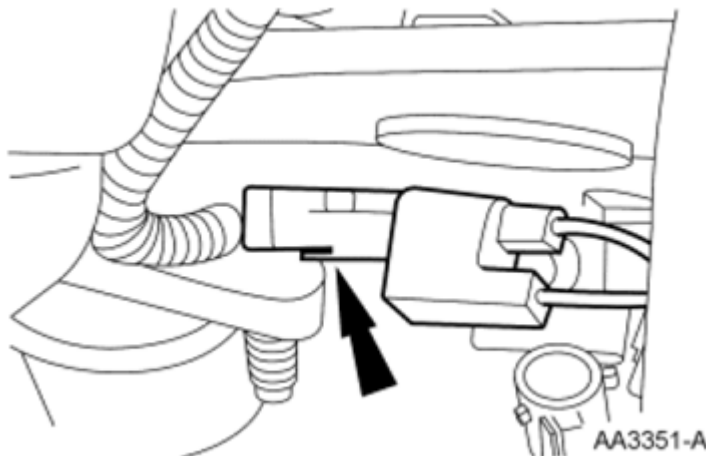


Fig. 528: Locating Radio Interference Capacitor
Courtesy of FORD MOTOR CO.

80. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

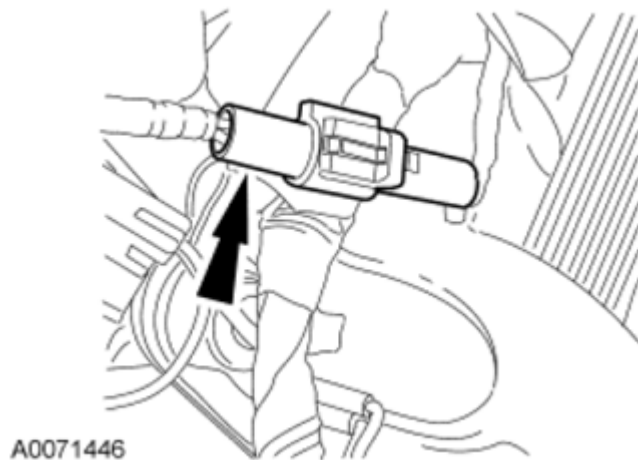


Fig. 529: Locating Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

81. Install the battery cables and the bolt.
82. Install the Engine Lifting Bracket to the RH cylinder head.

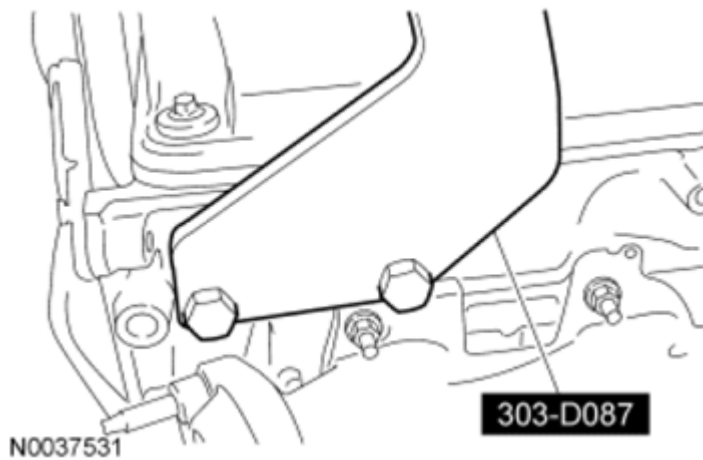


Fig. 530: Installing Engine Lifting Bracket To RH Cylinder Head
Courtesy of FORD MOTOR CO.

83. Install the Engine Lifting Bracket to the LH cylinder head.

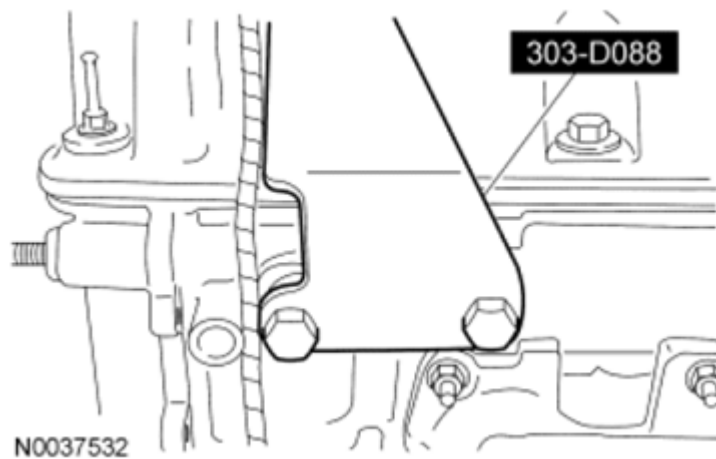


Fig. 531: Installing Engine Lifting Bracket To LH Cylinder Head
Courtesy of FORD MOTOR CO.

84. Using the Engine Lifting Bracket Set, remove the engine from the engine stand.

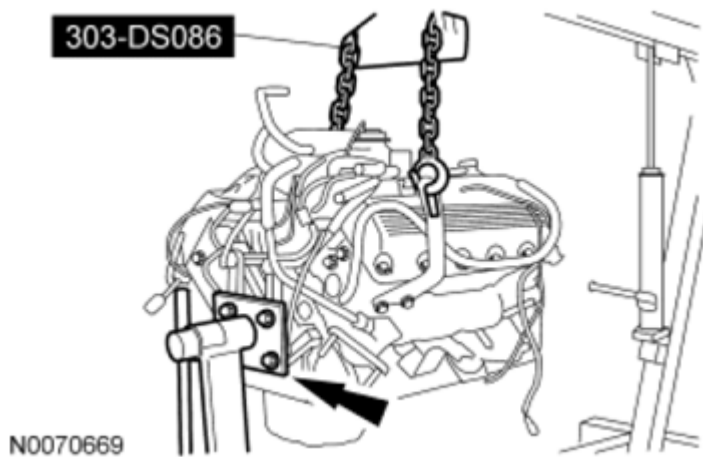


Fig. 532: Identifying Engine Lifting Bracket Set (303-DS086)
Courtesy of FORD MOTOR CO.

85. Install the engine/transmission spacer plate.

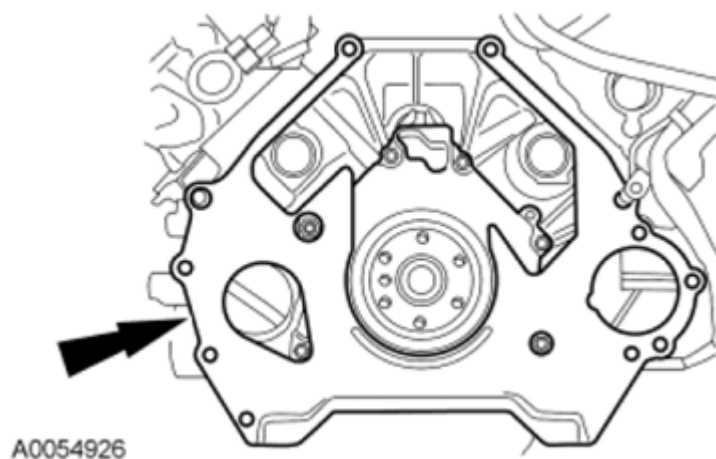


Fig. 533: Locating Engine/Transmission Spacer Plate
Courtesy of FORD MOTOR CO.

86. Position the flexplate and install the bolts in the sequence shown in the illustration.
- Tighten to 80 Nm (59 lb-ft).

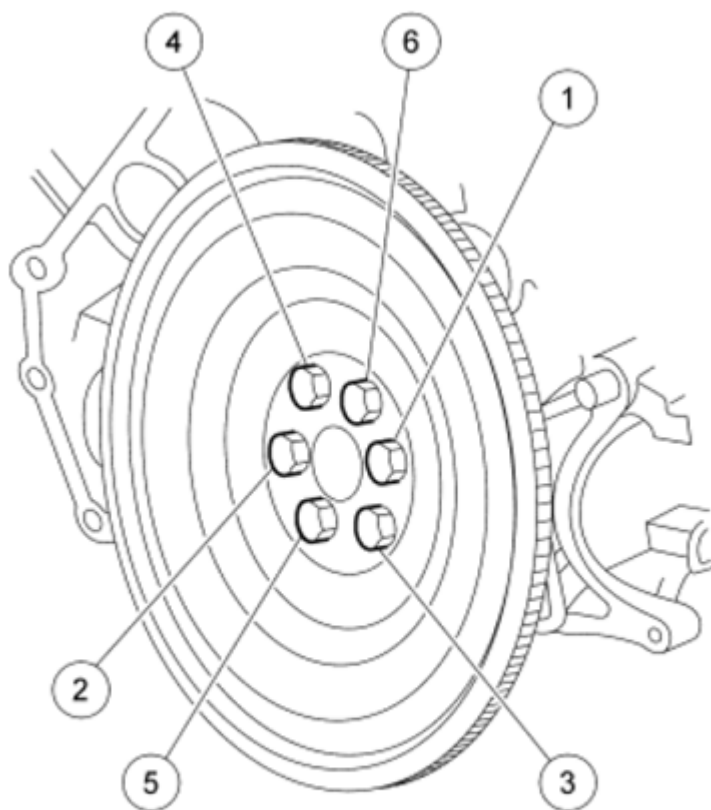


Fig. 534: Identifying Flexplate Mounting Bolts Tightening Sequence

Courtesy of FORD MOTOR CO.

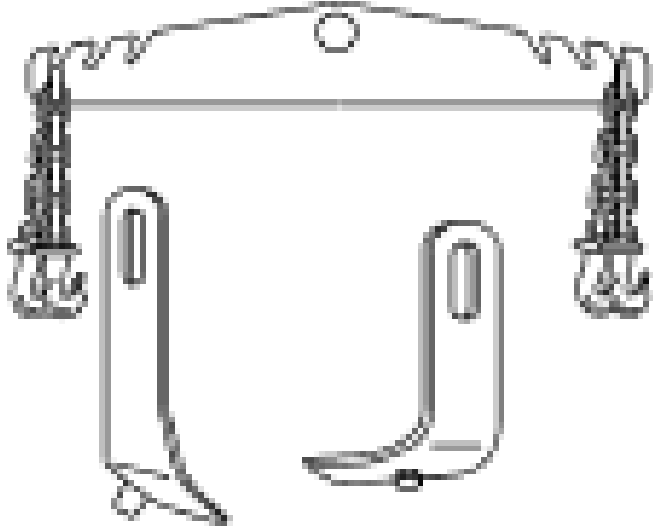
87. Install the engine. For additional information, refer to **ENGINE** in the Installation portion of this service information.

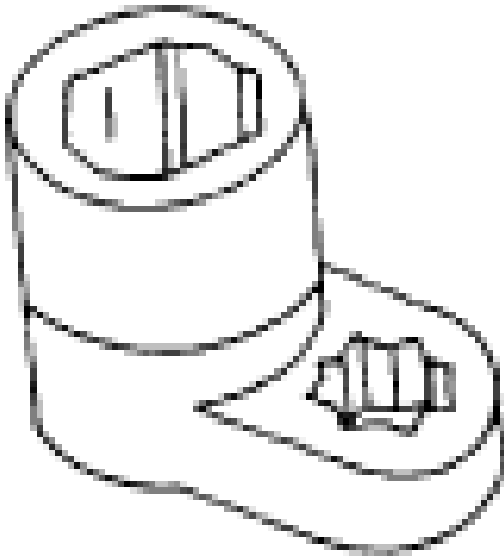
WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

88. If equipped with a fire suppression system, repower the system

ENGINE

SPECIAL TOOL(S)

 ST2443-A	Lifting Bracket Set, Engine 303-DS086 (D93P-6001-A) or equivalent
	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

**ST1448-A****MATERIAL**

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
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

INSTALLATION

WARNING: Before servicing a vehicle equipped with a fire suppression system, depower the system by following the procedure in **FIRE SUPPRESSION SYSTEM** article. Failure to follow the instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** article.
2. Using the Engine Lifting Bracket Set, install the engine assembly in the vehicle.

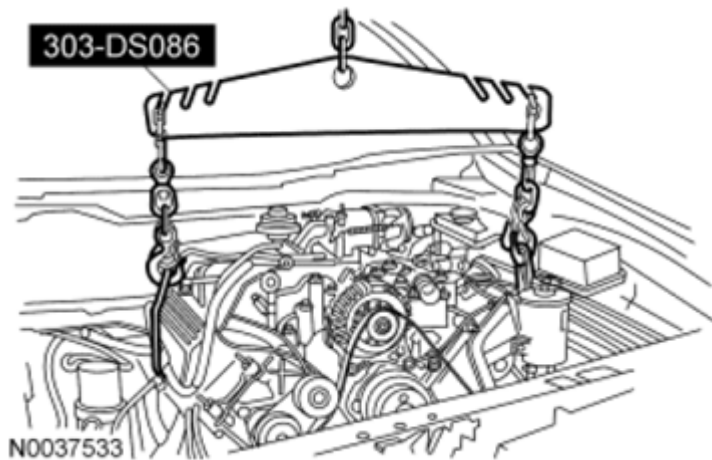


Fig. 535: Identifying Engine Lifting Bracket Set
Courtesy of FORD MOTOR CO.

NOTE: When vehicle is raised, verify that the torque converter is correctly seated.

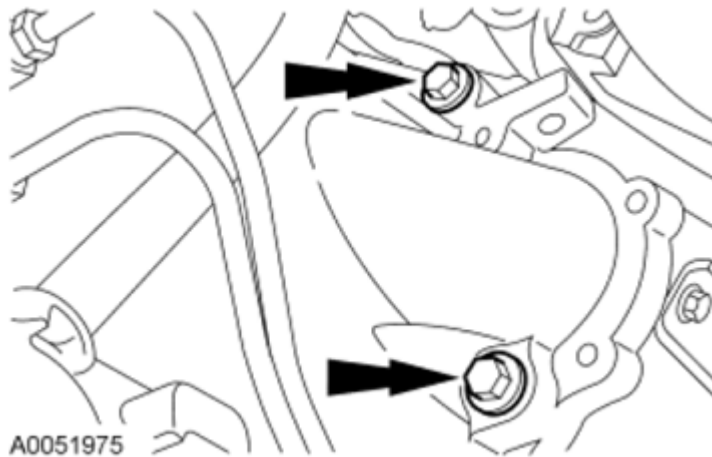


Fig. 536: Locating Bolts And Stud
Courtesy of FORD MOTOR CO.

3. Install the 4 transmission bellhousing bolts (2 shown in the illustration) and 1 stud.
 - Tighten to 48 Nm (35 lb-ft).
4. Attach the wiring harness to the retainers on the transmission.
5. Connect the Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor and the Turbine Shaft Speed (TSS) sensor electrical connectors.

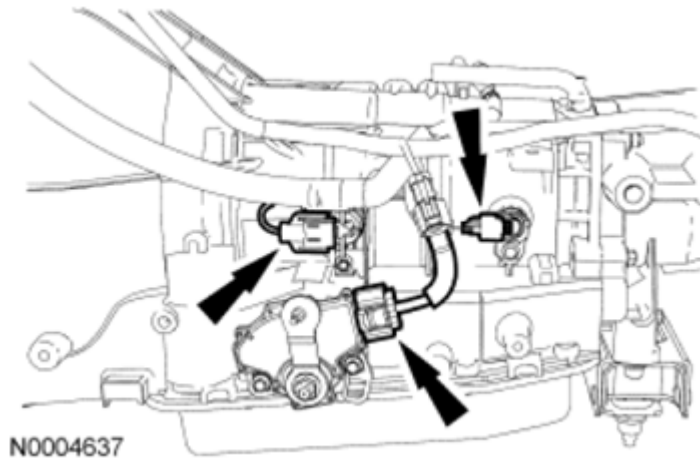


Fig. 537: Locating Output Shaft Speed Sensor, Transmission Range Sensor And Turbine Shaft Speed Sensor Electrical Connectors

Courtesy of FORD MOTOR CO.

6. Connect the Heated Oxygen Sensor (HO2S) and the solenoid body sensor electrical sensors.

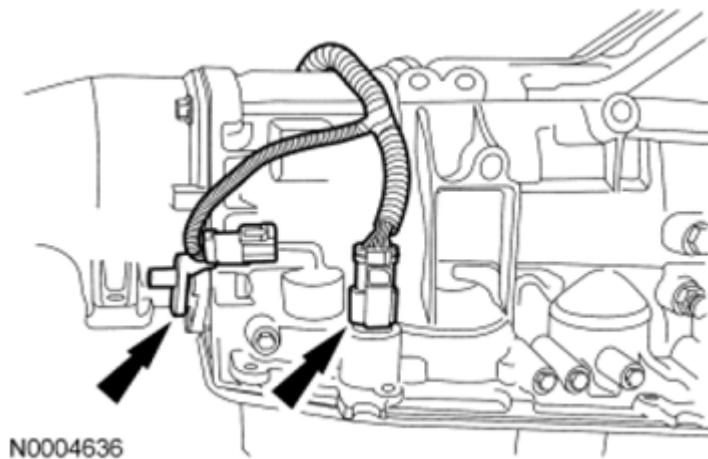


Fig. 538: Locating Heated Oxygen Sensor And Solenoid Body Sensor Electrical Connectors

Courtesy of FORD MOTOR CO.

7. Raise the transmission and install the transmission insulator.
8. Install the 2 insulator bolts.
 - Tighten to 90 Nm (66 lb-ft).

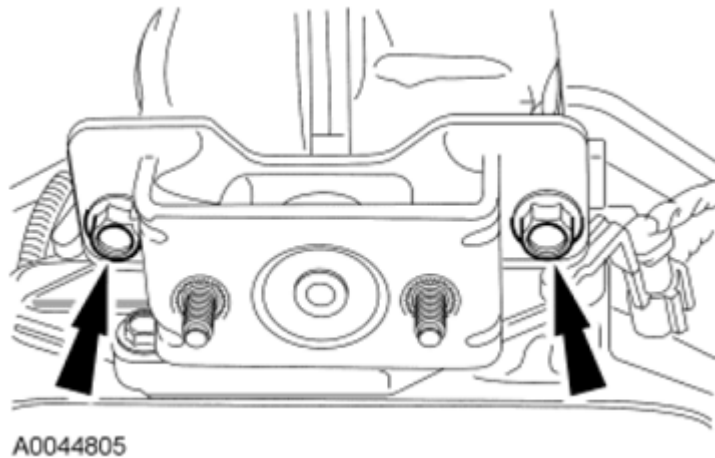


Fig. 539: Locating Rear Transmission Insulator Bolts
Courtesy of FORD MOTOR CO.

9. Lower the transmission and install the 2 transmission insulator nuts.
 - Tighten to 30 Nm (22 lb-ft).

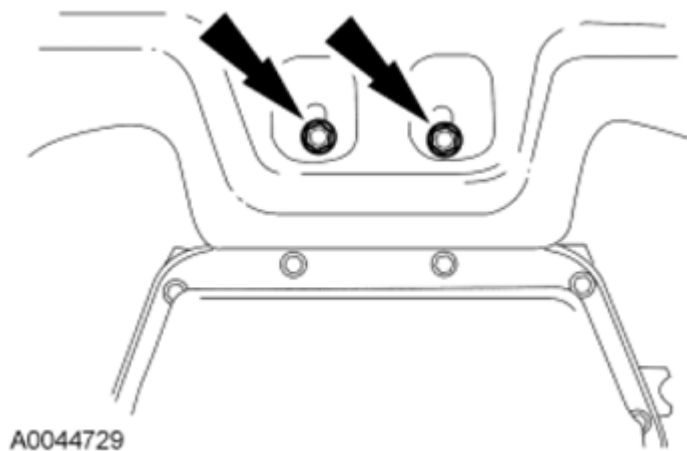


Fig. 540: Locating Rear Transmission Insulator Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown in the illustration, RH similar.

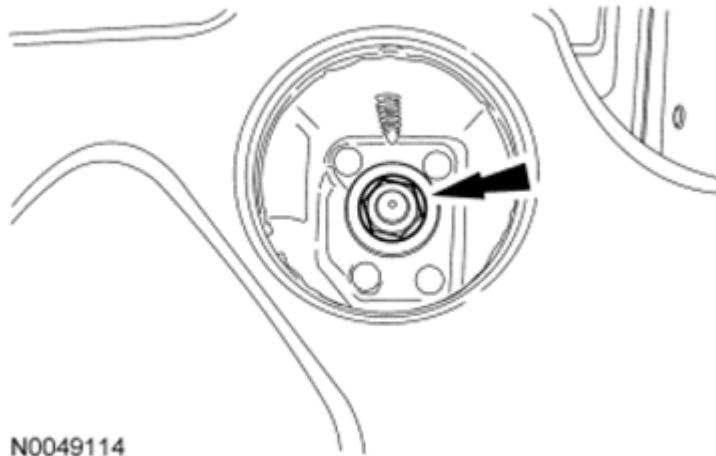


Fig. 541: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

10. Install the 2 engine mount nuts.
 - Tighten to 90 Nm (66 lb-ft).

NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

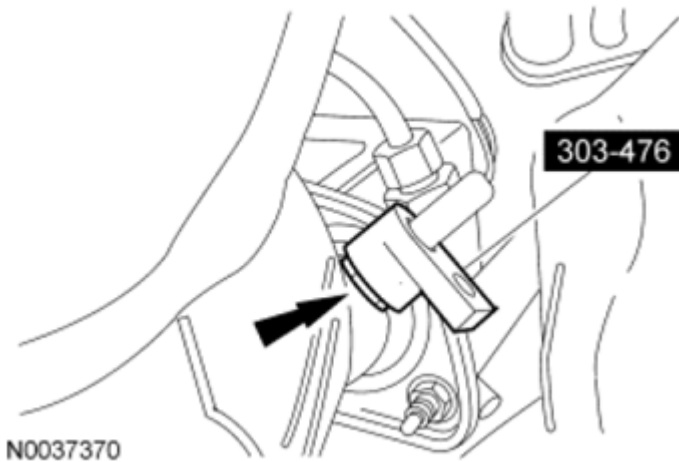
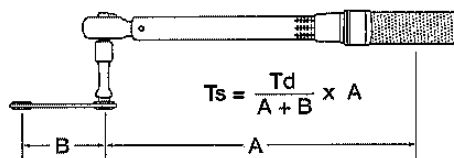
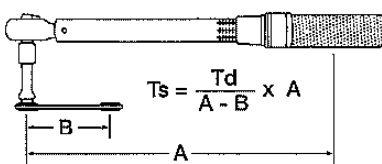
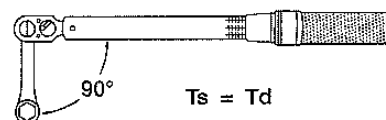
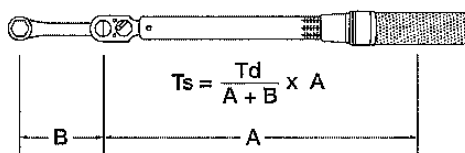
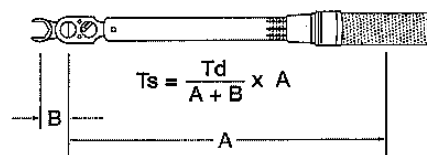
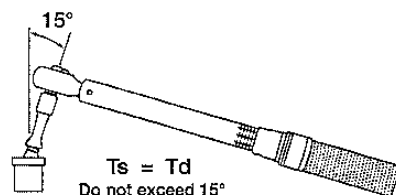
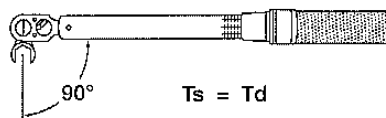
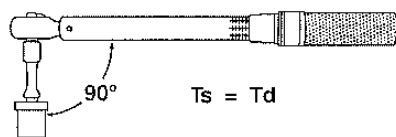


Fig. 543: Locating Exhaust Gas Oxygen Sensor Socket
Courtesy of FORD MOTOR CO.

11. Using the Exhaust Gas Oxygen Sensor Socket, install the HO2S.
 - Calculate the correct torque wrench setting for the following torque. For additional information, Refer to the illustration.

Torque Wrench Adapter Formulas



TORQUE FORMULA LEGEND

T_s = Torque wrench setting
 T_d = Fastener torque desired

A = Torque wrench length
B = Torque adapter length

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Fig. 542: Identifying Torque Wrench Adapter Formulas
Courtesy of FORD MOTOR CO.

- Tighten to 40 Nm (30 lb-ft).

12. Connect the LH HO2S electrical connector.

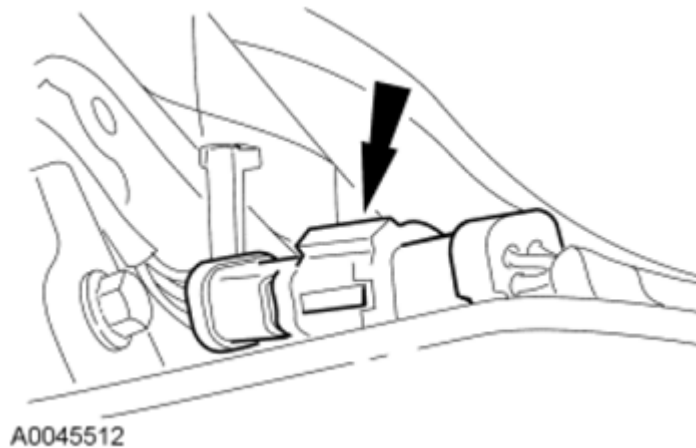


Fig. 544: Locating LH HO2S Electrical Connector
Courtesy of FORD MOTOR CO.

13. Connect the RH HO2S electrical connector.

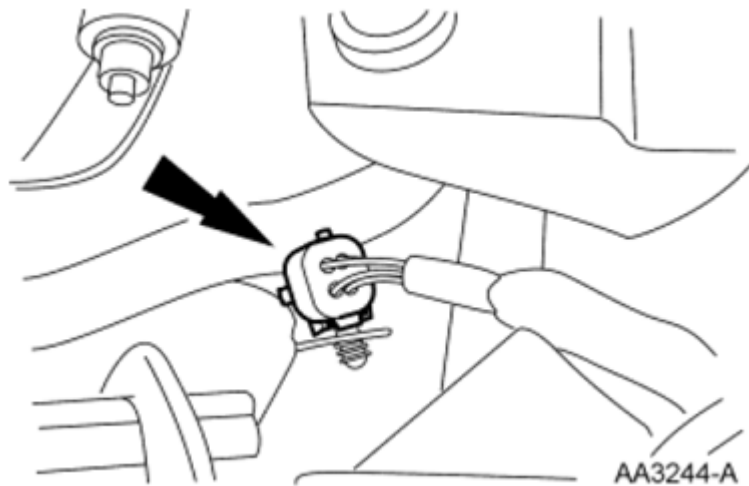


Fig. 545: Locating Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

14. Install the 4 torque converter nuts.
- Rotate the crankshaft to access the nuts.
 - Tighten to 36 Nm (27 lb-ft).

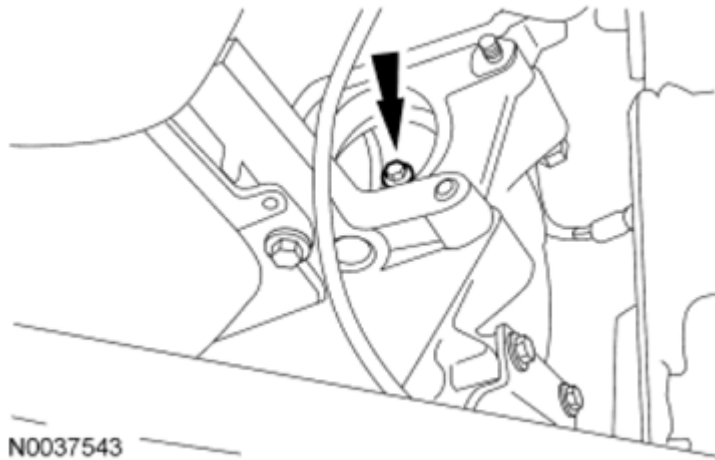


Fig. 546: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

15. Install the rubber access plug.

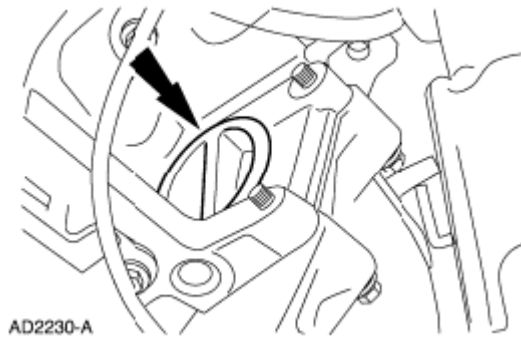


Fig. 547: Locating Rubber Access Plug
Courtesy of FORD MOTOR CO.

16. Install the inspection cover and the 3 bolts.
 - Tighten to 19 Nm (168 lb-in).

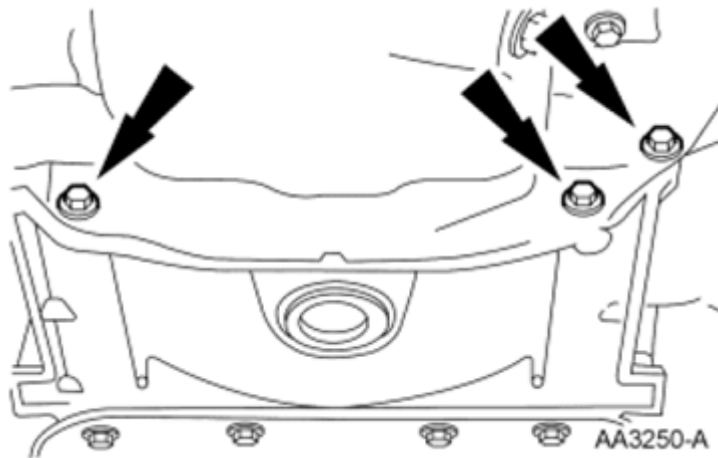


Fig. 548: Locating Inspection Cover Mounting Bolts
 Courtesy of FORD MOTOR CO.

17. Install the starter motor. For additional information, refer to **STARTING SYSTEM** article.
18. Position the exhaust, install the 4 new nuts and remove the support.
 - Tighten to 48 Nm (35 lb-ft).

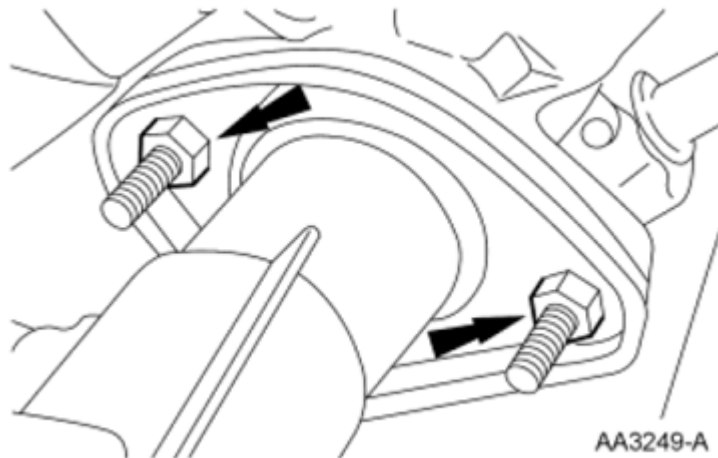


Fig. 549: Locating Exhaust Mounting Nuts
 Courtesy of FORD MOTOR CO.

19. Install the power steering pump and the 3 bolts.
 - Tighten to 25 Nm (18 lb-ft).

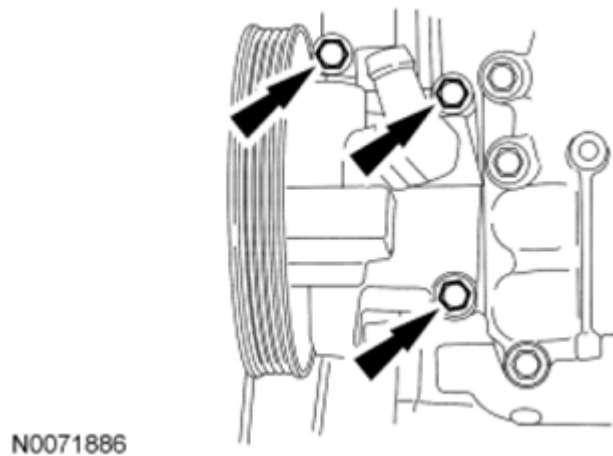


Fig. 550: Locating Power Steering Pump Mounting Bolts
Courtesy of FORD MOTOR CO.

20. Install the A/C compressor and the 3 bolts.
- Tighten to 25 Nm (18 lb-ft).

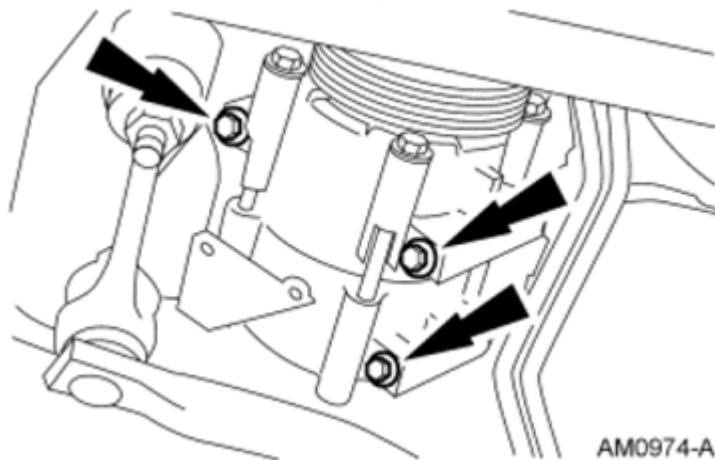


Fig. 551: Locating A/C Compressor Mounting Bolts
Courtesy of FORD MOTOR CO.

21. Connect the A/C compressor electrical connector.



Fig. 552: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

22. Connect the engine wiring harness retainers to the A/C compressor.

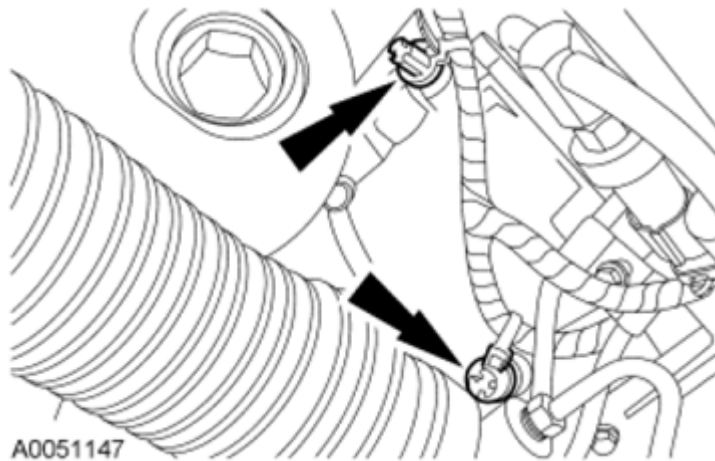


Fig. 553: Locating A/C Compressor Engine Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

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

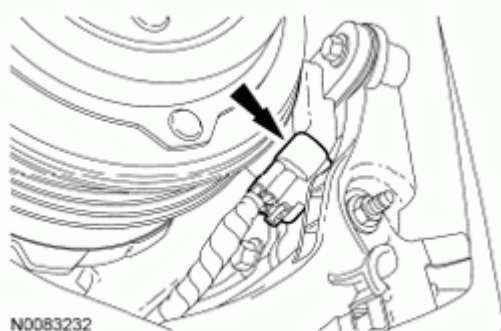


Fig. 554: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Position the transmission oil cooler tube bracket and install the bolt.
- Tighten to 15 Nm (133 lb-in).

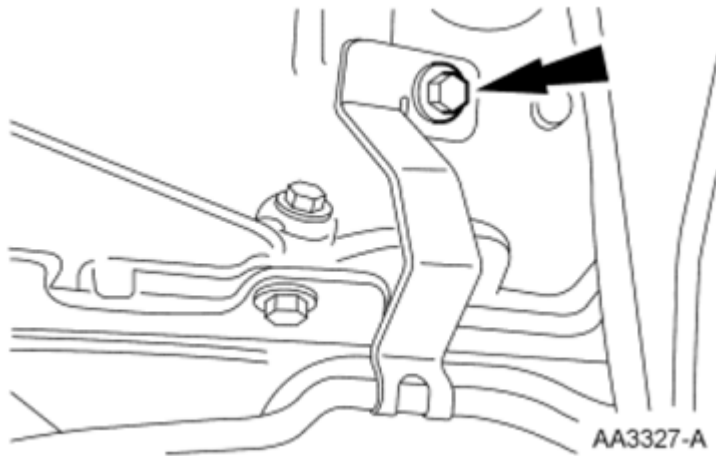


Fig. 555: Locating Transmission Oil Cooler Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

25. Install the transmission cooler tube support bracket.
- Tighten to 9 Nm (80 lb-in).

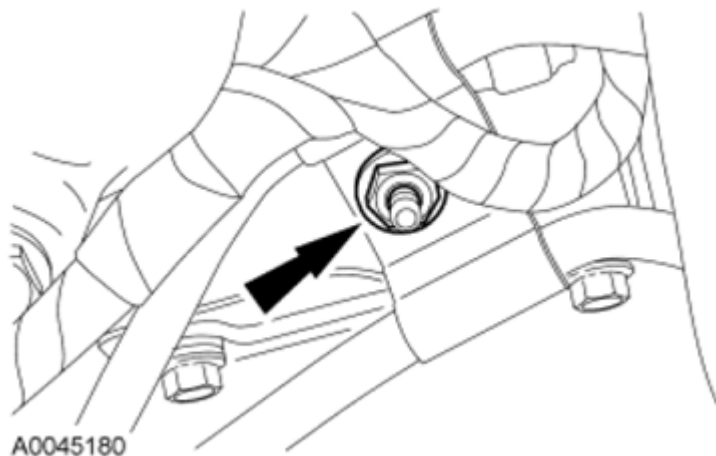
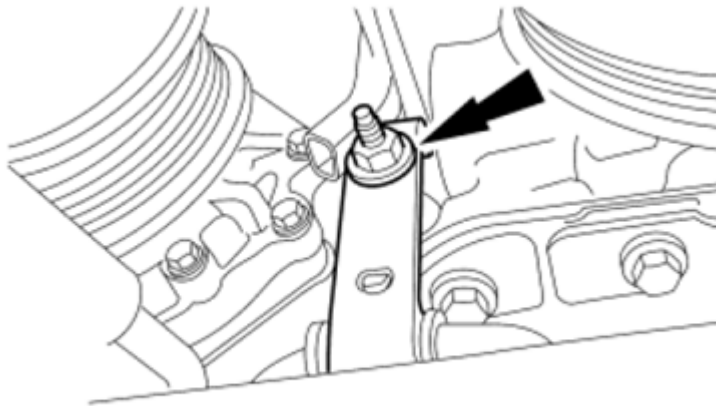


Fig. 556: Locating Transmission Cooler Tube Support Bracket
Courtesy of FORD MOTOR CO.

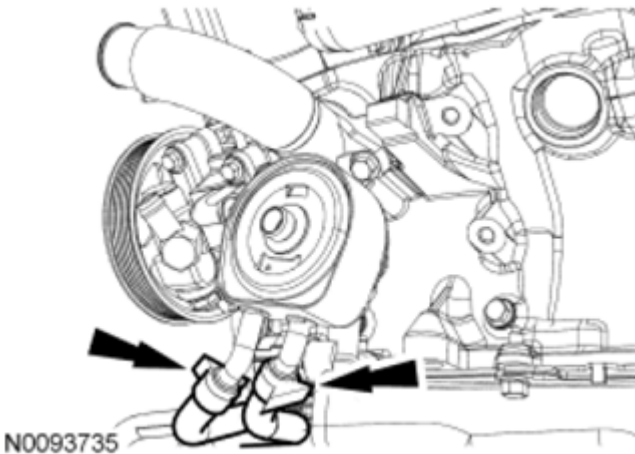
26. Install the power steering tube bracket.
- Tighten to 10 Nm (89 lb-in).



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Fig. 557: Locating Power Steering Tube Bracket Mounting Nut
Courtesy of FORD MOTOR CO.

27. If equipped, connect the 2 coolant hoses to the oil cooler.
- Align the white lines on the coolant hoses with the black dots on the cooler tubes.



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Fig. 558: Locating Oil Cooler Coolant Hoses
Courtesy of FORD MOTOR CO.

28. Connect the Power Steering Pressure (PSP) switch electrical connector.

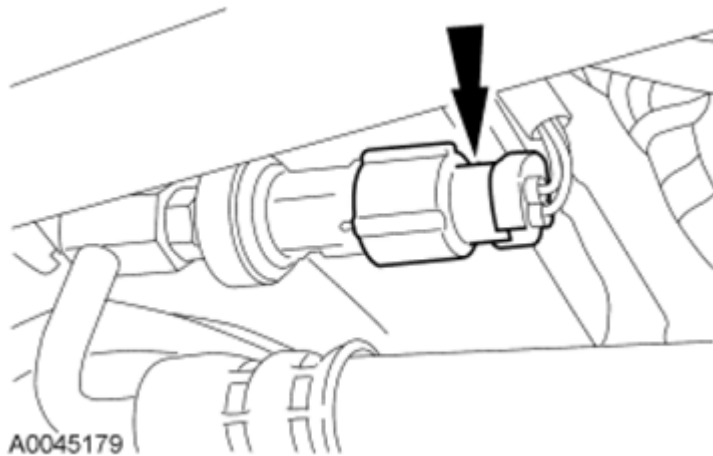


Fig. 559: Locating Power Steering Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

29. Connect the power steering electrical connector.

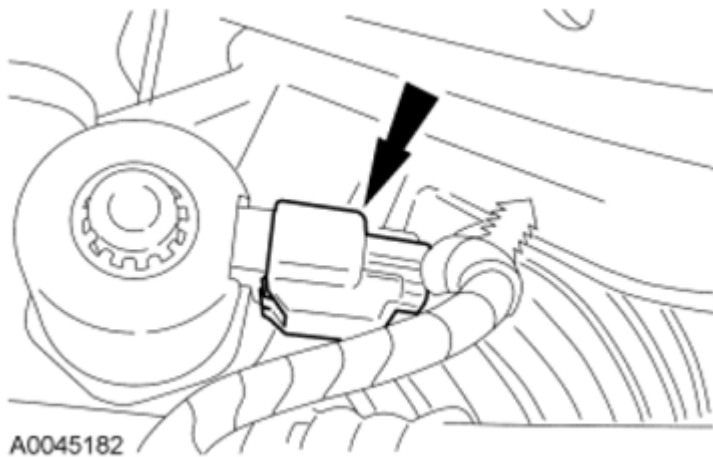


Fig. 560: Locating Power Steering Electrical Connector
Courtesy of FORD MOTOR CO.

30. If equipped, connect the block heater electrical connector.
31. Connect the EOP switch electrical connector.

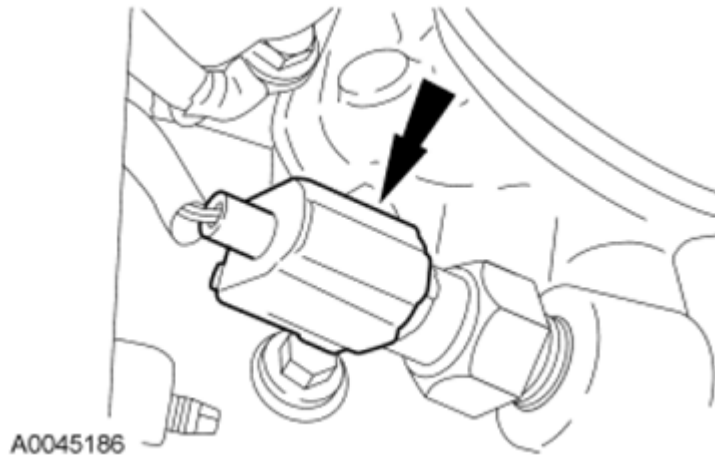


Fig. 561: Locating Engine Oil Pressure (EOP) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

32. Install the 2 top transmission bellhousing bolts.
- Tighten to 48 Nm (35 lb-ft).

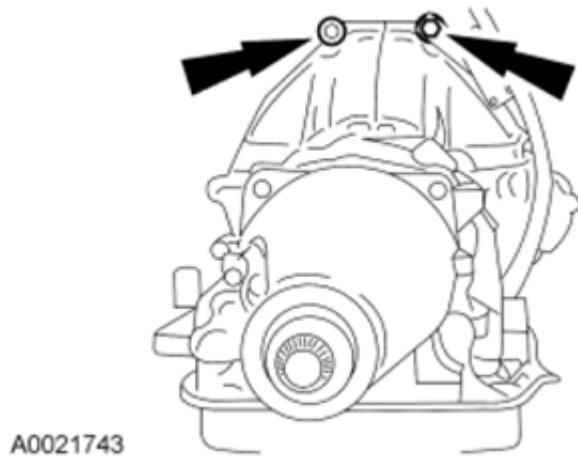


Fig. 562: Locating Bellhousing Bolts
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the oil filter seal with clean engine oil.

33. Install the oil filter.
34. Install the cooling fan. For additional information, refer to **ENGINE COOLING SYSTEM** article.

NOTE: Do not reuse hose clamps. Use appropriately sized worm-style clamps in place of the constant tension clamps.

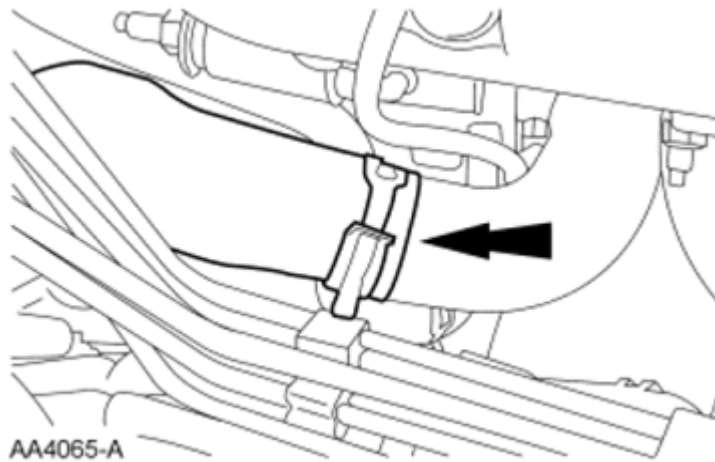


Fig. 563: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

35. Connect the lower radiator hose.
36. Connect the upper radiator hose to the hose connection.

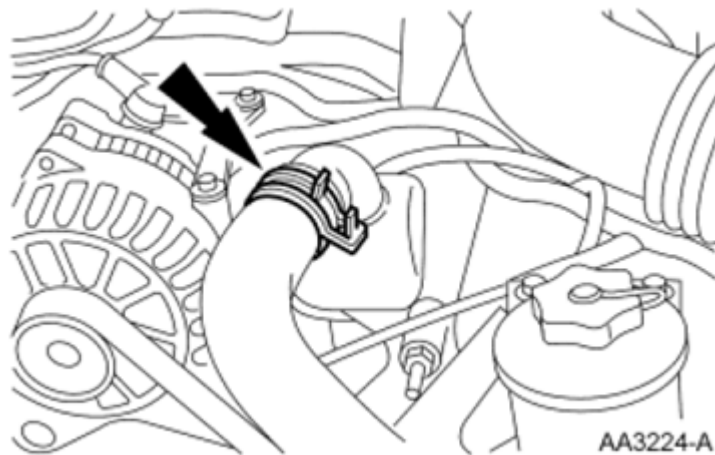


Fig. 564: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

37. Connect the PCM electrical connectors.

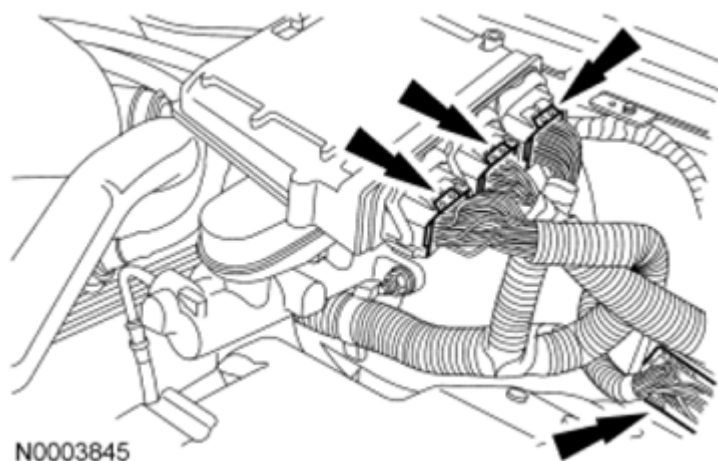


Fig. 565: Locating PCM Electrical Connectors
Courtesy of FORD MOTOR CO.

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

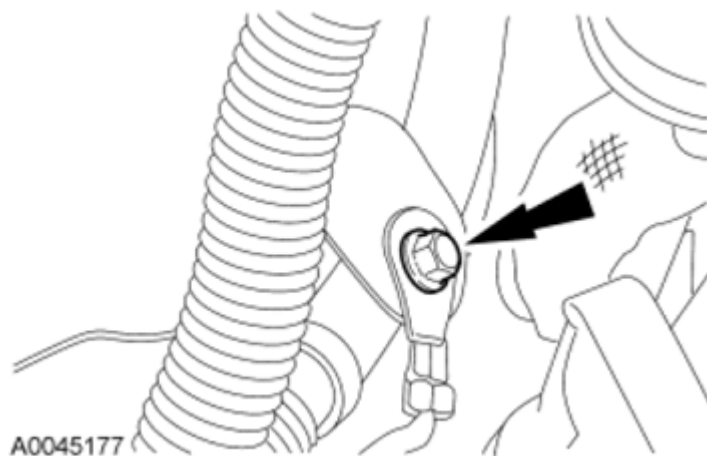


Fig. 566: Locating Ground Strap Mounting Bolt
Courtesy of FORD MOTOR CO.

NOTE: Do not reuse hose clamps. Use appropriately sized worm-style clamps in place of the constant tension clamps.

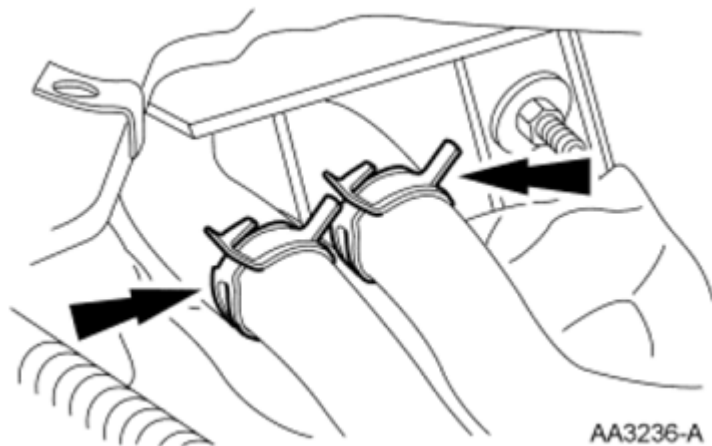


Fig. 567: Locating Heater Hoses
Courtesy of FORD MOTOR CO.

39. Connect the heater hoses.
40. Connect the A/C low charge protection switch electrical connector.

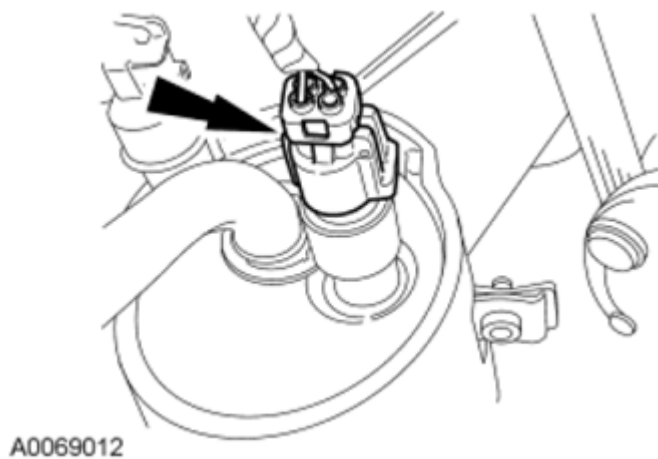


Fig. 568: Locating A/C Low Charge Protection Switch Electrical Connector
Courtesy of FORD MOTOR CO.

41. Connect the A/C electrical connector.

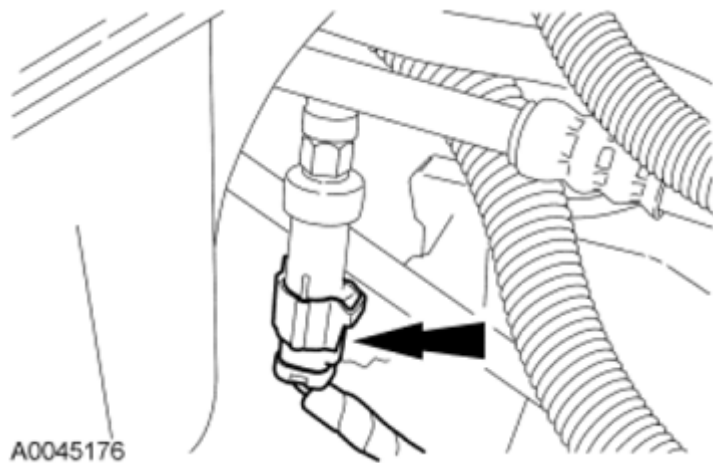


Fig. 569: Locating A/C Electrical Connector
Courtesy of FORD MOTOR CO.

42. Install the ground strap and the bolt.
- Tighten to 10 Nm (89 lb-in).

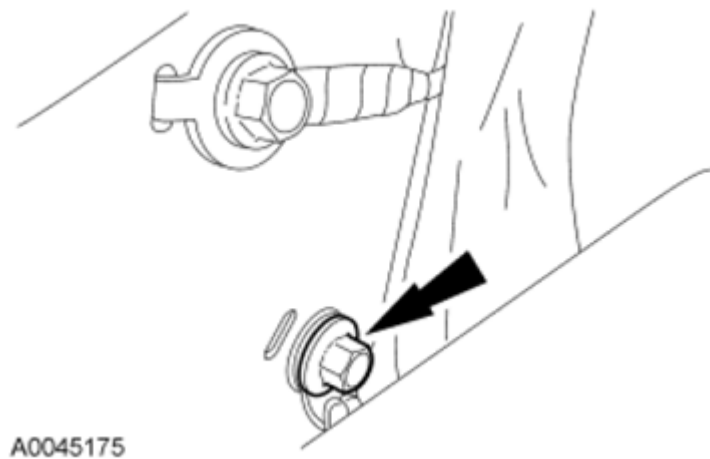


Fig. 570: Locating Ground Wire Mounting Bolt
Courtesy of FORD MOTOR CO.

43. Attach the pin-type retainer and install the generator battery cable and nut.
- Tighten to 9 Nm (80 lb-in).

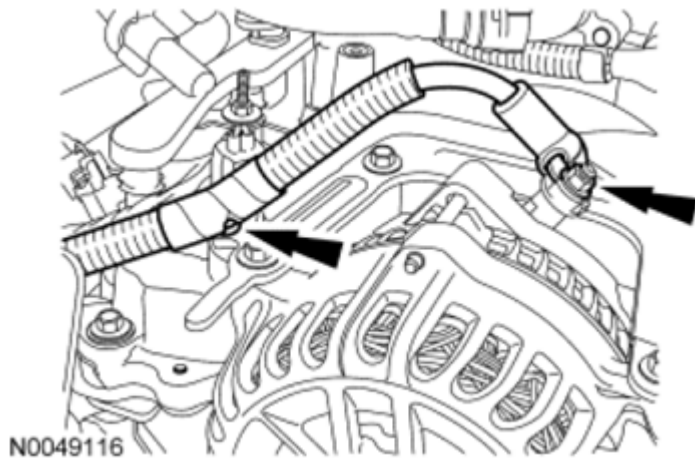


Fig. 571: Locating Generator Battery Cable Pin-Type Retainer
Courtesy of FORD MOTOR CO.

44. Attach the generator battery cable retainer to the RH valve cover stud bolt.

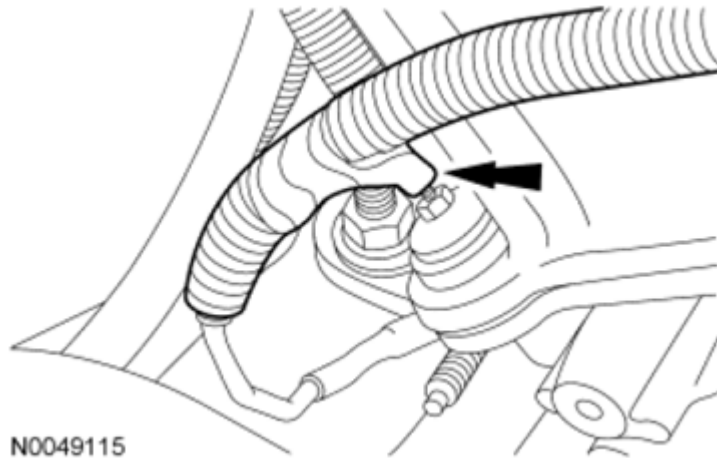


Fig. 572: Locating Generator Battery Cable Retainer
Courtesy of FORD MOTOR CO.

45. Connect the fuel tube spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
46. Connect the 2 hoses and the Evaporative Emission (EVAP) canister purge valve electrical connection.

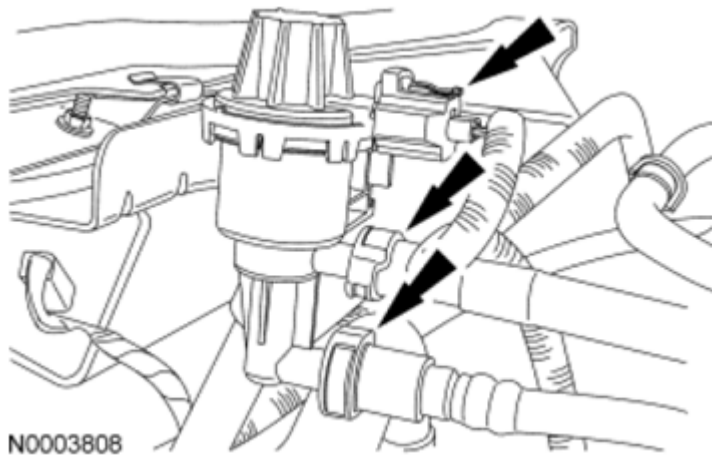


Fig. 573: Locating Quick Release EVAP Hoses And Electrical Connector
Courtesy of FORD MOTOR CO.

47. Connect the vacuum hose.

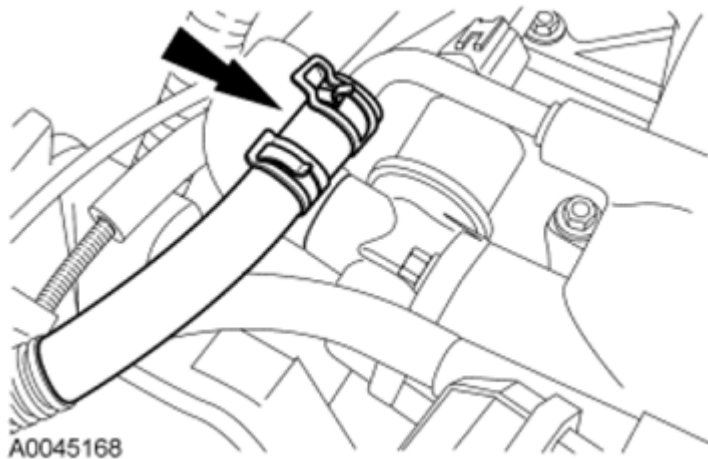


Fig. 574: Locating Vacuum Hose
Courtesy of FORD MOTOR CO.

48. Install the Air Cleaner (ACL) and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION SYSTEM & INTAKE AIR FILTERING SYSTEM** article.
49. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE BELT** article.
50. Install the support bracket and the 2 nuts.
- Tighten to 10 Nm (89 lb-in).

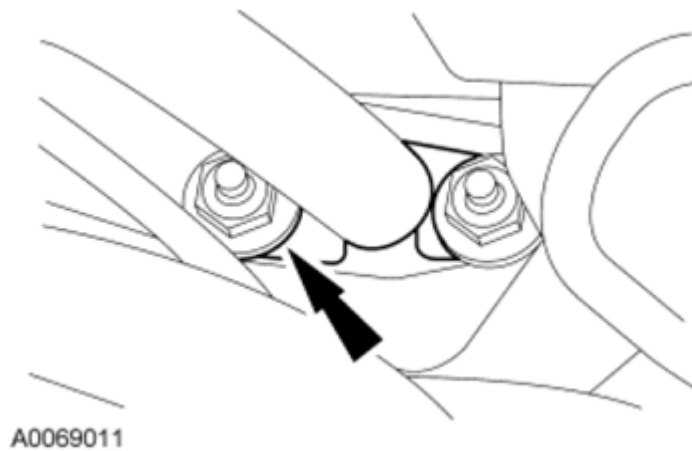


Fig. 575: Locating Support Bracket Mounting Nut
Courtesy of FORD MOTOR CO.

51. Install the wiper mounting arm and pivot shaft. For additional information, refer to **WIPER SYSTEM & WASHER SYSTEM** article.
52. Fill the crankcase with clean engine oil.
53. Connect both battery cables. For additional information, refer to **CHARGING SYSTEM** article.
54. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING SYSTEM** article.
55. Install the hood.

WARNING: If the vehicle is equipped with a fire suppression system, repower the system. For important safety warnings and procedures, refer to **FIRE SUPPRESSION SYSTEM** article. Failure to follow these instructions may result in serious personal injury.

56. If equipped with a fire suppression system, repower the system.